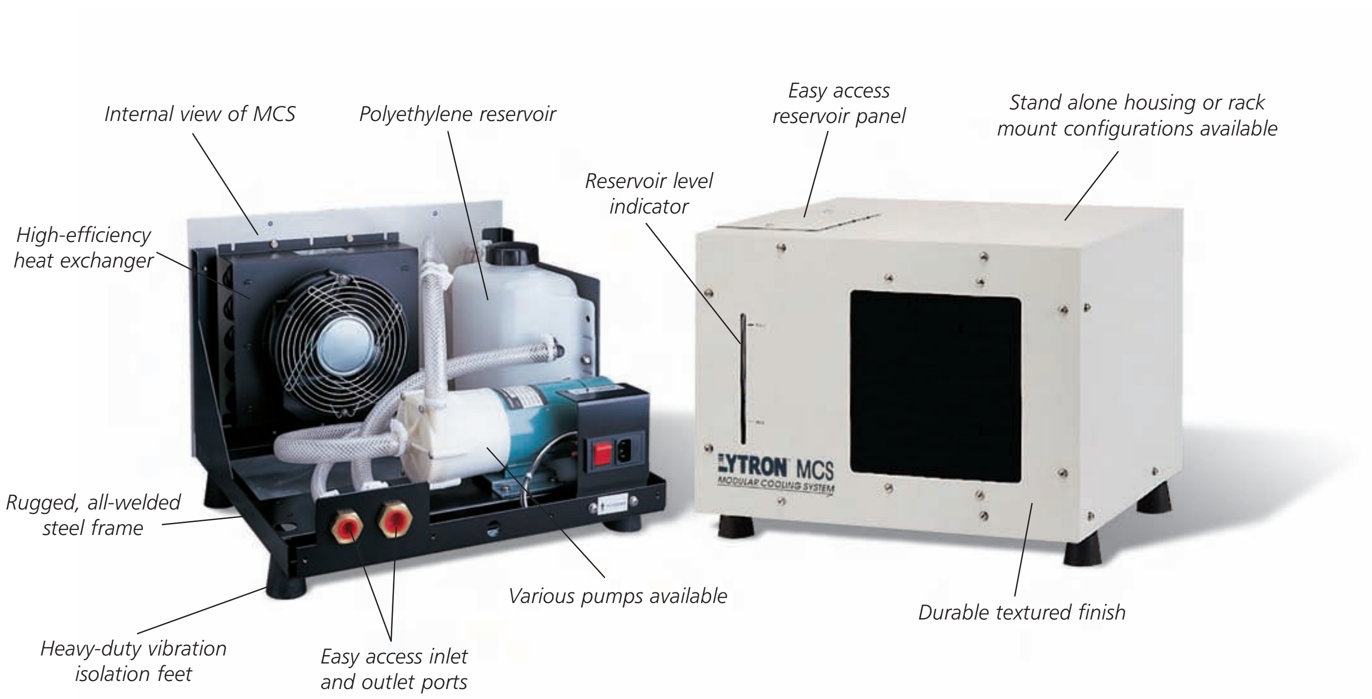
Modular Cooling Systems

Ambient cooling systems with cooling capacities up to 3.5 kW



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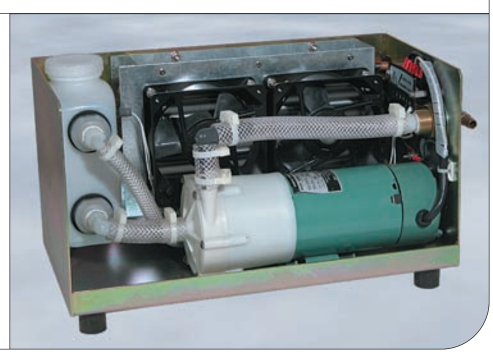
A Modular Cooling System (MCS) is a cost-effective and reliable alternative to refrigerated chillers for applications where precise temperature control and cooling below ambient temperature are not required. It consists of a high performance Lytron heat exchanger integrated with a fan, pump, and tank in a durable metal chassis.

- **Extremely efficient:** All components are performance-matched for maximum cooling capacity. Lytron has more than 50 years of experience in thermal design, so you can be sure that the most critical component of the MCS, the heat exchanger, is designed for optimum performance.
- **Easy-to-operate:** This easy-to-use, turnkey cooling package takes the guesswork and effort out of building a cooling loop. All you need to do is fill the tank and flip the switch.
- **Compatible with a range of coolants:** We offer systems with copper heat exchangers for use with water, stainless steel heat exchangers for use with deionized water, and aluminum heat exchangers for use with oil or Ethylene Glycol/Water (EGW) mixture. This ensures that we have a product optimized for virtually any cooling fluid.
- **19″ (48 cm) rack mount version available:** Integration into your system is simple with our rack-mounted versions (MCS20 and MCS30).
- **Extremely reliable:** All components in the MCS have been designed for long life and high reliability—a Lytron MCS will provide years of trouble-free operation.
- **ITSNA tested to UL 61010A-1 and CE certified**

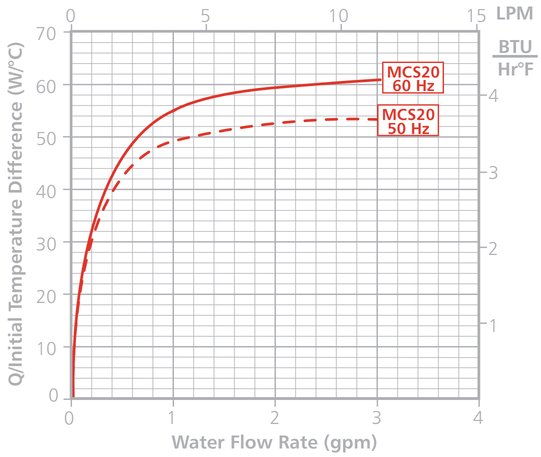
Custom Spotlight:

A customer needed a tightly packaged MCS to integrate into their system. Lytron engineers selected a high-efficiency OEM Coil heat exchanger, a long-life centrifugal pump, and a compact reservoir for the unit.

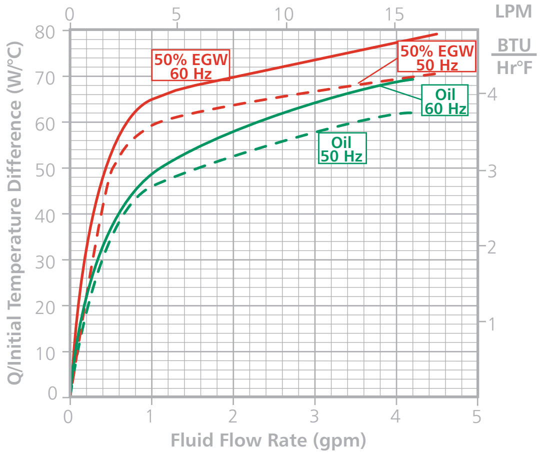
See page 8 for more custom cooling systems.



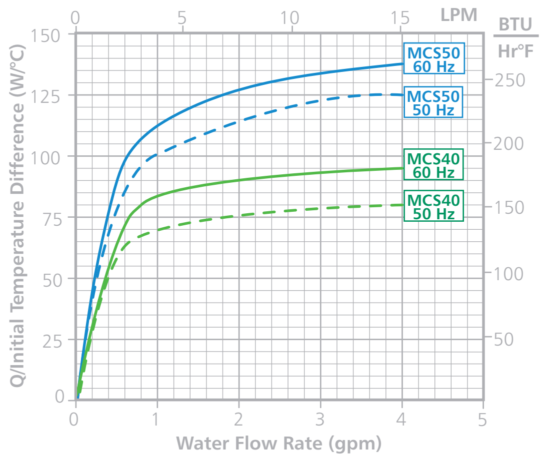
MCS20 Thermal Performance



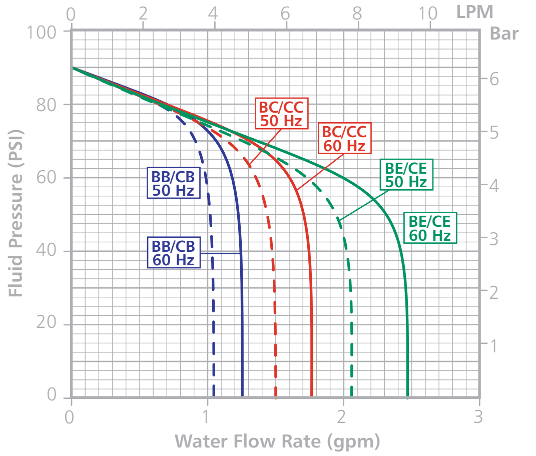
MCS30 Thermal Performance[1]



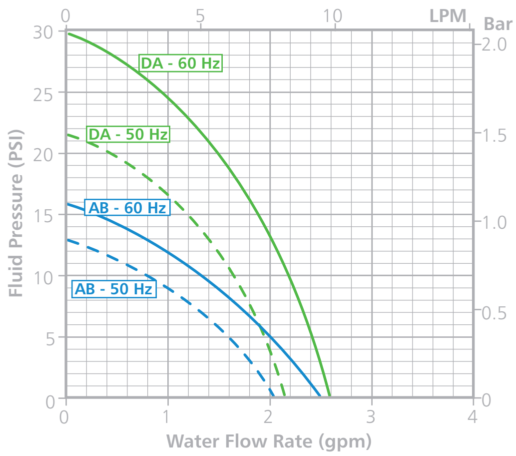
MCS40 and MCS50 Thermal Performance



MCS Positive Displacement Pumps



MCS20 Centrifugal Pumps[2]



[1] Oil @ 70°F, 50/50 EGW [2] Includes pressure drop through system. Visit www.Lytron.com for guidance on selecting a pump.

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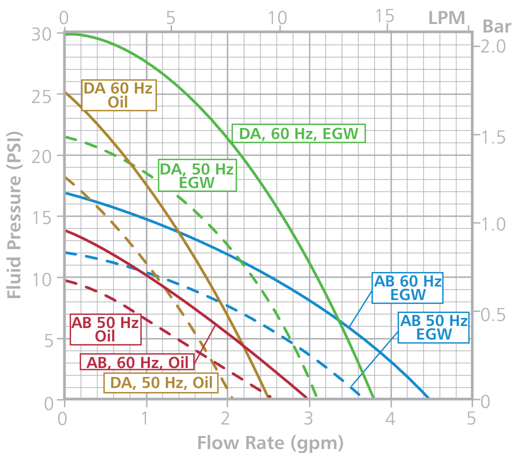
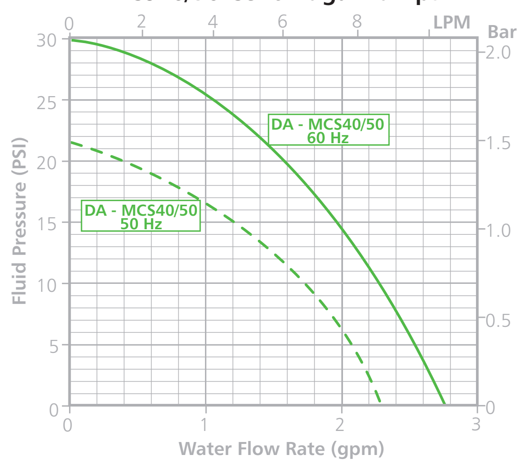
MCS30 Centrifugal Pumps[1,2]



MCS40/50 Centrifugal Pumps[2]



First select your model number

		MCS20	MCS30	MCS40	MCS50
Cooling capacity using water, 25°C initial temperature difference	W BTU/Hr	1300 4,450	2100 7,150	2400 8,200	3500 12,000
Fluid Inlet Connections		½″ FNPT	½″ Barb	½″ FNPT	½″ FNPT
Fluid Outlet Connections		½″ FNPT	½″ Barb	½″ FNPT	½″ FNPT
Reservoir capacity		0.75 gal/2.8 liters			
Maximum liquid temperature		131°F/55°C			
Dimensions (W x D x H)	inches mm	17.3 x 15.1 x 13.3 439 x 384 x 338		15 x 15 x 24 381 x 381 x 610	
Rack Mount Dimensions (W x D x H)	inches mm	19 x 15.1 x 12.3 482 x 384 x 312		n/a	
Weight – stand alone	lbs (kg)	35 (16)	37 (17)	60 (27)	65 (29)
Weight – rack mount	lbs (kg)	23 (10)	25 (11)	n/a	n/a
Recommended coolant		water	oil, EGW	water	water

Next, select an electrical configuration

Available electrical configurations and full load amperage[3]		MCS20	MCS30	MCS40	MCS50
G01: 115V, 60Hz, 1ph	Amps	5.3	5.3	n/a	n/a
G02: 115V, 60Hz, 1ph	Amps	n/a	n/a	5.6	5.8
H01: 230V, 50/60 Hz, 1ph	Amps	2.5	2.5	n/a	n/a
J02: 230V, 50/60 Hz, 1ph	Amps	n/a	n/a	2.7	2.8

Now, select a pump

Pump options (visit www.Lytron.com for guidance on selecting a pump; refer to page 25 & 26 for system pump graphs)	MCS20	MCS30	MCS40	MCS50
BB: PDP[4], Brass, 1.3 gpm/4.9 lpm	●	●		
BC: PDP[4], Brass, 1.8 gpm/6.8 lpm	○	○	●	●
BE: PDP[4], Brass, 2.3 gpm/8.7 lpm	○	○	○	○
CB: PDP[4,5], Stainless Steel, 1.3 gpm/4.9 lpm	○			
CC: PDP[4,5], Stainless Steel, 1.8 gpm/6.8 lpm	○			
CE: PDP[4,5], Stainless Steel, 2.3 gpm/8.7 lpm	○			
AB: Centrifugal, 1/16 HP[6]	○	○		
DA: Centrifugal, ¼ HP[6]	○	○	○	○

Add the ambient package

Package Options	MCS20	MCS30	MCS40	MCS50
Package **1**: Ambient Package	●	●	●	●

Add any additional options

Additional Options	MCS20	MCS30	MCS40	MCS50
M002: Heavy duty casters	○	○	○	○
M062: Rack mount configuration	○	○		
M004: High purity plumbing (stainless steel heat exchanger, nickel-plated bulkhead fittings)	○			
M063: Rack mount configuration and high purity plumbing	○			
M055: High purity plumbing and heavy duty casters	○			

● = standard ○ = available option [1] Oil @ 70°F, 50/50 EGW [2] Includes pressure drop through system. Visit www.Lytron.com for guidance on selecting a pump. [3] With standard pump [4] PDP = Positive Displacement Pump [5] Only available with high purity plumbing [6] Actual flow rate depends on system pressure drop. See www.Lytron.com for information on how to calculate flow rate.

To arrive at a part number

MCS20 G01 BB 1 MCS20, 115V, 60 Hz operation, with BB pump and no additional options

or

MCS40 G02 BC 1 M002 MCS40, 115V, 60 Hz operation, with BC (brass) pump, and heavy duty casters

Selecting a Recirculating Chiller

Selecting the proper recirculating chiller is a function of four factors:

1. Heat load generated by the device being cooled (Q)
2. Maximum acceptable temperature of the fluid exiting the heat source (T_{OUT})
3. Fluid flow rate ($\dot{v}$)
4. Ambient operating conditions

Often, an equipment manufacturer will specify the cooling capacity, set point temperature, and flow rate of the required chiller. In this case, selecting a chiller is easy. Simply mark the intersection of the desired cooling capacity and the set point temperature on the chiller graph. Any chiller with a performance curve above or equal to this point will provide enough capacity. Next, use the pump graph to select a pump that meets the desired flow rate.

Example:

A chiller needs to supply 2 gpm at 20°C to an x-ray tube that generates 2,000 W of heat. The power supply is 60 Hz. Marking this point on the chiller graph (Fig 1) we can see that an RC022 would be an appropriate choice. From looking at the pump curves (Fig 2) we see that a BE pump would provide the necessary flow rate. For more examples, please visit www.Lytron.com.

Fig 1: RC022-RC045 Performance

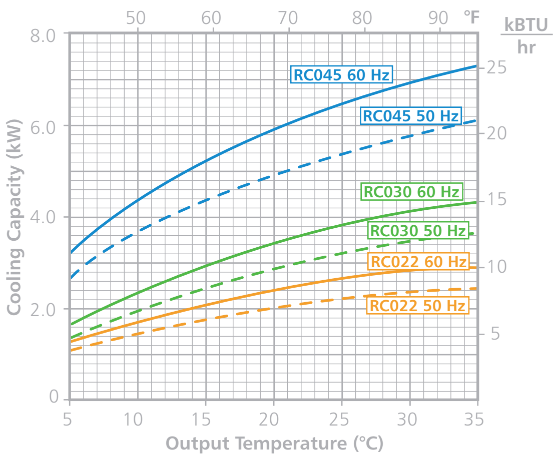
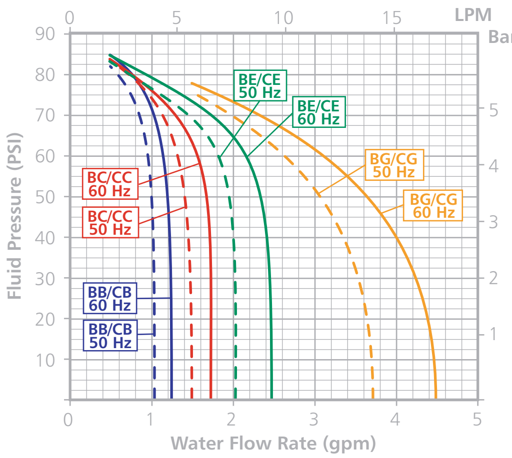
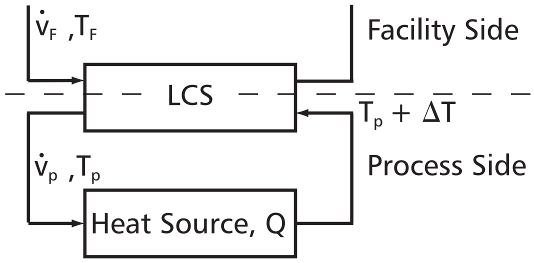


Fig 2: Kodiak Positive Displacement Pumps



Selecting a Liquid-to-Liquid Cooling System

In most LCS sizing applications, we know the temperature of the facility water (T_F), the desired process set point temperature (T_p), the flow rate through the process ($\dot{v}_p$) and the heat load of the process, Q. To determine the required capacity, Q/ITD, we first need to calculate the change in temperature, ΔT, through the process. We can do this either by using the heat capacity graphs found on www.Lytron.com or by solving the heat capacity equation:



$$Q = \dot{m}C_p\Delta T$$

Next, we calculate Q/ITD to find the required cooling capacity. Q is the process heat load. ITD, the Initial Temperature Difference, is the difference in temperature between the warm return water, (T_p+ ΔT), and the cold facility water (T_F).

$$\frac{Q}{ITD} = \frac{\dot{m}C_p\Delta T}{T_p + \Delta T - T_F}$$

Finally, refer to the LCS performance graph to determine the facility process flow rate required to achieve the calculated Q/ITD.

Example:

A solder reflow oven requires a process set point of 20°C. The heat load is 10 kW and the process water flow rate is 5 gpm. The facility water is at 10°C.

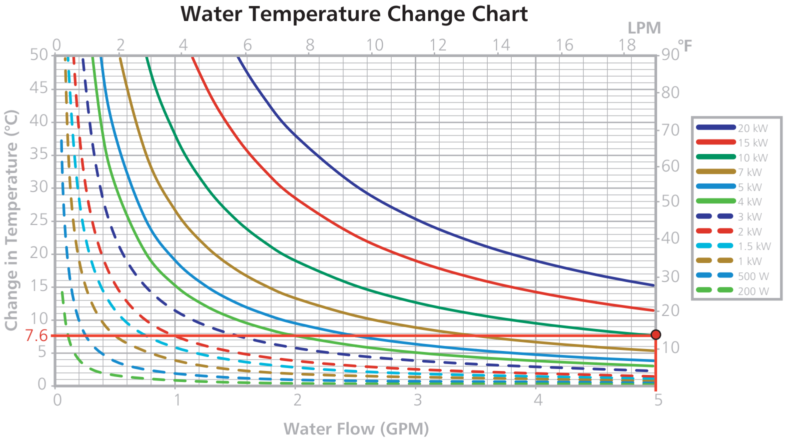
Using heat capacity graphs, which can be found on www.Lytron.com, we find that the ΔT through the process is approximately 7.6°C for the condition 10 kW at 5 gpm.

We can now solve for Q/ITD as follows:

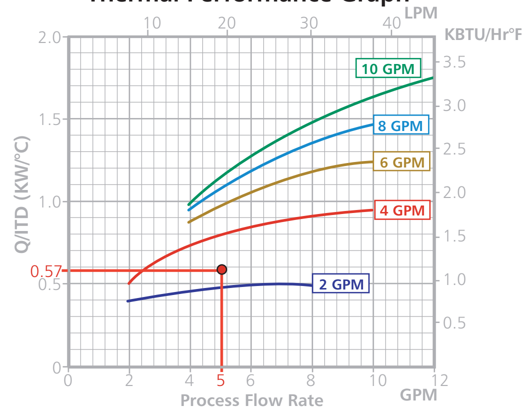
$$\frac{Q}{ITD} = \frac{10\text{ kW}}{20^\circ\text{C} + 7.6^\circ\text{C} - 10^\circ\text{C}} = 0.57\ \frac{\text{kW}}{^\circ\text{C}}$$

Referencing the LCS performance graph, we can see that a facility flow rate above 2 gpm will meet the required performance.

Water Temperature Change Chart



Thermal Performance Graph



Selecting a Modular Cooling System (MCS)

To select the correct MCS, you first need to determine Q/ITD. Q is the heat load, and ITD is the Initial Temperature Difference, or the difference between the MCS liquid inlet temperature and the ambient air temperature. Then, using the MCS performance graph, draw a horizontal line at the calculated Q/ITD value and a vertical line at the process flow rate. If the intersection of those is on or below the system curve, it will meet the required thermal capacity. Finally, check that the pump will provide sufficient flow rate.

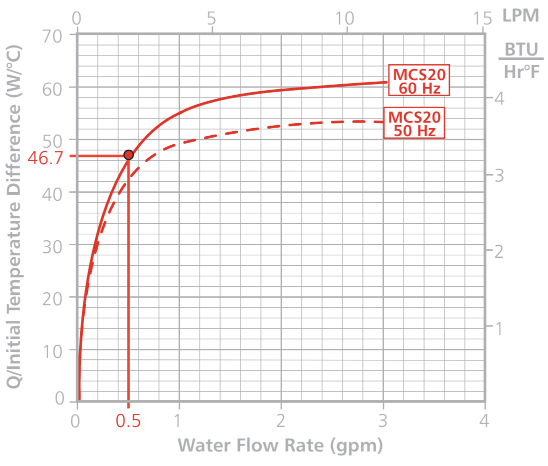
Example:

A laser produces 700 W of waste heat. The water temperature exiting the laser should be less than 35°C. Ambient room temperature is 20°C. The laser equipment requires a flow rate of at least 1 gpm. Which MCS system should be selected? First, determine Q/ITD:

$$Q/ITD = 700\text{ W}/(35^\circ\text{C}-20^\circ\text{C}) = 46.7\text{ W}/^\circ\text{C}$$

Using the thermal performance graph, you can see that at flow rates above 0.5 gpm, the MCS20 will provide adequate performance. The standard BB pump offers a flow rate of 1.3 gpm so it will work well.

Thermal Performance



MCS Positive Displacement Pumps