Case name: water cooled demo

Description:

Tue Dec 3 15:57:47 2024

Table 1. Propellant Specification

Component	Temperature, K	Pressure, MPa	Enthalpy, kJ/mol	Enthalpy, kJ/kg	Mass fraction
C2H5OH(L)	298.1	0.1013	-277.5087	-6023.834	0.4166667
O2(L)	90.2	0.1013	-12.9790	-405.608	0.5833333
Total			-100.7003	-2746.535	

Propellant exploded formula:

$C_{0.663225}\ H_{1.989674}\ O_{1.668388}$ (based on 1 mole)

$C_{15.347852}\ H_{46.043555}\ O_{38.608593}$ (by mass %)

α: 0.6718568 (oxidizer excess coefficient)

O/F: 1.4000000

O/F_0: 2.0837775 (stoichiometric)

rho: 932.61012 kg/m^3

Table 2. Combustion Properties

Parameter	Injector	Nozzle inlet	Nozzle throat	Nozzle exit	Unit
Pressure	2.4132	2.4085	1.3824	0.0703	MPa
Temperature	3121.0926	3120.6875	2926.3330	1868.8015	K
Enthalpy	-59322.7744	-59348.2072	-73854.3295	-134482.5749	J/mol
	-2746.5364	-2747.6887	-3391.1607	-6082.7695	kJ/kg
Entropy	262.9555	262.9659	265.1472	269.1684	J/(mol·K)
	12.1744	12.1747	12.1747	12.1747	kJ/(kg·K)
Internal energy	-85273.0117	-85295.0759	-98185.2431	-150020.6723	J/mol
	-3947.9850	-3948.9704	-4508.3604	-6785.5718	kJ/kg
Specific heat (p=const)	4.3462	4.3459	3.7445	2.1792	kJ/(kg·K)
Specific heat (V=const)	3.7391	3.7388	3.2179	1.8011	kJ/(kg·K)
Gamma	1.1624	1.1624	1.1636	1.2100	
Isentropic exponent	1.1474	1.1474	1.1540	1.2098	
Gas constant	0.3849	0.3849	0.3818	0.3761	kJ/(kg·K)
Molecular weight	21.5991	21.5993	21.7785	22.1088	
Density	2.0085	2.0050	1.2374	0.1001	kg/m^3
Sonic velocity	1174.0891	1174.0070	1135.4456	922.1084	m/s
Mach number	0.0000	0.0409	1.0000	2.8013	
Area ratio	14.5821	14.5821	1.0000	5.4355	A/At
Mass flux	96.2519	96.2519	1404.9828	258.4813	kg/(m^2·s)
Viscosity	1.0052	1.0051	0.9612	0.6987 x10^{-4}	kg/(m·s)
Conductivity, frozen	0.3473	0.3472	0.3272	0.2171	W/(m·K)
Specific heat (p=const), frozen	2.2620	2.2620	2.2443	2.0849	kJ/(kg·K)
Prandtl number, frozen	0.6548	0.6548	0.6592	0.6710	
Conductivity, effective	0.8769	0.8768	0.7141	0.2359	W/(m·K)
Specific heat (p=const), effective	4.3462	4.3459	3.7445	2.4760	kJ/(kg·K)
Prandtl number, effective	0.4982	0.4982	0.5040	0.7334	

Table 3. Combustion Products

Product	Injector mass fraction	Injector mole fraction	Nozzle inlet mass fraction	Nozzle inlet mole fraction	Nozzle throat mass fraction	Nozzle throat mole fraction	Nozzle exit mass fraction	Nozzle exit mole fraction
CO	0.3474146	0.2678980	0.3474034	0.2678918	0.3404424	0.2647016	0.2997904	0.2366288
CO2	0.2502044	0.1227961	0.2502221	0.1228059	0.2611721	0.1292432	0.3250580	0.1632973
COOH	0.0000093	0.0000044	0.0000092	0.0000044	0.0000047	0.0000023		
H	0.0007621	0.0163321	0.0007620	0.0163291	0.0005570	0.0120358	0.0000135	0.0002956
H2	0.0117465	0.1258578	0.0117466	0.1258602	0.0117825	0.1272919	0.0143116	0.1569596
H2O	0.3676637	0.4408043	0.3676683	0.4408138	0.3725501	0.4503718	0.3607700	0.4427453
H2O2	0.0000034	0.0000021	0.0000033	0.0000021	0.0000013	0.0000009		
HCHO,formaldehy	0.0000005	0.0000003	0.0000005	0.0000003	0.0000003	0.0000002		
HCO	0.0000096	0.0000071	0.0000096	0.0000071	0.0000048	0.0000036		
HCOOH	0.0000023	0.0000011	0.0000023	0.0000011	0.0000013	0.0000006		
HO2	0.0000126	0.0000083	0.0000126	0.0000082	0.0000045	0.0000030		
O	0.0012009	0.0016213	0.0012002	0.0016203	0.0005698	0.0007756		
O2	0.0033021	0.0022289	0.0033001	0.0022276	0.0016020	0.0010904	0.0000002	0.0000001
OH	0.0176681	0.0224382	0.0176598	0.0224280	0.0113071	0.0144791	0.0000562	0.0000731
Gaseous fraction:	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000
Condensed fraction:	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000

Table 4. Ideal Performance

Parameter	Sea level	Optimum expansion	Vacuum	Units
Characteristic velocity		1715.9295		m/s
Effective exhaust velocity	2463.1863	2583.1117	2855.1876	m/s
Specific impulse (by mass)	2463.1863	2583.1117	2855.1876	N·s/kg
Specific impulse (by weight)	251.1751	263.4041	291.1481	s
Thrust coefficient	1.4355	1.5054	1.6639	
Thrust	6.6579	6.9820	7.7174	kN
Altitude	0.0000	2.9768		km
Ambient pressure	1.0000	0.6941	0.0000	atm

Table 5. Estimated Delivered Performance

Parameter	Sea level	Optimum expansion	Vacuum	Units
Characteristic velocity		1669.4895		m/s
Effective exhaust velocity	2338.5858	2458.5112	2730.5871	m/s
Specific impulse (by mass)	2338.5858	2458.5112	2730.5871	N·s/kg
Specific impulse (by weight)	238.4694	250.6984	278.4424	s
Thrust coefficient	1.4008	1.4726	1.6356	
Thrust	6.3211	6.6452	7.3806	kN
Altitude	0.0000	2.9768		km
Ambient pressure	1.0000	0.6941	0.0000	atm

Table 6. Altitude Performance

Altitude, km	Pressure, atm	Specific impulse, N·s/kg	Specific impulse, s	Thrust coefficient	Thrust, kN
2.9768	0.6941	2461.4624	250.9993	1.4728	6.6532

Table 7. Throttled Performance

Table 8. Chamber Size

Combustion chamber size			Nozzle size		
Dc	186.52	mm	Type	Conical nozzle	
Dt	48.84	mm	Rn	9.33	mm
Lcyl	38.60	mm	Tn	15.00	deg
Lc	231.57	mm	Te	15.00	deg
L*	2174.69	mm	De	113.88	mm
R1	36.63	mm	Le	122.58	mm
R2	238.59	mm	Le/Dt	2.51	
b	30.00	deg	Le/Lc15		%
Ac/At	14.58		Ae/At	5.44	

Parameter		Engine	Chamber	
Thrust	sea level	6.3211	6.3211	kN
	opt exp	6.6452	6.6452	kN
	vacuum	7.3806	7.3806	kN
Specific Impulse	sea level	2338.5858	2338.5858	N·s/kg
	opt exp	2458.5112	2458.5112	N·s/kg
	vacuun	2730.5871	2730.5871	N·s/kg
Mass flow rate	total	2.7029	2.7029	kg/s
	oxidizer	1.5767	1.5767	kg/s
	fuel	1.1262	1.1262	kg/s
Number of chambers		1		

Table 10. Thermal Analysis

Location, mm	Radius, mm	Conv.heat coeff, kW/m²·K	Conv.heat flux, kW/m²	Rad. heat flux, kW/m²	Total heat flux, kW/m²	Twg, K	Twi, K	Twc, K	Tc, K	pc, MPa	wc, m/s	ρ, N kg/m³	Helix angle, degrees	A, m²	de, mm	hc, mm	a, mm	b, mm	Type / Comments
0.00	93.26	0.6576	1663.5424	0.0000	1663.5424	621.7393	621.7393	489.0450	407.2986	3.0256	11.2740	786.1519	50.0000	0.0001	1.5183	1.5000	1.5370	10.3100	regen channel loc_0.000000
2.41	93.26	0.6576	1663.9871	0.0000	1663.9871	621.2501	621.2501	488.5136	406.7608	3.0270	11.2226	789.7544	50.0000	0.0001	1.5183	1.5000	1.5370	10.3100	regen channel loc_0.000000

Location, mm	Radius, mm	Conv. heat coeff, kW/m²·K	Conv. heat flux, kW/m²	Rad. heat flux, kW/m²	Total heat flux, kW/m²	Twg, K	Twi, K	Twc, K	Tc, K	pc, MPa	wc, m/s	ρ, kg/m³	N	Helix angle, degrees	A, m²	de, mm	hc, mm	a, mm	b, mm	Type / Comments
4.82	93.26	0.6577	1664.4321	0.0000	1664.4321	620.7607	620.7607	487.9820	406.2228	3.0285	11.1717	793.3565	50	0.0000	0.0001	1.5183	1.5000	1.5370	10.3100	regen channel loc_0.000000
7.24	93.26	0.6577	1664.8774	0.0000	1664.8774	620.2711	620.2711	487.4502	405.6844	3.0299	11.1212	796.9583	50	0.0000	0.0001	1.5183	1.5000	1.5370	10.3100	regen channel loc_0.000000
9.65	93.26	0.6578	1665.3230	0.0000	1665.3230	619.7812	619.7812	486.9181	405.1457	3.0314	11.0711	800.5598	50	0.0000	0.0001	1.5183	1.5000	1.5370	10.3100	regen channel loc_0.000000
12.06	93.26	0.6578	1665.7688	0.0000	1665.7688	619.2912	619.2912	486.3857	404.6067	3.0328	11.0216	804.1609	50	0.0000	0.0001	1.5183	1.5000	1.5370	10.3100	regen channel loc_0.000000
14.47	93.26	0.6579	1666.2149	0.0000	1666.2149	618.8009	618.8009	485.8531	404.0674	3.0342	10.9724	807.7618	50	0.0000	0.0001	1.5183	1.5000	1.5370	10.3100	regen channel loc_0.000000
16.89	93.26	0.6579	1666.6613	0.0000	1666.6613	618.3103	618.3103	485.3202	403.5277	3.0356	10.9237	811.3624	50	0.0000	0.0001	1.5183	1.5000	1.5370	10.3100	regen channel loc_0.000000
19.30	93.26	0.6580	1667.1080	0.0000	1667.1080	617.8196	617.8196	484.7871	402.9878	3.0370	10.8755	814.9627	50	0.0000	0.0001	1.5183	1.5000	1.5370	10.3100	regen channel loc_0.000000
21.71	93.26	0.6580	1667.5550	0.0000	1667.5550	617.3286	617.3286	484.2536	402.4476	3.0384	10.8276	818.5628	50	0.0000	0.0001	1.5183	1.5000	1.5370	10.3100	regen channel loc_0.000000
24.12	93.26	0.6581	1668.0022	0.0000	1668.0022	616.8373	616.8373	483.7200	401.9070	3.0398	10.7802	822.1626	50	0.0000	0.0001	1.5183	1.5000	1.5370	10.3100	regen channel

Location, mm	Radius, mm	Conv. heat coeff, kW/m²·K	Conv. heat flux, kW/m²	Rad. heat flux, kW/m²	Total heat flux, kW/m²	Twg, K	Twi, K	Twc, K	Tc, K	pc, MPa	wc, m/s	ρ, kg/m³	N	Helix angle, degrees	A, m²	de, mm	hc, mm	a, mm	b, mm	Type / Comments
																				loc_0.000000
26.53	93.26	0.6581	1668.4498	0.0000	1668.4498	616.3459	616.3459	483.1860	401.3662	3.0412	10.7332	825.7623	50	0.0000	0.0001	1.5183	1.5000	1.5370	10.3100	regen channel loc_0.000000
28.95	93.26	0.6582	1668.8976	0.0000	1668.8976	615.8541	615.8541	482.6518	400.8250	3.0426	10.6867	829.3617	50	0.0000	0.0001	1.5183	1.5000	1.5370	10.3100	regen channel loc_0.000000
31.36	93.26	0.6582	1669.3458	0.0000	1669.3458	615.3622	615.3622	482.1173	400.2835	3.0440	10.6405	832.9609	50	0.0000	0.0001	1.5183	1.5000	1.5370	10.3100	regen channel loc_0.000000
33.77	93.26	0.6583	1669.7942	0.0000	1669.7942	614.8700	614.8700	481.5826	399.7417	3.0454	10.5947	836.5600	50	0.0000	0.0001	1.5183	1.5000	1.5370	10.3100	regen channel loc_0.000000
36.18	93.26	0.6583	1670.2429	0.0000	1670.2429	614.3776	614.3776	481.0475	399.1996	3.0468	10.5493	840.1589	50	0.0000	0.0001	1.5183	1.5000	1.5370	10.3100	regen channel loc_0.000000
38.60	93.26	0.6584	1670.6919	0.0000	1670.6919	613.8849	613.8849	480.5122	398.6571	3.0482	10.5043	843.7558	50	0.0000	0.0001	1.5183	1.5000	1.5370	10.3100	regen channel loc_0.000000
44.07	93.20	0.6593	1673.6835	0.0000	1673.6835	612.9715	612.9715	479.3508	397.4252	3.0513	10.4037	851.9206	50	0.0000	0.0001	1.5183	1.5000	1.5370	10.3021	regen channel loc_0.000000
49.54	93.01	0.6619	1680.6324	0.0000	1680.6324	612.4661	612.4661	478.2939	396.1897	3.0544	10.3048	860.0973	50	0.0000	0.0001	1.5183	1.5000	1.5370	10.2785	regen channel loc_0.000000

Location, mm	Radius, mm	Conv. heat coeff, kW/m²·K	Conv. heat flux, kW/m²	Rad. heat flux, kW/m²	Total heat flux, kW/m²	Twg, K	Twi, K	Twc, K	Tc, K	pc, MPa	wc, m/s	ρ, kg/m³	N	Helix angle, degrees	A, m²	de, mm	hc, mm	a, mm	b, mm	Type / Comments
55.01	92.69	0.6662	1691.5653	0.0000	1691.5653	612.3676	612.3676	477.3387	394.9489	3.0575	10.2074	868.2985	50	0.0000	0.0001	1.5183	1.5000	1.5370	10.2390	regen channel loc_0.000000
60.48	92.25	0.6722	1706.6231	0.0000	1706.6231	612.6880	612.6880	476.4861	393.7006	3.0605	10.1115	876.5369	50	0.0000	0.0001	1.5183	1.5000	1.5370	10.1836	regen channel loc_0.000000
65.95	91.69	0.6801	1726.0150	0.0000	1726.0150	613.4462	613.4462	475.7389	392.4430	3.0636	10.0168	884.8254	50	0.0000	0.0001	1.5183	1.5000	1.5370	10.1123	regen channel loc_0.000000
71.42	90.99	0.6897	1749.6400	0.0000	1749.6400	614.6207	614.6207	475.0832	391.1741	3.0666	9.9231	893.1769	50	0.0000	0.0001	1.5183	1.5000	1.5370	10.0249	regen channel loc_0.000000
76.89	90.17	0.7011	1777.6006	0.0000	1777.6006	616.2171	616.2171	474.5134	389.8921	3.0697	9.8304	901.6032	50	0.0000	0.0001	1.5183	1.5000	1.5370	9.9212	regen channel loc_0.000000
82.37	89.21	0.7153	1811.7896	0.0000	1811.7896	618.4541	618.4541	474.1062	388.5944	3.0727	9.7384	910.1204	50	0.0000	0.0001	1.5183	1.5000	1.5370	9.8012	regen channel loc_0.000000
87.84	88.12	0.7317	1851.2975	0.0000	1851.2975	621.2026	621.2026	473.8018	387.2786	3.0757	9.6470	918.7451	50	0.0000	0.0001	1.5183	1.5000	1.5370	9.6645	regen channel loc_0.000000
93.31	86.90	0.7502	1895.8701	0.0000	1895.8701	624.4143	624.4143	473.5706	385.9427	3.0787	9.5560	927.4903	50	0.0000	0.0001	1.5183	1.5000	1.5370	9.5111	regen channel loc_0.000000
98.78	85.54	0.7725	1948.9582	0.0000	1948.9582	628.4936	628.4936	473.5498	384.5837	3.0817	9.4653	936.3743	50	0.0000	0.0001	1.5183	1.5000	1.5370	9.3405	regen channel

Location, mm	Radius, mm	Conv. heat coeff, kW/m²·K	Conv. heat flux, kW/m²	Rad. heat flux, kW/m²	Total heat flux, kW/m²	Twg, K	Twi, K	Twc, K	Tc, K	pc, MPa	wc, m/s	ρ, kg/m³	N Helix angle, degrees	A, m²	de, mm	hc, mm	a, mm	b, mm	Type / Comments
																			loc_0.000000
104.25	84.05	0.7979	2009.1764	0.0000	2009.1764	633.2480	633.2480	473.6474	383.1984	3.0847	9.3748	945.4180	50	0.0000	0.0001	1.5183	1.5000	1.5370	9.1525	regen channel
																			loc_0.000000
109.72	82.41	0.8263	2076.3271	0.0000	2076.3271	638.7375	638.7375	473.9067	381.7846	3.0877	9.2964	953.3926	50	0.0000	0.0001	1.5183	1.5000	1.5370	8.9468	regen channel
																			loc_0.000000
115.19	80.63	0.8606	2156.2103	0.0000	2156.2103	645.9194	645.9194	474.9413	380.3384	3.0907	9.2861	954.4530	50	0.0000	0.0001	1.5183	1.5000	1.5370	8.7229	regen channel
																			loc_0.000000
120.66	78.70	0.8982	2243.5025	0.0000	2243.5025	653.7270	653.7270	476.0280	378.8565	3.0937	9.2755	955.5395	50	0.0000	0.0001	1.5183	1.5000	1.5370	8.4805	regen channel
																			loc_0.000000
126.14	76.62	0.9439	2348.6008	0.0000	2348.6008	663.3620	663.3620	477.5679	377.3347	3.0968	9.2647	956.6553	50	0.0000	0.0001	1.5183	1.5000	1.5370	8.2190	regen channel
																			loc_0.000000
131.61	74.38	0.9953	2465.7536	0.0000	2465.7536	674.0722	674.0722	479.2491	375.7681	3.0999	9.2536	957.8040	50	0.0000	0.0001	1.5183	1.5000	1.5370	7.9379	regen channel
																			loc_0.000000
137.08	71.99	1.0560	2602.8276	0.0000	2602.8276	686.7217	686.7217	481.3275	374.1523	3.1031	9.2421	958.9883	50	0.0000	0.0001	1.5183	1.5000	1.5370	7.6367	regen channel
																			loc_0.000000
142.55	69.42	1.1278	2762.8721	0.0000	2762.8721	701.5926	701.5926	483.8425	372.4807	3.1063	9.2303	960.2135	50	0.0000	0.0001	1.5183	1.5000	1.5370	7.3145	regen channel
																			loc_0.000000

Location, mm	Radius, mm	Conv. heat coeff, kW/m²·K	Conv. heat flux, kW/m²	Rad. heat flux, kW/m²	Total heat flux, kW/m²	Twg, K	Twi, K	Twc, K	Tc, K	pc, MPa	wc, m/s	ρ, kg/m³	N	Helix angle, degrees	A, m²	de, mm	hc, mm	a, mm	b, mm	Type / Comments
148.02	66.69	1.2124	2948.8848	0.0000	2948.8848	719.0275	719.0275	486.9079	370.7458	3.1095	9.2187	961.4293	50	0.0000	0.0001	1.5183	1.5000	1.5370	6.9708	regen channel loc_0.000000
153.49	63.77	1.3135	3167.8150	0.0000	3167.8150	739.6070	739.6070	490.5666	368.9398	3.1128	9.2068	962.6726	50	0.0000	0.0001	1.5183	1.5000	1.5370	6.6045	regen channel loc_0.000000
158.96	60.68	1.4354	3426.8269	0.0000	3426.8269	763.9401	763.9401	494.8591	367.0570	3.1162	9.1944	963.9686	50	0.0000	0.0001	1.5183	1.5000	1.5370	6.2153	regen channel loc_0.000000
164.43	57.52	1.5796	3726.5734	0.0000	3726.5734	792.0877	792.0877	499.7859	365.1046	3.1196	9.1816	965.3125	50	0.0000	0.0001	1.5183	1.5000	1.5370	5.8184	regen channel loc_0.000000
169.91	54.36	1.7462	4064.2745	0.0000	4064.2745	823.6632	823.6632	505.1675	363.0908	3.1230	9.1684	966.6986	50	0.0000	0.0001	1.5183	1.5000	1.5370	5.4214	regen channel loc_0.000000
175.38	51.20	1.9421	4450.0873	0.0000	4450.0873	859.7603	859.7603	511.2967	361.0133	3.1264	9.1553	968.0815	50	0.0000	0.0001	1.5183	1.5000	1.5370	5.0245	regen channel loc_0.000000
180.85	48.04	2.1741	4891.7263	0.0000	4891.7263	901.0376	901.0376	518.2378	358.8694	3.1298	9.1424	969.4548	50	0.0000	0.0001	1.5183	1.5000	1.5370	4.6275	regen channel loc_0.000000
186.32	44.88	2.4510	5398.7005	0.0000	5398.7005	948.1567	948.1567	525.8926	356.6573	3.1333	9.1290	970.8718	50	0.0000	0.0001	1.5183	1.5000	1.5370	4.2306	regen channel loc_0.000000
191.79	41.72	2.7857	5984.6255	0.0000	5984.6255	1002.2783	1002.278 3	534.3513	354.3757	3.1368	9.1153	972.3333	50	0.0000	0.0001	1.5183	1.5000	1.5370	3.8336	regen channel

Location, mm	Radius, mm	Conv. heat coeff, kW/m²·K	Conv. heat flux, kW/m²	Rad. heat flux, kW/m²	Total heat flux, kW/m²	Twg, K	Twi, K	Twc, K	Tc, K	pc, MPa	wc, m/s	ρ, kg/m³	N Helix angle, degrees	A, m²	de, mm	hc, mm	a, mm	b, mm	Type / Comments
																			loc_0.000000
197.26	38.56	3.1962	6665.6038	0.0000	6665.6038	1064.7362	1064.7362	543.6788	352.0242	3.1403	9.1012	973.8394	50	0.0000	0.0001	1.5183	1.5000	1.5370	3.4367 regen channel loc_0.000000
202.73	35.40	3.7076	7460.3420	0.0000	7460.3420	1137.4759	1137.4759	554.3689	349.6041	3.1438	9.0879	975.2676	50	0.0000	0.0001	1.5183	1.5000	1.5370	3.0397 regen channel loc_0.000000
208.20	32.25	4.3552	8391.7802	0.0000	8391.7802	1221.8557	1221.8557	565.9858	347.1191	3.1473	9.0742	976.7326	50	0.0000	0.0001	1.5183	1.5000	1.5370	2.6427 regen channel loc_0.000000
213.68	29.09	5.1884	9481.8985	0.0000	9481.8985	1319.3754	1319.3754	578.3186	344.5873	3.1509	9.0604	978.2252	50	0.0000	0.0001	1.5183	1.5000	1.5370	2.2463 regen channel loc_0.000000
219.15	26.59	6.0191	10461.6385	0.0000	10461.6385	1405.7560	1405.7560	588.1289	342.1355	3.1543	9.0470	979.6706	50	0.0000	0.0001	1.5183	1.5000	1.5370	1.9325 regen channel loc_0.000000
224.62	25.09	6.5845	11067.3052	0.0000	11067.3052	1458.7748	1458.7748	593.8072	339.8170	3.1575	9.0355	980.9226	50	0.0000	0.0001	1.5183	1.5000	1.5370	1.7433 regen channel loc_0.000000
230.09	24.45	6.7750	11247.6799	0.0000	11247.6799	1473.7960	1473.7960	594.7323	337.5803	3.1607	9.0244	982.1237	50	0.0000	0.0001	1.5183	1.5000	1.5370	1.6634 regen channel loc_0.000000
231.57	24.42	6.7545	11220.3511	0.0000	11220.3511	1471.0830	1471.0830	594.1554	336.9825	3.1615	9.0215	982.4441	50	0.0000	0.0001	1.5183	1.5000	1.5370	1.6596 regen channel loc_0.000000

Location, mm	Radius, mm	Conv. heat coeff, kW/m²·K	Conv. heat flux, kW/m²	Rad. heat flux, kW/m²	Total heat flux, kW/m²	Twg, K	Twi, K	Twc, K	Tc, K	pc, MPa	wc, m/s	ρ, kg/m³	N	Helix angle, degrees	A, m²	de, mm	hc, mm	a, mm	b, mm	Type / Comments
242.51	27.03	5.3064	9530.7090	0.0000	9530.7090	1315.9849	1315.9849	571.1115	332.6523	3.1679	9.0002	984.7693	50	0.0000	0.0001	1.5183	1.5000	1.5370	1.9867	regen channel loc_0.000000
253.46	29.96	4.2731	8165.0279	0.0000	8165.0279	1190.7343	1190.7343	552.5796	328.4526	3.1746	8.9816	986.8107	50	0.0000	0.0001	1.5183	1.5000	1.5370	2.3552	regen channel loc_0.000000
264.40	32.89	3.5279	7072.7801	0.0000	7072.7801	1088.7196	1088.7196	535.8992	324.4633	3.1813	8.9643	988.7127	50	0.0000	0.0001	1.5183	1.5000	1.5370	2.7236	regen channel loc_0.000000
275.34	35.82	2.9672	6180.4141	0.0000	6180.4141	1004.0967	1004.0967	520.9420	320.6695	3.1882	8.9487	990.4356	50	0.0000	0.0001	1.5183	1.5000	1.5370	3.0921	regen channel loc_0.000000
286.28	38.75	2.5337	5442.4833	0.0000	5442.4833	933.3379	933.3379	507.7569	317.0587	3.1951	8.9353	991.9240	50	0.0000	0.0001	1.5183	1.5000	1.5370	3.4605	regen channel loc_0.000000
297.23	41.69	2.1911	4827.5780	0.0000	4827.5780	873.1460	873.1460	495.4886	313.6176	3.2022	8.9225	993.3426	50	0.0000	0.0001	1.5183	1.5000	1.5370	3.8290	regen channel loc_0.000000
308.17	44.62	1.9150	4309.0322	0.0000	4309.0322	821.9222	821.9222	484.6192	310.3336	3.2093	8.9115	994.5707	50	0.0000	0.0001	1.5183	1.5000	1.5370	4.1974	regen channel loc_0.000000
319.11	47.55	1.6887	3867.5719	0.0000	3867.5719	777.8420	777.8420	474.8654	307.1954	3.2166	8.9020	995.6278	50	0.0000	0.0001	1.5183	1.5000	1.5370	4.5659	regen channel loc_0.000000
330.05	50.48	1.5018	3491.5764	0.0000	3491.5764	739.5231	739.5231	465.7426	304.1915	3.2240	8.8930	996.6399	50	0.0000	0.0001	1.5183	1.5000	1.5370	4.9343	regen channel

Location, mm	Radius, mm	Conv. heat coeff, kW/m²·K	Conv. heat flux, kW/m²	Rad. heat flux, kW/m²	Total heat flux, kW/m²	Twg, K	Twi, K	Twc, K	Tc, K	pc, MPa	wc, m/s	ρ, kg/m³	N Helix angle, degrees	A, m²	de, mm	hc, mm	a, mm	b, mm	Type / Comments
																			loc_0.000000
341.00	53.41	1.3455	3168.5943	0.0000	3168.5943	706.2196	706.2196	457.4792	301.3103	3.2314	8.8849	997.5511	50	0.0000	0.0001	1.5183	1.5000	1.5370	5.3028	regen channel loc_0.000000
354.15	56.94	1.1830	2823.9254	0.0000	2823.9254	670.4425	670.4425	448.3942	298.0000	3.2405	8.8775	998.3807	50	0.0000	0.0001	1.5183	1.5000	1.5370	5.7457	regen channel loc_0.000000