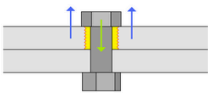


PUNCHING SHEAR CHECKS



Internal axial forces in bolts are transferred to bolted objects through the head and the nut; once these forces are known, it is possible to perform punching shear checks for involved objects. This check can be included or inhibited. If a **prying forces** factor greater than 1 has been defined, the traction forces used for this check are those of the analysis amplified by this factor.

EC3

According to Eurocode 3, the formula for computation is the following:

$$N_b < 0,6 \cdot \frac{\pi \cdot d_M \cdot t \cdot f_u}{\gamma_{M2}}$$

where N_b is internal axial force in the bolt, t is the thickness of the plate currently under check, f_u is the ultimate stress of plate material and d_M is bolt head mean diameter, computed as the average value between d_1 and d_2 , which are the lengths shown in the following figure.



For each involved plate, a check is performed for all combinations and renode instances and for all the bolts. From each check, an utilization ratio is computed.

CNR 10011 AS

$$N_b < 0,6 \cdot \pi \cdot d_M \cdot t \cdot f_d / 1.5$$

CNR 10011 LS

$$N_b < 0,6 \cdot \pi \cdot d_M \cdot t \cdot f_d$$

AISC ASD

$$N_b < 0,6 \cdot \pi \cdot d_M \cdot t \cdot 0.3 f_u$$

AISC LRFD

$$N_b < 0,6 \cdot \pi \cdot d_M \cdot t \cdot 0.6 \cdot 0.75 f_u$$

