

PRO SORB

HUMIDITY STABILIZER

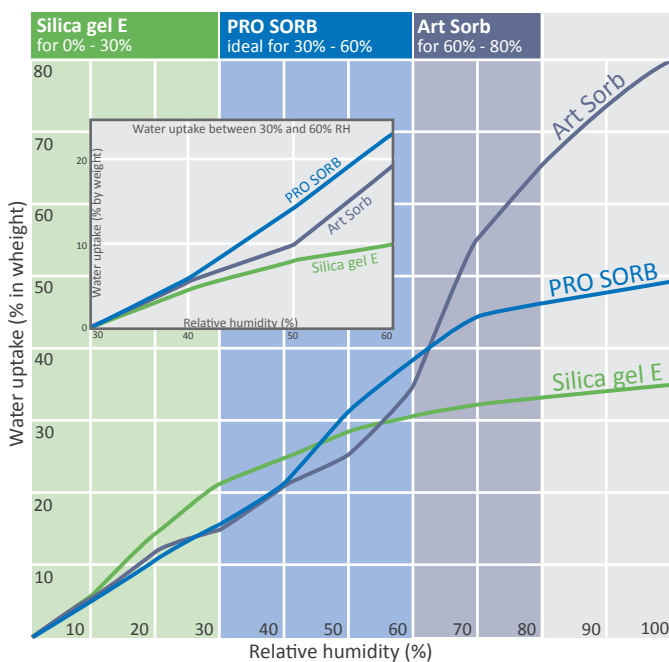
+ Art Sorb + Silica gel E

PRO SORB is a silica gel ideally suited for stabilizing relative humidity (RH) inside museum display cases and storage cabinets. Thanks to its large inner surface area and its ability to adsorb and desorb water vapour, PRO SORB can maintain a stable RH within narrow margins. It is supplied preconditioned for the individual humidity level you require. PRO SORB offers unique and exceptional adsorption capacity within the 30 - 60% RH range (see graph below), and surpasses other products sold for this purpose. Most museums tend to maintain their collections at an RH of between 30 - 60%. Thus PRO SORB precisely matches the needs of museum conservators.

Which silica gel is best for which humidity range?

To find out which silica gel will be best for a given humidity range you must look at its adsorption capacity graph: the silica gel with the steepest line in this particular region will be best. The following graph and table show that silica gel E (regular silica gel) is best adapted to achieve an RH of between 0 - 30%, PRO SORB for 30 - 60%, and ART SORB for 60 - 80% RH.

Water adsorption capacity at 25°C



Relative Humidity	Silica gel E		PRO SORB		Art Sorb	
	0-30%	30-60%	30-60%	30-60%	30-60%	30-60%
10%	7		6,2		6,5	
20%	14		10,6		11,5	
30%	20,5	10	16,2	22,6	16	19
40%	25		22,5		22	
50%	28,5		30,4		26	
60%	30,5		38,8		35	
70%	32		44,9		54	
80%	33	46	67			
90%	34	48	74			
100%	35	49	80			

Water uptake (% in weight)

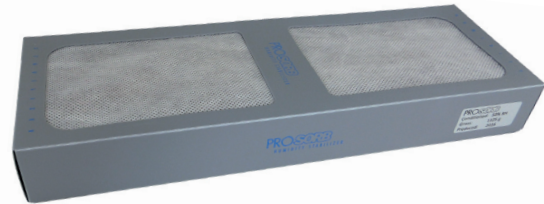
Technical data

Properties	Silica gel E	PRO SORB	Art Sorb
Composition	99% SiO ₂	97% SiO ₂ , 3% Al ₂ O ₃	90% SiO ₂ , 10% LiCl
Bulk density	approx. 0,75 kg/l	approx. 0,75 kg/l	approx. 0,5 kg/l
Pore volume	approx. 0,35 - 0,45 ml/g	approx. 0,5 ml/g	approx. 0,8 ml/g
Inner surface area	approx. 650 - 800 m ² /g	approx. 750 m ² /g	not available
Free of chlorides	yes	yes	no

In what forms is PRO SORB available?

PRO SORB is available in preconditioned form for 30, 35, 40, 45, 50, 55 or 60% RH. Cassettes and sachets are the most suitable forms for museum display cases. Cassettes are low-dusting and easy to handle. Sachets are dustproof, flexible and can be custom-made to special dimensions. Cassettes and sachets are easy to exchange and allow by-weight reconditioning. You can order made-to-measure PRO SORB panels for flat showcases and picture frames. PRO SORB can also be purchased in bulk to fill your own containers and trays.

Cassettes



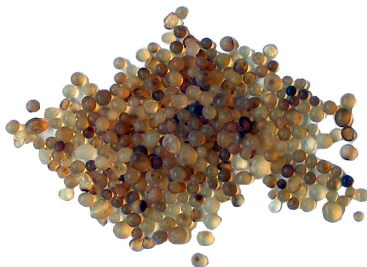
Use: medium-sized and large display cases
Large cassettes: dimensions: 333 x 110 x 43 mm, content: 950 g
Small cassettes dimensions: 333 x 110 x 24 mm, content: 500 g
Material: polypropylene, polyester fleece
Packaging: in aluminium composite foil

Sachets



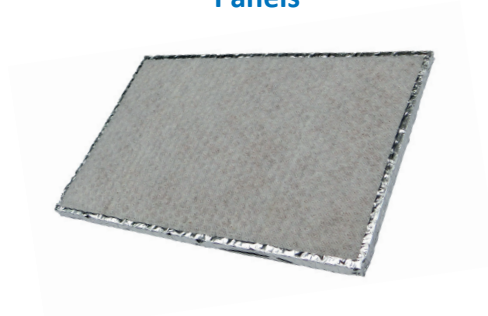
Use: small and medium-sized display cases, wall showcases, special dimensions
Standard: dimensions: 350 x 150 x 20 mm, content: 500 g
Customised: up to 350 x 350 mm and 1500 g
Material: TYVEK 1073 (polyethylene fleece: dustproof, vapour-permeable)/LDPE
Optional: straps or multiple compartments
Packaging: in aluminium composite foil

Granulate



Use: for use in your own containers
Packaging: in aluminium composite foil
From 5 kg in PE bag inside steel bucket with clamping ring

Panels



Use: flat picture cases
Customised panels: up to 600 x 1150 mm, special shapes possible
Thickness: 10 or 20 mm
Material: polypropylene honeycombed panel, polyester fleece, Marvelseal 360. Alternatively, polyester fleece on both sides

What preconditioning will I need?

The optimum preconditioning value largely depends on the requirements of the exhibit. Buffering humidity always implies buffering to an RH range, not to a simple RH point. Depending on whether ambient climatic conditions are drier or more humid than the desired humidity range, preconditioning of PRO SORB will have to be at the upper or at the lower end of the desired RH range.

Example: You want to keep a display case at an RH of 45 - 55% and the ambient RH is 60%. Ambient air will gradually enter even the best-fitted display case. The PRO SORB should be preconditioned to 45% RH in order to adsorb as much moisture as possible.

If the ambient RH is similar to the desired RH range of the showcase and the aim is simply to buffer RH fluctuations, preconditioning in the middle of the desired RH range should be chosen.

How much PRO SORB do I need?

The amount of PRO SORB that you need depends on a variety of factors. These include the tightness of the display case and the ambient climate. It is therefore difficult to make predictions. Basically, the more PRO SORB is used, the lower the fluctuations in humidity and the less frequently the display case will require maintenance. We recommend beginning with 2 - 4 kg of PRO SORB per cubic metre of display case volume and constantly monitoring the RH in each display case with a hygrometer.

Guideline values are:

- 2 kg/m³ for glass hood or large display cases > 2 m³
- 4 kg/m³ for very tall or small display cases (< 0.2 m³)

The amount required increases with:

- leakages in the display case,
 - high moisture gradients between the display case and the ambient air,
 - long exhibition durations or permanent exhibitions,
 - temperature fluctuations and air movements,
 - hygroscopic display case installations that are drier or damper than the desired climatic range.
- The exhibits themselves may sometimes be drier or damper than stated by the lender.

Use and location / display case requirements

Tightness

The display case should be as tight as possible. You can improve tightness retroactively with appropriate silicon seals or adhesive tape.

Wood-based materials

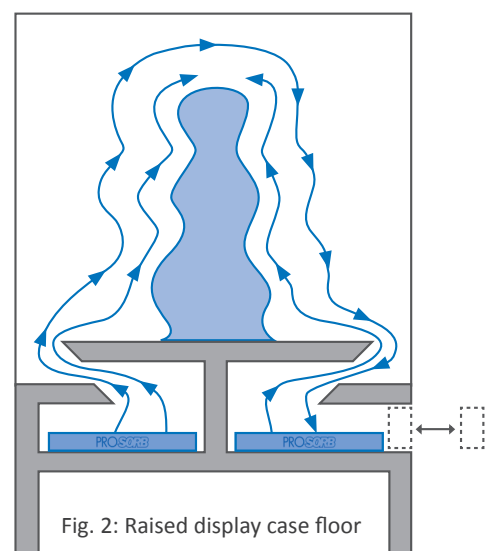
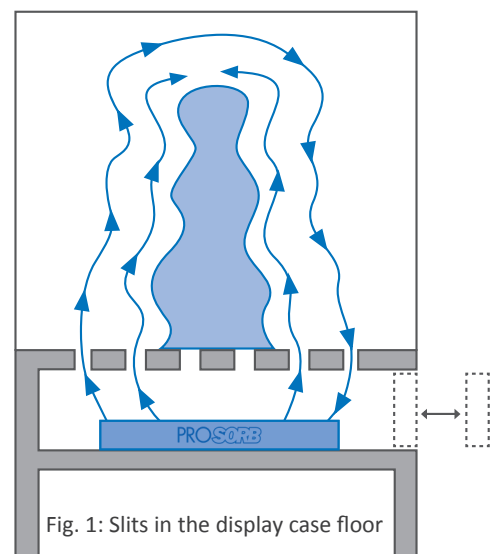
Wood-based materials (such as MDF boards) are not particularly suitable for display cases because they influence the climate in the display case and emit pollutants. The diffusion of water vapour and pollutants can be permanently prevented using melamine coatings or aluminium laminated film. Paints and varnishes are not very effective here.

Location / shelves

Shelves or drawers in display case plinths that are accessible from outside enable the exchange or reconditioning of PRO SORB without having to open the display case itself. The drawers should be spacious so that there is sufficient space for desiccant bags or a tray of water for reconditioning, in addition to the cassettes or sachets. The greater the granulate surface area, the better: two small cassettes next to one another are therefore more effective than one large cassette. If no shelves or drawers are available, PRO SORB can also be hidden in the plinth or base of the exhibited object, or attached to the back wall in the form of a panel.

Air circulation

Air must be able to circulate freely in the display case. This can be achieved by slits or holes in the floor of the display case that are as wide as possible (Fig. 1), a circumferential slit, or a raised display case floor (Fig. 2). A ventilator is recommended for very tall display cases.



How can I recondition PRO SORB?

As soon as the relative humidity of your display case has reached the desired level you must either replace PRO SORB or recondition it. You can carry out the reconditioning directly within the display case, offering the advantage that you do not need to prepare any replacement. Alternatively, PRO SORB can also be reconditioned in PE bags.

During the first two years you can recondition PRO SORB by weight: when cassettes or sachets are returned to the defined original weight they exhibit roughly the same conditioning value as the original. When older than this, or when using loose granulate, you must employ a hygrometer. If you have trouble conditioning you can also send your PRO SORB back to your supplier for attention.

Checking conditioning by weight

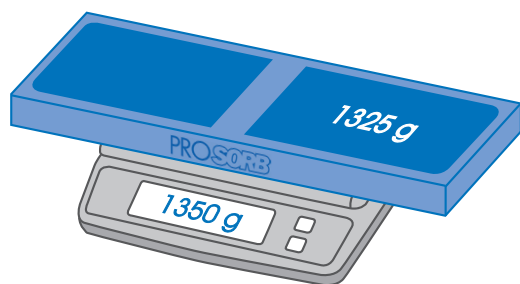


Fig. 3: Weighing the cassette or sachet

Weigh the cassette or sachet (Fig. 3) and calculate the difference from the printed defined weight. This difference must be removed from, or added to, the PRO SORB in the form of water. This takes place with desiccant bags or with normal tap water, as required. We explain this in greater detail on the next page.

Checking conditioning with a hygrometer

PRO SORB cassettes or sachets can no longer be reconditioned by weight after about two years because the conditioning value increases by about 0.8% RH per year due to ageing of the silica gel. You must therefore use a reliable hygrometer (Fig. 4). You also treat loose granulate similarly.

Use the hygrometer and the table on water vapour adsorption capacity (Page 1) to determine how much water you have to add or remove from the display case in order to return to the desired value. Experience of the values gained from the first few years can be of assistance here.

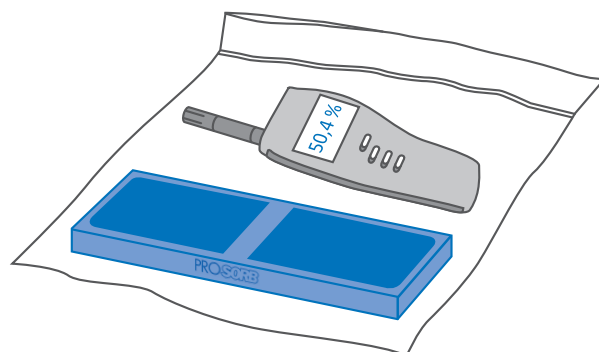


Fig. 4: Measuring RH with a hygrometer

Example: A display case contains 1 kg of PRO SORB; the hygrometer shows 50% RH. You want to reduce the RH back to 40%. The table shows you that PRO SORB takes up 22.5% water by weight at 40% RH and 30.4% water by weight at 50% RH. Accordingly, 1 kg of PRO SORB weighs 1225 g at 40% RH and 1304 g at 50% RH. You must therefore remove about 80 g of water from the PRO SORB in order to achieve an RH of 40%. As each bag of desiccant (30 g) takes up 6 g of water, you must add 13 bags. Check the result with the hygrometer after 1 - 2 weeks.

Reconditioning loose granulate

Loose granulate must not come into contact with liquid water because it would then burst. Condition PRO SORB granulate by laying it out in a dry or damp room, or drying it with desiccant bags or in a stove. Mix it well in a large PE bag. Then leave it in the PE bag in a room with a constant temperature for another 1 - 2 days before measuring it with the hygrometer.

Reconditioning within the display case

Drying (Fig. 5)

Desiccant bags absorb a defined amount of water. A 30-gram bag takes up about 6 g of water between 0 - 40% RH. The calculated weight difference (see above) shows how many desiccant bags you will need. Place the bags next to or below (not above!) the **PRO SORB** in the display case. The surface area of the bags should be smaller than the surface area of the **PRO SORB**, so that the RH does not fall too abruptly (if necessary stack the bags on top of one another). Repeat the process if the RH still remains too high for some time. The desiccant bags can be regenerated in an oven at 110°C.

Example: There are two cassettes/sachets in the display case. They are 60 g heavier than they were. Lay ten 30-gram desiccant bags next to or above the cassettes/sachets. As each 30-gram bag can take up 6 g of water you will remove a total of about 60 g of water from the **PRO SORB** cassettes/sachets.

If the RH does not fall as much as expected after addition of the desiccant bags this is mostly due to hygroscopic materials in the display case itself or the exhibit. Nevertheless, you should only add the calculated quantity of desiccant bags so that the RH cannot fall too far under any circumstances.

Moistening (Fig. 6)

Place a bowl with the calculated quantity of water next to the **PRO SORB** in the display case. The surface area of the bowl should be considerably smaller than that of the **PRO SORB** so that the RH does not rise too quickly.

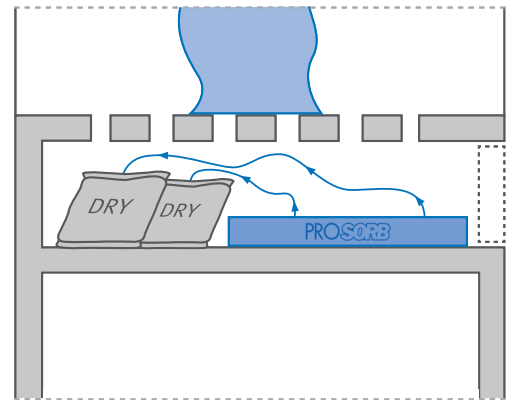


Fig. 5: Drying inside the display case

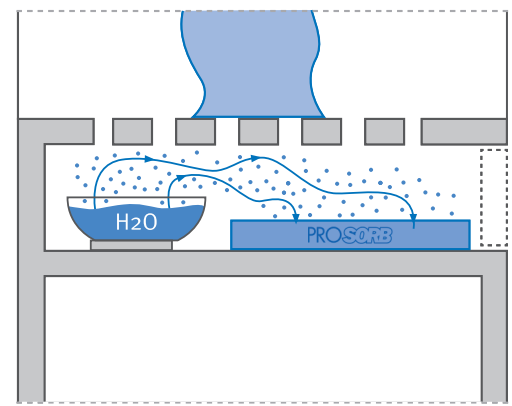


Fig. 6: Moistening inside the display case

Reconditioning outside the display case

Please note: it will be necessary to replace the **PRO SORB** in the display case if the display case needs climate control during the reconditioning process. In this case, you should keep the same quantity of preconditioned **PRO SORB** in stock.

Drying (Fig. 7)

Place each of your cassettes or sachets in an individual PE bag. Place the calculated quantity of desiccant bags directly on the cassettes or sachets.

Moistening (Fig. 8)

Place the cassettes or sachets on a weighing device. Place paper towels on top and then drip the calculated quantity of water onto them (tap water is sufficient). Then place each cassette or sachet in individual PE bags.

Wait about two weeks in both cases and check the results by weighing.

Alternatively, you can also recondition **PRO SORB** in a climatic chamber or in a room with an appropriate RH. Experience shows, however, that this can take several weeks or even months.

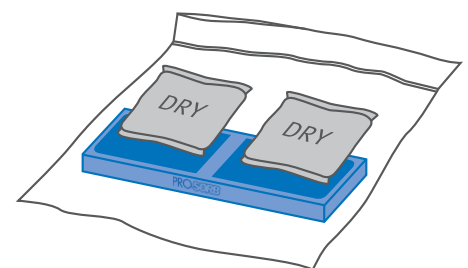


Fig. 7: Drying in a PE bag

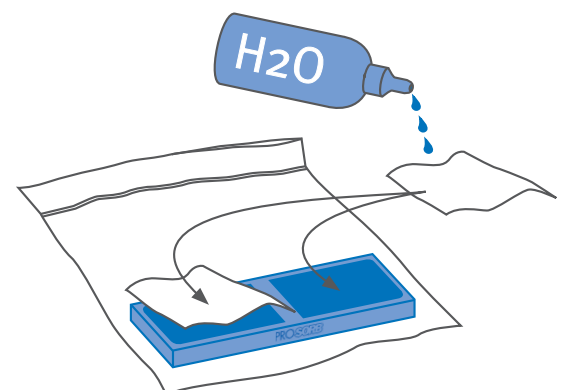


Fig. 8: Moistening in a PE bag

Durability and storage

Fundamentally, **PRO SORB** can be used for 10 - 20 years. The ability to adsorb water falls over time due to ageing: for a given weight, the conditioning value of **PRO SORB** rises by about 0.8% RH per year. This also applies if **PRO SORB** is stored in aluminium bags. Pollutants arising from the display case materials and exhibits accelerate this ageing process.

It is best to use bags made of aluminium composite foil for storing **PRO SORB**. PE bags are only suitable for shorter periods due to their permeability towards water vapour.

Precautions

Precautions are only necessary when handling loose granulate or panels. The water adsorbed by **PRO SORB** is present in liquid form on the surfaces of the granulate grains and can therefore, for example, lead to corrosion in direct contact with iron and zinc. **PRO SORB** should generally not come into direct contact with exhibits. Use careful handling to prevent raising any dust. Do not touch **PRO SORB** and exhibits one after another as this could transfer dust. The polyester fleece of the **PRO SORB** panels and cassettes is not completely dust-tight, so do not place plates or cassettes in overhead position.

Wear a dust mask when pouring loose **PRO SORB**. The dust dries out the skin. Wash your hands with soap after contact with **PRO SORB** or wear gloves for handling loose **PRO SORB**.

Sweep up spilled grains immediately to prevent the risk of slipping.



Disposal

PRO SORB can be disposed of in normal household waste as long as it has not absorbed any pollutants. In this case, contaminated **PRO SORB** must be disposed of using hazardous waste collection.

Troubleshooting

If the desired moisture level cannot be reached, please weigh the **PRO SORB** cassette or sachet:

Result 1: Weight is still the same as printed on the cassette or sachet. There is an insufficient air exchange between **PRO SORB** and the display case air.

- Ensure that the air between the **PRO SORB** and the inside of the display case can circulate freely.
- Check the accuracy of your hygrometer.

Result 2: Weight has changed considerably. The display case is leaking too much or the climate is being influenced by other hygroscopic materials.

- Improve the tightness of your display case, e.g. with silicon seals or by taping the joints with adhesive tape.
- Seal hygroscopic display case materials with foils so that they do not influence the climate within the display.
- Check the accuracy of your hygrometer.
- Increase the amount of **PRO SORB**, if necessary with a higher or lower conditioning level.



Christoph Waller
Long Life for Art

E-mail: info@LLFA.de
Web: www.LLFA.de

Hauptstraße 47
79356 Eichstetten (Germany)

Tel.: +49 7663 60899-0
Fax: +49 7663 60889-20