*Comments on Criteria **AC138**.*

Hongyong Mi
Nascor Ltd.

Comments:
To Whom It May Concern: We have following comments on AC138: 1. Remove the Restriction of using finger jointed lumber Clause 1.4.1 PreFabricated Wood I-Stud. We suggest to change ? The flanges shall be continuous solid-sawn lumber without finger joints, joined by an oriented strand board web ?.? into ?The flanges shall be joined by an oriented strand board web ?? for the following reasons: 1) Approved end-jointed lumber is permitted to be used interchangeably with solid-sawn members of the same species and grade, according to IBC 2006 (Clause 2303.1.1). 2) Acceptance Criteria for Prefabricated Wood I-joists (AC14) does not put a restriction for using finger jointed lumber as flange materials. 2. Remove the Shear Test Requirement Section 3.2 Number of Test Specimens; Clause 3.12.1 Axial, Flexural and Shear Capacity; Table 1. In above mentioned Section and clause, the shear tests are requested for the product evaluation/qualification. But in practices, the design of I-stud is governed combined bending and axial loading, and shear will not be an issue for the design of this kind of structural. So we are wondering if we could remove the requirement related to the shear tests in AC138. 3. Relative Density Range for S-P-F Table 2 Section 3.3 requires that the density for lumber of tested specimens should be within the range specified in Table 2 for its species group. Based on our one of our R&D project, it was found that, for S-P-F typically used for wall studs, its relative density range from 0.33 to 0.45, and its average is about 0.40. But in Table 2, the samples? relative density for S-P-F is required to be within 0.31 ? 0.36. How could the report holder meet this requirement? Could we get some background information for Table 2? Thanks very much for your consideration. Regards, Hongyon Mi

*Comments on Criteria **AC138**.*

Borjen Yeh
APA - The Engineered Wood Association

Comments:
The new Section 3.13 is the same as the provisions specified in the existing ASTM D5055. Is it necessary to duplicate them in this AC?

*Comments on Criteria **AC138**.*

Bruno Di Lenardo
Canadian Conctrustion Materials Centre (CCMC)

Comments:
The CCMC has evaluated prefabricated I-stud walls and a published evaluation report is attached. It should be noted in the shaded areas of the design stud capacity Tables that the higher values are capped as the design is limited by the compression perpendicular values of the plates. So unfortunately the full extent of the capacity of I-studs could not be realized.

Attachments:

- Nascor I-stud Walls - CCMC 12717-R.pdf

NRC·CNRC
Institute for Research in Construction

Evaluation Report
CCMC 12717-R

MASTERFORMAT	06 17 34.01
Issued	1996-02-06
Re-evaluated	2008-12-18
Re-evaluation due	2011-09-02

Nascor III and IV Wall System

1. Opinion

It is the opinion of the Canadian Construction Materials Centre (CCMC) that "Nascor III and IV Wall System," when used as an insulated structural exterior wall in accordance with the conditions and limitations stated in Section 3 of this Report, complies with the National Building Code of Canada (NBC) 2005:

- Clause 1.2.1.1.(1)(a), Division A, as an acceptable solution from Division B:
  - Sentence 4.3.1.1.(1), Article 9.4.1.1., and Article 9.25.2.2.

- Clause 1.2.1.1.(1)(b), Division A, as an alternative solution that achieves at least the minimum level of performance required by Division B in the areas defined by the objectives and functional statements attributed to the following applicable acceptable solution:

  - Subsection 9.23.10. and Table 9.23.10.1.

This opinion is based on CCMC's evaluation of the technical evidence in Section 4.1 provided by the Report holder.

2. Description

The "Nascor III and IV Wall System" is an above-grade exterior wall panel consisting of prefabricated wood I-studs and polystyrene cavity insulation, with top and bottom plates. The I-studs are manufactured in the shape of an "I" with the Nascor III having two 38 mm x 64 mm (2 in. x 3 in.) dimensional lumber elements and the Nascor IV having two 38 mm x 89 mm (2 in. x 4 in.) dimensional lumber elements, which are oriented on the flat and joined with a 9.5-mm oriented strandboard (OSB) web. The lumber flanges are routered to accept the OSB web and glued with a phenol-resorcinol adhesive. The web is then encased in expanded polystyrene to accept the interlocking spline.

The "Nascor III and IV Wall System" wall panels evaluated are available in heights ranging from 2438 mm to 7315 mm. Typical details of the system are shown in Figures 1 and 2.

The dimensional lumber flanges used are S-P-F #2 grade or better kiln dried lumber. The composite stud may be spaced at 305, 406 or 610 mm on centre (o.c.). The wall panels are 140 mm and 184 mm thick with cavities filled with Type 1 expanded polystyrene. The thermal resistance value of the expanded polystyrene is 26 $m^2 \cdot K/W$ per metre of thickness.

Intertek Testing Services NA Ltd. (Warnock Hersey Professional Services Ltd.) conducts monthly audits of the manufacturing plants and the quality assurance program for the "Nascor III and IV Wall System."

The engineering properties of the "Nascor III and IV Wall System" are listed in Tables 2.1 to 2.4.

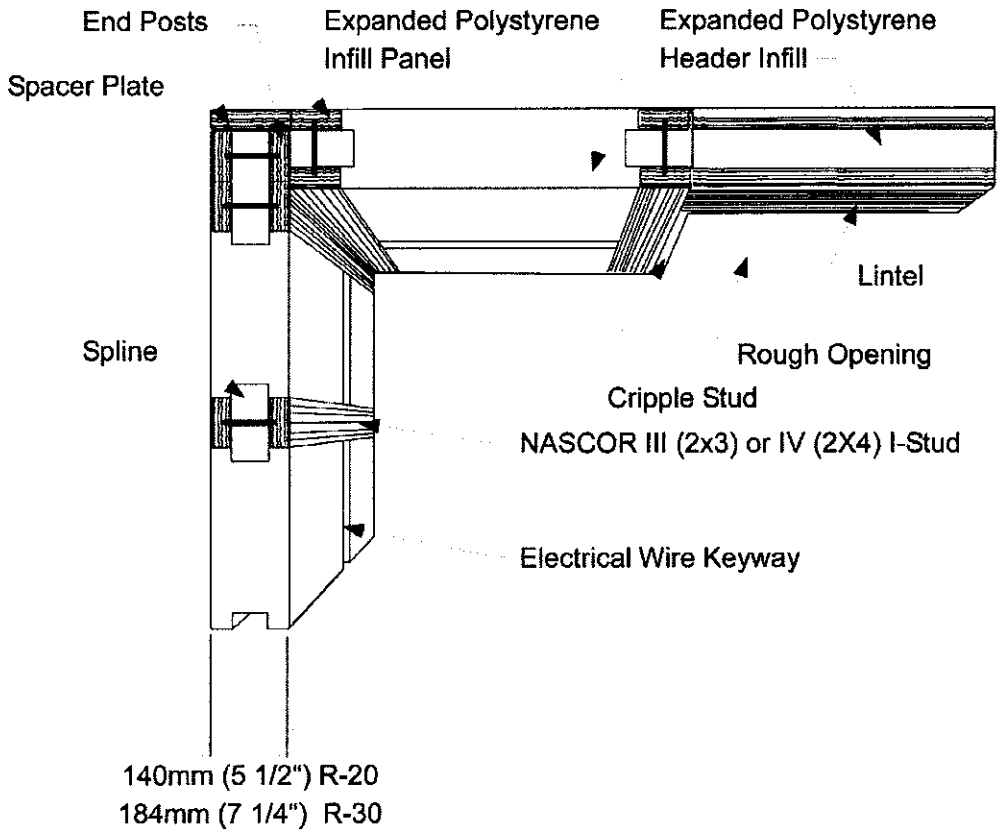

Figure 1. "Nascor III and IV Wall System" – Top View

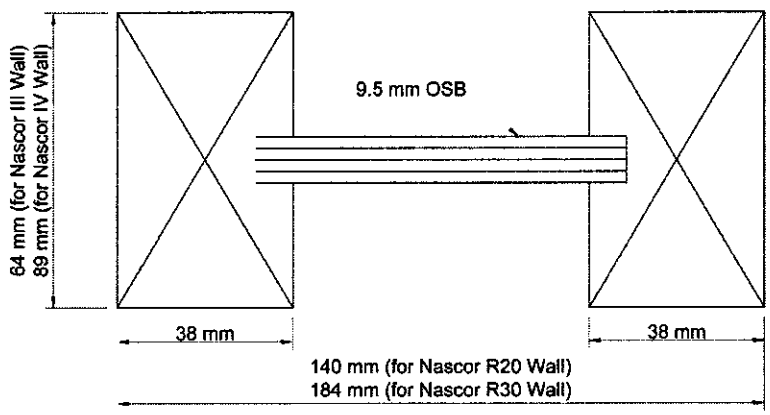

Figure 2. Nascor III and IV composite stud (available in thicknesses of 140 mm and 184 mm)

Tables 2.1 to 2.4 Maximum allowable uniform axial load for 140-mm- or 184-mm-thick "Nascor III and IV Wall System" panels at design wind load for the specific geographical area (kN/stud spacing provides kN/m of wall)

Table 2.1 Maximum Factored Axial Load for Nascor III-R20 Wall (kN)

Wall Height (mm)	O.C. Spacing (mm)	Maximum Allowable Reference Velocity Pressure Based on Probability of 1/50 ($q_{1/50}$, kPa)					
		0.40	0.45	0.50	0.55	0.60	0.65
2438	305	51.99	51.99	51.28	50.48	49.68	48.88
2438	406	50.73	49.68	48.63	47.58	46.58	45.53
2438	610	46.58	45.03	43.53	42.08	40.63	39.18
3048	305	37.27	36.32	35.37	34.42	33.52	32.57
3048	406	34.72	33.52	32.27	31.12	29.97	28.82
3048	610	29.97	28.22	26.57	24.97	23.37	21.82
3658	305	26.11	25.06	24.06	23.06	22.11	21.16
3658	406	23.41	22.11	20.86	19.61	18.46	17.26
3658	610	18.46	16.71	15.01	13.41	11.86	10.31
4267	305	18.06	17.06	16.06	15.06	14.11	13.21
4267	406	15.36	14.11	12.91	11.71	10.56	9.41
4267	610	10.56	8.86	7.26	5.71	4.26	2.81
4877	305	12.32	11.32	10.37	9.42	8.52	7.67
4877	406	9.72	8.52	7.37	6.27	5.17	4.12
4877	610	5.17	3.62	2.12	0.67	-	-
5486	305	8.21	7.26	6.36	5.51	4.66	3.86
5486	406	5.76	4.66	3.56	2.56	-	-
5486	610	-	-	-	-	-	-
6096	305	5.25	4.35	3.55	-	-	-
6096	406	-	-	-	-	-	-
6096	610	-	-	-	-	-	-
6706	305	-	-	-	-	-	-
6706	406	-	-	-	-	-	-
6706	610	-	-	-	-	-	-
7315	305	-	-	-	-	-	-
7315	406	-	-	-	-	-	-
7315	610	-	-	-	-	-	-

Table 2.2 Maximum Factored Axial Load for Nascor III-R30 Wall (kN)

Wall Height (mm)	O.C. Spacing (mm)	Maximum Allowable Reference Velocity Pressure Based on Probability of 1/50 ($q_{1/50}$, kPa)					
		0.40	0.45	0.50	0.55	0.60	0.65
2438	305	61.41	61.41	61.41	61.41	61.41	61.41
2438	406	61.41	61.41	61.41	61.37	60.52	59.72
2438	610	60.52	59.32	58.12	56.92	55.72	54.57
3048	305	54.66	54.36	53.46	52.56	51.66	50.76
3048	406	52.86	51.66	50.51	49.36	48.21	47.06
3048	610	48.21	46.51	44.81	43.21	41.56	39.96
3658	305	45.61	44.41	43.26	42.11	41.01	39.91
3658	406	42.51	41.01	39.56	38.11	36.66	35.31
3658	610	36.66	34.61	32.61	30.61	28.66	26.81
4267	305	36.67	35.27	33.92	32.62	31.32	30.07
4267	406	33.07	31.32	29.67	28.02	26.47	24.92
4267	610	26.47	24.17	21.92	19.77	17.72	15.67
4877	305	28.72	27.22	25.77	24.37	22.97	21.67
4877	406	24.82	22.97	21.22	19.52	17.87	16.32
4877	610	17.87	15.52	13.22	11.07	8.97	6.92
5486	305	21.91	20.36	18.91	17.46	16.11	14.76
5486	406	17.96	16.11	14.36	12.66	11.01	9.46
5486	610	11.01	8.71	6.46	4.31	2.26	0.26
6096	305	16.32	14.82	13.37	11.97	10.62	9.37
6096	406	12.42	10.62	8.92	7.27	5.72	4.22
6096	610	5.72	3.47	-	-	-	-
6706	305	11.81	10.36	8.96	7.66	6.36	5.16
6706	406	8.11	6.36	4.76	-	-	-
6706	610	-	-	-	-	-	-
7315	305	8.28	6.88	5.58	-	-	-
7315	406	-	-	-	-	-	-
7315	610	-	-	-	-	-	-

Notes to Tables 2.1 and 2.2:

(1) The above design tables were developed on the following two assumptions: the I-studs are laterally braced to prevent buckling in the narrow dimension and the loads are uniformly distributed along the top of the wall.

(2) Limit States Design load combinations used to develop Tables 2.1 and 2.2 include axial load alone and wind load plus axial load. For the combination of wind load plus axial load, the case where wind is the principal load is used for conservative purposes.

(3) The maximum factored axial load for the Nascor III-R20 and -R30 walls is for a location with a specified maximum $q_{1/50}$. For locations with $q_{1/50}$ falling between two categories, the maximum factored axial load in the category with the higher $q_{1/50}$ governs. For example, if $q_{1/50} = 0.48$ kPa, the maximum factored axial load in the category of 0.50 kPa shall be used if no further engineering design is conducted. For locations with $q_{1/50} > 0.65$ kPa, engineering design is required.

(4) When using Tables 2.1 and 2.2, the factored axial load resulting from the most critical load combination shall be determined first. If the factored axial load is less than the maximum value stated in these tables for a corresponding wall height, o.c. spacing and specific location, the application of the specified wall is acceptable. Otherwise, try another type of Nascor wall, or reduce the o.c. spacing of the I-stud, or reduce the height of the wall.

(5) "-" indicates the application for this case is not allowed.

(6) For the shaded cases, if S-P-F lumber is used for the top or bottom wall plate, the load-carrying capacity shall be governed by the bearing strength of the lumber plates, which is 23.59 kN. For other species and grades, the bearing capacity must be calculated in accordance with CAN/CSA-O86-01, "Engineering Design in Wood." The lower of the tabulated value and bearing capacity is taken to be the load-carrying capacity.

Table 2.3 Maximum Factored Axial Load for Nascor IV-R20 Wall (kN)

Wall Height (mm)	O.C. Spacing (mm)	Maximum Allowable Reference Velocity Pressure Based on Probability of 1/50 ($q_{1/50}$, kPa)					
		0.40	0.45	0.50	0.55	0.60	0.65
2438	305	58.15	58.15	58.15	58.15	58.15	58.15
2438	406	58.15	58.15	58.15	58.12	57.37	56.62
2438	610	57.37	56.22	55.12	54.02	52.92	51.82
3048	305	45.16	44.98	44.23	43.53	42.83	42.13
3048	406	43.78	42.83	41.88	40.98	40.08	39.18
3048	610	40.08	38.73	37.43	36.13	34.88	33.63
3658	305	33.77	32.97	32.17	31.37	30.57	29.82
3658	406	31.62	30.57	29.57	28.57	27.62	26.62
3658	610	27.62	26.17	24.77	23.42	22.12	20.82
4267	305	24.91	24.06	23.21	22.41	21.61	20.81
4267	406	22.66	21.61	20.56	19.56	18.56	17.61
4267	610	18.56	17.16	15.76	14.46	13.16	11.91
4877	305	18.27	17.42	16.62	15.82	15.02	14.27
4877	406	16.07	15.02	14.02	13.02	12.12	11.17
4877	610	12.12	10.72	9.42	8.12	-	-
5486	305	13.37	12.52	11.72	10.97	10.22	9.52
5486	406	11.22	10.22	9.27	8.37	-	-
5486	610	-	-	-	-	-	-
6096	305	9.68	8.88	8.18	-	-	-
6096	406	-	-	-	-	-	-
6096	610	-	-	-	-	-	-
6706	305	-	-	-	-	-	-
6706	406	-	-	-	-	-	-
6706	610	-	-	-	-	-	-
7315	305	-	-	-	-	-	-
7315	406	-	-	-	-	-	-
7315	610	-	-	-	-	-	-

Table 2.4 Maximum Factored Axial Load for Nascor IV-R30 Wall (kN)

Wall Height (mm)	O.C. Spacing (mm)	Maximum Allowable Reference Velocity Pressure Based on Probability of 1/50 ($q_{1/50}$, kPa)					
		0.40	0.45	0.50	0.55	0.60	0.65
2438	305	78.61	78.61	78.61	78.61	78.61	78.61
2438	406	78.61	78.61	78.61	78.61	78.61	78.61
2438	610	78.61	78.61	78.61	78.61	78.40	77.40
3048	305	70.02	70.02	70.02	70.02	70.02	70.02
3048	406	70.02	70.02	70.02	69.57	68.57	67.67
3048	610	68.57	67.17	65.77	64.37	63.02	61.67
3658	305	62.33	62.33	61.33	60.38	59.43	58.48
3658	406	60.68	59.43	58.18	56.93	55.68	54.48
3658	610	55.68	53.88	52.08	50.38	48.63	46.93
4267	305	52.90	51.70	50.50	49.35	48.20	47.10
4267	406	49.75	48.20	46.70	45.25	43.80	42.40
4267	610	43.80	41.70	39.70	37.70	35.75	33.85
4877	305	43.38	41.98	40.68	39.38	38.13	36.88
4877	406	39.83	38.13	36.48	34.88	33.33	31.83
4877	610	33.33	31.08	28.93	26.83	24.78	22.83
5486	305	34.94	33.49	32.09	30.74	29.44	28.19
5486	406	31.19	29.44	27.79	26.14	24.54	23.04
5486	610	24.54	22.29	20.09	17.99	15.94	13.99
6096	305	27.75	26.30	24.90	23.55	22.25	21.00
6096	406	24.00	22.25	20.55	18.95	17.40	15.90
6096	610	17.40	15.15	13.05	11.00	9.00	-
6706	305	21.78	20.33	18.98	17.68	16.43	15.18
6706	406	18.08	16.43	14.78	13.23	11.73	10.28
6706	610	11.73	-	-	-	-	-
7315	305	16.88	15.53	14.23	12.98	11.78	-
7315	406	13.38	11.78	-	-	-	-
7315	610	-	-	-	-	-	-

Notes to Tables 2.3 and 2.4:

(1) The above design tables were developed on the following two assumptions: the I-studs are laterally braced to prevent buckling in the narrow dimension and the loads are uniformly distributed along the top of the wall.

(2) Limit States Design load combinations used to develop Tables 2.3 and 2.4 include axial load alone and wind load plus axial load. For the combination of wind load plus axial load, the case where wind is the principal load is used for conservative purposes.

(3) The maximum factored axial load for the Nascor IV-R20 and -R30 walls is for a location with a specified maximum $q_{1/50}$. For locations with $q_{1/50}$ falling between two categories, the maximum factored axial load in the category with the higher $q_{1/50}$ governs. For example, if $q_{1/50}$ = 0.48 kPa, the maximum factored axial load in the category of 0.50 kPa shall be used if no further engineering design is conducted. For locations with $q_{1/50}$ > 0.65 kPa, engineering design is required.

(4) When using Tables 2.3 and 2.4, the factored axial load resulting from the most critical load combination shall be determined first. If the factored axial load is less than the maximum value stated in these tables for corresponding wall height, o.c. spacing and specific location, the application of the specified wall is acceptable. Otherwise, try another type of Nascor wall, or reduce the o.c. spacing of the I-stud, or reduce the height of the wall.

(5) "-" indicates the application for this case is not allowed.

(6) For the shaded cases, if S-P-F lumber is used for the top or bottom wall plate, the load-carrying capacity shall be governed by the bearing strength of the lumber plates, which is 33.03 kN. For other species and grades, the bearing capacity must be calculated in accordance with CAN/CSA-O86-01, "Engineering Design in Wood." The lower of the tabulated value and bearing capacity is taken to be the load-carrying capacity.

3. Conditions and Limitations

CCMC's compliance opinion in Section 1 is bound by the "Nascor III and IV Wall System," being used in accordance with the conditions and limitations set out below.

The use of "Nascor III and IV Wall System" wall panels is limited to the size of buildings permitted under NBC Part 9 construction as an alternative solution to Table 9.23.10.1. of the NBC 2005 and are intended for "dry service" use[(1)] applications only.

(1) All lumber, wood-based panels and proprietary engineered wood products are intended for "dry service conditions." "Dry service" is defined as the in-service environment under which the equilibrium moisture content (MC) of lumber is 15% or less over a year and does not exceed 19% at any time. Wood contained within the interior of dry, heated or unheated buildings has generally been found to have a MC between 6% and 14% according to season and location. During construction, all wood-based products should be protected from the weather to ensure that the 19% MC is not exceeded in accordance with the NBC 2005, Article 9.3.2.5.

The capacity of the wall system has been pre-calculated for uniform loads only. The factored axial loads outlined in Tables 2.1 to 2.4 must not be exceeded based on the sum of the factored dead loads and live loads for the combined floor and roof loads in accordance with Part 4 of the NBC 2005.

- A professional engineer shall provide the building official with suitable calculations demonstrating that the factored resistance of the studs is not exceeded by taking into account floor spans, anticipated floor loads, roof spans and snow loads for the geographical location being considered.

- For structural applications outside the scope of Tables 2.1 to 2.4, such as concentrated loads, seismic areas, etc., the drawings or related documents shall bear the authorized seal of a professional engineer skilled in wood design and licensed to practice under the appropriate provincial or territorial legislation.

- This evaluation is limited to the use of the Nascor III or Nascor IV I-stud only within the prefabricated "Nascor III and IV Wall System," with factory-installed expanded polystyrene infill cavity panels. The I-studs bearing the CCMC number shall not be used as individual building members in other forms of construction.

- All details of design, fabrication, handling and installation, including material, frame continuity (i.e. top plate), wall plates, sheathing, sheathing paper, bracing, fastening, hole drilling, construction of window/door openings, protection of polystyrene insulation and interior finish shall comply not only with the manufacturer's current specifications and instructions, but also with the NBC 2005.

- This product must be identified with the phrase "CCMC 12717-R" along the side of the I-stud. This CCMC number is only valid when it appears in conjunction with the certification mark of Intertek Testing Services NA Ltd. (Warnock Hersey Professional Services Ltd.).

- Evidence should be submitted to demonstrate that the thermal insulation conforming to the CAN/ULC-S701 is certified by a third-party within an accredited certification program for expanded polystyrene.

4. Technical Evidence

CCMC's Technical Guide for "Composite Wood I-Stud (glued wood web)" sets out the nature of the technical evidence required by CCMC to enable it to evaluate a product as an alternative solution in compliance with the NBC 2005. The Report holder has submitted test results for CCMC's evaluation. Testing was conducted by an independent testing agency recognized by CCMC. The corresponding test results for "Nascor III and IV Wall System" are summarized below.

4.1 NBC 2005 Compliance Data for "Nascor III and IV Wall System" on which CCMC Based its Opinion in Section 1

4.1.1 Axial Compression Tests

In total, 280 specimens were tested in axial compression as outlined in Table 4.1.1.

Table 4.1.1

Stud	Width, mm (in.)	Thickness, mm (in.)	Number of Specimens				
			Length, m (ft.)				
			2.4 (8)	3.0 (10)	3.65 (12)	4.26 (14)	4.87 (16)
Nascor III	63.5 (2.5)	140 (5.5)	30	10	10	10	10
	63.5 (2.5)	184 (7.25)	30	10	10	10	10
Nascor IV	89 (3.5)	140 (5.5)	30	10	10	10	10
	89 (3.5)	184 (7.25)	30	10	10	10	10

Note to Table 4.1.1:
(1) The axial strength characteristic value was carried out empirically. The test data was used to establish the applicable coefficient of variation, CV_w, and the reliability normalization factor from CAN/CSA-O86-01 was used to determine the specified strength and factored resistance.

4.1.2 Bending Strength and Stiffness

In total, 280 specimens were tested for bending strength and stiffness as outlined in Table 4.1.2.

Table 4.1.2

Stud	Width, mm (in.)	Thickness, mm (in.)	Number of Specimens				
			Length, m (ft.)				
			2.4 (8)	3.0 (10)	3.65 (12)	4.26 (14)	4.87 (16)
Nascor III	63.5 (2.5)	140 (5.5)	30	10	10	10	10
	63.5 (2.5)	184 (7.25)	30	10	10	10	10
Nascor IV	89 (3.5)	140 (5.5)	30	10	10	10	10
	89 (3.5)	184 (7.25)	30	10	10	10	10

Note to Table 4.1.2:
(1) The bending strength characteristic value was carried out empirically. The test data was used to establish the applicable coefficient of variation, CV_w, and the reliability normalization factor from of CAN/CSA-O86-01 was used to determine the specified strength and factored resistance. Bending stiffness was recorded at various deflection limits for wall stud design.

4.1.3 Adhesives

Adhesives for web-to-web and web-to-flange connection comply with CSA O112.7-M1977, "Resorcinol and Phenol-Resorcinol Resin Adhesives for Wood (Room and Intermediate Temperature Curing)."

4.1.4 Web Material

The web material complies with CAN/CSA-O325.0-92, "Construction Sheathing."

4.1.5 Manufacturing Quality Assurance

The manufacturing quality assurance program has been approved and is verified by Intertek Testing Services NA Ltd. (Warnock Hersey Professional Services Ltd.) as part of the product certification.

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