ENGINEERING REPORT

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IMPORTANT DESIGN CONSIDERATION IN USING SMALL SMOKE DAMPERS AND COMBINATION FIRE/SMOKE DAMPERS

NCA's 25+ years' experience in manufacturing fire, heat, and smoke isolation devices has given us the opportunity to deal with many design and installation problems that continue to occur in the industry today. With this engineering report, we begin a continuous program of disseminating information to our customers which we believe will help the industry achieve satisfactory installations and to avoid costly mistake and rework. Each report will deal with a specific problem and our recommendations.

THE PROBLEMS:

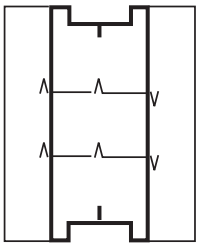
In using small smoke and fire/smoke dampers, the main problem is unsatisfactory pressure drop due to insufficient free area. This is caused by the lack of good and complete information being available to the designers of HVAC systems with regard to small dampers (i.e. dampers less than 16" high). The designers often are simply not aware of just how little free area there can be with a small damper. Most damper manufacturers publish pressure drop data on "representative" sizes, generally around 24" x 24". This data is really only useful for sizes and aspect ratios very close to the given size. To overcome the lack of free area on smaller dampers, the industry offers a choice of smaller frames (i.e. flat top & bottom) and/or oversizing the damper and reducing to duct size with sheet metal transitions. The problems occur at the design stage when the too small duct size is called for without the designer realizing just how little air he is going to get out. Then either a flat top and bottom damper or, worse, a standard frame style is put in the duct with the result that the engineer discovers (too late) that the pressure drop is unsatisfactory. After the blame laying exercise is done, the offending dampers are removed and an attempt is made to shoe-horn in a maximum free area damper into too small an opening. This, of course, is costly and sometimes does not remedy the situation.

NCA'S TEST PROGRAM:

We decided to run a comparison test program under "real world" conditions to find out the relative pressure drop of various frame and enclosure styles to determine the optimum solution. Since, it has long been known that free area is the prime determinant of pressure drop at lower velocities, it is fairly easy to calculate which style would be best; however, we wanted to know the actual pressure drop values so as to know whether the standard frame and flat top and bottom frame styles are acceptable under any conditions. It is obvious that a designer, given the choice between a standard frame and a flat top and bottom model frame with slightly better free area, will choose the later, but we wanted to know in making such a choice what then does the designer get and is it satisfactory? The types of frames and enclosures we tested (A-E) are outlined on the following page.

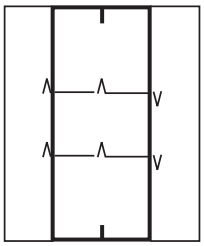
DAMPER FRAME / ENCLOSURE STYLES

A.



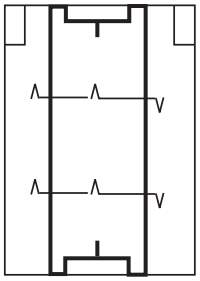
Standard Frame:
Damper Size: 11-3/4" x 11-3/4"
Duct Size: 12" x 12"
Head, sill, frame & stops in airstream.

B.



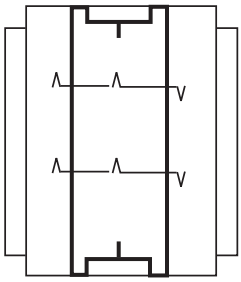
Flat Top & Bottom Frame:
Damper Size: 11-3/4" x 11-3/4"
Duct Size: 12" x 12"
Low profile head and sill, jambs and stops in airstream.

C.



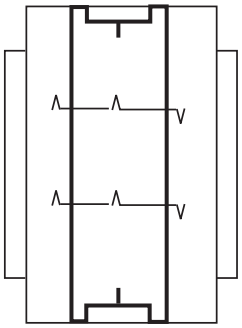
B-Type Enclosure:
Damper Size: 11-3/4" x 13-3/4"
Duct Size: 12" x 12"
Head & top stop out of airstream.

D.



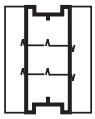
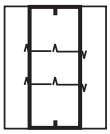
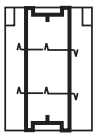
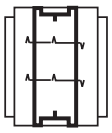
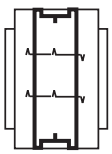
Standard S/R C-Type Enclosure:
Damper Size: 13-3/4" x 13-3/4"
Duct Size: 12" x 12"
Frame out of airstream.

E.



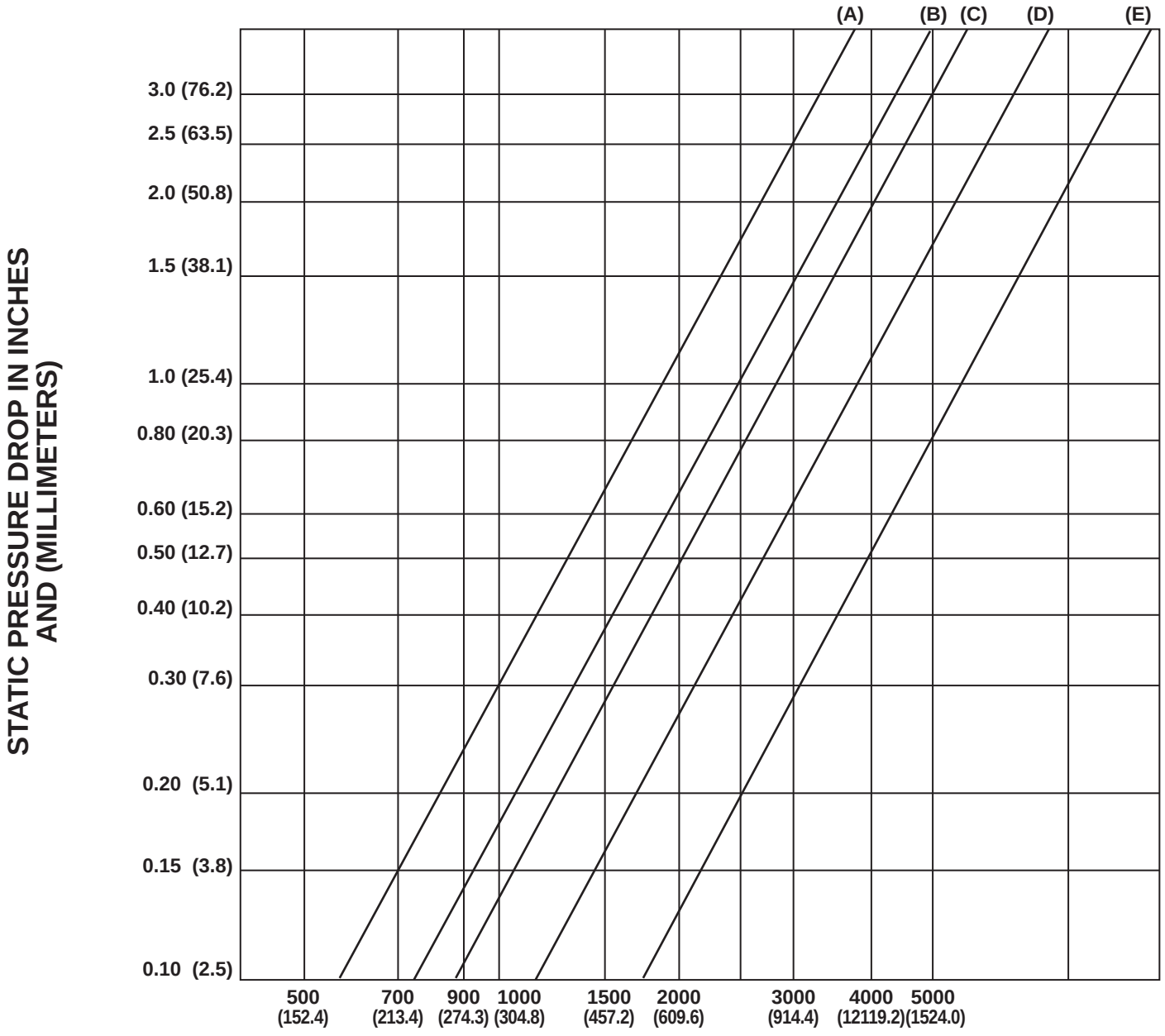
S/R C-Type Enclosure +2" on height:
Damper Size: 13-3/4" x 15-3/4"
Duct Size: 12" x 12"
Frame and stops out of airstream.

TEST RESULTS AND RECOMMENDATIONS

FRAME / ENCLOSURE	FREE AREA	PRESSURE DROP AT 2000 FPM	NCA'S RECOMMENDATIONS
A. 	52%	1.2 IN. W.G.	AVOID USING BELOW 16" HIGH DUCTS. (I.E. 17" HIGH AND ABOVE.)
B. 	65%	0.68 IN. W.G.	AVOID USING BELOW 14" HIGH DUCTS.
C. 	66%	0.51 IN. W.G.	AVOID USING BELOW 12" HIGH DUCTS.
D. 	79%	0.29 IN. W.G.	SUITABLE FOR ANY DUCT HEIGHTS OF 6" HIGH AND ABOVE.
E. 	96%	0.14 IN. W.G.	SUITABLE FOR ANY DUCT HEIGHTS OF 6" HIGH AND ABOVE.

COMPARISON TESTS OF FIVE FRAME / ENCLOSURE STYLES OF SMALL MULTI-BLADE DAMPERS

PRESSURE DROP VS VELOCITY (DAMPER FULL OPEN)



VELOCITY

TESTED AS PER AMCA STANDARD 500, FIG. 5.3 AIR VELOCITY IN FEET AND (METERS) PER MINUTE THROUGH FACE AREA.

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NCA'S RECOMMENDATIONS:

It seems clear that smaller dampers need to have their free maximized *with sleeved transitions* wherever possible. To do so, means that the HVAC designers must have the correct information before they begin their design. This requires oversizing the opening by *2 inches minimum*. In some rare cases this may not be possible, in which case the designer should specify a flat top and bottom frame style as a last resort.

It is important that this information reach the designers of HVAC systems. Please contact our sales office for reprints for your consulting engineers and contractors.

SUGGESTED SPECIFICATION:

All small smoke and fire/smoke dampers (under 16" in height) shall be oversized by 2" and transitioned down to duct size to maximize free area. Openings in fire and smoke separations shall be oversized accordingly to accommodate larger duct work. Dampers shall be tested and rated in accordance with UL555S and bear the UL label. Where it is impossible to oversize the duct/opening, then a flat top and bottom frame style shall be used on all small smoke and combination fire/smoke dampers. Bearings shall be bronze oilite turning in extruded jamb holes. Blade edge seals shall be silicone rubber designed to withstand 450 degree F. and jamb seals shall be stainless steel compression type. All combination fire/smoke dampers shall be tested and rated for 1-1/2 hours to UL555 as well as UL555S and shall bear the appropriate UL labels for these ratings. Damper manufacturer shall have tested a full range of sizes, single size testing will not be acceptable. All leakage rated dampers shall have been tested to 4" W.G. in the closed position.

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