



Small Duct High Velocity Heating, Cooling and IAQ Systems

Hi-Velocity Systems Case Study

Residential Feature in This Old House Magazine



This Old House at 81 Mt. Vernon St. in Melrose, MA was built in the late 1800's and was heated by a steam boiler and radiators with no A/C or ventilation.

The Hi-Velocity System was installed with a new hot water boiler & A/C. The indoor air quality has been increased with fresh outside-air ventilation, air filters and a humidifier in the winter.

The steam radiators have been removed and some pipe holes in the floor were used as vent openings. The hardwood grills were used in floor vents. Other vent locations are in ceilings, tops of walls and toe-space of cabinets. There will be one return vent on each floor to bring the room air to the blower.

The new hot water boiler has a vent through the foundation wall. An indirect water heater will use water from the same boiler to make and store hot water for showers, laundry, etc. The chimney for the old boiler and water heater have been abandoned.

The A/C system, including the outside condenser, will use new environmentally-friendly refrigerant instead of R-22, which damages the ozone. Government regulation will ban production of R-22 within 5 years, making it expensive to service systems that use it.

The 7 inch supply air and 10 inch return air pipes will run from the basement to the attic through a kitchen cabinet on the first floor and a boxed corner in the bathroom on the second floor. The supply trunk upstairs will run in the attic with a 2" duct to the ceiling and highwall vents. The downstairs supply trunk will run in the basement with a 2" duct to the floor and toe-space vents. Outside air will be brought into the blower to provide fresh air and to reduce draftiness from old windows and lack of insulation.

System Summary

Hi-Velocity:

- HV-100-H Air Handler w/ Heating Coil
- RM-100 Refrigerant Cooling Coil
- 2" x 10' Flex Duct w/ Standard Vent Plate, Rough-In Boot and Branch Take-Off
- Unfinished Oak Vent Plates

Peerless:

- Direct Vent, Natural-Gas Hot Water Boiler

Bryant:

- 6" Pleated Media Filter
- Automatic Steam Humidifier
- Puron Condenser

Amtrol:

- 41 Gallon Indirect Water Heater

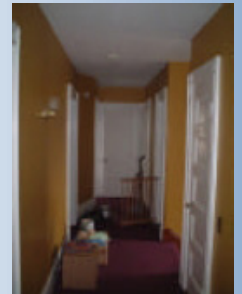
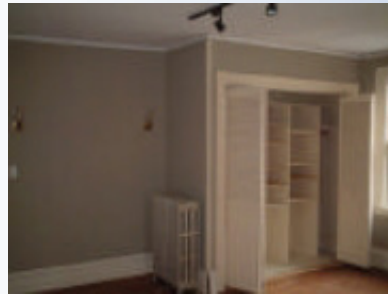
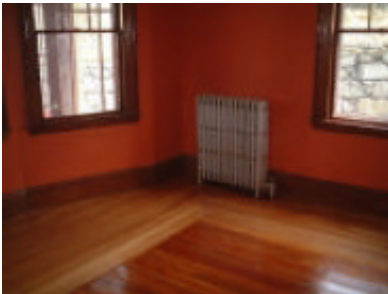


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The room air from the house is drawn back to the blower unit in the basement, through the air filter and through the two coils in the blower. If the thermostat upstairs calls for the air to be heated or cooled, one of the coils will be activated. The blower squeezes the air under pressure into the main 10" metal supply trunk. After a short run of 2-3 feet, the main trunk splits into two trunks for each floor above.



The first floor trunk will cross the center of the basement ceiling with two branch trunks coming off to reach outer walls. The basement trunk will be an 8" metal and the branch trunks will be as small as 4". The 2" flexible hoses will connect from the trunk to the floor vents. Some of the vents will be using existing holes for the steam radiators, which are being removed. The second floor trunk will be reduced to a 7" metal and run from the basement through holes cut into the floors and ceilings up to the attic, where it will run along the walls. The 7" trunk will be hidden in the back of a kitchen cabinet and a small, boxed area in the second floor bathroom. The 2" flexible hoses will connect the trunk in the attic to vents cut into either the ceiling or into the top of the walls. All of the 2" flexible duct will be 10 feet long to absorb the air noise, making the vents whisper quiet. Where the vents are close to the trunk, the hoses will be looped or coiled in the joist bays.

The air coming out of all of the vents will be under 5 times the pressure of a conventional forced air system, creating a venturi action or slip-stream effect in the air. All of the room air will be stirred by the stream of air from the vents, making the temperature at the ceiling very close to that near the floor. The air stream from the vents will be felt for the first 2-3 feet, which calls for locating the vents in the corners of the rooms blowing up from the floor or down from the ceiling. Alternatively, some of the kitchen vents will blow across the floor from the toe space under the cabinets, and some of the second floor bedroom vents will blow across the ceiling from vents located at the top of the wall.

The air will be drawn into two large return vents. One vent in the ceiling of the second floor hall and one in the floor near the first floor entrance. The bottom of bedroom and bathroom doors will be cut to give a 5/8" gap to allow airflow when the doors are closed. The return air duct from the second floor will run parallel to the 7" supply trunk back to the basement.



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A 4" metal pipe through the foundation will bring a small amount of outside air to mix into the return air trunk from both floors. This will provide fresh air and overcome draftiness from the older style windows. The two fireplaces and clothes dryer pull air out of the home, causing a negative pressure. Normally the only way a house can balance the pressure is to pull air in around windows and other weak spots in the house. The air handler will balance the pressure with the outside air pipe, virtually eliminating drafty windows.

The system is designed to maximize indoor air quality and comfort. In the summer the Hi-Velocity air conditioning coil will not only cool the air, it will also remove 30% more humidity than conventional A/C systems. In the winter the heating coil will warm the air using hot water from a boiler, which is up to 800 degrees less than the temperature of a warm air furnace. The lower coil temperature gives more even room temperatures and less "baked" air, often eliminating the need for a humidifier. The system in this house will have an automatic steam humidifier, because it has a lot of woodwork and wood floors, which absorb moisture. The humidifier will be located on the return air trunk between the fresh air pipe and the blower unit.

The blower unit has speed controls that allow it to run continuously using only 150 watts, the equivalent of two standard light bulbs. The advantage to continuous circulation are as follows:

- Air is filtered constantly, reducing dust and other pollutants.
- Ductwork becomes self-cleaning, because any dust is kept moving.
- Temperatures throughout the home are equalized.
- Negative pressure and draftiness are controlled.

Thermostats can be lowered in winter because heat at the ceiling is recirculated and the space near windows doesn't have drafts.

