Estimation of screw diameters

according to VDI guideline 2230[1]

The following procedure allows a rough estimate to be made of the required screw dimensions for a particular screwed connection and temperature around 20 °C, in correspondence with the details in VDI 2230. The result should be checked mathematically in each case.

Procedure:

A Select in column 1 the next higher force to the work force $F_{A,Q}$ acting on the bolted joint.

B The required minimum preload $F_{M\,min}$ is found by proceeding from this number:

4 steps for static or dynamic transverse (shear) force	or **2 steps** for dynamic, eccentric axial force
or **1 step** for either dynamic and centrical or static and eccentric force	or **0 step** for static, centrical axial force

C The required maximum preload force $F_{M\,max}$ is found by proceeding from this force $F_{M\,min}$ by:

2 steps for tightening the screw with a motorized / pneumatic screwdriver which is set for a certain tightening torque	
or **1 step** for tightening with a torque wrench / or precision motorized screwdriver, which is set and checked by means of dynamic torque measurement or elongation measurement of the screw	or **0 step** for «turn of the nut» method or yield point controlled method

D Once the preload (force) has been estimated, the correct screw size is found next to it in column 2 to 4 underneath the appropriate property class.

[1] VDI = Verein Deutscher Ingenieure (Association of German engineers)

Example:

A joint is loaded dynamically and eccentrically by the axial force F_A = 8500 N. The screw of property class 12.9 will be assembled with a manual torque wrench.
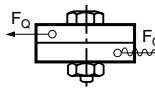
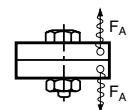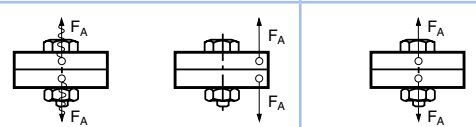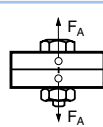**A** 10 000 N is the next higher force to F_A in column 1

B 2 steps for «eccentric and dynamic axial force» lead to $F_{M\,min}$ = 25 000 N

C 1 step for «tightening with manual torque wrench» leads to $F_{M\,max}$ = 40 000 N

D For $F_{M\,max}$ = 40 000 N thread size **M10** is found in column 2 (property class 12.9)

1	2	3	4
Force in [N]	Nominal diameter [mm]		
	Property class		
	12.9	10.9	8.8
250	–	–	–
400	–	–	–
630	–	–	–
1000	M3	M3	M3
1600	M3	M3	M3
2500	M3	M3	M4
4000	M4	M4	M5
6300	M4	M5	M6
10 000	M5	M6	M8
16 000	M6	M8	M10
25 000	M8	M10	M12
40 000	M10	M12	M14
63 000	M12	M14	M16
100 000	M16	M18	M20
160 000	M20	M22	M24
250 000	M24	M27	M30
400 000	M30	M33	M36
630 000	M36	M39	–