THE EFFORTS STUDY WITCH APPEAR ON THE JOINING INTO TWO DIFFERENT GEOMETRICAL COVERS

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Abstract: It appears challengers on the contour at the joining into two covers (cylindrical body and semi-spherical bottom) which are generated by the Q_0 effort and the M_0 moment.

1. Introduction

It appears bend effects at the joining into two different geometrical covers which affect the diaphragm state in case of an external effort.

These effects are generated by the Q_0 effort and the M_0 moment, which it's necessary to be determinate.

2. Apparatus presentation

The making of the 'Communication Apparatus' and the 'Wireless Phone for the divers', imposed the designing of the 'Container for testing the electric cables. The components are shown in Fig. 1.

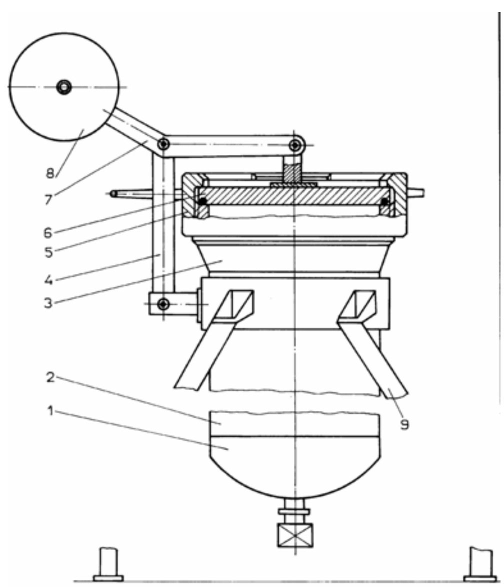

Fig. 1 Container for testing the electric cables
1. Recipient bottom 2. Body 3. Flange 4. Arm A 5. Coupling Flange 6. Cover 7.Arm B
8. Equilibrium weight 9. Pylon

This recipient under inner pressure may be used for testing the strength and tightness of the special electric cables and other apparatus used in diving activities.

The main characteristics of the container are:

- work pressure : 38 bars
- pressure for hydraulic check-up : 47 bars
- ringing fluids : water
- dimensions : ø 312*6 mm,
  H 1660 mm

The cylindrical body is soldered by the spherical bottom. The Q_0 effort and the M_0 moment are emphasised by the section between the two covers. (see Fig. 2).

The covers are too solicited by the inner pressure p_i=3,8 MPa.

The unknown quantities Q_0 and M_0, can be calculated by the continuity condition of the radial movement w and of a rotation angle θ. The w and the θ are shown in Fig. 2 .

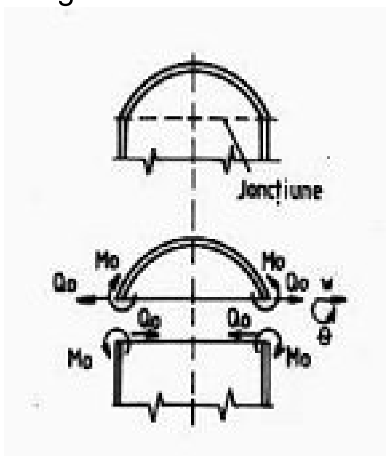

Fig. 2 Joining into cylindrical body and semi-spherical bottom

Writing the radial movement and rotation angle formula caused by the Q_0 effort, M_0 moment and internal pressure p_i, for the two covers.

Because these are soldering, it equals the radial movements and the rotation angles and results an equations system.

The solutions of system are the values Q_0 and M_0.

Then it determines the σ_{1x} and σ_{2x} efforts in any point at x away.

3. ELEMENTS OF CALCULATION

For the cylindrical body:

r = cylinder radius , δ_c = cylinder thickness

E = the elasticity modulus Poisson, D = stiffness,

K =amortissant coefficient, w_c = radial displacement, θ_c = angle displacement

For the semi spherical bottom:

R = spherical radius, δ_s = sphere thickness, w_s = radial displacement, θ_s = angle displacement, λ = amortissant coefficient

$$k = \frac{\left[3\left(1-\gamma^2\right)\right]^{\frac{1}{4}}}{\sqrt{r \times \delta_c}} = 42 \quad (1)$$

$$D = \frac{E\delta_c^3}{12\left(1-\gamma^2\right)} = 115.4 \, (2)$$

$$w_c = \frac{Q_0}{2K^3 D} + \frac{M_0}{2K^2 D} + \frac{pr^2}{2E\delta}(2-\gamma) \quad (3)$$

$$\theta_c = -\left(\frac{Q_0}{2K^2 D} + \frac{M_0}{KD}\right) \quad (4)$$

$$\lambda = \left[3(1-\gamma)\right]^{\frac{1}{4}} \left(\frac{R}{\delta_s}\right)^{\frac{1}{2}} = 0.167 \quad (5)$$

$$w_s = \frac{2\lambda^2 M_0}{E\delta_s} - \frac{2\lambda R Q_0}{E\delta_s} + \frac{pR^2}{2E\delta_s}(1-\gamma) \quad (6)$$

$$\theta_s = \frac{4\lambda^3 M_0}{ER\delta_s} - \frac{2\lambda^2 Q_0}{E\delta_s} \quad (7)$$

$$\begin{matrix} w_c = w_s & \\ \theta_c = \theta_s & \Rightarrow M_0 = 0.0595 NM \\ & Q_0 = -4.9N \end{matrix} \quad (8)$$

Considers the layer to contour stressed just by Q_0 and M_0, the final relations are:

$$\frac{d^4 w}{dx^4} + 4k^4 w = 0 (9)$$

The real solution of the equation is:

$$w = e^{-kx}\left(A\cos kx + B\sin kx\right)(10)$$

The final relations are:

$$Q_x(Q_0) = Q_0 e^{-kx}\left(\cos kx - \sin kx\right)(11)$$

$$Q_x(M_0) = -2kM_0 e^{-kx} \sin kx \quad (12)$$

$$M_x(Q_0) = Q_0 e^{-kx} \sin kx \quad (13)$$

$$M_x(M_0) = M_0 e^{-kx}\left(\cos kx - \sin kx\right) \quad (14)$$

$$K_x(Q_0) = \mu Q_x (15)$$

$$K_x(M_0) = \mu M_x \quad (16)$$

$$S_x(Q_0) = 0 \quad (17)$$

$$S_x(M_0) = 0 \quad (18)$$

$$T_x(Q_0) = 2krQ_0 e^{-kx} \cos kx \quad (19)$$

$$T_x(M_0) = 2k^2 r M_0 e^{-kx} (\cos kx - \sin kx) \quad (20)$$

$$\theta_x(Q_0) = \frac{2k^2 r^2}{\delta E} Q_0 e^{-kx} \cos kx \quad (21)$$

$$\theta_x(M_0) = \frac{4k^3 r^2}{\delta E} M_0 e^{-kx} \cos kx \quad (22)$$

$$w_x(Q_0) = -\frac{2kr^2}{\delta E} M_0 e^{-kx} \cos kx \quad (23)$$

$$w_x(M_0) = \frac{2k^2 r^3}{\delta E} M_0 e^{-kx} (\cos kx - \sin kx) \quad (24)$$

The efforts give by contour at x distance, are:

$$\sigma_{1x} = \frac{S_x(Q_0) + S_x(M_0)}{\delta} \pm 6\frac{M_x(Q_0) + M_x(M_0)}{\delta^2} (25)$$

$$\sigma_{2x} = \frac{T_x(Q_0) + T_x(M_0)}{\delta} \pm 6\frac{K_x(Q_0) + K_x(M_0)}{\delta^2} (26)$$

where: 1 for internal surface
2 for external surface

4. CONCLUSIONS

All the calculation relations depend by the four functions f_i (kx), from Fig.3

It observes: if kx→Π (27), f_i(kx)→0 (28). Therefore the f_i functions are amortized undulated and are nulls for kx=Π.

For kx∈(0-Π), The graphic is a semi wave with the length l_s.

$$\text{For } kls = \pi \Rightarrow ls = \frac{\pi}{k} \ (29),$$

the tensions are amortized.

The effect is null if

$$l_s > \frac{\pi}{k} \ (30).$$

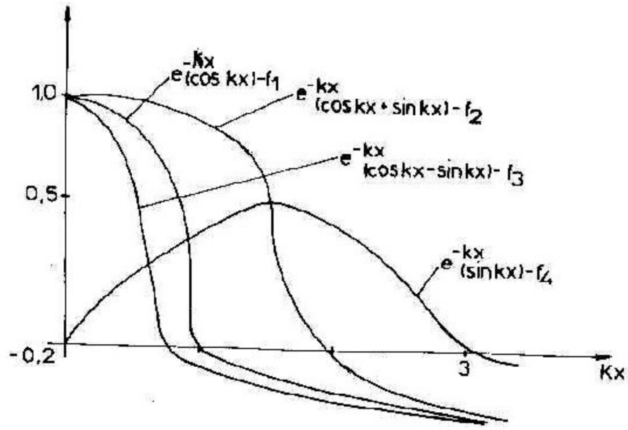

Fig.3 Functions f_i (kx) amortized undulated

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