ORION
冷熱と真空でイノベーション
Innovating with Thermal Control and Vacuum

Precision Air Processor

Precision Air Processor PAP Series

Oct. 2018 | D-EG13
Precision Air Processeor Catalog

Striving to Make Products that Move You

Energy Saving Precision Air Processor

PAP PRECISION AIR PROCESSOR SERIES

SUPER eco2 ORION

Combining Energy Savings and High Accuracy

Capacity Control from the Industry Leader in Heat Pump Balance Control

Max 80% Energy Savings

PAP Series

Energy Saving Precision Air Processor

mini Type PAGE 13

Temperature Control Type PAGE 15

Temperature And Humidity Control Type PAGE 17

JSRAE
Technology Prize
Energy Saving Precision Temperature Control Air Supply Unit
2013 Japan Society for Refrigeration and Air Conditioning Engineers

Energy Saving Precision Air Processing Equipment
9th Annual Prize for Promoting Machine Industry
Small and Medium Enterprise Agency Director's Prize
2011 Juridical Foundation, Japan Society for the Promotion of Machine Industry

Excellent Energy Saving Equipment
The Japan Machinery Federation Chairman's Award
Heat Pump Balance Control (Heatless) Air Processor (PAP Series)
2009, The Japan Machinery Federation

Ultra ECO Product:
Energy Savings of 50% or Better (compared with previous models)

SUPER eco2 ORION "eco2" means Economy (energy savings) and Ecology (environmental protection) and reduced CO_2 emissions.

PAP Web Site: http://www.orionkikai-pap.com/

Taking Temperature, Humidity, and the Environment to the Next Level

ORION is striving for a higher degree of temperature and humidity control combined with a clean-environment agenda to better serve technological innovation in this bewildering high-tech market of semiconductors and liquid crystal technologies, leading-edge energy related fields such as solar cell and biomass industries, etc., nanofabrication used in ultraprecision machine tool and medical and bio related industries, as well as other areas such as university and private research institutions and company research divisions.
ORION's motto is "From whole-area air conditioning to localized precision air conditioning", and ORION has the world-class, leading edge heat pump balance control and DC inverter control technology needed to offer it up in its PAP Series Precision Air Processors.

PAP D Series
Energy Saving Precision
Air Processors for Dehumidification
PAGE 21

PAP R Series
Facility Targeted Energy Saving Precision Air Processors
PAGE 25

PAP L Series
Energy Saving Precision
Air Processors for Low Temperature
PAGE 23

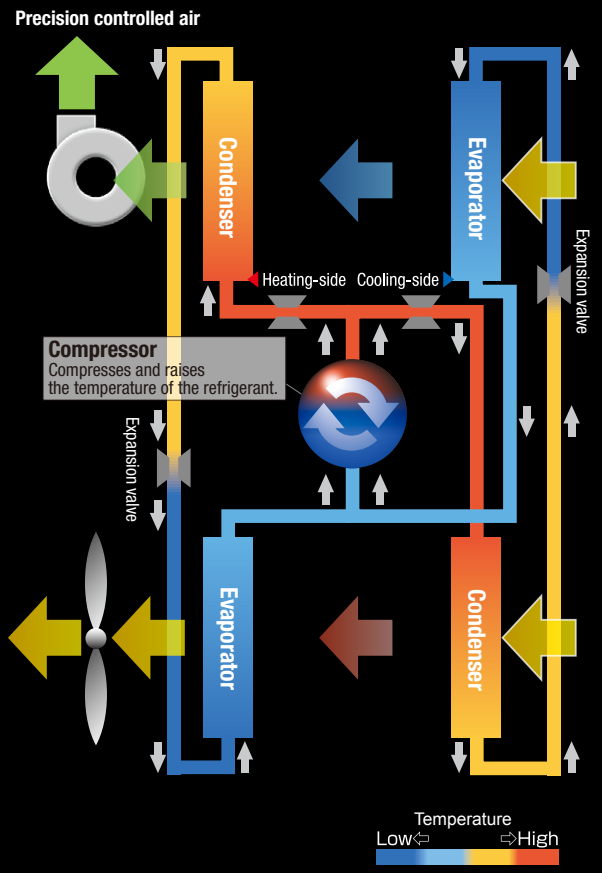
Air Processor
Circulation Type Temperature
And Humidity Control Equipment
PAGE 31

Energy Saving Dry Room
PAGE 33

PAP ORION PRECISION AIR PROCESSOR SERIES

SUPER eco2 ORION

Up To 80% Energy Savings With ORION'S Heat Pump Balance Control



Completely Heatless AND Energy Saving.

We've completely eliminated the electric heater thanks to our Heat Pump Balance Control.

Heater PID controls (*1), which are found in production fields that demand precision air processing, starting with semiconductor and FPD production processes, represent a large shortcoming when it comes to power consumption. Due to increasing miniaturization, the demand for higher precision is also increasing. ORION is responding with its development of completely heatless air dryers that provide high precision control tied with reduced power consumption. ORION has responded to our customers' needs with refrigerant reheating (*2), a renewed technology that offers energy savings incomparable with previous heater PID control systems, and formerly impossible to achieve wide ranging setting capabilities.

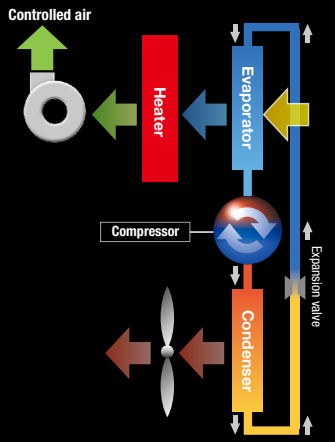
Heat Pump Balance Control *

Heat pump balance control is air processing which balances the high level control of seemingly simultaneous cooling and heating operations from a single air conditioning unit. In other words, unlike a common air conditioner that moves heat either from the inside of a room to the outside, or from the outside to the inside, we've developed a bleeding edge control technology that avoids normally wasted heat movement that includes advanced control technology yielding energy savings along with high accuracy temperature control operation.

How Other Precision Air Conditioners Work

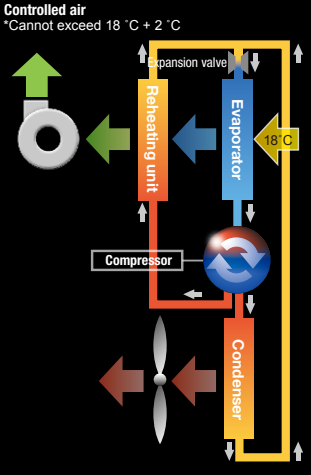
*1. Heater PID Control

Air temperature is controlled by passing air from a constantly operating cooler over a heater of power equal to or greater than the cooling capacity of the cooler. When compared with heat pump balance control, the losses are clear, and approximately 70% of energy is wasted when the heater is operating.



*2. Refrigerant Reheating Method

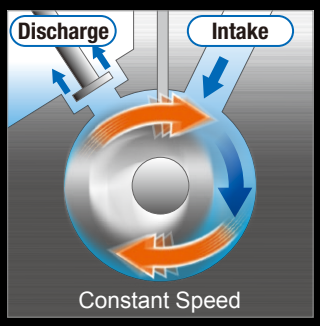
A second condenser (reheating unit) is installed, and the heat output from it is utilized, as air from the evaporator is passed through it in order to re-heat the air. Even if 100% of refrigerant gas circulated through the reheating side, there would be no change in the circulation load of the evaporator and the cooling capacity would be the same, therefore, since the heating power is only equal to that of the compressor power, the air temperature can only be controlled to 2 ˚C above the intake ambient air temperature. Under heat pump balance control, refrigerant is concentrated on the heating circulation side so that air can be controlled to temperatures to 7 ˚C over the intake temperature, thus offering a flexible response to changes in environment such as those due to seasonal changes.



DC Inverter Control For Optimum Capacity Control (Excluding PAPmini models)

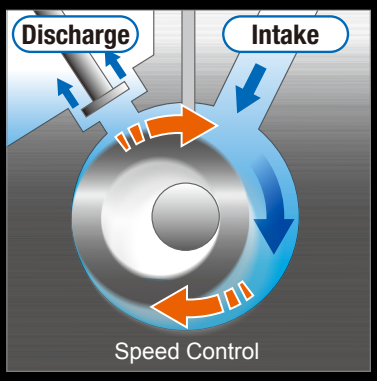
Automatic control of compressor speed in response to changes in load.

Our compressor uses a brushless DC motor for optimum high efficiency and energy saving control.



High rotation speed during high load conditions.

Constant speed compressor is always in this constant state.
There is no change in power consumption.

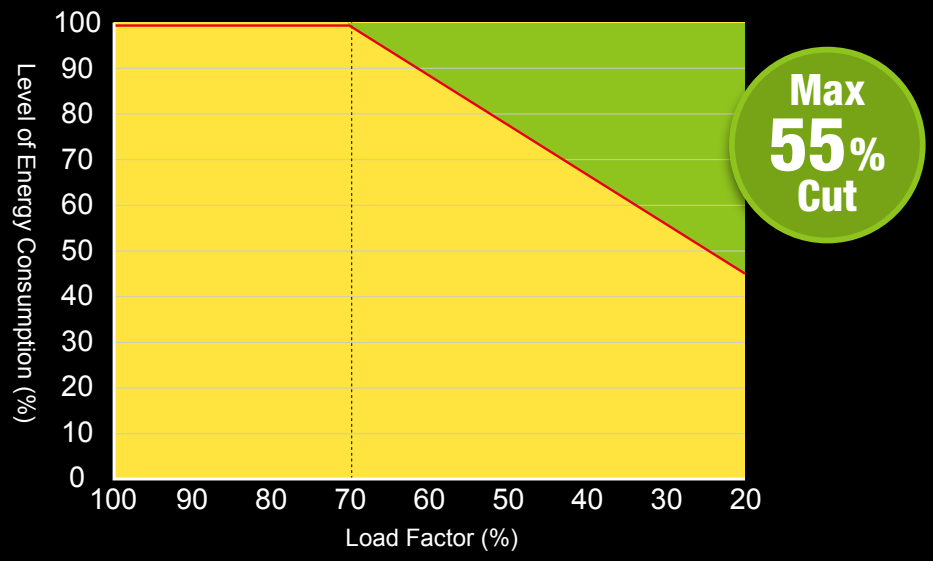


Low rotation speed during low load conditions.

The speed of the compressor is controlled in response to light load conditions in order to cut unnecessary cooling.

Controlled compressor speed during periods of low load, combined with heat pump balance control, means even greater energy savings. We offer a level of control that is impossible to achieve with constant-speed compressors.

Effective Energy Savings from Compressor Speed Control *Graph showing PAP10A-(F)W



Freeze-prevention Circuit Unnecessary

Cooling unit frost is prevented thanks to compressor speed control. Cooling possible right down to just nearly 0 ˚C.
Units with constant speed compressors require hot-bypass circuits as a measure for freeze prevention.

Heat Pump Balance Control

DC Inverter Control For Optimum Capacity Control

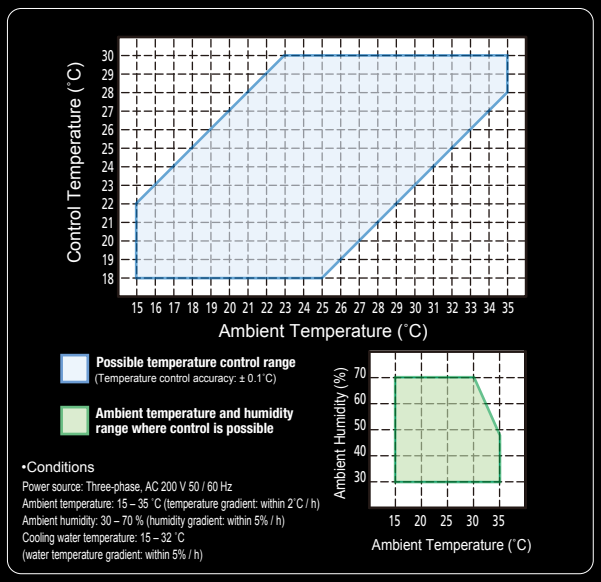
PAP SERIES ORION PRECISION AIR PROCESSOR

The Ultimate Algorithm Which Achieves Energy Savings And High Accuracy Temperature Control

PAP ORION PRECISION AIR PROCESSOR SERIES

SUPER eco2 ORION

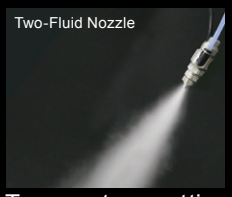
ORION gives you high accuracy humidity and temperature control across a wide range.



PAP Series Main Features

Temperature Settings as High as 7 ˚C Above Intake Temperature

Our heat pump balance control achieves the wide temperature differences between intake temperature and set temperature that are simply not possible with refrigerant reheating. (Industry top class specifications)
* Ambient temperature range of 15 – 35 ˚C. (See graph at left.)



Wide Range Achieved

See page 7 for heat pump balance control and two-fluid nozzle water mist humidification method (not including the PAPmini) that is completely heatless. Temperature setting range: 18 - 30 ˚C, humidity setting range: 40 - 75 %. (Vapor humidification is used in the humidity setting range of 65 - 75 %. The humidity setting range for the PAPmini is 45 - 75 %.)

Temperature Control Accuracy: ±0.1 ˚C

(during periods of stable load)

All-Fresh guarantees ±0.1 ˚C at the discharge port within the entire temperature control range. (Standard equipped sensor cable length: 10 m, or 5 m for the PAPmini.)

All Fresh Specifications

Only 1 duct connection for easy installation.
Meets your needs with a supply of clean air (class 100). (On HEPA installed models.) Circulation air processing is also possible.

Remote Management of All Air Processing

Remote operation via PC allows for combined management of all air processing within a factory.

External Communications Capability

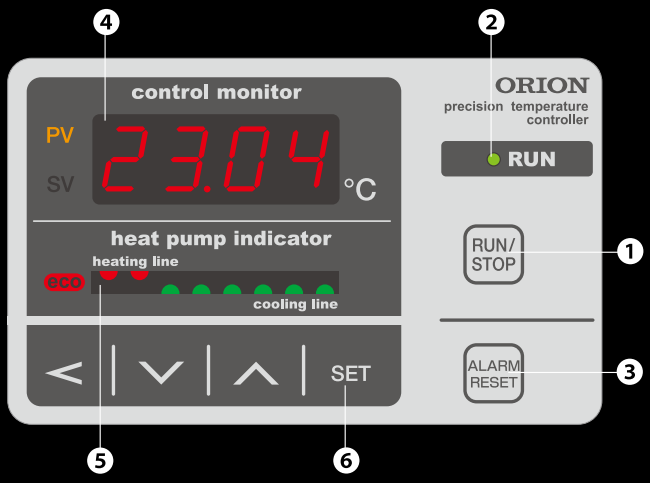
Operation and confirmation of temperature control conditions, etc. are possible with just one easily connected cable. Built-in support for 3 communications standards. (RS-232C, 422A, 485)

PRECISION AIR PROCESSOR For Local Area

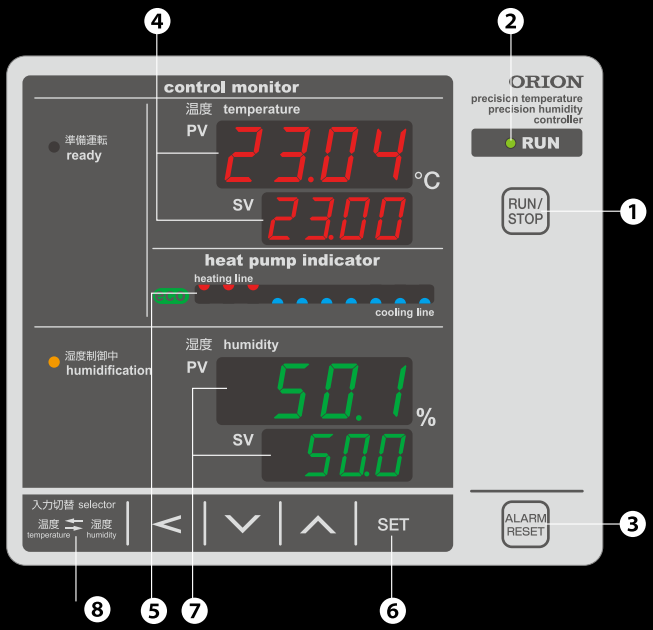
Built-in Intelligent Monitor

We've built in multiple parameter functions for improved ease of use.

Controller for Temperature Control Type Units



Controller for Temperature and Humidity Control Type Units



Option Remote Controller (not including the PAPmini)

Has all of the functionality of the main unit controller. (Wired)

Temperature Control Type

Temperature And Humidity Control Type

Controller Details

ORION's intelligent monitor offers a wealth of functions and monitoring capabilities combined for high-level operability.

1. **RUN/STOP button**
2. **RUN lamp**
3. **ALARM RESET button**
4. **Temperature PV / SV display**
5. **Heating / cooling indicator**
6. **Function setting buttons**
7. **Humidity PV / SV display**
   (only on units that have humidity and temperature control)
8. **Temperature / humidity input select key**
   (only on units that have humidity and temperature control)

List Of Main Functions

F001 Automatic recovery after power outage
Selects the recovery pattern after a power outage.

F002 RUN/STOP control selection
Selectively enables RUN/STOP control via the unit main control panel, remote switch, or communication functions, or any combination thereof.

F003 Alarm signal output select
Determines whether switched contacts are open or closed when an alarm condition occurs.

F099 Settings lock
This setting locks out changes to temperature and humidity settings.

F100 Controlled outlet air temperature warning
"Detection enabled" or "Detection disabled"

Self Diagnostics Built-in

Individual Warning/Alarm Indications Standard

Our intelligent monitor displays various monitoring system data. This allows for a quick response when alarm conditions occur or during maintenance.

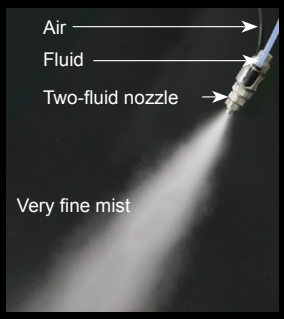
PAP ORION PRECISION AIR PROCESSOR SERIES SUPER eco2 ORION

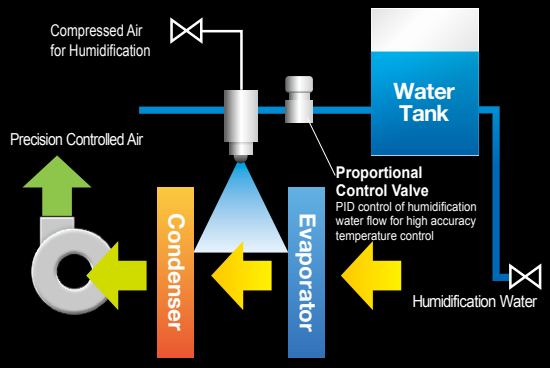
Completely Heatless Humidification Because ORION Is Particular About Saving Energy.

We have achieved completely heatless humidification.

Two-Fluid Nozzle Water Mist Humidification
(Not including the PAPmini)

The PAP Series takes energy saving all the way to the humidification method by going completely heatless. ORION's water mist humidification method does not rely on a heater like that used for steam humidification and therefore the electric power that would normally be wasted is saved. In addition, with ORION's original humidity control method and PID control of the humidification water supply flow, high accuracy humidity control of ±1 %, and temperature accuracy of ±0.1 ˚C are possible. All combined, ORION offers extremely high quality processed air.

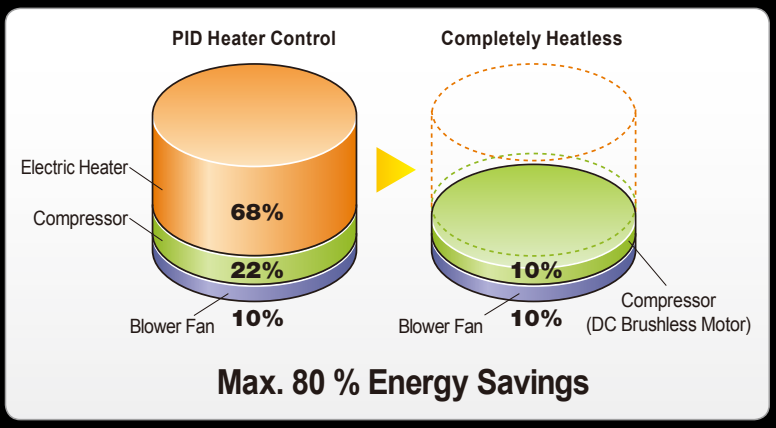




Two-fluid nozzle water mist humidification configuration diagram

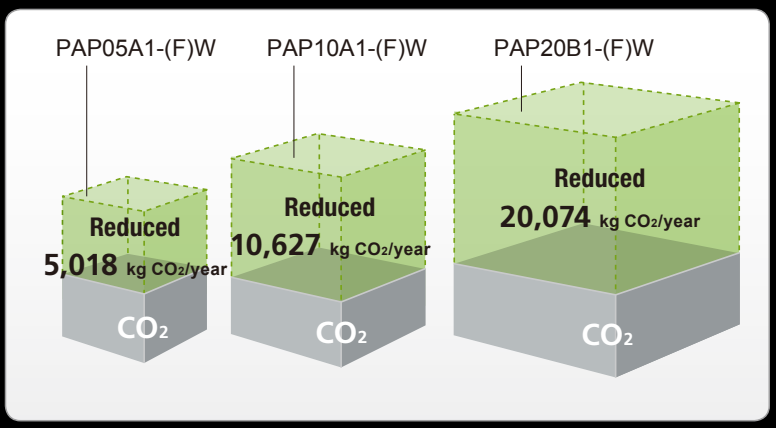
Energy Savings

Power Source Capacity and Power Consumption Comparison



Reduced CO_2. (greenhouse gases)

Our process offers a great reduction in global environment threatening released CO_2

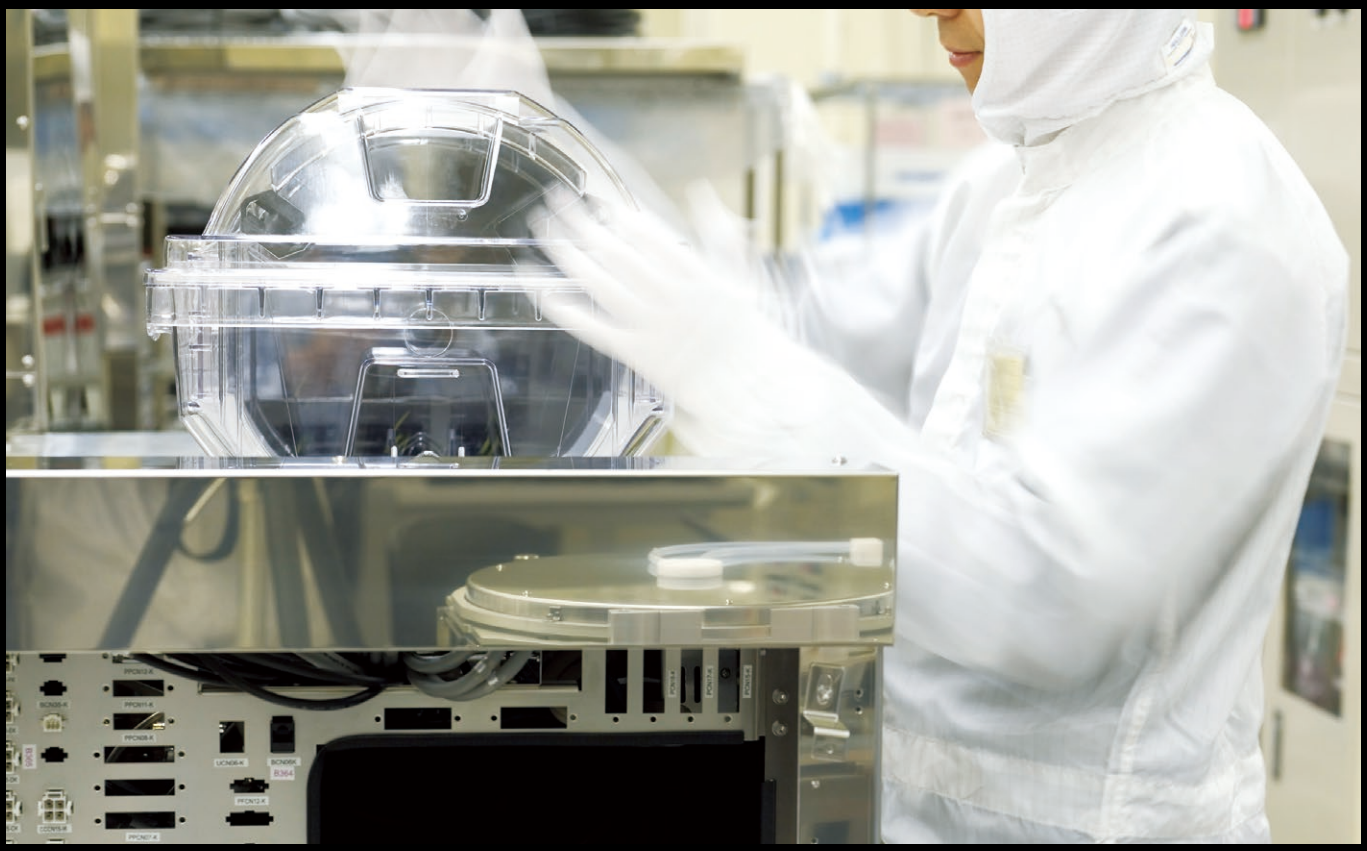


Model	Power Consumption Values (kWh), at 60 Hz			Difference in yearly power consumption (kWh)	Amount of reduced CO_2 ($kgCO_2$ / year)
	Other companies' previous method (A)	ORION's new method (B)	Difference in power (C) A−B		
PAP05A1-(F)W	3	1.3	1.7	12,240	**5,018**
PAP10A1-(F)W	5.3	1.7	3.6	25,920	**10,627**
PAP20B1-(F)W	10	3.2	6.8	48,960	**20,074**

*1 Under previous method, normal operation does not deviate from maximum power, therefore the value is calculated as the rated power consumption × 0.85.
*2 Calculated at 24 h/day, 300 days/year.
*3 Reduction in CO_2 emissions is 0.410, based on the average value of 8 electric companies.

PRECISION AIR PROCESSOR For Local Area

Problems Facing Whole-Area Air Conditioning



Problems Facing Precision Temperature And Humidity Cleanrooms

Air Processing is Very Expensive

When conditioning large spaces, generally represented by cleanrooms, where the level of cleanliness must be maintained or in large space where temperature and humidity must be controlled to high accuracy, the level of conditioning must match the level of each of the manufacturing processes. Excessive high accuracy air processing must be present in order to meet the most demanding equipment installation and processes within the same room. And in the same area or cleanroom where high precision air processing takes place, if there are high level equipment and manufacturing processes, there will also be low level equipment present. In order to achieve whole-area processing, highly accurate air processing equipment and a very high capital investment is generally necessary.

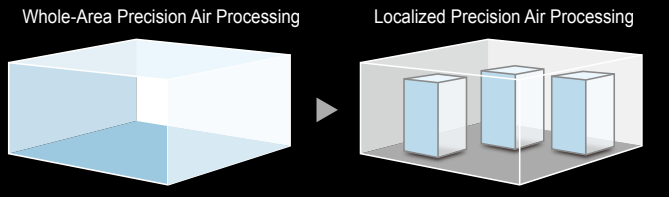
Very large capital investment is necessary to respond to sudden changes in manufacturing circumstances.

In order to surpass competitors, quality construction is a given. But on top of that, improvement of quality of conformance, which includes materials processing and assembly inspection, will incur short-term new investment. To respond to the demands of the sudden change in the manufacturing floor, whole-area air processing will also require a very large investment.

Bringing in Outside Air Requires Vast Administrative and Maintenance Expenses

Generally, a clean room requires fresh air to be piped in. The conditions of air processing cleanroom depend greatly on the supply of fresh air flowing in, as well as the ambient temperature and humidity of that air. The larger the space, the greater the cost and effort that will be required to maintain the same temperature, humidity, and level of cleanliness throughout the year. Basically, it's hard to say that there can be prudent management of high accuracy temperature and humidity air processing for large spaces like cleanrooms all the way down to the inner spaces of installed equipment involved in the manufacturing process.

Conventional Cleanrooms And ORION's Proposal For Local Air Processing



With conventional factory whole-area air processing, in addition to the high costs involved, air processing suitable to all machinery and equipment could not be realized. By managing air processing to the exact requirement of each stage of work, the scale of extremely high accuracy air processing can be reduced, and the resulting cost reductions can also be achieved.

ORION's Proposal For Energy Saving Via Localized Precision Air Processing

High Quality for Confined Spaces

Spaces containing equipment, production processes, and inspection processes related to semiconductor, liquid crystal, solar panel, and related technologies demand high precision and high stability air processing. As a result of these demands of whole-area air processing, there are extremely high associated expenses and maintenance costs. ORION proposes construction of a high precision air processing system made of localized high quality spaces that can minimize the utilization of limited energy.

Reductions in Expenses and Labor Associated with Maintenance Management

In whole-area air processing, expenses are associated with maintenance management of the entire area, and when trouble arises, the entire area may incur damages. In localized air processing, individual air processors can be maintained, thus reducing potential damage to the entire factory area. Furthermore, repairs and HEPA filter replacement can be done in a short time..

Easy Implementation of Highly Accurate and Stable Precision Air Processing

High quality whole-area air processing that provides a high level of accuracy and cleanliness requires large air processing facilities. Localized air processing boasts simple, high accuracy temperature and humidity controlled air.

Implement a Precision Air Processing System Suitable to Your Equipment, Manufacturing Processes, and space.

Diversification of workspace demands and other drastic changes require the swift creation of a suitable environment. Localized air processing offers a flexible and prompt response to the demands of the production area including improved temperature and humidity accuracy and improved levels of cleanliness.

Great Reductions in Facility Costs are Possible

By utilizing high accuracy temperature and humidity controlled clean air only in spaces where it is demanded, a great reduction of costs involved with whole-area high accuracy air processing can be realized by avoiding waste associated with high accuracy processing where it is not required.

Photolithography Equipment (stepper)

Photolithography equipment prints minute electrode patterns onto silicon or glass on the order of nano-microns to hundreds of nano-microns in size, and the process demands air processing management of extremely high degrees of cleanliness and temperature and humidity accuracy.

Spin Coater

A spin coater is used in the semiconductor manufacturing process to apply a resist fluid to a wafer that has undergone deposition and is also used in the production of optical recordable discs such as CDs, DVDs, BDs, etc. in order to apply the recordable layer to the disc. When doing so, the scale of the recording layer applied is in the order of nanometers, and when making the very uniform layer which is required, any changes in viscosity due to changes in temperature and humidity can spell disaster. It is vital to plan for constant temperature and humidity management, as well as stability in quality.

Liquid Crystal Manufacturing Process

During the liquid crystal manufacturing process, temperature changes can result in expansion, contraction, and electrostatic formation on the substrate. In order to avoid trouble arising from such issues, temperature, or possibly temperature and humidity of the working environment must be precisely controlled.

Solder Paste Printer

A solder paste printer applies solder paste to a printed circuit board. In the screen printing process, a metal mask of approximately 100 – 300 microns in thickness is commonly used through which solder paste is passed to be applied to the board. Powdered solder is mixed in flux so that a moderate viscosity is formed. However, the effects of temperature can prevent proper application. Also, electrostatic formation can occur depending on the humidity. For these reasons, temperature and humidity management is necessary.

Solar Simulator

Testing apparatus for evaluation of solar cell specifications by exposure to artificial sunlight. Temperature management is required to keep down heat from light sources in order to make stable conditions for measurement.

Precision Processing Machine

With current ultraprecision machine tools, sizes down to the sub-micron order are the norm, and there is a demand nano-unit scales. The smallest changes in temperature can result in expansion and contraction of equipment and the target work, so there is always the desire for absolute temperature control precision.

Localized Air Processing For All Kinds Of Equipment

Printed Circuit Board Stocker

Printed circuit boards must be kept at a uniform temperature and humidity throughout manufacturing processes before solder paste printing. Printed circuit boards have poor thermal properties, so management of storage temperature can reduce lower yields due to poor soldering, and is effective at increasing quality.

Electron Microscope

Electron microscope resolutions are at a level of 0.1 nm, and such a working environment demands a uniform range of temperature and humidity. In order to achieve more reliable, higher analytical results, better prepared environmental conditions are indispensable.

Tablet Press

Presently, "powder processing technology", which is the means to process powder into an easy to handle shape, has become vital for all industries. A tablet press (also known as a "tableting machine") solidifies a powder by means of a kind of molding machine, and the internals of such equipment require an environment with a constant temperature and low humidity.

3D Measuring Instrument

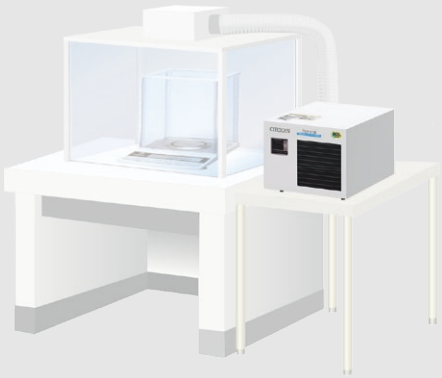
3D measuring instruments require a minimum high-accuracy scale of 0.0005 – 0.00001 mm. Improvement of measurement accuracy demands a stable installation environment.

Chromatograph

Chromatograph equipment measures the respective constituent contents of a sample.
Measurement sensitivity is in the order of PPM (parts per million) to PPQ (parts per quadrillion, or 1 part per 10^{15}), and the technology is particularly represented in the fields of biochemistry, pharmaceuticals, and foodstuffs. More reliable, higher level results come about with higher level improvements to the working environment.

Liquid Dispensing (pipetting) Equipment

Liquid dispensing equipment is widely used in the fields of biology, chemistry, and medicine. Improved accuracy can be achieved through temperature and humidity accuracy.



Electronic Balance

Presently, mass measurement in analytical chemistry is generally done using the electronic balance. Proper environmental management can prevent the subtle changes due to fluctuating temperature and humidity, and provide more stable measurement results.

Fume Hood

A fume hood provides internal temperature and humidity management of intake air.

PAP mini –Light Duty Series– Air Cooled

Models

PAP01B
PAP01B-KJ
PAP03C
PAP03C-KJ

- Air processing capacity **0.7–4 m³/min**
- Temperature control accuracy **±0.1 ˚C**
- Temperature setting range **18 – 30 ˚C**
- Humidity control accuracy **±1 %** *KJ models only
- Humidity setting range **45 – 75 %** *KJ models only

Intelligent Monitor | Heat Pump Balance Control | Flow Control | Hepa Filter (F type) | Air Cooled | Water Cooled | Temperature Control | Humidity Control (Kj type)

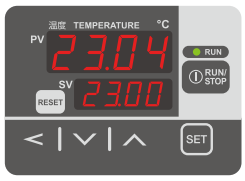
Special Order Model For more information on special order models ▶ Page 24

- Noise reducing intake duct
- Circulation intake chamber
- Exhaust chamber
- Compact chamber box

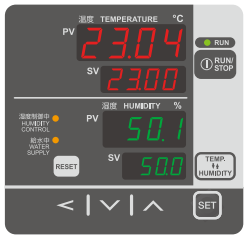
Please contact ORION regarding custom built models of specifications outside the ranges listed herein.

PAP01B

PAP03C-KJ



Temperature Control Type



Temperature And Humidity Control Type

Built-in Intelligent Monitor

Easy to use function keys for expanded functionality

List Of Main Functions

- **F001** Automatic recovery after power outage
- **F002** RUN/STOP control selection
- **F003** Alarm signal output select
- **F099** Settings lock
- **F100** Controlled outlet air temperature warning

*Photo: PAP03C series

Specifications

	Model		PAP01B	PAP01B-KJ	PAP03C	PAP03C-KJ
Performance specifications	Possible temperature and humidity setting range *1	˚C,%	18 – 30	18 – 30, 45 – 75	18 – 30	18 – 30, 45 – 75
	Temperature and humidity control precision *2	˚C,%	±0.1	±0.1, ±1.0	±0.1	±0.1, ±1.0
	Cooling / heating output (50 / 60Hz) *3	kW	0.33 / 0.39	0.77 / 0.84	1.65 / 1.85	1.8 / 2.12
	(Maximum cooling output)	(kW)	(0.22 / 0.26)	(0.37 / 0.44)	(1.15 / 1.35)	(1.2 / 1.42)
	Rated processing airflow	m³/min	0.7 – 1.0		2.0 – 4.0 *1	
	Maximum external static pressure *4	Pa	120 / 130	120 / 160	110 / 150	110 / 150
Environmental conditions	Surrounding (intake air) temperature and humidity range	˚C,%	15 – 35, 30 – 70 *1		15 – 40, 30 – 70 *1 *5	
	Temperature gradient at intake	˚C/h	Within ±1			
	Humidity gradient at intake	%/h	Within ±5			
	External dimensions (H×D×W)	mm	346 × 500 × 412 *5	765 × 620 × 390 *5	1070 × 590 × 480 *6	1350 × 680 × 520 *6
	Mass	kg	(32)	(69)	(95)	(135)
	Controlled air outlet port	mm	φ75	φ100	φ98	φ98
Humidification water	Water quality		–	Deionized water (electrical conductivity: 0.1 – 10 μS/cm)	–	Deionized water (electrical conductivity: 0.1 – 10 μS/cm)
	Maximum moisture output	kg/h	–	0.8 *6	–	2.3 *7
	Supply temperature range	˚C	–	10 – 40	–	10 – 40
	Connection port size		–	Rc1/4	–	Rc1/4
Power specifications	Power source	V(Hz)	Single phase 100V ± 10% (50 / 60) *7 *11		Three-phase 200 ± 10 % (50/60) *8	
	Power consumption	kW	0.32 / 0.34	1.2 / 1.2	0.75 / 0.85 *9	2.7 / 3.1 *9
	Electric current	A	4.0 / 3.9 *8	13 / 13 *8	3.8 / 3.8 *10	11 / 12 *10
	Power capacity	kVA	0.34 / 0.38 *9	1.5 / 1.5 *9	1.4 *11	4.0 *11
	Noise level (50 / 60Hz)	dB	54 / 56 *10	58 / 60 *10	64 / 65	65 / 66
	Refrigerant		R134a	R407c	R410A	R410A
	Compressor output	kW	0.25	0.3	0.8	0.85

About the PAP01B Series

*1 The temperature and humidity control ranges noted do not necessarily indicate the actual possible controllable ranges. The actual controllable temperature and humidity ranges will depend on the temperature and humidity of the intake air as well as process air flow rate. Set the processing air flow according to the operating environment. *2 When the intake air temperature and humidity are stable. Noted accuracy value displayed on the controller is for one point at the outlet port. When operating at the maximum rated air flow. *3 intake (surrounding) air temperature and humidity are 30 °C, 70 %, at a processing air flow of 1 m³/min . *4 The eternal static pressure at the controlled air outlet side of the blower fan outlet side when operating at the maximum rated processing air flow. *5 Height includes the outlet port. *6 The figure noted is when operating at the top of the specified level of humidification. *7 Plug the product into a dedicated outlet in order to prevent voltage drops. *8 Maximum value within the range of the product's specifications. *9 When operating at the maximum operating current within the specified range. *10 The noise level can be lowered by installing noise-absorbing ducting. *11 Includes a 2 m power cord.
Note: Ducting should be insulated, and ducting length should be kept as short as possible. (Recommended maximum length: 3 m)

About the PAP03C Series

*1 The temperature and humidity control ranges noted do not necessarily indicate the actual possible controllable ranges. The actual controllable temperature and humidity ranges will depend on the temperature and humidity of the intake air as well as the process air flow rate. Set the processing air flow according to the operating environment. *2 When the intake air temperature and humidity are stable. Noted accuracy value displayed on the controller is for one point at the outlet port. When operating at the rated processing air flow (3m³/min). After operation starts, for approx. 2 minutes the temperature will temporarily fluctuate due to operation while the compressor oil returns. Also, if the target humidity is high, and depending on the timing of the supply of the humidification water, the precision previously noted may not be able to be maintained. In such cases, by adjusting parameters related to supply water, the amount of fluctuation can be reduced. *3 When the intake (surrounding) air temperature and humidity are 30 °C, 70 %, at a processing air flow of 3 m³/min . *4 When the processing air flow is 3 m³/min. *5 See the operating manual for details regarding the possible operating range of ambient temperature and humidity. *6 Height includes the outlet port. *7 The figure noted is when operating at the top of the specified level of humidification. *8 The source voltage phase unbalance should be less than ±3 %. *9 The intake (surrounding) air temperature and humidity are 30 °C, 70 %, at a processing air flow of 3 m³/min . *10 Maximum value within the range of unit specifications. *11 The figure noted is when the product is operating at the highest capacity of its normal operating range.
Note: Ducting should be insulated, and ducting length should be kept as short as possible. (Recommended maximum length: 3 m)

ORION's compact class achieves the highest level of temperature control of ±0.1 ℃, and humidity control of ±1 %.

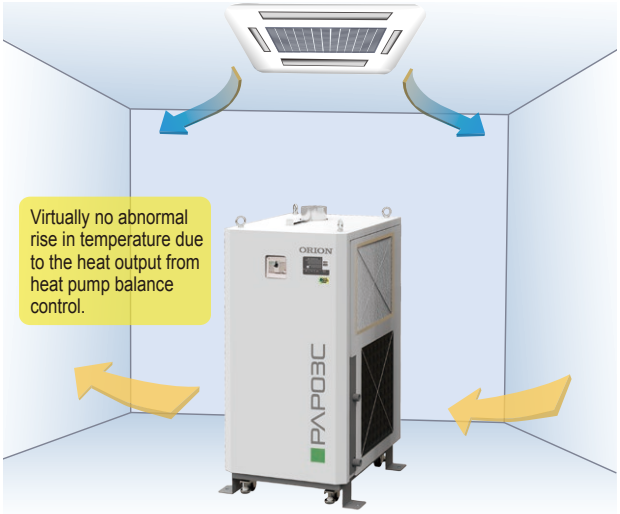
Simple and easy installation

You can plan on temperature and humidity control, and cleaning, in the air space where you need it, when you need it.
And very easy to move or remove when no longer needed.

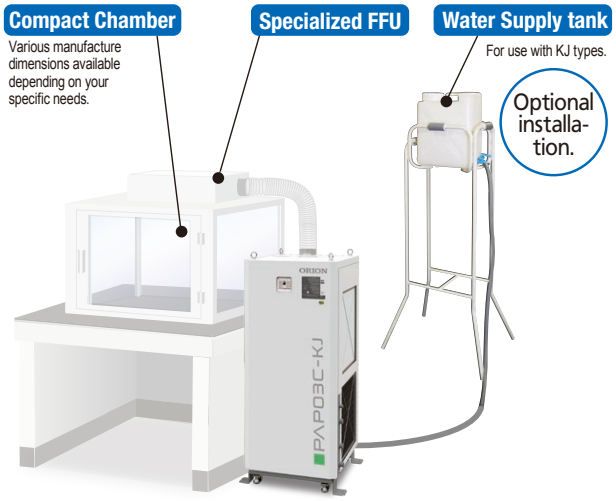
As much as 70 % Cut in Heat Output*

Extremely low heat output means a reduced load, even for air processors installed inside.

* Compared with sustained compressor operation + heater reheat method.



ORION has a System that Meets Your Needs

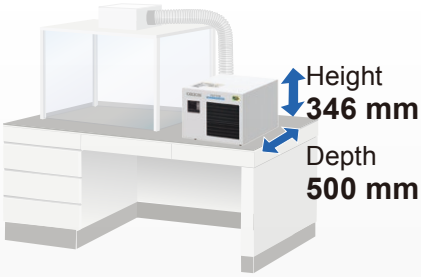


An answer ...
We can meet each of your temperature-control needs!
Our dealers are happy to provide further information.

Compact Design

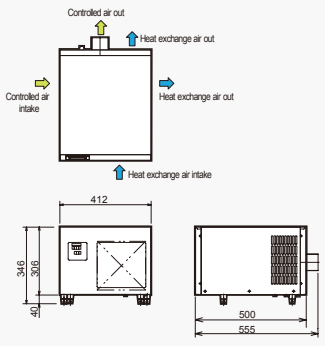
PAP01B-KJ type
A compact design that fits neatly besides your work desk.

PAP01B type
Can also be used on the desk top.

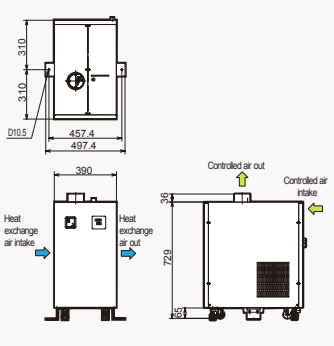


External Dimensions (units: mm)

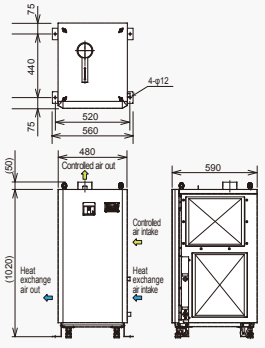
Temperature Control Type
PAP01B



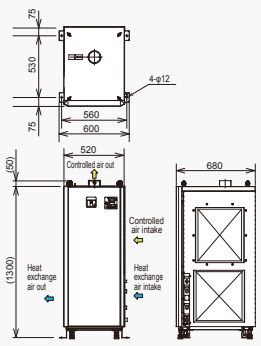
Temperature and Humidity Control Type
PAP01B-KJ



Temperature Control Type
PAP03C



Temperature and Humidity Control Type
PAP03C-KJ



PAP Temperature Control Type Air Cooled

Models

PAP05A1
PAP05A1-F
PAP10A1
PAP10A1-F
PAP20A
PAP20A-F

Air processing capacity **3 – 20 m³/min**

Temperature control accuracy **±0.1 ˚C**

Temperature setting range **18 – 30 ˚C**

Intelligent Monitor | Heat Pump Balance Control | Flow Control | Hepa Filter (F type) | Air Cooled | Water Cooled | Temperature Control | Humidity Control (Kj type)

Special Order Model For more information on special order models ▶ Page 24

■ Noise reducing intake duct ■ Circulation intake chamber
■ Exhaust chamber ■ Humidity display included

Please contact ORION regarding custom built models of specifications outside the ranges listed herein.

PAP10A1

Specifications

	Model		PAP05A1	PAP05A1-F	PAP10A1	PAP10A1-F	PAP20A	PAP20A-F
Performance specifications	Possible temperature setting range *1	˚C	18 – 30					
	Temperature and humidity control precision *2	˚C	±0.1					
	Cooling / heating output (50 / 60Hz)	kW	2.3 / 2.6		4.7 / 5.3		9.4 / 10.5	
	(Maximum cooling output)	(kW)	(1.6) / (1.8)		(3.2) / (3.6)		(6.5) / (7.2)	
	Rated processing airflow	m³/min	3 – 5		7 – 10		13 – 20	
	Maximum external static pressure (50 / 60Hz) *3	Pa	110	620	250	560	250	690
Environmental conditions	Surrounding (intake air) temperature and humidity range *1	˚C,%	15 – 35, 30 – 70					
	Temperature gradient at intake	˚C/h	Within ±1					
	Humidity gradient at intake	%/h	Within ±5					
	External dimensions (H×D×W) *4	mm	1140 × 700 × 600	1423 × 700 × 600	1305 × 822 × 661	1565 × 822 × 661	1610 × 1150 × 770	2010 × 1150 × 770
	Mass	kg	(130)	(155)	(185)	(210)	(290)	(365)
	Controlled air outlet port	mm	φ100	φ100 HEPA filter built in	φ150	φ150 HEPA filter built in	φ200	φ200 *5 HEPA filter built in
Power specifications	Power source *6	V(Hz)	Three-phase 200 ± 10 % (50/60)					
	Power consumption *7	kW	1.4		1.8		3.9	
	Electric current *7	A	6.2		7.5		14.9	
	Power capacity *8	kVA	2.2		2.6		5.2	
	Noise level (50 / 60Hz) *9	dB	66 / 66	71 / 71	68 / 68	73 / 73	69 / 69	76 / 76
	Operation control method		Heat pump balance control					
	Refrigerant		R410A					
	Compressor output	kW	0.7		1.7		3.0	

*1 The temperature control range noted does not necessarily indicate the actual controllable range possible. The range of temperature control depends on the condition of the air supplied at the intake.
*2 When the air temperature and humidity is stable at the air intake. Noted accuracy is based on measurement by the internal controller at a single air outlet point. *3 The noted external static pressure is when the controlled air is regulated at the outlet to produce the maximum rated processing air flow. *4 Height includes outlet port. *5 The HEPA filter box is shipped in a separate package from the main unit and must be installed on-site. *6 Source voltage phase unbalance should be less than ±3 %.
*7 Maximum value within the range of unit specifications. *8 The figure noted is when the equipment is operating at the highest capacity of its normal operating range. *9 Noise level can be decreased by installing a noise-reducing intake duct.
Note: All ducting should be insulated and ducting length should be kept as short as possible. (5 m or shorter recommended.)

PAP Temperature Control Type Water Cooled

Models

PAP05A1-W
PAP05A1-FW
PAP10A1-W
PAP10A1-FW
PAP20B1-W
PAP20B1-FW
PAP40B-W
PAP40B-FW

Air processing capacity **3 – 40 m³/min**

Temperature control accuracy **±0.1 ˚C**

Temperature setting range **18 – 30 ˚C**

Intelligent Monitor | Heat Pump Balance Control | Flow Control | Hepa Filter (F type) | Air Cooled | Water Cooled | Temperature Control | Humidity Control (Kj type)

Special Order Model For more information on special order models ▶ Page 24

■ Noise reducing intake duct ■ Circulation intake chamber
■ Exhaust chamber ■ Humidity display included

Please contact ORION regarding custom built models of specifications outside the ranges listed herein.

PAP10A1-W

Specifications

Model			PAP05A1-W	PAP05A1-FW	PAP10A1-W	PAP10A1-FW	PAP20B1-W	PAP20B1-FW	PAP40B-W	PAP40B-FW
Performance specifications	Possible temperature setting range *1	˚C	18 – 30							
	Temperature and humidity control precision *2	˚C	±0.1							
	Cooling / heating output (50 / 60Hz)	kW	3.2 / 3.2		6.5 / 6.5		13.0 / 13.0		22.0 / 22.0	
	(Maximum cooling output)	(kW)	(2.0)		(4.0)		(8.0)		(16.0)	
	Rated processing airflow	m³/min	3 – 5		7 – 10		13 – 20		25 – 40	
	Maximum external static pressure(50 / 60Hz) *3	Pa	410 / 660	300 / 620	870 / 870	560 / 560	650 / 1000	300 / 690	300 / 300	1000 / 1000
Environmental conditions	Surrounding (intake air) temperature and humidity range *1	˚C,%	15 – 35 , 30 – 70							
	Temperature gradient at intake	˚C/h	Within ±2							
	Humidity gradient at intake	%/h	Within ±5							
	Cooling water temperature gradient	˚C/h	Within ±5							
	External dimensions (H×D×W) *4	mm	1489 × 586 × 538		1703 × 763 × 655	2135 × 763 × 655	1842 × 973 × 653	2291 × 973 × 653	1800 × 1200 × 900	2323 × 1200 × 900
	Mass	kg	120	130	215	260	220	290	440	540
	Controlled air outlet port	mm	φ100	φ100 HEPA filter built in	φ150	φ150 *5 HEPA filter box included	φ200	φ200 *5 HEPA filter box included	□350	□350 *5 HEPA filter box included
Cooling water	Rate of supply *6	m3/h	1.0		1.5		2.2		3.0	
	Supply temperature range	˚C	15 – 32							
	Supply pressure	MPa	0.69 or less							
	Inlet/outlet pressure difference	MPa	0.2 or greater							
	Connection port size		Rc1/2		Rc3/4		Rc3/4		Rc1	
Power specifications	Power source *7	V(Hz)	Three-phase 200 ± 10 % (50/60)							
	Power consumption (50 / 60Hz) *8	kW	1.2 / 1.3		1.7		3.0 / 3.2		6.0	
	Electric current *8	A	4.5 / 5.2		7.1		12.0 / 12.5		24.0	
	Power capacity *9	kVA	1.8		2.5		4.4		8.3	
	Noise level (50 / 60Hz) *10	dB	68 / 71		73 / 73		73 / 76		75 / 75	83 / 83
	Operation control method		Heat pump balance control							
	Refrigerant		R410A							
	Compressor output	kW	0.7				1.7		3.0	

*1 The temperature control range noted does not necessarily indicate the actual controllable range possible. The range of temperature control depends on the condition of the air supplied at the intake. *2 Values indicated are for when the intake air temperature and humidity, and supply water temperature and supply water flow rate are stable. Noted accuracy is based on measurement by the internal controller at a single air outlet point. *3 The noted external static pressure is when the controlled air is regulated at the outlet to produce the maximum rated air flow. *4 Height includes outlet port. *5 The HEPA filter box is shipped in a separate package from the main unit and must be installed on-site. *6 When processing at the maximum air flow and at the highest cooling capacity, the difference between the cooling water inlet and outlet ports is 6.5 °C. *5 Source voltage phase unbalance should be less than ±3 %. *8 Maximum value within the range of unit specifications. *9 The figure noted is when the equipment is operating at the highest capacity of its normal operating range. *10 The noise level may be lowered by installing noise-absorbing ducting.
Note: All ducting should be insulated and ducting length should be kept as short as possible. (5 m or shorter recommended.)

PAP Temperature And Humidity Control Type Air Cooled

Models

PAP05A1-K
PAP05A1-FK
PAP10A1-K
PAP10A1-FK
PAP20A-K
PAP20A-FK

Air processing capacity **3 – 20 m³/min**
Temperature control accuracy **±0.1 ˚C**
Temperature setting range **18 – 30 ˚C**
Humidity control accuracy **±1 %**
Humidity setting range **40 – 65 % (75)*1**

Intelligent Monitor | Heat Pump Balance Control | Flow Control | Hepa Filter (F type) | Air Cooled | Water Cooled | Temperature Control | Humidity Control (K type)

Special Order Model For more information on special order models ▶ Page 24

- Noise reducing intake duct
- Circulation intake chamber
- Exhaust chamber

Please contact ORION regarding custom built models of specifications outside the ranges listed herein.

PAP10A1-K

Specifications

	Model			PAP05A1-K	PAP05A1-FK	PAP10A1-K	PAP10A1-FK	PAP20A-K	PAP20A-FK
Performance specifications	Possible temperature and humidity setting range	*1	˚C,%	18 – 30,40 – 65 (75)					
	Temperature and humidity control precision	*2	˚C,%	±0.1,±1.0					
	Cooling / heating output (50/60Hz)		kW	2.3 / 2.6		4.7 / 5.3		9.4 / 10.5	
	(Maximum cooling output)		(kW)	(1.6) / (1.8)		(3.2) / (3.6)		(6.5) / (7.2)	
	Rated processing airflow		m³/min	3 – 5		7 – 10		13 – 20	
	Maximum external static pressure (50/60Hz)	*3	Pa	110	620	250	560	250	690
Environmental conditions	Surrounding (intake air) temperature and humidity range		˚C,%	15 – 35, 30 – 70					
	Temperature gradient at intake		˚C/h	Within ±1					
	Humidity gradient at intake		%/h	Within ±5					
	External dimensions (H×D×W)	*4	mm	1589 × 800 × 650	1810 × 800×650	1798 × 940 × 664	2203 × 940 × 664	1863 × 1150 × 820	2263 × 1150 × 820
	Mass		kg	(190)	(215)	(235)	(280)	(370)	(445)
	Controlled air outlet port		mm	φ100	φ100 HEPA filter built in	φ150	φ150 *5 HEPA filter box included	φ200	φ200 *5 HEPA filter box included
Humidification water	Water quality			Deionized water (electrical conductivity: 1 – 10 μS/cm)					
	Maximum moisture output	*6	kg/h	2.5		5.0		10.0	
	Supply temperature range		˚C	10 – 40					
	Supply pressure range		MPa	0.1 – 0.5					
	Connection port size			Rc1/4					
Humidification air	Maximum air consumption	*7	NL/min	23		38		80	
	Supply temperature range		˚C	20 – 40					
	Supply pressure range		MPa	0.40 – 0.93					
	Connection port size			Rc1/4					
Power specifications	Power source	*8	V(Hz)	Three-phase 200 ± 10 % (50/60)					
	Power consumption	*9	kW	1.6		2.2		4.5	
	Electric current	*9	A	6.6		8.0		16.0	
	Power capacity	*10	kVA	2.3		2.8		5.6	
	Noise level (50/60Hz)	*11	dB	66 / 68	73 / 73	70 / 70	75 / 75	72 / 72	78 / 78
	Operation control method			Heat pump balance control					
	Refrigerant			R410A					
	Compressor output		kW	0.7		1.7		3.0	

*1 The temperature and humidity control range noted does not necessarily indicate the actual controllable range possible. The actual controllable temperature and humidity ranges will depend on the temperature and humidity of the intake air. (Vapor humidification is used in the humidity setting range of 65–75 %.) *2 When the air temperature and humidity is stable at the air intake. Noted accuracy is based on measurement by the internal controller at a single air outlet point. *3 The noted external static pressure is when the controlled air is regulated at the outlet to produce the maximum rated processing air flow. *4 Height includes outlet port. *5 The HEPA filter box is shipped in a separate package from the main unit and must be installed on-site. *6 The figure noted is when the equipment is operating at the highest level of humidification. *7 Supply compressed air that has been cleaned through filter and/or other processing. The cleanliness of the compressed air supply should match the air cleanliness standard of the target area to which the controlled air will be supplied. *8 Source voltage phase unbalance should be less than ±3 %. *9 Maximum value within the range of unit specifications. *10 The figure noted is when the equipment is operating at the highest capacity of its normal operating range. *11 Noise level can be decreased by installing a noise reducing duct.
Note: All ducting should be insulated and ducting length should be kept as short as possible. (5 m or shorter recommended.)

PAP Temperature And Humidity Control Type Water Cooled

Models

PAP05B-KW
PAP05B-FKW
PAP10B-KW
PAP10B-FKW
PAP20B-KW
PAP20B-FKW

Air processing capacity **3 – 20 m³/min**
Temperature control accuracy **±0.1 ˚C**
Temperature setting range **18 – 30 ˚C**
Humidity control accuracy **±1 %**
Humidity setting range **40 – 65 % (75)**[*1]

Intelligent Monitor | Heat Pump Balance Control | Flow Control | Hepa Filter (F type) | Air Cooled | Water Cooled | Temperature Control | Humidity Control (Kj type)

Special Order Model For more information on special order models ▶ Page 24

- Noise reducing intake duct
- Circulation intake chamber
- Exhaust chamber
- Humidity display included

Please contact ORION regarding custom built models of specifications outside the ranges listed herein.

PAP10B-KW

Specifications

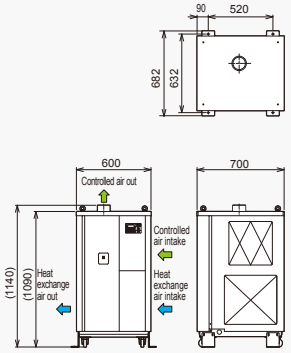
	Model			PAP05B-KW	PAP05B-FKW	PAP10B-KW	PAP10B-FKW	PAP20B-KW	PAP20B-FKW
Performance specifications	Possible temperature and humidity setting range	*1	˚C,%	18 – 30, 40 – 65 (75)					
	Temperature and humidity control precision	*2	˚C,%	±0.1, ±1.0					
	Cooling / heating output (50/60Hz)		kW	3.2 / 3.2		6.5 / 6.5		13.0 / 13.0	
	(Maximum cooling output)		(kW)	(2.0)		(4.0)		(8.0)	
	Rated processing airflow		m3/min	3 – 5		7 – 10		13 – 20	
	Maximum external static pressure	*3	Pa	110	620	200	560	250	690
Environmental conditions	Surrounding (intake air) temperature and humidity range	*1	˚C,%	15 – 35 , 30 – 70					
	Temperature gradient at intake		˚C/h	Within ±1					
	Humidity gradient at intake		%/h	Within ±5					
	Cooling water temperature gradient		˚C/h	Within ±3					
	External dimensions (H×D×W)	*4	mm	1610 × 749 × 609	1830 × 749 × 609	1670 × 940 × 664	2076 × 940 × 664	1831 × 973 × 773	2209 × 973 × 773
	Mass		kg	180	205	235	280	300	370
	Controlled air outlet port		mm	φ98	φ98 HEPA filter built in	φ148	φ148 *5 HEPA filter box included	φ198	φ198 *5 HEPA filter box included
Cooling water	Rate of supply	*6	m3/h	1.0		1.5		2.2	
	Supply temperature range		˚C	15 – 32					
	Supply pressure		MPa	0.69 or less					
	Inlet/outlet pressure difference		MPa	0.2 or greater					
	Connection port size			Rc1/2		Rc3/4		Rc3/4	
Humidification water	Water quality			Deionized water (electrical conductivity: 0.1 – 10 μS/cm)					
	Maximum moisture output	*7	kg/h	2.5		5.0		10.0	
	Supply temperature range		˚C	10 – 40					
	Supply pressure range		MPa	0.1 – 0.5					
	Connection port size			Rc1/4					
Humidification air	Maximum air consumption	*8	NL/min	80		80		160	
	Supply temperature range		˚C	20 – 40					
	Supply pressure range		MPa	0.40 – 0.93					
	Connection port size			Rc1/4					
Power specifications	Power source	*9	V(Hz)	Three-phase 200 ± 10 % (50/60)					
	Power consumption	*10	kW	1.5		2.2		3.8	
	Electric current	*10	A	6.3		7.8		13.5	
	Power capacity	*11	kVA	2.2		2.8		4.7	
	Noise level (50/60 Hz)	*12	dB	68 / 68	73 / 73	70 / 70	75 / 75	72 / 72	78 / 78
	Operation control method			Heat pump balance control					
	Refrigerant			R410A					
	Compressor output		kW	0.7		1.7			

*1 The temperature and humidity control range noted does not necessarily indicate the actual controllable range possible. The actual controllable temperature and humidity ranges will depend on the temperature and humidity of the intake air. (Vapor humidification is used in the humidity setting range of 65–75 %.) *2 Values indicated are for when the intake air temperature and humidity, and supply water temperature and flow rate are stable. Single output port; controller display precision. This product achieves humidification through use of a water mist nozzle. There may be momentary fluctuations in humidity exceeding ±1.0% due to the inflow of air bubbles into the humidification water mist system. *3 The noted external static pressure is when the controlled air is regulated at the outlet to produce the maximum rated processing air flow. *4 Height includes outlet port. *5 The HEPA filter box is shipped in a separate package from the main unit and must be installed on-site. *6 When processing at the maximum air flow and at the highest cooling capacity, the difference between the cooling water inlet and outlet ports is 6.5 ˚C. *7 The figure noted is when the equipment is operating at the highest level of humidification. *8 Supply compressed air that has been cleaned through filter and/or other processing. The cleanliness of the compressed air supply should match the air cleanliness standard of the target area to which the controlled air will be supplied. *9 Source voltage phase unbalance should be less than ±3 %. *10 Maximum value within the range of unit specifications. *11 The figure noted is when the equipment is operating at the highest capacity of its normal operating range. *12 The noise level may be lowered by installing noise-absorbing ducting.
Note: All ducting should be insulated and ducting length should be kept as short as possible. (5 m or shorter recommended.)

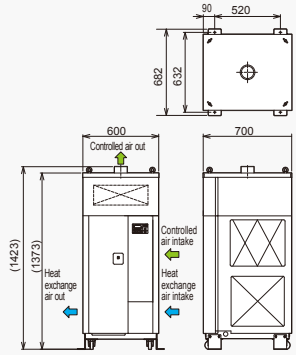
PAP Temperature Control Type Air Cooled Water Cooled

External Dimensions (units: mm)

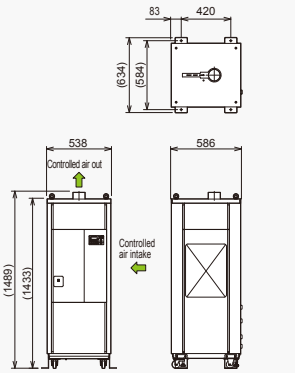
Temperature Control Type PAP05A1



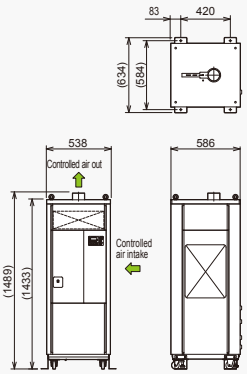
Temperature Control Type PAP05A1-F



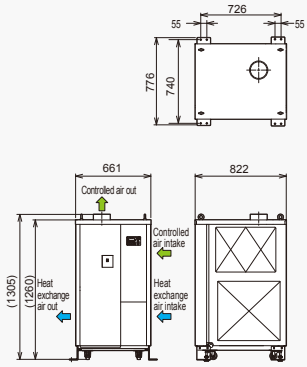
Temperature Control Type PAP05A1-W



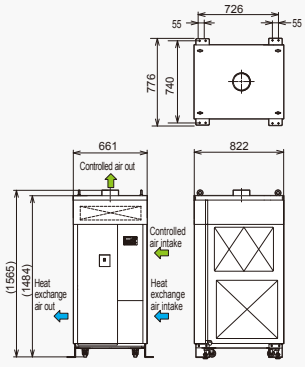
Temperature Control Type PAP05A1-FW



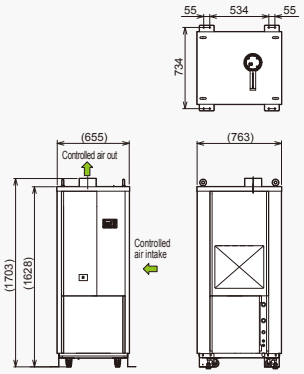
Temperature Control Type PAP10A1



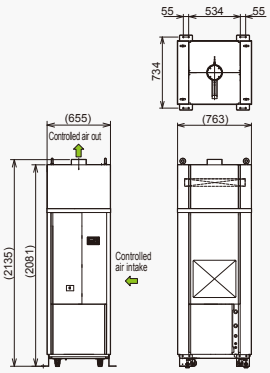
Temperature Control Type PAP10A1-F



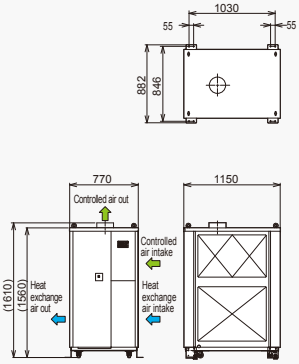
Temperature Control Type PAP10A1-W



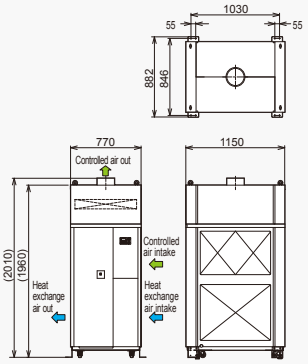
Temperature Control Type PAP10A1-FW



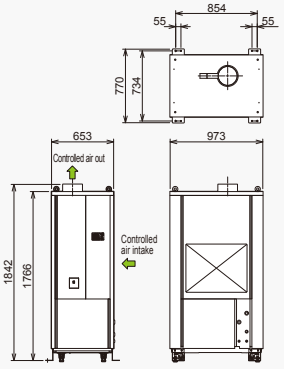
Temperature Control Type PAP20A



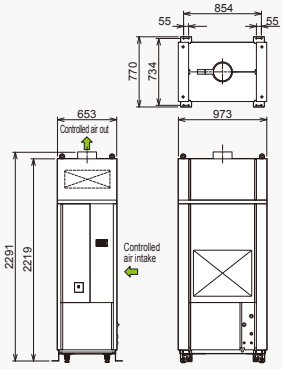
Temperature Control Type PAP20A-F



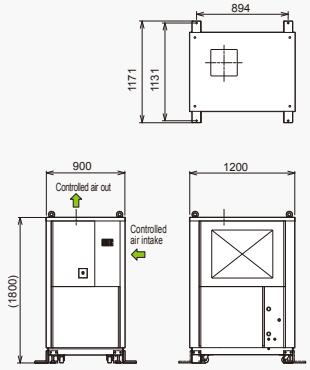
Temperature Control Type PAP20B1-W



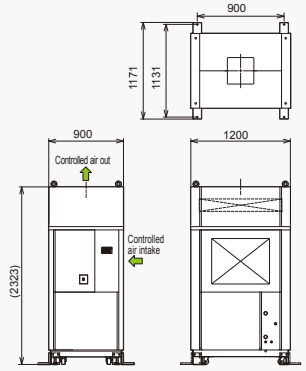
Temperature Control Type PAP20B1-FW



Temperature Control Type PAP40B-W



Temperature Control Type PAP40B-FW

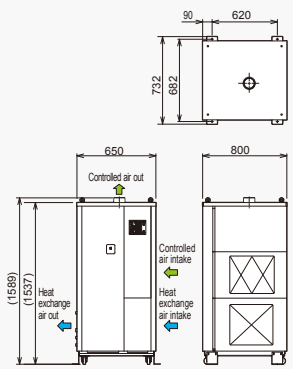


PAP Temperature And Humidity Control Type

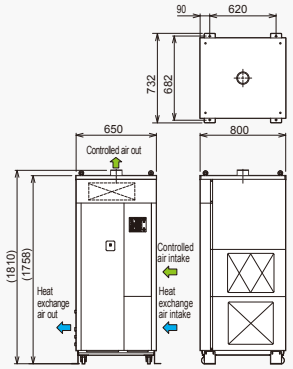
Air Cooled Water Cooled

External Dimensions (units: mm)

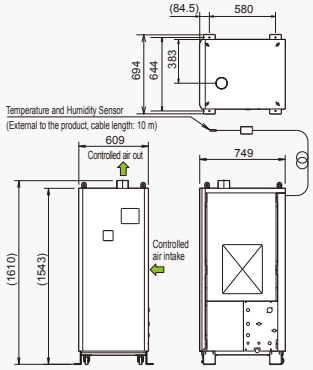
Temperature And Humidity Control Type **PAP05A1-K**



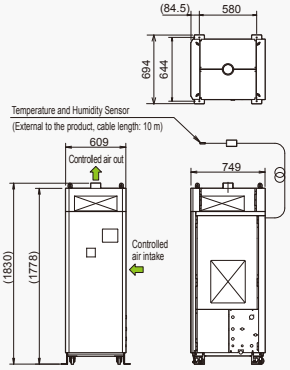
Temperature And Humidity Control Type **PAP05A1-FK**



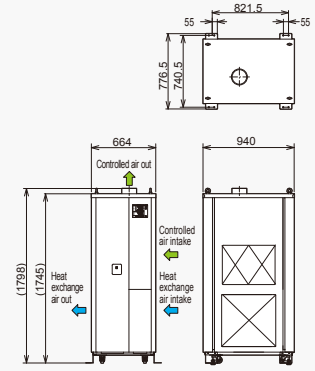
Temperature And Humidity Control Type **PAP05B-KW**



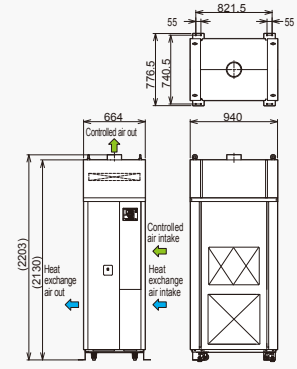
Temperature And Humidity Control Type **PAP05B-FKW**



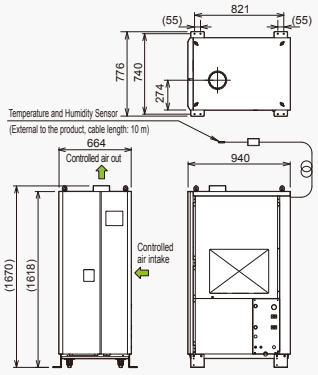
Temperature And Humidity Control Type **PAP10A1-K**



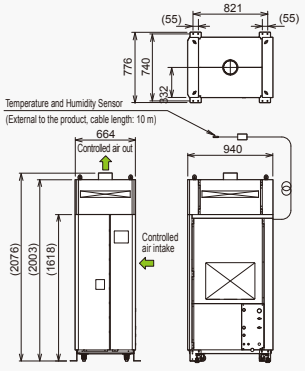
Temperature And Humidity Control Type **PAP10A1-FK**



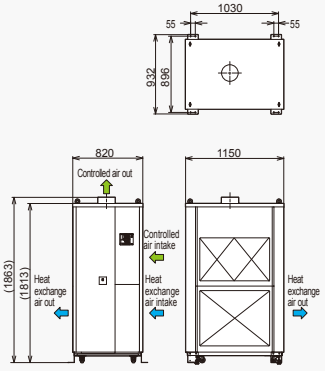
Temperature And Humidity Control Type **PAP10B-KW**



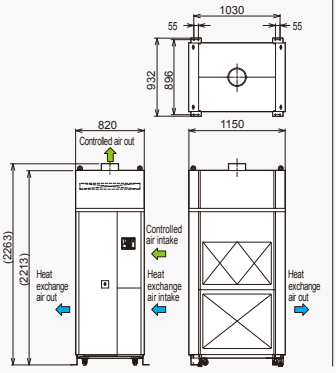
Temperature And Humidity Control Type **PAP10B-FKW**



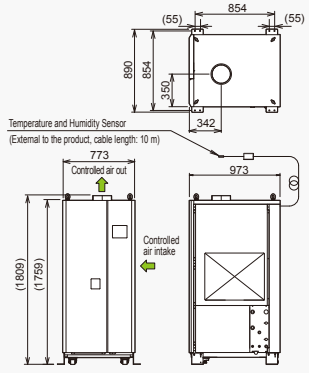
Temperature And Humidity Control Type **PAP20A-K**



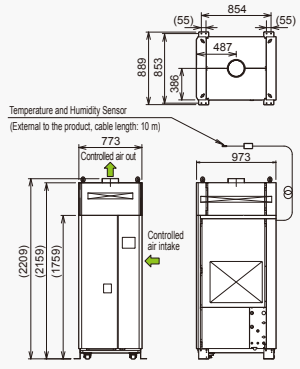
Temperature And Humidity Control Type **PAP20A-FK**



Temperature And Humidity Control Type **PAP20B-KW**



Temperature And Humidity Control Type **PAP20B-FKW**



PAP D Series Dehumidification

Air Cooled
Water Cooled

Models

PAP03A-D
PAP03A-WD
PAP06A-D
PAP06A-WD
PAP03A-D-CE (Built To Order)
PAP06A-D-CE (Built To Order)

Temperature setting range 18 – 30 ˚C
Humidity setting range 20 – 40 %
Temperature control accuracy ±0.2 ˚C

Intelligent Monitor | Heat Pump Balance Control | Flow Control | Hepa Filter (F type) | Air Cooled | Water Cooled | Temperature Control | Humidity Control (Kj type)

Special Order Model For more information on special order models ▶ Page 24

- Noise reducing intake duct
- Circulation intake chamber
- Exhaust chamber

Please contact ORION regarding custom built models of specifications outside the ranges listed herein.

Instant Dehumidification from 27 °C / 70 % to 23 °C / 28 % with All Fresh Air

Achieves defrost-free performance relying on the refrigeration cycle only, with an industry top-class dew point of 3.5 ˚C.

The PAP-D Series

Precision Air Processing
AND Dehumidification Combined

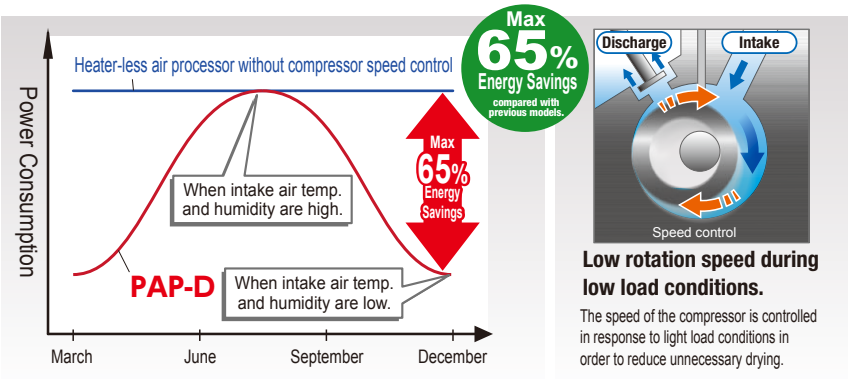
Air Cooled	Water Cooled
PAP03A-D(-CE)	PAP03A-WD
PAP06A-D(-CE)	PAP06A-WD
PAP10A-D	PAP10A-WD

Performance examples
PAP06A-D,WD(-CE), air flow : 6 m3/min
PAP03A-D,WD(-CE), air flow : 3 m3/min
PAP10A-D,WD, air flow : 10 m3/min

Intake Air	Outlet Air
30 °C / 55 %	25 °C / 25 % or lower
28 °C / 65 %	23 °C / 28 % or lower
27 °C / 70 %	21 °C / 32 % or lower

Of Course Heater-less! And Compressor Speed Control for Energy Savings as much as 65 %!

Once the set humidity is attained, compressor speed control takes over for energy savings.



Low rotation speed during low load conditions.

The speed of the compressor is controlled in response to light load conditions in order to reduce unnecessary drying.

CE Marking Certified

2 Lineups of CE Marking Certified Models (Built-to-Order)

UL/CSA61010-1 Conformity Evaluation Completed / Conformity Report Available for Submission

PAP03A-D-CE PAP06A-D-CE

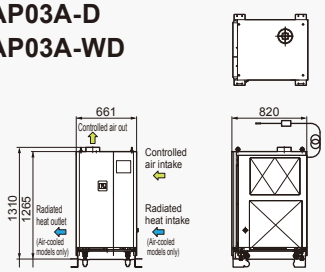
Specifications

	Model		Air Cooled					Water Cooled		
			PAP03A-D	PAP03A-D-CE	PAP06A-D	PAP06A-D-CE	PAP10A-D	PAP03A-WD	PAP06A-WD	PAP10A-WD
Performance specifications	Possible temperature and humidity setting ranges *1	˚C,%	18 – 30, 20 – 40							
	Temperature and humidity control precision *2	˚C,%	±0.2, ±2 (Does not support humidification.)							
	Attainable control air dew point (lower limit) *3	˚C	3.5							
	Maximum cooling output *4	kW	(3.7)		(6.6)		(10.5)	(4.1)	(6.8)	(11.0)
	Heating capacity *5	kW	(0.3)		(0.7)		(1.1)	(0.3)	(0.7)	(1.1)
	Rated processing airflow	m³/min	3 – 5		6 – 8		10 – 12	3 – 5	6 – 8	10 – 12
	Maximum external static pressure *6	Pa	500 (3m³/min)		500 (6m³/min)		500 (10m³/min)	500 (3m³/min)	500 (6m³/min)	500 (10m³/min)
		Pa	100 (5m³/min)		300 (8m³/min)		200 (12m³/min)	100 (5m³/min)	300 (8m³/min)	200 (12m³/min)
Environmental conditions	Surrounding temperature and humidity range	˚C,%	17 – 35, 30 – 70							
	Temperature gradient at intake	˚C/h	Within ±1							
	Humidity gradient at intake	%/h	Within ±5							
	Cooling water temperature gradient	˚C/h	–					Within ±3		
	External dimensions (H×D×W) *7	mm	(1310 × 820 × 661)	(1654 × 820 × 661)	(1610 × 1150 × 770)	(1802 × 1150 × 770)	(1860 × 1200 × 990)	(1310 × 820 × 661)	(1610 × 1150 × 660)	(1860 × 1200 × 900)
	Mass	kg	(210)	(230)	(330)	(350)	(450)	(210)	(330)	(450)
	Controlled air outlet port	mm	φ150		φ200		φ200	φ150	φ200	φ200
Cooling water	Rate of supply	m3/h	–					2.0	2.7	3.0
	Supply temperature range	˚C						5 – 32		
	Supply pressure	MPa						0.69 or higher		
	Inlet/outlet pressure difference	MPa						0.2 or higher		
	Connection port size							Rc3/4		Rc1
Power specifications	Power source *8	V(Hz)	Three-phase 200 ± 10 % (50/60)							
	Power consumption *9	kW	0.8 – 2.9		1.3 – 4.1	1.6 – 4.4	1.6 – 5.3	0.7 – 2.6	1.1 – 3.9	1.5 – 4.7
	Electric current *10	A	11.3		17.2	18.3	20.2	10.7	16.6	19.5
	Power capacity *11	kVA	4.7		6.6		7.2	4.2	6.3	6.9
	Operation control method		Heat Pump Balance Control (incorporates waste heat utilization)							
	Compressor output	kW	1.7		3.0			1.7	3.0	3.0
	Refrigerant		R410A							
			–	Built To Order	–	Built To Order	–	–		

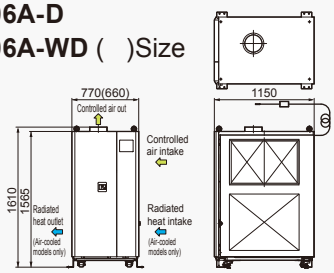
*1 The temperature and humidity control ranges noted do not necessarily indicate the actual controllable range possible. The actual controllable temperature and humidity ranges will depend on the temperature and humidity of the intake air. (**This unit does not include a humidification function.**) *2 Values indicated for when intake air temp. and humidity are stable. (For water cooled models: cooling water temperature and rate of supply are stable.) Noted accuracy is based on measurement by the internal controller at a single air outlet point. **Over-dehumidification in some cases depending on operating conditions.** *3 The attainable dew point depends on the condition of the air supplied at the intake. *4 The stand-alone capacity of the built in evaporator. *5 The difference in capacities between the built-in heater and evaporator. *6The eternal static pressure at the controlled air outlet side when the blower fan is operating at 60 Hz, and the product is operating at the prescribed air flow. *7 Height includes outlet port. *8 Source voltage phase unbalance should be less than ±3 %. *9 Minimum and maximum specified values for the specified operating range. * 10 Maximum value within the range of unit specifications. *11 The figure noted is when the equipment is operating at the highest capacity of its normal operating range.
Note: All ducting should be insulated and ducting length should be kept as short as possible. (5 m or shorter recommended.)

External Dimensions (Units: mm)

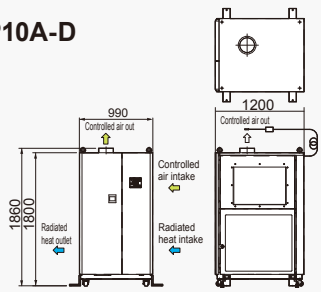
PAP03A-D
PAP03A-WD



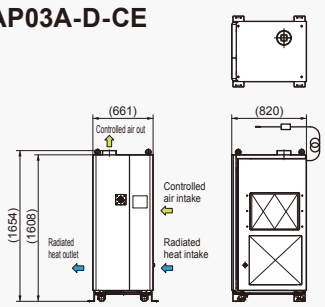
PAP06A-D
PAP06A-WD ( )Size



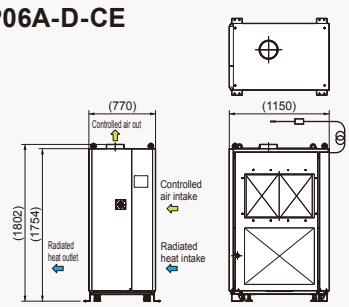
PAP10A-D



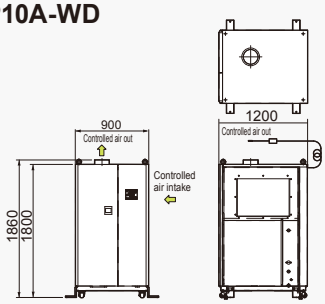
PAP03A-D-CE



PAP06A-D-CE



PAP10A-WD



PAP L Series Low Temperature

Models

PAP05A-L

Air processing capacity 5 – 7 m³/min
Temperature setting range 8 – 18 ˚C
Temperature control accuracy ±2 ˚C

Intelligent Monitor | Heat Pump Balance Control | Flow Control | Hepa Filter (F type) | Air Cooled | Water Cooled | Temperature Control | Humidity Control (Kj type)

SUPER eco2 ORION
省エネ率
50%以上(従来比)

Special Order Model For more information on special order models ▶ Page 24

■ Noise reducing intake duct ■ Circulation intake chamber
■ Exhaust chamber ■ Includes humidity display

Please contact ORION regarding custom built models of specifications outside the ranges listed herein.

PAP D/L Series

Can cool 35 ˚C fresh air down to 8 ˚C.

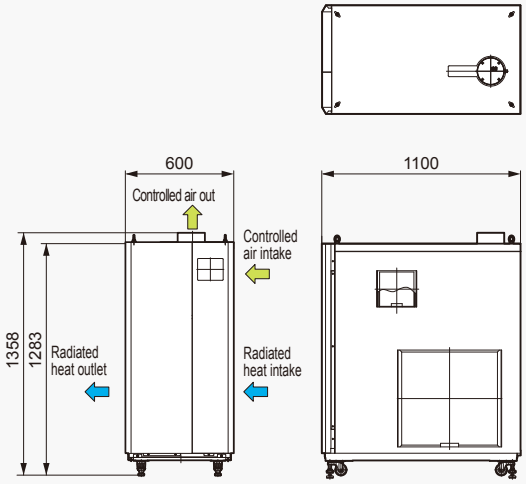
Useful in applications such as rapid cooling of heating devices or pre-cooling of desiccant airprocessors.

Specifications

Model			PAP05A-L
Performance specifications	Configurable temperature range *1	˚C	8 – 18
	Temperature control precision *2	˚C	±2
	Maximum cooling capacity *3	kW	7.0
	Rated processing airflow	m3/min	5 – 7
	Maximum external static pressure (50/60 Hz) *8	Pa	200
Environmental conditions	Urrounding temperature and humidity range *1	˚C,%	15 – 35,30 – 70
	Temperature gradient at intake	˚C/h	Within ±1
	Humidity gradient at intake	%/h	Within ±5
	External dimensions (H×D×W) *4	mm	(1358×1100×600)
	Mass	kg	(185)
	Controlled air outlet port	mm	φ150
Power specifications	Power source *5	V(Hz)	Three-phase 200 ± 10 % (50/60)
	Power consumption *6	kW	(4.7)
	Electric current *7	A	(17)
	Power capacity *7	kVA	(6.5)
	Operation control method		Inverter speed control + hot gas bypass control
	Refrigerant		R410A
	Compressor output	kW	1.7

External Dimensions (Units: mm)

PAP05A-L



*1 The temperature control range noted does not necessarily indicate the actual possible controllable range. The actual controllable temperature range will differ depending on the air flow and the temperature and humidity of the intake air. For cooling only. The temperature setting must be lower than the temperature of the air at the inlet port. If the ambient temperature is below 15 °C, the refrigeration compressor will stop, blower-fan-only operation will start, and the temperature will stay as-is. The condition of the 8 °C outlet temperature is when the load is less than the cooling load stated in comment *3. *2 Values indicated are for when the intake air temperature and pressure are stable and when the ambient temperature is in the range of 15 to 35 °C, at one point of the discharge port, and indicates the display precision of the controller. Note that this does not include times of light cooling load when the compressor is cycling ON and OFF. *3 Conditions of the cooling capacity calculation are as follows: Air flow: 5 m³/min. Outlet temp. and humidity: 8 °C, 100%. (Enthalpy: 5.92 kcal/kg.) Inlet temperature and humidity: 35 °C, 65%. (Enthalpy: 22.68 kcal/kg.) *4 Height includes discharge port. *5 Source voltage phase unbalance should be less than ±3%. *6 Maximum value within the range of product specifications. *7 The figure noted is when the product is operating at the highest capacity of its normal operating range. *8 The external static pressure is when operating under the following conditions: the blower fan operating frequency is 60 Hz, the controlled air outlet port shutter is fully open, and the controlled air discharge-side restricted air flow is 7 m³/min.
Note: All ducting should be insulated and ducting length should be kept as short as possible. (5 m or shorter recommended.)

Units with flow rates beyond the above specifications are available. Please consult with your dealer.

ORION Precision Air Processing For Every Application

PAP Series Special Order Equipment

1 Noise Reducing Intake Duct

Applicable Models

PAP Temperature Control Type
PAP Temperature And Humidity Control Type
PAPmini Series

2 Circulation Intake Chamber

Applicable Models

PAP Temperature Control Type
PAP Temperature And Humidity Control Type
PAPmini Series

3 Duct Set

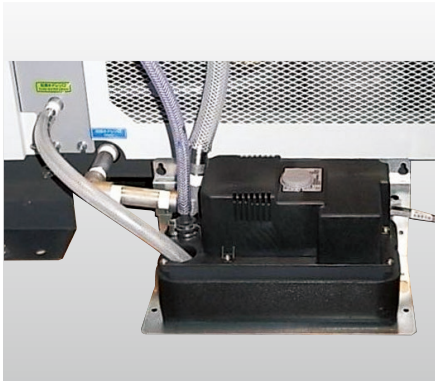
Applicable Models

PAP Temperature Control Type
PAP Temperature And Humidity Control Type
PAPmini Series

4 Drain Pump Set

Applicable Models

PAP Temperature Control Type
PAP Temperature And Humidity Control Type
PAPmini Series

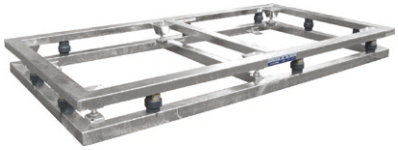


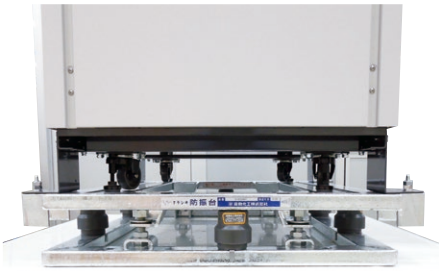
5 Sensor Extension

Applicable Models

PAP Temperature Control Type
PAP Temperature And Humidity Control Type
PAPmini Series

6 Vibration Reducing Base





Base Installation Example

Other Special Order Equipment

7 Steam Humidification

Applicable Models

PAP Temperature And Humidity Control Type

8 Humidity Display

Applicable Models

PAP Temperature Control Type

9 Hepa Differential Pressure Gauge

Applicable Models

PAP Temperature Control Type
PAP Temperature And Humidity Control Type

10 Low Ambient Temperature Cooling Water Specification

Applicable Models

PAP Temperature Control Type
PAP Temperature And Humidity Control Type

Constant Temperature (Constant Humidity) Equipment R Series

Features 1 Environmentally Friendly and Ultra-Energy-Saving Design

Conventional type: Typical Air Processor + Heater

22.4kW

Conventional type

PAP: Energy Savings from Heat Balance Control (Super Reheat Spec. Models)

Reduce 53%

10.5kW

PAP40C-R

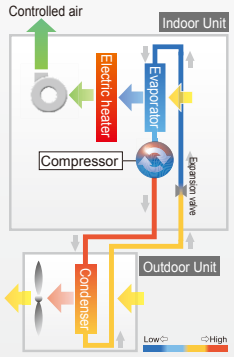
Inverter Speed Control for Added Energy Savings

Reduce 80%

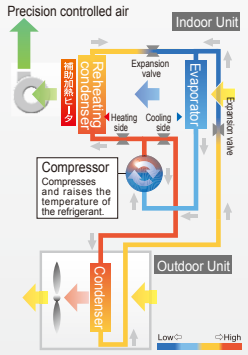
4.5kW

Setting temp: 23˚C
Outdoor unit Ambient temp: 35˚C
Reference value at no load condition

Conventional type: Typical Air Processor + Heater

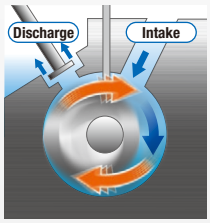


PAP: Heat Pump Balance Control (Super Reheat Spec. Models)



+

PAP: DC Inverter Controlled Compressor



Low Rotation Speed During Low Load Conditions

The speed of the compressor is controlled in response to light load conditions in order to cut unnecessary cooling.

Heat Pump Balance Control (Super Reheat Spec. Models)+ Inverter Speed Control

Thanks to our built-in heat pump balance control (Super Reheat Spec. Models)+ inverter speed control compressor, we've gained as much as 80 % in energy savings compared with constant temperature and humidity air processing offered by normal air processors + heater control.

Cuts Wasted Electricity by Turning OFF the Auxiliary Heater when the Temperature Rises to the Set Value

Heat formed from the cooling process is used, so that heat otherwise provided via an electric heater is no longer needed. This results in large energy savings compared to the common method of reheating with an electric heater. The heater is used when heating.

Built-in DC Inverter Drive Compressor

Great energy savings achieved through use of ORION's original speed control. Optimum operation is achieved by controlling the compressor based on the load conditions. Plus, the constant humidity type reduces wasted humidification, and offers energy saving operation

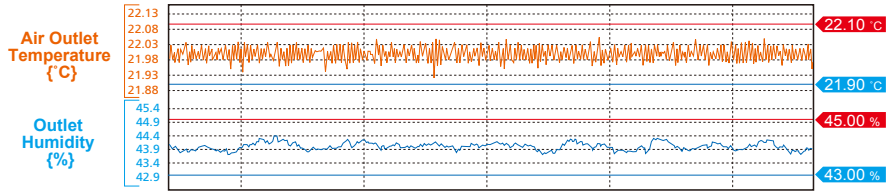
Inverter Fan Built Into Both the Indoor and Outdoor Units

This, combined with our newly developed special controller results in ORION's original, optimized refrigeration cycle control operation.

Features 2 High Accuracy Temperature Control Air Processing

Achieves the High Precision (heater PID-level control) which is Unattainable in Normal Air Processors and Previous Models' Reheat Control

Experience precision air processing from ORION's PAP Precision Air Processors.



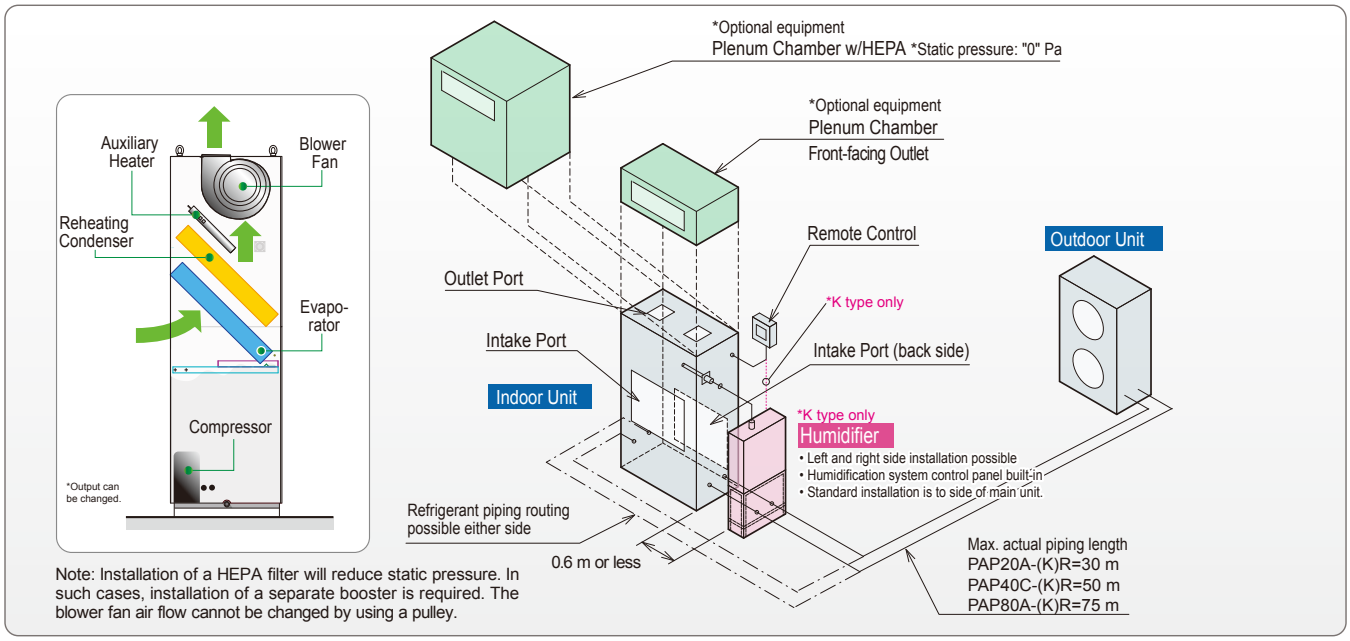
*Measured data when operating under settings of 22 ˚C and 44%.

Temperature control accuracy: ±0.2 ˚C

Humidity control accuracy: ±2.0 %

*Sensor installed at controlled air outlet side.
(Warranted value is only for the performance of the product itself.)

R Features 3 Easy to use All-In-One System Design



Note: Installation of a HEPA filter will reduce static pressure. In such cases, installation of a separate booster is required. The blower fan air flow cannot be changed by using a pulley.

No On-site Instrumentation Construction Required

The control board is built-in, so no on-site instrumentation construction is needed. Construction-saving realized for an easy constant temperature (and constant humidity) space.

Easy Control of On-site Initial Test Runs

Modularized air processor makes short work of troublesome post-installation initial test run control.

Easy System Design

A system of necessary equipment is already in place. That, and a wealth of options eliminates the need for troublesome system design.

Layout with Complete Control

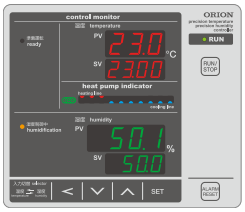
Indoor unit piping and wiring, including refrigerant piping connection port, wiring access port, condensation water outlet port, humidification water connection port (for models with humidification), can all be installed to the left or right. Freedom to make the installation layout as you like.

R Features 4 High Functionality and Enhanced Design

Constant Year-Round Fixed Air Control that Completely Eliminates the Need for A/C-style Cooling/Heating Switchover

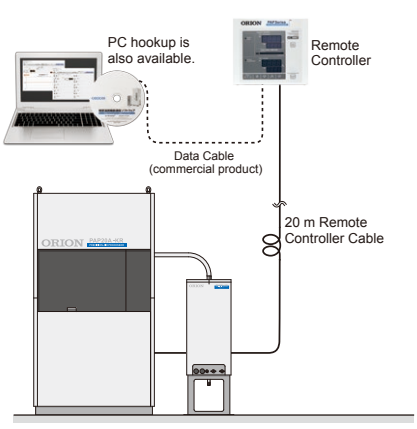
Constant precision air processing is delivered throughout the year.
In particular, the inverter air conditioner eliminates temperature fluctuations from difficult-to-control intermediary stage temperatures of spring and summer.

Multi-Function Control Panel Built-in



The intelligent monitor offers improved ease-of-use

- ○ Various parameter settings available that allow functionality such as power-cutoff recovery patterns, and operation/stop preferences via the local product control panel, remote switch, or by communications control.
- ○ Specific error codes are displayed when problems occur.
- ○ Comes equipped with external input/output contact terminals (for operation signal input, operation/alarm output).
- ○ Includes built-in support for external communications function standards (RS-232C, 422A, 485).



Includes 20 m Remote Control Cable

The remote control cable is 20 m long. Can be installed anywhere. Convenient for temperature and humidity control in pre-determined locations. Allows for the installation of an integrated control board. (Optional extended lengths available.) Optional software integration allows for remote operation via PC. Using our integrated controller (sold separately), up to 8 air processors can be simultaneously controlled via communication links.

For Cleanrooms and Precision Measurement Rooms

Constant Temperature (Constant Humidity) Equipment R Series

Models

Temperature Control Type	Temperature and Humidity Control Type
PAP20A-R	PAP20A-KR
PAP40C-R	PAP40C-KR
PAP80B-R (Built To Order)	PAP80B-KR (Built To Order)
PAP120A-R (Built To Order)	PAP120A-KR (Built To Order)

Air processing capacity **23 – 120 m³/min**

Temperature control accuracy **±0 .2 ˚C**

Temperature setting range **18 – 30 ˚C**

Humidity control accuracy **±2 %**

Humidity setting range **45 – 60 %**

* "Humidity control accuracy" and "Humidity setting range" specifications are for the following models only: PAP20A-KR, PAP40C-KR, PAP80B-KR.

PAP40C-KR (temperature and humidity control type)

Specifications

	Model			PAP20A-R	PAP40C-R	PAP80B-R	PAP120A-R	PAP20A-KR	PAP40C-KR	PAP80B-KR	PAP120A-KR
Performance specifications	Possible setting range	*1	˚C,%	18 – 30 , —				18 – 30 , 45 – 60			
	Control precision	*2. 13	˚C,%	±0.2 , —				±0.2 , ±2.0			
	Cooling capacity (50/60 Hz)	*3	kW	8	12	25	38	8	12	25	38
	Heating capacity (50/60 Hz)	*4	kW	3	5	13	14.5	3	5	13	14.5
	Rated processing airflow		m³/min	20 – 23	40 – 45	75 – 80	110 – 120	20 – 23	40 – 45	75 – 80	110 – 120
	Maximum external static pressure (50/60 Hz)	*5	Pa	200		400		200		400	
Environmental conditions	Indoor unit installation temperature conditions		˚C	5 – 35							
	Outdoor unit installation temperature conditions		˚C	-5 – 43							
	Temperature gradient at intake		˚C/h	Within ±2							
	Humidity gradient at intake		%/h	Within ±5							
External dimensions	Indoor unit (H×D×W)			1800×555×980	1800×555×1100	1800×600×1500	1870×790×1900	1800×555×980	1800×555×1100	1800×600×1500	1870×790×1900
	Outdoor unit (H×D×W)			824×420×810	1160×420×810	1420×800×870	1420×800×870× 2units	824×420×810	1160×420×810	1420×800×870	1420×800×870×2units
	Humidifier (H×D×W)			—				960×520×300	960×520×300	960×590×500	960×790×550
Mass	Indoor unit			240	260	400	700	240	260	400	700
	Outdoor unit (H×D×W)			65	80	130	130× 2	65	80	130	130× 2
	Humidifier			—				35		60	90
Humidifier	Water quality			Deionized water (electrical conductivity: 1 – 10 μS/cm)							
	Humidification capacity	*9	kg/h	—				5	8	20	30
Power specific	Power source	*8	V(Hz)	Three-phase 200 ± 10 % (50/60)							
	Power consumption (50/60 Hz) (when auxiliary heater is off)	*9	kW	6.6 (4.8)	10.5 (7.5)	17 (11)	31.5 (22.5)	11 (9.2)	16.5 (13.5)	32 (26)	54 (45)
	Operating current (50/60 Hz) (when auxiliary heater is off)	*9	A	23 (18)	40 (31)	60 (42)	122 (93)	35 (30)	58 (49)	104 (86)	193 (165)
	Power capacity	*10	kVA	8	14	23	40	14	20	38	66
Noise level	Sound pressure level Indoor unit (50/60 Hz)	*11	dB	68	69			68	69		
	Outdoor unit (50/60 Hz)	*11	dB	59							
Device Specifications	Compressor output		kW	1.7	3.0	4.6	7.5	1.7	3.0	4.6	7.5
	Blower fan Indoor unit	*12	kW	0.4		2.2	3.75	0.4		2.2	3.75
	Outdoor unit	*12	kW	0.2	0.1×2	0.75	0.75× 2	0.2	0.1×2	0.75	0.75× 2
	Auxiliary heater		kW	1.8	3	6	9	1.8	3	6	9
	Refrigerant piping connections Gas pipe		mm	φ15.88		φ19.05	φ25.4	φ15.88		φ19.05	φ25.4
	Liquid pipe		mm	φ9.53		φ12.70	φ15.88	φ9.53		φ12.70	φ15.88
	Refrigerant piping Max. length (one way)		m	30	50	75		30	50	75	
	Max. difference in height		m	10							
	Refrigerant			R410A			R407C	R410A			R407C
	High pressure gas safety act classification			Not required							

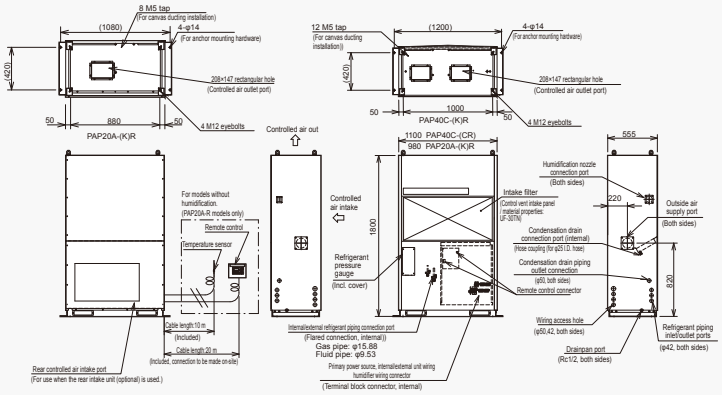
*1 The temperature and humidity control range noted does not necessarily indicate the actual controllable range possible. The range of control depends on the condition of the air supplied at the intake. *2 When the intake air temperature and humidity, and outdoor ambient temperature are stable. Noted accuracy is based on measurement by the internal controller at a single air outlet point. *3 When operating according to JIS B 8616.The displayed performance will be at least 80% when the intake air temperature of the outdoor unit is at least 35 ˚C. *4 When operating according to JIS B 8616.The displayed performance will be at least 75 % when the intake air temperature of the indoor unit is below 20 ˚C.The compressor will stop, and exclusive operation of the auxiliary heater may occur if the control air intake temperature drops to approx. 15 ˚C or lower. *5 External dimensions do not include miscellaneous protrusions such as eyebolts, etc. *6 Maximum value within the range of unit specifications. Starting current is equal to or less than the operating current. *7 The noted external static pressure is when the controlled air is regulated at the outlet to produce the maximum rated processing air flow. *8 Measured value (A scale) when operating at the rated processing air flow, at a position of non-resonance, 1 m from the front face of the indoor unit, and at 1 m from the front face of the outdoor unit, at a height of 1.5 m. *9 The figure noted is when the equipment is operating at the highest level of humidification.operating at the highest capacity of its normal operating range. *11 Noise level can be decreased by installing a noise reducing duct. *12 Blower fan output cannot be increased. *13 Use the measured temperature and humidity bias function to correct any error between the temperature and humidity shown on the control panel and the user's measured temperature and humidity.

Note 1: This product does not detect electrical shorts and does not have a protection function against them. An earth leakage breaker must be installed on the primary side of the power supply.

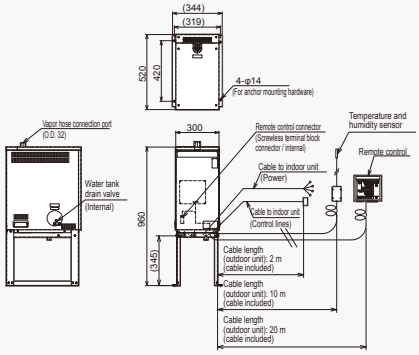
Note 2: All ducting should be insulated and ducting length should be kept as short as possible. (5 m or shorter recommended.)

External Dimensions (Units: mm)

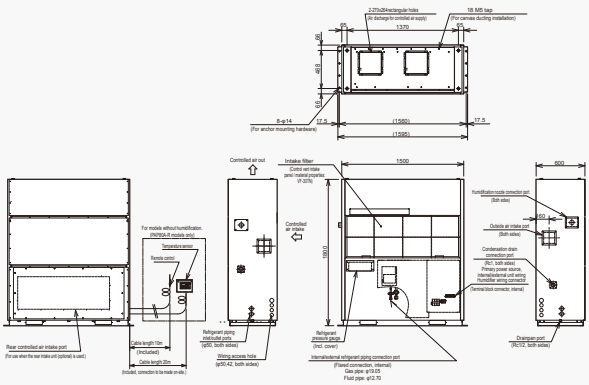
Indoor Unit -PAP20A-(K)R / PAP40C-(K)R-



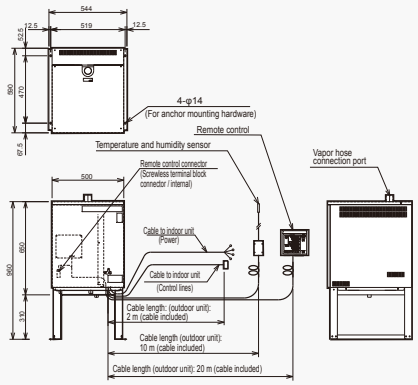
Humidifier -PAP20A-KR / PAP40C-KR-



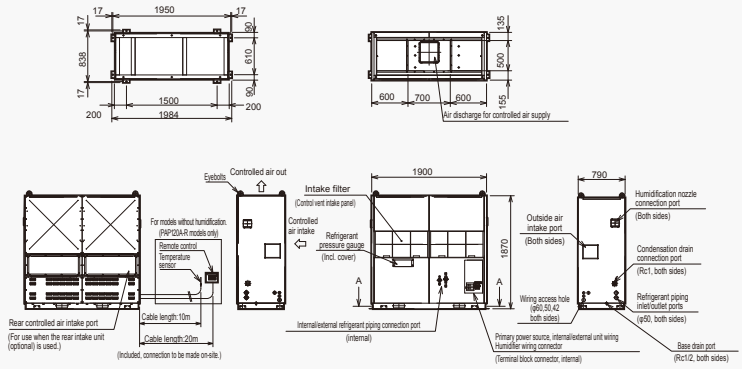
Indoor Unit -PAP80B-(K)R-



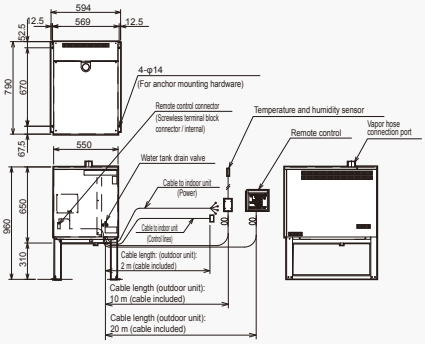
Humidifier -PAP80B-(K)R-



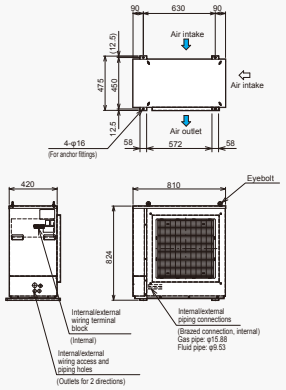
Indoor Unit -PAP120A-(K)R-



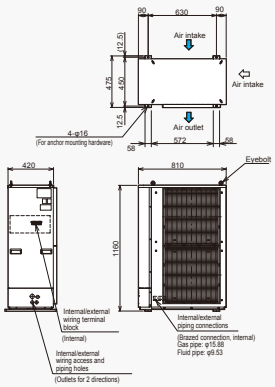
Humidifier -PAP120A-(K)R-



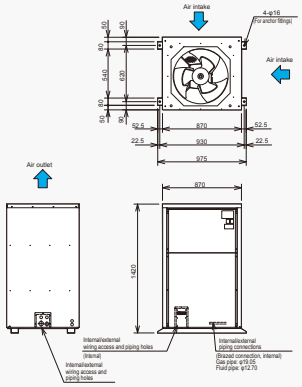
Outdoor Unit -PAP20A-(K)R-



Outdoor Unit -PAP40C-(K)R-

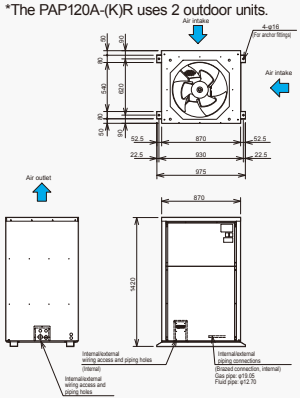


Outdoor Unit -PAP80B-(K)R-



Outdoor Unit -PAP120A-(K)R-

*The PAP120A-(K)R uses 2 outdoor units.



1. When installing the outdoor unit, have the air intake side facing the wall, and leave a space of at least 0.5 m. 2. Refrigeration piping length: PAP20A-(K)R=30 m, PAP40C-(K)R=50 m, PAP80A-(K)R=75 m (all are 1-way)
3. When there is a difference in height between the indoor and outdoor units: When the external unit is higher: 10 m. When the external unit is lower: 10 m.
4. Cables and piping going between the indoor and outdoor units are not included.

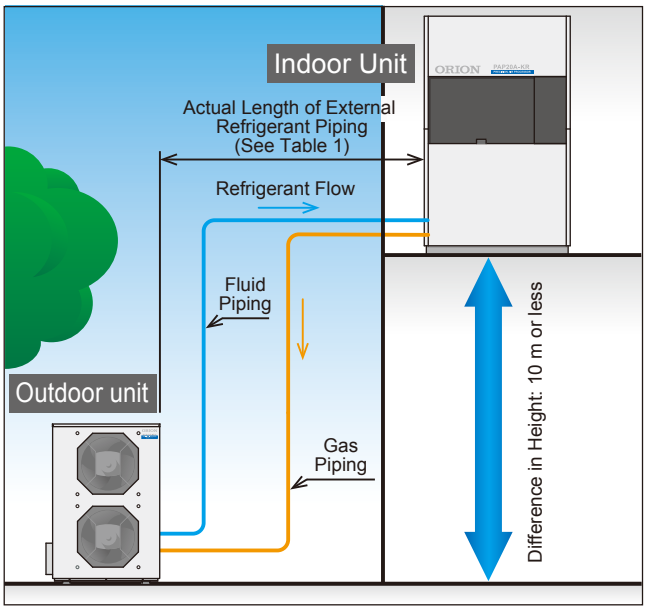
Installation Points

Greater Freedom of Installation, Fewer Constraints and, Excellent Construction

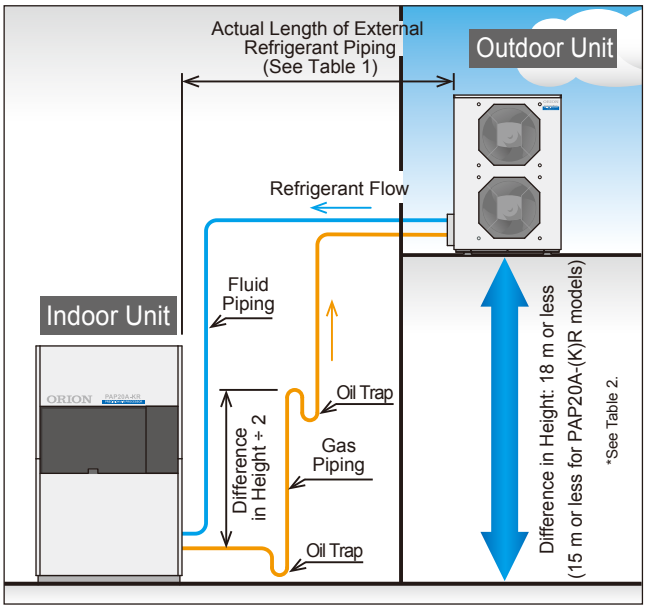
Item/Model				PAP20A-R	PAP20A-KR	PAP40C-R	PAP40C-KR	PAP80B-R	PAP80B-KR	PAP120A-R	PAP120A-KR
Power Supply Voltage	Voltage Fluctuation			Rated voltage ± 10 % or better							
	Phase Unbalance			3 % or lower							
Leakage Breaker Capacity			A	30	50	60	75	75	150	150	225
Current Sensitivity			mA	100100 (High-speed type. Switch delay time of 0.1 s or less.)							
Primary Power Supply Terminal Block ①				M5		M6		M8		M10	
Terminal Block Width			mm	13		19		23		32	
Indoor/Outdoor Unit Terminal Block ②				M3.5							
Terminal Block Width			mm	7.5							
Indoor/Outdoor Unit Terminal Block ③				M3.5							
Terminal Block Width			mm	7.5							
External Refrigerant Piping	Gas Piping	*1	φmm	15.88		15.88		19.05		25.4	
	Fluid Piping	*1	φmm	9.53		9.53		12.7		15.88	
External Refrigerant Piping Length	Piping Length (One way)	*2	m	Actual length: 30 or shorter Equiv. length: 35 or shorter		Actual length: 50 or shorter Equiv. length: 60 or shorter		Actual length: 75 or shorter Equiv. length: 90 or shorter			
Indoor/Outdoor Unit Difference in Height		*2	m	10							
Pipe-end Processing (Type)				Indoor: Flare connection / Outdoor: Brazing / Outdoor Unit Side: Expanding rubber pipe stopper / Indoor Unit Side: Service valve flared stop. * PAP 120 A -(K) R models have brazed indoor unit gaps piping connections. [When shipped] Cap: Brazed.							

*1 Does not include refrigerant piping, which must be prepared by the end-user. Also, if the length of refrigerant piping (one way) is 5 m or longer, then the following amount of additional refrigerant will be needed for each 1 m of fluid piping: PAP 20 A -(K)R: 30 g/m, PAP40C-(K)R: 32 g/m, PAP80B-(K)R: 63 g/ m, PAP120A-(K)R: 108 g/m. Example: One-way 20 m: (20 m - 5 m) × 30 g/m= 450 g of additional refrigerant
*2 If the difference in height to the outdoor unit is 10 m or more, then external refrigerant piping length (in meters) will be as shown in Table 1, and the cooling and heating capacity will be as shown in table 2. If the external unit is lower, then the difference in height should be 10 m or less.

Outdoor Unit is Lower



Outdoor Unit is Higher



■ Table 1 Actual Piping Length (Max.)

	Difference in Height	PAP20A-R	PAP20A-KR	PAP40C-R	PAP40C-KR	PAP80B-R	PAP80B-KR	PAP120A-R	PAP120A-KR
Actual Length of External Refrigerant Piping (m)	18 m	—		34		51		51	
	15 m	24		40		60		60	
	12 m	27		46		69		69	

■ Table 2 Cooling and Heating Capacity Nominal Value

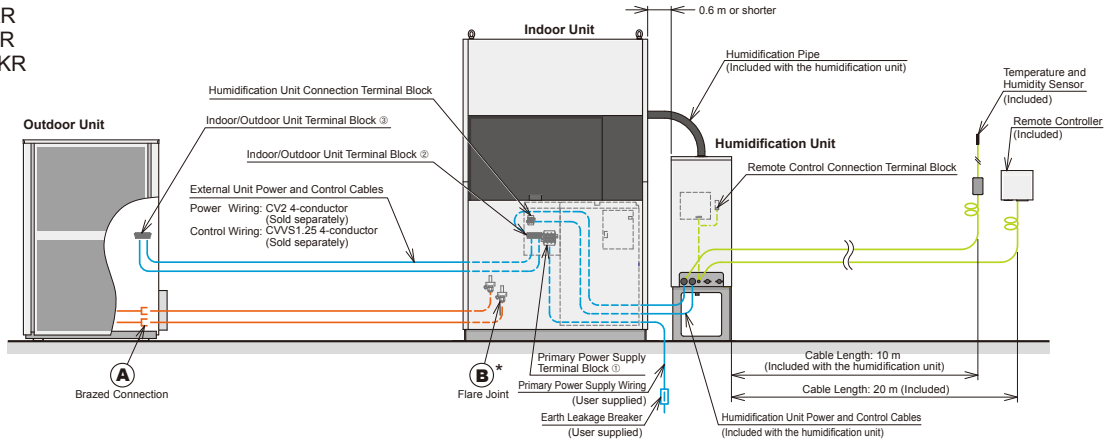
	Difference in Height	PAP20A-R	PAP20A-KR	PAP40C-R	PAP40C-KR	PAP80B-R	PAP80B-KR	PAP120A-R	PAP120A-KR
Cooling Capacity (kW)	18 m	—		9.6		20.0		30.4	
	15 m	7.0		10.5		21.8		33.3	
	12 m	7.6		11.4		23.7		36.0	
Heating Capacity (kW)	12 m or longer	1.8		3.0		6.0		9.0	

* Capacity is for operation in proportion to JISB8616.

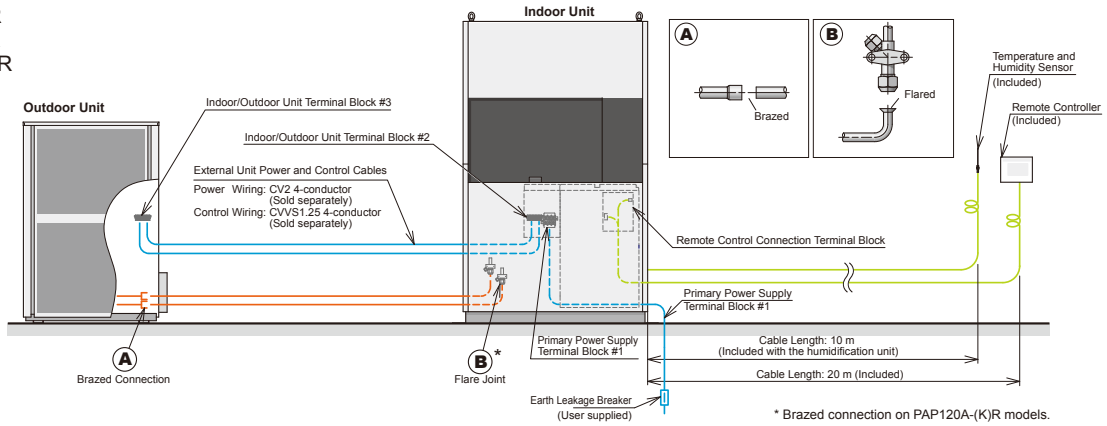
Installation Points

Greater Freedom of Installation, Fewer Constraints and, Excellent Construction

PAP20A-KR
PAP40C-KR
PAP80B-KR
PAP120A-KR



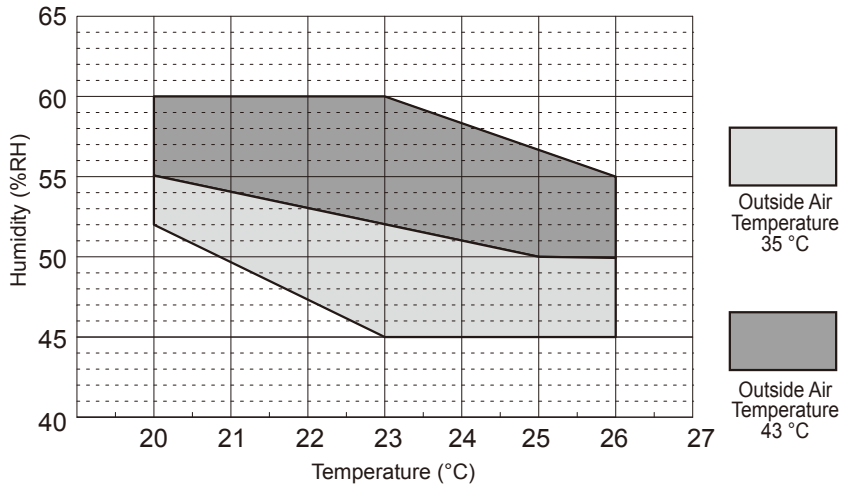
PAP20A-R
PAP40C-R
PAP80B-R
PAP120A-R



* Brazed connection on PAP120A-(K)R models.

PAP20A-(K)R
PAP40C-(K)R
PAP80B-(K)R
PAP120A-(K)R

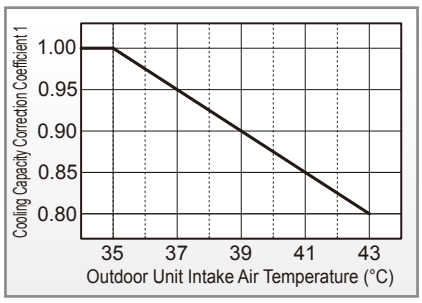
■ Temperature and Humidity Control Range Table



<Conditions>
Controlled Air Circuit: Circulating, with no load
Controlled-Air Air Flow: Rated air flow
*Indicates the range where control is possible within primary operating ranges while not under load. Take these ranges into consideration when carrying out actual load calculations.

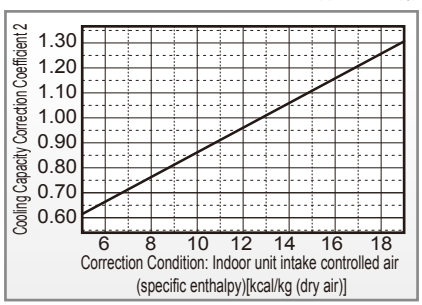
■ Cooling Capacity Correction Chart 1

Correction Condition: Outdoor unit intake air temperature



■ Cooling Capacity Correction Chart 2

Correction Condition: Indoor unit intake controlled air (specific enthalpy)



High Accuracy Temperature and Humidity Control Equipment

Air Processor (Circulation Type) Air Cooled

Models

AP-750M-E1
AP-750MV-E1
AP-750MVK-E1
AP-1500M-E1
AP-1500MV-E1
AP-1500MVK-E1

Air processing capacity **4 – 15 m³/min**

Humidity setting range **30 – 90 %**

A localized precision air processing unit that can be used to fill each of the needs of various industrial fields.
The circulating type air circuit easily enables low to high temperature environments.

Compact Design

The environment box (testing chamber) can be easily replace or moved according to your needs.

Three Functions to Choose From

3 functions of temperature control, humidity control, purification (special order) offer a total response to your local air space needs.

AP1500MVK-E1

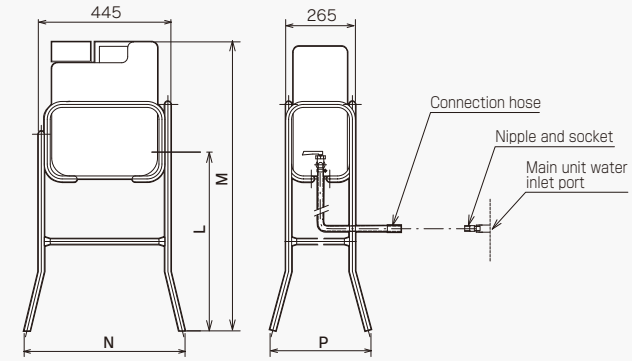
Specifications

	Model		AP-750M-E1	AP-750MV-E1	AP-750MVK-E1	AP-1500M-E1	AP-1500MV-E1	AP-1500MVK-E1
Performance specifications *1	Temperature control range	˚C	5 – 35	5 – 70	5 – 70 (During humidity control: 15 – 70)	5 – 35	5 – 70	5 – 70 (During humidity control: 15 – 70)
	Humidity control range *1	%	—		30 – 90 (When at 40 – 60 ˚C)	—		30 – 90 (When at 40 – 60 ˚C)
	Control precision *2	˚C,%	±0.5		±0.5, ±3	±0.5		±0.5, ±3
	Control method		Digital setting, Digital display, Heater PID control					
	Cooling capacity *3	kW	1.5 / 1.75			3.25		
	Processed air flow (50/60 Hz)	m³/min	4 – 6 / 4 – 7			10 – 13 / 10 – 15		
	Ambient temp. range	˚C	15 – 35					
	Outlet connection port		Air outlet φ100 (incl. companion flange)			Air outlet φ150 (incl. companion flange)		
Power specifications	Power source	V(Hz)	Three-phase 200 ± 10 % (50/60)					
	Maximum operating current	A	18		27	37		58
	Maximum operating power consumption	kW	5.7		9.0	11.5		19.0
	Circuit breaker		Built-in					
	Refrigerant		R407C					
	Compressor output	kW	0.65			1.4		
	Mass	kg	120		130	195		205
	External dimensions (H x D x W)	mm	1044×548×660			1374×618×753		

*1 Maximum air flow, control temp.: 25 ˚C, ambient temp.: 25 ˚C (Not the case for humidity control.)
*2 When under temperature and humidity control, refer to the "Temperature and humidity control range" chart shown in the next page.
*3 No load, no sample, specified voltage, temperature (humidity) taken of air at unit air outlet port for a short time.
* Never operate on explosive or combustible substances, nor with substances that may contain explosive or combustible compounds.
* Install in a location free from the effects of corrosive gases (especially those harmful to copper and stainless steel.)

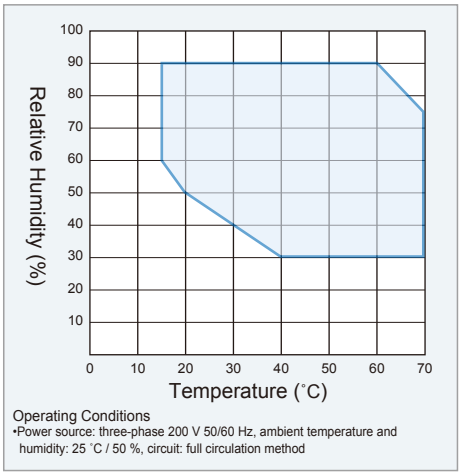
Water Supply Tank (optional equipment)

External Dimensions (units: mm)



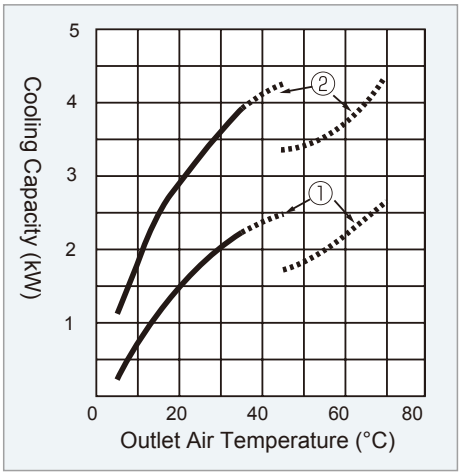
Model	L	M	N	P
AP-750MVK-E1	850	1230	535	370
AP-1500MVK-E1	1170	1560	660	480

Temperature and Humidity Control Range



Operating Conditions
•Power source: three-phase 200 V 50/60 Hz, ambient temperature and humidity: 25 ˚C / 50 %, circuit: full circulation method

Cooling Capacity Curves



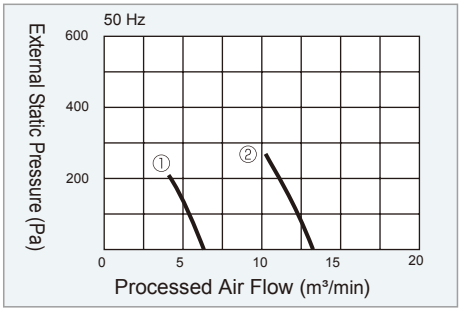
No.	Solid line applicable models
①	AP-750M-E1
②	AP-1500M-E1

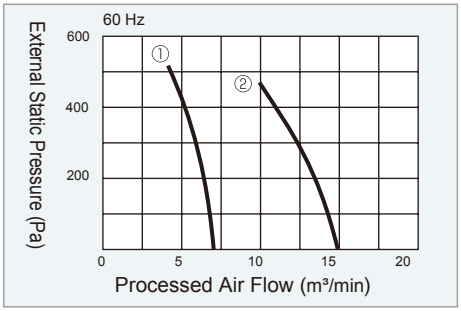
No.	Solid- and Dashed-line Applicable Models
①	AP-750M-E1 • MVK-E1
②	AP-1500M-E1 • MVK-E1

Operating conditions
- Power source: Three-phase, 200 V 60 Hz
- Ambient temperature and humidity: 25 ˚C / 50 %
- Processed air flow: rated air flow (external pressure: 0 Pa)

Cooling capacity compensation value
Note 1: Power source of 50 Hz will be 85 % of 60 Hz. (AP-1500 is same value for 50 or 60 Hz.)
Note 2: Cooling capacity curve during temperature control. The power curve will be different during humidity control.

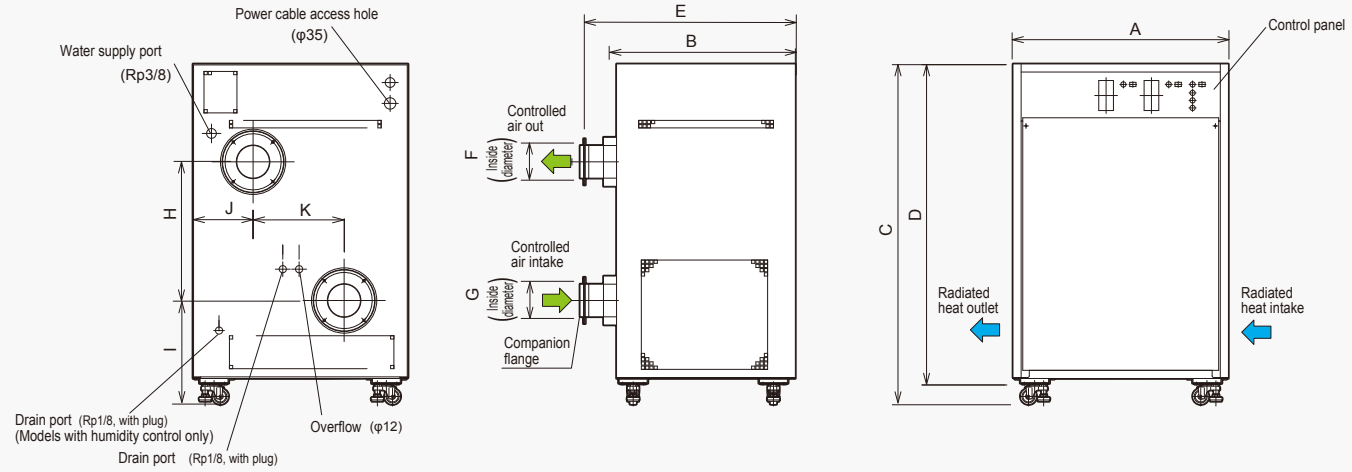
Processed Air Flow Performance Charts





① AP-750M-E1 • MV-E1 • MVK-E1
② AP-1500M-E1 • MV-E1 • MVK-E1
* Do not operate at Processed air flows outside what is listed in these charts.

External Dimensions (units: mm)



Model	A	B	C	D	E	F	G	H	I	J	K
AP-750M-E1 / MV-E1 / MVK-E1	660	548	1044	964	(647)	φ100	φ100	425	319	185	279
AP-1500M-E1 / MV-E1 / MVK-E1	753	618	1374	1294	(719)	φ150	φ150	598	446	227	283

ORION's Energy Saving Air Processing System Proposal

Energy Saving Dry Room System

Stable Supply for a Dry Air Space at a Dewpoint Temperature of -80 ˚C

From lithium ion battery and capacitor production to medical supply production and manufacturing processes, a strict low-humidity environment is required.I n answer to the needs of such manufacturing processes, ORION brings to the table its original dehumidifying system that offers a waste-free, energy saving, ultra-low humidity environment.

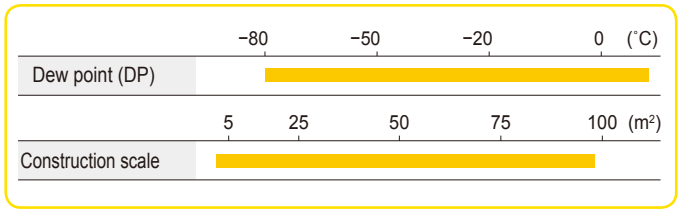
Typical Applications That Can benefit From This Technology

- Lithium-ion battery production
- Capacitor manufacturing process
- Medical supply manufacturing process
- Precision electronic components manufacturing process
- Precision electronic components anti-rust and condensation-prevention
- Humidity management of powder manufacturing process.

Compact Design

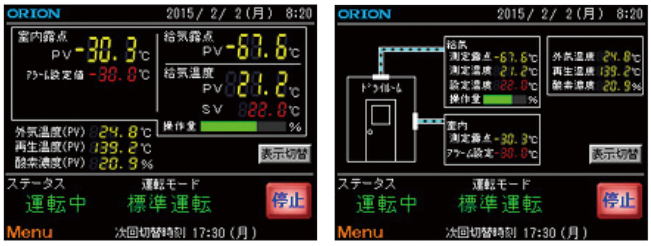
Pre-Cooling + Desiccant Dehumidifier Modular Design

Inter-unit ducting unnecessary thanks to our modular design
Offers space savings and lower construction cost.
(30 % reduction in required installation floor space (compared with our previous models))



Intelligent Touch Panel

With the touch panel display, various settings and information can be accessed, and current operating conditions can be easily checked.



ORION's Proposal for a Process-Localized Dew Point Energy Saving System

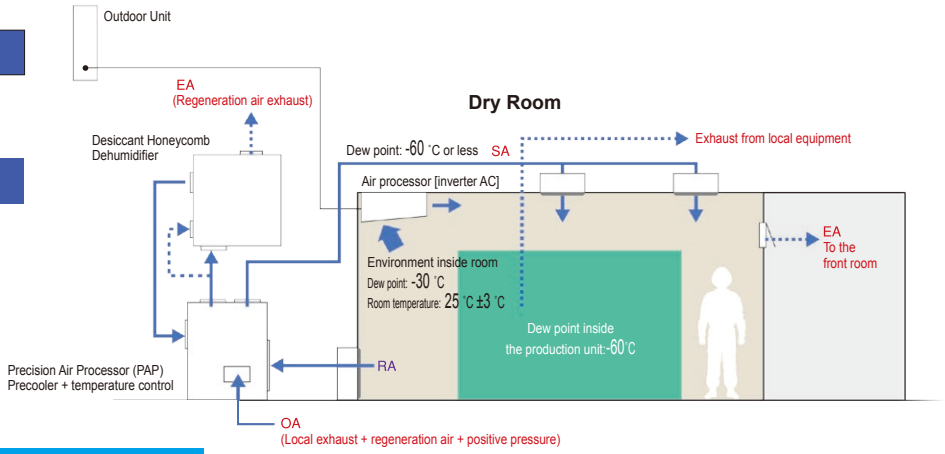
Energy Saving Dry Room System Configuration Example

Cost reductions and energy saving can be achieved by carrying out dew point management on just the processes that require it.

Dry room main unit dew point: **−30 ˚C**

+

production unit internal dew point: **−60 ˚C**



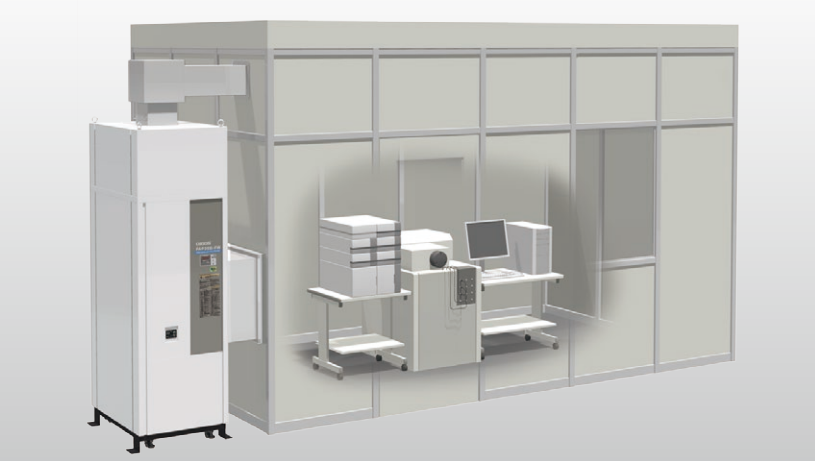
Examples of Installation

A System Design Not Limited to Dry Rooms

Compact Panel System

ORION Has System Proposals Built Around the PAP Series to Meet All of Your Needs

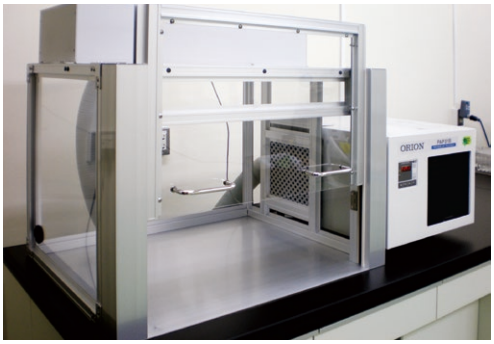
System Proposals that Fit in the Range of About 33 m².



Chromatograph

Constant Temperature, Constant Humidity Room

3D Measurement Room



Compact Tabletop Chamber

Example of Internal Air Discharge

Example of Internal Air Discharge

Example of External Air Intake

Clean Booth

ORION Has System Proposals Built Around the PAP Series to Meet All of Your Needs

Orion offers systems that offer localized precision air processing and localized cleaning.

ORION's original functionality gives improved reliability. With our wide selection, we have the booth that meets your needs.
Orion offers systems that offer localized precision air processing and localized cleaning.






Clean Booth System Examples

Temperature and Humidity Control Clean Booth

Temperature and
Humidity Control
Type with HEPA Filter

Effective Range	
Temperature	○
Humidity	○
Cleanliness class	○

Temperature Control Booth

Temperature Control
Type Configuration

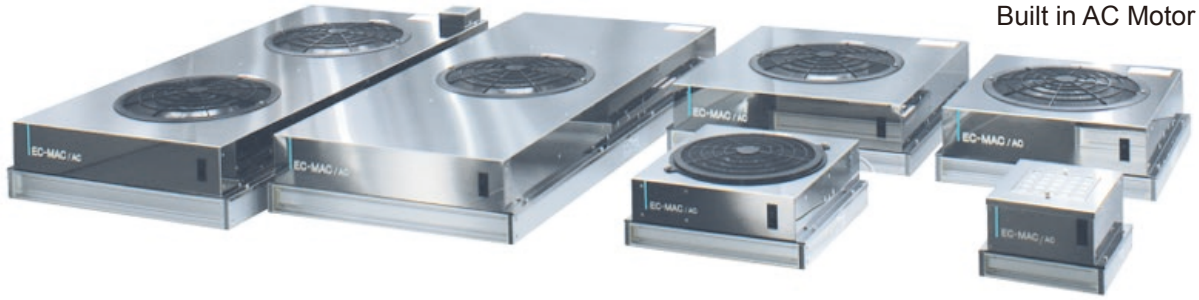
Effective Range	
Temperature	○
Humidity	×
Cleanliness class	×

Section Clean

Fan Filter Unit

Light duty to heavy duty (high air flow) models available for every application.

Built in AC Motor



1 **Made with mirror polished stainless steel for excellent chemical and corrosion resistance.**
Wide ranging applications include electronics, biotechnology, food service, optics, experimentation and research.

2 **Illuminated Filter**
LED indicator shows operating conditions.
(Not available on MAC•IIA-10 models.)

3 **Full Lineup**
S Series: Chamber box for duct connection available.

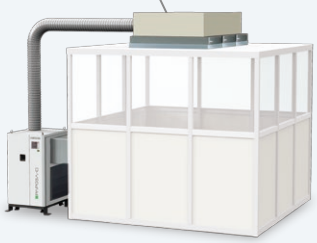
Specifications

Model	MAC-IIA-10	MAC-IIA-30	MAC-IIA-50	MAC-IIA-100	MAC-IIA-150	MAC-IIA-250
			MAC-IIA-50-21	MAC-IIA-100-21	MAC-IIA-150-21	MAC-IIA-250-21
Dust Collection Efficiency	Over 99.99 % of particulate of 0.3 μm or larger (at atmospheric pressure)					
Dust Collection Filter Elements — Main Filter	HEPA filter					
Dust Collection Filter Elements — Pre-filter	Non-woven fabric filter	Processed saran net				
Rated Processing Air Flow (m^3/min)	Approx. 1.0/0.8	Approx. 3.0/3.5	Approx. 5.0	Approx. 10.0	Approx. 15.0	Approx. 25.0
Air Flow Wind Speed (m/sec)	Avg.: 0.36/0.29	Avg.: 0.38/0.44	Avg.: 0.39	Avg.: 0.51	Avg.: 0.37	Avg.: 0.61
Noise (dBA)	Approx. 51/49	Approx. 53/56	Approx. 55/56	Approx. 56/57	Approx. 56/57	Approx. 59/59
Power Source	Single-phase AC 100 V, 50/60 Hz		Single-phase AC 100 V, 50/60 Hz or Single-phase AC 200 V, 50/60 Hz			
Power Consumption (W)	35/40	28/36	43/46	98/114	141/157	190/230
Blower Fan	AC Motor					
Number of Blower Fans	1	1	1	1	1	2
Mass (kg)	Approx. 4	Approx. 6.5	Approx. 11.5	Approx. 14.5	Approx. 22.0	Approx. 25.0
Construction	Body: SUS430 with mirror finish					
Operating Indicator Lamp	High luminosity LED * With Illuminated filter					
Accessories	Includes sponge gasket to seal the perimeter of the air outlet port.					

* Noise level measured at 1 m from the air outlet port in an anechoic room.

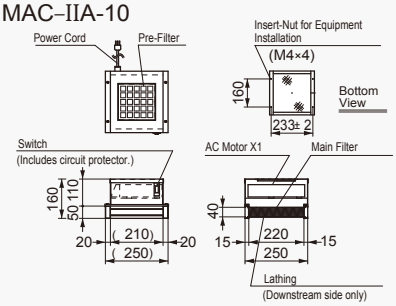
S Series: Models that include a chamber box for duct connections are available.
Please ask an ORION distributor for details.

Chamber Box for Duct Connections

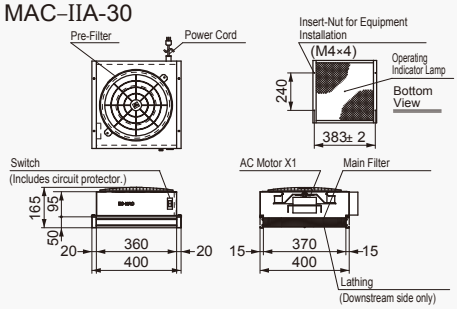


External Dimensions (Units: mm)

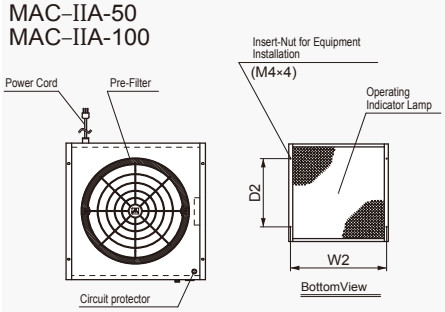
MAC–IIA-10



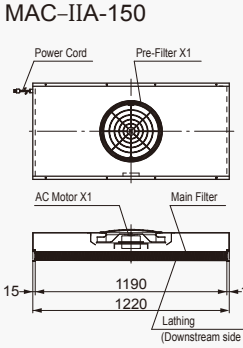
MAC–IIA-30



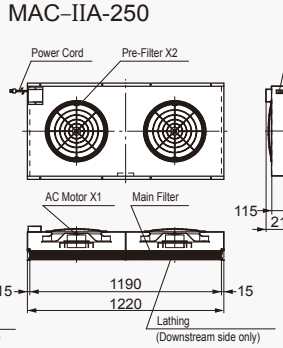
MAC–IIA-50
MAC–IIA-100

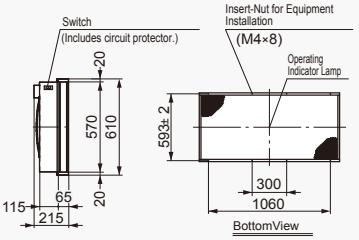


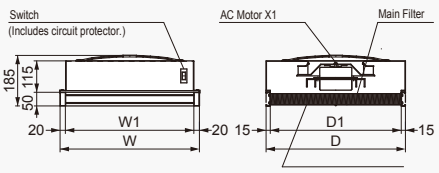
MAC–IIA-150



MAC–IIA-250







Important Safety Guidelines

Safety Symbols

The safety precautions listed herein are to ensure safe and proper use of this equipment for your protection and to prevent losses to you, the surrounding area, and people nearby. Important safety precautions are classified into two categories, ⚠WARNINGS and ⚠CAUTIONS.

⚠ WARNING **Failure to follow instructions contained in a WARNING may result in death or serious injury.**

⚠ CAUTION **Failure to follow instructions contained in a CAUTION may result in personal injury or damage to property.**

⚠symbols inform you of a WARNING or CAUTION to observe.The illustration within the triangle shows the nature of the precaution. (For example, the symbol at the left indicates possible danger from a rotating fan.)

❗symbols indicate actions which must be taken. The illustration within the triangle shows the nature of the precaution. (For example, the symbol at the left indicates that the unit must be grounded.)

🚫symbols indicate prohibited actions. The illustration within the circle shows the nature of the action which is prohibited. (The example to the left indicates that user disassembly is prohibited.)

Please note that items noted in ⚠ CAUTIONS can result in very serious consequences depending on the particular situation. Both CAUTIONS and WARNINGS must be heeded to ensure adequate safety.

⚠ WARNING Failure to follow instructions contained in a WARNING may result in death or serious injury.

Regarding the Working Environment

Product Use Limitations

(1) When using this equipment in connection with important facilities, be sure to establish backup and/or failsafe measures so that even in the event of breakdown of this equipment, such breakdown won't lead to serious accidents or losses.

(2) This equipment is designed and produced as general purpose equipment to be used in general manufacturing applications. Accordingly, the warranty does not apply to nor cover the following applications.However, in cases where the customer/user takes full responsibility and confirms the performance of the equipment in advance, and takes necessary safety precautions, please consult with ORION and we will consider if use of the unit in the desired application is appropriate.

1. Atomic energy, aviation, aerospace, railway works, shipping, vehicles, medical applications, transportation applications, and/or any applications where it might have a great effect on human life or property.
2. Electricity, gas, or water supply systems, etc. where high levels of reliability and safety are demanded.

Do not operate where the unit could come into contact with wind, rain, or water.

Exposure to water splash or rain could lead to electric shock or fire.

Operate the unit on a level and stable surface that can fully withstand the weight of the unit.

Failure to use the unit on a stable surface can lead to water leakage and tipping over or falling, which in turn could lead to injury.

Ensure adequate drain piping.

Improper drain construction can lead to trouble such as water leakage or failure of drainage to properly drain.

Be certain that all electrical wiring is done in accordance with relevant electrical construction and internal wiring regulations, and use only prescribed cables.

Installation with an insufficient power supply or improper installation can result in electric shock or fire.
Improperly securing cables to electrical contacts can lead to electric shock, overheating, or fire.

Do not operate this unit in areas where leakage of corrosive or flammable gases could possibly occur.

Corrosive gases either in the air to be processed, or in the area surrounding the unit, could lead to unit breakdown.And if by some chance there were a flammable gas leakage and the gas accumulated near the unit, it could result in a fire.

Always properly ground this equipment.

Do not attach the grounding wire to gas pipes, water pipes, lightning rods, etc. Improper grounding can lead to electric shock.

Please arrange for installation by your dealer or other qualified persons.

Installation undertaken by unqualified or inexperienced persons may result in improper installation, which can lead to water leakage, electric shock, or fire.

Be sure to install an earth-leakage breaker.

Using the equipment without an earth leakage breaker can lead to electric shock.

Regarding Installation

Be sure to read the operating manual before operating this equipment.

Mistakes in operation can lead to unit breakdown or result in an accident.Read the operating manual and use this equipment properly. Keep the operating manual in safe place.

Before cleaning or performing maintenance or inspections, always cut off the power source.

Failure to do so may result in electric shock, injury, or burns.

When transferring this unit, be sure to also include this operating manual.

The operating manual should be included with the unit in the event that it is sold or transfered so that the new owner can also refer to in order to safely operate the unit.

Operate the unit within its specified operating ranges.

Operating equipment outside specified operating ranges can result in damage to the equipment, which may result in injury, leakage, etc.

Do not modify this equipment.

Modifying this equipment will void the product warranty.

Do not stick fingers or other objects into the air intake or outlet vents.

Contact with the internal high speed fan could lead to injury.

Do not sit on or put things on this equipment.

Doing so can cause the machine to tip or fall and may lead to injury.

If abnormal operation is observed, stop operation of the unit and consult with your dealer or a qualified repair person.

Continued operation when the unit is performing abnormally can lead to electric shock or fire.

After confirming the safety of the product and everything related to it, have someone sufficiently knowledgeable and experienced operate the product.

Always carry out proper inspections and cleaning as indicated in the operating manual.

Do not modify settings of safety features of this equipment.

Modifying such settings can lead to an damage or fire.

Do not use water directly on the unit or in the unit component area and do not wash the unit with water.

Failure to follow this warning may lead to electric shock or fire.

CAUTION Failure to follow instructions contained in a CAUTION may result in personal injury or damage to property.

Regarding Standard Operation

Make sure that primary cooling water (cooling water for the condenser of a compressor unit and/or heat dissipating water for an electronic peltier cooling unit), water for a constant temperature circulating water temperature controller, and deionized water for humidification, meet the water quality standards listed below.

○ Primary cooling water water quality standard level …… As for water-cooled models, if using something other than distilled water for industrial use as the primary cooling water, please use water that falls within the following water standard guidelines.

	Item	Cooling Water Type		Has Tendency Towards:	
		Circulating Water	Make-Up Water	Corrosion	Scaling
Standard Components	pH(25℃)	6.5 – 8.2	6.0 – 8.0	○	○
	Conductivity (μS/cm) (25℃)	Max. 800	Max. 300	○	○
	Chloride ion ($mgCl^-/L$)	Max. 200	Max. 50	○	
	Sulphate ($mgSO_4^{2-}/L$)	Max. 200	Max. 50	○	
	Acid consumption (pH4.8) ($mgCaCO_3/L$)	Max. 100	Max. 50		○
	Total hardness ($mgCaCO_3/L$)	Max. 200	Max. 70		○
	Calcium hardness($mgCaCO_3/L$)	Max. 150	Max. 50		○
	Silica ion ($mgSiO_2/L$)	Max. 50	Max. 30		○
Reference Components	Iron ($mgFe/L$)	Max. 1.0	Max 0.3	○	○
	Copper ($mgCu/L$)	Max 0.3	0.1 or less	○	
	Sulfide ion (mgS^{2-}/L)	Not detected	Not detected	○	
	Ammonium ion ($mgNH_4^+/L$)	Max. 1.0	Max. 1.0	○	
	Residual chlorine ($mgCl/L$)	Max 0.3	Max 0.3	○	
	Free carbon dioxide ($mgCO_2/L$)	Max. 4.0	Max. 4.0	○	
	Ryznar Stability Index	6.0 – 7.0	——	○	○

Excerpt from JRA-GL-02-1994 of The Japan Refrigeration and Air Conditioning Industry Association

- Within the "Tendency toward" column, items marked with a ○ indicate this component can lead to corrosion or scaling as indicated.
- The 15 items listed above are the primary components that can lead to corrosion or scaling.

○Constant temperature circulating water …… Operate with water that meets the following water quality.

		Standard Level
Standard Components	pH(25℃)	6.0 – 8.0
	Conductivity (μS/cm) (25℃)	1 – 400
	Chloride ion ($mgCl^-/L$)	Max. 50
	Sulphate ($mgSO_4^{2-}/L$)	Max. 50
	Acid consumption (pH4.8) ($mgCaCO_3/L$)	Max. 50
	Total hardness ($mgCaCO_3/L$)	Max. 70
	Calcium hardness ($mgCaCO_3/L$)	Max. 50
	Silica ion ($mgSiO_2/L$)	Max. 30
Reference Components	Iron ($mgFe/L$)	Max. 1.0
	Copper ($mgCu/L$)	Max. 1.0
	Sulfide ion (mgS^{2-}/L)	Not detected
	Ammonium ion ($mgNH_4^+/L$)	Max. 1.0
	Residual chlorine ($mgCl/L$)	Max 0.3
	Free carbon dioxide ($mgCO_2/L$)	Max. 4.0

From JRA GL-02-1994 (water circulation for water cooled systems)

* If the quality of water to be used for constant temperature circulating water does not fall within the prescribed guidelines, it may result in corrosion in the circulation or refrigeration sections of the equipment, clogging, etc. Please confirm water quality prior to use. Also, periodically replace the water to help prevent deterioration of the water quality.
* Compatible models …… PEC, RKE

○ Deionized water for humidification …… Operate with RO treated (deionized) water that meets the following water quality.

Water Quality (Electrical conductivity)	1 – 10 μS/cm

* If the quality of water to be used for humidification does not fall within the prescribed guidelines, it may encourage corrosion and/or clogging, etc. in the circulation or humidifier sections of the equipment. Please confirm water quality prior to use.
* Compatible models……AP * FK • FSK • MVK, APS- * LLKP, PAP * K • KW • KR • KJ

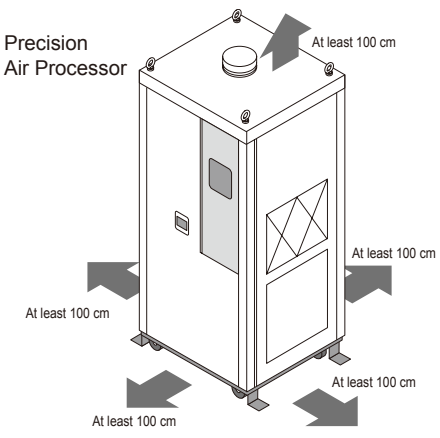
Do not apply excessive force to the temperature (or humidity) sensor.
Doing so can result in unit breakdown.

Regarding Inspection and Maintenance

Periodically inspect the condenser and each of the filters for dirt and clean as required.

When cleaning the condenser, do not directly touch the fins. (On air-cooled models only)
Doing so can result in injury.

Plan for enough space around the unit to facilitate optimum unit performance as well as a working space for maintenance tasks.



Technical Data

Making The Right Model Choice (temperature and humidity control types)

* Please ask your dealer about our D Series and L Series models.
* Please see page 5 for temperature-only control types.

■ Determine the Air Flow

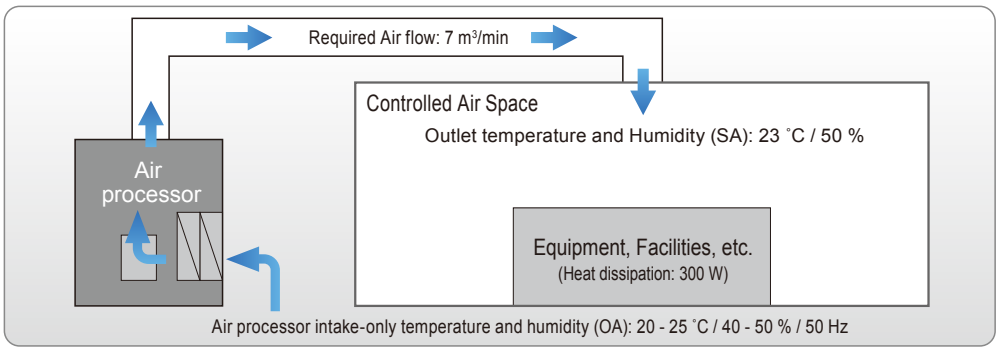
Required air flow is based on temperature accuracy and air ventilation frequency.

Calculation: $F = (V \times N) \div 60$ F: Air flow (m³/min), V: Volume of air space (m³), N: Ventilation frequency (ventilation cycles/h)

[Ventilation frequency estimate chart] * Note that these values are only offered as a rough estimate as actual results will vary greatly based on the surrounding environment and the insulation specifications of the booth itself.

Temperature Accuracy	±2 ˚C	±1 ˚C	±0.5 ˚C	±0.25 ˚C
Air Exchange Rate	15 ventilation cycles/h	30 ventilation cycles/h	60 ventilation cycles/h	120 ventilation cycles/h

[Sample Calculation]



Conditions: Temperature accuracy of around ±0.5 ˚C for a room of the following dimensions: width: 1.8 m, depth: 1.8 m, height: 2 m…

Calculation: In order to achieve a temperature accuracy of ±0.5 ˚C for this room, the ventilation frequency should be at least 60 ventilation cycles/h, and the required air flow would be …

$$F = (V \times N) \div 60 = 1.8 \times 1.8 \times 2 \times 60 \div 60 = 6.48 \text{ m}^3/\text{min}$$

The model that could adequately provide this air flow would be the PAP10 Series.

* Please use the information in the table below.

Volume of space [m³]		10	20	30	40	50	60	70	80	90	100
±2 ˚C	15 ventilation cycles/h	2.5	5.0	7.5	10.0	12.5	15.0	17.5	20.0	22.5	25.0
±1 ˚C	30 ventilation cycles/h	5.0	10.0	15.0	20.0	25.0	30.0	35.0	40.0	45.0	50.0
±0.5 ˚C	60 ventilation cycles/h	10.0	20.0	30.0	40.0	50.0	60.0	70.0	80.0	90.0	100.0
±0.25 ˚C	120 ventilation cycles/h	20.0	40.0	60.0	80.0	100.0	120.0	140.0	160.0	180.0	200.0

■ Find the Required "Cooling + Heating Power"

Calculation: $Q=Q_1+Q_2$ Q: Cooling + heating power (kW) Q1: Cooling power (kW) Q2: Reheating power (kW)

Conditions: Intake air into the PAP: 20 – 25 ˚C ÷ 40 – 50 % environment, and desired control of 23 ˚C / 50 % …

1) Confirm the Cooling Capacity

Formula: $$Q_1 = \frac{(i_2 - i_1) \times 1.2 \times F \times 60}{860}$$

Q_1: Cooling power kW (1 kW = 860 kcal/h), i_2: Intake air enthalpy (kcal/kg)
i_1: Enthalpy at the set air dew point temperature ÷100 % (kcal/kg),
1.2: Specific gravity of air kg/m³, F: Flow rate (m³/min)

1. According tot he **"Enthalpy Chart"** on page 43, the enthalpy for the high temperature and humidity intake air of 25 ˚C ÷ 50 % is **i_2=12.01**.

2. The dew point temperature for the set temperature and humidity of 23 ˚C/50%, according to the **"Dew Point Temperature Chart"** (page 42) is 12˚C* 1.

The enthalpy value for 12˚C/100% according to the **"Enthalpy Chart"** (page 43) is i_1=8.14.
If we take the flow rate of the PAP10A1-K, which has a rated processing air flow of 7 – 10 m³/min, to be 7 m³/min ...

$$Q_1 = \frac{(i_2 - i_1) \times 1.2 \times F \times 60}{860} = \frac{(12.01 - 8.14) \times 1.2 \times 7 \times 60}{860} \approx \mathbf{2.3\ kW}$$

* 1 The possible setting range of dewpoint will be from 8 ˚C or higher.

2) Confirm the Reheating Power

$$\textbf{Formula: } Q_2 = \frac{(i_3 - i_1) \times 1.2 \times F \times 60}{860}$$

Q_2: Reheating power kW (1 kW = 860 kcal/h), i_3: Set air enthalpy (kcal/kg)
i_1: Enthalpy at the set air dew point temperature / 100% (kcal/kg),
1.2: Specific gravity of air kg/m³, F: Flow rate (m³/min)

1. The enthalpy value for 23 ˚C / 50 % according to the **"Enthalpy Chart"** (page 43) is i_3=10.84.
2. The heating power for conditions of 12 ˚C ÷ 100 %, i_1=8.14 is ...

$$\textbf{Formula: } Q_2 = \frac{(i_3 - i_1) \times 1.2 \times F \times 60}{860} = \frac{(10.84 - 8.14) \times 1.2 \times 7 \times 60}{860} \approx 1.6 \text{ kW}$$

3) Find the Cooling + Heating Power

From the results from 1) and 2), $Q = Q_1 + Q_2 = 2.3 + 1.6 = 3.9$ kW

4) Find the Cooling + Heating Power

Q'= **"Cooling + Heating Power" × the power correction coefficient**

1. According to the **"Enthalpy Chart"** (page 43), the enthalpy intake air of 25 ˚C / 50 % is i_2= 12.01.
The power correction coefficient at this time, according to the **"<<Cooling + Heating Power>> Correction Coefficient Graph"** (page 41), is 0.85.Supposing the PAP10A1-K was chosen, the **"Cooling + Heating Power Chart"** below indicates 4.7 kW (50 Hz), therefore..

$Q' = 4.7 \text{ kW} \times 0.85 \approx 4.0 \text{ kW}$

2. $Q = 3.9$ kW, therefore $Q' \geq Q$

* According to the above, the PAP10A1-K satisfies the required specifications.

[Cooling + Heating Power Chart (kW)] 50/60 Hz

	PAP05		PAP10		PAP20		PAP40	
Air Cooled	2.3	2.6	4.7	5.3	9.4	10.5	—	—
Water Cooled	3.2	3.2	6.5	6.5	13.0	13.0	22.0	22.0

■ Confirm Power During Heating

Confirm the power for heating from the low intake air temperature and humidity, from 20 ˚C / 40% to 23 ˚C. According to the **"Enthalpy Chart"** (page 43), the 20 ˚C / 40% enthalpy is 8.32, therefore the heating power to get to an enthalpy of 10.84, for 23 ˚C / 50 %, is...

$$Q = \frac{(10.84 - 8.32) \times 1.2 \times 7 \times 60}{860} \approx \mathbf{1.48 \text{ kW}}$$

The enthalpy of the intake air of 20 ˚C/ 40 % is 8.32, therefore, according to the **"<< Cooling + Heating Power >> Correction Coefficient Graph"** (page 41), the power coefficient is 0.77.
Supposing the PAP10A1-K was chosen, the **"Cooling + Heating Power Chart"** above indicates 4.7 kW, therefore...

$Q' = 4.7 \text{ kW} \times 0.77 \approx 3.6 \text{ kW}$

$Q = 1.48$ kW, therefore $Q' \geq Q$

* According to the above, the PAP10A1-K satisfies the required specifications.

Technical Data

Making The Right Model Choice (continued from the previous page)

■ Confirm Humidification Power

Formula: $X = (x_1 - x_2) \times 1.2 \times F \times 60$

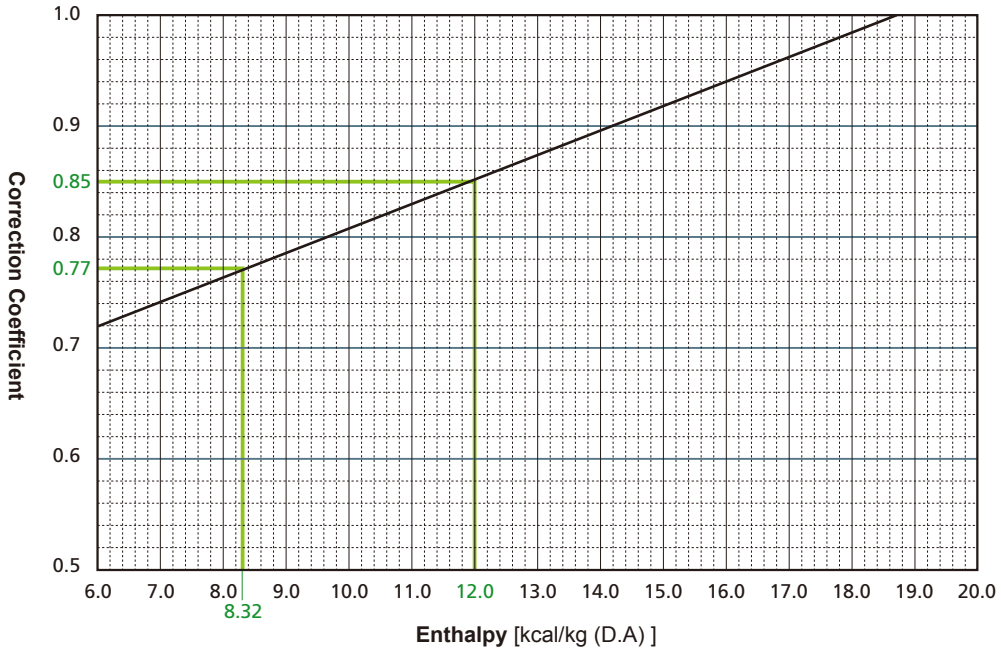
X: Humidification power (kg/h), x_2: Intake air specific humidity (kg/kg),
x_1: Set air specific humidity (kg/kg), 1.2: Specific gravity of air (kg/m³), F: Air flow (m³/min)

According to the **"Specific Humidity Chart"** (page 44), the specific humidity at 20 ˚C / 40 % is 0.00580 kg/kg.
Also according to the **"Specific Humidity Chart"**, the specific humidity at 23 ˚C / 50 % is 0.00875 kg/kg. Therefore...

$$X = (0.00875 - 0.00580) \times 1.2 \times 7 \times 60 = \mathbf{1.4868\ kg/h}$$

* The maximum humidification capacity of the PAP10A1-K is 5.0 kg/h, and therefore it satisfies the required specifications.

<<Cooling + Heating Power>> Correction Coefficient Graph



* Refer to the correction chart on page 30 for information about the R Series used in constant-temperature (constant-humidity) facilities.

Dew point Temperature Chart (°C)

Possible Setting Range

Temperature (°C)	Relative Humidity														
	20%	25%	30%	35%	40%	45%	50%	55%	60%	65%	70%	75%	80%	85%	90%
5												1	2	3	4
6												2	3	4	5
7										1	2	3	4	5	6
8										2	3	4	5	6	7
9								1	2	3	4	5	6	7	7
10								1	3	4	5	6	7	8	8
11								2	4	5	6	7	8	9	9
12							2	3	5	6	7	8	9	9	10
13						1	3	4	5	7	8	9	10	10	11
14						2	4	5	6	7	9	10	11	11	12
15					2	3	5	6	7	8	10	11	12	12	13
16				1	2	4	6	7	8	9	11	12	13	13	14
17				1	3	5	7	8	9	10	12	12	14	14	15
18				2	4	6	7	9	10	11	12	13	15	15	16
19			1	3	5	7	8	10	11	12	13	14	16	16	17
20			2	4	6	8	9	11	12	13	14	15	16	17	18
21			3	5	7	9	10	12	13	14	15	16	17	18	19
22		1	4	6	8	9	11	12	14	15	16	17	18	19	20
23		2	5	7	9	10	12	13	15	16	17	18	19	20	21
24		3	5	8	10	11	13	14	16	17	18	19	20	21	22
25	1	4	6	8	11	12	14	15	17	18	19	20	21	22	23
26	1	4	7	9	11	13	15	16	18	19	20	21	22	23	24
27	2	5	8	10	12	14	16	17	19	20	21	22	23	24	25
28	3	6	9	11	13	15	17	18	20	21	22	23	24	25	26
29	4	7	10	12	14	16	18	19	20	22	23	24	25	26	27
30	5	8	10	13	15	17	18	20	21	23	24	25	26	27	28

Technical Data

Enthalpy Chart (kcal/kg)

Temperature (°C)	Relative Humidity													
	20%	25%	30%	35%	40%	45%	50%	55%	60%	65%	70%	75%	80%	100%
5	1.84	2.00	2.17	2.33	2.49	2.65	2.81	2.97	3.14	3.30	3.46	3.62	3.79	4.44
6	2.13	2.30	2.48	2.65	2.82	3.00	3.17	3.34	3.52	3.69	3.87	4.04	4.22	4.92
7	2.42	2.61	2.79	2.98	3.16	3.35	3.54	3.72	3.91	4.10	4.28	4.47	4.66	5.41
8	2.71	2.91	3.11	3.31	3.51	3.71	3.91	4.11	4.31	4.51	4.71	4.91	5.11	5.92
9	3.01	3.22	3.44	3.65	3.86	4.08	4.29	4.51	4.72	4.94	5.15	5.37	5.58	6.45
10	3.31	3.54	3.77	4.00	4.22	4.45	4.68	4.91	5.14	5.37	5.60	5.83	6.07	6.99
11	3.61	3.86	4.10	4.35	4.59	4.84	5.08	5.33	5.58	5.82	6.07	6.32	6.56	7.56
12	3.92	4.18	4.44	4.71	4.97	5.23	5.49	5.76	6.02	6.28	6.55	6.81	7.08	8.14
13	4.23	4.51	4.79	5.07	5.35	5.63	5.91	6.20	6.48	6.76	7.04	7.33	7.61	8.75
14	4.55	4.85	5.15	5.45	5.75	6.05	6.35	6.65	6.95	7.25	7.55	7.86	8.16	9.38
15	4.87	5.19	5.51	5.83	6.15	6.47	6.79	7.11	7.43	7.76	8.08	8.40	8.73	10.03
16	5.20	5.54	5.88	6.22	6.56	6.90	7.25	7.59	7.93	8.28	8.62	8.97	9.32	10.71
17	5.53	5.89	6.25	6.62	6.98	7.35	7.71	8.08	8.45	8.82	9.19	9.56	9.93	11.42
18	5.86	6.25	6.64	7.03	7.41	7.80	8.20	8.59	8.98	9.37	9.77	10.16	10.56	12.15
19	6.20	6.62	7.03	7.44	7.86	8.28	8.69	9.11	9.53	9.95	10.37	10.79	11.21	12.92
20	6.55	6.99	7.43	7.87	8.32	8.76	9.20	9.65	10.10	10.54	10.99	11.44	11.90	13.71
21	6.90	7.37	7.84	8.31	8.78	9.26	9.73	10.21	10.68	11.16	11.64	12.12	12.60	14.54
22	7.26	7.76	8.26	8.76	9.27	9.77	10.27	10.78	11.29	11.80	12.31	12.82	13.33	15.40
23	7.63	8.16	8.69	9.23	9.76	10.30	10.84	11.38	11.92	12.46	13.00	13.55	14.10	16.30
24	8.00	8.57	9.13	9.70	10.27	10.84	11.42	11.99	12.57	13.14	13.72	14.31	14.89	17.24
25	8.38	8.98	9.59	10.19	10.80	11.40	12.01	12.63	13.24	13.86	14.47	15.09	15.71	18.22
26	8.77	9.41	10.05	10.69	11.34	11.98	12.63	13.28	13.94	14.59	15.25	15.91	16.57	19.24
27	9.17	9.85	10.53	11.21	11.90	12.58	13.27	13.97	14.66	15.36	16.06	16.76	17.47	20.31
28	9.57	10.29	11.02	11.74	12.47	13.20	13.94	14.67	15.41	16.15	16.90	17.65	18.40	21.43
29	9.99	10.75	11.52	12.29	13.06	13.84	14.62	15.40	16.19	16.98	17.77	18.57	19.37	22.59
30	10.41	11.22	12.04	12.86	13.68	14.50	15.33	16.16	17.00	17.84	18.68	19.53	20.38	23.81
31	10.85	11.71	12.57	13.44	14.31	15.19	16.07	16.95	17.84	18.73	19.63	20.53	21.43	25.09
32	11.29	12.20	13.12	14.04	14.96	15.89	16.83	17.77	18.71	19.66	20.61	21.57	22.53	26.43
33	11.74	12.71	13.68	14.66	15.64	16.63	17.62	18.62	19.62	20.63	21.64	22.66	23.68	27.82
34	12.21	13.23	14.26	15.30	16.34	17.39	18.44	19.50	20.56	21.63	22.71	23.79	24.88	29.29
35	12.68	13.77	14.86	15.96	17.06	18.17	19.29	20.41	21.54	22.68	23.82	24.97	26.13	30.82

Specific Humidity Chart (kg/kg)

Temperature (˚C)	Relative Humidity												
	20%	25%	30%	35%	40%	45%	50%	55%	60%	65%	70%	75%	80%
1	0.00081	0.00101	0.00121	0.00142	0.00162	0.00182	0.00203	0.00223	0.00243	0.00263	0.00284	0.00304	0.00324
2	0.00087	0.00108	0.00131	0.00152	0.00174	0.00196	0.00217	0.00240	0.00261	0.00283	0.00305	0.00327	0.00348
3	0.00093	0.00117	0.00140	0.00163	0.00187	0.00210	0.00234	0.00257	0.00281	0.00304	0.00328	0.00351	0.00375
4	0.00100	0.00125	0.00150	0.00176	0.00200	0.00226	0.00251	0.00276	0.00301	0.00326	0.00351	0.00377	0.00402
5	0.00108	0.00135	0.00161	0.00188	0.00215	0.00242	0.00269	0.00296	0.00323	0.00350	0.00377	0.00404	0.00431
6	0.00116	0.00144	0.00173	0.00202	0.00231	0.00260	0.00289	0.00317	0.00347	0.00376	0.00404	0.00434	0.00462
7	0.00124	0.00155	0.00185	0.00216	0.00247	0.00279	0.00309	0.00340	0.00371	0.00403	0.00433	0.00465	0.00496
8	0.00132	0.00165	0.00199	0.00232	0.00264	0.00298	0.00332	0.00364	0.00397	0.00431	0.00464	0.00498	0.00532
9	0.00141	0.00177	0.00212	0.00248	0.00284	0.00319	0.00355	0.00391	0.00426	0.00462	0.00498	0.00533	0.00569
10	0.00151	0.00189	0.00227	0.00265	0.00303	0.00341	0.00379	0.00418	0.00456	0.00494	0.00532	0.00570	0.00609
11	0.00162	0.00202	0.00243	0.00284	0.00324	0.00365	0.00406	0.00447	0.00488	0.00529	0.00569	0.00611	0.00651
12	0.00173	0.00216	0.00260	0.00303	0.00346	0.00390	0.00434	0.00478	0.00521	0.00565	0.00608	0.00653	0.00696
13	0.00185	0.00231	0.00277	0.00324	0.00370	0.00417	0.00464	0.00510	0.00557	0.00604	0.00650	0.00697	0.00744
14	0.00197	0.00247	0.00296	0.00346	0.00395	0.00445	0.00494	0.00545	0.00595	0.00644	0.00694	0.00745	0.00795
15	0.00211	0.00263	0.00316	0.00369	0.00422	0.00475	0.00528	0.00582	0.00634	0.00688	0.00742	0.00795	0.00849
16	0.00224	0.00281	0.00337	0.00394	0.00450	0.00507	0.00563	0.00620	0.00677	0.00735	0.00791	0.00848	0.00906
17	0.00239	0.00299	0.00359	0.00420	0.00480	0.00540	0.00600	0.00662	0.00722	0.00783	0.00844	0.00906	0.00967
18	0.00255	0.00319	0.00383	0.00447	0.00511	0.00576	0.00641	0.00705	0.00770	0.00834	0.00900	0.00965	0.01031
19	0.00271	0.00339	0.00408	0.00476	0.00545	0.00614	0.00682	0.00751	0.00820	0.00889	0.00959	0.01028	0.01098
20	0.00289	0.00361	0.00434	0.00507	0.00580	0.00653	0.00726	0.00800	0.00874	0.00947	0.01022	0.01095	0.01169
21	0.00307	0.00384	0.00461	0.00539	0.00617	0.00695	0.00773	0.00851	0.00929	0.01009	0.01088	0.01166	0.01245
22	0.00327	0.00409	0.00491	0.00574	0.00656	0.00740	0.00822	0.00905	0.00990	0.01073	0.01157	0.01242	0.01326
23	0.00347	0.00435	0.00522	0.00610	0.00697	0.00786	0.00875	0.00964	0.01052	0.01142	0.01231	0.01321	0.01411
24	0.00368	0.00462	0.00555	0.00648	0.00741	0.00836	0.00930	0.01024	0.01119	0.01215	0.01309	0.01405	0.01500
25	0.00392	0.00491	0.00590	0.00689	0.00787	0.00888	0.00988	0.01089	0.01190	0.01290	0.01392	0.01494	0.01595
26	0.00416	0.00521	0.00626	0.00731	0.00837	0.00942	0.01050	0.01156	0.01263	0.01371	0.01480	0.01587	0.01697
27	0.00441	0.00552	0.00664	0.00776	0.00889	0.01001	0.01115	0.01228	0.01342	0.01457	0.01571	0.01687	0.01802
28	0.00468	0.00586	0.00705	0.00823	0.00943	0.01063	0.01183	0.01303	0.01425	0.01547	0.01668	0.01791	0.01914
29	0.00496	0.00621	0.00747	0.00873	0.01000	0.01127	0.01255	0.01383	0.01512	0.01642	0.01771	0.01902	0.02032
30	0.00526	0.00526	0.00792	0.00925	0.01060	0.01196	0.01331	0.01467	0.01604	0.01742	0.01879	0.02017	0.02157

Humidification Water Management and Water Processing Maintenance Recommendations

Supply 0.1-1 mS/m (1-10 µS/cm) of deionized water to the humidification unit.

Examples of Improper Choice of Water Processing Equipment

Raw Water

Typical Water Quality (Equiv. to tap water)
- Electrical Conductivity: 7-20 mS/m (70-200 µS/cm)
- Total Hardness: 20-100 mg/L
- Silica: 5-25 mg/L

No Water-Processing Equipment

- Electrical Conductivity : 7-20 mS/m (70-200 µS/cm)
- Total Hardness : 20-100 mg/L
- Silica : 5-25 mg/L

Water Softener

* Only removes hardness.
- Electrical Conductivity : 7-20 mS/m (70-200 µS/cm)
- Total Hardness : 1 mg/L or lower
- Silica : 5-25 mg/L

Cartridge Deionizer

- Electrical Conductivity: Initially: 0.1-1 mS/m (1-10 µS/cm)

No Humidification Trouble

But...if maintenance* is not carried out...

Primary Causes of Trouble

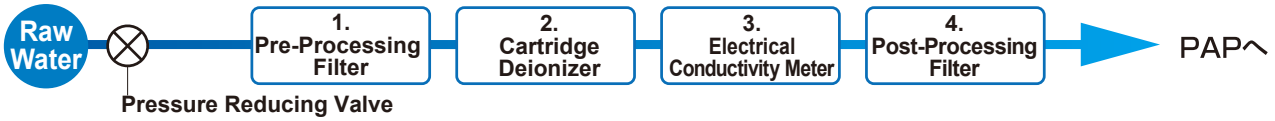
1. When Choosing
   A. When water quality problems exist in addition to hard water.
   B. Suitable pre/post filters are not chosen.
2. During Maintenance
   A. Regenerated salt components not are being managed.
   B. Scale removal (blow) is not being carried out.

Examples of Water-Quality Related Problems

	Scaling Residue in the Water Tank	Scaling Residue on the Float Switch	Scaling Residue on the Humidification Heater
Symptom			
Assumed Problems A	Reduced diameter of water supply line going to the humidification unit due to scaling ↓ Reduced water supply to the humidification unit due to reduced nominal diameter of line ↓ **Humidity Control Becomes Unstable**	Scaling residue on the float impedes proper action. ↓ Float switch malfunction ↓ **Leakage due to continuous uncontrolled supply of water**	Humidification water takes longer to heat up due to scaling. ↓ Reduced water supply to the humidification unit due to reduced nominal diameter of line ↓ **Humidity Control Becomes Unstable**
Assumed Problems B	The nominal diameter of drain piping inside the tank is decreased due to scaling. ↓ The flow of drainage water from the tank is reduced. ↓ **Water Takes Longer to Drain from the Tank. (Worse case: water doesn't drain.)**	Scaling residue on the float impedes proper action. ↓ **Float Switch Not Working -- Water Shortage Results** ↓ **Over-rise Prevention Activated (Worse case: fire outbreak)**	Corrosion forms on the heater due to scaling. ↓ Metal parts become corroded, resulting in holes forming in those parts. ↓ **Water Leaks into Holes Caused by Corrosion, Electric Shorts Occur**

* Regularly change the water in the humidification tank, and also blow out piping regularly. Consult your local sales staff for further details.

Water Piping Example for Deionized Water for Humidification



1. Pre-Processing Filter

A. Constituents to Remove
- Residual Chlorine (Activated carbon filter, etc.)
- Turbidity
- Iron, Manganese, Etc

* An activated carbon filter is commonly used, but other filters may additionally be used depending on the water quality.

2. Cartridge Deionizer

A. Constituents that can be Removed
- Ionized Substances

B. Purity: 0.1 mS/m (1 µS/cm)

3. Electrical Conductivity Meter

A. Included with ion exchange resin or RO membrane deionizers, but may also be installed separately down-line.

B. Choose a unit that can measure beyond the range of 0.1-1 mS/m (1-10 µS/cm).

* Note that using a water softener will prevent an exact measurement from an electrical conductivity meter.

4. Post-Processing Filter

A. Constituents to Remove
- Fine Particulate
- Bacteria

Other Water Processing Equipment

i RO Membrane (Reverse osmosis membrane)

A. Constituents that can be Removed
- Ionized Substances
- Organic Matter

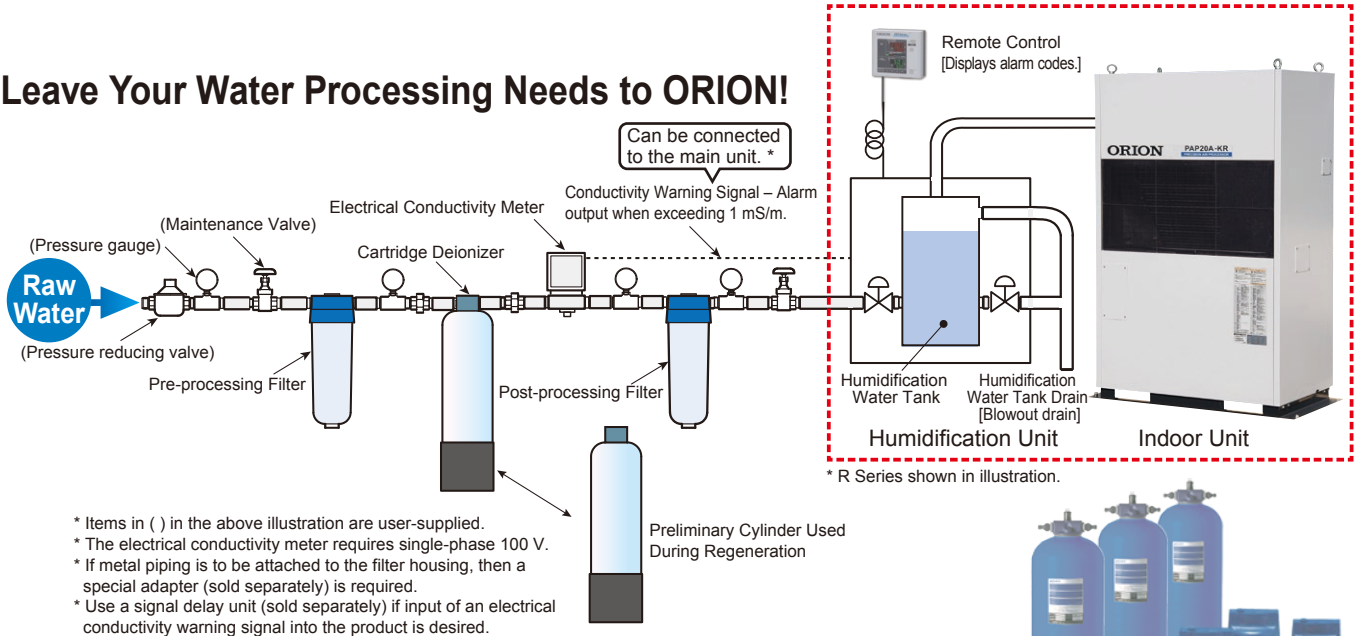
B. Purity: 1 mS/m (10 µS/cm)

ii Water Softener

A. Constituents that can be Removed
- Calcium Ion
- Magnesium Ion

B. Constituents that cannot be Removed
- Silica Constituents

Leave Your Water Processing Needs to ORION!



* R Series shown in illustration.

* Items in ( ) in the above illustration are user-supplied.
* The electrical conductivity meter requires single-phase 100 V.
* If metal piping is to be attached to the filter housing, then a special adapter (sold separately) is required.
* Use a signal delay unit (sold separately) if input of an electrical conductivity warning signal into the product is desired.

Preliminary Cylinder Used During Regeneration

Guideline for Choosing a Deionizer for Humidification

All of the deionizer models are made by Miura Co. Piping and support fittings not included. Please consult your dealer.

PAP Model	Cartridge Deionizer	Deionizer Regeneration Period *	Pre-Processing Filter	Post-Processing Filter	Filter Housing (Common for pre- and post-filters)
PAP20A-KR	IP-25E Incl. Electrical Conductivity Meter (7773-A101)	120Days [1.5L/h]	MOF-C2 250L	252L-SRL-010-PZ1µm 250L	1M1-PS 47063-05 250L
PAP40C-KR	IP-25E Incl. Electrical Conductivity Meter (7773-A101)	90Days [2.4L/h]	MOF-C2 250L	252L-SRL-010-PZ1µm 250L	1M1-PS 47063-05 250L
PAP80B-KR	IP-70E Incl. Electrical Conductivity Meter (7773-A101)	60Days [6.0L/h]	MOF-C2 500L	502L-SRL-010-PZ1µm 500L	1M2-PS 47063-09 500L
PAP120A-KR	IP-60E Incl. Electrical Conductivity Meter (7773-A101)	60Days [9.0L/h]	MOF-C2 500L	502L-SRL-010-PZ1µm 500L	1M2-PS 47063-09 500L

* Reference value when supply water electrical conductivity is 15 mS/m (150 µS/cm) and supply pressure to the air processor humidification unit is 0.08-0.2 MPa. The deionized water intake volume will differ depending on the supply water and the operating conditions of the air processor. Table values in [ ] are the assumed flow rate.
Note: Please consult Orion regarding use of water softeners or RO membrane water treatment.

⚠ Orion Products -- Service and Safety

● Safety Notes

・Before using this equipment, read the operating manual thoroughly and operate the equipment correctly as directed.
・Consult with a qualified professional or your ORION dealer for product installation and wiring.
・Please select a product that is suitable for the desired application.Do not use for other than intended purposes.
Use for other than intended purposes can lead to accidents or unit breakdown.

● Air-Cooled Spec. Models

If the condenser becomes clogged with dust or dirt, heat exchange will be greatly reduced and electricity consumption will increase. This will lead not only to decreased performance, but can also lead to the activation of built-in safety devices, and eventual damage to the equipment. For these reasons, the condenser should be cleaned on a regular basis.

● Water-Cooled Spec. Models

In general, water used to cool condensers will be well water, tap water, or water from a cooling tower. However water of insufficient quality can lead to scaling in cooling pipes resulting in lower levels of heat exchange, increased electricity consumption and lower performance. Therefore water quality should be confirmed on a regular basis.

Regarding After-Service

● Please contact your dealer for any repairs required after using this unit.
● Costs will be incurred by the customer for repairs conducted after the warranty period has expired. In cases where equipment function can be improved by certain service procedures, such procedures will be taken at the specific request of the customer.Spare parts are items necessary to maintain the proper function and operating specifications of the equipment.It is the policy of ORION to maintain a stock of replacement parts for 7 years after production of the product ceases.

Recommended Maintenance Inspections

● After having used the unit for a long time, actual performance may drop due to the effects of dirt or wear, etc. In order to realize continued best performance of this equipment, in addition to prescribed customer maintenance, it is also recommended that regular inspections be conducted. (Service and inspection fees apply.) For further information please consult with your dealer or contact ORION directly.

ORION is continuing to develop a complete and trustworthy nationwide network of expedient sales and service -- everywhere, anytime.

＊ORION has wide reaching regional service bases in various countries throughout the world.
Please consult your ORION dealer for details.

PERRY JOHNSON REGISTRARS, INC.
UKAS MANAGEMENT SYSTEMS
0105

ISO 9001, ISO 14001

ORION Machinery Co., ltd is an ISO Certified, Quality Management and Environmental Management company.

What is the ISO certification system?

ISO (International Organization for Standardization) is an established body that stipulates and certifies ISO9001 and ISO14001 directives. ISO9001 stipulates a system of Quality Management that ensures customer satisfaction and trust in a company's products and services it provides. ISO14001 stipulates a system of Environmental Management whereby production and business activities are carried out in an environmentally conscious manner.

For Inquiries, please contact the following representative:

ORION MACHINERY CO.,LTD.

International Group
246, Kotaka, Suzaka-shi, Nagano-ken, 382-8502 Japan
TEL +81-(0)26-246-5664 FAX +81-(0)26-246-5022
Email: kokusai@orionkikai.co.jp

Head Office & Factory
246, Kotaka, Suzaka-shi, Nagano-ken, 382-8502 Japan
TEL +81-(0)26-245-1230 FAX +81-(0)26-245-5424
URL: http://www.orionkikai.co.jp

This catalog contains product specifications as of October 2018.

No.3464 181214 5② SR ☆80