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Vertical Stack Water Source Heat Pump

Installation, Operation and Maintenance

IMPORTANT: Submittal documentation, specific to each project, supersedes the general guidelines contained within this manual.

Nomenclature
VS series, complete unit

1, 2, 3	4	5, 6	7	8	9	10	11	12	13, 14	15	16	17	18	19	20	21	22	23	24	25, 26
VHN	M	09	A	A	X	S	1	X	DB	1	D	A	X	A	1	1	A	A	-	AA

Unit type
VHN = Vertical Stack Water Source Heat Pump complete

Model
M = Master
S = Slave
A = Stand Alone

Nominal capacity

09 = 9,000 BTU/Hr	24 = 24,000 BTU/Hr
12 = 12,000 BTU/Hr	30 = 30,000 BTU/Hr
15 = 15,000 BTU/Hr	36 = 36,000 BTU/Hr
18 = 18,000 BTU/Hr	

Voltage

A = 208-230V/60/1	B = 277V/60/1

Blower/motor options

A = Standard/PSC	C = Standard/ECM
B = High static/PSC	D = High static/ECM

Options

X = None (standard)	S = With sight and sound baffle

Controls
S = Microprocessor controls
C = Microprocessor and customer supplied DDC controls
L = Microprocessor and Lon Network Communication
B = Microprocessor and BACnet network communication
N = Microprocessor and N2 network communication

Thermostat
1 = No thermostat
2 = Non-programmable thermostat
3 = Programmable thermostat
4 = Communicating thermostat

Power termination

X = No disconnect	1 = Disconnect switch

Supply air/risers

NA = None/back	DA = Front, right/back	DQ = front, top/right
NB = None/right	DB = Front, left/back	DR = Back, top/right
NC = None/left	DC = Left, right/back	DS = Left, top/right
SA = Front/back	DD = Front, top/back	TA = Front, left, right/back
SB = Right/back	DE = Front, left/right	TB = Front, top, right/back
SC = Left/back	DF = Back, left/right	TC = Front, top, left/back
SD = Top/back	DG = Front, back/right	TD = Top, left, right/back
SE = Left/right	DH = Left, top/back	TE = Front, back, left/right
SF = Front/right	DJ = Back, right/left	TF = Front, back, top/right
SG = Back/right	DK = Front, right/left	TG = Front, top, left/right
SH = Top/right	DL = Front, back/left	TH = Top, back, left/right
SJ = Right/left	DM = Right, top/back	TJ = Front, back,right/left
SK = Back/left	DN = Front, top/left	TK = Front, back, top/left
SL = Front/left	DO = Back, top/left	TL = Front, top, right/left
SM = Top/left	DP = Right, top/left	TM = Top, back, right/left

Heat exchanger
1 = Copper coax with air coil

Flow regulator
X = None
A = 1/2", 1.5 GPM (09, 12)
B = 1/2", 2.0 GPM (09, 12)
C = 1/2", 2.5 GPM (09, 12)
D = 1/2", 3.0 GPM (09, 12)
E = 3/4", 2.0 GPM (15, 18)
F = 3/4", 2.5 GPM (15, 18)
G = 3/4", 3.0 GPM (15-24)
H = 3/4", 3.5 GPM (24, 30)
I = 3/4", 4.0 GPM (24, 30)
J = 3/4", 5.0 GPM (24-36)
K = 3/4", 6.0 GPM (24-36)
L = 3/4", 7.0 GPM (30, 36)
M = 3/4", 8.0 GPM (30, 36)
N = 3/4", 9.0 GPM (36)
O = 3/4", 10.5 GPM (36)

Zone valve
X = None
A = 1/2" 24VAC zone valve (09, 12)
B = 3/4" 24VAC zone valve (15-36)

Y strainer
X = None
A = 1/2" Y strainer (09, 12)

Hose kit (3')
X = None
A = 1/2"
B = 3/4"

Air filter
1 = Washable
2 = 1" throwaway

Cabinet
1 = 88"
3 = Custom

Supply air size
X = None
A = 10" x 8" (09-18)
B = 12" x 10" (24-36)
C = 14" x 12" (09-18)
D = 16" x 14" (24-36)

Revision level
A = Rev. 1

Placeholder

Special option codes
AA = Standard

Nomenclature
VS series, cabinetry

1, 2, 3	4	5, 6	7	8	9	10	11	12, 13	14	15	16	17	18
VHN	M	09	A	A	X	S	X	DB	1	A	A	–	AA

Unit type
VHC = Vertical Stack Water Source Heat Pump cabinetry

Model
M = Master
S = Slave
A = Stand Alone

Nominal capacity
09 = 9,000 BTU/Hr
12 = 12,000 BTU/Hr
15 = 15,000 BTU/Hr
18 = 18,000 BTU/Hr
24 = 24,000 BTU/Hr
30 = 30,000 BTU/Hr
36 = 36,000 BTU/Hr

Voltage
A = 208-230V/60/1
B = 277V/60/1

Blower/motor options
A = Standard/PSC
B = High static/PSC
C = Standard/ECM
D = High static/ECM

Options
X = None (standard)
S = With sight and sound baffle

Controls
S = Microprocessor controls
C = Microprocessor and customer supplied DDC controls
L = Microprocessor and Lon Network Communication
B = Microprocessor and BACnet network communication
N = Microprocessor and N2 network communication

Power termination
X = No disconnect
1 = Disconnect switch

Supply air/risers

NA = None/back	DA = Front, right/back	TA = Front, left, right/back
NB = None/right	DB = Front, left/back	TB = Front, top, right/back
NC = None/left	DC = Left, right/back	TC = Front, top, left/back
SA = Front/back	DD = Front, top/back	TD = Top, left, right/back
SB = Right/back	DE = Front, left/right	TE = Front, back, left/right
SC = Left/back	DF = Back, left/right	TF = Front, back, top/right
SD = Top/back	DG = Front, back/right	TG = Front, top, left/right
SE = Left/right	DH = Left, top/back	TH = Top, back, left/right
SF = Front/right	DJ = Back, right/left	TJ = Front, back,right/left
SG = Back/right	DK = Front, right/left	TK = Front, back, top/left
SH = Top/right	DL = Front, back/left	TL = Front, top, right/left
SJ = Right/left	DM = Right, top/back	TM = Top, back, right/left
SK = Back/left	DN = Front, top/left	
SL = Front/left	DO = Back, top/left	
SM = Top/left	DP = Right, top/left	
	DQ = front, top/right	
	DR = Back, top/right	
	DS = Left, top/right	

Cabinet
1 = 88"
3 = Custom

Supply air size
X = None
A = 10" x 8" (09-18)
B = 12" x 10" (09, 12, 24-36)
C = 14" x 12" (15, 18)
D = 16" x 14" (24-36)

Revision level
A = Rev. 1

Placeholder

Special option codes
AA = Standard

Nomenclature
VS series, chassis

1, 2, 3, 4	5, 6	7	8	9	10	11	12	13	14	15	16, 17
VHCH	09	A	1	D	A	X	A	1	A	–	AA

Unit type
VHN = Vertical Stack Water Source Heat Pump complete

Nominal capacity
09 = 9,000 BTU/Hr
12 = 12,000 BTU/Hr
15 = 15,000 BTU/Hr
18 = 18,000 BTU/Hr
24 = 24,000 BTU/Hr
30 = 30,000 BTU/Hr
36 = 36,000 BTU/Hr

Voltage
A = 208-230V/60/1
B = 277V/60/1

Heat exchanger
1 = Copper coax with air coil

Flow regulator
X = None
A = 1/2", 1.5 GPM (1, 2)
B = 1/2", 2.0 GPM (1, 2)
C = 1/2", 2.5 GPM (1, 2)
D = 1/2", 3.0 GPM (1, 2)
E = 3/4", 2.0 GPM (3, 4)
F = 3/4", 2.5 GPM (3, 4)
G = 3/4", 3.0 GPM (3, 4, 5)
H = 3/4", 3.5 GPM (5, 6)
I = 3/4", 4.0 GPM (5, 6)
J = 3/4", 5.0 GPM (5, 6, 7)
K = 3/4", 6.0 GPM (5, 6, 7)
L = 3/4", 7.0 GPM (6, 7)
M = 3/4", 8.0 GPM (6, 7)
N = 3/4", 9.0 GPM (7)
O = 3/4", 10.5 GPM (7)

Zone valve
X = None
A = 1/2" 24VAC zone valve (09, 12)
B = 3/4" 24VAC zone valve (15-36)

Y strainer
X = None
A = 1/2" Y strainer (09, 12)

Hose kit (3')
X = None
A = 1/2"
B = 3/4"

Air filter
1 = Washable
2 = 1" throwaway

Revision level
A = Rev. 1

Placeholder

Special option codes
AA = Standard

General information

Warnings, cautions, and notices appear throughout this manual. Read these items carefully before attempting installation, service, or troubleshooting of the equipment.

⚠ DANGER

Indicates an immediate hazardous situation, which if not avoided will result in death or serious injury. **Danger** labels on unit access panels must be observed.

⚠ WARNING

Indicates a potentially hazardous situation, which if not avoided could result in death or serious injury.

⚠ CAUTION

Indicates a potentially hazardous situation or an unsafe practice, which if not avoided could result in minor or moderate injury or product or property damage.

NOTICE

Notification of installation, operation, or maintenance information, which is important, but is not hazard-related.

This installation and start-up instructions literature is for VS Series Water Source Heat Pumps. Water Source Heat Pumps are single packaged vertical units with microprocessor control designed for year-round cooling and heating. Refer to the product nomenclature for equipment specifications and options.

Important

The installation of Water Source Heat Pump units and all associated components, parts and accessories which make up the installation, shall be in accordance with the regulations of all authorities having jurisdiction and must conform to all applicable codes. It is the responsibility of the installing contractor to determine and comply with all applicable codes and regulations.

⚠ WARNING

To avoid the release of refrigerant into the atmosphere, the refrigerant circuit of this unit must be serviced only by properly trained technicians who meet local, state, and federal requirements.

⚠ CAUTION

To avoid equipment damage, **do not** use these units as a source of heating or cooling during the construction process. The mechanical components and filters will quickly become clogged with construction dirt and debris, which may cause system damage and/or void the warranty.

⚠ WARNING

The installation of water source heat pumps and all associated components, parts, and accessories which make up the installation shall be in accordance with the regulations of all authorities having jurisdiction and must conform to all applicable codes. It is the responsibility of the installing contractor to determine and comply with all applicable codes and regulations.

⚠ CAUTION

All refrigerant discharged from this unit must be recovered. Technicians must follow industry accepted guidelines and all local, state, and federal statutes for the recovery and disposal of refrigerants. If the compressor is removed, oil will remain in the compressor. To avoid oil leakage, compressor suction and discharge lines must be sealed after it is removed.

Inspection: Upon receipt of the equipment, carefully check the shipment against the bill of lading. Make sure all units have been received. Inspect the packaging of each unit and inspect each unit for damage. Ensure that the carrier makes proper notation of any shortages or damage on all copies of the freight bill and completes a common carrier inspection report. Concealed damage not discovered during unloading must be reported to the carrier within 15 days of receipt of shipment. If not filed within 15 days, the freight company can deny the claim without recourse.

Note: It is the responsibility of the purchaser to file all necessary claims with the carrier.

Storage: Equipment should be stored in its original packaging in a clean, dry area. Store units in an upright position at all times. Stack units a maximum of 3 units high.

General information

Unit protection: Cover units on the job site with either the original packaging or an equivalent protective covering. Cap the open ends of pipes stored on the job site. In areas where painting, plastering, and/or spraying has not been completed, all due precautions must be taken to avoid physical damage to the units and contamination by foreign material. Physical damage and contamination may prevent proper start-up and may result in costly equipment clean-up.

Examine all pipes, fittings, and valves before installing any of the system components. Remove any dirt or debris found in or on these components.

Pre-installation: Installation, operation and maintenance instructions are provided with each pallet. Horizontal equipment is designed for installation above false ceiling or in a ceiling plenum. The installation site chosen should include adequate service clearance around the unit. Before unit start-up, read all manuals and become familiar with the unit and its operation. Thoroughly check the system before operation.

Prepare units for installation as follows:

- Compare the data on the unit nameplate with ordering and shipping information to verify that the correct unit has been received.
- Keep the cabinet covered with the original packaging until installation is complete and all plastering, painting, etc. is finished.
- Verify refrigerant tubing is free of kinks or dents and that it does not touch other unit components.
- Inspect all electrical connections. Connections must be clean and tight at the terminals.
- Remove blower shipping support packaging, if applicable.
- Some airflow patterns are field convertible. Locate the airflow conversion section of this manual for instructions.

⚠ CAUTION

All three phase scroll compressors must have direction of rotation verified at start-up. Verification is achieved by checking compressor amp draw. Amp draw will be substantially lower compared to nameplate values if wired incorrectly. Additionally, reverse rotation results in an elevated sound level compared to correct rotation. Reverse rotation will result in compressor internal overload trip within several minutes. Verify compressor type before proceeding.

⚠ CAUTION

Do not store or install units in corrosive environments or in locations subject to temperature or humidity extremes (e.g., attics, garages, rooftops, etc.). Corrosive conditions and high temperature or humidity can significantly reduce performance, reliability, and service life. Always move and store units in an upright position. Tilting units on their sides may cause equipment damage.

⚠ CAUTION

Cut hazard: Failure to follow this caution may result in personal injury. Sheet metal parts may have sharp edges or burrs. Use care and wear appropriate protective clothing, safety glasses and gloves when handling parts and servicing heat pumps.

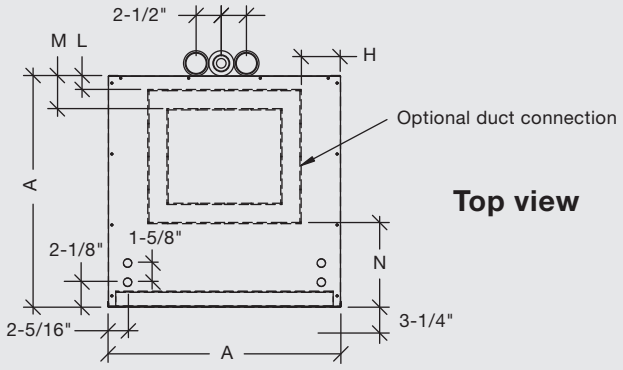
Unit physical data

Size	09	12	15	18	24	30	36
Cooling capacity (BTU/hr)	9200	12000	16500	18500	22500	30000	34000
Heating capacity (BTU/hr)	12500	16000	21500	23500	29500	37000	41000
Compressor (1 each)	Rotary	Rotary	Rotary	Rotary	Rotary	Rotary	Scroll
Factory refrigerant charge R-410A (oz)	27.5	31.7	45.8	47.0	52.9	64.6	60.0
Fan data							
Speeds	2	2	2	2	2	2	2
Blower wheel size (D x W) (in.) standard/high static	7.1 x 6.7	7.1 x 6.7	7.1 x 6.7	7.1 x 6.7	9.2 x 10.0	9.2 x 10.0	9.2 x 10.0
Air flow (CFM @ 0.0" of static pressure)	360	420	540	630	820	1080	1220
Water/condensate side data							
Flow rate (GPM)	2.6	3.6	4.9	5.3	6.6	8.7	9.4
Water connection size (female NPT, in.)	1/2	1/2	3/4	3/4	3/4	3/4	3/4
Water side pressure drop (psi)	4.5	6.2	5.8	6.5	5.0	7.3	7.8
Condensate connection size (in.)	3/4	3/4	3/4	3/4	3/4	3/4	3/4
Air coil data							
Total face area (ft.)	1.48	1.48	1.81	1.81	1.72	1.72	1.72
Tube size (in.)	3/8	3/8	3/8	3/8	3/8	3/8	3/8
Fin spacing (FPI)	14	14	14	14	12	12	12
Number of rows	2	3	4	4	3	4	4
Cabinet data							
Depth (in.)	18	18	18	18	24	24	24
Height (in.)	88	88	88	88	88	88	88
Width (in.)	18	18	18	18	24	24	24
Filter standards - washable filter (in.)	14-1/4 x 18-1/2	14-1/4 x 18-1/2	14-1/4 x 22-1/2	14-1/4 x 22-1/2	19 x 28-3/4	19 x 28-3/4	19 x 28-3/4
Cabinet weight (lb.)	120	120	120	120	170	170	170
Chassis weight (lb.)	99	105	119	122	187	198	225

Notes:

- Capacities based on a water loop application
- Cooling capacity based upon 80.6 °F DB, 66.2 °F WB entering air temperature.
- Heating capacity based upon 68 °F DB, 59 °F WB entering air temperature.
- All ratings based upon air flow at high speed and operation at lower voltage (208V) of dual voltage ratings.

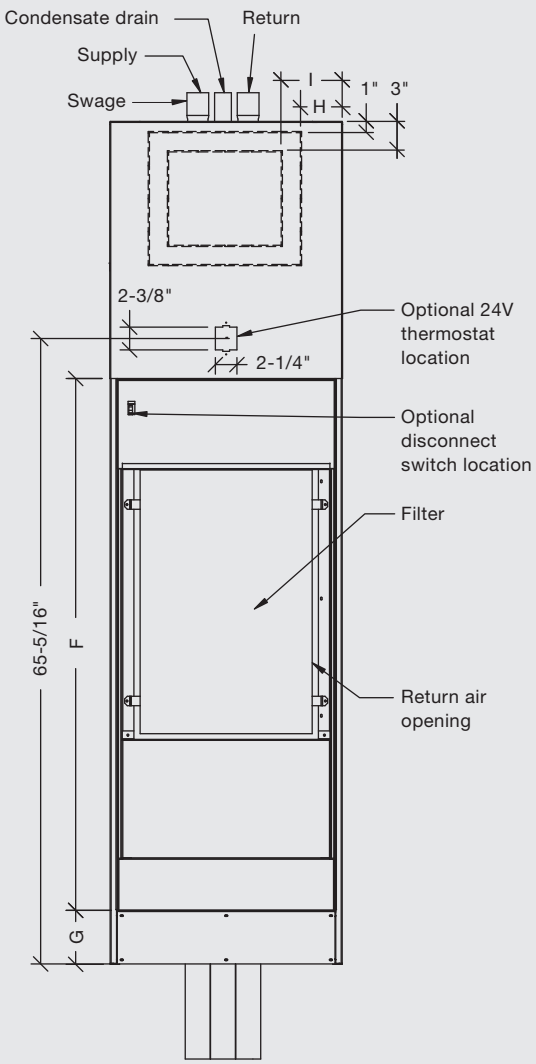
Dimensions and data: Stand Alone Unit (VHNA)



Top view

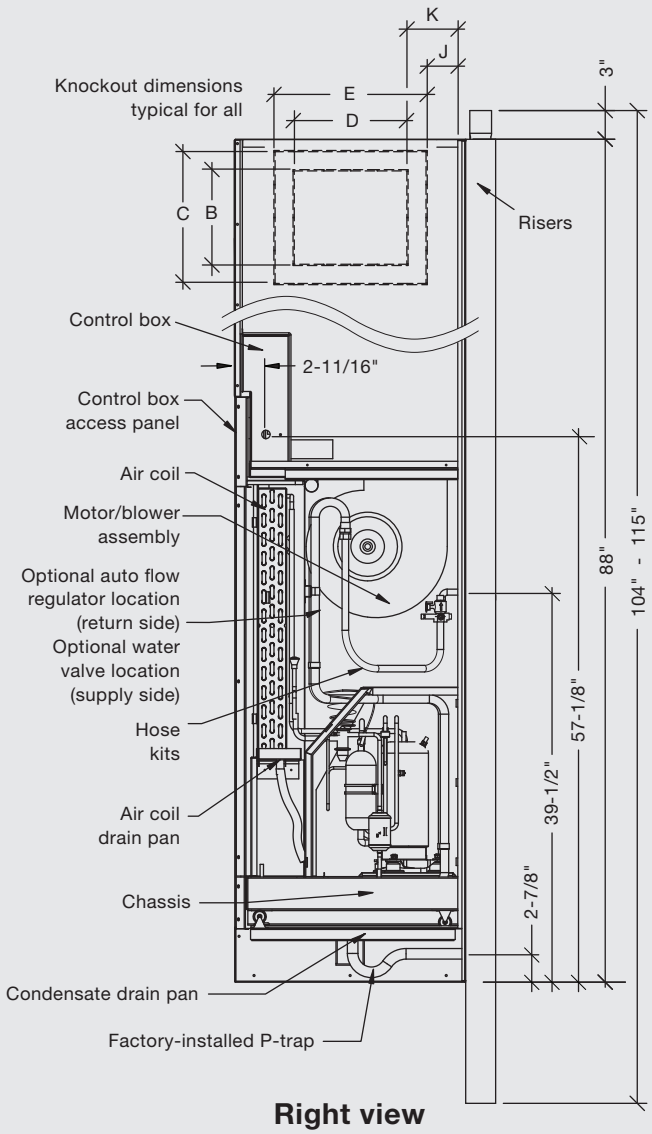
Unit dimensions: 88" height

Dimension	Models 09-18	Models 24-36
A	18"	24-1/4"
B	8"	10"
C	12"	14"
D	10"	12"
E	14"	16"
F	54-11/16"	55-1/2"
G	5-9/16"	5-5/8"
H	2-1/16"	4-1/8"
I	4-1/16"	6-1/8"
J	1-15/16"	4-1/16"
K	3-5/16"	6-1/16"
L	1-1/4"	1-7/16"
M	3-1/4"	3-7/16"
N	4-3/4"	8-13/16"



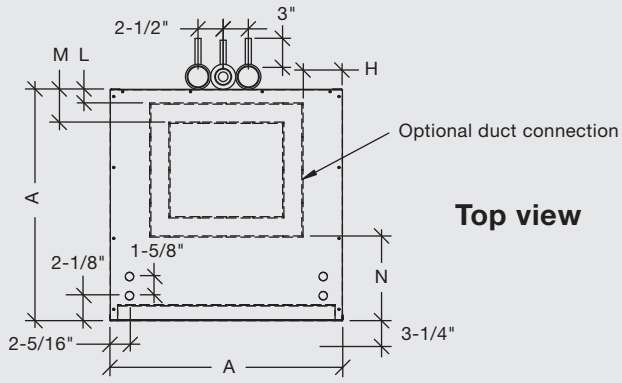
Front view

* Supply grille rough-in dimensions



Right view

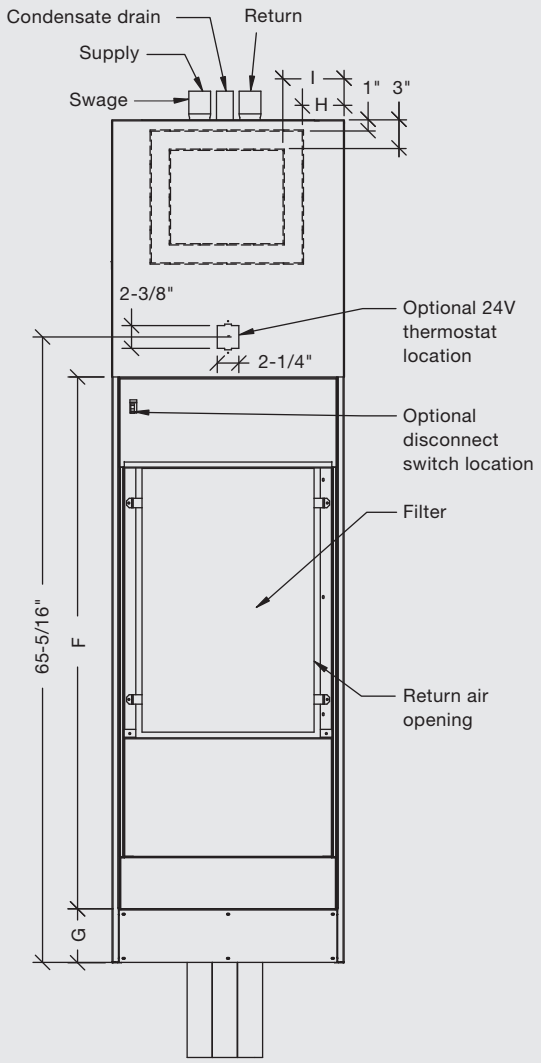
Dimensions and data: Master (VHNM)



Top view

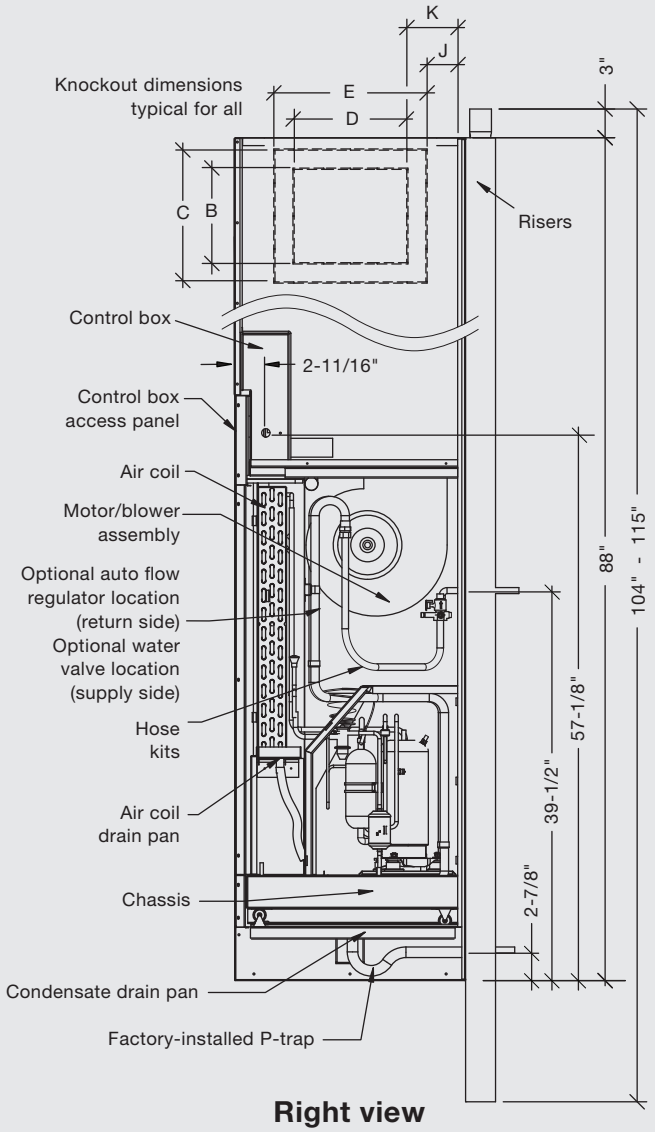
Unit dimensions: 88" height

Dimension	Models 09-18	Models 24-36
A	18"	24-1/4"
B	8"	10"
C	12"	14"
D	10"	12"
E	14"	16"
F	54-11/16"	55-1/2"
G	5-9/16"	5-5/8"
H	2-1/16"	4-1/8"
I	4-1/16"	6-1/8"
J	1-15/16"	4-1/16"
K	3-5/16"	6-1/16"
L	1-1/4"	1-7/16"
M	3-1/4"	3-7/16"
N	4-3/4"	8-13/16"



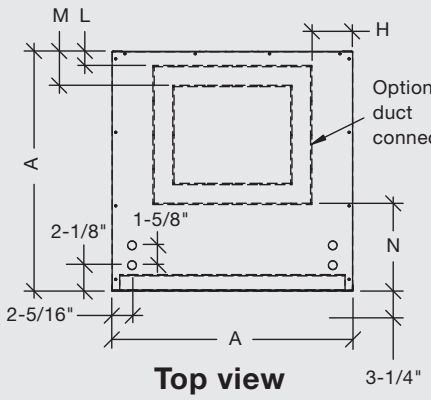
Front view

* Supply grille rough-in dimensions



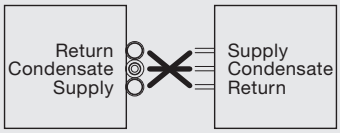
Right view

Dimensions and data: Slave (VHNS)



Top view

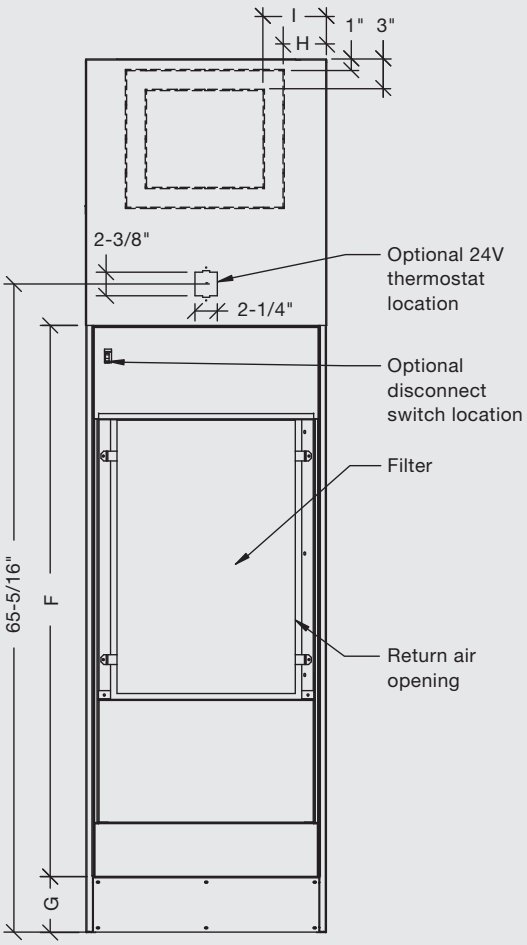
Reference only:
Field piping to master by others. Ensure master and slave are connected supply-to-supply and return-to-return



Note: Riser knockouts are 2-1/2" center to center

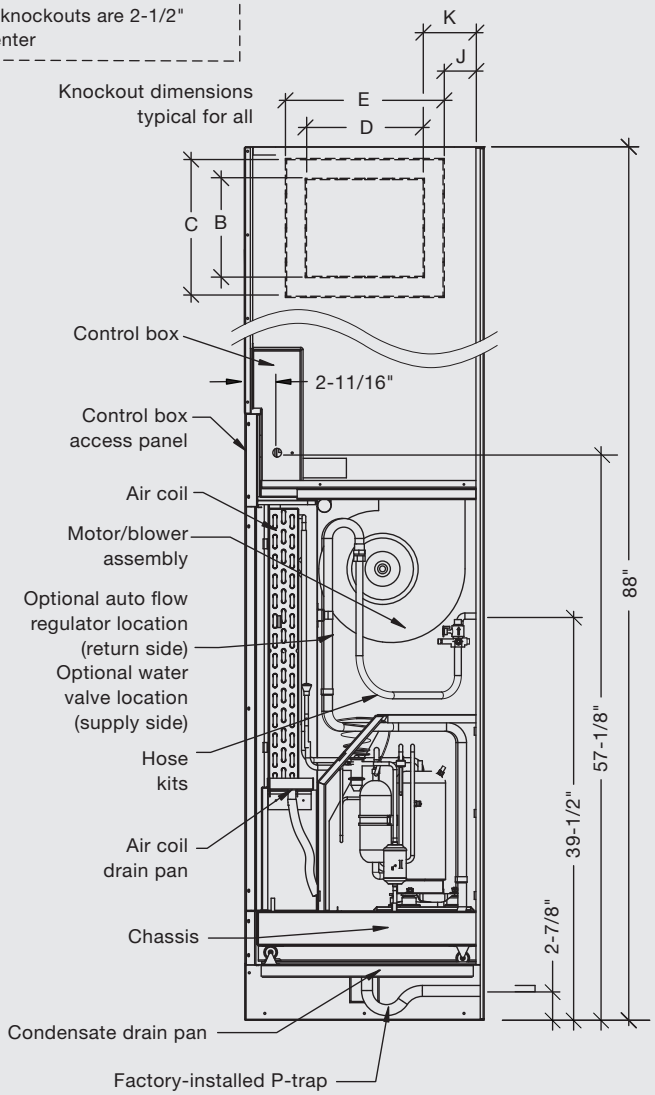
Unit dimensions: 88" height

Dimension	Models 09-18	Models 24-36
A	18"	24-1/4"
B	8"	10"
C	12"	14"
D	10"	12"
E	14"	16"
F	54-11/16"	55-1/2"
G	5-9/16"	5-5/8"
H	2-1/16"	4-1/8"
I	4-1/16"	6-1/8"
J	1-15/16"	4-1/16"
K	3-5/16"	6-1/16"
L	1-1/4"	1-7/16"
M	3-1/4"	3-7/16"
N	4-3/4"	8-13/16"



Front view

* Supply grille rough-in dimensions



Right view

Safety considerations

The installation and servicing of air conditioning equipment can be hazardous due to system pressure and electrical components. Only trained and qualified service personnel should install, repair and/or service air conditioning equipment.

Untrained personnel can perform basic maintenance functions such as cleaning coils and cleaning or replacing filters. All other operations should be performed by trained service personnel. When working on air conditioning equipment, observe precautions in the literature, tags and labels attached to the equipment and all other safety precautions that may apply.

Improper installation, adjustment, alteration, service, maintenance, or use can cause explosion, fire, electrical shock or other hazardous conditions which may cause serious personal injury and/or property damage. Consult a qualified installer, service agency, or your distributor or branch for information or assistance. The qualified installer or agency must use factory-authorized kits or accessories when modifying this product. Refer to the individual instructions packaged with kits or accessories when installing.

Follow all safety codes. Wear safety glasses and work gloves. Use quenching cloth for brazing operations. Have fire extinguisher available. Read these instructions thoroughly and follow all warnings or cautions attached to the equipment. Consult local building codes and the National Electrical Code (NEC) for special installation requirements.

Understand the signal words - danger, warning and caution. Danger identifies the most serious hazards which will result in severe personal injury or death. Warning signifies hazards that could result in personal injury or death. Caution is used to identify unsafe practices, which would result in minor personal injury or product and property damage.

Recognize safety information. This is the safety-alert symbol: **⚠ WARNING**. When you see this symbol on the unit and in instructions or manuals, be alert to the potential for personal injury.

⚠ WARNING

Electrical shock can cause personal injury or death. When installing or servicing system, always turn off main power to system. There may be more than one disconnect switch.

Installation: Check job site

Installation, operation and maintenance instructions are provided with each unit. Before unit start-up, read all manuals and become familiar with the unit and its proper operation. Thoroughly check out the system before operation. Complete the inspections and instructions listed in this manual to prepare a unit for installation.

Vertical stack units are designed for indoor installations. Most installations are located in the corner of the living space to be heated or cooled. Refer to the Framing Rough-In Detail in this manual for framing dimensions.

⚠ CAUTION

To avoid equipment damage, do not use these units as a source of heating or cooling during the construction process. The mechanical components and filters used in these units quickly become clogged with construction dirt and debris which may cause system damage.

Installation: Check equipment

Upon receipt of shipment at the job site, carefully check the shipment against the bill of lading. Make sure all units have been received. Inspect the carton of each unit and inspect each unit for damage. Ensure the shipping company makes proper notation of any shortages or damage on all copies of the freight bill. Concealed damage not discovered during unloading must be reported to the shipping company within 15 days of receipt of the shipment.

Note:
It is the responsibility of the purchaser to file all necessary claims with the shipping company.

- Verify unit is the correct model for the entering water temperature of the job.
- Be sure that the location chosen for the unit installation provides ambient temperatures maintained above freezing. Well water applications are especially susceptible to freezing.
- Check local codes to be sure a secondary drain pain is not required under the unit.
- Be sure that there will be sufficient slope for condensate drainage. A field supplied condensate pump may be required if drain slope is not adequate.
- Provide adequate clearance for filter replacement, the unit should not be secured to framing. Do not allow piping, conduit, etc., to block servicing of the equipment.

Storage
If the equipment is not needed immediately at the job site, it should be left in its shipping carton and stored in a clean, dry area of the building or in a warehouse. Units must be stored in an upright position at all times. Do not remove any equipment from its shipping package until it is needed for installation.

Protection
Once the equipment is properly positioned on the job site, cover the units with either a shipping carton, vinyl film, or an equivalent protective covering. Cap open ends of piping that is stored on a job site. This precaution is especially important in areas where painting, dry walling, or spraying of fireproof material, etc., has not yet been completed. Foreign material that accumulates within the units can prevent proper start-up and necessitate costly clean-up operations.

Before installing any of the system components, be sure to examine each pipe, fitting and valve, and remove any dirt or foreign material found in or on these components.

⚠ CAUTION

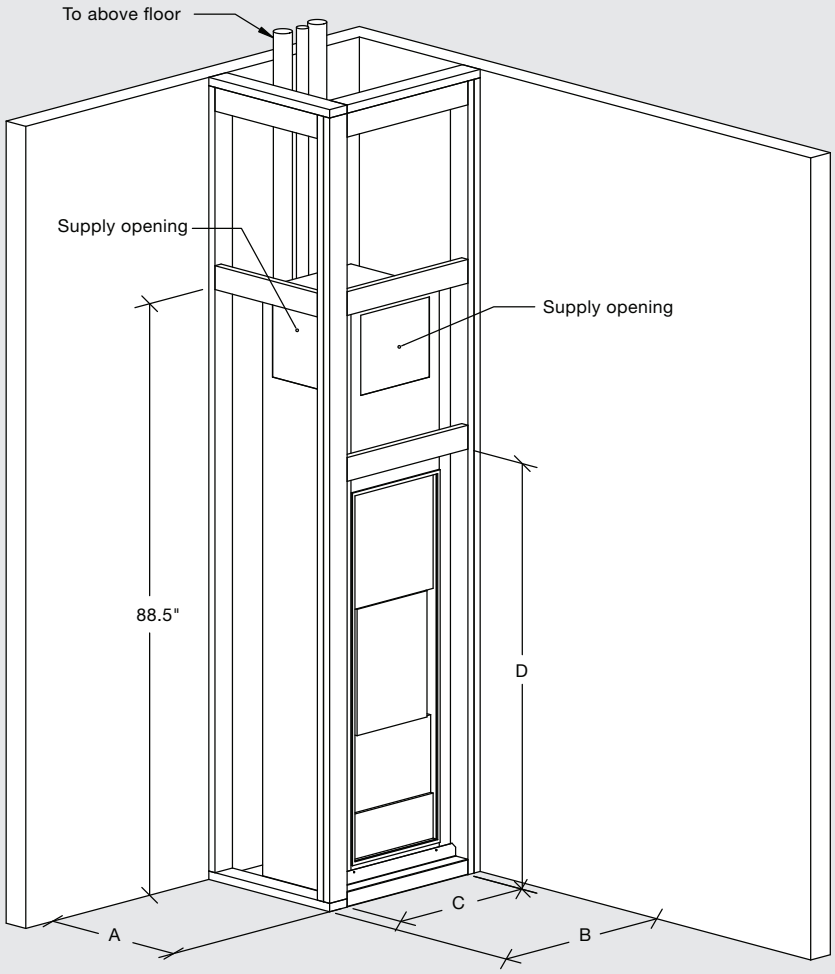
DO NOT store or install units in corrosive environments or in locations subject to temperature or humidity extremes (e.g., attics, garages, rooftops, etc.). Corrosive conditions and high temperature or humidity can significantly reduce system performance, reliability and overall service life. Always move units in an upright position. Tilting units on their sides may cause equipment damage.

Drywall installation

All rough-in instructions and drawings are designed for a single layer of 5/8" thick drywall. Refer to the Framing Rough-in Detail drawing to the right. Rough-in dimensions will be affected if drywall thickness is different than 5/8", the return panel will not fit snugly to the wall and form a tight seal. Install drywall using conventional construction methods. Drywall cannot be fastened to the studs with adhesive alone. Mechanical fasteners, such as drywall screws, must be used.

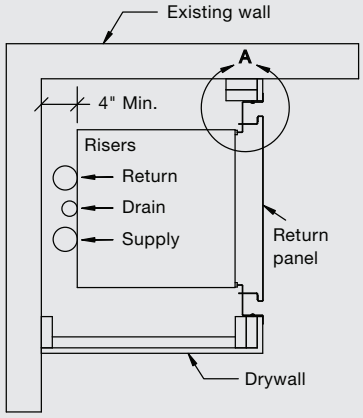
Vacuum all drywall dust and construction debris from coils, drain pans and blower discharge plenum after cutting out supply and return holes for grilles. When installation is complete, cover cabinet supply and return air openings. Do not allow paint or wall texture over-spray to contact coil, fan or other unit components. Warranties are void if paint or other foreign debris is allowed to contaminate internal unit components.

Framing rough-in detail

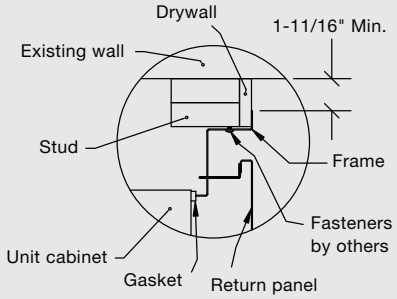


C and D are rough-in dimensions for return panel frame
Rough-in supply opening grille(s) using standard building practices

Top view



Detail A



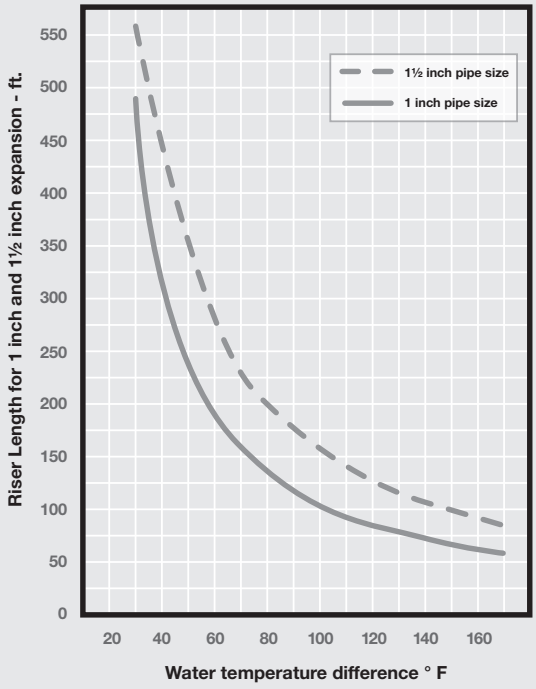
Dimensional data				
Unit Size	**A**	**B**	**C**	**D**
VHN 09-18	24-5/8"	30-11/16"	24-5/8"	63-11/16"
VHN 24-36	30-7/8"	36-11/16"	30-5/8"	64-7/16"

Riser material, sizing, installation and expansion

All factory supplied risers and riser extensions are insulated for the full length of the riser, eliminating the need for field insulation. Any concerns regarding excessive expansion and between-the-floor fireproofing have not been addressed in the Zehnder Rittling design and any additional materials to accommodate these concerns are to be field supplied and installed using proper building practices and local building codes.

Generally, in medium to high-rise buildings, allowances must be made for pipe expansion. Vertical Stack Water Source Heat Pump units are furnished with integral copper expansion loops that allow up to 1" of riser expansion and contraction. Additional expansion compensation must be made in the riser system in the field where movement is expected to exceed factory allowances. The table showing allowable riser lengths between system expansion loops displays expansion characteristics of risers compared to water temperature differential. Assuming a hot water temperature of 120 °F and 45 °F condenser water, the temperature difference of 75 °F indicates 150 feet of riser will expand or contract 1". To eliminate stress, a riser system must be anchored to the building structure at least once. Technical information on pipe expansion, contraction and anchoring can be found in the ASHRAE HVAC Systems and Equipment Handbook and various other technical publications. Riser expansion and anchoring is the responsibility of the design engineer and installing contractor. Ensure all condensate, riser, P-trap and drain pan connections are secure.

Allowable riser lengths between system expansion loops



Cabinet and riser installation

Riser expansion

Generally, in medium to high-rise buildings, allowances must be made for pipe expansion. In applications supplemented with factory (or field) supplied between-the-floor riser extensions, assemble and install extensions before installing cabinet.

All riser modifications necessitated by variations in floor-to-floor dimensions, including cutting off or extending risers, is the sole responsibility of the installing contractor.

Additional expansion compensation must be made in the riser system, in the field, where movement is expected to exceed the factory allowances. The “Allowable Riser Lengths Between System Expansion Loops” chart on the opposite page displays the expansion characteristics of risers compared to water temperature differential.

Notes

- Riser assemblies are designed to accommodate a maximum of 1-1/8" expansion and contraction up to a total movement of 2-1/4".
- If the total calculated rise expansion exceeds 2-1/4", expansion devices must be used (field provided).

Riser connections

Install cabinet with risers as follows:

- Move cabinet into position. **Caution:** Keep risers off the floor while moving the cabinet.
- Do not carry units by risers.
- Be sure that all the copper fittings are clean and free of dirt. Raise the cabinet upright and lower it into the riser from the floor below.
  Note: The top of each riser is equipped with a 3" deep swaged connection. There is sufficient extension at the bottom to allow insertion of approximately 2" of the riser into the swaged top of the riser below.
- Center risers in the pipe chase and shim the cabinet level. Plumb risers in two planes to assure proper unit operation and condensate drainage.
- Attach the cabinet assembly to the floor and the building structure on at least two sides using sheet metal angles (field provided). A field provided base vibration dampening pad can be used to help eliminate transfer of any vibration to the structure. If vibration dampening pads are used, some rough-in dimensional changes will need to be considered before installation due to style and thickness of the pads. Additional anchorage can be provided by installing brackets at the top of the cabinet (field provided).
- **Do not** attach drywall studs to the equipment cabinet.
- When all units on a riser are anchored into place, complete riser joints as follows:
  - Verify that all riser joints are vertically aligned and that risers penetrate at least 1" into the swaged joint of the riser below. **Do not** let riser joint bottom out.
  - Braze riser joints with a high-temperature alloy using proper Phos-copper of Silfos. Soft solder 50-50, 60-40, 85-15, or 95-5 or low temperature alloys are not suitable riser weld materials.
  - Anchor built-in risers to the building structure with at least one contact point. To accommodate vertical expansion and contraction **do not** fasten risers rigidly within the unit.
  - Verify that unit shut-off valves are closed. **Do not open valves** until the system has been cleaned and flushed.
  - Flush system, refer to the System Cleaning and Flushing Section on page 24 of this manual for more information.
  - Install vents in piping loop, as required, to bleed the system of air accumulated during installation.
- Ensure all riser penetrations into the cabinet are properly sealed. The insulation should be only slit open, not cut out and then sealed closed. Failure to properly seal penetrations may lead to operational issues and any damage caused by improper installation will not be covered under warranty.

Water loop applications

Commercial water loop

Commercial systems typically include a number of units connected to a common piping system. Any unit plumbing maintenance work can introduce air into the piping system; therefore air elimination equipment is a major component of the mechanical room plumbing. Consideration should be given to insulating the piping surfaces to avoid condensation. Zehnder Rittling recommends unit insulation any time the water temperature is expected to be below 60 °F (15.6 °C). Metal-to-plastic threaded joints should never be used due to their tendency to leak over time.

Piping installation

Teflon® tape thread sealant is recommended to minimize internal fouling of the heat exchanger. Do not over tighten connections and route piping so as not to interfere with service or maintenance access. Depending upon selection, hose kits may include shut-off valves, P/T plugs for performance measurement, high pressure stainless steel braided hose, “Y” type strainer with blow down valve, balancing valve, and/or “J” type swivel connection. Balancing valves and an external low pressure drop solenoid valve for use in variable speed pumping systems may also be included in the hose kit.

The piping system should be flushed to remove dirt, piping chips, and other foreign material prior to operation (see “Piping System Cleaning and Flushing Procedures” in this manual). The flow rate is usually set between 2.25 and 3.5 gpm per ton (2.9 and 4.5 l/m per kW) of cooling capacity. Zehnder Rittling recommends 3.3 gpm per ton (4.3 l/m per kW) for most applications of water loop heat pumps. To ensure proper maintenance and servicing, P/T ports are imperative for temperature and flow verification, as well as performance checks.

Loop conditions

Water loop heat pump (cooling tower/boiler) systems typically utilize a common loop, maintained between 60-90 °F (16-32 °C). The use of a closed circuit evaporative cooling tower with a secondary heat exchanger between the tower and the water loop is recommended. If an open type cooling tower is used continuously, chemical treatment and filtering will be necessary. For low entering water temperature applications, Zehnder Rittling recommends following the water limit guidelines:

Table 1: Water limit guidelines

EWT min. (°F)	Min. flow rate (GPM/ton)	Antifreeze required?
50	1.5	No
40-50	3	No
40-50	1.5	Yes
20-40	3	Yes

Low water temperature cutout setting

Zehnder Rittling’s heat pump controller includes a user configurable switch (DIP switch 2 on the PCB controller) to change the low water temperature cutout (FP1) setting between water (30 °F) and Glycol (10 °F). When loop conditions allow (antifreeze is used), the FP1 DIP switch should be set to the Glycol (10 °F) setting to avoid nuisance faults.

Ground loop applications

⚠ CAUTION

The following instructions represent industry accepted installation practices for closed loop, earth coupled heat pump systems. Instructions are provided to assist the contractor in installing trouble free ground loops. These instructions are recommendations only. State/provincial and local codes must be followed and installation must conform to all applicable codes. It is the responsibility of the installing contractor to determine and comply with all applicable codes and regulations.

⚠ CAUTION

Ground loop applications require extended range equipment and optional refrigerant/water circuit insulation.

Piping installation

All earth loop piping materials should be limited to polyethylene fusion only for in-ground sections of the loop. Galvanized or steel fittings should not be used at any time due to their tendency to corrode. All plastic to metal threaded fittings should be avoided due to their potential to leak in earth coupled applications. A flanged fitting should be substituted. P/T plugs should be used so that flow can be measured using the pressure drop of the unit heat exchanger.

Earth loop temperatures can range between 25 and 110 °F (-4 to 43 °C). Flow rates between 2.25 and 3 gpm (2.41 to 3.23 l/m per kW) of cooling capacity are recommended in these applications.

Pressure test water loop piping prior to unit installation. Pressures of at least 100 psig (689 kPa) should be used when testing. Do not exceed the pipe pressure rating. Test entire system when all loops are assembled.

Upon completion of system installation and testing, flush the system to remove all foreign objects and purge to remove all air.

Loop conditions

When entering loop conditions meet values specified in Table 3 below or where piping will be routed through areas subject to freezing, antifreeze is required. Alcohols and glycols are commonly used as antifreeze; however your local sales representative should be consulted to determine the antifreeze best suited to your area. Freeze protection should be maintained to 15 °F (9 °C) below the lowest expected entering loop temperature.

Table 2: Water limit guidelines

EWT Min. (°F)	Min. flow rate (GPM/ton)	Antifreeze required?
50	1.5	No
40-50	3	No
40-50	1.5	Yes
20-40	3	Yes

All alcohols should be premixed and pumped from a reservoir outside of the building when possible or introduced under the water level to prevent fumes.

Calculate the total volume of fluid in the piping system. Then use the percentage by volume shown in Table 3 for the amount of antifreeze needed. Antifreeze concentration should be checked from a well mixed sample using a hydrometer to measure specific gravity.

Low water temperature cutout setting

Zehnder Rittling's heat pump controller includes a user configurable switch (DIP switch 2 on the PCB controller) to change the low water temperature cutout (FP1) setting between water (30 °F) and Glycol (10 °F). When loop conditions allow (antifreeze is used), the FP1 DIP switch should be set to the Glycol (10 °F) setting to avoid nuisance faults.

Note:

- Low water temperature operation requires extended range equipment.

Table 3: Antifreeze percentages by volume

Type	Minimum temperature for low temperature protection			
	10 °F (-12.2 °C)	15 °F (-9.4 °C)	20 °F (-6.7 °C)	25 °F (-3.9 °C)
Methanol	25%	21%	16%	10%
Propylene glycol	38%	25%	22%	15%
Ethanol*	29%	25%	20%	14%

* Must not be denatured with any petroleum based product

Ground water applications

Open loop ground

Shut off valves should be included for ease of servicing. Boiler drains or other valves should be “tee’d” into the lines to allow acid flushing of the heat exchanger. Shut off valves should be positioned to allow flow through the coax via the boiler drains without allowing flow into the piping system.

P/T plugs should be used so that pressure drop and temperature can be measured. Piping materials should be limited to copper or PVC SCH80.

Water quantity should be plentiful and of good quality. Consult Table 5 for water quality guidelines. In ground water situations where scaling could be heavy or where biological growth such as iron bacteria will be present, an open loop system is not recommended. Heat exchanger coils may lose heat exchange capabilities, over time, due to build up of mineral deposits. Heat exchangers must only be serviced by a qualified technician, as acid and special pumping equipment is required. In areas with extremely hard water, the owner should be informed that the heat exchanger may require occasional acid flushing.

Water quality standards
Table 5 should be consulted for water quality requirements. Scaling potential should be assessed using the pH/calcium hardness method. If the pH <7.5 and the calcium hardness is less than 100 ppm, scaling potential is low. If this method yields numbers out of range of those listed, the Ryznar Stability and Langelier Saturation indicies should be calculated.

Use the appropriate scaling surface temperature for the application, 150 °F (66 °C) for direct use (well water/open loop); 90 °F (32 °F) for indirect use. A monitoring plan should be implemented in these probable scaling situations. Other water quality issues such as iron fouling, corrosion prevention and erosion and clogging should be referenced in Table 5.

Water control valve
Always maintain water pressure in the heat exchanger by placing the water control valve(s) on the discharge line to prevent mineral precipitation during the off-cycle. Slow closing valves are recommended to reduce water hammer. If water hammer persists, a mini-expansion tank can be mounted on the piping to help absorb the excess hammer shock. Ensure that the total ‘VA’ draw of the valve can be supplied by the unit transformer.

Ground water applications

Flow regulation
The preferred method of control requires a flow control device mounted on the outlet of the water control valve. The device is typically a brass fitting with an orifice of rubber or plastic material that is designed to allow a specified flow rate. On occasion, flow control devices may produce velocity noise that can be reduced by applying some back pressure from the ball valve located on the discharge line. Slightly closing the valve will spread the pressure drop over both devices, lessening the velocity noise.

Water coil low temperature limit setting
Zehnder Rittling's heat pump controller includes a user configurable switch (DIP switch 2 on the PCB controller) to change the low water temperature cutout (FP1) setting between water (30 °F) and Glycol (10 °F). When loop conditions allow (antifreeze is used), the FP1 DIP switch should be set to the Glycol (10 °F) setting to avoid nuisance faults.

Table 4: Water limit guidelines

EWT Min. (°F)	Min. flow rate (GPM/ton)	Antifreeze required?
50	1.5	No
40-50	3	No
40-50	1.5	Yes
20-40	3	Yes

Water quality standards

Proper maintenance of the water loop is critical to both the efficiency and longevity of the system. This includes cleaning, flushing and chemical treatment.

Three categories of issues can arise from use of water including:

- **Scale formation:** resulting from crystallization of dissolved salts in the water. These deposits form a water-side insulation layer that reduces heat transfer, increases pressure drop and may reduce flow.
- **Metal decay:** resulting from corrosion or erosion
- **Organic growths:** slime and algae can form under certain environmental conditions. These growths can have multiple adverse impacts including reduced heat transfer, increased pressure drop, reduced flow and corrosion.

System water should be evaluated for impurities. Testing is available from independent labs, health departments and/or state agencies. Table 6 provides a list of water characteristics, potential impurities and effects and recommended treatments.

Potential problems can be mitigated by:

- Using cupro-nickel coils
- Maintaining flow rates of <4 GPM per ton to minimize potential erosion

The Zehnder Rittling Water Quality Table provides water quality requirements for Zehnder Rittling coaxial heat exchangers. When water properties are outside of those requirements, an external secondary heat exchanger must be used to isolate the heat pump heat exchanger from the unsuitable water. Failure to do so will void the warranty for the coaxial heat exchanger.

Table 5: Water characteristics

Impurity	Copper coils	Cupro-nickel coils	Result	Application	
				Open recirculating	Closed recirculating
Calcium and magnesium salts (hardness)	<350 PPM	350 PPM sea water	Scaling	1. Bleed off 2. Surface active agents such as polyphosphates 3. Addition of acid 4. pH adjustment	No treatment required
Iron oxide	Low levels only	Moderate levels	Corrosion	1. Corrosion inhibiters 2. pH control 3. Proper materials of construction	1. Corrosion inhibiters (high concentrations) 2. Proper materials of construction
pH	7.0 - 8.5	5 - 10			
Hydrogen sulfide	<10 PPM	10-50 PPM			
CO_2	<50 PPM	50-75 PPM			
Chloride	<300 PPM	300-600 PPM			
Total dissolved solids	<100 PPM	1000-1500 PPM			
Slime and algae	Slime and algae can form under certain environmental conditions		Reduced heat transfer due to forming of insulating coating or pitting due to corrosion	1. Chlorinated phenols 2. Other biocides 3. Chlorine by hypochlorites ot by liquid chlorine	No treatment required

Notes:

- Water quality varies widely from locale to locale. Consult a local water treatment specialist for specific treatment recommendations.
- Cupro-nickel is recommended if iron bacteria, suspended solids, or dissolved oxygen is high.
- If concentration of corrosives exceeds Cupro-nickel maximums the potential for serious corrosion problems exist.

Electrical data

Standard PSC motors

Size	Voltage code	Rated voltage (V/Hz/Ph)	Voltage min./max.	Compressor		Power (W)	FLA	Total unit FLA	Min. circuit Amps	Max. fuse/ HACR size
				RLA	LRA					
09	A	208-230/60/1	197/254	4.7	20.0	37	0.44	5.1	6.3	15
	B	277/60/1	250/293	3.3	18.8	40	0.40	3.7	4.5	15
12	A	208-230/60/1	197/254	6.3	27.0	46	0.44	6.7	8.3	15
	B	277/60/1	250/293	4.6	20.0	50	0.40	5.0	6.2	15
15	A	208-230/60/1	197/254	9.9	42.0	87	1.30	11.2	13.7	25
	B	277/60/1	250/293	7.1	43.0	100	1.30	8.4	10.2	20
18	A	208-230/60/1	197/254	9.9	42.0	111	1.30	11.2	13.7	25
	B	277/60/1	250/293	9.0	54.0	125	1.30	10.3	12.6	20
24	A	208-230/60/1	197/254	10.8	46.0	304	2.10	12.9	15.6	25
	B	277/60/1	250/293	9.0	54.0	300	1.70	10.7	13.0	25
30	A	208-230/60/1	197/254	13.1	65.9	368	2.10	15.2	18.5	30
	B	277/60/1	250/293	12.2	72.0	340	1.70	13.9	17.0	30
36	A	208-230/60/1	197/254	18.6	79.0	442	2.10	20.7	25.4	40
	B	277/60/1	250/293	13.5	72.0	360	1.70	15.2	18.6	40

Standard EC motors

Size	Voltage code	Rated voltage (V/Hz/Ph)	Voltage min./ max.	Compressor		FLA	Total unit FLA	Min. circuit Amps	Max. fuse/ HACR size
				RLA	LRA				
09	A	208-230/60/1	197/254	4.7	20.0	2.9/2.6	7.6/7.3	8.8/8.5	15
	B	277/60/1	250/293	3.3	18.8	2.5	5.8	6.6	15
12	A	208-230/60/1	197/254	6.3	27.0	2.9/2.6	9.2/8.9	10.8/10.5	20
	B	277/60/1	250/293	4.6	20.0	2.5	7.1	8.3	15
15	A	208-230/60/1	197/254	9.9	42.0	2.9/2.6	12.8/12.5	15.3/15.0	25
	B	277/60/1	250/293	7.1	43.0	2.5	9.6	11.4	20
18	A	208-230/60/1	197/254	9.9	42.0	2.9/2.6	12.8/12.5	15.3/15.0	25
	B	277/60/1	250/293	9.0	54.0	2.5	11.5	13.8	25
24	A	208-230/60/1	197/254	10.8	46.0	2.9/2.6	13.7/13.4	16.4/16.1	25
	B	277/60/1	250/293	10.9	60.0	2.5	13.4	16.1	25
30	A	208-230/60/1	197/254	13.1	65.9	2.9/2.6	16.0/15.7	19.3/19.0	30
	B	277/60/1	250/293	12.2	72.0	2.5	14.7	17.8	30
36	A	208-230/60/1	197/254	18.6	79.0	2.9/2.6	21.5/21.2	26.2/25.9	50
	B	277/60/1	250/293	16.0	87.0	2.5	18.5	22.5	40

Notes: *(applies to both of the above tables)*

- Maximum circuit ampacity (MCA) = 1.25 x (FLA motor 1 + FLA motor 2 + FLA electric heat)
- Maximum overcurrent protection (MOP) = (2.25 x FLA motor 1) + FLA motor 2 + FLA electric heat
- If the calculated MOP is within 10% of the next smaller available fuse size, that fuse size shall be used. If not, the next larger fuse size above the calulated MOP must be used.
- If the selected MOP is smaller than the MCA, the selected MOP must be increased to the next larger available fuse size above the MCA.
- If the MOP is less than 15, it shall be rounded up to 15 amps. This is the minimum fuse or circuit breaker permitted by code.
- EC motor nameplate amperage indicates the motor hardware peak amperage while the motor full load amperage (FLA) is limited by the motor's factory programmed operating range, programmed specifically for each unit size. The programmed operating range is generally only a portion of the motor hardware full potential resulting in the motor FLA being lower than the nameplate FLA. Motor FLA will be reflected on the Fan Coil serial tag and should be used when sizing building electrical requirements.

Electrical data

High static PSC motors

Size	Voltage code	Rated voltage (V/Hz/Ph)	Voltage min./max.	Compressor		Power (W)	FLA	Total unit FLA	Min. circuit Amps	Max. fuse/ HACR size
				RLA	LRA					
9	A	208-230/60/1	197/254	4.7	20.0	79	1.3	6.0	7.2	15
	B	277/60/1	250/293	3.3	18.8	80	1.3	4.6	5.4	15
12	A	208-230/60/1	197/254	6.3	27.0	102	1.3	7.6	9.2	15
	B	277/60/1	250/293	4.6	20.0	120	1.3	5.9	7.1	15
15	A	208-230/60/1	197/254	9.9	42.0	155	3.2	13.1	15.6	25
	B	277/60/1	250/293	7.1	43.0	170	2.9	10.0	11.8	20
18	A	208-230/60/1	197/254	9.9	42.0	199	3.2	13.1	15.6	25
	B	277/60/1	250/293	9.0	54.0	210	2.9	11.9	14.2	25
24	A	208-230/60/1	197/254	10.8	46.0	450	3.4	14.2	16.9	30
	B	277/60/1	250/293	10.9	60.0	450	2.9	13.8	16.5	25
30	A	208-230/60/1	197/254	13.1	65.9	560	3.4	16.5	19.8	30
	B	277/60/1	250/293	12.2	72.0	560	2.9	15.1	18.2	30
36	A	208-230/60/1	197/254	18.6	79.0	650	3.4	22.0	26.7	50
	B	277/60/1	250/293	16.0	87.0	650	2.9	18.9	22.9	40

High static EC motors

Size	Voltage code	Rated voltage (V/Hz/Ph)	Voltage min./ max.	Compressor		FLA	Total unit FLA	Min. circuit Amps	Max. fuse/ HACR size
				RLA	LRA				
9	A	208-230/60/1	197/254	4.7	20.0	2.9/2.6	7.6/7.3	8.8/8.5	15
	B	277/60/1	250/293	3.3	18.8	2.5	5.8	6.6	15
12	A	208-230/60/1	197/254	6.3	27.0	2.9/2.6	9.2/8.9	10.8/10.5	20
	B	277/60/1	250/293	4.6	20.0	2.5	7.1	8.3	15
15	A	208-230/60/1	197/254	9.9	42.0	8.1/7.3	18.0/17.2	20.5/19.7	30
	B	277/60/1	250/293	7.1	43.0	5.5	12.6	14.4	20
18	A	208-230/60/1	197/254	9.9	42.0	8.1/7.3	18.0/17.2	20.5/19.7	30
	B	277/60/1	250/293	9.0	54.0	5.5	14.5	16.8	25
24	A	208-230/60/1	197/254	10.8	46.0	8.1/7.3	18.9/18.1	21.6/20.8	30
	B	277/60/1	250/293	10.9	60.0	5.5	16.4	19.1	30
30	A	208-230/60/1	197/254	13.1	65.9	8.1/7.3	21.2/20.4	24.5/23.7	40
	B	277/60/1	250/293	12.2	72.0	5.5	17.7	20.8	30
36	A	208-230/60/1	197/254	18.6	79.0	8.1/7.3	26.7/25.9	31.4/30.6	50
	B	277/60/1	250/293	16.0	87.0	5.5	21.5	25.5	40

Notes: *(applies to both of the above tables)*

- Maximum circuit ampacity (MCA) = 1.25 x (FLA motor 1 + FLA motor 2 + FLA electric heat)
- Maximum overcurrent protection (MOP) = (2.25 x FLA motor 1) + FLA motor 2 + FLA electric heat
- If the calculated MOP is within 10% of the next smaller available fuse size, that fuse size shall be used. If not, the next larger fuse size above the calulated MOP must be used.
- If the selected MOP is smaller than the MCA, the selected MOP must be increased to the next larger available fuse size above the MCA.
- If the MOP is less than 15, it shall be rounded up to 15 amps. This is the minimum fuse or circuit breaker permitted by code.
- EC motor nameplate amperage indicates the motor hardware peak amperage while the motor full load amperage (FLA) is limited by the motor's factory programmed operating range, programmed specifically for each unit size. The programmed operating range is generally only a portion of the motor hardware full potential resulting in the motor FLA being lower than the nameplate FLA. Motor FLA will be reflected on the Fan Coil serial tag and should be used when sizing building electrical requirements.

Electrical: Low voltage wiring

Table 7: Transformer loading

Component	VA
Typical blower relay	6 - 7
Typical reversing valve solenoid	4 - 6
30A compressor contactor	6 - 9
Subtotal	16 - 22
+ PCB controller (5 - 9 VA)*	21 - 31
Remaining VA for accessories	19 - 29

*Standard transformer is 50VA. Optional 75VA transformers are available.

208-230VAC volt operation
All commercial 208-230 volt units are factory wired for 208 volt single phase operation. For 230 volt single phase operation the primary voltage to the transformer must be changed. Remove the red lead from the compressor contractor, cap it with a wire nut and connect the orange 230VAC lead wire from the transformer to the compressor contactor.

Note:
- All 460V units require neutral regardless of motor.

Electrical: Power wiring

⚠ WARNING
To avoid possible injury or death due to electrical shock, open the power supply disconnect switch and secure it in an open position during installation.

⚠ CAUTION
Use only copper conductors for field installed electrical wiring. Unit terminals are not designed to accept other types of conductors.

Electrical: Line voltage
All field installed wiring, including electrical ground, must comply with the National Electrical Code as well as all applicable local codes. Refer to the unit electrical data for fuse sizes. Consult wiring diagram for field connections that must be made by the installing (or electrical) contractor. All final electrical connections must be made with a length of flexible conduit to minimize vibration and sound transmission to the building.

General line voltage wiring
Be sure the available power is the same voltage and phase shown on the unit serial plate. Line and low voltage wiring must be completed in accordance with local codes or the National Electric Code, whichever is applicable.

Compliance with all codes is the responsibility of the installing contractor.

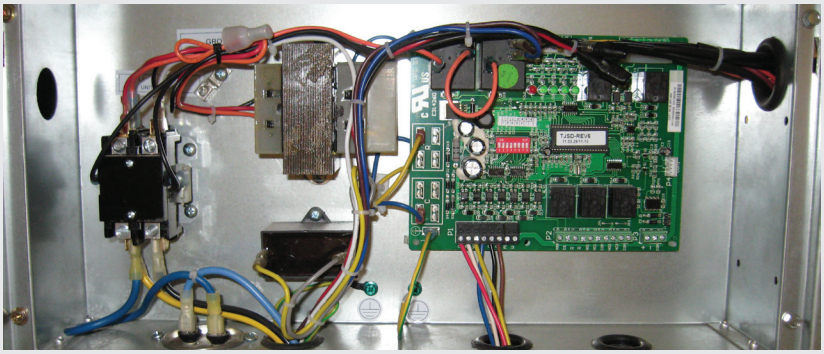
Three phase wiring is similar except that all four power wires are directly connected to the contractor.

Power connection: Line voltage connection is made by connecting the incoming line voltage wires to the “L” side of the contractor or to the optional service disconnect when provided. Consult electrical data tables for correct fuse size.

NOTICE

Transformer
All 208-230 volt units are factory wired for 208 volts. If supply voltage is 230 volts, installer must rewire transformer. See wiring diagram for connections.

Special note for AHRI testing
To achieve rated airflow for AHRI testing purposes on all PSC products, it is necessary to change the fan speed to “HI” speed and clean the coil with a mild surfactant such as Calgon to remove the oils left by manufacturing processes and enable the condensate to properly “sheet” off of the coil.



Single phase electrical control box

Table 8: Blower performance data, standard motors

Unit	Speed	Rated airflow	Min. CFM	Airflow (CFM) at external static pressure (in. wg)											
				0	0.01	0.05	0.1	0.15	0.2	0.25	0.3	0.35	0.4	0.45	0.5
VHN09	High	360	260	361	358	341	321	294	268						
	Low			316	310	294	278	262							
VHN12	High	420	300	424	421	398	376	350	315						
	Low			361	358	341	321	305							
VHN15	High	540	390	551	549	535	521	509	490	476	460	441	420	400	
	Low			470	465	455	439	428	412	397					
VHN18	High	630	455	626	622	604	592	577	561	548	530	513	495	476	
	Low			551	549	535	521	509	490	476	460				
VHN24	High	820	600	821	817	814	812	802	790	775	747	684	654	621	
	Low			768	765	762	759	751	742	722	683	653	625		
VHN30	High	1080	780	1081	1075	1070	1049	1024	931	880	843	801			
	Low			956	951	942	928	911	835	809					
VHN36	High	1220	850	1222	1219	1194	1160	1129	1088	1057	1017	961			
	Low			1102	1096	1091	1070	1044	949	897	860				

Table 9: Blower performance data, high static motors

Unit	Speed	Rated airflow	Min. CFM	Airflow (CFM) at external static pressure (in. wg)																			
				0	0.05	0.10	0.15	0.20	0.25	0.30	0.35	0.40	0.45	0.50	0.55	0.60	0.65	0.70	0.75	0.80	0.85	0.90	0.95	1.00
VHN09	High	474	320	474	453	447	435	418	406	397	379	363	345	324										
	Low			426	409	394	382	368	354	337	319	304	279											
VHN12	High	568	380	568	547	533	515	500	485	471	453	434	415	399										
	Low			474	459	444	426	415	404	386	369	354	338											
VHN15	High	635	474	669	659	649	641	632	621	608	595	584	573	561	542	532	520	511						
	Low			600	589	581	572	562	547	536	525	514	505	494	484	474	0	0						
VHN18	High	750	560	750	738	730	721	712	705	698	686	671	656	644	632	619	609	599						
	Low			669	659	649	641	632	621	608	595	584	573	561										
VHN24	High	1173	625	1172	1147	1129	1112	1094	1068	1041	996	947	915	882	859	838	812	785	750	732	706	685	662	638
	Low			1049	1029	1015	994	971	941	894	853	824	800	778	747	715	691	668	650	626				
VHN30	High	1412	790	1412	1388	1360	1344	1324	1306	1288	1265	1244	1212	1159	1097	1056	1021	986	961	942	914	882	847	
	Low			1288	1265	1247	1226	1212	1194	1174	1144	1115	1059	1015	979	947	918	897	882	850	818	794		
VHN36	High	1504	850	1504	1479	1459	1442	1421	1400	1382	1356	1324	1287	1256	1215	1168	1131	1084	1018	988	959	929	888	856
	Low			1412	1388	1360	1344	1324	1306	1288	1265	1244	1212	1159	1097	1056	1021	986	961	942	914	882		

Notes

- Airflow in CFM with wet coil and clean air filter.
- All airflow is rated and shown above at the lower voltage if unit is dual voltage rated, e.g., 208V for 208-230V units.
- Performance stated is at the rated power supply, performance may vary as the power supply varies from the rated.

System cleaning and flushing

Cleaning and flushing the unit is the most important step to ensure proper start-up and continued efficient operation of the system. Follow the instructions to the right to properly clean and flush the system.

- Verify that electrical power to the unit is off.
- Verify that supply and return riser service valves are closed at each unit.
- Fill the system with water, leaving the air vents open. Bleed all air from the system but do not allow the system to over flow. Check the system for leaks and make any required repairs.
- Adjust the water and air level in the expansion tank.
- With strainers in place, start the pumps. Systematically check each vent to ensure that all of the air is bled from the system.
- Verify that make-up water is available and adjusted to properly replace any space remaining when all air is purged. Check the system for leaks and make any additional repairs if needed.
- Set the boiler to raise the loop temperature to approximately 85 °F (29 °C). Open the drain at the lowest point in the system. Verify that make-up water replacement rate equals rate of bleed. Continue to bleed the system until the water appears clean or for at least three hours whichever is longer.
- Completely drain the system.

Flush risers as follows:

- Close shut-off valves at each unit on the riser except the shut-off valve on the top floor.
- Flush solution through supply riser. **Note:** The solution passes through the top floor connection down the return riser.
- When the building has more than ten floors, connect the supply and return run outs on the top two floors to divide the water flow and reduce pressure drop at the pump.
- Repeat flushing procedure for each set of risers in the building.
- Refill the system and add in a proportion of trisodium phosphate substitute approximately one pound per 150 gallons (0.4 kg per 500 liters) of water. Reset the boiler to raise the loop temperature to about 100 °F (37.8 °C).
- Circulate the solution for 8 to 24 hours. At the end of this period, shut off the circulating pump and drain the solution. Repeat system cleaning if needed.
- Open the supply and return riser service valves at each unit. Refill the system and bleed off all air.
- Test the system pH with litmus paper. The system water should have a pH of 6 to 8.5. Add chemicals, as appropriate, to maintain pH levels.
- When the cleaning process is complete, remove the short-circuited hoses. Reconnect the hoses to the proper supply and return the connections to each of the units. Refill the system and bleed off all air.

Note

- **Do not** use “Stop Leak” or similar chemical agent in this system. Addition of chemicals of this type to the loop water will foul the heat exchanger and inhibit unit operation.

Hose kit installation

- Refer to the hose kit installation detail on page 26 for an illustration of a typical supply/return hose kit assembly.
- Pipe joint compound or Teflon tape is not necessary when using factory supplied hose kits.
  Note: When antifreeze is used, ensure that it is compatible with Teflon tape and pipe joint compound that may have been applied to other pipe fittings in the system.
- Unpack and examine hose kit. Remove all shipping and/or packing material such as rubber bands, plastic caps and Styrofoam. Hose kit should contain two hoses, two ball valves with shut off, and two hose adapters.
- Locate the valves inside the unit cabinet marked “water in” and “water out.” Attach the hoses to the water valve. Always use a back-up wrench when tightening the hose to the valve.
- If you remove the valves to attach the hoses, be sure the O-ring is in the valve before attaching to the union in the cabinet.
  Note: The valve union is to be hand tight plus an additional quarter turn. Always use a back-up wrench on the fittings being tightened.
- Attach flex hoses. Let the universal ends of the hoses hang inside the cabinet.
  Note: Be sure the valve handles and P/T ports are in a position that enables them to be opened and closed and used for system readings. Check the swivel ends of the hoses. Gaskets must be in the hose for proper seal.
- Slide the chassis part way into the cabinet. Match the “water in” hose to the “water in” tube on the chassis and the “water out” hose to the “water out” tube. Tighten the swivel connection, keeping the copper tube parallel to the sides of the chassis and then tighten the hose to the copper tube, making sure the hose hangs straight without twisting or turning. **Note:** The copper union and the hose union are to be hand tight plus an additional quarter turn. Always use a back-up wrench on the fittings being tightened.
- Proceed to Chassis Installation, page 27.

Hose kit

Specifications:

- Designed for VS series applications.
- Temperature range of 35 °F (2 °C) to 180 °F (82 °C).
- Maximum working pressure of 400 psig (2756 kPa).
- Fire rated materials per ASTM E 84-00 (NFPA 255, ANSI/UL 723 and UBC 8-1).
- Kevlar® reinforced EPDM core with ANSI 302-304 stainless steel outer braid.
- Swivel connector(s) with NPSH at both ends. EPDM gasket, shipped inside connection.
- Two ball valves supplied with each hose kit

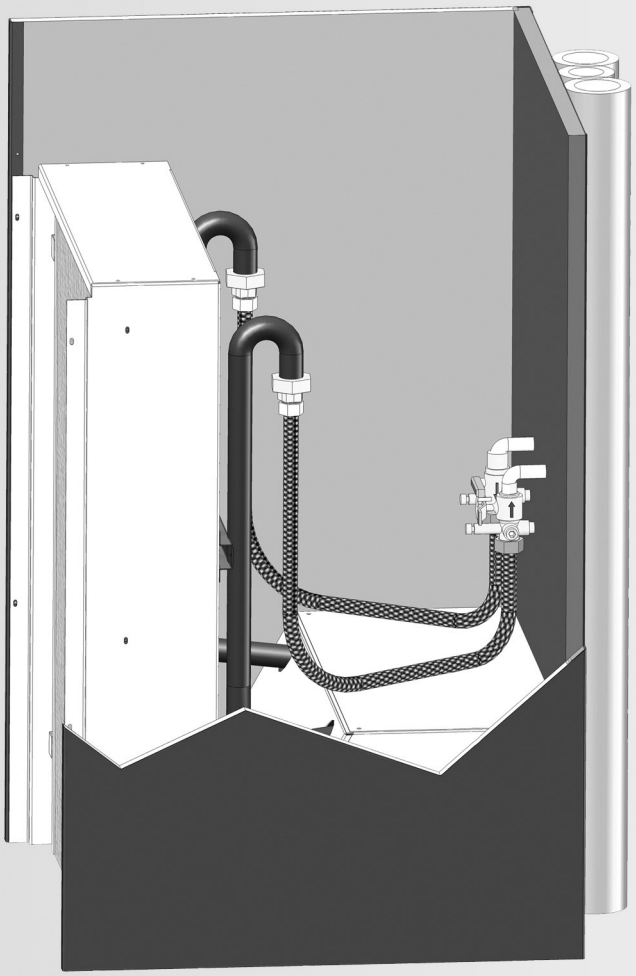


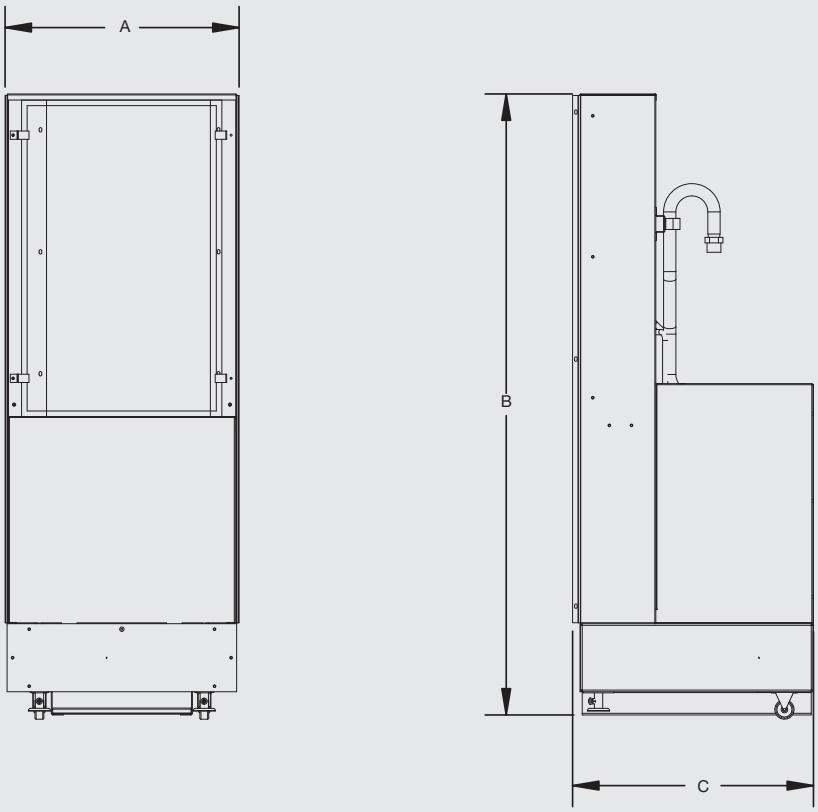
Table 10: Physical data

Unit sizes	Inside diameter inch (mm)	Length feet (cm)	Working pressure psig (kPa)	Minimum burst pressure psig (kPa)	Minimum bend radius inch (mm)
09, 12	1/2 (10.7)	3 (91)	400 (2756)	1600 (11024)	2-5/8 (66.7)
15, 18, 24, 30, 36	3/4 (19.1)	3 (91)	400 (2756	1600 (11024)	4-1/2 (114.3)

Notice: Do not allow hoses to rest against sharp edges or structural building components. Compressor vibration may cause hose failure and vibration transmission through the hoses to the structure, causing noise complaints.

Chassis installation

- Open the unit water valves and check piping for leaks.
- Complete electrical connections between cabinet and chassis by mating the quick-connect plugs on the chassis cable to the plugs located in the bottom surface of the blower deck, directly under the control box.
- Before installing the return panel, perform the following checks:
  - Ensure that fan wheel rotates freely and does not rub against housing. If rough handling during shipping has caused fan wheel to shift, adjust as necessary.
  - Verify that water piping connections to the chassis are complete and that unit service valves, which were closed during flushing, have been opened.
  - Verify that power between the cabinet and chassis is properly connected.
  - After the system has been filled and system pump is started, all connections should be re-checked for water leaks. Zehnder Rittling will not be responsible or liable for damage caused by any water leaks from a field installed water connection(s).
- Re-attach the upper electrical access panel. Do not start the unit with access panel removed, system lockout and possible equipment damage can occur.



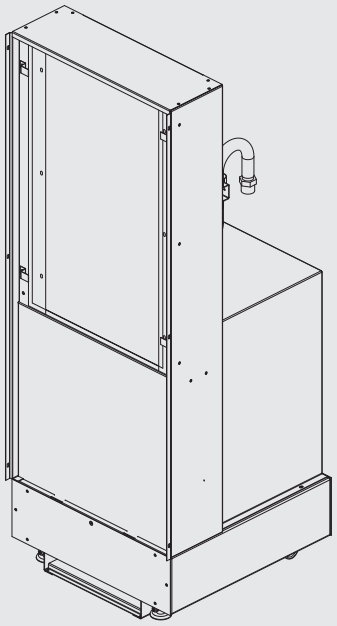


Table 11: Dimensional data

Unit size	A	B	C
09, 12	16-1/32"	37"	16-3/32"
15, 18		44"	
24-36	22-1/32"	46"	23"

Return panel installation

- Install the provided adhesive-backed gasket material on the outer perimeter of the cabinet to seal the return panel to the cabinet.
- Install the cabinet return panel. Refer to the Framing Rough-in Detail drawing on page 12, the Return Panel drawings on pages 32 through 34 and to the information to the right for additional direction.

Supply grille installation

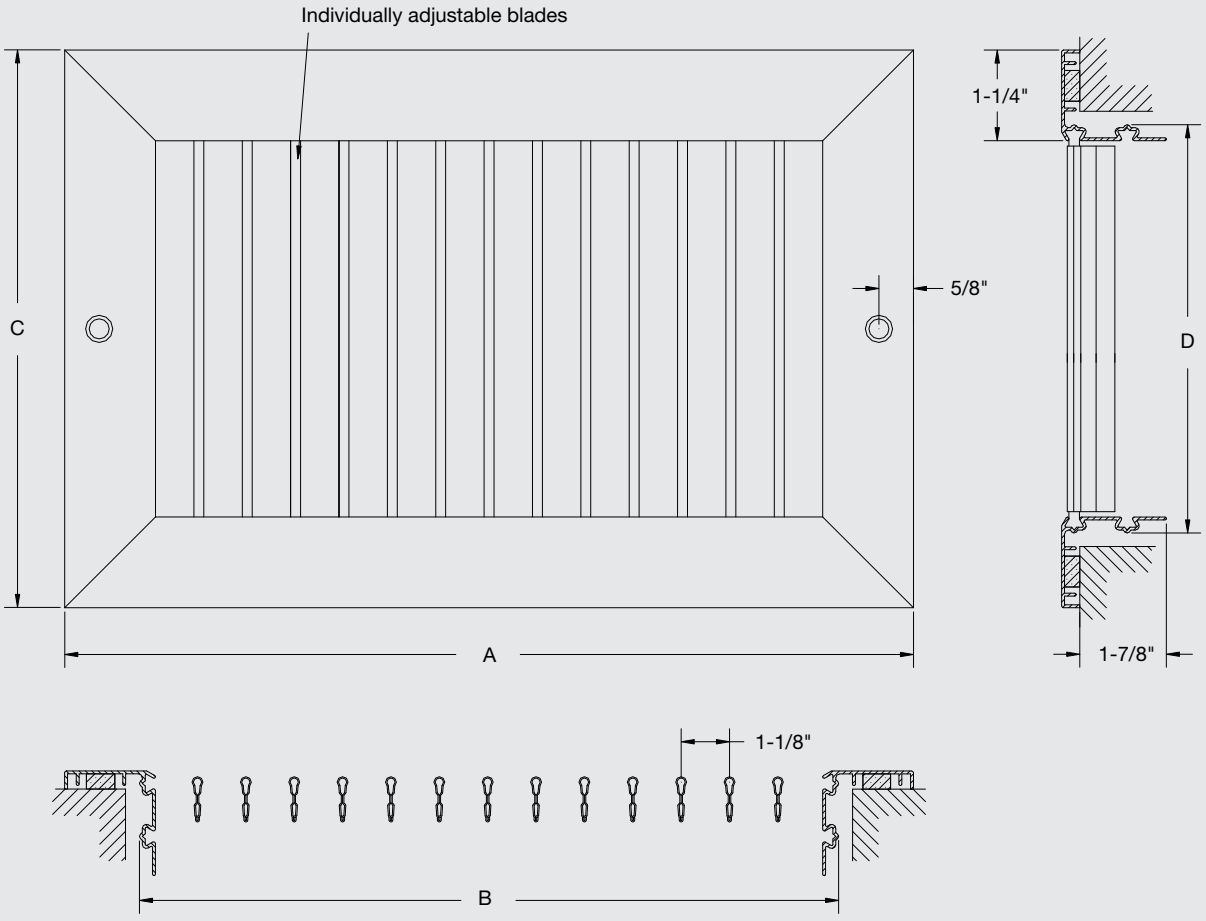
Install supply grilles over the cabinet discharge openings as follows:

- Insert the grille into the cabinet supply duct extension(s). Assure that the grille flange rests against the drywall covering the cabinet.
- Secure the grille to the drywall with the screws provided.

Table 12: Supply grille sizes and arrangements

Unit	Single discharge (1)	Double discharge (2)	Triple discharge (3)
VHN 09	14" x 12"	10" x 8"	Not recommended
VHN 12	14" x 12"	10" x 8"	Not recommended
VHN 15	14" x 12"	10" x 8"	10" x 8"
VHN 18	14" x 12"	10" x 8"	10" x 8"
VHN 24	Not recommended	12" x 10"	12" x 10"
VHN 30	Not recommended	12" x 10"	12" x 10"
VHN 36	Not recommended	12" x 10"	12" x 10"

Aluminum discharge grille
Single deflection



Dimensional data

Grille size	A	B	C	D
16" x 14"	17-11/16"	15-11/16"	15-11/16"	13-11/16"
14" x 12"	15-11/16"	13-11/16"	13-11/16"	11-11/16"
12" x 10"	13-11/16"	11-11/16"	11-11/16"	9-11/16"
10" x 8"	11-11/16"	9-11/16"	9-11/16"	7-11/16"

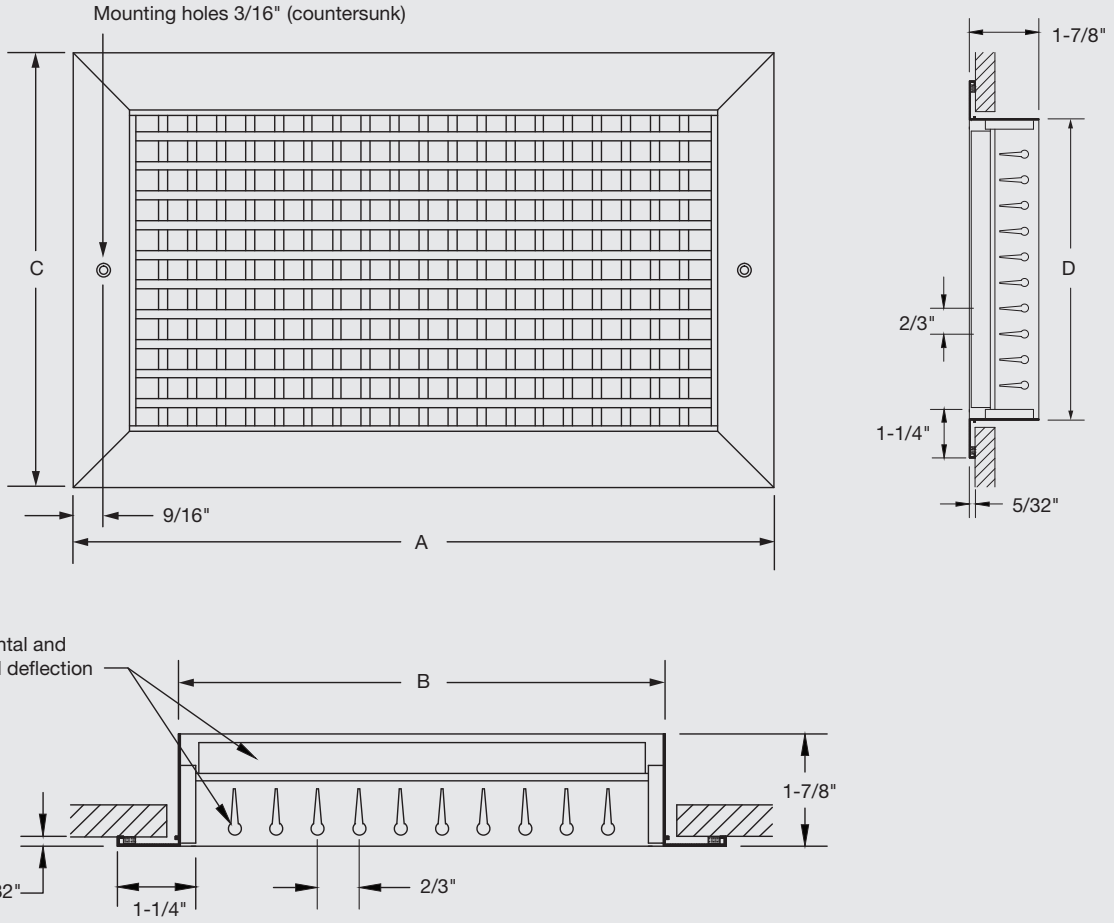
Supply grille arrangements

Unit Size	Single discharge	Double discharge	Triple discharge
09	14" x 12"	10" x 8"	10" x 8"
12	14" x 12"	10" x 8"	10" x 8"
15	14" x 12"	10" x 8"	10" x 8"
18	14" x 12"	10" x 8"	10" x 8"
24	16" x 14"	12" x 10"	12" x 10"
30	16" x 14"	12" x 10"	12" x 10"
36	16" x 14"	12" x 10"	12" x 10"

Notes
- Dimensions are in inches
- All dimensions are +/- 1/4
- Discharge grilles are shipped loose for field installation
- Construction is roll formed aluminum frame and blades
- Standard finish is powder coated and will be the same color as the return grille
- Mounting hardware included

All listed dimensions are approximate and are subject to change without notice.

Aluminum discharge grille
Double deflection



Dimensional data

Grille size	A	B	C	D
16" x 14"	17-11/16"	15-11/16"	15-11/16"	13-11/16"
14" x 12"	15-11/16"	13-11/16"	13-11/16"	11-11/16"
12" x 10"	13-11/16"	11-11/16"	11-11/16"	9-11/16"
10" x 8"	11-11/16"	9-11/16"	9-11/16"	7-11/16"

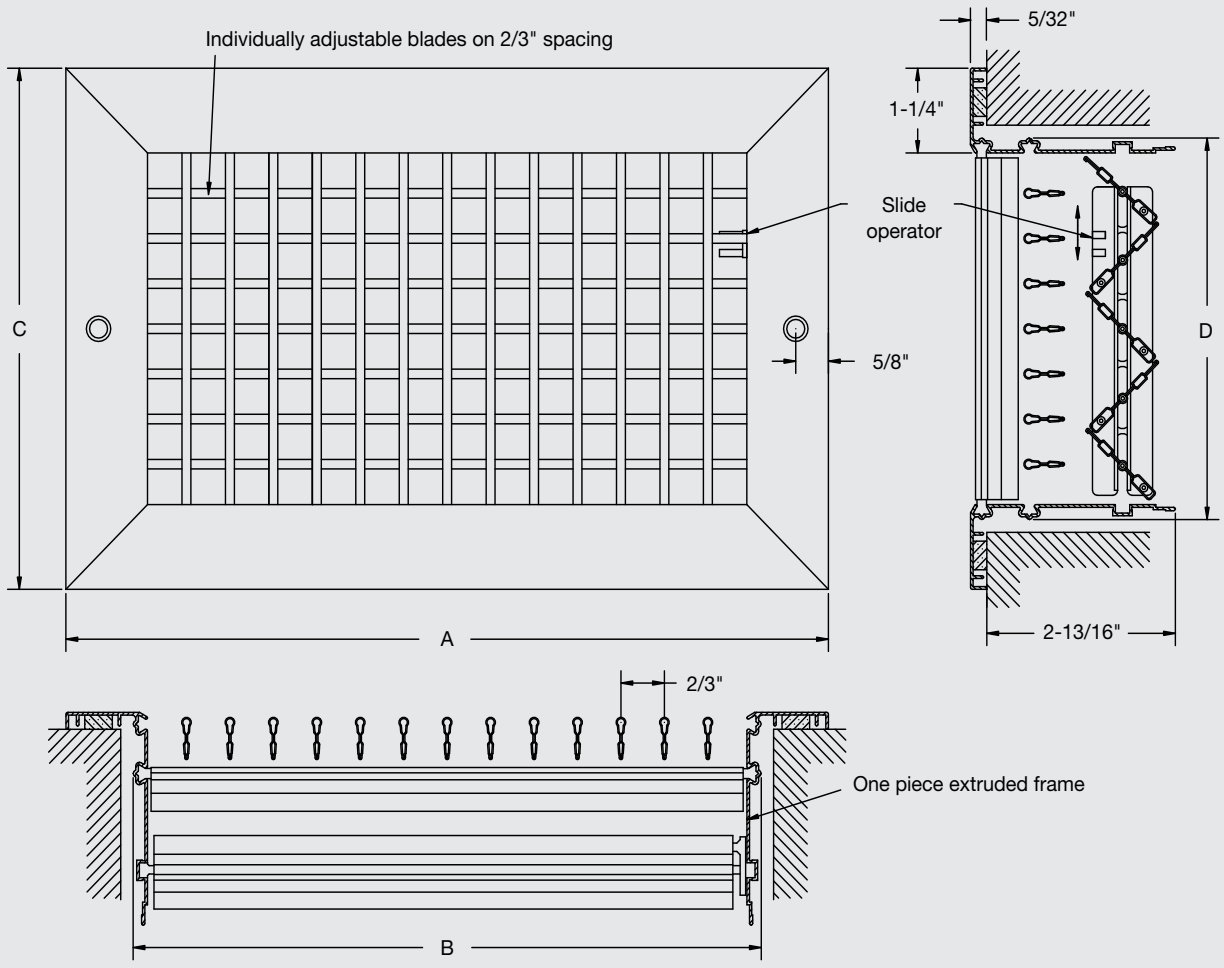
Supply grille arrangements

Unit Size	Single discharge	Double discharge	Triple discharge
09	14" x 12"	10" x 8"	10" x 8"
12	14" x 12"	10" x 8"	10" x 8"
15	14" x 12"	10" x 8"	10" x 8"
18	14" x 12"	10" x 8"	10" x 8"
24	16" x 14"	12" x 10"	12" x 10"
30	16" x 14"	12" x 10"	12" x 10"
36	16" x 14"	12" x 10"	12" x 10"

Notes
- Dimensions are in inches
- All dimensions are +/- 1/4
- Discharge grilles are shipped loose for field installation
- Construction is roll formed aluminum frame and blades
- Standard finish is powder coated and will be the same color as the return grille
- Mounting hardware included

All listed dimensions are approximate and are subject to change without notice.

Aluminum discharge grille
Double deflection with opposed blade damper



Dimensional data

Grille size	A	B	C	D
16" x 14"	17-11/16"	15-11/16"	15-11/16"	13-11/16"
14" x 12"	15-11/16"	13-11/16"	13-11/16"	11-11/16"
12" x 10"	13-11/16"	11-11/16"	11-11/16"	9-11/16"
10" x 8"	11-11/16"	9-11/16"	9-11/16"	7-11/16"

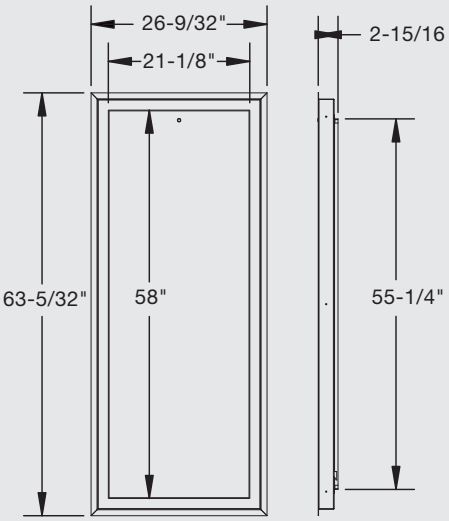
Notes
- All dimensions are in inches
- All dimensions are ± 1/4
- Discharge grilles are shipped loose for field installation
- Vertical blades in the front, horizontal blades in the back, both individually adjustable and on 2/3" spacing
- Opposed blade damper with slide operator
- Aluminum roll formed blade with semi-airfoil design
- Pressure fit nylon pivot pins (rattle-free and non-loosening)
- Aluminum extruded frame with mechanically locked corners
- Countersunk screw holes
- Standard finish is powder coated and will be the same color as the return grille
- Mounting hardware included

All listed dimensions are approximate and are subject to change without notice.

Supply grille arrangements

Unit Size	Single discharge	Double discharge	Triple discharge
09	14" x 12"	10" x 8"	10" x 8"
12	14" x 12"	10" x 8"	10" x 8"
15	14" x 12"	10" x 8"	10" x 8"
18	14" x 12"	10" x 8"	10" x 8"
24	16" x 14"	12" x 10"	12" x 10"
30	16" x 14"	12" x 10"	12" x 10"
36	16" x 14"	12" x 10"	12" x 10"

Standard removable perimeter return air panel



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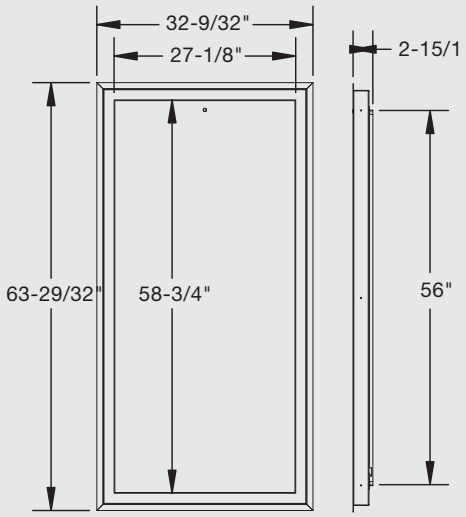

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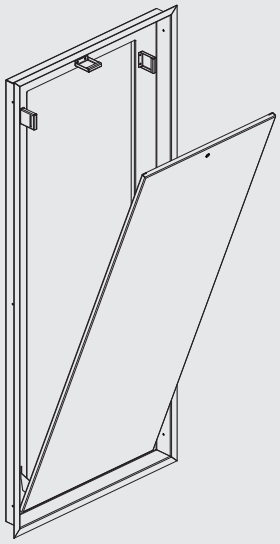
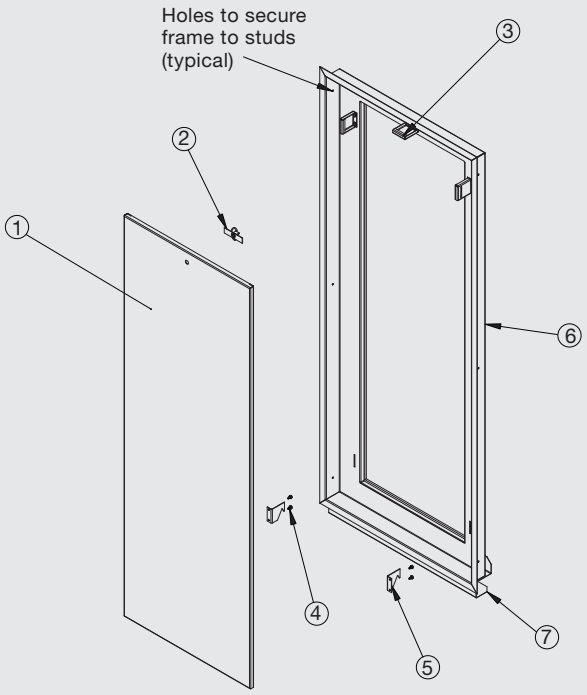


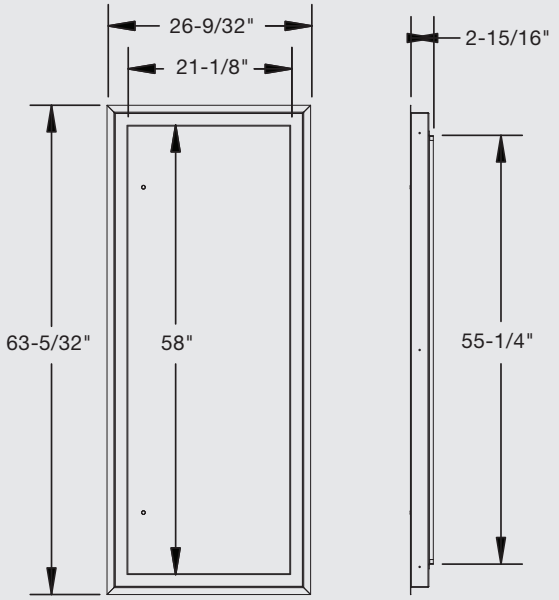


Notes:
- Seal between the frame and cabinet with a weather serial gasket (provided with cabinet) to avoid air from being pulled in from the wall cavity.
- Do not attach frame to cabinet.
- Frame support shipped with cabinet.
- Door assemblies shipped separately.

Allen lock, removable

Item number	Description	Quantity
1	Return panel	1
2	Quarter turn fastener	1
3	Door stop	3
4	Screw	10
5	Pivot angle	2
6	Frame	1
7	Frame support	1

Optional hinged perimeter return air panel



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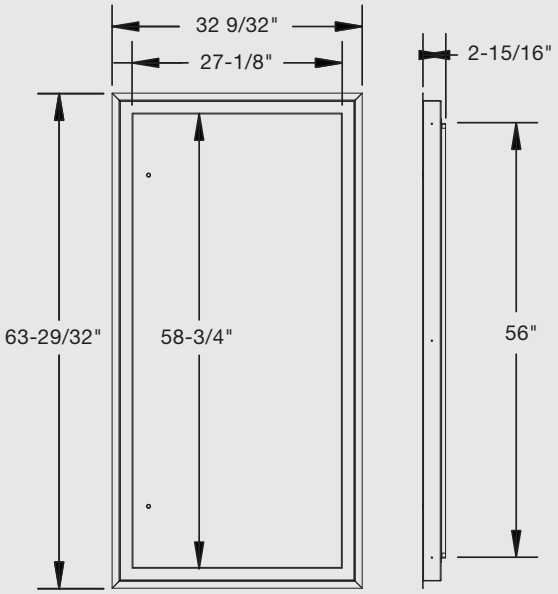

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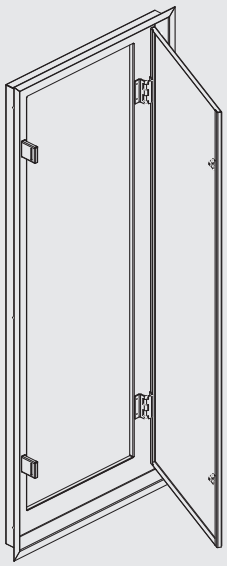
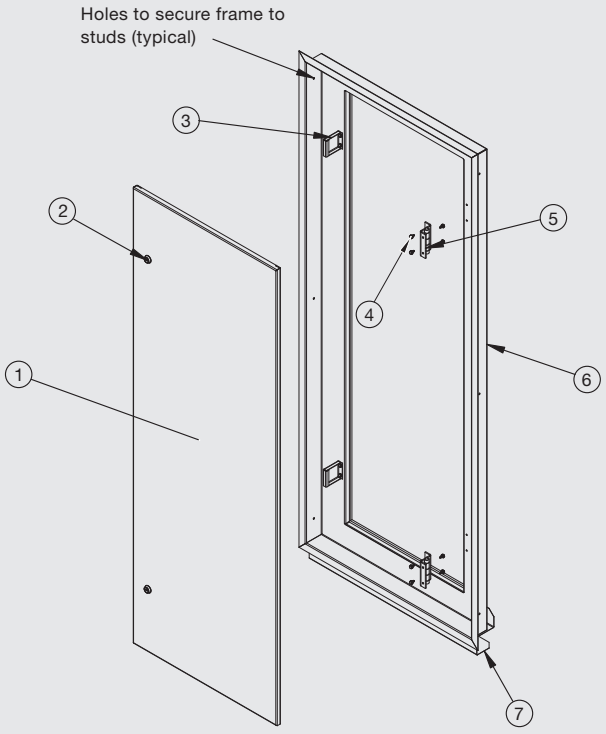




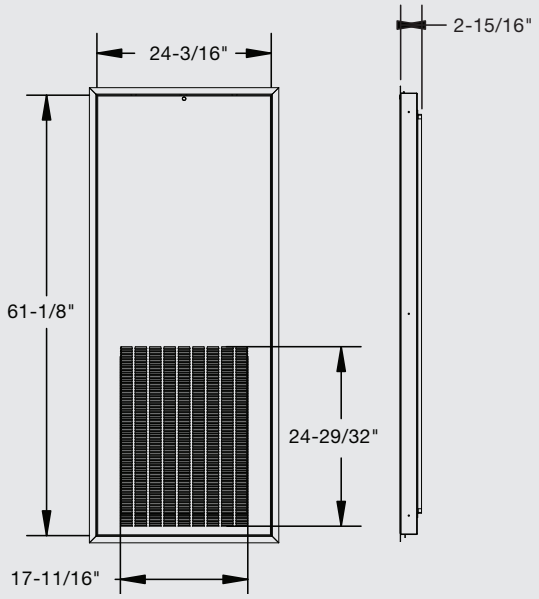
Notes:

- Seal between the frame and cabinet with a weather serial gasket (provided with cabinet) to avoid air from being pulled in from the wall cavity.
- Do not attach frame to cabinet.
- Frame support shipped with cabinet.
- Door assemblies shipped separately.

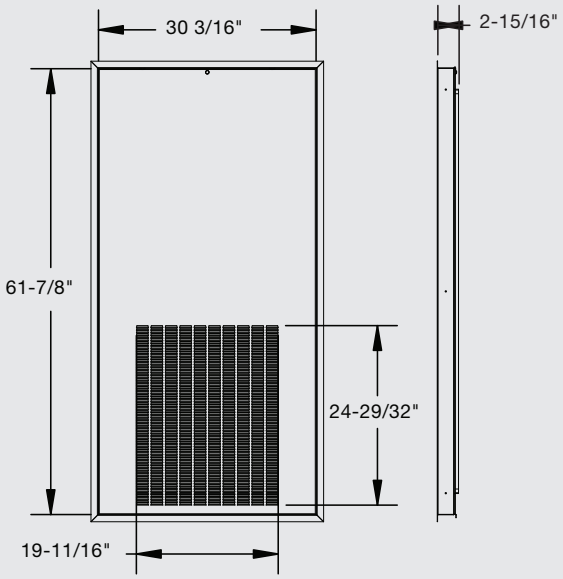
Key lock or Allen lock

Item number	Description	Quantity
1	Return panel	1
2	Quarter turn fastener or key lock	2
3	Door stop	2
4	Screw	12
5	Hinge	2
6	Frame	1
7	Frame support	1

Optional removable louvered return air panel



Available for sizes 09-18



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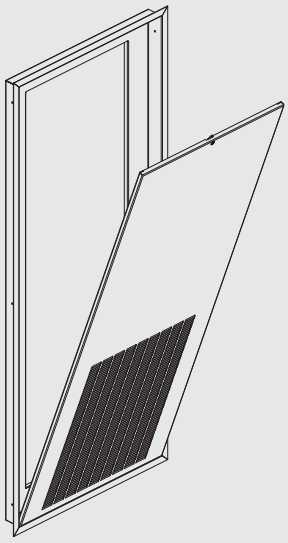
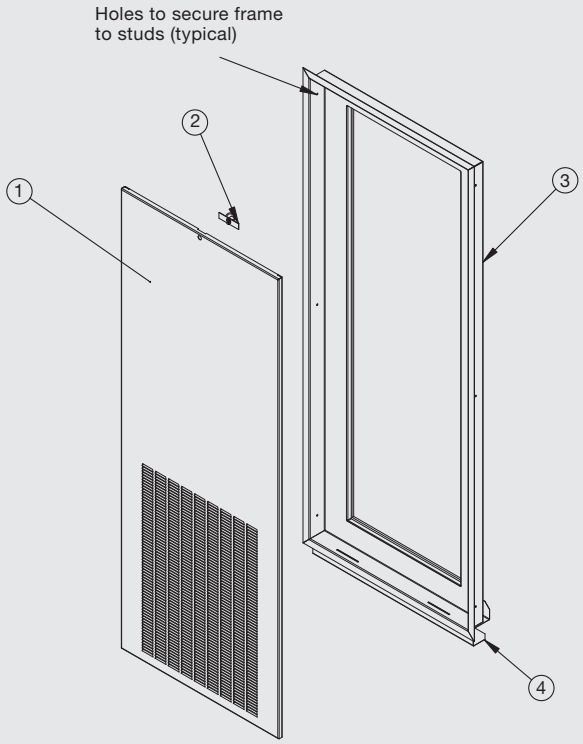




Notes:

- Seal between the frame and cabinet with a weather serial gasket (provided with cabinet) to avoid air from being pulled in from the wall cavity.
- Do not attach frame to cabinet.
- Frame support shipped with cabinet.
- Door assemblies shipped separately.

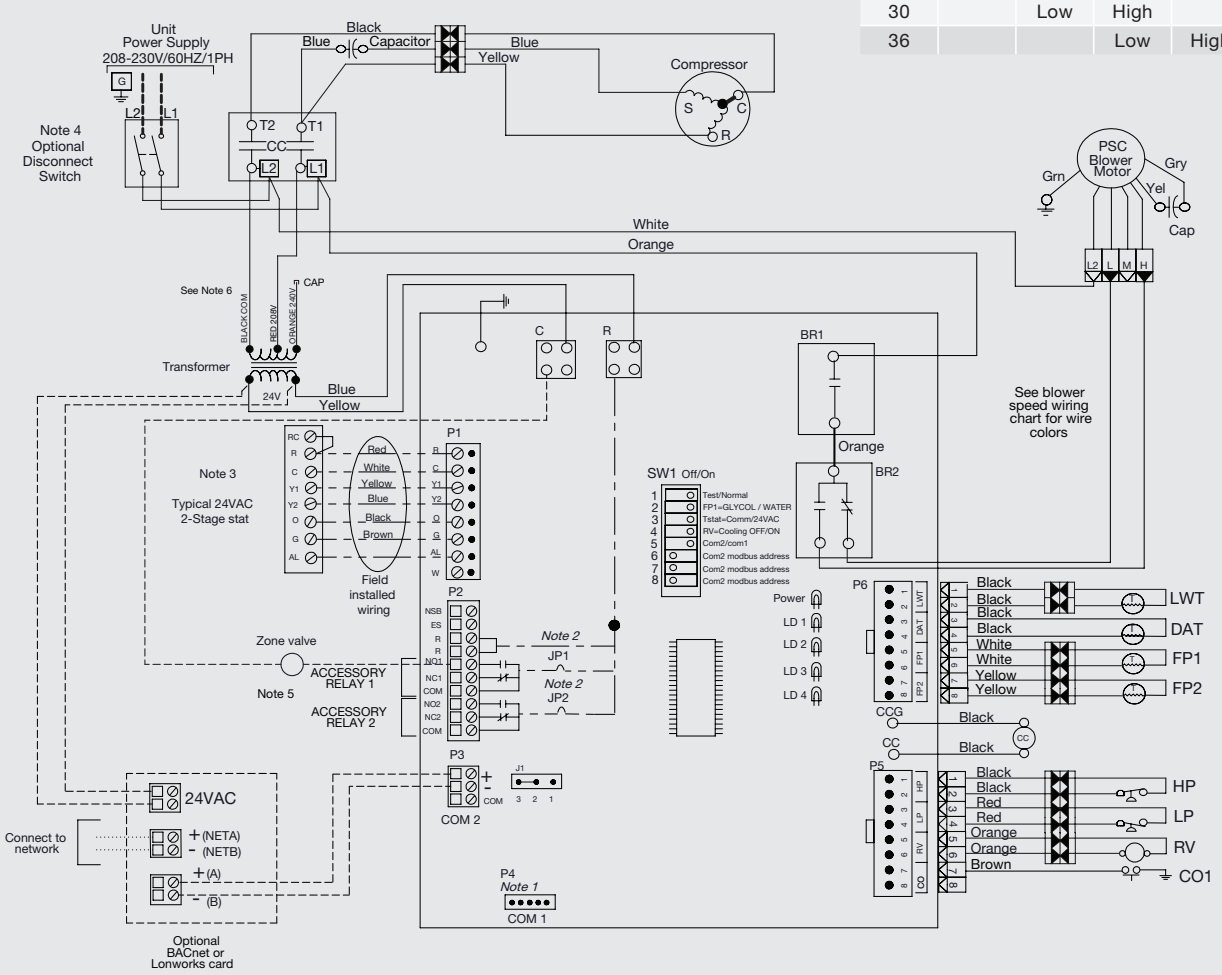
Allen lock, removable

Item number	Description	Quantity
1	Return panel	1
2	Quarter turn fastener	1
3	Frame	1
4	Frame support	1

Wiring diagram
208-230V, standard and high static

Blower speed wiring

Unit size	Orange	Brown	Blue	Red
09		Low	High	
12			Low	High
15		Low	High	
18			Low	High
24	Low	High		
30		Low	High	
36			Low	High



Legend	
———	Factory low voltage wiring
▬▬▬	Factory high voltage wiring
—·—·—	Field low voltage wiring
— — —	Field line voltage wiring
— — — —	Optional block
——— — —	Internal PCB connection
○	Quick connect terminal
⊘	Screw terminal

CC	Compressor contactor
BR1	Fan relay speed 1
BR2	Fan relay speed 2
HP	High pressure switch
LP	Low pressure switch
FP1	Freeze protection water side
FP2	Freeze protection air side
CO	Condensate overflow
RV	Reversing valve
DAT	Discharge air temperature
LWT	Leaving water temperature

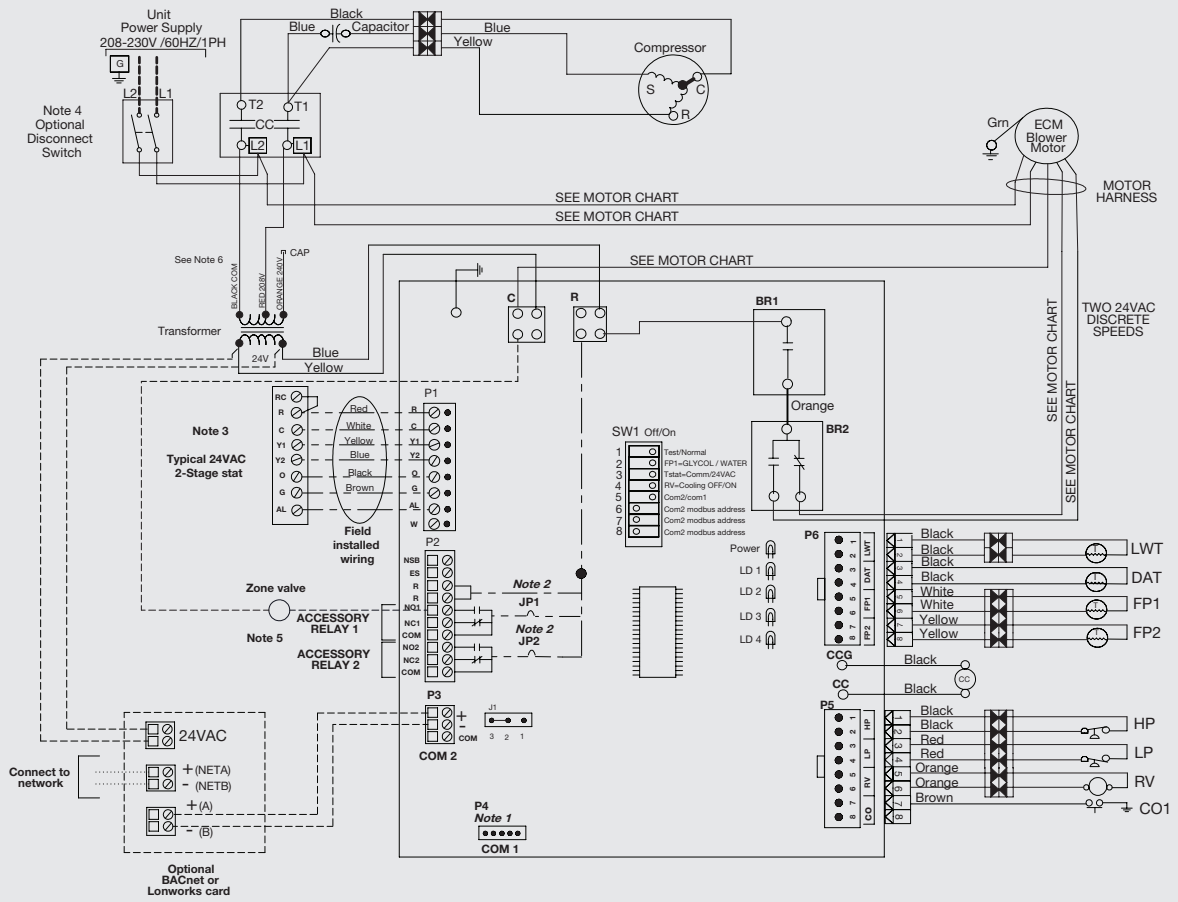
	Relay coil
	Capacitor
	High pressure switch
	Low pressure switch
	Temperature thermistor
	Condensate switch
	Relay contacts

Notes
1. Used for optional communicating thermostat.
2. Cut JP1 or JP2 for dry contact output on accessory relay 1 and 2.
3. If a single stage thermostat is used place a jumper wire between Y1 and Y2 at P1 terminal.
4. If disconnect option is not installed connect line power to the L1 and L2 lugs on the compressor contactor.
5. Accessory relays 24VAC max. Activated by compressor output.
6. All 208-230V units are factory wired for 208V operation. If supplier voltage is 230V, installer must rewire transformer.

Wiring diagram
208-230V, EC motor

Wire colors

	Discrete speeds			Power leads	
	1st spd	2nd spd	Comm	L1	L2
3/4 HP	Red	Blue	Brown	Black	White
1/4 HP	Purple	White	Blue	Black	Red



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RV	Reversing valve
DAT	Discharge air temperature
LWT	Leaving water temperature

	Relay coil
	Capacitor
	High pressure switch
	Low pressure switch
	Temperature thermistor
	Condensate switch
	Relay contacts

Notes

1. Used for optional communicating thermostat.
2. Cut JP1 or JP2 for dry contact output on accessory relay 1 and 2.
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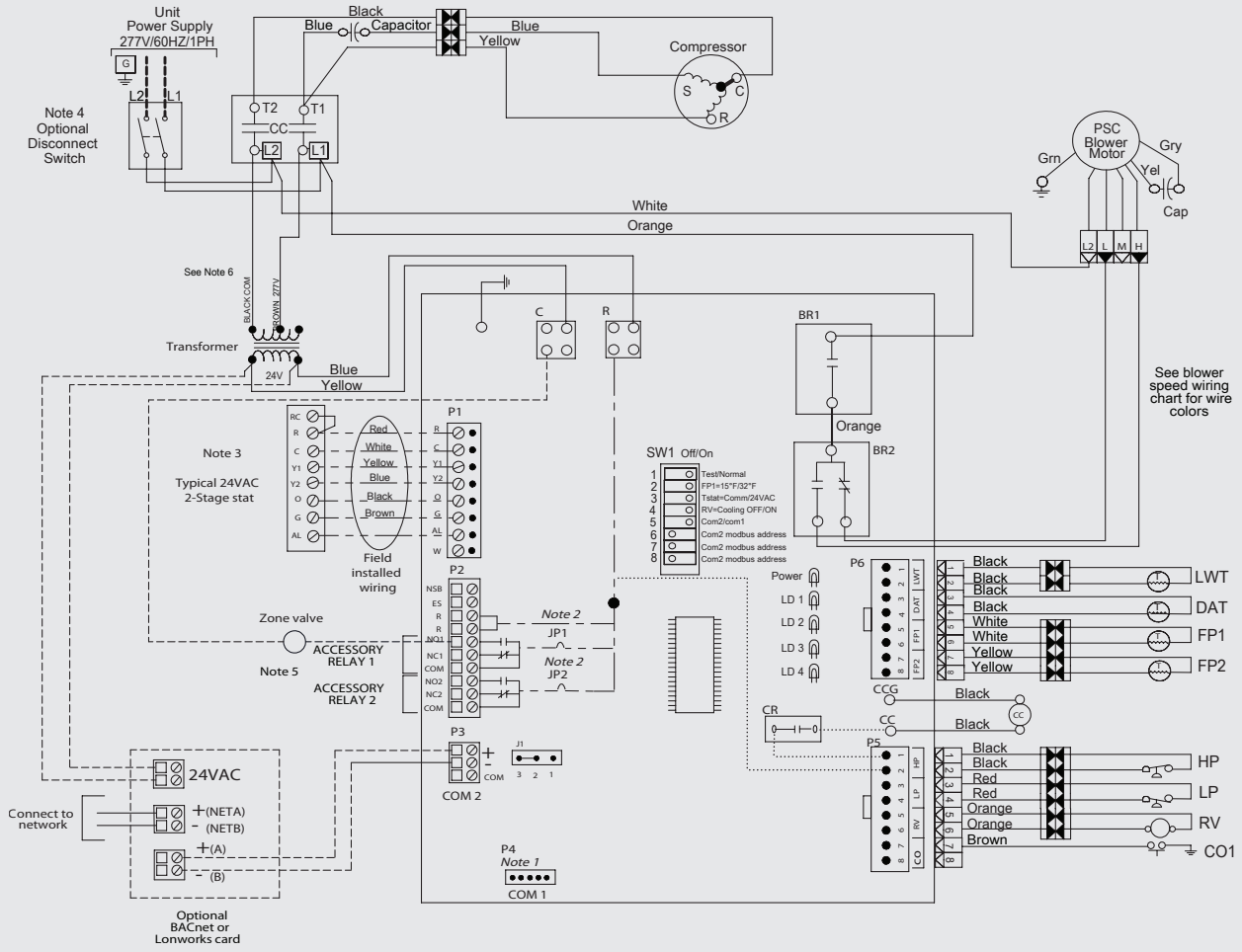
5. Accessory relays 24VAC max. Activated by compressor output.
6. All 208-230V units are factory wired for 208V operation. If supplier voltage is 230V, installer must rewire transformer.

Wiring diagram
277V, standard and high static

Blower speed wiring

Unit size	Orange	Brown	Black	Blue	Red
09			Low	High	
12				Low	High
15			Low	High	
18				Low	High
24	Low	High			
30			Low	High	
36				Low	High



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DAT	Discharge air temperature
LWT	Leaving water temperature

	Relay coil
	Capacitor
	High pressure switch
	Low pressure switch
	Temperature thermistor
	Condensate switch
	Relay contacts

Notes

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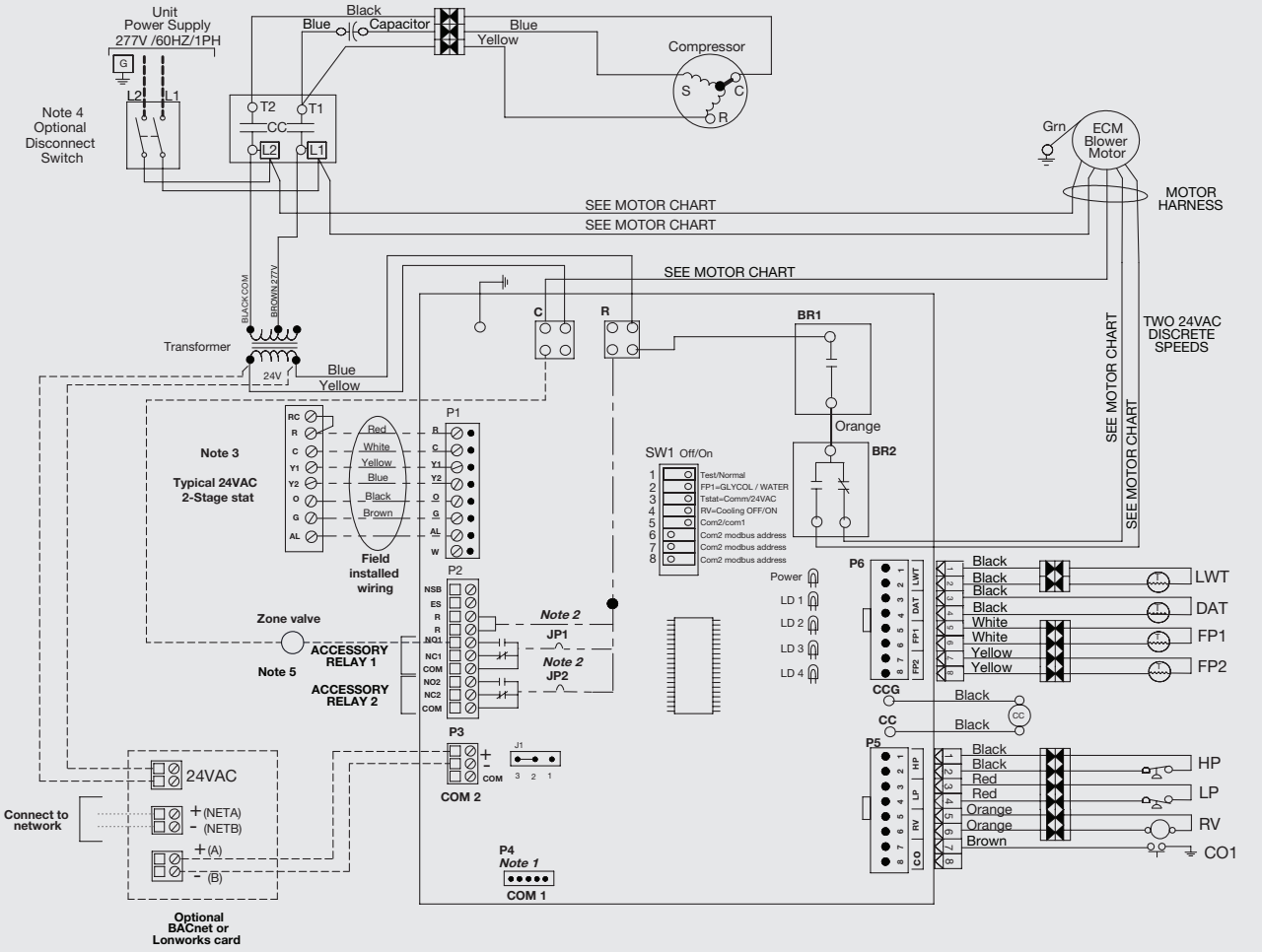
2. Cut JP1 or JP2 for dry contact output on accessory relay 1 and 2.
3. If a single stage thermostat is used place a jumper wire between Y1 and Y2 at P1 terminal.
4. If disconnect option is not installed connect line power to the L1 and L2 lugs on the compressor contactor.
5. Accessory relays 24VAC max. Activated by compressor output.
6. All 208-230V units are factory wired for 208V operation. If supplier voltage is 230V, installer must rewire transformer.

Wiring diagram
277V, EC motor

Wire colors

	Discrete speeds			Power leads	
	1st spd	2nd spd	Comm	L1	L2
3/4 HP	Red	Blue	Brown	Black	White
1/4 HP	Purple	White	Blue	Black	Red



Legend	
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— — —	Field line voltage wiring
— — — —	Optional block
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HP	High pressure switch
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FP1	Freeze protection water side
FP2	Freeze protection air side
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Notes

1. Used for optional communicating thermostat.
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5. Accessory relays 24VAC max. Activated by compressor output.
6. All 208-230V units are factory wired for 208V operation. If supplier voltage is 230V, installer must rewire transformer.

Microprocessor control system

Zehnder Rittling Horizontal Heat Pumps feature a microprocessor-based control system. The control system is specifically designed to protect the unit against abnormal building system conditions including high voltage spikes and brown-out situations, EMI, and RFI interference. The control system interfaces with a heat pump-type thermostat or a digitally communicating thermostat.

Features

- Rapid system refrigerant pressure equalization to prevent hard compressor starts
- Anti-short cycle time for compressor operation
- Random start on power up mode
- Low/high voltage protection
- Unit shutdown on high or low refrigerant pressures
- Unit shutdown on low water/air temperature
- Solid-state condensate overflow protection
- Option to reset unit at thermostat or disconnect
- If a fault occurs 3 times sequentially without thermostat meeting temperature, then lockout requiring manual reset will occur
- Time delay override for servicing
- Light emitting diodes (LEDs) on circuit board to indicate high or low pressure, high or low voltage, low water/air temperature, condensate overflow, control voltage status, temperature sensor failure
- The low-pressure switch shall not be monitored for the first 60 seconds after a compressor start command to prevent nuisance safety trips
- 24V output to cycle a motorized water valve or other device with compressor contactor.
- Water coil low temperature sensing (dip switch selectable for water or anti-freeze)
- Two speed fan control of cooling and heating modes
- Removable thermostat connector
- Two dry contact accessory relays that can be cycled with the compressor or the fan
- Ability to work with heat pump thermostats using O or B reversing valve control
- Emergency shutdown contacts
- Relay to operate an external damper
- Ability to automatically change fan speed from multistage thermostat
- 24V relay to start system pump
- 50VA control transformer - with load side short circuit and overload protection via a built in circuit breaker

Digital communicating thermostat

The microprocessor control system communicates with the thermostat to display (at the thermostat) the unit status, fault status, and specific fault condition. The digital communicating thermostat has an infrared remote control unit for operation of the temperature set point, mode and fan.

RS-485 communication port

The microprocessor shall have an RS-485 serial communication port that will allow connection of a PC. This port will allow read and write access to the microprocessor with proprietary software for maintenance and servicing functions. The RS-485 serial communication port shall also allow connections of BACnet and LonWorks application cards for connection to BAS systems.

Dip switch settings and operation

Dip switch 1

Test Mode=Off
Normal Mode=On

Test mode: Test mode is used to speed-up the operation sequence of the unit, therefore creating a more timely troubleshooting technique. All time delays are shortened by ten times with the exception of the high pressure lockout which is instantaneous regardless of which mode the switch is positioned to. Dip switch 1 must be placed into the normal mode to resume proper operation of the unit.

Dip switch 2

FP1-15 °F=Off/FP1-32 °F=On

Water side freeze protection setting: Dip switch 2 is used to determine the loop freeze protection setting. Depending on the brine concentration of the liquid source, the temperature can be set at 15 °F or 32 °F. The switch MUST be set to the “on” position if pure water is used as the source brine. This is normally the case in open loop systems. Set the dip switch to the “off” position for closed loop systems that contain a brine concentration that allows liquid temperatures to fall to, or below, 15 °F.

Dip switch 3

Tstat-Comm=Off
Tstat-24VAC=On

Thermostat selection: Dip switch 3 is used to select the type of thermostat that will be used to control the unit. A digital communicating thermostat can be purchased with the unit that will allow all fault signals to be displayed on the thermostat. This allows for efficient troubleshooting and does not require that the technician access the electrical control box to determine the unit error. If a digital communicating thermostat is used, dip switch 3 must be set in the “off” position. If a 24VAC thermostat is used, set dip switch 3 to the “on” position.

Dip switch 4

RV-Cooling=Off
RV-Cooling=On

Reversing valve operation: Dip switch 4 is used to determine the reversing valve position in the cooling mode (de-energized/energized). This function is used only when a 24VAC thermostat is used and is determined by the reversing valve output of the thermostat in the cooling mode. If the thermostat de-energizes the reversing valve in the cooling mode, set the dip switch to the “off” position. If the thermostat energizes the reversing valve in the cooling mode, set the dip switch to the “on” position.

Dip switch 5

Com2=Off/Bacnet or Lonworks
Com1=On/Communicating Thermostat

Dip switch 6	Protocol setting 1
Dip switch 7	Protocol setting 2
Dip switch 8	Protocol setting 3

Standard 24VAC sequence of operation

Random start delay

When the unit is first powered “on” the control microprocessor will generate a random number to determine the start delay of the compressor operation (3-5 minutes). This delay is used to prevent multiple units from cycling “on” at the same time. The purpose is to prevent a large power load on the building electrical system after a power outage. After the number, or delay time, is generated the microprocessor will use it to determine the minimum amount of time delay before the compressor is cycled “on” after a demand is received from the thermostat.

Anti-short cycling delay

After the random start delay is generated the microprocessor will use it to determine the minimum amount of delay before the compressor is cycled “on” after a demand is received from the thermostat. This allows the refrigerant system to equalize in pressure and prevents short-cycling of the compressor.

Minimum compressor runtime

The minimum compressor runtime of each cycle, heating or cooling, is 90 seconds. Once the compressor is energized it will not de-energize until the minimum runtime is satisfied, even if the thermostat input is removed.

Cooling 1st stage (Y1, O)

When the microprocessor receives (Y1, O) at the 24VAC thermostat input connection, the unit will proceed with the cooling 1st stage sequence. The microprocessor must receive these signals for 2 continuous seconds before it recognizes the inputs as valid. Once the input signals are determined to be valid the reversing valve will energize/de-energize after 5 seconds. The microprocessor will then verify that the anti-short cycling delay has been satisfied. Once the anti-short cycling delay has been satisfied the compressor will cycle “on.” The blower will cycle “on” in low speed 15 seconds after the compressor is cycled “on.”

Cooling 2nd stage (Y1, Y2, O)

When the microprocessor receives (Y1, Y2, O) at the 24VAC thermostat input connection, the unit will proceed with the cooling 2nd stage sequence. The microprocessor must receive these signals for 2 continuous seconds before it recognizes the inputs as valid. Once the input signals are determined to be valid the reversing valve will energize/de-energize after 5 seconds. The microprocessor will then verify that the anti-short cycling delay has been satisfied. Once the anti-short cycling delay has been satisfied the compressor will cycle “on.” The blower will cycle “on” in high speed 15 seconds after the compressor is cycled “on.”

Heating 1st stage (Y1)

When the microprocessor receives (Y1) at the 24VAC thermostat input connection, the unit will proceed with the cooling 1st stage sequence. The microprocessor must receive these signals for 2 continuous seconds before it recognizes the inputs as valid. Once the input signals are determined to be valid the reversing valve will enertize/de-energize after 5 seconds. The microprocessor will then verify that the anti-short cycling delay has been satisfied. Once the anti-short cycling delay has been satisfied the compressor will cycle “on.” The blower will cycle “on” in low speed 15 seconds after the compressor is cycled “on.”

Heating 2nd stage (Y1, Y2)

When the microprocessor receives (Y1, Y2) at the 24VAC thermostat input connection the unit will proceed with the heating 2nd stage sequence. The microprocessor must receive these signals for 2 continuous seconds before it recognizes the inputs as valid. Once the input signals are determined to be valid the reversing valve will energize/de-energize after 5 seconds. The microprocessor will then verify that the anti-short cycling delay has been satisfied. Once the anti-short cycling delay has been satisfied the compressor will cycle “on.” The blower will cycle “on” in high speed 15 seconds after the compressor is cycled “on.”

Fan only mode (G)

The fan only mode can only be used with a 24VAC thermostat and will energize the low speed blower when a (G) input has been received at the 24VAC thermostat input connection. When the input is removed the blower will de-energize immediately.

24 volt thermostats

Non-programmable and programmable thermostats use a control algorithm that uses both time and temperature difference from the setting to determine when to turn on stage 1 fan speed (low) and stage 2 fan speed (high). This logic therefore controls the room temperature to plus or minus 1 degree from set point.

Communicating thermostat

Failure code display area

Temperature adjustment

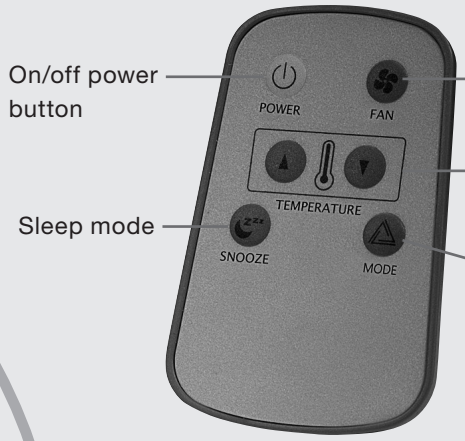
Wiring harness provided with communicating thermostat

On/off power button

PCB inside electrical box of cabinet

Dip switch positions for proper communicating thermostat operation

Dip Switch Position	Description
1	On
2	Varies, depends on system temperatures
3	Off
4	On
5	On
6	Off
7	Off
8	Off



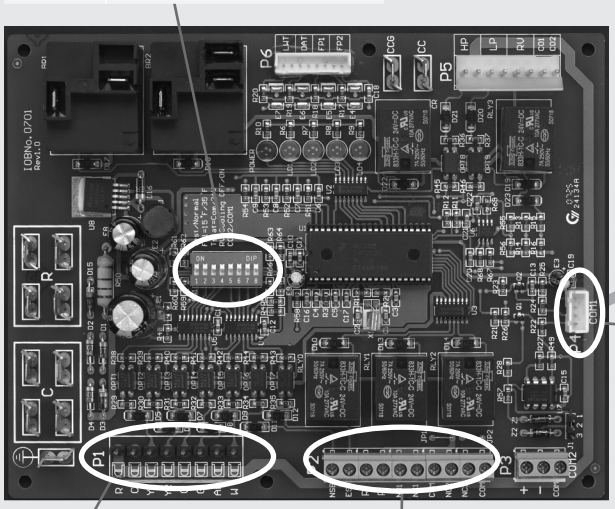
On/off power button

Fan: high/low

Temperature adjustment

Sleep mode

Mode: heat, cool or fan



Plug P2
Connection port to communicating thermostat

Plug P1
24 volt thermostat terminal block (for use with standard 24V thermostats)

Plug P2
Emergency shutdown, night setback and auxiliary contacts

⚠ WARNING

Electrical shock can cause personal injury or death. When installing or servicing system, always turn off main power to system. There may be more than one disconnect switch.

Communicating thermostat operating instructions

Power on/off

This button will switch the unit on and off. In power off mode, there is no screen display of operation mode or fan speed. Only the room temperature, day and time will be displayed.

Convert Celsius to Fahrenheit

Push the “cancel” and “humidify +/-” buttons simultaneously for three seconds to achieve the conversion of °C to °F. When power is first applied after installation the default temperature will be shown in °C.

Set temperature

Push either of the temperature adjust buttons (“+” or “-”) under the screen once and the temperature display and current temperature setting flashes (five flashes). Push the temperature adjust “+” one time and the temperature setting increases by 1°. Push the temperature adjust “-” one time and the temperature setting drops by 1°.

NOTICE

- The Celsius temperature setting ranges from 16 °C to 30 °C
- The Fahrenheit temperature setting ranges from 55 °F to 90 °F

Set time and day

To change the time, push the “time +” or “time -” button once and the time display will flash. Push the “time +” button once and one minute will be added to the time. Push the “time -” button once and one minute will be subtracted from the time. To change the hour, push the “time +” or “time -” button and hold for six seconds. The hour time display will show in this mode.

To change the day of the week, push the “DAY” button until the desired day of the week appears on the screen.

Set or change timed power on setting

In heating, cooling and fan only modes

Push the “timer” button once and the time and power on display will flash indicating entry to the timed power on menu. Push the “time +” or “time -” button to set the timing in minutes. Push the “time +” or “time -” button and hold for 6 seconds and the timing will change to the hour. To select the day of the week, push the “day” button until the desired day of the week appears. In this menu, push the “cancel” button to cancel the timing of power on for that day. If there is no timing of power on for that particular date, “-:-” will be displayed in the time display. To exit the timed power on setting mode push the “mode” button two times.

Set or change the timed power off setting

In heating, cooling and fan only modes

Push the “timer” button twice and the time and power off display will flash indicating entry to the timed power off menu. Push the “time +” or “time -” button to set the timing in minutes. Push the “time +” or “time -” button and hold for six seconds and the timing will change to the hour. To select the day of the week, push the “day” button until the day of the week appears. In this menu, push the “cancel” button to cancel the timing of power off for that day. If there is no timing of power off on that particular date, “-:-” will be displayed in the time display. To exit the timed power off setting push the “mode” button one time.

Set fan speed

Set the fan speed from high to low by pushing the “fan” button. Low speed will be displayed with two bars next to the fan symbol, high speed is six bars next to the fan symbol.

Change mode setting

Push “mode” button to switch between the cooling mode, heating mode or fan only mode.

Temperature inquiry

Push the “cancel” and “fan” buttons simultaneously and hold for six seconds. A chime will sound and the temperature inquiry menu will be displayed as follows:

Temp. area	Time area
C0	Freeze protection temperature - water side (FP 1)
C1	Freeze protection temperature – air side (FP 2)
C2	Discharge air temperature (DAT)
C3	Leaving water temperature (LWT)

Continue to push the “humidify +/-” button to select the temperature area from the C0 to C3 until it appears in the display. Push the “cancel” button to cancel the temperature.

Communicating thermostat operating instructions

Set system parameters

Push the “cancel” and “sleep” buttons simultaneously and hold for three seconds to set the system parameters. A chime will sound and “0- --” will be displayed. At this point password input is required. Push either of the temperature adjust buttons under the screen to type in the corresponding password. **Note:** Each digit requires the power button to be pushed to advance to the next digit. Push the “on/off” power button to switch password. Type in password 8699 and push the “fresh” button (if the password is incorrect d0 will not be shown on the thermostat display). The parameter modification menu will display as follows: “read” will be shown on the thermostat display for two seconds then d0 will show current temperature.

Temp. Area	Time Area
d0	Low voltage lockout lower limit (16-30V); 16V as default. Use temperature “-” or “+” to change setting, use humidify “+” or “-” to scroll up to d1.
d1	Low voltage lockout upper limit (16-30V); 28V as default. Use temperature “-” or “+” to change setting, use humidify “+” or “-” to scroll up to d2.
d2	Freeze protection air side (FP2) lockout temperature 35 °F (2 °C) as default. Use temperature “-” or “+” to change setting, use humidify “+” or “-” to scroll up to d3.
d3	Auxiliary relay 1 (Plug P2 on PCB) parameter - C means relay 1 starts up along with the compressor, 9 means relay starts up along with the fan. Use temperature “-” or “+” to change setting, use humidify “+” or “-” to scroll up to d4.
d4	Auxiliary relay 2 (Plug P2 on PCB) parameter - C means relay 2 starts up along with the compressor, 9 means relay 2 starts up along with the fan.

Important: If any settings have been changed the “fresh” button must be pushed to store new settings

Failure codes

When the system fails, the corresponding failure code is displayed in the failure display area (lower right hand corner of the thermostat display). If no failure code(s) are present the area on the thermostat display will be blank:

1. Refrigerant hi-pressure failure (lockout after three times)
2. Refrigerant low pressure failure (lockout after three times)
3. Not used
4. Freeze protection water side (FP1) temperature failure (lockout after three times)
5. Freeze protection air side (FP2) temperature failure (lockout after three times)
6. Emergency shutdown input (ES) failure (reset automatically)
7. Night setback (NSB) failure (reset automatically)
8. Communication failure (reset automatically)
9. Condensate overflow switch (CO1) failure (lockout after 3 times)
10. Not used
11. Line voltage (OUV) over-voltage failure (lockout after 3 times)
12. Not used
13. Low water temperature (LWT) sensor failure (reset automatically)
14. Discharge air temperature (DAT) sensor failure (reset automatically)
15. Freeze protection water side (FP1) sensor failure (reset automatically)
16. Freeze protection (FP2) sensor failure (reset automatically)

Communicating thermostat battery is dead

If the battery is dead or not installed, the thermostat screen will not display the time but will still retain its set point. The thermostat will still function in heating or cooling mode. Replace the battery with a 3-volt lithium battery. The battery is located between the wall mounting plate and thermostat. For access to the battery, loosen one Phillips screw located on the bottom of the thermostat face, disconnect interface cable from thermostat circuit board and replace battery.

Clearing fault code(s) manually

To manually clear a fault code, turn off the line voltage supply to the unit. If the unit cabinet is equipped with a disconnect switch, turn off and wait 30 seconds then turn the power back on. If no disconnect switch is installed on unit the main power will need to be shut off at the breaker box. If fault code remains, a fault code will appear on the communicating thermostat and on the PCB. Refer to the Troubleshooting section of this manual on page 52.

Unit starting and operating conditions

Operating limits

Environment: Units are designed for indoor installation only. Never install units in areas subject to freezing or where humidity levels could cause cabinet condensation (such as unconditioned spaces subject to 100% outside air).

Power supply: Voltage utilization range complies with AHRI Standard 110. Voltage Min/Max are shown in the appropriate Electrical Data tables elsewhere in this manual. In general, voltage variation of +/- 10% of nameplate utilization voltage is acceptable.

Determination of operating limits is dependent primarily upon three factors:

- Return air temperature
- Water temperature
- Ambient temperature

When any one of these factors is at minimum or maximum levels, the other two factors should be at normal levels to ensure proper unit operation. Extreme variations in temperature and humidity and/or corrosive water or air will adversely affect unit performance, reliability, and service life. Consult Tables 12 and 13 for operating limits.

Start-up conditions: Allowances are made for a wider range of entering air conditions during start-up and are shown in Table 12. **Start-up conditions are not normal or continuous operating conditions but may be used to bring the building space up to occupancy temperatures.** Units are not designed to operate under these conditions on a regular basis.

Table 13

Air limits		Standard range units		Extended range units	
		Cooling	Heating	Cooling	Heating
Ambient air	Minimum	50 °F (10 °C)	50 °F (10 °C)	50 °F (4 °C)	50 °F (4 °C)
	Maximum	100 °F (38 °C)	85 °F (29 °C)	100 °F (38 °C)	85 °F (29 °C)
Entering air (DB/WB)	Minimum	65/60 °F (18.3/15.6 °C)	50 °F (10 °C)	60/50 °F (16/10 °C)	45 °F (7 °C)
	Rated	80.6/67 °F (27/19 °C)	68 °F (20 °C)	80.6/67 °F (27/19 °C)	68 °F (20 °C)
	Maximum	100/83 °F (38/28 °C)	80 °F (27 °C)	95/75 °F (35/24 °C)	80 °F (27 °C)
Entering air: Start-up only (DB/WB)	Minimum	55/45 °F (10/7 °C)	40 °F (4 °C)	55/45 °F (10/7 °C)	40 °F (4 °C)
	Maximum	110/83 °F (43/28 °C)	80 °F (27 °C)	110/83 °F (43/28 °C)	85 °F (29 °C)

Table 14

Water limits		Standard range units		Extended range units	
		Cooling	Heating	Cooling	Heating
Entering water	Minimum	55 °F (13 °C)	55 °F (13 °C)	30 °F (-1 °C)	20 °F (-6 °C)
	Normal	85 °F (29 °C)	70 °F (21 °C)	77 °F (25 °C)	40 °F (4 °C)
	Maximum	110 °F (43 °C)	90 °F (32 °C)	120 °F (43 °C)	90 °F (32 °C)
GPM/ton	Minimum	1.5			
	Rated	3.3			
	Maximum	4.0			

Notes:

- Maximum and minimum values may not be used in combination.
- If one condition is max. or min., the other two conditions may not exceed the standard unit normal condition.
- Extended range units may combine up to two maximum conditions with the others being normal.

Piping system cleaning and flushing

Cleaning and flushing the heat pump piping system is the single most important step to ensure proper start-up and continued efficient operation of the system.

Follow the instructions below to properly clean and flush the system:

- Ensure that electrical power to the unit is disconnected.
- Install the system with the supply hose connected directly to the return riser valve. Use a single length of flexible hose.
- Open all air vents. Fill the system with water. **Do not** allow system to overflow. Bleed all air from the system. Pressurize and check the system for leaks and repair as appropriate.
- Verify that all strainers are in place (Zehnder Rittling recommends a strainer with a #20 stainless steel wire mesh). Start the pumps, and systematically check each vent to ensure that all air is bled from the system.
- Verify that make-up water is available. Adjust make-up water as required to replace the air which was bled from the system. Check and adjust the water/air level in the expansion tank.
- Set the boiler to raise the loop temperature to approximately 85 °F (29 °C). Open a drain at the lowest point in the system. Adjust the make-up water replacement rate to equal the rate of bleed.
- Refill the system and add trisodium phosphate substitute in a proportion of approximately one pound per 150 gallons (0.8 kg per 1000 l) of water (or other equivalent approved cleaning agent). Reset the boiler to raise the loop temperature to 100 °F (38 °C). Circulate the solution for a minimum of 8 to 24 hours. At the end of this period, shut off the circulating pump and drain the solution. Repeat system cleaning if desired.
- When the cleaning process is complete, remove the short-circuited hoses. Reconnect the hoses to the proper supply, and return the connections to each of the units. Refill the system and bleed off all air.
- Test the system pH with litmus paper. The system water pH should be in the range indicated in Table 5 . Add chemicals, as appropriate to maintain neutral pH levels.
- When the system is successfully cleaned, flushed, refilled and bled, check the main system panels, safety cutouts and alarms. Set the controls to properly maintain loop temperatures.

⚠ CAUTION

Do not use “Stop Leak” or similar chemical agent in this system. Addition of chemicals of this type to the loop water will foul the heat exchanger and inhibit unit operation.

Notes:

- The manufacturer strongly recommends all piping connections, both internal and external to the unit, be pressure tested by an appropriate method prior to any finishing of the interior space or before access to all connections is limited. Test pressure may not exceed the maximum allowable pressure for the unit and all components within the water system.
- The manufacturer will not be responsible or liable for damages from water leaks due to inadequate or lack of a pressurized leak test, or damages caused by exceeding the maximum pressure rating during installation.

Unit and system checkout: Before powering

Unit checkout

- **Filter**
  Clean or replace filter, if required.
- **Balancing/shut-off valves**
  Ensure that all isolation valves are open and water control valves are wired.
- **P-trap connections**
  Ensure all condensate P-trap connections are secure. Failure to do so could cause extensive damage to drywall and flooring.
- **Drain pan**
  Ensure drain hose from air coil is properly positioned over drain pan. Failure to do so could cause extensive damage to drywall and flooring.
- **Line voltage and wiring**
  Verify that voltage is within an acceptable range for the unit. Verify wiring and fuses/breakers are properly sized. Verify that low voltage wiring is complete.
- **Unit controls**
  Verify that the microprocessor dip switches are set for proper operation and system configuration and the thermostat is properly configured.
- **Entering water and air**
  Ensure that entering water and air temperatures are within operating limits of Tables 12 and 13.
- **Unit fan**
  Manually rotate fan to verify free rotation and ensure that blower wheel is secured to the motor shaft. Be sure to remove any shipping supports if needed. Do not oil motors upon start-up. Fan motors are permanently lubricated from the factory. Check unit fan speed selection and compare to design requirements.
- **Condensate line**
  Verify that condensate line is open and properly pitched toward drain.
- **Water flow balancing**
  Record inlet and outlet water temperatures for each heat pump upon startup. This check can eliminate nuisance lock outs and high velocity water flow that could erode heat exchangers.

System checkout

- **System water temperature**
  Check water temperature for proper range and also verify heating and cooling set points for proper operation.
- **System pH**
  Check & adjust water pH if necessary to maintain levels indicated in Table 5. Proper pH promotes longevity of hoses & fittings.
- **System flushing**
  Verify that all hoses are connected end to end when flushing to ensure that debris bypasses the unit heat exchanger, water valves and other components. Water used in the system must be potable quality initially and clean of dirt, piping slag and strong chemical cleaning agents. Verify that all air is purged from the system. Air in the system can cause poor operation and/or system corrosion.
- **Cooling tower/boiler**
  Check equipment for proper set points and operation.
- **Standby pumps**
  Verify that the standby pump is properly installed and in operating condition.
- **System controls**
  Verify that system controls function and operate in the proper sequence.
- **Low water temperature cut-out**
  Verify that low water temperature cut-out controls are provided for the outdoor portion of the loop. Otherwise, operating problems may occur.
- **System control center**
  If applicable, verify that the control center and alarm panel have appropriate set points and are operating as designed.

⚠ CAUTION

Verify that ALL water control valves are open and allow water flow prior to engaging the compressor. Freezing of the coax or water lines can permanently damage the heat pump.

⚠ CAUTION

To avoid equipment damage, DO NOT leave system filled in a building without heat during the winter unless antifreeze is added to the water loop. Heat exchangers never fully drain by themselves and will freeze unless winterized with antifreeze.

Unit start-up procedure

- Turn on line power to all heat pumps. See controls description for details.
- Turn the thermostat fan position to “ON.” Blower should start.
- Balance air flow at registers.
- Adjust all water valves to their full open positions.
- Room and entering water temperatures should be within the minimum-maximum ranges of Tables 12 and 13. During start-up checks, loop water temperature entering the heat pump should be between 60 °F (16 °C) and 95 °F (35 °C).

Two factors determine the operating limits of Zehnder Rittling heat pumps, (a) return air temperature, and (b) supply water temperature. When any one of these factors is at a minimum or maximum level, the other factor must be at normal level to ensure proper unit operation.

Cooling

- Adjust the unit thermostat to the warmest setting. Place the thermostat mode switch in the “COOL” position. Incrementally reduce thermostat setting 1° every 1 minute until the compressor activates.
- Check for cool air delivery at the unit grille within a few minutes after the unit has begun to operate. Verify that the compressor is on and that the water flow direction is correct by measuring pressure drop through the heat exchanger.

NOTICE

Units have a 3-5 minute time delay in the control circuit that can be eliminated on the microprocessor control board. See test mode described in the dip switch settings section, refer to page 40.

- Check the elevation and cleanliness of the condensate lines. Dripping may be a sign of a blocked line. Check that the condensate trap is filled to provide a water seal.
- Check the temperature of both entering and leaving water. If temperature is within range, proceed with the test (see Table 15). If temperature is outside of operating range, check refrigerant pressures.

Table 15: Temperature change through heat exchanger

Water flow	Rise in cooling	Drop in heating
Closed loop @ 3 GPM/ton (3.9 l/m/kW)	9-12 °F (5-6.7 °C)	4-8 °F (2.2-4.4 °C)
Open loop @ 2.5 GPM/ton (2.0 l/m/kW)	20-26 °F (11.1-14.4 °C)	10-17 °F (5.6-9.4 °C)

- Check air temperature drop across the air coil when compressor is operating. Air temperature drop should be between 15 °F and 25 °F (8 °C and 14 °C).
- Turn thermostat to “OFF” position. A hissing noise may be heard and indicates proper functioning of the reversing valve.
- Allow 5 minutes between tests for pressure to equalize before beginning heating test.

Unit start-up procedure

Heating

- Adjust the thermostat setting to the lowest setting. Place the thermostat mode switch in the “HEAT” position.
- Incrementally raise the thermostat setting 1° every 1 minute until the compressor activates.
- Check for warm air delivery within a few minutes after the unit has begun to operate.
- Check the temperature of both entering and leaving water. If temperature is within range, proceed with the test (see Table 15). If temperature is outside of operating range, check refrigerant pressures.
- Check air temperature rise across the air coil when compressor is operating. Air temperature rise should be between 20 °F and 30 °F (11 °C and 17 °C).
- Check for vibration, noise, and water leaks.

If unit fails to operate, perform troubleshooting analysis (see troubleshooting section). If the check described fails to reveal the problem and the unit still does not operate, contact a trained service technician to ensure proper diagnosis and repair of the equipment.

When testing is complete, set system to maintain desired comfort level.

Be certain to fill out and forward all warranty registration papers to Zehnder Rittling.

⚠ WARNING

When the disconnect switch is closed, high voltage is present in some areas of the electrical panel. Exercise caution when working with energized equipment.

⚠ CAUTION

Verify that ALL water control valves are open and allow water flow prior to engaging the compressor. Freezing of the coax or water lines can permanently damage the heat pump.

NOTICE

Units have a random 3 to 5 minute time delay in the control circuit.

If performance during any mode appears abnormal, refer to the controls section or troubleshooting section of this manual. To obtain maximum performance, the air coil should be cleaned before stat-up. Use a coil cleaner for use on indoor evaporator refrigeration equipment.

Preventive maintenance

Water coil maintenance

⚠ WARNING

Electrical shock can cause personal injury or death. When installing or servicing system, always turn off main power to system. There may be more than one disconnect switch.

⚠ WARNING

The installation and servicing of air conditioning equipment can be hazardous due to system pressure and electrical components. Only trained and qualified service personnel should install, repair, or service air conditioning equipment.

Direct ground water applications only

If the system is installed in an area with a known high mineral content (125 PPM or greater) in the water, it is best to establish a periodic maintenance schedule with the owner so the coil can be checked regularly. Consult the water quality section of this manual for a more detailed water coil material selection. Should periodic coil cleaning be necessary, use standard coil cleaning procedures, which are compatible with the heat exchanger material and copper water lines. Generally, the more water flowing through the unit, the less chance for scaling. Therefore, 1.5 gpm per ton (1.6 l/m per kW) is recommended as a minimum flow. Minimum flow rate for entering water temperatures below 50 °F (10 °C) is 3.0 gpm per ton (2.2 l/m per kW).

All other water loop applications

Generally water coil maintenance is not needed for closed loop systems. However, if the piping is known to have high dirt or debris content, it is best to establish a periodic maintenance schedule with the owner so the water coil can be checked regularly. Dirty installations are typically the result of deterioration of iron or galvanized piping or components in the system. Open cooling towers requiring heavy chemical treatment and mineral buildup through water use can also contribute to higher maintenance. Should periodic coil cleaning be necessary, use standard coil cleaning procedures, which are compatible with both the heat exchanger material and copper water lines. Generally, the more water flowing through the unit, the less chance for scaling. However, flow rates over 4 gpm per ton (4.3 l/m per kW) can produce water (or debris) velocities that can erode the heat exchanger wall and ultimately produce leaks.

Filters

Filters must be clean to obtain maximum performance. Filters should be inspected every month under normal operating conditions and be replaced when necessary. Units should never be operated without a filter.

Washable, high efficiency, electrostatic filters, when dirty, can exhibit a very high pressure drop for the fan motor and reduce air flow, resulting in poor performance and/or nuisance trips. It is especially important to provide consistent washing of these filters (in the opposite direction of the normal air flow) once per month using a high pressure wash similar to those found at self-serve car washes.

Preventive maintenance

Condensate drain
In areas where airborne bacteria may produce a “slimy” substance in the drain pan, it may be necessary to treat the drain pan chemically with an algaecide approximately every three months to minimize the problem. The condensate pan may also need to be cleaned periodically to ensure indoor air quality. The condensate drain can pick up lint and dirt, especially with dirty filters. Inspect the drain twice a year to avoid the possibility of plugging and eventual overflow.

Compressor
Conduct annual amperage checks to ensure that amp draw is no more than 10% greater than indicated on the serial plate data.

Fan motors
All units have lubricated fan motors. Fan motors should never be lubricated unless obvious, dry operation is suspected. Periodic maintenance oiling is not recommended, as it will result in dirt accumulating in the excess oil and cause eventual motor failure. Conduct annual dry operation check and amperage check to ensure amp draw is no more than 10% greater than indicated on serial plate data.

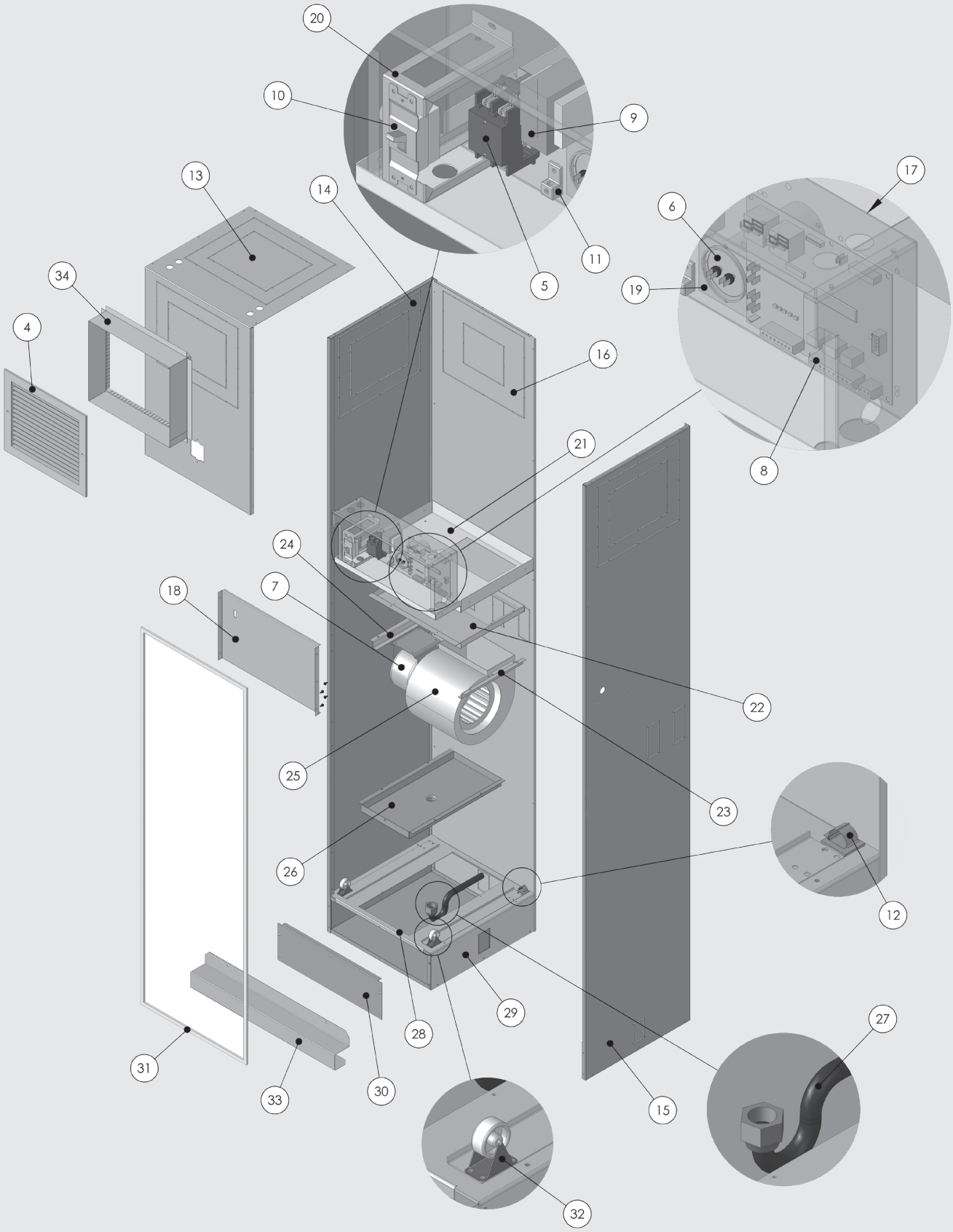
Air coil
The air coil must be cleaned to obtain maximum performance. Check once a year under normal operating conditions and, if dirty, brush or vacuum clean. Care must be taken not to damage the aluminum fins while cleaning.

⚠ CAUTION
Fin edges are sharp.

Cabinet
Do not allow water to stay in contact with the cabinet for long periods of time to prevent corrosion of the cabinet sheet metal. The cabinet can be cleaned using a mild detergent.

Refrigerant system
To maintain sealed circuit integrity, do not install service gauges unless unit operation appears abnormal. Reference the operating charts for pressures and temperatures. Verify that air and water flow rates are at proper levels before servicing the refrigerant circuit.

Exploded view repair parts diagram: Cabinet



Cabinet repair parts list: Return air panels

Item No.	Qty.	Description	Part number by unit model number						
			09	12	15	18	24	30	36
1	N/A	Standard perimeter bypass Allen lock, removable	Contact your Zehnder Rittling Sales Support Representative						
2	N/A	Optional perimeter bypass Allen lock or key lock, hinged							
3	N/A	Optional louvered Allen lock, removable							

Cabinet repair parts list: Supply air grilles

Item No.	Qty.	Description	Part number by unit model number						
			09	12	15	18	24	30	36
4	N/A	Single deflection grille 10" x 8"	11100001875A						
4	N/A	Single deflection grille 12" x 10"					11100001876A		
4	N/A	Single deflection grille 14" x 12"	11100001388A						
4	N/A	Single deflection grille 16" x 14"					11100001389A		
4	N/A	Double deflection grille 10" x 8"	11100001879A						
4	N/A	Double deflection grille 12" x 10"					11100001880A		
4	N/A	Double deflection grille 14" x 12"	11100001386A						
4	N/A	Double deflection grille 16" x 14"					11100001387A		
4	N/A	Double deflection with opposed blade grille 10" x 8"	11100002820A						
4	N/A	Double deflection with opposed blade grille 12" x 10"					11100002821A		
4	N/A	Double deflection with opposed blade grille 14" x 12"	11100002859A						
4	N/A	Double deflection with opposed blade grille 16" x 14"					11100002860A		

Notes:
- Specify color when ordering

Cabinet repair parts list: Miscellaneous

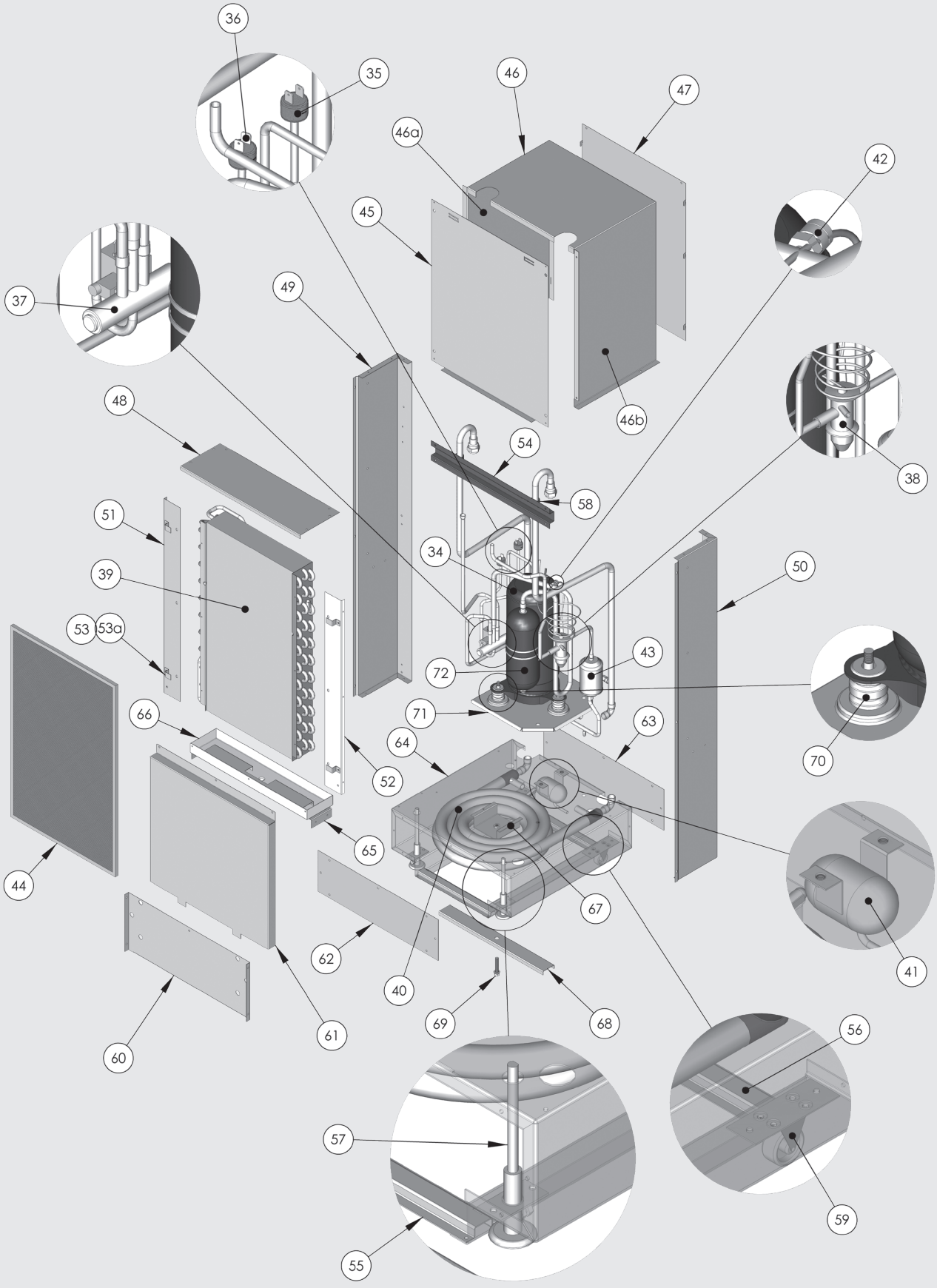
Item #	Qty.	Description	Part number by unit model number						
			09	12	15	18	24	30	36
18	1	Electrical box cover	11716000573A		11716000574A		11716000575A		
26	1	Drain pan	11100002770A				11100002771A		
27	1	Drain pan trap	11100001503A				11100002772A		
31	1	Frame gasket	11100002778A						
32	1	Cabinet directing wheel	11100002779A						
33	1	Frame support	11416000025A				11416000030A		

Notes:
- Specify color when ordering

Cabinet repair parts list: Electrical

Item #	Qty.	Description	Part number by unit model number						
			09	12	15	18	24	30	36
5	1	Compressor contactor HLC-2XQ04GGFLA:40A	11100001873A						
6	1	Capacitor 30uf 50/60HZ 450VAC	11100001863A						
6	1	Capacitor 35uf 50/60HZ 450VAC		11100001864A					
6	1	Capacitor 40uf 50/60HZ 450VAC			11100001865A				
6	1	Capacitor 45uf 50/60HZ 450VAC							11100001867A
6	1	Capacitor 50uf 50/60HZ 450VAC					11100001866A		
7	1	Fan motor capacitor 2.5uf 50/60HZ 450VAC	11100002764A						
7	1	Fan motor capacitor 5uf 50/60HZ 450VAC			11100002765A				
7	1	Fan motor capacitor 10uf 50/60HZ 450VAC						11100002766A	
7	1	Blower motor YDK120-30-6F02 208-230V	11100001868A						
7	1	Blower motor YDK120-90-4F01 208-230V			11100001869A				
7	1	Blower motor YDK120-200-6F01 208-230V						11100001870A	
25	1	Blower housing with cage	11100002893A					11100002769A	
–	N/A	Communicating thermostat with remote	11100002810A						
–	N/A	Thermostat, digital non-programmable	11716000009A						
–	N/A	Thermostat, digital programmable	11716000013A						
–	N/A	Wiring harness for digital thermostat	11417000001A						
–	N/A	LonWorks comm card	11100002808A						
–	N/A	BACnet comm card	11100002809A						
8	1	PCB, 208V-230V	11100023125A						
8	1	PCB, 277V	11100020846A						
9	1	Transformer	11100001871A						
10	1	Disconnect switch AC only 20A 120-277V	11100000127A		11100001543A			11100000339A	
10	1	Disconnect switch AC only 30A 120-277V						11100000339A	
1	1	Ground lug	11100002774A						
12	1	Cable mount	11100002775A						
–	1	Compressor wiring harness box side	11100002776A					11100002777A	

Exploded view repair parts diagram: Chassis



Chassis repair parts list: Electrical

Item No.	Qty.	Description	Part number by unit model number						
			09	12	15	18	24	30	36
34	1	Compressor	11100001856A	11100001857A	11100001858A	11100001859A	11100001860A	11100001861A	11100002747A
35	1	High pressure switch 600 PSI	11100002759A						
36	1	Low pressure switch 40 PSI	11100002760A						
37	1	Reversing valve	11100002761A				11100002762A	11100002763A	
–	1	Compressor power wiring harness	11100002780A				11100002781A		11100002782A
–	1	Temperature sensor assembly	11100001872A						
-	1	P5 chassis signal wiring harness	11100023107A				11100023108A		11100023109A
-	1	P5 cabinet signal wiring harness	11100023105A				11100023106A		

Chassis repair parts list: Miscellaneous

Item No.	Qty.	Description	Part number by unit model number						
			09	12	15	18	24	30	36
38	1	TXV	11100002755A		11100002756A		11100002757A	11100002758A	
39	1	Air coil assembly	11100021067A	11100021068A	11100021069A		11100021070A	11100021071A	
40	1	Coax	11100002748A	11100002749A	11100002750A		11100002752A	11100002753A	
41	1	Receiver	N/A		11100002767A				
42	2	1/4" Schrader valve	11100002783A						
43	1	Filter dryer	11100001862A						
44	1	Filter (washable)	11100002805A		11100002806A		11100002807A		
44	1	Filter (disposable)	11100002815A		11100002816A		11100002817A		
53	4	Filter clip	11716000007A						
–	1	Compressor blanket	11100020842A						
–	1	Complete chassis	11100002740A	11100002741A	11100002742A	11100002743A	11100002744A	11100002745A	11100002746A
–		Water valve body 1/2"	11100000192A		N/A				
–		Water valve body 3/4"	N/A		11100001608A				
–		Water valve 24VAC actuator	11100000220A						

Troubleshooting

Table G: Technical Diagnosis

Fault Description	Error Code (commtstat)	System Warning (Flash)				System Lockout (Steady On)				Possible Fault Cause
		LD1	LD2	LD3	LD4	LD1	LD2	LD3	LD4	
High pressure lockout > 600 psig	ER 1	Off	Off	Off	Flash	Off	Off	Off	On	Low air flow (heating) Low water flow (cooling)
Low pressure lockout < 40 psig	ER 2	Off	Off	Flash	Off	Off	Off	On	Off	Low refrigerant charge
Freeze protection H_2O side	ER 4	Off	Off	Flash	Flash	Off	Off	On	On	Water temperature < 35 °F or < 15 °F (heating)
Freeze protection air side < 35 °F	ER 5	Off	Flash	Off	Off	Off	On	Off	Off	Blower failure (cooling)
Condensate overflow	ER 9, ER 10	Off	Flash	Off	Flash	Off	On	Off	On	Clogged drain line
Over/under low voltage protection, 18 VAC > voltage < 30VAC	ER 11	Off	Flash	Flash	Flash	Off	On	On	On	Loss of power, brown out
LWT sensor failure (low water temperature)	ER 13	Flash	Off	Off	Off	N/a	N/a	N/a	N/a	Sensor resistance above or below specification
DAT sensor failure (discharge air temperature)	ER 14	Flash	Off	Off	Flash	N/a	N/a	N/a	N/a	Sensor resistance above or below specification
FP1 sensor failure (freeze protection)	ER 15	Flash	Off	Flash	Off	On	Off	On	Off	Sensor resistance above or below specification
FP2 sensor failure (freeze protection)	ER 16	Flash	Off	Flash	Flash	On	Off	On	On	Sensor resistance above or below specification

Troubleshooting

PCB System Error Codes (Green LEDs) Warning = FLASHING Lock-out = STEADY				System Error Code (COM T Stat)	Fault Description	Potential Causes
LD1	LD2	LD3	LD4			
OFF	OFF	OFF	X	Er 1	High pressure lockout > 600 PSI	■ Low air flow (heating), low water flow (cooling) ■ Blower fan inoperable (heat mode) ■ Dirty air filter (heat mode) ■ Airflow by-passing air coil through due to poor sealing of cabinet openings (heat mode) ■ Return air too hot (heat mode) ■ Air in risers (cool mode) ■ Dirty water strainer (cool mode) ■ Faulty zone valve (cool mode) ■ Mis-wired zone valve (cool mode) ■ Ball valves closed (cool mode) ■ Main water pump inoperable (cool mode) ■ Supply water too hot (cool mode)
OFF	OFF	X	OFF	Er 2	Low pressure lockout < 40 PSI	■ Low refrigerant charge ■ Blower fan inoperable (cool mode) ■ Airflow by-passing air coil through due to poor sealing of cabinet openings (cool mode) ■ Ball valves closed (heat mode) ■ Main water pump inoperable (heat mode)
OFF	OFF	X	X	Er 4	Freeze protection, water side	■ Water temperature < 35°F or < 15°F (heating) ■ DIP switch 2 incorrectly set ■ Air in risers (heat mode) ■ Ball valves closed (heat mode) ■ Faulty zone valve (heat mode) ■ Main water pump inoperable (heat mode) ■ Dirty water strainer (heat mode) ■ Refrigerant charge quantity below factory recommendation
OFF	X	OFF	OFF	Er 5	Freeze protection, air side, < 35°F	■ Blower failure (cooling) ■ Dirty air filter (cool mode) ■ Airflow by-passing air coil through due to poor sealing of cabinet openings (cool mode) ■ Return air too cool (cool mode) ■ Refrigerant charge quantity above factory recommendation
OFF	X	OFF	X	Er 9, Er 10	Condensate overflow	■ Clogged drain line ■ Condensate switch has residual water contacting from unit installation/removal
OFF	X	X	X	Er 11	Over/under low voltage protection 16VAC > voltage > 30VAC	■ Loss of power, brown-out ■ Main power voltage not within acceptable range
X	OFF	OFF	OFF	Er 13	LWT sensor failure	■ Sensor wiring not properly connected ■ Sensor resistance above or below specification
X	OFF	OFF	X	Er 14	DAT sensor failure	■ Sensor wiring not properly connected ■ Sensor resistance above or below specification
X	OFF	X	OFF	Er 15	FP1 sensor failure	■ Sensor wiring not properly connected ■ Sensor resistance above or below specification
X	OFF	X	X	Er 16	FP2 sensor failure	■ Sensor wiring not properly connected ■ Sensor resistance above or below specification

Lockout modes

Note: If the microprocessor board is flashing a system warning and the unit is locked out and not running the lockout can be cleared from the microprocessor by a momentary shut down of incoming line voltage (208VAC, 230VAC or 277 VAC). A lockout that still occurs after line voltage shut-down means that the fault still exists and needs to be repaired.

High pressure lockout (HP)

The high pressure lockout will occur if the discharge pressure of the compressor exceeds 600 psig. The lockout is immediate and has no delay from the time the high pressure switch opens to the lockout. Upon lockout the compressor will be de-energized immediately. The blower will be de-energized fifteen seconds after the compressor is de-energized.

Low pressure lockout (LP)

The low pressure lockout will occur if the suction pressure falls below 40 psig for thirty continuous seconds. The compressor will then be de-energized and the blower will de-energize fifteen seconds after the compressor is de-energized.

Freeze protection 1 lockout

The freeze protection 1 lockout will occur if the H_20 line temperature falls below the set point (15 °F or 30 °F) for thirty continuous seconds. See dip switch 2 described on page 23. The compressor will then be de-energized and the blower will de-energize fifteen seconds after the compressor is de-energized.

Freeze protection 2 lockout

The freeze protection 2 lockout will occur if the air coil temperature falls below the set point 32 °F for thirty continuous seconds. See dip switch 2 described on page 23. The compressor will then be de-energized and the blower will de-energize fifteen seconds after the compressor is de-energized.

Condensate overflow 1 lockout (CO1)

The unit contains one condensate overflow sensor, located in the chassis drain pan below the air coil. A condensate lockout will occur if the sensor senses condensate for thirty continuous seconds. The compressor will then be de-energized and the blower will de-energize fifteen seconds after the compressor is de-energized.

Over/under voltage protection

If the unit control voltage is 18VAC>voltage>30VAC the unit will shut down all inputs immediately. Once the voltage has reached acceptable levels the unit microprocessor will power “on” automatically and resume previous operation.

Leaving water temperature (LWT) sensor failure

If the leaving water temperature thermistor fails it will not affect the operation of the unit. This sensor is for monitoring purposes only.

Discharge air temperature (DAT) sensor failure

If the discharge temperature thermistor fails it will not affect the operation of the unit. This sensor is for monitoring purposes only.

Freeze protection 1 temperature sensor failure (FP1)

If the freeze protection 1 thermistor fails for thirty continuous seconds, FP1 lockout will occur. The compressor will then be de-energized and the blower will de-energize fifteen seconds after the compressor is de-energized. The sensor must be replaced if this lockout occurs.

Freeze protection 2 temperature sensor failure (FP2)

If the freeze protection 2 thermistor fails for thirty continuous seconds, FP1 lockout will occur. The compressor will then be de-energized and the blower will de-energize fifteen seconds after the compressor is de-energized. The sensor must be replaced if this lockout occurs.

Table 16: Temperature sensor resistance values (LWT, DAT, FP1, FP2)

°C	°F	Minimum (K)	Standard (K)	Maximum (K)
-40.0	-40.0	200.80	230.40	240.30
-39.0	-38.2	208.00	216.90	226.10
-38.0	-36.4	196.00	204.20	212.80
-37.0	-34.6	184.80	192.50	200.40
-36.0	-32.8	174.30	181.40	188.70
-35.0	-31.0	164.50	171.10	177.90
-34.0	-29.2	155.30	161.40	167.80
-33.0	-27.4	146.70	152.40	158.30
-32.0	-25.6	138.60	143.90	149.40
-31.0	-23.8	131.10	136.00	141.10
-30.0	-22.0	124.00	128.60	133.20
-29.0	-20.2	177.30	121.60	125.90
-28.0	-18.4	111.10	115.00	119.10
-27.0	-16.6	105.20	108.90	112.60
-26.0	-14.8	99.62	103.10	106.60
-25.0	-13.0	94.41	97.62	100.90
-24.0	-11.2	89.52	92.52	65.58
-23.0	-9.4	84.91	87.70	90.56
-22.0	-7.6	80.57	83.17	85.84
-21.0	-5.8	76.48	78.91	81.39
-20.0	-4.0	72.63	74.89	77.21
-19.0	-2.2	68.99	71.11	73.24
-18.0	-0.4	65.56	67.54	69.53
-17.0	1.4	62.32	64.17	66.03
-16.0	3.20	59.27	61.00	62.73
-15.0	5.0	56.38	58.00	59.62
-14.0	6.8	53.69	55.17	56.68
-13.0	8.6	51.12	52.50	53.91
-12.0	10.4	48.68	49.97	51.29
-11.0	12.2	46.38	47.58	48.81
-10.0	14.0	44.20	45.32	46.47
-9.0	15.8	42.13	43.19	44.26
-8.0	17.6	40.18	41.16	42.17
-7.0	19.4	38.33	39.25	40.19
-6.0	21.2	36.58	37.44	38.31
-5.0	23.0	34.92	35.72	36.54
-4.0	24.8	33.34	34.09	34.86
-3.0	26.6	31.85	32.55	33.26
-2.0	28.4	30.43	31.09	31.75
-1.0	30.2	29.08	29.70	30.32
0.0	32.0	27.80	28.38	28.96
1.0	33.8	26.59	27.13	27.68
2.0	35.6	25.44	25.94	26.45
3.0	37.4	24.34	24.81	25.29
4.0	39.2	23.30	23.74	24.19
5.0	41.0	22.31	22.72	23.14
6.0	42.8	21.37	21.75	22.14
7.0	44.6	20.47	20.83	21.19
8.0	46.4	19.62	19.95	20.29
9.0	48.2	18.81	19.12	19.44
10.0	50.0	18.03	18.32	18.62
11.0	51.8	17.29	17.57	17.84
12.0	53.6	16.59	16.85	17.10
13.0	55.4	15.92	16.16	16.40
14.0	57.2	15.28	15.50	15.73
15.0	59.0	14.67	14.88	15.09
16.0	60.8	14.09	14.28	14.48
17.0	62.6	13.53	13.71	13.90
18.0	64.4	13.00	13.17	13.34
19.0	66.2	12.50	12.65	12.81
20.0	68.0	12.01	12.16	12.31
21.0	69.8	11.55	11.69	11.82
22.0	71.6	11.11	11.24	11.36
23.0	73.4	10.69	10.81	10.92
24.0	75.2	10.29	10.39	10.50
25.0	77.0	9.90	10.00	10.10
26.0	78.8	9.523	9.623	9.723
27.0	80.6	9.163	9.263	9.363
28.0	82.4	8.819	8.918	9.018
29.0	84.2	8.489	8.588	8.687
30.0	86.0	8.174	8.272	8.371
31.0	87.8	7.872	7.970	8.068
32.0	89.6	7.583	7.680	7.777
33.0	91.4	7.306	7.402	7.499
34.0	93.2	7.041	7.136	7.232
35.0	95.0	6.787	6.881	6.976
36.0	96.8	6.543	6.637	6.731
37.0	98.6	6.310	6.402	6.495
38.0	100.4	6.086	6.177	6.269
39.0	102.2	5.871	5.961	6.052
40.0	104.0	5.665	5.754	5.844
41.0	105.8	5.468	5.556	5.644
42.0	107.6	5.278	5.365	5.452
43.0	109.4	5.096	5.182	5.268
44.0	111.2	4.921	5.006	5.091
45.0	113.0	4.754	4.837	4.921
46.0	114.8	4.592	4.674	4.757
47.0	116.6	4.437	4.518	4.600
48.0	118.4	4.289	4.368	4.448
49.0	120.2	4.146	4.224	4.303
50.0	122.0	4.008	4.085	4.163
51.0	123.8	3.876	3.952	4.028
52.0	125.6	3.749	3.823	3.899
53.0	127.4	3.627	3.700	3.774
54.0	129.2	3.509	3.581	3.654
55.0	131.0	3.396	3.467	3.539
56.0	132.8	3.287	3.356	3.427
57.0	134.6	3.182	3.250	3.320
58.0	136.4	3.081	3.148	3.216
59.0	138.2	2.983	3.050	3.117
60.0	140.0	2.890	2.955	3.021
61.0	141.8	2.799	2.863	2.928
62.0	143.6	2.712	2.775	2.839
63.0	145.4	2.628	2.690	2.753
64.0	147.2	2.547	2.608	2.670
65.0	149.0	2.469	2.529	2.589
66.0	150.8	2.394	2.452	2.512
67.0	152.6	2.321	2.379	2.437
68.0	154.4	2.251	2.308	2.365
69.0	156.2	2.184	2.239	2.296
70.0	158.0	2.119	2.173	2.228
71.0	159.8	2.056	2.109	2.163
72.0	161.6	1.995	2.047	2.101
73.0	163.4	1.936	1.988	2.040
74.0	165.2	1.879	1.930	1.982
75.0	167.0	1.825	1.874	1.925
76.0	168.8	1.772	1.821	1.870
77.0	170.6	1.721	1.769	1.817
78.0	172.4	1.671	1.718	1.766
79.0	174.2	1.624	1.670	1.717

Troubleshooting worksheet

This form MUST be submitted to Zehnder Rittling Sales Support staff prior to shipment of replacement parts.

Date installed	Model number
Technician	Serial number

Power				
Air side	Fan motor volts	Fan motor amps		
Refrigeration side	Compressor volts	Total volts	Compressor amps	Total amps

Note: All Zehnder Rittling Water Source Heat Pumps are pre-charged and factory run tested. The R410A refrigerant charge used on all unit chassis models is weighed into exact amounts, refrigeration gauges should only be attached as a last resort. Failure to replace lost charge may result in loss of capacity/ efficiency and equipment life.

Cooling cycle		
Air side	Inlet air temperature (return) °F	Outlet air temperature (supply) °F
Water side	Water inlet temperature °F	Pressure psig
	Water outlet temperature °F	Pressure psig
Refrigeration side	Compressor suction side temperature °F	Compressor discharge side temperature °F
	Compressor suction side pressure psig	Compressor discharge side pressure psig
	Expansion valve temperature, entering valve °F	Expansion valve temperature, leaving valve °F
Heating cycle		
Air side	Inlet air temperature (return) °F	Outlet air temperature (supply) °F
Water side	Water inlet temperature °F	Pressure psig
	Water outlet temperature °F	Pressure psig
Refrigeration side	Compressor suction side temperature °F	Compressor discharge side temperature °F
	Compressor suction side pressure psig	Compressor discharge side pressure psig
	Expansion valve temperature, entering valve °F	Expansion valve temperature, leaving valve °F

Note: Before recording above data, each cycle should be run for 10-15 minutes or until stable.

Warranty

Zehnder Rittling, manufacturer of Zehnder Rittling product line, guarantees its products to be free from defects in material and workmanship for a period of one year from date of shipment from our Buffalo, New York factory.

Should there be any defects in the good(s), the purchaser should promptly notify Zehnder Rittling. Upon receipt of written consent from Zehnder Rittling, the purchaser shall return the defective good(s) to the factory for inspection with freight prepaid. If inspection shows the goods to be defective, Zehnder Rittling will at its discretion repair or replace the said item(s).

Defects arising from damage due to shipment, improper installation, negligence or misuse by others are not covered by this warranty.

This warranty is extended only to the original purchaser from Zehnder Rittling.

Extended warranties may be available, please contact the factory for warranty options and pricing: 716-827-6510.

Important

Obligations of purchaser (not included in this warranty):

- Failure to start due to voltage conditions, blown fuses or other damage due to inadequacy or interruption of electrical service.
- Filter replacement or cleaning of evaporator coil, condenser coil or heat exchanger.
- Damage due to freezing of condensing water, inadequate or interrupted water supply, use of corrosive water or rearrangement of plumbing system.
- Damage caused by accident, misapplication, abuse, alteration, tampering or servicing by other than an authorized agency.
- Damage resulting from use of equipment in corrosive atmosphere.
- Damage due to lack of proper maintenance.

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