BREATHERS
VE Series

The best-selling traditional breather type, with hydraulic valve

www.cedaspe.com
1. GENERAL INFORMATION

Air dehydrating breathers are transparent hollow cylinder tubes which contain chemically pure silicium salt (silicagel) with colored 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 °C - 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 aluminum alloy casting. The hollow cylinder is made of Plexiglas (upon demand in glass) and it is protected by a stainless steel cylinder, with windows which allow the visual control of the silicagel colour.

In the bottom side of the breather, an hydraulic 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 kg/cm² inlet, or 0.005 kg/cm² outlet

The hollow container and the hydraulic 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

A table on the drawings in the following pages shows the general overall dimensions, the silicagel contained inside the cylinder, the max oil quantity, contained inside the transformer on which the breather must be installed, calculated for normal conditions, as below indicated, using the formula at paragraph 5:

Average air temperature 20 °C
Average air humidity 60%
Average thermal cycle "\(\Delta t\)" 20 °C
Average duration of thermal cycle T 8 hours
Maintenance interval M 90 days

Different environment conditions of the site where the transformer is installed may influence the maintenance interval, when the choice of the size of the breather has been made.

4. PROTECTION OF OUTER SURFACES

Outer surfaces in aluminium painted with an epoxy primer coat and a finish paint suitable to resist to all weather conditions and ambient temperature between -40 °C and +100 °C. All the screws and nuts are in stainless steel.

5. CHOICE OF THE BREATHER SIZE (or of the maintenance interval)

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 6 variable quantities, listed here following:
- Mass of oil "V" inside the transformer, denominated in dm³ 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 "\(\Delta t\)" 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 grams) for each m³ 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:

\[
\text{Mass of silicagel} = \frac{127,056 \times 10^{-9} \times V \times \Delta t \times A \times M}{T} \quad \text{[kg]}
\]
It is important to note that the result of the 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 statistically 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; the following conditions shall be the same in all the three cases:

- **Average thermal cycle \(\Delta t\):** 20°C
- **Average duration of thermal cycle \(T\):** 8 hours
- **Maintenance interval \(M\):** 90 days
- **Mass of oil \(V\):** 10000 dm³

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

1° CASE: Transformer installed in normal European conditions:
- Average air temperature: 20°C
- Average humidity: 60%  
  
  Silicagel mass: 2.95 kg

  Suggested size of the breather: size VEP 27/29

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 VE80-F

3° CASE: Transformer installed in desert conditions:
- Average air temperature: 35°C
- Average humidity: 40%  
  
  Silicagel mass: 4.50 kg

  Suggested size of the breather: size VE50-F or VEP47/49 or VEL/VEP41

7. MANUFACTURING PROGRAM

We propose a full range of dehydrating breathers for **Power Transformers**, starting from 1 kg silicagel content up to 15 kg; additionally, using dedicated modular units, it is possible to assemble breathers in racks with high silicagel content up to 45 kg, see drg. 3482, 3536, 3537, 3632.

All our models are identified with the letters 'VE' or 'VEP' followed by two figures which represent the size of each breather as indicated on the drawings, with a wide choice of silicagel content, scaled in kg: 1;3;5;8;10;15.

All these breathers can be connected to the tube coming from the conservator through a flanged connection (PN10); all models VEP have a special flange design which is suitable for fixation to a DIN 42567 flange with 3 holes and also to a DN25/PN10 standard flange; for threaded connections necessary to use adaptors, see drg. 3538.

Starting from size VE50-F all the breathers are fitted with a side support which enable to make a bolted connection to a transformer wall or to a rack.

When there is a need of silicagel content higher than kg 15, we propose a modular assy using multiple units of 5,8,10,15 kg silicagel content each, as shown at page 5.50.B; the modular unit follow the same identification lettering of the normal breathers adding the letter 'M' at the end.

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 hermetic bags, or even without filling, if the customer wants to manage silicagel separately from the breathers.

When they are mounted on the transformer, it is necessary to remove the protective plugs and pour mineral oil up to the mark on the jar.

For **Distribution Transformers** we propose the range of small breathers TV75/VE05 and VE10 which are available only with thread entry connection, see drg. 3535.

8. ORDER INSTRUCTIONS

As said, the identification of a model start with two letters VE followed by two figures which identify the size of the breather and the letter M for the modular unit. Few example, to make it completely clear:

VEP 29 Breather with 3 kg silicagel contain

VE150-F Breather with 15 kg silicagel contain

VE100M-F Modular unit with 10 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).

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

10. AIR DEHYDRATING BREATHER TYPE TV75 - VE05 – VE10 (drg 3535)

They are small sized dehydrating breathers, particularly fit for assembling on small distribution transformers.

The type VE05 follows the same manufacturing principles of the bigger sizes like the type VE10.

The type TV75 (or TV74) is the cheapest model of our breathers: its top flange is made in corrosion proof aluminium alloy.

The silicagel housing is made of cellulose triacetate (cellidor by Bayer), suitable for mineral oil; only upon request, this breather can be fitted with a stainless steel cylindrical protection.
**Traditional single Breathers**

new "VEP" series

**FILE = 3482 .DWC**

1. Top cap
2. Domed nuts M6 DIN1587
3. M6 rod
4. Bottom cap
5. Oil cup (transparent glass)
6. Fishing out cylinder
7. Drain hole
8. Data plate
9. Stainless steel frame
10. Oil cup protection
11. Inspection window
12. knurled ferrule
13. Filter plug

**Oil level**

<table>
<thead>
<tr>
<th>Type</th>
<th>Transf. oil (Kg)</th>
<th>H (mm)</th>
<th>Gel container material</th>
<th>G.W. Empty (kg)</th>
<th>Silicagel Q.ty</th>
<th>Vol.</th>
</tr>
</thead>
<tbody>
<tr>
<td>VEP &quot;01&quot;</td>
<td>3500</td>
<td>290</td>
<td>PMMA</td>
<td>3.5</td>
<td>1 Kg</td>
<td>1.35 dm³</td>
</tr>
<tr>
<td>VEP &quot;07&quot;</td>
<td>10000</td>
<td>495</td>
<td>Glass</td>
<td>5.5</td>
<td>3 Kg</td>
<td>4.05 dm³</td>
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<tr>
<td>VEP &quot;49&quot;</td>
<td>18000</td>
<td>685</td>
<td>PMMA</td>
<td>7.5</td>
<td>5 Kg</td>
<td>6.75 dm³</td>
</tr>
<tr>
<td>VEP &quot;47&quot;</td>
<td></td>
<td></td>
<td>Glass</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**Fig. A1 - Montaggio orizzontale**  
- Horizontal assembly

**Fixing Kit for vertical assembly**

<table>
<thead>
<tr>
<th>Pos.</th>
<th>Description</th>
<th>Q.ty</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>Stainless steel stud M12x50</td>
<td>4</td>
</tr>
<tr>
<td>6</td>
<td>Stainless steel washer M12 DIN125</td>
<td>8</td>
</tr>
<tr>
<td>7</td>
<td>Spring washer M12 DIN127</td>
<td>8</td>
</tr>
<tr>
<td>8</td>
<td>Stainless steel nuts M12 DIN934</td>
<td>8</td>
</tr>
<tr>
<td>9</td>
<td>Flange gasket</td>
<td>1</td>
</tr>
</tbody>
</table>

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**Fig. B1 - Montaggio verticale**  
- Vertical assembly

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**Example of multiple assembly of dehydrating breathers**

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Special flange adaptor for breathers