1. Derive stress & strain figures & plot them.

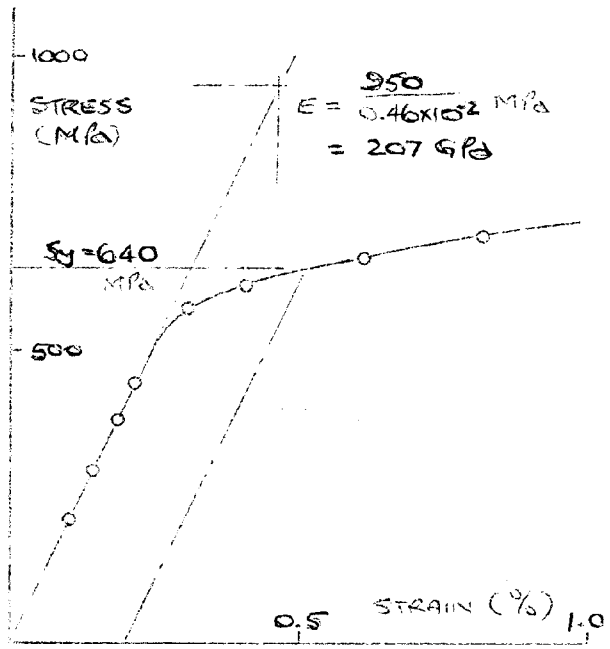
- with F in kN $\quad \sigma = F \times 10^3 / \frac{\pi}{4} \times 12.5^2 = 8.15F$ MPa
- with δ in mm $\quad \epsilon = (\delta/50) \times 100\ \% = 2\delta\ \%$

Hence:

σ MPa	212	293	379	444	539	611	656	693
ϵ %	0.10	0.14	0.18	0.22	0.30	0.40	0.62	0.82

The slope of the elastic line is $E = 207$ GPa, constructing a line // to this from $\epsilon = 0.2\%$ gives $S_y = 640$ MPa

Note: 2 significant figures only are really justifiable.



2. The safety factor (on load) is 2.5

$\therefore$ max. load, $\hat{F} = 5$ kN.

There are two criteria to consider

strength $\sigma \le S_y$

deflexion $\sigma \le E\hat{\epsilon} = E\hat{\delta}/L = 207 \times 10^3 \times 1/800 = 259$ MPa.

Since this is less than any yield, it becomes the overriding criterion, for all grades.

If $\sigma \le 259$ MPa
$= F/A = 5E3/\frac{\pi}{4} d^2$ } $\quad d \ge \sqrt{[4 \times 5E3/259\pi]} = 4.96$ mm

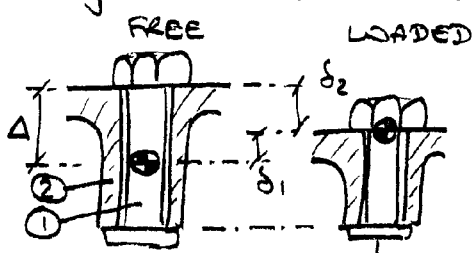
So select standard 5 mm in cheapest grade A.

3. Statically indeterminate problem, 2o 3-pronged attack - Equil^m, compatibility & constitutive law.

Compatibility -

Assume geometry as shown, where nut is screwed by Δ along thread to give initial force F_i.

$$\delta_1 + \delta_2 = \Delta$$



Equilibrium

Two contacts between 1 & 2. Let contact forces be as shown.

$$F_1 - F_2 = P$$