# AD 354
# Resistance of bolted connections in tension, for design to BS EN 1993-1-8

This Advisory Desk Note provides a simple method of determining the design tension resistance of bolted connections in accordance with BS EN 1993-1-5:2005 that avoids the need to evaluate prying forces. The method is based on the simple method provided in BS 5950-1:2000.

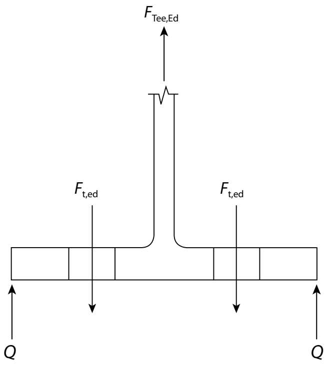
The design tension resistance ($F_{t,Rd}$) of individual fasteners is given by BS EN 1993-1-8, Table 3.4. However, in a tension connection, Clause 3.11 requires that the fasteners should be designed to resist a design tensile force ($F_{t,Ed}$) that includes any force due to prying action (see Figure 1 below). Clause 6.2.4 provides rules (in Table 6.2) for T-stub flanges that implicitly account for prying forces.

In contrast, BS 5950-1 has two approaches to verify the tension capacity of connections using bolts – the more exact method of clause 6.3.4.3, which corresponds to the Eurocode method and which also requires the consideration of the prying force, and the simple method of clause 6.3.4.2. The simple method of BS 5950-1 utilises a reduced "nominal tension capacity" (equal to 0.8 × the tension capacity) that is verified against a tensile force that excludes prying force; this means that, in certain circumstances, designers need not calculate the prying force.

This Advisory Desk recommends that, for verifying resistance of a bolted tension connection when designing to BS EN 1993-1-8, as an alternative to the 'exact method' of Table 6.2, the following simple approach may be adopted, provided that the cross-centres (gauge) of the bolt lines are not greater than 55% of the flange width or end plate width (see Figure 2):

- Calculate the design forces in individual fasteners, neglecting prying force
- Take the tensile resistances of the individual fasteners as $0.8F_{t,Rd}$, where $F_{t,Rd}$ is given by Table 3.4.

In addition, the bending resistance of the connected part should also be verified. For this simple approach, if the connected part is designed assuming double curvature bending, the moment resistance per unit length should be taken as $f_y t_p^2/6\gamma_{M0}$, where $t_p$ and $f_y$ are the thickness and yield strength, respectively, of the connected part.




$F_{t,ed}$ is the design tensile force on the fastener

$\frac{F_{Tee,Ed}}{2} + Q$

$Q$ is the prying force

*Figure 1. Prying action*

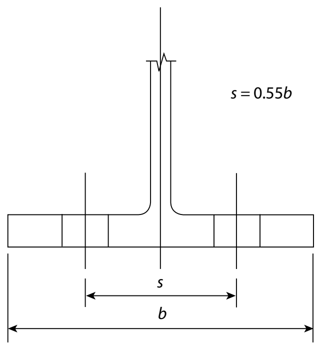



*Figure 2. Limiting cross-centres for the simple method*

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# New and revised codes & standards

**From BSI Update January 2011**

**BS EN PUBLICATIONS**

**BS EN ISO 148-1:2010**
Metallic materials. Charpy pendulum impact test. Test method
*Supersedes BS EN 10045-1:1990*

**NEW WORK STARTED**

**EN 1090-2:2008/A1**
Execution of steel structures and aluminium structures. Technical requirements for the execution of steel structures

**EN 10025-1**
Hot rolled products of structural steels. General technical delivery conditions
*Will supersede BS EN 10025-1:2004*

**EN 10025-2**
Hot rolled products of structural steels. Technical delivery conditions for non-alloy structural steels
*Will supersede BS EN 10025-2:2004*

**EN 10025-3**
Hot rolled products of structural steels. Technical delivery conditions for normalized/normalized rolled weldable fine grain structural steels.
*Will supersede BS EN 10025-3:2004*

**EN 10025-4**
Hot rolled products of structural steels. Technical delivery conditions for thermomechanical rolled weldable fine grain structural steels.
*Will supersede BS EN 10025-4:2004*