



DOCERAM[®]
ADVANCED CERAMIC SOLUTIONS

DOTHERM[®]
INDUSTRIAL INSULATIONS

COMPONENTS, ASSEMBLIES, STANDARD PRODUCTS

HIGH-PERFORMANCE CERAMICS AND ENGINEERING PLASTICS FOR GENERAL MECHANICAL ENGINEERING

Contact **G.E. SCHMIDT** for sales, service and support



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WEBSITE: geschmidt.com

CINCINNATI, OHIO

NOTE: Please reference serial numbers with all technical questions

GERMAN ENGINEERING



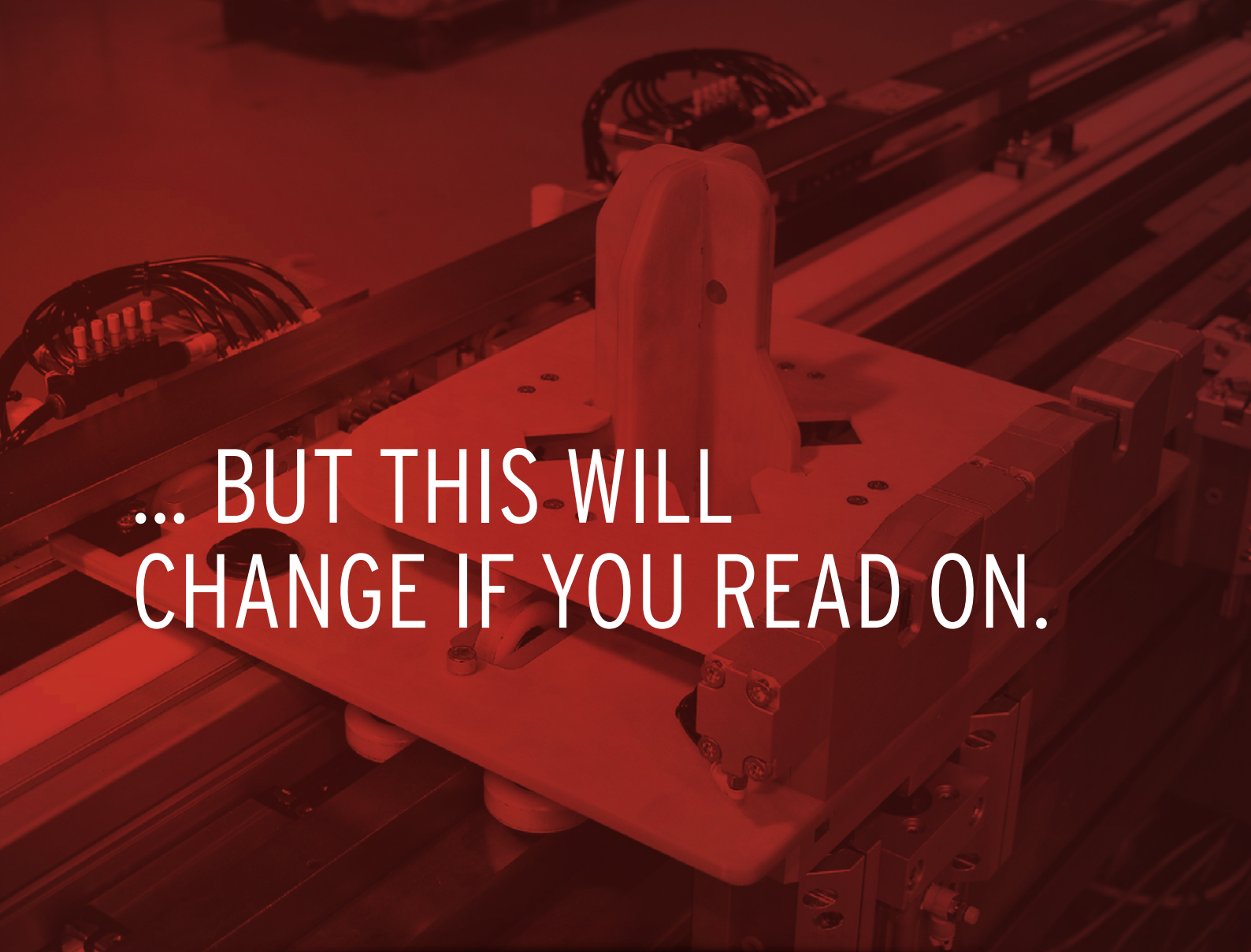


THERE ARE MATERIALS
THAT ONE DOESN'T THINK
OF IMMEDIATELY...



COMPONENTS, ASSEMBLIES
AND STANDARD PRODUCTS MADE OF
HIGH-PERFORMANCE CERAMICS





... BUT THIS WILL
CHANGE IF YOU READ ON.



COMPONENTS, ASSEMBLIES SEMI-FINISHED
PRODUCTS AND STANDARD PRODUCTS
MADE OF ENGINEERING PLASTICS





MATERIAL GROUP HIGH-PERFORMANCE CERAMICS



High-performance ceramics for general mechanical engineering ensure process safety and process quality -

due to reduced wear, significantly longer service lives and a broad range of superior properties that cannot be achieved by other materials.



ONLY DIAMONDS
ARE TOUGHER



CERAMICS STAY CLEAN...
(LOTUS EFFECT)



...AND TOLERATE EXTREMELY
HIGH APPLICATION
TEMPERATURES
(OF UP TO 1700 °C)

WHAT IS REQUIRED FOR INNOVATIVE TECHNICAL PROCESSES?

- High-performance ceramics, also called industrial or engineering ceramics, are non-metal materials that are based on ceramic powder. They are produced by sintering and are optimised for technical applications. Due to their superior properties with regard to hardness, wear resistance, temperature resistance, impact strength, abrasion resistance and anti-adhesion, they contribute to making processes and sequences of machines and plants safer and more quality-focussed. Components that are made of high-performance ceramics are increasingly replacing conventional materials such as metal.



Benefits of high-performance ceramics include:

- Exceptionally wear-resistant
- Extremely temperature-stable
- Electrically and magnetically neutral
- Frequency-neutral
- Solder-resistant and wear-resistant
- Resistant against galling, prevents any material accumulation
- Ideal for clean rooms
- Chemically inert
- More than 20 times the service life compared to conventional materials
- Self-cleaning due to the lotus effect
- Approved for food processing

Example: Gripper elements made of high-performance ceramics are electrostatically and magnetically neutral

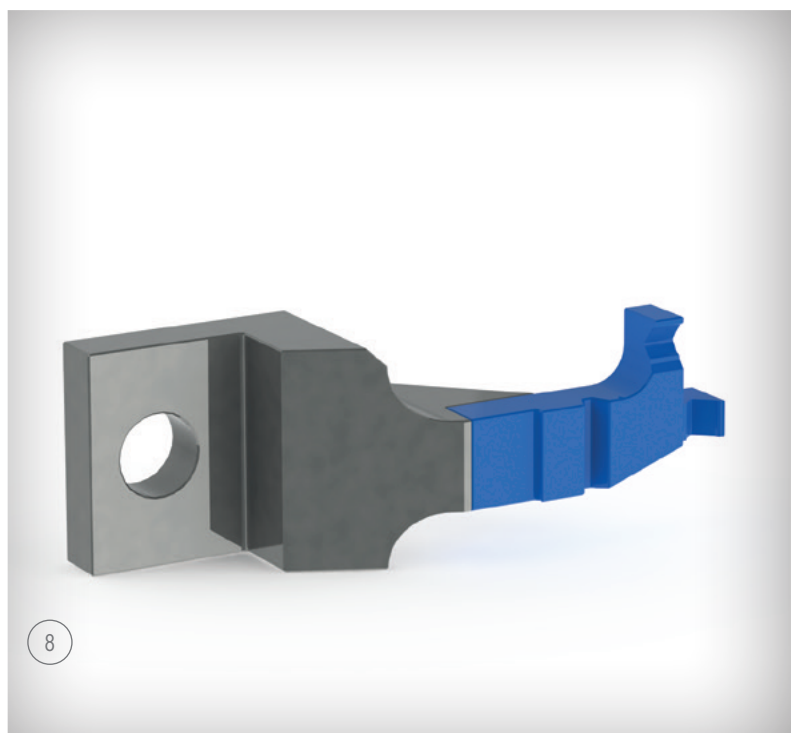
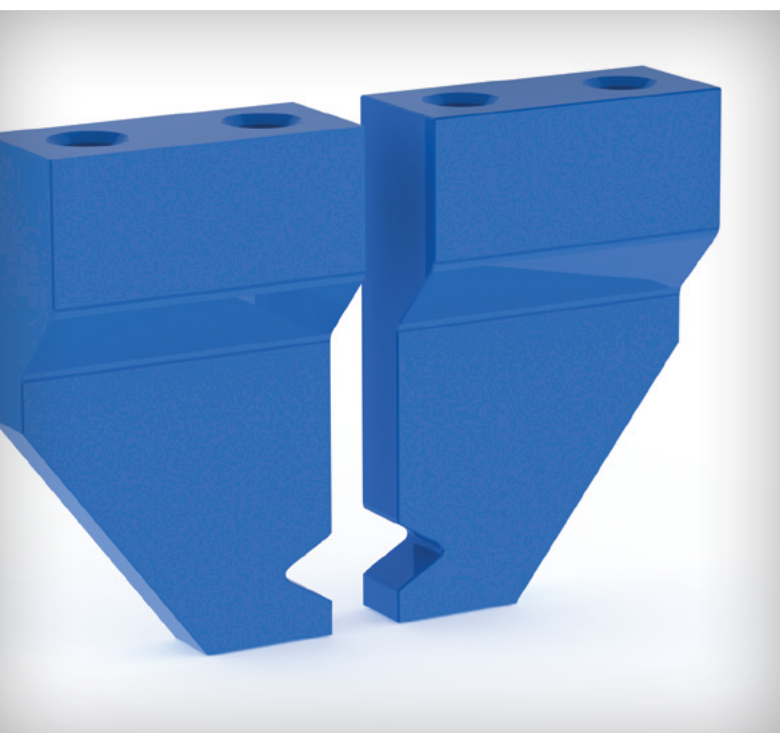
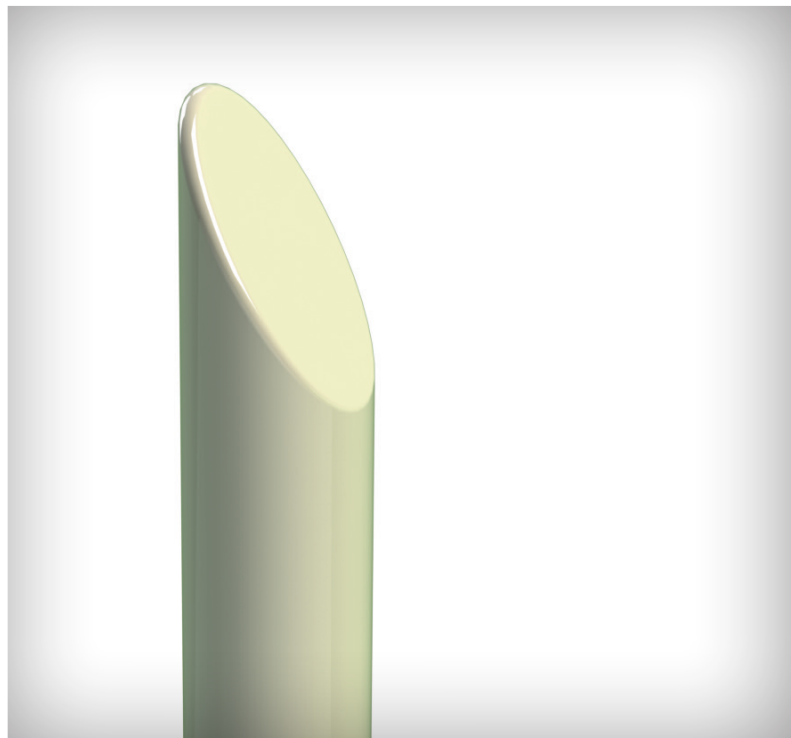
FOR EXAMPLE INNOVATIVE MA- TERIALS.

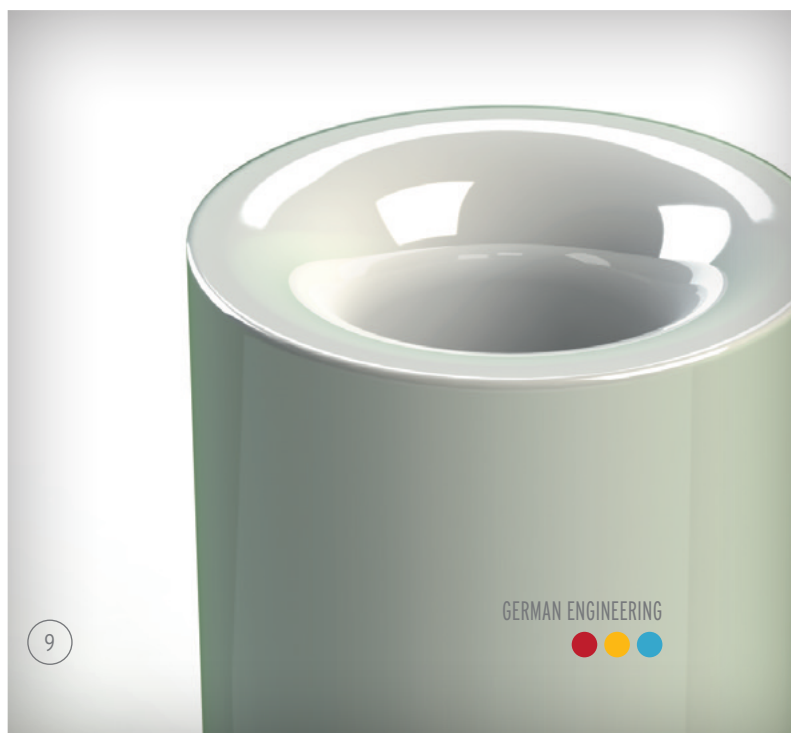
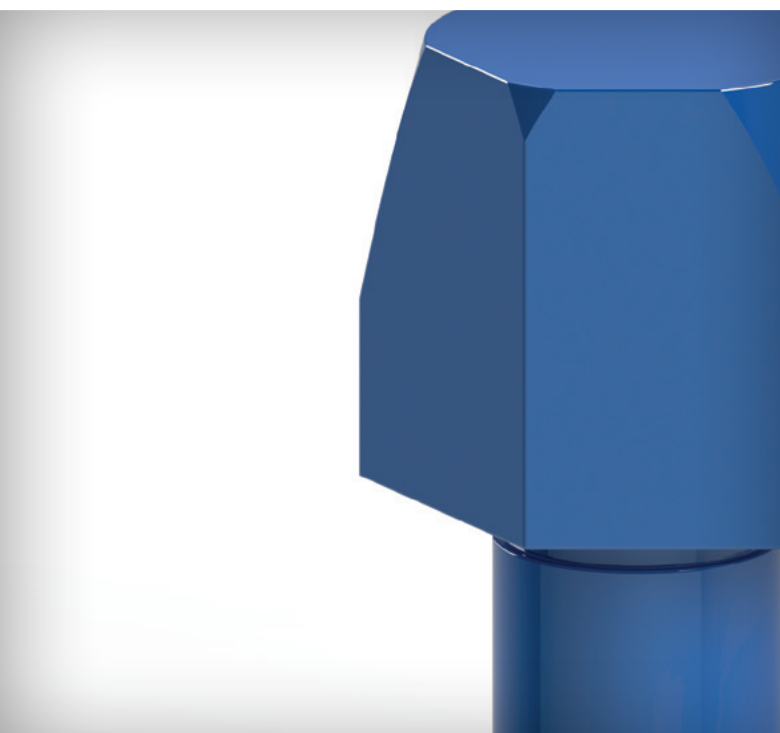
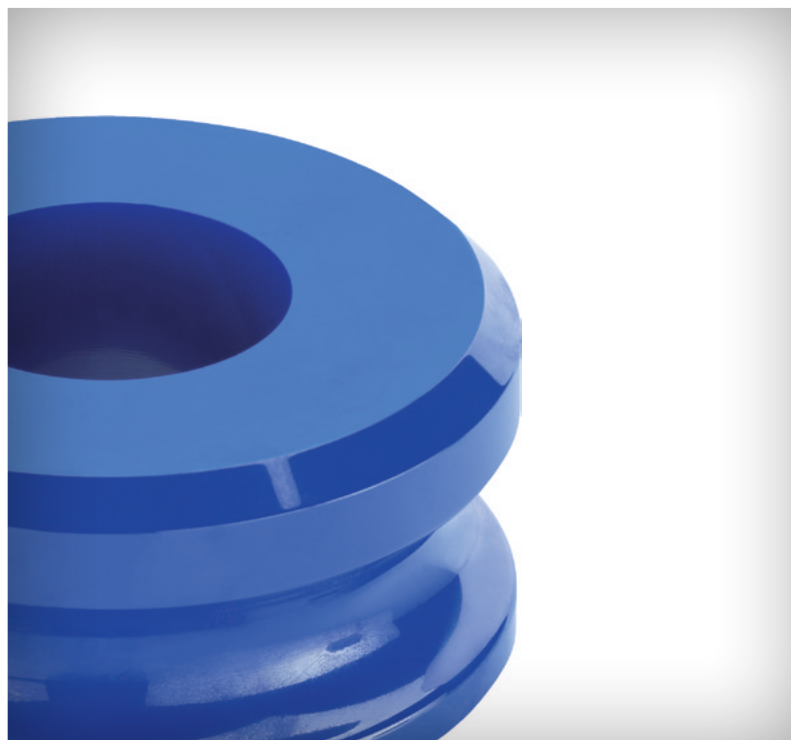
- Today, high-performance ceramics are used to manufacture metal forming tools, standard components such as cylinder, centring and welding pins, general-purpose wear elements, intakes for inductive processes, bushings, pressure pieces, sliding shoes, hydrocyclones, crucibles, spacers, jigs, grinding balls, supports, bases, protective discs and bearing bushes.





Today, components made of high-performance ceramics are often used where metals or plastics cause problems in technical processes.







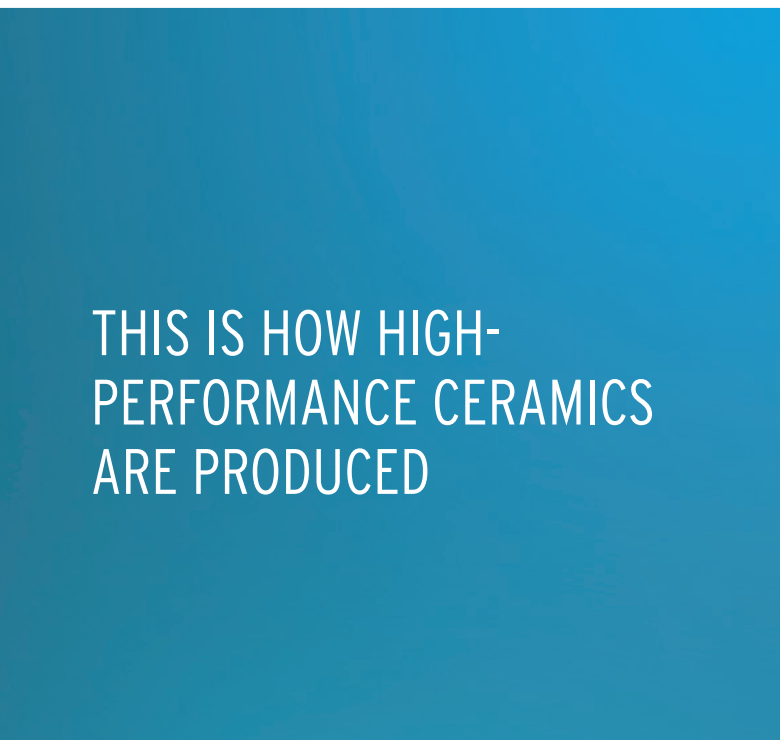
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POWDER

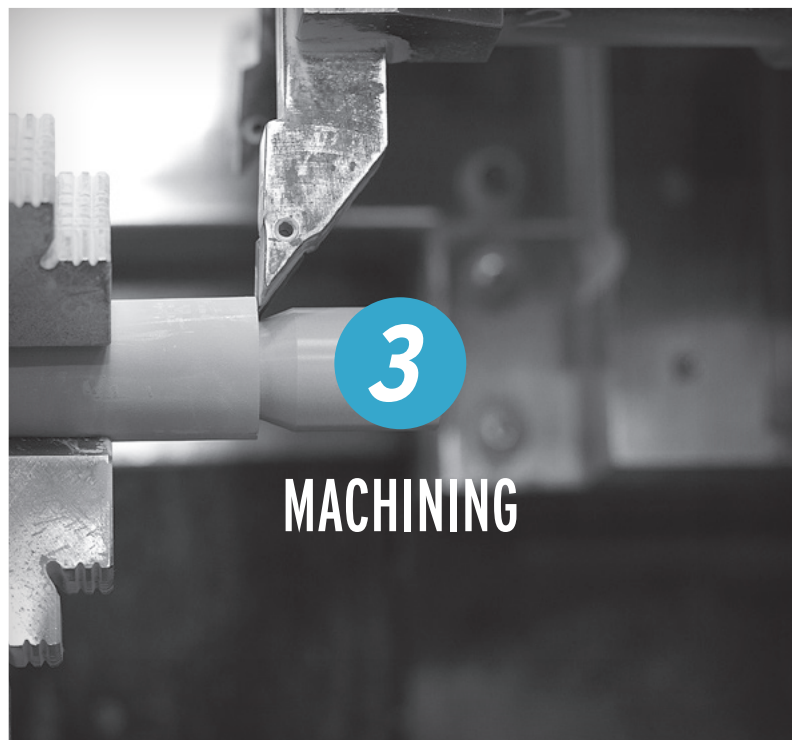


2

PRESSING



THIS IS HOW HIGH-PERFORMANCE CERAMICS ARE PRODUCED



3

MACHINING



4

SINTERING



5

GRINDING

OUR 3 MAIN CERAMIC MATERIALS AND THEIR PROPERTIES

A-132

for maximum temperatures and high hardness requirements
Basis: Aluminium oxide
Application example: Tools for metal forming, electrical industry

Cerazur®

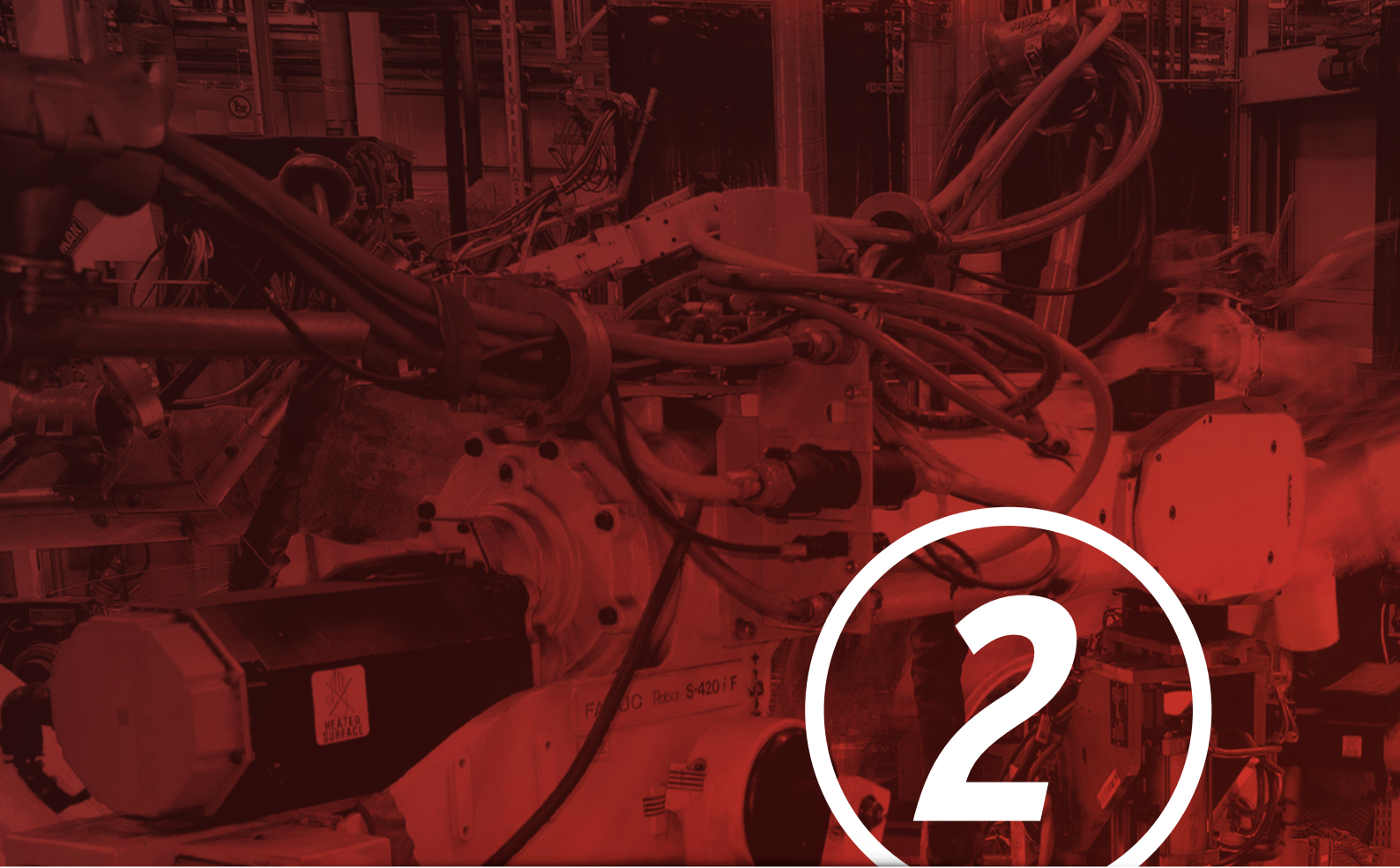
extreme impact strength and bending strength
Basis: Zirconium oxide
Application example: Positioning and fixing pins, metal-and-ceramic composite solutions

Volcera®

resistant against thermal shock and corrosion
Basis: Silicon nitride
Application example: Applications in connection with extreme heat and extreme mechanical stress (e.g. inductive hardening and soldering)

DOCERAM Name	Unit	A-132	Cerazur	Volcera 131
Composition	-	Al_2O_3 >99.7%	ZrO_2 Y-PSZ	Si_3N_4
Colour	-	ivory	blue	grey, black
Density	(g/cm ³)	3.9	6	3.2
Bending strength	(MPa)	390	1300	750
Compressive strength	(MPa)	3900	3000	2500
E-modulus	(Gpa)	390	205	320
Impact strength	(Mpa m1/2)	5.2	12	6.7
Weibull modulus	-	12	25	15
Vickers hardness	(HV 0.5)	2000	1150	1650
Thermal expansion	(10 ⁻⁶ K ⁻¹)	5.5-8.4	10	3.4
Thermal conductivity	(W/mK)	28	<2	22
Thermal shock resistance	(ΔT°C)	120	280	550
Maximum operating temperature	(°C)	1700	1000	1000
Specific resistance at 20°C	(Ω cm)	>10 ¹⁷	>10 ¹⁰	>10 ¹¹
Dielectric strength	(kV/mm)	22	-	20

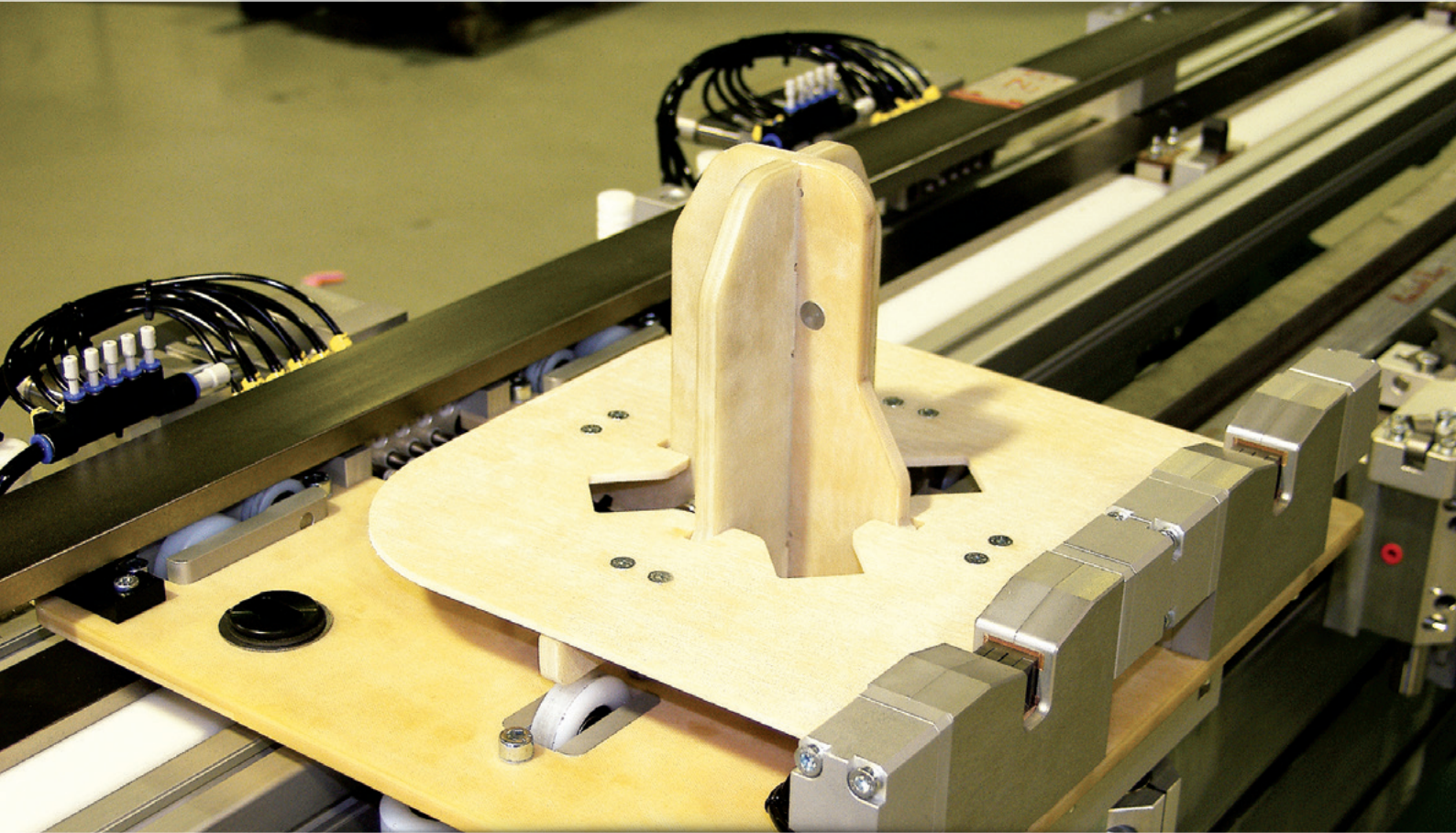
The values listed were determined on standard test specimens. The material properties can deviate from these values depending on the application and component geometry. Please contact us should you require a precise clarification of the material suitability. Other technical data on request. Subject to technical modifications and errors. 2015 edition.



2

MATERIAL GROUP ENGINEERING PLASTICS





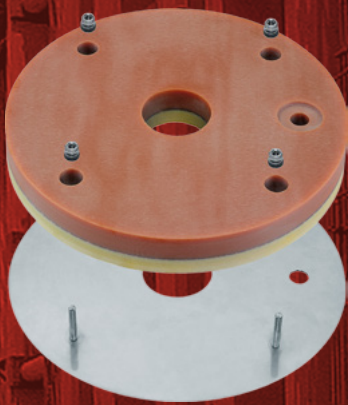
Engineering plastics in general mechanical engineering ensure stable processes by providing safe thermal and electrical insulation.

They have excellent properties that are adapted to the specific application. From standard materials to components for extreme requirements.



EXTREMELY HIGH
APPLICATION TEMPERATURES
(OF UP TO 1700 °C)

ENGINEERING PLASTICS IN INDUSTRY. FASCINATING POSSIBILITIES FOR DESIGNERS.



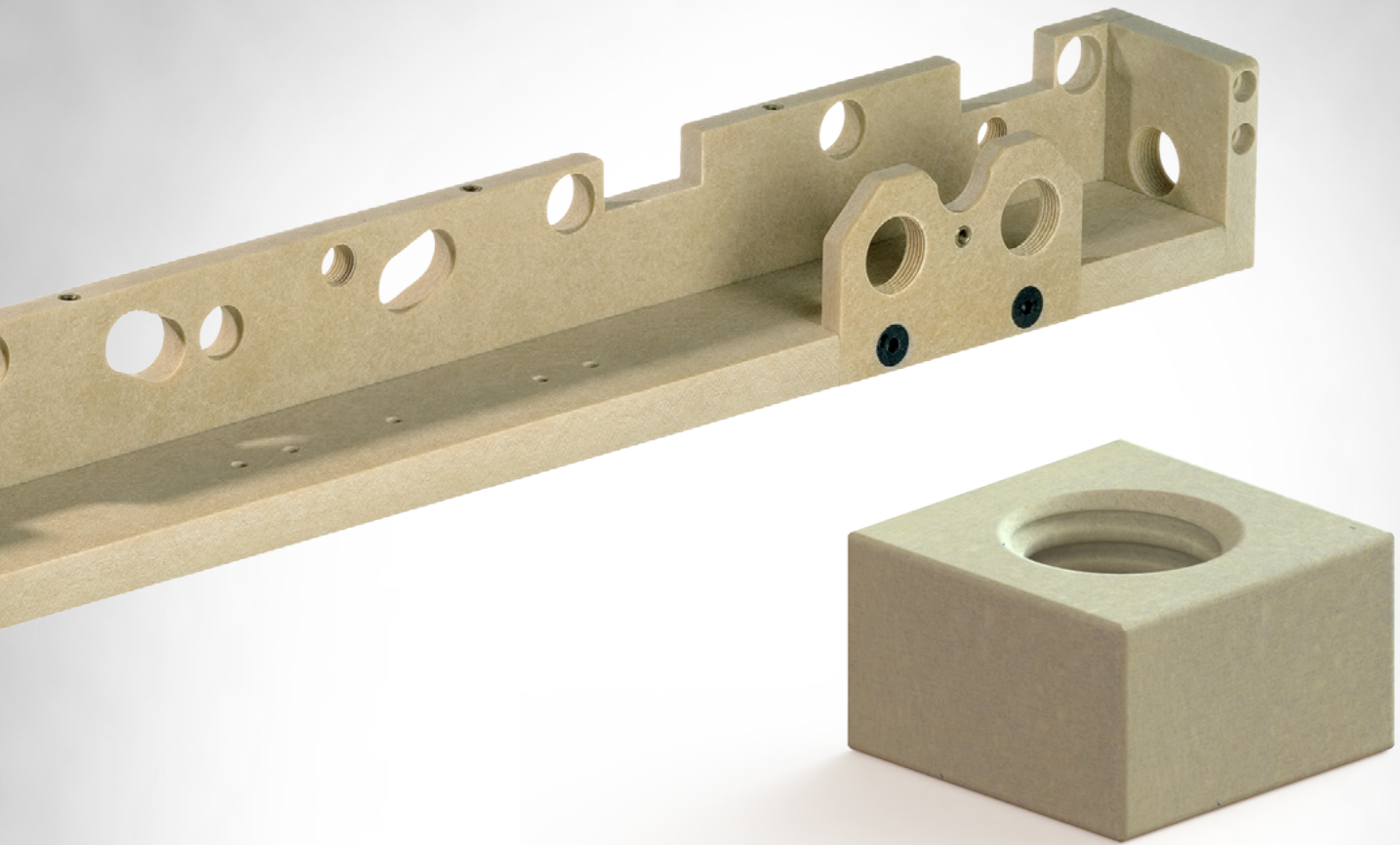
→ Our high-temperature materials are designed for components for machines and plants that are subject to high thermal and mechanical stress. They are available as semi-finished products, standard products or drawing parts. The basic materials are predominantly duroplastic composite materials on the basis of different resin and binder systems that are enhanced using various fibres and particles. The following filler materials are used:

- Short-fibre glass mats, fine or roving fabric
- Fabric and paper structures
- Chemically bound ceramics, mineral and carbon fibres
- Mica, glass or aramid fibres as well as acrylic fabrics



Benefits of high-performance plastics:

- Excellent mechanical strength that goes far beyond what is usually expected
- High chemical resistance
- Lower thermal expansion coefficient
- Excellent thermal insulation (up to 1,700°C)
- More precise tolerances can be realised for components
- Resistant against multi-axis stress and extreme surface pressures
- Low friction coefficients



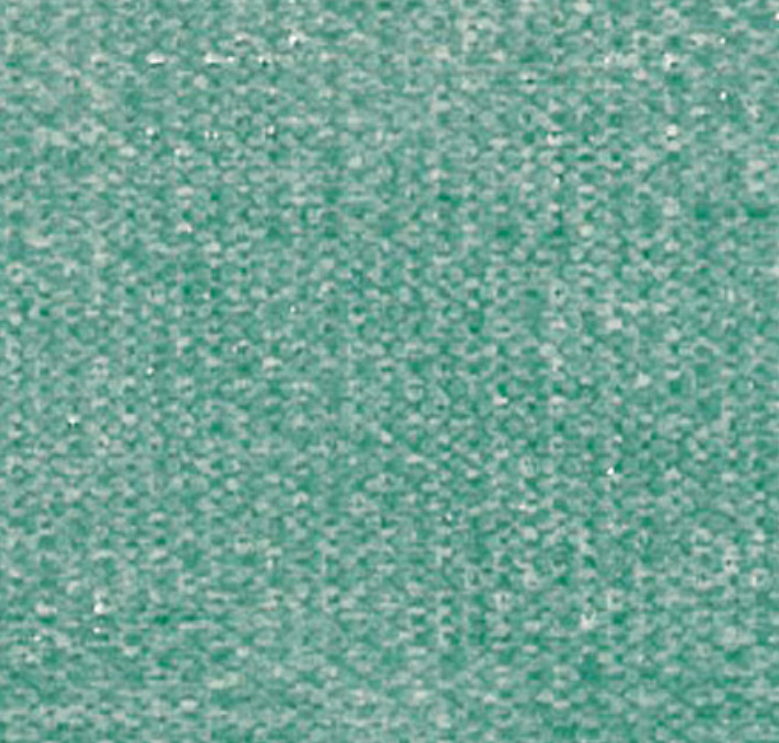
➔ DOGLIDE 350 is also part of our product range and is a high-performance plastic based on polyimide. Components for high-temperature applications, such as bushes, bearings, guides and seals, are produced from this material. This material is a:

- ➔ sintered polyimide
- ➔ also available as a graphite composite variant



Further application options are possible when our high-temperature materials are combined with ceramic components. For more details please read on.

Colour change caps made of DOGLIDE 350 are used in hot-duct engineering for injection moulding of thermoplastics



DOGLAS

Fibre glass-reinforced, duroplastic composite plastic

Resin systems: Polyester, epoxy, copolymer, polyimide or silicon resin

Carrier material: Short-fibre glass mats, fine and roving fabric

DOGLAS material properties

- High mechanical strength
- Excellent dimensional stability
- Temperature stability up to 300°C
- Low heat conductivity
- Good electrical insulation properties
- Chemical resistance
- Low water absorption



DOTEX

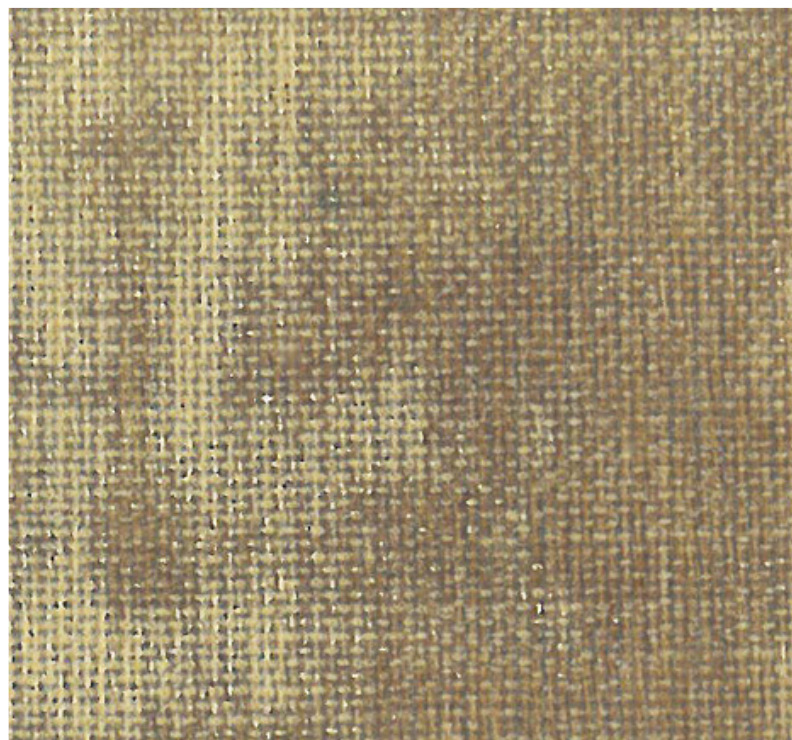
Fabric- and paper-enhanced composite plastic

Resin systems: Phenolic resin

Carrier material: Cotton fabric or paper layers

DOTEX material properties

- Good mechanical strength
- Good friction and sliding properties
- Excellent insulating and cushioning properties (for resin-bound cotton fabric)
 - Excellent machinability
 - Excellent value for money



DOTHERM

High-temperature materials

Resin systems: Silicates or silicon resin

Carrier material: Mica, chemically bound ceramic, mineral and carbon fibres

DOTHERM material properties

- Very high temperature stability
- Very low heat conductivity
- Excellent electrical insulating properties (for mica materials)

DOTHERM MATERIALS AND THEIR PROPERTIES

DOGLIDE

Sliding and wearing materials

Resin systems: Phenolic resin, graphite and polyimide
Carrier materials: Acrylic fabrics and aramid fibres

DOGLIDE material properties

- Good friction and sliding properties
- High temperature stability
- High wear resistance (polyimide)

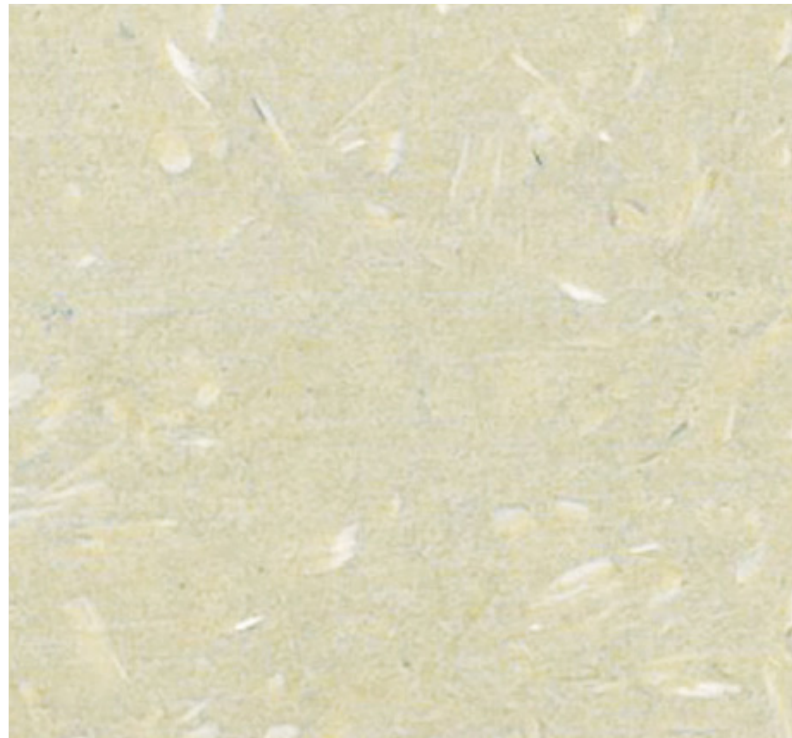
DOTEC

High-tech materials

Resin systems: Glass, phenolic or silicate resin
Carrier material: Mica, glass or aramid fibre

DOTEC material properties

- Good mechanical strength
- Excellent dimensional stability
- Good temperature stability
- Low heat conductivity
- Good electrical insulation properties
- Good friction and sliding properties
- Chemical resistance
- Suitable for cleanrooms (glass-bound mica material)



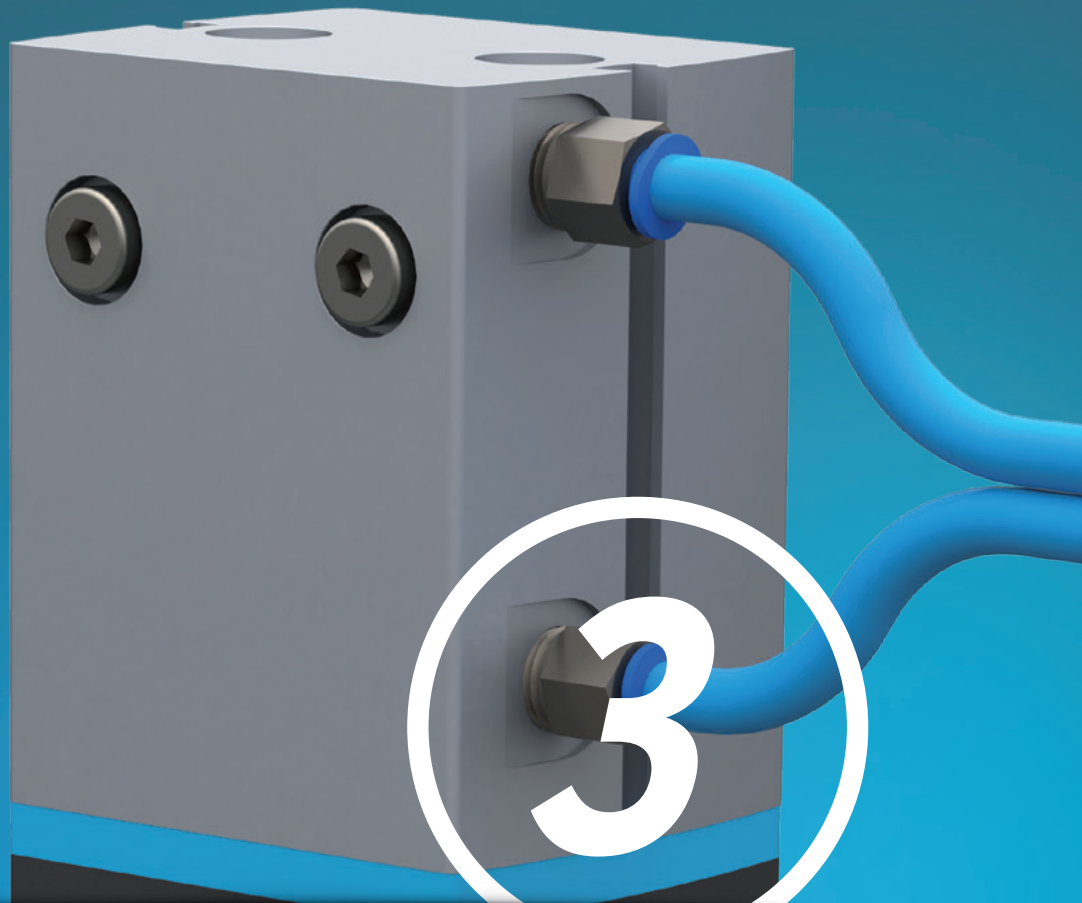
DOGLIDE 350 (G)

High-performance plastics

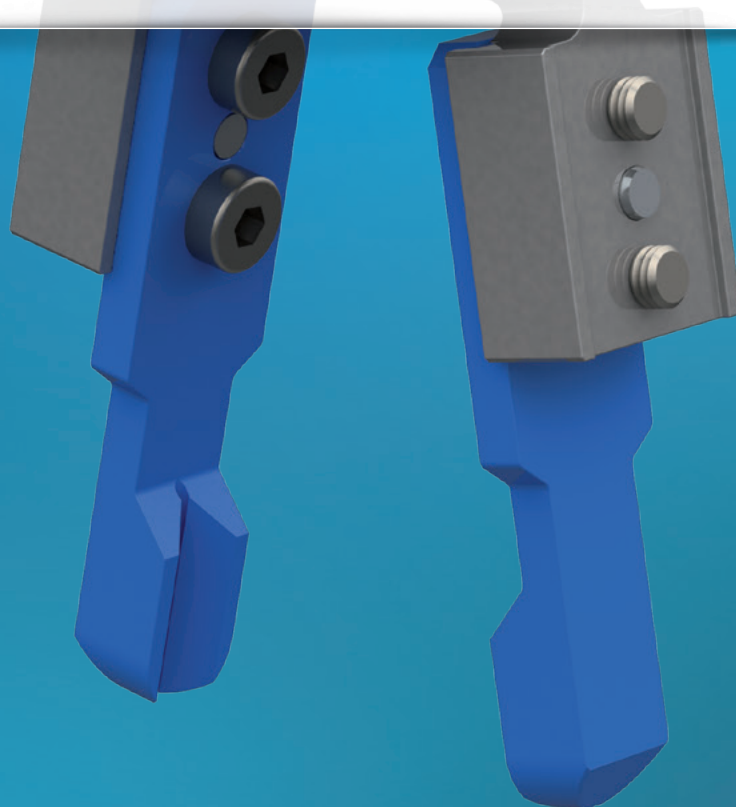
Basis: Polyimide
Variant: DOGLIDE 350 G as a compound with graphite as a solid lubricant for the adaptation of the tribological properties

DOGLIDE 350 (G) material properties

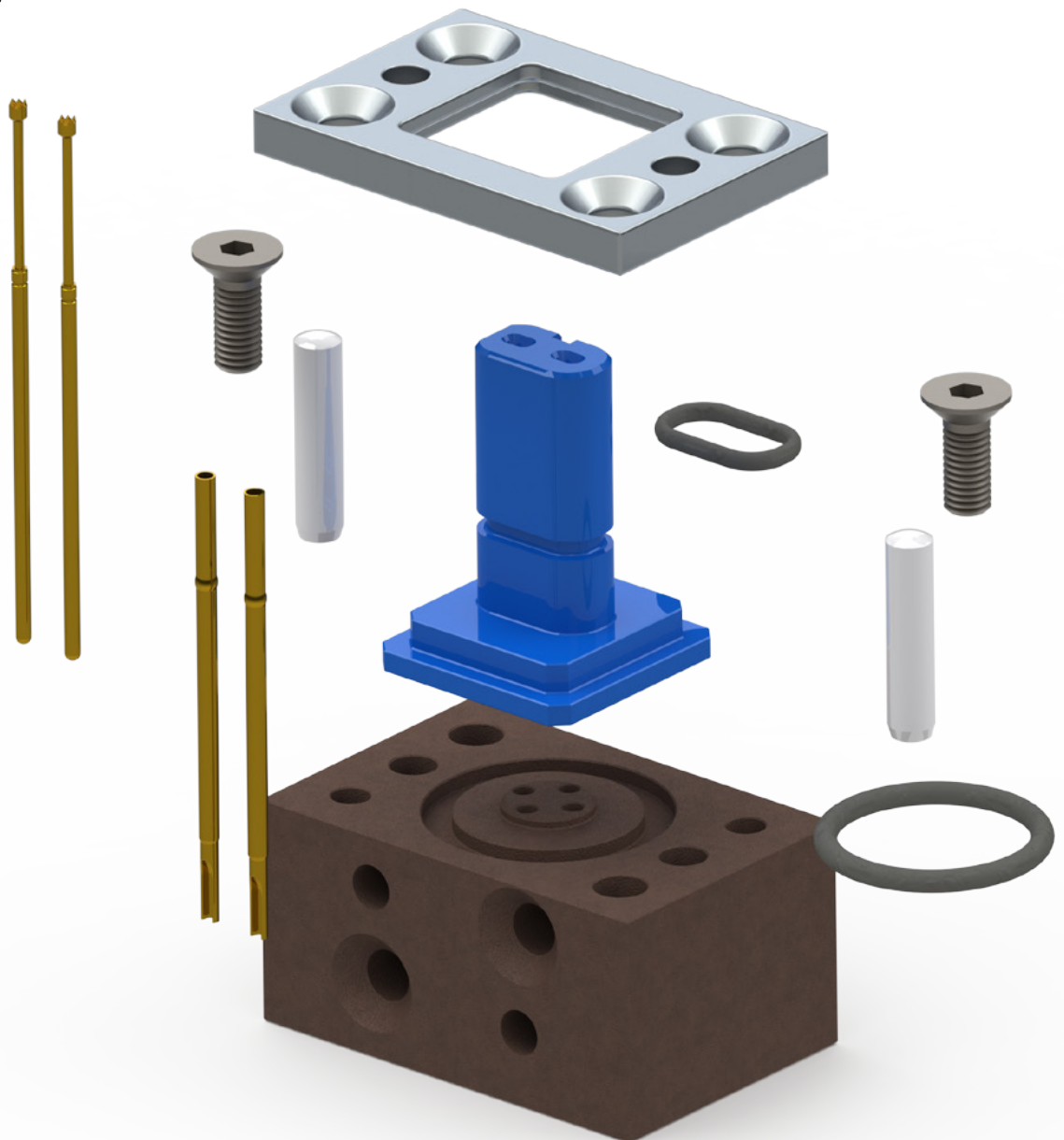
- Continuous temperature resistance up to 280°C (up to 400°C for short periods of time)
- High compressive strength of 600 N/mm²
- Dimensional stability across the entire temperature curve



COMPOSITE SOLUTIONS MADE OF
HIGH-PERFORMANCE CERAMICS AND
ENGINEERING PLASTICS



Plastics plus ceramics - our formula for highly efficient machine components



← Example: gripper finger

A typical example for such solutions are our gripper and transport fingers (see pages 16 and 18/19) that are predominantly used in electronics production. Depending on customer requirements, individual parts are manufactured from high-performance ceramics. This inductively neutral, wear-resistant, solder-repellent and chemically inert material fulfils all necessary conditions for fault-free handling as well as ensuring technical cleanliness and a long service life. For other components, which are less wear-prone, materials such as DOGLAS are sufficient.

↑ Example: test plug

Our test plugs are also designed according to the same principle, i.e. plastic plus ceramic materials. There are variants that fulfil the standard requirements as well as other variants that are suitable for high stresses, for example due to high cycle rates in production lines. The combined know-how of Doceram and Dotherm forms the basis for new, technically superior and at the same time cost-efficient solutions.

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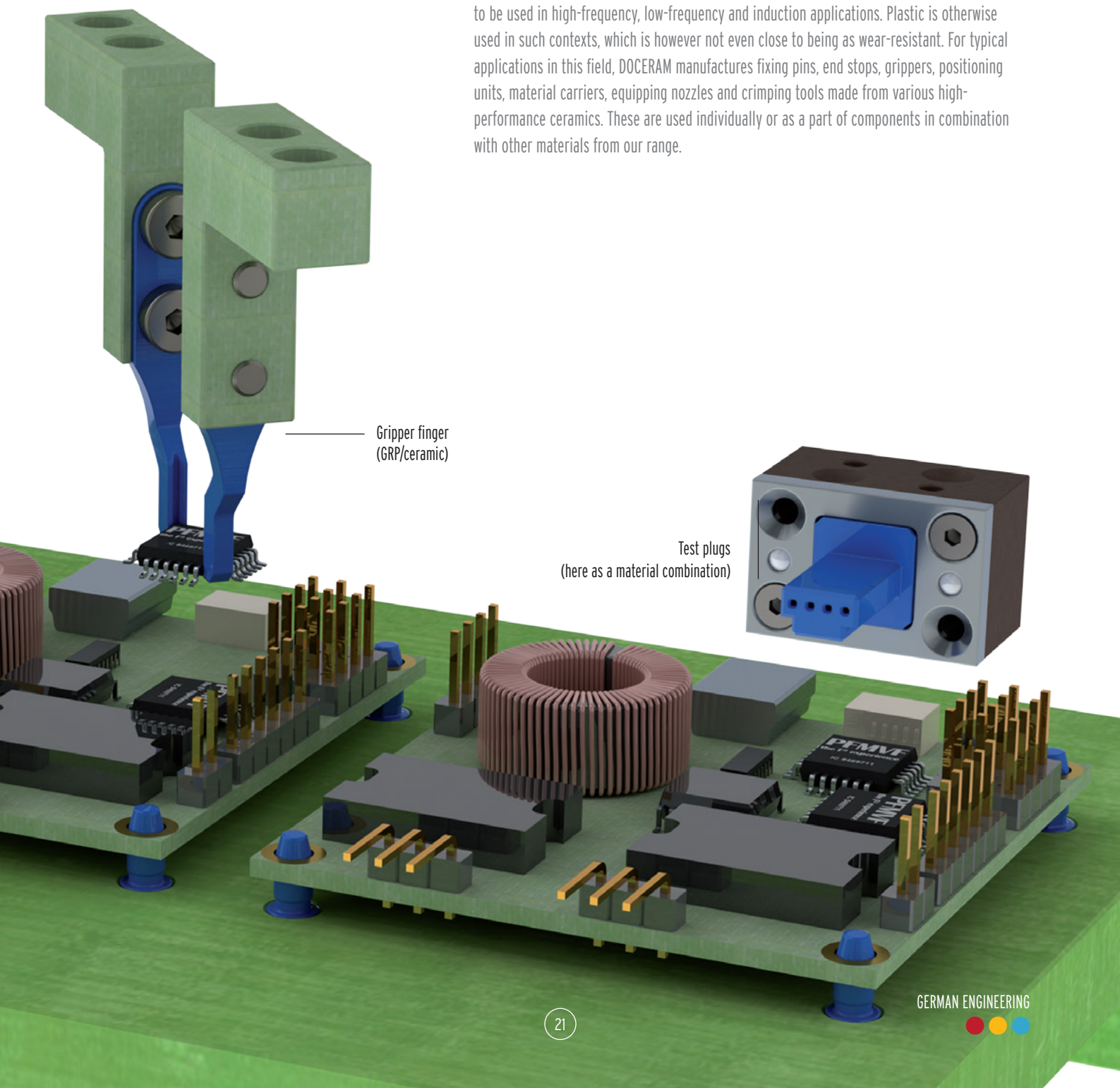
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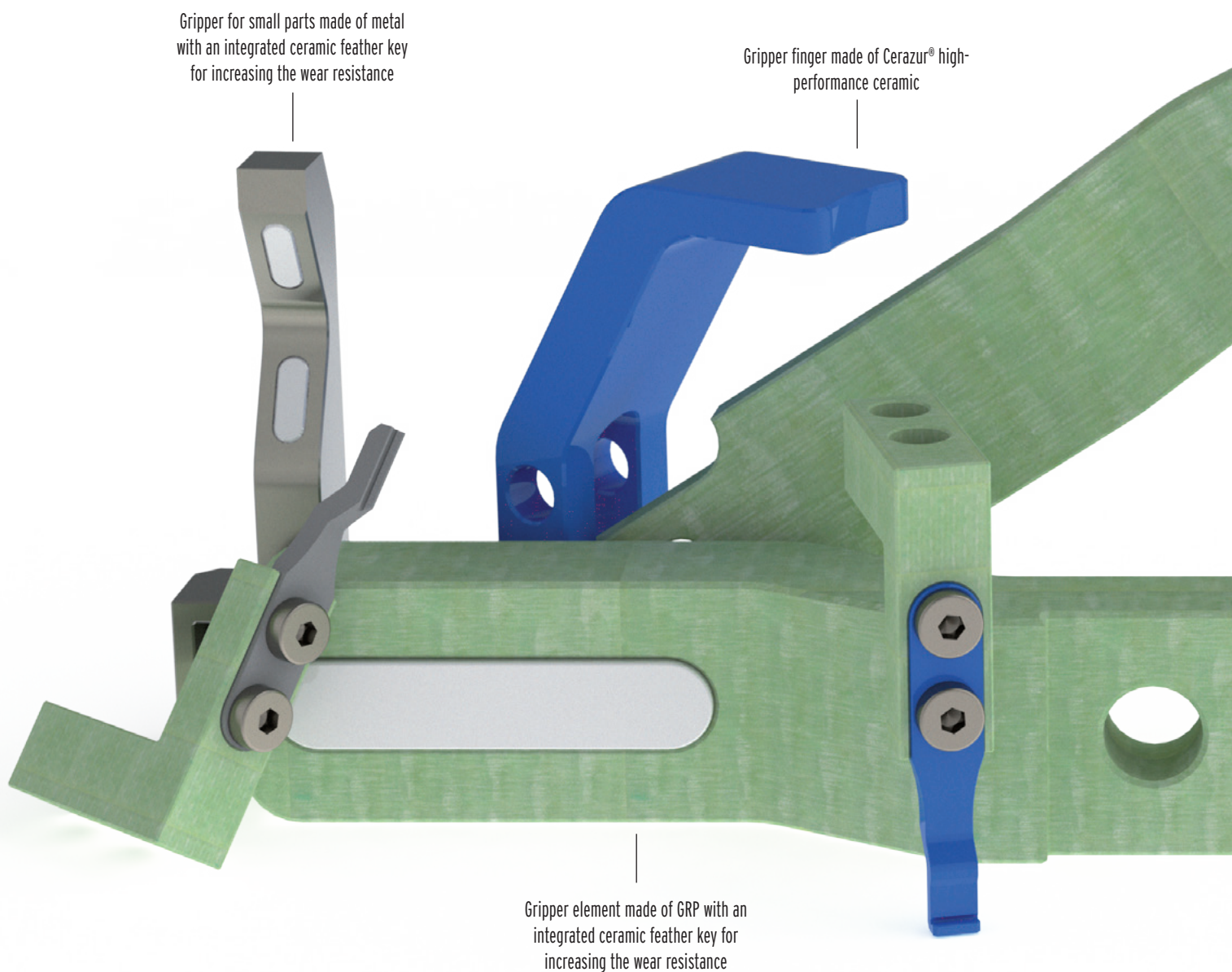
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- ➔ Tools and components for manufacturing technology in the electrical industry and mechatronics must face up to two significant challenges: high cycle rates and sensitive components. High-performance ceramics can handle this contradiction in terms particularly well. After all, they are highly wear-resistant, technically clean and electrically neutral. This latter property is important in the context of such components as PCBs, control devices, wireless keys, switches or sensors.
- ➔ A further property of this material is its electrical and electromagnetic neutrality, enabling it to be used in high-frequency, low-frequency and induction applications. Plastic is otherwise used in such contexts, which is however not even close to being as wear-resistant. For typical applications in this field, DOCERAM manufactures fixing pins, end stops, grippers, positioning units, material carriers, equipping nozzles and crimping tools made from various high-performance ceramics. These are used individually or as a part of components in combination with other materials from our range.

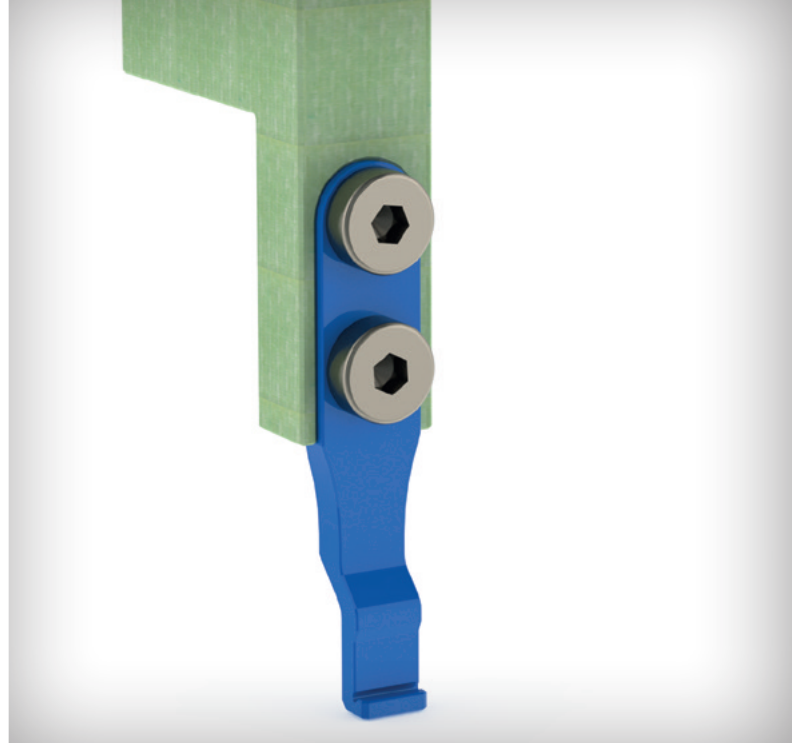
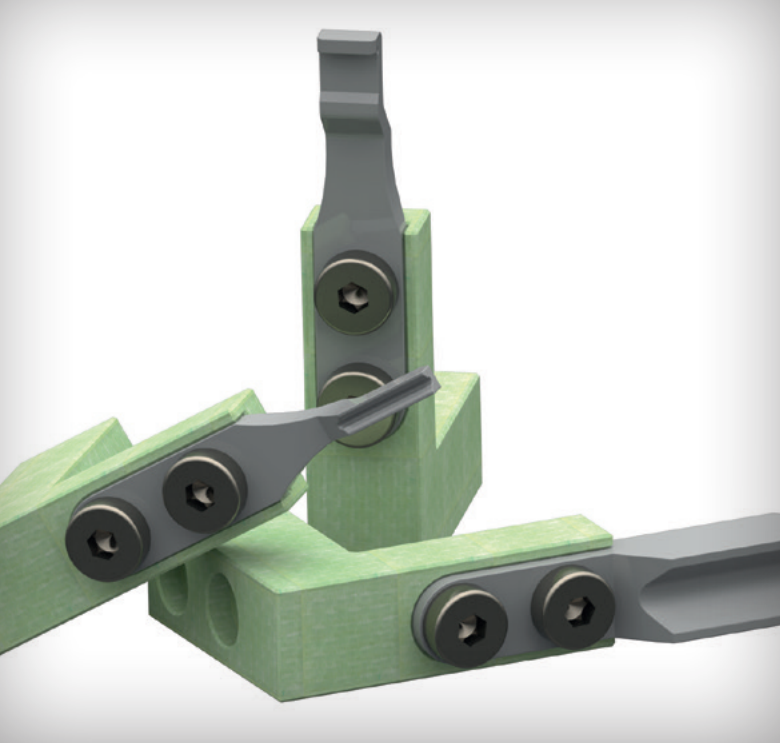


PLASTIC ONLY,
PLASTIC PLUS CERAMIC,
CERAMIC AND METAL,
CERAMIC ONLY...
ANYTHING IS POSSIBLE.

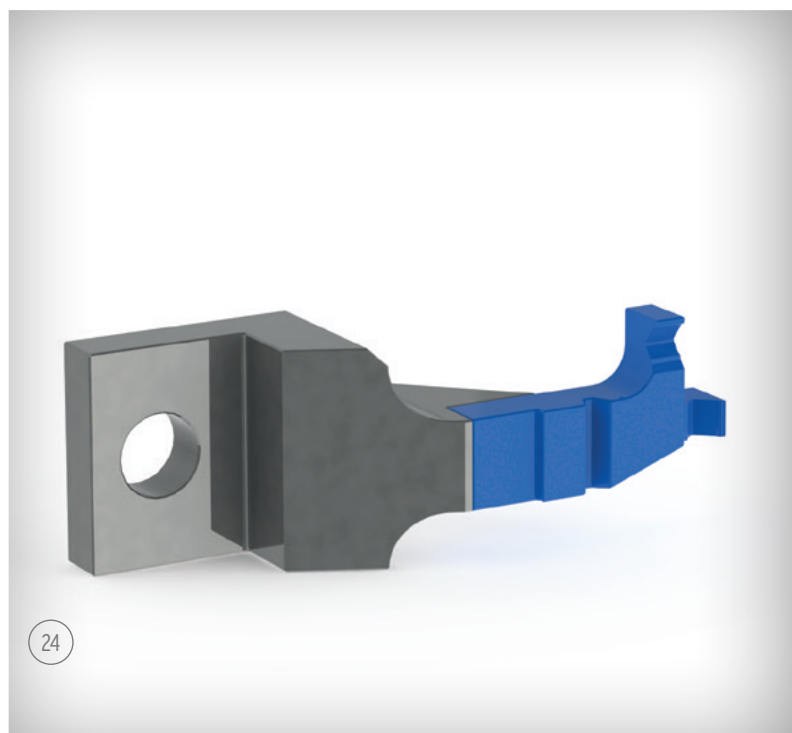
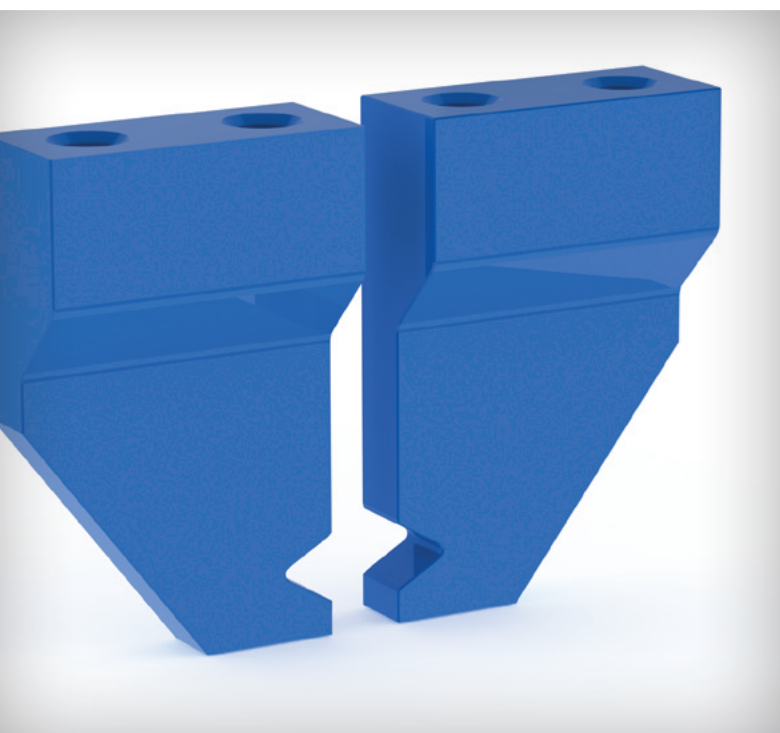
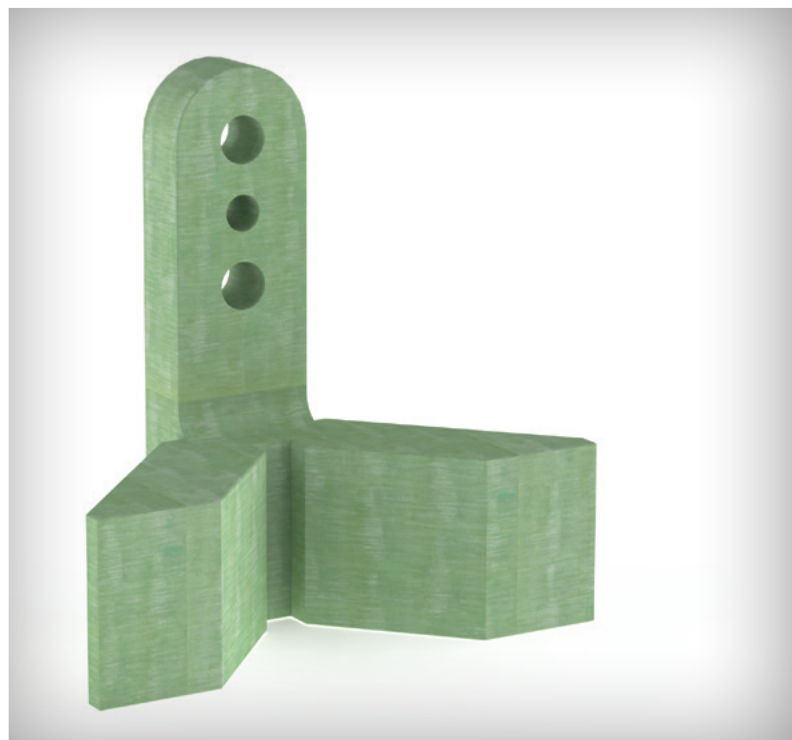


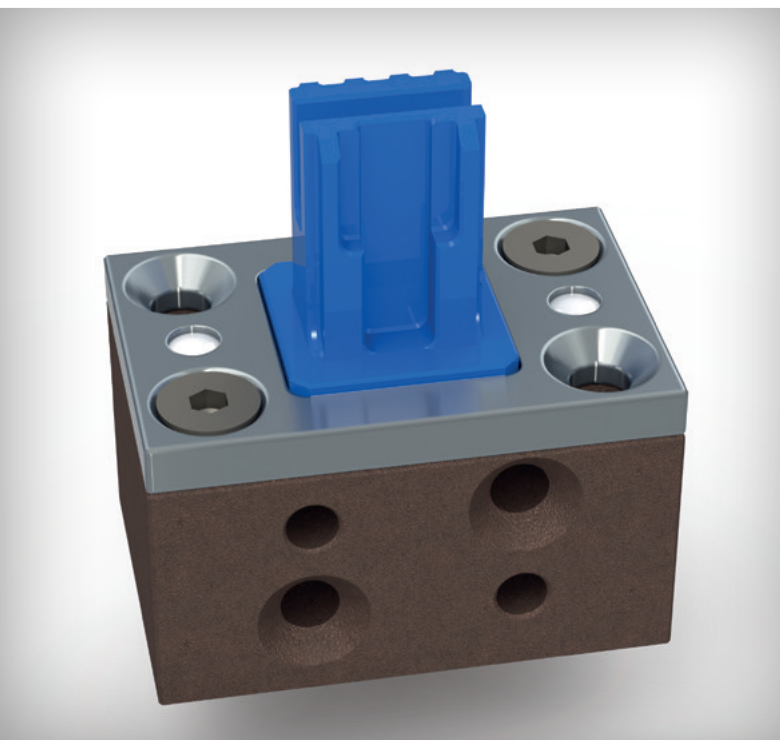
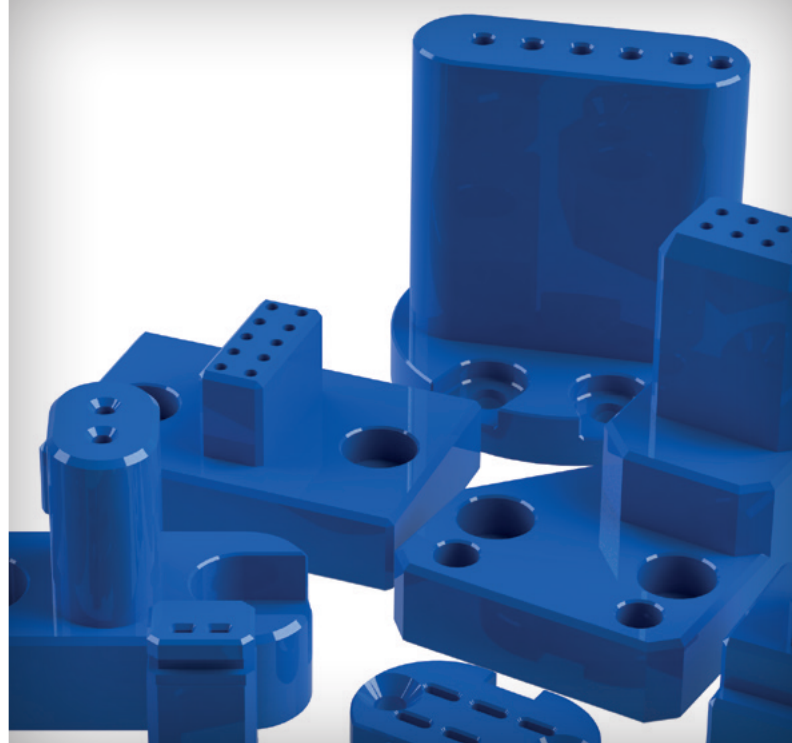
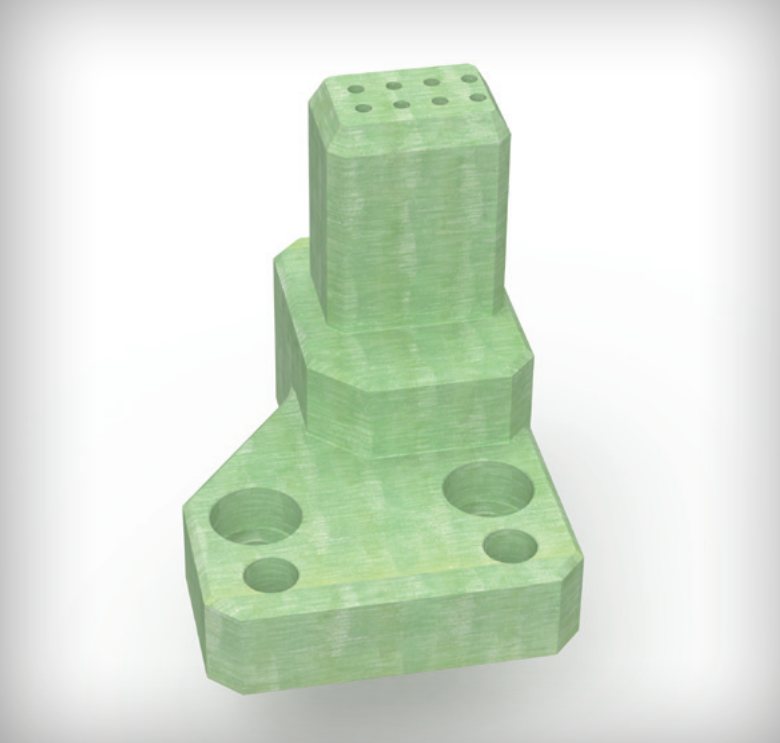
- ➔ Numerous factors determine the materials, which are used in a component, and the extent of their use. Whatever the solution, the technical requirements always need to be matched with efficiency aspects.
- ➔ Our concept states that ceramics as a highly engineered material with a perfect fit are only used in locations that are prone to exceptional thermal stress, chemical or mechanical wear. All other components are manufactured from plastics or metal.
- ➔ For each individual case, our designers, supported by our application consultants, decide the design of such a component (here shown using gripper and transport elements as an example). Both standard parts and drawing parts are used.



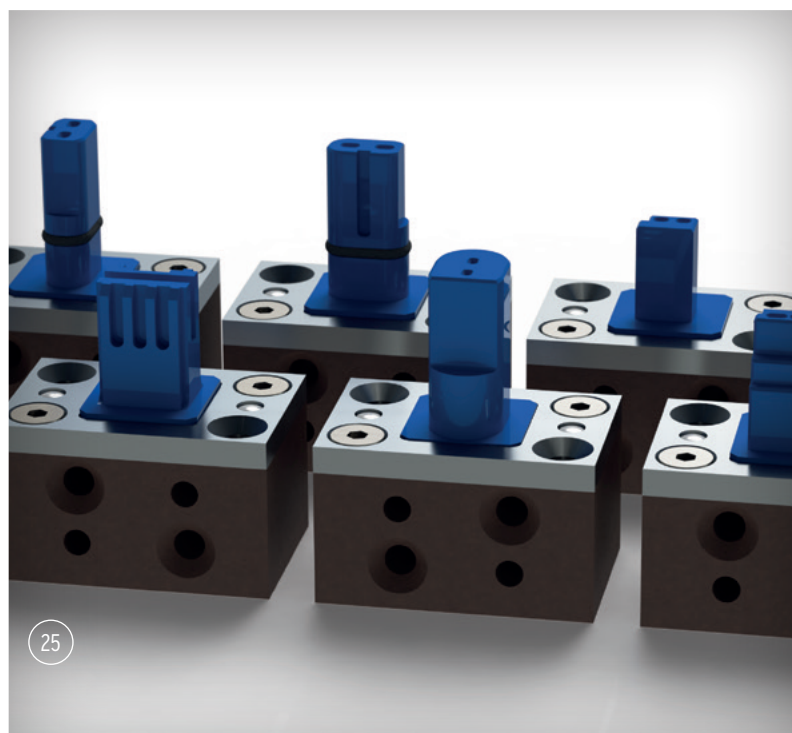
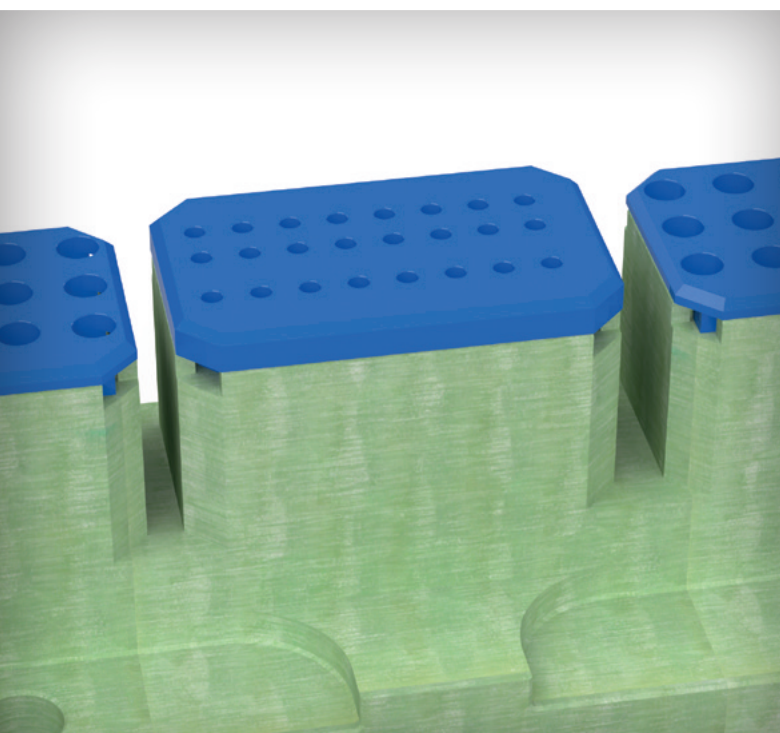


Examples of variants of gripper
and transport fingers with different
shares of high-performance ceramic
and plastic





Examples of variants of test plugs
with different shares of high-
performance ceramic and plastic





DAIMLER



BENTELER 
Automotive

 **KIRCHHOFF**
AUTOMOTIVE

SIEMENS

APPLICATION: AUTOMOTIVE



Elements made from high-performance ceramics are used in car building at various points, including in car body construction. This is due to the fact that, if pieces of sheet metal are welded to one another, they must be positioned exactly relative to each other, as even slight inaccuracies may impair a processed component's quality.

This task is assumed by positioning and fixing pins made from high-performance ceramics. Weld spatter, extremely high temperatures and high mechanical stress have a much smaller impact on them than on common pins made from hardened steel. This is why they can spot-weld for up to 20 times the conventional service life. Therefore, positioning and fixing pins made from

high-performance ceramics do not need to be replaced as often, the plants can be operated with fewer interruptions, and the process and maintenance costs are significantly lower. Ceramic components can be used in car building also as part of metal forming, equipping and testing tasks on other manufacturing lines.



Screws insulating sockets

- > Compressive strength up to 600 N/mm²
Duroplastic, no flowing under pressure
- > Able to carry loads (withstand stress) up to 180°C
- > Compact design due to high material stability



Insulating plates

- > Electrical and thermal insulation
- > For MIG/MAG and resistance welding
- > Heat-resistant up to 120°C

Welding electrodes

- > Replacement electrodes
- > Basic electrodes
- > Multi-functional welding devices that are adapted to the DOCERAM pin standard



Positioning pins

- > Fixing / positioning of car body panels in manufacturing
- > Handling of high-strength hot-worked steels, e.g. USIBOR / PHS ULTRAFORM
- > Resistant against galling on aluminium sheets



Dowel pins

- > Ideal for fixture construction
- > Dimensionally stable even at high temperatures
- > Electrically insulating



Welding centring pins

- > Projection welding without shunting
- > No weld spatter in the thread
- > For manual and automatic nut feeding

Stud welding

- > Ceramic mouth pieces
- > No adhesion of weld spatter
- > Maximum service life



Gas nozzles

- > Maximum service life
- > No plant downtime
- > Contact-free cleaning
- > Ideally suited for heavily splattering applications (overhead welding, sheet thickness > 3 mm, high volume, difficult-to-weld sheets)



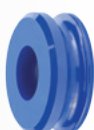
Flanging rollers

- > Flanging of aluminium and steel sheets
- > No plastic deformation
- > No aluminium galling
- > Wear-resistant



Forming tools

- > Flanging rollers
- > Seaming rollers
- > Forming rollers
- > Maximum service life
- > No damage to the formed surfaces





4

STANDARD PRODUCTS MADE OF
HIGH-PERFORMANCE CERAMICS AND
ENGINEERING PLASTICS





High-performance ceramics standard products

Dowel pins / cylindrical pins for fixture construction	30
Pull dowel pins / cylindrical pins	31
Configurable positioning pins	32-33
Locating bolts	34-35
Headed dowels	36
Guide bushes	37
Feather keys	38



Engineering plastics standard products

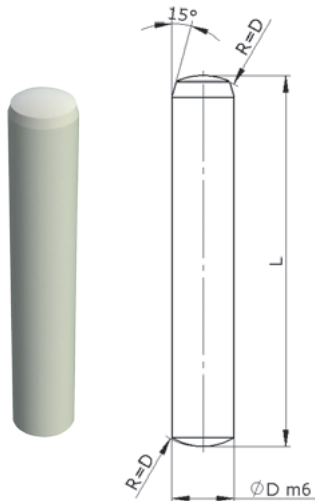
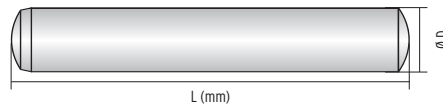
Compression-resistant screw head insulation	40
Insulating tubes	41-42
Insulating boards without bore	43
Threaded bars	44
Nuts	45



Dowel pins / cylindrical pins for fixture construction

made of Z101 high-performance ceramic

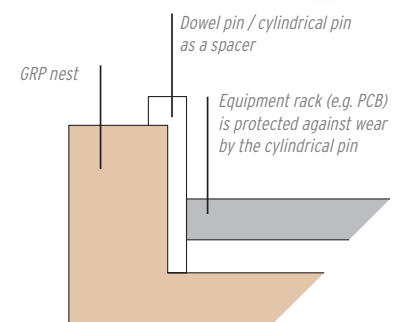
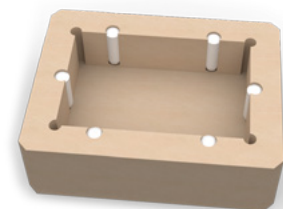
Tolerance m6
as per DIN 6325



Ø mm	L mm	PU	Item No.
2.0	6	25	8221-ZK-13019
	8	25	8221-ZK-13020
	10	25	8221-ZK-13021
	12	25	8221-ZK-13022
	14	25	8221-ZK-13023
3.0	10	25	8221-ZK-13037
	12	25	8221-ZK-13038
	14	25	8221-ZK-13039
	18	25	8221-ZK-13041
	20	25	8221-ZK-13042
4.0	28	25	8221-ZK-13044
	32	25	8221-ZK-13045
	10	25	8221-ZK-13046
	12	25	8221-ZK-13047
	16	25	8221-ZK-13049
5.0	18	25	8221-ZK-13050
	20	25	8221-ZK-13051
	28	25	8221-ZK-13053
	32	25	8221-ZK-13054
	16	25	8221-ZK-13059
6.0	18	25	8221-ZK-13060
	20	25	8221-ZK-13061
	24	25	8221-ZK-13062
	28	25	8221-ZK-13063
	32	25	8221-ZK-13064
6.0	36	25	8221-ZK-13065
	14	25	8221-ZK-13069
	18	25	8221-ZK-13071
	20	25	8221-ZK-13072
	24	25	8221-ZK-13073
6.0	28	25	8221-ZK-13074
	32	25	8221-ZK-13075
	36	25	8221-ZK-13076
	40	25	8221-ZK-13077
	50	25	8221-ZK-13079
6.0	60	25	8221-ZK-13081

Ø mm	L mm	PU	Item No.
8.0	18	25	8221-ZK-13082
	20	25	8221-ZK-13083
	24	25	8221-ZK-13084
	32	25	8221-ZK-13086
	40	25	8221-ZK-13088
	50	25	8221-ZK-13090
	60	25	8221-ZK-13092
10.0	70	25	8221-ZK-13093
	24	25	8221-ZK-13095
	32	25	8221-ZK-13097
	40	25	8221-ZK-13099
	50	25	8221-ZK-13101
	60	25	8221-ZK-13103
	70	25	8221-ZK-13104
12.0	90	25	8221-ZK-13106
	28	25	8221-ZK-13108
	40	25	8221-ZK-13111
14.0	60	25	8221-ZK-13115
	40	25	8221-ZK-13121

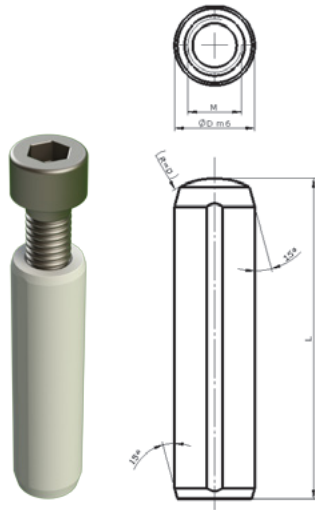
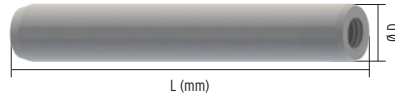
Application example



Pull dowel pins / cylindrical pins

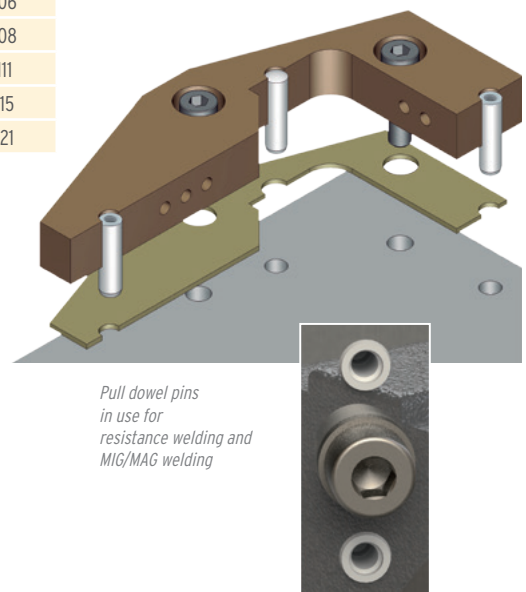
made of Z101 high-performance ceramic

Tolerance m6
as per DIN 7979-D



Ø mm	L mm	PU	Item No.
6.0	14	25	8221-ZK-23069
	18	25	8221-ZK-23071
	20	25	8221-ZK-23072
	24	25	8221-ZK-23073
	28	25	8221-ZK-23074
	32	25	8221-ZK-23075
	36	25	8221-ZK-23076
	40	25	8221-ZK-23077
	50	25	8221-ZK-23079
	60	25	8221-ZK-23081
8.0	18	25	8221-ZK-23082
	20	25	8221-ZK-23083
	24	25	8221-ZK-23084
	32	25	8221-ZK-23086
	40	25	8221-ZK-23088
	50	25	8221-ZK-23090
	60	25	8221-ZK-23092
	70	25	8221-ZK-23093
10.0	24	25	8221-ZK-23095
	32	25	8221-ZK-23097
	40	25	8221-ZK-23099
	50	25	8221-ZK-23101
	60	25	8221-ZK-23103
	70	25	8221-ZK-23104
	90	25	8221-ZK-23106
12.0	28	25	8221-ZK-23108
	40	25	8221-ZK-23111
	60	25	8221-ZK-23115
14.0	40	25	8221-ZK-23121

Application example



Pull dowel pins
in use for
resistance welding and
MIG/MAG welding



Configurable positioning pins

Proven standard qualities

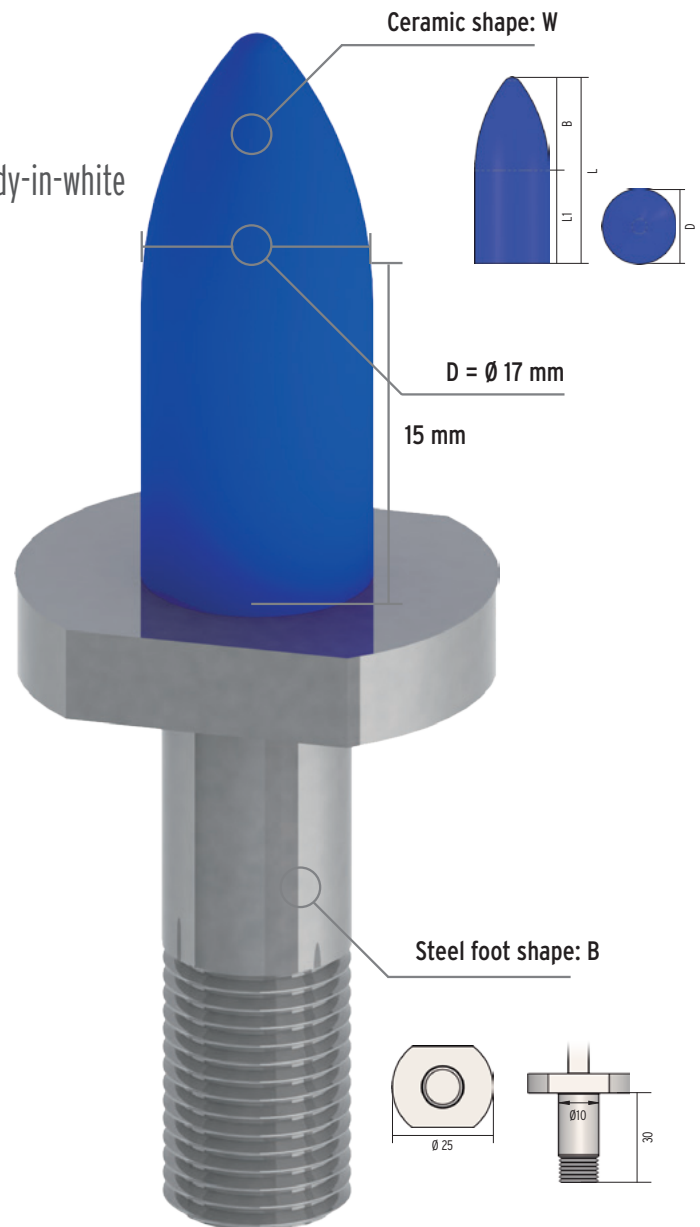
- Flexible modular system
- Individual head geometries
- Quickly available due to standard components
- Developed based on European car standards
- Immediately usable in the production process, e.g. body-in-white

Selection criteria for the standard positioning pin

Specification

- Fixing foot geometry
- Head diameter
- Head length

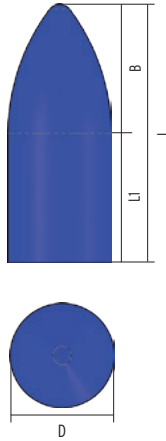
Further geometries are available on request



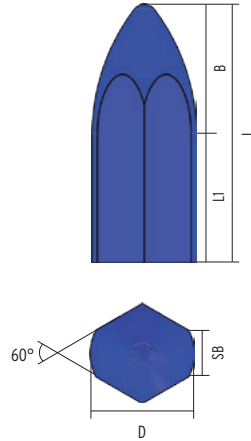
Ceramic shape	W
Diameter	Ø17
Cylinder length	15 mm
Tolerance	N
Steel foot	shape B

Example of ordering a positioning pin

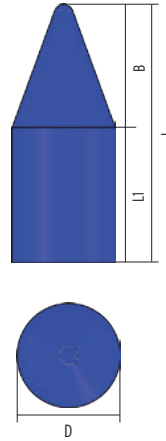
Shape W



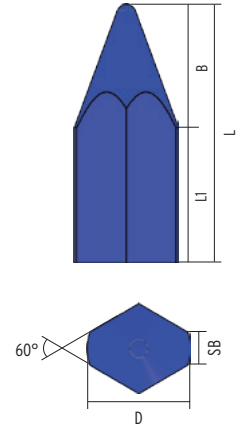
Shape X



Shape Y



Shape Z



D = diameter, L1 = cylinder length, L = overall length of the ceramic (L1 + B),
B = length of the transition (D x 1.25), SB = tip width

Diameter of the ceramic (D)

Diameter can be selected in steps of 0.1 mm								
8-10	10-12	12-15	15-20	20-25	25-30	30-35	35-40	>40

Tip width (SB)

Tip width (SB)								
3.0	3.5	4.0	4.5	5.0	7.0	7.5	8.0	9.0

Selection of the cylinder length (L1)

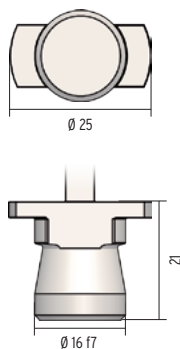
Cylinder length can be selected in steps of 0.1 mm								
--	--	--	--	--	--	--	--	--

Selection of tolerances

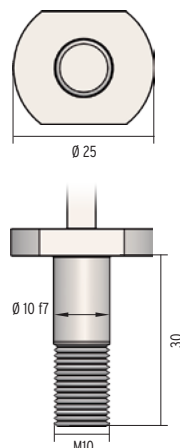
M	N	O	P	Q	R	S
0 / -0.05	0 / -0.1	-0.1 / -0.15	-0.1 / -0.2	-0.15 / -0.2	-0.2 / -0.3	-0.25 / -0.3

Steel feet

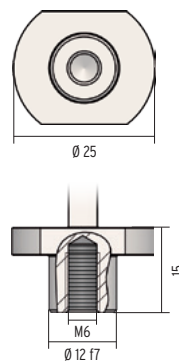
Shape A



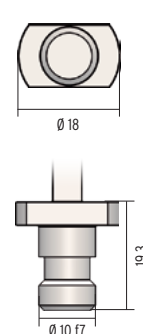
Shape B



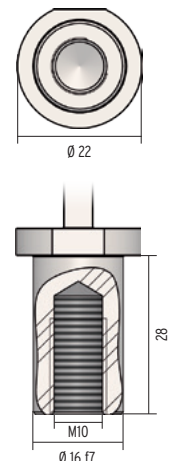
Shape C



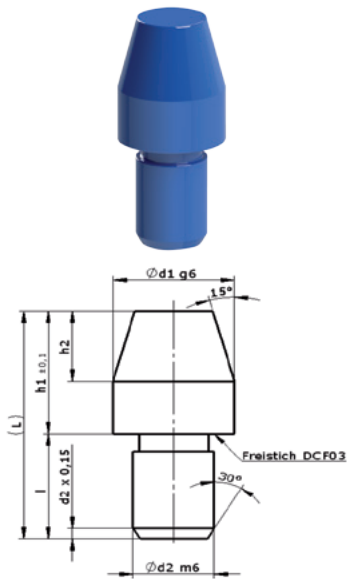
Shape D



Shape E

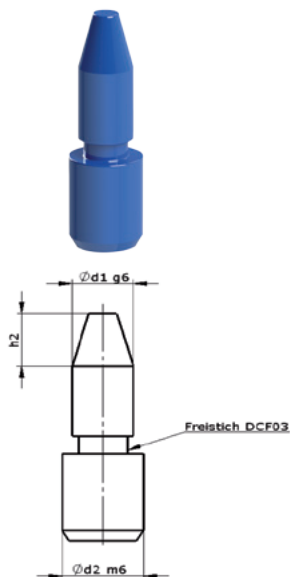


Locating bolts



Shape A

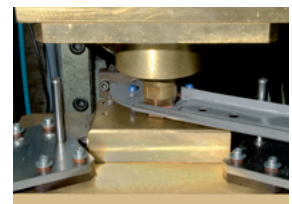
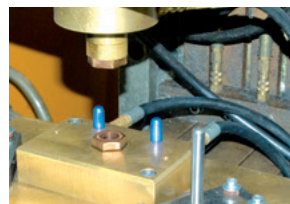
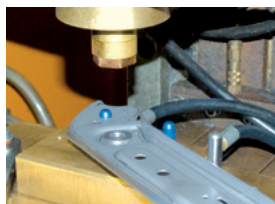
l	h 1	h 2	Ø d2 mm	Ø d1 mm	L mm	PU	Item No.
6	7	4	4	6	13	25	8228-K-72880
6	12	4	4	6	18	25	8228-K-72881
9	10	6	6	8	19	25	8228-K-72882
9	16	6	6	8	25	25	8228-K-72883
9	10	6	6	10	19	25	8228-K-72884
9	18	6	6	10	27	25	8228-K-72885
9	10	6	6	12	19	25	8228-K-72886
9	18	6	6	12	27	25	8228-K-72887
12	13	8	8	16	25	25	8228-K-72888
12	22	8	8	16	34	25	8228-K-72889

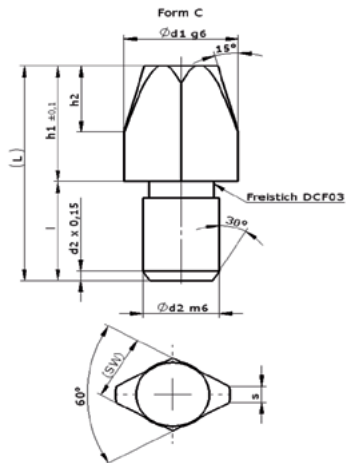


Shape B

l	h 1	h 2	Ø d2 mm	Ø d1 mm	L mm	PU	Item No.
6	7	3	4	3	13	25	8228-K-72890
6	12	3	4	3	18	25	8228-K-72891
9	10	4	6	4	19	25	8228-K-72892
9	16	4	6	4	25	25	8228-K-72893
9	10	5	8	6	19	25	8228-K-72894
9	18	5	8	6	27	25	8228-K-72895

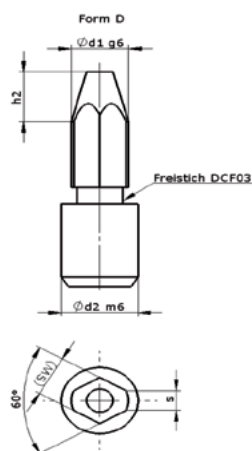
Application example





Shape C

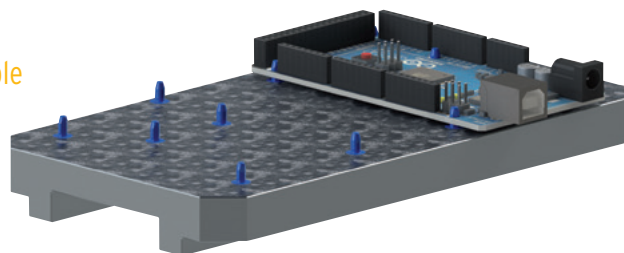
l	h 1	h 2	Ø d2 mm	Ø d1 mm	s	L mm	SW	PU	Item No.
6	7	4	4	6	1	13	3.8	25	8228-K-72896
6	12	4	4	6	1	18	3.8	25	8228-K-72897
9	10	6	6	8	1.6	19	5.3	25	8228-K-72898
9	16	6	6	8	1.6	25	5.3	25	8228-K-72899
9	10	6	6	10	2.5	19	7	25	8228-K-72900
9	18	6	6	10	2.5	27	7	25	8228-K-72901
9	10	6	6	12	2.5	19	8	25	8228-K-72902
9	18	6	6	12	2.5	27	8	25	8228-K-72903
12	13	8	8	16	3.5	25	10.8	25	8228-K-72904
12	22	8	8	16	3.5	34	10.8	25	8228-K-72905



Shape D

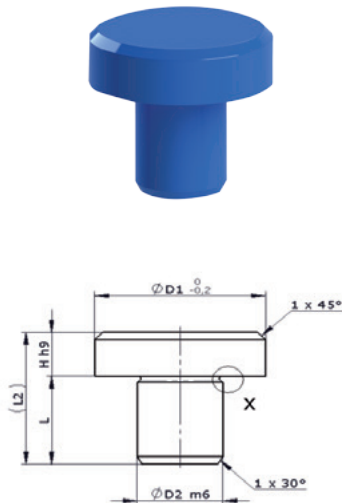
l	h 1	h 2	Ø d2 mm	Ø d1 mm	s	L mm	SW	PU	Item No.
6	7	3	4	3	1.2	13	2.4	25	8228-K-72906
6	12	3	4	3	1.2	18	2.4	25	8228-K-72907
9	10	4	6	4	1.6	19	3.2	25	8228-K-72908
9	16	4	6	4	1.6	25	3.2	25	8228-K-72909
9	10	5	8	6	2	19	4.5	25	8228-K-72910
9	18	5	8	6	2	27	4.5	25	8228-K-72911

Application example



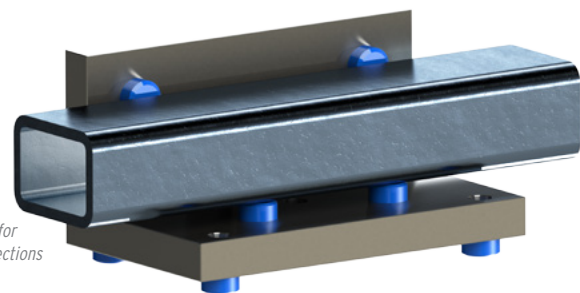
Positioning pins made of ceramic for the component production in the electronics industry

Headed dowels



Ø D1	H	Ø D2 mm	L mm	L2 mm	PU	Item No.
6	2.5	4	6.5	9	25	8228-K-60300
6	4.5	4	8.5	13	25	8228-K-60301
6	5	4	6	11	25	8228-K-60302
10	4	6	8.5	13	25	8228-K-60303
10	8	6	8.5	16.5	25	8228-K-60304
12	6	6	10	16	25	8228-K-72878
12	10	6	10	20	25	8228-K-72879
16	5	8	10	15	25	8228-K-60305
16	13	8	10	23	25	8228-K-60306
19.4	6	10	12	18	25	8228-K-60307
19.4	12	10	12	24	25	8228-K-60308
25	8	12	14	22	25	8228-K-60310
25	20	12	14	34	25	8228-K-60311
25	30	12	14	44	25	8228-K-60318
30	25	16	20	45	25	8228-K-60319
30	40	16	20	60	25	8228-K-60320
30	50	16	20	70	25	8228-K-60321
30	65	16	20	85	25	8228-K-60322

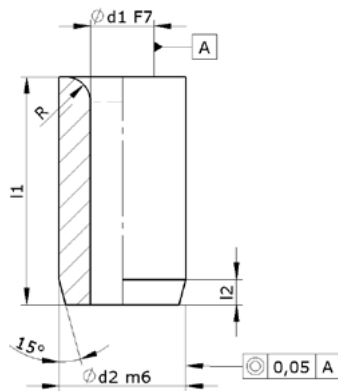
Application example



Ceramic headed dowels for wear-free guidance of sections / profiles

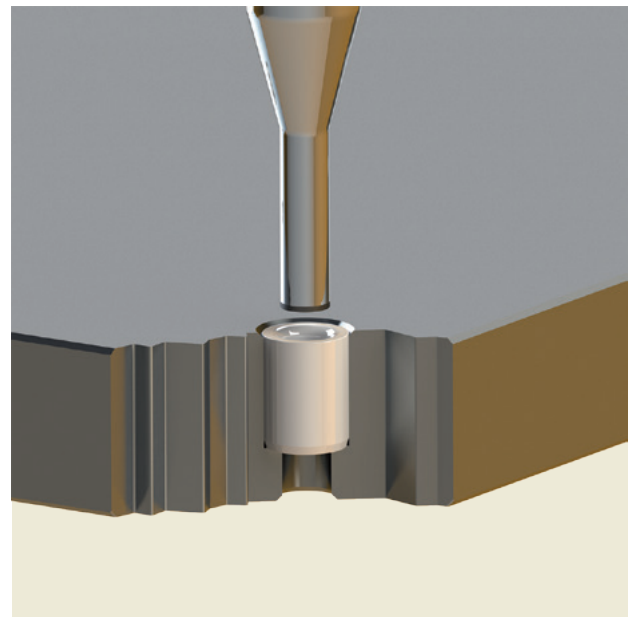


Guide bushes



d 2	l 1	d 1	l 2	R	Item No.
5	9	2.5	1	1	8227-K-73243
6	12	3	1	1	8227-K-73244
6	12	3.3	1	1	8227-K-73245
7	12	4	1	1	8227-K-73246
8	12	4.2	1	1	8227-K-73247
8	12	5	1	1	8227-K-73248
10	16	6	1.25	1.5	8227-K-73249
12	16	6.8	1.25	1.5	8227-K-73250
12	16	8	1.25	1.5	8227-K-73251
15	20	8.5	1.5	2	8227-K-73252

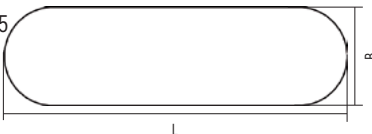
Application example



Feather keys

made of Z141 high-performance ceramics

similar to DIN 6885



B mm	H mm	L mm	Item No.
3	3	8	8229-K-10000
3	3	16	8229-K-10004
3	3	25	8229-K-10008
4	4	8	8229-K-10010
4	4	16	8229-K-10014
4	4	25	8229-K-10018
5	5	12	8229-K-10020
5	5	22	8229-K-10025
5	5	40	8229-K-10030
6	6	12	8229-K-10031
6	6	22	8229-K-10036
6	6	40	8229-K-10041
8	7	14	8229-K-10043
8	7	28	8229-K-10049
8	7	70	8229-K-10055
10	8	22	8229-K-10056
10	8	36	8229-K-10060
10	8	80	8229-K-10066
12	8	25	8229-K-10067
12	8	40	8229-K-10071
12	8	80	8229-K-10076
14	9	25	8229-K-10077
14	9	40	8229-K-10081
14	9	80	8229-K-10086
16	10	50	8229-K-10087
16	10	70	8229-K-10090
16	10	100	8229-K-10093

Application example see right-hand page



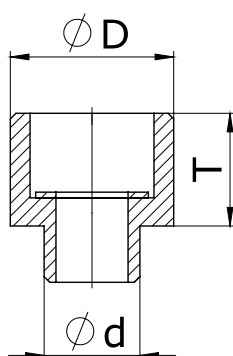


Compression-resistant screw head insulation

made of the DOGLAS 180 G insulating material

DOGLAS
180 G

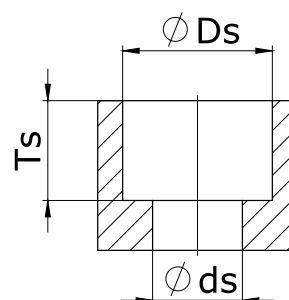
Screws insulating sockets



for screw (mm)	d	D	T	Item No.
M5	7.5	13	9	1462-Z-93653
M6	8.5	14.5	10	1462-Z-93655
M8	10.5	17.5	12	1462-Z-93657
M10	12.5	20.5	14	1462-Z-93658
M12	14.5	22.5	16	1462-Z-93659

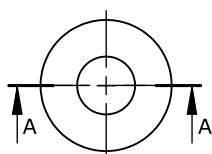
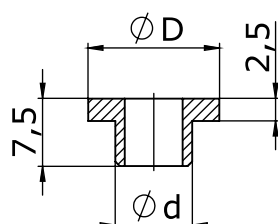
Recommendation for countersunk hole

for insulating bush (mm)	ds	Ds	Ts
M5	8	14	9
M6	9	18	10
M8	11	20	12
M10	13	24	14
M12	15	26	16



Countersunk hole

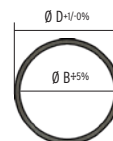
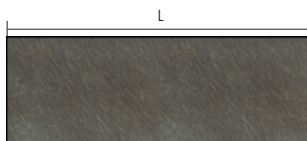
Screws insulating sockets without collar



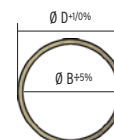
for screw (mm)	d	D	Item No.
M4	6.5	9	1462-Z-189662
M5	7.5	10	1462-Z-189663
M6	8.5	13	1462-Z-189664
M8	10.5	16	1462-Z-189665
M10	12.5	20	1462-Z-189666
M12	14.5	22	1462-Z-189667

Insulating tubes

made of the DOTEX 120, DOTEX 110 insulating materials



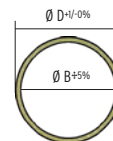
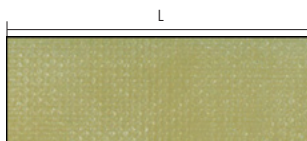
Ø A mm	Ø B mm	Length mm	Item No.
7.9	6.0	500	1408-R-140037
8.0	5.2	500	1408-R-140038
8.0	6.0	500	1408-R-140040
8.0	6.2	500	1408-R-140041
9.0	7.0	1050	1408-R-140042
10.0	7.0	1050	1408-R-140043
10.0	8.0	1050	1408-R-140044
10.0	8.2	1050	1408-R-140045
12.0	7.0	1050	1408-R-140047
12.0	9.0	1050	1408-R-140048
12.0	10.0	1050	1408-R-140049
14.0	12.0	1050	1408-R-140050
16.0	14.0	1050	1408-R-140051
25.0	19.0	1050	1408-R-140052
25.0	22.0	1050	1408-R-140053



Ø A mm	Ø B mm	Length mm	Item No.
7.9	6.0	500	1457-R-140037
8.0	5.2	500	1457-R-140038
8.0	6.0	500	1457-R-140040
8.0	6.2	500	1457-R-140041
9.0	7.0	650	1457-R-140042
10.0	7.0	650	1457-R-140043
10.0	8.0	650	1457-R-140044
10.0	8.2	650	1457-R-140045
12.0	7.0	650	1457-R-140047
12.0	9.0	650	1457-R-140048
12.0	10.0	650	1457-R-140049
14.0	12.0	650	1457-R-140050
16.0	14.0	650	1457-R-140051
25.0	19.0	650	1457-R-140052
25.0	22.0	650	1457-R-140053

Insulating tubes

DOGLAS 180 G

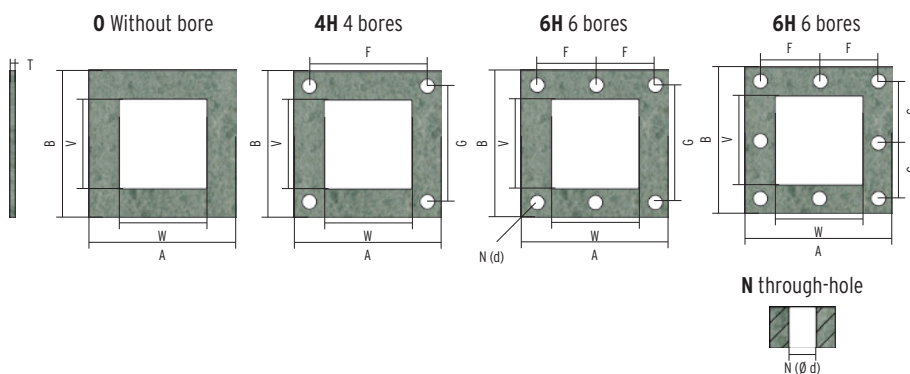


Ø A mm	Ø B mm	Length mm	Item No.
7.9	6.0	500	1468-R-140037
8.0	5.2	500	1468-R-140038
8.0	6.0	500	1468-R-140040
8.0	6.2	500	1468-R-140041
9.0	7.0	1050	1468-R-140042
10.0	7.0	1050	1468-R-140043
10.0	8.0	1050	1468-R-140044
10.0	8.2	1050	1468-R-140045
12.0	7.0	1050	1468-R-140047
12.0	9.0	1050	1468-R-140048
12.0	10.0	1050	1468-R-140049
14.0	12.0	1050	1468-R-140050
16.0	14.0	1050	1468-R-140051
25.0	19.0	1050	1468-R-140052
25.0	22.0	1050	1468-R-140053

Turned and polished version available on request.

High temperature gaskets

Material: DOFLEX[®] MSP



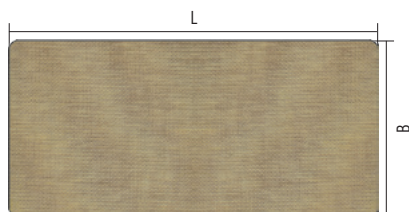
mm	T	A	B	W	V	F	G	N
		(for T=30, A≥30)	(for T=30, B≥30)					
	In steps of 1 mm (A≥B≥T)				In steps of 0.5 mm			
	1 / 2 / 3 / 5 / 6 / 8 / 10 / 15 / 20 / 25 / 30	25 - 500	25 - 500	Please consider the formulae				3 - 30

W ($W \geq 10$; $A-W \geq 5$), **V** ($V \geq 10$; $B-V \geq 5$), **F** ($F-N \geq 5$; $A-2F-N \geq 5$), **G** ($G-N \geq 5$; $B-2G-N \geq 5$)

4H	30	300	200	200	100	250	150	N11
Number of bores	Depth (T)	Width (A)	Height (B)	Internal width (W)	Internal height (V)	Hole distance (F)	Hole distance (G)	Ø bore (N)

Insulating boards without bore

DOTEX 110



DOTEX[®] 110

B x L mm	Thickness mm	Item No.
1050 x 2050	1.0	1450-BS-0010
1050 x 2050	3.0	1450-BS-0030
1050 x 2050	6.0	1450-BS-0060
1050 x 2050	8.0	1450-BS-0080
1050 x 2050	10.0	1450-BS-0100
1050 x 2050	15.0	1450-BS-0150
1050 x 2050	20.0	1450-BS-0200
1050 x 2050	30.0	1450-BS-0300
1050 x 2050	40.0	1450-BS-0400
1050 x 2050	50.0	1450-BS-0500
1050 x 2050	60.0	1450-BS-0600

DOTEX[®] 120

B x L mm	Thickness mm	Item No.
1050 x 2050	1.0	1400-BS -0010
1050 x 2050	3.0	1400-BS -0030
1050 x 2050	6.0	1400-BS -0060
1050 x 2050	8.0	1400-BS -0080
1050 x 2050	10.0	1400-BS -0100
1050 x 2050	15.0	1400-BS -0150
1050 x 2050	20.0	1400-BS -0200
1050 x 2050	25.0	1400-BS -0250
1050 x 2050	30.0	1400-BS -0300
1050 x 2050	35.0	1400-BS -0350

DOGLAS[®] 180 G

B x L mm	Thickness mm	Item No.
1220 x 2440	1.0	1462-BS -10010
1220 x 2440	3.0	1462-BS -10030
1220 x 2440	6.0	1462-BS -10060
1220 x 2440	8.0	1462-BS -10080
1220 x 2440	10.0	1462-BS -10100
1220 x 2440	15.0	1462-BS -10150
1220 x 2440	20.0	1462-BS -10200
1220 x 2440	25.0	1462-BS -10250
1220 x 2440	30.0	1462-BS -10300
1220 x 2440	40.0	1462-BS -10400
1220 x 2440	50.0	1462-BS -10500
1220 x 2440	60.0	1462-BS -10600

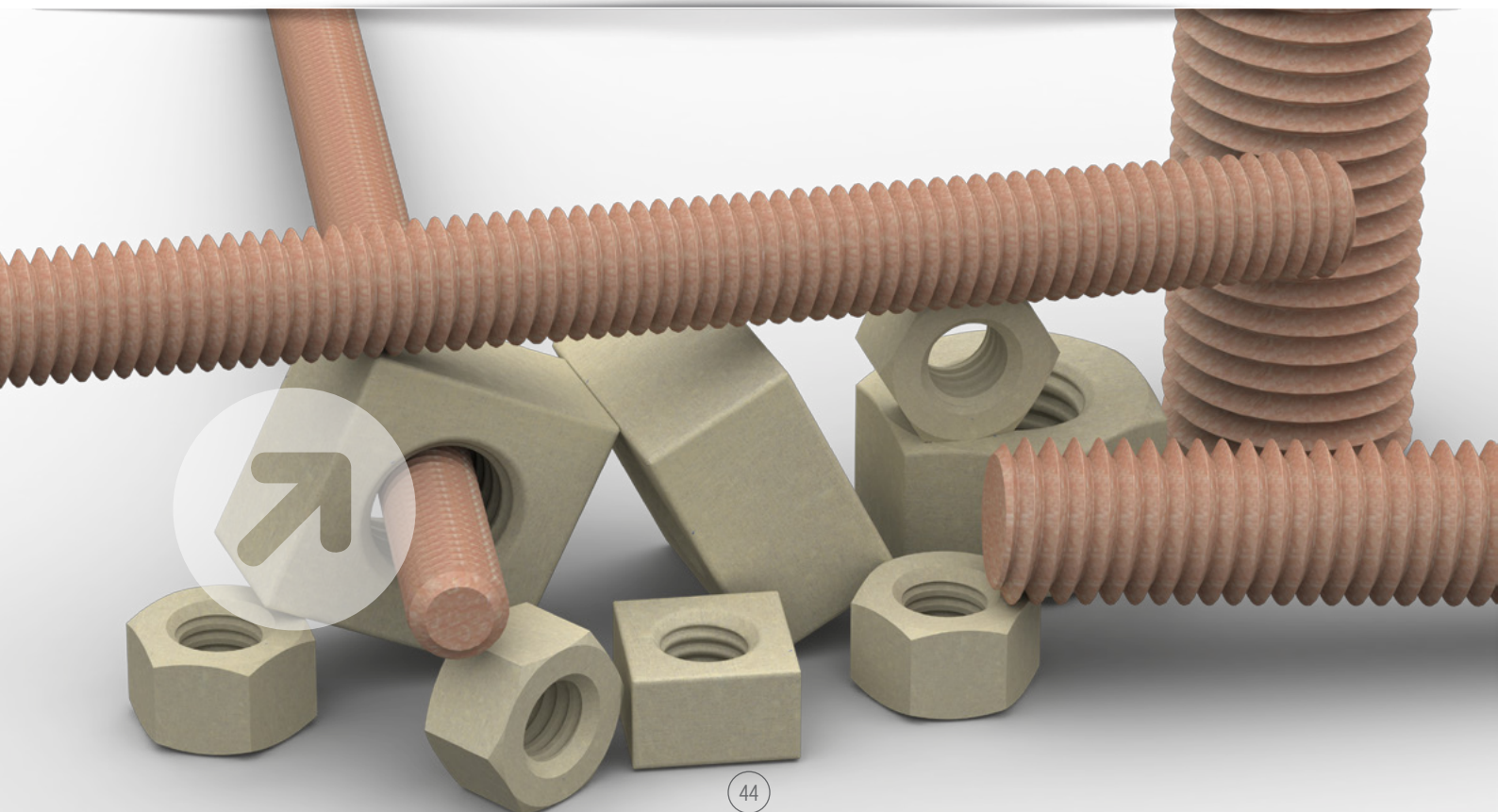
Thickness tolerance +/- 0.5 mm polished. Also available in other dimensions and as finished parts on request.

Threaded bars

Doglas 180 S



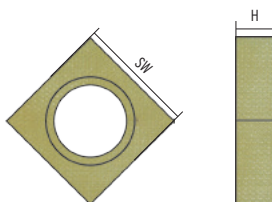
Type	Length mm	Item No.
M6	950	1474-Z- 2972
M8	1900	1474-Z- 2973
M10	1900	1474-Z- 2974
M12	1900	1474-Z- 2975
M16	1900	1474-Z- 2976
M20	1900	1474-Z- 2977
M24	1900	1474-Z- 2978



Nuts

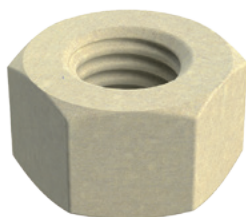
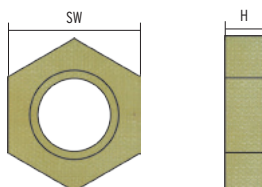
Doglas 180 M

Square nuts



Type	SW mm	H mm	Item No.
M6	10	6	1475-Z-55418
M8	13	8	1475-Z-2983
M10	17	10	1475-Z-2984
M12	19	12	1475-Z-25418
M16	24	16	1475-Z-2986
M20	30	20	1475-Z-2987
M24	36	24	1475-Z-2988

Hexagon nuts



Type	SW mm	H mm	Item No.
M6	10	6	1475-Z 94133
M8	13	8	1475-Z-19039
M10	17	10	1475-Z-17243
M12	19	12	1475-Z-38218
M16	24	16	1475-Z-50729
M20	30	20	1475-Z-19270
M24	36	24	1475-Z-45098



Contact **G.E. SCHMIDT** for sales, service and support

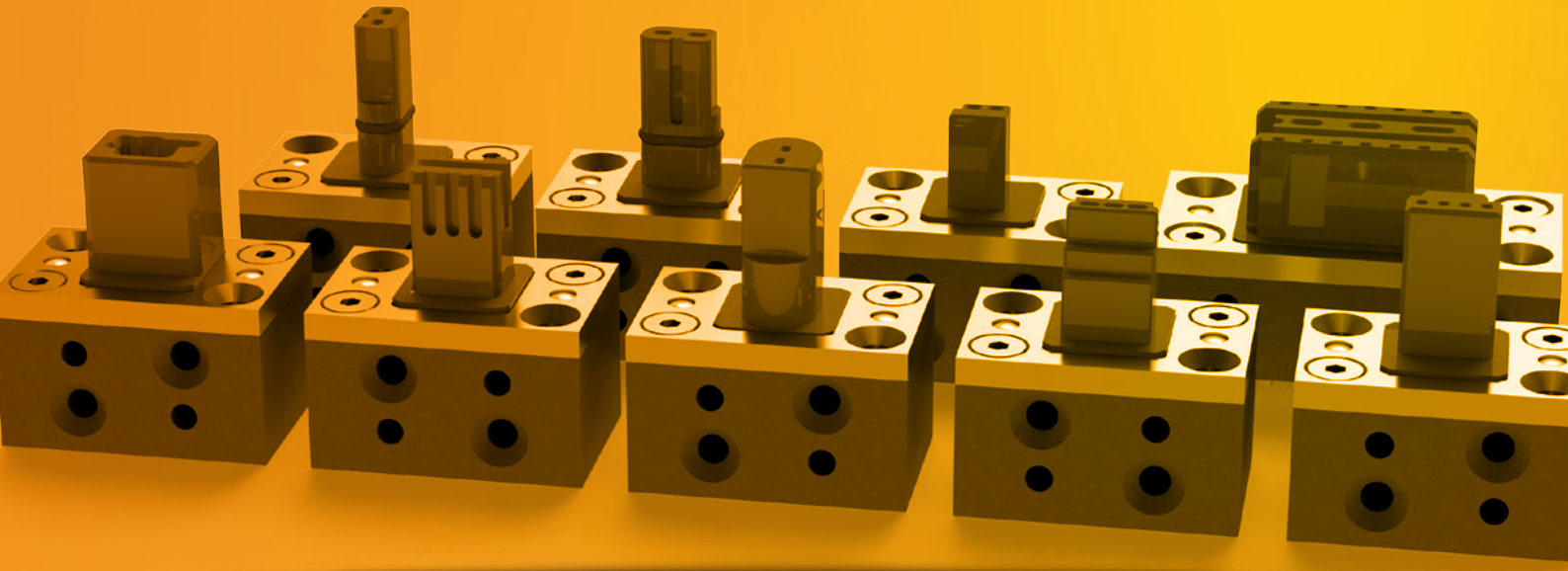


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CINCINNATI, OHIO

NOTE: Please reference serial numbers with all technical questions

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