



# TURMOIL

Oil and Coolant Coolers

**PRECISE TEMPERATURE CONTROL FOR  
PRECISION MACHINING**

# Precise Temperature Control for Precision Machining.

## MACHINE TOOL COOLING IS OUR SPECIALTY.

Turmoil began as a manufacturer of oil coolers specifically for use with machine tools. As both the speed and precision of machine tools increased, the control of heat became critical to the maintenance of extremely close tolerances. Close coolant temperature control can eliminate center line migration on high-speed spindles and heat distortion of machined parts. Lower temperature coolants increase tool life while reducing oxidation and evaporation. Parts positioning can be stabilized by controlling the temperature of hydraulic oils, lubricants, and coolants.

Machine tool cooling is still our specialty. Turmoil is completely familiar with the challenges of achieving precise control while minimizing downtime in a harsh industrial environment. For many years, Turmoil coolers have set the industry standard for quality and reliability.

Today Turmoil offers a complete line of oil and coolant coolers for many applications from machine tools to medical equipment, linear motors to hydrostatic bearings, lasers to X-ray equipment, EDM to high-speed spindles. Turmoil coolers provide the precise temperature control of recirculating coolants that is necessary for precision machining and reliable equipment operation.

With capacities from 2,500 to 360,000 BTU/HR, Turmoil coolers are available for Closed-Loop, Open-Loop, In-Line, or Drop-In tank applications and are specifically designed to cool either water-based coolants, light oil or synthetic coolants. They are available with a long list of options and accessories, allowing the engineer to design the best cooler for his or her specific application.

## APPLICATIONS

### MACHINE TOOLS

- Coolants
- Coolant Filtration Systems
- Cutting Oils
- EDM
- Grinding Fluids
- Headstocks
- High-Speed Spindles
- Hydraulic Systems
- Hydrostatic Bearings
- Lasers
- Linear Motors
- Plasma Cutting
- Power Supplies
- Welders

### X-RAY EQUIPMENT - NDT

### INDUCTION HEATERS

### DIFFUSION PUMPS

### JACKETED VESSELS

### CHILL ROLLS

### HEAT EXCHANGERS

### INJECTION MOLDING

### MEDICAL EQUIPMENT

- Linear Accelerators

- Scanners

- MRI

### VAPOR RECOVERY

### PRINTING EQUIPMENT



OC-100R  
Closed-Loop



OCO-300IL  
In-Line Cooler



OC-750DI  
Drop-In Cooler

## FEATURES

**Heavy-Duty Construction.** Coolers are designed for continuous industrial duty and dependable long life. Welded steel cabinet features lifting eyebolts and mounting skid. Panels are easily removable for complete access.

**High-Ambient Condensers.** Oversized to run cool in hot, dirty environments. All condensers are protected with a cleanable aluminum air intake filter.

**Ozone-Friendly Refrigerants.** Turmoil coolers use only approved, non-ozone-depleting refrigerants. HFC-134a refrigerant is standard on all models with up to 3 HP compressors and optional on all larger models. HCFC-22 refrigerant is standard on all models with 4 HP compressors or larger.

**Complete Temperature Control.** Choice of analog or digital controllers available with options to hold coolant within  $\pm 0.5^{\circ}\text{F}$  ( $\pm 0.25^{\circ}\text{C}$ ) of set-point. Hot gas bypass unloading eliminates compressor short cycling.

**Super-Efficient Evaporators.** For both oil- or water-based fluids. Brazed plate, immersion coil, or shell-and-tube design of stainless steel, copper, or steel construction depending on application. Tested for 350 PSI working pressure.

**Industrial-Duty Compressors.** Lifetime lubricated, hermetic reciprocating compressors (up to 3 HP). Dependable scroll compressors (up to 10 HP). Serviceable semi-hermetic compressors (up to 30 HP).

**Continuous-Duty Pumps.** Designed for use with the specific fluid being cooled and the application. Rotary gear pumps for oils. Centrifugal, turbine, and rotary vane pumps for water-based fluids.

**NEMA-12 Oil-Tight Electrical Enclosures.** Standard on most models. All three-phase models are supplied with a lockable rotary disconnect switch on the enclosure door.



**Wiring and Safety Certifications.** All wiring meets NEC standards.

All components are UL or CSA approved. Coolers can be customized with certified components and electrical designs to meet the specifications of many internationally recognized standards.

**Serviceable Design and Available Components.** Turmoil coolers are designed to be serviceable by qualified local refrigeration contractors. Only the highest quality, internationally available components are

## INDEX

### R CLOSED-LOOP COOLERS<sup>4-5</sup>

Recirculate coolant from a tank mounted in the cooler, through a sealed coolant loop and heat load and back to the tank. The tank, pump, and evaporator are all in the cooler.

### RO OPEN-LOOP COOLERS<sup>6-7</sup>

Recirculate fluid from a remote tank, through the cooler and back to the tank. The pump and evaporator are in the cooler. The tank is remote.

### IL IN-LINE COOLERS<sup>8-9</sup>

Cool fluid that is passing through the cooler under pressure. Only the evaporator is in the cooler. Both the pump and tank are remote.

### DI DROP-IN COOLERS<sup>10-11</sup>

The cooler is mounted on top of the coolant tank (by others) with the stainless steel immersion coil type evaporator submerged into the fluid.

### NRC NON-REFRIGERATED COOLERS<sup>12</sup>

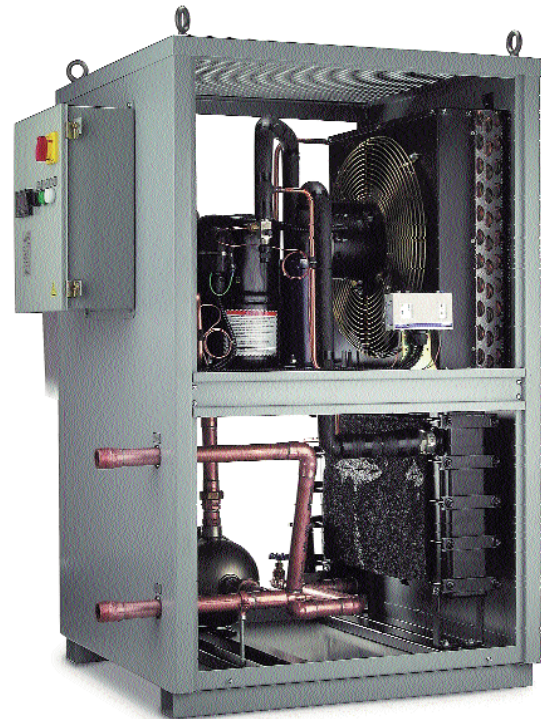
Use central chilled water or ambient air instead of refrigeration for many Closed-Loop or Open-Loop applications.

### ENGINEERING THE COOLER<sup>13</sup>

Determining the heat load. Sizing and designing a cooling system to meet your specific needs.

### OPTIONS & ACCESSORIES<sup>14-15</sup>

Select from a long list of available cooler options. How to order.



Model OC-300RO CEV  
Open-Loop Cooler with cleanable evaporator.



# R COOLERS CLOSED-LOOP

## SELF-CONTAINED RECIRCULATING CHILLERS

**OC Models for Water or Water-Based Coolants** including de-ionized water, water/glycol mixtures, and water-based synthetic coolants.

OC models are supplied with a durable stainless steel coolant tank with filler/breather port and coolant level gauge. Evaporators are stainless steel immersion coils (up to 3 HP) or stainless steel brazed plates. Piping and fittings are non-ferrous. Standard pumps are bronze, brass, or stainless steel.

**OCO Models for Oil or Oil-Based Coolants.** OCO models are supplied with a rugged steel tank with filler/breather port and oil level gauge. Evaporators are enhanced stainless steel, brazed plates. Piping and fittings are copper, bronze, steel, or hose. Cast iron gear pumps are standard.

### APPLICATIONS

High-Speed Spindles	Chill Rolls	Vacuum Systems
Lasers	Injection Molding	Heat Exchangers
Power Supplies	Linear Motors	
Diffusion Pumps	Medical Equipment	
Jacketed Vessels	Welding	



OC0-300R

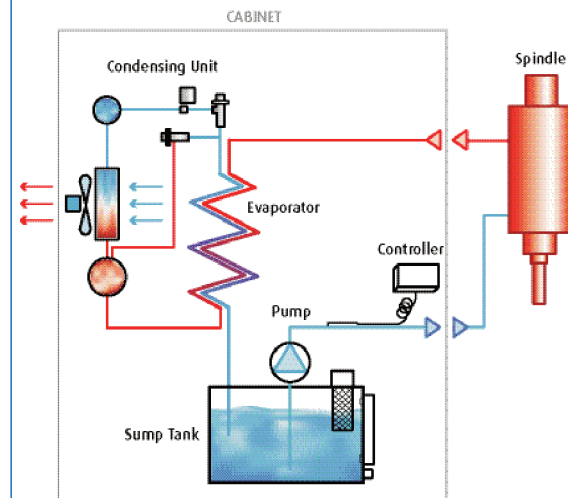


OC-100R



OC-25R

### THE CLOSED-LOOP SYSTEM



Closed-Loop coolers recirculate coolant from a tank mounted in the cooler, through a sealed coolant loop and heat load (spindle) and back to the tank. The tank, pump, and evaporator are all in the cooler.

Coolant is added to the tank through a filler/breather port. The coolant level is always visible in the tank level gauge. When the pump is energized, it draws coolant from the tank and pumps it through the coolant loop. The coolant absorbs heat from the heat load and then dissipates it in the evaporator before returning to the tank. The temperature controller senses the temperature of the coolant leaving the tank and controls the refrigeration effect in the evaporator to provide coolant at the desired discharge temperature.



## R COOLER OPTIONS

**Digital Temperature Controller.** Provides close temperature control ( $\pm 0.5^{\circ}\text{F}$ ). Displays both set-point and coolant temperature.

**Ambient Tracking Controller.** A dual input digital temperature controller allows the coolant temperature to track ambient temperature at a constant, adjustable differential. Displays both ambient and coolant temperature.

**Optional Pumps.** A variety of pumps are available to meet almost any flow and pressure requirement for both water- and oil-based coolants.

**Low Flow Interlock.** Prevents damage to machine on loss of flow.

**Temperature Fault Interlock.** Indicates coolant temperature is out of range.

**Low Level Interlock.** Indicates coolant level is low.

**Flow Meter/Switch.** Adjusts coolant flow to optimum setting.

**In-Line Heater.** Warms up coolant to optimum operating temperature.

**In-Line Filter.** Insures clean coolant.

**Pure System.** Coolant only comes in contact with stainless steel or plastic.

**Non-Refrigerated Cooler.** Uses central chilled water or ambient air instead of refrigeration. Saves space and maintenance.

**Water-Cooled Condenser.** For use with tower or city water. Removes heat from the work area while saving space and maintenance.

## R COOLER SPECS

MODEL	RATED COOLING CAPACITY*			COMP.	STANDARD PUMP CAPACITY		TANK CAPACITY		STANDARD VOLTAGE	STANDARD DIMENSIONS**						SHIPPING WEIGHT	
	BTU/hr	watts	Kcal/hr		hp	gpm	lpm	gal		ltr	inches			centimeters			lb
WATER										w	d	h	w	d	h		
OC-25R	2500	750	625	1/4	1.6	6	2	7.5	230/60/1	12.5	21	16.5	32	53	42	130	60
OC-33R	3300	970	825	1/3	1.6	6	2	7.5	230/60/1	15.75	20	27	40	51	69	175	80
OC-50R	5000	1760	1500	1/2	2.5	9	4	15	230/60/1	16	26	29	41	66	74	200	90
OC-75R	8000	2350	2000	3/4	4	15	4	15	230/60/1	16	26	29	41	66	74	200	90
OC-100R	12000	3520	3000	1	6	23	10	38	230/60/1	22	30	35	56	76	89	400	180
OC-150R	18000	5280	4500	1 1/2	8	30	10	38	460/60/3	22	30	35	56	76	89	400	180
OC-200R	24000	7040	6000	2	8	30	14	54	460/60/3	28	32	45	71	81	114	550	250
OC-300R	36000	10560	9000	3	12	45	20	75	460/60/3	32	36	56	81	92	144	600	273
OC-400R	48000	14000	12000	4	16	60	32	120	460/60/3	36	50	56	92	127	144	750	320
OC-500R	60000	17600	15000	5	20	75	32	120	460/60/3	36	50	56	92	127	144	850	395
OC-750R	90000	26400	22500	7 1/2	30	112	48	180	460/60/3	36	60	66	92	153	168	1000	460
OC-1000R	120000	35200	30000	10	40	150	60	225	460/60/3	46	74	60	117	188	153	1200	550
OC-1500R	180000	52800	45000	15	60	225	100	375	460/60/3	46	87	78	117	221	198	1500	680
OC-2000R	240000	70400	60000	20	80	300	150	560	460/60/3	46	87	78	117	221	198	2500	1150
OC-2500R	300000	88000	75000	25	100	375	150	560	460/60/3	48	116	78	122	295	198	2500	1150
OC-3000R	360000	105600	90000	30	120	450	200	750	460/60/3	48	116	78	122	295	198	2800	1300
<b>OIL</b>																	
OCO-25R	2500	750	625	1/4	1.5	5.6	4.5	17	230/60/1	16.5	18	39	42	47	99	150	68
OCO-33R	3300	970	825	1/3	1.5	5.6	4.5	17	230/60/1	16.5	18	39	42	47	99	150	68
OCO-50R	5000	1760	1500	1/2	2.5	9.5	4.5	17	230/60/1	18.5	24	40	46	61	102	200	90
OCO-75R	8000	2350	2000	3/4	5	19	4.5	17	230/60/1	18.5	24	40	46	61	102	200	90
OCO-100R	12000	3520	3000	1	8	30	12	45	230/60/1	22	30	46	56	76	117	300	135
OCO-150R	18000	5280	4500	1 1/2	8	30	12	45	460/60/3	22	30	46	56	76	117	350	160
OCO-200R	24000	7040	6000	2	12	45	16	60	460/60/3	28	32	50	71	81	127	550	250
OCO-300R	36000	10560	9000	3	18	68	20	75	460/60/3	32	36	56	81	92	144	600	273
OCO-400R	48000	14000	12000	4	24	90	32	120	460/60/3	36	50	56	92	127	144	750	320
OCO-500R	60000	17600	15000	5	30	112	32	120	460/60/3	36	50	56	92	127	144	850	395
OCO-750R	90000	26400	22500	7 1/2	40	150	48	180	460/60/3	36	60	66	92	153	168	1000	460
OCO-1000R	120000	35200	30000	10	50	190	60	225	460/60/3	46	74	60	117	188	153	1200	550
OCO-1500R	180000	52800	45000	15	75	280	100	375	460/60/3	46	87	78	117	221	198	1500	680
OCO-2000R	240000	70400	60000	20	100	375	150	560	460/60/3	46	87	78	117	221	198	2500	1150
OCO-2500R	300000	88000	75000	25	125	470	150	560	460/60/3	48	116	78	122	295	198	2500	1150
OCO-3000R	360000	105600	90000	30	150	560	200	750	460/60/3	48	116	78	122	295	198	2800	1300

\*Capacities based on cooling water to 60°F (16°C) or cooling oil to 80°F (28°C) in a 90°F (32°C) ambient. \*\*Options may affect dimensions.



# RO COOLERS OPEN LOOP

## RECIRCULATE FLUID FROM A REMOTE TANK

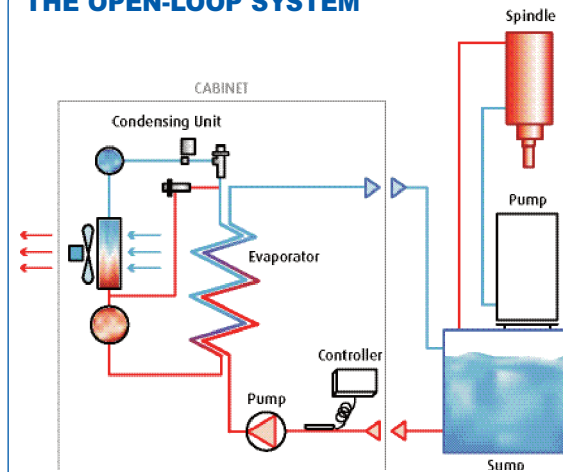
**OC Models for Water or Water-Based Coolants** including de-ionized water, water/glycol mixtures, and water-based synthetic coolants. Evaporators are brazed, stainless steel plates. Piping and fittings are non-ferrous. Self-priming, bronze, centrifugal pumps are standard. Coolant recirculating through the cooler must be clean, otherwise specify optional In-Line Filter (-ILF) or Cleanable Evaporator (-CEV).

**OCO Models for Oil or Oil-Based Coolants.** Evaporators are brazed, enhanced stainless steel plates. Piping and fittings are copper, bronze, steel, or hose. Self-priming, cast-iron gear pumps are standard. Oil recirculating through the cooler must be clean, otherwise specify optional In-Line Filter (-ILF) or Cleanable Heat Exchanger (-CHX).

### APPLICATIONS

Coolant Sumps	EDM	Headstocks
Filtration Tanks	Process Tanks	Gear Boxes
Hydraulic Tanks	Quench Tanks	Fish Tanks

### THE OPEN-LOOP SYSTEM



Open-Loop coolers recirculate fluid from a remote tank, through the cooler and back to the tank. The cooler works to maintain a constant fluid temperature in the tank. The pump and evaporator are in the cooler. The tank is remote.

When the pump is energized it draws fluid from the remote tank and pumps it through the evaporator in the cooler and back to the tank. The temperature controller senses the temperature of the fluid entering the cooler and controls the refrigeration effect in the evaporator to provide the desired fluid temperature in the tank. The cooler should be installed as near as possible to the tank.



OC-1000RO

OC-33RO



OCO-150RO-ILF



## RO COOLER OPTIONS

**Digital Temperature Controller.** Provides close temperature control ( $\pm 0.5^\circ\text{F}$ ). Displays both set-point and coolant temperature.

**Ambient Tracking Controller.** A dual input digital temperature controller allows the coolant temperature to track ambient temperature at a constant, adjustable differential. Displays both ambient and coolant temperature.

**Optional Pumps.** A variety of pumps are available to meet almost any flow and pressure requirement for both water-and oil-based coolants.

**Low Flow Interlock.** Prevents damage to machine on loss of flow.

**Temperature Fault Interlock.** Indicates coolant temperature is out of range.

**In-Line Heater.** Warms up coolant to optimum operating temperature.

**In-Line Filter.** Protects the evaporator from clogging.

**Cleanable Evaporator.** Required for dirty or potentially dirty fluids.

**Pure System.** Coolant only comes in contact with stainless steel or plastic.

**Non-Copper.** Oil only comes in contact with iron or stainless steel.

**Non-Refrigerated Cooler.** Uses central chilled water or ambient air instead of refrigeration. Saves space and maintenance.

**Water-Cooled Condenser.** For use with tower or city water. Removes heat from the work area while saving space and maintenance.

## RO COOLER SPECS

MODEL	RATED COOLING CAPACITY*			COMP.	STANDARD PUMP CAPACITY		STANDARD VOLTAGE	STANDARD DIMENSIONS**						SHIPPING WEIGHT	
	BTU/hr	watts	Kcal/hr		hp	gpm		lpm	inches			centimeters			lb
WATER								w	d	h	w	d	h		
OC-25RO	2500	750	625	1/4	1.6	6	230/60/1	16.5	18	32	42	47	81	150	68
OC-33RO	3300	970	825	1/3	1.6	6	230/60/1	16.5	18	32	42	47	81	150	68
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\*Capacities based on cooling water to 60°F (16°C) or cooling oil to 80°F (28°C) in a 90°F (32°C) ambient. \*\*Options may affect dimensions.



# IL COOLERS IN-LINE

## PUMP FLUIDS THROUGH THE IN-LINE COOLER

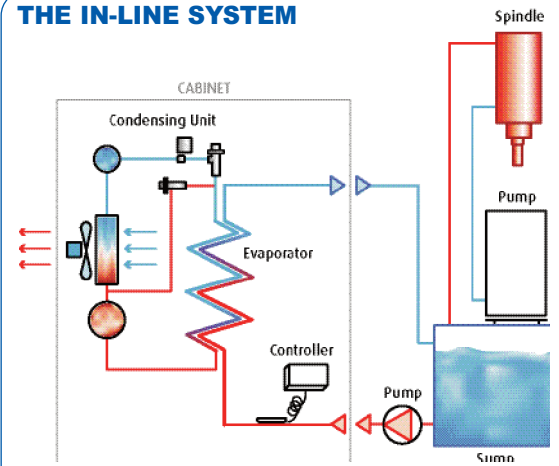
**OC Models for Water or Water-Based Coolants** including de-ionized water, water/glycol mixtures, and water-based synthetic coolants. Evaporators are brazed stainless steel plates rated for 350 PSI working pressure. Piping and fittings are non-ferrous. A Low Flow switch automatically shuts down refrigeration on loss of coolant flow. Coolant passing through cooler must be clean, otherwise specify optional In-Line Filter (ILF) or Cleanable Evaporator (CEV).

**OCO Models for Oil or Oil-Based Coolants.** Evaporators are brazed, enhanced stainless steel plates rated for 350 PSI working pressure. Piping and fittings are copper, bronze, steel or hose. A Low Flow switch automatically shuts down refrigeration on loss of oil flow.

### APPLICATIONS

Coolant Systems	EDM	Film Developing
Filtration Systems	Cold Spray	Ingredient Water
Hydraulic Systems	Batch Cooling	Food Processing

### THE IN-LINE SYSTEM



In-Line coolers cool fluid that is passing through under pressure. Only the evaporator is in the cooler. Both the pump and tank are remote.

These coolers are often used in applications where it is advantageous to have the pump mounted on or near the tank to recirculate fluid through the cooler and back to the tank. This type of installation is necessary when the cooler is installed too far above or away from the tank to allow for the use of an Open-Loop cooler. The temperature controller senses the temperature of the fluid entering the cooler and cycles the refrigeration effect to maintain the desired fluid temperature in the tank.



OC-1500IL



OCO-300IL

OC-50IL



## IL COOLER OPTIONS

**Digital Temperature Controller.** Provides close temperature control ( $\pm 0.5^{\circ}\text{F}$ ). Displays both set-point and coolant temperature.

**Ambient Tracking Controller.** A dual input digital temperature controller allows the coolant temperature to track ambient temperature at a constant, adjustable differential. Displays both ambient and coolant temperature.

**Temperature Fault Interlock.** Indicates coolant temperature is out of range.

**Flow Meter/Switch.** Adjust coolant flow to optimum setting.

**In-Line Heater.** Warms up coolant to optimum operating temperature.

**In-Line Filter.** Protects the evaporator from clogging.

**Cleanable Evaporator.** Required for dirty or potentially dirty fluids.

**Pure System.** Coolant only comes in contact with stainless steel or plastic.

**Non-Copper.** Oil only comes in contact with iron or stainless steel.

**Water-Cooled Condenser.** For use with tower or city water. Removes heat from the work area while saving space and maintenance.

## IL COOLER SPECS

MODEL	RATED COOLING CAPACITY*			COMP.	MINIMUM FLOW		STANDARD VOLTAGE	STANDARD DIMENSIONS**						SHIPPING WEIGHT	
	BTU/hr	watts	Kcal/hr		hp	gpm		lpm	inches			centimeters			lb
<b>WATER</b>								width	depth	height	width	depth	height		
OC-25 IL	2500	750	625	1/4	1	3.8	230/60/1	16.5	18	24	42	46	61	100	45
OC-33 IL	3300	970	825	1/3	1	3.8	230/60/1	16.5	18	24	42	46	61	100	45
OC-50 IL	5000	1760	1500	1/2	1.5	5.7	230/60/1	16.5	25	24	42	64	61	150	68
OC-75 IL	8000	2350	2000	3/4	2	7.5	230/60/1	16.5	25	24	42	64	61	150	68
OC-100 IL	12000	3520	3000	1	3	11	230/60/1	22	32	26	56	81	66	300	135
OC-150 IL	18000	5280	4500	1 1/2	4.5	17	460/60/3	22	32	26	56	81	66	350	160
OC-200 IL	24000	7040	6000	2	6	23	460/60/3	36	32	30	92	81	76	550	250
OC-300 IL	36000	10560	9000	3	9	34	460/60/3	36	36	34	92	92	86	600	273
OC-400 IL	48000	14000	12000	4	12	45	460/60/3	36	50	34	92	127	86	750	320
OC-500 IL	60000	17600	15000	5	15	56	460/60/3	36	50	34	92	127	86	850	395
OC-750 IL	90000	26400	22500	7 1/2	25	95	460/60/3	36	50	66	92	127	168	1000	460
OC-1000 IL	120000	35200	30000	10	30	112	460/60/3	46	74	60	117	188	153	1200	550
OC-1500 IL	180000	52800	45000	15	45	170	460/60/3	46	87	78	117	221	198	1500	680
OC-2000 IL	240000	70400	60000	20	60	225	460/60/3	46	87	78	117	221	198	2500	1150
OC-2500 IL	300000	88000	75000	25	75	280	460/60/3	48	116	78	122	295	198	2500	1150
OC-3000 IL	360000	105600	90000	30	90	340	460/60/3	48	116	78	122	295	198	2800	1300
<b>OIL</b>															
OCO-25 IL	2500	750	625	1/4	2	7.5	230/60/1	16.5	18	24	42	46	61	150	68
OCO-33 IL	3300	970	825	1/3	2	7.5	230/60/1	16.5	18	24	42	46	61	150	68
OCO-50 IL	5000	1760	1500	1/2	3	11	230/60/1	16.5	25	24	42	64	61	200	90
OCO-75 IL	8000	2350	2000	3/4	4	15	230/60/1	16.5	25	24	42	64	61	200	90
OCO-100 IL	12000	3520	3000	1	6	23	230/60/1	22	32	26	56	81	66	300	135
OCO-150 IL	18000	5280	4500	1 1/2	9	34	460/60/3	22	32	26	56	81	66	350	160
OCO-200 IL	24000	7040	6000	2	12	45	460/60/3	36	32	30	92	81	76	550	250
OCO-300 IL	36000	10560	9000	3	18	68	460/60/3	36	36	34	92	92	86	600	273
OCO-400 IL	48000	14000	12000	4	24	90	460/60/3	36	50	34	92	127	86	750	320
OCO-500 IL	60000	17600	15000	5	30	112	460/60/3	36	50	34	92	127	86	850	395
OCO-750 IL	90000	26400	22500	7 1/2	50	190	460/60/3	36	50	66	92	127	168	1000	460
OCO-1000 IL	120000	35200	30000	10	60	225	460/60/3	46	74	60	117	188	153	1200	550
OCO-1500 IL	180000	52800	45000	15	90	340	460/60/3	46	87	78	117	221	198	1500	680
OCO-2000 IL	240000	70400	60000	20	120	450	460/60/3	46	87	78	117	221	198	2500	1150
OCO-2500 IL	300000	88000	75000	25	150	560	460/60/3	46	87	78	117	221	198	2500	1150
OCO-3000 IL	360000	105600	90000	30	180	560	460/60/3	48	116	78	122	295	198	2800	1300

\*Capacities based on cooling water to 60°F (16°C) or cooling oil to 80°F (28°C) in a 90°F (32°C) ambient. \*\*Options may affect dimensions.

# DI COOLERS

## DROP-IN

### SPACE-SAVING DESIGN TO COOL FLUIDS IN A TANK

**OC Models for Water or Water-Based Coolants** including de-ionized water, water/glycol mixtures, and water-based synthetic coolants. Ideal for dirty coolants. Evaporators are seamless, stainless steel, immersion coils. Coil dimensions can be modified to fit tank. Agitation pumps are provided as standard on larger models (1 HP and above).

**OCO Models for Light Oil or Oil-Based Coolants.** Not suitable for all oils or installations (check with Turmoil). Minimum set-point temperature: 80°F (27°C). Evaporators are seamless, stainless steel, immersion coils. Coil dimensions can be modified to fit tank. Agitation pumps are standard on all models.

### APPLICATIONS

Coolant Tanks

Settling Tanks

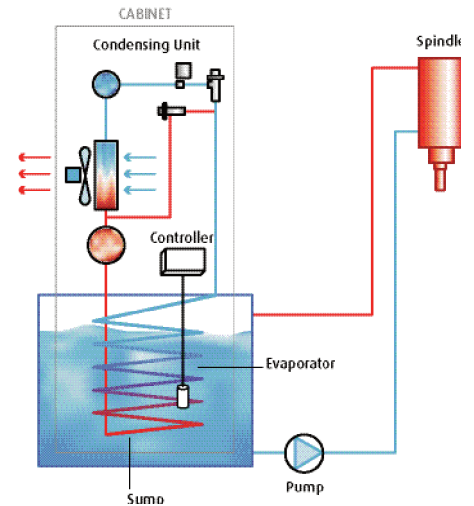
Quench Tanks

Filtration Tanks

EDM

Fish Tanks

### THE DROP-IN SYSTEM



Drop-In coolers are designed to be mounted on top of a tank to cool the fluid that is passing through it. The stainless steel immersion coil type evaporator is submerged into the fluid in the tank. A small agitation pump continuously moves the fluid around the evaporator coils ensuring proper heat transfer. The temperature controller senses the fluid temperature and controls the refrigeration effect to maintain the fluid in the tank at the desired temperature.

Drop-In coolers save floor space and are ideal for installation on tanks where the coolant is too dirty to pump through a heat exchanger. The cooler can readily be lifted out for tank cleaning or inspection.



OC-750DI



OC-300DI



## DI COOLER OPTIONS

**Digital Temperature Controller.** Provides close temperature control ( $\pm 0.5^{\circ}\text{F}$ ). Displays both set-point and coolant temperature.

**Ambient Tracking Controller.** A dual input digital temperature controller allows the coolant temperature to track ambient temperature at a constant, adjustable differential. Displays both ambient and coolant temperature.

**Temperature Fault Interlock.** Indicates coolant temperature is out of range.

**Low Level Interlock.** Protects cooler from operating at low coolant level.

**In-Line Heater.** Warms up coolant to optimal operating temperature.

**Special Dimensions.** Cabinets and/or coils sized to the application. Coils can be modified to fit specific tanks.

**Remote Controls.** Available for applications where the cooler is in-stalled out of reach, such as on top of a large coolant filtration system.

**No Agitation Pump.** For applications where there is sufficient coolant flow through the coils for proper heat exchange.

**Water-Cooled Condenser.** For use with tower or city water. Removes heat from the work area while saving space and maintenance.

## DI COOLER SPECS

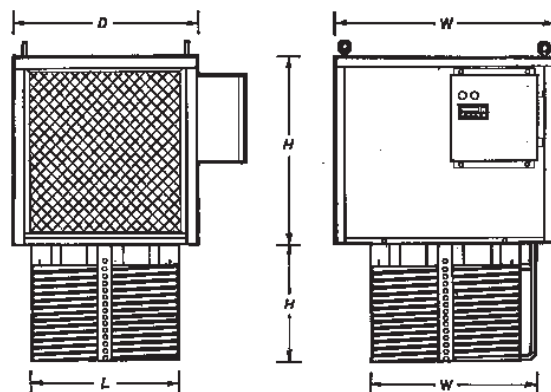
MODEL	RATED COOLING			COMP.	PUMP	STANDARD VOLTAGE	CABINET DIMENSIONS**						COIL DIMENSIONS**						SHIPPING WEIGHT	
	BTU/hr	watts	Kcal/hr				inches			centimeters			inches			centimeters			lb	kg
<b>WATER</b>				hp	hp		w	d	h	w	d	h	w	l	h	w	l	h	lb	kg
OC-25 DI	2500	750	625	1/4	na	230/60/1	16.5	22	16	42	56	41	12	14	12	30	35	30	100	45
OC-33 DI	3300	970	825	1/3	na	230/60/1	16.5	22	16	42	56	41	12	14	12	30	35	30	100	45
OC-50 DI	5000	1760	1500	1/2	na	230/60/1	16.5	22	16	42	56	41	14	16	12	35	41	30	180	82
OC-75 DI	8000	2350	2000	3/4	na	230/60/1	26	26	20	66	66	51	22	22	16	56	56	41	200	90
OC-100 DI	12000	3520	3000	1	1/6	230/60/1	26	26	20	66	66	51	22	22	16	56	56	41	300	135
OC-150 DI	18000	5280	4500	1 1/2	1/6	460/60/3	28	28	28	71	71	71	24	24	16	61	61	41	480	205
OC-200 DI	24000	7040	6000	2	1/4	460/60/3	28	28	28	71	71	71	24	24	16	61	61	41	550	250
OC-300 DI	36000	10560	9000	3	1/4	460/60/3	32	36	32	81	92	81	28	28	16	71	71	41	1000	460
OC-400 DI	48000	14000	12000	4	1/4	460/60/3	36	50	32	92	127	81	33	38	20	84	97	51	750	320
OC-500 DI	60000	17600	15000	5	1/4	460/60/3	36	50	32	92	127	81	33	38	20	84	97	51	850	395
OC-750 DI	90000	26400	22500	7 1/2	(2) 1/4	460/60/3	36	60	42	92	153	107	33	57	20	84	145	51	1000	460
OC-1000 DI	120000	35200	30000	10	(2) 1/4	460/60/3	46	74	56	117	188	142	38	62	20	97	158	51	1200	550
<b>OIL</b>																				
OCO-50 DI	5000	1760	1500	1/2	1/6	230/60/1	26	26	20	66	66	51	22	22	16	56	56	41	200	90
OCO-75 DI	8060	2350	2000	3/4	1/6	230/60/1	26	26	20	66	66	51	22	22	16	56	56	41	250	115
OCO-100 DI	12000	3520	3000	1	1/6	230/60/1	28	28	20	71	71	51	26	26	16	66	66	41	300	135
OCO-150 DI	18000	5280	4500	1 1/2	1/6	460/60/3	28	28	28	71	71	71	26	26	16	66	66	41	500	230
OCO-200 DI	24000	7040	6000	2	1/4	460/60/3	32	36	28	81	92	71	30	30	16	76	76	41	650	300
OCO-300 DI	36000	10560	9000	3	1/4	460/60/3	32	36	32	81	92	81	30	30	16	76	76	41	750	320
OCO-500 DI	60000	17600	15000	5	(2) 1/4	460/60/3	36	66	36	92	168	92	32	62	20	81	158	51	900	414
OCO-750 DI	90000	26400	22500	7 1/2	(2) 1/4	460/60/3	36	66	36	92	168	92	32	62	20	81	158	51	1000	460
OCO-1000 DI	120000	35200	30000	10	(2) 1/4	460/60/3	46	74	56	117	188	142	42	70	20	107	178	51	1400	694

\*Capacities based on cooling water to 60°F (16°C) or cooling oil to 80°F (28°C) in a 90°F (32°C) ambient. \*\*Options may affect dimensions.

## DIMENSIONS



OC-33DI



# NRC COOLERS NON-REFRIGERATED

## WATER-COOLED NRCW COOLERS

**Use central chilled water, instead of refrigeration, to provide close temperature control of recirculating coolants or oils.**

Any **R-Closed-Loop** or **RO-Open-Loop** cooler can be supplied with the **NRCW** option that replaces the standard refrigeration system with a water-to-coolant or water-to-oil heat exchanger. If chilled water is available at the installation, significant savings can be achieved in both initial and operating cost by using this chilled water to control the temperature of coolants being recirculated to your process.

Chilled water must be at least 10°F (6°C) colder than the lowest desired coolant temperature and have adequate flow and pressure for the application. Consult Turmoil for requirements.

A digital temperature controller operates an electronic mixing valve to control the flow of chilled water through the heat exchanger to provide close temperature control of recirculating fluids.

There are significantly fewer moving parts to maintain. Heat from the process is removed as warm water to a central location where it can be used or dissipated efficiently.

## AIR-COOLED NRCA COOLERS

**Use ambient air, instead of refrigeration, to provide close temperature control of recirculating coolants or oils.**

Many **R-Closed-Loop** or **RO-Open-Loop** coolers can be supplied with the **NRCA** option that replaces the standard refrigeration system with an air-to-coolant or air-to-oil heat exchanger. Significant savings can be achieved in both initial and operating cost by using ambient air to control the temperature of coolants being recirculated to your process.

Ambient air must be at least 15°F (9°C) cooler than the lowest desired coolant temperature. Desired coolant temperatures must usually be above 110°F (44°C).

A digital temperature controller cycles a fan moving air across a fin coil heat exchanger to provide close temperature control of recirculating fluids.

All models are supplied with cleanable aluminum air intake filters.

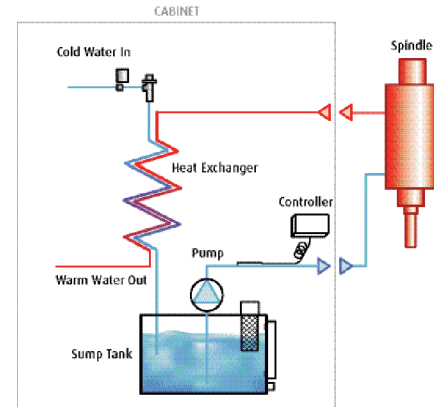


OCO-150 RO-NRCA  
Open-Loop  
Oil Cooler

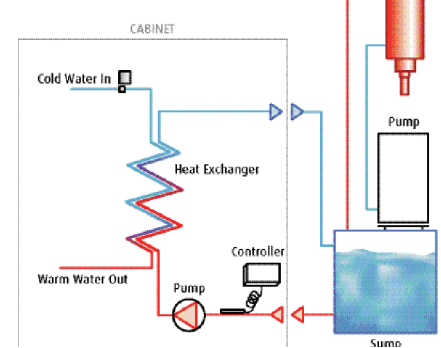


OC-100 R-NRCA  
Closed-Loop Coolant Cooler

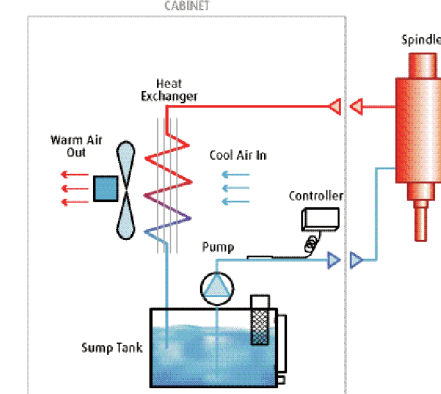
### WATER-COOLED NRCW COOLER Closed-Loop System



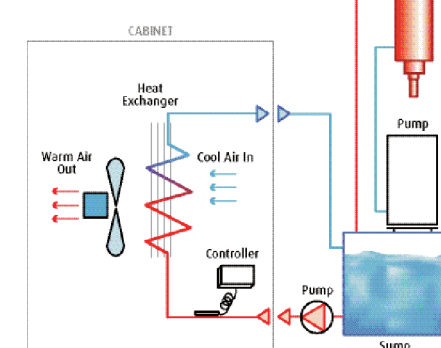
### WATER-COOLED NRCW COOLER Open Loop System



### AIR-COOLED NRCA COOLER Closed-Loop System



### AIR-COOLED NRCA COOLER Open-Loop System





# Engineering the Cooler.

Turmoil application engineers are specialists, available to help you select or design a cooling system to meet your specific needs. They are very familiar with your applications and our equipment. Turmoil prides itself on being able to provide accurate technical data when you need it. So, if you need help, give Turmoil a call.

## DETERMINING THE HEAT LOAD

The heat load is the amount of heat to be removed from the coolant as it passes through the chiller. In order to size a cooler, this heat load must be accurately determined. This can be done in several ways:

### 1. Measure flow and temperature change.

The most accurate way to determine heat load is to measure the flow of the coolant. (This can be done by timing how long it takes to fill a five-gallon bucket.) Measure the change in temperature ( $\Delta T$ ) of the coolant as it enters and leaves the heat source. Calculate the heat load as follows:

$$\text{Flow Rate (gal/hr) x Coolant Weight (lbs/gal) x Specific Heat of Coolant x } \Delta T^{\circ}\text{F} = \text{BTU/HR}$$

### 2. Measure the change in temperature of the coolant in the sump.

If there is a sump on your machine tool, measure the temperature of the coolant in the sump before machine start-up. Then measure the temperature of that same coolant at 30-minute intervals for three hours after start-up while the machine is operating at full capacity. Determine the total volume of coolant in the sump and coolant loop. Take the hour interval with the greatest temperature change and plug the numbers into the following formula:

$$\text{Gallons of Coolant x Coolant Weight (lbs/gal) x Specific Heat of Coolant x } \Delta T^{\circ}\text{F/HR} = \text{BTU/HR}$$

### 3. Size the cooler by the motor horsepower.

The coolant is heated either directly or indirectly by a motor or motors. Theoretically, if you know the motor horsepower you can easily determine the heat load. But, it is not always so simple. Duty cycle, motor efficiency, and ambient heat loss or gain can have a great effect on the heat load. However, if the motor horsepower is known and its operation is fairly steady at maximum output:

$$1 \text{ HP} = 746 \text{ WATTS} = 2545 \text{ BTU/HR}$$

## DETERMINING APPLICATION AND COOLANT

It is very important to determine the type of cooler that is required. All applications involve a fluid passing through an evaporator (heat exchanger), but how does the coolant get there?

**Closed-Loop** coolers recirculate coolant from a tank mounted in the cooler, through the heat load and back to the tank. The tank, pump, and evaporator are all in the cooler.

**Open-Loop** coolers recirculate coolant from a remote tank, through the cooler and back to the tank. The pump and evaporator are in the cabinet. The tank is remote.

**In-Line** coolers cool fluid that is passing through the cooler under pressure. Only the evaporator is in the cooler. The pump and tank are remote.

**Drop-In** coolers are mounted on top of the coolant tank with the stainless steel evaporator coils submerged in the coolant.

Because water and oil have such different heat transfer characteristics, it is very important that the type of coolant being used is determined. If in doubt, specify an OCO cooler.

**Water-Based Coolants** are fluids that contain not more than 5% oil. These coolants may contain additives such as rust inhibitors, algicides, and/or up to 30% glycol.

**Oil-Based Coolants** are fluids that contain more than 5% oil. Soluble oils, semi-synthetic fluids, hydraulic oils, cutting oils, and spindle oils are typical.

**Clean Coolants** are fluids that do not contain particles that could clog the pump or evaporator. The coolant is usually sealed from contamination or filtered to remove damaging particles.

**Dirty Coolants** contain or potentially can contain particles such as fines or chips that could clog the pump or evaporator. An In-Line filter or cleanable evaporator is often required.

## RULES OF THUMB

**Specific Heat of Water-Based Coolants: 1 BTU/lb<sup>o</sup>F**

**Specific Heat of Oil-Based Coolants: 0.5 BTU/lb<sup>o</sup>F**

**Weight of Water-Based Coolants: 8.3 lbs/gal**

**Weight of Oil-Based Coolants: 7.8 lbs/gal**

**Watts x 3.413 = BTU/HR**

**Kcal/Hr x 3.968 = BTU/HR**

**1 cubic foot = 7.5 gallons**

**Liters x 0.2542 = Gallons**

**Bar x 14.5 = PSI**

**Feet of water x 0.434 = PSI**

# TURMOIL

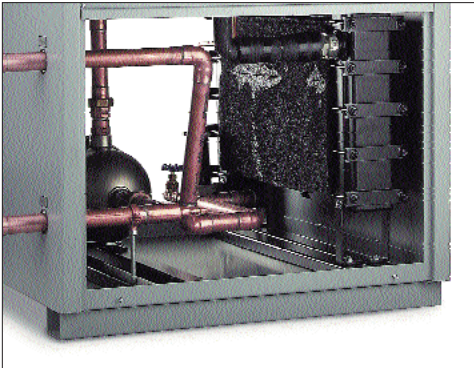
## Options and Accessories

### CONDENSERS

- HA High Ambient Condenser:** Oversized condenser for operating in ambients up to 110°F.
- W Water-Cooled Condenser:** Eliminates heat dissipation to ambient. Supplied with condenser water-regulating valve for hookup to city (65°F) or tower (85°F) water.
- NRC Non-Refrigerated Cooler.** Uses central chilled water or ambient air instead of refrigeration. Saves space and maintenance. Chilled water must be at least 10°F (6°C) colder than lowest desired coolant temperature.
- AR Remote Air-Cooled Condenser:** Shipped separately from cooler. Eliminates heat dissipation to surrounding ambient. Remote installation by others.
- WP WeatherProof** construction for outdoor installation. Takes the heat outside by mounting the complete cooler outdoors.

### TEMPERATURE CONTROLLERS

- CTC Digital Temperature Controller** for close temperature control within  $\pm 0.5^\circ$  of set-point. Large display indicates both set-point and coolant temperature.
- ATC Ambient Tracking Controller.** A dual-input, digital controller that allows the cooler to track the ambient (or machine bed) at a constant, adjustable differential. The controller displays both ambient and coolant temperatures.
- ATC/CTC Combination ATC and CTC Controller** allows operator to quickly switch between ambient tracking mode (ATC) and set-point mode (CTC).



**CEV Cleanable Evaporator;** for water-based coolants with removable endplates for in-place cleaning.

### PIPING AND EVAPORATOR

- PS Pure System** for de-ionized water applications. Coolant only comes in contact with stainless steel or plastic. Evaporator is all stainless steel coil or nickel brazed stainless steel plates.
- NC Non-Copper** for high-sulfur oils. Oil only comes in contact with stainless steel, steel, or iron. Evaporator is enhanced nickel brazed stainless steel plates.
- CEV Cleanable Evaporator** has removable end plates for in-place cleaning without disturbing plumbing or refrigeration lines. Only available for use with water-based coolants.
- CHX Cleanable Heat Exchanger** for use with oils or any coolant. The cooler recirculates water internally to a plate-type, water-to-oil heat exchanger that is easy to take apart and clean without disturbing plumbing connections.

### INTERLOCKS

- FS Low Flow Interlock.** A flow switch is installed in-line and wired to the terminal strip for remote flow fault indication.
- LL Low Coolant Level.** A level switch is installed in the tank and wired to the terminal strip for remote low coolant level indication.
- HT Temperature Fault.** Contacts are provided to indicate that the coolant temperature is out of range.
- FSM Flow Switch/Meter** is provided with a needle valve that permits visual flow rate adjustment and adjustable low flow interlock setting.
- LP Low Coolant Pressure Interlock.** A pressure switch is installed in the discharge and wired to the terminal strip for remote low pump pressure indication.
- RF Refrigeration Fault.** Contacts are provided to indicate that the refrigeration pressures are too high or too low.
- PO Pump On.** Contacts are provided to indicate that the recirculating pump is on.
- RE Remote On/Off.** Contacts are provided to permit the start/stop of the cooler from a remote location.
- RS Computer Interface.** Temperature controllers are available with RS232 or RS485 computer ports.

### PUMPS AND ACCESSORIES

- OP Optional Pump** for any requirement. Pump oil- or water-based coolants at desired flow and pressure.
- ILF In-Line Filter.** Suggested for installations with dirty or potentially dirty coolant to protect the evaporator from clogging. Supplied with a flow switch and a change filter warning light. A variety of filters and filter elements are available.
- ILH In-Line Heater** warms up coolant to optimum operating temperature to prevent cold starts or to provide closer temperature control.
- RC Rubber Casters** available on all models for complete mobility.
- PG Pressure Gauge** available for Discharge and/or Input.
- DT Dial Thermometer** available for Discharge and/or Input.
- FM Flow Meter** provides accurate indication of coolant flow.



**ILF In-Line Filter** mounted on cooler cabinet protects evaporator from clogging.



## WIRING AND SAFETY

**LD Lever-Type Fused Disconnect** installed on a NEMA-12 enclosure. Required by some electrical codes.

**MC Multi-pin Connector** to quickly interface cooler with machine. Can be supplied for both power and interlock connections.

**JIC Automotive JIC Wiring.** Coolers can be wired to meet specific automotive wiring specifications.

**IEC International Wiring.** Coolers meet the standards of the International Electrotechnical Commission (IEC) for machine safety.

**CE Certificate of Compliance.** Cooler to be provided with a CE tag and a Certificate of Compliance with CE Directives.

**N4 NEMA-4 Electrical Enclosure.** Waterproof.

**OV Optional Voltages.** Available on most models. Configurable for supply, domestic or export.



**LD Lever-Type Disconnect Switch** available on all models.

## MODIFICATIONS

**SP Special Paint Color.** Match the cooler to your machinery.

**SS All Stainless Steel Cabinet.**

**MOD Special Configuration.** Special dimensions or component locations to fit the cooler into a particular space.

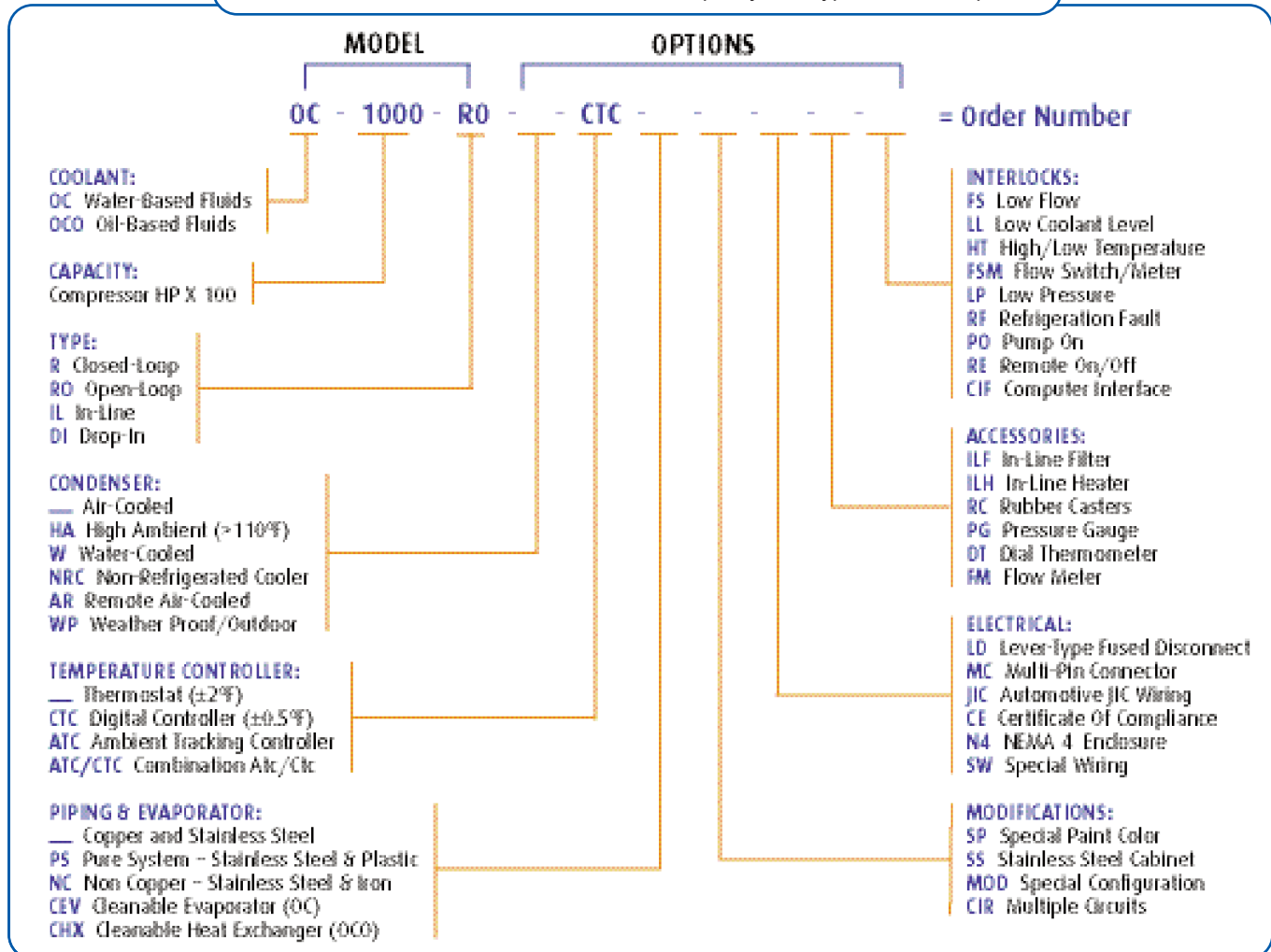
**CIR Multiple Circuits.** Cool more than one circuit from each cooler.

All models are available with multiple IN and OUT connections for balanced or unbalanced flow.

**MOD Coolers can be modified to fit special dimensions or configurations.**



**HOW TO ORDER:** Pick the coolant, capacity, and type, then add options.





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