CERV® Fan and Duct Sizing Information

Scope

Duct design for distributing fresh air and exhausting house air requires two considerations:

1) Sufficiently large ducts for available fan static pressure
2) Sufficiently low air velocities to minimize noise

The CERV is a balanced ventilation system designed to operate with airflow in the 100cfm to 200cfm range. Two external inline fans pull air through the CERV as shown in Figure 1 below. The supply blower pulls air through the CERV and blows into the house supply duct network. The exhaust blower pulls air through the CERV and exhausts air to the outside. Two high efficiency, variable speed, "ecm" fans (Fantech model "prioAir 6 EC") are used with the CERV. Small homes with minimal ductwork may use lower fan speed settings, while larger homes with more extensive ductwork and larger airflow demands would use high fan speed settings.

The following guide can be used for determining the air flow needed for a home, planning the supply and exhaust register locations, and selecting the proper fan size. Careful consideration must be given for local building codes, which may differ from these recommendations. Build Equinox is not liable for ventilation system design.

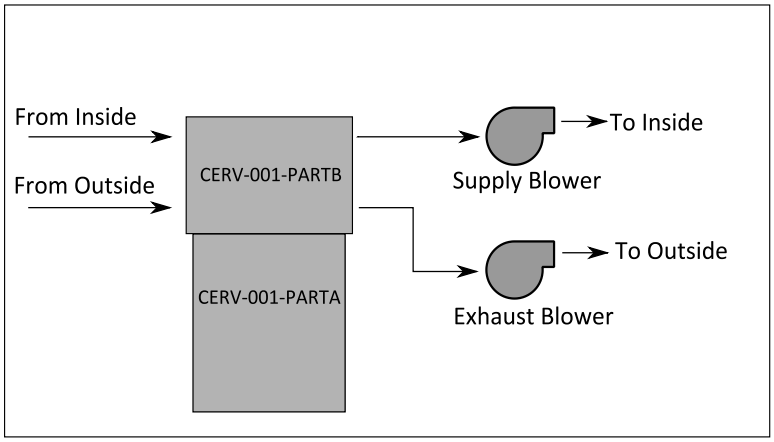

Figure 1. CERV system and fan configuration.

House Air Flow Rate and Supply/Exhaust Layout Recommendations

Indoor air supply and indoor return exhaust locations should be such that exhaust air is pulled from areas where moisture and odors are generated while fresh air is supplied to sleeping and living areas. This is the most favorable manner for purging polluted air from the house while replenishing fresh air. Table 1 provides guidelines for planning supply and exhaust air flows for a home. For areas listed with a range of air flows consideration should be given to the size of the room and expected utilization/occupancy. This same consideration should be used to estimate air flow for other areas not listed. Some air flow should be planned for all areas of a home within the conditioned envelope even if unutilized or storage space. For example a conditioned, but unfinished basement should have a minimal amount (5-10cfm) of both supply and exhaust air planned.

Maintaining 100-200cfm of total air flow is required for proper CERV operation. For homes with forced air systems, the CERV can be integrated into the central system ducting.

Table 1. Air flow recommendations for different areas.

Area	Supply [cfm]
Master Bedroom	40
Guest Bedroom	20
Office	10-20
Living Area	20-40
Dining Room	20-40

Area	Exhaust [cfm]
Kitchen	30-50
Master Bathroom	25-35
Full Bathroom	25
Half Bathroom	15
Laundry Room	10
Walk-In Closet	10
Pantry	10
Mud Room	10-15
Mechanical Room	10

Add the air flows needed for the supply side areas and separately add the air flow for the areas for the exhaust regions. The larger of the two air flow totals will be the total design air flow rate used for the house. Increase the lower air flow total (either the supply or exhaust) until it is equivalent to the larger total air flow. See below for an example.

Example: *A house with a Master Bedroom (40), two guest bedrooms (20+20), an office (20), a living room (30), and a dining room (20) would have a total supply air flow of 150cfm. This house has a kitchen (50), a Master Bathroom (30), one full bathroom (25), one half bathroom (15), a laundry room (10), a walk-in closet (10), a mud room (15), and a mechanical room (10) for a total exhaust air flow of 165cfm. The total design air flow rate for this house is 165cfm. The difference between 165-150=15cfm is distributed among the supply flows, so that the totaled is equal 165cfm.*

The minimum recommended total air flow rate for a home is 100cfm. The maximum design air flow rate is 200cfm. Large or complex home configurations should consider a second CERV system.

Once the desired air flow rate is established, the distribution ducts can be designed. Good duct design practice should be used in laying out the ducting. Some important considerations:

- Both supply and exhaust registers should be on the ceiling or high on walls
- Rigid duct is preferred to flex duct, although some flex can be used to mitigate fan noise
- Exhaust registers should not be placed directly over cooktops or where water vapor can be drawn in
- Ducts should be in the conditioned envelope as much as possible

Fan Air Flow Rates and Available External Static Pressure

Figure 2 shows the available external static pressures (ESP) for use in designing a duct layout to achieve the desired air flow rates calculated above. For each of the three fan operation conditions (6, 8 and 10 Volt "prioAir 6 EC' fan settings) there are two ESP curves. The solid line is the ESP available for the CERV including a 1" thick, 10"x20" MERV13 filter. Fresh air from outside must be filtered before entering the CERV. Locating the fresh air filter as close to the outdoor inlet in a manner that is convenient for checking and changing is strongly recommended. Any length of duct with unfiltered outdoor air will become extremely filthy. A second filter can be placed in the return duct to filter the air inside the house, but this is optional. The dashed line curve for each fan is the CERV with the MERV13 filter and the Geo-Boost™ ground loop option.

Example: *A CERV application with a MERV 13 filter requiring 100cfm of air flow can use the 6 Volt speed setting with 0.2"wg ESP available for duct losses. Using an 8 Volt speed setting, the prioAir 6 fan would supply 140cfm with 0.22"wg available ESP. At a 10 Volt fan speed setting, the fan can supply 180cfm at 0.23"wg of available ESP. If a Geo-Boost heat exchanger is included, the available duct static pressure levels are decreased as shown in the figure.*

An application requiring 150 cfm of ventilation air flow cannot use the 6 Volt fan speed setting, but can use fan speed settings between 8 Volts and 10 Volts, depending on the static pressure of the duct design. Ventilation air flow rates above 175cfm require the maximum 10 Volt speed setting.

Tables 3, 4, and 5 provide tabular values of the air flow and available ESP included in Figure 2.

Tables 5a/5b provide duct pressure drop and air velocity for common duct sizes over the ventilation air flow ranges of most interest. The tables are based on 100 feet of "equivalent" straight duct length. For example, a duct run with 50 feet of straight duct and 6 elbows may be equivalent to 100 feet of straight duct. These tables are for reference only. Duct pressure drop design methods (eg, Manual D) should be used for detailed duct design.

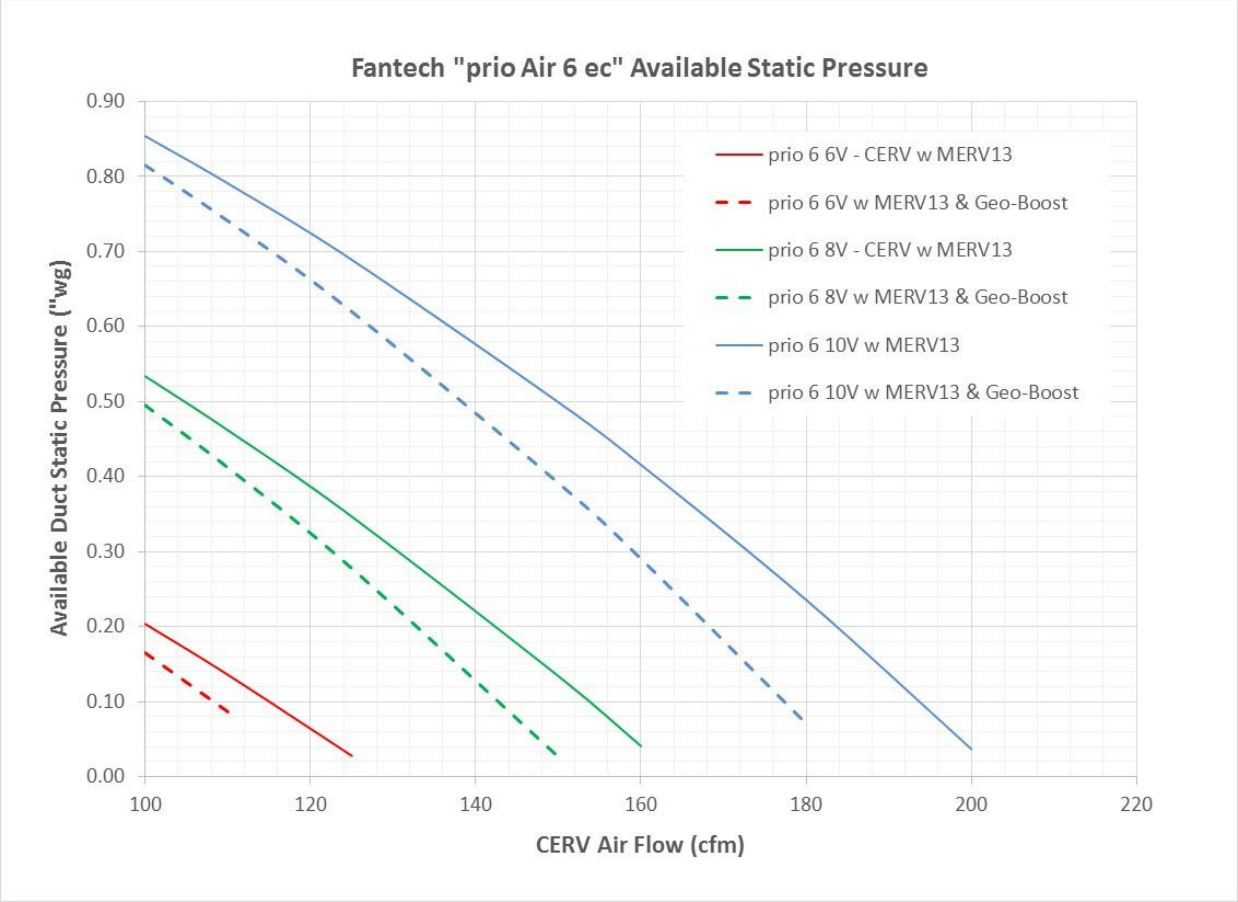

Figure 2. CERV air flow rates versus available external static pressure for Fantech “prioAir 6 EC” fan at 6 volts, 8 volts and 10 volts settings.

Table 2. Fantech prioAir 6 EC at 6 Volt setting airflow and available external static pressure.

AirFlow cfm	prio 6 6Volts MERV13 filter "wg	prio 6 6Volts MERV13 filter Geo-Boost "wg
100	0.20	0.17
110	0.14	0.09
125	0.03	

Table 3. Fantech prioAir 6 EC at 8 Volt setting airflow and available external static pressure.

AirFlow cfm	prio 6 8Volts MERV13 filter "wg	prio 6 8Volts MERV13 filter Geo-Boost "wg
100	0.53	0.50
110	0.46	0.41
125	0.35	0.28
150	0.13	0.03
160	0.04	

Table 4. Fantech prioAir 6 EC at 10 Volt setting airflow and available external static pressure.

AirFlow cfm	prio 6 10Volts MERV13 filter "wg	prio 6 10Volts MERV13 filter Geo-Boost "wg
100	0.85	0.82
110	0.79	0.74
125	0.69	0.62
150	0.50	0.39
160	0.42	0.29
180	0.24	0.07
200	0.04	

Tables 5a and 5b. Duct Pressure Drop and Flow Velocity Tables for 100 feet (equivalent) Duct Length

Flow versus Pressure

Flow cfm	4 "duct DP "wg	5 "duct DP "wg	6 "duct DP "wg	8 "duct DP "wg	10 "duct DP "wg
25	0.05	0.02	0.01		
50	0.18	0.06	0.02		
75	0.38	0.12	0.05		
100		0.21	0.09	0.02	
125			0.13	0.03	
150			0.18	0.04	
175				0.06	
200				0.08	0.02
225				0.09	0.03
250				0.11	0.04

Flow versus Velocity

Flow cfm	4 "duct DP fpm	5 "duct DP fpm	6 "duct DP fpm	8 "duct DP fpm	10 "duct DP fpm
25	286	183	127		
50	573	367	255		
75	859	555	382		
100		733	559	286	
125			637	358	
150			764	430	
175				501	
200				575	367
225				645	413
250				716	458