

LAMPIRAN

1. Perhitungan kapasitas GWT dan Hydrant

Parameter	Symbols		Inputs	Unit
Jumlah penghuni (max)		=	200	people
Liter/day/person		=	250	liter/day/person
safety factor		=	20	%

Tabel 1. Kebutuhan rata-rata penghuni (l/day)

Jumlah penghuni	l/day	safety factor	Unit
50	12500	15000	l/day
100	25000	30000	l/day
150	37500	45000	l/day
200	50000	60000	l/day
Rata rata	31250	37500	l/day

2. hydrant

Parameter	Symbols		Inputs	Unit
Kapasitas pompa kebakaran	Q	=	1000	G/min
Waktu estimasi pemadaman	t	=	30-45	min

1 gpm = 3,785 l/min

1000 gpm = 3785 l/min

Tabel 2. Liter yang dibutuhkan berdasarkan waktu pemadaman

Waktu (min)	liter
30	113550
35	132475
40	151400
45	170325
Rata-Rata	141937,5

3. Kapasitas GWT =

Kebutuhan Hydrant + Kebutuhan air bersih

37500 + 142000

179500 liter

180 m³

2. Perhitungan kapasitas RWT

Parameter	Symbols		Inputs	Unit
Kapasitas air bersih	AB	=	37,5	m ³
Waktu pengisian tank		=	2	
Roof Water Tank	RWT	=	20	m ³ /h

3. Perhitungan Friction Factor

Parameter	Symbols		Inputs	Unit
Pipe Roughness (PPR)	ϵ	=	0,0025	mm
Diameter pipa 2	d	=	65	mm
Relatif pipe Roughness		=	3,85E-05	mm
Debit air	Q	=	0,0034	m ³ /s
Luas Penampang	A	=	0,003	m
Kecepatan aliran	V	=	1,025	m/s
Densitas air	ρ	=	997	kg/m ³
Viskositas air	μ	=	0,001	kg/m.s
Bilangan reynold	Re	=	77677	reynold
Friction factor	f	=	0,018	

4. Perhitungan Major Losses

Parameter	Symbols		Inputs	Unit
Friction Factor	f	=	0,018	
Panjang pipa	l	=	1	m
Diameter pipa	d	=	0,065	m
Gravitasi	g	=	9,78	m/s ²
Kecepatan aliran	V	=	0,68	m/s

$$\begin{aligned}
 \text{Major Losses} &= \frac{f \cdot l \cdot V^3}{d^5} \\
 &= \frac{0,018 \cdot 1 \cdot 0,68^3}{0,065^5} \\
 &= 0,006
 \end{aligned}$$

Parameter	Symbols	Inputs		Unit
Friction Factor	f	=	0,018	
Panjang pipa	l	=	1,7	m
Diameter pipa	d	=	0,065	m
Gravitasi	g	=	9,78	m/s ²
Kecepatan aliran	V	=	1,025	m/s
Major Losses	pipa 2	=	0,018	1,7
				0,065
		=	0,018	26,1538
		=	0,025	m

1,050908958
2 9,78
0,053727

Parameter	Symbols	Inputs		Unit
Friction Factor	f	=	0,018	
Panjang pipa	l	=	1,2	m
Diameter pipa	d	=	0,065	m
Gravitasi	g	=	9,78	m/s ²
Kecepatan aliran	V	=	1,025	m/s

Major Losses pipa 3 = 0,018 1,2 1,050908958
0,065 2 9,78
= 0,018 18,4615 0,053727
= 0,018 m

Parameter	Symbols	Inputs		Unit
Friction Factor	f	=	0,018	
Panjang pipa	l	=	0,75	m
Diameter pipa	d	=	0,065	m
Gravitasi	g	=	9,78	m/s ²
Kecepatan aliran	V	=	1,025	m/s

Major Losses pipa 4 = 0,018 0,75 1,050908958
0,065 2 9,78
= 0,018 11,5385 0,053727
= 0,011 m

Parameter	Symbols	Inputs		Unit
Friction Factor	f	=	0,018	
Panjang pipa	l	=	10	m
Diameter pipa	d	=	0,065	m
Gravitasi	g	=	9,78	m/s ²
Kecepatan aliran	V	=	1,025	m/s

Major Losses pipa 5 = 0,018 10 1,050908958
0,065 2 9,78

$$= 0,018 \quad 153,846 \quad 0,053727$$

$$= 0,149 \quad \text{m}$$

Parameter	Symbols	Inputs	Unit
Friction Factor	f	= 0,018	
Panjang pipa	l	= 27,5	m
Diameter pipa	d	= 0,065	m
Gravitasi	g	= 9,78	m/s ²
Kecepatan aliran	V	= 1,025	m/s

$$\begin{array}{llll} \text{Major Losses} & \text{pipa 6} & = & 0,018 \quad 27,5 \quad 1,050908958 \\ & & & 0,065 \quad 2 \quad 9,78 \\ & & = & 0,018 \quad 423,077 \quad 0,053727 \\ & & = & 0,409 \quad \text{m} \end{array}$$

Parameter	Symbols	Inputs	Unit
Friction Factor	f	= 0,018	
Panjang pipa	l	= 3	m
Diameter pipa	d	= 0,065	m
Gravitasi	g	= 9,78	m/s ²
Kecepatan aliran	V	= 1,025	m/s

$$\begin{array}{llll} \text{Major Losses} & \text{pipa 7} & = & 0,018 \quad 3 \quad 1,050908958 \\ & & & 0,065 \quad 2 \quad 9,78 \\ & & = & 0,018 \quad 46,1538 \quad 0,053727 \\ & & = & 0,045 \quad \text{m} \end{array}$$

Parameter	Symbols	Inputs	Unit
Friction Factor	f	= 0,018	
Panjang pipa	l	= 1,5	m
Diameter pipa	d	= 0,065	m
Gravitasi	g	= 9,78	m/s ²
Kecepatan aliran	V	= 1,025	m/s

$$\begin{array}{llll} \text{Major Losses} & \text{pipa 8} & = & 0,018 \quad 1,5 \quad 1,050908958 \\ & & & 0,065 \quad 2 \quad 9,78 \\ & & = & 0,018 \quad 23,0769 \quad 0,053727 \\ & & = & 0,02 \quad \text{m} \end{array}$$

$$\text{JADI } \Delta p_{\text{major}} = 0,69 \quad \text{m}$$

5. Perhitungan Minor Losses

Fitting	Standart	Jumlah	K	Total
Elbow	Yunus Cengel	8	0,35	2,8
Gate Valve	Yunus Cengel	7	0,27	1,89
Strainer	Yunus Cengel	1	1	1
Check Valve	Yunus Cengel	1	2,6	2,6
Flexibel Conect	Yunus Cengel	2	0,04	0,08
				8,37

1. Fluid Velocity

Debit air	Q	=	0,0034	m ³ /s
Luas Penampang	A	=	0,0033	m
Fluid Velocity	V	=	1,025	m/s

2. Minor Losses

Koefisien	k	=	8,37	
Fluid Velocity	v ²	=	1,051	m/s
Gravitasi	g	=	9,78	m/s ²

$$\text{Minor losses} = 8,37 \times \frac{1,051}{19,56}$$

$$\text{Minor losses} = 8,37 \times 0,054$$

$$\text{Minor losses} = 0,45 \text{ m}$$

6. Total Head Losses

1. Total Head losses				
Major Head Losses	Δp_{major}	=	0,69	m
Minor Head Losses	Δp_{Minor}	=	0,45	m
Static head losses	S.head	=	26,75	m
Total head		=	27,89	m

7. Efisiensi Pompa

2. Tekanan diperlukan pompa				
Masa jenis air	ρ	=	997	Kg/m ³
Gravitasi	g	=	9,87	m/s ²
Head losses	h	=	27,89	m
Tekanan	P	=	274403	Pa

		=	2,74	Bar
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3. Power pompa				
Massa jenis	ρ	=	997	Kg/m ³
Gravitasi	g	=	9,87	m/s ²
Head losses	h	=	27,89	m
Debit aliran	Q	=	0,0034	m ³ /s
P pompa =	p	=	932,97	watt

Daya = 5500 W

Efisiensi pompa = $\frac{932,97}{5500} \times 100\%$

$0,169630957 \times 100\%$
17%

8. Tank Biocell

Parameter	Symbols	Inputs	Unit
Jumlah penghuni (max)		= 200	people
Liter/day/person		= 200	liter/day/person
safety factor		= 20	%

Jumlah penghuni	Air Kotor (liter)	Safety (20%)
50	10000	12000
100	20000	24000
150	30000	36000
200	40000	48000
125	25000	30000

Jadi kapastias tank biocell sebesar 30 m³.