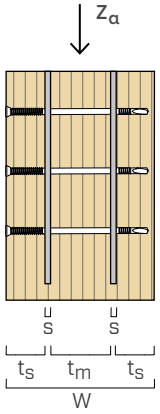
TIMBER-TO-METAL-TO-TIMBER STRUCTURAL VALUES

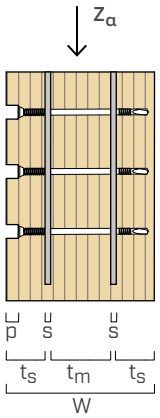
2 INTERNAL KNIFE PLATES - DOWEL HEAD INSTALLATION DEPTH 0 in



SBD Ø0.3 inch (7,5 mm)			[mm] [in]	135 5 5/16	155 6 1/8	175 6 7/8	195 7 11/16	215 8 7/16	235 9 1/4
beam width		**W**	[in]	5 1/2	6 3/4	7 1/2	8	8 3/4	9 3/4
head insertion depth		**p**	[in]	0	0	0	0	0	0
steel plate		**s**	**[in]**	**3/16**					
side wood		t_s	[in]	1.78	2.28	2.28	2.45	2.70	3.03
main wood		t_m	[in]	1.06	1.31	2.06	2.23	2.48	2.81
Z_α [lbf]	load-to-grain angle 0°	G=0.35		1297	1437	1485	1658	1722	1762
		G=0.42		1528	1686	1712	1857	1923	1936
		G=0.49		1758	1904	1934	2040	2082	2099
		G=0.55		1955	2079	2084	2168	2211	2231
	load-to-grain angle 30°	G=0.35		1058	1167	1232	1406	1457	1500
		G=0.42		1275	1415	1447	1598	1659	1686
		G=0.49		1495	1637	1662	1785	1835	1849
		G=0.55		1686	1817	1841	1929	1964	1981
	load-to-grain angle 45°	G=0.35		915	1006	1082	1260	1299	1336
		G=0.42		1122	1242	1289	1446	1503	1542
		G=0.49		1336	1478	1500	1632	1692	1705
		G=0.55		1525	1657	1683	1785	1825	1840
	load-to-grain angle 60°	G=0.35		803	879	962	1126	1172	1202
		G=0.42		998	1102	1159	1320	1368	1409
		G=0.49		1203	1336	1363	1500	1557	1581
		G=0.55		1387	1519	1542	1656	1703	1715
	load-to-grain angle 90°	G=0.35		689	752	834	974	1031	1055
		G=0.42		865	953	1016	1172	1211	1247
		G=0.49		1054	1168	1204	1341	1392	1422
		G=0.55		1226	1352	1373	1488	1541	1551
steel plate		**s**	**[in]**	**5/16**					
side wood		t_s	[in]	1.72	2.22	2.22	2.39	2.64	2.97
main wood		t_m	[in]	0.94	1.19	1.94	2.10	2.35	2.69
Z_α [lbf]	load-to-grain angle 0°	G=0.35		1218	1358	1483	1701	1781	1836
		G=0.42		1433	1605	1731	1914	2002	2035
		G=0.49		1646	1852	1954	2106	2191	2224
		G=0.55		1829	2063	2137	2259	2341	2379
	load-to-grain angle 30°	G=0.35		995	1104	1219	1430	1499	1551
		G=0.42		1197	1337	1452	1648	1719	1763
		G=0.49		1401	1573	1683	1838	1923	1949
		G=0.55		1579	1778	1863	1996	2071	2104
	load-to-grain angle 45°	G=0.35		862	953	1062	1263	1326	1382
		G=0.42		1054	1174	1285	1481	1553	1602
		G=0.49		1253	1404	1515	1683	1759	1791
		G=0.55		1428	1606	1701	1841	1918	1946
	load-to-grain angle 60°	G=0.35		757	834	938	1111	1188	1237
		G=0.42		938	1042	1149	1344	1409	1456
		G=0.49		1129	1262	1370	1549	1615	1654
		G=0.55		1300	1459	1562	1705	1784	1809
	load-to-grain angle 90°	G=0.35		650	714	811	955	1039	1079
		G=0.42		814	902	1001	1188	1241	1289
		G=0.49		990	1104	1204	1377	1441	1484
		G=0.55		1149	1288	1388	1534	1604	1631

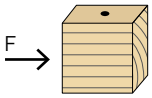
TIMBER-TO-METAL-TO-TIMBER STRUCTURAL VALUES

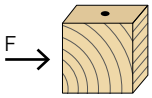
2 INTERNAL KNIFE PLATES - DOWEL HEAD INSTALLATION DEPTH 1/2 in



SBD Ø0.3 inch (7,5 mm)			[mm] [in]	135 5 5/16	155 6 1/8	175 6 7/8	195 7 11/16	215 8 7/16	235 9 1/4
beam width		**W**	[in]	6 3/4	7 1/2	8	8 3/4	9 3/4	10 3/4
head insertion depth		**p**	[in]	1/2	1/2	1/2	1/2	1/2	1/2
steel plate		**s**	**[in]**	**3/16**					
side wood		t_s	[in]	2.41	2.53	2.45	2.70	3.03	3.36
main wood		t_m	[in]	1.06	1.56	2.23	2.48	2.81	3.15
Z_α [lbf]	load-to-grain angle 0°	G=0.35		1235	1439	1550	1632	1682	1738
		G=0.42		1455	1654	1752	1824	1884	1918
		G=0.49		1674	1866	1917	2000	2061	2076
		G=0.55		1861	2035	2054	2143	2186	2204
	load-to-grain angle 30°	G=0.35		1007	1196	1285	1387	1424	1466
		G=0.42		1214	1401	1511	1571	1624	1672
		G=0.49		1424	1605	1679	1752	1808	1830
		G=0.55		1606	1780	1814	1893	1943	1958
	load-to-grain angle 45°	G=0.35		871	1041	1123	1245	1274	1307
		G=0.42		1068	1250	1346	1424	1467	1515
		G=0.49		1272	1450	1542	1603	1657	1689
		G=0.55		1452	1624	1677	1750	1807	1820
	load-to-grain angle 60°	G=0.35		764	911	993	1113	1152	1179
		G=0.42		950	1126	1210	1301	1337	1377
		G=0.49		1146	1319	1423	1475	1525	1567
		G=0.55		1321	1489	1558	1626	1677	1698
	load-to-grain angle 90°	G=0.35		656	779	858	958	1012	1037
		G=0.42		824	986	1057	1157	1186	1219
		G=0.49		1004	1167	1257	1319	1361	1405
		G=0.55		1167	1327	1404	1462	1510	1537
steel plate		**s**	**[in]**	**5/16**					
side wood		t_s	[in]	2.34	2.47	2.39	2.64	2.97	3.30
main wood		t_m	[in]	0.94	1.44	2.10	2.35	2.69	3.02
Z_α [lbf]	load-to-grain angle 0°	G=0.35		1157	1407	1518	1651	1734	1793
		G=0.42		1361	1644	1766	1866	1946	2000
		G=0.49		1564	1872	1953	2067	2147	2179
		G=0.55		1737	2060	2109	2222	2291	2327
	load-to-grain angle 30°	G=0.35		945	1145	1250	1392	1454	1516
		G=0.42		1137	1383	1485	1596	1675	1731
		G=0.49		1331	1602	1702	1801	1871	1913
		G=0.55		1500	1791	1853	1958	2030	2060
	load-to-grain angle 45°	G=0.35		819	988	1092	1232	1290	1346
		G=0.42		1002	1216	1316	1438	1509	1563
		G=0.49		1191	1439	1547	1638	1710	1760
		G=0.55		1357	1627	1706	1807	1876	1908
	load-to-grain angle 60°	G=0.35		719	865	967	1086	1159	1205
		G=0.42		891	1080	1178	1307	1366	1424
		G=0.49		1073	1303	1400	1500	1573	1626
		G=0.55		1235	1486	1579	1671	1736	1775
	load-to-grain angle 90°	G=0.35		618	741	836	936	998	1053
		G=0.42		774	935	1028	1157	1206	1260
		G=0.49		940	1144	1232	1336	1404	1450
		G=0.55		1092	1318	1417	1496	1559	1602

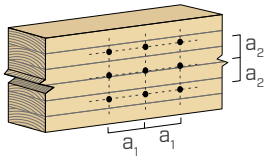
MINIMUM DISTANCES FOR DOWELS SUBJECT TO SHEAR



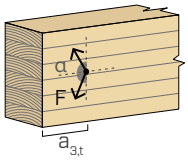


d_1	[in]		0.30	0.30
	[mm]		7,5	7,5
a_1	[in]	**4·d**	1 3/16	**4·d** 1 3/16
a_2	[in]	**5·d**	1 1/2	**5·d** 1 1/2
$a_{3,t}$	[in]	**7·d**	2 1/16	**4·d** 1 3/16
$a_{3,c}$	[in]	**4·d**	1 3/16	**4·d** 1 3/16
$a_{4,t}$	[in]	**4·d**	1 3/16	**4·d** 1 3/16
$a_{4,c}$	[in]	**4·d**	1 3/16	**4·d** 1 3/16

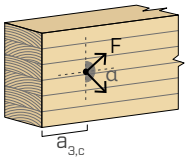
α = load-to-grain angle
d = d_1 = nominal dowel diamter



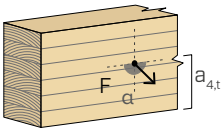
stressed end
-90° < α < 90°



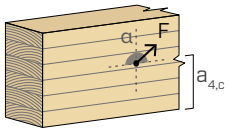
unloaded end
90° < α < 270°



stressed edge
0° < α < 180°



unload edge
180° < α < 360°



NOTES

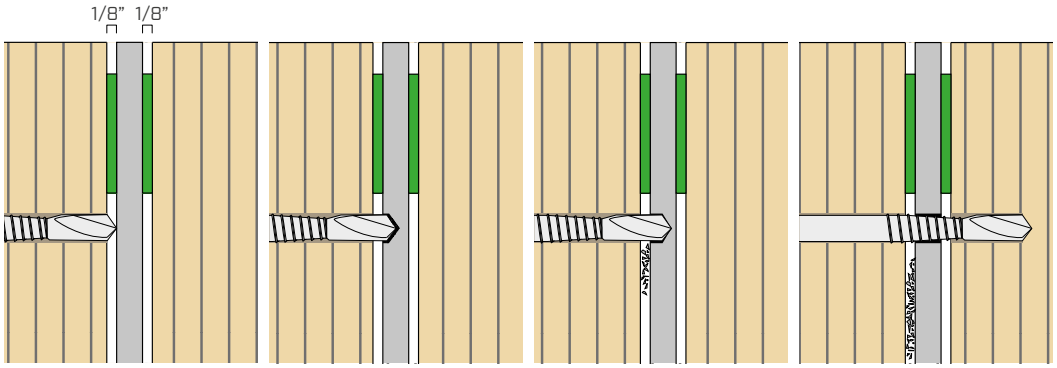
- The minimum spacing and distances comply with 2024 NDS, where d refers to the nominal diameter of the dowel.
- Wood member stresses must be checked in accordance with Section 11.1.2 and Appendix E of the NDS, and end distances, edge distances and fastener spacing may need to be increased accordingly.

GENERAL PRINCIPLES

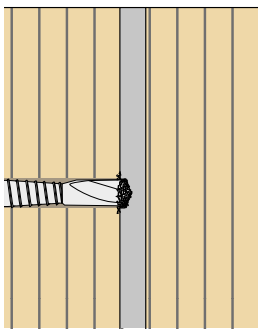
- Tabulated values comply with NATIONAL DESIGN SPECIFICATION FOR WOOD CONSTRUCTION in accordance with ESR-4645.
- To determine allowable loads for use with ASD, design loads for use with LRFD or both, tabulated values must be multiplied by all adjustment factors included in the NDS for dowel-type fasteners.
- As part of the connection design, the structural wood members, the steel plates must be sized and verified in accordance with the corresponding Section of the NDS and must be done separately by the designer.
- Connections with multiple fasteners must be designed in accordance with the corresponding Sections of the NDS.
- SBD must be installed and used in dry in-service conditions in accordance with the NDS (wet service factor for connection CM is 1.0).
- SBD must be positioned in accordance with the minimum distances.
- Tabulated values are determined from the yield model equations in the corresponding Section of the NDS.
- The steel member must have a minimum tensile strength equal to 58 ksi (400 MPa) and comply with the minimum requirements of ASTM A36.
- Designed connections must respect all requirements on general principles and minimum distances.
- Tabulated values, that are referred to a single fastener, are valid for Allowable Stress Design (ASD) considering a standard loading (CD = 1.0).
- Tabulated values are determined considering this specific geometry of the connection. Different configuration with different steel plates or wood thichensses and different dowel head installation depth can be calculated according to NDS.
- A milling of 1/8" is considered for each side of the steel plate.

INSTALLATION

It is important to have **a milling in the wood equal to the thickness of the plate, increased by at least 1/4"**, placing SHIM spacers between the wood and the plate to centre it in the milling.
In this way, the steel residue from the drilling of the metal has an outlet to escape and does not obstruct the passage of the drill through the plate, thus avoiding overheating of the plate and timber and also preventing the generation of smoke during installation.



Cutter increased by 1/8" on each side.



Shavings obstructing the holes in the steel during drilling (spacers not installed).

To avoid breakage of the tip at the moment of pin-plate contact, it is recommended to **reach the plate slowly, pushing with a lower force until the moment of impact and then increasing it to the recommended value** (90 lbs | 40 kg for top-down applications and 55 lbs | 25 kg for horizontal installations). Try to keep the dowel as perpendicular as possible to the surface of the timber and the plate.

Intact tip after correct installation of the dowel.

Broken (cut) tip due to excessive force during impact with metal.

If the steel plate is too hard, the dowel tip may shrink significantly or even melt. In this case, it is advisable to check the material certificates for any heat treatment or hardness tests performed. Try decreasing the force applied or alternatively changing the type of plate.

Tip melted during installation on a too hard plate without spacers between timber and plate.

Reduction of the tip when drilling the plate due to the high hardness of the plate.