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Understanding Basic Residential Ductwork Design

Please Note: All information provided in this document is to be used as a guideline only.

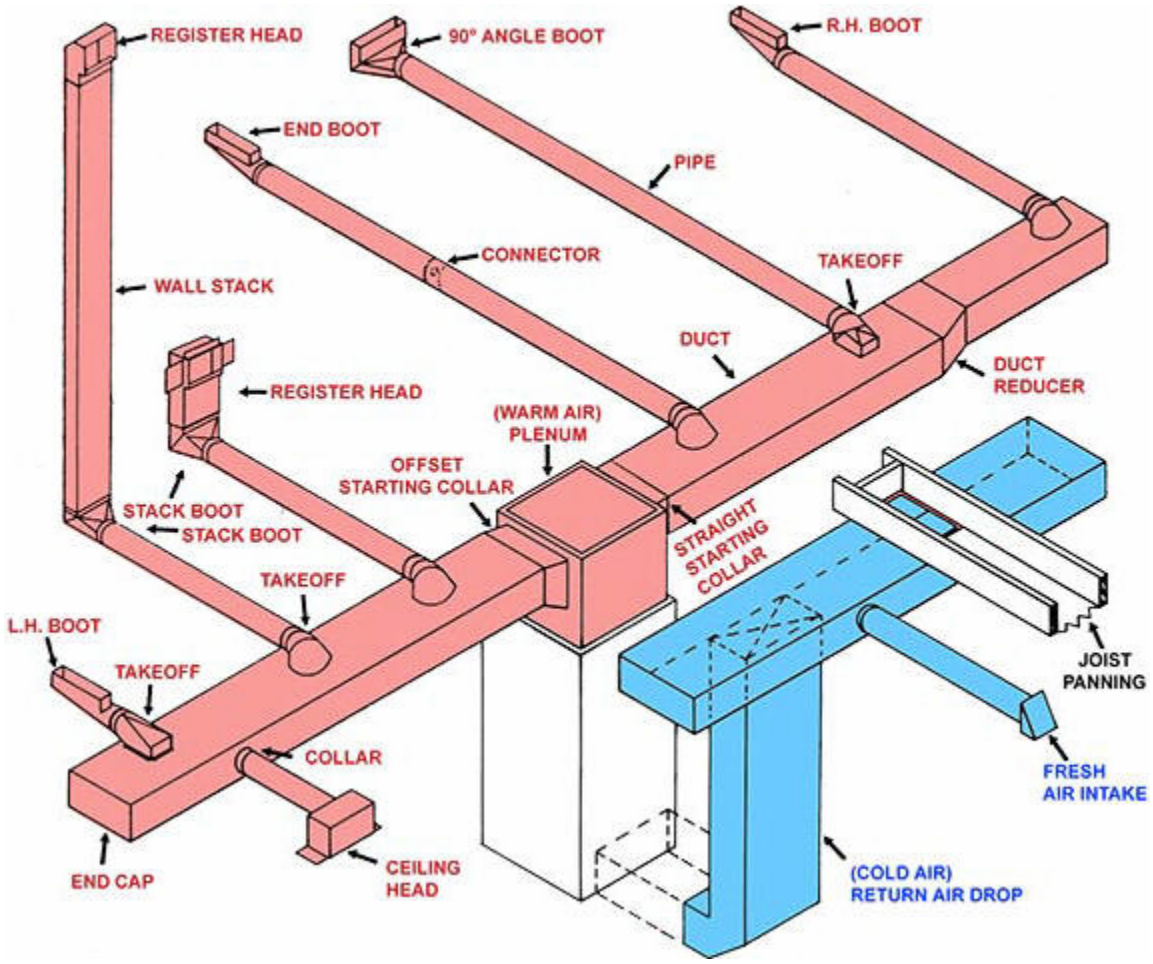
The purpose of Residential Ductwork Design is to properly distribute the airflow, produced by your heating/cooling system, to your house. This involves Return Air (unconditioned) coming into the heating/cooling system. Then, by heating/cooling that air, delivering the newly conditioned air to your home. An improperly designed ductwork systems can cost money through inefficiencies, and in some cases, cause premature failure of heating and cooling equipment. *This means that your home's ductwork system is just as important as the equipment used to heat and cool your home.*

The 3 Most Important Things to Understand About Residential Ductwork Designs are:

- Furnaces and air conditioners require a certain amount of airflow, measured in CFM (Cubic Feet Per Minute), to be passed through the equipment (supply and return ducts) in order for the equipment to function properly and efficiently.
- All homes have unique requirements and construction that pose obstacles when designing the ductwork system to accommodate each room with proper airflow. *(This is especially true with older homes.)*
- The *Ideal Ductwork System* achieves both goals by providing enough airflow to and from the heating/cooling equipment as well as the home. For maximum efficiency, this "ideal" system should also be sealed at all seams with *aluminum tape*, and should be properly insulated when exposed to unconditioned environments (i.e. crawl spaces and attics).

The most common design (Trunk Line Layout) is provided in the illustration below.

This type of system incorporates the use of a "Trunk Line" or series of Rectangular Ducts that act as a main supply channel throughout the house. From these "Trunk Lines" come branch ducts (usually round) that extend, in various ways, to the registers which are strategically placed throughout the home.



The size of each component is determined by the airflow that needs to pass through it. The overall sizing of the "Trunk Line" is designed to evenly distribute the appropriate amounts of air to every register. Caution must always be used when sizing individual components to insure that the heating/cooling equipment has adequate airflow for optimum performance.

The following duct sizes are based on a fraction drop of .10 inches per 100 feet of lineal duct. This "Equal-Friction" method of duct sizing should be adequate for normal residential furnace heating and air conditioning applications. Larger volumes or higher static pressures should be dealt with on an individual job basis.

Rectangular Duct and Round Duct

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Air Volume	Rectangular Duct Height (inches)					Equivalent Round	Air Volume
CFM	4"	6"	8"	10"	12"	Duct (inches)	CFM
50	6 x 4					5	50
75	6 x 4					6	75
100	8 x 4	6 x 6				6	100
125	10 x 4	6 x 6				7	125
150	10 x 4	8 x 6				7	150
175	12 x 4	8 x 6				8	175
200	14 x 4	8 x 6				8	200
225	16 x 4	10 x 6				8	225
250	16 x 4	10 x 6				9	250
275		12 x 6	8 x 8			9	275
300		12 x 6	8 x 8			9	300
400		14 x 6	10 x 8			10	400
500		18 x 6	12 x 8	10 x 10		11	500
600		20 x 6	14 x 8	12 x 10		12	600
700		24 x 6	16 x 8	12 x 10		12	700
800		26 x 6	18 x 8	14 x 10	12 x 12	13	800
900		30 x 6	20 x 8	16 x 10	12 x 12	14	900
1000			22 x 8	16 x 10	14 x 12	14	1000
1100			24 x 8	18 x 10	16 x 12	15	1100
1200			26 x 8	20 x 10	16 x 12	15	1200
1300			28 x 8	20 x 10	18 x 12	16	1300
1400			30 x 8	22 x 10	18 x 12	16	1400
1500				24 x 10	20 x 12	16	1500
1600				24 x 10	20 x 12	17	1600
1700				26 x 10	22 x 12	17	1700
1800				28 x 10	22 x 12	18	1800
1900				30 x 10	22 x 12	18	1900
2000					24 x 10	18	2000

Basic Guidelines for Ductwork Fittings and Placement

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- Supplies are located on outside walls.
- Returns are located on inside walls. They should not be located in the same area as the furnace, nor should they be located by moisture sources such as kitchens or bathrooms.
- Return Air CFM must be equal or greater than Supply Air CFM.
- Wyes commonly reduce.
- Tees split, but do not reduce, and an appropriate reducer must be added.
- Dampers on take-off duct runs allow for adjustments of air distribution.
- In order to maintain velocity, reduce duct size.
- Never locate ducts at the end of the trunk line run. Last take-off run to be located 12" - 18" from end.
- Always stagger take-off ducts by 12" to maintain pressure.
- Use insulated duct or duct board in unheated spaces.
- Flexible duct work must be stretched tightly for maximum air flow.

Example:

System is designed to move 3 Ton of A/C or 1200 CFM.