TECHNICAL MEMORANDUM WHOI-3-81

Woods Hole Oceanographic Institution

TECHNICAL MEMORANDUM NO. 3-81

DESIGN CURVES FOR OCEANOGRAPHIC PRESSURE-RESISTANT HOUSINGS

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part A. above. This would be the result of reinforcement provided by the end closures.

C. Inelastic Failure

$$(s)_{max.} = \frac{2b^2}{b^2-a^2}(p) \qquad \text{(Ref. 1)}$$

where $(s)_{max.}$ = maximum stress at tube inner surface

p = external pressure

b = outer radius of tube

a = inner radius of tube

Failure is considered to occur at that value of pressure where $(s)_{max.}$ is equal to the yield strength of the material.

D. Flat End Caps

Cylindrical pressure cases commonly use flat circular plates as end closures. These plates usually contain some type of seal, such as an o-ring, and some means of attachment to the cylinder. For practical design purposes the equation for a flat circular plate, simply supported around its edge, can be used. The diameter used in the equation is the diameter of the unsupported portion of the plate in the actual case. For greatest accuracy the plate thickness should be no more than about one-quarter of the effective diameter. The flat plate equation is

$$(s)_{max.} = \frac{3(3m+1)a^2}{8mt^2} (p) \qquad \text{(Ref. 1)}$$

where $(s)_{max.}$ = maximum stress at center of plate

p = external pressure (pressure uniformly distributed over plate surface)

a = radius of unsupported plate

t = thickness of unsupported plate

m = reciprocal of Poisson's ratio

Failure is considered to occur at that value of pressure where $(s)_{max.}$ is equal to the yield strength of the material.

Spheres

The following equations served as the basis for plotting the curves for spherical pressure vessels.

A. Elastic Buckling Collapse Pressure

The classical elastic buckling pressure for an ideal sphere is given by

$$p_e = \frac{2Et^2}{\sqrt{3(1-\mu^2)}\, r^2} \qquad \text{(Ref. 1)}$$

where p_e = elastic buckling pressure

E = modulus of elasticity

t = spherical shell thickness