BOSCH

Installation, Operation, and Maintenance Manual

TW Series Heat Pumps

TW025 | TW035 | TW049 | TW061 | TW122

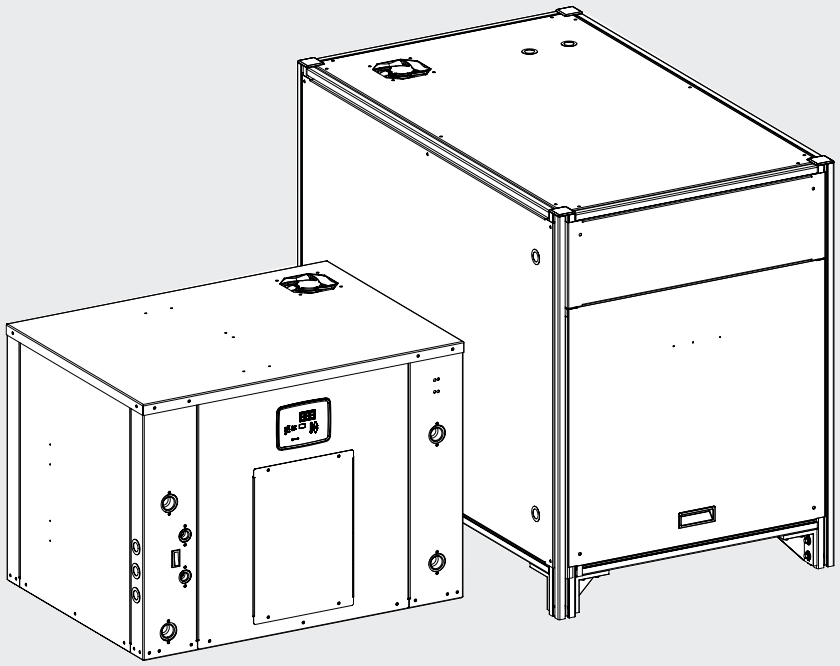

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Table of Contents

1 Document Conventions

1.1 Key to Symbols

1.1.1 Warnings

Warnings in this document are identified by a warning triangle followed by a signal word.

Signal words at the beginning of a warning indicate the type and seriousness of the ensuing risk if measures to prevent the risk are not taken.

The following signal words are defined and can be used in this document:

DANGER

DANGER indicates a situation that, if not avoided, will result in death or serious injury.

WARNING

WARNING indicates a situation that, if not avoided, could result in death or serious injury.

CAUTION

CAUTION indicates a situation that, if not avoided, could result in minor to moderate injury.

NOTICE

NOTICE is used to address practices not related to personal injury.

1.1.2 Important information

The info symbol indicates important information where there is no risk to property or people.

1.2 General Safety Instructions

DANGER

Personal injury hazard or property damage!

Improper installation, adjustment, alteration, service, maintenance, or use can cause explosion, fire, electrical shock, or other conditions that may cause death, 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 the kits or accessories when installing.

DANGER

Electric shock!

Before performing service or maintenance operations on the system, turn OFF main power to the unit. Electrical shock will cause personal injury or death.

WARNING

This product can expose you to chemicals including Lead and Lead components, which are known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.P65Warnings.ca.gov.

WARNING

Personal injury hazard!

Installation and servicing of this equipment can be hazardous due to system pressure and electrical components. Only trained and qualified personnel should install, repair, or service the equipment.

WARNING

Personal injury hazard!

When working on equipment, always observe precautions described in the literature, tags, and labels attached to the unit. Follow all safety codes. Wear safety glasses and work gloves. Use a quenching cloth for brazing, and place a fire extinguisher close to the work area.

WARNING

Fire hazard!

DO NOT use means to accelerate the defrosting process or to clean, unless recommended in these instructions.

WARNING

Fire hazard!

The appliance must be stored in a room without continuously operating ignition sources (for example: open flames, an operating gas appliance, or an operating electric heater).

WARNING

Fire hazard!

Auxiliary devices that may be ignition sources must NOT be installed in the ductwork, unless the auxiliary devices are approved for use with the specific appliance or declared suitable for the refrigerant.

WARNING

Burn Hazard!

Hot surfaces inside unit may cause burns.

WARNING

Personal injury hazard!

This appliance is not intended for use by people (including children) with reduced physical, sensory, or mental capabilities, or with lack of experience and knowledge, unless they are supervised or have been given instruction concerning use of the appliance by a person responsible for their safety.

Children should be supervised to ensure that they do not play with the appliance.

CAUTION

Personal injury hazard!

When servicing horizontal units do not remove top panel while unit is suspended as this compromises unit structure. If top panel removal is required for service, the base of the unit must be completely supported on a level surface strong enough to hold its weight.

CAUTION

Personal injury hazard!

Sheet metal parts may have sharp edges or burrs. Use care and wear appropriate protective clothing and gloves when handling parts.

NOTICE

Product damage!

To avoid equipment damage, DO NOT use these units as a source of heating or cooling during the construction process. Doing so may affect the unit's warranty. The mechanical components and filters will quickly become clogged with construction dirt and debris, which may cause system damage or failure.

1.2.1 Refrigerant Safety Warnings

DANGER

Poisonous gas!

Poisonous gas can be created when refrigerant (R-454B) is exposed to open flames.

WARNING

Risk of fire!

Flammable Refrigerant Used—To be repaired only by trained service personnel. DO NOT puncture refrigerant tubing.

WARNING

Risk of fire!

Flammable Refrigerant Used—Dispose of properly in accordance with federal or local regulations.

WARNING

Personal injury hazard!

DO NOT pierce or burn refrigerant lines.

WARNING

Asphyxiation hazard!

Be aware that refrigerants may not contain an odor.

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

All refrigerant discharged from this unit must be recovered WITHOUT exception. Technicians must follow industry accepted guidelines and all local, state, and federal statutes for the recovery and disposal of refrigerants. If a compressor is removed from this unit, refrigerant circuit oil will remain in the compressor. To avoid leakage of compressor oil, refrigerant lines of the compressor must be sealed after it is removed.

2 Model Nomenclature

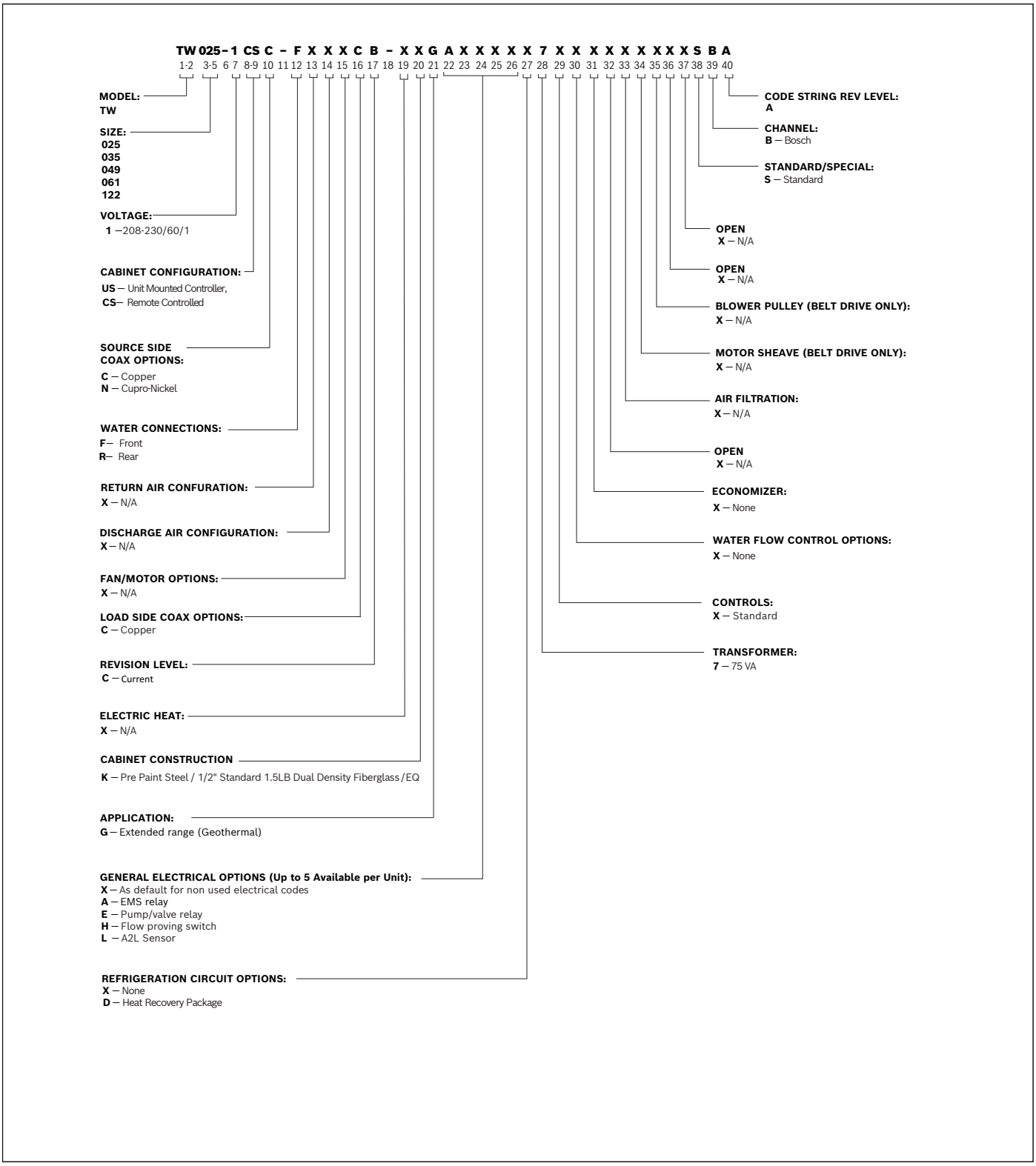

Figure 1 Model Nomenclature

3 Standard TW Package

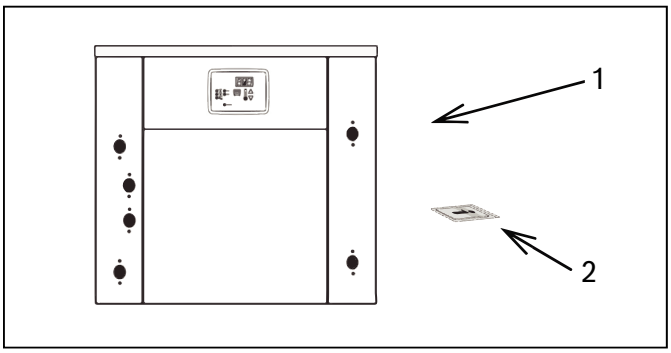

Figure 2 TW Series Water-to-Water Heat Pump

[1] TW Series Water-to-Water
[2] Installation and Operation Manual

General Description

TW series water-to-water heat pumps provide the best combination of performance and efficiency available.

All units are performance certified to American Heating and Refrigeration Institute (AHRI) ISO Standard 13256-2. All TW water-to-water heat pumps conform to UL60335-2-40 standard and are certified by Intertek-ETL.

4 General Description

4.1 Operating Limits

NOTICE

50° F Minimum Entering Water Temperature (EWT) is recommended for water applications with sufficient water flow to prevent freezing. Antifreeze solution is required for all closed-loop applications and EWT below 50°F.

Geothermal applications should have sufficient antifreeze solution to protect against extreme conditions and equipment failure. Frozen water coils are not covered under warranty. Other equivalent methods of temperature control are acceptable.

A heat pump operating under extreme conditions will have limitations on air/fluid flow rates and/or temperatures.

4.1.1 Environment

This equipment is designed for indoor installation only. Extreme variations in temperature, humidity, and corrosive water or air will adversely affect the unit performance, reliability and service life.

4.1.2 Power Supply

A voltage variation of ± 10% of nameplate utilization voltage is acceptable.

Operating limits listed in the Unit Starting Conditions section are not suitable for continuous operating conditions. Assume that such start-up conditions are for the purpose of bringing the building space up to occupancy temperature.

4.1.3 Normal Operating Conditions

Normal operating conditions must fall in the limits defined in the table below. (Refer to Table 1)

Limit			Cooling	Heating
Minimum ambient air			50°F	40°F
Maximum ambient air			100°F	85°F
Rated ambient air			80°F	68°F
Antifreeze Protection Required LWT / EWT			-	< 40 / 50°F
Minimum water coil entering fluid			45°F	30°F
Maximum water coil entering fluid			110°F	90°F
Rated water coil entering fluid	Water Loop application	Load	53.6°F	104°F
		Source	86°F	68°F
	Ground Loop application	Load	53.6°F	104°F
		Source	77°F/68°F (PL)	32°F/41°F (PL)
	Ground Water application	Load	53.6°F	104°F
		Source	59°F	50°F
Maximum operating water pressure		Ground Water	450psi/3102kPa	
Minimum operating water pressure		Standard Unit	1.5 GPM per ton	
NOTE: *Maximum and minimum operating limits may not be combined. If one value is at either maximum or minimum, the other value(s) must be within normal operating range. Refer to Engineer Submittal Sheet on the product information page.*				
ACRONYMS: *LWT: Leaving Water Temperature* *EWT: Entering Water Temperature*				

Table 1 Operating Limits

5 Inspecting and Storing the Equipment

5.1 Moving and Storage

If the equipment is not needed for immediate installation upon its arrival at the job site, it should be left in its shipping carton and stored in a clean and dry area. Units must only be stored or moved in the normal upright position at all times.

NOTICE

Product damage!

Never lift or move units by external piping, or attached options/accessories.

NOTICE

Product damage!

Never stack units when transporting them.

5.2 Initial Inspection

Verify that all items have been received and that there is no visible damage. Note any visible damage or shortage on all copies of the freight bill. Concealed damage not discovered until after removing the units from packaging must be reported to Bosch by the original purchaser by filing a claim at: https://claims.bosch-homecomfort.us

5.3 Inspection and Unpacking Prior to Installation

Inspect the product carefully for any defects or other discrepancies. If any are identified, contact the Bosch Wholesaler/Distributor from which you purchased the unit.

The following should be checked:

- Compare the electrical data on the unit nameplate with ordering and shipping information to verify that the correct unit has been shipped.
- Verify that the unit is the correct model for the entering water temperature of the job.
- Only remove the packaging when the unit is ready for installation.
- Verify that the refrigerant tubing is free of kinks or dents, and that it does not touch other unit components.
- Inspect all electrical connections. Be sure connections are clean and tight at the terminals.
- Remove any shipping brackets from the unit attached to the pallet.

6 Unit Installation

6.1 Location Selection

Unit location selection is very important for proper installation, functioning, and ease of servicing.
When selecting a location for the unit, the following conditions must be met:

- Location must be indoors.
- The ambient temperatures must be maintained above freezing.
- Location must be isolated from sleeping areas, private offices, and other acoustically sensitive spaces.
- Sufficient access to allow maintenance and servicing of the compressor and coils must be allowed.
- An unobstructed path to the unit within the closet or mechanical room must be present.
- Ready access to water valves, fittings, and all electrical connections must be provided.

WARNING

Personal injury hazard!

Installation and servicing of this equipment can be hazardous due to system pressure and electrical components. Only trained and qualified personnel should install, repair, or service the equipment.

NOTICE

Product damage!

These units are not approved for outdoor installation; therefore, they must be installed inside a structure in a conditioned space. Do not locate in areas that are subject to freezing.

NOTICE

Product damage!

DO NOT use TW series units for temporary heating or air conditioning during construction, especially when plastering, sanding, or painting. Warranty will be void if the units are used during construction.

6.2 Installation

The TW series unit must be mounted level on a vibration absorbing pad slightly larger than the base to minimize vibration transmission to the building structure, It is not necessary to anchor the unit to the floor. (See Figure 3)

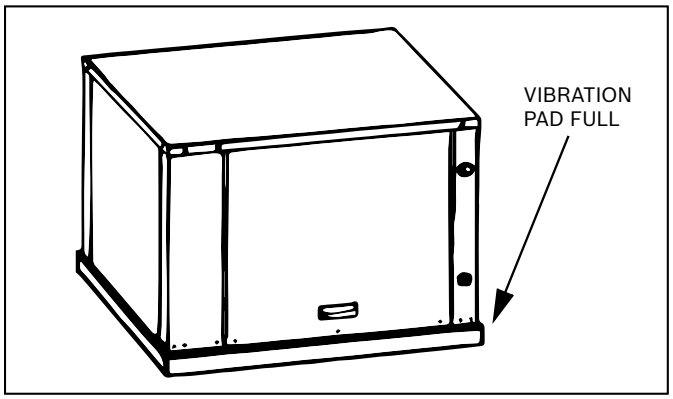

Figure 3 Vibration Pad

6.3 Piping

Supply and return piping must be as large as the unit connections on the heat pump (larger on long runs).

Flexible hoses should be used between the unit and the rigid system to avoid possible vibration.

NOTICE

Product damage!

Never use flexible hoses of a smaller inside diameter than that of the fluid connections on the unit.

TW units are supplied with either a copper or optional cupro-nickel Water to refrigerant Heat Exchanger on the load side. Copper is adequate for ground water that is not high in mineral content. (See Table 9)

Proper testing is required to ensure the well water quality is suitable for use with water source equipment. When in doubt, use cupro-nickel. (See the Water Quality Table 9)

In conditions, anticipating moderate scale formation or in brackish water a cupro-nickel heat exchanger is recommended.

Both the supply and discharge water lines will sweat if subjected to low-water temperature. These lines must be insulated to prevent damage from condensation.

All manual flow valves used in the system must be ball valves. Globe and gate valves must not be used due to their high-pressure drop and poor throttling characteristics.

Ball valves should be installed in the supply and return lines for unit isolation and unit water flow balancing.

6.4 Additional Installation requirements

There are certain requirements that must be met to employ the use of units with R-454B Refrigerant (A2L group) depending on the charge amount per UL 60335-2-40.

Use the following table and further sections to determine requirements and options depending on the unit charge amount.

R-454B Refrigerant Charge	Refrigerant Leak Detection System	Additional Installation Requirement
Less than or equal to 62.8oz	Not required. No further actions needed.	Not required. No further actions needed
Greater than 62.8oz	Installed Standard from Factory	Required Refer to the Installation Options section

Table 2 Installation Requirements

6.4.1 Refrigerant Leak Detection System

The refrigerant leak detection system is standard (factory-installed) for units with refrigerant charge amounts exceeding 62.8 oz, and available as an option for units with refrigerant charge amounts equal to or below 62.8 oz. The refrigerant leak detection system is comprised of three main components: the A2L refrigerant sensor, an exhaust fan, and the UPM board. The A2L sensor continually samples the air and if the concentration of refrigerant detected is higher than the preset threshold (15% LFL), it sends a signal to the UPM, which then switches OFF the compressor and turns ON the exhaust fan. The compressor remains OFF until the saturation level is below 15% LFL and the power is cycled in order to restore normal operations. Once the A2L sensor is connected to the UPM, it must always remain connected. If communication is lost, the UPM enters a refrigerant leak hard lockout fault and energizes the alarm contact.

To test that the communication between the sensor and board is active, the sensor can be disconnected from the UPM, which should simulate a fault. The A2L sensor for the refrigerant leak detection system must only be replaced with the part specified on the spare parts list.

6.4.2 Exhaust Fan

On units with the refrigerant leak detection system, the exhaust fan is installed on the top panel of the unit. There is a finger guard provided for added safety. When the refrigerant sensor detects a leak, the UPM board will immediately activate the exhaust fan.

WARNING

Personal injury hazard!

When the refrigerant leak detection system is installed, the unit must be powered except when servicing.

6.4.3 Installation Options

Option 1

Install the unit in a room larger than the required minimum room area (A_{min}).

The equipment must be installed in a room with a minimum floor area greater than or equal to the area listed in the following chart based on the total refrigerant charge of the system. In this scenario, no additional installation setup is required for refrigerant leak mitigation.

h_0 is the release height, the vertical distance from the floor to the point of release when the appliance is installed.

A_{min} is the required minimum room area for installation.

With this option, A_{min} can be further reduced if unit is installed on a stand. The table below shows the minimum area values at different installation heights.

Model	Refrigerant Charge in the System oz (kg)	Minimum Room Area ft² (m²)			
		Floor Installation	h_0=3.28 ft, 1 m	h_0=3.94 ft, 1.2m	h_0=4.92 ft, 1.5m
TW049	70 (2.0)	239.9 (22.3)	144.3 (13.4)	120.3 (11.2)	96.2 (8.9)
TW061	66 (1.9)	226.2 (21.0)	136.1 (12.6)	113.4 (10.5)	90.7 (8.4)
TW122	142 (4.0)	305.3 (28.4)	292.8 27.2	244.0 22.7	195.2 18.1

Table 3 Minimum Installation Area

H_{alt} refers to the ground level altitude of the installation location.

When installation location altitude is above 1,968 ft (600 m) the minimum room area of the space (A_{min}) must be corrected by multiplying A_{min} by the applicable altitude adjustment factor (AF) shown in Table 4.

Ground level altitude (H_{alt})		A_{min} Adjustment Factor (AF)
ft	m	
0	0	1.00
656	200	1.00
1,312	400	1.00
1,968	600	1.00
2,624	800	1.02
3,280	1,000	1.05
3,937	1,200	1.07
4,593	1,400	1.10
5,249	1,600	1.12
5,905	1,800	1.15
6,561	2,000	1.18

Table 4 Altitude Adjustment Factor

Option 2

If unit is installed in a room with area smaller than Amin, it must be ducted to the outdoors. The duct must not exceed 0.3 in H_2O of static pressure. Refer to table below for CFM requirements.

Model	Total Refrigerant Charge Per Circuit oz (kg)	Minimum Circulation Airflow ft^3/min (m^3/hr)
TW049	70 (2.0)	27 (46)
TW061	66 (1.9)	26 (44)
TW122	71 (2.0)	28 (47)

Table 5 Minimum Circulation Airflow

External Static Pressure (in H_2O)	CFM
0	100
0.10	90
0.15	78
0.20	63
0.25	30
0.30	20

Table 6 Airflow Output of Exhaust Fan

Option 3

Install unit in a machinery room as defined in ANSI/ASHRAE 15 (USA) or CSA B52 (Canada).

7 Electrical—Power Supply Wiring

7.1 High-Voltage Wiring

DANGER

Electric shock!

The system contains an oversize, protective, earthing (grounding) terminal that must be properly connected, otherwise personal injury or death may result.

WARNING

Personal injury hazard!

Field wiring must be installed by qualified and trained personnel.

WARNING

Personal injury hazard or property damage!

Power to the unit must be within the operating voltage range indicated on the unit's nameplate or on the performance data sheet.

NOTICE

Product damage!

Operation of unit on improper line voltage or with excessive phase imbalance will be hazardous to the unit, constitutes abuse and may void the warranty.

NOTICE

Product damage!

All field-installed wiring must comply with the National Electric Code as well as all applicable local codes.

NOTICE

Product damage!

Properly-sized fusible safety switches or HACR circuit breakers must be installed for branch circuit protection. See the unit nameplate for maximum fuse or breaker size.

NOTICE

Product damage!

Operation of unit on improper line voltage or with excessive phase imbalance will be hazardous to the unit, constitutes abuse and may void the warranty.

NOTICE

Product damage!

All high-voltage connections must be torqued as specified by the component's manufacturer.

Refer to the unit's electrical data on the unit's nameplate for wire and branch circuit protection sizing. Supply power voltage and phasing must match the required voltage and phasing shown on the unit's nameplate. Operating the unit below the minimum voltage, above the maximum voltage, or with incorrect phasing can result in poor system performance or damage to the heat pump. All field wiring must be installed by qualified and trained personnel. Refer to the unit's wiring diagram for field connection.

7.1.1 Power Supply and Ground Connections

To minimize the transmission of vibration from the unit cabinet to the building, enclose the power wiring to the heat pump in a flexible conduit.

The unit is provided with concentric knockouts for attaching common trade sizes of conduit. Route the power-supply wiring through the knockout opening and the flexible conduit inside the unit. After the field wiring is routed to the electrical box. Always connect the ground lead to the grounding lug provided in the unit. Follow the unit's wiring diagram and the following instructions for power leads and ground connection depending on unit options.

Standard Units

For standard models, power is connected to the line (L) side of the compressor contactor and the ground to the ground lug in the unit electrical box.

WARNING

Personal injury hazard!

Never route control wiring through the same conduit as power supply wiring.

CAUTION

Personal injury hazard!

The unit ground wire must never be used as a neutral wire.

Transformer Settings for 208/230-V Units

All 208/230-V units are factory wired to 240V by default. For job sites with a 208-V power supply, the primary leads on the unit transformer will need to be changed from 240V to 208V. Refer to the unit wiring diagram for details

7.1.2 Thermostat (Aquastat)

The TW heat pump can be controlled by most commonly available single-stage or two-stage heat pump thermostats, depending on model. The reversing valve on the TW series is energized when the unit is in cooling mode.

Avoid external walls and locations subject to direct sunlight and drafts. Thermostat wiring must be 18AWG (American Wire Gauge). Refer to the installation instructions of the thermostats for further details.

NOTICE

Product damage!

To prevent voltage drops in the control circuit, do not exceed the recommended thermostat wire lengths detailed in Table 8.

7.1.3 VA Capacity

The VA capacity of the transformer must be considered when connecting low-voltage accessories to the heat pump such as thermostats or solenoid valves. Table 7 shows the VA draw of factory-mounted components in the low-voltage heat pump. The total VA draw of the heat pump internal components plus attached accessories must be lower than the VA capacity of the unit control transformer.

WARNING

Personal injury hazard!

Exceeding the transformer capacity will result in low control voltage, erratic unit operation, or damage to the heat pump.

Low Voltage VA Draw			
Standard Construction		Electrical Options	
Component	VA	Component	VA
Reversing Valve Solenoid 1	12	Aux Relay	10
Reversing Valve Solenoid 2*	12	Energy Management Relay	4
Compressor Contactor 1	10	A2L Mitigation Fan	23
Compressor Contactor 2*	10		
UPM board 1st Stage	5		
UPM board 2nd Stage*	5		

Table 7 Low Voltage VA Draw

** Only available on the 2 circuit TW122*

7.1.4 Thermostat / (Aquastat) to HVAC Equipment Wiring

The thermostat may not function properly if the total resistance of any of the thermostat to HVAC equipment wires exceeds 2.5 ohms. To ensure that wire length does not cause excess resistance, refer to Table 8 and ensure that the wires from the thermostat to the HVAC equipment are not too long.

Copper Wire Gauge	Maximum Wire Length
22 AWG (0,33mm2)	150 ft. (46m)
20 AWG (0,50mm2)	240 ft. (73m)
18 AWG (0,75mm2)	385 ft. (117m)

Table 8 Thermostat to HVAC Equipment Wiring Maximum Wire Length

8 Specific Application Considerations

8.1 Well Water Systems

(Refer to Figure 4)

Refer to the Water Qualify Table on page 20 to ensure the water quality is suitably for use with water source equipment. In conditions of brackish water or where moderate scale formation is anticipated, a cupro-nickel heat exchanger is required. In well water applications, water pressure must always be maintained in the heat exchanger to avoid insufficient water flow. This can be accomplished with a control valve or a bladder-type expansion tank. When using a single water well to supply both domestic water and the heat pump care must be taken to ensure that the well can provide sufficient flow for both.

In well water applications a slow-closing solenoid valve must be used to prevent water hammer.

Connect the solenoid valves across Y1 and C1 on the interface board for all. Make sure that the VA draw of the valve does not exceed the contact rating of the thermostat.

8.2 Open Well Water Systems

When a water well is used exclusively for supplying water to the heat pump, operate the pump only when the heat pump operates. A 24 volt, double-pole single-throw (DP/ST) contactor can be used to operate the well pump with the heat pump. When two or more units are supplied from one well, the pump can be wired to operate independently from either unit. Two 24-volt double-pole single-throw relays wired in parallel are required. In either case, a larger sized VA transformer may be required.

The discharge water from the heat pump is not contaminated in any manner and can be disposed of in various ways depending on local codes (i.e., discharge well, dry well, storm sewer, drain field, stream, pond, etc.)

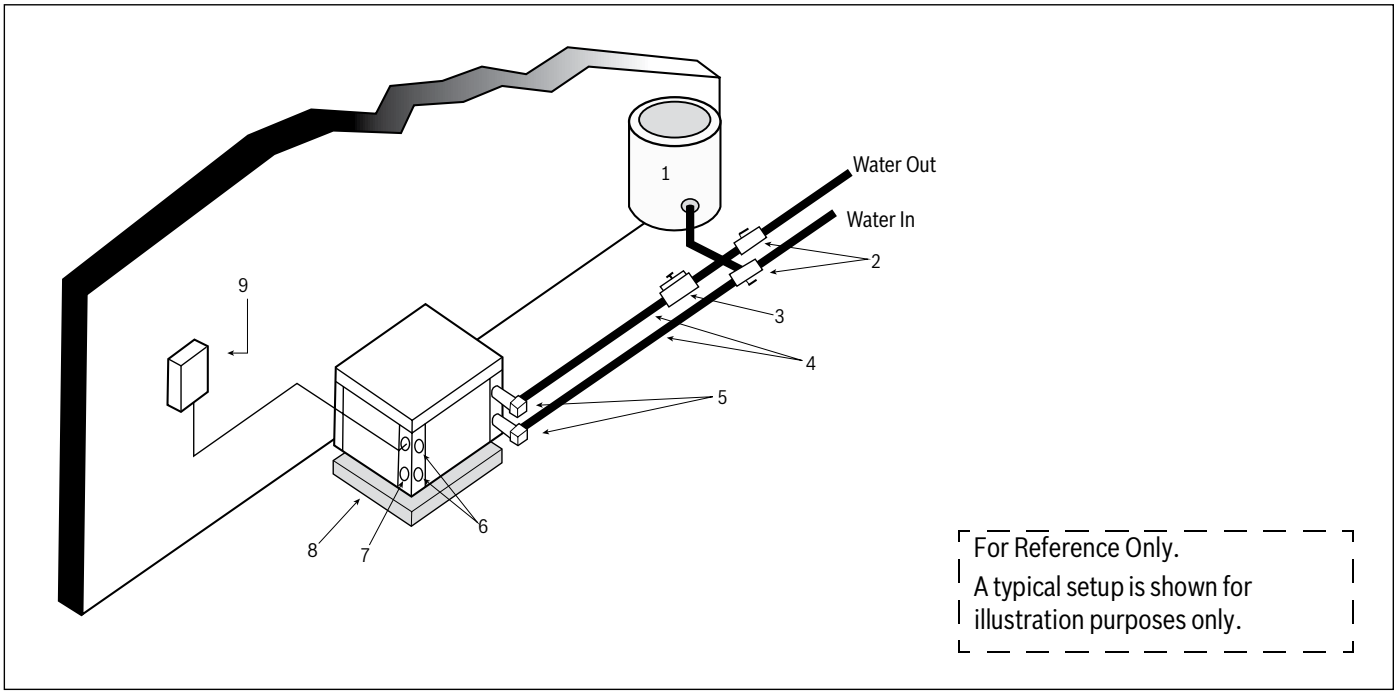

Figure 4 Typical Well Water Setup

[1] Pressure Tank
[2] Ball Valves
[3] Solenoid Valve
[4] Hose Kit
[5] P/T Kit
[6] Load-Side Connections
[7] Low-Voltage Control Connection
[8] Vibration Pad
[9] Line-Voltage Control Connection

8.3 Cooling Tower/Boiler Systems

(Refer to Figure 5)
These systems typically use a common loop temperature maintained at 50°F to 100°F to ensure adequate cooling and heating performance.

In the cooling mode, heat is rejected from the unit into the water loop. A cooling tower provides cooling to the loop water thus maintaining a constant supply temperature to the unit. When utilizing open cooling towers, chemical water treatment is mandatory to ensure the water is free from corrosive elements. A secondary heat exchanger (plate frame) between the unit and the open cooling tower may also be used. It is imperative that all air be eliminated from the closed loop side of the heat exchanger to ensure against fouling. In the heating mode, heat is absorbed from the water loop. A boiler can be utilized to maintain the loop at the desired temperature.

NOTICE

Product damage!

Water piping exposed to extreme low ambient temperatures is subject to freezing.

To ensure against leaks and possible heat exchanger fouling, use an appropriate thread sealant.

- Consult the dimensional drawings starting on page 62 for piping sizes.

To avoid possible vibration, use flexible hoses between the unit and the rigid system. For unit isolation and unit water-flow balancing, install ball valves in the supply and return lines.

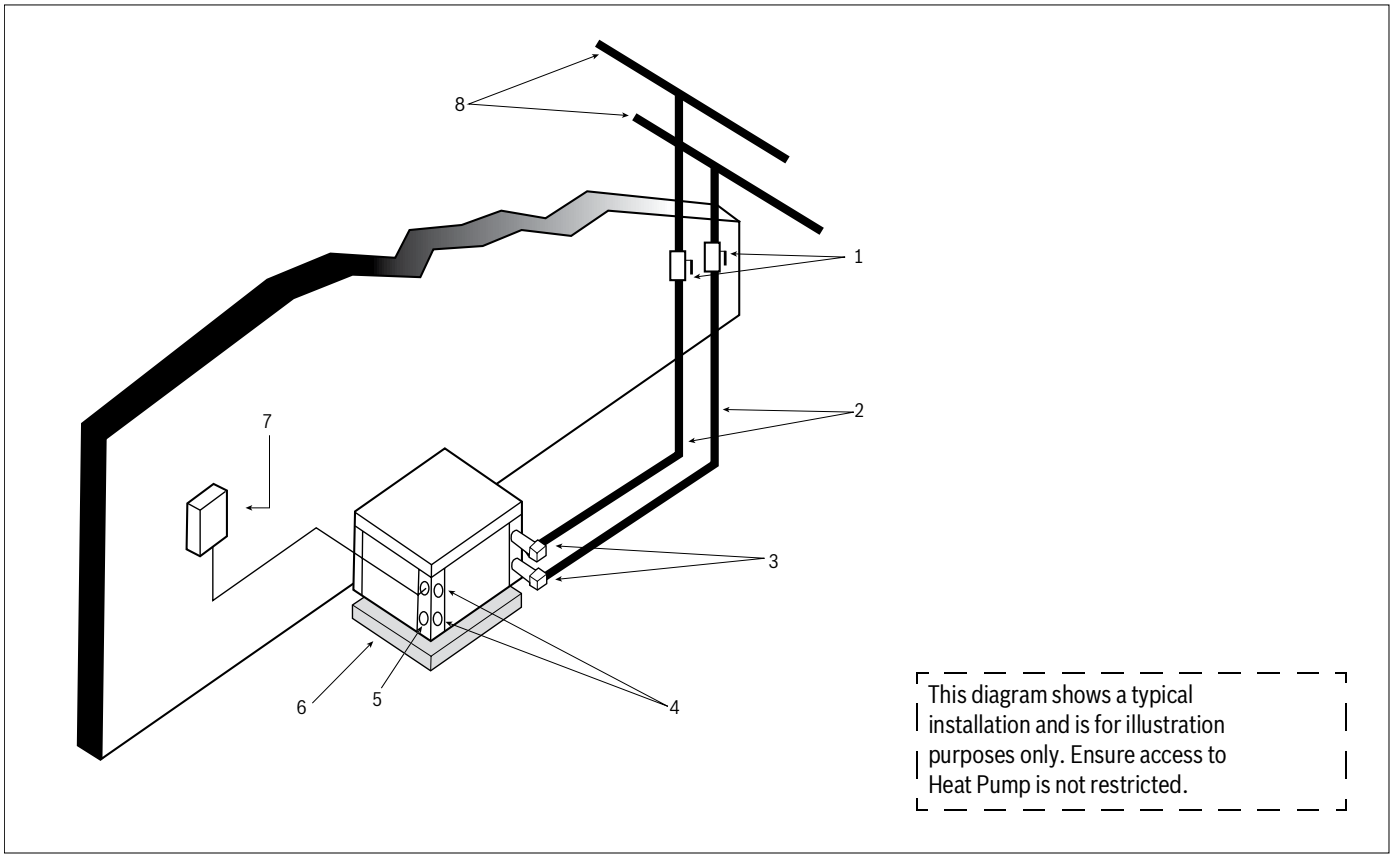

Figure 5 Typical Cooling Tower and Boiler System Setup

[1] Ball Valves
[2] Hose Kits
[3] P/T Plugs
[4] Load-Side Connections
[5] Low-Voltage Control Connections
[6] Vibration Pad
[7] Line-Voltage Disconnect
[8] Supply and Return Line of Central System

8.4 Geothermal Closed-Loop Systems

(Refer to Figure 6)

NOTICE

Product damage!

Closed-loop and pond applications require specialized design knowledge and specialized training.

Using Bosch Flow Centers makes the installation easier.

Anti-freeze solutions must be used when low loop temperatures are expected to occur.

Refer to the GLP installation manuals for more specific instructions.

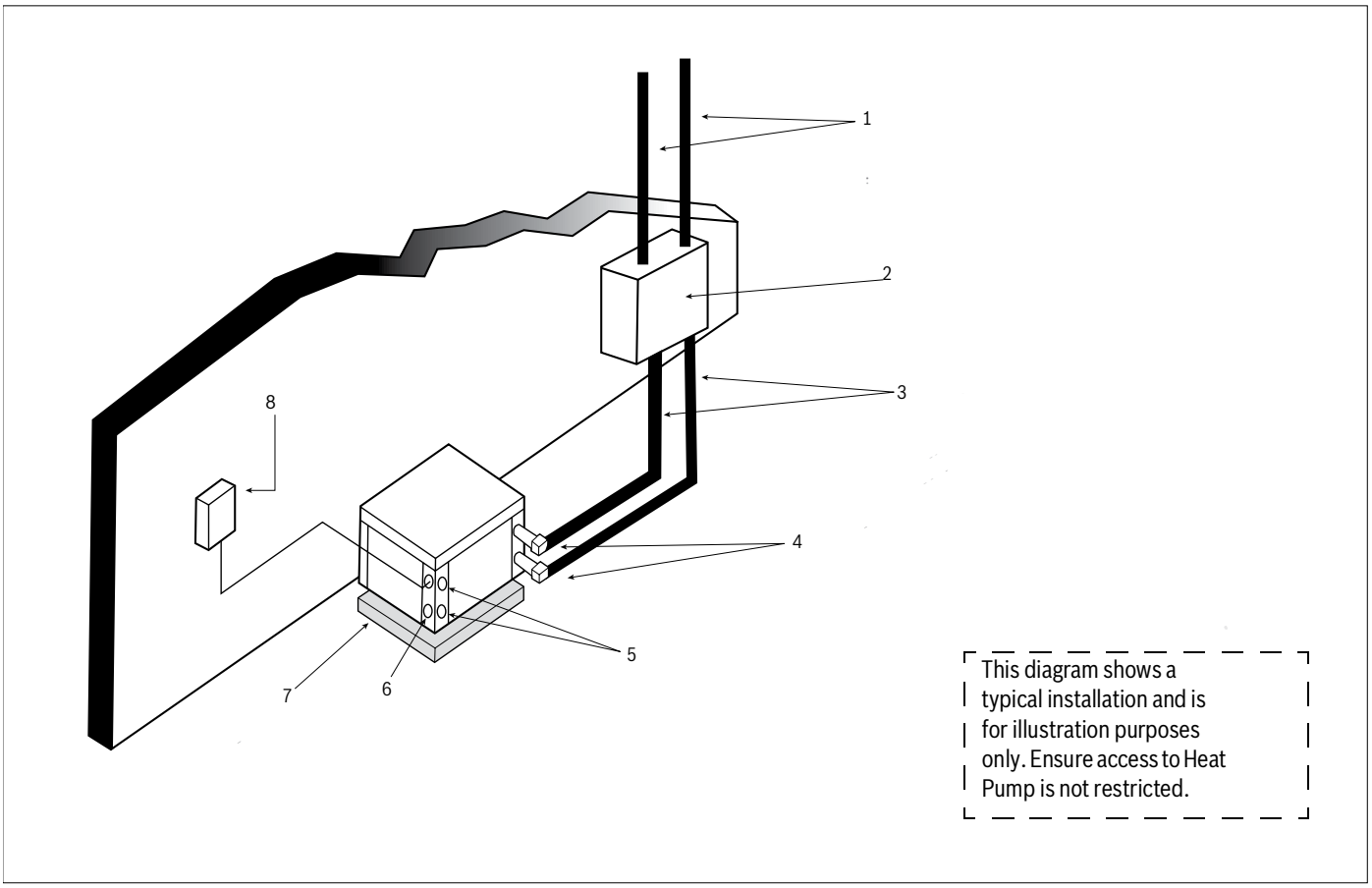

Figure 6 Geothermal Closed-Loop System

[1] Polybutylene or Polyethelene with insulation
[2] Ground loop pumping package (GLP)
[3] Ground loop connection kit
[4] P/T ports
[5] Load-side connection
[6] Low-voltage control connection
[7] Vibration pad
[8] Line voltage disconnect

9 Water-Quality Considerations

NOTICE

Product damage!

Failure to ensure proper water quality and flow rates can shorten the life of the heat pump and potentially void the unit warranty.

Maintaining proper water quality is required to ensure proper operation of the heat pump. (Refer to the Water Quality Table 9.)

For closed loop and boiler/cooling tower systems, water chemistry must be checked and maintained to ensure that corrosive elements, dissolved oxygen, and pH levels are kept in check. It is important to be sure that any additive, antifreeze, or corrosion inhibitor that is added to the water loop is compliant with all applicable laws and regulations and is compatible with copper, brass, and bronze alloys. Ensure that all recommended safety precautions are followed when handling or adding chemicals to the water loop.

For open loop systems, water quality is very important. Table 9 shows acceptable ranges for a variety of water quality factors. The three main concerns in open loop installations are scaling, corrosion, and fouling.

In installations with hard water, scaling due to a buildup of carbonates on the heat exchanger wall can gradually degrade the heat pump performance over time. Heat pumps that are affected by scaling may exhibit low suction pressures in heating and high head pressures in cooling with a gradual loss of capacity and efficiency. Scaled heat exchangers can be cleaned by a qualified technician, but care should be taken to avoid scaling in the first place. To limit scaling, water flow rates should be kept at 3 gallons/minute per nominal cooling ton (a 10°F temperature rise in cooling) and care should be taken to avoid air in the water lines from suction side leaks.

In installations with high hydrogen sulfide, chlorine or ammonia, corrosion is a potential problem. In these installations a cupro-nickel heat exchanger is required along with maintaining proper flow and keeping air out of the system. If water quality is outside of the values in the water quality table, then a closed loop is required. Fouling due to iron bacteria can also pose problems in some open loop installations. Iron bacteria fouling can quickly degrade system performance and plug heat exchangers.

Air in the water system will greatly accelerate the fouling or corrosion process.

10 Water Quality Table

Water Quality			
Potential Problem	Water Characteristic	Acceptable Value	
		Copper	Cupro-Nickel
	pH (Acidity/Alkalinity)	7-9	7-9
Scaling	Hardness ($CaCO_3$, $MgCO_3$)	< 350 ppm	< 350 ppm
	Ryznar Stability Index	6.0 - 7.5	6.0 - 7.5
	Langelier Saturation Index	-0.5 - +0.5	-0.5 - +0.5
Corrosion	Hydrogen Sulfide (H_2S)	< 0.5 ppm *	10-50 ppm
	Sulfates	< 125 ppm	< 125 ppm
	Chlorine	< 0.5 ppm	< 0.5 ppm
	Chlorides	< 20 ppm	< 150 ppm
	Carbon Dioxide	< 50 ppm	< 50 ppm
	Ammonia	< 2 ppm	< 2 ppm
	Ammonia Chloride	< 0.5 ppm	< 0.5 ppm
	Ammonia Nitrate	< 0.5 ppm	< 0.5 ppm
	Ammonia Hydroxide	< 0.5 ppm	< 0.5 ppm
	Ammonia Sulfate	< 0.5 ppm	< 0.5 ppm
	Dissolved Solids	< 1,000 ppm	< 1,500 ppm
Iron Fouling	Iron (Fe2+ Iron Bacteria Potential)	< 0.2 ppm	< 0.2 ppm
	Iron Oxide	< 1 ppm	< 1 ppm
Erosion	Suspended Solids	< 10 ppm, < 600 µm size **	< 10 ppm, < 600 µm size **
	Maximum Water Velocity	6 ft/sec	6 ft/sec
** No "rotten egg" smell present at < 0.5 ppm H2S.*			
*** Equivalent to 30 mesh strainer*			

Table 9 Water Quality

11 Post-Installation System Checkout

After completing the installation and before energizing the unit, the following system checks MUST be made:

1. Verify that the supply voltage to the heat pump is in accordance with the nameplate ratings.
2. Make sure that all electrical connections are tight and secure.
3. Check the electrical fusing and wiring for the correct size.

DANGER

Electric shock!

Ensure the cabinet and electrical box are properly grounded.

4. Verify that the low-voltage wiring between the thermostat and the unit is correct.
5. Verify that the water piping is complete and correct.
6. Check that the water flow is correct and adjust if necessary.
7. Verify that vibration isolation has been provided.
8. Confirm that all access panels are secured in place.

12 Pre-Start-Up

12.1 Check for Correct Compressor Rotation

To maintain optimal performance and prevent mechanical issues, the correct compressor operation must be ensured.

A compressor running in reverse has a noisier than normal operation and lower current draw than its rated value.

To correct the direction of compressor rotation:

1. Turn OFF power to the unit. (Always follow your lock out/tag out procedure.)
2. Remove the necessary access panels.
3. Inspect the compressor wiring. Make sure there are no loose leads, and that the compressor contactor is correctly wired.
4. Secure all panels and restore power to the unit.
5. Turn on the heat pump and confirm that the compressor rotates in the correct direction without unusual noises.

There is a time delay before the compressor will start.

13 Start-up

Use the procedure below to initiate a proper start-up.

1. Restore power to system.
2. Adjust all valves to the full-open position and turn ON the line power to the heat pump unit.
3. Operate unit in the cooling cycle first, then the heating cycle for unit operating limits. Allow 15 minutes between cooling and heating tests for pressure to equalize.

13.1 Unit Start Up Cooling Mode

1. Adjust the unit thermostat to the warmest position. Slowly reduce the thermostat position until the compressor activates.
2. Check the load coil for cool water a few minutes after the unit has begun to operate.
3. Verify that the compressor is ON and that the water flow rate is correct by measuring pressure drop through the heat exchanger using P/T plugs.
4. Check the temperature of both supply and discharge water.

13.2 Unit Start Up Heating Mode

Operate the unit in heating cycle after checking the cooling cycle. Allow five minutes between tests for the pressure to equalize.

1. Turn thermostat to lowest setting and set thermostat switch to HEAT position.
2. Slowly turn the thermostat to a higher temperature until the compressor activates.
3. Check the temperature of both supply and discharge water. If temperature is within range, proceed. If temperature is outside the range, check the heating refrigerant pressures.
4. Check for vibration, noise, and water leaks.

14 Commissioning

Record all system vitals using the “checkout sheet” and keep with equipment. (See page 69.)

15 Safety Devices and the UPM Controller Overview

TW models are equipped with the Unit Protection Module (UPM) that controls the compressor operation and monitors the safety. The TW122 is equipped with a second-stage UPM board.

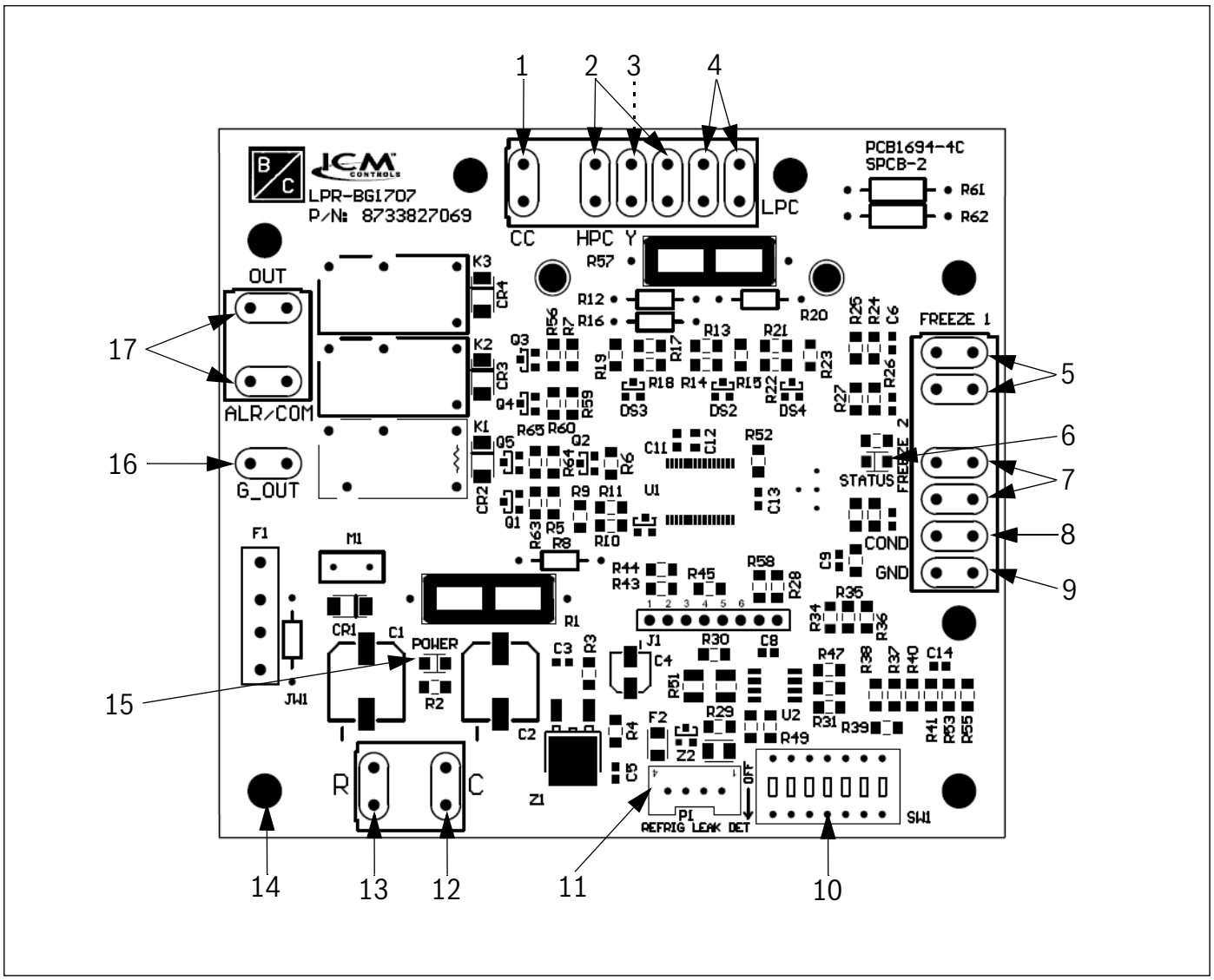

Figure 7 UPM Controller Board

[1] Compressor Contact Output
[2] High-Pressure Switch Connection
[3] Call for Compressor Input Signal (Y1)
[4] Low-Pressure Switch Connection
[5] Source Water Coil Freeze Connection (FREEZE 1)
[6] UPM Status LED Indicator (Fault Status)
[7] Load Coil Freeze Connection (FREEZE 2)
[8] Condensate Overflow Sensor Connection (not applicable to water- to- water units)
[9] Ground
[10] UPM Settings DIP Switch (SW1)
[11] A2L Sensor
[12] 24VAC Power Common
[13] 24VAC Power Input
[14] UPM Standoff
[15] Power LED
[16] Exhaust Fan (Fan in the event of an A2L leakage)
[17] Dry Contact

When a malfunction light is used for diagnostic purposes, the connection is made at the dry contact connection terminals of the UPM board.

15.1 Second-Stage UPM Board

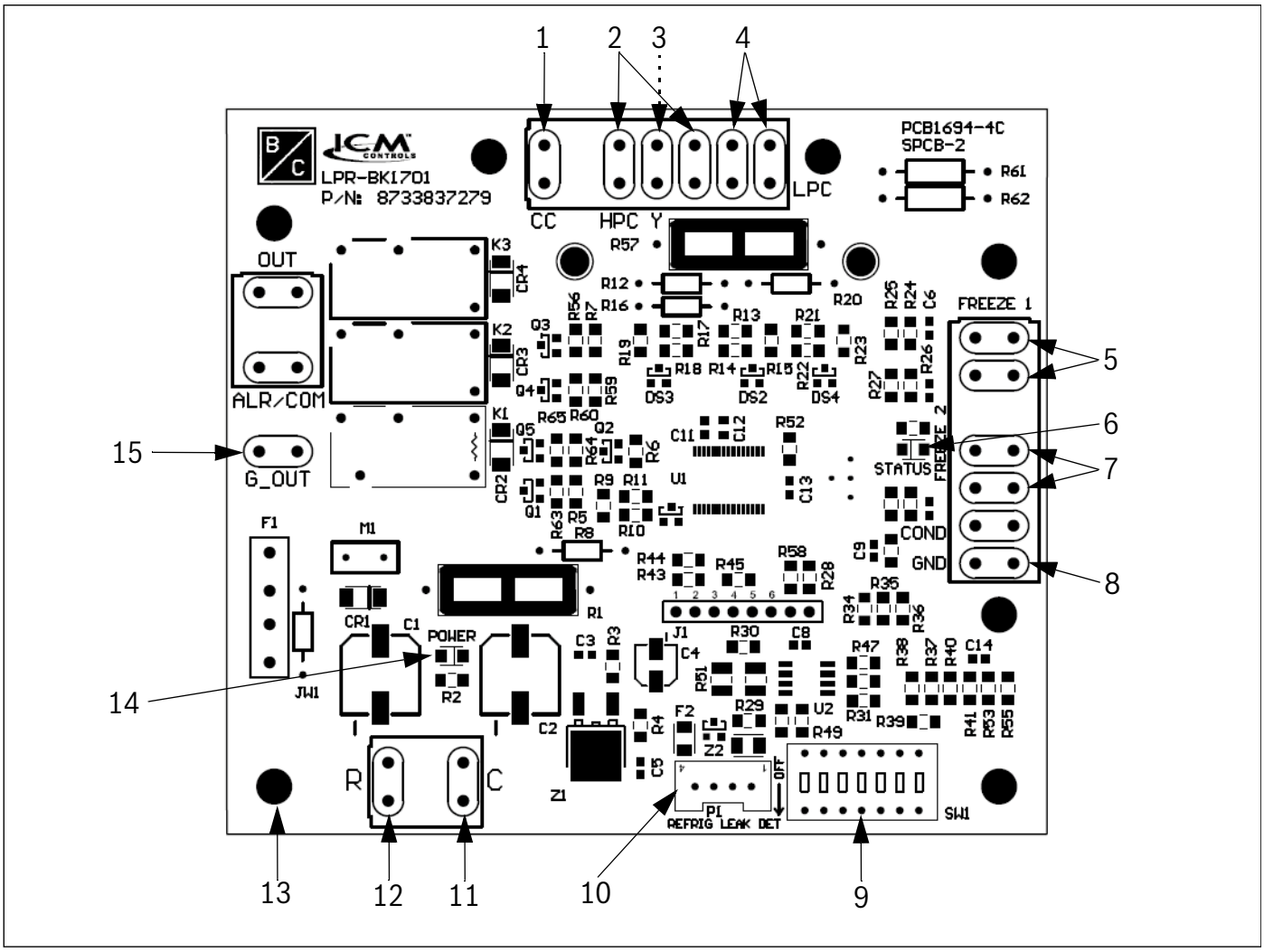

Figure 8 Second-Stage UPM Controller Board

[1] Compressor Contact Output
[2] High-Pressure Switch Connection
[3] Call for Compressor (Y2)
[4] Low-Pressure Switch Connection
[5] Source Coil Freeze Connection (FREEZE 3)
[6] LED Status Indicator (Fault Status)
[7] Load Coil Freeze Connection (FREEZE 4)
[8] Ground Connection
[9] UPM Board Settings DIP Switch
[10] A2L Sensor
[11] 24VAC Power Common
[12] 24VAC Power Input
[13] UPM Standoff
[14] Power LED
[15] Fan (Fan in the event of an A2L leakage)

If the thermostat is provided with a malfunction light powered off of the common (C) side of the transformer, a jumper between “R” and “COM” terminal of “ALR” contacts must be installed.

Each unit is factory equipped with a UPM that controls the compressor operation and monitors the safety controls that protect the unit.
Safety controls include the following:

- High-pressure switch located in the refrigerant discharge line and wired across the HPC (High-Pressure Switch Connection) terminals on the UPM.
- Low-pressure switch located in the unit refrigerant suction line and wired across the LPC (Low-Pressure Switch Connection) terminals on the UPM.
- Source coil freeze protection sensor (FREEZE 1) (Refer to Figure 9), monitors refrigerant temperature between source water coil and thermal expansion valve. If temperature drops below or remains at freeze limit trip for 120 seconds, the controller will shut down the compressor and enter into a soft-lockout condition. The default freeze limit trip is 25°F; however, this can be changed by flipping DIP switch SW1. (Refer to Figure 7, item [10].)(Refer to Figure 10.)

The UPM Board Dry Contacts are Normally Open (NO).

NOTICE

Product damage!

If the unit is employing a fresh water system (no anti-freeze protection), it is extremely important to have the Freeze 1 set to 25°F (DIP Switch SW1 set to OFF) in order to shut down the unit at the appropriate leaving water temperature and protect your heat pump from freezing if a freeze sensor is included.

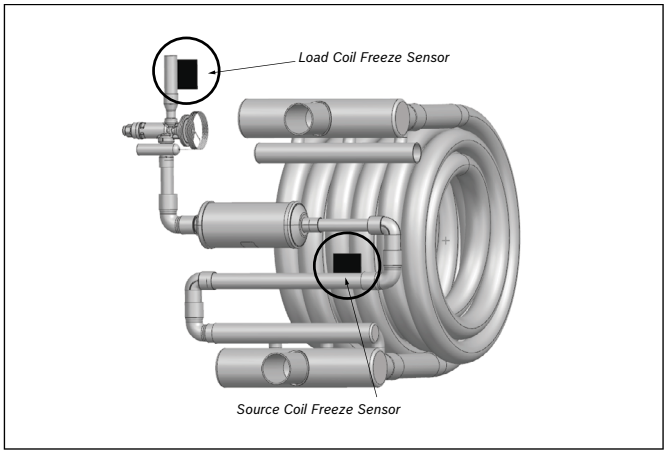

Figure 9 Source Coil Freeze Protection Sensor (FREEZE 1) and Load Coil Freeze Protection Sensor (FREEZE 2).

15.2 UPM Default Settings and DIP Switch Positions

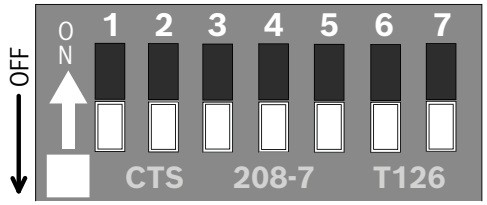

Figure 10 UPM Settings DIP Switch (SW1)

UPM DIP Switch Selectable Positions				
Position	Function	ON	OFF	Factory Default
1	Lockout	4	2	2
2	Reset	R	Y	Y
3	Alarm	Cont	Pulse	Pulse
4	Test	Yes	No	No
5	Freeze 1	15°F	25°F	25°F
6	Freeze 2	15°F	25°F	25°F
7	Pump	ON	OFF	OFF

Table 10 UPM DIP Switch Selectable Positions

NOTICE

Product damage!

DIP switches on units with two UPM boards must have the same settings.

15.3 UPM Board Features

The UPM Board includes the following features:

- **ANTI-SHORT CYCLE TIMER:** Five-minute delay on break timer to prevent compressor short cycling.
- **COMPRESSOR MINIMUM RUN TIME:** The UPM has a minimum compressor run time of five minutes. If Y-call is removed the compressor will remain energized until the five minutes have expired.
- **RANDOM START:** Each controller has an unique random start delay ranging from 270 to 300 seconds on initial power up to reduce the chance of multiple unit simultaneously starting at the same time after power up or after a power interruption, in order to avoid creating a large electrical spike.
- **TEST DIP SWITCH:** The DIP switch position “4” controls the Test function. When it is set to “ON,” it will reduce all time delays settings to 10 seconds during troubleshooting or verification of unit operation. (Refer to Figure 7, item [10].), (Refer to Figure 10.)(See Table 10)

CAUTION

Product damage!

Operation of the unit in test mode can lead to accelerated wear and premature failure of components. The "TEST" switch must be set back to "OFF" after troubleshooting/servicing.

- **LOW-PRESSURE BYPASS TIMER:** If the compressor is running and the low-pressure switch opens, the controller will keep the compressor ON for 120 seconds. After two minutes if the low-pressure switch remains open, the controllers will shut down the compressor and enter a soft lockout. The compressor will not be energized until the low-pressure switch closes and the anti-short cycle time delay expires. If the low-pressure switch opens two or four times in one hour, the unit will enter a hard lockout. In order to exit a hard lockout, power to the unit would need to be reset. The reset signal is either a Y or R signal depending on if DIP switch position “2” is set to ON or OFF. (Refer to Figure 10.)(See Table 10.) If it set to ON, the board must be manually powered OFF and powered back ON to exit the hard lock out.
- **BROWNOUT/SURGE/POWER INTERRUPTION PROTECTION:** The brownout protection in the UPM board will shut down the compressor if the incoming power falls below 18 VAC. The compressor will remain OFF until the voltage is above 18 VAC and the anti-short cycle timer (300 seconds) times out. The unit will not go into a hard lockout.
- **MALFUNCTION OUTPUT:** Alarm output is normally open (NO) dry contact. If pulse is selected the alarm output will be pulsed. The fault output will depend on the DIP switch setting for "ALARM." (Refer to Figure 10.)(See Table 10.) If DIP switch position “3” is set to “ON,” a constant signal will be produced to indicate a fault has occurred and the unit requires inspection to determine the type of fault. If it is set to“OFF," a pulse signal is produced and a fault code is detected by a remote device indicating the fault. (For blink code explanation, see Table 11.) The remote device must have a malfunction detection capability when the UPM board is set to "PULSE."

Blinks	Fault	Fault Criteria
None	None	All fault conditions normal.
1	High Pressure	Refrigerant discharge pressure has exceeded 600 PSIG.
2	Low Pressure	Refrigerant suction pressure has fallen below 40 PSIG.
3	Source Coil Freeze Condition	Refrigerant temperature to the water coil has fallen below 25°F for 120 seconds.
4	Condensate Overflow	Condensate levels in the unit drain pan are too high. (not applicable to water-to-water units)
5	Brownout	Control voltage has fallen below 18 VAC.
6	Load Coil Freeze Condition	Refrigerant temperature to the load coil has fallen below 25°F for 120 seconds.
7	Refrigerant Leak Fault	Refrigerant LFL% is more than 15%.

Table 11 UPM Fault Blink Codes

Blinks	Fault	Fault Criteria
None (Solid)	None	None. Adequate 18-30 VAC power is present.
1	High Pressure Sensor #1	Refrigerant discharge pressure has exceeded 600 PSIG.
2	Low Pressure Sensor#1	Refrigerant suction pressure has fallen below 40 PSIG.
3	High Pressure Sensor #2	Refrigerant discharge pressure has exceeded 600 PSIG.
4	Low Pressure Sensor #2	Refrigerant suction pressure has fallen below 40 PSIG.
5	Freeze Sensor #1 Source Coil Freeze Condition	Refrigerant temperature to the source coil has fallen below 25°F for 30 seconds.
7	Brownout	Control voltage has fallen below 18 VAC.
8	Freeze Sensor #2 Load Coil Freeze Condition	Refrigerant temperature to the load coil has fallen below 25°F for 30 seconds
9	Freeze Sensor #3 Source Coil (circuit 2) Freeze Condition	Refrigerant temperature to the source coil (circuit 2) has fallen below 25°F for 30 seconds.
10	Freeze Sensor #4 Load Coil (circuit 2) Freeze Condition	Refrigerant temperature to the load coil (circuit 2) has fallen below 25°F for 30 seconds
11	Refrigerant Leak	Refrigerant concentration has fallen outside of acceptable range(above 15% LFL, refer to leak detection system section)
12	Second-Stage UPM Board Fault	Lost communication with the Second Stage UPM board

Table 12 Second-Stage UPM Fault Blink Codes

Hot Water Switch

All water-to-water units have a temperature safety switch installed on the load coil. This switch is set to open when it senses that the water temperature in the load coil has reached 145°F (+/- 5°F). When this occurs, compressor operation will cease, and will not resume until the water has cooled to 115°F (+/- 9°F). One single hot water switch can be used for both single and dual circuit units.

- **FREEZE SENSOR:** The default setting for the freeze limit trip is 25°F (FREEZE 1); however, this can be changed to 15°F by flipping the DIP switch position "5" (Refer to Figure 7, item [10]) (Refer to Figure 10), freeze limit trip should only be changed to 15°F when a closed loop system with appropriate antifreeze mixture is used. **Since Freeze Sensor 2 is dedicated to monitoring the load side coil, it is recommended to leave the factory default setting on the board.** The UPM controller will constantly monitor the refrigerant temperature with the sensor (FREEZE 1) mounted close between the thermal expansion valve and the source water coil. If the temperature drops below or remains at the freeze-limit trip for 120 seconds, the controller will shut the compressor down and enter into a soft-lockout condition. Both the status LED and the alarm contact will be active. The status LED will be active, blinking the fault code. The LED will flash (three times) the code associated with this alarm condition. If this alarm occurs two times (or four if DIP switch position "1" is set to "ON") within an hour, the UPM controller will enter into a hard-lockout condition. It will constantly monitor the refrigerant temperature with the sensor (FREEZE 2) mounted between the thermal expansion valve and load coil, as shown in Figure 9. If the temperature drops below or remains at the freeze limit trip for 120 seconds, the controller will shut the compressor down and enter into a soft-lockout condition. Both the status LED and the alarm contact will be active. The status LED will be active, blinking the fault code. The LED will flash six times the code associated with this alarm condition. If this alarm occurs two times (or four times if DIP switch position "1" is set to "ON")(Refer to Figure 10) (See Table 11) within an hour, the controller will enter into a hard-lockout condition.

NOTICE

Product damage!

The freeze sensor (FREEZE 1) will not guard against the loss of water. A flow switch is recommended to prevent the unit from running if water flow is lost or reduced.

- **INTELLIGENT RESET:** If a fault condition is initiated, the five-minute delay on break time period is initiated and the unit will restart after these delays expire. During this period the fault LED will indicate the cause of the fault. If the fault condition still exists or occurs two or four times (depending if the Lockout DIP switch position "1" is set to "OFF" or "ON") (Refer to Figure 10) (See Table 10 on page 25) before 60 minutes, the unit will go into a hard lockout and requires a manual lockout reset.
- **LOCKOUT RESET:** The method to exit a hard lockout depends of the Reset DIP switch setting:
  - To clear a hard lockout when the DIP switch position "2" is set to "OFF" (Y), power can be cycled OFF then back ON either at the unit's thermostat or at the circuit breaker.
  - To clear a hard lockout when the DIP switch position "2" is set to "ON" (R), power must be cycled OFF then back ON at the circuit breaker (not at the thermostat).

(Refer to Figure 10.) (See Table 10 on page 25.)

The blower motor will remain active during a lockout condition.

- **PUMP DIP SWITCH:** When DIP switch position "7" is set to "ON" and no Y call has been received in the past 8 hours, the compressor will have a delay of 30 seconds to allow a loop pump to circulate water before compressor starts. (Refer to Figure 10.) (See Table 10.)

15.4 UPM Sequence of Operation

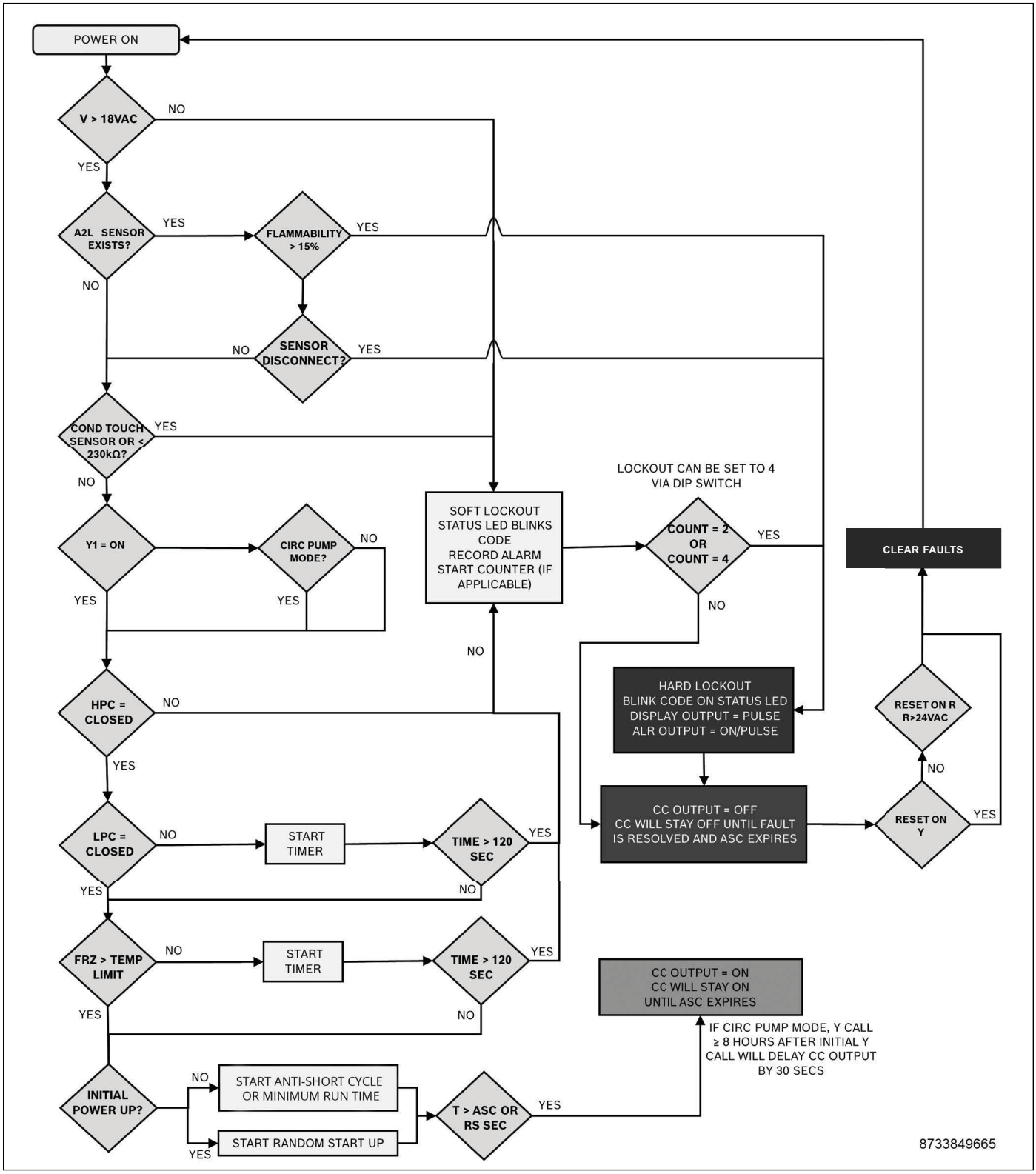

Figure 11 UPM Sequence of Operation Flowchart

16 Water to Water Unit Mounted Controller (Optional)

The Bosch water heat pump controller provides an economical and straightforward solution for managing a water-to-water heat pump unit. It is configurable to offer cooling only, heating only, or auto changeover control strategies based on the unit's application within a system.

The unit mounted controller (UMC) works in tandem with the unit protection module (UPM), which is installed on all units. Depending on temperature readings from the water and changeover sensor, the UMC will send signals to the UPM board to control compressor operation. In addition to functioning as a thermostat, the UMC will display high- and low-pressure fault codes specific to each circuit. All UPM safety functions and fault codes outlined in this manual are applicable.

In addition to the functions of the UPM, the UMC offers the following features:

Features:

- Selectable mode of operation: Cooling, Heating, or Auto Changeover, indicated by a color LED.
- Adjustable temperature differential for heating and cooling set points.
- Adjustable auto changeover set point with adjustable dead band setting.
- Intelligent auto reset of fault conditions to avoid nuisance hard lockouts.
- LED display showing control temperature and set points.
- ℉ or ℃ display options.
- Operates at 50/60 Hertz.
- Configurable pump operation for continuous or cycling operation with the compressor.
- Compressor lead-lag operation for units with dual compressors.
- Malfunction output and service LED can be set to steady or pulsing to indicate high- and low- pressure fault conditions. All other faults (including A2L) will be indicated by the UPM board.
- Set point retention in non-volatile memory in the event of a power failure.
- Five-minute anti-short cycling delay.

16.1 Unit Sensors

The unit controller is equipped with two sensors:

Water Sensor: This sensor regulates unit operation in cooling or heating mode based on the water temperature on the load side. It can be field-mounted, for example, on the return water line or in a water tank when used with a field-supplied immersion well. The specific location will depend on the job requirements.

Changeover Sensor: This sensor switches the unit between heating and cooling modes depending on the set point. It can be mounted in a location indicative of whether the unit should be in heating or cooling mode, such as outdoors. The sensor can be located up to 1000 feet from the unit, requiring additional field-supplied wiring.

16.2 Modes of Operation

The controller retains the last mode used before power removal and resumes that mode upon power restoration. In all modes, the control displays the temperature differential setting for five seconds upon powering up, during which adjustments can be made. Subsequently, the display switches to the monitored water temperature. When switching modes, the set point for the new mode is displayed for five seconds, allowing for adjustments.

Off Mode: In Off Mode, all outputs are disabled, and mode indication LEDs are off. The control first displays the temperature differential setting for user adjustment, then displays "OFF," and finally shows the water temperature.

Heating Mode: In Heating Mode, if the controlled water temperature is below the set point minus the differential setting, terminal Y1 closes, and the unit operates (first stage compressor in a two-stage unit). When the set point is satisfied, the compressor turns off. In a two-stage unit, if the water temperature drops an additional two degrees below the set point, the second stage (terminal Y2) activates (if configured for both compressors). Both stages remain on until the set point is satisfied. Upon power application or mode change from cooling to heating, if the fluid temperature is below the set point and remains unchanged for three minutes, the second stage of heating activates (applicable to two-stage machines). There is a five-minute delay on break after the unit cycles off due to temperature, power interruption, or fault condition. The control ignores a low-pressure switch condition for 120 seconds before turning off the compressor.

Cooling Mode: : In Cooling Mode, if the leaving water temperature exceeds the set point plus the differential setting, terminal Y1 closes (first stage compressor of a two-stage unit), and the unit operates in cooling mode. When the set point is satisfied, the compressor turns off. The reversing valve is always activated in cooling mode. In two-stage units, if the water temperature rises two degrees above the set point after first stage activation, the second stage (terminal Y2) activates (if configured for both compressors). Both stages remain on until the set point is satisfied. Upon power application or mode change from heating to cooling, if the fluid temperature exceeds the cooling point and remains unchanged for three minutes, the second stage of cooling activates (applicable to two-stage machines). There is a five-minute delay on break after the unit cycles off due to temperature, power interruption, or fault condition.

Auto Changeover Mode: The controller's auto changeover mode switches between heating and cooling based on the changeover sensor setting. There is a dead-band where the control does not call for heating or cooling, adjustable in configuration mode. When auto changeover mode is selected, the changeover set point is displayed for five seconds but is only adjustable in configuration mode. Once switched to heating or cooling mode, pressing the up or down buttons displays the set point for that mode. If the changeover sensor reading exceeds the set point plus the dead-band setting, the unit operates in cooling mode, maintaining the cooling set point temperature. The user can adjust the cooling set point while in cooling mode. Similarly, if the changeover sensor reading falls below the set point minus the dead-band setting, the unit switches to heating mode, maintaining the heating set point temperature. The user can adjust the heating set point while in heating mode. When the sensor reading enters the dead-band zone, it terminates the call for heating or cooling even if the set points are not satisfied. Mode switching follows a HEAT – COOL – OFF loop. If the changeover sensor is shorted in auto changeover mode, the control switches to OFF mode. If no sensor is connected, the controller indicates a sensor error code.

16.3 Unit Protection

The unit controller protects against high- or low-pressure conditions and brownouts. An intelligent reset function allows the unit to restart once in the event of a fault condition to avoid nuisance lockouts. If a fault condition occurs on any circuit, the corresponding compressor turns off, and a five-minute delay on break timer initiates. After the delay, the unit attempts to restart. If the fault persists or reoccurs within 60 minutes, the unit enters a hard lockout, requiring a manual reset. During this period, the fault LED indicates the fault cause. A 120-second delay is built into the low-pressure switch to avoid nuisance trips with low fluid temperatures. In a soft lockout condition, the display shows the specific fault (e.g., LP1), and the "service" LED turns on according to the malfunction mode. If set to "steady," the service LED remains on; if set to "pulse," the service LED blinks according to the blink code.

All other faults such as freeze fault on source coil, freeze fault on load coil, and A2L leak are communicated via the fault LED on the UPM board. Viewing these faults requires the removal of the control panel cover.

16.3.1 Lockout Reset

- To clear a hard lockout when the UPM DIP switch position “2” is set to “OFF” (Y), the power can be cycled OFF then back ON by pressing the UMC’s “MODE” button 3 times or at the circuit breaker.
- When DIP switch position “2” is set to “ON” (R), refer to the UPM section for reset instructions.

16.3.2 Brownout Protection

The control disables all outputs if the supply voltage drops below 17 VAC. Outputs are re-enabled if the supply voltage rises and remains above 17 VAC for five minutes. During this time, the control displays "bro."

16.4 Manual Lockout

Blink Code	Fault Condition
One blink	High pressure circuit 1
Two blinks	Low pressure circuit 1
Three blinks	High pressure circuit 2
Four blinks	Low pressure circuit 2

Table 13 UPM Manual Lockout

The unit or refrigeration circuit will enter a manual lockout if the high-pressure switch (HPS) or low-pressure switch (LPS) opens (LPS open for more than 120 seconds each time) within one hour. During manual lockout, the compressor(s) are turned off and locked out, and the display will indicate the fault (e.g., LP1). The "service" LED malfunction output will either be steady or blink according to the malfunction mode described above. When the compressor selection is set to "Du" (see configuration), and one compressor locks out, the control will switch the call to the other compressor.

16.5 Pump Cycling

When equipped with the optional pump relay, the controller will cycle the load pump, source pump, or both in conjunction with compressor operation. Refer to the typical wiring diagram for further details.

16.6 Operating Instructions

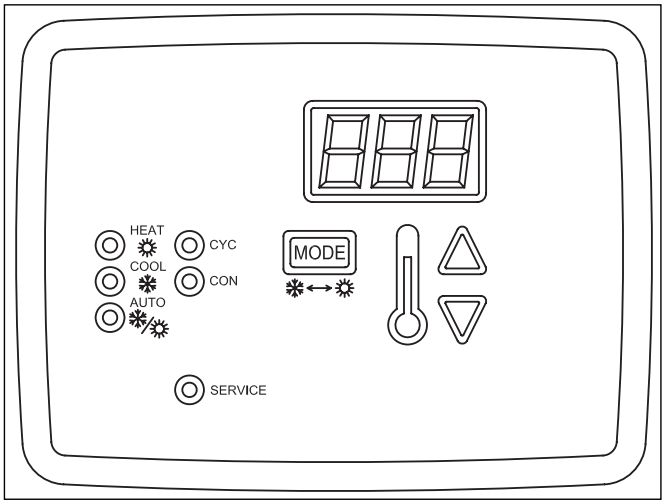

Figure 12 Unit Mounted Controller

16.6.1 User Interface

The following parameters are displayed on the screen:

- Control fluid temperature when in normal mode
- Settings within the configuration mode
- Individual operating mode temperature set points
- Fault display

16.6.2 UP Button

- Press once to display the current set point temperature.
- After current set point temperature is displayed, pressing again will increment the set point 1 degree for every push. Pressing and holding the up button will increment the set point at a rate of 4 degrees per second.
- When pressed together with the down arrow for 5-seconds, the control will display the current temperature scale (Fahrenheit or Celsius).
- Can be used to change the settings for: temperature scale, dead band, test mode, initial delay, compressor, pump, and malfunction settings.

16.6.3 DOWN Button

- Press once to display the current set point temperature.
- After current set point temperature is displayed, pressing again will decrease the set point 1 degree for every push. Pressing and holding the down button will decrease the set point at a rate of 4 degrees per second.
- When pressed with the up arrow for 5- seconds, the control will display the current temperature scale (Fahrenheit or Celsius).
- Can be used to change the settings for: temperature scale, dead band, test mode, initial delay, compressor, pump, and malfunction settings.

16.6.4 LED Indicators

Mode	Indication
HEAT	Red LED to Indicate that the control Is In the HEATING mode
COOL	Green LED to Indicate that the control Is In the COOLING mode
AUTO	Yellow LED to Indicate that the control Is In AUTO mode
CON	Red LED to Indicate that pump(s) are selected for continuous operation
CYC	Red LED to Indicate that pump(s) are selected for cycling operation
SERVICE	Red LED will turn steady on or blink to Indicate that a pressure switch has opened

Table 14 UMC LED Indicators

16.6.5 User Adjustable Settings Chart

Settings	Range	Default
TEMP SETTING	40-120° F Heating and Cooling	
DIFFERENTIAL	1-10°F	1°F
MODE	Heat, Cool, Auto, Off	Off
TEMP SCALE	F°, C°	F
PUMP MODE	Con (continuous), Cyc (cycle)	Von
DEAD BAND	1-6°F	3°F
AUTO CHANGE OVER	55-85°F	65°F
TEST MODE	De (delay). or Nd (No delay)	De
COMPRESSOR*	Du (Dual)	Du
LEAD LAG	0-14 Days	0
MALFUNCTION	St (Steady), Pu (Pulsing)	St

Table 15 User Adjustable Settings

**The compressor setting on TW residential units should only be set to dual.*

Upon unit power-up, the LED display will show the software version and the temperature differential setting, allowing the user to adjust it for ten seconds. It will then display "OFF" before finally showing the control temperature of the fluid being measured (e.g., entering fluid, leaving fluid, tank). The default differential setting is 1°F and can be adjusted from 1°F to 10°F at startup. The differential setting represents the difference between the set point temperature and the actual on/off temperature of the machine.

For example:

Cooling Mode: If the cooling set point is 45°F and the differential is 1°F, the heat pump will cycle on at 46°F. In a two-stage machine, stage 2 will activate at 48°F (2°F above the set point and 1°F differential). The unit will shut off at the set point.

Heating Mode: If the heating set point is 120°F and the differential is 1°F, stage one will activate at 119°F and stage 2 at 117°F. Both stages will remain running until the set point is achieved. Stage 1 and stage 2 will cycle on and off according to the programmed lead/lag interval.

Whenever there is a demand for heating or cooling, and during the first stage of operation the temperature does not change, the control will activate the second stage after a three-minute delay from the first stage activation. This logic applies upon power-up, after a power interruption, when the mode function is set to OFF and then back to either HEAT or COOL, and when switching between heating and cooling in auto changeover mode.

Heating and cooling set points are adjusted by selecting each mode on the keypad and using the up-down arrows to set the desired temperature. For instance, press the cool mode button and use the down arrow to set 45°F, or press the heat mode button and use the up arrow to set 120°F.

The controller can be configured to control heating only, cooling only, or auto change modes. The mode button is pressed until the circular LED is lit next to the chosen control mode.

17 Initial Configuration

After powering up and completing the initial steps, the default configuration settings can be modified. To enter configuration mode, hold down the up and down arrow buttons simultaneously for 10 seconds. If no commands are given within a 10-second period, the controller will exit configuration mode.

Review the following steps and enter the desired values at each display field to avoid a timeout period while configuring. This will also provide a record of the initial configuration settings.

First Display Field
Temperature scale (°C or °F). Select using the up or down arrows. Press the "mode" key to advance.

- Scale: _____

Second Display Field
Pump operation (Continuous or Cyclic). This setting controls the load or source pump output relay. Select continuous pump or cyclic pump mode to cycle with the compressor using the up or down arrows. Press the "mode" key to advance.

- Mode: _____

Third Display Field
Changeover dead band setting (1 to 6 degrees). Adjust using the up or down arrows. The dead band setting is used in auto change mode and defines the range where the unit will not operate, preventing rapid cycling between modes. Press the "mode" key to advance.

- Value: _____

Fourth Display Field
Auto changeover set point (S2), adjustable from 55 to 85 degrees. Adjust using the up or down arrows. The auto changeover sensor should be located in an area indicative of whether the unit should be in heating or cooling mode. Press the "mode" key to advance.

- Value: _____

Fifth Display Field
Test mode setting should only be controlled by the DIP switch (position 4) located on the UPM board. When DIP switch is set to "ON", time delays will be eliminated

- Setting: _____

Sixth Display Field
Compressor setting must always be set to "Du" for dual. "Si" should never be selected for the TW residential product.

- Setting: _____

Seventh Display Field
Lead/lag setting on the TW122 can be adjusted from 0 to 14 days for compressor rotation sequence. **This must be set to 0 for all other sizes.** Select using the up and down arrows. Press the "mode" key to advance.

- Setting: _____

Eighth Display Field
Malfunction output setting (Pu for pulsed or St for standard constant on). This setting configures the malfunction output relay to mimic the fault blink code causing the safety lockout, useful for remote monitoring and troubleshooting. Select using the up or down arrows. Press the "mode" key to advance.

Note: Since the UPM board will display every fault (including A2L), it is recommended that the UPM alarm contacts are used instead of the UMC.

- Setting: _____

The controller is now configured and fully operational. A copy of this configuration sheet should be left with the homeowner or building manager for their records of initial control settings.

18 Options

A number of options are available on TW Series of Heat Pumps. The following details the purpose, function, and components of each option.

18.1 Heat Recovery Package (HRP)

The heat recovery package is a factory-installed option on TW series heat pumps. The HRP can be used to heat potable water during unit operation using waste heat from the compressor discharge gas. In some cases, the HRP can provide most or all of the hot water requirements for a typical home.

The HRP consists of three major components:

- Double-walled, vented refrigerant-to-water heat exchanger
- Circulating pump, and
- Control circuit.

The heat exchanger is rated for use with potable water and is acceptable for use as a domestic water heating device in most building codes. The pump circulates water between the domestic hot water tank and HRP heat exchanger in the Heat Pump.

The control circuit ensures that the HRP only operates when there is available heat from the compressor, and when the domestic hot water is within a safe temperature range of below 120° F.

When the heat pump compressor operates, the HRP monitors the temperature of the discharge gas from the compressor. Once discharge gas is hot enough to provide useful heat to the domestic water tank, the circulating pump is enabled, drawing water from the tank through the HRP heat exchanger and then depositing the heated water back into the tank.

The HRP is provided with an ON/OFF switch in case the end user desires that the HRP be inactivated (typically during the winter months when space heating is most important).

NOTICE

Product damage!
If the heat recovery unit is installed in an area where freezing may occur, the unit must be drained during winter months to prevent heat exchanger damage. Heat exchanger ruptures that occur due to freezing will void the heat recovery package warranty along with the heat pump warranty.

18.1.1 HRP Water Tank Preparation

1. Turn OFF electrical or fuel supply to the water heater.
2. Attach garden hose to water tank drain connection and run other end of hose outdoors or to an open drain.
3. Close cold water inlet valve to water heater tank.
4. Drain tank by opening drain valve on the bottom of the tank, then open pressure relief valve or hot water faucet.
5. Once drained the tank should be flushed with cold water until the water leaving the drain hose is clear and free of sediment.
6. Close all valves and remove the drain hose.
7. Install HR water piping.

All hot water piping should be a minimum of 3/8th O.D. copper tube to a maximum distance of fifteen (15) feet. For distances beyond fifteen feet but not exceeding sixty (60) feet, use a 1/2" copper tube. Separately insulate all exposed surfaces of both connecting water lines with 3/8" walled closed-cell insulation. Install isolation valves on the supply and return to the heat recovery.

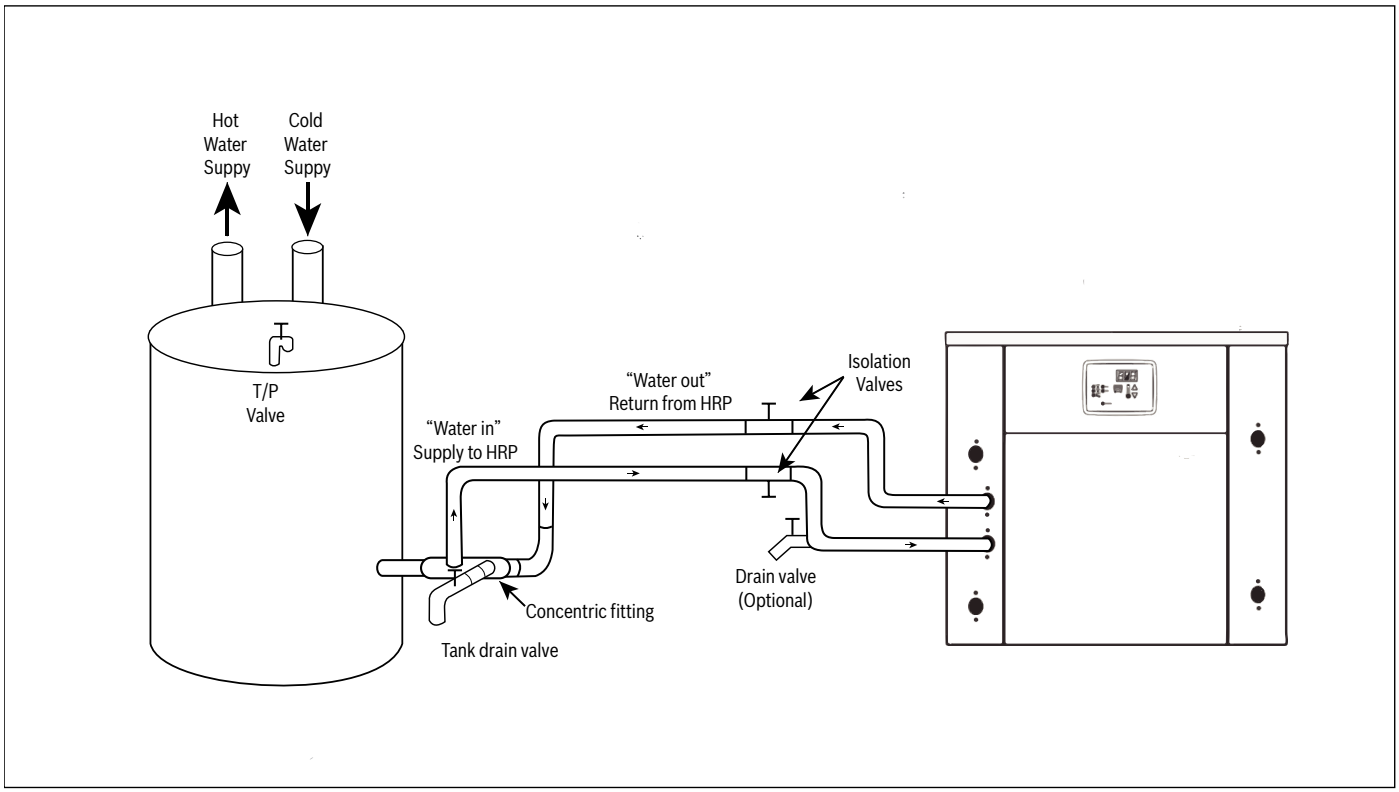

Figure 13 HRP System Setup

Diagram is for illustration purposes only. Ensure access to Heat Pump is not restricted.

All piping from HRP to domestic water tank must be copper or any metal suitable for domestic water.

HRP Water Tank Refil

1. Open the cold water supply to the tank.
2. Open a hot water faucet to vent air from the system until water flows from the faucet, then close.
3. Depress the hot water tank pressure relief valve handle to ensure there is no air remaining in the tank.
4. Carefully inspect all plumbing for water leaks. Correct as required.
5. Purge all air from HR through an external purge valve. Allow all air to bleed out until water appears at the valve. Locate the external purge value at the highest point in the installation.
6. Before restoring the power or fuel supply to the water heater, adjust the temperature setting on the tank thermostat(s) to ensure maximum utilization of the heat available from the refrigeration system and conserve the most energy. On tanks with both upper and lower elements and thermostats, the lower element should be turned down to 100° F, while the upper element should be adjusted to 120° F. Depending upon the specific needs of the customer, you may need to adjust the upper element differently. On tanks with a single thermostat lower the thermostat setting to 120° F or the “LOW” position.

After thermostat adjustments are completed, replace the access cover and restore the electrical or fuel supply to the water heater.

18.1.2 Initial Start-Up of a HRP System

CAUTION

Product damage!
Make sure all valves in the heat recovery water piping system are open. NEVER OPERATE THE HEAT RECOVERY PUMP DRY.

1. Turn ON the heat pump. The heat recovery pump should not run if the compressor is not running.
2. Turn HR switch to the “ON” position. The pump will operate if entering water temperature to HR is below 120°F.
3. The temperature difference between the water entering and leaving the heat recovery should be 5° to 15°F.
4. 4. Allow the unit to operate for 20 to 30 minutes to ensure it is functioning properly. The pump will shut off when the Heat Recovery entering water temperature reaches 120°F.

19 Maintenance

DANGER

Electric shock!

Before performing service or maintenance operations on the system, turn OFF main power to the unit. Electrical shock will cause personal injury or death.

WARNING

Personal injury hazard!

Servicing of this equipment can be hazardous due to system pressure and electrical components. Only trained and qualified personnel should install, repair, or service the equipment.

19.1 Annual Checkup

An annual “checkup” by a trained and qualified HVAC mechanic is required. Complete the check-out sheet on page 69 when performing the annual maintenance checkup. Record the performance measurements of volts, amps, and water temperature differences for both heating and cooling. This data should be compared to the information on the unit’s data plate and the data taken at the original startup of the equipment.

20 Handling Periodic Lockouts

Periodic lockouts almost always are caused by water flow problems. The lockout (shutdown) of the unit is a normal protective measure in the design of the equipment. If continual lockouts occur call a mechanic immediately and have them check for:

- water flow problems
- water temperature problems

Use of the pressure and temperature charts for the unit may be required to properly determine the cause.

21 Servicing and Repair Information

21.1 Personal Protective Equipment

Ensure that all personal protective equipment is available and being used correctly.

21.2 Confined Space Work

Work in confined spaces must be avoided.

21.3 Controlled Work Procedure

All work must be undertaken under a controlled procedure to minimize the risk of a flammable gas or vapor being present while the work is being performed.

21.4 Safety Checks

Prior to beginning work on systems containing flammable refrigerants, safety checks are necessary to ensure that the risk of ignition is minimized. The following precautions must be taken prior to conducting work on the refrigerating system.

21.4.1 Inform Everyone in the General Work Area

All maintenance staff and others working in the local area must be instructed on the nature of work being carried out.

21.4.2 Check for the Presence of Refrigerant

The area must be checked with an appropriate refrigerant detector prior to and during work, to ensure the technician is aware of potentially toxic or flammable atmospheres. Ensure that the leak detection equipment being used is suitable for use with R-454B refrigerant; i.e., non-sparking, adequately sealed, or intrinsically safe.

21.4.3 Fire Extinguisher

If any hot work is to be conducted on the refrigerating equipment or any associated parts, appropriate fire-extinguishing equipment must be available on hand. Have a dry powder or CO_2 fire extinguisher adjacent to the charging area.

21.4.4 Ignition Sources

Ensure the following prior to the work taking place:

1. The area around the equipment is to be surveyed to make sure that there are no flammable hazards or ignition risks.
2. "No Smoking" signs must be posted.
3. All possible ignition sources, including cigarette smoking, must be kept sufficiently far away from the site of installation, repair, removal, or disposal during which refrigerant may possibly be released and exposed to the surrounding area and the ignition sources.
4. Ensure that any person carrying out work in relation to a refrigerating system that involves exposing any pipe work knows that they must NOT use any sources of ignition in such a manner that it may lead to the risk of fire or explosion.

21.4.5 Ventilated Area

Ensure that the area is in the open or that it is adequately ventilated before breaking into the system or conducting any hot work. The ventilation must safely disperse all released refrigerant, preferably expelling it externally into the atmosphere. The ventilation must be present during the period that the work is carried out.

21.4.6 Checks to the Refrigerating Equipment

Where electrical components are being changed, they must be fit for the purpose and to the correct specification. At all times the manufacturer's maintenance and service guidelines must be followed. If in doubt, consult Bosch service and support for assistance.

The following checks must be applied to installations using flammable refrigerants:

1. Ensure the actual refrigerant charge is in accordance with the room size within which the refrigerant containing parts are installed.
2. Ensure that the ventilation machinery and outlets are operating adequately and are not obstructed.
3. Check the secondary circuit for the presence of refrigerant, if an indirect refrigerating circuit is being used.
4. Ensure the markings on the equipment continues to be visible and legible. Markings and signs that are illegible must be corrected.
5. Ensure the refrigerating pipes or components are installed in a position where they are unlikely to be exposed to any substance that may corrode refrigerant containing components, unless the components are constructed of materials that are inherently resistant to being corroded or are suitably protected against being so corroded.

21.5 Checks to Electrical Devices

Repair and maintenance to electrical components must include initial safety checks and component inspection procedures. If a fault exists that could compromise safety, then electrical supply must NOT be connected to the circuit until the safety fault is satisfactorily corrected. If the fault cannot be corrected immediately but it is necessary to continue operation, an adequate temporary solution must be used. This must be reported to the owner of the equipment, so all parties are advised.

The following are required initial safety checks:

1. Ensure that capacitors are discharged—this must be done in a safe manner to avoid possibility of sparking.
2. Ensure that no live-electrical components and wiring are exposed while charging, recovering, or purging the system.
3. Ensure that there is continuity of earth bonding.

21.6 Repairs to Sealed Components

NOTICE

Product damage!

Sealed-electrical components must be replaced.

21.7 Repair to Intrinsically Safe Components

NOTICE

Product damage!

Intrinsically safe components must be replaced.

21.8 Check Cabling

Check that cabling will not be subject to wear, corrosion, excessive pressure, vibration, sharp edges, or any other adverse environmental effects. The check must also take into account the effects of aging or continual vibrations from sources such as compressors or fans.

21.9 Detection of Flammable Refrigerants

Under NO circumstances may potential sources of ignition be used in the searching for or detection of refrigerant leaks. A halide torch (or any other detector using a naked flame) must NOT be used.

The following leak-detection methods are deemed acceptable for all refrigerant systems:

- Electronic leak detectors may be used to detect refrigerant leaks but in the case of flammable refrigerants, the sensitivity may not be adequate or may need re-calibration. (Detection equipment must be calibrated in a refrigerant-free area.). Ensure that the detector is not a potential source of ignition and is suitable for the refrigerant used. Leak-detection equipment must be set to a percentage for the Lower-Flammable Limit (LFL) (25% maximum) of the gas that is confirmed.
- Leak detection fluids are also suitable for use with most refrigerants but the use of detergents containing chlorine must be avoided as the chlorine may react with the refrigerant and corrode the copper pipe-work. Examples of leak detection fluids are:
  - bubble method
  - fluorescent method agents

If a leak is suspected, all naked flames must be removed/extinguished.

If a leakage of refrigerant is found that requires brazing, all of the refrigerant must be recovered from the system or isolated (by means of shut-off valves) in a part of the system remote from the leak.

21.10 Removal and Evacuation

When breaking into the refrigerant circuit to make repairs—or for any other purpose—conventional procedures must be used. However, for flammable refrigerants it is important that best practice be followed, since flammability is a consideration. The following procedure must be adhered to:

1. Safely remove refrigerant following local and national regulations.
2. Evacuate.
3. Purge the circuit with inert gas (optional for A2L).
4. Evacuate (optional for A2L).
5. Continuously flush or purge with inert gas when using flame to open circuit.
6. Open the circuit.

The refrigerant charge must be recovered into the correct recovery cylinders if venting is not allowed by local or national codes. For appliances containing flammable refrigerants, the system must be purged with oxygen-free nitrogen to render the appliance safe for flammable refrigerants. This process might need to be repeated several times. Compressed air or oxygen must not be used for purging refrigerant systems.

For appliances containing flammable refrigerants, refrigerant purging must be achieved by breaking the vacuum in the system with oxygen-free nitrogen and continuing to fill until the working pressure is achieved, then venting to atmosphere, and finally pulling down to a vacuum (optional for A2L). This process must be repeated until no refrigerant is within the system (optional for A2L). When the final oxygen-free nitrogen charge is used, the system must be vented down to atmospheric pressure to enable work to take place.

WARNING

Fire hazard!

The outlet for the vacuum pump must not be close to any potential ignition sources, and ventilation must be available.

21.11 Charging Procedures

In addition to conventional charging procedures, the following requirements must be followed.

1. Ensure that contamination of different refrigerants does not occur when using charging equipment.
2. Ensure hoses or lines are as short as possible to minimize the amount of refrigerant contained in them.
3. Ensure cylinders are kept in an appropriate position according to the instructions.
4. Ensure that the refrigerating system is earthed prior to charging the system with refrigerant.
5. Be sure to label the system when charging is complete (if not already).
6. Use extreme care not to overfill the refrigerating system.
7. Ensure the system is pressure-tested with the appropriate purging gas prior to recharging the system.
8. Ensure the system is leak-tested on completion of charging but prior to commissioning. A follow-up leak test must be carried out prior to leaving the site.

21.12 Recovery

When removing refrigerant from a system, either for servicing or decommissioning, it is recommended good practice that all refrigerants are removed safely.

Ensure the following:

1. Ensure that only appropriate refrigerant recovery cylinders are employed when transferring refrigerant into cylinders.
2. Ensure that the correct number of cylinders for holding the total system charge are available.
3. Ensure all cylinders to be used are designated for the recovered refrigerant and labeled for that refrigerant (i.e., special cylinders for the recovery of refrigerant).
4. Ensure all cylinders are complete with a pressure-relief valve and associated shut-off valves that are all in good working order.
5. Ensure empty recovery cylinders are evacuated and, if possible, cooled before recovery occurs.
6. Ensure the recovery equipment is in good working order.
7. Ensure set of instructions for the recovery equipment is at hand .
8. Ensure the recovery equipment is suitable for the recovery of the flammable refrigerant. If in doubt, the manufacturer should be consulted.
9. Ensure a set of calibrated weighing scales are available and in good working order.
10. Ensure the hoses are complete with leak-free disconnect couplings and are in good condition.
11. Ensure the recovered refrigerant is processed according to local legislations/regulations in the correct recovery cylinder, and the relevant waste transfer note arranged.
12. Ensure there is no mixing of refrigerants in the recovery units and especially not in cylinders.
13. If compressors or compressor oils are to be removed, ensure that they have been evacuated to an acceptable level to make certain that flammable refrigerant does not remain within the lubricant. The compressor body must NOT be heated by an open flame or other ignition sources to accelerate this process. When oil is drained from a system, it must be carried out safely.

22 Decommissioning Information

Only trained and qualified technicians are allowed to decommission and dispose of equipment following the requirements and local codes.

WARNING

Personal injury hazard!

Decommissioning of this equipment can be hazardous due to system pressure and electrical components. Only trained and qualified personnel should install, repair, service, or disconnect the equipment.

22.1 Protecting the Environment

22.1.1 Components

By disposing of this product correctly you will help ensure that the waste undergoes the necessary treatment, recovery, and recycling, thus preventing potentially negative effects on the environment and human health, which could otherwise arise due to inappropriate waste handling.

Many parts in the Heat Pump can be fully recycled at the end of the product life. Contact your city authorities for information about the disposal of recyclable products.

22.1.2 Refrigerant

At the end of the service life of this appliance, and prior to its environmental disposal, a person qualified to work with refrigerant circuits must recover the refrigerant from within the sealed system as per applicable local codes.

22.1.3 Hazardous Waste

Some components in the Heat Pump may be considered as hazardous waste, such as batteries. For their disposal contact your local household hazardous waste collection site.

22.2 Decommissioning Procedure

Before carrying out this procedure, it is essential that the technician is completely familiar with the equipment and all its detail.

It is recommended good practice that all refrigerants are recovered safely. Follow the procedure below.

1. Before attempting the procedure:

- Become familiar with the equipment and its operation.
- Ensure that electrical power is available for the recovery machine before the task is commenced.
- Ensure an oil and refrigerant sample is taken in case analysis is required prior to re-use of recovered refrigerant.
- Isolate the system electrically. Lock-Out/Tag-Out recommended.
- Ensure that mechanical handling equipment is available, if required, for handling refrigerant cylinders
- Ensure that all personal protective equipment is available and being used correctly.
- Ensure that the recovery process is supervised at all times by a competent person
- Ensure that the recovery equipment and cylinders conform to the appropriate standards.

2. Pump down refrigerant system, if possible.
3. If a vacuum is not possible, make a manifold so that refrigerant can be removed from various parts of the system.
4. Make sure that cylinder is situated on the scales before recovery takes place.
5. Start the recovery machine and operate in accordance with instructions.
6. DO NOT overfill cylinders (no more than 80% volume liquid charge).
7. DO NOT exceed the maximum working pressure of the cylinder, even temporarily.
8. When the cylinders have been filled correctly and the process completed, make sure that the cylinders and the equipment are removed from site promptly and all isolation valves on the equipment are closed off.
9. Recovered refrigerant must NOT be charged into another REFRIGERATING SYSTEM unless it has been cleaned and checked.

22.3 Labeling

The following are required:

1. Equipment must be labeled stating that it has been decommissioned and emptied of refrigerant.
2. The label must be dated and signed.
3. Ensure that there are labels on the equipment stating the equipment contains flammable refrigerant.

23 Troubleshooting

23.1 Unit Troubleshooting

If troubleshooting a system that is low on refrigerant due to a system leak, do not simply add refrigerant. The leak must be found and repaired per F-Gas regulation.

23.2 Online Help Resources

For FAQs, videos, service bulletins, and more, visit our Service and Support web page at www.bosch-homecomfort.us/service or use your cell phone to scan the code below.

Single Stage UPM Troubleshooting						
Problem	Mode		Check	Fault	Possible Cause	Action
	Cooling	Heating				
Unit does not run	x	x	1 blink on UPM	High Pressure Fault	Unit may be overcharged with refrigerant.	Reclaim refrigerant, evacuate, and recharge with factory recommended charge on unit nameplate.
	x				Insufficient or low flow to source water coil.	Check the water flow rate and ensure it is within operating limits. Adjust flow rate if necessary. Verify that the water pump is operating correctly and providing adequate flow. Repair or replace the pump if it is malfunctioning. Inspect the water lines for any blockages or restrictions that could be impeding flow. Clear any obstructions found. Ensure that all valves in the water circuit are fully open and correctly positioned to allow proper flow.
		x			Insufficient or low flow to load water coil.	
	x	x			Entering water temperature is too warm.	Measure the entering water temperature of both coils to confirm it is within the acceptable range as specified by the operating limits table.
	x				Scaled or plugged source coil.	Clean the source coil to remove any deposits or debris. Use a descaling solution suitable for the heat exchanger.
	x	x			High-pressure switch malfunction.	Check for defective or improperly calibrated high-pressure switch. Visually inspect switch and wiring for any signs of damage, corrosion, or loose connections. Repair or replace any damaged components.
	x	x	2 blinks on UPM	Low Pressure Fault	Unit may be low on refrigerant.	Check for refrigerant leak, repair, evacuate, and recharge with factory recommended charge on unit nameplate.
		x			Insufficient or low flow to source water coil.	Check the water flow rate and ensure it matches technical data. Adjust flow rate if necessary. Verify that the water pump is operating correctly and providing adequate flow. Repair or replace the pump if it is malfunctioning. Inspect the water lines for any blockages or restrictions that could be impeding flow. Clear any obstructions found. Ensure that all valves in the water circuit are fully open and correctly positioned to allow proper flow.
	x				Insufficient or low flow to load water coil.	
	x				Entering water temperature is too low.	Measure the entering water temperature of both coils to confirm it is within the acceptable range as specified by the operating limits table.
		x			Scaled or plugged load coil.	Clean the load coil to remove any deposits or debris. Use a descaling solution suitable for the heat exchanger.
	x	x			Low-pressure switch malfunction	Check for defective or improperly calibrated low-pressure switch. Visually inspect switch and wiring for any signs of damage, corrosion, or loose connections. Repair or replace any damaged components.

Table 16 Single Stage UPM Troubleshooting

Single Stage UPM Troubleshooting						
Problem	Mode		Check	Fault	Possible Cause	Action
	Cooling	Heating				
Unit does not run		x	3 blinks on UPM	Freeze 1 (Source)	Insufficient or low flow to source water coil.	Verify the flow rate to source coil is correct and adjust if necessary. Clean the source coil to remove any deposits or debris.
	x	x			Entering water temperature is too low.	If heat pump is connected to a closed loop with antifreeze, check that position 5 in the DIP switch on the UPM board is set to “ON”.
	x	x			Unit may be low on refrigerant.	Check for refrigerant leak, repair, evacuate, and recharge with factory recommended charge on unit nameplate.
	x	x			Freeze sensor malfunction.	Inspect the freeze sensor 1 location and ensure there is no damage, corrosion, or loose connections.
	x	x	5 blinks on UPM	Browout Fault	Low voltage supply	Check the transformer primary voltage taps. Ensure they are between the limits listed on the unit data plate.
	x	x			Bad thermostat connection	Check control voltage. If below 18 VAC, ensure the accessories connected to the unit do not exceed the VA draw shown in Table 7.
	x	x				Inspect thermostat wiring for damage. Ensure it is the correct gauge and length, and that no connections are loose.
	x		6 blinks on UPM	Freeze 2 (Load)	Insufficient or low flow to load water coil.	Verify the flow rate to source coil is correct and adjust if necessary. Clean the source coil to remove any deposits or debris.
	x	x			Entering water temperature is too low.	Measure entering water temperature on both coils and ensure they are within the acceptable range as specified by the operating limits table.
	x	x				If heat pump is connected to a closed loop with antifreeze, check that position 5 in the DIP switch on the UPM board is set to “ON”.
	x	x			Unit may be low on refrigerant.	Check for refrigerant leak, repair, evacuate, and recharge with factory recommended charge on unit nameplate.
	x	x			Freeze sensor malfunction.	Inspect the freeze sensor 1 location and ensure there is no damage, corrosion, or loose connections.
	x	x	7 blinks on UPM	A2L Fault	The A2L sensor has detected a refrigerant leak.	Conduct a thorough inspection of the refrigerant system to identify any leaks.
	x	x			A2L sensor malfunction.	Inspect the sensor and wiring for damage, corrosion, or loose connections.

Table 16 (Continued)

Two-Stage UPM Troubleshooting						
Problem	Mode		Check	Fault	Possible Cause	Action
	Cooling	Heating				
Unit does not run	x	x	1 blink on UPM	High Pressure Fault (Circuit 1)	Unit may be overcharged with refrigerant.	Reclaim refrigerant, evacuate, and recharge with factory recommended charge on unit nameplate.
	x				Insufficient or low flow to source water coil 1.	Check the water flow rate and ensure it is within operating limits. Adjust flow rate if necessary. Verify that the water pump is operating correctly and providing adequate flow. Repair or replace the pump if it is malfunctioning. Inspect the water lines for any blockages or restrictions that could be impeding flow. Clear any obstructions found. Ensure that all valves in the water circuit are fully open and correctly positioned to allow proper flow.
		x			Insufficient or low flow to load water coil 1.	
	x	x			Entering water temperature is too warm.	Measure the entering water temperature of both coils to confirm it is within the acceptable range as specified by the operating limits table.
	x				Scaled or plugged source coil 1.	Clean the source coil to remove any deposits or debris. Use a descaling solution suitable for the heat exchanger.
	x	x			High-pressure switch malfunction.	Check for defective or improperly calibrated high-pressure switch. Visually inspect switch and wiring for any signs of damage, corrosion, or loose connections. Repair or replace any damaged components.
	x	x	2 blinks on UPM	Low Pressure Fault (Circuit 1)	Unit may be low on refrigerant.	Check for refrigerant leak, repair, evacuate, and recharge with factory recommended charge on unit nameplate.
		x			Insufficient or low flow to source water coil 1.	Check the water flow rate and ensure it matches technical data. Adjust flow rate if necessary. Verify that the water pump is operating correctly and providing adequate flow. Repair or replace the pump if it is malfunctioning. Inspect the water lines for any blockages or restrictions that could be impeding flow. Clear any obstructions found. Ensure that all valves in the water circuit are fully open and correctly positioned to allow proper flow.
	x				Insufficient or low flow to load water coil 1.	
	x				Entering water temperature is too low.	Measure the entering water temperature of both coils to confirm it is within the acceptable range as specified by the operating limits table.
	x				Scaled or plugged load coil 1.	Clean the load coil to remove any deposits or debris. Use a descaling solution suitable for the heat exchanger.
	x	x			Low-pressure switch malfunction	Check for defective or improperly calibrated low-pressure switch. Visually inspect switch and wiring for any signs of damage, corrosion, or loose connections. Repair or replace any damaged components.
	x	x	3 blink on UPM	High Pressure Fault (Circuit 2)	Unit may be overcharged with refrigerant.	Reclaim refrigerant, evacuate, and recharge with factory recommended charge on unit nameplate.
	x				Insufficient or low flow to source water coil 2.	Check the water flow rate and ensure it is within operating limits. Adjust flow rate if necessary. Verify that the water pump is operating correctly and providing adequate flow. Repair or replace the pump if it is malfunctioning. Inspect the water lines for any blockages or restrictions that could be impeding flow. Clear any obstructions found. Ensure that all valves in the water circuit are fully open and correctly positioned to allow proper flow.
		x			Insufficient or low flow to load water coil 2.	
	x	x			Entering water temperature is too warm.	Measure the entering water temperature of both coils to confirm it is within the acceptable range as specified by the operating limits table.
	x				Scaled or plugged source coil 2.	Clean the source coil to remove any deposits or debris. Use a descaling solution suitable for the heat exchanger.
	x	x			High-pressure switch malfunction.	Check for defective or improperly calibrated high-pressure switch. Visually inspect switch and wiring for any signs of damage, corrosion, or loose connections. Repair or replace any damaged components.

Table 17 Two-Stage UPM Troubleshooting

Two-Stage UPM Troubleshooting						
Problem	Mode		Check	Fault	Possible Cause	Action
	Cooling	Heating				
Unit does not run	x	x	4 blinks on UPM	Low Pressure Fault (Circuit 2)	Unit may be low on refrigerant.	Check for refrigerant leak, repair, evacuate, and recharge with factory recommended charge on unit nameplate.
		x			Insufficient or low flow to source water coil 2.	Check the water flow rate and ensure it matches technical data. Adjust flow rate if necessary. Verify that the water pump is operating correctly and providing adequate flow. Repair or replace the pump if it is malfunctioning. Inspect the water lines for any blockages or restrictions that could be impeding flow. Clear any obstructions found. Ensure that all valves in the water circuit are fully open and correctly positioned to allow proper flow.
	x				Insufficient or low flow to load water coil 2.	
	x				Entering water temperature is too low.	Measure the entering water temperature of both coils to confirm it is within the acceptable range as specified by the operating limits table.
	x				Scaled or plugged load coil 2.	Clean the load coil to remove any deposits or debris. Use a descaling solution suitable for the heat exchanger.
	x	x			Low-pressure switch malfunction	Check for defective or improperly calibrated low-pressure switch. Visually inspect switch and wiring for any signs of damage, corrosion, or loose connections. Repair or replace any damaged components.
		x	5 blinks on UPM	Freeze 1 (Source Coil Circuit 1)	Insufficient or low flow to source water coil 1.	Verify the flow rate to source coil is correct and adjust if necessary. Clean the source coil to remove any deposits or debris.
	x	x			Entering water temperature is too low.	If heat pump is connected to a closed loop with antifreeze, check that position 5 in the DIP switch on the UPM board is set to “ON”.
	x	x			Unit may be low on refrigerant.	Check for refrigerant leak, repair, evacuate, and recharge with factory recommended charge on unit nameplate.
	x	x			Freeze sensor malfunction.	Inspect the freeze sensor 1 location and ensure there is no damage, corrosion, or loose connections.
	x	x	6 blinks on UPM	Condensate Fault	Not applicable to water-to-water heat pumps.	
	x	x	7 blinks on UPM	Brownout Fault	Low voltage supply	Check the transformer primary voltage taps. Ensure they are between the limits listed on the unit data plate.
	x	x			Bad thermostat connection	Check control voltage. If below 18 VAC, ensure the accessories connected to the unit do not exceed the VA draw shown in Table 7.
	x	x				Inspect thermostat wiring for damage. Ensure it is the correct gauge and length, and that no connections are loose.

Table 17 (Continued)

Two-Stage UPM Troubleshooting						
Problem	Mode		Check	Fault	Possible Cause	Action
	Cooling	Heating				
Unit does not run	x		8 blinks on UPM	Freeze 2 Fault (Load Coil Circuit 1)	Insufficient or low flow to load water coil 1.	Verify the flow rate to load coil is correct and adjust if necessary. Clean the load coil to remove any deposits or debris.
	x	x			Entering water temperature is too low.	Measure entering water temperature on both coils and ensure they are within the acceptable range as specified by the operating limits table.
	x	x				If heat pump is connected to a closed loop with antifreeze, check that position 5 in the DIP switch on the UPM board is set to “ON”.
	x	x			Unit may be low on refrigerant.	Check for refrigerant leak, repair, evacuate, and recharge with factory recommended charge on unit nameplate.
	x	x			Freeze sensor malfunction.	Inspect the freeze sensor 1 location and ensure there is no damage, corrosion, or loose connections.
		x	9 blinks on UPM	Freeze 3 Fault (Source Coil Circuit 2)	Insufficient or low flow to source water coil 2.	Verify the flow rate to source coil is correct and adjust if necessary. Clean the source coil to remove any deposits or debris.
	x	x			Entering water temperature is too low.	If heat pump is connected to a closed loop with antifreeze, check that position 5 in the DIP switch on the UPM board is set to “ON”.
	x	x			Unit may be low on refrigerant.	Check for refrigerant leak, repair, evacuate, and recharge with factory recommended charge on unit nameplate.
	x	x			Freeze sensor malfunction.	Inspect the freeze sensor 1 location and ensure there is no damage, corrosion, or loose connections.
	x		10 blinks on UPM	Freeze 2 Fault (Load Coil Circuit 2)	Insufficient or low flow to load water coil 2.	Verify the flow rate to source coil is correct and adjust if necessary. Clean the source coil to remove any deposits or debris.
	x	x			Entering water temperature is too low.	Measure entering water temperature on both coils and ensure they are within the acceptable range as specified by the operating limits table.
	x	x				If heat pump is connected to a closed loop with antifreeze, check that position 5 in the DIP switch on the UPM board is set to “ON”.
	x	x			Unit may be low on refrigerant.	Check for refrigerant leak, repair, evacuate, and recharge with factory recommended charge on unit nameplate.
	x	x			Freeze sensor malfunction.	Inspect the freeze sensor 1 location and ensure there is no damage, corrosion, or loose connections.
	x	x	11 blinks on UPM	A2L Fault	The A2L sensor has detected a refrigerant leak.	Conduct a thorough inspection of the refrigerant system to identify any leaks.
	x	x			A2L sensor malfunction.	Inspect the sensor and wiring for damage, corrosion, or loose connections.
	x	x	12 blinks on UPM	Second-stage Communication Fault	Lost communication with the second-stage UPM board	Inspect all electrical wiring and check for loose connections.

Table 17 (Continued)

Water to Water Troubleshooting						
Problem	Mode		Check	Fault	Possible Cause	Action
	Cooling	Heating				
No compressor operation	X	X	No Fault LED - Contactor Energized	N/a	Open compressor overload	Check for supply voltage at the load side of the contactor. For three-phase models check phase rotation and voltage at all three phases.
					Poor wiring connection	Look for signs of heat on the wiring insulation. Check that all wiring connections are secure and properly torqued.
					Burned out compressor	If the compressor does not hum when power is applied, check the resistance of the compressor windings using the values shown in the compressor characteristics chart. Note that the compressor must be cool (70°F) when checking the windings for accurate measurements.
	X	X	Power LED ON	N/a	Bad thermostat connection / faulty thermostat	Check thermostat and wiring. Check unit terminal block for 24VAC between "Y" and "C".
			Power LED OFF	N/a	Low or no supply power	Ensure that the supply voltage to the unit is within the range shown on the unit data plate.
					Faulty control transformer	Check for 24 VAC between "R" and "C" on the unit terminal block. For 75 and 100 VA transformers, check that the transformer circuit breaker has not tripped. Check low voltage circuit for overload conditions or short circuits before replacing the transformer.
Unit not switching between cooling and heating mode	X	X	Reversing valve solenoid energized	N/a	Faulty solenoid	Check that the reversing valve solenoid is receiving 24 VAC.
						If it is receiving 24 VAC, check the resistance of the solenoid--an open circuit may indicate a burned out solenoid.
	X	X	Reversing valve solenoid NOT energized	N/a	Miswired / Faulty thermostat	Check that the reversing valve thermostat wire is connected to the "O" terminal of the thermostat.
						Check for a contact closure between "O" and "R".
					Loose wire on "O" terminal	Check that the wires from the thermostat to the unit are securely connected and that the wires from the electrical box to the reversing valve are connected.
Excessively cold supply water temperature in cooling or excessively hot supply water temperature in heating	X	X	Reduced water flow	N/a	Dirty filter	Replace filter.
					Pump speed too low	Verify the flow rate to load coil is correct and adjust if necessary. Clean the load coil to remove any deposits or debris.
					Excessive pressure drop	Clean the load coil to remove any deposits or debris. Use a descaling solution suitable for the heat exchanger.
Excessively warm supply water temperature in cooling and/or excessively cool water in heating	X	X	Water flow too high	N/a	Pump speed too high	Verify the flow rate to load coil is correct and adjust if necessary.
			High or low water temperature	N/a	Inlet water temperature out of range	Check unit capacity vs. water temperature.
			loss of refrigeration capacity	N/a	Low refrigerant	Check refrigerant pressures with a gauge set. Inspect unit for leaks.

Table 18 Unit Troubleshooting

Water to Water Troubleshooting						
Problem	Mode		Check	Fault	Possible Cause	Action
	Cooling	Heating				
Objectionable noise levels	X	X	Air noise (A2L ductwork)	N/a	Poor exhaust ductwork/grill design	Ensure the exhaust ductwork and grills are properly sized for the unit airflow.
			Water noise	N/a	Air in system	Ensure that the system is fully purged of air.
				N/a	Pump speed too high	Verify the flow rate to load and/or source coil is correct and adjust if necessary.
			Structure-bourne noise	N/a	Unit not mounted on full vibration pad	Mount unit on vibration pad.
				N/a	Unit not connected with flexible conduit, water lines	Install unit in accordance with the installation instructions.
				N/a	Unit cabinet touching wall or other building components	Adjust unit location to avoid unit touching structure.
			Compressor noise	N/a	High water temperature or low water flow rate elevating head pressure	Increase water flow rate and/or reduce water temperature if possible.
				N/a	Scaled or fouled water coil elevating head pressure	Clean/descale water coil.
			Water hammer	N/a	Fast-closing valves installed	Change valves to slow-close type.

Table 18 (Continued)

24 Specification Tables

24.1 Operating Temperatures and Pressures

Cooling							
Size	Entering Fluid Temp (˚F) Source	Entering Fluid Temp (˚F) Load	GPM	Discharge Pressure	Suction Pressure	Water Temp Rise ˚F (Source)	Water Temp Drop ˚F (Load)
TW025	50	50	4	174-194	78-88	11-13	10-12
			8	161-181	88-98	6-8	5-7
		60	4	182-202	94-104	13-15	12-14
			8	167-187	105-115	7-9	6-8
		70	4	191-211	110-120	15-17	13-15
			8	174-194	125-135	8-10	7-9
		80	4	198-218	123-133	16-18	15-17
			8	182-202	146-156	9-11	9-11
		90	4	212-232	148-158	19-21	18-20
			8	190-210	170-180	10-12	10-12
	70	50	4	235-255	81-91	11-13	9-11
			8	221-241	89-99	5-7	5-7
		60	4	244-264	96-106	12-14	11-13
			8	228-248	107-117	7-9	6-8
		70	4	254-274	112-122	14-16	12-14
			8	236-256	127-137	8-10	7-9
		80	4	268-288	135-145	17-19	15-17
			8	244-264	149-159	9-11	8-10
		90	4	278-298	154-164	18-20	17-19
			8	253-273	174-184	10-12	9-11
	90	50	4	309-329	81-91	10-12	8-10
			8	295-315	89-99	5-7	4-6
		60	4	320-340	97-107	12-14	10-12
			8	302-322	108-118	6-8	5-7
		70	4	332-352	117-127	14-16	11-13
			8	312-332	131-141	7-9	6-8
		80	4	346-366	139-149	16-18	14-16
			8	317-337	145-155	8-10	7-9
		90	4	357-377	158-168	18-20	15-17
			8	328-348	175-185	9-11	8-10
	110	50	4	403-423	87-97	10-12	7-9
			8	388-408	95-105	5-7	4-6
		60	4	414-434	104-114	12-14	9-11
			8	395-415	114-124	6-8	5-7
		70	4	427-447	124-134	14-16	11-13
			8	404-424	134-144	7-9	5-7
		80	4	437-457	141-151	15-17	12-14
			8	413-433	156-166	8-10	6-8
		90	4	453-473	172-182	17-19	14-16
			8	418-438	175-185	9-11	7-9

Table 19 TW025 Operating Temperatures and Pressures, Cooling

Heating							
Size	Entering Fluid Temp (˚F) Source	Entering Fluid Temp (˚F) Load	GPM	Discharge Pressure	Suction Pressure	Water Temp Rise ˚F (Source)	Water Temp Drop ˚F (Load)
TW025	30	60	4	188-208	50-60	7-9	8-10
			8	178-198	57-67	3-5	4-6
		80	4	256-276	55-65	6-8	8-10
			8	243-263	59-69	3-5	4-6
		100	4	335-355	56-66	5-7	8-10
			8	323-343	61-71	3-5	4-6
		120	4	436-456	62-72	5-7	8-10
			8	422-442	67-77	2-4	4-6
	50	60	4	205-225	79-89	10-12	12-14
			8	190-210	87-97	5-7	6-8
		80	4	272-292	79-89	9-11	11-13
			8	256-276	87-97	5-7	6-8
		100	4	355-375	83-93	8-10	11-13
			8	338-358	92-102	4-6	5-7
		120	4	457-477	91-101	8-10	11-13
			8	438-458	99-109	4-6	5-7
	70	60	4	225-245	111-121	14-16	16-18
			8	205-225	124-134	8-10	8-10
		80	4	293-313	111-121	12-14	15-17
			8	272-292	125-135	7-9	8-10
		100	4	379-399	118-128	12-14	14-16
			8	357-377	133-143	6-8	8-10
		120	4	483-503	128-138	11-13	14-16
			8	456-476	139-149	6-8	7-9
	90	60	4	246-266	146-156	18-20	19-21
			8	221-241	169-179	10-12	11-13
		80	4	326-346	163-173	18-20	20-22
			8	290-310	176-186	9-11	11-13
		100	4	409-429	169-179	16-18	19-21
			8	374-394	181-191	9-11	10-12
		120	4	504-524	174-184	15-17	18-20
			8	470-490	191-201	8-10	10-12

Table 20 TW025 Operating Temperatures and Pressures, Heating

Cooling							
Size	Entering Fluid Temp (˚F) Source	Entering Fluid Temp (˚F) Load	GPM	Discharge Pressure	Suction Pressure	Water Temp Rise ˚F (Source)	Water Temp Drop ˚F (Load)
TW035	50	50	4.5	194-214	75-85	14-16	12-14
			9	178-198	85-95	8-10	7-9
		60	4.5	204-224	89-99	16-18	14-16
			9	186-206	102-112	9-11	8-10
		70	4.5	216-236	106-116	19-21	17-19
			9	194-214	121-131	10-12	9-11
		80	4.5	228-248	123-133	21-23	19-21
			9	199-219	142-152	12-14	11-13
		90	4.5	237-257	142-152	24-26	21-23
			9	205-225	164-174	13-15	12-14
	70	50	4.5	258-278	77-87	14-16	11-13
			9	242-262	88-98	7-9	6-8
		60	4.5	270-290	92-102	16-18	13-15
			9	250-270	105-115	9-11	7-9
		70	4.5	283-303	109-119	18-20	15-17
			9	258-278	124-134	10-12	9-11
		80	4.5	294-314	127-137	20-22	18-20
			9	262-282	145-155	11-13	10-12
		90	4.5	304-324	146-156	23-25	20-22
			9	269-289	168-178	13-15	11-13
	90	50	4.5	337-357	80-90	13-15	10-12
			9	321-341	90-100	7-9	5-7
		60	4.5	349-369	95-105	15-17	12-14
			9	329-349	107-117	8-10	7-9
		70	4.5	363-383	112-122	17-19	14-16
			9	337-357	127-137	9-11	8-10
		80	4.5	375-395	131-141	20-22	16-18
			9	341-361	148-158	11-13	9-11
		90	4.5	384-404	149-159	22-24	18-20
			9	347-367	172-182	12-14	10-12
	110	50	4.5	432-452	83-93	13-15	9-11
			9	417-437	92-102	7-9	5-7
		60	4.5	445-465	98-108	15-17	11-13
			9	424-444	109-119	8-10	6-8
		70	4.5	456-476	115-125	17-19	13-15
			9	430-450	129-139	9-11	7-9
		80	4.5	467-487	134-144	19-21	15-17
			9	436-456	151-161	10-12	8-10
		90	4.5	479-499	154-164	21-23	17-19
			9	442-462	175-185	11-13	9-11

Table 21 TW035 Operating Temperatures and Pressures, Cooling

Heating							
Size	Entering Fluid Temp (˚F) Source	Entering Fluid Temp (˚F) Load	GPM	Discharge Pressure	Suction Pressure	Water Temp Rise ˚F (Source)	Water Temp Drop ˚F (Load)
TW035	30	60	4.5	205-225	47-57	9-11	11-13
			9	205-225	53-63	5-7	6-8
		80	4.5	273-293	49-59	8-10	11-13
			9	257-277	52-62	4-6	5-7
		100	4.5	351-371	44-54	6-8	9-11
			9	343-363	56-66	4-6	5-7
		120	4.5	456-476	54-64	6-8	10-12
			9	446-466	59-69	3-5	5-7
	50	60	4.5	225-245	69-79	12-14	15-17
			9	208-228	80-90	7-9	8-10
		80	4.5	296-316	73-83	12-14	15-17
			9	277-297	82-92	6-8	8-10
		100	4.5	381-401	75-85	11-13	14-16
			9	361-381	84-94	6-8	7-9
		120	4.5	487-507	79-89	9-11	14-16
			9	462-482	86-96	5-7	7-9
	70	60	4.5	247-267	95-105	16-18	19-21
			9	224-244	114-124	10-12	11-13
		80	4.5	319-339	97-107	15-17	18-20
			9	293-313	116-126	9-11	10-12
		100	4.5	408-428	105-115	14-16	18-20
			9	377-397	119-129	8-10	10-12
		120	4.5	507-527	108-118	13-15	18-20
			9	476-496	122-132	7-9	9-11
	90	60	4.5	271-291	131-141	22-24	24-26
			9	234-254	149-159	12-14	14-16
		80	4.5	344-364	137-147	20-22	24-26
			9	308-328	160-170	12-14	13-15
		100	4.5	433-453	144-154	19-21	23-25
			9	390-410	163-173	11-13	13-15
		120	4.5	534-554	150-160	18-20	22-24
			9	491-511	167-177	10-12	12-14

Table 22 TW035 Operating Temperatures and Pressures, Heating

Cooling							
Size	Entering Fluid Temp (˚F) Source	Entering Fluid Temp (˚F) Load	GPM	Discharge Pressure	Suction Pressure	Water Temp Rise ˚F (Source)	Water Temp Drop ˚F (Load)
TW049	50	50	6	181-201	74-84	14-16	12-14
			12	167-187	84-94	7-9	6-8
		60	6	191-211	88-98	16-18	14-16
			12	175-195	101-111	9-11	8-10
		70	6	202-222	104-114	18-20	16-18
			12	179-199	118-128	10-12	9-11
		80	6	212-232	122-132	21-23	19-21
			12	184-204	137-147	11-13	10-12
		90	6	219-239	140-150	23-25	21-23
			12	192-212	161-171	13-15	12-14
	70	50	6	243-263	77-87	13-15	11-13
			12	227-247	86-96	7-9	6-8
		60	6	253-273	89-99	15-17	13-15
			12	235-255	101-111	8-10	7-9
		70	6	267-287	108-118	18-20	15-17
			12	240-260	121-131	9-11	8-10
		80	6	275-295	126-136	20-22	17-19
			12	246-266	141-151	11-13	10-12
		90	6	284-304	144-154	22-24	20-22
			12	252-272	165-175	12-14	11-13
	90	50	6	319-339	80-90	13-15	10-12
			12	298-318	82-92	6-8	5-7
		60	6	331-351	94-104	15-17	12-14
			12	311-331	105-115	8-10	6-8
		70	6	339-359	105-115	16-18	13-15
			12	316-336	124-134	9-11	7-9
		80	6	351-371	128-138	19-21	16-18
			12	321-341	145-155	10-12	9-11
		90	6	361-381	148-158	21-23	18-20
			12	327-347	168-178	12-14	10-12
	110	50	6	410-430	82-92	13-15	9-11
			12	392-412	91-101	6-8	5-7
		60	6	423-443	98-108	14-16	11-13
			12	400-420	107-117	7-9	5-7
		70	6	432-452	114-124	16-18	12-14
			12	403-423	118-128	8-10	6-8
		80	6	444-464	134-144	18-20	14-16
			12	408-428	136-146	9-11	7-9
		90	6	454-474	155-165	21-23	17-19
			12	417-437	172-182	11-13	9-11

Table 23 TW049 Operating Temperatures and Pressures, Cooling

Heating							
Size	Entering Fluid Temp (˚F) Source	Entering Fluid Temp (˚F) Load	GPM	Discharge Pressure	Suction Pressure	Water Temp Rise ˚F (Source)	Water Temp Drop ˚F (Load)
TW049	30	60	6	197-217	45-55	9-11	11-13
			12	185-205	50-60	4-6	6-8
		80	6	264-284	46-56	8-10	11-13
			12	252-272	52-62	4-6	5-7
		100	6	349-369	51-61	8-10	11-13
			12	335-355	56-66	4-6	5-7
		120	6	454-474	54-64	7-9	11-13
			12	434-454	58-68	3-5	5-7
	50	60	6	218-238	66-76	13-15	15-17
			12	201-221	74-84	7-9	8-10
		80	6	286-306	68-78	12-14	14-16
			12	268-288	76-86	6-8	8-10
		100	6	372-392	73-83	11-13	14-16
			12	350-370	78-88	5-7	7-9
		120	6	471-491	76-86	10-12	14-16
			12	446-466	82-92	5-7	7-9
	70	60	6	238-258	91-101	17-19	20-22
			12	212-232	104-114	10-12	11-13
		80	6	305-325	91-101	15-17	18-20
			12	280-300	109-119	9-11	11-13
		100	6	393-413	100-110	15-17	18-20
			12	358-378	103-113	7-9	9-11
		120	6	493-513	106-116	14-16	18-20
			12	459-479	115-125	7-9	9-11
	90	60	6	257-277	121-131	23-25	25-27
			12	228-248	144-154	14-16	15-17
		80	6	328-348	126-136	21-23	24-26
			12	293-313	144-154	12-14	13-15
		100	6	414-434	132-142	19-21	23-25
			12	376-396	152-162	11-13	13-15
		120	6	518-538	142-152	18-20	23-25
			12	475-495	157-167	10-12	12-14

Table 24 TW049 Operating Temperatures and Pressures, Heating

Cooling							
Size	Entering Fluid Temp (˚F) Source	Entering Fluid Temp (˚F) Load	GPM	Discharge Pressure	Suction Pressure	Water Temp Rise ˚F (Source)	Water Temp Drop ˚F (Load)
TW061	50	50	6.5	192-212	64-74	16-18	13-15
			13	175-195	73-83	8-10	7-9
		60	6.5	202-222	77-87	18-20	15-17
			13	180-200	89-99	10-12	9-11
		70	6.5	210-230	91-101	20-22	18-20
			13	185-205	105-115	11-13	10-12
		80	6.5	219-239	106-116	23-25	20-22
			13	192-212	126-136	13-15	12-14
		90	6.5	229-249	122-132	25-27	23-25
			13	200-220	146-156	15-17	14-16
	70	50	6.5	256-276	68-78	15-17	12-14
			13	237-257	75-85	8-10	7-9
		60	6.5	266-286	81-91	17-19	14-16
			13	241-261	92-102	10-12	8-10
		70	6.5	274-294	95-105	20-22	17-19
			13	247-267	110-120	11-13	10-12
		80	6.5	284-304	110-120	22-24	19-21
			13	253-273	128-138	12-14	11-13
		90	6.5	291-311	123-133	24-26	21-23
			13	261-281	149-159	14-16	13-15
	90	50	6.5	332-352	70-80	15-17	11-13
			13	313-333	80-90	8-10	6-8
		60	6.5	343-363	83-93	17-19	13-15
			13	316-336	94-104	9-11	7-9
		70	6.5	352-372	98-108	19-21	15-17
			13	322-342	113-123	10-12	9-11
		80	6.5	361-381	112-122	21-23	17-19
			13	328-348	132-142	12-14	10-12
		90	6.5	374-394	132-142	24-26	20-22
			13	336-356	151-161	13-15	11-13
	110	50	6.5	425-445	74-84	14-16	10-12
			13	402-422	80-90	7-9	5-7
		60	6.5	435-455	87-97	16-18	12-14
			13	407-427	96-106	9-11	6-8
		70	6.5	445-465	101-111	18-20	14-16
			13	413-433	114-124	10-12	8-10
		80	6.5	456-476	119-129	21-23	16-18
			13	419-439	133-143	11-13	9-11
		90	6.5	468-488	137-147	23-25	18-20
			13	428-448	157-167	13-15	10-12

Table 25 TW061 Operating Temperatures and Pressures, Cooling

Heating							
Size	Entering Fluid Temp (˚F) Source	Entering Fluid Temp (˚F) Load	GPM	Discharge Pressure	Suction Pressure	Water Temp Rise ˚F (Source)	Water Temp Drop ˚F (Load)
TW061	30	60	6.5	207-227	36-46	10-12	13-15
			13	195-215	43-53	5-7	7-9
		80	6.5	275-295	38-48	9-11	12-14
			13	260-280	43-53	5-7	6-8
		100	6.5	357-377	40-50	8-10	12-14
			13	338-358	42-52	4-6	6-8
		120	6.5	452-472	43-53	7-9	12-14
			13	442-462	46-56	3-5	6-8
	50	60	6.5	228-248	55-65	14-16	17-19
			13	205-225	62-72	8-10	9-11
		80	6.5	298-318	58-68	13-15	16-18
			13	273-293	65-75	7-9	9-11
		100	6.5	379-399	59-69	11-13	16-18
			13	355-375	68-78	6-8	8-10
		120	6.5	479-499	65-75	10-12	16-18
			13	455-475	73-83	6-8	8-10
	70	60	6.5	245-265	77-87	19-21	22-24
			13	218-238	89-99	11-13	12-14
		80	6.5	314-334	79-89	17-19	20-22
			13	285-305	92-102	10-12	12-14
		100	6.5	402-422	87-97	16-18	21-23
			13	367-387	96-106	9-11	11-13
		120	6.5	502-522	90-100	14-16	20-22
			13	466-486	101-111	8-10	11-13
	90	60	6.5	268-288	104-114	24-26	27-29
			13	236-256	123-133	14-16	16-18
		80	6.5	339-359	108-118	22-24	26-28
			13	303-323	127-137	13-15	15-17
		100	6.5	427-447	117-127	21-23	26-28
			13	385-405	131-141	12-14	14-16
		120	6.5	529-549	122-132	19-21	25-27
			13	484-504	138-148	11-13	14-16

Table 26 TW061 Operating Temperatures and Pressures, Heating

Cooling							
Size	Entering Fluid Temp (˚F) Source	Entering Fluid Temp (˚F) Load	GPM	Discharge Pressure	Suction Pressure	Water Temp Rise ˚F (Source)	Water Temp Drop ˚F (Load)
TW122	50	50	15	174-194	82-92	8-10	7-9
			30	163-183	89-99	4-6	3-5
		60	15	179-199	98-108	9-11	8-10
			30	167-187	107-117	5-7	4-6
		70	15	184-204	116-126	11-13	10-12
			30	171-191	128-138	6-8	5-7
		80	15	191-211	137-147	12-14	11-13
			30	176-196	151-161	6-8	6-8
		90	15	198-218	160-170	14-16	13-15
			30	182-202	176-186	7-9	7-9
	70	50	15	235-255	84-94	8-10	6-8
			30	224-244	90-100	4-6	3-5
		60	15	240-260	101-111	9-11	8-10
			30	226-246	109-119	4-6	4-6
		70	15	245-265	119-129	10-12	9-11
			30	230-250	130-140	5-7	4-6
		80	15	251-271	140-150	12-14	10-12
			30	235-255	153-163	6-8	5-7
		90	15	259-279	163-173	13-15	12-14
			30	240-260	179-189	7-9	6-8
	90	50	15	311-331	86-96	7-9	6-8
			30	298-318	92-102	4-6	2-4
		60	15	315-335	103-113	8-10	7-9
			30	301-321	111-121	4-6	3-5
		70	15	320-340	122-132	10-12	8-10
			30	304-324	132-142	5-7	4-6
		80	15	327-347	142-152	11-13	9-11
			30	308-328	155-165	6-8	5-7
		90	15	334-354	167-177	13-15	11-13
			30	313-333	182-192	6-8	5-7
	110	50	15	402-422	88-98	7-9	5-7
			30	389-409	94-104	3-5	2-4
		60	15	406-426	106-116	8-10	6-8
			30	391-411	113-123	4-6	3-5
		70	15	411-431	125-135	9-11	7-9
			30	395-415	134-144	5-7	3-5
		80	15	418-438	147-157	11-13	9-11
			30	399-419	158-168	5-7	4-6
		90	15	425-445	170-180	12-14	10-12
			30	404-424	184-194	6-8	5-7

Table 27 TW122 Operating Temperatures and Pressures, Cooling

Heating							
Size	Entering Fluid Temp (˚F) Source	Entering Fluid Temp (˚F) Load	GPM	Discharge Pressure	Suction Pressure	Water Temp Rise ˚F (Source)	Water Temp Drop ˚F (Load)
TW122	30	60	15	189-209	47-57	4-6	6-8
			30	182-202	49-59	2-4	3-5
		80	15	255-275	48-58	4-6	5-7
			30	249-269	51-61	1-3	2-4
		100	15	337-357	51-61	3-5	5-7
			30	330-350	52-62	1-3	2-4
		120	15	440-460	52-62	3-5	5-7
			30	430-450	56-66	1-3	2-4
	50	60	15	200-220	71-81	6-8	8-10
			30	189-209	76-86	3-5	4-6
		80	15	268-288	73-83	6-8	7-9
			30	256-276	77-87	3-5	4-6
		100	15	349-369	76-86	5-7	7-9
			30	338-358	79-89	2-4	3-5
		120	15	448-468	79-89	5-7	7-9
			30	437-457	82-92	2-4	3-5
	70	60	15	211-231	102-112	9-11	10-12
			30	198-218	111-121	5-7	5-7
		80	15	278-298	105-115	8-10	10-12
			30	263-283	113-123	4-6	5-7
		100	15	360-380	108-118	8-10	10-12
			30	343-363	115-125	4-6	5-7
		120	15	459-479	111-121	7-9	9-11
			30	442-462	116-126	3-5	4-6
	90	60	15	226-246	141-151	12-14	14-16
			30	210-230	155-165	6-8	7-9
		80	15	293-313	144-154	11-13	13-15
			30	274-294	156-166	6-8	7-9
		100	15	376-396	151-161	11-13	13-15
			30	354-374	159-169	5-7	6-8
		120	15	474-494	152-162	9-11	12-14
			30	452-472	162-172	5-7	6-8

Table 28 TW122 Operating Temperatures and Pressures, Heating

24.2 Waterside Pressure Drop

Model	GPM	Chilled Fluid Side (55°F)		Cond. Fluid Side (85°F)	
		Pressure Drop (PSIG)	Pressure Drop (ft of H_2O)	Pressure Drop (PSIG)	Pressure Drop (ft of H_2O)
TW025	3	0.39	0.89	0.31	0.71
	4	0.62	1.43	0.51	1.17
	5	0.90	2.08	0.75	1.73
	6	1.22	2.82	1.03	2.37
	8	1.99	4.59	1.70	3.92
TW035	4.5	0.78	1.80	0.66	1.52
	6	1.26	2.90	1.08	2.50
	7.5	1.83	4.21	1.60	3.69
	9	2.49	5.74	2.20	5.07
	12	4.07	9.38	3.64	8.41
TW049	6	0.66	1.53	0.86	1.99
	8	1.08	2.50	1.42	3.29
	10	1.59	3.68	2.11	4.86
	12	2.19	5.05	2.90	6.69
	16	3.62	8.36	4.81	11.11
TW061	7.5	1.30	3.00	1.24	2.86
	10	2.12	4.90	2.06	4.74
	12.5	3.12	7.19	3.05	7.03
	15	4.27	9.85	4.20	9.70
	20	7.05	16.27	7.00	16.14
TW122	18	1.30	3.00	1.24	2.86
	22	2.12	4.90	2.06	4.74
	26	3.12	7.19	3.05	7.03
	30	4.27	9.85	4.20	9.70
	34	7.05	16.27	7.00	16.14

Table 29 TW Waterside Pressure Drop Table

24.3 Compressor Characteristics

Models	Voltage Code	Compressor Service				Compressor PN	Supplier PN
		Cold Winding Resistance (Ω)			Run Capacitor (µF/V)		
		Single Phase: R-C	Single Phase: S-C	Three Phase +/-7% Line-Line			
TW025	208-230/60/1	1.07	1.65	-	30/370	8-733-968-399	YAS20K1EPFV
TW035	208-230/60/1	0.73	1.47	-	45/370	8-733-968-403	YAS30K1EPFV
TW049	208-230/60/1	0.44	1.66	-	40/440	8-733-968-406	YAS40K1EPFV
TW061	208-230/60/1	0.35	1.39	-	40/440	8-733-968-407	YAS51K1EPFV
TW122	208-230/60/1	0.35	1.39	-	40/440	8-733-968-407	YAS51K1EPFV

Table 30 TW Compressor Characteristics

24.4 Model 24 Thermistor (Freeze Sensor) Test Values

Temperature (°F)	Resistance
-35	280.1K
-30	324.1K
-25	196.3K
-20	165.1K
-15	139.3K
-10	118.0K
-5	100.2K
0	85.35K
5	72.91K
10	62.48K
15	53.64K
20	46.23K
25	39.91K
30	34.56K
35	30.00K
40	26.10K
45	22.76K
50	19.90K
55	17.44K
60	15.31K
65	13.48K
70	11.88K
75	10.50K
80	9298
85	8250
90	7331
95	6532
100	5826
105	5209
110	4663
115	4182
120	3757
125	3381
130	3047
135	2750
140	2486
145	2251
150	2041
155	1854
160	1686
165	1535
170	1400
175	1278
180	1168
185	1070
190	980.5
195	899.6
200	826.8
205	760.7
210	700.7
215	646.1
220	596.4
225	551.5
230	510.2
235	472.5
240	438.3

Table 31 Model 24 Thermistor (Freeze Sensor) Test Values

24.5 Wiring Diagrams

24.5.1 TW025-061, Unit Mounted Controller, Standard

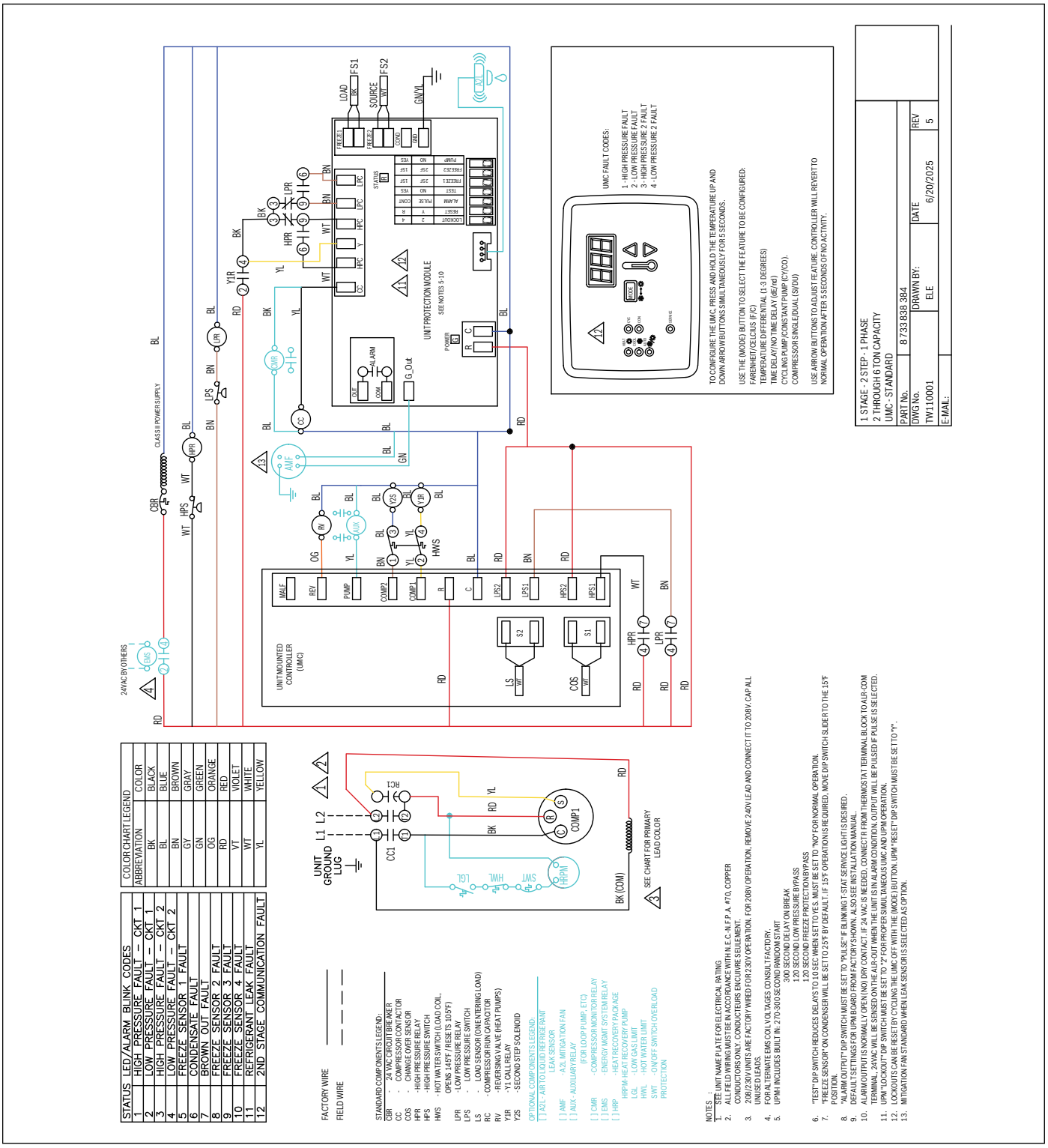

Figure 14 TW025-061, Unit Mounted Controller, Standard

24.5.2 TW025-061, Remote Controller, Standard

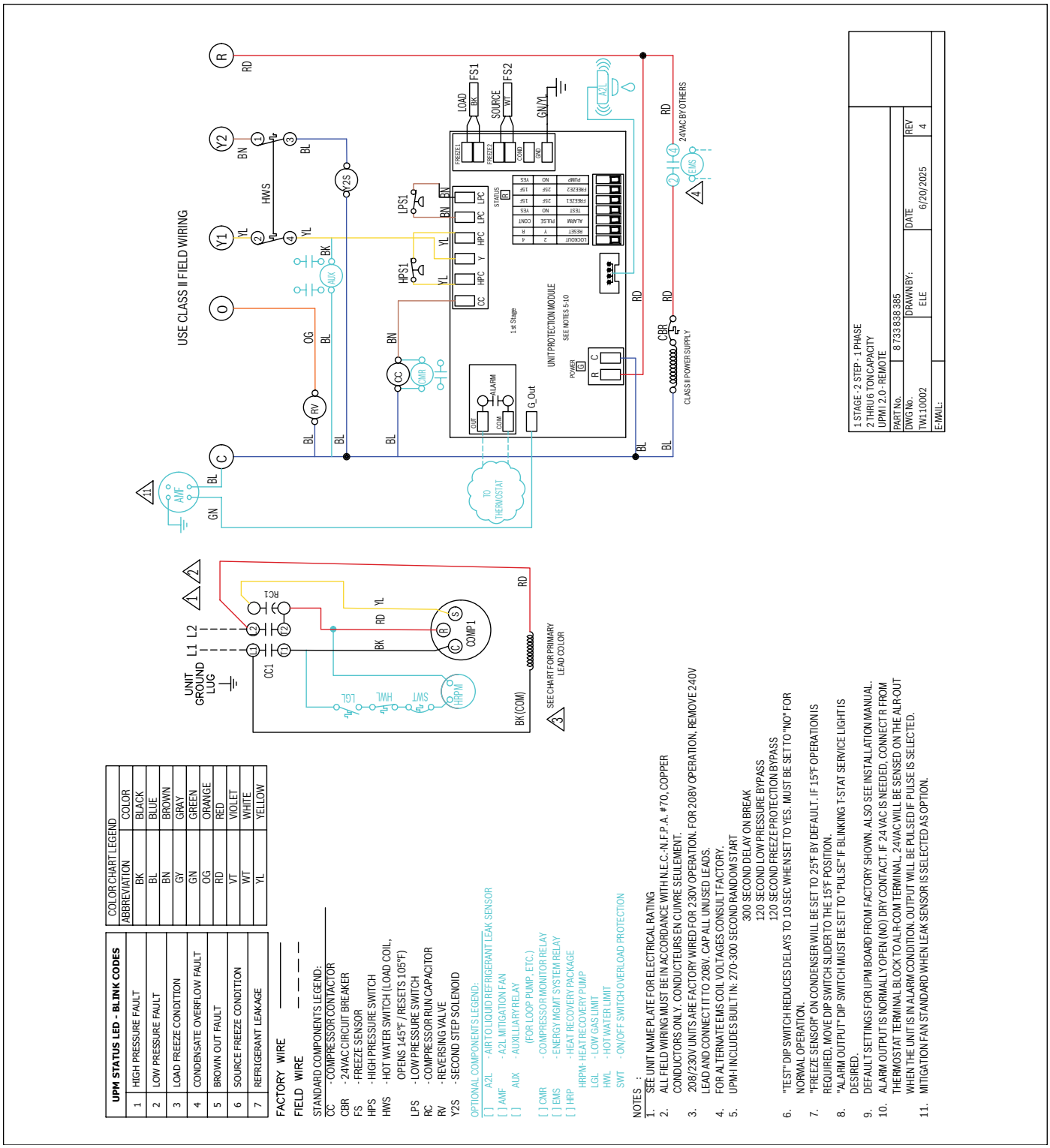

Figure 15 TW025-061, Remote Controller, Standard

24.5.3 TW122, Unit Mounted Controller, Standard

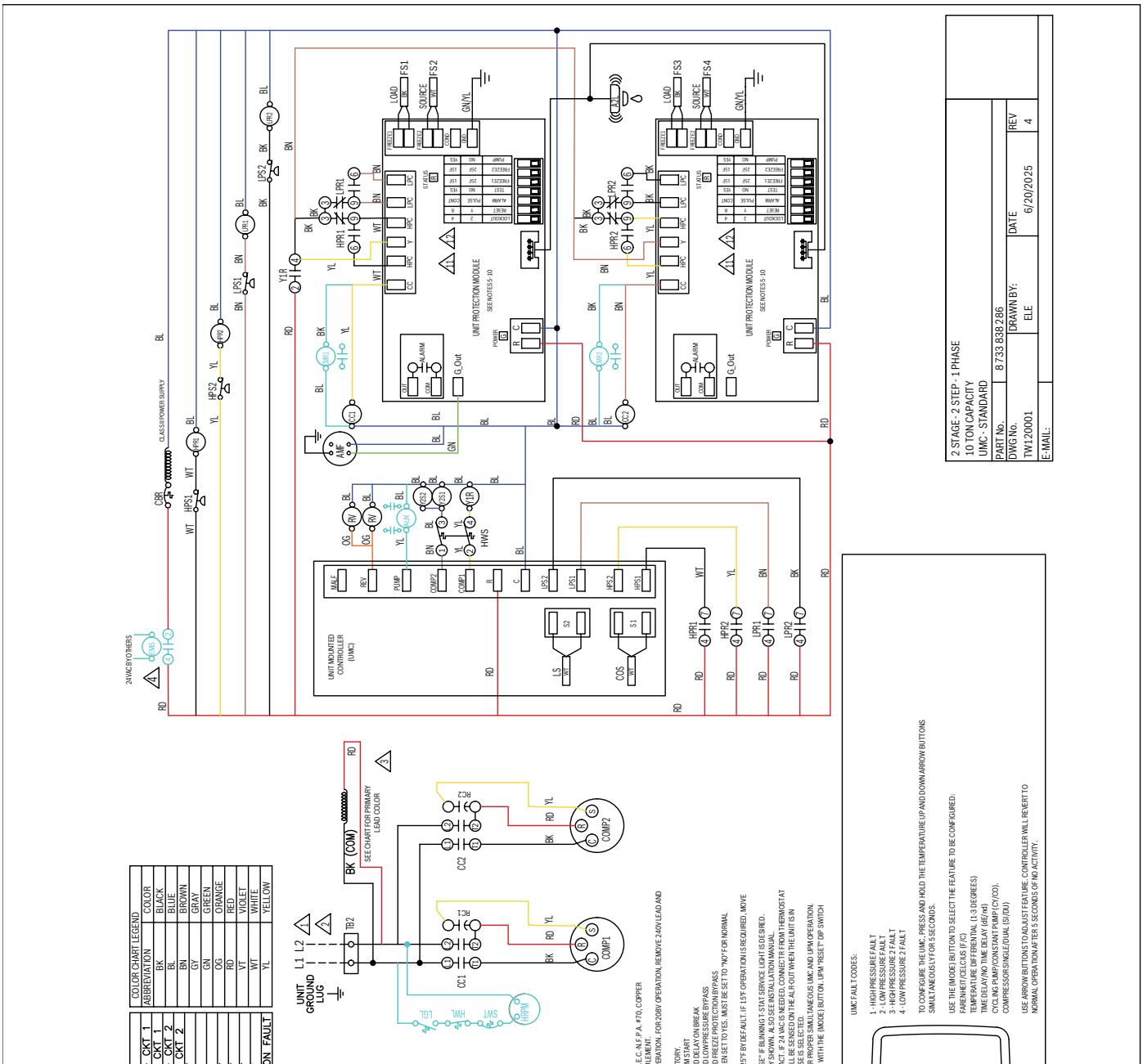

Figure 16 TW122, Unit Mounted Controller, Standard

24.5.4 TW122, Remote Controller, Standard

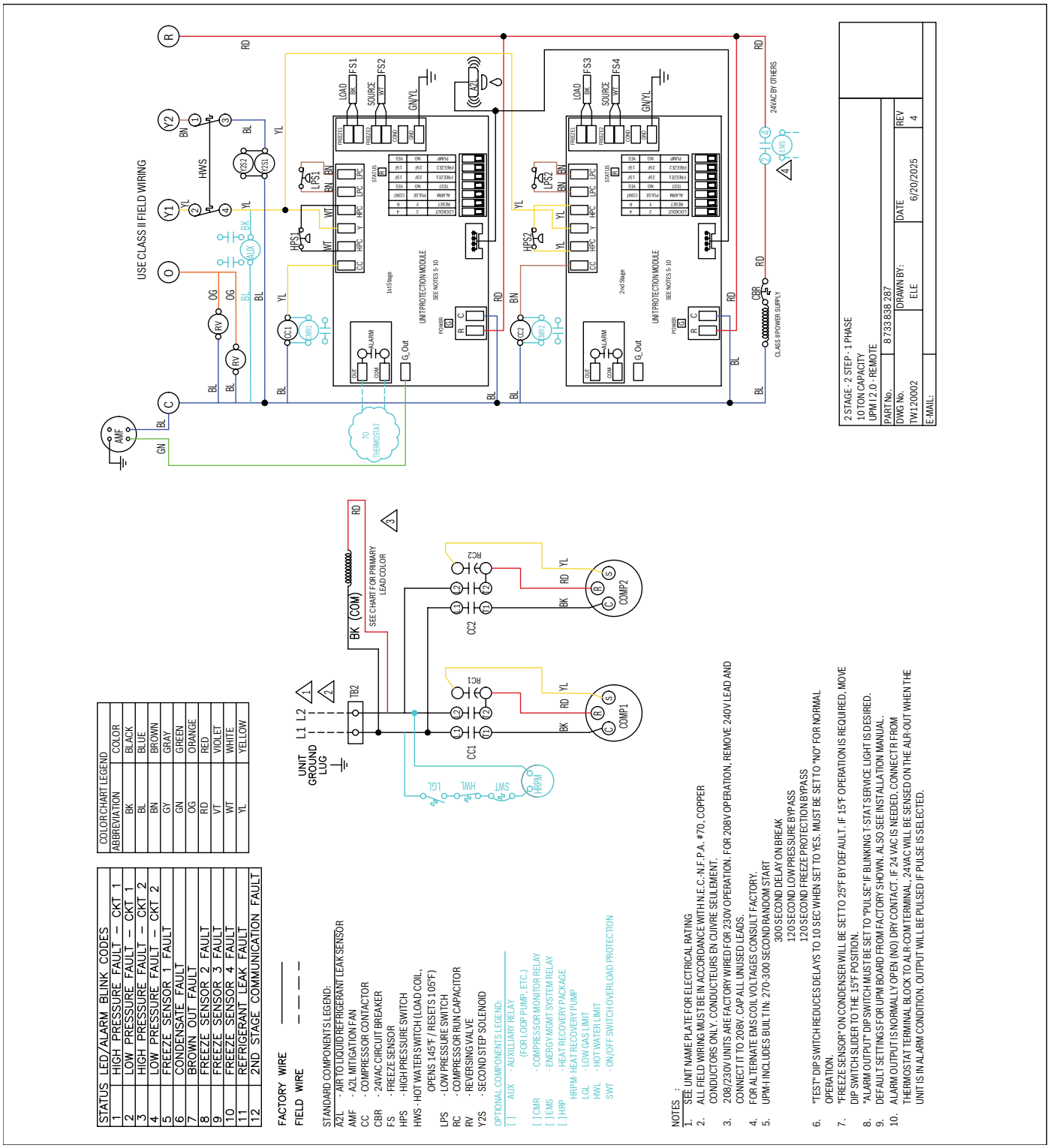

Figure 17 TW122, Remote Controller, Standard

24.6 Dimensional Drawings TW025-061

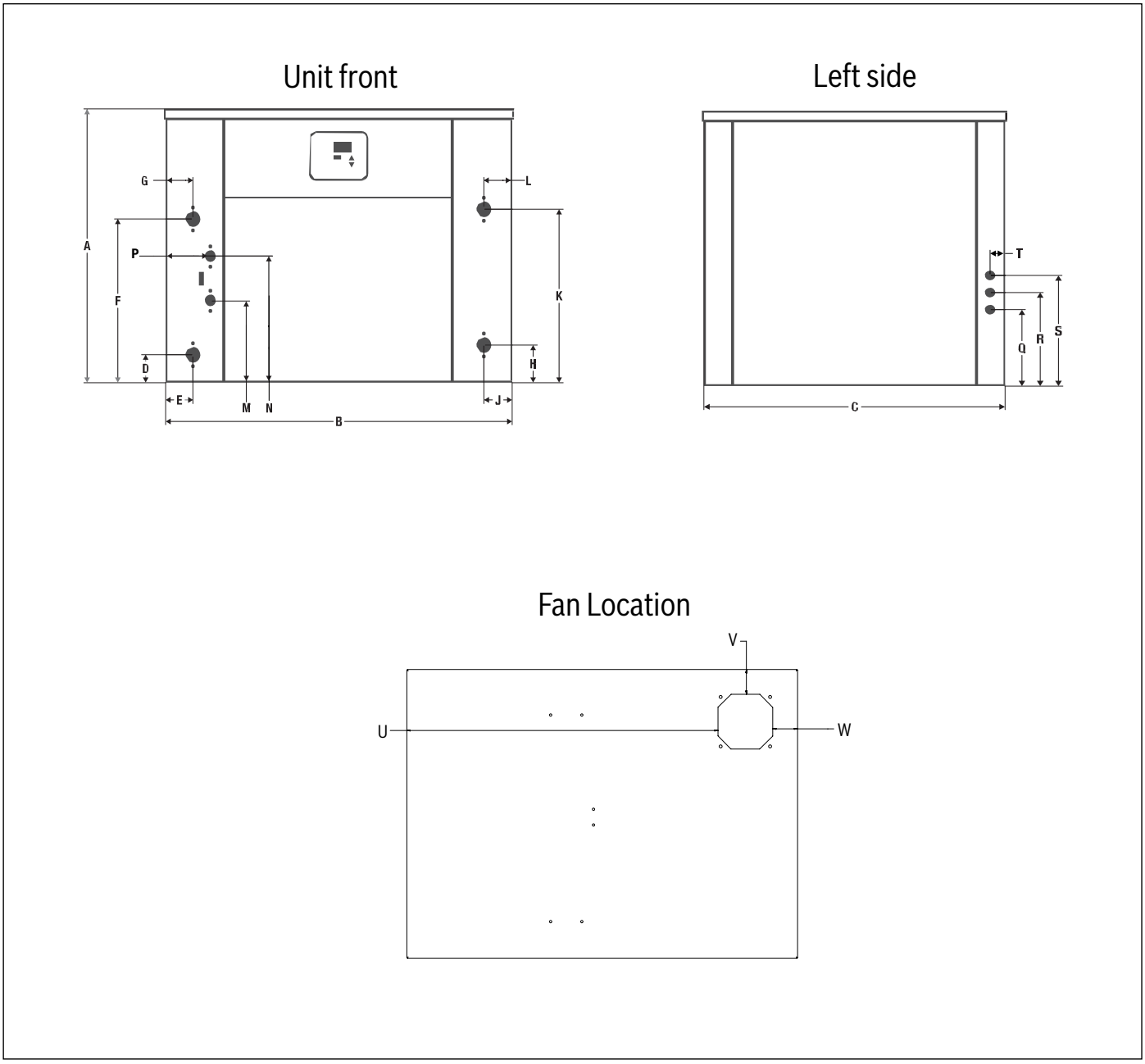

Figure 18 TW025-061 Dimensions

24.6.1 Overall Dimensions TW025-122

Models	Units	Overall Cabinet		
		Width	Depth	Height
TW025-061	in	32.50	24.00	24.00
	mm	825	610	613
TW122	in	28.00	46.00	37.75
	mm	711	1,168	960

Table 32 TW Cabinet Dimensions

24.6.2 Detailed Dimensions TW025-061

	Dimensions	TW025	TW035	TW049	TW061
A	Height	24.00	24.00	24.00	24.00
B	Width	32.50	32.50	32.50	32.50
C	Depth	24.00	24.00	24.00	24.00
D	Bottom to Load In	2.30	2.30	2.90	2.90
E	Left Side to Load In	2.55	2.55	2.19	2.19
F	Bottom to Load Out	14.30	14.30	16.90	16.90
G	Left Side to Load Out	2.65	2.65	2.19	2.19
H	Bottom to Source In	3.80	3.80	3.12	3.10
J	Right Side to Source In	2.67	2.67	2.17	2.17
K	Bottom to Source Out	15.80	15.80	17.12	17.10
L	Right Side to Source Out	2.67	2.67	2.17	2.17
M	Bottom to HRP In	7.24	7.24	7.24	7.24
N	Bottom to HRP Out	11.12	11.12	11.12	11.12
P	Left side to HRP Conn.	4.31	4.31	4.31	4.31
Q	Bottom to Low Voltage Connection	5.80	5.80	5.80	5.80
R	Bottom to Power Conn.	8.05	8.05	8.05	8.05
S	Bottom to Power Conn.	10.30	10.30	10.30	10.30
T	Front to Power Connections	1.25	1.25	1.25	1.25
U	Fan Location From Left	25.96	25.96	25.96	25.96
V	Fan Location From Back	2.07	2.07	2.07	2.07
W	Fan Location From Right	2.07	2.07	2.07	2.07
	Water Connection	3/4 FPT	3/4 FPT	1 FPT	1 FPT
	HRP Connection	1/2 FPT	1/2 FPT	1/2 FPT	1/2 FPT

NOTES:
All dimensions within +/- 0.125". Dimensions are in inches. Specifications subject to change without notice.

Table 33 TW025-061 Detailed Dimensions

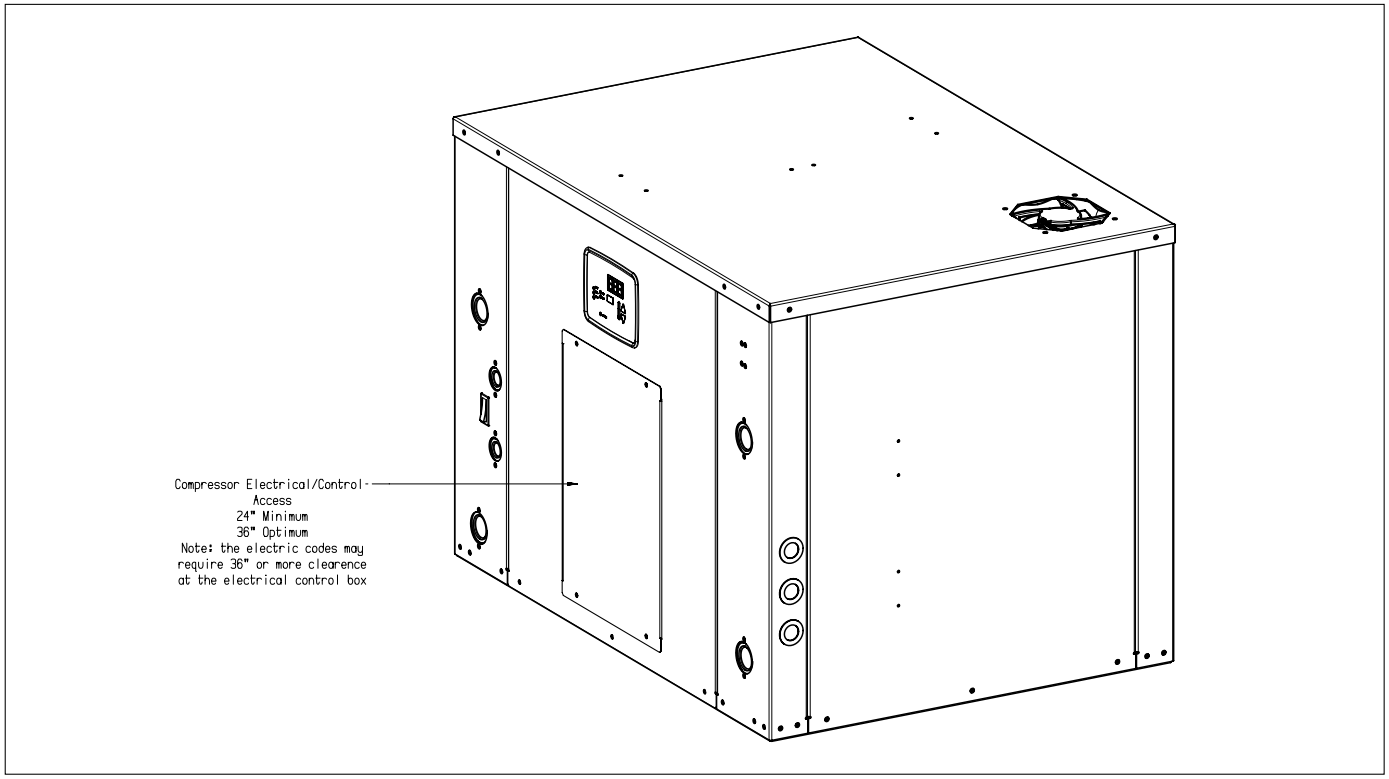

Figure 19 Service Cleareance, TW025-061

24.7 Dimensional Drawings TW122

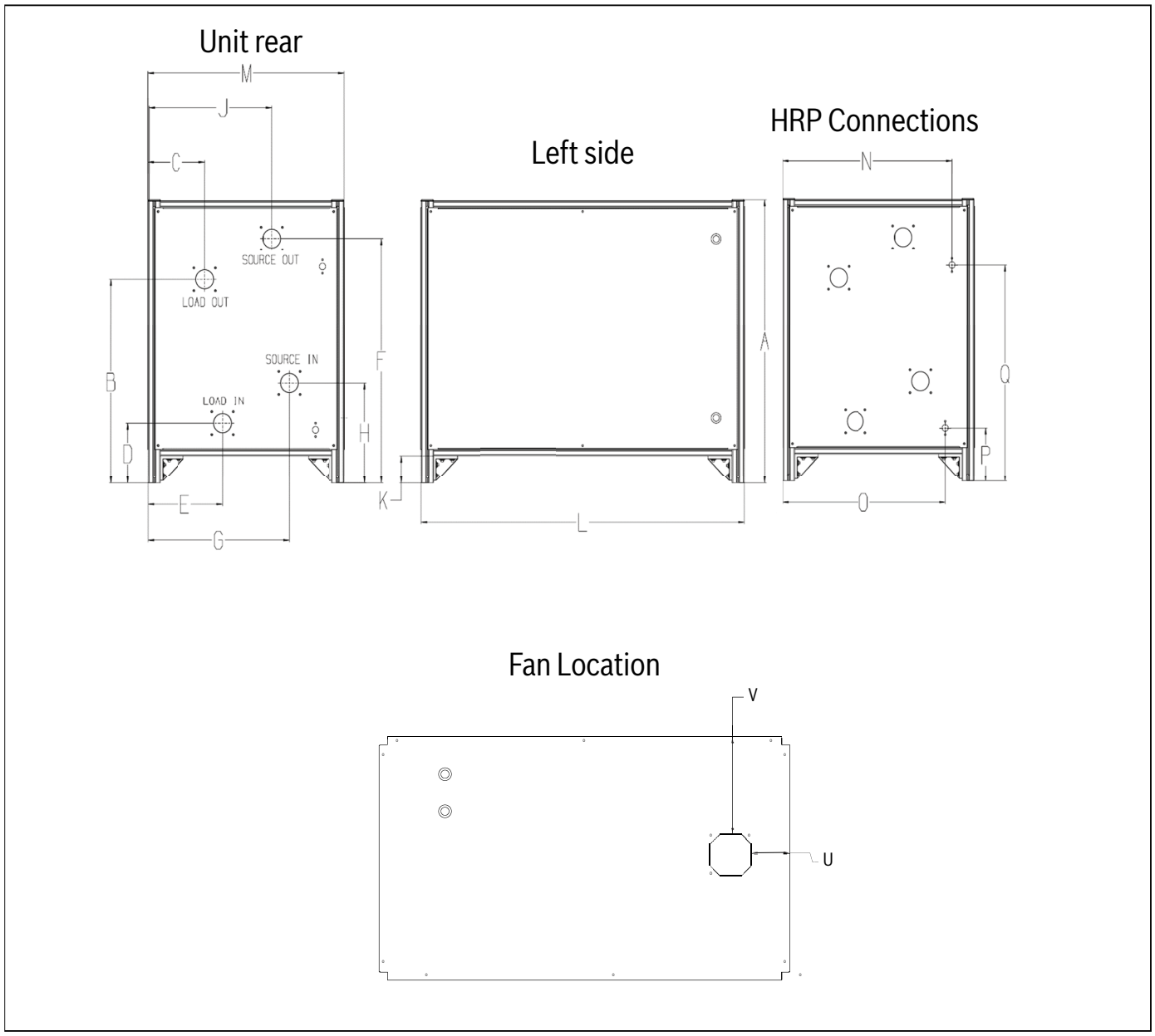

Figure 20 TW122 Dimensions

24.7.1 Detailed Dimensions TW122

Dimensions		TW122
A	Height	37.75
B	Bottom to Load Out	27.25
C	Right Side to Load Out	8.13
D	Bottom to Load In	8.00
E	Right Side to Load In	10.63
F	Bottom to Source Out	32.75
G	Right Side to Source In	20.13
H	Bottom to Source In	13.50
J	Right Side to Source Out	17.63
K	Floor to Bottom of Unit	3.75
L	Depth	46.00
M	Width	28.00
N	Right to HRP Out	24.80
O	Right to HRP In	23.81
P	Bottom to HRP In	7.12
Q	Bottom to HRP Out	28.93
U	Fan Location Depth From Back	4.15
V	Fan Location Width	10.51
Water Connections	1-1/4" FPT	

NOTES:
All dimensions within +/- 0.125". Dimensions are in inches. Specifications subject to change without notice.

Table 34 TW122 Detailed Dimensions

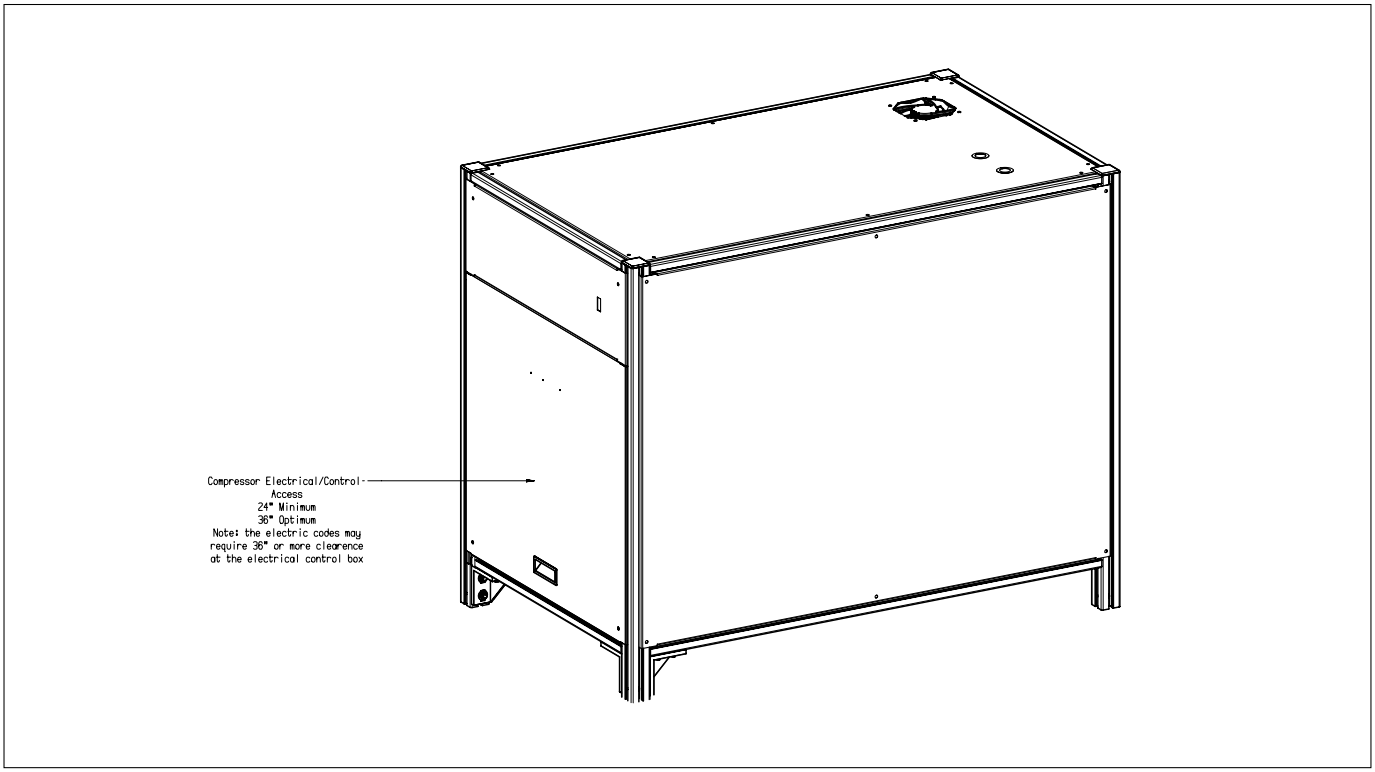

Figure 21 Service Clearance, TW122

25 Terminology

25.1 Acronyms

ASC—Anti-Short Cycle

AWG—American Wire Gauge

CFM—Cubic Feet per Minute

DDC—Digital Direct Controller

ECM—Electronically Commutated Motor

FLA—Full-Load Amps

GLHP—Ground Loop Heat Pump

HP—Horse Power

HPC—High-Pressure Switch Connection

HPS—High-Pressure Switch

IOM—Installation, Operation, and Maintenance Manual

LED—Light Emitting Diode

LPC—Low-Pressure Switch Connection

LPS—Low-Pressure Switch

LRA—Locked Rotor Amps

NO—Normally Open

NPA—Name Plate Amps

(RA)—Return Air

RLA—Running Load Amps

25.2 Terms

Conditioned Space—Space within a building provided with heated or cooled air or both (or surfaces) and, where required, with humidification or dehumidification means to maintain conditions for an acceptable thermal environment.

Decommissioning—Means the final shut-down and removal from operation or usage of a product or piece of equipment containing fluorinated greenhouse gases.

Discharge Pressure—Referring to the pressure leaving compressor.

Reclamation—Means the reprocessing of a recovered fluorinated greenhouse gas in order to match the equivalent performance of a virgin substance, taking into account its intended use.

Recovery—Referring to the collection and storage of fluorinated-greenhouse gases from products (including containers and equipment) during maintenance or servicing or prior to the disposal of the products or equipment.

Recycling—Referring to the reuse of a recovered fluorinated-greenhouse gas following a basic cleaning process.

Repair—Referring to the restoration of damaged or leaking products or equipment that contain, or whose functioning relies upon, fluorinated-greenhouse gases, involving a part containing or designed to contain such gases.

Suction Pressure—Referring to the pressure entering compressor.

26 Check-Out Sheet

Customer Data

Customer Name:_____ Date:_____

Address 1:_____

Address 2:_____

Phone:_____

Unit Number:_____

Customer Data

Unit Make:_____

Model Number:_____ Serial Number:_____

Refrigerant Charge (oz.):_____

Compressor RLA:_____ Compressor LRA:_____

Blower Motor FLA (or NPA):_____ Blower Motor HP:_____

Maximum Fuse Size (Amps):_____ Maximum Circuit Capacity:_____

Operating Conditions	Cooling Mode	Heating Mode
Entering Air Temperature:		
Entering Air Measured at:		
Leaving Air Temperature:		
Leaving Air Measured at:		
Entering Fluid Temperature:		
Leaving Fluid Temperature:		
Fluid Flow (L/min):		
Compressor Volts:		
Compressor Amps:		
Blower Motor Volts:		
Blower Motor Amps:		
Source Fluid Type:		
Fluid Flow (gpm)*:		
Fluid-Side Pressure Drop*:		
Suction Pressure (psig)*:		
Discharge Pressure (psig)*:		
Suction Temperature*:		
Discharge Temperature*:		
Suction Superheat*:		
Entering TXV/Cap Tube Temperature*:		
Liquid Subcooling*:		

* Required for Troubleshooting ONLY

NOTES:

NOTES:

United States and Canada
Bosch Thermotechnology Corp.
65 Grove St.
Watertown, MA 02472

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www.bosch-homecomfort.us

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