Cold Shot Chillers

INSTALLATION, OPERATION, AND MAINTENANCE INSTRUCTIONS

(ACWC-240-E model shown)

AIR-COOLED WATER CHILLERS
ACWC-120 through - 240 MODELS

Model#: ACWC-180-EM-DR-LT-0-5

COLD SHOT CHILLERS

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MODEL NUMBER NOMENCLATURE

Example Model#:	**ACWC**	-	**60**	-	**E**	-	**ST**	-	**LT**	-	**40**	-	**5**
Position:	1		2		3		4		5		6		7

Position-Description

1. **Model Type**: ACWC=AirCooledWaterChiller, WCWC=WaterCooledWaterChiller, etc.
2. **Nominal Capacity** in kBtu/hr
3. **Series System**: various
4. **Flow Design**: (_=Portable, ST=Stationary, RF=ReverseFlow, EXCH=HeatExchanger, DP=DualPump, DR=DualReturn)
5. **Leaving Fluid Temperature** (_=Standard, LT=LowTemperature-specify lowest temperature in °F)
6. **Ambient Temperature Conditions**:
    a. **IND**: Indoor use only. Casters, typically on frame.
    b. **40**: Suitable for outdoor use with an ambient of 40°F ambient. Casters, optional.
    c. **0**: Suitable for outdoor use to 0°F ambient. Includes low ambient fan control. Casters, optional.
    d. **M20**: Suitable for outdoor use to -20°F ambient. Hot Gas Bypass and/or Wind Baffles may be included. Casters, optional.
7. **Electrical Power** (See specification sheet)

(Variations of the above nomenclature exist and may not include every description).

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I. IMPORTANT

A. CODES AND REGULATIONS

The United States Environmental Protection Agency (EPA) has issued various regulations regarding the introduction and disposal of refrigerants in this unit. Failure to follow these regulations may harm the environment and can lead to the imposition of substantial fines. Because these regulations may vary due to the passage of new laws we suggest that, any work on this unit be done by a certified technician. Should you have any questions, please contact the local office of the EPA.

This product is designed and manufactured to permit installation in accordance with National Codes. It is the installer's responsibility to install the product in accordance with National Codes and/or prevailing local codes and regulations. The manufacturer assumes no responsibility for equipment installed in violation of any codes or regulations.

IMPORTANT MESSAGE TO OWNER:

These instructions should be carefully read and kept near the product, for future reference. While these instructions are addressed primarily to the installer, useful maintenance information is included. To insure proper set up, operation, and performance it is recommended that a licensed service professional start this piece of equipment. Have your installer acquaint you with the operating characteristics of the product and periodic maintenance requirements.

B. INSPECTION

This product has been inspected at the factory and released to the transportation agency without known damage. Inspect carton's exterior for evidence of rough handling in shipment. Carefully remove protective wrap and all banding to uncrate, for inspection; if damage is found, report immediately to the transportation agency and Cold Shot Chillers. Provide a report and photographs (highly recommended), if possible.

Once it is established that the unit has positive pressure, proceed to installation. Test the system service valves with refrigeration gauges to ensure refrigerant pressure is present and no undetectable damage (i.e. dropping the unit) has occurred, when possible.

C. SAFETY CONSIDERATIONS

Installation, start-up, and servicing of this equipment can be hazardous due to system pressures, electrical components, and equipment location (roofs, elevated structures, etc.) Only trained, qualified installers and service mechanics should install, start up, and service this equipment. When working on the equipment, observe precautions in the literature, tags, stickers, and labels attached to the equipment, and any other safety precautions that apply.

- Follow all safety codes.
- Wear safety glasses and work gloves.
- Use care in handling, rigging, and setting bulky equipment.
- Use care in handling electronic components.

D. REPLACEMENT PARTS

- For information on replacement parts, contact Cold Shot Chillers.
- When ordering parts, provide complete model and serial number as shown on the unit nameplate.
- Most parts will be available through local distributors.

II. INSTALLATION

A. MOVEMENT/RIGGING

1. The preferred method for movement of the chiller while on the pallet is with forklift or pallet jack.
2. For rigging, overhead rigging with spreader bars above the unit is preferred. Protect unit from being crushed. CAUTION! All panels must be in place when rigging. Failure to follow these requirements could result in personal injury or equipment damage.
3. Maneuvering of the system must be done with care to prevent damage to the panels or the internal components mounting.
4. See specification sheets for physical data and unit dimensions.

B. PLACEMENT

1. Select a location for air-cooled units with adequate air circulation that is as dust free as possible.
2. There must be a minimum of 3 ft of space for service and for unrestricted airflow on all sides of unit, and a minimum of 8 ft clear air space above unit. Select a location where air is not recirculated back into condenser. For multiple units, allow additional separation between units for airflow and service.
3. Verify ambient conditions that the system is suitable.
    a) IND - Indoor units are suitable for indoor use only. No wet environments.
    b) 40 - Outdoor units to 40°F (same as above) and are suitable for outdoors to 40°F ambient temperature and suitable for wet environments.
    c) 0 - Outdoor units to 0°F (same as above) and suitable for outdoors to 0°F ambient temperature.
    d) M20 - Outdoor units to -20°F (same as above) and suitable for outdoors to -20°F ambient temperature.
4. Avoid environments which may be corrosive to the chiller, unless properly treated.
5. Avoid locations that may have direct spray such as from roof edges or sprinklers.
6. Select location as near to the process as possible to reduce the system piping / pressure drop.

C. MOUNTING

1. Level the unit to ensure proper oil return to compressors and fluid draining.
2. When unit is in proper location, secure unit to foundation or on vibration isolators, as needed/required by local requirements. Fasteners for mounting unit are field supplied.
3. PIPING
    a) Connect piping or hoses to unit, making sure that the inside diameter (I.D.) of the pipe or hose is the same as or greater than unit connections and that the material is designed for the expected fluid conditions. Reverse Flow designs will require proper pipe size suction piping to ensure the pump maintains appropriate Net Positive Suction Head (NPSH). Most pumps are not self-priming.
    b) The fluid circuits must contain a bypass to prevent a “dead head” condition for the pump and to allow return process water to chiller tank. A bypass valve is required in the system to ensure proper flow through the evaporator and to provide adjustment of the pressure and flow to the process.
        (1) Refer to the system Flow Diagram for details, or to the actual unit.
    c) Typical Chiller Fluid Flow Designs:
        (1) Stationary: Chilling system with evaporator.
        (2) Reverse Flow: Chilling system with evaporator and circulating pump.
        (3) Portable: Chilling system with evaporator, circulating pump, and reservoir tank with bypass.
        (4) Extra Heat Exchanger: Same as Portable along with an extra chilled fluid heat exchanger.
        (5) Dual Pump: Same as Portable and includes a second pump typically for process use.
        (6) Dual Return: Same as Portable yet includes a second return direct to tank for some flow.
    d) System Recommendations:
        (1) Valves installed throughout the system, as needed. Typical at each load for isolation and flow/pressure balancing purposes through system.
        (2) Use low pressure drop design components. (Such as long radius 90s or 45s elbows)
        (3) Add piping and valve to the tank drain port.
        (4) Temperature and pressure gauges throughout system at ideal locations for monitoring.

(5) Vent and drain valves to provide ability to bleed air and drain fluids from system, as needed.
(6) Heat-trace cable. Protect any fluid system exposed to freezing ambient conditions.

e) Systems with the process piping located above the chiller, should be aware of possible fluid returning to the chiller when the system is turned off. Typically, the chiller inlet/outlet piping is below the tank water level which will limit draining fluid to tank, however if the process piping is opened, the fluid may return to the tank and overflow. Recommend isolation valves be installed on the inlet and outlet piping.

4. ACCESSORIES/ OPTIONS/EXTRA EQUIPMENT
   a) Any additional accessories, options, or equipment must be installed as necessary before the system is started. Refer to the accessory literature for installation instructions, as applicable.
   b) Wiring connections for field-supplied equipment are shown on wiring diagrams.

D. SPLIT SYSTEMS (Remote Condenser or Condensing Unit)

1. Conform to all local codes and standard practices for systems with refrigerant.
2. Systems with split refrigerant systems are typically shipped without refrigerant, however, are it is charged with nitrogen to maintain a positive pressure (typically 10-15 psi).
3. Verify and remove the nitrogen charge. Each marked section should have a positive charge (see tag/decal noted at connection point).
   a) If no pressure is present, reapply pressure and check for leaks before charging with refrigerant.
4. Pipe the refrigerant lines of the two units together as required.
5. Pressure test the system, pull vacuum, and degas. Use proper industry practices with system.
   a) Split systems need to be evacuated prior to charging with refrigerant.
6. Add refrigerant to the liquid line service port. See the equipment label plate for the type of refrigerant and typical amount of initial charge or check the specification sheet. Adjust as needed to set the appropriate charge as noted in Startup section-Refrigerant Charge.

E. ELECTRICAL POWER AND CONNECTIONS[1]

1. POWER SUPPLY: Field wiring must comply with national and local codes.
   a) Install a branch circuit fused disconnect of adequate size to handle starting current. The disconnect must be within sight from the unit and readily accessible, in compliance with National Electrical Code (NEC), Section 440-14.
   b) Verify electrical power on the Cold Shot Chillers label plate with actual voltage.
   c) Connect line power supply to terminal block or as noted in machine; typically, connect power leads to terminals L1, L2 and L3 on compressor contactor.
   d) Ensure Ground wire is connected appropriately.
   e) 208/230V/3Ø systems with high or "stinger" leg, connect this leg to L2 or middle terminal. Failure to do so will cause early control component malfunction.
      (1) If 208V, verify that the control circuit voltage out of the transformer is the proper amount. If not, check the transformer for additional tap wires for changing to 208V, when available.
2. Verify that the chiller selector switch is in "OFF" position before applying power.
3. <u>ROTATION (3-PHASE)</u> If using a phase sequence tester, electrical phase direction is clockwise (A-B-C).

[1] Electrical Notes:
- Factory wiring is in compliance with NEC. Any field modifications or additions must be in compliance with all applicable codes. Use copper, copper-clad aluminum for field power supply only.
- Field power supply wiring must be 75 C minimum.
- If any of the original wiring furnished must be replaced, it must be replaced with 90 C wire or its equivalent.
- Compressor thermally protected. Three-phase motors are protected against primary single-phasing condition.
- 60 Hz units have 120 volt control circuit. 50 Hz units have 230 volt control circuit. A separate source of supply at the correct voltage
- Must be field supplied through a fused disconnect device with a maximum rating of 15 A to TB2 connections L1 (Hot Side) and L2 (Neutral).
- Open control circuit disconnect switch for servicing only. Disconnect must remain closed for crankcase heater to operate.
- Transformers must be fused and grounded per applicable codes.

4. IMPORTANT: Allowing the unit to operate with a voltage imbalance in excess of 2% may void the warranty.

% Voltage Imbalance = 100 x (max voltage deviation from avg voltage) / (avg voltage)

Example: Expected supply voltage to unit is 240-3-60.
Determine maximum deviation from average voltage:

	MAXIMUM DEVIATION:		AVERAGE VOLTAGE:	
	$AB = 243_A - 239_B = 4$ volts*		AB = 243 volts	
	$AC = 239_A - 238_C = 1$ volt		BC = 236 volts	
	$BC = 239_B - 236_C = 3$ volts		AC = 238 volts	
	*MAX DEVIATION = **4 volts**		AVERAGE = 717/3 = **239 volts**	

- Determine % voltage imbalance:
  *%Voltage Imbalance = 100 x **4 / 239** = 1.7%*
- This amount of phase imbalance is Satisfactory as it is below the maximum allowable 2%.

5. UNBALANCED 3-PHASE SUPPLY VOLTAGE:
   a) Never operate a system where a phase imbalance in supply voltage is greater than 2%. Excess operation with voltage outside of tolerance (for example "Brown Outs" will result in motor damage. (This is considered abuse and is not covered under Warranty).
   b) If Voltage Imbalance Greater than 2%:
      (1) If the supply voltage phase imbalance is more than 2%, contact your local electric utility company immediately.
      (2) Check the voltage at the individual components such as each compressor and pump when operating.
      (3) A voltage imbalance may be an indication of loose wires/cable connections or faulty contactors.
      (4) Another issue may be the components themselves. Troubleshoot if needed.
6. Verify that the crankcase heaters are warming properly by using a thermometer or by carefully placing back of hand near the base of the compressor by the heater.

F. FREEZE PROTECTION

1. Protection of system components from freezing is of the utmost concern. Freezing can occur from the external ambient or internal system temperatures.
2. INTERNAL: The evaporator (or other heat exchanger) is the primary component that is susceptible to freezing even during normal operation. The refrigerant side commonly operates at 8 to 12 degrees below the temperature of the chilled fluid temperature. The fluid entering the evaporator must be capable of passing through without forming ice. Ice formation can quickly restrict the flow causing further freezing and eventually expansion of internals resulting in rupture. Attention must be made towards any process involving the evaporator. The chilled fluid characteristics need to have a freeze point that is well below any temperature that the chiller is capable of cooling. (See Glycol)
3. The chiller is equipped with various safety devices designed and set to assist with protecting the system from hazards.

IMPORTANT!!
DO NOT BYPASS OR ADJUST ANY SAFETY DEVICES OR PARAMETERS WITHOUT FIRST CONTACTING COLD SHOT CHILLERS.
ANY MODIFICATIONS OF THE CHILLER SYSTEM FROM THE MANUFACTURER'S DESIGN WILL REQUIRE PRIOR WRITTEN APPROVAL FROM COLD SHOT CHILLERS, OTHERWISE ALL WARRANTIES WILL BECOME VOID.

G. GLYCOL

1. Glycol and water mixtures are common methods to change a fluid's freezing point but may reduce the cooling performance of the chiller. Use of any glycol or other additives to the fluid should be carefully considered. Follow the glycol manufacturer or supplier's directions for system preparation, mixtures, disposal, and maintenance of concentrations.
2. Automatic/Manual refill or change over systems should be cautious and attentive to the specific concentration of mixtures dilution over time. Measure the system's concentration regularly.

3. Glycol concentrations affect cooling performance. As the temperature reduces, the fluid becomes thicker which may reduce heat transfer capabilities and reduces the circulating pump performance.

IMPORTANT!!
DAMAGE CAUSED BY FLUIDS WITH INADEQUATE FREEZE POINT PROTECTION IS NOT CONSIDERED FAILURE DUE TO PRODUCT OR WORKMANSHIP AND IS NOT COVERED BY WARRANTY.

H. PERFORMANCE

1. The basic function of a chiller is to "chill" fluid by removing heat from one location and transferring it to another by using the special properties of refrigerants. The performance or COOLING capacity of a chiller is based on a standard set of operating conditions. Changing the conditions, results in different capacity rating of the chiller.
2. Some conditions are:
    a) Ambient conditions (for air-cooled systems)
    b) Condenser fluid (for water-cooled systems)
    c) Type of fluid being chilled
    d) Design and setup of the chiller
    e) Leaving fluid temperature (Supply fluid to process from chiller)
    f) Flow rate of fluid recirculating in chiller
    g) The other side of the equation is the Heat load. Some of the main conditions affecting load are:
        (1) Entering fluid temperature (Return fluid to chiller from process)
        (2) Flow rate of fluid entering chiller

III. PRE-STARTUP

1. **STARTUP CHECKLIST** - Review and use. (Typically located at end of this manual.)
2. COMPRESSOR MOUNTS
    a) As shipped, the compressor(s) is held down by mounting bolts with vibration rubber grommets.
    b) Verify bolts are tight to base and that the compressor is able to move on the rubber grommets.
        (1) Single Compressor units: Verify that the shipping spacers (if installed) are removed from between the compressor bottom (or compressor plate) and the base of the unit.
        (2) Tandem Compressor units: Compressors are mounted on a common plate.
            (a) Do not loosen the compressor bolts connecting it to the plate.
            (b) Verify that the shipping spacers (if installed) are removed from between the compressor (or compressor plate) and the base of the unit. (Typically quantit

3. SERVICE VALVES
    a) Verify all service valves are open. (Typical valves on these models do not have backseats.)
4. FLUID IN SYSTEM:
    a) Fill the system with the desired solution.
    b) A 30% glycol mixture is recommended for all standard flow units. For "Low Temperature" chilled fluid and units installed outdoors may require a higher concentration to prevent freezing. See unit nameplate for specific concentration requirements or adjust based on the ambient conditions of the chiller, fluid temperature, and/or system design.
    c) For systems with a tank, fill to within a few inches from the top edge or just to the top of the sight glass.
    d) Fill system and bleed air from the highest point of piping. Vent air from pump and piping is possible by loosening or removing the strainer blowdown plug, which will vent air as the tank is filled, as long as the bypass valve is still open. Replace plug/cap after tank is full. Ensure that the pump and evaporator are filled with fluid prior to starting.
    e) Systems with an open tank are typically capable of bleeding excess air that is returned to the tank when the system is operating. Piping in and out are typically below the water line.
    f) For stationary systems (without an integral pump and tank), ensure that there is method for ensuring flow through the chiller system, such as with the use of a flow switch. See electrical system or specifications for details.

DO NOT ATTEMPT TO START CHILLER WITHOUT FLUID IN THE SYSTEM!!
This will damage the mechanical seal in the pump and void the pump warranty.
Also, potential freeze condition may exist in the evaporator.
DO NOT RESET ANY SAFETY CONTROLS UNTIL THE CAUSE HAS BEEN DETERMINED.

    g) **ROTATION**: Check for rotation prior to start-up. Do not use pump for checking rotation unless fluid is in the tank and the pump is full of fluid. Verify 3-Phase Power Electrical Rotation:
    h) All 3-phase (3Ø) motors are wired in phase. If motors are not turning in correct direction, then reverse 2 of the incoming power wires to chiller.
    i) For systems with 3Ø pumps: Pump rotation is normally clockwise as view from the back of the motor (Refer to direction decals if available). Pumps will still pump fluid if rotating reversed, so actual verification is necessary.
        (1) Quickly depress the pump contactor to verify proper rotation.
    j) For systems without 3Ø pumps: Attach refrigerant gauges to the test ports and verify that the discharge pressure rises and the suction pressure decreases. Loud noise may be indication of wrong rotation. Extended run time in reverse rotation will damage the compressor and lead to premature failure which is considered abuse and not covered by warranty.
5. CRANKCASE HEATERS:
    a) If compressor has crankcase heaters, allow the power to be applied to the heaters for at least 24 hours before starting the compressor.

IV. STARTUP

1. Verify installation is complete and all Pre-Startup steps are completed.
2. **STARTUP CHECKLIST** - Review and use. (Typically, located at end of this manual)
3. Attach refrigerant gauges to the appropriate service ports.
4. **PUMP ONLY**: Turn switch to Pump Only (or use local system pump) and operate for at least 15 minutes. Shut unit down and clean strainer to remove any debris that may have been in the system. Depending on the system cleanliness, this step may be conducted several times to help ensure all debris is removed from the system.
5. Depending on system design, if the pump is operated for extended periods without cooling, the fluid will heat up.
6. Once all the air is purged from the circuit and the system is free from debris, verify that the chilled fluid has the proper flow of 3 GPM per ton of capacity.
    a) Typical systems with a manual bypass valve which are factory set. The valve must be open enough to ensure proper flow to the evaporator or the system will shut down on low flow safety condition.
    b) Process systems with automatic and variable control flows will need to ensure that the bypass valve is throttled to accommodate all stopped process flow.
7. **TEMPERATURE CONTROLLER** (See Temperature Controller Section for details):
    a) Set the controller to the desired Set Point value. Typically, for smaller systems, press and hold the up or down scroll button for two seconds until the value starts changing. Adjust the value to the desired temperature then stop pressing any buttons. After two seconds, the new value will become operative. For larger systems, press Set after changing temperatures. (Do not adjust the set point below the temperature listed on the unit nameplate).
    b) The controller will also display “Present Value” (upper LED readout) which is an indication of the current temperature of the fluid in the chiller tank, or “Leaving Fluid Temperature” depending on the specific chiller design.
8. **COOLING CYCLE**: Unit is now ready to turn on for cooling. Move the selector switch to “Cooling Cycle” setting and the unit will begin cooling.
9. During the cooling cycle, condenser fans may turn on and off, due to changes in refrigerant pressure. This should be expected during normal operation and occurs due to ambient temperature and the amount of heat being returned in the water chiller.
10. Monitor the temperature at the process location and adjust the Set Value on the temperature controller to achieve the desired value.
11. **REFRIGERANT CHARGE:**

> **CAUTION!**: Never charge liquid into the low-pressure side of system when the system is off. Do not overcharge. During charging or removal of refrigerant, be sure there is fluid flow through the evaporator and all condenser fan(s) are operating.

    a) Refrigerant charge may need to be adjusted from the amount listed on the equipment label to achieve the proper operation of the chiller during final installation site as described below. Typically, on split systems.
    b) Charging refrigerant during system operation should only be performed into the suction line and then only is small bursts to ensure liquid does not enter compressor directly.
    c) Conditions to properly adjust the refrigerant charge of the system for optimum performance:
        (1) Chiller to be operated against a full heat load with approximately 70°F or above water temperature. Basically, the system must be at full capacity.
        (2) Fans for condenser coil must be on. (Bypass the fan cycling switch if necessary). (Flashing may occur in the refrigerant sight glass when fan turns on and off)
        (3) Refrigerant sight glass must be clear (flooded with refrigerant) while maintaining the appropriate subcooling and superheat parameters.

(4) Returning fluid temperature should not exceed 80°F on standard units or the chiller will cycle off on high head pressure and not run. Should this occur, allow water to cool down and restarting chiller once water is below 80°F.

d) SUPERHEAT: Verify or set the expansion valve (TXV) superheat to approximately 10 to 12°F immediately downstream of the TXV or approximately 12 to 14°F as measured 6 to 12 inches from the compressor on the suction line. Adjustments should be made in small increments, such as 1/4turn or less.

e) SUBCOOLING: While cooling at low load conditions, bubbles may become visible in the refrigerant sight glass. Ensure that the system is fully loaded, and then charge to establish approximately 10 to 14°F of subcooling.

f) Allow approximately five (5) minutes run time for equalization of system after any changes made (add or remove refrigerant, adjust TXV, etc).

g) Ensure all refrigerant system service ports are capped, service valves and caps tight, TXV cap is tight, etc.

V. SYSTEM COMPONENTS: (See your chiller's specification for details.)

IMPORTANT: Never open any switch or disconnect that de-energizes the crankcase heater unless unit is being serviced or is to be shut down for a prolonged period. After a prolonged shutdown on a service job, energize the crankcase heater for 24 hours before starting the compressor.

NOTE: Schrader valve cores: Most components connected to a refrigerant fitting include a Schrader valve for servicing. If leakage occurs during removal of a component, the valve may have been removed or damaged.

1. **ACCESS PANEL**
   a. Typically, accessible where the Cold Shot Chillers logo is located. Remove access screws and open.
   b. All hazardous area access panels must be in place prior to operation.
2. **COMPRESSORS**
   a. Scroll compressors are hermetically sealed with internal motor overload protection.
   b. Most Copeland compressors are equipped with an advanced scroll temperature protection (ASTP). A label located above the terminal box identifies models that contain this technology.

   c. Advanced scroll temperature protection is a form of internal discharge temperature protection that unloads the scroll compressor when the internal temperature reaches approximately 300 F. At this temperature, an internal bi-metal disk valve opens and causes the scroll elements to separate, which stops compression. Suction and discharge pressures balance while the motor continues to run. The longer the compressor runs unloaded, the longer it must cool before the bi-metal disk resets. Eventually, the motor's internal thermal electrical protection will shut down the compressor.
   d. To manually reset ASTP, the compressor should be stopped and allowed to cool. If the compressor is not stopped, the motor will run until the motor protector trips, which occurs up to 90 minutes later. Advanced scroll temperature protection will reset automatically before the motor protector resets, which may take up to 2 hours.
3. **CRANKCASE HEATER**
   a. This minimizes absorption of liquid refrigerant by oil in casing during brief or extended shutdown periods.
4. **CONTROLLER**
   a. The digital temperature controller may vary in design. For controller details, see the Controller Section of this manual.
5. **CONDENSER FANS**
   a. Fans operate along with the compressor operation along with the mode controls.
   b. Modes of fan cycling are:
      a) On (whenever the compressor is on). (Typically, 3ton and under)
      b) Cycling (with use of pressure actuated "head pressure switch". (5ton and over)
      c) Speed Controlled (if using a low ambient fan speed controller device when operating in low ambient condition).

6. **FILTER/DRIER**
   a. For system cleanliness and moisture capture. Every unit will have a filter drier factory installed.
7. **MOISTURE INDICATOR**
   a. For system charging and moisture condition. Every unit will have a sight glass (moisture indicator) factory installed.
8. **FLOW SAFETY THERMOSTAT (FST):**
   a. Generally the cause will be low or insufficient water flow caused by a clogged "Y" strainer or restricted flow in the process. Resetting this control and not determining the cause for tripping can cause the evaporator to freeze and rupture.
   b. Indoor chillers are normally equipped with a Low Flow Safety temperature sensor or thermostat that detects temperature of the refrigerant suction. This safety will automatically trip and requires manual resetting before the cooling cycle will resume. This safety can also be tripped by low ambient conditions or during shipping.
   c. Do not reset this control unless the exact cause for its tripping is determined.
9. **FREEZE SAFETY (FZT): (IF EQUIPPED)**
   a. Indoor chillers are typically equipped with a Freeze Safety temperature sensor that detects low temperature of the fluid in the system. This safety will automatically trip and is reset automatically when the water temperature returns to the higher sensor setting difference.
10. **LIQUID FLOW SWITCH (LFS): (IF EQUIPPED)**
    a. Refer to the LOW FLOW SAFETY for explanation and cautions.
    b. Outdoor units with Low Ambient Kits are normally equipped with a mechanical flow switch which monitors the fluid entering the evaporator. This switch is automatically reset when the fluid flow returns to the proper flow rate. Adjustment should not be performed unless necessary. If adjustments are made, ensure that the flow entering the evaporator is greater than 3 gallons per minute per ton of refrigeration rating of the chiller. For example, a 2 Ton chiller will need a minimum of 6 gpm.

Figure 1 Flow Switch

11. **REFRIGERANT LOW PRESSURE SAFETY (LPS)**
    a) Monitors the pressure of the refrigerant suction line and will automatically open when the pressure drops below the set point and will automatically reset when pressure is above the non-adjustable reset setting. (See specifications for details)
12. **REFRIGERANT HIGH PRESSURE SAFETY (HPS)**
    a. Monitors the pressure of the refrigerant and will automatically open when the pressure rises above the sensor fixed set point. (See specifications for details)
    b. Reset types are manual or automatic, depending on design and system.
    c. Manual Reset - requires that a button be pressed.
    d. Automatic Reset - automatically reset when pressure is below the reset setting.
13. **CAPACITY CONTROLS**
    a. System with multiple compressors permit the use of capacity control using the temperature controller system.
    b. Hot Gas Bypass (Option) - A bypass valve in the refrigerant system that permits cooling output capacity of the chiller to vary based on the load of the system.
14. **LOW AMBIENT CONDITION CONTROLS *(OPTIONS)***
    a. Low Ambient Conditions to 0°F Kit (Option)
    b. Temperature of the chiller's ambient condition is monitored and will change the operation of the chiller fans to reduce the possibility of cold temperatures affecting condenser fan/compressor operation.
    c. NOTE: Low Ambient chillers typically do not have the Low Flow Safety or a Freeze Safety. They are equipped with a pressure controlled fan control system which is used to operate the fan (or Fan #2 or #3 only on multiple fan unit chillers).
15. **WIND BAFFLES (DEPENDING ON DESIGN)**
    a. Panels mounted in or on the condenser coil section to limit/control the amount of air entering the coils. (Option)
    b. Typically used with Low Ambient kit systems with controls down to -20°F Kit.
16. **LOW CHILLED WATER TEMPERATURE (LOW LCWT)**
    a. Low Temperature refers to the temperature of the fluid leaving the chiller is lower than the temperature of the standard temperature machine's Leaving Chill Water Temperature (LCWT). Glycol or some other freeze protected fluid is required.

b. The temperature controller parameters must be setup for the lower leaving temperatures that the system will generate.
c. Also, some temperature thermostats may need to be adjusted.

17. **PUMP (DEPENDING ON DESIGN)**
    a. Systems with integral pump are typically setup to provide recirculating fluid for the chiller and some flow is routed for the process system. Refer to the unit's actual design for details.
    b. A secondary pump may be used for process specific applications, referred to as Process Pump.
18. **TANK (DEPENDING ON DESIGN)**
    a. Systems with integral tank will typically be 304 Stainless Steel with Open Top with Shoebox Type Lid, Fluid Level Sight glass, Fill Port, & Drain Plug.
19. **HEAT EXCHANGER (DEPENDING ON DESIGN)**
    a. A heat exchanger is used to transfer heat typically from the chiller fluid circuit to a separate process fluid circuit.
20. **REMOTE OPERATION/STATUS PANEL (OPTION)**
    a. Basic On/Off control switch with Cooling Mode status and Fault indicator light.
21. **REMOTE OPERATION CONTROLS (OPTION)**
    a. Various designs (contact Cold Shot Chillers for options)
22. **SWITCHOVER SYSTEM (CHILLER BYPASS) (*OPTIONS*)**
    a. Manual City Switchover (MCSO) (Option)
        a) System valves which can be aligned to a backup water supply system such as the city water supply. Outlet fluid flow is normally routed to the building's drain system. Valves are connected and must be actuated simultaneously or in the proper series to operate properly. Converting back is normally performed in the reverse order.
    b. Automatic City Switchover (See ACSO literature)
        a) System has electrically operated valves similar to MCSO, however it can be setup to change automatically based on a system safety situation.
23. **TANK LEVEL *(OPTIONS)***
    a. **Float Valve**
        a) Located inside the tank, the float valve is a mechanically float-actuated valve supplied with a makeup water source of fluid for the tank.
        b) The makeup water (such as city water supply) is connected to the pipe connection on the outside of the tank.
        c) Water pressure, typically, must be less than 30psi.
        d) When the level falls below a certain level, the valve will open and fill the tank. When it reaches the top setting adjustment, the valve closes.
        e) If the valve does not maintain level:
        f) Verify water pressure supply.
        g) Verify the float adjustment.
        h) Verify the mechanical linkages are free to move.
        i) Verify there is no dirt or debris on the valve seat.
    b. **Tank Level Float Switch Solenoid Valve**
        a) Tank Level Switches
        b) Float actuated switch(s) mounted in the tank to monitor when tank is at different levels depending on design such as:
            a) Safety – to stop the operation of something such as the chiller or pump.
            b) Notification – to provide a signal for notification for manual refill or that another action must be performed.
            c) Action – to provide signal for use with other system uses such as automatic fill systems.
        c) Low Tank Level- tank is at the low level point that will/should begin filling the tank. Above pump suction.
        d) High Tank Level- level in tank is at or near top of tank and tank filling will/should stop. Tank may overflow.
    c. **Tank Level Float Controlled Solenoid Valve**
        a) A solenoid valve is an electrically operated valve to start and stop fluid flow from an outside source of fluid such as city water to refill tank, typically.

VI. MAINTENANCE (BASIC GUIDE)

IMPORTANT

- **Always disconnect and lock out the electrical power source before attempting any connection, maintenance or repairs. Failure to do so can cause electrical shocks, burns and death.**
- **All work must be performed by a qualified service person based on the local codes and regulations of the area.**
- **This guide/instruction is to be used as a guide only. An understanding of the system being worked on must be understood before performing any service. Each equipment installation is unique and must be reviewed carefully.**
- **This is a list of basic maintenance items for your liquid chiller. The interval for this maintenance should be determined by the duty cycle of the chiller and the environmental conditions in which it operates. Each system may be unique, so contact the systems manager or the manufacturer for assistance.**

If any questions regarding the equipment, please contact Cold Shot Chillers for assistance.

NOTE: Not performing the following will cause early unit failure and considered abuse which is not covered by warranty.

1. **REVIEW AND COMPARE SYSTEM OPERATING PARAMETERS**
   a. Review original startup checklists and any log readings that may have been recorded to compare with existing parameters and conditions. Determine if further analysis is needed.
2. **AIR-COOLED CONDENSER (INSPECT AND CLEAN)**
   a. INSPECT: Light should be visible through the condenser coil for dirt or airborne particle build-up. Check deep into the coils with a flashlight and, if dirty, clean as needed.
   b. CLEANING: Be careful to disconnect the power first. Protect all electrical components from water and from water entering electrical conduit lines, and then cover the pump/motor, unless motor is a TEFC, to prevent water from entering the vent ports. If it needs to be cleaned, remove the covers of the chiller and use water or compressed air to blow back through the coil in the opposite direction of air flow. Avoid any damage to coil fins such as bending fins flat.
   c. EZ CLEAN FILTERS: If included on the condenser, remove the filters from the unit, and wash with water or soapy water, rinse thoroughly, and then allow filters to dry thoroughly before reinstallation. Reattach when completely dry.
3. **WATER-COOLED CONDENSERS (INSPECT AND CLEAN)**
   a. INSPECT: Clean the inline strainer on a regular basis. Depending on quality of water, the strainer may need to be cleaned more often. Verify the conditions of the condenser coil for dirt or airborne particle build-up. Check deep into the coils with a flashlight and, if dirty, clean as needed.
4. **UNIT SURFACE CLEANLINESS (INSPECT AND CLEAN)**
   a. Inspect all exposed surfaces for indications of corrosion.
   b. Metal, air, and/or water do not always mix well. When the proper concentration are in the same area, then corrosion results. Corrosion is the changing of a metal's properties from one material to another. Nearly all metals are susceptible to corrosion. One noticeable corrosion when iron and oxygen mix resulting in Iron-Oxide or Rust. Most commonly, the corrosion can be removed with wire brush and/or abrasive clothes, and then the surface can be recoated to reduce future corrosion. For severe environments, use a durable epoxy paint that can create an oxygen barrier.
   c. Fasteners which are corroded should be replaced with stainless steel fasteners.
5. **WATER QUALITY / TEST GLYCOL MIXTURE (VERIFY)**
   a. System water should be clean and free of contaminants. If the chiller has a reservoir, check for debris or contaminants which could reduce the efficiency of your chiller. If the chiller has a flow-through heat exchanger, check for normal inlet and outlet fluid pressure. A large pressure differential could indicate plugged up heat exchanger passages.
6. **STRAINERS, FLUID (INSPECT/CLEAN)**
   a. Fluid filters should be clear enough to allow for proper flow and pressure in the system. An increased fluid pressure on the system may indicate a dirty filter.
   b. To clean, turn the system off, isolate the process piping, if possible (if the chiller is not isolated from the process and the strainer is opened, then any fluid above the strainer will drain out immediately.) After isolating the

process, use a wrench to hold the strainer stationary while another wrench is placed on the strainer screen cap. The wrench on the strainer body must prevent the body from turning in the piping. Remove the cap and the strainer screen. Clean the screen and reinsert, taking care not to damage by crushing. Tighten the screen cap.

c. Setup a schedule based on the systems cleanliness and trends of use.

7. **FLUID SYSTEM CONNECTIONS (INSPECT FOR LEAKS OR LOOSE)**
   a. Visually check for fluid leaks throughout system. Physically check for loose pipe fittings or hoses. Ensure that no plumbing parts are wearing, cracking, or chaffing.
8. **PUMPS**
   a. Check the pumps for leakage. Visual indication of leakage from the pump end at the pump connection to the motor is usually an indication of a seal or O-ring failure. Only action is to replace the seal with a new seal. Seals are a consumable item.
   b. O-Rings may harden with age and may need to be replaced when they leak.
   c. Close-coupled centrifugal pumps have no bearings. Bearings in the motors are permanently grease lubricated and cannot be re-greased, unless indicated on motor.
9. **MOTOR LOADS (COMPRESSOR, PUMPS, FANS, ETC...) CHECK AMPS/OPERATION**
   a. Use an amp-meter to check for proper current draws on all motors and heaters. Refer to the chiller's electrical schematics or the motor nameplate for proper amp draws. Log readings.
10. **ELECTRICAL CONNECTIONS (CHECK ALL WIRING FOR LOOSE, CHAFFING, OR DAMAGE)**
    a. Disconnect power to the chiller. Check the electrical box and all junction boxes for any loose or damaged wiring. Replace any wiring that could cause problems with shorting or unintentional grounds.
    b. Check the condition of the contactor points for the compressor and pump. Replace them if the edges become jagged or splattered to avoid premature compressor and/or pump failure. Contactor points are consumable and their life is dependent on the amount of use and power characteristics at the unit.
11. **REFRIGERATION SYSTEM FOR LEAKS (INSPECT AND TEST)**
    a. If the system is operating and there is no indication of leaks, avoid accessing the system unless necessary.
    b. Have a certified refrigeration technician check the refrigeration system for proper operation.
    c. Leak check the unit, monitor operating pressures, and adjust as needed. Refer to manual for proper charging instructions.
12. **CASTER WHEELS AND SWIVELS**
    a. Wheels may require frequent lubrication based on the amount of use. Use good quality bearing grease and pump it into the grease fittings on the axle and swivel.
    b. If casters have locks, ensure that they are locked prior to connecting to fluid and electrical systems.
13. **COMPARE TEMPERATURE READOUT WITH ACTUAL TEMPERATURE**
    a. Use an independent thermometer (or multiple for averaging) and compare to the actual digital temperature display. If the temperature varies more than a few degrees, check condition of thermocouple/sensor. Variation more than a few degrees is usually not common.
    b. If the temperature controller is located in a different location than the thermocouple/sensor, then it may be necessary to adjust the offset in the controller parameters. Contact Cold Shot Chillers for assistance.
14. **WINTERIZATION**
    a. During cold operation months, the chiller piping exposed to freezing temperatures should be protected or damage will result. If the system is not needed during winter months, a possible option is to drain the system of all fluid and tag the system for non-use until needed again.
    b. All fluid must be removed from all components and piping to prevent possible damage.
    c. Follow the startup instructions in the manual for refilling and startup.

VII. TROUBLESHOOTING (BASIC GUIDE)

- The Troubleshooting Guide below is to be used as a guide only. All work should be performed by a trained technician and only with proper understanding of the system. Contact manufacturer for further assistance.
- Prior to resetting any safety devices, ensure that the issue is resolved or use care in operating the system until the cause is determined.

SYMPTOM AND PROBABLE CAUSE	PROBABLE REMEDY
COMPRESSOR DOES NOT RUN	
1. Power line open.	1. Reset circuit breaker/disconnect.
2. Contactor stuck open.	2. Replace contactor.
3. Loose terminal connection.	3. Check connections. Tighten.
4. Improperly wired controls.	4. Check and rewire.
5. Seized compressor.	5. Check motor winding for open or short. Replace compressor, if necessary. Determine cause.
6. Low line voltage.	6. Check line voltage — determine location of voltage drop and remedy deficiency.
7. Compressor motor defective.	7. Check motor winding for open or short. Replace compressor, if necessary.
8. Flow Safety Tripped	8. Determine cause of low flow issue and resolve. - Check reason for no flow. If flow is present, verify amount (~3 gpm/ton). - Verify flow is sufficient to the evaporator during all process circuit operations. - Adjust fluid bypass valve to increase flow. - Do not reset unless issue has been resolved. - Troubleshoot the switch. DO NOT BYPASS! **IMPORTANT! This condition can occur when the fluid in the evaporator nears freezing.**
9. Flow Switch Tripped (switch open)	9. Determine cause of low flow issue and resolve. (See Flow Safety Tripped)
10. Freeze Safety Tripped	10. Determine cause of low flow issue and resolve. (1) (See Flow Safety Tripped)- Typically, this is an automatic reset.
COMPRESSOR STOPS ON LOW-PRESSURE SWITCH	
1. Compressor suction shutoff valve partially closed.	1. Open valve.
2. Low refrigerant charge.	2. Determine cause of low refrigerant. Add refrigerant.
3. Liquid line solenoid valve(s) fails to open.	3. Check liquid line solenoid valve for proper operation. Replace if necessary.
4. Liquid line shutoff valve closed.	4. Open valve.
COMPRESSOR STOPS ON HIGH-PRESSURE SWITCH	
1. Compressor discharge valve partially closed.	1. Open valve or replace if defective.
2. Air in refrigerant system.	2. Purge and evacuate system, as appropriate.
3. Condenser fan(s) not operating.	3. Check, then repair or replace if defective: a. Motor/motor wiring. b. Head pressure switch. c. Capacitors.
4. System is overcharged.	4. Reclaim charge as needed.
5. Condenser coils dirty.	5. Clean coils, properly.
6. Ambient temperature too high for charge.	6. Reclaim charge as needed.
7. Partially plugged expansion valve or filter drier.	7. Clean or replace.
8. Condenser coils dirty.	8. Clean coils, properly.

SYMPTOM AND PROBABLE CAUSE	PROBABLE REMEDY
UNIT OPERATES TOO LONG OR CONTINUOUSLY	
9. Low refrigerant charge.	9. Add refrigerant.
10. Control contacts fused.	10. Replace control.
11. Air in system.	11. Purge and evacuate system.
SYSTEM IS NOISY	
1. Piping vibration.	1. Support piping as required.
COMPRESSOR LOSES OIL	
1. Leak in system.	1. Repair leak.
2. Crankcase heaters not energized during shutdown.	2. Check wiring and relays. Check heater and replace if defective. (Some heaters are always on.)
3. Improper interconnecting piping design.	3. Check piping for oil return. Replace if necessary.
FROSTED SUCTION LINE	
1. Expansion valve not operating properly.	1. Adjust expansion valve.
2. Low temperature operation.	2. Verify low temperature operation is proper, verify superheat.
3. Low refrigerant.	3. Determine cause of low refrigerant. Add refrigerant.
4. Low fluid flow.	4. Verify fluid flow. Clean strainer and bypass is throttled to maintain 3gpm/ton.
HOT LIQUID LINE	
1. Dirty condenser coil.	1. Clean condenser coil.
2. Expansion valve malfunctioning.	2. Verify Charge and adjust expansion valve.
3. Shortage of refrigerant due to leak.	3. Repair leak and recharge.
4. Overcharged system.	4. Remove refrigerant, adjust charge.
FROSTED LIQUID LINE AFTER DRIER	
1. Restricted filter drier.	1. Remove restriction or replace.
COMPRESSOR WILL NOT LOAD/UNLOAD – HOT GAS VALVE OPERATION	
1. Defective Hot Gas Bypass valve.	1. Replace valve/solenoid.
2. Defective Capacity Control solenoid/valve.	2. Replace valve/solenoid.
3. Weak, broken, or wrong valve body spring.	3. Replace spring.
4. Program (PLC) not sending signal to solenoid.	4. Verify PLC signal and wiring.
PUMP WILL NOT RUN	
1. No Control Circuit Power.	1. Replace Fuse or reset control circuit breaker.
2. No Power to Contactor.	2. Replace Fuse or reset main circuit breaker/disconnect.
3. Low Line Voltage.	3. Check line voltage — determine location of voltage drop and remedy deficiency. - Excess operation with voltage outside of tolerance (for example “Brown Outs” will result in motor damage. (This is considered abuse and is not covered under Warranty).
4. Contactor stuck open.	4. Verify control voltage to contactor. - No Voltage – find cause of no voltage. - Low Voltage - determine location of voltage drop and remedy. - Replace contactor.
5. Loose terminal connection.	5. Check connections. Clamp on insulation material.
6. Improperly wired remote controls.	6. Verify wiring, and rewire as needed.

7. Motor defective.	7. Check motor winding for open or short. Replace motor/pump, if necessary.
VOLTAGE IMBALANCE	
1. Voltage Imbalance over 2% - Incoming Power - (Check Voltage at front and backside of each contactor during operation.)	1. Main Incoming Voltage – - A voltage imbalance may be an indication of loose wires/cable connections or faulty contactors. - Another issue may be the components themselves. Troubleshoot if needed. - If the supply voltage phase imbalance is still more than 2%, issue may require contacting local electric utility company.
2. Voltage Imbalance over 2% - Load Power - (Check Voltage at front and backside of each contactor during operation.)	2. Main Incoming Voltage – - A voltage imbalance may be an indication of loose wires/cable connections or faulty contactors. - Another issue may be the components themselves. Troubleshoot if needed. - If the supply
TEMPERATURE CONTROLLER ERROR	
1. Temperature indication not accurate.	1. Verify temperature sensor is in good condition and mounted properly. - Adjust the offset (Typically it is only adjusted a few degrees. If the offset must be adjusted more than 3 degrees, determine potential issues.)
2. Temperature indication or sensor error on controller.	2. FOR TEST PURPOSES ONLY! - Turn system off. Disconnect power. - Disconnect the thermocouple wires from controller. - Connect a short length of copper wire (Jumper) between the two contacts on the controller where the thermocouple was connected. - Reconnect power. Turn system on. - If the controller “actual” is close in range to the ambient temperature of the controller, then the thermocouple is bad. – Replace the thermocouple. (remove the jumper wire) - If the controller “actual” is <u>not</u> in range to the ambient temperature of the controller, then the thermocouple may be good, the controller may have internal issues. – Replace the controller or thermocouple input device.

VIII. APPENDIX

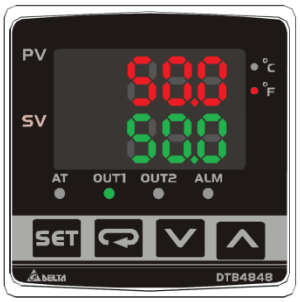
A. Temperature Controller Information
B. Technical Specification
C. Physical/Installation Drawings
D. Electrical Drawings
E. Component Technical (Pump, options, etc, when available)
F. Parts Warranty
G. Labor Warranty (if included)
H. Startup Checklist

Cold Shot Chillers
"ECONOMICALLY PRICED DEPENDABILITY"

DELTA TEMPERATURE CONTROLLER OPERATIONS

A1 Model

OPERATION



- PV is the actual Process Value temperature.
- SV is the desired Set Value temperature.
- Use ▼ ▲ keys to set the temperature set point.
- To adjust temperature value, use the ▼ ▲ keys to change to the desired value.
- Press SET key to save the changes. If the value is above or below the limits of the controller, the SV will go to the closest limit value.

Do not adjust any settings other that SV without contacting Cold Shot Chillers.
IMPORTANT! Continuous restarting of the system with a fault is considered abuse and will void all warranties.

SEQUENCE OF OPERATION

- NOTES:
  - Ensure that the system is ready to be operated according to the manual.
  - When power is applied to the chiller, the temperature controller, power supply and Programmable Logic Controller (PLC) will be lit.
  - If the above items do not have power at start up, determine cause.
  - Any faults will be displayed on the temperature controller on the lower SV display. (See Fault Code List)
  - Some faults are dependent on mode of operation and condition specific.
  - The following sequence of operation provides basic overview.
  - Control timers may limit operations to protect equipment and for efficiencies. For example, compressors have a time delay of three minutes before restarting is possible to prevent short cycling.
  - System design and components may vary.
- **PUMP ONLY Mode**
  - Ensure that the system is ready to be operated in Pump Only Mode according to the manual.
  - When the selector switch is turned to "Pump Only":
    (1) The system checks the Refrigerant Low Pressure Switch and (if included) the Pump Safety (Motor starter or overload) (or the Tank Level is above the low level, if included).
    (2) Any issues with these items will result in a fault.
  - There is an initial delay bypassing the flow switch to permit flow to start.
    (1) If flow is established, the system continues in Pump Only Mode until the selector switch is turned off or a fault occurs.
    (2) If flow is not established within the specified time, typically five seconds, the system will shut down and provide a fault code.
- **COOLING CYCLE Mode**
  - Ensure that the system is ready to be operated in Cooling Cycle Mode according to the manual.
  - When the selector switch is turned to "Cooling Cycle":
    (1) The pump sequence will begin as noted above under PUMP ONLY mode.
    (2) If no faults exist, then the Cooling Status (PLC output Y0) will turn on and then there is a 1 minute initial fluid circulation delay which provides time for mixing of the fluids throughout the system.
    (3) Then the control starts monitoring the temperature every few seconds.
    (4) The program operates to maintain temperature between the Upper Deviation 1 (UD1) and the Lower Deviation 2 (LD2). Variations will occur depending on cooling operations and the heat load on the system.
  - When the Process Value (PV) temperature is at or above the UD1 value, then the Cooling Operation starts:
    (1) The first compressor will start with the hot gas valve (if included) energized, along with the control signal which permits use of liquid line solenoid valve or fan relay (if included). The first compressor to operate is based on total run time.
    (2) During the initial start of the first compressor, the low pressure switch fault is bypassed for approximately 20 seconds. If a low pressure fault is not present following the initial bypass, then the system continues in Cooling Cycle Mode.
    (3) Thirty seconds after the first compressor starts, the hot gas valve will de-energize, if included.
  - When the PV is over the Upper Deviation 2, then the program will determine if temperature is increasing or decreasing:

(1) If temperature is decreasing, then the second compressor will not start.
  (a) The High Deviation fault condition is bypassed as long as temperature is decreasing.
(2) If temperature is increasing, then the second compressor will start.
  (a) If the temperature is above the High Deviation and temperature is increasing, then a timer starts, which if temperature does not lower within the time, then a High Deviation fault will occur.

- When the PV continues to decrease to the LD1:
  (1) If two compressors are operating, then the compressor with the longest run time will reset (turn off).
  (2) The hot gas valve will energize and operate in the low end of the band between LD1 and LD2 in a hot gas cycling mode as needed.
    (a) If temperature rises above LD1, then hot gas operation will reset.
    (b) If temperature lowers below LD2, then the cooling operation will reset.
    (c) If the temperature remains in the low band and the hot gas cycling mode time ends, then the cooling operation will reset, regardless of reaching LD2.
- The Cooling Operation cycles as needed to maintain the fluid temperature within the UD1 and LD2, until the selector switch is turned off or a fault occurs.

DISPLAYS

Power ON (typical) (Only at startup)		
PV	b190	DTB series, Firmware V1.90
SV	r r	Output type: Relay and Relay

Normal display		
PV	51.3	Present Value
SV	50.0	Set Value

FAULT		
PV	50.0	Present Value
SV	9##.#	Fault Code (Refer to next section for explanation)

Input error		
PV	E r r	Error
SV	InPt	Input

Sensor didn't connect (Temp Probe problem)		
PV	no	No
SV	Cont	Connect

Input over range		
PV	100.0	PV flash when over
SV	50.0	Input

EEPROM error		
PV	E r r	Error
SV	Pron	EEPROM (Temp Controller requires replacement)

EQUIPMENT DIAGNOSTICS/TROUBLESHOOTING

- During servicing of the system, it is possible to observe the PLC LED inputs and outputs to determine component status such as if a condition is operating/fluctuating/etc.
- This will allow the technician to see if a problem is occurring even without causing a fault condition or shutdown.
- Refer the electrical diagram for the input and output signal designations.
- The second digit of the Fault Code designates the PLC input number. (Only for 2 through 7).

FAULT CODES

- If a Fault Code is displayed, refer to the Fault Code List for description.
  - The first fault to occur will be displayed.
  - Document the Fault Code. Determine the cause of the fault before clearing.
  - The condition must be determined and corrected before restarting the system.
  - After a Fault Code is displayed, it must be acknowledged and cleared so that the system can resume.
  - To acknowledge and clear a fault code: turn switch to off and back to the desired mode.

- **IMPORTANT! Continuous restarting of the system with a fault is considered abuse and will void all warranties.**
- The Temperature Controller has additional normally open contacts available that will close during an alarm situation.
  - Alarm Output 1 indicates that the Process temperature has exceeded the allowable temperature range limits.
  - Alarm Output 2 indicates that the Process temperature has exceeded the allowable temperature limits.
  - Alarm Output 3 indicates that the Process temperature has deviated from the set value by the deviation high or low values.

FAULT CODE LIST

FAULT CODE	DESCRIPTION
9000	Only shown if there are no settings in the DTB Temperature Controller
9100	Set Value Temperature Outside the Permitted Range (Will reset the nearest range temperature limit)
9110	Process Value has Deviated Higher Than Set Value Limit without lowering within time period (approx 30 minutes). If this occurs and the cause is known, then raise the SV to be closer to the PV to permit recirculating system.
9120	Process Value Temperature Too High
9200	Refrigerant Pressure Too High at Startup (High Pressure Switch is open) – If manual switch, then press reset.
9210	Refrigerant Pressure Too High during Operation (High Pressure Switch is open) – If manual switch, then press reset.
9300	Refrigerant Pressure Low at Startup or During Pump Operation (Low Pressure Switch is open)
9310	Refrigerant Pressure Low during Compressor Operation after Initial Compressor Start Bypass Timer
9400	No Fluid Flow. Flow was not established in the initial time period (typically 5 seconds)
9410	Fluid Flow Loss for more than time period or Excessive Cycling of Flow Switch within time period
9500	Refrigerant Suction Temperature Low (Flow Safety Thermostat is open.) Possibly due to inconsistent flow
9510	Refrigerant Suction Thermostat Open at Startup (Suction Temperature Low)
9600	Leaving Fluid Temperature Too Low (Freeze Thermostat is open)
9700	Either: 1) Pump Safety Circuit has tripped or 2) Low Tank Level at Start
9710	Either: 1) Pump Safety circuit was tripped or 2) Low Tank Level or Excessive Cycling of Tank Level Switch
9800	Loss of Communications in Pump Mode (Typically, turn switch off and back on to re-establish communication)
9810	Loss of Communications between Temperature Controller and PLC
9820	Loss of Communications between Temperature Controller and Temperature Sensor/Thermocouple

If further assistance is needed regarding the Contact Cold Shot Chillers with any concerns or issues, as needed.

Example of Temperatures of Operation

Code	Description	Detail	Typical Values (°F)
TLH	Temperature Limit High	The highest temperature at which all functions will stop.	120
DTH	Deviation Temperature High	Difference above Set Value that a timer starts. If temperature does not lower, then fault.	SP + Δ30=85
RH	**Range High**	**Highest value that can be entered as a Set Value**	**80**
DU2	**Deviation Upper 2**	**Hysteresis value above Set Value plus 1°F**	**58**
DU1	**Deviation Upper 1**	**Hysteresis value above Set Value**	**57**
SV	**Setpoint Value**	**The desired temperature entered in the controller**	**55**
DL1	**Deviation Lower 1**	**Half of the hysteresis value below Set Value**	**54**
DL2	**Deviation Lower 2**	**Hysteresis value below Set Value**	**53**
RL	**Range Low**	**Lowest value that can be entered as a Set Value**	**44**
DTL	Deviation Temperature Low	Deviated temperature value below Set Value which resets all cooling functions.	SP - Δ7=48
TLL	Temperature Limit Low	Lowest temperature which resets all cooling functions.	37

CTS	Cooling Hysteresis	The number of degrees from Set Value that cooling operations start and stop.	SP Δ 2

Communication Option via PLC RS-232 Communication

Via DVP14SS2 COM1 port
Com1 Port: RS-232 PLC Modbus address: 1 Data Length: 7 bit Stop bits: 1 Parity: Even Baud rate: 9600

Register	Address	Description	Function
D0 (Machine mode)	1000hex	1 is Cooling Cycle mode. 2 is Pump Only mode. 3 is Off (selector switch is in OFF position).	Selector Switch Position
D1	1001 hex	SV	Set Value
D2	1002 hex	PV	Process Value
D3	1003 hex	Fault#	Fault #
D4	1004 hex	1 is Cooling Mode Status – OK 0 is Cooling Mode Status – Not Active	Cooling Mode Status

DTB4848 Series Temperature Controller Settings

ABA Setup

Initial Settings Mode		Value Set Codes	
Code	**Description**	**A**	**ACTUAL SETTINGS**
CnPt	Input Type	**J**	
tPUn	Temperature Unit	**F**	
tP-H	Scale Range Upper Limit (or default)	**999.9**	
tP-L	Scale Range Lower Limit (or default)	**-99.9**	
CtRL	Control Mode	**onoF**	
S-HC	Control Action	**CooL**	
ALA1	Alarm 1 Mode	**5**	
ALA2	Alarm 2 Mode	**5**	
ALA3	Alarm 3 Mode	**1**	
SALA	System Alarm	**OFF**	
CoSH	Communication Write Function	**On**	
C-SL	Communication Format	**ASCII**	
C-no	Communication Address	**1**	
Bps	Communication Baud Rate	**9600**	
LEN	Communication Data Length	**8**	
Prty	Communication Parity Bit	**Even**	
StoP	Communication Stop Bit	**1**	

Operation Mode		Value Set Codes	
Code	**Description**	**B**	**ACTUAL SETTINGS**
r-S	Operation Mode	**rUn**	
SP	Decimal point for SV	**1.0**	
AL1H	Range Upper Limit	**80.0**	
AL1L	Range Lower Limit	**20.0**	
AL2H	High Temperature Limit	**100.0**	
AL2L	Low Temperature Limit	**15.0**	
AL3H	Deviation above SV Limit	**30.0**	
AL3L	Deviation below SV Limit	**7.0**	
LoC	Locks all values except SV	**Loc2**	

Regulation Mode		Value Set Codes	
Code	**Description**	**A**	**ACTUAL SETTINGS**
CtS	Set point Hysteresis +/- Value	**2.0**	
tPoF	Offset of actual to display temp	**0.0**	

SV	Setpoint Value (°F)	**60.0**	

PT # LIFS-000-100-0-1

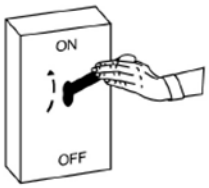
Liquid Flow Switch

Testing

a. Place cover on flow switch and turn on power. Initiate fluid flow through the system. Observe the device being activated by the flow switch to determine if device is operating as required.

b. Turn off fluid flow to determine if device is operating as required.

c. Repeat initiating and turning off fluid flow several times to test flow switch and device for proper operation.
- If operating as required, put system into service.
- If not operating as required, Flow Switch may need to be adjusted.



Adjustment

Adjustment is necessary only if required flow/no flow set-points are **above** factory set minimum.

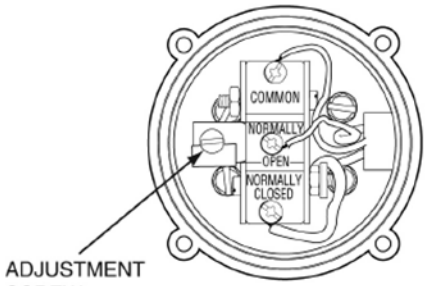
a. Turn off power. Remove electric enclosure cover.

b. Turn the adjusting screw clockwise to increase setpoint.

IMPORTANT: Do not attempt to lower flow switch setpoint from original factory minimum setting. Lowering (turning adjusting screw counterclockwise) the setpoint from original factory setting may cause erratic flow switch operation.

c. Place cover on flow switch and turn on power.

d. Test the operation of the flow switch after each adjustment.



TROUBLESHOOTING

Problem:

1. **Flow Switch Does Not Operate**
   Solution:
   - **a.** Make sure power has been turned on to device and flow switch.
   - **b.** Verify that flow rate is high enough for flow switch to activate. Measure flow rate and match with velocities shown in flow rate chart.
   - **c.** Check to see if paddle moves freely. Some system piping disassembly may be required.
2. **Flow Switch Operates Erratically**
   Solution:
   - **a.** Flow switch may be located in an area of high turbulence causing paddles to flutter.
   - **b.** Adjustment screw may have been turned below original factory setpoint. Verify that flow rate is high enough for flow switch to activate. Measure flow rate and match with velocities shown in flow rate chart.
   - **c.** Check to see if paddle moves freely. Some system piping disassembly may be required.
3. **Flow Switch Does Not Deactivate**
   Solution:
   - **a.** Check to see if paddle moves freely. Some system piping disassembly may be required.
   - **b.** Measure flow rate and match with velocities shown in flow rate chart. Flow switch must prove flow before it can indicate no flow.

MAINTENANCE SCHEDULE:

- **Inspect paddle annually. Turbulent or high flow velocity conditions may require more frequent inspection and/or replacement.**
- **Replace paddle if damaged or showing signs of wear.**
- **Replace flow switch every 5 years or 100,000 cycles, whichever occurs first.**

FLOW RATES

Flow rates required to activate the flow switch are shown in chart below. These values were calculated using clean water in a horizontal pipe.

Pipe Size NPT in. (mm)	Settings	Mode of Operation				Max. Flow Rate gpm (lpm) w/o Paddle Damage
		Flow gpm (lpm)	Velocity fps (mps)	No Flow gpm (lpm)	Velocity fps (mps)	
1 (25)	Factory or Minimum	4.9 (18.5)	1.82 (.55)	3.4 (12.9)	1.25 (.38)	27
	Maximum	17.6 (66.6)	6.53 (2.60)	15 (56.8)	5.56 (1.69)	(102)
1¼ (32)	Factory or Minimum	7.5 (28.4)	1.60 (.49)	5.3 (20.1)	1.14 (.35)	47
	Maximum	29 (110)	6.23 (1.9)	24.6 (93.1)	5.28 (1.61)	(178)
1½ (40)	Factory or Minimum	9.4 (35.6)	1.48 (.45)	6.7 (25.4)	1.05 (.32)	63
	Maximum	37.8 (143)	5.95 (1.81)	32.2 (122)	5.07 (1.54)	(239)
2 (50)	Factory or Minimum	13.7 (51.8)	1.31 (.4)	9.4 (35.6)	.9 (.27)	105
	Maximum	56.4 (214)	5.39 (1.64)	47.4 (179)	4.53 (1.38)	(398)

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Fax (800) 473- 9175, (281) 227-8404 www.waterchillers.com

SHEET #: 18

SHEET: Option: Low Ambient Fan Speed Control

LINE LEGEND

- FACTORY SUPPLIED/INSTALLED ——————
- DETAILS - - - - - - - - - -
- FACTORY OPTION —·—·—·—·—
- FIELD SUPPLIED/INSTALLED — — — —
- TERMINAL BLOCK CONTACT # [#]

LINE#

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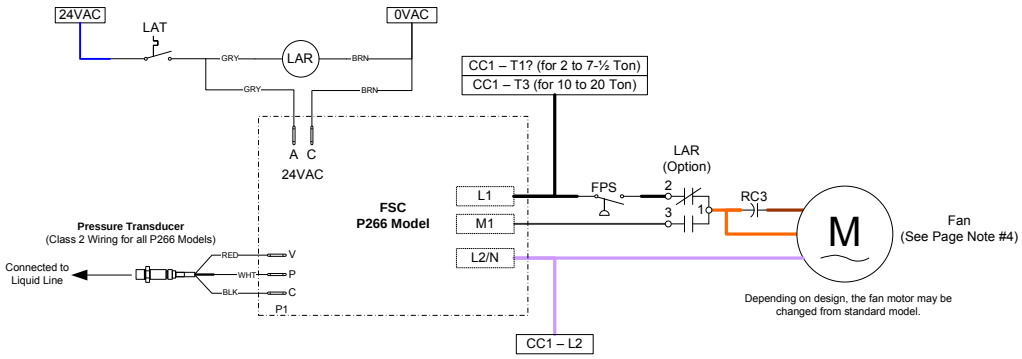
OPTION: 6 - LAFS1
LOW AMBIENT FAN SPEED CONTROL FOR SINGLE PHASE MOTOR

OPTION CODE VARIATIONS

LAFS1-5 208/230V Model
LAFS1-6 460V Model
LAFS1-1 575V Model



NOTES

- Single phase motors require a differential voltage to operate. Therefore, electrical connection to two phases of a 3-phase system or both phases of a 1-phase system. Depending on original wiring configuration of a condensing unit, the connections may vary, such as, from L1 to L3, L1 to L2, L2 to L3, T1 to L2, T2 to L3, etc.
- Function of LAR is to switch one of the voltage lines between the standard voltage and the Fan Speed Controller.

*** PAGE NOTES**

1. CONTROL TRANSFORMERS MUST BE WIRED/TAPPED FOR THE APPROPRIATE INCOMING VOLTAGE.
2. TRANSFORMERS: ONE OR TWO TRANSFORMERS MAY BE USED. ONE DUAL VOLTAGE OR TWO INDEPENDENT VOLTAGES.
3. COMPONENTS AND DESIGN ARE DEPENDENT ON SYSTEM DESIGN. (SINGLE PHASE VERSIONS ARE AVAILABLE).
4. FAN SPEED CONTROLLER WILL BE INSTALLED ON #2 FAN ON 120 TO 150 MODELS AND INSTALLED ON #3 ON 180 AND 240 MODELS. 120 AND 150 MODELS HAVE 2 FANS. 180 AND 240 MODELS HAVE 3 FANS.

COMPONENT CODES

AUX	Auxiliary (contact block)
BZ	Buzzer
CC#	Compressor Contactor 1 or 2
CCH	Crankcase Heater
COM	Common
CR#	Control Relay:
CR1	CR for Cooling Mode Status
CR2	CR for Active Cooling On
CR3	CR for Chiller Pump functions
CR4	CR for Process Pump functions
CR5	CR for Remote ON/OFF Operation
CR6	CR for Tank Level Control
DB	Distribution Block
DT	Digital Temperature Controller
F	Fuse
F1/F2	Fuse 1 and 2 (Transformer Primary)
F3	Fuse 3 (120VAC Control Voltage)
F4	Fuse 4 (24VAC Control Voltage)
FC	Fan Contactor
FPS	Fan-Cycling Pressure Switch
FST	Flow Safety Thermostat
FZT	Freeze Safety Thermostat
GND	Ground
HG	Hot Gas
HPS	High Pressure Switch
L	Line
LAR	Low Ambient Relay
LAT	Low Ambient Thermostat
LFS	Liquid Flow Switch
LPS	Low Pressure Switch
LT1	Light 1 for Cooling Status – OK
LT2	Light 2 for Cooling Status – Fault Condition
M	Motor
MS	Motor Starter
NC	Normally Closed
NO	Normally Open
PC1	Pump Contactor 1 (Chiller Pump)
PC2	Pump Contactor 2 (Process Pump)
PLC	Programmable Logic Controller
PM	Phase/Voltage Monitor
PS	Power Supply
RC	Run Capacitor
SW1	Selector Switch (Pump/Off/Cooling)
SW2	Selector Switch (Process Pump)
SW3	Local/Remote Switch
TB	Terminal Block
TC	Thermocouple (Type J only)
TLH	Tank Level Switch – High
TLL	Tank Level Switch – Low
TLM	Tank Level Switch – Mid
TRAN	Transformer

COLD SHOT CHILLERS ®

DESCRIPTION

Options for Series A Control System
Standard setup and typical variations shown or noted.

FILE: DWG_Electrical-DeltaControl-SeriesA122_020216.vsd

REF DATE: February 2, 2016

GENERAL NOTES

1. Circuit breaker(s) may be used in place of fuse(s).
2. WARNING-For continued protection against fire hazard replace fuses with the same type and rating only.
3. Unit must be permanently grounded and conform to N.E.C. & local codes.
4. Use copper conductors for field-wiring. Class 1, unless noted. All wire based on 105°C insulation wire, minimum.
5. Wire colors shown may differ from actual unit.
6. Drawing line item reference identification:
   - Number in parenthesis near output is location of controlled items. First number is sheet #, second & third are line#.
   - No underline indicates normally open (NO) contact, Underline indicates normally closed (NC) contact.
7. All intellectual property, including designs and programming logic are the property of Cold Shot Chillers and is not to be copied or used without permission from Cold Shot Chillers.
8. Design, specifications, and components are subject to change without notice.
9. Options and alternate design and components may exist and are typically dependent on design and specific parts used for the system.

P266 Series Single-Phase Condenser Fan Speed Control

Installation Instructions **Abbreviated Version**

P266xxx-x

Part No. 24-7664-2705, Rev. B
Issued April 29, 2009
Supersedes January 21, 2009

Application

IMPORTANT: Use this P266 Single-Phase Condenser Fan Speed Control only as an operating control. Where failure or malfunction of the P266 fan speed control could lead to personal injury or property damage to the controlled equipment or other property, additional precautions must be designed into the control system. Incorporate and maintain other devices, such as supervisory or alarm systems or safety or limit controls, intended to warn of or protect against failure or malfunction of the P266 fan speed control.

CAUTION: Risk of Property Damage
Use only single-phase Permanent Split Capacitor (PSC) motors approved by the manufacturer for speed control application with the P266 control. Failure to use a single-phase PSC motor may damage the motor and other property.

The P266 Single-Phase Condenser Fan Speed Control is a cost-effective, compact, weather-resistant, and durable speed control for single-phase, PSC motors used in a wide variety of low-ambient refrigeration and air conditioning condenser applications.

The P266 fan speed controls are designed to replace the Johnson Controls® P66 Series and P215 Series Fan Speed Controls and provide additional features and application flexibility.

Mounting

Location and Mounting Considerations

Observe these guidelines when locating and mounting a P266 fan speed control:

- Ensure that the mounting surface and mounting hardware can support the control and wiring.

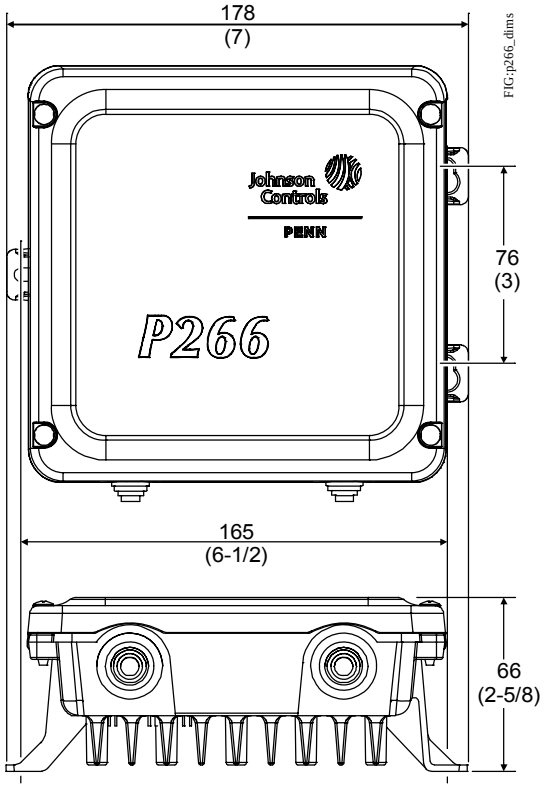


Figure 1: P266 Single-Phase Condenser Fan Speed Control Mounting Dimensions

- Mount the P266 control upright on a vertical surface with the heat sink fins oriented vertically and the conduit/electrical holes facing down.
- Ensure that air can flow through the heat sink fins and provide 10 cm (4 in.) minimum clearance around the heat sink.
- Mount the P266 control in a location away from sources of excessive heat and within the specified ambient operating conditions. See *Technical Specifications* for ambient operating conditions.

Johnson Controls

P266 Electronic Pressure Transducers

P266 controls are designed to reference either one or two Johnson Controls P266 Electronic Pressure Transducers to monitor condenser pressure.

P266 transducers are specialized versions of the P499 Series Electronic Pressure Transducers designed for use with P266 fan speed controls. See Table 3 for the available P266 transducer models.

Note: On P266 control applications that use two P266 transducers, the P266 control always references the transducer that is sensing the highest pressure.

IMPORTANT: When two P266 transducers are connected to a P266 control, the transducers must be the same model (product code number). Failure to connect the same P266 transducer models to the P266 control can result in erratic control behavior.

Refer to the *P499 Series Electronic Pressure Transducers Product/Technical Bulletin (LIT-12011190)* for information on installing P266 transducers.

Table 3: P266SNR Electronic Pressure Transducers

Product Code Number	Description
P266SNR-1C	Electronic Pressure Transducer: **0 to 35 bar (0 to 508 psi)** total range with a 1/4 in. SAE Female Flare connection and a 2 meter (3.1 ft) cable.
P266SNR-2C	Electronic Pressure Transducer: **0 to 52 bar (0 to 754 psi)** total range with a 1/4 in. SAE Female Flare connection and a 2 meter (3.1 ft) cable.

Technical Specifications

P266xxx-x

Product	P266xxx-x Single Phase Condenser Fan Speed Control
Input Supply Power	208-240 VAC 50/60 Hz or 480-575 VAC 50/60 Hz depending on model (Refer to the label inside the P266 control housing cover for rated voltage range and model-specific wiring diagram.)
Low-Voltage Power Supply	P266A and P266B Types: External 24 VAC Class 2, 20 VA Supply Transformer P266Exx Types: Low-voltage power for P266 control is provided by an onboard transformer. **Note:** When auxiliary fan starters are connected to P266E type controls, you must provide an external Safety Extra-Low Voltage (SELV) AC supply to power the fan starters (Figure 2).
Ambient Operating Conditions	**Temperature:** -20 to 60°C (-4 to 140°F) **Humidity:** Up to 95% RH non-condensing; Maximum Dew Point 29°C (85°F)
Ambient Shipping and Storage Conditions	**Temperature:** -40 to 85°C (-40 to 185°F) **Humidity:** Up to 95% RH non-condensing; Maximum Dew Point 29°C (85°F)
Low-Voltage Connections	1/4 in. Quick-Connect terminals, 30 m (100 ft) maximum wiring runs
Input Transducer	P266SNR-x Pressure Transducer: 5 VDC for 0.5 to 4.5 VDC ratio metric analog signal
Enclosure Type	NEMA 3R, IP54
Case Construction	Aluminum Die Casting
Cover Construction	UV Stabilized Polycarbonate/ABS
Dimensions (HxWxD)	159 x 177 x 70 mm (6-1/4 x 7 x 2-3/4 in.)
Weight	Heaviest Model Weight: 1.0 kg (2.2 lb) Approximate Shipping Weight: 1.2 kg (2.6 lb)
Compliance	**Europe:** Mark: CE Compliant; CENELEC EN 60947-1 & 4-2; RoHS Directive (2002/95/EC); WEEE Directive (2002/96/EC)
	North America: ETL, UL508C; cETL C22.2 No. 107.1; FCC Compliant to CFR47, Part 15, Subpart B, Class B Industry Canada (IC) Compliant to Canadian ICES-003, Class B limits
	Australia: C-Tick Compliant (N1813)

The performance specifications are nominal and conform to acceptable industry standards. For application at conditions beyond these specifications, consult Johnson Controls Application Engineering at (414) 524-5535. Johnson Controls, Inc. shall not be liable for damages resulting from misapplication or misuse of its products.

Cold Shot Chillers

"ECONOMICALLY PRICED DEPENDABILITY"

TECHNICAL SPECIFICATION

Model: ACWC-180-EM-DR[1]-__[2]-__[3]-__[4]

Description:
Two stage portable air-cooled water chiller system. To provide approximately 180,000 Btu/hr of cooling capacity with a leaving fluid temperature of 50°F with an ambient air temperature of 95°F.

CAPACITY ±5% AT 50° LCWT / 95°F AMBIENT		**180,000 BTU /HR**				
COMPRESSOR / REFRIGERANT		TANDEM HERMETIC SCROLL / R410A				
CONDENSER FANS / AIRFLOW		3 / 12000 CFM				
CONDENSER COILS TYPE		COPPER TUBE / ALUMINUM FIN				
EVAPORATOR TYPE		STAINLESS STEEL / COPPER BRAZED				
FLUID CONNECTIONS		2" MNPT (IN/OUT)				
ELECTRICAL:	**V - Ø - HZ**	COMP RLA / LRA (ea.)		FAN FLA (ea)	PUMP FLA	MCA
-1	**575 - 3 - 60**	9.0	78	1.0	3.3	26.5
- 5	**230 - 3 - 60**	25.0	164	2.4	8.4	71.8
- 6	**460 - 3 - 60**	12.2	100	1.4	3.9	35.5
PUMP HP / OUTPUT		3 HP / 95 GPM @ 30 PSI				
TANK SIZE / CONSTRUCTION		80 GALLON / 304 STAINLESS STEEL TANK WITH LID				
DIMENSIONS		88" L x 40" W x 70" H				
WEIGHT (APPROX.)		1600 LBS				

Note: All specifications subject to change without notice. Specify voltage and ambient condition upon ordering.
MCA: Minimum circuit amps per UL 1995.

STANDARD FEATURES:

- **Controls:** Electronic temperature controller with constant (set point & process) temperature readout on standard units, actual and programmed temperature LED readout.
- **Refrigeration Components:** Efficient scroll compressors, sight glass/moisture indicators, balance port expansion valves, filter drier, pump down valves, fan cycling head pressure controls.
- **Process Fluid Components:** Bronze "Y" strainer with 20 mesh stainless steel screen. Pumps are stainless steel centrifugal. Tanks are insulated with shoe box lid, fill port, and level sight glass. Portable systems will include a bypass flow valve.
- **Safety Controls:** High/low pressure refrigerant pressure, freeze, low water flow, overloads for compressor and fan motors, safety fuses or overloads for pump.
- **Construction:** Welded steel powder coated frame and full metal cabinet, copper piping connections.
- **Warranty:** One year parts / five year compressor.

SUITABLE AMBIENT CONDITIONS/FEATURES:

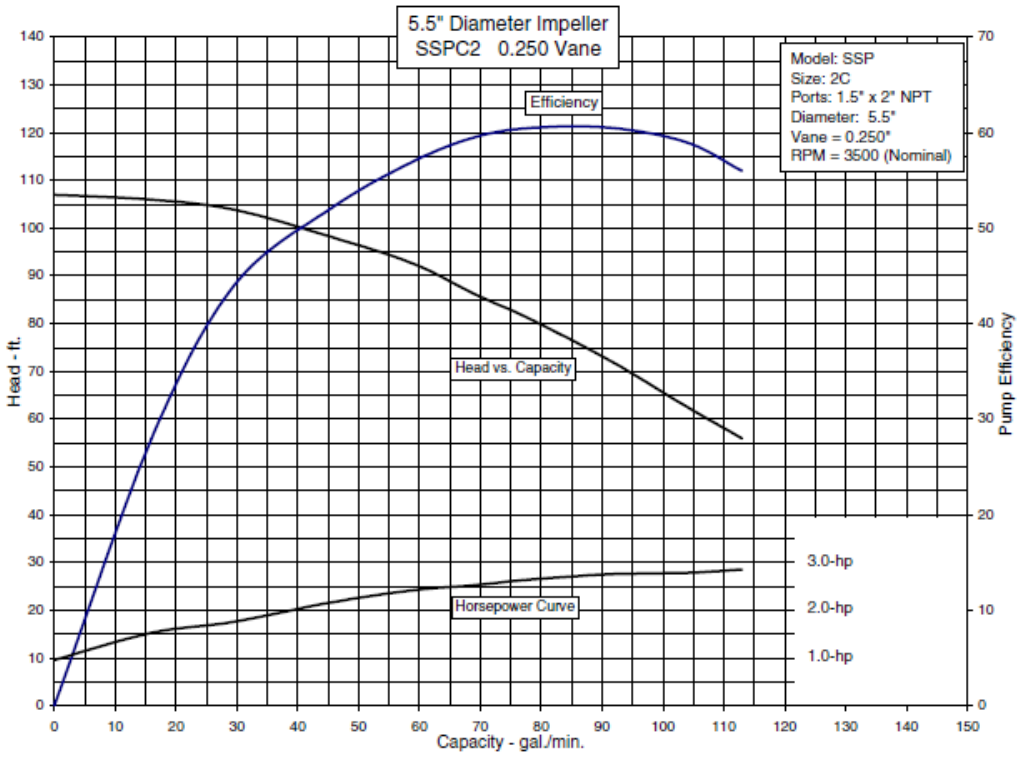
- **IND:** Indoor use only. Casters on frame.
- **40:** Suitable for outdoor use with an ambient of 40°F ambient. Casters, optional.
- **0:** Suitable for outdoor use to 0°F ambient. Includes low ambient fan speed controls with (LT) models. Casters, optional.
- **M20:** Suitable for outdoor use to -20°F ambient. Includes with low ambient fan speed controls with hot gas bypass. External Wind baffles. Casters, optional.

[1] Flow Design (_=Portable, ST=Stationary, RF=Reverse Flow, EXCH=Extra Heat Exchanger, DP=Dual Pump, DR=Dual Return)
[2] Leaving Fluid Temperature (_=Standard, LT=Low Temperature-specify lowest temperature in °F)
[3] Ambient Temperature Conditions (see above)
[4] Electrical Power Code (see above)

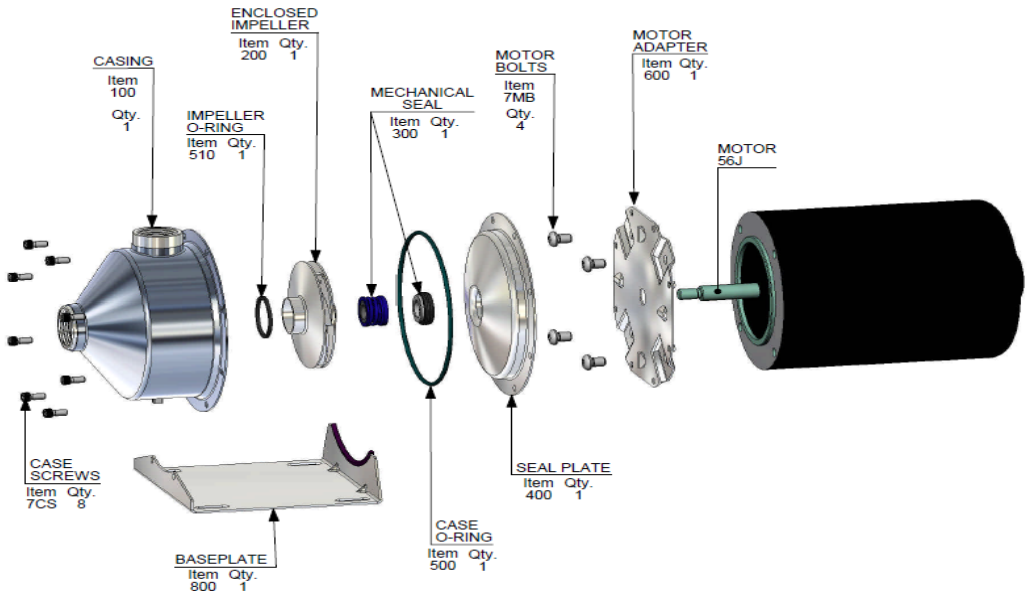
Performance Curve and Data Sheet

PUOD-240-003-0-0

3-Hp/3Ø Motor ODP/ Pump with 5.5”Impeller and 0.250”Vane at 3500rpm



Clean water based performance at 60 deg. F. 3/01/01



ASP-SSPC Pump/Motor Assembly Exploded View

- If needed, the pump label is located on the pump casing near outlet port under the insulation. Carefully pull insulation up near the unglued section. Pump Base *(not supplied with footed motors)*
- Reference the chiller serial number when ordering parts for specific supplied pump.

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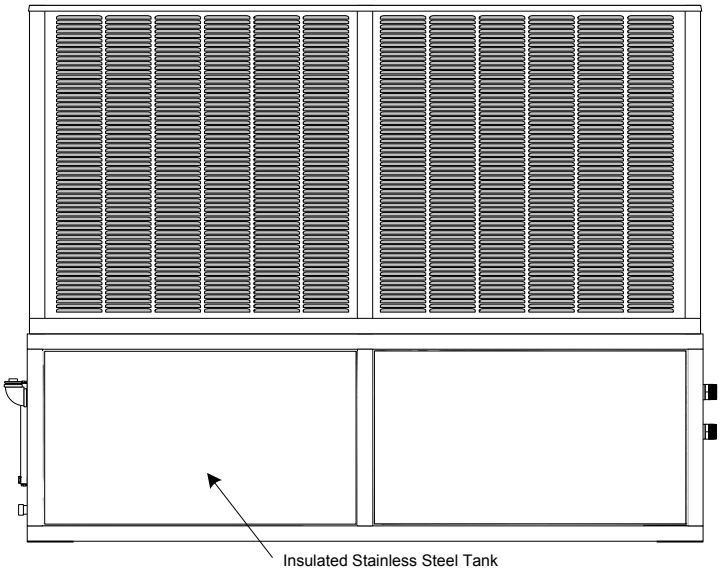
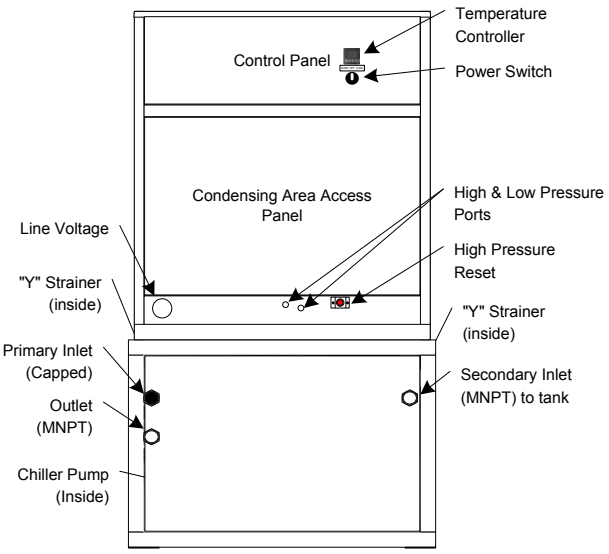
Fax (800) 473- 9175, (281) 227-8404 • www.waterchillers.com

LEFT



FRONT



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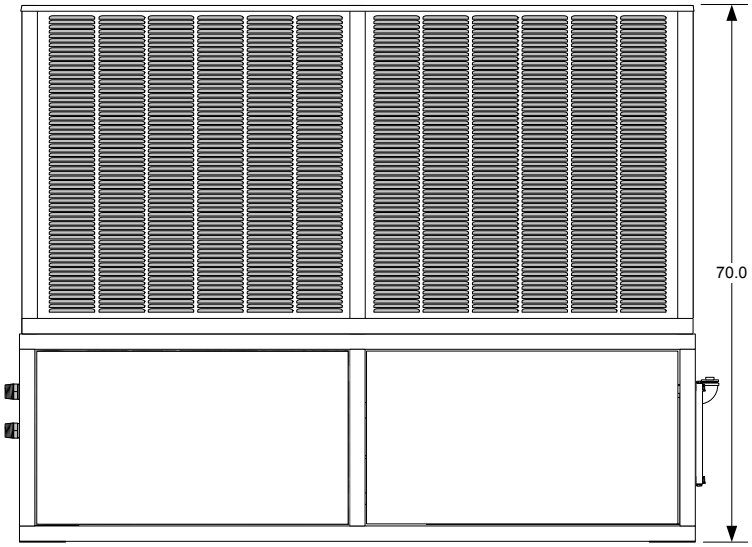
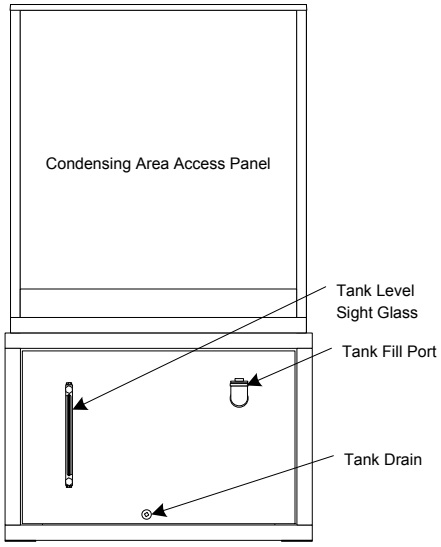
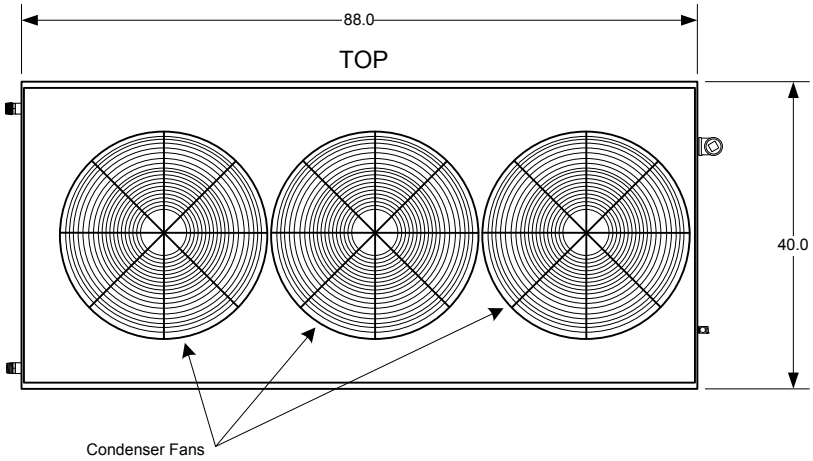


BACK



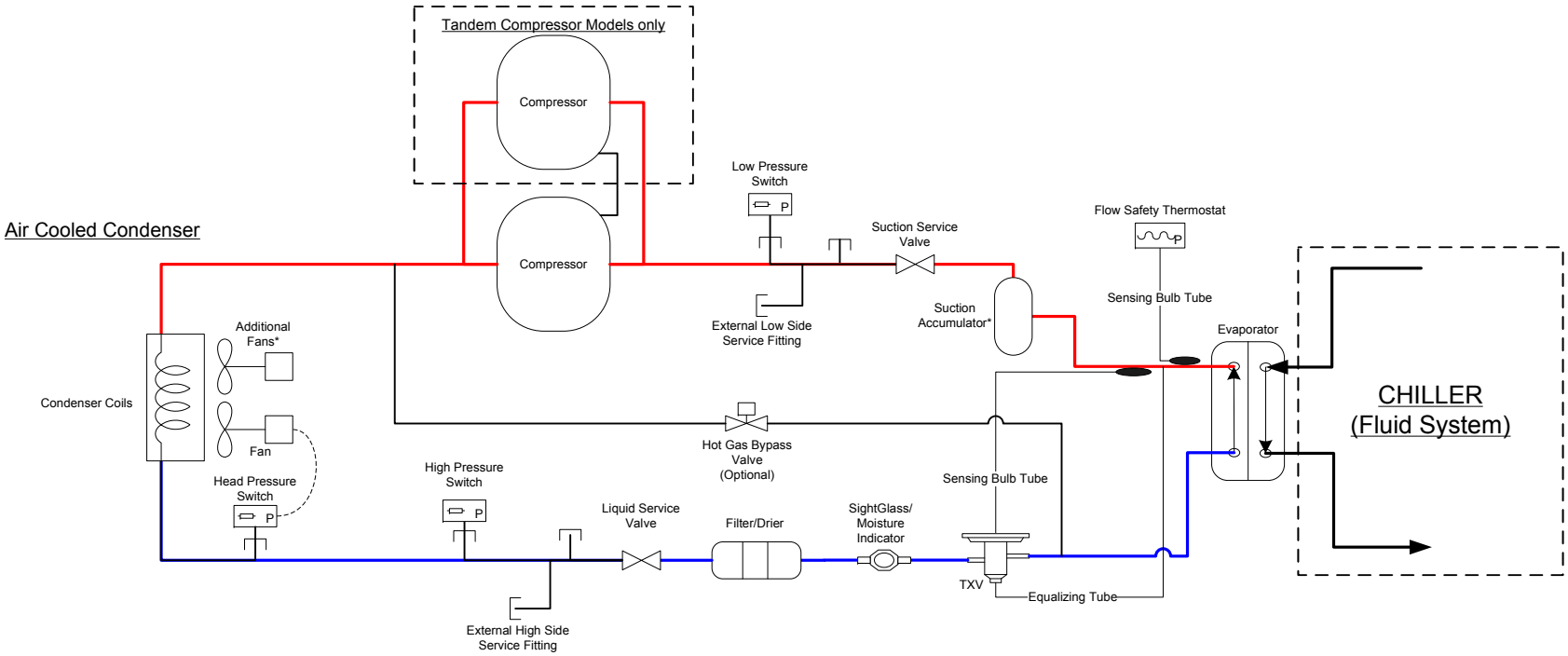
TOP



NOTES

- Unit should be installed with at least 4' clearance on all sides and a minimum of 8' clear air space above the unit
- Dimensions are approximate. (inches)
- Casters (Optional)
- All specifications subject to change without notice.

COLD SHOT CHILLERS	SIZE	VIEW	DWG NO	REV
	A	Front-Back-Left-Right-Top	**INSTALLATION DRAWING** **ACWC-180-240-E-DR (with Full Metal Cabinet)**	1
DRAWN ENGINEERING				
ISSUED 5/27/2016	SCALE N.T.S.	DWG-INST_ACWC-180-240-E-DR(FMCandWindBaffle)_(0216).vsd	SHEET 1 OF 3	



NOTES

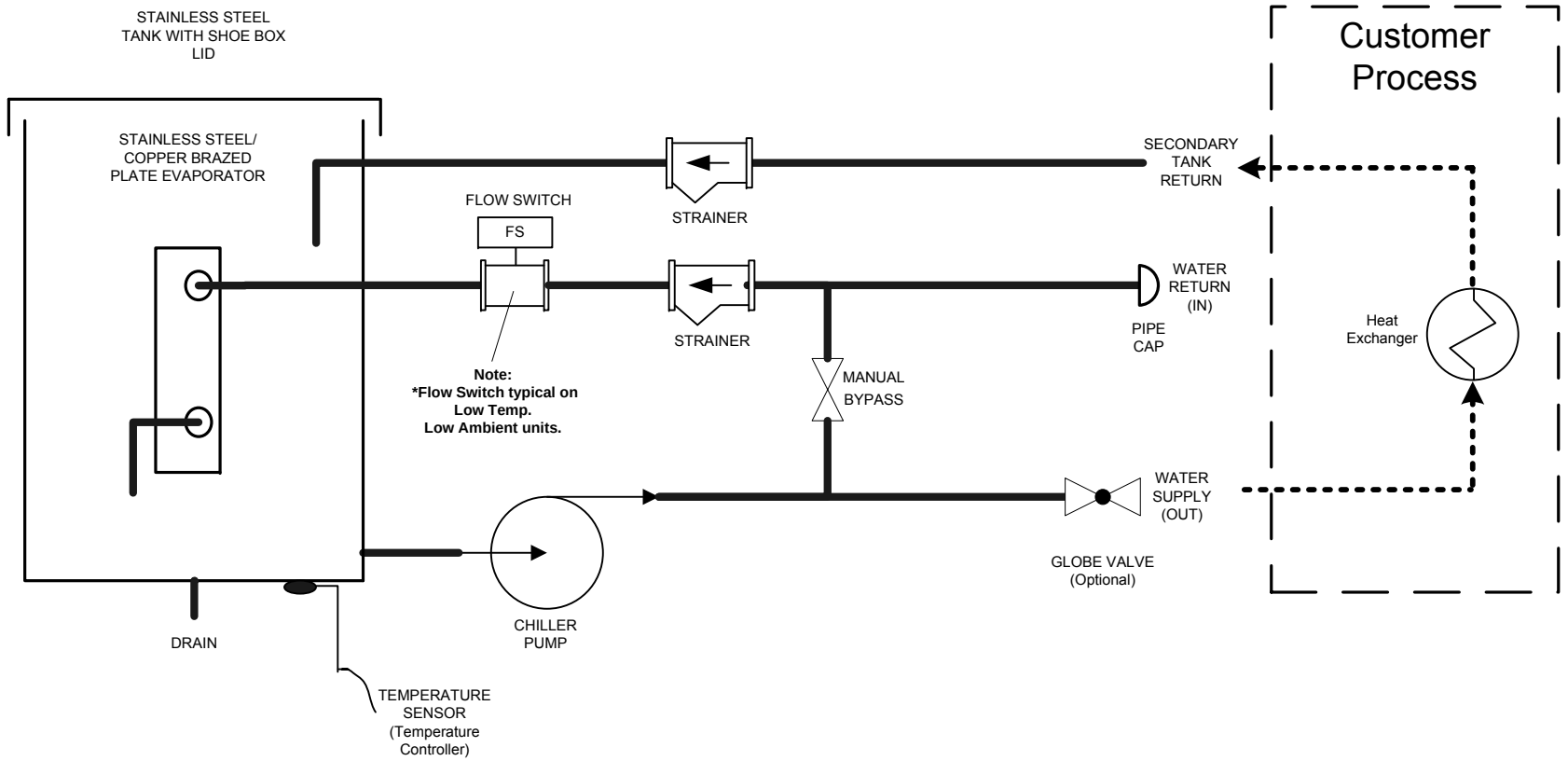
- All specifications and designs are subject to change without notice.
- Hot Gas Bypass optional. For capacity and/or ambient condition use.
- Temperature Controller typically monitors the tank temperature on portable models, the entering temperature (from the process) on stationary and reverse flow models.
- Flow Safety thermostat typical on indoor units or outdoors to 40F ambient, typically.
- External service fittings, typically on models sizes 120 to 240.
- * Dependent on system design.
- All service fittings contain Schrader valve cores.

LEGEND

- Service Fitting with Schrader Valve Core

COLD SHOT CHILLERS

DRAWN	ENGINEERING	SIZE: A	DETAIL: Typical ACWC 1circuit	REFRIGERATION & CHILLED FLUID CIRCUIT: **Typical Air-Cooled Water Chiller (ACWC) Single Refrigerant Circuit System**	REV: 2
ISSUED	3/5/2015	SCALE: NTS	DWG_RefrigerantCircuit(Ref-Chw)-ACWC-SingleCircuit-Typical_0215.vsd	SHEET: 1	



COLD SHOT CHILLERS

DRAWN: ENGINEERING	SIZE: A	FSCM NO:	DWG NO: **CHILL WATER CIRCUIT – TYPICAL** **E - "Portable - Dual Return with Globe Valve and Flow Switch"**	REV: 1
ISSUED: 05/2011	SCALE: NA			SHEET: 2

SHEET: 1

LINE LEGEND

- FACTORY SUPPLIED/INSTALLED
- DETAILS
- FACTORY OPTION
- FIELD SUPPLIED/INSTALLED
- TERMINAL BLOCK CONTACT # [#]

LINE#

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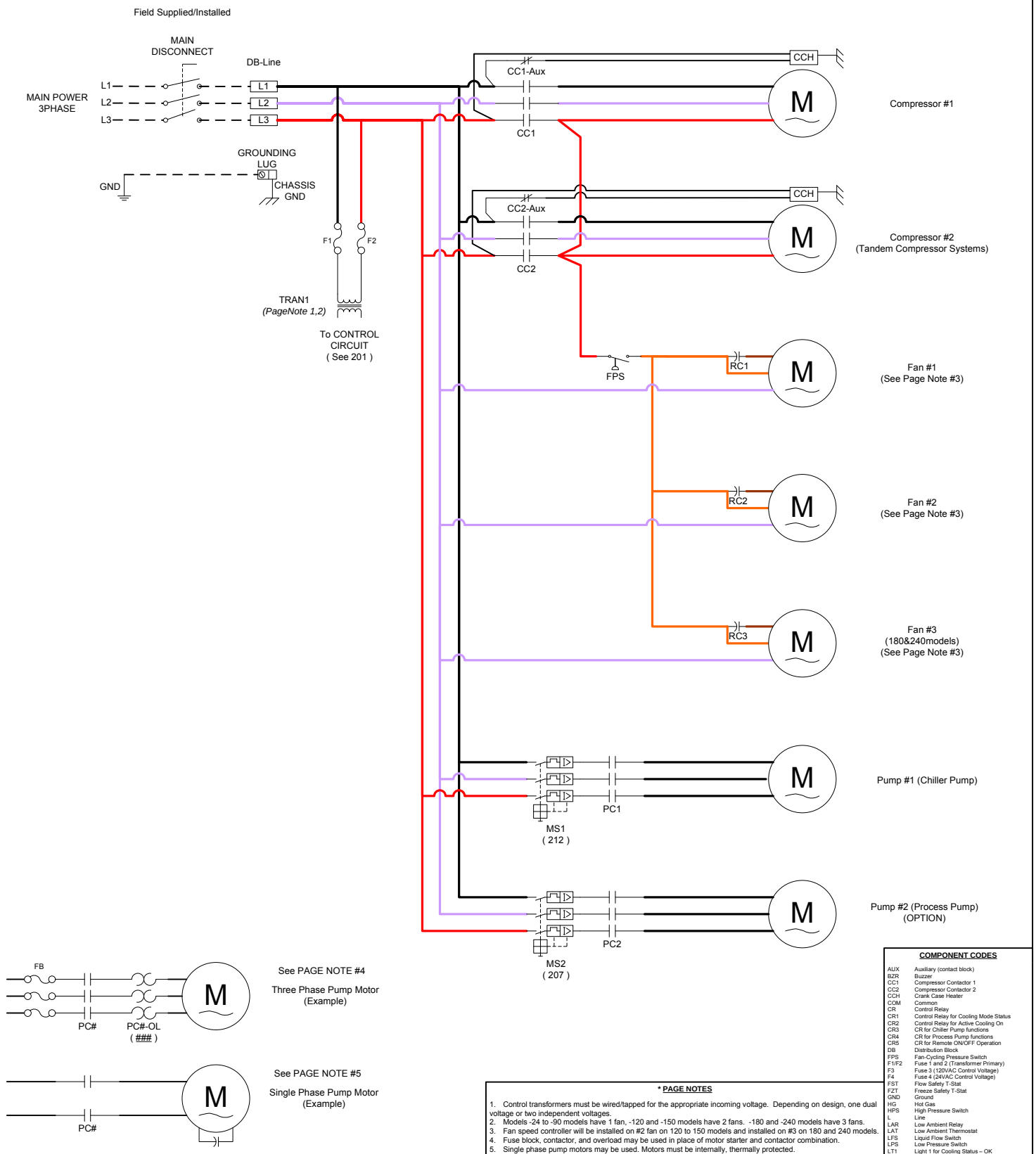

*** PAGE NOTES**

1. Control transformers must be wired/tapped for the appropriate incoming voltage. Depending on design, one dual voltage or two independent voltages.
2. Models -24 to -90 models have 1 fan, -120 and -150 models have 2 fans. -180 and -240 models have 3 fans.
3. Fan speed controller will be installed on #2 fan on 120 to 150 models and installed on #3 on 180 and 240 models.
4. Fuse block, contactor, and overload may be used in place of motor starter and contactor combination.
5. Single phase pump motors may be used. Motors must be internally, thermally protected.

COMPONENT CODES

AUX	Auxiliary (contact block)
BZR	Buzzer
CC1	Compressor Contactor 1
CC2	Compressor Contactor 2
CCH	Crank Case Heater
COM	Common
CR	Control Relay
CR1	Control Relay for Cooling Mode Status
CR2	Control Relay for Active Cooling On
CR3	CR for Chiller Pump functions
CR4	CR for Process Pump functions
CR5	CR for Remote ON/OFF Operation
DB	Distribution Block
FPS	Fan-Cycling Pressure Switch
F1/F2	Fuse 1 and 2 (Transformer Primary)
F3	Fuse 3 (120VAC Control Voltage)
F4	Fuse 4 (24VAC Control Voltage)
FST	Flow Safety T-Stat
FZT	Freeze Safety T-Stat
GND	Ground
HG	Hot Gas
HPS	High Pressure Switch
L	Line
LAR	Low Ambient Relay
LAT	Low Ambient Thermostat
LFS	Liquid Flow Switch
LPS	Low Pressure Switch
LT1	Light 1 for Cooling Status – OK
LT2	Light 2 for Cooling Fault Condition
M	Motor
MS	Motor Starter
NC	Normally Closed
NO	Normally Open
PC1	Pump Contactor 1 (Chiller Pump)
PC2	Pump Contactor 2 (Process Pump)
PLC	Programmable Logic Controller
PS	Power Supply
RC	Run Capacitor
SW1	Selector Switch (Pump/Off/Cooling)
SW2	Selector Switch (Process Pump)
SW3	Local/Remote Switch
TB1	Terminal Block 1 (for Internal)
TB2	Terminal Block 2 (for External)
TC	Thermocouple
TLH	Tank Level Switch – High
TLL	Tank Level Switch – Low
TLM	Tank Level Switch – Mid
TRAN	Transformer

COLD SHOT CHILLERS ®

DESCRIPTION

ELECTRICAL DRAWING: Series A – Level 1 Delta Controls
Typical design for One and Two Compressor systems.
Using standard 24VDC on/off inputs. 24VAC controls outputs.
Options and typical variations shown or noted.

PAGE: A120-PowerCircuit(3phase) **PAGE#:** 1

EDIT DATE: August 26, 2015

FILE: DWG_Electrical-DeltaControl-SeriesA120_081915.vsd

GENERAL NOTES

1. WARNING-For continued protection against fire hazard replace fuses with the same type and rating only.
2. Unit must be permanently grounded and conform to N.E.C. & local codes.
3. Use copper conductors for field-wiring. Class 1, unless noted. All wire based on 105°C insulation wire, minimum.
4. Wire colors shown may differ from actual unit.
5. Drawing line item reference identification:
   - Number in parenthesis near output is location of controlled items.
   - First number is sheet #, second & third are line#
   - No underline indicates normally open (NO) contact
   - Underline indicates normally closed (NC) contact
6. Design, specifications, and components are subject to change without notice.
7.

SHEET #: 2

SHEET: A1-Control

LINE LEGEND
- FACTORY SUPPLIED/INSTALLED
- DETAILS
- FACTORY OPTION
- FIELD SUPPLIED/INSTALLED
- TERMINAL BLOCK CONTACT # #

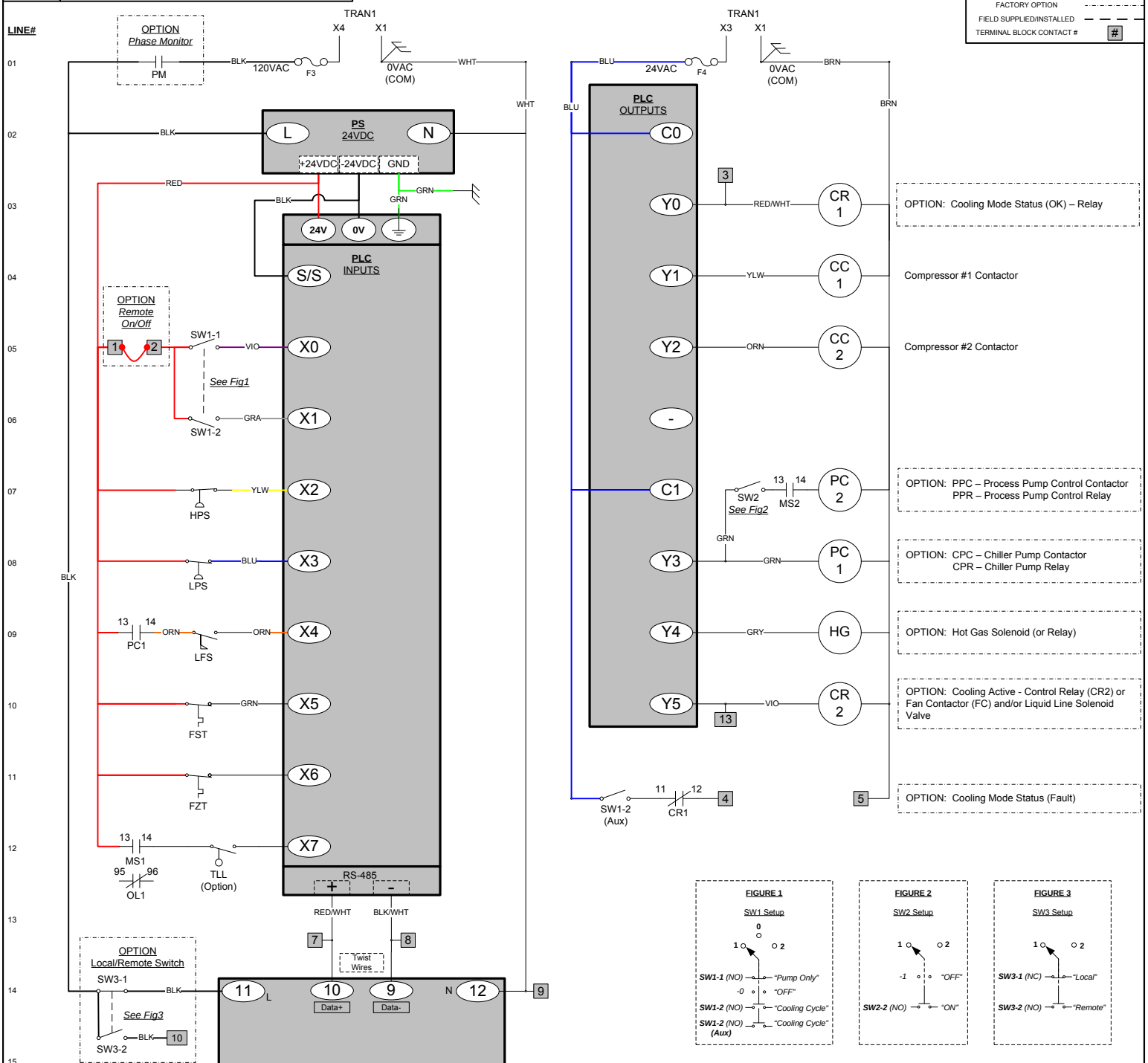

FIGURE 1
SW1 Setup
SW1-1 (NO) — "Pump Only"
-0 — "OFF"
SW1-2 (NO) — "Cooling Cycle"
SW1-2 (NO) (Aux) — "Cooling Cycle"

FIGURE 2
SW2 Setup
-1 — "OFF"
SW2-2 (NO) — "ON"

FIGURE 3
SW3 Setup
SW3-1 (NC) — "Local"
SW3-2 (NO) — "Remote"

*** PAGE NOTES**

1. Control transformers must be wired/tapped for the appropriate incoming voltage. Depending on design, one dual voltage or two independent voltages. Operation of system with improperly wired transformer is considered abuse and resulting damage is not covered by warranty. Transformers may include breaker.
2. **PLC inputs** dependent on system design. 24VDC required to unused inputs.
3. **PLC outputs** dependent on system design:
   Y0 - "Cooling Mode Status". Only available when in cooling cycle and cooling circuit is in operational mode (not in alarm condition).
   Y2 - used on tandem compressor systems only.
   Y3 - pump operation (for systems with internal chiller pump or output available for external pump) (optional). Pump condition status relay or light (optional). Pump relay use dependent on design.
   Y4 - hot gas solenoid or relay (optional).
   Y5 - on when any compressor is on (used for fan contactor/relay "CR1" and/or liquid solenoid valve purposes).
4. **Switch identification**: "SW#" is switch ID. "SW#-#" is switch ID with position.
   SW1 – Mode Selector switch (3 position to include 2 single NO contact blocks. Cooling Cycle may use double NO contacts for aux purposes or additional stacked NO single block)
   SW2 – Process Pump "ON/OFF" switch (2 position to include 1 single NO contact block)
   SW3 – Local/Remote switch (2 position to include 1 single NC and 1 single NO contact block)
5. Delta controls with program A1##. (PLC and Temperature Controller must be programmed for system model/design.
6. Terminal blocks are dependent on system design. TBs may or may not be included in system.
7. RS-232 communication available. Refer to instruction guide.
8. Motor Starter auxiliary contacts used with motor starter/contactor combination models. Overload auxiliary contacts used with overload models.

COMPONENT CODES

AUX	Auxiliary (contact block)
BZ	Buzzer
CC#	Compressor Contactor 1 or 2
CCH	Crankcase Heater
COM	Common
CR#	Control Relay:
CR1	CR for Cooling Mode Status
CR2	CR for Active Cooling On
CR3	CR for Chiller Pump functions
CR4	CR for Process Pump functions
CR5	CR for Remote ON/OFF Operation
CR6	CR for Tank Level Control
DB	Distribution Block
DT	Digital Temperature Controller
F	Fuse
F1/F2	Fuse 1 and 2 (Transformer Primary)
F3	Fuse 3 (120VAC Control Voltage)
F4	Fuse 4 (24VAC Control Voltage)
FC	Fan Contactor
FPS	Fan-Cycling Pressure Switch
FST	Flow Safety Thermostat
FZT	Freeze Safety Thermostat
GND	Ground
HG	Hot Gas
HPS	High Pressure Switch
L	Line
LAR	Low Ambient Relay
LAT	Low Ambient Thermostat
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LPS	Low Pressure Switch
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LT2	Light 2 for Cooling Status – Fault Condition
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MS	Motor Starter
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PC1	Pump Contactor 1 (Chiller Pump)
PC2	Pump Contactor 2 (Process Pump)
PLC	Programmable Logic Controller
PM	Phase/Voltage Monitor
PS	Power Supply
RC	Run Capacitor
SW1	Selector Switch (Pump/Off/Cooling)
SW2	Selector Switch (Process Pump)
SW3	Local/Remote Switch
TB	Terminal Block
TC	Thermocouple (Type J only)
TLH	Tank Level Switch – High
TLL	Tank Level Switch – Low
TLM	Tank Level Switch – Mid
TRAN	Transformer

DESCRIPTION

Options for Series A Control System
Standard setup and typical variations shown or noted.

FILE: DWG_Electrical-DeltaControl-SeriesA1-Options_010816.vsd

REF DATE: January 8, 2016

GENERAL NOTES

1. Circuit breaker(s) may be used in place of fuse(s).
2. WARNING-For continued protection against fire hazard replace fuses with the same type and rating only.
3. Unit must be permanently grounded and conform to N.E.C. & local codes.
4. Use copper conductors for field-wiring. Class 1, unless noted. All wire based on 105°C insulation wire, minimum.
5. Wire colors shown may differ from actual unit.
6. Drawing line item reference identification:
   - Number in parenthesis near output is location of controlled items. First number is sheet #, second & third are line#.
   - No underline indicates normally open (NO) contact, Underline indicates normally closed (NC) contact.
7. All intellectual property, including designs and programming logic are the property of Cold Shot Chillers and is not to be copied or used without permission from Cold Shot Chillers.
8. Design, specifications, and components are subject to change without notice.
9. Options and alternate design and components may exist and are typically dependent on design and specific parts used for the system.

SHEET #:	SHEET:
3	Option: System ON-OFF

OPTION CODE VARIATIONS

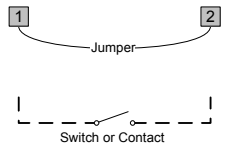
- RS Remote System ON/OFF Control with internal supplied 24VDC (requiring Dry Contacts)
- RS-V Remote System ON/OFF Control with internal supplied 24VAC
- RS-V-6 Remote System ON/OFF Control with internal supplied 120VAC
- RS-VE Remote System ON/OFF Control with **external** supplied 24VAC
- RS-VE-6 Remote System ON/OFF Control with **external** supplied 120VAC

LINE LEGEND

FACTORY SUPPLIED/INSTALLED ——————
DETAILS - - - - - - - - - -
FACTORY OPTION - · - · - · - · -
FIELD SUPPLIED/INSTALLED — — — —
TERMINAL BLOCK CONTACT # [#]

LINE#

STANDARD OPTION: RS
Remote System ON/OFF Control
(Start/Stop Chiller System using Internal 24VDC via Terminal Blocks to Remote Dry Contacts)



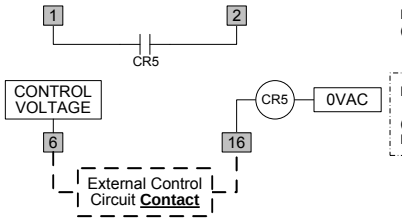
Factory Supplied (with temporary jumper)

Example 1 (Remove Jumper and connect to external dry contact)

NOTES

- USE: To provide low control voltage to a remote location control circuit dry set of contacts to permit start and stop the Chiller system function. Chiller operation dependent on position of system selector switch (SW1).
- METHOD: Designated numbered terminal blocks providing 24VDC (Class 1) voltage to the system selector switch SW1. Position of SW1 determines mode to start and stop.
  1. Contacts must Close for ON
  2. Contacts Open for OFF
  3. SW1 on chiller must be in the appropriate position
- Interconnections are field supplied and installed.
- Switch may be Factory or Field supplied.
- Temporary Jumper to be removed prior to operation ("J1" Tag typically attached to jumper wire)
- Note on chiller to state that prior to servicing, the selector switch (SW1) must be in the OFF position to prevent remote operation. Unit could start at any time.

OPTION: RS-V
Remote System ON/OFF Control
(Start/Stop Chiller System using Internal 24VAC via Terminal Blocks to Remote Dry Contacts)



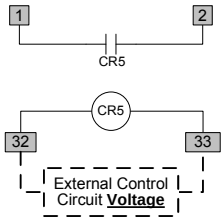
Remote ON/OFF Relay (CR5) NO Contact (Factory wiring to terminals)

Remote ON/OFF Relay (Voltage Specific, standard 24VAC) (Factory Mounted Internally, Operated Remotely)

NOTES

- USE: To provide internal control voltage to a remote location control circuit dry set of contacts to permit start and stop the Chiller system function. Chiller operation dependent on position of system selector switch (SW1).
- METHOD: Designated numbered terminal blocks providing 24VAC (Class 1) provide voltage to the system selector switch SW1.
  1. Contacts Close for ON
  2. Contacts Open for OFF
  3. SW1 on chiller must be in the appropriate position
- Interconnections are field supplied and installed.
- Switch may be Factory or Field supplied.
- Temporary Jumper to be removed prior to operation ("J1 "Tag typically attached to jumper wire)
- Note on chiller to state that prior to servicing, the selector switch (SW1) must be in the OFF position to prevent remote operation. Unit could start at any time.

OPTION: RS-VE
Remote System ON/OFF Control
with External Supplied Control Voltage



Remote ON/OFF Relay (CR5) NO Contact (Factory wiring to terminals)

Remote ON/OFF Relay (Voltage Specific, standard 24VAC) (Factory Mounted Internally, Operated Remotely)

NOTES

- USE: To provide low control voltage to a remote location control circuit dry set of contacts to permit start and stop the Chiller system function. Chiller Pump function is to pump fluid through the evaporator of the chiller.
- METHOD: Designated numbered terminal blocks requiring specific voltage supplied from external source, Class 2 wiring capable. Voltage depends on control relay (CR5) voltage. Standard voltage of relay is 24VAC, unless specified differently prior to order.
  1. Voltage to terminals for ON
  2. No Voltage to terminals for OFF
  3. SW1 on chiller must be in the appropriate position
- Interconnections are field supplied and installed.
- Temporary Jumper to be removed prior to operation ("J1 "Tag typically attached to jumper wire)
- Note on chiller to state that prior to servicing, the selector switch (SW1) must be in the OFF position to prevent remote operation. Unit could start at any time.
- System will have multiple power sources.

COMPONENT CODES

AUX	Auxiliary (contact block)
BZ	Buzzer
CC#	Compressor Contactor 1 or 2
CCH	Crankcase Heater
COM	Common
CR#	Control Relay:
CR1	CR for Cooling Mode Status
CR2	CR for Active Cooling On
CR3	CR for Chiller Pump functions
CR4	CR for Process Pump functions
CR5	CR for Remote ON/OFF Operation
CR6	CR for Tank Level Control
DB	Distribution Block
DT	Digital Temperature Controller
F	Fuse
F1/F2	Fuse 1 and 2 (Transformer Primary)
F3	Fuse 3 (120VAC Control Voltage)
F4	Fuse 4 (24VAC Control Voltage)
FC	Fan Contactor
FPS	Fan-Cycling Pressure Switch
FST	Flow Safety Thermostat
FZT	Freeze Safety Thermostat
GND	Ground
HG	Hot Gas
HPS	High Pressure Switch
L	Line
LAR	Low Ambient Relay
LAT	Low Ambient Thermostat
LFS	Liquid Flow Switch
LPS	Low Pressure Switch
LT1	Light 1 for Cooling Status – OK
LT2	Light 2 for Cooling Status – Fault Condition
M	Motor
MS	Motor Starter
NC	Normally Closed
NO	Normally Open
PC1	Pump Contactor 1 (Chiller Pump)
PC2	Pump Contactor 2 (Process Pump)
PLC	Programmable Logic Controller
PM	Phase/Voltage Monitor
PS	Power Supply
RC	Run Capacitor
SW1	Selector Switch (Pump/Off/Cooling)
SW2	Selector Switch (Process Pump)
SW3	Local/Remote Switch
TB	Terminal Block
TC	Thermocouple (Type J only)
TLH	Tank Level Switch – High
TLL	Tank Level Switch – Low
TLM	Tank Level Switch – Mid
TRAN	Transformer

COLD SHOT CHILLERS ®

DESCRIPTION

Options for Series A Control System
Standard setup and typical variations shown or noted.

FILE: DWG_Electrical-DeltaControl-SeriesA122_020216.vsd

REF DATE: February 2, 2016

GENERAL NOTES

1. Circuit breaker(s) may be used in place of fuse(s).
2. WARNING-For continued protection against fire hazard replace fuses with the same type and rating only.
3. Unit must be permanently grounded and conform to N.E.C. & local codes.
4. Use copper conductors for field-wiring. Class 1, unless noted. All wire based on 105°C insulation wire, minimum.
5. Wire colors shown may differ from actual unit.
6. Drawing line item reference identification:
   - Number in parenthesis near output is location of controlled items. First number is sheet #, second & third are line#.
   - No underline indicates normally open (NO) contact, Underline indicates normally closed (NC) contact.
7. All intellectual property, including designs and programming logic are the property of Cold Shot Chillers and is not to be copied or used without permission from Cold Shot Chillers.
8. Design, specifications, and components are subject to change without notice.
9. Options and alternate design and components may exist and are typically dependent on design and specific parts used for the system.

Notes

MAINTENANCE RECORD

DATE	PROCEDURE PERFORMED

Cold Shot Chillers

"ECONOMICALLY PRICED DEPENDABILITY"

TYPICAL START-UP CHECK LIST

EQUIPMENT MODEL#		SERIAL#			
OWNER NAME		PHONE#			
ADDRESS					
CITY		STATE		ZIP	
INSTALLING CONTRACTOR		PHONE#			
ADDRESS					
CITY		STATE		ZIP	
START-UP PERFORMED BY		PHONE#			

**** Designates Pre-Startup items. To be performed before Startup of system.***

1. *Manual referred to for details on installation and startup (IMPORTANT). ☐ Yes ☐ No
2. *Add additional information and notes on back of form, as needed. ☐ Yes ☐ No
3. *Is there any physical damage? ☐ Yes ☐ No
   a. Will this prevent start-up? ☐ Yes ☐ No

   Description:_____

   _____
4. *Unit is installed level as per the installation instructions. ☐ Yes ☐ No
5. *Electrical circuit protection has been sized & installed properly. ☐ Yes ☐ No
6. *Power supply agrees with the unit nameplate. ____V ____Ø ____Hz ☐ Yes ☐ No
7. *Electrical power wiring is installed properly. ☐ Yes ☐ No
8. *All terminals and plug assemblies are tight. ☐ Yes ☐ No
9. *Unit is grounded properly. ☐ Yes ☐ No
10. *Control voltage is appropriate per electrical drawing. _____V ☐ Yes ☐ No
11. *All piping is connected properly, as appropriate. ☐ Yes ☐ No
12. *All chilled water valves are open, as appropriate. ☐ Yes ☐ No
13. *Crankcase heaters energized for 24 hours before start-up. ☐ Yes ☐ No
14. *Outdoor piping wrapped with electric heater tape, if necessary. ☐ Yes ☐ No
15. *Water loop volume greater than 6gal/ton. ☐ Yes ☐ No
16. *Proper fluid loop freeze protection provided to _____˚F
    a. With type _____mixture_____% with_____%
17. Chilled water pump is operating with the correct rotation. ☐ Yes ☐ No
18. All air has been purged from the system. ☐ Yes ☐ No
19. Evaporator flow appropriate for capacity expected.(~3gpm/ton) ☐ Yes ☐ No
20. Check the pump(s) seals for any signs of leaking. ☐ Yes ☐ No
21. Measure the following under full load with clear refrigerant sight glass. ☐ Yes ☐ No

Suction Pressure:	PSI	Ambient Temp:	˚F
Discharge Pressure:	PSI	Entering Fluid Temp:	˚F
Suction Line Temp:	˚F	Leaving Fluid Temp:	˚F
Superheat:	˚F	Set Value:	˚F

22. Heat Exchanger models: If an extra heat exchanger is included with the chiller, ensure flow is adjusted through the exchanger to achieve desired cooling:

Flowrate: gpm	Temp In: ˚F	Temp Out: ˚F

23. Clean any strainers, as needed. ☐ Yes ☐ No
24. Operation Manual is given to customer. ☐ Yes ☐ No

COMMENTS:

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_____

SIGNATURES:

START UP TECHNICIAN _____

DATE _____

CUSTOMER REPRESENTATIVE _____

DATE _____

Cold Shot Chillers

"ECONOMICALLY PRICED DEPENDABILITY"

COLD SHOT CHILLERS

Marrone & Co., Inc.

2730 Maximilian Drive, Houston, Texas 77032 • Phone (800) 473-9178, (281) 227-8400
Fax (800) 473- 9175, (281) 227-8404 • www.waterchillers.com

Cold Shot Chillers®

"Economically Priced Dependability"

1 YEAR
COMPLETE PARTS
PRODUCT WARRANTY
LIMITED

EFFECTIVE WITH PRODUCT MANUFACTURED BEGINNING JANUARY 1995

Dear Consumer:

Congratulations on your purchase of this new Water Chiller. This certificate is our warranty to you. Please ensure that you have completed the reverse side of this certificate and mail a copy back to us.

COMPLETE UNIT WARRANTY
THE WATER CHILLER DESCRIBED ON THE REVERSE SIDE OF THIS CERTIFICATE IS WARRANTED AGAINST DEFECTS IN MATERIAL OR WORKMANSHIP UNDER NORMAL USE AND MAINTENANCE FOR A PERIOD OF ONE (1) YEAR FROM THE PURCHASE DATE WE WILL PROVIDE A REPLACEMENT PART FOR ANY PART FOUND TO BE DEFECTIVE. THIS WARRANTY DOES NOT INCLUDE SERVICE OR LABOR CHARGES CONNECTED WITH THE DETERMINATION OR REPLACEMENT OF DEFECTIVE PARTS OR FREIGHT CHARGES TO SHIP THESE PARTS.

EXTENDED PARTS WARRANTY
In addition to the above Complete Unit Warranty, the following extended warranties may apply to your unit:

FOUR YEAR ADDITIONAL EXTENDED WARRANTY of compressors. LIFETIME WARRANTY of tanks against leakage, base frames against rust through (20 tons and under) and casters.

Upon the expiration of the "Complete Unit Warranty", the above listed components are warranted for an additional term as listed above against defects in material or workmanship under normal use and maintenance. We will provide a replacement part for any part found to be defective. This warranty does not include service or labor charges connected with the determination or replacement of defective parts or freight charges to ship these parts.

EXCLUSIONS:
The foregoing provisions state the exclusive remedy for any breach of warranty or any other claim in respect to the product described on the reverse side of this certificate. THE EXPRESS WARRANTIES CONTAINED HEREIN ARE IN LIEU OF ALL OTHER WARRANTIES. IMPLIED WARRANTIES, INCLUDING WARRANTIES OF MERCHANTABILITY ARE LIMITED TO THE DURATION OF THE COMPLETE UNIT WARRANTY DESCRIBED ABOVE. CONSEQUENTIAL OR INCIDENTAL DAMAGES FOR BREACH OF ANY WARRANTY EXPRESS OR IMPLIED ARE EXCLUDED.

Some states do not allow limitations on how long an implied warranty lasts or the exclusions of consequential or incidental damages, so the above limitations and exclusions may not apply to you. This warranty gives you specific legal rights and you may also have other rights which vary from state to state.

This warranty shall be void if:

1. The unit is not installed, operated or serviced in accordance with the installation and operation instructions furnished, and with the recommendations of the Air Conditioning Contractors of America (ACCA). If you do not have a copy of the installation and operation instructions, please write directly to our office to receive one.
2. Components or other accessories not compatible with the unit have been used with or attached to the unit.
3. The user has otherwise abused or failed to maintain the unit.
4. The unit is installed outside the United States of America, Canada or Mexico.
5. The defect or damage is not caused by the manufacturer (see reverse side).

RETAIN THIS CERTIFICATE WITH YOUR VALUABLE DOCUMENTS

SHOULD YOU REQUIRE IN-WARRANTY PARTS UNDER THE TERMS STATED ABOVE, CONTACT US FOR REPLACEMENT PARTS.

Cold Shot Chillers®
Marrone & Co., Inc.
14020 Interdrive West • Houston, TX 77032
Tel: (281) 227-8400 • 1-800-473-9178 • Fax: (281) 227-8404

OWNER – PLEASE RETAIN A COPY OF THIS CERTIFICATE WITH YOUR VALUABLE DOCUMENTS

EQUIPMENT DESCRIPTION & INSTALLATION DATA

MODEL NUMBER	INSTALLED BY (SERVICE AGENCY OR PERSON)
UNIT SERIAL NO.	ADDRESS STREET
PURCHASER	CITY STATE
ADDRESS STREET	DATE INSTALLED
CITY STATE	AIR CONDITIONING REFRIGERATION LICENSE #, CLASS, STATE

IMPORTANT

The following are the responsibilities of the user. They are examples of defects or damages that are not manufacturing defects, and are, therefore, not included in this Limited Warranty.

1. Damage to unit or unsatisfactory operation due to improper cleaning or use of unit in corrosive atmosphere.
2. Damage to unit from unsatisfactory operation due to blown fuses, inadequate or interrupted electrical protective devices or operations of unit on power supply other than covered by name plate rating of unit.
3. Damage due to transportation or handling prior to and during installation.
4. Damage due to accident or from alteration, improper installation, or tampering.
5. Misapplication or under sizing of product.