



## ASME BPVC VIII-1 2023

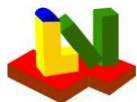
PTB-4-2021 / E4.7.1

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### Layout

Input values:	1.234	or	1.234
Calculated values:	<b>1.234</b>	or	<b>1.234</b>
Critical values:	<b>1.234</b>	or	<b>1.234</b>
Estimated values:	<b>1.234</b>	or	<b>1.234</b>



**ASME BPVC VIII-1 2023**  
PTB-4-2021 / E4.7.1

Strength Calculation Software		Program System ATLAS --- Version : 11.0.7.161					
Developed by Lauterbach Verfahrenstechnik GmbH							
Certified per DIN EN ISO 9001:2008		Certificate Number 01 100 044763					
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## E 4.7.1 a - Spherically dished covers (bolted heads) - ASME VIII APPENDIX 1, 1-6 2023 Edition

Spherically dished covers as shown in Fig.: 1-6 (b)

### Input

Flange moment from 2-6 or 2-11

Design pressure

Hydrostatic head

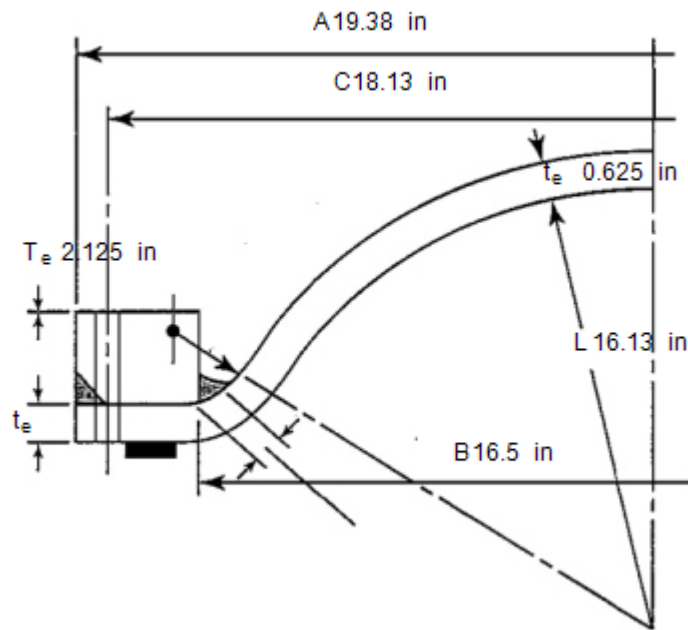
Calculation pressure

Design temperature

Gasket

$M_0$	8849 lbf·ft
$p_D$	psi
$D_p$	psi
$p_0$	213 psi
$T_0$	400 °F

Ring gasket



Outside diameter  
Inside diameter  
Bolt circle diameter  
Final flange thickness

A	19.38 in
B	16.5 in
C	18.13 in
$T_e$	2.125 in

Crown radius  
Final head thickness  
Wall thickness allowance  
Corrosion allowance

L	16.13 in
$t_e$	0.625 in
$c_1$	0 in
$c_2$	0.125 in

Material K02401-SA-515-60-Class:-Size:

Allowable stress

S	17114 psi
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### Calculation

Required head thickness

t	0.1672 in	(1)
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Required thickness incl. allowances

$t+c_1+c_2$	0.2922 in
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Required flange thickness (ring gasket)

T(2)	2.166 in	(2)
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Required flange thickness (full face)

T(3)	1.224 in	(3)
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Required flange thickness

T	2.166 in	(6)
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**Equations**

$$t = \frac{5 \cdot P_0 \cdot L}{6 \cdot S} = \frac{5 \cdot 1.469 \text{ N/mm}^2 \cdot 409.6 \text{ mm}}{6 \cdot 118 \text{ N/mm}^2} = 4.248 \text{ mm} \quad (1)$$

$$T = \sqrt{\frac{|M_0|}{S \cdot B} \cdot \left[ \frac{A+B}{A-B} \right]} = \sqrt{\frac{|1.2e+7 \text{ Nmm}|}{118 \text{ N/mm}^2 \cdot 419.1 \text{ mm}} \cdot \left[ \frac{492.1 \text{ mm} + 419.1 \text{ mm}}{492.1 \text{ mm} - 419.1 \text{ mm}} \right]} = 55.02 \text{ mm} \quad (2)$$

$$T = 0.6 \cdot \sqrt{\frac{P}{S} \cdot \left[ \frac{B \cdot (A+B) \cdot (C-B)}{A-B} \right]} = 0.6 \cdot \sqrt{\frac{1.469 \text{ N/mm}^2}{118 \text{ N/mm}^2} \cdot \left[ \frac{419.1 \text{ mm} \cdot (492.1 \text{ mm} + 419.1 \text{ mm}) \cdot (460.4 \text{ mm} - 419.1 \text{ mm})}{492.1 \text{ mm} - 419.1 \text{ mm}} \right]} = 31.1 \text{ mm} \quad (3)$$



### E.4.7.1 c.Step3 - Spherically dished covers (bolted heads) - ASME VIII APPENDIX 1, 1-6 2023 Edition

Spherically dished covers as shown in Fig.: 1-6 (b)

#### Input

Flange moment from 2-6 or 2-11

$M_0$  8849 lbf·ft

Design pressure

$p_D$  psi

Hydrostatic head

$D_p$  psi

Calculation pressure

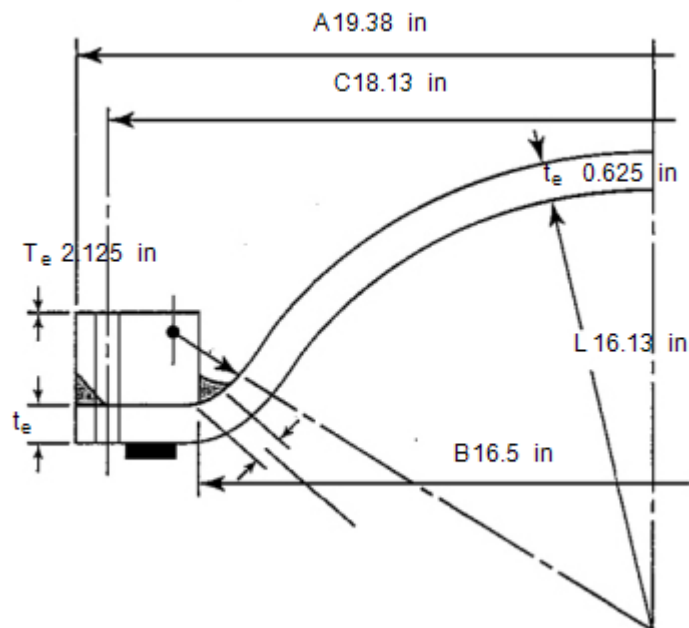
$p_0$  213 psi

Design temperature

$T_0$  400 °F

Gasket

Ring gasket



Outside diameter

A 19.38 in

Inside diameter

B 16.5 in

Bolt circle diameter

C 18.13 in

Final flange thickness

$T_e$  2.125 in

Crown radius

L 16.13 in

Final head thickness

$t_e$  0.625 in

Wall thickness allowance

$c_1$  0 in

Corrosion allowance

$c_2$  0.125 in

Material K03504-SA-105--Class:-Size:

Allowable stress

S 19989 psi

#### Calculation

Required head thickness

$t$  0.1432 in (1)

Required thickness incl. allowances

$t+c_1+c_2$  0.2682 in

Required flange thickness (ring gasket)

$T(2)$  2.004 in (2)

Required flange thickness (full face)

$T(3)$  1.133 in (3)

Required flange thickness

$T$  2.004 in (6)



**Equations**

$$t = \frac{5 \cdot P_0 \cdot L}{6 \cdot S} = \frac{5 \cdot 1.469 \text{ N/mm}^2 \cdot 409.6 \text{ mm}}{6 \cdot 137.8 \text{ N/mm}^2} = 3.637 \text{ mm} \quad (1)$$

$$T = \sqrt{\frac{|M_0|}{S \cdot B} \cdot \left[ \frac{A+B}{A-B} \right]} = \sqrt{\frac{|1.2e+7 \text{ Nmm}|}{137.8 \text{ N/mm}^2 \cdot 419.1 \text{ mm}} \cdot \left[ \frac{492.1 \text{ mm} + 419.1 \text{ mm}}{492.1 \text{ mm} - 419.1 \text{ mm}} \right]} = 50.91 \text{ mm} \quad (2)$$

$$T = 0.6 \cdot \sqrt{\frac{P}{S} \cdot \left[ \frac{B \cdot (A+B) \cdot (C-B)}{A-B} \right]} = 0.6 \cdot \sqrt{\frac{1.469 \text{ N/mm}^2}{137.8 \text{ N/mm}^2} \cdot \left[ \frac{419.1 \text{ mm} \cdot (492.1 \text{ mm} + 419.1 \text{ mm}) \cdot (460.4 \text{ mm} - 419.1 \text{ mm})}{492.1 \text{ mm} - 419.1 \text{ mm}} \right]} = 28.78 \text{ mm} \quad (3)$$