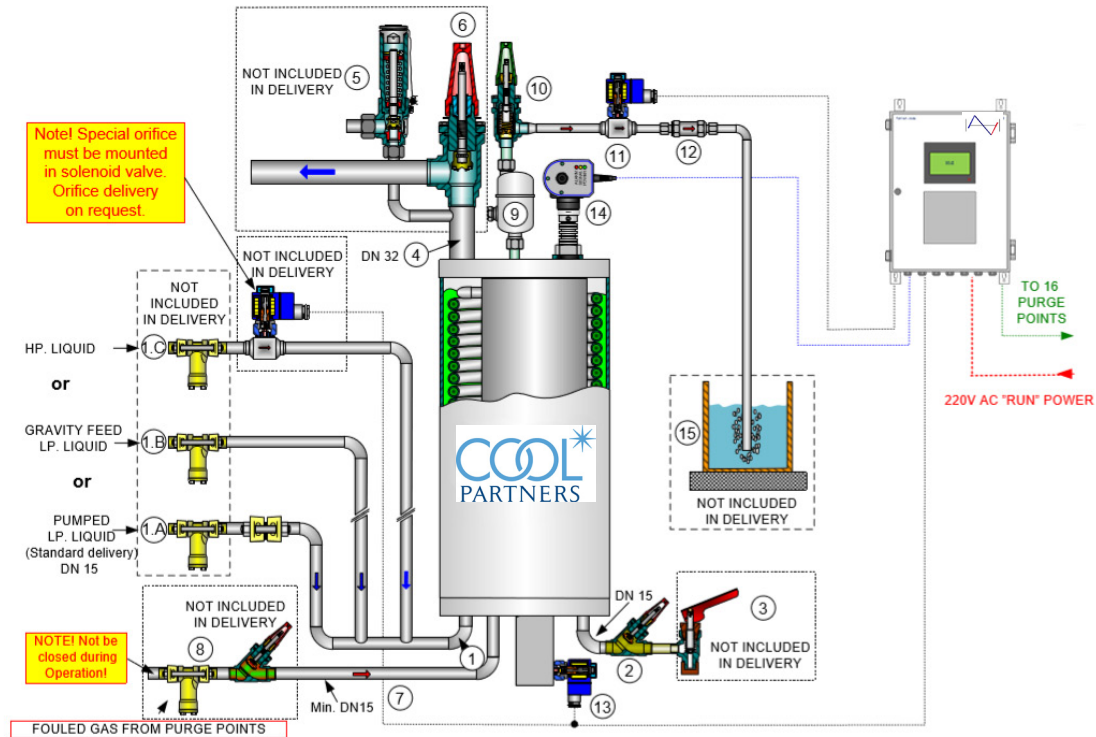


## Air purger type CPA10-3 with AV-AIR Controller C16 data sheet, installation, instruction and service manual



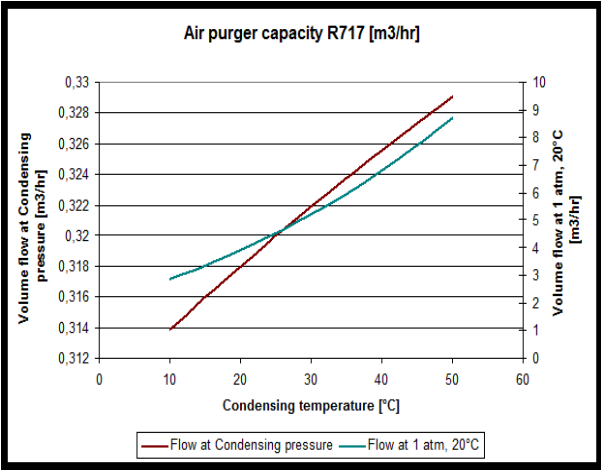
- Proven performance
- Suitable to work with NH<sub>3</sub> plant from 350kW upto 27000 kW
- Standard 16 purge points and option upto 32 purger points
- Record of qty of purged out air
- Works with liquid pump systems, HP valve systems, gravity feed systems
- Easy installation

**The only air purger that works efficiently and remove air out of  
NH<sub>3</sub> systems**

CPA10-3 Air purger nominal condensing capacity 10 kW Mk. 3 Description of (pos. no.) function and items

The heat exchanger in the air purger has a nominal design capacity of 10kW at 10°C differential pressure / temperature between suction pressure and condensing pressure on the system it is connected to. At larger pressure/temperature differences the capacity increase to a maximum of 13kW. The low pressure side connected to the air purger needs to be able to deliver this capacity. However the actual air (non condensable gas) venting capacity is dependent on the amount of non condensables in the condenser. On the high pressure side the air purger draws refrigerant gas and non condensables into the purger with a minimum of 10kW's capacity, ensuring that the purger vents as much non condensables as possible during its operation. Due to its high capacity it is recommended that on small systems the purger is only run for a relatively short period of time every day. Once the general level of non condensibles has been brought down to a low level, one hour once or twice a day is often appropriate. In conjunction with this we recommend that you compare the time the air purger is in operation with the time it vents. If the air purger vents a majority of time in operation, it is likely possible to get more air out by increasing the time in operation. On the other hand, if the air purger only vents for a short period of time during operation, it is recommended to shorten the time in operation and thereby saving the 10kW of heat load. Once the air purger gains access to large pockets of air, its capacity will be very large and not limited to the condensing capacity of the coil as illustrated in below diagram.

Purge flow by volume at condensing pressure. Liter/minute



CT / °C	At condensing pressure	At atmospheric pressure
10	5.23	47.8
15	5.27	56.0
20	5.30	65.2
25	5.33	75.5
30	5.36	86.9
35	5.40	99.5
40	5.43	113.3
45	5.46	128.4
50	5.48	144.9

The diagram outlines the amount of air purged per hour from the air purger as a function of the condensing pressure. The green curve illustrates the volumetric flow rate of air out of the air purger at atmospheric pressure (1bar), while the red curve shows the volumetric flow rate of air out of the air purger at condensing pressure. The mass flow is the same for the two curves. In other words the green curve shows the volume of the air when it is purged out of the air purger and the red curve shows how much volume the air occupied in the condenser at condensing pressure. By using the diagram the purged volume of air can be calculated, from the total time the purge solenoid valve has been opened. Example: If the purge solenoid valve has been open 10.250 seconds since the last venting and the average condensing pressure has been 22°C, the purged air (non condensable gas) volume will be: 10250/3600 = 2.8477 hours of open time (2 hours and 51 minutes) Air (non condensable gas) volume at atmospheric pressure (green curve): 3.9 m³/hr x 2.8477hrs = 11.1 m³= 11100 liters. Air (non condensable gas) volume at condensing pressure (red curve): 0.319 m³/hr x 2.8477 hrs = 0.908 m³= 908 liters. This means 908 liters of space in the condenser would have been occupied by air (non condensable gas) and would not have been used for condensing refrigerant resulting in higher condensing pressure if it wasn't purged out by the CPA10-3 Note: The "rule of thumb" is that every degree Celsius the condensing pressure rises the power consumption on the compressors will rise approx 3% and the cooling capacity will be approx 1% lower.

Installation:

If the CPA10-3 air purger is installed with either pumped or high pressure liquid feed (standard installation, see enclosed drawing), it does not need to be installed in any specific position in relation to the condenser, high pressure receiver etc. The CPA10-3 can be installed anywhere convenient for your system. If the CPA10-3 is installed for gravity feed circulation (see enclosed drawing), it needs to be placed appropriately in relation to the feed reservoir to enable a low pressure liquid flow into the air purger. The height difference requirement to secure this gravity circulation of the refrigerant is to place the CPA10-3 a minimum of 0.5 m. below lowest liquid level in the low pressure liquid separator. Important: The foul gas (pos 8) line from the condenser must be a minimum DN15 (½") and all the valves in this line should be a minimum DN 15 (½") (solenoid valves, stop valves) to ensure the necessary capacity can be transported to the air purger while it is purging. NOTE: Foul gas line must be connected to DN10 (3/8") inlet on purger, but should be DN15 until last possible moment.

Description of positions and function The following numbers refer to the position numbers in the enclosed drawing.

- 1) Connection for liquid supply: DN 15 (½").  
Function: The Low pressure liquid fills the CPA10-3 outer vessel to keep the inner vessel and coil cooled. The liquid supply can be done in three different ways either by low pressure pumped liquid, gravity circulation, or by high pressure liquid.
  - Pos. 1 A is the standard connection for the liquid supply to a low pressure pumped liquid line through the included orifice Ø 3,0 mm (pos.1.A).
  - Pos. 1.B is the connection type to be used if the CPA10-3 is feed by gravity circulation. When using gravity circulation the CPA10-3 must be placed min. 0,5 m below lowest liquid level in the low pressure liquid separator and the Ø 3,0 mm orifice must be removed.
  - Pos 1.C If the CPA10-3 is feed by high pressure liquid supply a Danfoss EVM + CVH (not included in delivery) + special orifice screw (Ø 1,2 mm included in delivery on request ) must be used. The special orifice screw must be mounted in the EVM solenoid valve (pos. 1.C) and the EVM mounted in the CVH housing. The EVM solenoid valve (pos. 1.C) must be opened when the air purger get "run" power from the refrigeration system by the same power supply as the EVM in pos. 13. and the HBCPA10-3 controller. The CPA10-3 must be stopped when the refrigeration systems stops and / or when the liquid separator it is connected to gives alarm / warning for high level. Otherwise there is a risk of overfilling the low pressure liquid separator.
- 2) Stop valve: DN15  
Function: Stop valve for oil draining Note: The costumer/user must mount a quick closing valve (self closing) (Pos. 3 not enclosed in delivery), for instance a quick closing drain valve, according to the local rules and regulations where the purger is mounted.
- 3) Quick closing drain valve. (Not enclosed in delivery)  
Function: Safety function during oil draining. Note: This valve must be mounted by the user according to local rules and regulations.
- 4) Connection to "wet" suction line: DN 32 (1 ¼") stainless steel. Function: Connects the air purger to the low pressure liquid separator.
- 5) Safety valve according to local rules and regulations. Not included in delivery. For calculation of safety valve for the CPA10-3 , an outer surface of 0.45 M² can be used.  
Function: Securing the vessel against excessive pressure. A safety valve must be selected and mounted by the user according to local rules and regulations.
- 6) Stop valve: DN32. Not included in delivery.  
Function: Close the "wet" suction line from the air purger for service etc.

7) Connection to fouled gas from purge points: DN 10 (3/8") stainless steel.

Function: Connects the internal coil with the purge points. Note: The connection from the coil to the purge points must be min. DN 15 (1/2") and the connection must never be closed during operation of the CPA10-3 as this can result in an unintended refrigerant gas release from the air purger.

8) Stop valve: DN15. Not included in delivery.

Function: Closing the fouled gas line from purge points during service. NOTE: This valve must never be closed during operation of the air purger as it can result in an unintended release of refrigerant gas thru the air purger vent line.

9) Air vent: Armstrong air vent type 11AV (part number: 99108044).

Function: The air vent is only an extra safety device against liquid refrigerant release in the event of electrical or mechanical problems. The air vent acts as a float valve that will only allow vapor to pass. As the air vent only has a metallic seal, it will not be able to close completely tight, so in the event of a major malfunction of the air purger a very small discharge of refrigerant vapor through this air vent can be observed.

10) Stop valve: DN15 or similar

Function: Stop valve for service of the air purging pipe and valve

11) Solenoid valve with special built in orifice: EVM pilot solenoid valve, with special orifice mounted in CVH pilot valve housing.

Function: When the solenoid valve opens it allows for air purging. Regulation: The solenoid opens when the liquid level in the separation chamber is pressed below the lowest switch point of the special level probe by the air (non condensable gas) above the liquid surface. The solenoid valve closes again when there has been enough air purged allowing the liquid level to reach the upper factory preset switch point of the level probe.

Note: A time counter is integrated in the AV-AIRC16 control box, counting how many seconds the purge solenoid (pos11) has been open. This gives a fairly accurate measurement of how much air has been purged from the system. Please see the diagram and example on page 1.

12) Check valve: Parker stainless steel hydraulic check valve with max. 0.5 bars opening pressure or similar.

Function: The check valve ensures that ambient air or water from a water reservoir/bubbler is not drawn into the CPA10-3 in the event of a malfunction where the pressure in the CPA10-3 could drop below atmospheric pressure.

13) Solenoid valve with special built in orifice: EVM pilot solenoid valve, with special expansion orifice mounted into the internal connection housing of the CPA10-3

Function: CPA10-3 on/off valve. The solenoid valve will start the CPA10-3 when it opens and stop the CPA10-3 when it closes. The special expansion orifice and the internal connection housing work as an expansion valve for return of condensed liquid to the suction side of the refrigeration system. Once the solenoid valve opens, the condensed and sub cooled liquid in the CPA10-3 separation chamber is drained back and expanded through the connection housing to the CPA's external chamber. As the separation chamber is drained for condensed liquid, new refrigerant and non condensable gas is drawn into the CPA10-3 for separation.

Regulation: The EVM must be energized when the AV-AIRC16 control box is energized. NOTE: The EVM solenoid valve must be energized by the power supply line to the AV-AIRC16 control box so the EVM is always open when the control box is energized.

14) Capacitive liquid level probe: A HBLC-SW3 special level control rod with build in heating element and two factory calibrated preset switch points for correct function.

Function: When the volume of air (non condensable gas) in the separation chamber increase it will displace the volume of condensed refrigerant in the separation chamber and the liquid level will drop. The level probe will open the air vent solenoid valve at low liquid level and close it again at high liquid level. Regulation: When the level drops below the lowest preset switch point on the level probe (pos. 14), the air purge solenoid (pos11) opens and the air (non condensable gas) purge at condensing pressure through the purge solenoid with its special orifice (pos.11). When the liquid level reach the upper preset switch point on the level probe (pos.14) the air purger solenoid (pos10) closes.

15) Water filled reservoir. Not included in delivery.

Function: Absorption of any ammonia gas that might be purged with the air (non condensable gas). Bubbles that pass through the water to the surface are air (non condensable gas), while bubbles that disappear in the water will be ammonia gas. Note: The ammonia content in the purged air will depend on the difference between the saturated condensing and saturated evaporating temperatures respectively. A large difference will result in a very low content of ammonia, while a low difference will result in a somewhat higher content.

16) AV-AIR C16 Control box: A complete control box for CPA10-3 (and CPAM) with connection for up to 16 purge points

Function: Start delay: The control box will delay the possible opening of the air out blow valve in 05 to 60 minutes (adjustable) from the start of the air purger to ensure that the CPA10-3 and the refrigeration system are in balance before it is allowed to vent air out. Recommended standard setting is 10 minutes. The delay time can be set longer on systems where it takes a long time for the starting compressors to make normal differential pressure in the system. The delay time can be set shorter if the starting compressor makes normal system differential pressure very quickly.

Liquid level indication: At normal operation the display on the AV-AIRC16 Control box will show the liquid level in the separation chamber of the CPA10-3. By following the liquid level it can be seen if air is building up in the separation chamber as the liquid level will slowly drop. When the level reaches the preset low switch point the air vent valve is opened. The air vent is closed again when the liquid level reaches the preset upper level. This can be followed on the AV-AIRC16 Control Box during operation.

Air purging start and stop: The control box will allow the CPA10-3 to vent air when the inner chamber is filled with air (non condensable gas) and after the start up timer has run out. The air purging starts when liquid level reaches the lower preset switch point of the special HBLCSW3 liquid level sensor and stops again when the liquid level reaches the preset upper switch point.

Purge time counter: The control box has a build in purge time counter so the volume of air purged can be calculated from the curves enclosed in the description material. The time counter counts the time the air vent valve (pos.11) has been opened in hours, minutes and seconds. On the operation screen total purge time can be seen. The total purge time is the total time the air vent valve (pos.11) has been open no matter the control box has been switched off (or lost power etc.) as the time is stored in the memory of the control box.

Purge points: The control box has connections for up to 16 purge points. When a time (05 to 30 minutes) is set for a purge point the purge point will be active. If zero (0 minutes) is entered for the purge point the purge point is not active.

Note: It is very important that only the purge points which are connected to the refrigeration system are set to be active in the control box. Otherwise the air purger can be turned on with no open connection to the fouled HP gas which can lead to an unintended release of refrigerant vapor.

Communication Port RS485  
The communication port RS485 is enable and you can extract data from controller to your PLC. Data re-trievable are 1)Liquid level, 2) Number of purge point, 3) Current active purge point, 4) Total purge time

CB  
The circuit board is protected by an 10A CB.

Regulation:  
When the refrigeration system is ON and the user wants to run the CPA10-3 air purger: The CPA10-3 ON solenoid valve pos. 13 AND the (optional) liquid solenoid valve pos. 1.C AND the control box pos. 16 AND the (optional) purge point sequencer pos. 17 must be switched ON by 240 V ac.  
Power supply.

Safety

- It is the customers/users responsibility to connect the air purger to a safety valve system in accordance with local rules and regulations. For calculation of safety valves an outer surface of the air purger vessel of 0.45 m² can be used.
- The customer/user must mount a quick closing drain valve on the oil drain in accordance with local rules and regulations.
- The customer/user must ensure that the air purger cannot be activated without access to an open purge point. If this requirement is not met it can result in refrigerant in the air purge line.
- It is not possible to get trapped liquid in the air purger as long as no service stop valves are closed since solenoid valves can open backwards allowing trapped liquid to escape.

Note:

It is recommended to check the refrigeration systems water content on the low pressure side, when air is found in the system as the air brings moisture with it. Since air and water are pollutants in a refrigeration system, the presence of them have serious consequences for the system’s capacity, power consumption, efficiency and maintenance cost. If any water is found in ammonia refrigeration systems it is recommended to mount a CPW-15 to clean the system for water and other impurities.

Practical installation guidelines

1. The CPA should be installed at a position which is easy to access and conduct service.
2. All systems might not be clean and there is dirt, particles, foreign agents in the system and it will block the valve at the bottom of the CPA. Cleaning will be needed.
3. The Controller should be installed near the CPA and under the roof. Should you need to extend the control cable provided by us, you must make sure the cable is of compatible screen type. Silver solder the connection points. Control cable may not be ran together with high voltage cable to avoid electrical noise/disturbances
4. There should be a main CB near the controller for easy setup and service
5. There should be filter on all solenoid valves at purge points.
6. If possible, you should have all purge pipes run down to lower level before joining the common pipe go to the CPA. The solenoid valves can be at one station for easy checking and replace the coil when needed.
7. Make sure the liquid pipe from LP vessel is not from the lowest point of the vessel. There is a risk of having decomposed oil from LP vessel enter the CPA and the CPA will not work properly.
8. Feed the liquid from LP vessel which should always be in operation mode. e.g. cold storage
9. All valves should be fully opened in operation mode (Only one solenoid valve at purge points should be energized)
10. The vessel should be insulated

Trouble shooting:

Condition	Possible cause/Solution
A little constant smell of ammonia from the air vent pipe and Arm-strong liquid trap (pos. 9) very cold at the bottom.	<ul style="list-style-type: none"><li>• Electrical failure keeping the air vent solenoid valve (pos. 11) open when there is no air trapped in the air purger.</li><li>• Air vent solenoid valve (pos. 11) is leaking.</li></ul>
High concentration of ammonia gas released when the air purger is purging air.	<ul style="list-style-type: none"><li>• There is no open connection to at least one purge point. This could be caused by a broken coil or an electrical problem where no solenoid valves at the purge points are open or a closed service stop valve in the fouled gas line</li><li>• Liquid feed orifice clogged</li></ul>
The air purger does not seem to have any condensing capacity.	<ul style="list-style-type: none"><li>• The coil on the ON / OFF solenoid valve (pos.13) is broken.</li><li>• The special built in orifice in the ON / OFF solenoid valve (pos. 13) is clogged and must be cleaned. (note the complete CPA10 must be emptied for liquid and high pressure refrigerant through the oil drain line before the solenoid valve (pos. 13) can be dismantle</li></ul>
The air vent never seems to open.	<ul style="list-style-type: none"><li>• No air in the system</li><li>• Foul gas line mounted on the refrigeration system at a spot where no air accumulates.</li></ul>

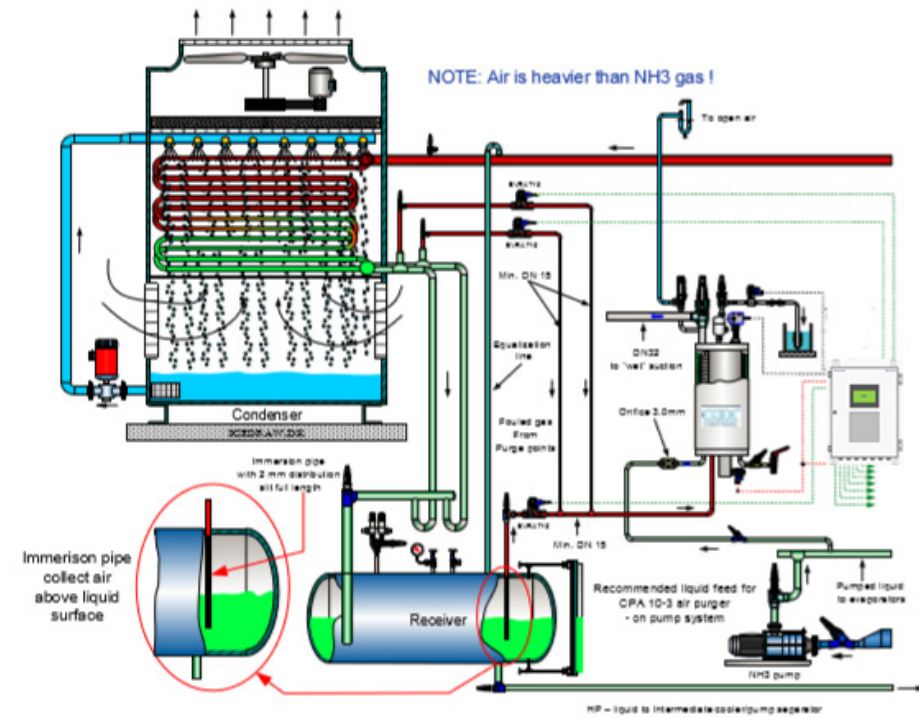


## Purge Point Installation

Below are some typical systems which purge points should be correctly installed.

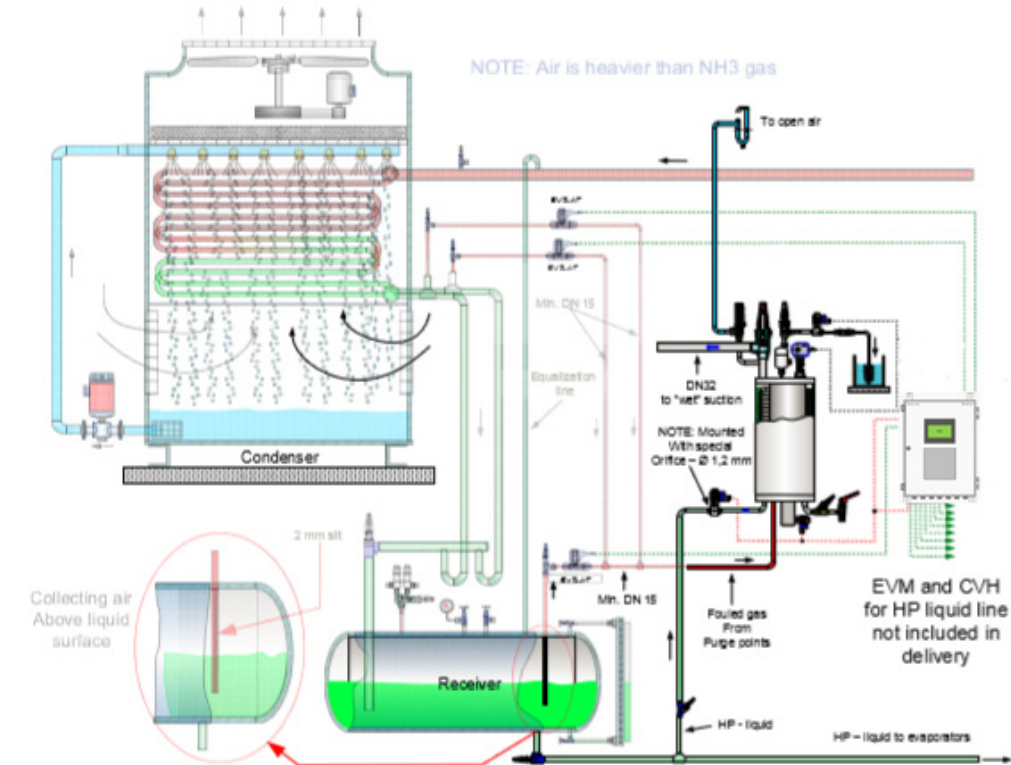
### Recommended Purge Point installation for LP float valve systems

Recommended Purge Point connections to condenser  
Recommended Purge Method from HP receivers  
Pumped LP liquid feed to CPA



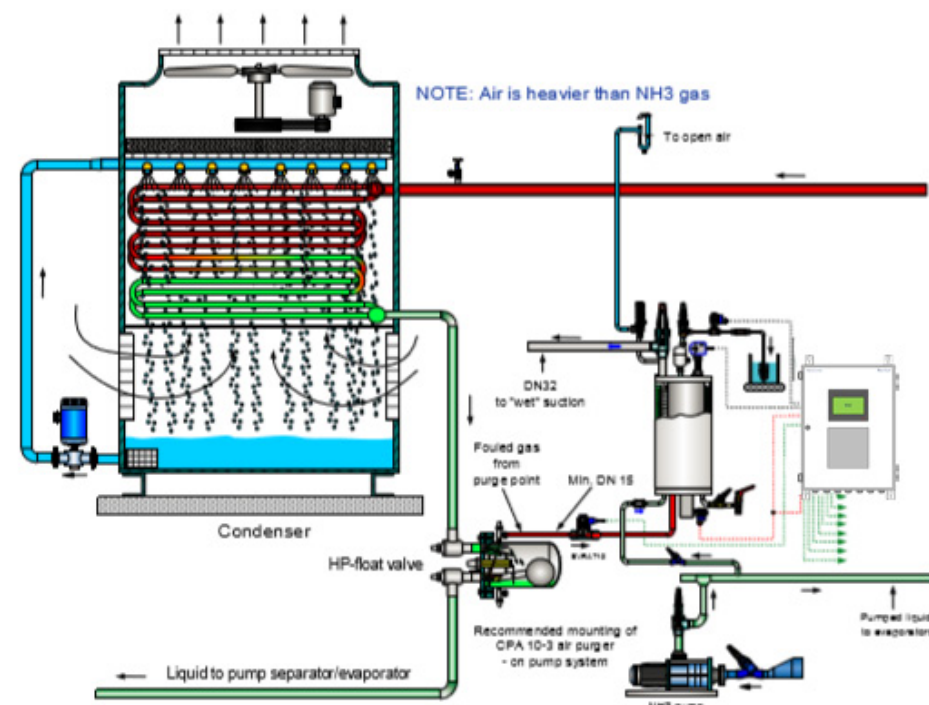
### Recommended installation of Air Purger with HP liquid supply

Note ø1.2mm orifice in HP feed line, included on request



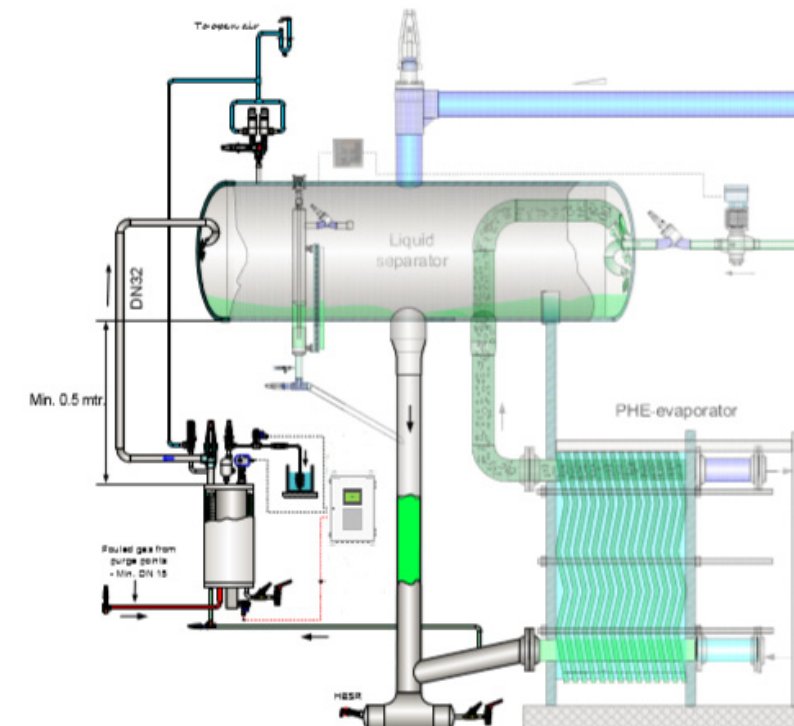
### Recommended Purge Point installation for HP float valve systems

Recommended Purge Point connection to HP float valve  
Pumped LP liquid feed to CPA

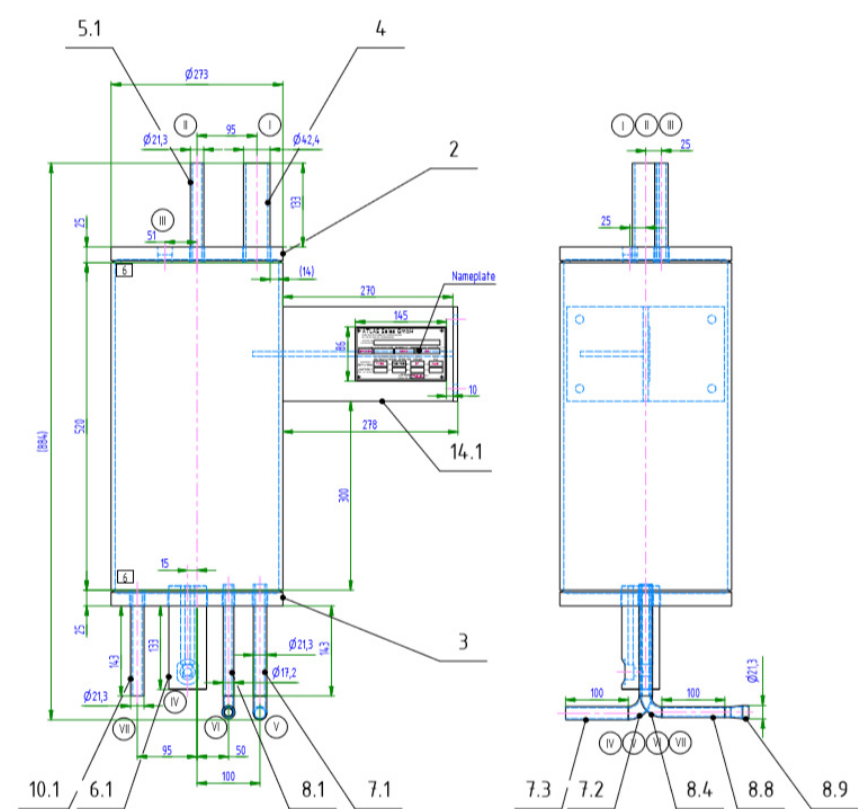


### Recommended installation of Air Purger with self circulation supply

Minimum 0.5m gravity height for self circulation



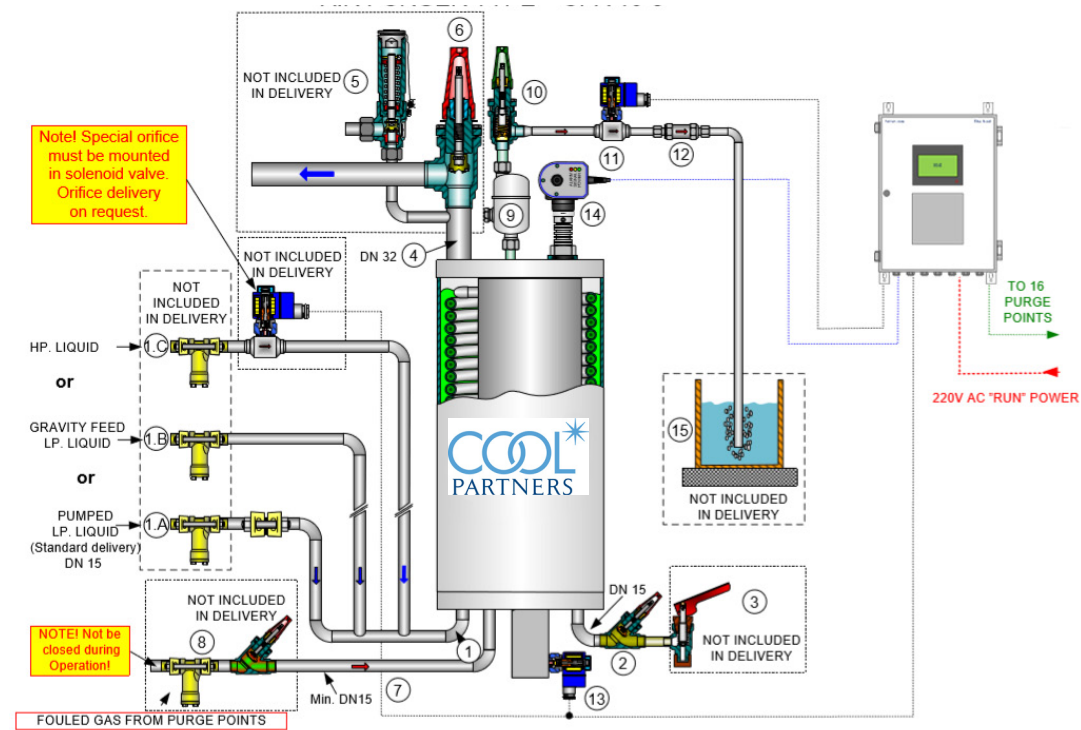
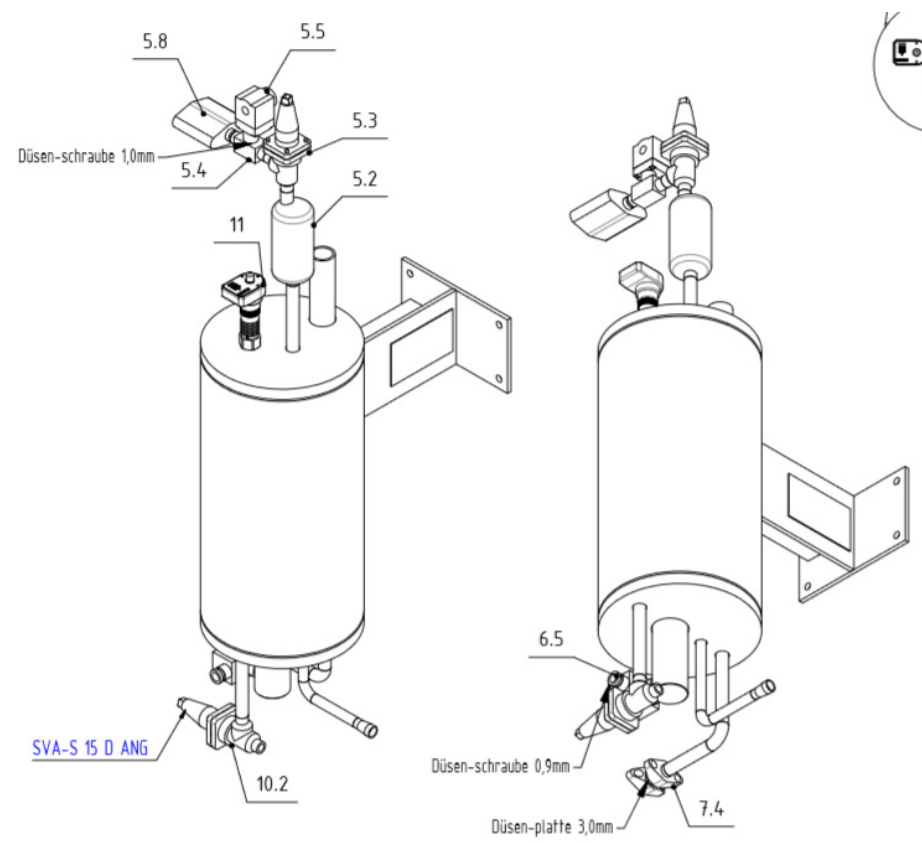
CPA10-3 Drawing



Technical Data:

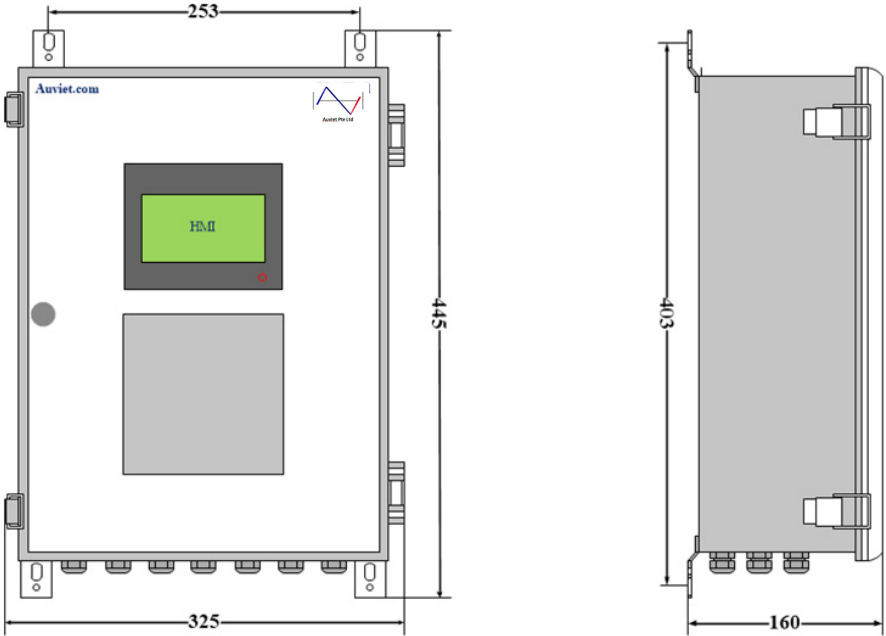
Operating pressure	-1/25bar
Design pressure	25bar
Test pressure	32bar
Operating temperture	-40C / +50C
Design temperature	+50C
Stress occassion	I (100%) Acc. To AD-Blatt W10
Working fluid	NH3
Testing fluid	Air*
Volume	115 liter
Actual weight	200kg
Corrosion allowance	1.5mm
Vessel position	Vertical
"Utilisation of calculating tension allowed"	0.85
*: only in pressure testing room	

CPA10-3 Installation overview

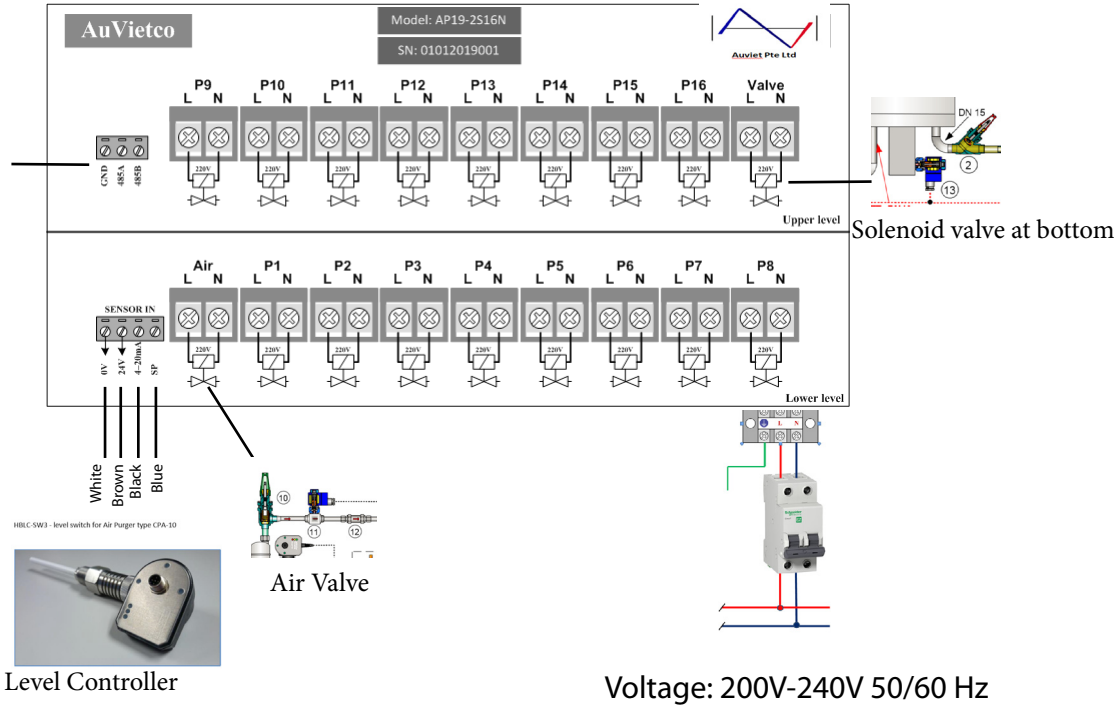


"Pos.Nr."	Bezeichnung	Stk.	Abmessung	Abmessung					Standard	Werkstoffangabe		"Nachweis n. DIN EN 10204"	"Werkstoff AD-2000M"
				S <sub>1</sub>	S <sub>2</sub>	b	c	L		Werkstoff	standard		
13	Nozzle DN 15	1	Dm 21.3	3.2				130	EN 10220	P235GH	EN 10216-2	3,1	W4
12	Marker	1	Fl.15	5				50	EN 10058	S235JRG2	EN 10025-2		
11	Name plate holder	1	Plate	4		150	150		EN 10029	S235JRG2	EN 10025-2		
9,3	Bassis	3	Plate	10		120	85		EN 10029	S235JRG2	EN 10025-2	3,1	
9,2	Profil	3	U80					780	DIN 1026-1	S235JRG2	EN 10025-2	3,1	
9,1	Supporting plate	3	Plate	8		135	180		EN 10029	P265GH	EN 10028-2	3,1	W1
9		3											
8,1	Nozzle DN 25	3	Dm033.7	4				125	EN 10220	P235GH	EN 10216-2	3,1	W4
8		3											
7,6	Holder	4	Fl.50	5				35	EN 10058	S235JRG2	EN 10025-2		
7,5	Elbow DN 65	1	Dm 76.1;90.3	2.9					EN 10253-2	P235GH	EN 10216-2	3,1	W4
7,4	Plate	1	Dm 69	3					EN 10029	S235JRG2	EN 10025-2	3,1	
7,3	Pipe DN 65	1	Dm 76.1;90-3	2.9				211	EN 10220	P235GH	EN 10216-2	3,1	W4
7,2	Plate	1	Dm 324	3					EN 10029	S235JRG2	EN 10025-2	3,1	
7,1	Case	1	Plate	3		1008	357		EN 10029	S235JRG2	EN 10025-2	3,1	
7		1											
6,9	Holder	3	Fl.25	5				191	EN 10058	S235JRG2	EN 10025-2		
6,8	Holder	3	Fl.25	5				203	EN 10058	S235JRG2	EN 10025-2		
6,7	Pipe DN 25	1	Dm 33.7	2.0				3400	EN 10220	1.4541	EN 10216-5	3,1	W2
6,6	Pipe DN 25	1	Dm 33.7	2.0				142	EN 10220	1.4541	EN 10216-5	3,1	W2
6,5	Elbow DN 25	4	Dm 33.7; 90-3	2					EN 10253-2	1.4541	EN 10216-5	3,1	W2
6,4	Pipe DN 25	1	Dm 33.7	2.0				23	EN 10220	1.4541	EN 10216-5	3,1	W2
6,2	Pipe DN 25	1	Dm 33.7	2.0				70	EN 10220	1.4541	EN 10216-5	3,1	W2
6,1	Nozzle DN 25	2	Dm 33.7	4				210	EN 10220	P235GH	EN 10216-2	3,1	W4
6		1											
5,5	Pipe DN 40	1	Dm 48.3	2.6				100	EN 10220	P235GH	EN 10216-2	3,1	W4
5,4	Elbow DN 40	1	Dm 48.3; 90-3	2.6					EN 10253-2	P235GH	EN 10216-2	3,1	W4
5,3	Nozzle DN 40	1	Dm 48.3	5.0				60	EN 10220	P235GH	EN 10216-2	3,1	W4
5,2	Torispherical head	1	Dm 114.3	4					DIN 28011	P265GH	EN 10028-2	3,1	W1
5,1	Nozzle DN 100	1	Dm 114.3	8.8				72	EN 10220	P235GH	EN 10216-2	3,1	W4
5		1											
4,6	Pipe DN 15	1	Dm 21.3	2.0				225	EN 10220	1.4541	EN 10216-5	3,1	W2
4,5	Pipe DN 15	1	Dm 21.3	2.0				780	EN 10220	1.4541	EN 10216-5	3,1	W2
4,4	Elbow DN 15	2	Dm 21.3; 90-3	2					EN 10253-2	1.4541	EN 10216-5	3,1	W2
4,3	Pipe DN 15	1	Dm 21.3	2.0				100	EN 10220	1.4541	EN 10216-5	3,1	W2
4,2	Nozzle DN 15	1	Dm 21.3	3.2				85	EN 10220	P235GH	EN 10216-2	3,1	W4
4,1	Nozzle DN 15	1	Dm 21.3	3.2				65	EN 10220	P235GH	EN 10216-2	3,1	W4
4		1											
3,1	Nozzle DN 40	1	DM 48.3	5.0				180	EN 10220	P235GH	EN 10216-2	3,1	W4
3		1											
2	Torispherical head	2	DM 406.4	8					DIN 28011	P265GH	EN 10028-2	3,1	W1
1	Vessel Shell	1	DM 406.4	6.3				820	EN 10220	P265GH	EN 10217-2	3,1	W4

AV AIR C16 Controller dimension



Communication Port RS485



Voltage: 200V-240V 50/60 Hz

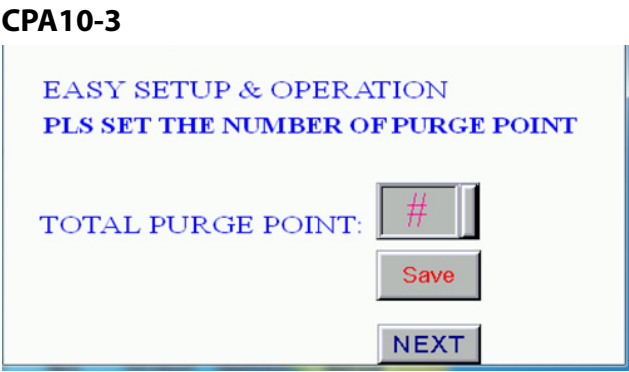


# AV AIR C16 Controller Setting

The AV AIR C16 controller is easy to set up.  
The factory setting default values are shown on table below

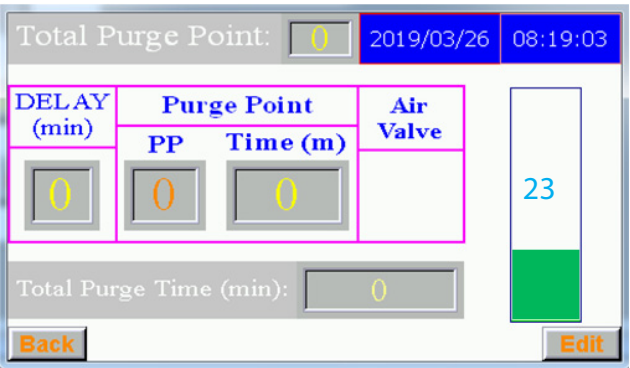
Start screen:

The only parameter you need to key in is the number of  
purge point (1-16)  
Press Save  
Press Next will lead you to operation screen.



Operation screen:

Total Purge Point: The number of purge point you have  
on your system  
Delay: Time delay before the AV-AIR C16 start its purging  
process. The time delay is needed for stablising conden-  
sation process inside the purger. (default 10min.)  
PP: The current active purge point  
Time: The remaining purge time of the current active  
purger point  
Air valve: Flashing when air valve open and air purging is  
in action  
Liquid level in percentage  
Total purge Time: The total time of air valve open in min.

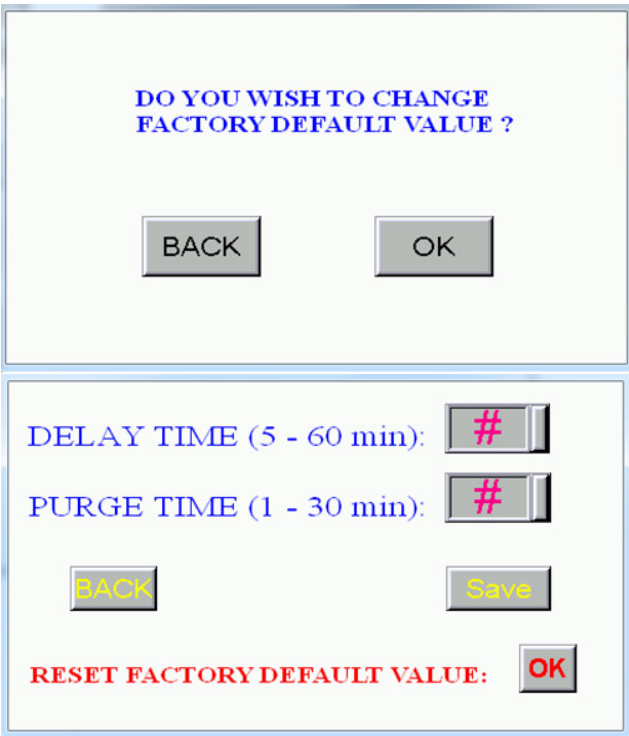


## Edit setting Parameters

You can change value of parameter by touching the Edit  
button **Edit** on operation screen and confirm by  
touching ok button  
Pasword: 12345678

Delay Time: 5-60 min  
Purge Time: 1-30 min  
Press save **Save** to store changed value  
You can reset all values to factory default values by  
pressing the ok button **OK**

**Note: Always restart system after editing  
parameters value.**



Unit			
Supply voltage	200-240V AC. 1ph, 50/60Hz		
Level sensor	24V DC		
Level sensor signal	4-20mA		
Number of purge point	16		
Expansion solenoid valve	1		
Air valve	1		
Total purge time	min.		
Parameters setting	Min.	Max.	Default
Purge point	1	30	10
Delay time	5	60	10

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