

Office of the Secretary of the Navy Safety and Survivability

Non-Development Item Review:
TEMP-COAT Liquid Ceramic Insulation
for Anti-Sweat Treatments



By:

Kurt Yankaskas

*Richard F. Healing
Director*



NDI PROFILE AND APPROVAL PROCEDURE FOR TEMP-COAT® “101”

- Verification of test results offered by TEMP-COAT®
- Verification of Product use criteria and application
- Verification of Thermal Values and Condensation Control Capabilities
- Performance Based Testing aboard the USS Bonhomme Richard, USS Anzio, USS INCHON and USS WASP
- Performance test and evaluation at Bath Iron Works, Thermal Conductivity, Clean ability Adhesion Control, Fire and Smoke Development
- Time and Motion Study verification
- Product application cost study
- Conclusion

TEMP-COAT® user verification list.

Lloyd's Register – FIRE Approval Certificate # SAS/F96/640

ASTM Tests Satisfied :

- ✓ C-177 (Thermo-Conductivity)
- ✓ D-792 (Density/Weight)
- ✓ G-53 (Accelerated Aging)
- ✓ B-117 (Salt Fog Testing)
- ✓ D-3359 (Cross Hatch Adhesion)
- ✓ D-882 (Tensile Strength)
- ✓ E-84 (Flame Spread)
- ✓ E-1461-92 (Thermal Diffusivity)
- ✓ E-1269 (Specific Heat Capacity)

WHO uses it :

> GOVERNMENT

- U.S. Coast Guard
- U.S. Navy
- U.S. Army
- National Guard
- U.S. Gov't Equipment & Facilities
- State of Louisiana-Dept. of Highways
- Arkansas Dept. of Human Services

> COMMERCIAL

- Safe Haven Enterprise, Inc.
- Dole, Chiquita & F. Christiana & Co.
Food Refrigerated Trucks
- Princess Cruise Lines
- M/S Grandeur of the Seas Cruise Liner
- State Farm Insurance

APPROVED BY :

- ↓ Dept. of Energy for Weatherization
- ↓ Dept. of Transportation-U.S. Coast Guard

ACCEPTED BY :

- ↓ U S D A
- ↓ F D A

> INDUSTRY

- SIKORSKY Helicopter
- ENTERGY Electric Power Co.
- Cytec Industries
- Shell Oil Offshore
- Helmerich & Payne International Drilling Co.
- Schouest
- GTS Finnjet
- Dixie Carriers
- LITTON Ingalls Shipbuilding
- Newport News Shipbuilding
- K & S Diesel Service
- Hollywood Marine
- Apex Towing
- Marathon Coach
- Horizontal Drilling
- Sam Woo Che Company, LTD.
- POLMIL, LTD
- UCAR Pipeline Inc.
- Nat'l Electric Energy Company (Puerto Cortez)
- Auburn Waste Oil Reprocessing Laboratory (Auburn University)

Primary Uses :

- ⊗ Anti-Sweat
- ⊗ Heat & Cold Temp. Control
- ⊗ Acoustic

Apply to :

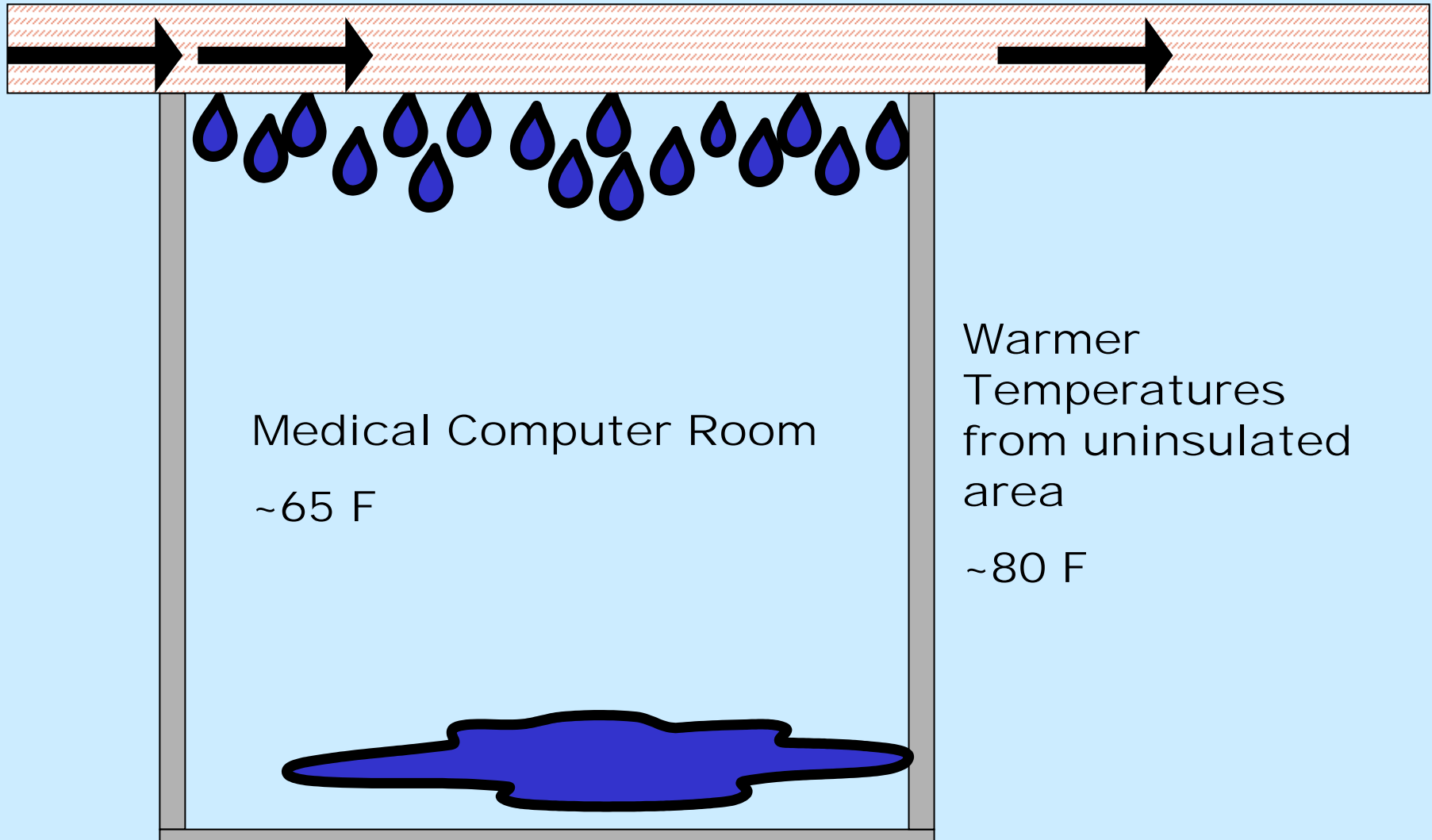
- ⊗ Roofs / Decks / Bulkheads / Ceilings
- ⊗ Bilges / Tanks
- ⊗ HVAC ducts / Wireways / Piping

Marine Condensation

- **Creates Shipboard corrosion/slip hazard**
 - **Clean-up is Labor Intensive**
- **Occurs when temperature drops below dew point**
 - **Examples:**
 - **Windshield Fog**
 - **Grass Dew**
- **Common in marine environments**
 - **Moisture saturated air**
 - **Contrasting temperature surfaces**
- **Solutions:**
 - **Raise Temperature above local dew point**
 - Heat Surface**
 - Insulate Surface**
 - **Remove Condensate**

USS Bonhomme Richard (LHD-6):

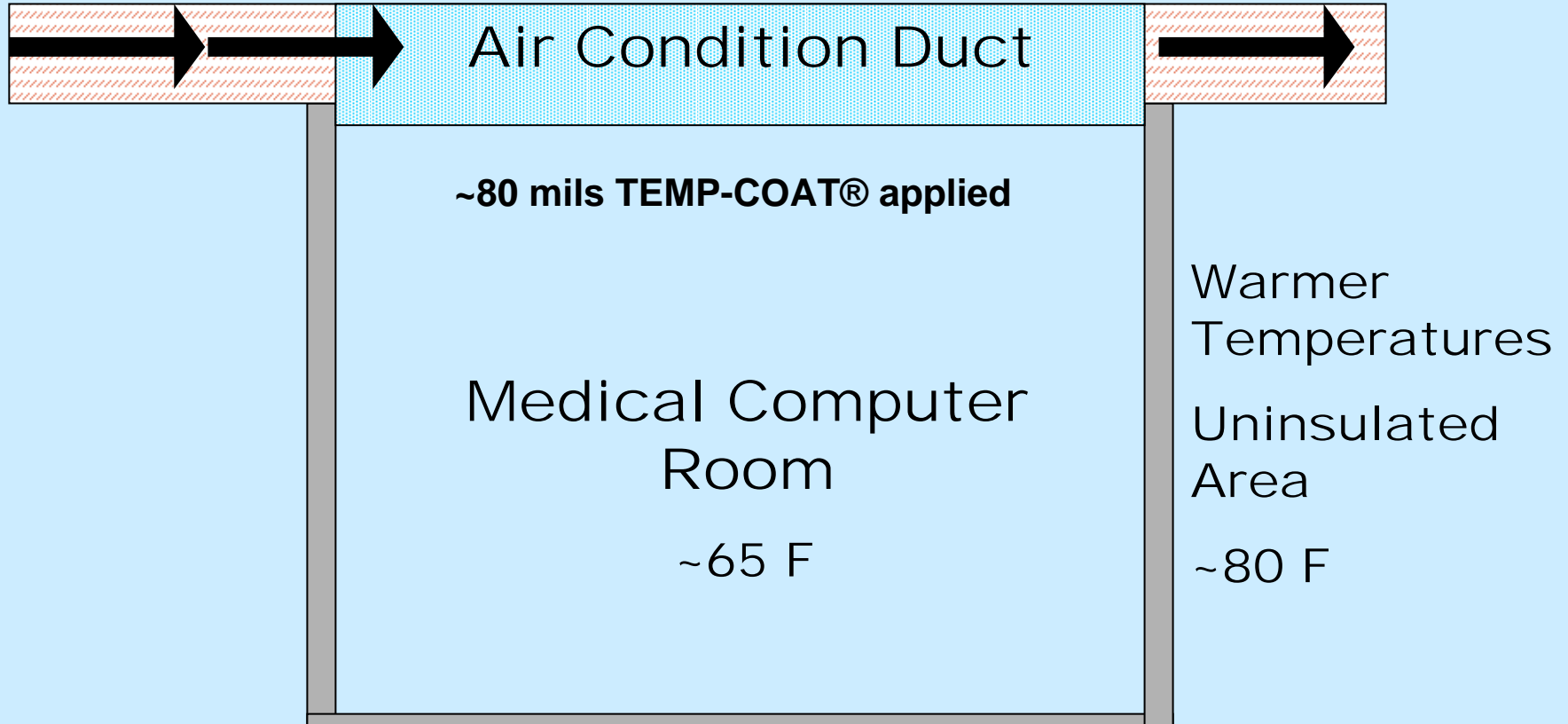
Air Condition duct condensation



USS Bonhomme Richard (LHD-6):

Air Condition duct condensation

***All areas where TEMP-COAT® is applied are holding up.
We are happy with what we have. (Lt. Valverde, 14 May 2000)***

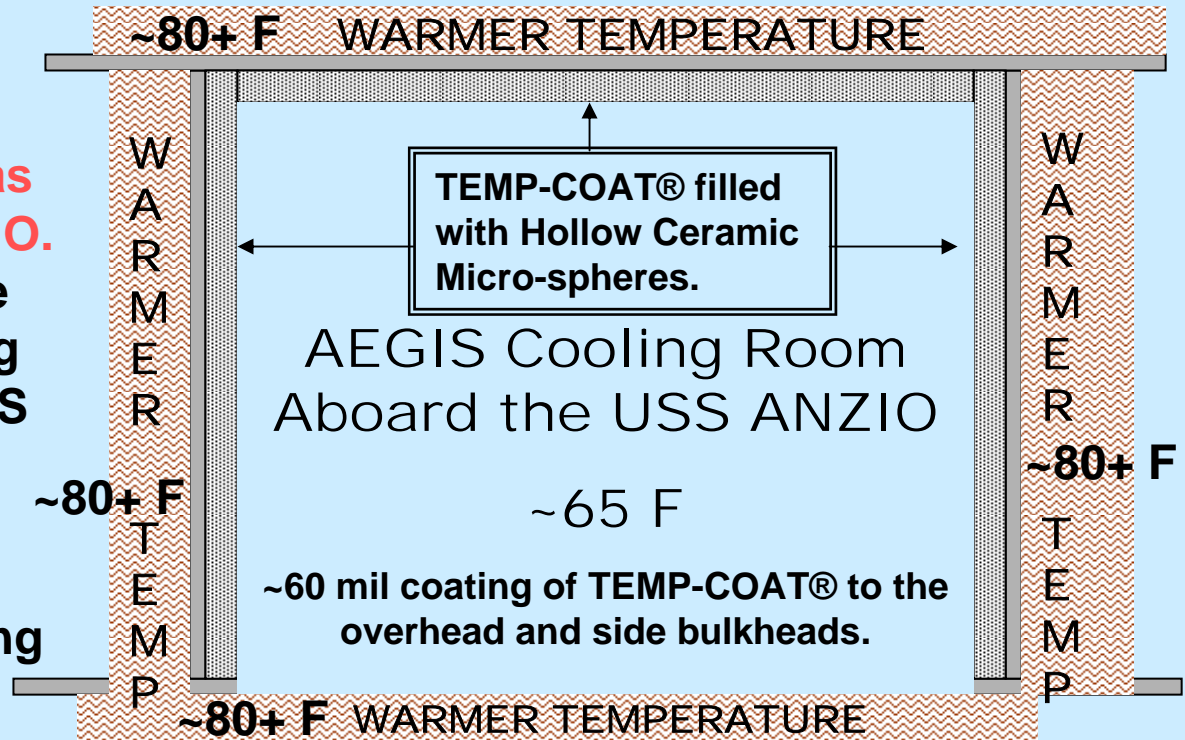


USS ANZIO, WEPS (Lt. Biggers) 3 October 2000

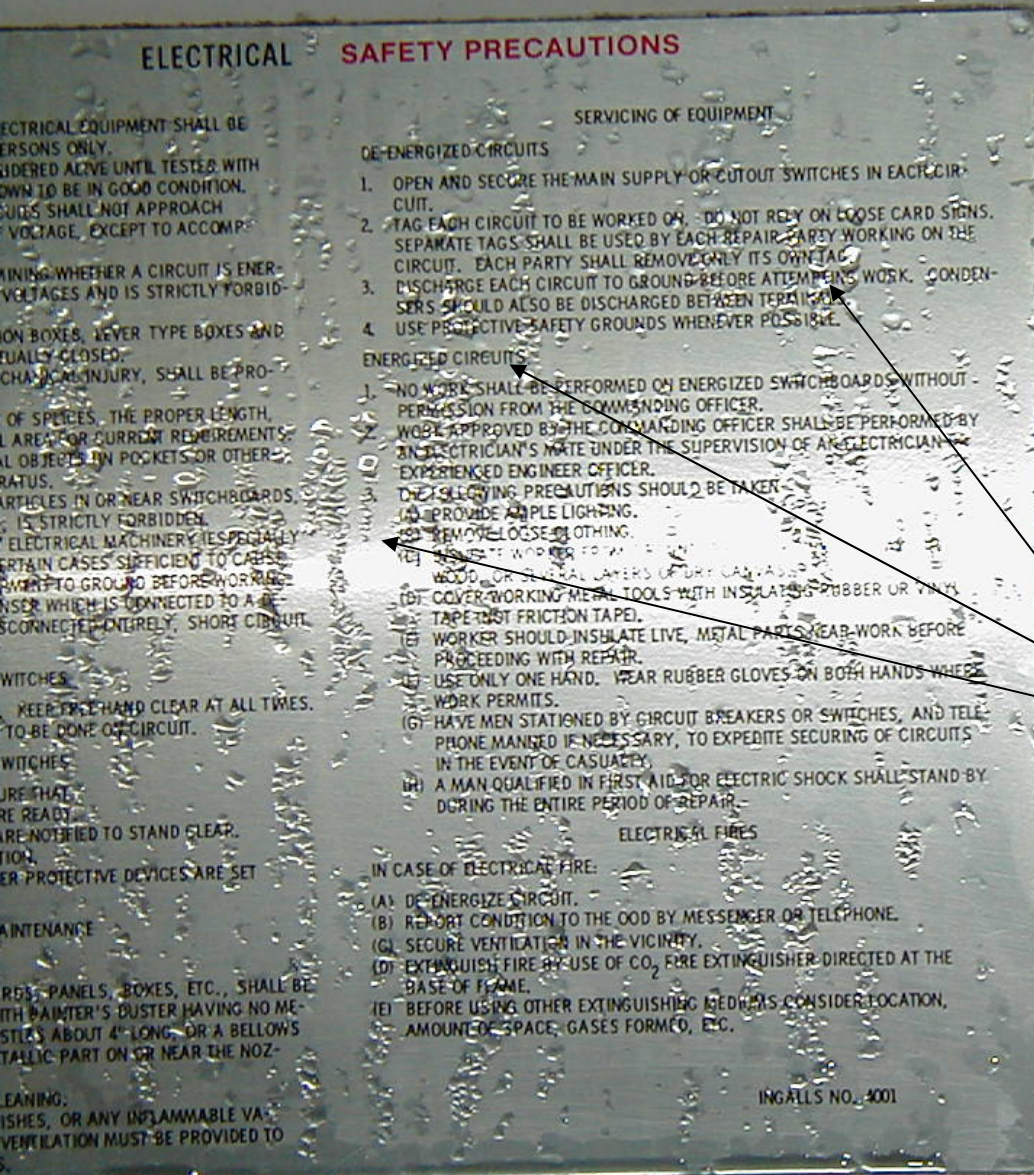
1. “Since applying Temp-Coat in February 2000 to AEGIS Cooling Room One, ANZIO has noticed the near complete elimination of condensate”.

2. “The Cooling Room's bulkheads and overhead stayed dry throughout ANZIO'S recent Mediterranean/Adriatic deployment, which included Winter, Spring and Summer conditions. Past condensate build up required a devotion of man-hours to keep Cooling Room bulkheads, overhead, deck, and equipment dry. With Temp-Coat ANZIO dedicated ZERO man-hours to cleaning up condensate”.

3. “Summary: Temp-Coat has been very beneficial to ANZIO. It has improved crew morale and quality of life by keeping ANZIO's highly skilled AEGIS technicians working and growing professionally in the area of AEGIS rather than spending hours cleaning up condensate”.



Condensation on bulkhead label plate



Uncoated label plate showing droplets of moisture due to condensation.

Bulkhead coated with TEMP-COAT® is dry

ADMINISTRATIVE MESSAGE

ROUTINE

R 131200Z APR 01 ZYB PSN 795796L43

FM INSURVLANT NORFOLK VA//00//

SUBJ/QUICKLOOK REPORT FOR USS ANZIO (CG 68) MATERIAL INSPECTION

C. "USS ANZIO IS THE TEST PLATFORM FOR A NEW TECHNOLOGY RADIANT BARRIER COATING (DFS CG68-01-00) MARKETED UNDER THE TRADE NAME "TEMP-COAT." **THIS CERAMIC COATING IS DESIGNED TO REDUCE HEAT TRANSFER AND ELIMINATE CONDENSATE BUILD-UP ON SURFACES BETWEEN SPACES OF SIGNIFICANTLY DIFFERENT AMBIENT TEMPERATURE.** USS ANZIO INSTALLED THIS PRODUCT ON THE BULKHEADS OF THE AEGIS COOLING ROOM (2-236-0-Q), A SPACE NOTORIOUS FOR EXCESSIVE CONDENSATION. **THE EFFECTIVENESS OF THIS LOW TOXICITY PRODUCT IS IMPRESSIVE. I STRONGLY RECOMMEND THAT EVALUATION OF THIS PRODUCT BE ACCELERATED AND IT BE APPROVED FOR FLEETWIDE USE AT THE EARLIEST POSSIBLE OPPORTUNITY - THE POTENTIAL MANPOWER SAVINGS AND COSMETIC IMPROVEMENTS PROVIDED ARE DRAMATIC".**

USS INCHON & USS WASP

USS INCHON

“That stuff worked wonders. The Radiomen put it up, so it’s sailor proof and we haven’t had any problems with condensation.” “I’d love to put it up in all my electronic spaces, but especially Radar 2.” EMO, 21, May 1999

- Radio Transmitter Room NR 1 & 2
- XMITTER Room Vent Duct & Cableway Enclosure

USS WASP

- Bulkhead(s) in the Main Engineering Space

Bath Iron Works Test and Evaluation of Ceramic Insulation Coating SSS 68-082 for PMS-400D

August 31, 1999

“Testing results generally supported manufacturer’s claim regarding thermal conductivity, and faired acceptably with regard to adhesion and chemical compatibility”. Signature Page (Mr. Greg Buczkowski and Mr. Gary West)

“The performance as anti-condensation coating on USS INCHON (LPH/MCS-12) has proven to be very successful. However, it appears that when used in appropriate situations, and when properly applied, have proven to be effective both as insulators and as anti-condensation measures”. Page 1 paragraph 3

“The thermal conductivity values determined by Sparrell Engineering Research Corporation for the ceramic insulation coating tested in this SSS were approximately twice the values claimed by the manufacturer. However. they were within an order of magnitude as those claimed, and the coating could be expected to present good insulation properties even at the values obtained. As a point of reference. The empirical values for thermal conductivity of the ceramic insulation coating obtained in this study correspond nearly identically to those of asbestos: an excellent, if not somewhat undesirable insulator”. Page 6 Paragraph 1

Excerpts from Engineering Report.

**BIW Determined
Thermal Conductivity
(BTU-in/”hr-ft²-° F) & (W/m-K)**

TEMP-COAT 101™	1.14 / 0.164	Radiant & Conductive equivalent ~R20 @ 15 mils
Asbestos	1.11/0.158	

Bath Iron Works

(CONTINUED)

“That the technical data provided by the manufacturer of TEMP-COAT™, via Purdue University TPRL, are corroborated by third party test data must be given reasonable weight Also, considering the possible errors introduced by the less than optimum 'field' conditions associated with the application of the coatings to the test panels in this SSS (as compared to a test samples prepared by the manufacturer under tight), controlled conditions). the differences in thermal conductivity obtained are explainable”. Page 6 Paragraph 2

Recommendation:

“further consideration should be given to other shipboard applications of this coating. Potential application would include use in areas with high radiant heat loads and temperature gradient or potentially as an anti- condensation coating in bilge areas”. Page 7 Paragraph 10

Report by: Mr. Greg Buczkowski

Approved by Mr. Gary West

Comparative Data Continued

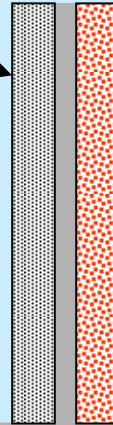
TEMP-COAT® & Hemple #617

TEMP-COAT® is filled with
Hollow Ceramic Micro-spheres

TEMP-COAT® “101” *DOES NOT ABSORB MOISTURE.*

TEMP-COAT® “101” *INSULATES* via
Thermal Conductivity, Diffusivity & Emmissivity

TEMP-COAT® “101” protects the coated surface from “*CUI*” (corrosion under insulation)

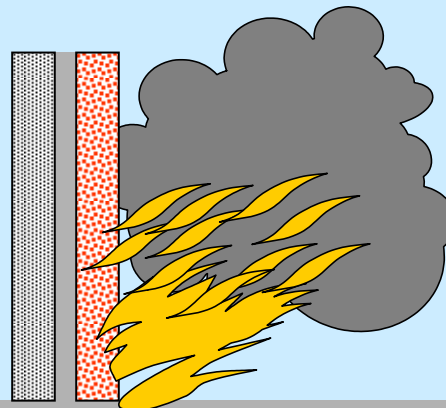


“Hemple #617 works by absorbing moisture”. The moisture is released back into the air after saturation including any bacteria or pathogens that may have accumulated. “The recommended 60 mil thickness will absorb approx. 1 qt. of water per 10 sq.ft. of coated surface”.

TEMP-COAT® is *NON-COMBUSTIBLE.*

TEMP-COAT® *WILL NOT FUEL A FIRE.*

TEMP-COAT® has a *LOW FLAME SPREAD* of 5 (ASTM E-84) (0 is concrete and 99 is red oak flooring)

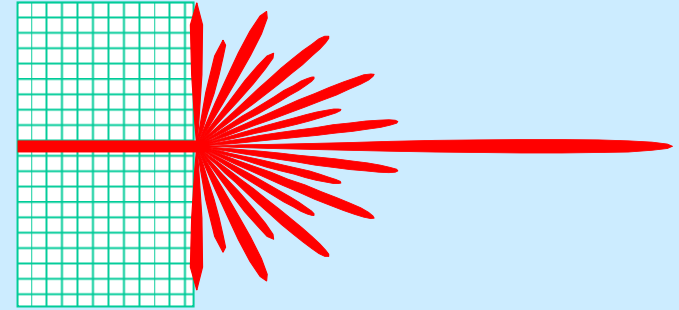
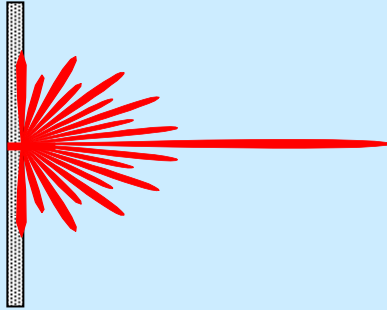


“Hemple #617 has a flashpoint of 135 F”.

“Hemple #617 will burn when dry as per MSDS pg 5 of 7”

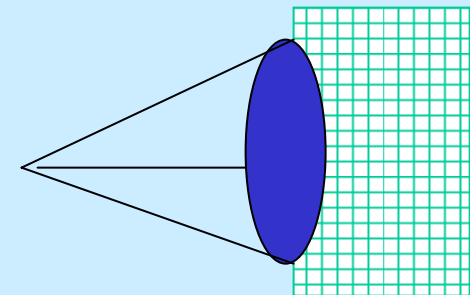
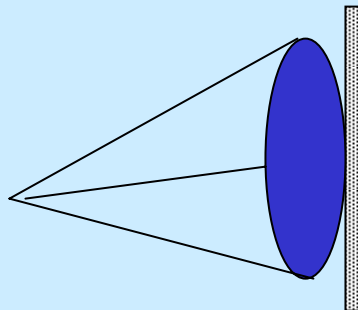
“Hemple #617 has a Lower Explosion Level of 33%”

Thermal Diffusivity, per ASTM E-1461-92, is determined using the laser flash diffusivity method



Note; According to Dr. Taylor this test records Specific Heat & Thermal Diffusivity of a given point on the coupon provided. It does not take into consideration TEMP-COAT'S added benefits of Reflectivity, Diffusivity and Emmissivity of the total mass of the barrier.

Specific heat (c), per ASTM E-1269, was measured using a differential scanning calorimeter and Thermal Conductivity (λ) values were calculated as a product of ie: $\lambda = aC_p d$



TEMP-COAT® LIQUID ACRYLIC LATEX INSULATION PROVIDES:

- **TEMP-COAT® , A MULTI-PURPOSE PRODUCT HAS PROVIDED SERVICES TO THE MARITIME INDUSTRY FOR OVER TEN YEARS.**
- **TEMP-COAT® IS APPROVED AND USED BY THE U.S. COAST GUARD, CHEVRON, EXXON, SHELL OFF SHORE, PEMEX, DIXIE CARRIERS, Del MONTE, DOLE, CHIQUITA AND A HOST OF OTHER MARITIME AND OFF-SHORE INTERESTS WHO RECOGNIZED THE NEED FOR A MULTI-PURPOSE PRODUCT.**
- **TEMP-COAT® INSULATES, HELPS PREVENT CORROSION BECAUSE IT ADHERES TO THE SURFACE IT INSULATES, WEIGHS LESS THAN 5.9 LBS. PER GALLON AND CAN BE TINTED ANY LIGHT TO MEDIUM COLOR.**
- **TEMP-COAT® IS EXTREMELY EASY TO INSTALL, INEXPENSIVE AND IS SAILOR FRIENDLY. TEMP-COAT® CONTAINS NO VOCs, NO HEAVY METALS, NO MERCURY OR CHLORIDES AND WILL NOT ADD TO A FIRE IF ONE OCCURS. TEMP-COAT® SMOKE IS NON-TOXIC.**

TEMP-COAT® LIQUID ACRYLIC LATEX INSULATION PROVIDES:

- TEMP-COAT® IS USED IN THE PRIVATE SECTOR TO PREVENT CONDENSATION BEHIND LAGGING SUCH AS THAT WHICH IS USED IN NAVY VESSELS. TEMP-COAT® HAS REPLACED INSULATION IN MANY INSTANCES WHERE MOISTURE AND SALT AIR HAS CAUSED CORROSION DAMAGE.**
- TEMP-COAT® IS USED TO INSULATE PIPES, BOILERS, CHILLED WATER LINES, CRYOGENICS AND A WIDE ARRAY OF OTHER IMPLEMENTS BECAUSE OF ITS SUPERIOR QUALITIES AND EASE OF APPLICATION.**
- TEMP-COAT® HAS BEEN TESTED AND DEEMED TO BE AN EXCELLENT FORM OF INSULATION AND ANTI-CONDENSATION MATERIAL VIA ITS THERMAL CONDUCTIVE NATURE. TESTS AND PRACTICAL FIELD TRIALS HAVE BEEN CONDUCTED SUCCESSFULLY BY THERMAL PHYSICAL PROPERTY LABS, PURDUE UNIVERSITY, BATH IRON WORKS, NEWPORT NEWS SHIPYARDS, INGALLS SHIPBUILDERS, FLEET TECHNICAL SUPPORT CENTER PACIFIC, U.S. COAST GUARD, ATLANTIC ASSIGNED VESSELS AS THE INCHON & THE ANZIO AND THE BOARD OF INSPECTION & SURVEY ALL OF WHICH IS AVAILABLE FOR YOUR REVIEW.**

TEMP-COAT® costs based on an installation to the USS ANZIO

TEMP-COAT® INSULATION, PRODUCT COST	\$ 42.00 per US Gal
TEMP-COAT® COVERAGE RATE @ 45 mils	21 sqft per US Gal
APPLICATION RATE IN THICKNESS* PER COAT, IN MILS (1/1000)	20 - 30
RECOMMENDED THICKNESS FOR GENERAL SHIPBOARD USE IN MILS (1/1000)	45 to 60
COATS TO OBTAIN 60 MIL THICKNESS	2
COST OF PRODUCT PER SQ. FT. AT 45 MILS	\$ 2.00
COST PER SQFT FOR LABOR VIA OUTSIDE CONTRACTOR ** FOR 2 COATS @ 45 MILS PER SQFT TOTAL. TURNKEY JOB	\$ 4.11
ALL END COST FOR AN ACTUAL INSTALLATION ON A NAVY VESSEL BY INDEPENDENT CONTR. (TIME & MATERIAL)	\$ 6.11 (45 MIL SF)
COST PER 10 SQ. FT. @ 45 MILS	\$61.10

TEMP-COAT® Costs

(Continued)

• APPLICATION RATES CAN VARY DEPENDING UPON WEATHER CONDITIONS, BAROMETRIC PRESSURE, DEW-POINT, TEMPERATURE AND WORKING CONDITIONS. APPROXIMATELY 83% SOLID BY VOLUME THEREFORE DRYING TIME IS EXTREMELY RAPID.

* SECOND COAT CAN BE APPLIED IMMEDIATELY UPON FIRST COAT FLASHING (TEMP-COAT® IS MICRO POROUS).

** INDEPENDENT CONTRACTOR INFORMATION BASED ON ONE ACTUAL APPLICATION ABOARD THE ANZIO. THIS JOB WAS 1000 SF AND THE COST INCLUDED TIME FOR ENTRY, SET-UP, MASKING, CLEANING AND PREP, APPLICATION, TAKEDOWN PLUS ALL RELATED TURNKEY JOB COSTS. PRODUCT WAS PURCHASED SEPARATELY BY THE ANZIO.

CONCLUSION

. TEMP-COAT® IS A THERMAL BARRIER FORM OF INSULATION WHICH PERFORMS WELL AS A CONDUCTIVE AND RADIANT MATERIAL. **A PROVEN BY-PRODUCT OF THE INSULATION IS ITS EXCELLENT PERFORMANCE AS A CONDENSATION BARRIER.**

. TEMP-COAT® IS A FOURTEEN YEAR OLD PRODUCT WHICH IS ACCEPTED BY INDUSTRY AND COMMERCIAL USERS WORLD-WIDE. TEMP-COAT® IS NOTED FOR ITS ABILITY TO INSULATE WHILE PREVENTING CORROSION UNDER INSULATION (CUI). BECAUSE IT ADHERES TO THE SURFACE IT INSULATES AND DOES NOT REQUIRE JACKETING, PROBLEM SOLVING AND INSPECTION IS SIMPLE and THOROUGH. TEMP-COAT® OFFERS A PERMANENT SOLUTION.

. TEMP-COAT® CAN SAVE THE NAVY MONEY WHILE IT PROTECTS ITS EQUIPMENT AND CREATES A BETTER, SAFER ENVIRONMENT FOR THE SHIPS INHABITANTS.

. TEMP-COAT® HAS BEEN TESTED USING EXACTING ASTM PROCEDURES PERFORMED BY A LEADING CERTIFIED THERMPPHYSICAL LAB. TEMP-COAT® HAS BEEN APPLIED TO NUMEROUS NAVY AND COAST GUARD VESSELS AS AN INSULATION AND AN ANTI-SWEAT COATING OVER A FIVE YEAR PERIOD WITHOUT A PRODUCT FAILURE. TEMP-COAT® IS APPROVED AS AN INSULATION AND AN ANTI-SWEAT PRODUCT BY THE U S COAST GUARD. SEVENTEEN TESTS WERE PERFORMED TO PROVE THE PRODUCTS OVERALL WORTHINESS.

. TEMP-COAT® IS EASY TO APPLY, VERY LIGHT WEIGHT AT LESS THAN 5.9 LB. PER GALLON, DOES NOT ABSORB SALT AIR OR MOISTURE AND IS EXTREMELY COST EFFECTIVE. TEMP-COAT® CAN BE TINTED TO ANY LIGHT TO MEDIUM COLOR TO COMPLY WITH THE NEEDS OF THE NAVY.

. TEMP-COAT® HAS BEEN APPLIED AND TESTED AT BATH IRON WORKS, NEWPORT NEWS SHIPYARD, INGALLS SHIPBUILDING, SAN DIEGO, BOLLINGER SHIPYARD (USCG) WITH COMPLETE SATISFACTION AS AN INTERIOR AND EXTERIOR INSULATION COATING.

. **TEMP-COAT® IS PROVEN TO BE A BENEFICIAL PRODUCT FOR THE NAVY.**