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Design of Push Rod Formulas

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List of 16 Design of Push Rod Formulas

Design of Push Rod

Diameter of Push Rod

1) Inner Diameter of Engine Push Rod given Radius of Gyration

$$\text{fx } d_i = \sqrt{16 \cdot k_G^2 - d_o^2}$$

[Open Calculator !\[\]\(de95854c7ee024cfadc48187bbb781b2_img.jpg\)](#)

$$\text{ex } 6.63325\text{mm} = \sqrt{16 \cdot (3\text{mm})^2 - (10\text{mm})^2}$$

2) Maximum Inner Diameter of Engine Push Rod given Outer Diameter

$$\text{fx } d_i = 0.8 \cdot d_o$$

[Open Calculator !\[\]\(6a9b39b98eb945faa14c645ec99e4eaa_img.jpg\)](#)

$$\text{ex } 8\text{mm} = 0.8 \cdot 10\text{mm}$$

3) Maximum Outer Diameter of Engine Push Rod given Inner Diameter

$$\text{fx } d_o = \frac{d_i}{0.6}$$

[Open Calculator !\[\]\(f1c5da15572e3e09d343161be98f508d_img.jpg\)](#)

$$\text{ex } 11.66667\text{mm} = \frac{7\text{mm}}{0.6}$$



4) Minimum Inner Diameter of Engine Push Rod given Outer Diameter

$$\text{fx } d_i = 0.6 \cdot d_o$$

[Open Calculator !\[\]\(cbe80b694ebd74fcfe136a095b608235_img.jpg\)](#)

$$\text{ex } 6\text{mm} = 0.6 \cdot 10\text{mm}$$

5) Minimum Outer Diameter of Engine Push Rod given Inner Diameter

$$\text{fx } d_o = \frac{d_i}{0.8}$$

[Open Calculator !\[\]\(3e2231b1ad3ca8da8658228c00dd08e0_img.jpg\)](#)

$$\text{ex } 8.75\text{mm} = \frac{7\text{mm}}{0.8}$$

6) Outer Diameter of Engine Push Rod given Radius of Gyration

$$\text{fx } d_o = \sqrt{16 \cdot k_G^2 - d_i^2}$$

[Open Calculator !\[\]\(0d5ec72f61334709c3fc9450209b754f_img.jpg\)](#)

$$\text{ex } 9.746794\text{mm} = \sqrt{16 \cdot (3\text{mm})^2 - (7\text{mm})^2}$$

Stress and Force in Push Rod

7) Actual Length of Engine Push Rod

$$\text{fx } l = \sqrt{\frac{k_G^2}{a} \cdot \left(\frac{\sigma_c \cdot A_{\text{rod}}}{P} - 1 \right)}$$

[Open Calculator !\[\]\(84f47badaad7772cd95667a7c387a639_img.jpg\)](#)

$$\text{ex } 90.11271\text{mm} = \sqrt{\frac{(3\text{mm})^2}{0.000133} \cdot \left(\frac{12\text{N/mm}^2 \cdot 42\text{mm}^2}{450\text{N}} - 1 \right)}$$



8) Area of Cross Section of Engine Push Rod

$$\text{fx } A_{\text{rod}} = \frac{\pi}{4} \cdot (d_o^2 - d_i^2)$$

[Open Calculator !\[\]\(e78f798d4ea5c530c9db49e7d26e6b95_img.jpg\)](#)

$$\text{ex } 40.05531\text{mm}^2 = \frac{\pi}{4} \cdot ((10\text{mm})^2 - (7\text{mm})^2)$$

9) Compressive Stress in Engine Push Rod

$$\text{fx } \sigma_c = \frac{P \cdot \left(1 + a \cdot \left(\frac{1}{k_G}\right)^2\right)}{A_{\text{rod}}}$$

[Open Calculator !\[\]\(05be7c7a8995decd503647c99211f7c2_img.jpg\)](#)

$$\text{ex } 11.49012\text{N/mm}^2 = \frac{450\text{N} \cdot \left(1 + 0.000133 \cdot \left(\frac{70\text{mm}}{3\text{mm}}\right)^2\right)}{42\text{mm}^2}$$

10) Cross Section Area of Engine Push Rod given Force, Stress, and Radius of Gyration

$$\text{fx } A_{\text{rod}} = \frac{P \cdot \left(1 + a \cdot \left(\frac{1}{k_G}\right)^2\right)}{\sigma_c}$$

[Open Calculator !\[\]\(fe3aebe81acea8d45108cd2768939da7_img.jpg\)](#)

$$\text{ex } 40.21542\text{mm}^2 = \frac{450\text{N} \cdot \left(1 + 0.000133 \cdot \left(\frac{70\text{mm}}{3\text{mm}}\right)^2\right)}{12\text{N/mm}^2}$$



11) Force Acting on Engine Push Rod

[Open Calculator !\[\]\(bd1a142de767a21e5362c595f844a4ff_img.jpg\)](#)

$$\text{fx } P = \frac{\sigma_c \cdot A_{\text{rod}}}{1 + a \cdot \left(\frac{1}{k_G}\right)^2}$$

$$\text{ex } 469.969\text{N} = \frac{12\text{N/mm}^2 \cdot 42\text{mm}^2}{1 + 0.000133 \cdot \left(\frac{70\text{mm}}{3\text{mm}}\right)^2}$$

12) Force Acting on Engine Push Rod given its Dimensions and Stress Generated

[Open Calculator !\[\]\(830769b31eeeaca920791081939ff8ba_img.jpg\)](#)

$$\text{fx } P = \frac{\sigma_c \cdot \frac{\pi}{4} \cdot (d_o^2 - d_i^2)}{1 + a \cdot \left(\frac{l^2}{\frac{d_o^2 + d_i^2}{16}}\right)}$$

$$\text{ex } 449.2263\text{N} = \frac{12\text{N/mm}^2 \cdot \frac{\pi}{4} \cdot ((10\text{mm})^2 - (7\text{mm})^2)}{1 + 0.000133 \cdot \left(\frac{(70\text{mm})^2}{\frac{(10\text{mm})^2 + (7\text{mm})^2}{16}}\right)}$$

13) Force Acting on Engine Push Rod Made of Steel

[Open Calculator !\[\]\(47734e4656765d20df4fdbd5b7aff048_img.jpg\)](#)

$$\text{fx } P = \frac{\sigma_c \cdot A_{\text{rod}}}{1 + \frac{1}{7500} \cdot \left(\frac{1}{k_G}\right)^2}$$

$$\text{ex } 469.8895\text{N} = \frac{12\text{N/mm}^2 \cdot 42\text{mm}^2}{1 + \frac{1}{7500} \cdot \left(\frac{70\text{mm}}{3\text{mm}}\right)^2}$$



14) Moment of Inertia of Cross Section of Engine Push Rod

$$\text{fx } I_a = \frac{\pi}{64} \cdot (d_o^4 - d_i^4)$$

[Open Calculator !\[\]\(d3fb9f94af8b26d1c844efa9a98805b0_img.jpg\)](#)

$$\text{ex } 373.015\text{mm}^4 = \frac{\pi}{64} \cdot ((10\text{mm})^4 - (7\text{mm})^4)$$

15) Radius of Gyration of Cross Section of Engine Push Rod

$$\text{fx } k_G = \sqrt{\frac{d_o^2 + d_i^2}{16}}$$

[Open Calculator !\[\]\(e1d6102fe77919492c04879c8450f1f5_img.jpg\)](#)

$$\text{ex } 3.051639\text{mm} = \sqrt{\frac{(10\text{mm})^2 + (7\text{mm})^2}{16}}$$

16) Radius of Gyration of Engine Push Rod given Stress, Force and Cross Section Area

$$\text{fx } k_G = \sqrt{\frac{(l^2) \cdot a}{\left(\frac{\sigma_c \cdot A_{\text{rod}}}{P}\right) - 1}}$$

[Open Calculator !\[\]\(ab4e2b3fc7e7887b7a72f548aa6f5e60_img.jpg\)](#)

$$\text{ex } 2.330415\text{mm} = \sqrt{\frac{((70\text{mm})^2) \cdot 0.000133}{\left(\frac{12\text{N/mm}^2 \cdot 42\text{mm}^2}{450\text{N}}\right) - 1}}$$



Variables Used

- **a** Constant used in Buckling Load Formula
- **A_{rod}** Cross Sectional Area of Push Rod (Square Millimeter)
- **d_i** Inner Diameter of Push Rod (Millimeter)
- **d_o** Outer Diameter of Push Rod (Millimeter)
- **I_a** Area Moment of Inertia of Push Rod (Millimeter⁴)
- **k_G** Radius of Gyration of Push Rod (Millimeter)
- **l** Length of Push Rod (Millimeter)
- **P** Force on Push Rod (Newton)
- **σ_c** Stress in Push Rod (Newton per Square Millimeter)



Constants, Functions, Measurements used

- **Constant:** **pi**, 3.14159265358979323846264338327950288
Archimedes' constant
- **Function:** **sqrt**, sqrt(Number)
Square root function
- **Measurement:** **Length** in Millimeter (mm)
Length Unit Conversion 
- **Measurement:** **Area** in Square Millimeter (mm²)
Area Unit Conversion 
- **Measurement:** **Force** in Newton (N)
Force Unit Conversion 
- **Measurement:** **Second Moment of Area** in Millimeter⁴ (mm⁴)
Second Moment of Area Unit Conversion 
- **Measurement:** **Stress** in Newton per Square Millimeter (N/mm²)
Stress Unit Conversion 



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