

Flow Calculation for Sonic Nozzle

revised 04/16/10

$m = 0.53257 * C * p * A / \text{sqrt}(T)$ (Marks Handbook, Seventh Edition, p. 4-61) - coefficient corrected

where:

Assume:

- m mass flow rate, lb/sec
- p inlet pressure lb/ft², absolute
- A throat area, ft²
- T inlet temperature, deg R
- C discharge coefficient
- 0.99 discharge coefficient for trial calculation
- 14.7 psi atmospheric pressure
- 100 psig inlet pressure
- 0.1225 in. diameter of throat
- 0.0752 lbm mass of one standard cubic foot of air
- 68 degrees F inlet temperature
- 0.044 lbm/hr-ft (mu) - 60 deg F
- $Re = G * d / \mu$
- $G = m / A$, lb/ft²sec
- $C = 1 - 4.47 / \text{sqrt}(Re)$

SAMPLE CALCULATION

Throat Area: 8.185E-05 ft² mass velocity: 377.155 lbm/sec-ft²
 Re: 315010
 Inlet pressure: 16,517 lb/ft² 1 / sqrt(Re): 0.00178
 Absolute temperature: 528 degrees R C: 0.99204
 mass flow: 0.0309 lb/sec or 24.63 scfm

SONIC NOZZLE FLOW											
Model 3025											
Flow shown in scfm referenced to air at 20 deg C.											
One standard cubic foot weighs 0.0752 lb.											
Inlet Conditions											
t (deg F) = 40 45 50 55 60 65 70 75 80 85 90											
p (psig)	40	45	50	55	60	65	70	75	80	85	90
10	5.44	5.41	5.38	5.36	5.33	5.31	5.28	5.26	5.23	5.21	5.18
15	6.55	6.52	6.48	6.45	6.42	6.39	6.36	6.33	6.30	6.27	6.24
20	7.66	7.62	7.58	7.55	7.51	7.47	7.44	7.40	7.37	7.34	7.30
25	8.77	8.73	8.69	8.64	8.60	8.56	8.52	8.48	8.44	8.40	8.36
30	9.88	9.83	9.79	9.74	9.69	9.65	9.60	9.56	9.51	9.47	9.42
35	11.00	10.94	10.89	10.84	10.78	10.73	10.68	10.63	10.58	10.53	10.49
40	12.11	12.05	11.99	11.93	11.87	11.82	11.76	11.71	11.65	11.60	11.55
45	13.22	13.16	13.09	13.03	12.97	12.90	12.84	12.78	12.72	12.67	12.61
50	14.34	14.27	14.20	14.13	14.06	13.99	13.93	13.86	13.80	13.73	13.67
55	15.45	15.37	15.30	15.22	15.15	15.08	15.01	14.94	14.87	14.80	14.73
60	16.57	16.48	16.40	16.32	16.24	16.17	16.09	16.01	15.94	15.87	15.79
65	17.68	17.59	17.51	17.42	17.34	17.25	17.17	17.09	17.01	16.93	16.86
70	18.79	18.70	18.61	18.52	18.43	18.34	18.26	18.17	18.09	18.00	17.92
75	19.91	19.81	19.71	19.62	19.52	19.43	19.34	19.25	19.16	19.07	18.98
80	21.02	20.92	20.82	20.72	20.62	20.52	20.42	20.33	20.23	20.14	20.05
85	22.14	22.03	21.92	21.81	21.71	21.61	21.50	21.40	21.30	21.21	21.11
90	23.25	23.14	23.03	22.91	22.80	22.69	22.59	22.48	22.38	22.27	22.17
95	24.37	24.25	24.13	24.01	23.90	23.78	23.67	23.56	23.45	23.34	23.24
100	25.49	25.36	25.23	25.11	24.99	24.87	24.75	24.64	24.52	24.41	24.30
105	26.60	26.47	26.34	26.21	26.08	25.96	25.84	25.72	25.60	25.48	25.36
110	27.72	27.58	27.44	27.31	27.18	27.05	26.92	26.79	26.67	26.55	26.43
115	28.83	28.69	28.55	28.41	28.27	28.14	28.00	27.87	27.74	27.62	27.49
120	29.95	29.80	29.65	29.51	29.37	29.23	29.09	28.95	28.82	28.68	28.55
125	31.06	30.91	30.76	30.61	30.46	30.31	30.17	30.03	29.89	29.75	29.62
130	32.18	32.02	31.86	31.71	31.55	31.40	31.25	31.11	30.96	30.82	30.68
135	33.29	33.13	32.97	32.81	32.65	32.49	32.34	32.19	32.04	31.89	31.75
140	34.41	34.24	34.07	33.91	33.74	33.58	33.42	33.27	33.11	32.96	32.81
145	35.53	35.35	35.18	35.01	34.84	34.67	34.51	34.35	34.19	34.03	33.87
150	36.64	36.46	36.28	36.11	35.93	35.76	35.59	35.42	35.26	35.10	34.94
155	37.76	37.57	37.39	37.21	37.03	36.85	36.67	36.50	36.33	36.17	36.00
160	38.88	38.68	38.49	38.31	38.12	37.94	37.76	37.58	37.41	37.24	37.07
165	39.99	39.79	39.60	39.40	39.22	39.03	38.84	38.66	38.48	38.31	38.13
170	41.11	40.90	40.70	40.50	40.31	40.12	39.93	39.74	39.56	39.37	39.19
175	42.22	42.01	41.81	41.60	41.40	41.21	41.01	40.82	40.63	40.44	40.26
180	43.34	43.13	42.91	42.70	42.50	42.30	42.10	41.90	41.70	41.51	41.32
185	44.46	44.24	44.02	43.80	43.59	43.39	43.18	42.98	42.78	42.58	42.39
190	45.57	45.35	45.12	44.91	44.69	44.48	44.27	44.06	43.85	43.65	43.45
195	46.69	46.46	46.23	46.01	45.78	45.56	45.35	45.14	44.93	44.72	44.52
200	47.81	47.57	47.34	47.11	46.88	46.65	46.43	46.22	46.00	45.79	45.58

CAUTION: NOZZLE MUST BE USED WITH MUFFLER.

CDI Meters, Inc.
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