

Educational version

Program : MDESIGN 2020 -
Module version : 18.0.2

User :
Date : 09.05.2024

Customer : Student
Project :

Crossbolt

With the following program based on the groundwork calculations of Roloff/Matek, Maschinenelemente, transverse bolts will be dimensioned and calculated.

Considered will be bolts without heads accord. to DIN EN 22340 (Form A and B), bolts with heads accord. to DIN EN 22341, as well as bolts with heads pins and with threads accord. to DIN 1445.

Input data:

Crossbolt

Geometry

Pole Width	t_S : 10	mm
Fork Width	t_G : 5	mm
Crossbolt Diameter	d : 10	mm
Width of Web	b : 60	mm
Diameter of Bore	d_L : 10	mm

Loading Data

Loading Type	static loading
Operational Factor	c_B : 1,4
Pole Force	F : 700 N

Material Data

Crossbolt - Material (strength values) according to	MDESIGN database
International materials	no

Material designation	E295
Material number	1.0050

Material group	Unalloyed structural steel
Heat treatment / State	none

Standard dimension	d_{Nm} = 40	mm
Standard dimension	d_{Np} = 40	mm
Ultimate strength for d_{Nm}	R_{mN} = 490	N/mm ²
Yield point for d_{Np}	R_{pN} = 295	N/mm ²
Temperature	T = 40	°C

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Material, surface hardened no
Loads mainly crosswise to the preferred direction of machining (rolling) no
Fork - Material (strength values) according to MDESIGN database
International materials no

Material designation S235JR
Material number 1.0038

Material group Unalloyed structural steel
Heat treatment / State none

Standard dimension $d_{Nm} = 40$ mm
Standard dimension $d_{Np} = 40$ mm
Ultimate strength for d_{Nm} $R_{mN} = 360$ N/mm²
Yield point for d_{Np} $R_{pN} = 235$ N/mm²

Temperature $T = 20$ °C

Material, surface hardened no
Loads mainly crosswise to the preferred direction of machining (rolling) no
Pole - Material (strength values) according to MDESIGN database
International materials no

Material designation S235JR
Material number 1.0038

Material group Unalloyed structural steel
Heat treatment / State none

Standard dimension $d_{Nm} = 40$ mm
Standard dimension $d_{Np} = 40$ mm
Ultimate strength for d_{Nm} $R_{mN} = 360$ N/mm²
Yield point for d_{Np} $R_{pN} = 235$ N/mm²

Temperature $T = 20$ °C

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Material, surface hardened no

Loads mainly crosswise to the preferred direction of machining (rolling) no

Results:

Loading Data

Existing Loadings

Building Case			1	2	3
Bending Moment	M_b	=	1,75	0,88	0,88 N·m
Existing Bending Stress	σ_{bvorh}	=	24,96	12,48	12,48 N/mm ²
Existing Shear Stress	τ_{vorh}	=	8,32	8,32	8,32 N/mm ²
Mean Surf. Pressure (Pole)	p_{svorh}	=	9,8	9,8	9,8 N/mm ²
Mean Surf. Pressure (Fork)	p_{gvorh}	=	9,8	9,8	9,8 N/mm ²

Allowable Loadings

Allowable Bending Stress ($0.30 \cdot R_m$)	σ_{bzul}	=	147	N/mm ²
Allowable Shear Stress ($0.20 \cdot R_m$)	τ_{bzul}	=	98	N/mm ²
Allowable Surface Pressure for Crossbolt ($0.35 \cdot R_m$)	p_{zul}	=	171,5	N/mm ²
Allowable Surface Pressure for Fork ($0.35 \cdot R_m$)	p_{zul}	=	126	N/mm ²
Allowable Surface Pressure for Pole ($0.35 \cdot R_m$)	p_{zul}	=	126	N/mm ²

Safeties

Building Case			1	2	3
For Bending	S_b	=	5,89	11,78	11,78
For Shearing	S_t	=	11,78	11,78	11,78
For Surface Pressure (Pole)	S_{ps}	=	12,86	12,86	12,86
For Surface Pressure (fork)	S_{pg}	=	12,86	12,86	12,86
Max. Normal Stress (Cheek Profile)	σ_w	=	12,15	N/mm ²	
Allowable Normal Stress (Cheek Profile)	σ_{wzul}	=	117,5	N/mm ²	

Material Data

Ultimate Strength for Crossbolt	R_m	=	490	N/mm ²	(for $d_{eff} = 10$ mm)
Ultimate Strength for Fork	R_m	=	360	N/mm ²	(for $d_{eff} = 10$ mm)
Ultimate Strength for Pole	R_m	=	360	N/mm ²	(for $d_{eff} = 10$ mm)
Yielding Point for Pole	R_e	=	235	N/mm ²	(for $d_{eff} = 10$ mm)

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Notice:

- For cheek diameter D normally the following values are used:

* For S_t bzw. GS: $D = (2...2.5) \cdot d$

* For GG : $D = (3...3.5) \cdot d$

- Building Case 1 : Bolt - Fork = Clearance Fit
Bolt - Pole = Clearance Fit

- Building Case 2 : Bolt - Fork = Pressure Fit
Bolt - Pole = Clearance Fit

- Building Case 3 : Bolt - Fork = Clearance Fit
Bolt - Pole = Pressure Fit