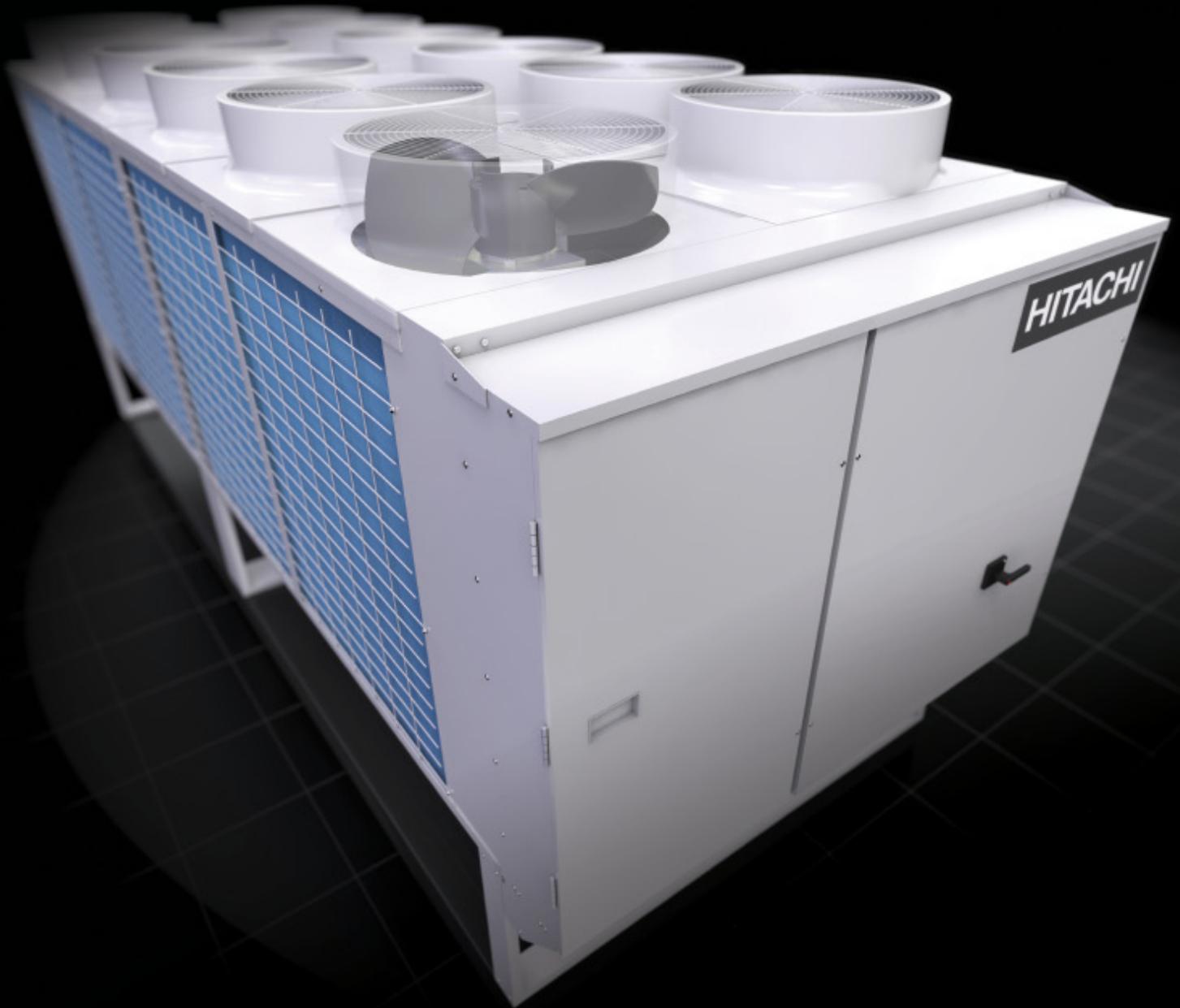


Hitachi Air Conditioning

Engineering for tomorrow. And the tomorrow after that.

Samurai



# Compact Chillers

Solutions for Industry and Commerce

Samurai Series

**HITACHI**  
Inspire the Next

# Hitachi air conditioning systems: Quality, efficiency and longevity

Hitachi loosely translated means “In the sunrise a man sees the sign of the dawning of a brighter future”. Namihei Odaira founded the Japanese company Hitachi Ltd in 1910 in Tokyo. His vision was to develop products that would bring a more comfortable and productive living environment. With our more than 100 years of company history, look with pride on a range of more than 20,000 products that impress in all areas of life through high quality and durability. The corporate statement “Inspire the Next” shows our look to the future, which enables us to identify people’s needs early and to satisfy them.

The responsible use of resources and the related environmental protection is a key factor in the development and production of various devices.

In Japan, the company is among the top five environmentally conscious companies and it is self-evident that these thoughts are transmitted to our 934 affiliates and to the approximately 359 000 employees worldwide. Planners and users can be assured that the price-performance ratio is right and that the environment is is top priority. See for yourself!

We at the Air Conditioning & Refrigerating Business Group (ARG) believe in the excellent performance and quality of our products. They represent a long-term investment. We offer air-conditioning systems for every need.

Our products range from industrial air conditioners, air conditioners for office units or a variety of room air conditioners and heat pumps for the private sector to chillers and compressors. These are produced among other things in our own plant in Barcelona. This reduces production costs, shortens delivery times and enables us to provide optimal, first class service. In addition to our high quality products, the service thought stands in the foreground. This includes advising as well as installation and subsequent maintenance. We achieve this through our well-trained specialist companies associated with us through a strong bond of trust.

A key criterion today for choosing an air conditioner is the saving of energy costs. In connection with the climate change debate, we have recognized this need of our customers. Already today, our products are characterized by high energy efficiency classes.

Many of our units include the DC inverter technology developed by Hitachi. Due to the variable speed of the inverter, the system can rapidly achieve the desired room temperature setting. This means that up to 30 percent of energy can be saved without the need to sacrifice comfort. At the same time, through the use of a DC-powered engine, performance rises by over 10 percent. In this manner, environment and budget are equally protected.

Be inspired and convinced by our products. On the following pages you will find extensive information about our equipment. Get to know us.

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Samurai

# Chillers

## Samurai Chillers - The Solution for Industry and Commerce

We offer our Samurai chillers in either the water-cooled or air-cooled version. They are deployed mainly in the manufacturing industry where they provide exactly the level of refrigeration for the machinery that is needed. They also provide, as massive power stations, the necessary fresh air in large shopping malls or in hotels.

Our Samurai water-cooled chillers are one of the most efficient solutions currently available for water-cooled chillers.

The air-cooled air conditioners are available as cooling devices and also heat pumps.

The key factor for their success is the use of plate heat exchangers, both as a condenser and as an evaporator. Hitachi's air- and water-cooled chillers operate more efficiently with Hitachi's own dual-rotor screw, which impresses with its longevity.

Samurai Chillers

**Air cooled , cooling only**

Model	40	50	60	70	80	100	120	140	160	180	210	240
 RCU2E-(xx)AG2	Refrigeration Capacity (kW)											
	112	130	156	178	206	260	312	356	412	468	534	618

**Air cooled, heat pump**

Model	40	50	60	70	80	100	120	140	160	180	210	240
 RHU2E-(xx)AG2	Refrigeration Capacity (kW)											
	106	123	148	169	195	246	296	338	390	444	507	585
	Thermal output capacity (kW)											
	110	127	152	185	185	254	304	370	370	456	555	555

**Water cooled, only cooling (with an optional heating feature)**

Model	40	50	60	80	100
 RCUE-(xx)WG2	Refrigeration Capacity (kW)				
	134	160	194	232	320
	Thermal output capacity (Optional) (kW)				
	168	200	243	287	400

**Without condenser, cooling only, compact design**

Model	40	50	60	80	100	120
 RCUE-(xx)CLG2	Refrigeration Capacity (kW)					
	120	145	180	240	290	360

Samurai Chiller

Optional versions		AG2	WG2	CLG2
Noise	Low Noise (quiet) -2dB	■	-	-
	Super Low Noise (very quiet) -4dB	■	-	-
Low supply temperatures	+4 °C ~ 0 °C	■	■	■
	-1 °C ~ -5 °C	■	■	■
	-6 °C ~ -10 °C	■	■	■
Control systems	Circuit breakers per compressor	■	■	■
	Circuit breakers per fan	■	-	-
	GLT (HARC-70CE1 / OP, HC-A32MB)	■	■	■
	Remote control (CSC-5S, CS-Net Web)	■	■	■
	Performance recording for CS-net web	■	■	■
Heat Exchanger	Copper fins	■	-	-
Refrigeration cycle	Ball valve in the hot gas pipe (for the compressor)	■	■	Standard
	Ball valve in the intake pipe (for the compressor)	■	■	■
	Additional pressure relief valve compressor	■	■	■
	Additional dual pressure relief valve compressor	■	■	■
	Dual pressure relief valve hot gas system	■	■	■
	Pressure relief valve intake pipe	-	■	■
	Intake pipe insulation	■	Standard	Standard
	Separate refrigeration cycle compressor	Standard for all versions		
	Compressor time gauge	Standard for all versions		
	HP/LP gauge	Standard for all versions		
Water cycle	Heat recovery (plate heat exchanger HG)	■	-	-
	PN16 flange (with counter flange)	■	■	■
	Pressure differential switch (WT inlet/outlet)	■	■	■
	Flow switch (client installation)	■	■	■
	Trace heating for the plate heat exchanger	■	■	■
	Common water inlet/outlet (only one connection)	■	■	-
	Stainless steel water pipes (AISI 304)	■	-	■
	Pressure taps WT (not with PN16 flange or manifold)	■	-	-
	Water filter	■	■	■
	Hydraulic module on request ( only with RCU2E-40 ~ 80AG2 possible)	■	-	-
Special operation	Heat pump special operation	-	■	-
	HP-operation at high external temperatures	■ (RHUE)	-	-
Miscellaneous	Function tests I + II with client ( in plant)	■	■	■
	Rubber vibration dampers (attached)	■	■	■
	Spring vibration dampers (attached)	■	■	■
	Reversed control cabinet position	■	-	-
	Wooden case for transport	-	■	■
	Enhanced corrosion protection for the housing	■	-	-
	Lower safety guard	■	-	-
	Reinforced transport version (struts)	■	-	-
	Double packaging foil for transport	■	-	-
	Flange connections (soldered version)	■	Standard	Standard
Available contacts	Remote On / Off, Alarm (24V AC), alarm light, pump blocking, pump operation, 2nd Temperature setting, signal-free cooling	Standard for all versions		

■ Optional accessories available  
 - Not available

See also Explanation of Options - from page 24.

# Installation characteristics

## Precise control of the water outlet temperature

Continuous capacity control is based on precise control of the water outlet temperature, depending on the thermal requirements of the load. This is reflected in lower operation costs as the unit will only provide the energy needed for the load.

To control the water temperature the SAMURAI uses two essential components:

1. A sliding valve in the screw compressor to change the refrigerant circuit variables, adapting them to the requested load.

2. A sophisticated electronic system based on control bands in which the aim is to maintain a constant outlet temperature.

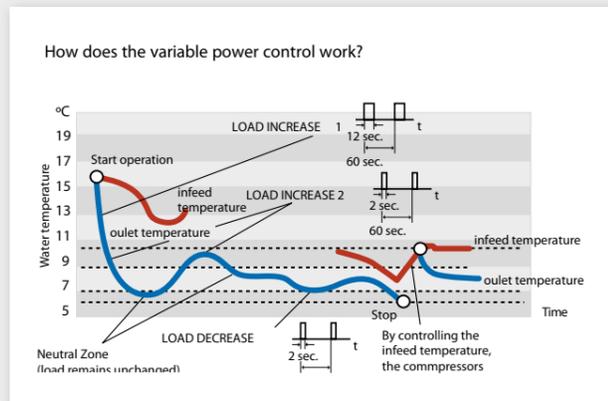
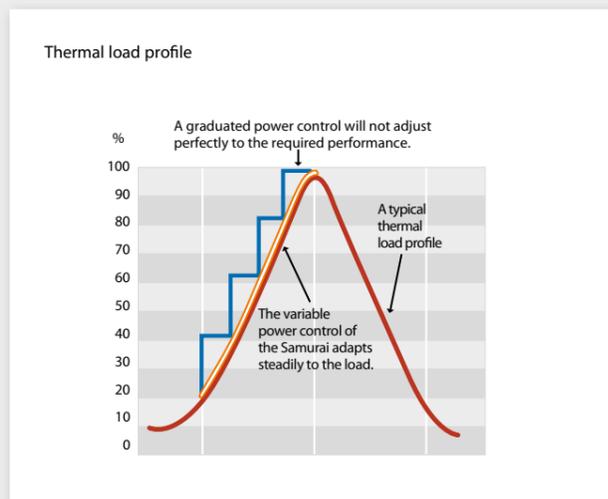
There are 4 bands which can be configured:

- LOAD UP 1 BAND
- LOAD UP 2 BAND
- NEUTRAL BAND
- LOAD DOWN BAND

Given a load and having selected a water outlet temperature, the electronic system compares the value measured by thermistors with the desired value. Depending on the measured value, and at one-minute intervals, a control signal is generated that varies the position of the sliding valve either to increase or to decrease the capacity as required.

The great advantage of this system is that it has control bands with different behaviours so the unit can adapt better to load requirements. When the measured temperature is very different from the desired temperature, the system can be programmed to provide quick control.

If the actual temperature is only slightly different to the required value, the program responds with a precise adjustment of the system performance.



Thus, a much faster response than with conventional PID controllers is possible. The reaction in load increase area 1 is much faster than with a PID system, which, in turn, also leads to a more rapid adaptation.

Therefore, thanks to the high flexibility thus obtained the response time or the accuracy of the specifications can be adapted to the system. This is done simply by programming the microprocessor with micro switches (see technical catalogue).

## Electronic expansion valve

The Samurai is equipped with an electronic expansion valve, which allows an excellent control under all temperature conditions. The electronic expansion valve saves much more energy compared with traditional systems.

## Excellent partial load performance

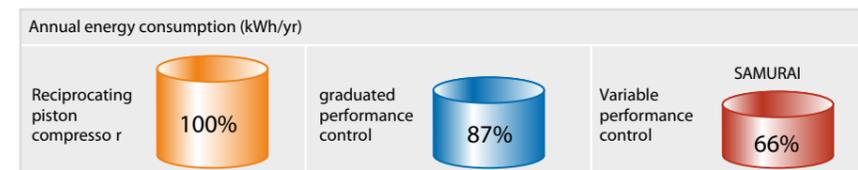
Through its continuous power control, the Samurai provides exactly the requested cooling capacity at all times. Thus, it can work with the exit temperature control rather than with the inlet temperature control. Thanks to the fine regulation excellent partial load performance can be achieved.

## ESEER (referring to Eurovent)

The ESEER (European Seasonal Energy Efficiency Ratios) are shown in the table below for the AG2-series. Thus, the average energy efficiency for partial loads is shown based on the four partial load conditions defined by Eurovent.

Model	40AG2	50AG2	60AG2	70AG2	80AG2	100AG2
ESEER	3.48	3.49	3.52	3.50	3.52	3.49
Model	120AG2	140AG2	160AG2	180AG2	210AG2	240AG2
ESEER	3.52	3.50	3.52	3.52	3.50	3.52

Operating cost savings(\*)



# Features and benefits

## Refrigeration cycle

All units have separate cooling circuits for each compressor.

On the liquid side each circuit is equipped as follows:

- Filter dryer
- Electronic expansion valve
- Stop valve
- Inspection glass

On the pressure side:

- Return valve
- Stop valve (option)
- Safety valve
- 4-way switching valve

Compressor protection:

- High-pressure switch
- Low-pressure switch
- Safety valve (option)
- Contactor control

Reduced refrigerant quantity

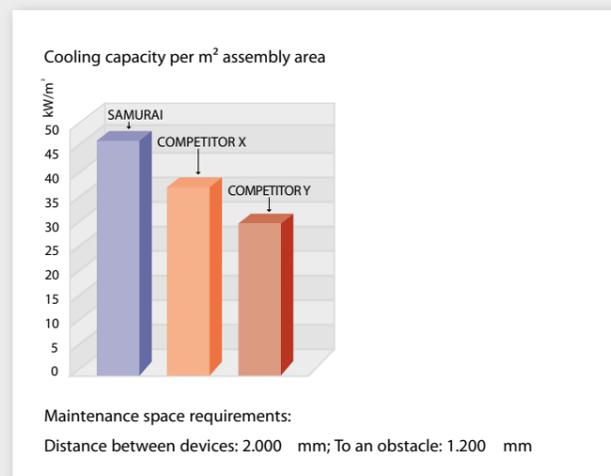
The Samurai chillers use a plate-type heat exchanger as an evaporator. These are much more compact than the conventional heat exchanger tubes and shells. With the same capacity, they need much less interior space.

## Little mounting space

Often, the space available for the installation of a chiller room is a critical factor. Obstacles and little space then decide on the selection of devices installed in HVAC systems\*. Thanks to the careful design of each component, the Hitachi Samurai chillers achieve an exceptionally high value of cooling capacity per installation area. Furthermore, thanks to the ingenious design, all major components are easily accessible, so that the required access area for maintenance and repair could be significantly reduced.

The illustration shows the value of cooling capacity per installation surface for the Hitachi model AG2 RCUE 80 compared with similar devices by competitors.

\* Heating Ventilation Air Conditioning

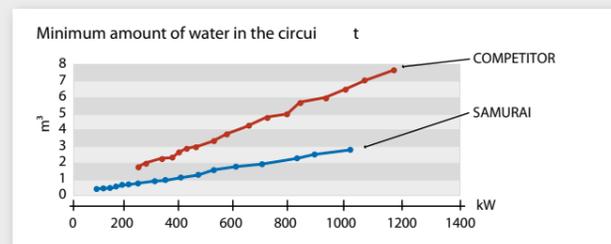


## Minimum amount of water in the circuit

To avoid frequent stopping and starting of the compressor, which is really at the expense of its lifespan, the installation must have a minimum volume of water, so that the system reaches enough thermal inertia.

This minimum amount of water depends on how well the controls function and what the minimum capacity of the unit is. Thanks to their extremely high useful power control range (15-100%) Samurai chillers only need a small amount of installed water. Furthermore, one of the optional contacts can be used (floating) to control the external compressor. With this optimization, it is possible

to reduce the installed minimum amount of water as per the following chart:



## The ideal start-up behaviour

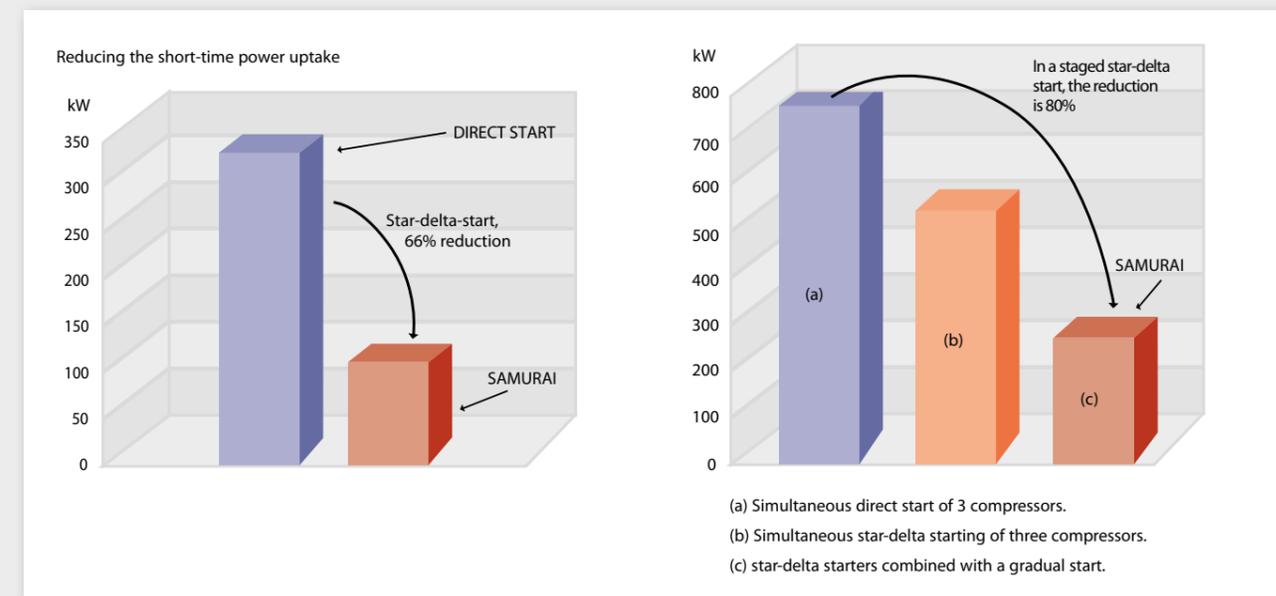
Due to the electrical starting system, there is no need to install oversized electrical wiring to prevent peak currents that are usually caused by conventional chillers.

This is achieved through two measures. First, the electric motors of the compressors are started by default in a star-delta circuit, which reduces power consumption when starting.

Second, the Samurai chillers employ a staged start-up process. If the system has more than one compressor, the start-up begins with the unit that has worked the least hours.

This compressor is working first on minimum load to keep the current consumption of the plant as small as possible. A minute later the second compressor is started. Both compressors continue to operate at minimum load, the third compressor starts and so on until all compressors of the plant are working to minimum load. After a safety time of 30 seconds, the installation will switch to normal operation.

Such a staged startup process has two main advantages. First, the short-time power consumption of a single compressor being switched on is much less than the multiple, simultaneous start-up of the compressors. Second, by minimizing the startup performance, the cable cross-section can be kept low and the power grid is not overloaded.



## Performance factor

Electricity companies usually charge extra for consuming the reactive current, used in electric motors to generate the magnetic field. Under normal operating conditions, the Samurai chillers have a high performance factor, which normally exceeds a value of 0.9 at full load. This keeps the consumption of reactive power to a minimum and it is not necessary to install a series of capacitors to compensate for the consumed reactive energy.

# Technical description

The Samurai chillers are very compact and equipped with continuously controlled screw compressors.

They are delivered pre-filled with refrigerant HFC R407C. The versions of "cooling only" and "heat pump" are possible. All units are subjected to extensive test runs to verify that all components are working properly. Therefore, locally the devices only need to be connected electrically and hydraulically.

### The semi-hermetic screw compressors by Hitachi

The semi-hermetic screw compressor is designed for the refrigerant R407C. Thanks to its direct connection with the electric motor no external connections for an electric motor are necessary, which reduces the number of internal components.

To protect against vibration, the compressors are mounted on silent blocks made of rubber and housed in a soundproof enclosure. This housing, patented by Hitachi, reduces the total noise emission considerably, since it is covered twice. Thanks to the pressure difference between the high pressure chamber and the low-pressure casing, oil is flushed continuously to the mechanical parts and to the power slide for the continuous power control. This eliminates the sensitive parts such as oil pumps, valves, etc.

The new cyclonic oil separator is located inside the casing of the compressor so there is no need for any external oil pipes which results in a compact design and high compressor reliability. The compressors are equipped with: Each compressor includes:

- Bipolar electric motor with star-delta starting circuit (standard)
- Solenoid valves for continuous capacity control
- Electronic protection against high temperature, with centralised manual reset
- New cyclonic oil separator, oil level and sight glass
- Mechanical operating time counter.



## Water Side Heat Exchanger

The SAMURAI chiller range uses an innovative plate heat exchanger. This exchanger allows the inner volume in the refrigerant cycle to be reduced, thus obtaining the maximum efficiency with the least possible amount of refrigerant. To avoid any kind of corrosion, the heat exchanger is produced from AISI-316 stainless steel plate.

Both refrigerant and water pass either side of profiled plates in contraflow, across which the heat exchange occurs. These plates are profiled to induce turbulence in both the water and refrigerant flow in order to increase the efficiency and optimize the heat exchange process both in time and space.

With R407C, the cooling capacity of this type of exchanger is greater than traditional shell and tube type evaporators.

## Air Side Heat Exchanger

The air side heat exchangers are constructed from copper tubes and aluminium fins (copper fins are an option), to the HITACHI patented "Slit Fin" design. The high efficiency of the aluminum fins combined with the internally grooved copper tubing make it possible to achieve a high heat transfer rate and a very compact size.

The fins are covered with a protective layer of anticorrosion as standard.

## DC Fan Motor with Outstanding Efficiency

The DC fan motor greatly improves efficiency compared to conventional products using an AC motor. In addition, air blasts are reduced by controlling the rotation speed of the fan.

### The concept of speed control PWM (pulse width modulation)

The switching element switches on and off in the rhythm of several thousand kHz. Thus, the on-off rate per cycle is controlled and the voltage supplied to the fan for speed control is adjusted.

## Power supply and control panel

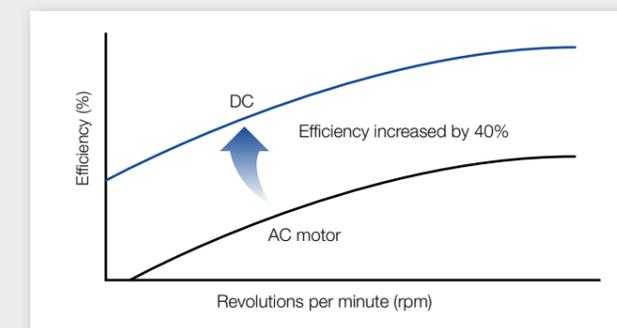
Power switch, power, operation and alarm LEDs, power supply and control panel with contactors and circuit breakers for the compressors and fans. The mains voltage corresponds to the standard CEN-60204. The control panel inside the unit frame is behind a sealed closing flap and is therefore, suitable for outdoor installation (air-cooled models).

The functions are located on the rear of the panel and are accessible by opening the flaps of the control panel.

## Microprocessor control

Hitachi has developed this based on its own control system technology. The power slider located in the compressor controls the compressors to match the respectively required load. With that, compliance with the discharge water temperature in the range of  $\pm 0.5$  °C is possible. The microprocessor monitors multiple points in the unit and controls the individual refrigerant circuits based on characteristic variables.

The microprocessor operates with up to 24 protection codes, including 15 different ones for each cycle. Thus, a very high operational reliability is achieved. The alarms are transmitted via an interface and can be read on four 7-segment displays. The control system includes all necessary operating times for the protection of the screw compressor and of the electrical system.



# Technical description

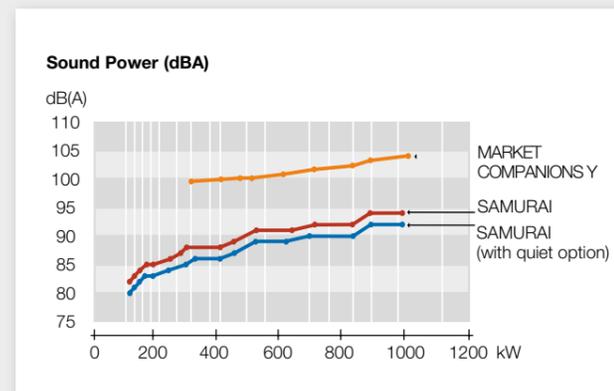
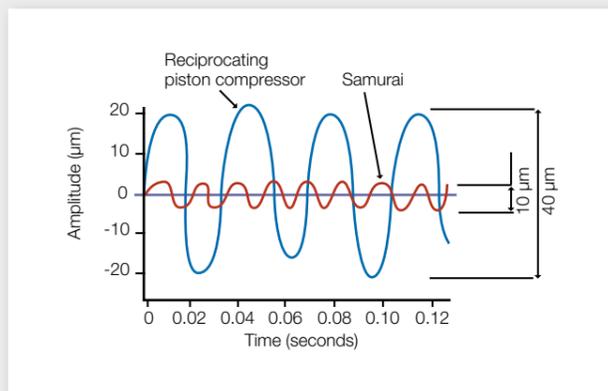
## Low noise level

The noise and vibration are joint determining factors when selecting a chiller. In many applications, it will be necessary to keep the noise under locally specified values.

The Samurai chillers operate with the sophisticated semi-hermetic screw compressors by Hitachi, their precise mechanical processing and careful assembly during manufacture, low noise and vibration levels. The compressors are mounted on silent blocks, which protect the equipment frame from vibrations - one of the reasons for the overall optimal result.

Hitachi uses the latest technology for the quietest operation. The new propellers with only two instead of four wings reduce the running noise, increase the air volume and also reduce considerably the power consumption. The compressor is installed in an enclosure that is lined with insulating material to keep noise levels as low as possible. Furthermore, the fan is designed for minimal noise and simultaneously with high air circulation for optimal working of the device.

The AG2-Series is equipped with a DC fan motor to adjust the air flow more efficiently and thus to control air flow and the acoustic load.



## Central station (CSC 5S)

Developed specifically for the Hitachi Samurai, Control CSC-5S offers individual control, quantity control and surveillance. It checks and controls up to 8 air chillers entirely customized to the needs of the customers. These functions can be conveniently monitored remotely from a control room. Unlike conventional machines, no visit to the engine room to check the equipment is needed.



## BMS interface (HARC70-CE1)

When connected to a building management system (BMS - available as an option) the following functions can be controlled:

- Power On / Off
- Programming the cold / hot water settings (outlet temperature)
- Selection of the cooling / heating mode

You can monitor:

- ON / OFF
- The set chilled water temperature
- The cold / hot water actual temperature
- The alarm codes
- The operational status

For these functions, the interface HARC70-CE1 must be selected from the options list. Through this interface, the connection of up to 4 machines via H-Link connection (Hitachi communication protocol) is possible. As a communication protocol LonWorks® is used.



# Quality assurance and maintenance

Hitachi Air Conditioning Products Europe SA (HAPE), the corporate sector for air conditioning products in Europe, is dedicated to the production of environmentally friendly products of the highest quality. Proof of this is the certification of the company according to ISO 9002 and ISO 14001.

During the manufacturing process of the Samurai chillers, already in the assembly, as well as after completion, they are subjected to a variety of inspections to ensure that they meet all required specifications.

The tests can be divided into two categories:

- Electrical and operational tests
- Pressure and leak tests

These tests are performed throughout the manufacturing process, both on the already assembled components in various states of assembly and on the finished product. For the electrical and operational tests, a comprehensive test run of all electrical and electronic connections is carried out on a simulator. After the control, cabinet has been installed.

MMechanical tests are performed at various assembly time points. First, the condition of the soldered joints is examined. Thus, each set of finished copper pipes and each capacitor is tested for leaks with refrigerant under maximum test pressure before installation in the unit. For this purpose, a special test apparatus is used, that can still detect refrigerant concentrations of 0.8 grams / year. Only when these components have been 100% tested are they incorporated.

After assembling the whole unit, a leak test is again carried out, whereby the emphasis is focused on the mechanical connections. In addition to examining each individual welding and soldering point in the system, 16 specific critical points in the refrigeration circuit are examined.

## Simple operation

When finally, the time comes to switch on the device, you will see how easy electronic control by Hitachi makes everything so easy for you.

The control panel consists of:

- 2 dual 7-segment LED displays
- 4 switches

This simple control panel gives you access to all variables of the device. With the button "CHECK" you get access to the storage of the last 10 error codes, to the power slider display and the display of the various variables (temperatures, pressures, etc.) of the refrigerant circuit. These can be read for each circuit individually.

Up to 24 different alarm signals in the form of error codes for the possible operation errors can be displayed. If such an error appears only in a single refrigerant circuit, the display shows in which, to facilitate troubleshooting. Should an error occur, the operating parameters are saved (sensor unit).

## Easy programming

In the design and configuration of the Samurai cooler Hitachi has developed a highly flexible solution. This allows them to be adapted all types of applications in the fields of HVAC and industrial cold-water supply. All operating parameters of the device are fully configurable. All you need are a few micro-switches located behind the control panel the electronics set accordingly. By setting this very simple micro-switch (ON / OFF) you can set the desired temperature, adjust the control range, etc.. This simple method of programming leads to a reliability that is unique on the market.

There are no complicated programming routines that may lead to incorrect execution and serious operational problems. Hitachi has created a very simple programming system that is very precise and extremely reliable. This makes it ideal not only for climate applications, but also for demanding industrial processes.

In this test, the device is operated with standard power. Meanwhile, with various tests the following is verified:

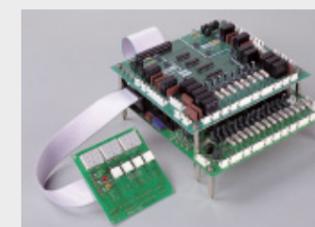
- The proper function of the fan, the correct rotational direction
- The power consumption of the device in relation with the chilled water outlet temperature
- ON / OFF with the remote control
- Activation of various safety chains to verify the correct operation of the refrigerant circuit in simulating extreme operating conditions
- The on/off switching of the device via the water pump.

During this acceptance testing all the critical points and solder joints of the device are re-examined for possible refrigerant leaks. As a result of the test real-time data is recorded from all coolant circuits, the amount of water and the ambient temperature data with a series of strategically placed sensors (temperature, pressure, flow, power consumption and voltage).

All these data are processed by a computer that constantly tracks the performance of the device. Once all the ratings are achieved, it is checked whether all the measured parameters are according to specification (cooling capacity, power consumption, etc.). Only then is the unit declared ready for delivery.



All cooling units are subject to an acceptance test which is conducted by simulating real operating conditions.



In the training courses electronic control system simulator used for the Samurai.

- Common inputs / outputs available (default)
- Constant power control
- Separate cooling circuits



RCU2E 40 - 140AG2

### Samurai chillers

SAMURAI RCU2E		40AG2	50AG2	60AG2	70AG2	80AG2	100AG2	120AG2	140AG2
Rated refrigeration capacity <sup>1</sup>	kW	112	130	156	178	206	260	312	356
Power input <sup>1</sup>	kW	38.6	44.7	53.0	61.0	70.0	89.4	106	122
Efficiency EER <sup>1</sup>	W/W	2.90	2.91	2.94	2.92	2.94	2.91	2.94	2.92
Housing colour		Off-white similar to RAL 9002							
Dimensions	Height	mm	2430	2430	2430	2430	2430	2430	2430
	Width	mm	1900	1900	1900	1900	1900	1900	1900
	Depth	mm	2190	2190	2190	2790	2790	4090	4090
Weight	kg	1430	1470	1560	1760	1820	2830	3000	3420
Sound pressure level	dB(A)	52	53	54	55	55	55	56	57
Sound level <sup>1</sup>	dB(A)	82	83	84	85	85	86	87	88
Number of compressors (refrigeration circuits)		1	1	1	1	1	2	2	2
Compressor regulation		Screw compressors, variable power control (15% ~ 100%) / star-delta starter compressor							
Heat exchanger (evaporator)		Stainless steel plate heat exchanger (soldered). 1 × each per refrigeration circuit							
Heat exchanger (condenser)		Air-cooled condenser with copper tubes with aluminum cooling fins							
Limits outside air	°C	-15 ° ~ +46 °C							
R407C refrigerant circuit		Electric E-valve, high and low pressure sensors, filters, sight glass, pressure switches and valve							
Water cycle		Maximum pressure 10 bar							
Water inlet / outlet		3-inch Victaulic (each refrigeration circuit and 1× intake and 1× discharge)							
Water flow rate min. ~ max.	m³/h	12 ~ 32	14 ~ 37	17 ~ 45	19 ~ 51	22 ~ 59	28 ~ 75	33 ~ 90	38 ~ 102
Water supply temperatures	°C	+5° ~ +15°C (Normal) to -10 °C with optional design and use of glycol							
Power Supply		400V/50Hz/3 Ph/N/PE							

The nominal cooling capacity / efficiency based on EN-14511.  
<sup>1</sup> Water temperature: 12°C inlet / outlet 7°C, outside air temperature 35°C  
<sup>2</sup> Sound pressure level measured at 10m distance.

- Common inputs / outputs available (default)
- Constant power control
- Separate cooling circuits



RCU2E-160 - 400AG2

### Samurai chillers

SAMURAI RCU2E		160AG2	180AG2	210AG2	240AG2
Rated refrigeration capacity <sup>1</sup>	kW	412	468	534	618
Power input <sup>1</sup>	kW	140	159	183	210
Efficiency EER <sup>1</sup>	W/W	2.94	2.94	2.92	2.94
Housing colour		Off-white similar to RAL 9002			
Dimensions	Height	mm	2430	2430	2430
	Width	mm	1900	1900	1900
	Depth	mm	5290	5990	7790
Weight	kg	3550	4450	5070	5250
Sound pressure level	dB(A)	57	57	58	58
Sound level <sup>1</sup>	dB(A)	88	89	91	91
Number of compressors (refrigeration circuits)		2	3	3	3
Compressor regulation		Screw compressors, variable power control (15% ~ 100%) / star-delta starter compressor			
Heat exchanger (evaporator)		Stainless steel plate heat exchanger (soldered). 1 × each per refrigeration circuit			
Heat exchanger (condenser)		Air-cooled condenser with copper tubes with aluminum cooling fins			
Limits outside air	°C	-15 ° ~ +46 °C			
R407C refrigerant circuit		Electric E-valve, high and low pressure sensors, filters, sight glass, pressure switches and valve			
Water cycle		Maximum pressure 10 bar			
Water inlet / outlet		3-inch Victaulic (each refrigeration circuit and 1× intake and 1× discharge)			
Water flow rate min. ~ max.	m³/h	44 ~ 118	50 ~ 135	57 ~ 153	66 ~ 177
Water supply temperatures	°C	+5° ~ +15°C (Normal) to -10 °C with optional design and use of glycol			
Power Supply		400V/50Hz/3 Ph/N/PE			

The nominal cooling capacity / efficiency based on EN-14511.  
<sup>1</sup> Water temperature: 12°C inlet / outlet 7°C, outside air temperature 35°C  
<sup>2</sup> Sound pressure level measured at 10m distance.

- Common inputs / outputs available (default)
- Constant power control
- Separate cooling circuits



RCU2E-40 ~ 100AG2

## Samurai chillers

SAMURAI RHU2E		40AG2	50AG2	60AG2	70AG2	80AG2	100AG2
Rated refrigeration capacity <sup>1</sup>	kW	106	123	148	169	195	246
Thermal output capacity <sup>2</sup>	kW	110	127	152	185	185	254
Nominal power consumption cooling <sup>1</sup>	kW	37.9	42.7	52.0	60.0	70.0	85.4
Nominal power consumption heating <sup>2</sup>	kW	40.7	44.5	54.0	68.0	68.0	89.0
Efficiency EER <sup>1</sup> / COP <sup>2</sup>	W/W	2.80/2.70	2.88/2.85	2.85/2.81	2.82/2.72	2.79/2.72	2.88/2.85
Housing colour		Off-white similar to RAL 9002					
Dimensions (height x width x depth)	mm	2430 x 1900 x 2190	2430 x 1900 x 2190	2430 x 1900 x 2190	2430 x 1900 x 2790	2430 x 1900 x 2790	2430 x 1900 x 4090
Weight	kg	1550	1600	1670	1880	1950	3050
Sound pressure level <sup>3</sup>	dB(A)	52	53	54	55	55	55
Sound level <sup>1</sup>	dB(A)	82	83	84	85	85	86
Number of compressors (refrigeration circuits)		1	1	1	1	1	2
Compressor regulation		Screw compressors, variable power control (15% ~ 100%) / star-delta starter compressor					
Heat exchanger (evaporator)		Stainless steel plate heat exchanger (soldered). 1 x each per refrigeration circuit					
Heat exchanger (condenser)		Air-cooled condenser with copper tubes with aluminum cooling fins					
Limits outside air	°C	Cooling: -15 ° ~ +46 °C Heating: -9.5 ° ~ +21 °C (optional: -9.5 ° ~ +35 °C)					
R407C refrigerant circuit		Electric E-valve, high and low pressure sensors, filters, sight glass, pressure switches and valve.					
Water cycle		Maximum pressure 10 bar					
Water inlet / outlet water		3-inch Victaulic (each refrigeration circuit and 1 x intake and 1 x discharge)					
Water flow rate min. ~ Max.	m <sup>3</sup> /h	12 ~ 32	14 ~ 37	17 ~ 45	19 ~ 51	22 ~ 59	28 ~ 75
Water supply temperatures	°C	Cooling: +5 ° ~ +15 °C (Normal) optional to -10 °C Heating: +35 ° ~ +55 °C					
Power supply		400V/50Hz/3 Ph/N/PE					

The nominal cooling resp. heating capacity / efficiency based on EN-14511.

<sup>1</sup> Water temperature: 12°C inlet / outlet 7°C, outside air temperature 35°C

<sup>2</sup> Water temperatures: intake 40°C / outlet 45°C, outside air temperature 6°C (FK)

<sup>3</sup> Sound pressure level measured at 10m distance.

- Common inputs / outputs available (default)
- Constant power control
- Separate cooling circuits



RCU2E-120 ~ 240AG2

## Samurai chillers

SAMURAI RHU2E		120AG2	140AG2	160AG2	180AG2	210AG2	240AG2
Rated refrigeration capacity <sup>1</sup>	kW	296	338	390	444	507	585
Thermal output capacity <sup>2</sup>	kW	304	370	370	456	555	555
Nominal power consumption cooling <sup>1</sup>	kW	104	120	140	156	180	210
Nominal power consumption heating <sup>2</sup>	kW	108	136	136	162	204	204
Efficiency EER <sup>1</sup> / COP <sup>2</sup>	W/W	2.85/2.81	2.82/2.72	2.79/2.72	2.85/2.81	2.82/2.72	2.79/2.72
Housing colour		Off-white similar to RAL 9002					
Dimensions (height x width x depth)	mm	2430 x 1900 x 4090	2430 x 1.900 x 5290	2430 x 1900 x 5290	2430 x 1900 x 5990	2430 x 1900 x 7790	2430 x 1900 x 7790
Weight	kg	3250	3670	3780	4780	5440	5650
Sound pressure level <sup>3</sup>	dB(A)	56	57	57	57	58	58
Sound level <sup>1</sup>	dB(A)	87	88	88	89	91	91
Number of compressors (refrigeration circuits)		2	2	2	3	3	3
Compressor regulation		Screw compressors, variable power control (15% ~ 100%) / star-delta starter compressor					
Heat exchanger (evaporator)		Stainless steel plate heat exchanger (soldered). 1 x each per refrigeration circuit					
Heat exchanger (condenser)		Air-cooled condenser with copper tubes with aluminum cooling fins					
Limits outside air	°C	Cooling: -15 ° ~ +46 °C Heating: -9.5 ° ~ +21 °C (optional: -9.5 ° ~ +35 °C)					
R407C refrigerant circuit		Electric E-valve, high and low pressure sensors, filters, sight glass, pressure switches and valve.					
Water cycle		Maximum pressure 10 bar					
Water inlet / outlet water		3-inch Victaulic (each refrigeration circuit and 1 x intake and 1 x discharge)					
Water flow rate min. ~ Max.	m <sup>3</sup> /h	33 ~ 90	38 ~ 102	44 ~ 118	50 ~ 135	57 ~ 153	66 ~ 177
Water supply temperatures	°C	Cooling: +5 ° ~ +15 °C (Normal) optional to -10 °C Heating: +35 ° ~ +55 °C					
Power supply		400V/50Hz/3 Ph/N/PE					

The nominal cooling resp. heating capacity / efficiency based on EN-14511.

<sup>1</sup> Water temperature: 12°C inlet / outlet 7°C, outside air temperature 35°C

<sup>2</sup> Water temperatures: intake 40°C / outlet 45°C, outside air temperature 6°C (FK)

<sup>3</sup> Sound pressure level measured at 10m distance.

- Common inputs / outputs available (default)
- Constant power control
- Separate cooling circuits
- Compact design



RCUE-40 ~ 100WG2

## Samurai chillers

SAMURAI RCUE		40WG2	50WG2	60WG2	80WG2	100WG2
Rated refrigeration capacity <sup>1</sup>	kW	134	160	194	232	320
Nominal power input <sup>1</sup>	kW	33.5	40.0	49.1	54.5	80.0
Efficiency EER <sup>1</sup>	W/W	4.00	4.00	4.00	4.30	4.00
Dimensions (height x width x depth)	mm	1542 x 1045 x 844	1542 x 1045 x 844	1542 x 1045 x 844	1542 x 1104 x 844	1700 x 1104 x 1430
Weight	kg	750	765	830	950	1570
Sound pressure level <sup>2</sup>	dB(A)	68	69	71	71	72
Sound level <sup>1</sup>	dB(A)	83	84	86	86	88
Number of compressors (refrigeration circuits)		1	1	1	1	2
Compressor regulation		Screw compressors, variable power control (15% ~ 100%) / star-delta starter compressor				
Heat exchanger		Stainless steel plate heat exchanger (soldered). 1x each per refrigeration circuit				
R407C refrigerant circuit		Electric E-valve, high and low pressure sensors, filters, sight glass, pressure switches and valve				
Water cycle (evaporation)		Maximum pressure 10 bar				
Water inlet / outlet water		3-inch Victaulic (each refrigeration circuit and 1x intake and 1x discharge)				
Water flow rate min. ~ max.	m <sup>3</sup> /h	14 ~ 39	17 ~ 46	21 ~ 56	25 ~ 67	38 ~ 92
Water supply temperatures	°C	+5° ~ +15 °C (Normal) optional to -10° ~ +15 °C				
Water cycle (condenser)		Maximum pressure 10 bar				
Water inlet / outlet water		3-inch Victaulic (1x inlet and 1x outlet)				
Water flow max.	m <sup>3</sup> /h	48.1	57.4	69.8	82.3	114.9
Cooling water outlet temperature	°C	+22° ~ +45 °C (in heat pump operation) optional to +22° ~ +55 °C				
Power supply		400V/50Hz/3 Ph/N/PE				

The nominal cooling and heating performance / efficiency based on EN-12055.

<sup>1</sup> Cold water temperatures: 12°C inlet / outlet 7°C, cooling water temperature: 30°C inlet / outlet 35°C

<sup>2</sup> Sound pressure level measured at 1m

- Common inputs / outputs available (default)
- Constant power control
- Separate cooling circuits
- Compact design



RCUE-40 ~ 120CLG2

## Samurai chillers

SAMURAI RCUE		40CLG2	50CLG2	60CLG2	80CLG2	100CLG2	120CLG2
Rated refrigeration capacity <sup>1</sup>	kW	120	145	180	240	290	360
Nominal power input <sup>1</sup>	kW	34.4	42.4	52.1	68.8	84.8	104
Efficiency EER <sup>1</sup>	W/W	3.49	3.42	3.45	3.49	3.42	3.45
Housing colour		Off-white similar to RAL 9002					
Dimensions (height x width x depth)	mm	1562 x 1045 x 885	1562 x 1045 x 885	1562 x 1104 x 885	1720 x 1104 x 1471	1720 x 1104 x 1471	1720 x 1104 x 1471
Weight	kg	630	680	730	1.200	1.310	1.380
Sound pressure level	dB(A)	68	69	71	71	72	74
Sound level <sup>1</sup>	dB(A)	83	84	86	86	88	90
Semi-herm. screw compressors		40ASC-Z	50ASC-Z	60ASC-Z	40ASC-Z	50ASC-Z	60ASC-Z
Number of compressors (refrigeration circuits)		1	1	1	2	2	2
Compressor regulation		Screw compressors, variable power control (15% ~ 100%) / star-delta starter compressor					
Heat exchanger (evaporator)		1x Stainless steel plate heat exchanger (soldered)					
Condenser		Condenser - provided by others. Note: The manifold must be placed next to the chiller.					
Condenser Connections HG / FL	mm	41.3/28.6 hot gas / liquid line		2 x (41.3/28.6) hot gas / liquid line			
Pipe length max. higher condenser	m	Pipe length max. 30m, height difference max. 25m					
Pipe length max. lower condenser	m	Pipe length max. 30m, height difference max. 5m					
Condensing temperature	°C	The condensing temperature must be between +30 ° ~ +65 °C.					
Refrigerant circuit R407C		Electric E-valve, high and low pressure sensors, filters, sight glass, pressure switches and valve.					
Water cycle		Maximum pressure 10 bar					
Water inlet / outlet water		3-inch Victaulic (1x inlet and 1x outlet)					
Min. Water system (2K)	m <sup>3</sup>	0.38	0.46	0.57	0.76	0.92	1.15
Water flow rate min. ~ Max.	m <sup>3</sup> /h	16 ~ 34	19 ~ 42	23 ~ 52	31 ~ 69	37 ~ 83	46 ~ 103
Water supply temperatures	°C	+5° ~ +15 °C (Normal) to -10 °C with optional version and use of glycol					
Power supply		400V/50Hz/3 Ph/N/PE					

The nominal cooling capacity / efficiency based on the following conditions:

<sup>1</sup> Cold water temperatures: 12°C inlet / outlet 7°C, condensing temperature 45°C

<sup>2</sup> Sound pressure level measured at 1m

# Explanation of the options

## Noise

Low noise

The compressor housing is lined with polyurethane foam. Thus, the noise is about 2dB lower than the standard version.

Super Low Noise (AG2B, AG2)

In order to reduce the noise by 4dB, the compressor room is double insulated (polyurethane foam (II) + ethylene propylene diene rubber Class M (I)).

## Low flow temperatures

The standard version for all devices is designed from the water outlet temperature 15 ~ 5°C. Lower temperatures must be chosen for the following options:

Low 1: +4 ~ 0 °C

Low 2: -1 ~ -5 °C

Low 3: -6 ~ -10 °C

If the chiller is operated at an outlet temperature below 5°C, antifreeze must be added. Otherwise there is danger of freezing. The frost protection thermostat is set at the factory. By blending anti-freeze, the technical data of the machine is changed. Our software calculates from the corresponding input values.

## Control systems

Circuit breakers for each compressor

Fuses are installed for magnetic circuit breaker for each compressor and fan motor-cycle as overcurrent protection. (H fuse)

Breakers per fan

For each fan, magnetic circuit breaker as the overcurrent protection installed (fuse std.).

GLT (HARK-70CE1 / OP, HC-A32MB)

To integrate the unit into a building control system, you will require this interface. It enables the connection of up to 4 devices via the LonWorks® communication protocol to a building management system. This system is easy to install, as only a 2-pin cable is used for the connection between the devices and the control unit via the HARC-70CE1. From there you can turn the device on or off and

determine the desired values for the chilled water outlet temperature. You will also receive information about:

- The device status (on / off / mode)
- The water outlet temperature and the nominal value
- The water inlet / outlet temperature
- The error codes

## Remote control (CSC-5S, CS-Net Web)

CSC-5S

8 chillers and 8 centralised CSC-5S remote addresses can be connected to an H-link. By default, an external input connector is provided for a possible connection to a timer. Basic function, heating-cooling mode and temperature setting are displayed accordingly. If an error occurs, an alarm code immediately shows the detailed information about the problem encountered. The alarms are divided into the following groups to facilitate the maintenance work:

- Start/Stop
- Mode (cooling / heating)
- Temperature settings (cold / hot)

Performance recording for CS-Net Web

The building control system, CS-Net, can work with all devices in its entire installation in a centralized manner. All temperatures and pressures of the system are visualised. It can be installed at any point in the building and is accessible from any computer in the building that is connected to the same network and is configured to do so. As an accessory, a touch screen for the centralised control of the building can be ordered. A BMS connection (MODBUS) is possible.

## Heat exchanger

Copper fins

For some special applications it may be necessary to use copper fins to prevent corrosion. Furthermore, substantial parts of the capacitor are coated with corrosion protection. Maximum outdoor temperature is reduced to 41°C. The cooling capacity is reduced (similar to the performance at 3°C higher outside temperature). The total weight is higher.

## Refrigeration cycle

### Ball stop valve in the hot gas line (before the compressor)

To shut off the refrigeration system directly at the compressor, ball valves are installed. This simplifies the maintenance of the facility.

### Ball valves in the intake line (before the compressor)

To shut off the refrigeration circuit directly at the compressor, ball valves can be installed. This simplifies the maintenance of the facility.

### Additional pressure relief valve, compressor

Single or double safety valve for the compressor (high pressure side). A simple safety valve is in the hot gas line installed as standard.

### Dual pressure relief valve hot gas line

Two safety valves are installed in parallel in the pressure line. A three-way valve determines which of the two valves is in operation. This allows a valve to be replaced without sucking off the refrigerant.

### Overpressure valve intake line

An additional safety valve is installed on the intake side (High temperature version).

### Intake line insulation

To avoid condensation and loss of cooling capacity, the suction line from the compressor to the evaporator and from the evaporator to the expansion valve is insulated (with WG2 and CLG2 this option is standard).

### Heat recovery (plate heat exchanger HG)

To recover the heat from the refrigeration process, an additional plate heat exchanger will be installed before the compressor. Water pipes can be connected to the installed connections. This is done per refrigerant circuit.

- In the cooling mode, depending on the model 30 ~ 35% "heat output" arises
- 70°C flow temperature at maximum capacity
- Water connection: 1-inch per circuit

## Water cycle

### PN16 Flange (with counter flange)

The PN16 flange is required for the Victaulic screw connection.

### Differential pressure switch (WT In-/Outlet)

This monitors the difference between inlet and outlet pressure. If water flow is not present, the compressor is not released.

### Flow switches (On site mounting)

The flow switch is supplied loose with the E-box. This must be built into the water pipe by the customer. Should a through-flow not be present, the compressor is not released.

### Plate heat exchangers for trace heating

To protect the heat exchanger from freezing at low temperatures, an electrical heating wire is installed on both sides. This is activated from 2°C.

### Common water inlet, outlet (only one connection)

Per circuit, one plate heat exchanger is installed. If, for a multi-circuit system you wish to combine this with the In-/Outlet, this option is recommended.

### Water pipes made of stainless steel (AISI 304)

To prevent corrosion, the piping can be executed in stainless steel (AISI 304).

### Pressure taps WT (not with flange PN16 or a Manifold)

To be able to measure the pressure difference, these connections can be installed.

### Water filters

A water filter should be installed on the inlet side of the chiller. A 16 or 20 meshed filter (1-2 or 3-5 loops) is available as an option.

### Hydraulic modules on request (for RCU2-40 ~ 80AG2 only).

Check with your local partner for further details.

# Explanation of the options

## Special operation

### Special heat pump operation

This option allows the heating mode. The samurai WG2 does not have reversible refrigeration circuits (no 4-way valve) . Cold and hot are always on the same side. If cooling or heating via the same consumer, it must be hydraulically connected.

### HP-operation at high outdoor temperatures

For air-cooled units this allows operation at higher outdoor temperatures. Thus, it is also possible in the summer to produce hot water.

- The power is equal to those at 15°C outside temperature
- Maximum outdoor temperature 40°C

If the hot gas temperature due to the outer parts is too high, coolant is injected through a solenoid valve into the compressor.

## Miscellaneous

### Function test I and II with customers (in plant)

If the customer wishes to accompany the test of the machine in the factory, it is feasible with this option. Two different variants are possible  
Witness Test I: Eurovent conditions  
Witness Test II: Customer specified test conditions

### Rubber vibration dampers (attached)

To reduce the vibration transmission to the building, vibration mats can be ordered. These can be found on delivery in the cabinet.

### Spring-vibration dampers (attached)

To reduce the vibration transmission to the building, spring vibration dampers can be ordered. These are delivered with the cabinet.

### Opposite cabinet position

If desired, the cabinet can be installed on the opposite side of the chiller.

### Shipped in wooden crate

For special delivery conditions, the chiller can be packed in a wooden box.

### Enhanced corrosion protection of housing

To improve corrosion resistance, the most important parts are coated with corrosion protection. In the case of a salty or corrosive environment, this should be ordered together with a copper plate capacitor.

### Bottom guard

To protect the system components, a grid for the bottom of the machine can be ordered.

### Increased transport model (struts)

Hereby, the machine is secured for long distance transport under extreme conditions (cross-struts, flexible pipe connectors, special screw locks, etc.)

### Double foil packaging for transport

By special request of customers, the cooling unit can be packed twice in plastic film.

## Available contacts (standard on all models)

1. Remote On / Off Alarm (24V AC) Alarm lamp, pump blockage, pump operation
2. Temperature setting, signal-free cooling

# Optional accessories



Anti Vibration Springs



Differential Pressure Switch



Suction Pressure Relief Valve  
(WG2, CLG2)



Suction and/or Discharge Valves



Dual Safety Valve



Compressor Safety Valve or Dual  
Safety Valve



Suction Pipe Insulation



Water Flow Switch

Specifications in this catalogue are subject to change without notice in order that HITACHI may bring the latest innovations to their customers, omitting typing errors.

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