

Flow Calculation for Sonic Nozzle

revised 04/16/10

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

where:

Assume:

m	mass flow rate, lb/sec	0.9945 discharge coefficient for trial calculation	0.044 lbm/hr-ft (mu) - 60 deg F
p	inlet pressure lb/ft2, absolute	14.7 psi atmospheric pressure	
A	throat area, ft2	100 psig inlet pressure	$Re = G * d / \mu$
T	inlet temperature, deg R	0.1730 in. diameter of throat	$G = m / A, \text{ lb/ft2sec}$
C	discharge coefficient	0.0752 lbm mass of one standard cubic foot of air	$C = 1 - 4.47 / \sqrt{Re}$
		68 degrees F inlet temperature	

SAMPLE CALCULATION

Throat Area:	0.0001632 ft2	mass velocity:	380.71 lbm/sec-ft2
Inlet pressure:	16,517 lb/ft2	Re:	449061
Absolute temperature:	528 degrees R	1 / sqrt(Re):	0.0015
mass flow:	0.0621 lb/sec or 49.58 scfm	C:	0.9933

SONIC NOZZLE FLOW											
Model 3050											
Flow shown in scfm referenced to air at 20 deg C.											
One standard cubic foot weighs 0.0752 lb.											
Inlet Conditions											
t (deg F) =											
p (psig)											
	40	45	50	55	60	65	70	75	80	85	90
10	10.9	10.8	10.8	10.7	10.7	10.6	10.6	10.5	10.5	10.4	10.4
15	13.1	13.0	13.0	12.9	12.8	12.8	12.7	12.7	12.6	12.5	12.5
20	15.3	15.2	15.2	15.1	15.0	14.9	14.9	14.8	14.7	14.7	14.6
25	17.5	17.4	17.4	17.3	17.2	17.1	17.0	16.9	16.9	16.8	16.7
30	19.8	19.7	19.6	19.5	19.4	19.3	19.2	19.1	19.0	18.9	18.8
35	22.0	21.9	21.8	21.7	21.5	21.4	21.3	21.2	21.1	21.0	21.0
40	24.2	24.1	24.0	23.8	23.7	23.6	23.5	23.4	23.3	23.2	23.1
45	26.4	26.3	26.2	26.0	25.9	25.8	25.7	25.5	25.4	25.3	25.2
50	28.6	28.5	28.4	28.2	28.1	28.0	27.8	27.7	27.6	27.4	27.3
55	30.9	30.7	30.6	30.4	30.3	30.1	30.0	29.8	29.7	29.6	29.4
60	33.1	32.9	32.8	32.6	32.4	32.3	32.1	32.0	31.8	31.7	31.6
65	35.3	35.1	35.0	34.8	34.6	34.5	34.3	34.1	34.0	33.8	33.7
70	37.5	37.4	37.2	37.0	36.8	36.6	36.5	36.3	36.1	36.0	35.8
75	39.8	39.6	39.4	39.2	39.0	38.8	38.6	38.4	38.3	38.1	37.9
80	42.0	41.8	41.6	41.4	41.2	41.0	40.8	40.6	40.4	40.2	40.0
85	44.2	44.0	43.8	43.6	43.4	43.2	42.9	42.7	42.5	42.4	42.2
90	46.4	46.2	46.0	45.8	45.5	45.3	45.1	44.9	44.7	44.5	44.3
95	48.7	48.4	48.2	48.0	47.7	47.5	47.3	47.0	46.8	46.6	46.4
100	50.9	50.6	50.4	50.1	49.9	49.7	49.4	49.2	49.0	48.7	48.5
105	53.1	52.9	52.6	52.3	52.1	51.8	51.6	51.4	51.1	50.9	50.6
110	55.3	55.1	54.8	54.5	54.3	54.0	53.8	53.5	53.3	53.0	52.8
115	57.6	57.3	57.0	56.7	56.5	56.2	55.9	55.7	55.4	55.1	54.9
120	59.8	59.5	59.2	58.9	58.6	58.4	58.1	57.8	57.5	57.3	57.0
125	62.0	61.7	61.4	61.1	60.8	60.5	60.2	60.0	59.7	59.4	59.1
130	64.3	63.9	63.6	63.3	63.0	62.7	62.4	62.1	61.8	61.5	61.3
135	66.5	66.1	65.8	65.5	65.2	64.9	64.6	64.3	64.0	63.7	63.4
140	68.7	68.4	68.0	67.7	67.4	67.1	66.7	66.4	66.1	65.8	65.5
145	70.9	70.6	70.2	69.9	69.6	69.2	68.9	68.6	68.3	67.9	67.6
150	73.2	72.8	72.4	72.1	71.7	71.4	71.1	70.7	70.4	70.1	69.8
155	75.4	75.0	74.6	74.3	73.9	73.6	73.2	72.9	72.5	72.2	71.9
160	77.6	77.2	76.9	76.5	76.1	75.7	75.4	75.0	74.7	74.3	74.0
165	79.8	79.4	79.1	78.7	78.3	77.9	77.5	77.2	76.8	76.5	76.1
170	82.1	81.7	81.3	80.9	80.5	80.1	79.7	79.3	79.0	78.6	78.3
175	84.3	83.9	83.5	83.1	82.7	82.3	81.9	81.5	81.1	80.7	80.4
180	86.5	86.1	85.7	85.3	84.8	84.4	84.0	83.6	83.3	82.9	82.5
185	88.8	88.3	87.9	87.5	87.0	86.6	86.2	85.8	85.4	85.0	84.6
190	91.0	90.5	90.1	89.6	89.2	88.8	88.4	88.0	87.5	87.1	86.7
195	93.2	92.7	92.3	91.8	91.4	91.0	90.5	90.1	89.7	89.3	88.9
200	95.4	95.0	94.5	94.0	93.6	93.1	92.7	92.3	91.8	91.4	91.0

CAUTION: NOZZLE MUST BE USED WITH MUFFLER.

CDI Meters, Inc.
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