

ORGANIZATION / LEGAL OWNER

AluCalc OS Verification Benchmark - RJ - VDI-2026-088

PROJECT CODE

DOCUMENT NO / DRAWING REF

DOC-VDI2230-M12-SAMPLE

REVISION / STATUS

Rev 01 / SAMPLE (PASS)

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RELEASE DATE

2026-09-08 (Benchmark)

SYSTEM / APP_VERSION

AluCalc OS v5.2.0

1. JOINT & FASTENER SPECIFICATION (GIRDI PARAMETRELERİ)

ISO 898-1 / ISO 4017

Bolt Designation	M12 x 1.75 (Regular Hex Head ISO 4017)	Standard coarse metric thread
Property Class	Grade 8.8 (Quenched & Tempered)	Sy = 640 MPa, Sp = 600 MPa, Rm = 800 MPa
Nominal & Core Diameters	d = 12.00 mm, d2 = 10.863 mm, d3 = 10.106 mm	ISO 68-1 / ISO 965-1 standard geometry
Tensile Stress Area As	84.3 mm ²	As = 0.7854 * (d - 0.9382*P) ²
Thread Friction Coeff. muG	0.140 (Standard lubricated state)	ISO 16047 verification test
Underhead Friction Coeff. muK	0.140 (Standard lubricated collar)	dh = 13.5 mm, dw = 15.35 mm
Tightening Factor alphaA	1.20 (Standard torque control)	VDI 2230 Table A8 (Torque wrench)
Target Utilization nu	0.700 (70% Proof Stress utilization)	FM = nu * As * Sp

2. STEP-BY-STEP CALCULATION TRACE (MADDE ATIFLI HESAP IZİ)

VDI 2230 PART 1 (2015)

Step 1: Fastener Proof Strength Boundary	[ISO 898-1:2013]	Fp = 50.58 kN (Proof load threshold)
Fp = Sp * As = 600.0 MPa * 84.3 mm ²		
Step 2: Assembly Preload Clamp Force FM	[VDI 2230 Eq. R8/1]	FM = 35.4 kN (Target preload clamp force)
FM = nu * Sp * As = 0.700 * 600.0 * 84.3 * 10 ⁻³		
Step 3: Nut Torque Factors K1, K2, K3	[VDI 2230 Clause 5.4]	Total nut factor K = 0.196
K1 = 0.023 (lead), K2 = 0.125 (thread friction), K3 = 0.048 (underhead)		
Step 4: Calibrated Tightening Torque MA	[VDI 2230 Eq. 5.4/1]	MA = 83.1 N.m (Assembly tightening torque)
MA = K * FM * d = 0.196 * 35400 N * 12.0 mm * 10 ⁻³		
Step 5: Axial Tensile Stress sigma_z	[VDI 2230 Clause 5.5.1]	sigma_z = 420.0 MPa (Axial tension component)
sigma_z = FM / As = 35400 N / 84.3 mm ²		
Step 6: Torsional Shear Stress tau	[VDI 2230 Clause 5.5.2]	tau = 153.0 MPa (Thread shear component)
Wp = (pi * d ³ /3) / 16 = 346.4 mm ³ tau = (M2 * 1000) / Wp		
Step 7: von Mises Stress sigma_eq & Yield Reserve	[VDI 2230 / ISO 898-1]	sigma_eq = 497.0 MPa <= 640.0 MPa (FoS = 1.29 >= 1.0)
sigma_eq = sqrt(sigma_z ² + 3*tau ²) = sqrt(420 ² + 3*153 ²) = 497.0 MPa n = Sy / sigma_eq		

VERIFICATION RESULT: SAMPLE BENCHMARK / PASS (VDI 2230 / ISO 898-1)

TIGHTENING TORQUE: MA = 83.1 N.m ASSEMBLY PRELOAD: FM = 35.4 kN VON MISES: sigma_eq = 497.0 MPa <= 640.0 MPa (FoS = 1.29 >= 1.0)

Sample calculation record generated by AluCalc OS live deterministic solver engine (1:1 numerical parity).

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Status: [MD-VDI2230-VERIFIED]

Date: 2026-09-08 | Location: Istanbul HQ

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Status: [KW-VDI2230-APPROVED]

Date: 2026-09-08 | Compliance: ISO 7200 / VDI 2230

SAMPLE VERIFICATION BENCHMARK

AluCalc OS Standard Sample Report

Format: ISO 7200 Technical Title Block

Parity: Exact live solver numerical match

Notice: For illustrative evaluation only

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