TEST: THERMAL PERFORMANCE OF AN INSULATED CONCRETE FORMS WALL SYSTEM AND A 2" x 6" WOOD FRAME WALL SYSTEM, IN ACCORDANCE WITH TEST PROCEDURE ASTM C1363-11
TESTED BY: CLEB LABORATORY INC.
REPORT: AT-00529 & AT-00556
REPORT DATE: 12/08/2016



UP TO 60% MORE ENERGY IS USED WITH A 2" X 6" WOOD FRAME WALL SYSTEM VS. AN ICF WALL SYSTEM

The attached report was prepared by CLEB Laboratories Inc. for the Insulating Concrete Forms Manufacturers Association of a Thermal Performance of an Insulating Concrete Form Wall System and a 2" x 6" Wood Frame Wall System, in accordance with test procedure ASTM C1363-11. This report proves an Insulating Concrete Form wall can achieve up to 60% annual energy savings and 58% greater R-Value/RSI than a 2" x 6" Wood Frame Wall. What does this mean for consumers? Consider two typical homes, each with 2,000 square feet of wall area – one constructed in wood frame to permitted code*, the other constructed using ICF technology and subjecting both to the same test condition. When incorporating the average kWH value for all North America, this study indicates that in many climate zones that during the most extreme cold conditions an ICF wall can save between $140 and $190 per month in equivalent electrical consumption when compared to a traditionally constructed wood frame wall.

ICFS ARE THE SUSTAINABLE FUTURE IN BUILDING CONSTRUCTION, DISCOVER MORE AT:
www.icf-ma.org • info@icf-ma.org

ICFMA
INSULATING CONCRETE FORMS MANUFACTURERS ASSOCIATION

* Tested wood frame wall assembly meets the Canadian National Building Code for above grade residential walls and the 2015 IRC in the USA for climate zones 1-5.

THERMAL PERFORMANCE OF AN INSULATED CONCRETE FORM WALL SYSTEM AND A 2X6 WOOD FRAME WALL SYSTEM, IN ACCORDANCE WITH TEST PROCEDURE ASTM C1363-11

Prepared for:

ICFMA
11-300 EARL GREY DRIVE, SUITE 460
OTTAWA, ON, CANADA
K2T 1C1

CLEB LABORATORY INC.

Report: AT-00529 & AT-00556
Date : 2016-12-08
Revision date : N/A

Number of pages: 11

1320 Lionel-Boulet Blvd
Varennes, Quebec J3X 1P7
laboratoire@cleb.com

www.cleb.com
Toll free : 855.353.CLEB (2532)

TABLE OF CONTENTS

THERMAL PERFORMANCE OF AN INSULATED CONCRETE FORM WALL SYSTEM AND A 2X6 WOOD FRAME WALL SYSTEM, IN ACCORDANCE WITH TEST PROCEDURE ASTM C1363-11

1.0 INTRODUCTION

CLEB laboratory Inc. has been mandated by the ***ICF Manufacturers Association (ICFMA)*** to evaluate the thermal performance of an insulated concrete forms wall system and a 2X6 wood frame wall system. The evaluation was performed in accordance with the procedure detailed in *ASTM C1363-11 Standard Test Method for Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus*. The composition of the tested samples is described in Section 3.0 of this report.

2.0 TESTING PROCEDURE

ASTM C1363-11: Standard Test Method for Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus.

3.0 DESCRIPTION OF THE TESTED SAMPLES

Specimen #1:

Type: Insulated concrete form wall system

Drawings: (See Appendix A)

Date of sample construction: 2016-05-31 – 2016-06-08

Date(s) of testing: 2016-07-28

***Wall composition from exterior to interior:**

- Exterior wall vinyl siding.
- Vertical wood furring strips 1” x 3” @ 16" c/c (19 x 64 mm @ 406 mm c/c), 7 furring strips of 96” (2438 mm) long were used.
- 6” core flat wall type Insulated Concrete Form System consisting of 2 5/8” - 2 5/8” (67mm – 67mm) thick expanded polystyrene panels integrally molded with polypropylene cross tie connecting webs every positioned vertically every 8” (203 mm) c/c. The cross tie connecting webs are embedded within each foam panel by 2” (50 mm) either side of the concrete cavity formed by the panels. (See details in the technical information provided in Appendix A). 5.5 panels of ICF forms were used in the tested assembly.

-Cavity formed by Insulated Concrete Forms was reinforced as follows:

-Horizontal Steel: No. 4 (10M) reinforcing steel bars at 18” c/c (457 mm) c/c – 96” (2438 mm) in width - Total - 5 bars.

-Vertical Steel: No. 4 (10M) reinforcing steel bars at 16” c/c (406 mm) c/c – 96” (2438 mm) in height - Total - 6 bars.

- Poured Concrete (between insulation layers described earlier) consisted of 6” (152 mm) thick, mechanically vibrated with an approximately density of 150 lb/ft^3 (2403 kg/m^3), intercepted by polypropylene cross tie webs (see details in the technical information provided in Appendix A) @ 8” c/c (203 mm c/c)
- Gypsum board 1/2” (13 mm) thick

**** Data obtained by the manufacturer***

Overall dimensions of the sample: 96” x 96” (2438.4 x 2438.4 mm)

Specimen #2:

Type: 2” x 6” (38 x 140 mm) wood frame wall system

Drawings: (See Appendix A)

Date of sample construction: 2016-10-21

Date(s) of testing: 2016-10-24

***Wall composition from exterior to interior:**

- Exterior wall vinyl siding.
- Vertical wood furring strips 1” x 3” @ 16" c/c (19 x 64 mm @ 406 mm c/c), 7 furring strips of 96” (2438 mm) long were used.
- Exterior air barrier membrane with taped joints (See Appendix A for material specification)
- 3/8” (10 mm) thick OSB wall sheathing, for sample constructed 2 sheets of 48” x 96” (1219 x 2438 mm) were used
- 2” x 6” (38 x 140 mm) wood stud wall constructed as itemized below:
    - 2” x 6” (38 x 140 mm) wood studs @ 16" c/c (406 mm c/c) with a bottom and a double top plates in which there was a window framing, rough opening of 45” x 35 5/8” (1143 x 905 mm) (see drawings provided in Appendix A):
        - Vertical studs: 5 studs of 2” x 6” (38 x 140 mm) by 91 1/2” (2324 mm) long
        - Bottom plate: 1 studs of 2” x 6” (38 x 140 mm) by 96” (2438 mm) long
        - Double top plate: 2 studs of 2” x 6” (38 x 140 mm) by 96” (2438 mm) long
        - Jack studs: 2 studs of 2” x 6” (38 x 140 mm) by 80 1/2” (2045 mm) long
        - Cripple studs: 4 studs of 2” x 6” (38 x 140 mm) by 43 3/8” (1102mm) long
        - Window sill plate: 1 studs of 2” x 6” (38 x 140 mm) by 45” (1143mm) long
        - Header: 1 studs of 2” x 6” (38 x 140 mm) with 2 studs of 2” x 10” (38 x 241 mm) by 48” (1219 mm) long
- Glass fibre batt insulation, 5 ½” (140 mm) thick; installed within wood stud cavities and framed window opening
- Vapor barrier (6 mil polyethylene, lapped and sealed with acoustical sealant)
- 1” x 3” @ 16" c/c (19 x 64 mm @ 406 mm c/c) Horizontal wood strappings, 7 furring strips of 96” (2438 mm) long were used.
- Gypsum board 1/2” (13 mm) thick

**** Data obtained by the manufacturer***

Overall dimensions of the sample: 96” x 96” (2438.4 x 2438.4 mm)

4.0 SPECIMEN PREPARATION PRIOR TO TEST

Specimen #1 was preconditioned for a minimum of 28 days at ambient laboratory conditions prior to testing. Specimen #2 was preconditioned for a minimum of 48 hours at ambient laboratory conditions prior to testing.

5.0 TEST PARAMETERS

The test to determine the Standardized Thermal Transmittance (Ust) of the specimen was performed in a guarded hot box thermal test chamber located in Varennes, Quebec. The test apparatus number is *TB-08-MTTB*. The most recent calibration of the hot box apparatus was performed on 2015-11-10. The thermal performance evaluations were completed in accordance with the *ASTM C1363-11* test procedure using dynamic wind conditions perpendicular to the specimen on the weather side and a parallel convection on the room side. A pressure differential equal to 0 +/- 0.1 psf (0 +/- 5 Pa) was maintained across the specimen during the test by pressurizing the guard box on the room side. The sample was installed vertically in the test bench and the heat flow was horizontally from the metering box through to the cold side of the wall specimen.

6.0 TEST DURATION AND STEADY STATE PERIOD

Specimen #1

The test chamber environmental systems were initiated at 8:50 AM on 2016-07-14. The test conditions were considered stable for a period of four hours followed by two consecutive test periods of two hours from 9:30 PM to 5:30 AM on 2016-07-28. The thermal performance test results were derived from the readings of the last 2-hour period.

Specimen #2

The test chamber environmental systems were initiated at 11:30 AM on 2016-10-21. The test conditions were considered stable for a period of four hours followed by two consecutive test periods of two hours from 11:35 PM to 7:35 AM on 2016-10-24. The thermal performance test results were derived from the readings of the last 2-hour period.

7.0 RESULTS

Specimen #1:

MEASURED RESULTS	(Imperial Units)	(Metric Units)
Test Specimen Thermal Conductance (C_s):	0.04 BTU/(hr•ft²•°F)	(0.24 W/(m²•°C))
Thermal Transmittance (U_s)[1]:	0.04 BTU/(hr•ft²•°F)	(0.24 W/(m²•°C))
Standardized Thermal Transmittance (U_{st})[2]:	0.04 BTU/(hr•ft²•°F)	(0.24 W/(m²•°C))

CALCULATED RESULTS	(Imperial Units)	(Metric Units)
Standardized Thermal Resistance (R_{st} \ RSI_{st}):	24.1 (hr•ft²•°F)/BTU	(4.25 (m²•°C)/W)

1. *U_s : Thermal Transmittance with interior and exterior test air film coefficient*
2. *U_{st} : Thermal Transmittance with standardized interior and exterior air film coefficient*

MEASURED TEST DATA

Heat Flows:	(Imperial Units)		(Metric units)	
1. Total Measured Input into Metering Box (Q_{total}):	322.82	BTU/hr	(94.52)	W
2. Surround Panel Heat Flow (Q_{sp}):	0.00	BTU/hr	(0.00)	W
3. Metering Box Wall Heat Flow (Q_{mb}):	-55.49	BTU/hr	(-16.25)	W
4. Net Specimen Heat Loss (Q_s):	267.32	BTU/hr	(78.27)	W

Areas:	(Imperial Units)		(Metric units)	
1. Test Specimen Projected Area (A_s):	64.00	ft²	(5.95)	m²
2. Test Specimen Interior Total (3-D) Surface Area (A_{int}):	64.00	ft²	(5.95)	m²
3. Test Specimen Exterior Total (3-D) Surface Area (A_{ext}):	69.92	ft²	(6.50)	m²
4. Metering Box Opening Area (A_{mb}):	64.00	ft²	(5.95)	m²
5. Metering Box Baffle Area (A_{b1}):	60.00	ft²	(5.57)	m²
6. Surround Panel Interior Exposed Area (A_{sp}):	0.00	ft²	(0.00)	m²

Test Conditions:	(Imperial Units)		(Metric units)	
1. Average Metering Room Air Temperature:	69.81	°F	(21.01)	°C
2. Average Cold Side Air Temperature:	-30.87	°F	(-34.93)	°C
3. Average Guard/Environmental Air Temperature:	70.77	°F	(21.54)	°C
4. Metering Room Maximum Relative Humidity:	13	%	(13)	%
5. Maximum Static Pressure Across Specimen:	0.06	psf	(3.03)	Pa

Surface Temperature Data:	(Imperial Units)		(Metric units)	
1. Area-Weighted Warm Side Surface Temperature:	66.57	°F	(19.21)	°C
2. Area-Weighted Cold Side Surface Temperature:	-30.27	°F	(-34.60)	°C

Surface Conductance:	(Imperial Units)		(Metric units)	
1. Room side surface conductance (h_h):	1.29	BTU/(hr•ft²•°F))	(7.32	W/(m²•°C)
2. Weather side surface conductance (h_c):	6.97	BTU/(hr•ft²•°F))	(39.56	W/(m²•°C)
3. Standardized room side surface conductance (h_{sth}):	1.35	BTU/(hr•ft²•°F))	(7.67	W/(m²•°C)
4. Standardized weather side surface conductance (h_{stc}):	5.28	BTU/(hr•ft²•°F))	(30.00	W/(m²•°C)

Specimen #2:

MEASURED RESULTS	(Imperial Units)	(Metric Units)
Test Specimen Thermal Conductance (C_s):	0.07 BTU/(hr•ft²•°F)	(0.40 W/(m²•°C))
Thermal Transmittance (U_s)[1]:	0.07 BTU/(hr•ft²•°F)	(0.38 W/(m²•°C))
Standardized Thermal Transmittance (U_{st})[2]:	0.07 BTU/(hr•ft²•°F)	(0.37 W/(m²•°C))

CALCULATED RESULTS	(Imperial Units)	(Metric Units)
Standardized Thermal Resistance (R_{st} \ RSI_{st}):	15.2 (hr•ft²•°F)/BTU	(2.68 (m²•°C)/W)

1. U_s : *Thermal Transmittance with interior and exterior test air film coefficient*
2. U_{st} : *Thermal Transmittance with standardized interior and exterior air film coefficient*

MEASURED TEST DATA

Heat Flows:	(Imperial Units)		(Metric units)	
1. Total Measured Input into Metering Box (Q_{total}):	497.53	BTU/hr	(145.68)	W
2. Surround Panel Heat Flow (Q_{sp}):	0.00	BTU/hr	(0.00)	W
3. Metering Box Wall Heat Flow (Q_{mb}):	-66.12	BTU/hr	(-19.36)	W
4. Net Specimen Heat Loss (Q_s):	431.41	BTU/hr	(126.32)	W

Areas:	(Imperial Units)		(Metric units)	
1. Test Specimen Projected Area (A_s):	64.00	ft²	(5.95)	m²
2. Test Specimen Interior Total (3-D) Surface Area (A_{int}):	64.00	ft²	(5.95)	m²
3. Test Specimen Exterior Total (3-D) Surface Area (A_{ext}):	69.92	ft²	(6.50)	m²
4. Metering Box Opening Area (A_{mb}):	64.00	ft²	(5.95)	m²
5. Metering Box Baffle Area (A_{b1}):	60.00	ft²	(5.57)	m²
6. Surround Panel Interior Exposed Area (A_{sp}):	0.00	ft²	(0.00)	m²

Test Conditions:	(Imperial Units)		(Metric units)	
1. Average Metering Room Air Temperature:	69.58	°F	(20.88)	°C
2. Average Cold Side Air Temperature:	-31.18	°F	(-35.10)	°C
3. Average Guard/Environmental Air Temperature:	69.69	°F	(20.94)	°C
4. Metering Room Maximum Relative Humidity:	15	%	(15)	%
5. Maximum Static Pressure Across Specimen:	-0.03	psf	(-1.60)	Pa

Surface Temperature Data:	(Imperial Units)		(Metric units)	
1. Area-Weighted Warm Side Surface Temperature:	66.83	°F	(19.35)	°C
2. Area-Weighted Cold Side Surface Temperature:	-30.76	°F	(-34.87)	°C

Surface Conductance:	(Imperial Units)		(Metric units)	
1. Room side surface conductance (h_h):	1.67	BTU/(hr•ft²•°F))	(9.50	W/(m²•°C)
2. Weather side surface conductance (h_c):	12.96	BTU/(hr•ft²•°F))	(73.59	W/(m²•°C)
3. Standardized room side surface conductance (h_{sth}):	1.35	BTU/(hr•ft²•°F))	(7.67	W/(m²•°C)
4. Standardized weather side surface conductance (h_{stc}):	5.28	BTU/(hr•ft²•°F))	(30.00	W/(m²•°C)

8.0 COMMENTS AND OBSERVATIONS

After conducting comparative analysis of the results obtained for the two different wall samples, the following comments and observations are noted:

The 2x6 wood wall test took 60 hours to reach steady state compared to 324 hours for the Insulated Concrete Form wall. This was CLEB Laboratory's first experience in evaluating according to ASTM C1363 Standard, a concrete mass wall containing foam plastic insulation on both sides of a solid concrete core. In our experience, the concrete wall assembly that is the subject of this report demonstrates the longest period of time required to reach thermal steady state of any previously tested by this laboratory.

Appendix C provides graphs of the most relevant parameters measured during both tests.

These graphs provide record of the power that was supplied throughout each test. The records reflect the power averaged for each four hours period of the test until thermal steady state for each wall sample was achieved. For the purpose of these observations, in order to compare the power and the energy supplied to each sample, a common time duration for each test was necessary, since the two samples reached their respective steady states after a different time interval. To achieve this comparison, the graph represents with dashed lines what would have been the recorded values if the wood wall test were to have continued operation at its thermal steady state for the same time duration as the ICF Wall took to reach its steady state (324 hours).

Based on the graphed data, the required energy projected to have been consumed for both tests is noted as follows:

	Imperial Units	Metric Units
Insulated Concrete Forms wall	53 209 BTU	15.6 kWh
2X6 Wood Wall	132 818 BTU	38.9 kWh

This means that if the 2x6 wood wall test had been continued for a full 324 hours (to match the ICF Wall test) it would have consumed 149% more energy than was required for the Insulated Concrete Form Wall.

The second graph shows the "Instant Apparent Thermal Resistance" for each wall specimen over time. This parameter is obtained from the following equation:

$$R = \frac{A\,\Delta T}{Q}$$

Where: R: Instant apparent thermal resistance (Imperial: (hr•ft²•°F)/BTU ; Metric: (m²•°C)/W)

A: Area of the sample, constant value of 64 ft² ; 5.95 m²

ΔT: Temperature difference, constant value of 56°C

Q: Power supplied in the metering box (Imperial: BTU ; Metric: W)

The calculation has been performed using a simplified method. We assumed a constant temperature differential across the sample equal to 56ºC instead of using both sides sample surface temperatures recorded every 5 minutes. We used this simplified calculation method due to limited data treatment capacity and since transient analysis is not covered by ASTM C1363.

Once again, on this graph, the dashed line represent what would have been the actual recorded values if the wood wall had been allowed to continue at its thermal steady state throughout the same time interval that it took for the ICF Wall to achieve its steady state.

It is noted that we did not preconditioned and bring to steady state the exact same way both walls. At the time we performed the tests we did not make sure to submit both walls to the same conditions for future comparative transient data analysis. There are many factors that affect the transient portion of the tests. Just to name a few, there is the ambient room temperature where walls were stored prior to tests, the schedule of the manual operations done on the test bench apparatus throughout the tests, and the manner heat is supplied during the transient part of the tests, etc. Although these factors have an impact on the transient part of the tests, they do not interfere with the steady state results.

Further, the recorded thermal resistance (R-Value) determined at steady state condition for the ICF Wall assembly at -35ºC in fact represents a 59% improvement compared to thermal resistance recorded for the 2" x 6" wood frame wall configuration that was tested at this same steady state temperature condition.

We conclude our comments by suggesting that the standard ASTM C1363 test procedure is not appropriate to show the effect of thermal inertia of a building component, due to the final results being obtained without considering the transient period of each sample. We strongly suggest that another procedure need to be developed with the objective of capturing the effects of thermal inertia.

9.0 CONCLUSION

The standardized thermal resistance of the tested Insulated Concrete Forms wall (specimen #1) (including standardized air film coefficients) is **R(imp.)$_{st}$** 24.1 (hr•ft²•°F)/BTU and **RSI$_{st}$** 4.25 (m²•°C)/W. The standardized thermal resistance of the tested 2" x 6" Wood Frame wall (specimen #2) (including standardized air film coefficients) is **R(imp.)$_{st}$** 15.2 (hr•ft²•°F)/BTU and **RSI$_{st}$** 2.68 (m²•°C)/W. A copy of this report will be retained by ***CLEB laboratory Inc.*** for a period of four (4) years. Results obtained apply only to the tested specimens. The primary units used in these tests and report are metric, Imperial values are for reference only. Testing described in this report was conducted in full compliance with *ASTM C1363-11* requirements.

10.0 REVISION LOG

Revision Number	Revision Date	Description

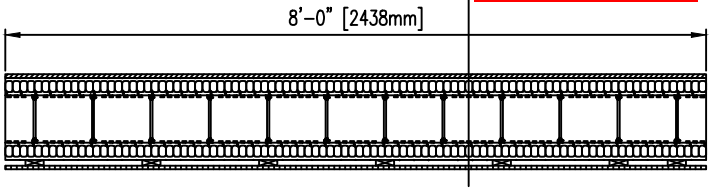
Dave Deshaies Mc Mahon, Eng.

Gilbert Riopel, B.Sc.
Program Director

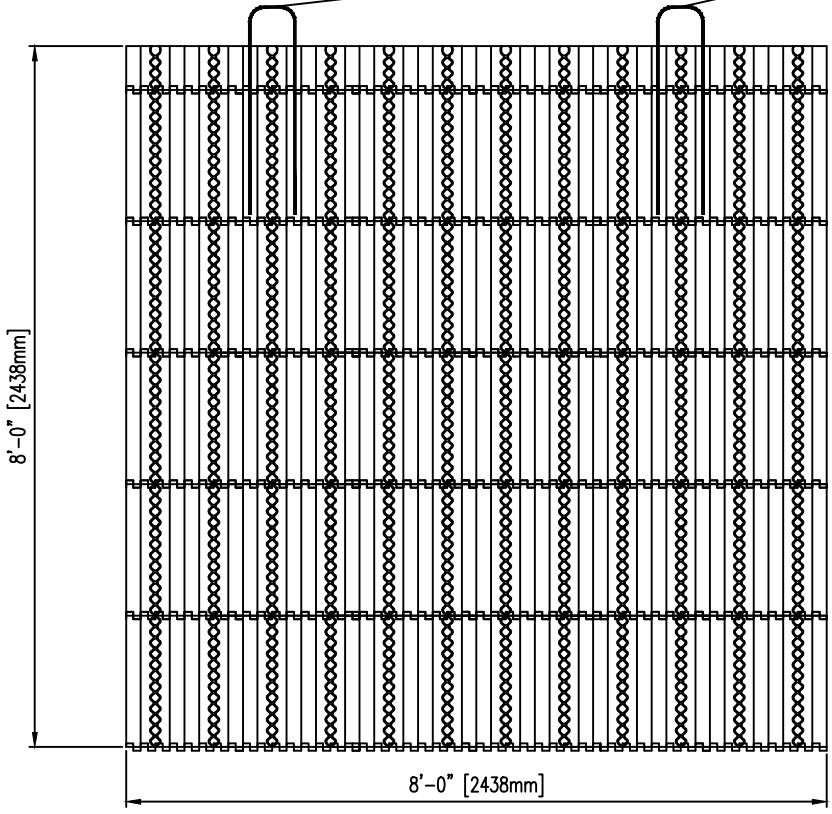
APPENDIX A: DRAWINGS AND TECHNICAL INFORMATION

CONFORME DOSSIER
AT-00529 & AT-00556
CLEB
COMPLIES TO FILE

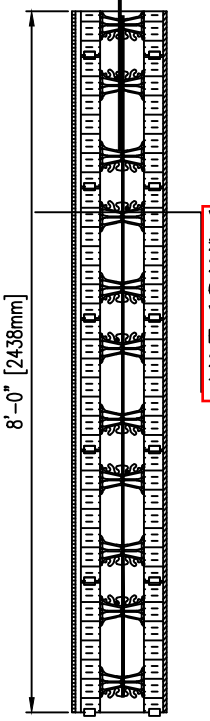
½" GYPSUM BOARD
2–5/8" EPS
6" CONCRETE CORE
VERTICAL 10M @ 16"
HORIZ 10M @ 18"
2–5/8" EPS
¾" 1X3 STRAPPING
VINYL SIDING



REBAR HOOKS TO MANIPULATE WALL SAMPLE



ICF WALL ELEVATION



VINYL SIDING
¾" 1X3 STRAPPING
2–5/8" EPS
6" CONCRETE CORE
VERTICAL 10M @ 16"
HORIZ 10M @ 18"
2–5/8" EPS
1/2" GYPSUM BOARD

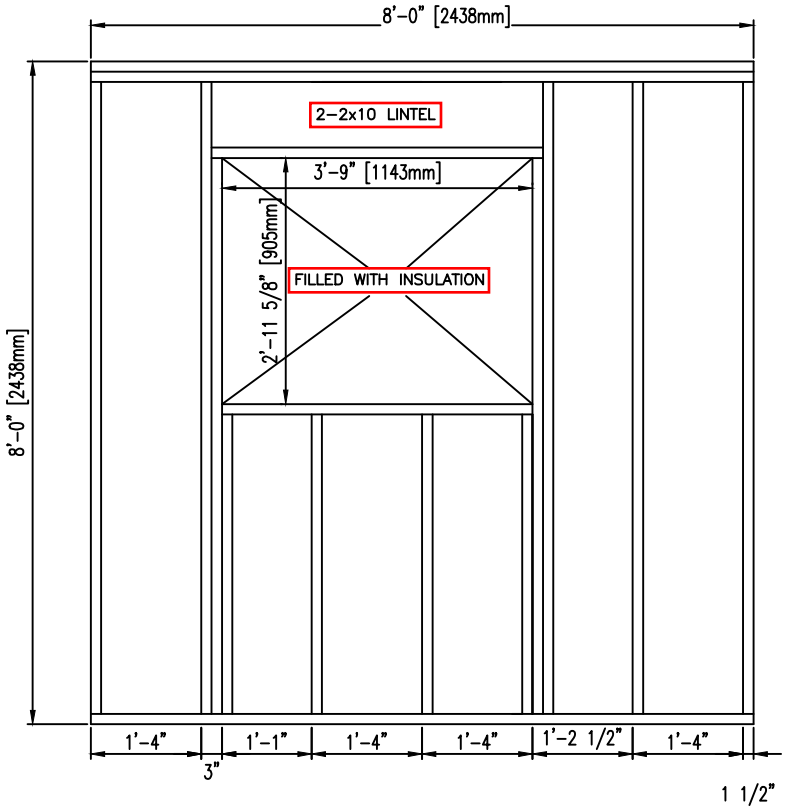
SECTION

ICFMA
INSULATING CONCRETE FORMS
MANUFACTURERS ASSOCIATION

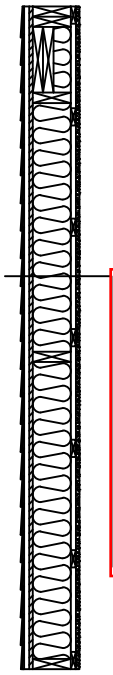
ICF TEST WALL
FOR ASTM–1363 TEST
AT CLEBB FACILITY

REV. NO.	DWG NO. ASTM–ICF
REV. DATE: 2016–12–12	
DRAWN BY: R.F	SCALE:

CONFORME DOSSIER
AT-00529 & AT-00556
CLEB
COMPLIES TO FILE

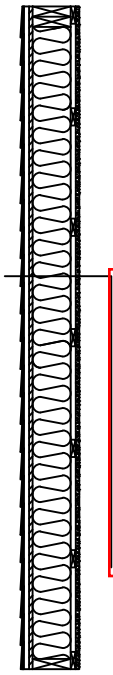


WOOD FRAME WALL ELEVATION



VINYL SIDING
VERTICAL 1X3 @ 16"O.C.
TYVECK TYPE AIR BARRIER
7/16" OSB
2X6 @ 16" O.C.
R20 FIBERGLASS INSULATION
6MIL POLYETHYLENE VAPOUR BARRIER
HORIZ 1X3 @ 16" O.C.
1/2" GYPSUM BOARD

SECTION AT WINDOW



VINYL SIDING
VERTICAL 1X3 @ 16"O.C.
TYVECK TYPE AIR BARRIER
7/16" OSB
2X6 @ 16" O.C.
R20 FIBERGLASS INSULATION
6MIL POLYETHYLENE VAPOUR BARRIER
HORIZ 1X3 @ 16" O.C.
1/2" GYPSUM BOARD

SECTION

ICFMA
INSULATING CONCRETE FORMS MANUFACTURERS ASSOCIATION

WOOD FRAME TEST WALL FOR ASTM-1363 TEST AT CLEBB FACILITY

REV. NO.	DWG NO.
	ASTM-WD
REV. DATE: 2016-12-12	
DRAWN BY: R.F.	SCALE:

Specification Sheet

MainStreet™

Vinyl Siding

CONFORME DOSSIER AT-00529 & AT-00556 COMPLIES TO FILE

General Description: MainStreet™ siding is appropriate for use in new construction for single family homes, multi-housing projects and light commercial developments. MainStreet is also an ideal product for remodeling.

Styles:

Profile	Finish	Panel Projection	Wall Thickness (Nominal)	Lock Design	Colors	Accessory Pocket
Double 4" Clapboard	Woodgrain	9/16"	.042"	Post-formed	24	½", 5/8"or ¾"
Double 4" Dutchlap	Woodgrain	9/16"	.042"	Post-formed	24	½", 5/8"or ¾"
Double 5" Clapboard	Woodgrain	9/16"	.042"	Post-formed	24	½", 5/8"or ¾"
Double 5" Dutchlap	Woodgrain	9/16"	.042"	Post-formed	24	½", 5/8"or ¾"
Triple 3" Clapboard	Smooth Brushed	9/16"	.042"	Post-formed	11	½", 5/8"or ¾"
Single 6-1/2" Beaded	Smooth Brushed	9/16"	.042"	Post-formed	13	½", 5/8"or ¾"
Single 8" Clapboard	Woodgrain	5/8"	.042"	Post-formed	1	¾"

Colors: MainStreet siding profiles are available in a wide selection of colors. All colors are Spectrophotometer controlled and utilize exclusive Permacolor™ color science.

Autumn Red	Colonial White	Forest	Light Maple	Sandstone Beige	Snow
Autumn Yellow	Cypress	Granite Gray	Natural Clay	Savannah Wicker	Spruce
Buckskin	Desert Tan	Hearthstone	Oxford Blue	Seagrass	Sterling Gray
Charcoal Gray	Flagstone	Heritage Cream	Sandpiper	Silver Ash	Suede

*Color availability varies by profiles - check Product Catalog for detail.

STUDfinder™: The patented STUDfinder Installation System combines precisely engineered nail slot locations with graphics. Nail slots are positioned 16" on center to allow for alignment with studs. STUDfinder graphics centered at each slot provide a quick and easy guide to help locate studs.

RigidForm™: MainStreet RigidForm 200 double nail hem technology stiffens siding for a straighter-on-the-wall appearance and provides wind load performance.

Lock: MainStreet's exclusive DuraLock™ is a substantially larger lock than is found on competing products, with a rigid teardrop shape and engineered angular locking leg for a positive, snap fit application and exceptional wind resistance.

Accessories: CertainTeed manufactures a wide range of siding accessories which are compatible with MainStreet siding styles and colors. Accessory products include installation components, soffit, window and door trim, corner lineals, corner systems and decorative moldings.

Composition: MainStreet siding products are produced using CertaVin™ custom-formulated PVC resin. This resin is produced exclusively by CertainTeed, allowing CertainTeed to maintain the high quality of its siding products.

Technical Data: MainStreet siding is in compliance with ASTM specification for Rigid Polyvinyl Chloride (PVC) Siding D 3679, and the requirements of section R703.11 of the International Residential Code, and section 1405.14 of the International Building Code. MainStreet siding meets or exceeds the properties noted in Table 1.

Table 1

ASTM E 84	Meets Class A flame spread requirements as tested according to ASTM E84.
ASTM D 1929	Self-ignition temperature 813°F
ASTM D 635	Material is self-extinguishing with no measurable extent of burn when tested in accordance with this specification.
NFPA 268	Radiant Heat Test - Ignition Resistance of Exterior Walls - Conclusion that CertainTeed met the conditions for allowable use as specified in section 1406 of the International Building Code.

Important Fire Safety Information: When rigid vinyl siding is exposed to significant heat or flame, the vinyl will soften, sag, melt or burn, and may thereby expose material underneath. Care must be exercised when selecting underlayment materials because many underlayment materials are made from organic materials that are combustible. You should ascertain the fire properties of underlayment materials prior to installation. All materials should be installed in accordance with local, state and federal Building Code and fire regulations.

Wind Load Testing: CertainTeed MainStreet double 4" siding has been tested per ASTM D 5206 standard test method for resistance to negative wind load pressures exceeding 55 psf, which equates to more than 200 mph(V_{ASD}) and 260mph (V_{ULT}), when installed with nails positioned 16" on center. Check with your local building inspector for wind load requirements in your area on the type of structure you are building.

Documents: CertainTeed Vinyl Siding meets the requirements of one or more of the following specifications.
Texas Department of Insurance Product Evaluation EC-11
Conforms to ASTM Specification D3679
Florida BCIS Approval FL1573
ICC-ES Evaluation Report ESR-1066
For specific product evaluation/approval information, call 800-233-8990.

Installation: Prior to commencing work, verify governing dimensions of building, examine, clean and repair, if necessary, any adjoining work on which the siding is in any way dependent for its proper installation. Sheathing materials must have an acceptable working surface. Siding, soffit and accessories shall be installed in accordance with the latest editions of CertainTeed installation manuals on siding and soffit. Installation manuals are available from CertainTeed and its distributors.

Warranty: CertainTeed supports MainStreet siding products with a Lifetime Limited Warranty including PermaColor Lifetime Fade Protection to the original homeowner. The warranty is transferable if the home is sold.

Technical Services: CertainTeed maintains an Architectural Services staff to assist building professionals with questions regarding CertainTeed siding products. Call 800-233-8990 for samples and answers to technical or installation questions.

Sample Short Form Specification: Siding as shown on drawings or specified herein shall be MainStreet™ Vinyl Siding as manufactured by CertainTeed Corporation, Valley Forge, PA. The siding shall have a .042" nominal thickness. Installation shall be in accordance with manufacturer's instructions.

Three-part Format Specifications: Long form specifications in three-part format are available from CertainTeed by calling our Architectural Services Staff at 800-233-8990. These specifications are also available on our website at certainteed.com.

CertainTeed Corporation
P.O. Box 860
Valley Forge, PA 19482
certainteed.com

EcoTouch® PINK® Fiberglas™ Insulation

Description

Owens Corning® EcoTouch® PINK® Fiberglas™ Insulation with PureFiber® Technology is a preformed, flexible blanket insulation. It is produced in R-values from 11 to 49, with thicknesses ranging from 3½ inches to 14 inches. It is available unfaced, or faced with either a kraft or foil vapor retarder.

Features

- Excellent thermal control
- Effective acoustical control
- Long term performance and will not settle nor slump within wall cavities
- With less dust than other fiberglass products, EcoTouch® PINK® Fiberglas™ insulation has excellent stiffness and recovery characteristics[1]
- Compression packaging from Owens Corning speeds job site handling and installation

1. According to 2010 clinical trial conducted in Toronto, Canada by Ducker Worldwide on behalf of Owens Corning Insulation Systems, LLC.

Applications

- Wood-framed wall, floor and roof/ceiling cavity wall assemblies
- Metal-framed wall and floor cavity wall assemblies
- Furring strips installed on the interior surface of basement walls
- Interior surfaces of basement and unvented crawl space foundation walls

Standards, Codes Compliance

- Manufactured in compliance with ASTM C 665
- Federal Specification HH-I-521F has been canceled and is replaced by ASTM C 665
- Classified non-combustible when tested in accordance with ASTM E 136
- Unfaced EcoTouch® PINK® Fiberglas™ insulation is acceptable for use in ICC building construction types I through V; kraft and foil faced EcoTouch® PINK® Fiberglas™ insulation are acceptable for use in ICC building construction types III, IV and V
- Certified to meet California Code of Regulations, Title 24, Chapter 12-13, Article 3, "Standards for Insulating Material"

Physical Properties

Property (unit)	Test	Value
Thermal Resistance	ASTM C518	See "Availability" table for R-values
Surface Burning Characteristics[2] (flame spread / smoke developed)	ASTM E 84 / UL 723	
Unfaced		25 / 50
Kraft faced		NR / NR
Foil faced		75 / 150
Critical Radiant Flux (W/cm²)	ASTM E970	>0.12
Water Vapor Permeance (perms)	ASTM E96	
Kraft faced		1.0
Foil faced		0.5
Water Vapor Sorption (by weight)	ASTM C1104	<5%
Odor Emission	ASTM C1304	Pass
Corrosion Resistance	ASTM C665, part 13.8	Pass
Fungi Resistance	ASTM C1338	Pass

2. The surface burning characteristics of EcoTouch® Insulation were derived from products tested in accordance with ASTM E84. This standard is used solely to measure and describe properties of products in response to heat and flame under controlled laboratory conditions, and should not be used to describe or approve the fire hazard of materials under actual fire conditions. However, the results of these tests may be used as elements of a fire risk assessment that takes into account all of the factors pertinent to an assessment of the fire hazard of a particular end use. Values are reported to the nearest five rating.

Design Considerations

- For optimum insulation performance the building thermal barrier (insulation) should be in continual alignment with the building air barrier. In framed cavities, the product thickness should match the depth of the framing members.
- Follow the local, applicable building code(s) to determine the need for and placement of a vapor retarder.
- Do not install insulation on top, or within 3 inches of a recessed light fixture unless the fixture is labeled as "insulation contact" (IC) rated.
- Kraft and standard foil facings will burn and cannot be left exposed. Install facings in substantial contact with the assembly finish material. Protect from open flame or other heat source.

Installation

See Owens Corning publication "Installation Guide for Light Density Insulation" (Pub. No. 10017858) for more information.

CLEB
CONFORME DOSSIER
AT-00529 & AT-00556
COMPLIES TO FILE

Environmental and Sustainability

Owens Corning is a worldwide leader in building material systems, insulation and composite solutions, delivering a broad range of high-quality products and services. Owens Corning is committed to driving sustainability by delivering solutions, transforming markets and enhancing lives. More information can be found at www.owenscorning.com.

Notes

Fiberglass products may cause temporary skin and mucous membranes itching due to the mechanical abrasion effects of fibers, a condition which is completely reversible. Owens Corning does not recommend the use of unfaced EcoTouch® PINK® Fiberglas™ Insulation in exposed applications where it will be subject to routine human contact due to this potential temporary irritation.

For additional information, refer to the Safe Use Instruction Sheet (SUIS) found in the SDS Database via http://sds.owenscorning.com.

CLEB
CONFORME DOSSIER
AT-00529 & AT-00556
COMPLIES TO FILE

Availability

	Width		Length		Thickness	R-Value
Metal Frame Construction	16" (406mm)	24" (609mm)	48" (1,219mm)	96" (2,438mm)	3 ½" (89mm)	11
	16" (406mm)	24" (609mm)	48" (1,219mm)	96" (2,438mm)	3 ½" (89mm)	13
	16" (406mm)	24" (609mm)		96" (2,438mm)	3 ½" (89mm)	15
	16" (406mm)	24" (609mm)		96" (2,438mm)	5 ½" (139mm)	21
Wood Frame Construction Walls	11" (406mm)		93" (2,362mm)	105" (2,667mm)	3 ½" (89mm)	11
	11" (406mm)		93" (2,362mm)		3 ½" (89mm)	13
	11" (406mm)			105" (2,667mm)	3 ½" (89mm)	15
	11" (406mm)		93" (2,362mm)		6 ¼" (159mm)	19*
	12" (406mm)		48" (1,219mm)		9 ½" (241mm)	30
	15" (381mm)	23" (584mm)	48" (1,219mm)	93" (2,362mm)	3 ½" (89mm)	11
	15" (381mm)	23" (584mm)	48" (1,219mm)	93" (2,362mm)	3 ½" (89mm)	13
	15" (381mm)	23" (584mm)		93" (2,362mm)	3 ½" (89mm)	15
	15" (381mm)	19¼" 23" (584mm)	48" (1,219mm)	93" (2,362mm)	6 ¼" (159mm)	19*
	15" (381mm)	23" (584mm)		93" (2,362mm)	5 ½" (139mm)	20
	15" (381mm)	23" (584mm)		93" (2,362mm)	5 ½" (139mm)	21
	15" (381mm)	23" (584mm)		105" (2,667mm)	5 ½" (139mm)	21
	23" (381mm)	23" (584mm)		93" (2,362mm)	5 ½" (139mm)	21
Floor/Ceiling	15" (381mm)	19¼" 23" (584mm)	48" (1,219mm)	93" (2,362mm)	6 ¼" (159mm)	19
	15" (381mm)	23" (584mm)	48" (1,219mm)		6 ¾" (171mm)	22
	15" (381mm)	23" (584mm)	48" (1,219mm)		8" (203mm)	25
	15½" (394mm)	23¾" (603mm)	48" (1,219mm)		8 ¼" (209mm)	30C
	16" (406mm)	19¼" 24" (609mm)	48" (1,219mm)		9 ½" (241mm)	30
	15½" (394mm)	23¾" (603mm)	48" (1,219mm)		10 ¼" (260mm)	38C
	16" (406mm)	24" (609mm)	48" (1,219mm)		12" (305mm)	38
	16" (406mm)	24" (609mm)	48" (1,219mm)		14" (356mm)	49

*Delivers R18 value when installed in 5.5" deep cavity.

Certifications and Sustainable Features

- Certified by SCS Global Services to contain a minimum of 65% with minimum 47% post-consumer and 18% pre-consumer*
- GREENGUARD Certified products are certified to GREENGUARD standards for low chemical emissions into indoor air during product usage. GREENGUARD validated to be Formaldehyde free. For more information, visit ul.com/gg
- Environmental Product Declaration (EPD) has been certified by UL Environment
- Gold Material Health Certificate from Cradle to Cradle Products Innovation Institute*

ENERGY STAR PARTNER

CERTIFIED ENVIRONMENTAL PRODUCT DECLARATION UL.COM/EPD

GREENGUARD GOLD
PRODUCT CERTIFIED FOR LOW CHEMICAL EMISSIONS UL.COM/GG UL 2818

CERTIFIED RECYCLED CONTENT SCS GLOBAL SERVICES *
AVERAGE 65% RECYCLED CONTENT
18% PRE-CONSUMER
47% POST-CONSUMER

*Unfaced EcoTouch® insulation only.

Disclaimer of Liability

Technical information contained herein is furnished without charge or obligation and is given and accepted at recipient's sole risk. Because conditions of use may vary and are beyond our control, Owens Corning makes no representation about, and is not responsible or liable for the accuracy or reliability of data associated with particular uses of any product described herein.

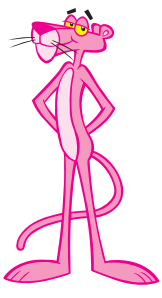
SCS Global Services provides independent verification of recycled content in building materials and verifies recycled content claims made by manufacturers. For more information, visit www.SCSglobalservices.com.

LEED® is a registered trademark of the U.S. Green Building Council.

OWENS CORNING INSULATING SYSTEMS, LLC
ONE OWENS CORNING PARKWAY
TOLEDO, OHIO, USA 43659

1-800-GET-PINK®
www.owenscorning.com

Pub. No. 10013811-D. Printed in U.S.A. September 2016.



CONFORME DOSSIER
AT-00529 & AT-00556
COMPLIES TO FILE
CLEB

MaxVapor™ Barrier Film

PRODUCT SELECTOR GUIDE

Balcan Plastics/First Film Extruding MaxVapor™ barrier film is made of polyethylene sheeting and used as a barrier to prevent moisture and humidity penetrating inside the external walls and ceilings of buildings. Vapor barrier is listed in the national building code and meets the national standard CAN GSB 51.34-M86. Our vapor barrier authorization number 69006 meets and exceeds all exacting requirements of the Canadian General Standards Board. Vapor barrier film can also be used under concrete slabs and in foundations for dampness proofing.

Code	Width	Length	Sq.ft./roll	Fold Type	Rolls/skid
05 V60 301	12"	300'	300	S	144
05 V60 506	102"	59'	500	V	108
05 V90 515	16"	375'	500	S	100
05 V61 006	102"	118'	1000	V	50
05 V61 007	120"	100'	1000	V	50
05 V61 208	144"	100'	1200	W	48
05 V61 506	102"	177'	1500	V	48
05 V61 507	120"	150'	1500	W	35
05 V61 610	192"	100'	1600	W	48
05 V62 011	240"	100'	2000	W	30
GAUGE: .010MIL					**Clear**
05V90211	240"	100'	2000	W	20

balcan
ISO-9001
Tel: 514.326.9130
Fax: 514.326.4565
Website: www.balcan.com

FIRST FILM extruding
Tel.: 1.888.633.0303
Fax: 1.888.311.0181
Website: www.ffebpl.com

All Balcan Plastics/First Film Extruding film is recyclable.

DuPont™ Tyvek® HomeWrap®

PHYSICAL PROPERTIES DATA SHEET

PROPERTIES	METHOD	DUPONT™ TYVEK® HOMEWRAP®
Air Penetration Resistance	ASTM E2178 (cfm/ft²@1.57 psf)	< .004
	Gurley Hill (TAPPI T-460) (sec/100cc)	1200
	ASTM E1677	Type 1
Water Vapor Transmission	ASTM E96-05 Method A (g/m²-24 hrs) (perms)	400 56
	Method B (glm²-24 hrs) (perms)	370 54
Water Penetration Resistance	ATTCC 127 (cm)	250
Basis Weight	TAPPI T-410 (oz/yd²)	1.8
Breaking Strength	ASTM D882 (lbs/in)	30/30
Tear Resistance (Trapezoid)	ASTM D1117 (lbs)	8/6
Surface Burning Characteristics	ASTM E84 Flame Spread Index	15 Class A
	Smoke Developed Index	15 Class A
Ultra Violet Light Exposure (UV)		120 days (4 months)

Test results shown represent roll averages. Individual results may vary either above or below averages due to normal manufacturing variations, while continuing to meet product specifications.

For more information about DuPont™ Tyvek® Weatherization Systems, please call 1-800-44-Tyvek or visit us at www.Construction.Tyvek.com

CONFORME DOSSIER
AT-00529 & AT-00556
CLEB
COMPLIES TO FILE

WARNING: DuPont™ Tyvek® is combustible and should be protected from an open flame and other high heat sources. If the temperature of DuPont™ Tyvek® reaches 750 °F (400 °C), it will burn and the fire may spread and fall away from the point of ignition.

DUPONT®
The miracles of science™

DuPont™ Tyvek® HomeWrap®

APPENDIX B: PICTURES OF THE TESTED SAMPLES

Exterior view of the wall assembly (Specimen #1)

Interior view of the wall assembly (Specimen #1)

Construction of the specimen (Specimen #1)

Construction of the specimen (Specimen #1)

Construction of the specimen (Specimen #1)

Construction of the specimen (Specimen #1)

Construction of the specimen (Specimen #1)

Construction of the specimen (Specimen #1)

Construction of the specimen (Specimen #1)

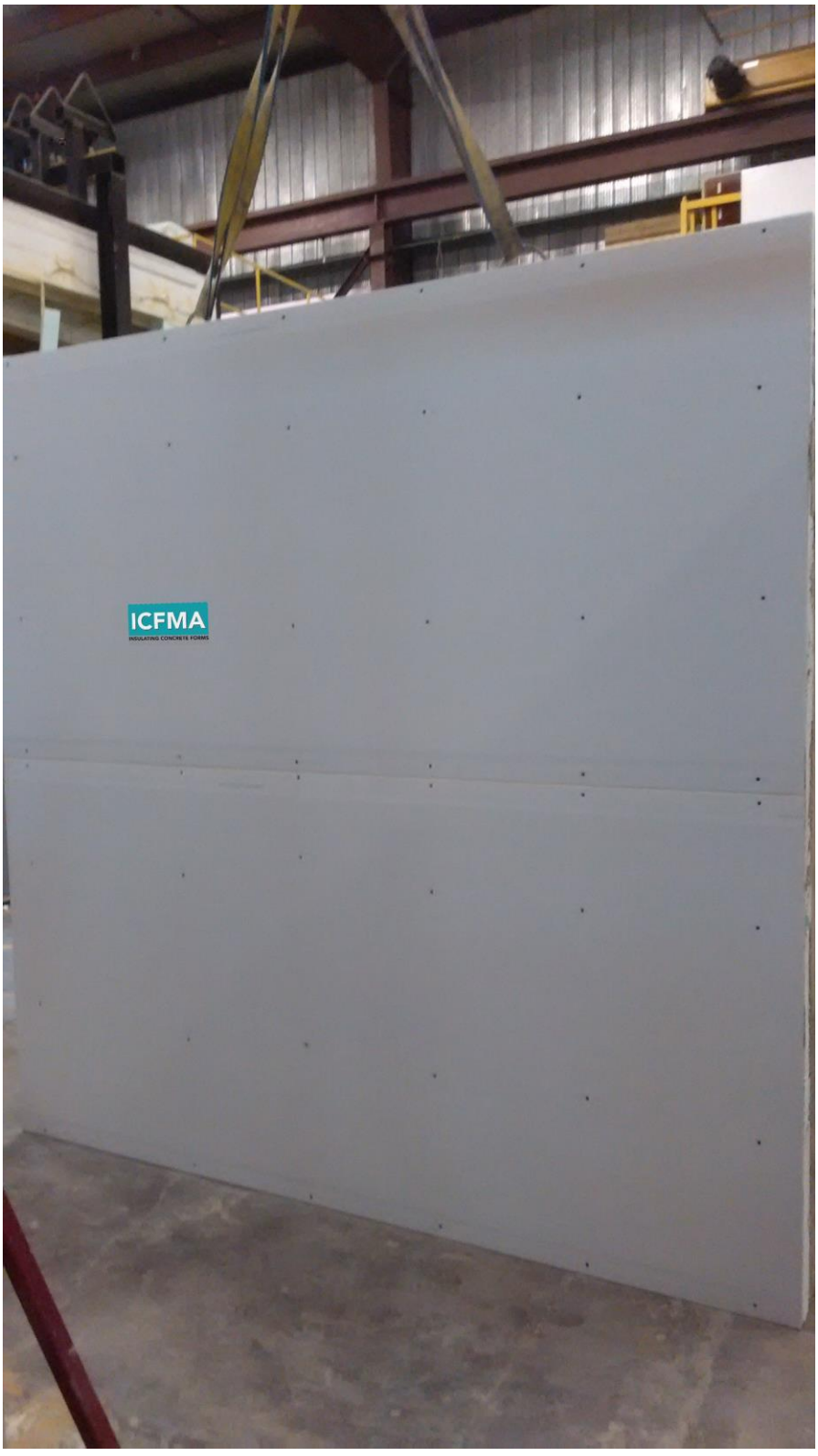
Construction of the specimen (Specimen #1)

Construction of the specimen (Specimen #1)

Construction of the specimen (Specimen #1)

Construction of the specimen (Specimen #1)

Construction of the specimen (Specimen #1)



Exterior view of the wall assembly (Specimen #2)

Interior view of the wall assembly (Specimen #2)

Construction of the specimen (Specimen #2)

Construction of the specimen (Specimen #2)

Construction of the specimen (Specimen #2)

Construction of the specimen (Specimen #2)

Construction of the specimen (Specimen #2)

Construction of the specimen (Specimen #2)

Construction of the specimen (Specimen #2)

Construction of the specimen (Specimen #2)

Construction of the specimen (Specimen #2)

Construction of the specimen (Specimen #2)

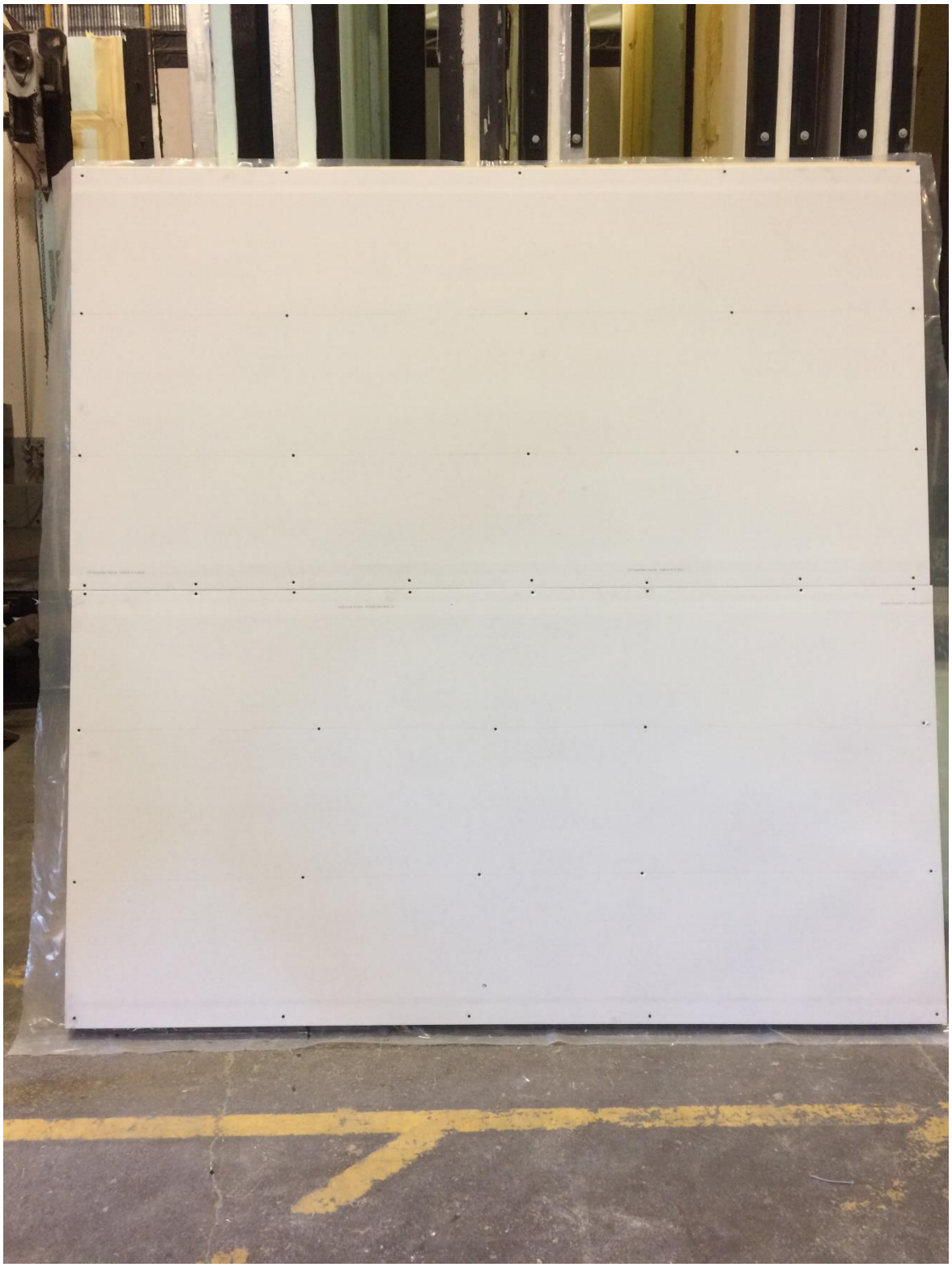
Construction of the specimen (Specimen #2)

Construction of the specimen (Specimen #2)

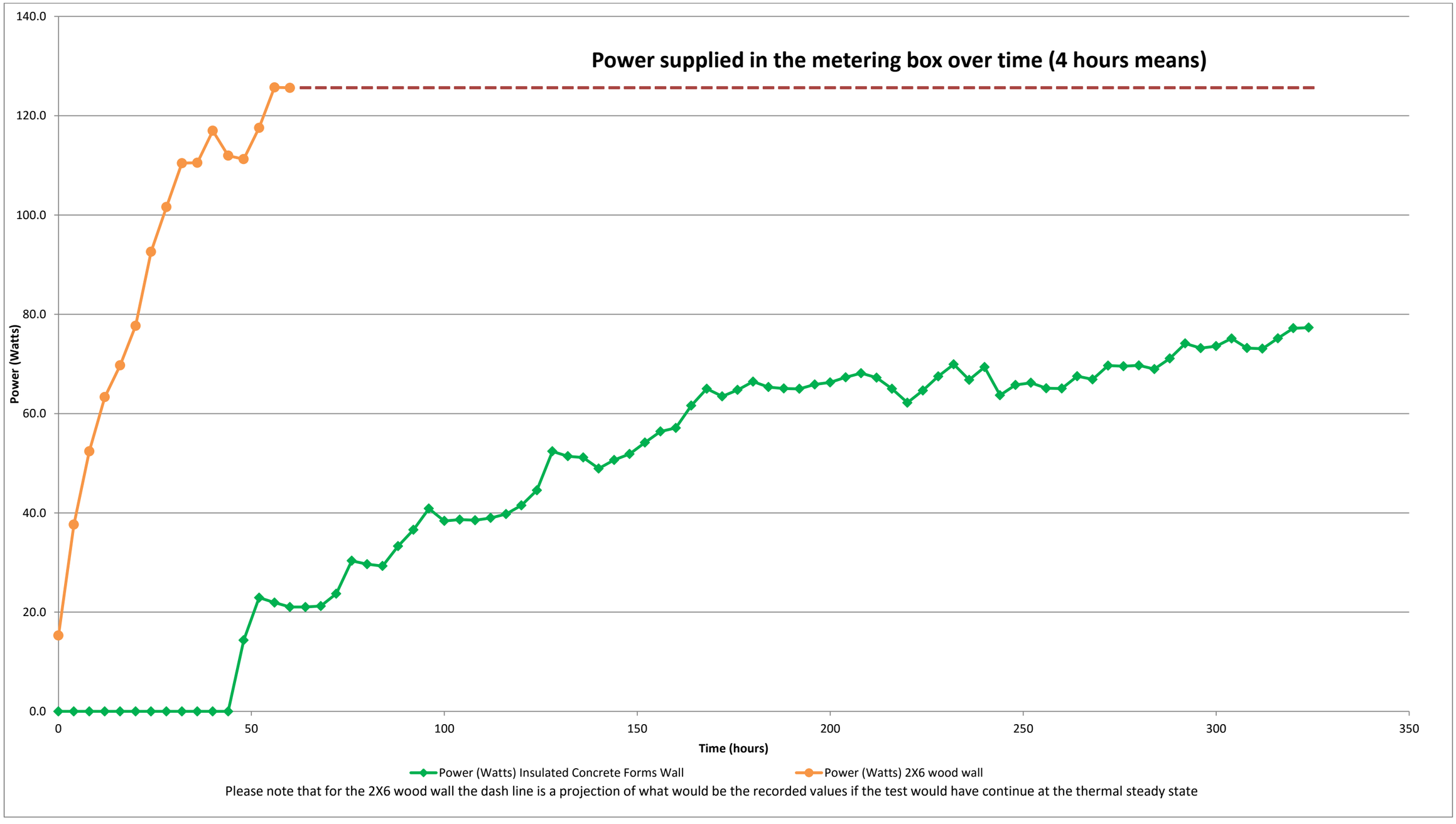
Construction of the specimen (Specimen #2)

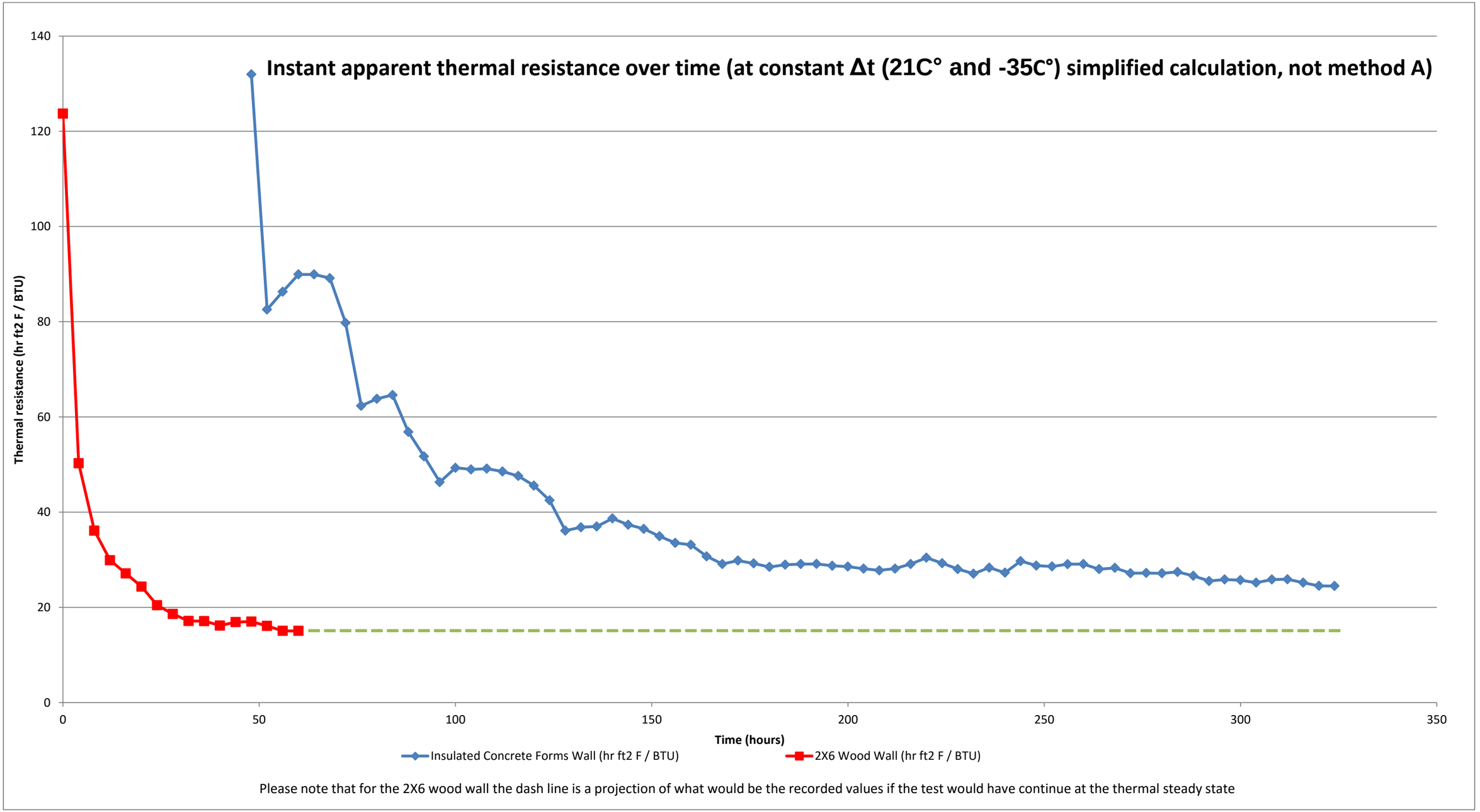
Construction of the specimen (Specimen #2)

Construction of the specimen (Specimen #2)



APPENDIX C: GRAPH





Please note that for the 2X6 wood wall the dash line is a projection of what would be the recorded values if the test would have continue at the thermal steady state