Listing and Technical Evaluation Report™

Report No: 2012-01

Issue Date: August 10, 2022

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Subject to Renewal: October 1, 2025

BASF HP+™ WALL E SERIES HFO

Trade Secret Report Holder:

BASF Corporation

Phone: 973-245-6000 Website: www.basf.com

CSI Designations:

DIVISION: 06 00 00 - WOOD, PLASTICS AND COMPOSITES

Section: 06 12 00 - Structural Panels

Section: 06 12 19 - Shear Wall Panels

Section: 06 16 00 - Sheathing

DIVISION: 07 00 00 - THERMAL AND MOISTURE PROTECTION

Section: 07 21 00 - Thermal Insulation

Section: 07 25 00 - Water-Resistive Barriers/Weather Barriers

1 Innovative Product Evaluated[1]

1.1 BASF HP+™ Wall E Series utilizing WALLTITE® LWP SPF with HFO Blowing Agents in Combination with NEOPOR® Graphite Polystyrene FPIS

2 Product Description and Materials

2.1 The innovative product evaluated in this report is shown in **Figure 1** and **Figure 2**.

2.2 BASF HP+™ Wall E Series HFO is a proprietary wall system consisting of BASF WALLTITE® LWP Spray Polyurethane Foam (SPF) featuring Hydrofluoroolefin (HFO) blowing agents combined with NEOPOR® Foam Plastic Insulating Sheathing (FPIS).

2.2.1 BASF HP+™ Wall E Series HFO described in this report contains a combination of the following materials:

2.2.1.1 1 1/2" (min.) WALLTITE® LWP SPF

2.2.1.2 Minimum 5/8" NEOPOR® FPIS

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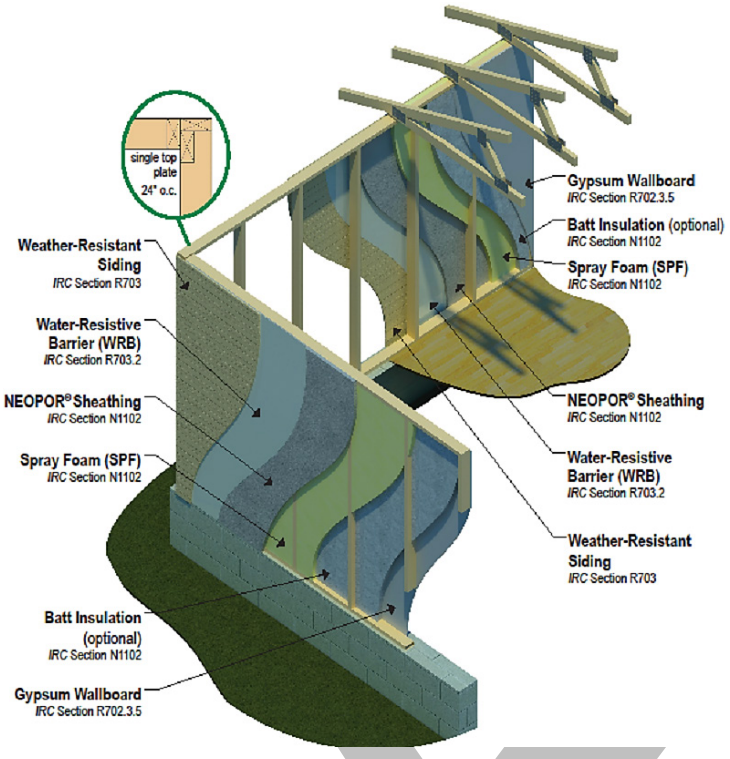


Figure 1. Illustration of HP+™ Wall E Series HFO System

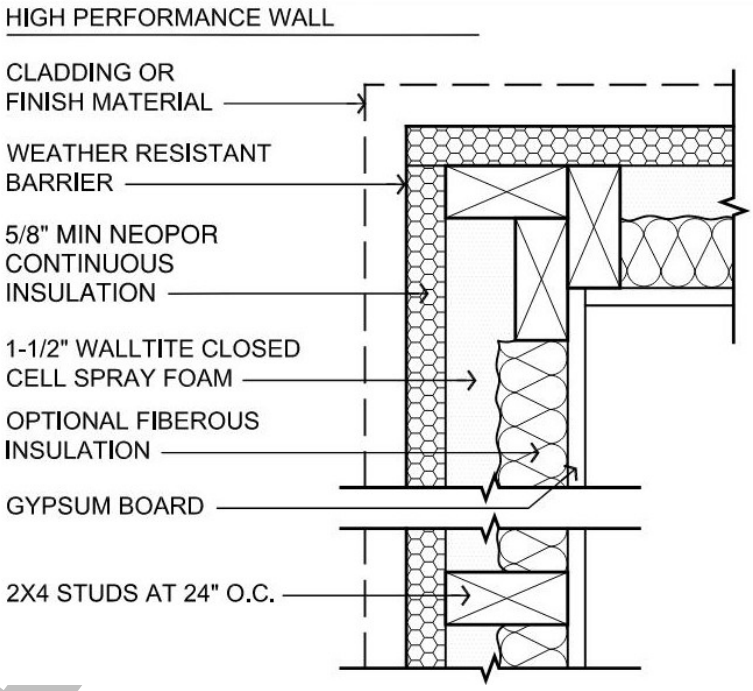


Figure 2. Cross Section of WALLTITE® LWP Wall E Series HFO with NEOPOR® Continuous Insulation

2.3 As needed, review material properties for design in Section **6** and to regulatory evaluation in Section **8**.

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3 Definitions

3.1 New Materials[2] are defined as building materials, equipment, appliances, systems or methods of construction not provided for by prescriptive and/or legislatively adopted regulations, known as alternative materials.[3] The design strengths and permissible stresses shall be established by tests[4] and/or engineering analysis.[5]

3.2 Duly Authenticated Reports[6] and Research Reports[7] are test reports and related engineering evaluations, which are written by an approved agency[8] and/or an approved source.[9]

3.2.1 These reports contain intellectual property and/or trade secrets, which are protected by the Defend Trade Secrets Act (DTSA).[10]

3.3 An approved agency is "approved" when it is ANAB ISO/IEC 17065 accredited. DrJ Engineering, LLC (DrJ) is listed in the ANAB directory.

3.4 An approved source is "approved" when a professional engineer (i.e., Registered Design Professional [RDP]) is properly licensed to transact engineering commerce. The regulatory authority governing approved sources is the state legislature via its professional engineering regulations.[11]

3.5 Testing and/or inspections conducted for this Duly Authenticated Report were performed by an ISO/IEC 17025 accredited testing laboratory, an ISO/IEC 17020 accredited inspection body and/or a licensed RDP.

3.5.1 The Center for Building Innovation (CBI) is ANAB[12] ISO/IEC 17025 and ISO/IEC 17020 accredited.

3.6 The regulatory authority shall enforce[13] the specific provisions of each legislatively adopted regulation. If there is a non-conformance, the specific regulatory section and language of the non-conformance shall be provided in writing[14] stating the nonconformance and the path to its cure.

3.7 The regulatory authority shall accept Duly Authenticated Reports from an approved agency and/or an approved source with respect to the quality and manner of use of new materials or assemblies as provided for in regulations regarding the use of alternative materials, designs or methods of construction.[15]

3.8 ANAB is an International Accreditation Forum (IAF) Multilateral Recognition Arrangement (MLA) signatory where recognition of certificates, validation and verification statements issued by conformity assessment bodies accredited by all other signatories of the IAF MLA with the appropriate scope, shall be approved.[16] Therefore, all ANAB ISO/IEC 17065 Duly Authenticated Reports are approval equivalent.[17]

3.9 Approval equity is a fundamental commercial and legal principle.[18]

4 Applicable Standards for the Listing; Regulations for the Regulatory Evaluation[19]

4.1 *Standards*

4.1.1 *AATCC TM127: Water Resistance: Hydrostatic Pressure Test*

4.1.2 *ACC: Guidance on Best Practices for the Installation of Spray Polyurethane Foam*

4.1.3 *ACC: Ventilation Considerations for Spray Polyurethane Foam*

4.1.4 *ANSI/AWC SDPWS: Special Design Provisions for Wind and Seismic*

4.1.5 *ASCE/SEI 7: Minimum Design Loads and Associated Criteria for Buildings and Other Structures*

4.1.6 *ASTM C518: Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus*

4.1.7 *ASTM C578: Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation*

4.1.8 *ASTM D1622: Standard Test Method for Apparent Density of Rigid Cellular Plastics*

4.1.9 *ASTM D1623: Standard Test Method for Tensile and Tensile Adhesion Properties of Rigid Cellular Plastics*

4.1.10 *ASTM D2126: Standard Test Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging*

4.1.11 *ASTM D2842: Standard Test Method for Water Absorption of Rigid Cellular Plastics*

4.1.12 *ASTM D6226: Standard Test Method for Open Cell Content of Rigid Cellular Plastics*

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4.1.13 *ASTM E72: Standard Test Methods of Conducting Strength Tests of Panels for Building Construction*

4.1.14 *ASTM E84: Standard Test Method for Surface Burning Characteristics of Building Materials*

4.1.15 *ASTM E96: Standard Test Methods for Water Vapor Transmission of Materials*

4.1.16 *ASTM E330: Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights, and Curtain Walls by Uniform Static Air Pressure Difference*

4.1.17 *ASTM E564: Standard Practice for Static Load Test for Shear Resistance of Framed Walls for Buildings*

4.1.18 *ASTM E2126: Standard Test Methods for Cyclic (Reversed) Load Test for Shear Resistance of Vertical Elements of the Lateral Force Resisting Systems for Buildings*

4.1.19 *ASTM E2178: Standard Test Method for Air Permeance of Building Materials*

4.2 Structural performance for shear wall assemblies used as lateral force resisting systems in Seismic Design Categories A through F, have been tested and evaluated in accordance with the following standards:

4.2.1 *ASCE/SEI 7: Minimum Design Loads and Associated Criteria for Buildings and Other Structures*

4.2.2 *ASTM D7989: Standard Practice for Demonstrating Equivalent In-Plane Lateral Seismic Performance to Wood-Frame Shear Walls Sheathed with Wood Structural Panels*

4.2.3 *ASTM E72: Standard Test Methods of Conducting Strength Tests of Panels for Building Construction*

4.2.4 *ASTM E564: Standard Practice for Static Load Test for Shear Resistance of Framed Walls for Buildings*

4.2.5 *ASTM E2126: Standard Test Methods for Cyclic (Reversed) Load Test for Shear Resistance of Vertical Elements of the Lateral Force Resisting Systems for Buildings*

4.2.5.1 ASTM D7989 is accepted engineering practice used to establish Seismic Design Coefficients (SDCs). Test data generated by ISO/IEC 17025 approved agencies and/or professional engineers and all associated professional engineering evaluations which use ASTM D7989 as their basis, are defined as intellectual property and/or trade secrets and are also defined as an Independent Design Review (i.e., Listings, certified reports, duly authenticated reports from approved agencies and/or research reports prepared by approved agencies and/or approved sources).

4.3 *Regulations*

4.3.1 *IBC – 15, 18, 21: International Building Code®*

4.3.2 *IRC – 15, 18, 21: International Residential Code®*

4.3.3 *IECC – 15, 18, 21: International Energy Conservation Code®*

4.3.4 *IFC – 15, 18, 21: International Fire Code®*

5 Listed[20]

5.1 A nationally recognized testing laboratory such as CBI, states that the materials, designs, methods of construction and/or equipment have met nationally recognized standards and/or have been tested and found suitable for use in a specified manner.

6 Tabulated Properties Generated from Nationally Recognized Standards

6.1 BASF HP+™ Wall E Series HFO is used in buildings constructed in accordance with the IBC requirements for Type V light-frame construction.

6.2 BASF HP+™ Wall E Series HFO is used in buildings constructed in accordance with the IRC for light-frame wood construction.

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6.3 BASF HP+™ Wall E Series HFO is used to provide the following:

6.3.1 Lateral load resistance (wind and seismic) for braced BASF HP+™ Wall E Series HFO panels used in light-frame wood construction.

6.3.2 Transverse load resistance (wind pressure) for braced BASF HP+™ Wall E Series HFO panels used in light-frame wood construction.

6.3.3 Thermal resistance in the exterior wall component of the building thermal envelope.

6.3.4 Resistance to uplift and compressive loads in single top plate applications for BASF HP+™ Wall E Series HFO assemblies used in light-frame wood construction.

6.4 Drilling and notching of studs shall follow the provisions stated in IRC Section R602.6 except as noted below with the additional requirements for consideration of the foam materials. All drilling and notching of studs and foam materials shall be performed with care to minimize the removal of materials.

6.4.1 Studs may be cut or notched to a depth not exceeding twenty-five percent (25%) of its width. Nonload-bearing studs may be notched to a depth not to exceed forty percent (40%) of a single stud width.

6.4.2 Studs may be bored or drilled if the diameter of the resulting hole is no more than sixty percent (60%) of the stud width and the edge of the hole is no more than $^{5}/_{8}$" (16 mm) to the edge of the stud at the interior side and 1" (25 mm) at the exterior edge. The hole shall not be located in the same section as a cut or notch. Studs located in exterior walls or bearing partitions drilled over forty percent (40%) and up to sixty percent (60%) shall also be doubled with no more than two successive doubled studs bored.

6.4.3 To accommodate the cutting, notching, drilling, and boring of studs, the foam spray within the cavity of the wall may be notched as necessary to allow passage of mechanicals (i.e., plumbing, electrical, HVAC) through the studs. In all cases, a minimum 1" spray foam thickness shall remain intact at the inside face of the NEOPOR® between the NEOPOR® and the hole or notch in the stud.

6.4.4 Top and bottom plates may be drilled or notched when piping or ductwork necessitates. If more than fifty percent (50%) of a top plate's width is cut or notched, a minimum 16-gauge x 1.5 inch wide metal tie must be fastened across and to the plate at each side of the opening and must extend a minimum of 6" past the opening. The metal tie must be fastened with eight 10d nails on each side. A minimum 1" spray foam thickness shall remain intact at the inside face of the NEOPOR® between the NEOPOR® and the notch in the top or bottom plates.

6.4.5 In no case, shall a surface area greater than 100 square inches be removed from any individual wall cavity without investigation into the effect on the bracing requirements for the wall.

6.5 *Through Penetrations*

6.5.1 Where through penetrations are necessary, they shall be limited to a total area of 100 square inches in a single wall cavity without investigation into the effect of the penetrations on the bracing requirements for the wall.

6.6 *Hold-Down and Anchor Bolt Locations*

6.6.1 Where it is desired to provide a void in the spray foam for the installation of hold-downs, blocking wrapped in plastic may be placed temporarily at the required locations during the spraying process and removed once the WALLTITE® has cured. Blocking size shall be minimized to the size required for the installation of the hold-downs.

6.6.2 Alternately, the WALLTITE® may be notched in the field per the requirements above.

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6.7 *Structural Applications*

6.7.1 Except as otherwise described in this report, the BASF HP+™ Wall E Series HFO shall be installed in accordance with the applicable building codes listed in Section **4** using the provisions set forth herein for the design and installation of Wood Structural Panels (WSP).

6.7.1.1 BASF HP+™ Wall E Series HFO is permitted to be designed in accordance with SDPWS for the design of shear walls using the methods set forth therein, including the perforated shear wall methodology, and subject to the SDPWS boundary conditions except as specifically allowed in this report.

6.7.2 The allowable design values in this report are applicable where BASF HP+™ Wall E Series HFO is installed on Spruce-Pine-Fir (SPF) framing (specific gravity of 0.42), or better.

6.7.3 Anchorage for in-plane shear shall be provided to transfer the induced shear force into and out of each shear wall.

6.7.3.1 For wind design, anchor bolt spacing shall not exceed 6' o.c. (1829 mm).

6.7.3.2 For seismic design, anchor bolt spacing shall not exceed 4' o.c. (1219 mm).

6.7.4 The maximum aspect ratio for full height BASF HP+™ Wall E Series HFO braced wall segments shall be 4:1.

6.7.5 The minimum full height panel width shall be 24" (610 mm).

6.7.6 All NEOPOR® panel edges shall be supported with dimensional lumber or blocking a minimum 2" (51 mm) nominal in the least dimension.

6.7.7 Where the application exceeds the limitations set forth herein, design shall be permitted in accordance with accepted engineering procedures, experience, and technical judgment.

6.7.8 *Prescriptive IRC Bracing Applications*

6.7.8.1 For wind design, BASF HP+™ Wall E Series HFO may be used to brace walls of buildings as an alternative to the IRC Continuous Wall Bracing provisions, IRC Section R602.10.4 (CS-WSP), in accordance with the bracing amounts shown in **Table 1** or **Table 2**, as adjusted in accordance with IRC Table R602.10.3(2).

6.7.8.2 For seismic design, required braced wall panel lengths for BASF HP+™ Wall E Series HFO shall be as shown in **Table 2**, and shall be used in conjunction with IRC Table R602.10.3(4), which provides the required adjustments.

6.7.8.2.1 Where a building, or portion thereof, does not comply with one or more of the bracing requirements within the prescriptive section of the IRC, those portions shall be designed and constructed in accordance with IRC Section R301.1.

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Table 1. IRC Bracing Requirements for BASF HP+™ Wall E Series HFO – Wind[1,4,5,6]

Condition	Braced Wall Line Spacing (ft)	Minimum Total Length(ft) of Braced Wall Panels Required Along Each Braced Wall Line with Continuous Sheathing											
		HP+™ Wall E Series HFO[2]						WSP Structural Sheathing[3]					
		Ultimate Design Wind Speeds[7] (mph)											
		< 95	≤ 110	≤ 115	≤ 120	≤ 130	< 140	< 95	≤ 110	≤ 115	≤ 120	≤ 130	< 140
One Story or the Top of Two or Three Stories	10	2.0	2.0	2.7	2.7	3.3	3.3	1.5	1.5	2.0	2.0	2.5	2.5
	20	3.3	4.0	4.7	4.7	5.3	6.7	2.5	3.0	3.5	3.5	4.0	5.0
	30	4.7	6.0	6.0	6.7	8.0	9.3	3.5	4.5	4.5	5.0	6.0	7.0
	40	5.3	7.3	8.0	8.6	10.0	12.0	4.0	5.5	6.0	6.5	7.5	9.0
	50	6.7	9.3	10.0	10.6	12.6	14.6	5.0	7.0	7.5	8.0	9.5	11.0
	60	8.0	10.6	12.0	12.6	14.6	17.3	6.0	8.0	9.0	9.5	11.0	13.0
First Story of Two Stories or Second Story of Three Stories	10	3.3	4.0	4.7	4.7	6.0	6.7	2.5	3.0	3.5	3.5	4.5	5.0
	20	6.0	7.3	8.6	9.3	10.6	12.0	4.5	5.5	6.5	7.0	8.0	9.0
	30	8.0	10.6	12.0	12.6	15.3	17.3	6.0	8.0	9.0	9.5	11.5	13.0
	40	10.6	14.0	15.3	16.6	20.6	22.6	8.0	10.5	11.5	12.5	15.5	17.0
	50	13.3	17.3	18.6	20.6	23.9	27.9	10.0	13.0	14.0	15.5	18.0	21.0
	60	15.3	20.6	22.6	24.6	28.6	33.3	11.5	15.5	17.0	18.5	21.5	25.0
First Story of Three Stories	10	4.7	6.0	6.7	7.3	8.6	10.0	3.5	4.5	5.0	5.5	6.5	7.5
	20	8.6	11.3	12.0	13.3	15.3	18.0	6.5	8.5	9.0	10.0	11.5	13.5
	30	12.0	16.0	17.3	19.3	22.6	25.9	9.0	12.0	13.0	14.5	17.0	19.5
	40	15.3	20.6	22.6	24.6	29.3	33.3	11.5	15.5	17.0	18.5	22.0	25.0
	50	19.3	25.3	27.9	30.6	35.2	41.2	14.5	19.0	21.0	23.0	26.5	31.0
	60	22.6	30.6	33.3	35.9	41.9	48.5	17.0	23.0	25.0	27.0	31.5	36.5

SI: 1 in = 25.4 mm, 1 mph = 1.61 km/h

1. Linear interpolation is permitted.
2. BASF HP+™ Wall E Series HFO sheathing installed on 2x4 or 2x6 SPF (min) studs spaced 24" o.c. and fastened with 8d box nails spaced 24" o.c. at panel edges and 48" o.c. in the field of the panels.
3. WSP installed on 2x4 or 2x6 SPF studs spaced 24" o.c. and fastened with 8d common nails spaced 6" at panel edges and 12" in the field of the panels.
4. Demonstrates equivalency to IRC Table R602.10.3(1). All adjustment factors from IRC Table R602.10.3(2) shall be applied.
5. Minimum 1/2" gypsum wallboard shall be installed as part of the wall assembly and fastened with a minimum 5d cooler nails or 1 1/4" #6 type W or S screws spaced 16" o.c. at panel edges and 16" o.c. in the field of the panels. Where gypsum wallboard is not applied to the interior side of the wall assembly, bracing lengths shall be multiplied by a factor of 1.3.
6. Bracing lengths are the result of comparative equivalency testing and analysis using both tested and published design values as points of comparison. DrJ relies upon the design values published in the codes and standards listed in Section **4** that are adopted into law and that the manufacturers of those products stand behind. DrJ performs all equivalency analysis based on legally defined design values, the responsibility for which is the manufacturer of those products or the members of the associations that publish those design values.
7. Wind speeds are V_{ult} in accordance with ASCE 7-22. To convert to equivalent V_{asd} wind speed in accordance with IBC Section 1609.3.1 use: $V_{asd} = V_{ult}/\sqrt{0.6}$.

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Table 2. IRC Bracing Requirements for BASF HP+™ Wall Series – Seismic[1,2,5,6,7,8]

Condition	Braced Wall Line Spacing (ft)	Minimum Total Length (ft) of Braced Wall Panels Required Along Each Braced Wall Line with Continuous Sheathing							
		HP+™ Wall E Series HFO[3]				WSP Structural Sheathing[4]			
		Seismic Design Category (SDC)							
		C	D_0	D_1	D_2	C	D_0	D_1	D_2
One Story or the Top of Two or Three Stories	10	1.9	2.2	2.3	2.8	1.4	1.6	1.7	2.1
	20	3.6	4.1	4.5	5.7	2.7	3.1	3.4	4.3
	30	5.5	6.1	6.7	8.5	4.1	4.6	5.1	6.4
	40	7.2	8.1	9.1	11.3	5.4	6.1	6.8	8.5
	50	9.1	10.2	11.3	14.1	6.8	7.7	8.5	10.6
First Story of Two Stories or Second Story of Three Stories	10	3.4	4.2	5.0	6.3	2.6	3.2	3.8	4.7
	20	6.7	8.5	10.2	12.5	5.1	6.4	7.7	9.4
	30	10.2	12.8	15.3	18.6	7.7	9.6	11.5	14.0
	40	13.6	17.0	20.4	24.9	10.2	12.8	15.3	18.7
	50	17.0	21.3	25.4	31.1	12.8	16.0	19.1	23.4
First Story of Three Stories	10	5.0	6.0	6.7	NP	3.8	4.5	5.1	NP
	20	10.2	11.9	13.6	NP	7.7	9.0	10.2	NP
	30	15.3	17.9	20.4	NP	11.5	13.4	15.3	NP
	40	20.4	23.8	27.1	NP	15.3	17.9	20.4	NP
	50	25.4	29.6	33.9	NP	19.1	22.3	25.5	NP

SI: 1 in = 25.4 mm, 1 mph = 1.61 km/h

1. NP = Not Provided
2. Linear interpolation is permitted.
3. BASF HP+™ Wall E Series HFO sheathing installed on 2x4 or 2x6 SPF (min) studs spaced 24" o.c. and fastened with 8d box nails spaced 24" o.c. at panel edges and 48" o.c. in the field of the panels.
4. WSP installed on 2x4 or 2x6 SPF (min) studs spaced 24" o.c. and fastened with 8d common nails spaced 6" at panel edges and 12" in the field of the panels.
5. Demonstrates equivalency to IRC Table R602.10.3(3). All adjustment factors from IRC Table R602.10.3(4) shall be applied.
6. Tabulated bracing lengths are based on the following:
   a. Soil class = D
   b. Wall height = 10 ft
   c. Floor dead load = 10 psf
   d. Roof/ceiling dead load = 15 psf
   e. Braced wall line spacing ≤ 25'
7. Minimum 1/2" gypsum wallboard shall be installed as part of the wall assembly and fastened with a minimum 5d cooler nails or 1 1/4" #6 type W or S screws spaced 16" o.c. at panel edges and 16" o.c. in the field of the panels. Where gypsum wallboard is not applied to the interior side of the wall assembly, bracing lengths shall be multiplied by a factor of 1.3.
8. Bracing lengths are the result of comparative equivalency testing and analysis using both tested and published design values as points of comparison. DrJ relies upon the design values published in the codes and standards listed in Section **4** that are adopted into law and that the manufacturers of those products stand behind. DrJ performs all equivalency analysis based on legally defined design values, the responsibility for which is the manufacturer of those products or the members of the associations that publish those design values.

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6.7.9 *Alternative Prescriptive IRC Bracing Applications:*

6.7.9.1 As an alternative to Section **6.7.8**, the following provisions are permitted:

6.7.9.1.1 BASF HP+™ Wall E Series HFO may be used to brace walls of buildings as an alternative to the Continuous Wall Bracing provisions of IRC Section R602.10.4, when installed in accordance with this report.

6.7.9.1.2 Required braced wall panel lengths for BASF HP+™ Wall E Series HFO shall be as determined by the equivalency factor shown in **Table 3** and IRC Table R602.10.3(1) or IRC Table 602.10.3(3) including all adjustments as required by IRC Table R602.10.3(2) or IRC Table 602.10.3(4), respectively.

6.7.9.1.2.1 Bracing lengths in these tables for Method CS-WSP shall be multiplied by the equivalency factor listed in **Table 3**.

Table 3. Braced Wall Line Length Equivalency Factor

Wall Assembly[5]	Gypsum Sheathing[1]	Max. Stud Spacing[2] (in)	Fastener	Fastener Spacing	Equivalency Factor to IRC CS-WSP[3,4]
BASF HP+™ Wall E Series HFO with 5/8" NEOPOR®	None	24 o.c.	8d galv. box nails	24:48	1.20
	1/2" GWB				1.33

SI: 1 in = 25.4 mm

1. Gypsum sheathing installed with Type W screws at 16":16" spacing. Where gypsum wallboard is not applied to the interior side of the HP+™ Wall E Series HFO assembly, bracing lengths shall be multiplied by a factor of 1.2.
2. SPF framing (minimum)
3. Multiply the bracing lengths in IRC Table R602.10.3(1) and IRC Table R602.10.3(2) Method WSP or CS-WSP as applicable, including all footnotes, by the factors shown here to establish the required bracing length.
4. Valid for single and double top plate HP+™ Wall E Series HFO installations.
5. 5/8" NEOPOR®, or thicker, may be used.

6.7.9.1.2.2 These braced wall line length equivalency factors are based on equivalency testing and are used to comply with Method CS-WSP of the IRC.

6.7.9.1.2.3 BASF HP+™ Wall E Series HFO tested equivalency factors in **Table 3** allow the user to determine the length of bracing required by multiplying the factor from **Table 2** by the length shown in the CS-WSP column in IRC Table R602.10.3(1) or IRC Table 602.10.3(3) as modified by all applicable factors in IRC Table R602.10.3(2) or IRC Table R602.10.3(4), respectively.

6.7.9.1.3 All IRC prescriptive bracing minimums, spacing requirements, and rules must still be met.

6.7.10 *Prescriptive IBC Conventional Light-Frame Wood Construction:*

6.7.10.1 BASF HP+™ Wall E Series HFO may be used to brace exterior walls of buildings as an equivalent alternative to Method WSP of the IBC when installed continuously along the length of the braced wall line with 1/2" (13 mm) gypsum on the interior fastened with a minimum 5d cooler nail or #6 type W or S screw spaced a maximum of 16" o.c. (203 mm) at panel edges and 16" o.c. in the field. Bracing shall be in accordance with the conventional light-frame construction method of IBC Section 2308.6.3 and this report.

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6.7.11 *Performance-Based Wood-Framed Construction:*

6.7.11.1 BASF HP+™ Wall E Series HFO designed as shear walls are permitted to be designed in accordance with the methodology used in SDPWS for WSP using the capacities shown **Table 4**, **Table 5**, **Table 6** and **Table 7**.

6.7.11.2 BASF HP+™ Wall E Series HFO shear walls are permitted to resist horizontal wind load forces using the allowable shear loads (in pounds per linear foot) set forth in **Table 4**.

Table 4. Allowable Stress Design (ASD) Capacity for Wind

Wall Assembly[4]	Fastener	Max. Stud Spacing[5] (in)	Fastener Spacing[1,2] (edge:field) (in)	Gypsum Wallboard (GWB)	GWB Fastener Spacing (edge:field) (in)	Allowable Unit Shear Capacity (plf)
BASF HP+™ Wall E Series HFO[2] with 5/8" NEOPOR®	8d Galv. Box nails	24 o.c.	24:48	None	N/A	265
OSB[3]	8d Galv. Box nails	16 o.c.	6:12	None	N/A	335

SI: 1 in = 25.4 mm, 1 lb/ft = 0.0146 kN/m

1. Minimum fastener size and spacing are as shown above with a minimum panel edge distance of 3/8".
2. Sheathing used in BASF HP+™ Wall E Series HFO shall have joints butted at framing members, and a single row of fasteners must be applied to each panel edge into the stud below.
3. OSB assembly is only listed for reference. Design values come from SDPWS.
4. 5/8" NEOPOR®, or thicker, may be used.
5. SPF framing (minimum)

6.7.11.3 BASF HP+™ Wall E Series HFO shear walls that require seismic design in accordance with IBC Section 1613 shall use the seismic allowable unit shear capacities set forth in **Table 5**.

6.7.11.3.1 The response modification coefficient, R, system overstrength factor, Ω_0, and deflection amplification factor, C_d, indicated in **Table 5** shall be used to determine the base shear, element design forces, and design story drift in accordance with ASCE 7 Chapter 12 and Section 14.5.

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Table 5. Seismic Allowable Unit Shear & Design Coefficients

Seismic Force Resisting System[1,7]	Max. Stud[8] Spacing (in)	Gypsum Wallboard[6] (GWB)	Seismic Allowable Unit Shear Capacity (plf)	Apparent Shear Stiffness, G_a (kips/in)	Response Modification Factor,[2] R	System Overstrength Factor,[3] Ω_0	Deflection Amplification Coefficient,[4] C_d	Structural System Limitations and Building Height Limit[5] (ft)				
								Seismic Design Category				
								B	C	D	E	F
BASF HP+™ Wall E Series HFO with 5/8" NEOPOR®	24 o.c.	1/2" GWB	210	5.6	6.5	3	4	NL	NL	65	65	65

SI: 1 in = 25.4 mm, 1 lb/ft = 0.0146 kN/m

1. NEOPOR® fastened to studs using minimum 8d galvanized box nails spaced 24":48" (edge:field) with a minimum panel edge distance of 3/8".
2. Response modification coefficient, R, for use throughout ASCE 7. Note: R reduces forces to a strength level, not an allowable stress level.
3. The tabulated value of the overstrength factor, Ω_0, is permitted to be reduced by subtracting 0.5 for structures with flexible diaphragms.
4. Deflection amplification factor, C_D, for use with ASCE 7 Section 12.8.6, 12.8.7, and 12.9.2
5. NL = Not Limited. Heights are measured from the base of the structure as defined in ASCE 7 Section 11.2.
6. Gypsum attached with minimum #6 type W or S screws 1 1/4" long spaced 16" o.c. at panel edges and in the field.
7. 5/8" NEOPOR®, or thicker, may be used.
8. SPF framing (minimum).

6.8 *Axial Loading*

6.8.1 BASF HP+™ Wall E Series HFO has been tested for both uplift and compression on single top plate applications.

6.8.2 **Table 6** shows the maximum allowable uplift and compression forces allowed in this application.

6.8.2.1 Designs using the allowable loads in **Table 6** shall have a load path capable of transferring loads from their point of origin to their final point of resistance, in accordance with IRC Section R301.1.

6.8.2.2 Installation is permitted for single top plate (advanced framing method) or double top plate applications.

Table 6. Allowable Floor or Roof Framing Reactions on BASF HP+™ Wall E Series HFO Top Plate

Wall Assembly[5]	Interior Sheathing Material	Maximum Floor/Roof Framing Reactions[1] (lbs)	
		Uplift	Compression
BASF HP+™ Wall E Series HFO with 5/8" NEOPOR®	None	670	1350

SI: 1 in = 25.4 mm, 1 lb = 4.45 N

1. Applies to placement anywhere along the wall top plate.
2. Maximum allowable load assumes load is concentrated at the mid-span of the top plate between studs.
3. HP+™ Wall E Series HFO assemblies are a maximum 24" o.c. stud spacing utilizing a single top plate. Framing shall be SPF at a minimum. All stud cavities are filled with 1.5" BASF SPF.
4. All other framing connections are in accordance with the applicable building code.
5. 5/8" NEOPOR®, or thicker, may be used.

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6.8.2.2.1 *Double Top Plate:*

6.8.2.2.1.1 Where truss reactions are less than or equal to the values in **Table 6**, trusses can be set anywhere along the double top plate as needed to frame the floor or roof system.

6.8.2.2.2 *Single Top Plate:*

6.8.2.2.2.1 Where a single top plate of No. 3, standard or stud grade dimensional lumber is used, studs below are spaced 24" o.c., and floor or roof framing members are spaced a maximum of 24" o.c., such members shall be located within 3" of the center of the studs below.

6.8.2.2.2.2 Where a single top plate of No. 2 SPF dimensional lumber or equivalent is used, studs below are spaced 24" o.c., and floor or roof framing members are spaced a maximum of 24" o.c., such members shall be located within 5" of the center of the studs below.

6.8.2.2.3 Uplift capacities are permitted to be increased through the use of mechanical connectors of the top plate to stud and sole plate to stud connections.

6.8.2.2.4 All other framing conditions shall be in accordance with the applicable code.

6.9 *Perforated Shear Walls*

6.9.1 BASF HP+™ Wall E Series HFO shear walls are permitted to be designed in accordance with the methodology found in 2015 SDPWS Section 4.3.3.5 with the following exceptions:

6.9.1.1 SDPWS Equation 4.3-6 for C_O shall be replaced with the equation from **Table 7**.

Table 7. C_O for Use with the SDPWS Perforated Shear Wall Methodology

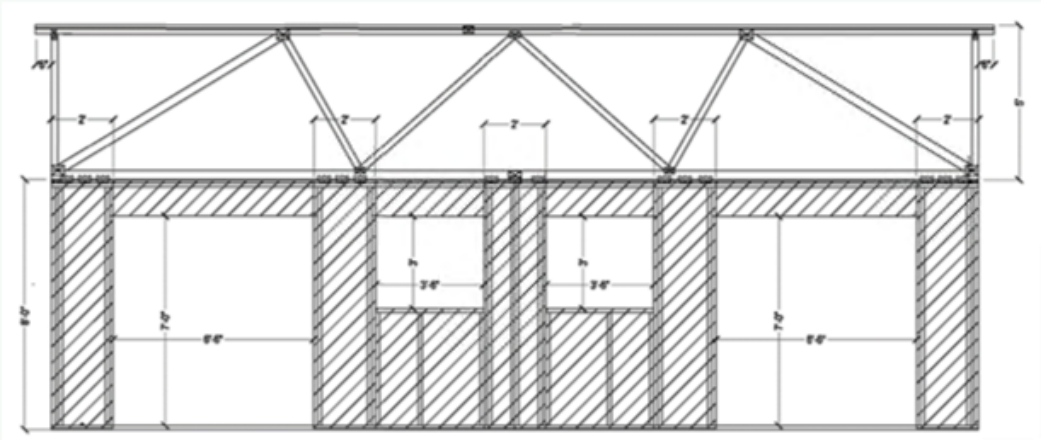
Wall Assembly	Replace 2015 SDPWS Eq. 4.3-5 with the Following
BASF HP+™ Wall E Series HFO with minimum 5/8" NEOPOR®	$C_o = \frac{r}{(0.75 + 0.25 * r)} * \frac{L_{tot}}{\sum L_i}$

6.9.1.2 The maximum aspect ratio for full height BASF HP+™ Wall E Series HFO braced wall segments shall be 4:1, instead of 3.5:1 as listed in 2015 SDPWS Section 4.3.4.3. The other requirements of 2015 SDPWS Section 4.3.4.3 shall be followed, including the adjustment factor for aspect ratio of perforated shear wall segments greater than 2:1.

6.9.1.3 **Figure 3** shows how to calculate the capacity of a perforated shear wall with the BASF HP+™ Wall E Series HFO system using the shear capacity adjustment factor in **Table 7**.

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$L_{tot} := 30\ ft$ — Total length of the perforated shear wall

$h := 8\ ft$ — Height of the perforated shear wall

$b_s := 2\ ft$ — Length of base of shear wall segment

$L_i := 2\ ft \cdot \left(\frac{2 \cdot b_s}{h}\right) = 1\ ft$ — Length of shear wall segment with aspect ratios greater than 2:1 adjusted in accordance with 2015 SDPWS Section 4.3.4.3

$\Sigma L_i := L_i \cdot 5 = 5\ ft$ — Summation of the five perforated shear wall segments

$A_o := \left(2 \cdot \left(7\ ft \cdot 6.5\ ft\right)\right) + \left(2 \cdot \left(3\ ft \cdot 3.5\ ft\right)\right) = 112\ ft^2$ — Total area of all four openings

$r := \frac{1}{\left(1 + \frac{A_o}{h \cdot \Sigma L_i}\right)} = 0.263$ — Sheathing area ratio, 2015 SDPWS Eq. 4.3-6

$C_o := \left(\frac{r}{0.75 + 0.25 \cdot r}\right) \cdot \frac{L_{tot}}{\Sigma L_i} = 1.94$ — Shear capacity adjustment factor (replaces 2015 SDPWS Eq. 4.3-5)

$v := 265\ \frac{lb}{ft}$ — Allowable unit shear capacity for wind

$V_{perforated} := v \cdot \Sigma L_i \cdot C_o = 2565\ lb$ — Shear capacity of perforated shear wall, 2015 SDPWS Section 4.3.3.5

Figure 3. Example of a Perforated Shear Wall

6.10 *Transverse Wind Loading*

6.10.1 BASF HP+™ Wall E Series HFO installed over exterior framing spaced a maximum of 24" o.c. without an interior covering can resist allowable wind loads (**Table 8**) and wind speeds (**Table 9**). Required components and cladding loads to be resisted are found in IBC Section 1609.1.1, IRC Table R301.2.1(1)[21] and IRC Table R301.2.1(2).[22]

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Table 8. Transverse (Out-Of-Plane) Wind Load Resistance

Wall Assembly[3]	Maximum Stud[4] Spacing (in)	Fastener Schedule[2]	Allowable Design Value (psf)[1]
BASF HP+™ Wall E Series HFO with 5/8" NEOPOR®	24 o.c.	0.113" x 2 3/8" galvanized nail, 24":48" o.c. to edge:field	75

SI: 1 in = 25.4 mm, 1 psf = 0.0479 kN/m²

1. Applies to the positive and negative wind directions.
2. The attachment of the sheathing to the framing is primarily through the adhesion of the SPF to the framing and NEOPOR®. Average depth is 1.5".
3. 5/8" NEOPOR®, or thicker, may be used.
4. SPF framing (minimum).

Table 9. Basic Wind Speed for Use in Exterior Wall Covering Assebmlies[2,3]

Wall Assembly[4,5]	Allowable Components & Cladding Basic Wind Speed[1] (mph)	
	ASCE 7-05 (V_{asd})	ASCE 7-16 and 7-22 (V_{ult})
BASF HP+™ Wall E Series HFO with 5/8" NEOPOR®	155	200

SI: 1 mph = 1.61 km/h

1. Allowable wind speeds are based on the following: Mean roof height 30', Exposure B, 10 sq. ft. effective wind area, corner zone 5.
2. 24" o.c. framing.
3. BASF HP+™ Wall E Series HFO fastened with 0.113" x 2 3/8" galvanized nail, 24":48" o.c. to edge:field.
4. 5/8" NEOPOR®, or thicker, may be used.
5. SPF framing (minimum).

6.11 *Water-Resistive Barrier (WRB)*

6.11.1 BASF HP+™ Wall E Series HFO shall be covered with a code-compliant WRB in accordance with IBC Section 1404.2[23] and IRC Section R703.2.

6.11.2 Flashing shall be installed at all sheathing penetrations and shall comply with the applicable code sections.

6.12 *Thermal Resistance (R-Value)*

6.12.1 BASF HP+™ Wall E Series HFO meets the continuous insulated sheathing requirements complying with the provisions of IRC Section N1102 and IECC Section C402.

6.12.2 BASF HP+™ Wall E Series HFO has the thermal resistance as shown in **Table 10**.

Table 10. Thermal Resistance Properties[1]

Product	Thickness (in)	R-Value (°F*ft²*hr/Btu)
NEOPOR®	1 1/8	5.0
	5/8	2.8
BASF WALLTITE® LWP SPF	1	7.8
	3.6	26.4

SI: 1 in = 25.4 mm

1. Tested at a mean temperature of 75° F.

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6.13 *Air Barrier*

6.13.1 BASF HP+™ Wall E Series HFO meets the requirements of IECC Section C402 for use as a component of the air barrier when installed in accordance with the manufacturer installation instructions and this report, shown in **Table 11**.

Table 11. Air Barrier Properties[1,2]

Product	Air Permeance [L/(s*m²)]
BASF WALLTITE® LWP SPF	< 0.02

1. Tested in accordance with ASTM E2178.
2. Testing conducted on SPF material only.

6.14 *Surface Burn Characteristics*

6.14.1 BASF HP+™ Wall E Series HFO panels have the flame spread characteristics shown in **Table 12**.

Table 12. Surface Burn Characteristics[1]

Product	Flame Spread	Smoke Developed
NEOPOR®	< 25	< 450
BASF WALLTITE® LWP SPF		

1. Tested in accordance with ASTM E84.

6.15 *Thermal Barrier Requirements – Attic, Crawlspace or Other Uninhabitable Space Applications*

6.15.1 Installation shall be fully protected from the interior of the building by an approved 15-minute thermal barrier or ignition barrier as required by IBC Section 2603.4 and IRC Section R316.4.

6.16 Where the application falls outside of the performance evaluation, conditions of use and/or installation requirements set forth herein, alternative techniques shall be permitted in accordance with accepted engineering practice and experience. This includes but is not limited to the following areas of engineering: mechanics or materials, structural, building science and fire science.

7 Certified Performance[24]

7.1 All construction methods shall conform to accepted engineering practices to ensure durable, livable and safe construction and shall demonstrate acceptable workmanship reflecting journeyman quality of work of the various trades.[25]

7.2 The strength and rigidity of the component parts and/or the integrated structure shall be determined by engineering analysis or by suitable load tests to simulate the actual loads and conditions of application that occur.[26]

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8 Regulatory Evaluation and Accepted Engineering Practice

8.1 BASF HP+™ Wall E Series HFO was evaluated to determine the following:

8.1.1 Structural performance for shear wall assemblies used as lateral force resisting systems in Seismic Design Categories A through F, have been tested and evaluated in accordance with the following standards:

8.1.1.1 ASCE/SEI 7: Minimum Design Loads and Associated Criteria for Buildings and Other Structures

8.1.1.2 ASTM D7989: Standard Practice for Demonstrating Equivalent In-Plane Lateral Seismic Performance to Wood-Frame Shear Walls Sheathed with Wood Structural Panels

8.1.1.3 ASTM E72: Standard Test Methods of Conducting Strength Tests of Panels for Building Construction

8.1.1.4 ASTM E564: Standard Practice for Static Load Test for Shear Resistance of Framed Walls for Buildings

8.1.1.5 ASTM E2126: Standard Test Methods for Cyclic (Reversed) Load Test for Shear Resistance of Vertical Elements of the Lateral Force Resisting Systems for Buildings

8.1.2 Lateral force resisting systems for use in both wind and seismic applications follow the performance-based provisions of IBC Section 2306.1, IBC Section 2306.3 and/or Section 4.3 SDPWS for light-frame wood wall assemblies.

8.1.2.1 **Table 5** provides SDCs that conform to the requirements in ASCE 7 Section 12.2.1, 12.2.1.1 and Table 12.2-1 for design of wall assemblies in buildings that require seismic design.

8.1.3 ASTM D7989 is accepted engineering practice used to establish SDCs. Test data generated by ISO/IEC 17025 approved agencies and/or professional engineers, and all associated professional engineering evaluations, which use ASTM D7989 as their basis, are defined as intellectual property and/or trade secrets and are also defined as an independent design review (i.e., Listings, certified reports, duly authenticated reports from approved agencies, and/or research reports prepared by approved agencies and/or approved sources).

8.1.4 Structural performance under lateral load conditions for use as an alternative to the IRC Continuous Wall Bracing provisions of IRC Section R602.10.4 Method CS-WSP (Continuously Sheathed Wood Structural Panel).

8.1.5 Structural performance under lateral load conditions for use as an alternative to the Conventional Wall Bracing provisions of IBC Section 2308.6.3, Method WSP (Wood Structural Panels).

8.1.6 Structural performance under lateral load conditions for use with the performance-based provisions of IBC Section 2306.1 and IBC Section 2306.3 for light-frame wood wall assemblies.

8.1.6.1 **Table 5** provides SDCs that conform to the requirements in ASCE 7 Section 12.2.1.1 and Table 12.2-1 for design of wall assemblies in buildings that require seismic design in accordance with ASCE 7 (i.e., all seismic design categories).

8.1.6.2 The basis for equivalency testing is outlined in ASCE 7 Section 12.2.1.1:[27]

> **Alternative Structural Systems.** Use of seismic force-resisting systems not contained in Table 12.2-1 shall be permitted contingent on submittal to and approval by the Authority Having Jurisdiction and independent structural design review of an accompanying set of design criteria and substantiating analytical and test data. The design criteria shall specify any limitations on system use, including Seismic Design Category and height; required procedures for designing the system's components and connections; required detailing; and the values of the response modification coefficient, R; overstrength factor, Ω_0; and deflection amplification factor, C_d.

8.1.7 Structural performance under lateral load conditions for use as an alternative to SDPWS Section 4.3 Wood-Frame Shear Walls.

8.1.8 Structural performance under uplift and gravity loads for use with single top plates in accordance with IBC Section 1604 and IRC Section R301.1.

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8.1.9 Resistance to transverse loads for wall assemblies used in light-frame wood construction in accordance with IBC Section 1609.1.1 and IRC Section R301.2.1.

8.1.10 Continuous insulated sheathing requirements for thermal resistance (R-value) complying with the provisions of IRC Section N1102 and IECC Section C402.

8.1.11 Performance for use as a component of the air barrier in accordance with IRC Section N1102.4.1, IECC Section R402.4.1.1 and IECC Section C402.5.1.

8.1.12 Surface burn characteristics complying with the provisions of IBC Section 2603.3 and IRC Section R316.3.

8.2 Performance of the BASF HP+™ Wall E Series HFO or any of its component materials for use as a WRB assembly or WRB material is outside the scope of this report.

8.3 Performance of the BASF HP+™ Wall E Series HFO or any of its component materials as used in the normal construction process is outside the scope of this report.

8.3.1 This includes storage, weather conditions, durability considerations, handling, installing, restraining, and bracing of the BASF HP+™ Wall E Series HFO system through the shipping, storing, and construction means and methods process.

8.4 Use of BASF HP+™ Wall E Series HFO in a portal frame is outside the scope of this report.

8.5 Any building code, regulation and/or accepted engineering evaluations (i.e., research reports, duly authenticated reports, etc.) that are conducted for this Listing were performed by DrJ Engineering, LLC (DrJ), an ISO/IEC 17065 accredited certification body and a professional engineering company operated by RDP/approved sources. DrJ is qualified[28] to practice product and regulatory compliance services within its scope of accreditation and engineering expertise, respectively.

8.6 Engineering evaluations are conducted with DrJ's ANAB accredited ICS code scope of expertise, which are also its areas of professional engineering competence.

8.7 Any regulation specific issues not addressed in this section are outside the scope of this report.

9 Installation

9.1 Installation shall comply with the approved construction documents, the manufacturer installation instructions, this report and the applicable building code.

9.2 In the event of a conflict between the manufacturer installation instructions and this report, the more restrictive shall govern.

9.3 BASF HP+™ Wall E Series HFO shall be installed in a workmanlike manner subject to industry-accepted tolerances.

9.4 A copy of the manufacturer published installation instructions shall be available at all times on the jobsite during installation.

9.4.1 Frame walls in accordance with the construction documents and the applicable building codes.

9.4.2 Wall panel/section shall be square and true prior to sheathing with NEOPOR®.

9.5 Where required, gypsum wallboard shall be a minimum $^1/_2$" (13 mm) thickness.

9.6 Refer to the BASF HP+™ Wall E Series HFO quality assurance (QC) procedures and installation manual for construction means and methods support.

9.7 Storage, weather conditions, durability considerations, handling, installing, restraining, and bracing of the panels are defined in the QC procedures and installation process to support proper construction means and methods.

9.8 Installation shall comply with the manufacturer installation instructions and this report. In the event of a conflict between the manufacturer installation instructions and this report, the more restrictive shall govern.

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9.9 *NEOPOR® Installation*

9.9.1 NEOPOR® must be installed over studs having a nominal thickness of not less than 2" (51 mm) in the least dimension and spaced a maximum of 24" (610 mm) o.c. (**Figure 4**).

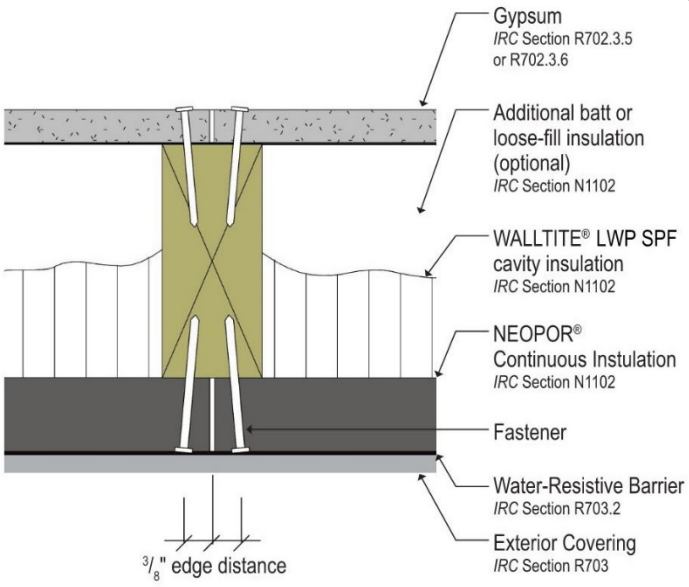


Figure 4. Fastening of NEOPOR® & Gypsum Sheathing

9.9.2 NEOPOR® must be installed vertically with the length dimension of the panels parallel to the framing behind and all panel edges supported by framing or blocking.

9.9.3 NEOPOR® shall be installed with minimum 0.099" shank diameter galvanized nail with a minimum $^3/_8$" diameter head.

9.9.4 Fasteners shall be of sufficient length to penetrate the framing a minimum of $^3/_4$" and shall be installed with the head flush with the surface of the sheathing.

9.9.5 Fasteners shall be spaced a minimum of 12" o.c. (305 mm) at panel edges and 16" o.c. (406 mm) in the field.

9.9.6 Fasteners are intended to provide a temporary connection until the SPF is cured. Ensure tight connection between the NEOPOR® and framing. Alternate methods of providing this restraint are acceptable.

9.10 *SPF Installation*

9.10.1 SPF shall be installed only by persons trained in accordance with the BASF Quality Assurance and Training Program (QATP).

9.10.2 SPF sets almost immediately. Ensure wall is square and true prior to SPF application.

9.10.3 Ensure NEOPOR® is fastened tightly to the stud to prevent spray foam from entering and expanding between the stud and NEOPOR®.

9.10.4 Take care to protect area and personnel from overspray.

9.10.5 Refer to Guidance on Best Practices for the Installation of Spray Polyurethane Foam and the Technical Product Data to understand how to properly process WALLTITE® LWP at various conditions.

9.10.6 Use properly functioning, high pressure proportioning spray equipment to process WALLTITE® LWP. All parts of the spray gun need to function as intended and be clean and free of debris.

9.10.7 Substrate shall be clear of debris and dry to the touch before applying WALLTITE® LWP.

9.10.8 Measure the temperature of the NEOPOR® surface with an infrared gun. Substrate temperature shall be a minimum of 30°F and maximum of 105°F.

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9.10.9 For proper processing of SPF components, refer to the WALLTITE® LWP Technical Product Data.

9.10.9.1 Spray the initial pass of WALLTITE® LWP to the NEOPOR® so that enough material is laid down to wet the surface without running or sagging.

9.10.9.2 WALLTITE® LWP first pass should not exceed 1/2" thickness.

9.10.9.3 Allow wetted surface to foam completely and cool before subsequent 1.5" thick applications.

9.10.9.4 Lapse time between passes will be dependent on the NEOPOR® or foam substrate layer temperature.

9.10.10 Panels may be handled immediately after spraying. Full strength develops after 24 hours.

9.10.11 For more detailed installation guidelines, see Guidance on Best Practices for the Installation of Spray Polyurethane Foam and Ventilation Considerations for Spray Polyurethane Foam.

9.10.12 For enhanced automation processes, contact BASF Corporation.

9.10.13 Contractor must be BASF Quality Assurance Training Program certified.

9.11 *Gypsum Wallboard Installation*

9.11.1 Where required, gypsum wallboard shall be a minimum 1/2" (13 mm) thickness and shall be installed with a minimum of either of the following:

9.11.1.1 #6 x 1 1/4" (32 mm) type W or S screws

9.11.1.2 5d cooler nails

9.11.2 For IBC and IRC prescriptive applications, gypsum fasteners shall be spaced a maximum of 16" (406 mm) o.c. at panel edges and 16" o.c. at intermediate framing. For engineered design, see **Table 3**.

9.11.3 Fastener edge distance is a minimum of 3/8" (10 mm).

10 Substantiating Data

10.1 Testing has been performed under the supervision of a professional engineer and/or under the requirements of ISO/IEC 17025 as follows:

10.1.1 Lateral load testing in accordance with ASTM E2126

10.1.2 Transverse wind load testing in accordance with ASTM E330

10.1.3 Uplift load testing in accordance with ASTM E72

10.1.4 Gravity load testing for single top plate applications in accordance with ASTM E72

10.1.5 Strength testing for NEOPOR® with BASF SPF in accordance with ASTM E72

10.1.6 Strength testing for OSB with BASF SPF in accordance with ASTM E72

10.1.7 Strength testing for OSB in accordance with ASTM E72

10.1.8 Surface burning testing for NEOPOR® in accordance with ASTM E84

10.1.9 Material property testing for NEOPOR® in accordance with ASTM C578

10.1.10 Uniform static air testing for NEOPOR® in accordance with ASTM E330

10.1.11 Material property testing for BASF SPF in accordance with ASTM D1623, D1622, D2842, D2126, D6226, E2178, C518, and E96

10.1.12 Water resistance properties of BASF SPF in accordance with AATCC TM 127

10.1.13 Thermal transmission properties of BASF SPF in accordance with ASTM C518

10.1.14 Surface burning testing of BASF SPF in accordance with ASTM E84

10.2 Information contained herein may include the result of testing and/or data analysis by sources that are approved agencies, approved sources and/or RDPs. Accuracy of external test data and resulting analysis is relied upon.

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10.3 Where pertinent, testing and/or engineering analysis are based upon provisions that have been codified into law through state or local adoption of regulations and standards. The developers of these regulations and standards are responsible for the reliability of published content. DrJ's engineering practice may use a regulation-adopted provision as the control. A regulation-endorsed control versus a simulation of the conditions of application to occur establishes a new material as being equivalent to the regulatory provision in terms of quality, strength, effectiveness, fire resistance, durability and safety.

10.4 The accuracy of the provisions provided herein may be reliant upon the published properties of raw materials, which are defined by the grade mark, grade stamp, mill certificate, or duly authenticated reports from approved agencies and/or approved sources provided by the supplier. These are presumed to be minimum properties and relied upon to be accurate. The reliability of DrJ's engineering practice, as contained in this duly authenticated report, may be dependent upon published design properties by others.

10.5 Testing and engineering analysis: The strength, rigidity and/or general performance of component parts and/or the integrated structure are determined by suitable tests that simulate the actual conditions of application that occur and/or by accepted engineering practice and experience.[29]

10.6 Where additional condition of use and/or regulatory compliance information is required, please search for BASF HP+™ Wall E Series on the DrJ Certification website.

11 Findings

11.1 As outlined in Section **6**, BASF HP+™ Wall E Series utilizing WALLTITE® LWP SPF with HFO Blowing Agents in Combination with NEOPOR® Graphite Polystyrene FPIS has performance characteristics that were tested and/or meet applicable regulations and is suitable for use pursuant to its specified purpose.

11.2 When used and installed in accordance with this duly authenticated report and the manufacturer installation instructions, BASF HP+™ Wall E Series utilizing WALLTITE® LWP SPF with HFO Blowing Agents in Combination with NEOPOR® Graphite Polystyrene FPIS shall be approved for the following applications:

11.2.1 Lateral load resistance due to wind and seismic loads carried by shear walls in accordance with **Table 1**, **Table 2**, **Table 3**, **Table 4**, and **Table 5**.

11.2.2 Resistance to axial and uplift loads in single top plate applications in accordance with **Table 6**.

11.2.3 Transverse wind load resistance in accordance with **Table 8** and **Table 9**.

11.2.4 Thermal resistance properties in accordance with **Table 10**.

11.2.5 Air barrier properties in accordance with **Table 11**.

11.2.6 Surface burning characteristics in accordance with **Table 12**.

11.3 Unless exempt by state statute, when BASF HP+™ Wall E Series HFO is to be used as a structural and/or building envelope component in the design of a specific building, the design shall be performed by an RDP.

11.4 This innovative product has been evaluated in the context of the codes listed in Section **4** and is compliant with all known state and local building codes. Where there are known variations in state or local codes applicable to this report, they are listed here:

11.4.1 No known variations.

11.5 Any application specific issues not addressed herein can be engineered by an RDP. Assistance with engineering is available from BASF Corporation.

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11.6 IBC Section 104.11 (IRC Section R104.11 and IFC Section 104.10[30] are similar) in pertinent part states:

> **104.11 Alternative materials, design and methods of construction and equipment.** The provisions of this code are not intended to prevent the installation of any material or to prohibit any design or method of construction not specifically prescribed by this code. Where the alternative material, design or method of construction is not approved, the building official shall respond in writing, stating the reasons the alternative was not approved.

11.7 **Approved**:[31] Building regulations require that the building official shall accept duly authenticated reports.[32]

11.7.1 An approved agency is "approved" when it is ANAB ISO/IEC 17065 accredited.

1.1.1 An approved source is "approved" when an RDP is properly licensed to transact engineering commerce.

11.7.2 Federal law, Title 18 US Code Section 242, requires that where the alternative product, material, service, design, assembly and/or method of construction is not approved, the building official shall respond in writing, stating the reasons why the alternative was not approved. Denial without written reason deprives a protected right to free and fair competition in the marketplace.

11.8 DrJ is a licensed engineering company, employs licensed RDPs and is an ANAB-Accredited Product Certification Body – Accreditation #1131.

11.9 Through the IAF Multilateral Agreements (MLA), this Duly Authenticated Report can be used to obtain product approval in any jurisdiction or country because all ANAB ISO/IEC 17065 Duly Authenticated Reports are equivalent.[33]

12 Conditions of Use

12.1 Material properties shall not fall outside the boundaries defined in Section **6**.

12.2 As defined in Section **6**, where material and/or engineering mechanics properties are created for load resisting design purposes, the resistance to the applied load shall not exceed the ability of the defined properties to resist those loads using the principles of accepted engineering practice.

12.3 As listed herein, BASF HP+™ Wall E Series HFO shall not be used:

12.3.1 Without wall bracing unless installed as wall bracing in accordance with this report.

12.4 When used in accordance with the IBC in Seismic Design Categories C, D, E, or F, special inspections shall comply with IBC Section 1705.13.[34]

12.5 When used in accordance with the IBC in high wind areas, special inspections shall comply with IBC Section 1705.13.[35]

12.6 Loads applied shall not exceed those recommended by the manufacturer as follows:

12.6.1 Allowable shear loads do not exceed values in **Table 1**, **Table 2**, **Table 3**, and **Table 4** as applicable.

12.6.2 Allowable axial loads do not exceed values in **Table 6**.

12.6.3 Allowable transverse loads do not exceed values in **Table 8**.

12.6.4 Allowable wind speeds do not exceed values in **Table 9**.

12.7 All panel edges shall be supported by wall framing or solid blocking a minimum of 2" (51 mm) nominal thickness in the least dimension.

12.8 The manufacturer installation instructions shall be available on the jobsite for inspection.

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12.9 Refer to the BASF HP+™ Wall E Series quality assurance (QC) procedures and installation manual for construction means and methods support.

12.9.1 Storage, weather conditions, durability considerations, handling, installing, restraining, and bracing of the panels are defined in the QC procedures and installation process to support proper construction means and methods.

12.9.2 The contractor or wall installer is responsible for following the BASF HP+™ Wall E Series QC procedures, installation instructions, and all means and methods of construction.

12.9.3 Contact BASF Corporation for additional information regarding means and methods.

12.10 When required by adopted legislation and enforced by the building official, also known as the authority having jurisdiction (AHJ) in which the project is to be constructed:

1.1.2 Any calculations incorporated into the construction documents shall conform to accepted engineering practice and, when prepared by an approved source, shall be approved when signed and sealed.

12.10.1 This report and the installation instructions shall be submitted at the time of permit application.

12.10.2 This innovative product has an internal quality control program and a third-party quality assurance program.

12.10.3 At a minimum, this innovative product shall be installed per Section **9** of this report.

12.10.4 The review of this report by the AHJ shall comply with IBC Section 104 and IBC Section 105.4.

12.10.5 This innovative product has an internal quality control program and a third party quality assurance program in accordance with IBC Section 104.4, IBC Section 110.4, IBC Section 1703, IRC Section R104.4 and IRC Section R109.2.

12.10.6 The application of this innovative product in the context of this report is dependent upon the accuracy of the construction documents, implementation of installation instructions, inspection as required by IBC Section 110.3, IRC Section R109.2 and any other regulatory requirements that may apply.

12.11 The approval of this report by the AHJ shall comply with IBC Section 1707.1, where legislation states in part, "*the building official shall accept duly authenticated reports from approved agencies in respect to the quality and manner of use of new material or assemblies as provided for in Section 104.11*", all of IBC Section 104 and IBC Section 105.4.

12.12 Design loads shall be determined in accordance with the regulations adopted by the jurisdiction in which the project is to be constructed and/or by the building designer (i.e., owner or RDP).

12.13 The actual design, suitability and use of this report for any particular building, is the responsibility of the owner or the authorized agent of the owner.

13 Identification

13.1 The innovative product listed in Section **1.1** is identified by a label on the board or packaging material bearing the manufacturer name, product name, this report number and other information to confirm code compliance.

13.2 Additional technical information can be found at www.basf.com.

14 Review Schedule

14.1 This report is subject to periodic review and revision. For the latest version, visit drjcertification.org.

14.2 For information on the status of this report, please contact DrJ Certification.

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15 Approved for Use Pursuant to U.S. and International Legislation Defined in Appendix A

15.1 BASF HP+™ Wall E Series utilizing WALLTITE® LWP SPF with HFO Blowing Agents in Combination with NEOPOR® Graphite Polystyrene FPIS is included in this report published by an approved agency that is concerned with evaluation of products or services, maintains periodic inspection of the production of listed materials or periodic evaluation of services. This report states either that the material, product, or service meets recognized standards or has been tested and found suitable for a specified purpose. This report meets the legislative intent and definition of being acceptable to the AHJ.

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Appendix A

1 Legislation that Authorizes AHJ Approval

1.1 **Fair Competition**: State legislatures have adopted Federal regulations for the examination and approval of building code referenced and alternative products, materials, designs, services, assemblies and/or methods of construction that:

1.1.1 Advance Innovation,

1.1.2 Promote competition so all businesses have the opportunity to compete on price and quality in an open market on a level playing field unhampered by anticompetitive constraints, and

1.1.3 Benefit consumers through lower prices, better quality and greater choice.

1.2 **Adopted Legislation**: The following local, state and federal regulations affirmatively authorize this innovative product to be approved by AHJs, delegates of building departments and/or delegates of an agency of the federal government:

1.2.1 Interstate commerce is governed by the Federal Department of Justice to encourage the use of innovative products, materials, designs, services, assemblies and/or methods of construction. The goal is to "protect economic freedom and opportunity by promoting free and fair competition in the marketplace."

1.2.2 Title 18 US Code Section 242 affirms and regulates the right of individuals and businesses to freely and fairly have new products, materials, designs, services, assemblies and/or methods of construction approved for use in commerce. Disapproval of alternatives shall be based upon non-conformance with respect to specific provisions of adopted legislation and shall be provided in writing stating the reasons why the alternative was not approved, with reference to the specific legislation violated.

1.2.3 The federal government and each state have a public records act. In addition, each state also has legislation that mimics the federal Defend Trade Secrets Act 2016 (DTSA),[36] where providing test reports, engineering analysis and/or other related IP/TS is subject to prison of not more than ten years[37] and/or a $5,000,000 fine or 3 times the value of[38] the Intellectual Property (IP) and Trade Secrets (TS).

1.2.3.1 Compliance with public records and trade secret legislation requires approval through the use of Listings, certified reports, Technical Evaluation Reports, duly authenticated reports and/or research reports prepared by approved agencies and/or approved sources.

1.2.4 For new materials[39] that are not specifically provided for in any regulation, the design strengths and permissible stresses shall be established by tests, where suitable load tests simulate the actual loads and conditions of application that occur.

1.2.5 The design strengths and permissible stresses of any structural material shall conform to the specifications and methods of design using accepted engineering practice.[40]

1.2.6 The commerce of approved sources (i.e., registered PEs) is regulated by professional engineering legislation. Professional engineering commerce shall always be approved by AHJs, except where there is evidence provided in writing, that specific legislation have been violated by an individual registered PE.

1.2.7 The AHJ shall accept duly authenticated reports from approved agencies in respect to the quality and manner of use of new materials or assemblies as provided for in IBC Section 104.11.[41]

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1.3 **Approved**[42] **by Los Angeles**: The Los Angeles Municipal Code (LAMC) states in pertinent part that the provisions of LAMC are not intended to prevent the use of any material, device, or method of construction not specifically prescribed by LAMC. The Department shall use Part III, Recognized Standards in addition to Part II, Uniform Building Code Standards of Division 35, Article 1, Chapter IX of the LAMC in evaluation of products for approval where such standard exists for the product or the material and may use other approved standards that apply. Whenever tests or certificates of any material or fabricated assembly are required by Chapter IX of the LAMC, such tests or certification shall be made by a testing agency approved by the Superintendent of Building to conduct such tests or provide such certifications. The testing agency shall publish the scope and limitation(s) of the listed material or fabricated assembly.[43] The Superintendent of Building Approved Testing Agency Roster is provided by the Los Angeles Department of Building and Safety (LADBS). The Center for Building Innovation (CBI) Certificate of Approval License is TA24945. Tests and certifications found in a DrJ Listing are LAMC approved. In addition, the Superintendent of Building shall accept duly authenticated reports from approved agencies in respect to the quality and manner of use of new materials or assemblies as provided for in the California Building Code (CBC) Section 1707.1.[44]

1.4 **Approved by Chicago**: The Municipal Code of Chicago (MCC) states in pertinent part that an Approved Agency is a Nationally Recognized Testing Laboratory (NRTL) acting within its recognized scope and/or a certification body accredited by the American National Standards Institute (ANSI) acting within its accredited scope. Construction materials and test procedures shall conform to the applicable standards listed in the MCC. Sufficient technical data shall be submitted to the building official to substantiate the proposed use of any product, material, service, design, assembly and/or method of construction not specifically provided for in the MCC. This technical data shall consist of research reports from approved sources (i.e., MCC defined Approved Agencies).

1.5 **Approved by New York City**: The 2022 NYC Building Code (NYCBC) states in part that an approved agency shall be deemed[45] an approved testing agency via ISO/IEC 17025 accreditation, an approved inspection agency via ISO/IEC 17020 accreditation and an approved product evaluation agency via ISO/IEC 17065 accreditation. Accrediting agencies, other than federal agencies, must be members of an internationally recognized cooperation of laboratory and inspection accreditation bodies subject to a mutual recognition agreement[46] (i.e., ANAB, International Accreditation Forum (IAF), etc.).

1.6 **Approved by Florida**: Statewide approval of products, methods, or systems of construction shall be approved, without further evaluation by:

1.6.1 A certification mark or listing of an approved certification agency,

1.6.2 A test report from an approved testing laboratory,

1.6.3 A product evaluation report based upon testing or comparative or rational analysis, or a combination thereof, from an approved product evaluation entity, or

1.6.4 A product evaluation report based upon testing, comparative or rational analysis, or a combination thereof, developed, signed and sealed by a professional engineer or architect, licensed in Florida.

1.7 For local product approval, products or systems of construction shall demonstrate compliance with the structural wind load requirements of the Florida Building Code (FBC) through one of the following methods;

1.7.1 A certification mark, listing or label from a commission-approved certification agency indicating that the product complies with the code,

1.7.2 A test report from a commission-approved testing laboratory indicating that the product tested complies with the code,

1.7.3 A product-evaluation report based upon testing, comparative or rational analysis, or a combination thereof, from a commission-approved product evaluation entity which indicates that the product evaluated complies with the code,

1.7.4 A product-evaluation report or certification based upon testing or comparative or rational analysis, or a combination thereof, developed and signed and sealed by a Florida professional engineer or Florida registered architect, which indicates that the product complies with the code, or

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1.7.5 A statewide product approval issued by the Florida Building Commission.

1.8 The Florida Department of Business and Professional Regulation (DBPR) website provides a listing of companies certified as a Product Evaluation Agency (i.e., EVLMiami 13692), a Product Certification Agency (i.e., CER10642) and as a Florida Registered Engineer (i.e., ANE13741).

1.9 **Approved by Miami-Dade County (i.e., Notice of Acceptance [NOA])**: A Florida statewide approval is an NOA. An NOA is a Florida local product approval. By Florida law, Miami-Dade County shall accept the statewide and local Florida Product Approval as provided for in Florida legislation 553.842 and 553.8425.

1.10 **Approved by New Jersey**: Pursuant to the 2018 Building Code of New Jersey in IBC Section 1707.1 General,[47] it states: "*In the absence of approved rules or other approved standards, the building official shall accept duly authenticated reports from approved agencies in respect to the quality and manner of use of new materials or assemblies as provided for in the administrative provisions of the Uniform Construction Code (N.J.A.C. 5:23)*".[48] Furthermore N.J.A.C 5:23-3.7 states: "*Municipal approvals of alternative materials, equipment, or methods of construction*."

1.10.1 **Approvals**: Alternative materials, equipment, or methods of construction shall be approved by the appropriate subcode official provided the proposed design is satisfactory and that the materials, equipment, or methods of construction are suitable for the intended use and are at least the equivalent in quality, strength, effectiveness, fire resistance, durability and safety of those conforming with the requirements of the regulations.

1.10.1.1 A field evaluation label and report or letter issued by a nationally recognized testing laboratory verifying that the specific material, equipment, or method of construction meets the identified standards or has been tested and found to be suitable for the intended use, shall be accepted by the appropriate subcode official as meeting the requirements of the above.

1.10.1.2 Reports of engineering findings issued by nationally recognized evaluation service programs such as but not limited to, the Building Officials and Code Administrators (BOCA), the International Conference of Building Officials (ICBO), the Southern Building Code Congress International (SBCCI), the International Code Council (ICC) and the National Evaluation Service, Inc., shall be accepted by the appropriate subcode official as meeting the requirements of the above.

1.10.2 The New Jersey Department of Community Affairs has confirmed that technical evaluation reports, from any accredited entity listed by ANAB, meets the requirements of item the previous paragraph, given that the listed entities are no longer in existence and/or do not provide "*reports of engineering findings*".

1.11 **Approved by the Code of Federal Regulations Manufactured Home Construction and Safety Standards**: Pursuant to Title 24, Subtitle B, Chapter XX, Part 3282.14[49] and Part 3280,[50] the Department encourages innovation and the use of new technology in manufactured homes. The design and construction of a manufactured home shall conform to the provisions of Part 3282 and Part 3280 where key approval provisions in mandatory language follow:

1.11.1 "*All construction methods shall be in conformance with accepted engineering practices*"

1.11.2 "*The strength and rigidity of the component parts and/or the integrated structure shall be determined by engineering analysis or by suitable load tests to simulate the actual loads and conditions of application that occur.*"

1.11.3 "*The design stresses of all materials shall conform to accepted engineering practice.*"

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1.12 **Approval by US, Local and State Jurisdictions in Genera**l: In all other local and state jurisdictions, the adopted building code legislation states in pertinent part that:

1.12.1 For new materials that are not specifically provided for in this code, the design strengths and permissible stresses shall be established by tests.[51]

1.12.2 For innovative alternatives and/or methods of construction, the building official shall accept duly authenticated reports from approved agencies with respect to the quality and manner of use of new materials or assemblies.[52]

1.12.2.1 An approved agency is "approved" when it is ANAB ISO/IEC 17065 accredited. DrJ Engineering, LLC (DrJ) is in the ANAB directory.

1.12.2.2 An approved source is "approved" when an RDP is properly licensed to transact engineering commerce. The regulatory authority governing approved sources is the state legislature via its professional engineering regulations.[53]

1.12.3 The design strengths and permissible stresses of any structural material…shall conform to the specifications and methods of design of accepted engineering practice performed by an approved source.[54]

1.13 **Approval by International Jurisdictions**: The USMCA and GATT agreements provide for approval of innovative materials, designs, services and/or methods of construction through the Agreement on Technical Barriers to Trade and the IAF Multilateral Recognition Arrangement (MLA), where these agreements:

1.13.1 State that conformity assessment procedures (i.e., ISO/IEC 17020, 17025, 17065, etc.) are prepared, adopted and applied so as to grant access for suppliers of like products originating in the territories of other Members under conditions no less favourable than those accorded to suppliers of like products of national origin or originating in any other country, in a comparable situation.

1.13.2 **Approved**: The purpose of the MLA is to ensure mutual recognition of accredited certification and validation/verification statements between signatories to the MLA and subsequently, acceptance of accredited certification and validation/verification statements in many markets based on one accreditation for the timely approval of innovative materials, designs, services and/or methods of construction.

1.13.3 ANAB is an IAF-MLA signatory where recognition of certificates, validation and verification statements issued by conformity assessment bodies accredited by all other signatories of the IAF MLA, with the appropriate scope, shall be approved.[55]

1.13.4 Therefore, all ANAB ISO/IEC 17065 Duly Authenticated Reports are approval equivalent.[56]

1.14 Approval equity is a fundamental commercial and legal principle.[57]

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Notes

1 For more information, visit drjcertification.org or call us at 608-310-6748.

2 https://up.codes/viewer/wyoming/ibc-2021/chapter/17/special-inspections-and-tests#1702

3 Alternative Materials, Design and Methods of Construction and Equipment: The provisions of any regulation code are not intended to prevent the installation of any material or to prohibit any design or method of construction not specifically prescribed by a regulation. Please review https://www.justice.gov/atr/mission and https://up.codes/viewer/colorado/ibc-2021/chapter/1/scope-and-administration#104.11

4 https://up.codes/viewer/wyoming/ibc-2021/chapter/17/special-inspections-and-tests#1706:~:text=the%20design%20strengths%20and%20permissible%20stresses%20shall%20be%20established%20by%20tests%20as

5 The design strengths and permissible stresses of any structural material shall conform to the specifications and methods of design of accepted engineering practice. https://up.codes/viewer/wyoming/ibc-2021/chapter/17/special-inspections-and-tests#1706:~:text=shall%20conform%20to%20the%20specifications%20and%20methods%20of%20design%20of%20accepted%20engineering%20practice

6 https://up.codes/viewer/wyoming/ibc-2021/chapter/17/special-inspections-and-tests#1707.1:~:text=the%20building%20official%20shall%20accept%20duly%20authenticated%20reports%20from%20approved%20agencies

7 https://up.codes/viewer/wyoming/ibc-2021/chapter/17/special-inspections-and-tests#1703.4.2

8 https://up.codes/viewer/wyoming/ibc-2021/chapter/2/definitions#approved_agency

9 https://up.codes/viewer/wyoming/ibc-2021/chapter/2/definitions#approved_source

10 https://www.law.cornell.edu/uscode/text/18/1832 (b) Any organization that commits any offense described in subsection (a) shall be fined not more than the greater of $5,000,000 or 3 times the value of the stolen trade secret to the organization, including expenses for research and design and other costs of reproducing the trade secret that the organization has thereby avoided. The federal government and each state have a public records act. To follow DTSA and comply state public records and trade secret legislation requires approval through ANAB ISO/IEC 17065 accredited certification bodies or approved sources. For more information, please review this website: Intellectual Property and Trade Secrets.

11 https://www.nspe.org/resources/issues-and-advocacy/professional-policies-and-position-statements/regulation-professional AND https://apassociation.org/list-of-engineering-boards-in-each-state-archive/

12 https://www.cbitest.com/accreditation/

13 https://up.codes/viewer/colorado/ibc-2021/chapter/1/scope-and-administration#104:~:text=to%20enforce%20the%20provisions%20of%20this%20code

14 https://up.codes/viewer/colorado/ibc-2021/chapter/1/scope-and-administration#104.11:~:text=Where%20the%20alternative%20material%2C%20design%20or%20method%20of%20construction%20is%20not%20approved%2C%20the%20building%20official%20shall%20respond%20in%20writing%2C%20stating%20the%20reasons%20why%20the%20alternative%20was%20not%20approved AND https://up.codes/viewer/colorado/ibc-2021/chapter/1/scope-and-administration#105.3.1:~:text=If%20the%20application%20or%20the%20construction%20documents%20do%20not%20conform%20to%20the%20requirements%20of%20pertinent%20laws%2C%20the%20building%20official%20shall%20reject%20such%20application%20in%20writing%2C%20stating%20the%20reasons%20therefore

15 https://up.codes/viewer/colorado/ibc-2021/chapter/17/special-inspections-and-tests#1707.1:~:text=the%20building%20official%20shall%20accept%20duly%20authenticated%20reports%20from%20approved%20agencies%20in%20respect%20to%20the%20quality%20and%20manner%20of%20use%20of%20new%20materials%20or%20assemblies%20as%20provided%20for%20in%20Section%20104.11

16 https://iaf.nu/en/about-iaf-mla/#:~:text=it%20is%20required%20to%20recognise%20certificates%20and%20validation%20and%20verification%20statements%20issued%20by%20conformity%20assessment%20bodies%20accredited%20by%20all%20other%20signatories%20of%20the%20IAF%20MLA%2C%20with%20the%20appropriate%20scope

17 True for all ANAB accredited product evaluation agencies and all International Trade Agreements.

18 https://www.justice.gov/crt/deprivation-rights-under-color-law AND https://www.justice.gov/atr/mission

19 Unless otherwise noted, all references in this Listing are from the 2021 version of the codes and the standards referenced therein. This material, product, design, service and/or method of construction also complies with the 2000-2021 versions of the referenced codes and the standards referenced therein.

20 https://www.ecfr.gov/current/title-24/subtitle-B/chapter-XX/part-3280#p-3280.2(Listed%20or%20certified); https://up.codes/viewer/colorado/ibc-2021/chapter/2/definitions#listed AND https://up.codes/viewer/colorado/ibc-2021/chapter/2/definitions#labeled

21 2018 IRC Table R301.2(2)

22 2018 IRC Table R301.2(3)

23 2015 IBC Section 1405.2

24 https://up.codes/viewer/colorado/ibc-2021/chapter/17/special-inspections-and-tests#1703.4

25 https://www.ecfr.gov/current/title-24/subtitle-B/chapter-XX/part-3280#:~:text=All%20construction%20methods%20shall%20be%20in%20conformance%20with%20accepted%20engineering%20practices%20to%20insure%20durable%2C%20livable%2C%20and%20safe%20housing%20and%20shall%20demonstrate%20acceptable%20workmanship%20reflecting%20journeyman%20quality%20of%20work%20of%20the%20various%20trades

26 https://www.ecfr.gov/current/title-24/subtitle-B/chapter-XX/part-3280#:~:text=The%20strength%20and%20rigidity%20of%20the%20component%20parts%20and/or%20the%20integrated%20structure%20shall%20be%20determined%20by%20engineering%20analysis%20or%20by%20suitable%20load%20tests%20to%20simulate%20the%20actual%20loads%20and%20conditions%20of%20application%20that%20occur

27 2010 ASCE 7 Section 12.2.1

28 Qualification is performed by a legislatively defined Accreditation Body. ANSI National Accreditation Board (ANAB) is the largest independent accreditation body in North America and provides services in more than 75 countries. DrJ is an ANAB accredited product certification body.

29 See Code of Federal Regulations (CFR) Title 24 Subtitle B Chapter XX Part 3280 for definition.

30 2018 IFC Section 104.9

31 Approved is an adjective that modifies the noun after it. For example, Approved Agency means that the Agency is accepted officially as being suitable in a particular situation. This example conforms to IBC/IRC/IFC Section 201.4 where the building code authorizes sentences to have an ordinarily accepted meaning such as the context implies.

32 https://up.codes/viewer/wyoming/ibc-2021/chapter/17/special-inspections-and-tests#1707.1

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33 Multilateral approval is true for all ANAB accredited product evaluation agencies and all International Trade Agreements.
34 2018 IBC Section 1705.12
35 2018 IBC Section 1705.11
36 http://www.drjengineering.org/AppendixC AND https://www.drjcertification.org/cornell-2016-protection-trade-secrets
37 https://www.law.cornell.edu/uscode/text/18/1832#:~:text=imprisoned%20not%20more%20than%2010%20years
38 https://www.law.cornell.edu/uscode/text/18/1832#:~:text=Any%20organization%20that,has%20thereby%20avoided
39 https://up.codes/viewer/wyoming/ibc-2021/chapter/17/special-inspections-and-tests#1706.2
40 IBC 2021, Section 1706.1 Conformance to Standards
41 IBC 2021, Section 1707 Alternative Test Procedure, 1707.1 General
42 See Section 11 for the distilled building code definition of **Approved**
43 Los Angeles Municipal Code, SEC. 98.0503. TESTING AGENCIES
44 https://up.codes/viewer/california/ca-building-code-2022/chapter/17/special-inspections-and-tests#1707.1
45 New York City, The Rules of the City of New York, § 101-07 Approved Agencies
46 New York City, The Rules of the City of New York, § 101-07 Approved Agencies
47 https://up.codes/viewer/new_jersey/ibc-2018/chapter/17/special-inspections-and-tests#1707.1
48 https://www.nj.gov/dca/divisions/codes/codreg/ucc.html
49 https://www.ecfr.gov/current/title-24/subtitle-B/chapter-XX/part-3282/subpart-A/section-3282.14
50 https://www.ecfr.gov/current/title-24/subtitle-B/chapter-XX/part-3280
51 IBC 2021, Section 1706 Design Strengths of Materials, 1706.2 New Materials. Adopted law pursuant to IBC model code language 1706.2.
52 IBC 2021, Section 1707 Alternative Test Procedure, 1707.1 General. Adopted law pursuant to IBC model code language 1707.1.
53 https://www.nspe.org/resources/issues-and-advocacy/professional-policies-and-position-statements/regulation-professional AND https://apassociation.org/list-of-engineering-boards-in-each-state-archive/
54 IBC 2021, Section 1706 Design Strengths of Materials, Section 1706.1 Conformance to Standards Adopted law pursuant to IBC model code language 1706.1.
55 https://iaf.nu/en/about-iaf-mla/#:~:text=it%20is%20required%20to%20recognise%20certificates%20and%20validation%20and%20verification%20statements%20issued%20by%20conformity%20assessment%20bodies%20accredited%20by%20all%20other%20signatories%20of%20the%20IAF%20MLA%2C%20with%20the%20appropriate%20scope
56 True for all ANAB accredited product evaluation agencies and all International Trade Agreements.
57 https://www.justice.gov/crt/deprivation-rights-under-color-law AND https://www.justice.gov/atr/mission

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