



DESIGN ACCELERATOR: PRESS FIT CALCULATOR

The use of the Press Fit Calculator enables the end-user to Calculate elastic cylindrical co-axial pressure connections for compact or hollow shafts in either hot or cold state. The program calculates geometric parameters of the joint, minimal fit, standard or actual fit, and pressed-on parts material selection.

The calculation is only valid for press fits in which permanent deformations will not occur after the connection. The deformations do not include trueing of peaks and ridges on the surface texture.

This calculation is only valid for connections that are not loaded by outside pressure or are made from tubular parts with unlimited length. The parts are made from materials that behave according to Hooke's law.

The calculation does not consider the influence of centrifugal forces, ribs, or other reinforcement parts or in parts where the temperature is distributed unevenly.

A press fit joint with unlimited length is a joint with the length that equals the diameter or greater. If it is shorter, the real contact pressure is greater than calculated. This calculation provides more safety against the press fit loosening.

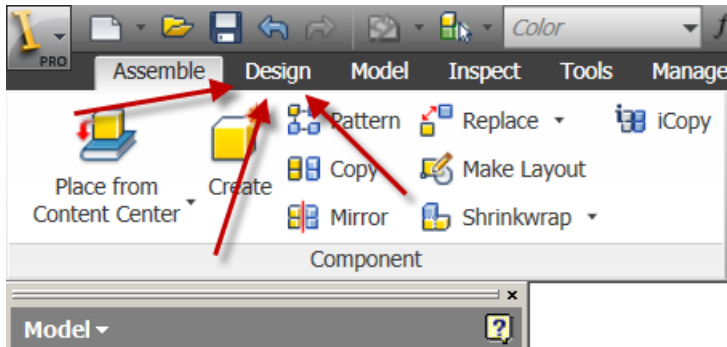
Minimal interference is determined when securing the least required loading capacity of the press fits, together with other factors.

The maximum interference is determined without existing plastic deformation, according to the HMM plasticity condition (Huber, Misses, Hencky) together with other factors.

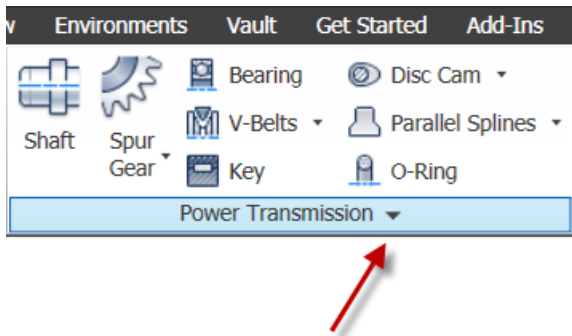
Pressing speed must be slow (about 3 mm/s ~ 0.12 in/s) while making the press fit. High speed reduces load capacity of the fit.

Calculated temperatures must be considered as minimum, because they do not consider temperature averaging during the pressing process, nor the hub cooling time after pulling it from the furnace, for example.

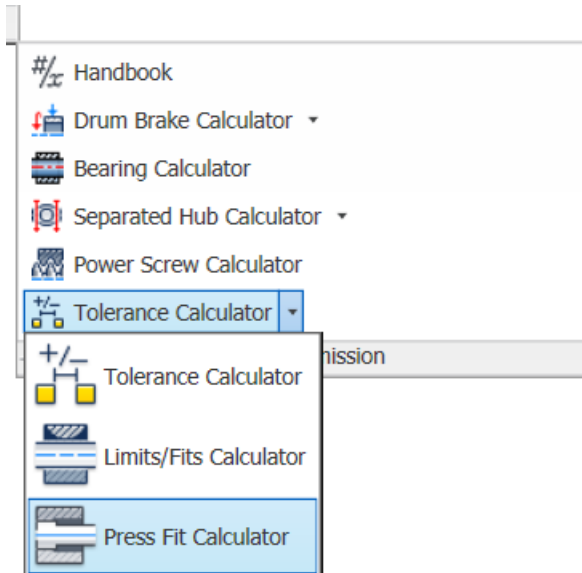
To access the Press Fit Calculator, In the Assembly environment, Click on the Design Tab:



On the Power Transmission Panel, Click the Black Down Arrow:



Click the Black Down Arrow Next to Tolerance Calculator, and Click Press Fit Calculator:

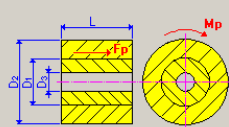


The Press Fit Dialogue Box now opens:

Press Fit Calculator

Calculation

Required Load
 Required Force: [Dropdown]
 Torque: M_p 370.000 lbf force
 Force: F_p 3552.000 lbf force
 Safety Factor: k_f 1.000 ul

Dimensions

 Outer Diameter: D_2 4.000 in
 Shaft Diameter: D_1 2.5000 in
 Inner Diameter: D_3 1.250 in
 Connection Length: L 3.000 in

Limits and Fits
 Fit Symbol: H9/x9 Change...
 Fundamental Deviation
 Specify manually
 ES: 0.003 in / es: 0.008 in
 EI: 0.000 in / ei: 0.005 in

Advanced
 Assembly Clearance V: 0.0031373 in
 Surface Smoothness H: 0.0007520 in
 Clamping Factor v: 0.130 ul
 Clamping Factor (pressing) v_1 : 0.055 ul

Hub Material
 User material
 Modulus of Elasticity E: 30000000.000 psi
 Allowable Stress σ : 65000.000 psi
 Poisson's Ratio μ : 0.300 ul
 Thermal Expansion α : 0.0000070 m/(° r)
 Surface Texture R_a : 125.000 micron

Shaft Material
 User material
 Modulus of Elasticity E: 30000000.000 psi
 Allowable Stress σ : 65000.000 psi
 Poisson's Ratio μ : 0.300 ul
 Thermal Expansion α : -0.0000070 m/(° r)
 Surface Texture R_a : 63.000 micron

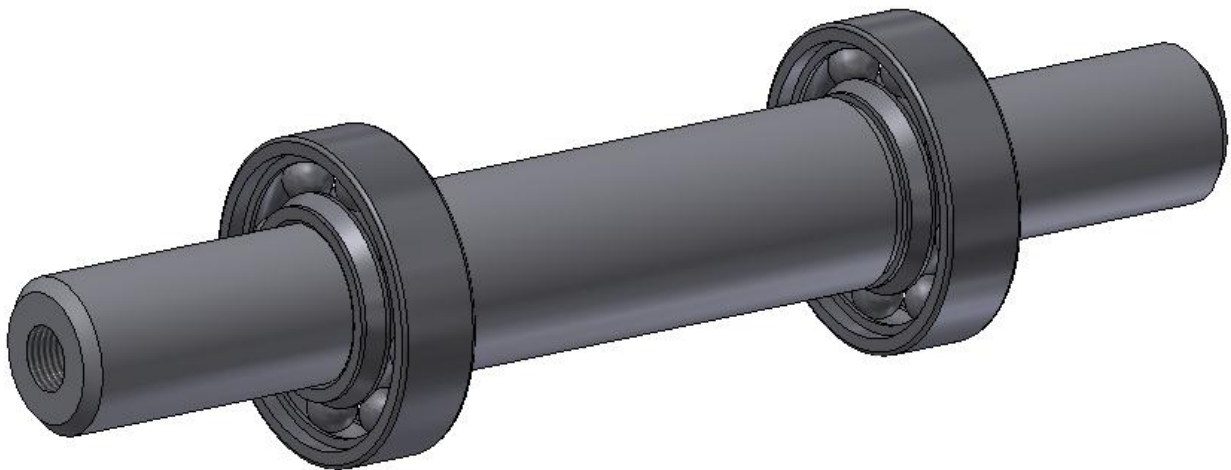
Temperature
 Limitation of: Shaft Cooling
 Hub Warming up: 704.416 f
 Base Temperature: 68.000 f
 Shaft Cooling: 68.000 f

Results

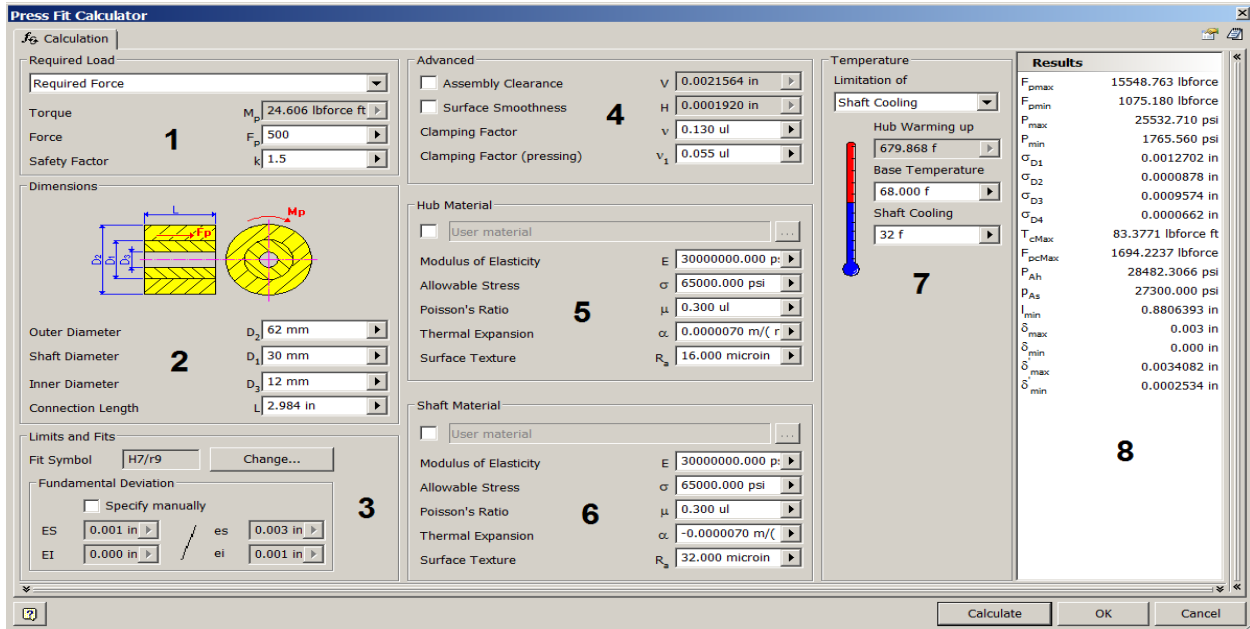
F_{pmax}	28544.152 lbf force
F_{pmin}	4914.887 lbf force
P_{max}	22026.390 psi
P_{min}	3792.623 psi
σ_{D1}	0.0037652 in
σ_{D2}	0.0006483 in
σ_{D3}	0.0024474 in
σ_{D4}	0.0004214 in
T_{clMax}	1210.1048 lbf force ft
F_{pcMax}	11617.0058 lbf force
F_{Ah}	22308.1927 psi
P_{As}	24375.000 psi
l_{min}	0.9172759 in
δ_{max}	0.008 in
δ_{min}	0.002 in
δ_{max}	0.0080927 in
δ_{min}	0.0011336 in

Calculate OK Cancel

In the following example, we will use a 10" lg. steel shaft, 30mm Dia., with a 12mm bore running the entire length. 2 AFBMA 30X62x18 bearing will be press on from both journal ends. We will calculate the Force required to press the bearing on to they hit the journal end:



For this example, we will heat up the bearings, and cool the shaft down to achieve our press fit. An interference H7/r9 fit will be used.



Section 1, Required Load: We are looking for the Required Force. Other option would be to

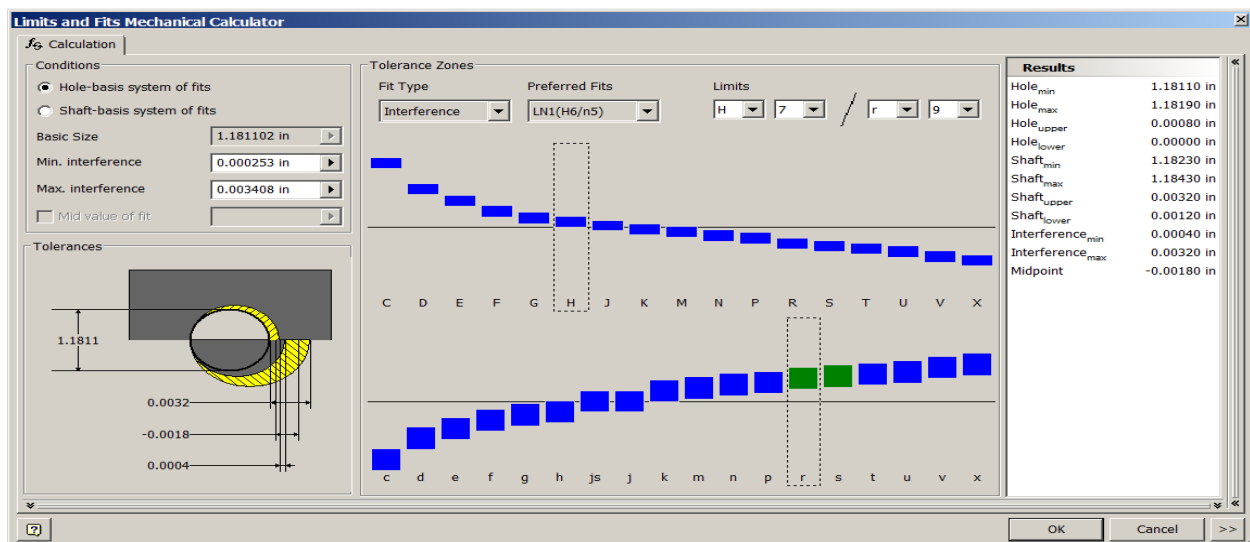
Calculate for required torque. Basic Force to Start will be 500lbs.

Factor of Safety: 1.5

Section 2, Dimensions: We input our dimensions from our model!


Section 3, Limits/Fits: We can specify manually by checking the box and inputting data, Or


We can click on change, and use the Limit/Fits Calculator:



Click OK after choosing the desired Fits(Note, second value(r9) must be green)

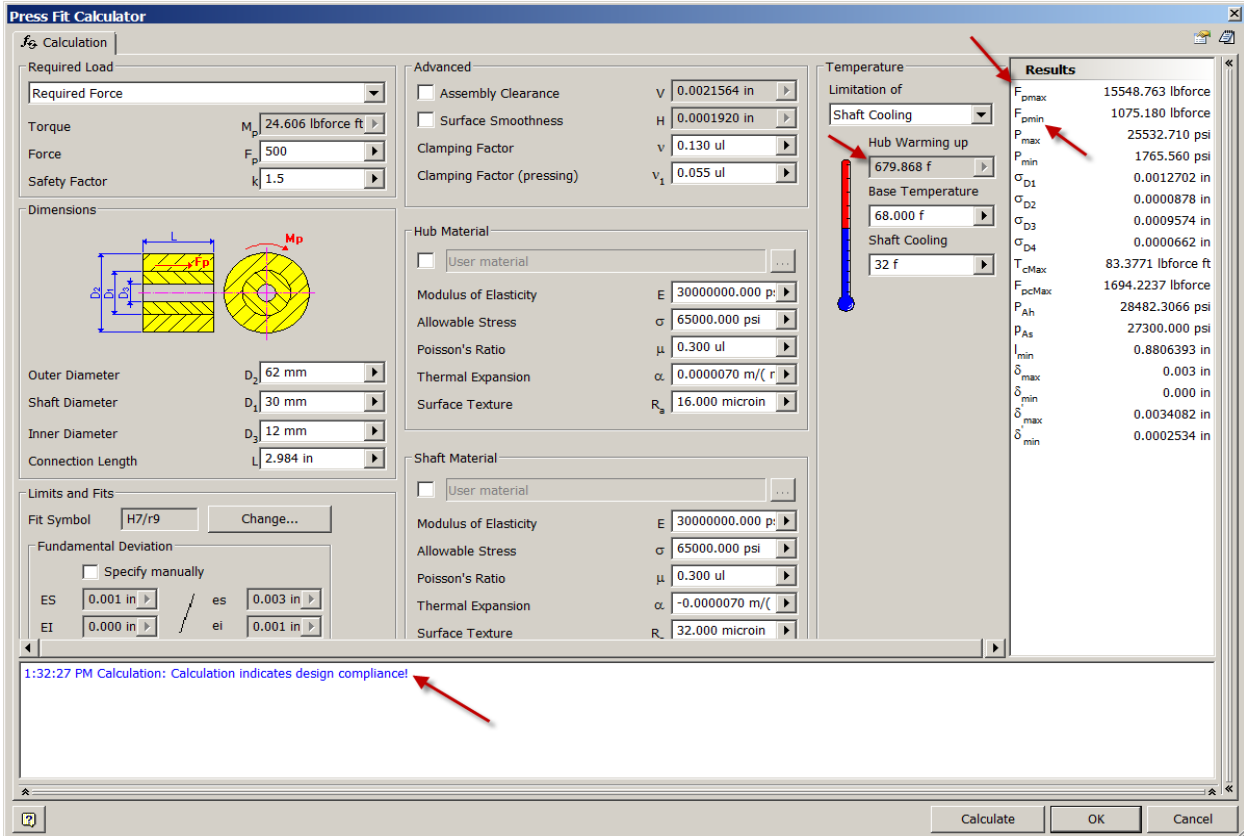
Section 4, Advance: We can manually specify Assembly Clearance, Surface Smoothness, And clamping factors if known.

Section 5, Hub Material: We can accept the material from our model, or, click on the  icon For additional Materials, or by checking the box. Surface Texture Can also be specified along with thermal expansion.

Section 6, Shaft Material: We can accept the material from our model, or, click the  icon For additional Materials, or by checking the box. Surface Texture Can also be specified along with thermal expansion.

Section 7, Temperature: We can specify either heating of the shaft, or heating of the hub.

Once all design criteria has been added, Click Calculate!



The screenshot shows the 'Press Fit Calculator' software interface. The 'Required Load' section includes fields for Required Force, Torque (24.606 lbf·ft), Force (500), and Safety Factor (1.5). The 'Dimensions' section shows Outer Diameter (62 mm), Shaft Diameter (30 mm), Inner Diameter (12 mm), and Connection Length (2.984 in). The 'Limits and Fits' section shows Fit Symbol (H7/r9) and Fundamental Deviation (ES: 0.001 in, es: 0.003 in; EI: 0.000 in, ei: 0.001 in). The 'Advanced' section includes checkboxes for Assembly Clearance, Surface Smoothness, and Clamping Factor, with values for V, H, v, and v1. The 'Hub Material' and 'Shaft Material' sections allow for user material selection and specify Modulus of Elasticity, Allowable Stress, Poisson's Ratio, Thermal Expansion, and Surface Texture. The 'Temperature' section includes a thermometer icon and dropdowns for Limitation of (Shaft Cooling), Hub Warming up (679.868 f), Base Temperature (68.000 f), and Shaft Cooling (32 f). The 'Results' section displays various force and stress values: F_{pmax} (15548.763 lbf), F_{pmin} (1075.180 lbf), P_{max} (25532.710 psi), P_{min} (1765.560 psi), and various clearance values (C_{D1} to C_{D4}). A status bar at the bottom indicates '1:32:27 PM Calculation: Calculation indicates design compliance'.

We see our design is within compliance, also, we can read what our max/min force needed to drive the bearing up to the journal seat! Also, what temp our bearing should be heated too.

