

Flow Calculation for Sonic Nozzle

revised 04/16/10

$m = 0.53257 * C * p * A / \sqrt{T}$ (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
- 0.245 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 / sqrt(Re)

SAMPLE CALCULATION

Throat Area: 0.0003274 ft² mass velocity: 377.155 lbm/sec-ft²
 Inlet pressure: 16,517 lb/ft² Re: 630020
 Absolute temperature: 528 degrees R 1 / sqrt(Re): 0.00126
 mass flow: 0.1235 lb/sec or 98.52 scfm C: 0.99437

SONIC NOZZLE FLOW											
Model 3100											
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)	10	15	20	25	30	35	40	45	50	55	60
10	21.9	21.8	21.6	21.5	21.4	21.3	21.2	21.1	21.0	20.9	20.8
15	26.3	26.2	26.1	25.9	25.8	25.7	25.6	25.4	25.3	25.2	25.1
20	30.8	30.6	30.5	30.3	30.2	30.0	29.9	29.7	29.6	29.5	29.3
25	35.2	35.1	34.9	34.7	34.5	34.4	34.2	34.1	33.9	33.7	33.6
30	39.7	39.5	39.3	39.1	38.9	38.7	38.5	38.4	38.2	38.0	37.8
35	44.1	43.9	43.7	43.5	43.3	43.1	42.9	42.7	42.5	42.3	42.1
40	48.6	48.4	48.1	47.9	47.7	47.4	47.2	47.0	46.8	46.6	46.3
45	53.1	52.8	52.5	52.3	52.0	51.8	51.5	51.3	51.1	50.8	50.6
50	57.5	57.2	57.0	56.7	56.4	56.1	55.9	55.6	55.4	55.1	54.9
55	62.0	61.7	61.4	61.1	60.8	60.5	60.2	59.9	59.7	59.4	59.1
60	66.5	66.1	65.8	65.5	65.2	64.9	64.5	64.2	63.9	63.7	63.4
65	70.9	70.6	70.2	69.9	69.5	69.2	68.9	68.6	68.2	67.9	67.6
70	75.4	75.0	74.6	74.3	73.9	73.6	73.2	72.9	72.5	72.2	71.9
75	79.8	79.5	79.1	78.7	78.3	77.9	77.6	77.2	76.8	76.5	76.1
80	84.3	83.9	83.5	83.1	82.7	82.3	81.9	81.5	81.1	80.8	80.4
85	88.8	88.3	87.9	87.5	87.1	86.6	86.2	85.8	85.4	85.0	84.6
90	93.2	92.8	92.3	91.9	91.4	91.0	90.6	90.1	89.7	89.3	88.9
95	97.7	97.2	96.8	96.3	95.8	95.4	94.9	94.5	94.0	93.6	93.2
100	102.2	101.7	101.2	100.7	100.2	99.7	99.2	98.8	98.3	97.9	97.4
105	106.6	106.1	105.6	105.1	104.6	104.1	103.6	103.1	102.6	102.1	101.7
110	111.1	110.6	110.0	109.5	109.0	108.4	107.9	107.4	106.9	106.4	105.9
115	115.6	115.0	114.4	113.9	113.3	112.8	112.3	111.7	111.2	110.7	110.2
120	120.0	119.5	118.9	118.3	117.7	117.2	116.6	116.1	115.5	115.0	114.5
125	124.5	123.9	123.3	122.7	122.1	121.5	120.9	120.4	119.8	119.3	118.7
130	129.0	128.3	127.7	127.1	126.5	125.9	125.3	124.7	124.1	123.5	123.0
135	133.5	132.8	132.1	131.5	130.9	130.2	129.6	129.0	128.4	127.8	127.2
140	137.9	137.2	136.6	135.9	135.2	134.6	134.0	133.3	132.7	132.1	131.5
145	142.4	141.7	141.0	140.3	139.6	139.0	138.3	137.7	137.0	136.4	135.8
150	146.9	146.1	145.4	144.7	144.0	143.3	142.6	142.0	141.3	140.7	140.0
155	151.3	150.6	149.8	149.1	148.4	147.7	147.0	146.3	145.6	144.9	144.3
160	155.8	155.0	154.3	153.5	152.8	152.0	151.3	150.6	149.9	149.2	148.5
165	160.3	159.5	158.7	157.9	157.2	156.4	155.7	154.9	154.2	153.5	152.8
170	164.7	163.9	163.1	162.3	161.5	160.8	160.0	159.3	158.5	157.8	157.1
175	169.2	168.4	167.5	166.7	165.9	165.1	164.3	163.6	162.8	162.1	161.3
180	173.7	172.8	172.0	171.1	170.3	169.5	168.7	167.9	167.1	166.3	165.6
185	178.1	177.3	176.4	175.5	174.7	173.9	173.0	172.2	171.4	170.6	169.9
190	182.6	181.7	180.8	179.9	179.1	178.2	177.4	176.5	175.7	174.9	174.1
195	187.1	186.2	185.2	184.3	183.5	182.6	181.7	180.9	180.0	179.2	178.4
200	191.6	190.6	189.7	188.7	187.8	186.9	186.1	185.2	184.3	183.5	182.6

CAUTION: NOZZLE MUST BE USED WITH MUFFLER.

CDI Meters, Inc.
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