

# System Effect of Damper Louver Combinations

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**ABSTRACT**

The placement of dampers behind a louver is an everyday occurrence and to my knowledge there is no comprehensive data established to recommend the location of the damper. This paper will give test results to verify the system effect of dampers placed at various distances from a louver.

The performance of flow control dampers in heating, ventilating and air conditioning HVAC systems is critical to indoor air quality and to the reliability, energy efficiency and overall performance of such systems. In the economizer portion of an air handling system, the damper louver selection determines the IAQ performance of the unit. And, in a typical system the ventilation air can be as high as 30% of the annual heating and cooling cost.

No testing of damper configuration has been performed and engineers do not have data to adequately size the dampers, consequently, the system fails to produce the design supply airflow causing system operating problems and wasted energy.

The purpose of this test is to determine the pressure required at various damper blade angles in different geometric configurations.

The size of the louvers and dampers is 36 X 48 and the louver had 48% free area. The dampers were 6" wide design, both parallel and opposed blade action and two different manufacturers of dampers to see if there was a difference between designs in compliance with AMCA Standard 500.

## DESCRIPTION OF TEST

Louver Entry	Test	Damper Blade	Spacing
	B9	Parallel	6"
	B10	Parallel 2	D/2
	B11	Parallel	D
	B3	OB	6"
	B4	OB	D/2
	B5	OB	D
	B6	Anti Parallel	6"
	B7	Anti Parallel	D/2
	B8	Anti Parallel	D

## RESULTS

For the most part it is permissible to place the damper close to the louver and you should avoid the opposed bladed damper because the curve shows that it will starve the system especially when used in an economizer control. Also, you can mount the parallel bladed damper with the blades in line with the louver blade or in the opposite direction with little change.

SUMMARY 7 OB and 11 PB Applications

OB Original loss coefficients for 7 applications:

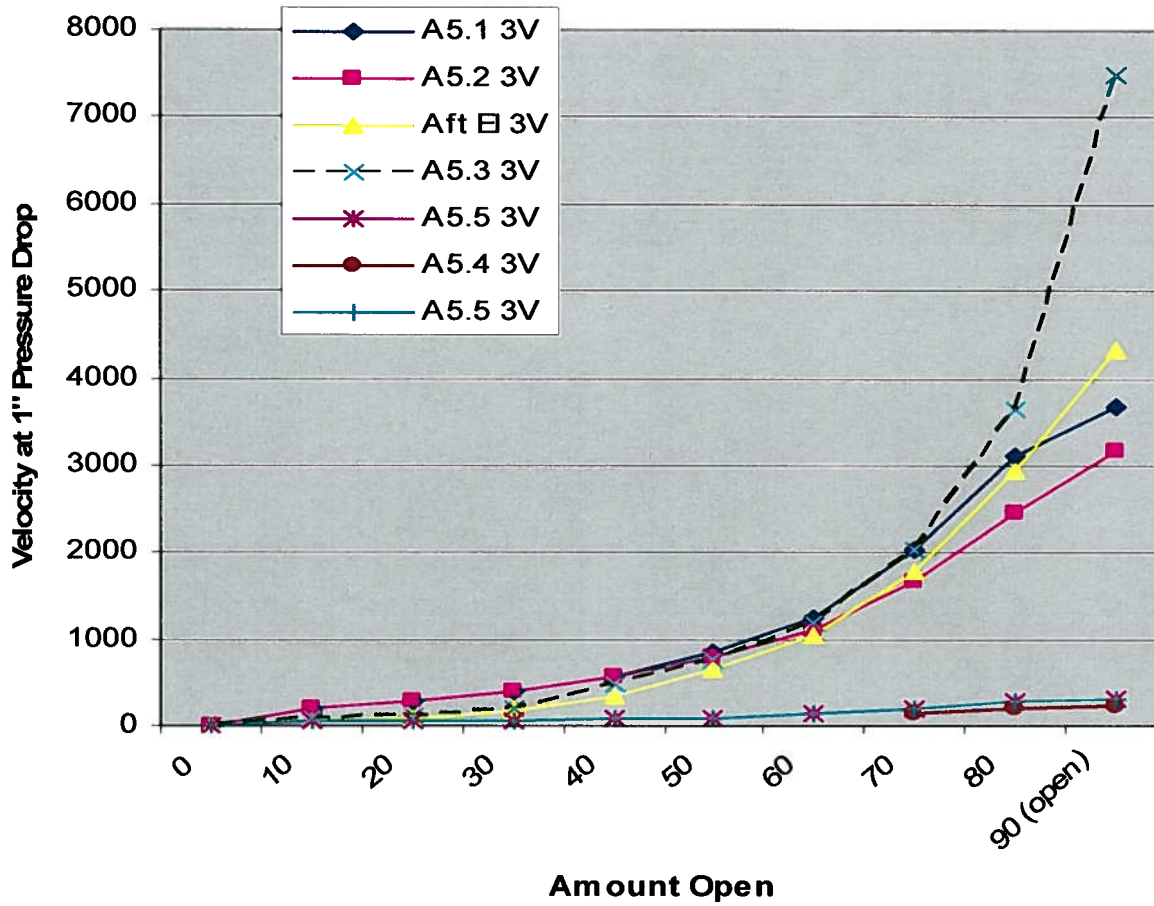
Angle	A5.1 3V	A5.2 3V	Aft EI 3V	A5.3 3V	A5.5 3V	A5.4 3V	A5.5 3V
0	1000000	1000000	1000000	1000000	1000000		1000000
10	400	400	3277	2500	8000		8000
20	200	200	2117	1127	6000		6000
30	100	100	660	471	4460		4460
40	50	50	150	68	3000		3000
50	22	26	38	28	1927		1927
60	10	13.2	15	11.2	977		977
70	3.9	5.7	5	3.8	392	703	392
80	1.7	2.7	1.8	1.2	198	367	198
90 (open)	1.2	1.6	0.9	0.29	172	297	172

Interpolated





OB Absolute Velocities with same damper





PB

Original loss coefficients for 11 applications:

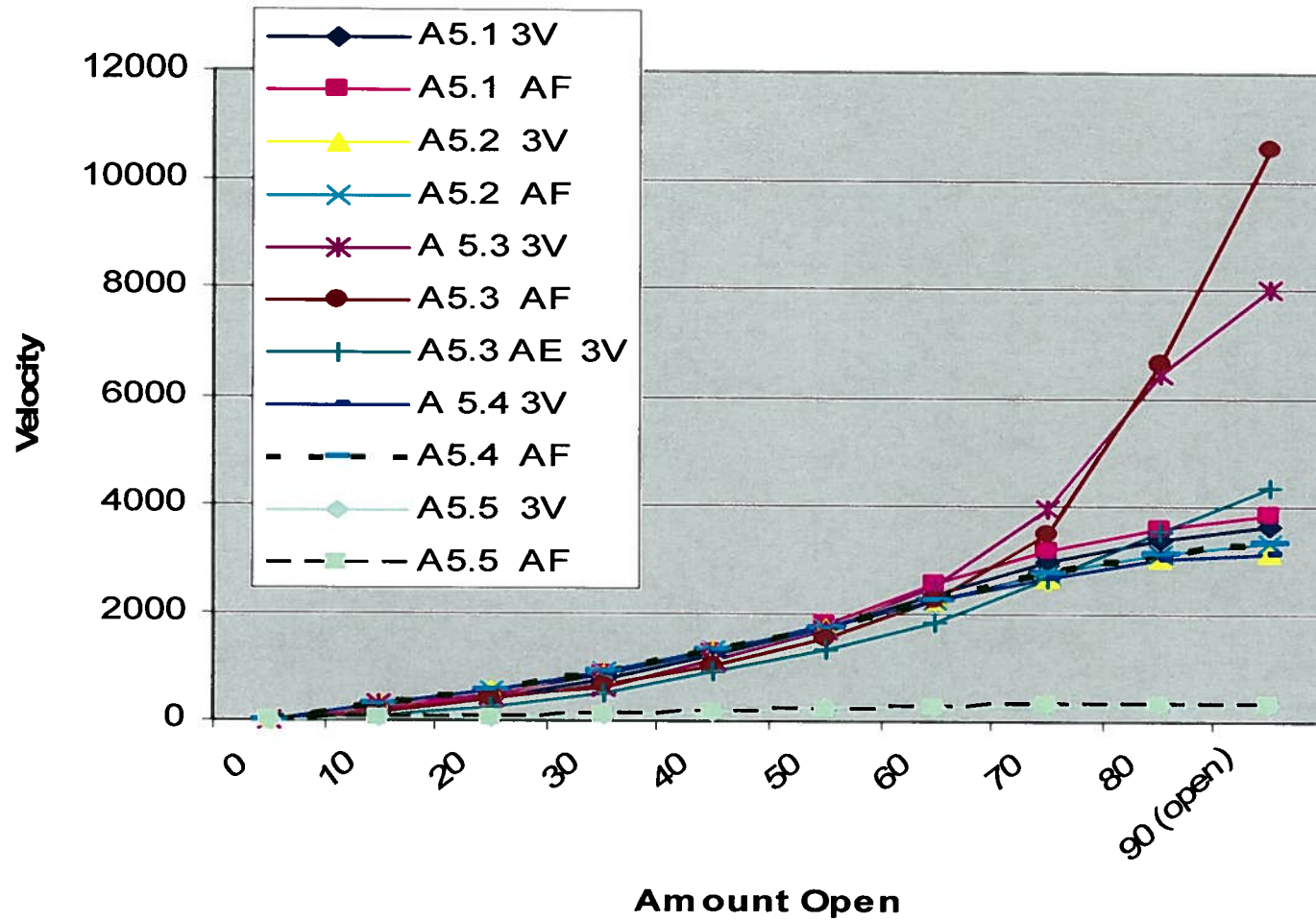
Angle	A5.1 3V	A5.1 AF	A5.2 3V	A5.2 AF	A 5.3 3V	A5.3 AF	A5.3 AE 3V	A 5.4 3V	A5.4 AF	A5.5 3V	A5.5 AF
0	100000	100000	100000	100000	100000	100000	100000	100000	100000	1000000	1000000
10	400	400	200	175	193	539	2151	200	175	20000	20000
20	100	69	50	51	75	90	214	50	51	5000	6152
30	27	22	22	20	40	36	56	22	20	1488	1675
40	10	10	10	9	13	15	20	10	9	610	731
50	5	5	5	5	6	7	9	5	5	302	369
60	3	2	3.2	3.1	2.6	3.1	4.7	3.2	3.1	221	242
70	1.9	1.6	2.3	2.1	1	1.3	2.3	2.3	2.1	186	191
80	1.4	1.2	1.7	1.7	0.39	0.37	1.27	1.7	1.7	178	172
90 (open)	1.2	1.1	1.6	1.5	0.25	0.14	0.86	1.6	1.5	174	164

Interpolated



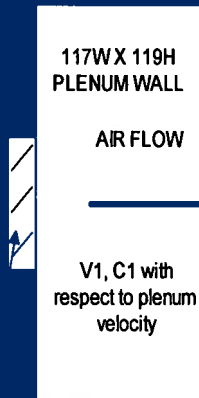


**PB Absolute Velocities at 1" Pressure Drop**

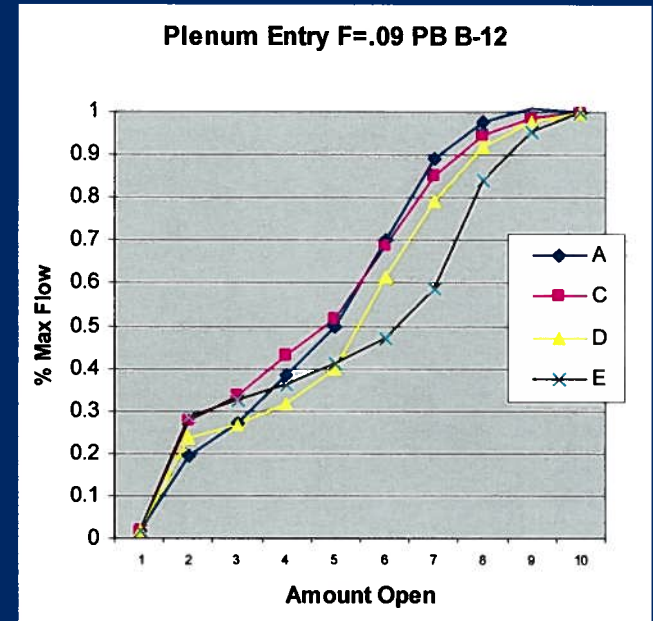


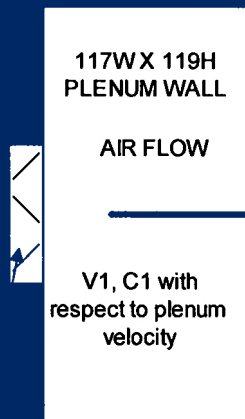
# Plenum Entries

## RP1157 Group 2

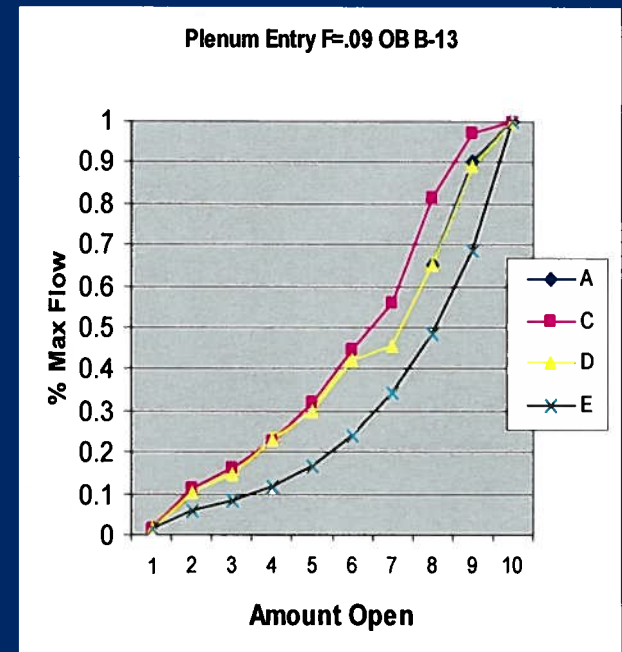


Angle	A	C	D	E
0	1000 00	1000 00	1000 00	1000 00
10	8000	3700	5200	3500
20	4000	2500	4000	2700
30	2000	1500	2850	2200
40	1195	1043	1767	1700
50	605	583	750	1285
60	374	385	449	827
70	310	310	336	405
80	292	286	296	312
90 (open)	274	277	283	285
Interpolat ed				
C2 <sub>90</sub>	2.22	2.25	2.29	2.31



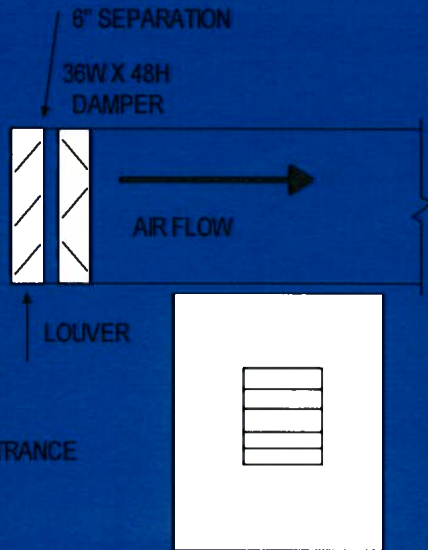


Angle	A	C	D	E
0	100000	100000	100000	100000
10	8000	3700	5200	3500
20	4000	2500	4000	2700
30	2000	1500	2850	2200
40	1195	1043	1767	1700
50	605	583	750	1285
60	374	385	449	827
70	310	310	336	405
80	292	286	296	312
90 (open)	274	277	283	285
Interpolated				
C2 <sub>90</sub>	2.22	2.25	2.29	2.31



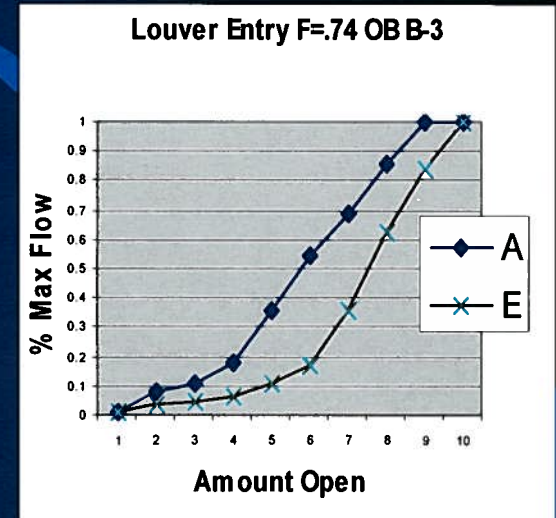
# Louvered Entries OB

Louver F = .5

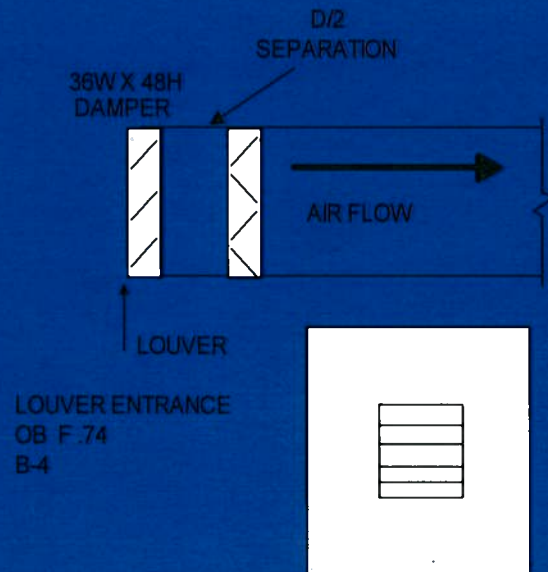


Angle	A 3V	E 3V
0	100000	100000
10	2025	12000
20	1215	6000
30	418	3175
40	110	1158
50	46	488
60	29	106
70	19	35
80	13.8	20
90 (open)	13.8	13.9

Interpolated

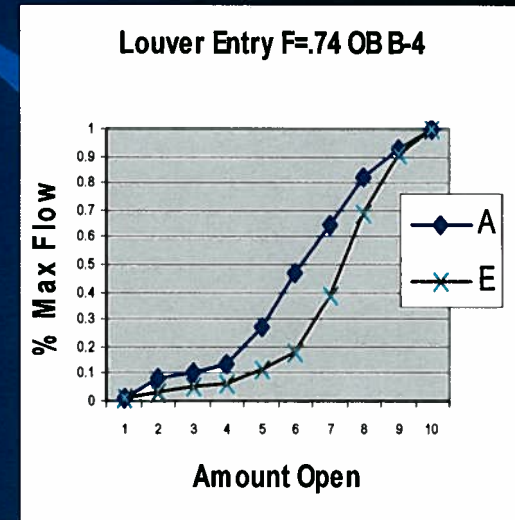


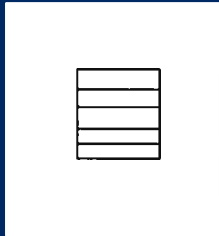




Angle	A 3V	E 3V
0	100000	100000
10	2256	12000
20	1388	6000
30	785	3158
40	187	1182
50	64	454
60	33	97
70	20	30
80	16	18
90 (open)	13.8	14.3

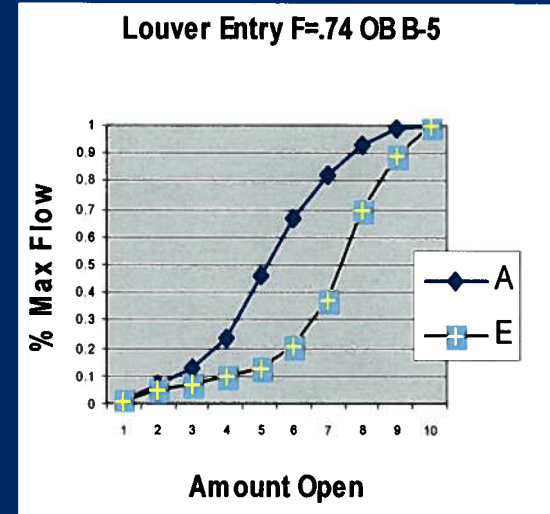
Interpolated





Angle	A 3V	E 3V
0	100000	100000
10	3000	6000
20	829	3000
30	252	1444
40	65	816
50	31	340
60	20	101
70	16	29
80	14.1	18
90 (open)	13.8	13.8

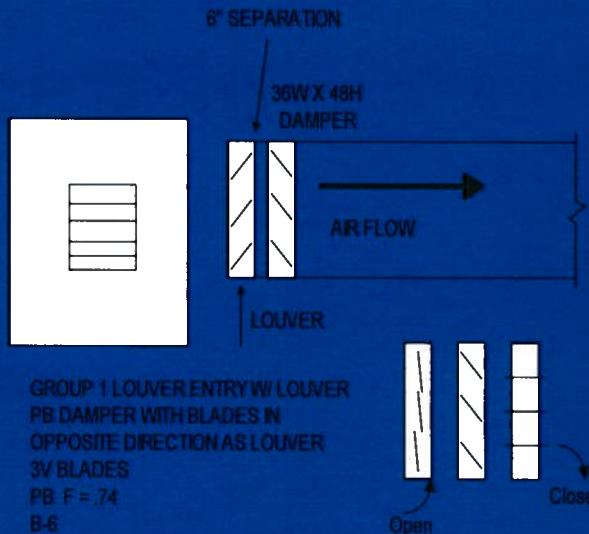
Interpolated



# Louvered Entries aPB

PB Anti-parallel

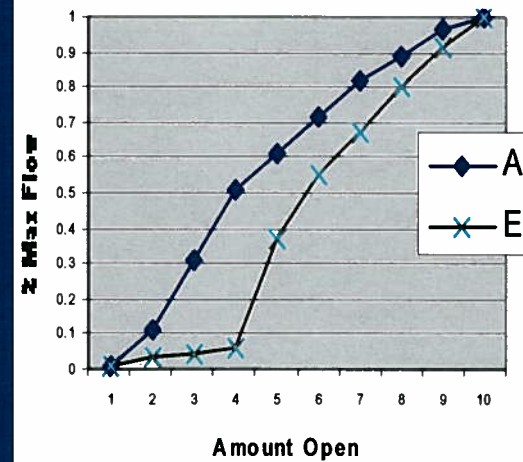
Louver F = .5

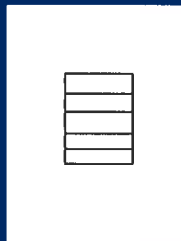


Angle	A 3V	E 3V
0	100000	100000
10	1172	11000
20	142	6300
30	53	3304
40	36	101
50	27	45
60	21	30
70	17	21
80	15	16
90 (open)	13.8	13.8

Interpolated

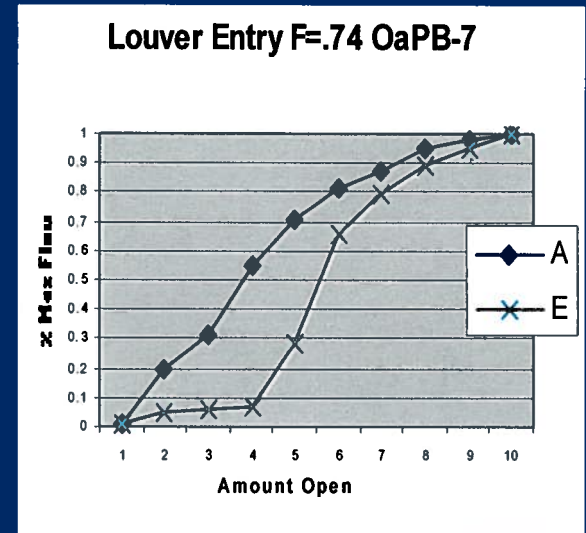
### Louver Entry F=.74 aPB B-6



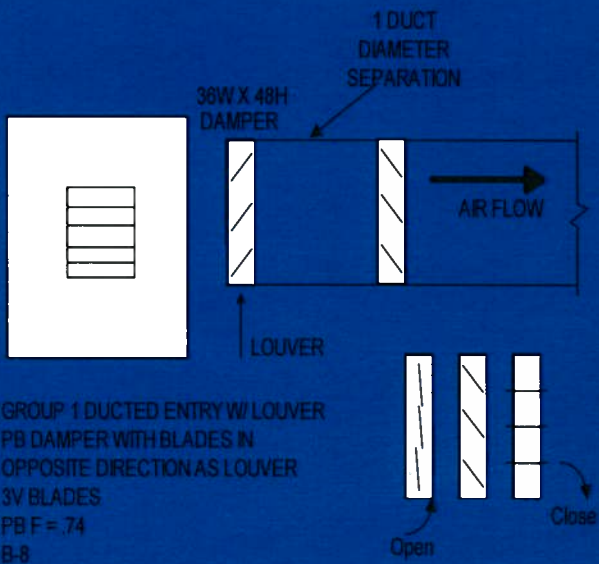


Angle	A 3V	E 3V
0	100000	100000
10	357	7000
20	141	3667
30	46	3158
40	27	179
50	21	33
60	18	23
70	15.2	18
80	14.2	16
90 (open)	13.7	14.3

Interpolated



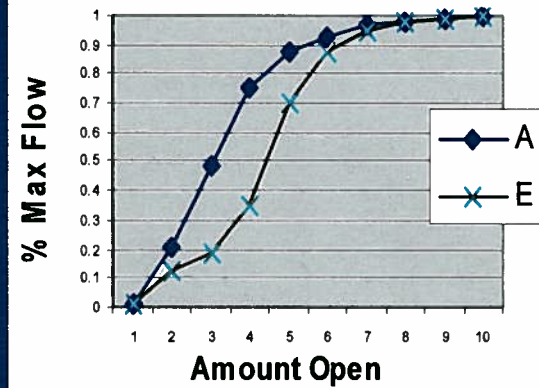




Angle	A 3V	E 3V
0	100000	100000
10	325	832
20	60	392
30	24	113
40	18	28
50	16	18
60	15	15
70	14.3	14.0
80	14.0	13.9
90 (open)	13.7	13.6

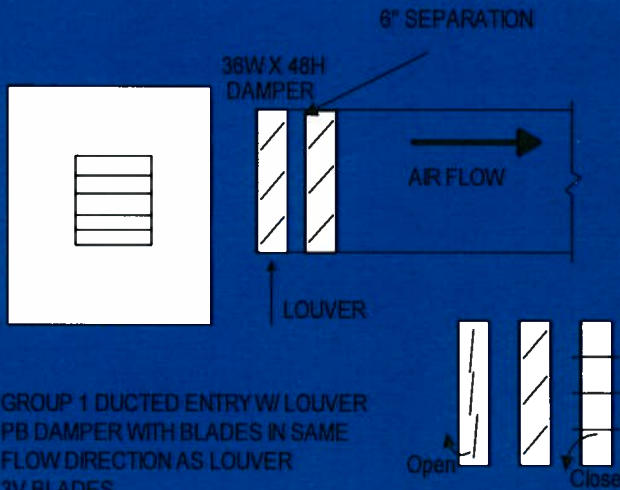
Interpolated

Louver Entry F=.74 aPB B-8



# Louvered Entries PB

Louver F = .5



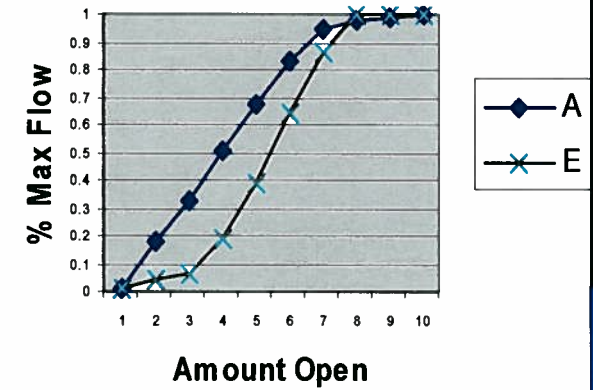
GROUP 1 DUCTED ENTRY W/ LOUVER  
PB DAMPER WITH BLADES IN SAME  
FLOW DIRECTION AS LOUVER  
3V BLADES

B-9

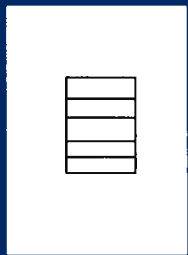
Angle	A 3V	E 3V
0	100000	100000
10	392	6500
20	118	3354
30	50	379
40	28	89
50	18	33
60	14	18
70	13.0	13.8
80	12.7	13.8
90 (open)	12.5	13.8

Interpolated

Louver Entry F=.74 PB B-9

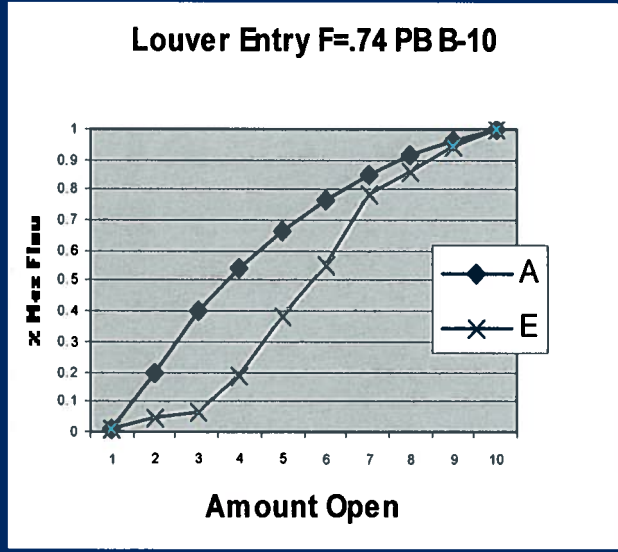


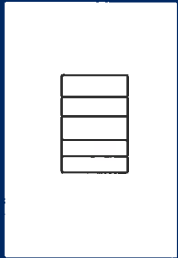




Angle	A 3V	E 3V
0	100000	100000
10	368	6500
20	86	3362
30	47	391
40	31	95
50	24	45
60	19	22
70	16.4	18.6
80	14.8	15.4
90 (open)	13.8	13.8

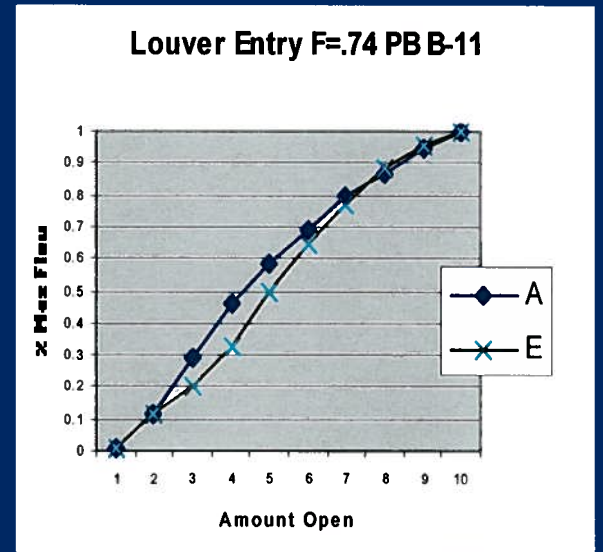
Interpolated



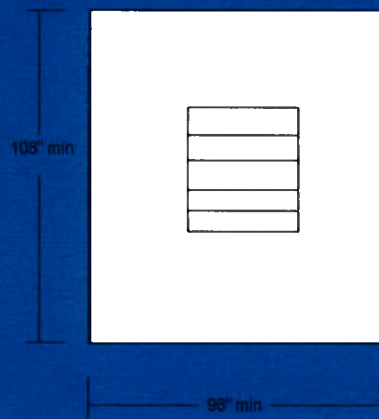
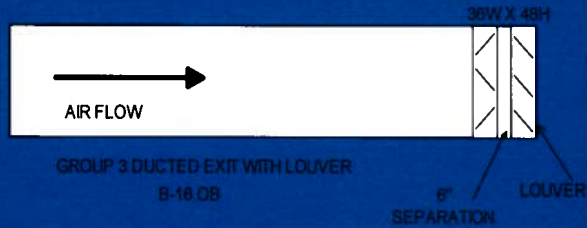


Angle	A 3V	E 3V
0	100000	100000
10	1007	1032
20	153	335
30	63	122
40	38	55
50	28	32
60	21	23
70	17.6	17.2
80	15.0	14.5
90 (open)	13.3	13.4

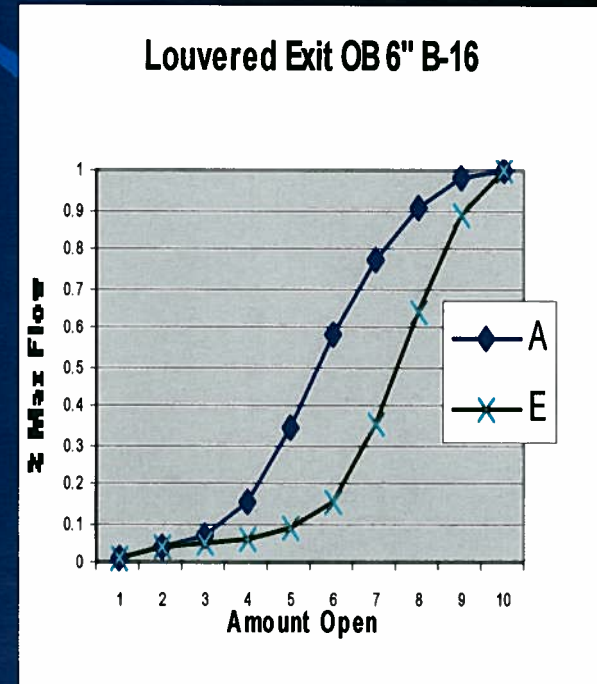
Interpolated

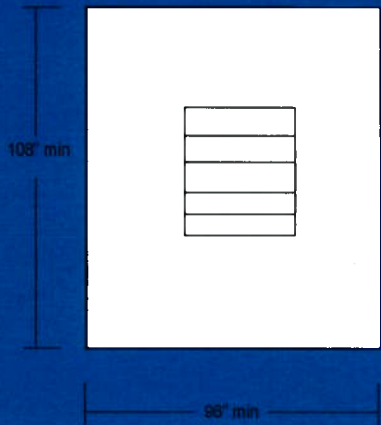
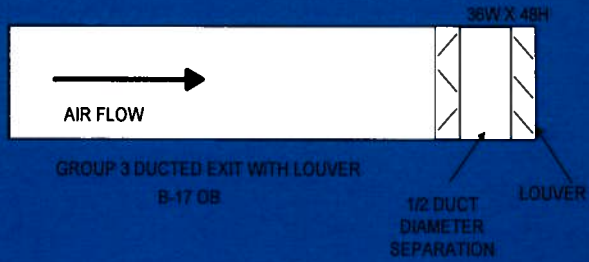


# Louvered Exits OB

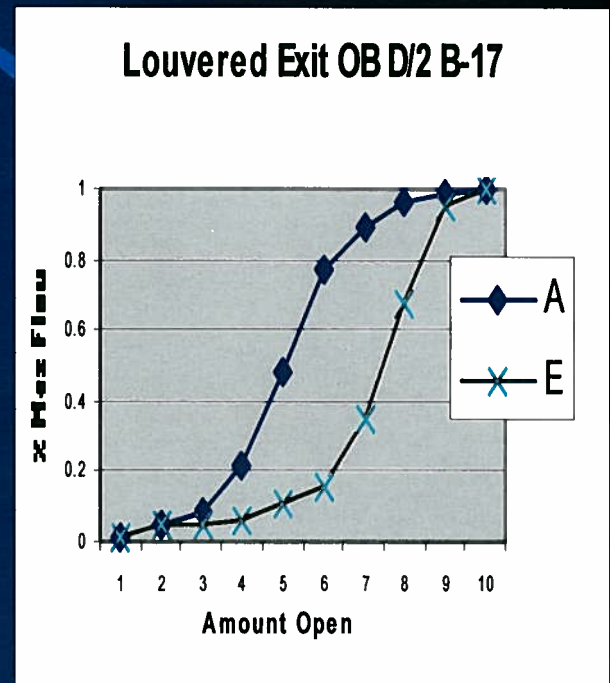


Angle	A 3V	E 3V
0	100000	100000
10	6250	6342
20	2162	4612
30	441	3120
40	92	1528
50	32	460
60	18	92
70	13	28
80	11	14
90 (open)	11	11
Interpolated		
C2 <sub>90</sub>	5.94	6.17

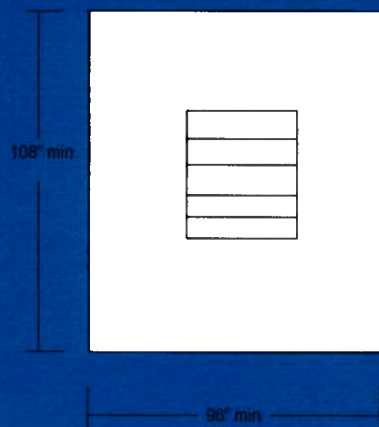
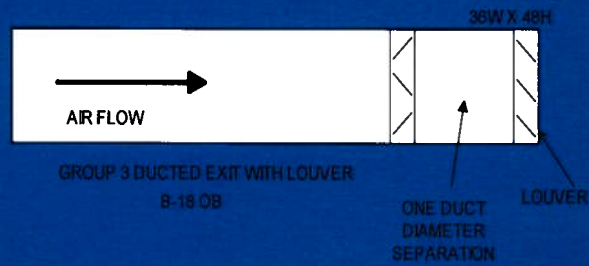




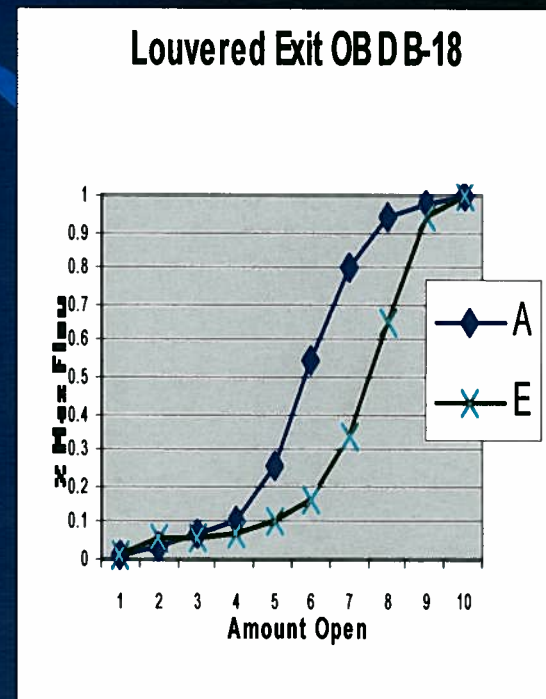
Angle	A 3V	E 3V
0	100000	100000
10	6353	6353
20	1670	5083
30	233	3075
40	50	1107
50	19	445
60	14.3	98
70	12.3	25
80	11.8	13.0
90 (open)	11.5	11.7
Interpolated		
C2 <sub>g0</sub>	6.31	6.43



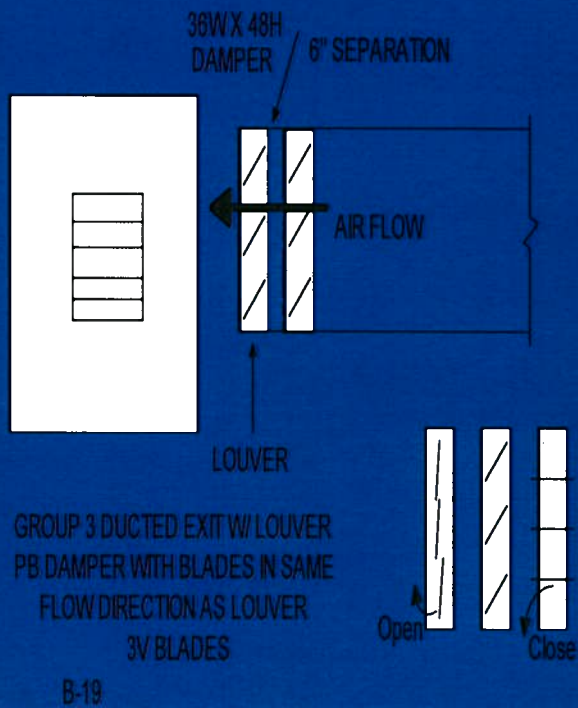




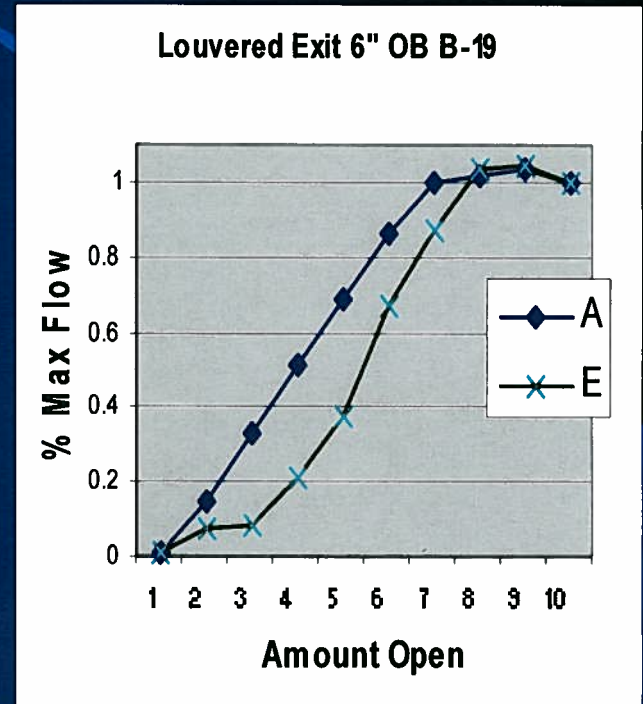
Angle	A 3V	E 3V
0	100000	100000
10	12910	3777
20	2419	3282
30	988	2415
40	167	962
50	38	429
60	18	104
70	12.8	27
80	11.8	13.0
90 (open)	11.3	11.5
Interpolated		
C2 <sub>90</sub>	6.18	6.30



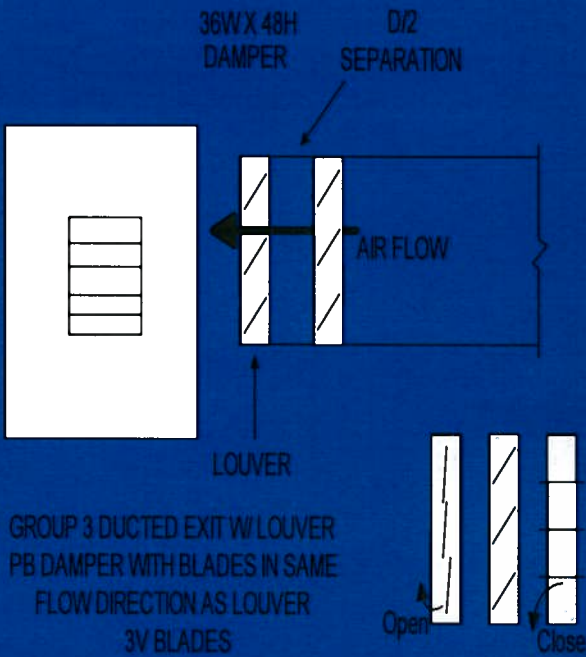
# Louvered Exits PB



Angle	A 3V	E 3V
0	C1	C1
10	100000	100000
20	580	2162
30	119	1766
40	49	260
50	27	83
60	16.9	25.9
70	12.7	15.4
80	12.2	10.9
90 (open)	11.7	10.8
Interpolated		
C2 <sub>90</sub>	6.40	5.94



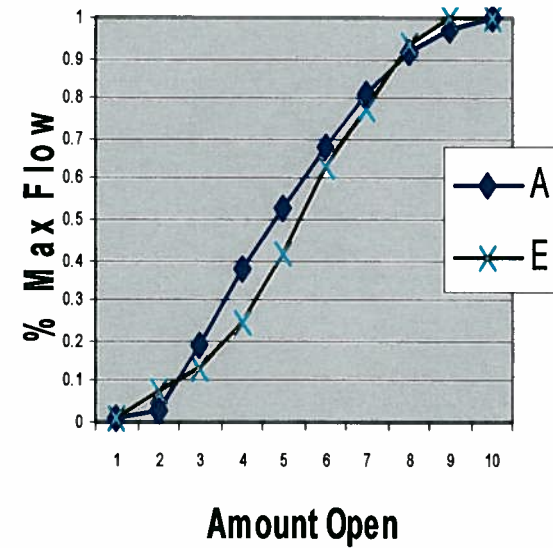


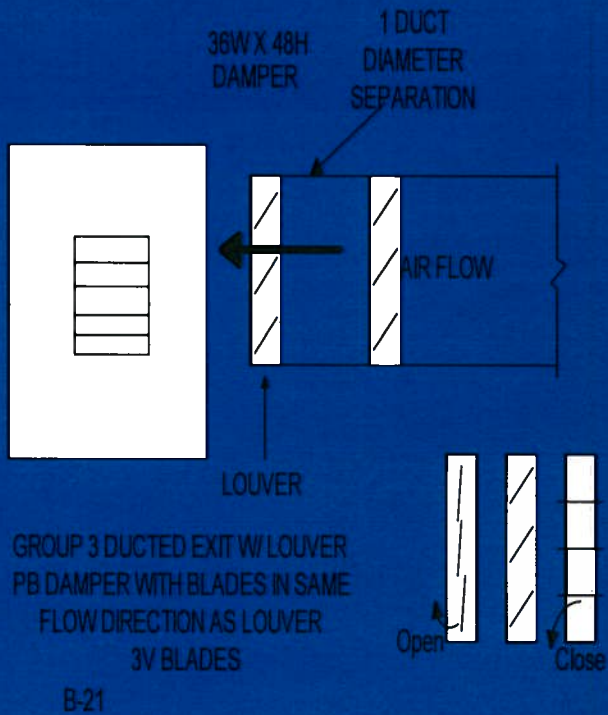


B-20

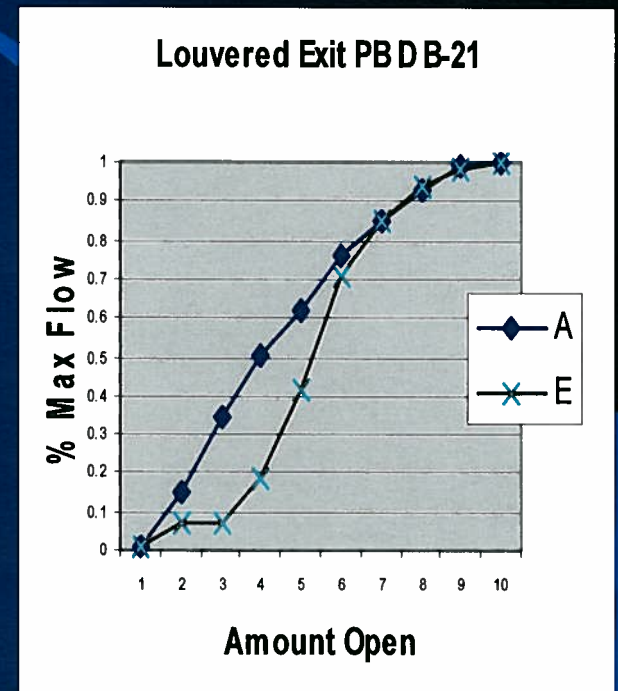
Angle	A 3V	E 3V
0	10000 0	100000
10	12862	1944
20	311	627
30	82	196
40	40	67
50	25	29
60	18	20
70	14	14
80	12	12
90 (open)	11	12
Interpolated		
C <sub>290</sub>	6.29	6.42

Louvered Exit PB D/2 B-20



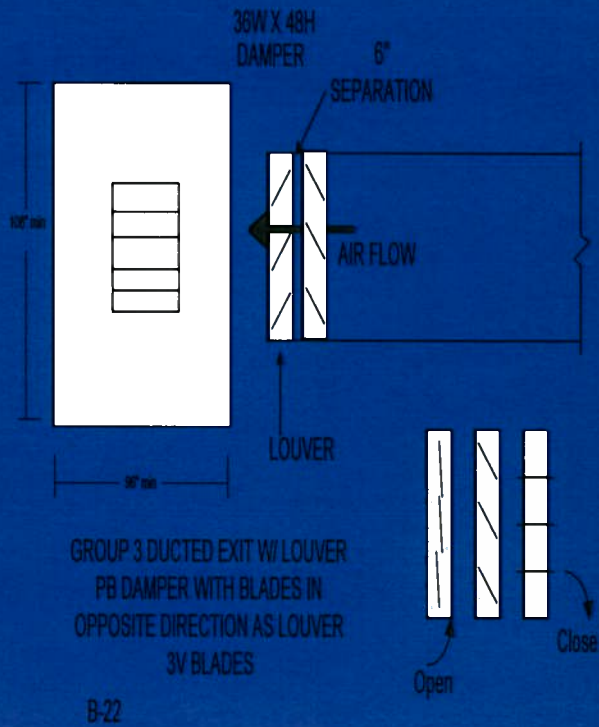


Angle	A 3V	E 3V
0	100000	100000
10	536	2543
20	99	2124
30	45	327
40	30	68
50	20	23
60	16.1	15.9
70	13.4	13.0
80	11.8	11.9
90 (open)	11.5	11.5
Interpolated		
C2 <sub>90</sub>	6.31	6.31

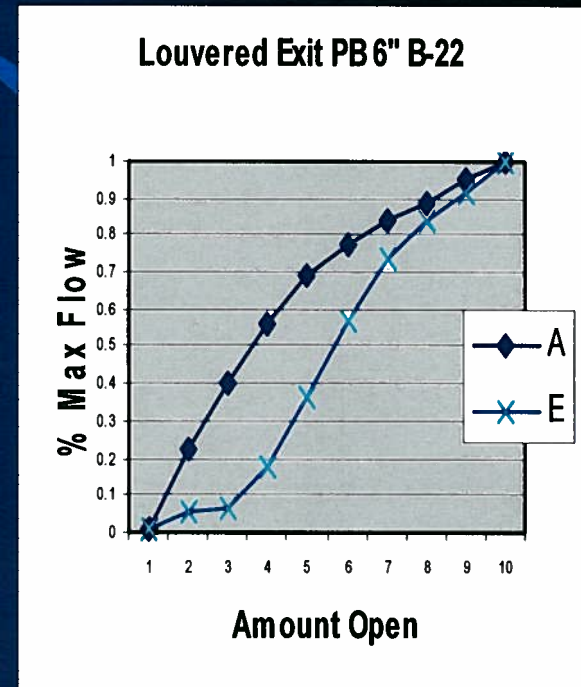


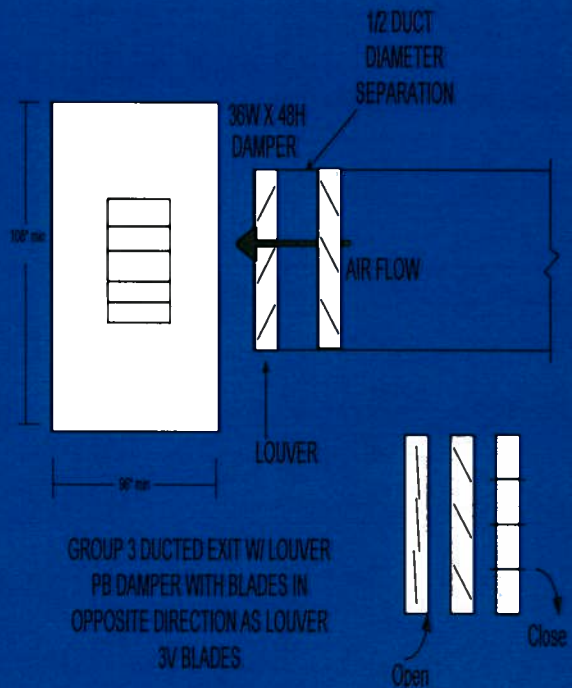


# Louvered Exits aPB



Angle	A 3V	E 3V
0	100000	100000
10	233	3508
20	69	2261
30	35	345
40	23	83
50	19	33
60	16	20
70	14.3	15.4
80	12.5	12.8
90 (open)	11.3	10.8
Interpolated		
C2 <sub>90</sub>	6.17	5.93

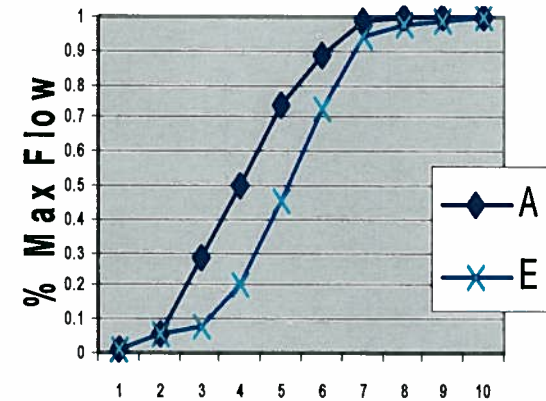




B-23

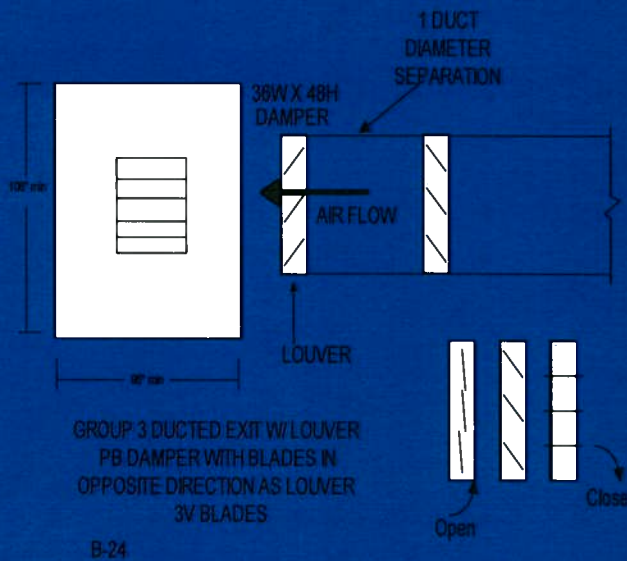
Angle	A 3V	E 3V
0	100000	100000
10	3219	2967
20	145	1833
30	46	267
40	20	55
50	14	22
60	11.6	13
70	11.3	12.0
80	11.3	11.7
90 (open)	11.3	11.5
Interpolated		
C2 <sub>90</sub>	6.17	6.30

Anti PB D/2 B-23

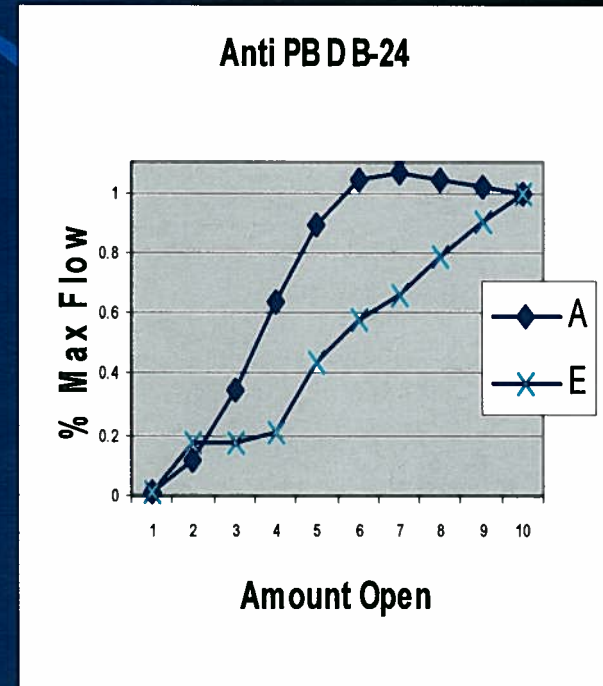


Amount Open



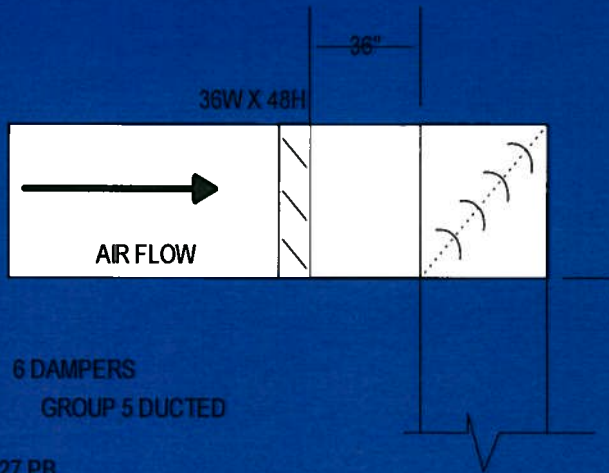


Angle	A 3V	E 3V
0	100000	100000
10	855	368
20	97	338
30	29	251
40	15	56
50	10.9	32
60	10.4	25
70	10.8	18
80	11.3	13.1
90 (open)	11.7	10.8
Interpolated		
C2 <sub>90</sub>	6.43	5.93



# Ducted Dampers Before Elbox AMCA 5.3 Type G5

RP1157 Group 5

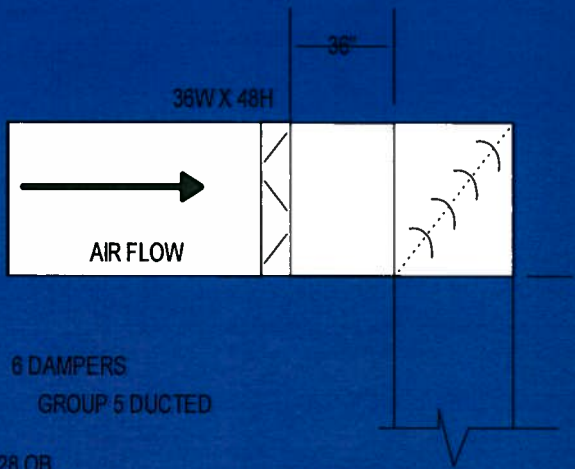


6 DAMPERS  
GROUP 5 DUCTED  
B-27 PB

Angle	A 3V	B	C AF	D AF	E 3V	F
0	100000	100000	100000	100000	100000	100000
10	193	307	539	1823	1190	6339
20	75	72	90	89	554	225
30	40	23	36	38	188	57
40	13	11	15	15	56	19
50	6	5	7	7	20	9
60	2.6	2.4	3.1	2.9	7.6	3.2
70	1.0	0.9	1.3	1.1	2.7	1.4
80	0.39	0.33	0.37	0.33	0.83	0.35
90 (open)	0.25	0.22	0.14	0.21	0.40	0.22

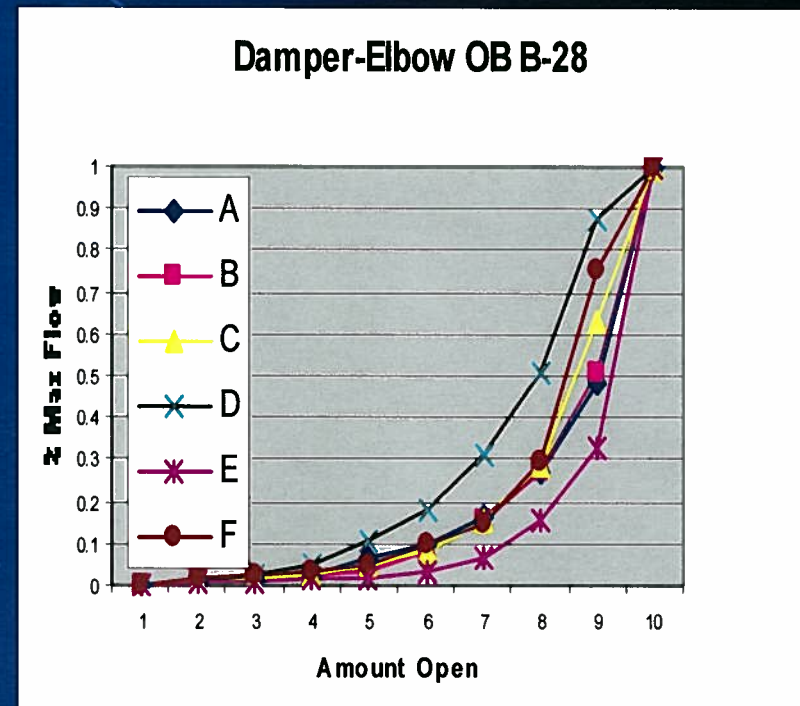
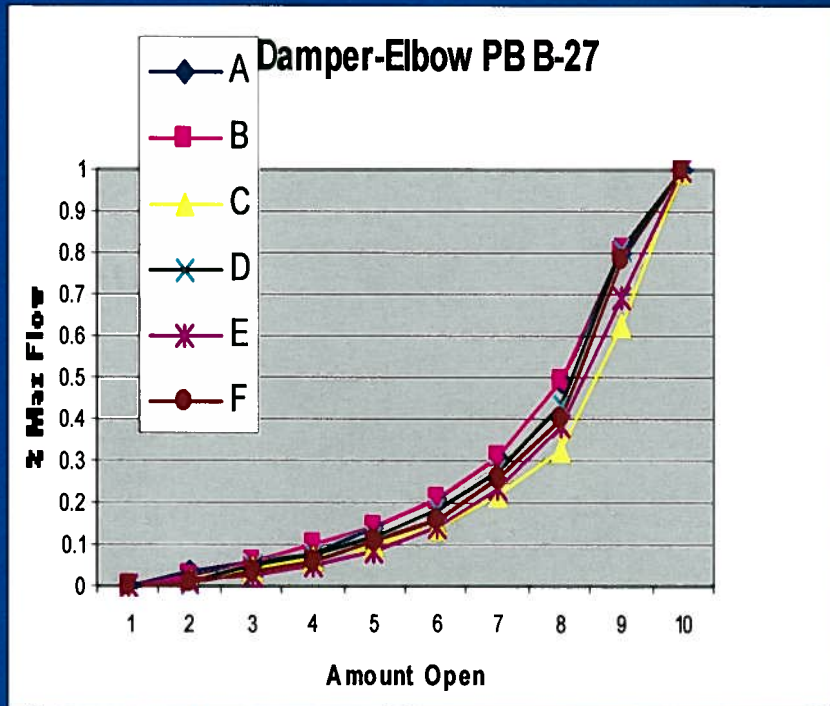
Interpolated





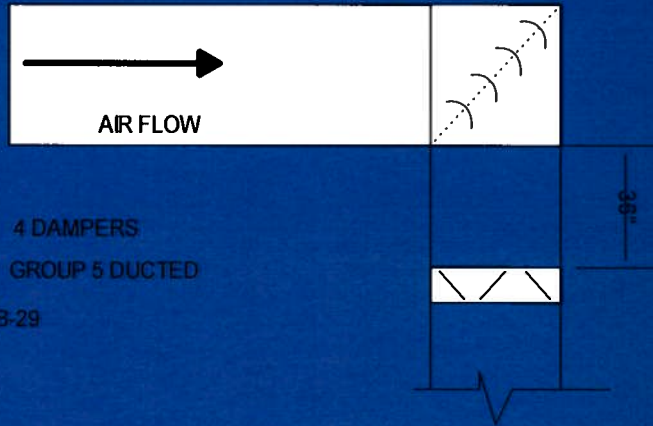
Angle	A 3V	B	C AF	D AF	E 3V	F
0	100000	100000	100000	100000	100000	100000
10	2500	3393	3169	1431	10000	2500
20	1127	1623	571	278	5000	1186
30	471	976	147	82	2500	443
40	68	444	48	17	1536	209
50	28	81	14	6	402	60
60	11.2	23.0	4.2	2.0	96.7	25.5
70	3.8	8.0	1.2	0.8	19.1	6.2
80	1.20	2.17	0.25	0.25	4.07	0.96
90 (open)	0.29	0.57	0.10	0.19	0.45	0.55

Interpolated





# Ducted Dampers After Elbow AMCA 5.3 Type G5



4 DAMPERS  
GROUP 5 DUCTED  
B-29

Angle	A 3V	B	E 3V	F
0	100000	100000	100000	100000
10	3277	3278	10000	6555
20	2117	1188	6553	375
30	660	405	2185	388
40	150	114	1041	175
50	38	34	594	54
60	15	13	128	24
70	5	4	30	7
80	1.8	1.2	4.8	1.6
90 (open)	0.9	0.7	1.0	0.7

Interpolated



4 DAMPERS  
GROUP 5 DUCTED  
B-30

Angle	A 3V	B	E 3V	F
0	100000	100000	100000	100000
10	2151	521	1019	3329
20	214	81	572	185
30	56	29	188	49
40	20	13	61	21
50	9	7	21	11
60	4.7	3.3	9.0	4.9
70	2.3	1.6	3.4	2.0
80	1.27	0.82	1.46	0.93
90 (open)	0.86	0.76	0.92	0.80

Interpolated



