QVF

member of De Dietrich PROCESS SYSTEMS

DURAPACK®
STRUCTURED BOROSILICATE GLASS PACKINGS FOR MASS TRANSFER

P107e.1

THE MATERIAL ADVANTAGE

Structured packing made of borosilicate glass 3.3 for mass transfer application - DURAPACK®.

Structured packings have successfully been used for mass transfer intensification in absorption, desorption, distillation and extraction columns for many years.

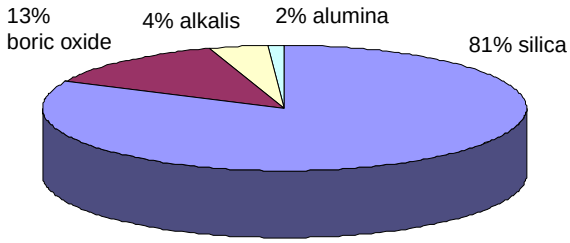
In order to allow for our customers to benefit from the known advantages of structured packings - such as high throughput at low pressure drop and at the same time high efficiency - the patented structured glass packing DURAPACK® was developed.

DURAPACK® mass transfer packings are comprising of alternating arranged corrugated plates of glass with flow channels inclined by 45 °. The glass plates are permanently fused together homogeneously so that borosilicate glass 3.3 is the only material of construction in contact with the process fluids. In this respect DURAPACK® is unique.

PROPERTIES OF BOROSILICATE GLASS 3.3

DURAPACK® structured packing is manufactured from temperature and corrosion resistant borosilicate glass 3.3. This glass has been used to manufacture laboratory and process plant components for many decades.

Chemical Composition:



Physical properties:

Density:	2230 kg/m^3
Coefficient of linear expansion:	3,3 x 10^{-6} K^{-1}
Thermal conductivity:	1,2 W/mK
Specific heat capacity:	0,98 kJ/kgK
Modulus of elasticity:	64 kN/mm^2
Poissons ratio:	0,2

Fig.: CORE-TRAY under the flame

MATERIAL OF CONSTRUCTION AND FIELDS OF APPLICATION

The outstanding properties of borosilicate glass 3.3 are:

- almost universal corrosion resistance
- high temperature resistance
- good shape stability
- catalytic inertness
- physiological and ecological harmlessness
- non flammability.

This means that DURAPACK® is especially useful as a mass transfer packing for processing corrosive or extremely pure process fluids in, for example:

- multipurpose production and pilot plants
- absorption columns such as adiabatic HCl and HBr absorbers,
- desorption and stripping columns for the removal of chlorinated hydrocarbons from liquid effluents,
- distillations of highly sensitive active pharmaceuticals at vacuum and
- extraction columns, used for the extractive purification of aggressive process effluents.

CHEMICAL RESISTANCE

Highly resistant to	water, acids, salt solutions, organic substances such as, for example, halogens
Resistant to	cold alkalis
Not resistant to	hydrofluoric acid, concentrated phosphoric acid above 100 °C, strong alkalis above 50 °C
Temperature resistant	up to 200 °C Temperature resistance is limited by the physical properties of the peripheral equipment such as gaskets, bellows, couplings and supports. The DURAPACK® glass is temperature resistant up to 300 °C.

Hydrolytic resistance

- DIN ISO 719 (98 °C), class HGB 1
- DIN ISO 720 (121 °C), class HGA 1

Acid resistance

- DIN 12116, class 1
- DIN ISO 1776, class 1

Alkali resistance

- DIN 52322, class A2
- ISO 695, class A2

Values of maximum allowable stress in accordance with AD data sheet N4:

- maximum allowable tensile/bending stress:	7 N/mm2
- maximum allowable compressive stress:	100 N/mm2
- Maximum allowable rapid temperature change :	120 K

DURAPACK® ELEMENTS

Decisive for the performance of a mass transfer packing is the phase interface that is influenced by turbulence and wettability, the uniform distribution of gas and liquid as well as the low pressure drop, which is in particular important for vacuum applications.

The turbulence and the separation effect is enhanced by notches embossed into the corrugated plates. Because the individual packing elements of 200mm height are arranged 180° shifted to each other, a proper redistribution of liquid is ensured. In particular for columns of larger diameters a proper initial distribution and redistribution after approximately 3-5m is eminent. Therefore we would like to direct your valued attention to the integrated support plates and distributors developed by QVF, in particular to the CORE-Tray.

The packing elements are in one piece for nominal diameters from DN 100 to DN 300. For nominal diameter DN 450 it is comprising of two half circular segments and can also be used on a support ring. Packing layers with a nominal diameter of DN 600 or larger are divided into individual segments and a support frame is required .

Fig.: Plate structure, segmented packing, installation in glass columns

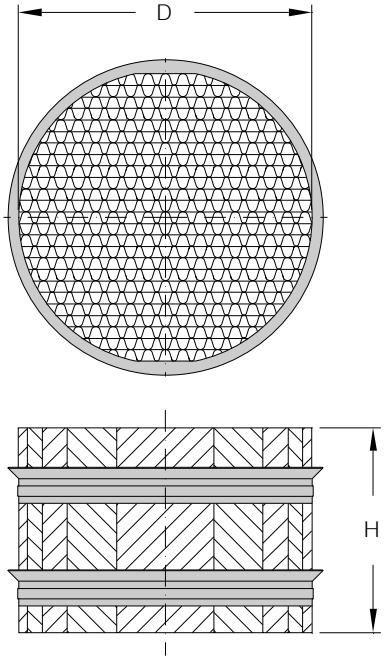


Fig.: DURAPACK® element DN 300

TECHNICAL DATA

DN	D*1)	H	Weight of one layer (kg)	Number of segments in a layer	Number of edge deflector	Reference
100	90	200	0,5	1	2	**DUPA100/300**
150	140	200	1,3	1	2	**DUPA150/300**
200	190	200	2,3	1	2	**DUPA200/300**
300	285	200	5,2	1	2	**DUPA300/300**
450	435	200	12,1	(1)	1	**DUPA450/300**
600	585	200	22,4	4	1	**DUPA600/300**
800	798	200	40,2	4	1	**DUPA800/300**
1000	973	200	60	7	1	**DUPA1000/300**

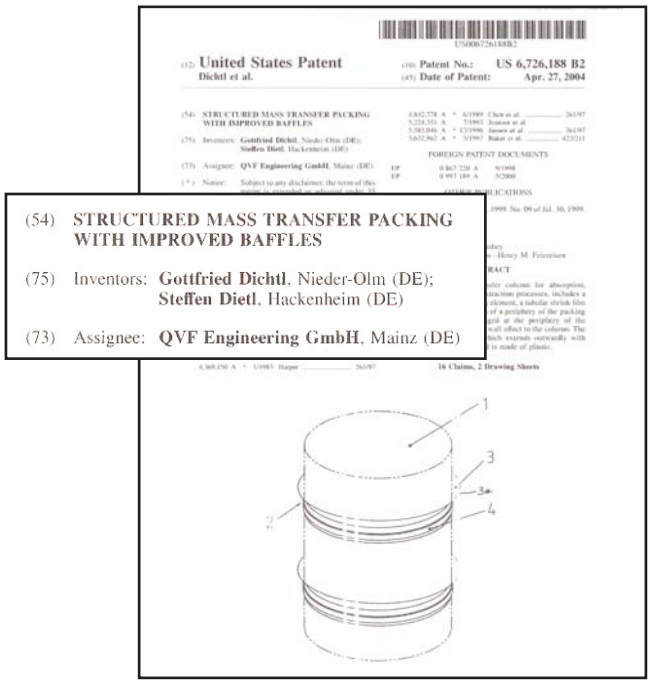
*1) specification for glass columns, for columns of other materials please specify the corresponding diameter.

WALL WIPER

DURAPACK® mass transfer packing can be used in both glass columns and columns made of other material such as glass lined steel . For glass columns up to a nominal diameter of DN 1000 the outer diameter of the packing is automatically adjusted to the column. For columns made of other materials the inner diameter of the column has to be specified including the corresponding tolerances with the order. To avoid wall effects the elements are equipped with patented wall wipers made of PTFE (included in delivery).

All packing elements have a height of 200 mm. Up to a nominal diameter of DN 300 the packing elements come with two wall wipers , from DN 300 on with one for each layer. Due to the flexible wall wipers the glass packing can be installed in standard column sections . Precision bore pipe sections are not required.

Fig.: DURAPACK® element DN300 with wall wiper.



(54) STRUCTURED MASS TRANSFER PACKING WITH IMPROVED BAFFLES

(75) Inventors: **Gottfried Dichtl**, Nieder-Olm (DE); **Steffen Dietl**, Hackenheim (DE)

(73) Assignee: **QVF Engineering GmbH**, Mainz (DE)

Fig.: Patent PTFE wall wipers

SUPPORTS AND SUPPORT FRAMES

The following standard components are available for glass columns:

PTFE SUPPORTING RING

Available up to a nominal diameter of DN300 and up to a maximum packing height of 1m.

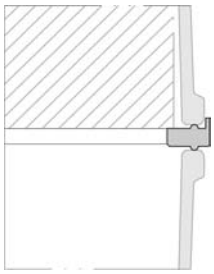


Fig.: PTFE support ring

SUPPOR RINGS STEEL/PTFE

Available up to a nominal diameter of DN 450 and up to a maximum packing height of 3 m. The support ring with a steel core can also be used for a fixed point in the frame.

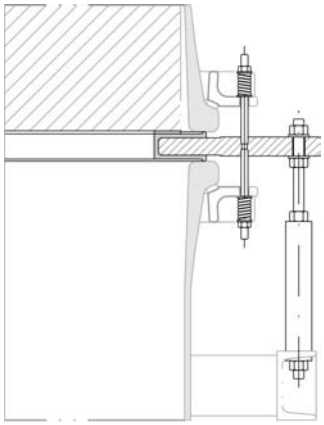


Fig.: Steel/PTFE support rings.

STEEL/PTFE SUPPORT RING WITH SUPPORT FRAME

Available from DN 600 up to a nominal diameter of DN 1000 and up to a maximum packing height of 2 m. Since the support frame is confining the free cross sectional area of the column to approx. 60%, the CORE-TRAY should be used for high performance applications and for columns of larger diameters.

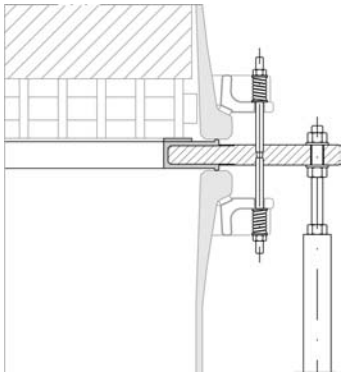


Fig.: Steel/PTFE support ring with support frame

CORE-TRAY - COLUMN INTERNALS

The CORE-TRAY support (patent applied) can also be supplied in a version acting as a liquid collector and distributor, and now also provides a solution for the problem of metal-free support trays with a large free cross-sectional area. Whereas previously available versions made of glass lined steel or graphite created a bottleneck in the column, CORE-TRAY provides a free cross-sectional area of approx. 120%. Using only glass-lined steel for the plates clamped between the buttress ends, borosilicate glass for the risers and PTFE for the gaskets, CORE-TRAY does not contain any metal and is highly resistant to corrosion.

Fig.: CORE-TRAY DIN 1000 assembly, here for packing with glass support

FUNCTION

In counter-current columns the pressure drop should not be too high wherever liquid and vapour streams come into contact. CORE-TRAY separates the liquid and vapour in the cross-section of the perforated plate and prevents a liquid accumulation. In the area of the gas risers, however, the opening for the gas is the equivalent of 120% of the column cross-sectional area, so that here, where the liquid and the vapour meet, the pressure drop remains low and no liquid accumulation occurs.

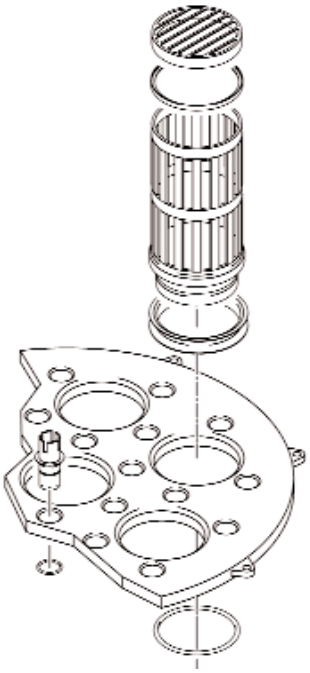


Fig.: CORE-TRAY column packing support with support grid on top for random packing and with distributor nozzles

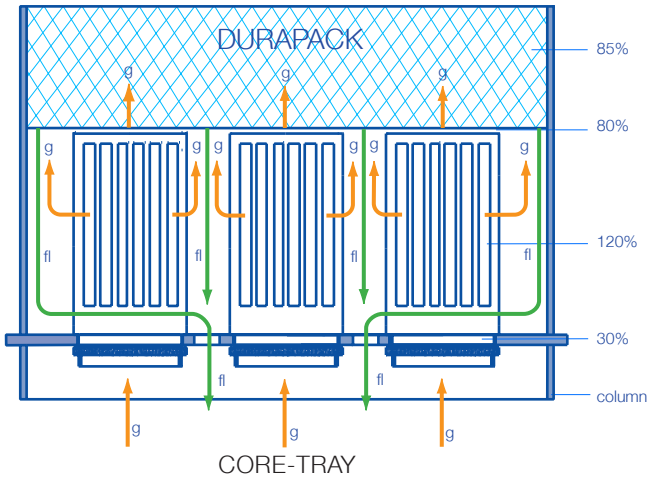


Fig.: Hydrodynamic levels of the CORE-TRAY

The illustration shows the various levels of the CORE-TRAY. It can be seen that the counter-current area which is crucial for the hydrodynamic design is located between the packing and the perforated plate and thus reveals a free cross-sectional area matching the DURAPACK® high-performance packing. A hight of 5 m of DURAPACK® can be placed on a plate. If random packing is used instead of structured packing, the top of the gas risers are covered with a glass grid to prevent any falling through of packing.

Liquid collectors, redistributors and liquid withdrawals based on the same design principle are also available. In all cases the plate is clamped between the column flanges and can be centred with the welded-on eyes.

TECHNICAL DATA

Material:	Glass-lined steel, Borosilicate glass 3.3
Diameter:	600 - 1800 mm
Free cross-sectional area:	up to 120%
Liquid loading:	0,5 - 100 m³/m²h
Distribution points per unit area:	100 - 300 per m²
Operating temperature:	-40 to +200°C
Bearing capacity: DURAPACK®	max. 5 m
Patent application:	No. DE 10140352.6

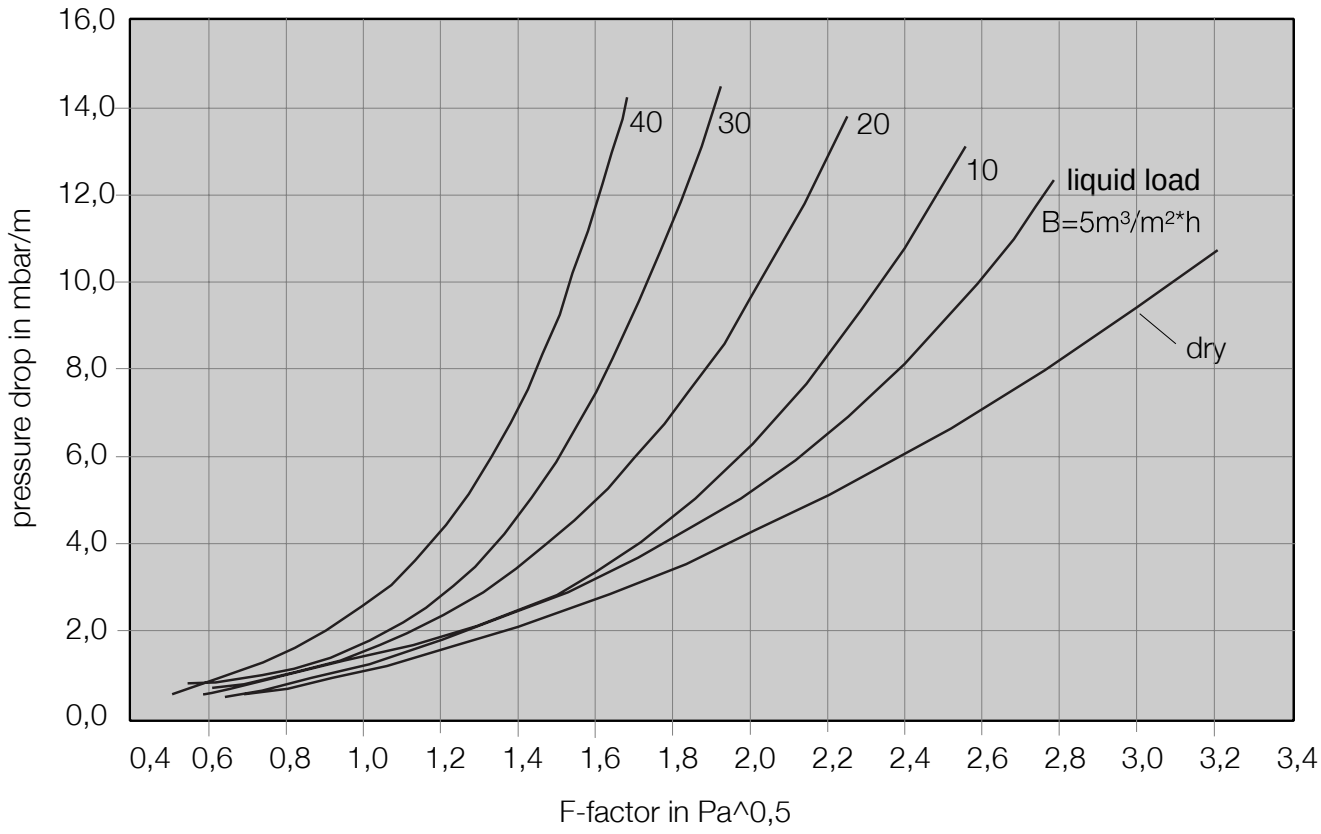
Fig.: Liquid collector and redistributor with distributor cup (view from below)

PERFORMANCE

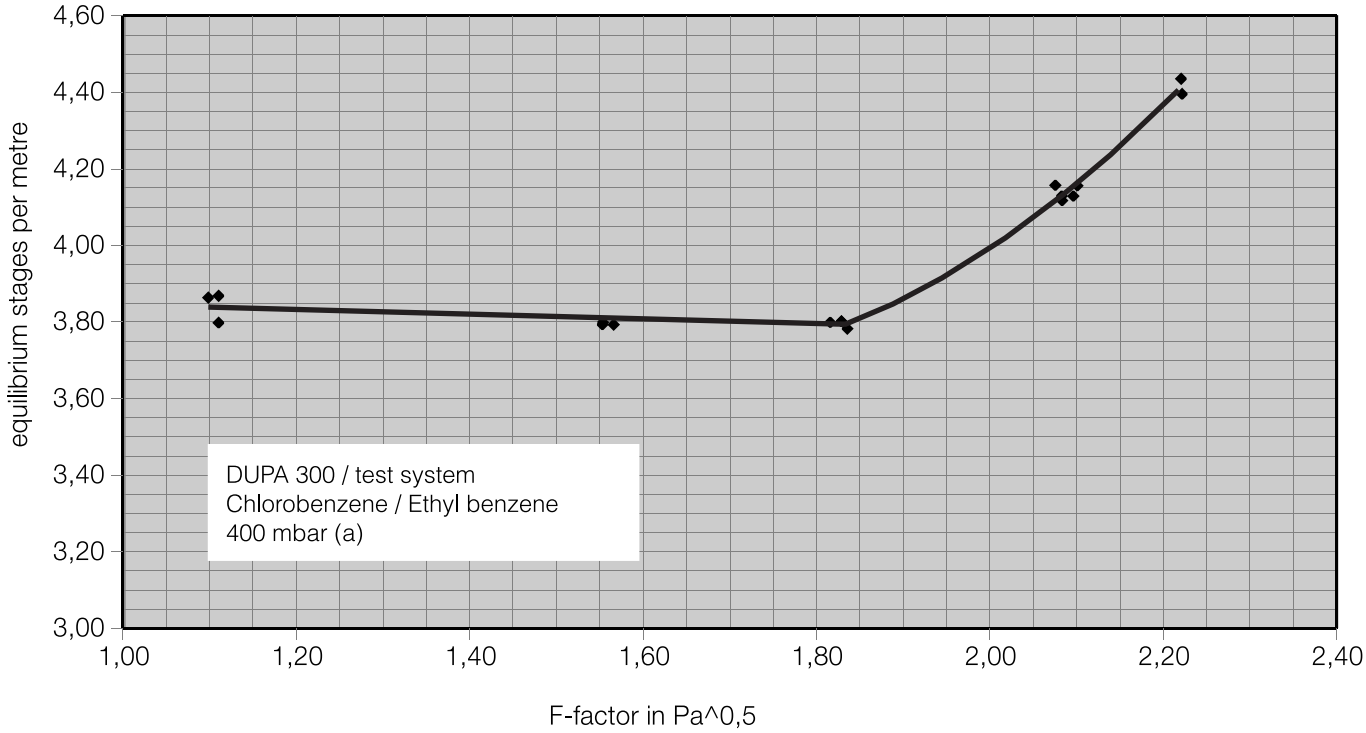
DURAPACK® packing can be used for distillation as well as for extraction processes. The easy-to-clean smooth and inert surface is extremely convenient. The specific surface amounts to 300 m²/m³. All following performance data have been obtained in standard glass columns

PERFORMANCE FOR DISTILLATION COLUMNS

Pressure drop

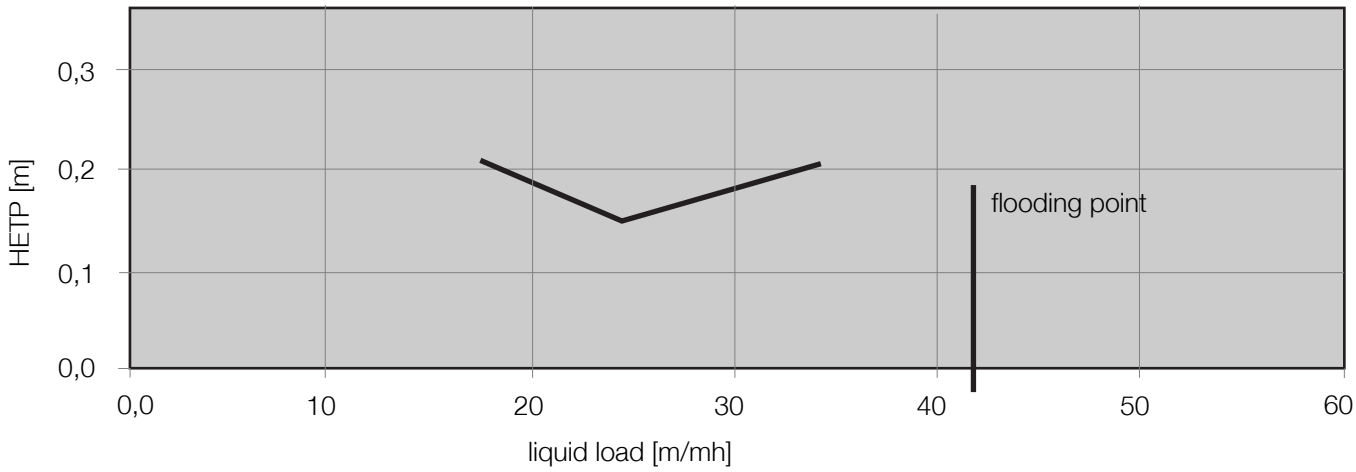


Number of theoretical stages



PERFORMANCE FOR EXTRACTION COLUMNS

Since it has to be avoided as far as possible that the packing surface become wetted by the normally organic dispersed phase during extraction, glass packings with smooth, fire-polished surfaces are very suitable for this application . The extraction experiments have been carried out in a pulsed column using toluene/acetone/water as a test system. During these experiments the flooding point was determined with an amplitude of 8 mm and a frequency of 100 min-1. The number of equilibrium stages have been measured for loads of 80, 60 and 40% of the flooding point.



QVF

THE MATERIAL ADVANTAGE

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