Excellence Without Compromise

EWC® CONTROLS INC.

TECHNICAL BULLETIN

ULTRA-ZONE®

Duct and Bypass Design Guidance

On new construction or when inspecting an existing HVAC system that will include an EWC Controls Zoning system, you should determine if the duct is correctly sized to handle the volume of air delivered from the HVAC system. You should also determine if the HVAC system was sized correctly for the home or building. In order to do all of that, a load calculation should be performed. Once it has been determined that the HVAC equipment and the duct work are correctly sized, then you may install an EWC Controls Forced Air Zone System. Otherwise, HVAC equipment and duct-work issues should be addressed *prior* to installing an Air Zone system. EWC provides Zone System Design Guidance that predates and compliments the ACCA Manual Zr.

Since the zoned heating and cooling requirements will be controlled through air zone dampers, the concern is how to effectively manage the airflow and volume resulting from closed and semi-closed air zone dampers. This means that as zones are satisfied, the airflow to those zones will be completely or partially shut off. This creates air volume build-up in the duct which can be dealt with using a combination of tools that help manage airflow and volume:

Tools that help manage airflow and volume:

1. ***Whenever possible, specify Multistage or Modulating HVAC systems when zoning.*** *This allows the EWC zone control system to match HVAC system capacity to the individual zone demands.*
2. ***Select the correct Zone Control system*** *for that HVAC system and the number of zones you want to create. Consider timer staging or thermostatic staging depending on preference and budget.*
3. ***If necessary, modify the existing duct and/or install new duct*** *that has been sized at a friction rate that will accommodate higher Cfm values at OEM specified static pressures and industry standard velocities. (Use ACCA Manual D to size your duct-work or use a duct calculator and select .07 friction rate value instead of the typical .10).*
4. ***Whenever possible, install Dampers in the Branch Runs, rather than Duct Trunks.*** *Now you can select which branch runs to dampen and which runs to leave alone(Open Runs). This method provides airflow to certain areas every time the HVAC system operates. (Bathrooms, Large Foyers and Washer/Dryer areas should not be dampened).*
5. ***Allow some or all Zone dampers to leak 10% to 20% air volume when closed****. When properly adjusted, this small amount of air leakage can offset the heat gain or heat loss in a particular zone and reduces air stratification.*
6. ***Install a Bypass Damper****, if there is sufficient clearance and route the bypass air back to the return duct or to a rarely used area of the home. The bypass damper is the most common and effective tool available to manage airflow and static pressure in a zoned HVAC system.*
7. ***Install a Balancing Hand Damper in the Bypass Duct.*** *The balancing hand damper allows you set sufficient pressure differential across the bypass duct, preventing the bypass duct from being the path of least restriction.*
8. ***Balance the System.*** *All HVAC systems needs to be balanced and an air zoned system is no exception. Use the zone damper itself to restrict or allow more flow to a particular zone and/or install balancing hand dampers in the branch runs.*

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Combine at least two or more of the eight tools together to effectively manage airflow and volume. Remember, the HVAC system must be able to deliver the proper volume of air to any and all zones. In addition to the eight tools, always bear in mind the following items:

- 100% of the equipment rated airflow (Cfm) must flow through the HVAC system at all times. Do not restrict the primary return airflow back to the HVAC system.
- Do not create numerous small zones. Two to four large zones works the best. Too many small zones makes it difficult to manage airflow and volume.
- Try to create zones using areas & rooms with similar heating and cooling loads. Do not combine rooms with drastically different loads.
- When sizing the bypass damper, assume the worst case scenario which is the smallest zone may be the only one to call at any given time.
- EWC Controls always recommends using the Electronic Bypass Damper (Part# EBD) on all zoning installations, although Barometric Bypass Dampers (Part# PRD and PRD-RD) work also, but are not as precise as the electronic type.
- Install a balancing hand damper (Part # RD-HD, ND-HD or SID-HD) in the bypass duct to limit bypass volume and achieve proper mixing of bypass and return air.
- Use the Zone Damper's travel limit adjustment and set up to 20% leakage on large zones. Smaller zones can be set lower or have no leakage at all.
- Whenever possible, group numerous zone dampers together on the individual branch ducts, rather than installing single dampers on the primary ducts. (Don't confine all the airflow too close to the HVAC system)
- Do not install dampers on branch runs serving bathrooms, washer/dryer areas and large foyers. (Open Runs) These areas should have airflow when any zone calls.
- Always use the SAS (Supply Air Sensor) to prevent the supply air temperature from rising too high or falling too low, during low load conditions.
- Make good use of and utilize the capacity control features available on all Ultra-Zone Control systems such as:

1. ***Timed or Thermostatic staging depending on preference & budget.***
2. ***50% Rule will inhibit Y2 until a sufficient number of zones are active.***
3. ***Outdoor Air Sensing to inhibit Auxiliary operation in mild weather.***
4. ***Return Air Monitoring will allow or prevent stage up operations.***
5. ***Communicating Zone Control can minimize or eliminate bypass flow.***

The most common tool available for effectively managing airflow and volume in an air zoned system is the bypass damper. This is done by tapping into the supply air plenum, installing an automatic bypass damper along with a volume control hand damper. This allows you to route the airflow back into the return duct, or divert the airflow into a rarely used area of the home that has an open return grille. The bypass diagram on the next page reflects bypassing into the return duct. Reference and utilize this diagram when planning and designing an air zoned system.

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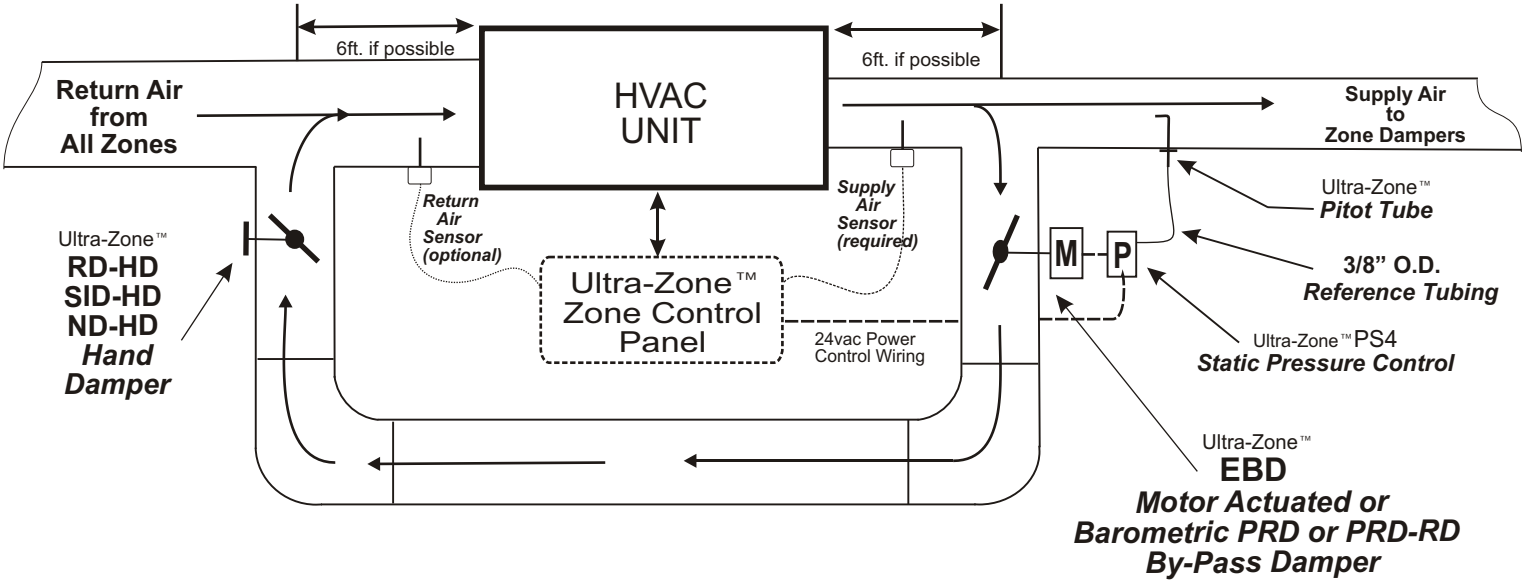

Note: **This EWC Controls drawing of the Bypass damper, Hand Damper, Static Pressure control and Related duct-work is intended to serve only as a guide. Your actual duct-work layout and components may differ. Use the graphic as a guide when planning or designing a Zone system regardless of the Equipment type, Duct layout and Airflow configuration.**

Note in the diagram above, the bypass taps are recommended to be at least 6 feet away on either side of the equipment. This is done to ensure that bypass airflow coming off the supply plenum has ample time to slowly mix with the return airflow. Typically there is no room to do this. Installing a restricting hand damper in the bypass is the perfect way to ensure sufficient differential pressure across the bypass duct and proper mixing of bypass air with return air.

Supply Air Temperature Sensors are mandatory when you install an air zone system. The sensor will prevent the HVAC equipment from exceeding the OEM recommended temperature rise during heating operations and protect the DX coil from frost conditions during cooling operations. EWC Controls includes the Supply Air Sensor **(Part# SAS)** with every micro-processor based Ultra-Zone control panel.

Whether the bypass tool is used exclusively or along with other air management tools, the bypass duct should be sized to manage the airflow and volume under the worst case scenario, less any open run Cfm and damper leakage Cfm. The calculation is done by taking the total Cfm capacity of the smallest zone and subtracting that number from the total Cfm delivered by the HVAC system. Any airflow from damper leakage and open runs will be deducted as well.

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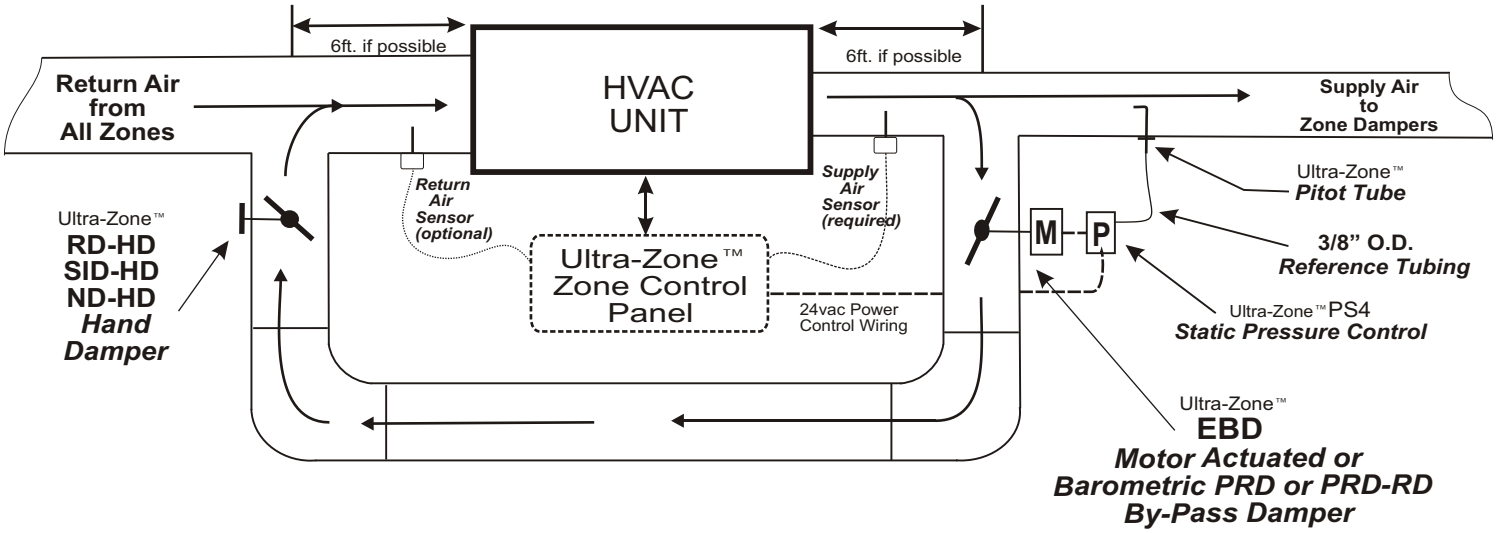
Example: ***3 Zone system:*** *Zone 1 = 700Cfm, Zone 2 = 600Cfm, Zone 3 = 700Cfm*

Total system Cfm	2000	Total system Cfm	= 2000Cfm
Less smallest zone Cfm	- 600	Smallest zone Cfm	= 600Cfm
Less 20% damper leakage Cfm	- 280	700Cfm x 20% = 140Cfm x 2	= 280Cfm
Less any open run Cfm	- 300	(3) 6" branch runs @ 100Cfm	= 300Cfm
Equals bypass flow Cfm	**= 820 Cfm Bypass Flow**		

The bypass duct would be sized to handle 800Cfm @ 900Fpm (feet per minute) velocity. (12"x12") If you don't have room for that size bypass duct, go to the next smaller size or select a Round model that is close to 800Cfm (12"@700Cfm). Just make sure to install a Hand Damper also, so you can prevent the bypass from becoming the path of least resistance. For typical bypass damper Cfm capacities, see the chart below. Contact EWC Controls for information on other bypass models and sizes.

Rectangular EBD	Cfm @ 900fpm	Round EBD	Cfm @ 900fpm
12"x8"	550 Cfm	8"	320 Cfm
12"x10"	680 Cfm	10"	500 Cfm
12"x12"	800 Cfm	12"	700 Cfm
20"x10"	1100 Cfm	14"	950 Cfm
20"x12"	1350 Cfm	16"	1250 Cfm



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