11 concluded.

Now want to check design 36 off M24×3 for gasket & bolt fatigue. But first....

JOINT FACTOR — BOLT.

grip ≈ 2×50 + 3 = 103 mm $A_s = 353\ mm^2$

Half head/unit length ≈ 0.5×0.9×24 = 11 mm

$1/k_b = \varepsilon/AE = [(103 - 2\times3 + 11)/\frac{\pi}{4}\times24^2 + (2\times3+11)/353]/207$

$\Rightarrow k_b = 720\ kN/mm$

— JOINT $A_g = \frac{\pi}{4}(1865^2 - 1840^2)/36 = 2020\ mm^2$

$k_g = F/\delta = A_g(P/\delta) = \frac{2020\times1.5}{mm^2\left(\frac{kN}{mm^2}\cdot\frac{1}{mm}\right)} = 3030\ kN/mm$

Use (4) to obtain some idea of flange compliance (This is v. rough... but?)

$k_f = 207\times24(0.702 + 0.654\,24/103)/(1 - 0.12\times24/103)$

$\approx 4370\ kN/mm$

$\therefore 1/k_j = 2/k_f + 1/k_g = 2/4370 + 1/3030$

$\Rightarrow k_j = 1270\ kN/mm$

$\therefore C = k_b/(k_b + k_j) = 720/(720 + 1270) = 0.36.$

BOLT FATIGUE Take σ_i = 90% proof = 585 MPa.

and so $F_i = 585\times353 = 206\ kN$

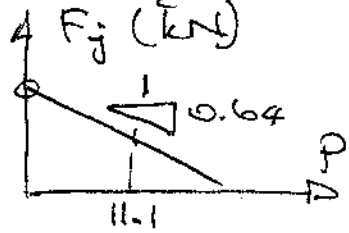
From above $P = 400/z = 400/36 = 11.1\ kN$

Inserting more accurately known parameters into (6b) to find n:

$585/900 + n(0.36\times11.1/2\times353)(1/900 + 1/141) = 1$

$\Rightarrow n = 7.5 > 5$ so OK.

GASKET STRESS



When fluid pres. loading is 11.1 kN

$F_j = 206 - 0.64\times11.1 = 199\ kN$

Initially — gasket stress

$\sigma_g = F_i/A_g = 206/2020 = 102\ MPa$

$> y = 50$ so no leaks (?!!)

$< 2y\ (=100)$ so no crushing.

On load

$\sigma_g = F_j/A_g = 199/2020 = 99\ MPa$

& $\sigma_g/P = 99/0.15 = 660$

$> m$ of 3.5 !! O.K.

The design seems satisfactory.