



Joint Evaluation Report



ESR-5157

Issued November 2022 Revised March 2023

This report is subject to renewal November 2023.

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A Subsidiary of the International Code Council®

DIVISION: 06 00 00—WOOD, PLASTICS AND COMPOSITES

Section: 06 17 13—Laminated Veneer Lumber Section: 06 17 19—Cross-laminated Timber

REPORT HOLDER:

BOISE CASCADE WOOD PRODUCTS, LLC

EVALUATION SUBJECT:

BOISE CASCADE VERSAWORKS® VENEER LAMINATED TIMBER

1.0 EVALUATION SCOPE

- 1.1 Compliance with the following codes:
- 2021, 2018, and 2015 International Building Code® (IBC)
- 2021, 2018, and 2015 International Residential Code® (IRC)
- ANSI/APA PRG 320-2019 Performance Standard for Cross-Laminated Timber

For evaluation for compliance with codes adopted by the Los Angeles Department of Building and Safety (LADBS), see <u>ESR-5157 LABC and LARC Supplement.</u>

For evaluation for compliance with codes adopted by the California Office of Statewide Health Planning and Development (OSHPD) AKA: California Department of Health Care Access and Information (HCAI) and the Division of State Architects (DSA), see ESR-5157 CBC and CRC Supplement

Properties evaluated:

Structural

Fire resistance

1.2 Evaluation to the following green code(s) and/or standards:

- 2019 California Green Building Standards Code (CALGreen), Title 24, Part 11
- 2020, 2015, and 2012 ICC 700 National Green Building Standard™ (ICC 700-2020, ICC 700-2015, and ICC 700-2012)

2.0 **USES**

Boise Cascade VersaWorks® Veneer Laminated Timber (VLT) panels are for use as components in roofs in Types I and II Construction (IBC), in walls (interior only), floors and roof in Type III Construction (IBC), and in walls, floors and roofs in Types IV and V Construction (IBC). When VLT panels are installed under the IRC, an engineered design is required in accordance with IRC Section R301.1.3.

3.0 DESCRIPTION

3.1 General:

The Boise Cascade VersaWorks* VLT panels described in this evaluation report comply with requirements noted in Section 2303.1.4 of the 2021, 2018, and 2015 IBC, for allowable stress design (ASD) in accordance with 2021 and 2018 IBC Section

2302.1(1) (2015 IBC Section 2301.2(1)) and load and resistance factor design (LRFD) in accordance with 2021 and 2018 IBC Section 2302.1(2) (2015 IBC Section 2301.2(2)). The VLT panels are manufactured with Boise Cascade 11/16-inch-thick (27 mm) 1.5E 1800_{plank} Douglas-fir laminated veneer lumber (LVL) described in ICC-ES evaluation report ESR-1040 in accordance with custom layups complying with ANSI/APA PRG 320 through product qualification and mathematical models using principles of engineering mechanics. The allowable properties for the LVL are shown in Table 1. The VLT layers (or LVL laminations) contain crossband veneers and are parallel-laminated, bonded with qualified structural adhesives, and pressed to form a solid VLT panel. The Boise Cascade VLT panels are available in plank billets with gross thickness of $2^{1}/_{8}$ inches (54 mm) to $12^{3}/_{4}$ inches (324 mm), nominal widths of 2 inches (51 mm) to 48 inches (1219 mm), and lengths up to 66 feet (20.1 m).

The attributes of the Boise Cascade VersaWorks* VLT panels have been verified as conforming to the provisions of (i) CALGreen Title 24 Part 11 Section A4.404.3 for efficient framing techniques; (ii) ICC 700-2020, 700-2015 and ICC 700-2012 Sections 608.1(2), 11.608.1(2) and 12(A).608.1 for resource-efficient materials. Note that decisions on compliance for those areas rest with the user of this report. The user is advised of the project-specific provisions that way be contingent upon meeting specific conditions, and the verification of those conditions is outside the scope of this report. These codes or standards often provide supplemental information as guidance.

3.2 Material:

- **3.2.1 Wood Laminations:** The 1¹/₁₆-inch-thick (27 mm) LVL laminations used in fabricating Boise Cascade VersaWorks* VLT panels must be manufactured in accordance with the approved inplant manufacturing standard and as described in ICC-ES evaluation report ESR-1040.
- **3.2.2** Adhesives: Adhesive used to face-bond LVL laminations (or layers) of Boise Cascade VersaWorks* VLT laminations and adhesives used for finger joints of LVL laminations are exterior-type structural adhesives conforming to ANSI/APA PRG 320 and the product specifications in the approved quality documentation.

4.0 DESIGN AND INSTALLATION

4.1 General:

Design and installation of Boise Cascade VersaWorks* VLT panels described in this evaluation report must be in accordance with this evaluation report, the applicable code provisions and the manufacturer's published design and/or installation instructions. The manufacturer's design and/or installation instructions must be available at the jobsite at all times during installation. The requirements specified for ASD and LRFD in accordance with the IBC sections noted in Section 3.1 of this report, Chapter 10 of the 2018 or 2015 NDS, and Sections 4.5 and 4.6 of the 2021 Special Design Provisions for Wind and Seismic (SDPWS) are applicable to Boise Cascade VLT panels.

4.2 Reference Design Values:

Tables 2 and 3 provide, respectively, reference design values for bending and shear capacities and in-plane shear properties of



Boise Cascade VersaWorks® VLT panels. The reference design values in Tables 2 and 3 are intended for allowable stress design and must be adjusted in accordance with Section 4.3 of this evaluation report. The design values used for the LRFD shall be obtained by multiplying the ASD design values by the factors specified in Table 10.3.1 of the 2018 or 2015 NDS. The minimum nail spacing and the equivalent specific gravities for fastener design for Boise Cascade VLT can be obtained from Tables 3 and 4 of ICC-ES evaluation report ESR-1040.

4.3 Adjustment Factors:

The reference design values in Tables 2 and 3 must be adjusted using the adjustment factors specified in Table 10.3.1 of the 2018 or 2015 NDS. The time dependent deformation (creep) factor, K_{cr}, of 2.0, as specified in Section 3.5.2 of the NDS must be used to calculate the total deflection due to long-term loading for Boise Cascade VLT panels used as components in floors and roofs under dry service condition where the moisture content in lumber in service is less than 16 percent, as in most covered structures.

4.4 Fire Resistance:

When fire resistance is required, the fire resistance rating (FRR) of the exposed Boise Cascade VersaWorks® VLT panels must be determined by calculation in accordance with Chapter 16 of the 2018 or 2015 NDS. As an alternative to the NDS calculation, the Boise Cascade VersaWorks® VLT panels shall be permitted to be tested in accordance with ASTM E119 or UL 263 and must be rated for fire resistance in accordance with the test results and conditions of such tests, and such tests must be submitted to the code official for approval and are outside the scope of this evaluation report.

5.0 CONDITIONS OF USE

The Boise Cascade VersaWorks® VLT described in this report complies with, or is a suitable alternative to what is specified in, those codes listed in Section 1.0 of this report, subject to the following conditions:

- Fabrication, design, and installation must comply with this evaluation report and the manufacturer's published design/installation instructions. In the event of a conflict between the manufacturer's published design/installation instructions and this evaluation report, the most restrictive one
- 5.2 Use of Boise Cascade VersaWorks® VLT panels must be limited to dry service conditions where the moisture content in lumber in service is less than 16 percent, as in most covered
- 5.3 Boise Cascade VersaWorks® VLT panels may be used as components in walls, floors and roofs under the IRC when an engineered design is submitted in accordance with Section R301.1.3.
- **5.4** The reference design values in Table 3 are applicable for inplane-shear design of diaphragms constructed with the Boise Cascade VersaWorks® VLT panels. The complete diaphragm designs have not been evaluated and are outside the scope of this report. To be considered as part of a floor and roof diaphragm, VLT panels used to resist in-plane shear forces shall be accompanied by complete detailing and diaphragm design in accordance with Section 4.5 of the 2021 SDPWS.
- 5.5 Properties shown in Tables 2 and 3 are limited to 1.5E VLT panels with thicknesses of 21/8 inches (54 mm) to 123/4 inches (324 mm).
- 5.6 Calculations and drawings demonstrating compliance with this evaluation report must be submitted to the code official.

- The calculations and drawings must be prepared by a registered design professional where required by the statutes of the jurisdiction in which the project is to be constructed.
- 5.7 Connections of Boise Cascade VersaWorks® VLT panels used as components in walls, floors and roofs must be designed by a registered design professional in accordance with the NDS or proprietary connectors and fasteners recognized in an ICC-ES Evaluation Report. Connectors and fasteners must be specified to include size, length, dimension, fastener bearing length and location.
- 5.8 Boise Cascade VersaWorks® VLT panels used to resist gravity or out-of-plane transverse forces in walls must be accompanied by complete detailing and wall design that are acceptable to the code official.
- Boise Cascade VLT panels used to resist in-plane shear forces in shear walls must be accompanied by complete detailing and shear wall design in accordance with Appendix B of the 2021 SDPWS
- 5.10 Cutting, drilling, and notching of Boise Cascade VersaWorks* VLT panels when used as components in walls, floors and roofs have not been evaluated and are outside the scope of this evaluation report.
- 5.11 Design properties for Boise Cascade VersaWorks® VLT panels, when used as beams or lintels with loads applied parallel to the face-bond gluelines, other than the edgewise shear properties (see Table 3), are outside the scope of this evaluation report.
- 5.12 Boise Cascade VersaWorks® VLT panel roofs must be covered with approved roof coverings secured to the building or structure in accordance with applicable provisions of IBC Chapter 15.
- 5.13 The special inspection shall be conducted in accordance with the applicable requirements of Sections 1704 and 1705 of the
- 5.14 Boise Cascade VersaWorks® VLT panels are fabricated in the Boise Cascade facilities located in White Clty, Oregon, under a quality-control program with inspections by ICC-ES and APA—The Engineered Wood Association.

6.0 EVIDENCE SUBMITTED

- Data in accordance with the ICC-ES Acceptance Criteria for Cross-laminated Timber Panels for Use as Components in Walls, Floors and Roofs (AC455), approved October 2022.
- 6.2 Data in accordance with ASTM D5456.

7.0 IDENTIFICATION

- 7.1 Boise Cascade VersaWorks* VLT panels are identified with stamps or sticker noting the report holder name (Boise Cascade Wood Products, LLC), plant number, product layup and designation (or thickness), production date and shift, and ICC-ES evaluation report number (ESR-5157).
- **7.2** The report holder's contact information is the following:

BOISE CASCADE WOOD PRODUCTS, LLC **PO BOX 2400** WHITE CITY, OREGON 97503-0400 (541) 826-0200 www.bc.com/ewp

TABLE 1—ASD REFERENCE DESIGN VALUES1 FOR LVL LAMINATIONS USED IN BOISE CASCADE VERSAWORKS® VLT PANELS

VLT Grade	LAMINATIONS USED IN MAJOR STRENGTH DIRECTION								LAMINATIONS USED IN MINOR STRENGTH DIRECTION							
	Grade & Species	F _b (psi)	E (10 ⁶ psi)	F _t (psi)	F _c (psi)	F _v (psi)	F _s (psi)	F _{c⊥} (psi)	Grade & Species	F _b (psi)	E (10 ⁶ psi)	F _t (psi)	F _c (psi)	F _v (psi)	F _s (psi)	F _{c⊥} (psi)
1.5E	Boise Cascade 1.5E 1800 _{plank} DF LVL	1,800	1.4	1,200	2,500	150	75	450	Boise Cascade 1.5E 1800 _{plank} DF LVL	1,800	1.4	1,200	2,500	150	37.5	450

For SI: 1 psi = 6,895 Pa

1 Tabulated values are reference design values intended for Allowable Stress Design (ASD) and not permitted to be changed for the LVL size adjustment factor. The design values shall be used in conjunction with the section properties provided by the VLT manufacturer based on the actual layup used in manufacturing the VLT panel (see Table 2).

TABLE 2—ASD REFERENCE DESIGN VALUES FOR BOISE CASCADE VERSAWORKS® VLT PANELS^{1,2}

VLT	THICKNESS	ı	MAJOR STRENG	TH DIRECTION	1	MINOR STRENGTH DIRECTION				
GRADE	t _p (in.)	(F _b S) _{eff,f,0} (Ib _f -ft/ft)	(EI) _{eff,f,0} (x10 ⁶ lb _f -in. ² /ft)	(GA) _{eff,f,0} (x10 ⁶ lb _f /ft)	V _{s,0} (Ib _f /ft)	(F _b S) _{eff,f,90} (Ib _f -ft/ft)	(EI) _{eff,f,90} (x10 ⁶ lb _f -in. ² /ft)	(GA) _{eff,f,90} (x10 ⁶ lb _f /ft)	V _{s,90} (lb _f /ft)	
	21/8	1,110	13.5	0.72	1,230	120	0.60	0.14	250	
	3 ³ / ₁₆	2,550	47	1.1	1,870	275	2.0	0.14	380	
1.5E	41/4	4,625	115	1.5	2,525	500	5.0	0.14	510	
	5 ⁵ / ₁₆	7,225	224	1.8	3,150	500	5.0	0.14	640	
	6 ³ / ₈	10,225	380	2.6	3,775	500	5.0	0.14	1,050	
	7 ⁷ / ₁₆	13,625	585	3.0	4,350	500	5.0	0.14	1,050	
	8 ¹ / ₂	17,600	863	3.7	4,975	500	5.0	0.14	1,050	
	9 ⁹ / ₁₆	22,300	1,229	4.2	5,600	500	5.0	0.14	1,050	
	10 ⁵ / ₈	25,625	1,602	4.6	6,225	500	5.0	0.14	1,050	
	11 ¹¹ / ₁₆	31,000	2,132	5.1	6,850	500	5.0	0.14	1,050	
	12 ³ / ₄	36,900	2,768	5.6	7,475	500	5.0	0.14	1,050	

For **SI**: 1 in. = 25.4 mm; 1 ft. = 304.8 mm; 1 lb_f = 4.448 N

TABLE 3—REFERENCE DESIGN VALUES FOR IN-PLANE SHEAR OF BOISE CASCADE VERSAWORKS® VLT PANELS1.2

VLT GRADE	THICKNESS	IN-PLANE S	HEAR CAPACITY	IN-PLANE SHEAR STIFFNESS					
	t _p (in.)	Both Stre	ngth Directions	Major S	trength Direction	Minor Strength Direction			
		(psi)	(lbf/ft of width)	G (ksi)	GA (kip/ft of width)	G (ksi)	GA (kip/ft of width)		
	21/8	225	5,550	155	3,837	53	1,312		
	3 ³ / ₁₆	225	8,425	155	5,812	53	1,987		
	41/4	225	11,350	155	7,826	53	2,676		
	5 ⁵ / ₁₆	225	14,200	155	9,783	53	3,345		
	6 ³ / ₈	225	17,025	155	11,740	53	4,014		
1.5E	7 ⁷ / ₁₆	225	19,675	155	13,557	53	4,635		
	81/2	225	22,475	155	15,493	53	5,297		
	9 ⁹ / ₁₆	225	25,300	155	17,430	53	5,959		
	10 ⁵ / ₈	225	28,100	155	19,368	53	6,622		
	11 ¹¹ / ₁₆	225	30,925	155	21,304	53	7,284		
	12 ³ / ₄	225	33,725	155	23,240	53	7,946		

For SI: 1 psi = 6,895 Pa

DISCLAIMER

APA Product Report® is a trademark of APA - The Engineered Wood Association, Tacoma, Washington. ICC-ES Evaluation Report is a trademark of ICC Evaluation Service, LLC (ICC-ES). The information contained herein is based on the product evaluation in accordance with the references noted in this report. Neither ICC-ES, nor APA or its members make any warranty, expressed or implied, or assume any legal liability or responsibility for the use, application of, and/or reference to opinions, findings, conclusions, or recommendations included in this report. The joint ICC-ES/APA Evaluation Reports are not to be construed as representing aesthetics or any other attributes not specifically addressed, nor are they to be construed as an endorsement of the subject of the report or a recommendation for its use. Consult the local jurisdiction or design professional to assure compliance with code, construction, and performance requirements. Because neither APA, nor ICC-ES, has any control over quality of workmanship or the conditions under which engineered wood products are used, it cannot accept responsibility for product performance or designs as actually constructed.

¹The tabulated values are reference design values intended for Allowable Stress Design (ASD) and must be adjusted in accordance with Section 4.3.

²The VLT layups are developed based on the ANSI/APA PRG 320, using 1¹/₁₆-inch-thick Boise Cascade 1.5É 1800_{plank} Douglas-fir LVL, as described in ICC-ES evaluation report ESR-1040.

¹The tabulated values are reference design values intended for ASD and must be adjusted in accordance with Section 4.3.

²The VLT layups are developed based on the ANSI/APA PRG 320, using 1¹/₁₆-inch-thick Boise Cascade 1.5E 1800_{plank} Douglas-fir LVL, as described in ICC-ES evaluation report ESR-1040.



ICC-ES Evaluation Report

ESR-5157 LABC and LARC Supplement

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DIVISION: 06 00 00—WOOD, PLASTICS AND COMPOSITES

Section: 06 17 13—Laminated Veneer Lumber Section: 06 17 19—Cross-laminated Timber

REPORT HOLDER:

BOISE CASCADE WOOD PRODUCTS, LLC

EVALUATION SUBJECT:

BOISE CASCADE VERSAWORKS® VENEER LAMINATED TIMBER

1.0 REPORT PURPOSE AND SCOPE

Purpose:

The purpose of this evaluation report supplement is to indicate that the Boise Cascade VersaWorks® Veneer Laminated Timber (VLT) panels, described in ICC-ES evaluation report <u>ESR-5157</u>, have also been evaluated for compliance with the codes noted below as adopted by the Los Angeles Department of Building and Safety (LADBS).

Applicable code editions:

- 2020 City of Los Angeles Building Code (LABC)
- 2020 City of Los Angeles Residential Code (LARC)

2.0 CONCLUSIONS

The Boise Cascade VersaWorks® VLT panels, described in Sections 2.0 through 7.0 of the evaluation report <u>ESR-5157</u>, comply with the LABC Chapters 6 and 23, and the LARC, and are subjected to the conditions of use described in this supplement.

3.0 CONDITIONS OF USE

The Boise Cascade VersaWorks* VLT panels, described in this evaluation report supplement must comply with all of the following conditions:

- All applicable sections in the evaluation report ESR-5157.
- The design, installation, conditions of use and identification of the Boise Cascade VersaWorks® VLT panels are in accordance with the 2018 *International Building Code*® (IBC) provisions noted in the evaluation report <u>ESR-5157</u>.
- The design, installation and inspection of the Boise Cascade VersaWorks® VLT panels are in accordance with additional requirements of LABC Chapters 16 and 17, as applicable.
- Under the LARC, an engineered design in accordance with LARC Section R301.1.3 must be submitted.

This supplement expires concurrently with the evaluation report ESR-5157, issued November 2022 and revised March 2023.





ICC-ES Evaluation Report

ESR-5157 CBC and CRC Supplement

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Purpose:

The purpose of this evaluation report supplement is to indicate that the Boise Cascade VersaWorks® Veneer Laminated Timber (VLT) panels, described in the ICC-ES evaluation report ESR-5157, have also been evaluated for compliance with the codes noted below

Applicable code editions:

■ 2022 and 2019 California Building Code (CBC)

For evaluation of applicable chapters adopted by the California Office of Statewide Health Planning and Development (OSHPD) AKA: California Department of Health Care Access and Information (HCAI) and the Division of State Architect (DSA), see Sections 2.1.1 and 2.1.2 below.

■ 2022 and 2019 California Residential Code (CRC)

2.0 CONCLUSIONS

2.1 CBC:

The Boise Cascade VersaWorks*VLT panels, described in Sections 2.0 through 7.0 of the evaluation report ESR-5157 comply with CBC Chapters 6 and 23, provided the design and installation are in accordance with the 2021 and 2018 *International Building Code*® (IBC) provisions, as applicable, noted in the evaluation report ESR-5157 and the additional requirements of CBC Chapters 6, 16, 17, and 23, as applicable.

2.1.1 OSHPD:

The Boise Cascade VersaWorks® VLT panels, described in Sections 2.0 through 7.0 of the evaluation report ESR-5157 comply with CBC amended Chapters 16, 17 and 23, and Chapters 6, 16A and 17A provided the design and installation are in accordance with the 2021 and 2018 *International Building Code®* (IBC) provisions, as applicable, noted in the evaluation report ESR-5157 and the additional requirements in Section 2.1.1.1 and 2.1.1.2 of this supplement.

2.1.1.1 Conditions of Use:

- 1. All loads applied to the Boise Cascade VersaWorks® VLT panels shall be determined by the registered design professional and shall comply with applicable loads and load combinations from CBC Chapter 16 and amendments [OSHPD 1R, 2, 3 & 5] and Chapter 16A [OSHPD 1 & 4].
- 2. Seismic Design Category shall be in accordance with CBC amended Section 1613.1, Exception 6 [OSHPD 1R, 2 & 5].
- 3. The Boise Cascade VersaWorks[®] VLT panels are prohibited from use as part of the seismic force-resisting system, unless approved as an alternative system in accordance with CBC Section 104.11 [OSHPD 1, 1R, 2, 4 & 5].
- **2.1.1.2 Special Inspection Requirement:** Special inspection of wood structural elements is required in accordance with CBC Sections 1705.5.3 [OSHPD 1R, 2, 3 and 5] or 1705A.5.3 [OSHPD 1 & 4], as applicable.



2.1.2 DSA:

The Boise Cascade VersaWorks® VLT panels, described in Sections 2.0 through 7.0 of the evaluation report ESR-5157 comply with CBC amended Chapters 16 and 23, and Chapters 6, 16A and 17A provided the design and installation are in accordance with the 2021 and 2018 International Building Code® (IBC) provisions, as applicable, noted in the evaluation report ESR-5157 and the additional requirements in Section 2.1.2.1 and 2.1.2.2 of this supplement.

2.1.2.1 Conditions of Use:

- 1. All loads applied to the Boise Cascade VersaWorks® VLT panels shall be determined by the registered design professional and shall comply with applicable loads and load combinations from CBC amended sections in Chapter 16 [DSA-SS/CC] and Chapter 16A [DSA-SS].
- 2. The Boise Cascade VersaWorks® VLT panels are prohibited from use as part of the seismic force-resisting system, unless approved as an alternative system in accordance with CBC Section 104.11 [DSA-SS & DSA-SS/CC].
- 2.1.2.2 Special Inspection Requirement: Special inspection of wood structural elements is required in accordance with the CBC Section 1705A.5.3 [DSA-SS & DSA-SS/CC].

2.2 CRC:

The Boise Cascade VersaWorks® VLT panels described in Sections 2.0 through 7.0 of the evaluation report ESR-5157, complies with CRC Chapters 5, 6 and 8, provided the design and installation are in accordance with the 2021 and 2018 International Residential Code® (IRC) provisions, as applicable, noted in the evaluation report and the additional requirements of CRC Chapter 3, as applicable.

This supplement expires concurrently with the evaluation report ESR-5157, issued November 2022 and revised March 2023.



ICC-ES Evaluation Report

ESR-5157 FBC Supplement

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Purpose:

The purpose of this evaluation report supplement is to indicate that the Boise Cascade VersaWorks® Veneer Laminated Timber (VLT) panels, described in ICC-ES evaluation report ESR-5157, has also been evaluated for compliance with the codes noted below.

Applicable code editions:

- 2020 Florida Building Code—Building
- 2020 Florida Building Code—Residential

2.0 CONCLUSIONS

The Boise Cascade VersaWorks*VLT panels, described in Sections 2.0 through 7.0 of ICC-ES evaluation report ESR-5157, comply with the *Florida Building Code—Building*, and the *Florida Building Code—Residential*. The design requirements must be determined in accordance with the *Florida Building Code—Building* and the *Florida Building Code—Residential*, as applicable. The installation requirements noted in ICC-ES evaluation report ESR-5157 for the 2018 *International Building Code*® meet the requirements of the *Florida Building Code—Building* and the *Florida Building Code—Residential*, as applicable.

Use of the Boise Cascade VersaWorks* VLT panels have also been found to be in compliance with the High-Velocity Hurricane Zone provisions of the 2020 Florida Building Code—Building and the 2020 Florida Building Code—Residential.

For products falling under Florida Rule 61G20-3, verification that the report holder's quality assurance program is audited by a quality assurance entity approved by the Florida Building Commission for the type of inspections being conducted is the responsibility of an approved validation entity (or the code official when the report holder does not possess an approval by the Commission).

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