HPC® Coating

TECHNICAL DATA SHEET

(4/27/09)

DESCRIPTION

HPC® Coating is designed to control heat transfer on surface temperatures up to 700°F degrees (371°C). It is water-borne and extremely lightweight in appearance. HPC® Coating uses a special acrylic resin blend with specific ceramic compounds added to provide a non-conductive block against heat transfer.

HPC® Coating offers a "Green", non-flammable, non-toxic formula for high heat surface applications over standard steam pipe or oven wall construction. HPC® Coating is easily applied using a texture sprayer, and can be applied over metal, concrete, wood, and other substrates.

TYPICAL USES

- As an insulation system over hot pipes, tanks, and valves
- To block heat migration into cold tanks, lines, and valves
- As a system to block conductive and convective heat
- Easily applied when a hot system cannot be shut down

APPLICATION METHOD

HPC® Coating should only be used for applications less than 700°F (371°C) Degrees unless directed by manufacturer.

HPC® Coating can be applied to metal, concrete, masonry and wood.

The application is applied using a texture sprayer. For specific instructions on surface preparation, mixing and application, please refer to the SPI Application Instruction sheet for HPC® Coating.

TESTS AND CERTIFICATIONS

1. ASTM C 177 – Conductivity (0.06 w / m °K)
2. ASTM E 84 – Class A
3. ISO 8302 – Thermal Conductivity
4. IMO – MSC.61(67) Smoke and Toxicity Test
5. Marine Approvals – American Bureau of Shipping;
6. USDA Approved

MINIMUM SPREAD RATES (mil thickness)

26.0 sq. ft./gal = 50 mils dry film thickness
13.0 sq. ft./gal = 100 mils dry film thickness
6.5 sq. ft./gal = 200 mils dry film thickness
5.2 sq. ft./gal = 250 mils dry film thickness

PHYSICAL DATA

- Solids: By Weight: 54.43% / By Volume: 80.31%
- Dry Time: If over 200-300°F.; 10-30 minutes per coat, or until steaming action has finished.
- Lead and chromate free
- Water-borne
- Cures by evaporation
- Weight: 4.4 lbs. per gallon
- Vehicle Type: Urethane / Acrylic Blend
- Shelf Life: Up to 1 year if unopened under appropriate storage conditions (See MSDS)
- VOC Level: 14 grams/liter
- pH: 8.5-9.0
- USDA Approved
- Maximum Surface Temperature when applying: 700°F (371°C)
- Minimum Surface Temperature when applying: 40°F (5°C)
- Maximum Surface Temperature after curing: 700°F (371°C)

IMPORTANT

Do not take internally. Avoid contact with eyes. If solution does come in contact with eyes, flush immediately with water and contact a physician for medical advice. Avoid prolonged contact with skin or breathing of spray mist. **KEEP OUT OF REACH OF CHILDREN.**

LIMITATION OF LIABILITY: The information contained in this data sheet is based upon tests that we believe to be accurate and is intended for guidance only. All recommendations or suggestions relating to the use of the products made by SPI, whether in technical documentation, or in response to a specific enquiry, or otherwise, are based on data which to the best of our knowledge is reliable. The products and information are designed for users having the requisite knowledge and industrial skills, and the end-user has the responsibility to determine the suitability of the product for its intended use.

SPI has no control over either the quality of condition of the substrate, or the many factors affecting the use and application of the product. Therefore, SPI does not accept any liability arising from loss, injury, or damage resulting from such use or the contents of this data sheet (unless there are written agreements stating otherwise)

The information contained in this data sheet is subject to modification as a result of practical experience and continuous product development. This data sheet replaces and annuls all previous issues and the user has the responsibility to ensure that this sheet is current prior to using the product.

Superior Products International II, Inc. • 10835 W. 78th Street • Shawnee, KS 66214
Website: www.spicoatings.com • Email: sales@spicoatings.com

HPC® Coating

Application Instructions

(4/03/09)

HPC® Coating is designed to control heat transfer for temperatures up to 700°F (371°C). It is lightweight and smooth in appearance after mixing. HPC® Coating is a water-borne system using a special acrylic/urethane blend with specific ceramic compounds to provide a non-conductive block against heat transfer. HPC® Coating offers a non-flammable/non-toxic formula for hot surface applications over standard steam pipe or oven wall construction, but can be used for insulation of vessels well below freezing, after cured. The coating was designed to create a monolithic insulation system that can be sprayed over most surfaces and higher temperatures. It can be applied over metal, concrete, wood, gypsum, and most other substrates.

SURFACE PREPARATION

Surface must be clean from oil, tar, rust, grease, salts, and films.

1) Clean ambient surfaces using TSP (tri-sodium-phosphate) or a citrus cleaner to release dirt and degreaser residue and pressure-wash if possible @ 3500 psi. and allow to dry
2) Salt contamination on a surface can come as a result of salt water, fertilizers, and car exhaust. Use Chlor*Rid or equivalent to decontaminate surface if salts are present. Acceptable levels: Nitrates: 5-10 mcg/cm², Sulfates: 5-10 mcg/cm², Chlorides: 3-5 mcg/cm²
3) Clean hot surfaces by removing pack rust, loose dirt and rust using a metal brush or mechanical tool, Remove mil-scale by grit blast, power tool or needle gun.
4) Prime the surface with Rust Grip® if specified.

NOTE: The temperature of a pipe, valve, or tank cannot be determined by taking the exterior surface temperature where heat is released into the atmosphere. Surface temperatures will rise to match the temperature of the fluid or gas contained once the surface is coated and the heat is held back.

MIXING

Mix with commercial drill and a 6" diameter dispersion blade at low or medium speed for 4 minutes to loosen product. Coating will initially look dry and have a "cake-like" appearance. Mechanically stir using blade until water and resins are mixed and coating appears as a thick whipped cream with no lumps. Use an up and down pumping motion while stirring. If it still appears to be dry, slowly add water while continuing to mix. In a 5-gallon pail, a maximum totaling 1 quart (1 liter) of water may be added as needed to achieve the desired consistency.

APPLICATION

HPC® Coating must be applied by spray.

1) Use a hopper gun for small applications.
2) Use a texture sprayer using a 2-4 mm nozzle.
3) Use an airless sprayer that applies 2 gallons per minute at 3300 psi minimum with a 0.33-0.35 tip.
4) See the SPI Application Equipment sheet to reference suggested machines. For specialty applications, contact SPI.
5) HPC® Coating is applied between 40°F (5°C) and 120°F (49°C) ambient. Applied HPC® Coating should never be put into use or exposed to below 40°F (5°C) until it is totally cured and moisture has evaporated from coating. Use a moisture meter to determine moisture content. (5% or less)

__Hot Surface Applications__: Apply a thin priming coat of HPC® Coating at 50 mils wet (1.25mm) and allow coating to cure down and moisture to steam off. (Approx. 5 minutes) Once steaming has stopped, apply additional coats of HPC® Coating at 100-200 mils wet per coat (depending on surface temp) to build to specified thickness. Allow coating to completely steam off between coats before applying additional product. After proper thickness is achieved, allow 24 hours to fully dry and cure before top-coating. Top-coat cured HPC® Coating with SUPER THERM® to toughen and weatherize the surface. RUST GRIP® or ENAMO GRIP can be used over SUPER THERM® to strengthen surface or add color when specified.

NOTE: If initial coat or additional coats are applied too thick, bubbles will appear and begin to rise. Bubbles can be punctured to release trapped air and pressed down to allow bubble to adhere.

__Cold Surface Applications__: Apply a thin priming coat at 50 mils wet (1.25 mm) and allow to dry down by evaporation. Build desired thickness to the specified amount using several applications giving each coat time to mostly dry. (Approximately 4 hours at 70° (21°C). Curing can be enhanced by introduction of dehumidification and heat into the surrounding environment.

__Manufacturing or OEM Applications__: Please contact SPI office.

CLEAN-UP EQUIPMENT

During breaks, spray systems should be flushed with water. After completion, spray systems should be flushed and cleaned with soap and water.

__Storage of Product__: Store HPC® Coating between 40°F (5°C) and 120°F (49°C)

April 1, 2004

FOR

UNITED STATES
DEPARTMENT OF AGRICULTURE
(USDA)

FOOD SAFETY AND INSPECTION SERVICE
WASHINGTON, D.C. 20250

"FSIS DIRECTIVE 11,000.4"
APPROVAL OF PAINTS AND COATINGS USED IN OFFICIAL ESTABLISHMENTS

LETTER OF WRITTEN CERTIFICATION
AS ACCEPTED BY USDA FROM MANUFACTURER

PRODUCT IDENTIFICATION: **HOT PIPE COATING**

SUPPLIER'S NAME AND ADDRESS: SUPERIOR PRODUCTS INTERNATIONAL II, INC.
10835 W. 78th St.
Shawnee, KS 66214
USA

STATEMENT FOR FINISHED PRODUCT:
HOT PIPE COATING is suitable for the intended purpose and will not result in adulteration of food products if used and applied as intended or indicated on the label directions/technical data sheets.
HOT PIPE COATING will perform, after curing completely and a topcoat of ENAMO GRIP, well under a daily regimen of cleaning, cyclical temperature change, and wet conditions.
HOT PIPE COATING is moisture resistant.
HOT PIPE COATING is a light solid color that will not obscure detection of debris or unsanitary conditions.
HOT PIPE COATING contains no known categories of carcinogens, mutagens and teratogens classified as hazardous substances, heavy metals or other toxic substances.
HOT PIPE COATING is not considered a pesticide and does not have pesticidal characteristics.
Manufacturer/supplier will provide to FSIS, in a timely fashion, the complete chemical composition of the materials used to manufacture the product upon request.

SIGNED:

J.E. Pritchett, President
Superior Products International II, Inc.

Karen M. Wasson, DVM
Director, USDA
Facilities, Equipment and Sanitation Division
Approval of Paints and Coatings

FACULTEIT INGENIEURSWETENSCHAPPEN
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KATHOLIEKE
UNIVERSITEIT
LEUVEN

RAPPORT

Superior products NV
Kampweg, 123
2990 Wuustwezel

Hot Pipe Coating

Thermal conductivity

Report 2006/20 (1)

1. Introduction

On November 8, 2006, the Superior Products NV company demanded the Laboratory of Building Physics at the K.U.Leuven to measure the thermal conductivity of 'Hot Pipe Coating'.

This report describes the measuring method, gives the results of the measurements and contains a short discussion on accuracy and values to use.

2. Thermal conductivity of Hot Pipe Coating

2.1 Samples

The laboratory received 4 samples, composed of a substrate board of 4 mm, finished with 'Hot Pipe Coating'. Characteristics:

Sample	Thickness M	Weight G
1	0.0372	1152
2	0.0376	1181
3	0.0175	647
4	0.0175	652

2.2 Measurements

2.2.1 Method

Thermal resistance of the 4 samples was measured with the heat flow meter apparatus for samples 30x30 cm, as described in the standard ISO 8302 (figure 1). The apparatus consists of a central hot plate with a cold plate above and below. That way, two samples can be tested at the same time. Round heat flow meters with a diameter of 10 cm are positioned centrally at the underside of the top plate, at both sides of the central plate and at the upside of the lower plate. These heat flow meters are embedded in a neoprene layer with the same thickness as the meters and as large as the area of the plates. In the centre of each plate side, extremely thin Cu/Co thermocouples are glued against the heat flow meters. The samples are then mounted between the top plate and the central plate and between the lower plate and the central plate. The whole is finally packed in a thermally isolating box as to create close to adiabatic conditions around the set-up. Before the measurements started, the heat flow meters were recalibrated using the reference samples of the EU's BCR.

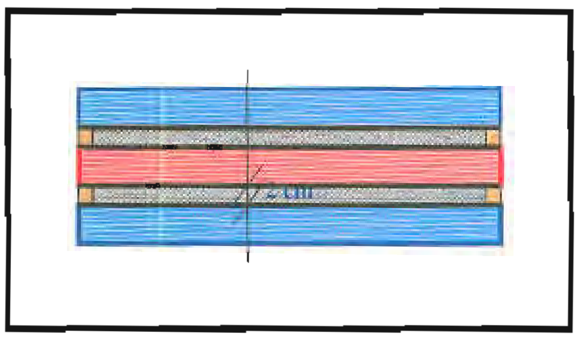

Figure 1 The experimental set-up. The central plate is coloured in red, the top and bottom plate in blue. The thick black line around the set-up coincides with the borders of the insulated box, which should create a near adiabatic border between the set-up and the environment. The thinner black lines against the plates represent the neoprene layers with embedded heat flow meters

Temperature difference between the thermostatic bath that keeps the top and lower cold plate on temperature and the thermostatic bath that keeps the central warm plate on temperature is set at 10°C. As soon as the temperatures and the heat fluxes at both surfaces of the samples turn constant, all data are logged at a time interval of 10" and stored on hard disk. All further calculations are done in Excel: transforming the 10" values in averages spanning three hours and calculating thermal resistance with the following equation:

$$R = \frac{2\Delta\theta}{C_1E_1 + C_2E_2} \qquad (m^2.K/W) \qquad [1]$$

with:
- C_1, C_2 — Calibration constants of the heat flow meters in $W/(m^2.mV))$
- E_1, E_2 — Measured electrical voltage difference over the heat flow meters in mV
- $\Delta\theta$ — Temperature difference over the samples in K (measured with the Cu/Co thermocouples)

2.2.2 Measured results

Sample	Thickness m	Vol. moisture ratio %m³/m³	Mean temperature °C	Temp. Difference °C	Thermal resistance [(1)] m².K/W
1	0.0372	0	1.5	9.0	0.60^{2}
			11.5	9.2	0.58^{7}
			21.4	9.2	0.58^{0}
			31.3	9.3	0.57^{2}
			41.2	9.2	0.56^{0}
2	0.0376	0	1.6	8.9	0.60^{7}
			11.6	9.1	0.59^{0}
			21.5	9.2	0.58^{0}
			31.4	9.2	0.57^{2}
			41.3	9.2	0.56^{2}
3	0.0175	0	1.6	8.4	0.26^{8}
			11.6	8.7	0.26^{2}
			21.4	8.6	0.25^{9}
			31.4	8.6	0.25^{3}
			41.3	8.6	0.25^{2}
4	0.0175	0	1.8	8.3	0.27^{4}
			11.7	8.6	0.26^{9}
			21.5	8.6	0.26^{5}
			31.5	8.6	0.26^{1}
			41.4	8.6	0.25^{8}

[(1)] The last number in superscript is unsure

2.2.3 Measuring accuracy

The maximum uncertainty on the measured data is given by:

$$\left|\frac{\partial R}{R}\right| \leq \left|\frac{\partial q}{q}\right| + \left|\frac{\partial \theta}{\theta}\right| + \left|\frac{qR_n}{\Delta\theta}\right| \qquad [2]$$

with q heat flux in W/m². The term $\left|\frac{qR_n}{\Delta\theta}\right|$ represents a systematic failure, the consequence of a kind of zero thickness thermal resistance between the plates and the samples in between (in m².K/W). In the case being, its value does not pass 0.006 m².K/W.

As most probable uncertainty, one has:

$$\frac{\partial R}{R} \leq \pm\sqrt{\left|\frac{\partial q}{q}\right|^2 + \left|\frac{\partial \theta}{\theta}\right|^2} \pm \left|\frac{qR_n}{\Delta\theta}\right| \qquad [3]$$

Results:

Sample	$\left\|\frac{\partial q}{q}\right\|$ %	$\left\|\frac{\partial \theta}{\theta}\right\|$ %	$\left\|\frac{qR_n}{\Delta\theta}\right\|$ %	Maximum uncertainty %	Most probable uncertainty %
1	1.5	0.55	1	3.1	1.9
2	1.5	0.55	1	3.1	1.9
3	1.5	0.55	2.2	4.4	2.8
4	1.5	0.55	2.2	4.4	2.8

2.2.4 Discussion

2.2.4.1 Thermal permeance versus mean temperature

- The measured data allow constructing the relationship between thermal permeance of the samples and the mean temperature in the samples. A least square analysis gives:

  In general

  $$P = \frac{1}{R} = a_\theta + b_\theta \bar{\theta}$$

  with P thermal permeance in W/(m².K) (is the inverse of thermal resistance) and $\bar{\theta}$ average temperature in °C

  Samples 1 and 2

  $a_\theta = 1.656$ $b_\theta = 0.00308$
  $\sigma_a = 0.0041$ $\sigma_b = 0.00016$
  $r^2 = 0.979$ $F = 366$
  10 values

  Samples 3 and 4

  $a_\theta = 3.692$ $b_\theta = 0.00584$
  $\sigma_a = 0.0032$ $\sigma_b = 0.00127$
  $r^2 = 0.727$ $F = 21.3$
  10 values

  [4][5]

  See also the figures 2 and 3.

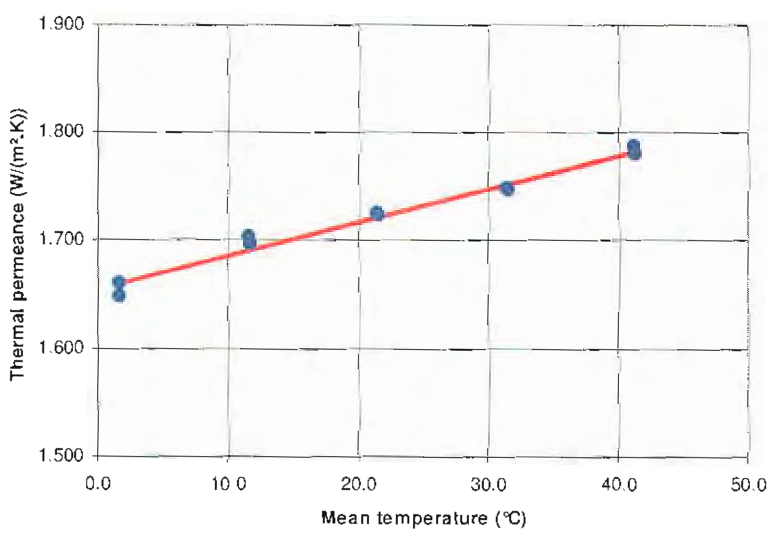

Figure 2 Samples 1 and 2, relationship between thermal permeance and mean temperature in the material

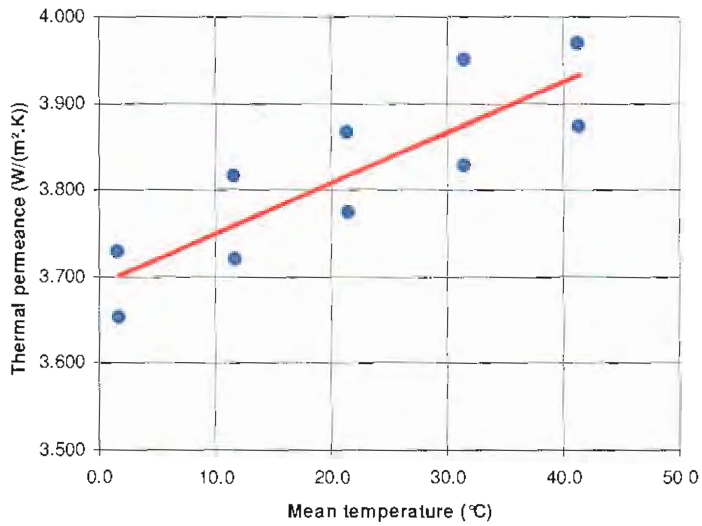

Figure 3 Samples 3 and 4, relationship between thermal permeance and mean temperature in the material

2.2.4.2 Thermal conductivity of Hot Pipe Coating

The samples 1, 2 3 en 4 are composed of a 4 mm thick substrate board finished with Hot Pipe Coating. With other words, the samples 1 and 2 contain 33.16 mm, respectively 33.56 mm of ceramic paste, while the samples 3 and 4 contain 13.53 mm, respectively 13.46 mm of ceramic paste. If we call the thermal resistance of the substrate board R_o, then at each mean temperature, we may write:

$$R = \frac{d_{hpc}}{\lambda_{hpc}} + R_o$$

That gives four equations per temperature step with two unknown: λ_{hpc} en R_o. These equations have been solved statistically, resulting in a thermal resistance R_o for the substrate board of 0.045 m².K/W, while the thermal conductivity of the ceramic paste became:

Mean temperature °C	Thermal conductivity W/(m.K)
1.6	0.059^6
11.6	0.061^5
21.5	0.062^5
31.4	0.063^1
41.3	0.065^0

In a formula:

$$\lambda = 0.059^8 + 0.000115\overline{\theta}$$

$$a_\theta = 0.00045 \quad b_\theta = 2.25\,10^{-5}$$

$$r^2 = 0.929 \qquad F = 26.2$$

5 values

Also see figure 4. Uncertainty: a maximum of ±6.3% and a most probable value of ±3.5%.

Thermal conductivity at a mean temperature of 10°C:

$$\lambda=0.061 \pm 0.002$$

i.e. a rather high value. The reason is the quite high density of Hot Pipe Coating: not less than 299 ±3.3 kg/m^3.

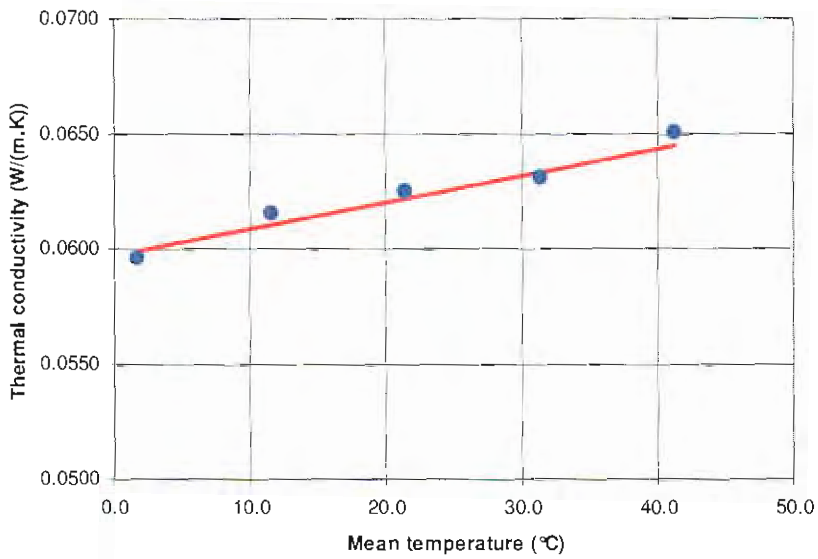

Figure 4 Relation between the thermal conductivity of Hot Pipe Coating and its average temperature

2.2.4.3 Thermal conductivity at different mean temperatures

These are given in the following table:

Mean temperature °C	Thermal conductivity W/(m.K)
-10	0.059
0	0.060
10	0.061
20	0.062
30	0.063
50	0.066
100	0.071
200	0.083
300	0.094
400	0.106
500	0.117

As all insulating materials, Hot Pipe Coating performs the best at low temperatures. Above a mean temperature of 350°C, its thermal conductivity passes 0.1 W/(m.K). The effect on the surface temperature and the heat loss of 1 meter run steel pipe thus depends on the temperature of the fluid in the pipe, de insulation thickness applied, the diameter of the pipe and the fact of the pipe hangs inside or outside. Only to illustrate the effect of Hot Pipe Coating, we calculated the reduction in heat loss per meter run for a steel pipe with an exterior diameter of 10 cm, hung in an environment with an effective temperature of 20°C. The pipe transports a 350°C hot fluid and is insulated with a 1 cm thick layer of Hot Pipe Coating. Without coating, the heat loss touches 3409 W/m. With Hot Pipe Coating it diminishes to 776 W/m, i.e. a decrease with 77.3%. The average thermal conductivity in the coating then reaches 0.088 W/(m.K).

Leuven, 4/7/2007

H. Hens
Professor

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HOT PIPE COATING

Conductivity Testing and Results

1. **<u>Conduction Testing via ASTM C-177 Method:</u>**
   Thermal conductivity over three tests: 0.560 BTU
   To find the Lambda Value or K (0.560 X 0.144 = 0.0806 k value
   Average 600 mils (14mm)
   Convert k 0.0806 X0.5778 (Heat Conversion Handbook Pg. 506) to K for sq.m = 0.0466.
   Whereas R = 1/K = 21.46

2. **<u>Conduction Testing via the ASTM FLASH METHOD (E 1269 and E 1461-92)</u>**
   K value average is 0.1083
   0.1083 X 0.5778 = 0.063K for sq.m
   R-1/K – 15.87
   Average 38 mils (.90 mm)

ASTM C 177 TESTING

FOR

SUPERIOR PRODUCTS INTERNATIONAL II, INC.

ON

HOT PIPE COATING

VTEC #100-1888

TESTED: FEBRUARY 26, 2004

VTEC Laboratories Inc.

March 4, 2004

Client: Superior Products International II, Inc.
10835 W. 78th Street
Shawnee, KS 66214

Attention: Mr. J.E. Pritchett

Subject: Standard Test Method For Thermal Conductivity According to ASTM C 177.

Sample Description: Hot Pipe Coating Batch #121703

RESULTS:

THERMAL CONDUCTIVITY(k) (Btu-in/h-sq. ft.-deg F)

SAMPLE THK. (mils)	HOT FACE TEMP DEG F	COLD FACE TEMP DEG F	AVERAGE TEMP DEG F	THERMAL CONDUCTIVITY(k)	HR FT2 °F/BTU RESISTANCE(R)
361	217.2	186.5	201.9	0.640	0.564
611	219.5	184.0	201.8	0.525	1.160
918	216.8	185.6	201.2	0.528	1.740

Neil Schultz
Executive Director

Amirudin Rahim
Technical Director

DISCLAIMER: This test result alone does not assess the fire hazard of the material, or a product made from this material, under actual fire conditions. Consequently, the results of this test alone are not to be quoted in support of claims with respect to the fire hazard of the material or product under actual fire conditions. The results when used alone are only to be used for research and development, quality control and material specifications.

NOTICE: VTEC Laboratories Inc. will not be liable for any loss or damage resulting from the use of the data in this report, in excess of the invoice. This report pertains to the sample tested only. Such report shall not be interpreted to be a warranty, either expressed or implied as to the suitability of fitness of said sample for such uses or applications, as the party contracting for the report may apply such sample.

##General_information

#Database	vtech-078
#Instrument	#LFA_447
#Identity	242s2202 05 08.30
#Date	8/30/2005
#Material	HPC
#Ref_temperature /°C	25
#Ref_density /(g/cm^3)	0.408
#Sample	HPC
#Type	#Single_layer
#Thickness_RT/mm	0.922
#Diameter/mm	12.7
#Sensor	InSb
#Operator	roc
#Remark_mment	Vtech
#Cp_table	HPC
#Expansion_table	dL_const

##Results

Shot_number	Temperature/°C	Diffusivity/(mm^2/s)	Conductivity/(W/(m*K))	Cp/(J/g/K)
1	24.9	0.204	0.1086	1.327
2	24.8	0.203	0.1086	1.307
3	24.8	0.202	0.1080	1.275
4	24.9	0.202	0.1080	1.300
5	24.9	0.204	0.1090	1.333
6	24.9	0.202	0.1078	1.315
7	25.0	0.203	0.1084	1.303
Mean	**24.9**	**0.203**	**0.1083**	**1.309**
Std_Dev		0.0008	0.0004	0.0193

Convert From	Into	Multiply By
Watts	Btu/sec	0.000948
	Btu (mean)/sec	0.000947
	Cal,g/hr	860.42
	Cal,g (mean)/hr	859.18
	Cal,g (@20°C)/hr	860.85
	Cal,g/min	14.34
	Cal,g (IST)/min	14.331
	Cal,g (mean)/min	14.3197
	Cal,kg/min	0.01434
	Cal,kg (IST)/min	0.01433
	Cal,kg (mean)/min	0.01432
	Ergs/sec	1×10^{7}
	Foot pound–force/min	44.2537
	Foot pound–force/sec	0.737562
	Horsepower	0.00134
	Horsepower (boiler)	0.0001
	Horsepower (electric)	0.00134
	Horsepower (metric)	0.0013596
	Joules/sec	1
	Kilogram–calories/min	0.01433
	Kilowatts	0.001
	Liter–atmosphere/hr	35.529
	Watts (Int)	0.99984
Watts (Int)	Btu/hr	3.41499
	Btu (mean)/hr	3.41008
	Btu/min	0.569165
	Btu (mean)/min	0.0568
	Cal,g/hr	860.56
	Cal,g (mean)/hr	859.326
	Cal,kg/min	0.0143
	Cal,kg (IST)/min	0.01433
	Cal,kg (mean)/min	0.01432
	Ergs/sec	1.000165×10^{7}
	Joules (Int)/sec	1
	Watts	1.000165
Watts/sq cm	Btu/(hr x sq ft)	3172.1
	Cal,g/(hr x sq cm)	860.421
	Foot lbf/(min x sq ft)	44113
Watts/sq in	Btu/(hr x sq ft)	491.68
	Cal,g/(hr x sq cm)	133.365
	Foot lbf/(min x sq ft)	6372.5
Watt/sq meter	Foot lbf/hr sq meter	2655.2
	Horsepower/sq meter	0.00134
	Joules/hr sq meter	3600
	Joules/sec sq meter	1.0
	Kilowatts/sq meter	0.001
Watt/meter K	Btu/hr foot °F	0.5778
	Kilocalories/hr foot °C	0.26200
Watt–hours	Btu	3.4144
	Btu (mean)	3.4095
	Cal,g	860.42
	Cal,kg (mean)	0.85918
	Cal,g (mean)	859.18
	Ergs	3.60×10^{10}

Convert From	Into	Multiply By
Watt–hours	Foot pound–force	2655.22
	Hp–hours	0.00134
	Joules	3600
	Joules (Int)	3599.41
	Kg-calories	0.8604
	Kg–force meter	367.098
	Kw–hours	0.001
	Watt–hours (Int)	0.9998
Watt–sec	Foot pound–force	0.73756
	Gram–force cm	10197.2
	Joules	1
	Liter–atmospheres	0.00987
	Volt–coulombs	1
Webers	Kilolines	1×10^{5}
	Lines	1×10^{8}
	Maxwells	1×10^{8}
	Volt–seconds	1
Webers/sq cm	Gausses	1×10^{8}
	Lines/sq cm	1×10^{8}
	Lines/sq in	6.4516×10^{8}
	Teslas	1×10^{4}
Webers/sq in	Gausses	1.550003×10^{7}
	Lines/sq inch	10^{8}
	Webers/sq cm	0.1550
	Webers/sq meter	1550
	Teslas	1.550003×10^{3}
Webers/sq meter	Gausses	10^{4}
	Lines/sq inch	6.452×10^{4}
	Teslas	1.0
	Webers/sq cm	10^{-4}
	Webers/sq inch	6.452×10^{-4}
Weeks (mean calendar)	Days (mean solar)	7
	Days (sideral)	7.01916
	Hours (mean solar)	168
	Hours (sideral)	168.46
	Minutes (mean solar)	10080
	Minutes (sideral)	10107.6
	Months (lunar)	0.237042
	Months (mean calendar)	0.230137
	Years (calendar)	0.019178
	Years (sideral)	0.0191646
	Years (tropical)	0.019165
Weys (Brit)	Pounds (avdp)	256
Yards	Centimeters	91.44
	Chains (Gunter's)	0.454545
	Chains (Ramden's)	0.03
	Cubits	2
	Fathoms	0.5
	Feet	3
	Feet (US Survey)	2.999994
	Furlongs	0.004545
	Inches	36
	Kilometers	9.144×10^{-4}
	Meters	0.9144

TEMPERATURE DIFFERENCE TESTING
FOR
SUPERIOR PRODUCTS INTERNATIONAL
ON
HOT PIPE COATING BATCH 062303
VTEC #100-1787
TESTED: OCTOBER 10, 2003

VTEC Laboratories Inc.

October 10, 2003

Client: Superior Products International
10835 West 78th street
Shawnee, Kansas 66214

Attn: J.E. Pritchett

Subject: Determine the Temperature Difference of Various Thickness of Hot Pipe Coating Batch 062303 on Steel Substrate Using a Hot Plate.

Procedure:

VTEC Laboratories Inc. prepared specimens using Hot Pipe Coating Batch 062303 provided by Superior Products International II, Inc. The Hot Pipe Coating Batch 062303 was applied at various thicknesses to 11 gauge steel substrates. The prepared specimens were tested for temperature difference using a hot plate.

The specimens were placed on the hot plate with the steel side exposed to the hot plate. A thermocouple was placed between the hot plate and the steel to measure hot face temperature. Another thermocouple was placed on the unexposed side of the Hot Pipe Coating Batch 062303 to measure cold face temperature. This thermocouple was kept in place using an aluminum tape, which also covered the tip to produce more accurate cold face temperature.

The temperature of the hot plate was adjusted to various temperatures and the hot and cold face temperatures were recorded when a steady state was reached. The edges of the specimens were insulated with 1" thick by 2" wide ceramic insulation blanket to prevent lateral heat loss.

212 Manida Street • Bronx, New York 10474 • (718) 542-8248 • Fax: (718) 542-8759 • www.vteclabs.com

HOT PIPE COATING

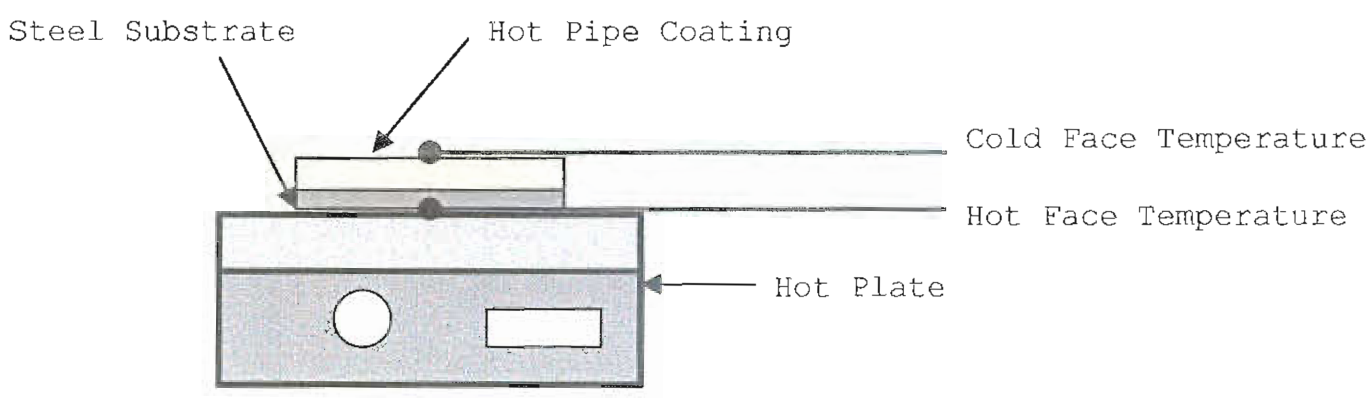
RESULTS:

PRODUCT: Hot Pipe Coating Batch 062303 on 11 Gauge Steel 4"x4"

HOT PIPE COATING BATCH 062303 Thickness (mils.)	Nominal Hot Plate Temperature (Deg. F): 200	300	400	500	600	700	800	900	1000
	Cold Face Temperature (Deg. F)								
50	154	203	296	-	-	-	-	-	-
100	123	168	262	315	-	-	-	-	-
250	147	163	204	254	304	343	-	-	-
400	120	144	181	232	271	321	-	-	-
500	118	146	179	194	234	257	-	-	-
600	-	96	119	146	169	196	223	-	-
700	-	-	95	116	130	158	201	240	-
800	-	-	-	107	124	170	182	216	232
1000	-	-	-	-	81	96	117	142	163

Neil Schultz
Executive Director

Amirudin Rahim
Technical Director



SUPERIOR PRODUCTS INTERNATIONAL - HOT PIPE COATING TEST SET-UP

MSC.41(64) TESTING

FOR

SUPERIOR PRODUCTS INTERNATIONAL II

ON

HOT PIPE COATING

BATCH #022304

VTEC #100-1944-20

TESTED: MAY 19, 2004

May 29, 2004

Client: Superior Products International II
10835 W. 78th Street
Shawnee, KS 66214

Attention: J.E. Pritchett

I. INTRODUCTION:

The following Scope, Summary of Method, Test Specimens, and Classification Criteria sections are abridged from the MSC.41(64) Standard Test Method for Measuring Smoke and Toxic Products of Combustion.

II. SCOPE:

The smoke generation test is conducted in accordance with ISO 5659 Part 2, with additional test procedures as described in the MSC.41(64) standard. The method of test covers a procedure for measuring the smoke generated by materials and assemblies in thickness up to and including one inch. The test is based on the attenuation of a light beam by smoke accumulating within a closed chamber. Specimens are mounted horizontally within the chamber and exposed to thermal radiation on their upper surfaces at a constant irradiance of 25 kW/m^2, in both the flaming and non-flaming modes, and at 50 kW/m^2 in only the non-flaming mode.

Additionally, the gas concentrations measured at each test condition. Colorimetric gas detector tubes for each specific gas are used in the toxic gas analysis.

III. SUMMARY OF METHOD:

This method employs an electrically-heated radiant energy source mounted within an insulated ceramic tube and positioned so as to produce the irradiance levels mentioned above. This exposure provides the non-flaming exposures of the test.

For the flaming condition, a six-tube burner is used to apply a row of air-propane flamelets across the lower edge of the exposed specimen area and into the specimen holder trough. The application of flame in addition to the specified irradiance level from the heating element constitutes the flaming combustion exposure.

The test specimens are exposed to the flaming and non-flaming conditions within a closed 18 cubic foot chamber. A photometric system with a 36″ vertical light path measure the continuous decrease in light transmission as smoke accumulates.

When the toxicity measurements are performed, the gases are sampled during the smoke testing of either the second or third specimen at each test condition, from the geometrical center of the chamber within 3 minutes of the time when a maximum specific optical density of smoke is reached. The concentration of each toxic gas is determined as ppm in the chamber volume.

IV. TEST SPECIMENS:

The test sample is comprised of nine specimens; six specimens are tested at 25 kW/m^2 (three in the non-flaming mode and three in the flaming mode), and three specimens are tested at 50 kW/m^2 in the non-flaming mode. A nominal 3″ X 3″ specimen is mounted within a holder, which exposes an area 2-9/16″ X 2-9/16″. The holder can accommodate specimens up to one inch thick, depending on the particular sample thickness. When coating substrates or cores as used in normal practice, including coating items such as paints and adhesives, the number of coats and type of substrate is included in the test report.

V. CLASSIFICATION CRITERIA:

For a material to classify as passing, all smoke and toxicity requirements, per the MSC.41(64) standard, must be met.

Smoke:
For materials used as surface of bulkheads, linings, or ceilings, D_m should not exceed 200 in any test condition.

For materials used as primary deck coverings, D_m should not exceed 400 in any test condition.

For materials used as floor coverings, D_m should not exceed 500 in any test condition.

Toxicity:
The gas concentration measured at each test condition should not exceed the following limits, regardless of whether the material is to be used for bulkheads, linings, ceilings, primary deck coverings, or the surface of floors:

CO	1,450 ppm	HBr	600 ppm
HCl	600 ppm	HCN	140 ppm
HF	600 ppm	SO_2	120 ppm
No_x	350 ppm		

VI RESULTS:

Client: Superior Products International II, Inc.
Sample: Hot Pipe Coating, BATCH #022304,
Date: May 19, 2004

Based upon the test data (found on the following pages), the sample met all the passing criteria as specified by the MSC.41(64) test standard.

Disclaimer: This test result alone does not assess the fire hazard of the material, or a product made from this material, under actual fire conditions. Consequently, the results of this test alone are not to be quoted in support of claims with respect to the fire hazard of the material or product under actual fire conditions. The results when used alone are only to be used for research and development, quality control and material specifications.

Notice: VTEC Laboratories Inc. will not be liable for any loss or damage resulting from the use of the data in this report, in excess of the invoice. This report pertains to the sample tested only. Such report shall not be interpreted to be a warranty, either expressed or implied as to the suitability of fitness of said sample for such uses or applications, as the party contracting for the report may apply such sample.

DATE: 5/19/2004
PROJECT #: 100-1944-20
SUPPLIED BY: Superior Products Inter. II
CONDITIONING TEMP: 73 deg. F
BURNER FUEL: 500 cc/min air; 50 cc/min. propane
SPECIAL PREPARATION: NONE
IRRADIANCE: 25 Kw/sq. m
DESCRIPTION OF MATERIAL: Hot Pipe Coating, batch 022304, applied at a thickness of 115 mils wet (100 mils dry) to an 11 gage steel panel.

	FLAMING			
SAMPLE #:	1	2	3	Average D_m
Type of Holder:	no trough	no trough	no trough	
Thickness (in):	0.23	0.23	0.23	
Weight (g):	154.7	153.8	151.5	
T 100%:	1.006	1.004	0.997	
Tmin:	0.458	0.501	0.458	
Tmin (%):	45.56	49.91	45.97	
D_m:	45.06	39.84	44.56	
T (clear):	0.889	0.841	0.941	
T% (clear):	88.37%	83.74%	94.35%	
D_c (clear):	7.4	10.4	3.2	
D_m (corr):	37.63	29.43	41.38	
D_m:	45.06	39.84	44.56	43.15
Color of Smoke:	Gray	Gray	Gray	

OBSERVATIONS:
The sample ignited at approximately 12 seconds and self extinguished at approximatey 1 minute and 30 seconds.

Neil Schultz
Executive Director

Amirudin Rahim
Technical Director

DATE:	5/19/2004
PROJECT #:	100-1944-20
SUPPLIED BY:	Superior Products Inter. II
CONDITIONING TEMP:	73 deg. F
BURNER FUEL:	500 cc/min air; 50 cc/min. propane
SPECIAL PREPARATION:	NONE
IRRADIANCE:	50 Kw/sq. m
DESCRIPTION OF MATERIAL:	Hot Pipe Coating, batch 022304, applied at a thickness of 115 mils wet (100 mils dry) to an 11 gage steel panel.

	NON-FLAMING			
SAMPLE #:	1	2	3	Average D_m
Type of Holder:	no trough	no trough	no trough	
Thickness (in):	0.23	0.23	0.23	
Weight (g):	152.3	153.0	153.8	
T 100%:	0.995	1.000	0.998	
Tmin:	0.285	0.261	0.294	
Tmin (%):	28.63	26.06	29.51	
D_m:	71.70	77.09	69.97	
T (clear):	0.881	0.789	0.830	
T% (clear):	88.56%	78.92%	83.18%	
D_c (clear):	6.7	13.6	10.4	
D_m (corr):	65.04	63.53	59.53	
D_m:	**71.70**	**77.09**	**69.97**	72.92
Color of Smoke:	Gray	Gray	Gray	

OBSERVATIONS:

The sample ignited at approximately 9 seconds and self extinguished at approximatey 1 minute and 39 seconds.

Neil Schultz
Executive Director

A. Rahim

Amirudin Rahim
Technical Director

TOXICITY

DATE: 5/19/2004
PROJECT #: 100-1944-20
SUPPLIED BY: Superior Products Inter. II
CONDITIONING TEMP: 73 deg. F
BURNER FUEL: 500 cc/min air; 50 cc/min. propane
SPECIAL PREPARATION: NONE
DESCRIPTION OF MATERIAL: Hot Pipe Coating, batch 022304, applied at a thickness of 115 mils wet (100 mils dry) to an 11 gage steel panel.

TOXICITY RESULTS

	25 Kw Non-Flaming	25 Kw Flaming	50 Kw Non-Flaming	
WEIGHT (g):	155.9	153.8	153.0	
GAS	CORRECTED PPM	CORRECTED PPM	CORRECTED PPM	REQUIRED CONCENTRATION LIMITS (PPM)
CO	70	150	250	1,450
HCN	10	2	10	140
SO_2	19	18	20	120
HCL	0	0	0	310
HF	0	0	0	590
NO_X	0	16	0	350
CO_2	2,000	20,000	4,000	60,000
Formaldehyde	2	2	3	3.2
HBr	0	0	0	50

AMBIENT TEMPERATURE: 74.7° F
RELATIVE HUMIDITY: 69%
BAROMETRIC PRESSURE: 29.57 inches of mercury

Neil Schultz
Executive Director

Amirudin Rahim
Technical Director

HPC

When engineers look over the conductive testing for HPC, they only see the K or U value **as stated for the thickness tested**. At this point, there is a very big difference between what thickness the rockwool or fiberglass was tested and the HPC. Given the vast difference in thickness, they must be equaled to make the comparison. When this is done as in any equation, the insulation value is clearly seen and the greater ability of the HPC is far superior.

They have missed a very important point here – "THICKNESS".

Taken from Table 16 of the European heat corss reference chart:
Mineral Wool/ Fiberglass is : 0.040 W/mK **per 2.5cm or 25mm thickness**.
HPC is: 0.1083 W/mK per **.09cm or 0.922mm thickness**

Mineral Wool/Fiberglass is measured per 2.5cm thickness. If 0.040 is at 2.5cm then the increased value is per additional 2.5cm thickness or the insulation value is mutiplied by the per 2.5cm additional thickness.

Therefore, to measure HPC to the Mineral Wool, we have to increase HPC to the thickness of 2.5cm to be equal in thickness in order to compare readings for the W/mK. This increases the insulation value of the HPC by 27.1 multiple increase making the HPC = 0.0004 W/mK per 2.5cm thickness.

Lambda Value: Measured at 2.5cm or 25mm
To convert W/mK to lambda and given from the Cross Reference Chart --(1 BTU/in/sq/ft/hour/F (K value) = 0.144 W/mk). You mulitply the W/mK per 2.5cm by 0.144.
Mineral Wool: 0.040 X 0.144 = 0.00576 lambda value per 2.5cm thickness.
HPC : 0.0004 X 0.144 = .0000576 lambda value per 2.5cm thickness.

From this simple calculation, the HPC increases in insulation value rapidly over mineral wool, fiberglass, foam or perlite.

If they want to compare back to HPC, then they must test their mineral wool / fiberglass at 0.09 cm. Then we will see how well mineral wool / fiberglass performs compared to the same thickness of HPC.

Comparison of Insulation materials.

Question was:
In a message dated 3/31/2007 1:21:05 P.M. Central Standard Time, sortoad@hotmail.com writes:
We came today morning to eastern province. We held a meeting with Al - Ju'aymah Gas Pant contractor today afternoon for some clarification on their BOQ.

Tomorrow I am scheduled to do a presentation at Al Hawyiah NGL for 50 Engineers of Aramco.
The main subject of the presentation is the comparison between:
HPC/HSC Vs, Rock Wool, Fiber Glass, Calcium Silicate, Perlite, PIR, SPF and Foamglas (of PC) for Hot and Cold application.

Please provide ASAP the R value or K value for all above mentioned products If the thickness of each products is One Inch.

you Immediate reply will be highly appreciated.

Regards,
Shareef

Fiberglass and Rock Wook is R 3 per 25mm.
Calcium Silicate is approximately R 3 per inch or 25mm.
A part of a report on the Calcium Silicate site that talks about Calcium and fiberglass and rock wool talks about moisture and the problems: See below in their Question/Answer Section:

Q. My insulation has gotten wet – can it be used?
A. IIG products are not designed for use in wet applications. In all cases, insulation that has been saturated, either through heavy rain or snow, persistent condensation, or immersion should be replaced.

There are several key factors that influence the decision to use or replace wet insulation. These are:

1. **The type of insulation**
2. **Quantity of water**
3. **Time or duration of exposure**
4. **Ambient conditions**

Obviously, the longer the insulation is exposed, the higher the probability of irreversible damage.

Calcium silicate absorbs water readily, and should be protected from environmental water prior to system operation. For industrial applications where water exposure is anticipated, consider the use of IIG Sproule Perlite insulation – it repels water, and the silicates can form a protective barrier to prevent possible corrosion against the piping.

IIG Minwool products can be used if exposed briefly to water, provided conditions allow the products to dry completely prior to installation. Minwool products that have become wet to the point of dimensional change or where "puddling" appears should be discarded.

In summary, wet insulation should generally be replaced. Thoroughly wet or saturated insulation should always be replaced. It is the judgment call of the user to determine whether the material is suitable for re-use.

I ran across an industry standard R value chart--see below:

R-Value Table

Insulation Values For Selected Materials

Use the R-value table below to help you determine the R-value of your wall or ceiling assemblies. To obtain a wall or ceiling assembly R-value you must add the r-values of the individual components together. See the following example:

Wall Assembly R-Value

Component	R-value
Wall - Outside Air Film	0.17
Siding - Wood Bevel	0.80
Plywood Sheathing - 1/2"	0.63
3 1/2" Fiberglass Batt	11.00
1/2" Drywall	0.45
Inside Air Film	0.68
Total Wall Assembly R-Value	**13.73**

R-Value Table

Material	R/ Inch	R/ Thickness
Insulation Materials		
Fiberglass Batt	3.14	
Fiberglass Blown (attic)	2.20	
Fiberglass Blown (wall)	3.20	
Rock Wool Batt	3.14	
Rock Wool Blown (attic)	3.10	
Rock Wool Blown (wall)	3.03	
Cellulose Blown (attic)	3.13	
Cellulose Blown (wall)	3.70	
Vermiculite	2.13	
Autoclaved Aerated Concrete	3.90	
Urea Terpolymer Foam	4.48	
Rigid Fiberglass (> 4lb/ft3)	4.00	
Expanded Polystyrene (beadboard)	4.00	

Extruded Polystyrene	5.00	
Polyurethane (foamed-in-place)	6.25	
Polyisocyanurate (foil-faced)		

In testing for heat transfer, both HPC and HSC were tested at 1mm and found to have a R value of 15.69 per only 1mm. See attached.

15 May 06

Mr. Keith Kieres
GBRX Inc.

Subject Preliminary Thermal Conductivity Calculations for Hot Pipe Coating (HPC) Superior Products

Dear Keith,

In reference to the above product, testing was performed to identify thermal characteristics. These included:

1- Diffusivity
2- Conductivity
3- Specific heat

The test method for the thermal testing is the ASTM E1461 (DIN EN 821 or DIN 30905). The equipment is calibrated with a NIST SRM 8421, thermal conductivity reference. The average conductivity value in W/mK at room temperature is 0.1083 which converts to a k value of 0.75 at one inch (Btu-in/hr ft F). However, since this value is at one inch and the HPC had an actual thickness of 0.037 in. an adjustment is necessary. This would then adjust the HPC k value of 0.028 at the 0.037 in. thick, which would yield an **R-value of 35**. However, Superior through their conservatism and other testing (ASTM C 236) has decided to establish an R-value of 19.

The majority of insulation thermal properties either tested or calculated are based on "standard" insulation such as foam or fiberglass. Hence the mechanisms for measurements and their related calculations are primarily oriented for properties of conduction. Convection and radiation play a small part in the measurement or calculation. When an insulation material has a mechanism of operation different than that of standard insulations, current technology for measuring and calculating become problematic. The most effective method of demonstrating the insulation value is through actual test of the product or a simulation.

Do not hesitate to contact me if there are any other questions.

Very truly yours,

Neil Schultz
Executive Director

HOT PIPE COATING

Heat Transfer blocking ability of the ceramics used in the HOT PIPE COATING is not new technology. The ceramics have been in the market between 10 to 100 years.

It is the combination of these ceramics working in a unique blend that allows each of the ceramic compounds to combine their blocking abilities and perform as a whole much better than if each one was used individually. These are known and proven ceramic used for blocking heat transfer in the industry.

Fiberglass, rockwool and foam materials depend totally on having enough thickness to try and resist the transfer of heat lost through the material over a given period of time. It is an established fact that when these materials gain any moisture, humidity or condensation from operational starts and stops, the moisture gain in the material in only a short amount of time will eliminate the insulation effectiveness of the thickness. These materials are only effective if enough thickness is used since trapped air is the main insulation component.

In the ceramic compounds, air has no part in the insulation effort. Since the air can gain moisture and stop it's ability to block heat, this weakest is not one of the components. The ceramic compounds have the physical ability to not absorb heat and will repel heat gain. The ceramics are packed into a tight coating layer to effectively act as a mirror to repel the gain of heat.

Where the fiberglass type materials use air to slow down the heat transfer, the ceramics use actual physical compounds to block the heat transfer by non absorption and repelling. This is why the ceramic compound coating does not absorb moisture and does not condensate during operational start/stops. There is no trapped air that can cool and heat and absorb moisture during the process.

As seen in the field testing over pipes in the petrochemical plants for Chevron/Texaco, Venezuela oil and other application areas, the coating is applied directly over the hot pipes. The Australian Chevron site had 750 F (400 C) surface temperature on the pipe. HOT PIPE COATING was applied at 1 inch (25 mm) and reduced the operational temp of the surface of the coating to 150 F (65 C). BTU heat lost is difficult to measure over fiberglass type materials because of the thickness of the trapped air (fiberglass is 90% air). After a thickness of 1 inch (25mm), the heat transfer is dissipating at a tremendous rate over the surface area of the fibers and the heat lost cannot be detected by touch or probe.

From a study and presentation of Thermal Conductivity of SUPER THERM from PhD Inn Choi on Heat Transfer, he states: "that while Thermal Conductivity does not change with thickness, R-Value is directly proportional to insulation thickness and Thermal Conductance is inversely proportional to insulation thickness. If insulation thickness

increases two fold from its orginal value. it's R-value increases two fold and Thermal Conductance decreases to one half from it's original value." **This simply means that the R-value is directly associated with thickness and not actual heat conductance.** The ceramics are measured directly on heat conductance and not thickness.
When the testing was performed on the coating using the ceramics, the coating at 250 micron thickness performed at a level of 68% increased heat resistance or controlling heat conductance better than three inches of fiberglass. When the ceramic coating was increased in thickness to double it's thickness to 500 microns, it was realized to outperform the fiberglass 75mm thickness by 148% better performance in heat conductance. This was using the reflective ceramics which are only 4 used in SUPER THERM compared to the 8 different ceramics used in HOT PIPE COATING. This testing was sponsored by Bombardier Engineering Group headquartered in Canada.

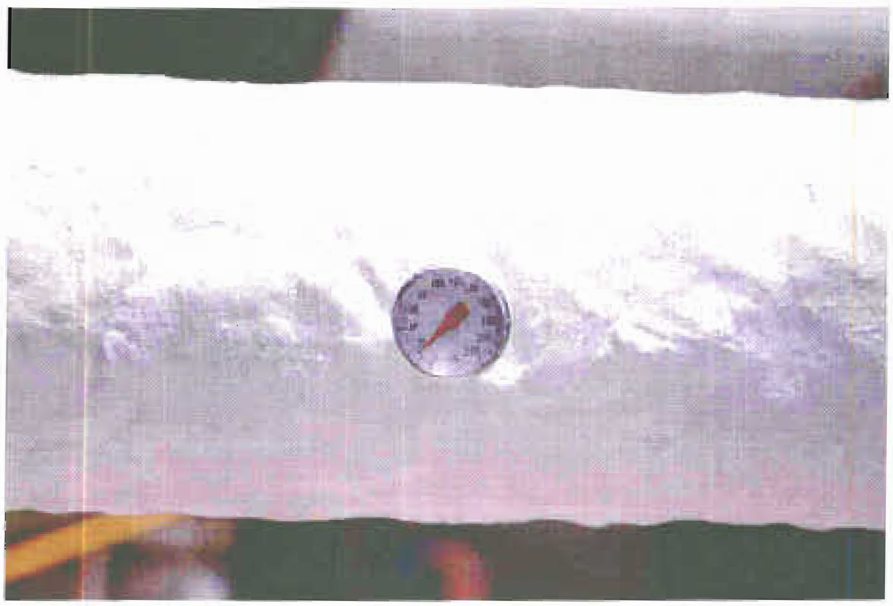
In analyzing insulation effect, the main focal point must be directed to blocking **heat conductance** and not to thickness and the R value given to thickness.

J.E. Pritchett
President
Superior Products International II, Inc.
USA

Cold Pipe

An air-conditioning unit created using dry ice and ducting pipe, to test the HOT PIPE COATING effectiveness in preventing condensation under industrial conditions.

- Outside temperature 93-100° F (34-38° C)
- 4 inch diameter pipe (100mm)
- Prime with RUST GRIP (one coat)
- 250 - 350 mils (6-8mm) thick HOT PIPE COATING.
- ENAMO GRIP W/B White Roofing as the top coat.



- No sweating down to interior temperature of 45° F (7° C).
- Some moisture appeared on the surface of the coating at 30° F (-1° C).
- No drips. Outside temperature at this time was 100° F (38° C)
- Interior temperature of pipe at 14 - 16° F (-10° C), moisture formed on exterior surface of pipe.
- Some drips developed and pooled at base of pipe.

Landsvirkjun, Krafla - wellhead.
Application of *HOT PIPE COATING* and *SUPER THERM*.

LV v06 03-2004

Krafla - the Geothermal Power Plant is the first and only Geothermal plant in Iceland that was built solely for generating electricity. For a while it was uncertain whether Krafla would ever actually enter operation, when large-scale volcanic eruptions started only two kilometres away from the station, posing a serious threat to its existence. Work continued, however, and the station went on stream early in 1977.


Steampipe from well to Power station

Problem.
A wellhead consisting of 300mm pipes and a valve is 220°C hot. The surface, which is ca 7m2, heats up the environment and the walls of a shed, which is dome of steel and fiberglass The heat causes damage to the fiberglass and makes work within the shed uncomfortable The high heat also causes threat of injuries to the workers.


HPC sprayed onto hot surface of the well head

Solution:
Insulate the wellhead and reduce the surface heat.

Task:
Apply HOT PIPE COATING (HPC), which throws back the heat in thickness of ca. 7mm and topcoat with SUPER THERM as reinforcement.

Process:
It was not necessary to shut down the well by closing the valve After preparation the HPC was sprayed directly onto the hot surface, the effect of the HPC was instantly felt after the first coat. The HPC was sprayed in several layers until the desired thickness was reached. When finished the heat of HPC surface was measured and readings showed 60-70°C The heat had therefore dropped by 150-160°C (It should be noted that readings from infrared meters are inaccurate when measuring HPC and SUPER THERM. This is due to ceramic particles that stop infrared waves) By fisically touching the surface the heat seemed even lower It was possible to hold the hand to the surface for a long time without burning


Touching at 7mm from 220°C

As reinforcement a thin layer of SUPER THERM was sprayed on top of the HPC This caused an increase of the surface heat to 70-80°C

Finally RUST GRIP was applied to supporting beams

It was especially noticed how much noise from the wellhead was reduced.

Material description:
HOT PIPE COATING (HPC) is a unique water based formula with 8 different ceramics designed for extreme heat

SUPER THERM is a unique combination of ceramics. Two are reflective, one acts as a dead air space between the coating surface and the substrate and the 4th blocks 99.5% infrared.

Reading on top of
Super Therm showed 74,9°C

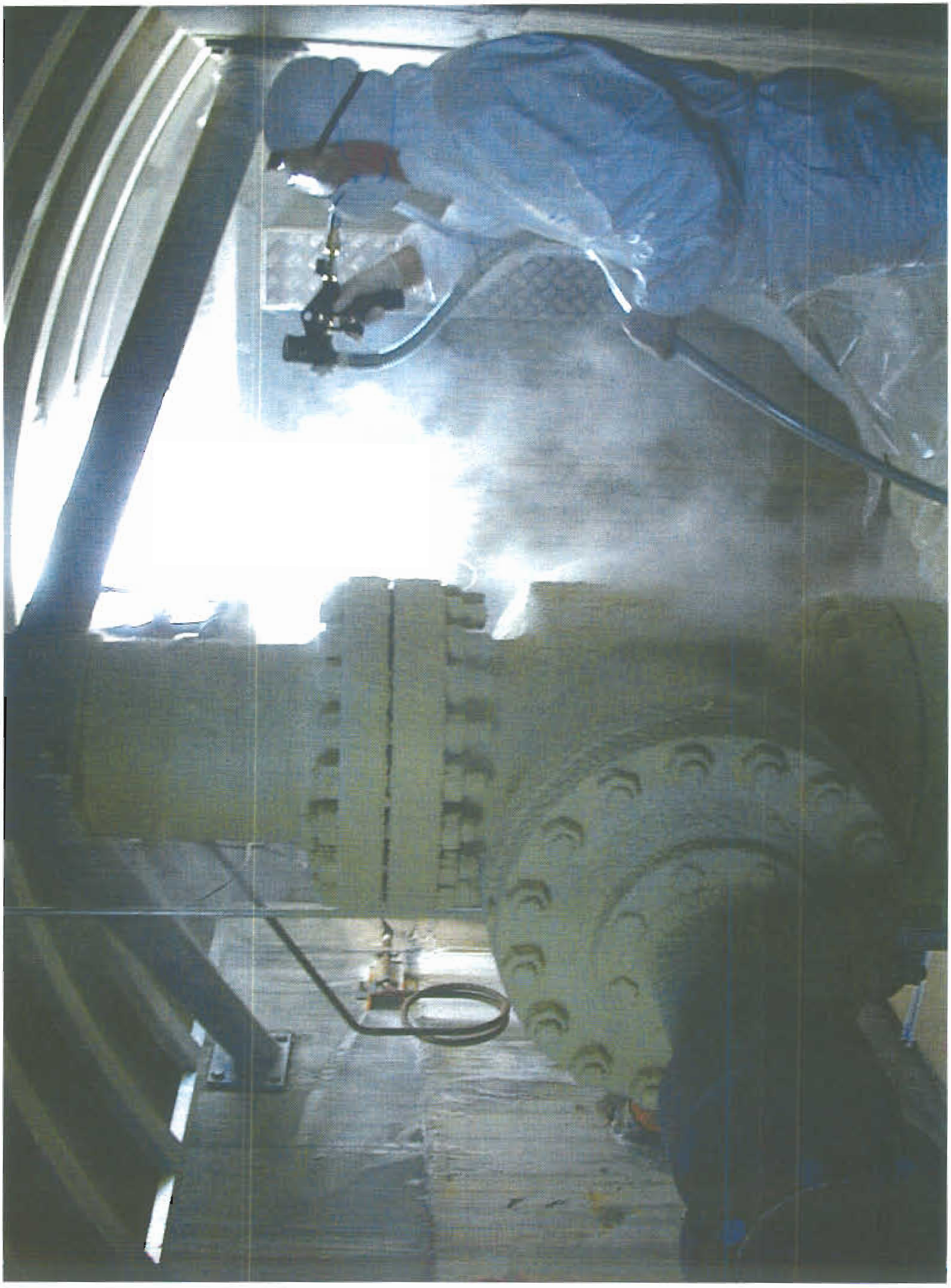

After aplication of
Super Therm and Rust Grip


A small chunk of ice (ca 1 tsp) at 7mm from 170°C took ca 6min to melt

RUST GRIP is a silver-gray solvent-based formula with metallic additives. It is a unique blend that fights corrosion. Designed for metal and concrete surfaces. It penetrates into pores and cracks of the substrate where it swells and bonds thigh


EMERGENCY


TUNEL DE SECADO
SUBE
BAJA

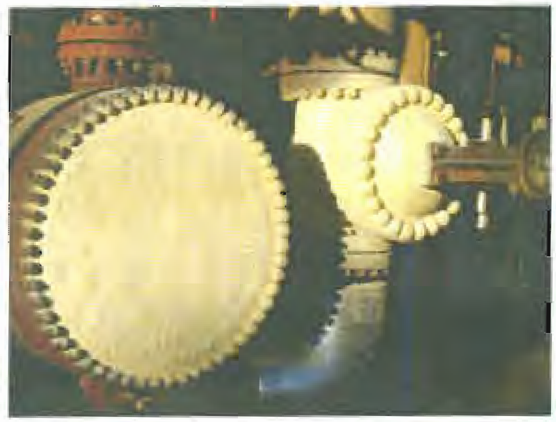



°C
190
ϵ=1.00
MAX 190
MODE
LOCK

64
€=1.00
MAX 67
MODE
LOCK

HOT PIPE COATING

THE HIGH \ LOW TEMPERATURE INSULATION COATING PROVEN TO SAVE BETTER THAN 35% OF FUEL CONSUMPTION INSULATING HIGH TEMPERATURE OVER STEAM PIPES



PROJECT PICTURES   CERTIFICATIONS   APPLICATION

PRODUCT DESCRIPTION:

HOT PIPE COATING is a unique combination of high performance specialy designed high-temperature resins in a waterborne formula. This coating will dry slowly by evaporation and can be aided in the dry down by adding high heat to the environment. The product remains flexible when dried. **HOT PIPE COATING** was built to be used as the initial primer coating and high build coating applied over hot pipes or other high temperature surfaces to achieve immediate adhesion while calming down the hot surface. Using this coating as the primer and base coat, we can achieve adhesion over the hot surface and create a surface that is insulated to stop heat flow. It is waterborne to offer a nonflammable, non toxic formula for high heat situations.

ROCKWOOL/FIBERGLASS WRAP VS. HPC FOR HOT PIPES :

Rockwool/Fiberglass with Metal Jacket	Hot Pipe Coating
Installation	
Must shut down operation to install	HPC is coated without a shut-down
Insulation Effectiveness	
Deteriorates rapidly and loses insulating value when moisture is present plus elbows & valves can not be wrapped effectively so heat losses are significant in these areas	Non Deteriorating and does not lose insulating value when moisture is present plus can be sprayed on elbows and valves reducing the significant heat losses through these areas
Crack Detection	
When a pipe cracks, the entire Jacket and RockWool or FiberGlass must be removed and	When a pipe cracks, it can be inspected directly on the spot without removal and

repaired that requires downtime	easily repaired by spraying or trowel application
Condensation	
High due to the air trapping characteristics of RockWool/Fiberglass	No condensation due to complete surface bond
Corrosion Under Insulation (CUI)	
High due to condensation problem	No condensation thus no corrosion
Repair	
Must shut down operation to repair	No repair is necessary for HPC
Maintenance Costs	
High due to frequent maintenance required for condensation & corrosion control plus high down time, labour and material costs	Low as HPC is directly sprayed without plant shut down plus the labour and material cost are much lower
Life Span	
Lasts about 6 months	Several years

Note : The cost comparison between Rockwool/Fiberglass vs. HPC coating for hot pipes should be made with respect to the total costs. The total costs include material costs, installation costs, repair costs, frequency of downtime, maintenance costs, labour costs and life span. When all these costs are combined, HPC coating is much superior to Rockwool/Fiberglass insulation as evident in the above comparison.

Insulation Chart

Waste of Fuel Per Year by Heat Loss From 1 Foot of Pipe
(Steam at 100 PSI / Ambient Temp. 60° F.)

			Equivalent Pounds of Fuel			
			Coal		Oil	
Pipe Size	BTUs/Hr. Loss	Working Hours	Uninsulated	Insulated	Uninsulated	Insulated
1"	326	2000	80	20	40	10
		6000	240	60	120	30
		8400	340	85	170	43
1½"	447	2000	112	28	56	14
		6000	336	84	178	42
		8400	470	117	235	59
2"	550	2000	136	34	68	17
		6000	408	102	204	51
		8400	508	127	254	64

3"	778	2000	200	50	100	25
		6000	600	150	300	75
		8400	840	210	420	105
4"	978	2000	220	55	110	28
		6000	660	165	330	88
		8400	1020	255	510	128

TECHNOLOGY USED IN THIS PRODUCT:

This formula offers a loose set that is required for quick adhesion while at the same time offering a thick body of ceramics to immediately calm the heat conduction from the surface of the pipe to give better adhesion to the refractory or metal surfaces.

Superior Products International has been experimenting with and developing the uses of "insulation and fire protection" ceramics for over 15 years. This category of ceramic functionality is new to the engineering fields. Only in recent years has the idea of insulation been associated with this new breed of ceramics.

Superior Products International began in the late 1980's to set up an extensive R&D procedure to gather ceramic compounds from all areas of the world for testing. Superior Products International knew that this area had not been thoroughly explored before, nor had any extensive documentation been presented for this application. In contrast, many articles and studies have been devoted to the abrasion resistant ceramic compounds and how they can be used in manufacturing and industrial markets.

Insulative ceramics are completely different and separate from those used for abrasion resistance. As noted in this category, no extensive studies have been performed to determine which ceramic compounds, either natural or manmade would be best suited for eliminating heat transfer. Some studies have acknowledge the "reflection" of heat by mere radiation of sunlight, but since very limited study has been performed, it was thought that reflection was all that this new category of ceramic could provide.

Superior Products International initially worked in the early 1990's with the aid of the **ceramic engineers** at the Marshall Space Center Laboratories, and it was discovered that no real research had been performed across the broad spectrum of possible ceramic compounds in order to determine the scope of ceramics stopping or slowing "heat conduction" rather than merely radiant heat reflection. It was also decided that Superior Products International would continue the R&D work over the next several years to discover the possibilities of this new design of ceramics. An extensive search was organized and begun to locate all possible types of ceramics compounds in the world market for trial-and-error testing. A system was designed to take each compound through a series of heat conduction tests to find its ability to stop heat conduction. More than 1,500 compounds were received and tested. From this R&D period, eight different compounds were identified as having the ability not only to catch and throw heat away from their surfaces in a manner similar to reflection but also to control heat transfer *via* conduction.

Superior Products International chose three of these ceramic compounds to develop its insulation coating called SUPERTHERM. This is a thin film coating that will protect against heat migration equal to six inches of fiberglass batt insulation when applied over surfaces facing the heat source. Eight of the ceramic compounds were also chosen to work in combination with one another to capture surface heat (HOT PIPE COATING), stop heat conduction (REFRACTORY COATING) and glaze or harden to stop flame, smoke or gas penetration (SP2001F).

LIMITED WARRANTY :

Unless Superior Products provides a written warranty of fitness for a particular use, Superior Product's sole warranty is that the product, as supplied, will meet the current sales specifications and is specific only to return of product fonnd to be defective npon opening of container within one year. Customer's exclusive remedy and Superior's sole liability for breach of warranty is limited to refund of the pnrchase price or replacement of any product shown to be other than as warranted and Snperior Products expressly disclaims any liability for incidental or consequential damages.

HOT PIPE COATING

Applied directly over the bolt and nut heads on hot pipes and valves.

I have attached the photo of the dollar plate and the valve on the right has been coated over the bolts and nuts with HPC and the coating follows the contours of the valve as it is designed to do and the valve is fully insulated.
In regards to the nut and bolt thread need to be exposed due to heat could loosen the nut I find this hard to believe and state the following

I have applied HPC in the Petroleum Industry / Refinery on pipes in excess of 450 C and reduced the temperature to 100 / 120 C by applying 15mm and reducing the temperature to 85 / 95 C at 20 mm over this 2 coats of Supertherm and 2 coats Enamo Grip solvent based as these pipes are some time submerged. above the water line we use Rust Grip as this gives a good cladded look finish

I have asked the question regarding leaving the nuts and threads exposed all the engineers that I have spoken to can not give me the full answer as to why as this is a directive by management (question still unanswered)

Doug you said that you going to coat pipes at 250F and are concern about the flanges coming loose due to heat if the HPC is left covering the nuts and threads

This is not right the nuts will not loosen up have a look at the bolt heads on the flanges they are covered with HPC no one has said anything about exposing them

The only reason that I can think of as to why the nuts and threads need to be left uncoated is so the nut can be removed on a clean thread as other paints clogg up the threads and are hard to clear

When the nuts and threads are coated with HPC it is easily removed at anytime simply by placing a wrench on the nut and the coating will come off leave the thread clear for the nut to be unthreaded the same applies to the bolt head as normally 2 wrenches are used to undo the bolts (still nothing has been said)

I have also insulated a 185 C pipe using only Supertherm 3 coats applied 2 coats Enamo Grip (s) all the bolts on the flanges were coated these bolts have not loosened this application was 18 month ago and is still in service

As you say that when bolts on engines are seized up they use a gas axe to heat the bolts to loosen them that is correct but the bolts don't loosen themself they need to have a wrench and pressure applied to loosen them

The bolts that hold the flanges together will not loosen by leaving the HPC covering them

Regards

Tony Brady

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Australia

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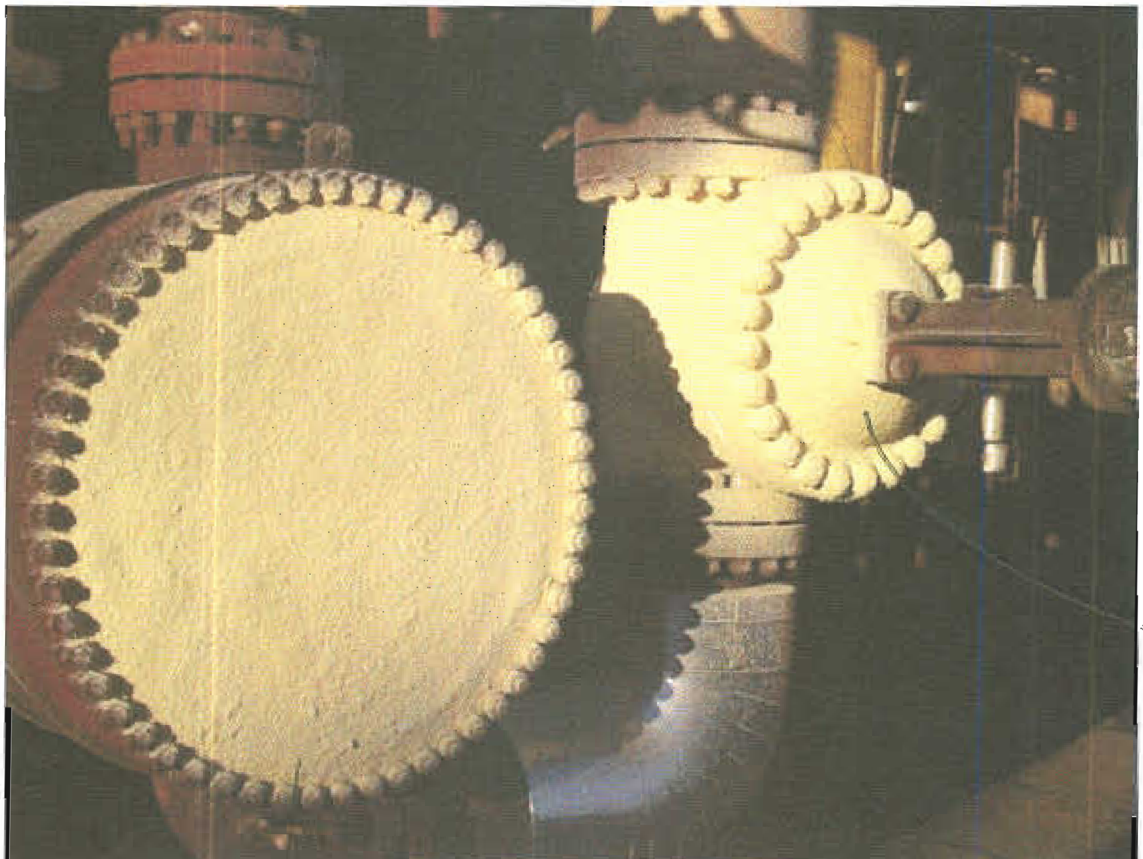


INCORRECT Application Coating not anchored over bolts and collar. Coating could fail off.

CORRECT Cover over bolts and collar

HPC Application on Surfuric Acid Tank and Valves in Korea

Courtesy of Mirae International Trade Company

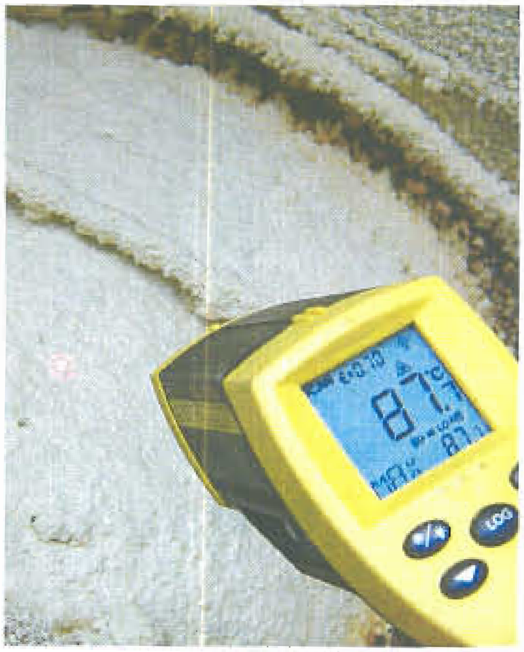
The picture below was taken in Koryo Zinc company in Korea. Currently they are using Rockwool (15 -25 cm thick) with Metal Jacket (0.6 mm thcik) to insulate Sulfuric Acid pipe line, Valves, and Storage Tank. The temperatures in these areas without insulation are: Sulfuric Acid pipe line = 470 C, Valves = 380 C, and Storage Tank a= 320 C. The tank is at 520 C in operation and at 320 C in an idle condition. With the current Rockwool & Metal Jacket, the temperatures stay in the range 60-80 C. After applying HPC, they are hoping to bring down the temperature to 60 C.

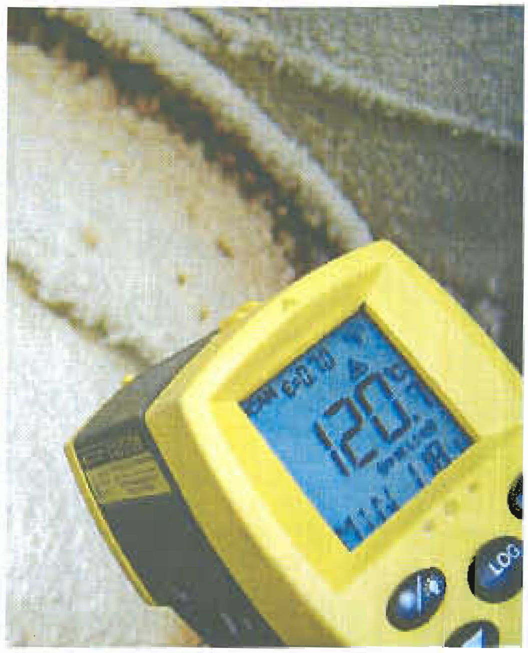
Application of HPC on Sulfuric Acid Tank

Surfuric Acid Tank

Surface temperature before HPC application: 474 C

HPC application at 25 mm thickness:





Temp. right after application: 87 C

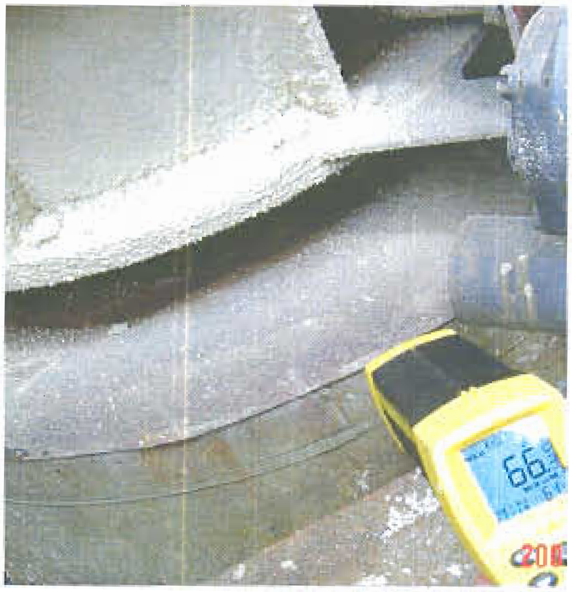
Temp. after 2 hours: 120 C

Temp. after 5 days: 145 C

Application are for Sulfuric Acid Tank

Surface temperature before HPC application: 320 C

HPC application to 25 mm thickness



Temp. right after HPC application: 66 C

Temp after 5 days: 88 C

We compared these data with VTEC HPC temperature drop vs, thickness result as well as with the data fro Chevron Oil.

Unit : ℃, mm

No.	Application Area	Temp. before Application	Coating thickness	Temp. after application	Temp. difference before and after application
1	Valve	474 (885F)	25 (WFT)	145 (293F)	-329
2	Tank	320	25 (WFT)	88	-232
3	VTEC 1	315.5	25 (1000mils)	27.2	-288.3
4	VTEC 2	482.2	25 (1000mils)	61.1	-421.1
5	Chevron	315	19 (DFT)	57	-258

Question

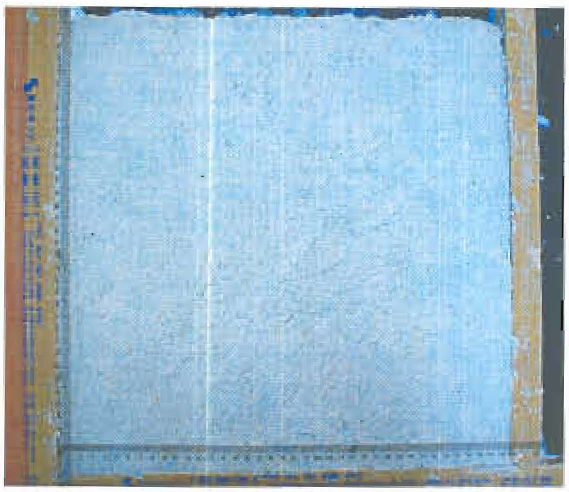
In the test data above, No. 1 (Valve) and No. 4 (VTEC 2) have similar surface temperature and coating thickness. But the temperature difference between the two cases is as much as 110 C. This needs to be explained.

Answer

The HPC test conducted by VTEC has the hot side temperature maintained at a fixed level. In actual field where HPC is applied on a tank or pipe, the hot side metal temperature goes up. Therefore the hot side temperature is different before and after the application. Therefore the hot side temperatures for No.1 & 2 case above (valve & tank) can not be compared with VTEC test case.

HPC Coverage Test

We have conducted an actual test to find out how much area we can cover with one gallon of HPC. For HPC thickness of 25 mm, we were able to cover HPC 38cm X 38cm = 0.1444 ㎡를. This means, with 7 gallon, we can cover about 1 m^2.



Response

You can use the following formula to find coverage area for HPC.

Coverage Area = (1604 x HPC Volume%) / Coating Thickness

(Example)

HPC Volume % = 85.1%

Coating Thickness = 1000 mil (= 25mm)

Coverage Area = (1604 x 0.851) / 1000=1.365 (ft^2) (= 0.127 m^2)

With 7 gal, the coverage area is 0.127 x 7=0.89 m^2

HOT PIPE COATING AT VANCOUVER SHIPYARDS

SHORT DEMONSTRATION VIDEO (Windows Media Player - 1.3mb)

SHORT DEMONSTRATION VIDEO (Real Media Player - 4.02mb)

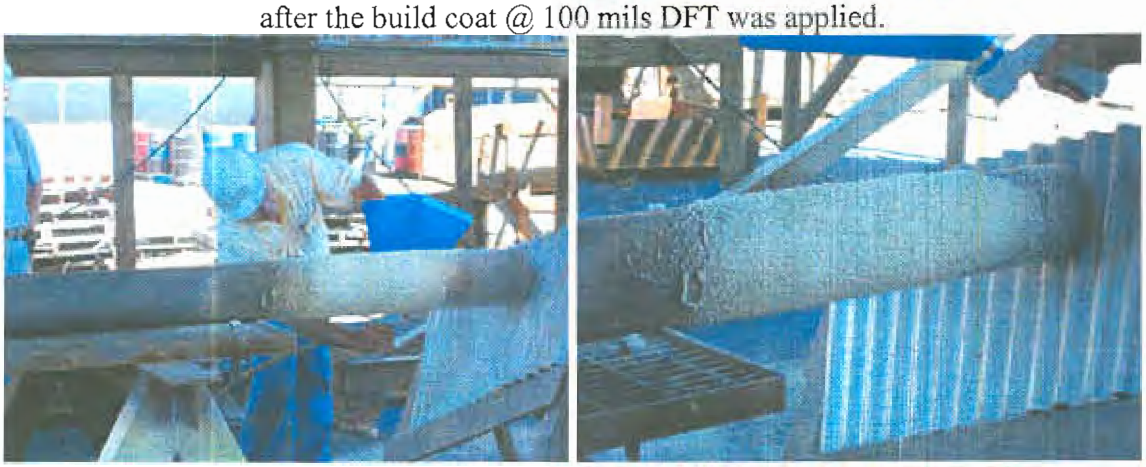
Note : This video was taken after the second primer coat of approximately 50 mils DFT and before it had finished steaming off to complete its cure down. This video is courtesy of Doug Robinson, the Health and Safety Officer at Vancouver Shipyards.


A piece of 8 " Schedule 40 pipe was preheated with a Tiger Torch.


A temperature reduction from 350C on the bare pipe to 170C after the initial primer coat @ 50 mils DFT was applied.

A temperature reduction from 370C on the bare pipe to 90C
after the second primer coat @ 50 mils DFT was applied. (Video)

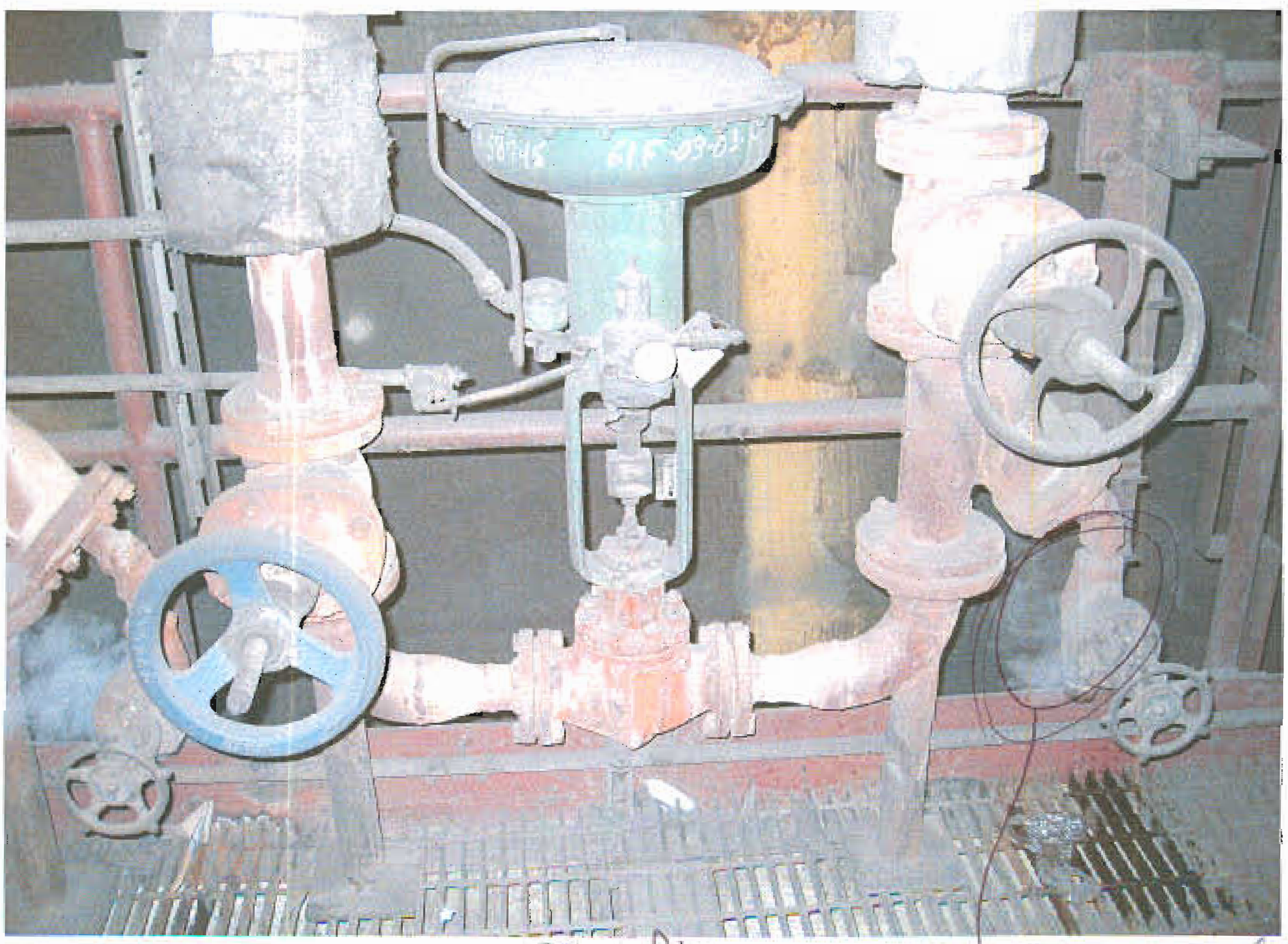
A temperature reduction from 395C on the bare pipe to 55C
after the build coat @ 100 mils DFT was applied.



A temperature reduction from 400C on the bare pipe to 50C
after the final build coat @ 250 mils DFT **TOTAL** was applied.

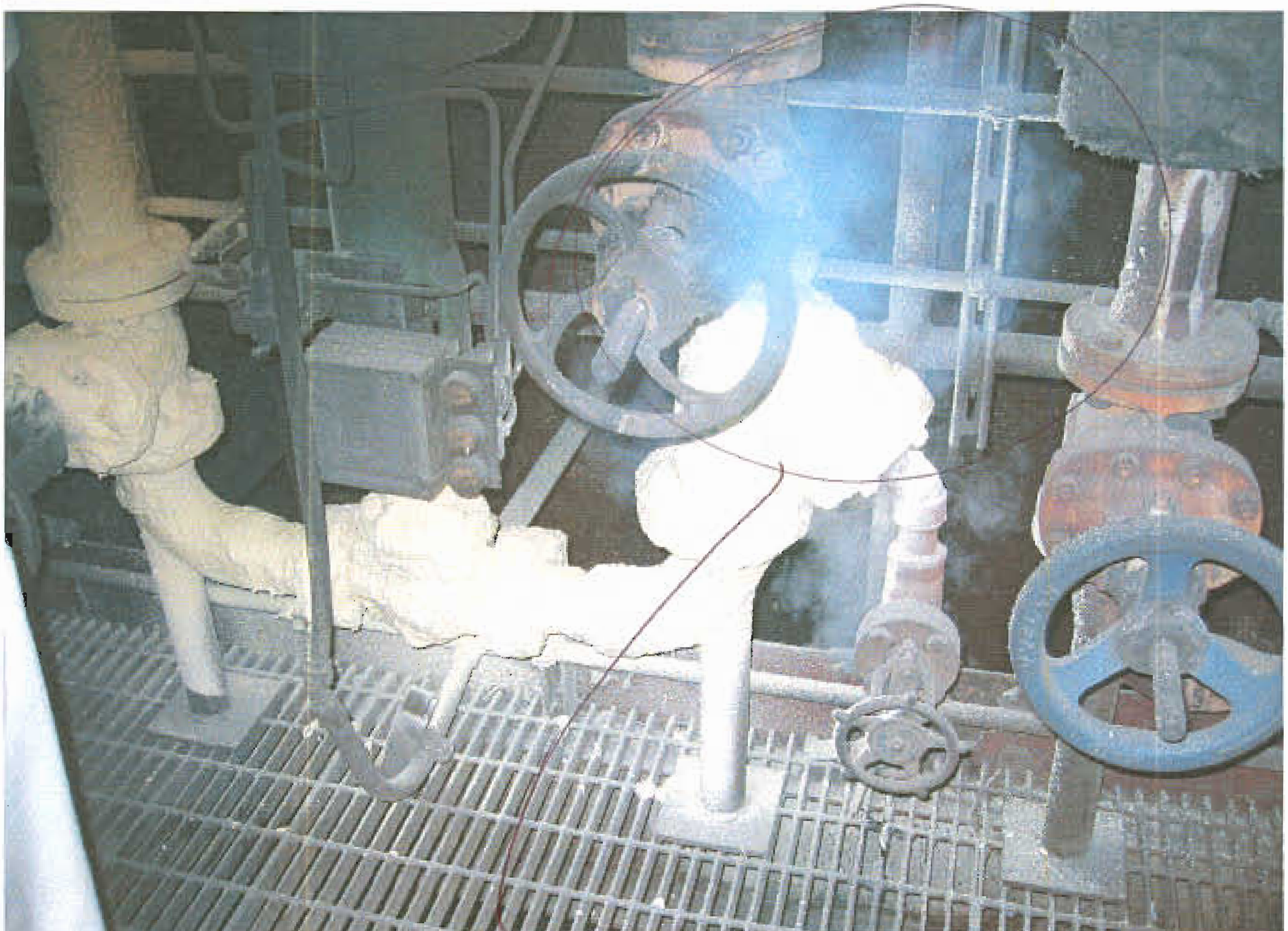
 

Of significant interest is the fact that Hot Pipe Coating can be applied to an **in service** surface without the necessity of an expensive shut down of operations. This applies to both initial application and any maintenance.

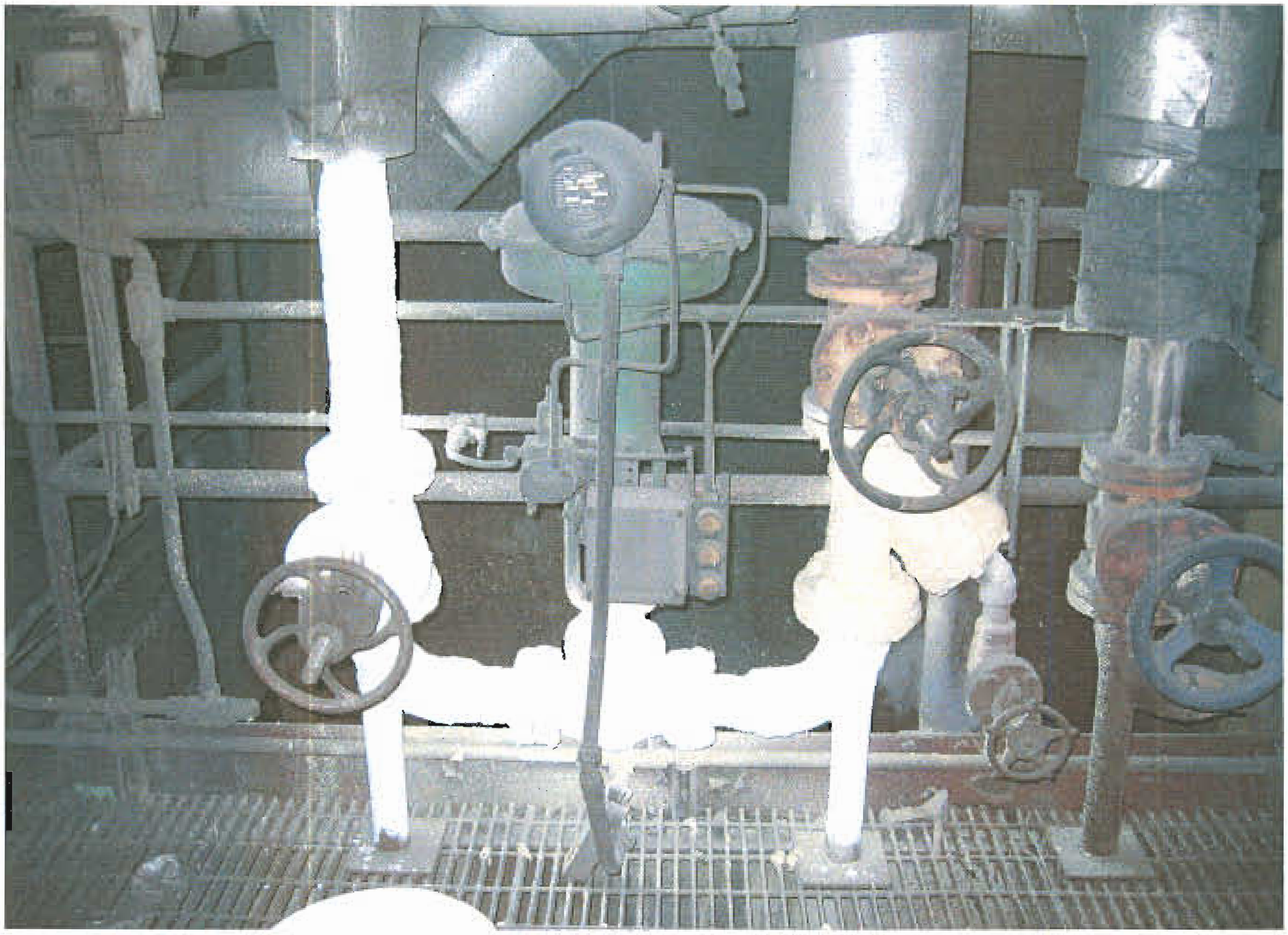


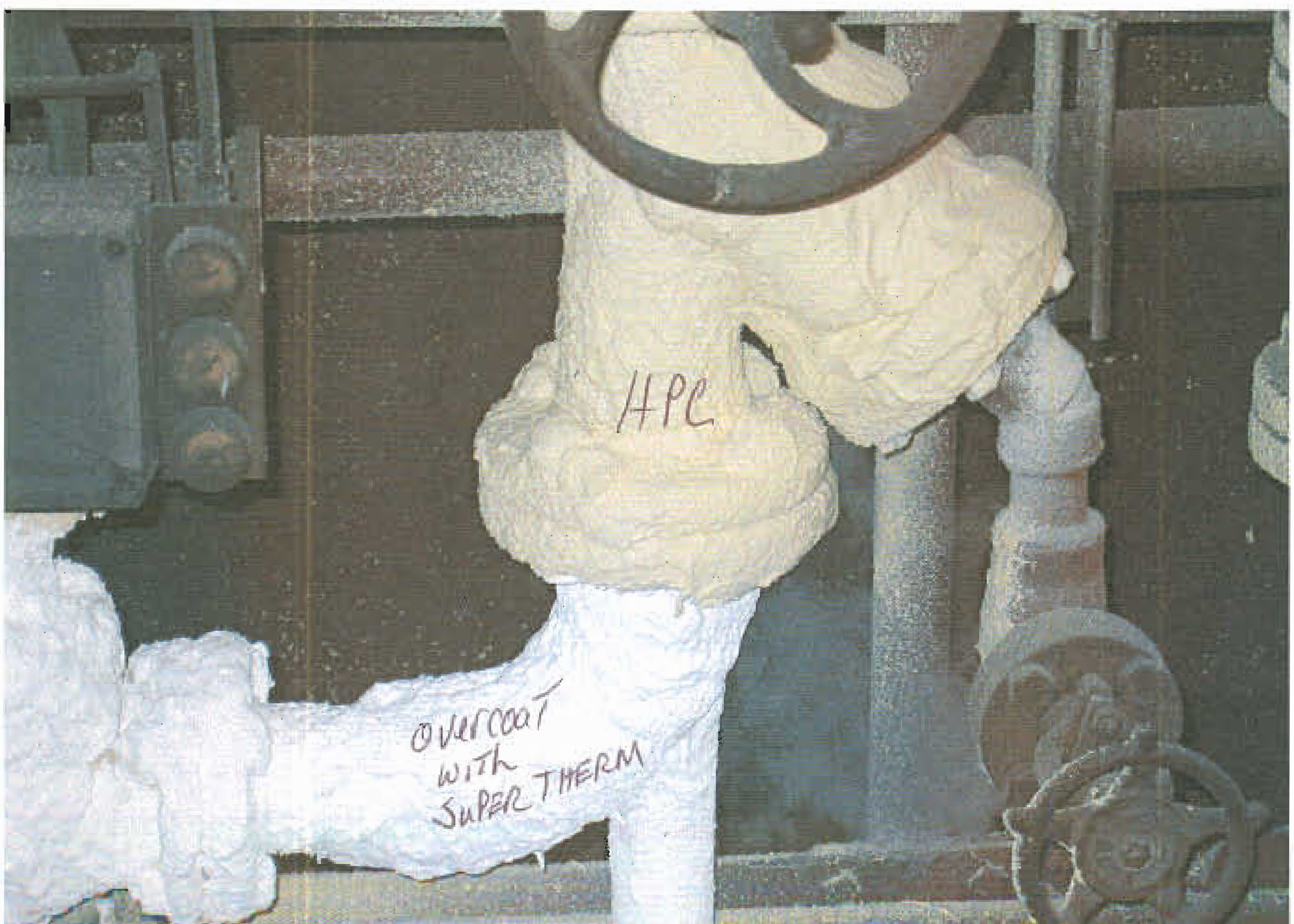
Steam Pipe
Uncontrol

Small amount of Steam
leakage



Coated Steam Pipe - Large amount of steam - holding heat - more pressure




HPC
Overcoat
with
SUPER THERM

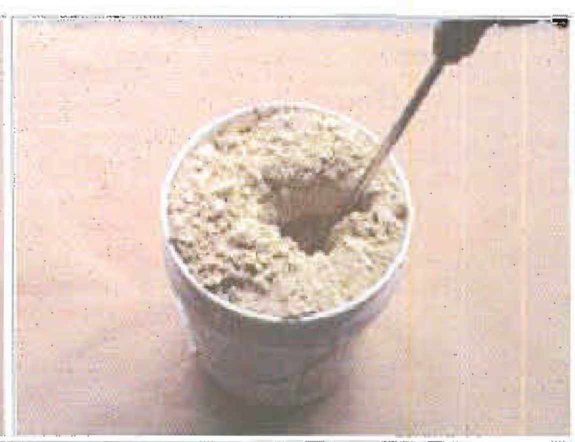
HOT PIPE COATING

APPLICATION METHODS:
Surfaces must be clean and dry before application. Loose or flaking old paints or corrosion must be removed from surfacc before applying. Surface must be clean of all residues and debris. Surfaces can be cleaned by power washing the surfaces or sandblasted as a "brush blast or sweep blast".

PRE-APPLICATION APPEARANCE AND PREPARATION OF HOT PIPE COATING

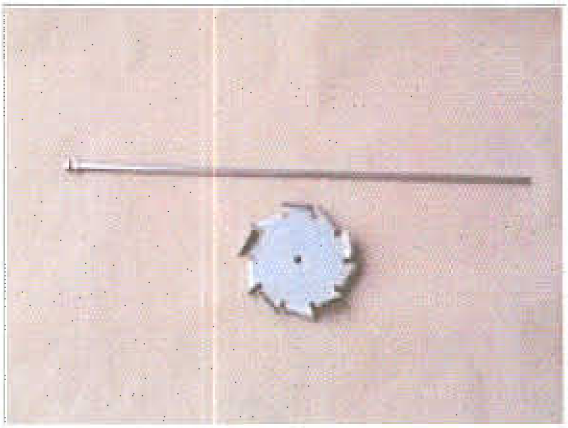
QUESTION: After delivery and storage, the top of a pail of **HOT PIPE COATING** has swollen and expanded, and the **HPC** appears too dry and chunky to use. Is the **HPC** defective? What causes the swelling of the pail and the dryness of the **HPC**?

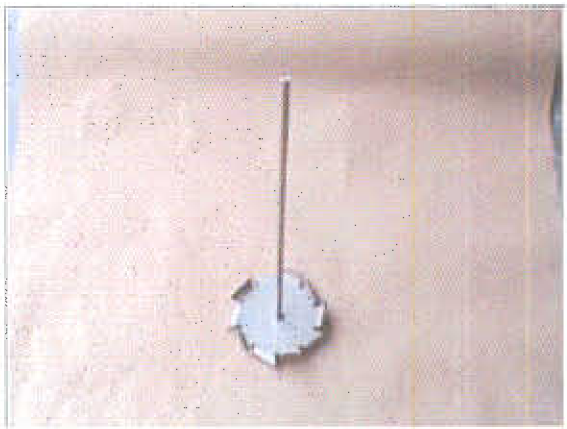

ANSWER: **HPC** is a water-based, ceramic coating and is delivered in a 5 gallon pail. After the pail is sealed and stored, **HPC** will gradually absorb and dissipate its own water over time. Some air pressure is created in the pail during this process and may cause the top of the pail to expand and swell. This absorption/dissipation process is commonly known as rheology and does not harm or adversely affect the use or performance of the coating.

HPC - Before Mixing In Pail	Early Stage During Mixing in Pail

Rheology occurs when a coating begins to set up because of non-activity. When the coating is stirred and water is added, the rheology allows the coating to relax and loosen and to return to its original consistency. After opening the pail, the top surface of HPC may appear very dry and dusty with some cracking. As a result, the applicator may believe that HPC is defective or too dry to use. This is not the case, and the appearance of HPC will change dramatically upon proper mixing.





Six Inch Dispersion Blade	Six Inch Dispersion Blade

Stir HPC with a six inch (6") diameter dispersion blade on a drill at a low to medium speed while adding water gradually. The coating will slowly return to a paste form as water is added during mixing. Continue to add water gradually while stirring until HPC becomes smooth, light, and fluffy and has the appearance of thick whipped cream. The amount of additional water that will be required will depend on the age of the coating and environmental conditions, but it can vary from one cup of added water to one to two quarts of added water. When properly mixed, HPC will be a smooth paste that is wet to the touch and will adhere easily to the surface. It will not appear lumpy or dry when properly mixed.

Late Stage During Mixing in Pail	After Proper Mixing / Ready to Apply

If a smoother surface for **HPC** is desired after application, use a wet, foam roller to lightly roll over the surface of the coating to obtain the desired smoothness.

Each pail of **HPC** must be **mechanically stirred for at least three minutes just before spraying.** It cannot be shaken or stirred by hand to reach the proper mix and texture.

HOT PIPE COATING was designed to be sprayed using a conventional HOPPER GUN or a GRACO Texspray RTX 1000 hopper feed texture sprayer. For small pipe, difficult access or small repair applications it can also be gloved or trowelled on. Use a thickness gauge to check the wet thickness being applied. The number of coats and total thickness of the **HOT PIPE COATING** will vary depending upon the desired results required and the application temperature ie. ambient temperature or operational temperature.

OPERATIONAL APPLICATIONS - Applied directly to a surface temperature of between 200F \ 93.3C - 600F \ 315.5C. If the surface temperature exceeds 600F \ 315.5C and cannot be lowered within that range contact Eagle for exact application instructions. Applications to a hot surface must be done with thin primer coats to steam the water out of each primer coat until the surface temperature settles down and stops doing the quick steam out of the coat -- usually two coats. Then the remaining mils WFT (Wet Film Thickness) can be applied to the required thickness needed. Allow to operate at the operational temperature overnight or for a couple of days and it is dry. This is multiple coat application.

First apply a primer coat at 32 sf per gallon giving a thickness of 50 mils WFT or 38.5 mils DFT. Once the primer coats have finished steaming off, apply the desired mils WFT. Three nozzles are included with the machine and hopper gun. Use the small size (6mm) nozzle. Adjust the airflow to the highest setting to start spraying the product onto the hot surface as the primer coat at 32 sf per gallon giving approximately 50 mils WFT or 38.5 mils DFT, to an **in service heated pipe** and allow to dry. This will only take a few minutes. Once the primer coat is complete, adjust the air pressure down to 60% - 75% to reduce the force of air and avoid blowing the product off while applying the build coat to the desired thickness.

AMBIENT APPLICATIONS - Applied to a **DRY** non operating pipe or surface. Apply a primer coat at 32 sf per gallon giving a thickness of 50 mils WFT or 38.5 mils DFT. Allow the primer coat to set up for at least 8 hours @ 70F \ 21C. Then apply a build coat to the desired WFT.

NOTE : Allow each coat to dry between applications. Dry times will vary depending on the temperature of the sprayed surface. Applications done on non operational surfaces will need sufficient time to dry and firm up between coats. This time can be shortened by applying heat at 200F \ 93.3C and \ or air to speed the drying process. Apply heat for up to two weeks or as long as possible. All moisture must be evaporated from the coating before bringing the substrate to full operational temperature otherwise it may steam out causing bubbles and \ or knocking the coating off.

TOPCOATING OPTIONS

If a durable protective finish is required because of the surrounding environment, such as **chemical, physical, mechanical abuse** or over pipes subject to vibration, apply as follows. After the last coat is applied but **before it dries,** wrap polyester mesh around the pipe with the edge slightly overlapping to provide complete coverage. Allow this to dry. For resistance from chemicals apply ENAMO GRIP Solvent in one coat at 18 sm \ 200 sf per gallon at 8 mils WFT or 95 microns \ 3.7 mils DFT. Allow to dry and cure over night.

For applications with **HIGH HUMIDITY or SUBMERGED UNDER WATER** allow the **HOT PIPE COATING** to dry then apply EPOXOTHERM in one coat at 9 sm \ 100 sf per gallon giving 16 mils WFT or 254 microns \ 12.5 mils DFT. The total system can be submerged under water in two days. The full cure for the EPOXOTHERM is 10 days but in two days it has cured enough to allow for submersion while it completes its curing cycle.

For exterior applications subjected to **WEATHERING** apply SUPERTHERM in one coat at 9 sm \ 100 sf per gallon giving 16 mils WFT or 250 microns \ 10 mils DFT.

FEATURES:

Percent Solid:	**77% solids by volume**
Weight	**5 pounds per gallon 49.22% solids by weight**
Dry Times:	**5 - 10 minutes as primer over hot surfaces, then build up as needed 24 hours to set.**
Spread:	**32 sq.ft. per gallon = 50 mils WFT = 38.5 mils DFT as a primer coat** **10 sq. ft. per gallon = 160 mils WFT = 124 mils DFT as a build coat** **5 sq. ft. per gallon = 321 mils WFT = 247 mils DFT as a build coat** **2.5 sq. ft. per gallon = 642 mils WFT = 494 mils DFT as a build coat** **1.23 sq. ft. per gallon = 1299 mils WFT = 1000 mils DFT as a build coat**
Elongation:	**125 %**
pH	**8.5 - 9.0**
VOC	**14 grams per liter USDA Approved**

IMPORTANT:

Do not take internally. Avoid contact with eyes. If solution does come in contact with eyes, flush immediately with water and contact a physician for medical attention. Avoid prolonged contact with skin or breathing of spray mist. For quickest removal from skin, wash with water before drying.

Questions are below then following answers:

From: Daiko Shokai [mailto:daiko@daikoshokai.com]
Sent: Friday, May 29, 2009 2:18 AM
To: J.E Pritchett
Cc: Timothy R Cappel; Craig Smith; Juli Pritchett; BJ
Subject: Specification for HSC and HPC coating at Sumitomo Metal
Dear J.E.,
I have received additional inquiry from the sales staff who is in charge of Sumitomo Metal.

As you can see from the past communication and attached files, we have already finished the repair job at this site.
Yet,we have to make a serious effort to recover the confidence of Sumitomo Metal lost through the test application.

Actually, we are going to re-do a whole test application process, thus, we definitely need your support to have this application success and close the deal with them.

Mr. Nojiri was going to discuss this subject at our meeting in June, however since it was postponed, we would like to have your cooperation over the e-mail since it can not wait.

We have two requests as below.
1. Could you please prepare an exclusive specification for HSC & HPC application over the recuperator, furnace body and exhaust gas pipe at Sumitomo Metal?

2. Could you please come over to Japan to help this project out if you think HSC & FC application can meet the client's expectation.

I am going to attache 3 files that you have already seen in last e-mail and the new file which gives you more detail of Sumitomo Metal site.

Your support on this matter would be highly appreciated.

Sincerely yours,
Akiko Takano

****
DAIKO SHOKAI CO., LTD.
3-11-23 Nagai-higashi, Sumiyoshi-ku, Osaka,
Japan 558-0004
TEL) +81-6-6696-1155
FAX) +81-6-6696-1175
E-MAIL daiko@daikoshokai.com
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****

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FAX) +81-6-6696-1175
E-MAIL daiko@daikoshokai.com
WEB SITE http://www.daikoshokai.com

****

I am concerned with the primer you are using.
If this primer gets too hot, it could peel off and release the HPC or HSC from the surface.

Do not use a primer.

If surface temperature is over 140C, only use the HPC and try spraying on with a Graco TesSpray 1500 Texture spray machine or a texture "hopper gun" found in the home improvement section of a building supply store where the wall board is found. When you spray on the coating onto a hot or cold surface, it has better adhesion and lay out.

When the furnace of the boiler is cold and you apply the product, it takes a week in good temperature over 30C to dry it down before the unit is turned on for operation. If you do not wait this long, the moisture that is still on the surface will steam and cause steam bubbles to rise through the coating causing bubbles on the surface and having to remove and recoat.
It is always best to spray on when hot. Doing thin coats 5 minutes apart is the best method until you have a minimum of 4mm, then you can add 6mm per coat after the steaming is under control and not steaming through the coating.

If you apply the thickness too quickly over a hot surface, you will have bubbles and cracks because the steam must move through the coating and escape to the outside. This is why you apply thin coats 5 minutes apart. This allows the steam from the applied coat to release off the surface and calm down before you apply the next coat.

If you apply over a cold surface and the coating is not dry on the adhesion surface of the metal, when the unit is turned on, the heat on the surface will cause the moisture to steam the coating on the surface of the metal and the steam must move through the coating to the top surface to escape. If the top surface has dried and is tough and feels dry, it will catch and try to hold the steam and this will cause bubbles and cracks on the surface of the coating.

Also, if you have a unit that is very hot and you think the unit is only 160C or so on the surface of the pipe before you coat, then after you coat with HPC/ HSC, the surface of the pipe will increase to 180C or 200C. The reason is that now, you are holding the heat on the surface of the pipe or wall and it is not escaping quickly. This means that you are now coating over a 180C or 200C surface and not the 130C or 150C you thought you were coating over.

When you have puffs on the surface of the coating, this means that you have not allowed the coating to dry and allowed the moisture to steam and escape before you applied the next coat -- or -- that you applied over a cold surface and it was not dry at the surface of the metal so that when the unit was turned on, it caused the moisture to steam and escape to the surface of the coating and because the surface was dry and tight, it did not allow the steam to release through it easily and caused bubbles and pulled the coating loose from the metal surface.

Remember, that when applying the coating around a hot area, you must coat all the way around the unit or around areas that have braces to help hold the coating on the surface when it becomes very hot under the coating and causes some char with the coating. Spraying or applying around braces or supports helps to hold the entire coating surface onto the unit must better and keep it in place.

If you have applied outside, then you must apply SP SEAL COAT or COOL THERM to seal the surface so that rain cannot be absorbed into the coating. For HPC to be an effective insulation material, it must be very light weight and this means it will absorb rain. Once the coating absorbs rain, it is harmed and may not be able to release all the water to go back to do its' job of insulation. So, be watchful that if rain is to come, the SP SEAL COAT or COOL THERM is applied to protect it.

Make sure that these instructions are read to and understood by the applicators and sales people.

J.E.

SUPERIOR PRODUCTS
INTERNATIONAL II, INC.

PRE-APPLICATION APPEARANCE AND PREPARATION OF HOT PIPE COATING

QUESTION: After delivery and storage, the top of a pail of HPC has swollen and expanded, and the HPC appears too dry and chunky to use. Is the HPC defective? What causes the swelling of the pail and the dryness of the HPC?

ANSWER: HPC is a water-based, ceramic coating and is delivered in a 5 gallon pail. After the pail is sealed and stored, HPC will gradually absorb and dissipate its own water over time. Some air pressure is created in the pail during this process and may cause the top of the pail to expand and swell. This absorption/dissipation process is commonly known as rheology and does not harm or adversely affect the use or performance of the coating.

Rheology occurs when a coating begins to set up because of non-activity. When the coating is stirred and water is added, the rheology allows the coating to relax and loosen and to return to its original consistency.

After opening the pail, the top surface of HPC may appear very dry and dusty with some cracking. As a result, the applicator may believe that HPC is defective or too dry to use. This is not the case, and the appearance of HPC will change dramatically upon proper mixing.

Stir HPC with a six inch (6) diameter dispersion blade on a drill at a low to medium speed while adding water gradually. The coating will slowly return to a paste form as water is added during mixing. Continue to add water gradually while stirring until HPC becomes smooth, light, and fluffy and has the appearance of thick whipped cream. The amount of additional water that will be required will depend on the age of the coating and environmental conditions, but it can vary from one cup of added water to one to two quarts of added water. When properly mixed, HPC will be a smooth paste that is wet to the touch and will adhere easily to the surface. It will not appear lumpy or dry when properly mixed.

If a smoother surface for HPC is desired after application, use a wet, foam roller to lightly roll over the surface of the coating to obtain the desired smoothness.

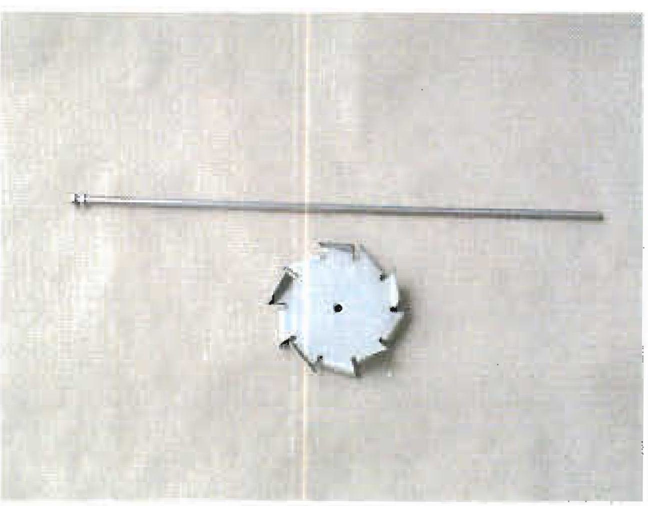
10835 W. 78th Street • Shawnee, Kansas 66214 • Phone: 913-962-4343; Fax: 913-962-6767

HPC – Before Mixing In Pail

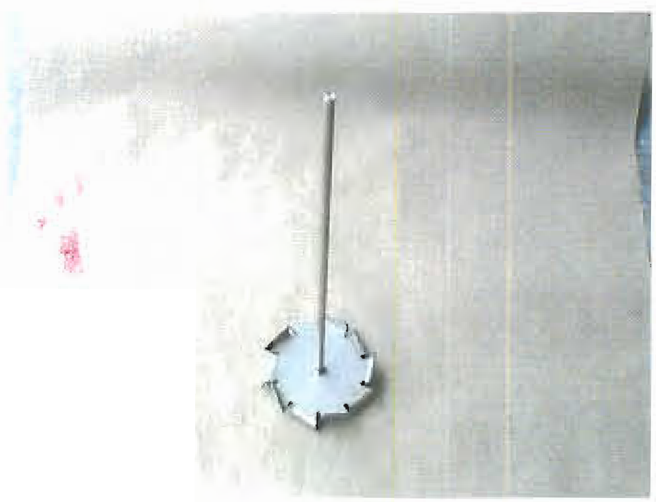
HPC – Early Stage During Mixing In Pail

HPC – Late Stage During Mixing In Pail

HPC – After Proper Mixing / Ready to Apply



Six Inch Dispersion Blade



Six Inch Dispersion Blade

APPLICATION INSTRUCTIONS:

GENERAL CONDITIONS:

Hot Pipe Coating will cover previous coatings, provided they are fully adhered to the surface. Powerwash at 250 bar or sandblasting is the best to do, if possible. Surfaces must be clean and dry before application and loose or flaking old paints or corrosion must be removed by power washing or sandblast. HPC can be applied to metal, concrete, masonry and wood.

MIXING:

After opening a pail the HPC may appear too dry and chunky to use. The pail has swollen and expanded. HPC will gradually absorb and dissipate its own water over time. Some air pressure is created in the pail during this process and may cause the top of the pail to expand and swell. This absorption/dissipation process is known as rheology and does not harm or adversely affect the use or performance of the coating. Stir HPC with a dispersion blade on a drill at a low to medium speed while adding water till the coating becomes smooth, light and fluffy and has the appeareance of thick whipped cream.
The amount of additional water that will be required will depend on the age of the coating and the environmental conditions. It can vary from 1 till 4 liter per 5 gal. pail. Pictures have been added to clearly show the consistency required.

APPLICATION METHODS:

This coating can be applied by using a hopper gun (nozzle 6 mm) or, preferably, a Graco Tex Spray RTX 1500 (nozzle (2 mm).
Apply a thin coat (1,5 mm) as the primer to lock down and reduce the surface heat. Build up slowly until specified thickness is achieved.
For heated applications: apply prime coat at 1,5 mm and allow to steam off. Once steaming has stopped, apply subsequent coats at 3 to 5 mm per coat to build up as specified and allow to steam off between coats.
For ambient applications: apply prime coat at 1.5 mm and allow to set up for 8 hours. Then apply additional coats up to 5 mm and allow 8 hours to dry between coats as necessary to build to desired thickness. Allow the final coat to set up for 8 hours before heat is returned to the surface.
For cold applications: never apply to pipes that are condensating or will be back in operation within 30 days.
Spray equipment should be flushed and cleaned with water.
Needs 24h. to fully cure out by warm surface.
Use: 8h. by 21°C if the pail is open.

RECOMMENDED SPREAD RATES:

Usage: 0,50 m^2/liter as primer
0,04 - 0,22 m^2/liter by more layers
Thickness: 1,5 mm as primer
Dry: 3 till 25 mm by more layers

NOTE:

HPC should be overcoated with SUPER THERM or ENAMO GRIP WB for weathering and UV protection or with RUST GRIP for abuse protection.

IMPORTANT:

Do not take internally. Avoid contact with eyes.If solution does come in contact with eyes, flush immediately with water and contact a physician for medical care. Avoid prolonged contact with skin or breathing of the spray mist. For quickest removal from skin, wash with water before drying. Keep out of reach of childeren.

HOT PIPE COATING

Heat Transfer blocking ability of the ceramics used in the HOT PIPE COATING is not new technology. The ceramics have been in the market between 10 to 100 years.

It is the combination of these ceramics working in a unique blend that allows each of the ceramic compounds to combine their blocking abilities and perform as a whole much better than if each one was used individually. These are known and proven ceramic used for blocking heat transfer in the industry.

Fiberglass, rockwool and foam materials depend totally on having enough thickness to try and resist the transfer of heat lost through the material over a given period of time. It is an established fact that when these materials gain any moisture, humidity or condensation from operational starts and stops, the moisture gain in the material in only a short amount of time will eliminate the insulation effectiveness of the thickness. These materials are only effective if enough thickness is used since trapped air is the main insulation component.

In the ceramic compounds, air has no part in the insulation effort. Since the air can gain moisture and stop it's ability to block heat, this weakest is not one of the components. The ceramic compounds have the physical ability to not absorb heat and will repel heat gain. The ceramics are packed into a tight coating layer to effectively act as a mirror to repel the gain of heat.

Where the fiberglass type materials use air to slow down the heat transfer, the ceramics use actual physical compounds to block the heat transfer by non absorption and repelling. This is why the ceramic compound coating does not absorb moisture and does not condensate during operational start/stops. There is no trapped air that can cool and heat and absorb moisture during the process.

As seen in the field testing over pipes in the petrochemical plants for Chevron/Texaco, Venezuela oil and other application areas, the coating is applied directly over the hot pipes. The Australian Chevron site had 750 F (400 C) surface temperature on the pipe. HOT PIPE COATING was applied at 1 inch (25 mm) and reduced the operational temp of the surface of the coating to 150 F (65 C). BTU heat lost is difficult to measure over fiberglass type materials because of the thickness of the trapped air (fiberglass is 90% air). After a thickness of 1 inch (25mm), the heat transfer is dissipating at a tremendous rate over the surface area of the fibers and the heat lost cannot be detected by touch or probe.

From a study and presentation of Thermal Conductivity of SUPER THERM from PhD Inn Choi on Heat Transfer, he states: "that while Thermal Conductivity does not change with thickness, R-Value is directly proportional to insulation thickness and Thermal Conductance is inversely proportional to insulation thickness. If insulation thickness

increases two fold from its orginal value, it's R-value increases two fold and Thermal Conductance decreases to one half from it's original value." **This simply means that the R-value is directly associated with thickness and not actual heat conductance**. The ceramics are measured directly on heat conductance and not thickness.
When the testing was performed on the coating using the ceramics, the coating at 250 micron thickness performed at a level of 68% increased heat resistance or controlling heat conductance better than three inches of fiberglass. When the ceramic coating was increased in thickness to double it's thickness to 500 microns, it was realized to outperform the fiberglass 75mm thickness by 148% better performance in heat conductance. This was using the reflective ceramics which are only 4 used in SUPER THERM compared to the 8 different ceramics used in HOT PIPE COATING. This testing was sponsored by Bombardier Engineering Group headquartered in Canada.

In analyzing insulation effect, the main focal point must be directed to blocking **heat conductance** and not to thickness and the R value given to thickness.

J.E. Pritchett
President
Superior Products International II, Inc.
USA

January 11, 2005
HOT PIPE COAT Update

The testing performed on our HOT PIPE COATING by VTEC Laboratories Inc. in October of 2003 is simple laboratory testing and this information should be used as such. It should be noted that this testing was performed under controlled circumstances which can differ from its use in real life situations. It was tested for thermal properties only and does not verify any type of adhesion, toughness, or durability.

In this test, the HOT PIPE COATING was applied to 11 gauge steel plates and allowed to dry. The plates were placed on a hot-plate used to regulate the direct heat being applied to the underside. Temperatures were recorded at various levels until they reached a steady state or leveled off. The temperatures recorded are accurate, but does not refer to the physical condition, adhesion, or toughness of the coating at the various temperatures.

HOT PIPE COATING is designed using a blend of resins that will adhere to surfaces up to 350F (177C). The resins used not only act as a medium for carrying ceramics and contribute to toughness, but act as "glue" for good adhesion. In spite of an excellent resin system, the resins will begin to char at temperatures above the 350F (177C) level. Although it will lose adhesion, it will leave the ceramics in place and will continue to perform. The amount of charring will be determined by the surface heat to which the coating is applied. The migration of the char into the coating will increase proportionally as surface temperatures increase. This charring must be taken into consideration when evaluating an application. Additional coating must be figured into the original application and must be applied to encapsulate, or "build a cast" around the charred area. The additional coating needed could be up to or over twice the amount shown on the chart done by VTEC Labs, depending on the application. This additional coating will hold the char in place and is also necessary for additional insulation.

It is extremely important to determine actual surface temperature before deciding on a thickness to be applied. An exposed hot surface recorded at a given temperature will not have the same surface temperature after it is coated. Before coating, the heat from the surface is allowed to emit quickly into the atmosphere, therefore lowering the surface temperature. This emission increases as the ambient temperature drops. When this heat is held back, the surface temperature starts to rise. It is always best to determine the surface temperature by the interior temperature needing to be maintained. The heat source will need to be reduced after the coating is applied to regulate the proper temperature.

Craig R. Smith
Technical Director
Superior Products International II, Inc.

ABS

TYPE APPROVAL PROGRAM

04-HS 458158-EC2
CERTIFICATE NUMBER

Superior Products International
COMPANY

Shawnee, Kansas, USA
PLANT LOCATION

Houston, Texas, USA
PORT OFFICE

EC Type Examination Certificate

Notified Body 0729

Product Designation: **Hot Pipe Coating**

This is to certify that ABS Europe Ltd, as a Notified Body under the authorization of UK MCA by Merchant Shipping Equipment Regulation, SI 1999, No. 1957 and M Notice No. 1734, as amended, did undertake the relevant type examination procedure of the product listed and same was found to be in compliance with the provisions of these Regulations and EU Directive 96/98/EC of 20 December 1996 as amended by EU Directive2002/75/EC of 2 September 2002

This certificate is issued in compliance with Conformity Assessment Module B of the Regulations and Directives listed above.

mca
Maritime and Coastguard Agency
The MCA is an Executive Agency of the Department of Environment, Transport and Regions.

15 September 2004
ISSUE DATE

14 September 2009
EXPIRATION DATE

SIGNATURE R.M.Bell

Certificate No.:	04-HS 458158-EC2
Entry Date:	15 September 2004
Name of Equipment/ Component Manufacturer:	Superior Products International 10835 W. 78th Street Shawnee Kansas 66214 USA Tel: +1-913-962-4848 Fax: +1-913-962-6767
Equipment/Component:	Coatings
Model:	Hot Pipe Coating
Description:	Unique high temperature, water-borne coating that performs as a primer and top coat over metal surfaces and provides heat insulation and protection for hot surfaces. Can be applied directly to hot pipes to provide insulation and to block heat flow. Offers a non-flammable and non-toxic formula for high heat situations. See attached " pdf"
Intended Service:	Bulkhead, ceilings, decks, and the outer surfaces of hot pipes in marine applications where compliance with IMO requirements for smoke and toxicity and low surface flammability are indicated.
Ratings:	Meets the SOLAS 1974 (as amended) requirements for paints/finish materials requiring compliance with Parts 2 (Smoke & Toxicity) and 5 (Surface Flammability) of the IMO FTP Code, Res.MSC.61(67).

Standards:

European Union Marine Equipment Directive 96/98/EC as Amended by 2002/75/EC

IMO Res.MSC.61(67) Parts 2 & 5, IMO Res.A.653(16)

Service Restrictions:

1) General shipboard and offshore use.
2) This product may not be used solely in order to provide A-Class, B-Class or F-Class fire resistance to coated surfaces where such classification is required, unless further testing has been performed and approval has been achieved.
3) This product may not be used in applications requiring intumescent coatings.

Comments:

1) Coating thickness - 115 mils (wet), 100 mils (dry).
2) Application and use are to be to the manufacturer's instructions and the limitations set forth herein.

ABS

ABS
TYPE APPROVAL PROGRAM

04-CH 458158-MED2
CERTIFICATE NUMBER

Superior Products International
COMPANY

Shawnee, Kansas, USA
PLANT LOCATION

Chicago, USA
PORT OFFICE

ABS Quality Assessment Certificate

Notified Body 0729

Manufacturing Plant - Location: Shawnee, Kansas, USA

This is to certify that ABS Europe Ltd, as a Notified Body under the authorization of UK MCA by Merchant Shipping Equipment Regulation, SI 1999, No. 1957 and M Notice No. 1734, as amended, did undertake the relevant conformity assessment of the manufacturing plant listed and same was found to be in compliance with the provisions of these Regulations and EU Directive 96/98/EC of 20 December 1996 as amended by EU Directive 2002/75/EC of 2 September 2002

Reference should be made to EC Type Examination Certificate,
No: 04 HS 458158 EC2 Dated 15 September 2004

This certificate is issued in compliance with Conformity Assessment Module D of the Regulations and Directives listed above.

mca
Maritime and Coastguard Agency
The MCA is an Executive Agency of the Department of Environment, Transport and Regions.

15 September 2004
ISSUE DATE

14 September 2009
EXPIRATION DATE

SIGNATURE R.M.Bell

Certificate No.:	04-HS 458158-MED2
Entry Date:	15 September 2004
Name of Equipment/ Component Manufacturer:	Superior Products International 10835 W. 78th Street Shawnee Kansas 66214 USA Tel: +1-913-962-4848 Fax: +1-913-962-6767
Equipment/Component:	Coatings
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ABS

Standards:

European Union Marine Equipment Directive 96/98/EC as Amended by 2002/75/EC

IMO Res.MSC.61(67) Parts 2 & 5, IMO Res.A.653(16)

The manufacturer is allowed to affix the U.S. Coast Guard approval number 164.112/0729/458158-2 as allowed by the "Agreement between the European Community and the United States of America on Mutual Recognition of Certificates of Conformity for Marine Equipment" signed February 27th, 2004

Service Restrictions:

1) General shipboard and offshore use.
2) This product may not be used solely in order to provide A-Class, B-Class or F-Class fire resistance to coated surfaces where such classification is required, unless further testing has been performed and approval has been achieved.
3) This product may not be used in applications requiring intumescent coatings.

Comments:

1) Coating thickness - 115 mils (wet), 100 mils (dry).
2) Application and use are to be to the manufacturer's instructions and the limitations set forth herein.

ABS

REPORT IT VISITS TECNICA REFINERY HPC

DATE: SEPTEMBER 8, 2005

PLACE: REFINERY BARRANCABERMEJA

SECTOR: UNIT OF BALANCE

PRESENTED/DISPLAYED BY: ING.. MARIO JAIMES

COMPANY: B.A.F. & ASOCIADOS LTDA..

OBJECTIVE

To verify the general behavior of the H.P.C. applied the 23rd and 24th of August, 2005 on a 600# steam pipeline at the Barrancabermeja's refinery.

In order to make this inspection we began assessing the product's insulation capabilities and impact tests, then a window was cut to verify the charring process and adhesion of the product.

ISULATION: The HPC. maintained its thermal insulation properties still having undergone a charring process of ½" with respect to 1"of final thickness applied.

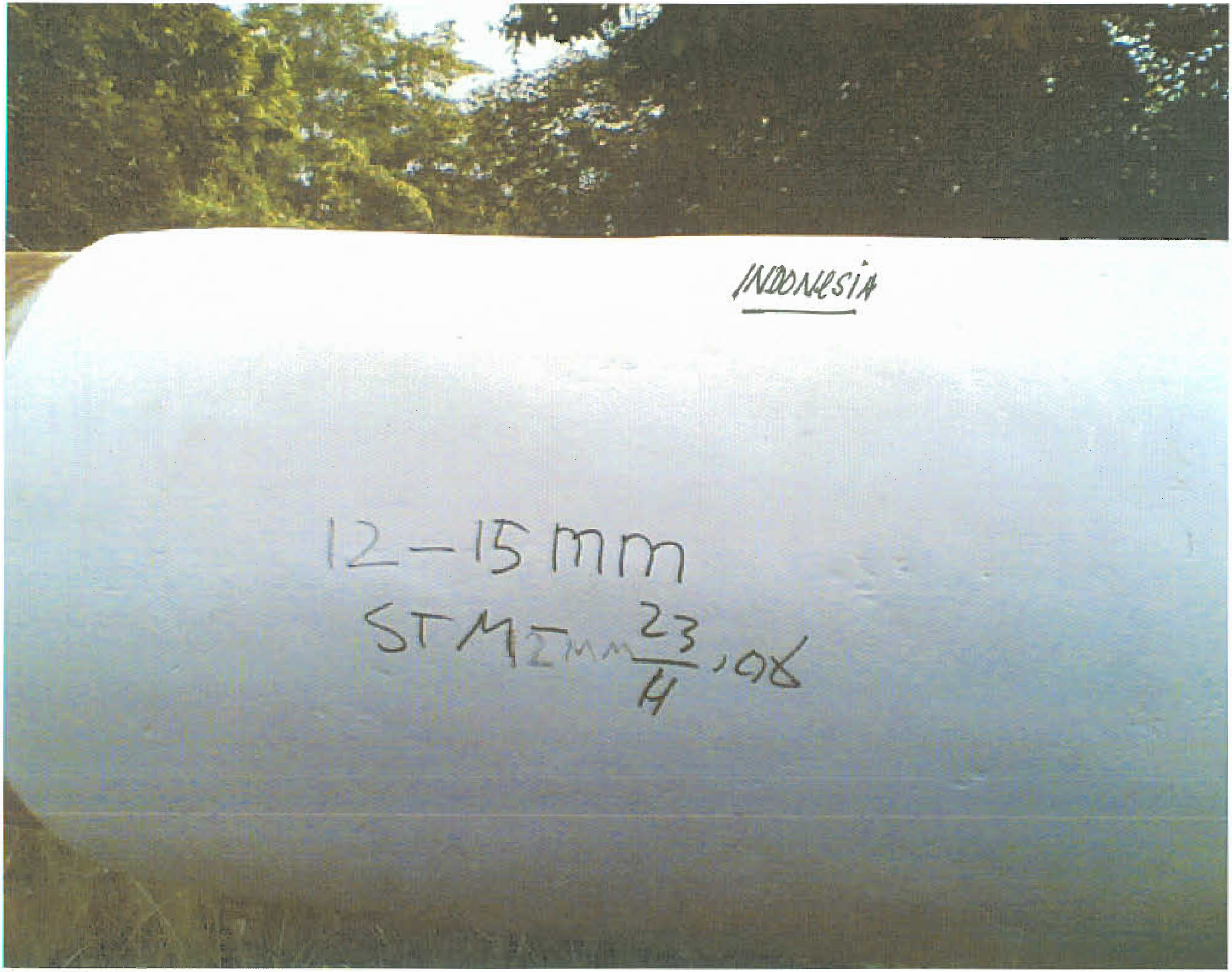
IMPACT TEST: The applied sample was put under rigorous impact tests which were cushioned by the HPC, observing a great resistance.

CHARRING PROCESS: The charring process begun with the first coat applied to the pipe. With respect to the previous inspection the charring has increased in 5mm approximately, the continuation of such behavior is causing major worries amongst Ecopetrol's evaluation team. They will continue to investigate and evaluate on this subject.

ADHESION: The charred surface of the HPC showed particles of dust and grains of very minimum size, which make Ecopetrol think the adhesion is very low due to the charring , but if applied throughout the contour of the pipe in a monolithic form, it maintains the product together.

SEALANT: The surface was seal with a mesh and three layers of supertherm, this is in perfect conditions. Maintaining the color, hardness and texture, not being affected by UV rays nor by waters rains.

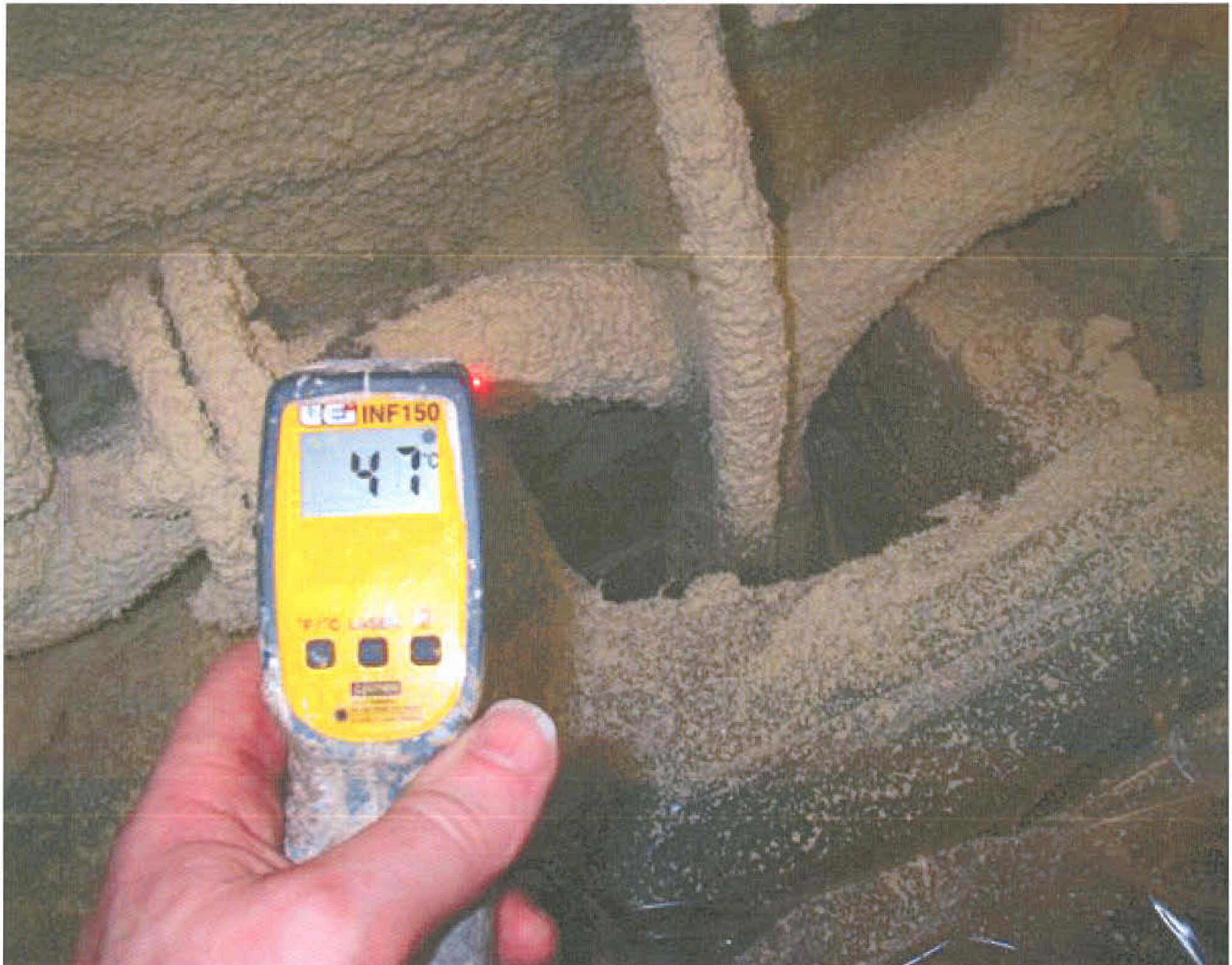

8-9-05
HPC - BAF


INDONESIA
12-15 mm
STM 2 mm 23/4 ,08

Exhaust Pipe
Coated - HPC

HPC - Italy - Belgium


INF150
108


INF150
47°C

BAF & Asociados Ltda.
Investigación y Tecnología para Producción y mantenimiento

NIT. 804.001.702 - 3

Technical Report
20-03-07-1

Bucaramanga March 20 – 2007

Client	PETROBRAS- PURIFICACION TOLIMA
Contact	ING. NELSON GAVIRIA.
Department	Maintenance Department
Telephone- fax	098 2282 750 749 cxt 112
City	Purificación- Tolima
Subject	APPLICATION OF HPC AS THERMAL INSULATION SOLUTION FOR IRRADIANT HEAT COMING FROM THE EXHAUST ON GAS ENGINES. .

TECHNICAL FACTS

PICTURES	DESCRIPTION
	We took lectures of the control panel and hot spots finding temperatures ranging from 1186 y 1246 °F, and in the cooler of about 194 °F
	We ask the operator to shut down the equipment for 1.5 hours to apply first coat. Once stabilized the HPC in the first layers we coordinate startup of the engine to take advantage of irradiated temperature to cure HPC. Final thickness of HPC applied is about 1.5”
	Additionally to decrease the irradiated heat coming from the manifold we provided a thin layer (3mm) in this way the HPC Hill reduce the water temperature passing through

Temp registry while engine working empty

Temp registry while engine working full throttle

The temperature registry indicated that after we applied the HPC we read temps of 398 °F when engine working on idle mode through 562 °F at full throttle with a delta T of 720 °F.

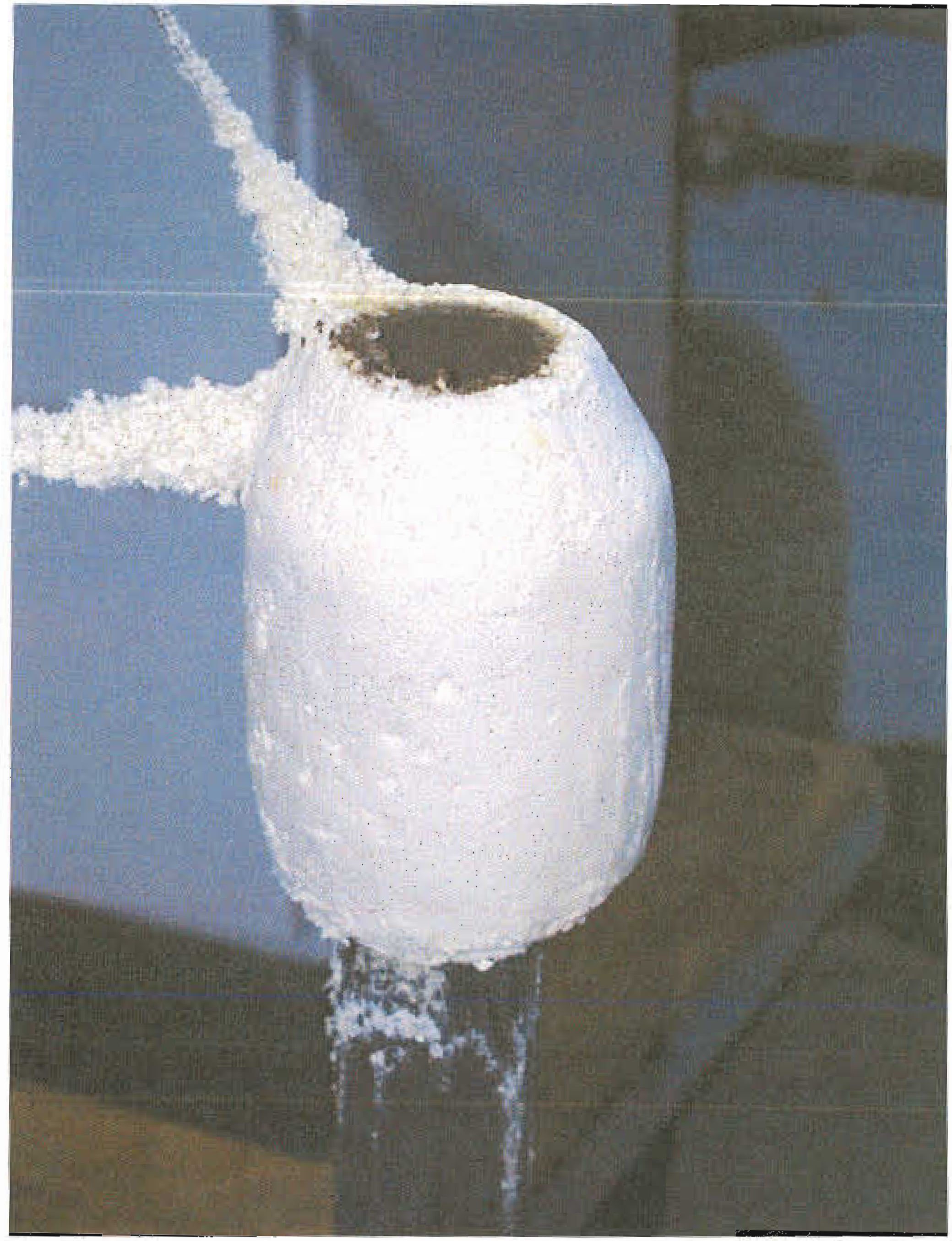
Nonetheless, we could not determine exactly the differential temperature due to irradiating heat coming from the expansion joints and the T coupling on the exhaust.

We demonstrated to the customer that HPC is a viable solution to decreasc extreme temperaturas, the readings form the control panel and the cooling system decrease to 186°F, this temperature fluctuates depending upon operating conditions on the equipment.

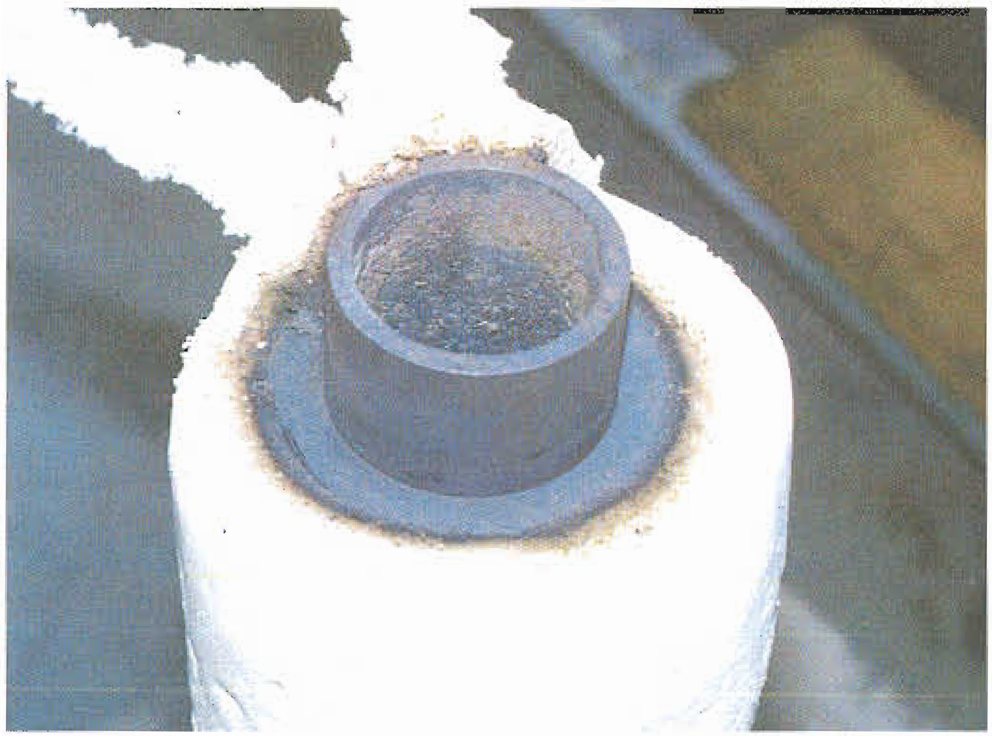
HPC Test

- The first layer was applied at a temperature of 200°C. Layer thickness was 8mm. Drying time was 16 hours. Surface temp. was 60°C.

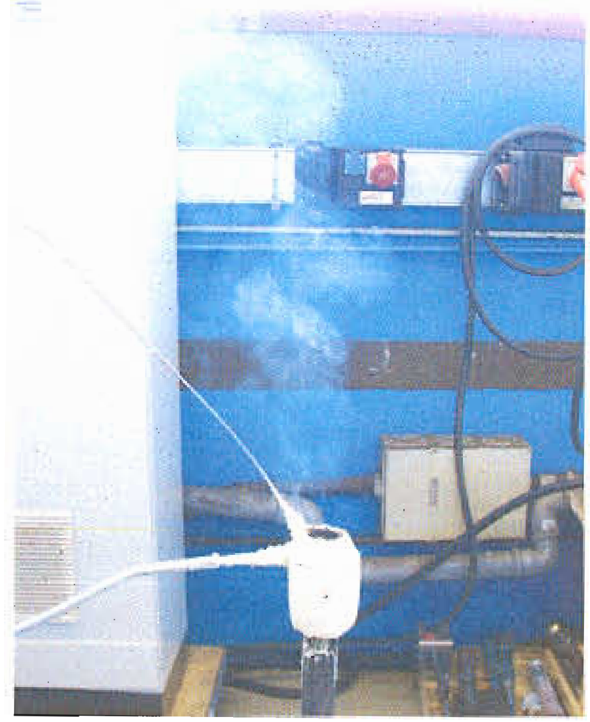
- Second layer was applied to a total thickness of 20 mm. Temp. was risen to 300°C. Drying time for the second layer was 4 hours. Surface temp. 55°C



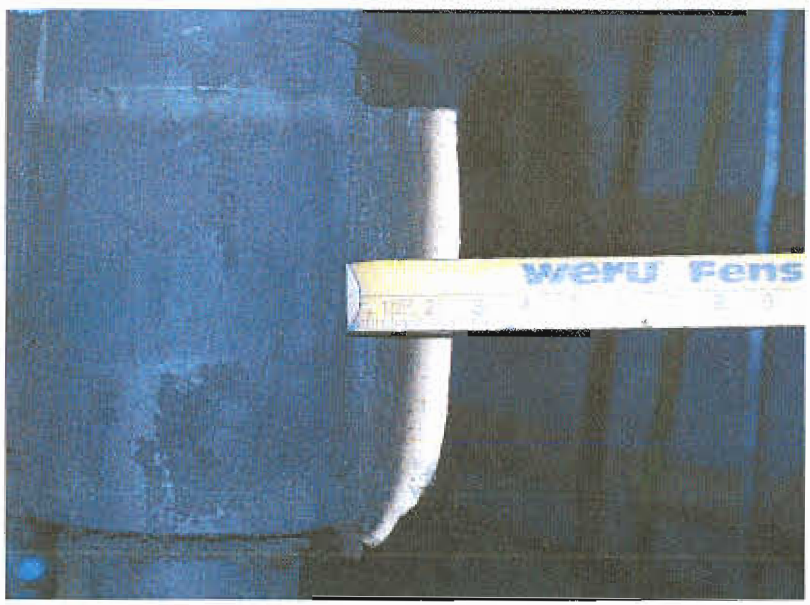
- Temp. was risen, in order to find out which temperatures the material would withstand.
- at 400°C, charred layer has a thickness of 4mm, surface temp. is 60°C



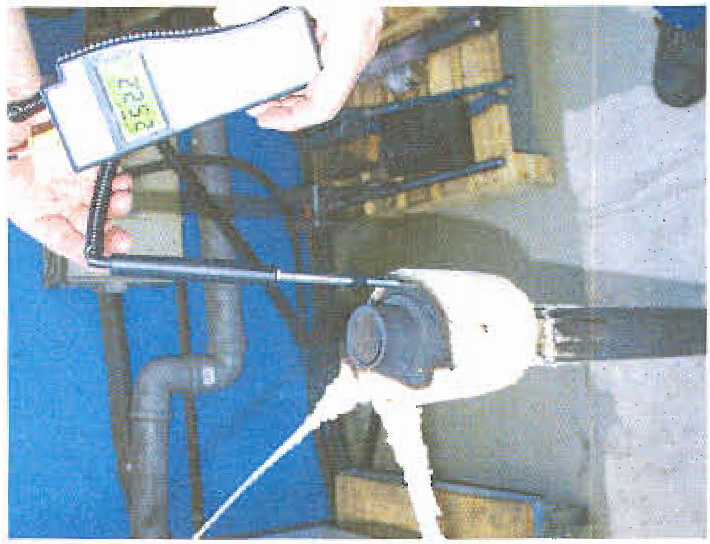
- at 500°C, charred layer is 11 mm thick, surface temp. is 88°C
- it is obvious, that smoke is developing

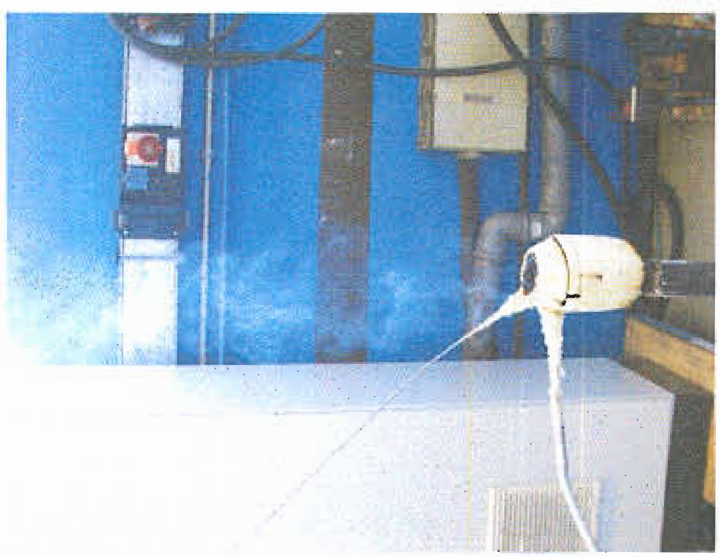


- at 600°C, charred layer is 14 mm thick, surface temp. is 110°C



- at temperatures of 500°C and higher, smoke is developing. We assume that the insulating performance of the charred HPC is not as good as if not charred.
- We work in a higher temperature range than 500°C and we therefore consider the material not suitable for our purposes.





HPC TESTING
GERMANY
OVER TIRE MOLD

Continental CONTITECH

Zusammenfassung:

Variante 1 (HPC-Coating).

Es ist ein spurbarer Effekt erkennbar, der jedoch bei weitem nicht das Optimum des Machbaren darstellt.

-> Oberflächentemperatur ca. 74°C. Emissionsgrad $\varepsilon \approx 0{,}8$

> **Version 1 (HPC Coating)**
>
> A noticeable effect can be seen, though not the maximum

Fertigungsbereich NFZ-Reifen Vulkanisation, Werk Stöcken, Variante 1

Bezeichnung	Var	Wert	Einheit	Bemerkung
1. Heizcontainer				
Oberfläche	A_H	2,35	[m²]	bezogen auf 0,5m Containerhöhe
Oberflächentemp.	ϑ_1	74	[°C]	
Wärmeübergangskoeffizient	α_H	[illegible]	[W/(m²K)]	Luft mäßig bewegt an Metallwand
Emissionsgrad	ε	0,8		Über IR-Bild und Kontaktmessung
Raumtemperatur	ϑ_{R}	25	[°C]	
Stefan-Boltzmann-Konstante (Strahlungskonst.)	σ	5,67E-08	[W/(m²K⁴)]	
Kosten "Dampf"		0,02	[EUR/kWh]	(Stand 2004)
Verluste durch Konvektion / Maschine		1155	[W]	
[illegible]		[illegible]	[illegible]	[illegible]
$P_{Konv} = A_H (\vartheta_H - \vartheta_{RT}) \cdot \alpha_H + A_B (\vartheta_B - \vartheta_{RT}) \cdot \alpha_B$				
Verluste durch Strahlungsleistung / Maschine		707	[W]	Abgegebene Strahlung abzüglich
$P_{Str} = [A_H (T_H^4 - T_{RT}^4) \cdot \varepsilon_H + A_B (T_B^4 - T_{RT}^4) \cdot \varepsilon_B] \cdot \sigma$			[W]	aufgenommene Strahlung
Summe / Presse		1862	[W]	je Maschine
Energiekosten / Jahr		**335**	[EUR]	Bei 250 Tagen/3 Schicht-Betrieb

> **Denomination**
> 1 Heating container
>
> Surface
> Surface Temperature
> Heat transmission coefficent
> Emission ratio
>
> **Room Temperature**
> Stefan-Boltzmann- Constant (Radiation constant)
> Costs « steam »
>
> **Loss through convection /machine**
> *(based on 1m container height)*
> Loss through radiation efficiency / machine
>
> Total per molding press
> Energy costs per year (based on 250 days / 3 shift operation)

Variante 2 (keine Isolierung):

Fertigungsbereich NFZ-Reifen Vulkanisation, Werk Stöcken, Variante 2

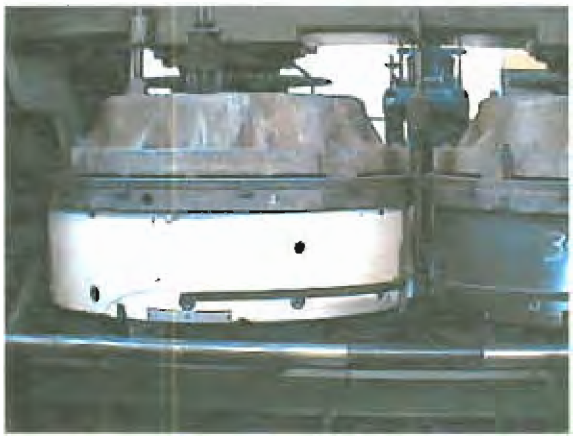
Bezeichnung	Var	Wert	Einheit	Bemerkung
1. Heizcontainer				
Oberfläche	A_H	2,35	[m²]	bezogen auf 0,5m Containerhöhe
Oberflächentemp.	ϑ_1	142	[°C]	
Wärmeübergangskoeffizient	α_H	42	[W/(m²K)]	Luft mäßig bewegt an Metallwand
Emissionsgrad	ε	[illegible]		Über IR-Bild und Kontaktmessung
Raumtemperatur	ϑ_{RT}	25	[°C]	
Stefan-Boltzmann-Konstante (Strahlungskonst.)	σ	5,67E-08	[W/(m²K⁴)]	
Kosten "Dampf"		0,02	[EUR/kWh]	(Stand 2004)
Verluste durch Konvektion / Maschine		11065	[W]	
[illegible]		[illegible]	[illegible]	[illegible]
$P_{Konv} = A_H (\vartheta_H - \vartheta_{RT}) \cdot \alpha_H + A_B (\vartheta_B - \vartheta_{RT}) \cdot \alpha_B$				
Verluste durch Strahlungsleistung / Maschine		2632	[W]	Abgegebene Strahlung abzüglich
$P_{Str} = [A_H (T_H^4 - T_{RT}^4) \cdot \varepsilon_H + A_B (T_B^4 - T_{RT}^4) \cdot \varepsilon_B] \cdot \sigma$			[W]	aufgenommene Strahlung
Summe / Presse		[illegible]	[W]	je Maschine
Energiekosten / Jahr		**2466**	[EUR]	Bei 250 Tagen/3 Schicht-Betrieb

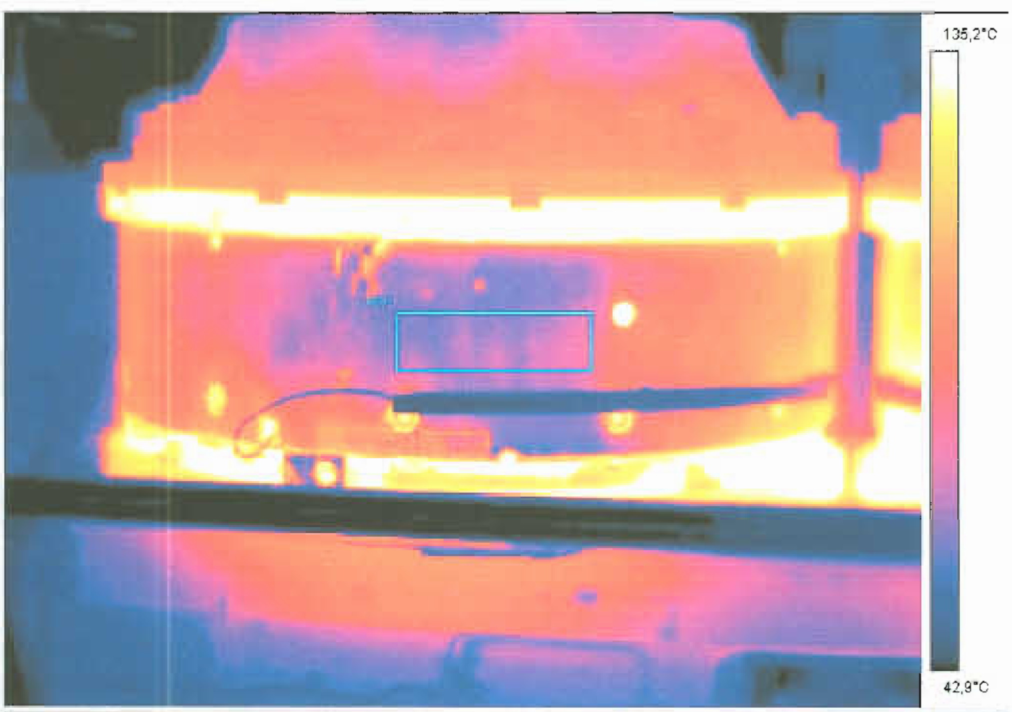
> Version 2 (no coating)

Exterior Surface of Mold

w/o Coating	MIN - 139.1 C	MAX - 144.4 C	Avg. 142.4
w/ HPC	MIN - 70.2	MAX - 78.7	Avg. 74.0

1. Isolierung durch HPC-Coating

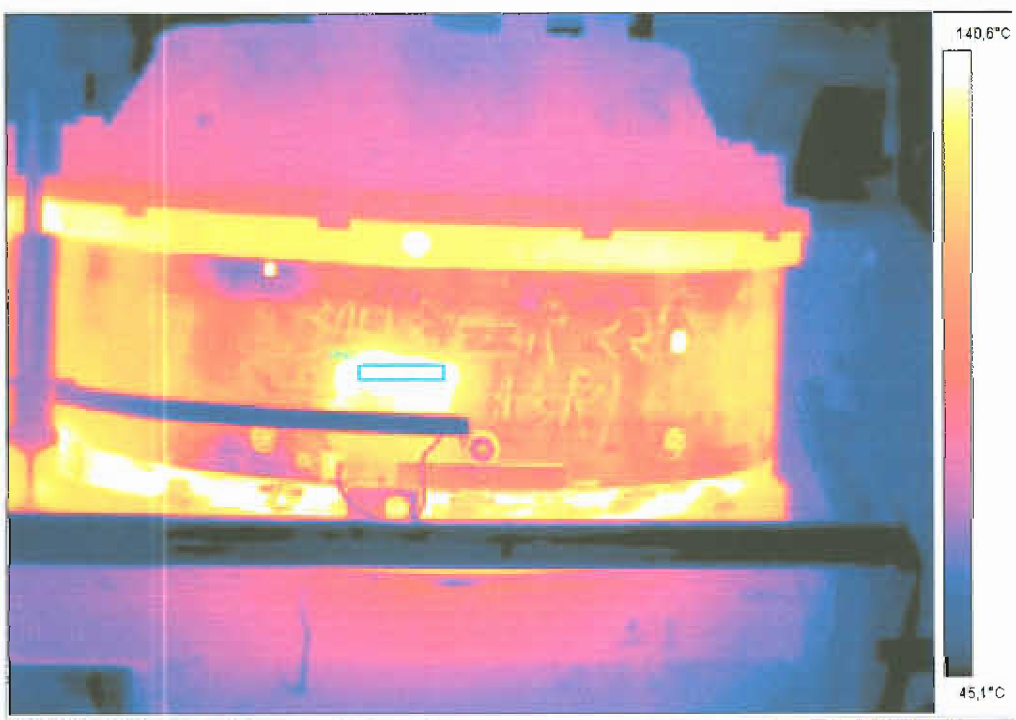




Analysis | Position | Obj. Par | Image

Label	Value [°...	Min	Max	Max - Min	Avg	Stdev	Result	Expressi...
Image		33,7	143,9	110,1				
AR01		70,2	78,7	8,6	74,0	1,7		

2. Ohne Isolierung



Analysis | Position | Obj. Par | Image

Label	Value [°..	Min	Max	Max-Min	Avg	Stdev	Result	Expressi..
Image		33,3	147,2	114,0				
AR01		139,1	144,4	5,3	142,4	1,1		

HPC APPLICATION

Verzonden: maandag 17 september 2007 12:11
Aan: Stefan@specoating.com
Onderwerp: HPC

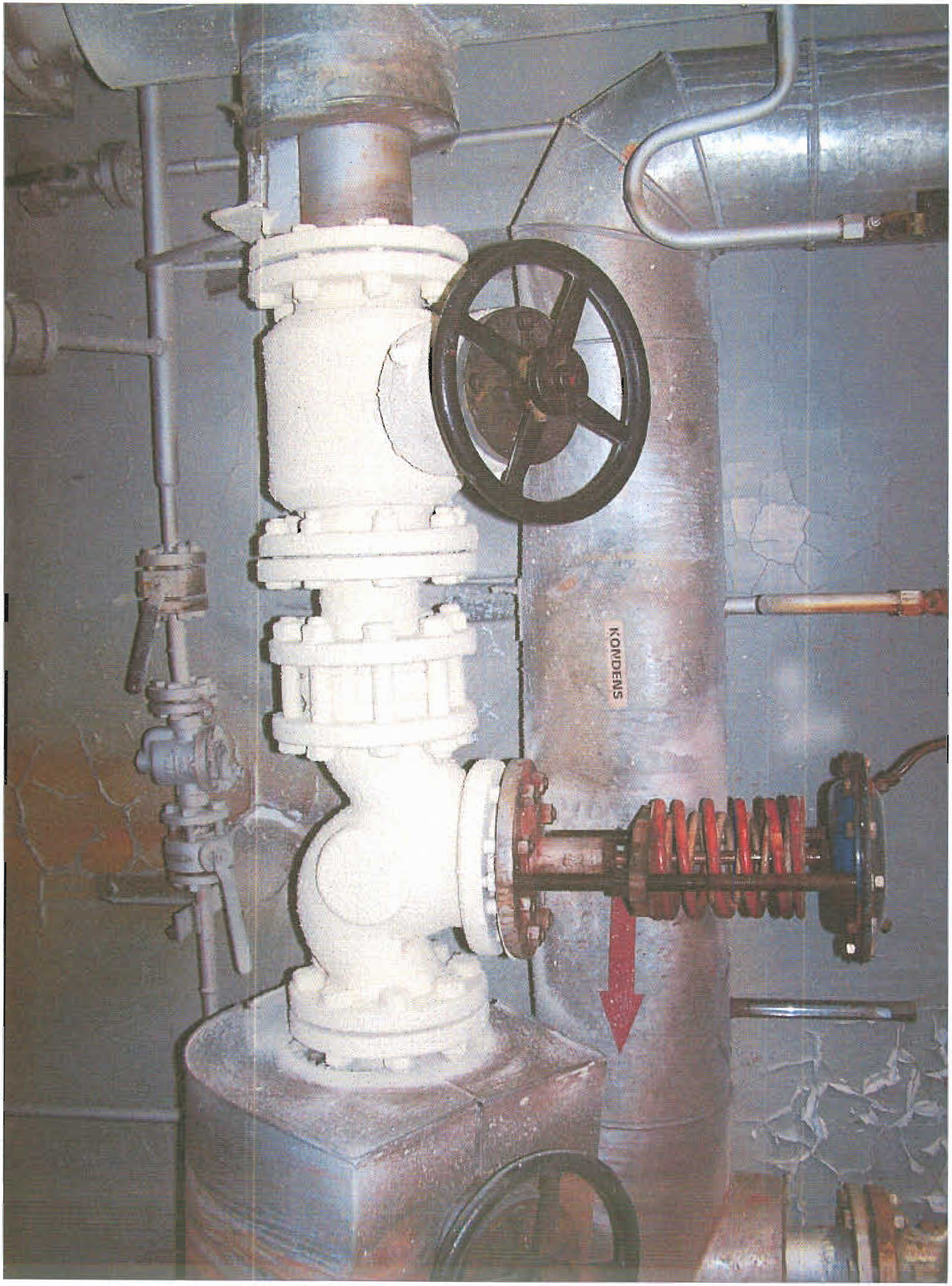
Hi Stefan,

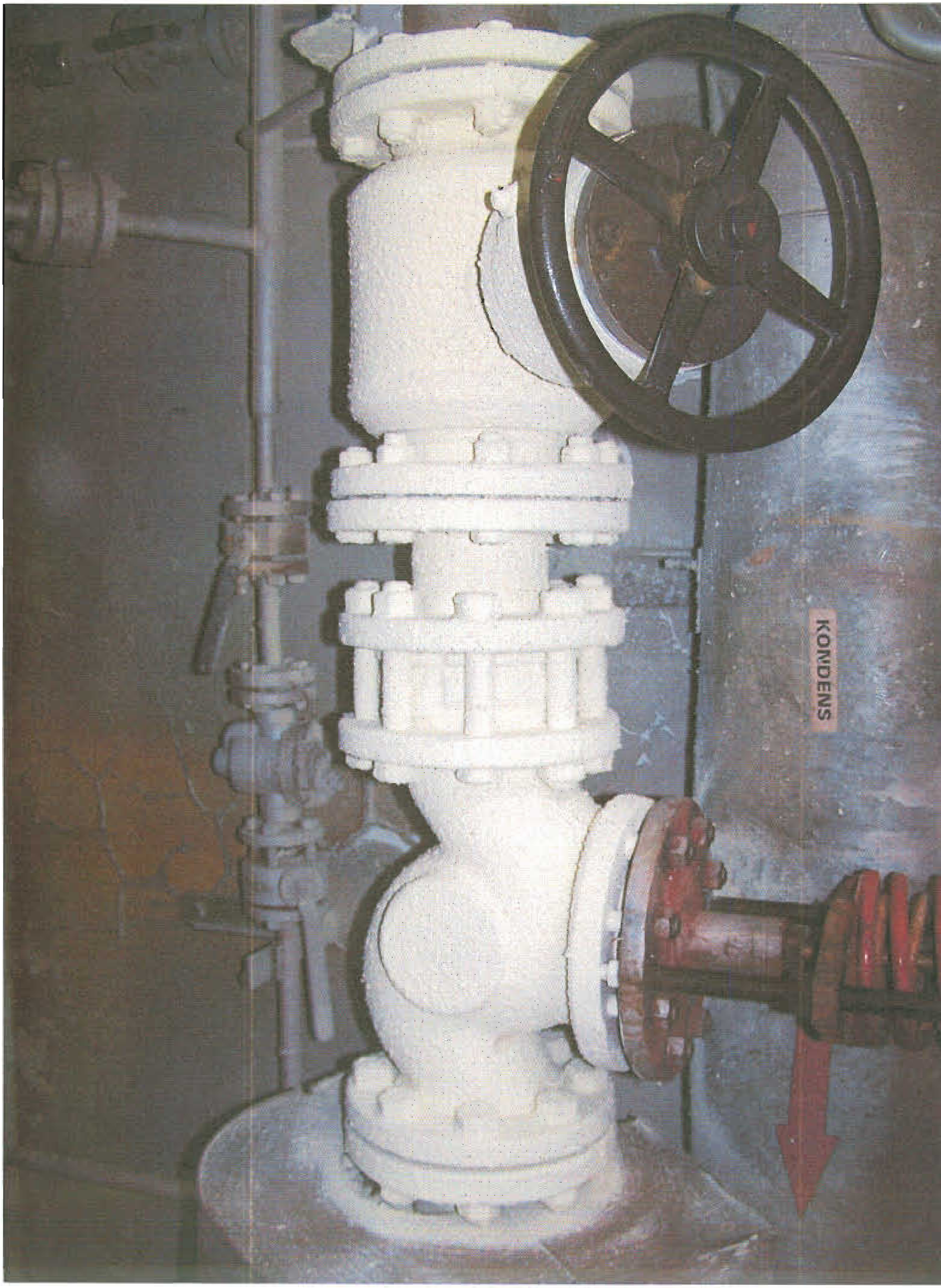
Please find attached pictures from the application of two valves made last week.
Some data :
Medium - hot water 150 °C
Surface temp. : 120 °C, 130 °C
Coverage - wet - 3,5 - 4,0 mm
Surface temperature after application:
Measured : with laser pirometer : 70 °C, 75 °C
with bi-metal : 60 °C
Anyhow the surface was easy to touchable and the customer stated : sufficient.
For a/m application we used 1 gallon. Next 7 gallons the customer will apply himself as found it not very complicated.

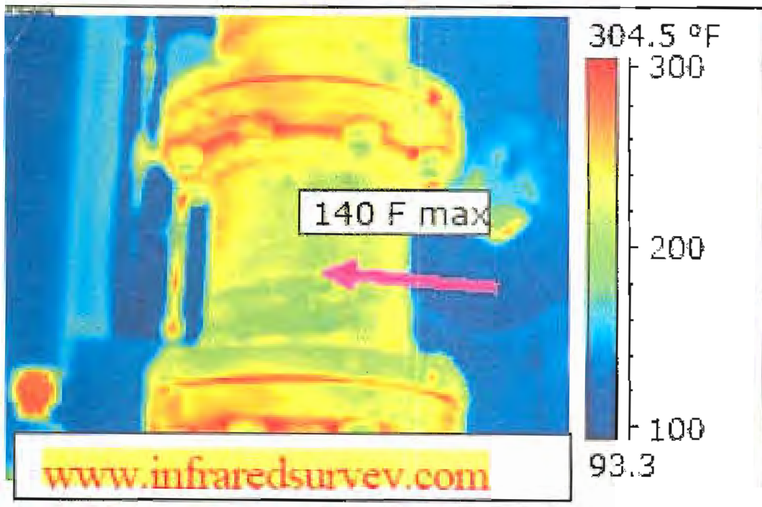
Best Regards

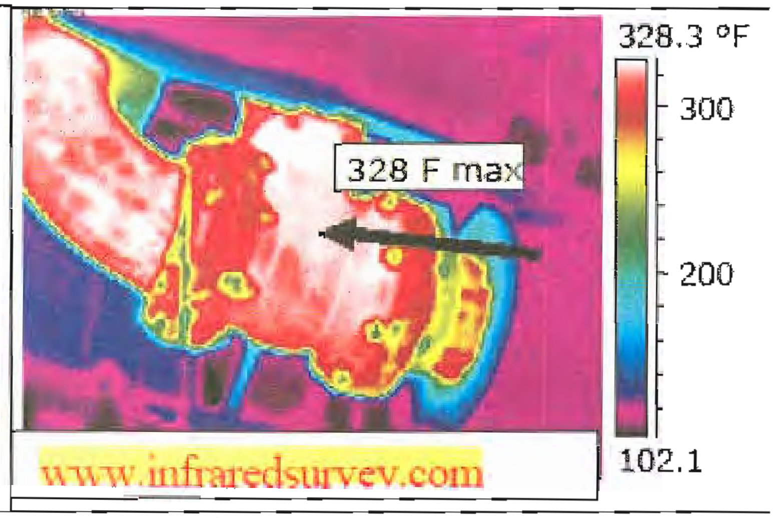
Zbigniew


POWROT


KONDENS

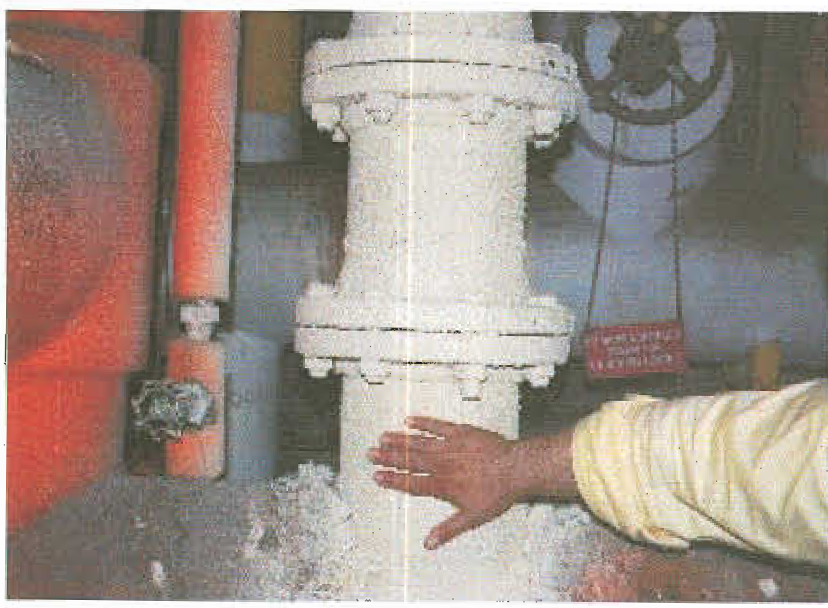

KONDENS





he same pipe train different section average temp 320 degrees F .
Iot pipe coat reduced the aver Temp by more than 180 degrees F

Vith   Without



Enercheck Systems, Inc.

www.enerchecksystems.com