

Self-Drilling Dowel Design Guide

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Building Forests in Cities



Vancouver, BC

MTC Solutions is a specialty supplier of connection solutions for modern mass timber applications in commercial, industrial and residential projects. We are proud to be working with the most innovative partners on cutting-edge projects across North America. Our goal is to see the wood construction industry thrive and help to maintain a low carbon footprint through education, research, and cost-effective approaches.



WE SUPPLY

MTC Solutions stocks more than 450 mass timber connection solutions ready for delivery throughout North America.



WE FUND

We do extensive research with leading North American universities to innovate Mass Timber Connections Solutions, reduce costs and extend the reach of mass timber in the market.



WE GUIDE

We offer free educational sessions on mass timber solutions in forms of webinars, technical learning sessions and event participation throughout North America.



WE EDUCATE

We provide the support needed to design efficient connection solutions. Our North American Support team is available to answer any design questions.

Engineered Solutions

The SDD Self-Drilling Dowel is a dowel designed for timber connections with knife plates.

It features:

Drilling tip eliminates the need for pre-drilling in wood, aluminum, and thin (1/8") steel plates.

Hardened steel resulting in higher shear resistance compared to non-hardened dowels.

Low installation torque allows it to be easily installed with cordless drills without the need for additional equipment.

Tight fit for reduced slip in the steel plate in all critical connections.

Application Examples

The SDD Self-Drilling Dowel can be used in multiple connection scenarios where internal steel plates are used for load transmission. Examples are shown below such as timber moment connections, custom beam hangers and hold down connections.





Concealable Head

Designed to be used with AW 40 Bits, for exceptional fit and durability. Easily plugged with wooden dowel.

Continuous Thread

Helps avoid slippage of the dowel out of the knife plate when loaded (cyclic or vibration).

Helps drive the dowel forward which reduces the amount of force needed to install.

Self-Drilling Tip

Enables fast and simple installation.

Notes to The Designer

- 1. Values given in the design tables are only valid for Limit State Design and need to be adjusted in accordance with CSA 086. The Factored Lateral Yielding Resistance Calculation is presented below.
- 2. Values given in the design tables are only valid for listed SDD Self-Drilling Dowels.
- 3. SSD Self-Drilling Dowels are only suitable for use in dry service conditions.
- 4. Load directions are listed as following:
 - N_{//} Parallel-to-grain loading
 - N₁ Perpendicular-to-grain loading

- 5. Geometry Requirements presented in this guide are based on CSA O86, for more details refer to clause 12.4.3.
- 6. If splitting of the wood, wood-based material or fastener damage is observed, a design professional must be contacted immediately.
- 7. Listed lateral yield resistance apply to different timber species according to their respective relative density (G) as per CSA 086.



S-P-F G = 0.42

Douglas Fir G = 0.49

Factored Lateral Yielding Resistance Calculation

Factored lateral yielding resistance (N,):

$$N_r = N \cdot n_F \cdot K'$$

N Unit lateral yielding resistance $(N_{\mu}, N_{\mu,CLT} \text{ or } N_{\perp})$ given in the provided design tables

 n_{F} Number of effective fasteners in a connection: $n_{F} = 0.9 \cdot n_{F}$

- n Number of fasteners acting together in a connection
- K' The adjustment factors for the connection, composed of:

 K_{D} ; K_{SF} ; K_{T}

 K_{SF} is to equal 1, for dry service conditions

Pre-Drilling Recommendation

To facilitate the installation of the SDD Self-Drilling Dowels with thicker (>1/8") knife plates or with multiple knife plates in a single connection, it is recommended to pre-drill the steel and wood with a ¼" **diameter** drill bit for the full length of the dowel.



SDD Specifications



Table 1.1, Fastener Sizes and Specified Dimensions

ltem#	Box size	D	1	L		- L _{Thread}		read	$D_{_{Head}}$	$L_{_{Head}}$		
#	pieces	in. [mm]	in.	[mm]	in.	[mm]	in. [mm]	in. [mm]	Bit			
36060730000	50	1/4	2-7/8	[73]	1-1/4	[31]						
36060930000	50		1/4	1/4		3-5/8	[93]	1-5/8	[40]			
36061130000	50				4-1/2	[113]	2	[50]				
36061330000	50				5-1/4	[133]	2-3/8	[60]				
36061530000	50	(0.273)	6	[153]	2-3/4	[70]	0.394 [10]	0.295 [7.5]	AW 40			
36061730000	50	[6.9]	6-3/4	[173]	3-1/8	[80]						
36061930000	50			-		7-5/8	[193]	3-1/2	[90]			
36062130000	50				8-3/8	[213]	3-7/8	[100]				
36062330000	50		9-1/8	[233]	4-3/8	[110]						

Yield Strength of Fastener

Table 1.2, Strength of Fastener

Diameter	Factored Dowel Shear Scrength	Yield Strength of Fastener in Bending, f _y
in. [mm]	kN	MPa
1/4" [6.9]	17.6	870



Lateral Yielding Resistance (N)

Table 2.1, Lateral Yielding Resistance for a Single Knife Plate

Relative	D	Fastener I	L	Steel Thickne	l Plate ss Range	Minimu Embe	m Wood dment	Lateral Yielding Resistance		
Density G	in. [mm]	in	[mm]		t	4	a _{min}	N _{II}	N _{II,CLT} ⁵	\mathbf{N}_{\perp}
			[]	in.	[mm]	in.	[mm]	Ν	Ν	Ν
	1/4 [6.9]	2-7/8	[73]			1-1/4	[31.7]	5428	5084	3089
0.42		3-5/8	[93]	3/16	[4.76]	1-5/8	[41.7]	5859	5472	3489
		5-1/4	[133]	5/16	[7.94]	2-3/8	[61.7]	6723	6249	3868
		6	[153]			2-7/8	[71.7]	7154	6638	4058
0.49		2-7/8	[73]	3/16	[4.76] to [7.94]	1-1/4	[31.7]	5978	5595	3604
	1/4 [6.9]	3-5/8	[93]	to		1-5/8	[41.7]	6482	6049	3836
	[0.0]	5-1/4	[133]	5/16		2-3/8	[61.7]	7489	6955	4280

Notes:

- 1. Lateral Yielding Resistance listed are only valid for Limit State Design.
- Lateral Yielding Resistance listed are only valid using listed SDD Self-Drilling Dowels.
- 3. Fasteners must be used in dry service conditions (K_{sF} =1.0).
- 4. Connector placement must respect the Geometry Requirements section.
- 5. The lateral yield resistances in Cross Laminated Timber (CLT) are $N_{_{\rm I,CLT}}$ with parallel-to-grain loading and $N_{_{\rm L}}$ with perpendicular-to-grain loading.
- 6. Steel plates must have a A36 steel grade.
- 7. Wood failure modes such as row shear, splitting, group tear-out and net tension failure are to be verified by the designer.
- 8. For structural applications $a_{min} > 1-1/2$ " [38 mm].
- 9. All connection design must meet all relevant requirements of the Notes to the Designer section of this guide and CSA O86.



	Fastener		Steel Plate		Minimum Wood				Lateral Yielding Resistance					
Relative Density	D	1	L	Thickne	ess Range		Emb	bedmen	t					
G	in.	in	[mm]		t	á	a _{min}		b	N _{II}	N _{II,CLT} ⁵	N_{\perp}		
	[mm]		[]	in.	[mm]	in.	[mm]	in.	[mm]	N	N	N		
		5-1/4	[133]			1-1/4	[31.7]	2-1/2	[63.5]	10788	10107	6031		
		5-1/4	[155]			1	[25.4]	3	[76.2]	11336	10600	6809		
		6	[152]			1-1/4	[31.7]	2-1/2	[63.5]	10788	10107	6031		
		0	[155]	3/16	[4.76]	1-1/2	[38.1]	3	[76.2]	11336	10600	6809		
0.42	1/4	7 5/0	[402]	4.0	ta	1-1/2	[38.1]	3	[76.2]	11336	10600	6809		
0.42	[6.9]	[6.9]	[193]	10	lÜ	1-3/4	[44.5]	3-1/2	[88.9]	11884	11094	7050		
		8-3/8	0.0/0	0 2/0	[040]	5/16	[7.94]	1-3/4	[44.5]	3-1/2	[88.9]	11884	11094	7050
			[213]			2	[50.8]	4	[101.6]	12432	11587	7291		
		0.4/0	0.4/0	0.4/0	0.4/0	10001			2	[50.8]	4	[101.6]	12432	11587
		9-1/8	[233]			2-1/4	[57.2]	4-1/2	[114.3]	12981	12080	7533		
		E 4/4	[400]			1-1/4	[31.7]	2-1/2	[63.5]	11878	11120	7036		
		5-1/4	ျားျ			1	[25.4]	3	[76.2]	12517	11696	7476		
			[450]			1-1/4	[31.7]	2-1/2	[63.5]	11878	11120	7036		
		6	[153]	3/16	[4.76]	1-1/2	[38.1]	3	[76.2]	12517	11696	7476		
0.40	1/4	7 5/0	[400]	4.	4-	1-1/2	[38.1]	3	[76.2]	12517	11696	7476		
0.49	[6.9]	/-5/8	7-5/8	[193]	το	lO	1-3/4	[44.5]	3-1/2	[88.9]	13157	12271	7758	
		0.0/0		5/16	[7.94]	1-3/4	[44.5]	3-1/2	[88.9]	13157	12271	7758		
		8-3/8	[213]			2	[50.8]	4	[101.6]	13797	12847	8039		
		0.4/0	100.01			2	[50.8]	4	[101.6]	13797	12847	8039		
		9-1/8	[233]			2-1/4	[57.2]	4-1/2	[114.3]	14436	13423	8321		

Notes:

- Lateral Yielding Resistance listed are only valid for Limit State 1. Design.
- 2. Lateral Yielding Resistance listed are only valid using listed SDD Self-Drilling Dowels.
- Fasteners must be used in dry service conditions (K_{sF} =1.0). 3.
- Connector placement must respect the Geometry Requirements 4. section.
- 5. The lateral yield resistances in Cross Laminated Timber (CLT) are $N_{\scriptscriptstyle II,CLT}$ with parallel-to-grain loading and $N_{\scriptscriptstyle \perp}$ with perpendicular-tograin loading.
- Steel plates must have a A36 steel grade. 6.
- Wood failure modes such as row shear, splitting, group tear-out and 7. net tension failure are to be verified by the designer.
- 8.
- For structural applications $a_{min} > 1-1/2$ " [38 mm]. All connection design must meet all relevant requirements of the 9. Notes to the Designer section of this guide and CSA O86.



Geometry Requirements



Lateral Loading Parallel-to-Grain

Lateral Loading Perpendicular-to-Grain

₽Û

Table 3.1, Min Geometry Requirements with Pre-drilled Holes

End Distance		Edge D	istance		Spacing Between Fasteners in a Row	Spa Betwee	cing n Rows
а	a _L	e _p	e _{Pl}	e _Q	S _c	S _R	S _{RL}
				[mm]			
50	50	max(10 or S _c /2)	25	28	21	28	21



Fasteners in Plane Surface

Fasteners in Narrow Edge

Table 3.2, Min CLT Geometry Requirements (mm) with Pre-drilled Holes

	End Di	stance	Edge [Distance		Spacing Between Fasteners in a Row	Spacing Betwee		
CLI Plane	а	a a _l e _P		$e_{_{P\perp}}$	e _Q	S _c	S _R	$S_{_{R\!\!\perp}}$	
			<u>`</u>		[mm]				
Fasteners in Plane Surface	50	50	max(10 or S _c /2)	25	28	21	28	21	
Fasteners in Narrow Edge	50	50	max(10 or S _c /2)	-	35	21	28	-	





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