



Inchcape Testing Services

REPORT OF STANDARD METHODS OF FIRE TESTS OF BUILDING CONSTRUCTION AND MATERIALS

1-HOUR TEST

**2 X 4 WOOD STUDS, 16" O.C., ICYNENE INSULATION
2 LAYERS OF ½" TYPE X GYPSUM WALLBOARD ON EACH SIDE**

STANDARDS TESTED TO:

**ASTM E-119-95
CAN4-S101-M89**

CLIENT:

**ICYNENE INC.
376 WATLINE AVENUE
MISSISSAUGA, ON L4Z 1X2**

REPORT PREPARED BY:

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8431 MURPHY DRIVE
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REPORT NO.: 295-1358-96-02

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INTRODUCTION

On October 3, 1996, a representative of Inchcape Testing Services witnessed the manufacture and verified the formulation of The Icynene Insulation System of Mississauga, Ontario.

During November 1996, Inchcape Testing Services witnessed the construction of walls in 10 foot by 10 foot test frames. The system is loadbearing and symmetrical. On November 21, Inchcape Testing Services supervised a 1-hour fire endurance and protective membrane and a hose stream test. Representatives of Icynene constructed the walls and witnessed the testing.

The tests were conducted at the Fire Testing Laboratory of Gold Bond Building Products, Research Centre, in Buffalo, New York.

The standards tested to:

American Society for Testing and Materials (ASTM)
Standard Method of Fire Tests of Building Construction and Materials
E-119-95

National Standards of Canada, CAN4-S101-M89
Standard Methods of Fire Endurance Tests of Building Construction and Materials

The purpose of the tests was to establish a 1-hour fire rating for this loadbearing wall.

The test assembly was constructed of the following components:

Support members: nominal 2 x 4 #2-KD-19 599 S-Dry Southern Yellow Pine
Firestop Blocking at Mid-Height: None
Wall:
Two Layers: ½" Type X Gypsum Wallboard
Cavity: 2" nominal of Icynene Insulation
Attachment to Studs:
Wallboard: 8d Box Nails, 2-1/2" long, 7" on center - Face Layer
6d Cement Coated Box Nails, 2" long spaced 24" on center - Base Layer
Load: 1,805 pounds per stud, 78% design

This loadbearing assembly met the criteria of ASTM E-119-95 and CAN4-S101-M89 for a 1-hour rating.

TEST FACILITY

The vertical furnace of the Fire Test Laboratory at Gold Bond Building Products, Research Centre, performance meets the criteria of ASTM E-119. Its structural steel test frames have 10 foot x 10 foot openings for test assemblies. The test frame sill is movable.

Hydraulic jacks apply the load to the assembly through the movable sill. Equipment in the control room regulates the hydraulic pressure to produce the desired load. Gauges indicate the pressure.

The furnace temperature is measured by eleven symmetrically-located thermocouples. The natural gas burners are controlled to produce an actual time/temperature curve, such that the area under it is under the variance permitted by the Standard. A Leeds & Northrup Multipoint Strip Recorder records the actual temperatures in degrees Fahrenheit.

Other temperatures are recorded on another Leeds & Northrup Multipoint Strip Recorder and with a Hewlett Packard Model 3054 A Automatic Data Acquisition/Control System and Series 310 Computer.

The temperature recorders were calibrated by Leeds & Northrup on August 28, 1996.

Gauges located at the control panel permit the furnace operator to maintain the pressure in the furnace chamber as nearly equal to atmospheric pressure as possible.

The hose system nozzle conforms to the test standard and is located as per the test standard. The hose stream pressure is measured with a pressure gauge next to the nozzle.

Timing is measured with a stopwatch.

MATERIALS

Framing

Studs: nominal 2 x 4 (actual 1-1/2 x 3-1/2) #2-KD-19 599 S-dry southern yellow pine

No firestop blocking at mid-height was used.

Wallboard

Manufacturer's Designation: Gold Bond ½-inch thick type X, FSW-G gypsum wallboard

Dimensions: 4-foot wide x 0.510-inch thick, avg. x 12 foot long

Weight: 2.02 pounds per square foot, avg.

Certification: UL

Fasteners

8d cement coated box nails, 2-1/2" long, spaced 7" on center on face layer

6d cement coated box nails, 2" long, spaced 24" on center, base layer

Joint Treatment

Gold Bond Sta-Smooth 90 Joint Compound

Gold Bond Joint Tape, Paper

Insulation

Manufacturer's Designation: The Icynene Spray Foam Insulation
Spray-In-Place Polyicynene Soft Foam
ITS/Warnock Hersey Listed Product

Average Thickness: 2"

Density: 0.5 pounds per cubic foot

TEST ASSEMBLY

The construction of the test assembly is briefly described here.

A 10 foot x 10 foot frame was built of nominal 2 x 4's, 16-inches on centers. Single top and bottom plates were fastened to the studs with two 16d common nails into each end of the studs. The second bottom plate was fastened to the first bottom plate with 10d common nails. The frame was positioned in the test frame. The moisture content of the studs, when the wallboard was applied, was 6 to 8%.

Both layers of ½" type X gypsum wallboard were applied vertically, with joints staggered. The base layer was fastened with 6d nails 24" on center. The face layer was fastened with 8d nails 7" on center. No nails went into the top or bottom plates..

The wallboard joints were taped and received one cover coat of Joint Compound. The nail heads received 1 coat of Joint Compound.

Thermocouple Locations

Fire Endurance Test (unexposed face)

One thermocouple was located at the center (face) of the wall. Four were located at the centers of the quarter sections. Five thermocouples were placed over joints, framing and field of wallboard (see Drawing 1).

Protective Membrane (finish rating)

Five thermocouples were located on the fire side of the studs (see Drawing 2). They were in intimate contact with the wood.

Wall Movement Measurements

Lateral deflections of the fire endurance wall were made at the center and quarterpoints of the horizontal centerline of the unexposed surface. The reference line is cotton string, mechanically fastened to the brick work at one side of the test frame and maintained taut by a weight at the other side.

Differential movement between the test frame and the movable test frame sill were measured at the two quarterpoints. This measurement indicates any compression of the partition during tests of loadbearing partitions or walls.

Furnace Pressure Measurements (not an E-119 requirement)

Installed were:

Two taps, located on the vertical centerline of the assembly. A pressure pipe was 35-inches below the top of the assembly, and the other was 22-inches up from the bottom of the assembly. They are 6 inches from the face of the furnace.

TESTS OF BEARING PARTITIONS

The vertical furnace of the Fire Test Laboratory of Gold Bond Building Products was used to test compliance with ASTM E-119-95, Fire Tests of Building Construction and Materials section on "Tests of Bearing Walls and Partitions".

A load of 1,805 pounds per stud was applied to the assembly.

1. Fire Endurance Test, WP-1167

The partition system was constructed as outlined in the "Test Assembly" section of this report. The 5/8-inch thick wallboard face had a fire exposure of 60 minutes. The ambient temperature was 61 degrees Fahrenheit.

Chart 1-1 shows the time/temperature readings of the eleven furnace thermocouples.

Chart 1-2 shows the time/temperature readings of the ten thermocouples on the unexposed surface:

at 30 minutes, the high reading was 103 degrees F on TC 5, the average reading was 79 degrees F; and

at 60 minutes, the high reading was 175 degrees F on TC 1, and the average reading was 136 degrees F.

Drawing 1 illustrates the thermocouple locations.

Table 1-1 records the observations.

Table 1-2 records the unexposed face movement.

Results:

The wall system, during the 1-hour fire exposure and 60 second hose stream, sustained the applied load, did not have a passage of flame or gases hot enough to ignite cotton waste. There was no penetration of water through the wall system.

The average temperature of the unexposed surface did not rise more than 250 degrees Fahrenheit above its initial temperature. A high single temperature of the unexposed surface did not rise more than 325 degrees Fahrenheit above the ambient temperature.

2. Performance of Protective Membranes

In conjunction with the Fire Endurance and Hose Stream Test, WP-1166, the protective performance of the 2 layers of ½-inch thick Gold Bond Fire-Shield type X gypsum wallboard for the studs facing the fire was recorded.

Chart 1-1 illustrates the time/temperature readings of the eleven furnace thermocouples.

Chart 4 shows the time/temperature readings of the five thermocouples, 1-5, on the studs protected by one layer of wallboard. The initial temperature was 71 degrees F.

at 10 minutes, the high reading was 177 degrees F on TC 2, the average reading was 163 degrees F;

at 20 minutes, the high reading was 208 degrees F on TC 2, the average reading was 198 degrees F;

at 30 minutes, the high reading was 216 degrees F on TC 1, the average reading was 211 degrees F;

at 40 minutes, the high reading was 269 degrees F on TC 3, the average reading was 248 degrees F.

Drawing 2 shows the thermocouple locations.

Results:

The average thermocouple readings were 248 degrees F over the initial temperature at 40 minutes.

CONCLUSIONS

An Icynene Insulation Systems wall partition using nominal 2 x 4 yellow pine #2 studs 16 inches on center with 2 layers of ½" type X Gold Bond FSW gypsum wallboard on both sides, with 2" nominal of Icynene Insulation in the stud cavity. No firestop blocking was used. This attained a 1-hour fire rating, for a loadbearing wall.

Test Standards: ASTM E-119-95a
 CAN4-S101-89

- a) Withstood 1-hour fire endurance tests, without passage of flames or gases hot enough to ignite cotton waste.
- b) Resisted heat transmission through the wall during the fire endurance tests such that the heat transmitted did not raise the temperature on the unexposed surface more than 250 degrees F above its initial temperature or any individual thermocouple more than 325 degrees F above its initial temperature.
- c) Withstood hose stream tests without permitting a projection of water beyond the unexposed surface.

This wood wall system, without firestopping blocking, thus meets the requirements for a 1-hour fire rating.

This system is eligible for an Inchcape Testing Services certification program. This report does not imply system certification. Products must bear the Warnock Hersey mark (with the system design) and be used in designs shown in the Inchcape Testing Services Certification Listings Book.

Construction Witnessed,
Tests Supervised and
Report Reviewed By:



R. Joseph Pearson
Fire Test Engineer

Report Reviewed By:



R. Davison
Manager, Certification