



DUCTLESS MULTI-PORT SYSTEM

Installation, Service & Troubleshooting

Models:

MULTI18HP230V1A

MULTI24HP230V1A

MULTI30HP230V1A

MULTI36HP230V1A

MULTI42HP230V1A

Table of Contents

Safety Precautions & Warnings.....	3
Model Number Identification.....	4
Physical & Electrical Data.....	5 - 7
System Overview.....	8
Approved Combinations and Capacities.....	9 - 20
Refrigeration Cycles and Components.....	21 - 25
Indoor & Outdoor Components.....	26 - 28
Basic & Protection Functions.....	29 - 34
Remote Control Operation.....	35 - 38
Refrigerant Lines, Connection, Evacuating and Charging.....	39 - 42
Installation, Filter Maintenance and Emergency Operation.....	43 - 49
Electrical Schematics.....	50 - 54
Printed Circuit Boards.....	55 - 58
Troubleshooting Indoor Components.....	59 - 60
Troubleshooting Outdoor Components.....	61 - 70
Fault Codes & Status Displays.....	71 - 76
Troubleshooting Flow Charts.....	77 - 83
Error Code Flow Charts.....	84 - 105
Disassembly of Indoor Units.....	106 - 107
Disassembly of 18,000 btuh Outdoor Systems.....	108 - 113
Disassembly of 24,000 & 30,000 btuh Outdoor Systems.....	114 - 117
Disassembly of 36,000 btuh Outdoor Systems.....	118 - 120
Disassembly of 42,000 btuh Outdoor Systems.....	121 - 124
Appendix 1 - 3 Temperature Sensor Resistance Tables.....	125 - 130

Safety Precautions & Warnings



Warning

Installing, starting up, and servicing air conditioner can be hazardous due to system pressure, electrical components, and equipment location, etc. Only trained, qualified installers and service personnel are allowed to install, start-up, and service this equipment. Untrained personnel can perform basic maintenance functions such as cleaning coils. All other operations should be performed by trained service personnel. When handling the equipment, observe precautions in the manual and on tags, stickers, and labels attached to the equipment. Follow all safety codes. Wear safety glasses and work gloves. Keep quenching cloth and fire extinguisher nearby when brazing. Read the instructions thoroughly and follow all warnings or cautions in literature and attached to the unit. Consult local building codes and current editions of national as well as local electrical codes.

Recognize the following safety information:



Warning: Incorrect handling could result in personal injury or death.



Caution: Incorrect handling may result in minor injury, or damage to product or property.



Caution

- Never install the unit in a place where a combustible gas might leak, or it may lead to fire or explosion.
- Make a proper provision against noise when the unit is installed at a telecommunication center or hospital.
- Provide a GFIC circuit when the local or national electric code requires it.
- Never wash the unit with water.
- Handle unit transportation with care. Use two people when the weight exceeds the capacity for one person.
- Never touch the heat exchanger fins with bare hands, sharp edges could cause personal injury.
- Never touch the compressor or refrigerant tubing without proper hand protection.
- Do not operate the unit without the air filters in place.
- Should any emergency occur, stop the unit and disconnect the electrical supply.
- Properly insulate tubing running inside the room to prevent water damage from condensation.



Warning

All installation or repair work shall be performed by your dealer or a specialized subcontractor as there is the risk of fire, electric shock, explosion or injury



Warning

All electrical work must be performed by a qualified, licensed electrician according to local and national codes as well as the instructions provided in the manual.

- Before installing, modifying, or servicing the system, the main electrical disconnect must be off. There may be more than one disconnect switch. Lock out and tag switch with a suitable warning label.
- Never supply power to the unit unless all wiring and tubing are completed, reconnected and checked.
- This system adopts highly dangerous electrical voltage. Incorrect connections or inadequate grounding can cause personal injury or death. Refer to your local and national codes for proper grounding.
- Have the unit properly grounded with all connections tight. Loose connections can cause overheating and a possible fire hazard.



Warning

Pressurized Refrigerant

Personal injury could result in failure to follow this warning. System contain oil and refrigerant under high pressure, proper refrigerant handling techniques should be completed by a qualified technician.



Warning

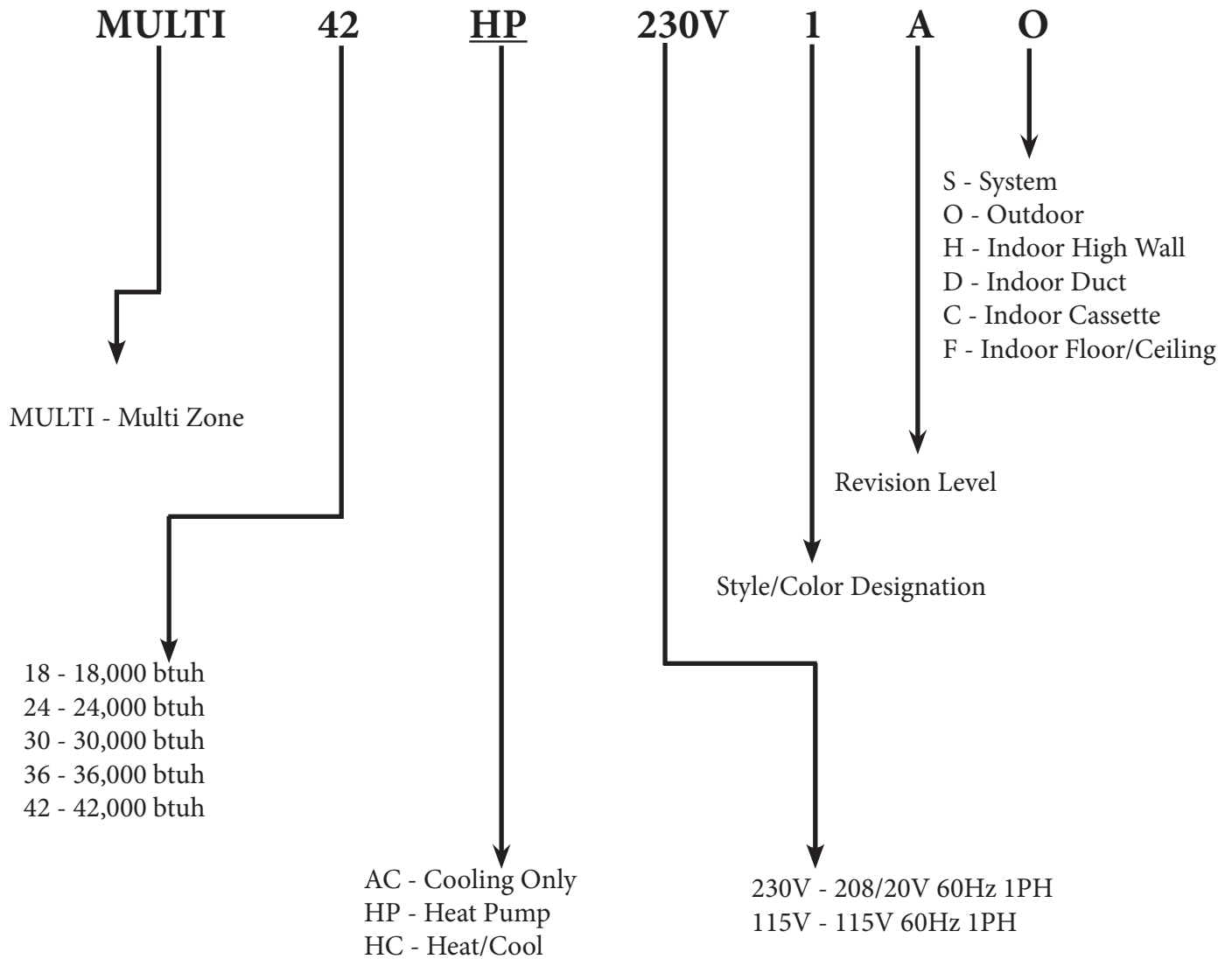
Live Electrical Components

Personal injury, property damage, or death could result in failure to follow this warning. Follow all electrical precautions when servicing this system, it may be necessary to service or troubleshoot with live electrical circuits. All work should be completed by a qualified technician.

Model Number Identification

Product Catalog Number-Nomenclature

Example MULTI42HP2301AO



Physical & Electrical Data, cont.

Model		MULTI18HP230V1A	MULTI24HP230V1A
System Type		Heat Pump	
Power Supply		208-230V / 60Hz	208-230V / 60Hz
Rated Current Cooling	Amps	7.6	13.5
Rated Current Heating	Amps	7.5	12.4
System Performance			
Cooling Cap (Min/Max)	Btu/h	18,000(7,000-21,000)	26,000(7,500-33,000)
Heating Cap (Min/Max)	Btu/h	19,000(8,530-22,600)	29,000(7,500-35,000)
Operating Range - Cooling	deg F	23 - 118	23 - 118
Operating Range - Heating	deg F	5 - 80	5 - 80
System Specifications			
Compressor Type		DC Inverter-driven Twin Rotary	
Sound Level	db	56	56
Unit Dimensions (WxHxD)	inches	35.4 x 23.5 x 14.9	37.2 x 27.6 x 15.6
Net/Gross Weight	lb	95 / 106	135 / 146
ID & OD Coil Type		Acrylic Resin / Anti-Corrosion Coated	
Max # Connectible Indoor Units		2	3
Refrigerant/Charge	oz	R410a / 47.6	R410a / 77.6
Port Size (Liquid - Suction)	inches	1/4" - 3/8"	1/4" - 3/8"
		1/4" - 3/8"	1/4" - 3/8"
			1/4" - 3/8"
Pre-Charged Lineset Ft.	Feet	33	98
Additional Refrigerant charge/additional feet	oz	0.2	0.2
Max. Total Piping Length	Feet	66	230
Max. Equivalent Length (Outdoor to last indoor unit)	Feet	33	66
Max. Elevation	Feet	33	66
MCA	Amps	13	20
MOP	Amps	20	30

Note: The manufacturer reserves the right to modify the design and/or change the specifications without notice. Please refer to specific installation manual for current information.

Physical & Electrical Data, cont.

Model		MULTI30HP230V1A	MULTI36HP230V1A
System Type		Heat Pump	
Power Supply		208-230V / 60Hz	208-230V / 60Hz
Rated Current Cooling	Amps	15.3	19.2
Rated Current Heating	Amps	12.6	15.8
System Performance			
Cooling Cap (Min/Max)	Btu/h	29,000 (7,500-34,000)	34,000 (8,530-34,120)
Heating Cap (Min/Max)	Btu/h	30,500 (7,500-36,000)	35,800 (10,663-40,944)
Operating Range - Cooling	deg F	23 - 118	23 - 118
Operating Range - Heating	deg F	5 - 80	5 - 80
System Specifications			
Compressor Type		DC Inverter-driven Twin Rotary	
Sound Level	db	56	57
Unit Dimensions (WxHxD)	inches	37.2 x 27.6 x 15.6	38.5 x 31.2 x 15
Net/Gross Weight	lb	153 / 165	161 / 172
ID & OD Coil Type		Acrylic Resin / Anti-Corrosion Coated	
Max # Connectible Indoor Units		4	4
Refrigerant/Charge	oz	R410a / 77.6	R410a / 102.2
Port Size (Liquid - Suction)	inches	1/4" - 3/8"	1/4" - 3/8"
		1/4" - 3/8"	1/4" - 3/8"
		1/4" - 3/8"	1/4" - 1/2"
		1/4" - 3/8"	3/8" - 5/8"
Pre-Charged Lineset Ft	Feet	131	131
Additional Refrigerant charge/additional feet	oz	0.2	0.2
Max. Total Piping Length	Feet	230	230
Max. Equivalent Length (Outdoor to last indoor unit)	Feet	66	82
Max. Elevation	Feet	66	82
MCA	Amps	26	28
MOP	Amps	45	45

Note: The manufacturer reserves the right to modify the design and/or change the specifications without notice. Please refer to specific installation manual for current information.

Physical & Electrical Data, cont.

Model	MULTI42HP230V1A	
System Type	Heat Pump	
Power Supply	208-230V / 60Hz	
Rated Current Cooling	Amps	19.5
Rated Current Heating	Amps	20.5
System Performance		
Cooling Cap (Min/Max)	Btu/h	41,000 (8,530 - 46,403)
Heating Cap (Min/Max)	Btu/h	44,500 (10,663 - 47,768)
Operating Range - Cooling	deg F	23 - 118
Operating Range - Heating	deg F	5 - 80
System Specifications		
Compressor Type	DC Inverter-driven Twin Rotary	
Sound Level	db	58
Unit Dimensions (WxHxD)	inches	40 x 43.5 x 17.4
Net/Gross Weight	lb	225 / 247
ID & OD Coil Type	Acrylic Resin/Anti-Corrosion Coated	
Max # Connectible Indoor Units	5	
Refrigerant/Charge	oz	R410a / 169.3
Port Size (Liquid - Suction)	inches	1/4" - 3/8"
		1/4" - 3/8"
		1/4" - 1/2"
		1/4" - 1/2"
		3/8" - 5/8"
Pre-Charged Lineset Ft	Feet	168
Additional Refrigerant charge/additional feet	oz	0.2
Max. Total Piping Length	Feet	262
Max. Equivalent Length (Outdoor to last indoor unit)	Feet	82
Max. Elevation	Feet	82
MCA	Amps	29
MOP	Amps	50

Note: The manufacturer reserves the right to modify the design and/or change the specifications without notice. Please refer to specific installation manual for current information.

Product Introduction

System Overview

The +MULTI Ductless split heat pumps are a multi zone unit available in size from 9000 btuh to 42,000 btuh providing heating and cooling. All comfort settings are controlled by a remote control. The +MULTI unit has many features to enhance comfort and efficiency. The operation of these features will be explained later in this service manual.

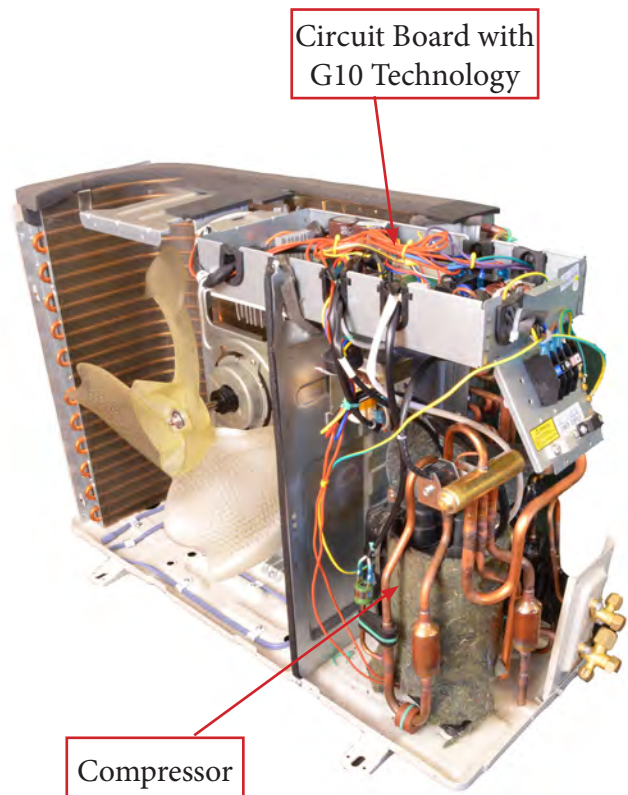
Superior inverter technology is used to control capacity while maintaining maximum efficiency. The +MULTI systems are equipped with G10 inverter technology providing precise control over the compressor frequency based on operating pressures and temperatures. Should an abnormal condition occur, the software will adjust the compressor frequency or shut down the system indicating the appropriate fault.

The indoor unit contains a digital display, which will indicate the current fault. The evaporator, swing motors, fan motors and circuit board are also components of the indoor unit. The indoor units have a bypass switch to bypass the remote control if lost or batteries fail. This will be explained later in this service manual.

The systems require R410A and are pre-charged for specific lineset length. Please refer to your installation manual for maximum pre-charge line length and additional charge for longer lineset lengths.

The maximum allowable line lift and distances vary by model, please refer to the charts in the manual for proper lineset applications.

The systems use a PVE oil and should require no additional oil. All +MULTI units utilize an Oil Return Mode which will return oil to the compressor should the need arise.



Product Introduction

Approved Combinations & Capacities

Matching combinations and capacities									
Outdoor Unit Model	+Multi	Cooling Capacity (Btu/h)				Heating Capacity (Btu/h)			
		Zone 1	Zone 2	Zone 3	Zone 4	Zone 1	Zone 2	Zone 3	Zone 4
MULTI18HP230V1AO									
9K+9K	Dual Zone	9,000	9,000			9,500	9,500		
9K+12K		9,000	12,000			9,500	13,000		
MULTI24HP230V1AO									
9K+18K	Dual Zone	8,400	16,600			9,000	18,000		
12K+12K		12,000	12,000			13,000	13,000		
12K+18K		10,000	15,000			11,200	16,800		
18K+18K		12,750	12,750			14,250	14,250		
9K+9K+9K	Tri Zone	8,667	8,667	8,667		9,667	9,667	9,667	
9K+9K+12K		8,000	8,000	10,000		9,000	9,000	11,000	
9K+9K+18K		7,000	7,000	12,000		6,000	6,000	17,000	
9K+12K+12K		6,000	10,000	10,000		6,000	11,500	11,500	
12K+12K+12K		8,667	8,667	8,667		9,667	9,667	9,667	
MULTI30HP230V1AO									
9K+12K+18K	Tri Zone	6,800	7,200	13,000		7,050	9,350	14,100	
12K+12K+12K		8,667	8,667	8,667		9,667	9,667	9,667	
12K+12K+18K		6,500	6,500	15,000		8,700	8,700	13,100	
9K+9K+9K+9K	Quad Zone	7,250	7,250	7,250	7,250	7,625	7,625	7,625	7,625
9K+9K+9K+12K		7,000	7,000	7,000	7,000	7,100	7,100	7,100	9,200
9K+9K+12K+12K		6,800	6,800	6,800	7,700	6,500	6,500	9,000	9,000
9K+9K+9K+9K	Quad Zone	8,359	8,359	8,359	8,359	10,031	10,031	10,031	10,031
9K+9K+9K+12K		7,506	7,506	7,506	10,918	9,008	9,008	9,008	13,102
9K+9K+9K+18K		6,824	6,824	6,824	12,283	8,189	8,189	8,189	14,740
9K+9K+12K+12K		6,824	6,824	9,895	9,895	8,189	8,189	11,874	11,874
9K+9K+12K+18K		6,312	6,312	8,871	12,283	7,575	7,575	10,645	14,740
9K+9K+18K+18K		5,459	5,459	11,260	11,260	6,551	6,551	13,512	13,512
9K+12K+12K+12K		7,848	8,530	8,530	8,530	9,417	10,236	10,236	10,236
9K+12K+12K+18K		6,142	7,506	7,506	12,283	7,370	9,008	9,008	14,740
12K+12K+12K+12K		8,359	8,359	8,359	8,359	10,301	10,031	10,031	10,031

Product Introduction

Approved Combinations & Capacities

MULTI36HP230V1AO (2 to3 indoor units) Cooling Performance Parameters						
Indoor units match	Total Capacity	Room A	Room B	Room C	Room D	Capacity (W) RATED
9+9	18	2500	2500	-	-	5000
9+12	21	2500	3600	-	-	6000
9+18	27	2200	4900	-	-	7100
9+21	30	2000	6000	-	-	8000
9+24	33	2000	6000	-	-	8000
12+12	24	3000	3000	-	-	6000
12+18	30	3100	4000	-	-	8000
12+21	33	3000	5000	-	-	8000
12+24	36	3000	5000	-	-	8000
18+18	36	4000	4000	-	-	8000
18+21	39	3600	4500	-	-	8000
18+24	42	3600	4500	-	-	8000
21+21	42	4000	4000	-	-	8000
21+24	45	4000	4000	-	-	8000
24+24	48	4000	4000	-	-	8000
9+9+9	27	2400	2400	2400	-	7200
9+9+12	30	2050	2150	3000	-	7200
9+9+18	36	2100	2100	4500	-	8700
9+9+21	39	1850	1850	5000	-	8700
9+9+24	42	1850	1850	5000	-	8700
9+12+12	33	2200	3250	3250	-	8700
9+12+18	39	1800	2950	3950	-	8700
9+12+21	42	1600	2350	4750	-	8700
9+12+24	45	1600	2350	4750	-	8700
9+18+18	45	1750	3450	3450	-	8700
9+18+21	48	1600	2650	4450	-	8700
9+18+24	51	1600	2650	4450	-	8700
9+21+21	51	1500	3600	3600	-	8700
12+12+12	36	2900	2900	2900	-	8700
12+12+18	42	2500	2500	3700	-	8700
12+12+21	45	2200	2200	4300	-	8700
12+12+24	48	2200	2200	4300	-	8700
12+18+18	48	2700	3600	3600	-	8700
12+18+21	51	1600	3100	4000	-	8700
18+18+18	54	2900	2900	2900	-	8700

Product Introduction

Approved Combinations & Capacities

MULTI36HP230V1AO (4 indoor units) Cooling Performance Parameters, cont.						
Indoor units match	Total Capacity	Room A	Room B	Room C	Room D	Capacity (W) RATED
9+9+9+9	36	2450	2450	2450	2450	9800
9+9+9+12	39	2200	2200	2200	3200	9800
9+9+9+18	45	2000	2000	2000	3600	9800
9+9+9+21	48	1800	1800	1800	4400	9800
9+9+9+24	51	1800	1800	1800	4400	9800
9+9+12+12	42	2000	2000	2900	2900	9800
9+9+12+18	48	1850	1850	2600	3600	9800
9+9+12+21	51	1600	1600	2700	3900	9800
9+9+18+18	54	1600	1600	3300	3300	9800
9+12+12+12	45	2300	2500	2500	2500	9800
9+12+12+18	51	1800	2200	2200	3600	9800
12+12+12+12	48	2450	2450	2450	2450	9800
12+18+18	48	2700	3600	3600	-	8700
12+18+21	51	1600	3100	4000	-	8700
18+18+18	54	2900	2900	2900	-	8700
9+9+9+9	36	2450	2450	2450	2450	9800
9+9+9+12	39	2200	2200	2200	3200	9800
9+9+9+18	45	2000	2000	2000	3600	9800
9+9+9+21	48	1800	1800	1800	4400	9800
9+9+9+24	51	1800	1800	1800	4400	9800

Product Introduction

Approved Combinations & Capacities

MULTI36HP230V1AO (2 to3 indoor units) Heating Performance Parameters						
Indoor units match	Total Capacity	Room A	Room B	Room C	Room D	Capacity (W) RATED
9+9	18	3250	3250	-	-	6500
9+12	21	3250	4680	-	-	7800
9+18	27	2860	6370	-	-	9230
9+21	30	2400	7200	-	-	9600
9+24	33	2400	7200	-	-	9600
12+12	24	3900	3900	-	-	7800
12+18	30	3720	4800	-	-	9600
12+21	33	3600	6000	-	-	9600
12+24	36	3600	6000	-	-	9600
18+18	36	4800	4800	-	-	9600
18+21	39	4320	5400	-	-	9600
18+24	42	4320	5400	-	-	9600
21+21	42	4800	4800	-	-	9600
21+24	45	4800	4800	-	-	9600
24+24	48	4800	4800	-	-	9600
9+9+9	27	2640	2640	2640	-	7920
9+9+12	30	2255	2365	3300	-	7920
9+9+18	36	2520	2520	5400	-	10440
9+9+21	39	2220	2220	6000	-	10440
9+9+24	42	2220	2220	6000	-	10440
9+12+12	33	2640	3900	3900	-	10440
9+12+18	39	2160	3540	4740	-	10440
9+12+21	42	1920	2820	5700	-	10440
9+12+24	45	1920	2820	5700	-	10440
9+18+18	45	2100	4140	4140	-	10440
9+18+21	48	1920	3180	5340	-	10440
9+18+24	51	1920	3180	5340	-	10440
9+21+21	51	1800	4320	4320	-	10440
12+12+12	36	3480	3480	3480	-	10440
12+12+18	42	3000	3000	4440	-	10440
12+12+21	45	2640	2640	5160	-	10440
12+12+24	48	2640	2640	5160	-	10440
12+18+18	48	3240	4320	4320	-	10440
12+18+21	51	1920	3720	4800	-	10440
18+18+18	54	3480	3480	3480	-	10440

Product Introduction

Approved Combinations & Capacities

MULTI36HP230V1AO (4 indoor units) Heating Performance Parameters, cont.						
Indoor units match	Total Capacity	Room A	Room B	Room C	Room D	Capacity (W) RATED
9+9+9+9	36	2940	2940	2940	2940	11760
9+9+9+12	39	2640	2640	2640	3840	11760
9+9+9+18	45	2400	2400	2400	4320	11760
9+9+9+21	48	2160	2160	2160	5280	11760
9+9+9+24	51	2160	2160	2160	5280	11760
9+9+12+12	42	2400	2400	3480	3480	11760
9+9+12+18	48	2220	2220	3120	4320	11760
9+9+12+21	51	1920	1920	3240	4680	11760
9+9+18+18	54	1920	1920	3960	3960	11760
9+12+12+12	45	2760	3000	3000	3000	11760
9+12+12+18	51	2160	2640	2640	4320	11760
12+12+12+12	48	2940	2940	2940	2940	11760
9+9+9+9	36	2940	2940	2940	2940	11760

Product Introduction

Approved Combinations & Capacities

MULTI42HP230V1AO (2 to3 indoor units) Cooling Performance Parameters							
Indoor units match	Total Capacity	Room A	Room B	Room C	Room D	Room E	Capacity (W) RATED
9+12	21	8530	11942	-	-	-	20472
9+18	27	7506	16719	-	-	-	24225
9+21	30	6824	20472	-	-	-	27296
9+24	33	6824	20472	-	-	-	27296
12+12	24	10236	10236	-	-	-	20472
12+18	30	10577	16719	-	-	-	27296
12+21	33	11942	20472	-	-	-	32414
12+24	36	10236	22178	-	-	-	32414
18+18	36	16207	16207	-	-	-	32414
18+21	39	14672	17742	-	-	-	32414
18+24	42	13989	18766	-	-	-	32755
21+21	42	16207	16207	-	-	-	32414
21+24	45	16036	16378	-	-	-	32414
24+24	48	16207	16207	-	-	-	32414
9+9+9	27	8189	8189	8189	-	-	24566
9+9+12	30	6995	7336	10236	-	-	24566
9+9+18	36	8018	8018	16378	-	-	32414
9+9+21	39	8359	8359	18766	-	-	35485
9+9+24	42	8189	8189	19107	-	-	35485
9+12+12	33	8530	10577	10577	-	-	29684
9+12+18	39	8530	10918	16036	-	-	35485
9+12+21	42	7848	9554	18084	-	-	35485
9+12+24	45	7848	9554	22178	-	-	39579
9+18+18	45	7165	15013	15013	-	-	37191
9+18+21	48	6824	13989	18766	-	-	39579
9+18+24	51	6824	13648	19107	-	-	39579
9+21+21	51	6142	16719	16719	-	-	39579
9+21+24	54	5971	16719	16889	-	-	39579
9+24+24	57	5800	16889	16889	-	-	39579
12+12+12	36	11771	11771	11942	-	-	35485
12+12+18	42	10918	10918	13648	-	-	35485
12+12+21	45	10236	10236	19107	-	-	39579
12+18+18	48	3240	4320	4320	-	-	10440
12+18+21	51	1920	3720	4800	-	-	10440
18+18+18	54	3480	3480	3480	-	-	10440

Product Introduction

Approved Combinations & Capacities

MULTI42HP230V1AO (2 to3 indoor units) Cooling Performance Parameters							
Indoor units match	Total Capacity	Room A	Room B	Room C	Room D	Room E	Capacity (W) RATED
9+12	21	8530	11942	-	-	-	20472
9+18	27	7506	16719	-	-	-	24225
9+21	30	6824	20472	-	-	-	27296
9+24	33	6824	20472	-	-	-	27296
12+12	24	10236	10236	-	-	-	20472
12+18	30	10577	16719	-	-	-	27296
12+21	33	11942	20472	-	-	-	32414
12+24	36	10236	22178	-	-	-	32414
18+18	36	16207	16207	-	-	-	32414
18+21	39	14672	17742	-	-	-	32414
18+24	42	13989	18766	-	-	-	32755
21+21	42	16207	16207	-	-	-	32414
21+24	45	16036	16378	-	-	-	32414
24+24	48	16207	16207	-	-	-	32414
9+9+9	27	8189	8189	8189	-	-	24566
9+9+12	30	6995	7336	10236	-	-	24566
9+9+18	36	8018	8018	16378	-	-	32414
9+9+21	39	8359	8359	18766	-	-	35485
9+9+24	42	8189	8189	19107	-	-	35485
9+12+12	33	8530	10577	10577	-	-	29684
9+12+18	39	8530	10918	16036	-	-	35485
9+12+21	42	7848	9554	18084	-	-	35485
9+12+24	45	7848	9554	22178	-	-	39579
9+18+18	45	7165	15013	15013	-	-	37191
9+18+21	48	6824	13989	18766	-	-	39579
9+18+24	51	6824	13648	19107	-	-	39579
9+21+21	51	6142	16719	16719	-	-	39579
9+21+24	54	5971	16719	16889	-	-	39579
9+24+24	57	5800	16889	16889	-	-	39579
12+12+12	36	11771	11771	11942	-	-	35485
12+12+18	42	10918	10918	13648	-	-	35485
12+12+21	45	10236	10236	19107	-	-	39579

Product Introduction

Approved Combinations & Capacities

MULTI42HP230V1AO (3 to 4 indoor units) Cooling Performance Parameters							
Indoor units match	Total Capacity	Room A	Room B	Room C	Room D	Room E	Capacity (W) RATED
12+12+24	48	10065	10065	19448	-	-	39579
12+18+18	48	9554	15013	15013	-	-	39579
12+18+21	51	9212	14330	16036	-	-	39579
12+18+24	54	9042	14160	16378	-	-	39579
12+21+21	54	8871	15354	15354	-	-	39579
12+21+24	57	8701	15183	15695	-	-	39579
12+24+24	60	8530	15525	15525	-	-	39579
18+18+18	54	13136	13136	13307	-	-	39579
18+18+21	57	12454	12454	14672	-	-	39579
18+18+24	60	12283	12283	15013	-	-	39579
18+21+21	60	12283	13648	13648	-	-	39579
21+21+21	63	13136	13136	13307	-	-	39579
9+9+9+9	36	8871	8871	8871	8871	-	35485
9+9+9+12	39	8189	8189	8189	10918	-	35485
9+9+9+18	45	7848	7848	7848	16036	-	39579
9+9+9+21	48	6995	6995	6995	18595	-	39579
9+9+9+24	51	6824	6824	6824	19107	-	39579
9+9+12+12	42	7165	7165	10577	10577	-	35485
9+9+12+18	48	6824	6824	10577	15354	-	39579
9+9+12+21	51	6142	6142	9895	17401	-	39579
9+9+12+24	54	6312	6312	9554	17572	-	39750
9+9+18+18	54	6483	6483	13307	13307	-	39579
9+9+18+21	57	6483	6483	11771	14842	-	39579
9+9+18+24	60	6142	6142	10407	16889	-	39579
9+9+21+21	60	5800	5800	13989	13989	-	39579
9+12+12+12	45	7848	10577	10577	10577	-	39579
9+12+12+18	51	7165	8701	8701	15013	-	39579
9+12+12+21	54	6483	8018	8018	17060	-	39579
9+12+12+24	57	6483	7933	7933	17231	-	39579
9+12+18+18	57	6483	8189	12454	12454	-	39579
9+12+18+21	58	6483	6824	11771	14501	-	39579
9+12+21+21	62	6142	6824	13307	13307	-	39579
9+18+18+18	63	5800	11260	11260	11260	-	39579

Product Introduction

Approved Combinations & Capacities

MULTI42HP230V1AO (5 indoor units) Cooling Performance Parameters							
Indoor units match	Total Capacity	Room A	Room B	Room C	Room D	Room E	Capacity (W) RATED
12+12+12+12	48	9895	9895	9895	9895	-	39579
12+12+12+18	54	8359	8359	8359	14501	-	39579
12+12+12+21	57	7506	7506	7506	17060	-	39579
12+12+12+24	60	7506	7506	7506	17060	-	39579
12+12+18+18	60	7848	7848	11942	11942	-	39579
12+12+18+21	63	6824	6824	11601	14330	-	39579
9+9+9+9+9	45	7916	7916	7916	7916	7916	39579
9+9+9+9+12	48	7421	7421	7421	7421	9895	39579
9+9+9+9+18	54	6824	6824	6824	6824	12283	39579
9+9+9+9+21	57	6483	6483	6483	6483	13648	39579
9+9+9+9+24	60	6483	6483	6483	6483	13648	39579
9+9+9+12+12	51	7165	7165	7165	9042	9042	39579
9+9+9+12+18	57	6483	6483	6483	8274	11857	39579
9+9+9+12+21	60	6483	6483	6483	7677	12454	39579
9+9+9+18+18	63	6483	6483	6483	10065	10065	39579
9+9+12+12+12	54	6483	6483	8871	8871	8871	39579
9+9+12+12+18	60	5971	5971	8018	8018	11601	39579
9+9+12+12+21	63	5971	5971	7506	7506	12624	39579

Product Introduction

Approved Combinations & Capacities

MULTI42HP230V1AO (2 to3 indoor units) Cooling Performance Parameters

Indoor units match	Total Capacity	Room A	Room B	Room C	Room D	Room E	Capacity (W) RATED
9+12	21	10663	14928	-	-	-	25590
9+18	27	9383	20899	-	-	-	30282
9+21	30	8530	25590	-	-	-	34120
9+24	33	8530	25590	-	-	-	34120
12+12	24	12795	12795	-	-	-	25590
12+18	30	13222	20899	-	-	-	34120
12+21	33	14928	25590	-	-	-	40518
12+24	36	12795	27723	-	-	-	40518
18+18	36	20260	20260	-	-	-	40521
18+21	39	18340	22178	-	-	-	40518
18+24	42	17487	23458	-	-	-	40944
21+21	42	20260	20260	-	-	-	40521
21+24	45	20046	20472	-	-	-	40518
24+24	48	20260	20260	-	-	-	40521
9+9+9	27	10236	10236	10236	-	-	30708
9+9+12	30	8745	9171	12795	-	-	30711
9+9+18	36	10024	10024	20472	-	-	40521
9+9+21	39	10451	10451	23458	-	-	44359
9+9+24	42	10236	10236	23884	-	-	44356
9+12+12	33	10663	13222	13222	-	-	37106
9+12+18	39	10663	13648	20046	-	-	44356
9+12+21	42	9810	11942	22605	-	-	44356
9+12+24	45	8929	10871	25239	-	-	45038
9+18+18	45	8155	17084	17084	-	-	42322
9+18+21	48	7766	15920	21356	-	-	45042
9+18+24	51	7766	15531	21741	-	-	45038
9+21+21	51	6988	19025	19025	-	-	45038
9+21+24	54	6793	19025	19220	-	-	45038
9+24+24	57	6599	19220	19220	-	-	45038
12+12+12	36	14716	14716	14928	-	-	44359
12+12+18	42	13648	13648	17060	-	-	44356
12+12+21	45	11649	11649	21741	-	-	45038
12+18+18	48	3240	4320	4320	-	-	10440
12+18+21	51	1920	3720	4800	-	-	10440
18+18+18	54	3480	3480	3480	-	-	10440

Product Introduction

Approved Combinations & Capacities

MULTI42HP230V1AO (2 to4 indoor units) Cooling Performance Parameters							
Indoor units match	Total Capacity	Room A	Room B	Room C	Room D	Room E	Capacity (W) RATED
12+12+24	48	11454	11454	22130	-	-	45038
12+18+18	48	10871	17084	17084	-	-	45038
12+18+21	51	10482	16306	18247	-	-	45035
12+18+24	54	10291	16111	18636	-	-	45038
12+21+21	54	10096	17473	17473	-	-	45042
12+21+24	57	9902	17278	17858	-	-	45038
12+24+24	60	9707	17667	17667	-	-	45042
18+18+18	54	14948	14948	15142	-	-	45038
18+18+21	57	14170	14170	16695	-	-	45035
18+18+24	60	13979	13979	17084	-	-	45042
18+21+21	60	13979	15531	15531	-	-	45042
21+21+21	63	14948	14948	15142	-	-	45038
9+9+9+9	36	11089	11089	11089	11089	-	44356
9+9+9+12	39	10236	10236	10236	13648	-	44356
9+9+9+18	45	8929	8929	8929	18247	-	45035
9+9+9+21	48	7960	7960	7960	21161	-	45042
9+9+9+24	51	7766	7766	7766	21741	-	45038
9+9+12+12	42	8957	8957	13222	13222	-	44356
9+9+12+18	48	7766	7766	12038	17473	-	45042
9+9+12+21	51	6988	6988	11260	19800	-	45035
9+9+12+24	54	7182	7182	10871	19994	-	45229
9+9+18+18	54	7377	7377	15142	15142	-	45038
9+9+18+21	57	7377	7377	13396	16889	-	45038
9+9+18+24	60	6988	6988	11843	19220	-	45038
9+9+21+21	60	6599	6599	15920	15920	-	45038
9+12+12+12	45	8929	12038	12038	12038	-	45042
9+12+12+18	51	8155	9902	9902	17084	-	45042
9+12+12+21	54	7377	9124	9124	19414	-	45038
9+12+12+24	57	7377	9028	9028	19609	-	45042
9+12+18+18	57	7377	9318	14170	14170	-	45035
9+12+18+21	58	7377	7766	13396	16500	-	45038
9+12+21+21	62	6988	7766	15142	15142	-	45038
12+12+24	48	10065	10065	19448	-	-	39579
12+18+18	48	9554	15013	15013	-	-	39579
18+18+18	54	3480	3480	3480	-	-	10440

Product Combinations and Capacities, cont.

Approved Combinations & Capacities

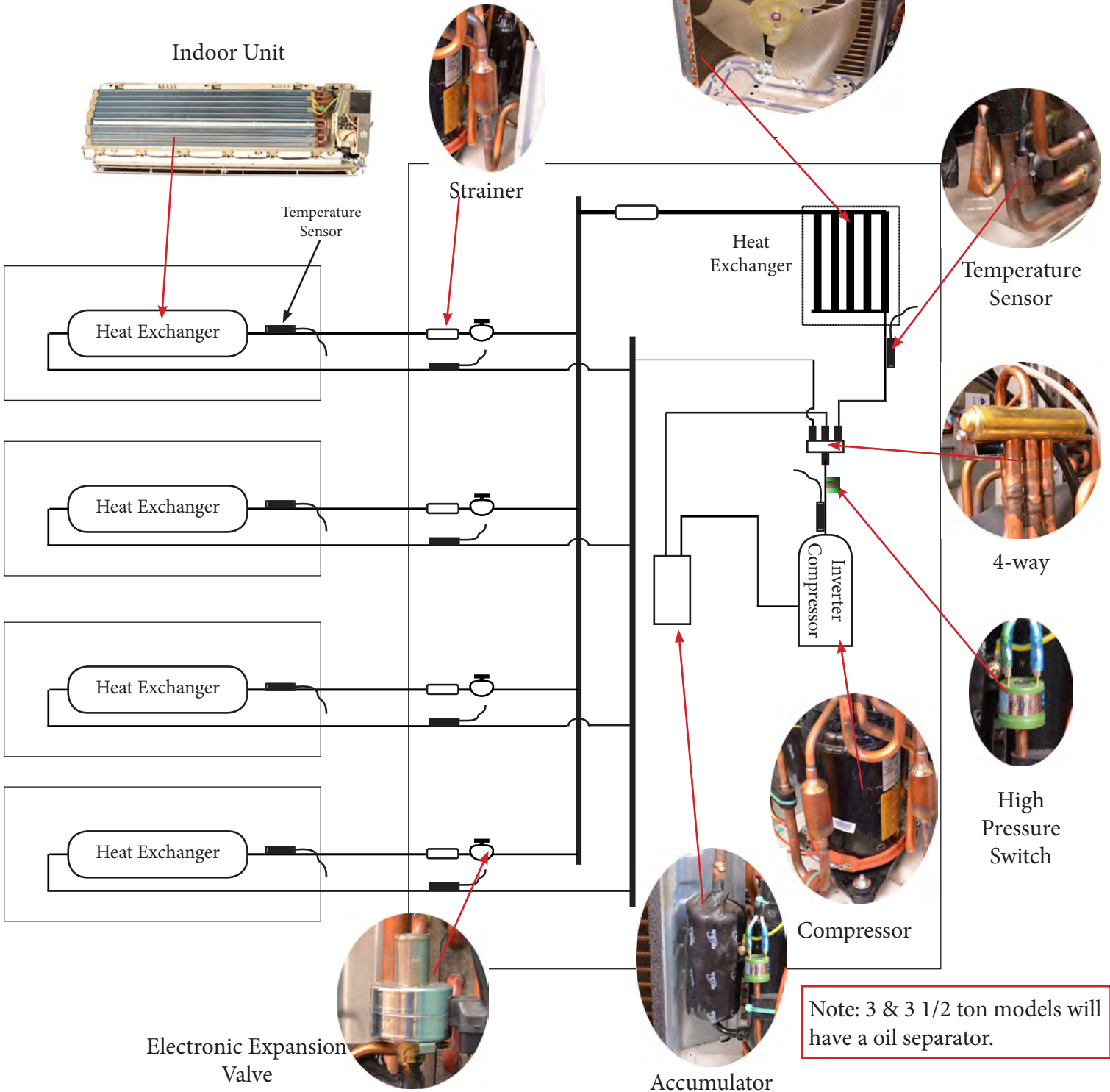
MULTI42HP230V1AO (4 to 5 indoor units) Cooling Performance Parameters							
Indoor units match	Total Capacity	Room A	Room B	Room C	Room D	Room E	Capacity (W) RATED
9+18+18+18	63	6599	12812	12812	12812	-	45035
12+12+12+12	48	11260	11260	11260	11260	-	45038
12+12+12+18	54	9513	9513	9513	16500	-	45038
12+12+12+21	57	8540	8540	8540	19414	-	45035
12+12+12+24	60	8540	8540	8540	19414	-	45035
12+12+18+18	60	8929	8929	13590	13590	-	45038
12+12+18+21	63	7766	7766	13201	16306	-	45038
9+9+9+9+9	45	9008	9008	9008	9008	9008	45038
9+9+9+9+12	48	8445	8445	8445	8445	11260	45038
9+9+9+9+18	54	7766	7766	7766	7766	13979	45042
9+9+9+9+21	57	7377	7377	7377	7377	15531	45038
9+9+9+9+24	60	7377	7377	7377	7377	15531	45038
9+9+9+12+12	51	8155	8155	8155	10291	10291	45045
9+9+9+12+18	57	7377	7377	7377	9414	13491	45035
9+9+9+12+21	60	7377	7377	7377	8735	14170	45035
9+9+9+18+18	63	7377	7377	7377	11454	11454	45038
9+9+12+12+12	54	7377	7377	10096	10096	10096	45042
9+9+12+12+18	60	6793	6793	9124	9124	13201	45035
9+9+12+12+21	63	6793	6793	8540	8540	14365	45032
9+12+12+12+12	57	7377	9414	9414	9414	9414	45032
9+12+12+12+18	63	6988	8639	8639	8639	12133	45038
12+12+12+12+12	60	9008	9008	9008	9008	9008	45038

Product Introduction

Refrigeration Components

Indoor Unit

Outdoor Unit

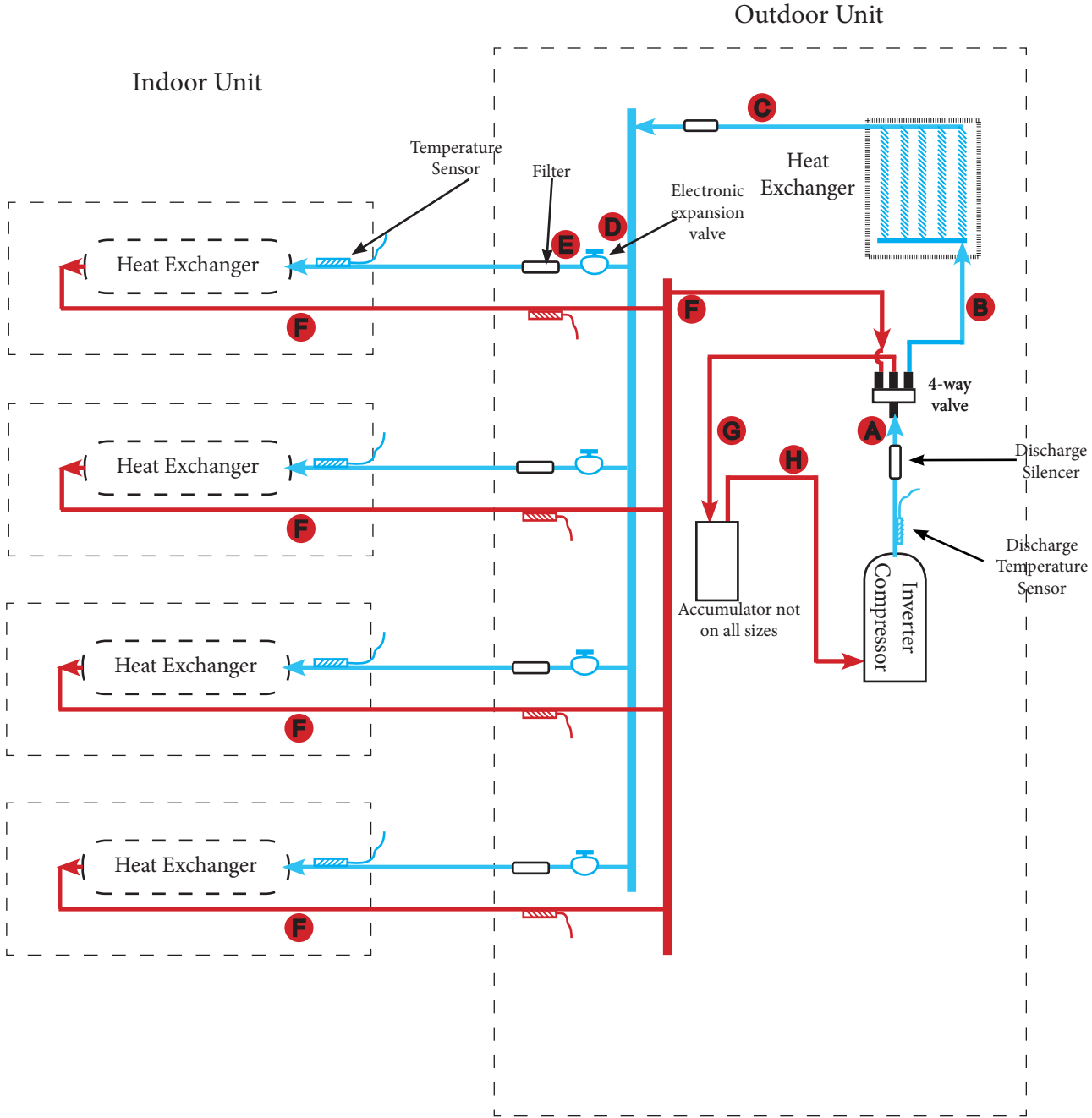


Note: 3 & 3 1/2 ton models will have a oil separator.

Note:
Component locations may vary depending on models.

Product Introduction

Cooling Mode



Product Introduction

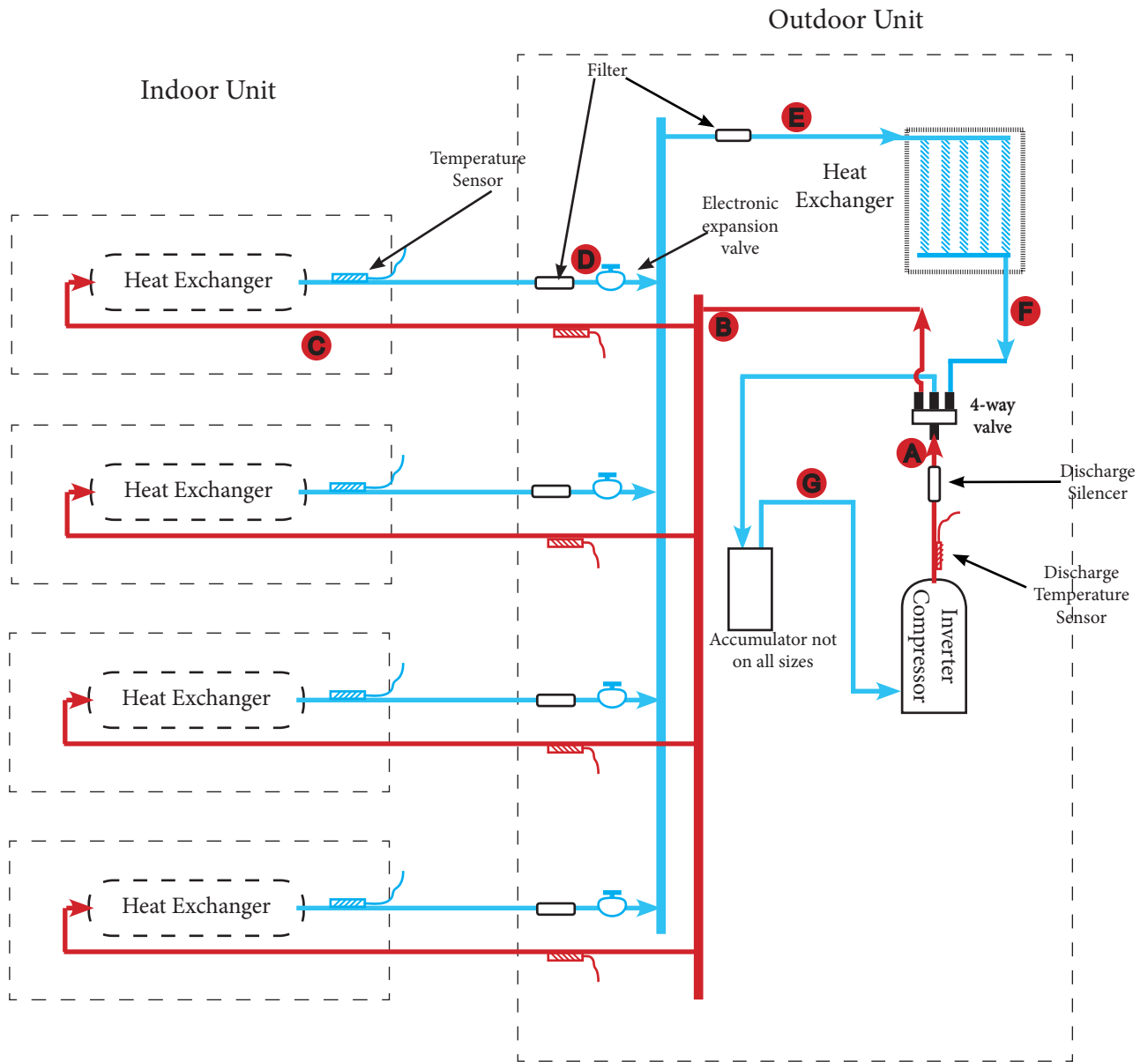
Cooling Mode

- A. Hot gas is discharged from the compressor. The temperature of the gas is monitored by the Discharge Temperature sensor and sent to the outdoor control panel.
- B. The hot gas is directed through the 4-way valve, then enters the outdoor coil. The hot gas will be slightly subcooled, however there are no pressure ports to take measurements.
- C. The subcooled liquid will enter the filter to remove contaminants.
- D. The subcooled liquid will enter the Electronic Expansion Valve (EEV) to the appropriate indoor unit and will regulate to about a 10 degree F superheat level. The EEV will adjust its flow based upon the temperature sensor readings. The adjustment process and compressor speed are controlled by the outdoor circuit board.
- E. The refrigerant leaving the EEV will be in a low pressure/temperature saturated state. This cold saturated refrigerant will move through the coil absorbing heat. This liquid will flash to a vapor and will be superheated to about 10 degrees F. Since this tubing is cold, it must be insulated.
- F. The superheated vapor will be returned to the outdoor unit's 4-way valve.
- G. The refrigerant will flow to the accumulator (not all models will have an accumulator) where liquid and vapor are separated.
- H. The refrigerant will flow to the compressor and complete another refrigeration cycle.

The control board will monitor the temperature and pressures and adjust the frequency of the compressor and flow rate of the EEV as needed. There are no pressure charts to evaluate temperature or pressures.

Product Introduction

Heating Mode



Product Introduction

Heating Mode

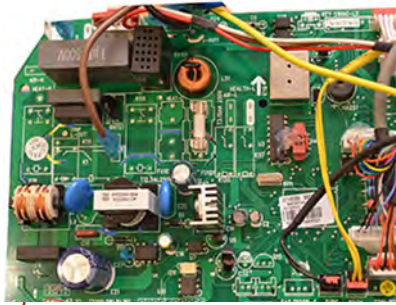
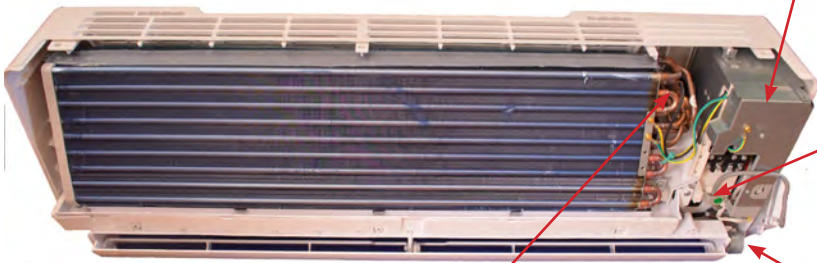
- A. Hot gas is discharged from the compressor. The temperature of the gas is monitored by the Discharge Temperature sensor and sent to the outdoor control panel.
- B. The hot gas is directed through the 4-way valve to the appropriate indoor coil making the line a hot gas line.
- C. The hot gas will enter the indoor coil and condense to a saturated mix as it travels through the coil and will be slightly subcooled.
- D. The refrigerant returns to the outdoor unit through the filter, then through the EEV reducing the refrigerant to a low pressure liquid and will maintain 10 degrees F of superheat.
- E. The cold refrigerant will travel through the outdoor coil (evaporator) and will pick up heat from the outdoor air. This will cause the cold saturated refrigerant to flash to a saturated mixture which will be superheated to 10 degrees F.
- F. The superheated vapor will travel through the 4-way valve to the accumulator which will prevent liquid floodback.
- G. The superheated gas will enter the compressor for another refrigeration cycle.

The control board will monitor the temperature and pressures and adjust the frequency of the compressor and flow rate of the EEV as needed. There are no pressure charts to evaluate temperature or pressures.

Product Introduction

Indoor Unit Components

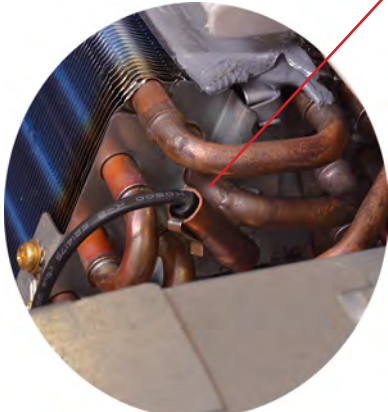
Evo+ 12,000 btuh model
Other Evo+ models may vary slightly.



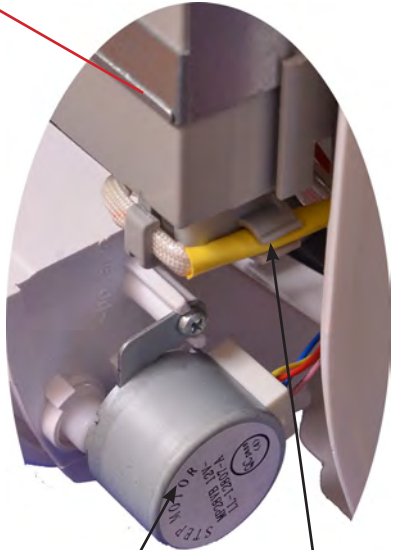
Indoor Circuit Board



Fan Motor



Indoor Tube Thermistor



Swing Motor

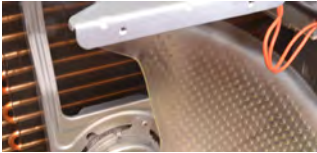
Ambient Temperature Sensor

Product Introduction

Outdoor Unit Components

+MULTI 24,000 btuh Outdoor Unit

Other +MULTI models may vary slightly.



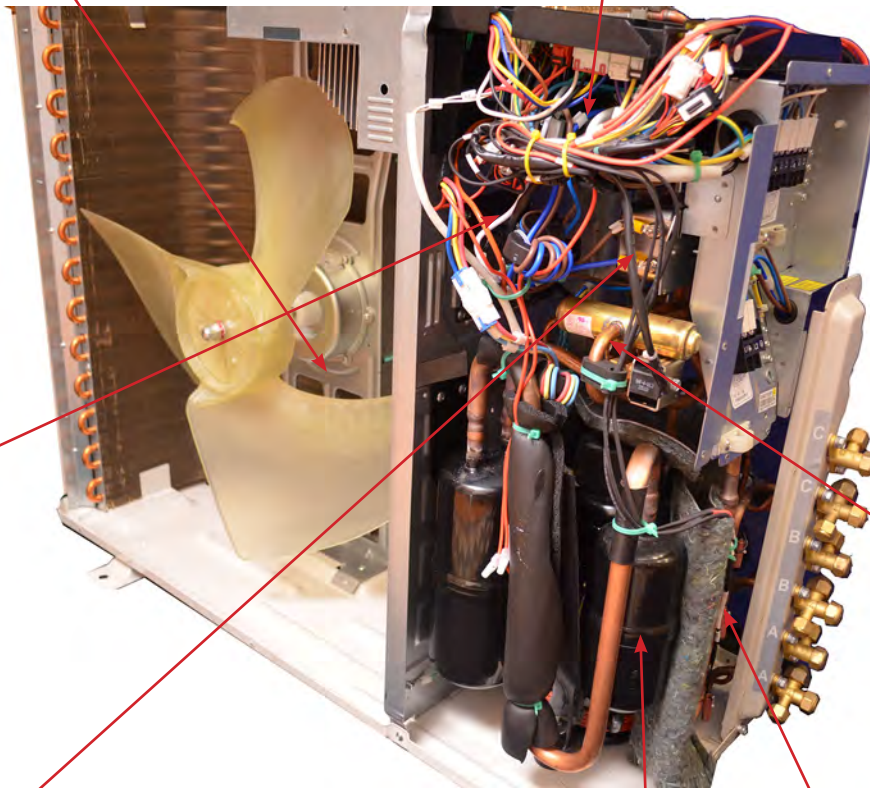
Outdoor Fan



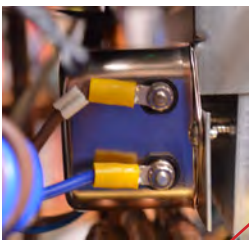
AP2 Board



Reactor



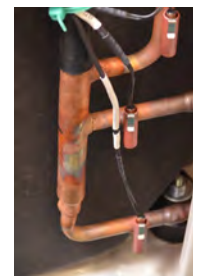
4-Way Valve



Line Filter



Compressor



Gas Valve Temp Sensors

Note;
Component locations may vary depending on models.

Product Introduction

Outdoor Unit Components



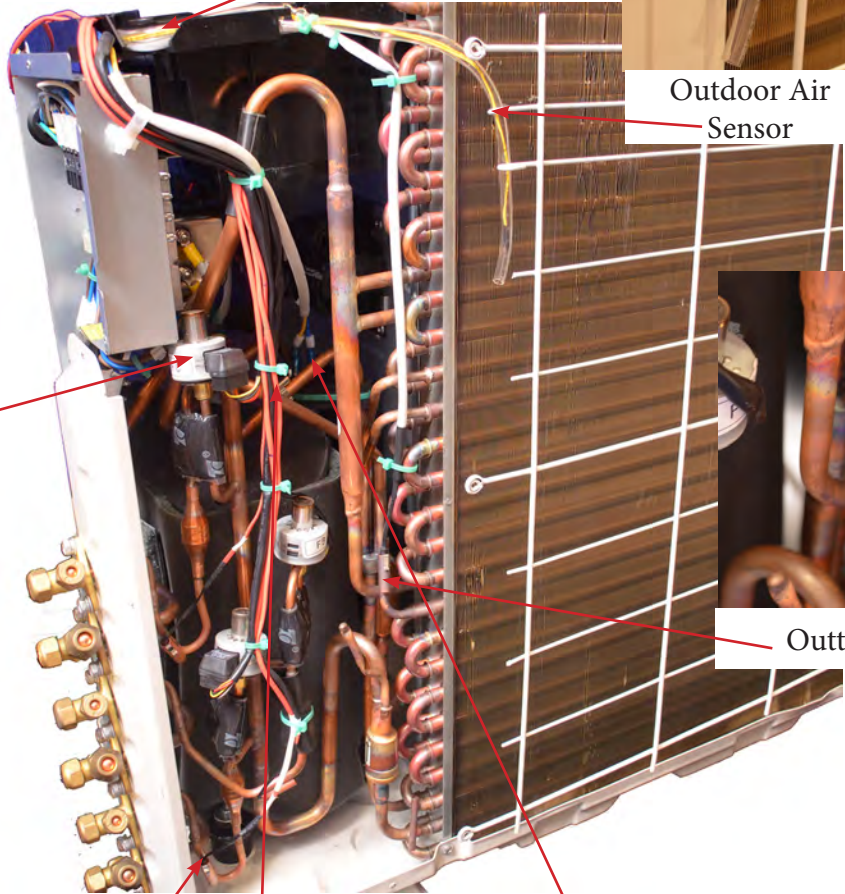
AP1 Board



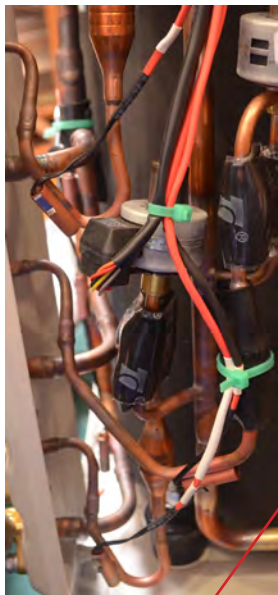
Outdoor Air Sensor



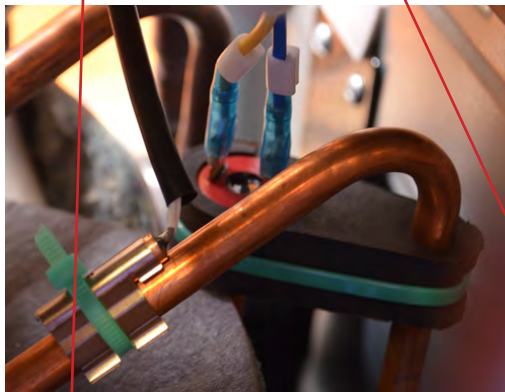
Electronic Expansion Valve



Outtube Sensor



Liquid Valve Temperature Sensors



High Pressure Switch

Discharge Temperature Sensor

Product Introduction

Basic Functions

The compressor should stay off for at least 3 minutes before starting the unit. The compressor circuit has a 3 minute delay if the compressor is de-energized during a run cycle. If the compressor starts from a de-energized cycle, there will be no time delay. The compressor has a minimum runtime of 6 minutes regardless of room temperature.

1) Cooling Mode

Cooling Process

When the indoor ambient rises 2° F above the preset temperature from a stopped state, the unit will start the cooling cycle. The outdoor fan and compressor will start. The indoor fan will run continuously at the selected speed. The outdoor unit will monitor the appropriate temperatures and pressure and adjust the compressor speed and the EEV as required. If the indoor ambient is > 2° F then the preset temperature, the compressor will increase the frequency; < 2° F the compressor will begin reducing the frequency. The EEV will be closed on indoor units with no cooling requirement. The G10 technology will control compressor speed based on indoor load and compressor amperage. When the indoor temperature is satisfied, the compressor will stop, then 60 seconds later the outdoor fan will stop. When the cooling mode transfers to heating mode, the 4-way valve will be energized after a two minute compressor delay.

Evaporator Freeze Protection

The software will monitor the indoor evaporator coil form freezing.

The following will occur 6 minutes after the compressor has been operating in the cooling or dry mode:

If the evaporator temperature drops below 36° F, the compressor will operate at a reduced frequency. If the evaporator is below 30° F for 3 minutes, the compressor will stop, 30 seconds later the outdoor fan will stop. In cooling mode, the indoor fan and swing motor will remain on. If the evaporator temperature is $\geq 50^\circ$ F and the compressor is off for at least 3 minutes, the compressor will resume its normal operation state.

Overcurrent Protection

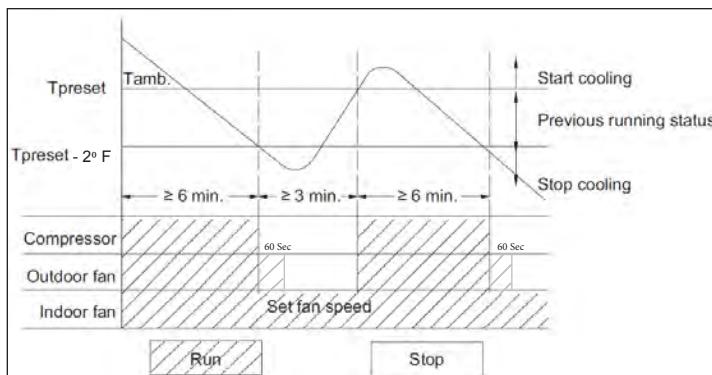
The software will monitor the compressor current to maintain it in a safety and reliable operating range.

If the total current is greater than the rating, the compressor will stop, the outdoor fan will continue to run for 60 seconds, then stop.

2) Dry Mode

Drying Process

This feature will not take the place of a dehumidifier, it is intended to dry the filter and slightly cool the air. If the indoor ambient temperature is greater than the preset temperature, the unit will enter the cooling and drying mode, in which case the compressor will operate and the indoor fan will run at a low speed. When the indoor ambient temperature is at or below the preset temperature, the unit will operate in its previous running state. When the indoor ambient drops to more than 2° F below the preset temperature the compressor will stop running, then 30 seconds later the outdoor fan will stop, the indoor fan will run at low speed.



Product Introduction

Basic Functions

3) Heating Mode

Heating Process

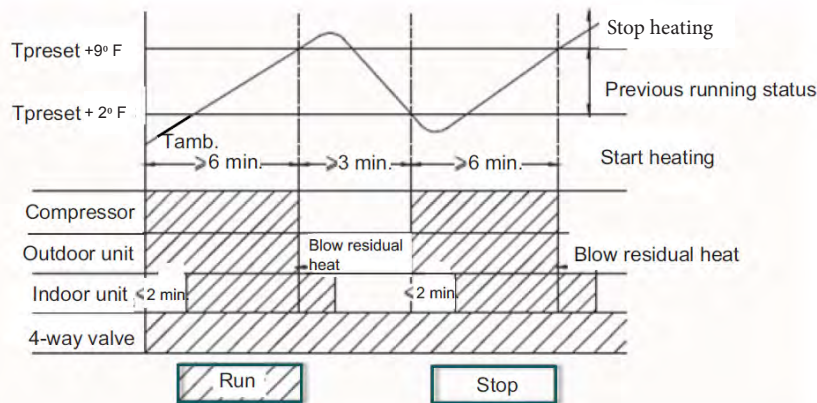
When the indoor ambient drops 2°F below the preset temperature, the unit will start the heating cycle. The outdoor fan, compressor and 4-way valve will operate. The indoor fan will operate in the “Cold Air Prevention” mode in which the indoor fan will have a 2 minute delay after the call for heating. The indoor evaporator coil temperature must reach 104°F before the indoor fan will start, this will prevent cold air from discharging from the indoor coil. When the indoor evaporator coil temperature is $> 104^{\circ}\text{F}$, the indoor fan will operate at low speed for 1 minute. With 1 minute of operation or 2 minutes of no fan operation and the indoor evaporator coil temperature is $> 108^{\circ}\text{F}$, the indoor fan will operate at its preset condition.

If the indoor ambient temperature is $< 9^{\circ}\text{F}$ and $> 2^{\circ}\text{F}$ of the preset temperature, the unit will run in its original mode of operation.

If the compressor is running and the mode is changed from heating to cooling, the compressor will stop, the 4-way valve will be de-energized 2 minutes later, the outdoor fan will stop after a 1 minute delay.

If the indoor ambient temperature is $\geq 9^{\circ}\text{F}$ than the preset temperature, the compressor will stop and the outdoor fan will stop after a 60 second delay. The indoor fan will continue to operate at its preset mode.

The G10 technology will determine compressor frequency based on ambient temperatures.



Product Introduction

Basic Functions

Defrost Process

You may force a defrost in heat mode by pressing the “+” and “-” buttons alternately three times within 5 seconds.

1) The unit will enter defrost when the following conditions are met:

- A. Outdoor ambient $\leq 41^{\circ}\text{F}$
- B. Compressor had accumulated more than 3 hours of operation in heating mode
- C. The outdoor coil $\leq 32^{\circ}\text{F}$

Note: The compressor runtime will be cleared when the outdoor ambient is $> 41^{\circ}\text{F}$ or when the compressor has started up after changing to cooling or drying mode and defrost has finished. The runtime will not be cleared when the unit has stopped after reaching the setpoint temperature, a protection fault or changing to fan mode.

There are 3 perimeters used in the defrost algorithms, Outdoor ambient ($T_{\text{outdoorambient}}$), Outdoor tube ($T_{\text{outdoor tube}}$) and a calculated $T_{\text{compensation}}$

$T_{\text{compensation}}$ is calculated by the following:

- D. After power-up, for the first defrost $T_{\text{compensation}} = 32^{\circ}\text{F}$
- E. $T_{\text{outdoor tube}} > 36^{\circ}\text{F}$ then $T_{\text{compensation}} = 32^{\circ}\text{F}$
- F. $T_{\text{outdoor tube}} \leq 36^{\circ}\text{F}$ then $T_{\text{compensation}} = 37^{\circ}\text{F}$

2) When heating has operated continuously for 45 minutes, or accumulated for 90 minutes, the unit will enter defrost mode in 3 minutes after meeting any of the conditions below:

- A. Outdoor ambient $\geq 41^{\circ}\text{F}$ and outdoor coil $\leq 28^{\circ}\text{F}$
- B. $28^{\circ}\text{F} \leq T_{\text{outdoorambient}} < 41^{\circ}\text{F}$, $T_{\text{outdoor tube}} \leq 21^{\circ}\text{F}$
- C. $23^{\circ}\text{F} \leq T_{\text{outdoorambient}} < 28^{\circ}\text{F}$ and $T_{\text{outdoor tube}} \leq 18^{\circ}\text{F}$
- D. $14^{\circ}\text{F} \leq T_{\text{outdoorambient}} < 23^{\circ}\text{F}$, $T_{\text{outdoor tube}} - T_{\text{compensation}} \leq (T_{\text{outdoorambient}} - 37^{\circ}\text{F})$

3) During defrost, if run time for the compressor does not reach 3 minutes, the defrost cycle will not start for the next 2 hours. At that time the compressor stops operation and 30 seconds later the outdoor fan will stop. 30 seconds after this the 4-way reversing valves will de-energized. Following another 30 second delay, the compressor will increase its compressor speed for defrosting. Defrosting will last for 450 seconds or until the $T_{\text{outdoor tube}} \geq 50^{\circ}\text{F}$, at this temperature the compressor will decrease its compressor speed for 30 seconds, then will stop. In another 30 seconds the 4-way valve will energize, the 60 seconds later the compressor and outdoor fan will start. The compressor speed for defrosting will be 85hz. During Defrost mode, a “H1” will be displayed on the indoor front panel display indicating the user selected mode has been overridden and the system is performing a outdoor coil defrost operation.

4) Defrost Sequence:

When a defrost condition has been met, the compressor will stop, all expansions valves will open fully, the outdoor fan will stop 40 seconds after the compressor stops. The 4-way valve will reverse direction (cooling mode), then the compressor will start and enter the defrost frequency. The control board along with ambient sensors will calculate defrost time.

5) Oil Return:

Oil return condition can be met if the unit operates at a low frequency for an extended time. The indoor display will indicate “H1” for this condition and is a normal procedure.

Product Introduction

Basic Functions

Cold Air Prevention (Heating mode with compressor running)

The system guards against discharging cold air in heating mode. It will delay the indoor fan until the evaporator coil has warmed up to discharge warm, comfortable air into the room.

1) When the $T_{\text{indoor,ambient}} < 75^{\circ}\text{F}$ and the $T_{\text{indoor,tube}} \leq 104^{\circ}\text{F}$ with the fan in a stopped state, the indoor fan will begin to run at low speed after a 2 minute delay. This will reduce cold air upon heating startup. Within 2 minutes, if $T_{\text{indoor,tube}} > 104^{\circ}\text{F}$, the indoor fan will run at low speed. After 1 minute of operation, the fan will run at the preset fan mode. Within 1 minute of low speed operation or 2 minutes of no fan operation, with the $T_{\text{indoor,tube}} > 108^{\circ}\text{F}$, the fan will run at the preset mode.

2) If the $T_{\text{indoor,ambient}} \geq 75^{\circ}\text{F}$ and the $T_{\text{indoor,tube}} \leq 108^{\circ}\text{F}$ the indoor fan will run at low speed for 1 minute than run at the preset mode. After 1 minute of low speed operation, if the and the $T_{\text{indoor,tube}} > 108^{\circ}\text{F}$ the fan will operate at its preset mode.

Note:

The $T_{\text{indoor,ambient}}$ in 1 & 2 above refers to the unit going into the heating mode coming out of defrost.

Overcurrent and Speed Protection (Total Current = I_{total})

The software will monitor the compressor current draw and adjust the compressor speed in order to maintain the inverter and compressor in a safety and reliable operating range.

- A. If $I_{\text{total}} \leq 6$, an increase in frequency will be allowed
- B. If $I_{\text{total}} \geq 7$, increasing the frequency is not allowed.
- C. If $I_{\text{total}} \geq 8$, the compressor will decrease its frequency
- D. If $I_{\text{total}} \geq 9$, the compressor will stop and the indoor fan will stop after 30 seconds.

4) Fan Mode

Under this mode, the fan will run at the preset speed and the outdoor fan, compressor and 4-way valve will stop.

5) Auto Mode

Auto Mode Process

Setting the auto mode will run the unit in heat or cool automatically depending on $T_{\text{indoor,ambient}}$

1) Operating Parameters

- A. If the $T_{\text{indoor,ambient}} \geq 79^{\circ}\text{F}$ the unit will operate in cooling mode. The set temperature is 77°F .
- B. If the $T_{\text{indoor,ambient}} \leq 72^{\circ}\text{F}$ the unit will operate in heat mode. The set temperature is 68°F .
- C. When the $T_{\text{indoor,ambient}} \leq 73^{\circ}\text{F}$ and $\geq 77^{\circ}\text{F}$, the unit will operate in the previous state. If it is energized for the first time, it will run in Fan mode
- D. In auto mode, the cooling frequency will be the same as the cooling only mode and the heating frequency will be the same as the heating only mode.

2) Protection

- A. In cooling operation, protection is the same as the cooling only mode
- B. In heating operation, protection is the same as the heating only mode
- C. When the indoor ambient temperature changes, the operation mode will be automatically selected. Once started the compressor will have a 6 minute runtime.

Product Introduction

Protection Functions

Common Protection Functions and Fault Displays

Coil High Temperature Protection

T_{tube} = measured temperature of outdoor coil in cooling mode, measured temperature of indoor coil in heating mode.

1) Outdoor Coil High Temperature Protection - *In cooling mode the software will monitor the outdoor coil for an abnormal high temperature condition.*

- A. If $T_{\text{tube}} \leq 126^{\circ}\text{F}$, the unit will return to its original operation state
- B. If $T_{\text{tube}} \geq 131^{\circ}\text{F}$, frequency rise is not allowed
- C. If $T_{\text{tube}} \geq 136^{\circ}\text{F}$, the compressor will run at reduced frequency
- D. If $T_{\text{tube}} \geq 144^{\circ}\text{F}$, the compressor will stop and the indoor fan will operate at preset speed

2) Indoor Coil Temperature Protection - *In heating mode the software will monitor the indoor coil for an abnormal high temperature condition.*

- A. If $T_{\text{tube}} \leq 122^{\circ}\text{F}$, the unit will return to its original operation state
- B. If $T_{\text{tube}} \geq 127^{\circ}\text{F}$, frequency rise is not allowed
- C. If $T_{\text{tube}} \geq 133^{\circ}\text{F}$, the compressor will run at reduced frequency
- D. If $T_{\text{tube}} \geq 140^{\circ}\text{F}$, the compressor will stop and the indoor fan will blow residual heat and then stop

3) Compressor Discharge Temperature Protection

The software will monitor the compressor discharge for an abnormal high temperature condition.

- A. If $T_{\text{tube}} \geq 208^{\circ}\text{F}$, frequency rise is not allowed
- B. If $T_{\text{tube}} \geq 217^{\circ}\text{F}$, the compressor will run at reduced frequency
- C. If $T_{\text{tube}} \geq 230^{\circ}\text{F}$, the compressor will stop
- D. If $T_{\text{tube}} \leq 194^{\circ}\text{F}$ and the compressor has been off for at least 3 minutes, the compressor will resume operation

4) Compressor High Pressure Protection

When the high pressure switch is detected for 6 seconds or more, the compressor will stop and can only be started by powering off the unit. Dirty coils, refrigerant overcharge and outdoor fan problems can cause this fault.

5) Compressor Phase-lacking Protection

If one of the compressor phases are detected open before startup, the compressor will enter phase-locking protection. The malfunction will be cleared after 1 min, then the unit will try a restart. If an error has been detected for 6 times continuously, the compressor will lock out and will need to have power cycled. The errors will be cleared after the compressor has run for 7 minutes continuously.

6) Module Protection (IPM)

Under module protection mode, the compressor will stop. When the compressor remains off for 3 minutes, the compressor will resume operation. If the module protection occurs six time in succession, the compressor will remain off. Power will need to be cycled to start unit. This is a thermal protection for the indoor module.

7) DC Buss Voltage Protection

The software will monitor the DC bus voltage.

If voltage on the DC Bus is below 150 or over 420v, the compressor will stop and the outdoor fan will stop in 30 seconds. When the voltage on the DC bus returns to normal and the compressor has been off for 3 minutes, the compressor will resume its operation.

Product Introduction

Protection Functions

8) Mode Conflict Protection of Indoor Unit

The first indoor unit calling for a comfort mode (heating or cooling) will be the basic call. If another indoor unit calls for the opposing comfort mode, the first unit will be satisfied before switching to another mode.

9) Communication Fault

If the unit fails to receive correct signals for a 3 minutes, communication fault will occur and the whole system will stop and a “E6” will be displayed on the front panel of the indoor unit.

Remote Control Operation

Remote Buttons



Note:

This remote control is used in other models and some features may or may not be available. Consult the owners manual for specific features for your model. There should be no obstructions between the remote control and the indoor unit for proper operation. Keep the remote from direct sunlight or any source that generates heat, keep clean and dry. Change batteries frequently.

Note:

For detailed explanation of the functions, refer to the “Other Controls” section of this manual for your model.

Button Identification

The function and operation of each button will be explained later in this manual under Product Functions.

1. On/Off button
2. Lower Temperature Setting
3. Raise Temperature Setting
4. Fan Button
5. Mode Button
6. IFeel Button, Senses ambient temperature at remote control location.
7. Function Not Available
8. Function Not Available
9. Clock Button
10. X-Fan Button
11. Turbo Fan Button
12. Timer On Button
13. Temp Button
14. Sleep Button
15. Swing Angle Button
16. Timer Off Button
17. Light Button

Press 9 & 10 for Energy Saving Mode

Press - & + to lock control

Remote Control Operation

Display Icons

1. IFeel
2. Auto Mode
3. Cool Mode
4. Dry Mode
5. Fan Mode
6. Heat Mode
7. Sleep Mode
8. Quiet Mode
9. X-Fan Mode
10. Turbo Mode
11. Timer On
12. Temperature Setting Display
13. Swing Display
14. Light Display
15. Lock Display
16. Digital Display
17. Set Time Display
18. Fan Speed Display
19. Not Used
20. Clock Icon



Replacing Batteries:

1. Locate the battery cover on the back of the remote.
2. Remove the small screw at the bottom of the cover.
3. Slide the cover downward.
4. Replace with two "AAA" batteries.
5. Replace cover and screw.



Product Introduction

Remote Control Functions

1) On/Off

The on-off state will change with each button press.

2) Lower Temperature Setting

Each time you press the “TEMP-” button the temperature setting will decrease by 1° F. The temperature range is 61° F - 86° F. In Auto Mode this button will not function.

3) Raise Temperature Setting

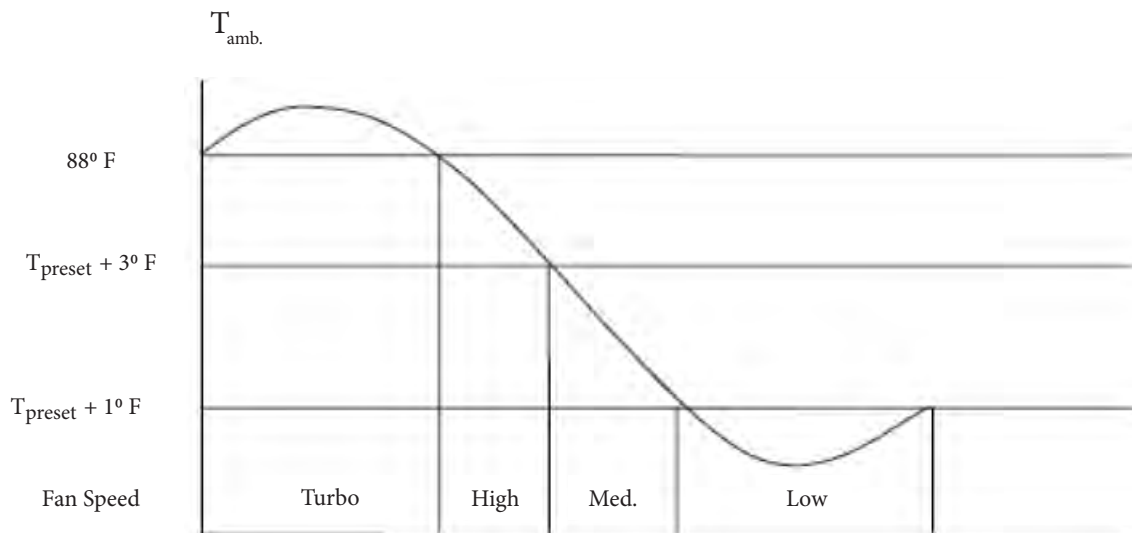
Each time you press the “TEMP+” button the temperature setting will raise by 1° F. The temperature range is 61° F - 86° F. In Auto Mode this button will not function.

4) Fan Switch

The fan switch will adjust the fan speed between Auto, Low, Medium and High.

5) Mode Selection

Press the “Mode” button to change from Auto, Cool, Dry, Fan or Heat Pump



6) IFeel

IFeel button senses the room temperature surrounding the remote every 10 minutes, adjusting the airflow and indoor temperature for maximum comfort and energy savings.

7) Function Not Used

8) Function Not Used

9) Clock

Press once to set clock. 24-hour format, use the “+” or “-” button to increase or decrease the time.

Product Introduction

Remote Control Functions

10) X-Fan

Allows fan to run after cooling cycle to dry off the coil and inhibit the growth of bacteria and mildew. Works with “Auto” mode.

11) Turbo Fan

Boost the cooling or heating airflow, allowing the unit to reach the preset temperature in the shortest amount of time.

12) Timer On Button

Press the “Timer-On” button once to set mode on time, press again to save setting. Holding the “+” or “-” button down will rapidly change the time in 10 minute intervals.

13) Temp Button

Toggles the display between set temperature, indoor temperature and outdoor temperature.

14) Sleep Button

Sets sleep mode function, see owners manual for specific model information

15) Swing Angle Button

Controls the angle of the louvers for the convenient adjustment of airflow

16) Timer Off Button

Press the “Timer-Off” button once to set mode off time, press again to save setting. Holding the “+” or “-” button down will rapidly change the time in 10 minute intervals.

17) Light Button

Turns the light on the indoor display on and off.

18) Auto Button (Manual Override) - *Located on indoor unit.*

In the event the controller is missed placed or the batteries are defective, this will override the remote controller. If the controller is on, pressing this button will stop it, if it is off, pressing the button will turn the controller on. When turning the controller on, the swing and light will be on and the unit will run in Auto Mode.



Refrigerant Lines Connection, Evacuating and Charging

Refrigerant Lines Preparation & Connection

The refrigerant lines should be kept sealed until ready to be connected. Follow the following steps to insure a quality leak proof installation:

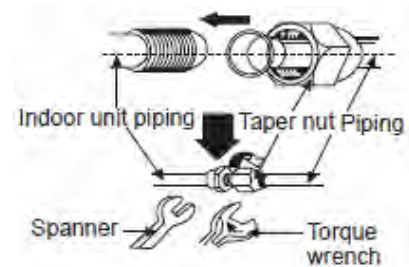
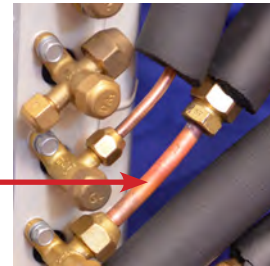
Step 1. Refrigerant Line Connection

Carefully bend and cut the tubing to prepare for flaring. Use a flaring tool designed for R410a, following the recommended manufacturer's procedure. Tighten the flare nut to the indicated torque by using a spanner wrench and a torque wrench. Connect the indoor unit first, then the outdoor unit. Use the 3/8" to 1/2" flare adapter if needed.

Note:

Over tightening flare nuts may damage flare connections and may cause leaks.

Tubing Size	Torque (foot-pounds)	Torque (inch-pounds)
1/4"	10-13	124-159
3/8"	25-31	301-372
1/2"	36-45	434-540
5/8"	50-60	602-726



Step 2. System Leak Check

Refrigerant lines should be pressurized prior to evacuating system to check for leaks.

Use only dry nitrogen with a pressure regulator for pressurizing unit. Pressurize with 150 psi of dry nitrogen. Apply soap and water to check whether the joints are leaky. A leak detector may also be used for a leakage test.

Hint:

You may want to perform leak testing and evacuation before wiring to save time, electrical connections can be completed while your vacuum pump is running.



Step 3. System Evacuation

Note: The outdoor unit contains a refrigerant charge, leave liquid and gas valves closed.

1. After no leaks have been detected, connect a vacuum pump to the outdoor unit.
2. Connect appropriate hoses to manifold gauge, vacuum pump and unit refrigeration connections.
3. Evacuate the system until the micron gauge reads no higher than 350 microns.
4. Close valve to vacuum pump; if pressure does not rise above 500 microns after one minute, the evacuation should be complete.
5. If it does rise, check for leaks and/or evacuate longer.
6. For refrigerant lines longer than 25 feet, refer to installation instructions chart included with the unit installation manual for additional charge.



Refrigerant Charging Procedure

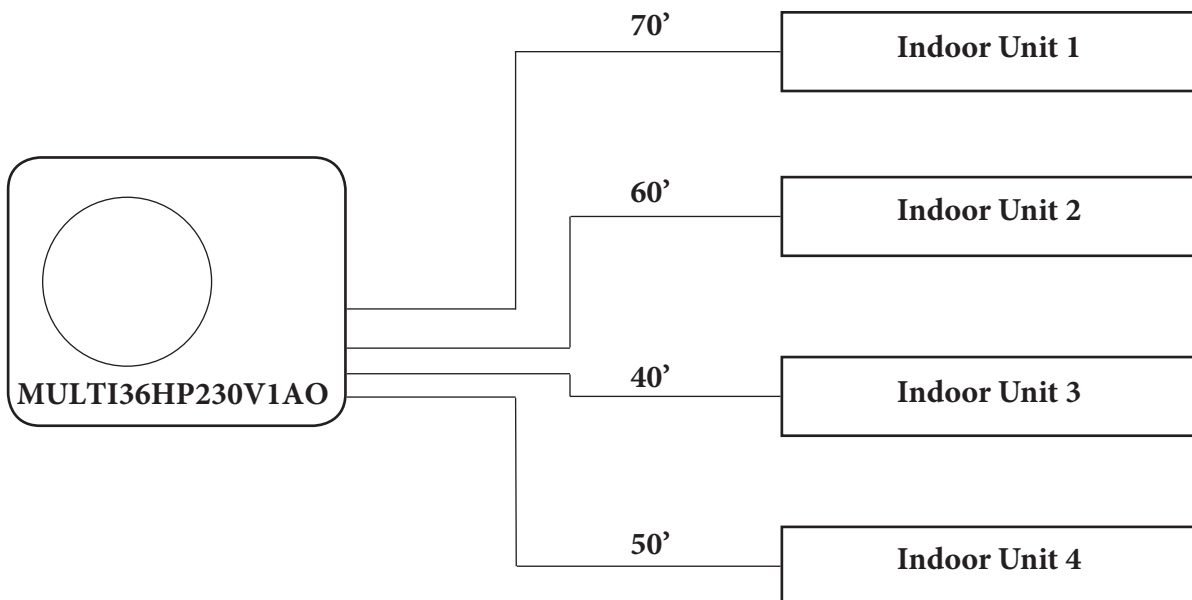
Please refer to your units installation manual for proper charge. If your lineset exceeds the chart below for your model, additional charge may be required. The charge must be weighed in with a refrigerant charging scale. **You can only add additional refrigerant to a new installation. If a low or high charge is suspected, you must reclaim the refrigerant, then weigh in the correct amount per specifications including any additional for long linesets. It is important to check for leaks before adding refrigerant.**

1. Determine additional refrigerant charge.

The +MULTI multi zone units contain a factory charge adequate for up to a total length of refrigerant line as indicated in the chart below. Additional refrigerant will need to be added for total lengths over the listed length.

Confirm the following chart with your installation manual for additional charge amounts:

	MULTI18 HP230V1AO	MULTI24 HP230V1AO	MULTI30 HP230V1AO	MULTI36 HP230V1AO	MULTI42 HP230V1AO
Additional Charge	0.2 oz./ft.	0.2 oz./ft.	0.2 oz./ft.	0.2 oz./ft.	0.2 oz./ft.
Max Length without Additional Charge	33ft	98 ft	131 ft	131 ft	164 ft
Factory Charge	48 oz.	78 oz.	78 oz.	102 oz.	169 oz.



Example:

Model MULTI36HP230V1AO

70 ft. + 60 ft. + 40 ft. + 50 ft. = 220 ft. Total Line Length

220 ft. - 131 ft. = 89 ft. Additional Line Length

89 ft. x 0.2 oz = 17.8 ounces of additional charge

Record the amount of additional charge for future reference.

Refrigerant Charging Procedure

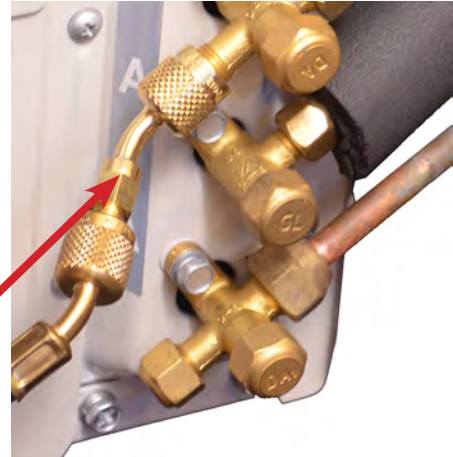
2. Leak Testing

Follow the procedures for leak testing with nitrogen prior to adding charge on a new installation or existing one suspected for leaks. See preceding page.

3. Attach hoses to the unit and vacuum pump

5/16" x 1/4" adapter may be required to connect hose to port.

Check to insure that the liquid and gas valves are closed on the unit. Close all valves on your gauge set, then connect the vacuum pump to your gauge set. Pump down lineset and indoor unit. This step will be repeated for all zones.



4. Zero charging scale

Place the refrigerant tank on the charging scale. Open the tank valve, turn on the scale, then zero the scale.



Refrigerant Charging Procedure, cont.

5. Begin adding additional refrigerant

Charging should be completed with the unit off (not running) and through the liquid side with liquid refrigerant. If there are no ports on the liquid side, use the gas side port connection, charging with liquid.

Record the amount of additional charge for future reference.



6. Charge to the correct weight

If the scale was zeroed with the refrigerant tank on the scale, the amount added to the system will be a negative amount since it was removed from the tank. After the proper amount of refrigerant has been weighed in, close the manifold valve.



7. Remove refrigerant tank

Close the tank valve, then carefully remove the hose and adapter. Replace the charging port cap back on the outdoor unit valves. On new installations, open all liquid and vapor service valves.



Installation

Proper installation site is vital for correct and efficient operation of the unit. Avoid the following sites where:

- Strong heat sources, vapors, flammable gas or volatile liquids are emitted.
- High-frequency electro-magnetic waves are generated by radio equipment, welders and medical equipment.
- The air is contaminated with industrial vapors and oils.
- The air contains sulfurous gas such as in hot spring zones.
- Poor air quality exists.

Indoor Unit



The air inlet and outlet should be away from any obstructions. Ensure the air will easily circulate through the entire room.

1. Select a site where the condensate can be easily routed or consider a condensate removal pump.
2. Select a place where it is out of reach of children.
3. Select a place that has adequate mounting structure, strong enough to withstand the full weight and vibration of the unit.
4. Be sure to leave enough space to allow access for routine maintenance. Refer to unit installation specifications for clearances. Select a place more than 3 feet away from any TV or other electrical appliances

Outdoor Unit



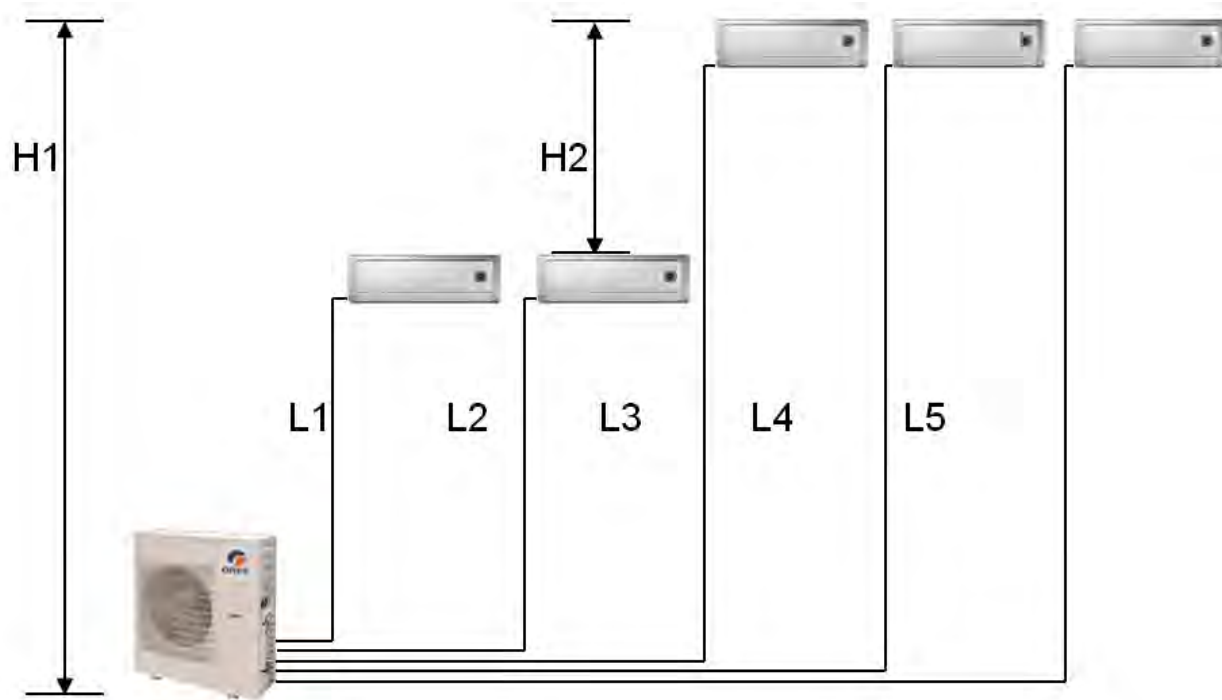
1. Select a suitable site where proper drainage will occur.
2. Select a site where there is sufficient ventilation.
3. Select a site where there is no obstruction blocking the inlet and outlet.
4. The site should be able to withstand the full weight of the unit.
5. Try to limit expose to direct sunlight or strong winds.
6. Make sure that the outdoor unit is installed in accordance with the installations instructions, and is convenient for maintenance and repair.
7. Refer to your outdoor unit installation manual for maximum lineset lengths and heights. This could be a factor in determining outdoor location.
8. Select a place where it is out of reach of children.
9. Install Heat Pump legs to allow for proper drainage.
10. Install drain fitting in bottom of outdoor unit



Installation

Lineset Limitations

Use this information for as guide only, please refer to the installation manual for your model.



Model	Total Line Length (TTL)	Max Line Run (TEL)	Max Height (Outdoor to Indoor H1)	Max Height (Indoor to Indoor H2)
MULTI18HP230V1AO	66	33	16	16
MULTI24HP230V1AO	230	66	33	25
MULTI30HP230V1AO	230	66	33	25
MULTI36HP230V1AO	230	82	50	25
MULTI42HP230V1AO	262	82	50	25

Installation

Mounting Plate Installation

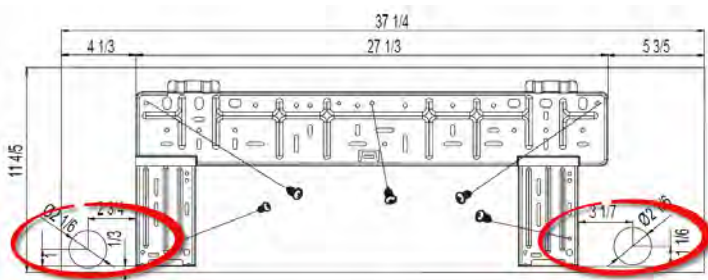


1. The mounting plate should be installed horizontally and level.
2. Measure the center of the indoor unit. Please note, that depending on model, the center of the bracket may not correspond with the center of the unit.
3. Attach the mounting plate on the wall with screws.
4. Be sure that the mounting plate has been attached firmly enough to withstand approximately 132 pounds.
5. Refer to specific models for dimensional data.

Locate and Drill Hole

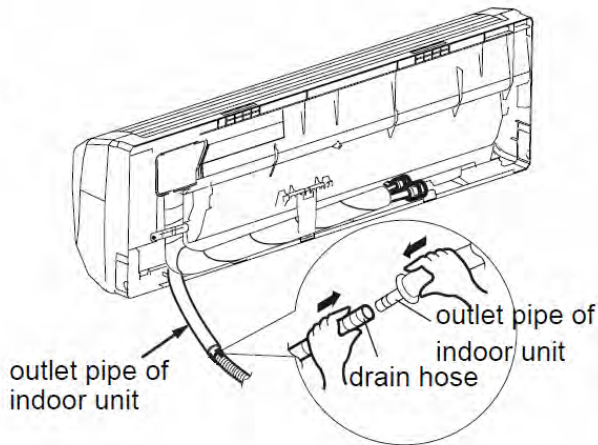


1. The piping can exit the indoor unit from either side, see pictured below.
2. Drill a 2-1/2" diameter hole at a slightly downward angle to the outdoor side.
3. Note: The outdoor hole should be approximately 1/4" lower than the indoor hole.
4. Insert the piping-hole sleeve into the hole to prevent the piping and wiring from being damaged when passing through the hole.

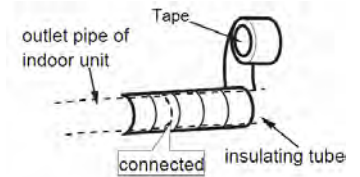
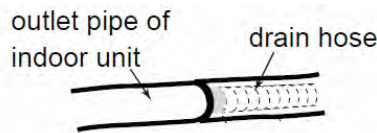


Installation

Install Drain Hose



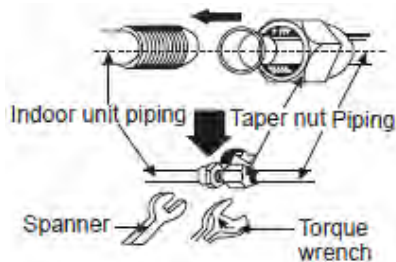
1. Connect the drain hose to the outlet pipe of the indoor unit using appropriate connections.
2. Insulate the condensate to prevent condensation.
3. Fasten the condensate, lineset and wiring together to prevent damage and movement. Slant the drain hose downward for smooth drainage.



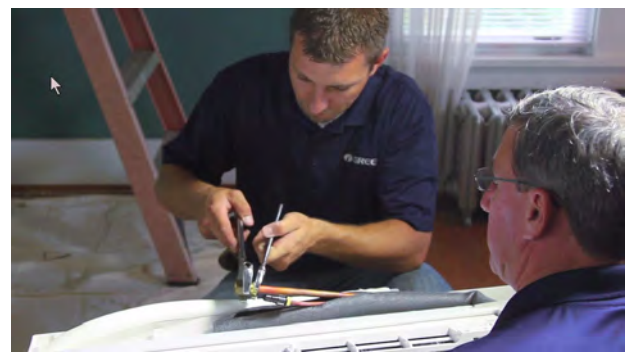
Install Line Set



1. Install lineset and wiring from the outside through the wall sleeve.
2. Bend the indoor lineset. Note: a tube bender will speed up the process.
3. Carefully remove flare nut from indoor coil. Listen for holding charge from indoor unit. No charge may indicate a leak and should be tested.
4. Use a flaring tool if necessary to create the flare, connect tubing tightening to the torque listed below.

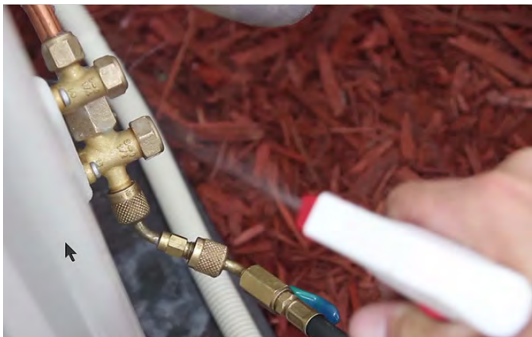
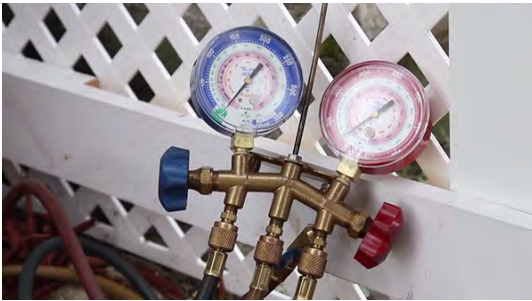


Tubing Size	Torque (foot-pounds)	Torque (inch-pounds)
1/4"	10-13	124-159
3/8"	25-31	301-372
1/2"	36-45	434-540
5/8"	50-60	602-726



Installation

Pressure and Leak Test



1. Use only dry nitrogen with a pressure regulator for pressurizing unit. Pressurize with 150 psi of dry nitrogen.
2. Apply soap and water to check whether the joints are leaky. A leak detector can also be applied for a leakage test.

Hint: You may want to perform leak testing and evacuation before wiring to save time, electrical connections can be completed while your vacuum pump is running.

Evacuating the System

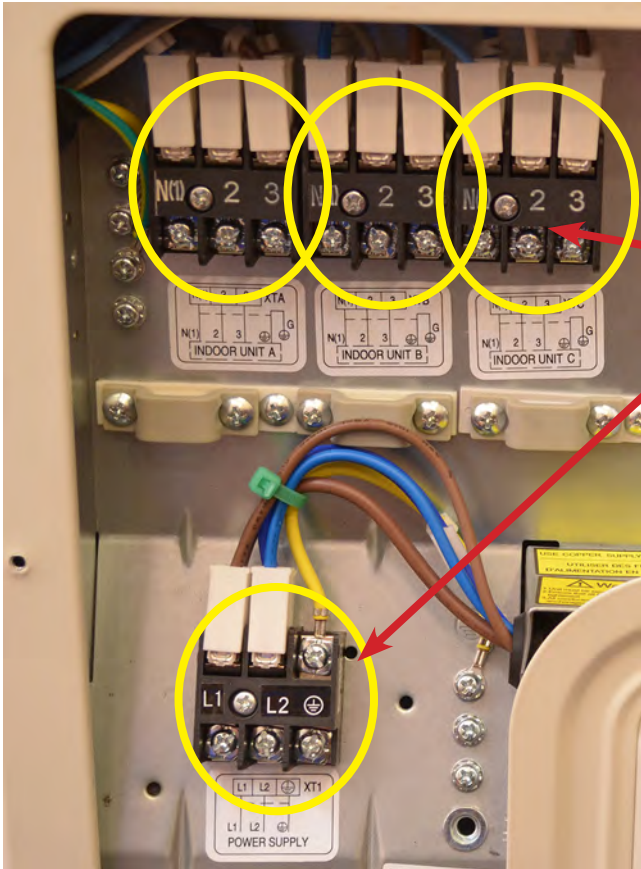


Note: The outdoor unit contains a refrigerant charge, leave liquid and gas valves closed.

1. After no leaks have been detected, connect a vacuum pump to the outdoor unit.
2. Connect appropriate hoses to manifold gauge, vacuum pump and unit refrigeration connections.
3. Evacuate the system until the micron gauge reads no higher than 350 microns.
4. Close valve to vacuum pump; if pressure does not rise above 500 microns after one minute, the evacuation should be complete.
5. If it does rise, check for leaks and/or evacuate longer.
6. For refrigerant lines longer than 25 feet, refer to installation instructions chart included with the unit installation manual for additional charge.

Installation

Connect the Outdoor Wiring



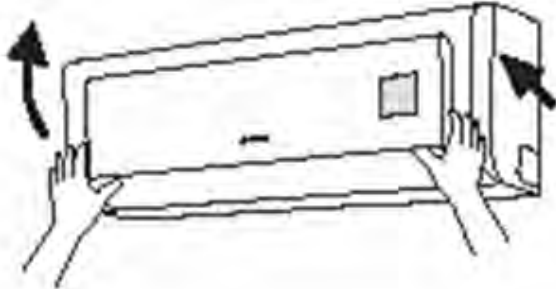
1. Remove the handle on the right side plate of the outdoor unit.
2. Connect wiring from indoor unit to 1,2,3 & ground, being careful to match color code of indoor connections. Repeat this for each indoor unit.
3. Connect power wiring form outdoor disconnect to L1, L2 and ground.
4. Check all connections to tightness.
5. Reinstall the cover/handle.

Note: Follow all local electrical codes for electrical wiring.

3 Zone system shown.

Filter Maintenance and Emergency Operation

Cleaning Air Filter



Titanium Dioxide filter
(2nd Stage Filter)

1. Remove the front panel as shown on the picture in the left.
2. The first stage filter can be cleaned with a vacuum cleaner or by washing with a mild soap and $< 113^{\circ}$ F water.
3. The second stage filter cannot be washed, use a vacuum cleaner to clean any dust, lint, etc. The filter is made up of Titanium Dioxide.
4. Recharge the Titanium Dioxide filter by placing it in the Sun for 3-4 hours every 3-6 months.



Missing or Inoperative Remote Control



Emergency Operation:


When the remote controller is lost or damaged, please use the auto switch on the indoor unit.

Press the AUTO/STOP button to enter AUTO mode.

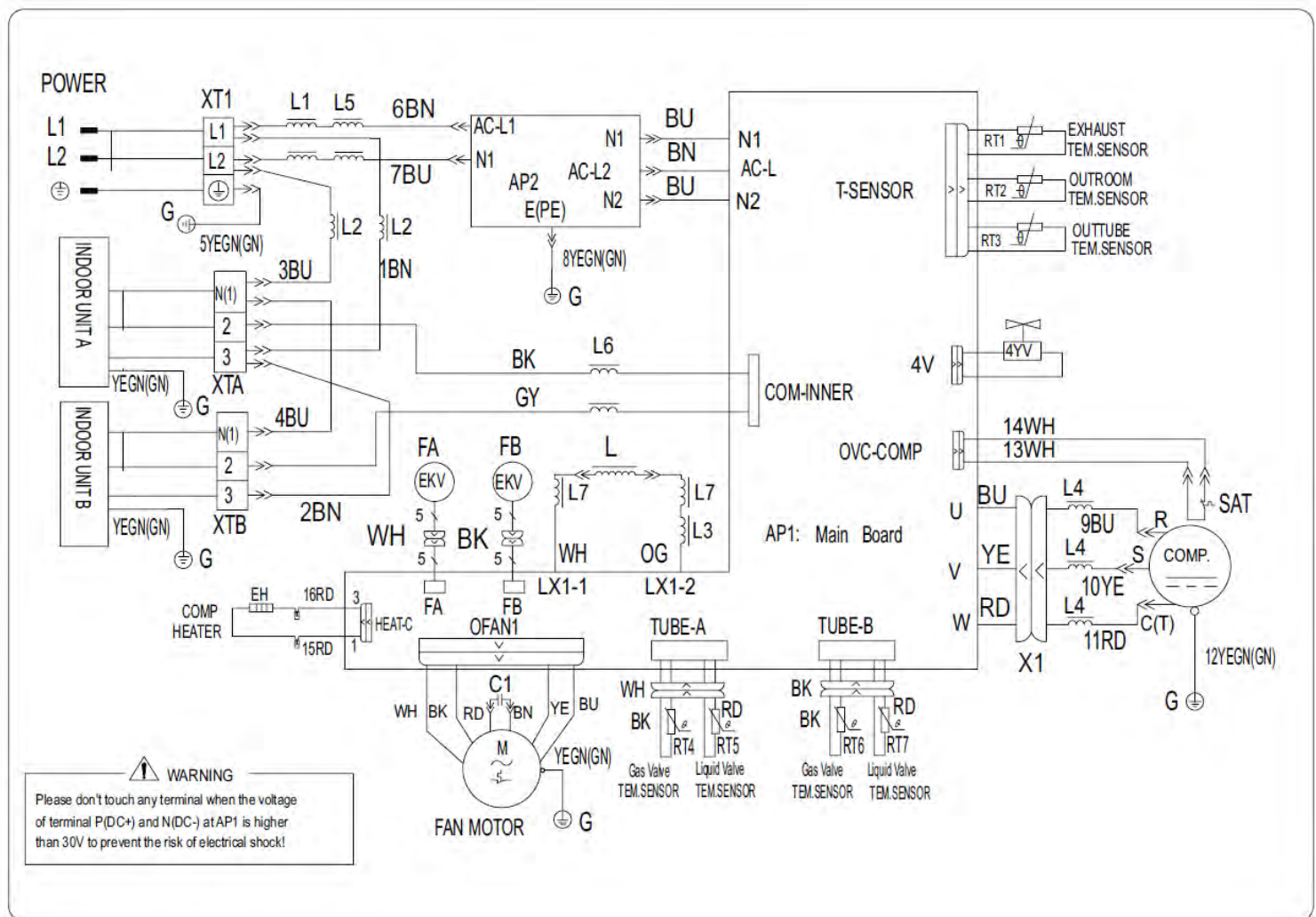
Press the AUTO/STOP button again to turn the unit off.

Electrical Schematics

Electrical Legend

Symbol	Color symbol	Symbol	Color symbol	Symbol	Parts name
WH	WHITE	GN	GREEN	SAT	OVERLOAD
YE	YELLOW	BN	BROWN	COMP	COMPRESSOR
RD	RED	BU	BLUE		PROTECTIVE EARTH
YEGN	YELLOW GREEN	BK	BLACK	/	/
VT	VIOLET	OG	ORANGE	/	/

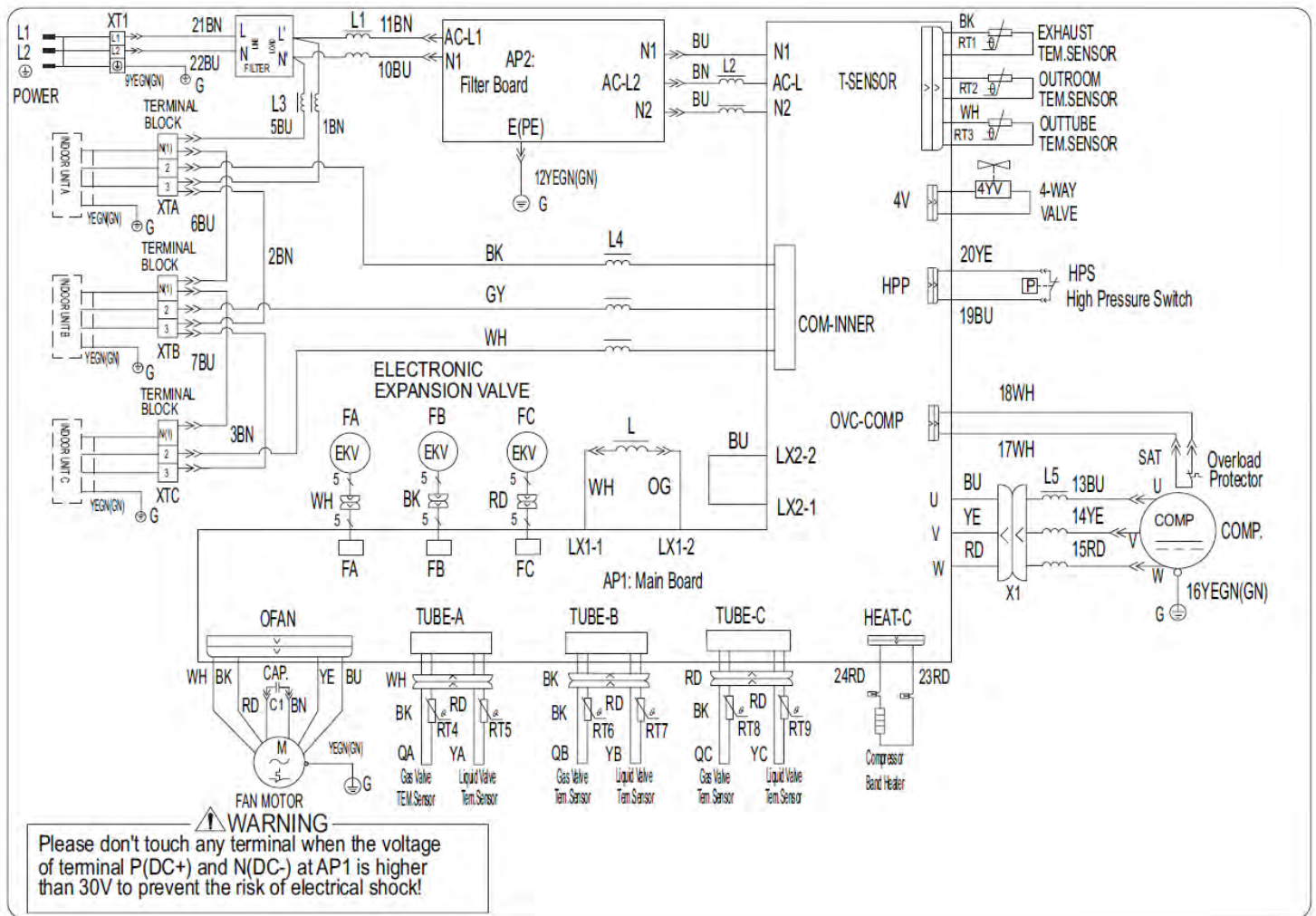
MULTI18HP230V1AO



These circuit diagrams are subject to change without notice, please refer to the one supplied with the unit.

Electrical Schematics

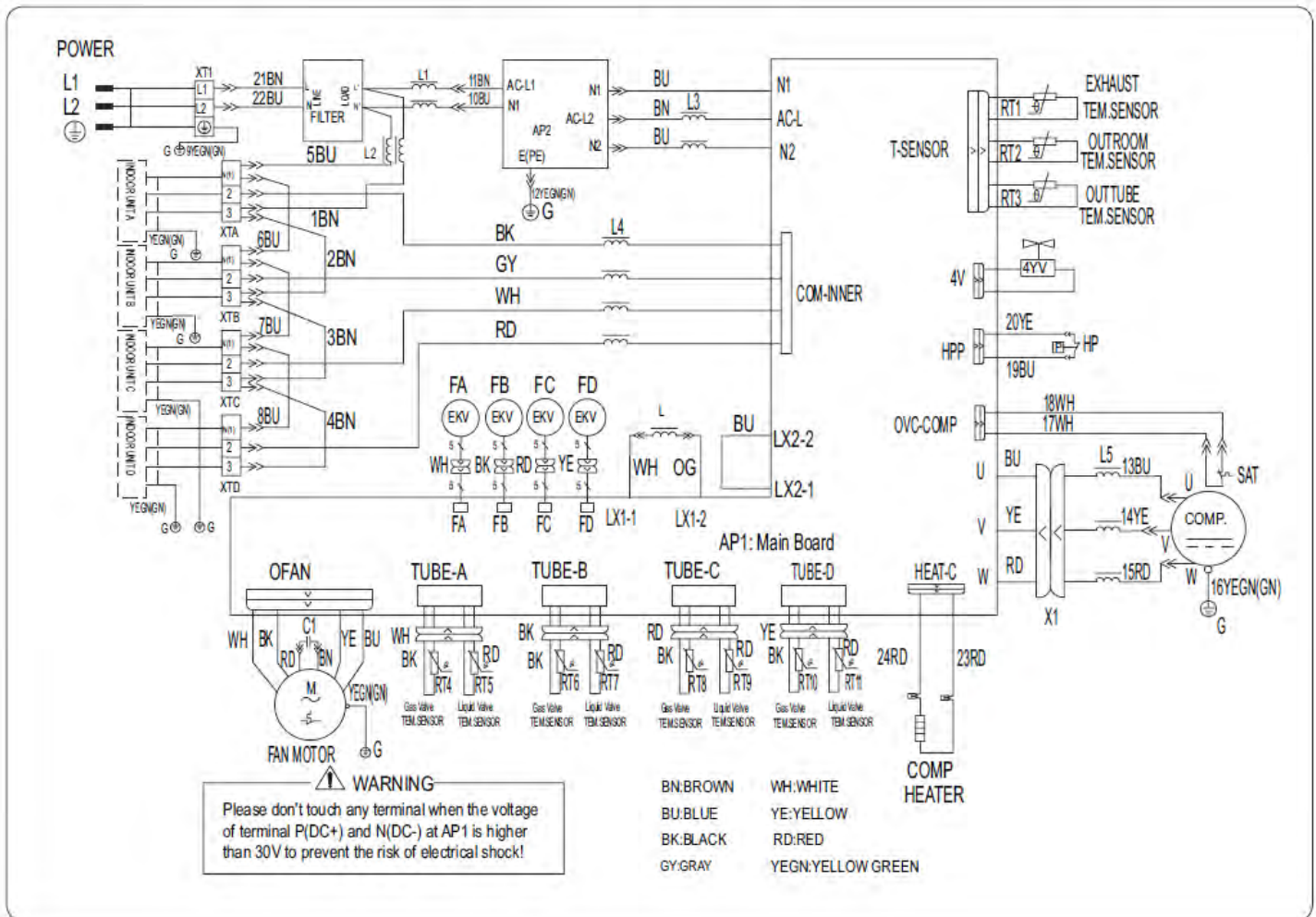
MULTI24HP230V1AO



These circuit diagrams are subject to change without notice, please refer to the one supplied with the unit.

Electrical Schematics

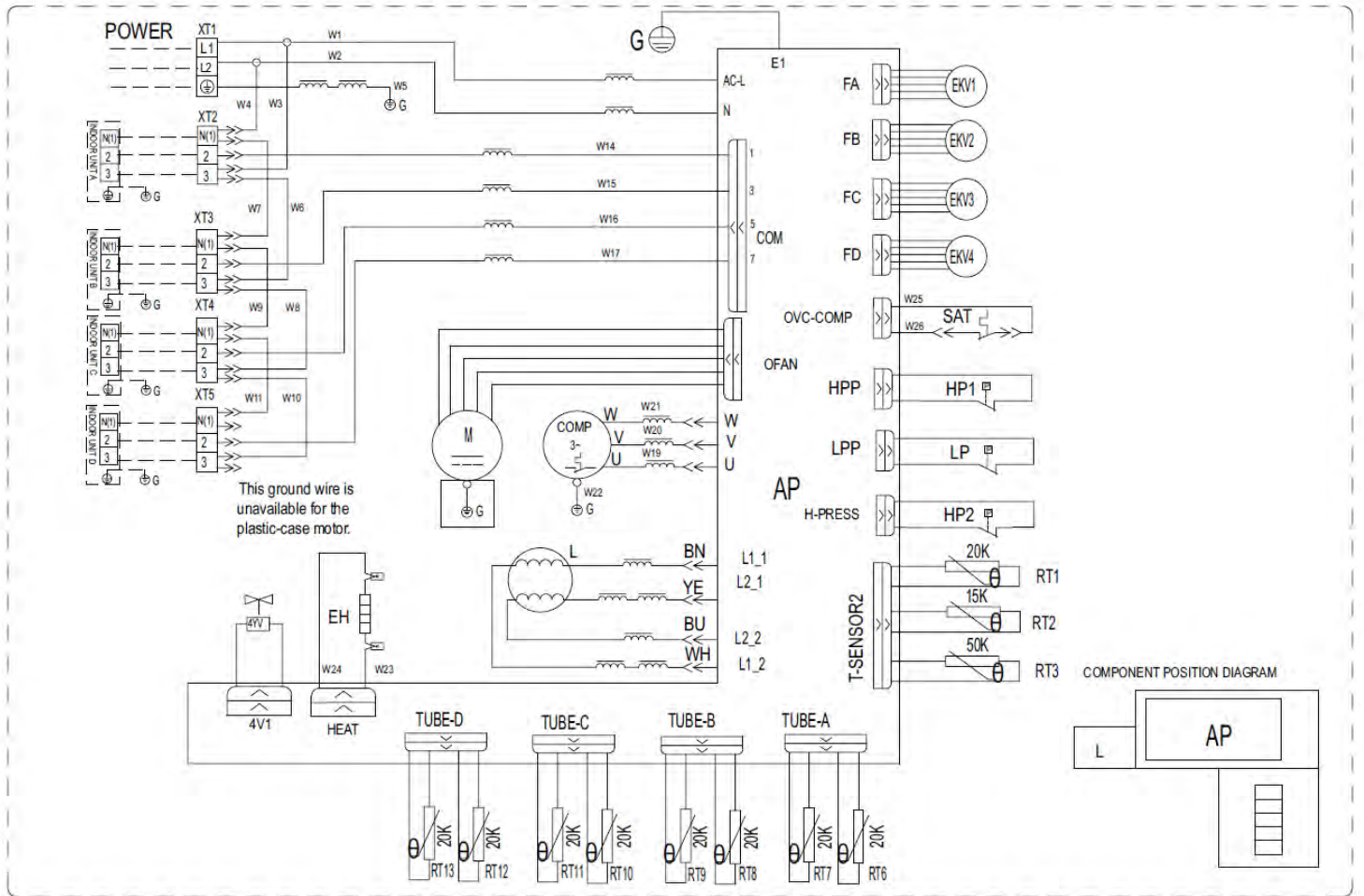
MULTI30HP230V1AO



These circuit diagrams are subject to change without notice, please refer to the one supplied with the unit.

Electrical Schematics

MULTI36HP230V1AO

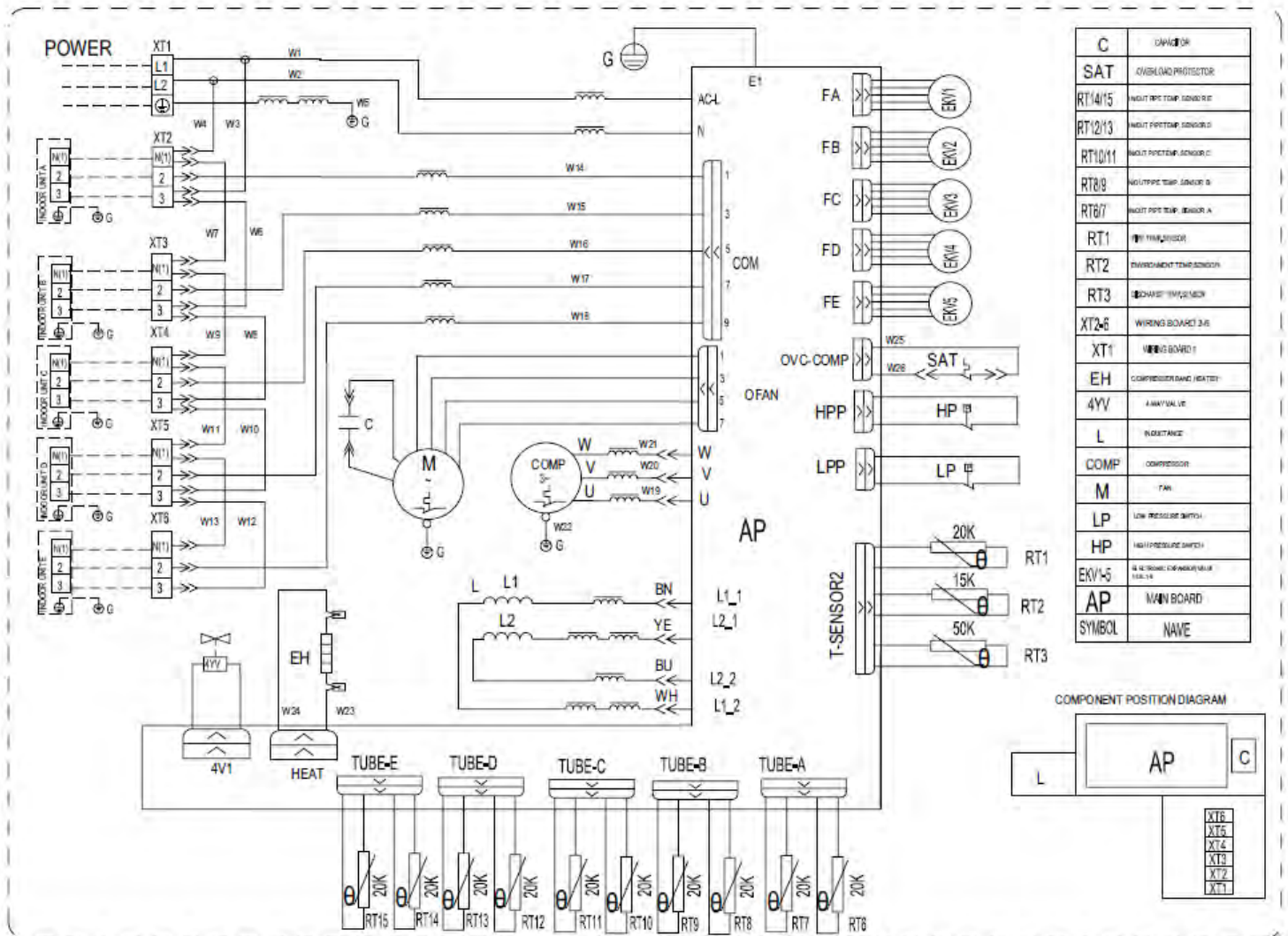


SAT	Overload Protector	RT 3	Discharge Temp. Sensor	EH	Compressor Band Htr
RT 12/13	Tubing Sensors Unit D	RT 2	Discharge Temp. Sensor	4YV	4 - Way Valve
RT 10/11	Tubing Sensors Unit C	RT 1	Discharge Temp. Sensor	L	Inductance
RT 8/9	Tubing Sensors Unit B	XT 2-5	Wiring Board 2-5	M	Fan
RT 6/7	Tubing Sensors Unit A	XT 1	Wiring Board 1	LP	Low Pressure Switch
HP2	High Pressure Switch	HP1	High Pressure Switch	EKV1-4	Electronic Exp Valve

These circuit diagrams are subject to change without notice, please refer to the one supplied with the unit.

Electrical Schematics

MULTI42HP230V1AO

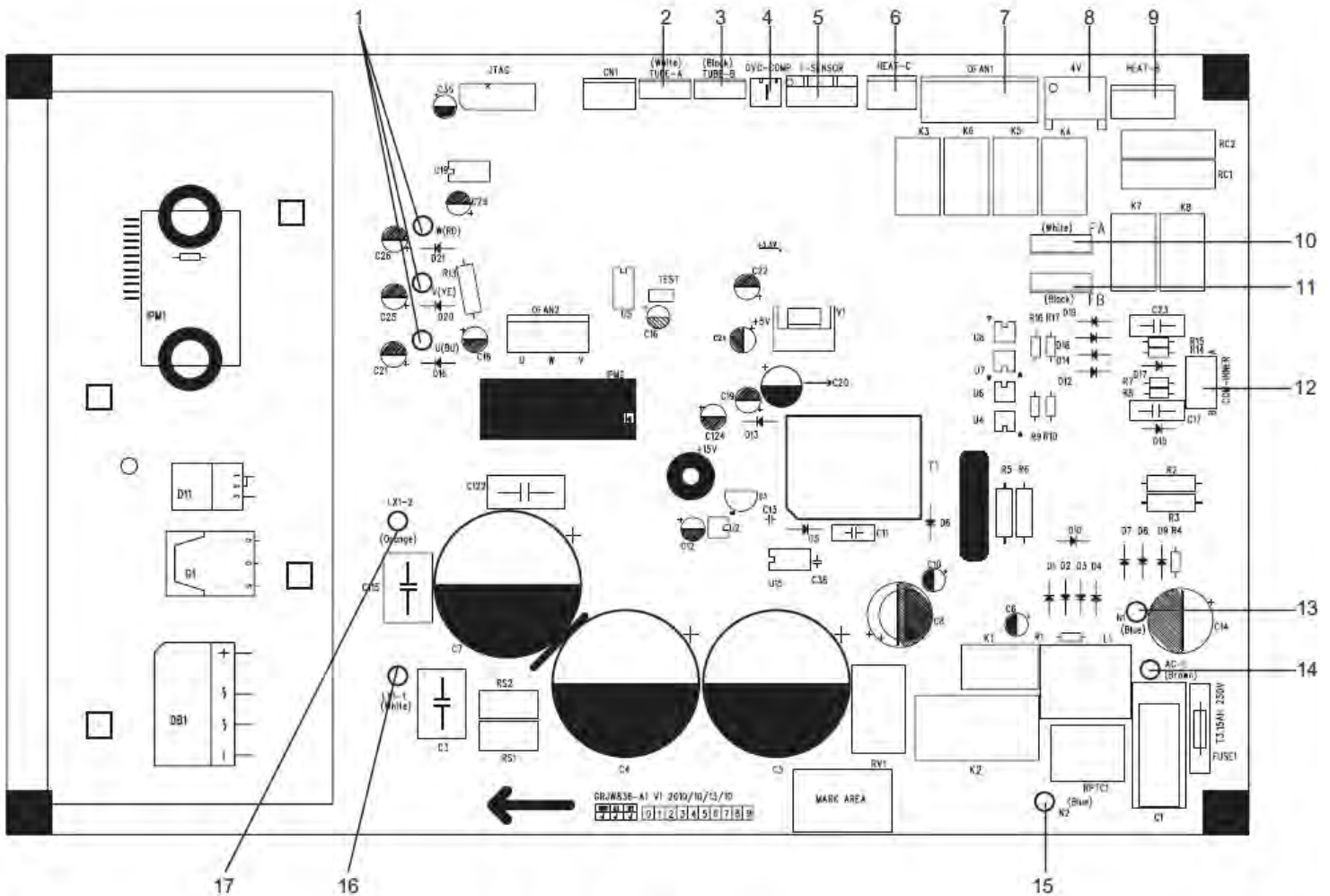


RT 14/15	Tubing Sensors Unit E	RT 3	Discharge Temp. Sensor	EH	Compressor Band Htr
RT 12/13	Tubing Sensors Unit D	RT 2	Discharge Temp. Sensor	4V1	4 - Way Valve
RT 10/11	Tubing Sensors Unit C	RT 1	Discharge Temp. Sensor	L	Inductance
RT 8/9	Tubing Sensors Unit B	XT 2-6	Wiring Board 2-6	M	Fan
RT 6/7	Tubing Sensors Unit A	XT 1	Wiring Board 1	LP	Low Pressure Switch
LP	Low Pressure Switch	HP	High Pressure Switch	EKV1-4	Electronic Exp Valve
C	Capacitor	SAT	Overload Protector		

These circuit diagrams are subject to change without notice, please refer to the one supplied with the unit.

Printed Circuit Boards

MULTI18HP230V1AO

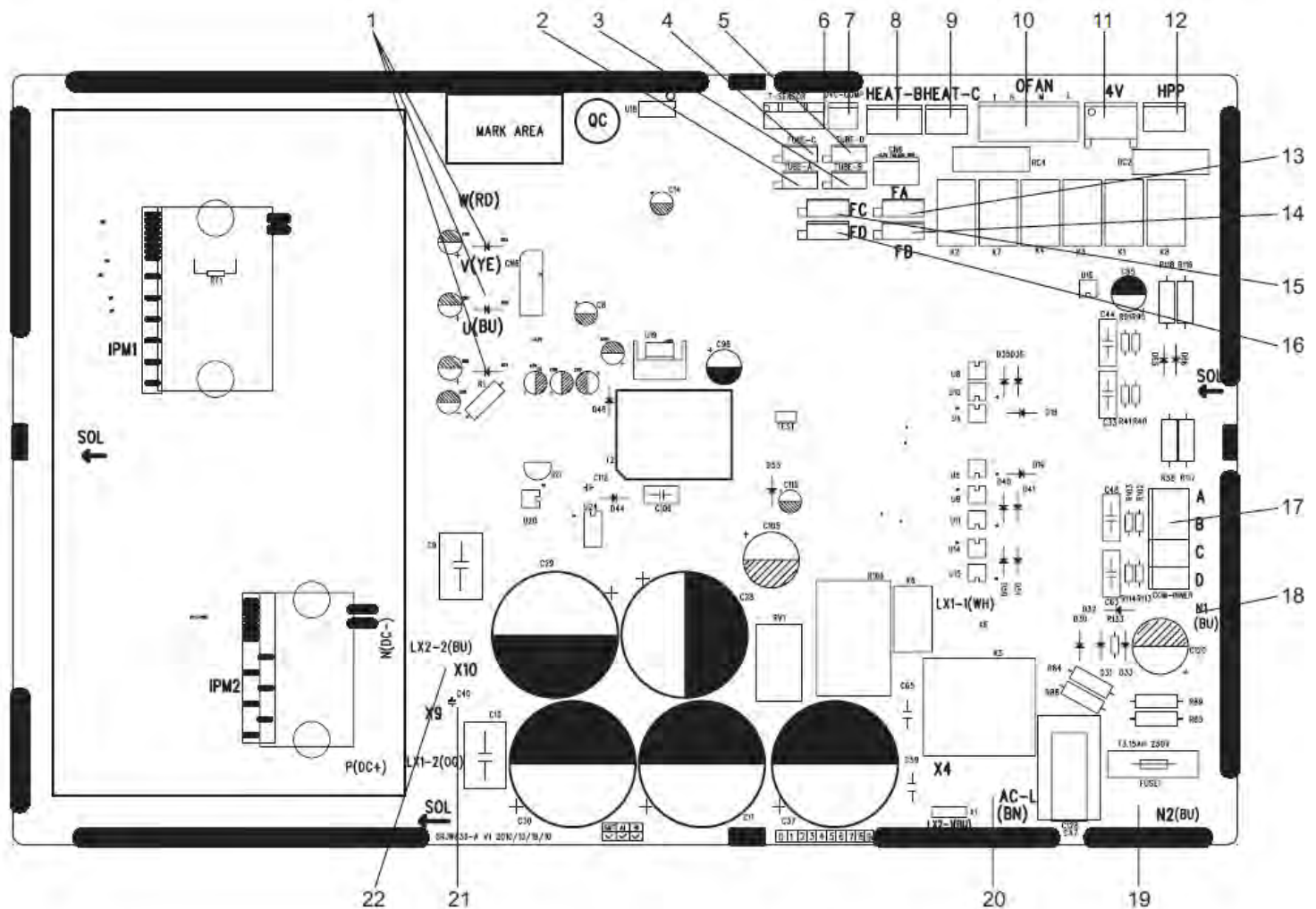


1	Compressor Interface	6	Compressor electric heater	11	Unit B electronic expansion valve	16	Reactor interface 1
2	Unit A liquid and gas valve	7	Outdoor Fan	12	Communication interface with indoor coil	17	Reactor interface 2
3	Unit B liquid and gas valve	8	4-way valve	13	Communication neutral wire		
4	Compressor overload protector	9	Chassis electric heater (reserved)	14	Hot wire of power supply		
5	Temperature sensor	10	Unit A electronic expansion valve	15	Neutral wire of power supply		

These circuit diagrams are subject to change without notice, please refer to the one supplied with the unit.

Printed Circuit Boards

MULTI24HP230V1AO & MULTI30HP230V1AO

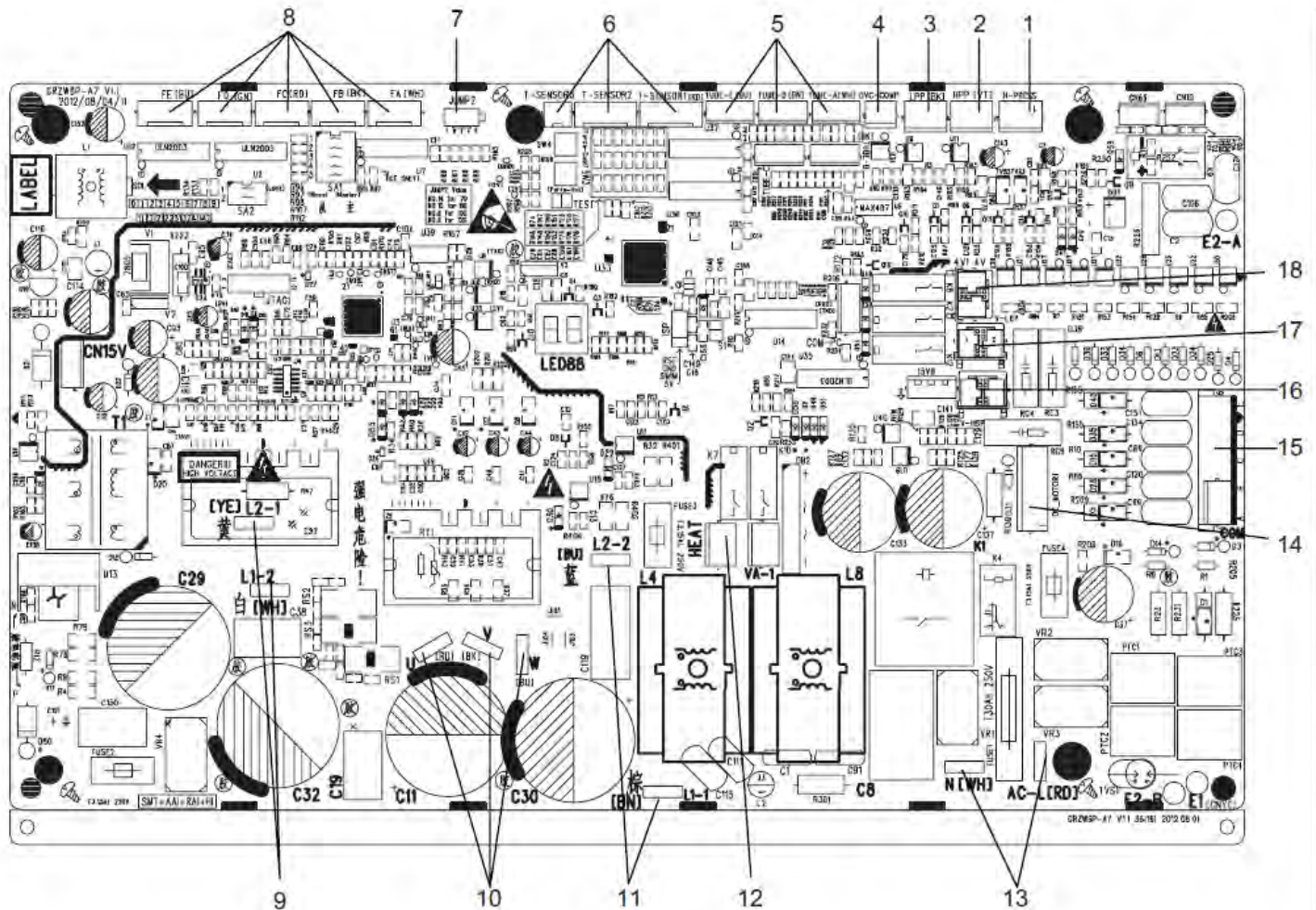


1	Compressor Interface	7	Compressor overload interface	13	Unit A electronic expansion valve	19	Power input neutral wire
2	Temperature sensor of unit A liquid and gas valve	8	Chassis electric heater interface	14	Unit B electronic expansion valve	20	Power input hot wire interface
3	Temperature sensor of unit B liquid and gas valve	9	Compressor electric heater interface	15	Unit C electronic expansion valve	21	PFC hot wire interface
4	Temperature sensor of unit C liquid and gas valve	10	Outdoor fan interface	16	Unit D electronic expansion valve	22	PFC neutral wire interface
5	Temperature sensor of unit D liquid and gas valve	11	4-way valve interface	17	Communication wire interface		
6	Temperature sensor interface	12	High voltage protection interface	18	Communication wire neutral interface		

These circuit diagrams are subject to change without notice, please refer to the one supplied with the unit.

Printed Circuit Boards

MULTI36HP230V1A0

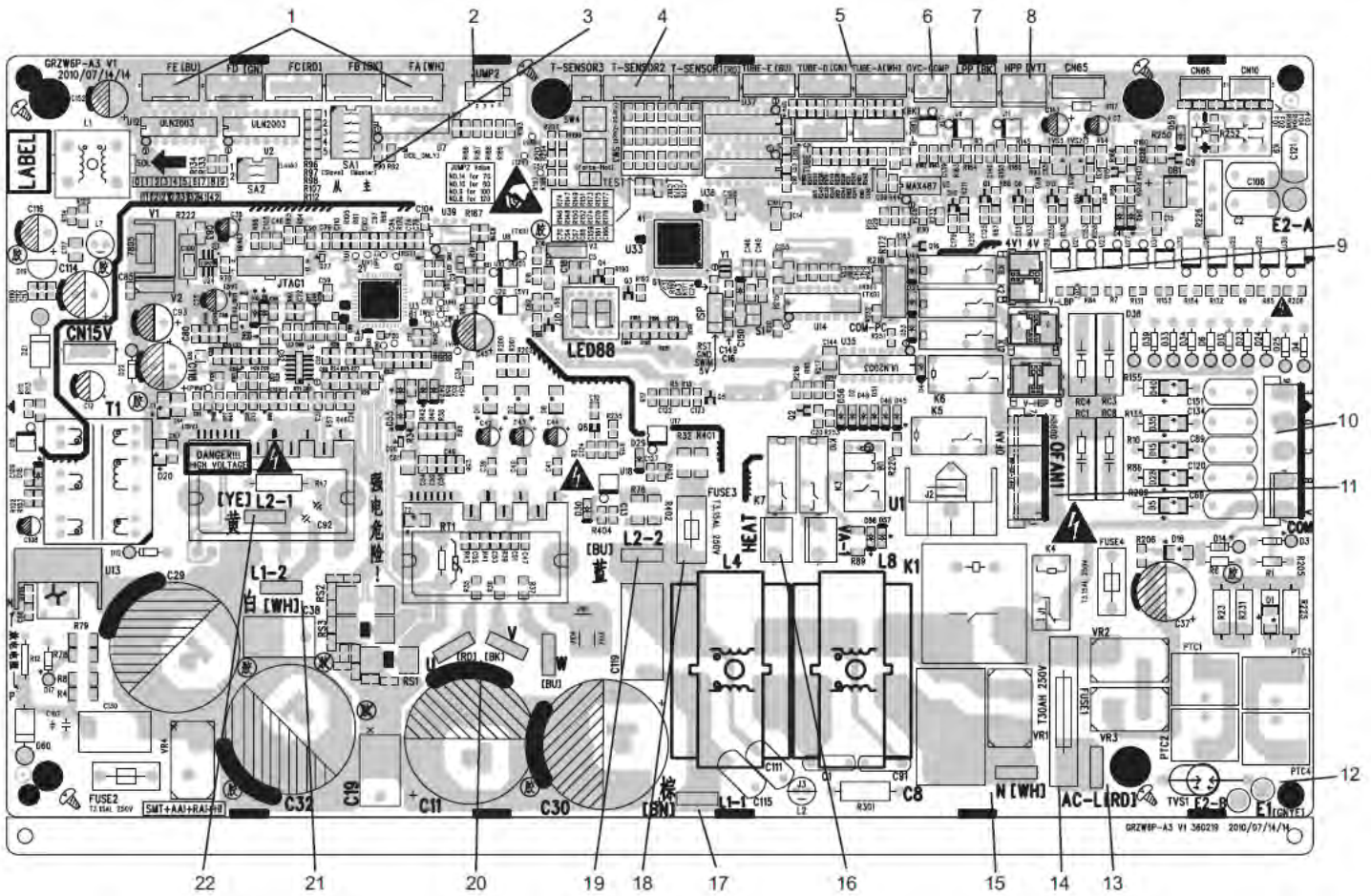


1	High Pressure Protection 1	7	Jumper Cap	13	Neutral and Power wire
2	High Pressure Protection 2	8	Electronic Expansion Valve	14	DC Fan
3	Low Pressure Protection	9	Yellow & White wires of PFC	15	Communication Wires
4	Overload Protection	10	Compressor Wire	16	Gas By-Pass Valve
5	Temperature Sensor	11	Brown & Blue wires of PFC	17	Liquid Bypass Valve
6	Temperature Sensor	12	Compressor Band Heater	18	4-Way Valve

These circuit diagrams are subject to change without notice, please refer to the one supplied with the unit.

Printed Circuit Boards

MULTI42HP230V1AO



1	FA-FE: Terminals of EXV(Electronic Expansion Valve)	7	Low Pressure Switch	13	Power Wire Terminals	19	Blue Reactor Wire
2	Jumper Terminals	8	High Pressure	14	Fuse	20	Compressor Terminals
3	Master Select Switch Terminals	9	4-Way Valve	15	Neutral Wire Terminals	21	White Reactor Wire
4	Temperature Sensor Terminals	10	Communication Terminals	16	Compressor Band Heater	22	Yellow Reactor Wire
5	Temperature sensor of Tubes	11	Fan Terminals	17	Brown Reactor Wire		
6	Overload Protector	12	Earth Ground	18	Fan Fuse		

These circuit diagrams are subject to change without notice, please refer to the one supplied with the unit.

Troubleshooting Indoor Components

Indoor Fan Motor Troubleshooting



To check the condition of the indoor fan motor voltage measurements and resistance measurements can be compared to the following charts. Care must be taken when checking voltage measurements, all wires and terminals must be isolated for safety. Resistance measurements must be taken with power off and “PG” connector removed from the circuit board.

The following chart indicates approximate voltage measurements, readings may vary slightly depending on models and should be used as a reference only. Voltages should be taken with unit running.

PG Wire Connector	Low	Medium	High	Turbo
Brown - White	130 vac	147 vac	161 vac	225 vac
Brown - Red	148 vac	184 vac	210 vac	340 vac
White - Red	123 vac	150 vac	180 vac	205 vac

The following chart indicates approximate resistance measurements, readings may vary slightly depending on models and should be used as a reference only. Turn power off and remove connector from circuit board before reading measurements.

PG Wire Connector	Resistance (ohms)
Brown - White	160 Ω
Brown - Red	400 Ω
White - Red	240 Ω

Troubleshooting Indoor Components

Step Motor Troubleshooting



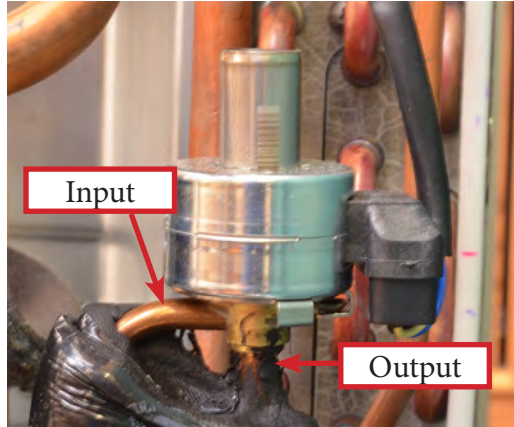
To check the condition of the indoor step (swing) motor resistance measurements may be compared to the following chart. Resistance measurements must be taken with power off and the connector removed from the board. The following charts indicates approximate readings and may vary with different models. **Turn power off and remove connector from circuit board.**

Connector	Blue	Pink	Yellow	Orange	Red
Blue		390 Ω	390 Ω	390 Ω	195 Ω
Pink			390 Ω	390 Ω	195 Ω
Yellow				390 Ω	195 Ω
Orange					195 Ω
Red					

Troubleshooting Outdoor Components

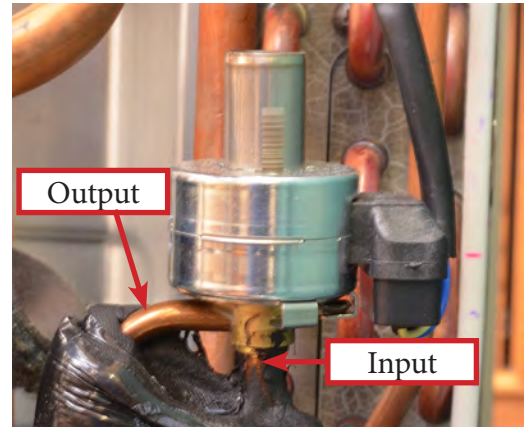
EEV Troubleshooting

Cooling Mode



To check the operation of the EEV Valve in cooling mode, using a digital thermometer record the temperature of the input line and the output line of the valve as indicated in the picture above. With the compressor running, the input side of the valve should have a higher reading than the output side indicating that the valve is metering. If the temperature readings are the same, the valve is fully open and the valve is not metering. Since the pressures and frequency are controlled by the G10 technology of the outdoor circuit board, there are no pressure checks that can be made.

Heating Mode



To check the operation of the EEV Valve in heating mode, using a digital thermometer record the temperature of the input line and the output line of the valve as indicated in the picture above. With the compressor running, the input side of the valve should have a higher reading than the output side indicating that the valve is metering. If the temperature readings are the same, the valve is fully open and the valve is not metering. Since the pressures and frequency are controlled by the G10 technology of the outdoor circuit board, there are no pressure checks that can be made.

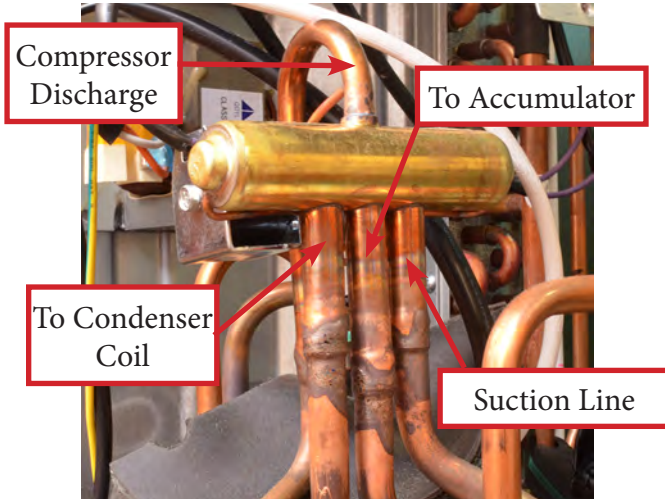
Resistance readings of EEV valve with wire plug disconnected from circuit board. Power to unit should be off when making resistance readings. Readings below are approximate values and may vary slightly with different outdoor models.

EEV Ω	Orange	Red	Yellow	Black	Blue
Orange		94.6 Ω	94.8 Ω	94.4 Ω	47.0 Ω
Red			94.7 Ω	94.4 Ω	47.5 Ω
Yellow				94.6 Ω	47.7 Ω
Black					47.4 Ω
Blue					

Troubleshooting Outdoor Components

4-Way Valve Troubleshooting

Cooling Mode



Checking the 4-way valve in cooling mode requires the measurement of 4 readings. First record the temperature of the compressor discharge tubing, secondly record the temperature of the tubing going to the condenser. There should be no more than a 10 degrees difference between the two readings.

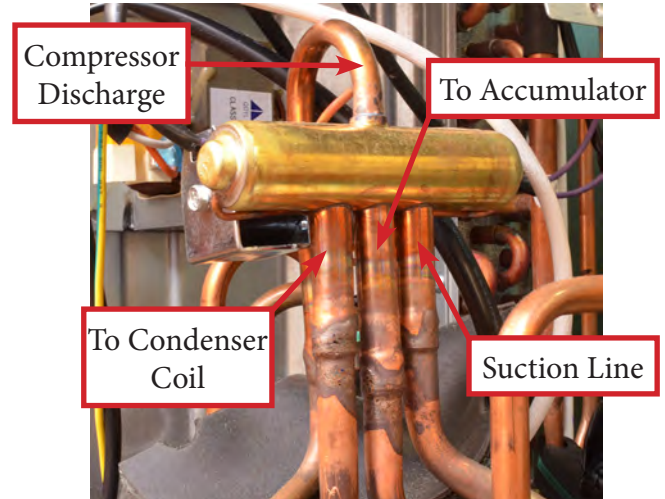
The next set of readings will require recording the temperature of the tubing going to the suction line and the temperature of the tubing going to the accumulator. Again, if there should be less than 10 degrees difference between these readings.

A temperature reading higher than 10 degrees may indicate a leaky valve (not fully shifter) or a blockage in the valve.

4-Way valve solenoid resistance check:

Be sure all power is off to the unit. Remove the plug connecting the 4-way valve to the circuit board. Check the resistance with an ohmmeter. The reading should indicate 1.8k Ω . If the reading is infinite, replace the solenoid coil.

Heating Mode



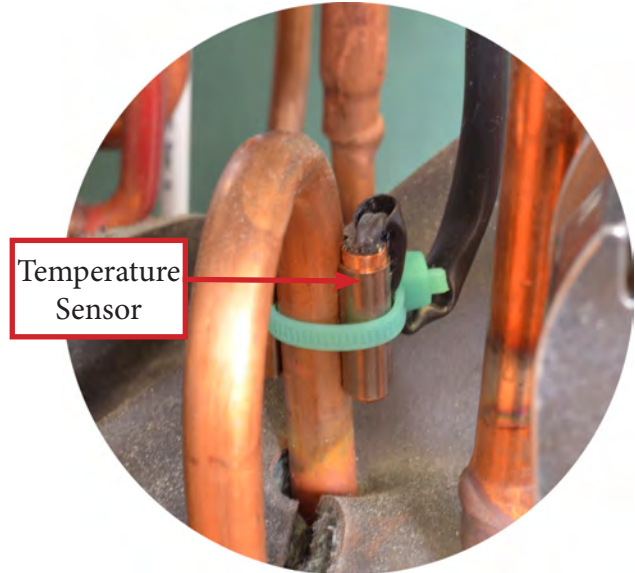
Checking the 4-way valve in heating mode requires the measurement of 4 readings. First record the temperature of the compressor discharge tubing, secondly record the temperature of the suction line tube. There should be no more than a 10 degrees difference between the two readings.

The next set of readings will require recording the temperature of the tubing going to the condenser coil and the temperature of the tubing going to the accumulator. Again, if there should be less than 10 degrees difference between these readings.

A temperature reading higher than 10 degrees may indicate a leaky valve (not fully shifter) or a blockage in the valve.

Troubleshooting Outdoor Components

Temperature Sensor Check

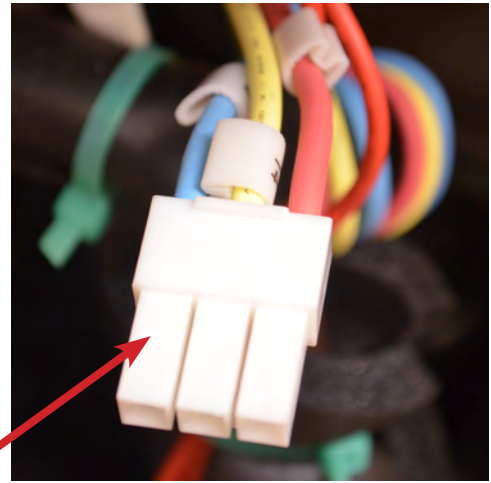
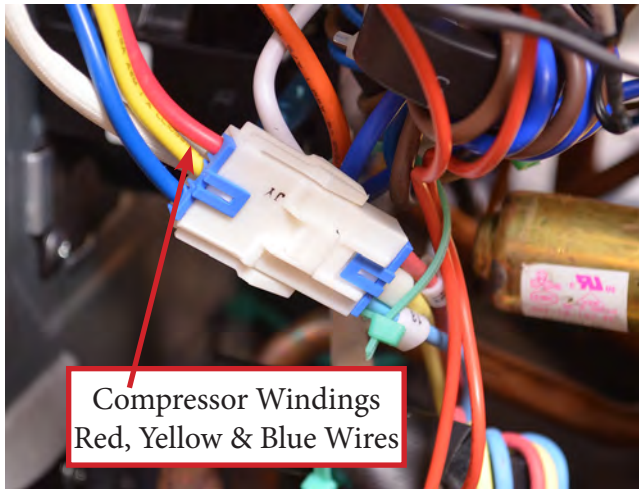


Using a glass of ice water, place the sensor into the glass with a digital thermometer. Wait a few minutes for the reading to stabilize. Compare the readings to the sensor tables in Appendix “A”, if the readings are not comparable, replace the sensor. When replacing the sensor, be sure to fasten the sensor securely if it is attached to a tube.

Temp (°C)	Temp (°F)	Resistance (kΩ)		Temp (°C)	Temp (°F)	Resistance (kΩ)		Temp (°C)	Temp (°F)	Resistance (kΩ)
0	32.0	49.02		52	125.6	4.986		104	219.2	0.898
1	33.8	46.6		53	127.4	4.802		105	221.0	0.873
2	35.6	44.31		54	129.2	4.625		106	222.8	0.848
3	37.4	42.14		55	131.0	4.456		107	224.6	0.825
4	39.2	40.09		56	132.8	4.294		108	226.4	0.802
5	41.0	38.15		57	134.6	4.139		109	228.2	0.779
6	42.8	36.32		58	136.4	3.99		110	230.0	0.758
7	44.6	34.58		59	138.2	3.848		111	231.8	0.737
8	46.4	32.94		60	140.0	3.711		112	233.6	0.717
9	48.2	31.38		61	141.8	3.579		113	235.4	0.697

Troubleshooting Outdoor Components

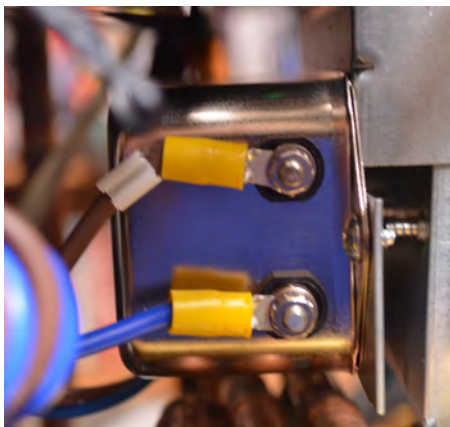
Compressor Windings



Compressor Winding Resistance Check:

Separate the plug from the compressor to AP1 circuit board. The wires red to yellow, yellow to blue & red to blue should have readings from 2 - 4 ohms. There should be no reading from any wire to chassis ground. If the readings between the windings differ greatly, the windings are bad. If there is a reading from any wire to the chassis, there is leakage in the windings.

Line Load Filter



The line load filter filters out electrical noise to the control board generated by the Inverter.

Troubleshooting Outdoor Components

Outdoor Fan Motor



Outdoor Motor Winding Resistance Check:

Disconnect power to the unit, all readings are made with no power and fan motor wires disconnected from circuit board.

Remove the red and brown wire from the reactor and then disconnect the plug from the circuit board. The chart below will indicate the approximate resistance values in ohms. Readings may vary slightly for different models.

Motor Leads	Blue	Yellow	Black	White	Red	Brown
Blue		21 Ω	37 Ω	144 Ω	205 Ω	144 Ω
Yellow			18 Ω	125 Ω	100 Ω	125 Ω
Black				108 Ω	85 Ω	108 Ω
White					190 Ω	0 Ω
Red						190 Ω
Brown						

Troubleshooting Outdoor Components

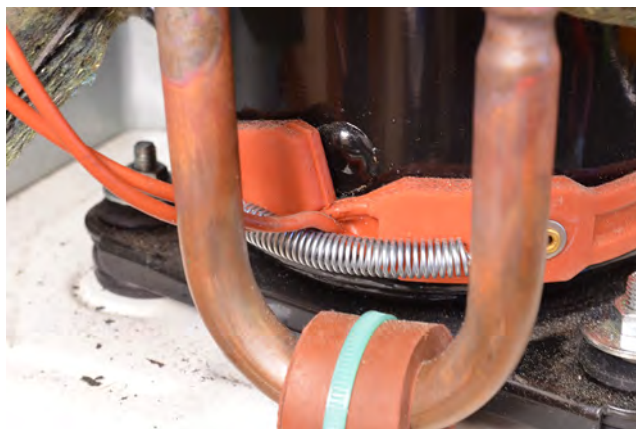
Reactor



Reactor Resistance Check:

The line reactor helps to smooth the inrush current, reduce harmonics and noise, and buffers the system, protecting the electronics from transient voltage noise. The resistance between the coils will be very low, approximately .3 ohms and should not have any resistance to ground. You should disconnect the wires from the reactor before taking any readings.

Compressor Crankcase Heater Check

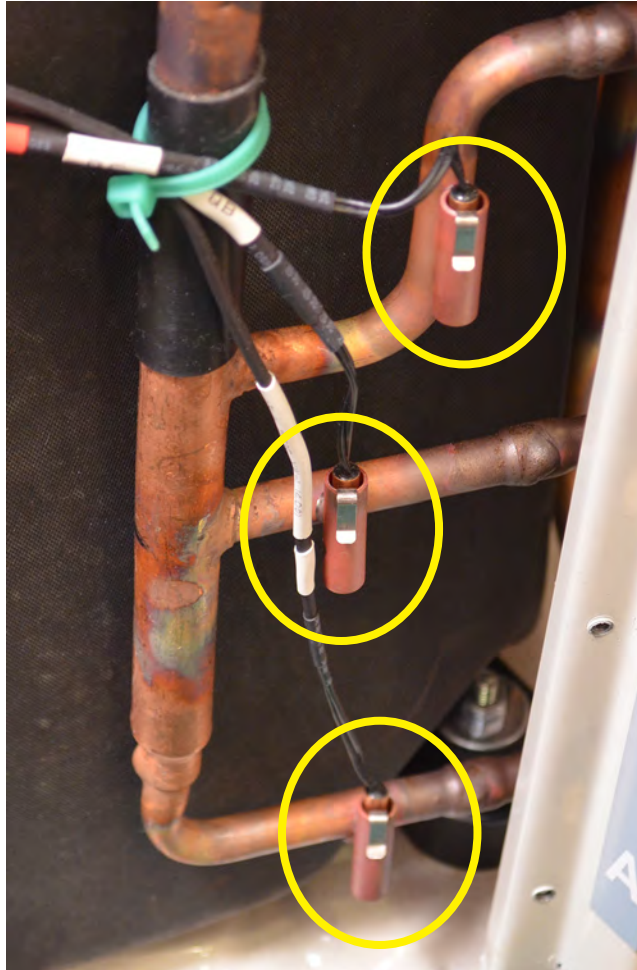


Compressor Crankcase Heater Resistance Check:

Unplug the wire connector from the circuit board. The resistance should read approximately 2.15K ohms. There should be no reading from either wire to ground. If readings vary from these measurements, replace the heater.

Troubleshooting Outdoor Components

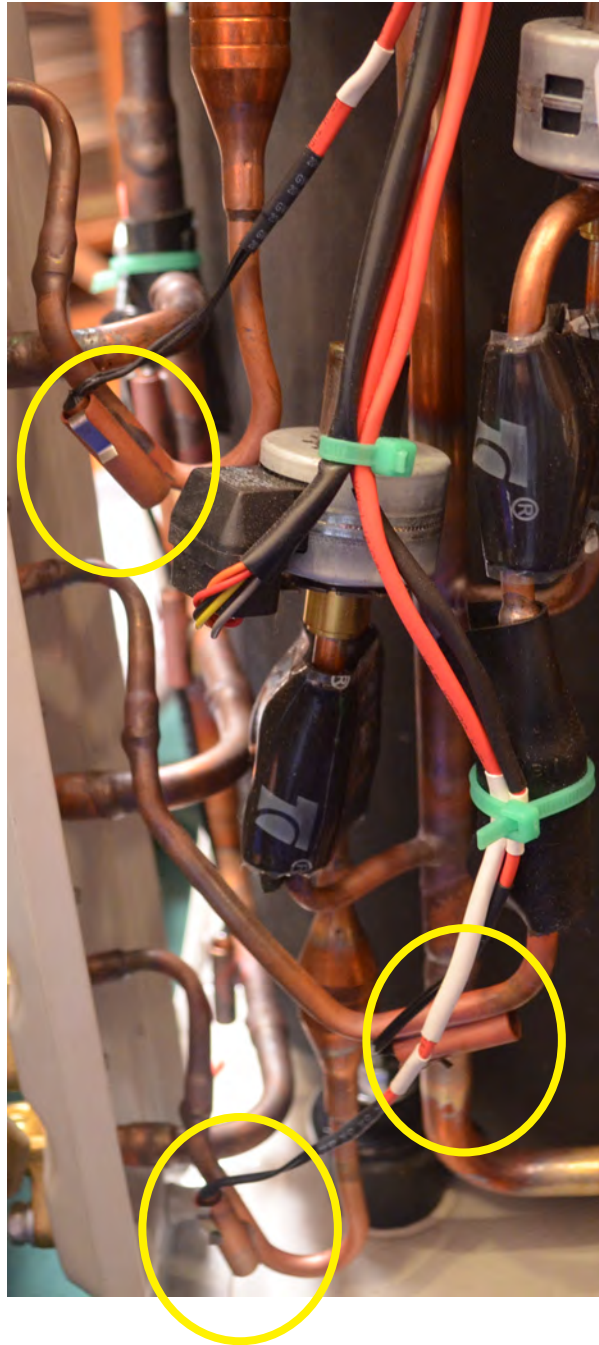
Gas Line Temperature Sensors Motor



These sensors are a negative coefficient thermistor that decrease in resistance as the temperature increases. The sensors are used to monitor the temperature of the refrigerant leaving the indoor coil to maintain a correct superheat operation. Please refer to the troubleshooting section for error codes generated by a sensor fault.

Troubleshooting Outdoor Components

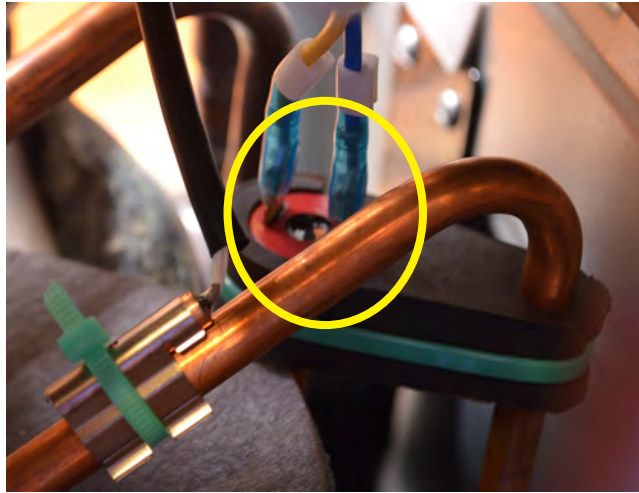
Liquid Line Temperature Sensors



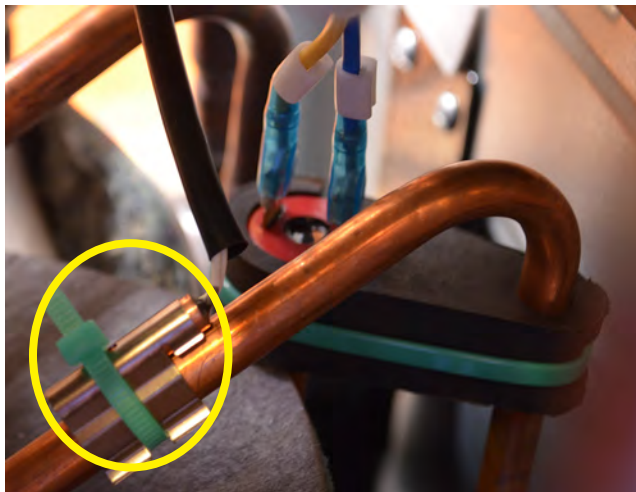
These sensors are a negative coefficient thermistor that decrease in resistance as the temperature increases. The sensors are used to monitor the temperature of the refrigerant leaving the EEV to maintain a correct superheat operation. Please refer to the troubleshooting section for error codes generated by a sensor fault.

Troubleshooting Outdoor Components

High Pressure Protection Switch & Exhaust Temperature Sensor



The high pressure switch monitors the refrigerant discharge pressure and will shut down the unit if pressures are higher abnormal. If this is detected, an E1 error code will be generated. Please refer to the troubleshooting section for more detailed information.



The exhaust temperature sensor monitors the refrigerant discharge temperature and will send information to the inverter control board for system operation.

The following actions can occur:

Exhaust Temperature > 208 F - Compressor will not rise above present level

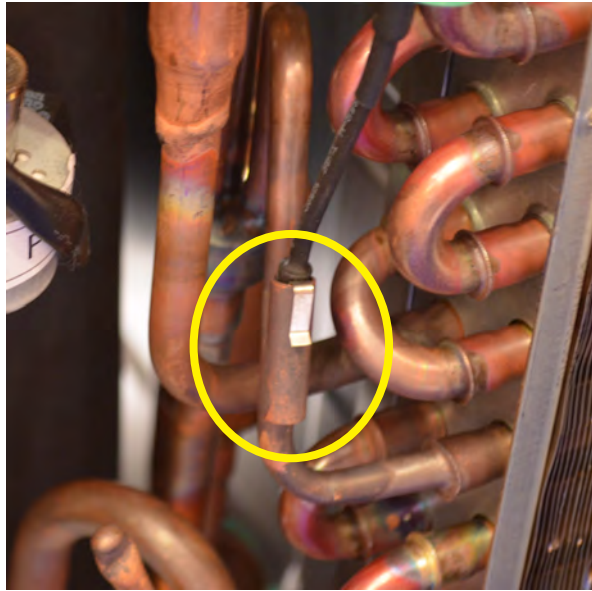
Exhaust Temperature > 217 F - Compressor will run at reduced frequency

Exhaust Temperature < 194 F - Compressor off for a3 minutes minimum, the compressor will restart

Error Code F5 will be generated if the sensor is open or shorted. Please refer to the troubleshooting section for more detailed information.

Troubleshooting Outdoor Components

Out Tube Temperature Sensor & Outdoor Temperature Sensor



This sensor is a negative coefficient thermistor that will decrease in resistance as the temperature increases. This sensor will monitor the temperature of the refrigerant leaving the outdoor coil. The reading will be used by the inverter board to adjust frequency calculations.

Error Code F4 will be generated if the sensor is open or shorted. Please refer to the troubleshooting section for more detailed information.



This sensor is a negative coefficient thermistor that will decrease in resistance as the temperature increases. This sensor will monitor the temperature of the outdoor air. The reading will be used by the inverter board to adjust frequency calculations.

Error Code F3 will be generated if the sensor is open or shorted. Please refer to the troubleshooting section for more detailed information.

Fault Displays

Models MULTI18HP230V1AO, MULTI24HP230V1AO & MULTI30HP230V1AO

Note: ○ Off ● On ○ Blink

Multiple malfunctions will be displayed every 5 seconds

#	Malfunction Description	LED 1	LED 2	LED 3	LED 4
0	Normal stop	○	○	○	○
1	Compressor run	●	○	○	○
2	Compressor overload protection	○	○	○	○
3	Discharge protection	○	●	○	○
4	Outdoor unit overload protection	●	●	○	○
5	High pressure protection	○	●	○	○
6	Over current protection	○	○	○	○
7	IMP protection	●	○	○	○
8	IMP over heating protection	○	○	○	○
9	PFC protection (including PFC overheating protection)	○	○	●	○
10	Phase current protection	●	○	●	○
11	Over voltage protection	○	○	●	○
12	Insufficient voltage protection	○	●	●	○
13	Start failure	●	●	●	○
14	Compressor desynchronizing	○	●	●	○
15	Compressor phase-lacking protection	○	○	●	○
16	Compressor phase current detection malfunction	●	○	●	○
17	Memory chip mistake	○	○	●	○
18	DC power supply circuit-short	○	○	○	○
19	Defrosting	●	○	○	○
20	Oil return	○	○	○	○
21	Complete unit frequency restriction protection	○	●	○	○
22	Complete unit frequency dropping protection	●	●	○	○
23	Unit A frequency restriction or frequency dropping protection	○	●	○	○
24	Unit B frequency restriction or frequency dropping protection	○	○	○	○
25	Unit C frequency restriction or frequency dropping protection	●	○	○	○
26	Unit D frequency restriction or frequency dropping protection	○	○	○	○
27	Outdoor ambient temperature sensor protection	○	○	○	●
28	Outdoor tube temperature sensor protection	●	○	○	●
29	Discharge temperature sensor protection	○	○	○	●
30	IPM thermal resistance malfunction	○	●	○	●

Fault Displays

Models MULTI18HP230V1AO, MULTI24HP230V1AO & MULTI30HP230V1AO

#	Malfunction Description	LED 1	LED 2	LED 3	LED 4
31	Unit A liquid pipe temperature sensor malfunction	●	●	○	●
32	Unit A gas pipe temperature sensor malfunction	○	●	○	●
33	Unit B liquid pipe temperature sensor malfunction	○	○	○	●
34	Unit B gas pipe temperature sensor malfunction	○	○	○	●
35	Unit C liquid pipe temperature sensor malfunction	○	○	○	●
36	Unit C gas pipe temperature sensor malfunction	○	○	●	●
37	Unit D liquid pipe temperature sensor malfunction	●	○	●	●
38	Unit D gas pipe temperature sensor malfunction	○	○	●	●
39	Unit A mode conflict	○	●	●	●
40	Unit B mode conflict	●	●	●	●
41	Unit C mode conflict	○	●	●	●
42	Unit D Mode Conflict	○	○	●	●
43	Communication failure with Unit A	●	○	●	●
44	Communication failure with Unit B	○	○	●	●
45	Communication failure with Unit C	○	○	○	●
46	Communication failure with Unit D	●	○	○	●
47	Unit A freeze protection	○	○	○	●
48	Unit B freeze protection	○	●	○	●
49	Unit C freeze protection	●	●	○	●
50	Unit D freeze protection	○	●	○	●
51	Unit A overheating prevention protection	○	○	○	●
52	Unit B overheating prevention protection	●	○	○	●
53	Unit C overheating prevention protection	○	○	○	●
54	Unit D overheating prevention protection	○	○	○	○
55	Unit A communication wire mis-connection or expansion valve malfunction	●	○	○	○
56	Unit B communication wire mis-connection or expansion valve malfunction	○	○	○	○
57	Unit C communication wire mis-connection or expansion valve malfunction	○	●	○	○
58	Unit D communication wire mis-connection or expansion valve malfunction	●	●	○	○

Fault Displays

Models MULTI36HP230V1AO & MULTI42HP230V1AO Table 15

Error Item	88 Display	Indicating LED Flashing Times			88 Display	Wired Controller Display	Error Type
		Running LED	Cooling LED	Heating LED			
High Pressure Protection	E1	Flash once	/	/	E1	E1	Outdoor
Shutdown for Whole Unit Anti-Freeze Protection	E2	Flash twice	/	/	E2	E2	System Error
Low Pressure Protection	E3	Flash 3 times	/	/	E3	E3	Outdoor
High Discharge Temp Protection	E4	Flash 4 times	/	/	E4	E4	Outdoor
Communication Error	E6	Flash 6 times	/	/	E6	E6	Outdoor & Indoor
Indoor Unit Water Full Error	E9	Flash 9 times	/	/	E9	E9	Indoor
Refrigerant Recovery Mode	Fo	Flash once	Flash Once	/	Fo	Fo	Special Mode
Outdoor Ambient Temp Sensor Error	F3	/	Flash 3 times	/	F3	F3	Outdoor
Outdoor Mid-Coil Temp Sensor Error	F4	/	Flash 4 times	/	F4	F4	Outdoor
Outdoor Discharge Air Temp Sensor Error	F5	/	Flash 5 times	/	F5	F5	Outdoor
Oil Return for Cooling	F7	/	/	/	/	/	Special Mode
Forced Defrosting	H1	Quick Flashing	/	/	H1	H1	Special Mode
Oil Return for Heating or Defrosting	H1	/	/	Flash once	H1	* 	Special Mode
Compressor Overheat Protection	H3	/	/	Flash 3 times	H3	H3	Drive Error
IPM Protection	H5	/	/	Flash 5 times	H5	H5	Drive Error

Fault Displays

Models MULTI36HP230V1AO & MULTI42HP230V1AO Table 15

Error Item	88 Display	Indicating LED Flashing Times			88 Display	Wired Controller Display	Error Type
		Running LED	Cooling LED	Heating LED			
PFC Error	HC	/	/	Flash 6 times	Hc	Hc	Drive Error
Startup Failure	LC	/	/	Flash 11 times	Lc	Lc	Drive Error
DC Fan motor Error	LA	Flash 24 times	/	/	LA	LA	Outdoor
Phase Loss	LD	/	/	/	Ld	Ld	Drive Error
Compressor Stalling	LE	/	/	/	LE	LE	Drive Error
Over-Speed	LF	/	/	/	LF	LF	Drive Error
IPM Reset	P0	/	/	/	P0	P0	Drive Error
Compressor Current Protection	P5	/	/	Flash 15 times	P5	P5	Drive Error
Communication Error between the Inverter Drive and the Main Controller	P6	Flash 16 times	/	/	P6	P6	Drive Error
Radiator Temp Sensor Error	P7	/	/	Flash 18 times	P7	P7	Drive Error
Radiator Over-heat Protection	P8	/	/	Flash 19 times	P8	P8	Drive Error
AC Contactor Protection	P9	/	/	/	P9	P9	Drive Error
Sensor Connection Protection	Pd	/	/	/	Pd	Pd	Drive Error
Over Voltage Protection	PH	/	Flash 11 times	/	PH	PH	Drive Error
Low Voltage Protection	PL	/	/	Flash 21 times	PL	PL	Drive Error
Temp Drift Protection	PE	/	/	/	PE	PE	Drive Error
Drive Board Ambient Temp Sensor Error	PF	/	/	/	PF	PF	Drive Error

Fault Displays

Models MULTI36HP230V1AO & MULTI42HP230V1AO Table 15

Error Item	88 Display	Indicating LED Flashing Times			88 Display	Wired Controller Display	Error Type
		Running LED	Cooling LED	Heating LED			
AC Current Protection	PA	/	/	/	35	35	Drive Error
Charging Circuit Error	PU	/	/	Flash 17 times	PU	PU	Drive Error
Unit n communication error	See Table 16	Flash 6 times	/	/	E6	E6	Indoor
Unit n indoor pipe midway temperature sensor error	See Table 16	/	Flash twice	/	E2	E2	Indoor
Indoor Evaporator Temp Sensor Short/Open-Circuit	See Table 16	/	Flash twice	/	F2	F2	Indoor
(Air Valve) Unit n indoor unit pipe outlet temperature sensor error	See Table 16	/	Flash 22 times	/	b7	b7	Indoor
(Liquid Valve) Unit n indoor pipe inlet temperature sensor error	See Table 16	/	Flash 19 times	/	b5	b5	Indoor
Unit n mode conflict	See Table 16	/	Flash once	/	F1	F1	Indoor
Mode conflict	See Table 16	Flash 7 times	/	/	E7	E7	Indoor

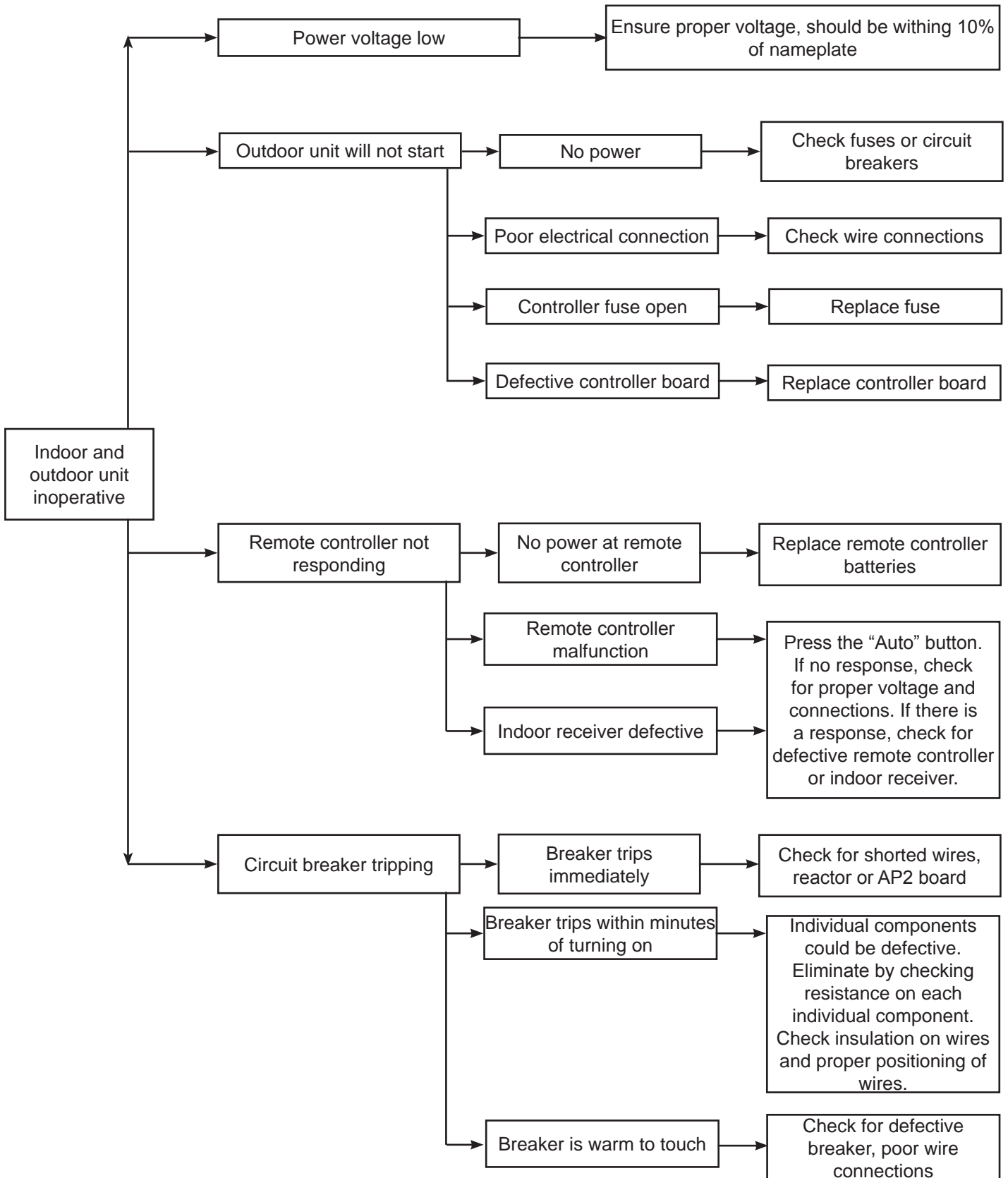
Fault Displays

Models MULTI36HP230V1AO & MULTI42HP230V1AO Table 16

Error Code	Error Description	Error Code	Error Description	Error Code	Error Description
13	Unit A indoor unit pipe outlet temperature sensor error	33	Unit C indoor unit pipe outlet temperature sensor error	46	Unit D mode conflict
14	Unit A indoor pipe inlet temperature sensor error	34	Unit C indoor pipe inlet temperature sensor error	47	Unit D anti-freezing protection
15	Unit A indoor ambient temperature sensor error	35	Unit C indoor ambient temperature sensor error	51	Unit E communication error
16	Unit A mode conflict	36	Unit C mode conflict	52	Unit E indoor pipe midway temperature sensor error
17	Unit A anti-freezing protection	37	Unit C anti-freezing protection	53	Unit E indoor unit pipe outlet temperature sensor error
23	Unit B indoor unit pipe outlet temperature sensor error	41	Unit D communication error	54	Unit E indoor pipe inlet temperature sensor error
24	Unit B indoor pipe inlet temperature sensor error	42	Unit D indoor pipe midway temperature sensor error	55	Unit E indoor ambient temperature sensor error
25	Unit B indoor ambient temperature sensor error	43	Unit D indoor unit pipe outlet temperature sensor error	56	Unit E mode conflict
26	Unit B mode conflict	44	Unit D indoor pipe inlet temperature sensor error	57	Unit E anti-freezing protection
27	Unit B anti-freezing protection	45	Unit D indoor ambient temperature sensor error	C5	Jumper terminal error

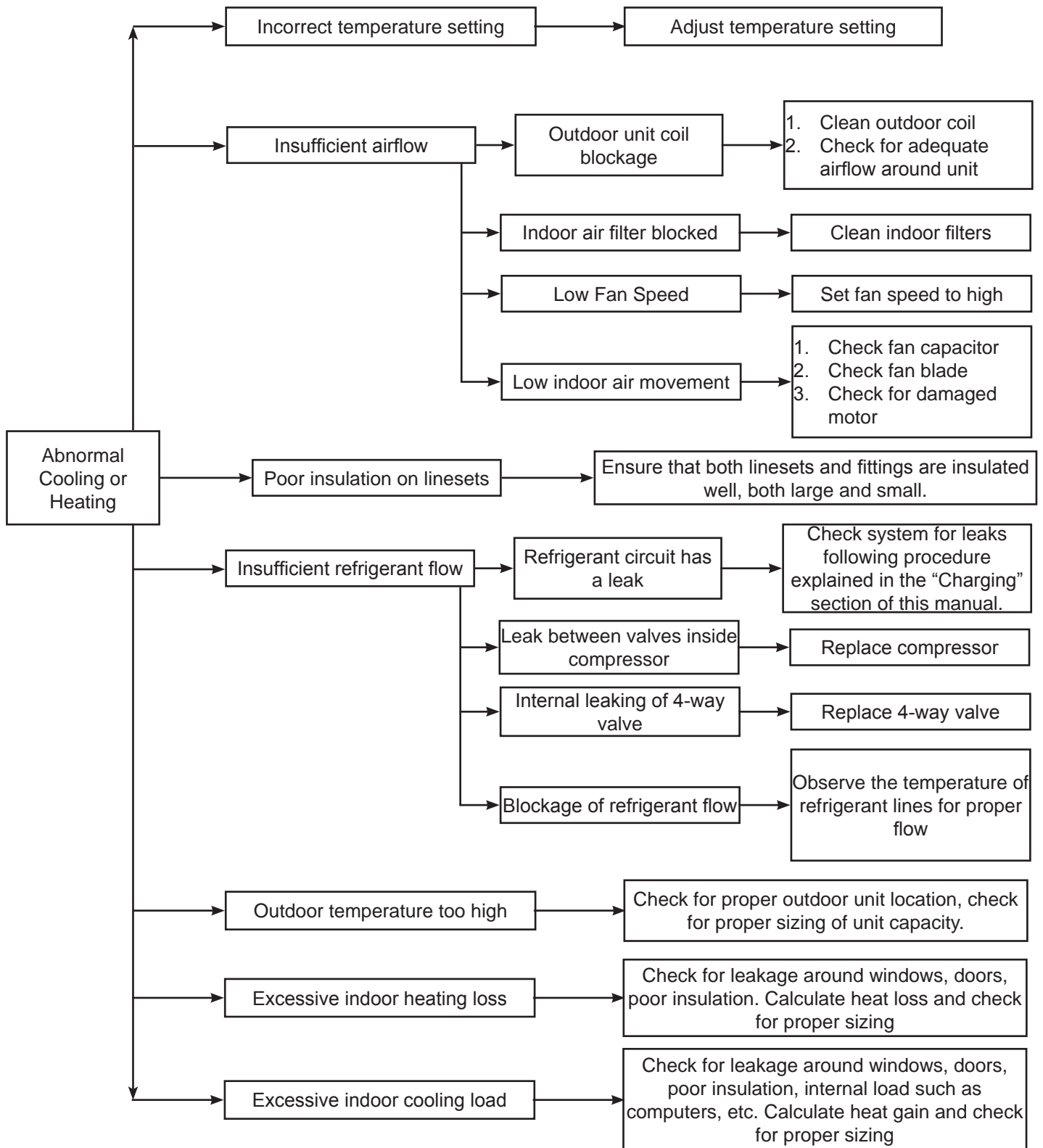
Troubleshooting

Unit Will Not Start



Troubleshooting

Inadequate Cooling or Heating



Troubleshooting

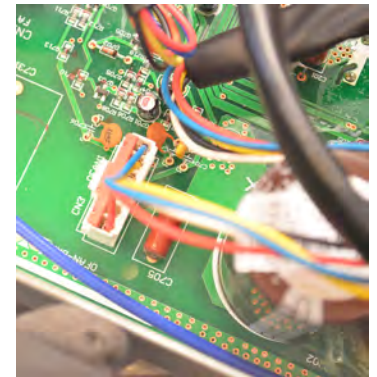
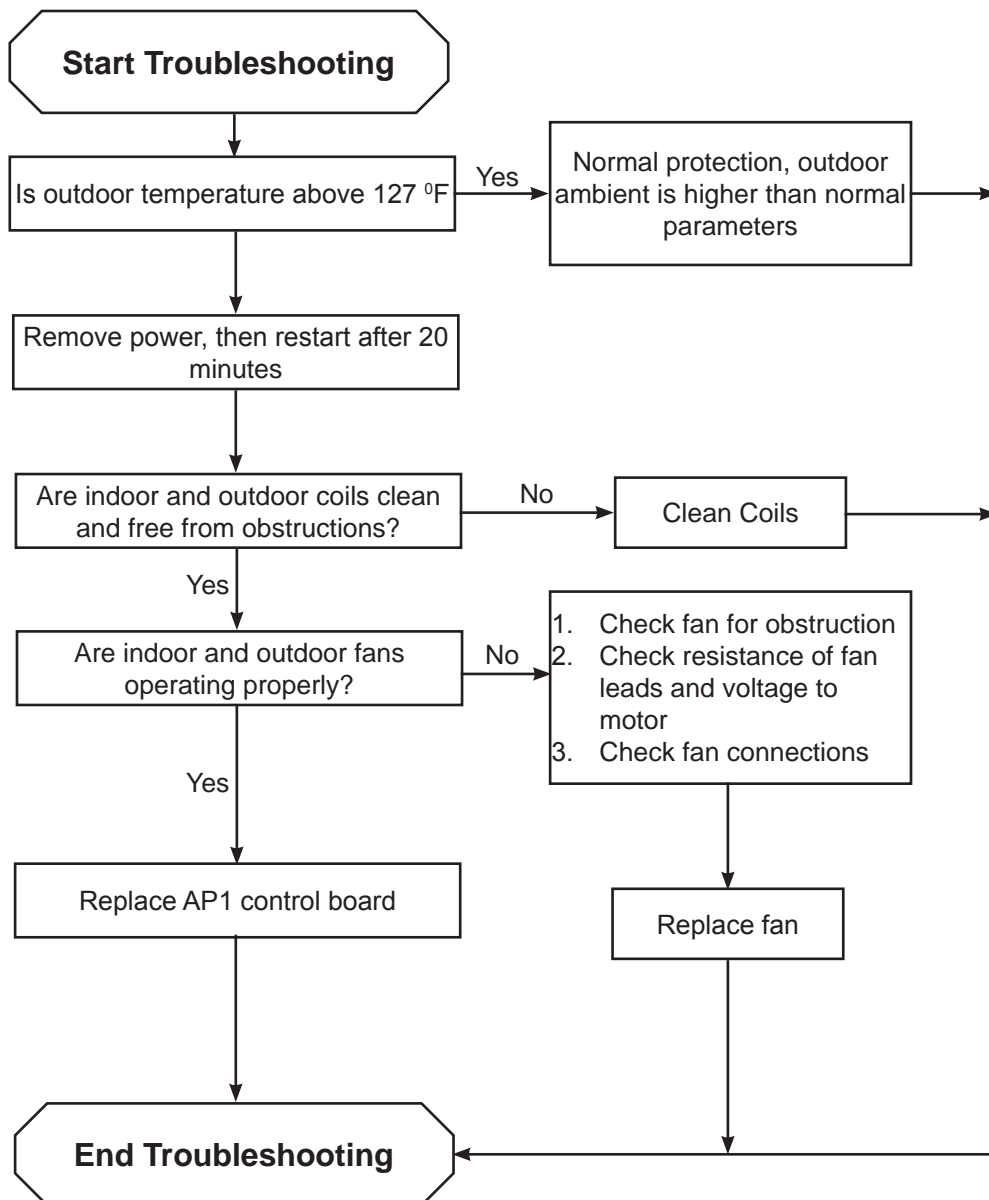
Anti-high temperature and overload malfunction

High Discharge Temperature Protection of Compressor.

Status:

Cooling operation, compressor stops while indoor fans runs. Heating operation, complete unit stops

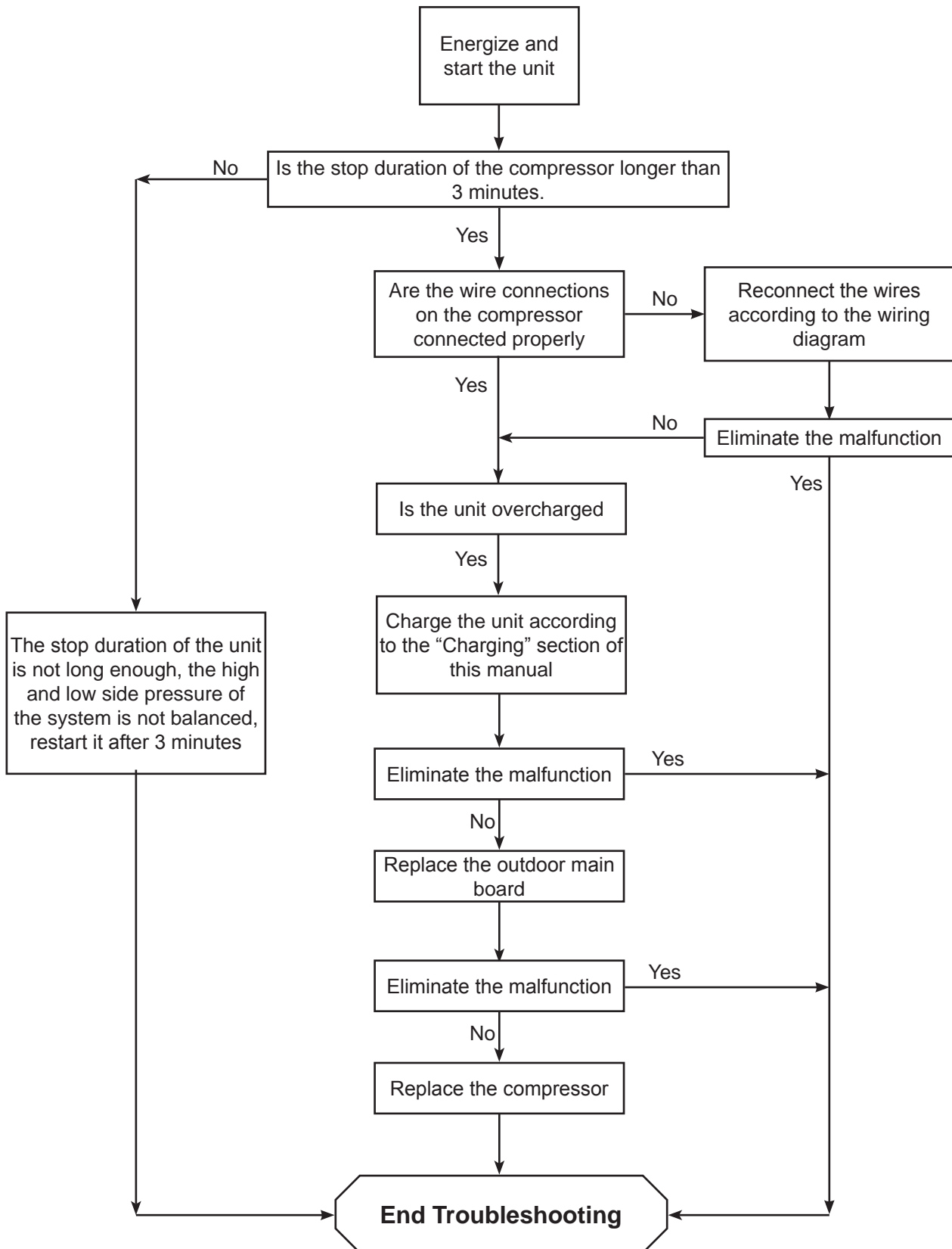
1. Is unit running in proper outdoor ambient range
2. Faulty outdoor temperature sensor
3. Refrigerant leak
4. Poor airflow of outdoor unit
5. Follow Troubleshooting procedure



Outdoor Fan Connection

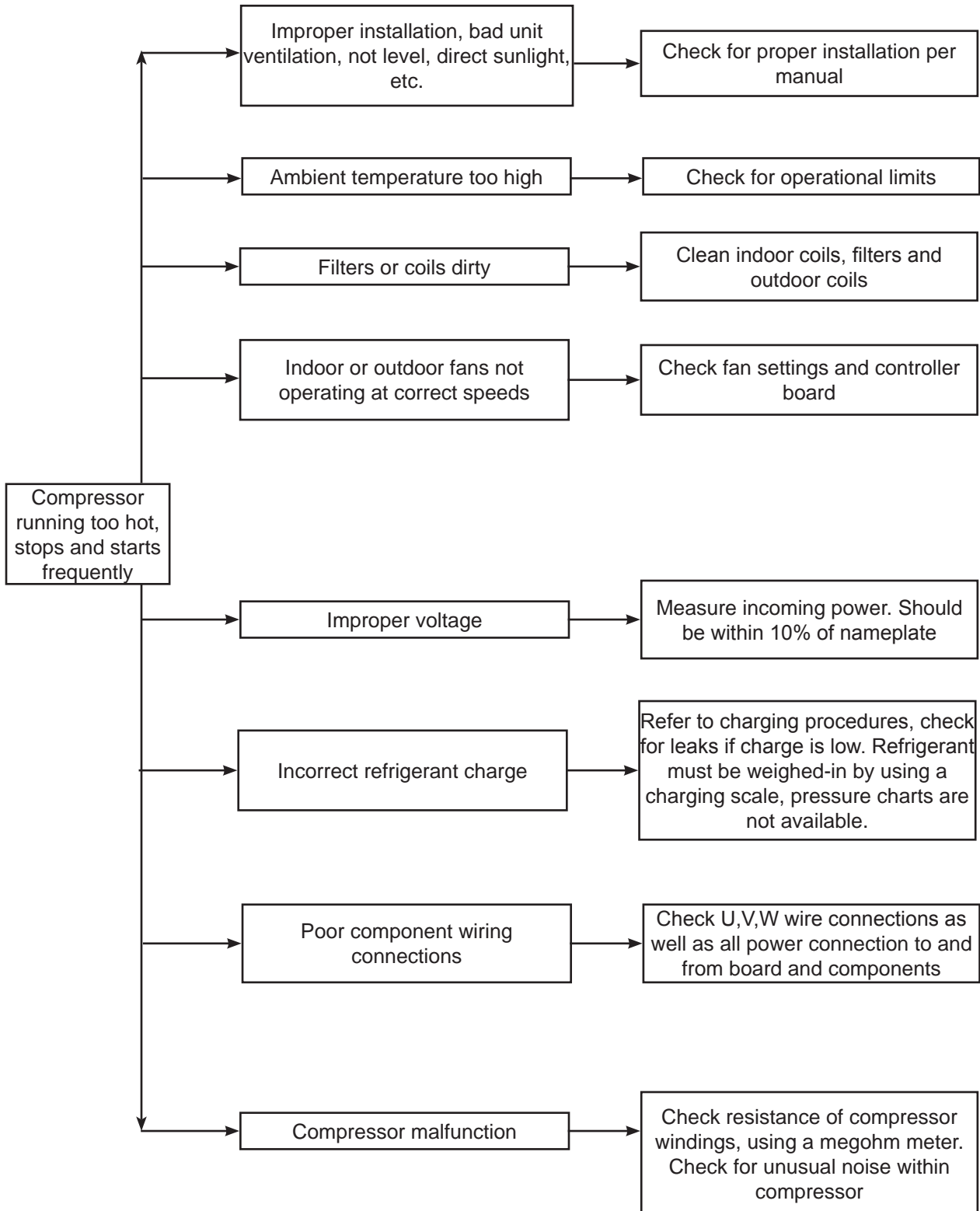
Troubleshooting

Start Failure Malfunction



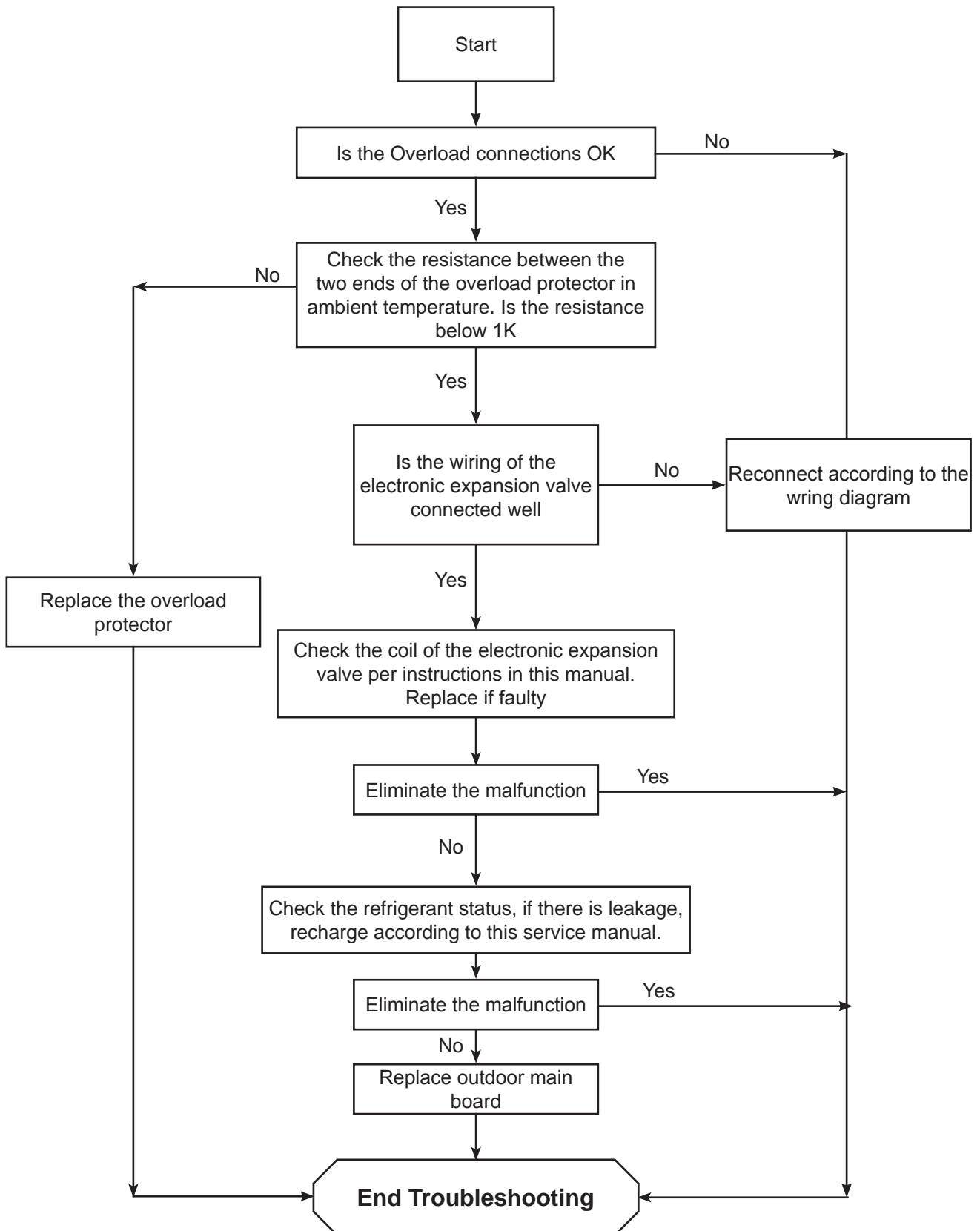
Troubleshooting

Compressor Running Hot



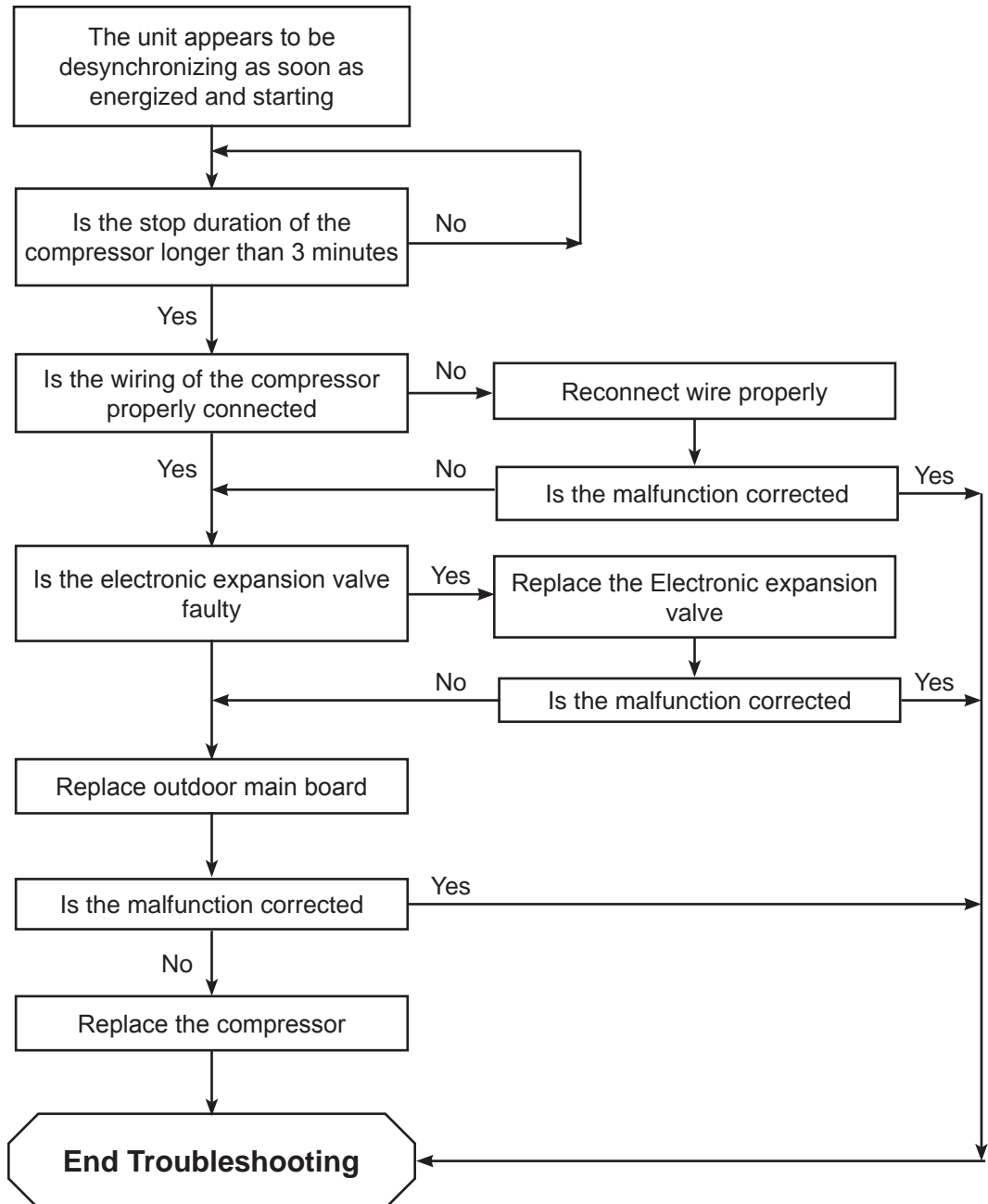
Troubleshooting

Compressor Overload, Discharge protection malfunction



Troubleshooting

Compressor Desynchronizing Malfunction



Error Code Diagnostics

C5 Error Code

C5

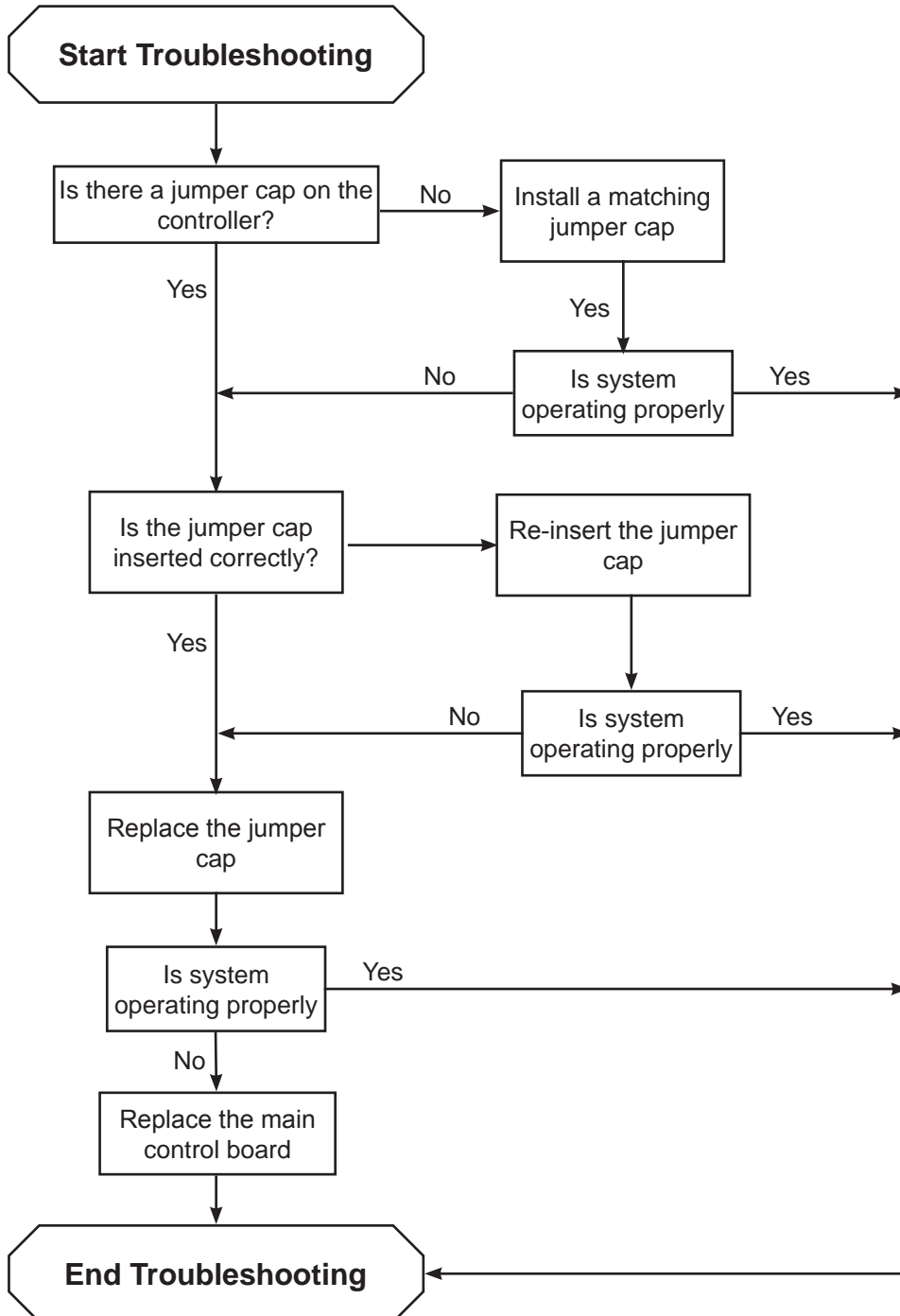


Jumper Cap Malfunction

Status:

Wireless remote will not send command to indoor unit.

1. No jumper cap inserted on board
2. Jumper cap not fully seated
3. Jumper cap damaged
4. Bad control board



Error Code Diagnostics

EE, EU, FH, E2 Error Codes

Fault & Status

Possible Causes

EE



EEProm Malfunction

Status:

During cooling & dehumidifying, indoor unit operates while other functions stop; During heating operation, complete unit stops

1. Faulty outdoor control board, replace AP1

EU



Decrease in Frequency due to over heating of Module

Status:

All units operate with decrease in capacity

1. After the unit is off for 20 minutes, check for sufficient thermal grease on IPM module of the outdoor control board and that is seated tightly.
2. Faulty control board, replace

FH



Decrease frequency due to anti-freezing

Status:

All units operate with decrease in capacity

1. Poor air return in indoor unit
2. Fan speed too slow

E2



Antifreeze Protection

Status:

Cooling operation, compressor stops while indoor fans runs. Heating operation, complete unit stops

1. Poor air return in indoor unit
2. Fan speed abnormal
3. Indoor coil dirty

Error Code Diagnostics

E1 Error Codes

Compressor High Pressure Protection

E1



Fault & Status

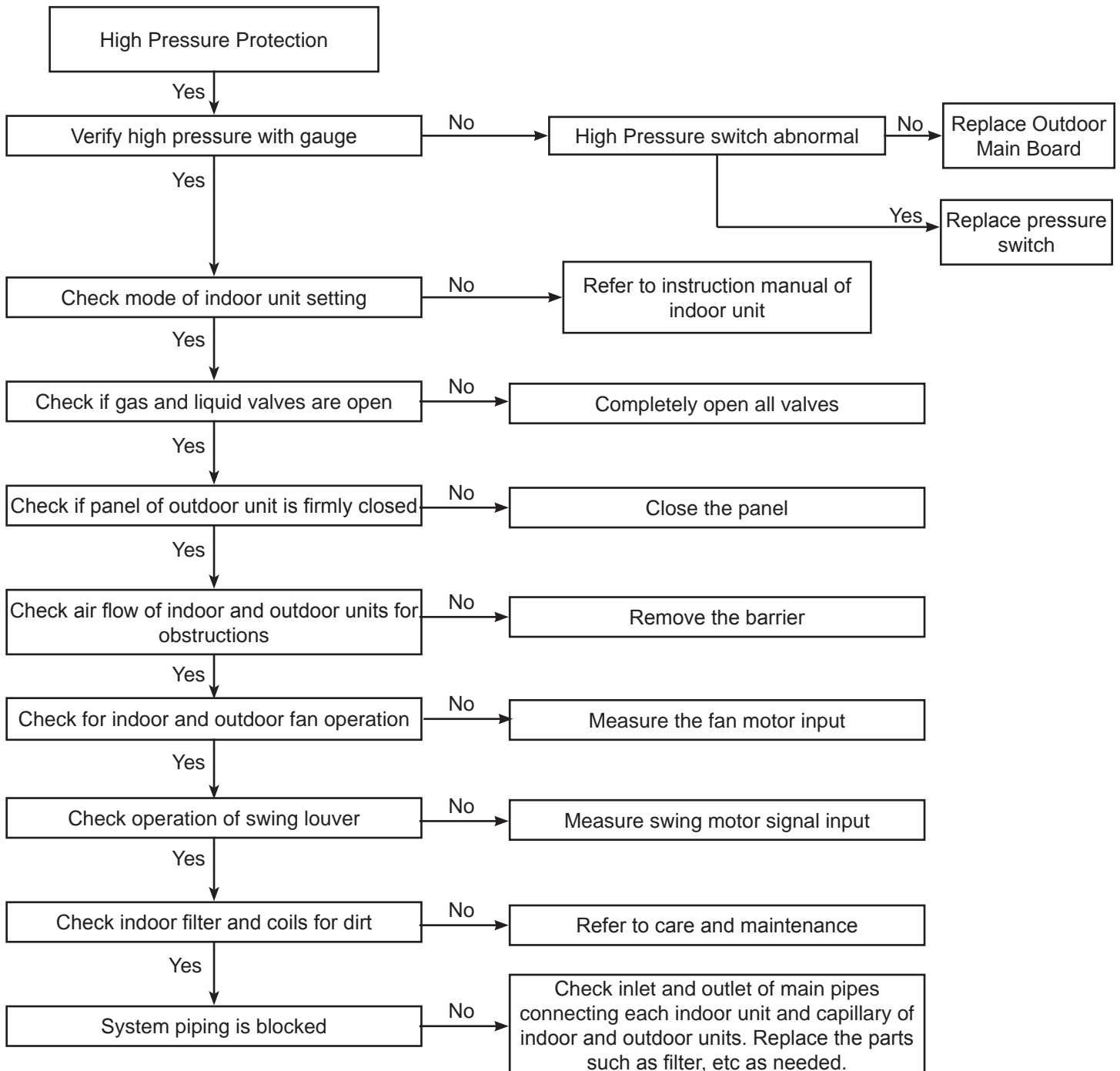
High Pressure Protection of System

Status:

During cooling & dehumidifying, indoor unit operates while other functions stop; During heating operation, complete unit stops

Possible Causes

1. Refrigerant overcharge
2. Dirty outdoor coil
3. Blockage of airflow
4. Outdoor ambient too high



Error Code Diagnostics

E3 Error Codes

Compressor Low Pressure Protection

E3



Fault & Status

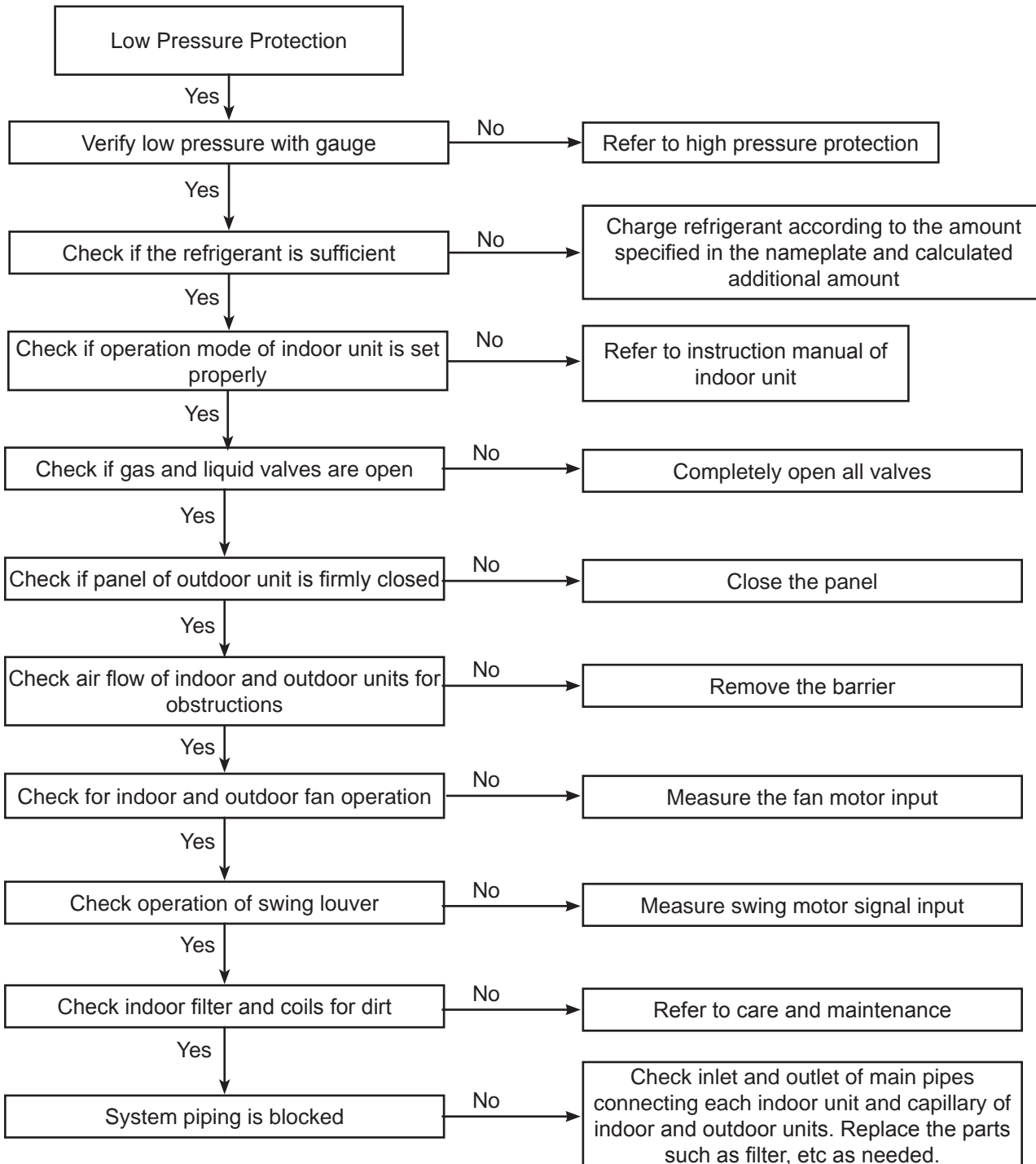
Low Pressure Protection

Status:

Cooling operation, compressor stops while indoor fans runs. Heating operation, complete unit stops

Possible Causes

1. Low refrigerant charge
2. Improper indoor mode setting
3. Improper fan operation
4. Refrigerant valve not fully opened



Error Code Diagnostics

E4 Error Code

High Discharge Temperature Protection of Compressor.

E4

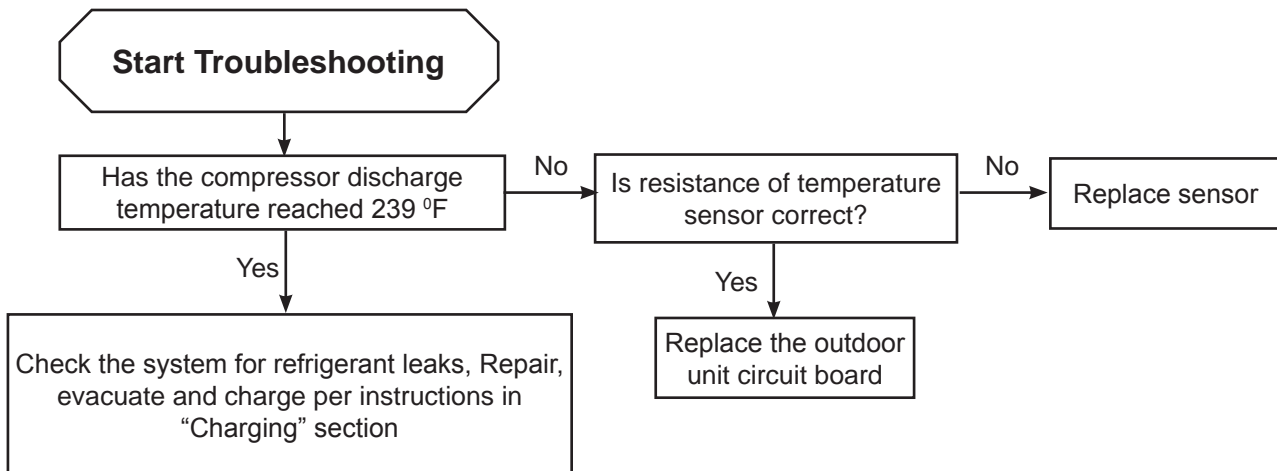


High Discharge Temperature Protection of Compressor.

Status:

Cooling operation, compressor stops while indoor fans runs. Heating operation, complete unit stops

1. Faulty outdoor temperature sensor
2. Refrigerant leak
3. Poor airflow of outdoor unit
4. Follow Troubleshooting procedure



Error Code Diagnostics

E5 Error Code

Overcurrent Protection



E5

Fault & Status

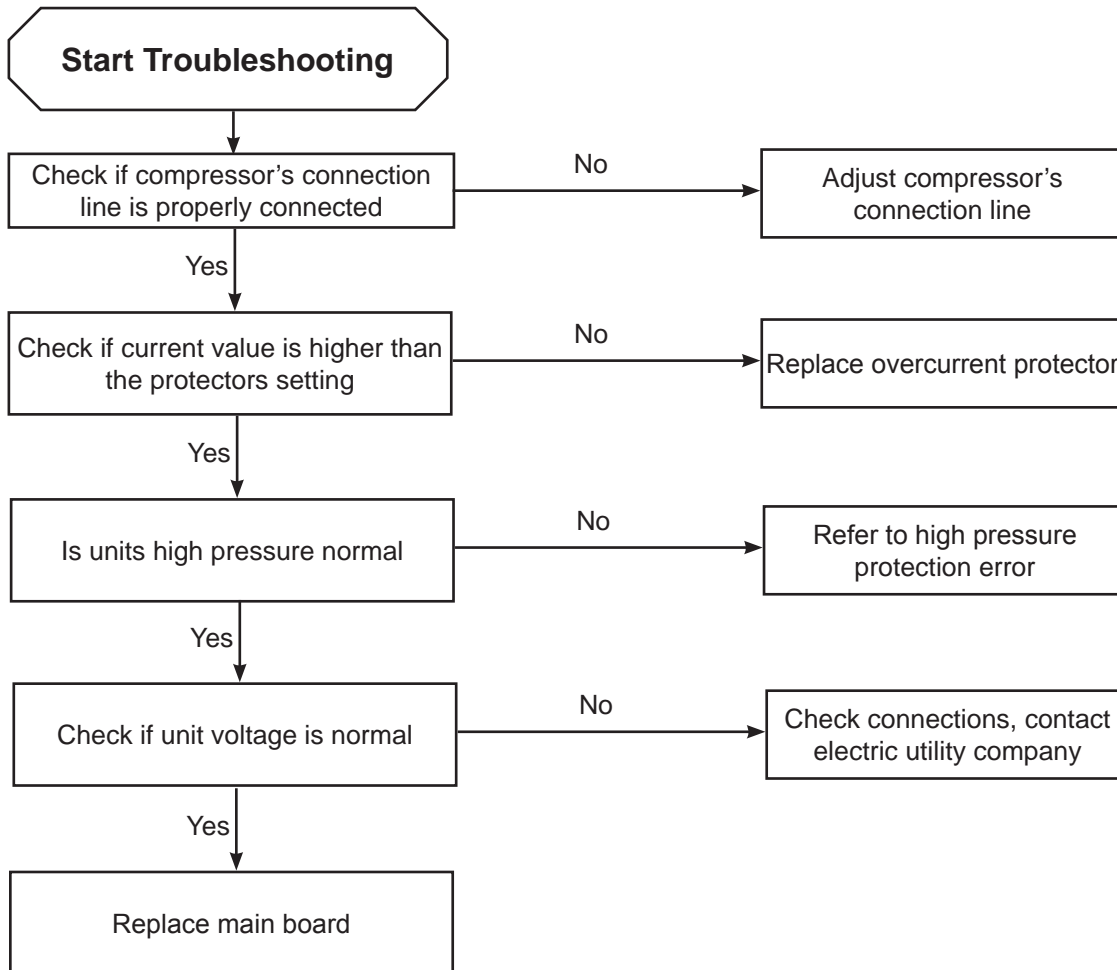
Overcurrent Protection

Status:

During cooling & dehumidifying, indoor unit operates while other functions stop; During heating operation, complete unit stops

Possible Causes

1. Supply voltage is unstable
2. Supply voltage is too low
3. Coils are dirty
4. Improper refrigerant charge



Error Code Diagnostics

E6 Error Code Communication Failure of Some Indoor Units

E6

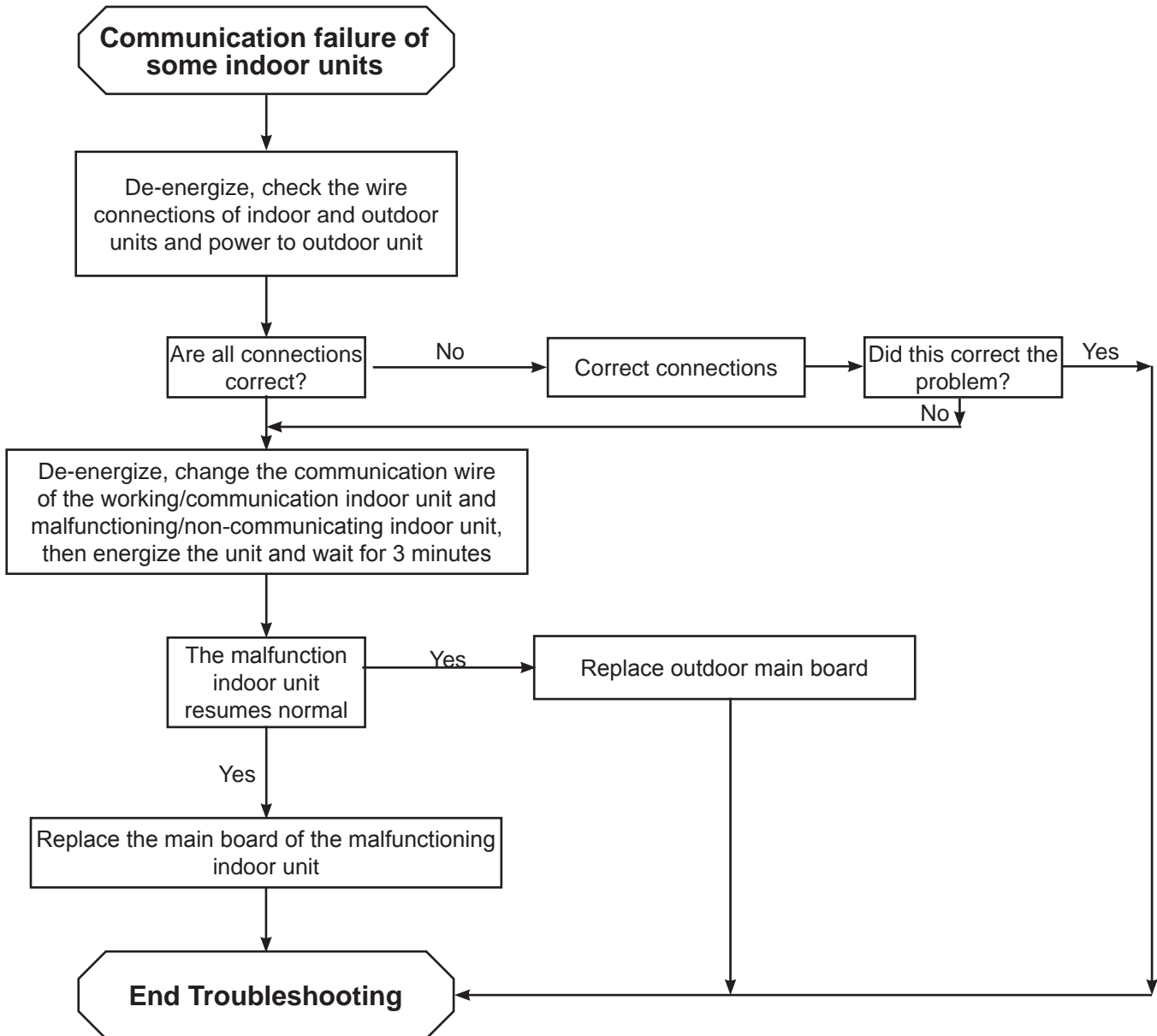


Communication Failure

Status:

Cooling operation, compressor stops while indoor fans runs. Heating operation, complete unit stops

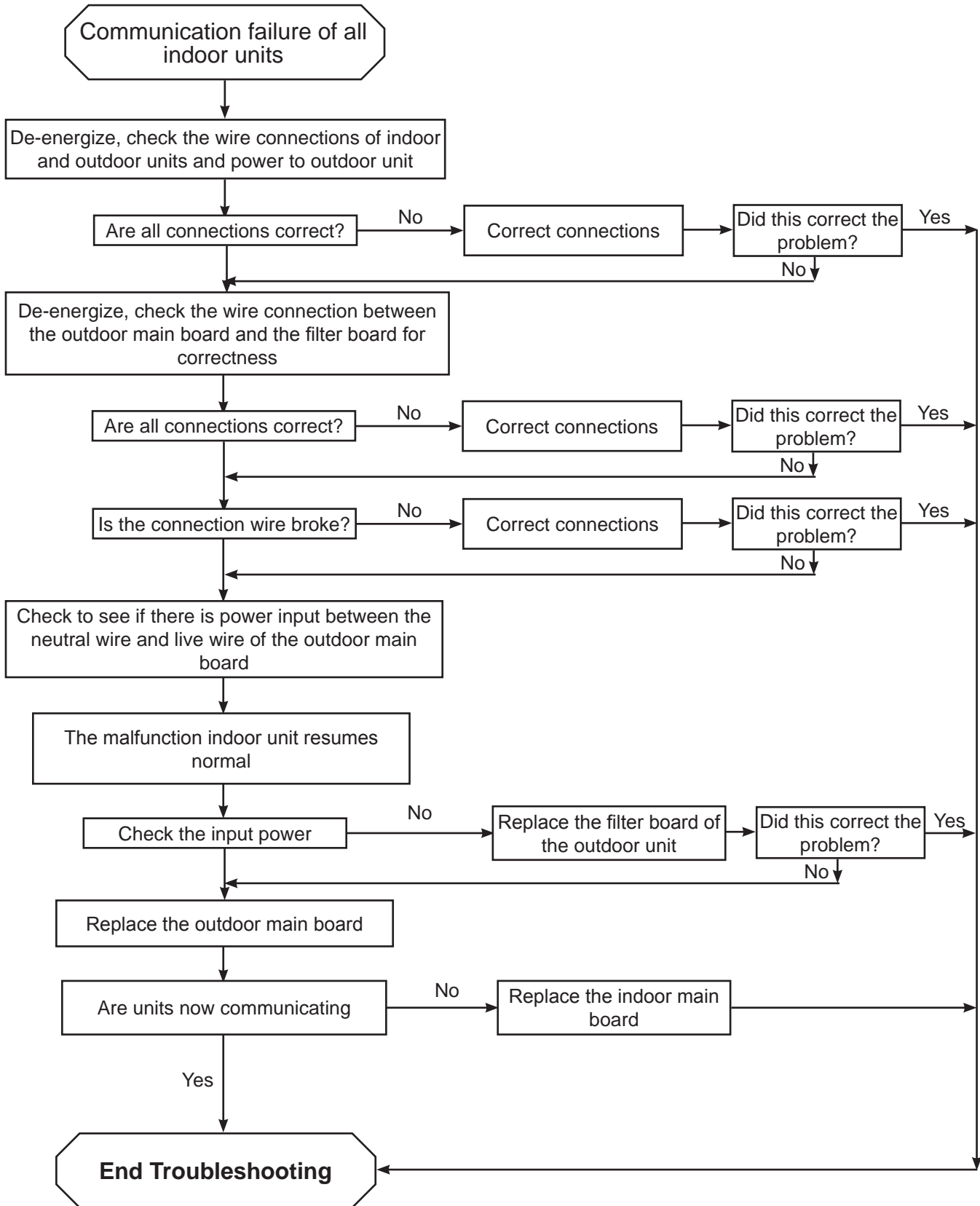
1. Improper voltages
2. Mis-matched indoor and outdoor units
3. Improper wiring between indoor and outdoor units



Error Code Diagnostics

E6 Error Code, continued

Communication Failure of All Indoor Units



Error Code Diagnostics

E8 Error Code

Overload System Protection Problem

E8



Overload System Protection Problem

Status:

Cooling operation, compressor stops while indoor fans runs. Heating operation, complete unit stops

1. Incorrect refrigerant charge
2. Metering device problem
3. Compressor failure

Start Troubleshooting after unit is powered off for 20 minutes

Is the overload protector positioned and wired correctly?

No



Compressor Overload

Under normal ambient conditions, is the resistance of the overload less than 1000 ohms?

No

Replace Overload

Are the wires to the expansion valve connected per the wiring diagram?

No

Correct wiring problem



Metering Device

Resistance between the first 4 pins and the 5th pin should be less than 100 ohms

Replace coil of electronic expansion valve

Is system operating normal?

Yes

No

Check Refrigerant for leakage and proper charge

Replace outdoor AP1 control board

Is system working properly?

Yes

End Troubleshooting

Error Code Diagnostics

E9 Error Code

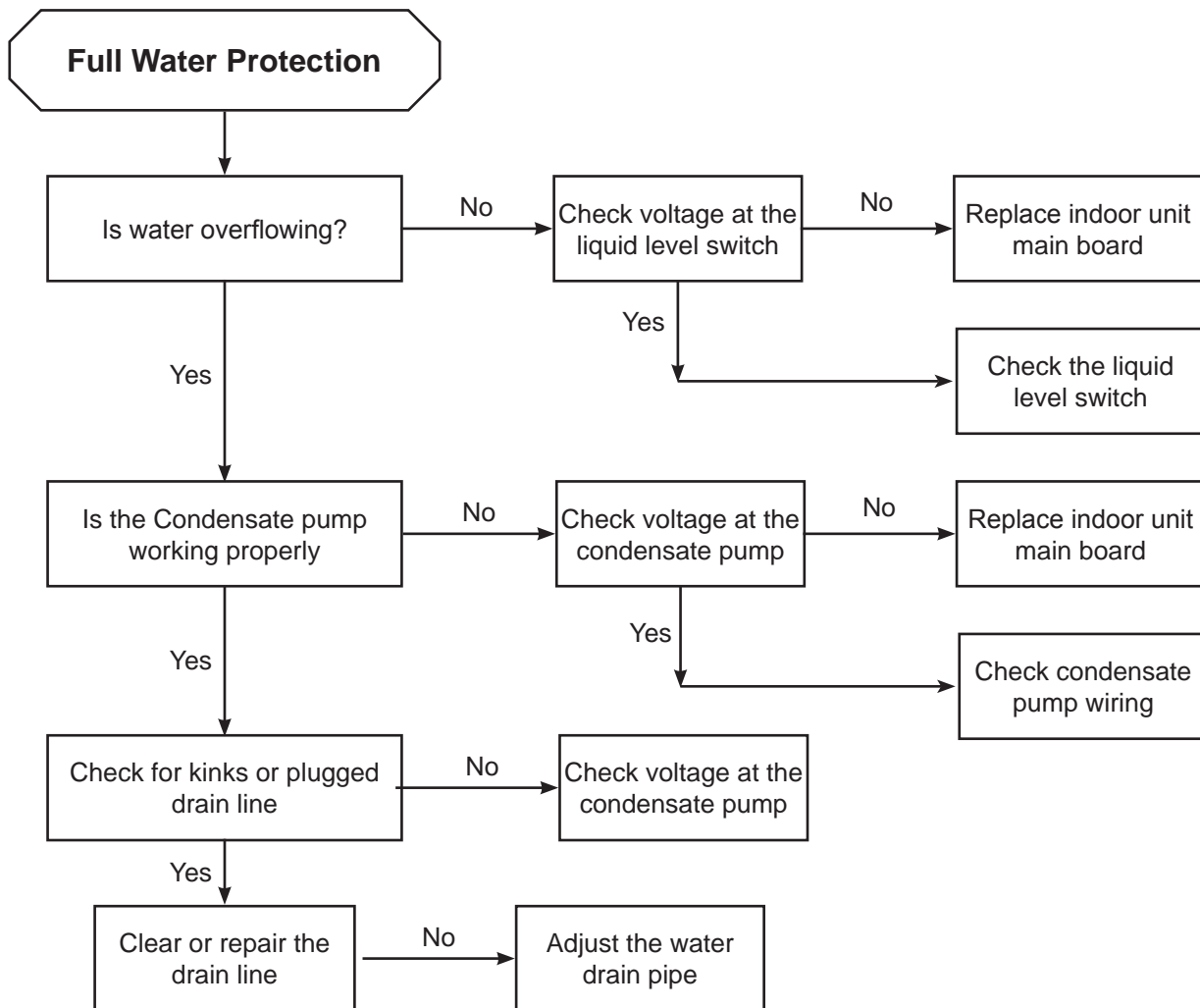
Full Water Protection

E9



Possible Causes

1. Drain line plugged
2. Faulty condensate pump
3. Faulty liquid level switch
4. Faulty main circuit board



Error Code Diagnostics

F1 - F5 Temperature Sensor Codes

See troubleshooting chart next page

Fault & Status

Possible Causes

F1



Indoor ambient temperature sensor is open or short circuited.

Status:

During cooling & dehumidifying, indoor unit operates while other functions stop; During heating operation, complete unit stops

1. Loose or bad contact of indoor temperature sensor
2. Sensor wire leads not properly connected
3. Faulty sensor, check readings with charts
4. Main circuit board defective

F2



Indoor evaporator temperature sensor is open or short circuited.

Status:

After reaching set-point, all components stop operation, cooling and heating modes

1. Loose or bad contact of indoor temperature sensor
2. Sensor wire leads not properly connected
3. Faulty sensor, check readings with charts
4. Main circuit board defective

F3



Outdoor ambient temperature sensor is open or short circuited.

Status:

Cooling operation, compressor stops while indoor fans runs. Heating operation, complete unit stops

1. Loose or bad contact of outdoor temperature sensor
2. Sensor wire leads not properly connected
3. Faulty sensor, check readings with charts
4. Main circuit board defective

F4



Outdoor Mid-Coil condenser temperature sensor is open or short circuited.

Status:

Cooling operation, compressor stops while indoor fans runs. Heating operation, complete unit stops

1. Loose or bad contact of outdoor temperature sensor
2. Sensor wire leads not properly connected
3. Faulty sensor, check readings with charts
4. Main circuit board defective

F5



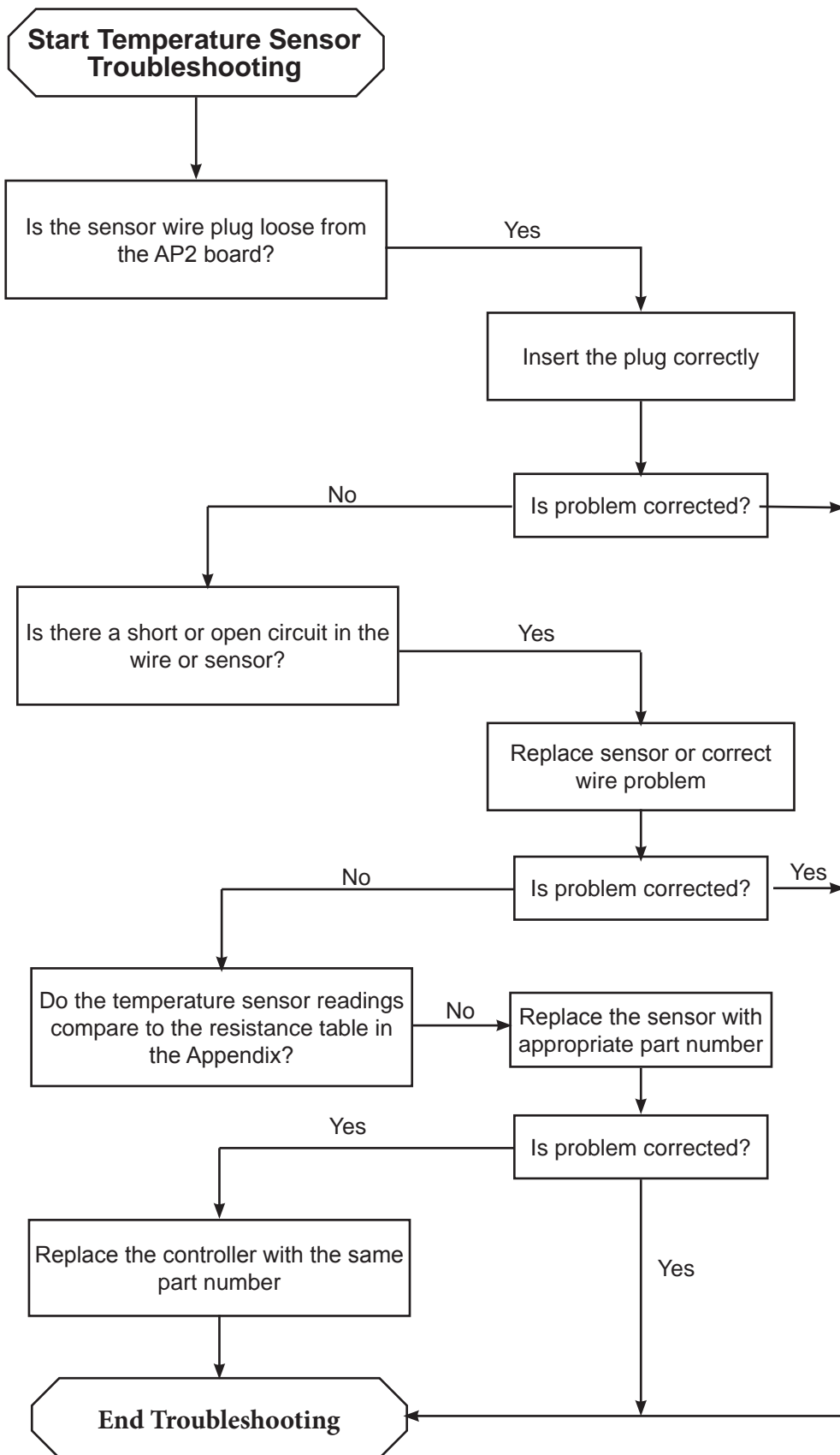
Outdoor discharge temperature sensor is open or short circuited.

Status:

Cooling operation, compressor stops after 3 minutes while indoor fans runs. Heating operation, complete unit stops after operating for 3 minutes

1. Loose or bad contact of outdoor temperature sensor, head of sensor should be inserted into the copper tubing
2. Sensor wire leads not properly connected
3. Faulty sensor, check readings with charts
4. Main circuit board defective

Temperature Sensor Troubleshooting



Error Code Diagnostics

F6 - F9 Temperature Sensor Codes

See troubleshooting chart preceding page

Fault & Status

Possible Causes

F6



Decrease frequency due to overload.

Status:

All systems operate normal with decrease in capacity

1. Refer to "E8" troubleshooting procedures

F7



Oil Return in Cooling

Normal function

F8



Decrease frequency due to overcurrent.

Status:

All systems operate normal with decrease in capacity

1. Input voltage too low.
2. System pressure is too high

F9



Decrease frequency due to high discharge air.

Status:

All systems operate normal with decrease in capacity

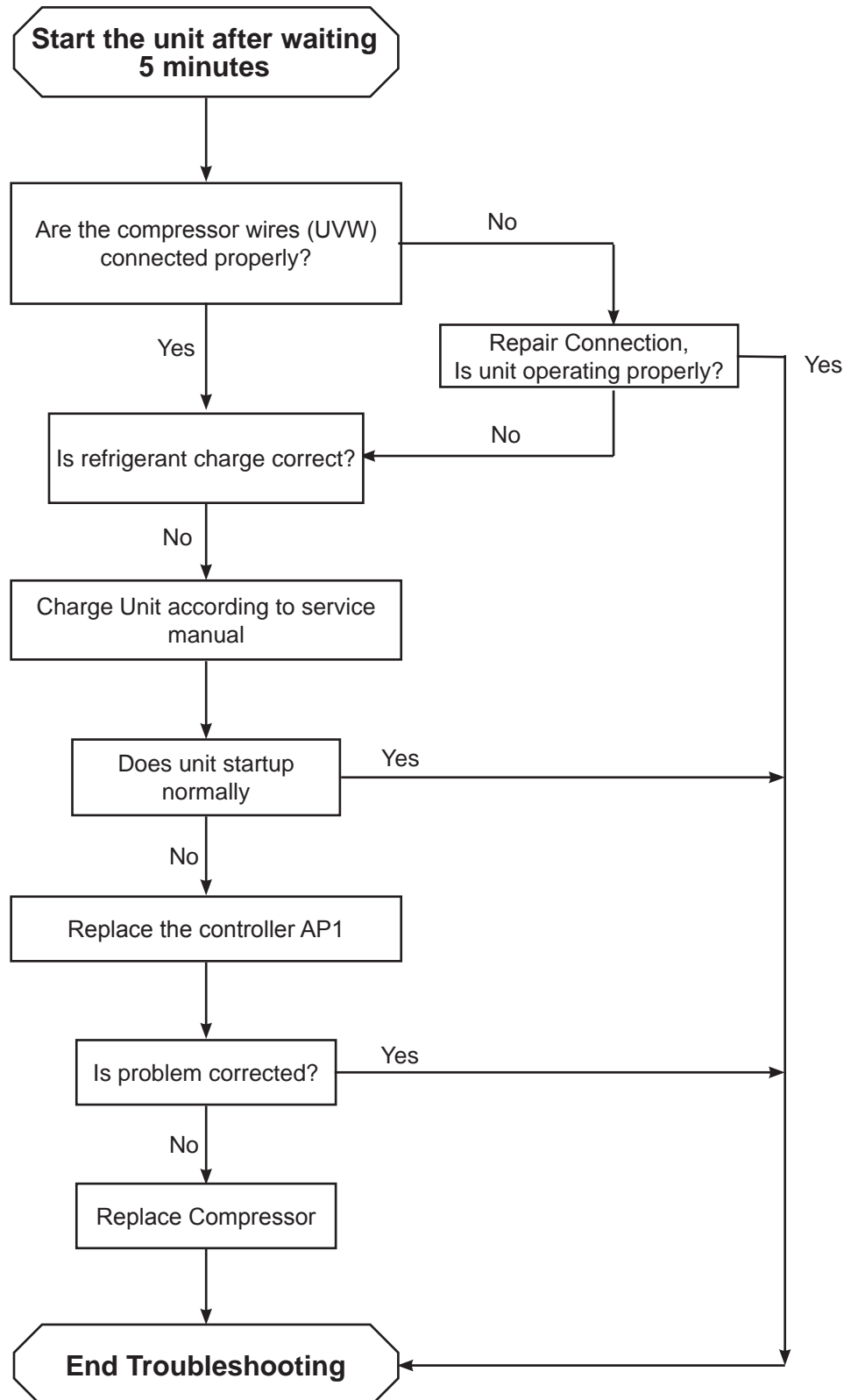
1. Cooling load is too great
2. Outdoor ambient too high
3. Refrigerant undercharge
4. Electronic expansion valve fault

Start-up Failure Troubleshooting

Lc - Start-up Failure



Compressor Connector



Error Code Diagnostics

HC

PFC (Power Factor Correction) Protection



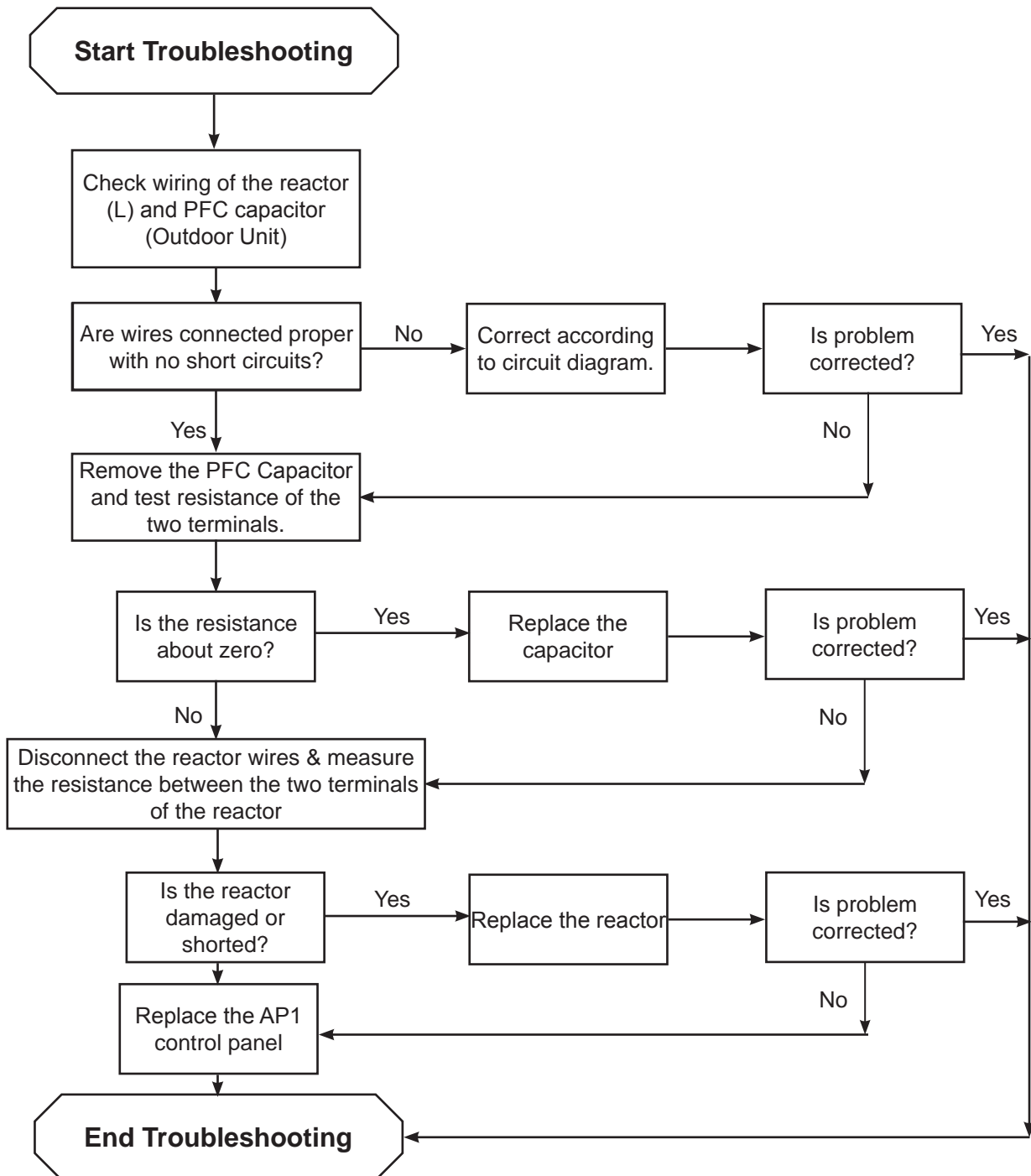
HC

PFC (Power Factor Correction) Protection

Status:

During cooling & dehumidifying, indoor unit operates while other functions stop; During heating operation, complete unit stops

1. Check for damage to the reactor and PFC capacitor of the outdoor unit
2. Refer to troubleshooting procedure below



Error Code Diagnostics

H0 - H3 Error Codes

Fault & Status

Possible Causes

H0



Decrease frequency due to overload.

Status:

All systems operate normal with decrease in capacity

1. Refer to "E8" troubleshooting procedures

H1



Defrosting

Status:

Defrosting will occur in heating mode. Compressor will operate while indoor fan stops.

Normal function

H3



Overload Protection for Compressor

Status:

During cooling mode, compressor will stop, indoor fan will run. Heating mode all units stop.

1. Wiring terminal OVC-COMP is loose. In normal state the resistance should be less than 1 ohm,
2. Refer to "E4" troubleshooting procedures.

Error Code Diagnostics

H5 Error Code IPM Protection



Fault & Status

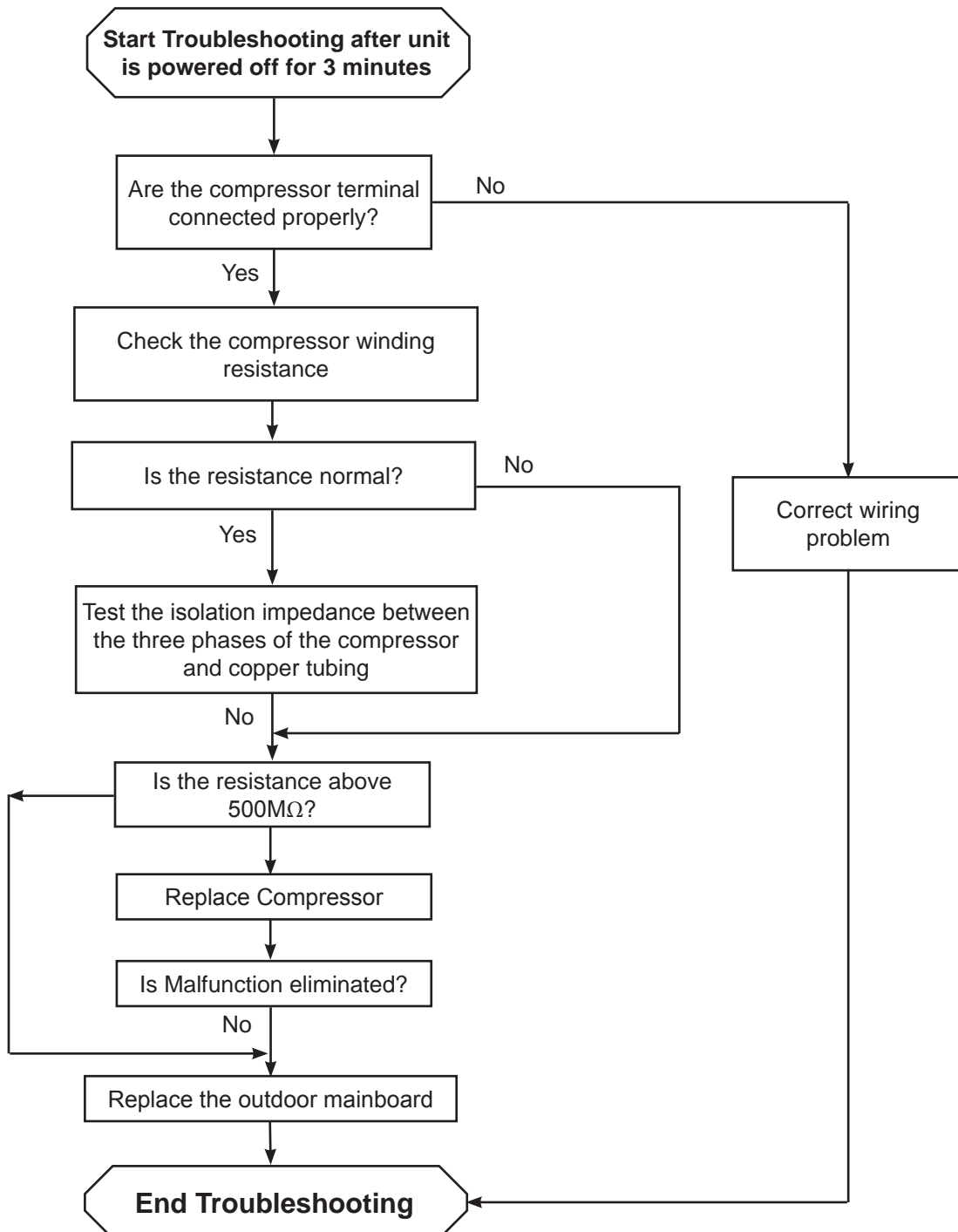
IPM Protection

Status:

During cooling mode, compressor will stop, indoor fan will run. Heating mode all units stop.

Possible Causes

1. Dirty indoor and outdoor coils
2. Faulty indoor or outdoor fans
3. High system pressure
4. Over charge of refrigerant



Error Code Diagnostics

H7 Error Code, continued on next page

H7



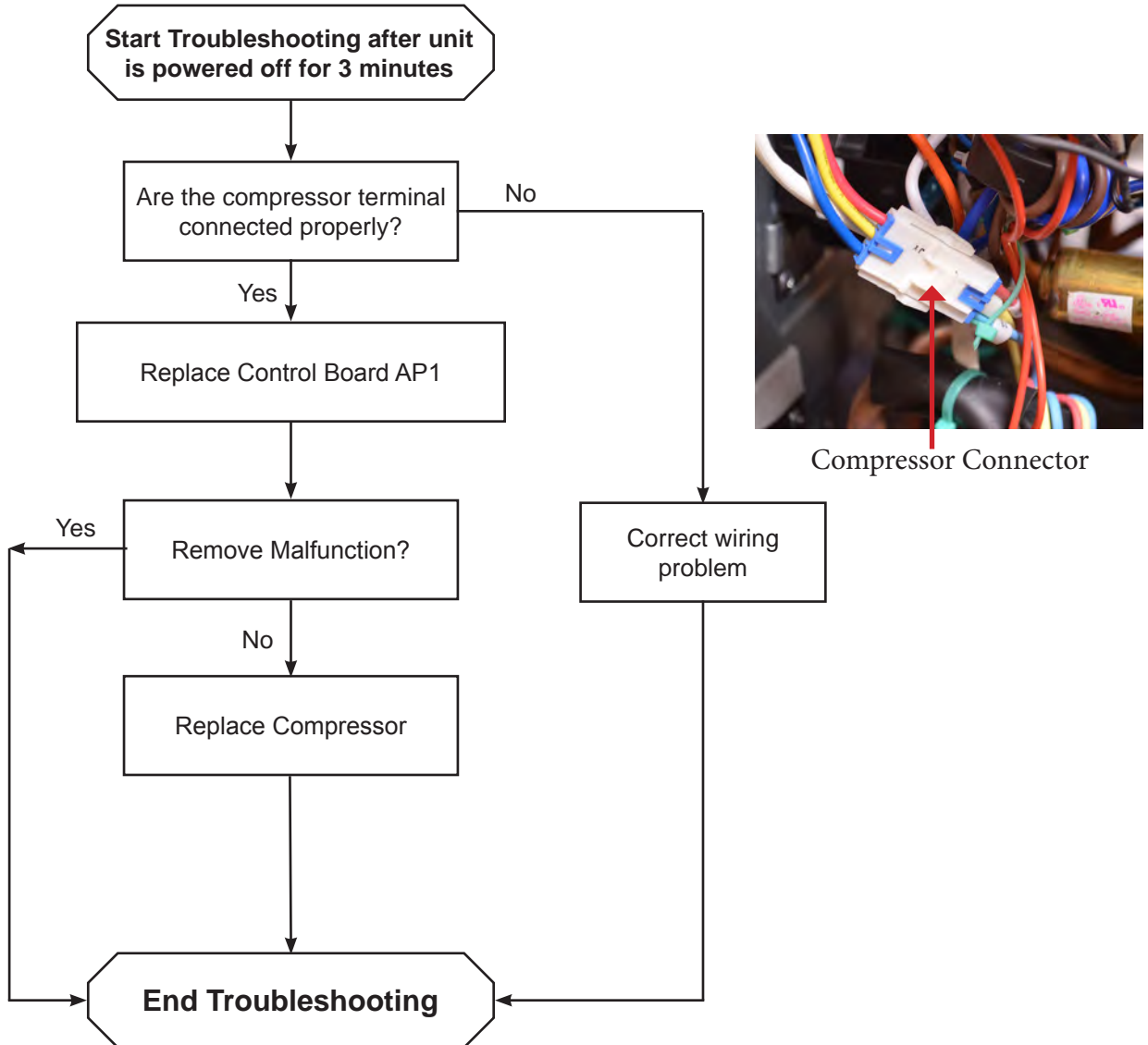
Desynchronizing of compressor

Status:

During cooling mode, compressor will stop, indoor fan will run. Heating mode all units stop.

1. Check the resistance of the compressor terminals and connections to the compressor
2. Check for overcharge of refrigerant
3. Check for correct voltage
4. Check for dirty coils and filters

Troubleshooting Procedure for Synchronizing Fault after Unit is Started



Error Code Diagnostics

H7 Error Code, continued

H7



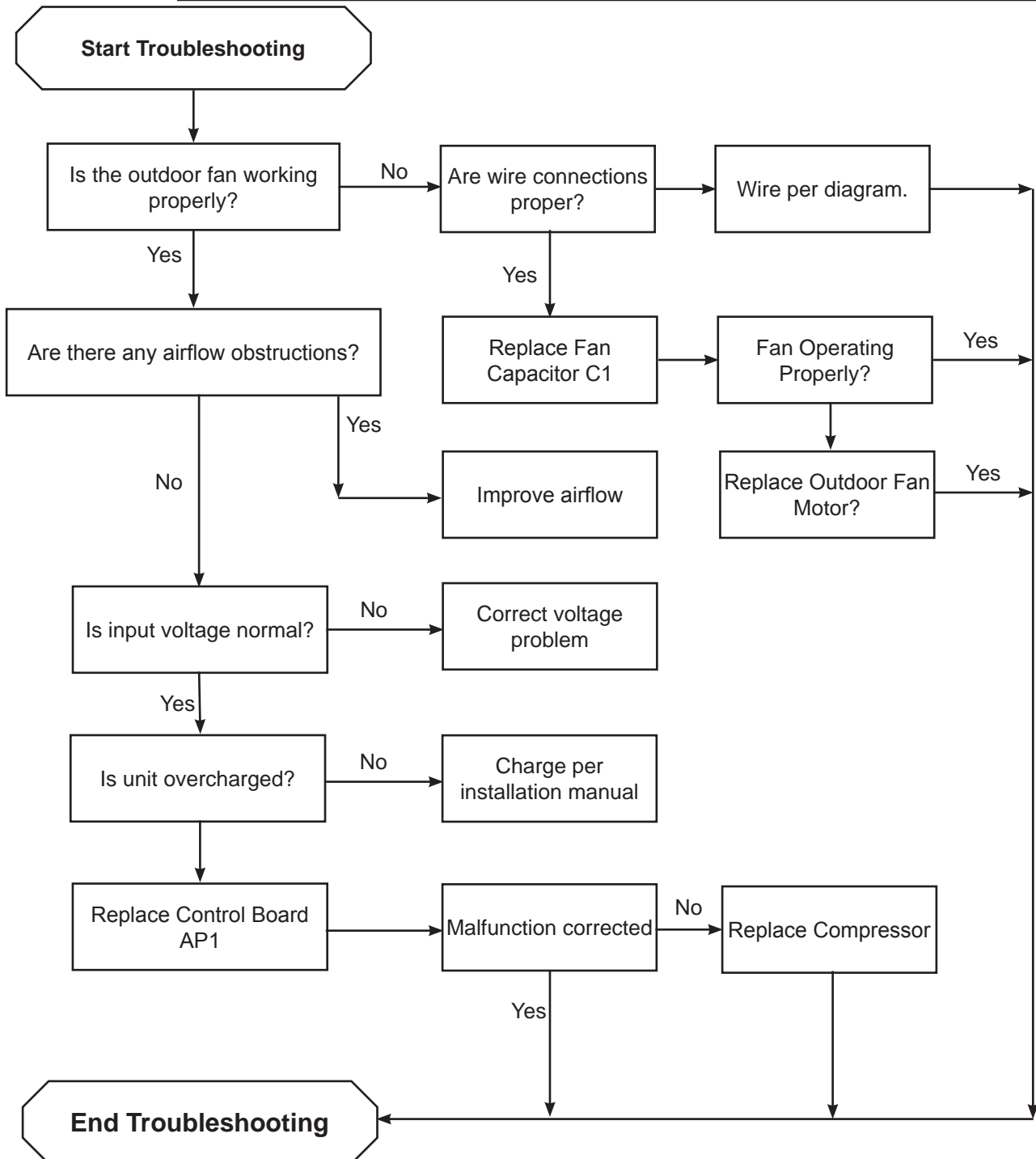
Desynchronizing of compressor

Status:

During cooling mode, compressor will stop, indoor fan will run. Heating mode all units stop.

1. Check the resistance of the compressor terminals and connections to the compressor
2. Check for overcharge of refrigerant
3. Check for correct voltage

Troubleshooting Procedure for Synchronizing Fault During Operation



Error Code Diagnostics

U1, U3, U5, U7, U9 Error Codes

Fault & Status

Possible Causes

U1



Compressor Phase Detection Error

Status:

During cooling mode, compressor will stop, indoor fan will run. Heating mode all units stop.

1. Replace outdoor control panel AP1

U3



DC Bus-Bar Voltage Unstable

Status:

During cooling mode, compressor will stop, indoor fan will run. Heating mode all units stop.

1. Supply voltage is unstable

U5



Circuit Board Malfunction on Outdoor Unit

Status:

During cooling mode, compressor will stop, indoor fan will run. Heating mode all units stop.

1. Replace outdoor control panel AP1

U7



Reversing Valve Malfunction

Status:

During heating mode, complete unit will stop

1. Supply voltage is too low
2. Wiring terminal on reversing valve is loose or broken
3. Replace reversing valve

U9



Zero crossing, malfunction of Outdoor Unit

Status:

During cooling mode, compressor will stop, indoor fan will run. Heating mode all units stop.

1. Replace outdoor control panel AP1

Error Code Diagnostics

PH, PL, P5, P7, P8 Error Codes

Fault & Status

Possible Causes

PH



High DC Bus-Bar Voltage

Status:

During cooling mode, compressor will stop, indoor fan will run. Heating mode all units stop.

1. Measure the voltage on "L" & "N" on line voltage, if it is higher then 265vac, correct high voltage.
2. If AC voltage is normal, measure the voltage on the electrolytic capacitor on control panel AP1, if it is normal replace the AP1 board.

PL



Low DC Bus-Bar Voltage

Status:

During cooling mode, compressor will stop, indoor fan will run. Heating mode all units stop.

1. Measure the voltage on "L" & "N" on line voltage, if it is lower then 200vac, correct incoming voltage.
2. If AC voltage is normal, measure the voltage on the electrolytic capacitor on control panel AP1, if it is normal replace the AP1 board.

P5



Overcurrent Protection of Compressor Phase Current

Status:

During heating mode, complete unit will stop

1. Refer to "H7" troubleshooting

P7



Module Temperature Sensor Circuit Failure

Status:

During cooling mode, compressor will stop, indoor fan will run. Heating mode all units stop.

1. Replace outdoor control panel AP1

P8



Module High Temperature Protection

Status:

During cooling mode, compressor will stop, indoor fan will run. Heating mode all units stop.

1. After unit is de-energized for 20 minutes, check for proper thermal grease on IPM module of outdoor control panel AP1 and contact is good. If this is OK, replace AP1 control module of outdoor unit.

Error Code Diagnostics

PU Error Code Capacity Charging Malfunction

PU

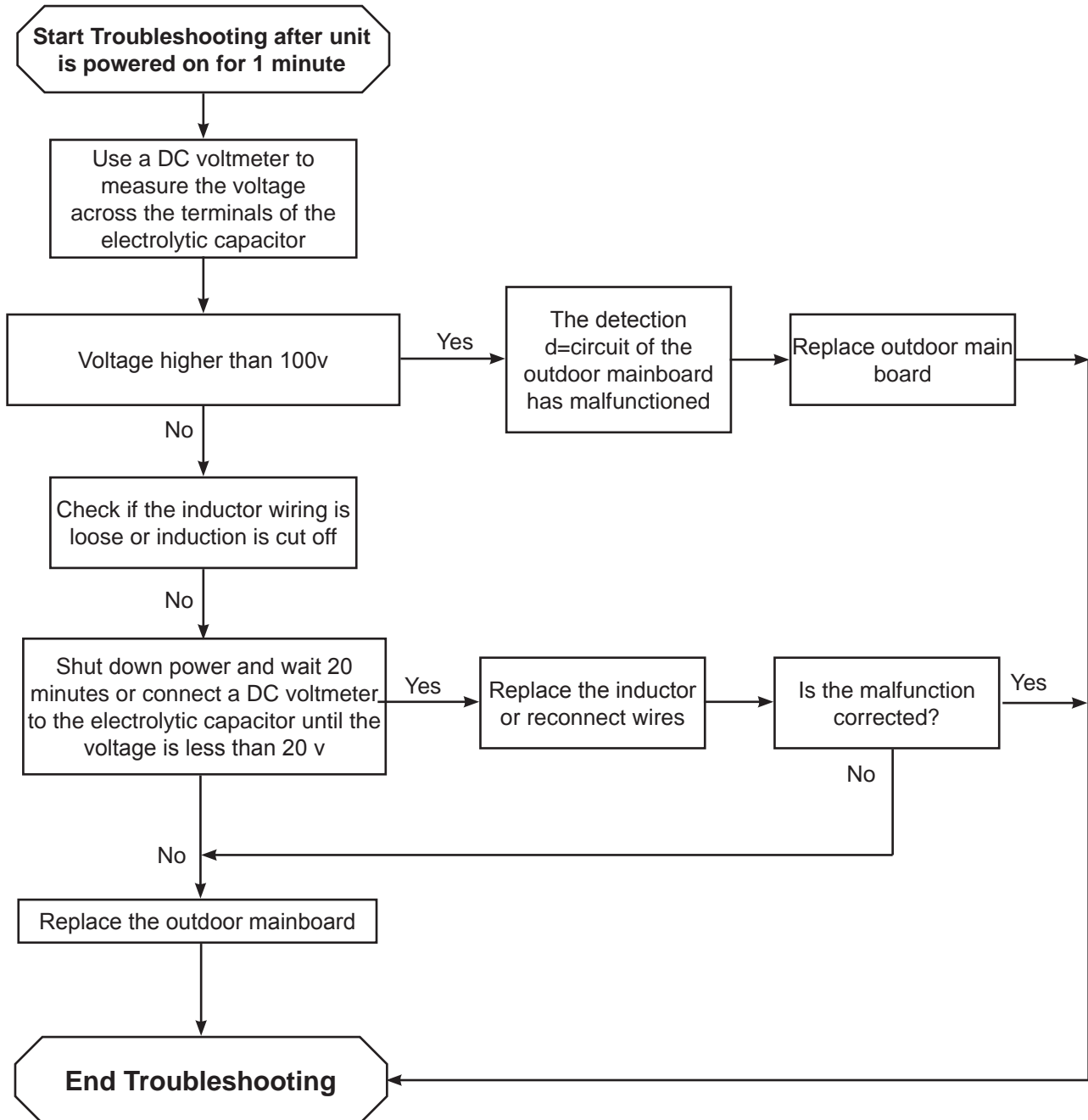


Charging Malfunction of Capacitor

Status:

During cooling mode, compressor will stop, indoor fan will run. Heating mode all units stop.

1. Improper input voltage
2. Poor connection on reactor
3. Reactor damaged
4. Bad AP1 control board



Disassembly of EVO+ Indoor Unit
12,000 btuh Other models may vary slightly
Warning - Wait 10 minutes after power is disconnected before starting disassembly.

1. Before disassembly of indoor unit

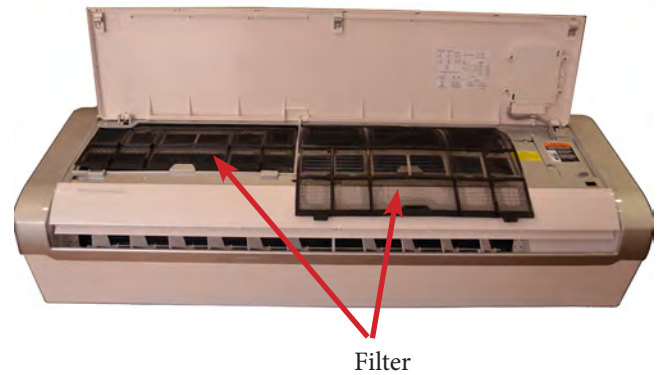
Before disassembly of indoor unit



2. Remove filter

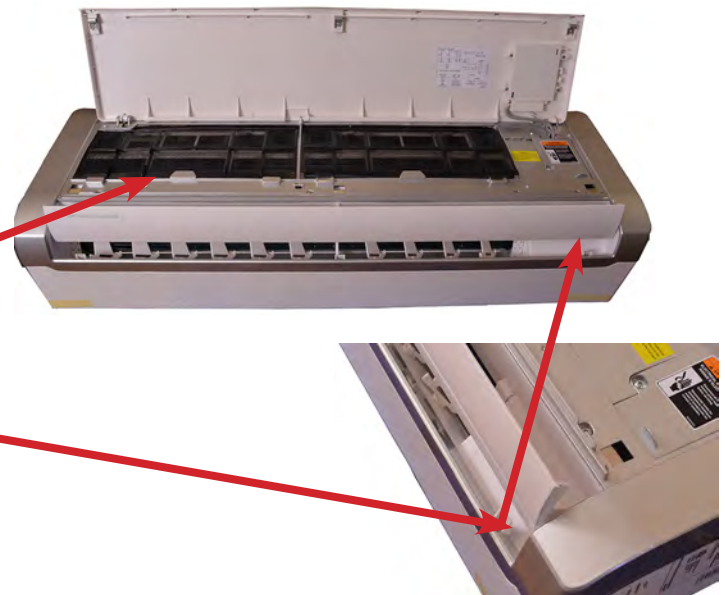
Step 1. Open the panel

Step 2. Loosen the clasps on the filter, push the filter inward, then pull upward, removing the filters.



3. Remove guide louver

Step 1. Remove screws near filter
Step 2. Remove screws under hinged cover



Disassembly of EVO+ Indoor Unit

12,000 btuh Other models may vary slightly

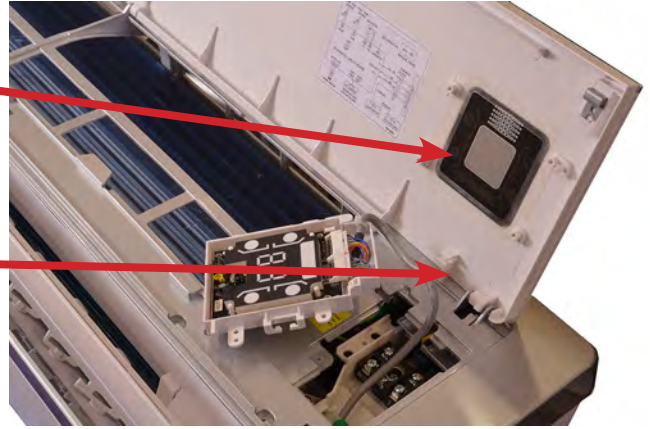
Warning - Wait 10 minutes after power is disconnected before starting disassembly.

4. Remove guide louver, continued

Small guide louver

Step 1. Remove the four screws holding the display. Carefully set to the side.

Step 2. Very carefully un-snap the cover and remove it.



5. Remove panel

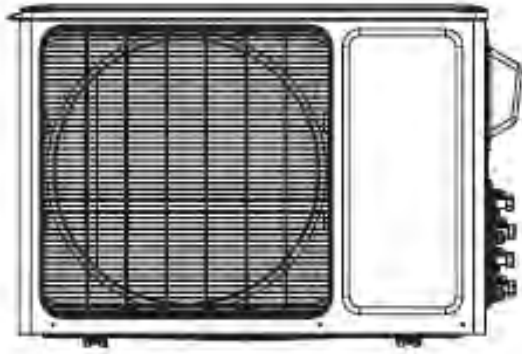
Step 1. Carefully remove the cover by slightly rotating up and un-snap from the back.



Disassembly of Outdoor Unit

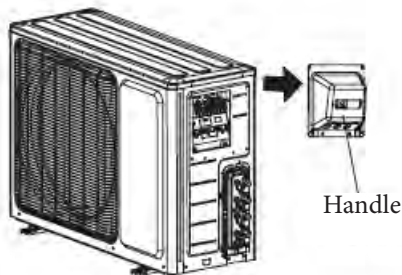
18,000 btuh **Warning - Wait 10 minutes after power is disconnected before starting disassembly.**

1. Before disassembly



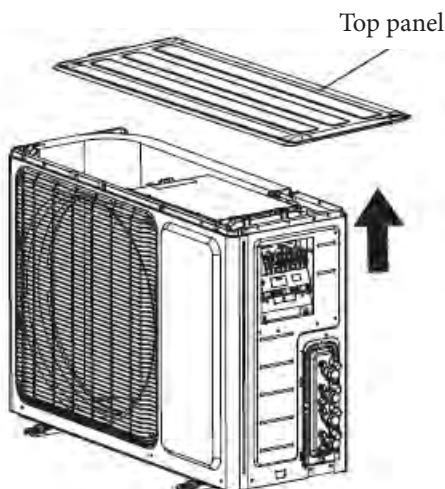
2. Remove handle

Remove the screws connecting the handle, pull the handle upward to remove it.



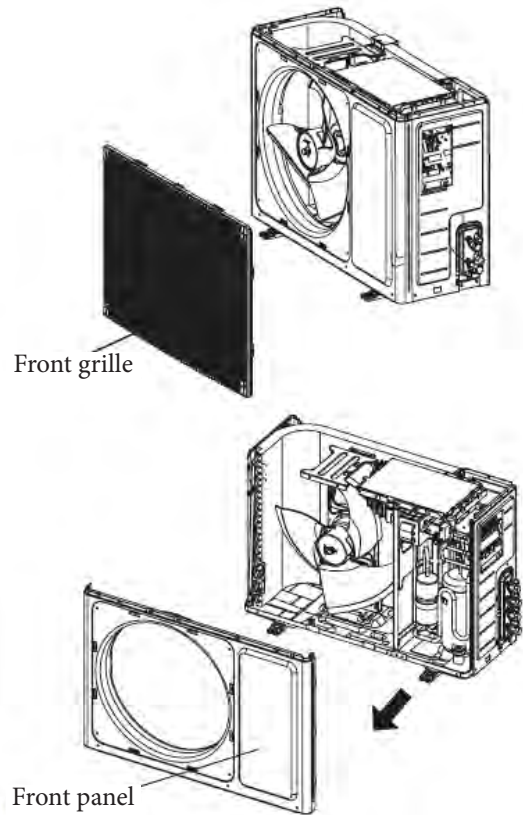
3. Remove top panel

Remove the screws connecting the handle



4. Remove front panel and front grille

Remove the screws holding the grille, then remove the grille. Remove the screws holding the front panel and clamp, then rotate the panel to the left and remove the front panel.



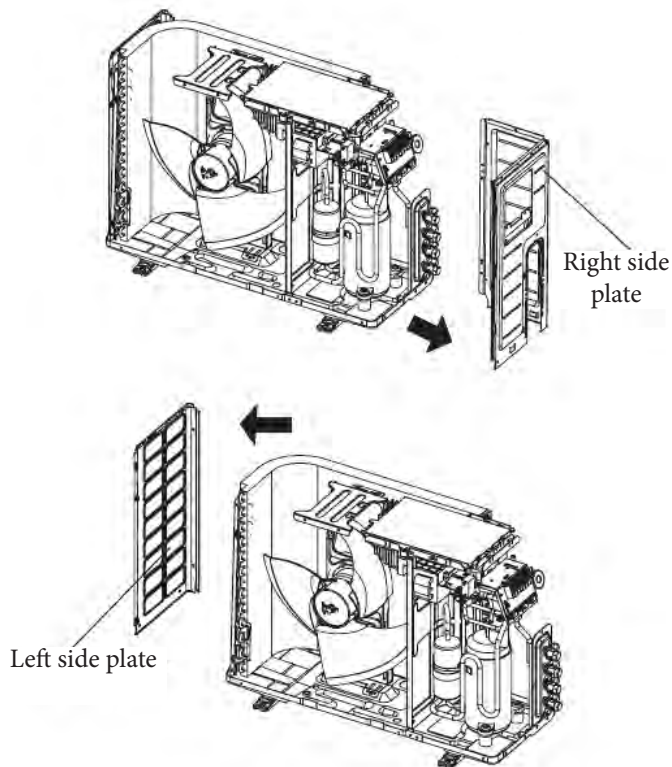
Disassembly of Outdoor Unit, continued

18,000 btuh **Warning - Wait 10 minutes after power is disconnected before starting disassembly.**

5. Remove right side panel

Remove the screws holding the right side panel to the chassis, valve support and electrical box. Remove the right side plate assembly.

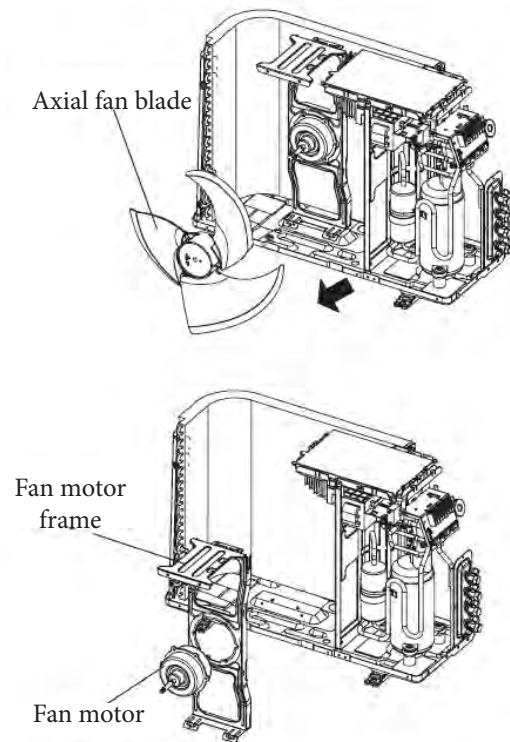
Remove the screws connecting the left side plate to the chassis, then remove it.



6. Remove the axial flow fan

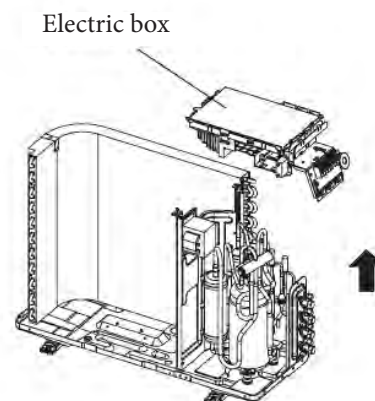
Remove the nuts holding the blade, then remove the blade.

Remove the screws holding the motor, disconnect the leading wire insert of the motor. Remove the two tapping screws holding the motor support and then pull the motor support upwards to remove it.



7. Remove electric box assembly

Remove the screws holding the electric box sub-assy, then loosen the wire bundle. Pull out the wire terminals and then pull the electric box upwards to remove it.

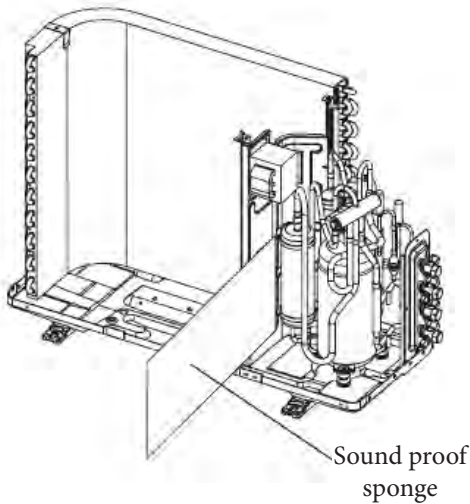


Disassembly of Outdoor Unit, continued

18,000 btuh **Warning - Wait 10 minutes after power is disconnected before starting disassembly.**

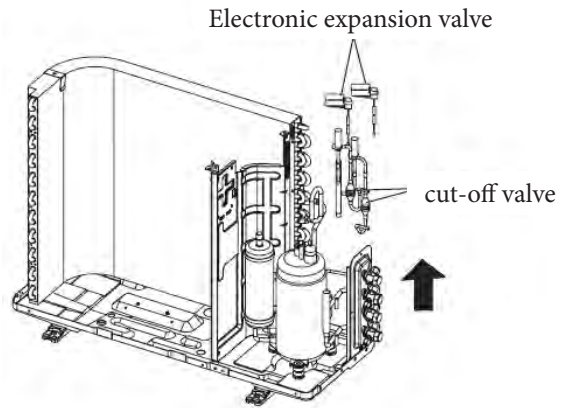
8. Remove sound proof sponge

Remove the sound proof sponge carefully.



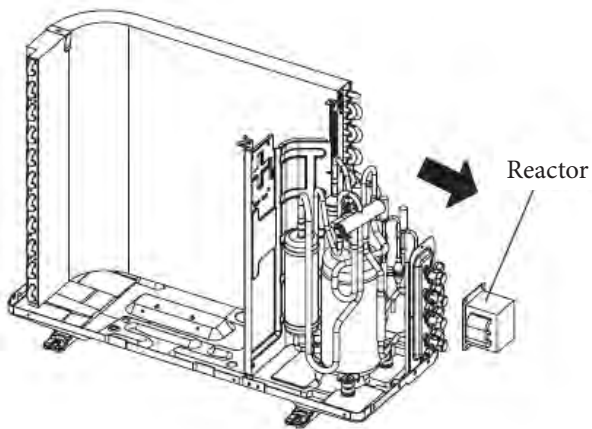
11. Remove electronic expansion valve and cut-off valve

Unsolder the electronic expansion valve and cut-off valve. Rotate and remove.



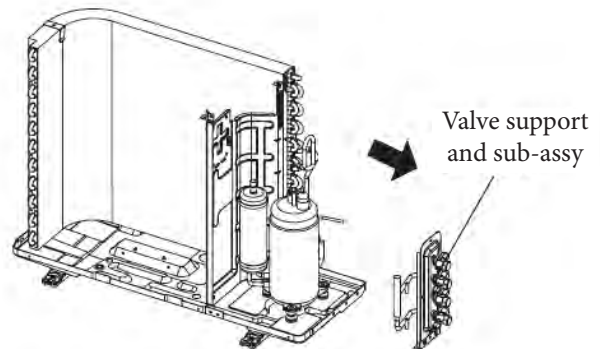
9. Remove reactor

Remove the three screws holding the reactor and middle isolation sheet, and then remove the reactor.



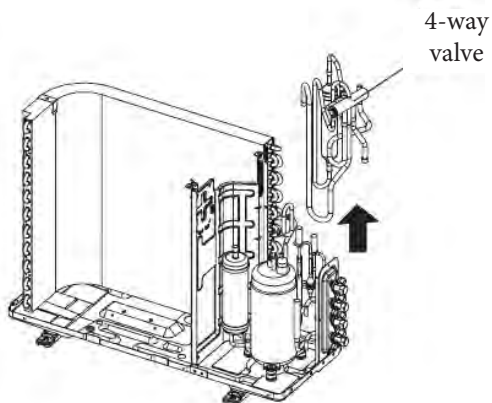
12. Remove valve support sub-assy.

Remove the screws holding the valve support and chassis, then remove the valve support sub-assy.



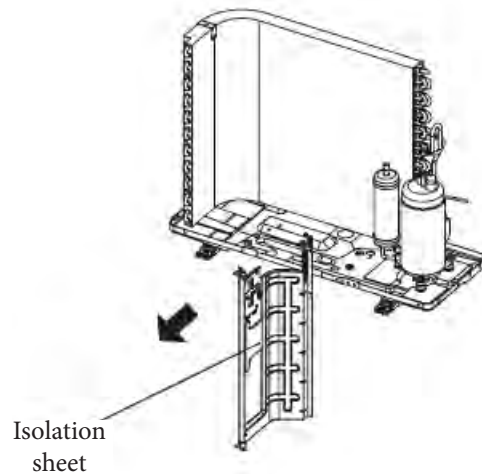
10. Remove 4-way valve

Discharge the refrigerant completely, unsolder the tubing connecting the compressor, then condenser assembly. Remove the 4-way valve assembly.



13. Remove isolation sheet

Remove the screws holding the isolation sheet then remove it.

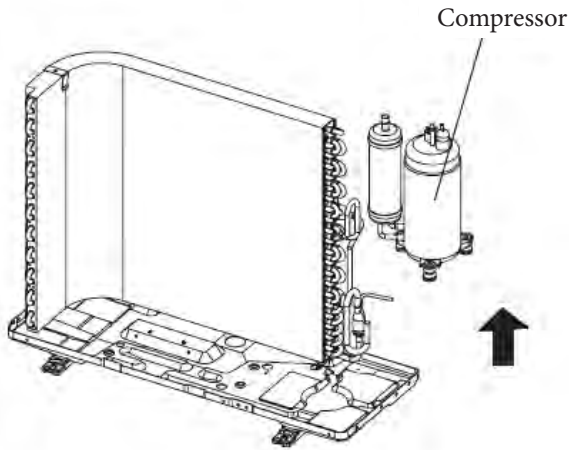


Disassembly of Outdoor Unit

18,000 btuh **Warning - Wait 10 minutes after power is disconnected before starting disassembly.**

14. Remove compressor

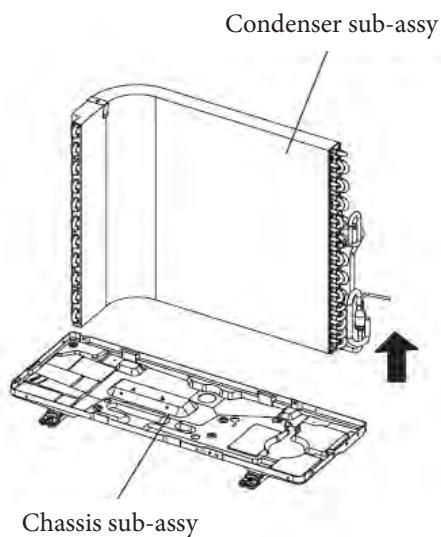
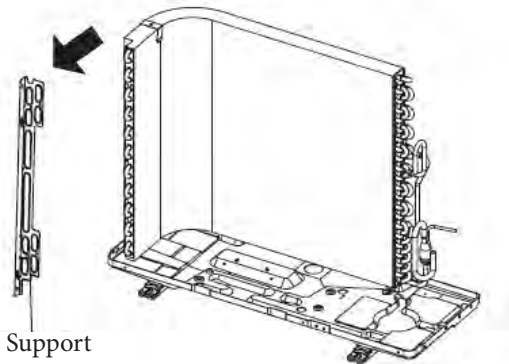
Remove the bolts holding the compressor to the chassis.



2. Remove condenser sub-assy.

Remove the screws holding the support (condenser) and condenser assy, and then remove the support.

Disassemble the chassis sub-assy and condenser sub-assy.

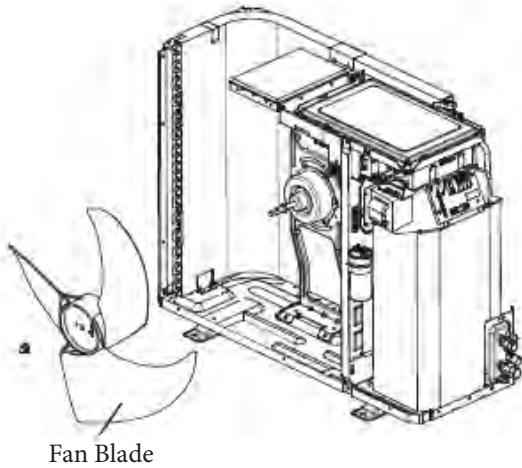


Disassembly of Outdoor Unit

18,000 btuh **Warning - Wait 10 minutes after power is disconnected before starting disassembly.**

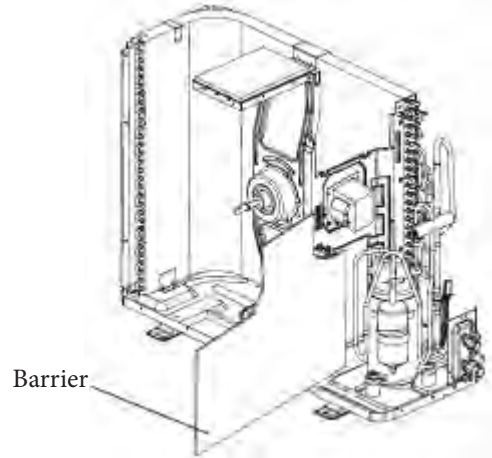
6. Remove fan blade

Remove the bolt holding the blade then remove.



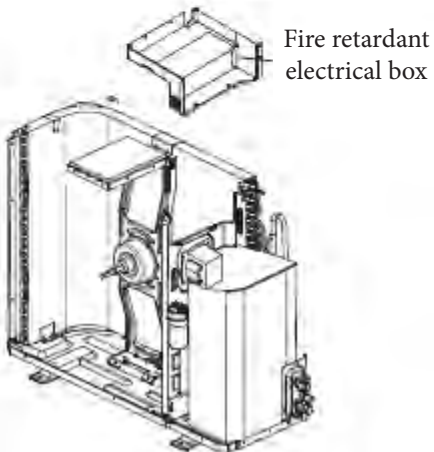
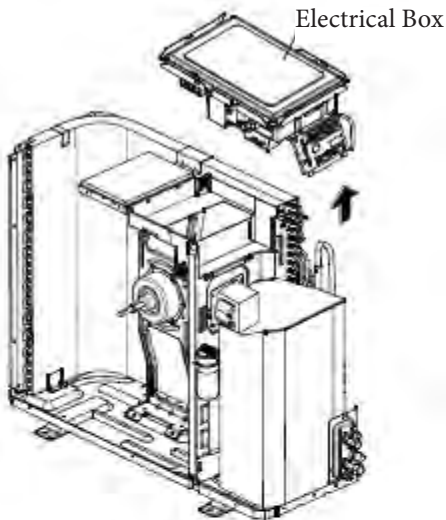
8. Remove sound proof barrier

Carefully remove barrier



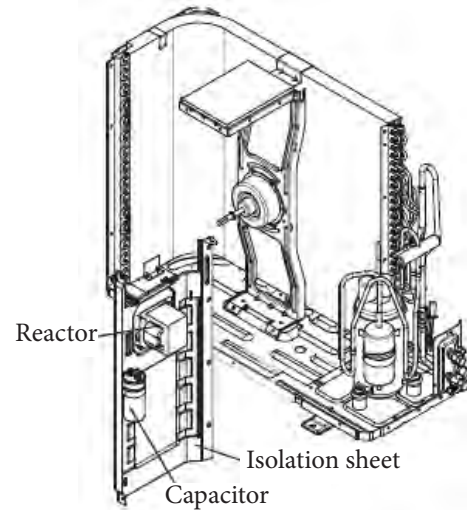
7. Remove electrical box assembly

Unplug the wire terminals of the compressor, motor, capacitor and reactor. Remove the bonding and ground screws, then remove screws holding box and remove box. Remove the screws holding the fire retardant box and remove,



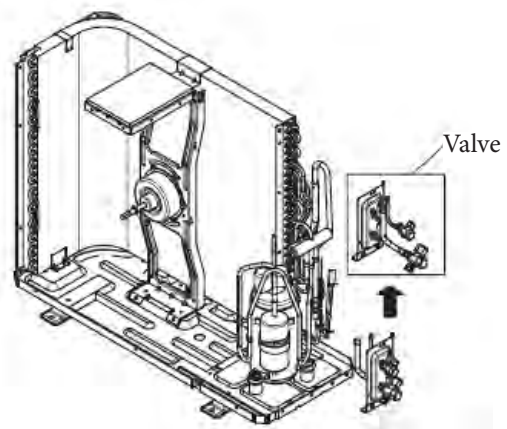
9. Remove isolation sheet

Remove screws holding sheet, then remove sheet



10. Remove refrigerant valves

Properly remove refrigerant. Protect valve assembly by wrapping valves with wet cloth, unsolder valves, then remove screws holding support. Remove screws holding valves, then remove valves.

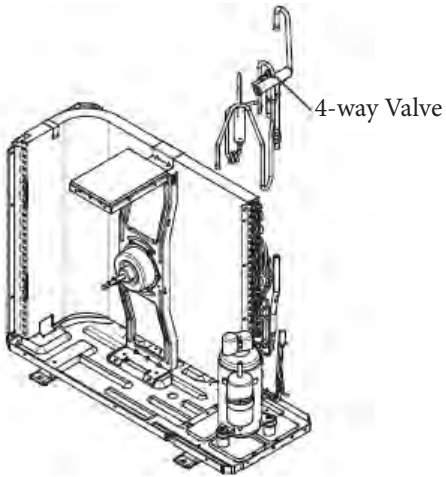


Disassembly of Outdoor Unit

18,000 btuh **Warning - Wait 10 minutes after power is disconnected before starting disassembly.**

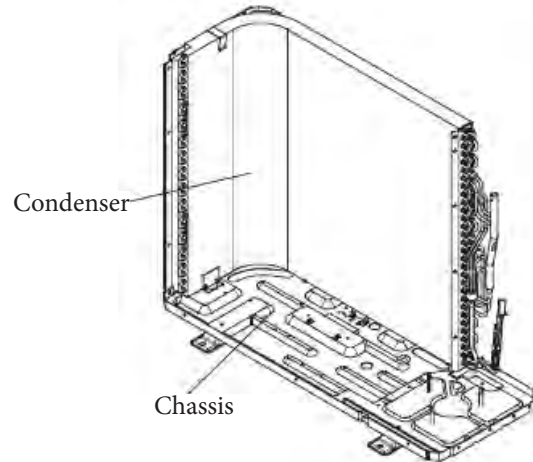
11. Remove 4-way valve

Properly remove refrigerant charge, then remove valve by heating brazed joints and withdrawing pipe from valve.



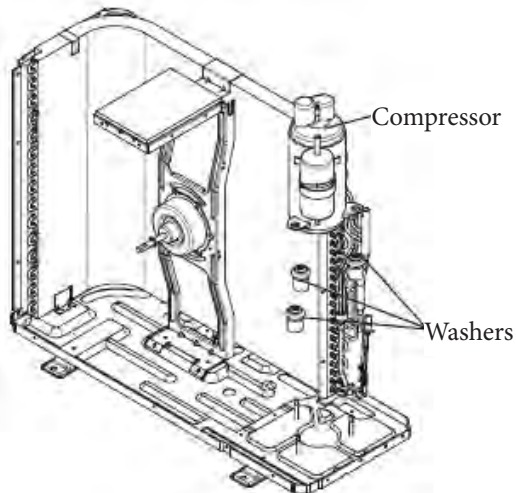
14. Remove condenser

Remove the screws holding the condenser assembly and chassis, then lift and remove



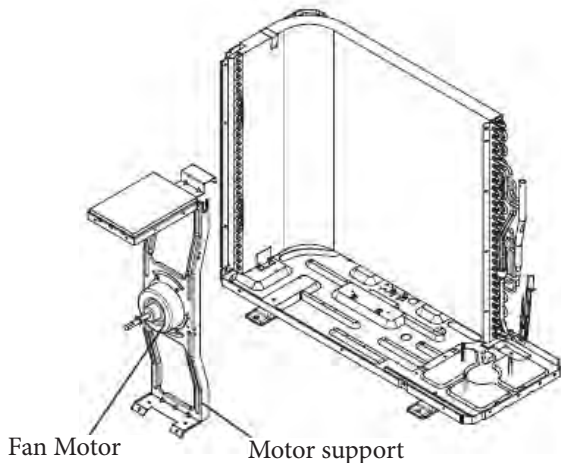
12. Remove compressor

Remove the three screws holding the compressor.



13. Remove fan motor and support

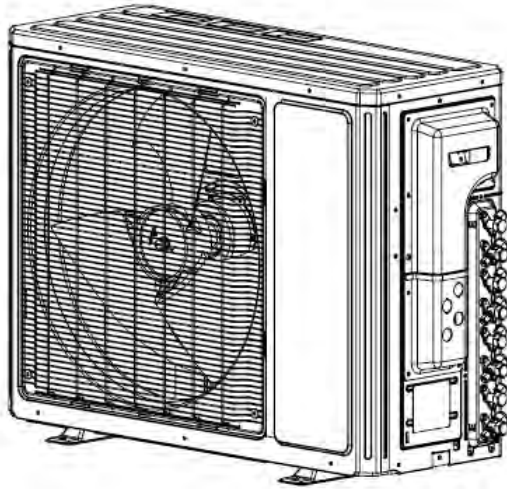
Remove the 4 screws holding the motor, remove wire connector, then remove the two screws holding the motor support bracket



Disassembly of Outdoor Unit

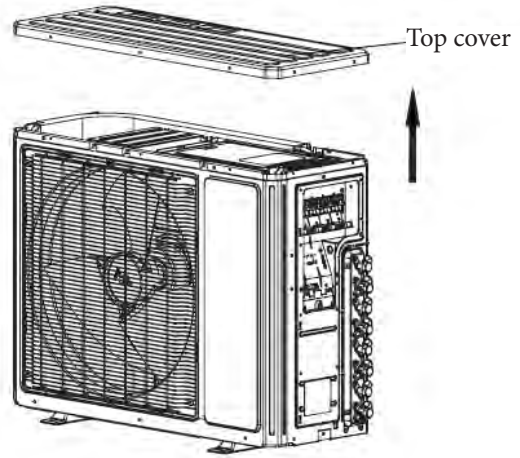
24,000 & 30,000 btuh **Warning - Wait 10 minutes after power is disconnected before starting disassembly.**

1. Before disassembly



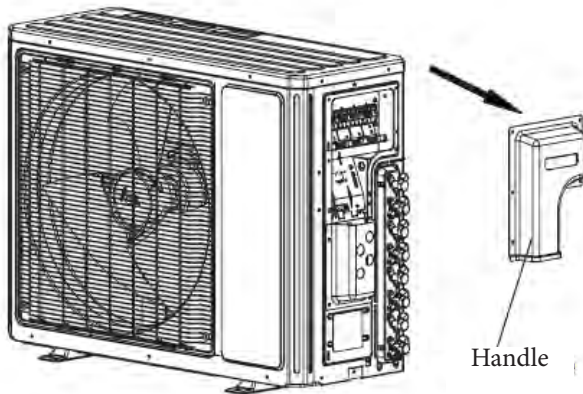
4. Remove top cover

Remove the screws holding the top cover, panel, left and right sides to remove the top cover.



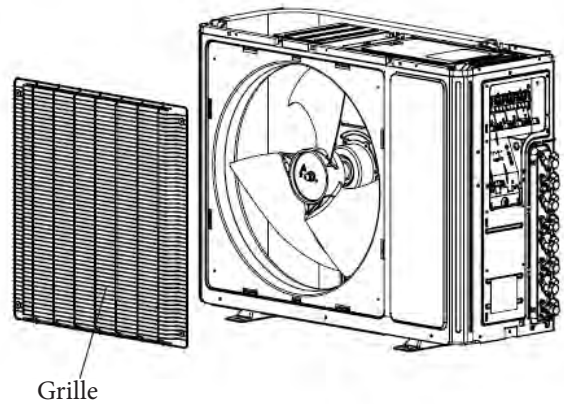
2. Remove handle

Remove the screws connecting the handle, pull the handle upward to remove it.



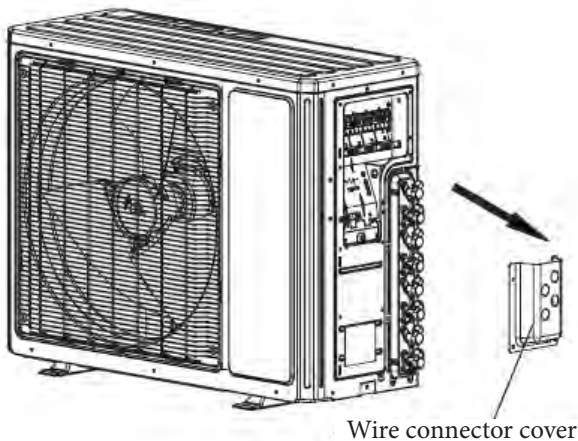
5. Remove grille

Remove the screws holding the grille and panel, then remove the grille.



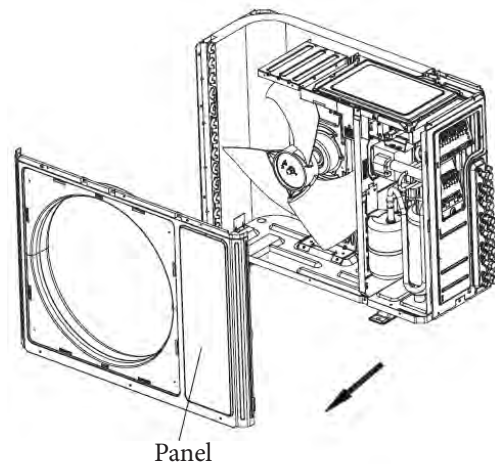
3. Remove wire connection cover

Remove the screws connecting the handle



6. Remove panel

Remove the screws holding the panel, chassis and motor to remove the panel.

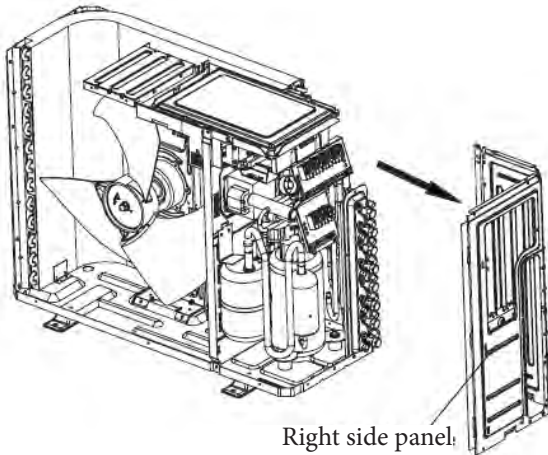


Disassembly of Outdoor Unit, continued

24,000 & 30,000 btuh **Warning - Wait 10 minutes after power is disconnected before starting disassembly.**

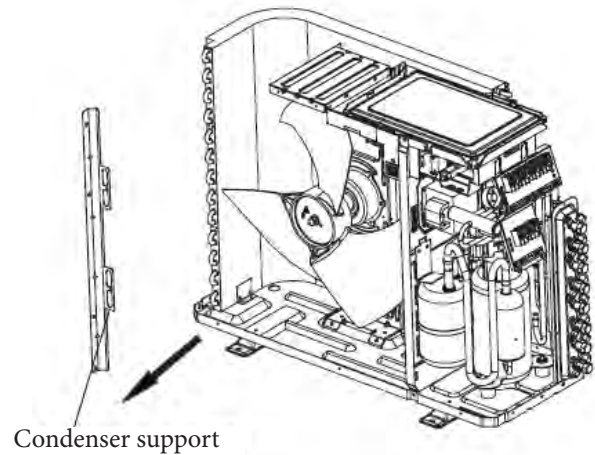
7. Remove right side panel

Remove the screws holding the right side panel, valve support and guard grille, to remove the right side panel



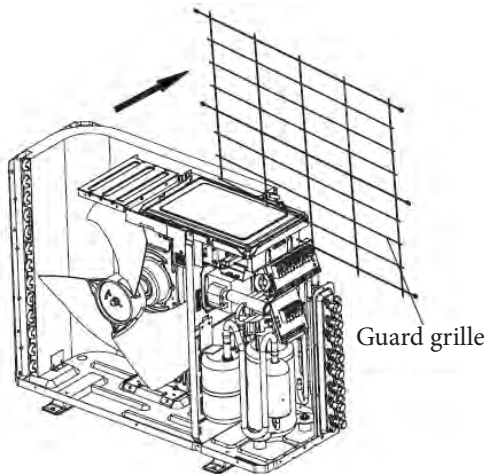
10. Remove condenser support

Remove the screws holding the support and chassis, then remove the support.



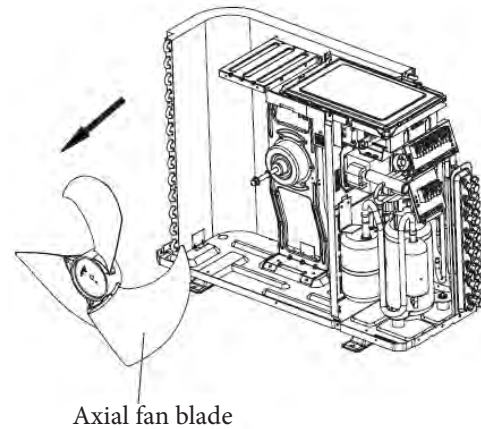
8. Remove guard grille

Remove the screws holding the guard grille and left side panel to remove guard grille



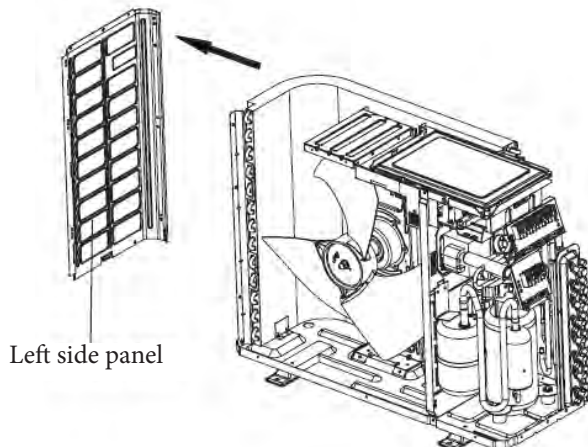
11. Remove axial fan blade

Remove the screws holding the fan blade on the fan, then remove blade.



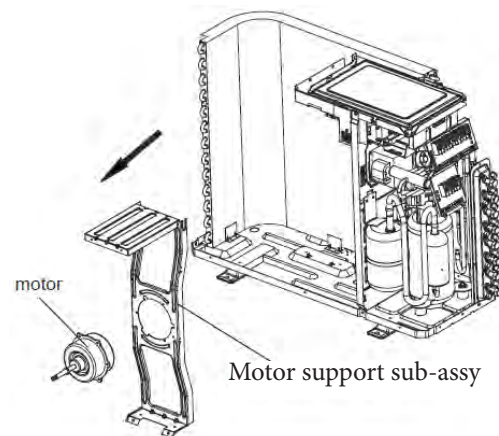
9. Remove left side panel

Remove the screws holding the panel to the chassis and condenser support.



12. Remove motor and motor support sub-assy.

Remove the screws holding the motor, pull out the pin of leading wire for motor and remove the screws holding the support and chassis.

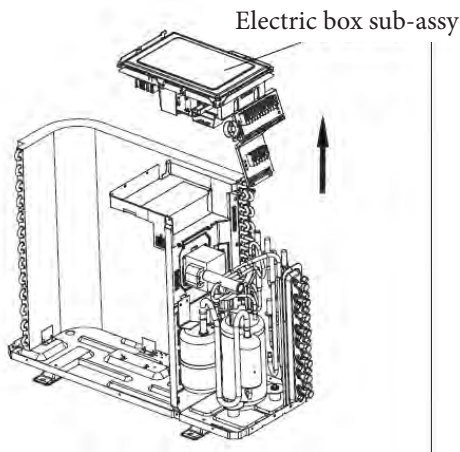


Disassembly of Outdoor Unit, continued

24,000 & 30,000 btuh **Warning - Wait 10 minutes after power is disconnected before starting disassembly.**

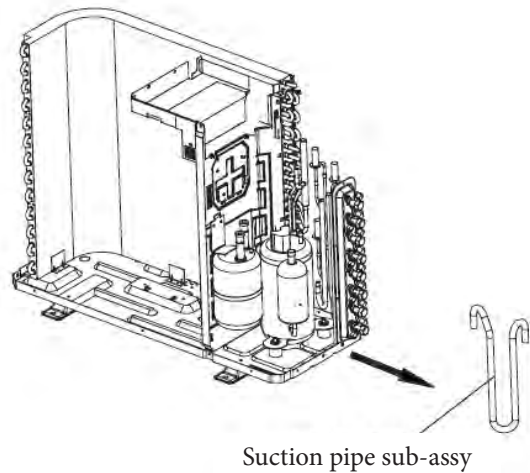
13. Before electric box sub-assy

Remove the screws holding the isolation sheet, loosen wire binds, pull out the terminals, then lift to remove the electric box sub-assy.



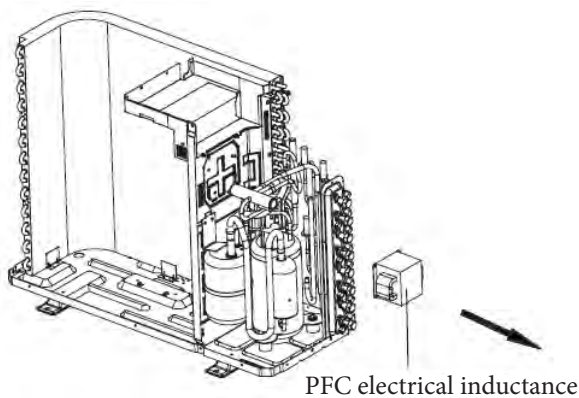
16. Remove suction pipe sub-assy

Unsolder the joints connecting the suction pipe sub-assy, then remove the assembly.



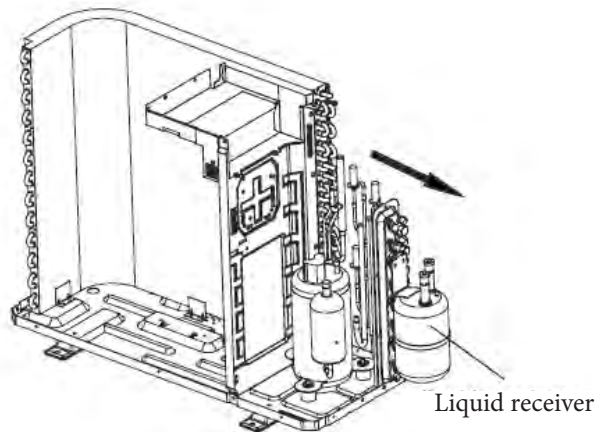
14. Remove PFC electrical inductance

Remove the screws holding the PFC electrical inductance and isolation sheet, then remove the PFC electrical inductance.



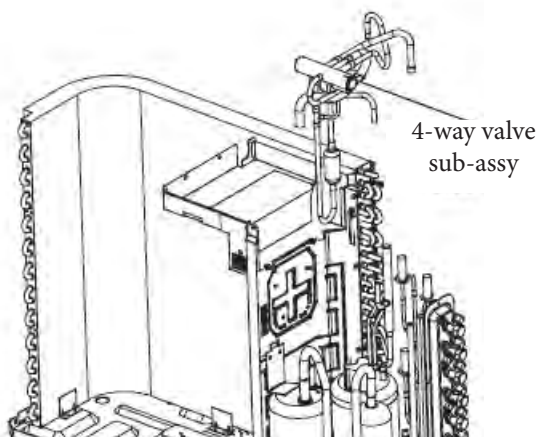
17. Remove liquid receiver

Remove the screws holding the isolation sheet and liquid receiver, then lift receiver out.



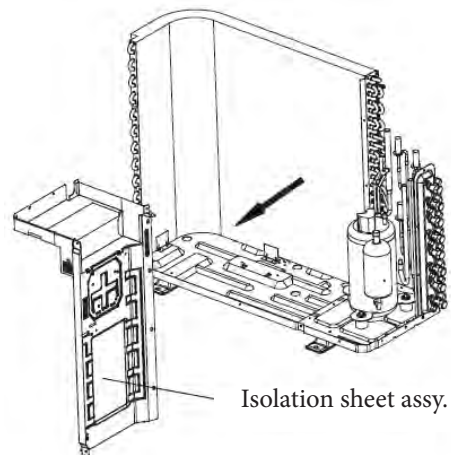
15. Remove 4-way valve sub-assy.

Remove all refrigerant from unit. Unsolder the tubing connecting the compressor, then condenser assembly. Remove the 4-way valve assembly.



18. Remove isolation sheet assy.

Remove the screws holding the isolation sheet and condenser side plate to remove the isolation sheet.

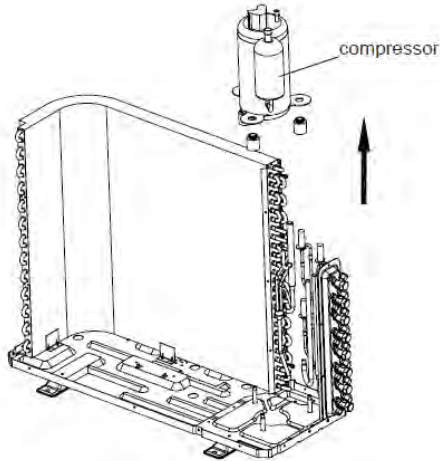


Disassembly of Outdoor Unit, continued

24,000 & 30,000 btuh **Warning - Wait 10 minutes after power is disconnected before starting disassembly.**

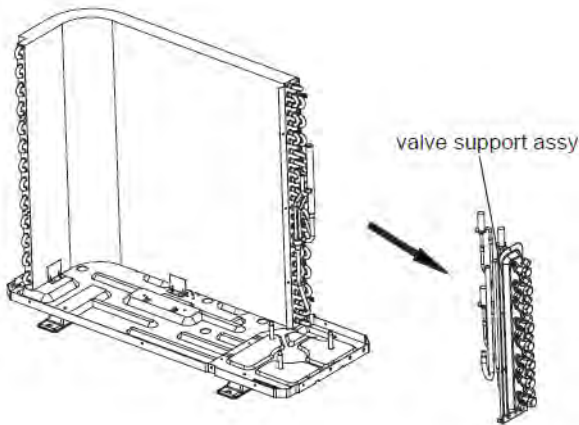
19. Remove compressor

Remove the screws holding the compressor feet and chassis as well as the cushions to remove the compressor.



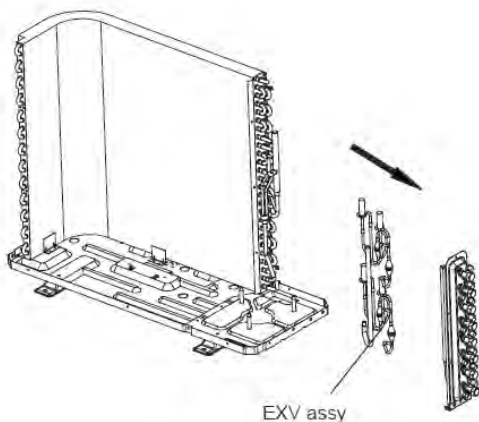
20. Remove valve support assy.

Remove the screws holding the valve support assy. and chassis sub-assy to remove the valve support assy.



21. Remove EEV Assy

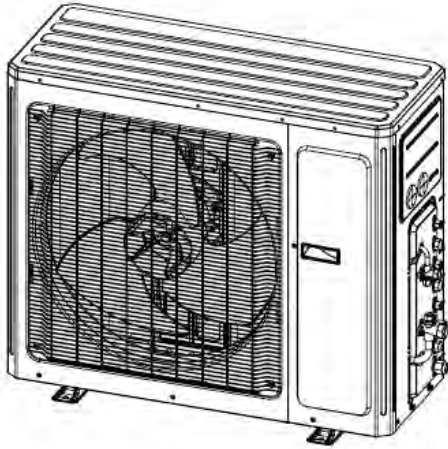
Unsolder the joints holding the EEV sub-assy and refrigerant collection pipe. Note: Fully pack the big valve with a cool wet cloth to prevent high temperature damage to valve.



Disassembly of Outdoor Unit

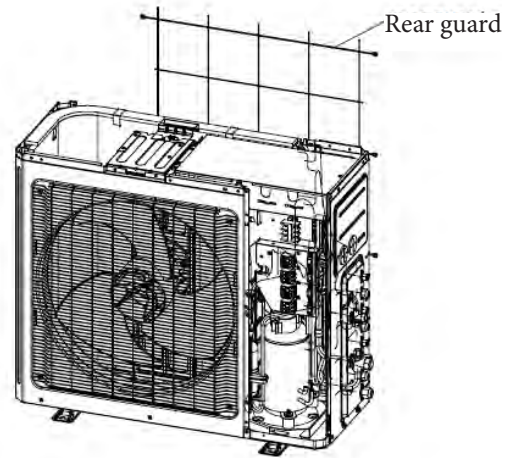
36,000 btuh **Warning - Wait 10 minutes after power is disconnected before starting disassembly.**

1. Before disassembly



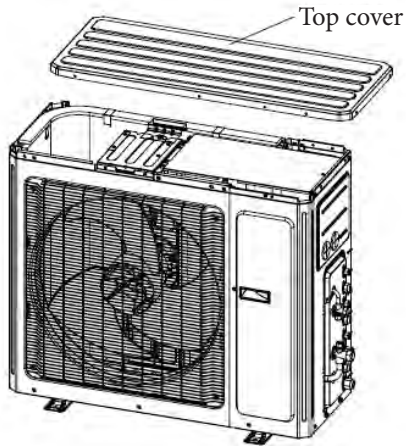
4. Remove rear guard

Remove the 6 screws holding the grille with the right side panel and left side panel, then remove the guard grille



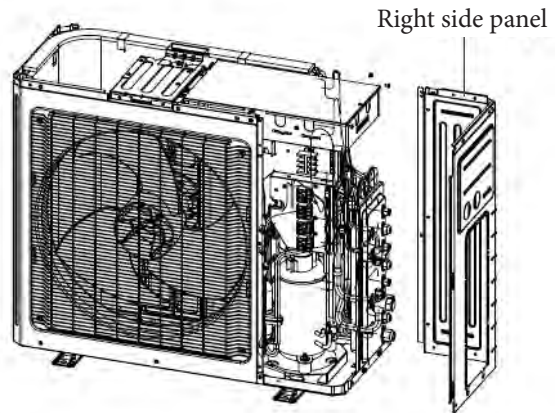
2. Remove top cover

Remove the screws holding the top cover, panel, left and right sides to remove the top cover..



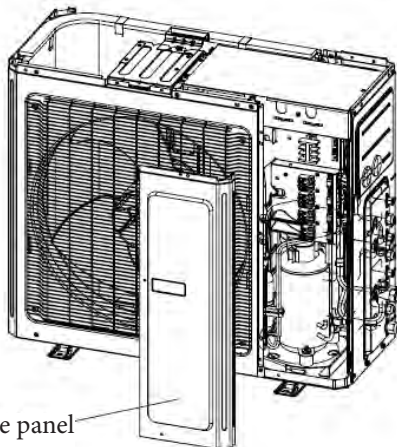
5. Remove right side panel

Remove the screws holding the right side panel with electric box assy, valve support, chassis and condenser side panel to remove the right side panel.



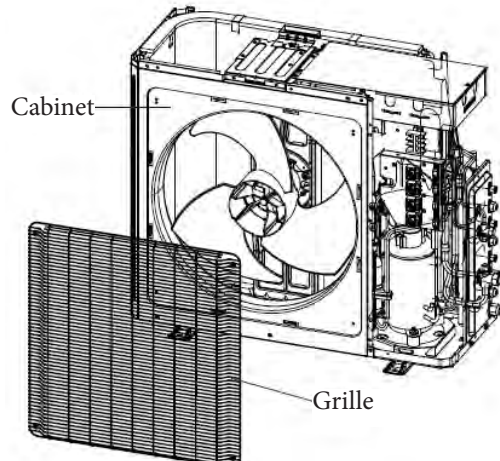
3. Remove front side panel

Remove the screws holding the panel, chassis and middle isolation sheet to remove panel.



6. Remove grille and cabinet

Remove the 4 screws holding the grille and outer case, then remove the panel grille.

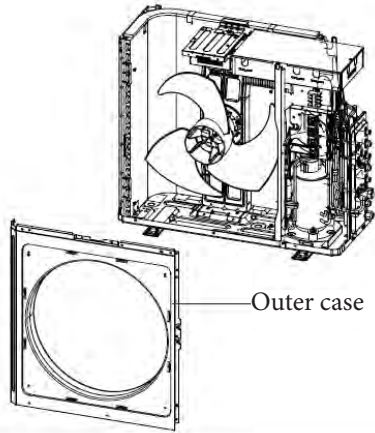


Disassembly of Outdoor Unit

36,000 btuh **Warning - Wait 10 minutes after power is disconnected before starting disassembly.**

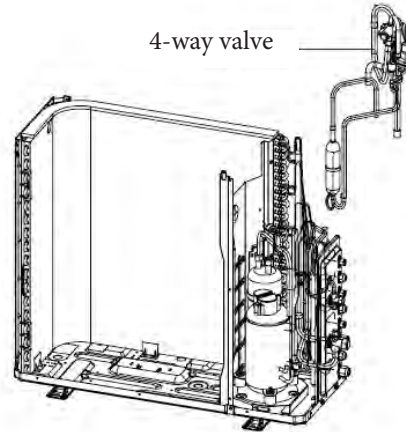
7. Remove outer case

Remove the screws holding the outer case and motor support, middle isolation sheet and chassis, pull the outer case slightly upward, loosen clasps between outer case and right side panel, then remove outer case.



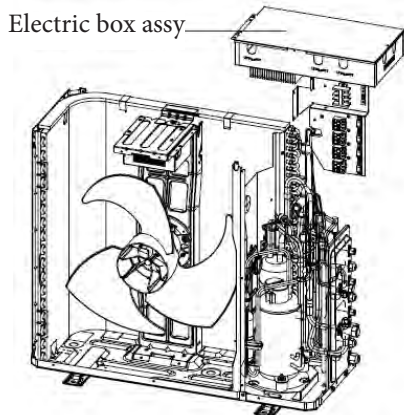
10. Remove 4-way valve

Remove all refrigerant from unit. Unsolder the tubing connecting the compressor, liquid separator, then condenser assembly. Remove the 4-way valve assembly.



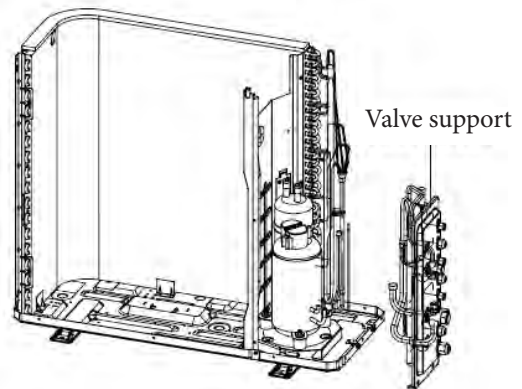
8. Remove electric box assy

Remove the ground wire screw on the electric box assy, then remove the grounding wire. Disconnect the wiring terminals of all components that are connected to the electrical box for removal. Remove the wire from inside the wiring groove.



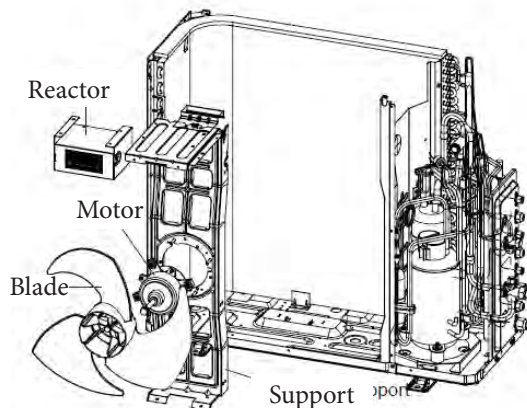
11. Remove valve support

Unsolder all joints on valve support, then remove. Note: Protect the valves by wrapping in wet cloth.



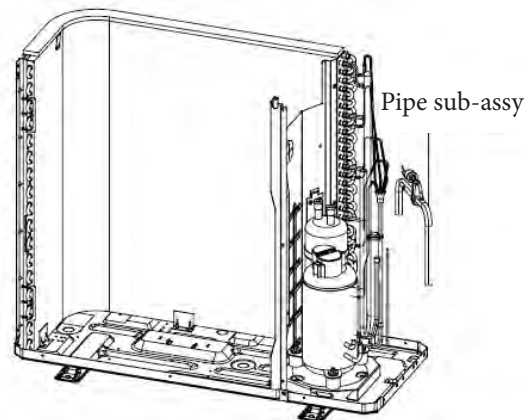
9. Remove blade, motor, reactor & motor support

Remove the screws holding the axial fan blade, then remove the blade. Remove the screws holding the motor support to the chassis, then remove the support. Remove the screws holding the motor and reactor, then remove each component.



12. Remove connection pipe sub-assy

Unsolder all joints on pipe sub-assy., then remove.

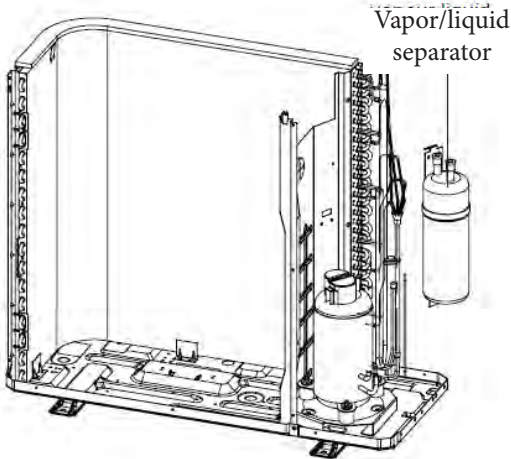


Disassembly of Outdoor Unit

36,000 btuh **Warning - Wait 10 minutes after power is disconnected before starting disassembly.**

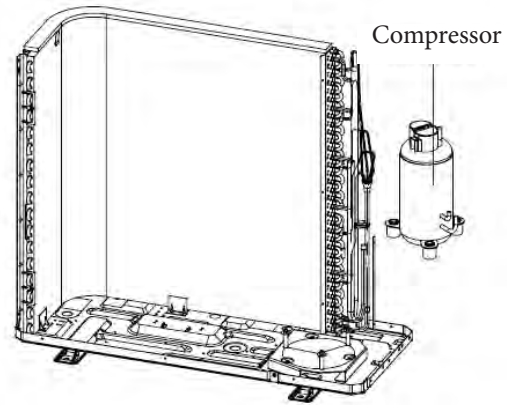
13. Remove vapor/liquid separator

Unsolder all joints connected with separator, then remove all screws connecting separator and middle isolation sheet.



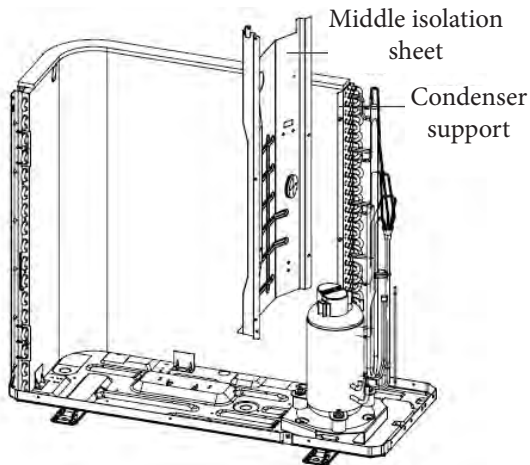
16. Remove compressor

Remove the screws holding the compressor feet and chassis as well as the cushions to remove the compressor. Prevent moisture and debris from entering tubing.



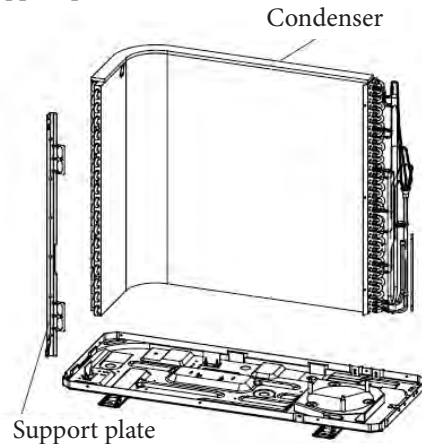
14. Remove middle isolation sheet

Remove the screws holding middle isolation sheet and chassis then remove the isolation sheet.



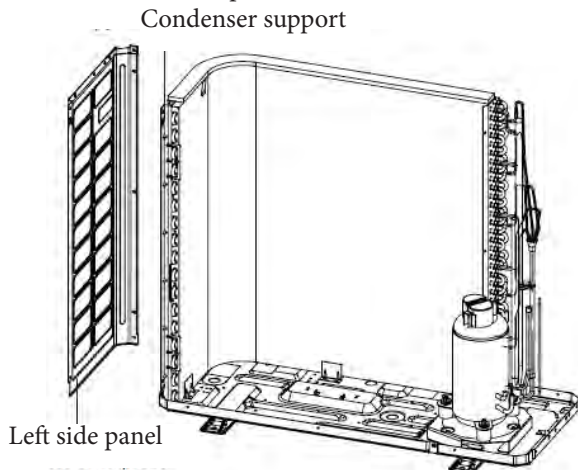
17. Remove condenser

Remove the screws holding condenser and chassis, then remove the condenser. Remove the screws holding the support plate, then remove the support plate.



15. Remove left side panel

Remove the screws holding the left side panel, chassis and middle isolation sheet to remove panel.

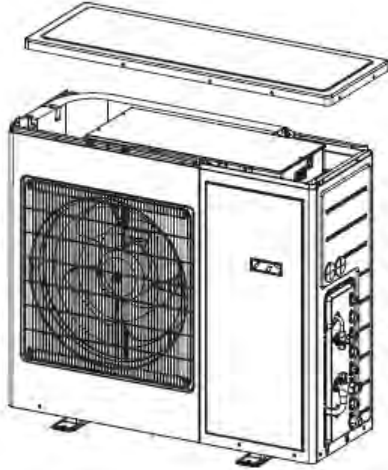


Disassembly of Outdoor Unit

42,000 btuh **Warning - Wait 10 minutes after power is disconnected before starting disassembly.**

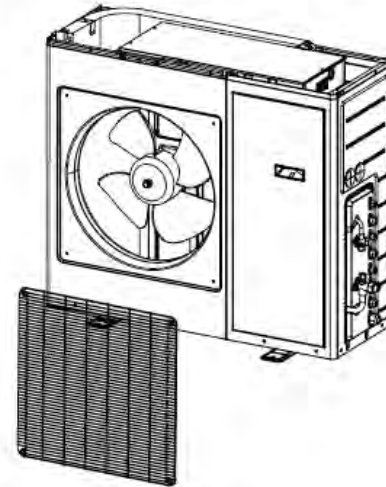
1. Remove the cover plate

Remove the screws holding the top cover, then remove the top cover.



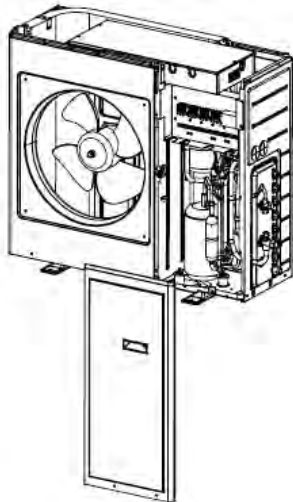
4. Remove grille

Remove the screws holding the grille, then remove the guard grille.



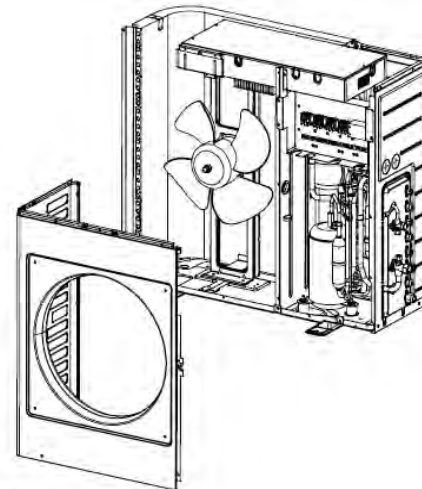
2. Remove front panel

Remove the screws holding the front panel, then remove the front cover.



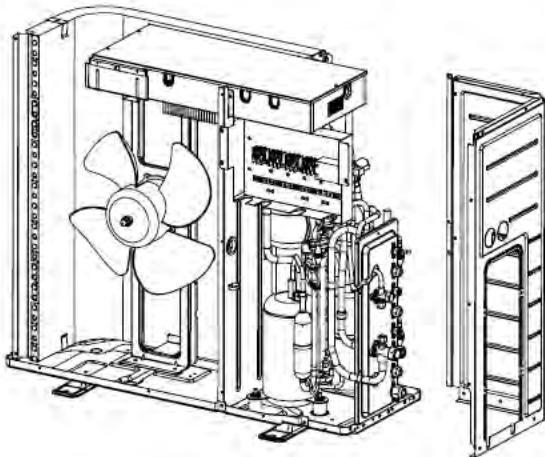
5. Remove outer casing

Remove the screws holding outer casing, then remove the outer casing.



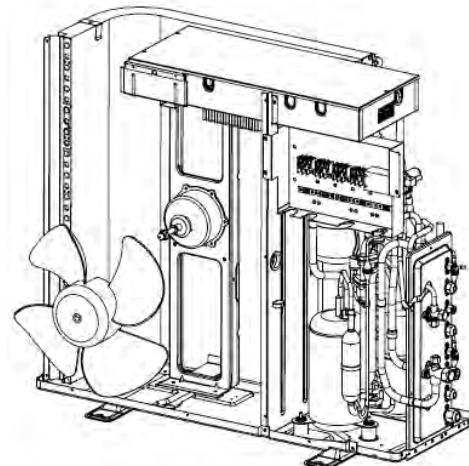
3. Remove right panel

Remove the screws holding the right panel, then remove the right cover.



6. Remove fan blades

Remove the 4 screws holding fan blade, then remove the fan blade.



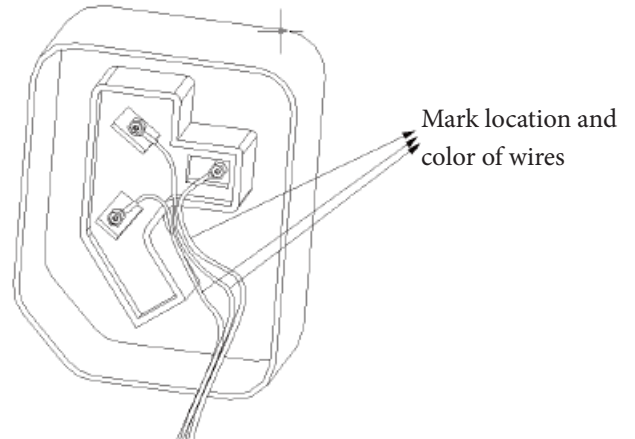
Disassembly of Outdoor Unit

42,000 btuh **Warning - Wait 10 minutes after power is disconnected before starting disassembly.**

Disassembly of the compressor

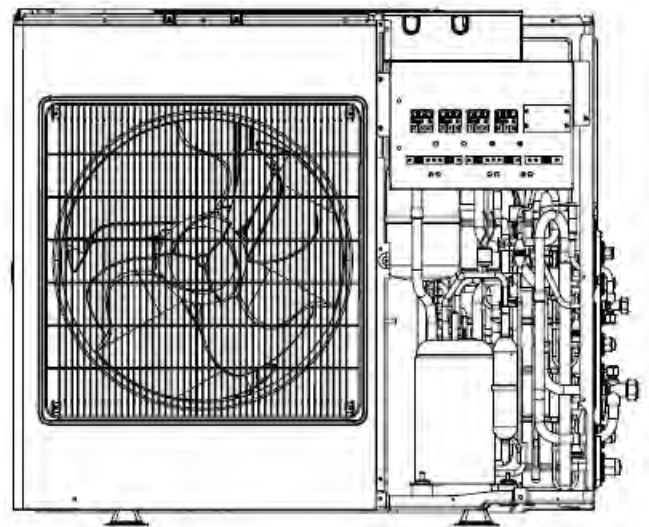
1. Disconnect wires

Remove the wires from the compressor, noting the colors and locations of each wire.



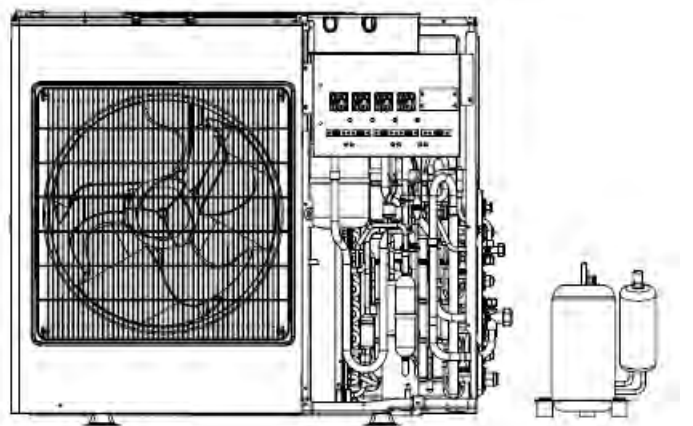
2. Disassemble piping

Reclaim all refrigerant from system before removing tubing. Follow proper procedure to disconnect tubing from compressor. Keep debris and moisture from entering system.



3. Remove compressor

Remove the bolts holding down the compressor to the chassis. Remove the compressor.



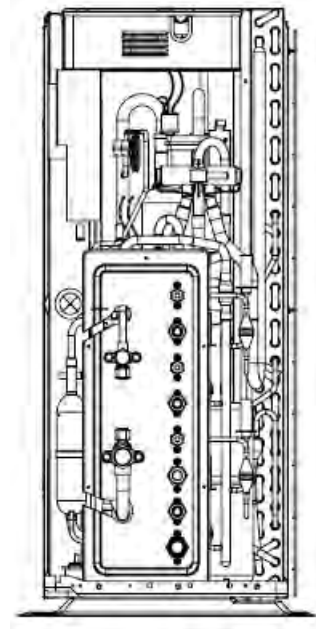
Disassembly of Outdoor Unit

42,000 btuh **Warning - Wait 10 minutes after power is disconnected before starting disassembly.**

Disassembly of the 4-way valve

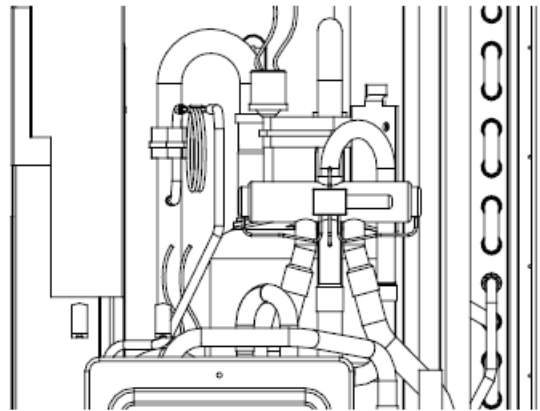
1. Remove the 4-way valve coil

Remove the screws holding the coil, then remove the coil.



2. Remove 4-way valve

Reclaim all refrigerant from system before removing tubing.
Remove tubing from 4-way valve, then remove the valve. Keep debris and moisture from entering system.



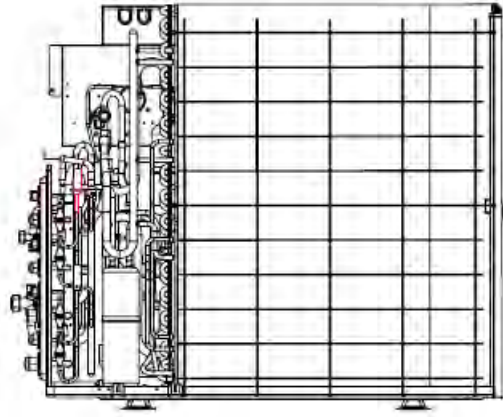
Disassembly of Outdoor Unit

42,000 btuh **Warning - Wait 10 minutes after power is disconnected before starting disassembly.**

Disassembly of the Electronic Expansion Valve

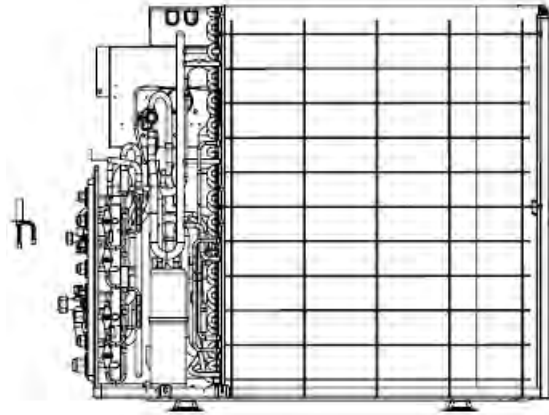
1. Remove EEV coil

Remove the coil by rotating until it is unlocked.



2. Disconnect the tubing

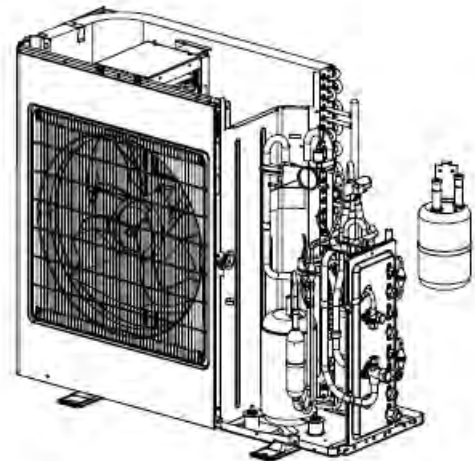
Reclaim all refrigerant from system before removing tubing. Follow proper procedure to disconnect tubing from EEV. Keep debris and moisture from entering system.



Disassembly of the Vapor/Liquid Separator

1. Disconnect piping

Reclaim all refrigerant from system before removing tubing. Remove tubing from separator, then remove the separator. Keep debris and moisture from entering system.



Appendix 1: Resistance Table of Ambient Temperature Sensor for Indoor and Outdoor Units (15K)

Temp (°C)	Temp (°F)	Resistance (kΩ)		Temp (°C)	Temp (°F)	Resistance (kΩ)		Temp (°C)	Temp (°F)	Resistance (kΩ)
-19	-2.2	138.1		33	91.4	10.63		85	185.0	1.594
-18	-0.4	128.6		34	93.2	10.2		86	186.8	1.544
-17	1.4	121.6		35	95.0	9.779		87	188.6	1.497
-16	3.2	115		36	96.8	9.382		88	190.4	1.451
-15	5.0	108.7		37	98.6	9.003		89	192.2	1.408
-14	6.8	102.9		38	100.4	8.642		90	194.0	1.363
-13	8.6	97.4		39	102.2	8.297		91	195.8	1.322
-12	10.4	92.22		40	104.0	7.967		92	197.6	1.282
-11	12.2	87.35		41	105.8	7.653		93	199.4	1.244
-10	14.0	82.75		42	107.6	7.352		94	201.2	1.207
-9	15.8	78.43		43	109.4	7.065		95	203.0	1.171
-8	17.6	74.35		44	111.2	6.791		96	204.8	1.136
-7	19.4	70.5		45	113.0	6.529		97	206.6	1.103
-6	21.2	66.88		46	114.8	6.278		98	208.4	1.071
-5	23.0	63.46		47	116.6	6.038		99	210.2	1.039
-4	24.8	60.23		48	118.4	5.809		100	212.0	1.009
-3	26.6	57.18		49	120.2	5.589		101	213.8	0.98
-2	28.4	54.31		50	122.0	5.379		102	215.6	0.952
-1	30.2	51.59		51	123.8	5.197		103	217.4	0.925
0	32.0	49.02		52	125.6	4.986		104	219.2	0.898
1	33.8	46.6		53	127.4	4.802		105	221.0	0.873
2	35.6	44.31		54	129.2	4.625		106	222.8	0.848
3	37.4	42.14		55	131.0	4.456		107	224.6	0.825
4	39.2	40.09		56	132.8	4.294		108	226.4	0.802
5	41.0	38.15		57	134.6	4.139		109	228.2	0.779
6	42.8	36.32		58	136.4	3.99		110	230.0	0.758
7	44.6	34.58		59	138.2	3.848		111	231.8	0.737
8	46.4	32.94		60	140.0	3.711		112	233.6	0.717
9	48.2	31.38		61	141.8	3.579		113	235.4	0.697

Appendix 1: Resistance Table of Ambient Temperature Sensor for Indoor and Outdoor Units (15K)

Temp (°C)	Temp (°F)	Resistance (kΩ)		Temp (°C)	Temp (°F)	Resistance (kΩ)		Temp (°C)	Temp (°F)	Resistance (kΩ)
10	50.0	29.9		62	143.6	3.454		114	237.2	0.678
11	51.8	28.51		63	145.4	3.333		115	239.0	0.66
12	53.6	27.18		64	147.2	3.217		116	240.8	0.642
13	55.4	25.92		65	149.0	3.105		117	242.6	0.625
14	57.2	24.73		66	150.8	2.998		118	244.4	0.608
15	59.0	23.6		67	152.6	2.896		119	246.2	0.592
16	60.8	22.53		68	154.4	2.797		120	248.0	0.577
17	62.6	21.51		69	156.2	2.702		121	249.8	0.561
18	64.4	20.54		70	158.0	2.611		122	251.6	0.547
19	66.2	19.63		71	159.8	2.523		123	253.4	0.532
20	68.0	18.75		72	161.6	2.439		124	255.2	0.519
21	69.8	17.93		73	163.4	2.358		125	257.0	0.505
22	71.6	17.14		74	165.2	2.28		126	258.8	0.492
23	73.4	16.39		75	167.0	2.206		127	260.6	0.48
24	75.2	15.68		76	168.8	2.133		128	262.4	0.467
25	77.0	15		77	170.6	2.064		129	264.2	0.456
26	78.8	14.36		78	172.4	1.997		130	266.0	0.44
27	80.6	13.74		79	174.2	1.933		131	267.8	0.433
28	82.4	13.16		80	176.0	1.871		132	269.6	0.422
29	84.2	12.6		81	177.8	1.811		133	271.4	0.412
30	86.0	12.07		82	179.6	1.754		134	273.2	0.401
31	87.8	11.57		83	181.4	1.699		135	275.0	0.391

Appendix 2: Resistance Table of Outdoor and Indoor Tube Temperature Sensors (20K)

Temp (°C)	Temp (°F)	Resistance (kΩ)		Temp (°C)	Temp (°F)	Resistance (kΩ)		Temp (°C)	Temp (°F)	Resistance (kΩ)
-19	-2.2	181.4		33	91.4	14.18		85	185.0	2.125
-18	-0.4	171.4		34	93.2	13.59		86	186.8	2.059
-17	1.4	162.1		35	95.0	13.04		87	188.6	1.996
-16	3.2	153.3		36	96.8	12.51		88	190.4	1.934
-15	5.0	145		37	98.6	12		89	192.2	1.875
-14	6.8	137.2		38	100.4	11.52		90	194.0	1.818
-13	8.6	129.9		39	102.2	11.06		91	195.8	1.736
-12	10.4	123		40	104.0	10.62		92	197.6	1.71
-11	12.2	116.5		41	105.8	10.2		93	199.4	1.658
-10	14.0	110.3		42	107.6	9.803		94	201.2	1.609
-9	15.8	104.6		43	109.4	9.42		95	203.0	1.561
-8	17.6	99.13		44	111.2	9.054		96	204.8	1.515
-7	19.4	94		45	113.0	8.705		97	206.6	1.47
-6	21.2	89.17		46	114.8	8.37		98	208.4	1.427
-5	23.0	84.61		47	116.6	8.051		99	210.2	1.386
-4	24.8	80.31		48	118.4	7.745		100	212.0	1.346
-3	26.6	76.24		49	120.2	7.453		101	213.8	1.307
-2	28.4	72.41		50	122.0	7.173		102	215.6	1.269
-1	30.2	68.79		51	123.8	6.905		103	217.4	1.233
0	32.0	65.37		52	125.6	6.648		104	219.2	1.198
1	33.8	62.13		53	127.4	6.403		105	221.0	1.164
2	35.6	59.08		54	129.2	6.167		106	222.8	1.131
3	37.4	56.19		55	131.0	5.942		107	224.6	1.099
4	39.2	53.46		56	132.8	5.726		108	226.4	1.069
5	41.0	50.87		57	134.6	5.519		109	228.2	1.039
6	42.8	48.42		58	136.4	5.32		110	230.0	1.01
7	44.6	46.11		59	138.2	5.13		111	231.8	0.983
8	46.4	43.92		60	140.0	4.948		112	233.6	0.956
9	48.2	41.84		61	141.8	4.773		113	235.4	0.93

Appendix 2: Resistance Table of Outdoor and Indoor Tube Temperature Sensors (20K)

Temp (°C)	Temp (°F)	Resistance (kΩ)		Temp (°C)	Temp (°F)	Resistance (kΩ)		Temp (°C)	Temp (°F)	Resistance (kΩ)
10	50.0	39.87		62	143.6	4.605		114	237.2	0.904
11	51.8	38.01		63	145.4	4.443		115	239.0	0.88
12	53.6	36.24		64	147.2	4.289		116	240.8	0.856
13	55.4	34.57		65	149.0	4.14		117	242.6	0.833
14	57.2	32.98		66	150.8	3.998		118	244.4	0.811
15	59.0	31.47		67	152.6	3.861		119	246.2	0.77
16	60.8	30.04		68	154.4	3.729		120	248.0	0.769
17	62.6	28.68		69	156.2	3.603		121	249.8	0.746
18	64.4	27.39		70	158.0	3.481		122	251.6	0.729
19	66.2	26.17		71	159.8	3.364		123	253.4	0.71
20	68.0	25.01		72	161.6	3.252		124	255.2	0.692
21	69.8	23.9		73	163.4	3.144		125	257.0	0.674
22	71.6	22.85		74	165.2	3.04		126	258.8	0.658
23	73.4	21.85		75	167.0	2.94		127	260.6	0.64
24	75.2	20.9		76	168.8	2.844		128	262.4	0.623
25	77.0	20		77	170.6	2.752		129	264.2	0.607
26	78.8	19.14		78	172.4	2.663		130	266.0	0.592
27	80.6	18.13		79	174.2	2.577		131	267.8	0.577
28	82.4	17.55		80	176.0	2.495		132	269.6	0.563
29	84.2	16.8		81	177.8	2.415		133	271.4	0.549
30	86.0	16.1		82	179.6	2.339		134	273.2	0.535
31	87.8	15.43		83	181.4	2.265		135	275.0	0.521
32	89.6	14.79		84	183.2	2.194		136	276.8	0.509

Appendix 3: Resistance Table of Outdoor Discharge Temperature Sensor (50K)

Temp (°C)	Temp (°F)	Resistance (kΩ)		Temp (°C)	Temp (°F)	Resistance (kΩ)		Temp (°C)	Temp (°F)	Resistance (kΩ)
-29	-20.2	853.5		23	73.4	53.74		75	167.0	7.224
-28	-18.4	799.8		24	75.2	51.41		76	168.8	6.998
-27	-16.6	750		25	77.0	49.19		77	170.6	6.761
-26	-14.8	703.8		26	78.8	47.08		78	172.4	6.542
-25	-13.0	660.8		27	80.6	45.07		79	174.2	6.331
-24	-11.2	620.8		28	82.4	43.16		80	176.0	6.129
-23	-9.4	580.6		29	84.2	41.34		81	177.8	5.933
-22	-7.6	548.9		30	86.0	39.61		82	179.6	5.746
-21	-5.8	516.6		31	87.8	37.96		83	181.4	5.565
-20	-4.0	486.5		32	89.6	36.38		84	183.2	5.39
-19	-2.2	458.3		33	91.4	34.88		85	185.0	5.22
-18	-0.4	432		34	93.2	33.45		86	186.8	5.06
-17	1.4	407.4		35	95.0	32.09		87	188.6	4.904
-16	3.2	384.5		36	96.8	30.79		88	190.4	4.754
-15	5.0	362.9		37	98.6	29.54		89	192.2	4.609
-14	6.8	342.8		38	100.4	28.36		90	194.0	4.469
-13	8.6	323.9		39	102.2	27.23		91	195.8	4.334
-12	10.4	306.2		40	104.0	26.15		92	197.6	4.204
-11	12.2	289.6		41	105.8	25.11		93	199.4	4.079
-10	14.0	274		42	107.6	24.13		94	201.2	3.958
-9	15.8	259.3		43	109.4	23.19		95	203.0	3.841
-8	17.6	245.6		44	111.2	22.29		96	204.8	3.728
-7	19.4	232.6		45	113.0	21.43		97	206.6	3.619
-6	21.2	220.5		46	114.8	20.6		98	208.4	3.514
-5	23.0	209		47	116.6	19.81		99	210.2	3.413
-4	24.8	198.3		48	118.4	19.06		100	212.0	3.315
-3	26.6	199.1		49	120.2	18.34		101	213.8	3.22
-2	28.4	178.5		50	122.0	17.65		102	215.6	3.129
-1	30.2	169.5		51	123.8	16.99		103	217.4	3.04
0	32.0	161		52	125.6	16.36		104	219.2	2.955
1	33.8	153		53	127.4	15.75		105	221.0	2.872
2	35.6	145.4		54	129.2	15.17		106	222.8	2.792
3	37.4	138.3		55	131.0	14.62		107	224.6	2.715
4	39.2	131.5		56	132.8	14.09		108	226.4	2.64

Appendix 3: Resistance Table of Outdoor Discharge Temperature Sensor (50K)

Temp (°C)	Temp (°F)	Resistance (kΩ)		Temp (°C)	Temp (°F)	Resistance (kΩ)		Temp (°C)	Temp (°F)	Resistance (kΩ)
5	41.0	125.1		57	134.6	13.58		109	228.2	2.568
6	42.8	119.1		58	136.4	13.09		110	230.0	2.498
7	44.6	113.4		59	138.2	12.62		111	231.8	2.431
8	46.4	108		60	140.0	12.17		112	233.6	2.365
9	48.2	102.8		61	141.8	11.74		113	235.4	2.302
10	50.0	98		62	143.6	11.32		114	237.2	2.241
11	51.8	93.42		63	145.4	10.93		115	239.0	2.182
12	53.6	89.07		64	147.2	10.54		116	240.8	2.124
13	55.4	84.95		65	149.0	10.18		117	242.6	2.069
14	57.2	81.05		66	150.8	9.827		118	244.4	2.015
15	59.0	77.35		67	152.6	9.489		119	246.2	1.963
16	60.8	73.83		68	154.4	9.165		120	248.0	1.912
17	62.6	70.5		69	156.2	8.854		121	249.8	1.863
18	64.4	67.34		70	158.0	8.555		122	251.6	1.816
19	66.2	64.33		71	159.8	8.268		123	253.4	1.77
20	68.0	61.48		72	161.6	7.991		124	255.2	1.725
21	69.8	58.77		73	163.4	7.726		125	257.0	1.682
22	71.6	56.19		74	165.2	7.47		126	258.8	1.64

