COMMERCIAL TESTING COMPANY
1215 South Hamilton Street • Post Office Box 985 • Dalton, GA 30722
Telephone (706) 278–3935 • Facsimile (706) 278–3936

Standard Method of Test for
Surface Flammability of Materials
Using a Radiant Heat Energy Source

ASTM E 162–06

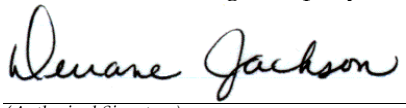
3M Safety S70 (3M Scotchshield SH7CLARL)

Report Number 09–01265

Test Number 4053–5565
January 23, 2009

3M Company
St. Paul, Minnesota

Commercial Testing Company



(Authorized Signature)

TESTED TO BE SURE®
Since 1974

INTRODUCTION

This report is a presentation of test results on a material submitted by 3M Company, St. Paul, Minnesota. The test was conducted in accordance with the American Society for Testing and Materials fire test response standard E 162–06, *Surface Flammability of Materials Using a Radiant Heat Energy Source*. The method provides a laboratory procedure for measuring and comparing surface flammability of materials when exposed to a prescribed level of radiant heat energy. It is intended for research and development only and should not be used as a basis of ratings for building codes.

This standard is used to measure and describe the response of materials, products, or assemblies to heat and flame under controlled conditions, but does not by itself incorporate all factors required for fire–hazard or fire–risk assessment of materials, products, or assemblies under actual fire conditions.

No consideration is made for results that may be obtained if the material being evaluated were tested in combination with other materials.

PURPOSE

Surface flammability is measured using a vertically mounted propane gas and air fueled radiant heat energy source and a 150 mm by 460 mm test specimen. The specimen orientation is at an inverted angle of 30° to the perpendicular surface of the radiant panel with ignition forced near its upper edge and the flame progressing downward. A pilot burner, fueled with an acetylene–air mixture, impinges on the specimen near its top edge and provides ignition. A factor derived from the rate of progress of the flame front, and another relating to heat liberation by the material being tested, are combined to provide the final test result.

TEST PROCEDURE

A minimum of four specimens with a maximum thickness of 25 mm is pre–conditioned for 24 hours in a circulating air oven maintained at 60°C. The dry specimens are then conditioned to equilibrium in an atmosphere with the temperature maintained between 21 and 23°C and the relative humidity between 45 and 55 percent. The conditioned specimens are wrapped with aluminum foil with only the face exposed, placed in a specimen holder, and backed with 13 mm thick inorganic millboard. When necessary, a 25 mm hexagonal wire mesh is placed across the face of the mounted specimens to maintain its integrity during testing.

The radiant heat energy panel is ignited and allowed to preheat at least 1.5 hours prior to commencement of testing. Stack temperature measurements in the range of 180 to 230°C indicate proper operating conditions. The thermal output of the radiant panel is verified to be within the specified operating range of 670 ± 4°C by measurements made on a 10–inch diameter area in the center of the panel using a Honeywell radiation pyrometer. Periodic calibration using a special burner fueled with methane gas provides data necessary for calculation of the final test result. The pilot burner is adjusted to give a flame approximately two to three inches in length. The prepared specimen is placed on the supporting framework in front of the panel and the timer started simultaneously. The time that the flame front on the surface of the specimen arrives at each 76 mm mark, and the maximum temperature rise measured in the exhaust stack thermopile, are recorded during a 15–minute test exposure.

CALCULATIONS

Test results are calculated and expressed as the Flame Spread Index. The Flame Spread Index is the product of the Flame Spread Factor, a factor derived from the rate of progress of the flame front, and the Heat Evolution Factor, a factor relating to the rate of heat liberation by the material. The Flame Spread Factor is calculated as:

$$F_s = 1 + \frac{1}{t_3 - t_0} + \frac{1}{t_6 - t_3} + \frac{1}{t_9 - t_6} + \frac{1}{t_{12} - t_9} + \frac{1}{t_{15} - t_{12}}$$

where:

F_S = flame spread factor
t_X = time until arrival of the flame at the 76 mm distance marks

If there are any segments of the curve where the slope increases, the increase is eliminated by segmenting the curve from the previous to the succeeding point, thus becoming a "skip point." These points are treated in the formula *Fs* by dropping the terms involving single curve points and replacing them with the single term *K/(Tf– Tb)* where *K* is an integer related to the number of skip points, *Tf* is the time at the first curve point after the skip, and *Tb* is the time at the last curve point before a skip point.

The Radiant Panel Index is calculated as $Is = FsQ$ and the Heat Evolution Factor as $Q = CT/ß$ where:

C = arbitrary constant 5.7
T = observed maximum stack temperature rise in °C between the specimen and that for a similar curve of fiber-reinforced cement board
ß = mean stack temperature rise for unit heat input rate in °C/kW, a constant for a particular test instrument

MATERIAL TESTED

Identification: 3M Safety S70 (3M Scotchshield SH7CLARL)
Type Material: Window Film
Thickness: 0.132" Total / Film 0.007"
Color: Clear

TEST DATA

Specimen	1	2	3	4
Flame Spread Factor, Fs	2.41	3.07	2.80	2.89
Temperature Rise, °C	1.7	1.7	1.1	2.2
Heat Evolution Factor, Q	0.28	0.28	0.19	0.38
Flaming Drippings, m:s	None	4.72	3.09	None
Test Duration, m:s	15:00	15:00	15:00	15:00
Radiant Panel Index, Is	0.68	0.87	0.53	1.09

TEST RESULT

Due to possible limitations of the test method, the test result, *Is*, is rounded to the nearest number divisible by five. Graphic presentation of individual test data is included at the end of this report.

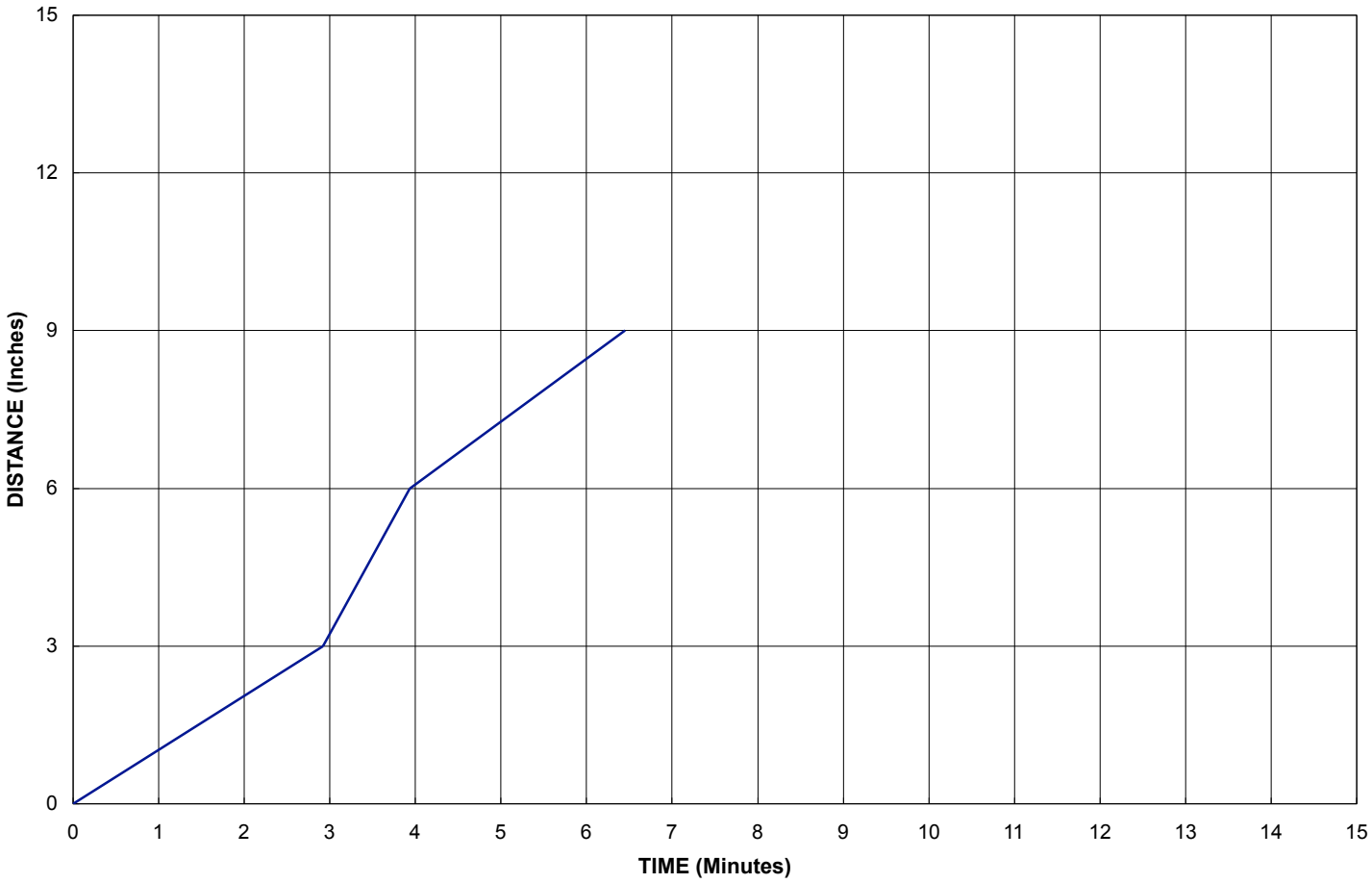
Specimen	1	2	3	4	Average
Radiant Panel Index, Is	0.68	0.87	0.53	1.09	**0**

NOTE: For testing, the film was applied to 0.125" plate glass by the client.

E 162 Radiant Panel

Client: 3M Company
Test Number: 4053-5565
Date: January 23, 2009
Specimen Number: 1

Flame Spread Factor, Fs: 2.41
Temperature Rise, °C: 1.7
Heat Evolution Factor, Q: 0.28
Radiant Panel Index, Is: 0.68

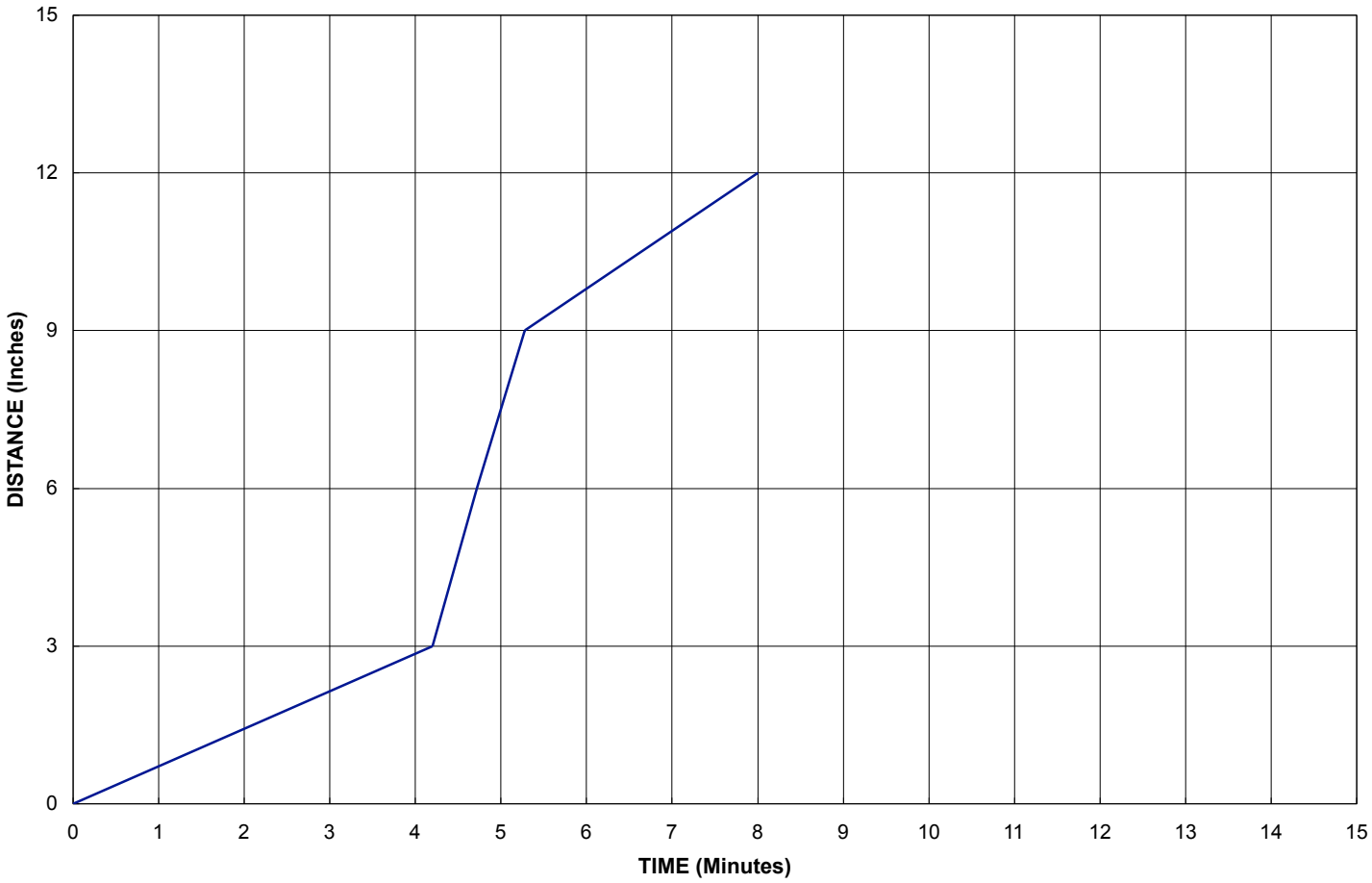


Skip Points Location: 3 inches

E 162 Radiant Panel

Client: 3M Company
Test Number: 4053-5565
Date: January 23, 2009
Specimen Number: 2

Flame Spread Factor, Fs: 3.07
Temperature Rise, °C: 1.7
Heat Evolution Factor, Q: 0.28
Radiant Panel Index, Is: 0.87

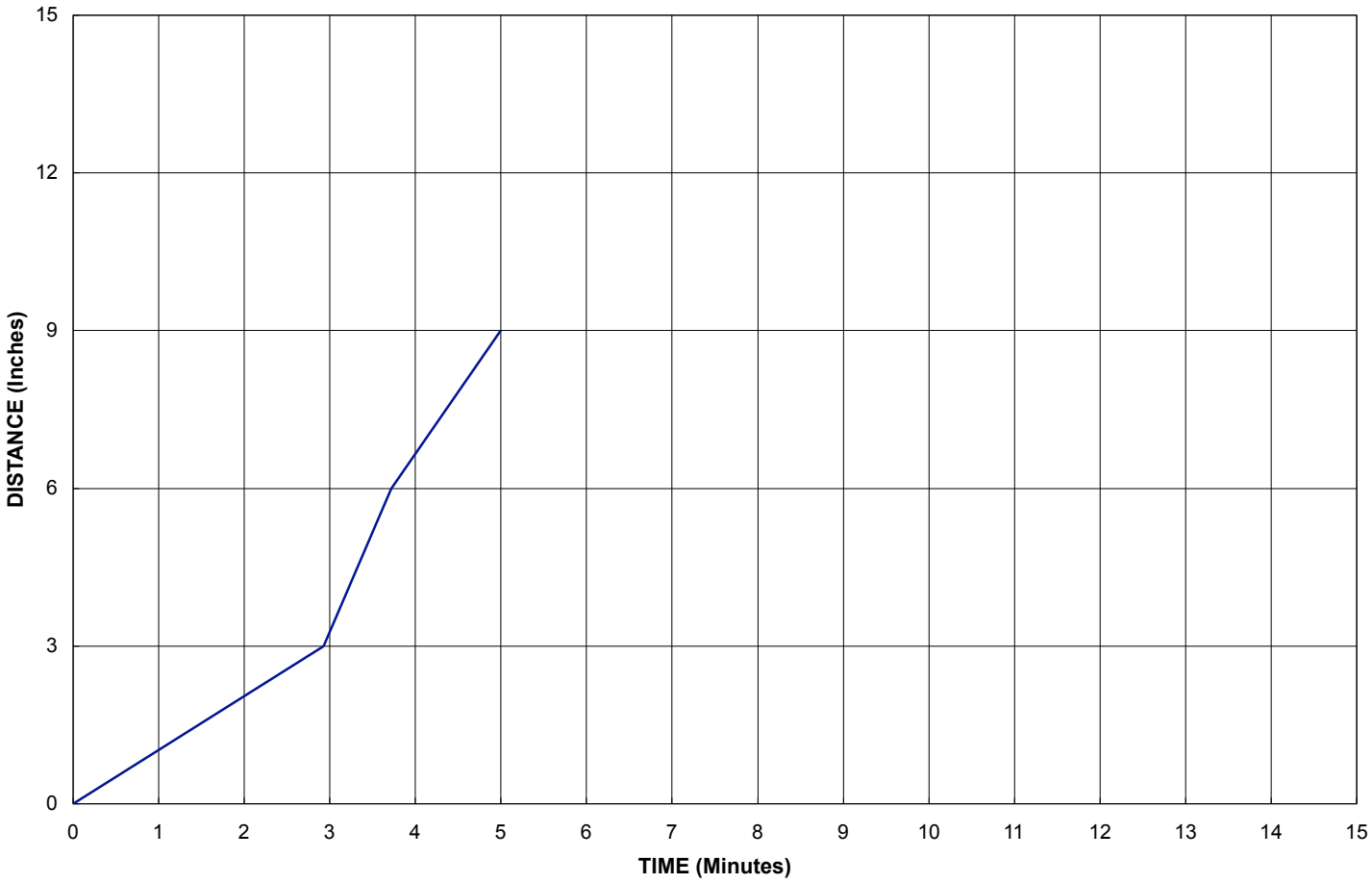


Skip Points Location: 3, 6 inches

E 162 Radiant Panel

Client: 3M Company
Test Number: 4053-5565
Date: January 23, 2009
Specimen Number: 3

Flame Spread Factor, Fs: 2.80
Temperature Rise, °C: 1.1
Heat Evolution Factor, Q: 0.19
Radiant Panel Index, Is: 0.53

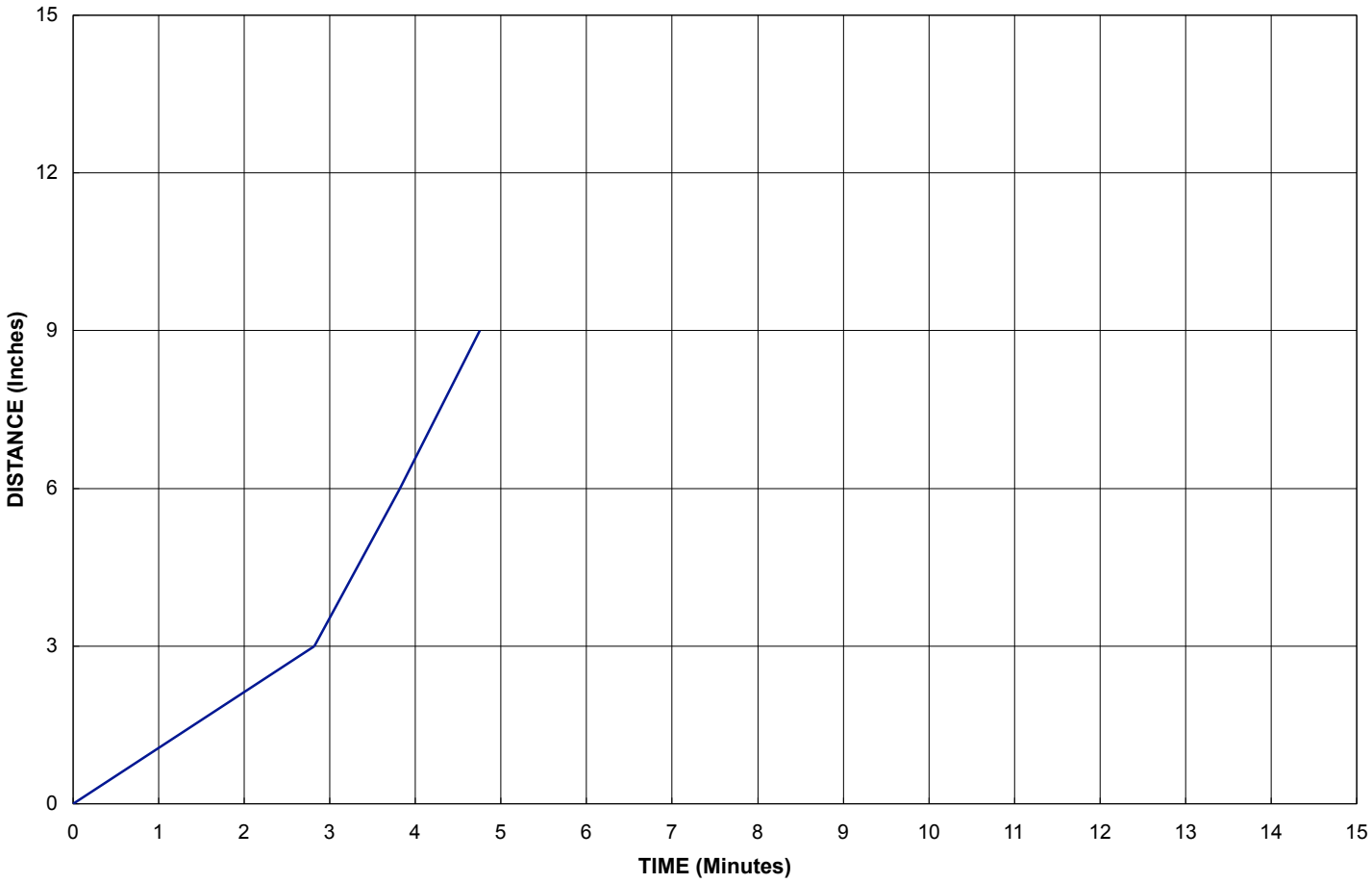


Skip Points Location: 3, 6 inches

E 162 Radiant Panel

Client: 3M Company
Test Number: 4053-5565
Date: January 23, 2009
Specimen Number: 4

Flame Spread Factor, Fs: 2.89
Temperature Rise, °C: 2.2
Heat Evolution Factor, Q: 0.38
Radiant Panel Index, Is: 1.09



Skip Points Location: 3, 6 inches