

Pipeline Design

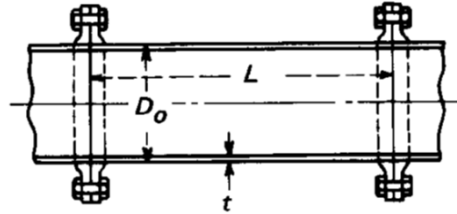
BPVC ASME VIII DIV.1

Case 3: Stiffening Rings

External Pressure Calculation

Design Conditions

2	148	T [°C] - External Design Temperature
3	0.1013	Pe [MPa] - External pressure
4	3.0	CA [mm] - internal corrosion allowance
5	0.0	eCA [mm] - external corrosion allowance



Dimensions:

7	1219.2	Do [mm] - outside diameter
9	6	t [mm] - nominal wall thickness without CA
10	20000	L [mm] - Distance between lines of support

Material and Conditions:

12	SA-387 Gr.12	Pipe Material
13	197,000	Ep [MPa] - moduli of Elasticity @design T° (II-D TM-1)
14	CS-1	External Pressure Chart
15	194	Ys [MPa] - yield strength @design T° (II-D Y-1)
16	A-36	Profile Material
17	198,000	Ep [MPa] - moduli of Elasticity @design T° (II-D TM-1)
18	CS-2	External Pressure Chart
19	219	Ys [MPa] - yield strength @design T° (II-D Y-1)

Stiffening Design: UG-29

21	N^o [dless] = Adopted number of rings	number of rings	= 6
22	Ls [mm] = Distance between rings	distance between lines of support	= 3333.3
23	L [mm] = $1,1 \cdot (Do \cdot t)^{0,5}$	pipe wall contributing length	= 94

External Pressure Verification, rings-pipe wall combination: UG-29

25	Profile Shape	Bar	Height [mm] = 60	thk [mm] = 10	
26	I' [cm ⁴] = $\sum AY^2 + \sum Ip - C \cdot \sum AY$	available moment of inertia of ring-shell combination			= 50
27	C [mm] = $\sum AY / \sum A$	distance from base to gravity center of the combination			= 20.0

Item	A [mm ²]	Y [mm]	Y ² [mm ²]	AY [mm ³]	AY ² [mm ⁴]	Ip [mm ⁴]
Pipe wall - 1	564	3	9	1693	5080	1693
Profile - 2	600	36	1296	21600	777600	180000
	1164			23293	782680	181693

32	B [dless] = $3/4 \cdot [Pe \cdot Do / (t + (As/Ls))]$	factor for Do/t < 4	= 15.0
33	A [dless] = Figure CS-1 (II-D, part 3)	Use Shell/Ring material resulting in bigger A	= 0.00016
34	$I's$ [cm ⁴] = $[Do^2 \cdot Ls \cdot (t + (As/Ls) \cdot A)] / 10,9$	required moment of inertia, stiffening rings only	= 45

35 Check I' = I' >= I's 50 > 45 = **Acceptable**