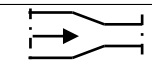
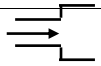
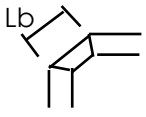
Table A. Equivalent length, $(L/D)_{EQ}$ of valves and pipe fittings.

No.	Item name & type	Condition	$(L/D)_{EQ}$	No.	Item name & type	Condition	$(L/D)_{EQ}$
1	*Globe valve*			6	*Butterfly valve*	Fully open	40
	A Plug type seat	Fully open	340				
	B No bevel w/pin guide	Fully open	450	7	*Cock valve*		
	C Y patern 60 degrees	Fully open	175		A Straight	Fully open	18
	D 45 degrees	Fully open	145		B Three way, straight flow	Fully open	44
					C Three way, to branch	Fully open	140
2	*Angle valve*						
	A Plug type seat	Fully open	145	8	*Elbow*		
	B No bevel w/pin guide	Fully open	200		A LR 90 degrees		20
					B SR 90 degrees		30
3	*Gate valve*				C SR 45 degrees		16
	A Wedge, double, plug disc	Fully open	13				
	B	1/2 open	260	9	*Standard Tee*		
	C	1/4 open	900		A Straight flow		20
					B To branch		60
4	*Check valve*						
	A Swing		135	10	*Street Elbow*		
	B Clearway swing		50		A 90 deg.		50
	C Globe, lift or step		340		B 45 deg.		26
	D Angle, lift or step		145				
	E In line ball check valve		150	11	Single mitter bend		
					A 45 deg.		15
5	*Foot valve*				B 90 deg.		58
	A With strainner & poppet		420				
	B With leather hinged		75	12	Return bend		50

Table B. Flow Resistance, K for several geometries

Note : $(D1/Do)^2$ or (D2/Do) where D1 or D2 is smaller diameter and flow is referred to upstream

No.	Item name & type	Condition $(D1/Do)^2$	K	No.	Item name & type	Condition D2/Do	K
1	*Reducer*	0.1	0.37		*Open end (to ambient orinfinite space)*		
		0.5	0.22				
		0.9	0.02	7	*Nozzle (angle 7 - 15 deg.)*	0.4	45
	Do D1					0.6	8.5
2	*Sudden contraction*	0	0.5			0.8	2.5
		0.5	0.25		Do D2		
		0.9	0.05	8	*Sharp nozzle*	0.2	70
						0.5	10
3	*Sudden enlargement*	0	1			0.9	1
		0.5	0.25				
		0.9	0.01	9	*Mitter bend*	Lb/D	
	D1 Do					0	1.2
4	*Orifice or perforated plate*	0.2	50		Lb	2	0.4
		0.5	3.9			6	0.47
		0.9	0.15				
5	*Infinite contraction*	0	0.5				
							
6	*Infinite enlargement*	0	1				

PRESSURE DROP CALCULATION SHEET

FOR LIQUID

	Item	Unit	Qty.
1	***Liquid data***		
2	Liquid name		Water
3	Volume flow (m3/hr)	m3/hr	120
4	Specific gravity		1
5	Viscosity	cP	0.8
6	***Pipe data***		
7	Inside pipe diameter, D	mm	115
8	Pipe length, L	m	50
9	Inside surface roughness, ε	mm	0.045
10			
11	Pipe (L/D)		434.78
12	Liquid velocity , V, *equation (5)*	m/s	3.209
13	Reynold no., Re, *eq. (10&11)*		4.61E+05
14	Relative roughness, ε/D		0.000391
15	Friction factor, f, *fig. 3*		0.017
16	Pressure drop, ΔP_{LOSS}	kg/cm2	**0.840**
17			
18			

19	***Material surface roughness data***	
20	Material	ε (mm)
21	Drawn tube, glass, plastic	0.0015 - 0.0025
22	Forged, structural steel	0.025
23	Commercial steel	0.045
24	Galvanized iron	0.15
25	Cast iron	0.25
26	Concrete new smooth/coarse	0.025/0.25
27	Water mains, old	1
28	Sewer, old	3

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30 Note :

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Number of pipe accessories

Valve & fittings

Item code no.	$(L/D)i_{EQ}$	Qty.
A.1.A	340	0
A.1.B	450	0
A.1.C	175	0
A.1.D	145	1
A.2.A	145	0
A.2.B	200	0
A.3.A	13	1
A.3.B	260	1
A.3.C	900	0
A.4.A	135	0
A.4.B	50	0
A.4.C	340	0
A.4.D	145	0
A.4.E	150	0
A.5.A	420	0
A.5.B	75	0
A.6	40	0
A.7.A	18	0
A.7.B	44	0
A.7.C	140	0
A.8.A	20	0
A.8.B	30	0
A.8.C	16	0
A.9.A	20	0
A.9.B	60	0
A.10.A	50	0
A.10.B	26	0
A.11.A	15	0
A.11.B	58	0
A.12	50	0
Other	0	0
Total $(L/D)_{EQ}$	418	

Other restriction component

Item code no.	Ki	Qty.
B.1	0	0
B.2	0.5	1
B.3	1	1
B.4	0	0
B.5	0	0
B.6	0	0
B.7	0	0
B.8	0	0
B.9	0	0
Other	0	0
Total flow resistance, K	1.5	

PRESSURE DROP CALCULATION SHEET

FOR LIQUID

	Item	Unit	Qty.
1	***Liquid data***		
2	Liquid name		Coco Oil
3	Volume flow (m3/hr)	m3/hr	30
4	Specific gravity		0.925
5	Viscosity	cP	30
6	***Pipe data***		
7	Inside pipe diameter, D	mm	52.48
8	Pipe length, L	m	50
9	Inside surface roughness, ε	mm	0.045
10			
11	Pipe (L/D)		952.74
12	Liquid velocity , V, *equation (5)*	m/s	3.852
13	Reynold no., Re, *eq. (10&11)*		6.23E+03
14	Relative roughness, ε/D		0.000857
15	Friction factor, f, *fig. 3*		0.038
16	Pressure drop, ΔP_{LOSS}	kg/cm2	**3.679**
17			
18			

19	***Material surface roughness data***	
20	Material	ε (mm)
21	Drawn tube, glass, plastic	0.0015 - 0.0025
22	Forged, structural steel	0.025
23	Commercial steel	0.045
24	Galvanized iron	0.15
25	Cast iron	0.25
26	Concrete new smooth/coarse	0.025/0.25
27	Water mains, old	1
28	Sewer, old	3

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30 Note :

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Number of pipe accessories

Valve & fittings

Item code no.	$(L/D)i_{EQ}$	Qty.
A.1.A	340	0
A.1.B	450	0
A.1.C	175	0
A.1.D	145	1
A.2.A	145	0
A.2.B	200	0
A.3.A	13	2
A.3.B	260	0
A.3.C	900	0
A.4.A	135	0
A.4.B	50	0
A.4.C	340	0
A.4.D	145	0
A.4.E	150	0
A.5.A	420	0
A.5.B	75	0
A.6	40	0
A.7.A	18	0
A.7.B	44	0
A.7.C	140	0
A.8.A	20	8
A.8.B	30	0
A.8.C	16	0
A.9.A	20	3
A.9.B	60	0
A.10.A	50	0
A.10.B	26	0
A.11.A	15	0
A.11.B	58	0
A.12	50	0
Other	0	0
Total $(L/D)_{EQ}$	391	

Other restriction component

Item code no.	Ki	Qty.
B.1	0	0
B.2	0.5	1
B.3	1	1
B.4	0	0
B.5	0	0
B.6	0	0
B.7	0	0
B.8	0	0
B.9	0	0
Other	0	0
Total flow resistance, K	1.5	

DENSITY AND VISCOSITY OF SEVERAL LIQUID

Liquid name	Density		Viscosity		Vapor pressure	
	Density (kg/m3)	Temp. range (C)	Viscosity (cPoise)	Temp. range (C)	Vap. Pres. (kg/cm2)	Temp. range (C)
COMMON LIQUID						
Vegetable oil	940 - 914	-				
- Cocoanut oil	925		30-15	21-54		
- Corn oil	924		26-8	21-54		
Water	1000 - 992	0 - 90	1-0.6	20 to 50	0.0125-0.126	10-50
Milk	1030	15				
Wyne	990	15				
Diesel oil	857	15				
Engine oil	911	15				
Lubricating oil						
- SAE-90	935-880	21-99	162	21		
- SAE-50	935-880	21-99	110	50		
- SAE-30	935-880	21-99	60	50		
- SAE-10	935-880	21-99	20	50		
Petoleum oil	660 - 650					
Kerosene	830-800					
Ammonia	719-701	-56 to -38	0.37-0.27	-56 to -38	0.605-4.43	-43 to 1
HYDROCARBON						
n-Buthane	692-623	-67 to -4.5	0.43-0.22		0.5-5	-30 to 40
n-Ethane	517-440	-136 to -93	-			
n-Methane	671-658	-172-166.5	-			
Pentane	627	15				
Hexane	658	15	0.46 to 0.22	-13 to 64		
Heptane	683	15	0.5 to 0.21	4 to 93		
Octane	700	15	0.48 to 0.22	34 to 121		
Propane	679-622	-116 to -48	0.71 to 0.21	-116 to -48	0.6-19	-50 to 50
AROMATIC HYDROCARBONS						
Benzene	861-818	43 to 75	0.47-0.32	43 to 75		
Ethyl Benzene	862-778	21 to 131	0.74-0.24	21 to 131		
Toluene (Methyl Benzene)	905-773	8 to 106	0.69-0.26	8 to 106	0.08-0.6	50-100

ASME standard dimension for Carbon steel pipe
(Table for pipe inside diameter)

Nom Size Inches	OD mm	Unit	Inside diameter, ID (mm)											
			STD	XS	sch10	sch20	sch30	sch40	sch60	sch80	sch100	sch120	sch160	XXS
1/8	10.3	mm	6.84	5.48				6.84		5.48				
1/4	13.7	mm	9.22	7.66				9.22		7.66				
3/8	17.1	mm	12.48	10.7				12.48		10.7				
1/2	21.3	mm	15.76	13.84				15.76		13.84			11.74	6.36
3/4	26.7	mm	20.96	18.88				20.96		18.88			15.58	11.06
1	33.4	mm	26.64	24.3				26.64		24.3			20.7	15.22
1 1/4	42.2	mm	35.08	32.5				35.08		32.5			29.5	22.8
1 1/2	48.3	mm	40.94	38.14				40.94		38.14			34.02	27.98
2	60.3	mm	52.48	49.22				52.48		49.22			42.82	38.16
2 1/2	73	mm	62.68	58.98				62.68		58.98			53.94	44.96
3	88.9	mm	77.92	73.66				77.92		73.66			66.64	58.42
3 1/2	101.6	mm	90.12	85.44				90.12		85.44				
4	114.3	mm	102.26	97.18				102.26		97.18		92.04	87.32	80.06
5	141.3	mm	128.2	122.24				128.2		122.24		115.9	109.54	103.2
6	168.3	mm	154.08	146.36				154.08		146.36		139.76	131.78	124.4
8	219.1	mm	202.74	193.7		206.4	205.02	202.74	198.48	193.7	188.92	182.58	173.08	174.66
10	273	mm	254.46	247.6		260.3	257.4	254.46	247.6	242.82	236.48	230.12	215.84	222.2
12	323.8	mm	304.74	298.4		311.1	307.04	303.18	295.26	288.84	280.92	273	257.16	273
14	355.6	mm	336.54	330.2	342.9	339.76	336.54	333.34	325.42	317.5	307.94	300.02	284.18	355.6
16	406.4	mm	387.34	381	393.7	390.56	387.34	381	373.08	363.52	354.02	344.48	325.42	
18	457.2	mm	438.14	431.8	444.5	441.36	434.94	428.66	419.1	409.54	398.48	387.36	366.72	
20	508	mm	488.94	482.6	495.3	488.94	482.6	477.82	466.76	455.62	442.92	431.8	407.98	
24	610	mm	590.94	584.6	597.3	590.94	581.46	575.04	560.78	548.08	532.22	517.96	490.12	
26	660.4	mm	641.34	635	644.56	635								
28	711.2	mm	692.14	685.8	695.36	685.8	679.44							
30	762	mm	742.94	736.6	746.16	736.6	730.24							
32	812.8	mm	793.74	787.4	796.96	787.4	781.04	777.84						
36	914.4	mm	895.34	889	898.56	889	882.64	876.3						
40	1016	mm	996.94	990.6										