



# **ENERGY RECOVERY VENTILATION (ERV) ENGINEERING MANUAL**



ERV Indoor Units  
470 to 1,180 CFM

# **PROPRIETARY DATA NOTICE**

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## Variable Refrigerant Flow (VRF) Technology

In the early 1980s, VRF technology was introduced to the world as an alternative method of cooling and heating in commercial structures designed to minimize energy consumption. VRF systems have become the system of choice for designers internationally because these systems offer better comfort at substantially lower operating costs when compared to traditional HVAC systems. Older

systems are being replaced with newer more efficient systems making VRF a viable option. Today, VRF is gaining popularity in the United States. LG air-source systems offer the opportunity to eliminate ductwork in the same configuration. The systems offer zoning without the need for zone damper systems. The advanced controls provide exceptional building dehumidification and temperature control and can rapidly adapt system operating parameters to the ever changing building load.

## Quality Commitment

LG is committed to the success of every Multi V project by providing the best industry technical support during project engineering, installation, and commissioning. LG offers a variety of classes designed for engineers, architects, installers, and servicers to ensure that every Multi V installation is completed successfully. Classes are conducted at LG's training centers and in field locations at various times throughout the year and upon special request.







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## TABLE OF SYMBOLS

 <b>WARNING</b>	<i>This symbol indicates a potentially hazardous situation which, if not avoided, may result in death or serious injury.</i>
<b>Note</b>	<i>This symbol indicates additional helpful information such as an explanation, a comment, or a clarification about the subject.</i>
	<i>This symbol indicates a recommendation or tip. Recommendations instruct the user to apply the suggested practice to ensure the best operating results in order to achieve the maximum benefit of the product. Tips contain practical information that may help the user solve a problem or describe actions that may save time.</i>

# ERV BENEFITS

**MULTI V™**

ZE, ZF Chassis



ZE Chassis



ZF Chassis

## Ventilation

Ventilation is a process that allows users to exchange indoor air with outdoor air in order to improve the air quality and to maintain environmental temperature conditions. The Energy Recovery Ventilation (ERV) system reduces the temperature and humidity of incoming fresh air. A balance is achieved between indoor and outdoor ambient which enables the cooling or heating load placed on the air conditioning system to be reduced. It can be controlled individually or as an integral part of the air conditioning system.

## Benefits

The ERV system provides efficiency, cost savings, superior performance, compact and light design, linear E.S.P control and easy maintenance. The ERV system is ideal for hotels, dormitories, restaurants, hospitals, retail establishments, theaters, schools, and office buildings.

## Energy Savings

The indoor air is passed through the heat exchanger to pre-warm or pre-cool the incoming outside air which saves energy and money.

## Design

Acoustically engineered and tested for quiet operation.

## Easy Maintenance

Offers easy filter replacement and heat exchanger cleaning.

Table 1: Energy Recovery Ventilation (ERV) Unit General Data

Type	ERV Units			
	ARVU053ZEA2	ARVU063ZEA2	ARVU093ZFA2	ARVU123ZFA2
<b>Performance</b>				
Capacity (CFM)	470	590	880	1,180
Power Input (SH <sup>1</sup> ) Watts	360	470	720	930
<b>Operating Range</b>				
Operating Range (°F DB)	14-113	14-113	14-113	14-113
<b>Heat Exchanger Data</b>				
Air-to-Air Heat Exchanger	Cross flow fixed core	Cross flow fixed core	Cross flow fixed core	Cross flow fixed core
Quantity	1	1	1	1
<b>Temperature Exchanger Efficiency (%) (fan speed SH<sup>1</sup>)</b>				
Cooling (fan speed SH <sup>1</sup> )	62	59	62	59
Heating (fan speed SH <sup>1</sup> )	61	58	61	58
<b>Enthalpy Exchange Efficiency (%)</b>				
Cooling (fan speed SH <sup>1</sup> )	37	34	37	34
Heating (fan speed SH <sup>1</sup> )	52	49	52	49
<b>Unit Data</b>				
Sound Pressure dB(A)	40/37/31	41/39/33	44/41/35	45/41/35
Net Unit Weight (lbs)	148	148	331	331
Shipping Weight (lbs)	177	177	397	397
<b>Fan</b>				
Type	Cross Flow	Cross Flow	Cross Flow	Cross Flow
Quantity	2	2	2	2
Motor/Drive	Brushless Digitally Controlled/Direct	Brushless Digitally Controlled/Direct	Brushless Digitally Controlled/Direct	Brushless Digitally Controlled/Direct
Airflow Rate SH/H/L (CFM)	471/471/388	589/589/471	883/883/706	1177/1177/942
External Static Pressure SH/H/L (in wg)	0.80/0.44/0.24	0.64/0.36/0.20	0.80/0.44/0.24	0.64/0.36/0.20
<b>Filters</b>				
Quantity	2	2	4	4
Size	41-9/16" x 8-3/8" x 13/32"	41-9/16" x 8-3/8" x 13/32"	41-9/16" x 8-3/8" x 13/32"	41-9/16" x 8-3/8" x 13/32"

<sup>1</sup>SH - Super High

Condensate drain not required.

ERV temperature and enthalpy exchange efficiencies are in accordance with AHRI 1060 test condition, 100% airflow, 0" external static pressure.

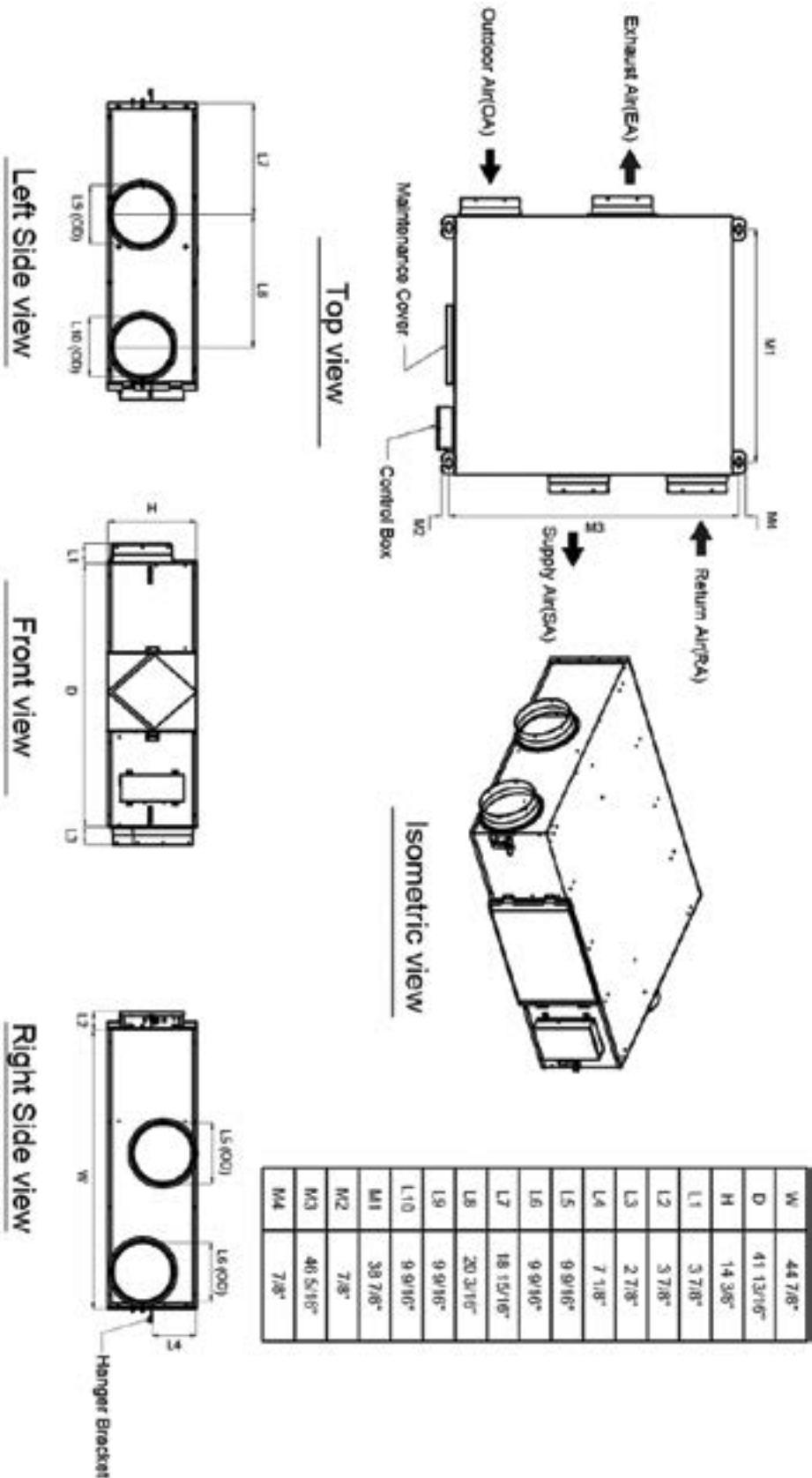
Cooling: Outdoor 95°F DB, 78°F WB; Exhaust 75°F DB, 63°F WB

Heating: Outdoor 35°F DB, 33°F WB; Exhaust 70°F DB, 58°F WB

DIMENSIONS



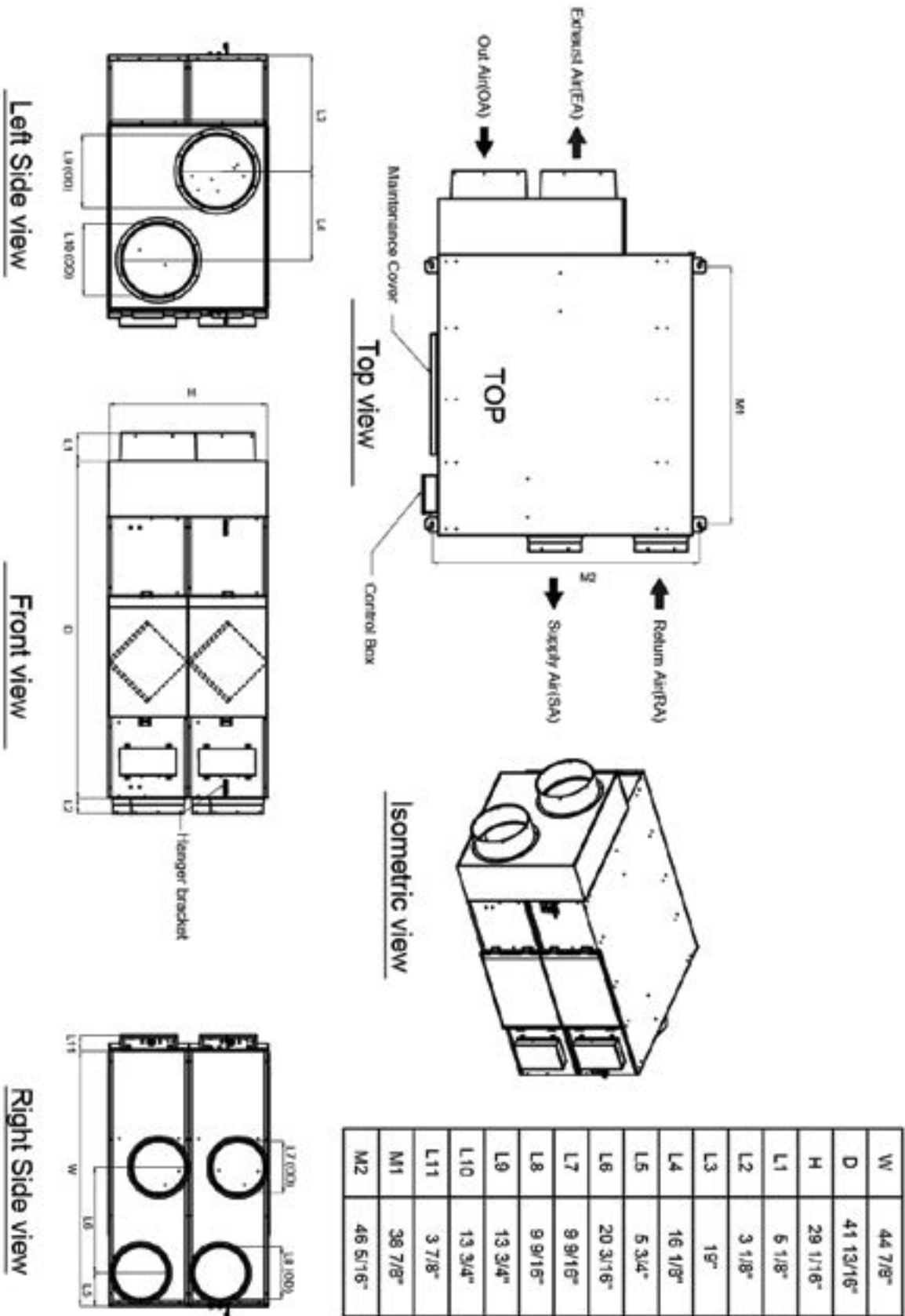
ZE Chassis



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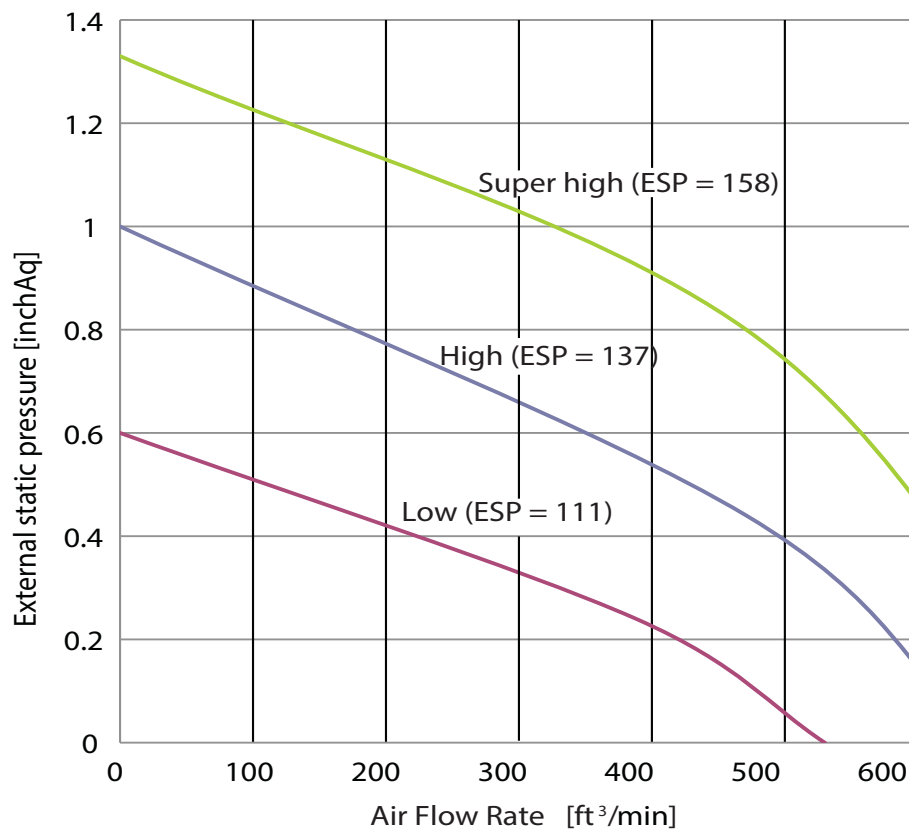


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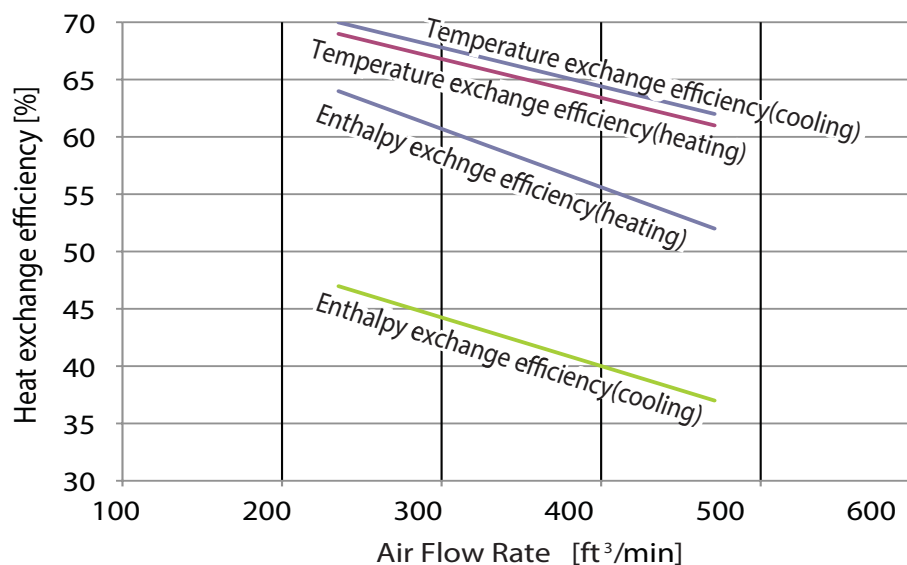
ARVU053ZEA2

Figure 1: ARVU053ZEA2

## Ventilation



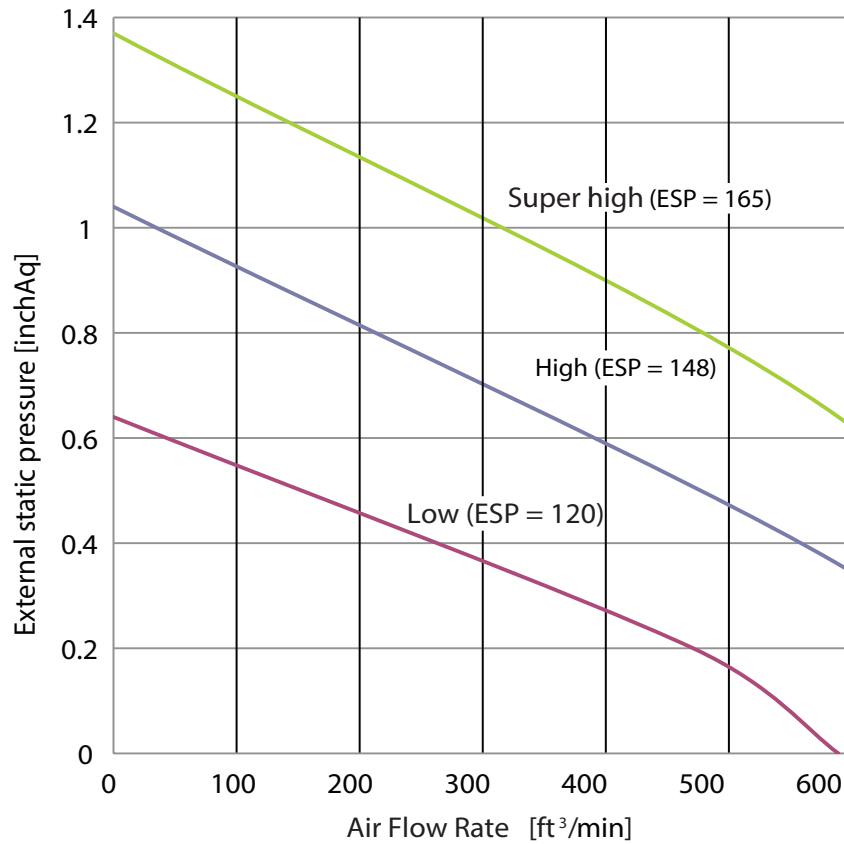
## Efficiency



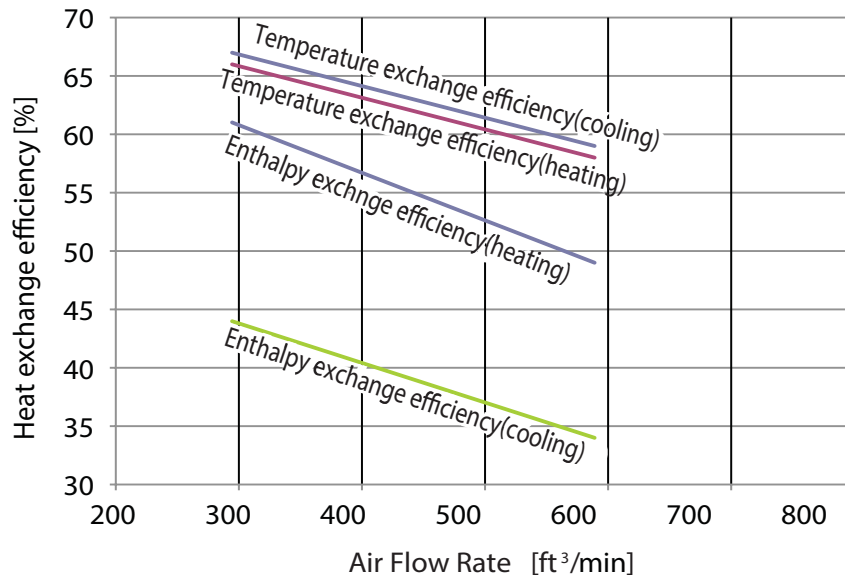
The graphs above show the available E.S.P range.

Figure 2: ARVU063ZEA2

## Ventilation



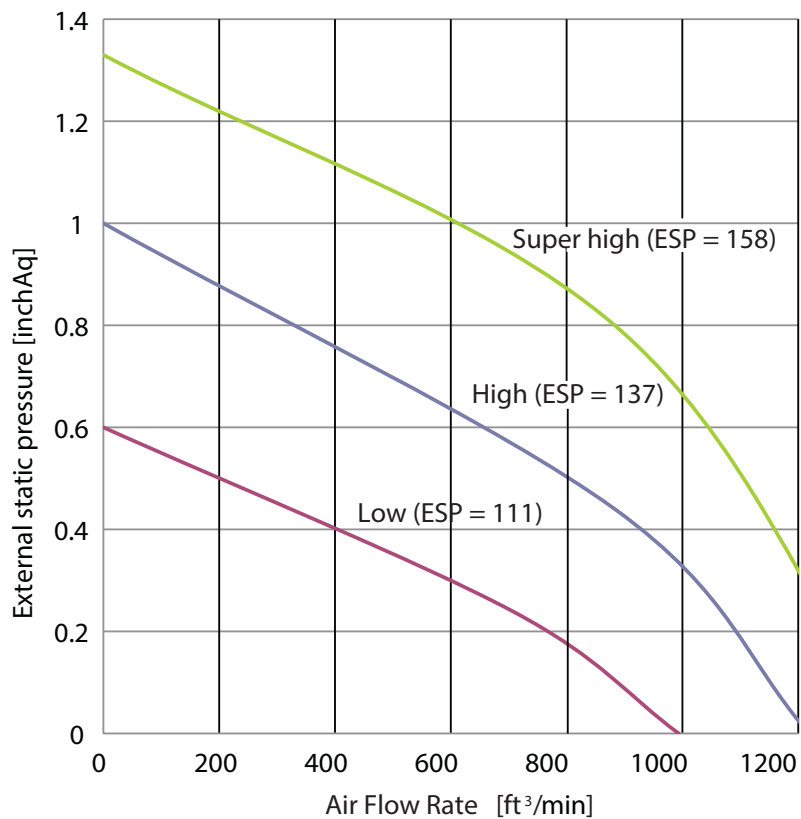
## Efficiency



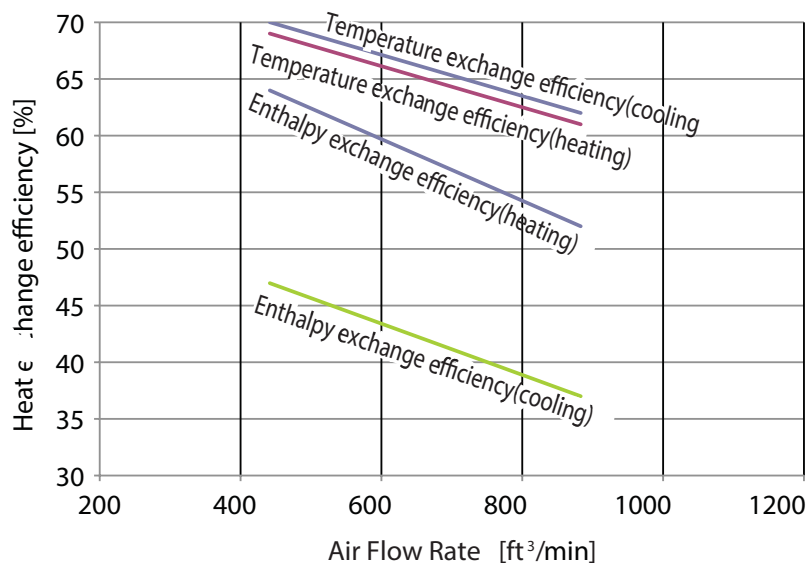
The graphs above show the available E.S.P range.

Figure 3: ARVU093ZFA2

## Ventilation



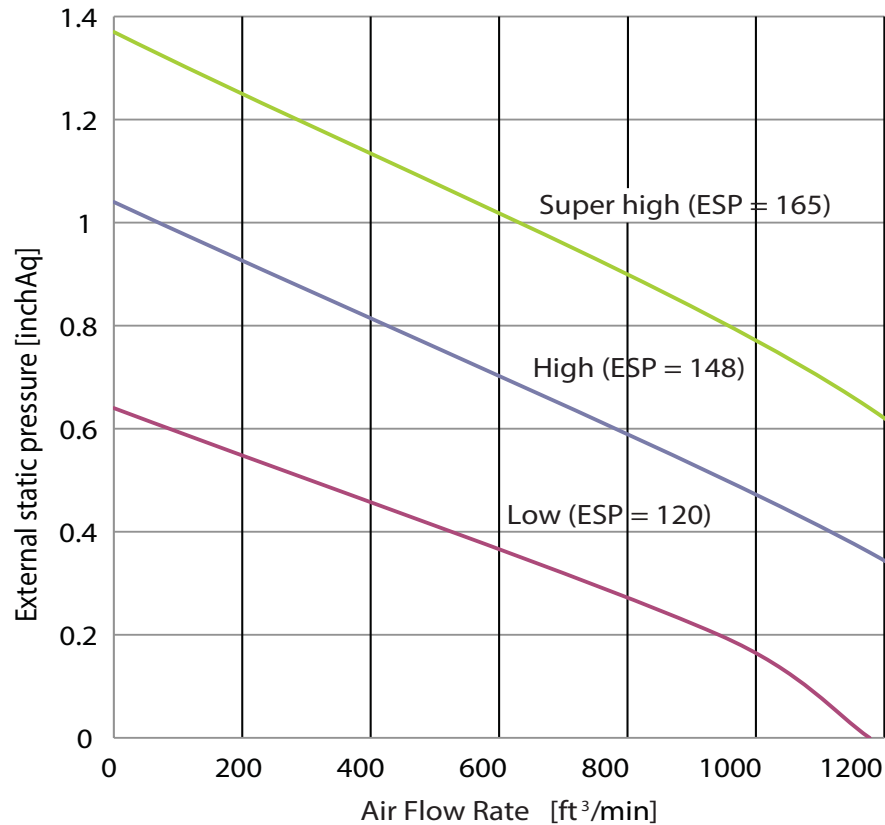
## Efficiency



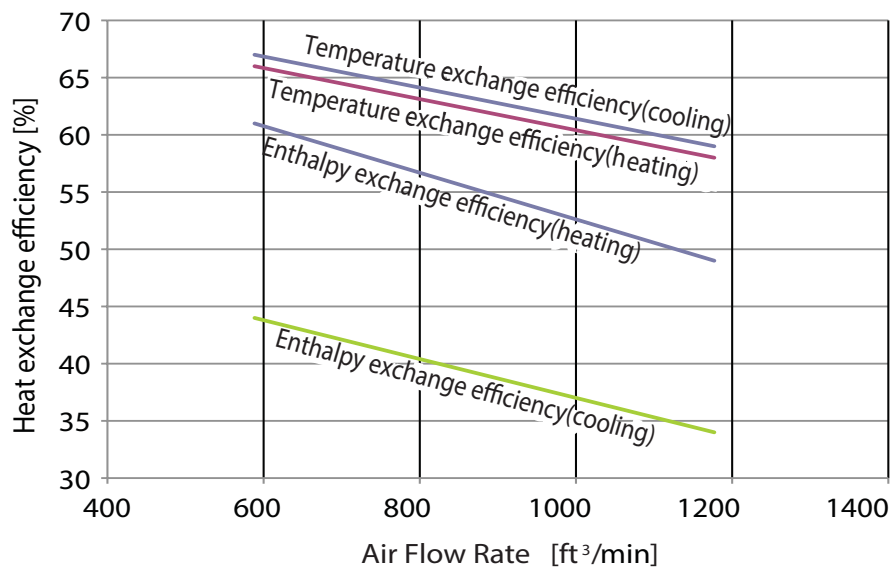
The graphs above show the available E.S.P range.

Figure 4: ARVU123ZFA2

## Ventilation



## Efficiency



The graphs above show the available E.S.P range.

## Electrical Data

Table 2: ERV Unit Electrical Data

Model	Voltage Range	Rated Amps (A)	Power Supply			Power Input (W)	
			Hz	Volts	Phase	Cooling	Heating
ARVU053ZEA2	187-253	2.8	60	208-230V	1	360/270/165	360/270/165
ARVU063ZEA2		3.44				470/385/210	470/385/210
ARVU093ZFA2		5.62				720/540/340	720/540/340
ARVU123ZFA2		6.82				930/770/420	930/770/420

Units are suitable for use on an electrical system where voltage supplied to unit terminals is within the listed range limits.

## Sound Pressure Data

Table 3: ERV Sound Levels

Model	Sound Levels dB(A)		
	Super High Fan Speed	High Fan Speed	Low Fan Speed
ARVU053ZEA2	40	37	31
ARVU063ZEA2	41	39	33
ARVU093ZFA2	44	41	35
ARVU123ZFA2	45	41	35

Sound pressure levels are tested in an anechoic chamber under ISO Standard 3745.

Figure 5: ARVU053ZEA2

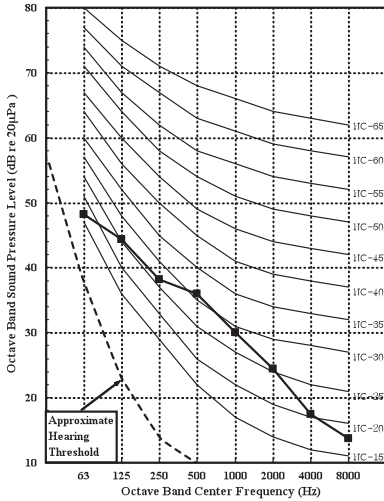


Figure 6: ARVU063ZEA2

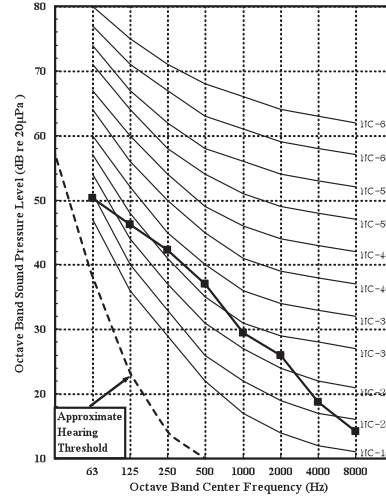


Figure 7: ARVU093ZFA2

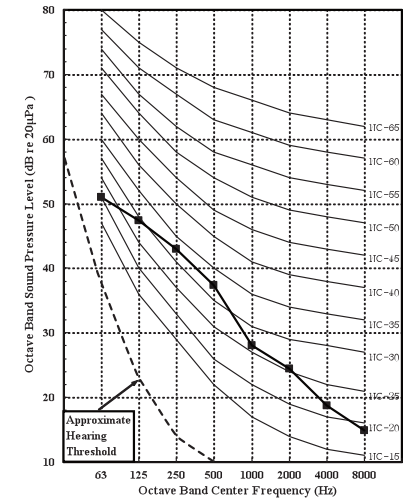
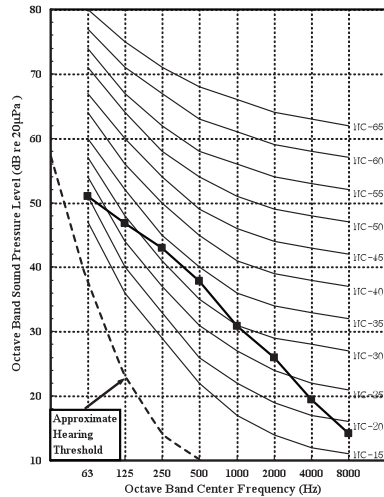
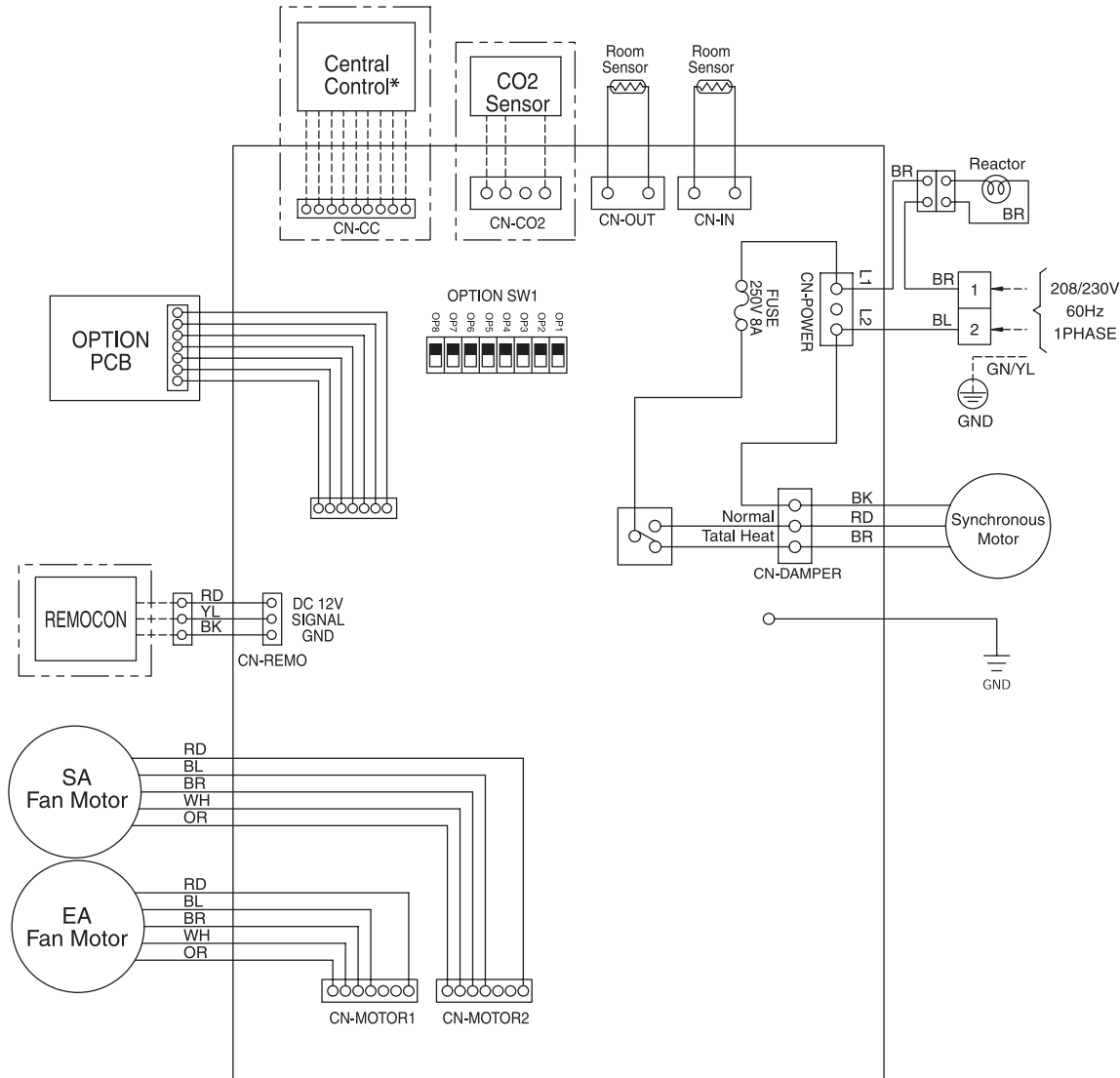


Figure 8: ARVU123ZFA2



## ZE CHASSIS

Figure 9: ZE Chassis Wiring Diagram



\*Central controller requires PI485 (PSNFP14A0)

### INFORMATION

- \* Purchase a dedicated circuit separately
- \* — — — — — Field Wiring
- \* [ — — — — — ] Accessory

### Note

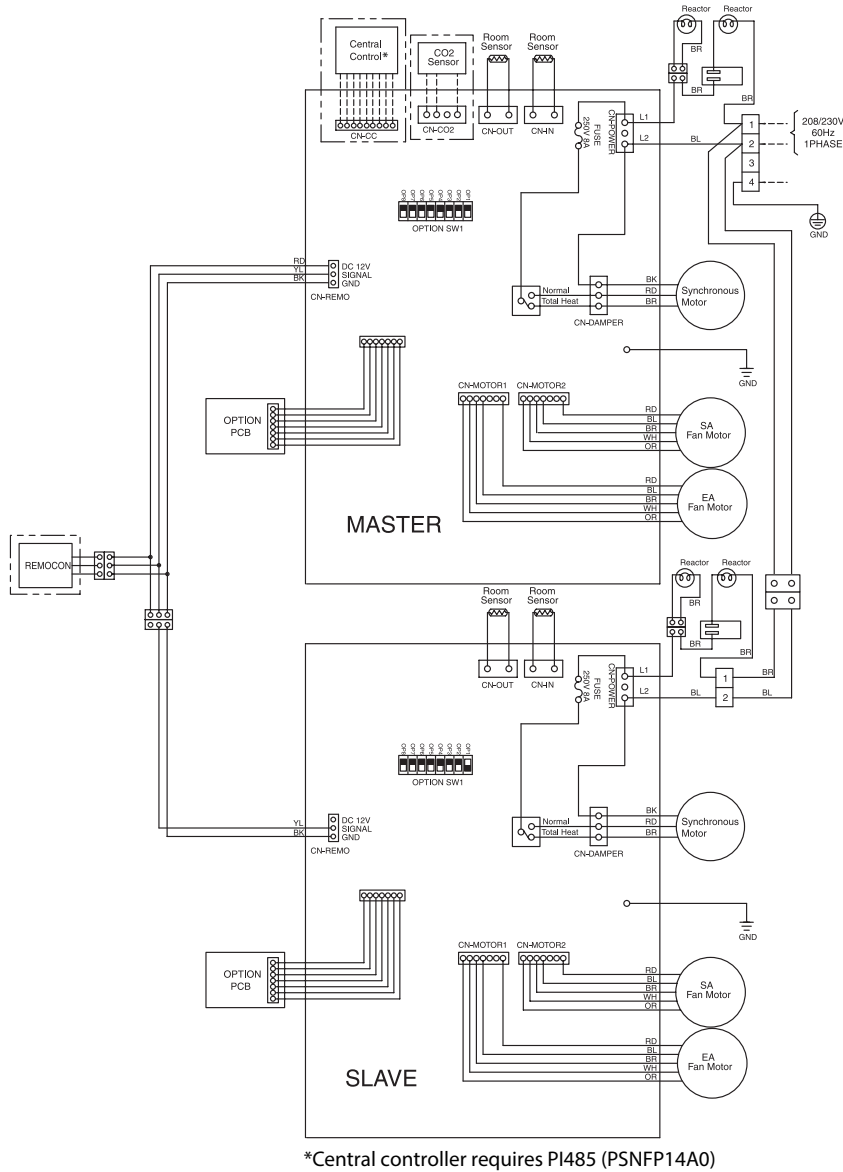
RD : RED  
BR : BROWN  
BL : BLUE  
BK : BLACK  
OR : ORANGE  
YL : YELLOW  
WH : WHITE  
GN/YL : GREEN / YELLOW

### ⚠ WARNING

- There is risk of electric shock due to failure or electric leakage.
- Installation work must be performed by authorized personnel and in accordance with the national wiring standards.



Figure 10: ZF Chassis Wiring Diagram



INFORMATION	
* Purchase a dedicated circuit separately	
* ——— Field Wiring	
* [ ] Accessory	

Note  
RD : RED  
BR : BROWN  
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### ⚠ WARNING

- There is risk of electric shock due to failure or electric leakage.
- Installation work must be performed by authorized personnel and in accordance with the national wiring standards.

## ZE CHASSIS

Figure 11: ZE Chassis Installation Drawing

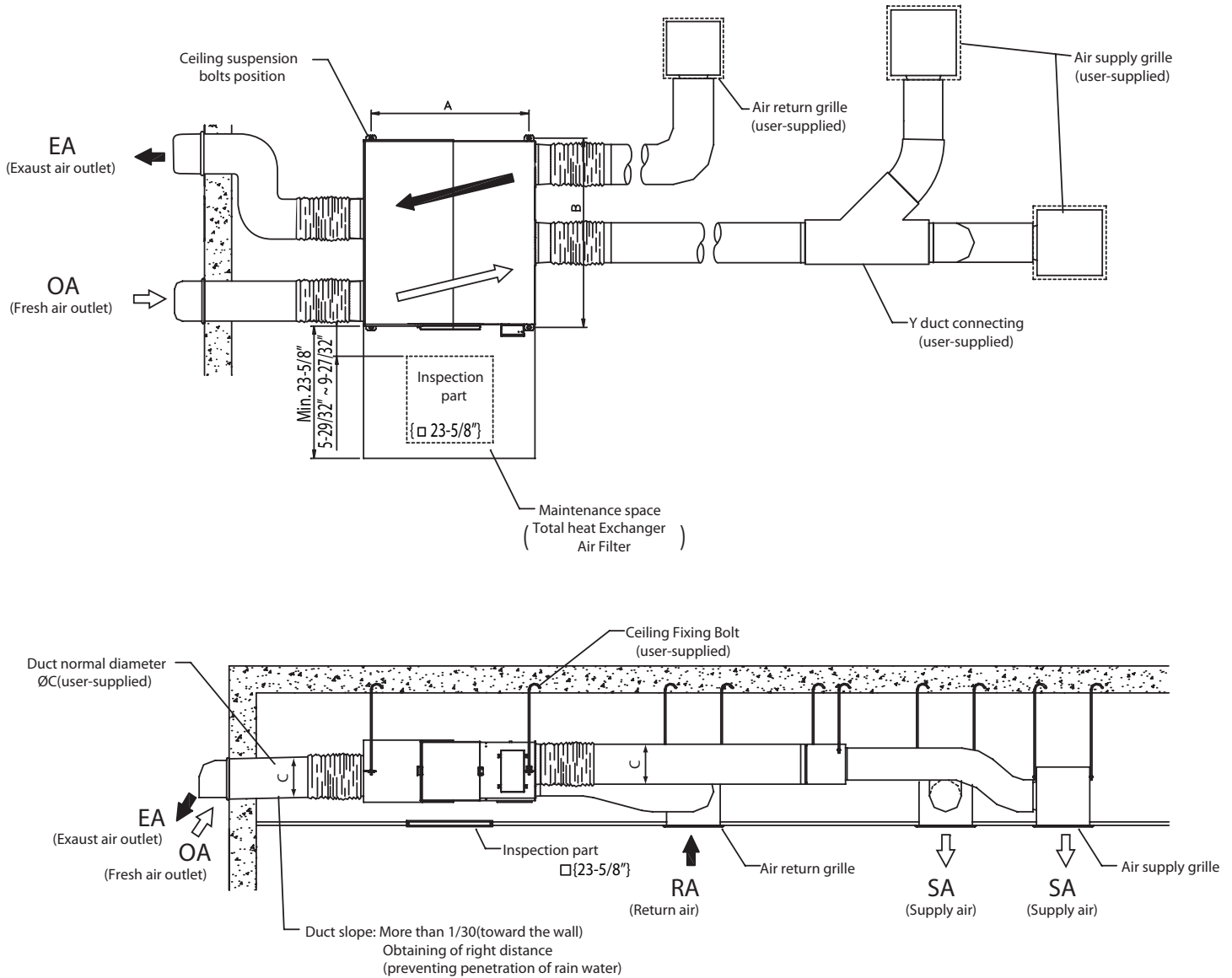


Table 4: ZE Chassis Installation Dimensions

Model	Dimensions (inch)		
	A	B	C
ARVU053ZEA2 ARVU063ZEA2	38-27/32	46-5/16	9-27/32

Figure 12: ZF Chassis Installation Drawing

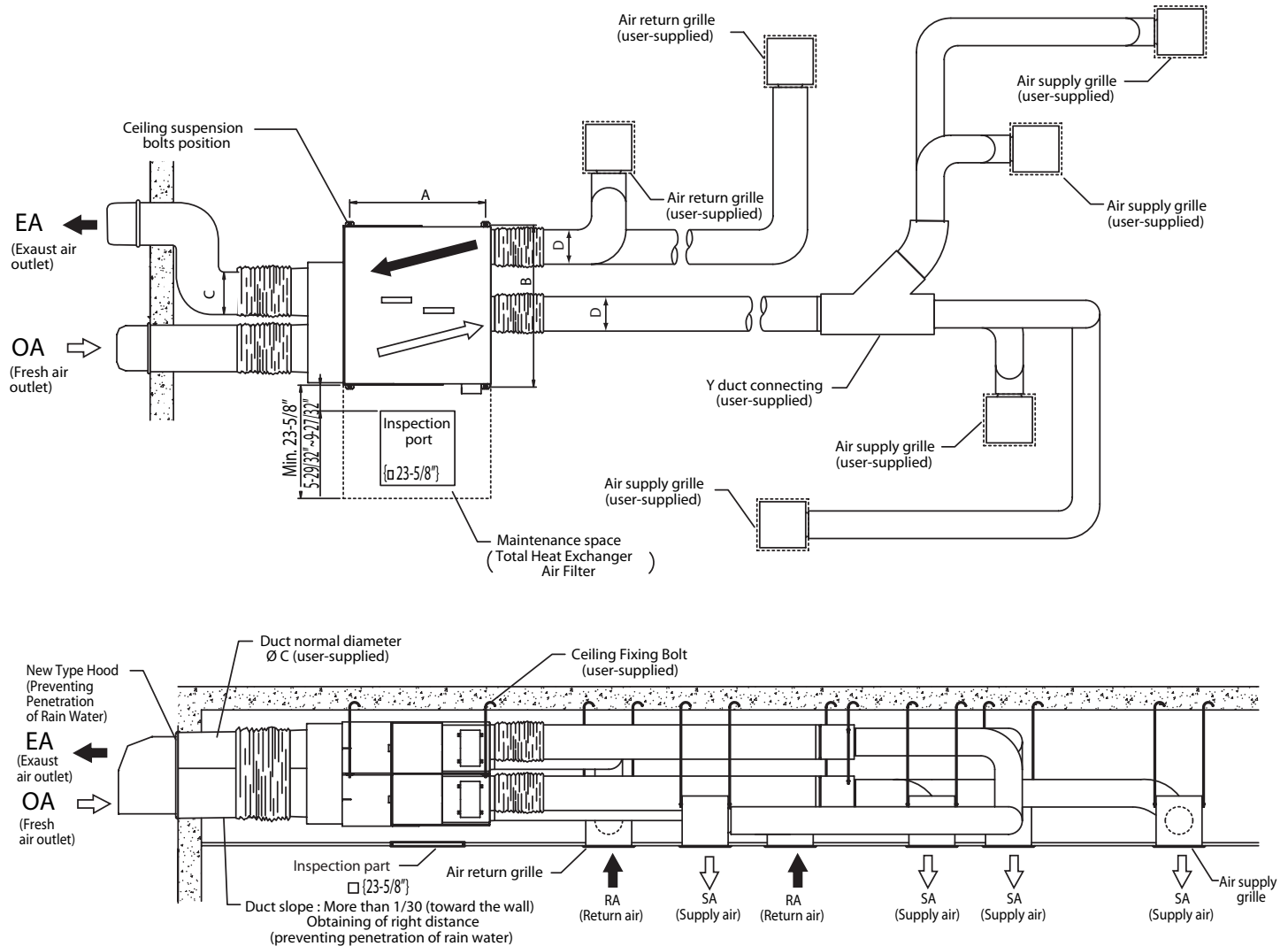


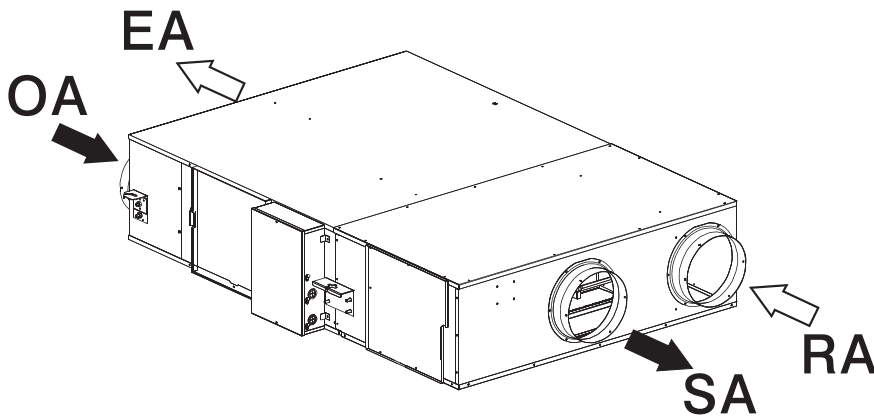
Table 5: ZF Chassis Installation Dimensions

Model	Dimensions (inch)			
	A	B	C	D
ARVU093ZFA2	38-27/32	46-5/16	13-25/32	9-27/32
ARVU123ZFA2				

## Main Body Installation

- Attach the hanger bracket to the suspension bolt. Use nuts and washers (field supplied) to secure the upper and lower sides of the hanger bracket.
- Install the unit after checking the indoor (SA/RA) and outdoor (EA/OA) in accordance with the figure duct direction label.
- Install flexible duct between the unit and duct.
- Minimum thickness of the insulation for the connecting duct must be 3/8 inch.
- Tighten the upper nut.
- Use a level instrument to make sure that the unit is level.

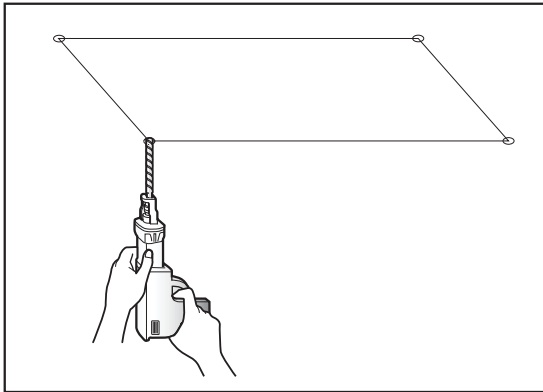
Figure 13: Main Body Installation



## Installing Fixing Bolts

- Select and mark the position for the fixing bolts.
- Drill a hole on the face of the ceiling for the anchor.

Figure 14: Installing Fixing Bolts



- Insert the anchor and washer on the suspension bolts to lock them in the ceiling.
- Firmly mount the suspension bolts to the anchor.
- User nuts, washers and spring washers to secure the installation plates onto the suspension bolt.

Figure 15: Securing Suspension Rods

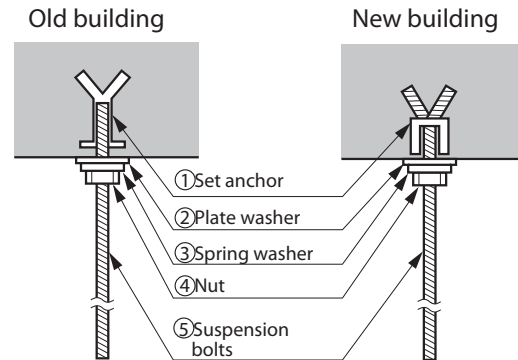
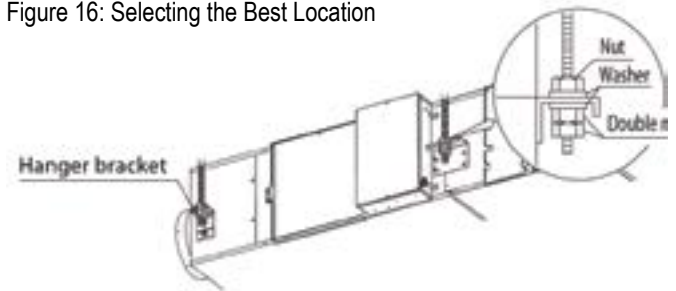


Figure 16: Selecting the Best Location



## Selecting the Best Location

### Do's

- Place the unit where it will be level and can support the weight of the unit.
- Install the unit where it can withstand vibration.
- Install the unit where service can be performed easily.

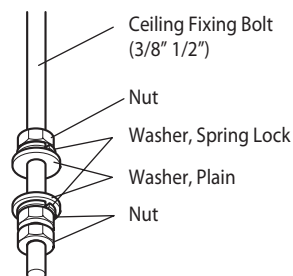
### Don'ts

- Avoid installing the unit where inflammable gas is generated, flows, stored or vented.
- Avoid installing the unit where sulfurous acid gas or corrosive gas is generated.
- Avoid installing the unit near places near high frequency generators.

## Assembling Washer Nut

- Tighten the commercial washer nut (more than 13/16) for the outside diameter of 3/8" to the commercial ceiling fixing bolt 3/8".

Figure 17: Assembling the Washer Nut



## Connecting Power Wiring

1. Remove two screws and open the cover of the control box.
2. Connect the main power wires to the terminal block.
3. After inserting the power wires into the bushing, fully insert it into the terminal block for connection.
4. Fix the power wires with the clamp.
5. Pull the power wires to ensure they cannot be removed.

Figure 18: Opening Control Box

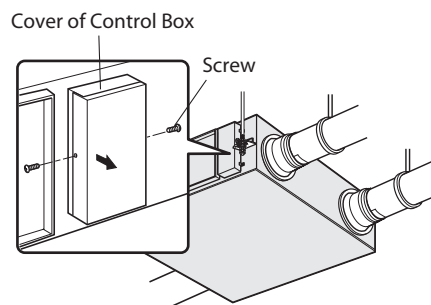
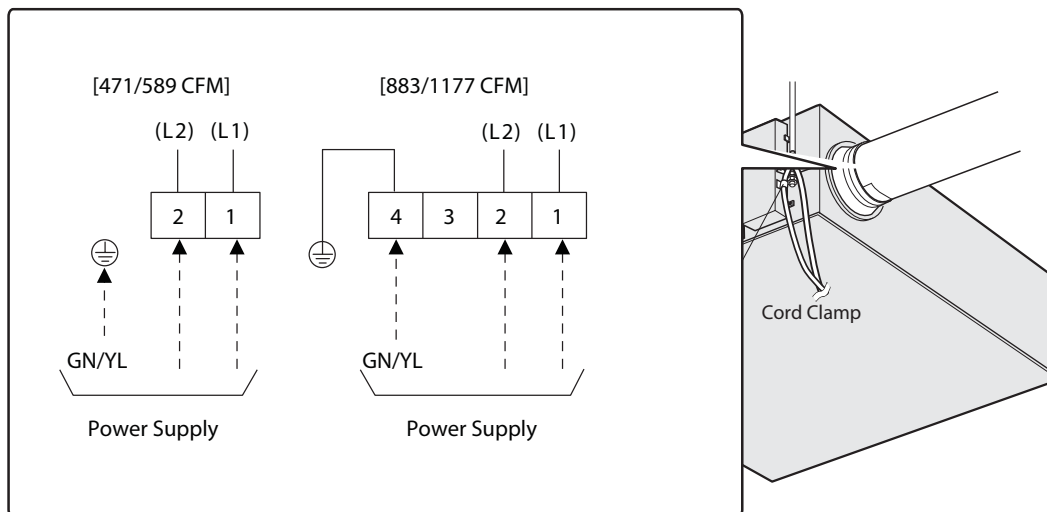


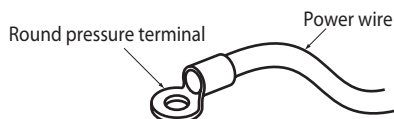
Figure 19: Inserting the Power Wiring



## Wiring Precautions

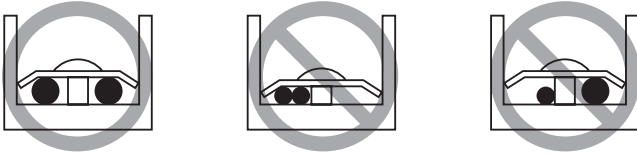
Use round pressure terminals for connections to the power terminal block.

Figure 20: Wiring Precautions



- Do not connect wiring of different thickness to the power terminal block (slack in the power wiring could cause abnormal heat).
- When connecting wiring which is the same thickness, connect the wiring according to the first image shown below.

Figure 21: Connecting Wiring



## Conduit Connection

1. Set the connecting cable into the terminal block of the indoor unit and tighten the screw to lock the conduit bracket to the indoor unit.
2. Join the conduit and the conduit bracket together.
3. Use the elbow type (L-Type) conduit.

Figure 22: Conduit Connection

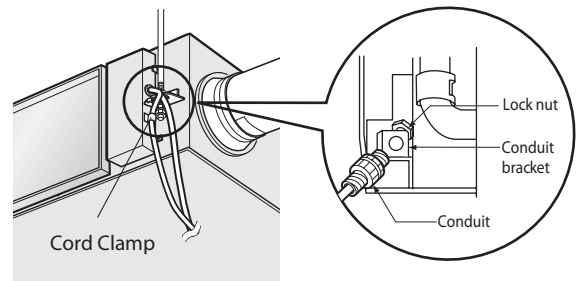
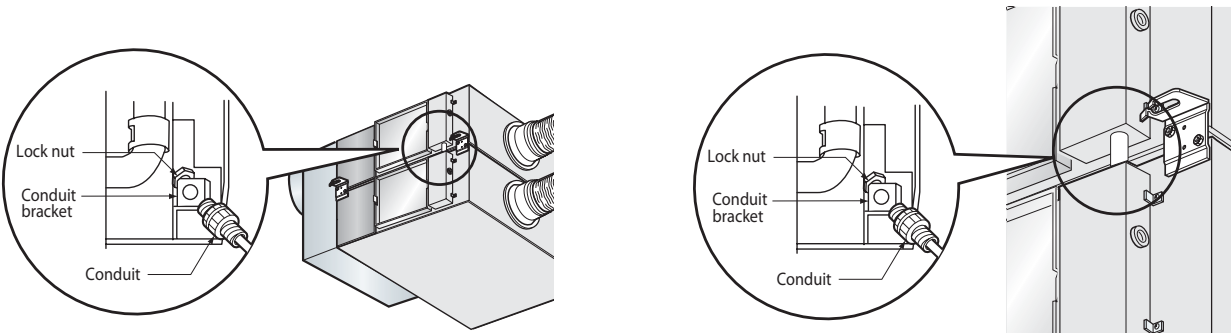


Figure 23: L-Type Conduit



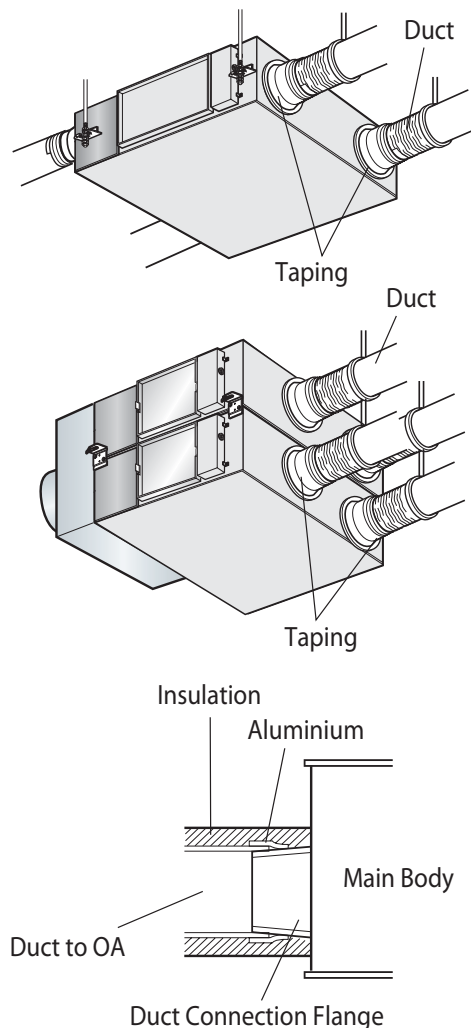
Figure 24: Using L-Type Conduit



## Connecting the Duct

- After securely connecting the duct with the duct connection flange, wrap it with commercial aluminum tape so that air cannot leak out.
- Adjust the duct from the ceiling so that no force is applied to the main body of the ventilation system.
- Ensure that there are no foreign materials in the duct before connecting the duct.
- Ductwork connected to ERV should be insulated to prevent condensation.

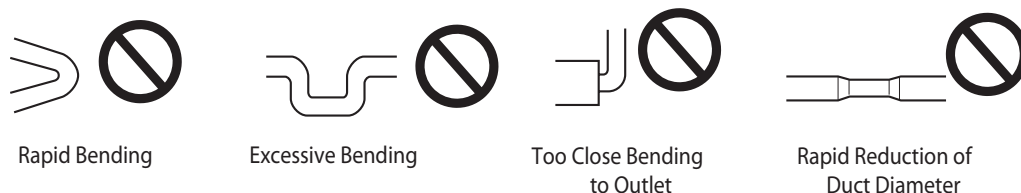
Figure 25: Connecting the Duct



### Note:

To avoid causing a reduction in air volume or abnormal noise, do not connect the duct as shown in the image below.

Figure 26: Bad Duct Connection Example



### ⚠ WARNING

- If an electric duct heater is connected, it must include a built-in safety device to prevent heater operation when airflow is not present, to prevent the possibility of fire, property damage, and/or personal injury.
- When the outdoor air temperature falls below the ERV operating limit (14°F), the electric duct heater temperature control shall energize the electric duct heater to pre-heat the outdoor air above 14°F.



Table 6: Installer Setting Code and Value Table

No.	Function	Code	Value
1	Setting Address of Central Control	01	00~FF : Address of central control
2	Supply ESP	02	Value1 - Step(01:low, 02:high, 03:super high)
3	Exhaust ESP	03	Value 2 - ESP value (0 ~ 255)
4	Product direction	04	01: Normal, 02:Reverse
5	Quick Refresh Priority	05	01:Supply air first, 02: Exhaust air first
6	Master setting	06	00:Slave, 01:Master
7	Dry Contact Auto	07	00:OFF, 01:ON
8	Release of 3 Min Delay	08	01:Set

## Setting Address of Central Control

1. When connecting central control, it sets the central control address of the indoor unit.
2. Function control and setting
  - Select the address code with inputting the up-down button (0~ F).
  - Change the items with inputting the right-left button. (Group address <-> indoor unit address)
  - Set the address with inputting Setting/Cancel button (indoor data send)

## Supply/Exhaust ESP Setting

1. Set the E.S.P (RPM) value of the air conditioner unit.
2. Function control and setting
  - Select the wind strength with inputting up-down button.
    - 01:low, 02:high, 03:very high (Seg flickering)
  - Move the setting items with inputting the right-left button.
    - Airflow selection <-> RPM value selection (Seg of selected item is flickering)
  - Select the RPM value of airflow with inputting up-down button.
    - 0~ 255 (Seg selecting)
  - Complete the RPM setting with inputting Setting/Cancel button (send RPM setting data of indoor unit).
  - Set the exhaust air ESP with conducting the steps above and inputting the function setting button and changing installer code to 04.

## Product Direction

1. Set the installation direction of the ventilation for the indoor unit.
2. Function control and setting
  - Select the direction value with inputting the up-down button.
    - 01:normal direction, 02:opposite direction
  - Complete the setting with inputting Setting/Cancel button (stop flickering and send the date to the indoor unit).

## V-Net Wiring

- This unit can be used as part of the combined operation system used together with Multi V indoor units or as an independent system for processing outside air.

Figure 27: V-Net Wiring - Combined Operation System

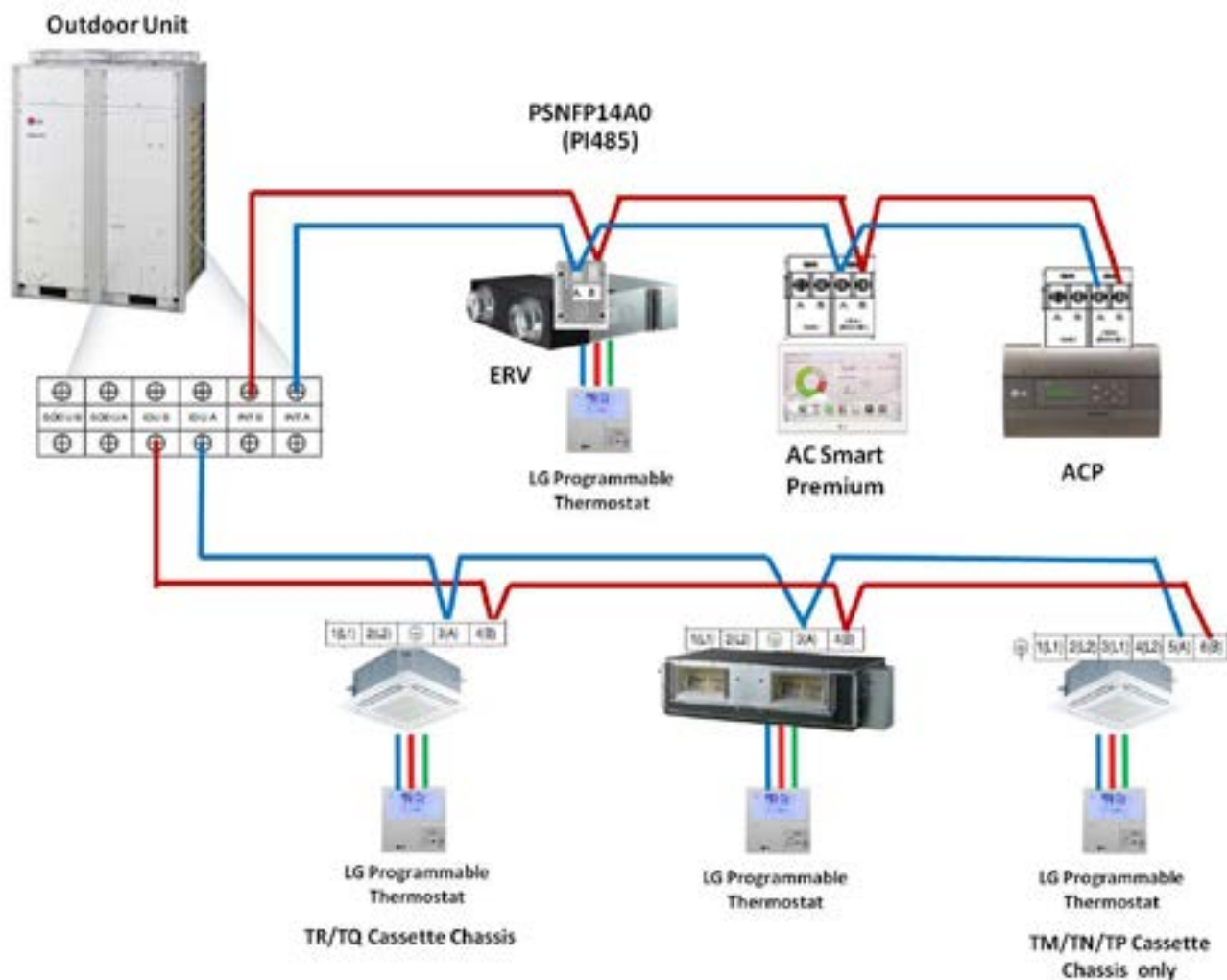
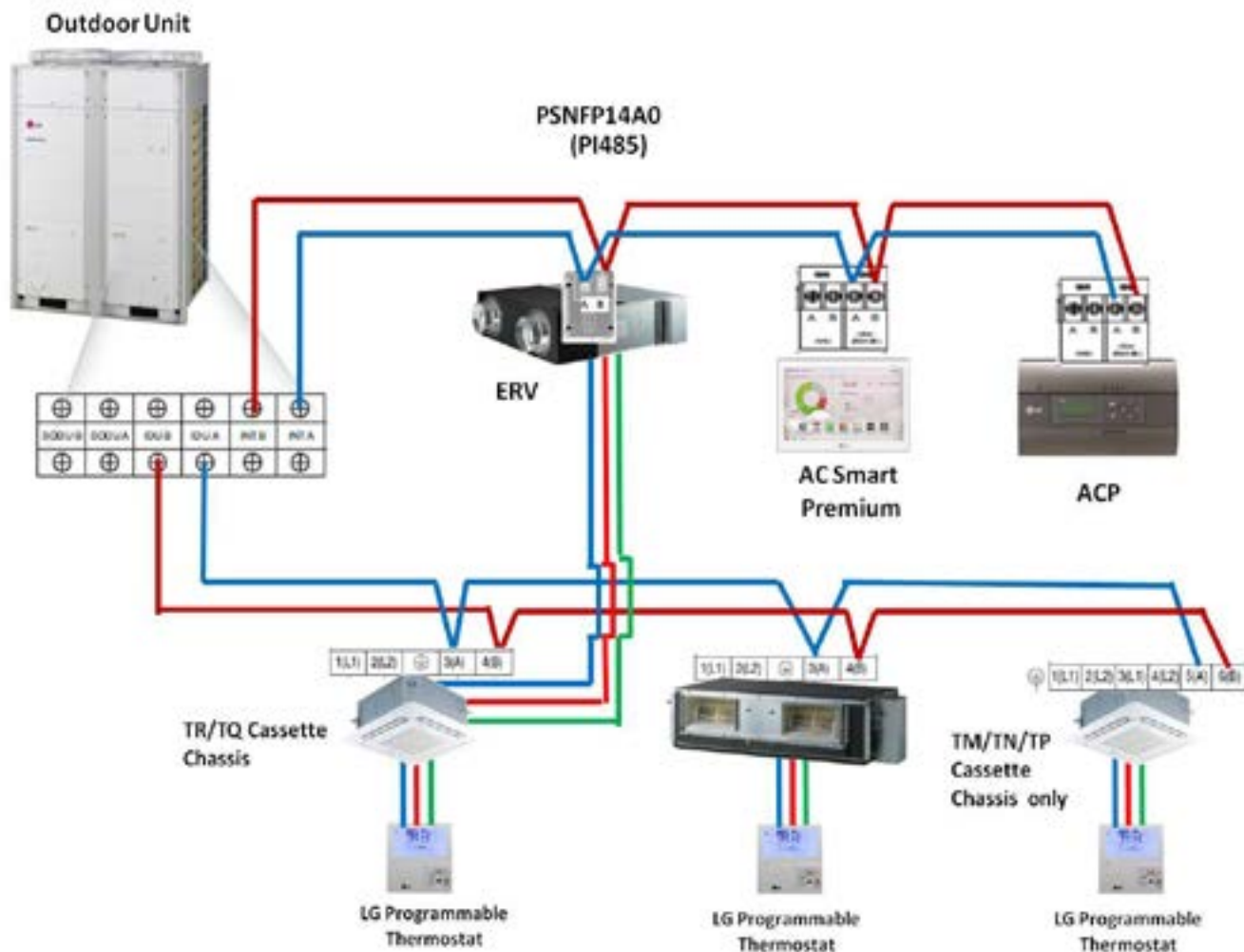


Figure 28: V-Net Wiring - Independent System



When interlocking ERV to indoor unit thermostat, ERV fan will **not** be interlocked to IDU fan. ERV mode and ON/OFF status can be controlled using "Vent" button.

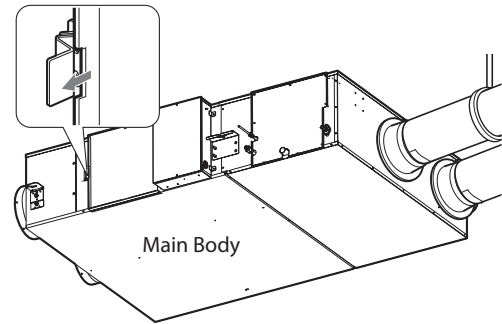
## Maintenance and Service

- To prevent the ventilator from deteriorating, clean dust off the air filter and total heat exchanger regularly.

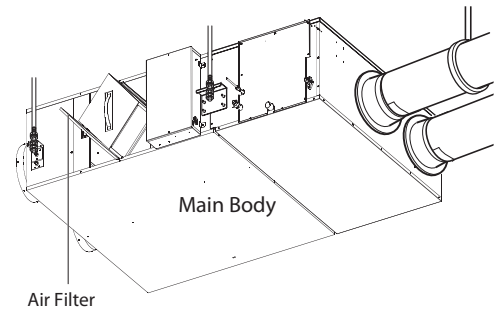
## Removing the Filter and Heat Exchanger

1. Remove the maintenance cover.
  - Place your hands inside of the ceiling from the maintenance cover and pull the maintenance cover up.
  - Loosen the hinge and detach the maintenance cover.

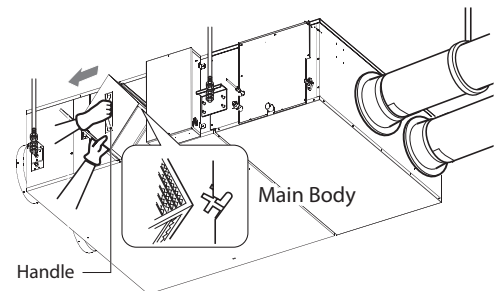
Figure 29: Removing the Filter and Heat Exchanger



2. Remove the air filter.



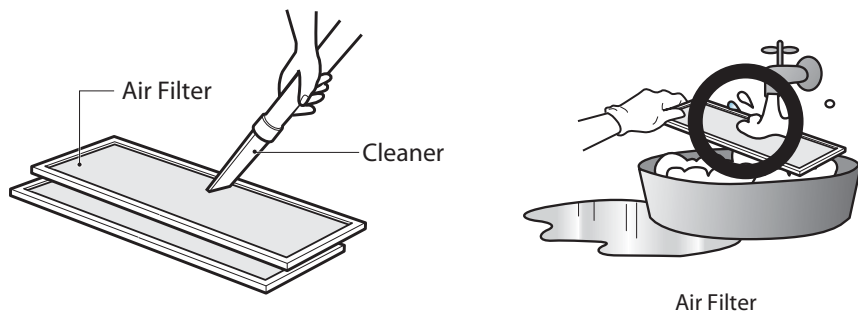
3. Remove the total heat exchanger.



## Air Filter Cleaning

- Clean the filter once every 6 months.
- Clean the dirt from the air filter using a vacuum cleaner or wash it with warm water.
- Dry the filter. Do not expose the air filter to direct sunlight or heat from fire.

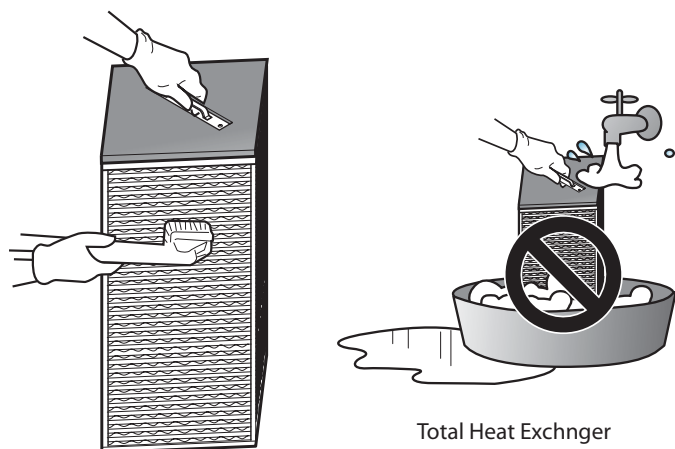
Figure 30: Cleaning the Air Filter



## Total Heat Exchanger Cleaning

- Use a soft brush and cleanser to remove dirt from the total heat exchanger.
- Never use water to clean the total heat exchanger.
- For service, contact the dealer or an authorized service center.

Figure 31: Cleaning the Total Heat Exchanger



## Reassembling the Total Heat Exchanger

1. Securely put the corners of the total heat exchanger into the holder for assembly and slide them into the main body.

2. Assemble the air filter into the holding structure inside the total heat exchanger.

Be careful not to damage the surface of the total heat exchanger.  
Dust on the total heat exchanger may cause deterioration of air volume.

3. Fix the maintenance cover to the right hinge and fix it to the left side (a nameplate is attached for ward the reading direction).

**⚠ WARNING**  
Turn the breaker off prior to cleaning this product.

Figure 32: Assembling Total Heat Exchanger and Air Filter

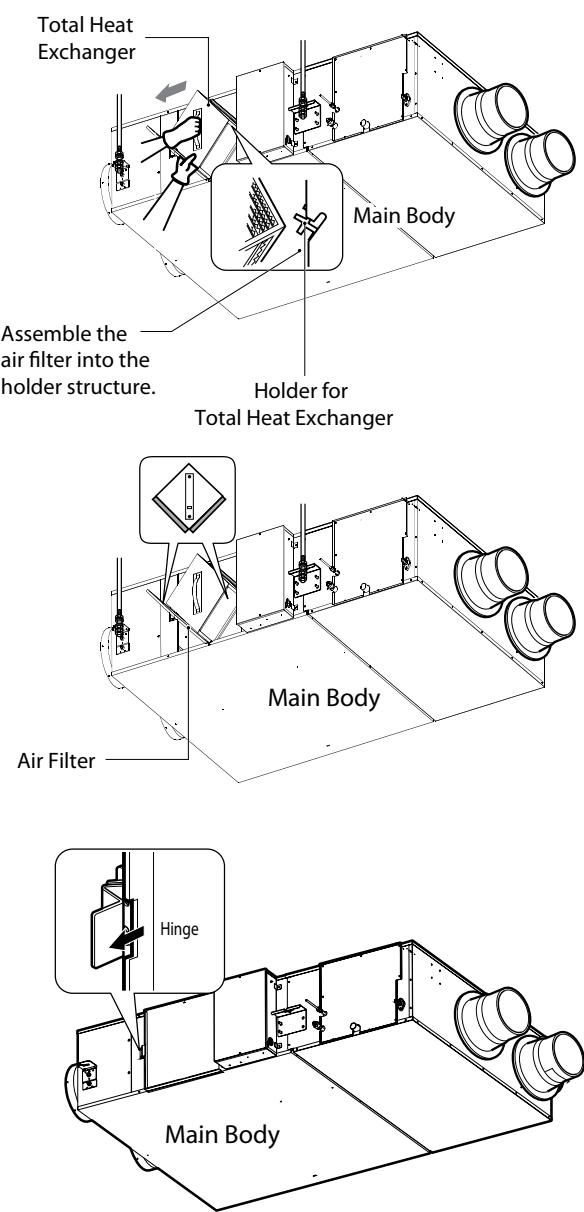


Table 7: Recommended Maintenance Cycle

Part Name	Inspection Cycle (cleaning cycle)	Replacement Cycle
Air Filter	6 Months	3 Years
Total Heat Exchanger	1 Year	10 Years

## General

ERV indoor units are factory assembled and provided with an internally mounted control circuit board, exhaust fan, supply fan, cross-flow air to air heat exchanger, washable outdoor air and return air filters, and bypass damper. Each unit is designed to operate using 208-230/60/1 power with voltage variances of  $\pm 10\%$ . ERV operation range is 14°F - 113°F outdoor temperature.

## Casing

The metal casing is designed to mount concealed above a finished ceiling. Supply fan discharge and exhaust fan inlet (return air) are front horizontal. Supply fan inlet (outdoor air) and exhaust fan discharge are rear horizontal. Cold metal surfaces are externally insulated. The case is provided with hanger brackets designed to support the unit weight on for corners. Hanger brackets have pre-punched holes designed to accept field supplied, all-thread rod hangers.

## Fan Assemblies

ERV units have two fans; one fan for supply air and one fan for exhaust air. Both fans are direct driven. Fan motors are brushless, digitally-controlled (BLDC) design with permanently sealed bearings. The fan/motor assemblies are mounted in vibration attenuated rubber grommets. The fan speeds are controlled using a microprocessor-based direct digital control algorithm that provides three fan speeds. Fan speeds are super high, high, and low. Each fan speed can be adjusted from the factory setting using external static pressure (ESP) control settings to change fan speeds to compensate for airflow resistance caused by field installed ductwork.

## Cross flow Air-to-air Heat Exchanger

Cross flow air-to-air heat exchanger is constructed of non-flammable, specially processed paper that allows transfer of heat and humidity. The air-to-air heat exchanger recovers energy from indoor air as it is exhausted outdoors. The recovered energy is transferred to the in-coming outdoor air without mixing airstreams. A hinged access panel allows removal of air-to-air heat exchanger for vacuum or brush cleaning. Since both heat and humidity are transferred, condensate drain is not required.

## Air Filter

Two washable mesh filters are provided at the outdoor air and return air inlets of the air-to-air heat exchanger.

## Microprocessor Controls

The ERV is provided with an integrated microprocessor-based controller. All unit operation parameters, excluding the unit operating schedule, are stored in non-volatile memory, resident on the ERV microprocessor. Operating schedules are stored in the wall controller or central controller. ERV units can be operated independently with a wall controller or interlocked to a Multi V system. When interlocking to a Multi V system, the field supplied communication cable between the ERV and outdoor unit is to be a minimum of 18 AWG, 2-conductor, stranded, and shielded cable (RS485), terminated via screw terminals on the control board. The microprocessor control provides the following functions:

- Auto restart following power restoration
- External static pressure (ESP) control of fans
- ERV mode allowing air to pass thru air-to-air heat exchanger
- Bypass mode allowing exhaust air to bypass air-to-air heat exchanger

The control board is also provided with terminals for connection of a field supplied CO2 sensor. DIP switch settings on the control board allow the ERV to operate independently or as a slave to a Multi V indoor unit.


# CONTROLLER GENERAL DATA



## Zone Controllers and Speciality Application Devices



### Specifications

Table 8: Summary Data—Zone Controllers

Zone Controller	Name	Model No.	Case Color	Max Wire Length (ft)	Description
	LG Programmable Thermostat	PREMTB010U	White	164	Allows control of indoor unit on/off, operation mode, occupied and unoccupied temperature setpoints, fan speed, and airflow direction for up to 16 indoor units. Programmable schedule with 5 events per day with control of occupied/unoccupied, on/off mode, setpoints and fan speed. Advanced functions include two setpoint autochangeover, minimum difference between setpoints, setback and timed override.

Before specifying or placing an order, refer to the V-Net Network Solution Engineering Product Data Book and review the detailed technical data provided to fully understand the capabilities and limitations of these devices.




Table 9: Summary Data—Speciality Application Devices

Speciality Application Device	Name	Model No.	Connect to	Application	Binary Signals Input/ Output	Description
	Dry Contact Unit 24 VAC	PQDSB1	Indoor Unit	On/Off, Run Status, Error Status	1/2	Enables the indoor unit to be controlled and monitored by third party controls using binary inputs and outputs.
	Dry Contact Unit for Communication	PQDSBCGCD0		On/Off, Mode, Controller Lock, Power Save, Run Status, Error Status	2/2	
	Dry Contact Unit for Thermostat	PQDSBNGCM1		On/Off, Thermo On/Off, Mode, Fan Speed, Run Status, Error Status	---	
	Digital Output (DO) Kit	PQNFP00T0	Comm Bus	On/Off	0/1	One 25 amp DPST normally open relay. Used with central controller to control third party device manually or by schedule.

Before specifying or placing an order, refer to the V-Net Network Solution Engineering Product Data Book and review the detailed technical data provided to fully understand the capabilities and limitations of these devices.





Table 10: Summary Data—Central Controllers (connect to the outdoor unit terminals Internet A, Internet B)

Central Controller	Name	Model No.	Devices per Controller	Systems per Comm Bus	Devices per Comm Bus	No. of Comm Bus Ports	Binary Signals Input/Output	Power, Conn	Description
	AC Smart Premium	PQCSW421E0A	128	16	128	1	2/2	24 VAC	Provides scheduling, autochangeover, setback, remote controller lock, setpoint, range limit, run time limit, web access, email alarm notification, visual floorplan navigation, peak/demand control, software device interlocking, PDI integration, and AC Manager Plus integration advanced functionality in addition to basic unit control and monitoring.
	AC Ez	PQCSZ250S0	32	16	256	1		12 VDC, ODU	Provides for scheduling in addition to basic indoor unit control and monitoring.
	Advanced Control Platform (ACP) Standard	PQCPA11A0E	256	16	64 (128 with PDI Premium)	4	2/2	24 VAC	Provides for scheduling, remote controller lock, setpoint range limit, web access, peak/demand control, PDI integration, and AC Manager Plus integration advanced functionality in addition to basic unit control and monitoring.
	Advanced Control Platform (ACP) Premium	PQCPB11A0E	256	16	64 (128 with PDI Premium)		10/4	24 VAC	

Before specifying or placing an order, refer to the V-Net Network Solution Engineering Product Data Book and review the detailed technical data provided to fully understand the capabilities and limitations of these devices.

Table 11: Summary Data—Integration Solutions (connect to outdoor unit terminals Internet A, Internet B)

Integration Solution	Name	Model No.	Devices per Controller	Systems per Comm Bus	Devices per Comm Bus	No. of Comm Bus Ports	Power	Binary Signals Input/Output	Description
	BACnet® Gateway	PQNFB17C1	256	16	64 (128 with PDI Premium)	4	24 VAC	10/4	Allow integration of LG equipment for control and monitoring by open protocol BACnet® and LonWorks® building automation and controls systems.
	LonWorks® Gateway	PLNWKB100	64	16	64	1	24 VAC	2/2	

Before specifying or placing an order, refer to the V-Net Network Solution Engineering Product Data Book and review the detailed technical data provided to fully understand the capabilities and limitations of these devices.



LG Electronics  
Commercial Air Conditioning Division  
11405 Old Roswell Road  
Alpharetta, Georgia 30009  
[www.lg-vrf.com](http://www.lg-vrf.com)

LG Electronics Commercial Products Support  
1-888-865-3026 USA

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VRF-EM-DT-001-US 013L12  
VRF-EM-DT-001-US 013H21  
VRF-EM-DT-001-US 013D10  
VRF-EM-DT-001-US 013F04