DAFTAR PUSTAKA

Austin H. Church, terjemahan Zulkifli Harahap, *Pompa dan Blower Sentrifugal*, Erlangga, Jakarta, 1986.

Diezel Frizt. (1993). *Turbin Pompa dan Kompresor*. Edisi Keempat. Erlangga. Jakarta.

Hicks dan Edward, *Teknologi Pemakaian Pompa.* Erlangga. Jakarta, 1996.

I. Karasik. (1975). *Pump Handbook*. Second Edition McGrawhill.USA.

Sularso, Haruo Tahara. *Pompa dan Kompresor*. Edisi Keempat. Pradnya Paramitha. Jakarta. 1991.

Sunyoto, dkk. *Teknik Mesin Industri* Jilid 1 Direktorat Pembinaan Sekolah Menengah Kejuruan Direktorat Jenderal Manajemen Pendidikan Dasar dan Menengah Departemen Pendidikan Nasional Tahun 2008.

Victor L. Streeter & E. Benjamin Wylie. *Mekanika Fluida.* Edisi Kedelapan Jilid I Erlangga. Jakarta. 1988.

www.google.com, *pompa multistage sentrifugal.*

Lampiran

Contraction cone angle 2θ, deg	K for gradual contraction
30	0.02
45	0.04
60	0.07

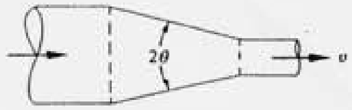


Figure 6-15 Flow losses in a gradual conical contraction region. Note that the loss is based on velocity head in the small pipe.[3,4]

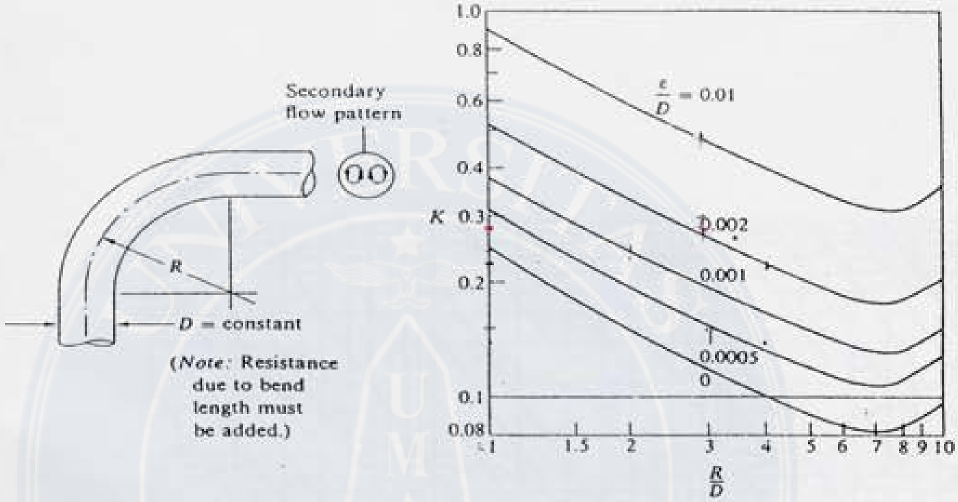


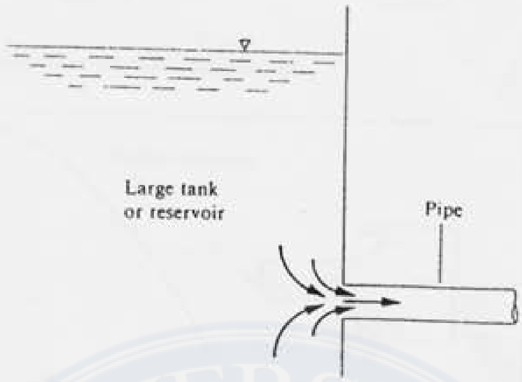
Figure 6-16 Resistance coefficients for 90° bends.[3]

Table 6-2 Resistance coefficients $K = \dfrac{h_m}{v^2/2g}$ for open valves, elbows, and tees [3]

Nominal diameter, in	Screwed				Flanged				
	½	1	2	4	1	2	4	8	20
Valves (fully open):									
Globe	14	8.2	6.9	5.7	13	8.5	6.0	5.8	5.5
Gate	0.30	0.24	0.16	0.11	0.80	0.35	0.16	0.07	0.03
Swing check	5.1	2.9	2.1	2.0	2.0	2.0	2.0	2.0	2.0
Angle	9.0	4.7	2.0	1.0	4.5	2.4	2.0	2.0	2.0
Elbows									
45° regular	0.39	0.32	0.30	0.29					
45° long radius					0.21	0.20	0.19	0.16	0.14
90° regular	2.0	1.5	0.95	0.64	0.50	0.39	0.30	0.26	0.21
90° long radius	1.0	0.72	0.41	0.23	0.40	0.30	0.19	0.15	0.10
180° regular	2.0	1.5	0.95	0.64	0.41	0.35	0.30	0.25	0.20
180° long radius					0.40	0.30	0.21	0.15	0.10
Tees:									
Line flow	0.90	0.90	0.90	0.90	0.24	0.19	0.14	0.10	0.07
Branch flow	2.4	1.8	1.4	1.1	1.0	0.80	0.64	0.58	0.41

Table 6-3 Increased losses of partially open valves [3]

Condition	Ratio K/K_{open}	
	Gate valve	Globe valve
Open	1.0	1.0
Closed, 25%	3.0-5.0	1.5-2.0
50%	12-22	2.0-3.0
75%	70-120	6.0-8.0



Exit losses: $K = 1.0$ for all shapes of exit (reentrant, sharp-edged, slightly, or well-rounded)

Figure 6-11 Entrance and exit loss coefficients.[3]

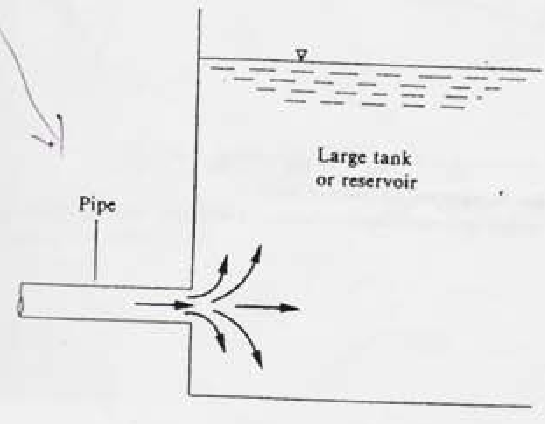


Figure 6-12 Exit loss.

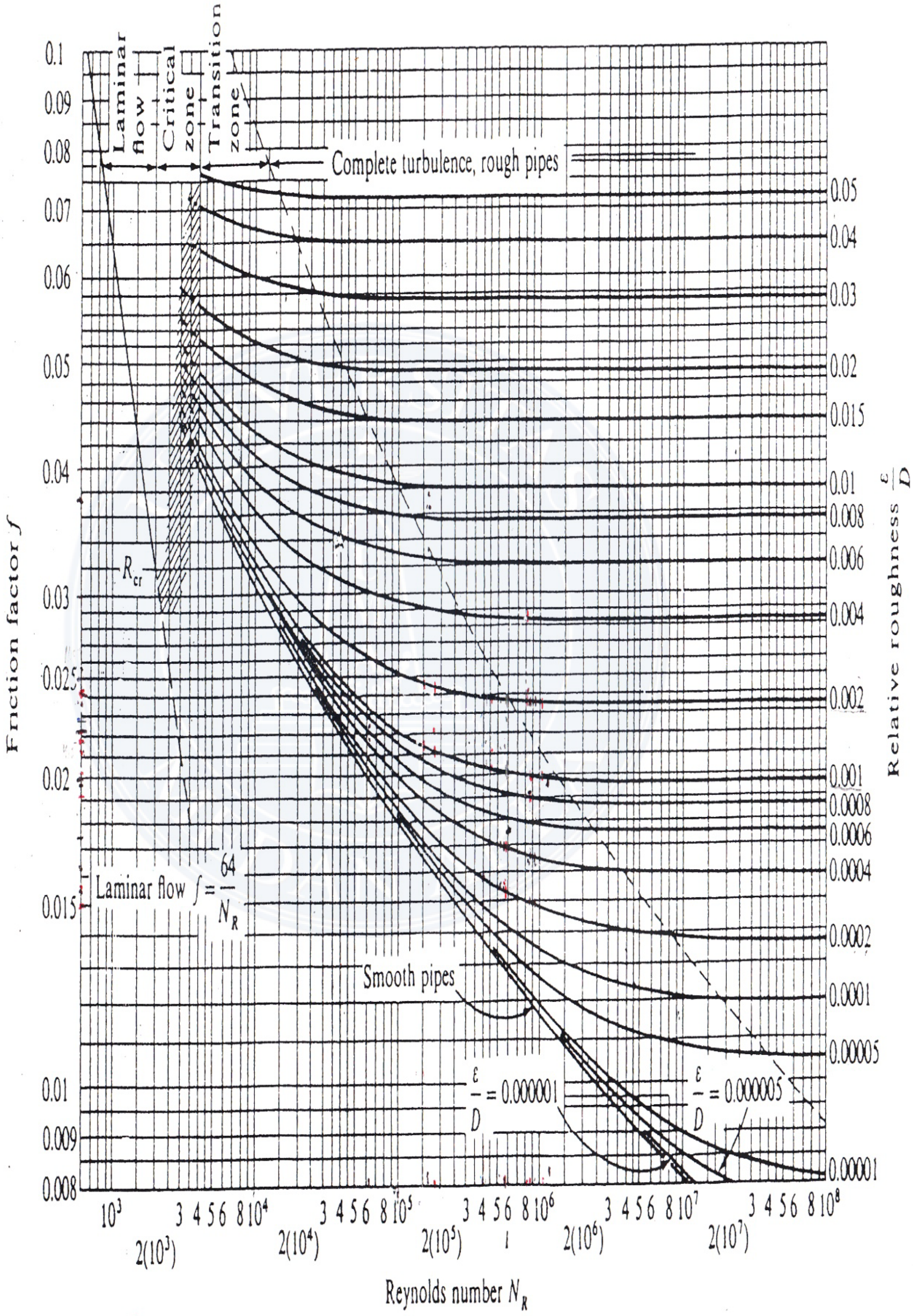


Figure 6-2 Moody diagram.[1]

Table 6-1 Typical wall roughness values for commerci conduits (from [1]†)

Material (new)	Roughness (ε) ft	m
Riveted steel	0.003-0.03	0.0009-0.00
Concrete	0.001-0.01	0.0003-0.0C
Wood stave	0.0006-0.003	0.0002-0.00
Cast iron	0.00085	0.00026
Galvanized iron	0.0005	0.00015
Asphalted cast iron	0.0004	0.0001
Commercial steel or wrought iron	0.00015	0.000046
Drawn brass or copper tubing	0.000005	0.000001
Glass and plastic	"smooth"	"smooth

Table 6-4 Typical values of the Hazen-Williams coefficient, C

Extremely smooth and straight pipes	140
New steel or cast iron	130
Wood; concrete	120
New riveted steel; vitrified	110
Old cast iron	100
Very old and corroded cast iron	80

Table 8-1 Typical values of the Manning coefficient, n

Brass ✓	0.010
Glass	0.010
Cement	0.011
Cast iron ✓	0.012
Wrought iron ✓	0.012
Concrete ✓	0.013
Glazed brick	0.013
Steel	0.014
Vitrified ✓	0.014
Channel lined with asphalt	0.015
Laminated wood	0.017
Earth, clean	0.018
Gravel	0.023
Corrugated metal	0.024
Earth with grass and weeds	0.030
Earth with dense weeds and brush	0.080
Riveted steel	0,015

Appendix A-20 Conversion Tables

Lengths

m	ft
1	3.281
0.3048	1

Masses

kg	lb
1	2.2
0.454	1

Surfaces

m	ft^2
1	10.76
0.0929	1

Densities

$\frac{kg}{m^3}$	$\frac{lb}{ft^3}$
1	0.0624
16.02	1

Volumes

m^3	ft^3
1	35.3
0.0283	1

Forces

N	kg_f	lb_f
1	0.102	7.24
9.80665	1	70.9
1.356	0.1382	1

Pressures

bar or pa or or 10^5 Nm^{-2}	ata $\frac{kg_f}{cm^2}$	$\frac{lb_f}{in^2}$	atm or 760 mm Hg	torr or mm Hg	m H_2O
1	1.02	14.5	0.987	750	10.2
0.9807	1	14.22	0.968	736	10.0
0.0689	0.0703	1	0.068	51.7	0.70[illegible]
0.01325	1.033	14.7	1	760	10.33
0.00133	0.00136	0.01934	0.001316	1	0.0136

Velocities

$\frac{m}{s}$	$\frac{ft}{min}$
1	196.8
0.00508	1

Flow Rates

$\frac{l}{s}$	$\frac{m^3}{min}$	$\frac{ft^3}{min}$
1	0.06	2.12
16.67	1	35.3
0.472	0.0283	1

2.7.2 Daya Poros

Daya poros yang diperlukan untuk menggerakkan sebuah pompa adalah sama dengan daya air ditambah kerugian daya di dalam pompa. Daya ini dapat dinyatakan sebagai berikut:

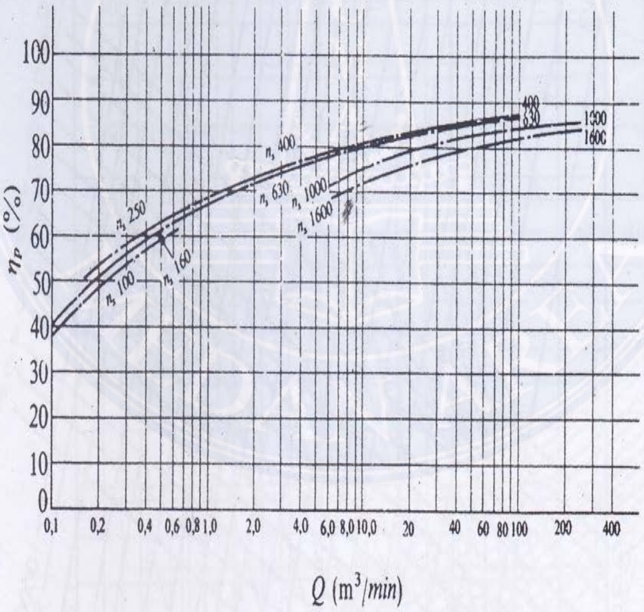
$$P = \frac{P_w}{\eta_p} \qquad (2.38)$$

di mana P: Daya poros sebuah pompa (kW)

η_p: Efisiensi pompa (pecahan)

Harga-harga standar efisiensi pompa η_p diberikan dalam Gb. 2.26. Efisiensi pompa untuk pompa-pompa jenis khusus harus diperoleh dari pabrik pembuatnya.

LAMPIRAN



Efisiensi standar pompa sentrifugal menurut n_s

Gb. 2.26 Efisiensi standar pompa.