FOR YOUR INFORMATION
SPEAKER DIAMETER VS SPEAKER DIRECTIVITY

An acoustical phenomenon not generally known or possibly overlooked is that a smaller diameter loudspeaker has a wider polar pattern than a larger diameter loudspeaker at a given frequency. In practical terms, a smaller diameter speaker can cover a given area in low level sound as well as if not better than a larger speaker provided certain other factors are present. We are, of course, assuming that the smaller speaker is satisfactory in reference to power handling capabilities and frequency response.

In order to pictorially demonstrate the above, the Atlas Sound Engineering Department plotted the polar patterns of a 4" flat rigid piston and an 8" flat rigid piston at 1000, 3000 and 7000 Hz. The rigid piston was chosen in order to avoid the conclusion that the directivity patterns as shown were the products of a particular speaker or manufacturer.

The difference in the polar patterns for the 4" and 8" radiators at a particular frequency are quite striking. To illustrate the point, refer to figure 1. If we assume the sound pressure level on the axis is identical and at 60dB for both the 4" and 8" radiators and that the distance from the radiators remains constant for all measurements, at a point 30 degrees off the axis for 1000 Hz, the sound pressure levels are:

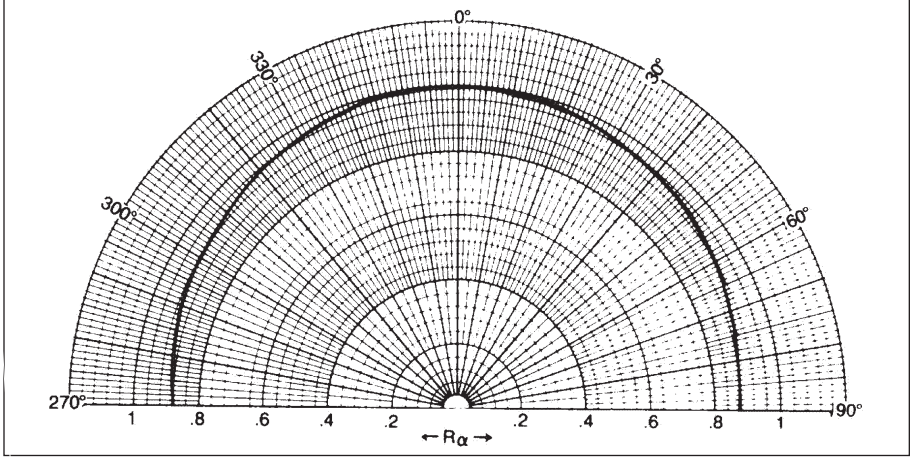
4" radiator - 58.2dB
8" radiator - 52.8dB

for 60 degrees off the axis

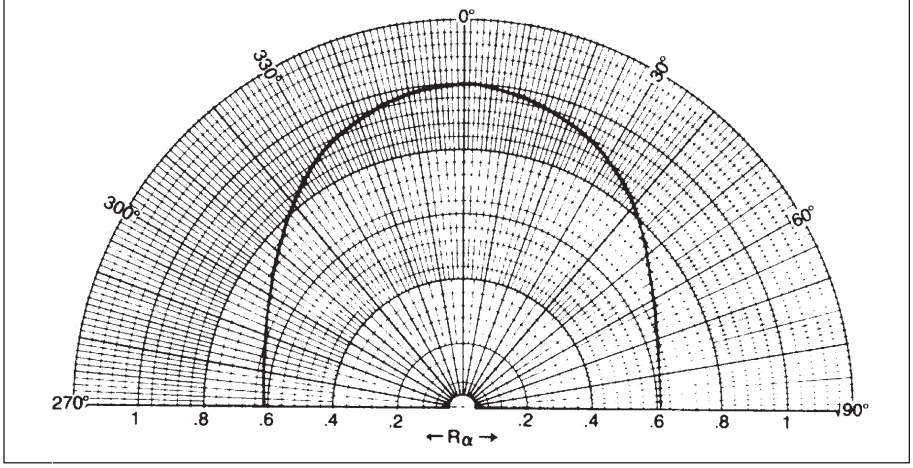
4" radiator - 55.2dB
8" radiator - 40.8dB

FIGURE 1

DISPERSION CHARACTERISTICS FOR 4" RIGID PISTON @ 1000 Hz



DISPERSION CHARACTERISTICS FOR 8" RIGID PISTON @ 1000 Hz



Atlas Sound
1601 JACK MCKAY BLVD. / ENNIS, TEXAS 75119 U.S.A.
TELEPHONE: (800) 876-3333 / FAX (800) 765-3435
AtlasSound.com

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The differences are brought out even more at higher frequencies. Figure 2 shows the polar patterns at 3000 hz. The sound pressure levels at 30 degrees are:

4" radiator - 45.6dB
8 "radiator-15.6db

at 60 degrees, the difference is even more startling:

4" radiator - 24dB
8" radiator - 7.8dB

The polar patterns described above are those for rigid piston radiators. The action of a cone on a loudspeaker is analogous to a piston that is pumping air. It differs only in that the cone is not entirely rigid at the high frequencies and is angled rather than flat.

As a result, the sound pressure level differences off axis between a 4" and 8" radiator are not as great as indicated above. An actual polar plot for a 4" and 8" speaker is reproduced in figure 4. You will note that although sound pressure level differences are not as great as for the rigid piston, the same general conclusion is evident; a 4" speaker's sound pressure level at a given frequency does not drop off as quickly as an 8" speaker as one moves off axis. A good point to remember! (See appendix for information on calculating rigid position polar plots.)

As a word of caution, there are other characteristics of a loudspeaker that are equally as important as directivity. These additional characteristics may be more conveniently met by a larger radiator - as an example, the power handling capabilities and the bass response. All factors must be considered when designing your system.

FIGURE 2

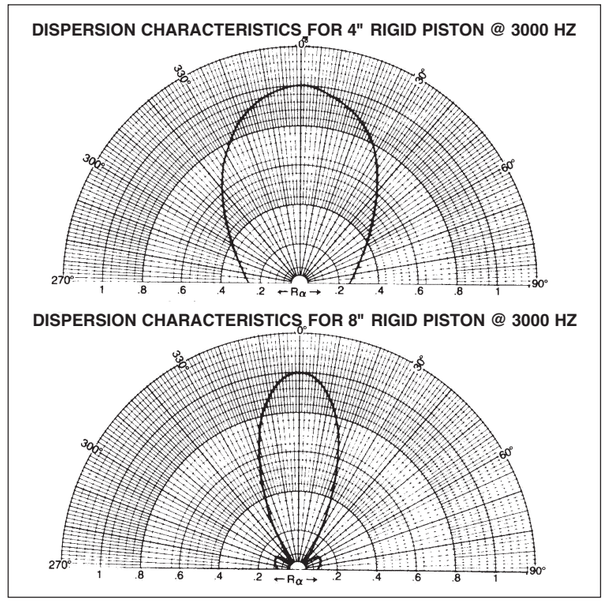

FIGURE 3

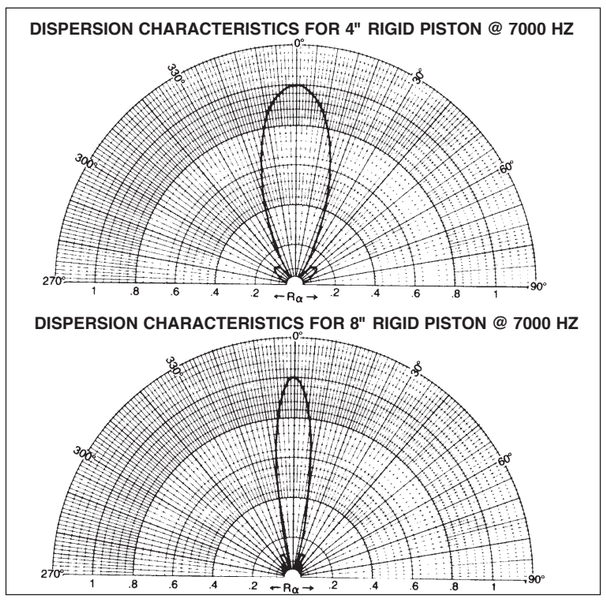

FIGURE 4

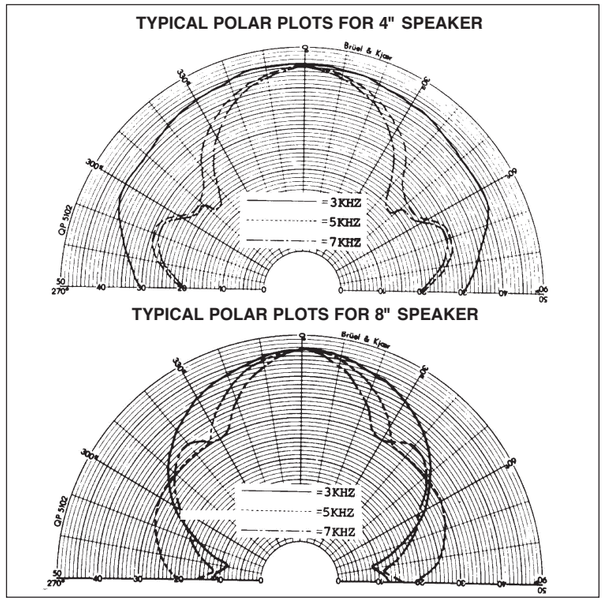

FIGURE 5

When you have weighed all the factors regarding speaker size and have determined a 4" speaker is what you need, consider the Atlas Sound FC104 (see figure 5).

The superb quality of this sound reproducer is complemented with an entire line of baffles and enclosures of contemporary design (see figure 6). Atlas Sound's X Series speaker baffles have the modern, clean, crisp lines required by many architects. They are designed to enhance and not compete with the interior decor.

Whether a cylindrical baffle of one piece aluminum or a simple trim ring is required, Atlas Sound is the one source for your 4" speaker needs!

MODEL FC104
(shown with optional transformer)

FC104 SPECIFICATIONS

Speaker Size:	4"
Frequency Response:	105 Hz to 17 KHz
Magnet Weight:	10 ounce Ceramic
Impedance:	8 ohms
Power Rating:	10 Watts Program
Voice Coil Dia.:	1"
Sensitivity:	93dB (SPL at 1W / 1M)
Resonance:	101 Hz
Dispersion Angle:	180˚ (-6dB, 2KHz Octave Band)
Flux Density:	10,500 Gauss
Speaker Depth:	2¼" (Less Transformer)

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Specifications subject to change without notice

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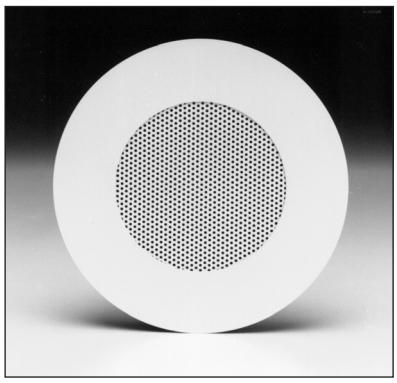
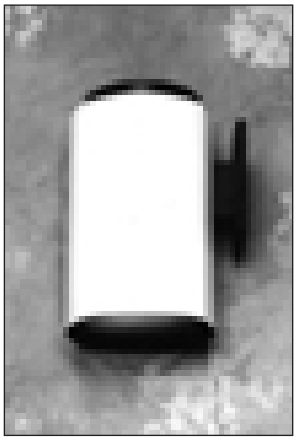
FIGURE 6

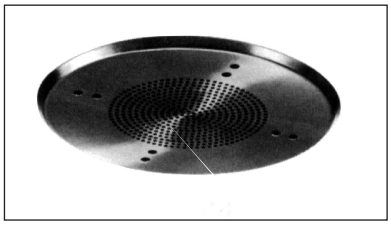
Shown below are some of Atlas Sound's 4" baffles for use with FC104 speakers. The range of colors and shapes assures you of a baffle suited to your needs. Consult Atlas Sound's Commercial Products Catalog for details, or call the representative in your area.



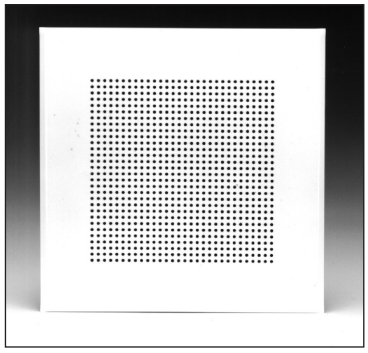
Model T740-4



Model X46



Model 60-4



Model 161-4

Model 510-4

Model T51-84

APPENDIX

The polar plots of a rigid piston are calculated by using the following formula:

$$R_a = \frac{2J_1\left(\frac{2\pi R}{\lambda}\sin_a\right)}{\frac{2\pi R}{\lambda}\sin_a}$$

Where: R = Radius of Rigid Piston
λ = Wave Length = Velocity of Sound in air (V) Divided by the Frequency Being Plotted (f) (i.e., V/f)
J_1 = Bessel Function of Order 1

The plot is formed by evaluating the equation above for various frequencies 0 and 90 degrees off axis.

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