Design for Manufacturability Reference and Training Book

Press Fit Engineering and Design Calculator

Torque Engineering and Design
Strength of Materials

Press Fit Engineering and Design Equations (See Below)

Use this engineering calculator to determine engineering and design parameters for cylindrical press fit applications.

Applications and Design

Engineering Analysis
Engineering Basics
Engineering Calculators
Engineering Materials

Enter numbers at BOLD Text Locations, Results in RED

Loads			Interference Parameters		
Torque to be transmitted (N-mm)	torque	**200**	Minimum required interface pressure (N/mm^2)	rPI	**2.20**
Axial force to be transmitted (N)	force	**0**	Differential Poisson radial interference due to axial force (mm)	ddp	**0.00**
Coefficient of friction	mu	**0.15**	Differential thermal radial expansion (mm)	ted	**0.00**
Operating temperature (°C)	ot	**20**	Outer body rotating inner diameter radial displacement (mm)	robd	**2.33**
Stress concentration factor at interface edge	scf	**2**	Inner body rotating outer diameter radial displacement (mm)	ribd	**1.79**
Rotation speed (rpm)	rpm	**1000**	Total additional diametrical interference amount to be added (to ibod) (mm)	addi	**-4.29**
Outer body input parameters			**Interference Fit Calculations (Assumes addi has been added to ibod)**		
Outside diameter (mm)	obod	**19.622**	Maximum diametrical interference (mm)	maxdelta	**1.50**
Interface diameter (mm)	obid	**12.000**	Maximum resulting interface pressure (N/mm^2)	maxip	**7.55**
Plus tolerance (mm)	obptol	**0.01**	Minimum diametrical interference (mm)	mindelta	**-1.50**
Minus tolerance (mm)	obmtol	**0.01**	Minimum resulting interface pressure (N/mm^2)	minip	**-7.55**
Modulus of elasticity (N/mm^2)	obe	**1.93e+5**	Minimum safety margin (min obtained pressure/required pressure)		**-3.44**
Yield strength (N/mm^2)	obsy	**172**	Maximum sustainable torque (N-mm)	maxt	**6.87**
Poisson's ratio	obn	**0.27**	Minimum sustainable Torque (N-mm)	mint	**-6.87**
Coefficient of thermal expansion (1/°C)	obcte	**1.60e-5**	Minimum safety margin (min obtained torque/required torque)		**-343.**
Density (g/cm^3)	obrho	**8**	**Outer body material stresses at maximum interface pressure**		
Inner body input parameters			Radial displacement of inner surface (mm)		**5.79**
Engagement length (mm)	L	**26.830**	Radial press-fit stress at ID (N/mm^2)	obsr	**-7.55**
Intended outside diameter (mm)	ibod	**12.000**	Circumferential press-fit stress at ID (N/mm^2)	obsc	**1.66**
Dimensioned outside diameter (mm)		**12.000**	Axial stress from applied axial Force (N/mm^2)	obsz	**0.00**
Plus tolerance (mm)	ibptol	**0.005**	Shear stress from applied Torque (N/mm^2)	obtau	**9.59**
Minus tolerance (mm)	ibmtol	**0.005**	Max radial centrifugal stress (N/mm2)	obrc	**5.21**
Inside diameter (mm)	ibid	**0**	Max circumferential centrifugal stress (N/mm^2)	obcc	**7.48**
Modulus of elasticity (N/mm^2)	ibe	**1.93e+5**	Max Von Mises stress (N/mm^2)	obvm	**2.14**
Yield strength, obsy (N/mm^2)	ibsy	**172**	Resulting safety factor (Yield stress)/(scf*Von Mises stress)		**0.**
Poisson's ratio	ibn	**0.27**	**Inner body material stresses at maximum interface pressure**		
Coefficient of thermal expansion (1/°C)	ibcte	**1.60e-5**	Radial displacement of outer surface (mm)		**-1.71**
Density (g/cm^3)	ibrho	**8**	Radial press-fit stress (N/mm^2)	ibsr	**-7.55**
Shrink-fit design			Circumferential press-fit stress (N/mm^2)	ibsc	**-7.55**
Desired assembly clearance at deltaT (mm)	ddt	**0**	Axial stress from applied axial Force (N/mm^2)	ibsz	**0.00**
Required differential temperature if heating outer body (°C)	robdt	**7.81e+1**	Shear stress from applied Torque (N/mm^2)	ibtau	**5.89**
Required differential temperature			Max radial centrifugal		

if cooling inner body (ºC)	ribdt	7.81e+1	stress (N/mm^2)	ibrc	1.29
Press-fit design			Max circumferential centrifugal stress at ID (N/mm^2)	ibcc	1.29
Maximum assembly force to press fit (N)	Fpfmax	1.15e+4	Von Mises stress at ID (N/mm^2)	ibvm	7.55
Minimum assembly force to press fit (N)	Fpfmin	-1.15e+4	Resulting safety factor (Yield stress)/(scf*Von Mises stress)		1.

Evaluate the stresses at inside, outside and sqrt(DiDo) diameters					
For the Outer Feature					
case 1: stresses at inner radius	6.000000	Case 2: stresses at outer radius	9.811000	Case 3: stresses sqrt (DiDo)/2	
Radial press-fit stress (N/mm^2)	-75.508638		0.000000		
Circumferential press-fit stress (N/mm^2)	165.734459		90.225821		
Axial stress from applied axial Force (N/mm^2)	0.000000		0.000000		
Shear stress from applied Torque (N/mm^2)	0.095862		0.156751		
Radial centrifugal stress (N/mm2)	0.000000		0.000000		
Circumferential centrifugal stress at ID (N/mm^2)	0.007480		0.004123		
Von Mises stress at ID (N/mm^2)	213.744989		90.230353		
For the Inner Feature					
case 1: stresses at inner radius	0.000000	Case 2: stresses at outer radius	6.000000	Case 3: stresses sqrt (DiDo)/2	
Radial press-fit stress (N/mm^2)	-75.508638		-75.508638		
Circumferential press-fit stress (N/mm^2)	-75.508638		-75.508638		
Axial stress from applied axial Force (N/mm^2)	0.000000		0.000000		
Shear stress from applied Torque (N/mm^2)	0.000000		0.589463		
Radial centrifugal stress (N/mm2)	0.001291		0.000000		
Circumferential centrifugal stress at ID (N/mm^2)	0.001291		0.000576		
Von Mises stress at ID (N/mm^2)	75.507347		75.515252		

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