U.S. FAN INTERNATIONAL®

USPB Backwardly Inclined And USPA Airfoil Blade Plenum Fans Sound Power Levels

USS813A
May 1999

Li censed to bear the AMCA Seal for Sound and Air Per for mance

U.S. FAN INTERNATIONAL® certifies that the USPB and USPA Series fans shown herein are licensed to bear the AMCA Seal. The ratings shown are based on tests and procedures performed in accordance with AMCA Publication 211 and AMCA Publication 311 and comply with the requirements of the AMCA Certified Ratings Program. For air performance data refer to catalog USC813.

INTRODUCTION

This catalog is a supplement to catalog USC813.

This catalog uses procedures in accordance with AMCA Standards. The sound power level ratings shown are in decibels, referred to 10^{-12} watts calculated per AMCA Standard 301. Values shown are for inlet (L_{wi}) sound power levels for installation type 'C', ducted inlet, free outlet. Ratings include the effects of duct end correction.

In order to use this catalog the user must understand two concepts, that of specific sound power and VP/SP as follows:

Specific sound power is the means by which a fan's overall sound can be reduced to a set of base numbers which still represent the "signature" of the original fan. This is provided in the form of decibels produced from a fan delivering one CFM at one inch pressure over a frequency range of eight octave bands. In order to predict the sound of another geometrically similar fan, the specific sound power level spectrum for that type of fan and its operating point location on the fan curve is found. The acoustic energy corresponding to the new fan is added back into the "base signature". This acoustic energy is called the "capacity fraction (L_{wf})". Therefore, the general equation is:

$L_{wi} = L_{wki} + L_{wf}$ Where: L_{wi} = Inlet sound power of fan
L_{wki} = Inlet specific sound power for a particular fan design
L_{wf} = Capacity fraction which is 10 log (CFM) + 20 log (total pressure)

The specific sound power of a fan changes with operating point location on the fan curve. Therefore, a means must be devised to identify the specific sound power levels which correspond to the operating point for which sound is being desired. This is done using the term VP/SP in that regard less of speed, fan size or density, the VP/SP ratio remains constant and defines the same corresponding operating point for the base fan as well as the new fan.

The capacity fraction (L_{wf}) and VP/SP ratio can easily be found using Tables I and II. It is important to note that the VP/SP ratio requires both the VP and SP values to be at the same density. Because it is necessary that SP values be known at standard conditions in order to use catalog USC813, it is convenient to determine the VP/SP ratio at standard conditions using Table I. However, the acoustic energy (capacity fraction - L_{wf}) is a function of the TP at the actual operating conditions of the new fan. Therefore, use the TP corresponding to the actual operating conditions in Table II or you will obtain the wrong values of sound power.

SAMPLE CALCULATION

This catalog is a supplement to the air performance catalog USC813. The sample calculation which follows is a continuation of the sample selection located on page 8 of USC813.

A USPA37 fan must deliver 25,134 CFM (11.86 m^3/sec) at 4.0 inches (993.4 Pa) static pressure. The fan must perform at an altitude of 5000 feet. (1524 m) with an entering air temperature of 150°F (65.5°C).

1. DETERMINE THE AERODYNAMIC RATING

   The aerodynamic rating is found using the procedures found on page 8 of catalog USC813. The final rating at actual operating conditions is:

   25,134 CFM (11.86 m^3/sec), 4.0 inches (993.4 Pa) static pressure, 1260 RPM and 24.50 HP (18.27 kw).

2. DETERMINE THE VP/SP RATIO

   Because the inlet and outlet areas of a plenum fan are different and the test method utilized an inlet duct, the inlet velocity of the fan must be used to determine the VP/SP ratio. From page 21 of USC813, the inlet area is 8.3 sq. ft. (.771 m^2).

   $$\text{Inlet velocity} = \frac{25134\ CFM\ (1186\ {}^{m^3}\!/_{sec})}{8.3\ sq.ft.\ (.771 m^2)} = 3028 \text{ ft/min (15.4 m/sec).}$$

   From Table I, for 3028 ft/min the Velocity Pressure is .57 inches wg., by interpolation, for standard air density. For conditions other than standard, Velocity Pressure must be converted by the same factor as Static Pressure in the example on page 8 of USC813:

   $$\text{VP} = \frac{\textbf{.57 inches wg.}}{1.38} = .41 \text{ inches wg.}$$

   Then for a Static Pressure of 4 inches wg. the VP/SP ratio is .11.

3. DETERMINE THE CAPACITY FRACTION (L_{wf})

   The Capacity Fraction (L_{wf}) is given in Table II as a function of Air Flow (CFM) and Total Pressure (inches wg.). Total Pressure is the sum of Velocity Pressure and Static Pressure, or 4.44 inches wg. By interpolation in Table II between 20,000 and 30,000 CFM, and 4 and 4.5 inches wg. Total Pressure, 25,134 CFM at 4.44 inches wg. has a Capacity Fraction of 57 dB.

4. DETERMINE THE SPECIFIC SOUND POWER (L_{wki}) FOR THE FAN SIZE AND SPEED DESIRED.

   The USPB37 fan will run at 1260 RPM and operate at a VP/SP ratio of .11. Interpolating for these values in the Sound Power Table determine the values of L_{wki}.

   For a speed of 1260 RPM and a VP/SP ratio of .11, the values of L_{wki} are:

   OCTAVE BANDS

1	2	3	4	5	6	7	8
51	48	40	29	27	22	18	18

5. DETERMINE INLET SOUND POWER LEVELS (L_{wi}) dB re 10^{-12} Watts.

   OCTAVE BANDS

	1	2	3	4	5	6	7	8
L_{wko}	51	48	40	29	27	22	18	18
L_{wf}	57	57	57	57	57	57	57	57
L_{wo}	106	105	97	86	84	79	75	75

VP/SP RATIO TABLE I
Standard Conditions

Inlet Velocity (FPM)	Velocity * Pressure (in wg.)	Static Pressure (inches wg.)																								
		1/4	3/8	1/2	5/8	3/4	7/8	1	1 1/4	1 1/2	2	2 1/2	3	3 1/2	4	4 1/2	5	5 1/2	6	6 1/2	7	8	9	10	12	14
600	.02	.09	.06	.04	.04	.03	.03	.02	.02	.01	.01	.01	.01	.01	.01											
800	.04	.16	.11	.08	.06	.05	.05	.04	.03	.03	.02	.02	.01	.01	.01	.01	.01	.01	.01	.01	.01					
1000	.06	.25	.17	.12	.10	.08	.07	.06	.05	.04	.03	.02	.02	.02	.02	.01	.01	.01	.01	.01	.01	.01	.01	.01	.01	
1200	.09	.36	.24	.18	.14	.12	.10	.09	.07	.06	.04	.04	.03	.03	.02	.02	.02	.02	.01	.01	.01	.01	.01	.01	.01	.01
1400	.12	.49	.33	.24	.20	.16	.14	.12	.10	.08	.06	.05	.04	.03	.03	.03	.02	.02	.02	.02	.02	.02	.01	.01	.01	.01
1600	.16	.64	.43	.32	.26	.21	.18	.16	.13	.11	.08	.06	.05	.05	.04	.04	.03	.03	.03	.02	.02	.02	.02	.02	.01	.01
1800	.20	.81	.54	.40	.32	.27	.23	.20	.16	.13	.10	.08	.07	.06	.05	.04	.04	.04	.03	.03	.03	.03	.02	.02	.02	.01
2000	.25	1.00	.67	.50	.40	.33	.29	.25	.20	.17	.12	.10	.08	.07	.06	.06	.05	.05	.04	.04	.04	.03	.03	.02	.02	.02
2200	.30		.80	.60	.48	.40	.34	.30	.24	.20	.15	.12	.10	.09	.08	.07	.06	.05	.05	.05	.04	.04	.03	.03	.03	.02
2400	.36		.96	.72	.57	.48	.41	.36	.29	.24	.18	.14	.12	.10	.09	.08	.07	.07	.06	.06	.05	.04	.04	.04	.03	.03
2600	.42			.84	.67	.56	.48	.42	.34	.28	.21	.17	.14	.12	.11	.09	.08	.08	.07	.06	.06	.05	.05	.04	.04	.03
2800	.49			.98	.78	.65	.56	.49	.39	.33	.24	.20	.16	.14	.12	.11	.10	.09	.08	.08	.07	.06	.05	.05	.04	.03
3000	.56				.90	.75	.64	.56	.45	.37	.28	.22	.19	.16	.14	.12	.11	.10	.09	.09	.08	.07	.06	.06	.05	.04
3200	.64				1.00	.85	.73	.64	.51	.43	.32	.26	.21	.18	.16	.14	.13	.12	.11	.10	.09	.08	.07	.06	.05	.05
3400	.72					.96	.82	.72	.58	.48	.36	.29	.24	.21	.18	.16	.14	.13	.12	.11	.10	.09	.08	.07	.06	.05
3600	.81						.92	.81	.65	.54	.40	.32	.27	.23	.20	.18	.16	.15	.13	.12	.12	.10	.09	.08	.07	.06
3800	.90							.90	.72	.60	.45	.36	.30	.26	.23	.20	.18	.16	.15	.14	.13	.11	.10	.09	.08	.06
4000	1.00							1.00	.80	.67	.50	.40	.33	.29	.25	.22	.20	.18	.17	.15	.14	.12	.11	.10	.08	.07
4200	1.10								.88	.73	.55	.44	.37	.31	.28	.24	.22	.20	.18	.17	.16	.14	.12	.11	.09	.08
4400	1.21								.97	.80	.60	.48	.40	.34	.30	.27	.24	.22	.20	.19	.17	.15	.13	.12	.10	.09
4600	1.32									.88	.66	.53	.44	.38	.33	.29	.26	.24	.22	.20	.19	.16	.15	.13	.11	.09
4800	1.44									.96	.72	.57	.48	.41	.36	.32	.29	.26	.24	.22	.21	.18	.16	.14	.12	.10
5000	1.56										.78	.62	.52	.45	.39	.35	.31	.28	.26	.24	.22	.19	.17	.16	.13	.11
5200	1.69										.84	.67	.56	.48	.42	.37	.34	.31	.28	.26	.24	.21	.19	.17	.14	.12
5400	1.82										.91	.73	.61	.52	.45	.40	.36	.33	.30	.28	.26	.23	.20	.18	.15	.13
5600	1.96										.98	.78	.65	.56	.49	.43	.39	.36	.33	.30	.28	.24	.22	.20	.16	.14

* Velocity Pressures are given for Standard Air at .075 lbs./cu. ft.

CAPACITY FRACTION (L_{wf}) TABLE II

CFM	Total Pressure at Operating Conditions (inches wg.)																									
	1/4	3/8	1/2	5/8	3/4	7/8	1	1 1/4	1 1/2	2	2 1/2	3	3 1/2	4	4 1/2	5	5 1/2	6	6 1/2	7	8	9	10	12	14
100	8	11	14	16	18	19	20	22	24	26	28	30	31	32	33	34	35	36	36	37	38	39	40	42	43
150	10	13	16	18	19	21	22	24	25	28	30	31	33	34	35	36	37	37	38	39	40	41	42	43	45
200	11	14	17	19	21	22	23	25	27	29	31	33	34	35	36	37	38	39	39	40	41	42	43	45	46
300	13	16	19	21	22	24	25	27	28	31	33	34	36	37	38	39	40	40	41	42	43	44	45	46	48
500	15	18	21	23	24	26	27	29	31	33	35	37	38	39	40	41	42	43	43	44	45	46	47	49	50
750	17	20	23	25	26	28	29	31	32	35	37	38	40	41	42	43	44	44	45	46	47	48	49	50	52
1000	18	21	24	26	28	29	30	32	34	36	38	40	41	42	43	44	45	46	46	47	48	49	50	52	53
1500	20	23	26	28	29	31	32	34	35	38	40	41	43	44	45	46	47	47	48	49	50	51	52	53	55
2000	21	24	27	29	31	32	33	35	37	39	41	43	44	45	46	47	48	49	49	50	51	52	53	55	56
3000	23	26	29	31	32	34	35	37	38	41	43	44	46	47	48	49	50	50	51	52	53	54	55	56	58
5000	25	28	31	33	34	36	37	39	41	43	45	47	48	49	50	51	52	53	53	54	55	56	57	59	60
7500	27	30	33	35	36	38	39	41	42	45	47	48	50	51	52	53	54	54	55	56	57	58	59	60	62
10000	28	31	34	36	38	39	40	42	44	46	48	50	51	52	53	54	55	56	56	57	58	59	60	62	63
15000	30	33	36	38	39	41	42	44	45	48	50	51	53	54	55	56	57	57	58	59	60	61	62	63	65
20000	31	34	37	39	41	42	43	45	47	49	51	53	54	55	56	57	58	59	59	60	61	62	63	65	66
30000	33	36	39	41	42	44	45	47	48	51	53	54	56	57	58	59	60	60	61	62	63	64	65	66	68
50000	35	38	41	43	44	46	47	49	51	53	55	57	58	59	60	61	62	63	63	64	65	66	67	69	70
75000	37	40	43	45	46	48	49	51	52	55	57	58	60	61	62	63	64	64	65	66	67	68	69	70	72
100000	38	41	44	46	48	49	50	52	54	56	58	60	61	62	63	64	65	66	66	67	68	69	70	72	73
150000	40	43	46	48	49	51	52	54	55	58	60	61	63	64	65	66	67	67	68	69	70	71	72	73	75
200000	41	44	47	49	51	52	53	55	57	59	61	63	64	65	66	67	68	69	69	70	71	72	73	75	76

IN LET SPE CIFIC SOUND POWER LEVELS IN DECI BELS RE FERRED TO 10^{-12} WATTS (L_{wk})

USPB SIZE 12 & 13

RPM	VP/SP = .03								VP/SP = .05								VP/SP = .1								VP/SP = .2								VP/SP = .4								VP/SP = .8							
	OCTAVE BANDS																																																
	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
600	40	42	35	32	29	26	23	20	40	42	35	32	29	26	23	20	43	45	39	36	33	29	25	21	48	50	43	40	37	33	29	25	52	54	46	44	42	37	32	27	57	60	52	50	47	41	36	30
800	38	42	37	33	30	27	24	21	38	42	37	33	30	27	24	21	41	46	40	37	35	31	27	23	46	51	44	41	39	35	31	27	50	55	48	45	43	39	34	29	55	60	53	50	49	44	38	32
1000	42	41	39	34	31	28	25	22	42	41	39	34	31	28	25	22	44	44	43	38	36	32	28	24	49	49	47	42	40	36	32	28	53	53	51	46	44	40	36	31	58	58	57	51	50	45	40	34
1200	45	40	42	35	32	29	26	23	45	40	42	35	32	29	26	23	46	43	45	39	36	33	29	25	51	48	50	43	40	37	33	29	55	52	54	46	44	42	37	32	61	57	60	52	50	47	41	36
1500	48	39	42	36	33	30	27	24	48	39	42	36	33	30	27	24	49	41	46	40	37	35	31	27	54	46	51	44	41	39	35	30	58	50	55	47	45	43	38	34	63	55	60	53	50	49	43	37
1800	52	40	42	38	34	31	28	25	52	40	42	38	34	31	28	25	52	43	45	42	37	35	32	28	57	48	50	46	41	39	36	32	61	51	54	50	45	44	40	35	66	57	59	55	51	49	45	39
2100	55	43	41	40	35	32	29	26	55	43	41	40	35	32	29	26	56	45	44	44	38	36	33	29	60	50	49	48	42	40	37	32	63	53	53	52	46	44	41	36	68	59	58	58	51	50	46	40
2400	57	45	40	42	35	32	29	26	57	45	40	42	35	32	29	26	58	46	43	45	39	36	33	29	62	51	48	50	43	40	37	33	65	55	52	54	46	44	42	37	70	61	57	60	52	50	47	41
3000	61	49	39	42	36	33	30	27	61	49	39	42	36	33	30	27	63	49	41	46	40	37	35	31	66	54	46	51	44	41	39	35	68	58	50	55	47	45	43	38	73	64	56	60	53	50	49	43
3600	62	52	40	42	38	34	31	28	62	52	40	42	38	34	31	28	64	53	43	45	42	37	35	32	67	57	48	50	46	41	39	36	69	61	51	54	50	45	44	40	74	66	57	59	55	51	49	45
4200	62	55	43	41	40	35	32	29	62	55	43	41	40	35	32	29	64	55	45	44	44	38	36	33	67	60	50	49	48	42	40	37	69	63	53	53	52	46	44	41	74	68	59	58	58	51	50	46
4800	62	57	45	40	42	35	32	29	62	57	45	40	42	35	32	29	64	58	46	43	45	39	36	33	67	62	51	48	50	43	40	37	69	65	55	52	54	46	44	42	74	70	61	57	60	52	50	47

USPA SIZE 15 - 16

RPM	VP/SP = .03								VP/SP = .05								VP/SP = .1								VP/SP = .2								VP/SP = .4								VP/SP = .8							
	OCTAVE BANDS																																															
	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
600	43	41	33	29	27	25	23	21	42	41	32	29	26	25	23	21	45	44	35	33	30	28	25	23	48	47	39	37	34	31	29	27	50	49	42	39	36	34	32	30	50	49	42	39	36	34	32	30
800	42	44	35	31	27	25	24	22	41	45	34	30	27	25	23	22	45	47	37	34	31	28	26	24	48	49	41	38	35	32	30	28	50	51	44	40	37	35	33	31	50	51	44	40	37	35	33	31
1000	43	44	38	32	28	26	24	22	41	43	38	31	28	26	24	22	45	46	41	35	32	29	27	25	48	49	44	39	36	33	31	29	50	51	46	41	38	35	33	31	50	51	46	41	38	35	33	31
1200	43	43	41	33	29	27	25	23	41	42	41	32	29	26	25	23	45	45	44	35	33	30	28	25	49	48	47	39	37	34	31	29	50	50	49	42	39	36	34	32	50	50	49	42	39	36	34	32
1500	44	42	44	34	30	27	25	23	42	41	45	33	30	27	25	23	46	45	47	36	34	30	28	26	49	48	49	40	38	34	32	30	51	50	51	43	40	37	35	33	51	50	51	43	40	37	35	33
1800	48	42	44	37	31	28	26	24	47	41	44	36	31	28	26	24	49	45	46	39	34	31	29	27	53	48	49	43	38	35	33	31	55	50	51	45	41	37	35	33	55	50	51	45	41	37	35	33
2100	52	43	43	39	32	29	26	24	52	41	43	39	31	28	26	24	52	45	46	42	35	32	29	27	56	48	49	45	39	36	33	31	59	50	51	47	41	38	36	34	59	50	51	47	41	38	36	34
2400	55	43	43	41	33	29	27	25	56	41	42	41	32	29	26	25	55	45	45	44	35	33	30	28	59	49	48	47	39	37	34	31	62	50	50	49	42	39	36	34	62	50	50	49	42	39	36	34
3000	60	44	42	44	34	30	27	25	62	42	41	45	33	30	27	25	59	46	45	47	36	34	30	28	63	49	48	49	40	38	34	32	66	51	50	51	43	40	37	35	66	51	50	51	43	40	37	35
3600	60	49	42	44	37	31	28	26	62	47	41	44	36	31	28	26	59	49	45	46	39	34	31	29	63	53	48	49	43	38	35	33	66	55	50	51	45	41	37	35	66	55	50	51	45	41	37	35
4200	60	52	43	43	39	32	29	26	62	52	41	43	39	31	28	26	59	52	45	46	42	35	32	29	63	56	48	49	45	39	36	33	66	59	50	51	47	41	38	36	66	59	50	51	47	41	38	36
4800	60	55	43	43	41	33	29	27	62	56	41	42	41	32	29	26	59	55	45	45	44	35	33	30	63	59	49	48	47	39	37	34	66	62	50	50	49	42	39	36	66	62	50	50	49	42	39	36

USPA SIZE 18 - 24

RPM	VP/SP = .03								VP/SP = .05								VP/SP = .1								VP/SP = .2								VP/SP = .4								VP/SP = .8							
	OCTAVE BANDS																																															
	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
400	44	36	35	33	28	19	10	1	44	36	35	33	28	19	10	1	45	38	36	34	28	24	19	14	48	41	38	36	32	30	29	27	51	45	41	39	35	34	33	32	54	48	45	43	38	36	34	31
500	45	37	35	34	31	22	13	4	45	37	35	34	31	22	13	4	46	39	36	35	30	25	20	15	49	42	39	38	33	31	29	28	52	46	42	40	36	35	34	33	54	50	45	44	39	37	34	32
600	44	40	35	34	32	24	15	6	44	40	35	34	32	24	15	6	45	41	36	36	31	26	22	17	49	44	40	38	34	31	30	28	52	48	43	41	37	35	34	33	55	51	46	45	40	37	35	33
800	42	44	36	35	33	28	19	10	42	44	36	35	33	28	19	10	44	45	38	36	34	28	24	19	48	48	41	38	36	32	30	29	52	51	45	41	39	35	34	33	55	54	48	45	43	38	36	34
1000	41	45	37	35	34	31	22	13	41	45	37	35	34	31	22	13	44	46	39	36	35	30	25	20	48	49	42	39	38	33	31	29	52	52	46	42	40	36	35	34	56	54	50	45	44	39	37	34
1200	45	44	40	35	34	32	24	15	45	44	40	35	34	32	24	15	47	45	41	36	36	31	26	22	52	49	44	40	38	34	31	30	56	52	48	43	41	37	35	34	59	55	51	46	45	40	37	35
1500	50	43	43	36	34	33	27	18	50	43	43	36	34	33	27	18	52	44	44	37	36	33	28	23	56	49	47	41	38	35	32	30	60	52	50	44	41	38	35	34	64	55	53	48	45	42	38	36
1800	54	42	45	37	35	33	29	20	54	42	45	37	35	33	29	20	56	44	46	38	36	35	29	24	60	48	49	42	39	37	32	31	64	52	52	45	41	40	35	34	68	56	54	49	45	44	39	36
2100	57	42	45	37	35	34	31	22	57	42	45	37	35	34	31	22	59	44	46	39	36	36	30	25	63	49	49	43	39	38	33	31	67	53	52	47	42	41	36	35	71	57	54	50	45	45	39	37
2400	57	45	44	40	35	34	32	24	57	45	44	40	35	34	32	24	59	47	45	41	36	36	31	26	63	52	49	44	40	38	34	31	67	56	52	48	43	41	37	35	71	60	55	51	46	45	40	37
3000	57	50	43	43	36	34	33	27	57	50	43	43	36	34	33	27	59	52	44	44	37	36	33	28	63	56	49	47	41	38	35	32	67	61	52	50	44	41	38	35	71	64	55	53	48	45	42	38
3600	57	54	42	45	37	35	33	29	57	54	42	45	37	35	33	29	59	56	44	46	38	36	35	29	63	60	48	49	42	39	37	32	67	64	52	52	45	41	40	35	71	68	56	54	49	45	44	39
4200	57	57	42	45	37	35	34	31	57	57	42	45	37	35	34	31	59	59	44	46	39	36	36	30	63	63	49	49	43	39	38	33	67	67	53	52	47	42	41	36	71	71	57	54	50	45	45	39

IN LET SPE CIFIC SOUND POWER LEVELS IN DECI BELS RE FERRED TO 10^{-12} WATTS (L_{wk})

USPA SIZE 27 - 33

RPM	VP/SP = .03								VP/SP = .05								VP/SP = .1								VP/SP = .2								VP/SP = .4								VP/SP = .8							
	OCTAVE BANDS																																																
	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
300	44	34	29	27	23	23	23	23	43	37	26	25	22	22	22	22	44	31	28	26	22	21	21	21	48	36	33	30	26	22	18	15	52	40	37	34	31	26	21	16	55	44	41	38	35	30	25	20
400	51	38	31	28	24	23	23	23	47	39	31	26	23	22	22	22	48	36	29	27	24	21	21	21	51	41	34	31	27	24	20	16	55	45	38	35	32	28	23	18	57	48	42	39	36	32	27	22
500	52	41	32	28	26	23	23	23	48	41	34	26	24	22	22	22	48	41	30	27	25	21	21	21	52	45	35	32	29	25	21	17	55	49	39	36	33	29	24	19	58	52	43	40	37	33	28	23
600	52	44	34	29	27	23	23	23	48	43	37	26	25	22	22	22	48	44	31	28	26	22	21	21	52	48	36	33	30	26	22	18	55	52	40	37	34	31	26	21	58	55	44	41	38	35	30	25
800	55	51	38	31	28	24	23	23	50	47	39	31	26	23	22	22	55	48	36	29	27	24	21	21	54	51	41	34	31	27	24	20	58	55	45	38	35	32	28	23	60	57	48	42	39	36	32	27
1000	57	52	41	32	28	26	23	23	52	48	41	34	26	24	22	22	59	48	41	30	27	25	21	21	56	52	45	35	32	29	25	21	60	55	49	39	36	33	29	24	62	58	52	43	40	37	33	28
1200	59	52	44	34	29	27	23	23	54	48	43	37	26	25	22	22	64	48	44	31	28	26	22	21	58	52	48	36	33	30	26	22	61	55	52	40	37	34	31	26	63	58	55	44	41	38	35	30
1500	59	54	50	37	30	27	24	23	54	50	46	39	30	26	23	22	64	53	47	35	29	27	23	21	58	54	51	40	34	31	27	23	61	57	54	44	38	35	32	27	63	59	57	47	42	39	36	31
1800	59	56	52	40	32	28	25	23	54	51	48	40	32	26	24	22	64	57	48	39	29	27	24	21	58	55	52	43	34	32	28	24	61	59	55	47	38	35	32	28	63	61	58	50	42	39	36	33
2100	59	58	52	42	33	28	26	23	54	53	48	42	35	26	24	22	64	61	48	42	30	27	25	21	58	56	52	46	35	32	29	25	61	60	55	50	39	36	33	30	63	62	58	53	43	40	37	34
2400	59	59	52	44	34	29	27	23	54	54	48	43	37	26	25	22	64	64	48	44	31	28	26	22	58	58	52	48	36	33	30	26	61	61	55	52	40	37	34	31	63	63	58	55	44	41	38	35
3000	59	59	54	50	37	30	27	24	54	54	50	46	39	30	26	23	64	64	53	47	35	29	27	23	58	58	54	51	40	34	31	27	61	61	57	54	44	38	35	32	63	63	59	57	47	42	39	36

USPA SIZE 37 - 89

RPM	VP/SP = .03								VP/SP = .05								VP/SP = .1								VP/SP = .2								VP/SP = .4								VP/SP = .8							
	OCTAVE BANDS																																															
	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
100	27	24	19	18	17	17	17	17	27	24	19	18	17	17	17	17	27	24	19	18	17	17	17	17	30	27	22	21	20	19	18	18	34	32	27	25	25	25	25	24	38	35	31	30	30	30	30	30
200	32	27	24	19	18	17	17	17	32	27	24	19	18	17	17	17	32	27	24	19	18	17	17	17	36	30	27	22	21	20	19	18	41	34	32	27	25	25	25	25	44	38	35	31	30	30	30	30
300	39	28	27	22	18	18	17	17	39	28	27	22	18	18	17	17	39	28	27	22	18	18	17	17	44	32	30	24	21	20	19	19	48	36	34	29	26	25	25	25	51	40	38	33	30	30	30	30
400	46	32	27	24	19	18	17	17	46	32	27	24	19	18	17	17	46	32	27	24	19	18	17	17	51	36	30	27	22	21	20	19	55	41	34	32	27	25	25	25	58	44	38	35	31	30	30	30
500	48	35	27	26	20	18	17	17	48	35	27	26	20	18	17	17	48	35	27	26	20	18	17	17	52	40	30	29	23	21	20	19	56	44	34	34	27	25	25	25	59	47	38	38	31	30	30	30
600	48	39	28	27	22	18	18	17	48	39	28	27	22	18	18	17	48	39	28	27	22	18	18	17	53	44	32	30	24	21	20	19	57	48	36	34	29	26	25	25	60	51	40	38	33	30	30	30
800	49	46	32	27	24	19	18	17	49	46	32	27	24	19	18	17	49	46	32	27	24	19	18	17	54	51	36	30	27	22	21	20	59	55	41	34	32	27	25	25	62	58	44	38	35	31	30	30
1000	50	48	35	27	26	20	18	17	50	48	35	27	26	20	18	17	50	48	35	27	26	20	18	17	54	52	40	30	29	23	21	20	60	56	44	34	34	27	25	25	64	59	47	38	38	31	30	30
1200	51	48	39	28	27	22	18	18	51	48	39	28	27	22	18	18	51	48	39	28	27	22	18	18	55	53	44	32	30	24	21	20	60	57	48	36	34	29	26	25	64	60	51	40	38	33	30	30
1500	51	49	45	31	27	24	19	18	51	49	45	31	27	24	19	18	51	49	45	31	27	24	19	18	55	54	50	35	30	27	22	21	60	58	54	40	34	31	26	25	64	62	57	43	38	35	30	30
1800	51	50	48	33	27	25	20	18	51	50	48	33	27	25	20	18	51	50	48	33	27	25	20	18	55	54	52	38	30	28	23	21	60	60	56	43	34	33	27	25	64	63	59	46	38	37	31	30
2100	51	51	48	36	27	27	21	18	51	51	48	36	27	27	21	18	51	51	48	36	27	27	21	18	55	55	52	40	30	30	23	21	60	60	56	45	34	34	27	25	64	64	59	48	38	38	31	30

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