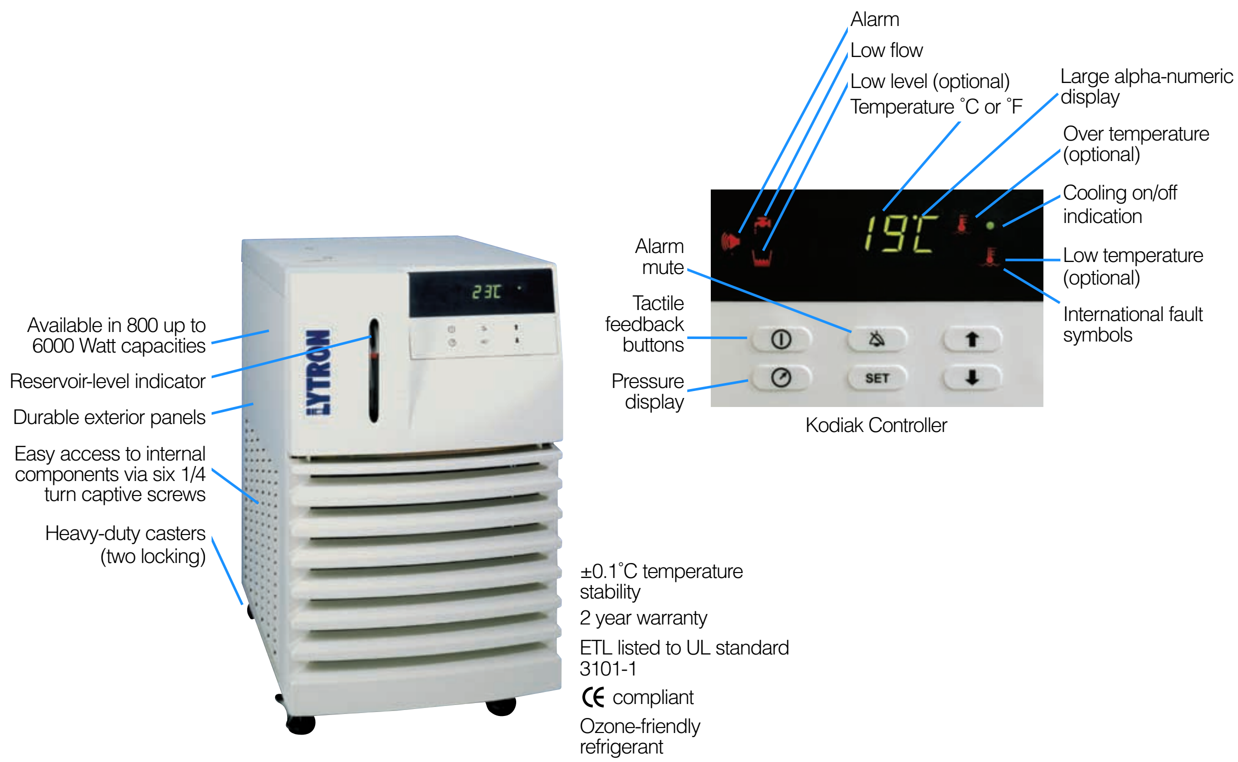
KODIAK RECIRCULATING CHILLERS



Lytron's third generation Kodiak® continues to set the standard in chiller design. The new Kodiaks provide improved cooling capacity and increased controller flexibility. Lytron's engineers took an extremely reliable design and improved it.

Engineered for process-fluid cooling applications, these compact chillers feature advanced industrial design, user-friendly controls, easy maintenance, and quiet operation. At the heart of each Kodiak chiller is a robust, ozone-friendly refrigeration system designed for years of reliable cooling in the most demanding applications. Lytron led the industry by offering a two-year warranty on these systems.

The Kodiak line consists of five models with nominal cooling capacities of 800W up to 6000W. Each Kodiak chiller contains many standard features, and Lytron offers a wide range of options to tailor any Kodiak chiller to your exact requirements. Additional modifications, available in OEM volumes, are described on page 34.

Applications:
Medical Lasers
Industrial Lasers
Electron Microscopes
Diffusion and Turbo Pump Cooling
FTIR and ICP Analytical Instrumentation

With over 40 years experience, thousands of liquid-cooling systems in the field, and a two-year warranty, you can count on Lytron's Kodiak chiller for years of reliable service in your cooling application.

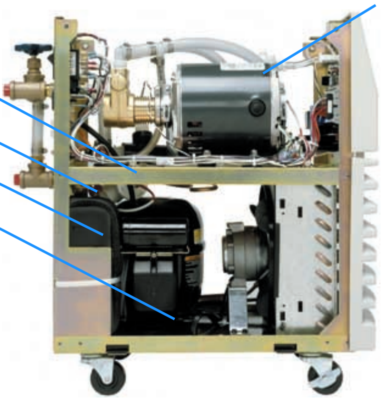
KODIAK STANDARD PRODUCTS

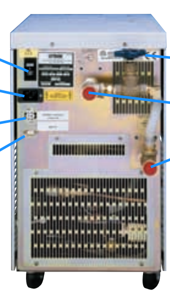
RC006

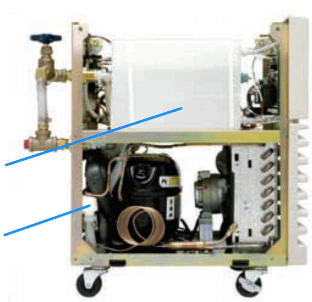
RC030, RC045

RC011, RC022

ADDITIONAL KODIAK FEATURES







KODIAK HAS THE FEATURES YOU NEED

Easy-To-Use Controller
Kodiak's microprocessor-based controller is easy-to-use and easy-to-read. The large alpha-numeric display, positioned at an ergonomic angle, enables the operator to monitor the unit from across the room. A pressure display speeds troubleshooting and makes real-time monitoring easy. Tactile feedback buttons reduce operator error. The optional features include visual and audible alarms for over and under temperature, low liquid level, and fault shut off. Relay-driven fault power interrupts are also available. The unit allows remote monitoring, data logging, and control through an optional RS232 interface.

Unsurpassed Reliability
Our ISO 9001 registered engineering process and manufacturing facility ensure reliable design and quality. For example, to extend compressor life, Lytron has eliminated unnecessary compressor cycling with a hot-gas bypass system on all Kodiaks. This system regulates the cooling cycle by diverting hot-gas refrigerant through the evaporator, bypassing the condenser and back to the compressor. This design dramatically extends chiller life.

Designed for demanding scientific and industrial applications, Kodiaks feature a two-year top-to-bottom warranty. No other manufacturer provides better reliability or higher quality.

Temperature Stability
Lytron's chillers have large thermal mass tanks for more stable temperature control during start-up conditions, dynamic loads, or changing environments. Standard Kodiak chillers feature ±0.1˚C stability under steady-state operating conditions.

Quiet Operation
Lytron has carefully considered the factors that decrease noise and vibration. Heavy-duty, vibration-damping feet on the compressor and pump, combined with sound-absorbing panels, reduce compressor noise and vibration. In addition, the hot-gas bypass eliminates noise related to compressor cycling. The result of our efforts is one of the industry's quietest recirculating chillers.

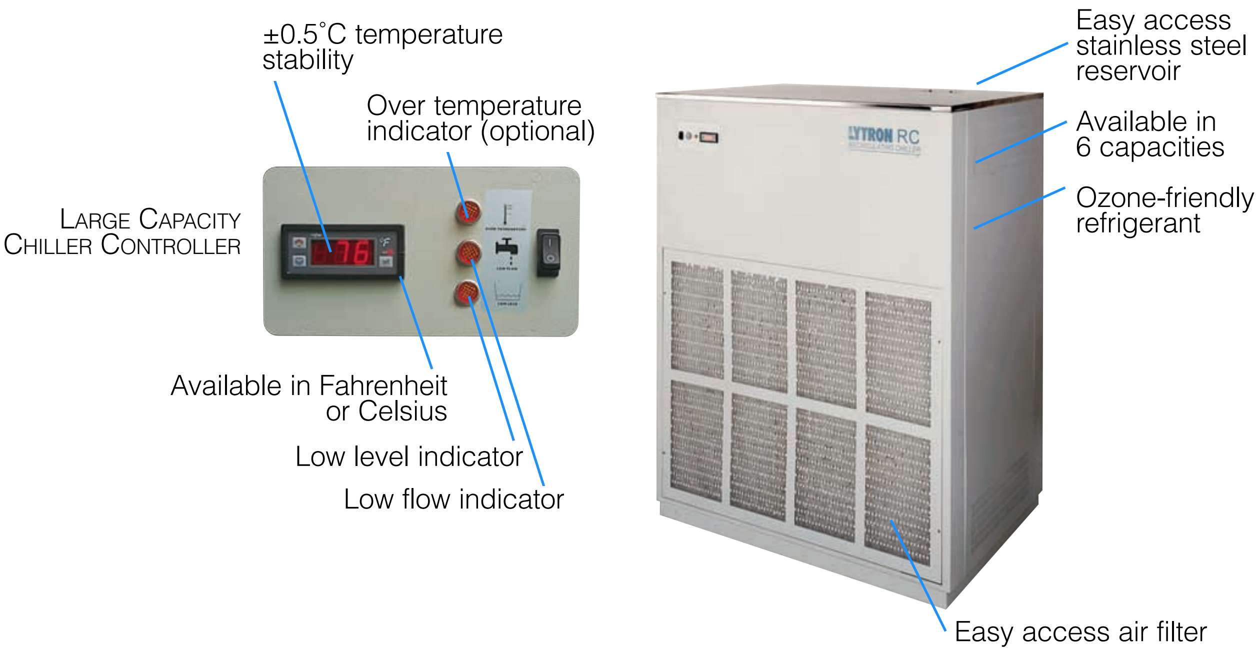
Easy Serviceability
Kodiak chillers offer many features designed to improve serviceability and maintenance. For example, easy-access panels, secured with just six 1/4 turn captive fasteners, can be removed in under 30 seconds. Inside the unit, the pump is readily accessed to allow easy bypass valve adjustment and pump strainer maintenance. The spill-proof reservoir minimizes potential damage from accidents when filling the reservoir, while the drain speeds liquid change or removal. Finally, Kodiak's front panel reservoir-level indicator helps prevent the system from running dry. Unlike other systems, you can see the level of the cooling fluid at a glance from across the room.

Variety of Pump Options
You can configure your chiller with either a positive displacement, centrifugal, or turbine pump. Positive displacement pumps provide a constant flow regardless of the pressure drop through the system. Centrifugal and turbine pumps provide reduced flow with increased pressure drop. However, these pumps have a significantly longer life, lasting up to 45,000 hours. Centrifugal pumps produce relatively low head pressure, while turbine pumps are ideal for applications with a large pressure drop. Our applications engineering department is available to help with pump selection.

Applications Engineers and Service Network
Lytron's applications engineering department consists of degreed engineers with extensive heat transfer, fluid dynamics and material analysis experience. They are available to consult on chiller size, pump and controller selection, as well as system design.

We are aware that occasionally a chiller may need repair. To limit the downtime of your equipment or production line, Lytron offers 24 hour, 7 day access to in-house service technicians for troubleshooting assistance. For information on our optional service programs, contact our service department. It's all designed to keep you up and running.

LARGE CAPACITY RECIRCULATING CHILLERS



If your high heat load application requires below-ambient or tight temperature control, choose a state-of-the-art, large capacity recirculating chiller from Lytron. Select from six chillers with cooling capacities from 7 kW to 35 kW.

For over a decade, we've been designing and manufacturing chillers that deliver trouble-free operation year-after-year. At the heart of each unit is a robust, ozone-friendly refrigeration system designed to provide years of reliable cooling. Engineered for demanding industrial applications, Lytron's large capacity chillers feature a two-year top-to-bottom warranty.

Standard options include ±0.5˚C temperature stability, a digital temperature controller, positive displacement pumps, hot-gas bypass, low level and low flow indicators, phase loss protection, as well as air and water filters. Lytron also offers a wide range of options to tailor a chiller to your application: over-temperature indicator, dry contacts for fault conditions, high purity plumbing and deionization kit, electrical and pump options, and heavy-duty casters. Additional modifications, which are available in OEM volumes, are described on page 34.

At Lytron, we have designed and manufactured liquid-cooling systems for over four decades. Take advantage of this experience for your next thermal design.

Applications:
Industrial Lasers
Industrial Machine Tools
Printing
Vacuum Pumps
Cryogenic Compressors
Servicing Multiple Applications

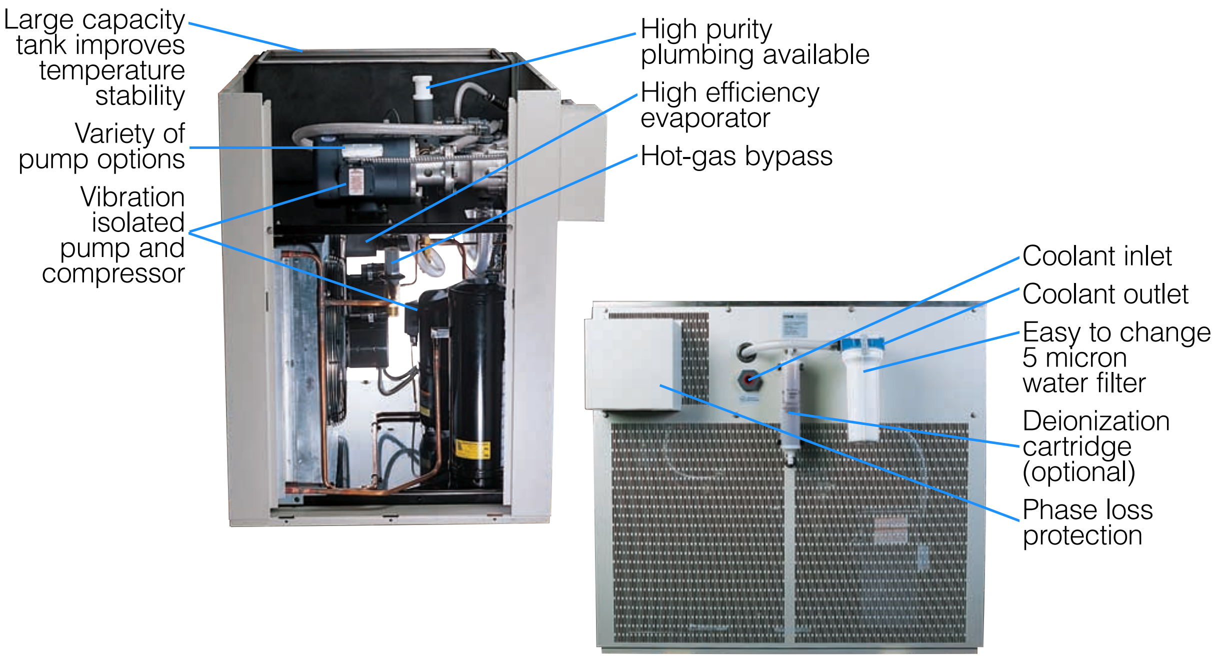
STANDARD LARGE CAPACITY CHILLERS

RC070, RC100

RC250, RC350

RC130, RC160

ADDITIONAL LARGE CAPACITY CHILLER FEATURES



LARGE CAPACITY CHILLERS OFFER THESE FEATURES

Proven Reliability
No other manufacturer provides better reliability, broader experience, or higher quality. Our chillers are hard at work in the most demanding industrial applications. Our superior design allows Lytron to offer a two-year top-to-bottom warranty.

An example of our reliable design is the elimination of compressor cycling. To extend compressor service life, Lytron has eliminated unnecessary cycling with a hot-gas bypass system on all large capacity chillers. This system regulates the cooling cycle by diverting hot-gas refrigerant through the evaporator, bypassing the condenser, and back to the compressor. This design dramatically extends chiller life.

Quiet Operation
We designed our chillers to be quiet. For quiet, reliable operation, motors, pumps and compressors are vibration-isolated. In addition, the hot-gas bypass eliminates noise related to compressor cycling.

Variety of Pump Options
You can configure your chiller with either a positive displacement, centrifugal, or turbine pump. Positive displacement pumps provide a constant flow regardless of the pressure drop through the system. Centrifugal and turbine pumps provide reduced flow with increased pressure drop. However, these pumps have a significantly longer life, lasting up to 45,000 hours. Centrifugal pumps produce relatively low head pressure, while turbine pumps are ideal for applications with a large pressure drop. Our applications engineering department is available to help with pump selection.

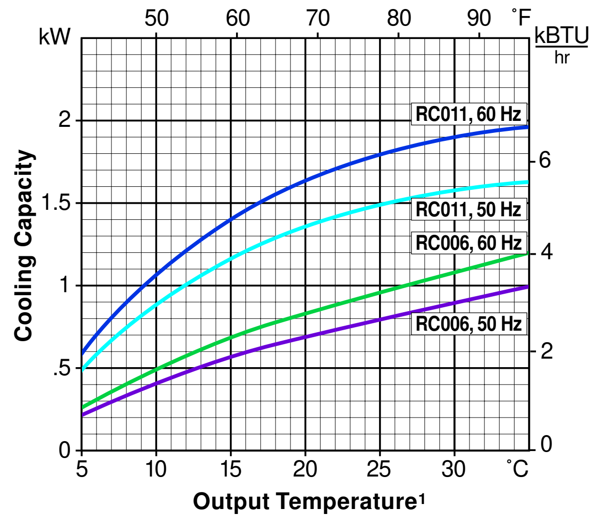
Ease of Maintenance
Our engineers designed Lytron's large capacity chillers for easy serviceability. The clean, open layout provides quick and easy access to the reservoir, coolant filter, air filter, and all internal components. Heavy-duty casters are available to facilitate moving the chiller.

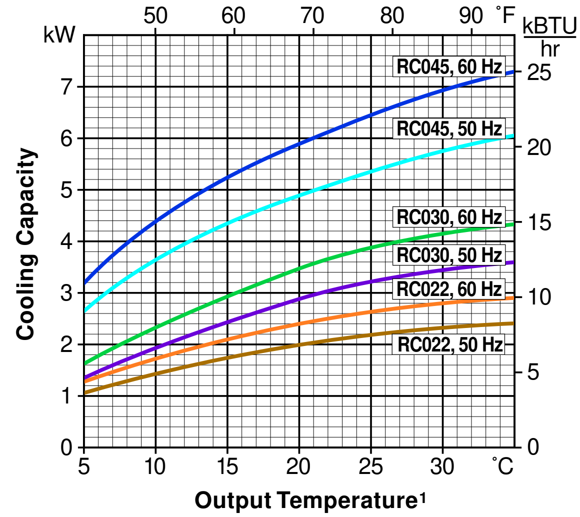
Easy-to-Use Controller
Our easy-to-use controller manages chiller operation and warns the user of fault conditions. It is available with either a Fahrenheit or Celsius digital display and maintains the coolant temperature to within half a degree Celsius. The controller's phase loss protection feature will automatically shut down the unit if one phase is lost. The standard low level indicator light and optional relays warn you of a low liquid level. To protect your investment, low flow indication is standard on all large capacity chillers. If freezing or some blockage inhibits the coolant flow, the chiller will automatically shut down. Other options include an indicator and dry contacts for over-temperature and dry contacts for low level and low flow (the standard controller package includes indicators).

Applications Engineers and Service Network
Lytron's applications engineers can assist with system configuration for your application. They are degreed engineers with extensive heat transfer, fluid dynamics and material analysis experience and are ready to consult on chiller size, pump and controller selection.

Occasionally a chiller may need repair. To limit downtime, Lytron offers 24 hour, 7 day access to in-house service technicians for troubleshooting assistance. In addition, our extensive service network provides local assistance should it be necessary. For information on our optional service programs, contact our service department. It's all designed to keep you up and running.

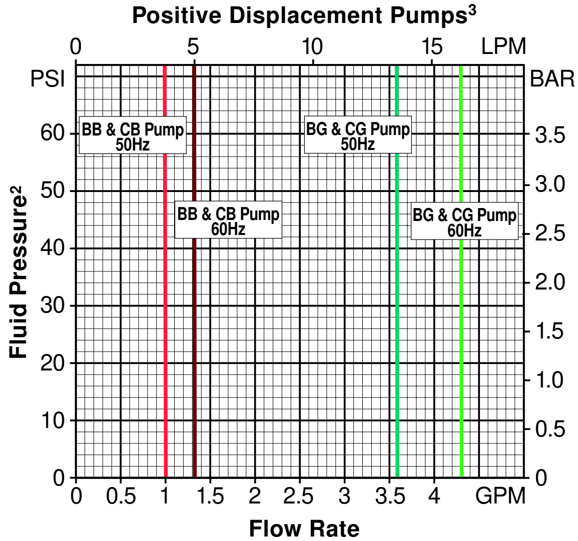
Performance Curves



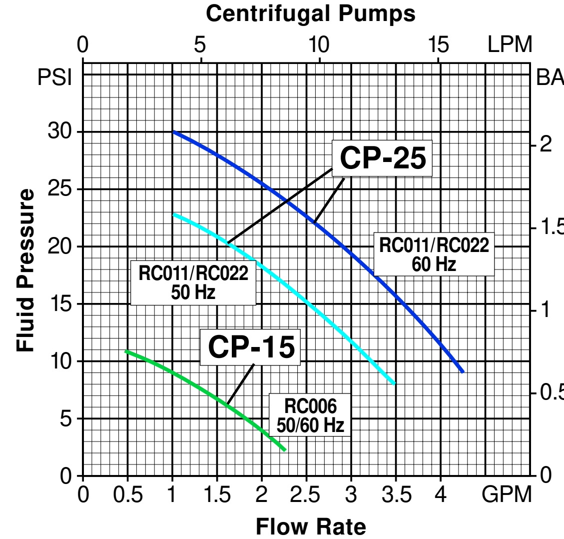


System Pump Curves

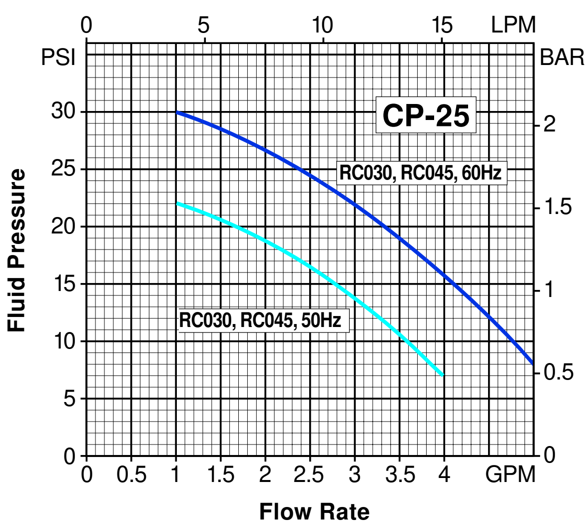
Positive Displacement Pumps[3]



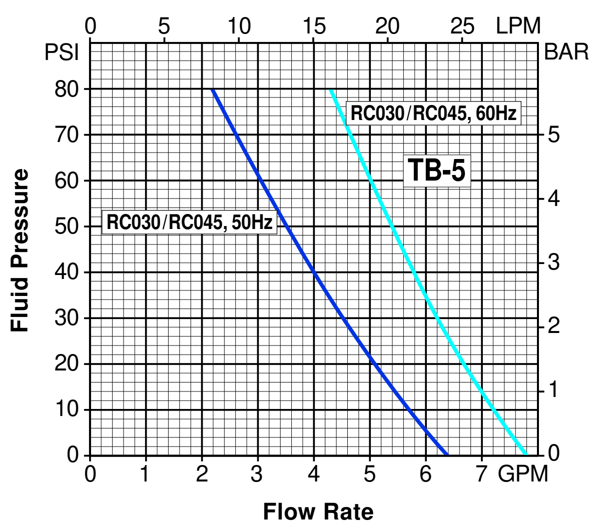
Centrifugal Pumps



Centrifugal Pumps



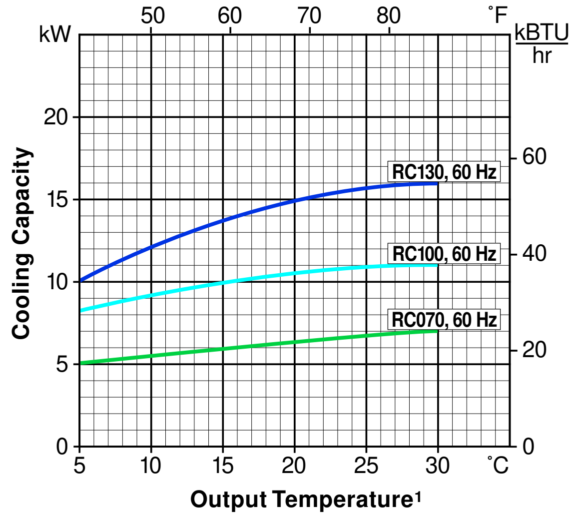
Turbine Pumps

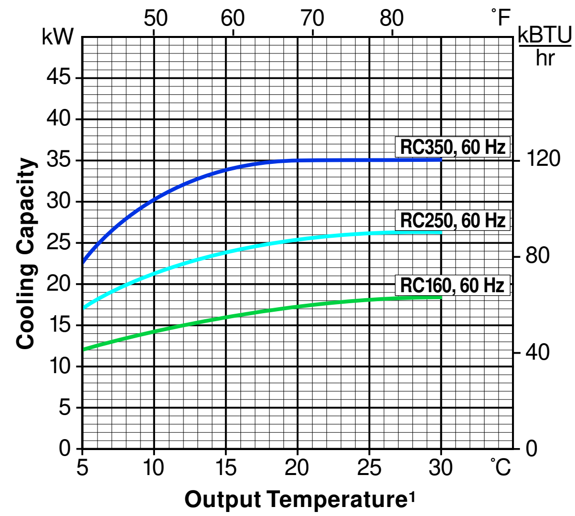


1) Temperature represents output temperature of water assuming 20˚C ambient air conditions. Performance subject to change due to variations such as fluid type or operating conditions. 2) Pressure relief is factory set at 60psi (4.1 Bars). Higher settings available. 3) See ordering Information on page 26 for pump descriptions.

LARGE CHILLER TECHNICAL INFORMATION

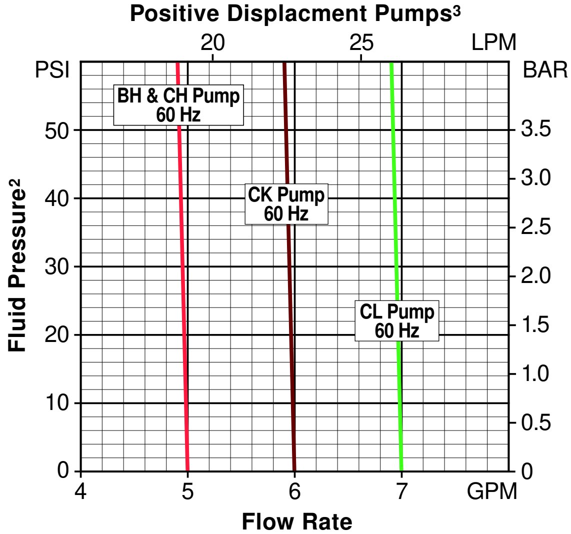
Performance Curves



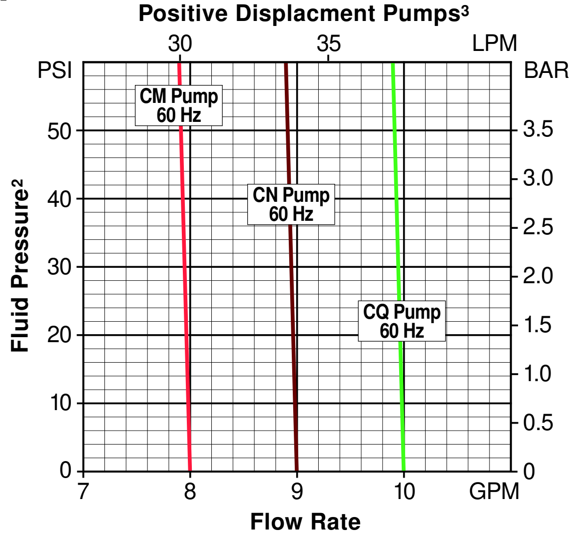


System Pump Curves

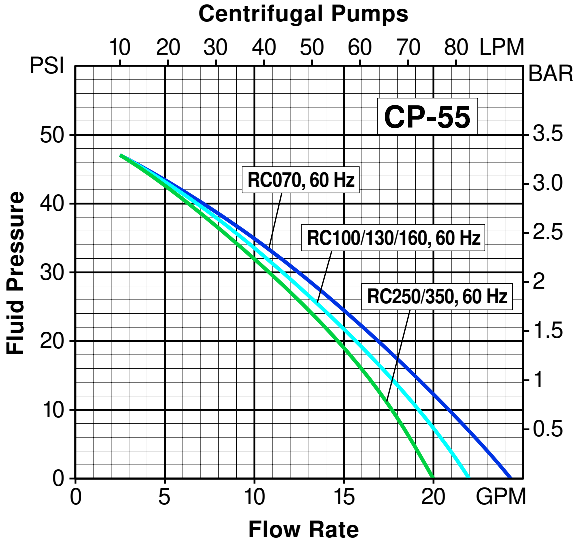
Positive Displacment Pumps³



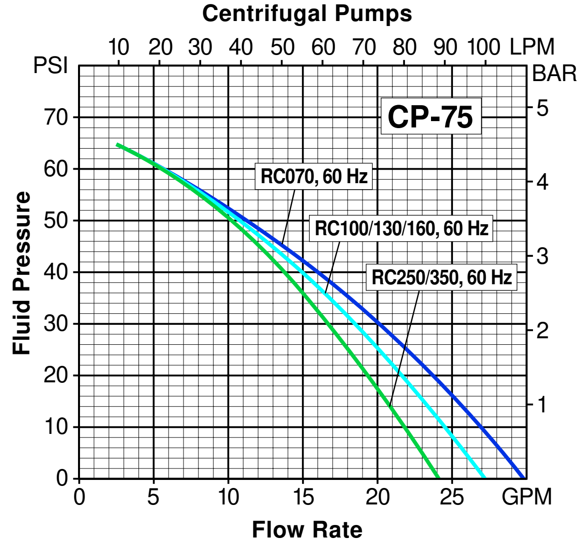
Positive Displacment Pumps³



Centrifugal Pumps



Centrifugal Pumps



1) Temperature represents output temperature of water assuming 20˚C ambient air conditions. Performance subject to change due to variations such as fluid type or operating conditions. 2) Pressure relief is factory set at 60psi (4.1 Bars). Higher settings available. 3) See ordering Information on page 26 for pump descriptions.

ORDERING INFORMATION

Kodiak Recirculating Chillers

To order a Kodiak chiller, select a model number (e.g. RC011), then choose the appropriate option codes. e.g.: RC011G03BB3.

		Option Codes	RC006	RC011	RC022	RC030	RC045
Electrical Configurations:	**115V 60Hz 1ph**	G03	G03	G03			
	230V 50Hz 1ph	H03	H03	H03	H03	H03	H03
	230V 60Hz 1ph	J03		J03	J03	J03	J03
Pumps[1]:	**Positive Displacement Pump--Brass 1.3 gpm**	BB	S	S	S		
	Positive Displacement Pump--Brass 1.8 gpm	BC	O	O	O		
	Positive Displacement Pump--Brass 4.3 gpm	BG		O	O	S	S
	Positive Displacement Pump--Stainless Steel 1.3 gpm[2]	CB	O	O	O		
	Positive Displacement Pump--Stainless Steel 4.3 gpm[2]	CG		O	O	O	O
	Centrifugal--CP-15 (1/20 hp)[3]	AA	O				
	Centrifugal--CP-25 (1/4 hp)[3]	DA		O	O	O	O
	Turbine--TB-5 (1/2 hp)[3]	EB		O	O	O	O

[1]See page 24 for system pump curves. [2]Available only with High Purity Plumbing Package.
[3]Water Filter and Deionization Cartridge not available with centrifugal pumps in Kodiak chillers.

Controller Packages:	Option Codes	RC006	RC011	RC022	RC030	RC045
Controller Package I: Digital Temperature Display, Calibration Offset, Low Flow Shut Off, Auto-Restart, °C/°F Toggle, Pressure Display, Audible Alarm, and Alarm Mute.	1	S	S	S	S	S
Controller Package II: Same as Package I plus Low Level, Low/High Temp, Fault Shut Off (Toggle on/off), Relay Contacts[4] (Normally open or Normally closed).	2	O	O	O	O	O
Controller Package III: Same as Package II plus RS232.	3	O	O	O	O	O

[4]Mating connector- Amp part number 350715-1 and 350547-1

Large Capacity Recirculating Chillers

To place an order for a large capacity chiller, select a model number (e.g. RC070), then choose the appropriate option codes,
For example: RC070L01BH5.

		Option Codes	RC070	RC100	RC130	RC160	RC250	RC350
Electrical Configurations	**208/230VAC 60Hz 3ph**	L01	L01	L01	L01	L01	L01	L01
	460V 60Hz 3ph	P01	P01	P01	P01	P01	P01	P01

Pumps[1]:		Option Codes	RC070	RC100	RC130	RC160	RC250	RC350
3/4" Female NPT Connections	**PDP[4]--Brass 5.3 gpm**	BH	S	S				
	PDP[4]--Stainless Steel 5.3 gpm	CH	O	O				
	PDP[4]--Stainless Steel 5.7 gpm	CK	O	O				
	PDP[4]--Stainless Steel 6.8 gpm	CL	O	O	S			
	PDP[4]--Stainless Steel 7.9 gpm	CM	O	O	O	S		
1" Female NPT Connections	**PDP[4]--Stainless Steel 9.0 gpm**	CN	O	O	O	O	S	
	PDP[4]--Stainless Steel 10.1 gpm	CQ	O	O	O	O	O	S
1 1/4" Female NPT Connections	**Centrifugal--CP-55 (1 hp)[5]**	DB	O	O	O	O	O	O
	Centrifugal--CP-75 (2 hp)[5]	DC	O	O	O	O	O	O

[1]See page 25 for system pump curves. [4]PDP stands for Positive Displacement Pump.
[5]Water Filter not available with centrifugal pumps in large capacity chillers.

Controller Packages:		Option Codes	RC070	RC100	RC130	RC160	RC250	RC350
Controller Package IV:	Digital Temperature Display in Fahrenheit, Low Flow Indicator, Low Level Indicator. No dry contacts.	4	S	S	S	S	S	S
Controller Package V[6]:	Digital Temperature Display in Celsius, Low Flow Indicator, Low Level Indicator. No dry contacts.	5	O	O	O	O	O	O
Controller Package VI:	Digital Temperature Display in Fahrenheit. Separate indicators and dry contacts for: Low Level, Low Flow and Overtemp. The dry contacts are open on fault condition.	6	O	O	O	O	O	O
Controller Package VII:	Digital Temperature Display in Celsius. Separate indicators and dry contacts for: Low Level, Low Flow and Overtemp. The dry contacts are open on fault condition.	7	O	O	O	O	O	O

[6]No charge for this option.

CHILLER SPECIFICATIONS[1]

MODEL NUMBERS		RC006	RC011	RC022	RC030	RC045	RC070	RC100	RC130	RC160	RC250	RC350
		Kodiak Recirculating Chillers					Large Capacity Recirculating Chillers					
Cooling Capacity[2]	WATTS	825	1650	2400	3450	5900	7k	10k	13k	16k	25k	35k
	BTU/HR	2.8k	5.6k	8.2k	11.8k	20.1k	23.2k	34.1k	44.3k	54.6k	85k	119k
Compressor Capacity	Hp	1/4	1/2	3/4	1	1 1/2	2	3	4	5	7 1/2	10
Temperature Stability[3]	°C	+/-0.1°C					+/-0.5°C					
Dimensions[4]	Width-inches (mm)	12.5 (318)	14.8 (376)		21.4 (543)		36.3 (920)		47.2 (1198)		46.8 (1187)	
	Depth-inches (mm)	19.0 (483)	24.5 (623)		27.8 (705)		32.1 (814)		36.1 (916)		36.8 (933)	
	Height-inches (mm)	22.0 (559)	26.5 (673)		31.9 (810)		37.0 (940)		43.0 (1092)		60.9 (1549)	
Connections (FNPT)	inches	1/2"					See large capacity chillers Ordering Information					
Reservoir Capacity	gallons (liters)	1 (4)	2 (8)		6 (23)		20 (76)		30 (114)		50 (189)	
Coolant Temp. Range	°F(°C)	40°F to 95°F (5°C to 35°C)										
Ambient Temp. Range	°F(°C)	50°F to 95°F (10°C to 35°C)										
Full Load Amperage[5]	115v 60Hz 1ph	10	15.4									
	230v 50Hz 1ph	4.4	6.9	9.4	15.0	16.4						
	208/230v 60Hz 1ph		7.4	10	16.0	19.6						
	208/230v 60Hz 3ph						12.5	18	21.5	25	34	46
	460v 60Hz 3ph						6	8.5	10.5	11.5	18	23
PDP Pressure Relief Setting	psi	60										
Weight	Dry-lbs (kg)	97 (44)	122 (55)	166 (75)	260 (118)	270 (122)	391 (177)	429 (195)	650 (295)	665 (302)	990 (449)	1260 (572)

[1]Specifications subject to change without notice. [2]20°C fluid out, 20°C ambient environment at 60 Hz input power. [3]Temperature stability specification assumes stable load. [4]Dimensions do not include filters or casters (RC070 and larger only). [5]Full Load Amperage for models with standard pump. Full Load Amperage for models with optional pumps – consult applications engineering.

Installed Options[6]

	Kodiak Recirculating Chillers RC006, RC011, RC022, RC030, RC045	Large Capacity Recirculating Chillers RC070, RC100, RC130, RC160, RC250, RC350
CE Certified (50Hz)	S	
ETL Tested to UL 3101-1	S	
Heavy-Duty Casters	S	O
Ozone-Friendly Refrigerant	S	S
Digital Temperature Display	S	S
Visual Reservoir Level	S	
Hot-Gas Bypass	S	S
Deionized Water Kit	O	O[7] (Available only as a package)
High Purity Option Package	O	
External Pressure Relief Valve	O	O
External Manually Adjustable Flow Valve	O	O
Anti Siphon Option	O	O
Heater Package	O[8]	O
Air Filter	O[8]	S
5 Micron Water Filter	O	S
Phase Loss Protection		S
Water Cooled Condenser	O[9]	O[9]

[6]Call for other OEM options such as Automatic Reservoir Refill, Remote Start and Remote Temperature Sensing. See Page 34 for modified systems. Call for part number configuration for chillers with installed options. [7]Not available on RC250 and RC350. [8]Not available on RC006. [9]Not available on RC006, 10 pc minimum on large capacity chillers.

Accessories

MODEL NUMBERS	RC006	RC011	RC022	RC030	RC045	RC070	RC100	RC130	RC160	RC250	RC350
5 Micron Replacement Water Filters[10]	330-0022					330-0037					
Air Filters[10]	NA	200-0173		200-0155		330-0682		330-0695		330-0693	
Deionization Cartridge	430-0330					440-0107					

[10]10 Piece Minimum Order

	Fluid Connections 3/8"	1/2"	3/4"	1"	1 1/4"
Filter Kit - Contains 5 micron filter, filter housing, mounting bracket & assembly instructions.	200-0441	200-0442	N.A.		
Plumbing Package - Contains 50ft. Nylabraid™ hose, 50 ft. Armorflex™ insulation, Male NPT to Barb Fittings, Hose Clamps.	200-0193		200-0194		200-0195
External Pressure Relief Valve - For applications requiring reduced pressure. This kit contains a Pressure Relief Valve, 2 Tees, Hose Clamps and Plumbing Instructions. Assembly required.	200-0196		200-0197		200-0198
External Manually Adjustable Flow Valve - For applications requiring flow control. Kit contains Flow Valve, 2 Tees, Hose Clamps and Plumbing Instructions. Assembly required.	200-0298		200-513		200-514

RS232 Cable - 10 feet	250-0091
Dry Contact Cable - 10 feet	250-0090
Algaecide - 250 g	580-0016

115v power cord for Kodiak - 25 feet	250-0092
230v power cord for Kodiak - 25 feet	250-0093

SELECTING A RECIRCULATING CHILLER

Selecting the proper recirculating chiller is a function of the following three factors:

1) The heat load generated by the device being cooled (Q)
2) The maximum acceptable temperature of the fluid exiting the heat source (T_{OUT})
3) Available fluid flow rate ($\dot{V}$)

If the Heat Load (Q) is known, but the Flow Rate is unknown, the following equation can be used to determine the required flow rate.

$$\dot{V} = \frac{Q}{(\rho \bullet C_p \bullet (T_{OUT} - T_{IN})}$$

Where: $\dot{V}$= Fluid Flow Rate
Q=Heat Load
ρ= Fluid Density
C_p= Fluid Specific Heat
T_{OUT}= Maximum Fluid Temperature Exiting the Heat Source
T_{IN}= Fluid Temperature Exiting Recirculating Chiller

For example: The fluid temperature of a laser head which generates 6,824 BTU/hr (2000 Watts) of heat must not exceed 68°F (20°C). Using a cooling fluid of 20/80 EGW[1] and 60 Hz power, select the appropriate Lytron recirculating chiller.

Using the Thermal Performance Curve provided for the recirculating chillers, a horizontal line is drawn at the appropriate heat load, (2000 W). As shown, the RC022 would match this requirement at 55°F (13°C). This is T_{IN}, (the temperature exiting the recirculating chiller). Therefore, the calculation then becomes:

$$\dot{V} = \frac{6824 \text{ BTU/hr}}{(63.8 \text{ Lbm/ft}^3 \bullet 0.93 \text{ BTU/Lbm/°F} \bullet (68°F - 55°F))}$$

$$\dot{V} = 8.8 \text{ ft}^3\text{/hr} = 1.1 \text{ gpm}$$

Where: $\rho_{20/80}$ = 63.8 Lbm/ft³
$C_{P\text{-}20/80}$ = 0.93 BTU/Lbm/°F

Next, determine if the recirculating chiller can meet the required flow rate. As shown on the system pump curve, the 1.3 gpm positive displacement pump (standard on the RC022) would more than satisfy the flow requirement.

[1]Thermal properties for 20/80 EGW are listed on page 65.