ICC-ES Evaluation Report

ESR-5348

Reissued February 2025

Subject to renewal November 2026

This report also contains:

- City of Chicago Supplement
- City of LA Supplement
- CA Supplement
- FL Supplement w/ HVHZ
- State of OR Supplement

DIVISION: 05 00 00—METALS **Section: 05 40 00—Cold-Formed Metal Framing** **Section: 05 41 00—Structural Metal Stud Framing** **DIVISION: 09 00 00—FINISHES** **Section: 09 22 16.13—Non-Structural Metal Stud Framing**	**REPORT HOLDER:** **NINGBO DEEPBLUE SMARTHOUSE CO., LTD.**	**EVALUATION SUBJECT:** **COLD-FORMED STEEL STUDS AND TRACKS**	

1.0 EVALUATION SCOPE

Compliance with the following codes:

- 2021, 2018, and 2015 *International Building Code*® (IBC)
- 2021, 2018, and 2015 *International Residential Code*® (IRC)

Properties evaluated:

- Structural

2.0 USES

The Cold-formed Steel Studs and Tracks (framing members) are used as structural members as defined by the North American Standard for Cold-Formed Steel Structural Framing (AISI S240) and the North American Standard for Cold-Formed Steel Framing – General Provisions (AISI S200), as applicable.

The framing members may also be used as nonstructural members as defined by the North American Standard for Cold-formed Steel Nonstructural Framing (AISI S220).

3.0 DESCRIPTION

3.1 General:

The designations and dimensions of framing members are provided in Table 1. Figure 1 shows the profile of framing members used as studs and tracks. The framing members are manufactured with and without punch-out. When provided, circular punch-outs with a diameter of 1.35 inches (34.2 mm) are made at the center of the web to be used as service holes. The punch-outs are spaced a minimum of 24 inches (610 mm) on-center

and have a minimum distance between the end of the member and the center of the last punch-out of 12 inches (305 mm).

3.2 Material:

The framing members are factory-formed from coils of light gage steel conforming to ASTM A792 Grade 50 class 4 and AS 1397/G350. All members have a minimum AZ50 Aluminum-Zinc alloy coating conforming to ASTM A792.

4.0 DESIGN AND INSTALLATION

4.1 General:

The stud and track members and their connections must be designed and installed in accordance with IBC Section 2210 using the section properties referenced in Section 4.2.

4.2 Design:

The structural properties provided in Tables 2 are for structural studs without punch-outs and tracks at location 1 indicated in Figure 1. These values have been determined in accordance with the North American Specification for the Design of Cold-Formed Steel Structural Members, AISI S100 [-16 (2020) w/S2-20 under the 2021 IBC and IRC, -16 under the 2018 IBC and IRC, and -12 under the 2015 IBC and IRC]. The allowable moments, as indicated in this report, are for use with Allowable strength Design (ASD). Additional design considerations per AISI S100 must be considered, such as the design of flexural members must address web crippling, combined bending and web crippling, and combined bending and shear, as applicable.

The highlighted framing members listed in Table 1 of this report qualify for use with the prescriptive requirements of the IRC. For use under the IRC for all other sections, the cold-formed steel framing members must be limited to engineered structures, in accordance with IRC Section R301.1.3.

4.3 Installation:

The framing members must be installed in accordance with the applicable code, the approved plans, and this report. If there is a conflict between the plans submitted for approval and this report, this report governs. The approved plans must be available at the jobsite at all times during installation.

5.0 CONDITIONS OF USE:

The framing members 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:

5.1 The framing members must be installed in accordance with the applicable code, the approved plans, and this report.

5.2 Minimum uncoated base-metal thickness of the framing members as delivered to the jobsite must be at least 95 percent of the design base-metal thickness in Table 1.

5.3 The construction documents prepared or reviewed by a registered design professional where required by the statutes of the jurisdiction in which the project is to be constructed specifying the cold-formed steel studs and tracks must indicate compliance with this evaluation report and applicable codes and must be submitted to the code official for approval.

5.4 Effective section properties and allowable capacities of sections with punch-outs, swagged ends (if any), and tracks at location 2 (see Figure 1) are outside the scope of this evaluation report.

5.5 The framing members are manufactured by Ningbo DeepBlue Smarthouse Co., Ltd under a quality control program with inspections by ICC-ES.

6.0 EVIDENCE SUBMITTED

Data in accordance with the ICC-ES Acceptance Criteria for Cold-formed Steel Framing Members (AC46), dated October 2019 (Editorially revised December 2020).

7.0 IDENTIFICATION

7.1 The ICC-ES mark of conformity, electronic labeling, or the evaluation report number (ICC-ES ESR-5348) along with the name, registered trademark, or registered logo of the report holder must be included in the product label.

7.2 In addition, at a spacing not exceeding 96 inches (2440 mm) on center, each cold-formed steel member is stamped, stenciled, or embossed with the report holder's name or initials; the minimum uncoated base-metal thickness in mils or decimal inches; the minimum specified yield strength; designation for the coating (minimum AZ50); in addition to the following:

- For nonstructural members, each member must have the designation "NS."

7.3 The report holder's contact information is the following:

Ningbo DeepBlue Smarthouse Co., Ltd.
No. 69, Rd. Linchun
Yinzhou Binhai Industrial Zone
Ningbo, Zhejiang 31500
China
+8654783066356
https://www.deepbluehome.com
david@deepbluehome.com

Definition of Symbols

F_y = Yield Strength.
K_Φ = 0, Distortional buckling moment was calculated without the beneficial effect of sheathing to rotational stiffness.

Gross Properties (away from punch-outs)
A = Area of the full unreduced cross section of the framing member.
Wt = Weight per foot of the full unreduced section of the framing member.
I_{xx} = Moment of inertia about the x-axis.
S_x = Elastic section modulus about the x-axis.
R_x = Radius of gyration about the x-axis.
I_{yy} = Moment of inertia about the y-axis.
R_y = Radius of gyration about the y-axis.

Torsional and Other Properties (away from punch-outs)
J = St. Venant torsion constant.
C_w = Torsional warping constant.
X_o = Distance from shear center to the centroid along the x-axis.
R_o = Polar radius of gyration about the centroidal principal axis.
β = Torsional flexural constant = $1 - (X_o / R_o)^2$
L_u = Critical unbraced length for lateral-torsional buckling. Moments are considered fully braced when unbraced length is less than Lu.

Effective Properties (away from punch-outs):

I_{xe} = Effective moment of inertia about the x-axis.
S_{xe} = Effective section modulus about the x-axis.
$M_{a\text{-}L}$ = Allowable moment based on local buckling.
$M_{a\text{-}D}$ = Allowable moment based on distortional buckling.

TABLE 1 – STUD AND TRACKMEMBERS PHYSICAL PROPERITES[1]

STUD/TRACK DESIGNATION	MILS	DESIGN BASE STEEL THICKNESS (in.)	WEB DEPTH (in.)	FLANGE (in.)	LIP (in.)	INTERNAL CORNER RADII (in.)
300S162-27[2]	27	0.0283	3.000	1.625	0.500	0.0796
300S162-30[2]	30	0.0312	3.000	1.625	0.500	0.0781
300S162-33[2]	33	0.0346	3.000	1.625	0.500	0.0764
300S162-43[2]	43	0.0451	3.000	1.625	0.500	0.0712
350S162-27[2]	27	0.0283	3.500	1.625	0.500	0.0796
350S162-30[2]	30	0.0312	3.500	1.625	0.500	0.0781
350S162-33	33	0.0346	3.500	1.625	0.500	0.0764
350S162-43	43	0.0451	3.500	1.625	0.500	0.0712
550S162-33	33	0.0346	5.500	1.625	0.500	0.0764
550S162-43	43	0.0451	5.500	1.625	0.500	0.0712
550S162-54	54	0.0566	5.500	1.625	0.500	0.0849
550S162-68	68	0.0713	5.500	1.625	0.500	0.1069
600S162-33[2]	33	0.0346	6.000	1.625	0.500	0.0764
600S162-43[2]	43	0.0451	6.000	1.625	0.500	0.0712
600S162-54[2]	54	0.0566	6.000	1.625	0.500	0.0849
600S162-68[2]	68	0.0713	6.000	1.625	0.500	0.1069

For **SI:** 1 lbf = 4.448 N, 1 kip = 4448 N, 1 inch = 25.4 mm, 1 lb/lin ft = 14.5939 N/m, 1 inch-kip = 113 N-m

[1] For Tracks at location 2 (see Figure 1), there are no lips. The flange width for tracks at location 2 = 1.625 – Design Thickness – Internal corner radius.
[2] For application under the IRC, engineered designs in accordance with IRC Section R301.1.3 are required.

TABLE 2 – STUD AND TRACK AT LOCATION 1 SECTION PROPERTIES [6]

SECTION	F_y	GROSS PROPERTIES[1]							EFFECTIVE PROPERTIES[2]				TORSIONAL PROPERTIES[1]						
		A	Wt	I_{xx}	S_{xx}	R_x	I_{yy}	R_y	I_{xe}[3]	S_{xe}	$M_{a\text{-}L}$[4]	$M_{a\text{-}D}$[4,5]	Jx1000	C_w	X_o	m	R_o	β	L_u
	(ksi)	(in^2)	(lb/ft)	(in^4)	(in^3)	(in)	(in^4)	(in)	(in^4)	(in^3)	(in-kip)	(in-kip)	(in^4)	(in^6)	(in)	(in)	(in)		(in)
300S162-27	50	0.197	0.671	0.296	0.197	1.224	0.081	0.64	0.269	0.170	5.10	4.51	0.053	0.171	-1.403	0.83	1.969	0.492	35.5
300S162-30		0.217	0.739	0.325	0.217	1.223	0.089	0.639	0.291	0.188	5.62	5.14	0.071	0.186	-1.399	0.828	1.965	0.493	35.4
300S162-33		0.240	0.820	0.357	0.238	1.218	0.093	0.622	0.33	0.208	6.24	5.91	0.096	0.205	-1.396	0.826	1.961	0.494	35.4
300S162-43		0.311	1.060	0.458	0.305	1.213	0.118	0.617	0.432	0.275	8.24	8.38	0.212	0.259	-1.385	0.819	1.95	0.495	35.2
350S162-27		0.212	0.710	0.421	0.239	1.407	0.081	0.62	0.409	0.174	5.21	5.24	0.056	0.23	-1.331	0.8	2.034	0.571	34.6
350S162-30		0.239	0.793	0.46	0.263	1.406	0.082	0.618	0.456	0.201	6.01	5.98	0.076	0.252	-1.328	0.798	2.030	0.572	34.8
350S162-33		0.258	0.880	0.508	0.291	1.404	0.098	0.617	0.508	0.227	6.78	6.88	0.103	0.277	-1.324	0.796	2.026	0.573	34.5
350S162-43		0.334	1.140	0.655	0.374	1.4	0.125	0.612	0.654	0.309	9.25	9.80	0.227	0.35	-1.312	0.789	2.014	0.575	34.2
550S162-33		0.327	1.110	1.459	0.53	2.112	0.113	0.589	1.459	0.444	13.28	11.26	0.130	0.713	-1.114	0.697	2.459	0.795	33.5
550S162-43		0.424	1.440	1.884	0.685	2.107	0.145	0.584	1.883	0.624	18.69	16.24	0.288	0.905	-1.103	0.691	2.449	0.797	33.4
550S162-54		0.528	1.800	2.325	0.845	2.098	0.176	0.577	2.285	0.822	24.60	22.39	0.564	1.105	-1.09	0.684	2.434	0.800	31.6
550S162-68		0.657	2.240	2.862	1.041	2.087	0.212	0.567	2.896	1.063	31.52	30.16	1.114	1.342	-1.072	0.675	2.414	0.803	31.1
600S162-33		0.344	1.170	1.793	0.598	2.282	0.116	0.581	1.793	0.482	14.43	12.32	0.137	0.861	-1.072	0.677	2.588	0.828	33.3
600S162-43		0.447	1.520	2.316	0.772	2.277	0.148	0.576	2.316	0.706	21.12	17.83	0.303	1.095	-1.062	0.670	2.577	0.83	33.1
600S162-54		0.556	1.892	2.886	0.962	2.278	0.191	0.585	2.813	0.916	27.76	24.66	0.597	1.337	-1.053	0.663	2.576	0.833	33.3
600S162-68		0.693	2.360	3.526	1.175	2.256	0.218	0.561	3.568	1.200	35.58	33.37	1.174	1.626	-1.032	0.655	2.543	0.835	32.8

For **SI:** 1 lbf = 4.448 N, 1 kip = 4448 N, 1 inch = 25.4 mm, 1 lb/ft = 14.5939 N/m, 1 inch-kip = 113 N-m

[1] Gross and torsional properties are based on the full-unreduced cross section of the members, away from web punch-outs and away from swaged ends (if any).
[2] Effective properties are based on framing members without punchouts and away from swagged ends (if any). Cold work of forming has not been considered.
[3] Use the effective second moment of inertia, I_{xe}, for deflection calculations.
[4] $M_{a\text{-}l}$ and $M_{a\text{-}d}$ are based on the compression flange fully braced. For other conditions of compression flange bracing, the allowable moment must be determined in accordance with AISI S100.
[5] $M_{a\text{-}d}$ is calculated without the beneficial effect of sheathing to rotational stiffness. K_Φ =0.
[6] For definition of symbols, see page 2.

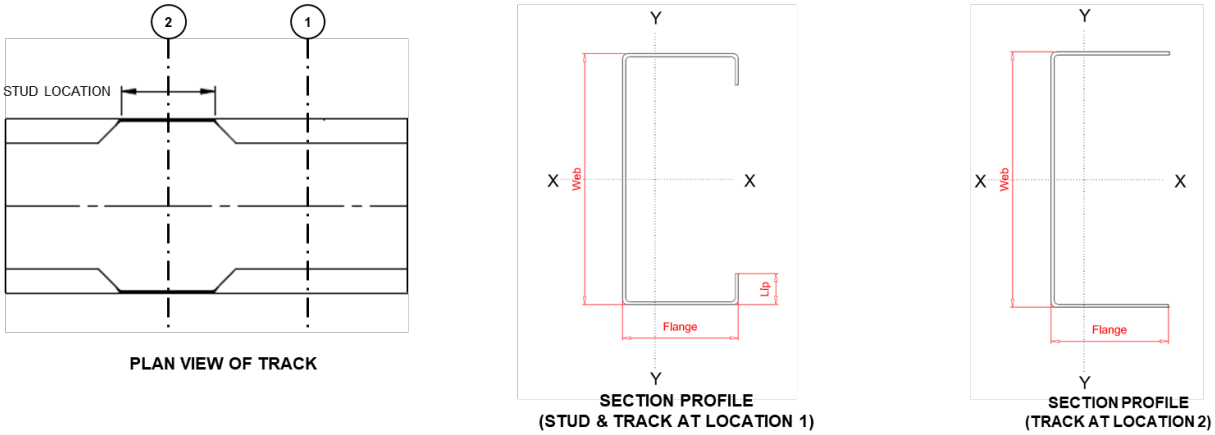

FIGURE 1 – STUD AND TRACK SECTION PROFILES

DIVISION: 05 00 00— METALS
Section: 05 40 00—Cold-Formed Metal Framing
Section: 05 41 00—Structural Metal Stud Framing

DIVISION: 09 00 00—FINISHES
Section: 09 22 16.13—Non-Structural Metal Stud Framing

REPORT HOLDER:

NINGBO DEEPBLUE SMARTHOUSE CO., LTD.

EVALUATION SUBJECT:

COLD-FORMED STEEL STUDS AND TRACKS

1.0 REPORT PURPOSE AND SCOPE

Purpose:

The purpose of this evaluation report supplement is to indicate that the cold-formed steel studs and tracks, described in ICC-ES evaluation report ESR-5348, have also been evaluated for compliance with the Chicago Construction Code (Title 14 of the Chicago Municipal Code) as noted below.

Applicable code edition:

- 2019 *Chicago Building Code* (Title 14B with Revised April 2022 Supplement)

2.0 CONCLUSIONS

In accordance with Sections 2210 and 2211 of Title 14B, the cold-formed steel studs and tracks, described in Sections 2.0 through 7.0 of the evaluation report ESR-5348, comply with Title 14B. These are subject to the conditions of use described in this supplement.

3.0 CONDITIONS OF USE

The cold-formed steel studs and tracks described in this evaluation report supplement must comply with all of the following conditions:

- All applicable sections in the evaluation report ESR-5348.
- The design, installation, conditions of use and identification of the cold-formed steel studs and tracks must be in accordance with the 2018 *International Building Code*® (IBC) provisions noted in the evaluation report ESR-5348.
- The design, installation and inspection are in accordance with additional requirements of Chapters 16, 17, and 22 of Title 14B, as applicable.

This supplement expires concurrently with the evaluation report, reissued February 2025.

DIVISION: 05 00 00—METALS
Section: 05 40 00—Cold-Formed Metal Framing
Section: 05 41 00—Structural Metal Stud Framing

DIVISION: 09 00 00—FINISHES
Section: 09 22 16.13—Non-Structural Metal Stud Framing

REPORT HOLDER:

NINGBO DEEPBLUE SMARTHOUSE CO., LTD.

EVALUATION SUBJECT:

COLD-FORMED STEEL STUDS AND TRACKS

1.0 REPORT PURPOSE AND SCOPE

Purpose:

The purpose of this evaluation report supplement is to indicate that cold-formed steel studs and tracks, described in ICC-ES evaluation report ESR-5348, 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:

- 2023 *City of Los Angeles Building Code* (LABC)
- 2023 *City of Los Angeles Residential Code* (LARC)

2.0 CONCLUSIONS

The cold-formed steel studs and tracks, described in Sections 2.0 through 7.0 of the evaluation report ESR-5348, comply with the LABC Chapter 22, and the LARC, and are subject to the conditions of use described in this supplement.

3.0 CONDITIONS OF USE

The cold-formed steel studs and tracks described in this evaluation report must comply with all of the following conditions:

- All applicable sections in the evaluation report ESR-5348.
- The design, installation, conditions of use and identification of the cold-formed steel studs and tracks are in accordance with the 2021 *International Building Code*® (IBC) provisions noted in the evaluation report ESR-5348.
- The design, installation and inspection are in accordance with additional requirements of LABC Chapters 16, 17 and 22, as applicable.
- Under the LARC, design, installation, conditions of use and identification are to be in accordance with the 2021 *International Residential Code*® (IRC) with the additional requirements of LARC Chapters 5, 6 and 8, as applicable, or an engineered design in accordance with the LARC Section R301.1.3 may be submitted.

This supplement expires concurrently with the evaluation report, reissued February 2025.

DIVISION: 05 00 00—METALS
Section: 05 40 00— Cold-Formed Metal Framing
Section: 05 41 00—Structural Metal Stud Framing

DIVISION: 09 00 00—FINISHES
Section: 09 22 16.13—Non-Structural Metal Stud Framing

REPORT HOLDER:

NINGBO DEEPBLUE SMARTHOUSE CO., LTD.

EVALUATION SUBJECT:

COLD-FORMED STEEL STUDS AND TRACKS

1.0 REPORT PURPOSE AND SCOPE

Purpose:

The purpose of this evaluation report supplement is to indicate that cold-formed steel studs and Tracks, recognized in ICC-ES evaluation report ESR-5348, has also been evaluated for compliance with the codes noted below.

Applicable code editions:

- 2022 *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 *California Residential Code* (CRC)

2.0 CONCLUSIONS

2.1 CBC:

The cold-formed steel studs and Tracks, described in Sections 2.0 through 7.0 of the evaluation report ESR-5348, comply with CBC Chapters 22, provided the design and installation are in accordance with the 2021 and *International Building Code®* (IBC) provisions, as applicable, noted in the evaluation report, and the additional requirements of CBC Chapters 16, 17 and 22, as applicable.

2.1.1 OSHPD:

The applicable OSHPD Sections and Chapters of the CBC are beyond the scope of this supplement.

2.1.2 DSA:

The applicable DSA Sections and Chapters of the CBC are beyond the scope of this supplement.

2.2 CRC:

The cold-formed steel studs and Tracks, described in Sections 2.0 through 7.0 of the evaluation report ESR-5348, comply with CRC Chapters 3, 5, 6 and 8, provided the design and installation are in accordance with the 2021 *International Residential Code®* (IRC) provisions, and the additional requirements of the CRC, as applicable.

This supplement expires concurrently with the evaluation report, reissued February 2025.

DIVISION: 05 00 00—METALS
Section: 05 40 00—Cold-Formed Metal Framing
Section: 05 41 00—Structural Metal Stud Framing

DIVISION: 09 00 00—FINISHES
Section: 09 22 16.13—Non-Structural Metal Stud Framing

REPORT HOLDER:

NINGBO DEEPBLUE SMARTHOUSE CO., LTD.

EVALUATION SUBJECT:

COLD-FORMED STEEL STUDS AND TRACKS

1.0 REPORT PURPOSE AND SCOPE

Purpose:

The purpose of this evaluation report supplement is to indicate that cold-formed steel studs and tracks, recognized in ICC-ES report ESR-5348, have also been evaluated for compliance with the codes noted below.

Applicable code editions:

- 2023 *Florida Building Code—Building*
- 2023 *Florida Building Code—Residential*

2.0 CONCLUSIONS

The cold-formed steel studs and tracks**,** described in Sections 2.0 through 7.0 of ICC-ES evaluation report ESR-5348, 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* or the *Florida Building Code—Residential,* as applicable. The installation requirements noted in ICC-ES evaluation report ESR-5348 for the 2021 *International Building Code®* meet the requirements of the *Florida Building Code—Building* or the *Florida Building Code—Residential,* as applicable.

Use of the cold-formed steel studs and tracks has also been found to be in compliance with the High-Velocity Hurricane Zone provisions of the *Florida Building Code—Building* and the *Florida Building Code—Residential* with the following exception:

1. Protection of metal must be in accordance with the *Florida Building Code—Building* Section 2222.6.
2. Members with thickness designation of 27 mils or 30 mils with a coating of less than G90 have not been evaluated for compliance with the High-Velocity Hurricane Zone provisions of the *Florida Building Code—Building.*

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).

This supplement expires concurrently with the evaluation report, reissued February 2025.

DIVISION: 05 00 00—METALS
Section: 05 40 00—Cold-Formed Metal Framing
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REPORT HOLDER:

NINGBO DEEPBLUE SMARTHOUSE CO., LTD.

EVALUATION SUBJECT:

COLD-FORMED STEEL STUDS AND TRACKS

1.0 REPORT PURPOSE AND SCOPE

Purpose:

The purpose of this evaluation report supplement is to indicate that cold-formed steel studs and tracks, described in ICC-ES evaluation report ESR-5348, have also been evaluated for compliance with the codes noted below.

Applicable code editions:

- 2022 Oregon Structural Specialty Code *(OSSC)*

2.0 CONCLUSIONS

The cold-formed steel studs and tracks, described in Sections 2.0 through 7.0 of the ICC-ES evaluation report ESR-5348, comply with the OSSC Chapter 22, and are subject to the conditions of use described in this supplement.

3.0 CONDITIONS OF USE

The cold-formed steel studs and tracks described in this evaluation report supplement must comply with all of the following conditions:

- All applicable sections in the evaluation report ESR-5348.
- The design, installation, conditions of use and identification of the cold-formed steel studs and tracks are in accordance with the 2021 *International Building Code®* (IBC) provisions noted in the ICC-ES evaluation report ESR-5348.
- The design, installation and inspection are in accordance with additional requirements of OSSC Chapters 16, 17, and 22, as applicable.

This supplement expires concurrently with the evaluation report, reissued February 2025.