Installation, Operation, and Maintenance

FLEX HP
Air-to-Water Scroll Heat Pumps

86 -147kW

R-454B Refrigerant

⚠ SAFETY WARNING

Only qualified personnel should install and service the equipment. The installation, starting up, and servicing of heating, ventilating, and air-conditioning equipment can be hazardous and requires specific knowledge and training. Improperly installed, adjusted or altered equipment by an unqualified person could result in death or serious injury. When working on the equipment, observe all precautions in the literature and on the tags, stickers, and labels that are attached to the equipment.

March 2026

TRCG-SVX1001A-EN

TRANE TECHNOLOGIES

Introduction

Read this manual thoroughly before operating or servicing this unit.

Warnings, Cautions, and Notices

Safety advisories appear throughout this manual as required. Your personal safety and the proper operation of this machine depend upon the strict observance of these precautions.

The three types of advisories are defined as follows:

DANGER	Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.
WARNING	Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.
CAUTION	Indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury. It could also be used to alert against unsafe practices.
NOTICE	Indicates a situation that could result in equipment or property-damage only accidents.

Important Environmental Concerns

Scientific research has shown that certain man-made chemicals can affect the earth's naturally occurring stratospheric ozone layer when released to the atmosphere. In particular, several of the identified chemicals that may affect the ozone layer are refrigerants that contain Chlorine, Fluorine and Carbon (CFCs) and those containing Hydrogen, Chlorine, Fluorine and Carbon (HCFCs). Not all refrigerants containing these compounds have the same potential impact to the environment. The Manufacturer advocates the responsible handling of all refrigerants.

Important Responsible Refrigerant Practices

The Manufacturer believes that responsible refrigerant practices are important to the environment, our customers, and the air conditioning industry. All technicians who handle refrigerants must be certified according to Local regulations. The law sets forth the requirements for handling, reclaiming, recovering and recycling of certain refrigerants and the equipment that is used in these service procedures. In addition, some states or municipalities may have additional requirements that must also be adhered to for responsible management of refrigerants. Know the applicable laws and follow them.

⚠ Warning

Proper Field Wiring and Grounding Required!

Failure to follow code could result in death or serious injury.

All field wiring MUST be performed by qualified personnel. Improperly installed and grounded field wiring poses FIRE and ELECTROCUTION hazards. To avoid these hazards, you MUST follow requirements for field wiring installation and grounding as described in NEC and your local/state electrical codes.

⚠ Warning

Refrigerant May Be Under Positive Pressure!

Failure to follow instructions below could result in an explosion which could result in death or serious injury or equipment damage.

System contains refrigerant and may be under positive pressure; system may also contain oil. Recover refrigerant to relieve pressure before opening the system. See unit nameplate for refrigerant type. Do not use non-approved refrigerants, refrigerant substitutes, or non-approved refrigerant additives.

⚠ Warning

Personal Protective Equipment (PPE) Required!

Failure to wear proper PPE for the job being undertaken could result in death or serious injury.
Technicians, in order to protect themselves from potential electrical, mechanical, and chemical hazards, MUST follow precautions in this manual and on the tags, stickers, and labels, as well as the instructions below:

- **Before installing/servicing this unit, technicians MUST put on all PPE required for the work being undertaken (Examples; cut resistant gloves/sleeves, butyl gloves, safety glasses, hard hat/bump cap, fall protection, electrical PPE and arc flash clothing). ALWAYS refer to appropriate Safety Data Sheets (SDS) and OSHA guidelines for proper PPE.**
- **When working with or around hazardous chemicals, ALWAYS refer to the appropriate SDS and OSHA/GHS (Global Harmonized System of Classification and Labelling of Chemicals) guidelines for information on allowable personal exposure levels, proper respiratory protection and handling instructions.**
- **If there is a risk of energized electrical contact, arc, or flash, technicians MUST put on all PPE in accordance with OSHA, NFPA 70E, or other country-specific requirements for arc flash protection, PRIOR to servicing the unit. NEVER PERFORM ANY SWITCHING, DISCONNECTING, OR VOLTAGE TESTING WITHOUT PROPER ELECTRICAL PPE AND ARC FLASH CLOTHING. ENSURE ELECTRICAL METERS AND EQUIPMENT ARE PROPERLY RATED FOR INTENDED VOLTAGE.**

⚠ Warning

Follow EHS Policies!

Failure to follow instructions below could result in death or serious injury.

- **All our Manufacturers personnel must follow the company's Environmental, Health and Safety (EHS) policies when performing work such as hot work, electrical, fall protection, lockout/tagout, refrigerant handling, etc. Where local regulations are more stringent than these policies, those regulations supersede these policies.**
- **Non-Trane Technologies personnel should always follow local regulations.**

Copyright

Trademarks

All trademarks referenced in this document are the trademarks of their respective owners.

Revision History

Revision A	New Release

Table of Contents

Unit Description

The Units are air-cooled scroll compressor units designed for outdoor Installation. The while heat pump units are reversible and can operate in both cooling and heating modes.

The units have one independent refrigerant circuits, One or two compressors per circuit. Units are packaged with braze a plate heat exchanger.

Each Unit is completely assembled, hermetic packaged, refrigerant circuit factory piped, electrical components wired, leak tested, dehydrated, charged and tested.

The chilled water inlet and outlet openings are covered for shipment.

Units feature of Symbio™ 800 Control logic and controls. It monitors the control variables that govern the operation of the unit. Control logic can correct these variables when necessary to optimize operational efficiencies, to avoid the unit shutdown, and keep producing the chilled or hot water.

These units come with various options and can be customized depending on capacity, efficiencies, acoustic levels, application requirements at the time of order placement.

The unit received and its options can be crosschecked with the serial and model number provided in unit nameplate and description provided under unit model number description provided in the manual.

Nameplates

The outdoor unit nameplates are applied to the exterior of the control panel. A compressor nameplate is located on each compressor.

Unit Nameplate

The unit nameplate provides the following information:

- Unit model and size description
- Unit serial number
- Identifies unit electrical requirements
- Lists correct operating charges of refrigerant and refrigerant oil
- Lists unit test pressures

Compressor Nameplate

The compressor nameplate provides following information:

- Compressor model number.
- Compressor serial number.
- Compressor electrical characteristics.
- Utilization range.
- Recommended refrigerant.

General Information

These instructions are given as a guide to good practice in the installation, start-up, operation, and maintenance by the user. They do not contain full service procedures necessary for the continued successful operation of this equipment. The services of a qualified technician should be employed through the medium of a maintenance contract with a reputable service company. Read this manual thoroughly before unit start-up.

Units are assembled, pressure tested, dehydrated, charged and tested in accordance with factory standard before shipment.

Safety Recommendations

To avoid death, injury, equipment or property damage, the following recommendations should be observed during maintenance and service visits:

1. The maximum allowable pressures for system leak testing on low and high pressure side are given in the chapter “Installation”. Insure to do note exceed test pressure by using appropriate device.
2. Disconnect the main power supply before any servicing on the unit.
3. Service work on the refrigeration system and the electrical system should be carried out only by qualified and experienced personnel.
4. To avoid any risk, it is recommended to place the unit on an area with restricted access.

Inspection

On arrival, inspect the unit before signing the delivery note. Specify any visible damage on the delivery note, and send a registered letter of protest to the last carrier of the goods within 7 days of delivery.

Notify the local Manufacturer at the same time. The delivery note must be clearly signed and countersigned by the driver.

Any concealed damage shall be notified by a registered letter of protest to the last carrier of the goods within 7 days of delivery. Notify the local sales office at the same time.

Important: *No shipping claims will be accepted by the manufacturer if the above mentioned procedure is not respected. For more information, refer to the general sales conditions of Manufacturer.*

Note: *Unit inspection in France. Delay to send registered letter in case of visible and concealed damage is only 72 hours.*

Loose Parts Inventory

Check all the accessories and loose parts that are shipped with the unit against the shipping list. Included in these items will be the all kind of sensors, thermostat and electrical diagrams, service literature, which are placed inside the control panel and/or indoor section for shipment.

Do not place elements inside of control box during unit operation, it could damage internal components.

Warranty

Warranty is based on the general terms and conditions of the manufacturer. The warranty is void if the equipment is repaired or modified without the written approval of the manufacturer, if the operating limits are exceeded or if the control system or the electrical wiring is modified. Damage due to misuse, lack of maintenance or failure to comply with the manufacturer’s instructions or recommendations is not covered by the warranty obligation. If the user does not conform to the rules of this manual, it may entail cancellation of warranty and liabilities by the manufacturer.

Refrigerant

Consult the addendum to Manuals for units with refrigerant, for conformity to the Pressure Equipment Directive (PED) 2014/68/EU and Machinery Directive 2006/42/EC.

Training

To assist you in obtaining the best use of it and maintaining it in perfect operating condition over a long period of time, the manufacturer has at your disposal a refrigeration and air conditioning service school. The principal aim of this is to give operators and technicians a better knowledge of the equipment they are using, or that is under their charge. Emphasis is

particularly given to the importance of periodic checks on the unit operating parameters as well as on preventive maintenance, which reduces the cost of owning the unit by avoiding serious and costly breakdown.

Maintenance Contract

It is strongly recommended that you sign a maintenance contract with your local Service Agency. This contract provides regular maintenance of your installation by a specialist in our equipment. Regular maintenance ensures that any malfunction is detected and corrected in good time and minimizes the possibility that serious damage will occur. Finally, regular maintenance ensures the maximum operating life of your equipment. We would remind you that failure to respect these installation and maintenance instructions may result in immediate cancellation of the warranty.

Model Number Description

Digits 1, 2, 3, 4 - Unit

FLHP = Air-Cooled Scroll Packaged Heat pump

Digit 5, 6, 7 - Unit Nominal Tonnage

026 = 26 Tons
028 = 28 Tons
032 = 32 Tons
037 = 37 Tons
041 = 41 Tons
045 = 45 Tons
051 = 51 Tons

Digits 8 - Electrical Supply

D = 400 Volt 50 Hz 3 Phase
G = 400 Volt 50 Hz 3 Phase Compatible With IT Neutral

Digits 9 - Manufacturing Plant

T = Trane
I = ICS
U = No Brand
M = MTA logo
Z = Bari, Thermocold

Digit 10 - Design Sequence

* = Major Design Sequence

Digit 11 - Design Sequence

* = Minor Design Sequence

Digit 12 - Efficiency Level

N = Standard Efficiency
H = High Efficiency with EC fans

Digit 13 - Agency Listing

C = CE Certification (EUR)
U = UKCA Marking

Digit 14 - Not Used

X = Not Used

Digit 15 - Sound Level

X = Standard
E = Extra Low Noise (XLN)
E = Super Low Noise (XXLN)

Digit 16 - Unit Application

X = Standard Ambient (down to –10 °C / 14F)
L = Low Ambient (down to –20 °C / –4F)

Digit 17 - Not used

X = Not Used

Digit 18 - Water Connection

X = Standard Grooved Pipe
W = Grooved pipe + Weld Couplings (supplied loose)

Digit 19 - Evaporator Application

N = Standard Cooling
P = Low Temperature Process (LWT below 4°C)
C = Ice Making with Hardwired Interface

Digit 20 - Evaporator Configurations

B = Brazed Plate Heat Exchanger
A = Alternative 1
D = Alternative 2
H = Aluminium Micro Channel Alternative Supplier

Digit 21 - Insulation

X = Without Thermal Insulation
N = Standard Thermal Insulation (10 mm)
H = With High Performance Insulation (20 mm)

Digit 22 - Condenser Coating

N = Micro Channel
B = Aluminium Hydrophilic (blue) Coating
E = Epoxy Coated Aluminum Fins (gold)
L = Blygold
C = E-coated MCHE

Digit 23 - Condenser Heat Recovery

X = No Heat Recovery
P = Partial Heat Recovery
T = Total Heat Recovery (full equipment)

Digit 24 - Hydraulic Pump

X = Signal On/Off Pump
2 = Single Pump Standard Pressure (150 kPa)
4 = Single Pump High Pressure (300 kPa)
1 = Dual Pump Standard Pressure
3 = Dual Pump High Pressure

Digit 25 - Free Cooling

F = Total Free Cooling - Direct
H = Total Free Cooling - Glycol Free
X = No Option

Digit 26 - Not used

X = None

Digit 27 - Control Panel Accessories

X = No Option
1 = Under/Over Voltage Protection
2 = Under/Over Voltage Protection And Ground Fault Protection

Digit 28 - Not Used

x = None

Digit 29 - Remote Interface (Digital Comm)

X = None Remote Interface
B = BACnet Interface RS485 (MSTP)
C = BACnet Interface TCP-IP
M = ModBus Interface RS485 (RTU)
N = ModBus Interface TCP
L = LonTalk Interface

Digit 30 - External Set points and Capacity outputs

X = None
A = External Setpoint and Capacity Outputs

Digit 31 - Flow Switch

X = No Flow Switch
F = With Flow Switch

Digit 32 - Electrical Panel Protection

1 = Enclosure with IP 54 Internal Protection

Digit 33 - Lead Lag Chiller Sequence (Master-Slave)

X = Without
A =With

Digit 34 - Unit User interface

L = Standard, Local UI supplied

Digit 35 - Energy Meter

X = No Energy Meter
M = Energy Meter Installed

Digit 36 - Automatic bypass hydraulic kit

X = None
1 = 1- With (supply loose)

Digit 37 - Variable Primary Flow

X = Constant Speed Pump (No VFD)
F = Constant Speed Pump -VFD Adjustment
T = Variable Speed Pump - Constant DT

Model Number Description

Digit 38 - Refrigeration Leak Detector

X = Not Installed
V = Installed

Digit 39 - Electrical Cabinet Heater

X = Not Installed
1 = With

Digit 40 - Power Socket

X = None
p = Included (230V - 100W)

Digit 41 - Factory Tests

X = None
B = Visual Inspection with Customer

Digit 42 - Unit isolation

X = None
1 = Rubber Isolators (supplied loose)
6 = Spring Isolators (supplied loose)

Digit 43 - Label and Literature Language

B = Bulgarian
C = Spanish
G = German
E = English
F = French
H = Dutch SI
I = Italian
K = Finish
L = Danish
M = Swedish
N = Norwegian
P = Polish
R = Russian
T = Czech
U = Greek
V = Portuguese
Z = Slovenian
2 = Romanian
3 = Serbian
4 = Slovak
5 = Croatian
6 = Hungarian
8 = Turkish

Digit 44 - Shipping Package

X = Standard
A = Unit Containerization Package

Digit 45 - Refrigerant

B = Full Factory Refrigerant Charge (R-454B)
3 = Nitrogen Charge with Oil for R–454B

Digit 46 - Human interface

X = None
A = Standard Display

Digit 47 - Power Factor Correction Capacitors

X = None
A = With Power Factor

Digit 48 - Coil Drain Pan Antifreeze Heater

A = With Drain Pain Anti-freeze Heater
X = Without Drain Pain Anti-freeze Heater

Digit 49 - Freeze Protection (Factory Installed Only)

X = Without Freeze Protection on BPHE
2 = With Freeze Protection on Hydraulic Kit

Digit 50 - Buffer Tank

X = No Tank
1 = With Tank

Digit 52 - Appearance Option

X = Without
B = Complete Anti-intrusion Grilles
C = Condensing Coil Protection Grilles
G = Bottom Enclousure with Condensing Coil Protection Grilles
L = Bottom Enclousure

Digit 53 - Staged auxiliary heaters command

X = None
1 = With Auxiliary Heater Relays (up to 4 stages)

Digit 54 - Starter Type

A = Across the Line Starter/Direct On Line
B = Soft Starter

Digit 55 - Annunciation Relay

X = None
A = With

Digit 56 - Fan Type

2 = EC
3 = EC HESP

Digit 57 - Night Noise Setback (NNSB)

X = None
1 = With NNSB (Noise reduction request) EC only

Digit 58 - Hydraulic Modularity Option

X = None
A = Hydraulic Modularity Kit (with clamps supplied loose)
B = Hydraulic Modularity Kit (with caps and clamps supplied loose)

Digit 59 - 3-way valve

X = None
W = 3-way Valve for Domestic Hot Water
Z = 3-way Valve Management (controller management without valve)

Digit 60 - Condenser coils protection with metallic filter

A = Condenser Coils Protection With Metallic Filters
X = None

Digit 61 - Circuit Breakers

X = With Thermal-magnetic Circuit Breakers
B = With Motor Protection Circuit Breakers

Digit 62 - Water Gauges

X = None
W = Water Gauges (supplied loose)

Digit 63 - Automatic Water Filling

X = None
A = Automatic Water Filling (supplied loose)

Digit 64 - Multi-manager controller

X = None
F = Multi-manager Controller for Modular Configuration (supplied loose)
S = Slave

Digit 65 - Special

X = Standard Catalog
S = Special Requirement

Note: *For additional information, please refer to the Option Guide.*

Pre-Installation and Pre-Startup Checklist

Inspection

When the unit is delivered, verify that it is the correct unit and that it is properly equipped. Compare the information which appears on the unit nameplate with the ordering and submittal information.

Inspect all exterior components for visible damage. Report any apparent damage or material shortage to the carrier and make a “unit damage” notation on the carrier’s delivery receipt. Specify the extent and type of damage found and notify the appropriate Sales Office. Do not proceed with installation of a damaged unit without sales office approval.

Mandatory Start-Up Checklist

This checklist is not intended to be a substitution for the contractor’s installation instruction. This checklist is intended to be a guide for the technician just prior to unit ‘start-up’. Many of the recommended checks and actions could expose the technician to electrical and mechanical hazards. Refer to the appropriate sections in the unit manual for appropriate procedures, component specifications and safety instructions.

Except where noted; it is implied that the technician is to use this checklist for inspection/ verification of prior tasks completed by the general contractor at installation.

- ☐ Unit clearances adequate for service and to avoid air recirculation, etc.
- ☐ Unit exterior inspected. The condenser coil will not be obstructed at any time by snow or ice during winter conditions.
- ☐ Unit properly grounded.
- ☐ Crankcase heaters working for 24 hours prior to arrival of technician performing start-up.
- ☐ Correct voltage supplied to unit and electric heaters (imbalance not to exceed 2%).
- ☐ Unit power phasing (A-B-C sequence) proper for compressor rotation.
- ☐ Copper power wiring meets sizing requirement in job submittal.
- ☐ All automation and remote controls installed/ wired.
- ☐ All wiring connections tight.
- ☐ Prove chilled water side Interlock and Interconnecting.
- ☐ Wiring Interlock and externals (chilled water pump).
- ☐ Field installed control wiring landed on correct terminals (external start/stop, emergency stop, chilled water reset…).
- ☐ Verify all refrigerant and oil valves are open/ back seated.
- ☐ Compressor oil levels (1/2 -3/4 high in glass) proper.
- ☐ Verify chilled water strainer is clean and free of debris and evaporator chilled water circuits are filled.
- ☐ A pressure switch device to detect lack of water is not included in the pump package. Installation of this type of device is highly recommended to avoid sealing damage due to operation of pump without enough water.
- ☐ Close the fused-disconnect switches that supplies power to the chilled water pump starter.
- ☐ Start the chilled water pump to begin circulation of the water. Inspect piping for leaks and repair as necessary. Check the physical presence of the water pressure switch.
- ☐ With water circulating through the system, adjust water flow and check water pressure drop through evaporator.
- ☐ Return chilled water pump to auto.
- ☐ Verify all the unit controller Menu Items.
- ☐ All panels/doors secured prior to start-up.
- ☐ All coil fins inspected and straightened.
- ☐ Rotate fans before starting unit to inspect for potential audible and visual signs of rubbing. Start unit.
- ☐ Press AUTO key. The unit will start if the unit control calls for cooling and the safety interlocks are closed.
- ☐ Check the evaporator and the condenser refrigerant pressure on the unit controller.
- ☐ Confirm Superheat and sub-cooling values are normal.
- ☐ Compressor operation normal and within amperage rating.

- ☐ Operating log completed.
- ☐ Press stop key.
- ☐ Inspect fans again after being under load to ensure no signs or rubbing exist.
- ☐ Verify the chilled water pump runs for at least 1 minute (possibility to configure max of 10 mins) after the unit is commanded to stop (for normal chilled water systems).

Unit Storage

If the unit is to be stored for more than one month prior to installation, observe the following precautions:

- Store the unit in a secured area, to avoid intentional damages.
- Close the suction, discharge and liquid-line isolation valves.
- Store the unit in a dry, vibration-free, secure area.
- At least every three months, attach a gauge and manually check the pressure in the refrigerant circuit.
- If the refrigerant pressure is below 12.5 bar (R-454B) at 20°C {or 9.5 bar (R-454B) at 10°C}, call a qualified service organization and the appropriate sales office.

Note: *If the unit is stored before servicing near a construction site it is highly recommended to protect micro channel coils from any concrete and iron element. Failure to do so may considerably reduce reliability of the unit.*

Installation Requirements and Contractor Responsibilities

A list of the contractor responsibilities typically associated with the unit installation process is provided.

Type of requirement	**Manufacturer-supplied Manufacturer-installed**	**Manufacturer-supplied Field-installed**	**Field-supplied Field-installed**
Foundation			Meet Foundation Requirements
Rigging			• Safety Chains • Clevis Connectors • Lifting Beams
Isolation		• Neoprene Pads • Isolators (Optional)	• Neoprene Pads • Isolators (Customer Supplied)
Electrical	• Disconnect Switch • Unit Mounted Starter		• Wiring Sizes Per Submittals and Local Codes and Regulations • Terminal Lugs • Ground Connection(s) • Bas Wiring (Optional) • Control Voltage Wiring • Chilled Water Pump Contactor and Wiring Including Interlock • Option Relays and Wiring
Water Piping	Water Strainer (Optional)	Flow Switch	• Taps For Thermometers and Gauges • Thermometers • Water Flow Pressure Gauges • Isolation and Balancing Valves in Water Piping • Vents and Drains • Pressure Relief Valves • Pressure Switch Device to Detect Lack of Water
Insulation	Insulation		Insulation (Piping)

Type of requirement	Manufacturer-supplied Manufacturer-installed	Manufacturer-supplied Field-installed	Field-supplied Field-installed
Water Piping Connection Elements	Grooved Pipe	Grooved Pipe Couplings (Or) Flanged Adapters	
	Leak Detector	Leak Detector is Supplied by manufacturer and Wired by Contractor	

Installation Checklist

Complete this checklist as the unit is installed, and verify that all recommended procedures are accomplished before the unit is started. This checklist does not replace the detailed instructions given in the “Installation Mechanical” and “Installation Electrical” sections of this manual. Read both sections completely, to become familiar with the installation procedures, prior beginning the work.

General

When installation is complete, before starting the unit, the following pre-start procedures must be reviewed and verified:

⚠ Warning

Hazardous Voltage!

Failure to disconnect power before servicing could result in death or serious injury.
Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/tagout procedures to ensure the power can not be inadvertently energized. Verify that no power is present with a voltmeter.

⚠ Warning

Live Electrical Components!

Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.
When it is necessary to work with live electrical components, have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks.

1. Inspect all wiring connections in the compressor power circuits (disconnects, terminal block, contactors, compressor junction box terminals and so forth) to ensure they are clean and tight.
2. Verify that all refrigerant valves in the discharge, liquid, and oil return lines are “OPEN”.
3. Check the power-supply voltage to the unit at the main-power fused-disconnect switch. Voltage must be within the voltage use range and stamped on the unit nameplate. Voltage fluctuation must not exceed 10%. Voltage imbalance must not exceed 2%.
4. Check the unit power phasing L1-L2-L3 in the starter to ensure that it has been installed in a “A-B-C” phase sequence.
5. Fill the evaporator chilled water circuit. Vent the system while it is being filled. Open the vents on the top of the evaporator during filling and close when filling is completed.
6. Close the fused-disconnect switch(es) that supplies power to the chilled water pump starter.
7. Start the chilled water pump to begin circulation of the water. Inspect all piping for leakage and make any necessary repairs.
8. With water circulating through the system, adjust the water flow and check the water pressure drop through the evaporator.
9. Adjust the chilled water flow switch for proper operation.
10. Apply power to complete the procedures.
11. Prove all interlock and interconnecting wiring interlock and external as described in the electrical installation section.
12. Check and set, as required, all Symbio™ 800 TD-7 menu items
13. Stop the chilled water pump.
14. Energize the compressor and oil separator heaters 24 hours, prior to unit start-up.

Unit Voltage Power Supply

Unit voltage must meet the criteria given in the electrical installation section. Measure each lead of the supply voltage at the main power fused disconnect switch for the unit. If the measured voltage on any lead is not within the specified range, notify the supplier of the power and correct the situation before operating the unit.

Unit Voltage Imbalance

Excessive voltage imbalance between the phases of a three-phase system can cause motors to overheat and eventually fail. The maximum allowable unbalance is 2%. Voltage imbalance is determined using the following calculations:

% Imbalance = [(Vx – Vave) x 100/Vave]

Vave = (V1 + V2 + V3)/3

Vx = phase with greatest difference from Vave (without regard to the sign)

Unit Voltage Phasing

It is important that proper rotation of the compressors be established before the unit is started. Proper motor rotation requires confirmation of the electrical phase sequence of the power supply. The motor is internally connected for clockwise rotation with the incoming power supply phases A-B-C.

When rotation is clockwise, the phase sequence is usually called “ABC”, when counterclockwise “CBA”.

This direction may be reversed by interchanging any two of the line wires.

1. Stop the unit from TD7 Symbio™ 800.
2. Open the electrical disconnect or circuit protection switch that provides line power to the line power terminal block(s) in the starter panel (or to the unit mounted disconnect).
3. Connect the phase-sequence indicator leads to the line power terminal block (L1-L2-L3).
4. Turn power on by closing the unit supply-power fused-disconnect switch.
5. Read the phase sequence on the indicator. The ABC LED of the phase indicator will glow.

Important: *It is imperative that L1, L2, and L3 in the starter be connected in the A-BC phase sequence to prevent equipment damage due to reverse rotation.*

⚠ Warning

Proper Wiring Required!

To prevent injury or death due to electrocution

Take extreme care when performing service procedures with electrical power energized.

⚠ Caution

Equipment Damage!

Doing so may damage the equipment.

Do not interchange any load leads that are from the unit contactors or the motor terminals.

Water System Flow Rates

Establish a balanced chilled water flow through the evaporator. The flow rates should be between the minimum and maximum values given on the pressure drop curves.

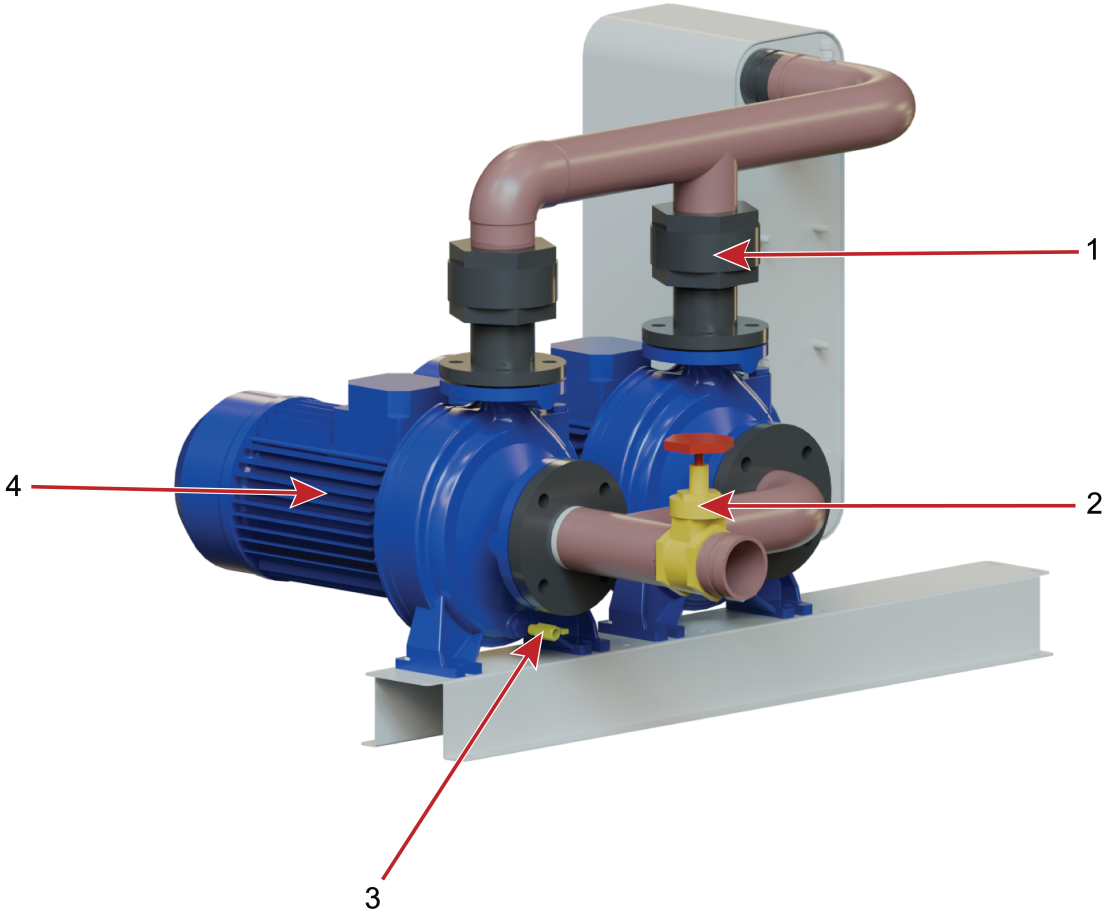
Water System Pressure Drop

Measure the water-pressure drop through the evaporator on the field installed pressure taps on the system water piping. Use the same gauge for each measurement. Do not include valves, strainers, or fittings in the pressure drop readings.

Integrated Pump Package (Optional)

Before starting up the pump, the pipe system must be thoroughly cleaned, flushed and filled with clean water. Do not start the pump until it has been vented. To ensure correct venting, open the vent screw located on the pump housing on the suction side (see figure).

Figure 1. Pump package



Items	Description	Items	Description
1	Check Valve	3	Drain Plug
2	Cock Valve	4	Pump

Note: *When using freeze inhibitor, never fill the system with pure glycol; this will damage the shaft seal. Always fill the system with diluted solution. Maximum concentration of glycol is 40% for unit with pump package.*

⚠ Caution

Pump Operation and Environmental Considerations!

Failure to operate pump without water or insert high glycol concentration will lead to premature seal damage and void the warranty.

If the unit is installed in a humid environment or a location with high air humidity, the bottom drain hole on the pump motor should be opened. The enclosure class of the motor is then changed from IP55 to IP44. The function of the drain holes is to drain off water which has entered the stator housing with air humidity.

Symbio™ 800 Setup

Using Tracer TU service tool, adjust the settings. Refer to Tracer TU manual and Symbio™ 800 user guide for instruction on settings.

⚠ Caution

Compressor Damage!

Failure to follow the safety instructions below could result in damage the compressor

Do not operate the unit until all refrigerant valves and oil line service valves are opened.

Important: *A clear sight glass alone does not mean that the system is properly charged. Also check system discharge superheat, approach temperature and unit operating pressures.*

General Data

Unit Size		026	028	032	037	041	045
Total cooling capacity[a]	kW	86	94	105	121	131	147
Total heating capacity[a]	kW	84	94	106	123	133	149
Unit Electrical Data [b] [c] [d]							
Short Circuit Unit Capacity	kA	10	10	10	10	10	10
SCOP		4.04	3.70	3.54	3.70	3.62	3.62
SEER		5.49	4.81	4.37	4.61	4.42	4.42
Digit 56=1 AC fan							
Max. Unit Power input	kW	34	42	48	54	59	67
Max. Unit Amps	A	53	70	78	89	97	109
Unit start up amps (w/o soft starter - digit 54=A) [d]	A	53	261	269	305	313	347
Unit start up amps (with soft starter - Digit 54=B) [d]	A	37	183	188	213	219	243
Displacement power factor (dpf)	-	0.92	0.87	0.89	0.88	0.88	0.89
Compressors							
Total compressors Tonnage (Ton)		30T	20+15T	20+20T	25+20T	25+25T	30+25T
Oil sump heater	W	90	180	180	180	180	180
Number or refrigerant circuits	-	1	1	1	1	1	1
Number of part load steps	-	-	3	2	3	2	2
Minimum capacity step	%	25	43	50	44	50	45
Mono Circuit Chilled Water Exchanger							
Brazed Plate Heat Exchanger Materials (model)	-	Stainless steel/copper	Stainless steel/copper	Stainless steel/copper	Stainless steel/copper	Stainless steel/copper	Stainless steel/copper
Water Content	l	8.4	11.8	11.8	14.9	14.9	19.2
Nominal water connection size without MHY	inches	2	2 1/2	2 1/2	2 1/2	2 1/2	2 1/2
Nominal water connection size with HYM	inches	2 1/2	2 1/2	2 1/2	2 1/2	2 1/2	2 1/2
(Grooved coupling) - without HYM	mm	50.8	63.5	63.5	63.5	63.5	63.5
(Grooved coupling) - with HYM	mm	63.5	63.5	63.5	63.5	63.5	63.5
Water Pressure Drop[a]	kPa	19.50	12.80	16.00	21.20	24.60	21.10
Condenser Module							
Coils							
Type	-	Aluminum/ copper fin and tube	Aluminum/ copper fin and tube	Aluminum/ copper fin and tube	Aluminum/ copper fin and tube	Aluminum/ copper fin and tube	Aluminum/ copper fin and tube
Total Quantity	-	2	2	2	2	2	2
Face area per circuit	m^2	4.7	4.7	4.7	4.7	4.7	4.7
Fans							
Type	-	EC					

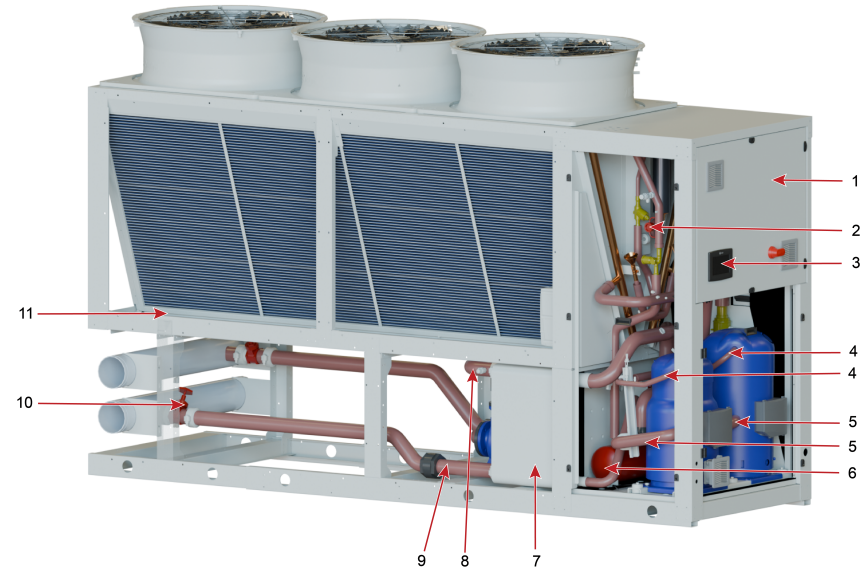
General Data

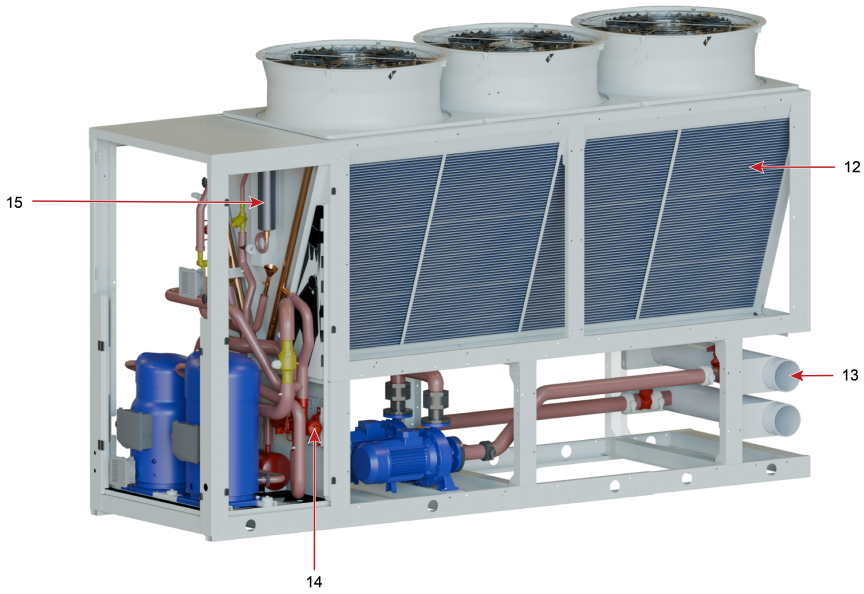
Unit Size		026	028	032	037	041	045
Number of fans	-	2	2	2	2	2	2
Airflow [a], cooling mode	m3/s	11	11	11	11	11	11
Airflow [b], heating/ heat pump mode	m3/s	9	11	11	14	14	15
Cifra 56 = 1 Ventilator EC							
Max Power Input per Motor	kW	1.82	1.82	1.82	1.82	1.82	1.82
Max Amps per Motor	A	2.9	2.9	2.9	2.9	2.9	2.9
Motor RPM (Cooling mode)	rpm	860	860	860	860	860	860
Chilled Water Pump Package options							
Single pump - Standard head pressure (digit 24=2)							
Available Head Pressure [a]	KPa	261.3	256.6	241.4	213.5	213.2	202.9
Motor Power	kW	2.2	2.2	3.0	3.0	3.0	3.0
Rated Amps	A	4.7	4.7	6.4	6.4	6.4	6.4
Single pump - High head pressure (digit 24=4)							
Available Head Pressure [a]	KPa	421.1	414.5	392.4	363.4	363.1	352.5
Motor Power	kW	4.0	4.0	4.0	5.0	5.0	5.0
Rated Amps	A	8.7	8.7	8.7	10.6	10.6	10.6
Dual pump - Standard head pressure (digit 24=1)							
Available Head Pressure [a]	KPa	261.3	256.6	241.4	213.5	213.2	202.9
Motor Power	kW	2.2	2.2	3.0	3.0	3.0	3.0
Rated Amps	A	4.7	4.7	6.4	6.4	6.4	6.4
Dual pump - High head pressure (digit 24=3)							
Available Head Pressure [a]	KPa	421.1	414.5	392.4	363.4	363.1	352.5
Motor Power	kW	4.0	4.0	4.0	5.0	5.0	5.0
Rated Amps	A	8.7	8.7	8.7	10.6	10.6	10.6
Dimensions and weight (basic model only)							
Length	mm	2774	2774	2774	3741	3741	3741
Width	mm	1115	1115	1115	1115	1115	1115
Height	mm	2327	2327	2327	2327	2327	2327
Weights							
Operating Weight	Kg	795	859	897	1095	1103	1167
Additional Weight of options							
Chilled water pump							
Single pump - Standard head pressure	Kg	61	61	64	64	64	64
Single pump - High head pressure	Kg	76	76	76	87	87	87
Dual pump - Standard head pressure	Kg	132	132	139	139	139	139
Dual pump - High head pressure	Kg	163	163	163	185	185	185
Optional Chilled Water Buffer tank	Kg	365	365	365	625	625	625

Unit Size		026	028	032	037	041	045
Oil and Refrigerant Charge (R454B)							
Total Refrigerant charge [e]	Kg	18	18	18	25	25	25
Refrigerant Charge per cooling kW [e]	Kg/KW	0.21	0.19	0.17	0.21	0.19	0.17
POE Oil Type		OIL057E	OIL057E	OIL057E	OIL057E	OIL057E	OIL057E
Total Oil charge Circuit [e]	l	8.9	10.9	13.4	13.8	13.8	13.8

[a] Indicative performance at chilled water exchanger water temperature : 12˚C / 7˚C and air temperature 35˚C for cooling only mode & hot water exchanger temperature: 40˚C / 45˚C and air temperature 7˚C (6˚C) for heating only mode for- detailed performances, on a given unit, consult Order Write Up.
[b] Under 400V/3/50Hz.
[c] Rated Condition without Pump Package.
[d] Electrical system data are indicative and subject to change without notice. Please refer to unit nameplate data.
[e] Refrigerant and oil charges are indicative. Refer to unit nameplate for real charges

Typical Components Location





Items	Description
1	Control Box
2	Expansion Valve
3	Display
4	Discharge Line
5	Suction Valve
6	Receiver
7	Brazed Plate Heat Exchanger
8	Water Inlet
9	Water Outlet
10	Cock Valve
11	Condensate Drain Plate
12	Condenser Coil
13	Header Pipe For Modular configuration
14	4-Way Valve
15	Filter Drier

Installation Requirements

Location Requirements

Sound Consideration

The most effective form of acoustical isolation is to locate the unit away from any sound sensitive area. Structurally transmitted sound can be reduced by isolators. Consult an acoustical engineer in critical sound applications.

For maximum isolation effect, isolate water lines and electrical conduit. Rubber isolated piping hangers can be used to reduce the sound transmitted through water piping. To reduce sound transmitted through electrical conduit, use flexible electrical conduit.

EU and Local Regulations codes on sound emissions should always be considered. Since the environment in which a sound source is located affects the sound pressure, unit placement must be carefully evaluated.

Clearances

When installing the unit, provide enough space around the unit to allow the installation and maintenance personnel unrestricted access to all service points. The clearance shall follow the instructions of submittal drawings according the unit configuration.

Unobstructed flow of coil air is essential to maintain the units capacity and operating efficiency. When determining unit placement, give careful consideration to ensuring a sufficient air flow across the condenser coils heat-transfer surface.

In case of enclosure around the unit, the height of the enclosure must not be higher than the unit itself. If the enclosure is higher than the unit, restrictive airflow louvers should be fitted to ensure fresh air supply.

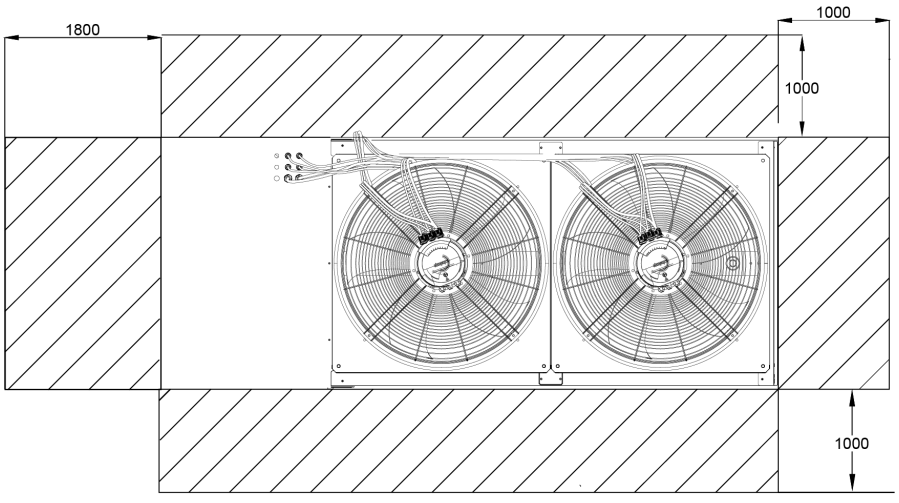
Minimum Space Requirement

Dimensional drawing shall be respected to avoid:

- Noise.
- Incorrect heat exchange and ventilation.
- Difficult maintenance or inaccessibility to components.

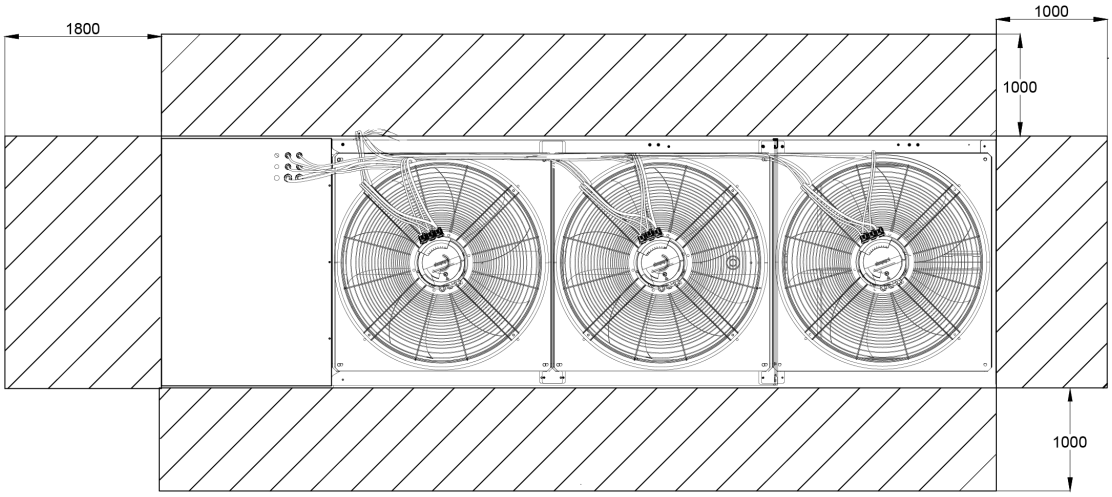
It is fundamental to respect minimum distances on all units, in order to ensure optimum ventilation for the condenser coils. Limited installation space could reduce the normal airflow, thus significantly reducing the unit performance and considerably increasing consumption of electrical energy.

Figure 2. Minimum Size Requirement for 026 - 037 [in mm]



SIZE 026-037

Figure 3. Minimum Size Requirement for 037 - 045 [in mm]



SIZE 037-045

Installation Responsibilities

Generally contractor must do the following Items when installing a unit:

1. Install the unit on a flat foundation strong enough to support unit loading and level (within 5 mm across the length and width of the unit).
2. Install the units as per instructions contained in this manual.
3. Where specified, provide and install valves in the water piping upstream and downstream of the evaporator water connections, to isolate the evaporator for maintenance, and to balance and trim the system.
4. Furnish and install a water flow prove device and or auxiliary contacts to prove unit water flow.
5. Furnish and install water pressure gauges in the inlet and outlet of the evaporator water box.
6. Supply and install an air vent cock to the top of the evaporator or evaporator piping.
7. Furnish and install strainers ahead of all pumps and automatic modulating valves.
8. Provide and install field wiring according to schematics provided in the control panel.
9. Install heat tape and insulate the chilled water lines and any other portion of the system, as required, to prevent sweating under normal operating conditions or freezing during low ambient temperature conditions.
10. Ensure that the compressor and compressor heaters have been operating for a minimum of 24 hours before starting. Failure to do so may result in equipment damage.
11. Start the unit under supervision of a qualified service technician.

Lifting and Moving Instructions

Note: *Lifting can be accomplished using either Forklifts or Cable lifting methods.*

It is recommended to use the special built-in rigging points shown in the below diagrams and to follow the following instructions:

1. Use the four rigging points which are built into the unit.
2. Slings and a spreader bar are to be provided by the rigger.
3. The minimum lifting capacity of each sling as well as the spreader bar must be equal or higher than the tabulated unit shipping weight.

Important: *This unit must be lifted and handled with care. Avoid shocks while handling.*

Important: *Lifting procedures provided with the unit must be respected.*

Details of lifting instruction and container pull out are given in the drawings specific for lifting and handling shipped with the unit.

⚠ Warning

Heavy Object!

Failure to follow instructions below could result in unit dropping which could result in death or serious injury, and equipment or property-only damage.

Ensure that all the lifting equipment used is properly rated for the weight of the unit being lifted. Each of the cables (chains or slings), hooks, and shackles used to lift the unit must be capable of supporting the entire weight of the unit. Lifting cables (chains or slings) may not be of the same length. Adjust as necessary for even unit lift.

⚠ Warning

Improper Unit Lift!

Failure to properly lift unit in a LEVEL position could result in unit dropping and possibly crushing operator/ technician which could result in death or serious injury, and equipment or property-only damage.

Test lift unit approximately 24 inches (61 cm) to verify proper center of gravity lift point. To avoid dropping of unit, reposition lifting point if unit is not level.

Figure 4. Lifting Procedure Using Fork Lift

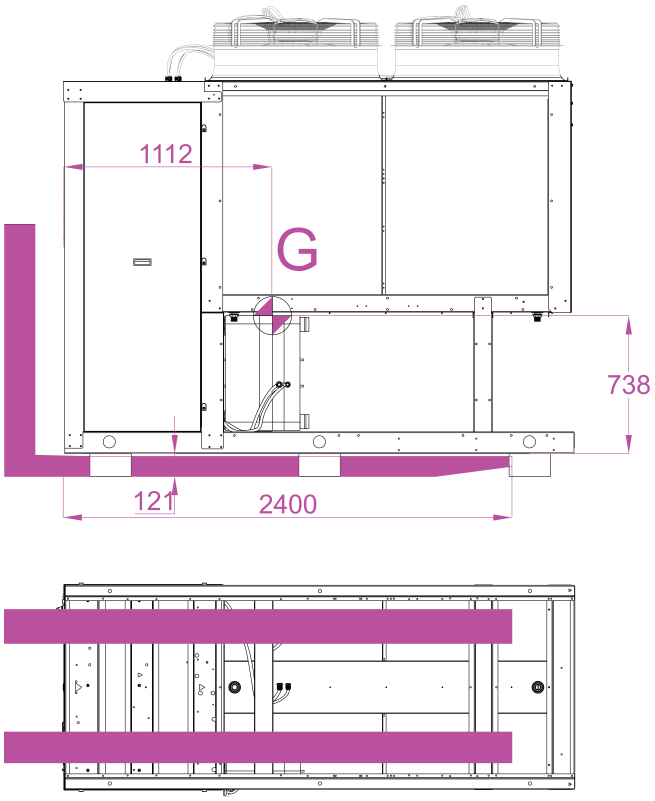


Figure 5. Lifting Procedure Using Fork Lift

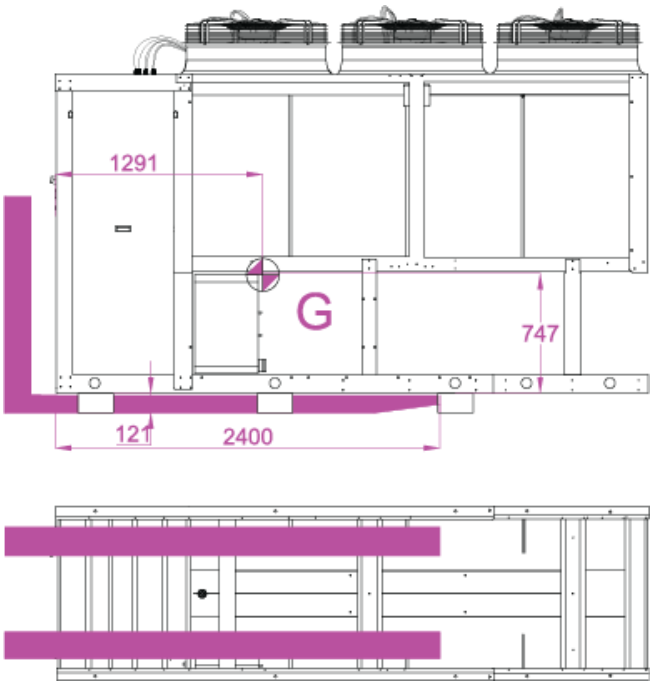


Figure 6. Lifting Procedure Using Fork Lift

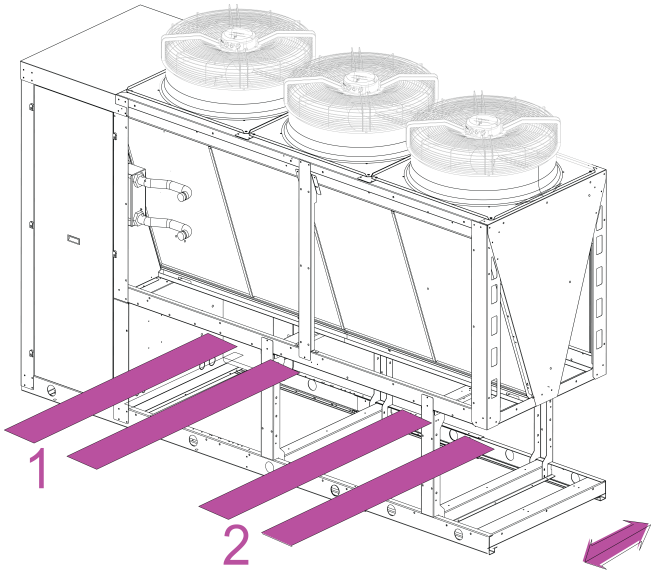
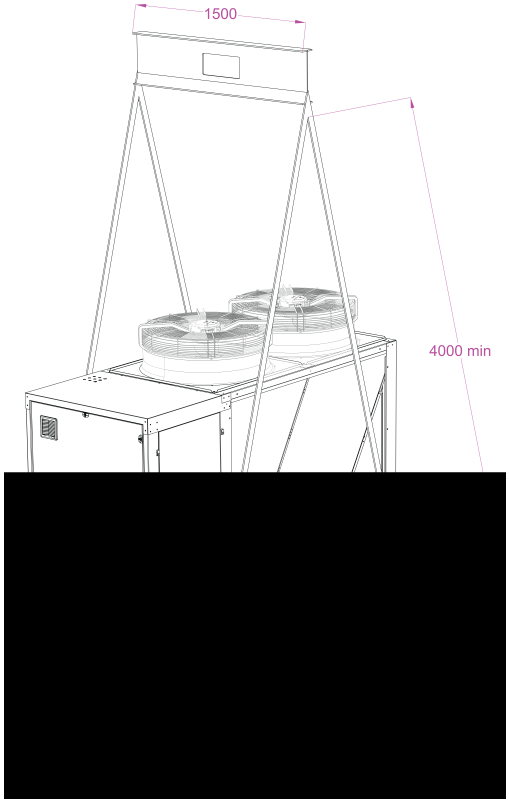


Figure 7. Lifting Procedure Using Cable Lift



Dimension and Weights

Dimensions details, dimensions of hydraulic connections, electrical connections, isolator positioning, specific features for heat recovery are included in submittals and diagrams provided in documentation package.

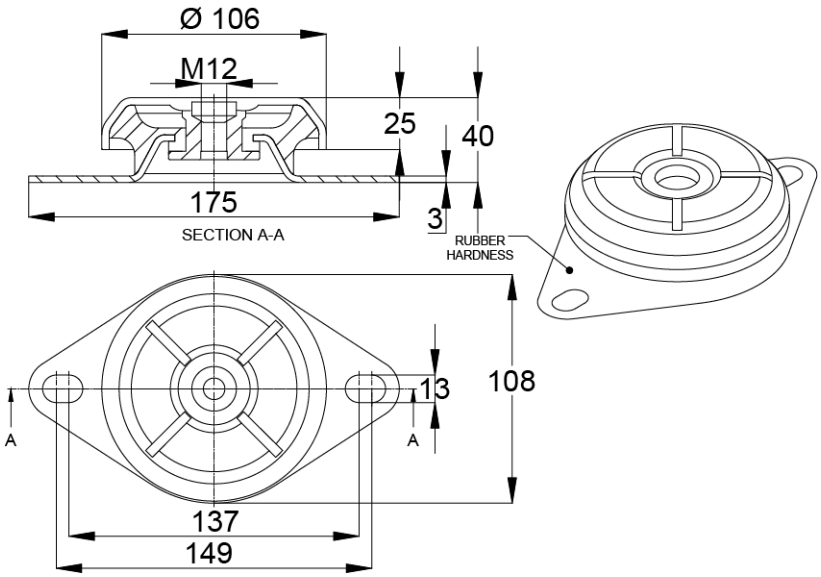
Center of Gravity

See instructions on lifting drawings, available on request.

Isolators Installation (Optional)

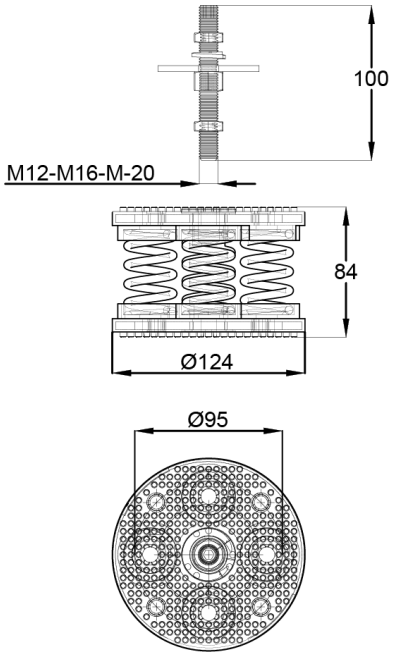
1. Make sure that the top hood does not rotate during the tightening of the central screw
2. Fix the base of the isolator to the ground
3. Level the unit carefully. Fully tighten the isolator mounting bolts.

Figure 8. Rubber Isolator



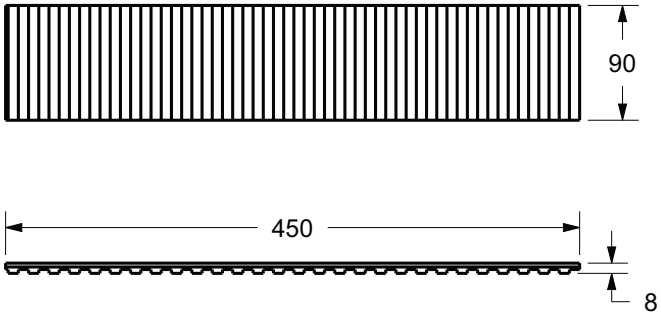
Note: *The maximum allowable tightening torque is 55 N·m.*

Figure 9. Spring Isolator



Isolator Pads Installation (Optional)

Figure 10. Isolator pads



Unit Isolation and Levelling

Provide a foundation with sufficient strength and mass to support the unit operating weight (that is, including completed piping, full operating charges of refrigerant and oil, and water). Refer to unit operating weights. The unit must be levelled within 5 mm over its length and width. Use shims as necessary to level the unit. For additional reduction of sound and vibration, install the optional isolator. Isolators Installation (Optional)

Isolators are ready to install. Mountings have to be placed on a rigid and level foundation. External equipment should not transmit additional vibration to the unit. The position of elastomeric isolator and weight per point are given in the Neoprene isolators installation drawing which is supplied with the unit. Wrong placement along the unit may result in excessive deflection.

1. Secure the isolators to the mounting surface using the mounting slots in the isolator's base plate. Do NOT fully tighten the isolators mounting bolts at this time. See the isolators submittals for isolators location, maximum weights, and isolators diagrams.
2. Align the mounting holes in the base of the unit with the threaded positioning pins on the top of the isolators.
3. Level the unit carefully. Fully tighten the isolator mounting bolts.

Evaporator Piping

Evaporator water connections are grooved. Thoroughly flush all water piping to the unit before making the final piping connections to the unit. Components and layout will vary slightly, depending on the location of connections and the water sources.

⚠ Caution

Equipment Damage!

If using an acidic commercial flushing solution, construct a temporary bypass around the unit to prevent damage to internal components of the evaporator.

Notice

Proper Water Treatment Required!

The use of untreated or improperly treated water could result in scaling, erosion, corrosion, algae or slime.

Use the services of a qualified water treatment specialist to determine what water treatment, if any, is required. Our Manufacturers assume no responsibility for equipment failures which result from untreated or improperly treated water, or saline or brackish water.

Drainage

Locate the unit near a large capacity drain for water vessel draining down during shutdown or repair. Condensers and evaporators are provided with drain connections. Refer to “Water Piping.” All local and national codes apply.

Water Treatment

In the evaporator the following material are in contact with water:

- Plate material: AISI 316 EN 10028-7 - 1.4401 +2B/2R
- Connection: AISI 316 EN 10272 - .4401/1.4404/1.4435/1.4436 - 1E
- Braze alloy: EN-13388, ISO Copper CU-HCP

When the unit is supplied with hydraulic module, the following additional materials are in contact with water:

- Pump frame and connections are made of cast iron
- Water pipes are made of carbon steel
- Pipe sealings are made of EPDM rubber (ethylene propylene diene monomer rubber)
- Pump sealings are made of silicon carbide
- Strainer is made of stainless steel

Dirt, scale, products of corrosion and other foreign material will adversely affect heat transfer between the water and system components. Foreign matter in the chilled water system can also increase pressure drop and consequently, reduce water flow. Proper water treatment must be determined locally, depending on the type of system and local water characteristics.

Neither salt nor brackish water is recommended for use in air-cooled unit. Use of either will lead to an unpredictably shorter life cycle. Manufacturer encourages the employment of a reputable water treatment specialist, familiar with local water conditions, to assist in this determination and in the establishment of a proper water treatment program.

If calcium chloride is used for water treatment, an applicable corrosion inhibitor must also be used. Failure to do so may result in damage to system components.

Standard Piping

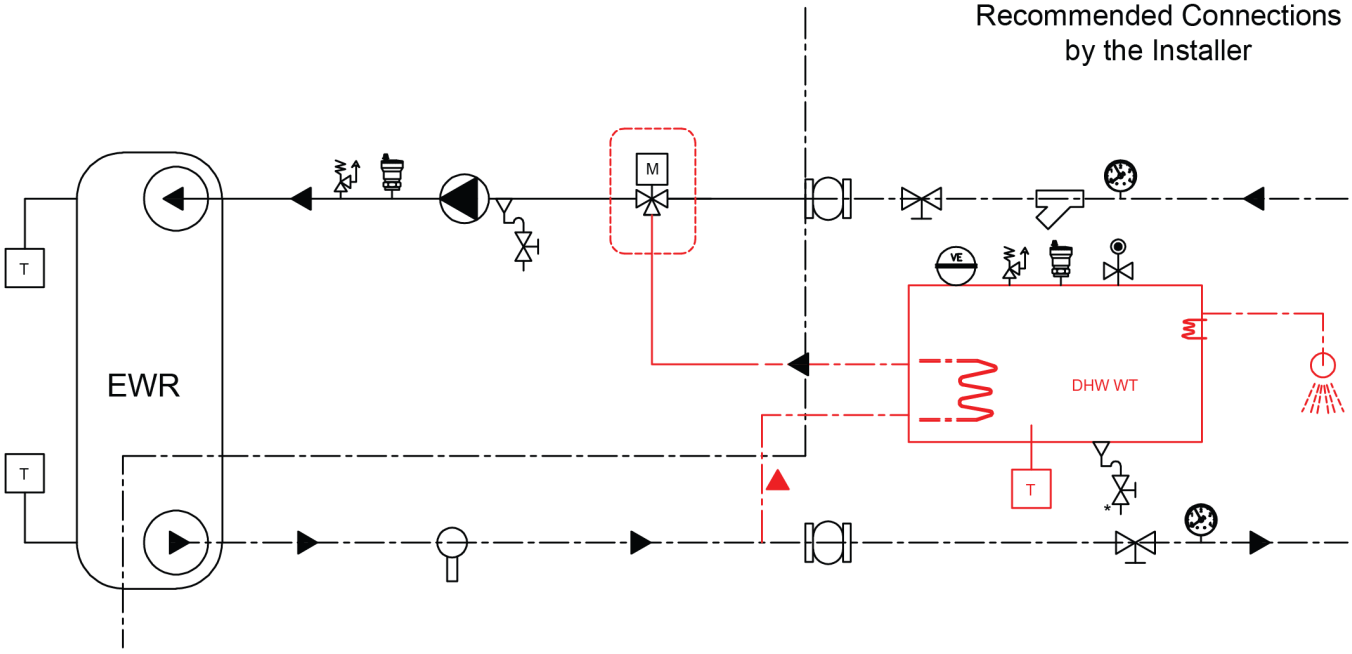
Piping components include all devices and controls used to provide proper water system operation and unit operating safety.

Reverse Water Flow Piping

Water flow direction on evaporator is always from up to down for units.

A typical evaporator piping instrumentation is shown below.

Figure 11. Unit typical water circuit



Note: *The drain valve will be installed at the lowest point of the system (1x).*

Symbols	Description	Symbols	Description	Symbols	Description	Symbols	Description
	Water Discharge		Shut Off Valve		Pump	VE	Expansion Vessel
M	2 Way Valve With ON/OFF Servo Control		Safety Valve (6 bar)		Relief Valve		Filter
	Flow Switch		Check Valve		Gauges		Water Charge
M	3 Way Valve With ON/OFF Servo Control		Electric heater		Antivibration System	T	Temperature Probe

Note: *A pressure switch device to detect lack of water is not included in the pump package. Installation of this type of device is highly recommended to avoid sealing damage due to operation of pump without enough water.*

An air vent is located on top of the evaporator at the unit water outlet. Be sure to provide additional air vents at the highest points in the piping to remove air from the chilled water system. Install the necessary pressure gauges to monitor the entering and leaving chilled water pressure, and ensure that the minimum water pressure suggested is 1.2 bar.

Provide shut-off valves in lines to the gauges to isolate them from the system when they are not in use. Use rubber vibration eliminators to prevent vibration transmission through the water lines. If desired, install thermometers in the lines to monitor entering and leaving water temperatures. Install a balancing valve in the leaving water line to control water flow balance.

Install shut-off valves on both the entering and leaving water lines so that the evaporator can be isolated for service.

It is mandatory to place a flow switch device at the outlet of the unit and to link it with the control of the unit (see wiring diagrams shipped with the unit).

⚠ Caution

Avoid Welding on Chilled Water Evaporator Connections!

The chilled water connections to the evaporator are to be "grooved pipe" type connections. Do not attempt to weld these connections, because the heat generated from welding can cause microscopic and macroscopic fractures on the heat exchanger connection that can lead to premature failure of the connection.
An optional grooved pipe stub and coupling should be used for welding on flanges.

The maximum service pressure depends on potential pump package option. The value of max service pressure is indicated on unit nameplate.

Entering Chilled Water Piping

- Air vents to bleed the air from the system (to be placed on the highest point)
- Water pressure gauges with shut-off valves
- Vibration eliminators
- Shut-off (isolation) valves
- Thermometers if desired (temperature readings available on units controller display)
- Clean-out tees
- Pipe strainer

Leaving Chilled Water Piping

- Air vents to bleed the air from the system (to be placed on the highest point)
- Water pressure gauges with shut off valves
- Vibration eliminators
- Shut-off (isolation) valves
- Thermometers (temperature readings available on the units controller display)
- Clean-out tees
- Balancing valve
- Flow Proving Device

Pressure Gauges

Install field-supplied pressure components. Locate pressure gauges or taps in a straight run of pipe; avoid placing them near elbow (at least at 10 pipe diameter from discontinuity).

To read manifold pressure gauges, open one valve and close the other (depending on the side of the desired reading), this eliminate errors resulting from differently calibrated

Evaporator Flow Switch

Specific connection and schematic wiring diagram are shipped within the unit.

For correct installation check the hydraulic scheme according the accessory of the unit.

Flow Switch Installation – Typical Requirements

1. Mount the switch upright, with a minimum of 10 pipes diameters of straight horizontal run on each side. Do not install close to elbows, orifices, or valves. The arrow on the switch must point in the direction of the flow. For additional information, consult the flow switch information sheet coming with the part.
2. To prevent switch fluttering, remove all air from the water system. Symbio™ 800 provides a 6 second time delay after a "loss-of-flow" diagnostic before shutting the unit down. Contact a service representative if nuisance machine shutdowns persist.
3. Adjust the switch to open when water flow falls below nominal values. Evaporator data is given on the General Information Section. Flow Switch contacts are closed on proof of water flow.

Important: *Control voltage from the unit to the flow proving device is 110V AC.*

Note: *In case of winter water drainage for freeze protection, it is mandatory to disconnect the evaporator heaters to protect them from burning due to overheat. It is also mandatory to fulfill the drainage, using pressurized air, and ensure that no water stays in the evaporator during winter season.*

Minimal Installation Water Content

The minimum water content is an important parameter because it ensures:

1. The minimum running time of compressors is large enough to avoid short cycling.
2. To get a reasonable return water temperature to protect the water heat exchanger against freezing up on the transient defrost mode. In case the local climate is not subject to make coil to frost (typically above 8°C), the “Avoid Short Cycle” content applies.

The water content is considered as the primary loop if a decoupling system equipes the water loop. On the contrary, the smallest loop on unit side considering all terminal valves closed.

Avoid Short-cycles

Climates that are unlikely to make coil frosting require the formula below.

For comfort application, we can allow water temperature fluctuation at part load. The parameter to take into account is the minimum operating time of the compressor. In order to avoid lubrication problem on a scroll compressor it must run at least 3 minutes (180 seconds) before it stops.

The minimum volume can be determined by using

With:

- Maximum unit capacity (kW) at full load
- Time (seconds),120s minimum operating time
- Specific heat (kJ/kg) e.g. 4.18 for water
- Dead band (K)

Recommended minimum water loop content for a single unit installation (based on pure water):

Table 1. Cooling Capacity

	Unit	**26**	**28**	**32**	**37**	**41**	**45**
Cooling	CC kW	85.8	93.7	104.9	121.4	131	147.4
	Step	0.25	0.57	0.50	0.56	0.50	0.55
	Min L/S	1.4	2.2	2.5	2.9	3.1	3.5
	Max L/S	8.2	8.9	10.0	11.6	12.5	14.1
	Water Content/ L	205	512	502	645	627	769

Table 2. Heating Capacity

	Unit	**26**	**28**	**32**	**37**	**41**	**45**
Heating	HC kW	83.7	94.4	106	123.3	133.4	148.5
	Step	0.25	0.57	0.50	0.56	0.50	0.55
	Min L/S	1.4	1.5	1.7	2.0	2.2	2.4
	Max L/S	8.1	9.1	10.2	11.9	12.9	14.2
	Water Content/ L	200	516	507	656	638	775

- For multiple unit installation or further information please contact your local sales office.
- The minimum water loop content is based on the anti-short cycling formula considering 2 minutes compressor running time for comfort applications and 4 minutes for process.

- In case the heat pump is subject to ice-formation on the coils, due to local ambient air temperatures dropping <8 °C, the strong recommendation is to install the water buffer tank after the unit supplying hot water to the building or to the process application.

Contents above shall be multiplied by the factor of the table below in case the coolant is a mixture with anti-freeze.

Concentration percentage	Propylene Glycol	Ethylene Glycol
10	1.01	1.02
20	1.03	1.06
30	1.06	1.10
40	1.10	1.15
50	1.14	1.22

Expansion Tank (Option)

The factory-installed expansion tank initial pressure should be adjusted about 0.2 bar lower than the static pressure of the circuit at the pump inlet. The expansion tank volume has been selected for typical loop volume.

It is recommended to check the expansion tank volume with the installation information.

The following data is required:

C = Water capacity of the circuit

e = Expansion coefficient (difference between max and min water temperature, in operation or not)

Pi = Initial pressure of the expansion tank

Pf = Final pressure: Max is given by the pressure relief valve

Minimum Volume of expansion tank = (C x e)/(1-Pi/Pf)

Expansion coefficient of water various temperatures:

Water capacity of the circuit (Degree Celcius) °C	Expansion coefficient (e)
0	0.000123
10	0.00027
20	0.00177
30	0.00435
40	0.00728
50	0.01210

Water loop and expansion tank volume

- Water loop FLHP 026 - 028 - 032: **237 l**
- Water loop FLHP 037 - 041 - 045: **475 l**

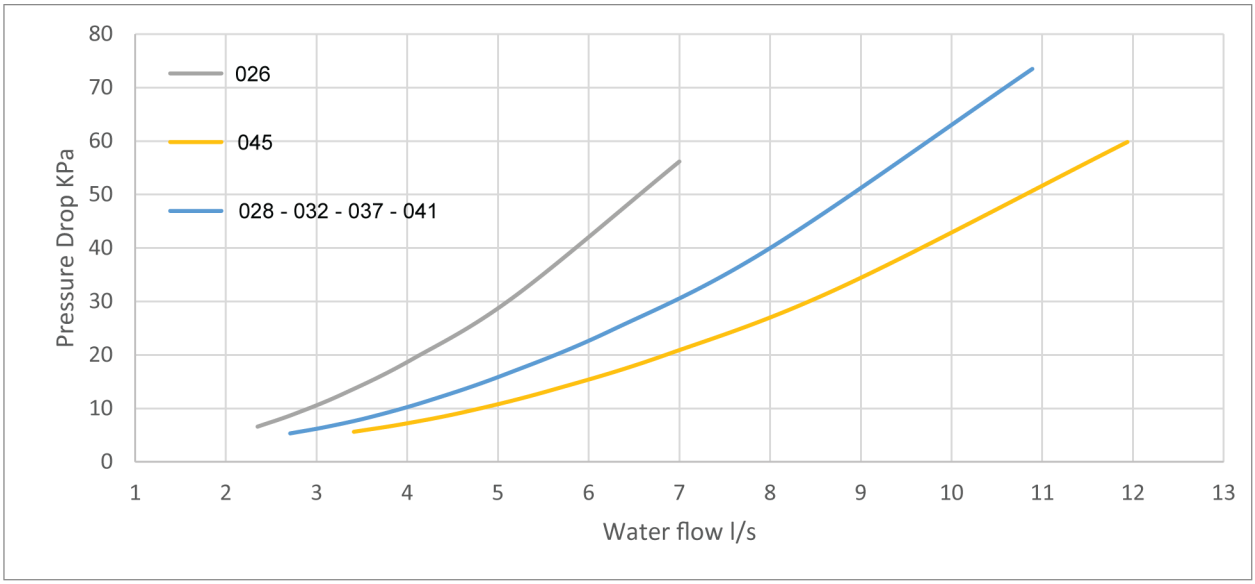
Expansion tank volume (option): **18 l**

Note: *Maximum pressure of the circuit is 400 kPa with pump package and 1000 kPa without.*

Installation - Mechanical

BPHE Evaporator Maintenance

Figure 12. Evaporator Water Pressure Drop



The unit uses a brazed plate heat exchanger (BPHE) with field installed flow switch that is positioned in the evaporator water pipe. The evaporator inlet also includes a water strainer that must be kept in place to keep debris out of the evaporator.

Note: *Strainer maintenance is critical to proper operation and reliability. Any particles larger than 1.6 mm entering the BPHE evaporator may cause the evaporator to fail, requiring replacement.*

Minimum water flow rate must be maintained to avoid laminar flow, potential evaporator freezing, scaling and poor temperature control.

The minimum and maximum water flow in BPHE should be guarantee.

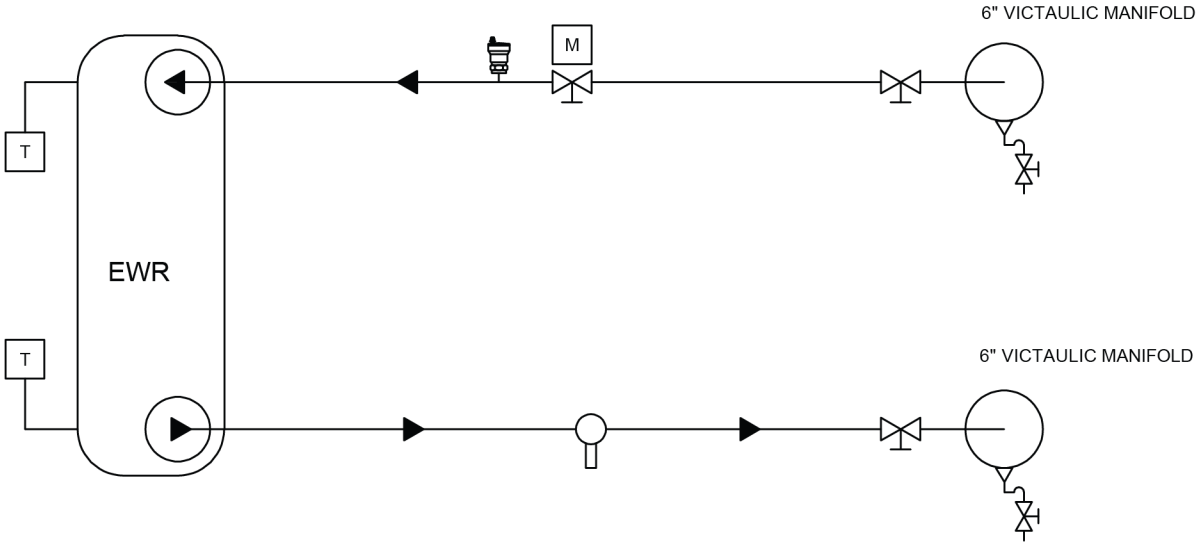
The BPHE evaporator is difficult to clean should it become plugged with debris. Indications of a plugged BPHE evaporator include “wet” suction due to lack of heat exchange, loss of superheat control, discharge superheat less than 35°C, compressor oil dilution and/or starvation and premature compressor failure.

BPHE Evaporator Replacement

If the BPHE evaporator requires replacement, it is very important that the new evaporator be replaced correctly and with the correct refrigerant and water piping connections. The refrigerant inlet/ liquid connection is at the bottom of the evaporator and the refrigerant outlet/ suction connection is at the top of the evaporator and both are on the same side. Pay particular attention to evaporators with dual circuits. Avoid cross-circuiting when installing the new evaporator.

Schematic Pump Package

Figure 13. Modular water system diagram without pump

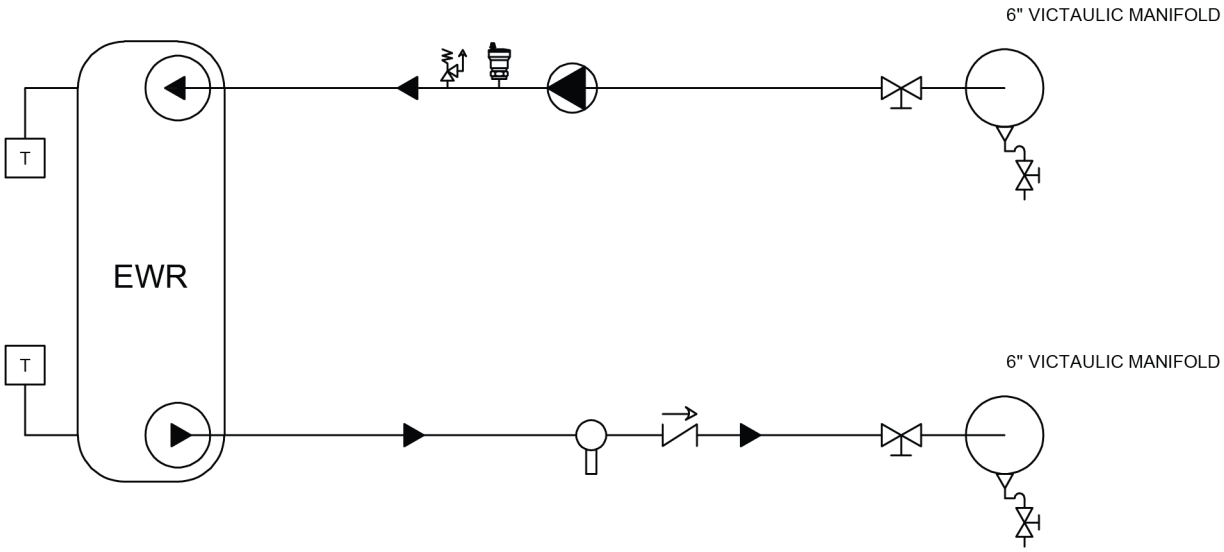


Note: *The drain valve will be installed at the lowest point of the system (1x).*

Symbols	Description	Symbols	Description
	Water Discharge		Shut Off Valve
M	2 Way Valve With ON/OFF Servo Control		Relief Valve
	Flow Switch		

Schematic Pump Package

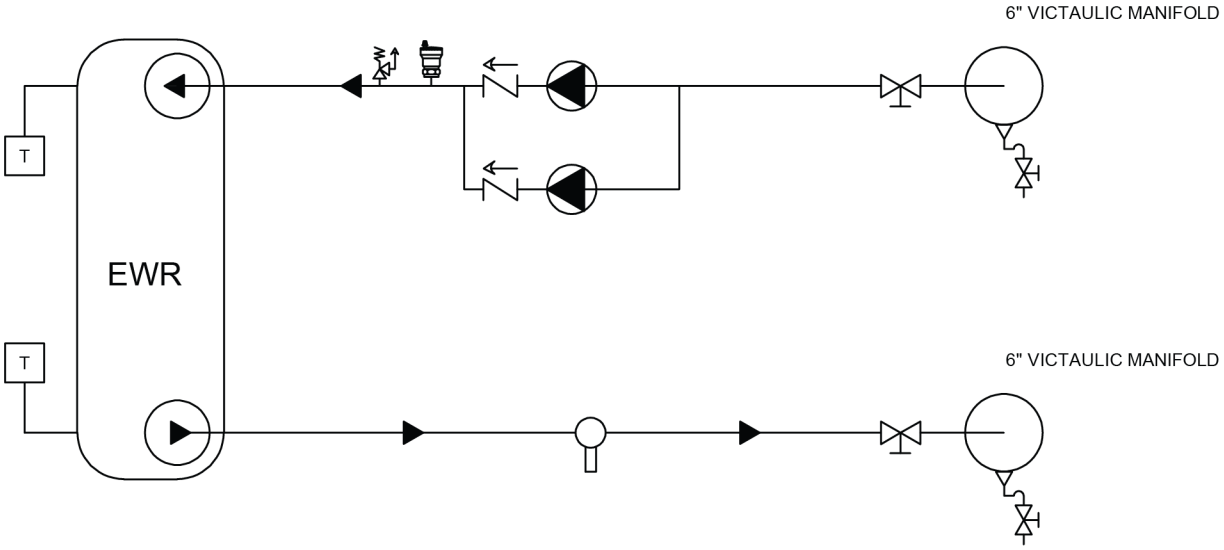
Figure 14. Modular water system diagram with single pump



Note: *The drain valve will be installed at the lowest point of the system (1x).*

Symbols	Description	Symbols	Description
	Water Discharge		Shut Off Valve
	Pump		Safety Valve (6 bar)
M	2 Way Valve With ON/OFF Servo Control		Relief Valve
	Flow Switch		Check Valve

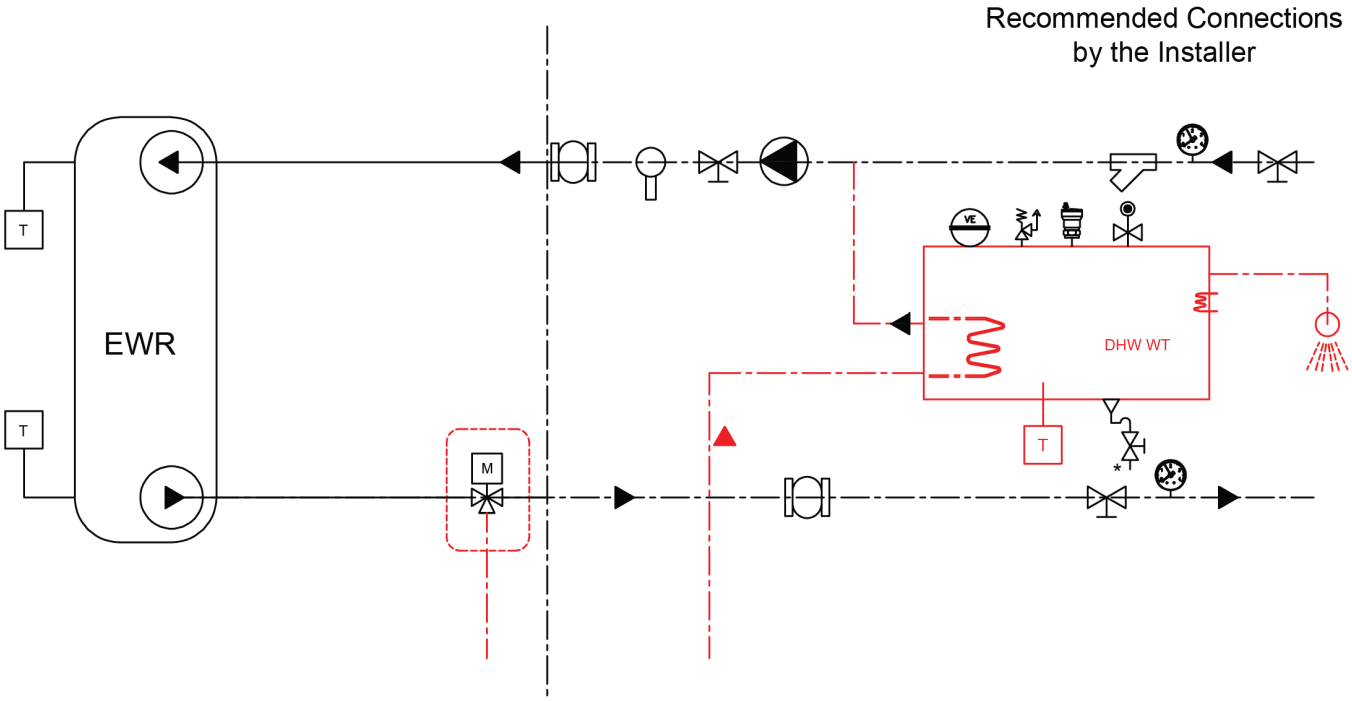
Figure 15. Modular water system diagram with dual pump



Note: *The drain valve will be installed at the lowest point of the system (1x).*

Symbols	Description	Symbols	Description
	Water Discharge		Shut Off Valve
	Pump		Safety Valve (6 bar)
	2 Way Valve With ON/OFF Servo Control		Relief Valve
	Flow Switch		Check Valve

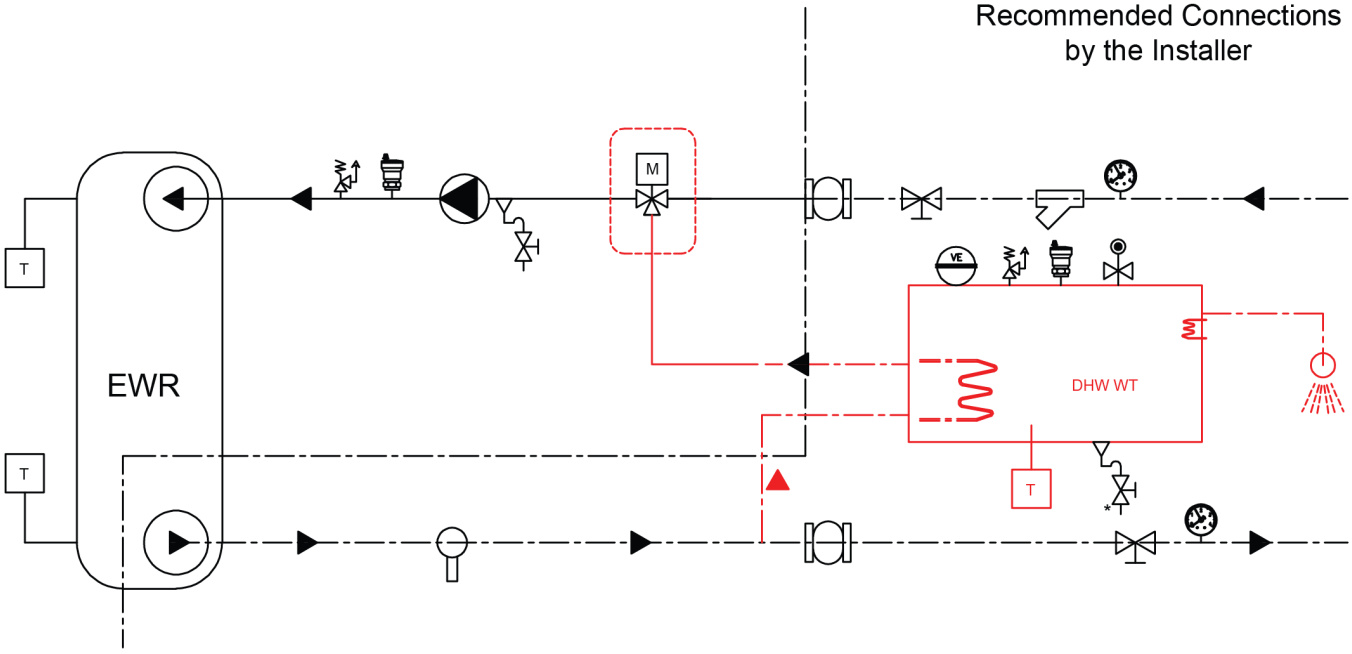
Figure 16. Water system diagram with DHW



Note: *The drain valve will be installed at the lowest point of the system (1x).*

Symbols	Description	Symbols	Description	Symbols	Description	Symbols	Description
	Water Discharge		Shut Off Valve		Pump	VE	Expansion Vessel
M	2 Way Valve With ON/OFF Servo Control		Safety Valve (6 bar)		Relief Valve		Filter
	Flow Switch		Check Valve		Gauges		Water Charge
M	3 Way Valve With ON/OFF Servo Control		Electric heater		Antivibration System	T	Temperature Probe

Figure 17. Water system diagram with DHW

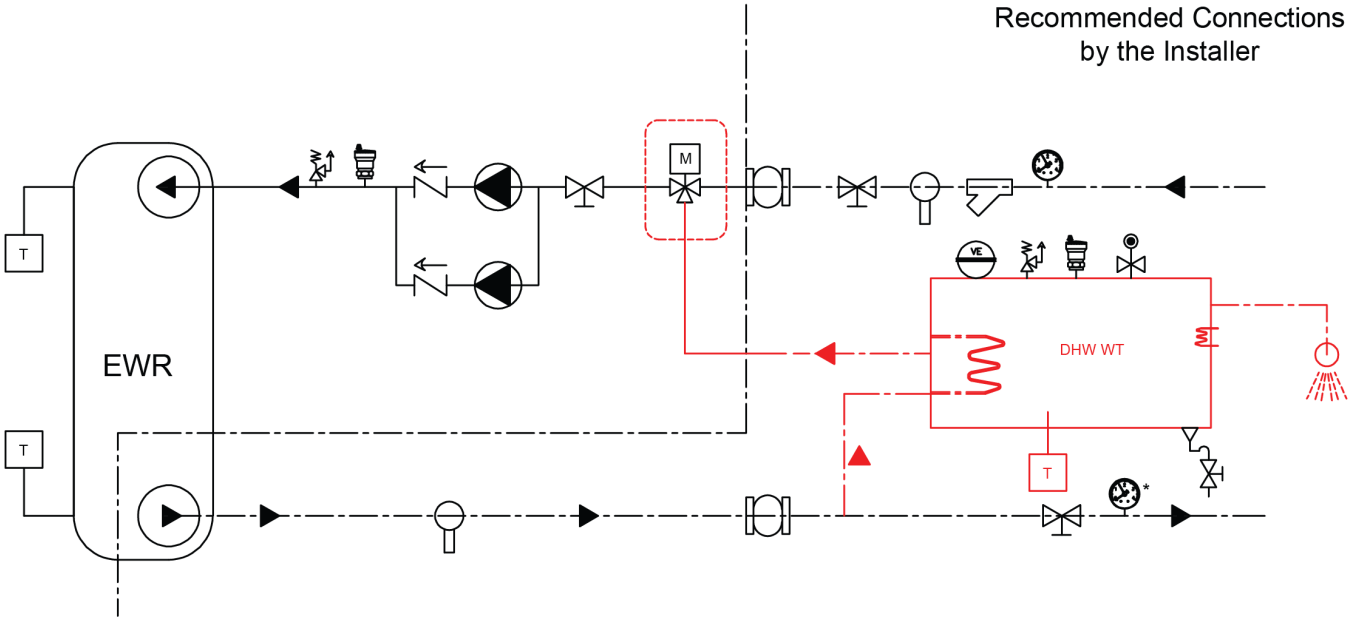


Note: *The drain valve will be installed at the lowest point of the system (1x).*

Symbols	Description	Symbols	Description	Symbols	Description	Symbols	Description
	Water Discharge		Shut Off Valve		Pump	VE	Expansion Vessel
M	2 Way Valve With ON/OFF Servo Control		Safety Valve (6 bar)		Relief Valve		Filter
	Flow Switch		Check Valve		Gauges		Water Charge
M	3 Way Valve With ON/OFF Servo Control		Electric heater		Antivibration System	T	Temperature Probe

Schematic Pump Package

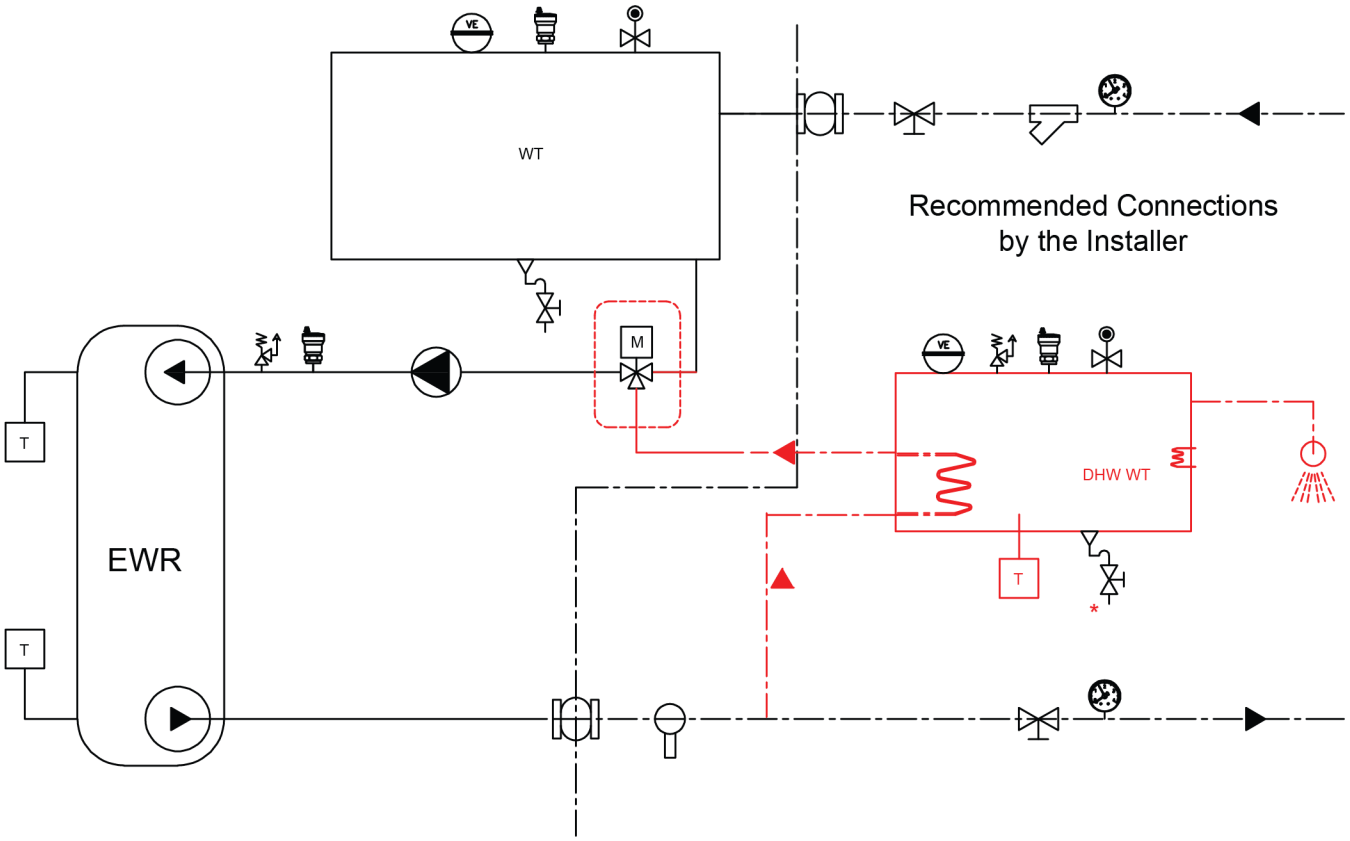
Figure 18. Stand alone double pump water system diagram



Note: *The drain valve will be installed at the lowest point of the system (1x).*

Symbols	Description	Symbols	Description	Symbols	Description	Symbols	Description
	Water Discharge		Shut Off Valve		Pump	VE	Expansion Vessel
M	2 Way Valve With ON/OFF Servo Control		Safety Valve (6 bar)		Relief Valve		Filter
	Flow Switch		Check Valve		Gauges		Water Charge
M	3 Way Valve With ON/OFF Servo Control		Electric heater		Antivibration System	T	Temperature Probe

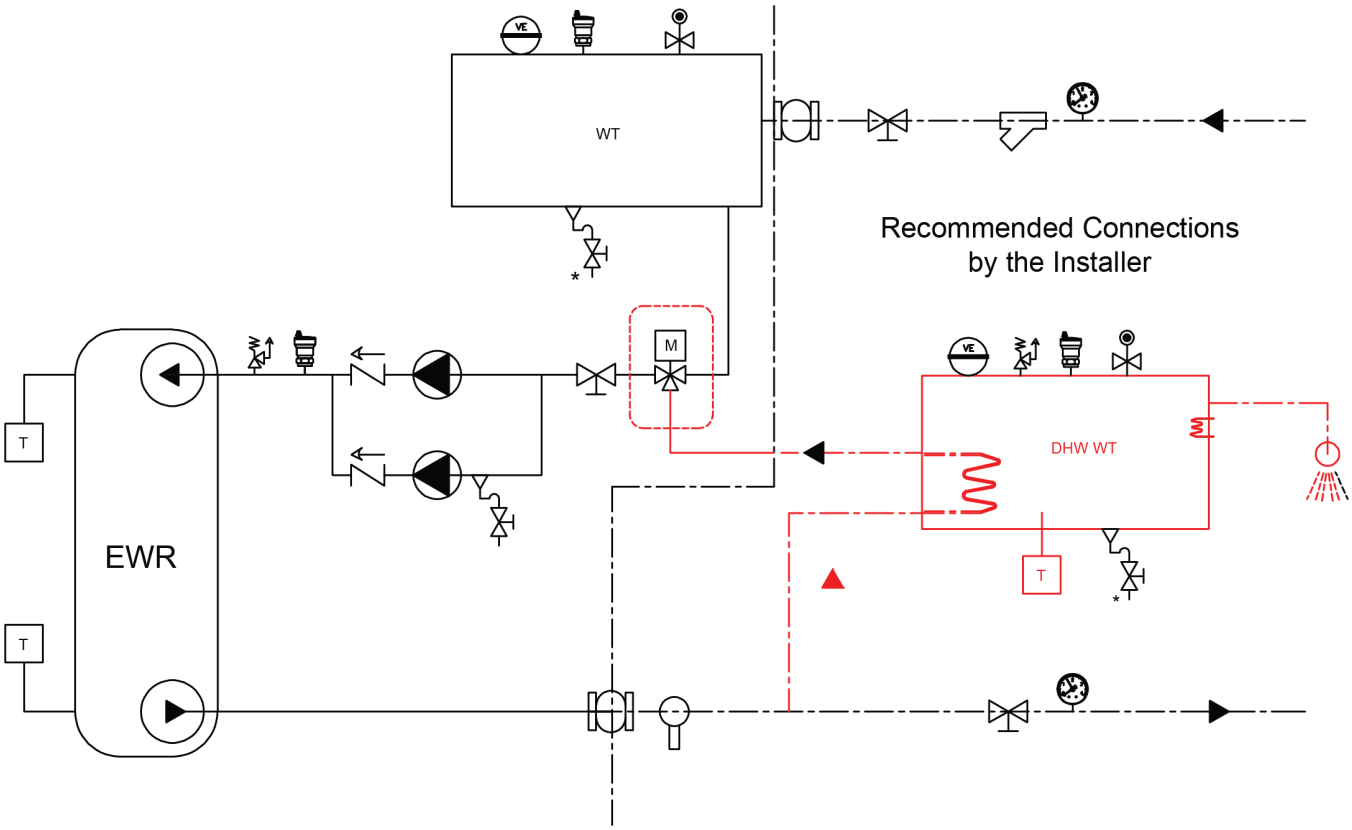
Figure 19. Stand alone single pump and tank water system diagram



Note: *The drain valve will be installed at the lowest point of the system (1x).*

Symbols	Description	Symbols	Description	Symbols	Description	Symbols	Description
	Water Discharge		Shut Off Valve		Pump		Expansion Vessel
M	2 Way Valve With ON/OFF Servo Control		Safety Valve (6 bar)		Relief Valve		Filter
	Flow Switch		Check Valve		Gauges		Water Charge
M	3 Way Valve With ON/OFF Servo Control		Electric heater		Antivibration System	T	Temperature Probe

Figure 20. Stand alone double pump and tank water system diagram



Note: *The drain valve will be installed at the lowest point of the system (1x).*

Symbols	Description	Symbols	Description	Symbols	Description	Symbols	Description
	Water Discharge		Shut Off Valve		Pump		Expansion Vessel
M	2 Way Valve With ON/OFF Servo Control		Safety Valve (6 bar)		Relief Valve		Filter
	Flow Switch		Check Valve		Gauges		Water Charge
M	3 Way Valve With ON/OFF Servo Control		Electric heater		Antivibration System	T	Temperature Probe

Integrated Pump Available Pressure

Performance Curve

The curves below describes the performance of the pump for the whole unit.

Figure 21. Pump package standard pressure

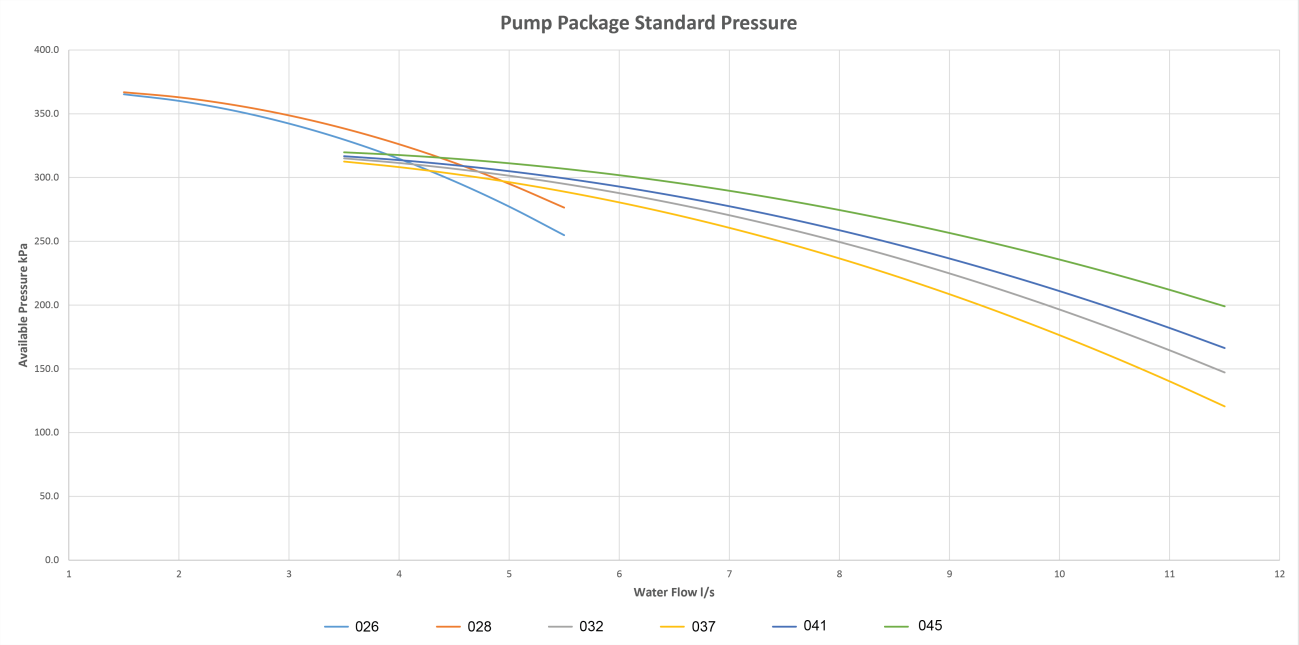
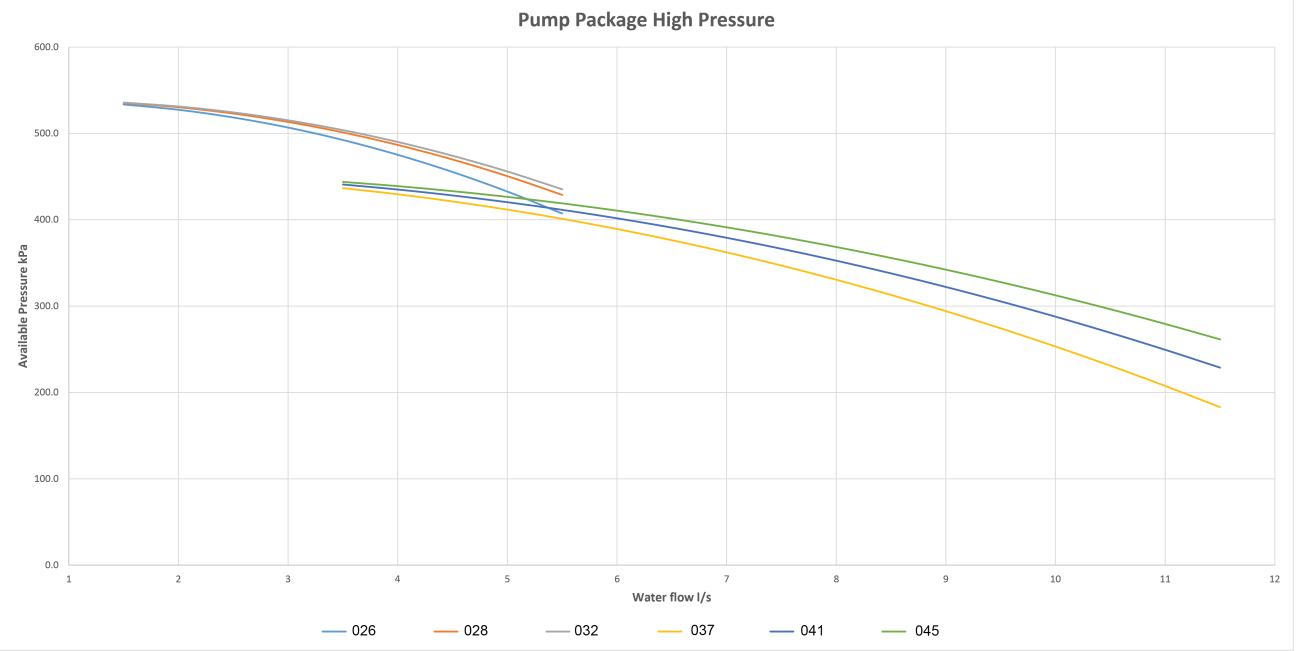


Figure 22. Pump package high pressure



Evaporator Waterside

Freeze Protection

Depending on the ambient temperature the unit may be exposed to freeze, there are multiple options for freeze protection. They are listed in order of highest ambient (least freeze protection) to the lowest ambient (most freeze protection).

For all units running with water under cold ambient temperature (below 0 °C), it is extremely important to keep full water flow in the evaporator for an extended time after last compressor stops. This will protect brazed plate evaporator from freezing by refrigerant migration. This is why evaporator water pump output relay must be used to control the chilled water pump. This is not mandatory if glycol is used with protection down to lowest ambient expected.

Water Pump and Heaters

1. Heaters are factory installed on brazed plates evaporator. They will protect it from freezing in ambient temperatures down to -18°C. Heaters are installed on the water piping and on the pumps of units equipped with hydraulic module.
2. Install heat tape on all water piping, pumps, and other components that may be damaged if exposed to freezing temperatures. Heat tape must be designed for low ambient temperature applications. Heat tape selection should be based on the lowest expected ambient temperature.
3. Symbio™ 800 controller can start the pump(s) when freezing conditions are detected. For this option the pumps must be controlled by the unit and this function.
4. Water circuit valves need to stay open at all times.

Note: *Water pump control and heater combination will protect the evaporator down to any ambient temperature provided power is available to the pump and the Symbio™ 800 controller. This option will NOT protect the evaporator in the event of power failure to the unit unless backup power is supplied to the necessary components.*

OR

Freeze Inhibitor

1. Freeze protection can be accomplished by adding sufficient glycol to protect against freezing down to the lowest ambient expected.
2. See “evaporator glycol requirement” section for guidance on determining the glycol concentration.

Note: *Use of glycol type antifreeze reduces the cooling capacity of the unit and must be considered in the design of the system specifications.*

Important: *When using freeze inhibitor, never fill the system with pure glycol. Always fill the system with diluted solution. Maximum concentration of glycol is 40%. Higher glycol concentration will damage pump seal.*

OR

Drain Water Circuit

For ambient temperatures below -20°C and for those installation not including either option 1 or 2 above described

1. Shut off power supply to unit and to all heaters.
2. Purge the water circuit
3. Blow out the evaporator to ensure that no liquid is left inside the evaporator and the water lines. Drain the pump.

Note: *It is not recommended to drain the water circuit for the following reasons.*

1. The water circuit will rust and its lifetime could be reduced.
2. Water will remain in the bottom of the plate heat exchangers and freeze damage could occur.

⚠ Caution

Evaporator damage!

If insufficient concentration or no glycol is used, the evaporator water pumps must be controlled by the Symbio™ 800 to avoid severe damage to the evaporator due to freezing. A power loss of 15 minutes during freezing can damage the evaporator.

- **It is the responsibility of the installing contractor and/or the customer to ensure that a pump will start when called upon by the unit controls. Please consult the service for unit setting and % of glycol required.**
- **With factory-fitted disconnect switch option, evaporator trace heating is taken from the live side of the isolator. As a consequence, the heaters are energized as long as the main switch is closed. Supply voltage to the heating tapes is 400V.**

- Avoid the use of very low or near minimum chilled fluid flow rates through the unit. Higher velocity chilled fluid flow reduces freeze risk in all situations.
- Flow rates below limits have increased freeze potential and have not been considered by freeze protection algorithms.
- Avoid applications and situations that result in a requirement for rapid cycling or repeated starting and stopping of the unit. Keep in mind that unit control algorithms may prevent a rapid compressor restart after shutting down when the evaporator has been operating near or below the LERTC (Low Refrigerant Temperature Cutout) limit.
- Maintain refrigerant charge at appropriate levels. If charge is in question, contact service. A reduced or low level of charge can increase the likelihood of freezing conditions in the evaporator and/or LERTC diagnostic shutdowns.

The warranty will be void, in case of freezing due to the lack of use of either of these protections.

Low Refrigeration Temperature Setpoint and Antifreeze Setpoint on Unit Control

The unit is provided with standard factory settings. It can be necessary to modify the low refrigerant cutout temperature and the antifreeze setpoint on the unit control. Based on the following examples, it is necessary to modify on the unit control the following settings:

- The LP saturation temperature
- The antifreeze setpoint

Examples for:

- 7°C, the LRTC setting must be -4°C where the antifreeze setting shall be 2°C.
- 0°C, the LRTC setting must be -12°C where the antifreeze setting shall be -6°C.

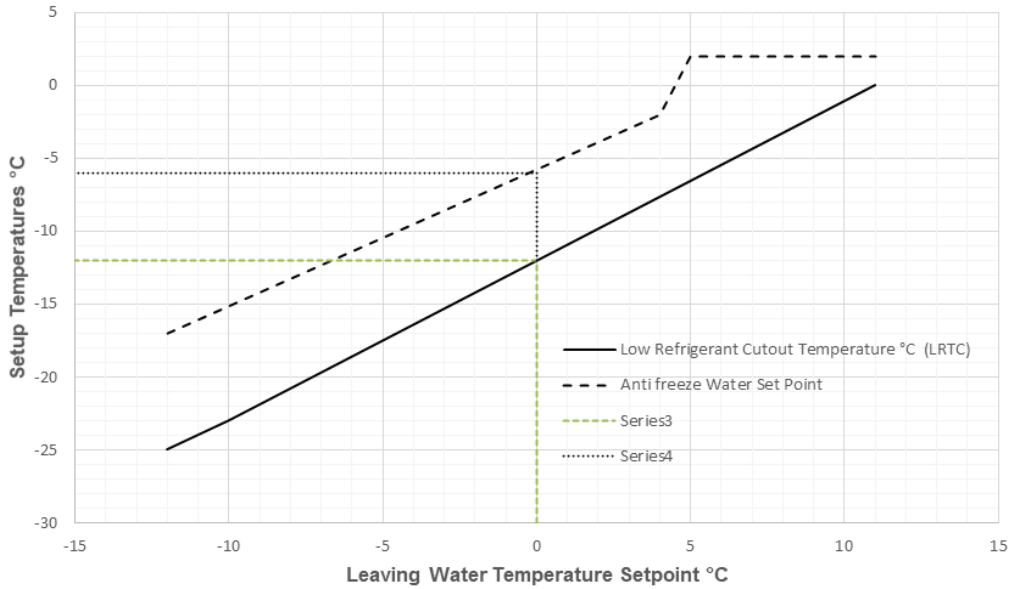
Freeze Protection with Glycol

It is mandatory to use a freeze inhibitor for leaving water setpoint less or equal to 5°C. On the glycol recommended concentration figure, you must select concentration on or above the curve. For example, for -4°C brine temperature, a concentration of 25% ethylene glycol is not sufficient. The concentration must be 28% ethylene glycol or 33% propylene glycol.

Using Glycol with Hydraulic Module

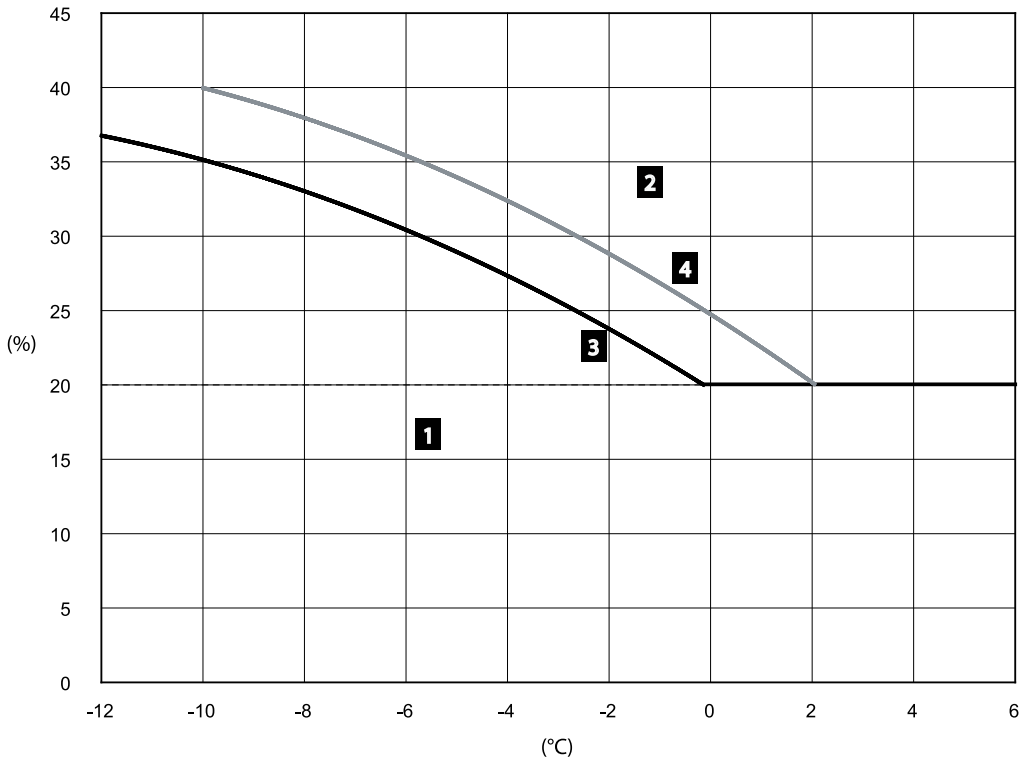
If the glycol brine percentage is not at the recommended percentage (greyed area), corrosion inhibitor present in the glycol may not be efficient enough. For instance, a glycol concentration of 15% will provide freeze protection to the unit down to -5°C, but it might generate additional corrosion.

Figure 23. Low refrigerant cutout temperature setpoint and antifreeze water temperature based on active chilled water setpoint



Evaporator Waterside (Not for Free-Cooling Version)

Figure 24. Glycol percentage recommendation curve



1= Critical risks of freezing

2= Efficient freeze protection

3= Ethylene glycol

4= Propylene glycol

%= Glycol percentage (mass concentration)

°C= Glycol or water temperature

Important:

1. *Additional glycol beyond the recommendations will adversely affect unit performance. The unit efficiency will be reduced and the saturated evaporator temperature will be reduced. For some operating conditions this effect can be significant.*
2. *If additional glycol is used, then use the actual % glycol to establish the low refrigerant cutout set point with the service advice.*
3. *The minimum low refrigerant cutout set point allowed is - 20.6°C. This minimum is established by the solubility limits of the oil in the refrigerant.*
4. *With glycol application, ensure that there is no fluctuation of brine flow versus Order Write Up value, as a reduction of flow will adversely affect unit performance and behavior.*
5. *Full unit simulation is required for proper prediction of unit performance for specific operating conditions. For information on specific conditions, contact representatives*

General Electrical Recommendations

Electrical Parts

When reviewing this manual keep in mind.

- All field-installed wiring must be in accordance with local regulations, CE directives and guidelines. Be sure to satisfy proper equipment grounding requirements according CE.
- The following standardized values - Maximum Amps - Short Circuit Amps - Starting Amps are displayed on unit nameplate.
- All field-installed wiring must be checked for proper terminations, and for possible shorts or grounds.

Note: *Always refer to wiring diagrams shipped with units or unit submittal for specific electrical schematic and connection information.*

Important: *To prevent control malfunctions, do not run low voltage wiring (<30V) in conduit with conductors carrying more than 30 volts.*

⚠ Warning

Hazardous Voltage with Capacitor!

Failure to disconnect power and discharge capacitors before servicing could result in death or serious injury. Disconnect all electric power, including remote disconnects and discharge all motor start/run and AFD (Adaptive Frequency Drive) capacitors before servicing. Follow proper lockout/tagout procedures to ensure the power cannot be inadvertently energized.

- For variable frequency drives or other energy storing components provided by the Manufacturer, refer to the appropriate manufacturer's literature for allowable waiting periods for discharges capacitors. Verify with an appropriate voltmeter that all capacitors have discharged
- DC bus capacitors retain hazardous voltages after input power has been disconnected. Follow proper lockout/tagout procedures to ensure the power cannot be inadvertently energized
- After disconnecting input power, wait five (5) minutes for units which are equipped with EC fans and wait twenty (20) minutes for units which are equipped with Variable frequency drive (0V DC) or with Power Factor correction option before touching any internal components.
- Failure to follow these instructions could result death or serious injury

For additional information regarding the safe discharge of capacitors, see "Adaptive Frequency™ Drive (AFD3) Capacitor Discharge" and BAS-SVX19*-E4.

⚠ Warning

Hazardous Voltage – Pressurized Burning Fluid!

The compressor contains hot, pressurized refrigerant. Motor terminals act as a seal against this refrigerant. Care should be taken when servicing NOT to damage or loosen motor terminals.
Do not operate compressor without terminal box cover in place. Failure to follow all electrical safety precautions could result in death or seriously injure.
Before removing compressor terminal box cover for servicing, or servicing power side of control panel, CLOSE COMPRESSOR DISCHARGE SERVICE VALVE and disconnect all electric power including remote disconnects. Discharge all motor start/ run capacitors. Follow lockout/tagout procedures to ensure the power cannot be inadvertently energized. Verify with an appropriate voltmeter that all capacitors have discharged.

⚠ Caution

Copper Mono-Conductors Required!

To avoid corrosion, overheating or general damage, at terminal connections, unit is designed for copper mono-conductors only. In case of multiconductor cable, an intermediate connection box must be added. For cable with alternative material, bi-material connecting devices are mandatory. Cable routing inside control panel should be made case by case by installer.

Do not allow conduit to interfere with other components, structural members or equipment. Control voltage (115V) wiring in conduit must be separate from conduit carrying low voltage (<30V) wiring. To prevent control malfunctions, do not run low voltage wiring (<30V) in conduit with conductors carrying more than 30V.

⚠ Warning

Strict Compliance Required!

Failure to do so may result in personal injury or death.

The Warning Label is displayed on the equipment and shown on wiring diagrams and schematics. Strict adherence to these warnings must be observed.

Note: *Units must not be linked to the neutral wiring of the installation. Units are compatible with the following neutral operating conditions:*

TNS	IT	TNC	TT
Standard	Standard[a]	Special	Standard[b]

[a] Filter RFI disconnect on VPF and EC fan.

[b] Differential protection should be suited for industrial machinery with current leak which can be higher than 500 mA (several motors and frequency drives).

Electrical Data

To get the following electrical data details: Refer to General Data tables for each unit configuration and size.

- Maximum Power input (kW)
- Unit rated amps (Max comp + Fan + Control)
- Unit start up amps (Starting Amps of the largest comp + RLA of 2nd comp + RLA of all fans+ control)
- Compressor Power factor
- Disconnect switch size (A)
- Short Circuit Rating for all sizes =15 kA

Wiring diagrams are shipped with unit and can be found in the unit control panel.

Note: *Rating is made for 400 V, 3 phases, 50 Hz power supply.*

Installer-Supplied Components

Customer wiring interface connections are shown in the electrical schematics and connection diagrams that are shipped with the unit. The installer must provide the following components if not ordered with the unit:

- Power supply wiring (in conduit) for all field wired connections
- All control (interconnecting) wiring (in conduit) for field supplied devices
- Fused-disconnect switches

Power Supply Wiring

All power supply wiring must be sized and selected accordingly by the project engineer in accordance with standard IEC 60364. All wiring must comply with local codes. The installing (or electrical) contractor must provide and install the system interconnecting wiring, as well as-the power supply wiring. It must be properly sized and equipped with the appropriate fuse-disconnect switches. The type and installation location(s) of the fused-disconnect switches must comply with all applicable codes.

Cut holes into the sides of the control panel for the appropriately-sized power wiring conduits. The wiring is passed through these conduits and connected to the terminal blocks.

To provide proper phasing of 3 phase input, make connections as shown in field wiring diagrams and as stated on the yellow WARNING label in the starter panel. Proper equipment grounds must be provided to each ground connection in the panel.

Note: *Customer wiring interface connections are shown in the electrical schematics and connection diagrams that are shipped with the unit. The installer must provide the following components if not ordered with the unit.*

⚠ Warning

Proper Wiring Required!

To prevent injury or death

Disconnect all electrical power sources before completing wiring connections to the unit.

⚠ Caution

Copper Mono-Conductors Required!

To avoid corrosion, overheating or general damage, at terminal connections, unit is designed for copper mono-conductors only. In case of multiconductor cable, an intermediate connection box must be added. For cable with alternative material, bi-material connecting devices are mandatory. Cable routing inside control panel should be made case by case by installer.

Control Power Supply

Unit is provided with control power transformer, it is not necessary to provide additional control power voltage to the unit

Heater Power Supply

The evaporator shell is insulated from ambient air and protected from freezing for temperature down to -20°C by two thermostatically-controlled immersion heaters combined with evaporator pumps activation through Symbio™ 800. Whenever the ambient temperature drops below 0°C the thermostat energizes the heaters and the Symbio™ 800 activates the pumps. If ambient temperatures below -20°C are expected, contact your local office.

⚠ Caution

Evaporator Damage!

Failure leads to catastrophic damage to the evaporator.

The control panel main processor does not check for loss of power to the heat tape nor does it verify thermostat operation. A qualified technician must frequently verify power to the heat tape and confirm operation of the heat tape thermostat.

Important: *With factory-fitted disconnect switch, trace heating is taken from the live side of the isolator, so power remains on. Supply voltage to the heating tapes is 400V.*

Do not energize heaters without water. In case of winter water drainage for freeze protection, it is compulsory to disconnect the evaporator heaters to protect them from burning due to overheat.

Water Pump Power Supply

Provide power-supply wiring with fused disconnect switch(es) for the chilled water pump(s).

Interconnecting Wiring

Chilled Water Flow (Pump) Interlock

The unit requires a field-supplied, control voltage contact input through a flow proving switch (6S51) and an auxiliary contact (6K51). Connect the proving switch and auxiliary contact to terminal 2 connector J2 cards (1A11). Refer to the field wiring diagram for details.

Chilled Water Pump Control

An evaporator water-pump output relay closes when the unit is given a signal to go into the AUTO mode of operation from any source. The contact is opened to turn off the pump in the event of most machine-level diagnostics, to prevent the buildup of pump heat.

Important: *The evaporator water pump output relay must be used to control the chilled water pump and to benefit from the water pump timer function at startup and shutdown of the chiller. This is required when the chiller is in operation under freezing conditions, especially if the chilled water loop does not contain glycol.*

Note: *Refer to Freeze Protection section for information about the evaporator circulating pump.*

Alarm and Status Relay Outputs (Programmable Relays)

See **User Guide** for alarm and status relay outputs.

EDLS and ECWS Analog Input Signal Wring Details

See **User Guide** for EDLS and ECWS.

Operating Principles

This section provides an overview of the operation of the heat pump equipped with a microcomputer-based control system. It outlines the system's primary functions and overall operating principles.

Note: *To ensure proper diagnosis and repair, contact a qualified service organization if a problem could occur.*

General

The Model units are scroll compressor(s), dual circuit, air-cooled liquid units. These units are equipped with unit mounted starter/control panels and operate with R-454B refrigerant.

The basic components of a unit are:

- Unit-mounted panel containing starter and Symbio™ 800 controller and Input/ Output LLIDS
- Scroll compressors
- Brazed plate evaporator
- Air-cooled Fin and tube condenser
- Electronic Expansion Valve (EEXV)
- Related interconnecting piping

Refrigerant Cycle

The refrigeration cycle of the unit is conceptually similar to other air-cooled products. The unit uses a brazed plate evaporator and an air-cooled Fin and tube condenser. The compressors use suction gas cooled motors and an oil management system to provide almost oil-free refrigerant to the condenser and evaporator for maximum heat transfer while lubricating and sealing compressor rotors and bearings. The lubrication system helps to assure long compressor life and contributes to quiet operation.

Refrigerant condenses in the Fin and tube air-cooled heat exchanger. Liquid refrigerant is metered into the brazed plate evaporator using an electronic expansion valve to maximize the efficiency at full and part load operation.

The unit is equipped with a unit-mounted starter and control panel. Microprocessor based unit control modules (Symbio™ 800) provide accurate chilled water control and providing monitoring, protection and adaptive limit functions. The adaptive nature of the controls intelligently prevent the unit from operating outside of its limits, or compensates for unusual operating conditions while keeping the unit running rather than simply shutting off the unit. If problems do occur, the Symbio™ 800 controls provide diagnostic messages to help the operator in troubleshooting.

Oil System

The oil is efficiently separated inside the scroll compressor and will remain in the scroll compressor during all run cycles. Between 1-2% of the oil circulates around with the refrigerant.

See compressor section for oil level information.

Condenser and Fans

The air-cooled Fin and tube condenser coils use Copper tube construction.

Whereas Fin and Tube coil is composed of four components: the holding frame, Circular tube, U-bends joining the tube ends, the aluminium fins located above the tubes, and two refrigerant Headers. Coils can be cleaned with high pressure water (see Condenser Coils maintenance for instructions).

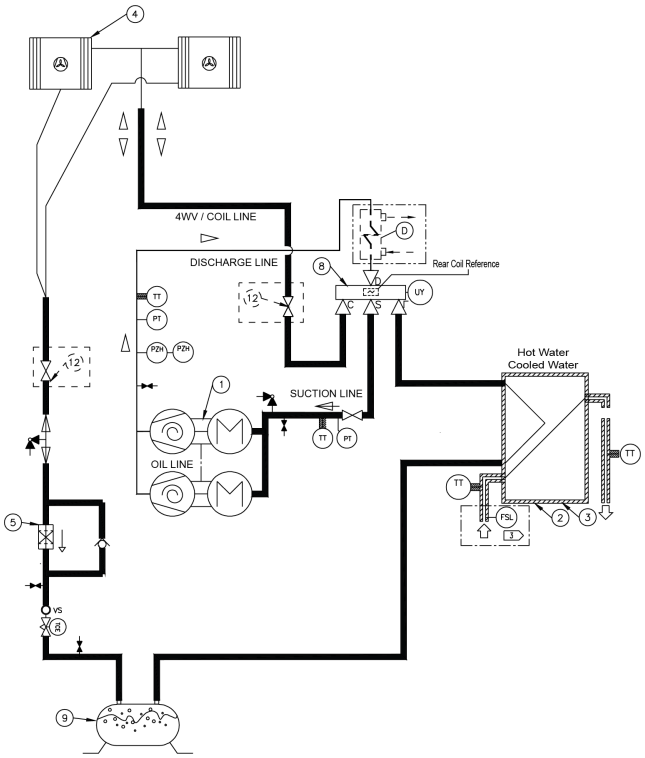
The condenser coils has an integral sub-cooling circuit. Condensers are factory proof and leak tested at 45 bars.

Direct-drive vertical-discharge airfoil condenser AC/EC fans are dynamically balanced.

Refrigerant Schematic Diagrams

This section describes the overall flow chart principle. Detailed information for a given order is supplied with order package documentation.

Figure 25. Refrigerant Schematic Diagram



Items	Description	Items	Description
1	Scroll Compressor	6	Service Valve
2	Evaporator (Cooled Water)	7	Pressure Tap
3	Heat Recovery (Hot Water)	8	4 Way Reversing Valve
4	Condenser (Air Cooled Exchanger)	9	Receiver
5	Filter Drier	12	Service Isolation Valve

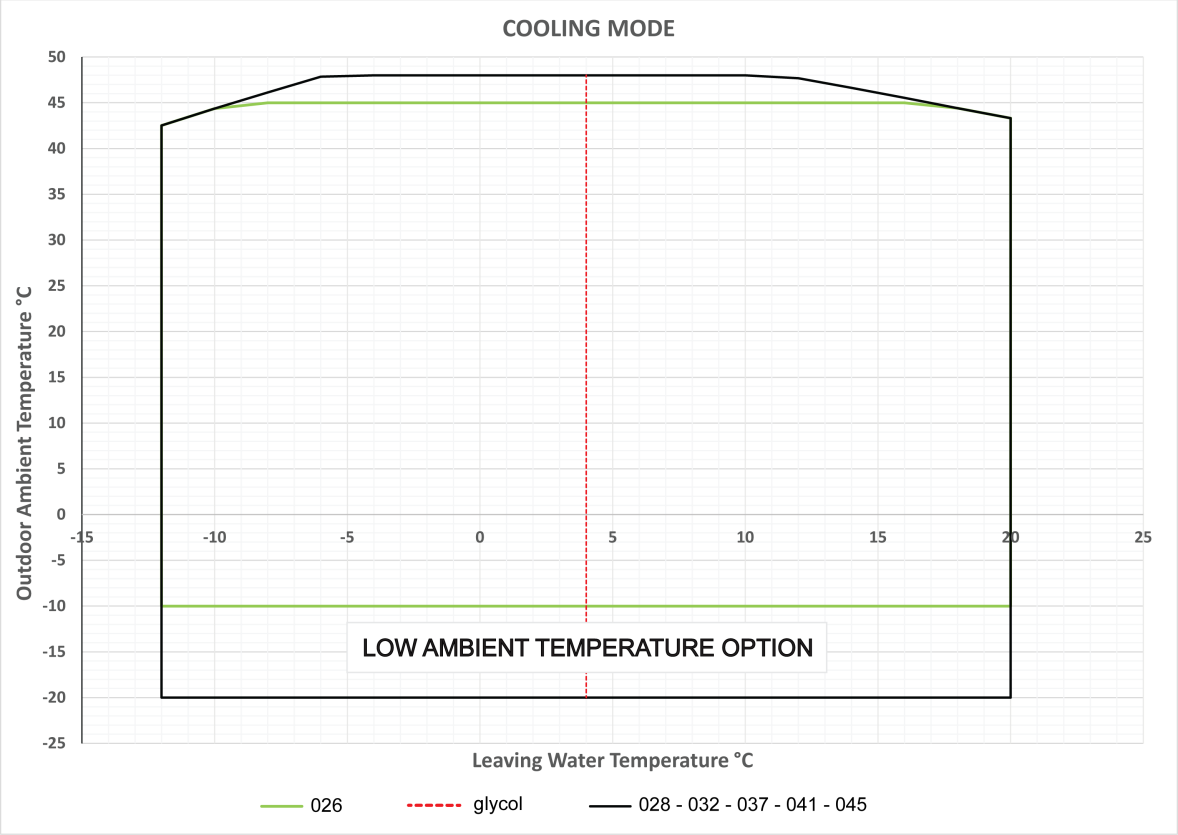
Symbols	Description	Symbols	Description
PT	Pressure Transducer	**UY**	Solenoid
PZH	High Pressure Switch	**PG**	Pressure Gauge
TT	Temperature Sensor	**PRD**	Pre-Distributor
TCE	Electric Expansion Valve		Desuper Heater (Optional)
FSL	Evaporator Water Flow Switch	3	Flow Switch FSL
M	Valve Motor		

Operating Map

Operating Map Cooling Mode

Important: *Temperature limit is 48°C. Inverter temperature limit is 45°C.*

Figure 26. Cooling Mode Graph



Note:

LWT = *Leaving Water Temperature.*

OAT = *Outdoor Ambient Temperature.*

	028 – 032 – 037 – 041 –045	**026**
LWT °C	**OAT °C**	**OAT °C**
20	43	43
18	44	44
16	46	45
14	47	45
12	48	45
10	48	45
8	48	45
6	48	45
4	48	45

	028 – 032 – 037 – 041 –045	026
LWT °C	**OAT °C**	**OAT °C**
2	48	45
0	48	45
-2	48	45
-4	48	45
-6	48	45
-8	46	45
-10	44	44
-12	43	43
-12	-20	-10
20	–20	–10
20	43	43

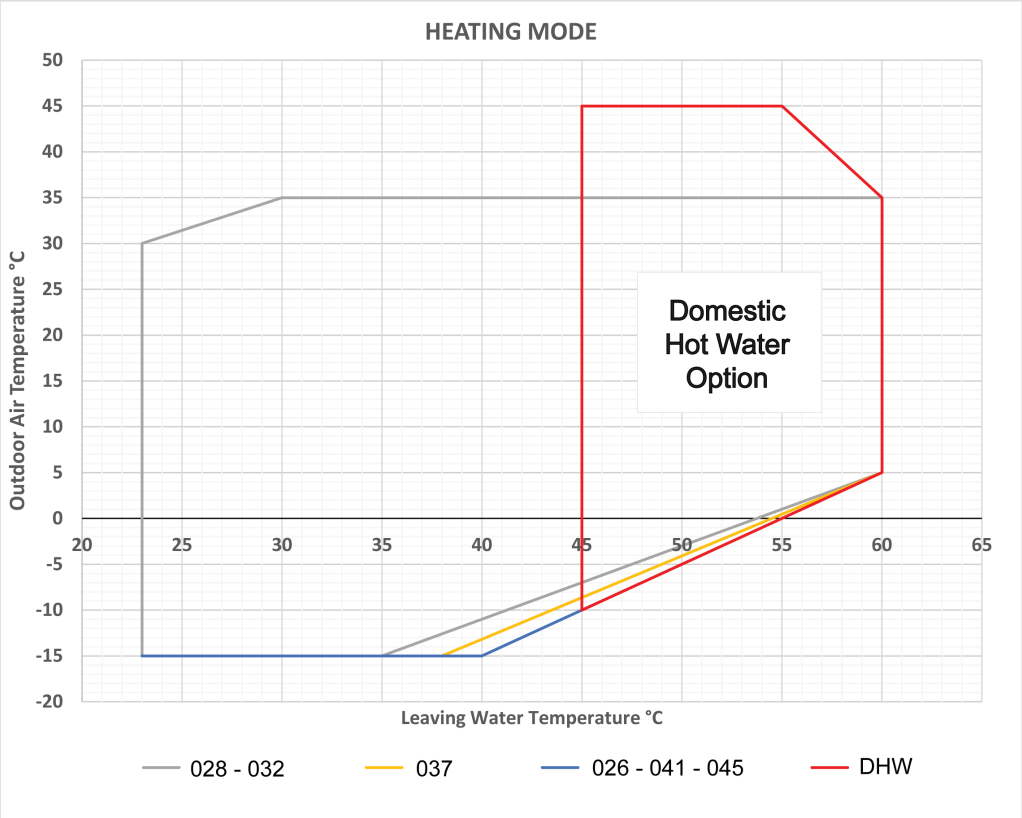
Glycol	
LWT °C	OAT °C
4	-20
4	48

Low Ambient Temp	
LWT °C	OAT °C
-12	-10
20	-10

Operating Map Heating Mode

Important: *Inverter temperature limit -10°C.*

Figure 27. Heating Mode Graph



Note:

LWT = *Leaving Water Temperature.*

OAT = *Outdoor Ambient Temperature.*

	V4	5K	10K
028	35	60	60
	25	60	60
	15	60	60
	10	60	60
	7	60	60
	5	60	60
	0	54	54
	-5	48	48
	-7	45	45
	-10	42	42
	-12	39	39
	-15	36	36
	-15	23	23
	30	23	23
	35	30	60
	35	60	23
026	30	60	60
	25	60	60
	15	60	60
	10	60	60
	7	60	60
	5	60	60
	0	55	55
	-5	50	50
	-7	48	48
	-10	45	45
	-10	43	43
	-10	40	40
	-10	23	23

Operating Map

	V4	5K	10K
032	35	60	60
	25	60	60
	15	60	60
	10	60	60
	7	60	60
	5	60	60
	0	54	54
	-5	47	47
	-7	45	45
	-10	41	41
	-12	38	38
	-15	35	35
	-15	23	23
037	35	60	60
	25	60	60
	15	60	60
	10	60	60
	7	60	60
	5	60	60
	0	54	54
	-5	49	49
	-7	47	47
	-10	43	43
	-12	41	41
	-15	38	38
	-15	23	23
041	35	60	60
	25	60	60
	15	60	60
	10	60	60
	7	60	60
	5	60	60
	0	55	55
	-5	50	50
	-7	48	48
	-10	45	45
	-12	42	43
	-15	39	40
	-15	23	23

	V4	5K	10K
045	35	60	60
	25	60	60
	15	60	60
	10	60	60
	7	60	60
	5	60	60
	0	55	55
	-5	50	49
	-7	48	47
	-10	45	44
	-12	43	42
	-15	40	39
	-15	23	23

Operating Map

DECLARED MAPS		
	LWT °C	OAT °C
028 - 032	60	35
	60	25
	60	15
	60	10
	60	7
	60	5
	35	-15
	35	-15
	35	-15
	35	-15
	35	-15
	35	-15
	23	-15
	23	30
	30	35
	60	35
026 - 041 - 045	60	35
	60	25
	60	15
	60	10
	60	7
	60	5
	40	-15
	40	-15
	40	-15
	40	-15
	40	-15
	40	-15
	23	-15

DECLARED MAPS		
	LWT °C	OAT °C
037	60	35
	60	25
	60	15
	60	10
	60	7
	60	5
	38	-15
	38	-15
	38	-15
	38	-15
	38	-15
	38	-15
	23	-15
DHW	45	-10
	45	45
	55	45
	60	35
	60	5
	45	-10

Partial Heat Recovery Option

Heat recovery option is made with a plate heat exchanger in series with the air-cooled condenser. This heat exchanger benefits the discharge gas superheat as well as a part of the condensing gas heat to be transferred to hot water system. The unit can simultaneously produce chilled water and hot water.

The heating capacity is driven by the cooling demand on the unit, the ambient temperature and the temperature of the heat recovery loop.

The partial heat recovery includes:

- One common brazed plate heat exchanger for refrigerant circuit.
- Two temperature sensors to read the inlet/ outlet hot water temperature information on the unit control display.
- Freeze protection heater (option).

Note: *Unit can recover only the compressor power input in Partial heat recovery mode.*

Water circulating inside the heat recovery heat exchanger should never be used for food process or drinking water. It must be used through a direct loop to heat or preheat water.

Note: *If the partial heat recovery heat exchanger is drained, the heater must be turned off to avoid damaging the partial heat recovery heat exchanger. The heater should only be on when the heat recovery heat exchanger has water in it.*

Important: *Discharge gas temperature can reach 130°C, may resulting in overheating of the heat recovery water if there is no appropriate flow.*

Partial Heat Recovery Piping

A field-installed safety or relief valve on the water side is required with the partial heat recovery to prevent risks resulting from a failure of the thermostat.

A 1 to 1.6 mm strainer must be installed close to the partial heat recovery heat exchanger entering water line to protect the heat exchanger.

The partial heat recovery water temperature entering the unit should be at least 40°C.

Insulate water lines and other portions of the heat recovery water loop to prevent heat loss and potential injury due to exposure to a hot surface.

For recommended partial heat recovery piping, see figure.

Do not use untreated or improperly treated water in the heat recovery water loop since it will cause inefficient operation and potential damage to the unit such as: reduced heat transfer between water and refrigerant, increased water pressure drop and reduced water flow.

Notice

Proper Water Treatment Required!

The use of untreated or improperly treated water could result in scaling, erosion, corrosion, algae or slime.
Use the services of a qualified water treatment specialist to determine what water treatment, if any, is required. Our Manufacturers assume no responsibility for equipment failures which result from untreated or improperly treated water, or saline or brackish water.

Note: *Manufacturer assumes no responsibility for equipment failures which result from untreated or improperly treated water, or saline or brackish water.*

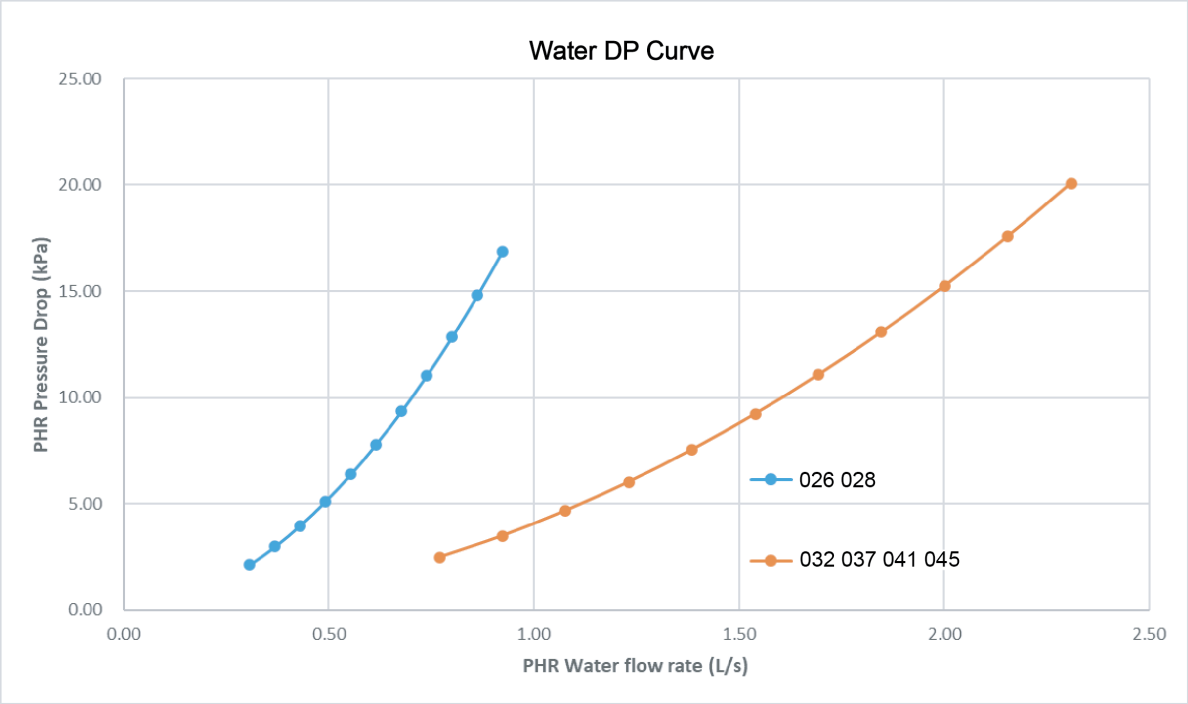
Partial Heat Recovery Freeze Protection (Option)

The heat recovery condenser is insulated and a factory-installed heater is installed and will protect the heat exchanger from freezing in ambient temperatures down to -18°C. When the ambient temperature drops to approximately 5°C, the main controller energizes the heaters.

Notes: *The inlet and outlet piping should be protected against freezing by one of the following methods:*

- *Install heat tape on all field installed water piping*
- *Add freeze inhibit fluid to the partial heat recovery water loop.*

Figure 28. Water pressure drop - heat recovery heat exchanger



PHR	26	28	32	37	41	45
Heat Exchanger module	SC.B12MTx16		SC.B12MTx40			
Water Connection (thread connection) inch mm	2" 60.3	2" 60.3	2" 60.3	2" 60.3	2" 60.3	2" 60.3
Water content volume liters	0.5	0.5	1.3	1.3	1.3	1.3

Controls/Tracer TD-7 Operator Interface

Controls Overview

The units use the following control/ interface components:

- Symbio™ 800 Controller
- Tracer TD-7 Operator Interface

Communication Interfaces

There are four connections on the Symbio™ 800 that support the communication interface. See User Guide to locate the following ports: “Wiring and Ports Description” section.

- BACnet ® MS/TP
- BACnet® IP (Only with Symbio™ 800)
- MODBUS™ RTU
- MODBUS™ TCP-IP (Only with Symbio™ 800)
- LonTalk®

See User Guide for information on communication interface.

Tracer TD-7 Operator Interface

Operator Interface

Information is tailored to operators, service technicians and owners. When operating a unit, there is specific information you need on a day-to-day basis, like set points, limits, diagnostic information, and reports.

Day-to-day operational information is presented at the display. Logically organized groups of information-chiller mode of operation, active diagnostics, settings and reports put information conveniently at your fingertips.

Tracer® TU

The TD-7 operator interface allows for daily operation tasks and set point changes. However to adequately service of units, Tracer® TU service tool is required (personnel, contact your local office for software purchase information). Tracer TU adds a level of sophistication that improves service technician effectiveness and minimizes unit downtime. This portable PC-based service-tool software supports service and maintenance tasks.

Unit Start-Up Procedures

Daily Unit Start-Up

The time line for the sequence of operation begins with a power-up of the main power to the unit. The sequence assumes single circuit, 2 compressors, air-cooled unit with no diagnostics or malfunctioning components. External events such as the operator placing the unit in AUTO or STOP, chilled water flow through the evaporator, and application of load to the chilled water loop causing loop water-temperature increases, are depicted and the unit responses to those events are shown, with appropriate delays noted. The effects of diagnostics, and other external interlocks other than evaporator water-flow proving, are not considered.

Note: *Unless the Symbio™ 800/ TD-7 and building automation system are controlling the chilled water pump, the manual unit start sequence is as follows. Operator actions are noted.*

General

If the present checkout, as discussed above, has been completed, the unit is ready to start.

1. Press the STOP key on the TD-7 display.
2. As necessary, adjust the set point values on the TD-7 menus using Tracer TU.
3. Close the fused-disconnect switch for the chilledwater pump. Energize the pump(s) to start water circulation
4. Check the service valves on the discharge line, suction line, oil line, and liquid line for each circuit. These valves must be open (back seated) before starting the compressors.
5. Verify that chilled water pump runs for at least one minute after the unit is commanded to stop (for normal chilled water systems).
6. Press the AUTO key. If the unit control calls for cooling, and all safety interlocks are closed, the unit will start. The compressor(s) will load and unload in response to the leaving chilled – water temperature.

After the system has been operating for approximately 30 minutes and has become stabilized, complete the remaining start up procedures, as follows:

1. Check the evaporator refrigerant pressure and the condenser refrigerant pressure under Refrigerant Report on the TD-7.
2. Check the EXV sight glasses after enough time has elapsed to stabilize the unit. The refrigerant flow through the sight glasses should be clear. Bubbles in the refrigerant indicate either low refrigerant charge or excessive pressure drop in the liquid line, or an expansion valve that is stuck open. A restriction in the line can sometimes be identified by a noticeable temperature differential between the two sides of the restriction. Frost will often form on the line at this point. Proper refrigerant charges are shown in the General Information Section.

Seasonal Unit Start-Up Procedure

1. Close all valves and reinstall the drain plugs in the evaporator.
2. Service the auxiliary equipment according to the startup and maintenance instructions provided by the respective equipment manufacturers.
3. Close the vents in the evaporator chilled water circuits.
4. Open all the valves in the evaporator chilled water circuits.
5. Open all refrigerant valves.
6. If the evaporator was previously drained, vent and fill the evaporator and chilled water circuit. When all air is removed from the system (including each pass), install the vent plugs in the evaporator water boxes.
7. Check the adjustment and operation of each safety and operating control.
8. Close all disconnect switches.
9. Refer to the sequence for daily unit start up for the remainder of the seasonal start up.

Important: *Ensure that the compressor and heaters have been operating for a minimum of 24 hours before starting. Failure to do so may result in equipment damage.*

System Restart After Extended Shutdown

1. Verify that the liquid-line service valves, compressor discharge service valves, and optional suction service valves are open (back seated).
2. Check the oil level (see Maintenance procedures section).
3. Fill the evaporator water circuit. Vent the system while it is being filled. Open the vent on the top of the evaporator while filling, and close it when filling is completed.
4. Close the fused-disconnect switches that provide power to the chilled water pumps.
5. Start the evaporator water pump and, while water is circulating, inspect all piping for leakage. Make any necessary repairs before starting the unit.
6. While the water is circulating, adjust the water flow and check the water pressure drops through the evaporator. Refer to “water-system flow rates” and “water-system pressure drop”.
7. Adjust the flow switch on the evaporator piping for proper operation.
8. Stop the water pumps. The unit is now ready for startup as described “Start-Up procedures”.

⚠ Caution

Compressor Damage!

Failure to follow the safety instructions below could result in damage the compressor

Do not operate the unit until all refrigerant valves and oil line service valves are opened.

Temporary Shutdown and Restart

Temporary Shutdown is used for control operation, maintenance or to repair the unit typically less than one week.

To shut the unit down for a short time, use the following procedure:

1. Press the STOP key on the TD-7. The compressors will stop when the compressor contactors de-energize.
2. Stop the water circulation by turning off the chilled water pump at least one minute after the stop of the compressors.

To restart the unit after a temporary shutdown, enable the chilled water pump and press the AUTO key.

The unit will start normally, provided the following conditions exist:

- The Symbio™ 800 receives a call for cooling and the differential-to-start is above the set point.
- All system operating interlocks and safety circuits are satisfied.

⚠ Caution

Evaporator freeze-up!

Under freezing conditions, the chilled water pump must remain in operation during the full shutdown period of the unit if the chilled water loop does not contain glycol, to prevent any risk of evaporator freeze-up.

Extended Shutdown Procedure

The following procedure is to be followed if the system is to be taken out of service for an extended period of time (i.e. seasonal shutdown):

1. Test the unit for refrigerant leaks and repair as necessary.
2. Open the electrical disconnect switches for the chilled water pump. Lock the switches in the “OPEN” position.
3. Close all chilled water supply valves. Drain the water from the evaporator.
4. Open the unit main electrical disconnect and unit-mounted disconnect (if installed) and lock in the “OPEN” position.
5. At least every three months (quarterly), check the refrigerant pressure in the unit to verify the refrigerant charge integrity.

⚠ Caution

Disconnect switch in the open position!

Lock the chilled water pump disconnects open to prevent pump damage. Lock the disconnect switch in the “OPEN” position to prevent accidental startup and damage to the system when it has been set up for extended shutdown.

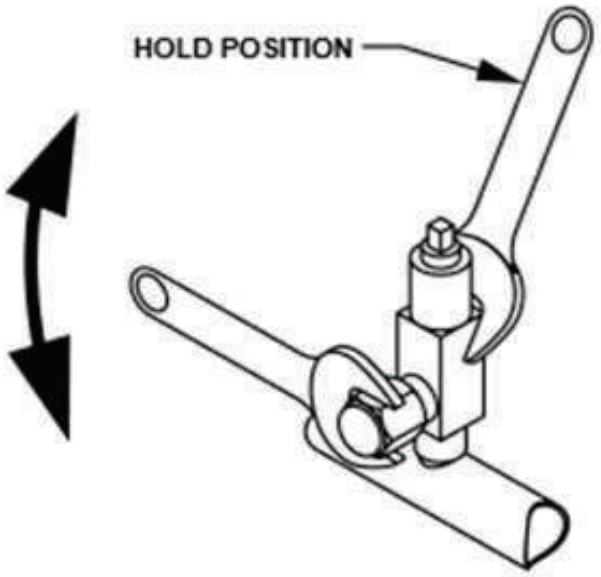
Note: *During an extended shutdown period, especially over the winter season, the evaporator must be drained of water, if the chilled water loop does not contain glycol, to prevent any risk of evaporator freeze-up.*

Periodic Maintenance

General

Perform all maintenance procedures and inspections at the recommended intervals. This will increase the life of the unit and minimize the possibility of serious and costly breakdown. Use an “Operator’s Log” to record the unit’s operating history. The log serves as a valuable diagnostic tool for service personnel. By observing trends in operating conditions, an operator can anticipate and prevent problem situations before they occur. If the unit is not operating properly during maintenance inspections, consult the “Diagnostic and Troubleshooting” section of this manual. Proper servicing of the service valves is required. Use a backup wrench as shown in Figure when loosening or tightening the service valve cap.

Figure 29. Servicing of service valves



Weekly Maintenance

After the unit has been operating for approximately 30 minutes and the system has stabilized, check the operating conditions and complete the procedures below:

1. Check on the TD-7 pressure for evaporator, condenser, and intermediate oil.

Note: *Pressures are referenced at sea level.*

2. Inspect the entire system for unusual conditions and inspect the condenser coils for dirt and debris. If the coils are dirty, refer to coil cleaning.

   Check the electronic expansion valve sight glasses.

Note: *The electronic expansion valve is commanded closed at unit shutdown and if the unit is off, there will be no refrigerant flow through the sight glasses. Only when a circuit is running will refrigerant flow be present.*

The refrigerant flow through the sight glasses should be clear. Bubbles in the refrigerant indicate either low refrigerant charge or excessive pressure drop in the liquid line. A restriction in the line can sometimes be identified by a noticeable temperature differential between the two sides of the restriction. Frost may often form on the liquid line at this point. Correct refrigerant charges is shown in nameplate.

Important: *A clear sight glass alone does not mean that the system is properly charged. Also check the system superheat, sub cooling and unit operating pressures.*

Check the system superheat, subcooling, evaporator temperature drop (Delta-T), evaporator water flow, evaporator approach temperature, compressor discharge superheat, and compressor RLA. Normal operating conditions at ISO conditions are:

Evaporator pressure: 7 to 8 bar in standard condition (R-454B).

Evaporator Approach: 3-5°C.

Evaporator Superheat: 6-7°C.

Note: *In Case of Optional Service valve, ensure the re-opening of the oil return valve (Item 13 in Refrigerant system schematic and Oil lube circuit schematic for FLHP – BPHE) after refrigerant transfer.*

Note: *If the superheat is unstable, check the suction temperature sensor. The suction temperature sensor should be well inserted into the well and thermal grease should be used to ensure a good contact between the sensor and the well.*

Electronic Expansion Valve: 30-50 percent open Evaporator Temperature Drop (Delta-T): 5°C Condensing Pressure: 26.5-30.5 bars (R-454B) Condensing Approach Temperature: 14-18°C System Subcooling: 6-10°C (R-454B) If operating pressures and sight glass conditions seem to indicate a refrigerant shortage, measure the system superheat and sub cooling.

Refer to “System Superheat” and “System Sub cooling.” If operating conditions indicate a refrigerant overcharge, remove refrigerant at the liquid line service valve.

Allow refrigerant to escape slowly to minimize oil loss. Use a refrigerant recovery cylinder and do not discharge refrigerant into the atmosphere.

⚠ Warning

Avoid Direct Contact with Refrigerant!

Do not allow refrigerant to directly contact skin as injury from frostbite may result.

Monthly Maintenance

1. Perform all weekly maintenance procedures.
2. Manually rotate the condenser fans to ensure that there is proper clearance on the fan shroud openings.
3. Check water pump (option): Manually rotate the pump. Remove plastic plug located at the bottom of the motor frame to drain any condensation which can occur in the motor.
4. Check and clean air filter of the control panel (option).
5. In case of Dual-pump, make sure there is no pump motor fault.

Note: *Pump operation will be alternated at each new request of water flow or when a pump fault is detected.*

⚠ Warning

Electrical Disconnects in the Open position!

Position all electrical disconnects in the “OPEN” position and lock them to prevent injury of death due to electrical shock or moving parts.

- **When electrical panels are ventilated, you need to change the fan filter.**
- **Clean the condenser fans. Check the fan assemblies for proper clearance in the fan shroud openings and for motor shaft misalignment or abnormal end-play, vibration and noise.**

6. Make any repairs necessary.

Annual Maintenance

1. Perform all weekly and monthly procedures.
2. Check the oil sump oil level and refrigerant charge while the unit is OFF.

Note: *Routine changing of the oil is not required. Make an oil analysis to determine the condition of the oil.*

3. Have qualified laboratory perform a compressor oil analysis to determine system moisture content and acid level. This analysis is a valuable diagnostic tool.
4. Contact a qualified service organization to leak-test the unit, to check operating and safety controls, and to inspect electrical components for deficiencies.

Notice

De-energize the heater!

Failure to de-energize the heater might cause it to burn out.
If the unit evaporator is drained of water, the freeze protection heater must be de-energized.

5. Inspect all piping components for leakage and damage.

6. Clean all water strainers.
7. Clean and repaint any areas that show signs of corrosion.
8. Clean the condenser coils.

Note: *A clear sight glass alone does not mean that the system is properly charged. Also check the rest of the system operating conditions.*

⚠ Warning

Electrical Disconnects in the Open position!

Position all electrical disconnects in the "OPEN" position and lock them to prevent injury of death due to electrical shock or moving parts.

- **When electrical panels are ventilated, you need to change the fan filter.**
- **Clean the condenser fans. Check the fan assemblies for proper clearance in the fan shroud openings and for motor shaft misalignment or abnormal end-play, vibration and noise.**

Refrigerant Emission Control

Conservation and emission reduction can be accomplished by following recommended Operation, Maintenance, and Service procedures, with specific attention to the following:

1. Refrigerant used in any type of airconditioning or refrigerating equipment should be recovered and/or recycled for reuse, reprocessed (reclaimed). Never release refrigerant into the atmosphere.
2. Always determine possible recycle or reclaim requirements of the recovered refrigerant before beginning recovery by any method.
3. Use approved containment vessels and safety standards. Comply with all applicable transportation standards when shipping refrigerant containers.
4. To minimize emissions while recovering refrigerant, use recycling equipment. Always attempt to use methods that will pull the lowest possible vacuum while recovering and condensing refrigerant into containment.
5. Refrigerant-system cleanup methods that use filters and dryers are preferred. Do not use solvents that have ozone depletion factors. Properly dispose of used materials.
6. Take extra care to properly maintain all service equipment that directly supports refrigeration service work, such as gauges, hoses, vacuum pumps, and recycling equipment.
7. Stay aware of unit enhancements, conversion refrigerants, compatible parts, and manufacturer's recommendations that will reduce refrigerant emissions and increase equipment operating efficiencies. Follow the manufacturer's specific guidelines for conversion of existing system.
8. In order to assist in reducing power-generation emissions, always attempt to improve equipment performances with improved maintenance and operations that will help conserve energy resources.

Refrigerant and Oil-charge Management

Proper oil and refrigerant charge is essential for proper unit operation, unit performances, and environmental protection. Only trained and licensed service personnel should service the unit.

Some of the symptoms of a refrigerant undercharged unit:

- Larger-than-normal evaporator approach temperatures (leaving water temperature – saturated evaporator temperature). If the refrigerant charge is correct the approach temperature is 4°C. These values are given for units running at full load and with water without antifreeze
- Low Evaporator-refrigerant temperature limit
- Low Refrigerant-Temperature cutout diagnostic
- Fully-open expansion valve
- Possible whistling sound coming from liquid line (due to high vapour velocity)
- High condenser + Sub cooler pressure drop

Some of the symptoms of a refrigerant overcharged unit:

- Condenser Pressure Limit
- High –Pressure Cutout diagnostic
- More-than-normal number of fans running
- Erratic fan control
- Higher-than-normal compressor power

Some of the symptoms of an oil over-charged unit:

- Larger-than-normal evaporator approach temperatures (Leaving-water-temperature – Saturated Evaporator Temperature)
- Low Evaporator-refrigerant Temperature limit
- Low Refrigerant – Temperature Cutout diagnostic
- Low unit capacity
- High oil-sump level after normal shutdown
- Discharge temperature is lower than prediction provided by compressor manufacturer selection program.

Some of the symptoms of an oil under-charged unit:

- Seized or Welded compressors
- Low oil-sump level after normal shutdown

Compressor Service Information

Compressor Electrical Connections

It is very important that DSH compressors used in unit are wired correctly for proper rotation. These compressors will not tolerate reverse rotation. Verify correct rotation/phasing using a rotation meter.

Proper phasing is clockwise, A-B-C. If wired incorrectly a DSH compressor will make excessive noise, will not pump and will draw about half the normal current. It will also become very hot if allowed to run for an extended period.

Note: *Do not "bump" the compressor to check rotation as incorrect rotation could cause compressor motor failure in as little as 4 to 5 seconds!*

Oil Level

To check compressor oil level, refer to the label near the compressor sight glass. The compressor(s) must be off. Wait three minutes. With tandem or triple compressors the oil level will equalize after shutdown. Compressor oil level should be no lower than the bottom of the sight glass and no more than a full sight glass. When operating, each compressor in a tandem or trio set may have a different oil level. The oil level may not be in the sight glass, but it must be visible through the sight glass.

Oil Fill, Removal and Capacity

The Model DSH compressors have an oil charging valve with a dip tube that goes to the bottom of the compressor. This can be used to add or remove oil from the compressor.

Care must be taken to prevent moisture from entering the systems when adding oil. Note that the POE oil used in this product is very hygroscopic and easily absorbs and retains moisture. Moisture is very difficult to remove from oil using vacuum. Also note that once the seal on a container of POE oil is opened, the oil must be used.

Use only OIL0057 (3.8 l) or OIL00058E (18.9 l). These are the same oil but different container size. Do not use any other POE oil.

Important: *Never reuse oil.*

Oil Testing

We recommend performing a complete oil analysis at least once a year with the specific laboratory dedicated to oil analysis for the equipment. It provides an in-depth view of both compressor and refrigerant circuit conditions including presence of water, wear particles, viscosity, acidity or dielectric data. If unacceptable wear conditions develop, a change in the characteristics of the oil will be evident. Minor problems can be detected and repaired before they become major problems.

Oil Equalizer Line

DSH Compressors

The oil equalizer line is equipped with a Rotolock fitting for easy removal. Torque value for tightening these fitting is 145 N.m. Recover the system refrigerant charge and Drain the oil to a level below the oil equalizer tube fitting before removing the oil equalizer line. This must be done on both compressors. Use the oil drain valve on the compressor. If the oil is drained below the level of the oil level sight glass, it will be below the oil equalizer line level. Pressurize the low side of the compressor using nitrogen to help drain the oil. No more than 70 kPa of pressure will be needed.

Tandem and Triple Compressor Suction Restrictors

Since most tandem and triple compressor sets use unequal size compressors, these combinations require the use of a restrictor in the suction line of one or more compressors in order to provide correct oil level balance between compressors when they are operating.

Compressor Replacement

If the unit suffers a failed compressor, use these steps for replacement:

Each compressor has lifting eyes. Both lifting eyes must be used to lift the failed compressor. Use proper lifting techniques, a spreader bar and rigging as for lifting both compressors simultaneously.

Important: *Do not lift a compressor using a single lifting eye.*

After a mechanical failure of a compressor, it is necessary to change the oil in the remaining compressor and also replace the liquid line filter drier. After an electrical failure of a compressor, it will also be necessary to change the oil in the remaining compressor, replace the liquid line filter drier and add a suction filter drier with clean-up cores.

Note: *Do not alter the refrigerant piping in any way as this can affect compressor lubrication.*

Refrigerant System Open Time

Model units use POE oil and therefore refrigerant system open time must be kept to a minimum. The following procedure is recommended:

- Leave a new compressor sealed until it is ready to be installed in the unit. Maximum system open time is dependent upon ambient conditions, but do not exceed one hour open time.
- Plug the open refrigerant line to minimize moisture absorption. Always change the liquid line filter drier.
- Evacuate the system to 500 microns or below.
- Do not leave POE oil containers open to the atmosphere. Always keep them sealed.

Mechanical Compressor Failure

Replace the failed compressor(s) and change the oil in the remaining compressor(s) along with the refrigerant system liquid line filter drier.

Electrical Compressor Failure

Replace the failed compressor and change the oil in the other compressor(s). Also add a suction filter with cleanup cores and change the liquid line filter drier. Change filters and oil until the oil no longer test acidic. See “Oil Testing.”

Compressor Motor Megging

Motor megging determines the electrical integrity of the compressor motor winding insulation. Use a 500 volt megger. A less than 1 meg-ohm reading is acceptable and 1000 ohms per nameplate volts is required to safely start the compressor.

Compressor Current Imbalance

Normal current imbalance could be 4 to 15 percent with balanced voltage due to motor design. Each phase should register 0.3 to 1.0 ohms and each phase should be within 7 percent of the other two phases. Phase to ground resistance must be infinity.

Note: *Maximum allowable voltage imbalance is 2 percent.*

Compressor Electrical Terminal Box

Be sure to protect the terminal box when unbrazing or brazing compressor refrigerant piping connections.

Compressor Crankcase Heaters

Compressor crankcase heaters must be energized at least eight hours before starting the unit. This is required to boil refrigerant out of the oil before startup. Ambient temperature (except 20°C and above) is not a factor and the crankcase heaters must always be energized prior to startup.

Refrigerant Piping

The compressor suction and discharge connections and piping are copper clad steel for easy brazing. In most instances, piping may be reused. If piping is not reusable, order the correct service parts. Cut all tubing with a tubing cutter to prevent copper filings from entering the system. Cut the tubing in a straight length of pipe after the compressor connection has been unsweated. The line can then be reinstalled using a slip coupling and brazing.

Note: *The compressor suction line configuration must not be changed in any way. Changing compressor suction line configuration will compromise proper oil return to the compressor(s).*

Integrated Pump Maintenance

Water Pump Maintenance

⚠ Warning

Power Supply!

Before starting work on the pump, make sure that the power supply has been switched off and that it cannot be accidentally switched on.

Important: *The lifting eyebolts of the motor are suitable for the weight of the motor only. It is not allowed to carry the complete pump on the lifting eyebolts of the motor.*

It is important to keep the motor clean in order to ensure adequate cooling of the motor. If the pump is installed in dusty environments, it must be cleaned and checked regularly. Take the enclosure class of the motor into account when cleaning.

If the water loop must be emptied during period of frost, the pump has to be drained to avoid damage. Remove the filling and drain plugs. Do not re-fit the plugs until the pump is taken into operation again.

Lubrication

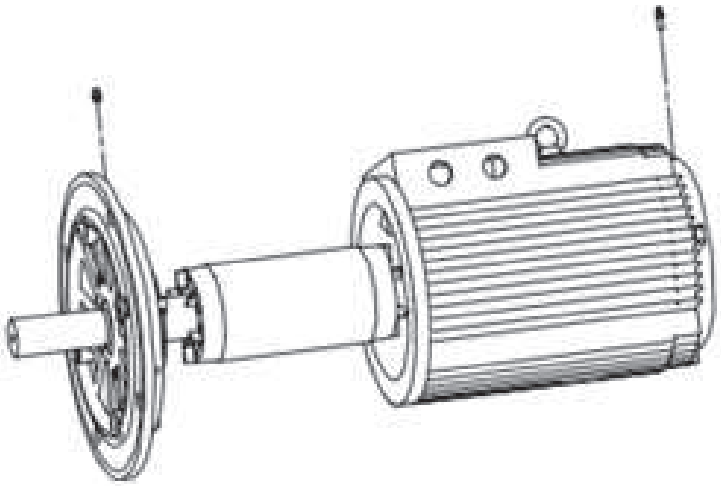
The bearings of motors 5.5kW and 7.5kW are greased for life and require no lubrication. Increasing bearing noise and undue vibration indicate a worn bearing. The bearing or the complete motor then needs replacement.

The bearing of motors 11kW and up must be greased every 4000 hours or at yearly service. The required grease quantity is 10g per bearing. The motor must run during lubrication. Use lithiumbased grease.

The pump shaft seal does not require any special maintenance. Visual leakage check are however required. Distinctly visible leakage will require an exchange of the seal.

For further details about pump maintenance please consult the pump supplier website.

Figure 30. Motor bearings



Log Check Sheet

The operator log sheet are included for use as appropriate, for installation completion verification before Start-up is scheduled, and for reference during the Start-up.

Operator Log				
Unit with Symbio™ 800 Controller - Tracer AdaptiView Reports - Log Sheet				
	Start	**15 minutes**	**30 minutes**	**1 hour**
Evaporator				
Active Chilled Water Setpoint				
Entering Water Temperature				
Leaving Water Temperature				
Ckt 1				
Saturated Refrigerant Temperature (°C)				
Refrigerant Pressure (kPa)				
Approach Temperature (°C)				
Water Flow Status				
EXV % Open				
Ckt 2				
Saturated Refrigerant Temperature (°C)				
Refrigerant Pressure (psia)				
Approach Temperature (°C)				
Water Flow Status				
EXV % Open				
Condenser				
Outdoor Temperature				
Ckt 1				
Airflow (%)				
Saturated Refrigerant Temperature (°C)				
Refrigerant Pressure (kPa)				
Sub cooling in °C				
Ckt 2				
Air flow (%)				
Saturated Refrigerant Temperature (°C)				
Refrigerant Pressure (kPa)				
Sub Cooling in °C				
Compressor 1A				
Running Status				
Starts				
Running Time (Hr:min)				
Oil Pressure (kPa)				

Log Check Sheet

Operator Log				
Unit with Symbio™ 800 Controller - Tracer AdaptiView Reports - Log Sheet				
	Start	**15 minutes**	**30 minutes**	**1 hour**
Compressor 1B				
Running Status				
Starts				
Running Time (Hr:min)				
Oil Pressure (kPa)				
Compressor 2A				
Running Status				
Starts				
Running Time (Hr:min)				
Oil Pressure (psia)				
Compressor 2B				
Running Status				
Starts				
Running Time (Hr:min)				
Oil Pressure (psia)				
Compressor 3A				
Running Status				
Starts				
Running Time (Hr:min)				
Oil Pressure (psia)				
Compressor 3B				
Running Status				
Starts				
Running Time (Hr:min)				
Oil Pressure (psia)				

Date:
Technician:
Owner:

Recommended Service Routine Frequencies

As a commitment to our customers, we have created a wide service network staffed with experienced factory-authorized technicians. We offer all the benefits of after sales service direct from the manufacturer and we are committed to our mission statement to provide efficient customer care.

We would be delighted to discuss your individual requirement with you. For further information regarding maintenance agreements please contact your local sales office.

Year	Com-mission-ing	Inspec-tion visit	Seasonal shut down	Seasonal start up	Oil analy-sis [a]	Vibration analysis[b]	Annual mainte-nance	Preventive maintenance	Tube analysis [c]	Compressor Renewal [d]
1	X	X	X	X		X		XX		
2			X	X	X		X	XXX		
3			X	X	X		X	XXX		
4			X	X	X		X	XXX		
5			X	X	X	X	X	XXX	X	
6			X	X	X	X	X	XXX		
7			X	X	X	X	X	XXX		
8			X	X	X	X	X	XXX		
9			X	X	X	X	X	XXX		
10			X	X	X	X	X	XXX	X	
Over 10			every year	every year	every year (2)	X	every year	every three year	every three year	40000h

[a] Schedule as per previous analysis result or at least once a year.
[b] Year 1 to define equipment baseline. Subsequent year based on oil analysis results or schedule as per vibration analysis.
[c] Tube testing required if aggressive water conditions exist. Applies to condensers only on water cooled units.
[d] Recommended at 40 000 run hours or 100 000 equivalent operating hours whichever comes first. Schedule also depends on results from oil analysis / vibration analysis.

This timetable is applicable to units operating in normal conditions with an average of 4000 hours per year. If operating conditions are abnormally severe, an individual timetable must be made for that unit.

Seasonal start up and shutdown are mainly recommended for comfort air conditioning. Annual and preventive maintenance are mainly recommended for Process applications.

Notes

Trane – by Trane Technologies (NYSE: TT), a global climate innovator – creates comfortable, energy efficient indoor environments through a broad portfolio of heating, ventilating and air conditioning systems and controls, services, parts and supply. For more information, please visit www.trane.eu or www.tranetechnologies.com

TRCG-SVX1001A-EN 06 Mar 2026
Supersedes (New)