



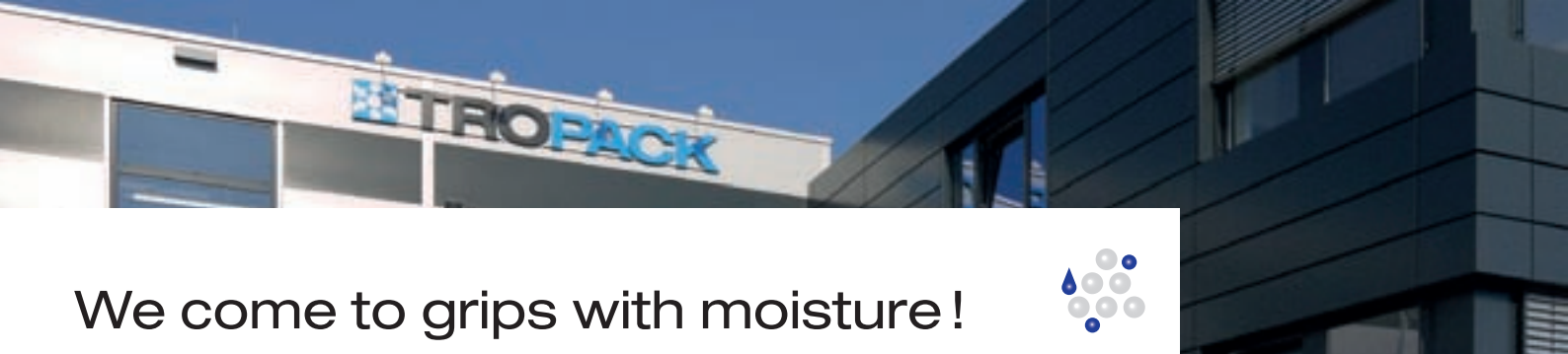
...WE COME TO GRIPS WITH MOISTURE!



Company

Technology

Products



# We come to grips with moisture !



For more than 20 years we have specialised in protecting goods from moisture caused damage during transport and storage. Our solution: a systematic calculated application of desiccants to protect a wide range of goods from medical and food products to machines and textiles.

Moisture means a high economic risk for manufacturers, carriers and recipients. Packing, dispatch and storage are key points at which insufficient care can have severe effects. Hermetic packaging is not sufficient to guarantee efficient protection.

Changing climate conditions with temperature fluctuations during a sea transport of several weeks lead to condensation that causes corrosion in metals. If no protective measures are taken, damage to surfaces, reduced storage capability and effectiveness or function errors as well as "total loss" may be the result.

TROPACK makes risks and preventive care calculable. Application methods and quantity vary by industry, product and case. The amount of desiccants a shipment requires is individually calculated in programmes specifically developed by TROPACK based on DIN 55474. Not enough desiccant leads to risk. Too big amounts cause preventable costs. The programme is available for the clients as well.

The solutions offered by TROPACK Packmittel GmbH are broadly recognized by a wide range of insurance companies who do not hesitate to grant coverage to shipments professionally protected by TROPACK solutions.

We come to grips with moisture and keep a tight grip on it! Our results are sustainable: as if there had never been any moisture at all. This is the TROPACK philosophy for protection of goods and their value.

This brochure offers information about applications, industries, production, material and technology, as well as on our comprehensive product range.



Key word: zero risk

TROPACK products mean: Zero risk tolerance! Moisture damage during transport and storage of goods is excluded using know-how, experience and technology.

During customer product analysis, all features and criteria are recorded and taken into full consideration.



## Moisture is everywhere. Lots to do for desiccants



Small or large – moisture threatens a nearly never-ending range of products from many industries. Surface corrosion of metals is not only a cosmetic problem. When moving parts in tool machines or conveyor technology are attacked, this leads to functional impairment up to uselessness.

Electronic devices from notebooks or communication equipment to the complete data system can be damaged by humidity. Visual measurement and test instruments, photo and film devices react as sensitive to moisture as textiles, leather goods and furniture. For chemical products, pharmaceuticals, raw materials and food, maintaining and controlling the internal package climate is of utmost importance.

TROPACK Packmittel GmbH offers a wide range of solutions depending on product, packaging and individual requirements. The common denominator with which TROPACK provides these solutions is “Knowledge”. TROPACK has control of the various technologies, materials and industries. It combines this with a vast experience for the respective application.

There are criteria for each project we work on. The perfect basis is formed by TROPACK desiccants: they are non-toxic, odourless, free of hazardous substances and do not damage surfaces. They adsorb residual moisture in the packaging without endangering the goods or the recipient.

TROPACK solutions for protection against moisture range in size to fulfill their task from TROPACK Mini desiccant bags to the large DIN 55473 sacks. Seaworthy packaging combines the effect of desiccant units with shielding by the TROPACK sealing layer foil, which is well suited for long transport and storage times.

New developments like the Activ-Polymer® technology permit efficient protection even in smallest containers. This new solution provides hermetically closing cans with integrated protection against moisture or bacteria, among others, it's used in transport and storage of medical and pharmaceutical products.

The investment into desiccant solutions pays off. Goods will reach the recipient undamaged. Correctly protected shipments can be fully insured.

Key word:  
Activ-Polymer® technology

This patented procedure developed by the US company CSP integrates product protection into the packaging. The combination of two polymers creates a composite material into which active substances are embedded.

Air-tight containers and cans, e.g., for medication or test strips, offer integrated goods protection against damage by moisture or bacteria.



## Technology and know-how. Calculable protection



TROPACK desiccant bags are filled with highly resilient natural clay mineral or silica gel. The adsorption agent is so clean that even direct contact with the goods is not harmful and therefore allowed for various uses. TROPACK desiccants are produced according to DIN 55473 (or military provision TL 6850-0008 and US specification MIL-D 3464 E). TROPACK desiccant bags conform to EU laws and the directives of the US Food and Drug Administration (FDA), depending on design, which permits use in transport, packaging and storage of food and pharmaceuticals as well.

The desiccant bag hull is made of dust-tight natron paper, highly tear-proof fleece or the special hull material Tyvek®- depending on requirements. Desiccant bags meet the requirements of DIN 55473, are available in the versions "A" (low-dust) and "B" (dust-tight) and may be disposed of with the household waste; the desiccant can be regenerated an unlimited number of times for reuse.

TROPACK uses packaging machines for precise customisation of the desiccant bags. TROPACK desiccant bags are produced according to DIN 55473 from 1/6 units (approx. 6 g) to 32 units (approx. 1,130 g). The adsorption capacity may be up to 35 % of their own weight, at 80 % relative humidity and a temperature of 25 °C.

Material, production and application of desiccant bags must be "clean". However, in spite of its prohibition in the EU since May 2009, goods contaminated with dimethylfumarate (DMF) are still getting into trade and endanger users as well as consumers. Stricter control mechanisms can reduce DMF danger.

TROPACK never uses the highly toxic DMF. DIN standards, EU directives and US FDA requirements for protection of the environment and health are sensible, balanced and correct. The TROPACK safety and quality claim is checked and approved by regular DIN/ISO certifications. Industry and trade can rely on it just as much as consumers.



Key word: DMF danger

Goods reaching e. g. from the Far East, in which the highly toxic dimethylfumarate (DMF) was used as an "auxiliary agent" are a great danger for mankind and the environment. DMF is a health hazard and strictly prohibited in the EU.

TROPACK desiccants are non-toxic, food-grade, free of hazardous substances, odourless and regenerative. The desiccant quantity required to protect the goods from moisture is calculated with the TROPACK programme.



## TROPACK desiccant products

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# Desiccant bags – TROPAGel®



Corrosion damage from moisture during transport and storage threatens a great number of goods from a wide range of industries. The range reaches from medical products to optical devices and electronics to machinery. Desiccant bags provide effective and environmentally compatible protection in a design perfectly suitable for each individual package. TROPACK has developed a dedicated programme for precise calculation of the required quantities. It is available to customers too.

TROPAGel® desiccant bags are filled with highly active desiccants that due to their high porosity warrant a high degree of air drying. Adsorption capacity can be up to 35 % of their own weight at 80 % rh and 25 °C. TROPAGel® desiccant bags are odourless, non-toxic, chemically indifferent and do not attack metal or other substances.

**The desiccant bag hulls are produced from the following materials that comply to the mentioned requirements:**

- **Fleece** (version A – DIN 55473 low-dust), for standard products
- **Tyvek®** (version B – DIN 55473 dust-tight), low-particle and highly tear-proof for sensitive products
- **Paper** (version B – DIN 55473 dust-tight), low-particle for standard applications

The hull substances are applied with a print pursuant to DIN 55473 by default. Alternatively, they can be provided neutrally with, “Drying Agent – Do not eat”, applied in 4 languages or an individual text.

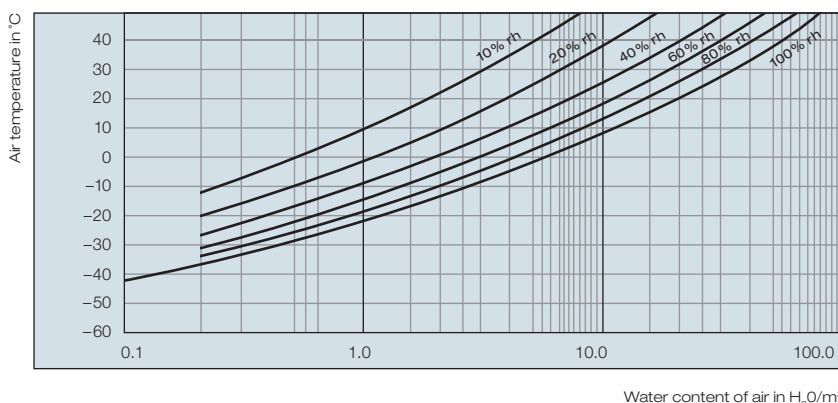
Desiccant bags are produced in the units defined in DIN 55473. Special sizes are available on request. A desiccant unit corresponds to a fill level of about 35 g. This is the desiccant volume that can adsorb at least 3 g of steam at 20 % and 6 g at 40 % relative humidity at a balance with air at 23 °C (+/-2).

**The required volume of desiccant in units for each individual case can be determined based on our calculation formula on page 23. The following factors must be observed:**

- Packaging design
- Steam volume from the outer atmosphere penetrating through the packaging
- Duration of transport and storage time
- Climate at transport and storage
- Humidity of the inner atmosphere of the packaging
- Volume and type of the padding (wood, paper, synthetics, cardboard, wooden wedges)

The TROPACK desiccant calculation programme meets DIN 55473 requirements and is available to customers free of charge on request.

Water content in the air depending on temperature and relative humidity



Desiccant units according to DIN 55473 correspond approximately to the following fill volumes:

Units	1/6	1/3	1/2	1	2	4	8	16	32
= g fill weight (approx.)	6	12	18	35	70	145	285	540	1130

TROPAGel® desiccant bags contain highly active desiccants that due to their high porosity warrant a high degree of air drying.

TROPAGel® desiccant bags are odourless, non-toxic, chemically indifferent and do not attack metal or other substances.

Trockenmittel  
Nicht einnehmen  
Deshydratante  
No ingest  
Drying Agent  
Do not eat  
Agent Dessiccant  
Ne pas avaler

Trockenmittel  
Nicht einnehmen  
Deshydratante  
No ingest

## Hull materials



TROPACK uses different high-quality hull materials for production of desiccant bags, depending on usage purpose. A difference is made between version A “low-dust” and version B “dust-free”.

### VA designates fleece bags

**Version A:** low-dust fleece bags of highly tear-proof fleece material as of 8 units with suspension band. Filling with 1/6 to 32 desiccant units. Area of use: for all packaging purposes in over-seas shipment.

### PA designates a bag of soda-paper

**Version B:** dust-free.  
Filling with 1/6 to 2 desiccant units.

### TA designates Tyvek® bags

**Version B:** dust-free Tyvek® bag of special highly tear-resistant and low-particle hull material. Areas of use: pharma industry, electronics and packaging subject to special strain. Meets the FDA requirements (DMF 1893). The medically tested Tyvek® is chemically inactive and suitable for food packaging. Filling with 1/6 to 16 desiccant units.

**Types PA:** 1/6–2 units  
**Types VA:** 1/6–32 units  
**Types TA:** 1/6–16 units

These types are in line with the DIN 55473 in the 2008-10 version and are provided with the DIN Certco sign 5B004.

All products can be equipped with a humidity indicator card as an additional feature. In that case, a “W” will be added to the product labelling (example: VAW).

Please contact us for custom-made desiccant bags which we will manufacture according to your request and requirements. We offer special sized bags with an imprint according to your own design.

We would be happy to assist you with your product needs.



TROPACK uses different materials for production of the desiccant bag hulls. They are used for specific applications according to properties. All types can be additionally applied with an effect designator.



# Delivery packaging



TROPACK desiccant bags are delivered in various packing units; the “basic package” and the “original corrugated cardboard box”.

The “basic package”, a polyethylene hose bag in accordance with DIN 55473, is the smallest packing unit for desiccant bags; it applies for all types. In the “basic package”, the desiccant bags can be stored in dry rooms for an extended period without reduced activity.

Each “basic package” is imprinted with an instruction manual and contains a humidity level indicator 8% rh. If the indicator is BLUE, the desiccant

bags are still active; if it turns PINK, the control sheet text applies.

The original corrugated cardboard box is the next-larger packing unit. It can bare loads up to 30 kg and is filled with a net of up to approx. 20 kg. A delivery pallet comprises of 27 original boxes maximum.

The dimensions of the different desiccant bag types, the number of pieces per basic package and the total volumes per original box are shown in the following table:

Units/Type	1/6	1/3	1/2	1	2	4	8	16	32
Width mm	70	70	70	70	70	150	150	150	200
Length mm	90	100	100	140	150	140	200	245	280
Number of pieces									
Basic package*	150	80	60	40	20	15	10	5	3
Original box*	1,350	800	720	400	240	120	60	30	18

\* Number of desiccant bags according to type

## Quantity table for packing material

Packaging should not include any hygroscopic material as padding. If this cannot be avoided, the volumes determined according to the table must be increased by the following number of units per kg of packing or padding material:

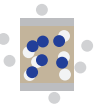
Wood or cardboard and synthetic material

Western Europe	17
Eastern Europe	20
North America	20
Central America	20
South America	20
Africa	20
Middle East	20
Far East	20
Pacific	20

The smallest delivery unit is the “basic package” in which the desiccant bags can be stored for a longer time in dry rooms without becoming inactive. The number of desiccant bags contained in the package, results from their size and fill volume.



## TROPACK mini desiccant bags



The compact TROPACK Minis provide effective protection even in the mini-bag packagings smallest of units and require little space. Its compact size (please refer to the table below) and the white silica gel filling offer a multitude of application possibilities. At the same time, our "TROPACK Mini" reliably offers its usual and outstanding humidity adsorption capacity.

The standard desiccant for TROPACK Mini is white silica gel, but can also hold a 4 Å or any other pore size molecular sieve filling if requested. The chemically indifferent fill material is non-toxic, odourless and does not attack surfaces. The product is protected from moisture damage like mould, corrosion and other detrimental chemical reactions.

The "TROPACK Mini" hull comprises highly tear-proof, low-particle Tyvek® and is heat-sealed. The medically tested Tyvek® is chemically inert and therefore suitable for food packaging. The very tightly spun polyolefin fibres warrant a dust-free product. The material surface is wear-resistant and lint-free.

All bags can be imprinted with a warning or caution statement and company logo according to your request. The bags come with a standard "do not eat" warning statement in German, English, French and Spanish. We would be happy to accommodate your requests.

The materials used for desiccant bags TROPACK Mini meet the requirements of the U.S. Food and Drug Administration and the German Federal Public Health Department ("Bundesgesundheitsamt").

The desiccant fill white silica gel is in line with the requirements of the FDA and approved for direct food contact applications. White silica gel further meets the TOSCA provisions of the positive list of additives of the Commission of the European Communities (CEC) for the manufacturers of food-proved additives, plastics and dyes, which may come into contact with food.

TROPACK desiccants are food-compatible, free of hazardous substances and of course free of DMF.



Tyvek® Mini desiccant bags filled with white gel 0.2–1 mm or molecular screen 4 Å

Weight	g	0.5	1.0	2.0	3.0
Volume +/- 2 mm	mm	20x30	20x40	23x50	23x58

TROPACK Minis need little space and offer effective protection of even smallest sales packages. The TROPACK Mini hull of highly tear-proof, low-particle Tyvek® is heat-sealed.

The medically tested Tyvek® is chemically inactive and therefore suitable for food packaging.

# Activ-Polymer® technology



The Activ-Polymer® technology offers innovative ways for the packaging of products such as pharmaceuticals and medical supplies. The hermetically sealed containers and boxes utilising the technology offer “built-in” product protection against damage caused by moisture or humidity or by germs or bacteria. Particles are contained in the composite synthetic plastic material which absorb moisture and humidity, oxygen or odours and fight against bacteria microbiologically.

**The new TROPACK product line currently encompasses the following areas:**

- Containers with an Activ-Polymer® insert which completely encloses the contents of the container, such as for the hermetically-sealing hinged-lid containers from CSP with a capacity of 10–200 ml for pharmaceuticals, laboratory samples or liquids.
- Activ-Polymer® foil with a thickness ranging from only 0.3 mm up to 1.5 mm, with which flat or shallow plastic pockets or bags, for test strips or diagnostic medical dipsticks, can protect the packaged products against damage caused by moisture or humidity.

**The patented Activ-Polymer® technology regulates the flow of the smallest molecules through the polymer. The technology is based on the combination of three materials:**

- As the basic component, a main polymer ensures the structure of the packaging product.
- The active component provides for the desired properties such as the adsorption of moisture,

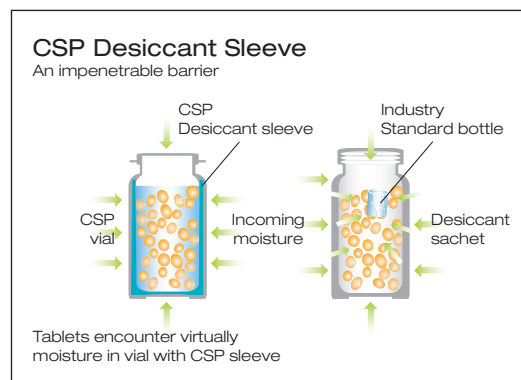
humidity and oxygen or the release of a biocide against germs and bacteria. In addition, the combination of various diverse components for the simultaneous adsorption of moisture and oxygen is possible.

- A second polymer, which does not mix with the main polymer, surrounds the active components and thus creates the means of access and flow.

The new active composite synthetic plastic materials transport gaseous molecules through the packaging or else absorb moisture in the packaging, which assures the optimal environment for the packaged product. Through the use of Activ-Polymer® technology, the interior “climate” or environment of the packaging is controlled, depending on the active component, by the adsorption of moisture, humidity, oxygen or odours, or by the release of aromas or biocides against germs and bacteria.

The Activ-Polymer® composite plastic comprises two polymers and an active component.

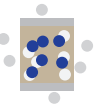
The opportunities for the application and use of Activ-Polymer® technology range far beyond standard packaging forms and designs. For every conceivable product form, such as inhalators or all kinds of medical products and supplies, active components can be developed accurate to exact measurement. The composite synthetic plastic material can be made into any form or shape desired by various injection moulding processes. The individual configuration of functional packaging is practically unlimited.



Activ-Polymer® technology controls the interior “climate” or environment of the packaging is controlled, depending on the active component, by the adsorption of moisture, humidity, oxygen or odours, or by the release of aromas or biocides against germs and bacteria.



## Desiccant bags for the automotive industry



TROPACK offers customised solutions for a wide range of applications – from mobile and stationary air conditioners in passenger cars, trucks, busses and light transporters, to the residential and industrial sectors, TROPACK provides customer-specific solutions for professionally solving humidity problems in connection with cooling systems.

**TROPACK desiccant bags provide the following advantages:**

- Prevention of corrosion
- Increase in system reliability
- Protection of attachment parts

**and thereby increase the service life of the system.**

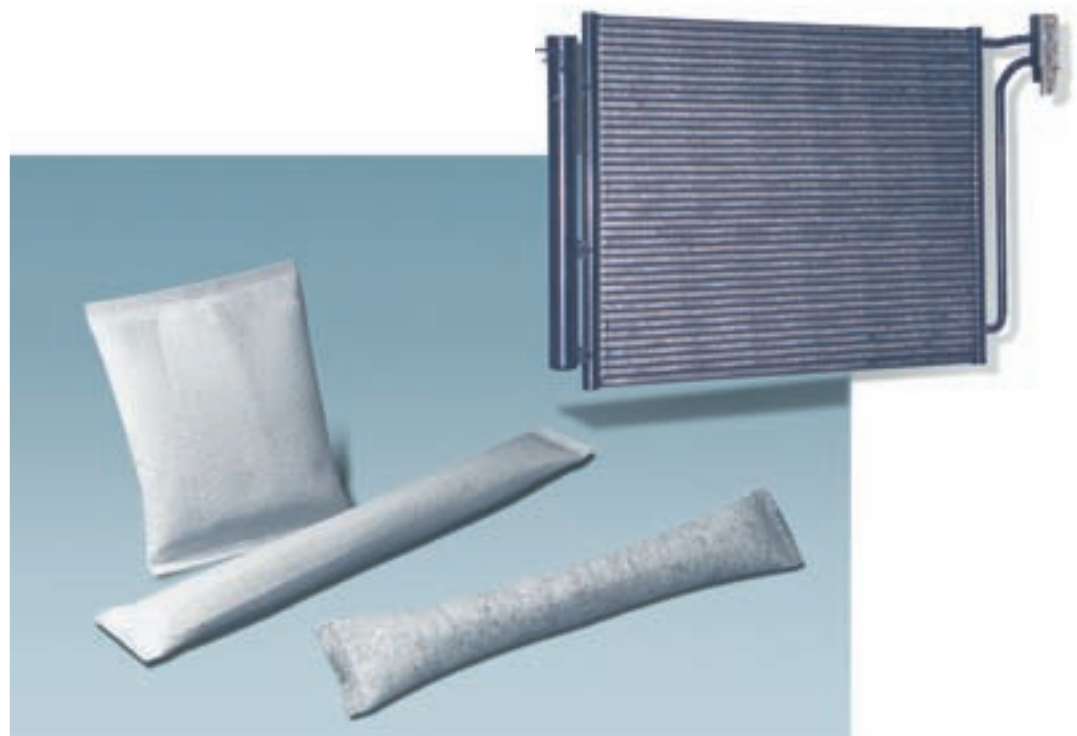
Based on individual requirements, TROPACK can also provide special solutions based on requirements and using our modern machinery. Testing and measuring equipment is readily available.

The bag can be designed in sizes ranging from 30–150 mm. The length is geared toward the respective customer specifications.

**Benefits of TROPACK desiccant bags for customers in the automotive sector are**

- High strength of the bag material
- Extreme strength in comparison to the four-side seam
- Work as filters in cooling systems
- Very low installation and handling costs
- Approval for the coolants R134a and HFO-1234yf

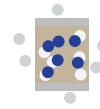
Special highly tear-proof fleeces in different versions and weights are used as hull materials depending on requirements. The adsorbents are molecular sieves tested and released in the automotive industry (IMDS registration).



TROPACK desiccant bags for the automotive industry contain molecular sieves tested and released by the automotive industry (IMDS registered) as adsorbent.

Desiccant and hull materials are chemically indifferent and do not attack surfaces.

# Desiccant bags for containers – TROPAsorb®



TROPAsorb® desiccant bags were specifically developed for use in freight containers to protect the goods from damage caused by moisture in transport. The 200 gram desiccant bags adsorb large amounts of moisture to protect goods in metal containers, steel products from rusting, and prevent food from spoiling.

TROPAsorb® desiccant bags contain a specially developed patented adsorbent mixture (Calcium Chloride Vermiculite) against “container rain”, which occurs due to condensation in large steel containers because of the temperature and climate changes in the course of long sea transports. Protection against such changing conditions is important to prevent damage during transport by truck or train and long-term storage as well.

The container desiccant bags are 13 x 28 cm in size. The number required for protection depends on container size; a typical 20-foot container requires 32 desiccant bags.

TROPAsorb® desiccant bags can adsorb up to 160% of their weight (at 20°C/90% rh) and enclose moisture. This highly efficient protection of the freight helps to avoid expensive returns of damaged goods. Application is simple. The bags can be placed on the floor in the corners of the container or suspended from container hooks in the upper third. Nets are available for this purpose.

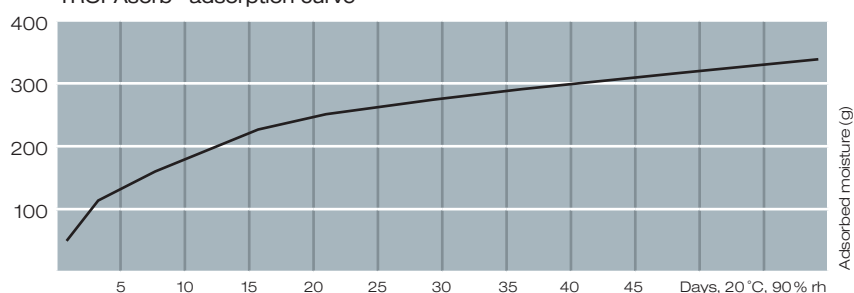
The bags are made of Tyvek® and are heat-sealed. The extremely resilient fabric of spun polyolefin fibres makes the bags dust-free. They have a wear-resistant, lint-free surface and are protected against heat.

The bags come with a standard “do not eat” warning statement in German, English, French and Spanish. All bags can be imprinted with a warning or caution statement and your company logo according to your request. Please contact us at any time for further inquiries.

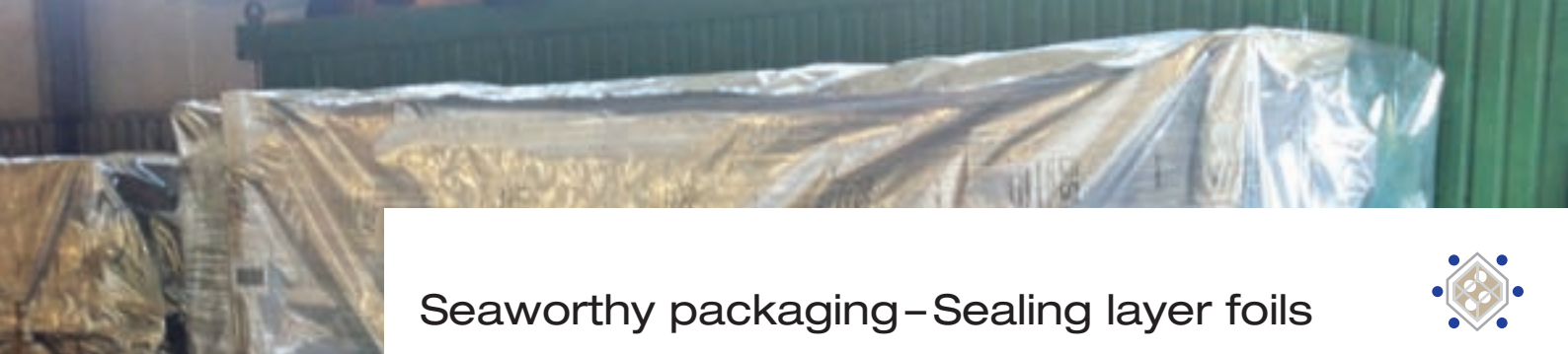


Filling goods	Calcium Chloride Vermiculite	
Weight	g	200 +/- 10%
Dimensions	mm	13 x 28 cm

TROPAsorb® adsorption curve



TROPAsorb® desiccant bags for containers are filled with a special patented adsorbent mixture (calcium, chloride, vermiculite) against “container rain”. Bags and desiccant are suitable for contact with food and harmless.



## Seaworthy packaging – Sealing layer foils

Goods in danger of corrosion must be protected in a “climatic packaging” for sea transport, polar and tropical shipment and during long-term storage. The packed goods are sealed into steam-tight Tropicac® layer foils (aluminium composite or polyethylene) that closes off the packed goods hermetically against the outer air. The inner atmosphere is kept securely below 50% rh with the volume of TROPAGel® desiccant units calculated accordingly, which adsorbs the residual moisture in the sealed packaging.

**Every foil type has a differentiated steam permeability. Therefore, calculation requires consideration of the continually penetrating volume of moisture – see DIN 55474.**

The following points are important for this:

- Climate zones that are crossed
- Duration of transport and/or storage
- Water vapor permeability of the foil
- Packaging surface in m<sup>2</sup> (all 6 sides)

**TROPACK recommends two material versions of sealing layer foils:**

**Polyethylene barrier foil** as standard packaging for a transport and storage time of no more than 1 year. A 200-µm thick foil with maximum permeability of 0.5 g/m<sup>2</sup> in 24 hours and at 23 °C/ 85% rh (see DIN 55122) offers the required protection.

**Aluminum barrier foil** (TL 8135-0003) is an aluminum sandwich foil that is suitable for a feed and a storage time from one year to five years. Long-term packing must be e.g. sealing in an aluminum sandwich foil, Tropicac® barrier layer sandwich foil.

### Products

**Tropicac®III** – for the highest requirements with increased tear proofness and increased bursting resistance.

**Tropicac®IV** – for medium requirements with good tear-proofness and good bursting resistance. Corresponds to the current MIL and TL.

**Clear®** – sealing-capable, transparent composite foil, can be processed with Tropicac®III and Tropicac®IV.

“Climatic packaging” can be used to protect goods with a corrosion risk for sea transport, polar or tropical shipment and for long-term storage.

The packaged goods are welded into the Tropicac® sealing layer foil (aluminium composite or polyethylene) with the calculated number of desiccant units.

TROPACK sealing foils	Unit	Tropicac® III	Tropicac® IV	Clear®
Material structure Polyethylene HD/LDPE Aluminium polyester	µm	12	7	Composite foil
Weight by area DIN 53104	g/qm	125	110	90
Thickness DIN EN ISO 527-3	µm	100	100	92
Tear resistance DIN 53455 lengthwise	N/15 mm	>55	>55	>45
crosswise	N/15 mm	>55	>50	>45
Tear resistance of the seal seam DIN EN ISO 527-3	N/15 mm	>30	>30	>45
Temperature range of the application	°C	-40 to +60	-40 to +60	-30 to +60
Permeability DIN 53122 part 2	g/m <sup>2</sup> /d	<0.02	<0.02	<0.05
Oil resilience FED-STD-101/3015		yes	yes	yes
Military approval TL 8135-0003-1 MIL-PRF 131 K+ DIN 55531-1		+ +	+ +	not in the standard
Roll length	m	100	100	100
Roll width	cm	100/125/150 + special widths	100/125/150 + special widths	100/125/150 + special widths



TROPACK sealing layer material is steam- and grease-tight, supple, abrasion- and decomposition-proof and may be heat-sealed on the matte side. Tropac® sealing layer foil is available as semi-hose, flat bag or box insert as well.

The combination of sealing layer foil and desiccant bags is the most economical solution for sea transport freight packaging because it can be perfectly adjusted. The freight costs can be minimised because the weight is low and little effort is required for preservation and removal of preservative agents.

#### Packaging with fixed sealing layer

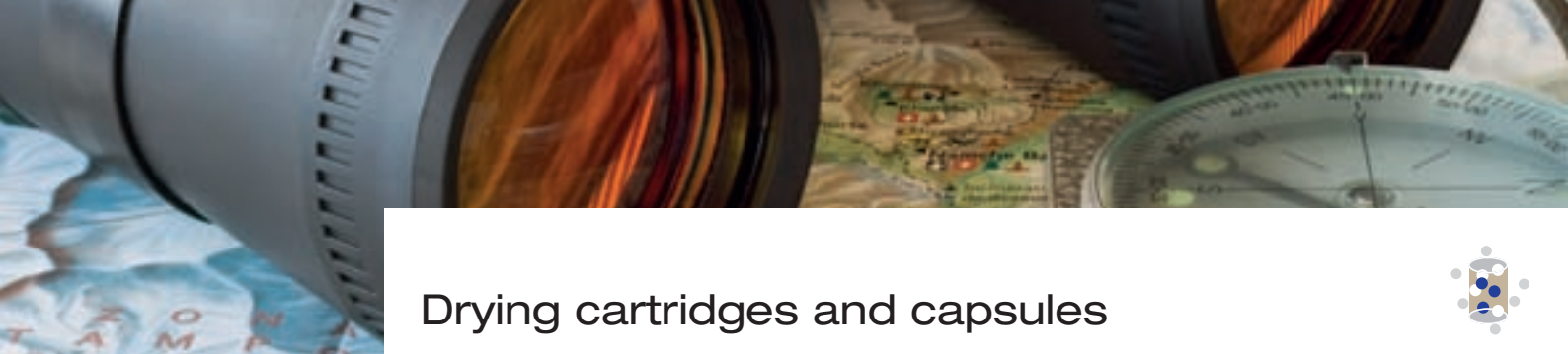
Sheet metal drums with a fixed sealing layer are good steam-tight packagings for individually packed small parts. They reliably prevent humidity from penetrating.

The air captured in the package is dried by inclusion of desiccant bags. The temperature in the packing space must be considered. About 1–2g per litre are needed to dry 200 l air space in the packaging (empty packages). Most frequently, silica gel is used.



TROPACK sealing layer foils are steam- and grease-tight, supple, abrasion- and decomposition-tight and can be heat-sealed.

The combination of sealing layer foil and desiccant bags is the most economic solution for sea transport freight packaging because it can be perfectly adjusted to the freight.



## Drying cartridges and capsules

TROPACK desiccant cartridges are used in high-value measuring and control technology devices along with other highly sensitive optical and electronic devices (in particular arms technology) to protect them from moisture and subsequent damage due to corrosion and fungi. Capsules containing desiccants are particularly suitable as protection for pharmaceutical products because they are available in many types, special sizes and designs.

The residual moisture in the device and the humidity entering through leaks that condensates due to temperature fluctuations will be adsorbed. Function and use are unimpaired. For best results the following prerequisites must be complied with: close assembled pieces tightly and seal passages. All parts must be clean and dry and must not contain any residual moisture. (Plastic parts may have a residual moisture of 3–5%.)

The housings of the drying agent capsule and cartridges are mainly state-of-the-art plastics like acrylic nitril copolymerisate. Paper or fleece is used for the cover discs to let humidity diffuse out. Sometimes, indicator papers are also integrated.

The active desiccant – mainly silica gel (silicon dioxide –  $\text{SiO}_2$ ) – is filled according to application and customer requirements. Molecular sieves are used as well. They are characterised by particularly fast adsorption and low dust.

The drying cartridges and capsules are customised in hermetically tight, protective packagings to prevent them from losing effectiveness during transport and storage.

- Standard packaging desiccant capsules: bag of 0.2 mm thick polyethylene foil with indicator
- Steam-tight bags of oblique aluminium composite foil (TL 8135-0003) with moisture indicator inside (can only be verified with the bag open)
- Standard packaging desiccant cartridges: transparent packaging bags of composite foil with very high steam tightness of MIL-B22191, type I and in cans according to TL 4440-0007

All information on Bundeswehr military standards are based on the currently valid issues.

Special moisture-tight, screw-on protective sleeves of transparent polystyrole according to TL 4440-0007 are used for the desiccant cartridges. Additionally, packaging in an aluminium can is possible. Only the undamaged and unopened collection and shipment packaging warrants proper characteristics of the capsules and cartridges.



TROPACK desiccant cartridges and capsules are used in high-quality devices for measuring and control technology and other visual and electronic instruments (in particular arms technology).

Highly sensitive device technology is effectively protected from damage caused by moisture like corrosion and fungi.





## Delivery range

Search no.	Item no. NATO Stock no.	Description	Dimensions Installation length in mm	
<b>Desiccant cartridges for fine-mechanical and optical devices according to VG 95 239 of black polystyrole with sight window and moisture indicator for 40% rh in the head part of the desiccant cartridge</b>				
1	4440-12-158-5262	Rated size 2.5 – 15 (transparent); Weight: M16 x 1.5; filling: 0.35 g molecular sieves	15	
2	4440-12-158-5263	Rated size 5 – 25 (transparent); Weight: M16 x 1.5; filling: 0.7 g molecular sieves	24	
3	4440-12-158-5264	Rated size 10 – 50 (transparent); Weight: M16 x 1.5; filling: 1.5 g molecular sieves	50	
4	4440-12-175-4087	Rated size 10 – 17 (transparent); Weight: M24 x 1.5; filling: 1.7 g molecular sieves	17	
5	4440-12-175-4086	Rated size 25 – 16 (transparent); Weight: M36 x 1.5; filling: 3.5 g molecular sieves	16	
6	4440-12-158-5265	Rated size 25 – 35 (transparent); Weight: M24 x 1.5; filling: 3.5 g molecular sieves	35	
7	4440-12-158-5429	Rated size 50 – 70 (transparent); Weight: M24 x 1.5; filling: 7 g molecular sieves	70	
8	4440-12-154-7226	Rated size 100 – 45 (transparent); Weight: M36 x 1.5; filling: 14 g molecular sieves	45	
<b>Desiccant plastic capsules (cylindrical container) with porous cover disc of cardboard, cannot be regenerated</b>				
9	HKS000001	Desiccant capsules KA 0.4 Filling: 0.5 g white gel	12.7 9	Ø Height
10	HKS000101	Desiccant capsule KA 1.25 Filling: 1.25 g white gel	20 10	Ø Height
11	HKS000003	Desiccant capsule KA 3 Filling: 3 g white gel	29 10	Ø Height
12	HKS000301	Desiccant capsule KO 0.65 Filling: 0.65 g Orange gel	15 10	Ø Height
13	HKS000300	Desiccant capsule KO 3 Filling: 3 g Orange gel	29 10	Ø Height
14	HKS000302	Desiccant capsule KO 4 Filling: 4 g Orange gel	31 10	Ø Height
15	HKS000031	Desiccant capsule KO 27 Filling: 27 g Orange gel	61.5 20	Ø Height
16	HKS000401	Desiccant capsule KM 1 Filling: 1 g molecular screen	13.9 17.3	Ø Height
<b>Desiccant plastic or metal cartridge. Different shapes and fillings, partially replaceable</b>				
17	4440-12-140-2234	Desiccant cartridge P1; filling: 5 g; Ø 11 2 pcs. per packaging	15 8.2	Ø Height

Rated size, e.g., 100 designates the empty volume of a device at max. 100 dm<sup>3</sup>. The desiccant cartridges TL 4440-0007 are tightly screwed into the protective sleeves. Cartridge head and sleeve are secured with red adhesive tape. The weights are indicated at a tolerance of +/- 10%.

Desiccant cartridges and capsules for special requirements can be developed. Please contact us to discuss product and order requirements.

The fill weights of the drying cartridges and capsules may vary corresponding to bulk weights of the desiccants used.

# Packaging aids



## Moisture indicators

These visual aids indicate – in connection with desiccants – the climate within a packaging or the degree of moisture. They are made of special adsorbent paper impregnated with concentrated cobalt II chloride solutions. The numbers in the impregnated areas show the relative humidity by changing colours from blue to violet to pink. With reducing humidity, the colour changes accordingly.

The moisture indicators are within the sealing layer hull or are part of sight windows. At proper expert packaging with desiccants, the relative humidity drops to less than 20% very quickly at regular temperatures. The moisture indicators show 30% blue in this case. If this is not the case, the packaging must be inspected for leaks, incorrectly calculated desiccant amounts or too-moist packaged goods.

The moisture indicators are small, simple and cost-efficient. The permissible tolerance at a test temperature of 2 °C (+/- 2 °C) is +/- 5% relative humidity. These values correspond to the technical delivery conditions of the Bundeswehr TL 6685-0003, issue 4.

During transport in areas with extreme climatic situations, the colour will change later at more than 20 °C and earlier at less than 20 °C. The deviations are about 2.5% rh per 5 °C above or below 20 °C.



## Packaging list sleeves

These plastic sleeves protect the shipping papers from contamination, dust and moisture. They are attached to the outside of the packaging with their self-adhesive back. Packaging list sleeves are also available in red as “front loaders”.

- Size I** for papers in DIN A6 format
- Size II** for papers in DIN A5 format

The packaging list designation is indicated in 8 languages: German, English, French, Portuguese, Spanish, Arabic, Chinese, Russian. Other foreign languages on request.

## Packaging list shields

Shields are nailed to the shipping boxes. They are available in 10 languages.

- Small** for paper insert DIN A6, with or without cut-outs for the documentation
- Large** for paper inserts DIN A5 with cut-outs



The moisture indicators are within the sealing layer hull or are part of sight windows. At proper packaging with desiccants, the relative humidity drops to less than 20% very quickly at regular temperatures.



### Warning notes and signs

for desiccant method II VG 95604, made of paper, surface water-repellent, reverse self-adhesive.  
Colour: red RAL 3000

#### Rated size 1

Dimensions: 34 x 74 mm, paper.  
Vers. No.: 7690-12-140-6350

#### Rated size 2

Dimensions: 52 x 100 mm, paper.  
Vers. No.: 7690-12-140-6351

#### Rated size 3

Dimensions: 74 x 148 mm, paper.  
Vers. No.: 7690-12-140-6352

### Ventilation sheets and swivel lid

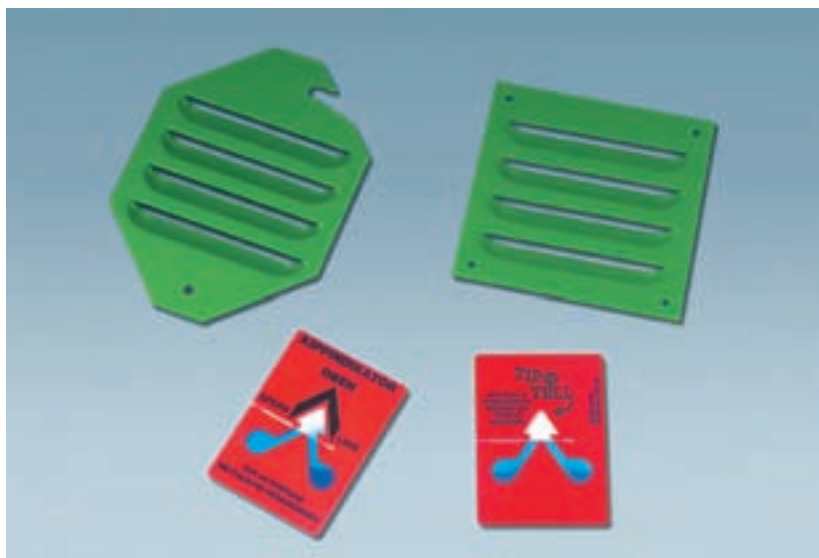
Vents and lids prohibit the danger of steam penetrating the sealing layer foil in large shipping packagings and ensure even air circulation. Depending on packaging size, two or more ventilation sheets are to be attached, preferably in the upper area.

The swivel lid version permits inspection of the moisture indicator attached at the packaging from the outside.

### Tipping indicators

These aids show whether special shipping provisions like “transport vertically” or “do not tilt” were complied with. They are attached right to the packaged goods with the self-adhesive reverse. The front of red plastic comprises a chamber pointing up like an arrow tip that is delineated by a metal strap and tapers out into two round chambers filled with blue grains towards the bottom. The metal strap is removed to activate the indicator.

When the goods are tipped, the grains trickle from the initial position up into the arrow tip, where they are held by the adhesive area. This irreversible indication permits best control. For safety reasons, several indicators should be used and marked to prevent malfunction or exchange. The included warning sign informs the transporter and recipient of the use and effect of the tipping indicator.



Ventilation sheet small  
130 x 130 mm large  
180 x 180 mm

Swivel lid small  
130 x 180 mm large  
180 x 250 mm

TROPACK tipping indicators show whether special shipping provisions like “transport vertically” or “do not tilt” were complied with. They are attached right to the packaged goods with the self-adhesive back.



## Packaging aids



### Shockwatch®

Shockwatch® is a reliable “bodyguard” for sensitive freight and transparently shows even transport damages that are not recognisable at first glance. In case the freight is exposed to strong vibrations and the defined handling provisions were not complied with, the indicator will alert you.

Shockwatch® is a strongly adhesive label with a high-precision glass tube that contains a red liquid in the invisible area. If the transported goods are treated contrary to the specified instructions, the liquid in the tube turns red irrevocably.

The indicator is attached to the packaging with a warning label containing handling notes before shipping. The person responsible for the freight confirms that there is no damage. Upon arrival, the condition of each indicator is noted – triggered, missing or intact. Every Shockwatch® has its own serial number that is also noted on the transport papers.

Shipments with Shockwatch® transport indicators are treated with greatest care by carriers around the world.

Starting at a volume of 1,600 pcs., individual prints are possible – please request a list of required production costs.



The indicator: the incorruptible monitor for your sensitive transport goods

Shockwatch® is a “bodyguard” for sensitive freight and shows even transport damages that are not recognisable at first glance. When the freight is exposed to strong vibrations and the defined handling provisions were not complied with, the indicator will alert you.

# Adsorption agents



## Silica gel

is one of the widest used adsorption agents against moisture with a wide range of applications. It consists of irregularly shaped and porous particles and is a form of silicic acid. The raw materials are mostly sodium silicate and sulphuric acid. Silica gel is inert, odourless, non-toxic and non-corrosive. The large inner pore surface allows adsorption up to approx. 36% of its own weight. It is available as white or indicator gel.

## Microporous white silicagel

is a maximum drying silica gel. The water vapour adsorption capacity is approx.: 15% by weight at 20% rh, or 25% by weight at 40% rh.

- **Grain 0.2–1 mm** – predominantly used in the insulation glass sector for dehydrating air between the glass panels. They can also be found inside desiccant cartridges and capsules. Other highly pure microscopic gels are used with fragrance carriers and the maintenance of pour ability of chemicals and pharmaceuticals. Further applications are in the cosmetic industry.
- **Grain sizes 1–2 or 2–3 mm** – used inside filters of gas masks, the insulation glass sector and for the dehydration of liquids and cooling agents.
- **Grain 1–3 mm** – represent a universal grain size for drying air and gas in smaller sized equipment and for the drying of cooling agents.
- **Grain sizes of 2–5 mm** – have an elevated adsorption capacity with excellent low pressure characteristics for the drying of gases (ethane, ethylene, butane, chlorine, natural gas, methane, methylene chloride, sulphur dioxide, nitrogen and hydrogen).

## Large-pore white gel

used where water may occur in an air or gas flow. Here it serves as buffer gel and is used upstream of narrow-pore gel.

## Orange self-indicating gel

is a white gel with moisture indicator that is free of heavy metals and particularly environmentally compatible. Active; up to a water load of approx. 6% by weight, it is orange; at increasing water adsorption, it turns white. The overall adsorption capacity is at approx. 23% by weight at 40% rh. Its benefit compared to the white gel is visual saturation control.

## Molecular sieves

synthetic zeolites characterized by a precisely defined and regular pore diameter possessing a crystalline structure. Regardless of the relative humidity, they adsorb about 20–22 weight-% of water vapour. The volume of a molecular sieve is very low at the same time providing excellent adsorption capacities and regenerates at temperatures of 300 to 400 °C.

## Clay

a mineral (60–80% montmorillonit) with strong water adsorption and swelling capability. Colour from grey/dark grey to reddish. When active, clay can also take up to approx. 19% by weight at 40% rh. depending on quality. The loaded material can be regenerated at 150 °C.



Indicator gel



Clay



White gel



Molecular sieve

TROPACK adsorbents store moisture in the narrow cavities of the structure that are built as layers, pores and channels by physical forces. Adsorbents are not water-soluble. The stored moisture is released to the ambience air again when heated. The adsorbents can be regenerated as desired without losing effectiveness.



# Products, materials, customer benefits



TROPACK Packmittel GmbH offers a wide range of desiccant bags with highly active TROPAgel® desiccants and related products up to sealing layer foils and packaging aids. This leads to safety and cost benefits for customers:

- Transport time optimisation
- Simpler packaging
- Minimisation of complaints
- Reduction of insurance premiums/ minimal risk exclusions
- No transport and storage damage from moisture
- Regeneration and environmentally compatible disposal of the desiccant (household waste)

### Calculation programme

TROPACK uses a dedicated programme to determine the amount of desiccant units required for a transport and/or storage project. It is freely available to customers on request.

### Special types

TROPACK delivers desiccant bags, desiccant cartridges and capsules as well as sealing layer foils according to individual customer requirements, also in special versions.

### Standards and approvals

TROPACK products correspond to regulations such as DIN 55473, issue 10/2008, and are marked according to the DIN sign 5B004. Desiccants meet the relevant provisions of the Federal Health Act and the US Food and Drug Administration.



### Print

TROPACK desiccant bags are marked by default according to DIN 55473 or alternatively with a warning note “Drying Agent – do not eat” in German, English, French and Spanish. The customer’s logo and related information can be printed upon request on the bags.

### Efficiency and environmental protection

TROPACK desiccants can be regenerated as often as desired without losing effectiveness. This is done by heating:

<b>Silica gel</b>	150°C
<b>Clay</b>	150°C
<b>Molecular screens</b>	to 300°–400°C
<b>Indicator gel</b>	to 120°C max.

The temperature resilience of the hull material must be considered for desiccant bags. Usually below the regeneration temperature.

### Consulting

The information in this brochure is meant for initial orientation. Desiccant bags must be used according to the envisaged purpose and the materials used. The TROPACK consulting team will gladly support you in this.

All information corresponds to the valid provisions and the state of research and development work. It does not constitute assumption of any warranty and no obligations for TROPACK can be derived from this. Subject to change without notice.

TROPACK does not assume any liability for the offered products or recipes and procedures being free of any national and international third-party property rights.

The general sales conditions apply for all TROPACK products.

Service, consulting and development of individual solutions for desiccants by TROPACK are pre-requisites for our customers’ and economic efficiency.

## Calculation of desiccant units



The required number of desiccant units is calculated according to DIN 55474 as follows:

$$n = 1/a \cdot (V \cdot b + m \cdot c + A \cdot e \cdot D \cdot t)$$

**n** = number of desiccant units

**a** = water volume to be taken up per desiccant unit according to permissible final humidity.

At

20% rel. humidity  $a = 3 \text{ g}$

40% rel. humidity  $a = 6 \text{ g}$

60% rel. humidity  $a = 8 \text{ g}$

**e** = corrective factor, relating to the final humidity:  
for 20% rel. humidity  $e = 0.9$ ; for 40% rel. humidity  
 $e = 0.7$ ; for 60% rel. humidity  $e = 0.6$

**V** = Inner volume of the packaging in  $\text{m}^3$

**b** = humidity ratio per  $\text{m}^3$  air depending on temperature and relative humidity during packaging, e.g., at  $20^\circ\text{C}$  and 85% rel. humidity  $b = 15 \text{ g}/\text{m}^3$

**m** = weight of hygroscopic packaging aids in kg

**c** = factor for humidity content per gramme of hygroscopic packaging aids depending on drying condition for wood, paper and cardboard, undefined moisture  $c = 140$ ; at defined pre-drying  $c = 0$

**A** = sealing layer hull surface in  $\text{m}^2$

**D** = steam permeability for the climate to be expected in  $\text{g}/\text{m}^2\text{D}$ . Determination according to DIN 53122 or value indication of the manufacturers of sealing layer foils

**t** = transport- and storage duration in t (days)

The TROPACK desiccant calculation programme according to DIN 55473 is available to the customer free of charge on request.

The desiccant bags must be attached within the product packaging and if required, distributed throughout. Until application, the desiccant bags must be kept in the air-tight delivery packaging which must be closed at once after desiccant bags are removed to protect the unused bags.

TROPAGel® desiccant bags are produced according to DIN 55473 or the German military regulation TL 6850-0008 and the American specification MIL-D 3464 E by the unit.

The number of desiccant units required to protect shipped goods from moisture damage can be calculated from a great number of factors the values of which are included in a formula. TROPACK uses a self-developed programme that is also provided to the customers.



TROPACK PACKMITTEL GMBH  
Vor dem Polstück 8  
D 35633 Lahnau  
Germany  
Phone +49 (0)6441 21089-0  
Fax +49 (0)6441 21089-20  
info@tropack.de  
<http://www.tropack.de>