EcoNet® 800 Series Zoning Application and Design Guide

Overview

This document is to be used as an application and design guide **before** selecting and installing an EcoNet® Zoning system and choosing HVAC equipment to be used. This guide is specific to M1 compliant equipment and using the 800 Series EcoNet Thermostat and Zone Control. It is not meant to be consulted for the first time at the installation but rather in the planning stages prior to the sale.

Only specific EcoNet® compatible air moving equipment can be used and with a few exceptions and critical design considerations can non-EcoNet outdoor units be used which are limited to two zones. Ideal applications will use fully modulating equipment where there is more flexibility in system minimum airflow requirements, and ideal applications will not generally need an Intelligent Bypass. **To achieve this, each of the individual zones should support the minimum airflow of the equipment. Do not depend on over-conditioning or an Intelligent Bypass for large volumes of excess air as this may create system issues.**

EcoNet® Zoning Components

- EcoNet Communicating Furnace or Air Handler with variable ECM motor.
  - RHMVZ, RH3VZ or RH2VZ EcoNet Enabled Communicating Air Handler
  - (-)802V, (-)962V, (-)97MV, or (-)98MV Gas furnace
    - NOTE: Single Stage, EcoNet enabled Gas furnaces should not be zoned.
    - NOTE: Systems containing either a single stage outdoor unit or two stage heat gas furnace should be limited to two zones.
    - NOTE: Recommend use of 13KW and higher Electric Heat Kits as they have three stages of heat.
- EcoNet Communicating outdoor multi-stage AC or Heat Pump.
  - (-)A15AZ, (-)A16AZ or (-)A18AZ Condenser
  - (-)P16AZ or (-)P18AZ, Heat Pumps
    - NOTE: Mid-Tier Outdoor units with inverters lower than 18 SEER2 are limited to two zones.
- EcoNet Smart Thermostat acting as Zone 1 Master Controller
  - (-)ETST800SYS
- EcoNet Zone Controller (2-5)
  - (-)ECTL800ZON
- EcoNet Zone Panel (1 or 2)
  - REPNL700ZON
- EWC® Brand Ultra-Zone® - Fully Modulating Dampers
  - URD Modulating Round Damper(s)
  - SID Slip in Modulating Round Damper(s)
  - Fully Modulating Rectangle Louvered Dampers
- Supply Air Sensors – Required when Intelligent Bypass is used.
  - RXHT-A02 For Air Handlers
  - 47-24225-01 for Gas Furnaces

EcoNet Communicating Furnace or Air handler with Variable ECM Motor.

Two stage or greater EcoNet-enabled HVAC systems with ECM variable speed (constant CFM) blower motors are supported. EcoNet systems with a constant torque (X-13 or similar) blower motor or single stage equipment with variable speed blowers are NOT supported (E.G. RH2TZ series air handlers or (-)801V). Selection of a two-stage furnace over the modulating will impact how zones can be designed because of a higher airflow requirement for lowest stage.

EcoNet Communicating Outdoor Multi-stage AC or Heat Pump

EcoNet-enabled outdoor units are compatible with the EcoNet zoning and also must be considered when determining system design. For instance, mid-tier inverter systems are limited to two zones. Inverter models in the (-)A18AZ or (-)P18AZ family will have a lower minimum airflow requirement than a two stage or mid-tier condenser like the difference between the modulating and two stage furnaces. While there is a little more flexibility with airflow in cooling mode using full inverter equipment, minimum airflow requirements must still be considered.

EcoNet Smart Thermostat Acting as Zone 1 Main Controller

The EcoNet Smart Thermostat, part number (-)ETST800SYS, serves as a main control of the EcoNet zoning system and is used as the zone 1 thermostat control. The previous 700 series smart thermostat is not compatible with current production equipment. The 800 series control is however backward compatible. Only the EcoNet Smart Thermostat contains the necessary programming and algorithms needed to operate the EcoNet Zone System. It allows the user to configure the HVAC equipment, zoning settings, and operate and monitor the system. Additionally, the EcoNet Smart Thermostat provides a single interface for users to view the status of each zone.

EcoNet Zone Controller

EcoNet Zone Controls, part number (-)ECTL800ZON, must be used as the zone control/sensor in zones 2-6. The zone control displays the zone temperature and allows the user to adjust the zone set points, fan speed, schedule and other settings for each individual zone. These controls do not have to be home run back to the EcoNet zoning panel, they can be wired in series to any device on the EcoNet communicating bus.

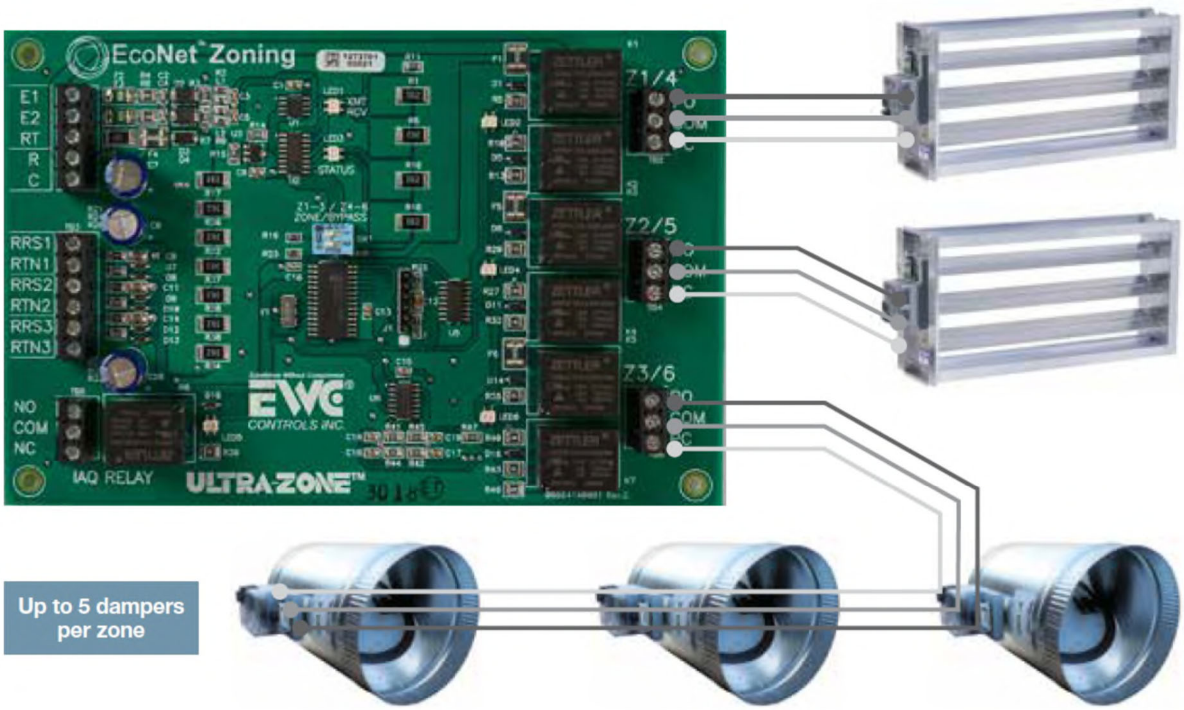
EcoNet Zone Panel

The EcoNet Zone Panel, part number RPENL700ZON, remains unchanged and is compatible with an 800 series zoning system and is the main control that drives communication between the thermostats and dampers. When there is a call for heating or cooling, the zone panel receives a signal from the EcoNet Smart Thermostat and modulates the dampers accordingly. Each zone panel will accommodate up to three (3) zones where allowed. Two panels may be combined for a total of six (6) zones where allowed. A dipswitch located on the panel will identify it as either zones 1-3 or 4-6. When only 2 zones are required, one zone panel will be used, and the bypass will be configured in the main thermostat.

We have partnered with EWC® to provide dampers to the EcoNet zoning system. While the dampers are also used in EWC® zoning systems the (-)EPNL700ZON panel, manufactured by EWC, is not compatible with any of their traditional systems. Likewise, any EWC® non-EcoNet® branded panels or EWC's smart bypass are not compatible with the EcoNet® system.

EWC® Brand Ultra-Zone®- Fully Modulating Dampers

The EcoNet Zoning System is compatible only with EWC® Ultra-Zone® damper models URD (ducted round), ND (rectangular louvered), or SID (slip-in round). They are all 24VAC power open/power close, allowing for full modulation to one of 35 positions. The dampers are wired to the zone panel, with each zone being able to support up to five (5) dampers. Depending on which zones require conditioning, the dampers automatically open and close to the appropriate position.



Definitions

Blower Cutback – Blower cutback occurs when the blower motor reaches maximum RPM and it cannot produce the airflow demanded. The higher the system or equipment static, the more likely this is to occur. Designing zones to handle the system minimum airflow will prevent this from happening.

Bypass-less System – An Intelligent Bypass is not always required, nor is it preferred over properly sizing each zone to handle the minimum airflow requirements of the system. A bypass-less, properly designed system will prevent the equipment from operating in a manner that causes excessive wear or damage to the HVAC equipment. Over-conditioning, dumping or using an Intelligent Bypass to manage large amounts of excess air may result in poor zone temperature control and customer dissatisfaction.

Duct Leakage – At the end of the duct measurement process, all dampers are closed, and the system will run the blower to determine any leakage in the plenum and ductwork before any dampers. Leakage will include dampers with mechanical minimums set, bypass type humidifiers, un-zoned ducts, plenum registers and the like. If more than 25% duct leakage is detected, a one-time alert will be generated and logged in the system alarm history.

Duct Measurement – Every seven days, the system will perform a duct measurement where the system will run a minimum blower speed, and open each zone damper, while others are closed. This process will occur right after a daily filter check is performed. This process can also be performed manually by entering the Service menu and selecting Zone Checkout, and it should be done at system commissioning. Installers may select to adjust cadence of duct measurement routines. The system will slowly increase airflow when the test is initiated to determine the test CFM used. The system static and number of zones works into this equation. There is no predetermined test airflow volume.

Unoccupied or Dump Zone – Using a zone control and overconditioning strategy or Intelligent Bypass damper are options, but instead of sending the excess supply air back into the return, it is sent to a part of the home where it will not cause objection. Bypass and Dump Zones may not be allowed in certain localities.

Intelligent Bypass – Duct with a modulating damper that returns excess air from the supply duct back into the return duct. CAUTION - This can cause violation of the discharge temperature setting, main or auxiliary limit controls, or freeze a coil. Remember safety controls are NOT to be used as operating controls. An Intelligent Bypass is used to allow a minimal amount of excess air to allow system to run when smallest zone is calling. Any expectation that more than 15% of the system's highest minimum airflow being sent back through the Intelligent Bypass must be reconsidered. (Example: if a system has a minimum airflow of 1000 CFM, the system must be designed to allow no more than 150 CFM though the bypass) A supply air sensor, (47-24225-01) for furnaces and kit (RXHT-A02) for air handlers, must be installed and connected to the indoor unit control board. Bypassing back into the return may be against codes in certain states or regions.

Linearization - Airflow through a damper changes non-linearly as the damper moves. This can cause uneven delivery of conditioning to a zone. To help correct this, there is a patented manual process to learn the airflow in each zone and adjust the damper movements accordingly. Enter the Service menu and select Zone Checkout to perform a damper linearization. The process will take about 5 minutes per zone. This only needs to be performed once after the system is installed during commissioning.

Over-conditioning - If a zone airflow limit does not allow the system to operate, it will look for other zones that are setback in temperature and use them for unoccupied conditioning or dumping. There is an over-conditioning setting for each zone that allows a user to adjust how much a zone can be over-conditioned. The Auto setting allows a zone to be over-conditioned up to the calling zone (or most conditioned zone). A user can also set over-conditioning to be anywhere from 1 to 10 degrees past its set point. If an Intelligent Bypass damper is present, the bypass will be used before over-conditioning takes place. CAUTION - This can cause spaces to be warmer or cooler than the user desires and may not be acceptable. Using guest or unused bedrooms may seem like a great idea at the time until, for example, guests arrive, or the home is sold to a family that intends on using those rooms.

SAT – Supply air thermistor. When an Intelligent Bypass damper is installed, a supply air sensor is required. This sensor must be installed in the supply plenum, after the coil. It should be out of line of sight from heat exchangers or electric heat elements. System logic will cause bypass to close if supply air exceeds the values set. When the Intelligent Bypass closes to protect the system, airflow will be forced into open zones which may result in blower cutback faults. Blower cutback occurs when a variable CFM motor reaches its full RPM limit but cannot supply the commanded CFM.

SAT limits are fixed for heat pump heating mode at 120°F, electric heat mode at 135°F, cooling mode at 45°F and are adjustable for gas furnaces from 100°F to 160°F.

System Minimum Airflow – You must look at the minimum for all modes at the end of this document. This includes cooling, heating, electric heat mode, etc. The highest minimum airflow is what must be considered.

Zone Airflow Limits – Zone airflow limits are used to manage airflow velocity noise in each zone. These values are calculated by the system during the initial duct measurement procedure. The smaller the duct, the lower these values are and can impact comfort. For this reason, it is important to make sure each zone can handle the minimum airflow of the system. The installer will adjust the airflow limits for noise, blower RPM, and duct static limits. At the end of the duct measurement exercise at start up, each zone will have a default airflow limit of 1700 CFM. It will be up to the installer to determine the allowable airflow as dictated by noise, blower RPM, static, etc. to set the proper airflow limit for each zone.

Initial Design and Planning

Layout

The first priority is to design **each and every zone** to handle the highest system minimum airflow for each unit in the system. Zoning a home in place of multiple systems has its limitations, and expectations must be managed. For example, a single HVAC system with zoning cannot operate heating and cooling simultaneously while two separate systems can. This needs to be considered if the home is going to have significant differences in load types.

Rooms within the individual zones should have similar loads and proper duct design.

Homes with multiple levels should be zoned by level. In select cases, each level may be broken further into separate zones, if desired, and if airflow can be supported when using fully modulating equipment.

Retrofit Existing Systems

In most cases, an existing duct system, even if having been zoned before, can become problematic if not addressed properly. Older or existing ductwork is not likely capable to manage the airflow requirements of modern equipment airflow needs once broken into zones. Replacing a traditional non-communicating zone system may cause a unit to cycle on a safety control without alerting anyone to the condition. Limit controls, especially, are safety controls, and must not be used as operating controls.

Damper Usage & Types

Each zone can have up to 5 dampers, wired in parallel. A mix-match of rectangle or round dampers is acceptable. Dampers must be EWC® fully modulating dampers. No other brand dampers are approved or supported.

Equipment Selection

Fully variable equipment such as 18 SEER2 inverter driven outdoor units with matching variable capacity air handlers or modulating gas furnaces are ideal. Modulating furnaces will provide more flexibility and smaller zones than two stage furnaces will. Consider airflow requirements that must be maintained. If a zone cannot handle the minimum airflow, the excess air that must be moved must be addressed if the system will be expected to condition that zone alone. While over-conditioning has applications in unused portions of the home, consider what will happen if that area of the home becomes occupied. Over-conditioning of an occupied space to allow another zone to be conditioned is generally not acceptable to the homeowner. Variable capacity equipment will reduce the need to deal with excess air.

Furnaces, especially, are designed to have a minimum or maximum temperature rise. Reducing airflow to the point the temperature rise exceeds the furnace rating plate will cause discomfort, may cause high limit faults, and impact system reliability and performance. Oversizing furnaces will cause additional difficulty. Consider a proper load calculation. Furnaces are designated by input BTUh's. Removing an existing 100,000 BTUh furnace which may have had a 70,000 BTUh output and installing a new high efficiency 100,000 BTUh furnace may have 96,000 BTUh output. These new furnaces will require more airflow than older, less efficient models.

Systems with any single cooling, two stage heating or cooling, or mid-tier inverters should be limited to no more than two zones to avoid system complications.

<u>Minimum Airflow</u>

Each furnace, condenser, or heat pump matchup has a minimum airflow requirement, and these must be maintained even for short periods of time. If we look at an example, we must consider systems that are both zoned and un-zoned. In the example system below, we have a furnace and condenser.

- (-)962VA085 – 85,000 BTUh Input 96% Condensing Gas Furnace
- (-)A18AZ36 – 3 ton, Inverter Condensing Unit.

Airflow requirements with no adjustments for each are as follows:

Furnace		Condenser	
1st Stage	2nd Stage	Lowest Stage	High Stage
1475 CFM	1735 CFM	580 CFM	1210 CFM

**Airflow may be reduced in furnace installer settings. If this is changed, a new duct measurement must be performed.*

As a rule of thumb, single zone duct sizing based on cooling CFM can result in a disadvantage from the start because, as shown, the furnace will need 1475 CFM. Imagine splitting that ductwork further into zones. If the duct system designed for roughly 1200 CFM was broken into two equal zones, the result will be 600 CFM per zone.

So, if we control staging, we can see now that low stage of the condensing unit only requires 580 CFM. This is not going to be a problem at all. However, when the system goes into heat mode, we need 1475 CFM with no airflow adjustments made in the furnace. Of course, we can configure the furnace airflow adjustment to a minimum CFM of 1195 CFM in the furnace installer's menu. That is still too much air for the ductwork designed for 600 CFM, and remember, lower airflow leads to higher temperature rise. By no means should the airflow on the furnace arbitrarily be configured for lowest airflow.

In fairness, we can send more than designed airflow into each of those zone's ducts in some short-term cases, but the result will be higher static, velocity, and possible noise if we violate that by too much. The installer should work with the homeowner to determine acceptable noise levels but should also be sure that the blower RPM's are not exceeding 1300 RPM either.

When following these guidelines, the duct system would need to be able to handle 1015 CFM in each of the two zones. At the end of the duct measurement during commissioning, the default airflow for each zone will be 1700 CFM. It is up to the installer to adjust these airflows using the test sequence in the installation instructions for each zone. Failure to set a proper limit on each zone will result in faults such as blower cut back or cause other issues impacting reliability and customer satisfaction.

Other options include manually setting a minimum position to the dampers mechanically of other zones so they can't close completely. The better solution would be to use fully variable equipment.

Minimum Airflow Requirements

The tables below on pages 7-10 show minimum airflows for design and application of the zoning system.

Note your selected outdoor unit, indoor unit, and, if it applies, your electric heat selection. The minimum airflow for design will be the highest of the components used.

Review the minimum airflows for each of the components in your system, and use the highest minimum airflow to determine your smallest zone capability.

Furnaces (Heat Mode)

Model	40% Firing Rate Airflow		
Modulating (-)98MV	(CFM)		
(-)98MV0603A17	550		
(-)98MV0703A17	719		
(-)98MV0855A21	925		
(-)98MV1005A21	1125		
(-)98MV1155A24	1000		
Model	Low Heat		
Modulating (-)97MV	(CFM)		
(-)97MV0603A17	550		
(-)97MV0703A17	719		
(-)97MV0855A21	925		
(-)97MV1005A21	1125		
(-)97MV1155A24	1000		
Model	Low Heat	Lower Heat Airflow	Lowest Heat Airflow
2 Stage (-)962V	(CFM)	(CFM)	(CFM)
(-)962V0403A17	870	783	722
(-)962V0603A17	990	872	802
(-)962V0703A17	1030	942	867
(-)962V0705A21	1200	1080	996
(-)962V0855A21	1475	1298	1195
(-)962V1005A21	1250	1162	1070
(-)962V1155A24	1400	1260	1162
Model	Low Heat	Lower Heat Airflow	Lowest Heat Airflow
2 Stage (-)802V UH	(CFM)	(CFM)	(CFM)
(-)802V0503A14UH	750	660	608
(-)802V0754A17UH	1000	900	830
(-)802V0755A21UH	1100	990	913
(-)802V1005A21UH	1200	1080	996
(-)802V1255A24UH	1400	1260	1162
(-)802V1505A24UH	1500	1320	1215
Model	Low Heat	Lower Heat Airflow	Lowest Heat Airflow
2 Stage (-)802V DZ	(CFM)	(CFM)	(CFM)
(-)802V0503A14DZ	695	626	577
(-)802V0754A17DZ	1000	900	830
(-)802V0755A21DZ	1176	1059	977
(-)802V1005A21DZ	1310	1179	1088
(-)802V1255A24DZ	1450	1305	1204

Furnaces w/ Non-Communicating 2 Stage OD Low Cool or Heat Pump Mode

Model	OD Unit Size & Minimum Airflow (CFM)						
Modulating (-)98MV	**1.5**	**2**	**2.5**	**3**	**3.5**	**4**	**5**
(-)98MV0603A17	394	525	656	788			
(-)98MV0703A17	394	525	656	788			
(-)98MV0855A21				788	919	1050	1313
(-)98MV1005A21				788	919	1050	1313
(-)98MV1155A24				788	919	1050	1313
Model	OD Unit Size & Minimum Airflow (CFM)						
Modulating (-)97MV	**1.5**	**2**	**2.5**	**3**	**3.5**	**4**	**5**
(-)97MV0603A17	394	525	656	788			
(-)97MV0703A17	394	525	656	788			
(-)97MV0855A21				788	919	1050	1313
(-)97MV1005A21				788	919	1050	1313
(-)97MV1155A24				788	919	1050	1313
Model	OD Unit Size & Minimum Airflow (CFM)						
2 Stage (-)962V	**1.5**	**2**	**2.5**	**3**	**3.5**	**4**	**5**
(-)962V0403A17	403	538	672	806			
(-)962V0603A17	403	538	672	806			
(-)962V0703A17	403	538	672	806			
(-)962V0705A21				772	901	1030	1287
(-)962V0855A21				772	901	1030	1287
(-)962V1005A21				772	901	1030	1287
(-)962V1155A24				772	901	1030	1287
Model	OD Unit Size & Minimum Airflow (CFM)						
2 Stage (-)802V Up	**1.5**	**2**	**2.5**	**3**	**3.5**	**4**	**5**
(-)802V0503A14UHSC	403	538	672	806			
(-)802V0754A17UHSC			671	805	939	1073	
(-)802V0755A21UHSC				772	901	1030	1287
(-)802V1005A21UHSC				772	901	1030	1287
(-)802V1255A24UHSC				772	901	1030	1287
(-)802V1505A24UHSC				772	901	1030	1287
Model	OD Unit Size & Minimum Airflow (CFM)						
2 Stage (-)802V DZ	**1.5**	**2**	**2.5**	**3**	**3.5**	**4**	**5**
(-)802V0503A14DZ	403	538	672	806			
(-)802V0754A17DZ			671	805	939	1073	
(-)802V0755A21DZ				772	901	1030	1287
(-)802V1005A21DZ				772	901	1030	1287
(-)802V1255A24DZ				772	901	1030	1287

Outdoor Units

Model	Low Cool	Low Cool – 10%	Low Heat	Low Heat – 10%
High Tier AC	(CFM)	(CFM)	(CFM)	(CFM)
(-)A18AZ24	310	279	NA	NA
(-)A18AZ36	580	522	NA	NA
(-)A18AZ48	475	426	NA	NA
(-)A18AZ60	516	464	NA	NA
Model	Low Cool	Low Cool – 10%	Low Heat	Low Heat – 10%
High Tier HP	(CFM)	(CFM)	(CFM)	(CFM)
(-)P18AZ24	500	450	600	540
(-)P18AZ36	516	464	550[1]	495[1]
(-)P18AZ48	550	495	600[2]	540[2]
(-)P18AZ60	630[3]	567[3]	700[4]	630[4]
Model	High Cool	High Cool – 10%	High Heat	High Heat – 10%
Mid-Tier AC	(CFM)	(CFM)	(CFM)	(CFM)
(-)A15AZ24	750	675	NA	NA
(-)A15AZ36	1125	1013	NA	NA
(-)A15AZ48	1450	1305	NA	NA
(-)A15AZ60	1800	1620	NA	NA
(-)A16AZ24	750	675	NA	NA
(-)A16AZ36	1125	1013	NA	NA
(-)A16AZ48	1450	1305	NA	NA
(-)A16AZ60	1800	1620	NA	NA
Model	High Cool	High Cool – 10%	High Heat	High Heat – 10%
Mid-Tier HP	(CFM)	(CFM)	(CFM)	(CFM)
(-)P16AZ24	750	675	750	675
(-)P16AZ36	1125	1013	1125	1013
(-)P16AZ48	1450	1305	1450	1305
(-)P16AZ60	1800	1620	1800	1620

Note 1: (-)P1836AZ When is zoned with 800 Series Thermostat, low heat min airflow changes to 550 cfm from 960 un-zoned (Min Compressor Speed Changed 1300-1800 in Heat)
Note 2: (-)P1848AZ When is zoned with 800 Series Thermostat, low heat min airflow changes to 600 cfm from 950 un-zoned (Min Compressor Speed Changed 1400-1800 in Heat)
Note 3: (-)P1860AZ When is zoned with 800 Series Thermostat, low cool min airflow changes to 630 cfm from 1100 un-zoned (Min Compressor Speed Changed 1200-1500 in Cool)
Note 4: (-)P1860AZ When is zoned with 800 Series Thermostat, low heat min airflow changes to 700 cfm from 1100 un-zoned (Min Compressor Speed Changed 1200-1500 in Heat)

Air Handler Connected to Non-Communicating OD 2 Stage AC or HP

Model	2 Stage OD Low Airflow (CFM)			
	Half Ton Cool	Full Ton Cool	Half Ton HP	Full Ton HP
RH2VZ2417STANNJ	435	580	435	580
RH2VZ3617STANNJ	605	727	605	727
RH2VZ3621STANNJ	605	727	605	727
RH2VZ3621MTANAJ	605	727	605	727
RH2VZ3621MTANNJ	605	727	605	727
RH2VZ4821STANNJ	896	1024	896	1024
RH2VZ4821STANAJ	896	1024	896	1024
RH2VZ4824STANNJ	896	1024	896	1024
RH2VZ6021STANAJ	NA	1140	NA	1140

Electric Heat

Heater Kit Size	Heater Kit Part Number	Number of Stages	Lowest Stage Airflow (CFM)
3 KW	RXBH-1724?03J-B	1	400
5 KW	RXBH-1724?05J-B	1	400
7 KW	RXBH-1724?07J-B	1	450
10 KW	RXBH-1724?10J-B	1	600
13 KW	RXBH-1724?13J-B	3	350
15 KW	RXBH-1724?15J-B	3	350
18 KW	RXBH-1724?18J-B	3	400
20 KW	RXBH-1724?20J-B	3	600
25 KW	RXBH-24?25J-B	3	500
30 KW	RXBH-24?30J-B	3	600