Technical Evaluation Report™ - Canada

Conformity Assessment by an Approved Certification Agency

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U2 Fasteners™ UNI, CS, and Flat Head Screws: Fastener Properties and Design Values - Canada

Trade Secret Report Holder:

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CSI Designations:

DIVISION: 06 00 00 - WOOD, PLASTICS AND COMPOSITES Section: 06 05 23 - Wood, Plastic, and Composite Fastenings

1 Innovative Products Evaluated[1]

1.1 U2 Fasteners:

1.1.1 UNI – Universal Screw™

1.1.2 CS – Construction Screw™

1.1.3 Flat Head Screws™

2 Product Description and Materials

2.1 The innovative products evaluated in this report are shown in **Figure 1**, **Figure 2**, and **Figure 3**.

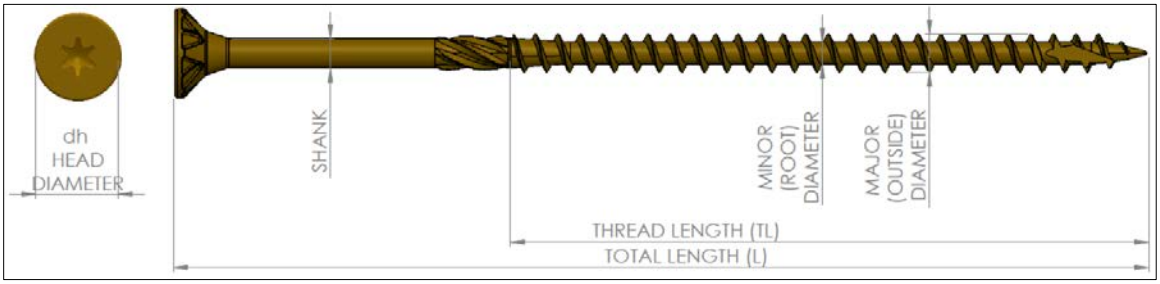


Figure 1. UNI Screw

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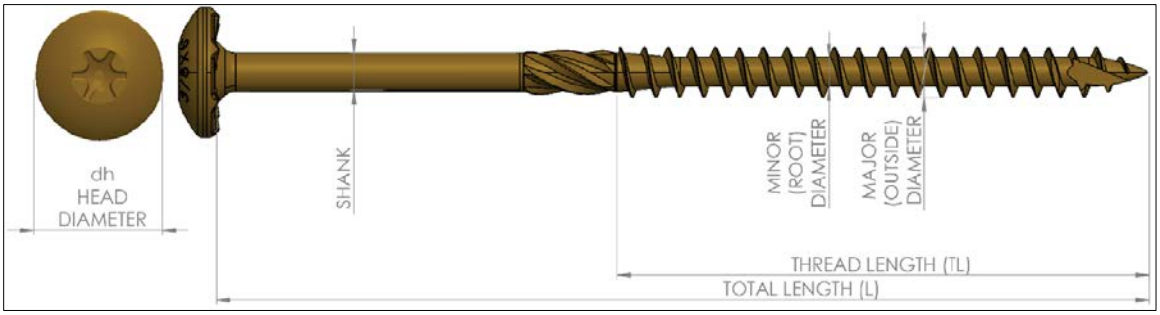


Figure 2. CS Screw

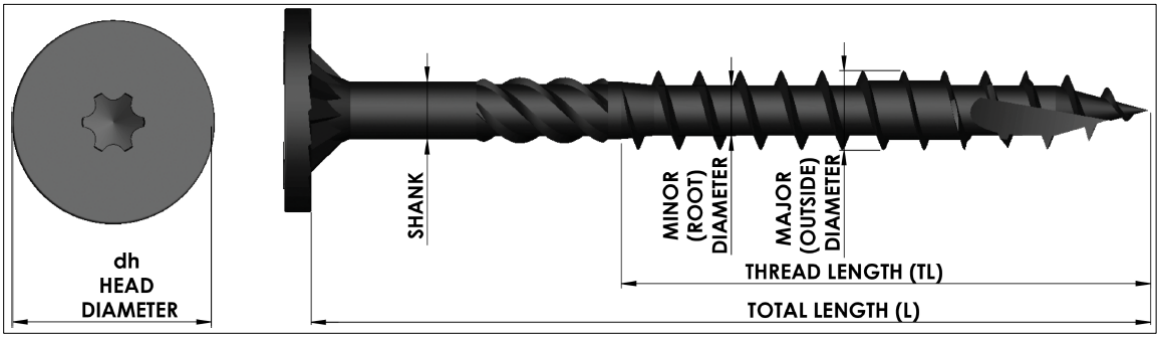


Figure 3. Flat Head Screw

2.2 *General*

2.2.1 U2 Fasteners are identified on the product packaging with the logo shown in **Figure 4**.

Figure 4. U2 Fasteners Logo

2.2.2 UNI and CS Screws are partially threaded, self-drilling dowel-type fasteners that are manufactured using standard cold forming processes and are subsequently heat-treated and coated with a proprietary multilayer coating identified as U2 Gold Coating.

2.2.2.1 Stainless steel UNI and CS screws are coated with the U2 Gold Coating.

2.2.2.2 UNI fasteners are star-driven screws with a countersinking head with burrow pockets and reamer threads above the cutting threads.

2.2.2.3 CS fasteners are star-driven screws with a dome-shaped washer head with Talon Grip™ on the bottom-side of the head, and reamer threads above the cutting threads.

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2.2.3 Flat Head Screws are partially-threaded, self-drilling, dowel-type fasteners that are manufactured using standard cold forming processes and are subsequently heat-treated and coated with a proprietary black Nano-coating.

2.2.3.1 Flat Head fasteners are star-driven screws with a washer head with Talon Grip on the bottom-side of the head, and reamer threads above the cutting threads.

2.3 *Fastener Material*

2.3.1 UNI and CS are made of hardened carbon steel or 316 stainless steel.

2.3.2 Flat Head Screws are made of hardened carbon steel.

2.4 *Fastener Specifications*

2.4.1 **Table 1** lists the dimensions and mechanical properties of the U2 Fasteners evaluated in this report.

Table 1. U2 Fasteners Specifications

Product Name	Fastener ID	Fastener Length in (mm)	Thread Length in (mm)[3]	Head Diameter in (mm)	Unthreaded Shank Diameter In (mm)	Thread Diameter in (mm)		Specified Bending Yield, F_{yb} psi (MPa)[4]	Factored Resistance lbf (kN)		
						Minor	Major		Tensile	Shear	
										Thread	Shank
UNI Universal Screw[1]	#9 x 2 3/4"	2 3/4 (70)	2 (51)	0.329 (8.4)	0.131 (3.3)	0.113 (2.9)	0.176 (4.5)	215,000 (1,482)	708 (3.15)	405 (1.80)	464 (2.06)
	#9 x 3 1/8"	3 1/8 (79)	1 1/2 (38)								
	#10 x 2 1/2"	2 1/2 (64)		0.371 (9.4)	0.146 (3.7)	0.130 (3.3)	0.197 (5.0)	220,000 (1,517)	966 (4.30)	483 (2.15)	634 (2.82)
	#10 x 4 1/2"	4 1/2 (114)	3 (76)								
	#12 x 3 1/2"	3 1/2 (89)	2 1/4 (67)	0.441 (11.2)	0.172 (4.4)	0.154 (3.9)	0.237 (6.0)	235,000 (1,620)	1,334 (5.94)	725 (3.23)	926 (4.12)
	#12 x 6"	6 (152)	4 (102)								
CS Construc-tion Screw[2]	#10 x 3 1/8"	3 1/8 (79)	1 1/2 (38)	0.445 (11.3)	0.143 (3.6)	0.125 (3.2)	0.195 (5.0)	225,000 (1,551)	966 (4.30)	483 (2.15)	634 (2.82)
	5/16 x 2 1/2"	2 1/2 (64)		0.632 (16.1)	0.197 (5.0)	0.170 (4.3)	0.274 (7.0)	220,000 (1,517)	1,530 (6.81)	869 (3.87)	1,158 (5.15)
	5/16 x 3 1/8"	3 1/8 (79)									
	5/16 x 4"	4 (102)	2 1/2 (64)								
	3/8 x 6"	6 (152)	3 1/2 (89)	0.715 (18.2)	0.225 (5.7)	0.194 (4.9)	0.312 (7.9)	215,000 (1,482)	2,005 (8.92)	1,136 (5.05)	1,634 (7.27)
	3/8 x 7"	7 (178)									
Stainless Steel Universal Screws[1]	#9 x 2"	2 (51)	1.32 (34)	0.328 (8.3)	0.135 (3.4)	0.112 (2.8)	0.172 (4.4)	165,000 (1,138)	570 (2.54)	382 (1.70)	393 (1.75)
	#10 x 2 1/2"	2 1/2 (64)	1.62 (41)	0.366 (9.3)	0.147 (3.7)	0.129 (3.3)	0.194 (4.9)	185,000 (1,276)	642 (2.86)	480 (2.14)	489 (2.17)
	#10 x 3"	3 (76)	1.96 (50)								
	#10 x 4"	4 (102)	2.50 (64)								

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Table 1. U2 Fasteners Specifications

Product Name	Fastener ID	Fastener Length in (mm)	Thread Length in (mm)[3]	Head Diameter in (mm)	Unthreaded Shank Diameter In (mm)	Thread Diameter in (mm)		Specified Bending Yield, F_{yb} psi (MPa)[4]	Factored Resistance lbf (kN)		
						Minor	Major		Tensile	Shear	
										Thread	Shank
Stainless Steel Construc-tion Screws[2]	5/16 x 2 1/2"	2 1/2 (64)	1.59 (40)	0.621 (15.8)	0.201 (5.1)	0.176 (4.5)	0.275 (7.0)	200,000 (1,379)	1,281 (5.70)	931 (4.14)	1,049 (4.67)
	5/16 x 4"	4 (102)	2.53 (64)								
	5/16 x 5"	5 (127)	2.96 (75)								
	5/16 x 6"	6 (152)	3.97 (101)								
Black Flat Head Wood Screw[2]	25/64 x 3 3/8"	3 3/8 (86)	1 1/2 (38)	0.962 (24.4)	0.278 (7.1)	0.251 (6.4)	0.386 (9.8)	190,000 (1,310)	3,110 (13.84)	2,318 (10.31)	2,450 (10.9)
	25/64 x 4"	4 (102)	2 1/2 (64)								
	25/64 x 5"	5 (127)	3 (76)								
	25/64 x 6 3/4"	6 3/4 (152)	4 1/2 (89)								

SI: 1 in = 25.4 mm, 1 lb = 4.45 N, 1-psi = 0.00689 MPa

1. Overall fastener length was measured from the top of the head to the bottom of the point.
2. Overall fastener length was measured from the underside of the head to the bottom of the point.
3. Thread length includes the point.
4. Bending yield strength was determined in accordance with ASTM F1575/F1575M

2.5 As needed, review material properties for design in **Section 4** and the regulatory evaluation in **Section 5**.

3 Applicable Codes and Standards[2]

3.1 *Codes*

3.1.1 *NBC—15, 20, 25: National Building Code of Canada*

3.1.2 *O Reg. 163/24: Ontario Building Code (Ontario Building Code or OBC)[3]*

3.2 *Standards and Referenced Documents*

3.2.1 *AISI S100: North American Specification for the Design of Cold-Formed Steel Structural Members*

3.2.2 *AISI S904: Standard Test Methods for Determining the Tensile and Shear Strengths of Screws*

3.2.3 *ASTM A153: Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware*

3.2.4 *ASTM D1761: Standard Test Methods for Mechanical Fasteners in Wood*

3.2.5 *ASTM F1575: Standard Test Method for Determining Bending Yield Moment of Nails, Spikes, and Dowel type Threaded Fasteners*

3.2.6 *AWC NDS: National Design Specification for Wood Construction*

3.2.7 *CSA O86: Engineering Design in Wood*

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4 Tabulated Properties Generated from Nationally Recognized Standards

4.1 *General*

4.1.1 The U2 Fasteners described in this report are self-tapping fasteners for wood-to-wood connections in conventional light frame construction. They provide resistance against withdrawal, head pull-through, axial, and shear loads. See **Section 6** for installation requirements.

4.1.1.1 U2 Fasteners can be used in applications including structural and general timber construction work.

4.1.1.2 U2 Fasteners are typically installed without lead holes, as prescribed in CSA O86 Article 12.11.2.1. However, lead holes are permitted to avoid splitting.

4.2 *Corrosion Resistance*

4.2.1 UNI and CS Screws are coated with U2 Gold Coating. This multi-layered coating meets the requirements of ASTM A153, Class D, and does not contain any Chrome 6^4 or other chemical amounts listed in Proposition 65.

4.2.2 UNI and CS Screws may be used where the equilibrium moisture content of wood that has been pressure treated with waterborne Alkaline Copper Quaternary (ACQ) having a maximum retention of 0.60-pcf meets the dry service conditions of CSA O86 with occasional exposure to high humidity.

4.2.3 UNI and CS Screws may be used where they are exposed to freshwater and wood that has been pressure treated with waterborne ACQ having a maximum retention of 0.60-pcf.

4.2.4 Flat Head Screws are coated with U2 Fasteners' proprietary black Nano-coating. This black Nano-coating is applied on top of a CR3 free base coat.

4.3 *Pressure-Preservative Treated (PPT) Wood Applications*

4.3.1 U2 Fasteners, with the proprietary coating, are recognized for use in PPT lumber provided the conditions set forth by the PPT lumber manufacturer be met, including appropriate strength reductions.

4.4 *Fire-Retardant Treated (FRT) Wood Applications*

4.4.1 U2 Fasteners, with the proprietary coating, are recognized for use in FRT lumber provided the conditions set forth by the FRT lumber manufacturer be met, including appropriate strength reductions.

4.5 *Wood Members*

4.5.1 Solid sawn wood members connected using U2 Fasteners shall consist of lumber species or species combinations having a specific gravity of 0.36 to 0.55.

4.5.2 Structural composite lumber (e.g., LVL, LSL, PSL, etc.) connected with U2 Fasteners shall be recognized in evaluation reports having published equivalent specific gravities for lateral and withdrawal resistance.

4.6 *Design*

4.6.1 Design of UNI and CS screws are governed by the applicable code and the provisions for wood screws in CSA O86.

4.6.2 Unless otherwise noted, applicable modification factors shall be applied in accordance with CSA O86 and the applicable building code.

4.6.3 The factored resistances in **Table 2**, **Table 3**, and **Table 4** are for the standard-term load duration in a dry service condition. The wet service factor is given for certain results. Tabulated values shall be factored by all of the appropriate adjustment factors per CSA O86.

4.6.4 Where the fasteners are subject to combined lateral and withdrawal loads, connections shall be designed in accordance with the applicable codes and standards.

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4.6.5 The factored axial resistance for a single fastener where the fastener is loaded in tension shall be the lower of:

4.6.5.1 The factored design value shown in **Table 3**, adjusted by all applicable adjustment factors.

4.6.5.2 The factored head pull through design value shown in **Table 4**, adjusted by all applicable adjustment factors.

4.6.5.3 The factored screw tension strength as shown in **Table 1**.

4.6.6 The factored shear resistance for a single fastener shall be the lower of:

4.6.6.1 The factored design value shown in **Table 2**, adjusted by all applicable adjustment factors.

4.6.6.2 The factored screw shear strength as shown in **Table 1**.

4.7 *UNI and CS Screws Factored Lateral Design Values (N_r)*

4.7.1 The factored lateral resistance for shear load parallel-to-grain for UNI and CS screws are specified in **Table 2**.

Table 2. UNI and CS Screw Factored Lateral Resistance Values (N_r) for Wood-to-Wood Connections (Parallel to Grain)

Product Name	Fastener ID	Minimum Side Member Thickness, in (mm)	Main Member Penetration, in (mm)	Factored Lateral Design Values[1,5,6] lbf (kN)				
				Species[2,3,4] (Specific Gravity)				
				BF (0.36)	HF/SPF (0.42)	DF-L, SCL (0.50)	SP (0.55)	LVL Equiv. SG = 0.50
UNI Universal Screw	#9 x 2 3/4"	1 1/2 (38)	1 1/4 (32)	360 (1.60)	435 (1.93)	535 (2.38)	600 (2.67)	540 (2.4)
	#9 x 3 1/8"		1 5/8 (41)	335 (1.49)	430 (1.91)	625 (2.78)	640 (2.85)	625 (2.78)
	#10 x 2 1/2"		1 (25)	305 (1.36)	380 (1.69)	490 (2.18)	540 (2.40)	490 (2.18)
	#10 x 4 1/2"	3 1/2 (89)	1 (25)	400 (1.78)	490 (2.18)	690 (3.07)	675 (3.00)	690 (3.07)
	#12 x 6"		2 1/2 (64)	550 (2.45)	810 (3.60)	1,080 (4.80)	1,375 (6.12)	1,080 (4.8)
CS Construction Screw	#10 x 3 1/8"	1 1/2 (38)	1 5/8 (41)	425 (1.89)	585 (2.58)	735 (3.27)	920 (4.09)	735 (3.27)
	5/16 x 2 1/2"		1 (25)	420 (1.87)	465 (2.07)	685 (3.05)	555 (2.47)	685 (3.05)
	5/16 x 3 1/8"		1 1/2 (38)	430 (1.91)	550 (2.45)	725 (3.22)	795 (3.54)	725 (3.22)
	5/16 x 4"	3 1/2 (89)	1/2 (13)	790 (3.51)	850 (3.78)	965 (4.29)	985 (4.38)	965 (4.29)
	3/8 x 6"		2 1/2 (64)	750 (3.34)	1,050 (4.67)	965 (4.29)	1,700 (7.56)	965 (4.29)
	3/8 x 7"		3 1/2 (89)	1,175 (5.23)	1,365 (6.07)	1,410 (6.27)	1,780 (7.92)	1,410 (6.27)
Stainless Steel Universal Screws	#9 x 2"	1 1/2 (38)	1/2 (13)	305 (1.36)	365 (1.62)	335 (1.49)	440 (1.96)	515 (2.29)
	#10 x 2 1/2"		1 (25)	310 (1.38)	420 (1.87)	460 (2.05)	475 (2.11)	465 (2.07)
	#10 x 3"		1 1/2 (38)	555 (2.47)	575 (2.56)	585 (2.60)	665 (2.96)	795 (3.54)
	#10 x 4"							
Stainless Steel Construction Screws	5/16 x 2 1/2"	1 1/2 (38)	1 (25)	550 (2.45)	590 (2.62)	605 (2.69)	590 (2.62)	665 (2.96)
	5/16 x 4"		2 1/2 (64)	930 (4.14)	1,040 (4.63)	1,305 (5.80)	865 (3.85)	825 (3.67)
	5/16 x 5"							
	5/16 x 6"	3 1/2 (89)	2 1/2 (64)	965 (4.30)	1,285 (5.72)	1,510 (6.72)	1,520 (6.76)	1,285 (5.72)

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Table 2. UNI and CS Screw Factored Lateral Resistance Values (N_r) for Wood-to-Wood Connections (Parallel to Grain)

Product Name	Fastener ID	Minimum Side Member Thickness, in (mm)	Main Member Penetration, in (mm)	Factored Lateral Design Values[1,5,6] lbf (kN)				
				Species[2,3,4] (Specific Gravity)				
				BF (0.36)	HF/SPF (0.42)	DF-L, SCL (0.50)	SP (0.55)	LVL Equiv. SG = 0.50
Black Flat Head Wood Screw	25/64 x 3 3/8"	1 1/2 (38)	1 7/8 (48)	895 (3.98)	1,110 (4.94)	1,345 (5.98)	1,630 (7.25)	-
	25/64 x 4"		2 1/2 (64)					
	25/64 x 5"		3 1/2 (89)					
	25/64 x 6 3/4"		5 1/4 (133)					

1. Design values shall be multiplied by all applicable adjustment factors in accordance with CSA O86, Section 12.2.1.6 through 12.2.1.9.
   a. Exceptions:
      i. The service-condition factor, K_{SF} for connections fabricated with dry lumber and where the service condition is *"wet"* shall be 0.7 for specific gravity up to 0.55. For specific gravity = 0.55. The wet service factor shall be 0.6.
      ii. Where fastener strength controls the design, no adjustment factors shall be used.
2. The specific gravity used shall be the specific gravity assigned to the lumber or wood structural panels in accordance with NDS Table 12.3.3A or NDS Table 12.3.3B, respectively. For SCL, use the equivalent specific gravity assigned per the manufacturer published data.
3. When the specific gravity of the side and main member differ, use the lower of the two.
4. Design values apply to fasteners installed into the side grain of the main member with the fastener installed perpendicular to the wood fibers.
5. Tabulated values are for standard-term loading (K_D = 1.0) and dry service condition (K_{sf} = 1.0). Values may be adjusted for other conditions per CSA O86
6. Values are for a single fastener. For connections with multiple fasteners, see CSA O86, clause 12.2.2.3.

4.8 *UNI and CS Screws Factored Withdrawal Design Values (P_{rw})*

4.8.1 The design provisions for withdrawal noted in CSA O86 Subsection 12.11.5 apply to UNI and CS screws, unless otherwise noted in this report. Factored withdrawal resistances for UNI and CS screws in select lumber species are specified in **Table 3**.

Table 3. UNI and CS Screws Factored Withdrawal Resistance Values (P_{rw}) in Side Grain Applications

Product Name	Fastener ID	Fastener Length, in (mm)	Thread Length, in (mm)	Minimum Penetration Depth in (mm)	Factored Withdrawal Values[1,2,5,6] lbf/in (N/mm)				
					Species[3,4] (Relative Density)				
					BF (0.36)	HF/SPF (0.42)	DF-L, SCL (0.50)	SP (0.55)	SCL SG_{eqv} (0.50)
UNI Universal Screw	#9 x 2 3/4"	2 3/4" (70)	2" (51)	1 1/4" (32)	225 (39)	290 (51)	455 (80)	430 (75)	430 (75)
	#9 x 3 1/8"	3 1/8" (79)	1 1/2" (38)	1 5/8" (41)	230 (40)	270 (47)	420 (74)	365 (64)	365 (64)
	#10 x 2 1/2"	2 1/2" (64)		1" (25)	220 (39)	280 (49)	475 (83)	400 (70)	400 (70)
	#10 x 4 1/2"	4 1/2" (114)	3" (76)	3" (76)	325 (57)	375 (66)	485 (85)	485 (85)	485 (85)
	#12 x 6"	6" (152)	4" (102)	4 1/2" (114)	290 (51)	360 (63)	515 (90)	515 (90)	515 (90)

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Table 3. UNI and CS Screws Factored Withdrawal Resistance Values (P_{rw}) in Side Grain Applications

Product Name	Fastener ID	Fastener Length, in (mm)	Thread Length, in (mm)	Minimum Penetration Depth in (mm)	Factored Withdrawal Values[1,2,5,6] lbf/in (N/mm)				
					Species[3,4] (Relative Density)				
					BF (0.36)	HF/SPF (0.42)	DF-L, SCL (0.50)	SP (0.55)	SCL SG_{eqv} (0.50)
CS Construction Screw	#10 x 3 1/8"	3 1/8" (79)	1 1/2" (38)	1 1/2" (38)	270 (47)	295 (52)	445 (78)	350 (61)	350 (61)
	5/16 x 2 1/2"	2 1/2" (64)		1" (25)	335 (59)	415 (73)	485 (85)	590 (103)	590 (103)
	5/16 x 3 1/8"	3 1/8" (79)		1 1/2" (38)	355 (62)	410 (72)	500 (88)	530 (93)	530 (93)
	5/16 x 4"	4" (102)	2 1/2" (64)	2 1/2" (64)	375 (66)	450 (79)	560 (98)	615 (108)	615 (108)
	3/8 x 6"	6" (152)	3 1/2" (89)	4 1/2" (114)	340 (60)	425 (74)	595 (104)	610 (107)	610 (107)
	3/8 x 7"	7" (178)		5 1/2" (140)	320 (56)	455 (80)	645 (113)	740 (130)	740 (130)
Stainless Steel - Universal Screws	#9 x 2"	2" (51)	1 5/16" (34)	1/2" (13)	315 (55)	390 (68)	470 (82)	470 (82)	390 (68)
	#10 x 2 1/2"	2 1/2" (64)	1 5/8" (41)	1" (25)	400 (70)		455 (80)	455 (80)	445 (78)
	#10 x 3"	3" (76)	2" (51)	1 1/2" (41)	530 (93)	520 (91)	570 (100)	570 (100)	550 (96)
	#10 x 4"	4" (102)	2 1/2" (64)	2 1/2" (64)					
Stainless Steel - Construction Screws	5/16 x 2 1/2"	2 1/2" (64)	1 9/16" (40)	1" (25)	440 (77)	505 (88)	545 (95)	620 (108)	520 (91)
	5/16 x 4"	4" (102)	2 1/2" (64)	2 1/2" (64)					
	5/16 x 5"	5" (127)	3" (76)	3 1/2" (89)					
	5/16 x 6"	6" (152)	4" (102)	4 1/2" (114)		540 (95)	550 (96)	555 (97)	530 (93)
Black Flat Head Wood Screw	25/64 x 3 3/8"	3 3/8" (86)	1 1/2" (38)	1 7/8" (48)	445 (78)	560 (98)	670 (117)	805 (141)	500 (88)
	25/64 x 4"	4" (102)	2 1/2" (64)	2 1/2" (64)					
	25/64 x 5"	5" (127)	3" (76)	3 1/2" (89)					
	25/64 x 6 3/4"	6 3/4" (171)	4 1/2" (89)	5 1/4" (133)					

SI: 1 in = 25.4 mm, 1 lb = 4.45 N

1. Design values shall be multiplied by all applicable adjustment factors in accordance with CSA O86, Section 12.2.1.6 through Section 12.2.1.9
2. Exceptions:
   a. The service-condition factor, K_{SF} for connections fabricated with dry lumber and where the service condition is *"wet"* shall be 0.7.
      i. Design values shall be multiplied by the length of the thread penetration into the main member not including the tip.
3. The specific gravity used shall be the specific gravity assigned to the lumber or wood structural panels in accordance with NDS Table 12.3.3A or NDS Table 12.3.3B, respectively. For SCL, use the equivalent specific gravity assigned per the manufacturer published data.
4. Design values apply to fasteners installed into the side grain of the main member with the fastener installed perpendicular to the wood fibers.
5. Tabulated values are for standard term loading (K_d = 1.0) and dry service condition (K_{sf} = 1.0). Values may be adjusted for other conditions per CSA O86, Clause 12.12.
6. Values are for a single fastener. For connections with multiple fasteners, see CSA O86, clause 12.2.2.3.

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4.9 *UNI and CS Screws Factored Head Pull-Through Design Values (P_{pt})*

4.9.1 The factored resistances for the head pull-through limit state for UNI and CS screws are given in **Table 4**.

Table 4. UNI and CS Screw Factored Head Pull-Through Resistance Values (P_{pt})

Product Name	Fastener ID	Side Member Thickness, in (mm)	Factored Head Pull-Through Values[1,2,3,4,5] lbf (N) (Specific Gravity)			
			BF (0.36)	HF/SPF (0.42)	DF-L, SCL (0.50)	SP (0.55)
UNI Universal Screw	#9 x 2 3/4"	1 1/2 (38)	125 (556.03)	140 (622.75)	335 (1490.15)	170 (756.2)
	#9 x 3 1/8"					
	#10 x 2 1/2"		150 (667.23)	170 (756.2)	410 (1823.77)	220 (978.61)
	#10 x 4 1/2"					
	#12 x 6"		145 (644.99)	185 (822.92)	530 (2357.56)	275 (1223.26)
CS Construction Screw	#10 x 3 1/8"		340 (1512.4)	470 (2090.66)	775 (3447.37)	750 (3336.17)
	5/16 x 2 1/2"		585 (2602.21)	590 (2624.45)	990 (4403.74)	595 (2646.69)
	5/16 x 3 1/8"					
	5/16 x 4"					
	3/8 x 6"		620 (2757.9)	710 (3158.24)	1085 (4826.32)	900 (4003.4)
	3/8 x 7"					
Stainless Steel-Universal Screw	#9 x 2"	1 1/2 (38)	230 (1,023)	285 (1,268)	405 (1,802)	405 (1,802)
	#10 x 2 1/2"		265 (1,179)	320 (1,423)	440 (1,957)	440 (1,957)
	#10 x 3"		460 (2,046)	550 (2,447)	610 (2,713)	610 (2,713)
	#10 x 4"					
Stainless Steel - Construction Screws	5/16 x 2 1/2"		1,410 (6,272)	1,580 (7,028)	1,610 (7,162)	2,000 (8,896)
	5/16 x 4"					
	5/16 x 5"					
	5/16 x 6"					
Black Flat Head Wood Screw	25/64 x 3 3/8"	1 1/2 (38)	1,045 (4,648)	1,395 (6,208)	1,560 (6,937)	1,985 (8,822)
	25/64 x 4"					
	25/64 x 5"					
	25/64 x 6 3/4"					

SI: 1 in = 25.4 mm, 1 lb = 4.45 N

1. Resistance values shall be multiplied by all applicable adjustment factors in accordance with CSA O86, Section 12.2.1.6 through Section 12.2.1.9.
   a. Exceptions:
      i. The service-condition factor, K_{SF} for connections fabricated with dry lumber and where the service condition is *"wet"* shall be 0.7.
2. Tabulated resistance values are for a standard load duration. Values shall be factored by all applicable modification factors per CSA O86 for self-tapping screws.
3. The specific gravity used shall be the specific gravity assigned to the lumber or wood structural panels in accordance with NDS Table 12.3.3A or NDS Table 12.3.3B, respectively. For SCL, use the equivalent specific gravity assigned per the manufacturer published data.
4. Resistance values apply to fasteners installed into the side grain of the main member with the fastener installed perpendicular to the wood fibers.
5. Resistance values are based on a 1 1/2" (38mm) thick side member.

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4.10 *Special Applications*

4.10.1 *Connection of Ledger to Studs:*

4.10.1.1 The UNI #12 x 3$^1/_2$" fastener was developed specifically for the connection of 1$^1/_2$" SP and LVL side members to SP vertical members as shown in **Figure 5**. Design of this connection shall be in accordance with **Table 5**.

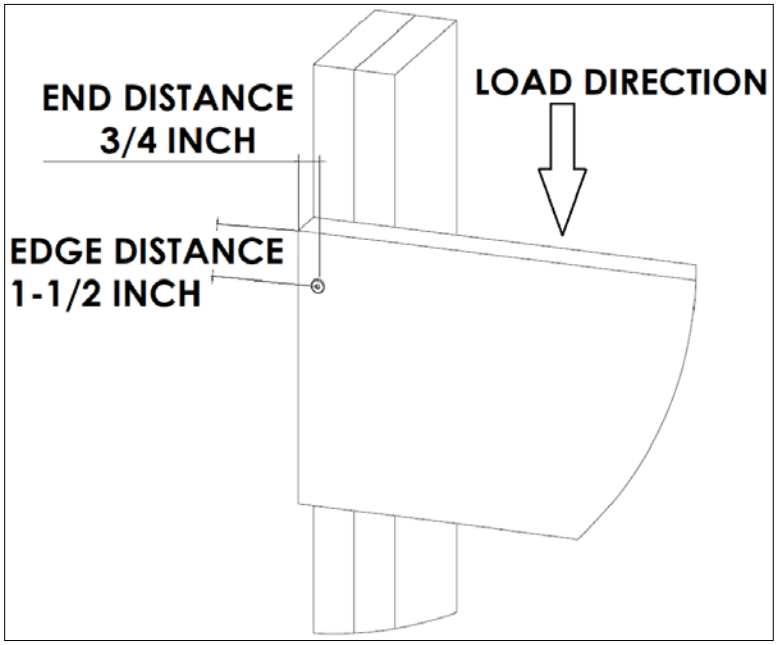


Figure 5. Connection Detail applicable to **Table 5**

Table 5. Factored Lateral Strength Values for #12 x 3$^1/_2$" Universal Screws to Connect SP Lumber or LVL Side Members to SP Main Members in accordance with **Figure 5**

Product Name	Fastener ID	Side Member Thickness, in (mm)	Minimum Fastener Penetration into Main Member, in (mm)	Factored Lateral Strength[1,2,3,4,5,6,7,8] lbf (kN)	
				SP	LVL
UNI – Universal Screw	#12 x 3$^1/_2$	1$^1/_2$ (38)	2 (51)	985 (4.38)	950 (4.23)

1. Factored lateral strength values are additive where multiple screws are used.
2. Minimum screw spacing in the same row with loading parallel grain shall be 2$^5/_8$" (66.5 mm).
3. Minimum screw spacing in the same row with loading perpendicular to grain shall be 1$^3/_4$" (44.5 mm).
4. Minimum fastener end distance into side member is $^3/_4$" (19 mm).
5. Minimum fastener edge distance in main member is $^3/_4$"(19 mm).
6. Minimum fastener edge distance in side member is 1$^1/_2$" from loaded edge (38 mm).
7. SP specific gravity is assumed to be 0.55, LVL minimum equivalent specific gravity shall be 0.50.
8. Capacities listed in this table are applicable to longer Universal Screw No. 12 fasteners.

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4.11 Alternative solutions shall be permitted where they achieve at least the minimum level of performance required by the applicable acceptable solutions of NBC Division B in the areas defined by the attributed objectives and functional statements, in accordance with accepted engineering practice and experience.

4.11.1 These provisions for the use of alternative materials, designs, and methods of construction are not intended to prevent the installation of any material or to prohibit any design or method of construction not specifically prescribed herein. This includes, but is not limited to, the following areas of engineering: mechanics of materials, structures, building science, and fire science.

5 Regulatory Evaluation and Accepted Engineering Practice

5.1 U2 Fasteners comply with the following adopted codes referenced standards, and/or accepted engineering practice for the following reasons:

5.1.1 Withdrawal resistance in accordance with ASTM D1761 per CSA O86 Clause 12.12

5.1.2 Bending yield in accordance with ASTM F1575

5.1.3 Tensile strength in accordance with AISI S904

5.1.4 Shear strength in accordance with AISI S904

5.1.5 Head pull-through in accordance with ASTM D1761 per CSA O86 Clause 12.12

5.1.6 Lateral resistance in accordance with ASTM D1761 per CSA O86 12.12

5.1.7 Corrosion resistance of fasteners meeting or exceeding the protection afforded hot dipped galvanized fasteners in accordance with ASTM A153

5.2 Any building code, regulation and/or accepted engineering evaluations (i.e., research reports, duly authenticated reports, conformity assessments by approved certification agencies etc.) that are conducted for this report were performed by DrJ, which is an ISO/IEC 17065 accredited certification body and a professional engineering company operated by RDP or approved sources. DrJ is qualified[5] to practice product and regulatory compliance services within its scope of accreditation and engineering expertise,[6] respectively.

5.3 Testing and related engineering evaluations are defined as intellectual property and/or trade secrets.[7]

5.4 Engineering evaluations are conducted with DrJ's ANAB accredited ICS code scope of expertise that is also its areas of professional engineering competence.[8]

6 Installation

6.1 Installation shall comply with the approved construction documents, the manufacturer installation instructions, this report, and the applicable building code.

6.2 In the event of a conflict between the manufacturer installation instructions and this report, contact the manufacturer for counsel on the proper installation method.

6.3 *Installation Procedure*

6.3.1 UNI and CS screws shall be installed using a high-torque low speed drill or impact driver in accordance with the manufacturer installation instructions, applicable code, the approved construction documents, this report, CSA O86, and standard framing practice as applied to wood fasteners.

6.3.2 Pre-drilling of pilot holes is not required but may be used where lumber is prone to splitting.

6.3.3 All fastener spacing, edge distance, and end distance shall be per **Table 5** where applicable, and **Table 6**.

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Table 6. Edge Distance, End Distance, and Spacing Distance for UNI and CS Screws

Condition		Minimum Spacing[1,2] in (mm)					
		Labelled Screw Size					
		#9	#10	#12	5/16"	3/8"	25/64"
Edge Distance	Loading parallel or perpendicular to Grain	1 3/4 (44)	1 3/4 (44)	See Note 1	1 3/4 (44)	1 3/4 (44)	1 3/4 (44)
End Distance[3]	Loading Toward End	2 3/16 (56)	2 5/16 (59)	2 5/8 (67)	3 3/16 (81)	3 1/2 (89)	4 3/16 (106)
	Loading Away from End	1 7/16 (37)	1 9/16 (40)	1 3/4 (44)	2 1/8 (54)	2 3/8 (60)	2 13/16 (71)
	Loading Perpendicular to Grain			See Note 1			
Spacing Between Fasteners in a Row	Loading Parallel to grain	2 3/16 (56)	2 5/16 (59)	2 5/8 (67)	3 3/16 (81)	3 1/2 (89)	4 3/16 (106)
	Loading Perpendicular to grain	1 7/16 (37)	1 9/16 (40)	1 3/4 (44)	2 1/8 (54)	2 3/8 (60)	2 13/16 (71)
Spacing Between Rows of Fasteners	In-Line Rows	3/4 (19)	13/16 (21)	7/8 (22)	1 1/16 (27)	1 3/16 (30)	1 7/16 (37)
	Staggered Rows[4]	3/8 (9.5)	7/16 (11)	7/16 (11)	9/16 (14)	5/8 (16)	3/4 (19)

SI: 1 in = 25.4 mm

1. Refer to Table 5 for required spacing in the special application. Where the conditions of Table 5 do not apply, use the values calculated per NDS (Table 6).
2. Unthreaded shank diameter was used as D for calculations.
3. End distances, edge distances, and screw spacing must be sufficient to prevent wood splitting, or as shown in this table, whichever is more restrictive, or as permitted in Table 5 and Table 6. Pilot holes may be used to aid in preventing splitting.
4. Values for spacing between staggered rows apply where the spacing between screws in adjacent rows are offset by half of the spacing between fasteners in a row.

6.3.4 Minimum penetration is 1" (25.4 mm) unless otherwise stated in this report.

6.3.5 Install UNI Universal screws with topside of the head flush to the surface of the wood member.

6.3.6 Install CS Construction screws with the underside of the head flush with the surface of the side member being connected.

7 Substantiating Data

7.1 Testing has been performed under the supervision of a professional engineer and/or under the requirements of ISO/IEC 17025 as follows:

7.1.1 Withdrawal in accordance with ASTM D1761

7.1.2 Lateral strength in accordance with ASTM D1761

7.1.3 Head pull-through in accordance with ASTM D1761

7.1.4 Bending yield in accordance with ASTM F1575

7.1.5 Tensile strength in accordance with AISI S904

7.1.6 Shear strength in accordance with AISI S904

7.1.7 Corrosion resistance in accordance with ASTM B117

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7.2 Information contained herein is the result of testing and/or data analysis by sources that conform to the conformity assessment framework described in NBC Volume 1, *"Relationship of the NBC to Standards Development and Conformity Assessment"*, and/or professional engineering regulations. DrJ relies upon accurate data to perform its ISO/IEC 17065 evaluations.

7.3 Where appropriate, DrJ's analysis is based on provisions that have been codified into law through provincial, territorial, or local adoption of codes and standards. The developers of these codes and standards are responsible for the reliability of published content. DrJ analysis may use code-adopted provisions as a benchmark in evaluating whether a product, material, assembly, design, or method of construction demonstrates equivalency in quality, strength, effectiveness, fire resistance, durability and safety.

7.4 The accuracy of the provisions provided herein may be reliant upon the published properties of raw materials, which are defined by the grade mark, grade stamp, mill certificate, listings, certified reports, conformity assessments by approved certification agencies, and research reports prepared by approved agencies and/or approved sources provided by the suppliers of products, materials, designs, assemblies and/or methods of construction. These are presumed to be minimum properties and relied upon to be accurate. The reliability of DrJ's engineering practice, as contained in this report, may be dependent upon published design properties by others.

7.5 *Testing and Engineering Analysis*

7.5.1 The strength, rigidity and/or general performance of component parts and/or the integrated structure are determined by suitable tests that simulate the actual conditions of application that occur and/or by accepted engineering practice and experience.

7.6 Where additional condition of use and/or code compliance information is required, please search for U2 Fasteners on the DrJ Certification website.

8 Findings

8.1 As outlined in **Section 4**, U2 Fasteners have performance characteristics that were tested and/or meet applicable regulations. In addition, U2 Fasteners are suitable for use pursuant to their specified purpose(s).

8.2 When used and installed in accordance with this certification report for conformity assessment and the manufacturer installation instructions, U2 Fasteners shall be approved for the following application(s):

8.2.1 UNI and CS screws meet the requirements of the NBC Article 4.3.1.1.

8.2.2 UNI and CS screws are an alternative to wood screws specified in NBC Article 9.23.3.3.

8.3 Any application specific issues not addressed herein can be engineered by an RDP. Assistance with engineering is available from U2 Fasteners.

8.4 These innovative products have been evaluated in the context of the codes listed in **Section 3** and are compliant with all known provincial, territorial, and local building codes. Where there are known variations in provincial, territorial, or local codes applicable to this report, they are listed here:

8.4.1 No known variations

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8.5 NBC Volume 1 *"Relationship of the NBC to Standards Development and Conformity Assessment"*:

> Certification
>
> Certification is the confirmation by an independent organization that a product, service, or system meets a requirement. Certification may entail physical examination, testing as specified in appropriate standards or other normative documents, an initial plant inspection, and/or follow-up unannounced plant inspections… Certification bodies publish lists of certified products and companies.
>
> Evaluation
>
> An evaluation is a written opinion by an independent professional organization that a product will perform its intended function. An evaluation is typically done to determine the ability of an innovative product, for which no standards exist, to satisfy the objectives of a Code requirement.

8.6 ISO/IEC 17065 accredited third-party certification bodies,[9] including but not limited to, Standards Council of Canada (SCC)[10] and ANSI National Accreditation Board (ANAB),[11] confirm that product certification bodies have the expertise to provide technical evaluation services within their scope of accreditation. All SCC and ANAB product certification bodies meet NBC requirements to offer evaluation services for alternative solutions.[12]

8.6.1 DrJ is an ISO/IEC 17065 ANAB-Accredited Product Certification Body – Accreditation #1131[13] and employs professional engineers.[14]

8.7 Through ANAB accreditation and the Global ACI Multilateral Recognition Arrangement (MRA), this report can be used to obtain product approval in any jurisdiction or country that has Global ACI Members and Global ACI Signatories to meet the Purpose of the MRA.

8.8 Product certification organizations, accredited by the SCC and ANAB, are defined as equivalent evaluation services:

8.8.1 Canada-United States-Mexico Agreement (CUSMA), Article 11.6 Conformity Assessment confirms mutual recognition by stating, "*...each Party shall accord to conformity assessment bodies located in the territory of another Party treatment no less favorable than that it accords to conformity assessment bodies located in its own territory or in the territory of the other Party*."

8.8.2 The SCC National Conformity Assessment Principles states, "*SCC is a member of a number of international organizations developing voluntary conformity assessment agreements that help ensure the international acceptance of Canadian conformity assessment results. Signatories to these agreements (like SCC) recognize each other's accreditations as being equivalent to their own*."[15]

8.9 Building official approval of a licensed professional engineer is performed by verifying the professional engineer and/or their business entity are listed by the engineering regulators of the relevant jurisdiction.

9 Conditions of Use

9.1 As defined in **Section 4**, where material and/or engineering mechanics properties are created for load resisting design purposes, the resistance to the applied load shall not exceed the ability of the defined properties to resist those loads using the principles of accepted engineering practice.

9.2 The U2 Fasteners covered in this report shall be installed in accordance with this report and the manufacturer installation instructions.

9.3 Where installation causes splitting of the wood, pilot holes shall be pre-drilled in accordance with CSA O86, Section 12.11.2.1.

9.4 Use of fasteners in locations exposed to saltwater or saltwater spray is outside the scope of this report.

9.5 For conditions not covered in this report, connections shall be designed in accordance with generally accepted engineering practice. When the capacity of a connection is controlled by fastener metal strength rather than wood strength, the metal strength must not be multiplied by the adjustment factors specified in CSA O86.

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9.6 When required by regulation and enforced by the building official, also known as the Authority Having Jurisdiction (AHJ) in which the project is to be constructed:

9.6.1 Any calculations incorporated into the construction documents shall conform to accepted engineering practice and, when prepared by an approved source, shall be approved when signed and sealed.

9.6.2 This report and the installation instructions shall be submitted at the time of permit application.

9.6.3 These innovative products have an internal quality control program and a third-party quality assurance program.

9.6.4 At a minimum, these innovative products shall be installed per **Section 6**.

9.6.5 This report shall be reviewed for code compliance by the AHJ in concert with the duties and powers granted to the building official by the provincial regulations governing such duties and powers.

9.6.6 The application of these innovative products in the context of this report is dependent upon the accuracy of the construction documents, implementation of installation instructions, inspections, and any other regulatory requirements that may apply.

9.7 Design loads shall be determined in accordance with the building code adopted by the jurisdiction in which the project is to be constructed and/or by the building designer (i.e., owner).

9.8 The actual design, suitability, and use of this report for any particular building, is the responsibility of the owner or the authorized agent of the owner.

10 Identification

10.1 U2 Fasteners (UNI – Universal Screw, CS – Construction Screw, and Flat Head Screws), as listed in **Section 1.1**, are identified by a label on the board or packaging material bearing the manufacturer name, product name, this report number, and other information to confirm code compliance.

10.2 Additional technical information can be found at:

10.2.1 UNI: u2fasteners.com/product/universal-screw

10.2.2 CS: u2fasteners.com/product/construction-screw

10.2.3 Flat Head: u2fasteners.com/product/black-flat-head-screw

11 Review Schedule

11.1 This report is subject to periodic review and revision. For the latest version, visit www.drjcertification.org.

11.2 For information on the status of this report, please contact DrJ Certification.

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Notes

1 For more information, visit drjcertification.org or call us at 608-310-6748.

2 Unless otherwise noted, all references in this report are from the 2020 version of the NBC. This alternative solution is also approved for use with the 2010 and 2015 NBC and the standards referenced therein.

3 References in this report to the National Building Code of Canada (NBC) apply to the Ontario Building Code (OBC), unless noted otherwise.

4 Chrome 6 (hexavalent chromium) is a toxic, cancer-causing chemical that can be found in industrial processes like chrome plating, welding, and the production of dyes and paints. Exposure can occur through inhaling contaminated air, skin contact, or consuming contaminated food and water, and it targets the respiratory system, kidneys, and liver. While it is a useful anti-corrosive agent and industrial chemical, it must be contained to prevent the spread of harmful exposures and associated health risks.

5 Qualification is performed by a legislatively defined Accreditation Body. ANSI National Accreditation Board (ANAB) is the largest independent accreditation body in North America and provides services in more than 75 countries. DrJ is an ANAB accredited product certification body.

6 ANAB Product Certification Accreditation Program, DrJ Engineering, LLC, Accreditation ID 1131; https://anabpd.ansi.org/Accreditation/product-certification/AllDirectoryDetails?prgID=1&orgID=2125&statusID=4#:~:text=Bill%20Payment%20Date-,Accredited%20Scopes,-13%20ENVIRONMENT.%20HEALTH

7 Canada Foreign Interference and Security of Information Act – 19 - Economic Espionage – (1) Every person commits an offence who, at the direction of, for the benefit of or in association with a foreign economic entity, fraudulently and without colour of right and to the detriment of Canada's economic interests, international relations or national defence or national security. (a) communicates a trade secret to another person, group or organization; or (b) obtains, retains, alters or destroys a trade secret. (2) Every person who commits an offence under subsection (1) is guilty of an indictable offence and is liable to imprisonment for a term of not more than 10 years…

8 ANAB is part of the CUSMA/USMCA and Global ACI, where the purpose of these agreements are to ensure mutual recognition of accredited certification and validation/verification statements between agreement signatories, and subsequent acceptance of ANAB accredited certification and validation/verification statements by professional engineers based upon having one universal approval process for the timely approval of innovative materials, products, designs, services, assemblies and/or methods of construction.

9 https://anabpd.ansi.org/Accreditation/product-certification/DirectoryListingAccredited?menuID=1&prgID=1

10 https://global-aci.org/en/member-details/?member_id=91

11 https://global-aci.org/en/member-details/?member_id=14

12 NBC Division A Clause A-1.2.1.1.(1)(b) provides information on code compliance via alternative solutions and defines alternative solutions as *"...achiev[ing] at least the minimum level of performance required by Division B."* NBC Division C Section 2.3 includes additional guidance for documentation of alternative solutions.

13 https://anabpd.ansi.org/Accreditation/product-certification/AllDirectoryDetails?&prgID=1&OrgId=2125&statusID=4

14 Through ANAB accreditation and the Global ACI, DrJ certification can be used to obtain material, product, design, or method of construction approval in any jurisdiction or country that has Global ACI Full Members and Global ACI Signatories to meet the Purpose of the MRA – "*certified once, accepted everywhere*".

15 The National Conformity Assessment Principles states, "*Product regulations and standards may vary from country to country. If these are set arbitrarily, they could be deemed as protectionist. The World Trade Organization (WTO) Agreement on Technical Barriers to Trade (TBT Agreement) aims to ensure that technical regulations, standards, and conformity assessment procedures are non-discriminatory and do not create unnecessary obstacles to trade. At the same time, it recognises WTO members' right to implement measures to achieve legitimate policy objectives, such as the protection of human health and safety, or protection of the environment. The TBT Agreement strongly encourages members to base their measures on international standards as a means to facilitate trade. Through its transparency provisions, it also aims to create a predictable trading environment.*"

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