



VEREINIGTE
FÜLLKÖRPER-FABRIKEN
GMBH & CO. KG

MADE IN GERMANY

+++Tower Packings+++Inert-Balls+++Catalyst Support Materials+++Column Internals+++Droplet Separators+++

DURANIT®

Maximum compression strength
for maximum operational safety

Please give us a call
+ 49 (0) 26 23 / 895 -10



VFF – our experience for your benefit

Founded in 1967, ongoing innovation and the highest possible standards of quality have allowed VFF to develop into Europe's largest producer of tower packings and inert balls. VFF has now become a globally operating company with more than 30 representations.

As a result of decades of cooperation with its customers, and through intensive work with the product, VFF is able to rely on extensive know-how. This has served as the basis for consistent further development of DURANIT® inert balls.

VFF has the largest capacity in Europe for the manufacture of inert balls. The company's own raw material mines ensure that quality remains constant, and also permit extremely fast reactions to large orders.

Wide experience, and careful preparation of the raw materials, give close homogeneity to DURANIT® inert balls at every stage of the process. Latest processing and monitoring technology ensure the reliability of VFF product quality, and reinforce the VFF principle: All from one source!

To keep ahead of the rest VFF places a lot of emphasis on the fact that its products are "Made in Germany".

All our products are produced according to the strict German and European safety standards for employees and the environment. In addition, VFF puts itself through regular internal and external checks, and therefore exceeds the strict German and European working and environmental requirements in every point.

You can also find further information about VFF's products online at www.vff.com

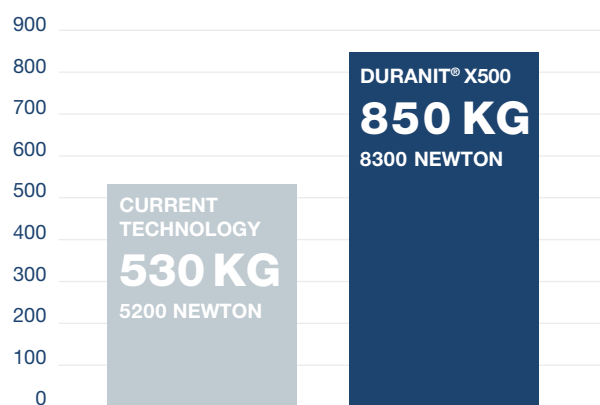
DURANIT® X500 – compression strength, far greater than that of current standard technology

When using catalyst supports, a high degree of operational safety through stability and homogeneity of the support material is an important factor for the customer. The specially developed manufacturing process from VFF means that the compression strength of the Duranit® X500 inert balls is significantly higher than that of comparable products.

The mean compression strength of the 1" balls is well above 1000 kg, guaranteeing VFF customers an unsurpassed level of operational safety when filling reactors.

With the DURANIT® X500 balls VFF have succeeded, after much intensive engineering work, to develop a catalyst support that is far superior state of the art not just for that point. The quality of DURANIT® X500, just like the well-proven DURANIT® quality, is of course free from any type of catalyst poisons, and also exhibits extremely low water absorption.

Compression strength of 3/4" inert balls (average value in kg)



Compression strength (average value) of DURANIT® X500 balls (extract)

| Ball size | | Compression strength | |
|-----------|----------|----------------------|---------|
| Zoll | mm | kg | Newton |
| 1/2 | 11... 14 | > 450 | > 4400 |
| 3/4 | 19... 21 | > 850 | > 8300 |
| 1 | 24... 27 | > 1050 | > 10300 |

The usual, permitted tolerances for ceramic products apply.

DURANIT® – Advantages at a glance

Meets all standard safety tests and impresses with its unbeatable quality

When using catalyst supports, a high degree of operational safety, provided by the stability and homogeneity of the support material, is an important factor.

The quality of DURANIT® X500 inert balls does not just comply with all relevant international safety standards, specifications and requirements, but significantly exceeds them. This results from the fact that DURANIT® X500 inert balls are manufactured using a process specially developed by VFF, that give the balls a compression strength that is far superior to the current state of the art technology and hence offers the customer a maximum of operational safety. This high mechanical strength comes along with extremely low water absorption of less than 0.25 % by weight.

Exclusive raw materials from in-house production

The right raw material is a very important factor for consistent quality. VFF is the only packings manufacturer of its kind in the world that has its own mines of different types of raw material. This ensures consistent product homogeneity. The raw materials are thoroughly tested by internal and external labs before, during and after processing.

Internal and external quality controls

The quality of the raw materials, of the product in the course of manufacture, and of the final product is ensured through both our own test facilities and through monitoring by reputable, independent institutes in the context of certification according to DIN EN ISO 9001.

Trouble-free use thanks to extremely low water absorption

DURANIT® inert balls, and DURANIT® X500 inert balls in particular, have extremely low water absorption of less than 0.25 % by weight. This is only possible due to a manufacturing process developed by VFF and is a further safety aspect when using the material. The extremely low water absorption prevents liquids from penetrating far inside the balls and causing expansion, e.g. due to heating, or chipping, that in turn could cause major damage in the system. DURANIT® inert balls and DURANIT® X500 inert balls rule out such risks. Of course this is provided that they are handled correctly on site.

Trouble-free reactor filling due to high compression strength

The unsurpassed compression strength of DURANIT® X500 inert balls offers the customer a high degree of safety, to avoid problems during reactor filling for example and hence save unnecessary expenses. VFF also recommends that reactor filling is carried out according to international specifications, to protect the product and system from unnecessary negative influences.



Fields of application

In cases where DURANIT® catalyst supports are used according to international specifications, the processes encompass the whole spectrum of thermal or catalytic mass conversion:

Of course, DURANIT® Inert-Balls and other VFF-shapes can also be used for other applications, such as the high temperature filtration of solid and/or liquid particles from exhaust gases.

| | |
|----------------------|---------------------|
| Alkylation | Catalytic reforming |
| Dehydrogenation | Hydrofining |
| Desulfurization | Isomerisation |
| Catalytic cracking | Powerforming |
| Catalytic conversion | Thermal cracking |
| Catalytic oxidation | and other processes |

DURANIT® – Technical Data

Physical-chemical properties, Average values for inert balls

| Parameter | Unit | DURANIT® | DURANIT® X500 | DURANIT® D92 Alumina | DURANIT® D99 High Alumina |
|---|-------------------|--|------------------------|-------------------------|------------------------------|
| SiO ₂ | % | max. 80 | max. 80 | max. 7 | max. 0,2 |
| Al ₂ O ₃ | % | min. 20 | min. 20 | min. 90 | ~ 99 |
| TiO ₂ + Fe ₂ O ₃ | % | max. 4 | max. 4 | max. 2 | max. 1 |
| K ₂ O + Na ₂ O | % | max. 4 | max. 4 | max. 0,5 | max. 0,4 |
| CaO + MgO | % | max. 1 | max. 1 | max. 0,5 | max. 0,2 |
| Roundness | dmax / dmin | < 1,25 | < 1,25 | < 1,25 | < 1,25 |
| Void space | % | 40 - 45 | 40 - 45 | 40 - 45 | 40 - 45 |
| Compression strength | kg | Exceeds all international specifications | | | |
| Material density | g/cm ³ | 2,2 - 2,4 | 2,2 - 2,4 | 3,2 - 3,4 | 3,0 - 3,6 |
| Water absorption | % | < 3 | < 0,25 | 2 - 6 | 2 - 7 |
| BET-surface | m ² /g | < 0,1 | < 0,1 | < 0,1 | < 0,1 |
| Mohs-Hardness | Mohs | ~ 8 | ~ 8 | ~ 8 | ~ 9 |
| Max. application temp. | °C | 1000 | 1000 | 1600 | 1800 |
| Expansion coefficient | 1/K | 4,7 x 10 ⁻⁶ | 4,7 x 10 ⁻⁶ | 5 x 10 ⁻⁶ | 6,7 x 10 ⁻⁶ |
| Spec. thermal energy | kJ / (kg x K) | ~ 0,84 | ~ 0,84 | ~ 1,1 | ~ 1,1 |
| Thermal conductivity | kJ / (m x h x K) | ~ 6,3 | ~ 6,3 | ~ 8 | ~ 14,6 |

Special ceramic upon request; Carbon (full cylinders) upon request; Other qualities upon request

Physical properties, Average values for inert balls

| Nominal size [" "] Inch | Diameter [mm] | Spec. surface [m ² / m ³] | DURANIT® Bed weight [kg / m ³] | DURANIT® X500 Bed weight [kg / m ³] | DURANIT® D92 Alumina Bed weight [kg / m ³] | DURANIT® D99 High Alumina Bed weight [kg / m ³] |
|----------------------------|--------------------|--|---|--|--|---|
| 1/8 | 3 - 5 | 1285 | 1300... 1400 | 1300... 1400 | -- | 2000... 2200 |
| 1/4 | 6 - 8 | 500 | 1300... 1400 | 1300... 1400 | 2000... 2100 | 2000... 2200 |
| 3/8 | 9 - 11 | 350 | 1300... 1400 | 1300... 1400 | 2000... 2100 | 2000... 2200 |
| 1/2 | 11 - 14 | 280 | 1300... 1400 | 1300... 1400 | 2000... 2100 | 2000... 2200 |
| 5/8 | 14 - 17 | 220 | 1300... 1400 | 1300... 1400 | 2000... 2100 | 2000... 2200 |
| 3/4 | 19 - 21 | 170 | 1300... 1400 | 1300... 1400 | 2000... 2100 | 2000... 2200 |
| 1 | 23 - 28 | 125 | 1300... 1400 | 1300... 1400 | -- | 2000... 2200 |
| 1,25 | 29 - 35 | 105 | 1300... 1400 | 1300... 1400 | -- | 2000... 2200 |
| 1,5 | 35 - 43 | 85 | 1300... 1400 | *) | -- | 2000... 2200 |
| 2 | 48 - 55 | 65 | 1300... 1400 | *) | -- | 2000... 2200 |
| 3 | 72 - 80 | 45 | 1300... 1400 | *) | -- | 1900... 2000 |
| 4 | 98 - 110 | 32 | 1200...1300 | *) | *) | *) |

Generally accepted tolerances apply to all ceramic products. Special geometric properties (full cylinders, prisms, etc.) upon request. *) upon request

Sizes and raw materials

| | 1/8" | 1/4" | 3/8" | 1/2" | 5/8" | 3/4" | 1" | 1 1/4" | 1 1/2" | 2" | 3" | 4" |
|------------------------------|------|------|------|------|------|------|----|--------|--------|----|----|----|
| DURANIT® | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| DURANIT® X500 | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ▲ | ▲ | ▲ | ▲ |
| DURANIT® D92 Alumina | ▲ | ■ | ■ | ■ | ■ | ■ | ▲ | ▲ | ▲ | ▲ | ▲ | ▲ |
| DURANIT® D99 High Alumina | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ▲ |
| DURANIT® Porcelain | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ▲ | ▲ | ▲ | ▲ |

■ available sizes ▲ upon request

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