THERMAL CARE
PiovanGroup

Product Catalog

TCF Series Centrifugal Variable-Speed Central Chillers

Contents

Standard Features

Variable Speed Compressor
Direct-drive variable speed centrifugal compressor technology continuously adjusts speed to match load to reduce operating costs.

Magnetic Bearing
A magnetic field levitates the drive shaft and eliminates the friction of conventional bearings for higher efficiencies and an oil-free refrigeration system.

Integral Variable Speed Drive
High-efficiency brushless DC motor with built-in variable speed drive technology is refrigerant cooled, compact, and energy efficient.

Soft-Start
The variable speed drive limits soft-starts to 2 amps inrush current per compressor to reduce peak energy demand and extend compressor motor life.

Low Noise Operation
The magnetic bearings keep the drive shaft in position under high-speed operation for virtually no structural vibration and low noise.

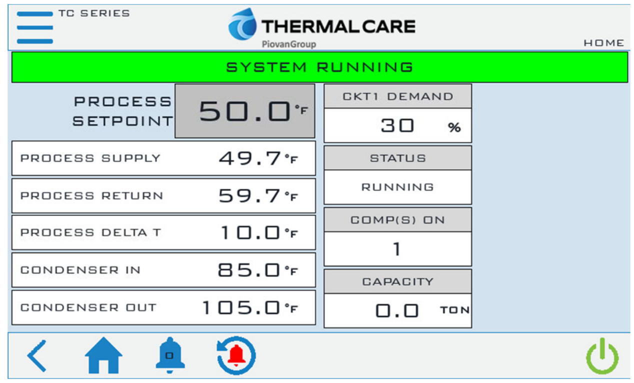
Compressor Rotary Circuit Breaker
A through-the-door rotary circuit breaker for each compressor allows easy maintenance of a compressor without the need to shut down power to the chiller.

UL 508A Industrial Control Panel
Every chiller has a UL label certifying our panel design and components comply with UL 508A standards ensuring the panels are safe and consistent for reliable operation.

Hybrid Film Evaporator
Advanced design provides the most efficient heat transfer while minimizing the refrigerant charge requirement, which results in a compact, extremely energy-efficient unit.

Modular Expandable System
Our modular system allows for flexible system design and provides for system expansion to over 600 tons using up to six chillers.

Advanced Controls with Color Touch-Screen
7-inch color touch-screen shows chiller operation for quick and easy monitoring and control of the system. Our advanced PLC system can control up to six chillers.



Standard PLC Home Screen

CONNEX4.0 Ready Controls
Every chiller is equipped with an Ethernet port and is fully compatible with the CONNEX4.0 plant-wide equipment control and monitoring system.

Warranty
1 year entire unit parts
1 year labor

Available Options

BACnet Communications Port
Adds a ModBUS to BACnet gateway wired to a RS-485 connector on the control panel.

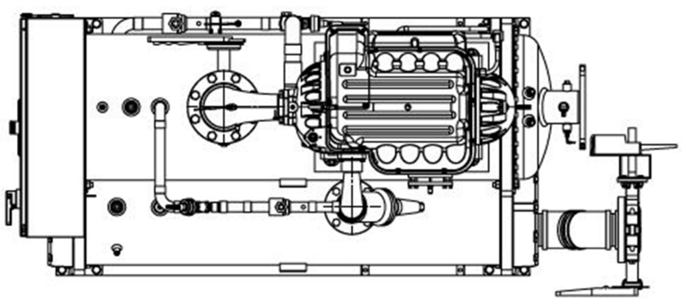
Industrial PC with Ethernet
Used for remote access.

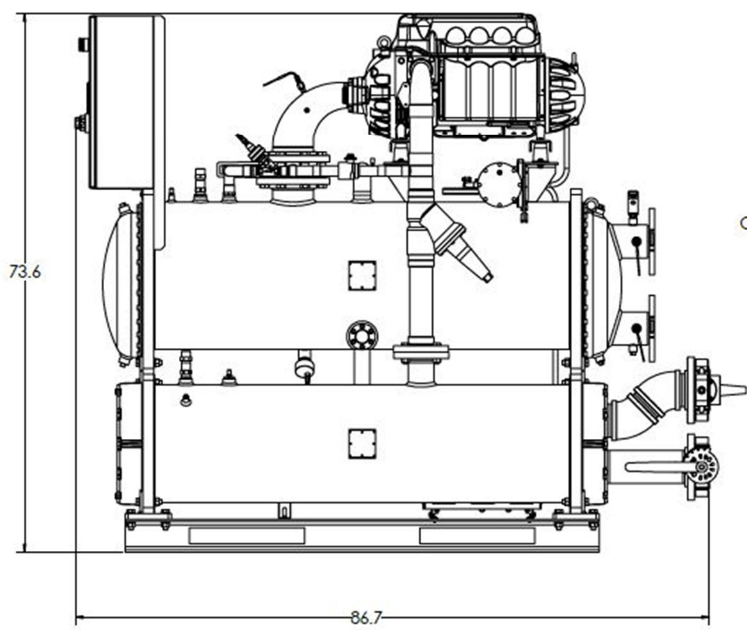
Physical and Electrical Data

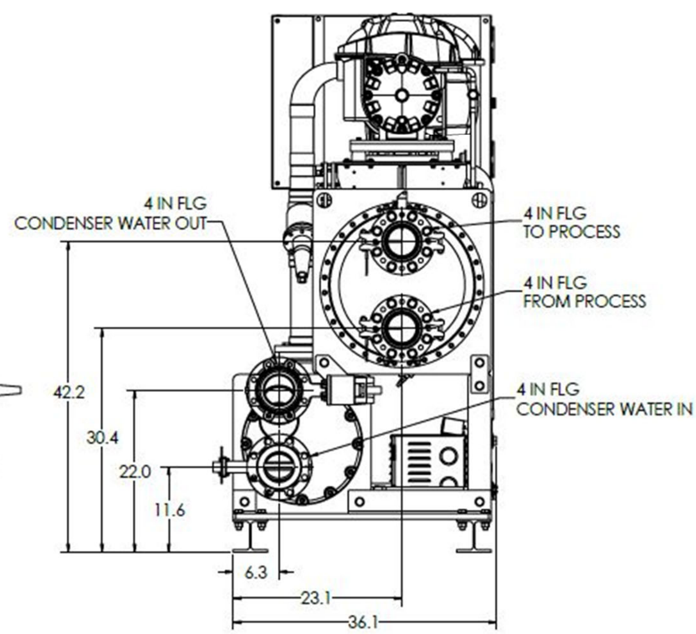
Water Cooled Condenser Single-Circuit Chillers Physical Data

	TCFW350S
Cooling Capacity Range (ton)[1]	40 to 120
Set Point Range (°F)	40 to 75
Compressor (qty)	1
Shipping Weight (lbs)	3,400
Operating Weight (lbs)	3,800
MCA @ 460/3/60 (amps)[2]	229
MOP @ 460/3/60 (amps)[3]	400

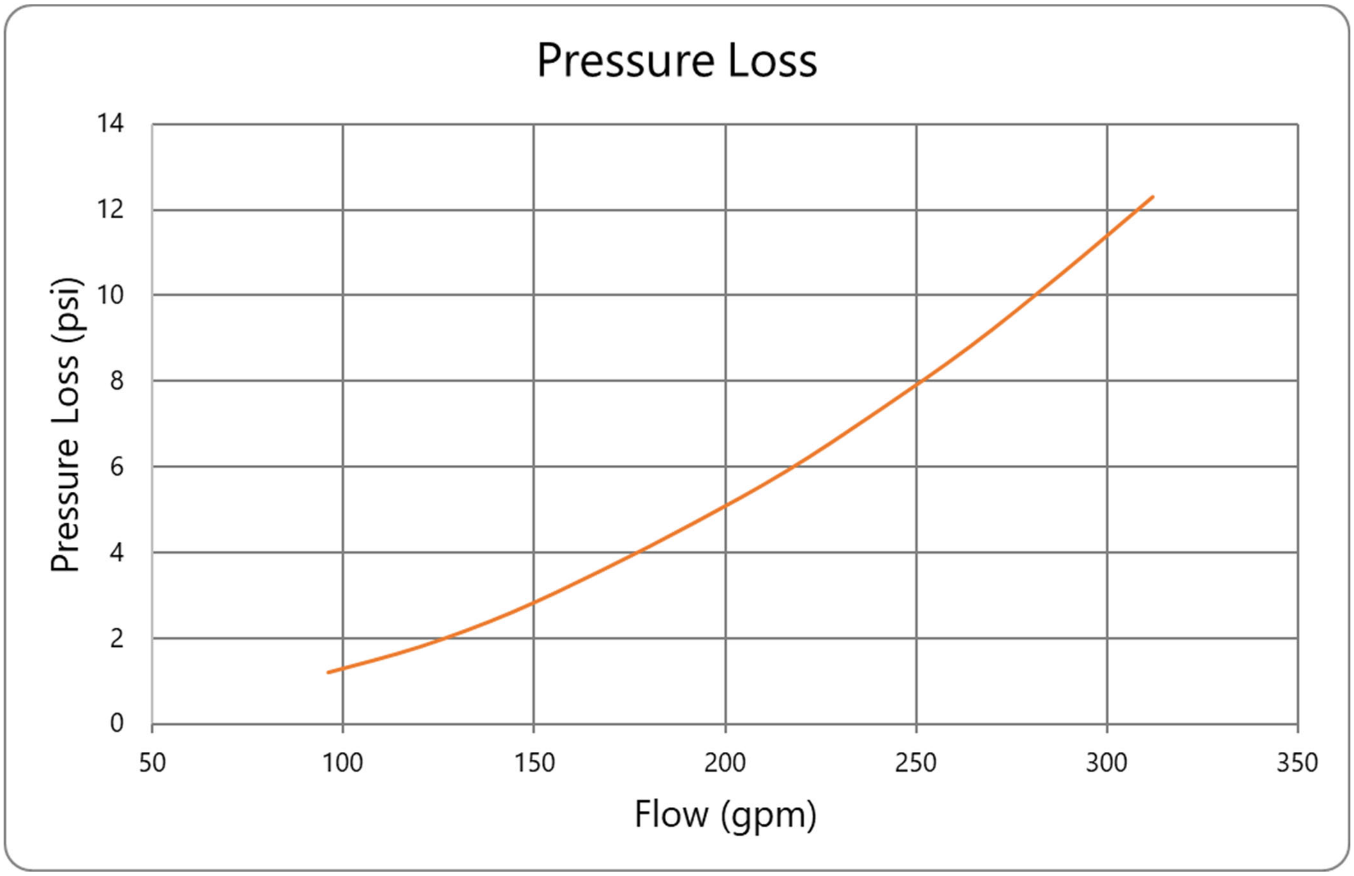
[1]Cooling capacity when cooling water with 50°F set point, 60°F return, 85°F condenser water, R134a refrigerant.
[2]MCA is Minimum Circuit Amps under full load, used for minimum wire size requirement.
[3]MOP is Maximum Overcurrent Protection, used for sizing main power protection device.







Chiller Process Fluid Circuit Pressure Loss



Application Considerations

When designing a chilled water system, it is important all aspects of the system are considered to ensure steps are taken to provide stable and reliable operation. The following provides some general guidelines for designing a system.

Foundation

Install the unit on a rigid, non-warping mounting pad, concrete foundation, or floor suitable to support the operating weight of the chiller. Level the chiller within ¼ inch over its length and width.

Chiller Unit Location

Proper ventilation is an important consideration when locating the condenser. In general, locate the unit in an area that will not rise above 110°F.

To ensure proper airflow and clearance space for proper operation and maintenance allow a minimum of 36 inches of clearance between the sides of the equipment and any walls or obstructions. Avoid locating piping or conduit over the unit to ensure easy access with an overhead crane or lift to lift out heavier components during replacement or service. In addition, ensure the condenser and evaporator refrigerant pressure relief valves can vent in accordance with all local and national codes.

Process Fluid Piping

Proper insulation of chilled process fluid piping is crucial to prevent condensation. The formation of condensation adds a substantial heat load to the chiller.

The importance of properly sized piping cannot be overemphasized. See the ASHRAE Fundamentals Handbook or other suitable design guide for proper pipe sizing. Avoid long lengths of hoses, quick disconnect fittings, and manifolds wherever possible as they offer high resistance to water flow. When manifolds are required, install them as close to the use point as possible. Provide flow-balancing valves at each machine to assure adequate water distribution in the entire system.

Process Fluid Temperature

The chiller has a standard set point range of 40°F to 70°F. Under normal operation, the entering water temperature should not exceed 80°F; however, the chiller can start and operate short-term with entering fluid temperatures up to 90°F to allow the chiller to pull down the temperature of a reservoir or process fluid loop on start-up.

Process Fluid Flow Rate

The nominal flow rate of the chiller is 240 gpm of water with a practical range of 150 to 350 gpm.

If the flow requirement through the process is less than 150 gpm, use a primary pumping loop for the process and a secondary pumping loop for the chiller to operate between 150 to 350 gpm and ensure the mixed temperature of coolant entering the chiller evaporator is a minimum of 5°F above the design set point of the chiller.

If the flow requirement thought the process is more than 350 gpm, use a primary pumping loop for the process and a secondary pumping loop for the chiller to operate between 150 gpm to 350 gpm and ensure the mixed temperature of coolant entering the chiller evaporator is a minimum of 5°F above the set point of the chiller.

The use of varying chiller flows is sometimes necessary; however, a dedicated evaporator circulation pump provides increased system stability. If the flow through the chiller is varied, the minimum fluid loop volume must be in excess of 3 gallons of coolant per ton of cooling and the flow rate must change at a rate of no greater than 10% per minute in order to maintain an acceptable level of temperature control. If the chiller sees a net rate of change greater than 10% per minute it may result in temporary supply temperature fluctuations greater than 1°F.

Condenser Water Temperature and Flow

The chiller includes a factory mounted condenser water-regulating valve to regulate condenser water flow to maintain the proper refrigerant pressures. The nominal design is for 300 gpm of 85°F water entering the condenser. The chiller will start and operate with inlet water temperatures between 55°F and 95°F. The actual flow requirements will vary.

System Fluid Chemistry Requirements

The properties of water make it ideal for heat transfer applications. It is safe, non-flammable, non-poisonous, easy to handle, widely available, and inexpensive in most industrialized areas.

When using water as a heat transfer fluid it is important to keep it within certain chemistry limits to avoid unwanted side effects. Water is a "universal solvent" because it can dissolve many solid substances and absorb gases. As a result, water can cause the corrosion of metals used in a cooling system. It is common to have water is in an open system (exposed to air) and when the water evaporates, the dissolved minerals remain in the fluid. When the concentration exceeds the solubility of some minerals, scale forms. The life giving properties of water can also encourage biological growth that can foul heat transfer surfaces.

To avoid the unwanted side effects associated with water cooling, proper chemical treatment and preventive maintenance is required for continuous plant productivity.

Unwanted Side Effects of Improper Water Quality

- Corrosion
- Scale
- Fouling
- Biological Contamination

Cooling Water Chemistry Properties

- Electrical Conductivity
- pH
- Alkalinity
- Total Hardness
- Dissolved gases

Chillers at their simplest have two main heat exchangers: one absorbs the heat from the process (evaporator) and one removes the heat from the chiller (condenser). These, as are all heat exchangers, are susceptible to fouling of heat transfer surfaces due to scale or debris. Fouling of these surfaces reduces the heat-transfer surface area while increasing the fluid velocities and pressure drop through the heat exchanger. All of these effects reduce the heat transfer and affect the efficiency of the chiller.

The complex nature of water chemistry requires a specialist to evaluate and implement appropriate sensing, measurement and treatment needed for satisfactory performance and life. Recommendations may include filtration, monitoring, treatment and control devices. With the ever-changing regulations on water usage and treatment chemicals, the information is usually up-to-date when a specialist in the industry is involved.

Fill Water Chemistry Requirements

Water Characteristic	Quality Limitation
Alkalinity (HCO3-)	70-300 ppm
Aluminum (Al)	Less than 0.2 ppm
Ammonium (NH3)	Less than 2 ppm
Chlorides (Cl-)	Less than 300 ppm
Electrical Conductivity	10-500µS/cm
Free (aggressive) Carbon Dioxide (CO2)†	Less than 5 ppm
Free Chlorine(Cl2)	Less than 1 PPM
HCO3-/SO42-	Greater than 1.0
Hydrogen Sulfide (H2S)	Less than 0.05 ppm
Iron (Fe)	Less than 0.2 ppm
Manganese (Mn)	Less than 0.1 ppm
Nitrate (NO3)	Less than 100 ppm
pH	7.5-9.0
Sulfate (SO42-)	Less than 70 ppm
Total Hardness (dH)k	4.0-8.5

† Dissolved carbon dioxide calculation is from the pH and total alkalinity values shown below or measured on the site using a test kit. Dissolved Carbon Dioxide, PPM = TA x $2^{[(6.3-pH)/0.3]}$ where TA = Total Alkalinity, PPM as $CaCO_3$

Recommended Glycol Solutions

Chilled Water Temperature	Percent Glycol By Volume
50°F (10°C)	Not required
45°F (7.2°C)	5 %
40°F (4.4°C)	10 %
35°F (1.7°C)	15 %
30°F (-1.1°C)	20 %
25°F (-3.9°C)	25 %
20°F (-6.7°C)	30 %

CAUTION: When your application requires the use of glycol, use industrial grade glycol specifically designed for heat transfer systems and equipment. Never use glycol designed for automotive applications. Automotive glycols typically have additives engineered to benefit the materials and conditions found in an automotive engine; however, these additives can gel and foul heat exchange surfaces and result in loss of performance or even failure of the chiller. In addition, these additives can react with the materials of the pump shaft seals resulting in leaks or premature pump failures.

WARNING: Ethylene Glycol is flammable at higher temperatures in a vapor state. Carefully handle this material and keep away from open flames or other possible ignition sources.

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January 2024