Ceramic Packings and Balls

Product Bulletin 1001

Subject **page**

Superior performance by design™

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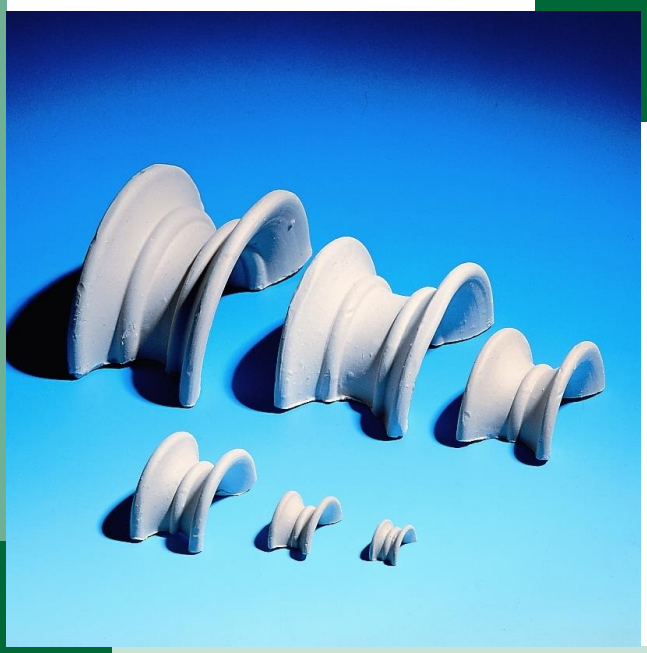
Torus Saddle

Sizes mm	Surface m^2/m^3	Free Vol. %
12	522	73
20	390	74
25	255	74
38	166	75
50	120	77
90	85	79



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Pall-Ring

Sizes mm	Surface m^2/m^3	Free Vol. %
25	220	75
35	165	78
50	120	78
80	80	79
100	55	81

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Raschig-Ring

Sizes mm	Surface m^2/m^3	Free Vol. %
5	1000	56
6	940	58
8	550	65
10	440	65
12	360	67
15	310	70
25	195	73
35	140	76
50	100	77
80	60	77
100	44	81

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Balls
Ceramics

Ball-Ø inch	Ball-Ø mm	Surface m^2/m^3	Free Vol. %
1/8	3-5	620	44
1/4	6-7	420	44
3/8	9-10	390	44
1/2	12-13	314	45
5/8	15-16	210	45
3/4	19-20	157	45
1	25-26	125	45
1 1/2	35-38	85	48
2	50-52	65	45

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Resistance table for ceramic and hard porcelain

The data listed in this table is based on experience gained in actual operation as well as on laboratory studies. In some cases, data from the raw clay suppliers has been incorporated in the evaluations.
The figures given refer to the maximum operating temperature. No entry means "normally, no temperature influence".
This data is reliable, but it does not represent a direct or indirect guarantee for resistance under operating conditions.

Acetic acid 5%	A 120	Monoethanolamine	A
Acetic acid 95%	A 180	Nitric acid 10%	A 100
Acetone	A	Nitric acid 70%	A
Ammonia sulfate		Oleic acid	A
Aniline	A	Phenol	A 100
Benzol	A	Phosphoric acid 10%	C 120
Bromine/water	A 100	Phosphoric acid 85%	C 150
Butanol	A	Potassium carbonate 40%	A 150
Carbon tetrachloride (dry)	D	Potassium chromate (saturated solution)	A
Carbon tetrachloride (moist)	A	Potassium hydroxide 30%	C 40
Chlorine (dry)	A	Sodium carbonate 10%	A 150
Chlorine (moist)	A	Sodium chloride 10%	A
Chlorobenzol	A	Sodium hydroxide solution 5%	B 40
Chloroform	A	Sodium hydroxide solution 10%	C 40
Chloronitrous acid	A	Sodium hydroxide solution 30%	C 40
Chrome acid (20%)	A	Sodium hypochlorite + Cl_2	A 100
Citric acid	A	Sodium hypochlorite + NaOH	C 40
Diethanolamine	A	Sulfuric acid + hydrochloric acid	A 150
Ethanol	A 150	Sulfuric acid + nitric acid	A 150
Ethylene dichloride	A	Sulfuric acid 10 %	A 120
Ethylene glycol	A	Sulfuric acid 72%	A
Hydrochloric acid 10%	A 120	Sulfuric acid 98%	A
Hydrochloric acid 35%	A 120	Terpentine	A
Hydrofluoric acid 5%	D	Toluene	A
Hydrogen superoxide 30%	A	Trichloroethylene (dry)	D
Kerosine	A	Trichloroethylene (moist)	A
Methanol	A 150	Triethanolamine	A 150
Methyl ethylene ketone	A	Water	A
Monochlorobenzol	A		

A = no noticeable effect
B = slight effect
C = noticeable effect – limited service life
D = strong effect – not resistant

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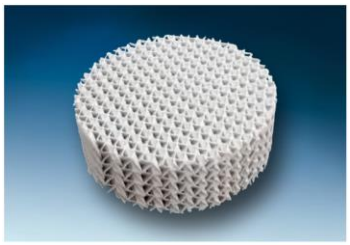
Raschig-Pak Ceradur®

The CERADUR® is a special ceramic with unique chemical composition, what results in superior chemical resistance. This often allows the use of CERADUR® as alternative to more expensive glass packings.



Raschig-Pak Ceradur®

Size	Style		Surface (m^2/m^3)	Free Vol. %
100	X	Y	100	83
125	X	Y	125	82
160	X	Y	160	81
200	X	Y	200	80
250	X	Y	250	80
300	X	Y	300	79
350	X	Y	350	78
400	X	Y	400	78
450	X	Y	450	77
500	X	Y	500	76
550	X	Y	550	75
600	X	Y	600	75
650	X	Y	650	74
700	X	Y	700	73
750	X	Y	750	72
1000	X	Y	1000	70
1200	X	Y	1200	68

Y = Angle of inclination 45°
X = Angle of inclination 60°

The Raschig-Pak Ceradur® is available with different design features, like:

- glazed / unglazed
- perforated
- dimpled
- chamfered

Raschig-Pak Ceradur®

The Raschig-Pak Ceradur® is a traditional channel type structure packing, as it is widely used in the chemical and petrochemical industry.
Decades of experience allow for reliable design with high capacities and low pressure drops.

Its advantage is the unique composition of the ceramic, that provides superior chemical resistance compared to conventional ceramic materials.
It is resistant against nearly all mineral and organic acids and partly resistant against alkalis. Typical applications include:

- formic acid
- acetic acid
- chloroacetic acid
- chlorinated hydrocarbons
- fatty acid anhydride
- acyl chloride
- sulfuric acid
- nitric acid
- hydrochloric acid
- hydrobromic acid
- halogenides
- chlorinated aromatics
- naphthenic acid
- acrylonitrile

and others.

Let us know if you are interested in the Raschig-Pak Ceradur® for your application.

Nomenclature

Latin symbols

a	m^2/m^3	specific surface area of packing
a_{Ph}	m^2/m^3	specific effective surface area of packing
C_S	m/s	$= u_V (\rho_V /(\rho_L - \rho_V))^{1/2}$ capacity factor
D_S, d_S	m	column diameter
F_V, F_G	m/s $(kg/m^3)^{1/2}$	$= u_V (\rho_V)^{1/2}$ gas capacity factor
F	-	Packing factor
g	m/s^2	$= 9.81\ m/s^2$, acceleration
H	m	section height
HETP	m	height equivalent to a theoretical plate
HTU_{OV}	m	overall gas side height of a transfer unit
$k_G a_{Ph}$	1/s	volumetric mass transfer coefficient in gas phase
$k_L a_{Ph}$	1/s	volumetric mass transfer coefficient in liquid phase
L	kg/h	Liquid mass flow rate
h_L	m^3/m^3	superficial liquid hold-up
n_{th}	-	number of theoretical stages
p	bar	pressure
u_L	m^3/m^2h	superficial liquid velocity
u_V	m/s	superficial gas velocity
V, G	kg/h	Vapor mass flow rate

Greek symbols

$\beta_V a_{Ph}$	1/s	volumetric mass transfer coefficient in gas phase
$\beta_L a_{Ph}$	1/s	volumetric mass transfer coefficient in liquid phase
ρ_L	kg/m^3	liquid density
ρ_V	kg/m^3	gas density
$\Delta p/H$	mbar/m	specific pressure drop
η	Pas, kg/(ms)	dynamic viscosity

Subscripts

Fl	flooding condition
L	liquid phase
V	vapour phase