



Fuel Injection in IC Engine Formulas

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Conversions!

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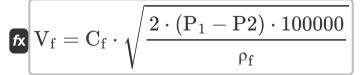




List of 12 Fuel Injection in IC Engine Formulas

Fuel Injection in IC Engine &

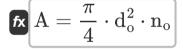
1) Actual Fuel Velocity of Injection Considering Orifice Flow Coefficient



Open Calculator 🗗

ex
$$138.0537 \mathrm{m/s} = 0.9 \cdot \sqrt{\frac{2 \cdot (140 \mathrm{Pa} - 40 \mathrm{Pa}) \cdot 1000000}{850 \mathrm{kg/m^3}}}$$

2) Area of all Orifices of Fuel Injectors



Open Calculator

- 3) Energy Content per Unit Cylinder Volume of Mixture Formed in Cylinder of Diesel Engine

$$\mathbf{H}_{\mathrm{de}} = rac{
ho \cdot LHV_f}{\lambda \cdot R_{af}}$$

Open Calculator

$$ext{ex} 0.586395 ext{MJ/m}^{_3} = rac{1.293 ext{kg/m}^{_3} \cdot 10 ext{MJ/m}^{_3}}{1.5 \cdot 14.7}$$





4) Energy Content Per Unit Cylinder Volume of Mixture Formed Prior to Induction into Cylinder

 $\mathbf{H}_{\mathrm{p}} = \frac{\rho_{\mathrm{mix}} \cdot \mathrm{LHV_{\mathrm{f}}}}{\lambda \cdot \mathrm{Ref} + 1}$

Open Calculator 2

Open Calculator

Open Calculator

Open Calculator

 $ext{ex} 347.0716 ext{MJ/m}^3 = rac{800 ext{kg/m}^3 \cdot 10 ext{MJ/m}^3}{1.5 \cdot 14.7 + 1}$

5) Fuel Consumption Per Cycle

 $ext{FC}_{ ext{c}} = rac{ ext{FC}}{60 \cdot ext{N}_{ ext{c}}}$

- 6) Fuel Consumption per Cylinder
- $ext{FC} = rac{ ext{FC}_{ ext{h}}}{ ext{n}_{ ext{o}}}$

 $oxed{ex} 0.000417 \mathrm{kg/s} = rac{9 \mathrm{kg/h}}{c}$

- 7) Fuel Consumption Per Hour in Diesel Engine 🗗
- $\mathbf{fx} | \mathrm{FC_h} = \mathrm{BSFC} \cdot \mathrm{BP}$

ex $8.99505 {
m kg/h} = 0.405 {
m kg/h/W} \cdot 22.21 {
m W}$





8) Fuel Velocity at Time of Release into Engine Cylinder

 $\left| \mathbf{V}_2 = \sqrt{2 \cdot \mathrm{v_f} \cdot \left(\mathrm{P}_1 - \mathrm{P}2
ight)}
ight|$

Open Calculator

Open Calculator

Open Calculator 2

Open Calculator

 $ext{ex} 15.36229 ext{m/s} = \sqrt{2 \cdot 1.18 ext{m}^3/ ext{kg} \cdot (140 ext{Pa} - 40 ext{Pa})}$

9) Number of Fuel Injections Per Minute for Four Stroke Engine

 $N_{
m i}=rac{\omega_{
m e}}{2}$

 $261.7994 = \frac{5000 \text{rev/min}}{2}$

10) Total Time Taken for Fuel Injection in One Cycle

 $ag{T_{
m f}} = rac{ heta}{360} \cdot rac{60}{\omega_{
m e}}$

 $oxed{ex} 0.000167 ext{s} = rac{30^\circ}{360} \cdot rac{60}{5000 ext{rev/min}}$

11) Volume of Fuel Injected Per Cycle 🗗

 $V_{
m c} = rac{{
m FC}_{
m c}}{{
m S}_{
m g}}$

 $ext{ex} 0.051765 ext{m}^{\scriptscriptstyle 3} = rac{0.044 ext{kg}}{0.85}$

12) Volume of Fuel Injected Per Second in Diesel Engine 🚰

Open Calculator



$$=$$
 $4.22341 \mathrm{m}^{_3} = 42 \mathrm{m}^{_2} \cdot 138 \mathrm{m/s} \cdot 0.000167 \mathrm{s} \cdot rac{261.8}{60}$



Variables Used

- A Area of All Orifices of Fuel Injectors (Square Meter)
- **BP** Brake Power (Watt)
- BSFC Brake Specific Fuel Consumption (Kilogram per Hour per Watt)
- Cf Flow Coefficient of Orifice
- d_o Diameter of Fuel Orifice (Meter)
- FC Fuel Consumption per Cylinder (Kilogram per Second)
- **FC**_c Fuel Consumption per Cycle (*Kilogram*)
- FC_h Fuel Consumption per Hour (Kilogram per Hour)
- H_{de} Energy Content per Unit Cylinder in Diesel Engine (Megajoule per Cubic Meter)
- H_p Energy Content per Unit Cylinder (Megajoule per Cubic Meter)
- LHV_f Lower Heating Value of Fuel (Megajoule per Cubic Meter)
- N Number of Cycles per Minute
- Ni Number of Injections per Minute
- n_o Number of Orifices
- P₁ Injection Pressure (Pascal)
- P2 Pressure in Cylinder during Fuel Injection (Pascal)
- Qf Volume of Fuel Injected per Second (Cubic Meter)
- Raf Stoichiometric Air Fuel Ratio
- S_α Specific Gravity of Fuel
- T_f Total Time Taken for Fuel Injection (Second)





- V₂ Fuel Velocity at Tip of Nozzle (Meter per Second)
- **V**_C Volume of Fuel Injected per Cycle (*Cubic Meter*)
- **V**_f Specific Volume of Fuel (Cubic Meter per Kilogram)
- **V**_f Actual Fuel Velocity of Injection (Meter per Second)
- θ Time of Fuel Injection in Crank Angle (Degree)
- λ Relative Air Fuel Ratio
- Density of Air (Kilogram per Cubic Meter)
- **P**f Density of Fuel (Kilogram per Cubic Meter)
- ρ_{mix} Density of Mixture (Kilogram per Cubic Meter)
- We Engine RPM (Revolution per Minute)





Constants, Functions, Measurements used

- Constant: pi, 3.14159265358979323846264338327950288
 Archimedes' constant
- 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: Length in Meter (m)

 Length Unit Conversion
- Measurement: Weight in Kilogram (kg)
 Weight Unit Conversion
- Measurement: Time in Second (s)

 Time Unit Conversion
- Measurement: Volume in Cubic Meter (m³)
 Volume Unit Conversion
- Measurement: Area in Square Meter (m²)
 Area Unit Conversion
- Measurement: Pressure in Pascal (Pa)
 Pressure Unit Conversion
- Measurement: Speed in Meter per Second (m/s)
 Speed Unit Conversion
- Measurement: Power in Watt (W)
 Power Unit Conversion
- Measurement: Angle in Degree (°)

 Angle Unit Conversion
- Measurement: Mass Flow Rate in Kilogram per Second (kg/s), Kilogram per Hour (kg/h)







- Measurement: Angular Velocity in Revolution per Minute (rev/min)
 Angular Velocity Unit Conversion
- Measurement: Density in Kilogram per Cubic Meter (kg/m³)
 Density Unit Conversion
- Measurement: Specific Volume in Cubic Meter per Kilogram (m³/kg)
 Specific Volume Unit Conversion
- Measurement: Energy Density in Megajoule per Cubic Meter (MJ/m³)
 Energy Density Unit Conversion
- Measurement: Specific Fuel Consumption in Kilogram per Hour per Watt (kg/h/W)
 - Specific Fuel Consumption Unit Conversion





Check other formula lists

• Air-Standard Cycles Formulas • Fuel Injection in IC Engine Formulas

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