Engine name: RS-68A

Sat Nov 8 11:59:42 2014

Propellant Specification

Component	Temperature (K)	Mass fraction	Mole fraction
H2(L)	20.27	0.14	0.73
O2(L)	90.17	0.86	0.27
	Total	1.00	1.00

Exploded propellant formula: $O_{0.549}\ H_{1.451}$

O/F = 6.000

O/F^0 = 7.937 (stoichiometric)

α_{ox} = 0.756 (oxidizer excess coefficient)

Table 1. Thermodynamic properties

Parameter	Injector	Nozzle inlet	Nozzle throat	Nozzle exit	Unit
Pressure	10.2500	10.2500	5.9010	0.0501	MPa
Temperature	3526.4324	3526.4324	3325.3627	1672.0785	K
Enthalpy	-986.3083	-986.3083	-2143.7175	-9202.2863	kJ/kg
Entropy	17.5979	17.5979	17.5979	17.5979	kJ/(kg·K)
Specific heat (p=const)	8.2029	8.2029	7.5024	3.2137	kJ/(kg·K)
Specific heat (V=const)	7.0177	7.0177	6.4490	2.6235	kJ/(kg·K)
Gas constant	0.6152	0.6152	0.6088	0.5892	kJ/(kg·K)
Molecular weight	13.5161	13.5161	13.6563	14.1105	
Isentropic exponent	1.1427	1.1427	1.1433	1.2249	
Density	4.7251	4.7251	2.9146	0.0509	kg/m³
Sonic velocity	1574.4462	1574.4462	1521.4532	1098.5689	m/s
Velocity	0.0000	0.0000	1521.4532	4053.6349	m/s
Mach number	0.0000	0.0000	1.0000	3.6899	
Area ratio	infinity	infinity	1.0000	21.5000	
Mass flux	0.0000	0.0000	4434.4977	206.3268	kg/(m²·s)

Table 2. Fractions of the combustion products

Species	Injector mass fractions	Injector mole fractions	Nozzle inlet mass fractions	Nozzle inlet mole fractions	Nozzle throat mass fractions	Nozzle throat mole fractions	Nozzle exit mass fractions	Nozzle exit mole fractions
H	0.0023022	0.0308713	0.0023022	0.0308713	0.0018558	0.0251438	0.0000056	0.0000788

Species	Injector mass fractions	Injector mole fractions	Nozzle inlet mass fractions	Nozzle inlet mole fractions	Nozzle throat mass fractions	Nozzle throat mole fractions	Nozzle exit mass fractions	Nozzle exit mole fractions
H2	0.0369896	0.2480091	0.0369896	0.2480091	0.0361987	0.2452239	0.0348549	0.2439728
H2O	0.8975643	0.6734066	0.8975643	0.6734066	0.9155926	0.6940582	0.9651231	0.7559348
H2O2	0.0000320	0.0000127	0.0000320	0.0000127	0.0000160	0.0000064		
HO2	0.0000804	0.0000329	0.0000804	0.0000329	0.0000392	0.0000162		
O	0.0033383	0.0028202	0.0033383	0.0028202	0.0020937	0.0017871		
O2	0.0069627	0.0029410	0.0069627	0.0029410	0.0045987	0.0019626		
OH	0.0527303	0.0419061	0.0527303	0.0419061	0.0396052	0.0318017	0.0000164	0.0000136

Table 3. Theoretical (ideal) performance

Parameter	Sea level	Optimum expansion	Vacuum	Unit
Characteristic velocity		2311.42		m/s
Effective exhaust velocity	3805.60	4053.63	4296.69	m/s
Specific impulse (by mass)	3805.60	4053.63	4296.69	N·s/kg
Specific impulse (by weight)	388.06	413.36	438.14	s
Thrust coefficient	1.6464	1.7537	1.8589	

Table 4. Estimated delivered performance

Parameter	Sea level	Optimum expansion	Vacuum	Unit
Characteristic velocity		2293.15		m/s
Effective exhaust velocity	3673.81	3921.85	4164.90	m/s
Specific impulse (by mass)	3673.81	3921.85	4164.90	N·s/kg
Specific impulse (by weight)	374.62	399.92	424.70	s
Thrust coefficient	1.6021	1.7102	1.8162	

Ambient condition for optimum expansion: H=5.56 km, p=0.495 atm