

# Arc Welding Machines (Water-cooled) and Resistance Welding Machines

Improves  
weld quality!

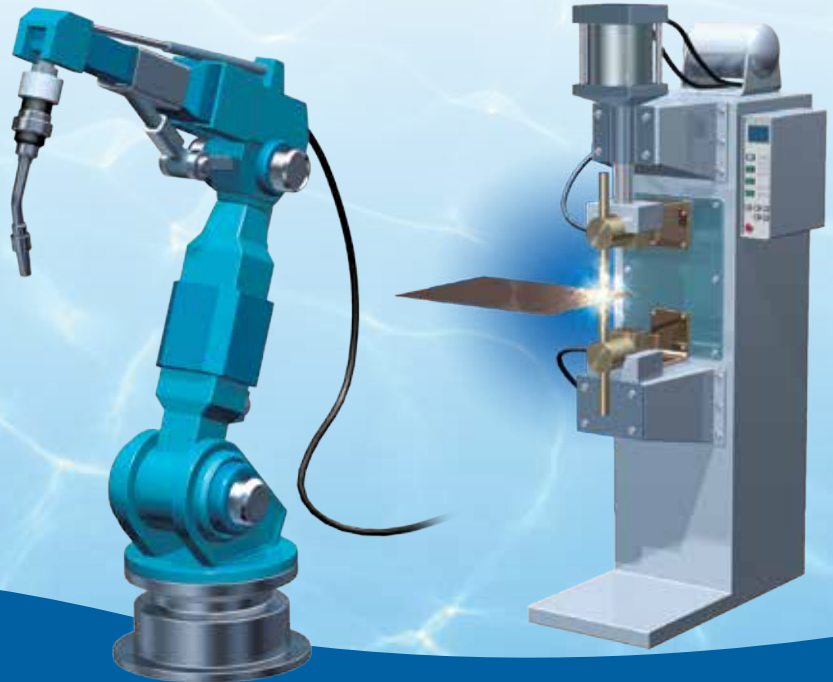
Reduces  
spatter!

Extends  
life of tips!

**Triple effect!!**

## Proposal for Installation of Thermo-chiller

Supplies  
“cooling water”  
at a stable  
temperature anytime  
and anywhere!!



Circulating Fluid Temperature Controller  
Thermo-chiller HRSE/HRS/HRSH Series  
(Refrigerated)



### Temperature stability

$\pm 3.6^{\circ}\text{F} [\pm 2^{\circ}\text{C}]$  (HRSE)

$\pm 0.18^{\circ}\text{F} [0.1^{\circ}\text{C}]$  (HRS, HRSH)

### Lightweight

77 lbs [35 g] (HRSE)

95 lbs [43 kg] (HRS012/018/024)

### Space-saving

# Proposal for Thermo-chiller used with Arc Welding Machines (Water-cooled)

## Solves problems caused by insufficient cooling of “welding torches.”

When a welding torch reaches a high temperature, various problems may arise.



## Have you experienced any of the following problems?

### Effects of rising torch temperature

- Process becomes unstable, which causes wavy beads (weld marks), and generates bubbles.
- Requires work-hours for polishing due to excessive scattering of spatter to surroundings.
- Tip life deteriorates due to softening.



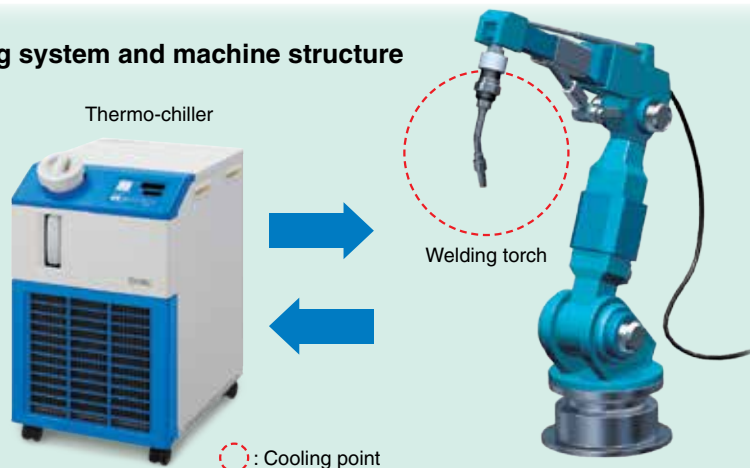
### Effects obtained by cooling and stabilizing the welding torch temperature

- Stable power supply produces stable beads (weld marks).
- Improved shielding reduces spatter scattering.
- Prevents softening of welding tips. Long life.
- Stable torch temperature improves operability of tip replacement.
- Can be used with large currents.

**Triple effect!!**

**The use of a “Thermo-chiller” promotes improvement in both quality and operability. Reduce your costs and problems at once!**

### Main welding system and machine structure

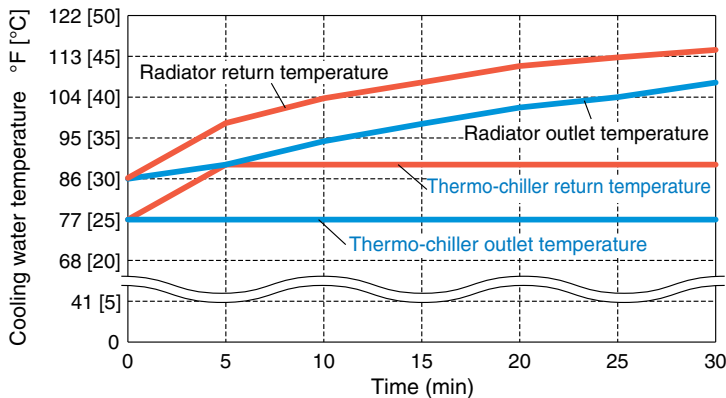


## Reference Data

This test data compares the effectiveness of a radiator type and a thermo-chiller when used in a cooling water circulating system. This reference data is based on SMC conditions, and the values are not guaranteed.

# 1 Comparison of Cooling Water Temperature

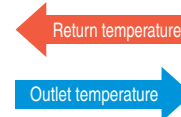
● Continuous 30 min ● Ambient temperature: 86°F (30°C) ● Current value: 450 A



Thermo-chiller  
Radiator type



CO<sub>2</sub> welding machine



**Radiator type** → **Thermo-chiller**  
Cooling water temperature increases. → Cooling water temperature is always constant.

# 2 Tip Durability Comparison

**Tip Hardness Comparison** Change in the level of hardness was compared with a new product.

- Current value: 300 A
- Tap welding: Measures tip hardness after 280 welds
- Number of samples: 5
- New product hardness standard value: 178 HV

<Cooling water circulating system>

- Radiator type  
Discharge pressure: 73 psi [0.5 MPa]
- Thermo-chiller (HRS018)  
Discharge pressure: 26 psi [0.18 MPa]  
Temperature setting: 77°F [25°C]

**Radiator type**

	Hardness (HV)	Difference compared with new product
Sample 1	158.9	-19.1
Sample 2	165.2	-12.8
Sample 3	159.0	-19.0
Sample 4	166.0	-12.0
Sample 5	164.0	-14.0
Average	163.0	-15.4

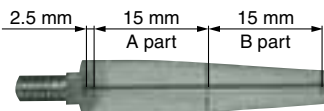
**Thermo-chiller**

Hardness (HV)	Difference compared with new product
171.0	-7.0
168.5	-9.5
169.6	-8.4
168.2	-9.8
168.9	-9.1
169.2	-8.8

Less change in the level of hardness was seen compared with the radiator type.

**Tip Roughness Comparison** Change in the level of roughness was compared with a new product.

\* The surface roughness is defined in JIS Standard (JIS B 0601-2001).



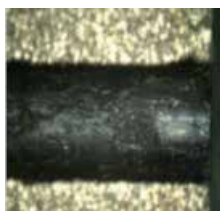
Tip cross section  
Measurement direction →

**New Product Roughness Parameters (μm)**

	A	B
Ra (Ave.)	0.0845	0.0728
Rz (Max.)	0.5843	0.5235

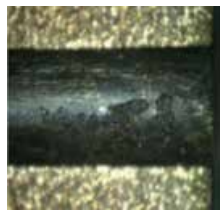
**Radiator type**

450 A continuous



(200 times)

250 A continuous



(200 times)

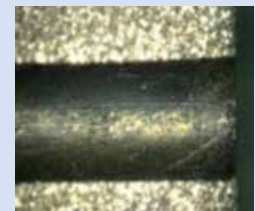
**Thermo-chiller**

450 A continuous



(200 times)

250 A continuous



(200 times)

**Difference in Level of Roughness Compared with New Product**

	450 A continuous		250 A continuous	
	Difference A	Difference B	Difference A	Difference B
Ra (Ave.)	0.2379	0.6232	0.1525	0.5201
Rz (Max.)	2.5286	4.6334	2.2117	4.1374

Turns black due to carbon adhesion, and inner surface becomes rough.

**Difference in Level of Roughness Compared with New Product**

	450 A continuous		250 A continuous	
	Difference A	Difference B	Difference A	Difference B
Ra (Ave.)	0.0754	0.1546	0.0791	0.2726
Rz (Max.)	0.8195	1.2486	0.7498	2.8755

Less change in the level of roughness was seen compared with the radiator type.

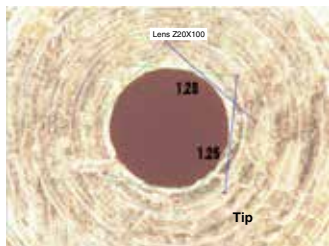
## Reference Data

This test data compares the effectiveness of a radiator type and a thermo-chiller when used in a cooling water circulating system. This reference data is based on SMC conditions, and the values are not guaranteed.

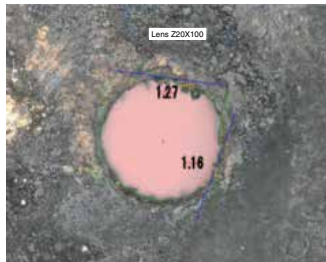
## 2 Tip Durability Comparison

### Tip Hole Size Comparison

New product

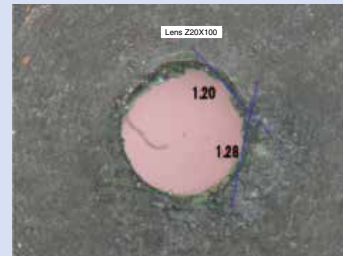


Radiator type  
300 A tap welding



**Thermo-chiller**

300 A tap welding



Change in hole size is less than the radiator type.

## 3 Shielding Gas Comparison

Radiator type  
450 A



Shielding gas is turbulent.



**Thermo-chiller**  
450 A



Shielding gas is stable.



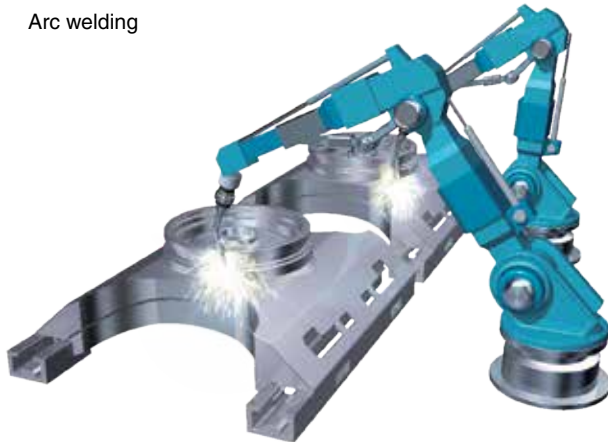
## Application Examples

\* The following are some of the application examples. Since the amount of heat generated changes with conditions and usage rates, the effectiveness is not guaranteed.

### Equipment Water-cooled Arc Welding Machine

Specifications	CO <sub>2</sub> welding (400 A)
Chiller type	HRS018-A-20-T + HRS-BP001 (Bypass piping)
Application	Welding of construction machinery parts Changed from radiator type to a thermo-chiller.
Effect	The set temperature could be maintained, which extended the life of the welding tip, and reduced costs. ⇒ Greatly reduced tip replacement costs

Arc welding



### Equipment General-purpose TIG Welding Machine

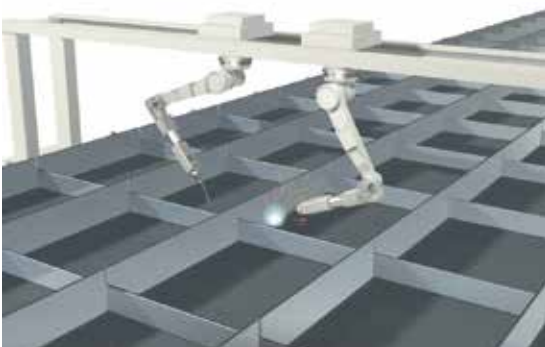
Specifications	Rated output current value 300 A
Chiller type	HRSE018-A-20-T HRSE012-A-20-T + HRS-BP001 (Bypass piping)
Application	Stainless tank welding Changed from radiator type to a chiller.
Effect	Stable water temperature reduced the consumption of the tungsten electrode and power cable. The durability of the collet also improved. By suppressing the increase of the torch temperature, continuous manual welding became possible.



### Equipment Water-cooled Arc Welding Machine (Tandem Welding)

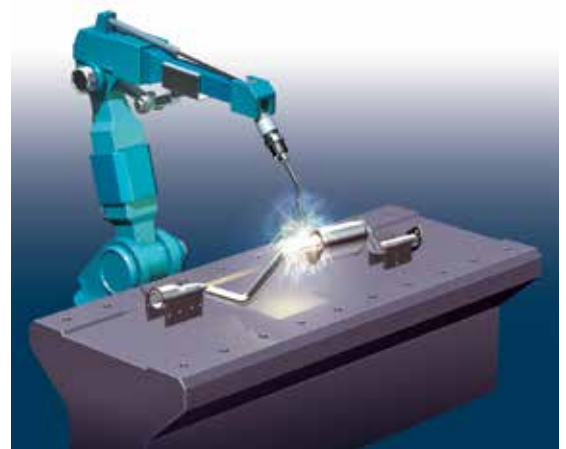
Specifications	Tandem CO <sub>2</sub> welding (450 A) + CO <sub>2</sub> welding (400 A)
Chiller type	HRS050-A-20 + HRS-BP004 (Bypass piping)
Application	Thick material continuous welding. Although two radiator types were used conventionally, the improved life of the tip and the cooling system are integrated into one unit.
Effect	When a radiator was used, the water temperature increased immediately after the welding started, and the tip eventually disappeared. After the chiller was introduced, the water temperature stabilized immediately after the welding started, and the set temperature was maintained. The life of the tip was greatly improved. Furthermore, spatter was reduced, and a stable bead formation was obtained.

Arc welding (Tandem welding)



### Equipment Plasma Welding Machine

Specifications	Plasma welding machine (300 A)
Chiller type	HRS050-A-20 + HRS-BP004 (Bypass piping)
Application	The cooling of the water-cooled torch used on a muffler plasma welding robot.
Effect	Cooling water at a stable temperature can be supplied even in plasma welding with high radiant heat. The costs of expensive argon gas could be reduced due to turbulence suppression. The wear of the torch tip was also suppressed.



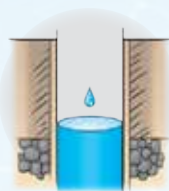
# Proposal for Thermo-chiller used with Resistance Welding Machines

Have you experienced any of the following problems?



## Ground water

Since the water is too cold, dew condensation occurs in summer.  
→ Cause of failures!



## Ground water

Algae grow and adhere to the inside of welding machines.  
→ Cause of failures!



## Tap water

High tap water costs (running costs)!



## Radiator type circulation systems and cooling towers

Water temperature increases in summer.  
→ Quality deteriorates and shortens life of tips!



**These problems can be solved by thermo-chillers!**

The temperature of the cooling water can be controlled.  
(Maintains a constant temperature at all times.)

## Ground water

- Set to 68 to 77°F [20 to 25°C]  
→ Cools without condensation.
- Stable water quality without foreign objects from the chiller. Prevents the growth of algae by periodic replacement of water.

## Cooling towers

- Water temperature remains stable even in summer.  
→ Extends the life of tips.  
Reduces maintenance requirements!
- Even in poor surrounding environments, since the product is sealed, it is not affected by dust etc.

## Difference between chiller and radiator type circulation systems

The radiator type is not equipped with a compressor, and the circulating water is cooled by a fan. Therefore, the temperature cannot be reduced below the ambient temperature. For this reason, the water temperature differs by season.

Air conditioner = Thermo-chiller **77°F**  
[25°C]



Electric fan = Radiator type **95°F**  
[35°C]



## Tap water

- Circulates the water in the tank.  
→ Greatly reduces running costs.

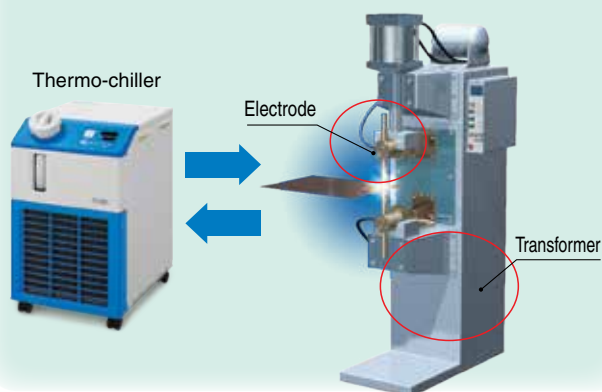
## Radiator type circulation systems

- The stable water temperature, even during the summer, improves tip life and operability.
- Wear particulate-free HRS series (Standard) does not require maintenance.

## Cooling locations

AC: Electrodes (upper/lower), transformer (built-in)

DC: Electrodes (upper/lower), transformer (built-in), transistor (thyristor)



## Improves Life by Cooling the Electrode

Increasing the number of spots decreases the number of electrodes used.

- Spot welding machine (Nut welding)
- Rated capacity: 75 kVA
- Cooling water circulating system: Thermo-chiller HRS050-A-20

### Cooling tower (Without chiller)

Water temperature	Electrode surface temperature	No. of spots	Electrodes used/month
95°F [35°C]	158°F [70°C]	2100	52.3

### Cooling water circulating system: Thermo-chiller HRS050-A-20

Set temperature	Electrode surface temperature	No. of spots	Electrodes used/month
68°F [20°C]	131°F [55°C]	3000	36.6

**142% increase**      **30% reduction**

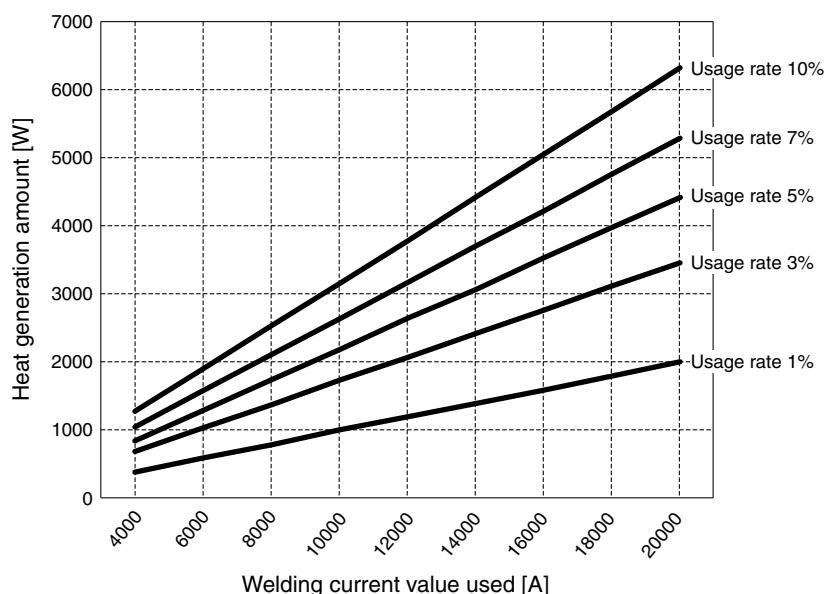
### Example of electrode reduction (Welding machines: 5, Electrode unit cost: \$ 5)

Cooling tower (Without chiller)		Thermo-chiller
No. of electrodes used	52.3 x 5 machines x 12 months = 3138 electrodes/year	36.6 electrodes x 5 machines x 12 months = 2196 electrodes/year
Electrode cost	500 x 3138 = \$15,690/year	500 x 2196 = \$10,980

**\$4,710/year reduction**

## Amount of Heat of Resistance Welding Machine and Chiller Selection

Graph of Amount of Heat by Welding Current Value Used (A) and Usage Rate



The amount of heat of a resistance welding machine is determined by the welding current value used (A), and the usage rate.

### ⚠ Note for Selecting a Chiller

#### Amount of heat of resistance welding machine < Chiller cooling capacity

Note that the chiller cooling capacity is influenced by the ambient temperature. We recommend that the selection be performed with sufficient margin in consideration of the surrounding environment.

\* Please contact SMC when selecting a chiller.

## Application Examples

\* The following are some of the application examples. Since the amount of heat generated changes with conditions and usage rates, the effectiveness is not guaranteed.

### Equipment AC Spot Welding Machine

Specifications	Rated capacity: 50 kVA
Chiller type	HRS024-A-20 + HRS-BP001 (Bypass piping)
Application	<b>[Parts welding for large air conditioners]</b> Since the water temperature increases in the current radiator type, the welding machine stops, and it takes time until it cools down.
Effect	Maintains the set temperature even after continuous operation. The sufficiently cooled torch solved the momentary stops, which improved the operability.

### Equipment Projection Welding Machine

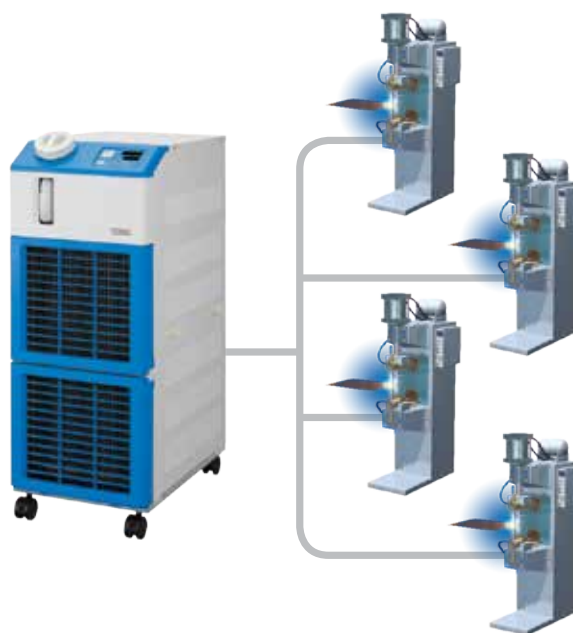
Specifications	Rated capacity: 110 kVA
Chiller type	HRS050-A-20 + HRS-BP004 (Bypass piping)
Application	Ground water was used conventionally, which generated condensation. Problems with flow path clogging also occurred due to the foreign objects in the poor quality water.
Effect	Stable water temperature prevented condensation. Stable water quality prevented further problems.

### Equipment AC Spot Welding Machine

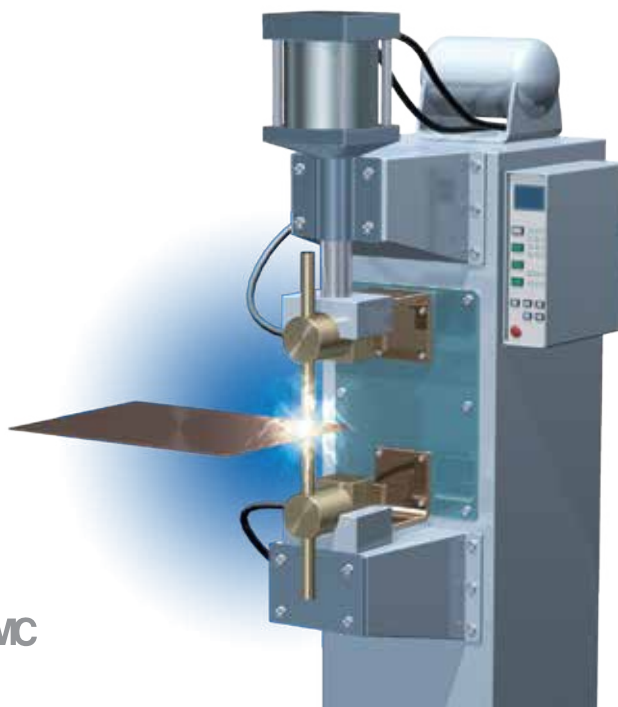
Specifications	Rated capacity: 35 kVA
Chiller type	HRSE024-A-20-T + HRS-BP001 (Bypass piping)
Application	<b>[Auto parts welding]</b> Water piping installation was required to change from air cooling to water cooling.
Effect	The water resource was secured without installing new water piping. The increase in the torch temperature could also be suppressed.

### Equipment AC Resistance Welding Machine (Multiple Units)

Specifications	30 kVA, 35 kVA, 40 kVA, 50 kVA Total of four units
Chiller type	HRS050-A-20 + HRS-BP004 (Bypass piping)
Application	<b>[Precision frame welding for medical applications]</b> Reduction of water costs was demanded, because tap water was used conventionally. There was a requirement to cool four resistance welding machines with one chiller (individual operation). A proposal to reduce tap water usage was presented.
Effect	Tap water cost: 0 JPY; Reduced about 300,000 JPY per year. Introduction costs were recovered in about two years.



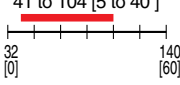


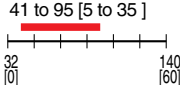


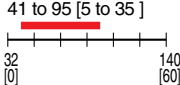


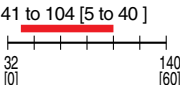


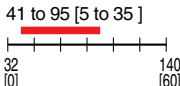


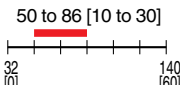


\* The amount of heat generated changes with the usage rate and current value.





## Thermo-chiller Variations

Series	Features	Temperature range setting °F [°C]	Cooling capacity	Cooling method	Temperature stability °F [°C]	Pump capacity g/min [L/min]	Pump type	Power supply	Circulating fluid
<b>Thermo-chiller Standard type</b> <b>HRS Series</b>   <small>(Only 60 Hz)</small>	<ul style="list-style-type: none"> <li>With this chiller, cooling water can be supplied to anywhere it is necessary because of its easy installation and easy operation.</li> <li>For a wide range of applications, such as laser machine tools, analytical equipment, LCD manufacturing equipment, mold temperature control, etc.</li> </ul>	41 to 104 [5 to 40] 	1.3 kW 1.9 kW 2.4 kW 3.2 kW 5.1 kW 5.9 kW (60 Hz)	Air-cooled Water-cooled	±0.18 [±0.1]	11 g/min [42 L/min]	Magnet pump (Mechanical seal pump for high pressure pump mounted type)	Single-phase 100 VAC (50/60 Hz) Single-phase 115 VAC (60 Hz) Single-phase 200 to 230 VAC (50/60 Hz)	Tap water Deionized water Ethylene glycol aqueous solution (15%)
<b>Thermo-chiller Standard type</b> <b>HRS090 Series</b>   <small>(Only 400 VAC)</small>	<ul style="list-style-type: none"> <li>Compact: W377 x H615 x D500 mm, 40 kg (HRS012/018/024)</li> <li>Timer function, Low liquid level protection, Power failure auto-restart, Anti-freezing function, etc.</li> <li>Self diagnosis function</li> <li>No heater required, as circulating fluid is heated using heat exhausted by refrigerating circuit.</li> <li>Low-noise design: 70 dB (A) (HRS100/150)</li> <li>Outdoor installation: IPX4 (HRS100/150)</li> </ul>	41 to 95 [5 to 35] 	9 kW	Air-cooled Water-cooled	±0.9 [±0.5]	18 g/min [68 L/min]			
<b>Thermo-chiller Standard type</b> <b>HRS100/150 Series</b>   <small>(Only 400 VAC)</small>	<ul style="list-style-type: none"> <li>W377 x H615 x D500 mm, 40 kg (HRS012/018/024)</li> <li>Timer function, Low liquid level protection, Power failure auto-restart, Anti-freezing function, etc.</li> <li>Self diagnosis function</li> <li>No heater required, as circulating fluid is heated using heat exhausted by refrigerating circuit.</li> <li>Low-noise design: 70 dB (A) (HRS100/150)</li> <li>Outdoor installation: IPX4 (HRS100/150)</li> </ul>	41 to 95 [5 to 35] 	9.5 kW 14.5 kW (60 Hz)	Air-cooled Water-cooled	±1.8 [±1.0]	18 g/min [68 L/min]	Mechanical seal pump	3-phase 200 VAC (50 Hz) 3-phase 200 to 230 VAC (60 Hz) 3-phase 380 to 415 VAC (50/60 Hz)	Tap water Deionized water Ethylene glycol aqueous solution (15%)
<b>Thermo-chiller Inverter type</b> <b>HRS090 Series</b>   <small>(Only 400 VAC)</small>	<ul style="list-style-type: none"> <li>Reduces power consumption by 53% Complete with energy-saving triple inverter!</li> <li>Compact/Space-saving: W377 x H1080 x D970 mm</li> <li>Low-noise design: Max. 66 dB</li> <li>Max. ambient temperature: 113°F [45°C]</li> </ul>	41 to 104 [5 to 40] 	9.5 kW	Air-cooled Water-cooled	±0.18 [±0.1]	16 g/min [60 L/min]	Mechanical seal pump	3-phase 200 VAC (50 Hz) 3-phase 200 to 230 VAC (60 Hz) 3-phase 380 to 415 VAC (50/60 Hz)	Tap water Deionized water Ethylene glycol aqueous solution (15%)
<b>Thermo-chiller Inverter type</b> <b>HRS090 Series</b>   <small>(400 V as standard, 200 V as an option) (Only 200 V as an option)</small>	<ul style="list-style-type: none"> <li>Complete with energy-saving triple inverter!</li> <li>Outdoor installation: IPX4</li> <li>Max. ambient temperature: 113°F [45°C]</li> <li>Space-saving, Lightweight: 280 kg (HRS0250/300)</li> </ul>	41 to 95 [5 to 35] 	10 kW 15 kW 20 kW 25 kW 28 kW	Air-cooled Water-cooled	±0.18 [±0.1]	48 g/min [180 L/min]	Immersion pump	3-phase 200 VAC (50 Hz) 3-phase 200 to 230 VAC (60 Hz) 3-phase 380 to 415 VAC (50/60 Hz)	Tap water Deionized water Ethylene glycol aqueous solution (15%)
<b>Thermo-chiller Basic type</b> <b>HRSE Series</b>   <small>(Only 230 VAC type)</small>	<ul style="list-style-type: none"> <li>Simple function and performance. Thermo-chiller basic type.</li> <li>Complete with energy-saving triple control! Reduces power consumption by 33%</li> <li>Compact/Lightweight: 32 kg (100 VAC)</li> <li>Maintenance free: Magnet pump</li> <li>Low-noise design: 55 dB (A)</li> </ul>	50 to 86 [10 to 30] 	1.2 kW 1.6 kW 2.2 kW (60 Hz)	Air-cooled	±3.6 [±2.0]	6.6 g/min [25 L/min]	Magnet pump	Single-phase 100 VAC (50/60 Hz) Single-phase 200 VAC (50/60 Hz) Single-phase 230 VAC (50/60 Hz)	Tap water Ethylene glycol aqueous solution (15%)

## Related Products

**Flow Switch:** Monitors flow rate and temperature of the circulating fluid.

For details, refer to the [Web Catalog](#).

### 3-Color Display Digital Flow Switch for Water **PF3W**



Integrated flow adjustment valve and temperature sensor



PVC Piping

### 3-Color Display Electromagnetic Type Digital Flow Switch **LFE**



### Digital Flow Switch for Deionized Water and Chemical Liquids **PF2D** 4-Channel Flow Monitor **PF2□200**



**Pressure Switch:** Monitors pressure of the circulating fluid.

For details, refer to the [Web Catalog](#).



### 2-Color Display High-Precision Digital Pressure Switch **ISE80**



### Pressure Sensor for General Fluids **PSE56**

### Pressure Sensor Controller **PSE200, 300**

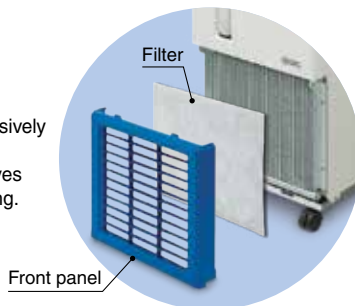


## Optional Accessories

For details, refer to the [Web Catalog](#).

### Replacement type dustproof filter set

Suitable for use in excessively dusty atmospheres. The disposable type filter saves time and effort of cleaning.



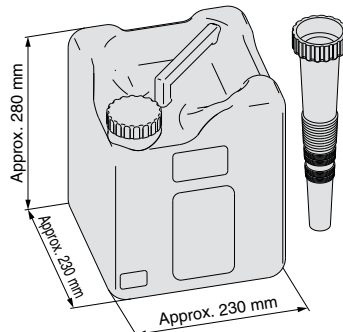
### Particle filter set

Removes foreign objects in the circulating fluid.

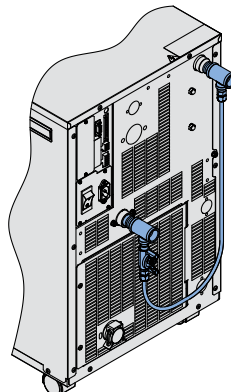


### 60% ethylene glycol aqueous solution

This solution can be used as a circulating fluid for ethylene glycol type thermo-chillers. (Capacity: 10 L)

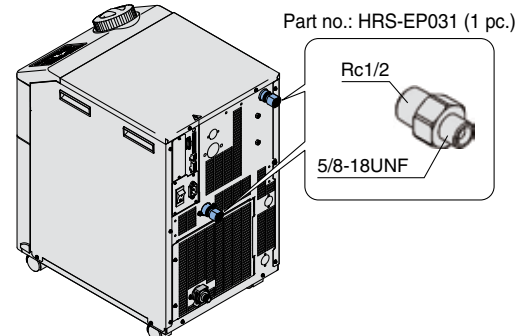



### Bypass piping set



### Piping conversion fitting

Converts the circulating fluid port from Rc1/2 to 5/8-18UNF.



 <b>Safety Instructions</b>	Be sure to read the "Handling Precautions for SMC Products" (M-E03-3) and "Operation Manual" before use.
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# Global Manufacturing, Distribution and Service Network

## Worldwide Subsidiaries

### EUROPE

**AUSTRIA**  
SMC Pneumatik GmbH (Austria)

**BELGIUM**  
SMC Pneumatics N.V./S.A.

**BULGARIA**  
SMC Industrial Automation Bulgaria EOOD

**CROATIA**  
SMC Industrijska Automatika d.o.o.

**CZECH**  
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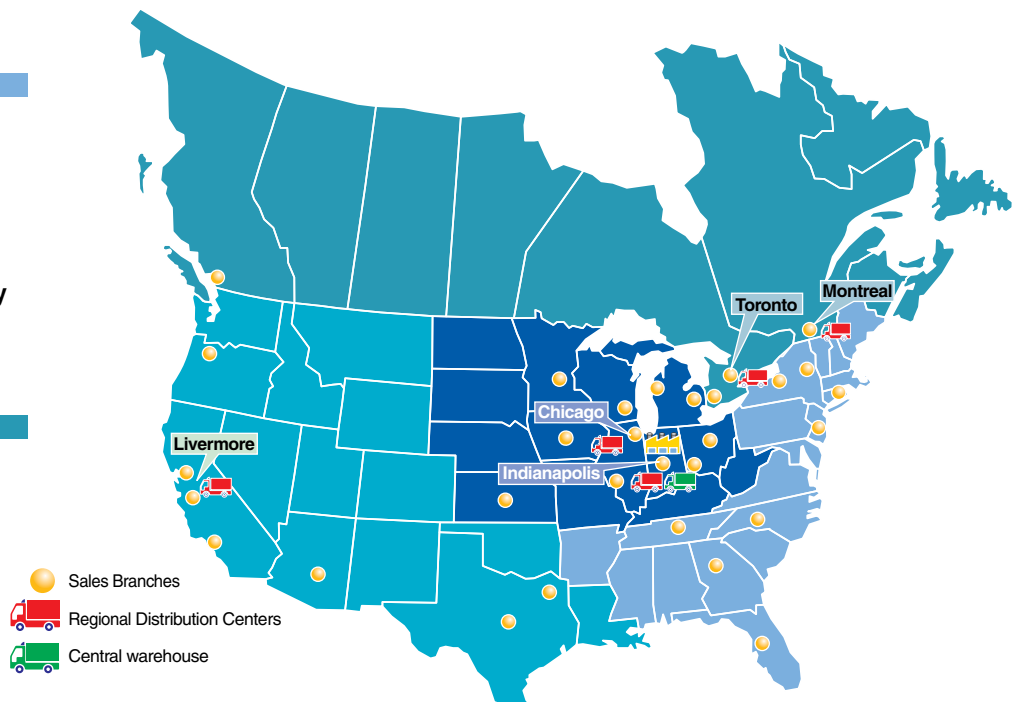
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