Code Compliance Research Report
CCRR-0491

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DIVISION: 07 00 00 – THERMAL AND MOISTURE PROTECTION
Section: 07 21 00 – Thermal Insulation
Section: 07 21 19 – Foamed-In-Place Insulation

REPORT HOLDER:
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REPORT SUBJECT:
Dynamo D5, Dynamo 500, Dynamo ECO 2000, and Dynamo X Spray-applied Polyurethane Insulation

1.0 SCOPE OF EVALUATION

1.1 This Research Report addresses compliance with the following Codes:

- 2024, 2021, 2018 *International Building Code®* (IBC)
- 2024, 2021, 2018 *International Residential Code®* (IRC)
- 2024, 2021, 2018 *International Energy Conservation Code®* (IECC)

NOTE: This report references the most recent edition of the Codes cited. Section numbers in earlier versions of the Codes may differ.

1.2 The insulations have been evaluated for the following properties (see Table 1):

- Physical properties
- Surface-burning characteristics
- Thermal resistance
- Air permeance

1.3 The insulations have been evaluated for the following uses (see Table 1):

- Use as a nonstructural thermal insulating material on or in interior and exterior walls, floors, ceilings, and the underside of roofs
- Alternative to Code-prescribed thermal barriers
- Alternative to Code-prescribed ignition barriers
- Use in Type I, II, III, IV, and V construction (IBC) and buildings regulated under the IRC

2.0 STATEMENT OF COMPLIANCE

Dynamo D5, Dynamo 500, Dynamo ECO 2000, and Dynamo X insulations comply with the Codes listed in Section 1.1, for the properties stated in Section 1.2, and uses stated in Section 1.3, when installed as described in this report, including the Conditions of Use stated in Section 6.0.

2.1 2024 IBC and IRC Evaluation Reports: The Intertek CCRR is an *Evaluation Report* for approval of an alternate material, design, or method of construction in accordance with Section 104.2.3.6.1 of the 2024 IBC and Section R104.2.2.6.1 of the 2024 IRC.

3.0 DESCRIPTION

3.1 Dynamo D5, Dynamo 500, Dynamo ECO 2000, and Dynamo X: The insulations are two-component spray-applied polyurethane foam plastic, 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 must be stored at temperatures between 50°F and 90°F. The A and B components have a shelf life of six months when stored in factory-sealed containers at these temperatures.

Dynamo D5 and Dynamo 500 have a nominal density of 0.5 pcf. Dynamo ECO 2000 has a nominal density of 2 pcf. Dynamo X has a nominal density of 0.57 pcf.

3.2 DC315 Intumescent Coating: DC315 intumescent coating, manufactured by International Fireproof Technology, Inc., 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 and 95°F. DC315 complies with ICC-ES AC456 and is recognized in ICC-ES ESR-3702.

3.3 Flame Control 60/60A Intumescent Coating: Flame Control 60/60A is a water-based intumescent coating

manufactured by Flame Control Coatings, LLC. The coating is supplied in 5-gallon pails and 55-gallon drums and has a shelf life of 12 months when stored in factory sealed containers at temperatures above 50°F. The coating is recognized in IAPMO UES ER-0596 for compliance with ICC-ES AC456.

3.4 ICP F10E Intumescent Coating: ICP F10E intumescent coating, manufactured by ICP Construction, is a water-based coating supplied in 5-gallon pails and 55-gallon drums. The coating material has a shelf life of 12 months when stored in factory-sealed containers at a temperature between 45°F and 95°F. The coating is recognized in ICC-ES ESR-3997 for compliance with ICC-ES AC456.

3.5 No-Burn® ThB Spray Seal Intumescent Coating: No-Burn® ThB Spray Seal™ intumescent coating, manufactured by No Burn, Inc., is a white, water-based latex coating, supplied in 5-gallon pails and 55-gallon drums. The coating material has a shelf life of 12 months when stored in factory-sealed containers at a temperature between 40°F and 90°F. The coating is recognized in IAPMO UES ER-0305 for compliance with ICC-ES AC456.

4.0 PERFORMANCE CHARACTERISTICS

4.1 Surface-burning Characteristics: The insulations, at a maximum thickness of 4 inches and the nominal densities stated in Section 3.1 of this report, have 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 and ICC-ES AC377 Appendix X, the insulations can be installed at greater thicknesses as described in Sections 5.3 and 5.4. When the insulations are separated from the interior occupied space of the building with minimum 1/2-inch-thick gypsum board, the maximum insulation thickness is not limited. Under the IRC, a thermal barrier of minimum 23/32-inch-thick wood structural panel is also permitted, and the maximum insulation thickness is not limited.

4.2 Thermal Resistance: The thermal resistance of the insulations is shown in Table 2.

4.3 Air Permeability: Dynamo D5 at a minimum thickness of 3 inches, Dynamo 500 at a minimum thickness of 3-1/2 inches, and Dynamo ECO 2000 at a minimum thickness of 1-1/2 inches, are considered air-impermeable insulations in accordance with IBC Section 1202.3 or IRC Sections R202 and R806.5 and are considered an air barrier material complying with IECC Section C402.6.2.3.1, based on testing in accordance with ASTM E283 or ASTM E2178.

4.4 Vapor Permeance:

4.4.1 Dynamo 500 has a vapor permeance of less than 10 perms when applied at a minimum thickness of 2 inches and may be used where a Class III vapor retarder is required.

4.4.2 Dynamo ECO 2000 has a vapor permeance of 0.45 perms when applied at a minimum thickness of 2 inches and may be used where a Class II vapor retarder is required.

5.0 INSTALLATION

5.1 General: The insulation 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.

5.2 Application: The insulation is spray-applied on the jobsite using a volumetric positive displacement pump as identified in the manufacturer's application instructions. The insulation must be applied when the ambient temperature is greater than 14°F. The insulation must not be used in areas that have a maximum in-service temperature greater than 180°F. The insulation must not be used in electrical outlets or junction boxes or in contact with water, rain, or soil. The insulation 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.

Dynamo D5 and Dynamo 500 may be applied to the intended thickness, with each pass being a maximum of 12 inches thick. Where multiple passes are required, no cure time between passes is required.

Dynamo ECO 2000 is applied in passes having a maximum thickness of 3-1/2 inches per pass. When multiple passes are required, subsequent passes can be sprayed once the core temperature drops below 100°F.

Dynamo X is applied in passes having a maximum thickness of 12 inches per pass. Where multiple passes are required, no cure time is required.

5.3 Thermal Barrier:

5.3.1 Application with a Prescriptive Thermal Barrier: The 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 R303.4, as applicable. Exceptions are provided in Sections 5.3.2 and 5.4.

When the insulation is separated from the interior living space of the building with a minimum of 1/2-inch-thick gypsum board, the maximum thickness is not limited. Under the IRC, a thermal barrier of 23/32-inch-thick wood structural panel is also permitted, and the maximum insulation thickness is unlimited.

5.3.2 Application without a Prescriptive Thermal Barrier:

This section applies to the following insulations:

- Dynamo D5
- Dynamo 500
- Dynamo ECO 2000

The above insulations may be installed without the 15-minute thermal barrier prescribed in IBC Section 2603.4 and IRC Section R303.4, when installed as described in this section and in Table 3.

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.

5.4 Attics and Crawl Spaces: The insulation may be applied in attics and crawl spaces as described in either 5.4.1 or 5.4.2. When the insulation is installed in an attic or crawlspace in accordance with this section, a thermal barrier is not required between the insulation and the attic or crawl space but is required between the insulation and the interior living space. Attics and crawl spaces must be ventilated in accordance with the applicable Code.

5.4.1 Application with a Prescriptive Ignition Barrier: When the 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 R303.5.3 or R303.5.4, 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.

5.4.2 Application without a Prescriptive Ignition Barrier:

This section applies to the following insulations:

- Dynamo D5,
- Dynamo 500,
- Dynamo ECO 2000
- Dynamo X

The above insulations may be installed in attics and crawl spaces without the ignition barrier prescribed in IBC Section 2603.4.1.6 and IRC Sections R303.5.3 and R303.5.4, 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 1202.4 or IRC Section R408.1, as applicable.
e. Attic ventilation is provided when required by IBC Section 1202.2.1 or IRC Section R806, except when air-impermeable insulation is permitted in unvented attics in accordance with IBC Section 1202.3 or IRC Section R806.5.
f. Combustion air is provided in accordance with IMC (International Mechanical Code) Section 701.

The 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 and in Table 4.

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.

5.4.3 Use on Attic Floors: The insulations may be applied between and over the joists in attic floors to a maximum thickness as noted below with no coating or covering.

- Dynamo ECO 2000 – 10 inches
- Dynamo 500 – 12 inches
- Dynamo D5 – 12 inches

- Dynamo X – 10 inches

The insulation must be separated from the interior occupied space by an approved thermal barrier.

5.4.4 Unvented Attics:

This section applies to the following insulations:

- Dynamo D5
- Dynamo 500

In unvented attics conforming with IBC Section 1202.3 or IRC Section R806.5, the Dynamo D5 and Dynamo 500 insulations may be left exposed to the attic without a prescriptive ignition barrier or an intumescent coating, to a maximum thickness of 18 inches and a minimum thickness of 3 inches, subject to the following conditions:

a. Entry to the attic is only to service utilities, and no storage is permitted.
b. There are no interconnected attic areas.
c. Air in the attic is not circulated to other parts of the building.
d. Combustion air is provided in accordance with IMC (International Mechanical Code) Section 701.
e. A downward opening attic hatch is required. The hatch shall remain closed at all times except for when servicing of utilities is required. The hatch shall be able to be opened freely without disengaging a latching or locking mechanism.
f. The maximum uniform pressure required to open the downward opening attic hatch shall be less than 10 psf. The performance of the downward opening hatch is outside the scope of this evaluation report, but adequate information shall be provided to the Code Official to demonstrate that this requirement has been satisfied. For field verification, the force required to open the downward opening hatch, when measured from the edge of the downward opening hatch opposite the hinges shall not exceed the value calculated using the equation below:

F_{open} (lbf)≤*Hatch Width* (ft.) x *Hatch Length* (ft.) x 5 lbf/sf

g. An installation certificate with the following information shall be posted at each entrance to the attic:
   - Product name and installation thickness
   - Manufacturer name, address, and contact information
   - Installation contractor name, address, and contact information
   - Attestation that the product has been installed in accordance with the manufacture's installation instructions and the requirements of the CCRR
   - A notice that the certificate is not to be removed or altered
   - A list of limitations for the space including the following:
     - Entry to the space is only to service utilities and no storage is permitted
     - The hatch shall remain closed at all times except for when servicing of utilities is required. No locks or latches that would prevent the hatch from opening freely may be added at the hatch
     - FIRE SAFETY WARNING: If hot work (welding / cutting) is required to be performed, all necessary procedures, precautions and limitations must be observed in accordance with OSHA 1926, Subpart J, Standard 1926.352 requirements for hot work performed in the vicinity of combustible materials
     - Notification that the space has been designed and constructed / installed as an unvented attic assembly; introduction of any penetrations to the exterior or alterations to the insulation shall be designed by a registered design professional. The design of the change shall be submitted to the local Code Official for approval, as required by the local jurisdiction.

For items penetrating the roof deck or walls, such as skylight wells or vents, the annular space must be covered with a minimum of 3 inches of insulation.

5.4.5 Exterior Walls in Types I, II, III, and IV Construction: Dynamo ECO 2000 may be installed in or on exterior walls of building Types I, II, III, and IV construction complying with IBC Section 2603.5 and as described in Tables 5A and 5B. Maximum permitted thickness of foam plastic is specified in Tables 5A and 5B.

6.0 CONDITIONS OF USE

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

6.2 The insulation must be separated from the interior occupied space of the building by a thermal barrier as described in Section 5.3, except as described in Section 5.3.2 and 5.4.

6.3 The insulation must not exceed the thicknesses noted in Sections 4.1, 5.3, and 5.4, as applicable.

6.4 Dynamo D5 and Dynamo 500 may be installed in unvented attics without a prescriptive ignition barrier or intumescent coating, subject to the conditions noted in Section 5.4.4.

6.5 Use of the insulations in areas where the probability of termite infestation is "very heavy" must be in accordance with IRC Section R305.4 or IBC Section 2603.8, as applicable.

6.6 Except as noted in Section 4.4, walls in which the insulation is applied must include a vapor barrier complying with the Code.

6.7 Jobsite certification and labeling of the insulation must comply with IRC Section N1101.10, N1101.14 and IECC Sections C303.1 or R303.1 and R401.3, as applicable.

6.8 The insulations are manufactured under a quality control program with inspections by Intertek Testing Services NA, Inc.

7.0 SUPPORTING EVIDENCE

7.1 Reports of tests in accordance with ASTM E84, ASTM E96, ASTM E283, ASTM E2178, NFPA 285, NFPA 286, and US-FTC CFR Title 16 Part 460.

7.2 Data in accordance with the ICC-ES Acceptance Criteria for Spray-applied Foam Plastic Insulation (AC377), dated February 2023, including reports of tests in accordance with Appendix X and Appendix U.

7.3 Data in accordance with ICC 1100 (2019).

7.4 Research Reports for evaluation of data in accordance with ICC-ES Acceptance Criteria for Fire-protective Coatings Applied to Spray-applied Foam Plastic Insulation Installed without a Code-prescribed Thermal Barrier (AC456), dated October 2015.

7.5 Priest & Associates Engineering Evaluation 11238 dated April 18, 2023.+

7.6 Intertek Listing Report "Dynamo D5, Dynamo 500, Dynamo ECO 2000, and Dynamo X spray-applied polyurethane insulation", on the Intertek Directory of Building Products.

8.0 IDENTIFICATION

The A and B components of the insulations described in this Research Report are identified with the report holder's name (Dynamo Polyurethane Systems Inc.), address and telephone number; the product name; use instructions; the flame-spread and smoke-developed indices; the lot number; the Intertek Mark as shown below; and the Code Compliance Research Report number (CCRR-0491).

CODE COMPLIANCE
ETL US
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9.0 OTHER CODES

This section is not applicable.

10.0 CODE COMPLIANCE RESEARCH REPORT USE

10.1 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.

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

10.3 Reference to the 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	2024 IBC SECTION[1]	2024 IRC SECTION[1]	2024 IECC SECTION[1]
Physical Properties	2603.1.1	Not required	Not required
Surface-burning Characteristics	2603.3	R303.3	Not applicable
Thermal Barrier/Ignition Barrier	2603.4	R303.4	Not applicable
Air Permeability	1202.3	R806.5	C402.6
Thermal Resistance	1301	N1101.10 N1102	C303.1 R303.1
Exterior Walls in Types I-IV Construction	2603.5	Not Applicable	Not applicable

[1] Section numbers may be different for earlier versions of the International Codes.

TABLE 2 – THERMAL RESISTANCE

THICKNESS (in.)	R-VALUE (˚F.ft².h/Btu)[1, 2, 3, 4]			
	Dynamo D5	Dynamo 500	Dynamo ECO 2000	Dynamo X
1	3.75	4.1	7.5	4.0
3.5	13	13	26	14
16	57	59	117	62

[1]R-values are calculated based on tested K values at 1- and 3-1/2-inch thicknesses
[2]R-values may be interpolated between 1 and 3-1/2 inches
[3]Above 3-1/2 inches, R-values may be calculated as follows:
- Dynamo D5: R-values are calculated using R=3.6/inch
- Dynamo 500: R-values are calculated using R=3.67/inch
- Dynamo ECO 2000: R-values are calculated using R=7.3/inch
- Dynamo X: R-values are calculated using R=3.9/inch

[4]R-values greater than 10 are rounded to the nearest whole number

TABLE 3 – USE OF INSULATION WITHOUT A PRESCRIPTIVE THERMAL BARRIER

Insulation Type	Maximum Thickness (in.) (Wall Cavities)	Maximum Thickness (in.) (Ceilings, Underside of Roof Sheathing / Rafters and Floors)	Intumescent Coating Minimum Thickness & Type (Applied to All Foam Surfaces)	Minimum Application Rate of Intumescent Coating	May Be Left Exposed as an Interior Finish	Tests Submitted
Dynamo ECO 2000	7-1/4	7-1/4	DC315 18 wet mils	1.13 gal / 100 ft^2	Yes	NFPA 286
	8	12	DC315 20 wet mils	1.28 gal / 100 ft^2	Yes	NFPA 286
	8	10	Flame Control 60/60A 14 wet mils	0.87 gal / 100 ft^2	Yes	NFPA 286
	6	10	ICP F10E 14 wet mils	0.86 gal / 100 ft^2	Yes	NFPA 286
	8	10	No-Burn Plus ThB 14 wet mils	0.87 gal / 100 ft^2	Yes	NFPA 26
Dynamo 500	10	14	DC315 14 wet mils	0.90 gal / 100 ft^2	Yes	NFPA 286
	10	14	Flame Control 60/60A 16 wet mils	1.00 gal / 100 ft^2	Yes	NFPA 286
	10	14	No-Burn ThB Spray Seal 14 wet mils	0.87 gal/100ft^2	Yes	NFPA 286
Dynamo D5	8	12	DC315 14 wet mils	0.90 gal / 100 ft^2	Yes	NFPA 286
	10	14	Flame Control 60-60A 16 wet mils	1.00 gal/100ft^2	Yes	NFPA 286

TABLE 4 – USE OF INSULATION IN ATTICS AND CRAWL SPACES WITHOUT A PRESCRIPTIVE IGNITION BARRIER

Insulation Type	Maximum Thickness (in.) (Wall Cavities and Attic Floors)	Maximum Thickness (in.) (Underside of Roof Sheathing/Rafters and Floors)	Intumescent Coating Minimum Thickness and Type (Applied to All Foam Surfaces)	Minimum Application Rate of Intumescent Coating	Tests Submitted
Dynamo ECO 2000	6	10	No coating required	NA	Appendix X
Dynamo D5 Dynamo 500	8	12	DC315 4 wet mils	0.25 gal./100 ft^2	Appendix X
Dynamo X	10	14	No coating required	NA	Appendix X

TABLE 5A – NFPA 285 COMPLYING WALLS – Dynamo ECO 2000 in Wall Cavities

WALL COMPONENT	MATERIALS
Base Wall System – Use either 1, 2, or 3	1. Concrete Wall 2. Concrete Masonry Wall 3. One layer of min. 5/8-in. thick Type X gypsum wallboard installed on the interior side of 3-5/8-in. deep, minimum 25-GA thick steel studs spaced a maximum 24-in. on center. Lateral bracing installed minimum every 4-ft vertically or as required. Wall stud cavities shall be filled at each floor line with minimum 4 pcf mineral wool friction fit between steel studs.
Perimeter Fire Barrier System	Perimeter fire barrier system complying with IBC Section 715.4 shall be installed, as applicable, to fill the void between the edge of the concrete floor slab and the interior surface of the exterior wall assembly.
Wall Cavity Insulation	Full wall stud cavity depth or less of Dynamo ECO 2000 applied using exterior sheathing as the substrate and covering the width of the cavity and the inside of the steel wall stud framing flange. Maximum thickness 3-5/8 inches.
Exterior Sheathing	Min. 5/8-in thick Type X exterior type gypsum sheathing complying with ASTM C1177
Exterior Wall Covering – Use either 1, 2, or 3	1. Any non-combustible exterior wall covering material using any standard installation technique. 2. Any non-combustible exterior wall covering system with a combustible WRB that has been successfully tested in accordance with NFPA 285. 3. Any combustible exterior wall covering system with or without WRB that has been successfully tested in accordance with NFPA 285.

TABLE 5B – NFPA 285 COMPLYING WALLS – Dynamo ECO 2000 on Exterior Sheathing

WALL COMPONENT	MATERIALS
Base Wall System – Use either 1, 2, or 3	1. Concrete Wall 2. Concrete Masonry Wall 3. One layer of min. 5/8-in. thick Type X gypsum wallboard installed on the interior side of 3-5/8-in. deep, minimum 20-GA thick steel studs spaced a maximum 24-in. on center. Lateral bracing installed minimum every 4-ft vertically or as required. Wall stud cavities shall be filled at each floor line with minimum 4 pcf mineral wool friction fit between steel studs.
Perimeter Fire Barrier System	Perimeter fire barrier system complying with IBC Section 715.4 shall be installed, as applicable, to fill the void between the edge of the concrete floor slab and the interior surface of the exterior wall assembly.
Exterior Sheathing	Min. 5/8-in thick Type X exterior type gypsum sheathing complying with ASTM C1177
Exterior Insulation	Maximum 3-in. (nominal) thick of Dynamo ECO 2000 applied to the exterior side of the exterior sheathing.
Exterior Wall Covering – Use either 1, 2, 3, or 4	1. Any non-combustible exterior wall covering material using any standard installation technique. 2. Install nominal 4-in. thick clay brick or veneer with max. 2-in. air gap, with brick ties/anchors spaced max. 16-in. on center vertically and max. 24-in. on center horizontally, aligned with framing. 3. Any non-combustible exterior wall covering system with a combustible WRB that has been successfully tested in accordance with NFPA 285. 4. Any combustible exterior wall covering system with or without WRB that has been successfully tested in accordance with NFPA 285.