Fatigue resistance

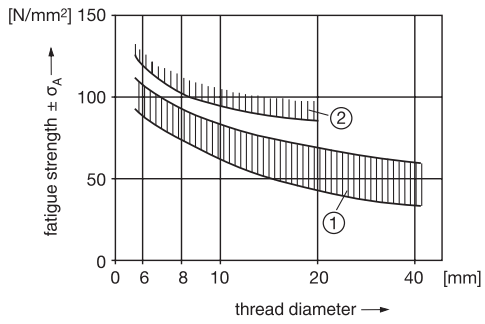
Strength under dynamic load
according to VDI 2230

Screws are notched components; the notching is provided by the thread. Under conditions of changing load, fatigue fractures can occur in the screws. In 90 % of the cases the break occurs in the first load-bearing part of the thread, at the entry into the internal (female) thread. In these cases the design must allows for the fatigue strength $\pm\sigma_A$ of the screws; this amounts to a fraction of the tensile strength, **independent** of the static loading!

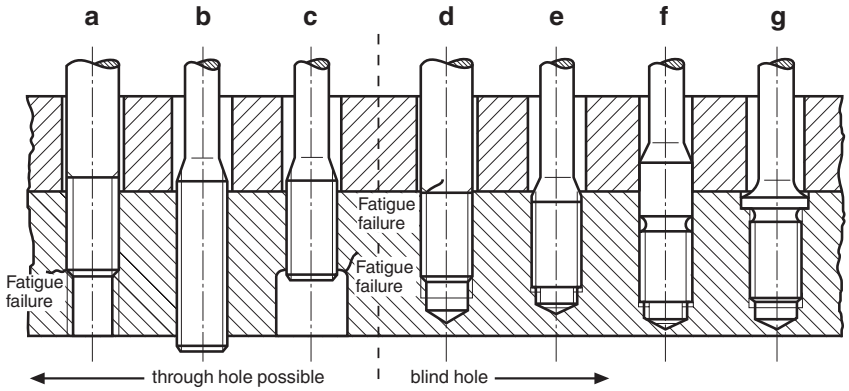
The fatigue strength of fine threads decreases with increasing rigidity and fineness of thread. The fatigue strength of fine threaded fasteners with a property class of 12.9, it can be up to 30 % lower than for coarse threads.

For hot-dip galvanized screws the fatigue strength is about 20 % lower than for screws hardened and tempered at the end of the manufacturing process.

Other constructive measures which can increase the fatigue strength:
Basically, all measures which can reduce the effective peak stresses or prevent combined loading (loading along more than one axis), are suitable for increasing the fatigue strength of the screwed connections. Long rather than short screws, screws with waisted shanks rather than screws with normal shanks, pins or fitted shoulder screws to absorb lateral forces, adequate and above all controlled preloading of the screws.



Graphic: VDI 2230, Edition 1986
① Thread rolled then hardened and tempered (standard practice)
② Hardened and tempered, then thread rolled



a Danger of fatigue failure in the internal thread as well
b Reduces the danger of fatigue failure
– in the internal thread through overlapping screw threads
– in the first load-bearing part of the thread, through design which allows flexibility in the reduced shank
c Reduces the danger of fatigue failure in the internal thread through rounded indentation and overlapping screw threads
d Danger of fatigue failure in yesmmed thread run out of the screw thread
e Reduces the danger of fatigue failure compared with (d) through design which allows flexibility, overlapping internal thread and bracing the screw with the starter head.
f As for e but here the centre belt serves to reduce bending stresses in the screw thread.
g Reduces the risk of fatigue failure through tensioning the belt against the bearing surfaces of the internal thread, leading to general release of the screw thread from bending stresses.