ENGINEERING SUBMITTAL DATA

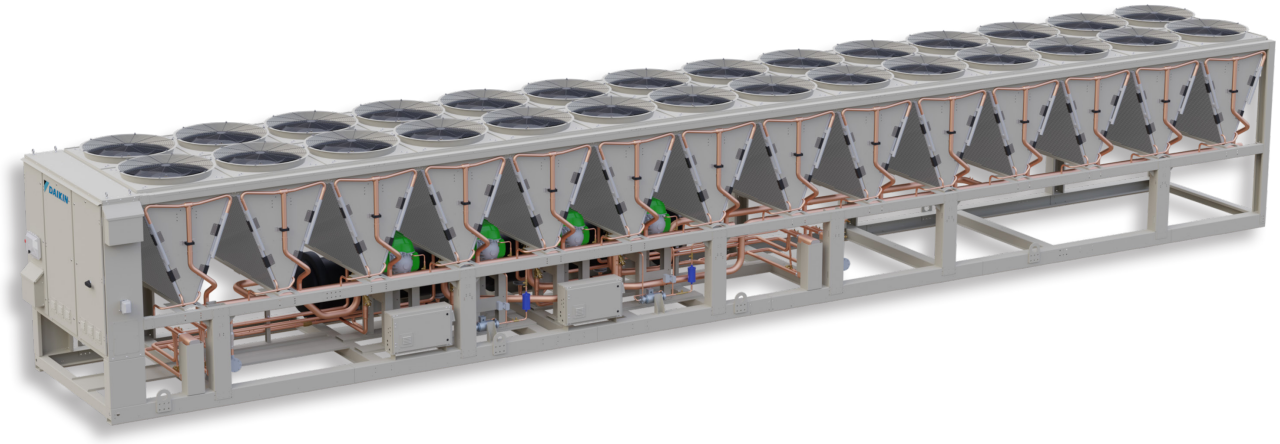
ED 19152

JULY 2026

AWM

AIR-COOLED MAGNETIC BEARING CENTRIFUGAL CHILLERS

Model AWM, A-Vintage
400 to 600 Tons
R-515B or R-1234ze(E) Refrigerant



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Hazard Identification

⚠ DANGER

Danger indicates a hazardous situation, which will result in death or serious injury if not avoided.

⚠ WARNING

Warning indicates a potentially hazardous situation, which can result in property damage, personal injury, or death if not avoided.

⚠ CAUTION

Caution indicates a potentially hazardous situations, which can result in minor injury or equipment damage if not avoided.

NOTICE

Notice indicates practices not related to physical injury.

AHRI CERTIFIED® www.ahridirectory.org
Air-Cooled Water Chilling Packages
AHRI Standards 550/590 and 551/591

**Configurations available outside of AHRI ACCL Certification Program Scope*

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Introduction

General Description

Daikin Applied model AWM chillers are complete, self-contained, automatically controlled, liquid-chilling units featuring variable speed magnetic-bearing Centrifugal compressors. All model AWM chillers are equipped with a single evaporator and microchannel condenser coils along with four compressors.

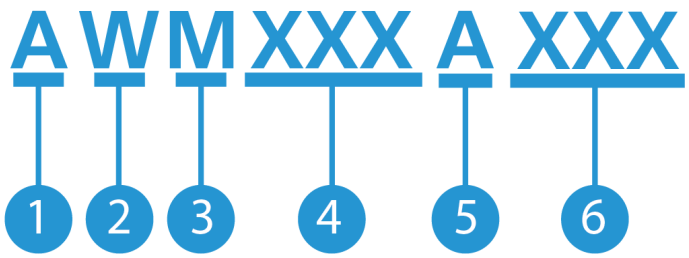
NOTICE

AWM chillers are designed for outdoor installation only. The chillers use refrigerant R-515B or R-1234ze(E) that has no ozone depletion level. The maximum operating altitude for the AWM is 3000m. Consult a Daikin Applied application engineer for derating schedule.

Only normal field connections such as water piping, electric power, and control interlocks are required, thereby simplifying installation and increasing reliability. Necessary equipment protection and operating controls are included.

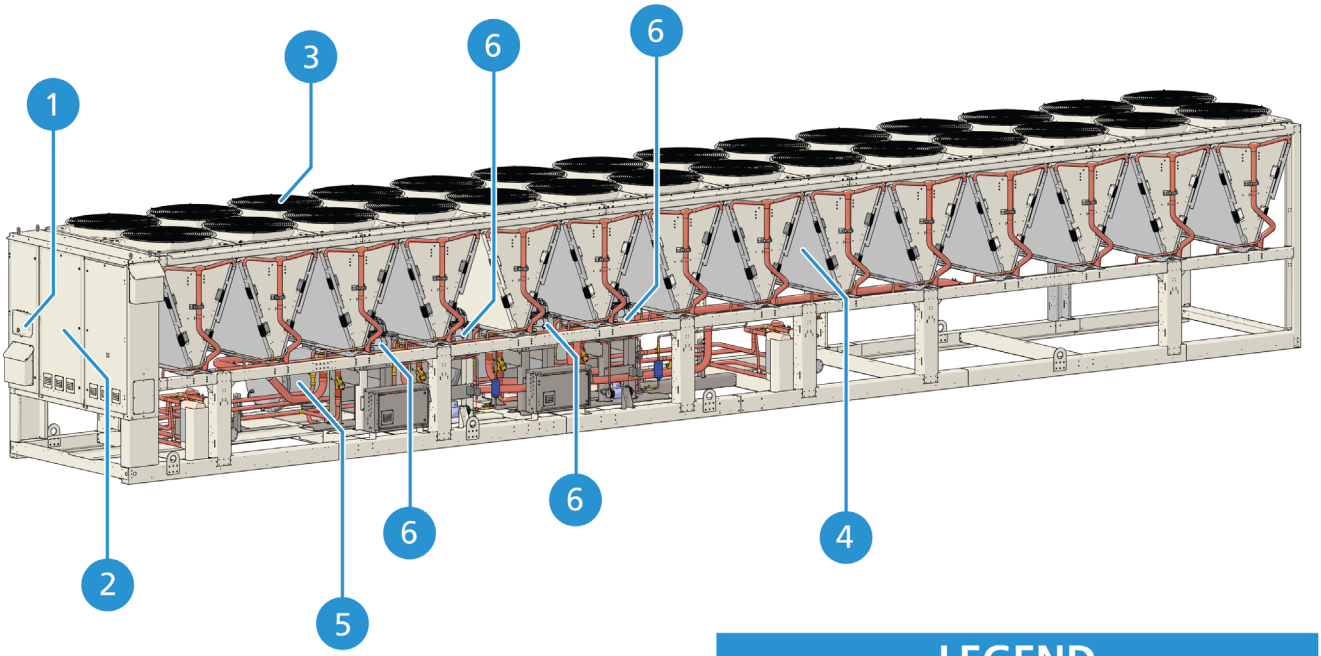
All Daikin Applied oil-free magnetic bearing chillers must be commissioned by a Daikin Applied service technician or an authorized service provider. Failure to follow this startup procedure can affect the equipment warranty. The standard limited warranty on this equipment covers parts that prove defective in material or workmanship. Specific details of this warranty can be found in the warranty statement furnished with the equipment.

Nomenclature



No.	Description
1	A = Aircooled
2	W = World
3	M = Magnetic Bearing Chiller
4	Number of Fans
5	Design Vintage
6	Compressor Code

Figure 1: AWM Component Locations



LEGEND	
1 Unit Controller	4 Condenser Coils
2 Control/Power Box	5 Evaporator
3 Condenser Fan Assembly	6 Compressors

Components and Technology

AWM chillers are designed to meet low-GWP refrigerant requirements and are optimized for use with low-GWP HFC/HFO and ultra-low-GWP HFO refrigerants R-515B and R-1234ze(E). Engineered to support evolving regulations and sustainability goals, AWM enables high-efficiency data center cooling with lower input kW, helping optimize electrical capacity for high-density cooling applications.

Combining premium energy efficiency with a flexible refrigerant platform, AWM helps support compliance with current and future building codes while providing a future-ready solution for sustainable cooling. With industry-leading efficiency, reduced maintenance requirements, and optimized performance, AWM delivers reliable cooling for data center applications up to 600 tons.

Environmentally Friendly

Model AWM chillers are an environmentally friendly air cooled chiller solution, combining high efficiency, low-GWP refrigerant compatibility, and advanced technologies like variable speed drives and ECM Fan Motors. These features reduce energy consumption, lower greenhouse gas emissions, and support sustainable building practices. Optimized for data center applications, AWM delivers reliable performance while helping facilities meet environmental and regulatory goals.

Low GWP Refrigerant

Model AWM chillers are built to meet today's low-GWP refrigerant needs, offering compatibility with R-515B an A1 classified refrigerant, or R-1234ze(E) an A2L classified refrigerant. Engineered to align with evolving regulations and sustainability targets, its adaptable design ensures compliance with current and future refrigerant standards, making it a smart, future-ready choice for environmentally focused operations.

Industry-Leading Efficiency

With a full load EER that exceeds the highest ASHRAE 90.1 Path A Full Load efficiency standard by more than 80%, Model AWM contributes to lower Annualized MLC as outlined and required by ASHRAE 90.4 for efficient data center design. Magnetic bearing compressor technology removes friction and eliminates the need for oil, reducing mechanical losses while improving overall system efficiency and enabling more stable, consistent performance across fluctuating load conditions.
This results in up to 25% greater full load efficiency than comparable compressor technologies.

Designed for Data Centers

Designed to meet the demanding requirements of modern data centers, this air-cooled chiller combines configurable performance, advanced free-cooling capabilities and magnetic bearing compressor technology to deliver reliable, energy-efficient operation.

The integrated closed-loop free-cooling system harnesses cool outdoor air to reduce compressor workload while helping eliminate the need for glycol beyond the unit, minimizing contamination risk and supporting efficient operation in colder climates.

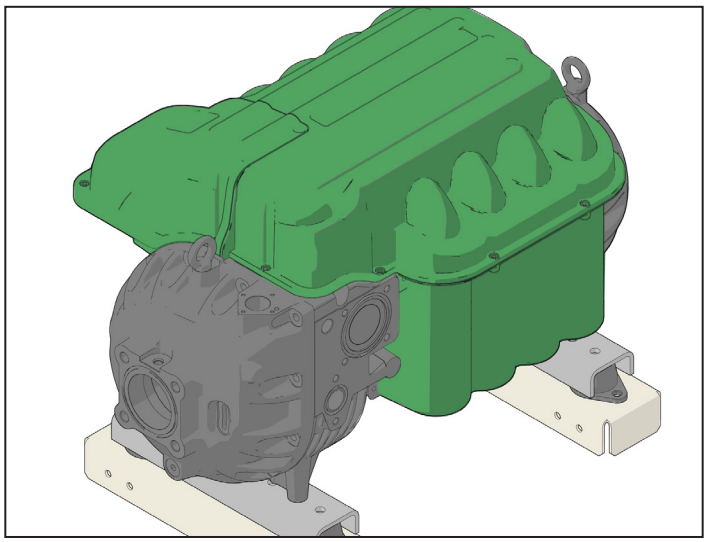
Paired with a friction-free, oil-free magnetic bearing compressor design and flexible system configurability, AWM provides industry-leading efficiency, reduced maintenance requirements and optimized performance for mission-critical cooling applications up to 600 tons.

The Compressor Technology

Experience the next evolution in air-cooled chillers with the new model AWM featuring magnetic bearing compressor technology. This unites Daikin Applied's renowned air-cooled chiller platform with a friction-free, oil-free, magnetic bearing compressor package.

The result is a chiller designed for industry-leading efficiency, low maintenance and superior longterm savings in data center applications.

Figure 2: Magnetic Bearing Compressors



Benefits of Magnetic Bearing Compressors

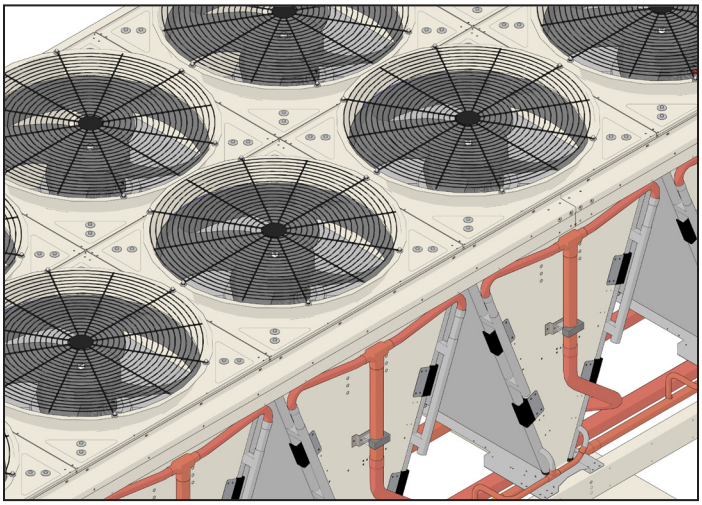
Optimized Energy Use: Friction-free magnetic bearings improve efficiency across varying loads, supporting energy-sensitive environments like data centers.

Consistent Heat Transfer: Oil-free operation eliminates fouling, maintaining peak heat exchanger performance over the life of the system.

Precision Capacity Control: Variable speed operation delivers tight temperature control to support critical cooling demands.

The Condenser Technology

Figure 3: Condenser Fan Assembly



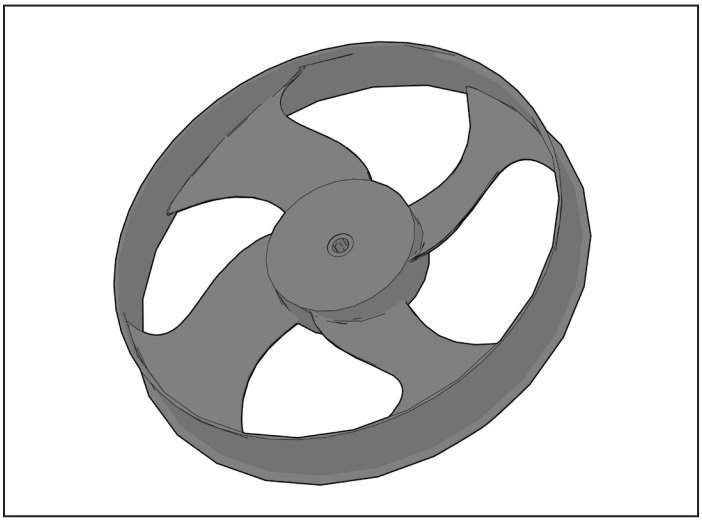
Condenser coils are all 9153 aluminum alloy microchannel design with a series of flat tubes containing multiple, parallel flow microchannels layered between the refrigerant manifold piping. Aluminum alloy 9153 offers higher resistance to corrosion than other alloys such as 3102 alloy.

Compared to traditional copper and aluminum coil designs, microchannel coils have proven to be environmentally friendly by using significantly less refrigerant , more energy efficient, and resistant to galvanic corrosion with all aluminum design.

ECM Fan Motors

Daikin's electronically commutated motors (ECM) are advanced fan motor technologies that combine a permanent magnet (PM) rotor with integrated variable speed control to deliver precise, efficient airflow. Enabling real-time speed adjustments based on system demand.

Figure 4: Enhanced Fab Blade Design



This approach reduces mechanical losses, improves reliability, and minimizes maintenance requirements. Daikin ECM motors operate on 3-phase power and can integrate with building control systems to optimize performance dynamically, delivering up to 15% fan energy savings compared to conventional motor and belt-driven configurations.

In applications such as data centers, where uptime and efficiency are essential, Daikin ECM fan motors provide a distinct advantage. The ability to precisely modulate airflow supports consistent temperature control across fluctuating load conditions, helping protect sensitive equipment and reduce the risk of hot spots.

Improved energy performance contributes to lower operating costs and supports sustainability goals, while the simplicity of a direct drive design enhances reliability and reduces downtime. This makes ECM-equipped air chiller units well-suited for mission-critical environments, while remaining effective across a wide range of commercial and industrial applications.

The Control Technology

The MicroTech chiller unit controller provides an easy to use control environment. The control logic is designed to provide maximum efficiency, to continue operating during extreme, unexpected conditions and to give a history of unit operation.

MicroTech allows the Building Automation System (BAS) flexibility for seamless integration and comprehensive monitoring, control, and two-way data exchange using industry standard protocols such as BACnet® or Modbus®. The open protocol platform benefits include:

- Easy to integrate into your BAS of choice without an expensive gateway panel
- Factory- or field-installed communications module
- Integrated control logic for factory options
- Easy-to-use local user interface
- Comprehensive data exchange

RapidRestore

Following a power loss event, Model AWM has the best solution in the industry with RapidRestore. Using RapidRestore, A quick start-up is ensured, leaving a positive impact on facility uptime.

Integrated Waterside Economizer

Model AWM chillers with an integrated system of waterside economizer coils may be able to satisfy 100% of cooling load without starting a compressor. Through a set of valves, the chiller will automatically control where the fluid from the load is directed to achieve optimal system efficiency.

Figure 7 illustrates mechanical cooling only mode which would be necessary for high ambient temperatures. Cooling from the integrated waterside economizer (IWSE) coils, as shown in Figure 5, is possible when the outdoor air temperature is colder than the fluid temperature requirements.

The unit controller automatically adjusts two 2-way control valves to bring the IWSE coils in or out of the loop. Bypassing the IWSE coils during mechanical operation only mode avoids the additional pressure drop from the economizer coils.

Hybrid cooling mode operation further maximizes the efficiency of the system by rejecting some heat to the IWSE coils before sending the fluid to the evaporator. The mechanical cooling loop will further cool the fluid to the required setpoint but will use much less energy. Figure 5 shows how the two loops work together in hybrid cooling mode.

Waterside Economizer Operating Guidelines

1. Fluid used in IWSE systems must contain glycol. The system glycol percentage must be high enough to avoid burst conditions at the lowest possible ambient temperature of the installed location, regardless of whether the unit is operating or turned off at that minimum temperature. The chiller fluid loop is required to be protected against burst conditions at least 5°F below minimum operating and non-operating ambient temperatures. It is recommended to protect the system against freeze conditions 5°F below minimum operating and non-operating ambient temperatures. Failure to ensure adequate glycol freeze protection may result in damage of the water-side economizer coils and coolant leakage from the system.

Figure 5: Hybrid Cooling Mode Operation

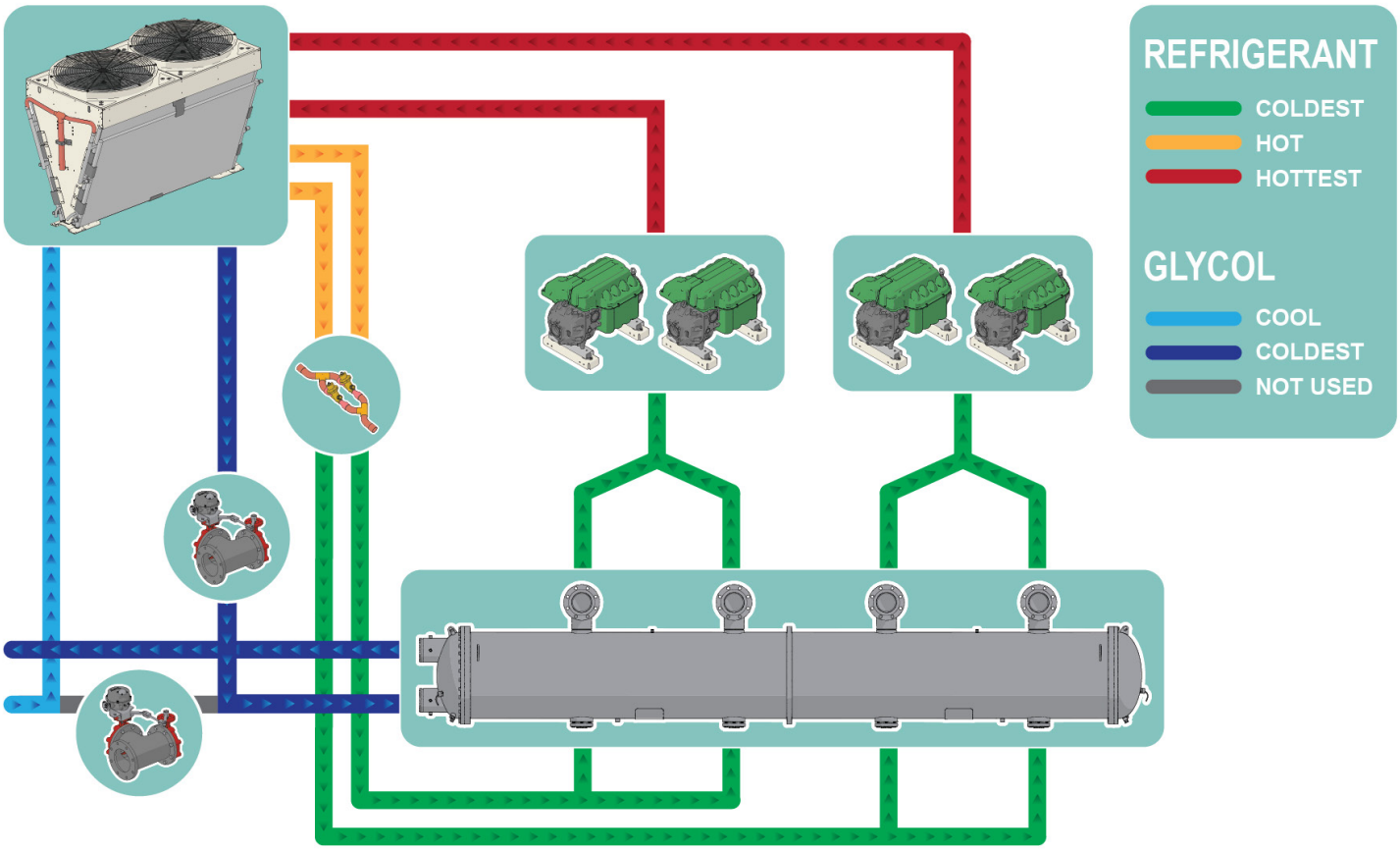
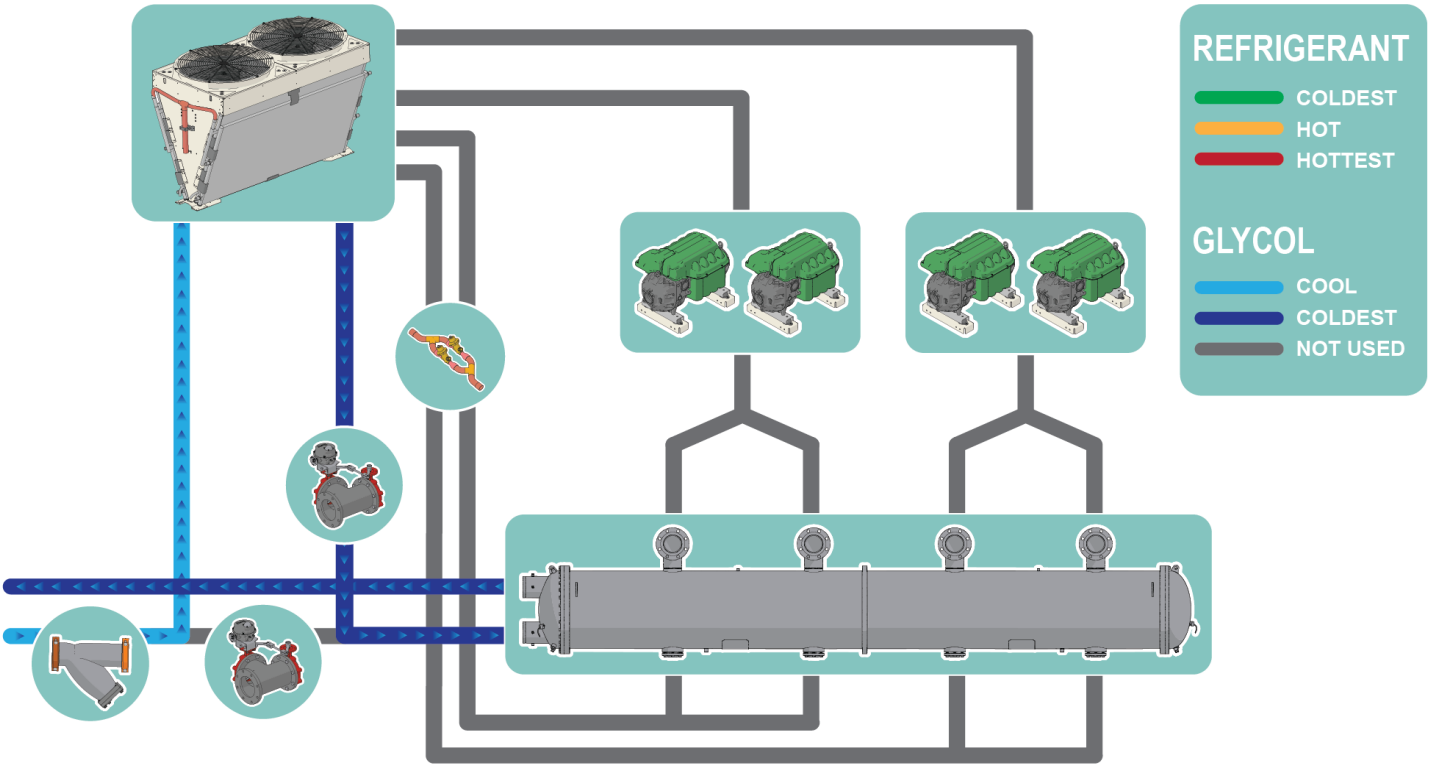


Figure 6: Integrated Waterside Economizer Operation



2. If the chiller is hydraulically isolated, some method of pressure relief must be added to the chiller side fluid loop such as a relief valve or expansion tank. The system must not have quick-acting valves or other sources of surge pressure in the fluid loop.
3. Maximum flow rate limits from submittal documents must be observed to protect the IWSE coils and piping.
4. A strainer for the glycol system must meet the requirements on page 13.
5. Inhibitors for steel, copper, brass, and aluminum must be included for all closed water loop systems. Some glycols include inhibitors and should be considered when commissioning the water system. As water chemistry can vary, Daikin Applied recommends that a water treatment professional determine the appropriate chemical treatment and maintenance plan for the water/glycol loop to ensure the fluid is clean and non-corrosive to the materials present in the system, including but not limited to the steel, copper, and aluminum alloys in contact with the fluid.
   - The glycol system should include a biocide to protect the system against biological growth. The biocide should be non-ionic, non-foaming, and non-oxidizing.
   - The glycol used must be approved for use with aluminum.
   - Water system maximum allowable chlorides content is 25 ppm to prevent corrosion of aluminum IWSE coils.

Closed Loop Economizer

For applications which are suitable for free-cooling but prohibit glycol in the chilled-water loop, the AWM Free-Cooling offers an optional Closed Loop which allows the chilled water to be free of glycol.

Figure 8 highlights how the closed loop design provides a water-side economizer which is independent of the evaporator by providing additional components such as an intermediate heat exchanger, circulating pump, and actuating valves.

The waterside economizer operating guidelines 1 through 5 as stated above are still applicable for the waterside economizer side. However, with the closed loop option the chilled water can be free of glycol.

NOTICE
The unit is shipped without any fluid in the closed loop. Appropriate glycol percentage must be added in the field.

Figure 7: Mechanical Cooling Operation Only

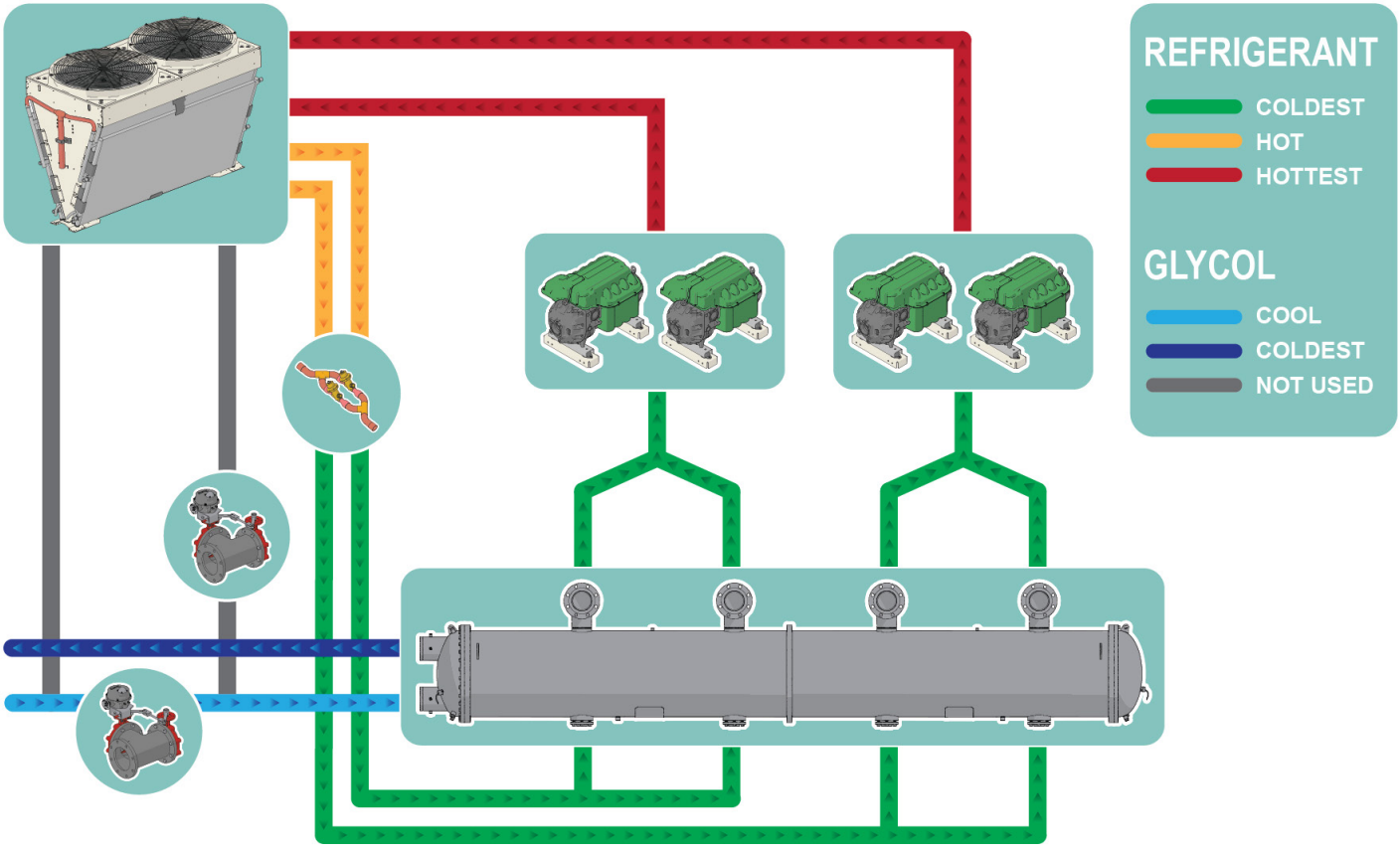
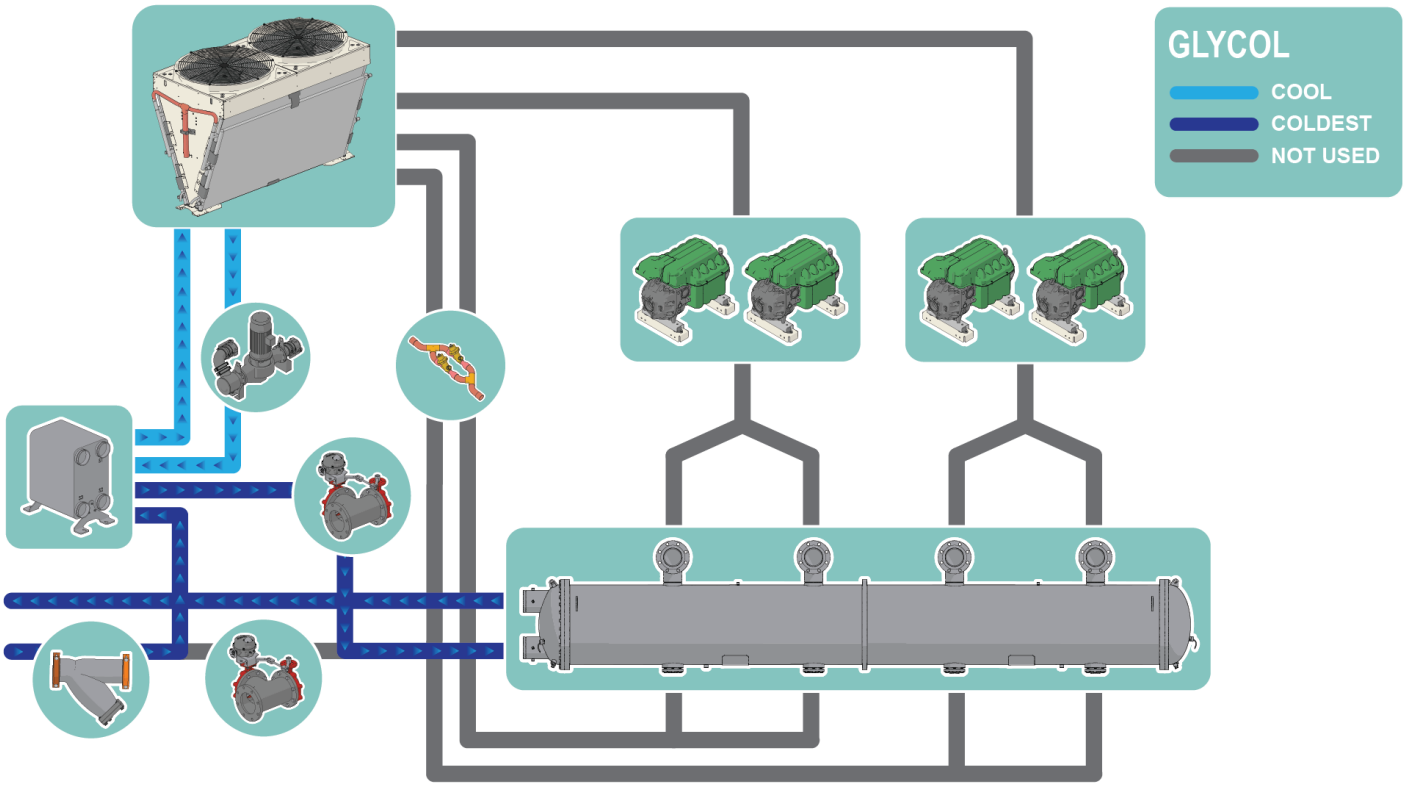


Figure 8: Closed Loop Waterside Economizer



Options and Accessories

Integrated Waterside Economizer

The integrated waterside economizer (IWSE) option adds fluid-to-air heat exchanger coils in series with the airflow of the primary chiller condenser coils in order to reject heat to the outdoor air without the need for vapor compression cooling. This type of cooling is possible when the outdoor air temperature is colder than cooling fluid temperature requirements.

Condenser Fan Configurations

Variable speed drive options can be added on the condenser fan motors in three different configurations. Combined with the MicroTech® controller logic, the speed of the condenser fans is adjusted to optimize chiller efficiency and maintain proper head pressure. This feature improves part load efficiency substantially and offers the ability to start and operate in low ambient conditions. Configuration options are:

- Variable speed ECM/DC permanent magnet fan motors on every condenser fan
- Higher speed ECM/DC fan motor option supports higher airflow through the condenser or higher static pressure applications.

Units with ECM/DC permanent magnet fan motors with fully variable speed fans also include a sound reduction mode to allow for reduced-sound operation. Based on a user-settable time schedule, the chiller will enter the reduced sound mode, which will limit the speed of the condenser fans in order to reduce sound levels.

Low Ambient Operation

Selecting variable speed condenser fan option allows a chiller to start at an ambient down to -10°F (-23.3°C) and operate at an ambient down to -20°F (-28.9°C).

- Units with the additional IWSE option may start and operate as low as -20°F (-28.9°C) in full IWSE mode.
- Combining the higher speed/static pressure ECM/DC fan motors with IWSE configurations further reduce the operating ambient limit to -30°F (-34.4°C) in IWSE mode only. The lower ambient capabilities to -30°F (-34.4°C) require heat trace to be field installed on the control valves.

Baked Epoxy Condenser Fin Coating

Epoxy coated coils have a flexible dip and baked epoxy protective coating with 10,000+ hour salt spray resistance (ASTM B117-90). The coating is available on the microchannel condenser coils. Provides protection against adverse environments such as salt air as found on seacoast applications and many chemical environments. Consult the local Daikin Applied sales office for complete specification and chemical resistance chart.

Protective Coil Guards

Optional factory installed wire mesh upper coil guards provide protection against coil damage from debris.

Protective Base Guards

Optional factory installed wire mesh lower base guards provide protection for ground level installations.

Sound Attenuation

Model AWM with magnetic bearing compressor technology features inherently low sound levels when compared to comparable compressor technologies. Should additional sound attenuation be required, there are factory installed sound reduction options available, such as sound resonator, which is a compressor discharge coupling that slightly reduces sound emission associated with compressor discharge gas.

Suction Shutoff Valves

Factory-mounted suction shutoff valves that, when used in conjunction with the compressor discharge valves, isolate compressors for service.

Liquid Line Solenoid Valve

Factory-mounted liquid line solenoid valve acts in conjunction with the electronic expansion valve for liquid shutoff to the evaporator.

Evaporator Inlet Strainer

Evaporator inlet water strainer kit consisting of Y-type strainer with 304 stainless steel perforated basket, blowdown valve, matching pipe extension with two Schrader fittings and two Victaulic couplings for field installation.

Double Evaporator Insulation

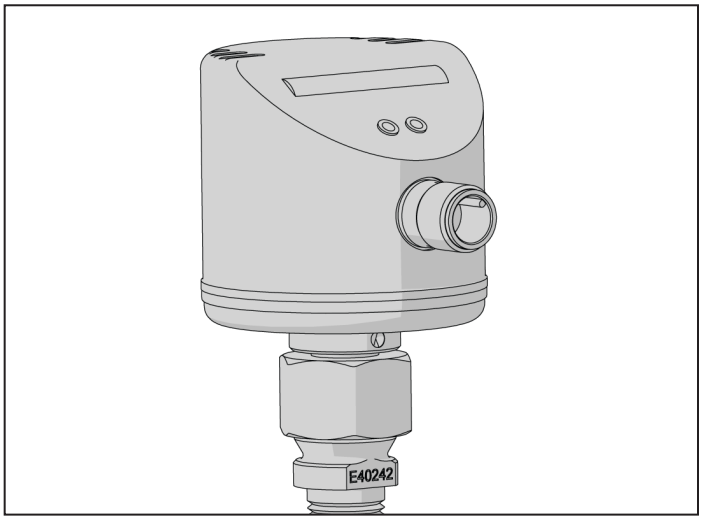
Double evaporator thermal insulation is available and recommended for low ambient applications.

Controls Options

Flow Switch

A flow switch is necessary to avoid evaporator freeze-up under low or no flow conditions. A thermal dispersion flow switch located in the evaporator outlet nozzle is factory installed and wired as standard (packaged models). Terminals are provided in the unit control center for field connection of the water flow switch.

Figure 9: Flow Switch



BAS Communication Modules

A factory-installed communication module allows communications with BAS standard protocols such as BACnet with MSTP, BACnet with Ethernet, or Modbus. The module can also be retrofitted after shipment.

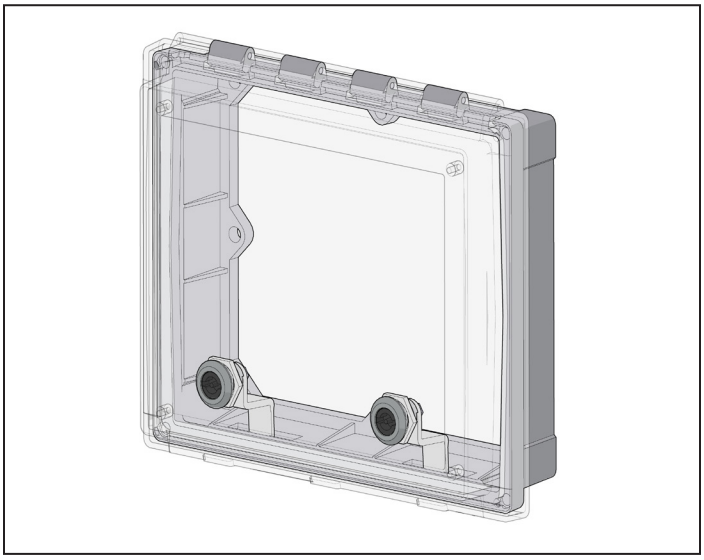
Connected Building Controls

Connected Building Controls from Daikin Applied is a secure, scalable, cloud-based controls solution that can optimize the performance of equipment and building systems. Connected Building Controls provides real-time analytics for energy management, indoor air quality (IAQ) and sustainability. BAS installation is easy with out-of-the box functionality for both new and retrofit applications.

Door Mounted User Display

The control panel display is mounted on the door with a cover for weather protection. Information is easily accessible through the clear cover that can be secured for additional unit security.

Figure 10: Covered Door Mounted Display



Installation Considerations

Operating Limits

Table 1: Operating/Standby Limits

Refrigerant	R-515B or R-1234ze(E)	
Ambient		
Maximum standby temperature	140°F (60°C)	
NOTE: Maximum operating ambient temperature is determined by unit configuration.		
Minimum ambient temperature	**Starting**	**Operating**
Standard ambient control	0°F (-17.8°C)	0°F (-17.8°C)
Low ambient control, ECM fan motors, and low ambient option	-20°F (-28.9°C)	-20°F (-28.9°C)
Low ambient control, higher speed/static ECM/DCM fan motors, and IWSE (full IWSE mode only and requires field provided heat trace on control valves)	-30°F (-34.4°C)	-30°F (-34.4°C)
Water		
Leaving chilled water temperature (water only)	57°F to 86°F (13.9°C to 30°C)	
Leaving chilled fluid temperatures (with glycol)	60°F to 86°F (15.5°C to 30°C)	
Operating chilled water delta-T range	10°F to 30°F (-12.2°C to -1.1°C)	
Maximum evaporator operating inlet fluid temperature	116°F (46.7°C)	
Maximum evaporator non-operating inlet fluid temperature	131°F (55°C)	
NOTE: Contact a Daikin Applied representative for performance at specific operating conditions.		

Unit Placement

For roof-mounted applications, the unit must be installed on a steel channel or I-beam frame to support the unit above the roof. Vibration isolators are recommended for all roof-mounted installations or wherever vibration transmission is a consideration. Isolator loads and kit numbers can be found in the current installation and operation manual at www.DaikinApplied.com.

For ground level applications, the unit must be installed on a substantial base that will not settle.Daikin Applied recommends a one-piece concrete slab with footings extended below the frost line, and the installation engineer should determine its necessity. The foundation must be level within 13 mm (1/2 inch) over its length and width and strong enough to support the unit's operating weight as listed in the as-built submittal drawings. The addition of neoprene waffle pads (supplied by customer) under the frame allows water to drain from inside the frame, which can act as a dam.

On ground level applications, protection against vandalism is recommended; either by the optional factory-installed lower wire mesh guards, or by a field installed screening fence. Note that the fence must allow free flow of air to the condenser coil for proper unit operation. Upper wire mesh coil guards are optional.

Restricted Air Flow

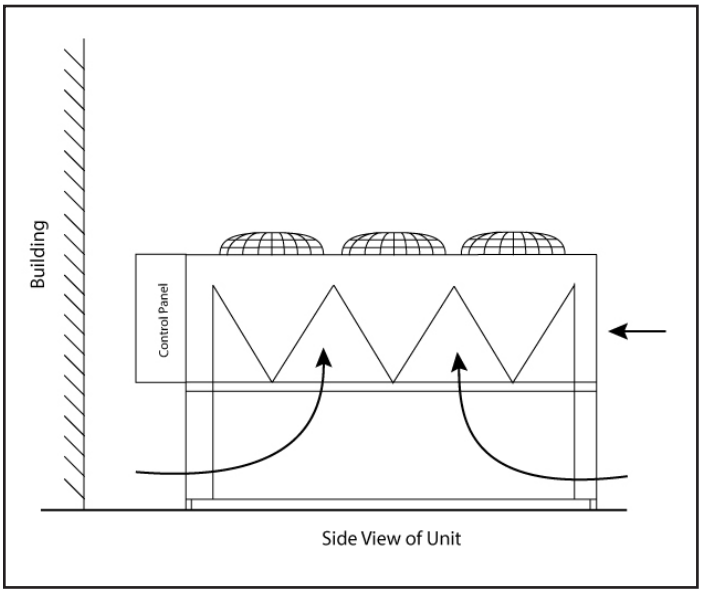
NOTICE

For complex installations, a CFD analysis is strongly recommended. Insufficient clearances will result in a capacity reduction and an increase in power consumption.

The clearances required for design operation of AWM air-cooled chillers are described in Figure 12. Occasionally, these clearances cannot be maintained due to site restrictions such as units being too close together or a fence or wall restricting airflow, or both. AWM chillers have several features that may help mitigate the penalties attributable to restricted airflow.

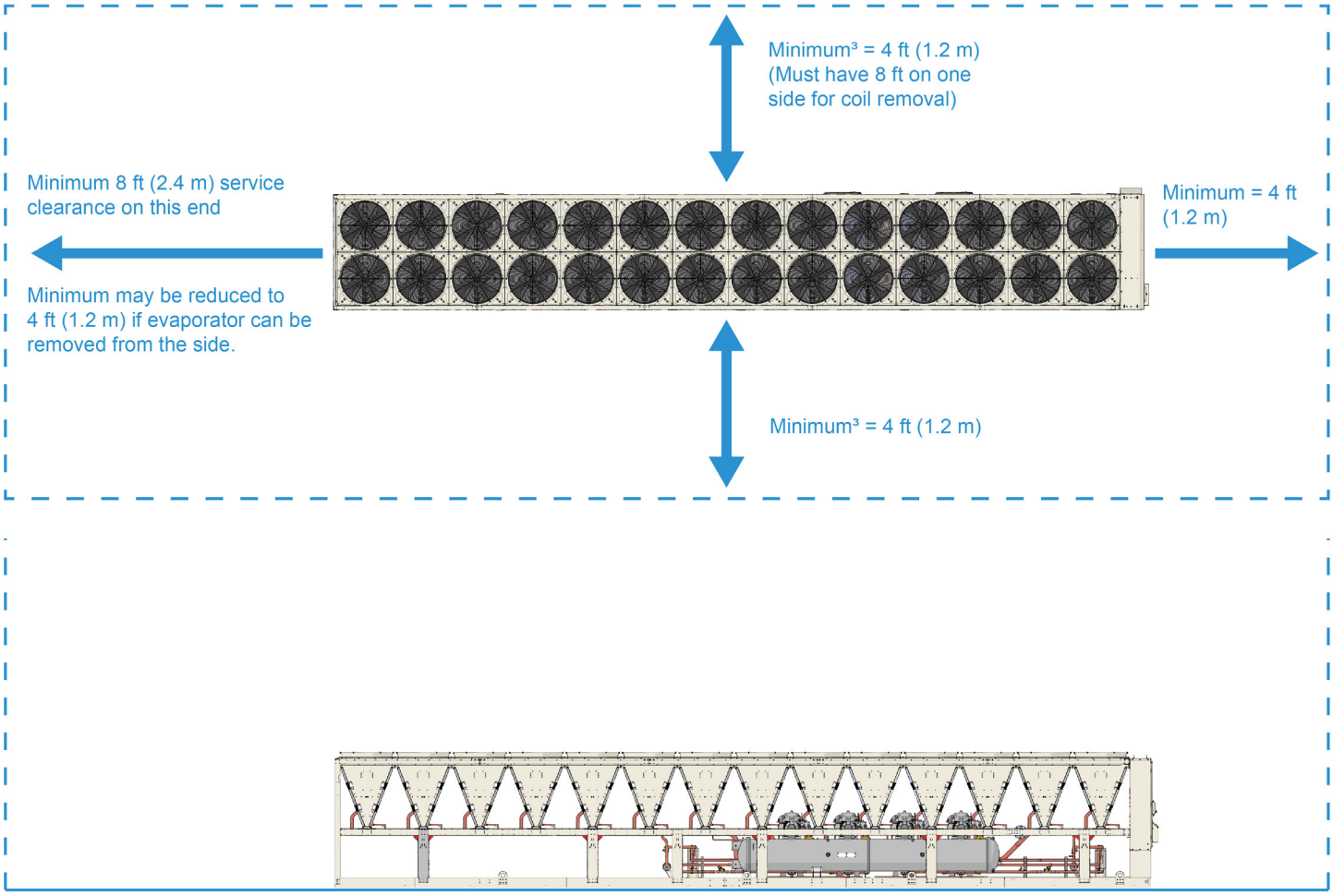
The MicroTech control is proactive in response to "off-design conditions". In the case of single or compounded influences restricting airflow to the unit, the microprocessor will act to keep the unit running (at reduced capacity), rather than allowing a shut-off on high discharge pressure.

Figure 11: Representative Air Flow



Clearance Requirements

Figure 12: Spacing Guidelines



NOTICE

Ensure there is no obstructions within the dashed lines above. Recommended area is applicable for service access ONLY. Performance clearance graphs are provided in submittal documents and may require additional spacing.

Sufficient clearance must be maintained between the unit and adjacent walls or other units to allow the required unit air flow to reach the coils. Failure to do so will result in a capacity reduction and an increase in power consumption. No obstructions are allowed above the unit at any height.

Adhere to the following clearance requirements:

- There should be no obstruction above the fan deck to interfere with fan discharge.
- Electrical conduit and field installed electrical devices should not block service access to any chiller components.
- Integrated Waterside Economizer (IWSE) units need a minimum side clearance of 5 ft (1.5 m) as measured from the outer base rail of the unit.
- Such factors as prevailing winds, additional equipment within the space, design outdoor air temperature, and numerous other factors may require more clearance than what is shown.
- Evaporator water piping should not block access to any chiller components should service or a compressor need to be removed.
- Ensure all local and national building code requirements are met.

Chilled Water Systems

Water Piping

Start-up procedures should confirm that the chilled water piping system had been properly flushed out before being connected to the chiller vessel. Be sure water inlet and outlet connections match certified drawings and nozzle markings. All evaporators have OGS-type grooved water connections (adhering to Standard AWWA C606) or optional flange connections. PVC piping should not be used.

⚠ CAUTION

To prevent damage to the evaporator and potential chiller failure, a supply strainer is required in the inlet water piping which connects to this evaporator. This strainer must be installed prior to operation of the chilled liquid pumps.

Field installed water piping to the chiller **must** include:

- A cleanable strainer installed at the water inlet to the evaporator to remove debris and impurities before they reach the evaporator, causing damage. See the Inlet Strainer Guidelines on page 13 and the current version of the product installation, operation and maintenance manual on www.DaikinApplied.com for additional details.
- A water flow switch must be installed in the horizontal piping of the supply (evaporator outlet) water line to avoid evaporator freeze-up under low or no flow conditions. A flow switch proves that there is adequate water flow to the evaporator before the unit can start or to shut down the unit if water flow is interrupted.
- Purge air from the water system before unit start-up to provide adequate flow through the evaporator with an air vent located at the piping system high point. An air vent is also located at the top of each water head of the evaporator. Each evaporator water head is also provided with a drain connection.
- Adequate piping support, independent from the unit, to eliminate weight and strain on the fittings and connections.

It is **recommended** that the field installed water piping to the chiller include:

- Thermometers at the inlet and outlet connections of the evaporator.
- Water pressure gauge connection taps and gauges at the inlet and outlet connections of the evaporator for measuring water pressure drop.
- An expansion tank or regulating valve to maintain adequate water pressure.
- Vibration eliminators in both the supply and return water lines to reduce transmissions to the building.
- Regular water analysis and chemical water treatment for the evaporator loop is recommended immediately at equipment start-up.

Inlet Strainer Guidelines

An inlet water strainer kit must be installed in the chilled water piping before the evaporator inlet. Two paths are available to meet this requirement:

1. A field-installed kit shipped loose with the unit is available for all unit sizes and consists of:

- Y-type area strainer with 304 stainless steel perforated basket, grooved pipe connections and strainer cap
  - — a strainer with perforations no larger than 0.033” (0.84 mm) diameter for AWM models with the open loop IWSE option along with a gasket and bolts.
  - — a strainer with perforations no larger than 0.063” (1.6 mm) diameter for AWM models with the closed loop IWSE option along with a gasket and bolts.
  - — a strainer with perforations no larger than 0.125” (1/8”, 3.2 mm) diameter for AWM models with a flooded evaporator
- Extension pipe with two couplings that may be used for gauges and sensors. The pipe provides sufficient clearance from the evaporator for strainer basket removal (non-IWSE configurations)
- ½-inch blowdown valve (non-IWSE configurations)
- Two grooved clamps (non-IWSE configurations)

Connection sizes are listed on installation specific drawings available from a Daikin Applied sales representative.

2. A field-supplied strainer that meets specification and installation requirements of the current product.

Water Volume

All chilled water systems need adequate time to recognize a load change to avoid short cycling of the compressors or loss of control. The potential for short cycling usually exists when the building load falls below the minimum chiller plant capacity or on close-coupled systems with very small water volumes.

Design considerations for water volume are the minimum cooling load, the minimum chiller plant capacity during the low load period and the desired cycle time for the compressors.

Assuming that there are no sudden load changes and that the chiller plant has reasonable turndown, a rule of thumb of “gallons of water volume equal to two to three times the chilled water gpm flow rate” is often used.

A properly designed storage tank should be added if the system components do not provide sufficient water volume.

Variable Flow Rates

Many chiller system control and energy optimization strategies require significant changes in evaporator water flow rates. The AWM chiller line is well suited to take full advantage of these energy saving opportunities using different combinations of shell sizes, number of tubes, and baffle arrangements.

Both excessively high and excessively low fluid flow rates should

be avoided. Excessively high fluid flow rates will result in high fluid pressure drops, high pumping power, and potentially tube erosion or damage. Excessively low fluid flow rates should also be avoided as they will result in poor heat transfer, high compressor power, and sedimentation.

Reducing Evaporator Fluid Flow

Several chiller plant control practices — including variable primary flow systems — advocate reducing the evaporator fluid flow rate as the chiller capacity is reduced. This practice can significantly reduce the evaporator pumping power while having little effect on chiller energy consumption. The AWM chillers are ideal for application in variable evaporator flow systems as long as the published flow limits are taken into consideration when selecting the chiller. If it is decided to vary the evaporator water flow rate, the rate of change should not exceed the minimum or maximum velocity limits. Additionally, the rate of change should not exceed 10% of the design flow per minute. For example, if the maximum design flow is 200 gpm and it will be reduced to a flow of 140 gpm, the change in flow is 60 gpm. Ten percent of 200 gpm equals 20 gpm change per minute, or a minimum of three minutes to go from maximum to desired flow.

Chilled Water Pump

It is important that the chilled water pumps be wired to, and controlled by, the chiller controller. The controller has the capability to selectively send the signal to a pump relay (by others) to start pump A or B or automatically alternate pump selection and also has standby operation capability. The controller will energize the pump whenever at least one circuit on the chiller is enabled to run, whether there is a call for cooling or not. This helps ensure proper unit start-up sequence. The pump will also be turned on when the water temperature goes below the Freeze Setpoint for longer than a specified time to help prevent evaporator freeze-up.

⚠ CAUTION

Adding glycol or draining the system is the recommended method of freeze protection. If the chiller does not have the ability to control the pumps and the water system is not drained in temperatures below freezing, catastrophic evaporator failure may occur.

Failure to allow pump control by the chiller may cause the following problems:

1. If any device other than the chiller attempts to start the chiller without first starting the pump, the chiller will lock out on the No Flow alarm and require manual reset.
2. If the evaporator water temperature drops below the “Freeze setpoint” the chiller will attempt to start the water pumps to avoid evaporator freeze. If the chiller does not have the ability to start the pumps, the chiller will alarm due to lack of water flow.
3. If the chiller does not have the ability to control the pumps and the water system is not to be drained in temperatures below freezing, the chiller may be subject to catastrophic evaporator failure due to freezing. The freeze rating of the evaporator is based on the immersion heater and pump operation. The immersion heater itself may not be able to properly protect the evaporator from freezing without circulation of water.

Evaporator Freeze Protection

Evaporator freeze-up can be a concern in the application of air-cooled water chillers in areas experiencing below freezing temperatures. To protect against freeze-up, insulation and an electric heater are furnished with the evaporator. This helps protect the evaporator down to -20°F (-29°C) ambient air temperature. Although the evaporator is equipped with freeze protection, it does not protect water piping external to the unit or the evaporator itself if there is a power failure or heater burnout, or if the chiller is unable to control the chilled water pumps. Use one of the following recommendations for additional protection:

- If the unit will not be operated during the winter, drain evaporator and chilled water piping and flush with glycol. Drain and vent connections are provided on the evaporator for this purpose.
- Add a year-round glycol solution to the chilled water system to provide freeze protection. Freeze point should be approximately 10°F(5.6°C) below minimum design ambient temperature or 10°F below the lowest design leaving water temperature, whichever is lower. The use of glycol anti-freeze is generally considered the safest protection against freeze-up, however, it will reduce the performance of the unit, depending the concentration. Take this into consideration during initial system design and selection. On glycol applications, a minimum fluid concentration should be based on Burst Protection limits.
- The field addition of thermostatically controlled heat tracing and insulation to exposed piping. (Dependent on power availability)
- Continuous circulation of water through the chilled water piping and evaporator. (Dependent on power availability).
- The evaporator immersion heater is factory wired to the 115-volt circuit in the control box. This power can be supplied from a separate source, or it can be supplied from the control circuit. Operation of the heater cable is automatic through the fluid sensing thermostat that energizes the evaporator heater cable for protection against freeze-up. Unless the evaporator is drained in the winter, the disconnect switch to the evaporator heater must be closed. Conversely, do not apply heat to the evaporator if it is drained.

Electrical Connections

All field wiring must comply with applicable local and national electrical codes. Power connections to the chiller must be made using copper conductors. The conductor size and quantity must be compatible with the power connection lug sizes specified in the unit submittal. AWM units are provided with a standard single-point power connection.

Wiring within the unit is sized in accordance with the U.S.A. National Electrical Code. Field-supplied disconnect switches are required if not factory-supplied with the unit. Disconnecting means are addressed by Article 440 of the U.S.A. National Electrical Code (NEC), which requires “disconnecting means capable of disconnecting air conditioning and refrigerating equipment including motor-compressors, and controllers from the circuit feeder.”

Terminals are provided in a unit control panel for optional field hookup of the control circuit to a separate fused 115-volt power supply in lieu of the standard factory installed control transformer.

Control panels are rated for the amount of current that can be passed through during a short circuit event and still contain any damage within the enclosure; this value is known as the short circuit current rating as shown in Table 2. This option may be required to meet electrical code. Consult with a licensed electrical engineer to determine if the short circuit current rating supplied is adequate for the installed electrical system.

Table 2: Short Circuit Current Ratings (kAmps)

Voltage/Hz	High Short Circuit Panel Rating
460/60	65kA

Electrical Options

RapidRestore® and Fast Loading

Data center and other critical installations often require a fast return to 100% cooling load after a power interruption. RapidRestore® provides a 35 -second restart capability and fast compressor loading. More information is available at www.DaikinApplied.com.

Power Connections

The standard power connection is single-point to a factory-mounted, molded case, disconnect switch. Each circuit is factory-wired from the disconnect switch to an isolating circuit breaker for each compressor circuit. See page 15 for ratings of standard and optional electrical panels.

Single-Point Power with HSCCR Panel

High short-circuit current rated panel includes high interrupting capacity unit disconnect switch and factory-wiring to standard isolating circuit breakers for each circuit. The high short circuit rated panel means that a short circuit current up to the ratings shown on page 15 will be contained within the panel enclosure.

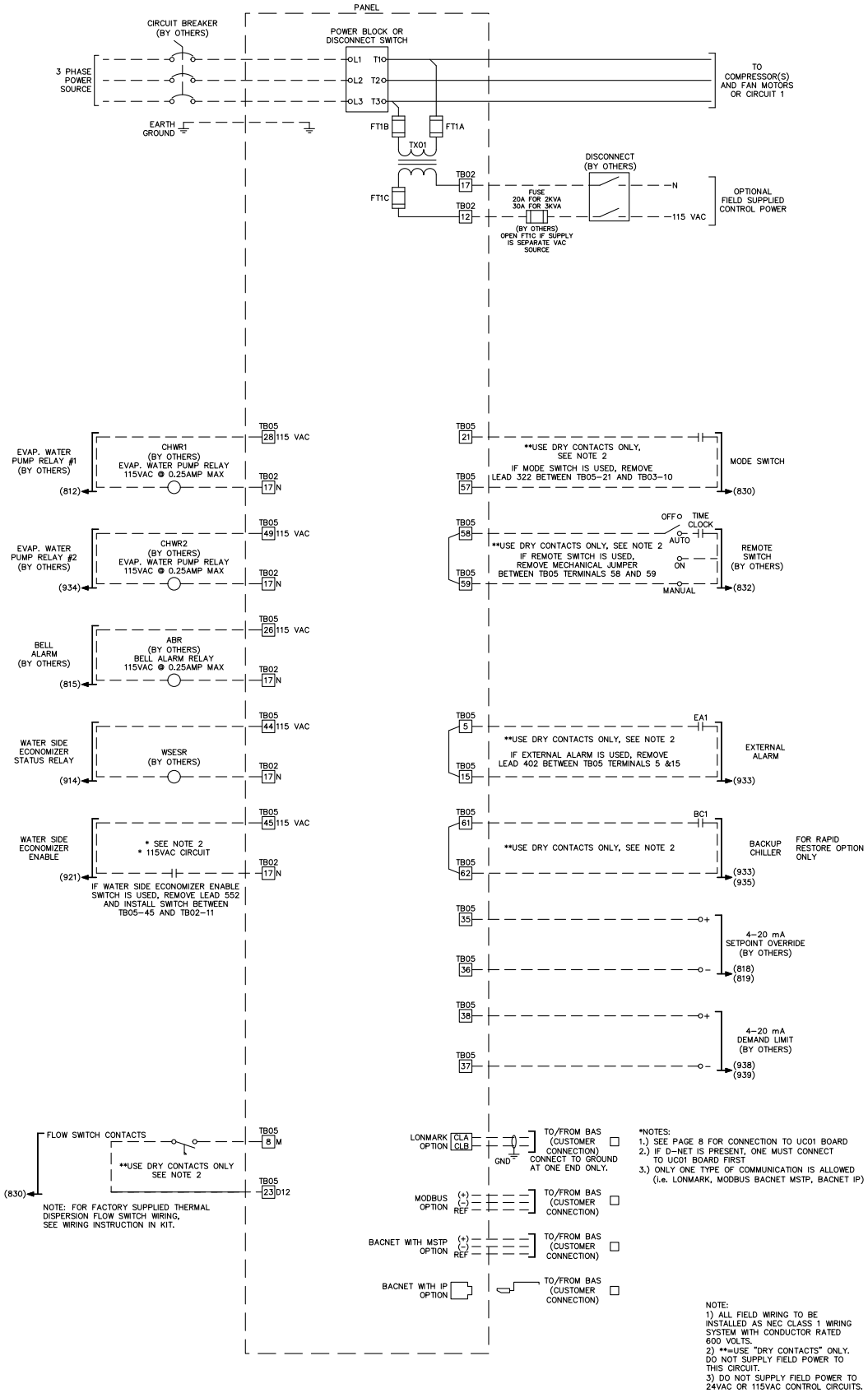
Ground Fault Protection

Provides ground fault protection for the entire unit.

115V Convenience Outlet

Outlet mounted in unit electrical panel.

Figure 13: Field Wiring Diagram



Engineering Specifications

AIR-COOLED MAGNETIC BEARING CHILLERS

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes design, performance criteria, refrigerants, controls, and installation requirements for air-cooled oil-free magnetic bearing packaged chillers.

1.02 REFERENCES

A. Comply with applicable Standards/Codes of AHRI 550/590, ANSI/ASHRAE 15, ASHRAE 90.1 current version requirements, and ASME Section VIIII.

1.03 SUBMITTALS

A. Submit shop drawings and product data in accordance with specification requirements.

B. Submittals shall include the following:

1. Dimensioned plan and elevation view drawings, required clearances, and location of all field connections.
2. Single line schematic drawing of the field power hookup requirements, indicating all items that are furnished.
3. If field refrigerant piping is required, furnish a single line piping drawing.
4. Schematic diagram of control system indicating points for field connection and fully delineate field and factory wiring.
5. Installation manuals.

1.04 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with the codes and standards specified.

B. Factory Tested: Packaged chiller shall be pressure tested, evacuated, and fully charged with refrigerant and oil, and be functionally tested at the factory.

C. Chiller must be manufactured in an ISO certified facility.

D. Factory trained and authorized service personnel shall perform pre-startup checks and startup procedures.

1.05 DELIVERY AND HANDLING

A. Chillers shall be delivered to the job site completely assembled and charged with refrigerant and oil by the manufacturer.

[OPTIONAL] Remote Evaporator: The outdoor condensing unit shall be delivered to the job site completely assembled and charged with refrigerant and oil by the manufacturer. The evaporator shall have a nitrogen holding charge and be shipped loose for field mounting, piping and charging.

B. Comply with the manufacturer's instructions for rigging and handling.

C. If unit is to be stored, comply with Manufacturer's instructions for storage.

1.06 WARRANTY

A. The chiller manufacturer's warranty shall cover parts and labor costs for the repair or replacement of defects in material or workmanship for a period of one year from equipment startup or 18 months from shipment, whichever occurs first.

[OPTION] include an additional extended warranty for one -OR- two- OR three -OR- four years on the entire unit -OR- on entire unit including refrigerant coverage -OR- compressor only. Warranty support shall be provided by company direct or factory authorized service permanently located near the jobsite.

B. Extended Compressor Warranty: None.

C. Extended Unit Warranty: none.

D. Refrigerant Warranty: None.

E. Delayed Warranty Start: None. (Startup within 6 months of shipment)

1.07 SUSTAINED OPERATIONAL PERFORMANCE AND RELIABILITY

A. Maintenance of the chillers shall be the responsibility of the owner and performed in accordance with the manufacturer's instructions.

PART 2: PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Basis of Design - Daikin Model AWM, including the standard product features and all special features required per the plans and specifications.

B. Equal Products - Equipment manufactured by [ENTER MANUFACTURER NAME HERE] may be acceptable as an equal. Equipment proposed "as equal", must meet the specifications including all architectural, mechanical, electrical, and structural details, all scheduled performance and the job design, plans and specifications.

2.02 UNIT DESCRIPTION

A. Provide and install as shown on the plans, factory assembled, factory charged with R-515B or R-1234ze(E), air-cooled, oil-free magnetic bearing compressor packaged chiller(s) in the quantity and size specified. Each chiller shall be furnished with oil-free magnetic compressors, flooded evaporator, air-cooled condenser section, control system and all components necessary for protected and controlled unit operation.

2.03 DESIGN REQUIREMENTS

A. General: Provide a complete air-cooled oil-free magnetic bearing compressor packaged chiller as specified and as shown on the drawings. The unit shall be in accordance with the standards referenced in section 1.02.

B. Performance: Refer to the schedule of performance on the drawings. The chiller shall be capable of stable operation to a minimum of 25 percent of full load without hot gas bypass. The unit shall have factory mounted, low ambient head pressure control providing low ambient start capability to -10°F (-23.3°C) and operation to -20°F (-28.9°C) ambient temperatures.

C. Manufacturer must provide both sound power and sound pressure data in decibels. Sound pressure data per AHRI 370 must be provided in 8 octave band format at full load. In addition, A-weighted sound pressure at 30 feet should be provided at 100%, 75%, 50% and 25% load points to identify the full operational noise envelope. Sound power must be provided in 1/8 octave band format to highlight any tonal quality issues. If manufacturer cannot meet the noise levels (per the attached chart), sound attenuation devices and/or barrier walls must be installed to meet this performance level.

Sound Pressure (at 30 feet)												
63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz	Overall dBA	75% Load dBA	50% Load dBA	25% Load dBA
Sound Power											
63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz	Overall dBA	75% Load dBA	50% Load dBA	25% Load dBA

One-third Octave Band Sound Power																				
50 Hz	63 Hz	80 Hz	100 HZ	125 Hz	160 Hz	200 Hz	250 Hz	315 Hz	400 Hz	500 Hz	630 Hz	800 Hz	1000 Hz	1250 Hz	1600 Hz	2000 Hz	2500 Hz	3150 Hz	4000 Hz	5000 Hz	6300 Hz	8000 Hz	10 KHz

2.04 CHILLER COMPONENTS

A. Compressors:

1. The unit shall utilize magnetic bearing, oil-free, semi-hermetic centrifugal compressors. The compressor drive train shall be capable of coming to a controlled, safe stop in the event of a power failure.
2. The motor shall be of the semi-hermetic type, of sufficient size to efficiently fulfill compressor horsepower requirements. It shall be liquid refrigerant cooled with internal thermal sensing devices in the stator windings. The motor shall be designed for variable frequency drive operation.
3. 3. If the compressor design requires a shaft seal to contain the refrigerant, the manufacturer shall supply a 20 year parts and labor warranty on the shaft seal and a lifetime refrigerant replacement warranty if a seal failure leads to refrigerant loss, or the chiller manufacturer shall assume all costs to supply and install a self-contained air conditioning system in the mechanical space sized to handle the maximum heat output of the open drive motor. The energy required to operate this air conditioning system shall be added to the chiller power at all rating points for energy evaluation purposes.
4. 4. If the compressor/motor uses any form of anti-friction bearing (roller, ball, etc), the chiller manufacturer shall provide the following at no additional charge:

   a. A 20-year bearing warranty and all preventative maintenance as specified by the manufacturer's published maintenance instructions.

   b. At start up, a three-axis vibration analysis and written report to establish bearing condition baseline.

   c. An annual three-axis vibration analysis and written report indicating bearing condition.
5. The chiller shall be equipped with an air-cooled or integrated refrigerant-cooled Variable Frequency Drive (VFD) to automatically regulate compressor speed in response to cooling load and the compressor pressure lift requirement. If a condenser water-cooled VFD is supplied, the manufacturer shall supply factory installed dual water filters with a bypass valve and pressure differential switch, factory wired to the chiller control panel to indicate that a filter has clogged and requires service. The pressure differential switch shall also provide a separate dry contact which can be connected to the BAS system as a means of notifying operating personnel of the need to service the filters. If the condenser cooling circuit includes an intermediate heat exchanger, it must be of the brush cleanable shell and tube style. Brazed plate heat exchangers which cannot be field cleaned are not acceptable. Movable inlet guide vanes and variable compressor speed, shall provide unloading. The chiller controls shall coordinate compressor speed and guide vane position to optimize chiller efficiency.
6. 6. Each compressor circuit shall be equipped with a 5% line reactor to help protect against incoming power surges and help reduce harmonic distortion.

B. Evaporator: The evaporator shall be of the flooded type with two-passes on the refrigerant and water side for high efficiency counterflow heat transfer and low pressure drops, carbon steel shell, and high efficiency finned copper tubes rolled into steel tube sheets. The evaporator shall be designed, inspected, and stamped in accordance with ASME Section VIIII requirements.

1. The evaporator shall be protected with an electric

resistance immersion heater. The evaporator shall be insulated with 3/4" thick CFC and HCFC-free closed-cell flexible elastomeric foam insulation material with 100% adhesive coverage. The insulation shall have an additional outer protective layer of 3mm thick PE embossed film to provide superior damage resistance. Insulation without the protective outer film shall not be acceptable. UV resistance level shall meet or exceed a rating of 'Good' in accordance with the UNI ISO 4892 - 2/94 testing method. This combination of an immersion heater and insulation shall provide freeze protection down to -20°F (-29°C) ambient air temperature.

2. 2. Flow Switch: The evaporator shall be equipped with a factory-mounted and wired flow switch.
3. 3. Evaporator shall have standard universal grooved connections.

C. Condenser: Coil shall be microchannel design and shall have a series of flat tubes containing multiple, parallel flow microchannels layered between the refrigerant manifolds. Tubes shall be 9153 aluminum alloy. Tubes made of 3102 alloy or other alloys of lower corrosion resistance shall not be accepted. Coils shall consist of a two-pass arrangement. Each condenser coil shall be factory leak tested with high-pressure air under water. Condenser coils shall include baked epoxy coating providing 10,000+ hour salt spray resistance (ASTM B117-90) applied to both the coil and the coil frames.

1. Condenser fans shall be propeller type arranged for vertical air discharge and individually driven by direct drive fan motors. Fan motors shall be weather protected, three-phase, direct-drive, TEAO, totally enclosed air-over motors with class F insulation or better. Each fan motor shall be equipped with ECM control providing fan speed control as a function of the condenser pressure. ODP motors are not acceptable. Each fan section shall be partitioned to avoid cross circulation. The fans shall be equipped with a heavy-gauge vinyl-coated fan guard. Condenser fans must be constructed of a single piece, molded composite material to provide low noise levels and protection against corrosion.

D. Refrigerant Circuit: The unit must have two refrigerant circuits completely independent of each other with two compressors per circuit. Each circuit shall include an electronic expansion valve, liquid line shut-off valve, replaceable core filter-drier, sight glass with moisture indicator, and combination discharge check and shutoff valve.

1. Unit shall be equipped with suction shut-off valve.
2. Unit formed sheet metal components shall be painted using a corrosion resistant paint system, for aesthetics and long-term durability. Paint system will include a base primer with a high-quality polyester resin topcoat. Painted galvanized parts shall be G60 or greater and finished, unabraded panel surfaces shall be capable of being exposed to an ASTM B117 salt spray environment and exhibit no visible red rust at a minimum of 3,000 hours exposure. Finished, abraded surfaces shall be tested per ASTM D1654, having a mean scribe creepage not exceeding 1/16" at 1,000 hours minimum exposure to an ASTM B117 salt spray environment.

E. Electrical Panel:

1. Control Panel: Single-point power connection to high short-circuit current rated panel including a high interrupting capacity disconnect switch with through-the-door handle and circuit breakers for each circuit. A UL-approved weatherproof electrical panel shall contain the unit control system, control interlock terminals and field-power connection points. Box shall be designed in accordance with NEMA 3R rating. Hinged control panel access doors shall be tool-lockable. Barrier panels shall be provided to protect against accidental contact with line voltage when accessing the control system. Fan motors shall have inherent overload protection and compressor motors shall have three-phase motor overload protection. Factory-supplied power components shall include:

   a. Individual contactors and circuit breakers for fan motors,

   b. Circuit breakers and factory-mounted transformers for each control-circuit,

   c. Unit power terminal blocks for connection to remote disconnect switch,

   d. Terminals for power supply to the evaporator heater circuit.

   e. Fan motors shall have inherent overload protection and compressor motors shall have three-phase motor overload protection.

2. The control logic shall be designed to maximize operating efficiency and equipment life with protections for operation under unusual conditions and to provide a history of operating conditions. The system shall intelligently stage the unit to sustain leaving water temperature precision and stability while minimizing compressor cycling.
3. 3. Equipment protection functions controlled by the microprocessor shall include high discharge pressure, loss of refrigerant, loss of water flow, freeze protection, and low refrigerant pressure. User controls shall include:

   a. auto/stop switch,

   b. chilled water set-point adjustment,

   c. anti-recycle timer,

   d. digital display with water temperature and setpoint,

   e. operating temperatures and pressures, and diagnostic messages.

4. The following features and functions shall be included:

   a. Durable liquid crystal display (LCD) screen type, having minimum four 20-character lines with 6 key input pad conveniently mounted on the unit

controller. Default language and units of measure shall be English and I-P respectively. Messages shall be in plain English. Coded messages, LED indicators and LED displays are not acceptable.

b. Separate control section and password protection for critical parameters.

c. Remote reset of chilled water temperature using a 4-20mA signal.

d. Soft-load operation, protecting the compressor by preventing full-load operation during the initial chilled fluid pull-down period.

e. BAS communication flexibility through modular plug-in Modbus®

f. Non-volatile program memory allowing auto-restart after a power failure.

g. Recording of safety shutdowns, including date-and-time stamp, system temperatures and pressures. A minimum of six previous occurrences shall be maintained in a revolving memory.

h. Start-to-start and stop-to-start cycle timers, providing minimum compressor off time while maximizing motor protection.

i. Lead-lag compressor staging for part-load operation by manual selection or automatically by circuit run hours.

j. Discharge pressure control through intelligent cycling of condenser fans to maximize efficiency.

k. Pro-active compressor unloading when selected operating parameters exceed design settings, such as high discharge pressure or low evaporator pressure.

l. Diagnostic monitoring of unit operation, providing a pre-alarm signal in advance of a potential shutdown, allowing time for corrective action.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install in strict accordance with manufacturer's requirements, shop drawings, and contract documents.

B. Measures must be taken to avoid accumulation of debris in the evaporator during initial system flushing. A strainer with perforations no larger than 0.125" (3.2 mm) diameter must be placed in the supply water line just prior to the inlet of the evaporator. Care shall be exercised when welding pipe or flanges to the evaporator to prevent any slag from entering the vessel. Any welds after the strainer must be mechanically cleaned to avoid slag entering the evaporator.

C. Adjust and level chiller in alignment on supports.

D. Coordinate electrical installation with electrical contractor.

E. Coordinate controls with control contractor.

F. Provide all required accessories or accompanying parts to insure a fully operational and functional chiller.

3.02 STARTUP

A. Provide Factory Authorized starting of chillers, and instruction to the owner on operation and maintenance.

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