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# Design of Parabolic Grit Chamber Formulas

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# List of 41 Design of Parabolic Grit Chamber Formulas

## Design of Parabolic Grit Chamber

### Parabolic Grit Chamber

#### 1) Area of Parabolic Channel given Width of Parabolic Channel

$$fx \quad A_p = \frac{w \cdot d}{1.5}$$

[Open Calculator !\[\]\(de95854c7ee024cfadc48187bbb781b2\_img.jpg\)](#)

$$ex \quad 3.49864m^2 = \frac{1.299m \cdot 4.04m}{1.5}$$

#### 2) Constant given Discharge for Rectangular Channel Section

$$fx \quad x_o = \left( \frac{Q_e}{d} \right)$$

[Open Calculator !\[\]\(6a9b39b98eb945faa14c645ec99e4eaa\_img.jpg\)](#)

$$ex \quad 9.856436 = \left( \frac{39.82m^3/s}{4.04m} \right)$$



### 3) Flow Area of Throat given Discharge

$$fx \quad F_{\text{area}} = \frac{Q_e}{V_c}$$

[Open Calculator !\[\]\(cbe80b694ebd74fcfe136a095b608235\_img.jpg\)](#)

$$ex \quad 7.869565\text{m}^2 = \frac{39.82\text{m}^3/\text{s}}{5.06\text{m}/\text{s}}$$

### 4) Head Loss given Critical Velocity

$$fx \quad h_f = 0.1 \cdot \left( \frac{(V_c)^2}{2 \cdot g} \right)$$

[Open Calculator !\[\]\(3e2231b1ad3ca8da8658228c00dd08e0\_img.jpg\)](#)

$$ex \quad 0.130631\text{m} = 0.1 \cdot \left( \frac{(5.06\text{m}/\text{s})^2}{2 \cdot 9.8\text{m}/\text{s}^2} \right)$$

### 5) Total Critical Energy

fx

[Open Calculator !\[\]\(0d5ec72f61334709c3fc9450209b754f\_img.jpg\)](#)

$$E_c = \left( d_c + \left( \frac{(V_c)^2}{2 \cdot g} \right) + \left( 0.1 \cdot \left( \frac{(V_c)^2}{2 \cdot g} \right) \right) \right)$$

ex

$$4.056937\text{m} = \left( 2.62\text{m} + \left( \frac{(5.06\text{m}/\text{s})^2}{2 \cdot 9.8\text{m}/\text{s}^2} \right) + \left( 0.1 \cdot \left( \frac{(5.06\text{m}/\text{s})^2}{2 \cdot 9.8\text{m}/\text{s}^2} \right) \right) \right)$$



6) Total Energy at Critical Point [Open Calculator !\[\]\(dfbd6b3763a6d1d9afaa974f64e2e4b5\_img.jpg\)](#)

$$\text{fx } E_c = \left( d_c + \left( \frac{(V_c)^2}{2 \cdot g} \right) + h_f \right)$$

$$\text{ex } 4.056306\text{m} = \left( 2.62\text{m} + \left( \frac{(5.06\text{m/s})^2}{2 \cdot 9.8\text{m/s}^2} \right) + 0.130\text{m} \right)$$

Critical Depth 7) Critical Depth at Different Discharges [Open Calculator !\[\]\(05be7c7a8995decd503647c99211f7c2\_img.jpg\)](#)

$$\text{fx } d_c = \left( \frac{(Q_e)^2}{g \cdot (W_t)^2} \right)^{\frac{1}{3}}$$

$$\text{ex } 2.619658\text{m} = \left( \frac{(39.82\text{m}^3/\text{s})^2}{9.8\text{m/s}^2 \cdot (3\text{m})^2} \right)^{\frac{1}{3}}$$

8) Critical Depth given Depth of Parabolic Channel [Open Calculator !\[\]\(fe3aebe81acea8d45108cd2768939da7\_img.jpg\)](#)

$$\text{fx } d_c = \left( \frac{d}{1.55} \right)$$

$$\text{ex } 2.606452\text{m} = \left( \frac{4.04\text{m}}{1.55} \right)$$



### 9) Critical Depth given Discharge through Control Section

$$fx \quad d_c = \left( \frac{Q_e}{W_t \cdot V_c} \right)$$

[Open Calculator !\[\]\(e2376d476d06eb31946dc01a69a4403a\_img.jpg\)](#)

$$ex \quad 2.623188m = \left( \frac{39.82m^3/s}{3m \cdot 5.06m/s} \right)$$

### 10) Critical Depth given Maximum Discharge

$$fx \quad d_c = \left( \frac{Q_p}{W_t \cdot V_c} \right)$$

[Open Calculator !\[\]\(0b5e7e25e8775f7e7e80906ada4f0021\_img.jpg\)](#)

$$ex \quad 2.619895m = \left( \frac{39.77m^3/s}{3m \cdot 5.06m/s} \right)$$

### 11) Critical Depth in Control Section

$$fx \quad d_c = \left( \frac{(V_c)^2}{g} \right)$$

[Open Calculator !\[\]\(bd3b31712ad9bab5a241210fa6925cdd\_img.jpg\)](#)

$$ex \quad 2.612612m = \left( \frac{(5.06m/s)^2}{9.8m/s^2} \right)$$



## Critical Velocity

### 12) Critical Velocity given Critical Depth in Control Section

$$fx \quad V_c = \sqrt{d_c \cdot g}$$

[Open Calculator !\[\]\(950a62bbddad88d64435fd35607dfc42\_img.jpg\)](#)

$$ex \quad 5.067149\text{m/s} = \sqrt{2.62\text{m} \cdot 9.8\text{m/s}^2}$$

### 13) Critical Velocity given Depth of Section

$$fx \quad V_c = \sqrt{\frac{d \cdot g}{1.55}}$$

[Open Calculator !\[\]\(73002692dd5e7a64e60946be3158e719\_img.jpg\)](#)

$$ex \quad 5.054031\text{m/s} = \sqrt{\frac{4.04\text{m} \cdot 9.8\text{m/s}^2}{1.55}}$$


### 14) Critical Velocity given Discharge

$$fx \quad V_c = \left( \frac{Q_e}{F_{\text{area}}} \right)$$

[Open Calculator !\[\]\(104fbf564e2e5a8fbd84f31656d114c7\_img.jpg\)](#)

$$ex \quad 5.066158\text{m/s} = \left( \frac{39.82\text{m}^3/\text{s}}{7.86\text{m}^2} \right)$$




15) Critical Velocity given Discharge through Control Section 

$$fx \quad V_c = \left( \frac{Q_e}{W_t \cdot d_c} \right)$$

Open Calculator 


$$ex \quad 5.066158\text{m/s} = \left( \frac{39.82\text{m}^3/\text{s}}{3\text{m} \cdot 2.62\text{m}} \right)$$

16) Critical Velocity given Head Loss 

$$fx \quad V_c = \left( \frac{h_f \cdot 2 \cdot g}{0.1} \right)^{\frac{1}{2}}$$

Open Calculator 

$$ex \quad 5.047772\text{m/s} = \left( \frac{0.130\text{m} \cdot 2 \cdot 9.8\text{m/s}^2}{0.1} \right)^{\frac{1}{2}}$$

17) Critical Velocity given Maximum Discharge 

$$fx \quad V_c = \left( \frac{Q_p}{W_t \cdot d_c} \right)$$

Open Calculator 

$$ex \quad 5.059796\text{m/s} = \left( \frac{39.77\text{m}^3/\text{s}}{3\text{m} \cdot 2.62\text{m}} \right)$$

18) Critical Velocity given Total Energy at Critical Point 

$$fx \quad V_c = \sqrt{2 \cdot g \cdot (E_c - (d_c + h_f))}$$

Open Calculator 

$$ex \quad 5.047772\text{m/s} = \sqrt{2 \cdot 9.8\text{m/s}^2 \cdot (4.05\text{m} - (2.62\text{m} + 0.130\text{m}))}$$



## Depth of Channel

### 19) Depth given Critical Velocity

$$\text{fx } d = 1.55 \cdot \left( \frac{(V_c)^2}{g} \right)$$

[Open Calculator !\[\]\(96cc62f861fdd6e50510c0224a756dff\_img.jpg\)](#)

$$\text{ex } 4.049549\text{m} = 1.55 \cdot \left( \frac{(5.06\text{m/s})^2}{9.8\text{m/s}^2} \right)$$

### 20) Depth given Discharge for Rectangular Channel Section

$$\text{fx } d = \frac{Q_e}{x_o}$$

[Open Calculator !\[\]\(f95dab70c751fda7d824b8b03650f7aa\_img.jpg\)](#)

$$\text{ex } 4.040179\text{m} = \frac{39.82\text{m}^3/\text{s}}{9.856}$$

### 21) Depth of Parabolic Channel given Critical Depth

$$\text{fx } d = 1.55 \cdot d_c$$

[Open Calculator !\[\]\(e9474ce1d70442456f8fe9c393ea149c\_img.jpg\)](#)

$$\text{ex } 4.061\text{m} = 1.55 \cdot 2.62\text{m}$$

### 22) Depth of Parabolic Channel given Width of Parabolic Channel

$$\text{fx } d_p = \frac{1.5 \cdot A_{\text{filter}}}{w}$$

[Open Calculator !\[\]\(9db214d549b9aeebe72aa11d3a5c4b1a\_img.jpg\)](#)

$$\text{ex } 57.73672\text{m} = \frac{1.5 \cdot 50.0\text{m}^2}{1.299\text{m}}$$





## Discharge in Channel

### 23) Discharge Coefficient with known Discharge

$$fx \quad C_D = -\log\left(\frac{Q_{th}}{c}, d\right)$$

[Open Calculator !\[\]\(d66ff64371a51729ac8c1cdaa685ba6f\_img.jpg\)](#)

$$ex \quad 0.271095 = -\log\left(\frac{0.04m^3/s}{6.9}, 4.04m\right)$$

### 24) Discharge for Rectangular Channel Section

$$fx \quad Q_e = A_{cs} \cdot \left(R^{\frac{2}{3}}\right) \cdot \frac{i^{\frac{1}{2}}}{n}$$

[Open Calculator !\[\]\(faf942dc3e59ce8eb64b4ac481eca7e0\_img.jpg\)](#)

$$ex \quad 46.2992m^3/s = 3.5m^2 \cdot \left((2.000m)^{\frac{2}{3}}\right) \cdot \frac{(0.01)^{\frac{1}{2}}}{0.012}$$

### 25) Discharge given Critical Depth

$$fx \quad Q_e = \sqrt{\left((d_c)^3\right) \cdot g \cdot (W_t)^2}$$

[Open Calculator !\[\]\(95b425611cbd2b8716a140cf67c81822\_img.jpg\)](#)

$$ex \quad 39.82779m^3/s = \sqrt{\left((2.62m)^3\right) \cdot 9.8m/s^2 \cdot (3m)^2}$$

### 26) Discharge given Flow Area of Throat

$$fx \quad Q_e = F_{area} \cdot V_c$$

[Open Calculator !\[\]\(56549452e01ca28bdf2500ced9653143\_img.jpg\)](#)

$$ex \quad 39.7716m^3/s = 7.86m^2 \cdot 5.06m/s$$



## 27) Discharge Passing through Parshall Flume given Discharge Coefficient

$$fx \quad Q_e = c \cdot (d)^{C_D}$$

[Open Calculator !\[\]\(0f848bbd71cef6b345273b16f905912a\_img.jpg\)](#)

$$ex \quad 10.0594 \text{m}^3/\text{s} = 6.9 \cdot (4.04 \text{m})^{0.27}$$

## 28) Discharge through Control Section

$$fx \quad Q_e = W_t \cdot V_c \cdot d_c$$

[Open Calculator !\[\]\(3211b5d1d968fc1665909b34f9f16010\_img.jpg\)](#)

$$ex \quad 39.7716 \text{m}^3/\text{s} = 3 \text{m} \cdot 5.06 \text{m}/\text{s} \cdot 2.62 \text{m}$$

## 29) Maximum Discharge given Width of Throat

$$fx \quad Q_p = W_t \cdot V_c \cdot d_c$$

[Open Calculator !\[\]\(9c2e8d1b5bd77cb5c9f83b7a9cff79fd\_img.jpg\)](#)

$$ex \quad 39.7716 \text{m}^3/\text{s} = 3 \text{m} \cdot 5.06 \text{m}/\text{s} \cdot 2.62 \text{m}$$

## Width of Channel


## 30) Width of Parabolic Channel

$$fx \quad w = \frac{1.5 \cdot A_{cs}}{d}$$

[Open Calculator !\[\]\(eabd9f9ababee93effadc3b380fe65fd\_img.jpg\)](#)

$$ex \quad 1.299505 \text{m} = \frac{1.5 \cdot 3.5 \text{m}^2}{4.04 \text{m}}$$



31) Width of Throat given Critical Depth [Open Calculator](#) 

$$fx \quad W_t = \sqrt{\frac{(Q_e)^2}{g \cdot (d_c)^3}}$$

$$ex \quad 2.999413m = \sqrt{\frac{(39.82m^3/s)^2}{9.8m/s^2 \cdot (2.62m)^3}}$$

32) Width of Throat given Discharge through Control Section [Open Calculator](#) 

$$fx \quad W_t = \left( \frac{Q_e}{d_c \cdot V_c} \right)$$

$$ex \quad 3.003651m = \left( \frac{39.82m^3/s}{2.62m \cdot 5.06m/s} \right)$$

33) Width of Throat given Maximum Discharge [Open Calculator](#) 

$$fx \quad W_t = \left( \frac{Q_p}{d_c \cdot V_c} \right)$$

$$ex \quad 2.999879m = \left( \frac{39.77m^3/s}{2.62m \cdot 5.06m/s} \right)$$



## Parshall Flume

### 34) Depth of Flow in Parshall Flume given Discharge Coefficient 1.5

$$\text{fx } H_a = \left( \frac{Q_e}{1.5} \right)^{\frac{1}{1.6}}$$

Open Calculator 

$$\text{ex } 7.762583\text{m} = \left( \frac{39.82\text{m}^3/\text{s}}{1.5} \right)^{\frac{1}{1.6}}$$

### 35) Depth of Flow in Upstream Leg of Flume at One Third Point given Discharge

$$\text{fx } d_f = \left( \frac{Q_e}{2.264 \cdot W_t} \right)^{\frac{2}{3}}$$

Open Calculator 

$$\text{ex } 3.25139\text{m} = \left( \frac{39.82\text{m}^3/\text{s}}{2.264 \cdot 3\text{m}} \right)^{\frac{2}{3}}$$

### 36) Depth of Parshall Flume given Discharge

$$\text{fx } d_f = \left( \frac{Q_e}{c} \right)^{\frac{1}{1.6}}$$

Open Calculator 

$$\text{ex } 2.990767\text{m} = \left( \frac{39.82\text{m}^3/\text{s}}{6.9} \right)^{\frac{1}{1.6}}$$



37) Depth of Parshall Flume given Width 

$$fx \quad d_{pf} = (c \cdot w)^{\frac{1}{C_D-1}}$$

[Open Calculator !\[\]\(e2376d476d06eb31946dc01a69a4403a\_img.jpg\)](#)

$$ex \quad 0.049575m = (6.9 \cdot 1.299m)^{\frac{1}{0.27-1}}$$

38) Discharge Passing through Parshall Flume 

$$fx \quad Q_e = \left( 2.264 \cdot W_t \cdot (d_f)^{\frac{3}{2}} \right)$$

[Open Calculator !\[\]\(0b5e7e25e8775f7e7e80906ada4f0021\_img.jpg\)](#)

$$ex \quad 40.71633m^3/s = \left( 2.264 \cdot 3m \cdot (3.3m)^{\frac{3}{2}} \right)$$

39) Width of Parshall Flume given Depth 

$$fx \quad w_p = \frac{(d)^{C_D-1}}{c}$$

[Open Calculator !\[\]\(bd3b31712ad9bab5a241210fa6925cdd\_img.jpg\)](#)

$$ex \quad 0.052299m = \frac{(4.04m)^{0.27-1}}{6.9}$$

40) Width of Parshall Flume given Depth of Parshall Flume 

$$fx \quad w = \sqrt{\frac{d}{c}}$$

[Open Calculator !\[\]\(7bc43b319a082987e20f7bf78f4bab80\_img.jpg\)](#)

$$ex \quad 0.765184m = \sqrt{\frac{4.04m}{6.9}}$$



41) Width of Throat given Discharge [Open Calculator](#) 

$$\text{fx } W_t = \frac{Q_e}{2.264 \cdot (d_f)^{\frac{3}{2}}}$$

$$\text{ex } 2.933958\text{m} = \frac{39.82\text{m}^3/\text{s}}{2.264 \cdot (3.3\text{m})^{\frac{3}{2}}}$$



## Variables Used

- $A_{CS}$  Area of Cross Section (Square Meter)
- $A_{filter}$  Area of Trickling Filter (Square Meter)
- $A_p$  Area of Parabolic Channel (Square Meter)
- $c$  Integration Constant
- $C_D$  Discharge Coefficient
- $d$  Depth (Meter)
- $d_c$  Critical Depth (Meter)
- $d_f$  Depth of Flow (Meter)
- $d_p$  Depth of Parabolic Channel (Meter)
- $d_{pf}$  Depth of Parshall Flume given Width (Meter)
- $E_c$  Energy at Critical Point (Meter)
- $F_{area}$  Flow Area of Throat (Square Meter)
- $g$  Acceleration due to Gravity (Meter per Square Second)
- $H_a$  Depth of Flow in Parshall Flume (Meter)
- $h_f$  Head Loss (Meter)
- $i$  Slope of Bed
- $n$  Manning's Roughness Coefficient
- $n_p$  Constant for a 6-inch Parshall flume
- $Q_e$  Environmental Discharge (Cubic Meter per Second)
- $Q_p$  Peak Discharge (Cubic Meter per Second)
- $Q_{th}$  Theoretical Discharge (Cubic Meter per Second)








- **R** Hydraulic Radius (Meter)
- **V<sub>c</sub>** Critical Velocity (Meter per Second)
- **w** Width (Meter)
- **w<sub>p</sub>** Width of Parshall Flume given Depth (Meter)
- **W<sub>t</sub>** Width of Throat (Meter)
- **x<sub>o</sub>** Constant





## Constants, Functions, Measurements used

- **Function: log**,  $\log(\text{Base}, \text{Number})$   
*Logarithmic function is an inverse function to exponentiation.*
- **Function: sqrt**,  $\text{sqrt}(\text{Number})$   
*A square root function is a function that takes a non-negative number as an input and returns the square root of the given input number.*
- **Measurement: Length** in Meter (m)  
*Length Unit Conversion* 
- **Measurement: Area** in Square Meter ( $\text{m}^2$ )  
*Area Unit Conversion* 
- **Measurement: Speed** in Meter per Second (m/s)  
*Speed Unit Conversion* 
- **Measurement: Acceleration** in Meter per Square Second ( $\text{m}/\text{s}^2$ )  
*Acceleration Unit Conversion* 
- **Measurement: Volumetric Flow Rate** in Cubic Meter per Second ( $\text{m}^3/\text{s}$ )  
*Volumetric Flow Rate Unit Conversion* 



## Check other formula lists

- [Design of Parabolic Grit Chamber Formulas](#) 

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