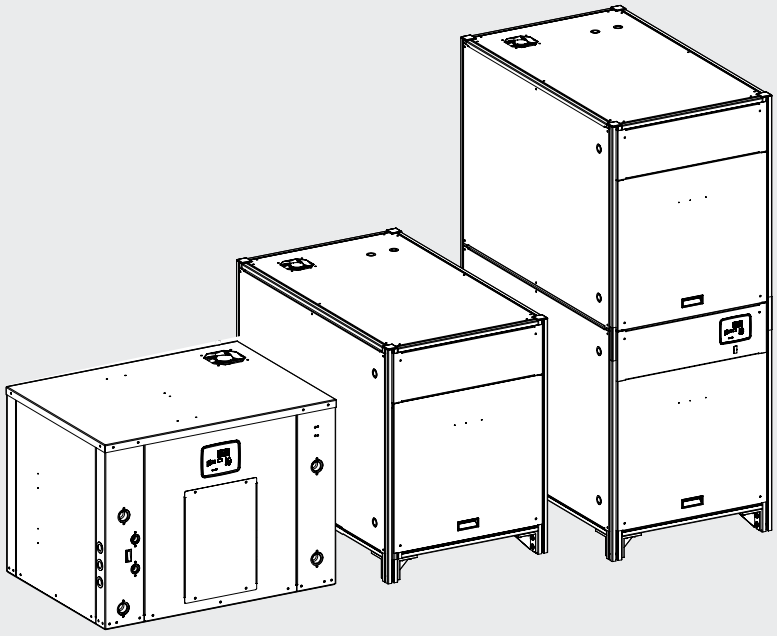
BOSCH

Installation, Operation, and Maintenance Manual

WW/WT Series Heat Pumps

WW120 | WW122 | WW180 | WW210 | WW240 | WW360 | WW420
WT025 | WT035 | WT049 | WT061 | WT071



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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

2.1 WW Nomenclature

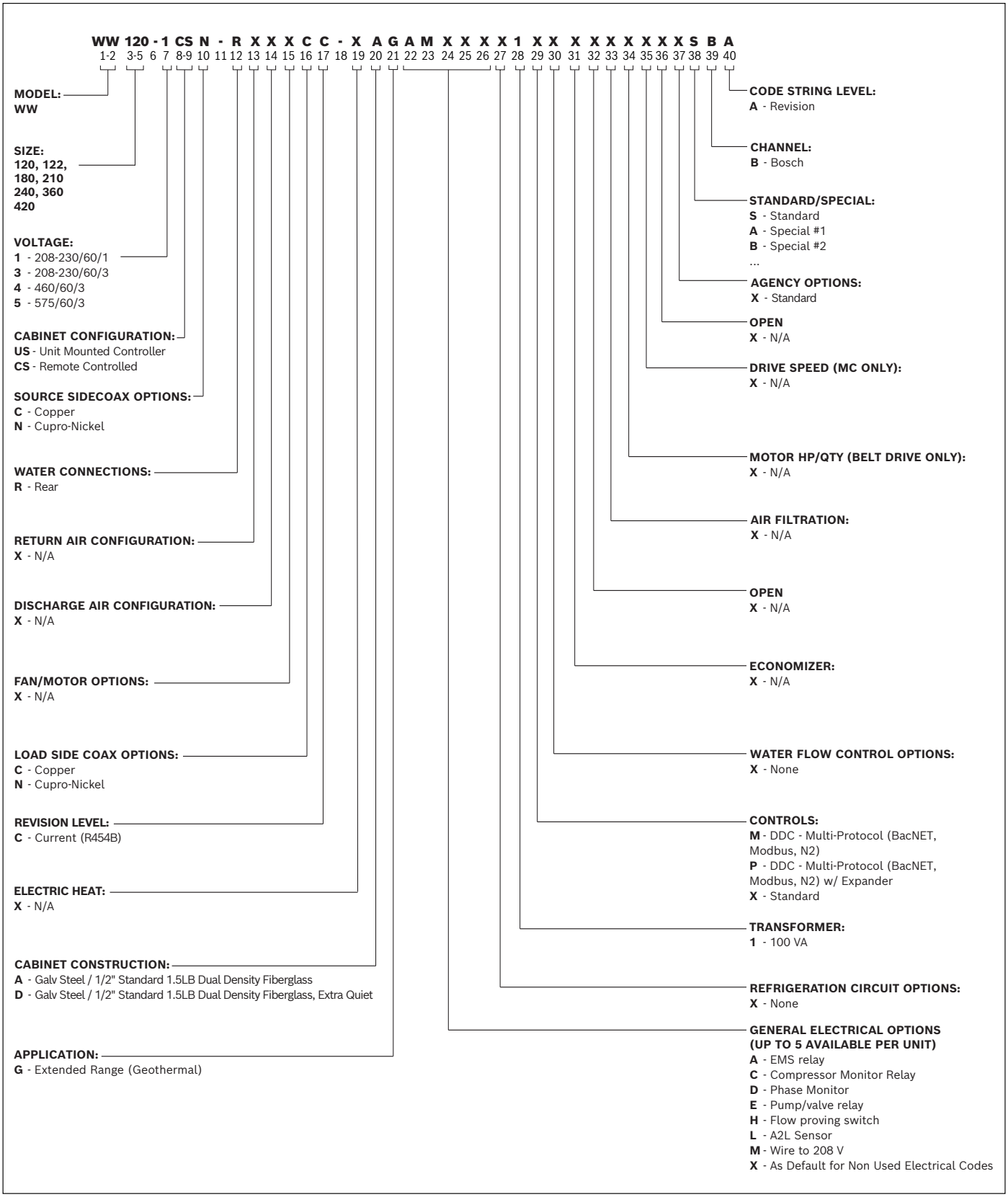


Figure 1 WW Model Nomenclature

2.2 WT Nomenclature

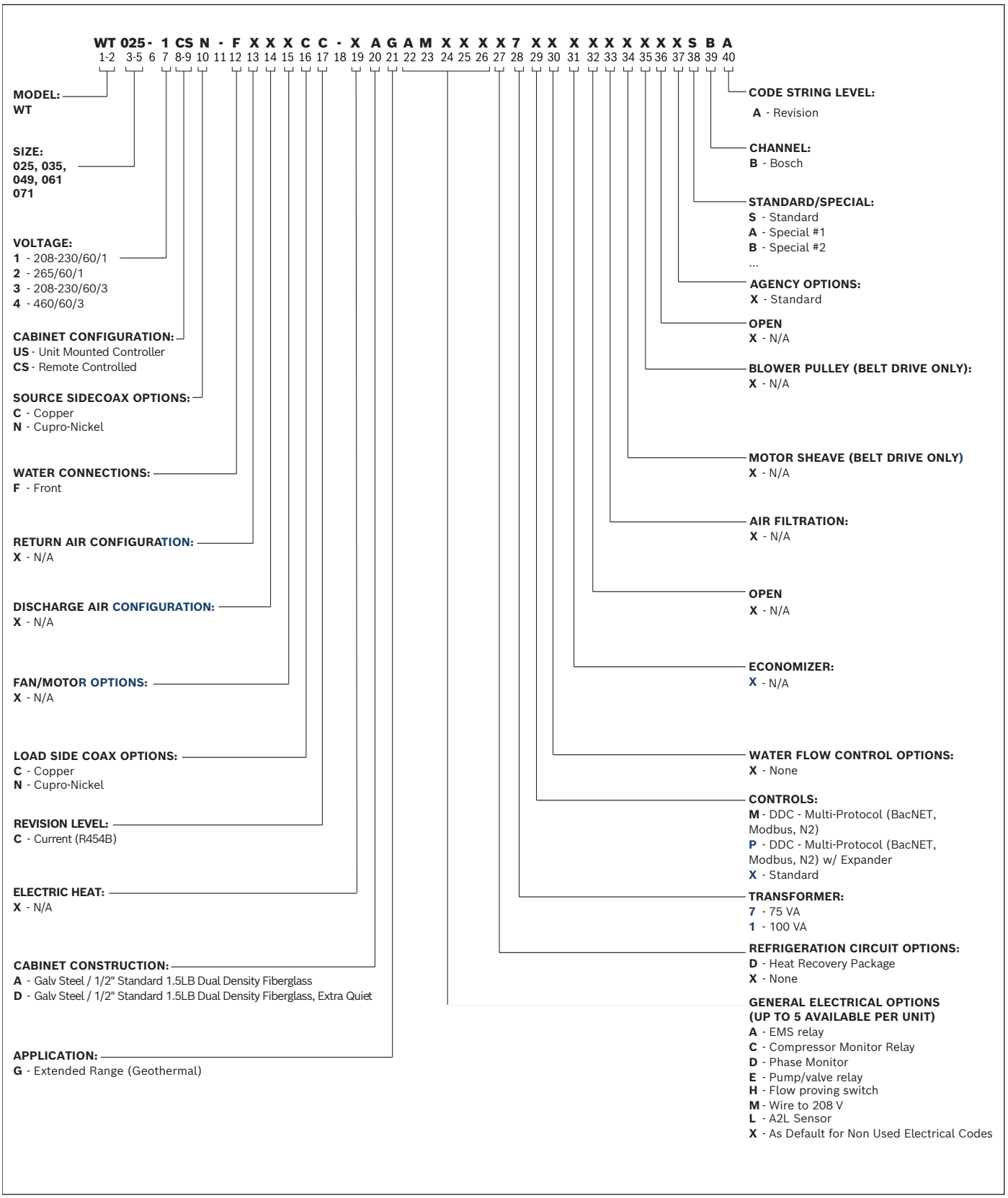


Figure 2 WT Model Nomenclature

3 Standard WW/WT Package

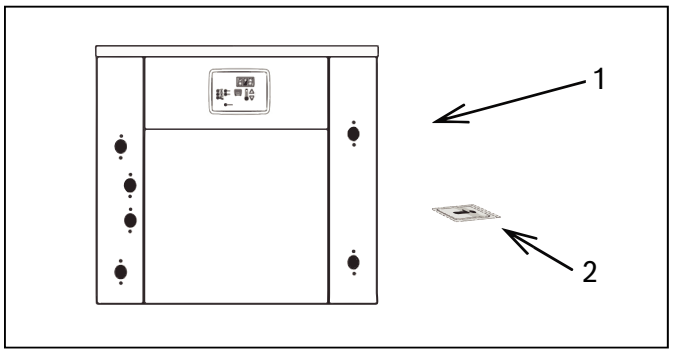


Figure 3 WW/WT Series Water-to-Water Heat Pump

[1] WW/WT Series Water-to-Water
[2] Installation and Operation Manual

General Description

The WW/WT 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 WW/WT Water-to-Water Heat Pumps conform to UL60335-2-40 standard and are certified by Intertek-ETL.

4 General Description

4.1 Operating Limits

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

NOTICE

Product damage!

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

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

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			450psi/3102kPa	
Minimum operating water flow rate			1.5 GPM per ton	

NOTE: *Maximum and minimum operating limits may not be combined. Refer to the Engineer Submittal Sheet on the product information page.*

ACRONYMS:
LWT: Leaving Water Temperature
EWT: Entering Water Temperature
PL: Part Load
GPM : Gallons Per Minute

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 WW/WT 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 WW and WT 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 4)

All WW and WT units should be vibration isolated according to the design engineer's specifications.

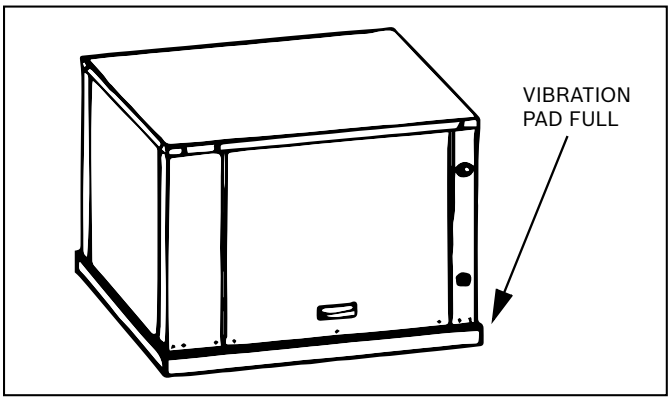


Figure 4 Vibration Pad

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.

WW/WT units are supplied with either a copper or optional cupro-nickel water to refrigerant heat exchanger. Copper is adequate for ground water that is not high in mineral content. (See Table 12)

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 12)

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 Antifreeze

In areas where entering water temperatures drop below 50°F or where piping will be routed through areas subject to freezing, antifreeze is needed. Alcohols and glycols are commonly used as antifreeze agents. Freeze protection must be maintained to 15°F below the lowest expected entering loop temperature. For example, if the lowest expected entering water temperature is 30°F, the leaving water temperature would be 22°F to 25°F. Therefore, the freeze protection must be at 15°F (30°F-15°F=15°F).

6.5 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 62.8 oz	Not required. No further actions needed.	Not required. No further actions needed
Greater than 62.8 oz	Installed standard from factory	Required. Refer to the Installation Options section

Table 2 Refrigerant Charge and Installation Requirements

6.5.1 Refrigerant Leak Detection System

The refrigerant leak detection system is standard (factory-installed) for units with refrigerant charge amounts exceeding 62.8 oz, and optional 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.

⚠ WARNING

Personal injury hazard!

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

6.5.2 Installation Options

Option 1

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

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

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 required for refrigerant leak mitigation.

With this option, A_{min} can be further reduced if unit is installed on a stand.The table below shows the required minimum room area for installation, A_{min}, at different release heights, h_0. The release height is the vertical distance from the floor to the point of release when the appliance is installed.

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, 1.2 m	h_0=4.92 ft, 1.5 m
WW120	142 (4.0)	292.8 (27.2)	244.0 (22.7)	195.2 (18.1)
WW122	142 (4.0)	292.8 (27.2)	244.0 (22.7)	195.2 (18.1)
WW180	238 (6.7)	490.7 (45.6)	408.9 (38.0)	327.1 (30.4)
WW210	224 (6.4)	461.9 (42.9)	384.9 (35.8)	307.9 ft² (28.6 m²)
Model	Refrigerant Charge in the System oz (kg)	Minimum Room Area (Floor Installation, h_0 = 5.9 ft, 1.8 m) oz (kg)		
WW240	300 (8.5)	347.9 (32.3)		
WW360	472 (13.4)	547.3 (50.9)		
WW420	432 (12.2)	501.0 (46.5)		

Table 3 A_{min} Requirements for WW Series

Model	Refrigerant Charge in the System oz (kg)	Minimum Room Area ft² (m²)		
		Floor Installation"	h_0=3.94 ft, 1.2 m	h_0=4.92 ft, 1.5 m
WT071	74 (2.1)	254.3 (23.6)	127.1 (11.8)	101.7 (9.4)

Table 4 A_{min} Requirement for WT Series

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

When the ground level altitude, h_{alt}, of the installation location 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 5.

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 5 Altitude Adjustment Factor

Option 2

If unit is installed in a room with area smaller than A_{min}, it must be ducted to the outdoors. The duct must not exceed 0.3 in H_2O of static pressure. Refer to Tables below for CFM requirements, and ESP/CFM table with the factory installed Refrigerant Leak Detection System.

Model	Total Refrigerant Charge Per Circuit oz (kg)	Minimum Circulation Airflow ft^3/min (m^3/hr)
WW120	142 (4.0)	55 (94)
WW122	71 (2.0)	28 (47)
WW180	238 (6.7)	93 (157)
WW210	224 (6.4)	87 (148)
WW240	150 (4.3)	58 (99)
WW360	236 (6.7)	92 (156)
WW420	216 (6.1)	84 (143)

Table 6 Minimum Circulation Airflow for WW Series

Model	Total Refrigerant Charge Per Circuit oz (kg)	Minimum Circulation Airflow ft^3/min (m^3/hr)
WT071	74 (2.1)	29 (49)

Table 7 Minimum Circulation Airflow for WT Series

External Static Pressure (in H_2O)	CFM
0.00	100
0.10	90
0.15	78
0.20	63
0.25	30
0.30	20

Table 8 Mitigation Fan ESP/CFM Table with the Factory Installed Refrigerant Leak Detection System

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.

CAUTION

Personal injury hazard!

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

7.1.2 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.

WARNING

Personal injury hazard!

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

7.1.3 Thermostat (Aquastat)

Unless provided with DDC controls, the WW/WT heat pumps can be controlled by most commonly available single-stage or two-stage heat pump thermostats, depending on model.

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!

The reversing valve on the WW/WT series is energized when the unit is in cooling mode. Position thermostats on an interior wall away from supply ducts.

7.1.4 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 9 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	DDC	26
Reversing Valve Solenoid 2*	12	Reversing Valve Relay	10
Compressor Contactor 1	10	Aux Relay	10
Compressor Contactor 2*	10	Compressor Monitor Relay	4
UPM board 1st Stage	5	Energy Management Relay	4
UPM board 2nd Stage*	5	A2L Mitigation Fan	23

Table 9 WW Low Voltage VA Draw

** Only available on units with 2 circuits.*

Low Voltage VA Draw			
Standard Construction		Electrical Options	
Component	VA	Component	VA
Reversing Valve Solenoid	12	DDC	26
Compressor Contactor	10	Aux Relay	10
UPM Board 1st Stage	15	Compressor Monitor Relay	4
		Energy Management Relay	4
		A2l Mitigation Fan	23

Table 10 WT Low Voltage VA Draw

7.1.5 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 11 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 11 Thermostat to HVAC Equipment Wiring Maximum Wire Length

8 Specific Application Considerations

8.1 Well Water Systems

(Refer to Figure 5)

Refer to the Water Qualify Table on page 22 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.)

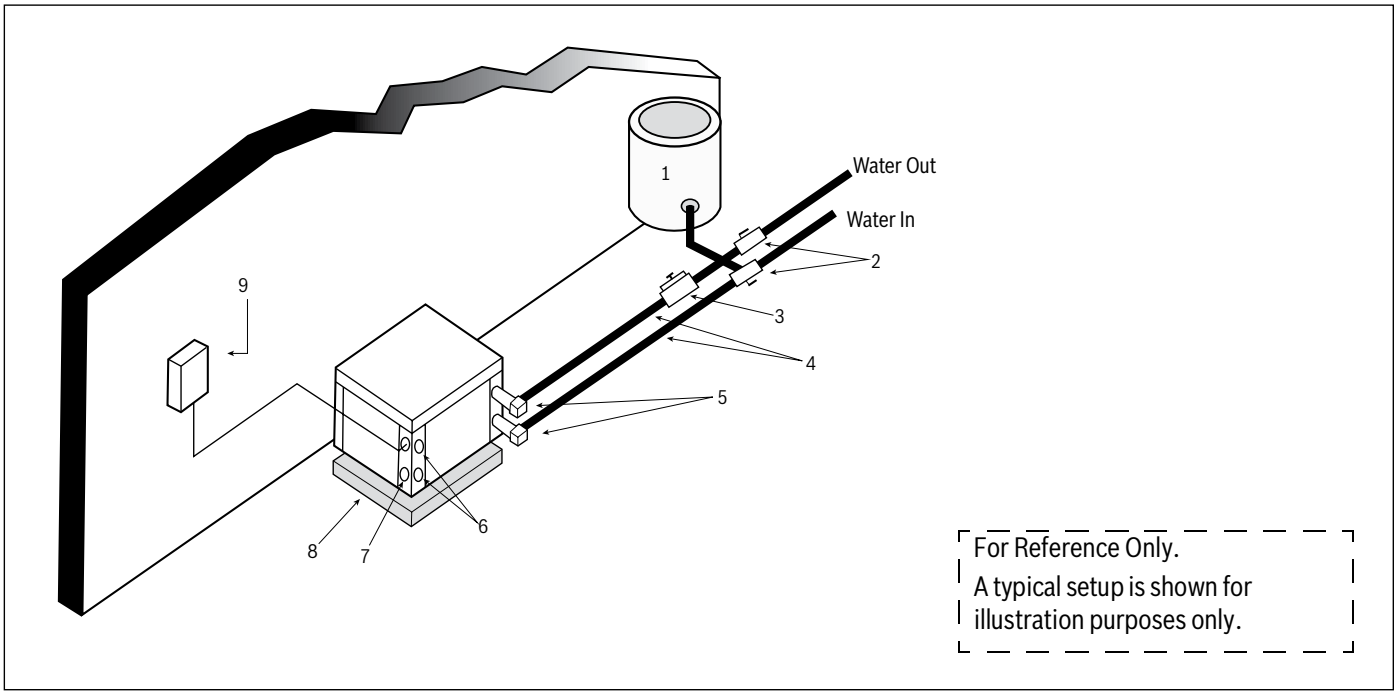


Figure 5 Typical Well Water Setup

[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 6)
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 91 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.

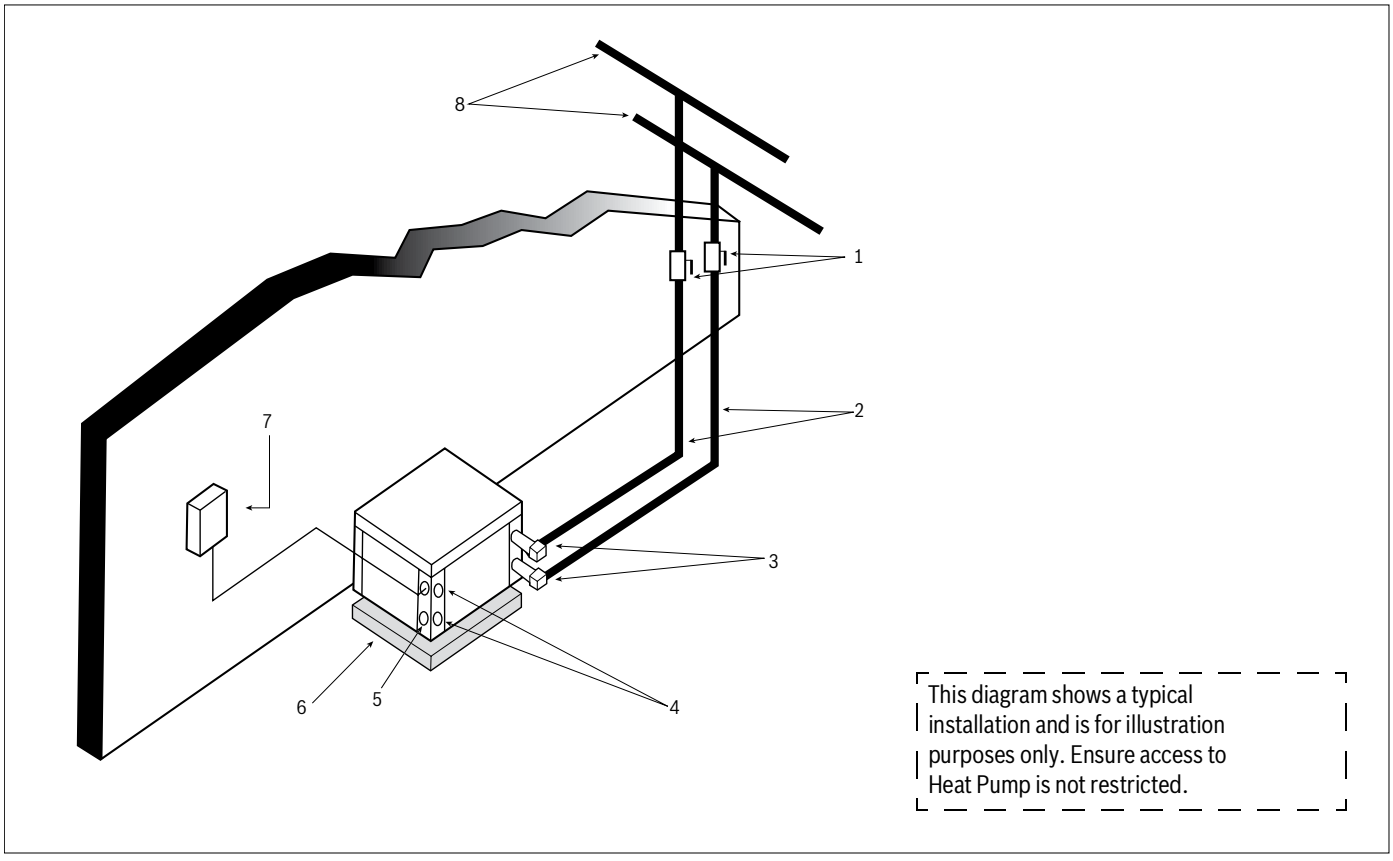


Figure 6 Cooling Tower Setup

[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 7

Operation of an WW/WT Series unit on a closed loop application requires the extended range option.

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.

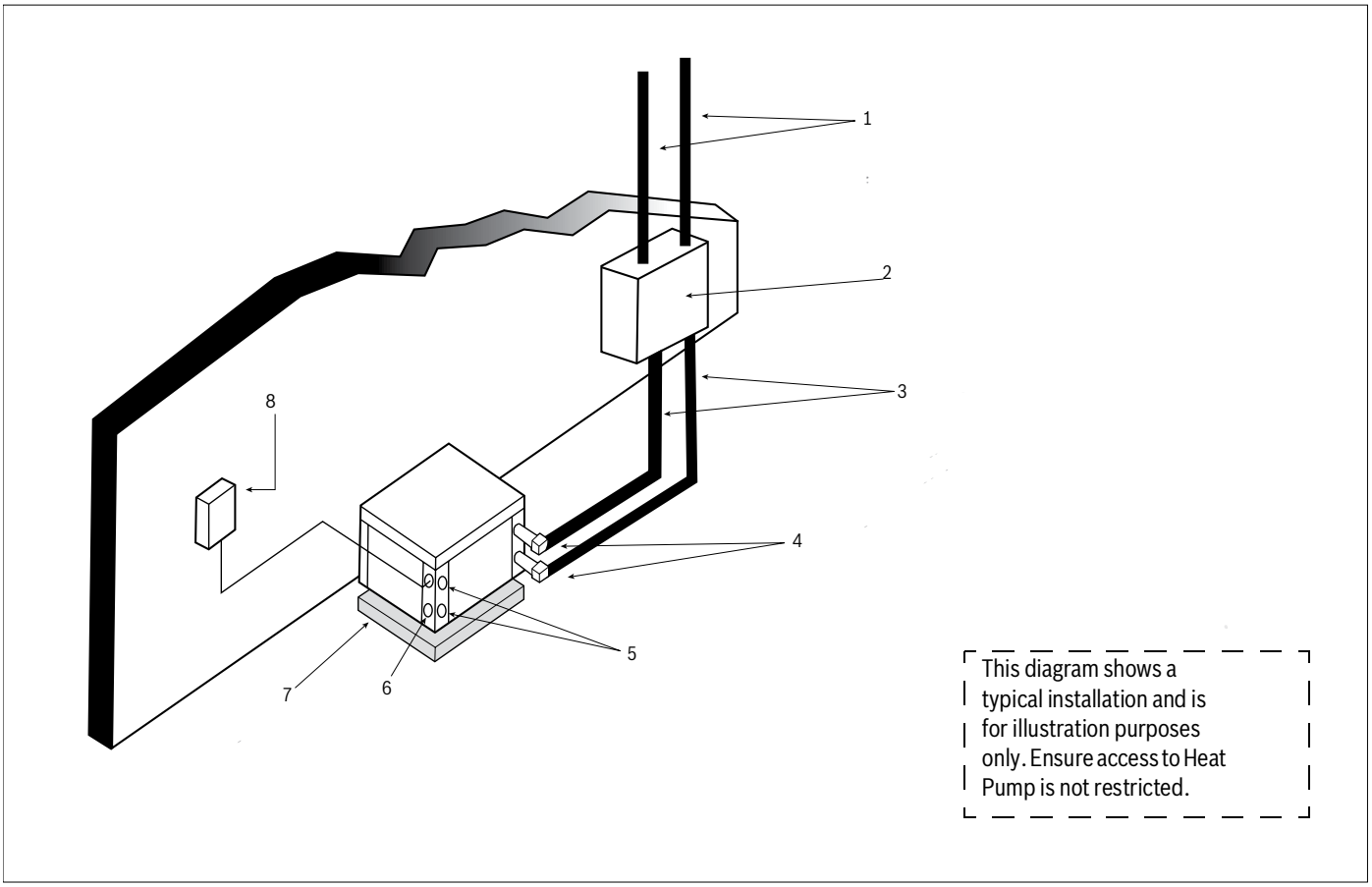


Figure 7 Geothermal Closed-Loop System

[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 12.)

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 12 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 H_2S.			
** Equivalent to 30 mesh strainer			

Table 12 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

Scroll compressors, like the ones used on the WW and WT series, are phase sensitive. When out of phase, the compressors will run in reverse. After a few minutes of reverse operation, a scroll compressor internal overload protection will open, activating the unit lockout. (This requires a manual reset. To reset, power cycle the unit.)

NOTICE

Product damage!

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

This means that for proper operation, the correct direction of rotation must be ensured. The most accurate way to ascertain this is through the use of gauges. Follow the steps below when using gauges:

1. Connect service gauges to the suction and discharge pressure fittings.
2. Energize the compressor.

The suction pressure should drop and the discharge pressure should rise, as is normal on any start up. If the suction pressure does not drop and the discharge pressure does not rise to normal levels, follow the steps in 12.1.1 Correct Direction of Rotation.

Alternatively, in locations with multiple units attached to the same branch circuit, where it is difficult to place pressure gauges on all of them, and several units are determined to be phased incorrectly:

1. Install pressure gauges and a phase rotation meter on one system to serve as a baseline.
2. Check the remaining systems with the phase rotation meter.
3. Follow the steps in 12.1.1 Correct Direction of Rotation to make corrections.

12.1.1 Correct Direction of Rotation

If you determine that the entire job site has a concern with electrical phasing, contact the utility company to ensure phasing is corrected.

1. Turn OFF power to the unit. (Always follow your Lock-out/Tag-out procedure.)
2. Reverse any two of the unit power leads.
3. Reapply power to the unit and verify pressures are correct.

The suction and discharge pressure levels should now move to their normal start-up levels.

There is a time delay before the compressor will start.

13 Start-up

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

DANGER

Electrical shock!

Disconnect switch is only to be closed when the electrical box cover is secured to electrical box and all exterior panels are secured on the unit.

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. 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.
3. 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 99)

15 Safety Devices and the UPM Controller Overview

WW and WT models are equipped with the Unit Protection Module (UPM) that controls compressor operation and monitors the safety. Units with dual circuits are equipped with a second-stage UPM board.

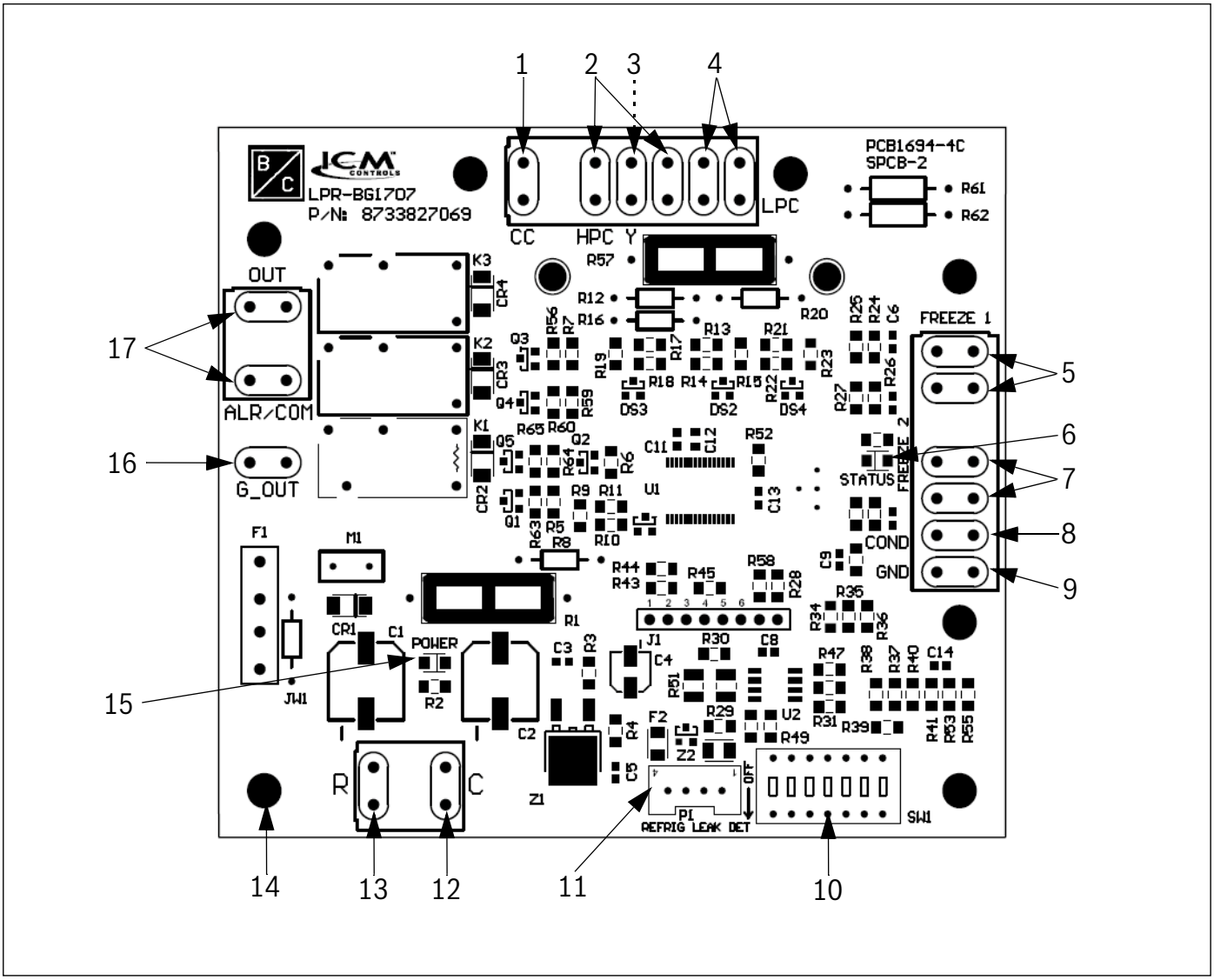


Figure 8 UPM Controller Board

[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/s

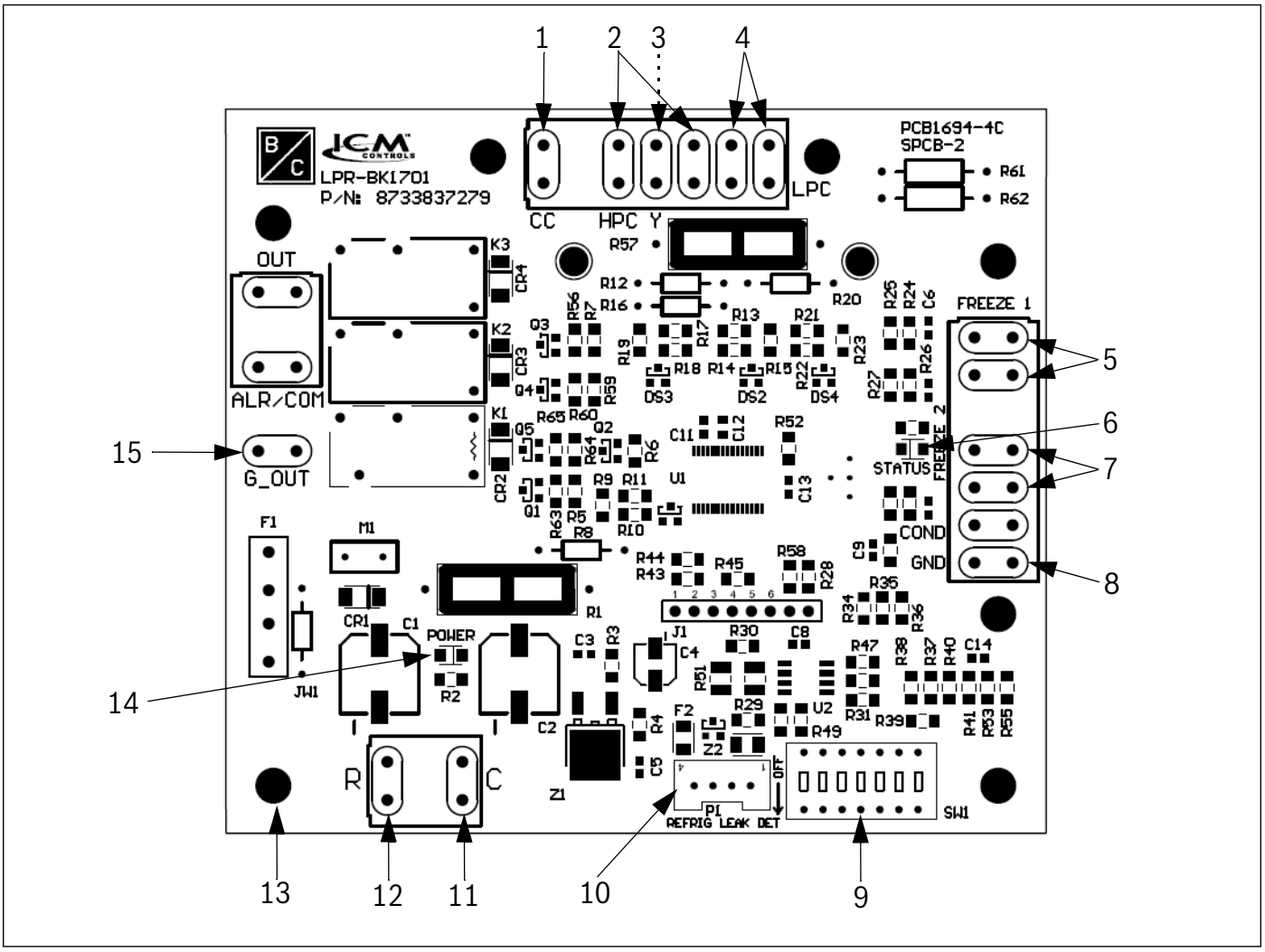


Figure 9 Second-Stage UPM Controller Board

[1] Compressor Contact Output
[2] High-Pressure Switch Connection
[3] Call for Compressor (Y2)
[4] Low-Pressure Switch Connection
[5] Water 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.
- The source side freeze protection sensor (FREEZE 1), monitors refrigerant temperature between the 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 8, item [10].)

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.

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

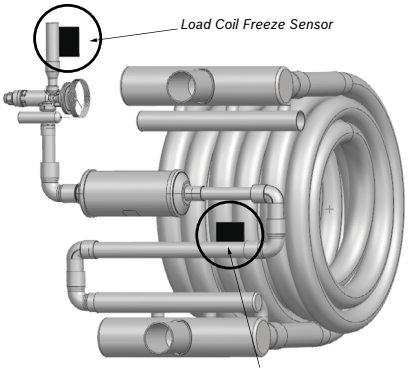


Figure 10 Source Coil Freeze Protection Sensor (FREEZE 1) and Load Coil Freeze Protection Sensor (FREEZE 2).

15.2 UPM Default Settings and DIP Switch Positions

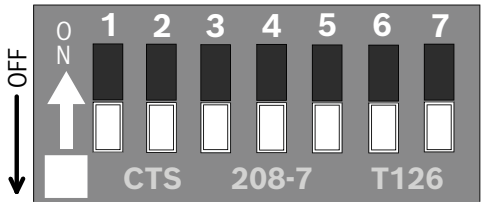


Figure 11 UPM Settings DIP Switch (SW1)

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 13 UPM DIP Switch Selectable Positions

NOTICE

Product damage!

DIP switch on UPM stage 1 and stage 2 boards must be set to match each other.

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 8, item [10].), (Refer to Figure 11.)(See Table 13)

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 11.)(See Table 13.) 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 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 11.)(See Table 13.) 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 14.) 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 525 PSIG.
2	Low Pressure	Refrigerant suction pressure has fallen below 35 PSIG.
3	Freeze 1 (source coil)	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.
5	Brownout	Control voltage has fallen below 18 VAC.
6	Freeze 2 (Load Coil)	Refrigerant temperature to the air coil has fallen below 25°F for 120 seconds.
7	Refrigerant Leak Fault	Refrigerant LFL% is more than 15%.

Table 14 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 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 15 Second Stage UPM Fault Codes

15.4 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. When this occurs, compressor operation will cease, and will not resume until the water has cooled to 115 °F. On dual circuit units, there is a single switch that controls both circuits.

- **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 8, item [10]) (Refer to Figure 11), 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 DIP switch.** The UPM controller will constantly monitor the refrigerant temperature with the sensor (FREEZE 1) mounted 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. 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 11)(See Table 13) within an hour, the controller will enter into a hard-lockout condition.

NOTICE

Product damage!

The freeze sensor (FREEZE 1) (source coil) 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 11)(See Table 13) 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 11.) (See Table 13.)

- **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.

15.5 UPM Sequence of Operation

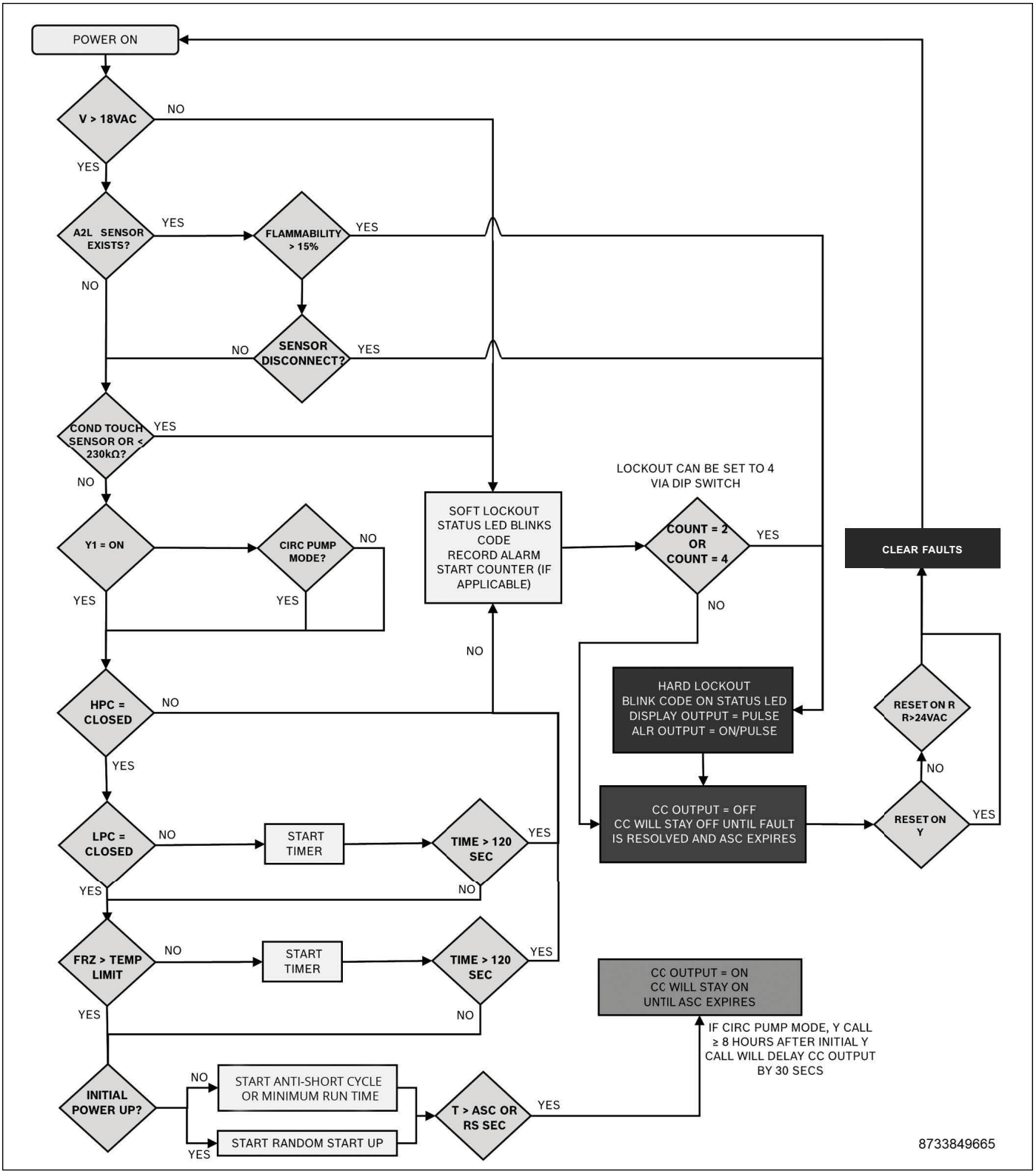


Figure 12 UPM Sequence of Operation Flowchart

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.
- °F or °C 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 16 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. If the compressor selection is set to "Du" (see configuration), and one compressor locks out, the control will switch the call to the other compressor. If the compressor setting is "Si," the control will not switch the call to the other compressor.

Blink Code Fault Conditions:

- One Blink: High pressure circuit 1
- Two Blinks: Low pressure circuit 1
- Three Blinks: High pressure circuit 2
- Four Blinks: Low pressure circuit 2

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

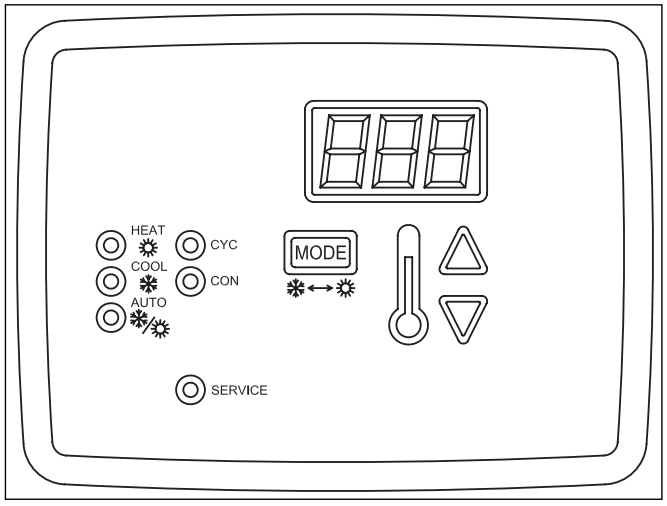


Figure 13 Unit Mounted Controller

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 17 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	Si (Single), Du (Dual)	Si
LEAD LAG	0-14 Days	0
MALFUNCTION	St (Steady), Pu (Pulsing)	St

Table 18 UMC User Adjustable Settings

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 (Si for single or Du for dual). Select using the up or down arrows. This setting is applicable only on multi-stage units. For dual circuit units, set to Du to enable the second stage. Press the "mode" key to advance.

- Setting: _____

Seventh Display Field
Lead/lag setting (dual compressor only), adjustable from 0 to 14 days for lead compressor rotation sequence. Select using the up or down arrows. Must be set to 0 for all WW/WT models. 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

There are multiple factory-installed options available on WW and WT series 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 WT 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.

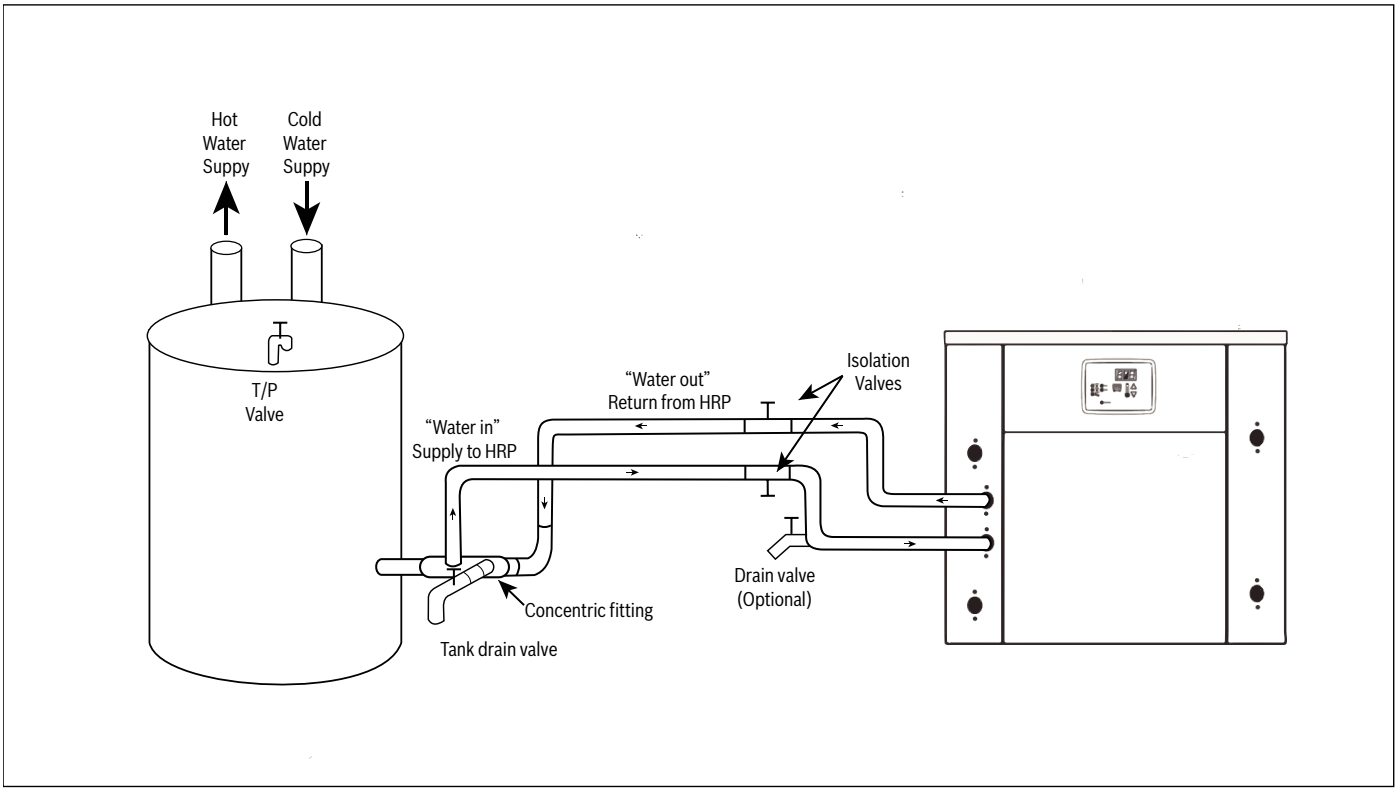


Figure 14 HRP System Setup

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 approved for domestic water.

18.2 HRP Water Tank Refill

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.

18.3 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.

18.3.1 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.

18.4 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.

18.5 Repairs to Sealed Components

NOTICE

Product damage!

Sealed-electrical components must be replaced.

18.6 Repair to Intrinsically Safe Components

NOTICE

Product damage!

Intrinsically safe components must be replaced.

18.7 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.

18.8 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.

18.9 Removal and Evacuation

WARNING

Fire hazard!

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

NOTICE

Product damage!

Before removing refrigerant ensure water is drained from water coils. Low pressure refrigerant can cause the water to freeze potentially damaging the water coils.

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 safely remove refrigerant following local and national regulations:

1. Evacuate.
2. Purge the circuit with inert gas (optional for A2L).
3. 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, refrigerants 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.

18.10 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.

18.11 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.

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 99 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.

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.

Refer to Servicing and Repair Information on page 40 for additional safety precautions.

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. If a vacuum is not possible, make a manifold so that refrigerant can be removed from various parts of the system.
3. Make sure that cylinder is situated on the scales before recovery takes place.
4. Start the recovery machine and operate in accordance with instructions.
5. DO NOT overfill cylinders (no more than 80% volume liquid charge).
6. DO NOT exceed the maximum working pressure of the cylinder, even temporarily.
7. 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.
8. Recovered refrigerant must NOT be charged into another REFRIGERATING SYSTEM unless it has been cleaned and checked through reclamation according to local legislations/regulations..

22.3 Labeling

The following are required:

- Equipment must be labeled stating that it has been decommissioned and emptied of refrigerant.
- The label must be dated and signed.
- 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 19 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	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 9.
	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 19 (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 20 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 9.
	x	x				Inspect thermostat wiring for damage. Ensure it is the correct gauge and length, and that no connections are loose.

Table 20 (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 20 (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 21 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 21 (Continued)

24 Specification Tables

24.1 Operating Temperatures and Pressures

24.1.1 WW 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)
WW120	50	50	17.5	234-254	43-53	13-15	11-13
			35	211-231	50-60	7-9	6-8
		60	17.5	242-262	52-62	15-17	13-15
			35	218-238	61-71	8-10	7-9
		70	17.5	253-273	63-73	17-19	15-17
			35	225-245	74-84	10-12	8-10
		80	17.5	265-285	74-84	19-21	17-19
			35	235-255	88-98	11-13	10-12
		90	17.5	279-299	86-96	21-23	19-21
			35	247-267	101-111	12-14	11-13
	70	50	17.5	303-323	46-56	13-15	10-12
			35	278-298	52-62	7-9	5-7
		60	17.5	312-332	55-65	14-16	12-14
			35	283-303	65-75	8-10	7-9
		70	17.5	322-342	66-76	16-18	14-16
			35	291-311	77-87	9-11	8-10
		80	17.5	335-355	78-88	18-20	16-18
			35	301-321	92-102	11-13	9-11
		90	17.5	349-369	91-101	21-23	18-20
			35	313-333	106-116	12-14	10-12
	90	50	17.5	387-407	48-58	12-14	9-11
			35	361-381	55-65	7-9	5-7
		60	17.5	396-416	59-69	14-16	11-13
			35	366-386	67-77	8-10	6-8
		70	17.5	407-427	70-80	16-18	13-15
			35	373-393	80-90	9-11	7-9
		80	17.5	420-440	83-93	18-20	15-17
			35	383-403	95-105	10-12	8-10
		90	17.5	435-455	97-107	20-22	17-19
			35	395-415	111-121	11-13	10-12
	110	50	17.5	486-506	52-62	12-14	9-11
			35	460-480	58-68	6-8	4-6
		60	17.5	499-519	63-73	14-16	10-12
			35	465-485	71-81	7-9	5-7
		70	17.5	510-530	75-85	16-18	12-14
			35	473-493	84-94	8-10	6-8
		80	17.5	524-544	88-98	18-20	14-16
			35	484-504	100-110	10-12	8-10
		90	17.5	541-561	103-113	20-22	16-18
			35	495-515	117-127	11-13	9-11

Table 22 WW120 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)
WW120	30	60	17.5	254-274	21-31	8-10	10-12
			35	232-252	26-36	4-6	5-7
		80	17.5	326-346	23-33	7-9	10-12
			35	306-326	28-38	3-5	5-7
		100	17.5	409-429	26-36	7-9	10-12
			35	390-410	31-41	3-5	5-7
		120	17.5	498-518	28-38	6-8	10-12
			35	536-556	35-45	3-5	5-7
	50	60	17.5	263-283	38-48	11-13	13-15
			35	239-259	45-55	6-8	7-9
		80	17.5	338-358	41-51	10-12	13-15
			35	311-331	47-57	5-7	7-9
		100	17.5	427-447	44-54	9-11	13-15
			35	398-418	50-60	5-7	7-9
		120	17.5	518-538	47-57	8-10	13-15
			35	513-533	54-64	4-6	7-9
	70	60	17.5	282-302	57-67	14-16	17-19
			35	253-273	66-76	8-10	9-11
		80	17.5	357-377	60-70	13-15	17-19
			35	325-345	69-79	7-9	9-11
		100	17.5	447-467	64-74	13-15	16-18
			35	413-433	73-83	7-9	9-11
		120	17.5	566-586	68-78	11-13	16-18
			35	522-542	78-88	6-8	9-11
	90	60	17.5	309-329	79-89	19-21	21-23
			35	277-297	91-101	11-13	12-14
		80	17.5	385-405	84-94	18-20	21-23
			35	347-367	97-107	10-12	12-14
		100	17.5	477-497	89-99	16-18	20-22
			35	435-455	102-112	9-11	11-13
		120	17.5	576-596	95-105	15-17	20-22
			35	546-566	109-119	8-10	11-13

Table 23 WW120 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)
WW122	50	50	17.5	175-195	65-75	7-9	6-8
			35	159-179	68-78	3-5	3-5
		60	17.5	180-200	80-90	8-10	7-9
			35	189-209	86-96	4-6	3-5
		70	17.5	186-206	96-106	10-12	9-11
			35	176-196	102-112	5-7	4-6
		80	17.5	193-213	113-123	11-13	10-12
			35	181-201	124-134	6-8	5-7
		90	17.5	201-221	133-143	12-14	12-14
			35	188-208	146-156	7-9	6-8
	70	50	17.5	237-257	68-78	7-9	6-8
			35	222-242	77-87	3-5	3-5
		60	17.5	241-261	82-92	8-10	7-9
			35	245-265	88-98	4-6	3-5
		70	17.5	246-266	98-108	9-11	8-10
			35	252-272	107-117	4-6	4-6
		80	17.5	253-273	116-126	10-12	9-11
			35	229-249	125-135	5-7	5-7
		90	17.5	261-281	136-146	12-14	11-13
			35	245-265	148-158	6-8	5-7
	90	50	17.5	313-333	70-80	6-8	5-7
			35	312-332	71-81	3-5	2-4
		60	17.5	318-338	84-94	7-9	6-8
			35	297-317	92-102	4-6	3-5
		70	17.5	322-342	101-111	9-11	7-9
			35	302-322	107-117	4-6	3-5
		80	17.5	329-349	120-130	10-12	9-11
			35	315-335	127-137	5-7	4-6
		90	17.5	336-356	140-150	11-13	10-12
			35	321-341	150-160	6-8	5-7
	110	50	17.5	404-424	72-82	6-8	4-6
			35	386-406	80-90	3-5	2-4
		60	17.5	411-431	87-97	7-9	5-7
			35	405-425	88-98	3-5	2-4
		70	17.5	415-435	104-114	8-10	7-9
			35	393-413	114-124	4-6	3-5
		80	17.5	421-441	123-133	9-11	8-10
			35	400-420	130-140	5-7	4-6
		90	17.5	429-449	144-154	11-13	9-11
			35	404-424	153-163	5-7	4-6

Table 24 WW122 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)
WW122	30	60	17.5	192-212	33-43	4-6	5-7
			35	186-206	35-45	1-3	2-4
		80	17.5	259-279	38-48	4-6	5-7
			35	251-271	38-48	1-3	2-4
		100	17.5	338-358	38-48	3-5	4-6
			35	331-351	40-50	1-3	2-4
		120	17.5	439-459	43-53	3-5	4-6
			35	430-450	43-53	1-3	2-4
	50	60	17.5	201-221	55-65	6-8	7-9
			35	191-211	59-69	3-5	3-5
		80	17.5	268-288	57-67	5-7	7-9
			35	257-277	60-70	2-4	3-5
		100	17.5	350-370	60-70	5-7	6-8
			35	338-358	63-73	2-4	3-5
		120	17.5	449-469	64-74	4-6	6-8
			35	436-456	67-77	2-4	3-5
	70	60	17.5	213-233	81-91	8-10	9-11
			35	199-219	87-97	4-6	5-7
		80	17.5	279-299	85-95	8-10	9-11
			35	265-285	90-100	4-6	5-7
		100	17.5	361-381	87-97	7-9	9-11
			35	343-363	90-100	3-5	4-6
		120	17.5	457-477	89-99	6-8	8-10
			35	442-462	95-105	3-5	4-6
	90	60	17.5	231-251	114-124	12-14	13-15
			35	217-237	124-134	6-8	7-9
		80	17.5	290-310	112-122	10-12	11-13
			35	278-298	127-137	5-7	6-8
		100	17.5	377-397	123-133	10-12	11-13
			35	357-377	131-141	5-7	6-8
		120	17.5	475-495	128-138	9-11	11-13
			35	454-474	134-144	4-6	5-7

Table 25 WW122 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)
WW180	50	50	25	233-253	42-52	11-13	10-12
			50	213-233	48-58	6-8	5-7
		60	25	241-261	52-62	13-15	11-13
			50	220-240	59-69	7-9	6-8
		70	25	251-271	62-72	15-17	13-15
			50	228-248	71-81	8-10	7-9
		80	25	263-283	73-83	17-19	15-17
			50	240-260	84-94	10-12	8-10
		90	25	277-297	86-96	19-21	17-19
			50	251-271	99-109	11-13	10-12
	70	50	25	300-320	46-56	11-13	9-11
			50	279-299	52-62	6-8	5-7
		60	25	309-329	56-66	13-15	11-13
			50	285-305	63-73	7-9	6-8
		70	25	319-339	66-76	14-16	12-14
			50	293-313	75-85	8-10	7-9
		80	25	331-351	78-88	16-18	14-16
			50	303-323	89-99	9-11	8-10
		90	25	346-366	91-101	19-21	16-18
			50	315-335	104-114	11-13	9-11
	90	50	25	383-403	51-61	11-13	8-10
			50	362-382	56-66	6-8	4-6
		60	25	392-412	60-70	12-14	10-12
			50	366-386	67-77	7-9	5-7
		70	25	402-422	71-81	14-16	12-14
			50	374-394	80-90	8-10	6-8
		80	25	415-435	83-93	16-18	13-15
			50	384-404	94-104	9-11	7-9
		90	25	430-450	97-107	18-20	15-17
			50	396-416	110-120	10-12	9-11
	110	50	25	481-501	55-65	10-12	7-9
			50	460-480	60-70	6-8	4-6
		60	25	494-514	65-75	12-14	9-11
			50	466-486	71-81	6-8	5-7
		70	25	505-525	77-87	14-16	11-13
			50	473-493	85-95	7-9	6-8
		80	25	519-539	89-99	16-18	12-14
			50	484-504	100-110	9-11	7-9
		90	25	535-555	104-114	17-19	14-16
			50	496-516	116-126	10-12	8-10

Table 26 WW180 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)
WW180	30	60	25	251-271	28-38	6-8	8-10
			50	232-252	32-42	3-5	4-6
		80	25	320-340	33-43	6-8	8-10
			50	306-326	36-46	3-5	4-6
		100	25	402-422	36-46	5-7	8-10
			50	386-406	40-50	2-4	4-6
		120	25	489-509	40-50	4-6	8-10
			50	475-495	43-53	2-4	4-6
	50	60	25	259-279	46-56	9-11	11-13
			50	238-258	52-62	5-7	6-8
		80	25	332-352	50-60	8-10	11-13
			50	309-329	56-66	4-6	6-8
		100	25	421-441	55-65	7-9	10-12
			50	397-417	59-69	4-6	6-8
		120	25	550-570	61-71	6-8	10-12
			50	518-538	65-75	3-5	5-7
	70	60	25	277-297	67-77	12-14	14-16
			50	253-273	76-86	7-9	8-10
		80	25	350-370	71-81	12-14	14-16
			50	322-342	80-90	6-8	8-10
		100	25	439-459	77-87	11-13	14-16
			50	409-429	85-95	6-8	7-9
		120	25	558-578	83-93	9-11	13-15
			50	515-535	90-100	5-7	7-9
	90	60	25	303-323	92-102	16-18	18-20
			50	276-296	104-114	9-11	11-13
		80	25	376-396	98-108	15-17	18-20
			50	345-365	110-120	9-11	10-12
		100	25	467-487	104-114	14-16	17-19
			50	430-450	117-127	8-10	10-12
		120	25	592-612	113-123	13-15	17-19
			50	537-557	124-134	7-9	9-11

Table 27 WW180 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)
WW210	50	50	25	200-220	56-66	12-14	10-12
			50	190-210	62-72	6-8	5-7
		60	25	209-229	68-78	14-16	12-14
			50	196-216	77-87	7-9	6-8
		70	25	219-239	82-92	16-18	14-16
			50	206-226	92-102	9-11	8-10
		80	25	231-251	97-107	18-20	16-18
			50	218-238	110-120	10-12	9-11
		90	25	244-264	113-123	20-22	18-20
			50	247-267	132-142	11-13	10-12
	70	50	25	262-282	59-69	12-14	10-12
			50	248-268	66-76	6-8	5-7
		60	25	270-290	72-82	14-16	11-13
			50	255-275	80-90	7-9	6-8
		70	25	281-301	85-95	16-18	13-15
			50	263-283	96-106	8-10	7-9
		80	25	293-313	101-111	18-20	15-17
			50	273-293	114-124	9-11	8-10
		90	25	306-326	118-128	20-22	17-19
			50	285-305	134-144	11-13	9-11
	90	50	25	339-359	63-73	12-14	9-11
			50	324-344	69-79	6-8	4-6
		60	25	347-367	76-86	13-15	10-12
			50	331-351	83-93	7-9	5-7
		70	25	358-378	90-100	15-17	12-14
			50	338-358	99-109	8-10	6-8
		80	25	370-390	106-116	17-19	14-16
			50	348-368	118-128	9-11	8-10
		90	25	384-404	123-133	19-21	16-18
			50	359-379	139-149	10-12	9-11
	110	50	25	434-454	67-77	11-13	8-10
			50	412-432	72-82	6-8	4-6
		60	25	442-462	80-90	13-15	9-11
			50	425-445	87-97	7-9	5-7
		70	25	453-473	94-104	15-17	11-13
			50	432-452	103-113	8-10	6-8
		80	25	465-485	111-121	17-19	13-15
			50	442-462	122-132	9-11	7-9
		90	25	479-499	129-139	19-21	15-17
			50	451-471	144-154	10-12	8-10

Table 28 WW210 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)
WW210	30	60	25	213-233	34-44	7-9	9-11
			50	201-221	37-47	3-5	5-7
		80	25	281-301	38-48	6-8	9-11
			50	268-288	41-51	3-5	5-7
		100	25	364-384	42-52	5-7	9-11
			50	350-370	44-54	2-4	4-6
		120	25	455-475	45-55	5-7	9-11
			50	444-464	48-58	2-4	4-6
	50	60	25	227-247	53-63	10-12	12-14
			50	214-234	59-69	5-7	7-9
		80	25	294-314	57-67	9-11	12-14
			50	278-298	63-73	4-6	6-8
		100	25	377-397	61-71	8-10	12-14
			50	359-379	66-76	4-6	6-8
		120	25	487-507	66-76	7-9	11-13
			50	458-478	70-80	3-5	6-8
	70	60	25	248-268	78-88	14-16	16-18
			50	232-252	87-97	7-9	9-11
		80	25	315-335	82-92	13-15	16-18
			50	296-316	91-101	7-9	9-11
		100	25	398-418	87-97	12-14	15-17
			50	375-395	96-106	6-8	8-10
		120	25	499-519	93-103	10-12	15-17
			50	473-493	100-110	5-7	8-10
	90	60	25	276-296	108-118	18-20	21-23
			50	216-236	113-123	9-11	11-13
		80	25	343-363	113-123	17-19	20-22
			50	322-342	128-138	9-11	11-13
		100	25	425-445	120-130	15-17	19-21
			50	399-419	133-143	8-10	11-13
		120	25	526-546	127-137	14-16	18-20
			50	495-515	140-150	7-9	10-12

Table 29 WW210 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)
WW240	50	50	36	203-223	58-68	6-8	5-7
			72	191-211	64-74	3-5	2-4
		60	36	208-228	71-81	7-9	6-8
			72	195-215	77-87	4-6	3-5
		70	36	215-235	84-94	8-10	7-9
			72	201-221	92-102	5-7	3-5
		80	36	224-244	99-109	9-11	9-11
			72	209-229	109-119	5-7	4-6
		90	36	234-254	115-125	11-13	10-12
			72	217-237	128-138	6-8	5-7
	70	50	36	269-289	61-71	6-8	5-7
			72	256-276	66-76	3-5	2-4
		60	36	274-294	73-83	7-9	6-8
			72	259-279	80-90	4-6	2-4
		70	36	280-300	87-97	8-10	7-9
			72	265-285	95-105	4-6	3-5
		80	36	289-309	103-113	9-11	8-10
			72	271-291	113-123	5-7	4-6
		90	36	298-318	120-130	10-12	9-11
			72	280-300	132-142	6-8	5-7
	90	50	36	350-370	63-73	5-7	4-6
			72	336-356	68-78	3-5	2-4
		60	36	354-374	77-87	6-8	5-7
			72	340-360	82-92	3-5	2-4
		70	36	361-381	91-101	7-9	6-8
			72	344-364	99-109	4-6	3-5
		80	36	369-389	108-118	9-11	8-10
			72	350-370	117-127	5-7	3-5
		90	36	379-399	125-135	10-12	9-11
			72	358-378	137-147	5-7	4-6
	110	50	36	448-468	66-76	5-7	4-6
			72	433-453	71-81	3-5	1-3
		60	36	452-472	80-90	6-8	5-7
			72	437-457	85-95	3-5	2-4
		70	36	459-479	95-105	7-9	6-8
			72	441-461	103-113	4-6	2-4
		80	36	467-487	113-123	8-10	7-9
			72	447-467	121-131	4-6	3-5
		90	36	477-497	131-141	9-11	8-10
			72	455-475	143-153	5-7	4-6

Table 30 WW240 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)
WW240	30	60	36	229-249	29-39	4-6	5-7
			72	218-238	33-43	1-3	3-5
		80	36	302-322	31-41	3-5	5-7
			72	289-309	35-45	1-3	3-5
		100	36	384-404	33-43	3-5	4-6
			72	375-395	37-47	1-3	2-4
		120	36	483-503	35-45	3-5	4-6
			72	472-492	40-50	1-3	2-4
	50	60	36	235-255	48-58	5-7	6-8
			72	220-240	53-63	2-4	4-6
		80	36	307-327	50-60	5-7	6-8
			72	292-312	55-65	2-4	3-5
		100	36	393-413	53-63	4-6	6-8
			72	378-398	57-67	2-4	3-5
		120	36	497-517	56-66	4-6	6-8
			72	481-501	60-70	1-3	3-5
	70	60	36	249-269	70-80	8-10	9-11
			72	234-254	77-87	3-5	5-7
		80	36	320-340	74-84	7-9	8-10
			72	302-322	80-90	3-5	5-7
		100	36	406-426	78-88	6-8	8-10
			72	387-407	84-94	3-5	4-6
		120	36	511-531	82-92	6-8	8-10
			72	490-510	88-98	2-4	4-6
	90	60	36	270-290	97-107	10-12	11-13
			72	252-272	107-117	5-7	6-8
		80	36	340-360	103-113	10-12	11-13
			72	319-339	112-122	5-7	6-8
		100	36	427-447	108-118	9-11	11-13
			72	403-423	118-128	4-6	6-8
		120	36	533-553	114-124	8-10	10-12
			72	507-527	124-134	4-6	6-8

Table 31 WW240 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)
WW360	50	50	45	211-231	58-68	6-8	5-7
			90	197-217	63-73	4-6	2-4
		60	45	217-237	71-81	7-9	6-8
			90	202-222	77-87	4-6	2-4
		70	45	226-246	84-94	8-10	7-9
			90	210-230	92-102	5-7	3-5
		80	45	237-257	100-110	10-12	8-10
			90	219-239	109-119	6-8	4-6
		90	45	249-269	117-127	11-13	10-12
			90	229-249	128-138	6-8	5-7
	70	50	45	278-298	61-71	6-8	4-6
			90	263-283	66-76	3-5	2-4
		60	45	284-304	74-84	7-9	5-7
			90	267-287	80-90	4-6	2-4
		70	45	293-313	88-98	8-10	6-8
			90	274-294	96-106	5-7	3-5
		80	45	304-324	104-114	9-11	8-10
			90	283-303	113-123	5-7	3-5
		90	45	317-337	122-132	10-12	9-11
			90	293-313	132-142	6-8	4-6
	90	50	45	360-380	65-75	5-7	4-6
			90	343-363	69-79	3-5	1-3
		60	45	366-386	78-88	6-8	5-7
			90	347-367	84-94	4-6	2-4
		70	45	375-395	93-103	7-9	6-8
			90	353-373	100-110	4-6	2-4
		80	45	386-406	109-119	8-10	7-9
			90	362-382	118-128	5-7	3-5
		90	45	400-420	128-138	10-12	8-10
			90	372-392	137-147	6-8	4-6
	110	50	45	454-474	69-79	5-7	4-6
			90	440-460	73-83	3-5	1-3
		60	45	464-484	82-92	6-8	4-6
			90	444-464	88-98	3-5	2-4
		70	45	474-494	97-107	7-9	5-7
			90	451-471	104-114	4-6	2-4
		80	45	485-505	115-125	8-10	6-8
			90	459-479	123-133	5-7	3-5
		90	45	499-519	133-143	9-11	7-9
			90	470-490	143-153	5-7	3-5

Table 32 WW360 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)
WW360	30	60	45	231-251	32-42	3-5	4-6
			90	221-241	36-46	1-3	3-5
		80	45	302-322	35-45	3-5	4-6
			90	294-314	40-50	1-3	2-4
		100	45	380-400	38-48	2-4	4-6
			90	373-393	43-53	0-2	2-4
		120	45	479-499	42-52	2-4	3-5
			90	469-489	47-57	0-2	2-4
	50	60	45	236-256	51-61	5-7	6-8
			90	224-244	56-66	2-4	3-5
		80	45	305-325	55-65	4-6	6-8
			90	292-312	59-69	2-4	3-5
		100	45	393-413	59-69	4-6	5-7
			90	379-399	63-73	1-3	3-5
		120	45	491-511	62-72	3-5	5-7
			90	480-500	66-76	1-3	3-5
	70	60	45	249-269	75-85	7-9	8-10
			90	237-257	82-92	3-5	5-7
		80	45	319-339	79-89	6-8	8-10
			90	303-323	86-96	3-5	4-6
		100	45	404-424	83-93	6-8	7-9
			90	387-407	90-100	2-4	4-6
		120	45	508-528	88-98	5-7	7-9
			90	489-509	94-104	2-4	4-6
	90	60	45	270-290	103-113	10-12	11-13
			90	256-276	114-124	5-7	6-8
		80	45	338-358	109-119	9-11	10-12
			90	324-344	119-129	4-6	6-8
		100	45	424-444	115-125	8-10	10-12
			90	403-423	125-135	4-6	6-8
		120	45	528-548	121-131	7-9	9-11
			90	505-525	131-141	3-5	5-7

Table 33 WW360 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)
WW420	50	50	45	191-211	64-74	8-10	7-9
			90	163-183	68-78	4-6	3-5
		60	45	198-218	78-88	9-11	8-10
			90	249-269	88-98	5-7	4-6
		70	45	208-228	93-103	11-13	10-12
			90	165-185	99-109	5-7	5-7
		80	45	218-238	111-121	12-14	11-13
			90	348-368	136-146	6-8	5-7
		90	45	230-250	130-140	14-16	13-15
			90	401-421	162-172	7-9	6-8
	70	50	45	251-271	67-77	8-10	6-8
			90	237-257	74-84	4-6	3-5
		60	45	259-279	81-91	9-11	8-10
			90	231-251	86-96	4-6	4-6
		70	45	267-287	97-107	11-13	9-11
			90	303-323	107-117	5-7	4-6
		80	45	278-298	114-124	12-14	10-12
			90	326-346	128-138	6-8	5-7
		90	45	288-308	134-144	14-16	12-14
			90	271-291	150-160	7-9	6-8
	90	50	45	328-348	70-80	8-10	6-8
			90	340-360	76-86	4-6	3-5
		60	45	335-355	84-94	9-11	7-9
			90	323-343	91-101	4-6	3-5
		70	45	343-363	100-110	10-12	8-10
			90	362-382	110-120	5-7	4-6
		80	45	353-373	119-129	12-14	10-12
			90	378-398	131-141	6-8	5-7
		90	45	364-384	139-149	13-15	11-13
			90	349-369	152-162	7-9	6-8
	110	50	45	423-443	74-84	8-10	5-7
			90	430-450	79-89	4-6	2-4
		60	45	429-449	88-98	9-11	6-8
			90	437-457	96-106	4-6	3-5
		70	45	437-457	104-114	10-12	7-9
			90	445-465	113-123	5-7	3-5
		80	45	446-466	123-133	11-13	9-11
			90	458-478	134-144	5-7	4-6
		90	45	457-477	145-155	13-15	10-12
			90	445-465	156-166	6-8	5-7

Table 34 WW420 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)
WW420	30	60	45	205-225	38-48	4-6	6-8
			90	197-217	41-51	1-3	4-6
		80	45	272-292	42-52	4-6	6-8
			90	263-283	44-54	1-3	3-5
		100	45	355-375	45-55	3-5	6-8
			90	345-365	47-57	1-3	3-5
		120	45	446-466	49-59	3-5	6-8
			90	439-459	51-61	1-3	3-5
	50	60	45	217-237	60-70	7-9	8-10
			90	209-229	65-75	3-5	5-7
		80	45	282-302	64-74	6-8	8-10
			90	271-291	68-78	2-4	5-7
		100	45	364-384	67-77	5-7	8-10
			90	352-372	71-81	2-4	4-6
		120	45	465-485	71-81	5-7	8-10
			90	451-471	75-85	2-4	4-6
	70	60	45	237-257	88-98	9-11	11-13
			90	346-366	107-117	4-6	6-8
		80	45	301-321	92-102	9-11	11-13
			90	288-308	99-109	4-6	6-8
		100	45	381-401	96-106	8-10	10-12
			90	365-385	103-113	3-5	6-8
		120	45	480-500	101-111	7-9	10-12
			90	463-483	107-117	3-5	6-8
	90	60	45	262-282	122-132	13-15	15-17
			90	198-218	119-129	6-8	8-10
		80	45	326-346	127-137	12-14	14-16
			90	275-295	129-139	5-7	8-10
		100	45	405-425	133-143	11-13	13-15
			90	388-408	144-154	5-7	8-10
		120	45	503-523	140-150	9-11	13-15
			90	482-502	150-160	4-6	7-9

Table 35 WW420 Operating Temperatures and Pressures, Heating

24.1.2 WT 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)
WT025	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 36 WT025 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)
WT025	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 37 WT025 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)
WT035	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 38 WT035 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)
WT035	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 39 WT035 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)
WT049	50	50	5	206-226	63-73	17-19	14-16
			10	188-208	72-82	9-11	8-10
		60	5	219-239	74-84	19-21	16-18
			10	192-212	86-96	11-13	9-11
		70	5	227-247	86-96	21-23	19-21
			10	199-219	102-112	12-14	11-13
		80	5	238-258	101-111	24-26	22-24
			10	207-227	119-129	14-16	13-15
		90	5	250-270	116-126	27-29	24-26
			10	215-235	138-148	16-18	15-17
	70	50	5	271-291	65-75	16-18	13-15
			10	252-272	74-84	9-11	7-9
		60	5	285-305	77-87	19-21	15-17
			10	256-276	89-99	10-12	9-11
		70	5	294-314	90-100	21-23	18-20
			10	262-282	105-115	12-14	10-12
		80	5	305-325	105-115	24-26	20-22
			10	270-290	122-132	14-16	12-14
		90	5	317-337	120-130	26-28	23-25
			10	279-299	142-152	15-17	14-16
	90	50	5	351-371	67-77	16-18	12-14
			10	330-350	76-86	8-10	6-8
		60	5	365-385	80-90	18-20	14-16
			10	334-354	92-102	10-12	8-10
		70	5	375-395	94-104	21-23	16-18
			10	340-360	108-118	11-13	9-11
		80	5	387-407	109-119	23-25	19-21
			10	348-368	125-135	13-15	11-13
		90	5	400-420	125-135	26-28	21-23
			10	357-377	146-156	15-17	13-15
	110	50	5	447-467	71-81	16-18	11-13
			10	422-442	79-89	8-10	6-8
		60	5	459-479	84-94	18-20	13-15
			10	428-448	94-104	10-12	7-9
		70	5	472-492	98-108	20-22	15-17
			10	435-455	111-121	11-13	8-10
		80	5	483-503	113-123	23-25	17-19
			10	442-462	130-140	13-15	10-12
		90	5	498-518	131-141	25-27	20-22
			10	451-471	149-159	14-16	11-13

Table 40 WT049 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)
WT049	30	60	5	212-232	43-53	9-11	12-14
			10	198-218	49-59	5-7	6-8
		80	5	282-302	45-55	9-11	12-14
			10	267-287	51-61	5-7	6-8
		100	5	367-387	47-57	8-10	12-14
			10	351-371	52-62	4-6	6-8
		120	5	464-484	49-59	7-9	12-14
			10	449-469	54-64	3-5	6-8
	50	60	5	235-255	63-73	13-15	16-18
			10	216-236	73-83	8-10	9-11
		80	5	308-328	66-76	12-14	16-18
			10	286-306	75-85	7-9	9-11
		100	5	395-415	69-79	11-13	16-18
			10	371-391	78-88	6-8	9-11
		120	5	488-508	72-82	10-12	16-18
			10	473-493	80-90	5-7	8-10
	70	60	5	257-277	87-97	18-20	21-23
			10	227-247	102-112	11-13	12-14
		80	5	331-351	91-101	17-19	21-23
			10	297-317	105-115	10-12	12-14
		100	5	418-438	95-105	16-18	21-23
			10	382-402	108-118	9-11	11-13
		120	5	527-547	99-109	14-16	20-22
			10	485-505	113-123	8-10	11-13
	90	60	5	280-300	116-126	24-26	27-29
			10	244-264	138-148	14-16	16-18
		80	5	355-375	121-131	22-24	26-28
			10	314-334	141-151	13-15	15-17
		100	5	444-464	127-137	21-23	26-28
			10	399-419	147-157	12-14	14-16
		120	5	569-589	133-143	18-20	25-27
			10	502-522	151-161	11-13	14-16

Table 41 WT049 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)
WT061	50	50	6.5	203-223	45-55	17-19	14-16
			13	182-202	51-61	9-11	8-10
		60	6.5	211-231	54-64	19-21	17-19
			13	188-208	61-71	11-13	9-11
		70	6.5	221-241	65-75	22-24	19-21
			13	195-215	74-84	12-14	11-13
		80	6.5	232-252	76-86	25-27	22-24
			13	203-223	89-99	14-16	13-15
		90	6.5	244-264	88-98	28-30	25-27
			13	213-233	103-113	16-18	15-17
	70	50	6.5	268-288	47-57	16-18	13-15
			13	246-266	54-64	9-11	7-9
		60	6.5	277-297	57-67	19-21	16-18
			13	251-271	65-75	10-12	9-11
		70	6.5	287-307	68-78	21-23	18-20
			13	258-278	77-87	12-14	10-12
		80	6.5	299-319	79-89	24-26	21-23
			13	266-286	91-101	13-15	12-14
		90	6.5	315-335	96-106	28-30	24-26
			13	276-296	108-118	15-17	14-16
	90	50	6.5	347-367	51-61	16-18	12-14
			13	322-342	56-66	9-11	7-9
		60	6.5	356-376	60-70	18-20	14-16
			13	330-350	68-78	10-12	8-10
		70	6.5	367-387	72-82	21-23	17-19
			13	337-357	80-90	11-13	9-11
		80	6.5	380-400	84-94	24-26	19-21
			13	344-364	94-104	13-15	11-13
		90	6.5	395-415	97-107	26-28	22-24
			13	354-374	111-121	15-17	13-15
	110	50	6.5	444-464	54-64	16-18	11-13
			13	425-445	59-69	8-10	6-8
		60	6.5	453-473	64-74	18-20	13-15
			13	423-443	72-82	10-12	7-9
		70	6.5	464-484	76-86	21-23	15-17
			13	433-453	84-94	11-13	8-10
		80	6.5	478-498	89-99	23-25	18-20
			13	441-461	98-108	12-14	10-12
		90	6.5	493-513	102-112	26-28	20-22
			13	450-470	114-124	14-16	11-13

Table 42 WT061 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)
WT061	30	60	6.5	213-233	27-37	10-12	13-15
			13	199-219	31-41	5-7	7-9
		80	6.5	284-304	30-40	9-11	13-15
			13	266-286	32-42	4-6	6-8
		100	6.5	368-388	32-42	8-10	13-15
			13	351-371	34-44	4-6	6-8
		120	6.5	466-486	35-45	7-9	13-15
			13	447-467	37-47	3-5	6-8
	50	60	6.5	231-251	44-54	14-16	17-19
			13	208-228	49-59	8-10	9-11
		80	6.5	302-322	47-57	13-15	17-19
			13	277-297	52-62	7-9	9-11
		100	6.5	387-407	49-59	12-14	16-18
			13	360-380	53-63	6-8	8-10
		120	6.5	488-508	53-63	11-13	16-18
			13	462-482	58-68	5-7	8-10
	70	60	6.5	251-271	63-73	19-21	22-24
			13	221-241	72-82	11-13	12-14
		80	6.5	323-343	67-77	18-20	21-23
			13	289-309	74-84	10-12	12-14
		100	6.5	409-429	70-80	16-18	21-23
			13	373-393	77-87	9-11	11-13
		120	6.5	514-534	75-85	15-17	21-23
			13	475-495	82-92	8-10	11-13
	90	60	6.5	276-296	86-96	24-26	27-29
			13	240-260	99-109	14-16	16-18
		80	6.5	350-370	91-101	23-25	27-29
			13	309-329	103-113	13-15	15-17
		100	6.5	438-458	96-106	21-23	26-28
			13	393-413	108-118	12-14	15-17
		120	6.5	543-563	101-111	19-21	26-28
			13	495-515	113-123	11-13	14-16

Table 43 WT061 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)
WT071	50	50	7.5	202-222	50-60	17-19	14-16
			15	182-202	57-67	9-11	8-10
		60	7.5	210-230	60-70	19-21	16-18
			15	188-208	69-79	10-12	9-11
		70	7.5	219-239	71-81	22-24	19-21
			15	195-215	83-93	12-14	11-13
		80	7.5	230-250	84-94	24-26	22-24
			15	203-223	98-108	14-16	13-15
		90	7.5	242-262	98-108	27-29	24-26
			15	212-232	116-126	16-18	14-16
	70	50	7.5	267-287	53-63	16-18	13-15
			15	246-266	60-70	9-11	7-9
		60	7.5	275-295	63-73	19-21	15-17
			15	251-271	72-82	10-12	8-10
		70	7.5	285-305	75-85	21-23	18-20
			15	257-277	86-96	12-14	10-12
		80	7.5	297-317	88-98	24-26	20-22
			15	265-285	102-112	13-15	12-14
		90	7.5	309-329	102-112	26-28	23-25
			15	274-294	119-129	15-17	13-15
	90	50	7.5	346-366	57-67	16-18	12-14
			15	323-343	61-71	8-10	6-8
		60	7.5	355-375	67-77	18-20	14-16
			15	329-349	75-85	10-12	8-10
		70	7.5	365-385	79-89	20-22	16-18
			15	335-355	89-99	11-13	9-11
		80	7.5	377-397	92-102	23-25	19-21
			15	343-363	105-115	13-15	11-13
		90	7.5	391-411	107-117	26-28	22-24
			15	352-372	123-133	14-16	12-14
	110	50	7.5	474-494	64-74	16-18	11-13
			15	424-444	66-76	8-10	6-8
		60	7.5	451-471	72-82	18-20	13-15
			15	423-443	79-89	9-11	7-9
		70	7.5	461-481	83-93	20-22	15-17
			15	432-452	93-103	11-13	8-10
		80	7.5	474-494	97-107	23-25	17-19
			15	439-459	109-119	12-14	10-12
		90	7.5	489-509	112-122	25-27	20-22
			15	447-467	127-137	14-16	11-13

Table 44 WT071 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)
WT071	30	60	7.5	195-215	42-52	11-13	13-15
			15	182-202	44-54	5-7	7-9
		80	7.5	262-282	44-54	10-12	13-15
			15	248-268	47-57	5-7	7-9
		100	7.5	344-364	46-56	9-11	13-15
			15	328-348	49-59	4-6	6-8
		120	7.5	439-459	49-59	8-10	13-15
			15	423-443	51-61	3-5	6-8
	50	60	7.5	211-231	63-73	15-17	18-20
			15	192-212	68-78	8-10	9-11
		80	7.5	279-299	66-76	14-16	17-19
			15	259-279	71-81	7-9	9-11
		100	7.5	362-382	68-78	12-14	17-19
			15	340-360	73-83	6-8	9-11
		120	7.5	463-483	71-81	11-13	16-18
			15	435-455	73-83	5-7	8-10
	70	60	7.5	229-249	89-99	20-22	23-25
			15	204-224	99-109	11-13	13-15
		80	7.5	299-319	93-103	19-21	22-24
			15	268-288	99-109	10-12	12-14
		100	7.5	383-403	97-107	17-19	22-24
			15	351-371	106-116	9-11	12-14
		120	7.5	483-503	100-110	15-17	21-23
			15	446-466	102-112	8-10	10-12
	90	60	7.5	251-271	122-132	26-28	29-31
			15	221-241	141-151	15-17	17-19
		80	7.5	323-343	126-136	24-26	28-30
			15	286-306	143-153	14-16	16-18
		100	7.5	409-429	131-141	22-24	27-29
			15	368-388	147-157	13-15	15-17
		120	7.5	509-529	135-145	20-22	26-28
			15	466-486	149-159	11-13	14-16

Table 45 WT071 Operating Temperatures and Pressures, Heating

24.2 Waterside Pressure Drop

24.2.1 WW Waterside Pressure Drop

Model	GPM	Chilled Fluid Side		Cond. Fluid Side	
		Pressure Drop (PSIG)	Pressure Drop (ft of H_2O)	Pressure Drop (PSIG)	Pressure Drop (ft of H_2O)
WW120	18	1.05	2.43	0.90	2.08
	22	1.48	3.42	1.29	2.97
	26	1.98	4.56	1.73	3.99
	30	2.53	5.85	2.23	5.15
	34	3.15	7.26	2.79	6.44
WW122	18	1.98	4.56	1.65	3.81
	22	2.78	6.42	2.35	5.43
	26	3.71	8.56	3.16	7.30
	30	4.75	10.95	4.07	9.40
	34	5.90	13.61	5.09	11.73
WW180	22	1.49	3.43	1.29	2.97
	26	1.98	4.57	1.73	3.99
	30	2.54	5.85	2.23	5.15
	34	3.15	7.27	2.79	6.43
	38	3.83	8.83	3.40	7.85
WW210	25	1.86	4.28	1.61	3.71
	30	2.54	5.86	2.22	5.13
	35	3.32	7.66	2.93	6.76
	40	4.19	9.67	3.72	8.58
	45	5.15	11.88	4.59	10.60
WW240	36	1.05	2.43	0.90	2.08
	44	1.48	3.42	1.29	2.97
	52	1.98	4.56	1.73	3.99
	60	2.53	5.85	2.23	5.15
	68	3.15	7.26	2.79	6.44
WW360	44	1.49	3.43	1.29	2.97
	52	1.98	4.57	1.73	3.99
	60	2.54	5.85	2.23	5.15
	68	3.15	7.27	2.79	6.43
	76	3.83	8.83	3.40	7.85
WW420	50	1.86	4.28	1.61	3.71
	60	2.54	5.86	2.22	5.13
	70	3.32	7.66	2.93	6.76
	80	4.19	9.67	3.72	8.58
	90	5.15	11.88	4.59	10.60

Table 46 WW Waterside Pressure Drop Table

24.2.2 WT 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)
WT025	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
WT035	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
WT049	6	0.92	2.12	1.10	2.55
	8	1.49	3.45	1.83	4.21
	10	2.19	5.05	2.70	6.23
	12	3.00	6.92	3.72	8.58
	16	4.95	11.43	6.17	14.24
WT061	7.5	2.19	5.06	1.82	4.20
	10	3.56	8.21	3.02	6.97
	12.5	5.21	12.01	4.48	10.33
	15	7.12	16.44	6.18	14.26
	20	11.73	27.07	10.29	23.75
WT071	9	1.99	4.59	1.66	3.84
	12	3.25	7.50	2.76	6.37
	15	4.77	11.01	4.10	9.46
	18	6.55	15.11	5.66	13.07
	24	10.81	24.95	9.44	21.79

Table 47 WT Waterside Pressure Drop Table

24.3 Compressor Characteristics

24.3.1 WW Compressor Characteristics

Models	Voltage Code	Rated Voltage	Compressor Service				Compressor PN	Supplier PN
			Cold Winding Resistance (Ω)			Run Capacitor (µF/V)		
			Single Phase: S-C	Single Phase: R-C	Three Phase: Line-Line			
WW120	3	208-230/3/60	-	-	0.33	-	8-733-972-544	YA122K1EPFV
	4	460/3/60	-	-	1.19	-	8-733-972-545	YA122K1ETFD
	5	575/3/60	-	-	2.06	-	8-733-972-546	YA122K1ETFE
WW122	1	208-230/1/60	0.340	0.920	-	80/370	8-733-961-618	YA57K1EPFV
	3	208-230/3/60	-	-	0.54	-	8-733-961-619	YA57K1ETF5ASH
	4	460/3/60	-	-	2.16	-	8-733-961-620	YA57K1ETFDASH
	5	575/3/60	-	-	T1-T2 4.91, T2-T3 3.75, T3-T1 4.91	-	8-733-961-621	YA57K1ETFEASH
WW180	3	208-230/3/60	-	-	0.27	-	8-733-960-779	YA137K1ETF5ERZ
	4	460/3/60	-	-	1.04	-	8-733-960-780	YA137K1ETFDERZ
	5	575/3/60	-	-	1.69	-	8-733-960-781	YA137K1ETFEERZ
WW210	3	208-230/3/60	-	-	0.18	-	8-733-960-782	YA182KTF5ERZ
	4	460/3/60	-	-	0.79	-	8-733-960-783	YA182K1ETFDERZ
	5	575/3/60	-	-	1.38	-	8-733-960-784	YA182K1ETFEERZ
WW240	3	208-230/3/60	-	-	0.33	-	8-733-972-544	YA122K1EPFV
	4	460/3/60	-	-	1.19	-	8-733-972-545	YA122K1ETFD
	5	575/3/60	-	-	2.06	-	8-733-972-546	YA122K1ETFE
WW360	3	208-230/3/60	-	-	0.27	-	8-733-960-779	YA137K1ETF5ERZ
	4	460/3/60	-	-	1.04	-	8-733-960-780	YA137K1ETFDERZ
	5	575/3/60	-	-	1.69	-	8-733-960-781	YA137K1ETFEERZ
WW420	3	208-230/3/60	-	-	0.18	-	8-733-960-782	YA182KTF5ERZ
	4	460/3/60	-	-	0.79	-	8-733-960-783	YA182K1ETFDERZ
	5	575/3/60	-	-	1.38	-	8-733-960-784	YA182K1ETFEERZ

Table 48 WW Compressor Characteristics

24.3.2 WT Compressor Characteristics

Models	Voltage Code	Rated Voltage	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			
WT025	1	208-230/1/60	1.07	1.65	-	30/370	8-733-968-399	YAS20K1EPFV
	2	265-277/1/60	1.49	1.57	-	30/370	8-733-968-400	YAS20K1E-PFQ-ASE
	3	208-230/3/60	-	-	1.412	-	8-733-968-409	YAS20K1E-TF6-ASE
	4	460/3/60	-	-	7.638	-	8-733-968-410	YAS20K1E-TFK-ASE
WT035	1	208-230/1/60	0.73	1.47	-	45/370	8-733-968-403	YAS30K1EPFV
	2	265-277/1/60	0.96	1.39	-	45/370	8-733-968-404	YAS30K1E-PFJ-ASE
	3	208-230/3/60	-	-	1.150	-	8-733-968-413	YAS30K1E-TF5-ASE
	4	460/3/60	-	-	4.484	-	8-733-968-414	YAS30K1E-TFD-ASE
WT049	1	208-230/1/60	0.44	1.66	-	40/440	8-733-968-406	YAS40K1EPFV
	3	208-230/3/60	-	-	0.979	-	8-733-968-417	YAS40K1E-TF5-ASC
	4	460/3/60	-	-	3.907	-	8-733-968-418	YAS40K1E-TFD-ASC
WT061	1	208-230/1/60	0.35	1.39	-	40/440	8-733-968-407	YAS51K1EPFVASC
	3	208-230/3/60	-	-	T1-T2 .525, T2-T3 .678, T3-T1 .678	-	8-733-968-419	YAS51K1E-TF5-ASC
	4	460/3/60	-	-	T1-T2 3.864, T2-T3 3.165, T3-T1 3.165	-	8-733-968-420	YAS51K1E-TFD-ASC
WT071	1	208-230/1/60	0.33	1.40	-	55/440	8-733-968-408	YAS60K1EPFV
	3	208-230/3/60	-	-	0.56	-	8-733-968-421	YAS60K1E-TF5-ASC
	4	460/3/60	-	-	T1-T2 2.549, T2-T3 3.11, T3-T1 2.549	-	8-733-968-422	YAS60K1E-TFD-ASC

Table 49 WT 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 50 Model 24 Thermistor (Freeze Sensor) Test Values

24.5 Wiring Diagrams

24.5.1 WW120, WW180, WW210 Standard, Unit Mounted Controller

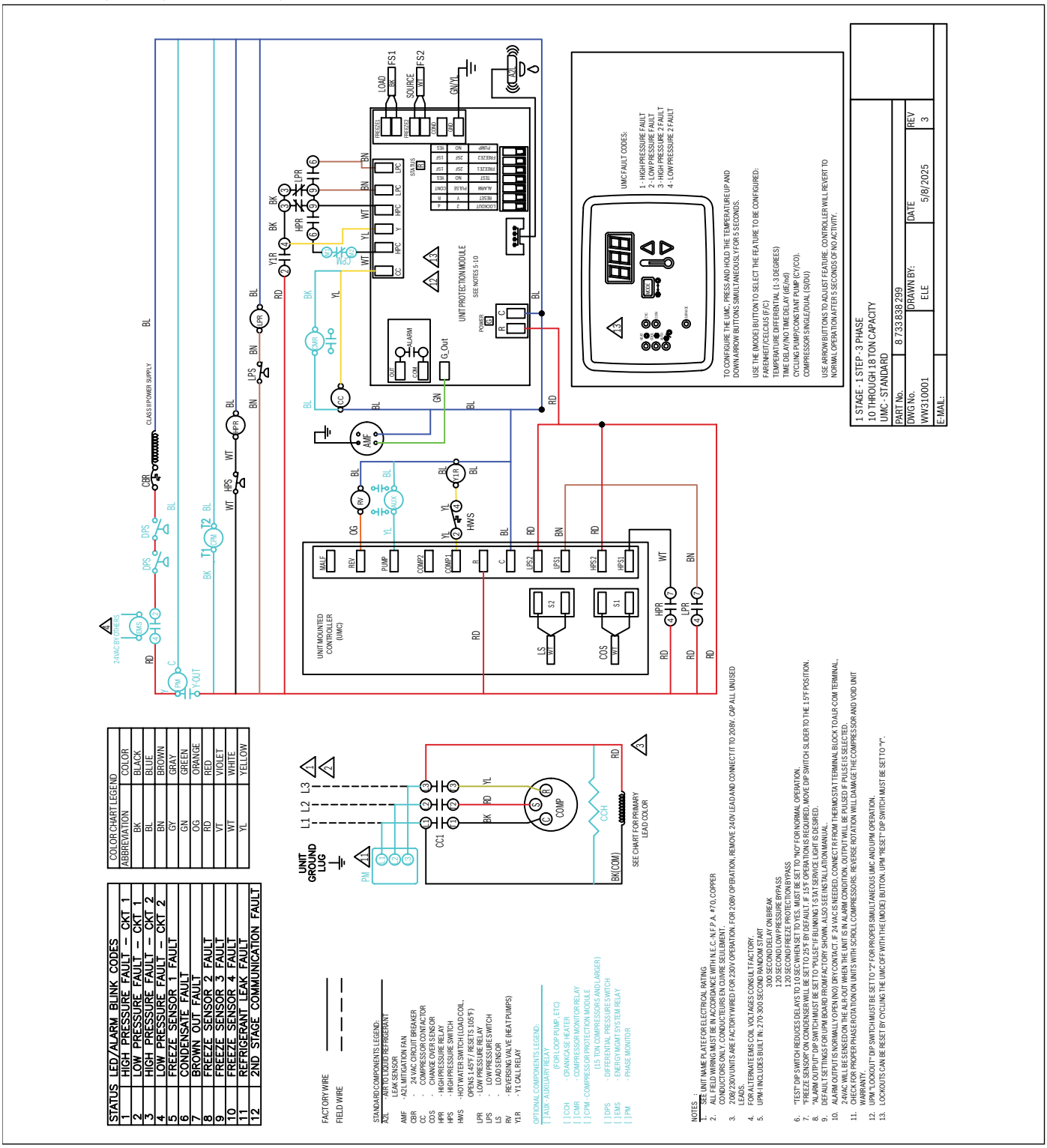


Figure 15 WW120, WW180, WW210 Standard, Unit Mounted Controller

24.5.2 WW122, Standard, Unit Mounted Controller

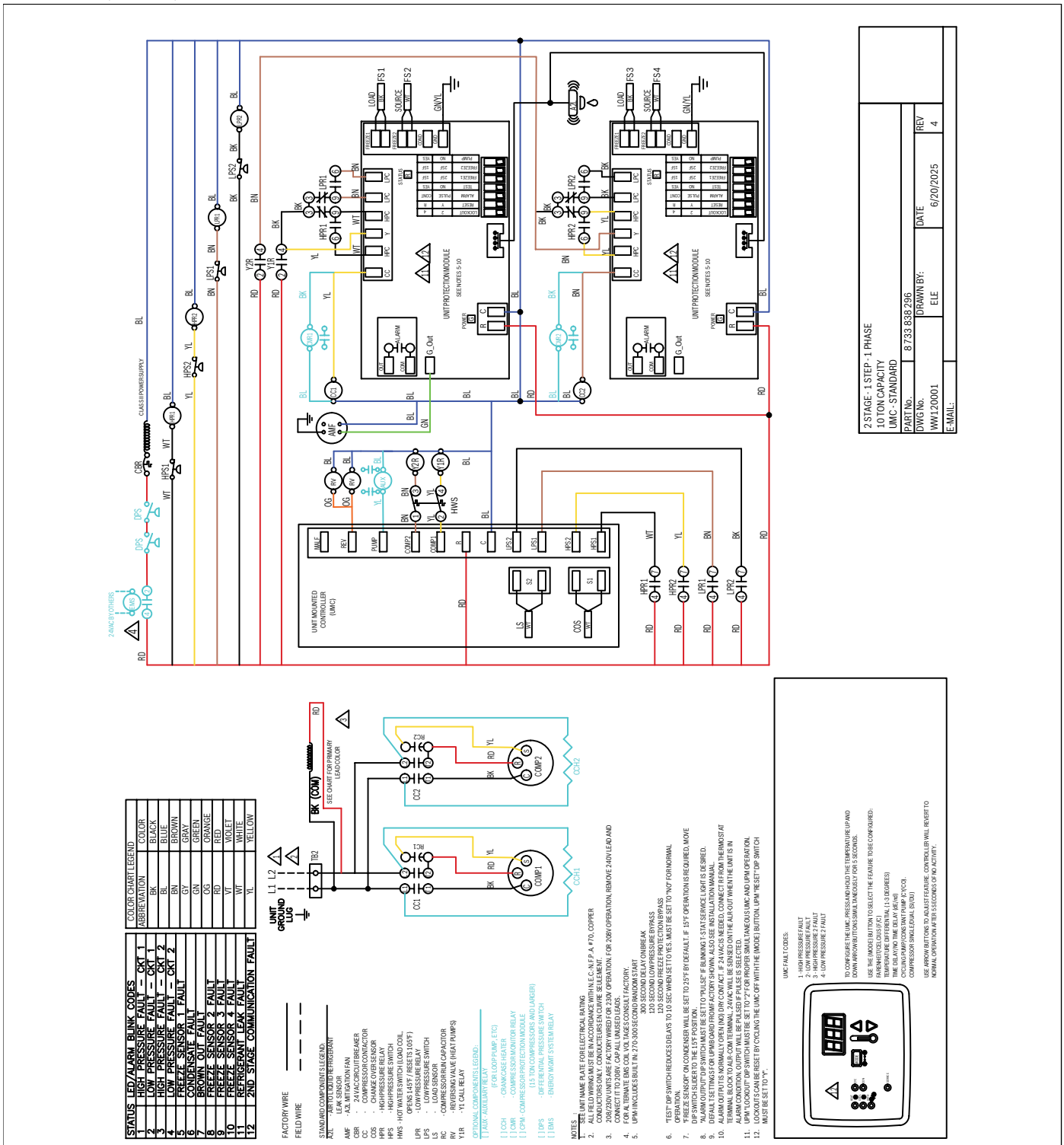


Figure 16 WW122, Standard, Unit Mounted Controller

24.5.3 WW120, WW180, WW210 Standard, Remote Controller

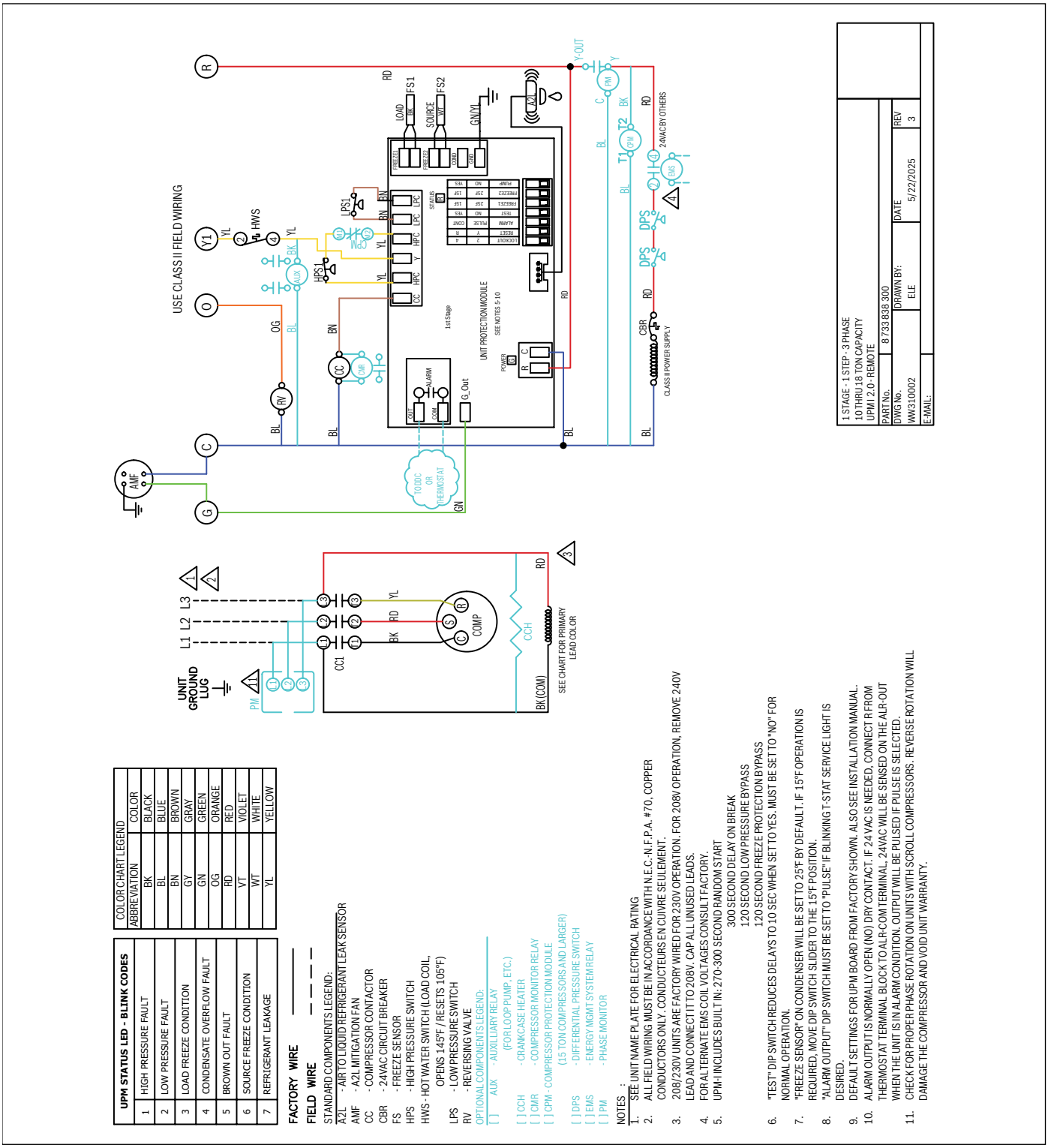


Figure 17 WW120, WW180, WW210 Standard, Remote Controller,

24.5.4 WW122, Standard, Remote Controller

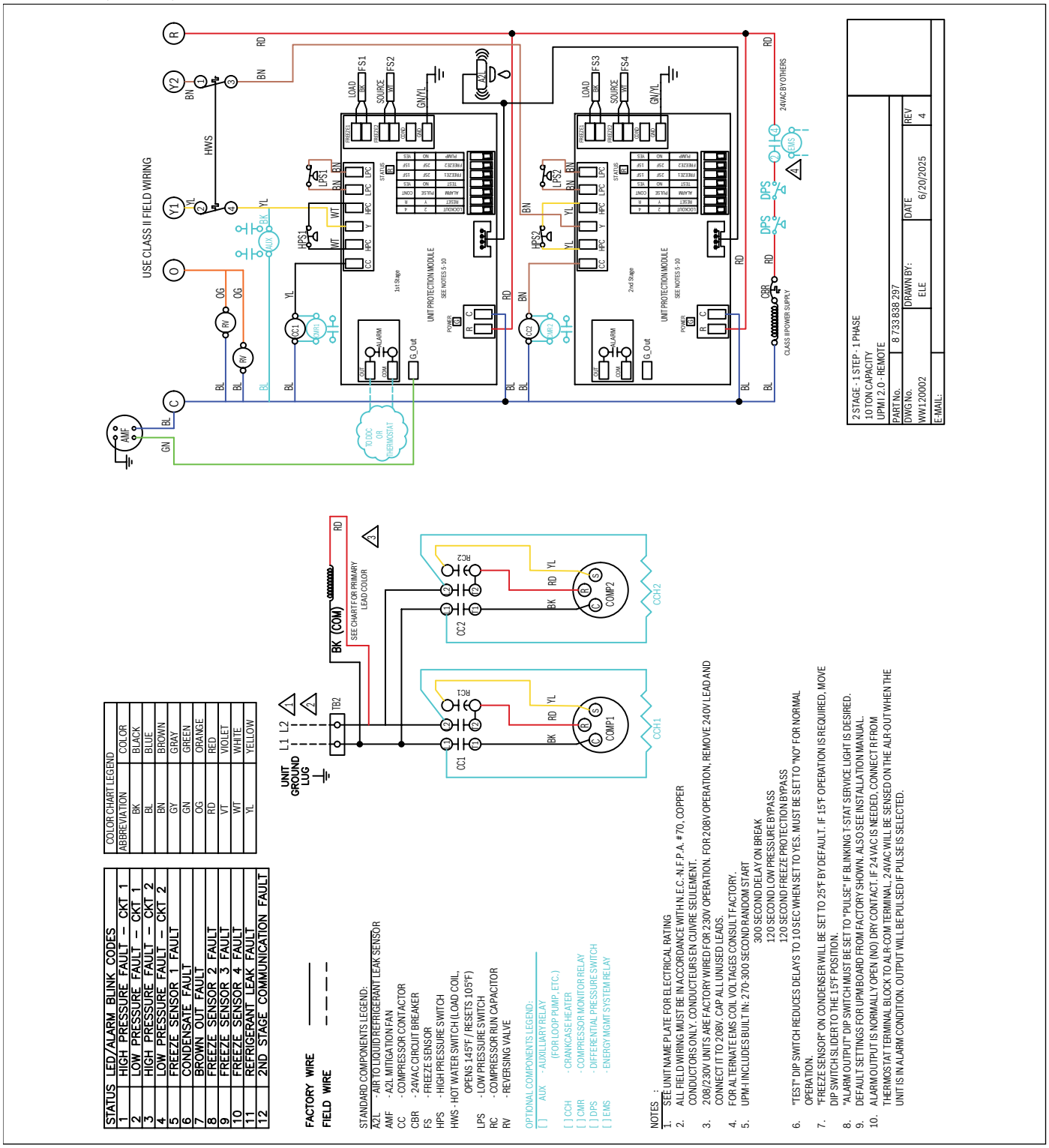


Figure 18 WW122, Standard, Remote Controller

24.5.5 WW240, WW360, WW420, Remote Controller

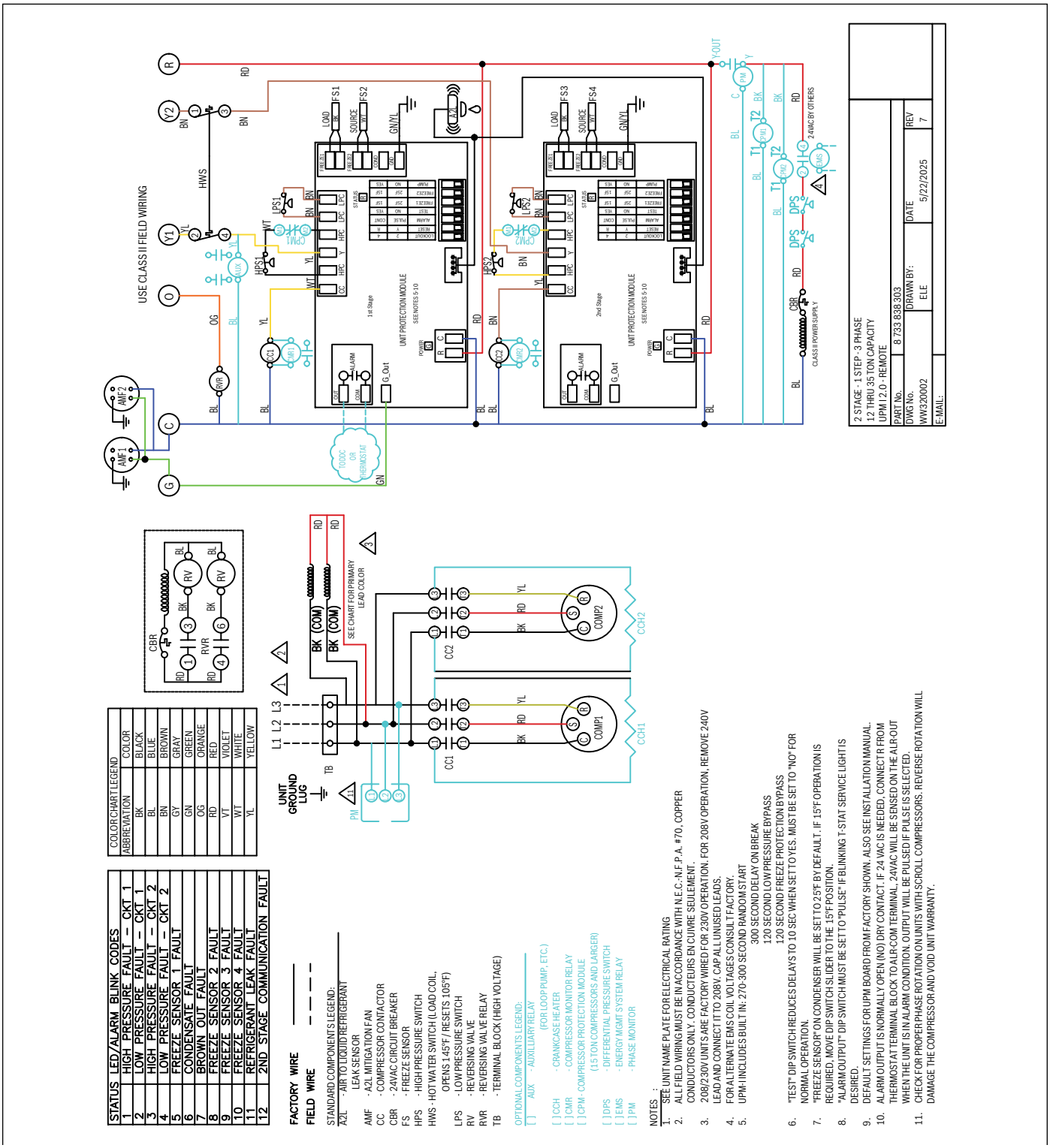


Figure 19 WW240, WW360, WW420, Remote Controller

24.5.6 WW240, WW360, WW420, Unit Mounted Controller

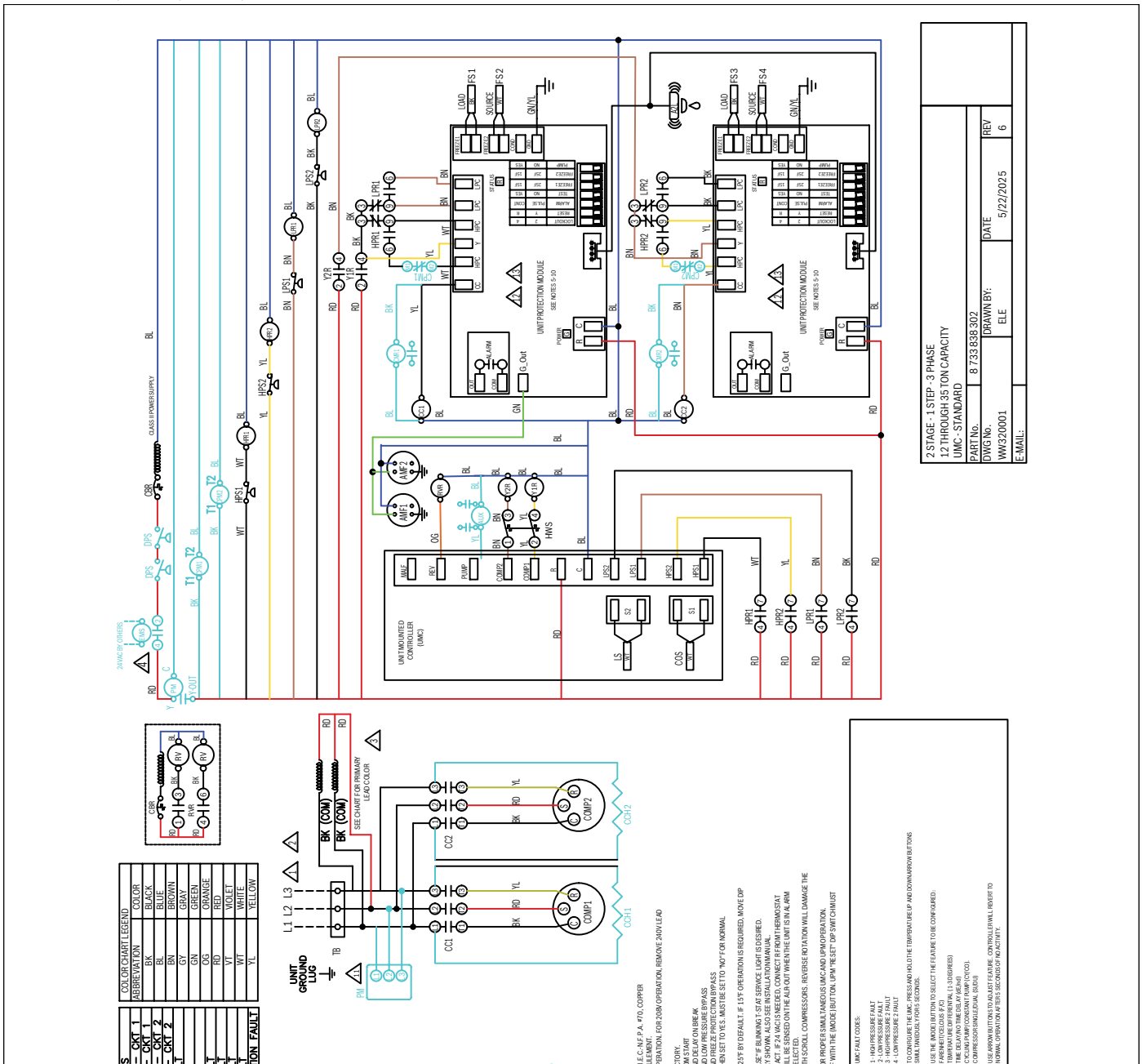


Figure 20 WW240, WW360, WW420, Unit Mounted Controller

24.5.7 WW120, WW180, WW210 Remote Controller with DDC

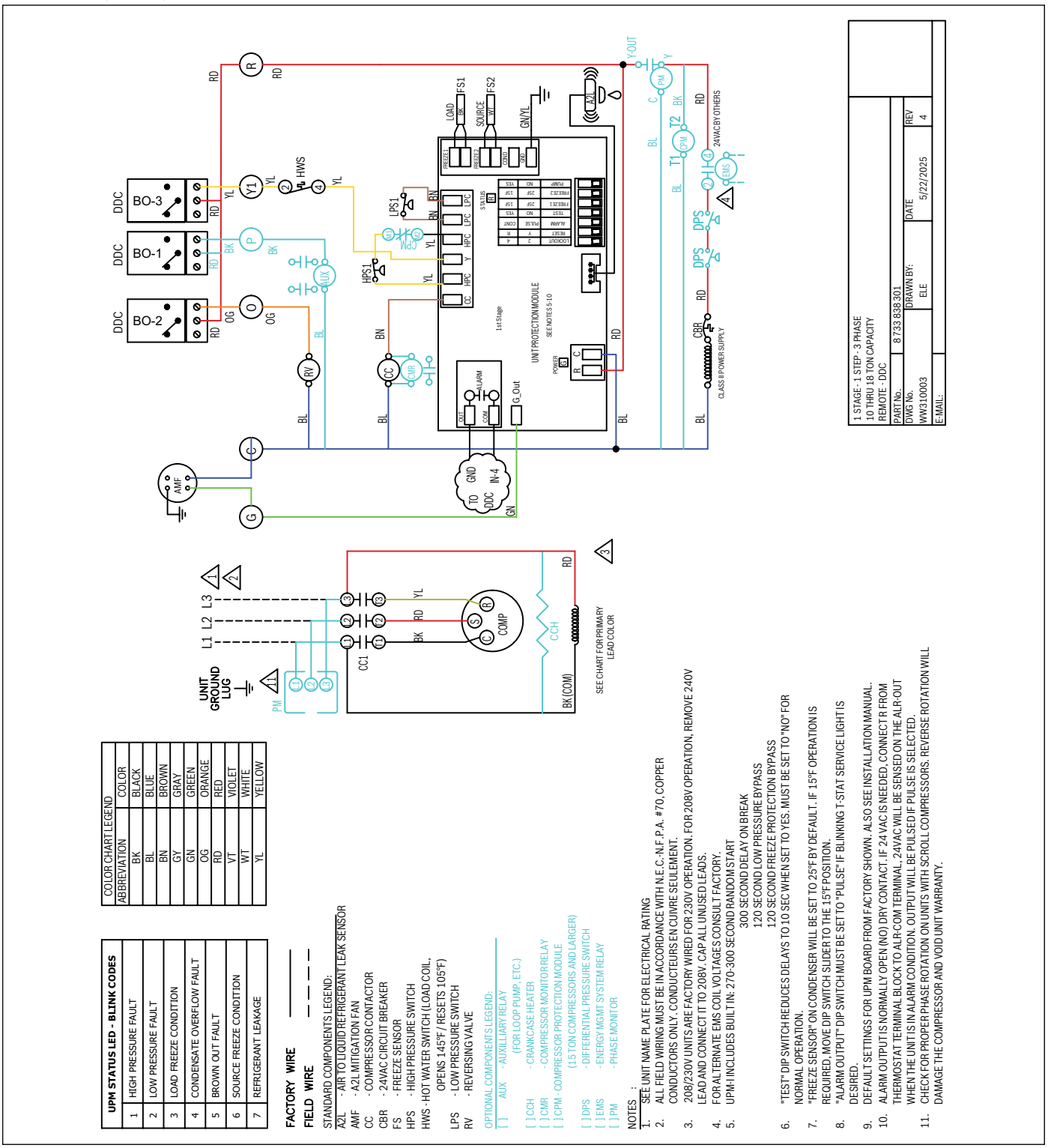


Figure 21 WW120, WW180, WW210 Remote Controller with DDC

24.5.8 WW122, Remote Controller with DDC

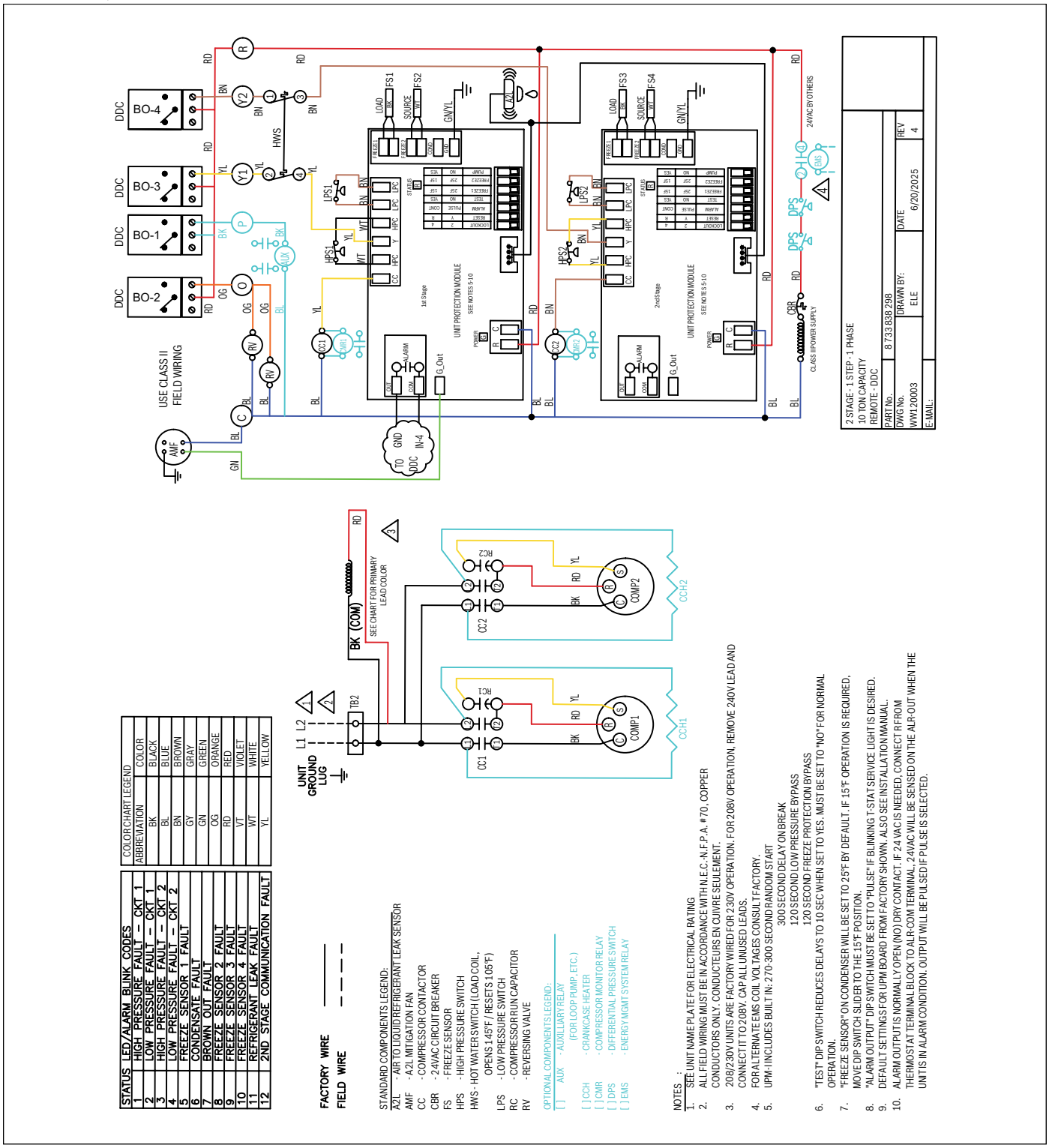


Figure 22 WW122, Remote Controller with DDC

24.5.9 WW240, WW360, WW420, Remote Controller with DDC

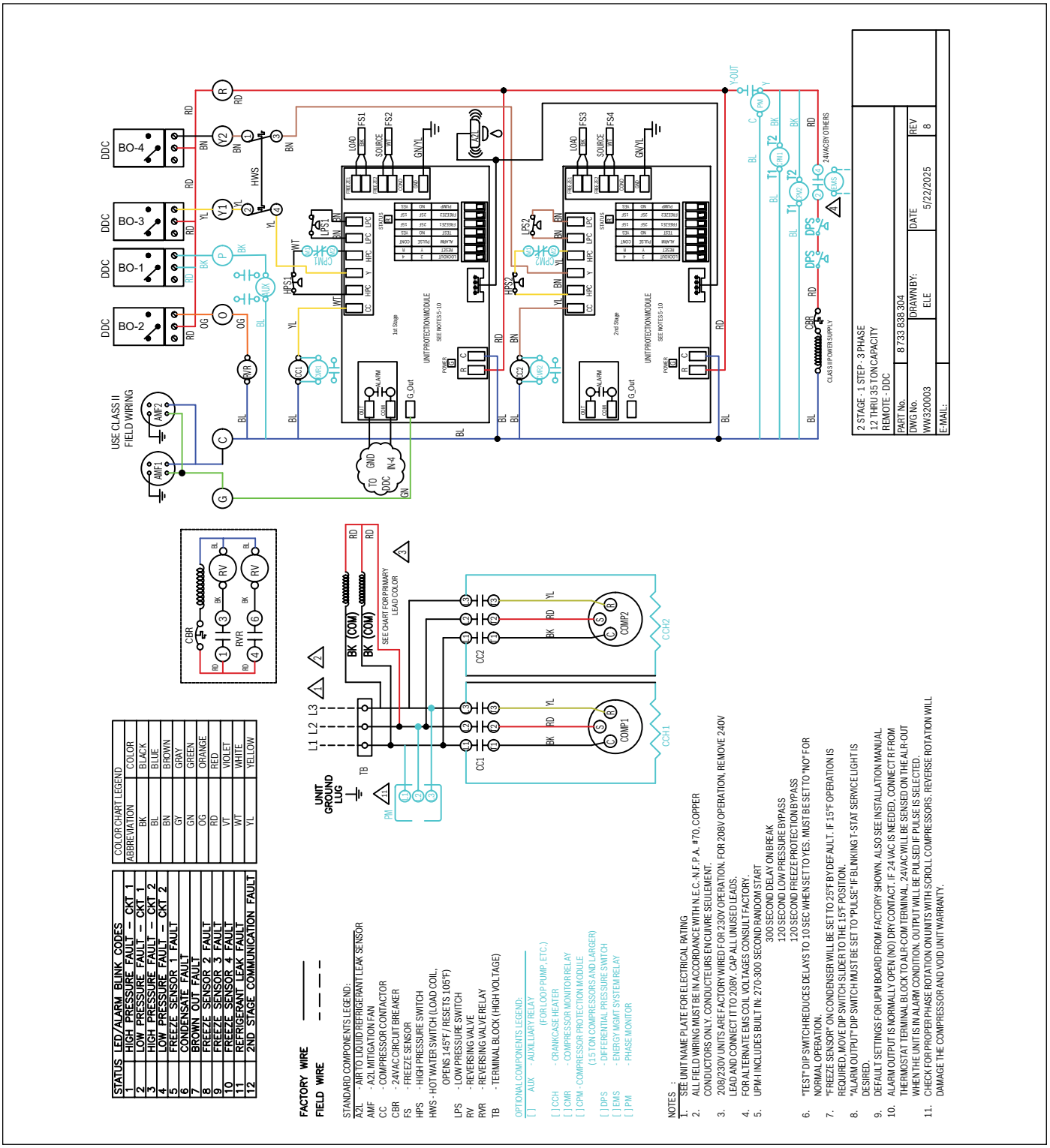


Figure 23 WW240, WW360, WW420, Remote Controller with DDC

24.5.10 WT025-071, Standard, Unit Mounted Controller

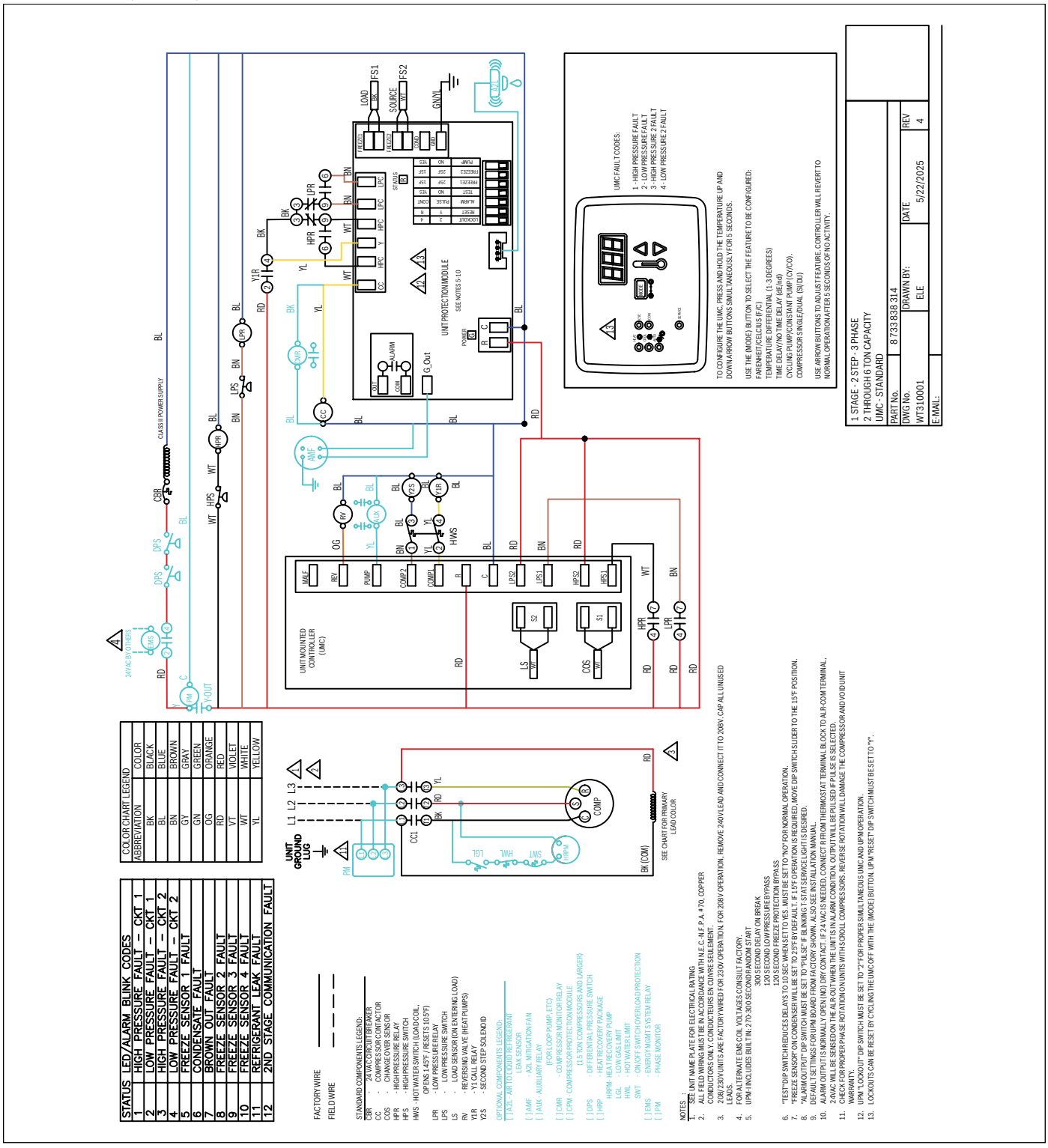
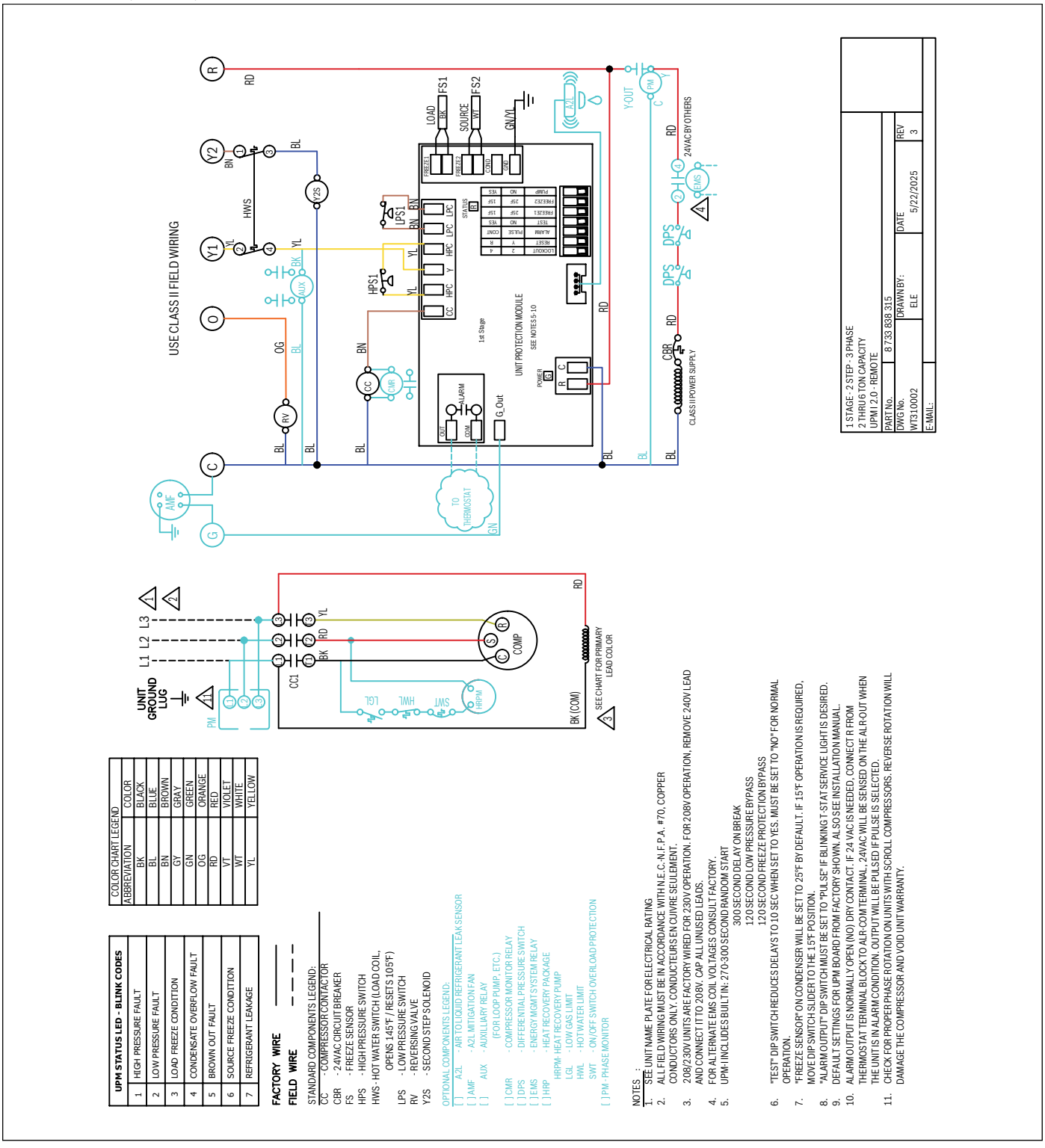


Figure 24 WT025-071, Standard, Unit Mounted Controller

24.5.11 WT025-071, Standard, Remote Controller



UPM STATUS LED - BLINK CODES	
1	HIGH PRESSURE FAULT
2	LOW PRESSURE FAULT
3	LOAD FREEZE CONDITION
4	CONDENSATE OVERFLOW FAULT
5	BROWN OUT FAULT
6	SOURCE FREEZE CONDITION
7	REFRIGERANT LEAKAGE

COLOR CHART LEGEND	
ABBREVIATION	COLOR
BK	BLACK
BL	BLUE
BN	BROWN
GY	GRAY
GN	GREEN
OG	ORANGE
RD	RED
VT	VIOLET
WT	WHITE
YL	YELLOW

FACTORY WIRE ———
FIELD WIRE – – – –

STANDARD COMPONENTS LEGEND:
CC - COMPRESSOR CONTACTOR
CBR - 24VAC CIRCUIT BREAKER
FS - FREEZE SENSOR
HPS - HIGH PRESSURE SWITCH
HWS - HOT WATER SWITCH (LOAD COIL, OPENS 145°F / RESETS 105°F)
LPS - LOW PRESSURE SWITCH
RV - REVERSING VALVE
Y2S - SECOND STEP SOLENOID

OPTIONAL COMPONENTS LEGEND:
[ ] A2L - AIR TO LIQUID REFRIGERANT LEAK SENSOR
[ ] AMF - A2L MITIGATION FAN
[ ] AUX - AUXILLIARY RELAY (FOR LOOP PUMP, ETC.)
[ ] CMR - COMPRESSOR MONITOR RELAY
[ ] DPS - DIFFERENTIAL PRESSURE SWITCH
[ ] EMS - ENERGY MGMT SYSTEM RELAY
[ ] HRP - HEAT RECOVERY PACKAGE
HRPM- HEAT RECOVERY PUMP
LGL - LOW GAS LIMIT
HWL - HOT WATER LIMIT
SWT - ON/OFF SWITCH OVERLOAD PROTECTION
[ ] PM - PHASE MONITOR

NOTES :
1. SEE UNIT NAME PLATE FOR ELECTRICAL RATING
2. ALL FIELD WIRING MUST BE IN ACCORDANCE WITH N.E.C.-N.F.P.A. #70, COPPER CONDUCTORS ONLY. CONDUCTEURS EN CUIVRE SEULEMENT.
3. 208/230V UNITS ARE FACTORY WIRED FOR 230V OPERATION. FOR 208V OPERATION, REMOVE 240V LEAD AND CONNECT IT TO 208V. CAP ALL UNUSED LEADS.
4. FOR ALTERNATE EMS COIL VOLTAGES CONSULT FACTORY.
5. UPM-I INCLUDES BUILT IN: 270-300 SECOND RANDOM START
300 SECOND DELAY ON BREAK
120 SECOND LOW PRESSURE BYPASS
120 SECOND FREEZE PROTECTION BYPASS
6. "TEST" DIP SWITCH REDUCES DELAYS TO 10 SEC WHEN SET TO YES. MUST BE SET TO "NO" FOR NORMAL OPERATION.
7. "FREEZE SENSOR" ON CONDENSER WILL BE SET TO 25°F BY DEFAULT. IF 15°F OPERATION IS REQUIRED, MOVE DIP SWITCH SLIDER TO THE 15°F POSITION.
8. "ALARM OUTPUT" DIP SWITCH MUST BE SET TO "PULSE" IF BLINKING T-STAT SERVICE LIGHT IS DESIRED.
9. DEFAULT SETTINGS FOR UPM BOARD FROM FACTORY SHOWN. ALSO SEE INSTALLATION MANUAL.
10. ALARM OUTPUT IS NORMALLY OPEN (NO) DRY CONTACT. IF 24 VAC IS NEEDED, CONNECT R FROM THERMOSTAT TERMINAL BLOCK TO ALR-COM TERMINAL. 24VAC WILL BE SENSED ON THE ALR-OUT WHEN THE UNIT IS IN ALARM CONDITION. OUTPUT WILL BE PULSED IF PULSE IS SELECTED.
11. CHECK FOR PROPER PHASE ROTATION ON UNITS WITH SCROLL COMPRESSORS. REVERSE ROTATION WILL DAMAGE THE COMPRESSOR AND VOID UNIT WARRANTY.

Figure 25 WT025-071, Standard, Remote Controller

24.5.12 WT025-071, Remote Controller with DDC, 3 Phase

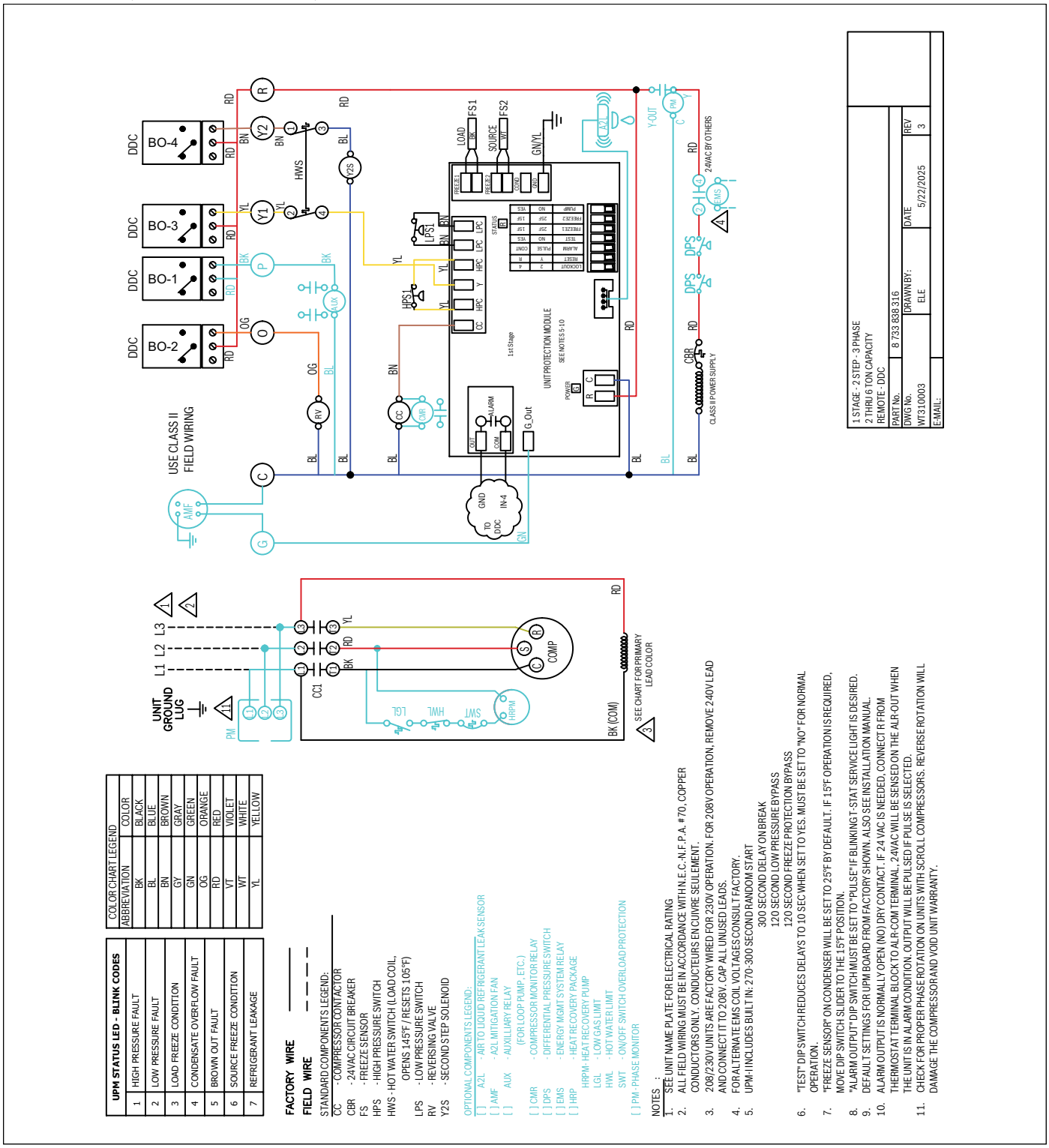


Figure 26 WT025-071, Remote Controller with DDC, 3 Phase

24.5.13 WT025-071, Remote Controller with DDC, Single Phase

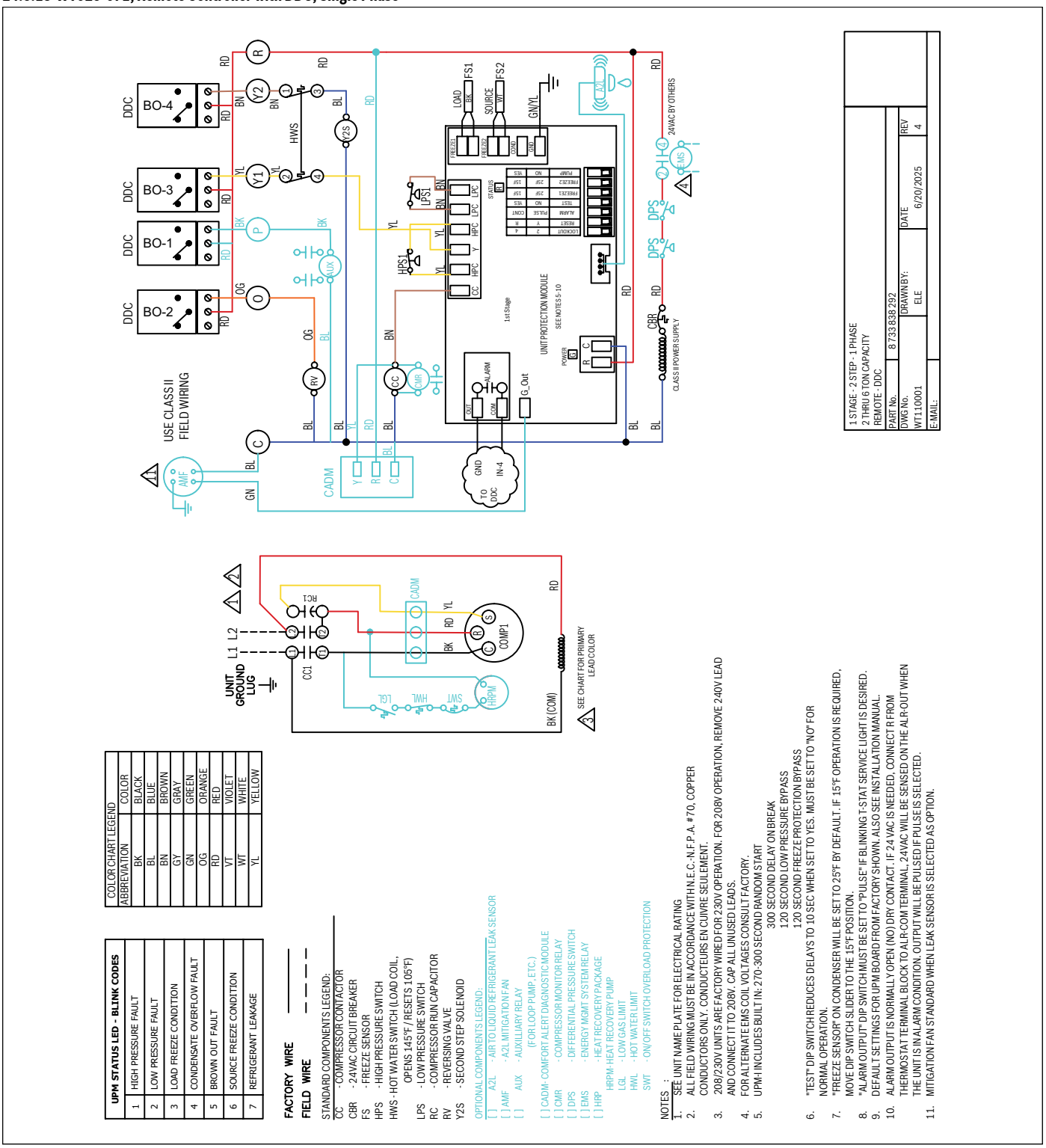


Figure 27 WT025-071, Remote Controller with DDC, Single Phase

24.6 Dimensional Drawings

24.6.1 Dimensional Drawings WW120-210

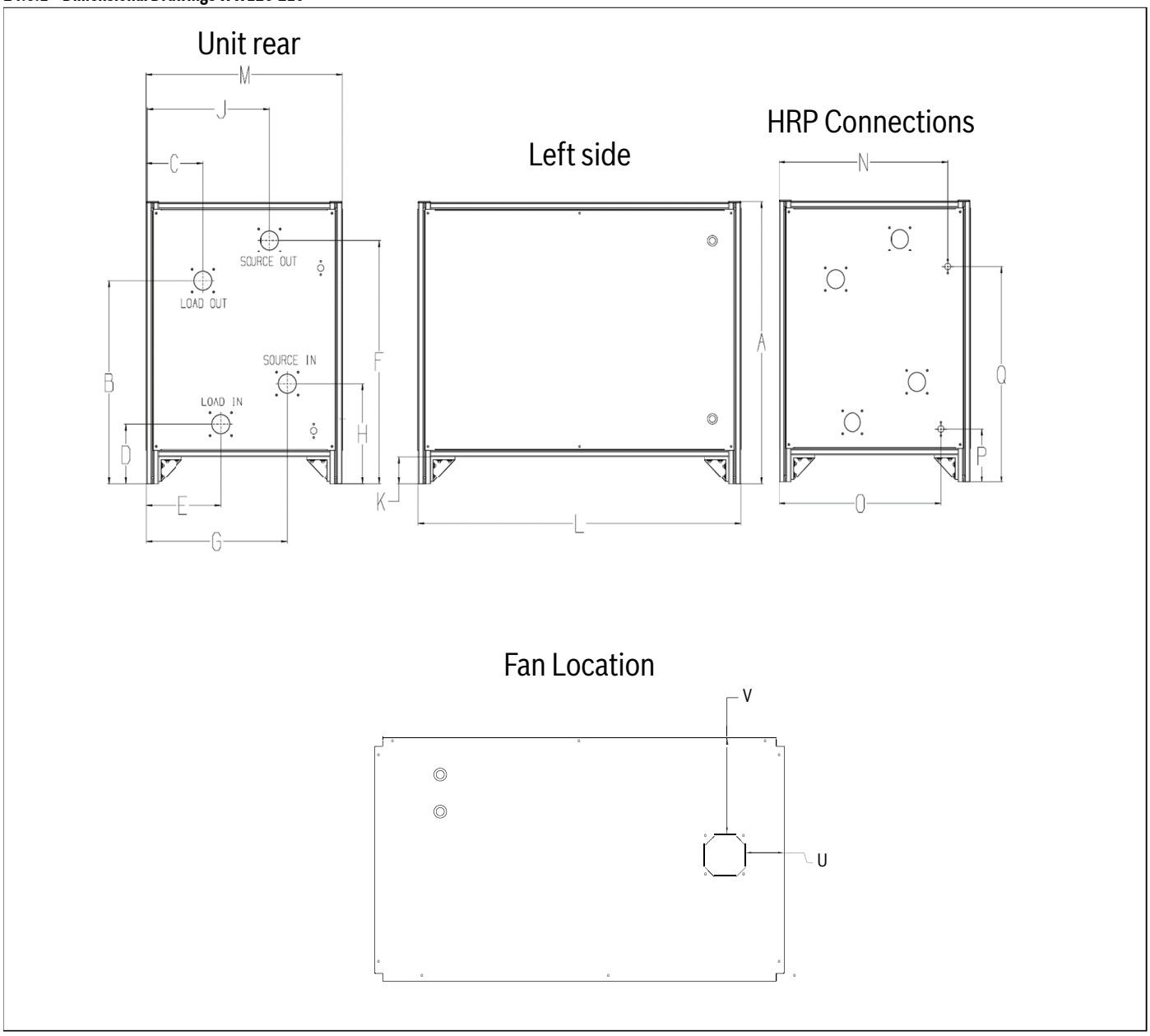


Figure 28 WW 120-210 Dimensional Drawings

24.6.2 Dimensional Drawings WW240-420

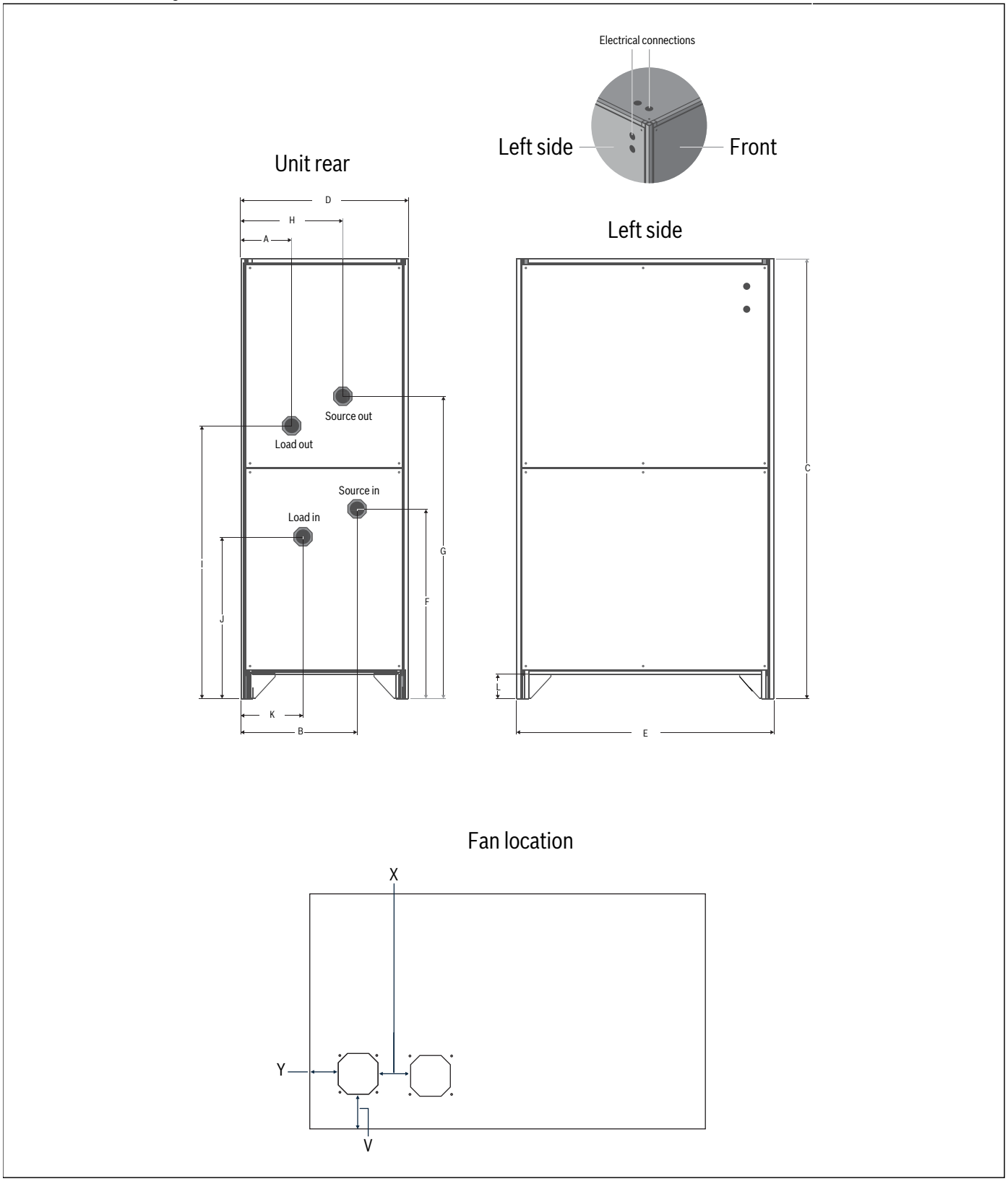


Figure 29 WW 240-420 Dimensional Drawings

24.6.3 Overall Dimensions WW

Cabinet		Overall Cabinet		
		Height	Width	Depth
WW120	in	37.50	28.00	46.00
	mm	953	711	1,168
WW122	in	37.50	28.00	46.00
	mm	953	711	1,168
WW180	in	37.50	28.00	46.00
	mm	953	711	1,168
WW210	in	37.50	28.00	46.00
	mm	953	711	1,168
WW240	in	70.00	28.00	46.00
	mm	1,778	711	1,168
WW360	in	70.00	28.00	46.00
	mm	1,778	711	1,168
WW420	in	70.00	28.00	46.00
	mm	1,778	711	1,168

Table 51 WW Cabinet Dimensions

24.6.4 Detailed Dimensions WW

	Dimensions	WW120	WW122	WW180	WW210	WW240	WW360	WW420
C	Height	37.50	37.50	37.50	37.50	70.00	70.00	70.00
D	Width	28.00	28.00	28.00	28.00	28.00	28.00	28.00
E	Depth	46.00	46.00	46.00	46.00	46.00	46.00	46.00
A	Right Side to Load Water Out	8.50	8.50	4.50	4.50	8.50	4.50	4.50
B	Right Side to Source Water In	19.50	19.50	23.50	23.50	19.50	23.50	23.50
F	Source Water In Height	13.50	13.50	13.50	13.50	29.25	29.25	29.25
G	Source Water Out Height	32.25	32.25	32.25	32.25	48.50	48.50	48.50
H	Right Side to Source Water Out	17.50	17.50	17.50	17.50	17.50	17.50	17.50
I	Load Water Out Height	27.62	27.62	27.62	27.62	43.50	43.50	43.50
J	Load Water In Height	8.37	8.37	8.37	8.37	24.50	24.50	24.50
K	Right Side to Load Water In	10.50	10.50	10.50	10.50	10.50	10.50	10.50
L	Unit Leg Height	3.50	3.50	3.50	3.50	3.50	3.50	3.50
U	Fan Location Depth From Front	4.15	4.15	4.15	4.15	-	-	-
V	Fan Location Width Right	10.51	10.51	10.51	10.51	3.83	3.83	3.83
X	Distance Between Fans	-	-	-	-	3.43	3.43	3.43
Y	Fan Location Depth From Front	-	-	-	-	3.11	3.11	3.11
Water Connections		1 1/4" FPT	1 1/4" FPT	1 1/2" FPT	1 1/2" FPT	2" FPT	2" FPT	2" FPT

NOTE: All dimensions in inches unless otherwise noted. All dimensions within +-0.125". Specifications subject to change without notice.

Table 52 WW Detailed Dimensions

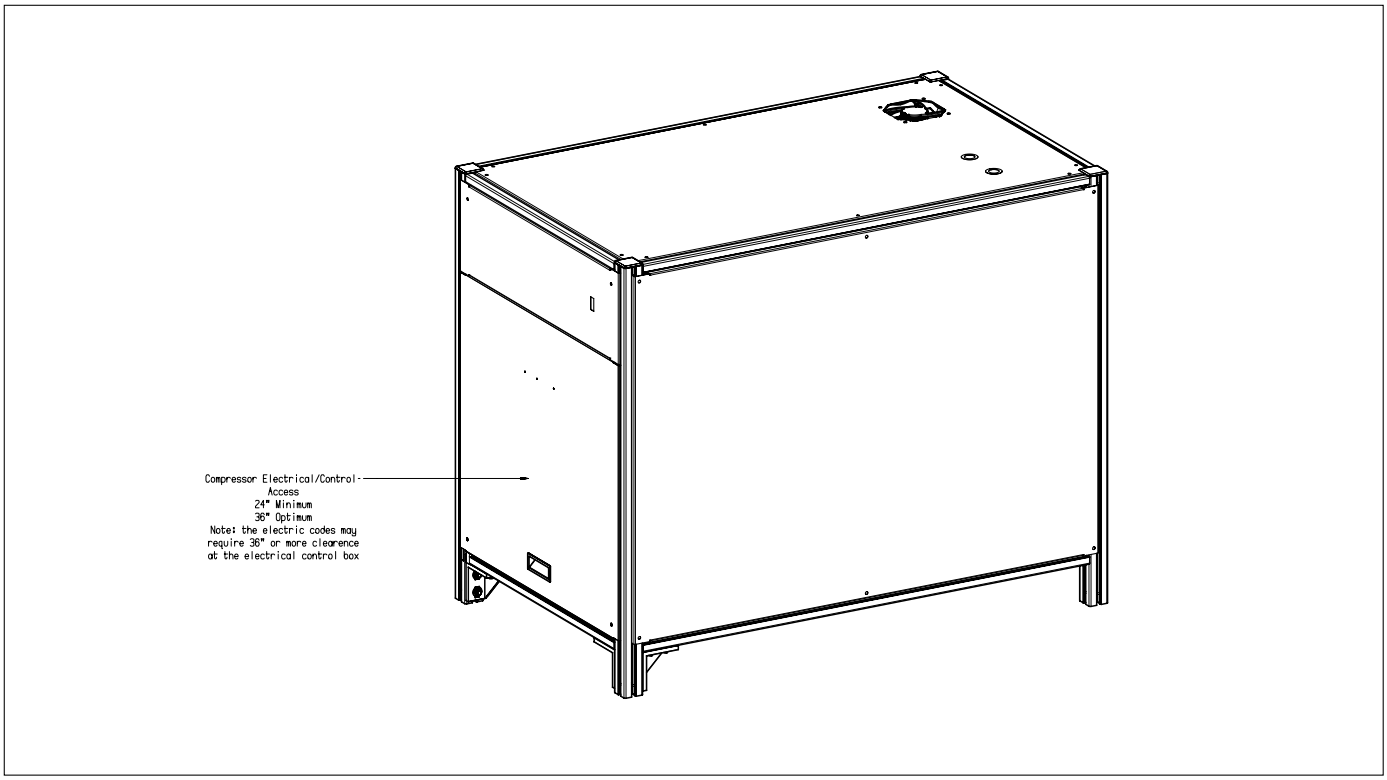


Figure 30 Service Cleareance, WW120-210

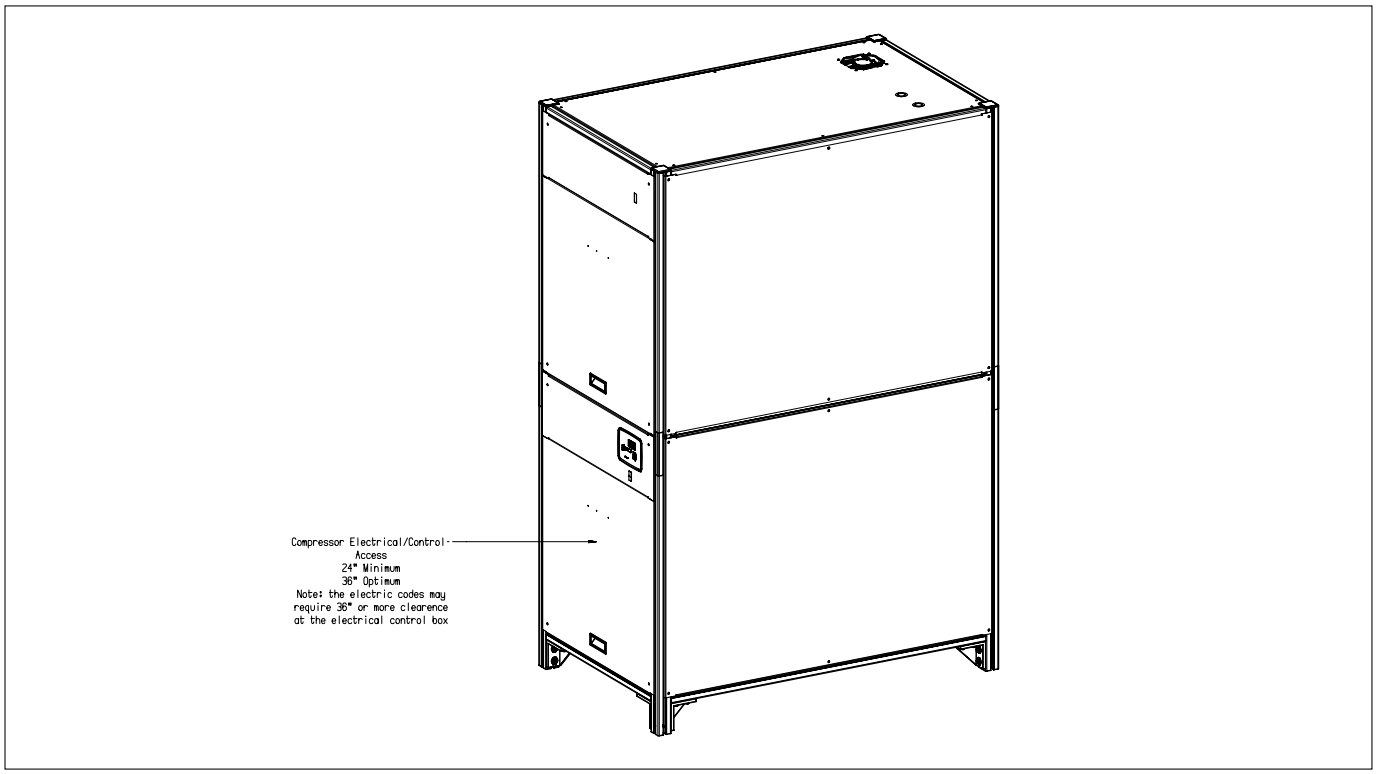


Figure 31 Service Clearance, WW240-420

24.6.5 Dimensional Drawings WT

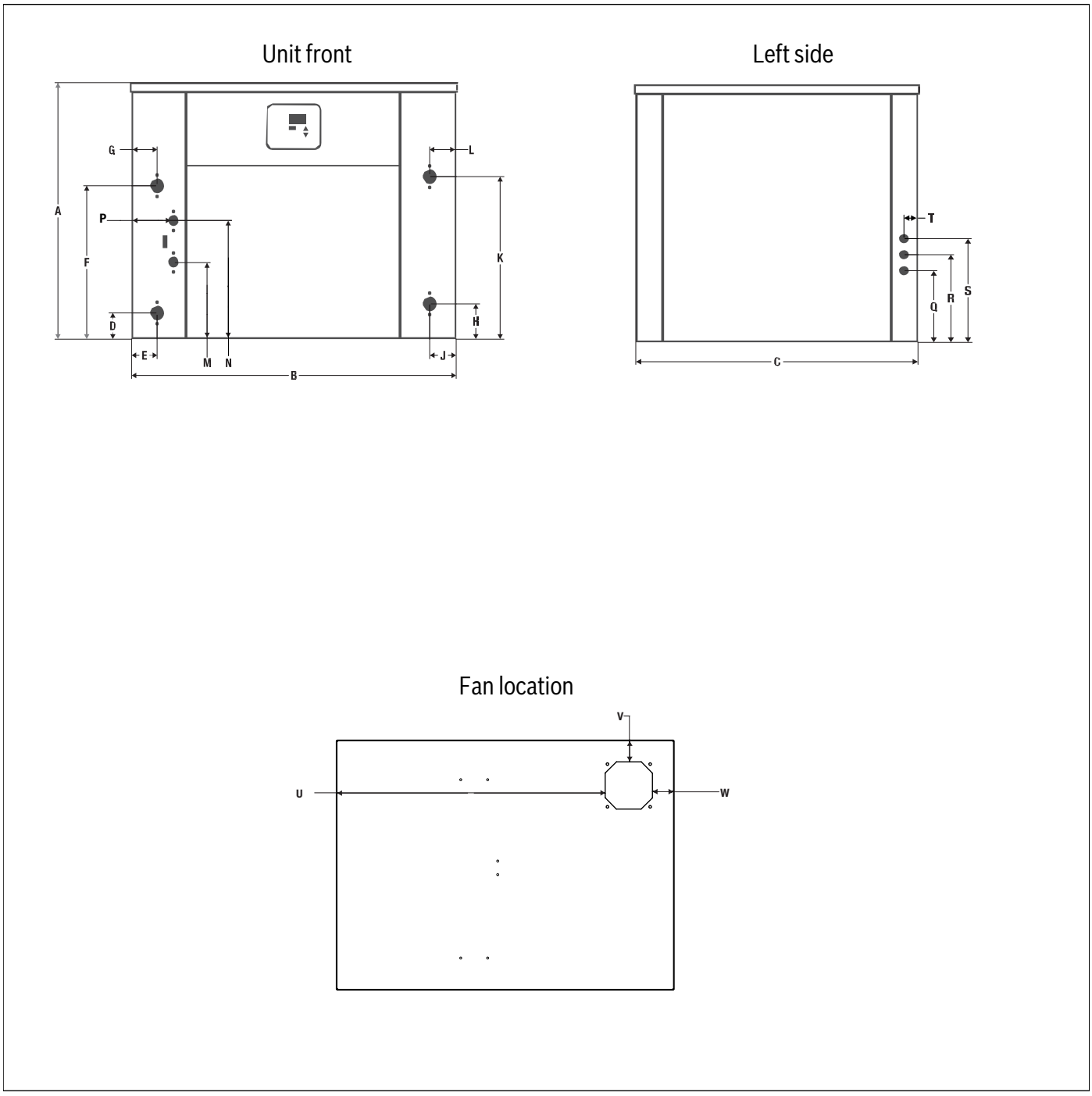


Figure 32 WT Dimensional Drawings

24.6.6 Overall Dimensions WT

Cabinet		Overall Cabinet		
		Height	Width	Depth
WT025	in	24.00	32.50	24.00
	mm	610	826	610
WT035	in	24.00	32.50	24.00
	mm	610	826	610
WT049	in	24.00	32.50	24.00
	mm	610	826	610
WT061	in	24.00	32.50	24.00
	mm	610	826	610
WT071	in	24.00	32.50	24.00
	mm	610	826	610

Table 53 WT Cabinet Dimensions

24.6.7 Detailed Dimensions WT

	Dimensions	WT025	WT035	WT049	WT061	WT071
A	Height	24.00	24.00	24.00	24.00	24.00
B	Width	32.50	32.50	32.50	32.50	32.50
C	Depth	24.00	24.00	24.00	24.00	24.00
D	Load Side Water In Height	2.20	2.30	2.30	2.80	3.00
E	Left Side to Load Side Water In	1.70	2.30	2.10	1.38	2.25
F	Load Side Water Out Height	13.20	14.30	14.30	14.80	17.25
G	Left Side to Load Side Water Out	1.70	2.50	2.65	2.63	2.25
H	Source Side Water In Height	3.75	3.70	2.75	2.51	3.25
J	Right Side to Source Side Water Out	1.50	2.55	2.65	2.00	2.25
K	Source Side Water Out Height	14.25	15.70	14.75	14.38	17.00
L	Right Side to Source Side Water Out	1.95	2.55	2.65	3.40	2.25
M	HRP Water In Height	7.15	7.15	7.15	7.15	7.15
N	HRP Water Out Height	11.00	11.00	11.00	11.00	11.00
P	Left Side to HRP Water Out	4.25	4.25	4.25	4.25	4.25
Q	Electrical Knockout Heights	6.55	6.55	6.55	6.55	6.55
R		8.05	8.05	8.05	8.05	8.05
S		9.55	9.55	9.55	9.55	9.55
T	Left Side to Electrical Knockouts	1.25	1.25	1.25	1.25	1.25
U	Fan Location From Left	25.96	25.96	25.96	25.96	25.96
V	Fan Location From Back	2.07	2.07	2.07	2.07	2.07
W	Fan Location From Right	2.07	2.07	2.07	2.07	2.07
Water Connections		3/4" FPT	3/4" FPT	1" FPT	1" FPT	1" FPT
HRP Connections		1/2" FPT	1/2" FPT	1/2" FPT	1/2" FPT	1/2" FPT

NOTE: All dimensions in inches unless otherwise noted. All dimensions within +-0.125". Specifications subject to change without notice.

Table 54 WT Detailed Dimensions

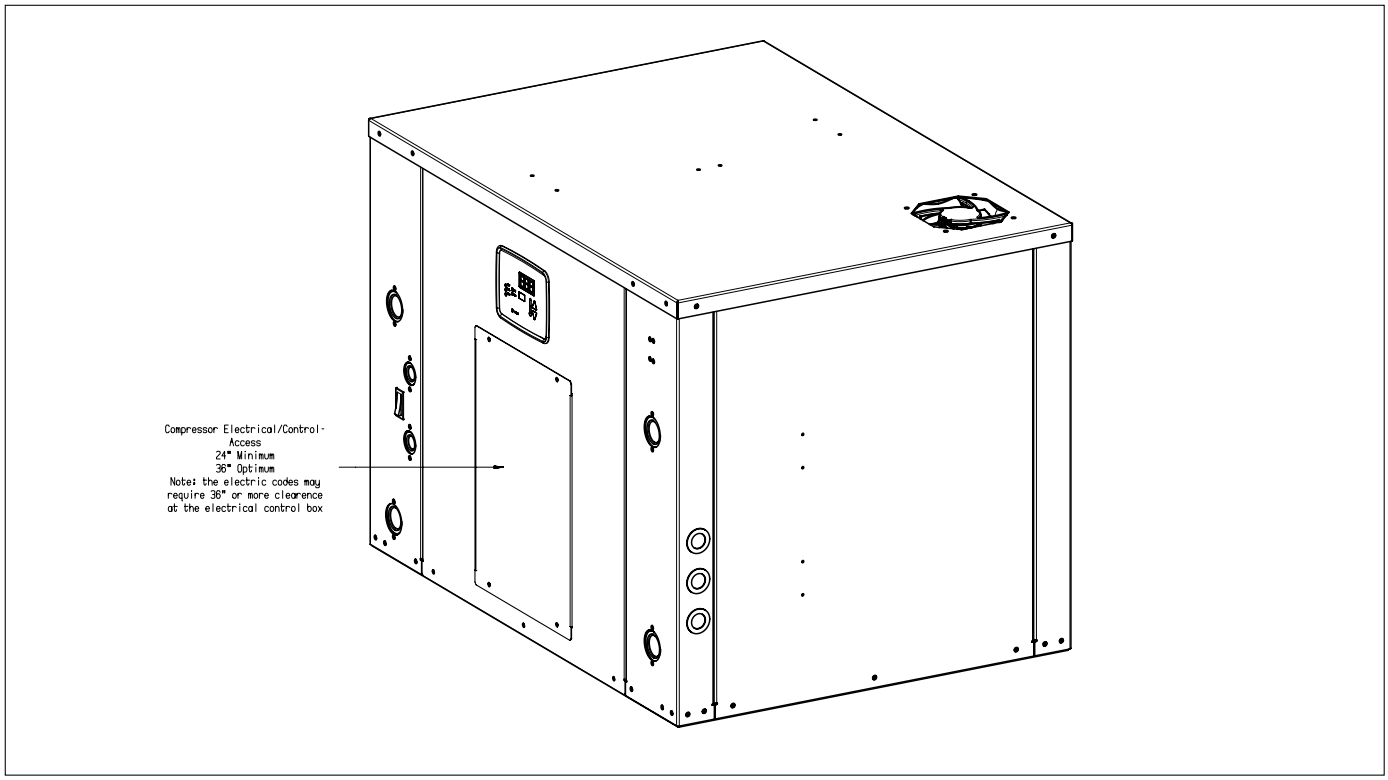


Figure 33 Service Clearance, WT

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

(R/A)—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

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Additional Product Information Page

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www.bosch-homecomfort.com/us/ or scan the QR code below.