DrJ CERTIFICATION

Technical Evaluation Report™

Report Number 2304-03

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

U2 Fasteners™

Product:
UNI, CS and Flat Head Screws

Issue Date:
July 19, 2023

Revision Date:
September 24, 2024

Subject to Renewal:
October 1, 2025

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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 UNI, CS and Flat Head Screws

2 Applicable Codes and Standards[2]

2.1 *Codes*

2.1.1 *NBC—10, 15, 20: National Building Code of Canada*

2.1.2 *O Reg. 332/12: Ontario Building Code (OBC)*[3]

2.2 *Standards and Referenced Documents*

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

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

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

2.2.4 *ASTM F1575: Standard Test Method for Determining Bending Yield Moment of Nails*

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

2.2.6 *CSA O86: Engineering Design in Wood*

3 Performance Evaluation

3.1 Testing and related engineering evaluations are defined as intellectual property and/or trade secrets.[4]

3.2 Engineering evaluations are conducted within DrJ's ANAB accredited ICS code scope, which are also its areas of professional engineering competence.[5]

3.3 Any regulation specific issues not addressed in this section are outside the scope of this report.

3.4 UNI, CS and Flat Head Screws were tested and evaluated to determine their structural resistance properties, which are used to develop reference design values for Limit States Design (LSD) in accordance with CSA O86. The following conditions were evaluated:

3.4.1 Withdrawal resistance in accordance with ASTM D1761 per CSA O86 Clause 12.11.5 or Clause 12.6.5 as applicable

3.4.2 Bending yield in accordance with ASTM F1575

3.4.3 Tensile strength in accordance with AISI S904

3.4.4 Shear strength in accordance with AISI S904

3.4.5 Head pull-through in accordance with ASTM D1761 per CSA O86 Clause 12.11.5.3

3.4.6 Lateral resistance in accordance with ASTM D1761 per CSA O86 12.11.4 or 12.6.6 as applicable

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

3.5 Any regulation specific issues not addressed in this section are outside the scope of this report.

4 Product Description and Materials

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

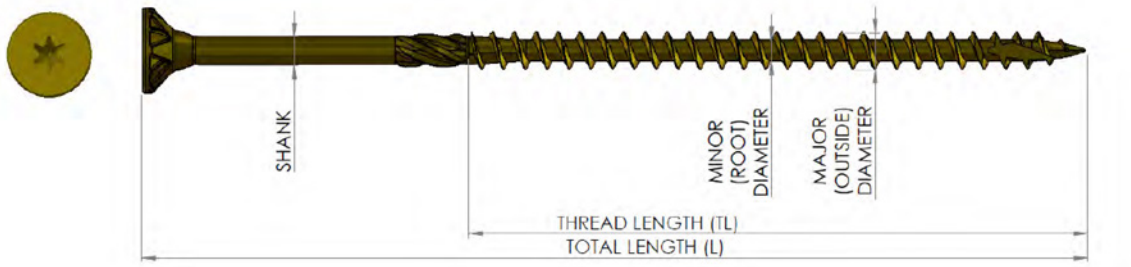


Figure 1.UNI Universal Screw

Figure 2. CS Construction Screw

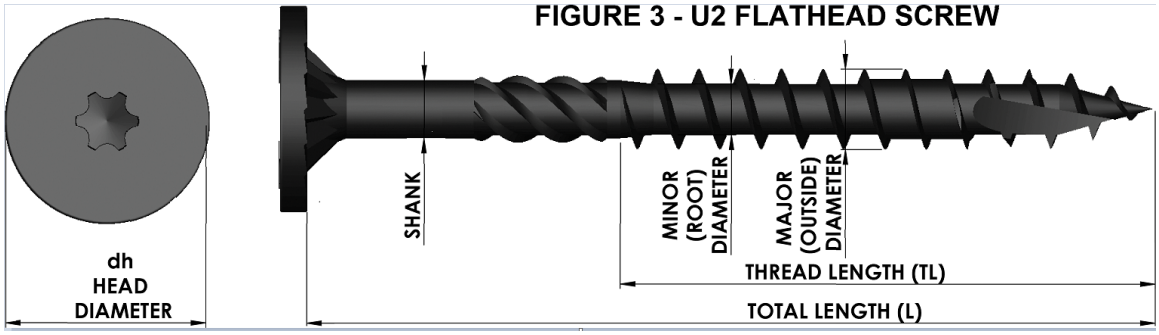


Figure 3. Black Flat Head Screw

4.2 *General*

4.2.1 U2 fasteners are identified on the product packaging with the logo as shown in **Figure 4**.

Figure 4. U2 Fasteners Logo

4.2.2 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.

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

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

4.2.2.3 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.

4.2.3 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.

4.2.3.1 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.

4.3 *Fastener Material*

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

4.3.2 Flat Head Screws are made of hardened carbon steel.

4.4 *Fastener Specifications*

4.5 **Table 1** lists the dimensions and mechanical properties of UNI, CS and Flat Head Screws that are evaluated in this report.

Table 1. Fastener 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 (57)	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 Construction 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)								
Stainless Steel - Construction 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 based on ASTM F1575 based on the minor (root) diameter.

5 Applications

5.1 *General*

5.2 UNI, CS and Flat Head Screws 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.

5.2.1 UNI, CS and Flat Head Screws can be used in applications including structural and general timber construction work.

5.2.2 UNI, CS and Flat Head Screws are typically installed without lead holes, as prescribed in CSA O86 Article 12.11.2.1. However, lead holes are permitted to avoid splitting.

5.3 *Corrosion Resistance*

5.3.1 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 or other chemical amounts listed on Proposition 65.

5.3.2 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 NDS with occasional exposure to high humidity.

5.3.3 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.

5.3.4 Flat Head Screws are coated with U2 Fastener's proprietary black Nano-coating.

5.3.4.1 This black Nano-coating is applied on top of a CR3 free base coat.

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

5.4.1 UNI, CS and Flat Head Screws having the proprietary coating are recognized for use in PPT lumber provided the conditions set forth by the PPT lumber manufacturer are met, including appropriate strength reductions.

5.5 *Fire Retardant Treated (FRT) Wood Applications*

5.5.1 UNI, CS and Flat Head Screws having the proprietary coating are recognized for use in FRT lumber provided the conditions set forth by the FRT lumber manufacturer are met, including appropriate strength reductions.

5.6 *Wood Members*

5.6.1 Solid sawn wood members connected using UNI, CS and Flat Head Screws shall consist of lumber species or species combinations having a specific gravity of 0.36 to 0.55.

5.6.2 Structural composite lumber (i.e., LVL, LSL, PSL, etc.) connected with UNI, CS and Flat Head Screws shall be recognized in evaluation reports having published equivalent specific gravities for lateral and withdrawal resistance.

5.7 *Design*

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

5.7.2 Unless otherwise noted, modification factors shall be applied in accordance with the applicable code.

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

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

5.7.5 The factored load for a single fastener where the fastener is loaded in tension shall be the lower of:

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

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

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

5.7.6 The factored lateral load for a single fastener shall be the lower of:

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

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

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

5.8.1 The factored lateral design values 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)

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 (SG) up to 0.55. For SG = 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 SG used shall be the specific gravity assigned to the lumber or wood structural panels in accordance with NDS Table 12.3.3A or 12.3.3B, respectively. For SCL, use the equivalent specific gravity assigned per the manufacturer published data.
3. When the SG 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, Clause 12.6.6.1
6. Values are for a single fastener. For connections with multiple fasteners, see CSA O86, clause 12.2.2.3.

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

5.9.1 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 design values 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)

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 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. Design values shall be multiplied by the length of the thread penetration into the main member not including the tip.
3. The SG used shall be the specific gravity assigned to the lumber or wood structural panels in accordance with NDS Table 12.3.3A or 12.3.3B, respectively. For SCL, use the equivalent SG 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 12.6.5.1.
6. Values are for a single fastener. For connections with multiple fasteners, see CSA O86, clause 12.2.2.3.

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

5.10.1 The factored design value for head pull-through for UNI and CS screws are specified 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 (1023)	285 (1268)	405 (1802)	405 (1802)
	#10 x 2 1/2"		265 (1179)	320 (1423)	440 (1957)	440 (1957)
	#10 x 3"		460 (2046)	550 (2447)	610 (2713)	610 (2713)
	#10 x 4"					
Stainless Steel - Construction Screws	5/16 x 2 1/2"		1410 (6272)	1580 (7028)	1610 (7162)	2000 (8896)
	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 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 wood screws.
3. The SG used shall be the specific gravity assigned to the lumber or wood structural panels in accordance with NDS Table 12.3.3A or 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.

5.11 *Special Applications*

5.11.1 *Connection of Ledger to Studs:*

5.11.1.1 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**.

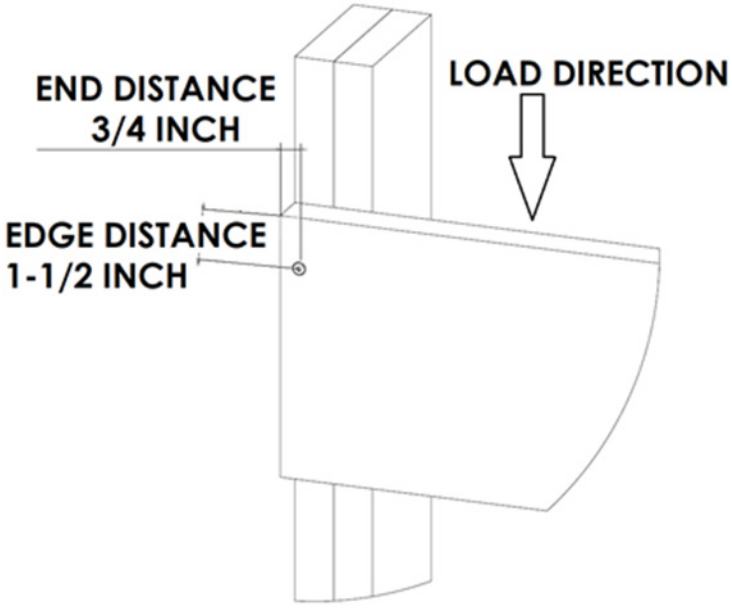


Figure 5. Connection Detail applicable to **Table 5**

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 SG is assumed to be 0.55, LVL minimum equivalent specific gravity shall be 0.50.
8. Capacities listed in table are applicable to longer Universal Screw No. 12 fasteners.

5.12 Where the application falls outside of the performance evaluation, conditions of use and/or installation requirements set forth herein, alternative techniques shall be permitted in accordance with accepted engineering practice and experience. This includes but is not limited to the following areas of engineering: mechanics or materials, structural, building science and fire science.

6 Installation

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

6.2 In the event of a conflict between the manufacturer installation instructions this report and the applicable building code, the more restrictive shall govern.

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**.

Table 6. Edge, End and Spacing Distances 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 applicable to 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

7.2 Information contained herein is the result of testing and/or data analysis by sources that conform to the evaluation requirements of 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 control sample. A control sample versus a test sample establishes a product as being equivalent to that prescribed in this code 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, duly authenticated reports from approved 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: 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 UNI, CS and Flat Head Screws on the DrJ Certification website.

8 Findings

8.1 As delineated in **Section 3**, UNI, CS and Flat Head Screws have performance characteristics that were tested and/or meet pertinent standards and is suitable for use pursuant to its specified purpose.

8.2 When used and installed in accordance with this report and the manufacturer installation instructions, UNI, CS and Flat Head Screws shall be approved for the following applications:

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 2** 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

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 bodies publish lists of certified products and companies…Several organizations, including the Canadian Construction Materials Centre (CCMC), offer such evaluation services.
>
> **Evaluation**
> An evaluation is a written opinion by an independent professional organization that a product will perform its intended function. An evaluation is very often done to determine the ability of an innovative product, for which no standards exist, to satisfy the intent of the Code requirement...

8.6 ISO/IEC 17065 accredited third-party certification bodies,[6] including but not limited to, Standards Council of Canada (SCC)[7] and ANSI National Accreditation Board (ANAB),[8] 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.[9]

8.6.1 DrJ is an ISO/IEC 17065 ANAB-Accredited Product Certification Body – Accreditation #1131[10] and employs professional engineers.[11]

8.7 Through ANAB accreditation and the IAF Multilateral Agreements, this report can be used to obtain innovative products approval in any jurisdiction or country that has IAF MLA Members & Signatories to meet the Purpose of the MLA – "*certified once, accepted everywhere*." IAF specifically says, "*Once an accreditation body is a signatory of the IAF MLA, it is required to recognise certificates and validation and verification statements issued by conformity assessment bodies accredited by all other signatories of the IAF MLA, with the appropriate scope*."[12]

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*."[13]

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 Material properties shall not fall outside the boundaries defined in **Section 3**.

9.2 As defined in **Section 3**, 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.

9.3 The UNI, CS and Flat Head Screws covered in this report shall be installed in accordance with this report and the manufacturer installation instructions.

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

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

9.6 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.

9.7 Where 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:

9.7.1 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.

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

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

9.7.4 At a minimum, these innovative products shall be installed per **Section 6** of this report.

9.7.5 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.

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

9.8 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 designer (i.e., owner).

9.9 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 The innovative products listed in **Section 1.1** are identified by a label on the board or packaging material bearing the manufacturer name, product name, report number and other information to confirm code compliance.

10.2 Additional technical information can be found at www.u2fasteners.com.

11 Review Schedule

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

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

12 Legislation that Authorizes New Product Approval in International Markets is Found in Appendix A

12.1 UNI, CS and Flat Head Screws have been tested by an ISO/IEC 17025 accredited laboratory and/or evaluated to be in conformance with accepted engineering practice to ensure durable, livable and safe construction.

12.2 This report is published by an ISO/IEC 17065 accredited certification body with the expertise to evaluate products, materials, designs, services, assemblies and/or methods of construction.

12.3 This report meets the legislative intent and definition of a duly authenticated report, which shall be accepted by the AHJ, unless there are specific reasons why the alternative shall not be approved as provided for in writing.

Appendix A

1 Legislation that Authorizes New Product Approval in Canada

1.1 The Competition Act is a Canadian federal law governing competition law in Canada. The Act contains both criminal and civil provisions aimed at preventing anti-competitive practices in the marketplace. The Act is enforced and administered by the Competition Bureau, whose regulations encourage the approval of NBC referenced and alternative products, materials, designs, services, assemblies and/or methods of construction that:

1.1.1 Advance Innovation,

1.1.2 Promote competition so all businesses have the opportunity to compete on price and quality in an open market on a level playing field unhampered by anticompetitive constraints, and

1.1.3 Benefit consumers through lower prices, better quality, and greater choice.

1.2 **Approved by International Jurisdictions**: The USMCA and GATT agreements provide for approval of innovative materials, products, designs, services, assemblies and/or methods of construction through the Technical Barriers to Trade (TBT) agreements and the International Accreditation Forum (IAF) Multilateral Recognition Arrangement (MLA), where these agreements proclaim the desire of both countries to have their markets open to innovation.

1.3 These agreements:

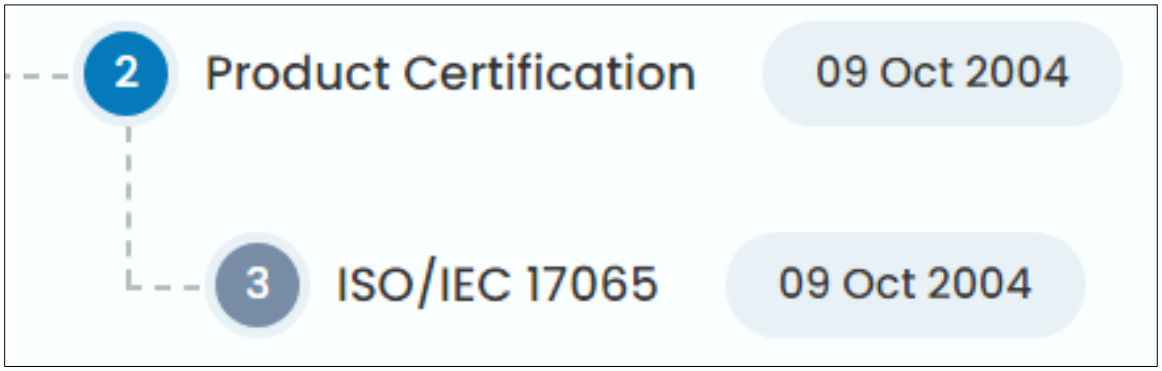
1.3.1 Permit participation of conformity assessment bodies located in the territories of other Members (defined as GATT Countries) under conditions no less favourable than those accorded to bodies located within their territory or the territory of any other country,

1.3.2 State that conformity assessment procedures (i.e., ISO/IEC 17020, 17025, 17065, etc.) are prepared, adopted, and applied so as to grant access for suppliers of like products originating in the territories of other Members under conditions no less favourable than those accorded to suppliers of like products of national origin or originating in any other country, in a comparable situation.

1.3.3 State that conformity assessment procedures are not prepared, adopted, or applied with a view to or with the effect of creating unnecessary obstacles to international trade. This means that conformity assessment procedures shall not be more strict or be applied more strictly than is necessary to give the importing Member adequate confidence that products conform to the applicable technical regulations or standards.

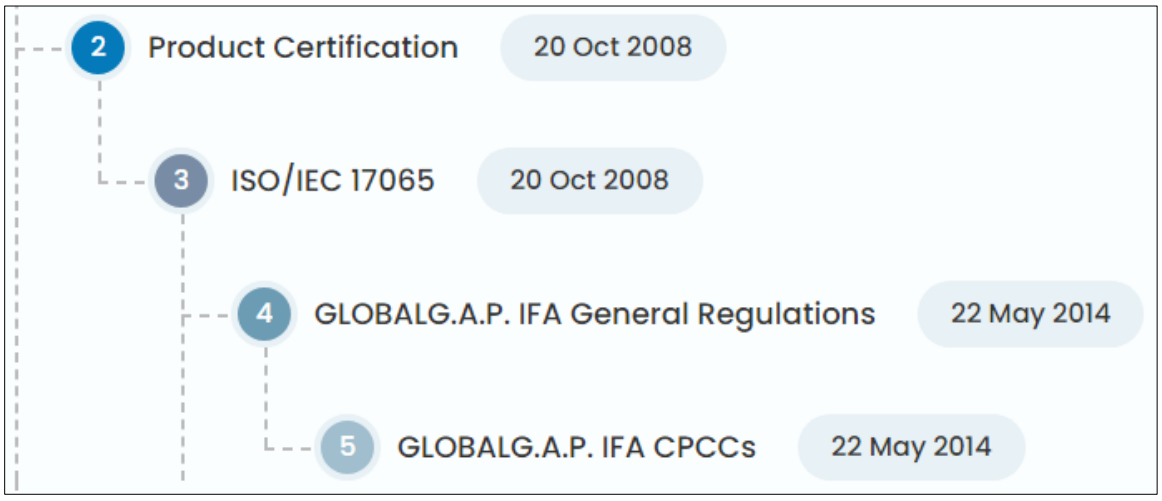
1.4 To this end, Canada operates an accreditation system as follows:

1.5 This includes ISO/IEC 17065 product certification as follows:

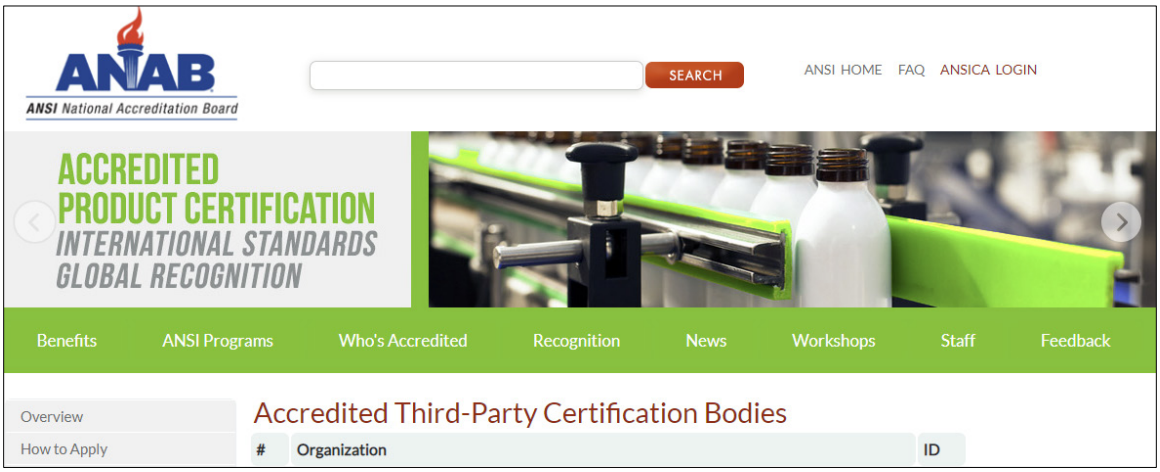


1.6 Similarly, the United States operates multiple accreditation processes with ANAB being the most prominent ISO/IEC 17065 product certification organization as follows:

1.7 This includes ISO/IEC 17065 product certification as follows:



1.8 The list of ANAB accredited ISO/IEC 17065 product certification organizations can be found at the following link: https://anabpd.ansi.org/Accreditation/product-certification/DirectoryListingAccredited?menuID=1&prgID=1



1.9 Approval is granted via International Agreement, where the purpose of the IAF MLA is to ensure mutual recognition of accredited certification and validation/verification statements between signatories. Subsequent acceptance of accredited certification and validation/verification statements is required so that one accreditation can be used for the timely approval of innovative materials, products, designs, services, assemblies and/or methods of construction. Accreditations granted by IAF MLA signatories are recognised worldwide based on their equivalent accreditation programs, therefore reducing costs and adding value to businesses and consumers.

1.10 Consequently, and as one example, these agreements permit product approval of innovative Australian and New Zealand products into US markets and vice-versa.

1.11 Finally, questions that often arises are, "*Why do these agreements exist?" and "Why is the ISO/IEC 17065 accredited third-party certification process so important?*"

1.11.1 The answer is that all countries desire to protect the intellectual property and trade secrets of their country's businesses.

1.11.2 In the US this protection is provided by 18 U.S. Code § 1831 Under Economic Espionage, where it states "*whoever, intending or knowing that the offense will benefit any foreign government, foreign instrumentality, or foreign agent, knowingly steals, or without authorization appropriates, takes, carries away, or conceals, or by fraud, artifice, or deception obtains a trade secret shall be fined not more than $5,000,000 or imprisoned not more than 15 years, or both.*"

1.11.3 Any organization that commits any offense described shall be fined not more than the greater of $10,000,000 or three (3) times the value of the stolen trade secret to the organization, including expenses for research and design and other costs of reproducing the trade secret that the organization has thereby avoided.[14]

1.11.4 Protection of intellectual property and trade secrets reinforces the value of the IAF MLA, the GATT/TBT and the ISO/IEC 17065 product approval process.

1.11.5 The goal is to protect everyone's best interests while also facilitating economic freedom and opportunity by promoting free and fair competition in the marketplace.

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] 18 U.S. Code § 1831 - Economic espionage - Whoever, intending or knowing that the offense will benefit any foreign government, foreign instrumentality, or foreign agent, knowingly steals, or without authorization appropriates, takes, carries away, or conceals, or by fraud, artifice, or deception obtains a trade secret shall be fined not more than $5,000,000 or imprisoned not more than 15 years, or both. Any organization that commits any offense described shall be fined not more than the greater of $10,000,000 or 3 times the value of the stolen trade secret to the organization, including expenses for research and design and other costs of reproducing the trade secret that the organization has thereby avoided. https://www.law.cornell.edu/uscode/text/18/part-I/chapter-90.

[5] ANAB is part of the USMCA and IAF MLA, 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.

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

[7] https://iaf.nu/en/member-details/?member_id=91

[8] https://iaf.nu/en/member-details/?member_id=14

[9] 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.

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

[11] Through ANAB accreditation and the IAF MLA, DrJ certification can be used to obtain material, product, design, or method of construction approval in any jurisdiction or country that has IAF MLA Members & Signatories to meet the Purpose of the MLA – "*certified once, accepted everywhere*".

[12] https://iaf.nu/en/about-iaf-mla/#:~:text=required%20to%20recognise

[13] 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) is intended to ensure that technical regulations, standards and conformity assessment procedures of member countries do not create unnecessary obstacles to trade. Under the TBT Agreement, members of the WTO agree to use international standards, including conformity assessment standards and guides, as a basis for their technical requirements.*"

[14] https://www.law.cornell.edu/uscode/text/18/part-I/chapter-90