

**REPORT OF A  
FIRE ENDURANCE TEST PROGRAM  
CONDUCTED ON  
INSULATING CONCRETE FORMS**

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## PREFACE

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## INTRODUCTION

On June 24, 2004, Intertek Testing Services NA Ltd./Warnock Hersey conducted a three hour fire endurance test on IntegraSpec<sup>®</sup> insulating concrete forms (ICF)/building system submitted by Phil-Insul Corporation. Testing was conducted in accordance with CAN/ULC S101-M89, NFPA 251, and ASTM E119-98 (UBC 8-1), *Standard Test Methods for Fire Tests of Building Construction and Materials*, with exception to the size of sample being tested.

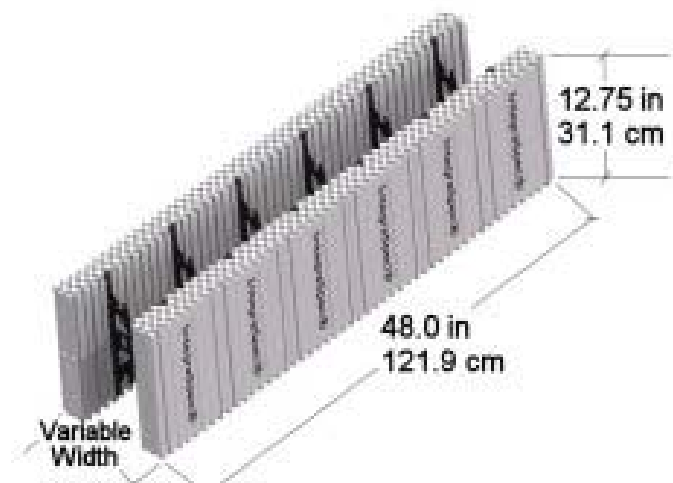
The fire resistance of the wall assembly is provided by virtue of the 6 in. concrete wall thickness. The objective of the test was to determine whether the polystyrene web, a component of the form system, would melt out and cause a loss of support for the non-fire side standard 1/2 in. gypsum thermal barrier and consequently create a through opening in the concrete wall, and/or flaming of the polystyrene web and expanded polystyrene foam on the unexposed side, or create openings in the concrete wall that would result in the ignition of cotton waste. A reduced scale sample was selected for the fire endurance test, as these results would be shown with equal certainty whether the sample was tested on a reduced scale or on a full scale basis due to the small size of the plastic webs.

The fire test sample was constructed to be representative of the code requirements for a foam insulated concrete wall system. A wall incorporating the use of foam plastic as a component of its construction requires the use of a thermal barrier. The 1994 Uniform Building Code states in Chapter 26, Section 2602.4, "The interior of the building shall be separated from the foam plastic insulation by an approved thermal barrier having an index of 15 when tested in accordance with UBC standard 26-3. The thermal barrier shall be installed in such a manner that it will remain in place for the time of its index classification based on approved diversified tests. The Phil-Insul Corporation. insulating concrete form system was tested in accordance with UBC 26-3, *Room Fire Test Standard For Interior of Foam Plastic Systems*, (refer to Intertek/Warnock Hersey report number 3050556), and met the conditions of acceptance for a 15 minute index. The standard 1/2 in. gypsum wallboard thermal barrier and mounting method used on the test sample evaluated in this report were identical to that used for the construction of the test sample for the room fire test.

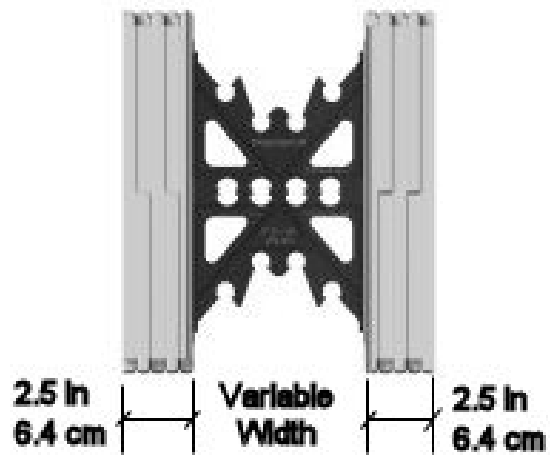
### MATERIAL SPECIFICATIONS

Description:	Interlocking, stackable, expanded polystyrene (EPS) foam concrete form units
Height:	12-3/4 in.
Length:	48 in.
Width:	2-1/2 in.
Overall Thickness:	11 in.
Material:	Type II expanded polystyrene foam (EPS), nominal 1.60 pcf density
Bead Type:	BASF BFL-327
Colour:	White
Web Description:	High impact polystyrene (HIPS) reinforcing webs cast into the EPS-ICF panels
Web Dimensions:	12-1/2 in. high by 9-5/8 in. wide by 1-5/8 in. thick
Web Spacing:	8 in.
Web Colour:	Black

**FIGURE I**  
**INSULATING CONCRETE FORMS**



Expanded Polystyrene (EPS) Foam Concrete Form Unit



High Impact Polystyrene (HIPS) Reinforcing Web

### **TEST SAMPLE INSTALLATION**

The IntegraSpec® Insulating Concrete Forms (ICF)/Building System insulating concrete form units were assembled to construct a concrete wall form. The finished form dimensions were 6 ft. in length by 6 ft. in height. Concrete was pumped into the form, packed, and heat cured for two weeks prior to running the fire test. The heat curing process was able to dry the concrete to prevent spalling during fire exposure and achieve a normal concrete moisture content. Standard 1/2 in. gypsum wallboard oriented vertically was installed over the foam panels on the non-fire side only and was fastened to the polystyrene web using 1-1/2 in. standard drywall screws spaced 12 in. apart vertically and 16 in. apart horizontally.

### THERMOCOUPLE LOCATIONS

A total of three 24 gauge Type K welded thermocouples were installed on the face of the sample wall underneath ceramic insulating pads as required by the standards to determine unexposed surface temperature rise performance.

<b>Thermocouple No.</b>	<b>Location</b>
1	Centre of top left quadrant, 10 in. below upper exposed surface
2	Centre of test wall sample
3	Centre of bottom right quadrant, 10 in. below upper exposed surface



## **THE FIRE TEST**

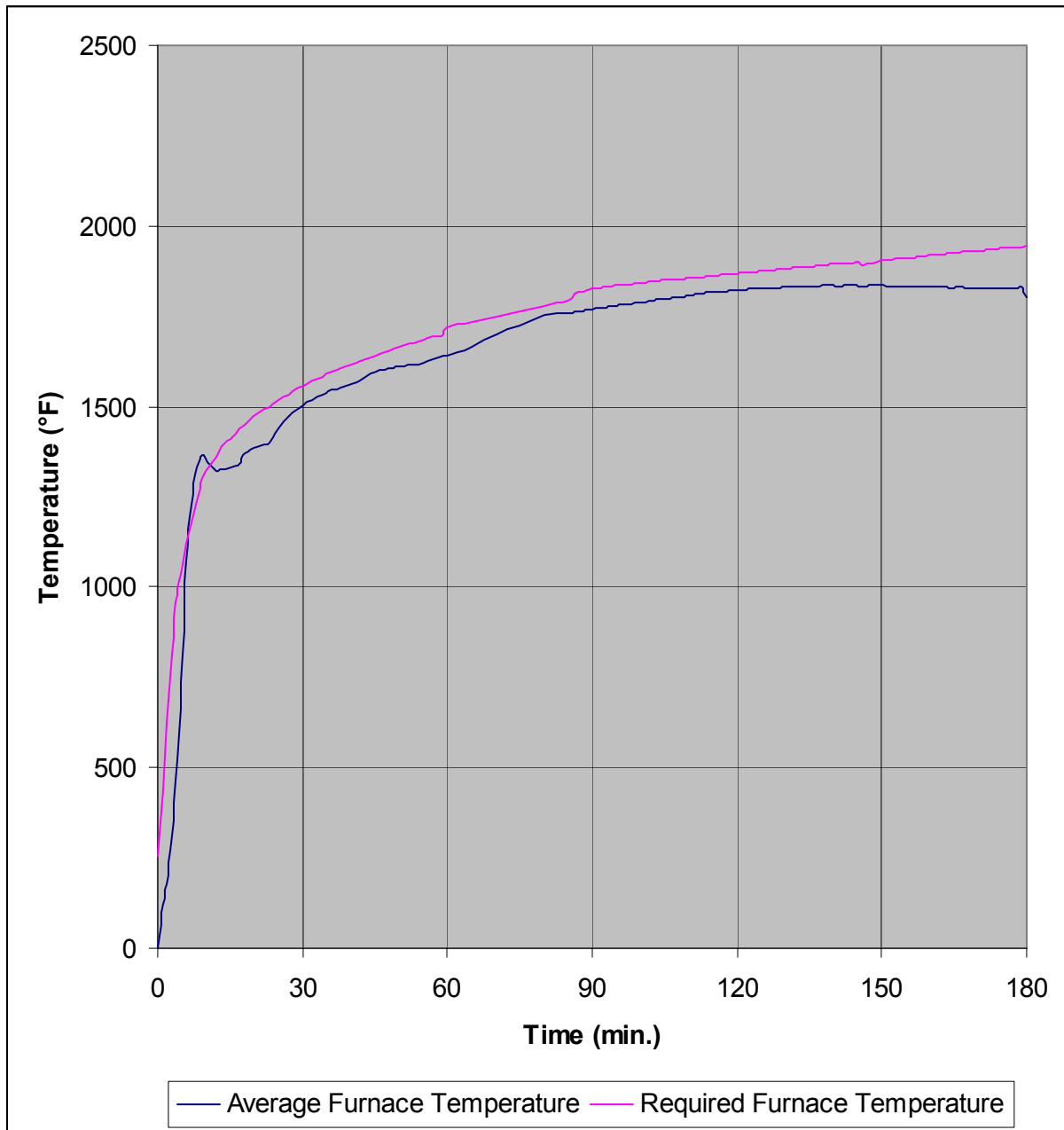
The test assembly was mounted on our pilot scale vertical fire test furnace. The furnace opening has dimensions of 58 in. in width by 62 in. in height. Furnace temperatures are measured by six uniformly distributed thermocouples, horizontally extending to 12 in. from the test wall. The exhaust opening is located along the back of the furnace. Six natural gas burners are located in the furnace, as are ten 2 in. secondary air inlets.

The burners were ignited and controlled to maintain furnace temperature rise to conform as closely as possible to the standard time/temperature curve. After three hours of fire exposure, the test was discontinued. Observations, furnace temperatures, and unexposed temperatures were recorded throughout the test duration.

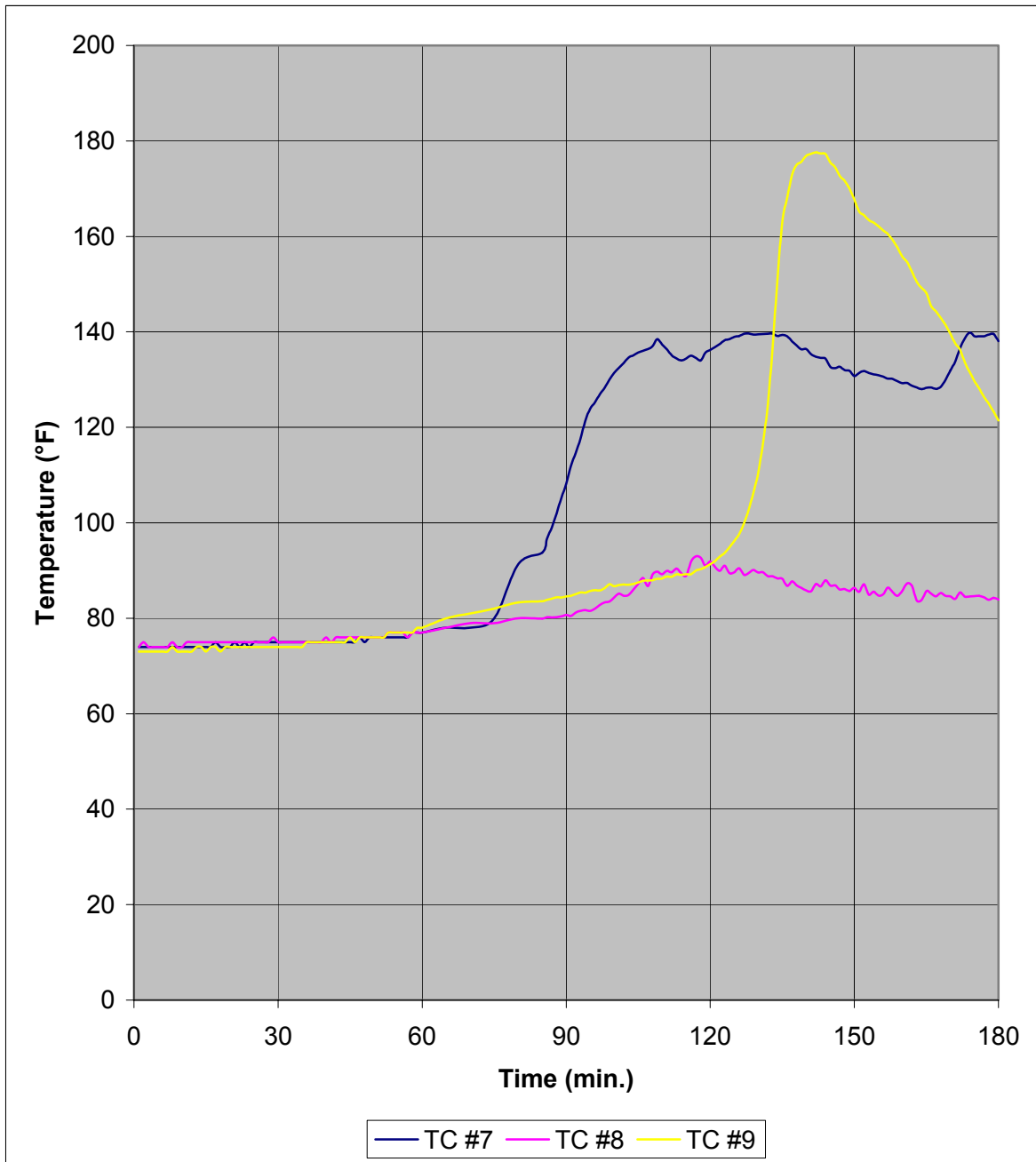
**FIRE TEST OBSERVATIONS**

<b>TIME</b>	<b>EXPOSED SIDE</b>	<b>UNEXPOSED SIDE</b>
5:00	No change	
10:00		No change
19:00	Minor spalling on surface	
30:00	No change	No change
40:00		Slab is warping
60:00	No change	No change
120:00	No change	No change
180:00	No change, test discontinued	No change

**FURNACE TEMPERATURE/TIME CURVE  
AVERAGE TEMPERATURE OF FURNACE DURING THE FIRE TEST**



**UNEXPOSED SURFACE TEMPERATURES**



**PHOTOGRAPH**



Unexposed Side After Fire Test, with Portions of Gypsum Wallboard Removed

### **THE HOSE STREAM TEST**

The reinforced concrete was too fragile to move for the hose stream test, however, it was not possible to physically remove the plastic web connectors from the concrete. From this we know that the hose stream test would not be able to create a through-opening by dislodging the plastic webs.

## CONCLUSIONS

The IntegraSpec<sup>®</sup> Insulating Concrete Forms (ICF)/Building System protected by a 1/2 in. standard gypsum wallboard thermal barrier, installed as described in this report, met the criteria of acceptance of CAN/ULC S101-M89, NFPA 251, and ASTM E119-98 (UBC 8-1), *Standard Test Methods for Fire Tests of Building Construction and Materials*, for a three hour fire resistance rating. The high impact polystyrene web did not melt out and did not cause a loss of support for the non-fire side standard 1/2 in. gypsum thermal barrier. As no through-openings developed in the concrete wall section, no possibility of ignition of cotton waste occurred. There was no occurrence of burn-through or through-openings in the concrete wall, nor was there flaming of the high impact polystyrene and expanded polystyrene foam on the unexposed side. There was enough strength in the webs to pass a hose stream test.

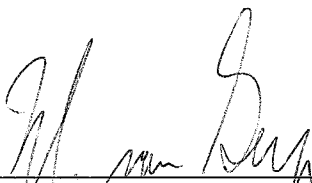
The IntegraSpec<sup>®</sup> Insulating Concrete Forms (ICF)/Building System is consequently eligible for a three hour fire resistance rating, based on concrete thickness and that the test showed that web burn-through will not occur.

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