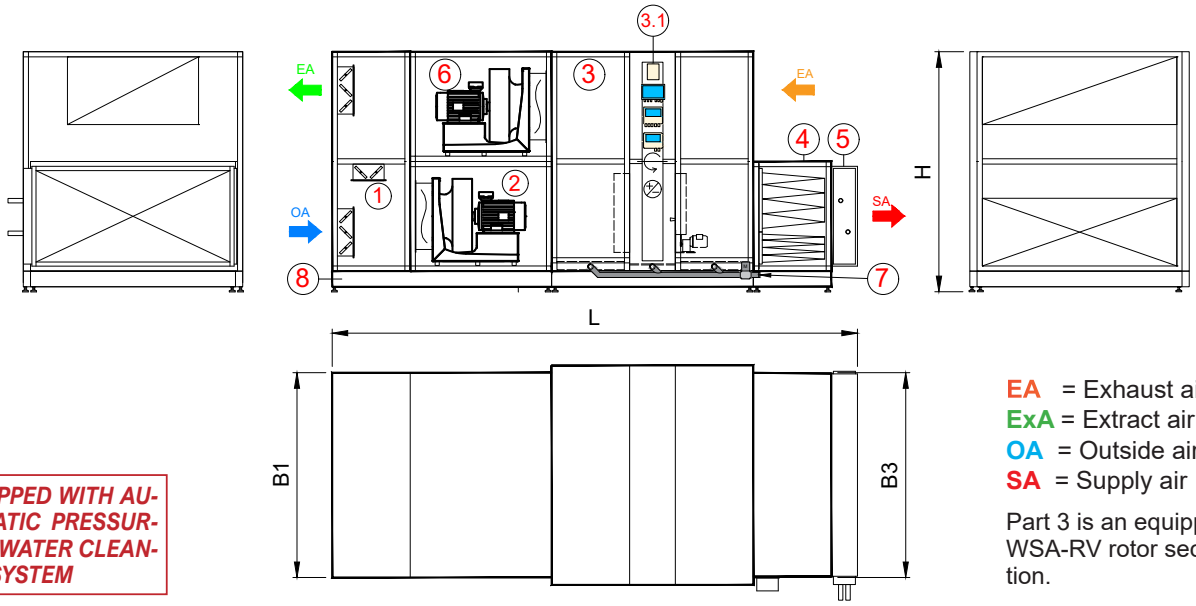
TANIPLAN OY

WSA-K AHU for welding shops

The WSA-K AHU with automatic cleanable Rotary Exchanger saves more than 80% of ventilation operating costs!



EA = Exhaust air
ExA = Extract air
OA = Outside air
SA = Supply air

Part 3 is an equipped WSA-RV rotor section.

EQUIPPED WITH AUTOMATIC PRESSURIZED WATER CLEANING SYSTEM

WSA-K UNIT SERIE is designed to be delivered: (1) pre-assembled, not equipped, (2) pre-assembled and equipped, or (3) as a piece of equipment. The unit includes a powerful heat recovery rotor, which is kept clean by an automatic high-pressure cleaning system. The rotor has a higher than usual efficiency of 74%.

THE SAVINGS ARE BASED ON AN EFFICIENT HEAT RECOVERY ROTOR AND LOW REPLACEMENT FILTER COSTS. THERE ARE NO EXHAUST AIR FILTERS OR OUTDOOR PRE-FILTERS. THE ANNUAL COST OF WASHING IS A FRACTION OF THE PRICE OF REPLACEMENT FILTERS!

SCOPE OF USE OF WSA-K UNITS

Typical applications are work shops and welding shops. Washable rotors have in Finland over thirty years of excellent user experience. If two units are used, the airflow is sufficient for a workspace of approx. 2500 m² in size.

VENTILATION REQUIREMENTS

The air distribution method is displacement ventilation, in which supply air is brought to the working area with low-speed terminals. See Design Bases on page 2.

MAIN DIMENSIONS OF WSA-K UNITS

The dimensions L, B1 and B3 in the table are indicative. Depends on the ventilation device used.

Unit size	V max (m^3/s)	L (mm)	B1 (mm)	B2 (mm)	B3 (mm)	H (mm)
WSA-K-2.5	2,8	4705	1055	1750	1360	2260
WSA-K-4.5	4,5	5050	1970	2110	1970	2260
WSA-K-7	7,7	5210	1970	2750	2275	2850

Table 1: Main dimensions and maximum airflow

PARTS LIST

1. Outdoor air-extract air-return air chamber. Return air is used only for heating downtime.
2. Supply air fan, direct drive
3. Rotor section WSA-RV ready for installation
- Splashproof chambers and RFe drainage basins
- Rotor, special material for washing up to 120 bar- resistance to high pressure water. A third water collection basin is installed in the rotor casing.
- Cleanng device WSA-C70 using cold water 70 bar, compressed air 7 bar, tested with water at the factory. Includes conveyor belt, nozzle tray and nozzles for water and air.
- Washing jet receiving gutter behind the rotor
- Cleaning control system RCC+RDC, rotor control center and the terminal block housing **(3.1)** are mounted and cabled on the outside of the rotor casing.
4. Supply air filter F6 or F7
5. Heating coil, hot water
6. Exhaust air fan, direct drive
7. Drainage equipment, incl. ball spindle valve
8. Beam platform with adjustable legs
9. Standard equipment
- Inspection windows and lighting 2 pcs
- Air flow meters
- EMC safety switches for motors cabled

10.Accessories
- On-site user guidance and commissioning
- Inverters
- Electrical and control equipment and internal cabling
- High pressure washer 70 bar, cold tap water

DESIGN BASES OF VENTILATION IN THE WORKSHOP

1. DISPLACEMENT AIR DISTRIBUTION

In displacement air distribution, supply air that is colder than room air is brought to the working area using low-speed terminals. The impurities generated in the process rise with the warm air to the upper part of the room, from where they are led out with the exhaust air. The supply air terminals are mainly located at the edges of the workspace, but some of them can also be placed in the middle of the room 3-4 m above floor level. The principle is that the filtered supply air flows to the workstations with as little turbulence as possible. Correct implementation of air distribution always requires expert designing. The air distribution system shall conform to the conceptual drawing (Figure 1) in order to maintain contaminants above the seating area. The supply air temperature is 1-3 °C lower than the room temperature.

2. THE AMOUNT OF VENTILATION

In welding plants, based on practical experience, the measured air exchange is about **2.2 x the room volume per hour**. This is enough for a plant performing heavy welding work, too. The most important thing is to distribute the supply air evenly over the entire working area. Exhaust air is collected at 1-3 points at the highest point in the production room.

Note 1:
Air-circulating filtering devices shall not be used in combination with displacement ventilation, as toxic welding gases will then mix with the room air.

Note 2:
Mechanical filtration of air with circulation leaves welding gases in the room air. Only sufficient displacement ventilation ensures layered room air and good air quality throughout the work-space..

3. CLEANING SYSTEM REQUIREMENTS

The cleaning device is connected to a water hose from the high-pressure washer and to a 6-7 bar compressed air network. cleaning water is discharged through the drainage equipment into the tank or directly into the building's sewer system.

3.1 Starting the cleaning cycle

Cleaning is started according to the time schedule from the building control system. The interval between cleaning cycles depends on how much dirt accumulates in the rotor, i.e. the fouling rate is always case-specific. Since the cost of one wash is very small, in practice it is enough to wash the disc often enough.
Practical guidelines for the length of the washing interval and a detailed description of the wash can be found on page 3 under "CLEANING DEVICE WSA-C-70".

3.2 Washing water and compressed air

The water and air nozzles of the rotor washer are connected to the high-pressure washer and pressurized air with hoses included in the delivery. Outside the WSA-unit solenoid valves are required for water (0.17 l/s) and compressed air (7 bar/102 l/min). The valves are controlled from the WSA-RV rotor section Cleaning control system.

Technical data:

Pressure washer	Motor (kW)	Press. (bar)	Cold water (l/s)	Air 7 bar (l/min)	Controller
WSA-C-70	4,5	70	0,17	102	RCC

3.2. Sewage treatment

The washing water is led out of the unit's water collection basins through the drainage equipment. The motor valve for drainage fitting is open during the washing cycle and is closed when washing is completed. This prevents supply air being blown into the engine room.
On a case-by-case basis, drained washing water sometimes has to be discharged into an intermediate tank. The tank is not included in the equipment delivery. The volume of this container must be large enough to provide an appropriate interval between cleaning and emptying.
Table 3 (Page 3) shows the water consumption per wash. In 1-shift work, this amount of water accumulates in 2 weeks, in 2-shift work once a week and in 3-shift work twice a week. The volume of the tank is selected based on these data.

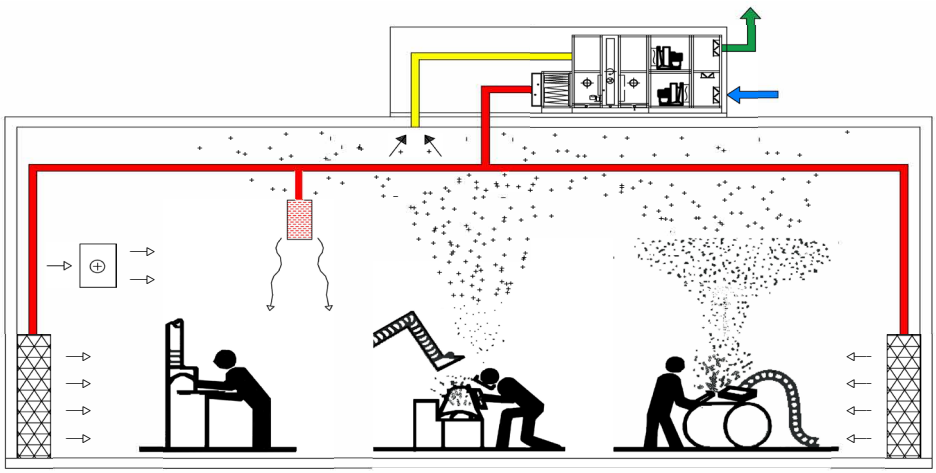


Figure1: The principle of displacement ventilation

SELECTION OF A READY-TO-INSTALL UNIT WSA-K

There are three AHU sizes and two rotor power options. The maximum airflow rate is selected on the basis of a rotor efficiency of 73 or 74%. The maximum airflow rates of the instruments are in yellow boxes.

Example 1: The required airflow rate is 4.3 m3/s ->The unit size is 4.5, the rotor power class is 2. The efficiency is > 74%.
Example 2: The required airflow rate is 13 m3/s -> Implementation with two instruments a' 6.5 m3/s. The instrument size is 7 and the rotor power class is 2. The efficiency is >75%.

Rotor	Power class 1				Power class 2			
η (%) f=1:1	76	75	74	73	77	76	75	74
Δp rotor (Pa)	129	143	159	172	177	200	221	243
Unit size	V (m^3/s)				V (m^3/s)			
WSA-K-2.5	1,83	2,03	2,24	2,44	2,05	2,29	2,53	2,80
WSA-K-4.5	3,00	3,31	3,61	3,94	3,33	3,72	4,11	4,51
WSA-K-7	5,14	5,69	6,28	6,75	5,69	6,38	7,02	7,69

Table 2: Selection of unit size

CLEANING DEVICE WSA-C-70

WSA-C-70 is an automatic washing device that uses high-pressure cold water to clean the rotor. The adhering dirt is loosened and crushed at the inlet edge of the rotor and transferred with the water jet through the rotor to the receiving gutter. Cleaning device parts are:

- Cleaning rail, nozzle tray, conveyor belt and conveyor motor
- High pressure nozzle for water (70 bar) and compressed air (7 bar)
- Jet receiving drip pan behind the rotor
- Controller RCC, RCD and rotor control cabled
- Solenoid valve for water (not included)
- Solenoid valve for compressed air (included)
- Pressure washer and water/compressed air hoses
- System testing with water at the factory

Figure 3: Cleaning device

Figure 4: Receiving chute

The cleaning system is delivered installed in place and tested. The high-pressure washer and water /compressed air hoses are delivered separately.
Cleaning is started either according to the time program from the building control or manually according to the recommendation below.

- 1-shift work Every two weeks
- 2-shift work Once a week
- 3-shift work Twice a week

Figure 5: Nozzles

Figure 6: Control center

At the beginning of the washing cycle the nozzle sled is moved near the rotor hub, the water and compressed air solenoid valves open, the high-pressure washer starts and the nozzle sled begins to be moved to the circumference in steps 10 mm at a time. For the washing period, the rotor rotation is controlled by the center RCD. After each move, the tray is stopped for one rotor revolution to clean the 10 mm wide area of the rotor. When the tray has stepped all the way to the circumference of the rotor, the entire rotor has been washed.
The compressed air nozzle after the water nozzle blows water away from the rotor throughout the wash.
As additional drying, a second wash cycle without water is often used, in which case compressed air dries the rotor disc.

Figure 7: Pressure washer

THE COST OF WASHING COMPARED TO THE COST OF FILTERING EXHAUST AIR

Unit size	Building volume (m^3)	Cleaning cost (EUR/a)			Exhaust air. filter cost (EUR/a)			Water consumption max. (dm^3/wash)	Duration of cleaning (min.)
		1-shift	2-shift	3-shift	1-shift	2-shift	3-shift		
WSA-K-2.5	4600	76	152	304	2780	5560	11120	460	48
WSA-K-4.5	7400	104	209	417	4160	8320	16640	620	65
WSA-K-7	12600	138	276	553	5590	11180	22360	800	84

Table 3: Cost of washing, water consumption and duration of washing

The washing process uses cold domestic water and compressed air of 6-7 bar. The cost of washing depends on the diameter of the rotor, as well as the cost of water and electricity. The annual cost of washing is a fraction compared to the cost of replacing filters in an instrument with exhaust filters,

ENERGY SAVING, CONSUMPTION AND OTHER COSTS

*) Criteria: Electricity 110 €/MWh, heat 80 €/MWh. Water 3,6 €/m³, running time 80 h/week. For efficiency, see table 2 and table 5.

Unit size	Ventilation max. (m^3/s)	Building volume (m^3)	Cleaning cost (EUR/a)			Exhaust air filter cost (EUR/a)			Water consumption (dm^3/wash)	Energy saving / consumption MWh/a *) Climate zone I..IV (design outside temperature)			
			1-shift	2-shift	3-shift	1-shift	2-shift	3-shift		I (-26°C)	II (-29°C)	III (-32°C)	IV (-38°C)
WSK-2.5	2,8	4580	76	152	304	2800	5600	11100	458	142/10	149/11	160/13	198/22
WSK-4.5	4,5	7360	104	209	417	4200	8300	16600	620	229/16	239/18	257/21	318/36
WSK-7	7,7	12600	138	276	553	5600	11200	22400	801	391/27	409/30	440/36	544/61

Table 4: Heatin energy consumption.
*) Outside air is heated to +15°C, the exhaust air temperature is 20°C.

UNIT DELIVERY OPTIONS

1. PRE-ASSEMBLED AND EQUIPPED

1.1 Factory assembled non-equipped: WSA-K

The cased unit sections and the ready-to-install rotor section WSA-RV are pre-installed on a beam base. The rotor section is always factory tested and electrified. Standard equipment (9) according to the parts list on page 1 is fitted to the instrument.

1.2. Pre-equipped AHU: WSA-K-V

Configuration 1.1 is fitted with the accessories listed on page 1. The frequency converters, group centre and control equipment have been installed and internal cabling has been completed at the factory. The device is tested before delivery at the factory. Testing on site and user guidance are included.

1.3. Units supplied in pieces WSA-K-P

In the piece delivery, the unit parts are connected and installed on site. Accessories are supplied according to the customer's choice.

1.4 About ready-to-install instruments

The physical sizes of WSA-K enable normal road transport anywhere. When the airflow of one unit is insufficient, two units are used in parallel, In this case, the functions of two instruments can be programmed behind one controller.

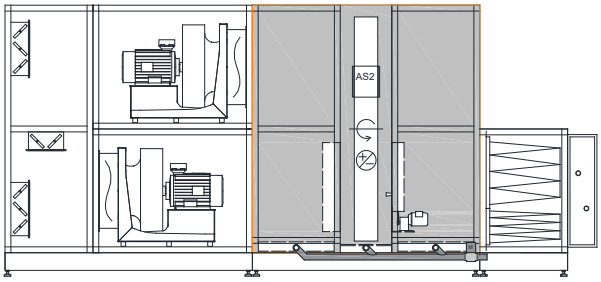


Figure 8: Delivery assembled and, if desired, equipped. WSA-K or WSA-K-V, see sections 1.1 and 1.2.

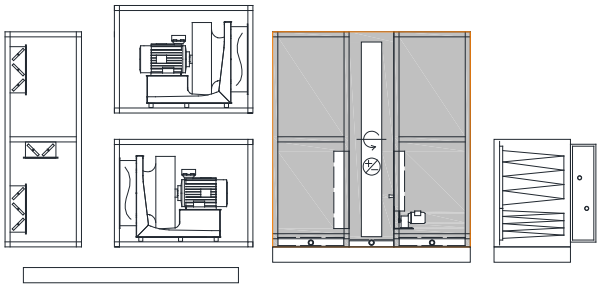


Figure 9: AHU delivery in pieces, unit type WSA-K-P

In the type designation:
K = AHU comprising all instrument parts
V = AHU with all equipment
P = AHU to be supplied in pieces. Accessory if included are installed on site.

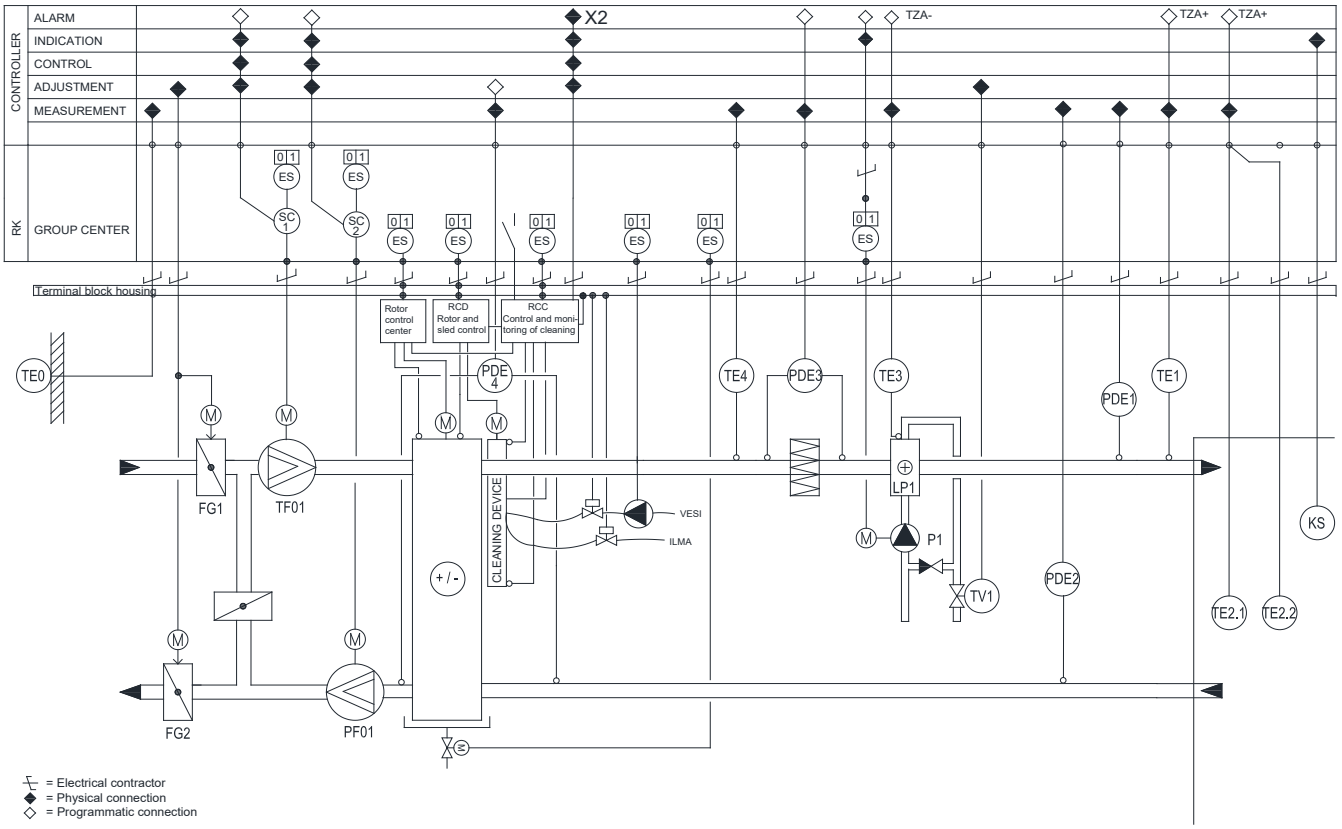
HIGH AIRFLOWS: WSA-R UNITS ARE USED AT 9..38 m³/s

In large workshops, when even two WSA-K-7 instruments do not have sufficient airflow, WSA-R rotor units are used. These devices can achieve air flows of 9...38 m3/s with an efficiency according to the Eco Directive 2018. The WSA-R product catalogue can be found on Taniplan Oy's website **www.taniplan.fi**

We have implemented dozens of workshop air conditioning projects with pressure-washable rotors, starting with Finland's first ventilation unit with a washable rotor in 1991.
Taniplan Oy has developed this system further. We are happy to help our customers and end users of products in all related design matters.
We do free of charge calculations related to operating costs and profitability of investments to support your investment decisions.
Taniplan Oy has been a pioneer in energy saving since 1983.

Jussi Tani, CEO

OPERATION DIAGRAM OF AN EQUIPPED WSA-K UNIT



DESCRIPTION OF THE OPERATION

Running times are controlled according to the time program of the control system. With the switch KS, the running is controlled outside the program. ,Rreturn air is not used during working hour.
Heating during ithe downtime: Dampers FG1.. 3 drive into the convection position. The TE1 setpoint is adjusted based on TE2.1/TE2.2 measurement.

Rotor washing operation

Washing starts according to the time schedule when the unit is at a standstill. The water and air nozzles are mounted on a conveyor sled that runs on a rail parallel to the rotor radius. The control panel RCC is given a starting pulse (min. 3 s). The rotor rotation speed and conveyor sled are controlled by a regulator RCD.
The sled is driven near the rotor hub. The solenoid valves for water and compressed air, as well as the shut-off valve for the sewer fitting, are opened and the pressure washer is started. After each rotation of the rotor, the cleaning device advances along the width of the nozzle jet 10 mm. In this way, the rotor is completely cleaned of its entire surface..
When the cleaning cycle is completed, the high-pressure washer is stopped and the water solenoid valve closes. The nozzle sled is driven to the circumference of the rotor and the compressed air solenoid valve closes. The motor valve of the sewer fitting closes after the water drainage time (1-2 h).

If additional drying of the rotor is selected, it will turn on automatically after the washing cycle. In additional drying, a wash cycle is run without water, in which case the compressed air dries the disc additionally.

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