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COMPARISON OF WALL THICKNESSES OF SHELLS AND HEADS CONSTRUCTED OF STAINLESS STEEL AND ALUMINUM

WALL THICKNESSES FOR SHELLS AND HEADS ARE DETERMINED
FROM TWO CRITERIA:

- 1) FROM MAXIMUM STRESSES
- 2) FROM ELASTIC INSTABILITIES (DEFLECTION)

FOR SHELLS AND USING CRITERIA 1 THE GOVERNING EQUATION
IS: $T = P \cdot D / 2 \cdot S$

WHERE T = WALL THICKNESS

P = INTERNAL PRESSURE

D = DIAMETER OF SHELL

S = ALLOWABLE STRESS FOR THE GIVEN MATERIAL

THEREFORE: T FOR AL $1/S$ FOR AL

AND T FOR SS $1/S$ FOR SS

THEN T FOR AL = S FOR SS * T FOR SS / S FOR AL

S FOR SS = 18750 PSI AND S FOR AL = 10,000 PSI

THEN T FOR AL = $1.875 \cdot T$ FOR SS

FOR SHELLS AND USING CRITERIA 2 THE GOVERNING EQUATION
IS: $T = D \cdot (PC / 2 \cdot E)^{.33}$

WHERE T = WALL THICKNESS

D = DIAMETER OF SHELL

E = MODULUS OF ELASTICITY

PC = COLLAPSING PRESSURE (EXTERNAL PRESSURE)

THEREFORE: T FOR AL $(1/E \text{ FOR AL})^{.33}$

AND T FOR SS $(1/E \text{ FOR SS})^{.33}$

THEN T FOR AL = $(E \text{ FOR SS} / E \text{ FOR AL})^{.33} \cdot T$ FOR SS

E FOR SS = 28E6 PSI AND E FOR AL = 10E6

THEN T FOR AL = $1.41 \cdot T$ FOR SS

FOR HEADS AND USING CRITERIA 1 THE GOVERNING EQUATION
IS: $T = P \cdot D \cdot K / 2 \cdot S$

WHERE T = WALL THICKNESS

P = INTERNAL PRESSURE

D = DIAMETER OF HEAD

K = CONSTANT FOR GIVEN HEAD GEOMETRY

S = ALLOWABLE STRESS FOR GIVEN MATERIAL

THEREFORE: T FOR AL $1/S$ FOR AL

AND T FOR SS $1/S$ FOR SS

THEN T FOR AL = $(S \text{ FOR SS} / S \text{ FOR AL}) \cdot T$ FOR SS

S FOR SS = 18750 PSI AND S FOR AL = 10000 PSI

THEN T FOR AL = $1.875 \cdot T$ FOR SS

FOR HEADS AND USING CRITERIA 2 THE GOVERNING EQUATION
IS: $T = 1.86 \cdot R \cdot (PC / E)^{.5}$

WHERE T = WALL THICKNESS

R = CROWN RADIUS OF TORISPHERICAL HEAD

PC = COLLAPSING PRESSURE (EXTERNAL PRESSURE)

E = MODULUS OF ELASTICITY

THEREFORE: T FOR AL $(1/E \text{ FOR AL})^{.5}$

AND T FOR SS $(1/E \text{ FOR SS})^{.5}$

THEN T FOR AL = $(E \text{ FOR SS} / E \text{ FOR AL})^{.5} \cdot T$ FOR SS

E FOR SS = 28E6 PSI AND E FOR AL = 10E6 PSI

THEN T FOR AL = $1.67 \cdot T$ FOR SS