



Code Compliance Research Report CCRR-1002

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DIVISION: 07 00 00 – THERMAL AND MOISTURE PROTECTION

Section: 07 21 00 – Thermal Insulation

REPORT HOLDER:

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REPORT SUBJECT:

Gaco 183M 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 183M has been evaluated for the following properties:

- Physical properties
- Surface-burning characteristics
- Thermal resistance
- Air permeability
- Vapor permeance
- Alternatives to thermal barriers
- Alternatives 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 parenthesis where they differ.

2.0 USES

Gaco 183M insulation has been evaluated for the properties noted in Section 1.0 and Table 1. The insulation is a nonstructural thermal insulating material for use on or in interior and exterior walls, floors and roofs.

Under the IRC, the insulation may be used as air-impermeable insulation as described in Section 3.1.3.

The insulation may be used as vapor retarder as described in Sections 3.1.4.

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.

Use of the insulation in fire-resistance-rated construction is outside the scope of this report.

3.0 MATERIAL DESCRIPTION

3.1 Gaco 183M:

Gaco 183M spray-applied foam insulation is a two-component, semi-rigid, medium density, polyurethane foam plastic. The insulation is produced in the field by combining a polymeric isocyanate (A component) with a polymeric resin (B component), resulting in products having a nominal density of 2.5 pcf. The liquid components are supplied in 55-gallondrums or 250-gallon totes and must be stored at a temperature between 50°F and 70°F. The Gaco 183M components have a shelf life of 12 months for the A component and 6 months for the B component when stored in factory-sealed containers at these temperatures.

3.1.1 Surface Burning Characteristics:

Gaco 183M, at a maximum thickness of 4.5 inches and a nominal density of 2.5 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. Based on large scale tests in accordance with NFPA 286, Gaco 183M can be installed at greater thickness as described in Section 4.3 and 4.4. 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.

3.1.2 Thermal Resistance:

Gaco 183M has thermal resistance (R-value) at a mean temperature of 75°C as shown in Table 2.

3.1.3 Air Permeability:

Gaco 183M, at a minimum thickness of 1 inch, is considered air-impermeable insulation in accordance with 2015 IBC Section 1203.3 [not applicable in the 2012 and 2009 IBC] IRC Section R806.5 [2009 - R806.4], based on testing in accordance with ASTM E283.

3.1.4 Vapor Permeance:

Gaco 183M has a vapor permeance of less than 1 perm (5.7×10^{-11} kg/Pa-s-m²) at a minimum thickness of 1.12 inches and may be used where a Class II vapor retarder is required by the applicable code.

3.2 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 temperatures between 41°F to 95°F.

4.0 INSTALLATION

4.1 General:

Gaco 183M must be installed in accordance with the manufacturer's published installation instructions, the applicable Code and this Research Report. A copy of the manufacturer's instructions must be available on the jobsite during installation.

4.2 Application:

Gaco 183M insulation is spray-applied on the jobsite using a volumetric positive displacement pump as identified in the Gaco Western application manual. The insulation must be applied when the ambient temperature is greater than 23°F. The insulation must not be used in areas that have a maximum in-service temperature greater than 200°F. The foam plastic must not be used in electrical outlet or junction boxes or in contact with water. 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. A minimum pass thickness of 3/4 inches is recommended with the maximum not to exceed 2 inches per pass.

Where the insulation is used as an air-impermeable insulation, such as in unvented attic assemblies under 2015 IBC Section 1203.3 [not applicable under the 2012 and 2009 IBC] or IRC Section R806.5 [2009 - R806.4], the insulation must be installed at a minimum thickness of 1 inch.

4.3 Thermal Barrier:

4.3.1 Application with a Prescriptive Thermal Barrier:

Gaco 183M spray foam 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, as applicable. Exceptions are provided in Section 4.3.2 and Section 4.4.

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 183M spray foam insulation may be installed without the 15-minute thermal barrier prescribed in IBC Section 2603.4 and IRC Section R316.4, when installed in accordance with one of the following options:

Option 1: The thickness of the foam plastic applied to the underside of roofs, ceiling or floors must not exceed 7-1/2 inches and vertical wall surfaces must not exceed 5-1/2 inches. The insulation must be covered on all surfaces with DC 315 intumescent coating at a minimum application rate of 71 sq. ft per gallon yielding a minimum wet film thickness of 20 mils and a dry film thickness of 13 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 adhesion of the coating. The coating is applied with low-pressure airless spray equipment.

Option 2: The thickness of the foam plastic applied to the underside of roofs, ceilings or floors must not exceed 9-1/2 inches and to vertical wall surfaces must not exceed 5-1/2 inches. The insulation must be covered on all surfaces with DC 315 intumescent coating in two coats. The primer coat shall be a minimum application rate of 267 sq. ft per gallon yielding a minimum wet film thickness of 6 mils, and a dry film thickness of 4 mils. The top coat shall be a minimum application rate of 72 sq. ft per gallon yielding a minimum wet film thickness of 22 mils, and a dry film thickness of 15 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 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 crawlspaces as described in either 4.4.1 or 4.4.2. When foam insulation installed in an attic or crawlspace in accordance with this section, a thermal barrier is not required between the foam insulation and the attic or crawlspace, but is required between the insulation and the interior living space.

4.4.1 Application with a Prescriptive Ignition Barrier:

When Gaco 183M spray foam insulation is installed within attics or 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 Sections 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 183M spray-applied foam insulation as described in this section may be installed in unvented attics in accordance with 2015 IBC Section 1203.3 [not applicable under the 2012 and 2009 IBC] or IRC Section R806.5 [2009 - R806.4].

4.4.2 Application without a Prescriptive Ignition Barrier:

4.4.2.1 General:

Gaco 183M spray-applied foam 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 as described in Sections 4.4.2.2 and 4.4.2.3, subject to the following conditions:

- a. Entry to the attic or crawl space is 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 insulation is permitted in unvented attics in accordance with 2015 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.

The insulation may be installed in unvented attics as described in this section when applied at a thickness of 1 inch or greater.

4.4.2.2 Application of insulation:

Gaco 183M 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 plastic applied to the underside of the top of the space must not exceed 9-1/2 inches and to vertical surfaces must not exceed 7-1/2 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.

4.4.2.3 Use on Attic Floors:

Gaco 183M insulation may be installed exposed (no coating) at a maximum thickness of 9-1/2 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 a protective coating.

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

Gaco 183M 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 this 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 portion of the wall must not exceed 7142 Btu/ft².

4.6 Duct Insulation:

Gaco 183M may be applied to residential ducts in compliance with IRC Section M1601.3 to a maximum thickness of 5-1/2 inches. The material may be installed without an ignition barrier or protective coating.

5.0 CONDITIONS OF USE

The Gaco 183M spray-applied foam plastic insulation described in this Research Report complies with, or is a suitable alternative to, what is specified in those Codes listed in Section 1.0 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 an approved 15-minute thermal barrier as described in Section 4.3.

5.3 The installed insulation thickness must not exceed the thicknesses noted in Sections 4.3, 4.4 and 4.5 of this report.

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

5.5 The insulation must be applied by contractors certified by Gaco Western, LLC.

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

5.7 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.

5.8 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 E96, ASTM E283, NFPA 259, NFPA 285 and NFPA 286.

6.2 Data in accordance with the ICC-ES Acceptance Criteria for Spray-applied Foam Plastic Insulation (AC 377), dated May 2015, including reports of test in accordance with Appendix X.

6.3 Hughes Associates, Inc. Letter No. 1JJB00105.001, dated November 02, 2012.

6.4 Hughes Associates, Inc. Letter No. 1JJB00105.001 Justification Letter, dated July 26, 2013

6.5 Intertek Listing Report "[Gaco 183M Spray-applied Polyurethane Insulation](#)".

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 Intertek Mark, and the Code Compliance Research Report number (CCRR-1002). Gaco 183M is also labeled with use instructions, the flame spread and smoke-development indices, and the lot number.

8.0 OTHER CODES

This section is not applicable.

9.0 CODECOMPLIANCE RESEARCH REPORT USE

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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	2603.4	R316.4	Not applicable
Vapor retarder	202, 1405.3.1	R702.7.1 [R601.3]	Not applicable
Air permeability	1203.3 [1301]	R806.5 [2009 - R806.4]	C402.4 R402.4
Thermal resistance	1301	N1101.12 N1102 [N1101.1]	C303.1.1 C303.1.4 R303.1.1 R303.1.4 [303.1.1 and 303.1.2]
Exterior walls of Types I – IV construction	2603.5	Not applicable	Not applicable
Duct insulation	Not applicable	N1103.2.1 M1601.3	R403.2.1

¹ Section numbers refer to the 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	6.4
3.5	23
4	27
5.5	37
6	40
7.25	48
8	53
9.25	62
9.50	63
10	67
11.25	75

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 be determined through linear interpolation or
- b. greater than 3.5 inches can be calculated based on R=6.67/inch

TABLE 3 – NFPA 285 COMPLYING WALLS WITH Gaco 183M 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 183M 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 3	1. None 2. Gaco 183M 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 inches 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.

TABLE 4 – NFPA 285 COMPLYING WALLS WITH GACO 183M 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 $\frac{5}{8}$ in. thick Type X gypsum board installed on the interior side of minimum $3\frac{5}{8}$ in. deep, minimum No. 20 gage steel studs spaced at a maximum of 24 in. 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	1. Full cavity depth or less of 183M applied using sheathing as substrate and covering the width of the cavity and inside of the stud flange.
Exterior sheathing	$\frac{5}{8}$ 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.