



## THERMAL 3Ht....Saving Energy, One Steel Building at a Time.

"Green" Steel Construction in the 21<sup>st</sup> Century

Pre-engineered steel buildings have seen substantial growth in popularity over the past several years. Steel is 100% recyclable and is the most recycled material in the world. Thus, each ton of recycled steel saves 2,500 pounds of iron ore and approximately 1,000 pounds of coal. Most steel utilized in the construction of steel buildings consists of 70% recycled content - in fact, the Green Building Resource Guide gives steel framing its highest 5 icon rating making it a true "green" product.

### Steel Buildings and Energy Conservation

Steel building enclosure issues are perhaps the most common and least understood construction problem. One major issue with steel construction; steel conducts approximately 300 times more heat/cold than wood. Unfortunately, this results in short circuit thermal bridging through steel framing members. Properly insulated steel buildings can save natural resources, energy and money. Currently, however, conventional methods of insulating steel buildings will not meet proposed new prescriptive energy codes.

Steel buildings that are properly insulated save natural resources, energy and money! Studies show consumers are willing and prepared to invest in steel buildings that are comfortable and energy efficient.

### Labeled R-value vs. Effective or In-service R-value

The chart below shows the labeled R-value of fiberglass insulation is much lower than its effective or in-service R-value.

| Effective R-value of R-19 Fiberglass in a 6" Steel Wall Assembly as Commonly Installed |                  |                 |                   |              |
|--|------------------|-----------------|-------------------|--------------|
| Product  | Type of Assembly | Labeled R-Value | Effective R-Value | Reduction    |
| R-19 Fiberglass  | 2X6 Steel Frame  | 19              | 7.2               | <b>- 62%</b> |

Reference: ASHRAE (American Society of Heating, Refrigeration and Air-conditioning Engineers)

Conventional R-value testing takes place in laboratory environments that are not indicative of "real world" conditions.

The conventional R-value test method has little or no consideration for sub zero outside temperatures, wind, radiant heat loss or gain, moisture, air infiltration, interior steel liner panels, framing members or exterior metal sheathing, *e.g.*, R-19 fiberglass insulation as commonly installed in a 2X6 steel buildings has an effective or in-service R-value of approximately R-7.2, *i.e.*: 62% lower than the labeled R-value of the insulation.

**Effective or in-service R-value is the R-value of a steel wall assembly containing a steel liner panel, vapor retarder (if applicable), steel framing members, insulation and exterior metal sheathing.**

The ASTM testing method considers simulated "real world" environment, *i.e.*: Temperature Range: 70°F / 21°C inside and 0°F / -18°C outside.

Thermal 3Ht Testing

- Thermal 3Ht has been tested to the ASTM 1363-05 standard by (ATI) Architectural Testing Inc.
- ATI is an independent and accredited laboratory in Canada and the USA.
- The ASTM 1363-05 test considers "real world" like temperatures, wind, moisture, insulation, vapor retarder if applicable, interior steel liner panel, and steel framing members, insulation and exterior steel sheathing.
- Test results provide an overall R-value of the complete wall assembly.

**ASTM 1363-05 TESTING**

Temperature Range: 70°F / 21°C inside and 0°F / -18°C outside.

**TEST RESULTS: THERMAL 3Ht, (EMPTY CAVITY) STEEL WALL ASSEMBLIES**

| Product        | Type of Assembly | Labeled R-Value | Effective R-Value of Assembly | Increase      |
|----------------|------------------|-----------------|-------------------------------|---------------|
| ½" Thermal 3Ht | 6" Steel Frame   | 1.93            | 5.22                          | <b>+ 170%</b> |
| 1" Thermal 3Ht | 6" Steel Frame   | 3.85            | 6.85                          | <b>+ 78%</b>  |

Note\* Wall Assemblies include interior steel liner panel, 2X6 steel stud frame, empty cavity, horizontal 2X4 Steel Studs (Simulates steel girts), Thermal 3Ht, exterior steel sheathing.

**TEST RESULTS: ½" THERMAL 3Ht & R-19 FIBERGLASS STEEL WALL ASSEMBLY**

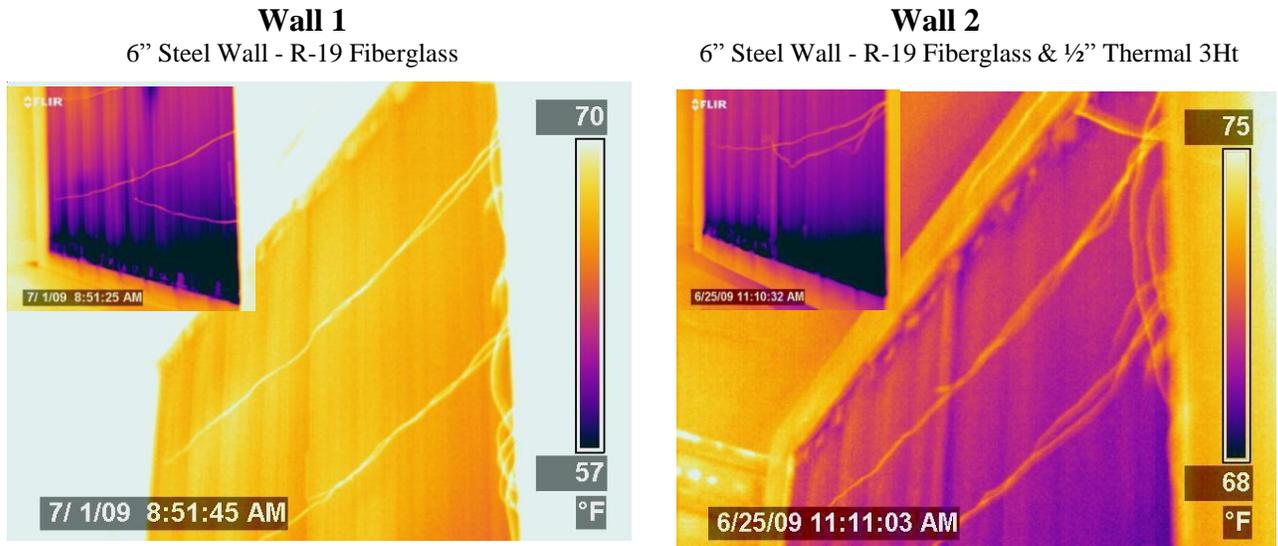
| Conventional 6" Steel Frame R-19 Fiberglass Insulated Wall Assembly Combined with ½" Thermal 3Ht  | Effective R-Value of Conventional R- 19 Fiberglass Assembly | Effective R-Value of Assembly with ½" Thermal 3Ht | Improvement Over Conventional Wall Assembly |
|---|---|---|---|
| Interior Steel Liner, 2X6 Steel Stud Frame, ½" Thermal 3Ht, R-19 Fiberglass Batt, Horizontal 2X4 Steel Studs (Simulates Steel Girts) Exterior Steel Sheathing | 7.2   | 14.77   | <b>+107%</b>                                |

When considering insulation performance, what is most important? Is it the labeled R-value of an insulation product tested in non-"real world" conditions? Or is it the overall in-service/effective R-value of an insulated steel wall assembly, tested in simulated "real world" conditions?

**It is the overall R-value of an insulated steel wall assembly tested in simulated "real world" conditions!**

## INFRARED IMAGES STEEL WALL ASSEMBLY ASTM 1363-05

Actual infrared images (IR) of two actual ASTM 1363-05 wall assemblies



### Observations:

- Inset pictures on the top left corner of both infrared images are actual IR images of the bottom left hand corner of each wall assembly.
- The colors in infrared images are relative to the overall temperature range of the image and is only valid for that image unless the temperature range is normalized across the image set.
- Wall 1 - 13°F difference in temperature from its coldest point to its warmest point.
- Wall 2 - there is only 7°F difference from its coldest point to its warmest point.
- Wall 2 - at its coldest point, Wall 2 is 11°F warmer than Wall 1.
- Wall 2 - at its warmest point, Wall 2 is 5°F warmer than Wall 1 and the controlled inside temperature setting of 70°F. Why is this happening? Is Thermal 3Ht reflecting radiant heat back to its source warming up the surface of the interior steel liner panel? Probably!