



UNCLASSIFIED — FOR TECHNICAL INFORMATION

MECHANICAL JUSTIFICATION DOCUMENT

CALCULATION NOTE

THREADED ASSEMBLY — TIGHTENING & MARGINS

Document reference	SAMPLE-001
Revision	A
Date	07/08/2026
Designation	Threaded assembly M8 Cl.8.8 — Hex

PRESCRIBED TIGHTENING TORQUE

16.00 N·m

[14.40 — 17.60] N·m

JOINT STATUS

Low margin on : Rupture.ult — check assumptions

Caution

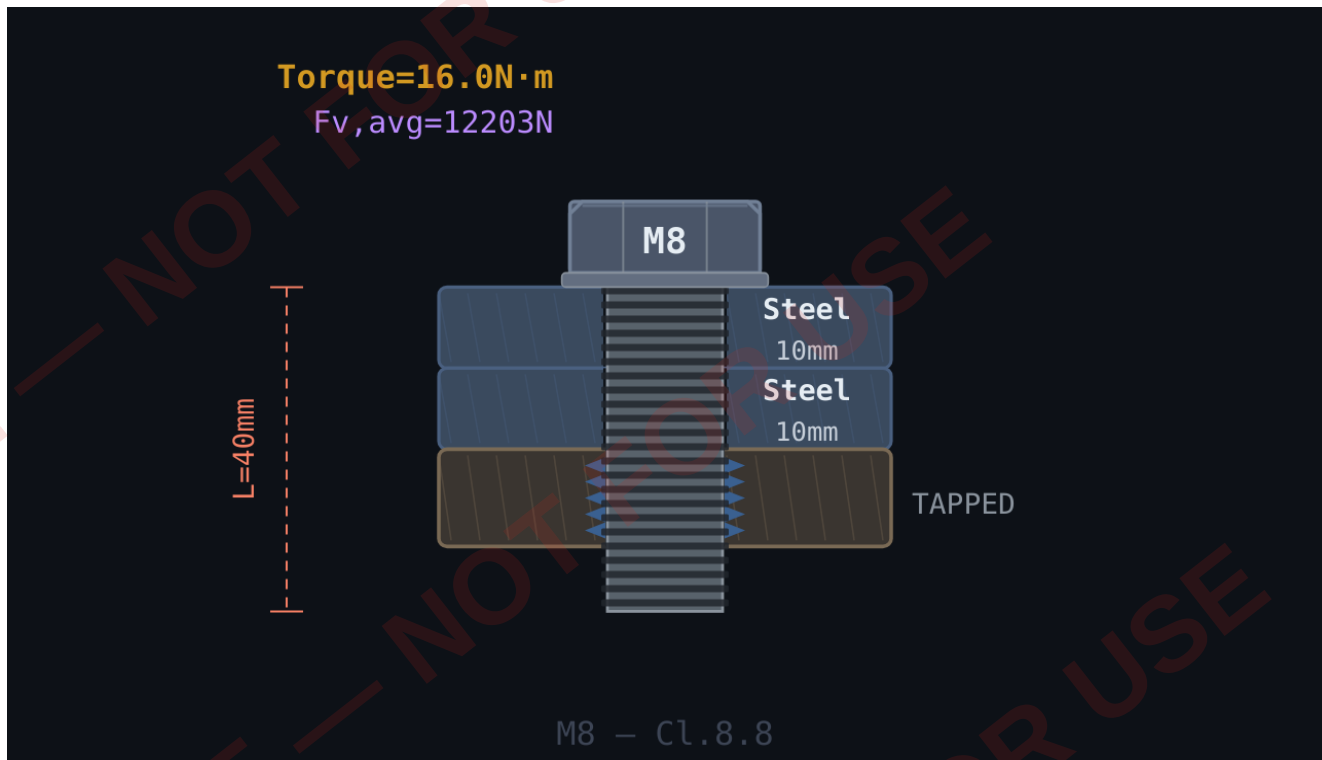
DESIGN STATUS

Bolt length, clearance hole and thread engagement

OK



ASSEMBLY SCHEMATIC



1. BOLT CONFIGURATION

Nominal diameter	M8	Strength class	8.8
Head Ø (dw)	13.00 mm	Thread pitch	1.0 mm
Head type	Hex (ISO 4014)	Length	40 mm
Yield strength Re	640 MPa	Ultimate strength Rm	800 MPa
Young's modulus E	210,000 MPa	Bolt CTE alpha	11.0 x10-6/°C
tau_ult male thread	462 MPa		
d2 (thread flank)	7.188 mm	d3 (bolt thread root)	6.466 mm
D1 (female thread root ISO 724)	5.835 mm	As (stress area)	36.6 mm ²

APPLICABLE STANDARDS

Metric thread	Metric thread — standard dimensions
Bolt head	Hex head bolt
Mechanical properties	Steel bolt
Stress area As	Calculated from thread diameters d2 and d3



2. TIGHTENING PARAMETERS

Tightening method	Torque wrench ($\pm 10\%$)		
Preload uncertainty (eps)	$\pm 25\%$	μ thread (th)	0.12 (Unique)
μ under-head (uh)	0.12 (Unique)	μ interface (T)	0.16
Mp,min (prevailing torque)	0 N·m	Mp,max (prevailing torque)	0 N·m
Nominal torque MA	16.00 N·m	Min / max torque	14.40 / 17.60 N·m
FZ embedding	5 %	FA / FQ	0 N / 0 N
Preload Fv,min	7376 N	Preload Fv,max	16934 N

3. ASSEMBLY GEOMETRY

Thread type	Tapped hole / Helicoil (w=2)	Engagement length	12 mm
Clearance hole	8.4 mm	Edge distance al.	20 mm
Loading plane factor n	0.5	$\Phi = dc/(db+dc)$	0.075
$\Phi_{i,n} = n \times \Phi$	0.038		

4. ASSEMBLY PARTS & MATERIALS

Part 1 — Acier S235		th. 10 mm	
Re (Rp0.2)	235 MPa	Rm (ultimate)	360 MPa
E (Young)	210000 MPa	CTE [$\times 10^{-6}/^{\circ}\text{C}$]	11.0
Bearing limit yield	235 MPa	Bearing limit ult.	360 MPa

Part 2 — Acier S235		th. 10 mm	
Re (Rp0.2)	235 MPa	Rm (ultimate)	360 MPa
E (Young)	210000 MPa	CTE [$\times 10^{-6}/^{\circ}\text{C}$]	11.0
Bearing limit yield	235 MPa	Bearing limit ult.	360 MPa

5. ENVIRONMENT & EXTERNAL LOADS

External loads per bolt			
Axial load FA [N]	0 N	(no axial load)	
Shear load FQ [N]	0 N	(no shear)	

Thermal environment			
T reference (assembly)	21 °C	Min service T	-10 °C
Max service T	80 °C	Delta T min / max	-31 / 59 °C



6. PRELOAD & COMPLIANCES

Fv,min [N]	7376 N	Fv,max [N]	16934 N
Fv nominal [N]	12203 N	Fvs,min service [N]	7376 N
Fvs,max service [N]	16934 N		
Thermal loss/gain [N]	+0 N / +0 N		

Compliances

db (bolt compliance)	4.109 x10-6 mm/N	dc (plate compliance)	0.335 x10-6 mm/N
Phi = dc/(db+dc)	0.075	Phi_n = n x Phi	0.038

Von Mises — Tightening

sigma_ax (tension)	462.6 MPa	tau (residual torsion)	80.8 MPa
sigma_VM	483.3 MPa	Tightening margin	32%

7. SAFETY MARGINS

Criterion	Description	MoS (%)	SF	Status
Tightening (Von Mises)	Analytical calculation	32.0 %	—	PASS
Rupture yield	Analytical calculation	26.0 %	1.10	PASS
Rupture ultimate	Analytical calculation	15.0 %	1.50	CAUTION
Separation	Analytical calculation	N/A	1.10	PASS
Sliding	Analytical calculation	N/A	1.10	PASS
Plate bearing (yield)	Analytical calculation	47.0 %	1.10	PASS
Plate bearing (ult)	Analytical calculation	49.0 %	1.50	PASS
Thread stripping (ext. FA)	Analytical calculation	N/A	2.30	PASS
Thread stripping (total)	Analytical calculation	255.0 %	2.30	PASS