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Fire Demand Formulas

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List of 11 Fire Demand Formulas

Fire Demand

1) Number of Simultaneous Fire Stream

$$fx \quad F = 2.8 \cdot \sqrt{P}$$

[Open Calculator !\[\]\(a870788d6ed9b8fd294b7654a8c8526b_img.jpg\)](#)

$$ex \quad 10.47664 = 2.8 \cdot \sqrt{14}$$

2) Period of Occurrence of Fire given Quantity of Water

 fx
[Open Calculator !\[\]\(c50c8b7b2cc2cf9ff925edec0ee94c0d_img.jpg\)](#)

$$T = \left(\left(Q_w \cdot \frac{\left(\left(\frac{t_d}{60} \right) + 12 \right)^{0.757}}{4360} \right)^{\frac{1}{0.275}} \right) \cdot 31556952$$

 ex

$$2.999991 \text{ Year} = \left(\left(759.265 \text{ L/min} \cdot \frac{\left(\left(\frac{3 \text{ min}}{60} \right) + 12 \right)^{0.757}}{4360} \right)^{\frac{1}{0.275}} \right) \cdot 31556952$$

3) Population by Buston's Formula given Quantity of Water

$$fx \quad P = \left(\frac{Q}{5663} \right)^2$$

[Open Calculator !\[\]\(235bfe13ebf007ce2eea9e689707fac7_img.jpg\)](#)

$$ex \quad 8.563607 = \left(\frac{16572 \text{ L/min}}{5663} \right)^2$$




4) Population by Freeman's Formula given Quantity of Water 

$$fx \quad P = 5 \cdot \left(\left(\frac{Q}{1136} \right) - 10 \right)$$

Open Calculator 


$$ex \quad 22.94014 = 5 \cdot \left(\left(\frac{16572L/min}{1136} \right) - 10 \right)$$

5) Population by Kuichling's Formula given Quantity of Water 

$$fx \quad P = \left(\frac{Q}{3182} \right)^2$$

Open Calculator 

$$ex \quad 27.12374 = \left(\frac{16572L/min}{3182} \right)^2$$

6) Population given Number of Simultaneous Fire Stream 

$$fx \quad P = \left(\frac{F}{2.8} \right)^2$$

Open Calculator 

$$ex \quad 28.69898 = \left(\frac{15}{2.8} \right)^2$$

7) Quantity of Water by Buston's Formula 

$$fx \quad Q = \left(5663 \cdot \sqrt{P} \right)$$

Open Calculator 

$$ex \quad 21189.01L/min = \left(5663 \cdot \sqrt{14} \right)$$



8) Quantity of Water by Freeman's Formula [Open Calculator](#) 


$$fx \quad Q = 1136 \cdot \left(\left(\frac{P}{5} \right) + 10 \right)$$

$$ex \quad 14540.8L/min = 1136 \cdot \left(\left(\frac{14}{5} \right) + 10 \right)$$

9) Quantity of Water by Kuichling's Formula [Open Calculator](#) 


$$fx \quad Q = 3182 \cdot \sqrt{P}$$

$$ex \quad 11905.95L/min = 3182 \cdot \sqrt{14}$$

10) Quantity of Water by National Board of Fire Underwriters [Open Calculator](#) 

$$fx \quad Q = 4637 \cdot \sqrt{P} \cdot \left(1 - \left(0.01 \cdot \sqrt{P} \right) \right)$$

$$ex \quad 16700.89L/min = 4637 \cdot \sqrt{14} \cdot \left(1 - \left(0.01 \cdot \sqrt{14} \right) \right)$$

11) Quantity of Water given Duration of Fire [Open Calculator](#) 

$$fx \quad Q_w = \frac{4360 \cdot \left(\frac{T}{31556952} \right)^{0.275}}{\left(\left(\frac{t_d}{60} \right) + 12 \right)^{0.757}}$$

$$ex \quad 759.2656L/min = \frac{4360 \cdot \left(\frac{3Year}{31556952} \right)^{0.275}}{\left(\left(\frac{3min}{60} \right) + 12 \right)^{0.757}}$$



Variables Used

- **F** Number of Fire Streams
- **P** Population in Thousands
- **Q** Quantity of Water in Liters Per Minute (*Liter per minute*)
- **Q_w** Quantity of Water (*Liter per minute*)
- **T** Time Period (*Year*)
- **t_d** Time Duration (*Minute*)



Constants, Functions, Measurements used

- **Function:** **sqrt**, sqrt(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:** **Time** in Year (Year), Minute (min)





















Time Unit Conversion 

- **Measurement:** **Volumetric Flow Rate** in Liter per minute (L/min)

Volumetric Flow Rate Unit Conversion 



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