

Flange Input Data Values**Description: New Flange :****Left Blind Flange**

Description of Flange Geometry (Type)	TEMA Channel Cover		
Design Pressure	P	6.00	kgf/cm ²
Design Temperature		100	°C
Internal Corrosion Allowance	ci	3.0000	mm
External Corrosion Allowance	ce	0.0000	mm
Use Corrosion Allowance in Thickness Calcs.		Yes	
Flange Outside Diameter	A	1010.000	mm
Flange Thickness	t	65.0000	mm
Flange Material		SA-105	
Flange Material UNS number		K03504	
Flange Allowable Stress At Temperature	Sfo	1406.14	kgf/cm ²
Flange Allowable Stress At Ambient	Sfa	1406.14	kgf/cm ²
Bolt Material		SA-193 B7	
Bolt Allowable Stress At Temperature	Sb	1757.68	kgf/cm ²
Bolt Allowable Stress At Ambient	Sa	1757.68	kgf/cm ²
Diameter of the Load Reaction, Long Span D		0.000	mm
Diameter of the Load Reaction, Short Span d		0.000	mm
Perimeter along the Center of the Bolts L		3022.212	mm
Youngs Modulus for Blind Flange Matl.	Sy	2020629.12	kgf/cm ²
Allowed Channel Cover Deflection dfAllow		1.0750	mm
Diameter of Bolt Circle	C	962.000	mm

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Flg Calc [Int P] : New Flange Flng: 5 10:29am Feb 22,2016

Nominal Bolt Diameter a 24.0000 mm

Type of Threads TEMA Metric

Number of Bolts 12

Flange Face Outside Diameter Fod 922.000 mm

Flange Face Inside Diameter Fid 890.000 mm

Flange Facing Sketch 2, Code Sketch 1b

Gasket Outside Diameter Go 920.000 mm

Gasket Inside Diameter Gi 890.000 mm

Gasket Factor m 2.0000

Gasket Design Seating Stress y 112.49 kgf/cm²

Column for Gasket Seating 2, Code Column II

Gasket Thickness tg 3.0000 mm

ASME Code, Section VIII, Division 1, 2015Gasket Contact Width, $N = (Go - Gi) / 2$ 15.000 mmBasic Gasket Width, $bo = N / 2$ 7.500 mmEffective Gasket Width, $b = Cb \sqrt{bo}$ 6.901 mmGasket Reaction Diameter, $G = Go - 2 * b$ 906.198 mm**Basic Flange and Bolt Loads:**

Hydrostatic End Load due to Pressure [H]:

$$= 0.785 * G^2 * Peq$$

$$= 0.785 * 906.1979^2 * 6.000$$

$$= 38697.828 \text{ kgf}$$

Contact Load on Gasket Surfaces [Hp]:

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Flg Calc [Int P] : New Flange Flng: 5 10:29am Feb 22,2016

$$= 2 * b * \pi * G * m * P$$

$$= 2 * 6.9011 * 3.1416 * 906.1979 * 2.0000 * 6.00$$

$$= 4715.210 \text{ kgf}$$

Operating Bolt Load [Wm1]:

$$= \max(H + H_p + H'p, 0)$$

$$= \max(38698 + 4715 + 0 , 0)$$

$$= 43413.039 \text{ kgf}$$

Gasket Seating Bolt Load [Wm2]:

$$= y * b * \pi * G + y_{Part} * b_{Part} * l_p$$

$$= 112.49 * 6.9011 * 3.141 * 906.198 + 0.00 * 0.0000 * 0.00$$

$$= 22100.785 \text{ kgf}$$

Required Bolt Area [Am]:

$$= \text{Maximum of } Wm1/S_b, Wm2/S_a$$

$$= \text{Maximum of } 43413/1758, 22101/1758$$

$$= 24.699 \text{ cm}^2$$

ASME Maximum Circumferential Spacing between Bolts per App. 2 eq. (3) [Bsmax]:

$$= 2a + 6t / (m + 0.5)$$

$$= 2 * 24.000 + 6 * 62.000 / (2.00 + 0.5)$$

$$= 196.800 \text{ mm} \text{ Maximum Bolt Spacing Exceeded !}$$

For vessels in lethal service or when specified by the user/agent, the maximum bolt spacing shall not exceed the value of [Bsmax]. See ASME VIII-1 Appendix 2 paragraph 2-5(d) for more information.

Actual Circumferential Bolt Spacing [Bs]:

$$= C * \sin(\pi / n)$$

$$= 962.000 * \sin(3.142/12)$$

$$= 248.984 \text{ mm}$$

ASME Moment Multiplier for Bolt Spacing per App. 2 eq. (7) [Bsc]:

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$$= \max(\sqrt{Bs/(2a + t)}, 1)$$

$$= \max(\sqrt{248.984/(2 * 24.000 + 62.000)}, 1)$$

$$= 1.5045$$

Bolting Information for TEMA Metric Thread Series (Non Mandatory):

	Minimum	Actual	Maximum
Bolt Area, cm ²	24.699	37.530	
Radial distance bet. bolts and the edge	28.580	24.000	
Circumferential spacing between bolts	58.740	248.984	196.800

Min. Gasket Contact Width (Brownell Young) [Not an ASME Calc] [Nmin]:

$$= Ab * Sa / (y * \pi * (Go + Gi))$$

$$= 37.530 * 1757.68 / (112.49 * 3.14 * (920.000 + 890.00))$$

$$= 10.313 \text{ mm}$$

Flange Design Bolt Load, Gasket Seating [W]:

$$= Sa * (Am + Ab) / 2$$

$$= 1757.68 * (24.6992 + 37.5298) / 2$$

$$= 54689.03 \text{ kgf}$$

Gasket Load for the Operating Condition [HG]:

$$= Wm1$$

$$= 43413.04 \text{ kgf}$$

Moment Arm Calculations:

Distance to Gasket Load Reaction [hg]:

$$= (C - G) / 2$$

$$= (962.0000 - 906.1979) / 2$$

$$= 27.9011 \text{ mm}$$

Tangential Flange Stress, Flat Head (UG-34), Operating [STo]:

$$= 1.9 * Wm1 * hG * Bsc / (t^2 * G) + C * Z * Peq * G^2 / t^2$$

$$= 1.9 * 43413 * 27.9011 * 1.5045 / (62.0000^2 * 906.1979) +$$

$$0.30 * 1.0000 * 6.00 * 906.1979^2 / 62.0000^2$$

$$= 483.93 \text{ kgf/cm}^2$$

Tangential Flange Stress, Flat Head (UG-34), Seating [STa]:

$$= 1.9 * W * hG * Bsc / (t^2 * G)$$

$$= 1.9 * 54689 * 27.9011 * 1.504 / (62.0000^2 * 906.1979)$$

$$= 125.22 \text{ kgf/cm}^2$$

Bolt Stress, Operating [BSO]:

$$= (Wm1 / Ab)$$

$$= (43413 / 37.5298)$$

$$= 1156.76 \text{ kgf/cm}^2$$

Bolt Stress, Seating [BSa]:

$$= (Wm2 / Ab)$$

$$= (22101 / 37.5298)$$

$$= 588.89 \text{ kgf/cm}^2$$

Flange Stress Analysis Results: kgf/cm²

	Operating		Gasket Seating	
	Actual	Allowed	Actual	Allowed

Tangential Flange	484.	1406.	125.	1406.
Bolting	1157.	1758.	589.	1758.

TEMA Channel Cover Deflection Calculations:

Actual deflection at center per TEMA formula	0.5387 mm
Allowed deflection at center of Cover	1.0750 mm

Reqd. Blind Flange Thickness at Center	42.451	mm
Reqd. Blind Flange Thickness at Gasket	23.068	mm
Min. Required Flange Thickness per TEMA	49.245	mm
Estimated M.A.W.P. (Operating)	9.117	kgf/cm ²
Estimated Finished Weight of Flange at given Thk.	403.6	kgm
Estimated Unfinished Weight of Forging at given Thk	403.6	kgm

Minimum Design Metal Temperature Results:

Stress Ratio = 1.000 , Temperature Reduction per Fig. UCS 66.1 = 0 °C

Min Metal Temp. w/o impact per UCS-66, Curve B -14 °C