

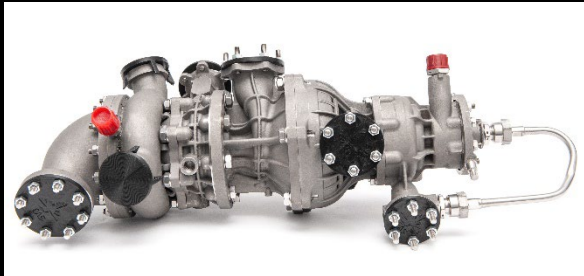


FlightControl
P R O P U L S I O N

FLIGHT CONTROL PROPULSION PUMPS

Turbopump for 3tf staged combustion cycle engine

Fuel – kerosene, oxidizer – liquid oxygen. Structurally, the turbopump includes: turbine with oxidizer pump, fuel pumps assembly (main and preburner pumps) with an integrated electric generator. All the body parts, impellers and the turbine wheel are manufactured by the method of 3D-printing.

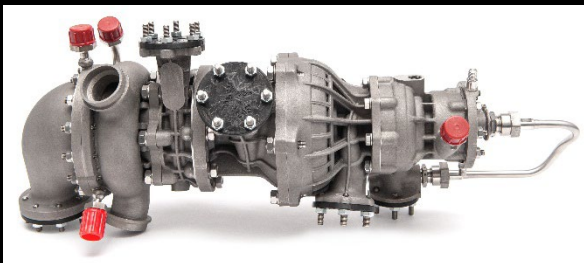


General characteristics

Parameter	Value
Overall dimensions, mm	190x230x562
Mass, kg	13

Turbine

Parameter	Value
Pressure ratio	1.8
Gas temperature, K	732

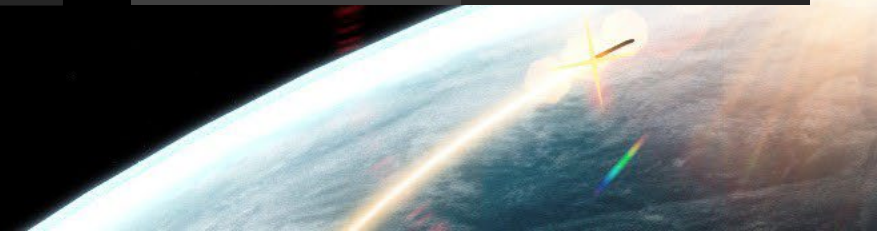


Oxidizer & Fuel pumps

Parameter	Oxidizer Pump	Main fuel pump	Preburner fuel pump
Flowrate, m ³ /s	0.005525	0.002693	0.18848
Head, J/kg	21882	19040	8511

Electric generator

Parameter	Value
Type	PMSG (Permanent magnet synchronous generator)
Rated Power, kW	4



Turbopump for 7tf staged combustion cycle engine

Fuel – kerosene, oxidizer – liquid oxygen. Structurally, the turbopump is composed of two units – turbine with the oxidizer pump and fuel pumps (main and preburner pumps) with the starting turbine. All the body parts, impellers and the turbine wheel are manufactured by the method of 3D-printing.



General characteristics

Parameter	Value
Overall dimensions, mm	350x313x894
Mass, kg	38

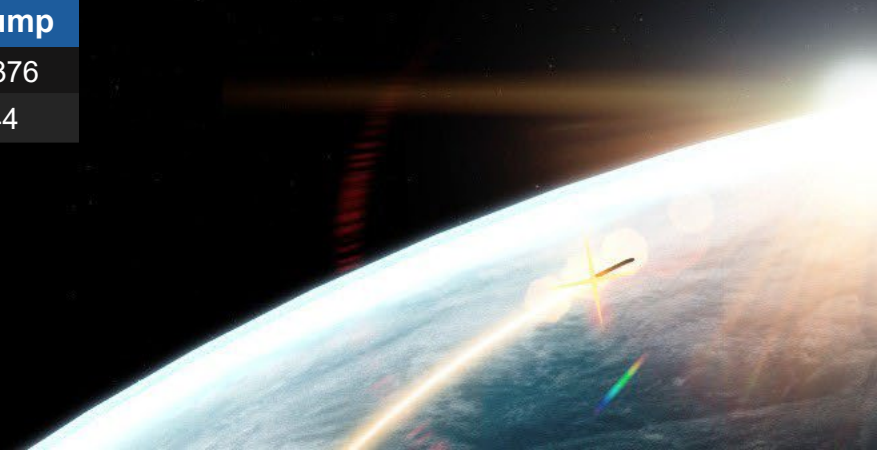
Turbine

Parameter	Value
Pressure ratio	1.93
Gas temperature, K	690



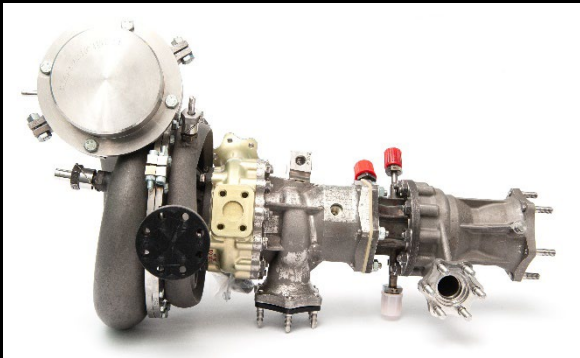
Oxidizer & Fuel pumps

Parameter	Oxidizer Pump	Main fuel pump	Preburner fuel pump
Flowrate, m ³ /s	0.01681	0.008	0.000376
Head, J/kg	21494	23750	11144



Turbopump for 7tf gas generator cycle engine

Fuel – kerosene, oxidizer – liquid oxygen. It has high efficiency due to the relatively high rotor speed. All the body parts, impellers and the turbine wheel are manufactured by the method of 3D-printing.

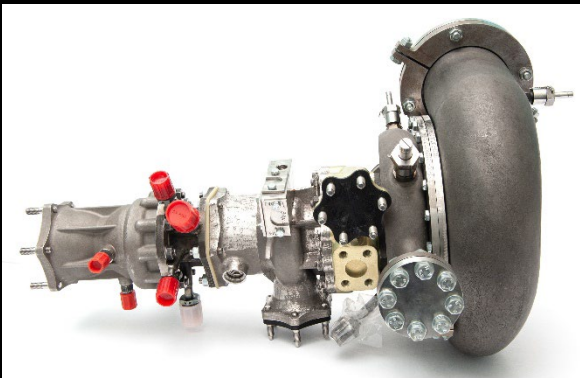


General characteristics

Parameter	Value
Overall dimensions, mm	310x330x555
Mass, kg	16

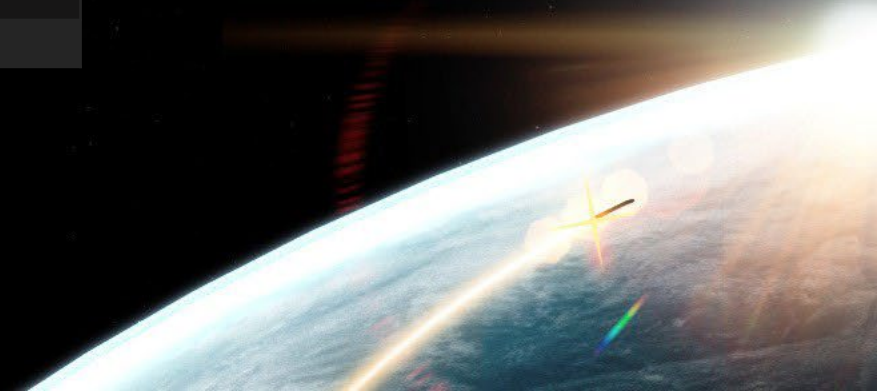
Turbine

Parameter	Value
Pressure ratio	33.3
Gas temperature, K	1048



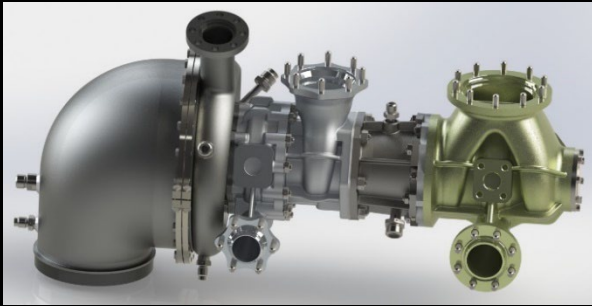
Oxidizer & Fuel pumps

Parameter	Oxidizer Pump	Fuel pump
Flowrate, m ³ /s	0.0117	0.009
Head, J/kg	9097	18410



Turbopump for 17.5 tf gas generator cycle engine

Fuel – kerosene, oxidizer – liquid oxygen. It has high efficiency due to the relatively high rotor speed. All the body parts, impellers and the turbine wheel are manufactured by the method of 3D-printing.

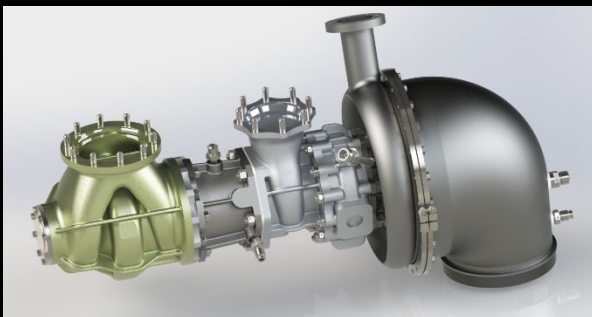


General characteristics

Parameter	Value
Overall dimensions, mm	365x310x710
Mass, kg	26

Turbine

Parameter	Value
Pressure ratio	31.8
Gas temperature, K	1048

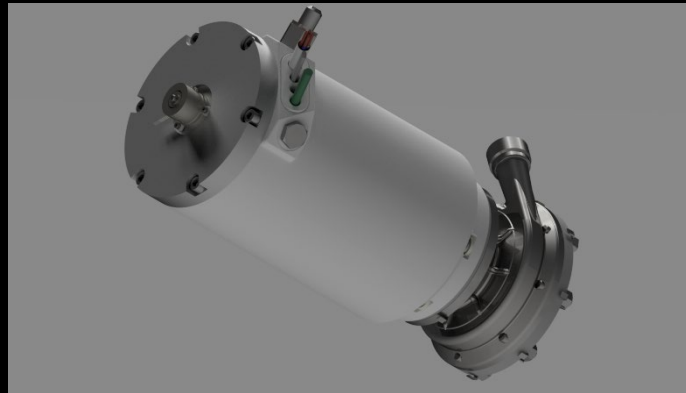
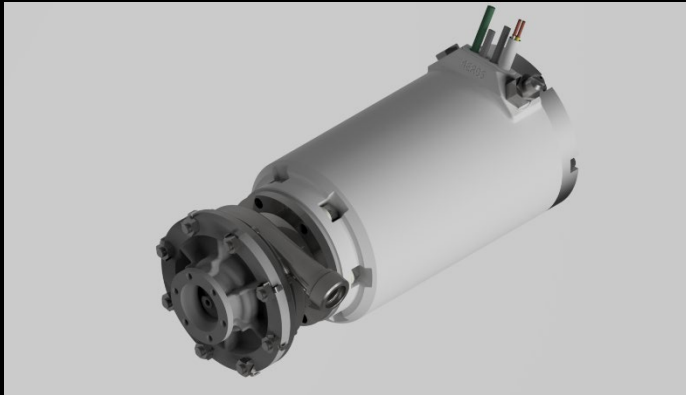


Oxidizer & Fuel pumps

Parameter	Oxidizer Pump	Fuel pump
Flowrate, m ³ /s	0.03865	0.0249
Head, J/kg	10777	16404

E-pumps for 1 tf electric-pump-fed engine

Fuel – liquid methane, oxidizer – liquid oxygen. Each pump is driven by a separate electric motor PMSM – Permanent Magnet Synchronous Motors.



General characteristics

Parameter	Oxidizer E-pumps	Fuel E-pumps
Length, mm	290	290
Diameter, mm	110	110
Mass, kg	8.7	9.2

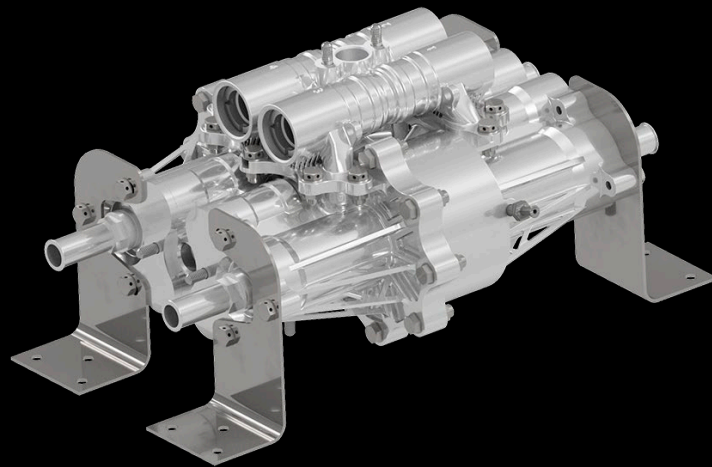
Oxidizer & Fuel E-pumps

Parameter	Oxidizer Pump	Fuel pump
Flowrate, m ³ /s	0.0022	0.0017
Head, J/kg	5322	13890

Pneumatic pump unit

Fuel – unsymmetrical dimethylhydrazine, oxidizer – nitrogen tetroxide. Pneumatic pump unit is used to supply propellants to the LV upper stages and booster stages by converting compressed gas energy into liquid energy.

General characteristics



Parameter	Value
Pilot gas	helium, T= from +50 to +80°C
Fuel inlet pressure, kgf/cm ²	15
Oxidizer inlet pressure, kgf/cm ²	15
Pilot gas pressure, kgf/cm ²	22
Fuel flowrate, kg/s	0.395
Oxidizer flowrate, kg/s	0.890
Fuel outlet pressure, kgf/cm ²	56
Oxidizer outlet pressure, kgf/cm ²	56
Efficiency, not less than	0.77
Pumps frequency, Hz	9.86
Volumetric mixture ratio	1.23
Passage conventional diameter, mm:	
Pilot line	12
Oxidizer and fuel inlets	12
Oxidizer outlet	12
Fuel outlet	11
Mass, kg	5.8