China National Center test-Interior application in Cold Climate

February 9, 2008

Subject: Result of CeraTherm Demo Project in Beijing

Purpose: To determine the energy saving characteristics of **CeraTherm** -added paint during winter months when applied on interior walls and ceilings of a structure

Test Agency: China National Center for Quality Supervision and Test of Building Engineering, Chinese Academy of Building Research

Test Dates: Dec. 26, 2007 - January 4, 2008

Test Site: Huai Rou District, Beijing, CHINA

Test Structure: Two identical-sized rooms on the upper floor of a two-story brick apartment building.

Method of Evaluation: Painted the interior walls and ceiling of one room with ordinary paint (Libong Paint, the most popular brand in China) and the other room with **CeraTherm** added to the same ordinary paint. Both rooms were instrumented with an array of automated recording instruments to monitor the inside and outside temperatures during the test. Each room was heated up by its own electric heater with their temperatures set and maintained at 20oC (68oF), while the usage of electricity from both heating units was recorded throughout the test. The difference of the usage in electricity thus gives a direct measure of the amount of energy saved from the use of **CeraTherm**.

Inside Room Temperature: 20oC (68oF)
Outside Air Temperature (Average): 0oC (32oF)

Test Result: After carefully established the balance and stability of the test environment, as mentioned above, within a 52.5hrs time span, the electric heater for the room without **CeraTherm** registered a reading of 61.8KWh, whereas the one with **CeraTherm** of 53.1KWh. The difference was 8.7KWh and the energy saving is calculated to be 14.1% ((61.8 - 53.1)/61.8). With some adjustments related to the recording systems, it is concluded to a minimum energy saving of 12% and higher.

Conclusions:

- The use of I **CeraTherm** -added paint showed significant energy saving effect during winter months when compared with application using ordinary paint.

- Under the same exterior temperature (0oC (32oF)) and the same room temperature controlled at 20oC (68oF), the use of **CeraTherm** -added paint resulted in an energy saving rate of 12% and higher.

NATIONAL CENTER FOR QUALITY SUPERVISION AND TEST OF BUILDING ENGINEERING

Client: Beijing Elite Union Engineering Consultation, Ltd., China Real Estate Chamber of Commerce

Address: No. 172, Danyao Building, Dongcheng District, Beijing.

Phone number: 010-65289953

Name of Engineering: Apartment building with **CeraTherm** Application

Place of Engineering: Village Sidu River, Town Jiuduhe, Huairou District, Beijing.

Test:

Item: Testing and evaluation of energy-saving effect with **CeraTherm** application.

Date: Dec. 26, 2007 to Jan. 4, 2008

Instruments: Data Acquisition System, infrared camera, electric meter, and temperature control system.

Reference documents:
1. Industry Standard, "Test standard for energy-saving effect of buildings during winter heating."
2. Construction drawings as provided by client.

Conclusions:

Test results show the following:

- Comparing with the use of ordinary paint applied to the interior walls and ceilings of a structure, the use of **CeraTherm** -added same paint on these surfaces showed significant energy-saving effect during winter weather conditions.
- When compared, under the same air temperature outside of a structure and the inside temperature controlled at 20oC, the interior walls and ceilings coated with **CeraTherm** -added paint, as supplied by M. J. Trading International, Inc. USA,

with the surfaces applied using ordinary paint; the former showed significant energy-saving for its winter application, with its energy-saving rate above 12%.

- See the following pages for detail.

As requested by the Beijing Elite Union Engineering Consultation Ltd., China Real Estate Chamber of Commerce, and M. J. Trading International, Inc., USA, the Center conducted a comprehensive test program evaluating the difference in using **CeraTherm**, a paint-additive, with respect to its effect in winter energy-saving. The test was carried out in a two-story apartment in Huai Rou District, Beijing, from December 26, 2007 to January 4, 2008, between two rooms; one room's inside walls and ceiling used **CeraTherm** -added paint and these surfaces of the other room used the same paint without **CeraTherm** (the paint used is called "Li Bong Paint"). Through measurements and monitoring, we obtained the actual consumption readings in electricity of the two rooms. Along with all the environmental temperature recordings, we were able to make an objective analysis and evaluation with respect to **CeraTherm** 's energy-saving effects.

Results from the test program showed that under the same inside (basically controlled at 20oC) and outside temperatures of the two test rooms, the room that coated with **CeraTherm** -added paint showed an energy-saving of over 12%, as determined from the measured difference in energy consumption.

A. Basic Characteristics of The Test Building

The test building is at Village Sidu River, Town Jiuduhe, Huairou District, Beijing. It is basically a two-story brick structure. Total constructed area is about 200m2 and the height of the building is 6m. (See Figure 1)

The building is located on the north flank of the North Mountain where the Shidu River meanders its south. Because its close proximity to the mountain, the building is ideal for such a comparative test program. It is a brick structure; with exterior walls made of 240mm clay bricks. The roof line is inclined. Windows are wood-frame single-pane windows.

B. Testing and Data Processing

1. Testing

We selected two rooms that face north as test rooms. They both have an inclined roof line and have one exterior wall facing north. Locations and sizes of their windows are the same. (see Figures 2 and 3). See also Figures 4 for structural detail of the exterior wall and the roof. Dimensions of the two rooms are basically the same: areas are 11.3m2 and 11.7m2, respectively. The direction of the other exterior wall of these two test rooms is different; one faces east, and the other west. Because the building is right next to the mountain, the room temperature of this building is not affected by radiation heat from the sun.

The interior walls and ceilings of the two test rooms were painted using Li Bong paint with and without **CeraTherm** respectively. Both windows were also sealed off using thin plastic sheets.

2. Temperature control, Measurement of electricity, and Infrared Photography

The inside temperature of both rooms were set at 20oC, as controlled and monitored by a temperature control system. Electric meter readings for each room were taken four times per day, as a direct measure of their energy consumption. Using a comprehensive data collection system, we also gathered the data on the air temperatures inside and outside of the test rooms and the surface temperature inside and outside of the exterior walls and windows (See Figure 5). We have also used infrared photography to capture the temperature distribution of these exterior walls and windows. Based on these data, we were able to make an objective assessment on the comfort-ability of the rooms where their interior walls and ceilings were with or without the use of **CeraTherm** -added paint.

3. Locations of Measuring Points

20 measuring points were placed in and outside the two test rooms to measure the inside and outside air temperatures of the rooms and the temperature on the inside and outside surface of the exterior walls. The measuring system also included four heat flux measurement devices, measuring the change in heat flux as it passed through the exterior walls. Locations of these measuring points are shown in Figure 6.

4. Test Results

From the collected and analyzed test data, we were able to obtained the energy consumption readings of each room and the temperature distribution on both surfaces of the exterior walls during the test duration when the outside air temperature varied from -4°C (30F) to 4°C (34F), and the room temperatures maintained at 19.6°C (67F) to 22.5°C (72F).

(3) Analysis of I CeraTherm 's energy-saving effect

Table 1 presented the daily electricity consumption data of both test rooms as well as their cumulative consumptions under the condition when the air temperatures both inside and outside the test rooms were maintained at their constant conditions.

It is clearly demonstrated that, during winter weather conditions when the outside air temperature varied from -4oC (30F) to 4oC (34F), and the room temperatures maintained at 19.6oC (67F) to 22.5oC (72F), within a time frame of 52.5hrs, the room without the use of I **CeraTherm** -added paint, resulted in an additional electricity consumption of 8.7KWh when compared it with the room using **CeraTherm** -added paint. The energy-saving rate is 14.1%.

(4) Infrared photography

The use of a "VCi175" infrared camera, made by Infra Tec, Germany, allowed us to assess the difference in indoor heat environment as captured from the photos taking on both test rooms; as well as the improvement in thermal characteristics of the exterior wall of the room using **CeraTherm** -added paint.

The building itself has a very serious "cold bridge" problem because its exterior walls were made of 240mm bricks with no other insulation provision. The heat loss through windows was also very high because they were wood-frame single-pane windows. Overall the buildings' air tightness is very poor.

From Figure 8, we can see that the external surface temperature of the widow of the test room with **CeraTherm** -added paint was -6.2oC, whereas it was -9.2oC for that of the room with ordinary paint.

The temperature difference between these windows was 3.0oC. For the external surface temperature of the exterior walls, the wall of the room with **CeraTherm** -added paint had a reading of -6.9oC; whereas it with ordinary paint had a reading of -6.3oC. The former was 0.6o C higher than the latter, which means that the room with **CeraTherm** -added paint because of its lower radiation rate, it brought up the comfort-ability of the room and at the same time improved the thermal characteristics of the exterior wall.

C. Conclusion

The test results showed that the structure, when it is applied with **CeraTherm** -added paint, resulted in significant energy consumption due to the paint's low radiation characteristics with respect to the indoor heat environment. After some careful adjustments from the test conditions, we have concluded its energy-saving effect to be above 12%.

China Exterior Summer

2008 Conducted by: Center for Energy-saving Research School of Architecture Huanan University of Science and Technology Guangzhou, Guangdong, CHINA

Summary:
The test program was carried out at the Huanan Univeriesty of Science and Technology's Center for Energy-saving Research, using two of its fully-instrumented real-size rooms, during the late summer of 2008. The test lasted seven days from September 26 to October 3, with maximum temperature exceeding 30C (85F), comparing the difference in electricity consumption between the two rooms, one's exterior walls and roof coated with **CeraTherm**-added exterior paint and the other not. The test resulted in a significant energy-saving of 24.8% from the former where **CeraTherm** -added paint was applied.

1. Objective
Through a comparative study on energy consumption from real-size test rooms to determine the energy-saving rate of buildings in Guangzhou area when the **CeraTherm**-added ordinary exterior paint is applied to these buildings. The findings will offer fundamentally-sound experimental data for **CeraTherm** 's application to exterior walls and rooftops of buildings in China's hot-summer/warm-winter regions.

2. Scope
2.1 Method of testing:
Selected two energy-saving test rooms - two typical office rooms, identical in structure, adjacent-room condition, interior heat environment including A/C temperature setting and working schedule. Both rooms are made of metal-boards, with inside and outside wall thickness of 2mm sandwiched with 4.6mm EPS material. The rooftop is made of inside and outside metal-wallboards of 3mm in thickness insulating with 9.4mm EPS in between. The exterior walls and the roof of one room (called "Treated Room," TR) were coated with **CeraTherm** -added exterior paint; those of the other (called "Untreated Room," UR) were coated only with the same regular exterior paint without **CeraTherm** serving for comparison purpose. The paint used was a Dulux Weather-shield Plus Paint, an ordinary exterior paint. **CeraTherm** was added to the paint with a ratio of 1 to 9 by weight. In addition, a 10% of water by weight was added to dilute the mixture. Photos of the test site, testing in progress, and the data collection system are given in Appendix 1.

Thermal probes for temperature measurement at various points in the rooms are given in Table 1 below. Exact locations of these probes are shown in Appendix 2.

Table 1 Thermal Probe Locations

Probe	Number of temperature measuring points	Location measurement was made
1	1	TR's southern exterior wall
2	1	TR's southern interior wall
3	1	TR's indoor air temperature
4	1	TR's northern interior wall
5	1	TR's northern exterior wall
6	1	TR's roof temperature
7	1	UR's southern exterior wall
8	1	UR's southern interior wall
9	1	UR's indoor air temperature
10	1	UR's northern interior wall
11	1	UR's northern exterior wall
12	1	UR's roof temperature
13	1	TR's ceiling temperature

2.2 Test Instrument and Layout

2.2.1 Test Instrument

All instruments and equipment are FLUKE Hydra digital data collection type. All 14 temperature probes are thermal couples.

2.2.2 Test Process and Layout

All temperature probes were coated with Vaseline to enhance its thermal conductivity for better temperature measurement. The two indoor air temperature probes were covered by a cone-shaped tin-foil to eliminate the interference of heat from solar radiation. Other probes used for exterior temperature measurement were all coated with Vaseline as well as one coat of paint (with or without **CeraTherm**) - for more accurate temperature measurement.

2.3 Testing and Notes Related to Testing

<u>Test dates</u> 2008.09.26~2008.10.03,
<u>Time</u> 8:00~18: 00
<u>Test condition</u> Throughout testing the air-conditioning units at both the UR and TR rooms were maintained at 26oC, the government required winter temperature setting. Temperature probe readings were recorded via the digital data collection device on ten-minute intervals. Rooms adjacent to the UR and TR rooms also had their room temperature controlled by A/C at 26oC. Electricity usage by the UR and TR rooms were recorded on hourly basis to determine the usage throughout the day. Total number of

days tested were seven; most days were sunny, occasionally cloudy. Maximum air temperatures outside during the days were all above 30oC.

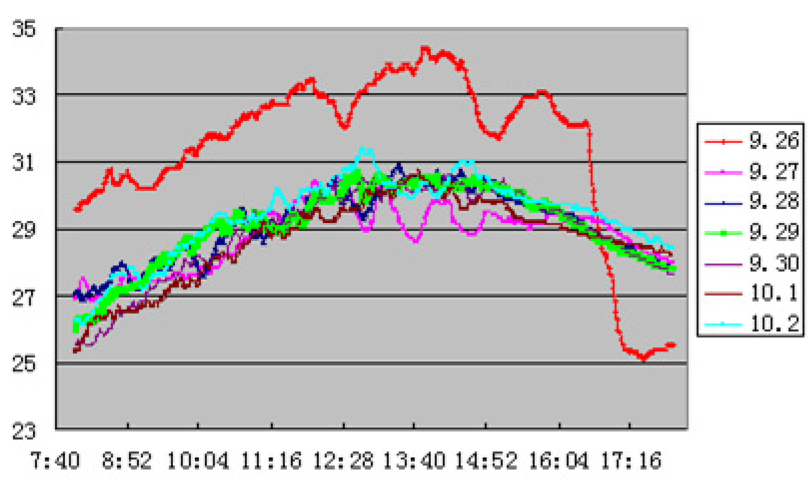


Figure 1 Outdoor Air Temperature during Testing Period
(Data provided by Wushan Weather Station, Guanghzou, Guangdong, CHINA)

3. Data Reduction

3.1 Calibration and correction of Collected Data

Upon completing the field measurement, all collected temperature data were calibrated against an officially calibrated mercury thermometer; and then all went through a linear regression analysis (see Appendix 3). The obtained data were then corrected against these curves.

3.2 Test Results

3.2.1 Electricity Consumption and Average Indoor Temperature

Table 2 presents the daily electricity consumption of the UR and TR rooms throughout the day; whereas Table 3 shows their respective daily average indoor temperatures.

Table 2 Electricity Consumption of Treated and Untreated Rooms

Date	Time of day	Electricity Consumption (degree)- TR	Electricity Consumption (degree) - UR	Percent of Energy Saving
2008.09.26	9: 00~18: 00	8.4	10.6	20.8
2008.09.27	8: 00~18: 00	3.55	4.9	27.6
2008.09.28	8: 00~18: 00	4.05	6.75	40.0
2008.09.29	8: 00~18: 00	3.6	5.55	35.0
2008.09.30	8: 00~18: 00	4.88	6.5	24.9
2008.10.01	8: 00~18: 00	4.66	5.55	16.0

2008.10.02	8: 00~18: 00	3.96	5.85	32.3
Total consumption in 7days		33.1	45.7	27.6

Table 3 Average Temperature During Testing

Date	Time of day	Average Temp °C - TR	Average Temp °C - UR	Temp Difference, °C
2008.09.26	9: 00~18: 00	24.56	24.80	-0.14
2008.09.27	8: 00~18: 00	25.49	24.95	0.54
2008.09.28	8: 00~18: 00	24.91	25.16	-0.25
2008.09.29	8: 00~18: 00	25.15	24.58	0.57
2008.09.30	8: 00~18: 00	24.20	24.09	0.11
2008.10.01	8: 00~18: 00	24.44	24.58	-0.14
2008.10.02	8: 00~18: 00	24.71	24.51	0.2
Average indoor temperature in 7days		24.78	24.67	0.11

3.2.2 Temperature Probes Data Analysis

Because of the similar characteristics of the collected temperature throughout the seven days of testing period, we have chosen herein the data from September 26th as an example for analysis of the temperature measured at various points: both above and below the rooftop and inside and outside of walls at the southern and the northern walls, for the Treated and Untreated Rooms. In the following figures, ■ are data points for the TR room; and ▲ for the UR room.

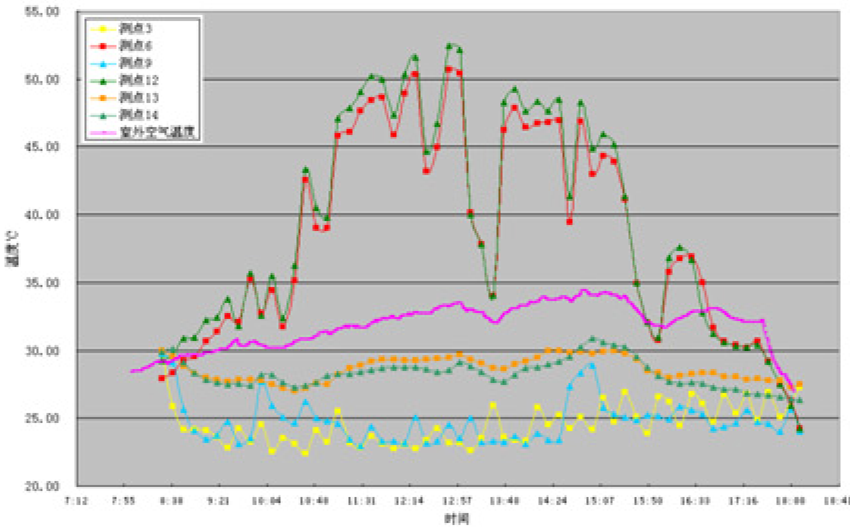


Figure 2 Comparison of Temperature readings at points above and below the rooftop of UR and TR rooms - Sept. 26, 2008

Figure 2 shows the distribution of temperature readings at points both above and below the rooftops of the UR and TR rooms on September 26, 2008. It can be seen that in most cases the outside (rooftop) temperature of the TR room is 0 to 2oC lower than those of the UR's. At 1pm, both the roof and ceiling temperatures were lowered substantially most likely because of the cloud coverage. Because the indoor temperature was controlled by A/C, it resulted in a very small temperature difference between the two rooms. Throughout the testing period, the average indoor temperature of the TR room was 24.56oC; whereas that of the UR room was at 24.80oC; with a difference of 0.14oC. The probes were placed at the same location of its respective room, 1.5m above ground but a bit skewed to the wall where the A/C unit was located. That was the reason why the temperature readings were lower; as compared with the overall indoor temperature, which was in between 25 and 26oC.

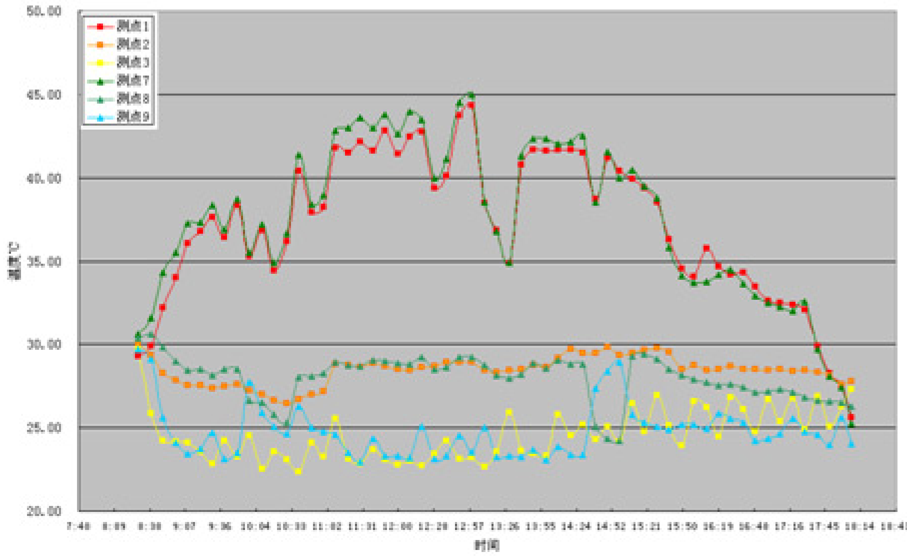


Figure 3 Comparison of Temperature readings on the southern interior and exterior walls of UR and TR - Sept. 26, 2008

Figure 3 shows that the temperature on the exterior southern wall of the TR room is in general 0 to 1.6oC lowered than those on the same location of the UR room. The temperatures measured at Probes 2 and 8 do not show a fixed trend, probably was affected by the indoor temperature. The reading on the interior southern wall of the UR room showed a sudden drop at 14:52, which was caused by an unexpected shifting of the air-flow deflector of the A/C unit, thereupon let the direction of the cold air blowing onto the probe directly. The problem was rectified as soon as it had been discovered.

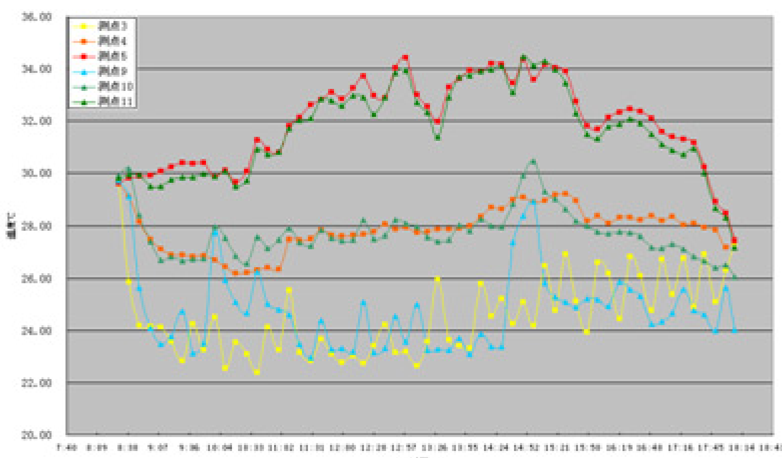


Figure 4 Comparison of Temperature readings on the northern interior and exterior walls of UR and TR rooms - Sept. 26, 2008

Figure 4 compares the temperature measurements on the northern interior and exterior walls between the UR and TR rooms. It seems that the temperatures on the northern exterior wall of the TR room are 0 to 0.8oC higher than those measured on the northern exterior wall of the UR room, most likely due to the fact that there is a semi-transparent plastic awning cover over the northern exterior wall of the UR room where the temperature probe was placed, whereas no plastic cover for the TR room.

4. Summary
Based on the electricity consumption data in Table 2, the Treated Room (TR) shows an energy-saving rate of 27.6% over the Untreated Room (UR). A 10% correction was made on this saving rate based on the average indoor temperature data given in Table 3, where it showed that the temperature in the Treated Room is 0.11°C higher than that of the Untreated Room. And the adjusted energy-saving rate is 27.6% x 0.9 = 24.8%.

Temperature data collected from the thermal probes placed on the rooftops and the southern exterior walls showed that the temperature on the rooftop of the Treated Room was 0 to 2°C lower than that of the Untreated Room; whereas the temperature on the southern exterior wall of the Treated Room was 0 to 1.6°C lower than its counterpart of the Untreated Room. The rooftop and the southern walls are the primary routes for solar rays entering the rooms. When the Treated Room was coated with **CeraTherm** -added paint, it offers a better solar reflection capability than the Untreated Room that was painted with the same paint without **CeraTherm**, as reflected by the lower temperature readings as described just above. When the heat flux into a room is reduced, there upon the electricity consumption from its air-conditioning unit. And this is where the 24.8% energy-saving rate is coming from.

Appendix 1 Test Photos

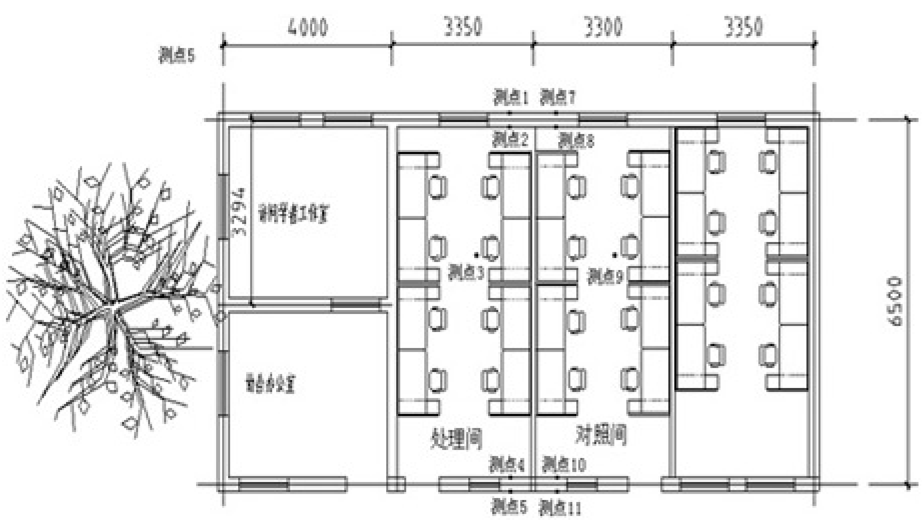
Front of the Treated Room

Front of the Untreated Room

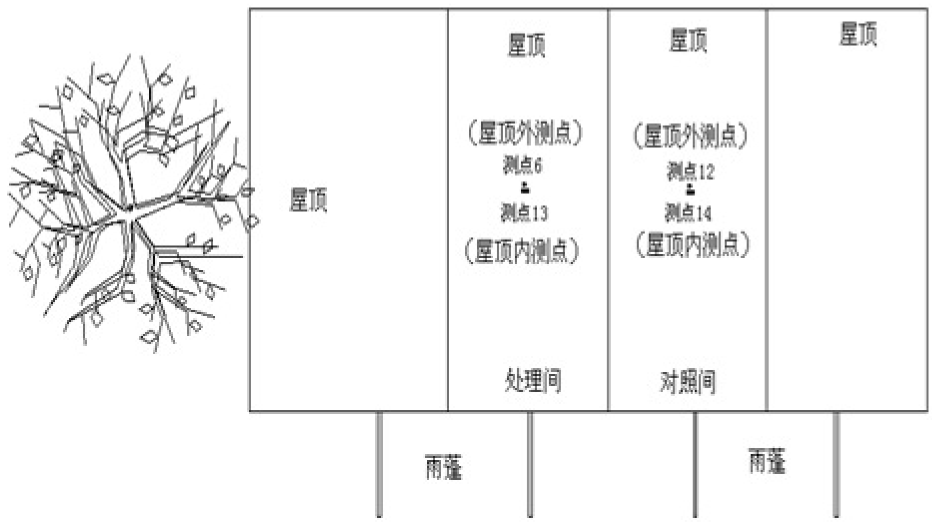

Painting the rooftop

Digital data collection device - Fluke

Appendix 2, Layout of Thermal Probes

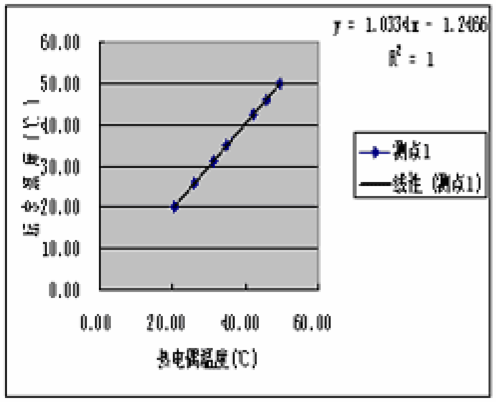


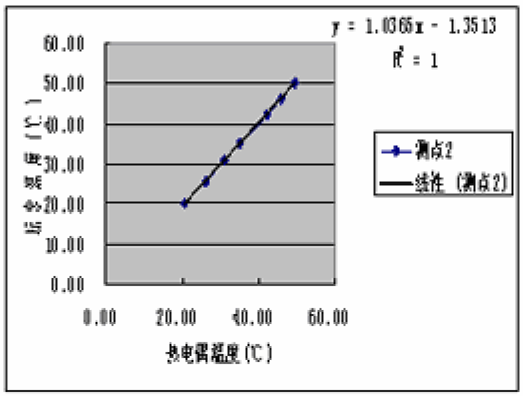
Layout of Thermal Probes (Exterior and Interior walls) - Treated Room is on the left.

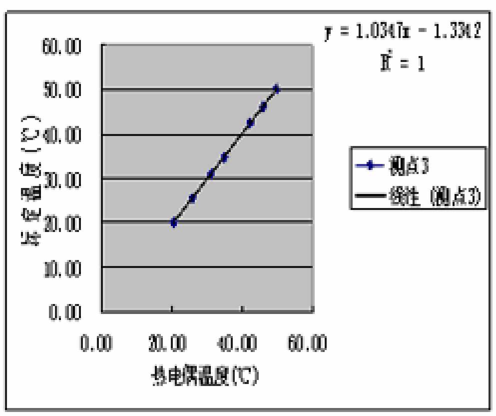


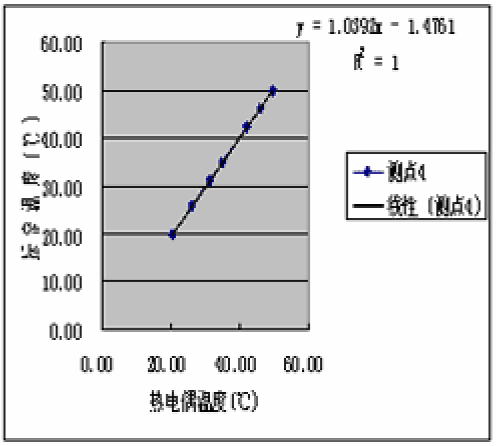
Layout of Thermal Probes (Rooftops)

Appendix 3 Calibration of Temperature Measurement Probes





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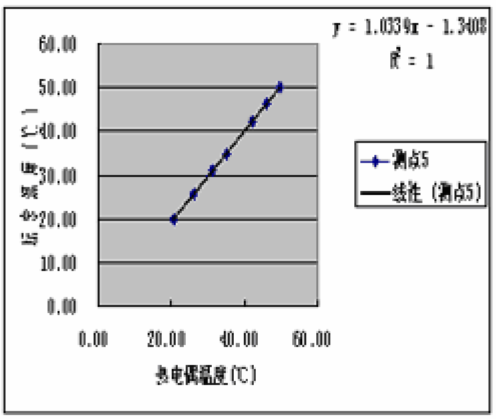
测点4
线性（测点4）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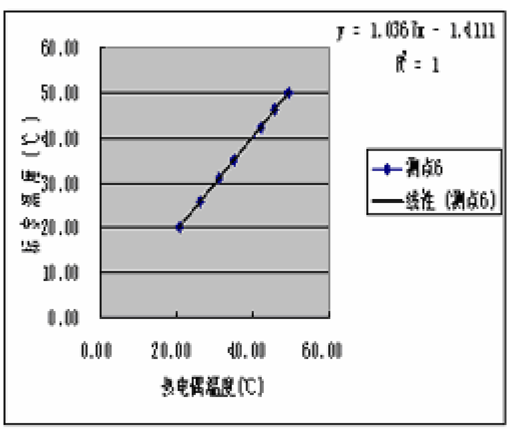
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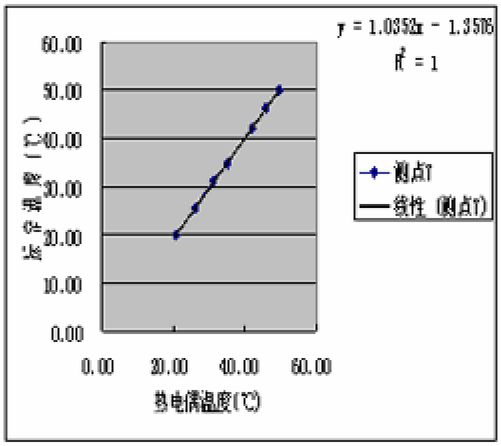
线性（测点6）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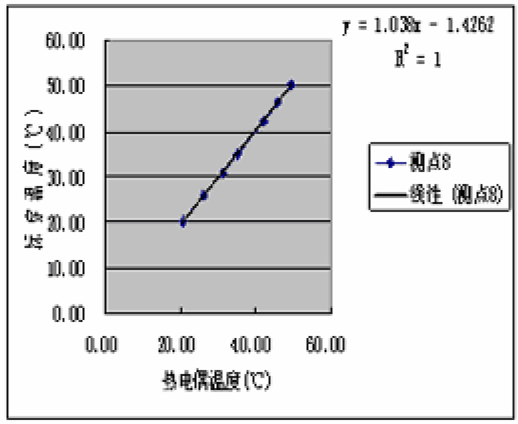
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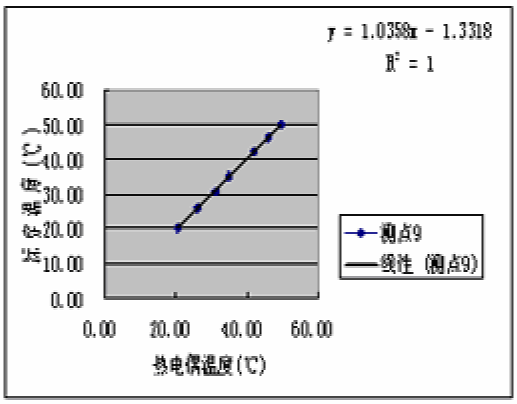
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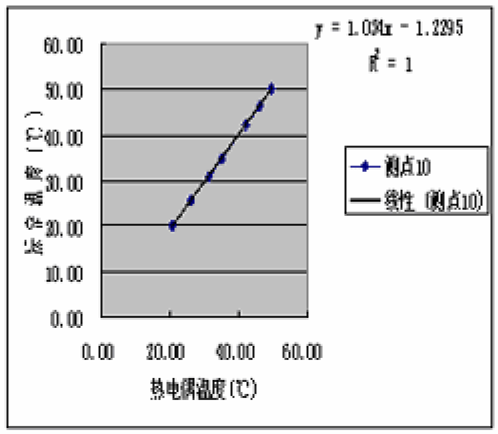
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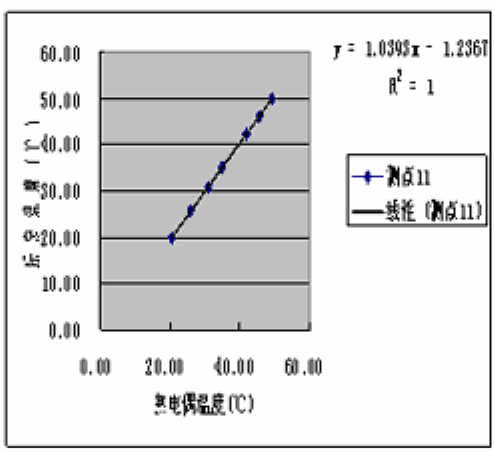
线性 (测点10)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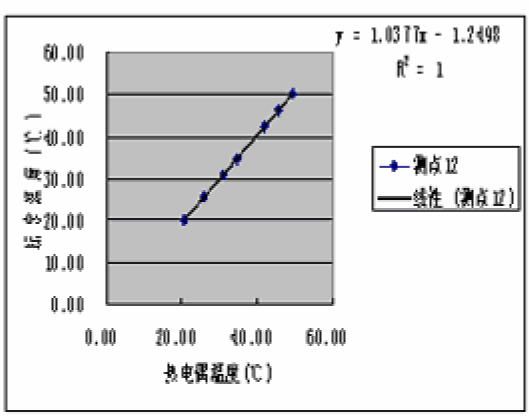
测点11
线性 (测点11)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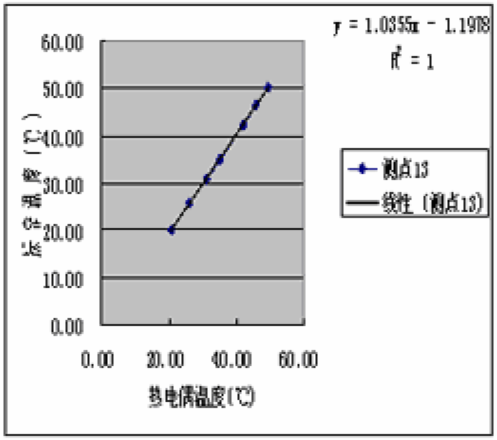
测点12
线性 (测点12)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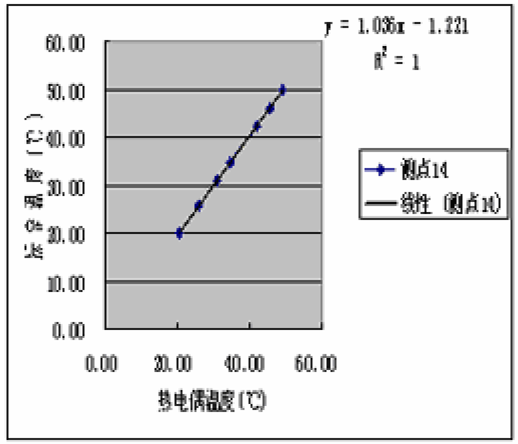
测点13
线性（测点13）
热电偶温度(℃)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60.00
50.00
40.00
30.00
20.00
10.00
0.00
0.00
20.00
40.00
60.00
测点14
线性（测点14）
热电偶温度(℃)

Military

Application of CeraTherm REDUCES the Effects of Radiant Energy

Dramatic results can be seen when **CeraTherm** insulating paint additive is mixed with ordinary paint. But the most dramatic of all results may be the use by the U.S. Military. If people who defend our country use **CeraTherm** , just think how well **CeraTherm** will defend your home or business from the elements.

The results of a test on reducing radiant energy and heat at a United States rocket launching range were conclusive, "**CeraTherm** had lower temperatures during the test." The test proved that **CeraTherm** helps keeps heat out "at every location"!

CeraTherm not only enhances lighter colored paints and keeps heat and cold out, it works well even with dark colored paints in some of the most extreme and hostile environments.

Below are some results of the test conducted on the effectiveness of **CeraTherm** that was used at the rocket launching facility. It's clear that **CeraTherm** stands up to the most intense rigors of military stresses. It can easily protect your home from any challenges from the elements. Look at the test results conducted by the Climatic Test Branch of the Environmental Test Division and see for yourself. Even rocket scientists agree; **CeraTherm** makes a difference.

Test Data

MEMORANDUM FOR DISTRIBUTION

SUBJECT: Letter Report for Multiple Launch Rocket System (MLRS) M270 Launcher Solar Radiation Test

Test Data Results Provided by:

Climatic Test Branch
Environmental Test Division
Redstone Technical Test Center

CSTE-DTC-RT-M-CL
8 Oct 99

W. Byam 6-0591

1. Solar radiation tests were conducted by Climatic Test Branch (CTB) at Building 7290 from September 29, to October 6, 1999. These tests were conducted to determine the effectiveness of a paint additive (**CeraTherm**) applied to the cab section of the launcher. Mr. Steve Bramlett, MLRS Project Office, requested the tests.

2. High cab temperatures have been experienced during days with bright sunlight or high solar irradiance; the cab is not air-conditioned. The paint additive, **CeraTherm** has been proposed by a local vendor to lower cab temperatures. This paint additive increases the resistance to heat transfer on the surface it's applied to; the improvement being primarily to reduce the effects of radiant energy.

M270 Launcher Solar Radiation Test

Multiple Launch Rocket System (MLRS)

3. The launcher is too large for this chamber to conduct a standard MIL-STD-810 solar radiation test. However, the objective was to determine the effectiveness of the paint additive on the cab area. To accomplish the objective two launchers were subjected to identical solar loading over a two day period. Launcher, S/N 4AA00481, had been painted using **CeraTherm** and launcher, S/N 4AA00222, was not.

Note: The irradiance level in the solar chamber is normally varied by raising and lowering the light bank. This was not possible because of the height of the launcher. With the light bank at its highest point, the lights were only 30 inches above the cab!

4. For the first day the launchers were in the operational configuration with the blast shields in place and were exposed to a MIL-STD-810 daily solar radiation cycle. On the second day the blast shields were lowered and windows opened and the launchers were exposed to three hours of maximum solar radiation. Thermocouples were placed on the outside and inside of the cab in various locations, see enclosed photographs. The enclosed plots are arranged to compare the temperatures during the test at the following locations:

- Commanders side overhead
- Drivers side overhead
- Air in the cab

5. At every location monitored the cab painted with **CeraTherm** had lower temperatures during the test. On the first day temperatures in the cab peaked at 131.7 F in the launcher with the paint additive and 137.8 F for the other launcher. On the second day the cab temperature peaked at 97.7 F and 100.5 F.

End of Report

These last temperatures reflect the fact that the air temperature outside and inside the cab was almost the same due to the fact that the blast shields were lowered and the windows were open.

SUMMARY: The launchers almost completely filled the solar chambers. It is believed that much more dramatic results would show from the use of **CeraTherm** if the chamber was larger or if the tests were conducted in a natural outdoor environment.

If **CeraTherm** works this well in a dark colored paint in an extremely hostile environment, just imagine how well it works with lighter colored paints and in a normal environment!

Stucco Walls

Evaluation of CeraTherm for Stucco Wall Applications

CeraTherm has proven to help improve energy efficiency of stucco walls and it's backed up with scientific testing. The tests results below compare two identical rental apartments made of stucco. The outside walls of the building treated with **CeraTherm** dramatically decreased the surface temperature of the apartment. The same goes for the interior walls. **CeraTherm** is the difference when it comes to reducing energy costs in your home.

Test Data

Test: June 14th, 1997
Location: Ft. Pierce, FL.
Conditions: Clear and sunny with a temperature of 91 deg. F at 1:00 PM.

Structure: 2 identical free standing rental apartments. One structure had stucco walls painted with a regular off white house paint with no **CeraTherm.**The other structure had stucco walls using the same paint with **CeraTherm** added to it as directed by the manufacturer. Wall insulation of the structures was verified to be of the same type and rating.

Results:	**Painted stucco wall**	**CeraTherm painted stucco wall**
Outside wall surface temperature in direct sunlight:	114 deg. F	92 deg. F
Interior wall surface temperature. (sun bearing side of structure with A/C set at 72 deg. F)	83 deg. F	76 deg. F

Summary: The use of **CeraTherm** in the paint applied to the exterior wall of the apartment studied in the test showed a marked drop in the measured heat influx into the structure. The resulting difference in the interior wall surface temperatures registered between the **CeraTherm** painted wall compared to the standard painted wall was 7 deg. F in this test. This temperature difference is a substantial increase in the energy efficiency of the stucco structure painted with **CeraTherm.**

Test supervisor: Clem Hawkins
C12R-400M
Test validated: 6/20/97