

TECHNICAL MANUAL

KODIAK RECIRCULATING CHILLERS MODELS RC006, RC011, RC022, RC030 AND RC045 SERIES G02/H02/J02



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Introduction

Receiving your New Kodiak™ Chiller

Inspect your new chiller immediately upon receiving it. If the unit shows shipping damage, contact the transportation company and file a freight damage claim. Retain all cartons and packing material until the unit is operated and found to be in good condition. Your chiller has been fully tested at the Boyd factory with clean water. Although the system has been drained, some residual fluid may remain. This will not hinder the performance of the chiller.

About the Warranty

All units returned for warranty claims must have an RMA (Returned Material Authorization) number on the outside of the container. Call Boyd Customer Service at (781) 933-7300 for an RMA number. Refer to the end of manual for the chiller warranty.

Customer Service Support

Boyd is committed to servicing the customer, both during and after the sale. If you have any questions concerning the operation of your unit, contact our Application Engineering Department at (781) 933-7300. To facilitate your call, please have the **model number** and **serial number** of the unit (located on the rear of the chiller) for the Boyd Applications Engineer.

24 hrs. / 7 day service

Boyd has a 24 hours per day, 7 days per week service hotline to help you with questions on the startup and operation of your Kodiak™ recirculating chiller. **(We recommend you review the troubleshooting guide on page Error! Bookmark not defined. before calling our service hotline.)** Boyd service can be reached by dialing (781) 933-7305. To facilitate your call please have the **model number** and **serial number** (located on rear of the chiller) of the unit for the Boyd Service Technician.

Safety Precautions

This system is designed to provide fluid cooling only as specified in this manual. If you use this system in a manner other than as specified, the safety protection of the system may be impaired.

Warnings are posted throughout the manual. Read and follow these important instructions. Failure to observe these instructions or use other than specified may impair safety protection, void the warranty, and can result in permanent damage to the unit, significant property damage, personal injury and/or death.

Make sure you read, understand, and follow all instructions and safety precautions listed in this manual before operating your unit. If you have any questions concerning the operation of your unit or the information in this manual, please contact our Applications Engineering Department at (781) 933-7300.

- **If the set point is 10°C or below, a freezing point depression additive, such as ethylene glycol, is required. This unit is equipped with a low flow switch. This feature will shut the chiller down during a low flow situation to prevent freezing.**
- **DO NOT USE AUTOMOTIVE ANTI-FREEZE IN THE CHILLER. The rust inhibitors in the automotive type will cause premature failure of the pump seals. Use of automotive anti-freeze in a Boyd chiller will void the warranty.**
- **Never place the unit in a location where excessive heat, moisture, or corrosive materials are present.**
- **The unit must be plugged into a properly grounded power source.**
- **Do not connect the SUPPLY or RETURN fitting to your building water supply or any pressurized source.**
- **Performance of installation, operation, or maintenance procedures other than those described in this manual may result in a hazardous situation and may void the Boyd warranty.**
- **Transport the unit with care. Sudden jolts or drops can damage the unit.**
- **Observe all warning labels. Never remove warning labels.**
- **Do not operate damaged or leaking equipment.**
- **Do not operate the unit without fluid in the reservoir.**
- **Always turn the unit "OFF" and disconnect the power cord from the power source before performing any service, maintenance procedures, or before moving the unit.**
- **Do not operate equipment with damaged power cords.**
- **A qualified technician should perform Service and repairs.**

Labels and Silkscreen marking

(located in the back of unit)

RETURN



This silkscreen marking identifies the connection where heated fluid is supplied from the user’s machine.

SUPPLY



This silkscreen marking identifies the connection where chilled fluid is supplied to the user’s machine.



The triangle symbol tells maintenance personnel and users to consult the product technical manual for more information. In this example, the symbol calls attention to the High Voltage Warning in the Control Box.

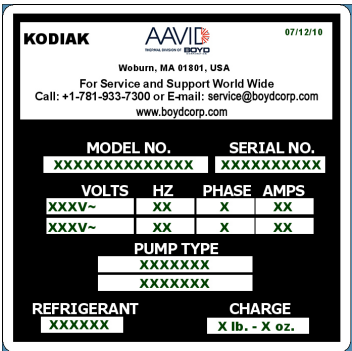


The Protective Earth (ground) Terminal.



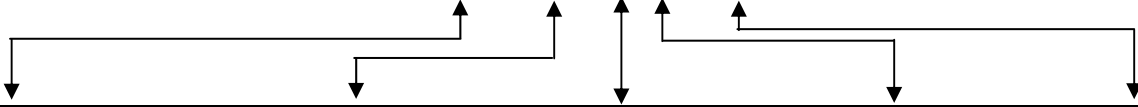
This symbol certifies that the chiller conforms to the EMC Directive and all applicable directives at the time of marking.

Product ID Label: Identifies the model number, serial number, electrical information volts, amps, Hz, phase, pump type, refrigerant, and charge.



Part Number Description

RC006 G02 BB 1 MXXX



Basic Model No.	Electrical Configurations	Pump Options =	Controller Configuration	Standard Modifications
RC006 - 600 Watts RC011 - 1100 Watts RC022 - 2200 Watts RC030 - 3000 Watts RC045 - 4500 Watts NOTE: Cooling capacity and pump flows are rated at 60Hz. For 50Hz power, derate capacity by 17%.	G02 = 115V~/1 Ph/60Hz H02 = 230V~/1 Ph/50Hz J02 = 230V~/1 Ph/60Hz	AA* = CP-15 Centrifugal Pump BB = 1.3 gpm Positive Displacement Pump BC = 1.8 gpm Positive Displacement Pump BG = 4.3 gpm Positive Displacement Pump DA* = CP-25 Centrifugal Pump EB* = TB-2 Turbine Pump * Water filter and DI cartridge not recommended with Centrifugal & Turbine pumps.	1 = Temperature control, calibration offset, pressure indication, low flow shut off. 2 = Temperature control, calibration offset, pressure indication, low flow shut off. a. Low level indication. b. Low temperature indication. c. High temperature indication. d. Chiller fault shut down (toggle “on” and “off”). e. Relay contacts for customer interface. f. Audible alarm (toggle “on” and “off”) 3 = Same as "2" above with the addition of RS232 communications.	

NOTES:

1. Refer to the product ID label on the rear of your chiller for the configuration you have purchased.
2. The above mentioned table refers to Boyd's standard product offering for the Kodiak™ product line.

Specifications

	RC006		RC011		RC022		RC030		RC045	
Thermal Capacity ²	60 Hz	50 Hz	60 Hz	50 Hz	60 Hz	50 Hz	60 Hz	50 Hz	60 Hz	50 Hz
Watts	600	480	1100	913	2200	1826	3000	2500	4500	3735
Btu/Hr	2000	1660	3700	3070	7500	6225	10,200	8500	15000	12450
115V~ 60Hz 1ph	G02				N/A					
230V~ 60Hz 1ph	N/A		J02							
230V~ 50Hz 1ph	H02									
Full Load Amperage ⁴	10.0 Amps N/A 4.4 Amps		15.4 Amps 7.4 Amps 6.9 Amps		N/A 10.0 Amps 9.4 Amps		NA 11.9 Amps 11.0 Amps		N/A 19.6 Amps 16.4 Amps	
G02										
J02										
H02										
Compressor Capacity Hp	1/4		1/2		3/4		1		1 1/2	
Refrigerant Type	R134A									
Temperature Stability	+/- 0.1°C									
Operating Environment	15° to 40° C (59° to 92° F), 80% R.H. (consult factory for environments below 15°C (59° F))									
Coolant Temperature Range	40°F-95°F 5°C-35°C									
Reservoir Capacity, Gallons Liter	1	(3.8)	2	(7.6)	2	(7.6)	6	(22.6)	6	(22.6)
Dimension, in. (mm) ³	12.5"	(318)	14.8"	(376)	14.8"	(376)	21.4"	(543)	21.4"	(543)
Width, in. (mm)	19.0"	(483)	24.5"	(622)	24.5"	(622)	27.8"	(705)	27.8"	(705)
Depth, in. (mm)	22.0"	(559)	26.5"	(673)	26.5"	(673)	31.0"	(787)	31.0"	(787)
Height, in. (mm)										
Connection, FNPT	3/8"		3/8"		3/8"		1/2"		1/2"	
Weight, lbs (Kg)	97	(44)	122	(55)	166	(75)	260	(118)	270	(123)
Process Coolant Delivery Pressure	60 psig maximum (factory preset for PD pumps only)									

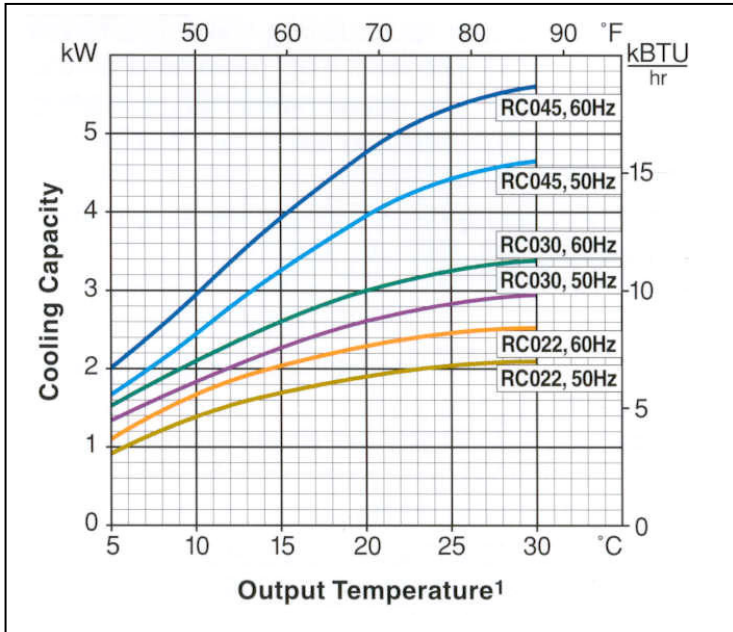
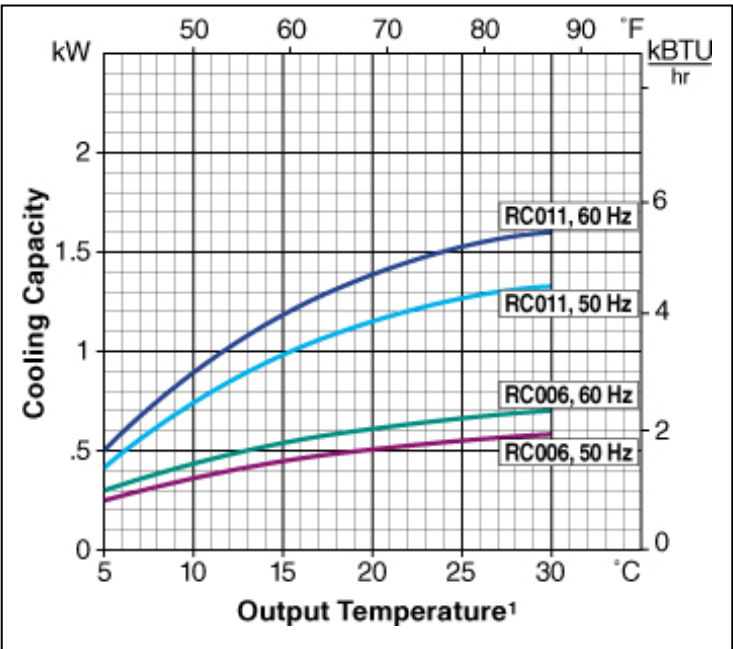
¹Specifications subject to change.

²Capacity for 20°C delivery water at a 20°C ambient.

³Dimensions do not include filters.

⁴Full load amperage for models with standard pumps without heater.

Performance Curves RC006/011/022/030/045

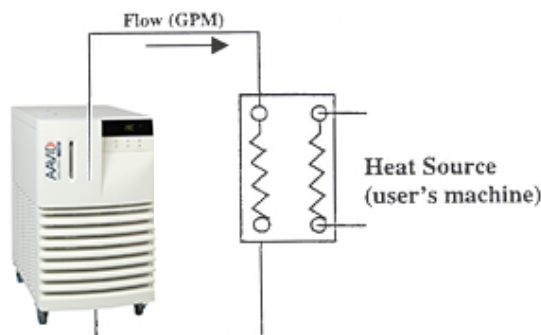


General Information

Chiller System Description

Your chiller consists of a refrigeration system, a coolant loop, associated controls and plumbing. The pump draws coolant from the internal reservoir and pumps it out to cool your equipment, and then the coolant flows back to the chiller. It flows through the evaporator, where the heat is removed, and then flows back into the reservoir.

**Kodiak
Recirculating Chiller
(FRONT VIEW)**



Coolant Loop (flow control)

Kodiak chillers are designed to operate with continuous coolant flow through a closed loop. This loop contains the system pump, temperature sensor, reservoir, internal and external plumbing lines and fittings, and the external heat load. The external plumbing and the heat loads are provided by the end user and are generally unique to the user's process and/or location.

******CAUTION******

Do not put valves in the system that can stop flow while the chiller is operating.

Refrigeration System and Hot Gas Bypass

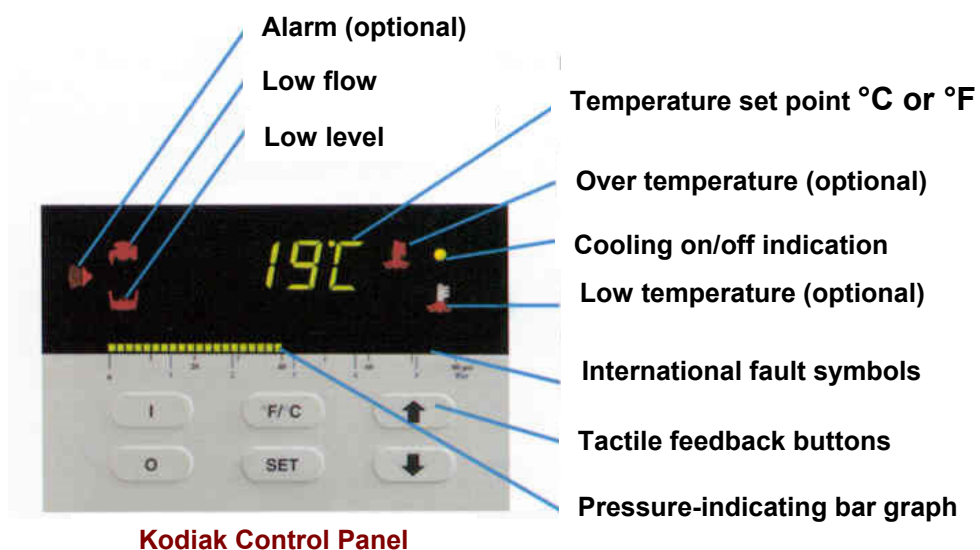
The chiller uses a standard refrigeration system to keep the coolant at the process temperature set point. The compressor compresses the refrigerant vapor (gas), which then passes through the condenser where it is cooled and turns to a liquid. The refrigerant in its liquid state then passes through the evaporator. The coolant also flows into the evaporator, through passages separated by thin layers of metal from the refrigerant. The refrigerant evaporates, drawing heat from the coolant. The refrigerant vapor returns to the compressor and continues the cycle.

Many refrigeration systems, such as those used in household refrigerators, control the temperature by turning the compressor on and off. This is a simple, inexpensive method of controlling the cooling, but its temperature control is not precise and the frequent on-off cycles cause wear on the compressor motor.

Boyd's recirculating chillers use a better method for controlling the cooling rate: a hot-gas bypass system. This employs a liquid line solenoid valve and a hot-gas bypass valve to meter the refrigerant flow through the evaporator when refrigeration is needed. When the coolant reaches its set point temperature, the liquid line solenoid valve closes, causing the hot-gas valve to open. The hot-gas valve lets hot-gas from the compressor discharge into the evaporator inlet, adjusting the temperature in the evaporator to maintain the correct coolant temperature. When refrigeration is needed, the liquid line solenoid valve opens, the hot-gas valve closes and the cycle starts again.

This hot gas bypass control method provides precise temperature control. It also minimizes wear on the compressor motor, since the compressor runs continuously and does not experience the stress of repeated cycling.

Control Panel Functions



Key	Operation
I	Turn on chiller
O	Turn off chiller
“UP”+ “DOWN”  + 	Enter menu (press simultaneously and hold for 3 seconds and release)
“SET”	Push to display or change set point.
“UP” arrow 	Increase set point temperature
“DOWN” arrow 	Decrease set point temperature
°F/°C	Toggles between °F and °C

Description of Indicators:

- Pressure-indicating bar:** Displays output pump pressure in psi/bar, 2 psi/segment, 0.14 bar/segment.
- Temperature set point:** Displays coolant temperature or set point in °C or °F.

Cooling indicator: To maintain set point temperature the chiller must cycle between cooling and hot gas bypass mode. This indicator illuminates while in cooling mode.

Low flow indicator: Illuminates to indicate a low flow condition. The chiller will also shut down during this condition.

Controller package II and III

Alarm indicator: Illuminates to indicate an alarm fault condition.

Low level indicator: Illuminates to indicate a low fluid level condition

Over temperature indicator: Illuminates to indicate an over-temperature condition.

Low temperature indicator: Illuminates to indicate a low-temperature condition.

Optional System Features

Deionization Package:

The Deionization Package consists of a factory-installed deionization cartridge. The deionization cartridge requires replacement only when the mixed bed is depleted. For replacement cartridges, Call Boyd's Customer Service at 781-933-7300. This package is offered for deionized water applications where the resistance of the water does not exceed 1 megohm-cm, and where the use of brass and copper fittings is acceptable. The deionization package is not recommended with centrifugal pumps.

Coolant Water Filter:

This factory installed water filter removes particulate from the coolant water. The water filter is not recommended with centrifugal pumps. For replacement filters, call Boyd's Customer Service at 781-933-7300.

Heater Package RC011, RC022, RC030, RC045:

The heater package is for applications requiring coolant temperature well above ambient temperature. This package is a single set point type. The heater is activated when the water temperature is 3°F below setpoint.

****NOTE:** The heater option is not intended to provide tight temperature control, but to bring coolant temperature up to an application's requirement.*

******WARNING******

If your unit was not built with the heater package, do not attempt to retrofit it. If you do, severe damage will occur to the unit, personal injury may result, and the warranty will be voided.

High Purity Plumbing:

This option is intended for use with deionized water. Only stainless steel and/or plastic components and a nickel-brazed heat exchanger come in contact with the coolant. You must specify this option before you purchase a chiller; it is not field retro-fittable.

External Manually Adjustable Flow Valve:

This option is a valve plumbed between the supply and the return of the chiller. It allows you to manually adjust the flow rate. To be sure your equipment is receiving enough flow, install a flow meter at the outlet from your equipment.

External Pressure Relief Valve:

This option is for applications requiring reduced pressure. This kit contains a Pressure Relief Valve, 2 Tees, Hose Clamps and Plumbing Instructions.

Auto Tank Refill RC011, RC022, RC030 and RC045:

This option automatically maintains the fluid level in the reservoir. This feature requires a city water connection or equivalent pressurized coolant supply.

Water Cooled Condenser RC022, RC030 and RC045:

This feature replaces the standard condenser and fan with a water cooled condenser. This requires facility cooling water to be supplied to the chiller at 75°F (25°C). Minimum flow rates are as follows:

Model	Flow Rate (min)
RC022	1.4 gpm
RC030	1.9 gpm
RC045	3.4 gpm

Controller Options

Basic Controller (Package 1; standard with all units)

- Temperature control, $\pm 0.1^{\circ}\text{C}$.
- Temperature display in $^{\circ}\text{C}$ or $^{\circ}\text{F}$.
- Pump output pressure display psi/bar, 2 psi/segment.
- Offset temperature calibration -4°C to 4°C , -7°F to 7°F with 0 the midpoint.
- Low flow shut off.
- Auto Restart

Package 2: (option)

Has the same function as the basic controller, and includes the following:

- Low level indication
- Low temperature indication
- High temperature indication
- Audible alarm (toggle on/off)
- Fault chiller shutoff (toggle on/off)
- External normally closed contacts. Open under fault. 0.5 amp. Maximum

Package 3: (option)

Has all the same functions as Package 2 above, plus:

- RS232 communications

Additional Options:

- Remote Start

Installation

Coolant Requirements:

- Boyd recommends using filtered clean water above 10°C as coolant.
- If the set point is 10°C or below, a freezing point depressant, such as ethylene glycol, is required. This unit is equipped with a low flow switch. This feature will shut the chiller down during a low flow situation to prevent freezing.
- Avoid using water with a high mineral content.
- Standard RC units may not be compatible with deionized water. Consult Boyd Application Engineering for deionized water applications.
- If the coolant is exposed to sunlight add an algicide to control organic growth in lines.

*****CAUTION*****

Positive displacement pumps are susceptible to damage from abrasive materials in the coolant. To reduce risk of damage, a factory-installed water filter is recommended.

Electrical Requirements (for unit without heater option)

Refer to the Specification section and to the product ID label on the rear of the chiller for the specific electrical requirements of your unit. The chiller power module is configured with a standard international IEC320/C20 inlet. To safely operate the chiller, use a SJT cord set with an IEC 320/C19 receptacle and an inlet plug that is compatible to the local power grid and the power requirements of the chiller. All Kodiak chillers should use CSJT 3 conductor 12 awg minimum power cord.

*****WARNING*****

It is the user's responsibility to provide a proper ground connection.

Selecting Chiller Location

To minimize the heat gain and pressure drop through the connecting hoses, the chiller unit should be located as close as possible to the heat load (user equipment). This is more important for units with centrifugal pumps. Coolant lines are best run at or near the same level as the cooling system. Once the chiller is in position lock the casters.

Air flow is critical to optimize performance of the chiller. The front and one side or the back of the unit **MUST** be kept clear and unobstructed. The remaining two sides or back must have minimum clearance of 18". The top clearance must be at least 6". Ensure that the hot air exiting the chiller does not recirculate into the inlet openings. The front of the unit must have a free supply of ambient-temperature air.

NOTE:

The circuit breaker located on the rear of the unit must be kept clear and easily accessible.

To move the chiller, cap all ports to prevent any coolant leakage. Unlock the casters and move to new location. Once in the new location lock the casters. To prevent freezing during storage drain water if the chiller is located in an area below (10°C 50°F).

Plumbing the Coolant Lines

The coolant ports are located on the rear of the system and are labeled with the Supply  and Return  symbols.

- To minimize the pressure loss in the coolant lines, use the largest practical diameter tubing. If substantial lengths of cooling lines are required, they should be pre-filled with coolant before connecting them to the chiller.
- To minimize heat gain, all lines should be as short as possible. Keep them away from heat sources such as radiators and hot water pipes. Lines that cannot be routed away from heat sources should be protected with thermal insulation, preferably at least 1/2" (12.7mm).
- Flexible tubing, should be of heavy wall or reinforced construction. All tubing should be rated to withstand 125 psig at 186°F (30°C). Make sure all tubing connections are secured and leak-tight. Also, whenever possible use opaque lines to prevent algae growth during prolonged non-operating periods.

******CAUTION******

Do not connect the SUPPLY or RETURN fitting to your building water supply or any pressurized source.

Installation Procedure

To connect the fluid lines to the chiller and user equipment follow these steps:

1. Remove the plastic caps covering the supply and return ports on the rear panel of the unit.
 2. Attach coolant lines to the supply and return ports on the rear panel.
- **Supply port:** chilled coolant goes out to user equipment
 - **Return port:** hot coolant returns from user equipment

3. Refer to the table below for the fitting sizes required for the your unit.

Model#	Fitting Size
RC006, RC011, RC022	3/8" FNPT
RC030, RC045	1/2" FNPT

Note: Fittings should either be brass, stainless steel or plastic. Never use steel or cast iron fittings, as the corrosion will damage the chiller. For chillers with deionization cartridges or high purity plumbing Boyd recommends the use of either stainless steel or nylon fittings.

4. Remove water filler cover on top of the unit to access the reservoir.

5. Fill the reservoir. Use the reservoir sight tube on the front of the unit to see the coolant level in the tank as you are filling. Be sure to allow for the volume of coolant needed to fill the cooling lines between the chiller and the equipment, if they were not filled with coolant before installation.

6. Centrifugal Pumps must be primed before operation. To prime pumps, disconnect supply line from rear of chiller, allow air to vent and out of pump head and reconnect line.

For Water Cooled Chillers

7. Connect facility water to connections labeled "City Water In" and "City Water Out". Minimum flow rate of facility water is shown on **page 14**. Facility water flow must be started before chiller is turned on.

******CAUTION******

Standard RC units may not be compatible with deionized water. Consult Boyd Application Engineering for deionized water applications.

Connecting Power (for units without heater option)

Connect a 3-conductor SJT type power cord with an IEC 320/C19 receptacle to the inlet power to the module on the rear of the unit and to an appropriate AC power source. All chillers should use a 12 gauge power cord.

******WARNING******

Be sure to provide a proper ground connection.

Startup Procedure

1. Turn "ON" the circuit breaker on the rear of the unit. The controller will go through a diagnostic test. Turn on the chiller unit using the (I) key located on the Keypad Display panel. The controller displays "OFF" for 8 seconds. The delay prevents rapid cycling of the compressor using the "ON" and "OFF" switch.

******IMPORTANT******

If you have optional controller package 2 or 3, the fault shutoff may prevent the chiller from operating. If you turn on the unit and it does not operate, disable the fault shutoff. Then turn on the chiller. After the chiller is operating and the coolant reaches its setpoint temperature, you can enable the fault shutoff.

2. Set the temperature setpoint using the controls on the keypad display as follows:
 - Press the "SET" key once to display the current coolant temperature set point.
 - Press the "UP" or "DOWN" arrow key until the desired coolant temperature setpoint appears on the LED display.
 - Press the "SET" key again to accept the setpoint and return to normal operation.
3. Operate the chiller for a short time and then check the coolant level in the reservoir. If the level drops, add more coolant.
4. Check all fittings and hoses for fluid leaks. If a leak exists, turn chiller off, disconnect power and take necessary action to repair the leak.

******IMPORTANT******

Do not operate chiller until leak has been repaired.

Chiller Operation

The following sections explain how to perform other operations with the chiller's controller, using the keys and display on the front of the unit. Refer to the Control Panel illustration and table on [page 11](#).

In normal operation the display shows the current temperature of the coolant (or the current temperature with an offset applied).

Changing temperature scales

Press the “°F/°C” key to toggle between °F and °C.

Programming Chiller Functions:

Entering menu

Press and hold both the “UP” and “DOWN” arrow keys for 3 seconds and release.

Selecting and setting features

1. Use the “SET” key to scroll through the menu choices.
2. When feature is displayed press the “UP” or “DOWN” arrow key to change setting.
3. Press “SET” to accept setting and continue to the next feature.

Exiting menu

Press “SET” to accept any parameters you have programmed and exit the menu.

Chiller Functions

<i>Display Abbreviation</i>	<i>Function</i>
CAL	Calibration Offset (standard) Adjusts the reading on the display by the offset that you enter, from – 4°C to 4°C (–7°F to 7°F).
Ar	Auto Restart (standard) When enabled this allows the chiller to start automatically in the event of a power failure.
Ot	Over temperature Fault Indication (option) Indicator illuminates when the coolant temperature exceeds the over-temperature setpoint. The over-temperature setpoint must be at least 3°C (6°F) above the coolant setpoint.
Lt	Low-temperature Fault Indication (option) Indicator illuminates when the coolant temperature falls below the low-temperature setpoint. The over-temperature point must be at least 3°C (6°F) below the coolant set point.
AL	Audible alarm (option) When this is enabled, an audible alarm sounds when any fault occurs.
FS	*Fault chiller shutoff (option) When enabled, this turns off the chiller when any fault occurs.
rS	Remote Start (option) Allows the chiller to be started and stopped with a dry contact.

**This feature is always enabled for standard low flow.*

CAL—Calibration offset (standard)

1. To enter the menu, press and hold both the “UP” and “DOWN” arrow keys for 3 seconds and release.
2. Use the SET key to scroll to **CAL**.
3. The display toggles between "CAL" and current offset setting.
4. Use “UP” or “DOWN” arrows to change the calibration offset, which must be between –4°C and +4°C. If you do not want to use an offset, set it to zero (0).
5. Press “SET” to accept the setting on the display and exit the menu.

Ar—Auto Restart Feature (standard)

If auto restart is enabled (ON),

And if the chiller is running,

And if the power is interrupted due to power outage, tripped circuit breaker, etc.

Then when the power is restored the chiller will automatically start.

If auto restart is enabled (ON),

And if the chiller is not running,

And if the power is interrupted due to power outage, tripped circuit breaker, etc.

Then when the power is restored the chiller will stay off. Push “ON” to start the chiller.

This chiller was shipped with the auto restart disabled. To activate the auto restart feature:

1. Enter the customer menu by holding both the “UP” and “DOWN” arrow keys for 3 seconds.
2. Use the “SET” key to scroll to Ar.
3. The display toggles between “Ar” and its current setting.
4. Use “UP” or “DOWN” arrow key to toggle between “ON” and “OFF”.
5. Press “SET” to accept the setting on the display and continue to the next feature.

Ot— Over temperature indication (option)

1. To enter the menu, press and hold both the “UP” and “DOWN” arrow keys for 3 seconds and release.
2. The display toggles between "Ot" and current over temperature setpoint.
3. Use “UP” or “DOWN” arrows to change the over temperature setpoint, which must be at least 3°C (6°F) above the coolant set point temperature.
4. Press “SET” to accept the setting on the display and continue to the next feature.

Lt— Low temperature indication (option)

1. To enter the menu, press and hold both the “UP” and “DOWN” arrow keys for 3 seconds.
2. Use the “SET” key to scroll to Lt.
3. The display toggles between "Lt" and current over-temperature setpoint
4. Use “UP” or “DOWN” arrows to change the low temperature setpoint, which must be at least 3°C (6°F) below the coolant set point temperature.
5. Press “SET” to accept the setting on the display and continue to the next feature.

AL—Audible Alarm (option)

1. To enter the menu, press and hold both the “UP” and “DOWN” arrow keys for 3 seconds.
2. Use the “SET” key to scroll to AL.
3. The display toggles between "AL" and its current setting.
4. Use “UP” or "DOWN" arrow key to toggle between “ON” and “OFF.”
5. Press “SET” to accept the setting on the display and continue to the next feature.

FS—Fault Chiller Shutoff (option)

Note: Always enabled for standard low flow.

1. To enter the menu, press and hold both the “UP” and “DOWN” arrow keys for 3 seconds.
2. Use the “SET” key to scroll to FS.
3. The display toggles between "FS" and its current setting.
4. Use “UP” or "DOWN" arrow key to toggle between “ON” and “OFF.”
5. Press “SET” to accept the setting on the display and continue to the next feature.

rS—Remote Start Feature (option)

When it is set to off the chiller acts as if it does not have the remote start feature. By setting this feature to NC (normally closed, or run on closed), the chiller will start when pins 4 and 5 on the six-pin connector on the rear of the chiller are closed. The chiller will shut off when pins 4 and 5 are open. By setting this feature to NO (normally open or run on open), the chiller will start when pins 4 and 5 are open. It will shut off when pins 4 and 5 are closed.

The electrical connector on the rear is an Amp Mate-N-Lok connector, part number 1-480705-0. Pins 1 and 2 are for the External Contact Feature (see page 15 of the manual) and pins 4 and 5 are for the Remote Start Feature. The mating connecting is Amp part number 1-480704-0. The mating part should use Amp pins for Mate-N-Lok connector, such as Amp part number 350552-1.

This chiller was shipped with remote start disabled. To activate the remote start feature:

1. Enter the customer menu by holding both the “UP” or “DOWN” arrow keys for 3 seconds.
2. Use the “SET” key to scroll to rS.
3. The display toggles between “rS” and it’s current setting.
4. Use “UP” or “DOWN” arrow key to toggle between “OFF”, “NO” and “NC”.
5. Press “SET” to accept the setting on the display and continue ton the next feature.

System Maintenance/Service

****CAUTION****

All service and maintenance internal to the chiller must be performed by a qualified service technician.

After your Kodiak™ Chiller System is up and running, it takes only a small amount of care and maintenance to keep it running well.

Every installation is unique, and the conditions in your installation determine how often you should inspect and perform maintenance on your equipment. Here are some guidelines.

Weekly Inspections:

Noise Level

Any abnormal sound or substantial increase in noise level since the last weekly inspection may indicate an impending pump, fan or coolant blockage problem. Investigate the cause and perform the necessary service. Refer to the troubleshooting section that starts on page **Error! Bookmark not defined.** in this manual.

Leakage

If you notice coolant on the floor near the chiller or dripping from the chiller enclosure, turn off the chiller. Disconnect power. Find and repair any leaks immediately.

Coolant Level

Any significant drop in the coolant level since the previous weekly check should be investigated further. If there is no visible system leak, then the loss may be due to equipment leakage elsewhere.

Fan Assembly

No maintenance is required on the fan. Listen for any abnormal sounds.

Condenser Fin

Remove the front grill by sliding it upward, pulling the bottom out, and pulling it straight down. For maximum performance, the condenser fin should be free of dust and debris. Use a shop vac to remove any debris and keep the fin clean.

Water Filter (Option)

With a new system the filter quickly accumulates foreign matter introduced during system setup. This can lead to a decrease in system performance in a short period of time. Inspect the filter cartridge one day after you set up a new system to ensure the filter is clean and the system runs at maximum capacity. After this initial filter inspection, check the filter weekly. For replacement filters contact Boyd's Customer Service at 781-933-7305.

Deionization Package

The cartridge life is a function of the user's application. Check the water resistivity weekly and change the cartridge as required. For replacement filters contact Boyd's Customer Service at 781-933-7305.

Control Box Fuse Replacement

This fuse is an inline fuse internal to the control box and should only be replaced by a qualified technician. To replace the fuse remove the top and side panel on the unit and remove the two fasteners holding the control box cover in place. Open the inline fuse holder. Remove blown fuse and replace the cover. Use a 5x20 mm time lag fuse 3.15A 250V (Bussman P/N GDC-3.15) or equivalent.

Periodic Maintenance*******CAUTION*******

A qualified service technician must perform all service and maintenance internal to the chiller.

Low Level Switch (Option)

The level switch protects the pump in the event of accidental fluid loss. Since this switch is "passive" during normal operation, it is advisable to check it every 6 months. Open the tank cover and push down on the switch to see if the low level alarm is activated.

Algae

Boyd recommends the use of an algae inhibitor to prevent growth in the reservoir.

Cleaning the System and Reservoir

1. To clean the system drain the unit and replace the coolant with clean water.
2. Run the unit with the clean water.
3. Drain the unit again.
4. Replace all filters.
5. Refill unit with either water or a water and freezing point depressant.

Pump Motor Lubrication

Positive displacement pump motors use sleeve type bearings with large lubricant reservoirs. Oiling instructions are posted on each motor. In the absence of instructions, add approximately 30 to 35 drops of SAE 20 non-detergent oil to each bearing on the following schedule (SAE 20 = 142 CS viscosity):

<i>Duty Cycle</i>	<i>Oiling Frequency</i>
Continuous	Once every year
Intermittent	Once every 2 years
Occasional	Once every 5 years

Pump Strainer

Periodically inspect and clean the positive displacement pump strainer. If it becomes fouled flow rate will decrease and the pump may wear prematurely.

Troubleshooting Guide

****CAUTION****

A qualified service technician must perform all service and maintenance, internal to the chiller.

<i>Problem</i>	<i>Possible Cause</i>	<i>Recommended Remedy</i>
Unit does not start or shuts off shortly after starting.	No power to the unit, circuit breaker "off" or tripped.	Make sure the unit is plugged in. Verify power to the unit. Turn circuit breaker to the "ON" (I) position. Turn on the unit with the ON (I) key on the keypad.
	Fault shutoff enabled.	Disable fault shutoff. Start unit. Enable shutoff after it is running, if desired.
	<i>(Units with controller package II and III only)</i> Low flow shut off may not allow the chiller to start. Low Flow activated	Fill external line prior to start up.
	Low Voltage.	Have a qualified electrician check the electrical service to the unit.
	Fuse blown in control box	Have a qualified service technician replace the fuse. (See fuse replacement in the system maintenance/service section of this manual.)
Unit does not cool	Cooling load exceeds cooling capacity.	Reduce the cooling load on the unit.
	Controller set point temperature is too high.	Reset the set point to the proper temperature.
	Condenser coil fouled with dust or debris.	Remove the lower grill and vacuum the coil face clean.

<i>Problem</i>	<i>Possible Cause</i>	<i>Recommended Remedy</i>
Unit does not cool (Continued)	Unit has tripped the high-pressure cutout. (RC045 only), RC022 Water Cooled, RC030, and RC045	Remove air obstructions from around the unit; manually reset the high-pressure control (Inside rear of unit, this is a blue button on a white box. Press to reset.)
	Compressor has tripped its internal overload.	Let the unit cool, the overload will reset itself, normally in 30 minutes or less.
Unit does not cool (Water cooled Condenser)	Facility water flow rate too low.	Check page 14 for required flow rate. Ensure that at least this much is provided.
Excessive noise on startup	Liquid refrigerant in the suction line to the compressor.	This should go away after the system runs for a few minutes.
	Low voltage or wrong voltage to unit.	Verify power source; check electrical service.
Noisy compressor	Unit stored in cool environment for a long period may have collected liquid refrigerant in the compressor.	This should go away after the system runs for a few minutes.
Leaking pump	Pump shaft seal damage.	Replace pump.
	Faulty pump casing.	Replace pump.
	Fluid is incompatible with pump seals.	Drain fluid immediately - Call Boyd Systems Service Department.
Pump motor overheats	Improper voltage to the system.	Verify and correct the voltage to the chiller.
	Obstruction in pump head.	Shut down unit, clear obstruction, restart unit. Check lines for restrictions.

<i>Problem</i>	<i>Possible Cause</i>	<i>Recommended Remedy</i>
Low level indicator and/or alarm stays on <i>(control package II and III only)</i>	Low reservoir level.	Top off the reservoir.
	Level switch float is stuck.	Clean the reservoir and level switch.
	Level switch failure.	Replace level switch.
Low temp. indicator and/or alarm stays on <i>(control package II and III only)</i>	Low temperature alarm set point is set too close to cooling set point temperature.	Reset low temperature set point to at least 3 degrees below cooling set point.
High temp. indicator and/or alarm stays on <i>(control package II and III only)</i>	High temperature alarm set point is set too close to cooling temperature setpoint.	Reset high temperature set point to at least 3 degrees above set point temperature for cooling.
Low coolant flow	Pump suction strainer is clogged. (Positive displacement pump only.)	Remove strainer and reinstall.
	Low coolant level in the reservoir.	Check for leaks, fix leaks, and fill reservoir.
	Optional water filter obstructed.	Check filter. Change cartridge if necessary.
	Pressure relief on the pump is set too low. (Positive displacement pump or turbine pump)	Adjust the pressure relief to 60 psig. For a high-pressure application (over 60 psig) consult Boyd Applications Engineering.
	Restriction in coolant lines external to the chiller.	Eliminate restrictions in the coolant lines.
	Frozen evaporator.	Shut down unit - Call Boyd.

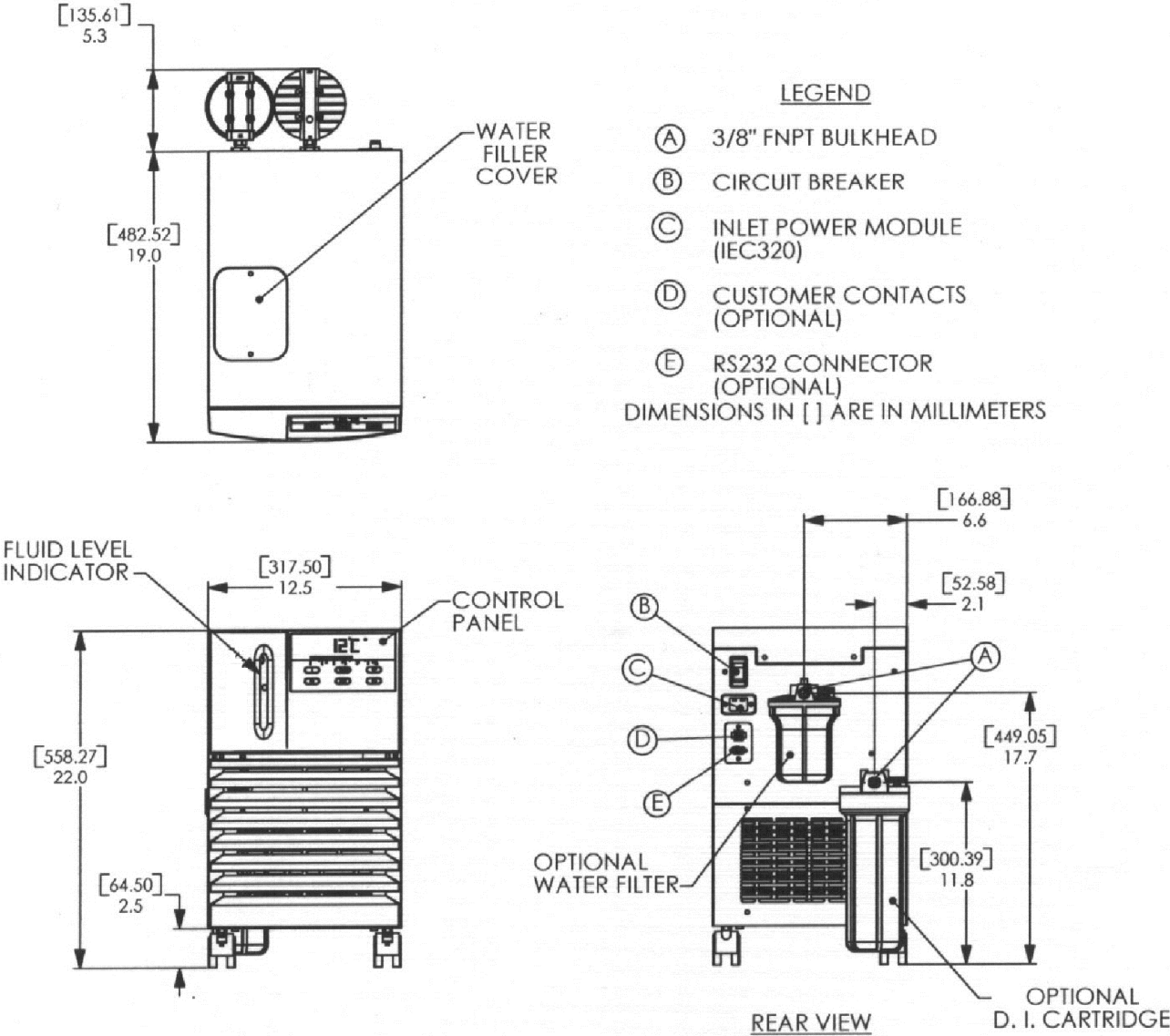
<i>Problem</i>	<i>Probable Cause</i>	<i>Recommended Remedy</i>
No coolant flow	Pump suction strainer fouled or clogged.	Remove and clean strainer, then reinstall.
	No coolant in reservoir.	Check for leaks fix leaks, and fill reservoir.
	Pump overload has tripped.	Turn unit off. Wait for overload to cool. It will reset on its own in 15 minutes or less.
	Leaks in external piping.	Repair leaks.
	Pump motor shaft is bound.	Replace pump motor.
	Closed valve or obstruction in the external piping.	Open valve or remove the obstruction.
	Damaged pump.	Replace pump.
Chiller shuts down during operation	Shutoff feature is enabled in the controller set up menu. (Controllers with options II and III)	Find out and correct the fault that is causing the shutoff. Disable shutoff feature (see controller set up).
	Low flow switch tripped.	See No coolant flow
Temperature display reads incorrectly	Offset incorrectly set.	Reset temperature offset.
Recirculating pressure is too high	Pump internal pressure relief is set too high.	Reset pressure relief to 60 psig.
	Pressure drop through system is too large.	Reduce line length or increase line diameter.
Coolant temperature too cold.	Temperature setpoint is not set properly.	Verify values in the controller, including offset. Reset as necessary.

Kodiak Spare Parts

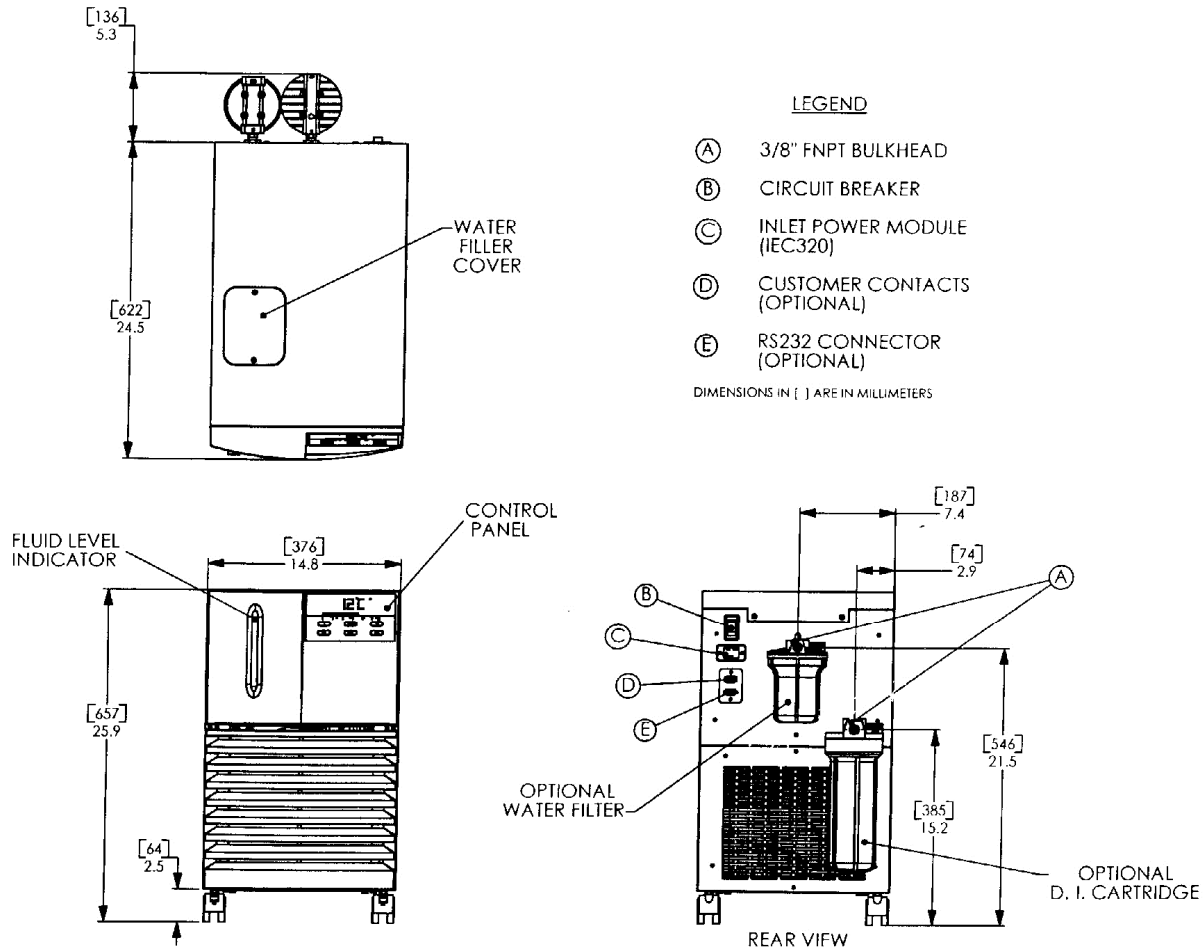
Kodiak Spare Parts	RC006	RC011	RC022	RC030 & RC045
Positive Displacement Pumps & Motors				
1.3 gpm Brass Pump	410-0101	410-0101	410-0101	410-0101
1.8 gpm Brass Pump	410-0103	410-0103	410-0103	410-0103
2.3 gpm Brass Pump	410-0112	410-0112	410-0112	410-0112
4.3 gpm Brass Pump	-	410-0108	410-0108	410-0108
1.3 gpm Stainless Steel Pump	410-0221	410-0221	410-0221	410-0221
4.3 gpm Stainless Steel Pump	-	410-0222	410-0222	410-0222
1/4 Hp 115 V Motor	230-0202	230-0202	-	-
1/4 Hp 230 V Motor	230-0214	230-0214	230-0214	230-0214
1/3 Hp 115/230 V Motor	230-0215	230-0215	230-0215	230-0215
1/2 Hp 115/230 V Motor	-	230-0203	230-0203	230-0203
Centrifugal Pumps				
1/20 Hp Pump 115 V 60 Hz	410-0196	-	-	-
1/20 Hp Pump 230 V 50 Hz	410-0197	-	-	-
1/4 Hp Pump 115 V 50/60 Hz	-	101773-06	-	-
1/4 Hp Pump 230 V 50/60 Hz	-	101773-05	101773-05	101773-05
Turbine Pumps				
Turbine Pump EA 50/60 Hz	-	200-0253	200-0253	-
Turbine Pump EB 50/60 Hz	-	200-0264	200-0264	-

Drawing Specifications RC006

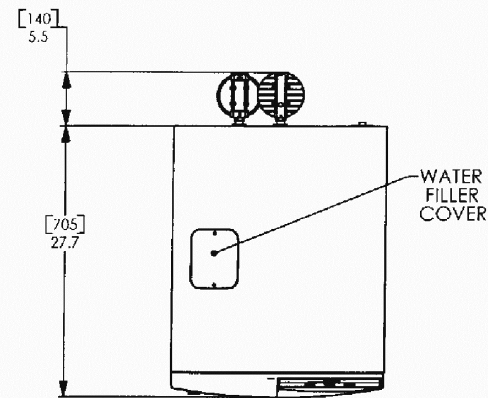
DRAWING / SPECIFICATIONS RC006



Drawing Specifications RC011/022



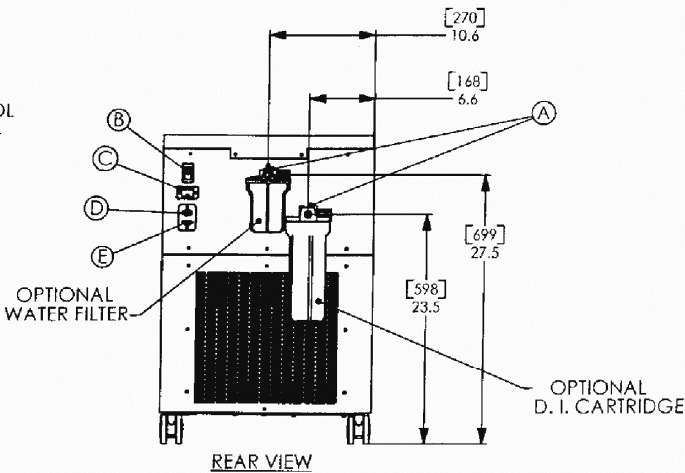
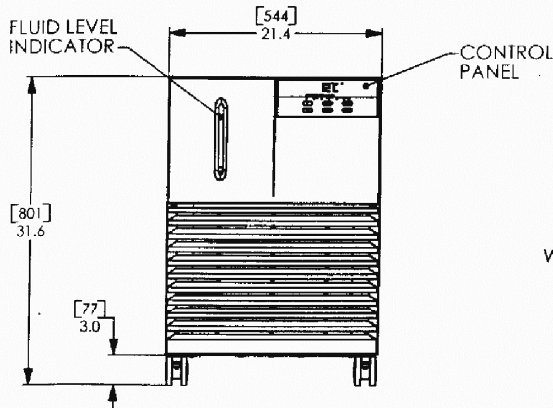
Drawing Specifications RC030/RC045



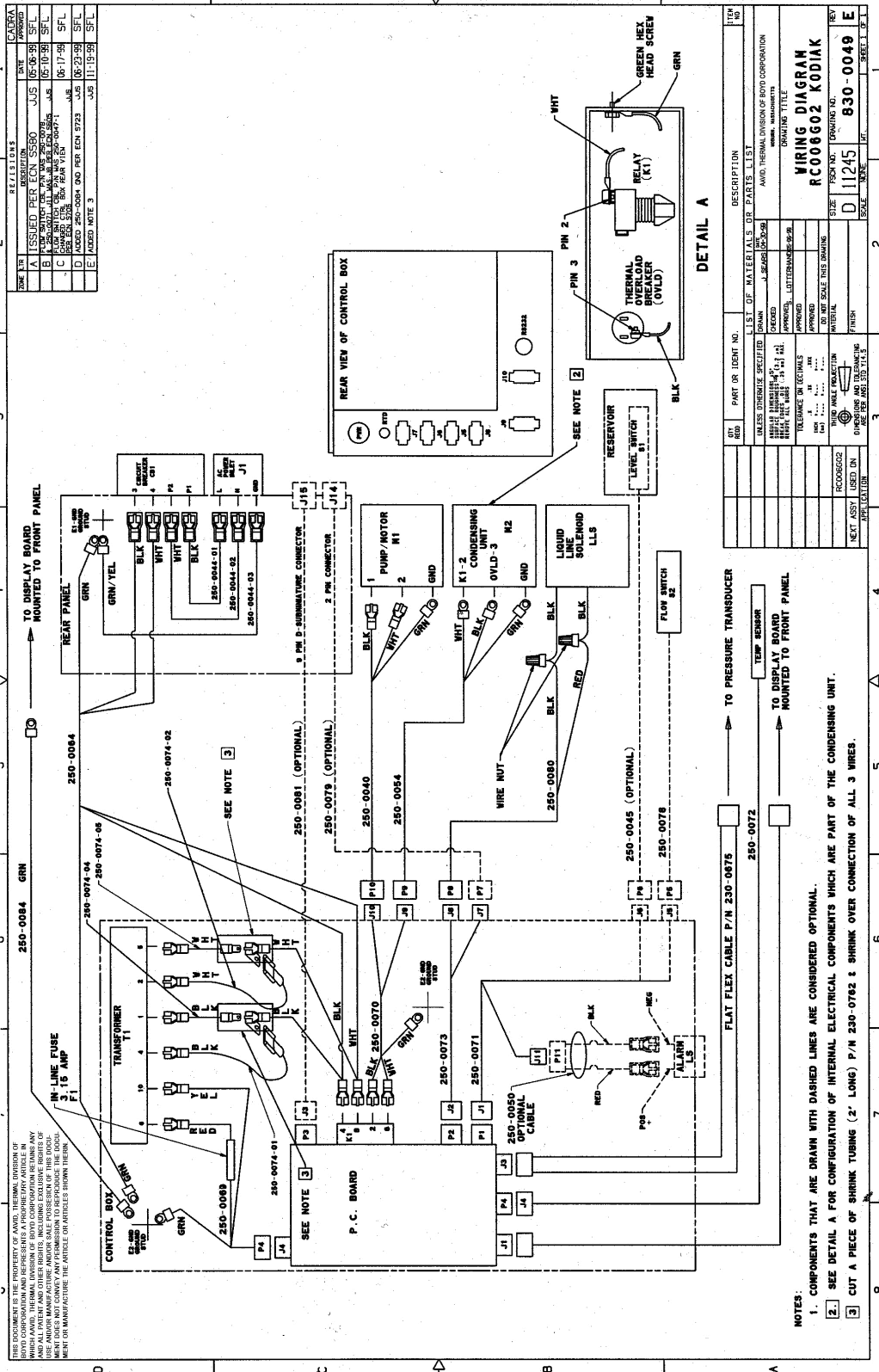
LEGEND

- (A) 1/2" FNPT BULKHEAD
- (B) CIRCUIT BREAKER
- (C) INLET POWER MODULE (IEC320 CONN.)
- (D) CUSTOMER CONTACTS (OPTIONAL)
- (E) RS232 CONNECTOR (OPTIONAL)

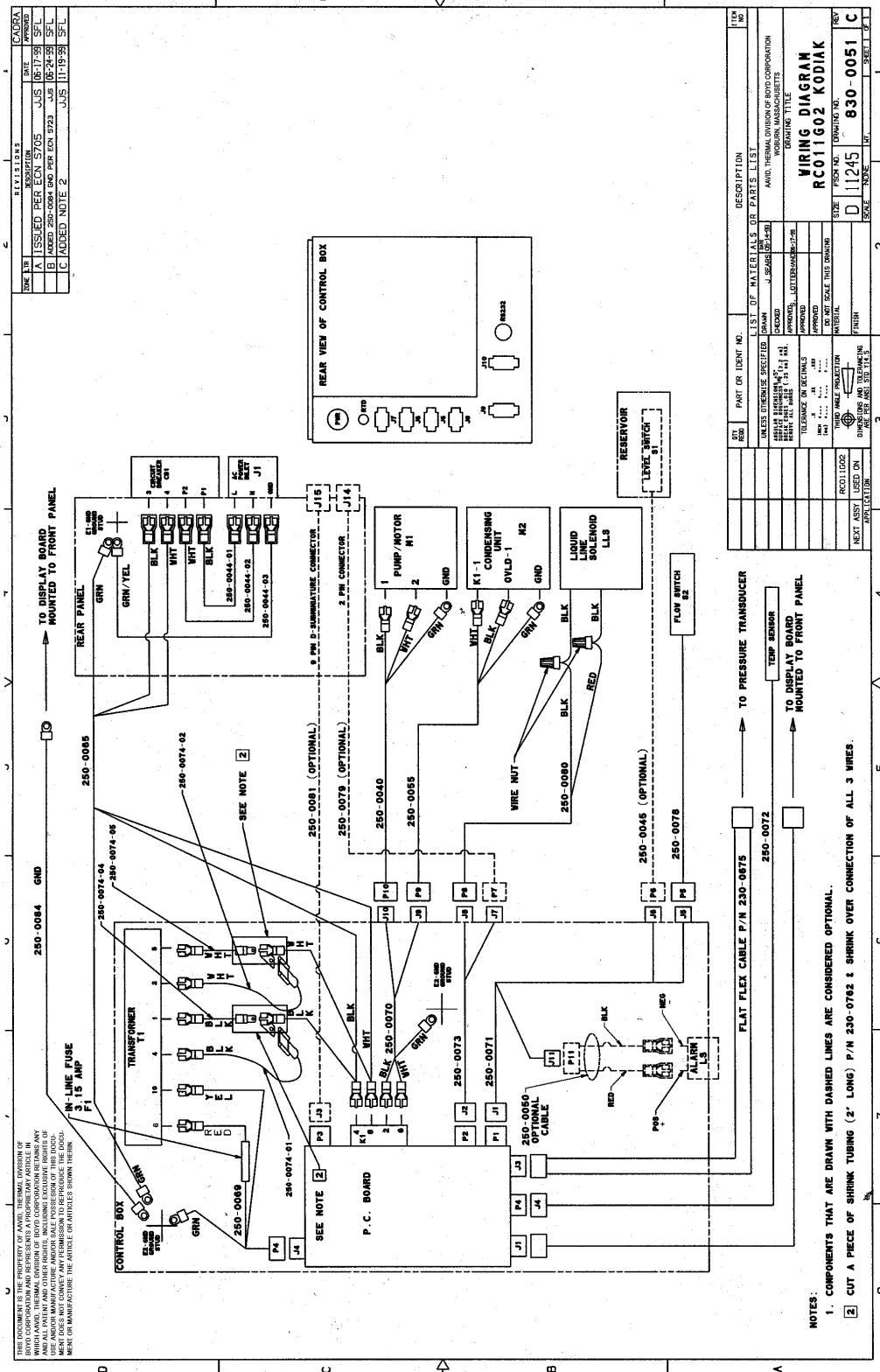
DIMENSIONS IN [] ARE IN MILLIMETERS



Wiring Diagram RC006G02



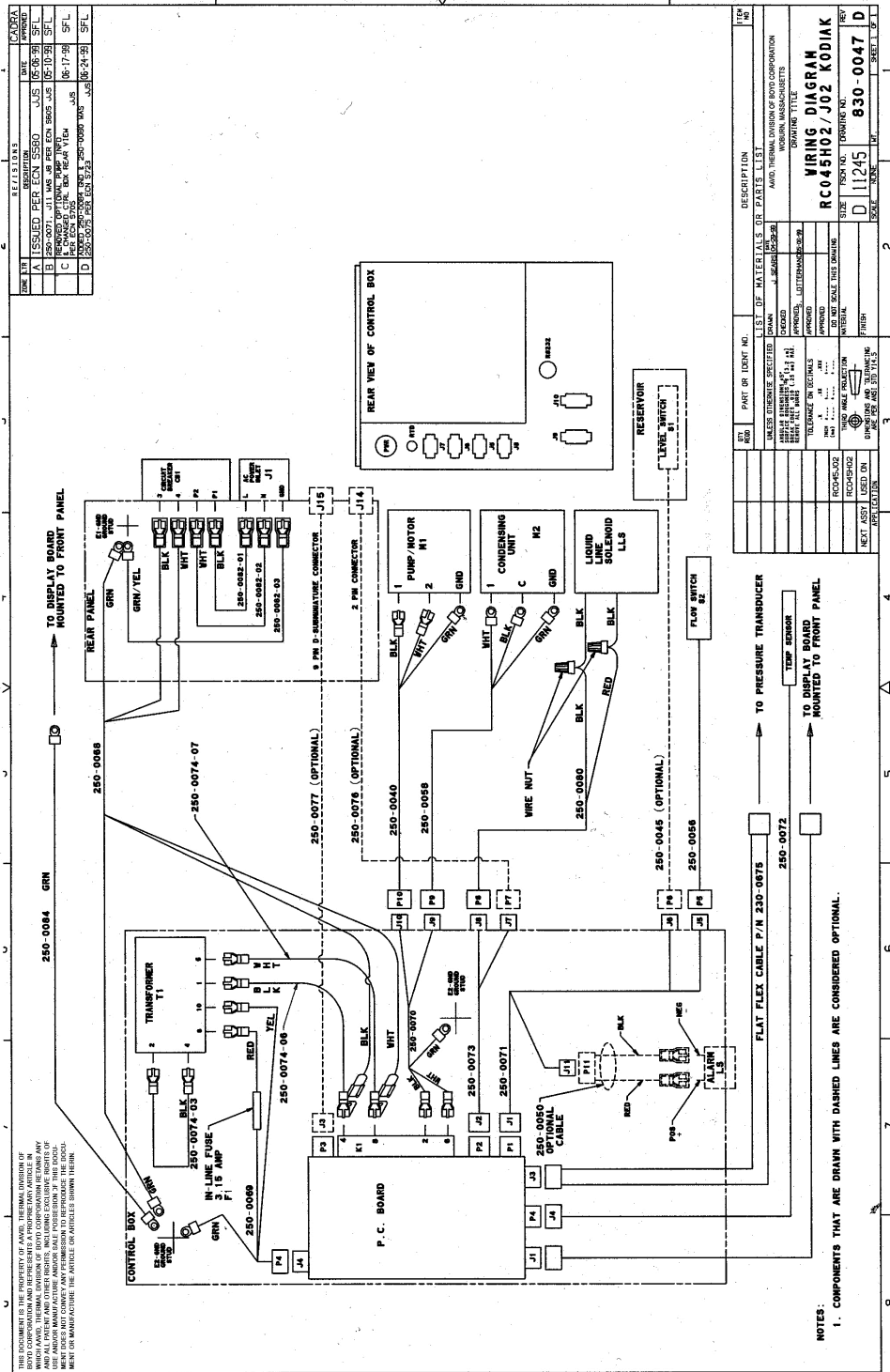
Wiring Diagram RC011G02



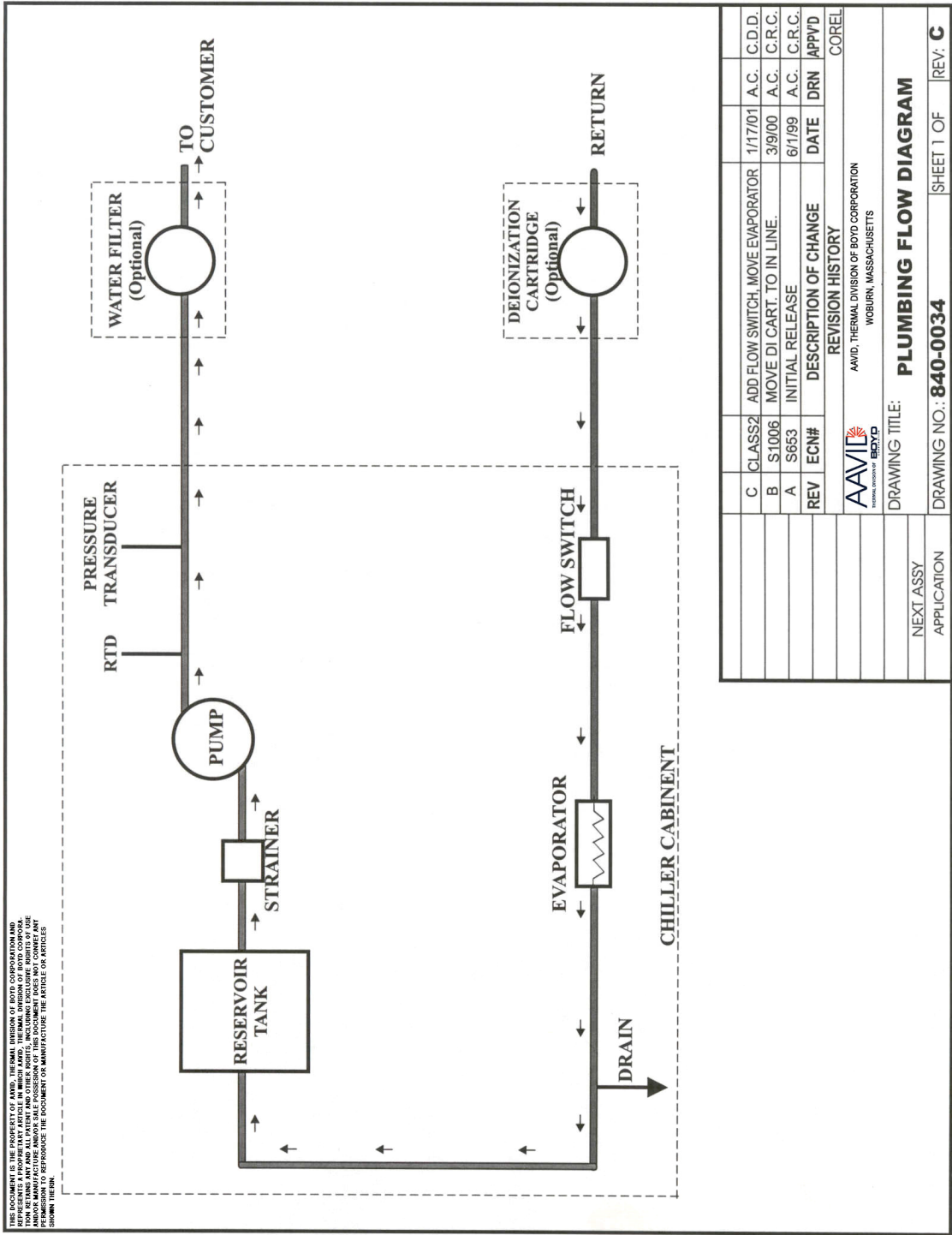




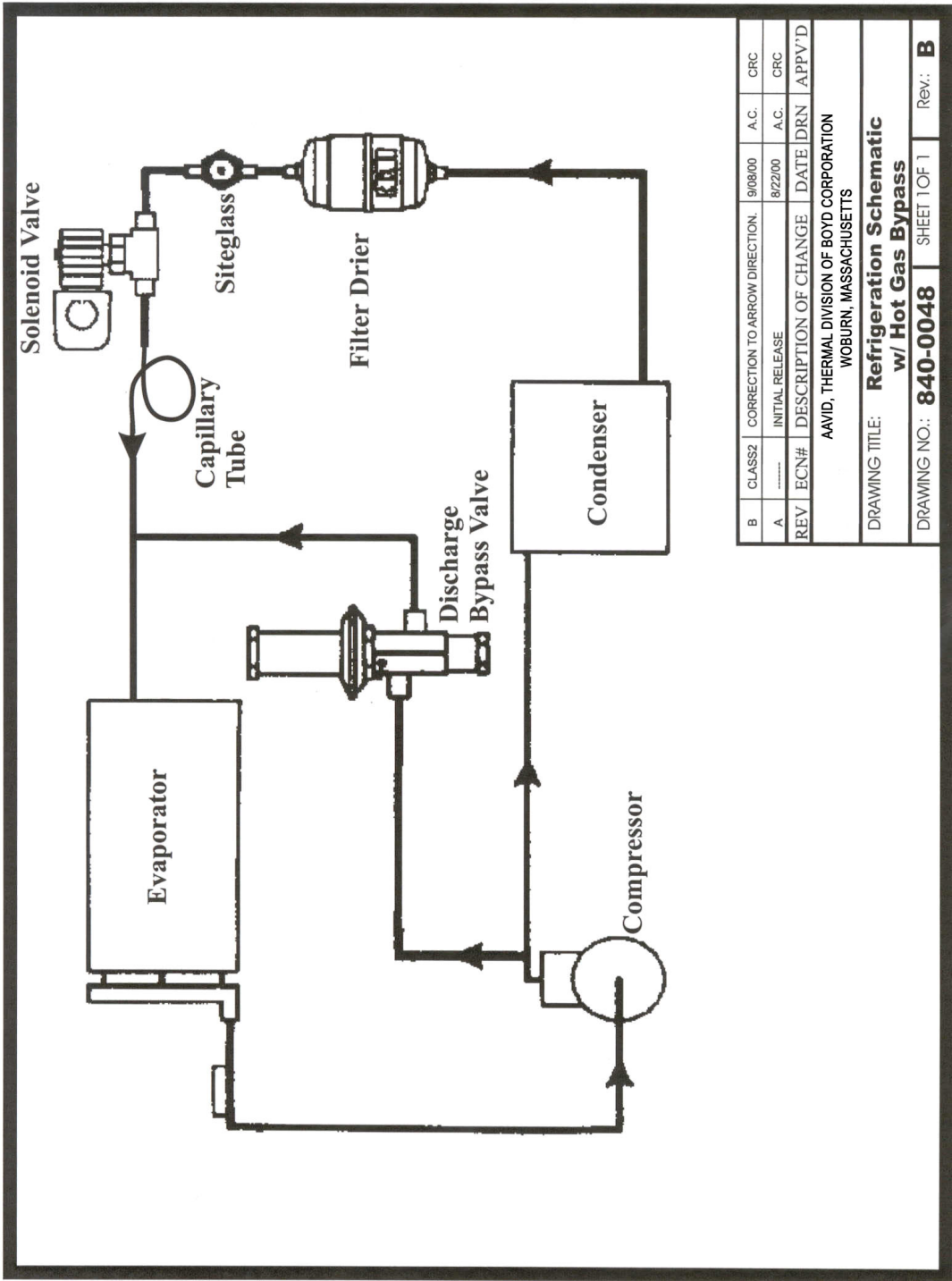
Wiring Diagram RC030H02/J02 & RC045H02/J02



Plumbing Diagram



Refrigeration Diagram



Form F4.5.9, Rev A, Effective Date: 6/1/99

Boyd Kodiak™ Chiller Control Host Interface Data Link

1. Host Interface Data Link

The chiller supports basic host control capability through the Chiller RS-232 port.

1.1 Port Settings

The host port runs at 9600 baud, 8 data bits, 1 stop bit, no parity.

1.2 Flow Control

The chiller negates the Chiller RTS (output from Chiller) line whenever the Chiller is busy in a non-interruptible process. The Chiller ignores the Host CTS line. No software (Xon/Xoff) flow control is provided. It is the responsibility of the host to issue only a single command for which a response from the Chiller Control is required until the response is received from the Chiller Control. Inter and intra message timeout is defined as 1 second. (Typical response times and character pacing will be baud rate limited.)

1.3 Encoding

All characters are to be ASCII characters. All messages from the host to the control and from the control to the host will have 0x10 (ASCII Line Feed) as a start-of-message delimiter, and 0x0D (ASCII Carriage return) as an end-of-message delimiter. Permitted message characters are in the range of 0x20 through 0x7F (hexadecimal).

1.4 Numeric Representation

All numeric values will be represented by hexadecimal numbers, using ASCII characters '0' – '9' & 'A' – 'F'. When multiple variables or parameters are returned by the Chiller Control they will be white space separated (using ASCII 0x20). The host should recognize and use comma, tab and space as white space characters.

1.5 Units

All temperature values will be communicated in two byte hex values of °Cx100 (.01 C°). Resolution of temperature values is .1 degree. All pressure values will be communicated in integer psi with no offset.

1.6 Commands

1.6.1 The following host Control messages are defined:

1.6.2 Read Chiller Status

This command ('R') will cause the Chiller Control to return a complete status string with the following form:

^JR ControlFlags AlarmFlags PlantTemp SetTemp Pressure ^M

Where:

ControlFlags Status in Bit encoded Byte (2 chars).

Bit 7 (MSB)	Machine On	; lights the temperature display and pressure indicator bar
Bit6	ExpansionRelay2On	; not used by host program
Bit5	ExpansionRelay1On	; not used by host program
Bit4	HeaterOn	; not used by host program
Bit3	AutoFillOn	; not used by host program
Bit2	CondenserRelayOn	; not used by host program
Bit1	CoolValveOn	; light the Cool Status
Bit0 (LSB)	CelsiusDisplayOn	; determines the display in Low resolution

AlarmFlags Status in Bit encoded Byte (2 chars). Assignments are:

Bit7 (MSB)	Over Temp	;Over Temperature Alarm is lit
Bit6	LoTemp	;Low Temperature Alarm is lit
Bit5	Low Flow	;LoFlow Alarm is lit
Bit4	Low level	;LoLevel Alarm is lit
Bit3	NotUsed	;not used
Bit2	NotUsed	;not used
Bit1	AudibleAlarmOn	;Alarm transistor (Al toggle)
Bit0 (LSB)	SummaryAlarmOn	;beeps computer

PlantTemp and SetTemp encoded (2-byte hex (°Cx100))

Pressure encoded is integer value (hex 1-byte)

1.6.3 Read Plant Temperature

This command ('T') will cause the Chiller Control to return the plant temperature in a status string with the following form:

^JT PlantTemp^M

Where:PlantTempPlant Temperature Value (2-byte hex (°Cx100))

^J ^MAscii Linefeed and Carriage Return

1.6.4 Read SetPoint Temperature

This command ('S') will cause the Chiller Control to return the current setpoint temperature in a status string with the following form:

^JS SetTemp^M

Where: SetTemp Setpoint Temperature Value (2-byte hex (°Cx100))

^J ^M ASCII Linefeed and Carriage Return

1.6.5 Read User Menu Configuration

This command ('U') will cause the Chiller Control to return the current User Menu configuration information in a status string with the following form:

^JU UserControlFlags OverTempAlmLmt LowTempAlmLmt OffsetCal^M

Where:

UserControlFlags Status in Bit encoded Byte (2 chars). Audible Alarm Enable & Fault Chiller Shutoff are encoded in this byte as follows:

Bit 7 (MSB)	;Chiller PowerOn	;Host signal to turn on
Bit6	;Chiller PowerOff	;Host signal to turn off
Bit5	;Chiller F/C	;Host Signal to toggle F/C
Bit4	;Fault Chiller Shut Off	; fault chiller shutoff is enabled, lights host window
Bit3	;Audible Alarm Enable	; Audible Alarm is enabled
Bit2	-----	;not used
Bit1	;Remote Start NC	;remote start contact closure to run, else Off
Bit0 (LSB)	;Remote Start NO	;remote start contact open to run ,else Off

OverTempAlmLmt;High Temp Limit Setpoint (2-byte hex (°Cx100))

LowTempAlmLmt;Low Temp Limit Setpoint (2-byte hex (°Cx100))

OffsetCalPlant Temp Offset (2-byte hex (°Cx100))

^J ^M ASCII Linefeed and Carriage Return

1.6.6 Set Chiller Control Plant Setpoint Temperature

This command ('P') from the host will set the Chiller Control Temperature Setpoint. The Host command is of the form:

^JP SetTemp^M

Where: SetTemp Setpoint Temperature Value (2-byte hex (°Cx100))

^J ^M ASCII Linefeed and Carriage Return

1.6.7 Set Optional Over-temperature Limit

This command ('X') from the host will set the Chiller Optional Over-temperature Limit. Note that it is the host's responsibility to determine if this option is active. The Host command is of the form:

^JX OverTempAlmLmt ^M

Where: OverTempAlmLmt High Temp Limit Setpoint (2-byte hex (°Cx100))

^J ^M ASCII Linefeed and Carriage Return

1.6.8 Set Low Temperature Alarm Limit

This command ('Y') from the host will set the Chiller Optional Low-temperature Limit. Note that it is the host's responsibility to determine if this option is active. The Host command is of the form:

^JY LowTempAlmLmt ^M

Where: LowTempAlmLmt Low Temp Limit Setpoint (2-byte hex (°Cx100))

^J ^M ASCII Linefeed and Carriage Return

1.6.9 Set Offset Calibration

This command ('Z') from the host will set the Chiller Plant Temperature Offset Calibration. The Host command is of the form:

^JZ OffsetCal ^M

Where: OffsetCal Offset Calibration (2-byte hex (°Cx100))

^J ^M ASCII Linefeed and Carriage Return

Set User Control Flags

This command ('W') from the host will set the Chiller User Control Flags. As noted in the bit descriptions above, the host may use the Power-On and Power-off bits to force the Chiller On/Off. The Host command is of the form:

^JW UserControlFlags ^M

Where: UserControlFlags in Bit encoded Byte (2 chars)

Bit 7 (MSB) ; Chiller On

Bit 6 ; Chiller Off

Bit 5 ; F/C degree display toggle (not active in .1 display mode)

Bit 4 ; Fault Chiller Shutoff enable

Bit 3 ; Audible alarm enable

Bit 2 ; not used

Bit 1 ; AutoStart with NC

Bit0 (LSB) ; Auto Start with NO

^J ^M ASCII Linefeed and Carriage Return

Boyd Recirculating Chiller Service Policy

Boyd's cooling systems are the product of over 50 years of thermal engineering and manufacturing experience. We designed them to provide superior reliability, easy maintenance, and worry-free operation. However, occasionally a system may need repair. To ensure your process is back up and running quickly, Boyd has implemented the following cooling system service policy.

Boyd's Standard Warranty

Boyd's warranty is set forth in the Terms and Conditions included with each system quotation and are available here <https://www.boydcorp.com/terms-and-conditions-of-sale.html>

Diagnostic Consultation:

At no cost, Boyd will attempt to diagnose the problem over the phone. Our service department can be reached by calling 781-933-7305 and following the menu or contacting one of our regional [Service-Depots](#). Service technicians are available 24 hours/7 days for consultation. Boyd strongly encourages customers to take advantage of this service before returning a cooling system to Boyd for evaluation. Often a problem with a system can be fixed quickly in-house or it is determined that it is an application problem. By utilizing our service hotline, you can avoid the downtime and expense associated with returning the system to our factory. Phone diagnosis can be difficult and may actually be a trial and error process. Boyd will not assume any liability for misdiagnosis when diagnosing over the phone.

Warranty and Non-warranty Returns:

To return a cooling system, a Boyd Return Material Authorization (RMA) number must be obtained from Boyd's service department which can be reached by calling 781-933-7300, or by completing the [Request-for-RMA](#) form and e-mailing it to service@boydcorp.com. Prior to calling Boyd, the system part number, serial number, and a detailed description of the problem must be collected, as this information is required to assign an RMA number.

A credit card or, for existing customers, a purchase order, (PO), is also required for the evaluation and repair charges if Boyd determines the system is not defective as defined by the warranty (see below for more details). The amount suggested will cover the evaluation fee and most repair charges for non-warranty repairs.

The RMA number should be indicated on the outside packaging of the returned unit. Systems must be returned clean, dry, and free from chemicals to Boyd's factory, shipping costs prepaid. Boyd is not responsible for any damage incurred in the return shipment. Coolant disposal fees may apply for returned units. Please contact your service representative for details.

Debit memos should not be issued for any repair, either warranty nor non-warranty repairs.

Boyd ordinarily will evaluate the unit within 2 or 3 business days of receipt. Boyd will use reasonable effort to repair the unit promptly, in most cases within one week of receiving all of the required parts.

Boyd's warranty covers repair of the unit but Boyd's warranty does not cover cosmetic issues. If upon examination Boyd determines the system has not failed as defined by the warranty, an evaluation fee will be charged. The evaluation fee will be charged regardless of disposition (i.e.: scrap) and will be credited towards the total repair cost. Once the unit has been evaluated by our Service Group, all work will be quoted to the customer before proceeding with the repair. This quote will not cover the repair of cosmetic issues unless specifically requested to do so.

Repair warranty:

Boyd warrants the replacement parts and labor for 90 days from the repair date under the terms of our standard warranty or the balance of the original warranty, whichever is longer.

Product Specific, Defined Refurbishment Program:

Boyd warrants the replacement parts and labor per the specific quoted length of time from the refurbishment date under the terms of our standard warranty or the balance of the original warranty, whichever is longer. The refurbishment of the unit(s) must be quoted as such with a defined bill of material listing the items covered and the length of the extended warranty.

Return Shipments:

Boyd's warranty covers payment for standard, ground return shipment of warranted repairs. The incremental difference for expedited return shipments, if requested, are the responsibility of the customer. After non-warranty repair, Boyd will ship the system back using the customer's preferred shipping method.

Field Service/Commissioning Charges

Where available, Boyd can arrange field service for cooling system commissioning or repair. Under no circumstances does Boyd's warranty cover on-site service. All on-site service must be arranged through Boyd's service department. The charges for this service include an administrative fee, a charge for on-site services provided, any related travel charges, and parts not covered under warranty.

All requests for On-Site Services require a PO or credit card authorization before services will be scheduled.

When using Boyd-arranged, on-site service, Boyd warrants the replacement parts and repair labor for 90 days from the repair date under the terms of our standard warranty or for the balance of the original warranty, whichever is longer. If non-authorized labor repairs the system or installs replacement parts, Boyd does not warranty the parts or work and this action potentially voids any remaining warranty.

Boyd is expanding its worldwide service presence. Please contact the Service Department for the latest areas where on-site service is available.

Replacement Parts:

Replacement parts can be ordered using a credit card or purchase order. Parts being returned from systems under warranty should be returned using a Boyd issued RMA number. If the parts are found to be defective and the claim is within the warranty period, credit will be issued for the price of the parts and one-way ground shipping charges. If the parts are not defective or indicate end user damage, no

credit will be issued. Boyd will not cover the incremental cost of air shipment of replacement parts, regardless of warranty status.

In-stock parts will normally ship the next business day; non-stocked parts will be shipped as quickly as reasonably possible.

This policy is subject to change. Please check with Boyd's service department for the current policy.

Form F7.02.25 Rev G 06/24/19

Boyd Warranty

Boyd agrees that the apparatus manufactured by it will be free from defects in materials and workmanship for the warranty period under normal use and service and when properly installed. The warranty period for Kodiak® standard, RM, and XL recirculating chillers is two years from date of shipment of such apparatus to the original purchaser, maintenance items excluded, and one year from date of shipment of such apparatus to the original purchaser for all other products Boyd sells. See Boyd's Cooling System Service Policy (F7.02.25) for additional warranty details on systems. Boyd's obligation under this agreement is limited solely to repair or replacement, at its option, at its factories, of any part or parts thereof, returned to Boyd with transportation charges prepaid, which examination shall disclose to Boyd's satisfaction to have been defective. THE FOREGOING EXPRESS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING BUT NOT LIMITED TO WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. BOYD'S OBLIGATION UNDER THIS WARRANTY IS STRICTLY AND EXCLUSIVELY LIMITED TO THE REPAIR OR REPLACEMENT OF DEFECTIVE COMPONENT PARTS AND BOYD DOES NOT ASSUME OR AUTHORIZE ANYONE TO ASSUME FOR IT ANY OTHER OBLIGATION. BOYD ASSUMES NO RESPONSIBILITY FOR INCIDENTAL, CONSEQUENTIAL, OR OTHER DAMAGES INCLUDING, BUT NOT LIMITED TO LOSS OR DAMAGE TO PROPERTY, LOSS OF PROFITS OR REVENUE, LOSS OF THE UNIT, LOSS OF TIME, OR INCONVENIENCE. Boyd's liability does not include any labor charges for replacement of parts, adjustments, repairs, or any other work done outside its factories or service centers and its liability does not include any resulting damage to persons, property, equipment, goods or merchandise arising out of any defect in or failure of its apparatus. Boyd's obligation to repair or replace shall not apply to any apparatus which shall have been repaired or altered outside of its factory or service centers in any way, or which has been subject to negligence, to misuse, or to pressures in excess of stated limits. On parts not of Boyd's manufacture, such as motors, controls, etc., Boyd extends only those warranties given to Boyd, Corporation to the extent Boyd can do so. Boyd's agreement hereunder runs only to the immediate purchaser from Boyd, Corporation and does not extend, expressly or by implication, to any other person.

Form F7.02.18 Rev J Effective December 2, 2013