EXAMPLE:

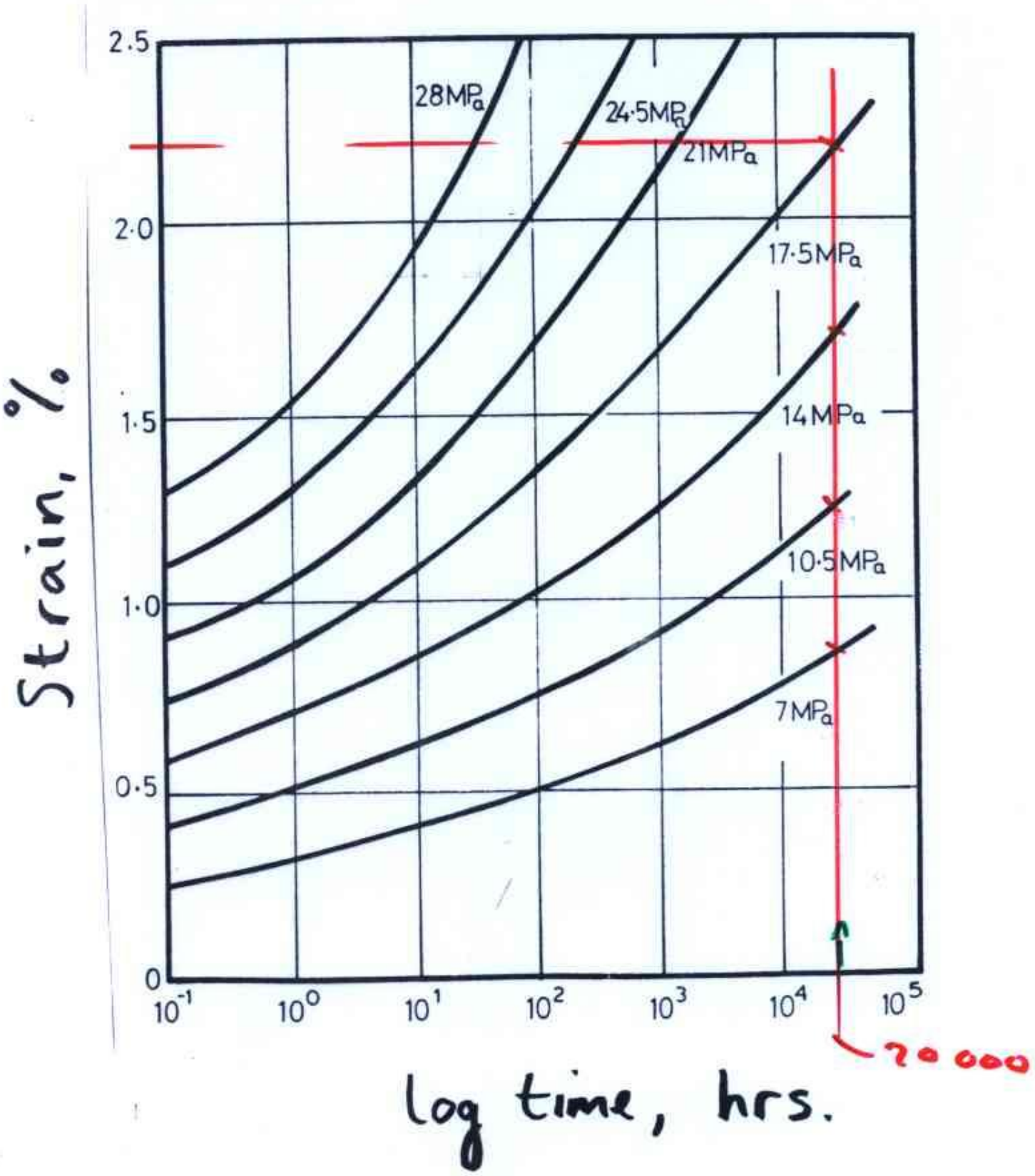
Thin walled plastic pipe subjected to an internal pressure of 0.7MPa. The service life of the pipe should be 20000 hrs with a maximum strain of 2%.

If the pipe diameter, d, is 150mm what is a suitable wall thickness?

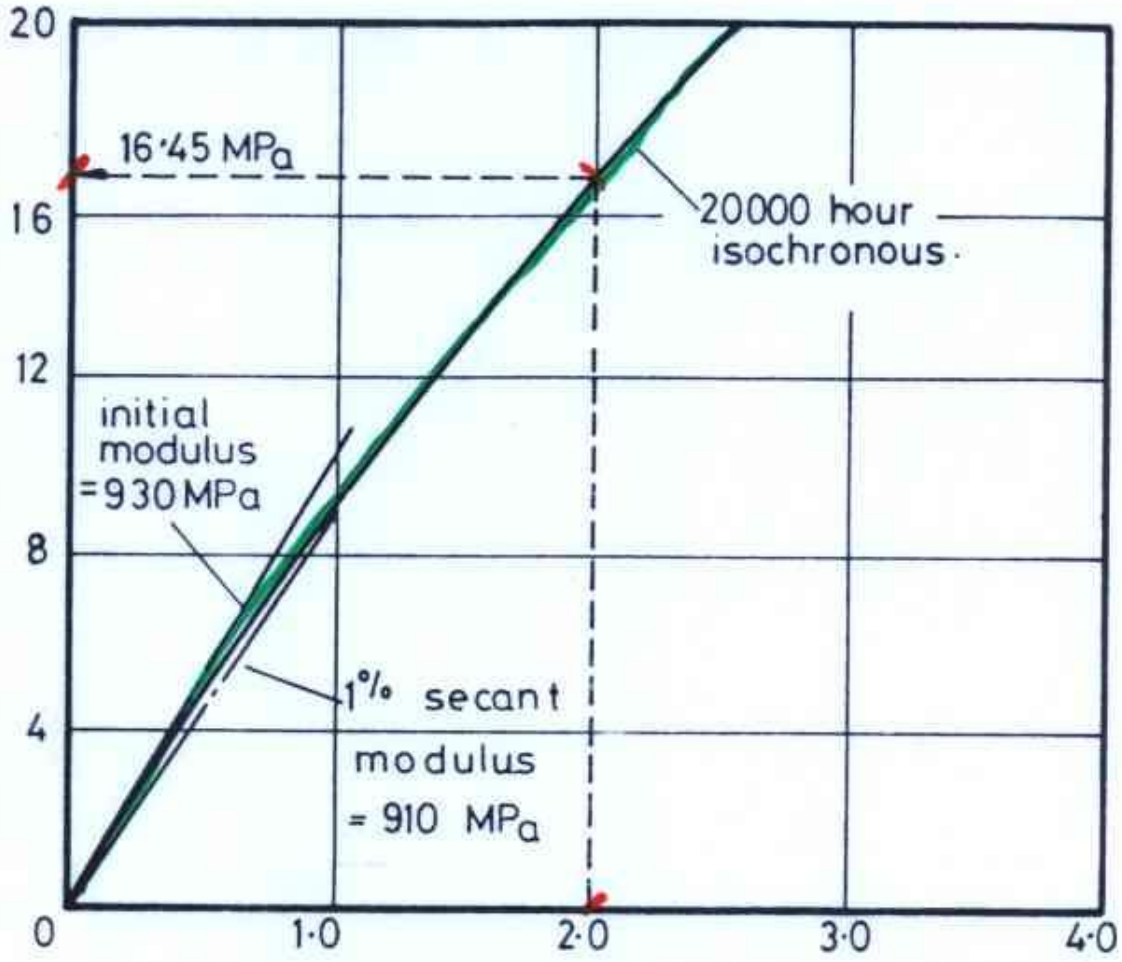
Data to be considered:

- creep curves for material
- 20000 hr isochronous (σ–ε) curve
- hoop stress in pipe wall

Creep curves at 20°C given below:



20000 hr isochronous curve given below:



STRESS Strain, MPa

Hoop stress given by:

Pressure

diameter

$$\sigma = \frac{Pd}{2h}$$

wall thickness

$$\Rightarrow h = \text{wall thickness} = \frac{Pd}{2\sigma}$$

Design stress at 2% strain (after 20000 hrs):

from GRAPH 16.45MPa

20,000 ISOCHRONAL HOUR

$$\Rightarrow h = \frac{0.7 \cdot 150}{2 \cdot 16.45}$$

$$= 3.19 \text{ mm}$$

EXAMPLE:

Plastic beam 200mm long. → L

Simply supported at each end.

Point load, W, at centre span.

Same material as previous example.

If max. permissible strain in material is 1% what is the largest load that can be applied such that beam deflection, δ, does not exceed 5mm within 20000 hrs of use?

$$\delta = \frac{WL^3}{48EI}$$

→ $2800\ mm^4$

$$\Rightarrow W = \frac{48 E I \delta}{L^3}$$

Get modulus, E, from isochronal $\simeq$ 910 MPa

$\Rightarrow$

$$W = 76.4 \text{ N}$$