DuctlessAire

Service Manual

Mini-Splits

Contents

1. Applications and Features

1.1 Computer or Data Server Rooms

Mini-splits are designed to primarily keep people comfortable. That means the typical range of temperatures for the zone is 70-72 Deg F.

Mini Splits were not specifically designed for cooling server rooms or other data rooms however due to their size and ease of installation this is a very common application, and also the #1 Technical Service issue.

But **FOLLOWING** these guidelines can make for a reliable, profitable installation in this application.

Sizing

Sizing of the Mini Split to the room is **EXTREMELY IMPORTANT**.

DuctlessAire recommends a 12,000 Btu/h capacity per 200 to 250 Sq Ft of room size. Do not exceed this sizing guideline.

Installing large capacity systems in small rooms will lead to short cycling of the compressor as the supply airflow from the unit to "bounces back" into the return air stream of the unit

If using the larger capacity units, Supply air is discharged at a velocity of approximately 6ft per second.

With a small room, where the opposite wall to the unit is less than 10ft away the supply air only circulates for approximately 4 seconds before returning to the unit.

The room temperature sensor is located on the surface of the cooling coil, if the supply air quickly "bounces back" into the unit, it will satisfy the sensor and the compressor will be cycled off.

All DuctlessAire mini splits feature continuous fan operation, maintaining circulation in the room rapidly picking up the warmer return air from the room, causing the return air sensor

to quickly sense a rise in temperature and call for compressor operation.

This leads to short cycling of the unit, poor temperature control and a greatly reduced unit life span.

Due to this scenario we recommend that you **DO NOT install any capacity of Mini Split in rooms of less than 100 Sq Ft in Size**

Unit Location

Ensure that no obstacles to the air flow from the Indoor unit are within 10 feet of the unit, be especially aware that Computer server units create an airflow baffle and can have the same effect on airflow to and from the unit as a small room size.

In Computer room application the DuctlessAire Mini Split units must be installed a MINIMUM of 6ft from the floor so that the airflow from the unit is unimpeded.

Sensible Heat and Humidity

DuctlessAire units are designed to provide an approximate SHR of 0.66. Be aware that low humidity conditions will further reduce unit performance, requiring either additional higher fan speeds to be programmed into the unit, or introduction of some latent load into the room, e.g. Use of a humidifier.

Compressor Run Times

To ensure compressor longevity it is paramount that the **compressor run time be longer than 5 minutes at all times throughout the year**. This will allow oil return to the compressor, and will ensure that the max number of starts per hour is not exceeded.

If the compressor runtime is less than 5 minutes, especially at design ambient temperature it is very likely that the unit is oversized.

Ambient

The other major issue with Computer or Data rooms is that they are designed to operate

365 days 24/7. This means that the Outdoor unit will be exposed to temperature below the minimum design ambient of 65 DegF

Therefore for cooling below 65 DegF, DuctlessAire insists on the following items to be installed on the system.

1. ICM 326H Fan Speed controller
2. Crankcase Heater on ALL units

If winter temperature fall below 32 DegF a Wind Baffle on the Coil Inlet and the Exhaust of the condenser fan is required.

This will isolate the unit from any wind that could cause the unit to over condense, slugging liquid refrigerant back to the Compressor, which can damage the valve plate, wash oil from the bearing services and eventually cause the Compressor to fail.

A Wind Baffle will provide cooling operation down to an Ambient of 0 DegF Wind Baffles are field fabricated, drawings are available on request from DuctlessAire.

1.2 Commercial, Offices, Shops, Churches etc

Sizing

Again Sizing and Location of the Mini Split to the room is **EXTREMELY IMPORTANT.**

DuctlessAire recommends a 12,000 Btu/h capacity for each 350 to 450 Sq Ft of the Room Do not exceed this sizing guideline for the same reason as the computer room application information

Again **DO NOT** install DuctlessAire Mini Splits in rooms of less than 100 Sq Ft

Ambient

Check as to the lowest ambient temperature that will be required for cooling, the minimum

design temperature for the Outdoor unit is 65 DegF, if cooling is required below that, down to 32 DegF, DuctlessAire insists on an ICM 326H Fan Speed controller being installed on the Outdoor unit. On ALL units, a Crankcase Heater should also be installed.

For cooling down to 0 DegF, the use of Wind Baffles is required, per the computer room application information.

Filters

DuctlessAire Mini Splits, because of the constant operation of the fan require much more frequent filter cleanings or replacements than the standard "ducted US style" units which are generally used for commercial buildings. DuctlessAire recommends that the filters are cleaned every 4 weeks of operation, more frequently in areas subject to dirtier conditions e.g. Warehouse offices etc.

Condensers located inside the Building

Especially with Warehouse or additional office space the condensers can be installed inside the building, this provides two specific issues to address:

1. Lower ambient, these units are rated at 95 DegF ambient, if the ambient in the building does not rise above 80 DegF, we can downsize the unit as it will produce more capacity and operate more efficiently.
2. Cleaning the condenser coil, use soapy water and keep the condenser coil clean, put it on the same schedule as the indoor unit filter cleaning.

1.3 Residential

Sizing

Sizing and Location of the Mini Split to the room is still **EXTREMELY IMPORTANT**. **DuctlessAire recommends a 12,000 Btu/h capacity for each 500 to 600 Sq Ft of the Room for most applications inside the house**.

The throw of the 9 or 12,000 Btu/h units is approximately 15 feet, and the 18 or 24,000 Btu/h units have a throw of approximately 25 feet.

Therefore when applying these units in a residential application make sure that the units are not mounted at the top of the stairs blowing directly onto a wall or inside a niche or cut out in a room.

Again the temperature sensor is designed to sense the returning air after it has been supplied to the room, extracted the heat and humidity and then returned to the unit, not when it has been bounced directly back off a wall or other obstacle.

Ambient

As standard the units are capable of cooling down to an ambient of 65 DegF, which is sufficient for the majority of residential applications.

Indoor unit Location

For optimum unit operation the High Wall Indoor unit should be mounted a minimum of 6 feet from the floor. A minimum height of 4 feet must be maintained for correct unit operation. Ensure air flow is never directly straight onto areas where people may sit or congregate, as the temperature difference between Supply and Return air will be approximately 35 DegF.

Outdoor unit location

The Outdoor units are designed to operate with extremely low noise levels compared to the standard US condensing unit, this allows the outdoor units to located in areas closer to property lines, however when locating the DuctlessAire Outdoor unit, ensure that the spacing detailed in the Installation manual are observed, and that the maximum line length and lift restrictions are adhered to.

Garages or FROG's/Bonus Rooms

DuctlessAire Mini Splits are perfect for adding conditioning to Garages and Bonus Rooms Use a 400 sq per 12,000 Btu/h sizing guide and as always follow the location

guidelines provided for the Indoor and Outdoor unit.

1.4 Sun Rooms or 4 Season Rooms

Sizing

Sizing and Location of the Mini Split to the room is still **EXTREMELY IMPORTANT. DuctlessAire recommends a 12,000 Btu/h capacity for each 325 to 350 Sq Ft of the Room**.

The throw of the 9 or 12,000 Btu/h units is approximately 15 feet, and the 18 or 24,000 Btu/h units have a throw of approximately 25 feet.

Sun Rooms are a great application for DuctlessAire Mini Split units however there are several items that must be addressed to make the installation a success.

Ambient

Sun Rooms are different in their application as they by definition have a large solar gain and therefore can require cooling in cold ambient temperatures. Therefore as per Computer room and Commercial applications it is mandatory to install the ICM 326H low ambient control and a crankcase heater on the system.

Indoor unit Location

For optimum unit operation the High Wall Indoor unit should be mounted a minimum of 6 feet from the floor. A minimum height of 4 feet must be maintained for correct unit operation.

Ensure air flow is never directly straight onto areas where people may sit or congregate, as the temperature difference between Supply and Return air will be approximately 35 DegF.

Heat Pumps

In order to use the Sun Room year round Heat Pumps are the recommended system,

however it may be advisable to install some additional source of heat, such as electric baseboard if the Sun Room is to be used in temperatures below 24 DegF.

Below 24 DegF the air temperature delivered from the unit will be close to body temperature making it feel uncomfortable, as when the Outdoor temperature falls the unit capacity and efficiency reduces, together with the unit requiring more frequent defrost cycles.

This will assist in truly making the Sun Room a room to be enjoyed in comfort all year round.

1.5 Low Ambient Cooling

As stated in the Computer Room, Commercial and Sun Room application pages -

ALL DuctlessAire models are capable of providing **COOLING** operation down to an ambient temperature of 65 DegF.

Therefore to operate in Cooling down to an ambient temperature of 32 DegF, both an ICM326H Fan Speed Controller, plus a Crankcase Heater, either a Mars #32342 or Raychem #CCH-1 or 2 bellyband types **MUST** be installed.

For cooling operation below 32 DegF, and down to a minimum of 0 DegF, DuctlessAire recommends that Wind Baffles be installed on both the Coil Inlet and Fan Outlet of the Outdoor unit. Please contact DuctlessAire directly for details of the design requirements for the Wind Baffles.

We also recommend using these Wind Baffles in applications where the units may be exposed to prevailing winds blowing though the condenser coils. These winds may cause the unit to over condense and freeze the indoor unit, or allow liquid refrigerant to be inadvertently slugged back into the compressor.

Installing the ICM326H Fan Speed Controller

The controller should be located per the instructions provided, it is not weatherproof, therefore should be mounted inside the compressor compartment of the Outdoor unit.

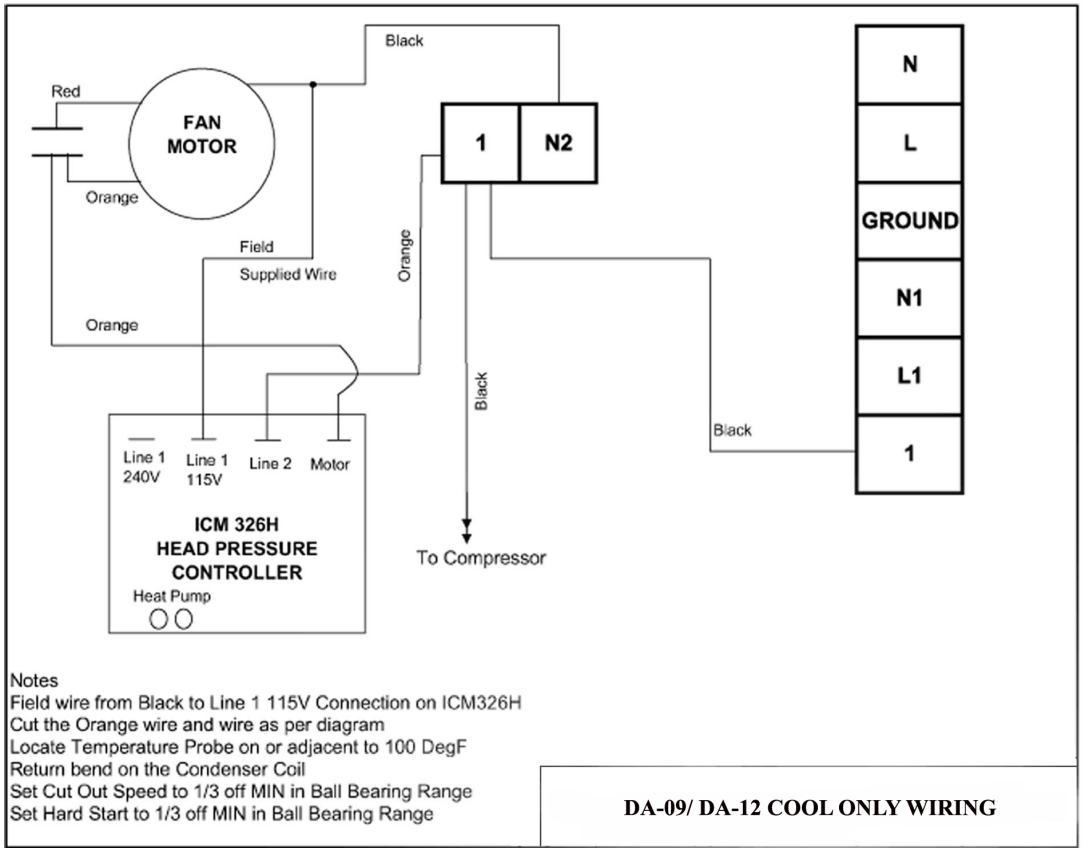
DuctlessAire Units have Ball Bearing Condenser Fan motors, set both the Hard Start and cut out speed setting dials to 1/3 off the **MINIMUM** position.

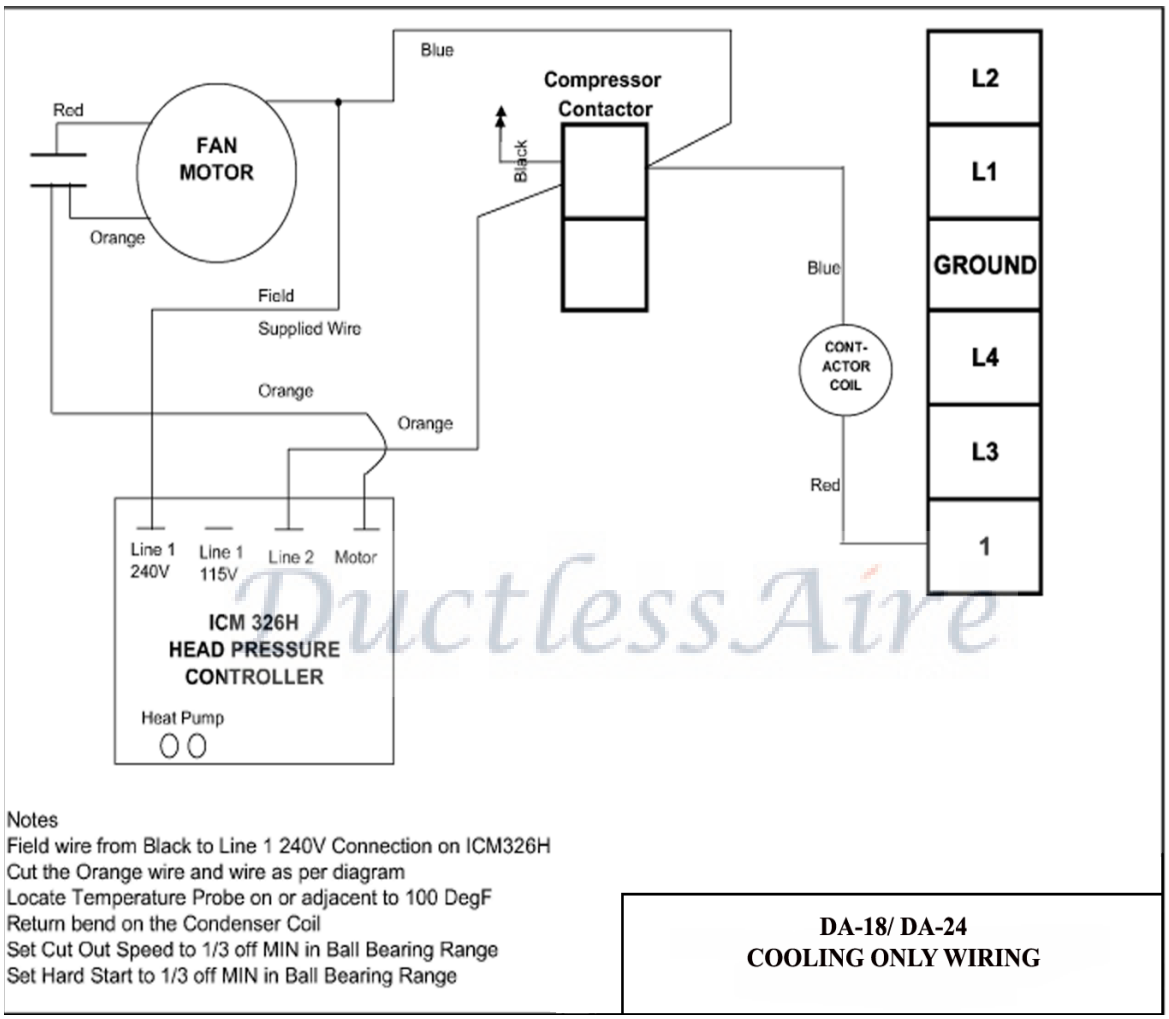
The Temperature sensing probe should be securely attached on or adjacent to a return bend on the condenser coil that measures 100 DegF in normal operation. In practice this works out to be the 3rd Return bend down from the top of the coil. Securely strap the probe to the bend or tube and insulate to ensure accurate temperature sensing.

Wiring

Wiring should be in accordance with the diagrams on the following pages, **DO NOT** deviate from the wiring shown, if in doubt please call Technical Support for assistance.

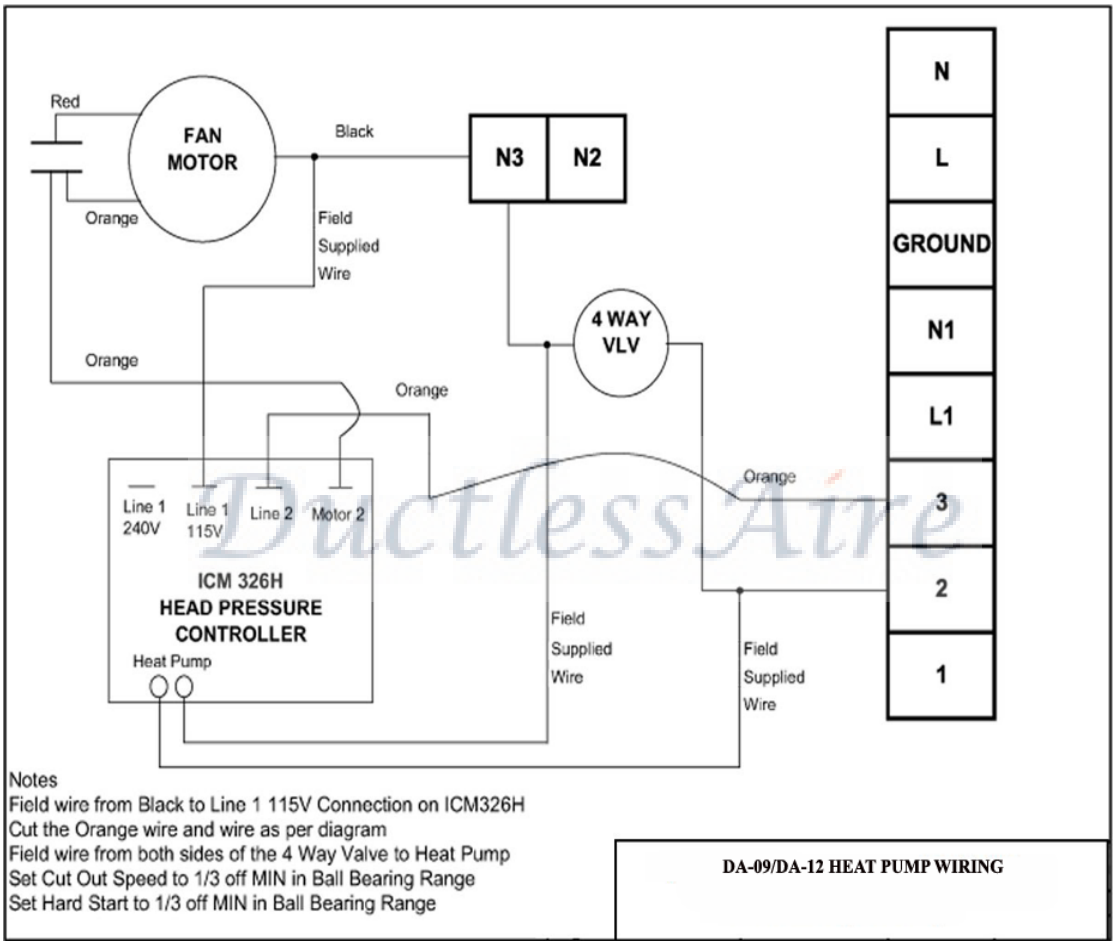
Please note on Heat Pump units the bypass connection must be wired from the Reversing Valve to the ICM controller to ensure that the Outdoor fan operates at full speed in the Heat Pump Heating mode.

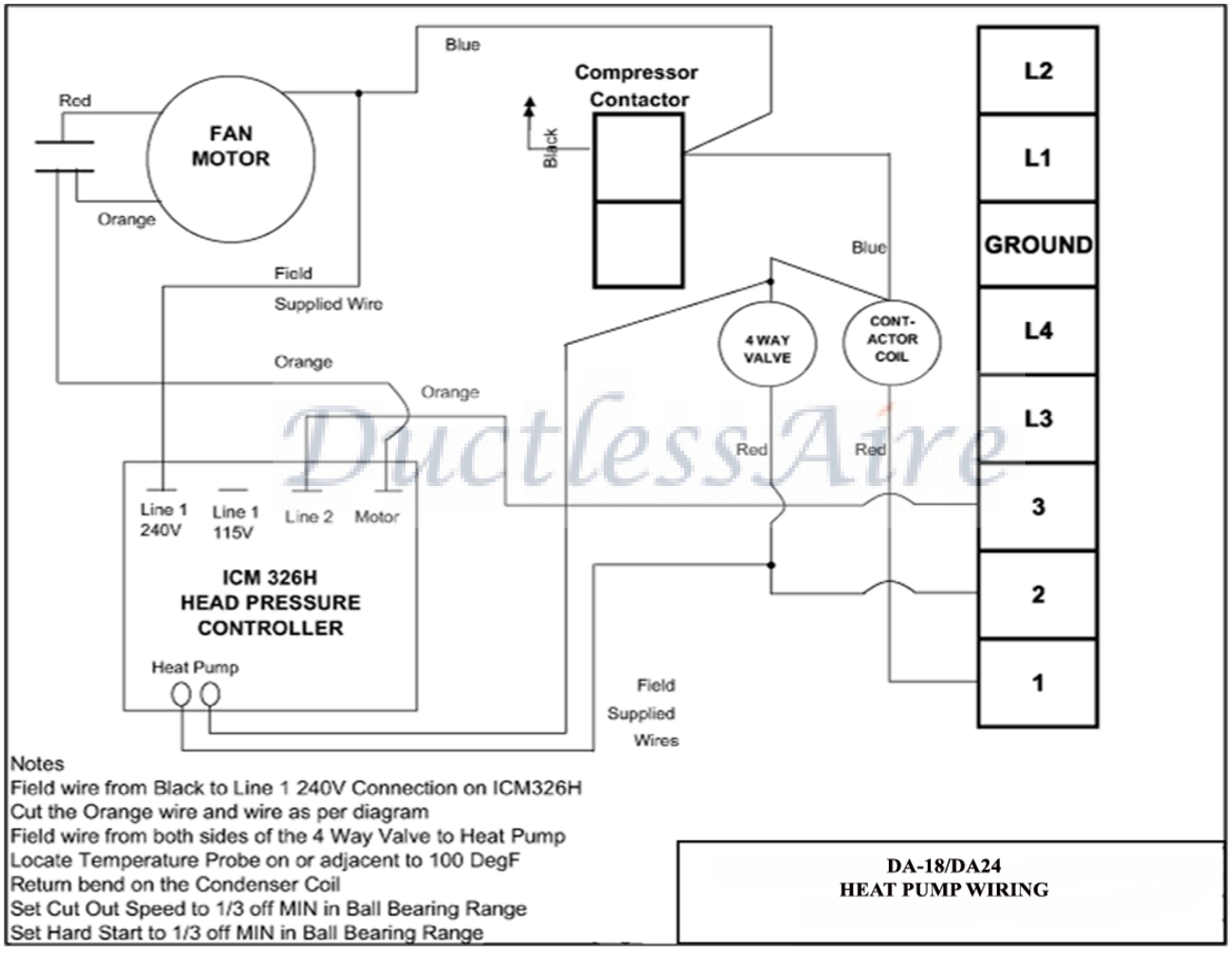




Notes
Field wire from Black to Line 1 240V Connection on ICM326H
Cut the Orange wire and wire as per diagram
Locate Temperature Probe on or adjacent to 100 DegF
Return bend on the Condenser Coil
Set Cut Out Speed to 1/3 off MIN in Ball Bearing Range
Set Hard Start to 1/3 off MIN in Ball Bearing Range

DA-18/ DA-24
COOLING ONLY WIRING


Red
FAN MOTOR
Black
N3
N2
Orange
Field Supplied Wire
4 WAY VLV
Orange
Orange
Orange
Line 1 240V
Line 1 115V
Line 2
Motor 2
ICM 326H
HEAD PRESSURE CONTROLLER
Heat Pump
Field Supplied Wire
Field Supplied Wire
N
L
GROUND
N1
L1
3
2
1
Notes
Field wire from Black to Line 1 115V Connection on ICM326H
Cut the Orange wire and wire as per diagram
Field wire from both sides of the 4 Way Valve to Heat Pump
Set Cut Out Speed to 1/3 off MIN in Ball Bearing Range
Set Hard Start to 1/3 off MIN in Ball Bearing Range
DA-09/DA-12 HEAT PUMP WIRING


Blue
Compressor
Contactor
Red
FAN
MOTOR
Orange
Black
Field
Supplied Wire
Orange
Orange
Blue
4 WAY
VALVE
CONT-
ACTOR
COIL
L2
L1
GROUND
L4
L3
3
2
1
Red
Red
Line 1
240V
Line 1
115V
Line 2
Motor
ICM 326H
HEAD PRESSURE
CONTROLLER
Heat Pump
Field
Supplied
Wires
Notes
Field wire from Black to Line 1 240V Connection on ICM326H
Cut the Orange wire and wire as per diagram
Field wire from both sides of the 4 Way Valve to Heat Pump
Locate Temperature Probe on or adjacent to 100 DegF
Return bend on the Condenser Coil
Set Cut Out Speed to 1/3 off MIN in Ball Bearing Range
Set Hard Start to 1/3 off MIN in Ball Bearing Range
DA-18/DA24
HEAT PUMP WIRING

1.6 Heat Pump

DuctlessAire Heat Pump units are **NOT** fitted with any type of auxiliary heating for back up heat during periods of time when the outdoor ambient is too cold to allow for full capacity operation. Basically the colder the air outside, the lower the capacity and supply air temperature provided by your DuctlessAire Heat Pump.

If the Outdoor Coil temperature is below 14 DegF, Heat Pump operation is stopped and the unit will shut down, until the coil temperature increases.

Therefore we recommend that the DuctlessAire heat pump should **NOT** be used as the primary source of heating where Outdoor temperatures are regularly below 24 DegF for sustained periods of time.

If a Heat Pump is used in these applications ensure that an additional source of heat (baseboard electric or hydronic, or other type) be used when the temperature falls below 24 DegF.

Warm Start

In Heat Pump operation the Indoor fan motor will only start operating, when the indoor coil temperature has reached 86 DegF. Then the fan will start operating in an ultra low speed mode, increasing in fan speed back to the selected speed on the remote control as the Indoor coil temperature increases.

When the unit completes Defrost, the warm start feature will be used to allow the coil to warm up before restarting the Indoor fan. Warm start operation is indicated by a the run light on the display blinking once.

Heat Pump Heating on the Remote Control

The symbol on the Remote Control for Heat Pump Heating is a little confusing

The symbol that is a **SUN** is the correct symbol for Heat Pump Heating Press the mode button until the **SUN** is displayed, and then selects the desired temperature and fan speed and the unit will operate in Heat Pump mode.

The symbol that looks like a **FLAME** is actually be a **DRIP** of water. This mode is the DRY mode, which is used to cool the room down at the lowest possible fan speed, which removes the most moisture from the room.

Therefore if your customer complains that his heat pump is not operating in heating, first check that he has it in the correct mode on the remote control.

Defrost

DuctlessAire units feature "Demand Defrost" which allows the unit to choose when to enter into defrost, not just every 30, 60 or 90 minutes as most heat pumps

An Outdoor coil temperature sensor is located in the Outdoor unit, it MUST be connected back to the Indoor PCB, the sensor will assist in determining if defrost is required. (Not connecting the sensor will result in a fault code – see fault section)

During Defrost the Indoor fan motor will stop so that cold air is not blown into the room. The Outdoor fan motor will also stop to speed up the defrost process.

After defrost has finished the compressor will stop to equalize pressures. A single blink of the operating light shows that unit is in defrost.

Defrost Initiation and Termination

Come into the defrosting status state: (only meet one of the following conditions, the unit will come into the defrosting status)

A After the accumulated running time of the compressor reaches thirty minutes in the heating mode, if the temperature inspected and measured by the sensor on the outdoor coil pipe is below 5DegF (programmable data 28#) in continuous one minutes and the compressor has been continuously working for three minutes, then the system will come into the defrosting status.

B After the accumulated running time of the compressor reaches forty minutes in the heating mode, if the temperature inspected and measured by the sensor on the outdoor coil

pipe is below 23DegF (programmable data 27#) in one minutes continuously and the compressor has been continuously working for three minutes, then the system will come into the defrosting status.

C After the waiting time of the air conditioning is longer than thirty minutes, the unit will come into the heating mode after been started up. Or it will come into the heating mode at the first time of powering on. If the temperature of the outdoor coil pipe is below 28.4DegF, then the air condition will firstly come into the defrosting status.

The conditions of exiting the defrosting status: (only meet one of the following conditions, the unit will exit the defrosting status)

A When the sensor temperature of the outdoor coil pipes is above 59DegF(programmable data 29#), the unit will exit the defrosting status.

B When the defrosting time is longer than fifteen minutes, the unit will exit the defrosting status.

Reversing Valve

The reversing or 4 way valve is energized for HEATING in a DuctlessAire unit. If the unit does not produce heat when in the Heat Pump mode, check for line voltage starting at the Indoor unit terminal, and follow that voltage out via the interconnecting wire to the solenoid coil on the valve.

Reversing valve coils are line voltage, again units do not use any 24V AC controls

Over heating protection

When the inspected and measured temperature of the indoor coil Tp1 is higher than or equal to 145DegF(programmable data 26#), the compressor, outdoor blower will

stop operation, the indoor blower will operate according to the set wind speed, (when the start up condition of the compressor is satisfactory to) the operation will be restarted up six minutes later, if the temperature of the indoor coil Tp1 is higher than or equal to 145DegF for the second time within ten minutes after the start up, all of the output will be closed, and E8 will be displayed on the display panel.

Sleep function

A When the "Sleep" key on the remote controller is pressed down, the air conditioning will come into the sleep status, the indoor blower will be switched to the low wind speed operation, when the "Sleep" key is pressed down for the second time, the sleep will be canceled, the air conditioning will come back to the operation status the same as the status before the sleep, the indoor blower will still be operating according to the set wind speed that is set during the sleep. The unit can be shut down through pressing down the "ON/OFF" key on the remote controller, and the sleep setting will also be canceled at the same time.

B Pressing down the "Sleep" key on the remote controller to set the sleep operating, after five seconds, there will be only sleep icon displayed on the display screen or the operation light and the sleep light are lighting, all of the other icons are closed, this is the sleep and screen closing status.

a For the colorful screen display: at the time of sleep, only the sleep icon is displayed, and all of the other icons are closed.

b For the 8LED + LED light display: the operation light and the sleep light are lighten, all of the other icons are closed. If there is no operation light and the

sleep light, then all of the lights will not be lighten.

Annotation: during the sleep operation, if the unit receives the timing time that has been adjusted, the twinkling of the 8LED on the display screen means that the status is being changed, if the unit receives that the set temperature has been adjusted, the 8LED will be lighten, the air conditioning will be adjusted to the operation status the same as the status before the sleep during the changing status, it will be closed if there is not any change in five seconds.

C Set the sleep in the cooling mode, it will be Ts＋1℃ after one hour, it will be Ts＋2℃ after two hours, and it will keep the same value from that time on.

D Set the sleep in the heating mode, it will be Ts－1℃ after one hour, it will be Ts－3℃ after two hours, it will be Ts－5℃ after three hours ,and it will keep the same value from that time on.

E Set the “sleep” in the dehumidify mode, the unit will keep on the operation according to the dehumidify mode, but the sleep and screen closing will be execute.

F Set the “sleep” in the ventilation mode, the set temperature will not be adjusted, the sleep and screen closing will be execute.

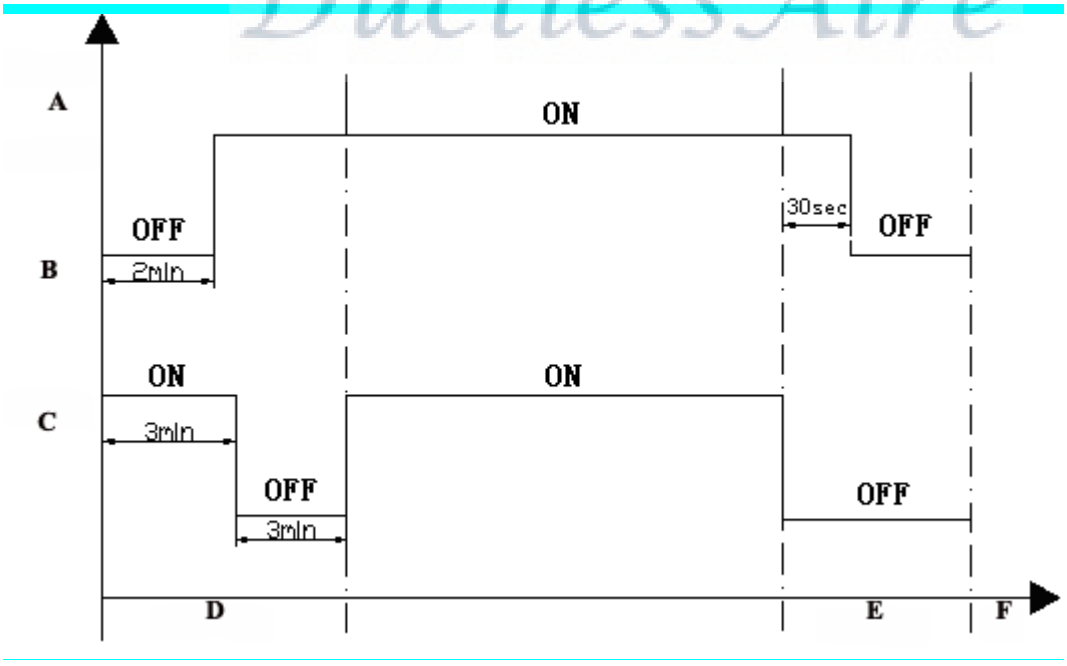
G Set the sleep in the automation mode, no matter which mode the automation mode come into, then the sleep function will be operated according to the corresponding mode during the setting of the sleep.

H Under the sleep mode, the wind speed of the indoor blower can be adjusted, except for the dehumidify mode.

I The “sleep” and “turbo” can not be operated at the same time, that is to say there is no sleep function during the turbo operation, and there is no turbo function in the sleep status.

Anti- mildewing operation function

If the air conditioning is shut down during the cooling operation under the cooling,dehumidify or automation mode, then the air conditioning will execute the anti- mildewing operation function. The compressor and indoor blower will be operated according to the curve in the start up period that is shown in the following figure, the indoor blower is in the operation status of low wind speed, the air flap will be closed thirty seconds after it has been operated according to the original status, the outdoor blower and the four- way valve are in the closing status.



A： controlled object B: indoor blower C:compressor

D: start up E: shut down F: time

Remember function at the time of power failure

Storage of the data

A In the status of start up or waiting, when the correct remote control code is received, the effective remote control code and the data check sum will be written into the unit designated by the E2PROM with the time delay of three seconds.

B When the start up or shut down is using the emergency key, or when the key is used to set the status of the air conditioning, the operation result of the key will be translated into the control code and which will be written into the unit designated by the E2PROM with the time delay of three seconds.

C When the timing on function is set, if the power is supplied again after the power failure, then the "immediate start up" should be selected; when the timing off function is set, if the power is supplied again after the power failure, then the "immediate shut down" should be selected.

D When the sleep function is set, because this sleep function has no timing off operation, if the power is supplied again after the power failure, then the start up should be selected, and the sleep function will not be remembered; when there is failure and the unit is shut down, if the power is supplied again after the power failure, then the shut down should be selected.

E For the split type wall mounting unit, start up unit through pressing the emergency key, the selection of the working mode will be execute according to the original scheme.

F If it is provided with lock key function before the power failure, then the lock key function will be canceled after powering on.

G The remember function during the power failure can only remember the operation mode, the turbo, economy, and sleep function can not be remembered.

2. Pre Installation Requirements

2.1 Unit sized correctly and applied correctly

Refer to Pages 3 through 10 for information on the sizing and additional requirements for the specific application required.

2.2 Electrical Requirements

All the DuctlessAire units require Line Voltage interconnect for both power for the Indoor unit and Control voltage for the Outdoor unit.

There is **NO** 24V AC wiring on these units, therefore all the electrical wiring between the units **MUST** be a minimum of 14 AWG.

The Outdoor unit **MUST** be fed with power from a Breaker and/or Local Disconnect. The Outdoor unit **MUST** provide power for the Indoor unit.

Do not install local disconnects or J boxes adjacent to the Indoor unit as this can cause mis-wiring and polarity issues for the system.

2.3 Breaker Size

Check the Breaker Size is correct for the system, DuctlessAire units do not have start components for the compressor, and therefore they rely on the correct power and amperage supply to start

Unit	Power Supply	Breaker Size
DA-09	115V-1Ph-60Hz	15A

DA-12	115V-1Ph-60Hz	15A
DA-18	208/230V-1Ph-60Hz	20A
DA-24	208/230V-1Ph-60Hz	25A

2.4 Line Set Lengths and Sizes

Ensure that the Maximum Line Set lengths are observed; the System will not operate correctly and will probably experience premature failure of its components.

DO NOT upsize or alter the Line Set Sizes from those published, Quietside cannot guarantee operation with incorrectly sized or extended Line Sets

DO NOT install Sight Glasses or Filter Driers in the Line Set

Model	Suction	Expanded Gas	Total Length	Lift
DA-09	1/2”	1/4”	50ft	20ft
DA-12	1/2”	1/4”	50ft	20ft
DA-18	5/8”	3/8”	50ft	20ft
DA-24	5/8”	3/8”	50ft	20ft

All of the units have the expansion device located in the Outdoor unit; therefore both the Suction and the “Liquid” line MUST be insulated (separately)

2.5 Indoor Unit Positioning

High Wall units must be mounted high on the wall, use a height of 6 to 8 feet, with nothing that would restrict airflow in front of the indoor units. This will provide optimum operation. Minimum height from the floor is 4ft.

The air returned to the indoor unit must be indicative of the true temperature of the entire space. When the unit is high on the wall, and the discharge air travels along the longest path possible to return to the unit (no blockage or reflected air returned) the system will

operate properly. Wall units throw air approximately 15’ (9 & 12,000 Btu/h units) and 25’ (18 & 24,000 Btu/h units)

Use the templates provided to locate the unit on the wall and to center the refrigerant connection hole – DuctlessAire recommends a 3” wall penetration to ease mounting of the unit.

2.6 Outdoor Unit Positioning

Ensure that a minimum distance of 6” behind the unit, and 24” in front of unit is maintained; otherwise the condenser airflow will be affected.

Ensure adequate access for service and repair is provided. The easiest access to the unit can be obtained by removing the top cover to the condensing unit. All valve and electrical connections are on the RHS of the Outdoor unit when looking at the condenser fan.

3. Installation Tips

Tools required for installing a DuctlessAire Mini Split

10” or 12” Crescent wrenches (x 2)
Small Electrical Screwdriver
Tool to help knockout the cable entry holes
Refrigerant Gauges and 5/16” Gauge Adaptor
Vacuum Pump and Vacuum gauge
Digital Refrigerant scale to weigh in extra R410A for long line set lengths
Temperature measurement device
Multi Meter

3.1 R410a Refrigerant

R410a refrigerant has similar temperatures to that of R22, however as well documented the pressures of R410A are approximately double that of R22. In addition to this the compressor oil used with R410A is extremely hydroscopic i.e. attracts water; therefore several precautions must be taken when installing R410A refrigerant units.

These are:

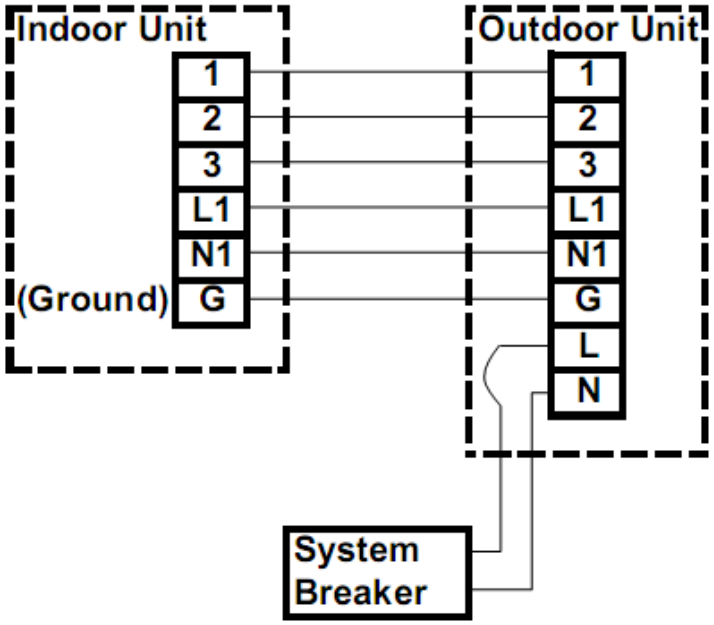
1) Minimize the time that the system piping is open to the atmosphere. Avoid problems with a clean installation of refrigerant lines. Make sure that the flares are free of burrs and seat correctly.
2) DuctlessAire does not recommend any brazing of refrigerant line sets.
3) Do not install Sight Glasses or Filter Driers in the interconnecting Line Set.
4) Pressure tests the system with dry Nitrogen or other dry gas.The system must be put into a deep vacuum (200 Microns minimum), DuctlessAire recommends a minimum of 45 minutes evacuation using the double evacuation process, breaking the original vacuum with dry Nitrogen, then re-evacuating prior to opening the service valves as the best method of ensuring a perfectly dry system.
5) In order to prevent confusion with what type of refrigerant is used in the system DuctlessAire uses a 5/16" Schrader connection on the Suction line to attach a gauge set to. Therefore an adaptor is required to connect to a standard US gauge set.

It is always a good practice to insulate the flare nuts to prevent loosening as the system operates; this is especially recommended for Heat Pump units due the changes in the temperatures seen at the service connections when the units operate in heating and then enter defrost.

3.2 Electrical Wiring Connections

These systems are ALL POLARITY SENSITIVE to the power supply, even the 208/230V units, it is VITALLY IMPORTANT that the wiring from Outdoor to Indoor unit is point to point, with the wire leaving one terminal on the Outdoor units landing in the same numbered or lettered terminal on the Indoor unit.

This is a sample electrical interconnect for the following units, DA-09/DA12



115V Power is supplied from the Breaker on N & L
115V Power for the Indoor unit is provided on N1 & L1
Compressor signal is Terminal #1
4 Way Valve signal is Terminal #2
Condenser Fan signal is Terminal #3
G is Ground (or Earth as it is sometimes called)

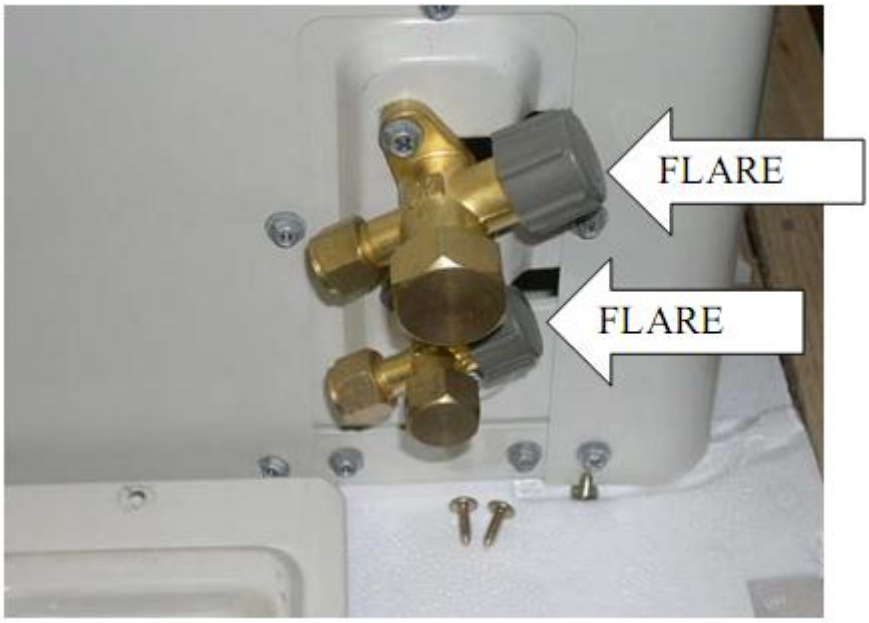
Electrical terminals at both the Indoor and Outdoor units require the use of a “small” bladed electrical screwdriver to access the terminal screws.

3.3 Number of Electrical Interconnect Wires

If a question on the wiring occurs, the IOM manual contains the unit wiring diagrams

Model	Number of Interconnect Wires, including Ground
9/12000btu Cooling Only	4
18/24btu Cooling Only	4
9/12000btu Heat Pump	6
18/24000btu Heat Pump	6

3.4 2-Way Valve and 3-Way Valve



The refrigerant line set connections can be found under the GRAY plastic caps not the brass ones which cover the valve stems.

DO NOT TRY TO PUT THE FLARE NUTS ON THE THREADS FOR THE SERVICE VALVE STEMS – THEY WILL NOT FIT

Once the line set is connected, the system, it should be pressure tested and then evacuated to a minimum of 200 Microns, the charge for the system has to be released from the Outdoor unit.

To do this, it is very important that the **SUCTION SERVICE VALVE MUST BE OPENED FIRST**

This will allow the refrigerant to flood the system without passing through the capillary tube. If the Liquid service valve is opened first it is possible to log Oil in the capillary tube, especially if the outdoor temperature is low.

If this happens the unit will drop into a vacuum immediately on start up of the unit, to repair this either recover the refrigerant charge and start evacuation again or it is possible to clear the log by driving up the condenser head pressure by blocking off the outdoor coil or unwiring the condenser fan.

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3.5 Adding Refrigerant Charge

If the unit interconnect length exceeds the standard charge length of the system, additional refrigerant must be added to the system. DuctlessAire systems are charged for a 25ft line set as standard.

The additional refrigerant MUST BE WEIGHED INTO THE SYSTEM, as these are critically charged systems.

The additional amount of refrigerant required is calculated from the extra length of interconnect multiplied by the refrigerant quantity in oz/ft.

All systems use R410A:

9000/12000btu Models Add 0.3 oz/ft of R410A over 25ft

18000/24000btu Models Add 0.5 oz/ft of R410A over 25ft

Added Charge required for a line set of:

Unit	30ft	35ft	40ft	45ft	50ft
9000/12000btu	1.5oz	3.0oz	4.5oz	6.0oz	7.5oz
18000/24000btu	2.5oz	5.0oz	7.5oz	10.0oz	12.5oz

Remember the Schrader connection for these R410A units is a 5/16” size, not the standard ¼”, this distinguishes the system from an R22 system, so that the incorrect gauges or refrigerant cannot be used by mistake.

3.6 Condensate Piping

Follow installation instructions and remember water runs down hill. Installation diagram is in the Installation and Operation Manual.

To check the condensate piping system, all condensate should be completely drained from

the system if the unit has not been in the cooling mode for at least 4 hours.

To connect from the 18” condensate hose provided on the Indoor unit we recommend an ø 5/8” ID or ¾” OD clear flexible PVC hose, this will provide a tight interference fit on the unit connection and allow standard rigid copper or PVC piping (depending on local codes) to be used for the remainder of the drain.

4. Common Technical Problems and solution

These are a sample of the common Technical questions that are asked of our Technical Support staff. By having these available it may help diagnose a problem before calling.

No	Fault	The possible reason	Solution
01	Not cooling well.	The room is too large ;the window or door is not closed.	Close the window and door
		Too many persons or too much heat source in room.	Reduce the heat source.
		The installed position of outdoor unit isn’t good. Have insolation or not good in ventilation.	Reinstall the unit.
		The installed position of indoor unit isn’t good. Bad in air circulation.	Reinstall the unit.
		The air filter is dirty or blocked.	Clean this air filter.
		The system blocked.	Check capillary tube, strainer etc. repair or

			replace them.
		The refrigerant leakage.	refill up refrigerant after checking the leak source.
		The set temperature is too high .	reduce the set temperature.
		The condenser blocked by dust or others.	clean the dust and dirt.
		Too much quantity of refrigerant.	take the redundant refrigerant out.
		Blockage in airinlet or air outlet.	Clear the obstacles.
		Air mixed in refrigerant.	refill the refrigerant after vacuumizing
		outdoor temperature is above 109 DegF	
		The indoor or outdoor fan motor is running slow	Change this indoor or outdoor fan motor
		The compressor suction or venting capability is very poor	Change the compressor or outdoor unit
		4-way valve slight mixes up	Change the 4-way valve
02	Cannot cool.	The fan doesn't run (motor or capacitor of fan failed, Poor	Check. Repair and replace.

		contact for the line of capacitor, line fault. The motor relay and drive circuit is fault)	
		The compressor doesn't work(the voltage is too low, overload, wiring error. The compressor failed. The capacitor of compressor failed. the capacity of electric fence isn't enough.)	Check. Repair and replace.
		The refrigerant leaked completely	refill up refrigerant after checking the leak source.
		The system blocked completely	Check capillary tube,strainer etc. repair or replace them.
03	Not heating well.	The room is too large ;the window or door is not closed.	Close the window and door
		The set temperature is too low.	Heighten the set temperature.
		The air filter is dirty.	Clean this filter.
		The refrigerant leaked.	refill up refrigerant after checking the leak source.

		The system blocked slightly	Check capillary tube, strainer etc. repair or replace them.
		The outdoor temperature is below 20DegF	
		The A/C can't defrost	Replace this sensor or move the sensor to the thickest position of frost
		The indoor or outdoor motor speed is lower	Replace this fan motor
		The compressor suction or venting capability is very poor	Replace the compressor
		4-way valve slight mixes up	Let the four-way valve moving continually. Replace the four-way valve if it can't move
		The capillary valve has been blocked.	Replace the capillary valve
04	Cannot heat.	The fan doesn't run (motor or capacitor of fan failed, Poor contact for the line of capacitor,	Check. Repair and replace.

		line or PCB fault.).	
		The compressor doesn't work(the voltage is too low or high, overload, wiring error. The compressor failed. The capacitor of compressor failed.the capacity of electric fence isn't enough.)	Check. Repair and replace.
		The refrigerant leaked.	refill up refrigerant after checking the leak source and welding the leak point, vacuumizing
		The system blocked completely	Check capillary tube,strainer etc. repair or replace them.
		The compressor failed.	Replace compressor.
		The compressor is blocked	Knock the compressor With wooden hammer repeatedly or shunt another capacitor，if can not shart，change the compressor

		The four-way valve failed and can't replace direction.	Check the circuit and replace the four-way valve.
		The PCB damaged and no output.	Replace PCB.
		The indoor temp-sensor has been damaged.	Replace this indoor tempsensor
07	The compressor doesn't work.	The compress connecting wire is loose	reconnect this line.
		supply voltage is too low.	install voltage regulator.
		The capacitor of compressor failed.	Replace the capacitor.
		The PCB failed	Check. Repair and replace the PCB.
		The compressor locked.	Replace the compressor.
		The compressor open circuit or short circuit.	Replace the compressor.
		The overload protector has been damaged	Replace the overload protector
05	The AC can't turn on	No power in AC.	power connection.
		The remote have no power or damaged.	replace the battery or remote.
		The electric outlet failed.	Replace electric outlet.

		missing phrase for supply voltage.	Match right power
		supply voltage is too low.	install voltage regulator.
		The main fuse burn-out.	Replace fuse.
		The voltage dependent resistor has been burst	Change the voltage dependent resistor
		This AC can't receive the remote signal because of receiving head or window failure	Repair or replace this receiving head or window
		poor contact for socket connector of PCB.	Check. Repair or replace this PCB.
		The transformer damaged.	Replace the transformer.
		The PCB damaged and no output.	Replace the PCB.
08	Unit suddenly doesn't work after running some time.	Power failure.	
		fuse of power supply burn out.	Replace this fuse.
		poor contact for the plug.	Check repair and replace the plug and socket.
		Have set regularly shutdown.	Restart the A/C.
		The PCB has any trouble	Repair or replace the PCB

		electromagnetic interference	Turn on the machine afte Putting down the power and turnning on again
09	Can not heating and cooling.	no refrigerant in system.	Please fill up refrigerant.
		The refrigerant leaked.	refill up refrigerant after checking the leak source.
		Disconnecting valve dosen't turn on.	Please turn on disconnecting valve.
		The system is blocked. For example the strainer or connect pipe.	Replace this parts which blocked.
		The compressor failed.	Replace the compressor.
		The indoor fan is not running	Check one by one,change fan motor capacitor or pcb
10	Noise and vibration is existent during running.	electromagnetic noise from compressor.	Replace the compressor.
		resonance between the compressor and other parts.	Add bumper block or adjust the position
		The indoor and outdoor motor rusted or electromagnetic noise.	Replace the motor.

		The cross flow fan collides with the slot basis	Reconfigure.
		The noise of the refrigerant moving.	Readjust the position of the H&L pressure pipe.
		The screw of outdoor unit is loose and caused the noise and vibration.	Screw down this screw.
		The bearing of cross flow fan broke.	Replace the bearing.
		The cross flow fan collides with the foam or sponge	Reconfigure or cut out some foam or sponge
		The pipe of outdoor unit contact with crust	Adjust the pipes and keep them away more than 3" from the metallic or plastic parts
		The noise come from synchronous motor, stepper motor, capacitance, transformer, reactor.	Replace the faulted parts
		the indoor and outdoor air circulation channel is clogged, which generated noise.	Clear the sundries

		The fan damaged or bad fitting	Replace or reassemble

Temperature and resistance cross-references

celsius	Fahrenheit	Min (KΩ	Standard (KΩ)	Max (KΩ)	celsius	Fahrenheit	Min (KΩ)	Standard (KΩ)	Max (KΩ)
-30	-22	51.159	52.84	54.521	26	78.8	4.771	4.821	4.871
-29	-20.2	48.659	50.232	51.805	27	80.6	4.599	4.649	4.699
-28	-18.4	46.299	47.772	49.248	28	82.4	4.434	4.485	4.535
-27	-16.6	44.071	45.452	46.832	29	84.2	4.277	4.327	4.377
-26	-14.8	41.968	43.261	44.554	30	86	4.126	4.176	4.226
-25	-13	39.981	41.193	42.405	31	87.8	3.981	4.031	4.081
-24	-11.2	38.102	39.238	40.375	32	89.6	3.842	3.892	3.942
-23	-9.4	36.326	37.391	38.457	33	91.4	3.709	3.759	3.808
-22	-7.6	34.646	35.645	36.645	34	93.2	3.581	3.631	3.68
-21	-5.8	33.055	33.993	34.931	35	95	3.495	3.508	3.557
-20	-4	31.55	32.43	33.31	36	96.8	3.34	3.389	3.438
-19	-2.2	30.097	30.923	31.748	37	98.6	3.226	3.275	3.323
-18	-0.4	28.722	29.497	30.271	38	100.4	3.117	3.165	3.213
-17	1.4	27.42	28.147	28.873	39	102.2	3.012	3.06	3.107
-16	3.2	26.186	26.868	27.55	40	104	2.912	2.959	3.006
-15	**5**	**25.017**	**25.657**	**26.297**	**41**	**105.6**	2.815	2.861	2.908
-14	6.8	23.908	24.509	25.11	42	107.4	2.722	2.768	2.814
-13	8.6	22.857	23.421	23.985	43	109.2	2.633	2.678	2.724
-12	10.4	21.859	22.389	22.918	44	111	2.547	2.592	2.637
-11	12.2	20.912	21.409	21.907	45	112.8	2.464	2.509	2.553
-10	14	20.013	20.48	20.917	46	114.6	2.385	2.429	2.473
-9	15.8	19.116	19.584	20.023	47	116.4	2.308	2.352	2.395
-8	17.6	18.322	18.734	19.146	48	118.2	2.235	2.278	2.231
-7	19.4	17.54	17.927	18.314	49	120	2.164	2.207	2.249
-6	21.2	16.797	17.16	17.524	50	121.8	2.096	2.138	2.18
-5	23	16.09	16.431	16.733	51	123.6	2.03	2.071	2.112
-4	24.8	15.418	15.739	16.06	52	125.4	1.966	2.006	2.047
-3	26.6	14.779	15.08	15.382	53	127.2	1.904	1.944	1.984
-2	28.4	14.17	14.454	14.737	54	129	1.844	1.884	1.923
-1	30.2	13.591	13.857	14.124	55	130.8	1.787	1.826	1.865
0	**32**	**13.04**	**13.29**	**13.54**	**56**	**132.6**	1.732	1.77	1.809

1	33.8	12.505	12.739	12.974	57	134.4	1.679	1.717	1.754
2	35.6	11.995	12.215	12.436	58	136.2	1.628	1.665	1.702
3	37.4	11.509	11.717	11.924	59	138	1.579	1.615	1.652
4	39.2	11.047	11.241	11.436	60	139.8	1.531	1.567	1.603
5	41	10.606	10.789	10.971	61	141.6	1.485	1.521	1.556
6	42.8	10.186	10.357	10.529	62	143.4	1.441	1.476	1.511
7	44.6	9.785	9.945	10.107	63	145.2	1.399	1.433	1.467
8	46.4	9.403	9.554	9.705	64	147	1.357	1.391	1.425
9	48.2	9.038	9.18	9.322	65	148.8	**1.318**	**1.351**	**1.384**
10	50	8.69	8.823	8.956	66	150.6	1.279	1.312	1.344
11	51.8	8.357	8.482	8.607	67	152.4	1.242	1.274	1.306
12	53.6	8.04	8.157	8.274	68	154.2	1.206	1.237	1.269
13	55.4	7.736	7.816	7.957	69	156	1.171	1.202	1.233
14	57.2	7.446	7.55	7.653	70	157.8	1.137	1.168	1.199
15	59	7.169	7.266	7.363	71	159.6	1.105	1.135	1.165
16	60.8	6.9	6.991	7.082	72	161.4	1.074	1.103	1.133
17	62.6	6.644	6.729	6.814	73	163.2	1.043	1.072	1.101
18	**64.4**	**6.398**	**6.478**	**6.558**	**74**	**165**	1.014	1.043	1.071
19	66.2	6.163	6.238	6.313	75	166.8	0.986	1.014	1.042
20	68	5.938	6.008	6.078	76	168.6	0.959	0.986	1.014
21	69.8	5.723	5.789	5.854	77	170.4	0.932	0.959	0.986
22	71.6	5.517	5.578	5.64	78	172.2	0.907	0.933	0.96
23	73.4	5.32	5.377	5.484	79	174	0.882	0.908	0.934
24	75.2	5.131	5.185	5.238	80	175.8	0.858	0.884	0.91
25	77	4.95	5	5.05					

5. Unit Fault Codes

The units have a self diagnostic capability should certain faults occur with the system.
The Indoor unit will blink the run light a certain number of times to signify which fault have occurred.

LED		lamp display		failure	The reason of fault and solution
code	explain	code	说明 explain		
DF	display	flicker		defrost	Normal, the defrost

	at on state	1/1 SEC		indication	state is removed, it will return to normal condition automatically
FF	display at on state	flicker 1/1 SEC		Outdoor Low temperature indication	Normal, the unit will stop running when the outdoor temperature is below 14DegF
	display at on state	flicker 1/3 SEC		anti cold wind	1.Normal (during heating mode) 2.It will be removed when the coil pipe temperature sensor reaches certain temperature.
E1	display at off state		display at on/off state	Outdoor temp. sensor fault	1.Check whether the resistance of the sensor is normal, when it is abnormal the sensor should be replaced. 2.Check whether there is short circuit or open circuit in the wire of the sensor, and whether the plug is

					connected well, whether there is welding off or rosin joint on the electric control board, if there is any, it should be repaired. 3.When the 1 and 2 are both normal, then the components or integrated circuit is damaged, the electric control board should be replaced.
E2	display at off state	flicker 2/4 SEC	display at on/off state	room temp. sensor fault	1.Check whether the resistance of the sensor is normal, when it is abnormal the sensor should be replaced. 2.Check whether there is short circuit or open circuit in the wire of the sensor, and whether the plug is connected well, whether there is welding off or

					rosin joint on the electric control board, if there is any, it should be repaired. 3.When the 1 and 2 are both normal, then the components or integrated circuit is damaged, the electric control board should be replaced.
E3	display at off state	flicker 3/5 SEC	display at on/off state	coil temp. sensor fault	1.Check whether the resistance of the sensor is normal, when it is abnormal the sensor should be replaced. 2.Check whether there is short circuit or open circuit in the wire of the sensor, and whether the plug is connected well, whether there is welding off or rosin joint on the electric control board, if there is any, it should be repaired. 3.When the 1 and 2 are both

					normal, then the components or integrated circuit is damaged, the electric control board should be replaced.
E4	display at on/off state	flicker 4/6 SEC	display at off state	outdoor unit abnormal	1.Check whether the winding resistance and operation current of the compressor are normal. 2.Check whether the high and low pressure is normal when the unit is running. 3.Check (whether the coil pipe sensor is normal) whether the contact of the inserter on the circuit board is well, the coil pipe temperature sensor is fixed(whether there is water in the fixed clap), the evaporation of the indoor unit is well, the key is to check the evaporator temperature detected by the coil pipe

					temperature sensor has reached the cooling or heating temperature(whether the temperature is higher or equal to 77DegF in cooling mode). 4. Check whether the surface of the condenser is too dirty, it should be cleaned when it is too dirty. 5.Check whether the capacitance of the outdoor motor and the fan is damaged, it should be replaced when it is damaged. 6.If the above items are normal, the electric control board should be replaced.
E5	PG motor display at off state	flicker 5/7 SEC	display at off state	no feedback signal of indoor fan	1.Check whether two sets of plugs on the outlet end of the motor have loosed from the socket of the

					electric control board, insert it firmly when loosing. 2.Check whether the indoor motor has damaged, the motor should be replaced when it is damaged 3.Check whether the controllable silicon and other components on the electric control board have damaged, replace the controllable silicon or electric control board when they are damaged.
E6	PG motor display at off state	flicker 6/8 SEC	display at off state	no over zero signal	1.Firstly check whether the indoor fan is normal. 2.Check whether the signal outputting from the integrated chip of the electric control board is normal, the electric

					control board should be replaced when the signal is abnormal.
E7	display at off state	flicker 7/9 SEC	display at off state	outdoor feedback fault	1.Check whether the winding resistance and operation current of the compressor are normal 2.Check whether the high and low pressure is normal when the unit is running. 3.Check whether the indoor and outdoor wiring is right; when it is wrong, connect them again according to the circuit diagram 4 Check whether the contact of the inserter on the circuit board and the connection are well, otherwise repair. 5.Check whether the signal feedback wire is disconnected,

					replace or connect the signal feedback wire. 6.Check whether the supply power is phase-lacking or phase opposition. 7.Check whether the AC electromagnetic contactor is well. 8.Check whether the outdoor signal feedback wire in the terminal inserts firmly, which is between the indoor PCB and the display board
E8	display at off state	flicker 8/10 SEC	display at off state	frost protection/over heat protection	1.Check whether the filter of the indoor unit is dirty or blocked, and clean if it is dirty 2.Check whether the indoor fan is running normally, and replace the motor if it is abnormal. 3.Check whether indoor pipe

					temperature sensor is normal, and replace the sensor if it is abnormal. 4.Check whether the system pressure is normal, if abnormal, should check whether there is leakage, and fill the refrigerant again.

6.Maintenance

Mini Splits are very easy to maintain, in reality they are not very different to the maintenance on a Central A/C or Heat Pump system, and can be placed on a similar maintenance schedule with one major exception.

Filters & the Continuous Fan

All Mini Splits feature continuous Indoor fan operation when the unit is powered and turned on, the Indoor fan does not cycle with the compressor as is common with the standard “US style” systems.

The reason for this is:

While the system is on, the fan slowly moves air throughout the conditioned space, monitoring the temperature of the air returning to the fan coil. This action provides accurate temperature control and eliminates temperature and air stratification inside the room.

The system will quickly react to changes in temperature in the conditioned space, allowing a minimal temperature fluctuation and a more comfortable environment.

The energy use and wear on a constantly moving fan is less than a fan constantly starting and stopping. The additional cost per year is negligible.

It can be compared to a 40-watt light bulb being used all year (approximate cost per day of less than a quarter) to a 1/3 to ½ (500 to 750 watts) hp motor. (Which is started and stopped 4 to 6 times in an hour, consuming far more energy and costing more: 500W x 20minutes = 166W consumed per hour versus 40W for the DuctlessAire unit.

But the constant fan operation does have one drawback; the unit air filters work harder and therefore clog up faster than on a regular central unit.

Therefore DuctlessAire recommends that in ALL applications the 2 large Air Filters be cleaned **MONTHLY**.

This is very important, especially with the lower airflows of the DuctlessAire units any loss of airflow due to dirty or clogged filters can cause the unit to possibly freeze up the indoor coil or to cycle on the freeze protection thermostat.