

Important Turbofans Formulas PDF



Formulas Examples with Units

List of 10 Important Turbofans Formulas

1) Bypass Exhaust Velocity given Turbofan Thrust Formula ↻

Formula

$$V_{j,b} = \frac{T - m_c \cdot (V_{j,c} - V)}{\dot{m}_b} + V$$

Evaluate Formula ↻

Example with Units

$$249.9922 \text{ m/s} = \frac{17.8 \text{ kN} - 43 \text{ kg/s} \cdot (300 \text{ m/s} - 198 \text{ m/s})}{258 \text{ kg/s}} + 198 \text{ m/s}$$

2) Bypass Mass Flow Rate Formula ↻

Formula

$$\dot{m}_b = m_a - m_c$$

Example with Units

$$258 \text{ kg/s} = 301 \text{ kg/s} - 43 \text{ kg/s}$$

Evaluate Formula ↻

3) Bypass Mass Flow Rate given Turbofan Thrust Formula ↻

Formula

$$\dot{m}_b = \frac{T - m_c \cdot (V_{j,c} - V)}{V_{j,b} - V}$$

Example with Units

$$257.9615 \text{ kg/s} = \frac{17.8 \text{ kN} - 43 \text{ kg/s} \cdot (300 \text{ m/s} - 198 \text{ m/s})}{250 \text{ m/s} - 198 \text{ m/s}}$$

Evaluate Formula ↻

4) Bypass Ratio Formula ↻

Formula

$$\text{bpr} = \frac{\dot{m}_b}{m_c}$$

Example with Units

$$6 = \frac{258 \text{ kg/s}}{43 \text{ kg/s}}$$

Evaluate Formula ↻

5) Cooling Effectiveness Formula ↻

Formula

$$\epsilon = \frac{T_g - T_m}{T_g - T_c}$$

Example with Units

$$0.6494 = \frac{1400 \text{ K} - 900 \text{ K}}{1400 \text{ K} - 630 \text{ K}}$$

Evaluate Formula ↻



6) Core Exhaust Velocity given Turbofan Thrust Formula

Formula

$$V_{j,c} = \frac{T - \dot{m}_b \cdot (V_{j,b} - V)}{\dot{m}_c} + V$$

Evaluate Formula 

Example with Units

$$299.9535 \text{ m/s} = \frac{17.8 \text{ kN} - 258 \text{ kg/s} \cdot (250 \text{ m/s} - 198 \text{ m/s})}{43 \text{ kg/s}} + 198 \text{ m/s}$$

7) Mass flow rate hot primary engine Formula

Formula

$$\dot{m}_c = \dot{m}_a - \dot{m}_b$$

Example with Units

$$43 \text{ kg/s} = 301 \text{ kg/s} - 258 \text{ kg/s}$$

Evaluate Formula 

8) Primary Mass flow Rate in Turbofan Engine Formula

Formula

$$\dot{m}_c = \frac{T - \dot{m}_b \cdot (V_{j,b} - V)}{V_{j,c} - V}$$

Example with Units

$$42.9804 \text{ kg/s} = \frac{17.8 \text{ kN} - 258 \text{ kg/s} \cdot (250 \text{ m/s} - 198 \text{ m/s})}{300 \text{ m/s} - 198 \text{ m/s}}$$

Evaluate Formula 

9) Total mass flow rate through turbofan engine Formula

Formula

$$\dot{m}_a = \dot{m}_c + \dot{m}_b$$

Example with Units

$$301 \text{ kg/s} = 43 \text{ kg/s} + 258 \text{ kg/s}$$

Evaluate Formula 

10) Turbofan thrust Formula

Formula

$$T = \dot{m}_c \cdot (V_{j,c} - V) + \dot{m}_b \cdot (V_{j,b} - V)$$

Evaluate Formula 

Example with Units

$$17.802 \text{ kN} = 43 \text{ kg/s} \cdot (300 \text{ m/s} - 198 \text{ m/s}) + 258 \text{ kg/s} \cdot (250 \text{ m/s} - 198 \text{ m/s})$$



Variables used in list of Turbofans Formulas above

- **bpr** Bypass Ratio
- **m_a** Mass Flow Rate (Kilogram per Second)
- **m_b** Mass Flow Rate Bypass (Kilogram per Second)
- **m_c** Mass Flow Rate Core (Kilogram per Second)
- **T** Turbofan Thrust (Kilonewton)
- **T_c** Temperature of Cooling Air (Kelvin)
- **T_g** Temperature of Hot Gas Stream (Kelvin)
- **T_m** Temperature of Metal (Kelvin)
- **V** Flight Speed (Meter per Second)
- **V_{j,b}** Exit Velocity Bypass Nozzle (Meter per Second)
- **V_{j,c}** Exit Velocity Core Nozzle (Meter per Second)
- **ε** Cooling Effectiveness

Constants, Functions, Measurements used in list of Turbofans Formulas above

- **Measurement: Temperature** in Kelvin (K)
Temperature Unit Conversion 
- **Measurement: Speed** in Meter per Second (m/s)
Speed Unit Conversion 
- **Measurement: Force** in Kilonewton (kN)
Force Unit Conversion 
- **Measurement: Mass Flow Rate** in Kilogram per Second (kg/s)
Mass Flow Rate Unit Conversion 



Download other Important Jet Propulsion PDFs

- [Important Turbofans Formulas](#) 
- [Important Turbojets Formulas](#) 

Try our Unique Visual Calculators

-  [Percentage share](#) 
-  [HCF of two numbers](#) 
-  [Improper fraction](#) 

Please SHARE this PDF with someone who needs it!

This PDF can be downloaded in these languages

[English](#) [Spanish](#) [French](#) [German](#) [Russian](#) [Italian](#) [Portuguese](#) [Polish](#) [Dutch](#)

7/8/2024 | 7:42:27 AM UTC

