

Engineering Software

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P.O. Box 1180

Germantown, MD 20875

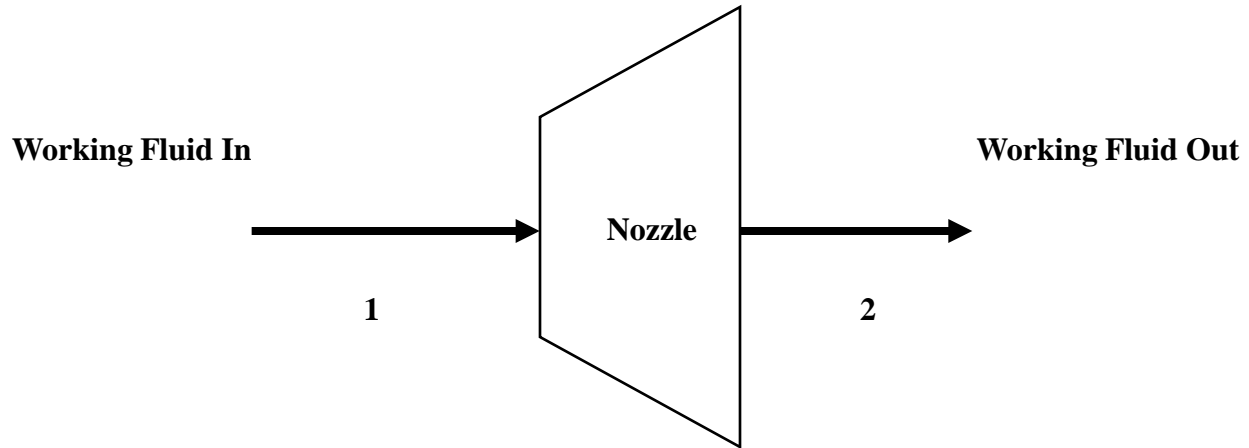
Phone/FAX: (301) 540-3605

E-Mail: info@engineering-4e.com

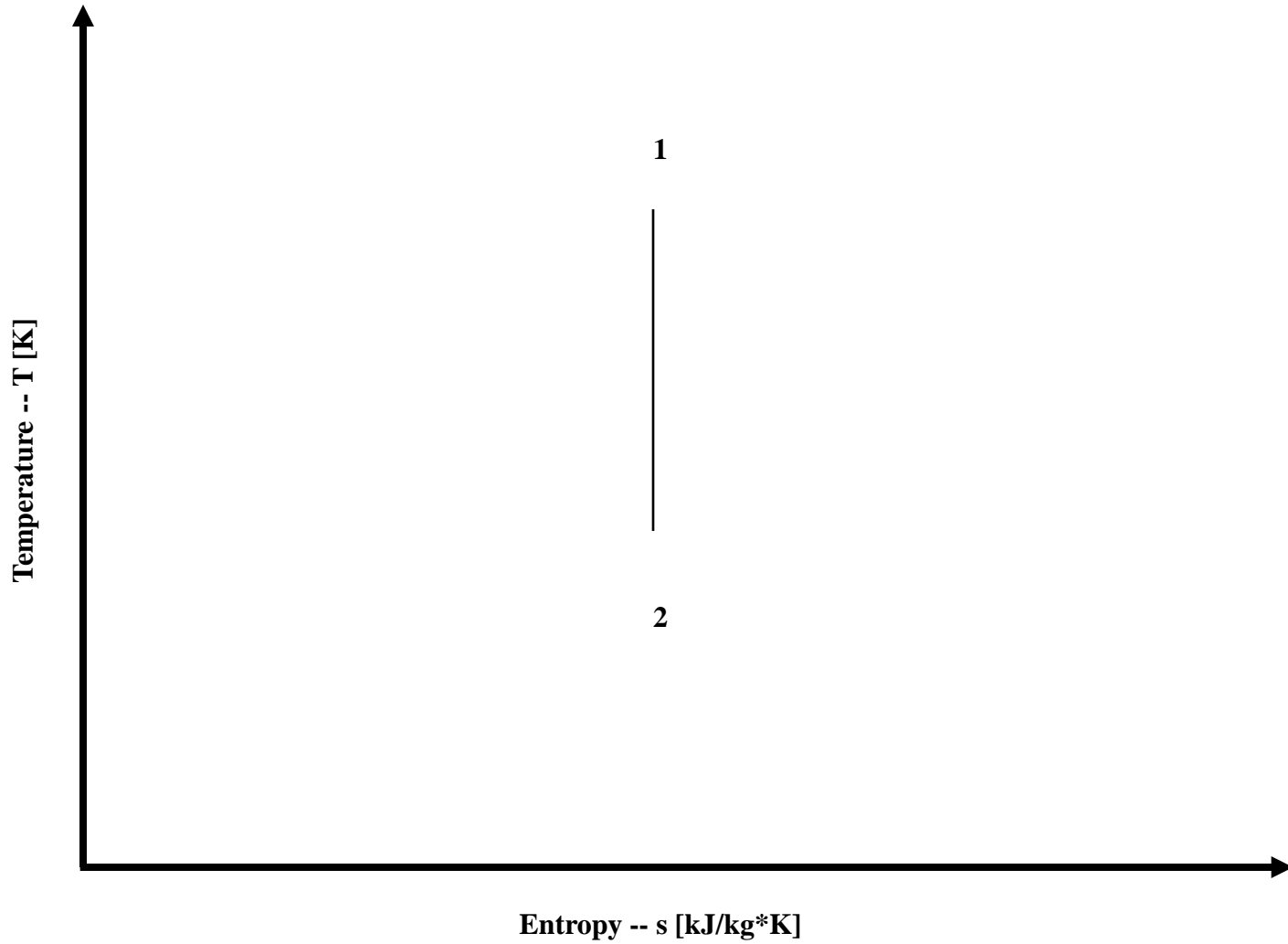
<http://www.engineering-4e.com>

Nozzle

Here are some of the basic subsonic isentropic nozzle data tables and plots.



Nozzle Schematic Layout



Nozzle T - s Diagram

Input and Output Data

Stagnation inlet temperature [K]: 1500
Stagnation inlet pressure [atm]: 10
Outlet Mach number [/]: 0.83
Velocity delta step [m/s]: 10
Working fluid kappa [/]: 1.4
Working fluid cp [J/kg*K]: 1004
Working fluid gas constant [J/kg*K]: 286.7

Step [/]	Tin [K]	Pin [atm]	Tout [K]	Pout [atm]	Velocity [m/s]	Mach Number [/]
1	1500	10	1500	10	0	0
2	1500	10	1499.95	9.99884	10	0.0128879
3	1500	10	1499.8	9.99535	20	0.0257772
4	1500	10	1499.55	9.98954	30	0.038669
5	1500	10	1499.2	9.98142	40	0.0515646
6	1500	10	1498.76	9.97098	50	0.0644654
7	1500	10	1498.21	9.95823	60	0.0773726
8	1500	10	1497.56	9.94318	70	0.0902876
9	1500	10	1496.81	9.92583	80	0.103212
10	1500	10	1495.97	9.90619	90	0.116146
11	1500	10	1495.02	9.88428	100	0.129092
12	1500	10	1493.97	9.8601	110	0.142051
13	1500	10	1492.83	9.83367	120	0.155024
14	1500	10	1491.58	9.80499	130	0.168013
15	1500	10	1490.24	9.77409	140	0.181018
16	1500	10	1488.79	9.74098	150	0.194042
17	1500	10	1487.25	9.70567	160	0.207086
18	1500	10	1485.61	9.66818	170	0.22015
19	1500	10	1483.86	9.62854	180	0.233237
20	1500	10	1482.02	9.58676	190	0.246348

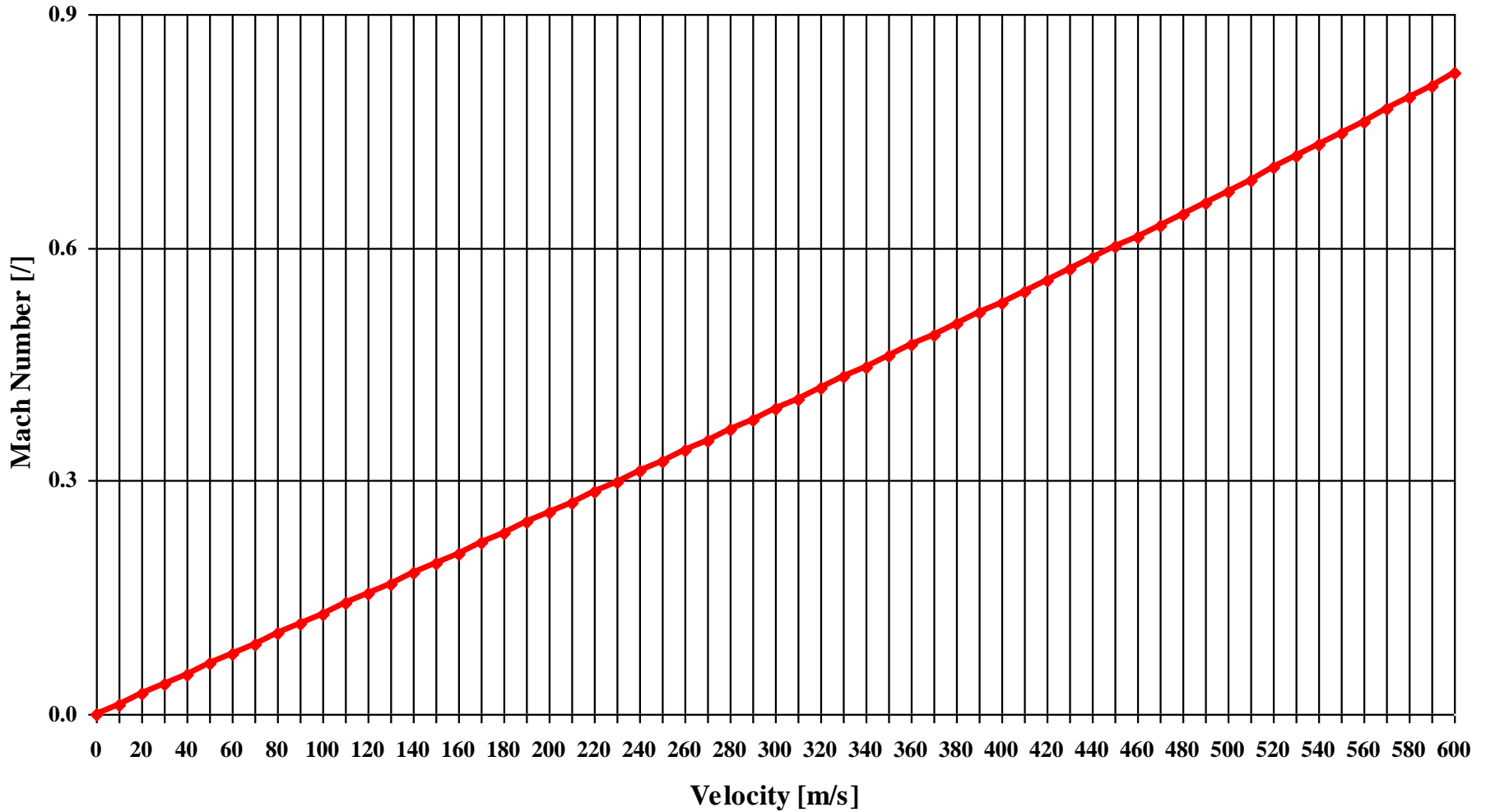
Input and Output Data

21	1500	10	1480.08	9.54286	200	0.259483
22	1500	10	1478.04	9.49686	210	0.272646
23	1500	10	1475.9	9.44879	220	0.285836
24	1500	10	1473.66	9.39867	230	0.299056
25	1500	10	1471.31	9.34653	240	0.312306
26	1500	10	1468.87	9.29238	250	0.325589
27	1500	10	1466.33	9.23627	260	0.338906
28	1500	10	1463.7	9.17821	270	0.352258
29	1500	10	1460.96	9.11824	280	0.365647
30	1500	10	1458.12	9.05638	290	0.379074
31	1500	10	1455.18	8.99267	300	0.392541
32	1500	10	1452.14	8.92713	310	0.40605
33	1500	10	1449	8.85981	320	0.419602
34	1500	10	1445.77	8.79073	330	0.433198
35	1500	10	1442.43	8.71992	340	0.446842
36	1500	10	1438.99	8.64743	350	0.460533
37	1500	10	1435.46	8.57329	360	0.474274
38	1500	10	1431.82	8.49754	370	0.488067
39	1500	10	1428.09	8.42021	380	0.501913
40	1500	10	1424.25	8.34134	390	0.515814
41	1500	10	1420.32	8.26097	400	0.529772
42	1500	10	1416.28	8.17914	410	0.543789
43	1500	10	1412.15	8.0959	420	0.557867
44	1500	10	1407.92	8.01128	430	0.572008
45	1500	10	1403.59	7.92532	440	0.586213
46	1500	10	1399.15	7.83808	450	0.600485
47	1500	10	1394.62	7.74958	460	0.614825
48	1500	10	1389.99	7.65987	470	0.629237
49	1500	10	1385.26	7.56901	480	0.643721
50	1500	10	1380.43	7.47703	490	0.658281

Input and Output Data

51	1500	10	1375.5	7.38398	500	0.672918
52	1500	10	1370.47	7.28991	510	0.687635
53	1500	10	1365.34	7.19485	520	0.702434
54	1500	10	1360.11	7.09887	530	0.717317
55	1500	10	1354.78	7.002	540	0.732287
56	1500	10	1349.35	6.9043	550	0.747347
57	1500	10	1343.82	6.80581	560	0.762498
58	1500	10	1338.2	6.70658	570	0.777744
59	1500	10	1332.47	6.60666	580	0.793088
60	1500	10	1326.64	6.50609	590	0.808532
61	1500	10	1320.72	6.40494	600	0.824078

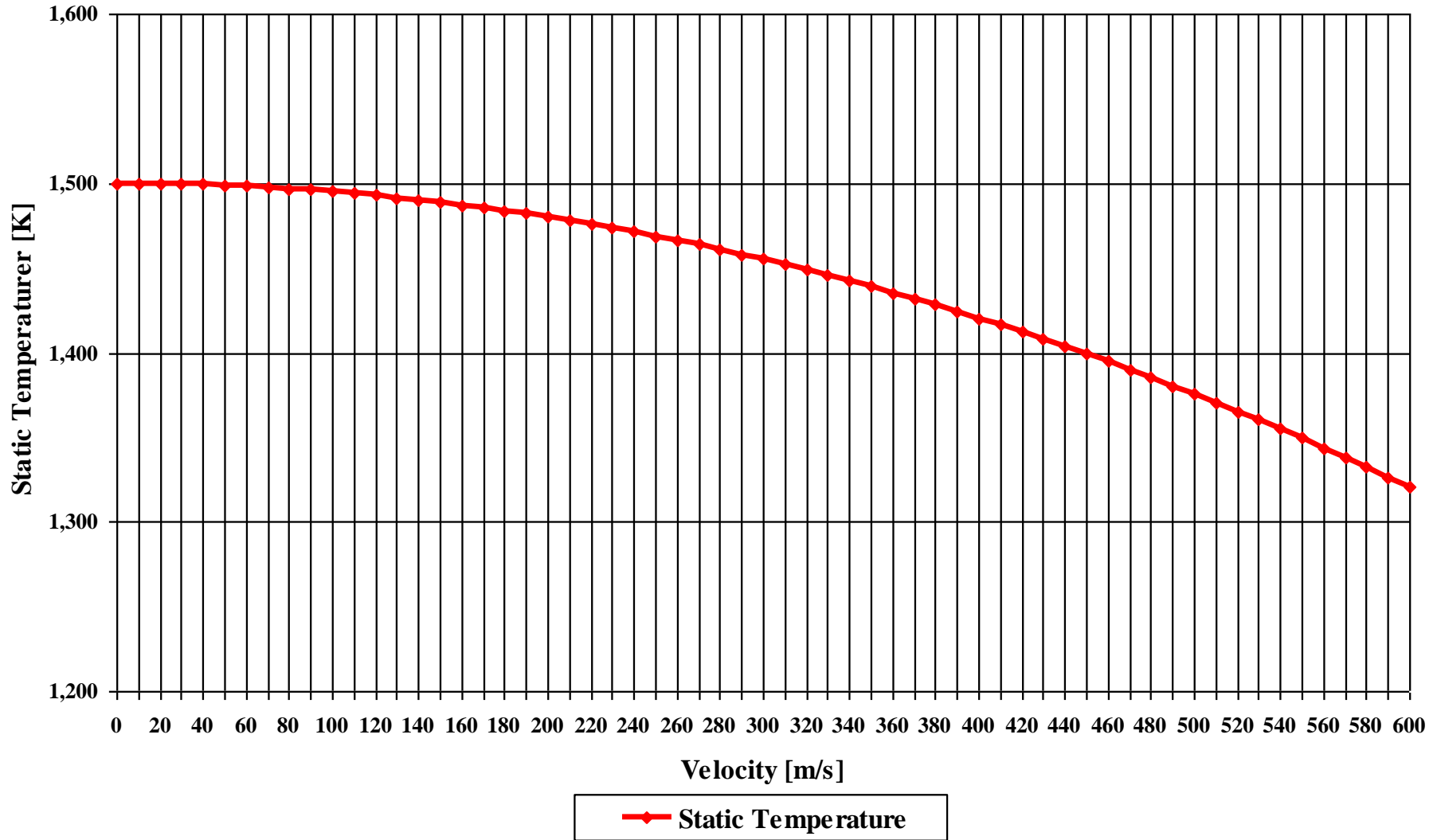
Mach Number



—◆— Mach Number

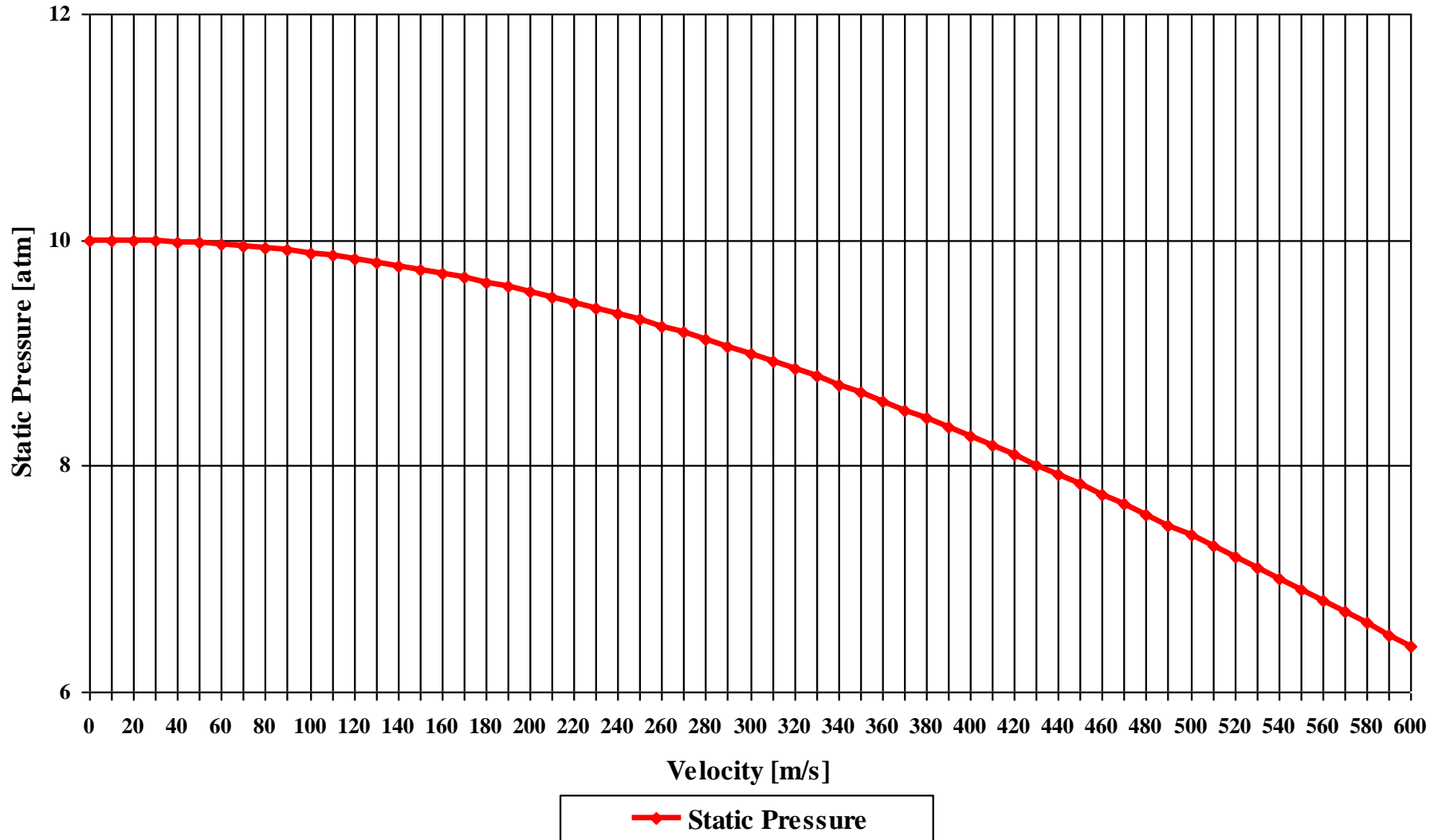
Inlet Stagnation Temperature: 1500 [K] and Stagnation Pressure: 10 [atm]

Static Temperature



Inlet Stagnation Temperature: 1500 [K] and Stagnation Pressure: 10 [atm]

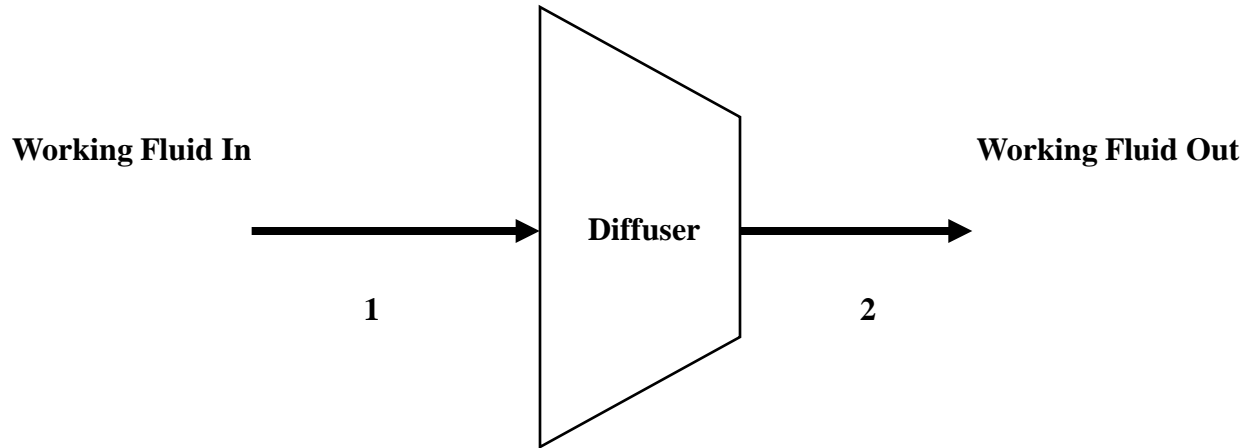
Static Pressure



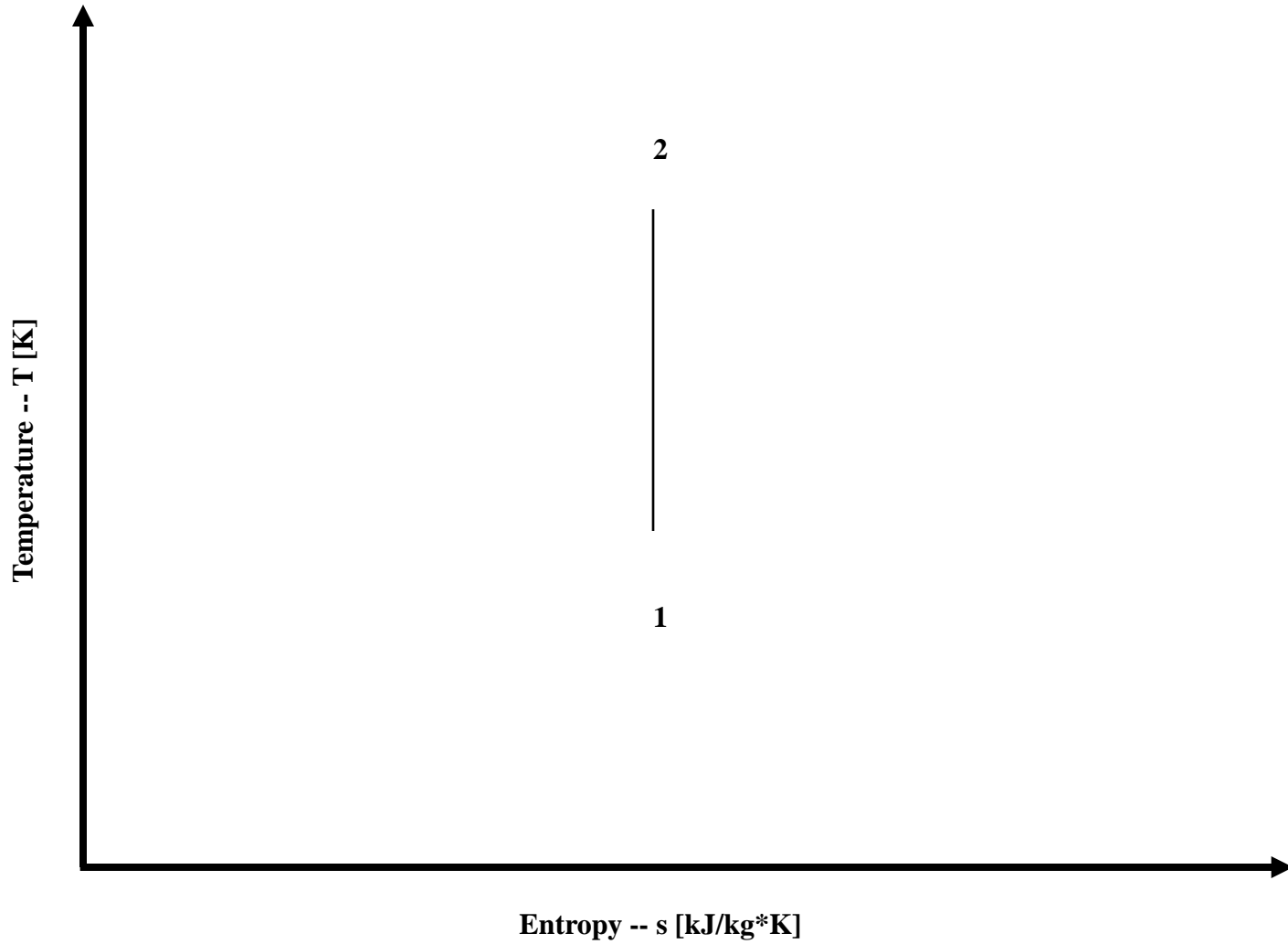
Inlet Stagnation Temperature: 1500 [K] and Stagnation Pressure: 10 [atm]

Diffuser

Here are some of the basic subsonic isentropic diffuser data tables and plots.



Diffuser Schematic Layout



Diffuser T - s Diagram

Input and Output Data

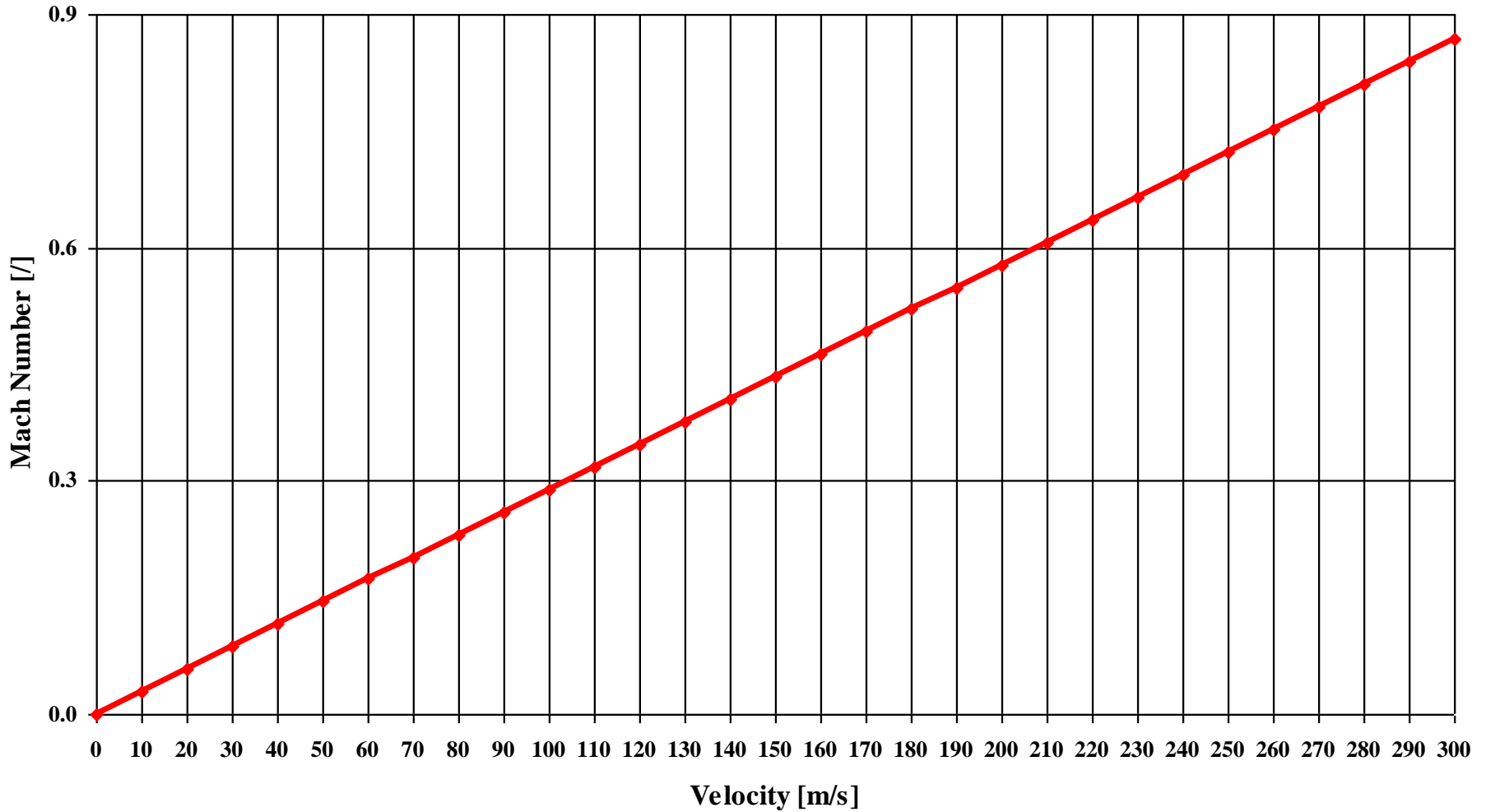
Static inlet temperature [K]: 298
Static inlet pressure [atm]: 1
Inlet Mach number [/]: 0.87
Velocity delta step [m/s]: 10
Working fluid kappa [/]: 1.4
Working fluid cp [J/kg*K]: 1004
Working fluid gas constant [J/kg*K]: 286.7

Step [/]	Tin [K]	Pin [atm]	Tout [K]	Pout [atm]	Velocity [m/s]	Mach Number [/]
1	298	1	298	1	0	0
2	298	1	298.05	1.00059	10	0.0289144
3	298	1	298.199	1.00234	20	0.0578288
4	298	1	298.448	1.00527	30	0.0867432
5	298	1	298.797	1.00939	40	0.115658
6	298	1	299.245	1.0147	50	0.144572
7	298	1	299.793	1.02121	60	0.173486
8	298	1	300.44	1.02895	70	0.202401
9	298	1	301.187	1.03794	80	0.231315
10	298	1	302.034	1.04818	90	0.260229
11	298	1	302.98	1.05972	100	0.289144
12	298	1	304.026	1.07258	110	0.318058
13	298	1	305.171	1.08679	120	0.346973
14	298	1	306.416	1.10239	130	0.375887
15	298	1	307.761	1.11941	140	0.404801
16	298	1	309.205	1.13791	150	0.433716
17	298	1	310.749	1.15792	160	0.46263
18	298	1	312.392	1.17949	170	0.491545
19	298	1	314.135	1.20269	180	0.520459
20	298	1	315.978	1.22756	190	0.549373

Input and Output Data

21	298	1	317.92	1.25417	200	0.578288
22	298	1	319.962	1.28259	210	0.607202
23	298	1	322.104	1.31289	220	0.636117
24	298	1	324.345	1.34514	230	0.665031
25	298	1	326.685	1.37942	240	0.693945
26	298	1	329.125	1.41582	250	0.72286
27	298	1	331.665	1.45443	260	0.751774
28	298	1	334.305	1.49535	270	0.780688
29	298	1	337.044	1.53867	280	0.809603
30	298	1	339.882	1.58451	290	0.838517
31	298	1	342.821	1.63297	300	0.867432

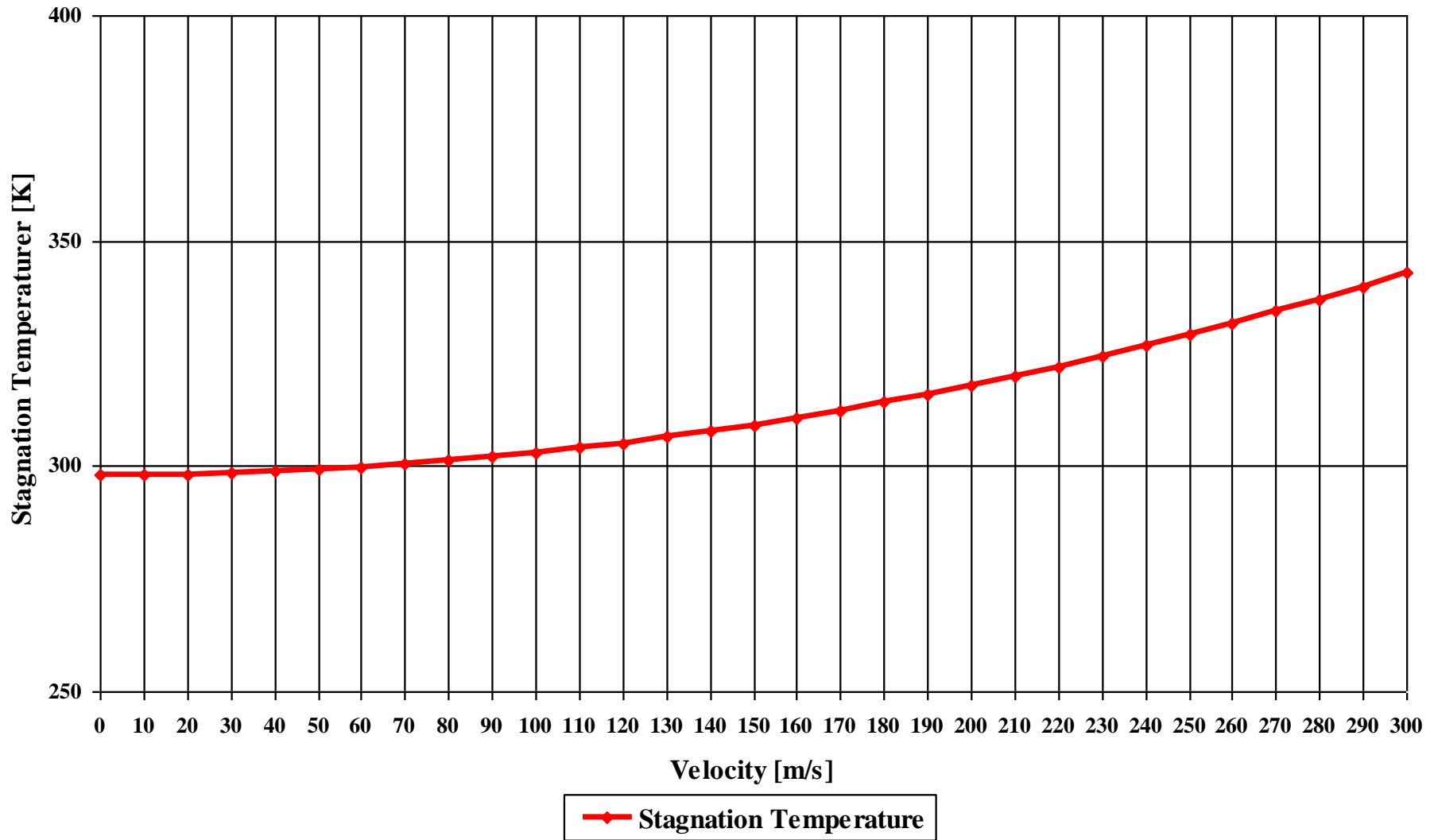
Mach Number



—◆— Mach Number

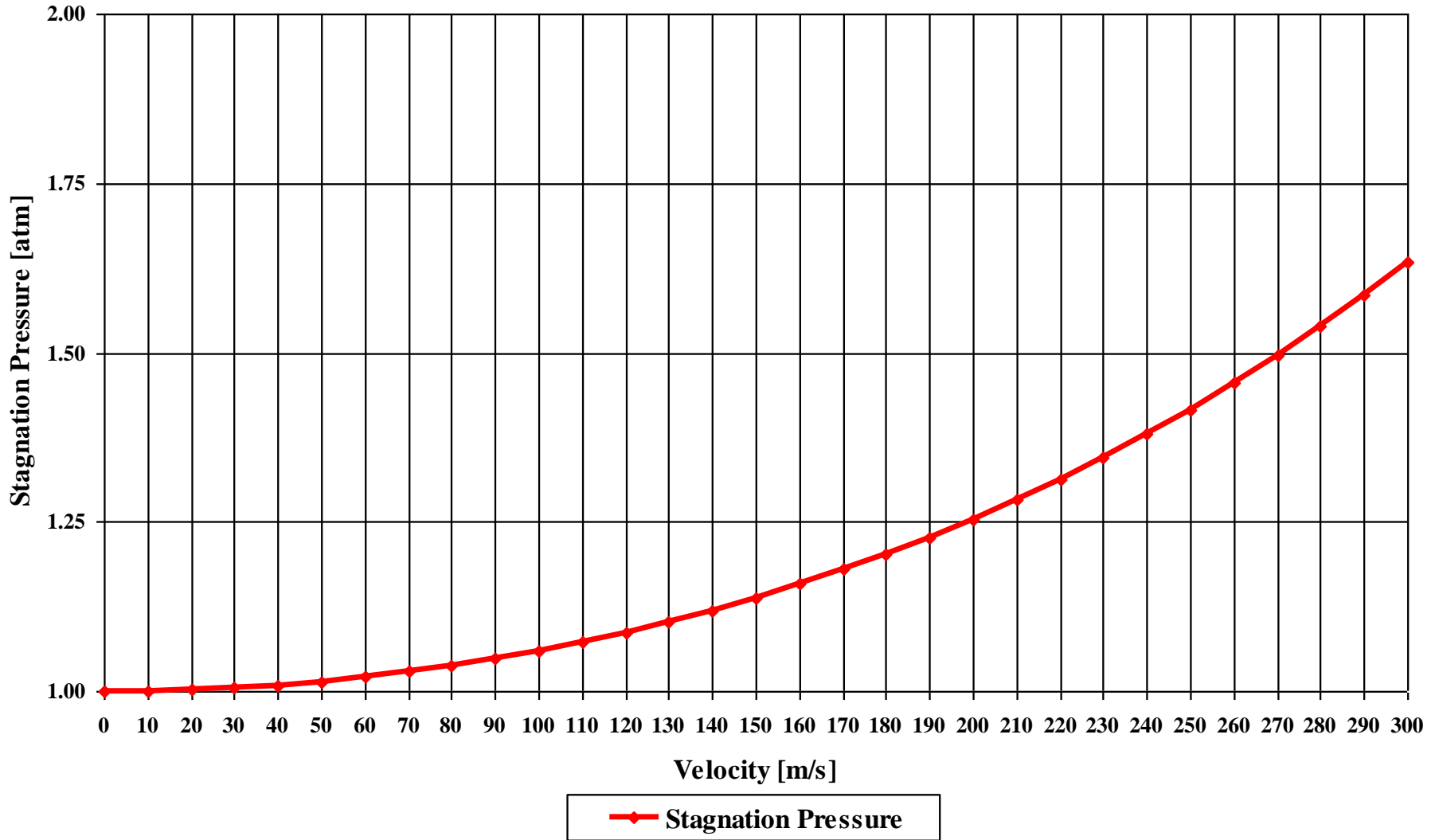
Inlet Static Temperature: 298 [K] and Static Pressure: 1 [atm]

Stagnation Temperature



Inlet Static Temperature: 298 [K] and Static Pressure: 1 [atm]

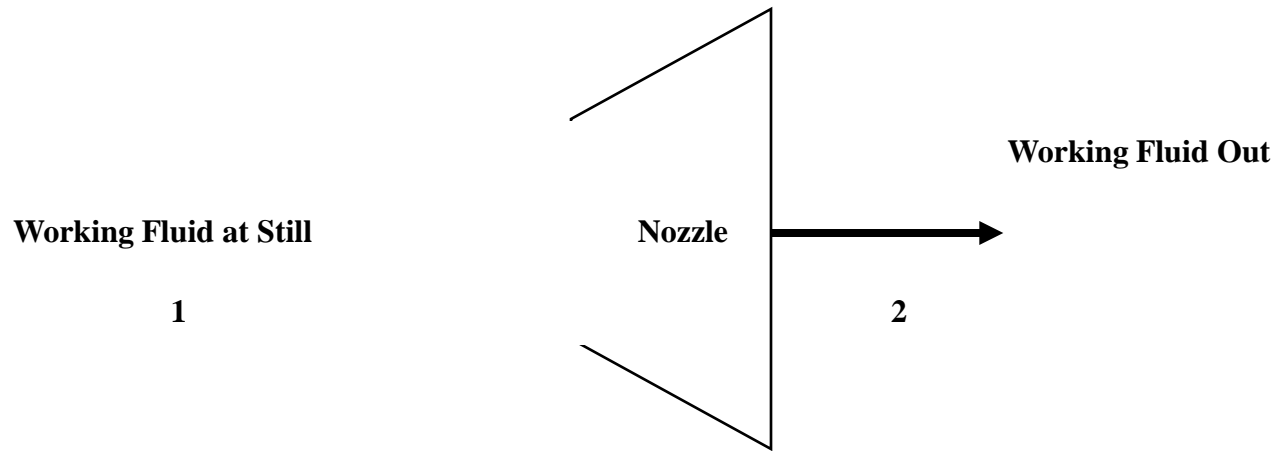
Stagnation Pressure



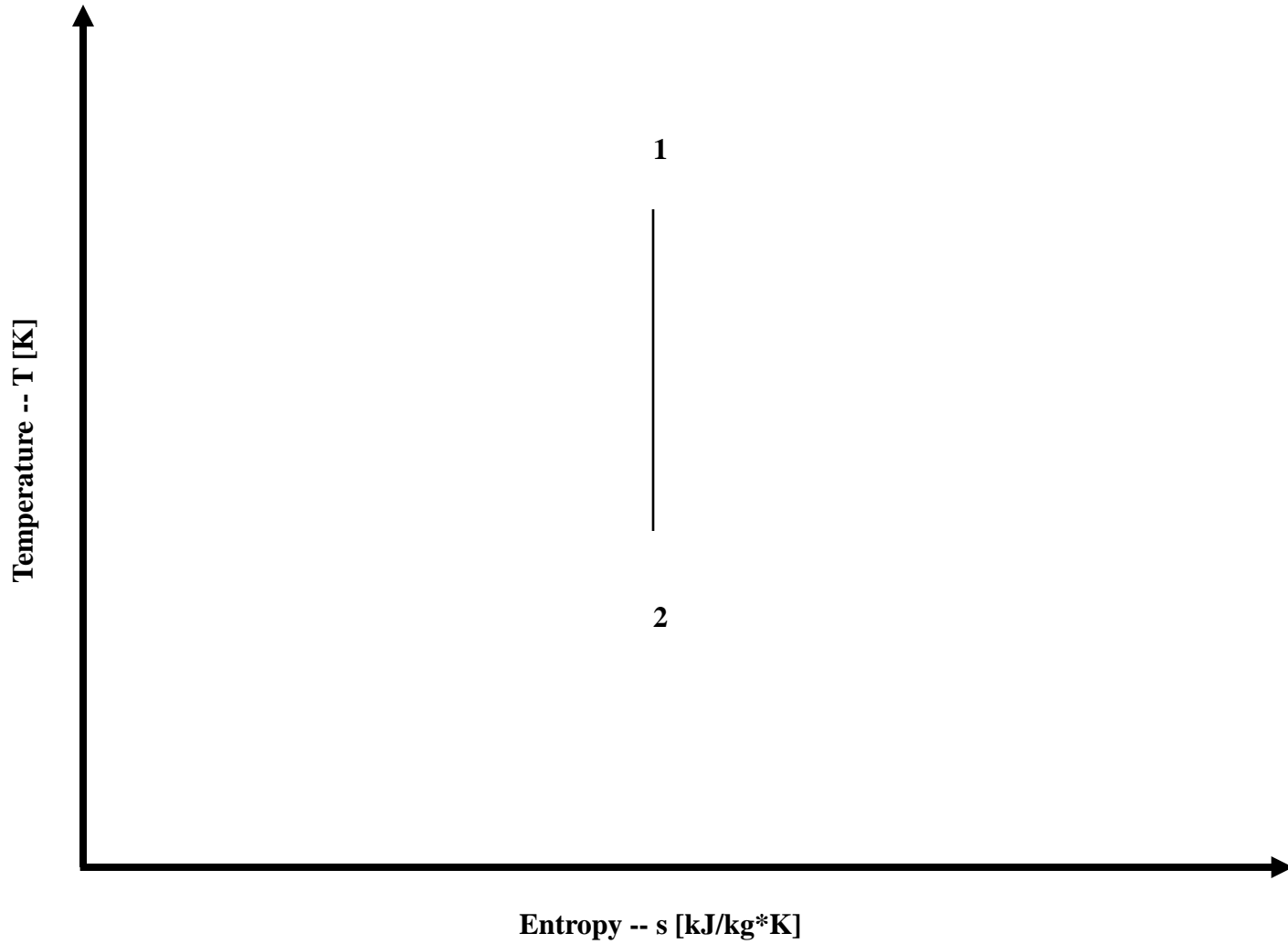
Inlet Static Temperature: 298 [K] and Static Pressure: 1 [atm]

Thrust

Here are some of the basic subsonic isentropic thrust data tables and plots.



Thrust Schematic Layout



Thrust T - s Diagram

Input and Output Data

Stagnation inlet temperature [K]: 1500
Stagnation inlet pressure [atm]: 10
Outlet Mach number [/]: 0.83
Velocity delta step [m/s]: 10
Working fluid kappa [/]: 1.4
Working fluid cp [J/kg*K]: 1004
Working fluid gas constant [J/kg*K]: 286.7
Ambient pressure [atm]: 1
Working fluid mass flow rate [kg/s]: 1

Step [/]	Tin [K]	Pin [atm]	Tout [K]	Pout [atm]	Velocity [m/s]	Mach Number [/]	Thrust [N]
1	1500	10	1500	10	0	0	0
2	1500	10	1499.95	9.99884	10	0.0128879	38712.7
3	1500	10	1499.8	9.99535	20	0.0257772	19368.7
4	1500	10	1499.55	9.98954	30	0.038669	12926.1
5	1500	10	1499.2	9.98142	40	0.0515646	9708.99
6	1500	10	1498.76	9.97098	50	0.0644654	7781.97
7	1500	10	1498.21	9.95823	60	0.0773726	6500.04
8	1500	10	1497.56	9.94318	70	0.0902876	5586.71
9	1500	10	1496.81	9.92583	80	0.103212	4903.77
10	1500	10	1495.97	9.90619	90	0.116146	4374.42
11	1500	10	1495.02	9.88428	100	0.129092	3952.58
12	1500	10	1493.97	9.8601	110	0.142051	3608.93
13	1500	10	1492.83	9.83367	120	0.155024	3323.92
14	1500	10	1491.58	9.80499	130	0.168013	3084.02
15	1500	10	1490.24	9.77409	140	0.181018	2879.56
16	1500	10	1488.79	9.74098	150	0.194042	2703.46
17	1500	10	1487.25	9.70567	160	0.207086	2550.39
18	1500	10	1485.61	9.66818	170	0.22015	2416.29
19	1500	10	1483.86	9.62854	180	0.233237	2298
20	1500	10	1482.02	9.58676	190	0.246348	2193.02

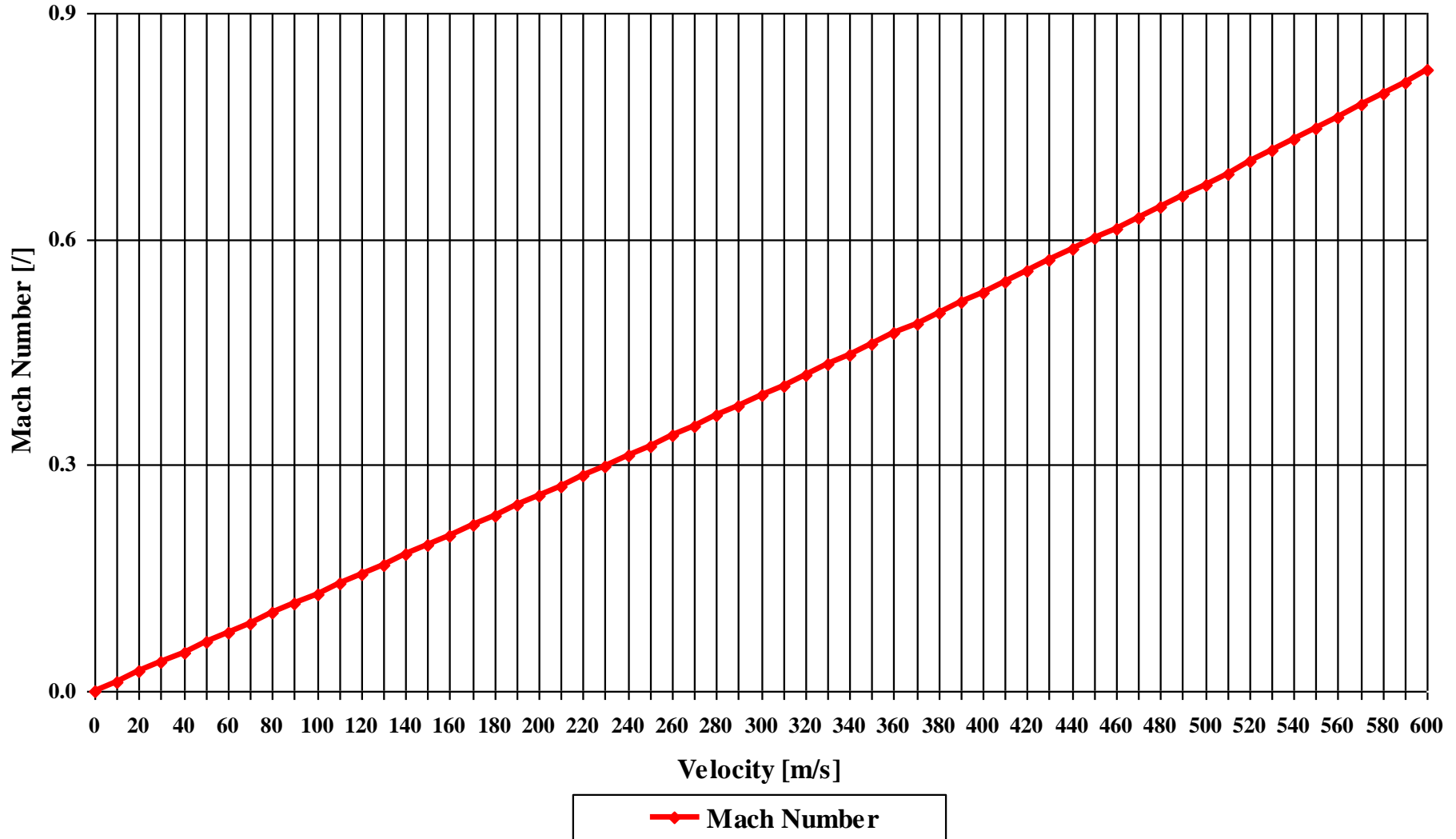
Input and Output Data

21	1500	10	1480.08	9.54286	200	0.259483	2099.36
22	1500	10	1478.04	9.49686	210	0.272646	2015.4
23	1500	10	1475.9	9.44879	220	0.285836	1939.8
24	1500	10	1473.66	9.39867	230	0.299056	1871.5
25	1500	10	1471.31	9.34653	240	0.312306	1809.56
26	1500	10	1468.87	9.29238	250	0.325589	1753.23
27	1500	10	1466.33	9.23627	260	0.338906	1701.85
28	1500	10	1463.7	9.17821	270	0.352258	1654.89
29	1500	10	1460.96	9.11824	280	0.365647	1611.86
30	1500	10	1458.12	9.05638	290	0.379074	1572.35
31	1500	10	1455.18	8.99267	300	0.392541	1536.02
32	1500	10	1452.14	8.92713	310	0.40605	1502.56
33	1500	10	1449	8.85981	320	0.419602	1471.69
34	1500	10	1445.77	8.79073	330	0.433198	1443.18
35	1500	10	1442.43	8.71992	340	0.446842	1416.82
36	1500	10	1438.99	8.64743	350	0.460533	1392.43
37	1500	10	1435.46	8.57329	360	0.474274	1369.84
38	1500	10	1431.82	8.49754	370	0.488067	1348.91
39	1500	10	1428.09	8.42021	380	0.501913	1329.49
40	1500	10	1424.25	8.34134	390	0.515814	1311.49
41	1500	10	1420.32	8.26097	400	0.529772	1294.78
42	1500	10	1416.28	8.17914	410	0.543789	1279.28
43	1500	10	1412.15	8.0959	420	0.557867	1264.89
44	1500	10	1407.92	8.01128	430	0.572008	1251.55
45	1500	10	1403.59	7.92532	440	0.586213	1239.17
46	1500	10	1399.15	7.83808	450	0.600485	1227.69
47	1500	10	1394.62	7.74958	460	0.614825	1217.05
48	1500	10	1389.99	7.65987	470	0.629237	1207.2
49	1500	10	1385.26	7.56901	480	0.643721	1198.09
50	1500	10	1380.43	7.47703	490	0.658281	1189.67

Input and Output Data

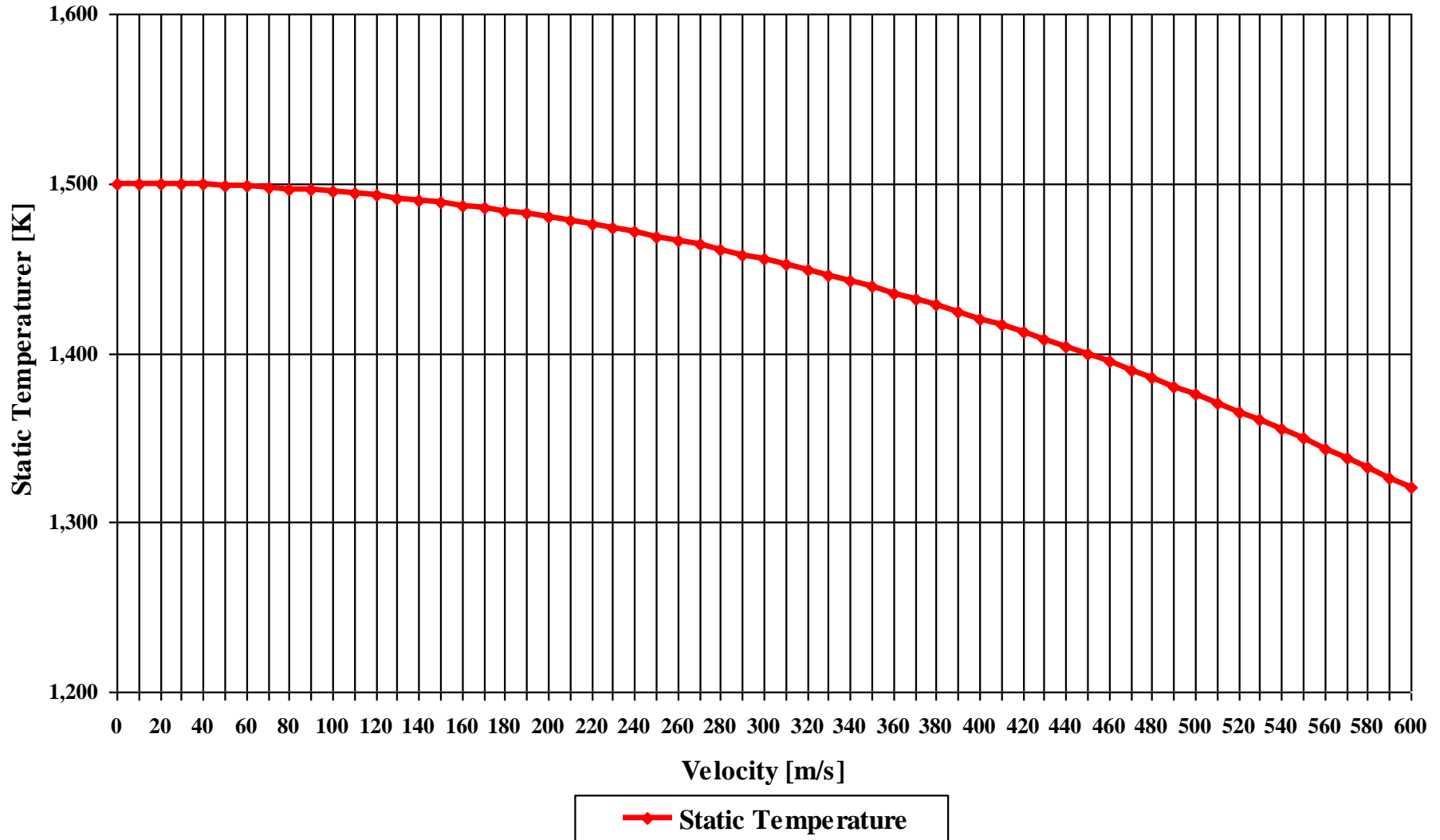
51	1500	10	1375.5	7.38398	500	0.672918	1181.9
52	1500	10	1370.47	7.28991	510	0.687635	1174.74
53	1500	10	1365.34	7.19485	520	0.702434	1168.15
54	1500	10	1360.11	7.09887	530	0.717317	1162.1
55	1500	10	1354.78	7.002	540	0.732287	1156.56
56	1500	10	1349.35	6.9043	550	0.747347	1151.51
57	1500	10	1343.82	6.80581	560	0.762498	1146.9
58	1500	10	1338.2	6.70658	570	0.777744	1142.73
59	1500	10	1332.47	6.60666	580	0.793088	1138.96
60	1500	10	1326.64	6.50609	590	0.808532	1135.57
61	1500	10	1320.72	6.40494	600	0.824078	1132.55

Mach Number



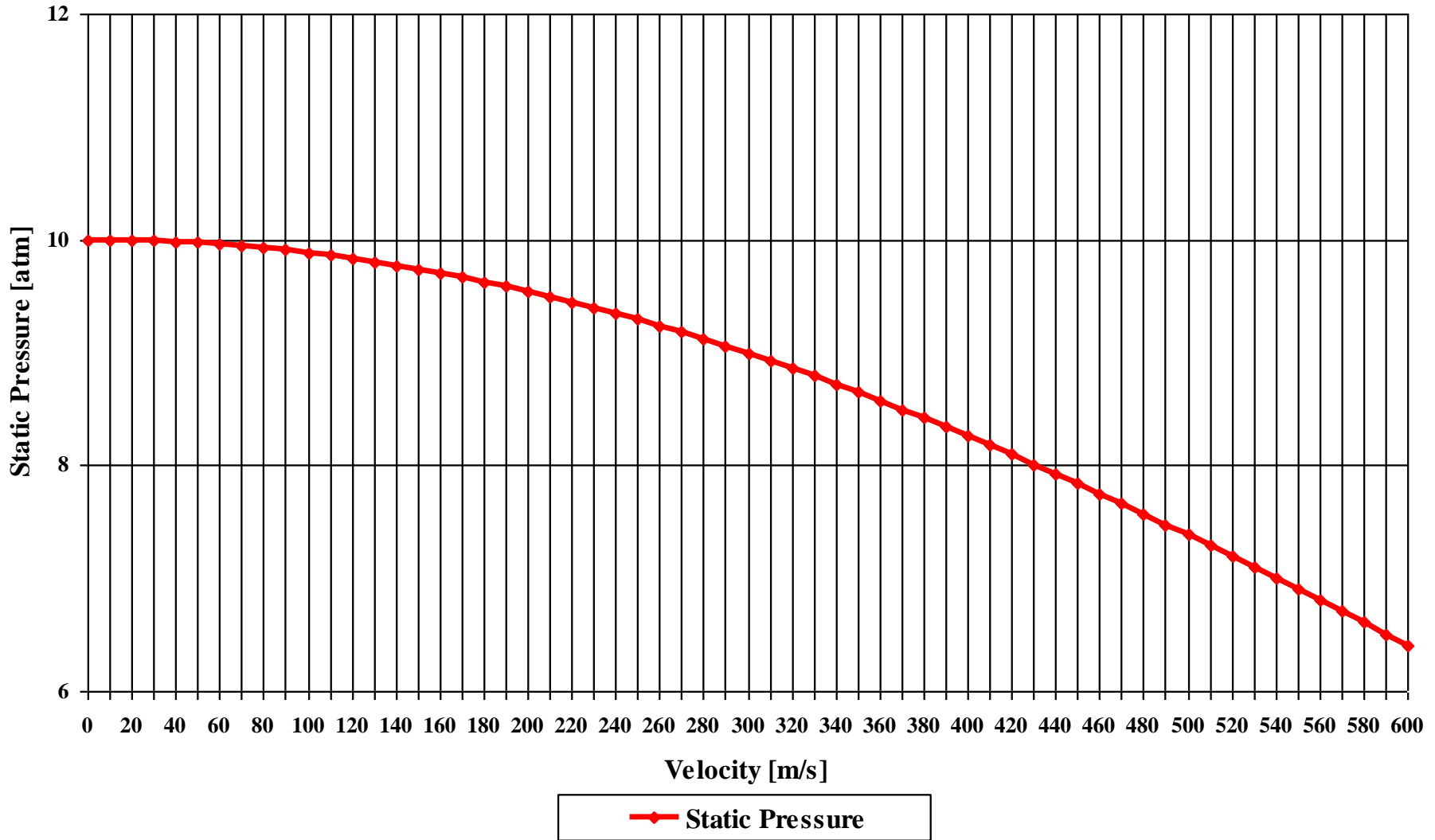
Inlet Stagnation Temperature: 1500 [K] and Stagnation Pressure: 10 [atm] – Ambient Pressure: 1 [atm]

Static Temperature



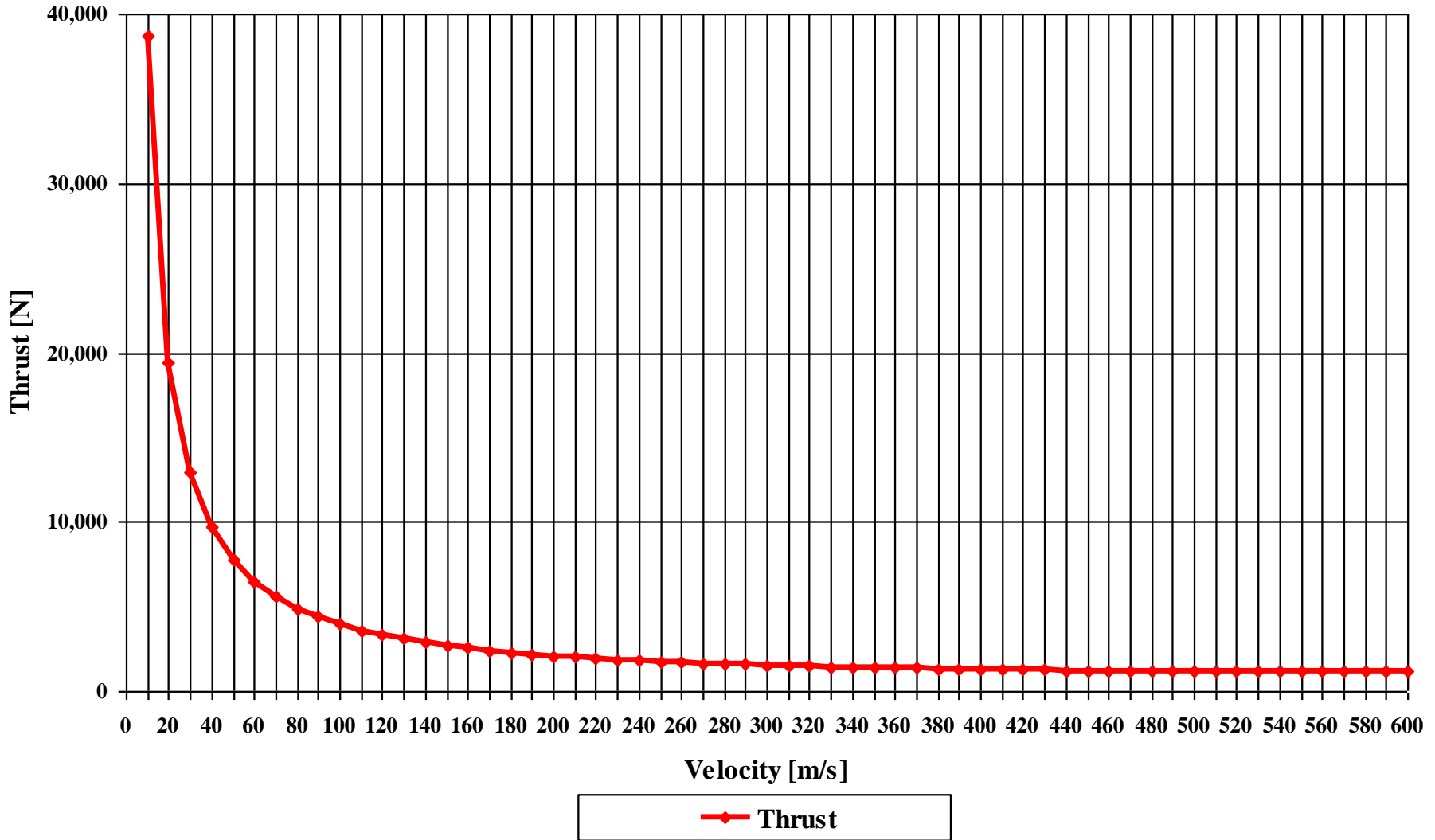
Inlet Stagnation Temperature: 1500 [K] and Stagnation Pressure: 10 [atm] – Ambient Pressure: 1 [atm]

Static Pressure



Inlet Stagnation Temperature: 1500 [K] and Stagnation Pressure: 10 [atm] – Ambient Pressure: 1 [atm]

Thrust



Inlet Stagnation Temperature: 1500 [K] and Stagnation Pressure: 10 [atm] – Ambient Pressure: 1 [atm]