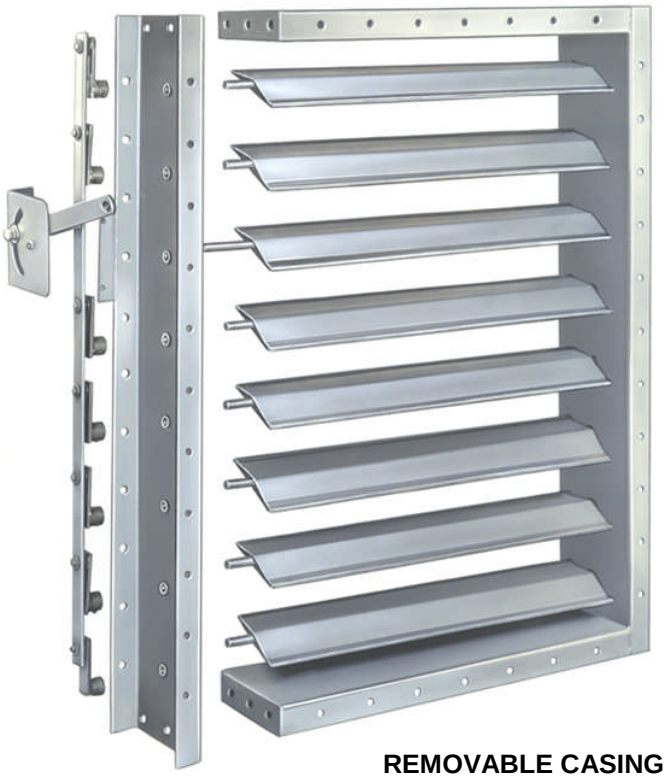

REMOVABLE CASING DETAIL

PARALLEL BLADE DAMPER

OPPOSED BLADE DAMPER

Outlet dampers for centrifugal fans

DAMPER FEATURES

- Rugged construction for long service.
- Choice of parallel or opposed vanes to best suit dampering requirements.
- Choice of sleeve bushing or ball-bearing design to best suit modulation requirements.
- Serviceable design . . . removable linkage and removable casing side allow replacement of bearings and vanes . . . replacement part packages available.
- Temperature ranges available to 1000°F.
- Stuffing-box option available for minimal leakage through casing.
- Locking quadrant furnished as standard.

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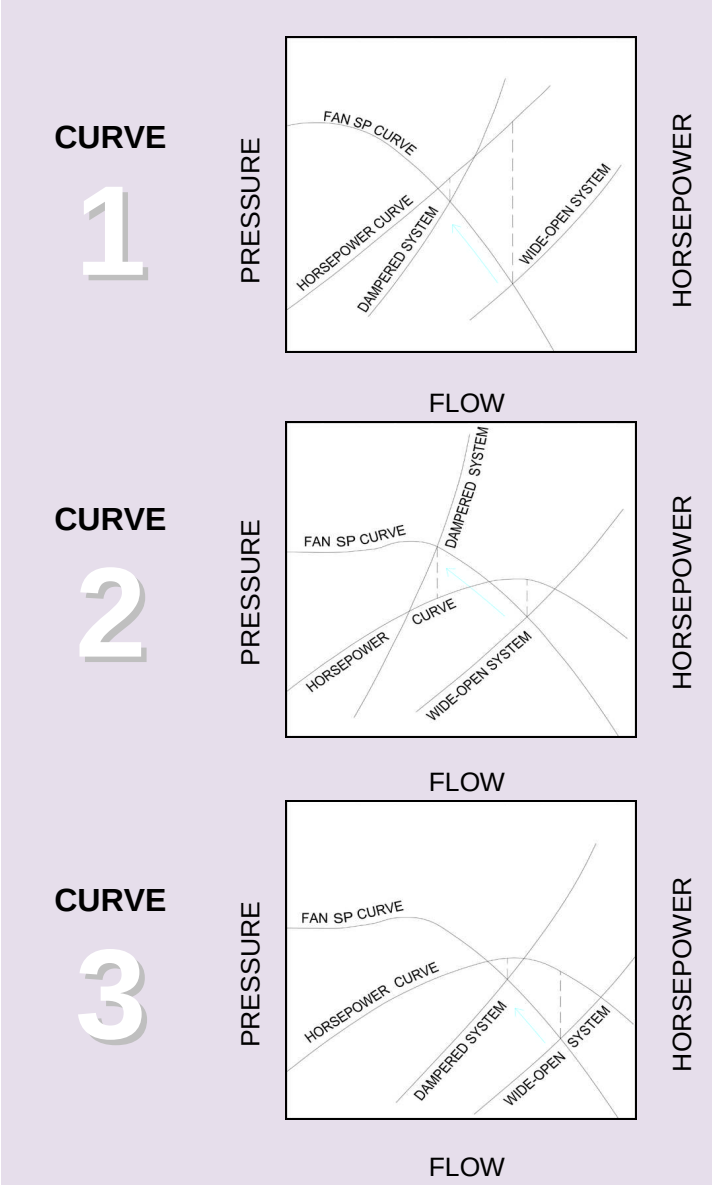
THE EFFECTS OF DAMPERS ON FAN PERFORMANCE



Outlet dampers work on the principle of adding resistance to airflow. Consequently, when a wide-open damper begins to close, a variable system is created causing fan performance to follow the fan's pressure curve to a new point of operation to the left of the original point. The result is lower volume and a new corresponding BHP requirement.

Curve 1 shows a typical performance change when dampering a radial-bladed fan. The horsepower curve of a radial-bladed fan rises with volume; therefore, a reduction in volume yields a reduction in horsepower.

New York Blower GI [General Industrial] Fans have radial-bladed wheels with this rising horsepower characteristic. RTS [Radial-Tip] Fans are also included in this category.

Curve 2 shows a typical performance change when dampering a backwardly inclined or airfoil fan, which has a non-overloading horsepower characteristic. Since most fans of this type are selected for operation at a point near the maximum BHP, reduced volume normally produces reduced horsepower requirements.

However, Curve 3 does show that dampering a "non-overloading" type fan from a point far to the right on the fan pressure curve could result in an increase in horsepower requirement. Refer to separate **nyb** Engineering Letter for complete details.

New York Blower AcoustaFoil®, PLR, BC, General Purpose, AF, and HPBC Fans fall into this non-overloading category.

Important note: Outlet dampers effectively move the fan's point of operation to the left on the fan's SP curve. Therefore, closing the damper fully may force the point of operation of some types of fans into an unstable region.

AcoustaFoil® is a registered trademark of The New York Blower Company.

WHEN TO USE OPPOSED BLADE VS. PARALLEL BLADE

PARALLEL BLADE	Parallel blade dampers are usually selected for volume control from wide open to 75% of wide open. A relatively large control arm swing provides sensitive control through a relatively small change in air volume. Parallel blade dampers also offer the best first-cost selection for simple open-closed damper requirements. See page 3 for available bearing and temperature options.
OPPOSED BLADE	Opposed blade dampers are selected for applications requiring volume control over a broad range, from wide open to 25% of wide open, as the control arm swing is more proportional to the dampered effect. See page 3 for available bearing and temperature options.

BEARING AND TEMPERATURE OPTIONS

STANDARD DAMPERS

Standard dampers [Illustration 1] use aluminum sleeve bushings...suitable for applications requiring infrequent modulation.

Temperature options [temperature limits refer to airstream temperatures].

300°F. maximum for standard damper with standard paint.

800°F. maximum for standard damper with high temperature paint and SST case bushings.

1000°F. maximum for standard damper with high temperature paint and SST case bushings, blades and rods.

Stuffing-box option [Illustration 2] available with sleeve bushing design only...provides for minimal leakage through damper casing.

Illustration 1-Sleeve brushing detail

Illustration 2 - Stuffing-box option

BALL-BEARING CONSTRUCTION

Ball-bearing construction [Illustration 3] is recommended for applications requiring frequent modulation…vane rods are supported by relubricatable ball bearings on both ends.

Temperature options [temperature limits refer to airstream temperatures].

300°F. maximum for ball-bearing damper with standard paint.

800°F. maximum for ball-bearing damper with high temperature paint, SST case bushings, and heat sinks [Illustration 4].

Illustration 3 - Ball bearing to 300°F.

Illustration 4 - Ball bearing to 800°F.

Temperature options shown pertain to outlet dampers only. The temperature capability of the fan may not be equal to that of the damper. The temperature capability of the actual fan/damper assembly is the lesser of the two components: the fan or the damper.

PERFORMANCE CORRECTIONS AND OPERATING DATA

DAMPER STATIC PRESSURE DROP

Dampers, even in a wide-open position, create system resistance. Consequently, static pressure loss across a damper should be added to the total system resistance when sizing a fan in a critical operation. The following procedure can be used to estimate the static pressure drop across a fully open **nyb** outlet damper. Note: Where system designers have considered damper pressure drop in their calculation of total system resistance, the damper pressure drop need not be added again when selecting the fan.

STEPS TO FOLLOW		**EXAMPLE:** Determine the SP drop across a fully open damper mounted on a Size 454 Series 30 GI Fan handling 18,450 CFM of standard density air, .075 lbs./cu.ft.
1	Determine the Air Velocity, V[FPM], at the damper. Velocity = CFM/Area where CFM is the Air Volume in cubic feet per minute and Area is the inside area of the damper [fan outlet area] (page 4/5).	V = 18,450/3.70 ft.^{2} = 4986 FPM
2	Determine Velocity Pressure, VP, at the damper. $VP = \left[\frac{\text{Velocity}}{4005}\right]^2 \times \frac{\text{Gas density}}{.075}$	$VP = \left[\frac{4986}{4005}\right]^2 \times \frac{.075}{.075} = 1.55$" WG
3	Determine SP drop through the damper. SP drop = 0.24 x VP where 0.24 is an empirical constant and VP is Velocity Pressure from Step 2.	SP drop = 0.24 x 1.55 = 0.37" WG

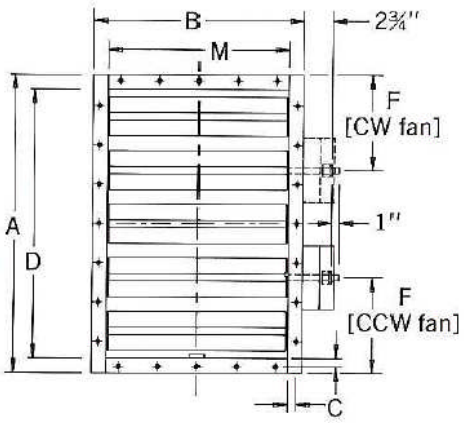
DAMPER OPERATING TORQUE

Determination of damper operating torque is a critical factor in the selection of an actuator. The operating torque of a damper is equal to the linkage torque at no-load conditions [no air-flow or pressure] plus or minus the torque due to air resistance. Air resistance adds to the amount of force required to open a damper, but aids in closing a damper. Air resistance is a function of the damper type, area, and the peak fan static pressure at operating speed. Steps for determining damper operating torque are as follows.

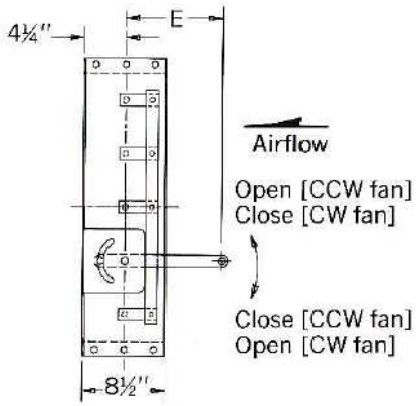
STEPS TO FOLLOW		**EXAMPLE:** Determine the operating torque for an opposed blade damper on a Size 454 Series 30 GI Fan with a DH wheel operating at 1200 RPM.
1	Determine damper linkage torque, T_L (lb.in.). T_L = 2 x D where D is the inside height of the damper (page 4/5) and 2 is an empirical constant.	T_L = 2 x 25.75 = 51.5 lb. in.
2	Determine Air Resistance Torque, T_A (lb.in.). T_A = K x A x SP where K = 2.8 for parallel blade dampers, K = 2.1 for opposed blade dampers, A is the inside area (ft.^{2}) of the damper (page 4/5), and SP is the peak SP at the fan's operating RPM.	T_A = 2.1 x 3.70 ft.^{2} x 16.8" WG (obtained from fan performance curve) = 130.5
3	Determine operating torque, T, to open or close the damper. T (open) = T_L + T_A, or T (close) = T_L - T_A	T (open) = 51.5 + 130.5 = 182 lb.in. T (close) = 51.5 - 130.5 = -79 lb.in.

NOTE: The maximum static pressure capability of the fan can be used to calculate operating torque in the event that system requirements are subject to change.

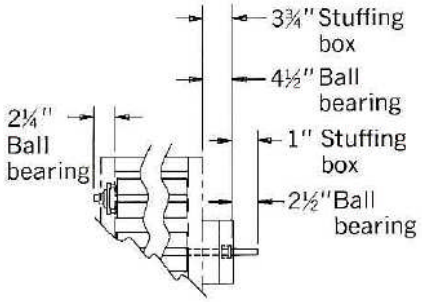
OUTLET DAMPERS - ACOUSTAFOIL/PLR, GENERAL PURPOSE, AF, RTS, HPBC FANS



STANDARD DAMPER



ALL DAMPERS



BALL BEARING AND STUFFING-BOX DAMPERS

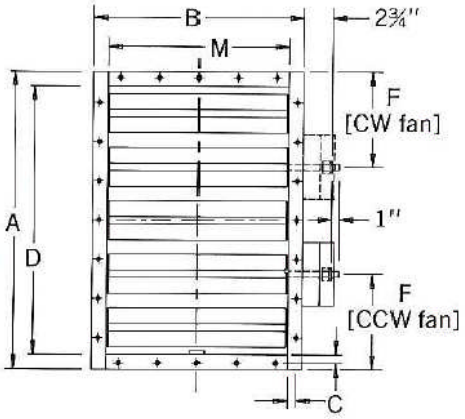
NOTES: 1. Control arm located on inlet side of fan. 2. Control arm swings 45° each side of centerline.
3. Mounting holes on 4" centers from centerline. 4. Dimensions not to be used for construction unless certified.

ACOUSTAFOIL/PLR, GENERAL PURPOSE, AF*, RTS*, HPBC* FANS – DIMENSIONS [INCHES]

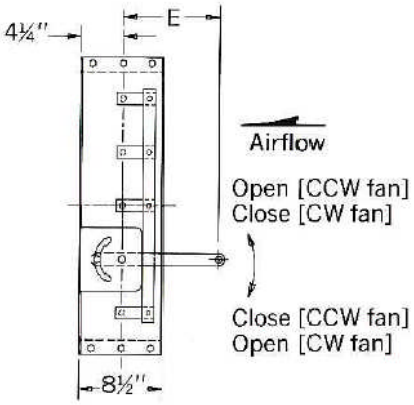
Size			A	B		C	D	E		F	M		No. holes per flange			Dia. Holes	Damper Inside Area (ft^2)		Weight (lbs)	
AcF/PLR, GP	AF, RTS	HPBC		SW	DW			SW	DW		SW	DW	Sides	Top and Bottom SW	Top and Bottom DW		SW	DW	SW	DW
10	--	--	13 3/8	10 1/8	--	5/8	11 3/8	5	--	3	8 1/8	--	3	1	--	5/16	0.64	--	15	--
12	--	--	15 3/4	11 3/8	--	5/8	13 3/4	5	--	3 3/8	9 3/8	--	3	3	--	5/16	0.90	--	20	--
13	--	--	17 1/4	12 3/8	--	5/8	15 1/4	5	--	3 3/4	10 3/8	--	5	3	--	5/16	1.10	--	25	--
15	--	--	18 7/8	13 3/8	--	5/8	16 7/8	5	--	3 7/8	11 3/8	--	5	3	--	5/16	1.33	--	30	--
16	--	--	21 1/8	14 3/4	--	3/4	18 5/8	5	--	4 1/2	12 1/4	--	5	3	--	7/16	1.58	--	38	--
18	--	24	23	16 3/8	27 1/4	3/4	20 1/2	5	10	3 7/8	13 7/8	24 3/4	5	3	5	7/16	1.98	3.52	44	79
20	24	27	25	17 1/2	29 1/2	3/4	22 1/2	5	10	4 1/8	15	27	7	3	7	7/16	2.34	4.22	56	82
22	27	30	27 3/8	19 3/8	32 5/8	3/4	24 7/8	8	10	13 3/4	16 7/8	30 1/8	7	3	7	7/16	2.92	5.20	65	84
24	30	33	30 3/8	21 1/2	36 1/4	7/8	27 3/8	10	10	15 1/4	18 1/2	33 1/4	7	5	7	7/16	3.52	6.32	79	102
27	33	36	33 1/4	23 3/8	39 1/2	7/8	30 1/4	10	10	14 1/8	20 3/8	36 1/2	9	5	9	7/16	4.28	7.67	96	124
30	36	40	36 1/2	25 5/8	43 1/2	7/8	33 1/2	10	10	15 1/2	22 5/8	40 1/2	9	5	9	7/16	5.26	9.42	118	152
33	40	44	39 7/8	27 7/8	47 5/8	7/8	36 7/8	10	10	14 3/4	24 7/8	44 5/8	9	5	11	7/16	6.37	11.43	143	185
36	44	49	44 3/4	31 1/2	53 1/4	1 1/8	40 3/4	10	10	16 5/8	27 1/2	49 1/4	11	7	11	9/16	7.78	13.94	175	225
40	49	54	48 7/8	34 3/8	58 3/8	1 1/8	44 7/8	10	10	16 1/8	30 3/8	54 3/8	11	7	13	9/16	9.47	16.94	180	274
44	54	60	53 5/8	37 1/2	64	1 1/8	49 5/8	10	10	15 7/8	33 1/2	60	13	7	15	9/16	11.54	20.68	186	325
49	60	66	58 5/8	40 7/8	70 1/8	1 1/8	54 5/8	10	10	15 3/4	36 7/8	66 1/8	15	9	17	9/16	13.99	25.08	226	394
54	66	73	64 3/8	44 3/4	77 1/8	1 1/8	60 3/8	10	10	15 3/4	40 3/4	73 1/8	15	9	17	9/16	17.09	30.66	276	482
60	73	80	70 7/8	49	84 3/4	1 1/8	66 7/8	10	10	16	45	80 3/4	17	11	19	9/16	20.90	37.50	338	823
66	80	89	77 1/2	53 1/2	92 7/8	1 1/8	73 1/2	10	10	16 1/4	49 1/2	88 7/8	19	11	21	9/16	25.27	45.36	408	996
73	89	--	85 1/4	58 3/4	102 1/4	1 1/8	81 1/4	10	10	16 3/4	54 3/4	98 1/4	21	13	25	9/16	30.89	55.44	499	1217
80	--	--	94	64 3/4	--	1 1/8	90	10	--	16 3/8	60 3/4	--	23	15	--	9/16	37.97	--	504	--
89	--	--	103	70 7/8	--	1 1/8	99	10	--	17	66 7/8	--	25	17	--	9/16	45.98	--	581	--

* The dimensions shown here are for fans without evases. Consult **nyb** for the dimensions of dampers to be used on the discharges of evases.

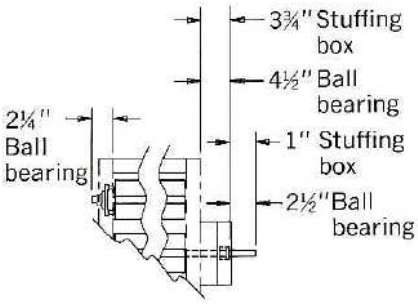
OUTLET DAMPERS – GENERAL INDUSTRIAL FANS



STANDARD DAMPER



ALL DAMPERS



BALL BEARING AND STUFFING-BOX DAMPERS

NOTES: 1. Control arm located on inlet side of fan. 2. Control arm swings 45° each side of centerline.
3. Mounting holes on 4" centers from centerline. 4. Dimensions not to be used for construction unless certified.

GENERAL INDUSTRIAL FANS – DIMENSIONS [INCHES]

Size	A	B	C	D	E	F	M	Total Flange Holes	Dia. Holes	Damper Inside area (ft^2)	Weight (lbs)
14	10 3/4	10 3/8	3/4	8 1/4	7	3 3/8	7 7/8	8	7/16	0.41	13
17	12 5/8	12	3/4	10 1/8	7	3 3/4	9 1/2	12	7/16	0.62	20
19	13 1/8	12 3/4	7/8	10 1/8	7	4	9 3/4	12	7/16	0.63	25
22	16	13 3/4	7/8	13	8	3 3/4	10 3/4	12	7/16	0.91	29
26	18	15 3/8	7/8	15	7	4	12 3/8	16	7/16	1.22	38
29	19 7/8	17	7/8	16 7/8	10	4 3/8	14	16	7/16	1.56	48
33	21 3/4	18 5/8	7/8	18 3/4	10	8 1/2	15 5/8	16	7/16	1.95	60
36	23 3/4	20 1/4	7/8	20 3/4	10	9 1/4	17 1/4	20	7/16	2.39	73
40	26 7/8	23	1 1/8	22 7/8	10	10 5/8	19	24	9/16	2.91	89
45	29 3/4	25 3/8	1 1/8	25 3/4	10	11 5/8	21 3/8	24	9/16	3.70	113
50	32 3/4	27 7/8	1 1/8	28 3/4	10	10 5/8	23 7/8	24	9/16	4.63	141
57	36 5/8	31 1/8	1 1/8	32 5/8	10	18 3/8	27 1/8	32	9/16	5.99	151
64	40 1/2	34 1/2	1 1/8	36 1/2	10	17 1/4	30 1/2	32	9/16	7.56	162
71	44 3/8	37 5/8	1 1/8	40 3/8	10	18 7/8	33 5/8	36	9/16	9.24	173
78	48 1/4	40 7/8	1 1/8	44 1/4	10	20 1/2	36 7/8	40	9/16	11.12	209
85	52 1/4	44 1/8	1 1/8	48 1/4	10	26 1/8	40 1/8	44	9/16	13.22	247

M and D are outside dimensions to match fan M and D dimensions. Tolerance: ± 1/8"

MATERIAL SPECIFICATIONS

Damper case and flanges

Sizes 10 - 15 AcF/PLR: 12 gauge
All others: 7 gauge

Vanes

14 gauge*	10 gauge	7 gauge*
40-89 SW	10-36 SW	60-73 DW
30-54 DW	18-27 DW	
49-89 AF/RTS	24-44 AF/RTS	
57-85 GI	14-50 GI	

* 2-piece vane construction.

Vane Rods

5/8" diameter all SW, GI and 18-40 DW dampers
3/4" diameter 44-73 DW dampers

Control arm and linkage bars

1/4" x 1 1/4" steel