Diámetro Interior y Perdida de Carga

Tramos rectos de tuberías, Válvulas y Accesorios

arveng
training & engineering

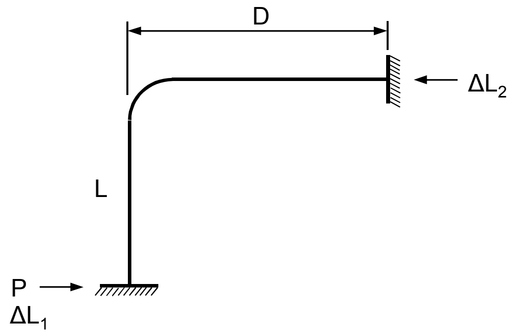
1	***Datos del Proyecto y del líquido:***				
2	Servicio	=	Descarga Bomba Centrífuga (Agua)		
3	P [bar]	=	Presión de diseño de la línea		45
4	Q [m^3/h]	=	Caudal de operación		150
5	v [m/s]	=	Velocidad de proyecto		2,50
6	v [m/s]	=	Velocidad real en la tubería		2,48
7	T [ºC]	=	Temperatura de Operación		100
8	ρ [kg/m^3]	=	Densidad del fluido		960,0
9	μ [kg/ms]	=	Viscosidad Dinámica @ temperatura de trabajo		0,0002829
10	ν [m^2/s]	=	Viscosidad Cinemática @ temperatura de trabajo		0,0000003
11	***Datos de la tubería:***				
12	Material	=	Metalurgia de la tubería para determinar la rugosidad		Acero comercial
13	NPS [in]	=	Nominal Pipe Size tubería		6
14	De [mm]	=	Diámetro exterior		168,3
15	SCH [adim]	=	Schedule		80
16	D [mm]	=	Diámetro interior		146,36
17	L [m]	=	Longitud del tramo recto		475
18	ε [mm]	=	Rugosidad absoluta tubería limpia		0,0500
19	***Pérdida de Carga Total del sistema***				
20	hf [mcl]	=	Pérdida de carga total del sistema	=	26,024
21	hf [bar]	=		=	2,549
22	***Pérdida de Carga en tramos rectos de tubería:***				
23	hft [mcl]	=	f*L*v2 / D*2g pérdida de carga en tramo recto de tubería (Darcy-Weisbach)	=	16,224
24	htf [bar]	=		=	1,589
25	Re [adim]	=	D*ρ*v / μ -> D*v / Vc Número de Reynolds	=	1.230.027
26	f [adim]	=	64/Re flujo laminar -> RE < 2000 (Poiseuille)	=	NA
27	f [adim]	=	Chuchill 1977, reproduce Moody en todos los regímenes	=	0,0160
28	f [adim]	=	Cheng 1979, buena performance para régimen turbulento -> solo para referencia	=	0,0159
29	***Pérdida de Carga en fittings, válvulas y otros***				
30	hff [mcl]	=	Pérdida de carga total en Fittings (mcl)	=	9,800
31	hff [bar]	=		=	0,960
32	f [adim]	=	Crane, tubería de acero comercial, flujo totalmente turbulento -> para válvulas y fittings	=	0,015

Se calcula la pérdida de carga mediante las ecuaciones más usadas de acuerdo a las buenas prácticas de ingeniería
Se calcula la pérdida de carga según las ecuaciones del método analítico de Crane.

Piping Flexibility Analysis

Design Code: ASME B31.1

Case 6. Calculation of Reaction Force in support



1 ***Design Conditions***

2	21	**Ta** [ºC] - Ambient Temperature
3	70	**Ta** [ºF] - Ambient Temperature
4	390	**Td** [ºC] - Design Temperature
5	734	**Td** [ºF] - Design Temperature
6	35000	**N** [dless] - Total number of thermal cycles

7 ***Dimensions:***

8	8	**NPS** [in] - nominal pipe size
9	8.625	**Do** [in] - pipe outside diameter
10	40	**SCH** [dless] - schedule of the pipe
11	6	**D** [m] - Distance subjected to thermal growth
12	0	**ΔL_1** [in] - Initial displacement of left end
13	1.5	**ΔL_2** [in] - Initial displacement of right end

14 ***Material and Conditions:***

15	A-335 P5	**Material** (5 Cr)
16	17.1	**Sc** [Ksi] - allowable stress @ ambient conditions
17	15.1	**Sh** [Ksi] - allowable stress @ design conditions
18	31,000	**E** [Ksi] - Moduli of Elasticity @ ambient (Table C-1)
19	6.40	**Exp** [in/100 ft] - Total expansion coeficient (Table B-1)
20	0.7	**f** [dless] - Stress Range Factor (fig.102.3.2)
21	16.81	**Z** [in3] - section modulus

22 ***Preliminary calc's:***

			in	*mm*
23	**ΔL_3** [in] = L * Exp	Total movement of pipeline due to expansion	= 1.28	32.53
24	**ΔL** [in / mm] = $\Delta L_1 + \Delta L_2 + \Delta L_3$	Total movement of the pipeline due to expansion	= 2.78	70.6
25	**SA** [Ksi] = f*(1,25*Sc + 0,25*Sh)	allowable displacement stress range	= 19	

26 ***Cantilever method: Arm to absorb expansion***

			ft	*m*
27	**L** [ft] = $(3 \cdot E \cdot Do \cdot \Delta L/144 \cdot SA)^{0,5}$	minimum required arm	= 28.85	8.79

28 ***Flector moment at fixed support***

			lb-ft	*Nm*
29	**M** [lb-ft / Nm] = P*L / 2 -> S = M / z	flector moment at fixed support	= 26076	34971

30 ***Load at fixed support***

			lb	*N*
31	**P** [lb / N] = SA*2*z / L	load at fixed support	= 1808	7955

This sheet provides a simplyfied method to establish the number of loops for a given shape
This sheet can only deliver conservative results. For a more accure design, please use flexibility software.
This sheet will not calculate biplanar systems
This sheet is for educational use only - use at your own risk.

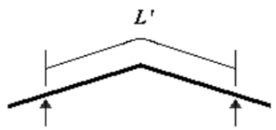
MAXIMUM SPACING BETWEEN SUPPORTS FOR SPECIAL CONFIGURAIONS

Correction Factors

Select the appropiate configuration of your pipeline from the options below and the design conditions entered above will be corrected for the special configuration selected.
Find corrected values for the chosen option below.

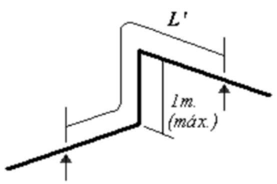
☐ **Direction change in the same plane:**

L'=0,75L



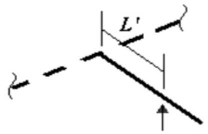
☐ **Direction Change in two planes:**

L'=0,65L



☑ **Branches:**

L'=0,70L



☐ **Concentrated loads (valves, fittings)**

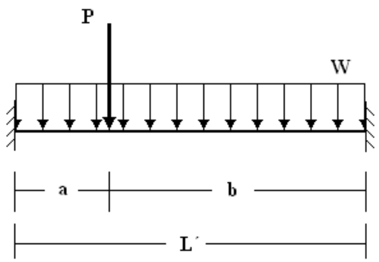
$L'=CL^{(*)}$

$$C = -6\alpha\beta(1-\alpha)^2 + \sqrt{1+\left[6\alpha\beta(1-\alpha)^2\right]^2}$$

Where: $\alpha = a/L'$, $\beta = P/WL$

Data:

P	2000	[kg]
a/L'	0.50	



a : distance from load to nearest support
P : weight of the Concentrated load
W : Pipe+fluid+insulation weight by length unit
L : support spacing for straight runs
L´ : corrected spacing considering concentrated load

Support Spacing Special Configuration

	Empty	Empty, Insulated	Fluid	Fluid + Insulation	
L'	**6186**	**6078**	**5812**	**5733**	**Selected configuration**
L'	**4137**	**4065**	**3887**	**3834**	**Free End (last spacing)**