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: \[ T = \frac{P \cdot D}{2 \cdot S} \]
WHERE \( T \) = WALL THICKNESS
\( P \) = INTERNAL PRESSURE
\( D \) = DIAMETER OF SHELL
\( S \) = ALLOWABLE STRESS FOR THE GIVEN MATERIAL

THEREFORE: \( T \) FOR AL \( = \frac{1}{S} \) FOR AL
AND \( T \) FOR SS \( = \frac{1}{S} \) FOR SS

THEN \( T \) FOR AL \( = S \) FOR SS \( \times T \) FOR SS
S FOR SS = 18750 PSI AND S FOR AL = 10,000 PSI

THEN \( T \) FOR AL = 1.875 \( \times T \) FOR SS

FOR SHELLS AND USING CRITERIA 2 THE GOVERNING EQUATION
IS: \[ T = \frac{D \cdot (P \cdot C)}{2 \cdot E^{3.3}} \]
WHERE \( T \) = WALL THICKNESS
\( D \) = DIAMETER OF SHELL
\( E \) = MODULUS OF ELASTICITY
\( P \cdot C \) = COLLAPSING PRESSURE (EXTERNAL PRESSURE)

THEREFORE: \( T \) FOR AL \( = \left( \frac{1}{E} \right) \) FOR AL \( \times 0.33 \)
AND \( T \) FOR SS \( = \left( \frac{1}{E} \right) \) FOR SS \( \times 0.33 \)

THEN \( T \) FOR AL \( = \left( \frac{E \text{ FOR SS} \times E \text{ FOR AL}}{E \text{ FOR SS}} \right) \times 0.33 \times T \) FOR SS
E FOR SS = 28E6 PSI AND E FOR AL = 10E6

THEN \( T \) FOR AL \( = 1.41 \times T \) FOR SS

FOR HEADS AND USING CRITERIA 1 THE GOVERNING EQUATION
IS: \[ T = \frac{P \cdot D \cdot K}{2 \cdot S} \]
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 \( = \frac{1}{S} \) FOR AL
AND \( T \) FOR SS \( = \frac{1}{S} \) FOR SS

THEN \( T \) FOR AL \( = \left( S \text{ FOR SS} \times S \text{ FOR AL} \right) \times T \) FOR SS
S FOR SS = 18750 PSI AND S FOR AL = 10000 PSI

THEN \( T \) FOR AL \( = 1.875 \times T \) FOR SS

FOR HEADS AND USING CRITERIA 2 THE GOVERNING EQUATION
IS: \[ T = \frac{1.86 \times R \times (P \cdot C)}{E^{0.5}} \]
WHERE \( T \) = WALL THICKNESS
\( R \) = CROWN RADIUS OF TORISPHERICAL HEAD
\( P \cdot C \) = COLLAPSING PRESSURE (EXTERNAL PRESSURE)
\( E \) = MODULUS OF ELASTICITY

THEREFORE: \( T \) FOR AL \( = \left( \frac{1}{E} \right) \) FOR AL \( \times 0.5 \)
AND \( T \) FOR SS \( = \left( \frac{1}{E} \right) \) FOR SS \( \times 0.5 \)

THEN \( T \) FOR AL \( = \left( \frac{E \text{ FOR SS} \times E \text{ FOR AL}}{E \text{ FOR SS}} \right) \times 0.5 \times T \) FOR SS
E FOR SS = 28E6 PSI AND E FOR AL = 10E6 PSI

THEN \( T \) FOR AL \( = 1.67 \times T \) FOR SS