TUTORIAL – BOLT DESIGN

17.12.2025

Q. The figure below illustrates full sectional view of a pressure cylinder which will be tightened by using certain number of bolts. Pressure inside the cylinder changing between 2 and 14 MPa pressure (Pmin, Pmax). A compressed asbestos gasket (Eg=69MPa) having 2 mm thickness is used in the joint for sealing purpose. The cover (cylinder head) and cylinder body is made of steel with E=207 GPa.

Determine the size, the type (grade) and number of bolts and proper preload to be assigned to the bolts by considering both static (P=Pmax) and fatigue failure (P is fluctuating between Pmin and Pmax).

Not: use Shigley's approach for cone angle of 45^0

Use the following Shigley's approach in the stiffness calculations of the members; $k_i = \dfrac{\pi E_i . d . \tan\alpha}{\ln \dfrac{(2L_i.\tan\alpha + D - d)(D + d)}{(2L_i.\tan\alpha + D + d)(D - d)}}$	– Load factor of safety for bolts:1.3 – Strength factor of safety:1.2 – Thread type: Rolled (Fatigue stress concentration factor, K_f=3) – Reliability: 99.9% – Life requirement: Infinite