TEST REPORT OF CHINA NATIONAL CENTER FOR QUALITY SUPERVISION AND TEST OF CONSTRUCTION ENGINEERING

February 9, 2008

Subject: Result of Insuladd Demo Project in Beijing

Purpose: To determine the energy saving characteristics of INSULADD-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 INSULADD 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 20°C (68°F), 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 INSULADD.

Inside Room Temperature: 20°C (68°F)
Outside Air Temperature (Average): 0°C (32°F)

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 INSULADD registered a reading of 61.8KWh, whereas the one with INSULADD 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 INSULADD-added paint showed significant energy saving effect during winter months when compared with application using ordinary paint.
- Under the same exterior temperature (0°C (32°F)) and the same room temperature controlled at 20°C (68°F), the use of INSULADD-added paint resulted in an energy saving rate of 12% and higher.

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TEST REPORT

BETC-JN2-2007-28

Name of Engineering/Product Apartment building with INSULADD Application

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

Test Category Per Request

NATIONAL CENTER FOR QUALITY SUPERVISION AND TEST OF BUILDING ENGINEERING

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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 INSULADD Application

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

Test:

Item: Testing and evaluation of energy-saving effect with INSULADD 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 INSULADD-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 20^{o}C, the interior walls and ceilings coated with INSULADD-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.

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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 INSULADD, 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 INSULADD-added paint and these surfaces of the other room used the same paint without INSULADD (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 INSULADD's energy-saving effects.

Results from the test program showed that under the same inside (basically controlled at 20^{o}C) and outside temperatures of the two test rooms, the room that coated with INSULADD-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 200m^2 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 11.3m^2 and 11.7m^2, 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 INSULADD respectively. Both windows were also sealed off using thin plastic sheets.

Explanations for Figure 2, the Plan View:
□□□□ – with INSULADD
□□ – Porch

Explanations for Figure 4, Structural Details
25mm □□ – 25mm mortar
240 □□ – 240mm brick wall
□□□□ – waterproof plastic sheet
3 – 5cm □□□ – 3 – 5cm cement board
10cm EPS □□□ – 10cm EPS insulating board
10x10 □ – 10x10cm square wooden post used as beams
□□□□□□□□- gypsum board (with reinforcing elements)

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

The inside temperature of both rooms were set at 20^oC, 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 INSULADD-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.

Explanation for Figure 6
□□ - window
□□□□□□□ – interior measuring points
□□□□□□□ – exterior measuring points
□□□□□□□□ – Measuring point distribution on the north wall

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).

(1) The inside and outside air temperature distribution during test period (Figure 7)

Explanations for Figure 7
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(2) Electricity consumption data

Table 1 shows the daily electricity consumption readings during testing and the total consumptions in KWh. The cumulative consumption for the room with INSULADD was 53.1KWh; and the room without was 61.8KWh.

Explanations for Table 1
□□ – sequential number
□□ – date
□□□□ – recording time
□□□□□□□□□ – room with INSULADD-added paint
□□□□□□ – room with ordinary paint
□□□□□□ – room temperature (note these were meter readings before converting)
□□□□ – Electricity meter reading
□□□□□ – cumulative electricity consumption
□ - KWh

(3) Analysis of INSULADD'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 -4^{o}C (30F) to 4^{o}C (34F), and the room temperatures maintained at 19.6^{o}C (67F) to 22.5^{o}C (72F), within a time frame of 52.5hrs, the room without the use of INSULADD-added paint, resulted in an additional electricity consumption of 8.7KWh when compared it with the room using INSULADD-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 INSULADD-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 INSULADD-added paint was -6.2^{o}C, whereas it was -9.2^{o}C for that of the room with ordinary paint.

The temperature difference between these windows was 3.0°C. For the external surface temperature of the exterior walls, the wall of the room with INSULADD-added paint had a reading of -6.9°C; whereas it with ordinary paint had a reading of -6.3°C. The former was 0.6° C higher than the latter, which means that the room with INSULADD-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 INSULADD-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%.