



NEMO|etc.

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ENGINEER

TEST

CONSULT

P.E. EVALUATION REPORT (PEER)

GAF

1 Campus Drive
Parsippany, NJ 07054
(800) 766-3411

PEER-GAF-003.B.R23

FL11946-R26 (HVHZ)

Date of Issuance: 12/18/2013

Revision 23: 08/19/2025

SCOPE:

This P.E. Evaluation Report (henceforth 'PEER') is issued under **F.A.C. Rule 61G20-3** and the applicable rules and regulations governing the use of construction materials in the State of Florida. The documentation submitted has been reviewed by Robert Nieminen, P.E. for compliance with the **8th Edition (2023) Florida Building Code, High Velocity Hurricane Zone (HVHZ)** [sections noted herein](#).

DESCRIPTION: GAF Conventional Built-Up Roof Systems (HVHZ)

LABELING: Labeling shall be in accordance with the requirements of the Accredited Quality Assurance Agency noted herein.

CONTINUED COMPLIANCE: This PEER is valid until such time as the named product(s) changes, the referenced Quality Assurance or production facility location(s) changes, or Code provisions that relate to the product(s) change. Acceptance of our PEERs by the named client constitutes agreement to notify NEMO ETC, LLC of any changes to the product(s), the Quality Assurance or the production facility location(s). NEMO ETC, LLC requires a complete review of its PEER relative to updated Code requirements with each Code Cycle.

ADVERTISEMENT: "NEMO P.E. Evaluated" may be displayed in advertising literature. If any portion of the PEER is displayed, then it shall be done in its entirety.

INSPECTION: Upon request, a copy of this entire PEER shall be provided to the user by the manufacturer or its distributors and shall be available for inspection at the job site at the request of the Building Official.

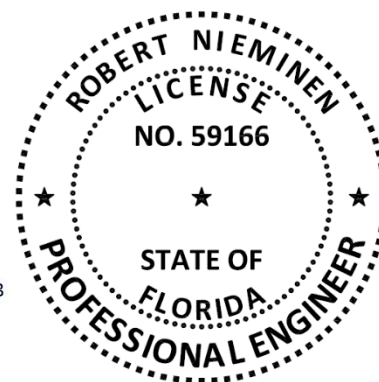
This PEER consists of pages 1 through 5, plus 36-pages of Appendix.

Prepared by:

Digitally signed by
Robert Nieminen
Date: 2025.08.20
'09:11:12 -04'00

This item has been digitally signed and sealed by Robert Nieminen, P.E.

Printed copies of this document are not considered signed and sealed, and the signature must be verified on any electronic copies.
Robert Nieminen, Florida P.E. 59166, FBC ANE1983
NEMO ETC, LLC, Florida CA #32455



CERTIFICATION OF INDEPENDENCE:

1. NEMO ETC, LLC does not have, nor does it intend to acquire or will it acquire, a financial interest in any company manufacturing or distributing products it evaluates.
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4. Robert Nieminen, P.E. does not have, nor will acquire, a financial interest in any other entity involved in the approval process of the product.
5. This is a building code evaluation. Neither NEMO ETC, LLC nor Robert Nieminen, P.E. are, in any way, the Designer of Record for any project on which this PEER, or previous versions thereof, is/was used for permitting or design guidance unless retained specifically for that purpose.

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ROOFING SYSTEM EVALUATION:

1. SCOPE:

Product Category: Roofing
Sub-Category: Built-Up Roofing Systems
Product Approval Method: Method 1, Option D: Codified Material, Evaluation by Engineer
Compliance Statement: **GAF Conventional Built-Up Roof Systems**, as produced by **GAF**, have demonstrated compliance with the following sections of the **8th Edition (2023) Florida Building Code, High Velocity Hurricane Zones (HVHZ)** through testing in accordance with the following Standards. Compliance is subject to the [Installation Requirements](#) and [Limitations of Use](#) set forth herein.

2. STANDARDS:

SECTION	PROPERTY	STANDARD
TAS 110	Resistance to Foot Traffic	TAS 114, Section 8.9
TAS 110	Wind resistance	TAS 114, Appendix C, D or J
TAS 110	Susceptibility Hail Damage	TAS 114, Appendix F
TAS 110	Susceptibility to Leakage	TAS 114, Appendix G
TAS 110	Material standard	ASTM D2178, D3909, D4601, D4897
TAS 110	Material standard	ASTM D6163, D6164, D6222

3. REFERENCES:

ENTITY	EXAMINATION	REFERENCE	DATE	ENTITY	EXAMINATION	REFERENCE	DATE
NEMO (TST6049)	ASTM D2178 (GA)	4S-GAF-18-001.01.19-1	01/02/19	FM (TST1867)	FM 4470 / 4474	797-09972-267	10/27/14
NEMO (TST6049)	ASTM D3909 (CA,GA)	4q-GAF-20-SSMBB-01.A	03/04/21	FM (TST1867)	FM 4470 / 4474	797-09973-267	10/27/14
NEMO (TST6049)	ASTM D4601 (AL)	4q-GAF-21-SSMBB-01.A	09/07/21	FM (TST1867)	FM 4470 / 4474	797-10025-267	11/12/14
NEMO (TST6049)	ASTM D4897 (AL)	4q-GAF-21-SSMBB-01.B	09/07/21	FM (TST1867)	Criticality	3056207 (released)	02/09/16
NEMO (TST6049)	ASTM D3909 (AL)	4q-GAF-21-SSMBB-02.A	12/02/21	FM (TST1867)	FM 4470 / 4474	3056933	07/19/18
NEMO (TST6049)	ASTM D2178 (AL)	4q-GAF-22-SSMBB-03.B	04/18/23	FM (TST1867)	FM 4470 / 4474	3061784	07/25/18
NEMO (TST6049)	ASTM D4897 (CA-F)	4q-GAF-23-SSMBB-01.A	12/04/23	FM (TST1867)	FM 4470 / 4474	3055904	10/25/18
NEMO (TST6049)	Physical Properties	4j-GAF-SSUDL-004.A	11/19/24	FM (TST1867)	FM 4470 / 4474	RR215191-267	11/07/18
NEMO (TST6049)	ASTM D3909 (CA-S)	4q-GAF-SSMBB-005.A	12/13/24	FM (TST1867)	Criticality	PR452971-R1	01/28/20
NEMO	PEER	PEER-GAF-007.A.R43	10/15/24	FM (TST1867)	FM 4474	PR455417	12/23/20
PRI (TST5878)	ASTM D2178 (AL)	MSA-039-02-02	09/27/17	FM (TST1867)	FM 4474	PR458073	04/08/21
PRI (TST5878)	ASTM D2178 (AL)	MSA-039-02-01	09/27/17	FM (TST1867)	FM 4470	RR227768	04/09/21
PRI (TST5878)	ASTM D4601 (GA)	376T0229	12/20/21	FM (TST1867)	FM 4474	PR457312	04/20/21
PRI (TST5878)	ASTM D4897 (GA)	376T0227	12/20/21	FM (TST1867)	FM 4470	PR459831	04/21/21
PRI (TST5878)	ASTM D4897 (GA)	376T0228	12/20/21	FM (TST1867)	FM 4474	PR456101	06/24/21
PRI (TST5878)	ASTM D4601 (GA)	376T0240	12/21/21	FM (TST1867)	FM 4474	PR460889	08/01/22
PRI (TST5878)	ASTM D2178 (CA-F)	376T0275	01/31/22	FM (TST1867)	FM 4474	PR460126	09/20/22
PRI (TST5878)	ASTM D4601 (CA-F)	376T0276	02/03/22	FM (TST1867)	FM 4474	PR464081	02/20/23
ACRC (TST4671)	TAS 114	ACRC 11-048	08/10/11	FM (TST1867)	FM 4474	RR237726	08/23/23
ACRC (TST4671)	TAS 114	ACRC 11-049	08/10/11	FM (TST1867)	FM 4474	RR237973	09/13/23
ACRC (TST4671)	TAS 114	ACRC 11-053	08/12/11	FM (TST1867)	FM 4474	PR468153	11/04/24
ERD (TST6049)	TAS 114	01880.09.03	09/10/03	FM (TST1867)	FM 4470	RR245882	04/23/25
ERD (TST6049)	TAS 114	GAF-SC16825.12.17-1	12/31/17	FM (TST1867)	FM 4470	PR469015	05/13/25
FM (TST1867)	FM 4470 / 4450	2B8A4.AM	07/02/97	FM (TST1867)	FM 4470	PR469209	06/03/25
FM (TST1867)	FM 4470 / 4450	3B9Q1.AM	01/08/98	IRT (TST7408)	TAS 114	00001	04/05/00
FM (TST1867)	FM 4470 / 4450	0Y9Q5.AM	04/01/98	IRT (TST7408)	TAS 114	00002	04/05/00
FM (TST1867)	FM 4470 / 4450	0D0A8.AM	07/09/99	IRT (TST7408)	TAS 114	01-0136	12/18/01
FM (TST1867)	FM 4470 / 4450	3011140	08/14/01	IRT (TST7408)	TAS 114	02-005	01/18/02
FM (TST1867)	FM 4470 / 4450	3014547	05/22/03	IRT (TST7408)	TAS 114	02-011	02/26/02
FM (TST1867)	FM 4470 / 4474	3017250	04/05/04	IRT (TST7408)	TAS 114	02-014	03/22/02
FM (TST1867)	FM 4470 / 4474	3020703	07/30/04	IRT (TST7408)	TAS 114	02-015	03/26/02
FM (TST1867)	FM 4470 / 4474	3025524	03/13/06	IRT (TST7408)	TAS 114	02-026	07/26/02
FM (TST1867)	FM 4470 / 4474	3023458	07/18/06	IRT (TST7408)	TAS 114	04-009	01/26/04
FM (TST1867)	FM 4470 / 4474	3028478	01/05/07	NEMO (TST6049)	TAS 114	4L-GAF-18-002.05.19.A	05/29/19
FM (TST1867)	FM 4470 / 4474	3029832	05/11/07	PRI (TST5878)	TAS 114	GAF-549-02-01	08/08/14
FM (TST1867)	FM 4470 / 4474	Approval Extension	05/07/08	PRI (TST5878)	TAS 114	GAF-549-02-02	08/08/14
FM (TST1867)	FM 4470 / 4474	797-05610-267	06/10/10	PRI (TST5878)	TAS 114	GAF-559-02-01	10/16/14
FM (TST1867)	FM 4470 / 4474	797-05695-267	07/15/10	PRI (TST5878)	TAS 114	GAF-559-02-04	10/16/14
FM (TST1867)	FM 4470 / 4474	797-05748-267	08/10/10	PRI (TST5878)	TAS 114	GAF-559-02-05	10/16/14
FM (TST1867)	FM 4470 / 4474	797-05970-267	10/25/10	PRI (TST5878)	TAS 114	GAF-559-02-06	10/16/14
FM (TST1867)	FM 4470 / 4474	797-05550-267	10/25/10	PRI (TST5878)	TAS 114	GAF-559-02-07	10/16/14
FM (TST1867)	FM 4470	3042887	11/14/11	PRI (TST5878)	TAS 114	GAF-559-02-08	10/16/14
FM (TST1867)	FM 4470 / 4474	3043900	08/16/12	PRI (TST5878)	TAS 114	GAF-559-02-09	10/16/14

ENTITY	EXAMINATION	REFERENCE	DATE	ENTITY	EXAMINATION	REFERENCE	DATE
FM (TST1867)	FM 4470 / 4474	3046388	09/24/12	PRI (TST5878)	TAS 114	GAF-559-02-11	10/16/14
FM (TST1867)	FM 4470 / 4474	3041769	09/27/12	PRI (TST5878)	TAS 114	GAF-559-02-12	10/16/14
FM (TST1867)	FM 4470	3047636	08/08/13	PRI (TST5878)	TAS 114	GAF-559-02-13	10/16/14
FM (TST1867)	FM 4470 / 4474	797-09636-267	07/24/14	PRI (TST5878)	TAS 114	GAF-559-02-14	10/16/14
FM (TST1867)	FM 4470 / 4474	797-09662-267	07/24/14	PRI (TST5878)	TAS 114	GAF-559-02-18	10/16/14
FM (TST1867)	FM 4470 / 4474	797-09665-267	07/24/14	PRI (TST5878)	Criticality	376T0006-3	09/06/19
FM (TST1867)	FM 4470	3051408	08/13/14	PRI (TST5878)	Criticality	376T0006-1	01/18/21
FM (TST1867)	FM 4470 / 4474	797-09934-267	10/23/14	UL (QUA9625)	Quality Control	Service Confirm	04/22/25
				UL (QUA9625)	Quality Control	Florida BCIS	Current

4. PRODUCT DESCRIPTION:

This PEER covers **GAF Built-Up Roof Systems (BUR)** installed in accordance with **GAF** published installation instructions and the [Limitations of Use](#) herein.

TABLE 1: EVALUATED MEMBRANES				
TYPE	PRODUCT	MATERIAL STANDARD		PLANT(S)
		REFERENCE	TYPE	
BASE SHEETS AND BASE PLYS:	GAFGLAS® #75 Base Sheet	ASTM D4601	II	AL, CA-F, GA-S
	Tri-Ply® #75 Base Sheet		II	AL, CA-F, GA-S
	GAFGLAS® #80 Ultima™ Base Sheet	ASTM D4897	II	AL, GA-S
	GAFGLAS® Stratavent® Nailable Venting Base Sheet		II	AL, GA-S
VENTING BASE PLYS:	GAFGLAS® Stratavent® Perforated Venting Base Sheet	ASTM D4897	II	AL, CA-F, GA-S
PLYs:	GAFGLAS® Ply 4	ASTM D2178	IV	AL, CA-F, GA-S
	GAFGLAS® Ply 4 M		IV	AL
	Tri-Ply® Ply 4 Ply Sheet		IV	AL, CA-F, GA-S
	GAFGLAS® FlexPly™ 6		VI	AL, GA-S
	GAFGLAS® FlexPly™ 6 M		VI	AL
PLYs, MODIFIED BITUMEN:	Ruberoid® 20 Smooth	ASTM D6163	I	AR
	Ruberoid® Mop Smooth	ASTM D6164	I	GA-S
	Ruberoid® Mop Smooth 1.5		I	GA-S
CAP PLYs:	GAFGLAS® Mineral-Surfaced Cap Sheet	ASTM D3909	N/A	AL, CA-F, GA-S
	Tri-Ply® BUR Granule Cap Sheet		N/A	AL, CA-F, GA-S
	GAFGLAS® EnergyCap™ Mineral-Surfaced Cap Sheet		N/A	CA-S
VAPOR BARRIER MEMBRANES:	Ruberoid® 20 Smooth	ASTM D6163	I	AR
	Ruberoid® HW 20 Smooth		I	AR
	Ruberoid® HW 25 Smooth		I	GA-S
	Ruberoid® HW 30 Smooth		I	AR
	Ruberoid® HW Smooth		I	GA-S
	Ruberoid® Mop Smooth	ASTM D6164	I	GA-S
	Ruberoid® Mop Smooth 1.5		I	GA-S
	Ruberoid® Mop Plus Smooth		I	GA-S
	Liberty™ SBS Self-Adhering Cap Sheet		I	AR, GA-S
	Ruberoid® HW Granule		I	GA-S
	Ruberoid® Mop Granule		I	CA-S, GA-S
	Ruberoid® HW Plus Granule		II	GA-S
	Ruberoid® Torch Smooth	ASTM D6222	I	CA-S, GA-S, IN
	Ruberoid® Torch Granule		I	CA-S, GA-S, IN
	GAF SA Vapor Retarder XL and XL40	N/A	N/A	IN

5. LIMITATIONS:

- 5.1 This is a building code evaluation. Neither NEMO ETC, LLC nor Robert Nieminen, P.E. are, in any way, the Designer of Record for any project on which this PEER, or previous versions thereof, is/was used for permitting or design guidance. PEERs are not to be construed as representing any attributes not specifically listed, nor are PEERs to be construed as an endorsement of the subject, or a recommendation for its use. There is no warranty by NEMO ETC, LLC or Robert Nieminen, P.E., express or implied, as to any finding or other matter in this PEER, or as to any product covered by the PEER.
- 5.2 This PEER is exclusively for use in High Velocity Hurricane Zone jurisdictions, as defined in FBC Chapter 2 (Broward and Miami-Dade Counties).
- 5.3 The evaluation herein pertains to above-deck roof components; deck-attachment details pertain to 'as-tested' conditions under [Testing Application Standard TAS 114, Appendix J](#). Roof decks shall be in accordance with **FBC HVHZ** requirements to the satisfaction of the Authority Having Jurisdiction.
- 5.4 This PEER does not include evaluation of fire classification. Refer to **FBC HVHZ 1516** for requirements and limitations regarding roof assembly fire classification. Refer to **FBC 2603** for requirements and limitations concerning the use of foam plastic insulation.
- 5.5 This PEER does not include evaluation of roof edge termination. Refer to [Roofing Application Standard RAS 111](#) for requirements and limitations regarding edge securement for low-slope roofs.
- 5.6 Refer to **FBC HVHZ 1521** for requirements and limitations regarding recover installations.
- 5.6.1 For mechanically attached components over existing roof decks, fasteners shall be tested in the existing deck for withdrawal resistance. A qualified design professional shall review the data for comparison to the minimum requirements for the system. Testing shall be in accordance with [Testing Application Standard TAS 105](#).
- 5.6.2 For bonded insulation or membrane over existing substrates in a re-roof (tear off) or recover installation, the existing deck or existing roof surface shall be examined for compatibility with the adhesive to be installed. If any surface conditions exist that bring system performance into question, field uplift testing in accordance with [Testing Application Standard TAS 124](#) shall be conducted on mock-ups of the proposed new roof assembly.
- 5.6.3 For bonded insulation or membrane over existing substrates in a recover installation, the existing roof system shall be capable of resisting project design pressures on its own merit to the satisfaction of the Authority Having Jurisdiction, as documented through field uplift testing in accordance with [Testing Application Standard TAS 124](#).
- 5.7 Refer to Appendix 1 for system attachment requirements for wind load resistance.
- 5.7.1 "MDP" = Maximum Design Pressure is the result of testing for wind load resistance based on allowable wind loads, and reflects the ultimate passing pressure divided by 2 (the 2 to 1 margin of safety per [Testing Application Standard TAS 114](#) has already been applied). Refer to **FBC HVHZ 1620** and [Roofing Application Standard RAS 128](#) for determination of design wind loads.
- 5.7.2 For mechanically attached components, the maximum design pressure for the selected assembly shall meet or exceed at least the Zone 1 PRIME design pressure determined in accordance with **FBC HVHZ 1620** or [Roofing Application Standard RAS 128](#). Elevated pressure zones shall employ an attachment density designed by a qualified design professional to resist the elevated pressure criteria. Analysis shall be in accordance with [Roofing Application Standard RAS 117](#) or **RAS 137**. **This extrapolation is not permitted for systems marked with an asterisk*.*
- 5.7.3 For tables and/or assemblies marked with an asterisk*, the maximum design pressure (MDP) limitation shall be applicable to all roof pressure zones. Rational analysis is not permitted.
- 5.8 All components in the roof assembly shall have quality assurance audit in accordance with **F.A.C. Rule 61G20-3**. Refer to the Product Approval of the component manufacturer for components listed in Appendix 1 that are produced by a Product Manufacturer other than the report holder on [Page 1](#) of this PEER.

6. INSTALLATION:

GAF Conventional Built-Up Roof Systems shall be installed in accordance with **GAF** published installation instructions, subject to the [Limitations of Use](#) herein.

7. BUILDING PERMIT REQUIREMENTS:

As required by the Building Official or Authority Having Jurisdiction to properly evaluate the installation of this product.

8. MANUFACTURING PLANTS:

Contact the named QA entity for manufacturing facilities covered by **F.A.C. Rule 61G20-3** QA requirements. Refer to [Section 4](#) herein for products and production locations having met codified material standards.

9. QUALITY ASSURANCE ENTITY:

[UL \(QUA9625\)](#): (360) 817-5512; bsai.inspections@ul.com

- THE 36-PAGES THAT FOLLOW FORM PART OF THIS PEER -

APPENDIX 1: ATTACHMENT REQUIREMENTS FOR WIND UPLIFT RESISTANCE

TABLE	DECK	APPLICATION	TYPE	DESCRIPTION	PAGE
1A	Wood	New, Reroof (Tear-Off) or Recover	B-1	Mechanically Attached Base Insulation, Bonded Top Insulation, Bonded Roof Cover	9
1B	Wood	New or Reroof (Tear-Off)	B-3	Mechanically Attached Anchor Sheet (nails & caps), Bonded Insulation, Bonded Roof Cover	9
1C	Wood	New, Reroof (Tear-Off) or Recover	B-3	Mechanically Attached Anchor Sheet (screws & plates), Bonded Insulation, Bonded Roof Cover	10
1D	Wood	New, Reroof (Tear-Off) or Recover	C-1	Mechanically Attached Insulation, Bonded Roof Cover	11
1E	Wood	New, Reroof (Tear-Off) or Recover	D-2	Insulated, Mechanically Attached Base Sheet, Bonded Roof Cover	12
1F	Wood	New or Reroof (Tear-Off)	E-2	Non-Insulated, Mechanically Attached Base Sheet (nails & caps), Bonded Roof Cover	12
1G	Wood	New, Reroof (Tear-Off) or Recover	E-2	Non-Insulated, Mechanically Attached Base Sheet (screws & plates), Bonded Roof Cover	13
2A	Steel	New, Reroof (Tear-Off)	A-1	Bonded Insulation, Bonded Roof Cover	14
2B	Steel or Structural Concrete	New, Reroof (Tear-Off) or Recover	B-1	Mechanically Attached Base Insulation, Bonded Top Insulation, Bonded Roof Cover	14
2C	Steel or Structural concrete	New, Reroof (Tear-Off), Recover	B-2	Mechanically Attached Thermal Barrier, Bonded Vapor Retarder, Bonded Insulation, Bonded Roof Cover	16
2D	Steel or Structural Concrete	New, Reroof (Tear-Off) or Recover	C-1	Mechanically Attached Insulation, Bonded Roof Cover	17
2E	Steel or Structural Concrete	New, Reroof (Tear-Off) or Recover	D-2	Insulated, Mechanically Attached Base Sheet, Bonded Roof Cover	18
3A	Structural Concrete	New or Reroof (Tear-Off)	A-1	Bonded Insulation, Bonded Roof Cover	20
3B	Structural Concrete	New or Reroof (Tear-Off)	F	Non-Insulated, Bonded Roof Cover	23
4A	Deck with Lightweight concrete	New or Reroof (Tear-Off)	A-1	Bonded Insulation, Bonded Roof Cover	24
4B	Deck with Lightweight concrete	New or Reroof (Tear-Off)	B-3	Mechanically Attached Anchor Sheet, Bonded Insulation, Bonded Roof Cover	24
4C	Deck with Lightweight concrete	New, Reroof (Tear-Off) or Recover	D-2	Insulated, Mechanically Attached Base Sheet, Bonded Roof Cover	26
4D	Deck with Lightweight concrete	New or Reroof (Tear-Off)	E-2	Non-Insulated, Mechanically Attached Base Sheet, Bonded Roof Cover	27
4E	Deck with Lightweight concrete	New or Reroof (Tear-Off)	F	Non-Insulated, Bonded Roof Cover	27
5A	Cementitious wood fiber	Reroof (Tear-Off) or Recover	B-1	Mechanically Attached Base Insulation, Bonded Top Insulation, Bonded Roof Cover	28
5B	Cementitious wood fiber	Reroof (Tear-Off) or Recover	B-3	Mechanically Attached Anchor Sheet, Bonded Insulation, Bonded Roof Cover	28
5C	Cementitious wood fiber	Reroof (Tear-Off) or Recover	C-1	Mechanically Attached Insulation, Bonded Roof Cover	29
5D	Cementitious wood fiber	Reroof (Tear-Off) or Recover	D-2	Insulated, Mechanically Attached Base Sheet, Bonded Roof Cover	29
5E	Cementitious wood fiber	Reroof (Tear-Off) or Recover	E-2	Non-Insulated, Mechanically Attached Base Sheet, Bonded Roof Cover	29
6A	Existing gypsum	Reroof (Tear-Off)	B-1	Mechanically Attached Base Insulation, Bonded Top Insulation, Bonded Roof Cover	30
6B	Existing gypsum	Reroof (Tear-Off)	B-3	Mechanically Attached Anchor Sheet, Bonded Insulation, Bonded Roof Cover	30
6C	Existing gypsum	Reroof (Tear-Off)	C-1	Mechanically Attached Insulation, Bonded Roof Cover	31
6D	Existing gypsum	Reroof (Tear-Off)	D-2	Insulated, Mechanically Attached Base Sheet, Bonded Roof Cover	31
6E	Existing gypsum	Reroof (Tear-Off)	E-2	Non-Insulated, Mechanically Attached Base Sheet, Bonded Roof Cover	32
7A	Various	Recover	A-1	Bonded Insulation, Bonded Roof Cover	33
7B	Various	Recover	F	Non-Insulated, Bonded Roof Cover	36

The following notes apply to the systems outlined herein:

- The roof system evaluation herein pertains to above-deck roof components. Roof decks and structural members shall be in accordance with FBC HVHZ requirements to the satisfaction of the Authority Having Jurisdiction. Deck-attachment details pertain to 'as-tested' conditions under [Testing Application Standard](#) TAS 114, Appendix J.
- Unless otherwise noted, fasteners and stress plates shall be as follows. Recessed plates are not for use with cement-based or gypsum-based hardboard coverboards. Fastener shall be of sufficient length for the following engagements:

FASTENER/PLATE OPTIONS				
DECK TYPE	BY	PARTS		MINIMUM ENGAGEMENT
		LOOSE PARTS	PRE-ASSEMBLED PARTS	
Wood	GAF	Drill-Tec #12 Fastener, Drill-Tec #12 DP Fastener, Drill-Tec #12 DPH Fastener, Drill-Tec #14 Fastener or Drill-Tec #14 HD Fastener with Drill-Tec 3" Standard Steel Plate, Drill-Tec 3" Steel Plate, Drill-Tec AccuTrac Flat Plate, Drill-Tec AccuTrac Recessed Plate (insulation only), Drill-Tec 3" Flat Steel Plate or Drill-Tec 3" Recessed Steel Plate	Drill-Tec 3" ASAP Flat, Drill-Tec 3" ASAP Recessed, Drill-Tec ASAP 3S or Drill-Tec Heavy Duty ASAP Roofing Fastener Assembled with a 3" Metal Plate	Minimum ¾-inch plywood penetration or minimum 1-inch wood plank embedment
Steel	GAF	Drill-Tec #12 Fastener, Drill-Tec #12 DP Fastener, Drill-Tec #12 DPH Fastener, Drill-Tec #14 Fastener, Drill-Tec #14 HD Fastener, Drill-Tec XHD Fastener or Drill-Tec #15 EHD Fastener with Drill-Tec 3" Standard Steel Plate, Drill-Tec 3" Steel Plate, Drill-Tec AccuTrac Flat Plate, Drill-Tec AccuTrac Recessed Plate (insulation only), Drill-Tec 3" Flat Steel Plate or Drill-Tec 3" Recessed Steel Plate	Drill-Tec 3" ASAP Flat, Drill-Tec 3" ASAP Recessed, Drill-Tec ASAP 3S, Drill-Tec Heavy Duty ASAP Roofing Fastener Assembled with a 3" Metal Plate or Drill-Tec Extra Heavy Duty ASAP Roofing Fastener – Insulation	Minimum ¾-inch steel penetration and engage the top flute of the steel deck
	Note:	Unless otherwise noted, Drill Tec #12 DF Fastener or Drill Tec #14 DF Fastener with Drill Tec 3" DF Steel Insulation Plate may be used in place of Drill-Tec #12 Fastener or Drill-Tec #14 Fastener with Drill-Tec 3" Standard Steel Plate when used to secure DensDeck Prime, SECUROCK Gypsum-Fiber Roof Board or SECUROCK Ultralight Coated Glass-Mat Roof Board to steel deck, up to a maximum allowable design pressure (MDP) of -120.0 psf.		
	Note:	Unless otherwise noted, Drill Tec #12 DF Fastener or Drill Tec #14 DF Fastener with Drill Tec 3" DF Steel Insulation Plate may be used in place of Drill-Tec #12 Fastener or Drill-Tec #14 Fastener with Drill-Tec 3" Standard Steel Plate when used to secure min. 0.5-inch thick Structodek High Density Fiberboard Roof Insulation or min. 1.5-inch EnergyGuard POLYISO INSULATION or EnergyGuard Ultra Polyiso Insulation to steel deck.		
Structural Concrete	GAF	Drill-Tec #14 Fastener, Drill-Tec #14 HD Fastener or Drill-Tec CD-10 with Drill-Tec 3" Standard Steel Plate, Drill-Tec 3" Steel Plate, Drill-Tec AccuTrac Flat Plate, Drill-Tec AccuTrac Recessed Plate (insulation only), Drill-Tec 3" Flat Steel Plate or Drill-Tec 3" Recessed Steel Plate	Drill-Tec 3" ASAP Flat (#14 only) or Drill-Tec Heavy Duty ASAP Roofing Fastener Assembled with a 3" Metal Plate	Minimum 1.25-inch embedment. Fasteners installed with a pilot hole in accordance with the fastener manufacturer's published installation instructions
	Note:	Unless otherwise noted, Drill Tec #14 DF Fastener with Drill Tec 3" DF Steel Insulation Plate may be used in place of Drill-Tec #14 Fastener with Drill-Tec 3" Standard Steel Plate when used to secure min. DensDeck Prime, SECUROCK Gypsum-Fiber Roof Board or SECUROCK Ultralight Coated Glass-Mat Roof Board to structural concrete deck, up to a maximum allowable design pressure (MDP) of -120.0 psf.		
	Note:	Unless otherwise noted, Drill Tec #14 DF Fastener with Drill Tec 3" DF Steel Insulation Plate may be used in place of Drill-Tec #14 Fastener with Drill-Tec 3" Standard Steel Plate when used to secure min. 0.5-inch thick Structodek High Density Fiberboard Roof Insulation or min. 1.5-inch EnergyGuard POLYISO INSULATION or EnergyGuard Ultra Polyiso Insulation to structural concrete deck.		

- Unless otherwise noted, insulation may be any one layer or combination of FBC Approved (Local or Statewide) board(s) that meet FBC HVHZ 1516 and, for foam plastic, FBC Chapter 26, when installed with the roof cover.
- Minimum 200 psi, minimum 2-inch thick FBC HVHZ Approved lightweight insulating concrete may be substituted for or installed below, rigid insulation board for System Types B-1, C-1, C-2, D-1 or D-2, whereby fasteners are installed through the lightweight insulating concrete to engage the structural deck. The structural deck shall be of equal or greater type, thickness and strength to the steel and structural concrete deck listings. Roof decks and structural members shall be in accordance with FBC requirements to the satisfaction of the Authority Having Jurisdiction. This is a wind uplift resistance allowance and does not purport to address non-wind-uplift-related issues, such as deck venting or moisture levels within the LWIC and the potential effect on overlying components. If mechanical attachment to the structural deck through lightweight insulating concrete is proposed, field withdrawal resistance testing shall be performed to confirm equivalent or determine enhanced fastening patterns and density. All testing and fastening design shall be in compliance with [Testing Application Standard](#) TAS 105 and [Roofing Application Standard](#) RAS 117 and/or RAS 137. Calculations shall be prepared, signed and sealed by a qualified design professional.
- Preliminary insulation attachment: Unless otherwise noted, use FBC HVHZ Approved roofing fasteners and plates minimum four fasteners per 4 x 8 ft board or minimum two fasteners per 4 x 4 ft board.

- 6 Unless otherwise noted, insulation adhesive application rates are as follows.
- Ribbon or bead width is at the time of application; the ribbons/beads shall expand as noted in the manufacturer's published instructions.
 - If applying hot asphalt to concrete deck, deck shall be primed with ASTM D41 primer.
 - When multiple layers(s) of insulation and/or coverboard are installed in ribbon-applied adhesive, board joints shall be staggered.
 - The maximum edge distance from the adhesive ribbon to the edge of the insulation board shall be not less than one-half the specified ribbons spacing.

INSULATION ADHESIVE REFERENCES				
By	ADHESIVE	REFERENCE	FBC FILE OR NOA	MINIMUM RATE
GAF	GAF LRF Adhesive M	'LRF-M'	N/A	Continuous 0.75 to 1-inch ribbons, 12-inch o.c.
GAF	GAF LRF Adhesive M Canister	'LRF-M Canister'	N/A	Continuous 1 to 1.5-inch ribbons, 12-inch o.c.
GAF	GAF LRF Adhesive XF	'LRF-XF'	N/A	Continuous 0.75 to 1-inch ribbons, 12-inch o.c.
H.B. Fuller Company	Millennium One Step Foamable Adhesive	'M-OSFA'	25-0417.03	Continuous 0.25 to 0.5-inch wide ribbons, 12-inch o.c.
OMG, Inc.	OlyBond 500 Adhesive Fastener	'OB500'	24-0422.18	Continuous 0.75-inch wide ribbons, 12-inch o.c. (PaceCart, SpotShot or Canister)
Generic, ASTM D312, Type IV	hot asphalt	N/A	N/A	Full coverage at 25-30 lbs/square

- 7 Unless otherwise noted, all insulations are flat-stock or taper board of the minimum thickness noted. Tapered polyisocyanurate at the following thickness limitations may be substituted with the following Maximum Design Pressure (MDP) limitations. In no case shall these values be used to 'increase' the MDP listings in the tables; rather if MDP listing below meets or exceeds that listed for a particular system in the tables, then the thinner board listed below may be used as a drop-in for the equivalent thicker material listed in the table.

MDP LIMITATIONS FOR TAPERED POLYISOCYANURATE INSULATIONS				
ADHESIVE	INSULATION		MIN. TAPERED THICKNESS (IN)	MDP (psf)
	LISTED PRODUCT	FBC FILE OR NOA		
LRF-M	EnergyGuard Polyiso Insulation, EnergyGuard Ultra Polyiso Insulation	24-1114.02	0.5	-232.5
LRF-XF	EnergyGuard Polyiso Insulation, EnergyGuard Ultra Polyiso Insulation	24-1114.02	0.5	-292.5
LRF-XF	EnergyGuard RA	25-0123.02	0.5	-487.5
M-OSFA	Any EnergyGuard polyisocyanurate listed with adhesive herein	various	0.5	-157.5
OB500	EnergyGuard Polyiso Insulation, EnergyGuard Ultra Polyiso Insulation	24-1114.02	0.5	-292.5
OB500	EnergyGuard RA	25-0123.02	0.5	-487.5
Hot asphalt	Any EnergyGuard polyisocyanurate listed with adhesive herein	Various	0.5	-240.0

- 8 Bonded polyisocyanurate insulation boards shall be maximum 4 x 4 ft.
- 9 For mechanically attached components, the maximum design pressure for the selected assembly shall meet or exceed at least the Zone 1 PRIME design pressure determined in accordance with FBC HVHZ 1620 or [Roofing Application Standard](#) RAS 128. Elevated pressure zones shall employ an attachment density designed by a qualified design professional to resist the elevated pressure criteria in accordance with [Roofing Application Standard](#) RAS 117 or RAS 137. *This extrapolation is not permitted for systems marked with an asterisk*
- 10 For tables and/or assemblies marked with an asterisk*, the maximum design pressure for the selected assembly shall meet or exceed critical design pressure determined in accordance with FBC Chapter 16. No rational analysis is permitted for these systems.
- 11 For mechanically attached components over existing decks, fasteners shall be tested in the existing deck for withdrawal resistance in accordance with [Testing Application Standard](#) TAS 105. A qualified design professional shall review the data for comparison to the minimum requirements for the system. Should the fastener resistance be less than that required, a revised fastener spacing – prepared, signed and sealed by a qualified design professional in accordance with [Roofing Application Standard](#) RAS 117 or RAS 137 – may be submitted to the Building Official for review and acceptance. For systems using Trufast Versa-Fast, the number of Versa-Fast Fasteners installed through the Versa-Fast Plate may be increased from the minimum noted in order to yield minimum required withdrawal resistance.

- 12 Refer to FBC HVHZ 1521 for requirements and limitations regarding recover installations. For bonded insulation or membrane over existing substrates in a re-roof (tear off) or recover installation, the existing deck or existing roof surface shall be examined for compatibility with the adhesive to be installed. If any surface conditions exist that bring system performance into question, field uplift testing shall be conducted on mock-ups of the proposed new roof assembly. For bonded insulation or membrane over existing substrates in a recover installation, the existing roof system shall be capable of resisting project design pressures on its own merit to the satisfaction of the Authority Having Jurisdiction, as documented through field uplift testing in accordance with [Testing Application Standard](#) TAS 124.
- 13 For Structural Concrete Deck or Recover Applications using System Type C-1 the base insulation layer is optional and for System Type C-2, D-1 or D-2, the insulation is optional. Alternatively, an FBC HVHZ Approved insulation board or coverboard may be used as a separation layer. Board products shall be preliminarily attached prior to roof cover installation ([Note 5](#)). The separator component shall be documented as meeting FBC HVHZ 1516 and, for foam plastic, FBC Chapter 26, when installed with the roof cover in Recover applications.
- 14 Lightweight insulating concrete (LWIC) shall be cast in accordance with FBC Section 1917 to the satisfaction of the Authority Having Jurisdiction. For systems where specific LWIC is referenced, refer to current LWIC FBC HVHZ Product Approval for specific deck construction and limitations. Unless otherwise noted, for systems where specific LWIC is not referenced, the minimum design mix shall be 300 psi. In all cases, the minimum top-coat thickness is 2-inches. For LWIC over structural concrete, reference is made to FBC Section 1917.4.1, Point 1. For “pre-existent” LWIC references, listings were established through testing over lightweight concrete cast using only foaming agent (ASTM C896), water and Portland cement (ASTM C150), with no proprietary additives, in accordance with procedures adopted by Miami-Dade BCCO (FBC CER1592). Use of these listings in new construction or re-roof (tear-off) applications is at the discretion of the Designer or Record and Authority Having Jurisdiction.
- 15 For bonded membrane applications, unless otherwise noted, refer to the following.

MEMBRANE / ADHESIVE COMBINATIONS ROOF COVERS		
REFERENCE	TYPE	APPLICATION
BP: Base Ply	Optional base sheet of GAFGLAS #75 Base Sheet, Tri-Ply #75 Base Sheet, GAFGLAS #80 Ultima Base Sheet, GAFGLAS Ply 4, GAFGLAS Ply 4 M, Tri-Ply Ply 4 Ply Sheet or GAFGLAS FlexPly 6, GAFGLAS FlexPly 6 M	Hot asphalt
V-BP: Venting Base Ply	GAFGLAS Stratavent Perforated Venting Base Sheet	Loose-laid
P: Ply	Two or more plies of GAFGLAS Ply 4, GAFGLAS Ply 4 M, Tri-Ply Ply 4 Ply Sheet or GAFGLAS FlexPly 6, GAFGLAS FlexPly 6 M	Hot asphalt
P-MB: Ply, Modified Bitumen	One or two plies of GAFGLAS #80 Ultima Base Sheet, Ruberoid 20 Smooth , Ruberoid Mop Smooth or Ruberoid Mop Smooth 1.5	Hot asphalt
CP: Cap Ply	Optional cap sheet of GAFGLAS Mineral-Surfaced Cap Sheet, Tri-Ply BUR Granule Cap Sheet or GAFGLAS EnergyCap Mineral-Surfaced Cap Sheet	Hot asphalt

Note: Systems without a cap sheet shall be surfaced in accordance with GAF requirements, meeting the fire resistance requirements of FBC Section 1516, and in accordance with FBC Section 1519.12.

MEMBRANE / ADHESIVE COMBINATIONS VAPOR BARRIERS		
REFERENCE	MATERIAL	APPLICATION
VB-APP-TA (smooth)	Ruberoid Torch Smooth	Torch-applied
VB-APP-TA (granule)	Ruberoid Torch Granule	Torch-applied
VB-BP1-AA	One or more GAFGLAS #75 Base Sheet, Tri-Ply #75 Base Sheet, GAFGLAS #80 Ultima Base Sheet	Hot asphalt at 25 lbs/square.
VB-BP2-AA	One or two plies, GAFGLAS Ply 4, GAFGLAS Ply 4 M, Tri-Ply Ply 4 Ply Sheet, GAFGLAS FlexPly 6 or GAFGLAS FlexPly 6 M	Hot asphalt at 25 lbs/square.
VB-SBS-AA	Ruberoid 20 Smooth, Ruberoid Mop Smooth, Ruberoid Mop Smooth 1.5, Ruberoid Mop Plus Smooth or Ruberoid Mop Granule	Hot asphalt at 25 lbs/square.
VB-SBS-CA	Ruberoid 20 Smooth, Ruberoid Mop Smooth, Ruberoid Mop Smooth 1.5, Ruberoid Mop Plus Smooth or Ruberoid Mop Granule	Matrix 102 SBS Membrane Adhesive at 1.5 gal/sq.
VB-SBS-SA	Liberty SBS Self-Adhering Cap Sheet	Self-adhering
VB-SBS-TA	Ruberoid HW 20 Smooth, Ruberoid HW 25 Smooth, Ruberoid HW 30 Smooth, Ruberoid HW Smooth, Ruberoid HW Granule or Ruberoid HW Plus Granule	Torch-applied

16 **Thermal Barrier and/or Vapor Barrier Options:**

16A **Structural Concrete Decks:** The lesser of the MDP listings below vs. that for the selected assembly applies.

STRUCTURAL CONCRETE DECK: VAPOR BARRIER FOLLOWED BY ADHERED INSULATION					
OPTION #	PRIMER	VAPOR BARRIER (Note 15)		INSULATION ADHESIVE PER TABLE 3A	MDP (PSF)
		TYPE	APPLICATION		
C-VB-1.	Matrix 307 Premium Asphalt Primer or ASTM D41 primer	VB-APP-TA (granule)	Torch-applied	Hot asphalt	-225.0
C-VB-2.	Matrix 307 Premium Asphalt Primer or ASTM D41 primer	VB-BP-AA1	Hot asphalt applied	Hot asphalt	-360.0
C-VB-3.	Matrix 307 Premium Asphalt Primer or ASTM D41 primer	VB-BP2-AA or VB-SBS-AA	Hot asphalt applied	Hot asphalt	-495.0
C-VB-4.	None	GAF SA Vapor Retarder XL	Self-adhering	LRF-M, 12-inch o.c.	-180.0
C-VB-5.	Matrix 307 Premium Asphalt Primer or ASTM D41 primer	VB-APP-TA (granule), VB-SBS-AA, VB-SBS-CA, VB-SBS-SA or VB-SBS-TA	See Note 15	LRF-M, 12-inch o.c.	-180.0
C-VB-6.	GAF SA Primer	GAF SA Vapor Retarder	Self-adhering	LRF-M, 12-inch o.c.	-202.5
C-VB-7.	Matrix 307 Premium Asphalt Primer or ASTM D41 primer	VB-BP1-AA, VB-BP2-AA or VB-SBS-AA	Hot asphalt applied	LRF-M, 12-inch o.c.	-495.0
C-VB-8.	Matrix 307 Premium Asphalt Primer or ASTM D41 primer	VB-APP-TA (granule)	Torch-applied	LRF-XF, 12-inch o.c.	-169.0
C-VB-9.	None	GAF SA Vapor Retarder XL	Self-adhering	LRF-XF 12-inch o.c.	-180.0
C-VB-10.	Matrix 307 Premium Asphalt Primer or ASTM D41 primer	VB-APP-TA (granule), VB-SBS-AA, VB-SBS-CA, VB-SBS-SA or VB-SBS-TA	See Note 15	LRF-XF, 12-inch o.c.	-180.0
C-VB-11.	GAF SA Primer	GAF SA Vapor Retarder	Self-adhering	LRF-XF, 12-inch o.c.	-202.5
C-VB-12.	Matrix 307 Premium Asphalt Primer or ASTM D41 primer	VB-SBS-SA	Self-adhering	LRF-XF, 12-inch o.c.	-250.0
C-VB-13.	Matrix 307 Premium Asphalt Primer or ASTM D41 primer	VB-BP1-AA, VB-BP2-AA or VB-SBS-AA	Hot asphalt applied	LRF-XF, 12-inch o.c.	-262.5
C-VB-14.	Matrix 307 Premium Asphalt Primer or ASTM D41 primer	Ruberoid 30	Hot asphalt applied	LRF-XF, 12-inch o.c.	-270.0
C-VB-15.	Matrix 307 Premium Asphalt Primer or ASTM D41 primer	VB-APP-TA (smooth)	Torch-applied	OB500, 12-inch o.c.	-165.0
C-VB-16.	None	GAF SA Vapor Retarder XL	Self-adhering	OB500, 12-inch o.c.	-180.0
C-VB-17.	Matrix 307 Premium Asphalt Primer or ASTM D41 primer	VB-SBS-AA, VB-SBS-CA, VB-SBS-SA or VB-SBS-TA	See Note 15	OB500, 12-inch o.c.	-180.0
C-VB-18.	Matrix 307 Premium Asphalt Primer or ASTM D41 primer	VB-SBS-SA	Self-adhering	OB500, 12-inch o.c.	-187.5
C-VB-19.	Matrix 307 Premium Asphalt Primer or ASTM D41 primer	Ruberoid 20 Smooth	Matrix 102 SBS Membrane Adhesive at 1.5 gal/square	OB500, 12-inch o.c.	-202.5
C-VB-20.	GAF SA Primer	GAF SA Vapor Retarder	Self-adhering	OB500, 12-inch o.c.	-202.5
C-VB-21.	Matrix 307 Premium Asphalt Primer or ASTM D41 primer	VB-APP-TA (granule)	Torch-applied	OB500, 12-inch o.c.	-225.0
C-VB-22.	Matrix 307 Premium Asphalt Primer or ASTM D41 primer	Ruberoid HW Smooth	Torch-applied	OB500, 12-inch o.c.	-232.5
C-VB-23.	Matrix 307 Premium Asphalt Primer or ASTM D41 primer	VB-BP1-AA, VB-BP2-AA or VB-SBS-AA	Hot asphalt applied	OB500, 12-inch o.c.	-352.5

16B For System Types B-1, B-2, C-1, C-2, D-1 or D-2, GAF SA Vapor Retarder or GAF SA Vapor Retarder XL may be installed atop the roof deck, or to a loose-laid thermal barrier of DensDeck, DensDeck Prime, DensDeck StormX Prime, DEXcell Glass Mat Roof Board, DEXcell FA Glass Mat Roof Board, SECUROCK Gypsum-Fiber Roof Board, SECUROCK Ultralight Coated Glass Mat Roof Board or SECUROCK Cement Roof Board, prior to installation of the insulation and roof cover. When adhering GAF SA Vapor Retarder to structural concrete, the substrate shall be primed with GAF SA Primer, TPO QSA or TPO QSA LV50. When adhering GAF SA Vapor Retarder to gypsum or cement boards, the substrate shall be primed with GAF SA Primer, TPO QSA, TPO QSA LV50 or Matrix 307 Premium Asphalt Primer. Refer to [FM Loss Prevention Data Sheet](#) 1-29 for design and installation limitations.

16C Fire barrier of VersaShield® Solo™ Fire-Resistant Slip Sheet is optional in all assemblies when overlying components are mechanically fastened.

17 Unless otherwise noted, insulation or coverboard attachment patterns for Type B-1, Type B-2, Type C-1 and C-2 systems are as outlined below.

TABLE 1F: WOOD DECKS – NEW CONSTRUCTION OR REROOF (TEAR-OFF)
SYSTEM TYPE E-2: NON-INSULATED, MECHANICALLY ATTACHED BASE SHEET (NAILS & CAPS), BONDED ROOF COVER

System No.	Deck (Note 1)	Base Sheet			Roof Cover (Note 15)	MDP (psf)
		Type	Fastener (Note 11)	Attach		
W-23.	Min. 19/32-inch plywood or wood plank; 24" span, 8d common nails 6" o.c.	GAFLAS #75 Base Sheet, Tri-Ply #75 Base Sheet, GAFLAS #80 Ultima Base Sheet, GAFLAS Stratavent Nailable Venting Base Sheet, Ruberoid 20 Smooth	32 ga., 1-5/8-inch dia. tin caps with 11 ga. annular ring shank nails	8-inch o.c. at min. 4-inch laps and 8-inch o.c. in two, equally spaced, staggered center rows	GAF BUR. Note 15. (No V-BP)	-45.0
W-24.	Min. 19/32-inch plywood or wood plank; 24" span, 8d common nails 6" o.c.	GAFLAS #80 Ultima Base Sheet, GAFLAS Stratavent Eliminator Nailable Venting Base Sheet, Ruberoid 20 Smooth, Ruberoid Mop Smooth, Ruberoid Mop Smooth 1.5	32 ga., 1-5/8-inch dia. tin caps with 11 ga. annular ring shank nails	9-inch o.c. at the 4-inch lap and 12-inch o.c. in two staggered center rows	GAF BUR. Note 15. (No V-BP)	-45.0
W-25.	Min. 19/32-inch plywood or wood plank; 24" span, 8d ring shank nails 6" o.c.	GAFLAS #75 Base Sheet, Tri-Ply #75 Base Sheet, GAFLAS #80 Ultima Base Sheet, GAFLAS Stratavent Nailable Venting Base Sheet, GAFLAS FlexPly 6, GAFLAS FlexPly 6 M, Ruberoid 20 Smooth	32 ga., 1-5/8-inch dia. tin caps with 11 ga. annular ring shank nails	9-inch o.c. at the 4-inch lap and 9-inch o.c. in two staggered center rows	GAF BUR. Note 15. (No V-BP)	-52.5
W-26.	Min. 19/32-inch plywood or wood plank; 24" span, 8d ring shank nails 6" o.c.	GAFLAS #80 Ultima Base Sheet, GAFLAS Stratavent Nailable Venting Base Sheet, Ruberoid 20 Smooth	FBC (HVHZ) approved 1.25-inch annular ring shank nails and inverted Drill-Tec 3-inch Galvalume Plate	9-inch o.c. at the 4-inch lap and 9-inch o.c. in two staggered center rows	GAF BUR. Note 15. (No V-BP)	-60.0
W-27.	Min. 19/32-inch plywood or wood plank; 24" span, 8d ring shank nails 6" o.c.	GAFLAS #80 Ultima Base Sheet	32 ga., 1-5/8-inch dia. tin caps with 11 ga. annular ring shank nails	7-inch o.c. at min. 4-inch laps and 7-inch o.c. in three, equally spaced, staggered center rows	GAF BUR. Note 15. (No V-BP)	-82.5
W-28.	Min. 19/32-inch plywood at max. 24-inch span; 8d ring shank nails, 3" o.c.	GAFLAS #75 Base Sheet, Tri-Ply #75 Base Sheet, GAFLAS #80 Ultima Base Sheet, GAFLAS Stratavent Nailable Venting Base Sheet, Ruberoid 20 Smooth	32 ga., 1-5/8-inch dia. tin caps with 11 ga. annular ring shank nails	4-inch o.c. at min. 2-inch laps and 4-inch o.c. in four (4), equally spaced, staggered center rows	GAF BUR. Note 15. (No V-BP)	-97.5

TABLE 1G: WOOD DECKS – NEW CONSTRUCTION, REROOF (TEAR-OFF) OR RECOVER
SYSTEM TYPE E-2: NON-INSULATED, MECHANICALLY ATTACHED BASE SHEET (SCREWS & PLATES), BONDED ROOF COVER

System No.	Deck (Note 1)	Base Sheet			Roof Cover (Note 15)	MDP (psf)
		Type	Fastener (Note 11)	Attach		
W-29.	Min. 19/32-inch plywood or wood plank; 24" span, 8d common nails 6" o.c.	GAFLAS #75 Base Sheet, Tri-Ply #75 Base Sheet, GAFLAS #80 Ultima Base Sheet, GAFLAS Stratavent Nailable Venting Base Sheet, GAFLAS Ply 4, GAFLAS Ply 4 M, Tri-Ply Ply 4 Ply Sheet, GAFLAS FlexPly 6, GAFLAS FlexPly 6 M, Ruberoid 20 Smooth	Note 2	12-inch o.c. at the 2-inch lap and 12-inch o.c. in two center staggered center rows	GAF BUR. Note 15. (No V-BP)	-45.0
W-30.	Min. 19/32-inch plywood or wood plank; 24" span, 8d ring shank nails 6" o.c.	GAFLAS #75 Base Sheet, Tri-Ply #75 Base Sheet, GAFLAS #80 Ultima Base Sheet, GAFLAS Stratavent Nailable Venting Base Sheet, Ruberoid 20 Smooth	Note 2 (#14 ONLY)	16-inch o.c. at 4-inch laps and 16-inch o.c. in two, equally spaced, staggered center rows	GAF BUR. Note 15. (No V-BP)	-52.5
W-31.	Min. 19/32-inch plywood or wood plank; 24" span, 8d ring shank nails 6" o.c.	GAFLAS #75 Base Sheet, Tri-Ply #75 Base Sheet, GAFLAS #80 Ultima Base Sheet, GAFLAS Stratavent Nailable Venting Base Sheet, Ruberoid 20 Smooth	Note 2 (#14 ONLY)	12-inch o.c. at 4-inch laps and 12-inch o.c. in two, equally spaced, staggered center rows	GAF BUR. Note 15. (No V-BP)	-60.0
W-32.	Min. 19/32-inch plywood or wood plank; 24" span, 8d ring shank nails 6" o.c.	GAFLAS #75 Base Sheet, Tri-Ply #75 Base Sheet, GAFLAS #80 Ultima Base Sheet, GAFLAS Stratavent Nailable Venting Base Sheet, Ruberoid 20 Smooth	Note 2	12-inch o.c. at the 2-inch lap and 12-inch o.c. in three staggered center rows	GAF BUR. Note 15. (No V-BP)	-60.0
W-33.	Min. 19/32-inch plywood or wood plank; 24" span, 8d ring shank nails 6" o.c.	GAFLAS #75 Base Sheet, Tri-Ply #75 Base Sheet, GAFLAS #80 Ultima Base Sheet, GAFLAS Stratavent Nailable Venting Base Sheet, Ruberoid 20 Smooth	Note 2	8-inch o.c. at the 2-inch lap and 8-inch o.c. in three staggered center rows	GAF BUR. Note 15. (No V-BP)	-75.0

Note: We are enhancing our systems and you may notice duplicate entries/missing/outdated data. During this interim period, please contact our Customer Service at <https://www.ul.com/about/locations>.

Roofing Systems

COMPANY

GAF

1 Campus Dr
Parsippany, NJ 07054 United States

R1306

"RUBEROID® 20 Smooth" or "RUBEROID® Mop Smooth" or "RUBEROID® Mop Smooth 1.5" may be utilized as an alternate to Type G2 "GAFGLAS® #75 Base Sheet" or "Tri-Ply® #75 Base Sheet" or "GAFGLAS® #80 Ultima™ Base Sheet" base sheets in any of the following Classifications.

Torch applied "RUBEROID® HW" SBS roofing membranes may be used as alternates to "RUBEROID® Mop" SBS roofing membranes in any applicable Classification as follows:

- A. "RUBEROID® HW Smooth" may be used as an alternate to "RUBEROID® Mop Smooth" or "RUBEROID® Mop Smooth 1.5"
- B. "RUBEROID® HW 25 Smooth" or "Ruberoid® HW 20 Smooth" may be used as an alternate to "RUBEROID® 20 Smooth"
- C. "RUBEROID® HW Granule" may be used as an alternate to "RUBEROID® Mop Granule"
- D. "RUBEROID® HW Plus Granule" may be used as an alternate to "RUBEROID® Mop Plus Granule"
- E. "Ruberoid® HW Granule FR" may be used as an alternate to "Ruberoid® Mop Granule FR"
- F. "RUBEROID® HW Plus Granule FR" may be used as an alternate to "RUBEROID® Mop Plus Granule FR"
- G. "RUBEROID® EnergyCap HW Plus Granule FR" may be used as an alternate to "RUBEROID® EnergyCap Mop Plus Granule FR"

Minimum 1/2-in. thick gypsum board or minimum 1/4-in. thick Georgia-Pacific Gypsum LLC "DensDeck® Roofboard" or "DensDeck® Prime Roofboard" or "DensDeck® DuraGuard™ Roofboard" or 5/8-in. thick Georgia-Pacific Gypsum LLC "DensDeck Prime® STORMX™ Roofboard" or minimum 1/4-in. thick United States Gypsum Co. "SECUROCK® Roof Board" (Type FRX-G) or "SECUROCK® Glass-Mat Roof Board" (Type SGMRX) or "SECUROCK UltraLight Coated Glass-Mat Roof Board" (Type SGMRX) may be used in any existing noncombustible roof deck Classification. When this is done, the resulting roofing system is acceptable for use over minimum 15/32-in. thick combustible roof decks. However, the butt joints in the

gypsum board and Georgia-Pacific Gypsum LLC "DensDeck® Roofboard" or "DensDeck® Prime Roofboard" or "DensDeck® DuraGuard™ Roofboard" are to offset a minimum of 6-in. with the butt joints in the roof deck. If polystyrene is part of the roof system, it must be placed below the overlayment board. Minimum ¼-in. thick United States Gypsum Co. "SECUROCK® Roof Board" (Type FRX-G) and "SECUROCK® Glass-Mat Roof Board" (Type SGMRX) and "SECUROCK UltraLight Coated Glass-Mat Roof Board" (Type SGMRX) are limited to a maximum 3:12 inline when used over a combustible roof deck in a system with any UL Classified insulation except polystyrene.

"EnergyGuard™ NH HD Barrier" is an acceptable alternate to "EnergyGuard™ HD Barrier", "EnergyGuard™ NH HD" and "EnergyGuard™ NH HD Plus" in all applicable Classifications with a limitation that the minimum thickness of any single ply membranes used in the Classification shall be 60-mils.

Multiple plies of Type G1 "GAFGlas® Ply 4" or "Tri-Ply® Ply 4" or "GAFGlas® Flex Ply 6" or "Tri-Ply® Ultra-Flexible Ply 6" may be adhered to Georgia-Pacific Gypsum LLC "DensDeck® Roofboard" or "DensDeck® Prime Roofboard" or "DensDeck® DuraGuard™ Roofboard" in hot roofing asphalt.

"GAFGlas® FlexPly™ 6 5L" and "GAFGlas® FlexPly™ 6" may be used interchangeably in any roof covering system listed below.

"EnergyGuard™ Ultra" is an acceptable alternate to "EnergyGuard™" in any applicable Classification.

"GAFGlas® StrataVent® Nailable Venting Base Sheet" may be mechanically fastened or fully adhered with hot roofing asphalt over noncombustible roof decks and as a recover over existing roof covering systems.

"EnergyGuard™ Perlite Insulation" may be utilized as a cover board over "EnergyGuard™" in any of the following systems.

Unless otherwise indicated, the roof insulation is mechanically fastened, fully adhered with hot roofing asphalt or UL Classified urethane insulation adhesive. Polystyrene referenced in any of the following Classifications include insulation.

Unless otherwise indicated, all insulations may be adhered with any UL Classified Insulation Adhesive per the manufacturer's installation instructions (excluding "LRF Adhesive O") in any applicable non-combustible roof deck Classifications.

"EnergyGuard™ Tapered" is an acceptable alternate to "EnergyGuard™" in any applicable Classification.

"EnergyGuard™ Ultra Tapered" is an acceptable alternate to "EnergyGuard™ Ultra" in any applicable Classification.

"EnergyGuard™ NH Tapered" is an acceptable alternate to "EnergyGuard™ NH" in any applicable Classification.

"EnergyGuard™ NH Ultra Tapered" is an acceptable alternate to "EnergyGuard™ NH Ultra" in any applicable Classification.

"EnergyGuard™ Barrier Tapered" is an acceptable alternate to "EnergyGuard™ Barrier".

"EnergyGuard™ NH Barrier Tapered" is an acceptable alternate to "EnergyGuard™ NH Barrier".

Minimum ½-in. thick "EnergyGuard™ Barrier" is an acceptable alternate to "EnergyGuard™ Ultra" in any applicable Classification.

Minimum ½-in. thick "EnergyGuard™ NH Barrier" is an acceptable alternate to "EnergyGuard™ NH Ultra" in any applicable Classification.

"EnergyGuard™ RA Tapered" may be substituted for "EnergyGuard™ RA" in any of the systems listed below that utilize "EnergyGuard™ RA". "EnergyGuard™ RA" may be perforated on one side for use as the contact side for BUR or modified bitumen membrane.

"EnergyGuard™ RA Ultra Tapered" may be substituted for "EnergyGuard™ RA Ultra" in any of the systems listed below.

"EnergyGuard™ RA Ultra" may be substituted for "EnergyGuard™ RA" polyisocyanurate insulation in any of the following Classifications.

For Combustible Roof Decks – Class A: A minimum 3 in. layer or a minimum two layers of 1.5 in. of "EnergyGuard™ RA Ultra" is placed directly over a combustible deck and is covered with any UL Classified roofing membrane used in any UL Class A roofing assembly to achieve a Class A fire Classification. As an alternative, any UL Classified insulation (except expanded or extruded polystyrene), any combination, any thickness, may be used below the 3 in. minimum total thickness

of "EnergyGuard™ RA Ultra". The insulation may be loosely laid or attached with fasteners and plates, hot roofing asphalt or cold adhesive. A vapor barrier (non-UL classified) may also be used below the insulation. All insulation joints must be staggered a minimum of 6 in. from the deck joints or from the insulation joints directly below. The maximum incline shall be in accordance with the Classification established for the membrane/insulation roofing assembly, however the incline cannot exceed ½:12.

ASPHALT FELT SYSTEMS WITH HOT ROOFING ASPHALT

Type G2 asphalt glass mat base sheet ("GAFGLAS® #75 Base Sheet" or "Tri-Ply® #75 Base Sheet" or "GAFGLAS® #80 Ultima™ Base Sheet") is a suitable alternate for Type G1 asphalt glass fiber ply sheet ("GAFGLAS® Ply 4" or "Tri-Ply® Ply 4" or "GAFGLAS® Flex Ply 6" or "Tri-Ply® Ultra-Flexible Ply 6") in the Class A, B or C roof covering systems indicated below.

The roof deck may first be covered with one ply Type G2 asphalt saturated glass mat base sheet "GAFGLAS® Stratavent® Nailable Venting Base Sheet" or "GAFGLAS® Stratavent® Perforated Venting Base Sheet". Perforated base sheets to be loose laid or fully adhered with hot roofing asphalt and nailable base sheets are to be mechanically fastened granule side down.

As an option Type G2 asphalt glass mat base sheet ("GAFGLAS® #75 Base Sheet" or "Tri-Ply® #75 Base Sheet" or "GAFGLAS® #80 Ultima™ Base Sheet" or "GAFGLAS® Stratavent® Nailable Venting Base Sheet") may be substituted for Type G1 asphalt glass fiber ply sheet ("GAFGLAS® Ply 4" or "Tri-Ply® Ply 4" or "GAFGLAS® Flex Ply 6" or "Tri-Ply® Ultra-Flexible Ply 6") as the nailed base ply in the following systems.

Bottom ply or base sheet may be fully adhered with hot roofing asphalt or mechanically fastened.

Unless otherwise indicated, all insulations may be fully adhered with hot roofing asphalt or mechanically fastened.

"GAFGLAS® Flashing" or "RUBEROID®" may be used for flashing in any of the Class A, B or C systems listed below.

When "perlite" is referenced, this includes any UL Classified perlite insulation.

Crushed stones or slag are suitable alternates for gravel in any of the Class A, B or C systems listed.

Structural cement fiber building units are considered suitable to be included as a deck in the following Class A, B or C systems listed over C-15/32 or NC.

The use of gypsum board under any of the following Class A, B or C systems does not adversely affect the rating. The use of minimum ½-in. thick gypsum board is an acceptable alternate for minimum insulation over C-15/32 thick roof decks.

The use of polystyrene insulation board between minimum ¾-in. thick perlite board and deck with rosin paper (perlite/rosin paper/polystyrene/perlite) is a suitable alternate for polyisocyanurate board in the following Class A, B or C systems.

Trumbull "Perma Mop" may be utilized with any of the following "Asphalt Felt Systems with Hot Roofing Asphalt".

"GAFGLAS® #80 Ultima™ Base Sheet" may be used in any of the following systems.

"GAFTemp Permalite Recover Board" may be used in lieu of any perlite insulation in any of the following NC Classifications.

Unless otherwise indicated, any of the "Asphalt Felt Systems with Hot Roofing Asphalt" may be surfaced with "United Coatings™ FireShield MB Roof Coating" or "FireShield® MB Roof Coating" applied at a rate of 2-1/2 to 3-gal./100-ft².

Class A, B and C

Hot roofing asphalt, for use with glass felts or modified bitumen membranes.

Torch applied "RUBEROID® Heat Weld" SBS roofing membranes may be used as alternates to "RUBEROID® Mop" SBS roofing membranes in any applicable Classification.

"RUBEROID® HW 25 Smooth" or "Ruberoid® HW 20 Smooth" may be used as an alternate to "RUBEROID® Mop Smooth" or "RUBEROID® Mop Smooth 1.5".

adhered with hot roofing asphalt.

Coating: — or "TOPCOAT® MB Plus Coating" or "United Coatings™ Roof Mate™ MB Plus Coating" or "Bleed-Block Acrylic Base Coat" or "GAF Bleed-Block Acrylic Base Coat" applied at a rate of 2-gal./100-ft.².

18. Deck: NC

Incline: 1

Insulation (Optional): — Any thickness perlite or wood fiber or glass fiber or polyisocyanurate, mechanically fastened or adhered with "LRF Adhesive M" or "TPO LRF Adhesive M Low Temp" or OMG Inc. "Olybond Fastening System", applied as a nominal 3/4-in. bead or "GAF 2-Part Roofing Adhesive", applied as a nominal 2 1/2-in. bead with a maximum on-center spacing of 12-in. or any UL Classified insulation adhesive, applied per the manufacturer's installation instructions.

Base Sheet: — One ply "GAFGlas® Stratavent® Perforated Venting Base Sheet", loose laid or Type G2 "GAFGlas® #75 Base Sheet" or "Tri-Ply #75 Base Sheet" or "GAFGlas® #80 Ultima™ Base Sheet", fully adhered with hot roofing asphalt.

Ply Sheet: — One or two plies "RUBEROID® Mop Smooth", "RUBEROID® Mop Smooth 1.5", "RUBEROID® Mop Plus Smooth", "RUBEROID® 20 Smooth", "RUBEROID® 20 Plus Smooth", "RUBEROID® HW 25 Smooth" or "RUBEROID® HW 20 Smooth", fully adhered with hot roofing asphalt.

Membrane: — "GAFGlas® Mineral Surfaced Cap Sheet" or "Tri-Ply® BUR Granule Cap Sheet", fully adhered with hot roofing asphalt.

Coating: — or "TOPCOAT® MB Plus Coating" or "United Coatings™ Roof Mate™ MB Plus Coating" or "Bleed-Block Acrylic Base Coat" or "GAF Bleed-Block Acrylic Base Coat" applied at a rate of 2-gal./100-ft.².

19. Deck: C-15/32

Incline: 1

Insulation (optional): — Any thickness perlite or wood fiber or glass fiber or polyisocyanurate mechanically fastened or adhered with OMG Inc. "OlyBond Fastening System" or any UL Classified insulation adhesive.

Barrier Board: — Minimum 1/4-in. thick Georgia-Pacific Gypsum LLC "DensDeck® Roofboard" or "DensDeck® Prime Roofboard" or "DensDeck® DuraGuard™ Roofboard"; or 5/8-in. thick Georgia-Pacific Gypsum LLC "DensDeck Prime® STORMX™ Roofboard"; or minimum 1/4-in. thick United States Gypsum Co. "SECUROCK® Roof Board" (Type FRX-G) or "SECUROCK® Glass-Mat Roof Board" (Type SGMRX) or "SECUROCK UltraLight Coated Glass-Mat Roof Board" (Type SGMRX) or minimum 1/4-in. thick National Gypsum Co. "DEXcell Glass Mat Roof Board" or "DEXcell FA Glass Mat Roof Board" or minimum 7/16-in. thick "DEXcell Cement Roof Board" mechanically fastened or adhered with OMG Inc. "OlyBond Fastening System" or any UL Classified insulation adhesive with butt joints in the barrier board products staggered a minimum of 6-in. from plywood deck joints.

Base Sheet: — One ply "GAFGlas® Stratavent® Nailable Venting Base Sheet" or "GAFGlas® Stratavent® Perforated Venting Base Sheet", loose laid or Type G2 "GAFGlas® #75 Base Sheet" or "Tri-Ply #75 Base Sheet" or "GAFGlas® #80 Ultima™ Base Sheet", fully adhered with hot roofing asphalt.

Ply Sheet: — One or two plies "RUBEROID® Mop Smooth" or "RUBEROID® Mop Plus Smooth" fully adhered with hot roofing asphalt.

Membrane: — "GAFGlas® Mineral Surfaced Cap Sheet" or "Tri-Ply® BUR Granule Cap Sheet", fully adhered with hot roofing asphalt.

Coating: — or "TOPCOAT® MB Plus Coating" or "United Coatings™ Roof Mate™ MB Plus Coating" or "Bleed-Block Acrylic Base Coat" or "GAF Bleed-Block Acrylic Base Coat" applied at a rate of 2-gal./100-ft.².

20. Deck: C-15/32

Incline: 1

Base Sheet: — One ply Type G2 "GAFGlas® #75 Base Sheet" or "Tri-Ply® #75 Base Sheet" mechanically fastened.

Insulation (Optional): — Any thickness or combination: perlite or wood fiber or glass fiber or polyisocyanurate, mechanically fastened or hot mopped or adhered with OMG Inc. "OlyBond Fastening System" or any UL Classified insulation adhesive.

Base Sheet (Optional): — One ply "GAFGlas® Stratavent® Perforated Venting Base Sheet", loose laid or

mechanically fastened.

Base Sheet: — One or more plies "RUBEROID® 20 Smooth", "Ruberoid® 20 Plus Smooth", "RUBEROID® HW 25 Smooth" or "Ruberoid® HW 20 Smooth", mechanically fastened or fully adhered with hot roofing asphalt.

Cap Sheet: — Type G3 "GAFGLAS® Mineral Surfaced Cap Sheet" or "Tri-Ply® BUR Granule Cap Sheet" or "GAFGLAS® EnergyCap™ Mineral-Surfaced Cap Sheet".

21. Deck: NC

Incline: 2

Barrier Board (Optional): — One or more layers minimum 1/4-in. thick Georgia-Pacific Gypsum LLC "DensDeck® Roofboard" or "DensDeck® Prime Roofboard" or "DensDeck® DuraGuard™ Roofboard"; or 5/8-in. thick Georgia-Pacific Gypsum LLC "DensDeck Prime® STORMX™ Roofboard"; or minimum 1/4-in. thick United States Gypsum Co. "SECUROCK® Roof Board" (Type FRX-G) or "SECUROCK® Glass-Mat Roof Board" (Type SGMRX) or "SECUROCK UltraLight Coated Glass-Mat Roof Board" (Type SGMRX) or minimum 1/4-in. thick National Gypsum Co "DEXcell Glass Mat Roof Board" or "DEXcell FA Glass Mat Roof Board" or minimum 7/16-in. thick "DEXcell Cement Roof Board".

Insulation (Optional): — One or more layers perlite or wood fiber or glass fiber or polyisocyanurate or urethane or perlite/polyisocyanurate composite or perlite/urethane composite or wood fiber/polyisocyanurate composite or phenolic, any thickness.

Base Sheet: — Two plies Type G1 "GAFGLAS® Ply 4" or "Tri-Ply® Ply 4" or "GAFGLAS® Flex Ply 6", "GAFGLAS Ply 4 M", "GAFGLAS FlexPly 6 M" or one ply Type G2 "GAFGLAS® #75 Base Sheet" or "Tri-Ply® #75 Base Sheet" or "GAFGLAS® #80 Ultima™ Base Sheet" mechanically fastened or fully adhered with hot roofing asphalt or one ply Type G2 "GAFGLAS® Stratavent® Nailable Venting Base Sheet" or "GAFGLAS® Stratavent® Perforated Venting Base Sheet" loose laid, mechanically fastened or fully adhered.

Ply Sheet: — One or more plies Type G1 "GAFGLAS® Ply 4" or "Tri-Ply® Ply 4" or "GAFGLAS® Flex Ply 6", "GAFGLAS Ply 4 M", "GAFGLAS FlexPly 6 M", fully adhered with hot roofing asphalt.

Cap Sheet: — Type G3 "GAFGLAS® Mineral Surfaced Cap Sheet" or "Tri-Ply® BUR Granule Cap Sheet" or "GAFGLAS® EnergyCap™ Mineral-Surfaced Cap Sheet", fully adhered with hot roofing asphalt.

22. Deck: NC

Incline: 3

Base Sheet: — "GAFGLAS FlexPly 6 M", "GAFGLAS Ply 4 M", mechanically fastened or hot mopped. May use "Modified BUR Asphalt".

Insulation (Optional): — Perlite or glass fiber, any thickness, mechanically fastened or hot mopped. May use "Modified BUR Asphalt".

Ply Sheets: — One or more layers "GAFGLAS FlexPly 6 M", "GAFGLAS Ply 4 M".

Surfacing: — Gravel, crushed stone or crushed slag, in a flood coat of hot roofing asphalt.

Class B

1. Deck: C-15/32

Incline: 3-1/2

Barrier Board (Optional): — One or more layers minimum 1/4-in. thick Georgia-Pacific Gypsum LLC "DensDeck® Roofboard" or "DensDeck® Prime Roofboard" or "DensDeck® DuraGuard™ Roofboard"; or 5/8-in. thick Georgia-Pacific Gypsum LLC "DensDeck Prime® STORMX™ Roofboard"; or minimum 1/4-in. thick United States Gypsum Co. "SECUROCK® Roof Board" (Type FRX-G) or "SECUROCK® Glass-Mat Roof Board" (Type SGMRX) or "SECUROCK UltraLight Coated Glass-Mat Roof Board" (Type SGMRX) or minimum 1/4-in. thick National Gypsum Co "DEXcell Glass Mat Roof Board" or "DEXcell FA Glass Mat Roof Board" or minimum 7/16-in. thick "DEXcell Cement Roof Board".

Insulation (Optional): — One or more layers perlite or wood fiber or glass fiber or polyisocyanurate or urethane or perlite/polyisocyanurate composite or perlite/urethane composite or wood fiber/polyisocyanurate composite or