DIVISION: 07 00 00 –THERMAL AND MOISTURE PROTECTION
Section: 07 21 00 –Thermal Insulation

REPORT HOLDER:
Gaco Western, LLC
1245 Chapman Drive
PO Box 646
Waukesha, WI 53186
262-542-8072
www.gacowallfoam.com

REPORT SUBJECT:
Gaco F1850 Spray-applied Polyurethane Insulation

1.0 SCOPE OF EVALUATION

This Research Report addresses compliance with the following Codes:

- 2015, 2012, and 2009 *International Building Code®* (IBC)
- 2015, 2012, and 2009 *International Residential Code®* (IRC)
- 2015, 2012, and 2009 *International Energy Conservation Code®* (IECC)

Gaco F1850 has been evaluated for the following properties:

- Physical properties
- Surface-burning characteristics
- Thermal resistance
- Air permeability
- Air Barrier
- Vapor permeance
- Water-resistive barrier
- Alternative to thermal barriers
- Alternative to ignition barriers
- Use in Types I, II, III, and IV construction
- Use in Type V construction
- Duct insulation

See Table 1 for applicable Code sections related to these properties.

NOTE: This report references 2015 Code sections with [2012] and [2009] Code sections shown in brackets where they differ.

2.0 USES

Gaco F1850 spray-applied polyurethane foam insulation is used as a nonstructural thermal insulating material on or in interior and exterior walls, floors, ceilings, and roofs.

Under the IRC, the insulation may be used as air-impermeable insulation when installed in accordance with Section 3.2.3.

The insulation may be used as an air barrier when installed as described in Section 3.2.4.

The insulation may be used as vapor retarder as described in Section 3.2.5.

The insulation may be used as a water-resistive barrier on exterior walls as described in Section 3.2.6.

The insulation may be used in Types I, II, III, IV, and V construction. When used in exterior walls in Types I, II, III, and IV construction (IBC), the wall construction must be in accordance with Section 4.5.

The insulation may be used as duct insulation material when installed as described in Section 4.6.

3.0 DESCRIPTION

3.1 Materials:

3.1.1 Gaco F1850: Gaco F1850 insulation is a closed cell, medium-density, polyurethane foam plastic. The insulation is a two-component,spray-applied foam plastic with a nominal in-place density of 2.1 pcf. The insulation is produced in the field by combining a polymeric isocyanate (A component) with a resin (B component). The insulation liquid components are supplied in 55-gallon drums and 250-gallon totes, and must be stored at temperatures between 50ºF and 100ºF. The resin (B component) must be protected from freezing temperatures. Gaco F1850 insulation has a shelf life of 1 year on the polymeric isocyanate (A component) and 6 months on the resin (B component) when stored in factory-sealed containers at these temperatures.

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3.1.2 DC 315 Intumescent Coating: DC 315 intumescent coating, manufactured by IFTI, Paint to Protect, is a water-based coating supplied in 5-gallon pails and 55-gallon drums. The coating material has a shelf life of 24 months when stored in factory-sealed containers at a temperature between 41°F to 95°F.

3.2Performance Characteristics:

3.2.1 Surface Burning Characteristics: The insulation, at a maximum thickness of 4 inches and a nominal density of 2.1 pcf, has a flame-spread index of 25 or less and a smoke-developed index of 450 or less when tested in accordance with ASTM E84. Thicknesses of up to 9-1/2 inches in ceilings and floors, and 7-1/2 inches in vertical surfaces,are recognized based on full scale fire performance testing in accordance with NFPA 286. When the insulation is separated from the interior living space of the building with minimum 1/2 inch thick gypsum board, the maximum thickness is not limited.

3.2.2 Thermal Resistance: The insulation has thermal resistance (R-value) at a mean temperature of 75ºF as shown in Table 2.

3.2.3 Air Permeability: Gaco F1850 insulation, at a minimum thickness of 1 inch, is considered air-impermeable insulation in accordance with 2015 IBC Section 1203.3 [not applicable under the 2012 and 2009 IBC] or IRC SectionsR202 and R806.5 [2009 - R806.4], based on testing in accordance with ASTM E2178.

3.2.4 Air Barrier: Gaco F1850 insulation, at a minimum thickness of 1 inch, is considered an air-barrier material in accordance with IECC Section C402.5.1.2.1 [C402.4.1.2.1], based on testing in accordance with ASTM E2178.

The insulation, at a minimum thickness of 1 inch, is also considered an air barrier assembly in accordance with IECC Section C402.5.1.2.2 based on testing in accordance with ASTM E2357. Window and door penetrations must be flashed in accordance with manufacturer's installation instructions and the air barrier assembly must conform toIECC Section C402.5.1.1.

3.2.5 Vapor Permeance: Gaco F1850 has a vapor permeance of less than 1 perm (5.7 x 10^{-11} kg/Pa-s-m^2) at a minimum thickness of 0.44 inch and may be used where a Class II vapor retarder is required by the applicable Code.

3.2.6Water-resistive Barrier: Gaco F1850 may be used as an alternative to the water-resistive barrier specified in IBC Section 1404.2 and IRC Section R703.2 when installed at a minimum of 1 inch thickness on exterior side of exterior wall sheathing.

4.0 INSTALLATION

4.1 General:

Gaco F1850 must be installed in accordance with the manufacturer's published installation instructions, the applicable Code, and this Research Report. The manufacturer's published installation instructions and this Research Report must be strictly adhered to, and a copy of the instructions must be available on the jobsite during installation.

4.2 Application:

Gaco F1850 insulation is spray-applied on the jobsite using a volumetric positive displacement pump as identified in the Gaco Western application instructions. The insulation must be applied when the ambient temperature is greater than 32ºF. The insulation must not be used in areas that have a maximum in-service temperature greater than 200ºF. The foam plastic must not be used in electrical outlet or junction boxes or in contact with water, rain or soil. The foam plastic must not be sprayed onto a substrate that is wet, or covered with frost or ice, loose scales, rust, oil, or grease. The insulation must be protected from the weather during and after application. The insulation may be applied to the maximum thickness in a single pass.

4.3 Thermal Barrier:

4.3.1 Application with a Prescriptive Thermal Barrier: Gaco F1850 insulation must be separated from the interior living space of the building by an approved thermal barrier of 1/2 inch thick gypsum board or an equivalent 15-minute thermal barrier complying with, and installed in accordance with, IBC Section 2603.4 or IRC Section R316.4. Exceptions are provided in Sections 4.3.2 and 4.4.

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When the insulation is separated from the interior living space of the building with minimum 1/2 inch thick gypsum board, the maximum thickness is not limited.

4.3.2 Application without a Prescriptive Thermal Barrier: Gaco F1850 insulation may be installed without the 15-minute thermal barrier prescribed in IBC Section 2603.4 and IRC Section R316.4, when installed as described in this section. The thickness of the foam plastics insulation applied to the underside of the roofs, ceilings, or floors must not exceed 9-1/2 inches, and applied to vertical wall surfaces must not exceed 7-1/2 inches. The insulation must be covered on all exposed surfaces with DC 315 intumescent coating at a nominal wet film thickness of 18 mils (dry film thickness of 12 mils). The coating must be applied over the insulation in accordance with the coating manufacturer's instructions and this report. Surfaces to be coated must be dry, clean, and free of dirt, loose debris, and other substances that could interfere with the adhesion of the coating. The coating is applied with low-pressure airless spray equipment.

4.4 Attics and Crawl Spaces:

The insulation may be applied in attics and crawl spaces as described in either Section 4.4.1 or 4.4.2. When foam insulation is installed in an attic or crawl space in accordance with this section, a thermal barrier,as described in Section 4.3.1, is not required between the foam plastic insulation and the attic or crawl space but is required between the insulation and the interior living space.

4.4.1 Application with a Prescriptive Ignition Barrier: When Gaco F1850 insulation is installed within attics and crawl spaces where entry is made only for service of utilities, the ignition barrier must be installed in accordance with IBC Section 2603.4.1.6 or IRC Section R316.5.3 or R316.5.4, as applicable. The ignition barrier must be consistent with the requirements for the type of construction required by the applicable Code and must be installed in a manner so the foam plastic insulation is not exposed. Gaco F1850 insulation as described in this section may be installed in unvented attics in accordance with IBC Section 1203.3 or IRC Section R806.5 [2009 - R806.4] at a minimum thickness of 1 inch.

4.4.2 Application without a Prescriptive Ignition Barrier:

4.4.2.1 General: Gaco F1850 insulation may be installed in attics and crawl spaces, without the ignition barrier prescribed in IBC Section 2603.4.1.6 and IRC Sections R316.5.3 and R316.5.4, subject to the following conditions:

a. Entry to the attic or crawl space is only to service utilities, and no storage is permitted.

b. There are no interconnected attic or crawl space areas.

c. Air in the attic or crawl space is not circulated to other parts of the building.

d. Under-floor (crawl space) ventilation is provided when required by IBC Section 1203.4 [1203.3] or IRC Section R408.1, as applicable.

e. Attic ventilation is provided when required by IBC Section 1203.2 or IRC Section R806, except when air-impermeable insulation is permitted in unvented attics in accordance with IBC Section 1203.3 [not applicable under the 2012 and 2009 IBC] or IRC Section R806.5 [2009 - R806.4].

f. Combustion air is provided in accordance with IMC (International Mechanical Code) Section 701 [Sections 701 and 703].

Gaco F1850 is an air-impermeable insulation and may be installed in unvented attics, as described in this section, in accordance with 2015 IBC Section 1203.3 or IRC Section R806.5 [R806.4], when applied at a minimum thickness of 1 inch.

4.4.2.2 Application of Insulation: Gaco F1850 insulation may be spray-applied to the underside of the roof sheathing and/or rafters in attics; the underside of wood floors in crawl spaces; and to vertical surfaces in both attics and crawl spaces, as described in this section. The thickness of the foam plastics applied to the underside of the top of the space must not exceed 10 inches, and to vertical surfaces must not exceed 8 inches. The insulation may be installed without prescriptive ignition barrier required by IBC Section 2603.4.1.6 or IRC Section R316.5.3 and R316.5.4 or a protective coating.

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4.4.2.3 Use on Attic Floors: Gaco F1850 insulation may be installed exposed (no coating) at a maximum thickness of 10 inches between and over the joists in attic floors. The insulation must be separated from the interior living space by an approved thermal barrier. The insulation may be installed without the prescriptive ignition barrier required by IBC Section 2603.4 and IRC Section R316.5.3 or protective coating.

4.5Exterior Walls in Types I, II, III, and IV Construction:

Gaco F1850 may be installed in exterior walls of buildings of Types I, II, III, and IV construction complying with IBC Section 2603.5 and as described in the section. Intertek Design Listings GWL/FI 30-01 and GWL/FI 30-02 describe the assemblies tested and certified by Intertek as complying with NFPA 285. The test wall assemblies were extended to include various wall constructions described in Tables 3 and 4 through a third-party engineering analysis. The potential heat of the foam plastic in any portionof the wall must not exceed 7142Btu/ft^2.

4.6 Duct Insulation:

Gaco F1850 may be applied to residential ducts in attics and crawl spaces in compliance with IRC Section M1601.3. The insulation must be protected in accordance with the ignition barrier requirements of either Section 4.4.1 or 4.4.2.

5.0 CONDITIONS OF USE

The Gaco F1850 described in this Research Report complies with, or is a suitable alternative to, what is specified in those Codes listed in Sections 1.0 and 2.0 of this report, subject to the following conditions:

5.1 Installation must comply with this Research Report, the manufacturer's published installation instructions, and the applicable Code. In the event of a conflict between the manufacturer's instructions and this report, this report governs.

5.2 The insulation must be separated from the interior living space of the building by a thermal barrier as described in Section 4.3, except as described in Sections 4.3.2 and 4.4.

5.3 The insulation must not exceed the thicknesses noted in Sections 3.2, 4.3, 4.4, and 4.5 as applicable.

5.4 Use of the insulation in Types I, II, III, and IV construction must be as described in Section 4.5.

5.5 Use of the insulation in areas where the probability of termite infestation is "very heavy" must be in accordance with IRC Section R318.4 or IBC Section 2603.8 [2012 - 2603.9] [2009 - 2603.8], as applicable.

5.6 Jobsite certification and labeling of the insulation must comply with IRC Section N1101.10 [2012 – N1101.12] [2009 – N1101.4] and IECC Sections C303.1 or R303.1 [2009 – 303.1], as applicable.

5.7 The insulation is produced in Waukesha, Wisconsin, under a quality control program with inspections by Intertek Testing Services NA, Inc. (AA-647).

6.0 SUPPORTING EVIDENCE

6.1 Reports of tests in accordance with: ASTM C518, ASTM E84, ASTM E2178, ASTM E2357, ASTM E96, ASTM C411, NFPA 285, and NFPA 259.

6.2 Data in accordance with the ICC-ES Acceptance Criteria for Spray-applied Foam Plastic Insulation (AC 377), dated April 2016, including reports of test in accordance with Appendix X.

6.3 Data in accordance with the ICC-ES Acceptance Criteria for Foam Plastic Sheathing Panels used as Water-Resistive Barriers (AC71), approved February 2003, editorially revised January 2016.

6.4 Intertek Listing Report "Gaco F1850 Spray-Applied Polyurethane Foam Insulation".

6.5 Priest & Associates Consulting Letter Report No. 10318B, dated July 22, 2015.

7.0 IDENTIFICATION

The A and B components of the insulation are identified with the manufacturer's name (Gaco Western, LLC), address and telephone number, the product name (Gaco F1850), use instructions, the flame spread and smoke-development indices, the lot number, the Intertek Mark, and the Code Compliance Research Report number (CCRR-1043).

8.0 OTHER CODES

This section does not apply.

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9.0 CODE COMPLIANCE RESEARCH REPORT USE

9.1 Approval of building products and/or materials can only be granted by a building official having legal authority in the specific jurisdiction where approval is sought.

9.2 Code Compliance Research Reports shall not be used in any manner that implies an endorsement of the product by Intertek.

9.3 Reference to https://bpdirectory.intertek.com is recommended to ascertain the current version and status of this report.

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TABLE 1 –PROPERTIES EVALUATED

PROPERTY	IBC SECTION[1]	IRC SECTION[1]	IECC SECTION[1]
Physical properties	Not required	Not required	Not required
Surface-burning characteristics	2603.3	R316.3	Not applicable
Thermal barrier/ignition barrier	2603.4	R316.4	Not applicable
Air permeability	1203.3 [1301]	R806.5 [2009 - R806.4]	C402.4 R402.4
Air Barrier	Not applicable	Not applicable	C402.4.1.2.1 [C402.4.1.2.1] C402.5.1.2.2 [C402.4.1.2.2]
Vapor retarder	202, 1405.3.1	202, R702.7.1 [R601.3]	Not applicable
Thermal resistance	1301	N1101.10 N1102 [N1101.1, N1101.12]	C303.1.1 C303.1.4 R303.1.1 R30301.4 [303.1.1 and 303.1.2]
Water-resistive Barrier	1404.2	R703.2	Not applicable
Duct Insulation	Not applicable	N1103.2.1 M1601.3	R403.2.1
Exterior walls of Types I – IV construction	2603.5	Not applicable	Not applicable

[1] Section numbers refer to 2015 Codes with 2012 and 2009 Codes in parentheses where different

TABLE 2 –THERMAL RESISTANCE (R Values)[1,2,3]

THICKNESSES (inches)	R-VALUE (°F.ft^2.h/Btu)
1	6.5
2	14
3	21
3.5	25
4	29
5.5	40
6	43
7.25	52
8	58
9.25	67
10	72
11.25	81

[1] R-values are calculated based on tested K-values at 1 inch and 3.5 inch thicknesses.
[2] R-values greater than 10 are rounded to the nearest whole number.
[3] To determine R values for thickness not listed:
a. Between 1 inch and 3.5 inch can bedetermined through linear interpolation; or,
b. Greater than 3.5 inches can be calculated based on R 7.2/inch

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TABLE 3 –NFPA 285 COMPLYING WALLS WITH GACO F1850 ON EXTERIOR

WALL COMPONENTS	MATERIALS
Base wall system Use either 1, 2 or 3	1. Concrete Wall 2. Concrete Masonry wall 3. One layer of 5/8 in. thick Type X gypsum wallboard installed on the interior side of minimum 3-5/8 in. deep, minimum No. 20 gage steel studs spaced a maximum of 24 in. on center (OC) with lateral bracing every 4 ft. vertically.
Floorline Firestopping	Mineral wool (4.0 lb/ft^3 density) friction fit in each stud cavity and at each floorline.
Cavity Insulation Use wither 1, 2 or 3	1. None 2. Full cavity depth or less of Gaco F1850 applied using sheathing as substrate and covering the width of the cavity and inside of the stud flange. 3. Any noncombustible insulation (batts can be either faced or unfaced).
Exterior sheathing Use either 1 or 2	1. 1/2 in. thick exterior gypsum sheathing 2. 5/8 in. thick Type X exterior gypsum sheathing
Exterior insulation Use either 1 or 2	1. None 2. Gaco F1850 with a total maximum thickness of 4 in.
Exterior Veneer Use either 1, 2, 3, 4 or 5	1. Brick: Standard type brick veneer anchors installed a maximum of 24 in. OC vertically in each stud. Maximum 2 in. air gap between exterior insulation and standard nominal 4 in. thick clay brick. 2. Stucco: Minimum 3/4 in. thick, exterior cement plaster and lath. A secondary water resistive barrier can be installed between the exterior insulation and the lath. The secondary water resistive barrier shall not be full-coverage asphalt or butyl-based self-adhered membranes. 3. Minimum 2 in. thick natural stone (granite, limestone, marble and sandstone). Any standard non-open-jointed installation technique can be used. 4. Minimum 1-1/2 in. thick artificial cast stone. Any standard non-open-jointed installation technique can be used. 5. Minimum 1-1/4 in. thick Terra Cotta non-open jointed. Any standard non-open-jointed installation technique can be used.

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TABLE 4 – NFPA 285 COMPLYING WALLS WITH GACO F1850 IN WALL CAVITY ONLY

WALL COMPONENTS	MATERIALS
Base wall system Use either 1, 2 or 3	1.Concrete wall 2. Concrete masonry wall 3. One layer of 5/8 in. thick Type X gypsum board installed on the interior side of minimum 3-5/8 in. deep, minimum No. 20 gage steel studs spaced at a maximum of 24 in. with lateral bracing every 4 ft. vertically.
Floorline Firestopping	Mineral wool (4.0 lb/ft^3 density) friction fit in each stud cavity and at each floorline.
Cavity Insulation	1. Full cavity depth or less of F1850 applied using sheathing as substrate and covering the width of the cavity and inside of the stud flange.
Exterior sheathing	5/8 in. thick Type X exterior gypsum sheathing
Exterior wall covering Use either 1 or 2	1. Any noncombustible exterior wall covering material 2. Any combustible exterior wall covering system that has successfully been tested in accordance with NFPA 285.