

UL Evaluation Report

UL ER5817-02

Issued: October 02, 2014

Revised: July 27 , 2018

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UL Category Code: ULEX

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DIVISION: 07 00 00 – THERMAL AND MOISTURE PROTECTION

Sub-level 2: 07 20 00 - Thermal Protection

Sub-level 3: 07 21 00 - Thermal Insulation

COMPANY:

BASF CORP STYRENIC FOAMS DIV

1609 BIDDLE AVE

WYANDOTTE, MI 48192

<http://www.neopor.basf.us>

1. SUBJECT:

Polystyrene beads designated Neopor F5 Pro, F2200, F2300, F2400, F5300, F5300 Plus, F5200 Plus, KF2200, KF2300, KF2300S, KF2400

2. SCOPE OF EVALUATION

- 2015, 2012, 2009 and 2006 *International Building Code* ® (IBC)
- 2015, 2012, 2009 and 2006 *International Residential Code* ® (IRC)
- 2015, 2012 *International Green Construction Code* ® (IgCC)
- ICC-ES Acceptance Criteria for Foam Plastic Insulation (AC12), dated June 2012
- ICC ES Acceptance Criteria for Quality Documentation (AC10), Dated June 2014

Underwriters Laboratories Inc.
333 Pfingsten Road, Northbrook, IL 60062-2096 USA
T: 847.272.8800 / F: 847.272.8129 / W: UL.com



The products were evaluated for the following properties:

- Surface Burning Characteristics (ANSI/UL723, ASTM E84)
- Physical Properties (ASTM C578)
- Roofing Systems for Exterior Fire Exposure (ANSI/UL790, ASTM E108)
- Roof Deck Construction Material With Resistance to Internal Fire Exposure (ANSI/UL1256)
- Flammability Testing for Use in Attics and Crawl Spaces (AC12, App. A and B)
- For Use on Exterior Commercial Walls (NFPA 285)
- Material Emissions (UL2818 and California Department of Public Health, CDPH/EHLB/Standard Method V.1.1)

Throughout this report, unless specifically indicated otherwise, the reference to NEOPOR Expandable Polystyrene Resins will apply to all EPS Resins described above.

3. REFERENCED DOCUMENTS

- ICC-ES Acceptance Criteria for Foam Plastic Insulation (AC12), dated June 2012
- ICC-ES Acceptance Criteria for Quality Documentation (AC10), dated June 2014
- ANSI/UL723 (ASTM E84), Test for Surface Burning Characteristics of Building Materials
- ANSI/UL790 (ASTM E108), Standard Test Methods for Fire Tests of Roof Coverings
- ANSI/UL1256, Standard for Fire Test of Roof Deck Constructions
- ASTM C578, Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation
- UL2818, GREENGUARD Certification Program for Chemical Emissions for Building Materials, Finishes and Furnishings
- NFPA 285, Standard Fire Test for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Assemblies Containing Combustible Components
- California Department of Public Health, CDPH/EHLB/Standard Method V.1.1

4. USES

The expandable polystyrene resins designated as BASF NEOPOR are used by independent manufacturers to produce expanded polystyrene (EPS) insulation products. See [Table 6](#) for a list of molders under the BASF Neopor Brand Marketing Agreement that utilize BASF NEOPOR resins in their UL Certified end-use products.

5. PRODUCT DESCRIPTION

EPS insulation products manufactured with expandable polystyrene resins are produced through the introduction of heat, without other additives. The process expands the resins, which are then molded into insulation products at the densities and thicknesses specified in this report. Finished boards manufactured from these resins at the maximum densities and thicknesses indicated in Table 1 are qualified to bear a label with a flame-spread index of 25 or less and a smoke-developed index of 450 or less when tested in accordance with ANSI/UL723 (ASTM E84), provided the finished boards are listed and labeled by an approved agency.

NEOPOR expandable polystyrene resins have been qualified in accordance with Section 4.5.15.1.1 of the ICC-ES Acceptance Criteria for Foam Plastic Insulation (AC12). The resins can be used to produce EPS insulation products that comply with the ASTM C578 properties described in Table 2, provided the finished EPS insulation products are listed and labeled by an approved agency.

NEOPOR expandable polystyrene resins have been qualified for use in producing EPS insulation products as a roofing insulation as follows:

- As part of a UL Classified Class A, B or C roof-covering assembly in accordance with UL 790, and
- As part of a UL Classified Roof Deck Construction in accordance with UL 1256

NEOPOR expandable polystyrene resins have been qualified for use in producing EPS insulation products on the exterior of above grade walls as follows:

- Exterior Walls of One- and Two-Family Dwellings in accordance with the 2012 IRC,
- Exterior walls of one story buildings of Types I, II, III, or IV construction in accordance with Section 2603.4.1.4 of the IBC,
- Exterior walls of Type V construction in accordance with Section 2603.2, 2603.3, and 2603.4 of the IBC, or
- Exterior walls of buildings more than one story of Types I, II, III, or IV construction in accordance with Section 2603.5 of the IBC, when part of a UL Classified Exterior Wall System in accordance with NFPA 285. See Table 4

NEOPOR expandable polystyrene resins have been found to comply with IgCC Section 806.6 for insulation for material emissions and Section A108.5 Total VOC limit project elective. Refer to UL's [GREENGUARD GOLD](#) certification of these products.

Table 1a – Maximum Insulation Board Density and Thickness for UL723

BEAD TYPE	MAXIMUM DENSITY (lb/ft ³)	MAXIMUM THICKNESS (In.)	Flame Spread *	Smoke Developed *
Neopor F2200, F2300, F2400, F5200 Plus, F5300, and F5300 Plus, KF2200, KF2300, KF2300S, KF2400	2.0	6	5	25

Flame spread and smoke developed recorded while material remained in the original test position. Ignition of molten residue on the furnace floor resulted in flame travel equivalent to calculated flame spread index of 175 and smoke developed index of over 500.

Table 1b – Maximum Insulation Board Density and Thickness for UL723

BEAD TYPE	MAXIMUM DENSITY (lb/ft ³)	MAXIMUM THICKNESS (In.)	Flame Spread *	Smoke Developed *
Neopor F5 Pro	3.0	6	25	40

Flame spread and smoke developed recorded while material remained in the original test position. Ignition of molten residue on the furnace floor resulted in flame travel equivalent to calculated flame spread index of 175 and smoke developed index of over 500.

Table 2 – ASTM C578 Physical Property Requirements⁽¹⁾

Bead Type	Type XI	Type I	Type VIII	Type II	Type II – High Density⁽²⁾	Type IX	Type XIV	Type XV
Neopor F2200, F2300, F2400			X	X	X	X		
Neopor KF2200, KF2300S, KF 2300, KF2400, F5300, F5300 Plus		X	X	X	X	X		
Neopor F5 Pro						X	X	X
Neopor F5200 Plus	X	X	X	X	X	X		
Compressive Resistance, min, psi	5.0	10.0	13.0	15.0	20.0	25.0	40.0	60.0
Flexural Strength, min, psi	10.0	25.0	30.0	35.0	40.0	50.0	60.0	75.0
Water Vapor Permeance of 1.00 in. thickness, max. perm	5.0	5.0	3.5	3.5	3.5	2.5	2.5	2.5
Water Absorption by total immersion, max, volume %	4.0	4.0	3.0	3.0	3.0	2.0	2.0	2.0
Dimensional Stability (change in dimensions), max, %	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Oxygen Index, min, volume %	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0
Density, min, lb/ft ³	0.70	0.90	1.15	1.35	1.45	1.80	2.40	3.0

(1) Refer to the Standard, ASTM C578 for further information on the requirements for Rigid, Cellular Polystyrene Thermal Insulation

(2) This Type II is not in ASTM C578 but is marketed as a higher density material of the ASTM C578 Type II by the manufacturer.

Table 3a – Minimum Density and R-Value – Neopor F5 Pro¹, F2200, F2300, F2400, F5300, KF2200, KF2300, KF2300S, and KF2400

ASTM C578 EPS TYPE	MINIMUM DENSITY (pcf)	R-VALUE (F•ft²•h/Btu) Mean temperature: 75° (minimum) *
I	0.90	4.5
VIII	1.15	4.5
II	1.35	4.5
II – High Density	1.45	4.6
IX	1.80	4.6
XIV ¹	2.40	4.5
XV ¹	3.0	4.4

*Thermal resistance (R-values) are based on tested values at 1.00 inch thickness at 75°F average temperature and must be multiplied by the installed thickness.

¹Denotes F5 Pro for Types XIV and XV only

Table 3b – Minimum Density and R-Value – Neopor F5300 Plus, F5200 Plus

ASTM C578 EPS TYPE	MINIMUM DENSITY (pcf)	R-VALUE (F•ft²•h/Btu) Mean temperature: 75° (minimum) *	R-VALUE (F•ft²•h/Btu) Mean temperature: 75° (minimum) **
XI	0.70	4.9	4.6
I	0.90	5.0	4.7
VIII	1.15	5.0	4.7
II	1.35	5.0	4.7
II – High Density	1.45	5.0	4.7
IX	1.80	5.0	4.7

*Thermal resistance (R-value) is based on tested values at 1.06-inch thickness at 75°F average temperature and must be multiplied by the installed thickness.

**Thermal resistance (R-value) is based on tested values at 1.00-inch thickness at 75°F average temperature and must be multiplied by the installed thickness.

Table 4 – NFPA 285 Compliant Assembly Options

Wall Component	Options
Base Wall Use 1, 2 or 3	1) Cast Concrete Walls 2) CMU Cast Concrete Walls 3) 20 GA (min), 3- $\frac{5}{8}$ in. (min) to 6 in. (max) steel studs spaced 24 in. OC, lateral bracing spaced every 4 ft. vertically
Interior Stud Sheathing	1) $\frac{5}{8}$ in. (min) thick Type X Gypsum Wallboard
Fire Stopping at Floor Lines	1) 4 in. thick, 4.0 pcf density mineral fiber insulation in each stud cavity at floor line, full depth of stud cavity and friction fit
Stud Cavity Insulation Use 1, 2, 3, 4, or 5 Note: Use option 1, 3, 4, or 5 only if exterior sheathing option 1 is used.	1) None 2) Mineral fiber insulation (full stud depth required when no exterior sheathing is used) 3) Any faced or unfaced fiberglass matt or non-combustible insulation 4) BASF Spray Foam Spraytite 178 (up to full cavity depth) 5) BASF Walltite® HP+, Walltite® US, Walltite® US-N, Spraytite® 81206 spray applied foam plastic insulation, up to full cavity depth or partial fill with a maximum 1 in. air gap
Exterior Sheathing Use 1 or 2 Note: Item 2 (None) may only be used when stud cavity insulation is item 2 (mineral fiber insulation – full depth)	1) $\frac{1}{2}$ in. (min) exterior-grade glass mat gypsum board 2) None when utilizing Item 2 Stud Cavity Insulation
Weather Resistive Barrier over Exterior Sheathing Surface Use 1 or 2	1) None 2) Any of the following, applied per individual manufacturer instruction: - BASF Enershield HP or Enershield I - Tremco EXOAir 130 or EXOAir 230 - Grace Perm-A-Barrier VPS, AWM, VPL, NPS, NPL, NPL 10, VPL LT - CCW Barritech NP, VP, VP LT, FireResist 705VP or FireResist 705FR-A - Prosoco R-Guard Car-5, R-Guard VB, R-Guard MVP (NLA), R-Guard Spray Wrap (NLA), R-Guard Spraywrap MVP Note: NLA = No Longer Available, but may be used if needed. - Henry VP160, Air Bloc 21 FR, Air Bloc 33MR, or Air Bloc 31 MR - STO Emerald Coat - Dow Corning DefendAir 200 Low Temp (now known only as DefendAir 200) - Hohmann & Barnard Enviro-Barrier VP or Enviro-Barrier

Table 4 (cont.) – NFPA 285 Compliant Assembly Options

Exterior Insulation Use 1, 2, 3 or 4	1) 10 in. (max) thick, 1 pcf, BASF Neopor® Expanded Polystyrene Insulation 2) 8 in. (max) thick, 1-¼ pcf, BASF Neopor® Expanded Polystyrene Insulation 3) 6.7 in. (max) thick, 1-½ pcf, BASF Neopor® Expanded Polystyrene Insulation 4) 5 in. (max) thick, 2 pcf, BASF Neopor® Expanded Polystyrene Insulation
Weather Resistive Barrier Over Exterior Insulation Use 1 or 2 Apply using manufacturer instructions.	1) None 2) Tyvek Commercial Wrap (1 layer)
Exterior Cladding Use 1, 2, 3, 4, 5 or 6 Note: Cladding items 1-5 may use maximum 2 in. air gap between cladding and exterior insulation.	1) Brick – 4 in. (nom) clay brick with brick ties spaced 24 in. (max) OC horizontally and 16 in. (max) OC vertically 2) Concrete – 2 in. (min) thick 3) Concrete Masonry Units – 2 in. (min) thick 4) Natural Stone Veneer – 2 in. (min) thick installed using any standard non-open joint installation technique 5) Terracotta Cladding – 1-¼ in. (min) thick installed using any standard non-open joint installation technique 6) Stucco – ¾ in. (min) thick exterior cement plaster lath
Window Header Use 1 or 2 Note: 25 GA sheet steel caps the mineral fiber or wood	1) 25 GA (min) sheet steel with 1 in. (min) mineral fiber insulation 2) 25 GA (min) sheet steel with 2 layers (min) of ¾ in. plywood or 1-½ in. solid lumber
Window Jambs Use 1 or 2 Note: 25 GA sheet steel caps the mineral fiber	1) 25 GA (min) thick sheet steel with 1 in. mineral fiber insulation

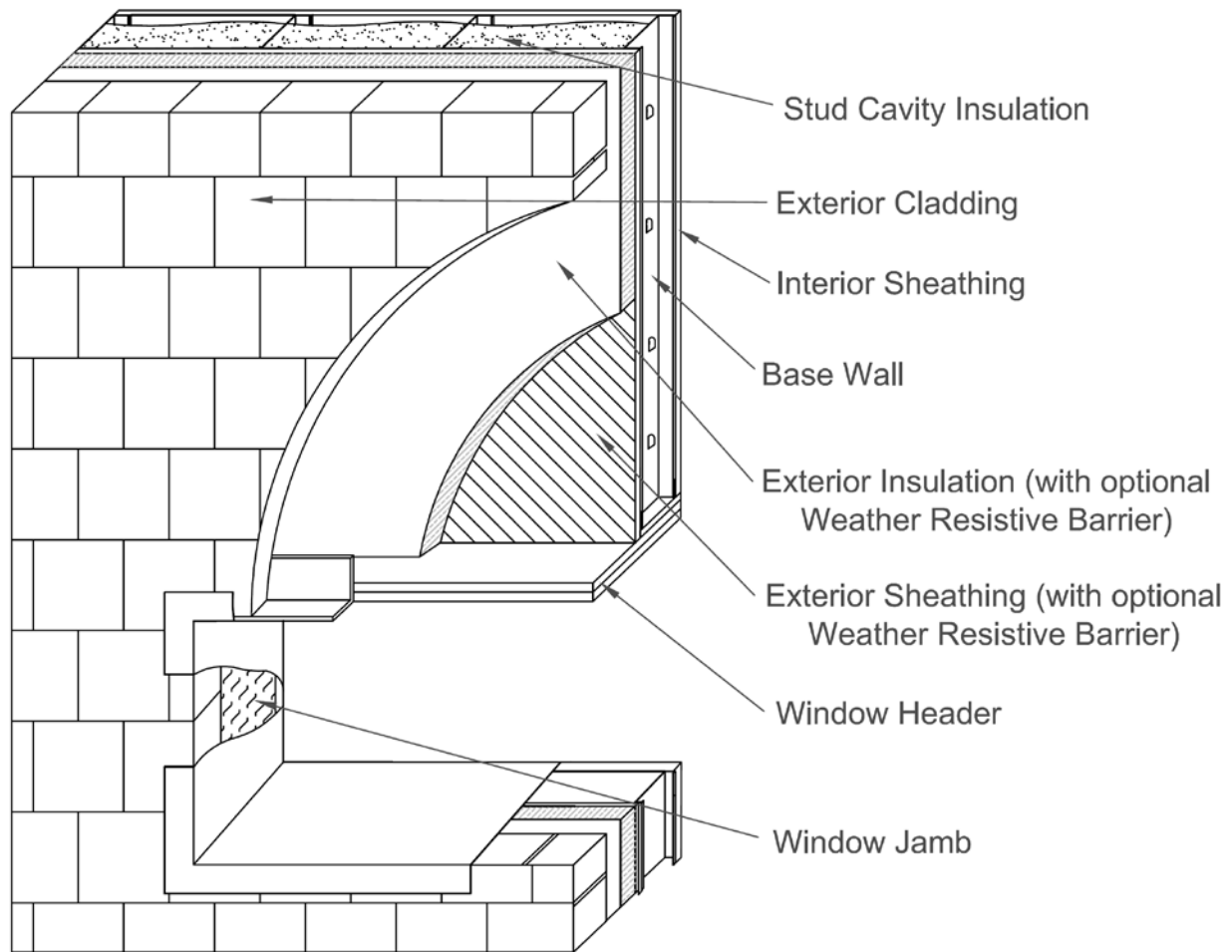


Figure 1 – BASF NFPA 285 Wall Design

6. INSTALLATION

6.1 General:

Installation of finished EPS insulation products manufactured from NEOPOR expandable polystyrene resins must be installed in accordance with the finished EPS manufacturer's installation instructions and in accordance with IBC Section 2603 of the 2015, 2012, 2009 or 2006 code, IRC Section R316 of the 2015, 2012 and 2009 code, and/or Section R314 of the 2006 code, as applicable.

6.2 Attics and Crawl Spaces:

Finished EPS insulation boards produced from NEOPOR resins may be used on walls of attics and crawl spaces at maximum thicknesses described in Table 5, without the coverings specified in IBC Section 2603.4.1.6 of the 2015, 2012, 2009 or 2006 code, or IRC Sections R316.5.3 or R316.5.4 of the 2015, 2012 and 2009 code or R314.5.3 or R314.5.4 of the 2006 code, as applicable, provided all of the following conditions are met:

- Entry to the attic or crawl space is only for service utilities, and no storage is permitted.
- There are no interconnected attic or crawl space areas.
- Air in the attic or crawl space must not be circulated to other parts of the building.
- Attic ventilation is provided when required by IBC Section 1203.2 of the 2015, 2012, 2009 or 2006 code or IRC Section R806 of the 2015, 2012, 2009 or 2006 code, as applicable. Under-floor (crawl space) ventilation is provided when required by IBC Section 2304.11.9 of the 2015, 2012, 2009 or 2006 code or, IRC Section R408.1 of the 2015, 2012, 2009 or 2006 code, as applicable.
- Combustion air is provided in accordance with Section 701 of the 2015, 2012 and 2009 IMC or Sections 701 and 703 of the 2006 IMC.

Table 5 – Type and Maximum Thickness for EPS Products Used in Attics and Crawl Spaces

NEOPOR GRADE DESIGNATION	ASTM C578 EPS TYPE	MAXIMUM THICKNESS (INCHES)
F5 PRO, F5300, F5300 PLUS, F5200 PLUS, KF2200, KF2300, KF2300S, KF2400	I	4.0
F2200, F2300, F2400, F5300, F5300 PLUS, F5200 PLUS KF2200, KF2300, KF2300S, KF2400	VIII	3.2
F2200, F2300, F2400, F5300, F5300 PLUS, F5200 PLUS KF2200, KF2300, KF2300S, KF2400	II	2.66
F5 PRO, F2200, F2300, F2400, F5300, F5300 PLUS, F5200 PLUS KF2200, KF2300, KF2300S, KF2400	IX	2.0
F5 PRO	XIV	1.5
F5 PRO	XV	1.2

6.3 Exterior Insulation and Finish Systems (EIFS):

Finished EPS insulation boards produced from NEOPOR resins may be used as a component of the BASF Corporation – Wall Systems [Senerflex Platinum CI](#), [Pebbletex Platinum CI](#) and [Acrotex Platinum CI](#) EIFS when installed in compliance with IBC Section 1408 of the 2015, 2012 and 2009 code or IRC Section R703.9 of the 2015, 2012 and 2009 code, as applicable.

6.4 Stucco with Continuous Insulation

Finished EPS insulation boards produced from NEOPOR resins may be used as a component of the BASF Corporation – Wall Systems [Senergy](#), [Finestone](#) and [Acrocrete](#) Platinum CI Stucco, Platinum CI Stucco Plus and Platinum CI Stucco Ultra systems when evaluated for that purpose.

7. CONDITIONS OF USE

The BASF NEOPOR expandable polystyrene resins described in this report comply with, or are suitable alternatives to what is specified in, those codes listed in Section 2 of this report, subject to the following conditions:

- 7.1 The density and thickness of the insulation boards must be as noted in Sections 5 and 6 of this report.
- 7.2 Finished EPS insulation products manufactured from the resins must be listed and labeled by an approved agency.
- 7.3 Except as noted in Section 6.2 of this report, finished insulation products manufactured from the resins must be separated from the building interior by a thermal barrier complying with IBC Section 2603.4 of the 2015, 2012, 2009 or 2006 code, IRC Section R316.4 of the 2015, 2012 and 2009 code and/or Section R314.4 of the 2006 IRC, as applicable.
- 7.4 For a listing of applicable UL Certifications for EPS boards manufactured from NEOPOR expandable polystyrene resins, see the Online Certifications Directory for the following categories.
 - See UL Online Certifications Directory for Foamed Plastic, UL Classified for Surface Burning Characteristics in accordance with UL723 ([BRYX](#)).
 - See UL Online Certifications Directory for Foamed Plastic, Component ([BRYX2](#)).
 - See UL Online Certifications Directory for Polystyrene Thermal Insulation, Rigid Cellular, UL Classified in accordance with ASTM C578 ([QORW](#)).
 - See UL Online Certifications Directory for Class A, B or C roof-covering assemblies UL Classified in accordance with UL 790 ([TGFU](#)).
 - See UL Online Certifications Directory for Roof Deck Constructions for assemblies UL Classified in accordance with UL 1256 ([TJBX](#)):
 - See UL Online Certifications Directory for Exterior Walls for assemblies UL Classified in accordance with NFPA 285 (FWFO):
 - o Exterior Wall System [EWS0025](#)
 - o Exterior Wall System [EWS0026](#)
- 7.5 See UL GREENGUARD Certification, [GreenGuard Neopor](#)
- 7.6 The resins are produced by BASF SE in Ludwigshafen, Germany and BASF BK in Ulsan, South Korea under the UL LLC Recognition and Follow-Up Service Program, which includes regular audits in accordance with quality elements of ICC-ES Acceptance Criteria for Quality Documentation, AC 10.

8. SUPPORTING EVIDENCE

- 8.1 Data in accordance with ICC-ES Acceptance Criteria for Foam Plastic Insulation (AC12), dated June 2012, including data in accordance with Appendix A and B of AC12.

- 8.2** UL Certifications for finished EPS boards manufactured from BASF NEOPOR resins in accordance with UL 723, ASTM C578, UL 790, UL 1256, and NFPA 285. See UL Product Certification Categories (BRYX), (QORW), (TGFU), (TJBX), and (FWFO) respectively, as described in 7.4.
- 8.4** GREENGUARD Certification for Material Emissions. See UL GREENGUARD Certification, [GreenGuard Neopor](#).
- 8.5** Documentation of quality system elements described in AC10.

9. IDENTIFICATION

The BASF NEOPOR expandable polystyrene resins described in this evaluation report are identified by a marking bearing the report holder's name (BASF Corp), the plant identification, the UL Component Recognition Mark, and the evaluation report number UL ER5817-02. The validity of the evaluation report is contingent upon this identification appearing on the product.

10. BASF AND MOLDER NEOPOR BRAND MARKETING AGREEMENT

[Table 6](#) – List of Approved Molders Under the BASF NEOPOR Brand Marketing Agreement

Manufacturer	ASTM C578 Types	Manufacturer's ID
Insulfoam, A Div. of Carlisle Construction Materials Inc 19727 57 th Ave E Puyallup, WA 98375-2703	I, VIII, II and IX	I-61
Insulfoam, A Div. of Carlisle Construction Materials Inc 12601 E 33 rd Ave Ste 114 Aurora, CO 80011-1839	I, VIII, II and IX	I-42
FMI-EPS, LLC 9456 North McGuire Rd. Post Falls, ID 83854	I, VIII, II and IX	Post Falls, ID
Progressive Foam Technologies, Inc 1 Southern Gateway Dr. Gnadenhutten, OH 44629	I, VIII, and XI	Gnadenhutten, OH
Progressive Foam Technologies, Inc 6753 Chestnut Ridge Rd. Beach City, OH 44608	I and VIII	Beach City, OH
Perma R Products Inc. 109 Perma R Rd. Johnson City, TN 37604-9328	I, VIII and IX	Johnson City, TN
Perma R Products Inc. PO Box 279 Grenada, MS 38902-0279	I, VIII and IX	Grenada, MS
ACH Foam Technologies LLC 2731 White Sulphur Rd. Gainesville, GA 30501-7540	I, VIII, II, IX, and II-High Density	U-04
Star R Foam Inc. 3220 Ave. F Arlington, TX 76011	I, VIII, II, IX, and II-High Density	Arlington, TX

Table 6 – List of Approved Molders Under the BASF NEOPOR Brand Marketing Agreement (continued)

Manufacturer	ASTM C578 Types	Manufacturer's ID
Star R Foam Inc. 4555 Olympic Way Kingman, AZ 86401	I, VIII, II, IX, and II-High Density	Kingman, AZ
Atlas EPS, Div. of Atlas Roofing Corp. 8240 Byron Center Rd. Byron Center, MI 49315	I, VIII, II, IX, and II-High Density,	Byron Center, MI
Atlas EPS, Div. of Atlas Roofing Corp. 455 Industrial Park Dr. Ridgeway, VA 24148	I, VIII, II, IX, and II-High Density,	Ridgeway, VA

11. USE OF UL EVALUATION REPORT

- 11.1** The approval of building products, materials or systems is under the responsibility of the applicable authorities having jurisdiction.
- 11.2** UL Evaluation Reports shall not be used in any manner that implies an endorsement of the product, material or system by UL.
- 11.3** The status of this report, as well as a complete directory of UL Evaluation Reports may be found at UL.com via our On-Line Certifications Directory at www.ul.com/erdirectory.

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