Joint Design Using **ONESIDE™ Structural Assembly**

This technical note provides guidance on using ONESIDE™ bolt for structural joint designs in accordance with AS 4100:2020.

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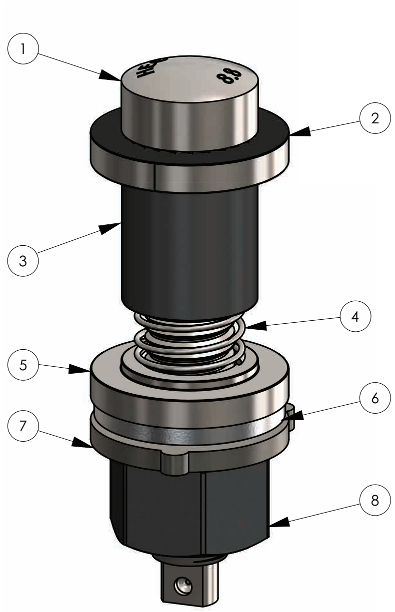
The ultimate high strength structural blind fastening system, the ONESIDE™ bolt provides true structural strength for joints where access is limited to only one side of the joint. Using ONESIDE™ the full structural strength of Class 8.8 high strength bolts as per AS4291.1 can be achieved in both shear and tension. With the use of a high tensile sleeve, ONESIDE™ provides full shear strength corresponding to the hole-size.

Components of ONESIDE™ bolt

The ONESIDE™ bolt assembly includes:

1. Bolt with circular head
2. Split-step washer
3. Shear sleeve
4. Spring
5. Step washer
6. Direct Tension Indicating (DTI) washer
7. AS/NZS 1252 structural washer
8. AS/NZS 1252 structural nut



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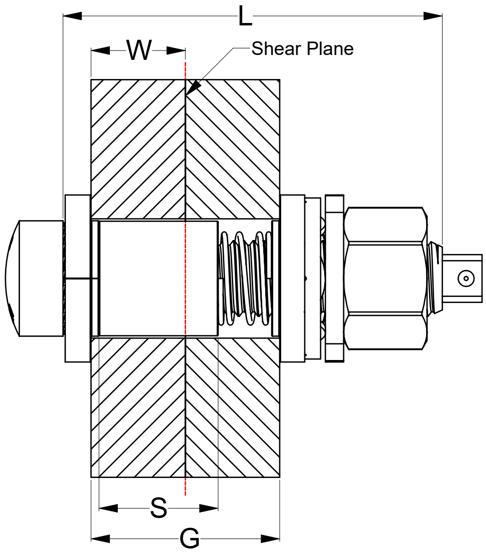
ONESIDE™ Bolt Length and Sleeve Selection

It is critical that the correct sleeve length is selected for the required grip range. The shear plane must always intersect the sleeve for the ONESIDE™ bolt. The grip range should be taken from the TDS. The thickness of the inner ply of the grip **(W)** must be less than the sleeve length to ensure that the shear plane crosses the sleeve.

Description	Sleeve Length	Grip Length
	S (mm)	G (mm)
M20 X 65mm - Green	6	12-20
M20 X 95mm - Black	18	23.5-36
M20 X 95mm - Yellow	30	36-47
M20 X 135mm - Blue	39	47-57
M20 X 135mm - Brown	48	57-73
M20 X 135mm - Purple	57	73-87
M20 X 165mm - Red	76	86-120



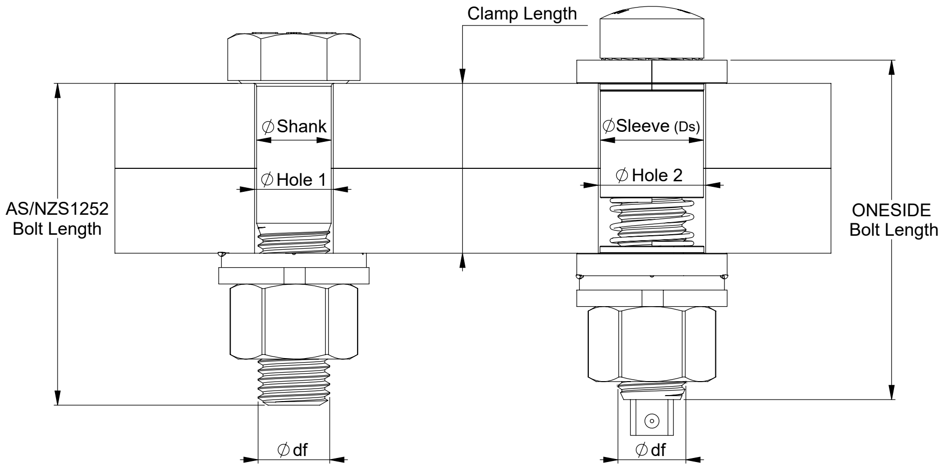
Mechanical Properties of ONESIDE™ bolt

ONESIDE™ bolt has been designed to comply with the design requirements of AS 4100 and mechanical properties of PC8.8 structural bolts to AS/NZS 4291. Thread stress area and tensile capacities for any designation of bolt may be taken from the technical data sheet (TDS) or AS/NZS 4291. The bolt head has been designed to allow the bolt assembly to provide the full structural strength of PC8.8 bolts as per AS/NZS 4291.1 in both tension and shear. With the use of the high tensile sleeve ONESIDE™ will provide full shear strength for the corresponding hole size.

Bolt Size	Ultimate Stress	Yield Stress	Proof Stress	Hardness Range	Shank Stress Area	Thread Stress Area	Core Shear Area	Sleeve Shear Area
Dia x Pitch	(MPa)	(MPa)	(MPa)	(HRC)	(mm^2)	(mm^2)	(mm^2)	(mm^2)
M20x2.5	830	660	600	23-34	314	245	225	280

Bolt Size	Tensile Loads N_{tf}		Shear Across Shank V_{shank}		Shear Across Thread $V_{threads}$		Shear Across Sleeve V_{sleeve}	
Dia x Pitch	Ultimate	Proof	Ultimate	Proof	Ultimate	Proof	Ultimate	Proof
	(kN)	(kN)	(kN)	(kN)	(kN)	(kN)	(kN)	(kN)
M20x2.5	203	147	162	117	116	84	144	104

Design Details for ONESIDE™ bolt



Standard Structural Bolt **ONESIDE™ Bolt**

Minimum Pitch

The minimum pitch is based on the distribution of stress within the joint where the bolt develops a stress volume. It has been found that a minimum area of not more than 2.5 times the bolt diameter in the joint interface will experience the increased stress due to clamp force.

AS 4100 clause 9.5.1 specifies the minimum pitch as not being less than 2.5 times the nominal bolt diameter in order to avoid any increased stress due to overlap of the clamping stress volume. Since it is the bolt diameter that determines the allowable pitch a ONESIDE™ bolt will have the same minimum pitch as a standard structural bolt.

Edge Distance

Minimum edge distances are calculated to avoid a shear failure. The minimum edge distance depends on whether the bolt is installed into standard or non-standard holes. Since the ONESIDE™ bolt requires a larger hole diameter they are considered as installed into non-standard holes. The minimum edge distance is then measured from the nearer edge of the hole to the physical edge plus half the fastener diameter (df).

As the ONESIDE™ bolt sleeve increases the shear capacity of the bolt assembly, the nominal fastener diameter (df) should be replaced by the sleeve diameter (Ds) when calculating the minimum edge distance.

Minimum Edge Distance – AS 4100:2020 Table 9.5.2		
Sheared or hand flame cut edge	**Rolled plate, flat bar or section: machine cut, sawed or planed edge**	**Rolled edge of a rolled flat bar or section**
1.75df	1.50df	1.25df

Bolt Strength Limit State

Bolt in Shear (Clause 9.2.2.1)

A bolt subject to a design shear force (V_f*) shall satisfy –

$V_f^* \leq \phi V_f$ Where; ϕ = Capacity Factor

V_f = Nominal shear capacity of a bolt;

When calculating V_f for ONESIDE™ bolt take the shear breaking loads (V) from the technical data sheet and multiple by the number of shear planes (n_n). Add the shear capacity of the sleeve to either the shear capacity of the threads or shank, whichever the shear plane crosses.

$$V_f = (V_{sleeve} + V_{threads,\ shank}) \times n_n$$

Note for bolted lap connection a reduction factor of kr should be used as per AS 4100:2020 table 9.2.2.1.

Bolt in Tension (Clause 9.2.2.2)

A bolt subject to a design tension force (N_{tf}*) shall satisfy –

$N_{tf}^* \leq \phi N_{tf}$ Where; ϕ = Capacity Factor

N_{tf} = Nominal tensile capacity of a bolt;

The nominal tensile capacity of the ONESIDE™ bolt should be taken from the technical data sheet or AS/NZS 4291.1 for the corresponding bolt diameter and property class.

Bolt subject to Combined Shear and Tension (Clause 9.2.2.3)

A bolt required to resist both design shear (V_f*) and design tensile forces (N_{tf}*) at the same time shall satisfy—

$$\left(\frac{V_f^*}{\phi V_f}\right)^2 + \left(\frac{N_{tf}^*}{\phi N_{tf}}\right)^2 \leq 1.0$$

Where; ϕ = Capacity Factor

V_f = Nominal shear capacity of a bolt;

N_{tf} = Nominal tensile capacity of a bolt;

The shear capacity of the bolt should be calculated as previously described using the shear capacity of the sleeve, thread and shank from the TDS.

$V_f = (V_{sleeve} + V_{threads,\ shank}) \times n_n$

Ply in Bearing

A ply subject to a design bearing force (V_b*) due to a bolt in shear shall satisfy—

$V_b^* \leq \phi V_b$ Where; ϕ = Capacity Factor

V_b = Nominal shear capacity of a bolt = $3.2 d_f t_p f_p$

and;

d_f = diameter of the bolt

t_p = thickness of the ply

f_{up} = tensile strength of the ply

As with calculating minimum edge distance the ONESIDE™ bolt sleeve diameter shall replace the diameter of the bolt when calculating bearing capacity of the ply.

$d_f = d_{sleeve}$

Friction Type (T/F) Joints

In friction type joint design, the shear sleeve does not affect the design considerations. Shear and tensile capacities will be the same as for a standard structural bolt of the same diameter. Design capacities should be calculated in accordance with AS 4100:2020 clause 9.2.3.

Tensile Strength	Shear Strength	Minimum Pitch	Min Edge Distance
$N_{Oneside} = N_{Standard}$	$V_{Oneside} > V_{Standard}$	$S_{Oneside} = S_{Standard}$	$C_{Oneside} > C_{Standard}$