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Weight Estimation Formulas

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List of 17 Weight Estimation Formulas

Weight Estimation

1) Fuel Load from Unity Equation

Open Calculator

fx $$W_f = W_{TO} - (W_E + W_P)$$

ex $$29244\text{kg} = 45000\text{kg} - (8890\text{kg} + 6866\text{kg})$$

2) Gross weight

Open Calculator

fx $$W_G = W_E + W_U$$

ex $$16755\text{kg} = 8890\text{kg} + 7865\text{kg}$$

3) Landing Weight given Take Off Weight and Mission Fuel Weight

Open Calculator

fx $$W_L = W_{TO} - W_f$$

ex $$16756\text{kg} = 45000\text{kg} - 28244\text{kg}$$

4) Landing Weight given Zero Fuel Weight and Reserve Fuel Weight

Open Calculator

fx $$W_L = W_{ZF} + W_{RF}$$

ex $$16756\text{kg} = 15756\text{kg} + 1000\text{kg}$$

5) Maximum take off weight

Open Calculator

fx $$\mathrm{MTOW} = \frac{\mathrm{W_P}}{1 - \left(\left(\frac{\mathrm{W_E}}{\mathrm{W_{TO}}}\right) + \left(\frac{\mathrm{W_f}}{\mathrm{W_{TO}}}\right)\right)}$$

ex $$39279.18\mathrm{kg} = \frac{6866\mathrm{kg}}{1 - \left(\left(\frac{8890\mathrm{kg}}{45000\mathrm{kg}}\right) + \left(\frac{28244\mathrm{kg}}{45000\mathrm{kg}}\right)\right)}$$

6) Mission Fuel given Take Off, Reserve and Zero Fuel Weight

Open Calculator

fx $$\mathrm{W_f} = \mathrm{W_{TO}} - \mathrm{W_{ZF}} - \mathrm{W_{RF}}$$

ex $$28244\mathrm{kg} = 45000\mathrm{kg} - 15756\mathrm{kg} - 1000\mathrm{kg}$$

7) Operating Empty Weight

Open Calculator

fx $$\mathrm{W_E} = \mathrm{W_G} - \mathrm{W_U}$$

ex $$8890\mathrm{kg} = 16755\mathrm{kg} - 7865\mathrm{kg}$$

8) Operating Empty Weight considering Zero Fuel Weight

Open Calculator

fx $$\mathrm{W_E} = \mathrm{W_{ZF}} - \mathrm{W_P}$$

ex $$8890\mathrm{kg} = 15756\mathrm{kg} - 6866\mathrm{kg}$$

9) Operating Empty Weight from Unity Equation

Open Calculator

fx $$\mathrm{W_E} = \mathrm{W_{TO}} - (\mathrm{W_P} + \mathrm{W_f})$$

ex $$9890\mathrm{kg} = 45000\mathrm{kg} - (6866\mathrm{kg} + 28244\mathrm{kg})$$

10) Payload of aircraft

Open Calculator

$$W_P = W_{ZF} - W_E$$

$$6866\text{kg} = 15756\text{kg} - 8890\text{kg}$$

11) Payload Weight from Unity Equation

Open Calculator

$$W_P = W_{TO} - W_E - W_f$$

$$7866\text{kg} = 45000\text{kg} - 8890\text{kg} - 28244\text{kg}$$

12) Take Off Weight from Unity Equation

Open Calculator

$$W_{TO} = W_E + W_P + W_f$$

$$44000\text{kg} = 8890\text{kg} + 6866\text{kg} + 28244\text{kg}$$

13) Take Off Weight given Reserve, Mission and Zero Fuel Weight

Open Calculator

$$W_{TO} = W_{ZF} + W_{RF} + W_f$$

$$45000\text{kg} = 15756\text{kg} + 1000\text{kg} + 28244\text{kg}$$

14) Useful Load

Open Calculator

$$W_U = W_G - W_E$$

$$7865\text{kg} = 16755\text{kg} - 8890\text{kg}$$

15) Zero fuel weight

Open Calculator

fx $W_{ZF} = W_E + W_P$

ex $15756\text{kg} = 8890\text{kg} + 6866\text{kg}$

16) Zero Fuel Weight given Mission Fuel, Reserve and Take Off Weight

Open Calculator

fx $W_{ZF} = W_{TO} - W_f - W_{RF}$

ex $15756\text{kg} = 45000\text{kg} - 28244\text{kg} - 1000\text{kg}$

17) Zero Fuel Weight given Reserve and Landing Weight

Open Calculator

fx $W_{ZF} = W_L - W_{RF}$

ex $15756\text{kg} = 16756\text{kg} - 1000\text{kg}$

Variables Used

- **MTOW** Maximum Take Off Weight *(Kilogram)*
- W_E Operating Empty Weight *(Kilogram)*
- W_f Fuel Load *(Kilogram)*
- W_G Gross Weight *(Kilogram)*
- W_L Landing Weight *(Kilogram)*
- W_P Payload *(Kilogram)*
- W_{RF} Reserve Fuel *(Kilogram)*
- W_{TO} Takeoff Weight *(Kilogram)*
- W_U Useful Weight *(Kilogram)*
- W_{ZF} Zero Fuel Weight *(Kilogram)*

Constants, Functions, Measurements used

- Measurement: **Weight** in Kilogram (kg)
  Weight Unit Conversion

Check other formula lists

- **Aerodynamic Design Formulas** **Weight Estimation Formulas**
- **Structural Design Formulas**

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