

# BREATHERS VC Series



The best-selling traditional breather type, with mechanical valve



**AIR DEHYDRATING BREATHERS**  
**threaded and/or flanged connection, with mechanical valve**  
**type VCP 10 – 30 & VC 50 - 80 - 100 - 150**  
**for use on mobile transformers or on tanks**  
**and small breather VC 05 (1/2" thread entry)**

### 1. GENERAL INFORMATIONS

Air dehydrating breathers are transparent hollow cylinder tubes which contain chemically pure silicium salt (silicagel) with coloured indicator. The air breathed inside the transformer due to the thermal contraction of the oil mass, passes through the silicagel.

The silicagel absorbs the humidity, indicating the saturation degree by changing colour as follows:

ORANGE                      silicagel completely dry  
GREEN                        silicagel saturated with humidity

The salt contained in the breather, when saturated, may be easily removed and regenerated by heating it, inside a ventilated oven, at 120° - 150°C, until the colour becomes orange again.

The specific property of the silicagel is its high absorption power of humidity. This is total until the salt has absorbed water for about 15% of its weight, and saturation is reached when the salt has absorbed water for 30 to 40 % of its weight.

### 2. TECHNICAL FEATURES

The upper and lower parts are made in a non-porous corrosion-proof aluminium alloy casting. The hollow cylinder is made of plexiglas and it is protected by a stainless steel cylinder, with windows which allow the visual control of the silicagel colour.

On the bottom side of the breather, a mechanical valve prevents continuous air contact with the silicagel and allows the air to pass in both direction (inlet or outlet) only when there is pressure deficiency or excess inside the transformer.

Pressure values for air passage into the dehumidifier are:

$$0.003 \text{ kg/cm}^2 \text{ inlet, or } 0.005 \text{ kg/cm}^2 \text{ outlet}$$

The hollow container and the mechanical valve are separated by a drilled plate with a labyrinth system, which have the double purpose of diffusing inlet air uniformly, and of avoiding that any salt dust may damage the closing system.

### 3. DRAWINGS AND TECHNICAL DATA

On the following drawings (PAG5.55, PAG5.56A) are shown all the breathers of VC series.

### 4. PROTECTION OF OUTER SURFACES

Outer surfaces in aluminium alloy are covered with a double coat of high protective paint against all weather conditions, and temperature between – 40°C and + 100°C. All the screws are made in mild steel zinkplated; upon request in stainless steel.

### 5. CHOICE OF THE BREATHER SIZE (or maintenance interval) FOR USE ON TRANSFORMERS

The choice of the breather size (or maintenance interval) is directly related to the quantity of the silicagel contain.

The mass of silicagel necessary for the proper functioning is given approximately by a function of 6 variable quantities, listed here following:

- Mass of oil "V" inside the transformer, denominated in dm<sup>3</sup> or in litres.
- Average temperature of the air in the environment where the transformer is installed, denominated in °C
- Average Humidity of the air in the environment where the transformer is installed, denominated in %.
- Average thermal cycle "Δ t" of the transformer, denominated in °C, to be calculated as difference between the minimum and the maximum temperatures reached by the oil inside the transformer within a time period.
- Average duration of thermal cycle "T" denominated in hours, to be calculated as the time interval between two thermal cycles.
- Maintenance interval "M" denominated in days.

From the saturated steam table for water (see next pages), depending from the average temperature and humidity of the air, it is possible to calculate the quantity of water "A" (denominated in gram) for each m<sup>3</sup> of air which enter inside the transformer.

Now, using the following formula, we are ready to calculate the quantity of silicagel (denominated in Kg) necessary for the proper functioning of the transformer:

$$\text{Mass of silicagel} = (127,056 \times 10^{-9} \times V \times \Delta t \times A \times M) : T \quad [\text{kg}]$$

It is important to note that the result of above formula is only a first approximation value, due to the simplification related to the average values considered as constant values for the duration of the thermal cycles between two following maintenance intervals.

It is also evident that shortening the maintenance interval, the average conditions used in the formula simulate more exactly the true conditions of the transformer during its working life (i.e. the average temperature of the air for 30 days in January has a statistic scattering degree lower than the average temperature for 90 days in Dec/Jan/Feb); same comments must be done for humidity, thermal cycle duration and temperature

Only two data may be easily fixed without doubt: mass of oil inside the transformer and maintenance interval.

For a better understanding, we show here following three examples of the choice of quantity of silicagel necessary for the same transformer installed in three different places, but with the same thermal cycle and maintenance interval:

Average thermal cycle "Δ t "	20°C
Average duration of thermal cycle T	8 hours
Maintenance interval M	90 days
Mass of oil V	10000 dm <sup>3</sup>

The mass of silicagel necessary for a good functioning of the transformer will be:

1° CASE: Transformer installed in normal European condition:

- Average air temperature	20 °C
- Average humidity	60 %
- Silicagel mass	2,95 kg
Suggested size of the breather: size VC30	

2° CASE: Transformer installed in tropical climate:

- Average air temperature	30 °C
- Average humidity	90 %
- Silicagel mass	7,77 kg
Suggested size of the breather: size VC100	

3° CASE: Transformer installed in desert condition:

- Average air temperature	35 °C
- Average humidity	40 %
- Silicagel mass	4,50 kg
Suggested size of the breather: size VC50	

## 6. CHOICE OF THE BREATHER SIZE (or maintenance interval) FOR USE ON TANKS

The choice of the breather size (or maintenance interval) is directly related to the quantity of the breather silicagel contain. The mass of silicagel necessary for the proper functioning is given approximately by a function of 5 variable quantities, listed here following:

- Volume of air V inlet for each cycle, denominated in dm<sup>3</sup> or in litres
- Average temperature of the air in the environment where the tank is installed, denominated in °C
- Average Humidity of the air in the environment where the tank is installed, denominated in %
- Number of cycles C per day
- Maintenance interval M denominated in days

From the saturated steam table for water (see next page), depending from the average temperature and humidity of the air, it is possible to calculate the quantity of water A (denominated in grams) for each m<sup>3</sup> of air which enter inside the tank. Now, using the following formula, we are ready to calculate the quantity of silicagel (denominated in Kg) necessary for the proper functioning of the breather:

$$\text{Mass of silicagel} = 6.7 \times 10^{-6} \times V \times A \times C \times M \text{ [kg]}$$

It is important to note that the result of above formula is only a first approximation value, due to the simplification related to the average values considered as constant values for the duration of the cycles between two following maintenance intervals.

It is also evident that shortening the maintenance interval, the average conditions used in the formula simulate more exactly the true conditions in which the breather is working (i.e. the average temperature of the air for 30 days in January has a statistic scattering degree lower than the average temperature for 90 days in dec./Jan./Feb.); same comments must be done for humidity and temperature.

Only two data may be easily fixed without doubt: volume of air inlet and maintenance interval.

For a better understanding, we show here following three examples of the choice of quantity of silicagel necessary for the same tank installed in three different places, but with the same cycle and maintenance interval; the following conditions shall be the same in all the tree cases:

Number of cycles per day C	2
Maintenance interval M	90 days
Volume of air inlet V	150 dm <sup>3</sup>

The mass of silicagel necessary for a good functioning of the breather will be:



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1° CASE: Tank installed in normal European condition:  
 - Average air temperature 20 °C  
 - Average humidity 60 %  
 - Silicagel mass 1.86 kg  
 Suggested size of the breather: size VC30

2° CASE: Transformer installed in tropical climate:  
 - Average air temperature 30 °C  
 - Average humidity 90 %  
 - Silicagel mass 4.96 kg  
 Suggested size of the breather: size VC50

3° CASE: Transformer installed in desert condition:  
 - Average air temperature 35 °C  
 - Average humidity 40 %  
 - Silicagel mass 2.86 kg  
 Suggested size of the breather: size VC30

## 7. MANUFACTURING PROGRAM

We propose a full range of dehydrating breathers for power transformers, starting from 1 kg silicagel contain up to 15 kg; All our models are identified with two letters 'VC' followed by two figures which represent the quantity (denominated in hg) of silicagel contain, with this scale in kg 0,5; 1 ; 3 ; 5 ; 10 ; 15.

All these breathers can be connected to the tube coming from the conservator by means of a threaded connection or by means of a flange.

Starting from size VC50 all the breathers are fitted with a side support which enable to make a bolted connection to a wall or to a rack.

The dehydrating breathers, complete with salts are despatched in sealed packages in order to avoid alteration of the dry state of silicagel. Upon request, we supply also empty breathers with silicagel filling packed separately in ermetic bags, or even without filling, if the customer wants to manage silicagel separately from the breathers.

## 8. ORDER INSTRUCTIONS

As said, the identification of a model start with two letters VC followed by two figures which represent the weight of silicagel inside the breather

Few example, to make it completely clear:

VC 50 Breather with 5 kg silicagel contain

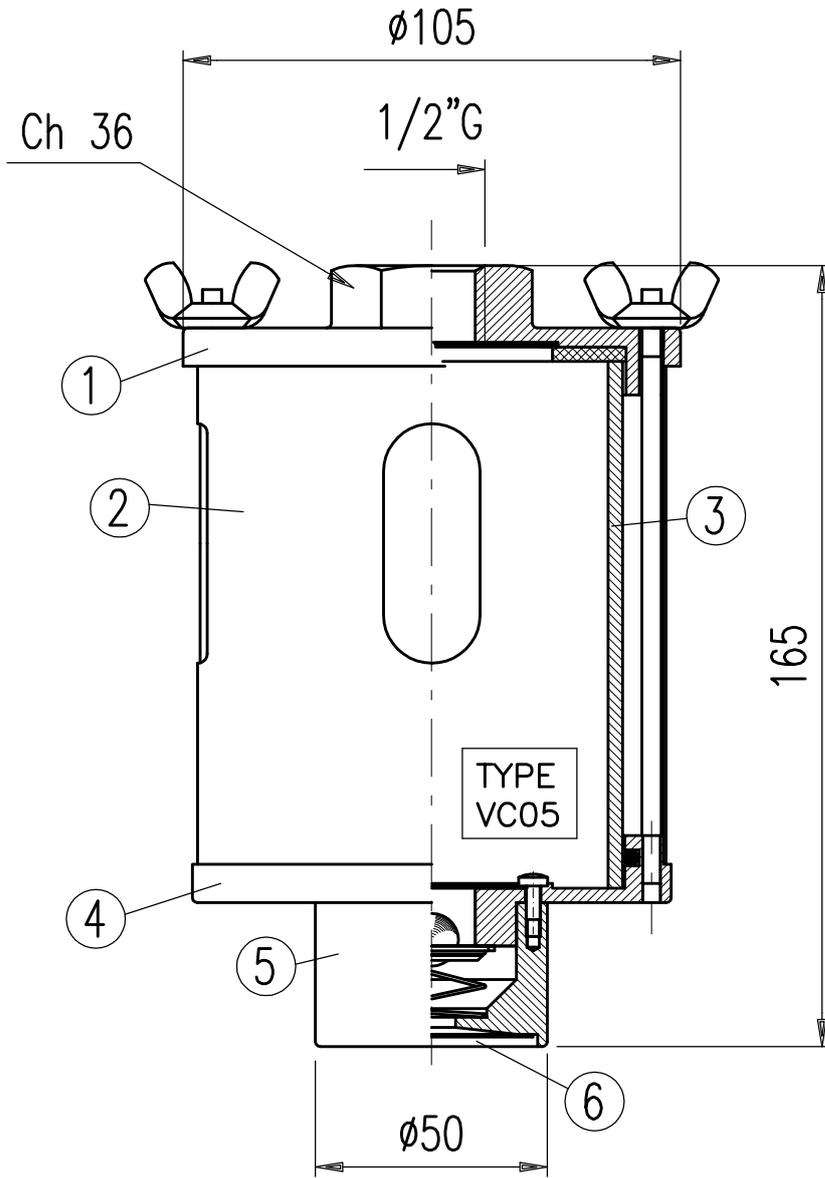
VC150 Breather with 15 kg silicagel contain

Special instruction must be indicated separately.

## 9. SATURATED STEAM TABLE FOR WATER

Showing the mass of water, in gram ( $10^{-3}$  kg), contained in one cubic meter of air (related to the air temperature and the air humidity).

AIR TEMPERATURE	AIR HUMIDITY [%]									
	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
0	0.49	0.98	1.47	1.96	2.45	2.94	3.43	3.92	4.40	4.90
5	0.68	1.36	2.04	2.72	3.40	4.08	4.76	5.44	6.10	6.80
10	0.94	1.87	2.82	3.76	4.70	5.64	6.58	7.52	8.50	9.40
15	1.28	2.56	3.84	5.12	6.40	7.68	8.96	10.20	11.50	12.80
20	1.72	3.44	5.16	6.88	8.60	10.30	12.00	13.80	15.50	17.20
25	2.29	4.58	6.87	9.16	11.45	13.70	16.00	18.30	20.60	22.90
30	3.02	6.04	9.05	12.10	15.10	18.10	21.10	24.10	27.20	30.20
35	3.94	7.88	11.80	15.80	19.70	23.60	27.60	31.50	35.40	39.40
40	5.08	10.20	15.30	20.40	25.40	30.50	35.60	40.70	45.80	50.90
50	8.27	16.50	24.80	33.10	41.40	49.60	57.80	66.20	74.40	82.70
60	13.00	26.00	39.00	52.00	65.00	78.00	91.00	104.00	117.00	130.00



		VC05
Silicagel	Volume	0,48 dm <sup>3</sup>
	Quantity	0,35 kg
Weight	Full	1,25 kg
	Empty	0,90 kg

Pos	Descrizione / Description
1	Coperchio <i>Top cap</i>
2	Protezione acciaio inox <i>Stainless steel housing</i>
3	Contenitore trasparente dei sali <i>Gel container (transparent)</i>
4	Coperchio inferiore <i>Bottom cap</i>
5	Valvola meccanica <i>Mechanical valve</i>
6	Presca d'aria <i>Air intake</i>

Dim. in mm; EX PAG. 5.55

**CEDASPE**

Titolo

Breather type  
VC05

Data 08/03/12

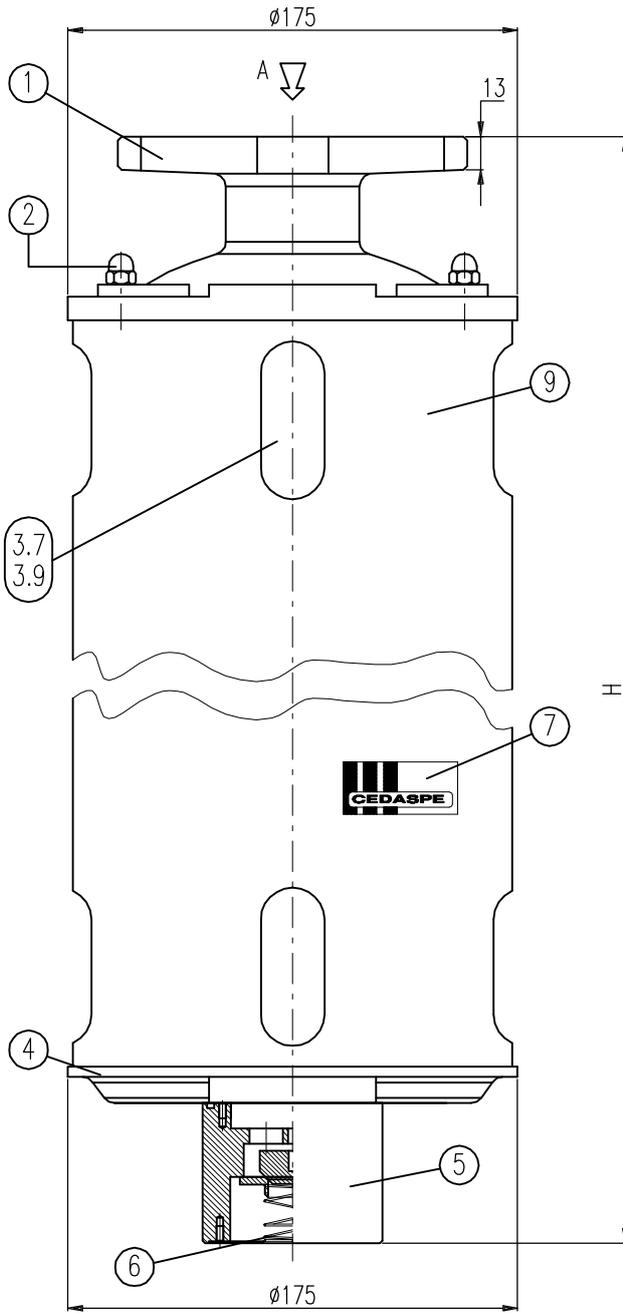
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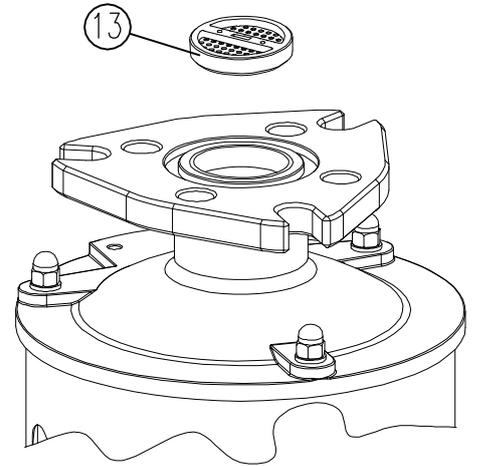
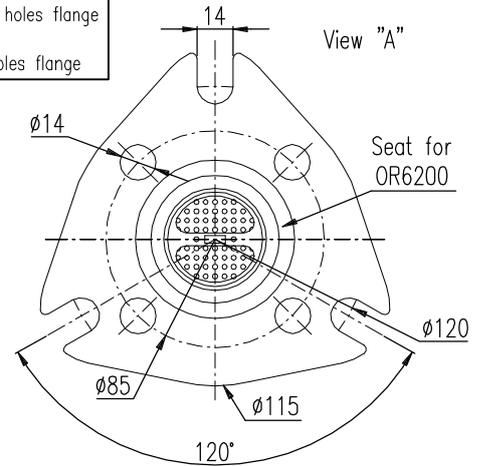
Dis. Nr

3602

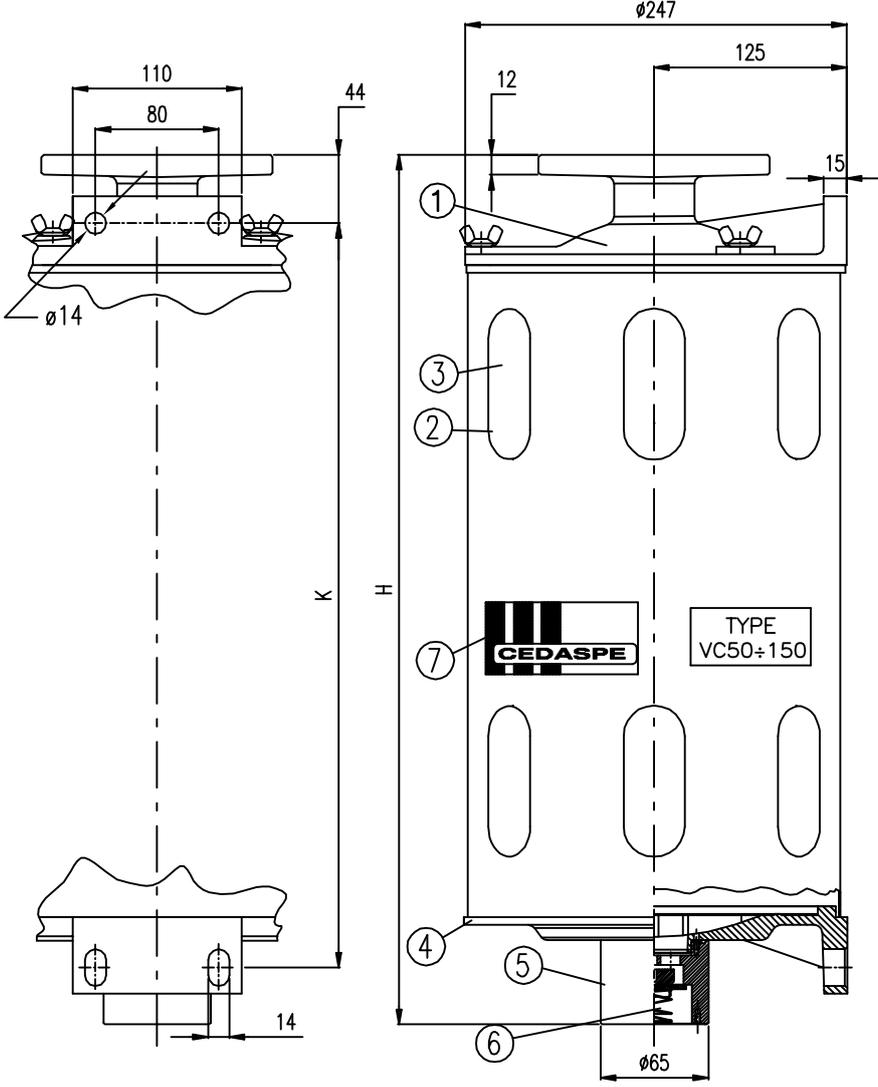
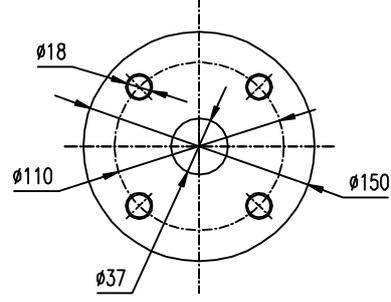


Pos.	Description
1	Top cap
2	Domed nuts M6 DIN1587
3.7	Gel container (Glass)
3.9	Gel container (PMMA)
4	Bottom cap
5	Mechanical valve
6	Air intake
7	Data plate

Double fixation:  
 - DN25/PN10 4 holes flange  
 or  
 - DIN42562 3 holes flange



Type	Transf. oil (Kg)	H (mm)	Gel container material	G.W. Empty (Kg)	Silicagel Q.ty	Vol.
VCP 10	3500	240	PMMA	2.5	1 Kg	1.35 dm <sup>3</sup>
			Glass			
VCP 30	10000	445	PMMA	5	3 Kg	4.05 dm <sup>3</sup>
			Glass			



Pos	Descrizione / Description
1	Coperchio <i>Top cap</i>
2	Protezione acciaio inox <i>Stainless steel housing</i>
3	Contenitore trasparente dei sali <i>Gel container (transparent)</i>
4	Coperchio inferiore <i>Bottom cap</i>
5	Valvola meccanica <i>Mechanical valve</i>
6	Presa d'aria <i>Air intake</i>
7	Targhetta d'identificazione <i>Data plate</i>

Data plate

	VC 50-F	VC80-F	VC 100-F	VC 150-F
K	320	410	578	760
H	405	495	660	840

VC 50-F	VC 80-F	VC 100-F	VC 150-F		
6,70 dm <sup>3</sup>	10,70 dm <sup>3</sup>	13,50 dm <sup>3</sup>	21,00 dm <sup>3</sup>	Volume	Silicagel
5,00 kg	8,00 kg	10,00 kg	15,00 kg	Quantity	
12,50 kg	16,50 kg	19,00 kg	26,00 kg	Full	G.W. (Kg)
7,00 kg	7,50 kg	9,00 kg	10,00 kg	Empty	

Dim. in mm; Scala 1:5

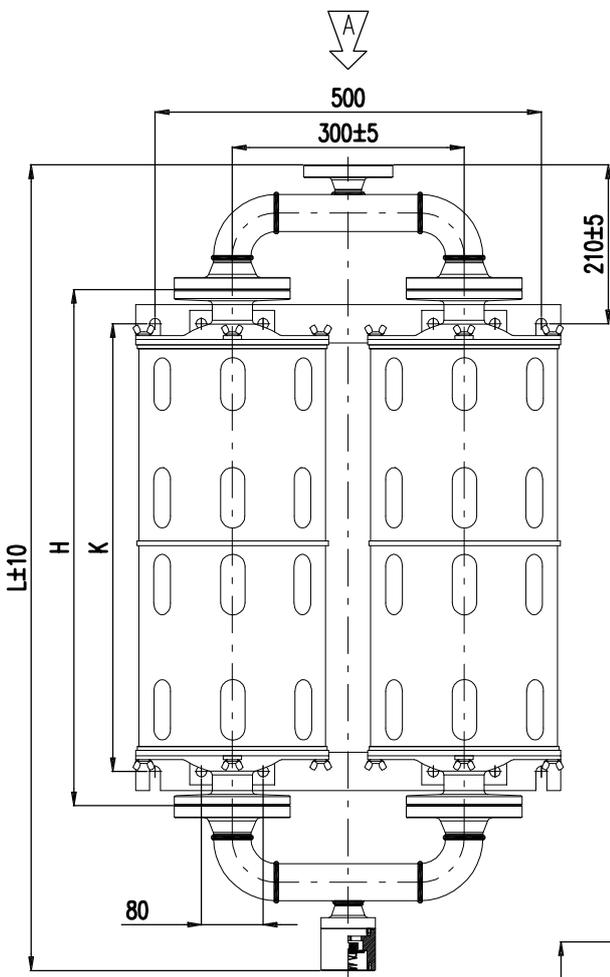


Titolo  
**Breathers type**  
**VC50-F ÷ VC150-F**

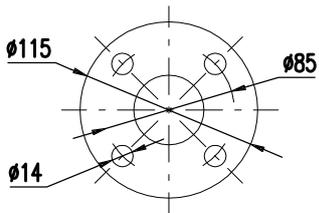
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 Visto

Dis. Nr  
**3601**

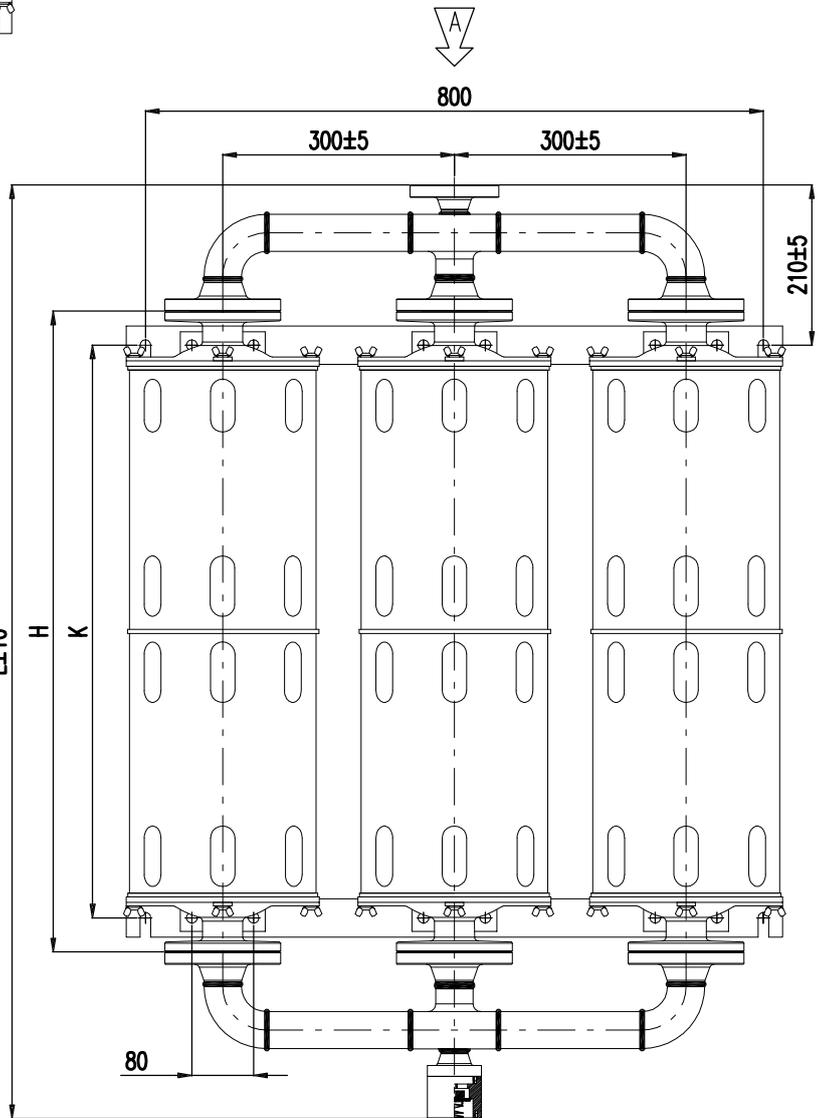
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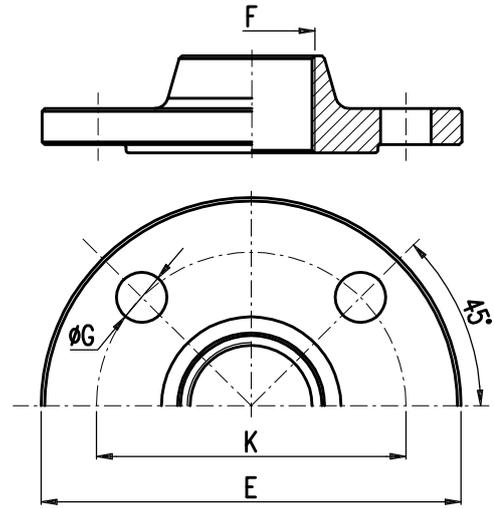
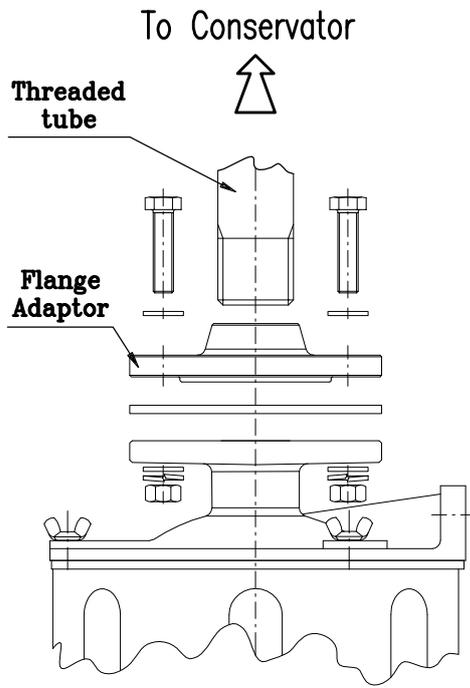


3	VC450 (3 x VC150-M)	1210	747	853	45 Kg
2	VC300 (2 x VC150-M)	1210	747	853	30 Kg
1	VC200 (2 x VC100-M)	1030	567	673	20 Kg
Pos.	Breather	L	K	H	Q.ty of Silicagel



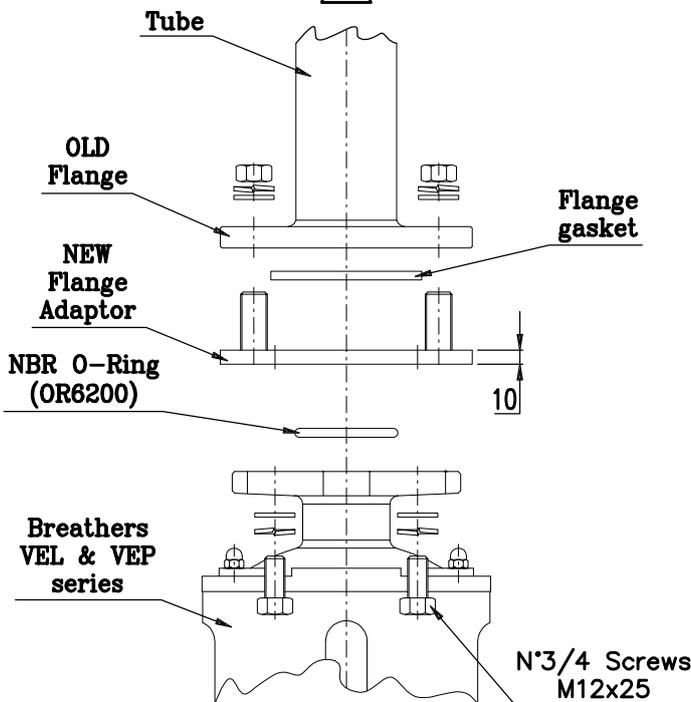
View "A"  
Scale 1:2



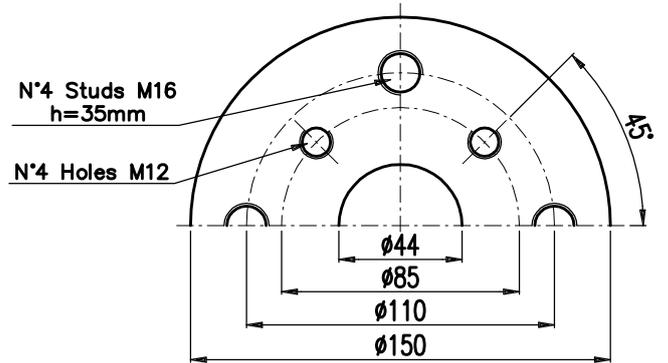


3	115	85	1"1/2 G	14	VEP27-29-37-37	Ex VE30/VE4-EL	Flange adaptor to 1"1/2 BSP pipe
2	115	85	1"G	14	VEP01 ÷ VEP07	Ex VE10	Flange adaptor to 1" BSP pipe
1	150	110	1"1/2 G	18	VE50 ÷ VE150	Ex VE50...150-A1	Flange adaptor to 1"1/2 BSP pipe
Pos.	E	K	F	øG	Type of breathers	Ex breathers	Note

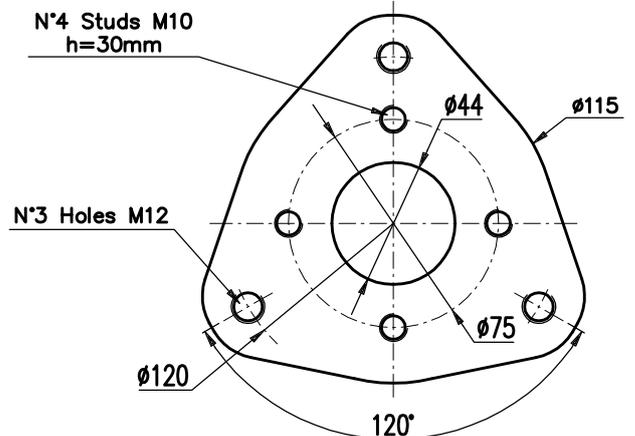
To Conservator



Pos. 4 for breathers VEP27-29-37-39  
Flange adaptor DN25 to DN40/PN10 (Ex VE30/VE4-EL)



Pos. 5 for breathers VEP01 ÷ VEP07  
Flange adaptor to DN25/PN6 (Ex VE10)



Ex PAG.5.50.C



Titolo  
**Special flange adaptor  
for breathers**

30/09/11  
Scala =====  
Dis.  
Visto

Dis. Nr  
**3538**  
1