

Requirements and Calculations of the Rocket Engine

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System Requirements/Specifications

Requirement	Value	From?
Thrust	900 N	Rocket Weight
Specific Impulse	250 s	Previous Engines using IPA and N2O
Tank Pressure	5127 kPa	Material Characteristic (Vapor Pressure at 20 C)
Weight Flow Rate	3.6 N/s	Calculated

Deriving the weight flow rate

Specific Impulse Equation: $I_{sp} = \frac{T}{\dot{m}g_0} \rightarrow$ Weight Flow Version: $\dot{W} = \dot{m}g_0 = \frac{T}{I_{sp}}$

Solve: $\dot{W} = \frac{900N}{250s} = 3.6N/s$

Deriving Oxidizer/Fuel Ratio

Ideal Reaction: $C_3H_8O + 9N_2O \rightarrow 3CO_2 + 4H_2O + 9N_2$

In reality the reaction is more complicated. the heat of reaction causes many radicals and exotic species that can be calculated but are ignored for simplicity.

O/F Ratio of 9 (9 Moles of N2O for 1 mole of C3H8O).

$$M_{N_2O} = 2 * 14 + 16 = 44$$

$$M_{C_3H_8O} = 3 * 12 + 8 * 1 + 16 = 60$$