

# AquaSust Aeration Volume Calculator

Blue block is the design datameter : be filled in

Brown: calculate process data

Red : last result for your process

## 1.Aerobic Tank volume calculation

$$V = \frac{Q_{max} \times (S_o - S_e)}{BOD_{SS} \times MLSS} \approx$$

Design parameters:		
Qmax	150	Daily sewage design flow, m3/d
So	400	Sewage untreated for five days - (BOD5 concentration), mg/l
Se	20	Five days after treatment - (BOD5 concentration), mg/l
BODSS	0.12	Sludge load, kg-BOD/kg-MLSS/day
MLSS	4000	Sludge concentration, mg/l
Result	118.75	M3

## 2.Denitrification cabinet volume calculation

$$V_{DN} = \frac{Q_{max} \times (N_{IKN} - N_{ETN})}{M_{DNL} \times MLSS} \approx$$

Design parameters:		
N <sub>IKN</sub>	250	Concentration of ammonia nitrogen in treated effluent, mg/l
N <sub>ETN</sub>	30	Concentration of ammonia nitrogen in treated effluent, mg/l
M <sub>DNL</sub>	0.5	Sludge denitrification load, kg-NH3-N/kg · MLSS/day
MLSS	3000	Sludge concentration, mg/l
Result	22	M3

## 3.Aeration Calculation

$$R_{O_2} = 0.001aQ(S_o - S_e) - c\Delta X_v + b[0.001Q(N_k - N_{ke}) - 0.12\Delta X_v] - 0.62b[0.001Q(N_T - N_{ke} - N_{oe}) - 0.12\Delta X_v] + cdVN'$$

Design parameters:		
R <sub>O<sub>2</sub></sub>	172.35	Design sewage oxygen demand, kgO <sub>2</sub> /d
S <sub>o</sub>	400	Five-day biochemical oxygen demand of influent water, mg/L
S <sub>e</sub>	20	Five-day biochemical oxygen demand of effluent, mg/L
ΔX <sub>v</sub>	11.08	Amount of microorganisms discharged from the oxidation tank to the system, kg/d
N <sub>k</sub>	275.00	Total Kjeldahl nitrogen in influent, mg/L
N <sub>ke</sub>	45	Total Kjeldahl nitrogen in effluent, mg/L
N <sub>t</sub>	275.00	Total nitrogen in influent, mg/L
N <sub>oe</sub>	21	Amount of nitrate nitrogen in effluent, mg/L
a	1.47	Carbon equivalent, when the carbonaceous material is measured in terms of five-day biochemical oxygen demand, take 1.47
b	4.57	Constant, oxygen demand for oxidizing each kilogram of ammonia nitrogen, kgO <sub>2</sub> /kgN, take 4
c	1.42	Constant, oxygen content of bacterial cells, taken as 1.42
d	0.08	Constant, sludge auto-oxidation rate, taken as 0.08
N'	2.8	Average concentration of volatile suspended solids in the mixture (g vss/L) at 70% of the sludge volume
θ	30	Sludge age, 30d
Result	172.3518987	kgO <sub>2</sub> /d

## 4. Absolute Pressure Calculation

$$P_b = P + 9.8 \times 10^3 H =$$

Design parameters:		
P <sub>b</sub>	133040	Absolute pressure at which the aeration device is located, Pa
H	4.3	Aeration diffuser gas port at the water depth, m (water depth minus the aeration disc installation height, according to the depth of
P	90900	Atmospheric pressure, Pa (actual atmospheric pressure at location)
Result	133040	Pa

## 5.Calculation of oxygen content in per cent

$$O_t = \frac{21 \times (1 - E_A)}{79 + 21 \times (1 - E_A)} \times 100\% =$$

Design parameters:		
O <sub>t</sub>	16.62%	Percentage of oxygen in the gas escaping from the aeration basin, dimensionless
E <sub>A</sub>	25%	Transfer coefficient of diffusion device, % oxygen utilisation (value selected with reference to technical parameters provided by SSI manufacturer)
Result	0.166226913	

## 6.Calculation of average dissolved value

$$C_{sm} = C_{sw} \left( \frac{P_b}{2.026 \times 10^5} + \frac{Q}{42} \right) =$$

Design parameters:		
C <sub>sm</sub>	8.82	T <sup>o</sup> C. Average dissolved value of clear water from the depth of the water under
C <sub>sw</sub>	8.38	T <sup>o</sup> C. Saturated dissolved oxygen on the surface of clear water at actual calculated pressure, mg/l (CS(20)=9.17mg/L, CS(25)=8.38mg/L)
T	25	°C
Result	8.818924806	mg/L

## 7.Calculation of oxygen demand correction factor

$$K_o = \frac{C_s}{\alpha(\beta C_{sm} - C_o)} \times 1.024^{(T-20)} =$$

Design parameters:		
K <sub>o</sub>	1.715	Oxygen demand correction factor
C <sub>o</sub>	2	Remaining dissolved oxygen concentration of mixed liquid, mg/L
C <sub>s</sub>	9.17	Saturated dissolved oxygen mass concentration in clear water under standard condition, mg/l
α	0.8	Transfer efficiency resistance coefficient, the influence of the nature of wastewater on dissolved oxygen, correction factor
β	0.9	Raw domestic sewage value of about 0.4-0.5 Industrial wastewater value varies greatly 0.8-0.85 The effect of salts in wastewater on dissolved oxygen, saturated oxygen resistance factor
β	0.9	β value is generally between 0.9-0.97
Result	1.71478688	

## 8.(Calculated on 24h basis) Aeration basin air supply volume Aeration basin air supply volume calculation

$$R_o = R_{O_2} \times K_o =$$

$$G_s = \frac{R_o}{0.28E_A} \times 100\% =$$

Design parameters:		
R <sub>o</sub>	295.52	kgO <sub>2</sub> /d
G <sub>s</sub>	12.31	kgO <sub>2</sub> /h Aeration basin gas supply (24h)
G <sub>s</sub>	175.91	m <sup>3</sup> /h
G <sub>s</sub>	2.93	m <sup>3</sup> /min

$$G_{smax} = G_s \times (E_A + 100\%) =$$

Design parameters:		
G <sub>s max</sub>	3.66	m <sup>3</sup> /min
G <sub>s max</sub>	219.88	m <sup>3</sup> /h

## 9.Air pressure required for aeration P (relative pressure)

$$P = h_1 + h_2 + h_3 + h_4 + \Delta h$$

Design parameters:		
h <sub>1</sub> +h <sub>2</sub>	0.2	m(Duct length and local resistance)
h <sub>3</sub>	4.3	m(Aeration head submergence depth)
h <sub>4</sub>	0.3	m(Aerator resistance)
Δh	0.5	m(Have a high head of water)
P	5.3	m(Total air pressure0.53kg/m <sup>2</sup> )