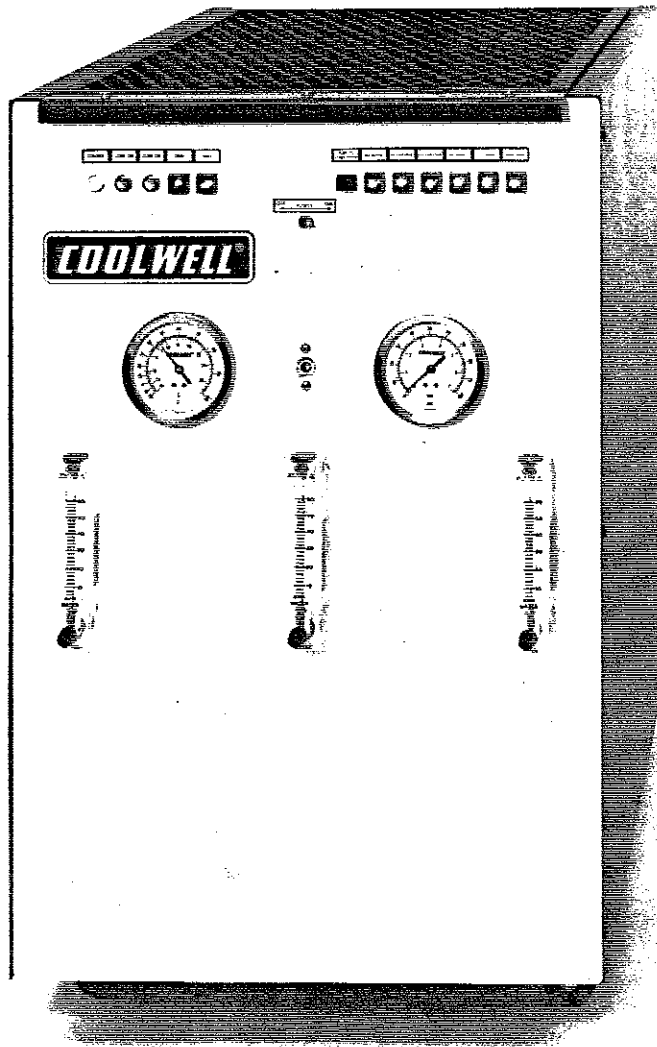


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COOLWELL

SE-082W

SE - STYLE CHILLER



OPERATING MANUAL

SECTION 1 --- GENERAL DESCRIPTION

The COOLWELL refrigerated recirculating liquid chiller is designed to provide a coolant to a heat load (e.g., laser, optical instrument, process equipment) at a consistent temperature.

The COOLWELL SE-style unit uses a uniquely designed refrigeration system which acts in conjunction with the hermetically-sealed closed-loop pumping system which delivers coolant at the prescribed temperature to the heat load, then returns the now-heated coolant to an evaporator (thereby cooling the coolant back to the prescribed temperature while heating the refrigerant gas).

The condenser cools the refrigerant gas using either air or water. This basic refrigeration concept can be enhanced by various diagnostic and protective features, most of which are incorporated into most units.

The COOLWELL chiller requires very little maintenance. When the occasional breakdown eventually does occur, contact the factory with any questions or to order repair parts. Section 5 of this Operating Manual provides some basic diagnostic guidance for use in communicating the chiller's status to the COOLWELL technical representative.

See the nameplate mounted on the front panel for certain data pertinent to that particular unit.

SECTION 2 --- INSTALLATION

Site

Select a suitable clean and dry indoor location. The ambient air temperature must be between 48°F and 90°F (9°C to 32°C). The general rule not to install any electrical motors or apparatus into a non-ventilated enclosure or closet applies to the COOLWELL recirculator as well. An air-conditioned or well-ventilated room with a steady temperature is desirable.

Air-Cooled models have a heat output that is approximately 30% higher than the removed heat load of the instrument being cooled. The chiller's air intake is in the rear and the exhaust is on the top; neither one should be blocked, thereby permitting free air flow.

Water-Cooled models produce negligible heat. The only heat-producing device in this unit is the pump motor and the hermetically-sealed compressor. The heat removed from the instrument being cooled goes down the drain with the condensing cooling water. Should the building have a cooling tower, the COOLWELL could be connected to that system, thereby saving on the use of tap water.

Connections

(1) Electrical

- (a) Ensure chiller switch is in "OFF" position; this switch can be found either on the front panel of the unit or inside on the electrical circuit box (accessed by removing the top grating).
- (b) Connect the line power to the junction box located at the rear panel in accordance with applicable electrical codes.

(c) make other connections to the served heat load's circuit using workmanlike electrical terminations to the terminal block located in the junction box on the rear panel.

(2) Tap or Cooling Tower Water

The tap water connections are to be made to the back of the chiller according to the markings "Tapwater IN" and "Tapwater OUT". The copper fittings have a 3/8" female pipe thread.

(3) Sealed Cooling Loop

Connect a reinforced high pressure hose to the "Supply" and "Return" (labeled as such) connectors of the COOLWELL and to the instrument being cooled. The standard size hose connectors are for 3/8" ID hoses; use a good quality hose and clamps.

(4) Open Tank Cooling

The hermetically-sealable tank of the COOLWELL permits the cooling of open containers, such as cooling baths, aquariums, etc. The use of bigger 5/8" ID return hose to reduce the suction pressure should be considered. If there is the possibility of particles being sucked into the return line, an oversized strainer --- one which does not restrict the flow rate --- should be installed inside the tank being cooled. Be aware that a partially-blocked suction line may cause the hose to collapse and the pump to run dry with substantial damage to it.

IMPORTANT NOTE

When installing connectors, use a second wrench on the fitting to counteract the tightening force. When connecting the tap water supply and drain, follow the local plumbing codes and requirements. Be careful in the use of nylon tape sealing dope. Small bits and pieces have occasionally jammed the automatic water regulating valve. Non-hardening paste dope, like "Leak-Lock", "Permatex #2" or equals have performed satisfactorily.

SECTION 3 --- START-UP

3a. Pre-Heat Compressor

Pre-heating the compressor before start-up is a good preparatory measurement. Liquid refrigerant may have migrated into the compressor and its lubricating oil. Refrigerant in liquid form is a degreasing solvent and as such may hinder the proper lubrication during the start-up time. Furthermore, when the refrigerant changes its state from liquid to gas, it produces a deep chill which could result in breaking or bending of the compressor's valve reeds.

The applied heat from the crankcase heater gently changes the liquid refrigerant inside the compressor into gas, providing the compressor with the media it was designed to pump (i.e., gas), and raises the oil temperature for the best lubrication.

The COOLWELL's compressor is equipped with a small crankcase heater. It is good practice to have the heater connected for 8 to 10 hours prior to start, particularly when the unit's temperature is below 68°F (20°C). This is accomplished by keeping the COOLWELL's power switch in the OFF position while the power is supplied to the unit. The white panel light indicates that the heater is ON.

3b. Fill Coolant Tank

- (1) If the unit has a Low Liquid Tank Level Switch, flip the bypass service switch labeled "Normal-Bypass" into the "bypass" position. In this position the tank's liquid level control switch is bypassed and the compressor will not operate.
- (2) Remove the tank lid wing nuts and fill the tank with coolant fluid to a point 1" from the top of the tank; if using the recommended COOL-PREP coolant additive, refer to the instructions included with the additive. The unit's coolant system capacity is approximately 2 gallons. Have some distilled or demineralized water nearby and ready to pour.
- (3) Turn the power switch ON; if the unit is equipped with a Low Flow switch, depress the "Push to Start Flow" button usually found on the front panel; watch the tank level go down, but continue pouring the fill water.

3c. Fill Coolant Tank (Open-Tank installation only)

If the chiller is being used to maintain the temperature of an open tank, that tank's liquid will serve as the coolant itself. The procedures outlined in Section 3b should be followed, using the open tank's liquid as coolant fluid; the chiller tank can be separately filled as outlined in Section 3b or the open tank's liquid can be allowed to flow into the chiller tank through gravity or suction (siphon) flow.

3d. Tap water supply

Open tap or facility cooling tower water supply valve (water-cooled units only).

3e. Power On

After all procedures of the previous sections have been completed, set the Normal-Bypass switch inside the unit to the "Normal" position. The compressor will start after a short delay time when the power switch is ON.

NOTE: START-UP WITHOUT PRE-HEATING

If the recommended pre-heat time (see Section 3a) is not available, as a precautionary measure the initial start-up of the compressor should be done with repetitive interruptions. When the compressor comes on, turn it off again immediately using the unit's "Power ON/OFF" switch, permitting only a very brief turnover. Repeat this ON/OFF, ON/OFF procedure several times. Note that the start of the compressor is always time delayed after every power interruption. The protective time delay module will space the ON/OFF interval time safely. The purpose of this short boost jogging is to remove the liquid refrigerant out of the compressor in small portions in order not to cause any harm.

SECTION 4 --- OPERATION

4a. Coolant supply temperature

- (1) The temperature set-point for the coolant supply to the heat load is pre-set at the factory. Changes in the level of heat load will not vary the coolant supply temperature unless the heat load is increased above the rated capacity of the chiller.
- (2) In order to adjust the coolant supply temperature, a flat-blade screwdriver is used to turn the control thermostat shaft found on the front panel. Very small angular rotation of the thermostat shaft will alter the coolant temperature several degrees, rotating clockwise to increase. Be sure to allow adequate time after adjustment for the coolant loop to achieve thermal balance before deciding to adjust further.

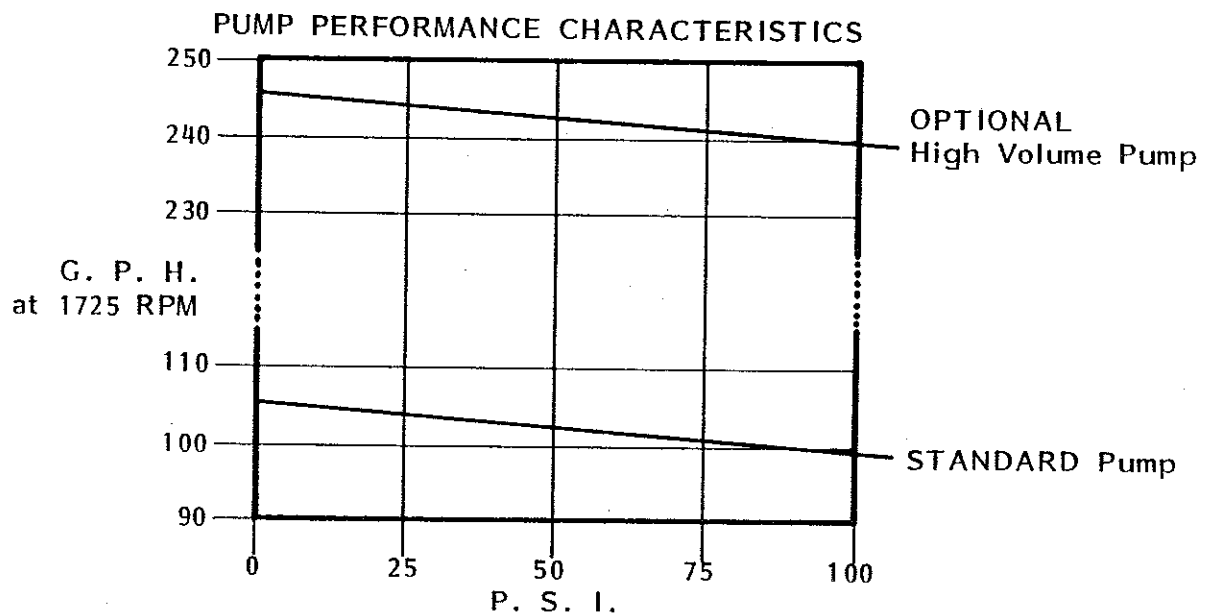
4b. Coolant pressure/flow rate

(1) Pressure

The pumping pressure in the coolant loop may be adjusted with the regulating valve (marked "P2 Bypass Adjustment") found inside the unit in the coolant path after the pump discharge; the specific location of this valve will depend on the options installed on a given unit. The pressure may range up to 100 psi loop resistance within the parameter of the pump's flow-rate capacity. For stress reduction of the cooling loop and in the best interest of the instrument cooled, it is recommended to keep the supply pressure as low as practical. Remember, the main determinant of an efficient cooling process is the flow-rate.

For readjusting, loosen the lock-nut and turn clockwise to increase and counterclockwise to decrease pressure. The factory - "not to exceed" - pressure setting is 60 psi. (You will read less, but if you block the supply line by kinking the hose, you will read 60 psi.)

- (2) The pump capacity of the standard COOLWELL recirculator is 100 GPH (6.3 l/min.). The optional high-capacity pump is rated 240 GPH (15.2 l/min.). Both pumps have flat flow rate/pressure ratios as shown in the diagram:



The flow rate should be changed with the pressure adjusting valve. However, if no flowmeter is incorporated in the recirculating loop, it is difficult to judge the exact flow rate. Some instruments have restrictive safety switches incorporated which require a certain amount of pressure to function.

If an optional flowmeter with a metering valve feature is incorporated in the circuit, the metering valve should only be used for a fine adjustment. Therefore, it is preferably kept wide open (approximately 5.5 turns) and the adjustment carried out with the valve itself.

4c. Tap water flow adjustment (water-cooled models only)

The tap water regulating valve is found near the floor of the chiller prior to the water's entry into the condenser. This valve is factory-set and should not need any correction.

However, if it seems to be necessary, it is serviceable and field adjustable, but this adjustment should only be attempted under the direction of a COOLWELL factory technician.

4d. Flushing Coolant

Coolant should be drained annually in order to insure cleanliness of plumbing lines and to maximize the heat transfer efficiency within the evaporator and the heat load.

In order to drain the coolant loop,

- (1) shut off the heat load (or temporarily re-plumb it from the chiller to tap water);
- (2) remove the left side panel of the unit (as viewed from rear facing forward);
- (3) open the drain valve immediately in front of the reservoir tank and allow the approximately two gallons of coolant to drain into catch vessel;
- (4) open the small in-line drain cap near the floor of the unit near the front, using a 3/8" I.D. hose to lead approximately 1 cup of coolant to a shallow catch vessel;

- (5) if the unit has a filter, unscrew the filter bowl and empty its coolant contents into a catch vessel; use this opportunity to change filter cartridge; replace cartridge and bowl;
- (6) unscrew the bowl of the small strainer found just before the pump in the coolant flow line, emptying its coolant content into a catch vessel; wash the filter element; replace the element and bowl;
- (7) Follow the procedure outlined in Section 3, para. 3b to re-fill the coolant system.

NOTE

If the unit is being drained for storage or shipment, the evaporator and plumbing (including tap water) lines should be freeze-protected by blowing all coolant out; this can easily be done with compressed air.

NOTE

The coolant treatment, filter cartridges, and filter bowl are available from COOLWELL.

SECTION 5 --- TROUBLE-SHOOTING

5a. General

The diagnostic and protective circuitry included in most COOLWELL chillers combine to reduce maintenance problems and to provide fast and correct maintenance action once trouble does develop.

The diagnostic profile described in this section presumes a model which is fully equipped with the recommended gauges and indicators.

It is anticipated that the Coolwell factory technical staff will be contacted in case of the unit's failure to function. Knowledgeable observation of the diagnostic indicators along with simple observation of the unit's noise level, cycling, etc. will normally greatly speed the return of the chiller to full operating function once this information is shared with the COOLWELL technical staff.

5b. Specific properties/modes monitored

1) Compressor heater	white light
2) Compressor	green light
3) Pump	green light
4) Coolant temperature	dial gauge
5) Coolant pressure	dial gauge
6) Cooling mode	blue light
7) Non-cooling mode	red light
8) Low Flow (coolant pump rate)	red light
9) High Cut-Out (refrigerant discharge pressure)	red light
10) Low Cut-Out (refrigerant suction pressure)	red light
11) High Temperature (coolant temperature)	red light
12) Low Temperature (coolant temperature)	red light
13) Low Tank Level (coolant tank level)	red light

5c. Abnormal indications

(1) Hi Cut-Out: red lamp is lit, the unit is off.

The "hi cut-out" is a compressor head-pressure limiting control with a manual reset feature. It trips when the compressor's head pressure is too high. The control (labeled "Hi Cut-Out") can be found inside the unit behind the electrical component enclosure.

Excessive head pressures develop when the condenser does not get sufficient cooling or when the ambient air temperature is above 90°F.

Remedy: Air-cooled condenser: remove air blockage from around compressor.

Water-cooled condenser: clear tap water lines, including particularly the strainer and filter.

(2) Lo Cut-Out: red lamp is lit, the unit is off.

The "Lo Cut-Out" is a pressure limiting control with a manual reset feature. It senses the compressor's suction line pressure and trips when the suction pressure gets too low. The control (labeled "Lo Cut-Out") can be found inside the unit behind the electrical component enclosure. Too low pressure develops when the evaporator temperature is too low or the system has lost refrigerant.

Remedy: Leak test, repair leak, recharge refrigeration system, using local refrigeration service technician

(3) Hi-Temp: red lamp is lit, the unit is off

The Hi-Temp is a safety thermostat incorporated to limit the coolwater temperature to the high side. It resets automatically when the coolwater temperature lowers approximately 10°F below its set point. The factory set point is 95°F.

Possible causes of the switch activating include:

- a) Control thermostat is set too high
- b) Ambient temperature too high
- c) The analytical instrument's heat load exceeds the cooling capacity of the chiller
- d) Freon loss.

Expedient recovery:

In order to pull water temperature down fast with the help of the compressor, a momentary pushbutton switch (labeled "Hi-Temp Bypass" has been installed just above the toggle bypass switch inside the unit. To speed matters up, shut off the heat load and depress the switch until the temperature reads approximately 83°F. At this temperature the Hi-Temp limit control should have reset. Take in consideration that when the button is first depressed the compressor will not start right away because of the normal time delay for the compressor to start. The control is factory set at 95°F.

Remedy: a) replace control thermostat

b) reduce heat load to a level within its rated capacity

c) leak test, repair leak, recharge refrigeration system using local refrigeration service technician.

(4) Lo-Temp: red lamp is lit, the compressor is off

The Lo-Temp control is a thermostat that provides a lower limit for the coolwater temperature. It resets automatically when the coolwater temperature rises 1°F above its lower limit set point and is factory set at 60°F.

(5) Tank level: red lamp is lit, the unit is off

The liquid level of the tank should be filled to approximately one inch below the rim. If the liquid level should fall approximately 3" below the top, the magnetic float of a reed-switch will open and shut down the system.

It may be a good practice to check the tank level from time to time because of a possible small loss of liquid due to dripping of the pump (which is normal) or other small leaks somewhere else in the cooling loop which may be too small to be noticed. Checking tank level and refilling should always be done while the pump is operating.

Remedy: repair leak

(6) No Flow: red lamp is lit, unit is off

The pump is pumping at too low a flow rate, causing a magnetic switch to activate, shutting the unit down.

Possible causes of low flow include:

- a) Failure of pump or pump motor
- b) blockage in coolant line.

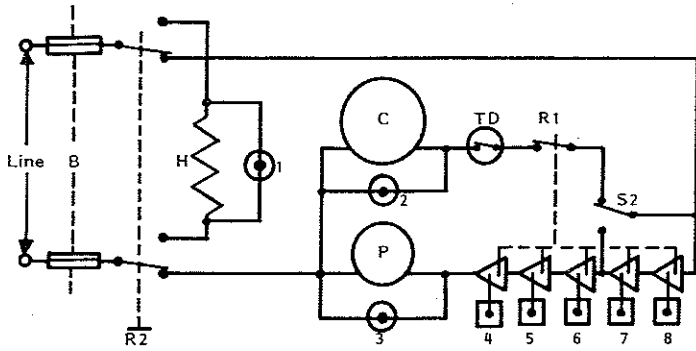
Remedy: a) repair/replace pump/motor;

- b) remove blockage in coolant line (e.g., filter, strainer).

NOTE

The "Push to Start Flow" button must be depressed in order to restart the unit.

ELECTRICAL SYSTEM DIAGRAM



- 1 white Indicator Lamp for Heater
- 2 green Indicator Lamp for Compressor
- 3 green Indicator Lamp for Pump
- 4 red Lamp with Switch for High Pressure Limit
- 5 red Lamp with Switch for Low Pressure Limit
- 6 red Lamp with Switch for High Temperature Limit
- 7 red Lamp with Switch for Low Temperature Limit
- 8 red Lamp with Switch for Tank Water Level

- B Magnetic Circuit Breaker
- H Compressor Oil Heater
- C Compressor
- P Recirculating Pump
- TD 5 min. Time Delay Switch
- R1 Compressor Switch
- R2 Main Switch DPDT
- S2 Bypass Service Switch

OPERATION

The COOLWELL S-Series single unit recirculating cooling system consists of two hermetically sealed closed-loop circuits – the pumping cycle and the chiller cycle.

The pumping cycle supplies the instrument with a clean, pulsation-free and non-fluctuating coolant to prevent image shake and loss of resolution quality. This is accomplished through a five-micron fine filter cartridge, the Puls-Out™ dampening device, and the unique B-F-L System™. The heat loaded liquid from the instrument flows back into the hermetically sealed stainless steel tank for re-cooling. It whirls turbulently around the Twist-Ex™ heat exchanger coil at a rate of 100 GPH (380 l/h) for highest efficiency and temperature stability. The hermetically sealable tank keeps oxygen out, thus inhibiting the growth of algae and bacteria. It also permits the cooling of open baths. The magnetic tank-level control switch activates a warning light and will turn the system off if as little as a quart of coolant is lost.

The chiller cycle with the B-F-L System™ provides the proper cooling. The quiet, fully hermetic compressor is safe-guarded by an accumulator and a crankcase heater. The accumulator, a liquid trap, assures that only gas enters the compressor. The crankcase heater keeps the oil warm during the off-duty period to provide a better start and longer life for the compressor. The fins of the air-cooled condenser are protected by a reusable filter to maintain full cooling efficiency.

The electrical system is circuit breaker protected. A safe low-voltage pilot circuit and magnetic contactors are used to switch power. Five safety controls and a solid state time-delay module protect the equipment. Eight panel-mounted control lights indicate electrical functions. A terminal junction box is standard with each unit. This provides an easy remote control or electrical integration with the instrument cooled.

DESIGN FEATURES

Electrical:

- Slow speed quiet compressor motor
- Slow speed quiet pump motor
- System magnetic circuit breaker protection
- Time delay, short-cycle protection
- Low-voltage electronic control circuitry
- Five pilot lights for safety indications
- Three pilot lights for operations
- Wiring of military specs. No. MIL-W-76, exceeding the requirements of VDE
- Outlet for low-voltage remote control

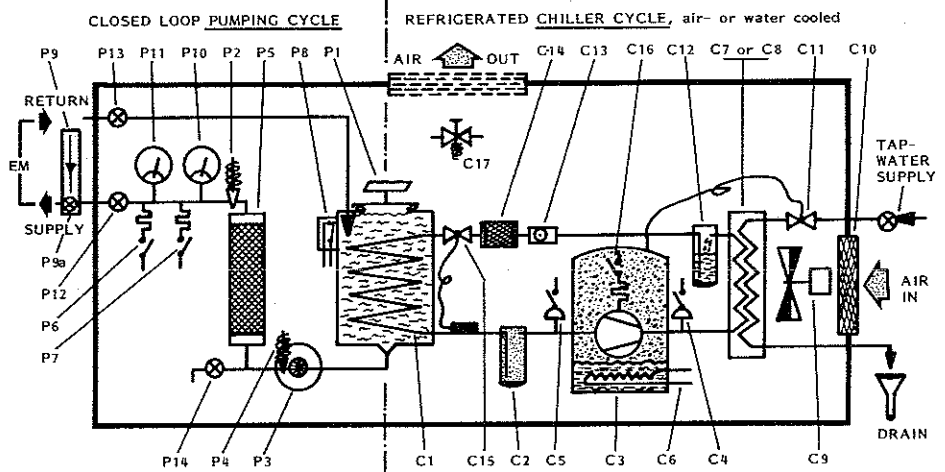
Pumping Cycle:

- Hermetically sealable stainless steel coolwater tank
- Magnetic water-level-control switch
- High pressure pump with 100 GPH (6.3 l/min.) capacity
- Adjustable pressure regulator
- Puls-Out™ pulsation dampener
- Stainless steel filter, with micro-fine cartridge
- High- & low-temperature limiting controls
- Two 3½" panel-mounted temp. & pressure gauges
- Three hand valves for service convenience.

Chiller Cycle:

- High efficiency Twist-Ex™ evaporator
- Quiet, fully hermetic compressor sealed in oil for trouble-free performance.
- Heater for compressor oil, assuring better lubrication and long life.
- High- & low pressure limiting controls with manual-reset feature
- Accumulator, liquid trap compressor protection
- Receiver, vapor trap x-valve protection
- Sight-glass refrigerant inspection
- Filter-dryer refrigerant cleaner
- High- & low side service ports with valves
- Air filter (reusable), condenser-fin protection

COOLWELL RECIRCULATING COOLING SYSTEM, SINGLE UNIT "S"-SERIES



PUMPING CYCLE

- P1 Stainless steel hermetically sealed tank
- P2 Adjustable automatic pressure limiting valve
- P3 High capacity positive displacement pump
- P4 Automatic pressure limiting valve
- P5 Stainless steel micro-fine filter
- P6 High temperature safety control
- P7 Low temperature safety control
- P8 Magnetic tank level control switch
- P9 Flow-metering device (optional)
- P9a Metering valve incorporated in P9
- P10 Panel mounted 3/8" diam. pressure gauge
- P11 Panel mounted 3/8" diam. temperature gauge
- P12 Supply line service hand valve
- P13 Return line service hand valve
- P14 Unit drain & service hand valve

CHILLER CYCLE

- C1 High efficient Twist-Ex evaporator coil inside the tank
- C2 Accumulator, low side liquid trap
- C3 Hermetically sealed, low speed compressor
- C4 High pressure limit control with manual-reset feature
- C5 Low pressure limit control with manual reset feature
- C6 Compressor crankcase oil heater
- C7 Condenser, air-cooled (in combination with C9 & C10)
- C8 Condenser, water-cooled (in combination with C11)
- C9 Fan with motor (air-cooled unit)
- C10 Air-intake filter, reusable (air-cooled unit)
- C11 Automatic tap-water regulating valve
- C12 Receiver, high-side vapor trap
- C13 Refrigerant sight-glass
- C14 Refrigerant filter-dryer
- C15 Refrigerant metering, automatic expansion valve
- C16 Compressor protective safety switch
- C17 Temperature regulator

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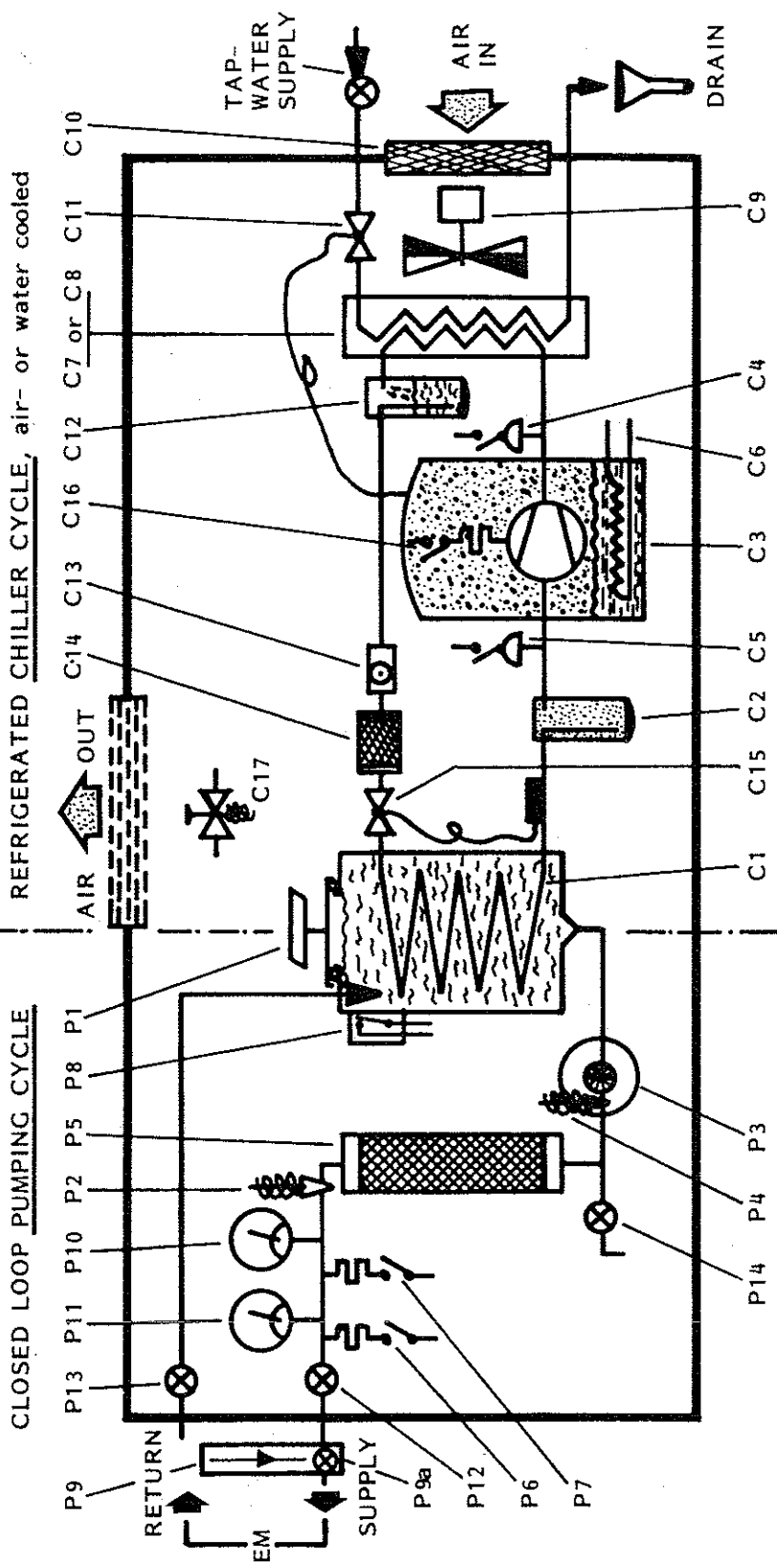
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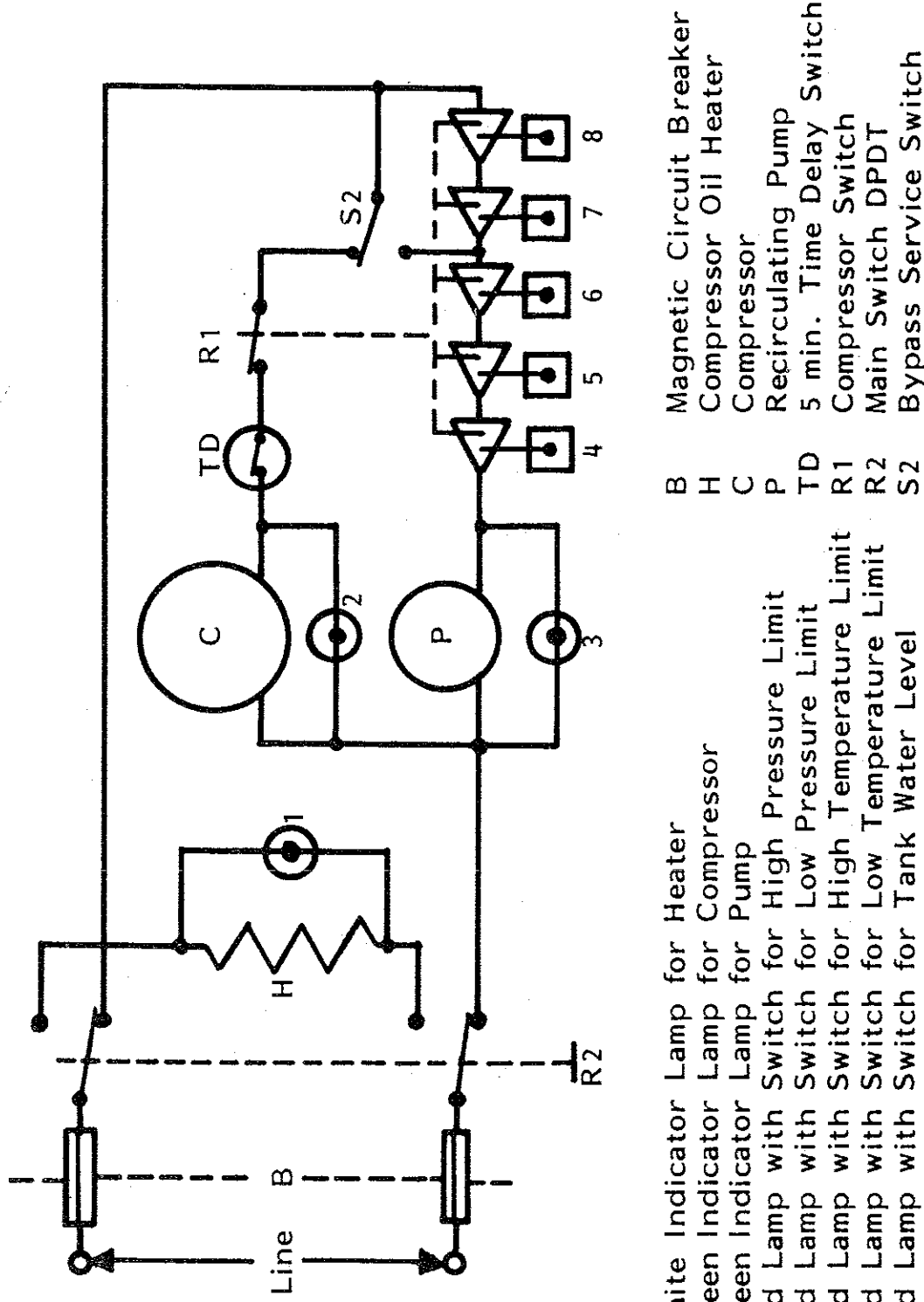
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DESIGN FEATURES

Electrical:

- Slow speed quiet compressor motor
- Slow speed quiet pump motor

OPERATION

The COOLWELL system consists of two circuits — the pump and the chiller. The pumping cycle is a pulsation-free and image shake and is achieved through a Puls-Out™ damper. The System™. The flows back into the tank for re-cooling.

Twist-Ex™ heat exchanger (380 l/h) for high efficiency. The hermetically sealed tank inhibiting the growth of bacteria. The cooling of the tank. The switch activates and deactivates the pump as little as a

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