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Hart&Cooley
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Sizing a Register or Diffuser

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Conceptually, choosing a supply register or diffuser would seem to be straightforward, and most of the time it is. There are a number of influences that could affect the choice. Putting emphasis on one influence over the others will alter the outcome, but much depends on one's priorities. It's like pouring various ingredients into a blender and ending up with a flavored drink. Too much of one ingredient will dominate the taste. Some selection options for choosing a register will be more important than others, thus influencing the model and size.

Some of the possible input criteria for making a selection are:

- CFM
- Face velocity
- Throw
- Pressure loss
- Noise criteria
- Mounting location
- Heating/cooling/both
- Looks
- Availability
- Price
- Style
- Size limitation
- Material
- New/replacement

In practice, one's experience, geographical location, and the type of occupancy or activity in the space under consideration may eliminate some variables, such as mounting location, heating or cooling or both, availability, style, and material like steel, aluminum, or even plastic.

Ceiling Diffuser

For this initial discussion of sizing a supply register or diffuser, we will narrow the selection criteria to only CFM, face velocity, and throw, which will minimize unnecessary complications. The location is a ceiling, and a circular or 4-way pattern is required. A circular ceiling diffuser, such as our #16, is one possible choice.

The chart below is the engineering data for Hart & Cooley's #16 round ceiling diffuser.

With a requirement of 120 CFM, there are a number of choices for a size that can deliver this airflow. A 6-inch diameter will deliver 120 CFM at a face velocity of 900 feet per minute (FPM) and a radial throw of 5 feet. An 8-inch will also deliver 120 CFM, but at a reduced face velocity (and quieter delivery) of about 530 FPM and a throw of approximately 4 feet. And lastly, a 10-inch will have a face velocity of 350 FPM and a throw of 3 feet.

Given the three potential choices, think about throw as the next selection criteria. The greatest throw comes with the highest face velocity, but don't forget that the same high face velocity may cause some background noise that might be bothersome if used in a library as opposed to a room with a higher level of activity. Increasing face velocity will intensify the pressure loss. (Doubling the velocity will quadruple the pressure loss!)

This simple table allows for a visual interpolation of data. A more precise method is to use the relationship:

CFM = Face Velocity x Area

The "Area" (in square feet) for each size is the "Ak" number listed under each diameter. For instance, to find the face velocity of the 10-inch at our stated 120 CFM requirement, divide 120 by the Area: CFM ÷ Area = Face Velocity or 120 ÷ .345 = 348 FPM face velocity.

Another ceiling diffuser to consider is the A504. This product is square and made of aluminum, providing an alternative when looks and material become selection criteria.

I consider this example an "introduction" to sizing a supply diffuser. In future editions, we will study examples where we must choose the register or diffuser based on more stringent performance limitations, as well as examples that require narrowing a choice of product by prioritizing many of the selection criteria.

Engineering Data for 16 Round Ceiling Diffuser

Face Velocity		**300**	**400**	**500**	**600**	**700**	**800**	**900**	**1000**
Pressure Loss		**.006**	**.010**	**.016**	**.022**	**.031**	**.040**	**.050**	**.062**
6"	CFM		55	65	80	95	105	120	135
Ak .135	Throw		2.5	3.0	3.5	4.0	4.5	5.0	5.5
8"	CFM	70	90	115	135	160	180	200	225
Ak .225	Throw	2.0	3.0	3.5	4.5	5.0	5.5	6.5	7.0
10"	CFM	105	140	175	210	240	275	310	345
Ak .345	Throw	2.5	3.5	4.5	5.0	6.0	7.0	8.0	8.5
12"	CFM	150	200	250	300	350	400	450	500
Ak .500	Throw	3.0	4.0	5.0	6.0	7.5	8.5	9.0	10.5
14"	CFM	190	250	315	375	440	500	565	625
Ak .625	Throw	3.5	4.5	5.5	6.5	8.0	9.0	10.0	11
18"	CFM	310	415	520	625	730	830	935	1040
Ak 1.04	Throw	4.5	6.0	7.0	8.5	10.0	11.5	13.0	14.5

Terminal Velocity of 50 FPM