

**CYLINDRICAL SHELL THICKNESS UNDER INTERNAL PRESSURE**  
(FROM ASME SEC.VIII DIV.1)

PART NAME : SHELL

MATERIAL : SUS304

## 1. DESIGN CONDITION

P	: DESIGN INTERNAL PRESSURE + STATIC HEAD	=	1	Kg/cm <sup>2</sup> G
Pd	: DESIGN INTERNAL PRESSURE	=	1	Kg/cm <sup>2</sup> G
Ph	: STATIC HEAD	=	0	Kg/cm <sup>2</sup> G
Dn	: NOMINAL INSIDE DIAMETER	=	2200	mm
DT	: DESIGN TEMPERATURE	=	150	°C
CA	: INSIDE CORROSION ALLOWANCE	=	0	mm
CAo	: OUTSIDE CORROSION ALLOWANCE	=	0	mm
E <sub>1</sub>	: JOINT EFFICIENCY (CIRCUMFERENTIAL)	=	1	
E <sub>2</sub>	: JOINT EFFICIENCY (LONGITUDINAL)	=	1	
D	: CORRODED INSIDE DIAMETER	=	2200	mm
R	: CORRODED INSIDE RADIUS	=	1100	mm
S	: ALLOWABLE TENSILE STRESS AT DESIGN TEMPERATURE	=	1162.4	Kg/cm <sup>2</sup>
Sc	: ALLOWABLE TENSILE STRESS AT AMB. TEMPERATURE	=	1325.6	Kg/cm <sup>2</sup>
tm	: ASME MINIMUM THICKNESS = 1/16" + CA + CAo	=	1.59	mm

## 2. CALCULATED THICKNESS

## 1) CIRCUMFERENTIAL STRESS PER UG-27(c)(1)

( Thickness not to exceed 0.5R, or P not to exceed 0.385S·E<sub>1</sub> )

$$\begin{aligned}
 t1 &= P \cdot R / (S \cdot E_1 - 0.6P) + CA + CAo \\
 &= 1 \times 1100 / (1162.4 \times 1 - 0.6 \times 1) + 0 + 0 \\
 &= 0.95 \text{ mm}
 \end{aligned}$$

## 2) LONGITUDINAL STRESS PER UG-27(c)(2)

( Thickness not to exceed 0.5R, or P not to exceed 1.25S·E<sub>2</sub> )

$$\begin{aligned}
 t2 &= P \cdot R / (2S \cdot E_2 + 0.4P) + CA + CAo \\
 &= 1 \times 1100 / (2 \times 1162.4 \times 1 + 0.4 \times 1) + 0 + 0 \\
 &= 0.47 \text{ mm}
 \end{aligned}$$

## 3) REQUIRED MINIMUM THICKNESS

$$t_r = \text{THE GREATER OF } t_1, t_2, t_m = 1.59 \text{ mm} \quad \text{USED : } 8 \text{ mm}$$

## 3. MAWP CALCULATION

## 1) HOT &amp; CORRODED CONDITION

$$\begin{aligned}
 P_{mh} &= S \cdot E \cdot t / (R + 0.6t) - P_h \\
 &= 1162.4 \times 1 \times 8 / (1100 + 0.6 \times 8) - 0 \\
 &= 8.42 \text{ Kg/cm}^2
 \end{aligned}$$

## 2) NEW &amp; COLD CONDITION

$$\begin{aligned}
 P_{mc} &= S_c \cdot E \cdot t / (R + 0.6t) \\
 &= 1325.6 \times 1 \times 8 / (1100 + 0.6 \times 8) \\
 &= 9.60 \text{ Kg/cm}^2
 \end{aligned}$$