

Durostone® & Perma-Bolt®

Composite

Fasteners



Competence in Plastics

The Röchling Group, which is headquartered in Mannheim, includes a large number of locations in countries all over the world. With a workforce of several thousand employees, we manufacture our products in close proximity to our customers and markets. Our three company divisions, Industrial, Automotive and Medical, generate billions in sales every year on the European, American and Asian continents.

Roehling Industrial

The Industrial division supplies almost every sector of industry with optimal, application-oriented materials. To achieve this, Roehling has probably the world's biggest product portfolio of thermoplastics and composite materials. The company manufactures a range of semi-finished parts such as sheets, rods, tubes, flat bars, finished castings and profiles as well as machined and assembled precision components.

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What distinguishes Durostone® fasteners?

Durostone® fasteners are used in technical fields that have high demands on electrical, chemical and thermal properties. Durostone® fasteners are based on glass fibre-reinforced epoxy or polyester resin systems with special additives and a special structure.

Electrical properties

All Durostone® fasteners are **electrically insulating** and **non-magnetic**. Some qualities are, moreover, **partial discharge free** up to high electric field strengths and especially **non-tracking**. They are excellent for use in transformers, in electrical engineering, in high-frequency, switching and electrostatic powder coating equipment.

Chemical properties

Durostone® fasteners are particularly **resistant** against **aggressive fluids and gases, resistant to transformer oil and dielectric liquids, and highly UV and weather resistant**. They are in use, for example, in chemical equipment, flue gas desulfurization and cable trays, the onshore and offshore technology, seawater desalination, wastewater treatment and cable trays.

Thermal properties

Compared to steel (15 – 58 W/mK), all Durostone® qualities have a very **low thermal conductivity** of 0.3 W/mK, and are therefore at the level of mineral wool, which is used in construction as insulation. They are ideal for use in refrigeration, HVAC and areas suitable for applications, where thermal bridges must be avoided.

Lightweight

Durostone® fasteners have a density of 1.9 to 2 g/cm³ and thus weigh only about ¼ of steel. They are well-suited for applications where weight reduction is an important factor – for example, in vehicle construction or the construction of nacelles for wind turbines.

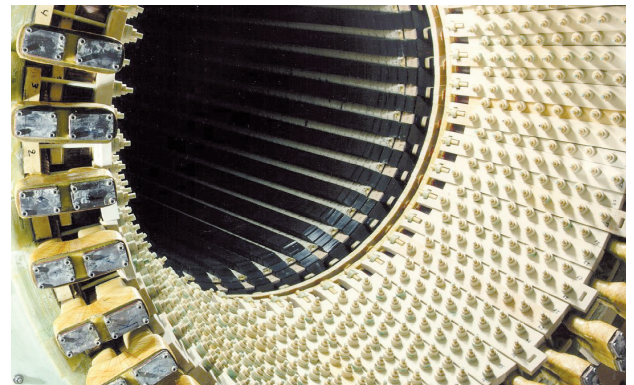
High tensile strength

Compared to threaded rods made of thermoplastic such as for example polyamide, Durostone® threaded rods have a six-fold higher tensile strength.

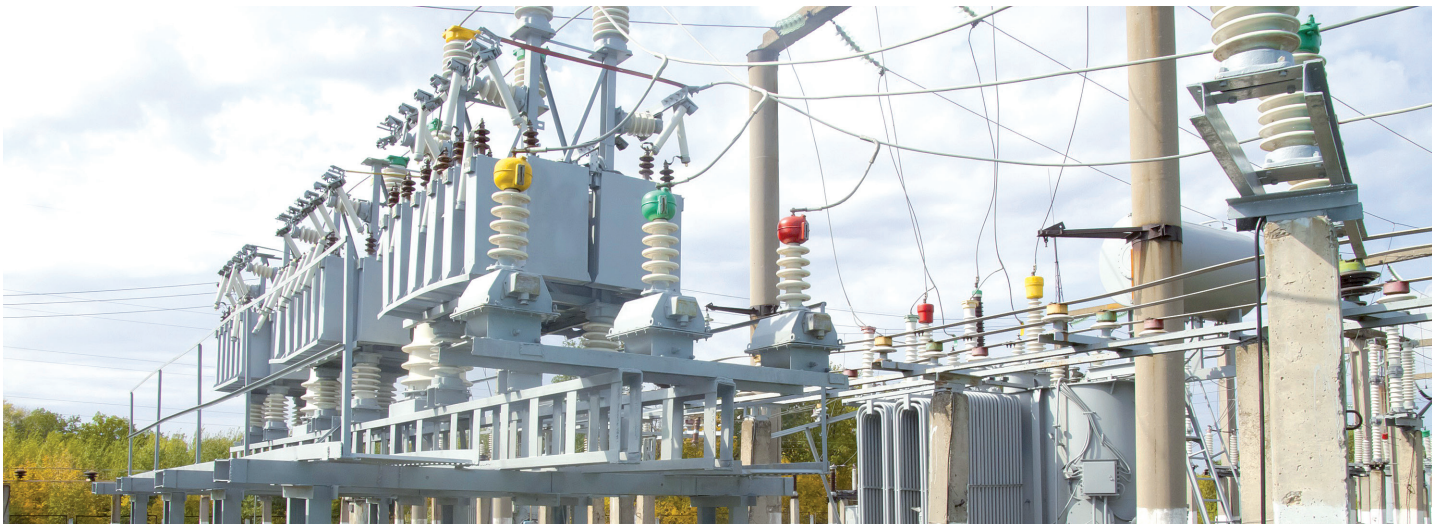
Applications

- Flue gas desulphurization plants
- Onshore/offshore engineering
- Chemical plants
- Hydraulic engineering, sewage treatment plants, desalination of seawater
- Transformers, dry-type and oil immersed
- Generators
- Switchgears
- Instrument construction, high-frequency systems
- Traffic engineering
- Refrigeration and air conditioning
- Cable trays
- Electrostatic powder coating
- Electroplating plants

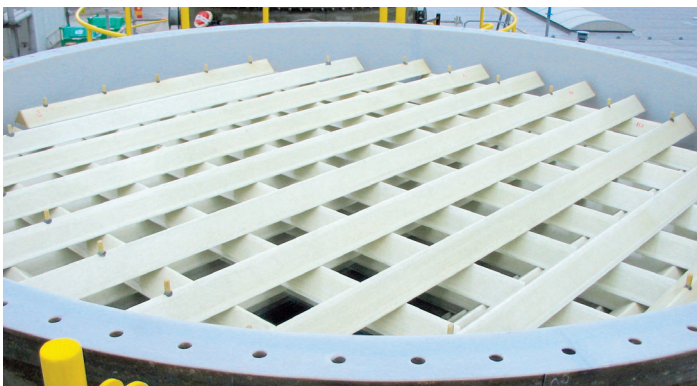
Please contact us for choosing the right Durostone® grade for your application. We examine the loads and offer a grade suitable for your particular application.



Generators



Transformer



Flue gas desulphurization plant



Chemical plants

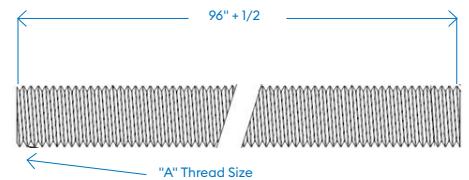
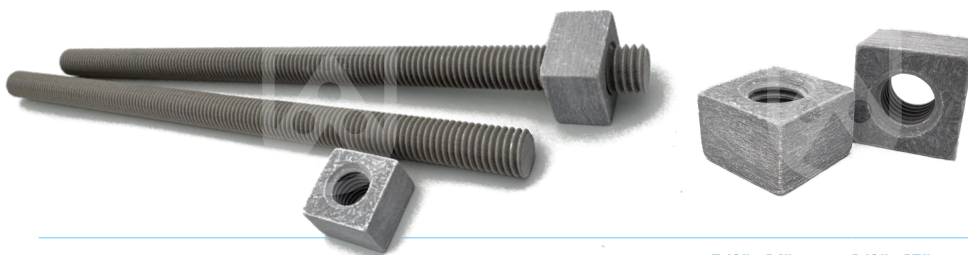
Durostone® Perma-Bolt®



Durostone® Perma-Bolt®

Durostone® Perma-Bolt® composite fasteners are extremely versatile, adaptable, lightweight, and resist corrosion in harsh environments. They are used primarily in technical fields that have high demands on electrical and chemical properties. Perma-Bolt® fasteners are based on a glass fiber reinforced internal structure and vinyl ester resin system with special additives to enhance its properties. Whether exposed to the outdoor environment, electrical currents, salt water, or other demanding applications, they shine in terms of their adaptability and longevity!

Product Line	RIMP Part #	Description & Thread Size	Part #	Stock Mating Nuts
Perma-Bolt®	PB0400MA	Threaded rod 3/8" - 16 x 96"	PB0442MA	Square nut 3/8"
Perma-Bolt®	PB0399MA	Threaded rod 1/2" - 13 x 96"	PB0444MA	Square nut 1/2"
Perma-Bolt®	PB0401MA	Threaded rod 5/8" - 11 x 96"	PB0446MA	Square nut 5/8"
Perma-Bolt®	PB0398MA	Threaded rod 3/4" - 10 x 96"	PB0448MA	Square nut 3/4"
Perma-Bolt®	PB0397MA	Threaded rod 1" - 8 x 96"	PB0452MA	Square nut 1"

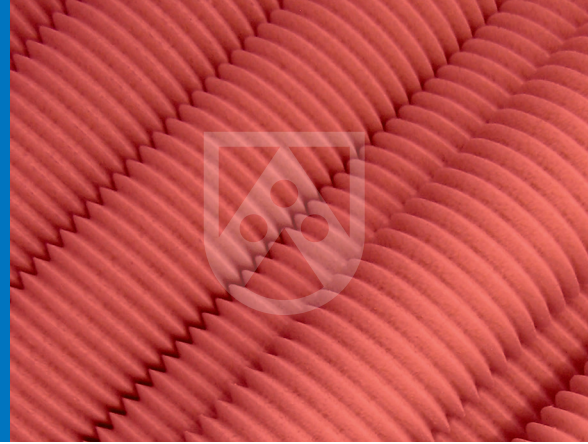


	3/8" - 16"	1/2" - 13"	5/8" - 11"	3/4" - 10"	1" - 8"
** Ultimate thread shear (lbs)	1,250	2,500	3,800	5,500	7,400
Ultimate transverse shear - Double shear ASTM B-565 (load lbs)	4,200	7,400	11,600	17,200	27,400
Transverse shear yield - Double shear (load lbs)	2,100	3,300	4,500	7,500	12,500
Compressive strength - Longitudinal ASTM D- 695 (psi)	55,000	55,000	55,000	55,000	60,000
Flexural strength ASTM D-790 (psi)	60,000	60,000	60,000	60,000	60,000
Flexural modulus ASTM D-790 (psi x 10 ⁶)	2.0	2.0	2.0	2.5	2.75
**Ultimate torque strength lubricated with SAE 10W30 oil (ft-lbs)	8	15	33	50	115
Dielectric strength ASTM D-149 (kv/in)	40	40	40	40	40
Water absorption, 24 hr. immersion ASTM D-570 (%)	1	1	1	1	1
Coefficient of thermal expansion - Longitudinal (per °F)	3.0	3.0	3.0	3.0	3.0
Maximum recommended operation temperature based on 50% retention of ultimate thread shear (°C)	100	100	100	100	100
Stud weight (lbs/ft)	0.076	0.129	0.209	0.315	0.592
Color	Gray	Gray	Gray	Gray	Gray
Flammability ASTM D-635	Self-extinguishing for all				

** Values listed above are only valid when using a Roechling Industrial Mt. Pleasant nut.

All information and recommendations regarding properties and applications are based upon tests and data believed accurate. Any particular application is the sole responsibility of the user. No warranty is expressed or implied. Under no circumstances shall we be liable for incidental or consequential loss.

Durostone® EPR S1



Durostone® EPR S1

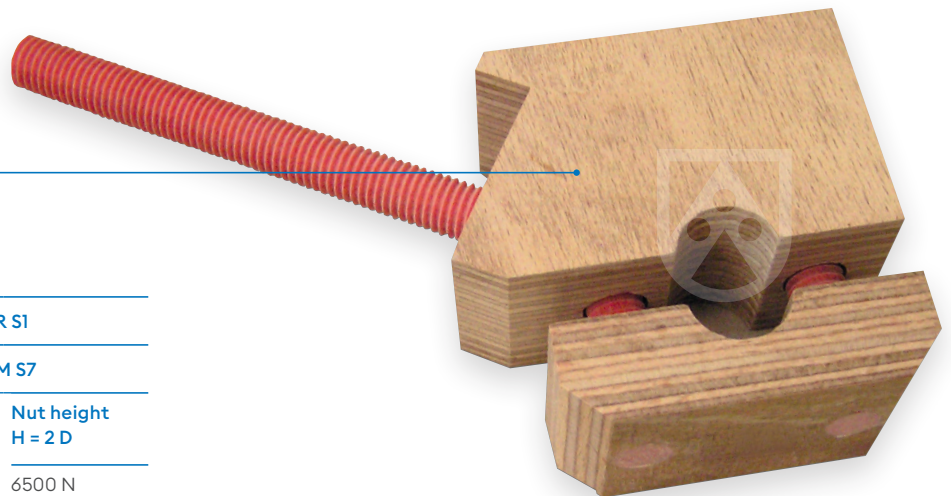
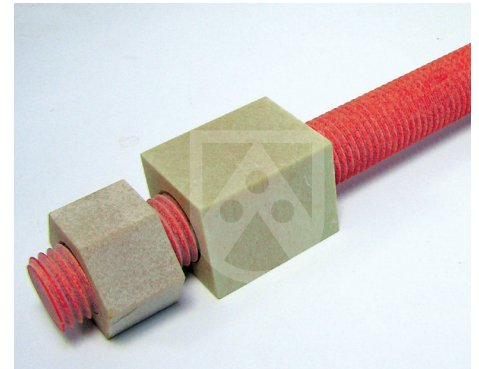
Durostone® EPR S1 threaded rods consist of two main components, a special designed glass reinforcement and an embedding epoxy resin matrix.

Durostone® EPR S1 is our standard grade for threaded rods and is successfully used for decades in many different areas.

- Standard length: 1900 mm
- Standard size: M8 – M30
- Threads in accordance with ISO 965
- Tolerance zone 6 g, all sizes in mm

Larger sizes on request.

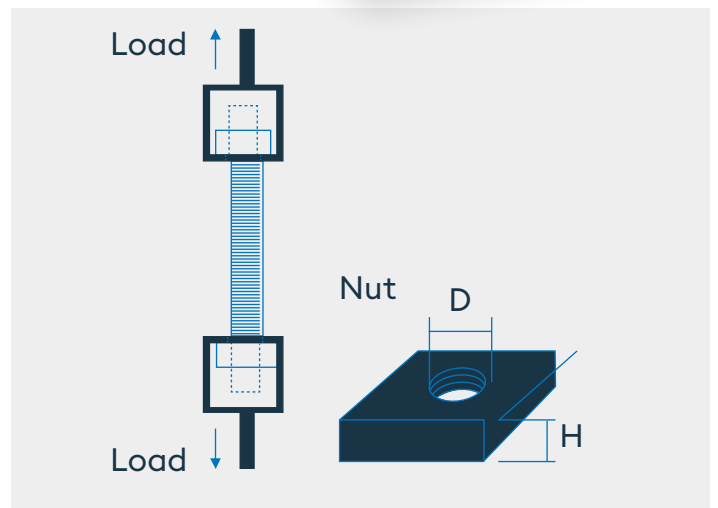
Lignostone® component with Durostone® fastener for a traction transformer



Breaking load ¹⁾

Threaded rod	Durostone® EPR S1	
Nut	Durostone® EPM S7	
Nominal diameter	Nut height H = D	Nut height H = 2 D
M6	4000 N	6500 N
M8	7000 N	12000 N
M10	12000 N	22000 N
M12	17500 N	31000 N
M16	32000 N	58000 N
M20	50000 N	80000 N
M24	67000 N	110000 N
M27	90000 N	145000 N
M30	110000 N	170000 N

¹⁾ Average values. Corresponding safety factors should be considered in the design. A constant tensile load should be less than 50 % of the achieved short time breaking load.



Used test set-up, Pulling speed: 5 mm/min, Clamping length: 250 mm

Durostone® EPR S5



Durostone® EPR S5

Durostone® EPR S5 threaded rods are highly resistant to aggressive media and can be used for **chemical and maritime applications**.

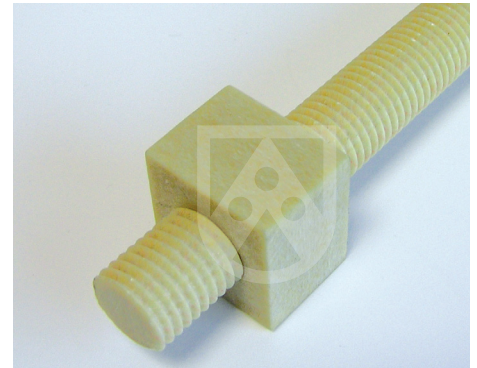
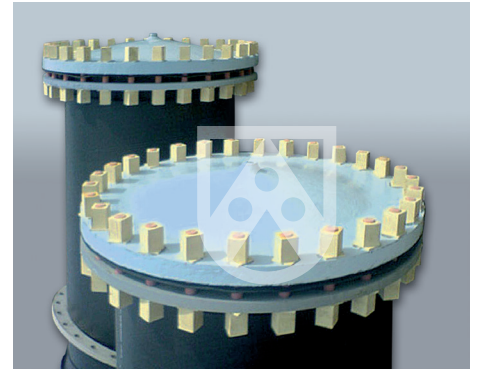
- Threads in accordance with ISO 965
- Tolerance zone 6 g, all sizes in mm
- Standard length: 1900 mm
- Standard size: M8 – M30

Permissible load values in acidic medium ¹⁾

Threaded rod	Durostone® EPR S5			
Nut	Durostone® EPM S7			
Nominal diameter	pH-value = 3.5 – 6		pH-value = 1	
	Nut height H = D	Nut height H = 2 D	Nut height H = D	Nut height H = 2 D
M8	1400 N	3100 N	650 N	1500 N
M10	2550 N	5000 N	1100 N	2150 N
M12	3750 N	7450 N	1600 N	3100 N
M16	6800 N	13600 N	2900 N	5600 N
M20	10600 N	20450 N	4500 N	8700 N
M24	15150 N	27250 N	6500 N	11800 N
M27	19400 N	33300 N	8300 N	14800 N
M30	23000 N	43000 N	10100 N	19000 N

¹⁾ Load values apply for temperatures of 70 °C and a load duration of 2×10^5 hours at pH = 3.5 – 6 respective 5 years pH = 1. The pH-value is based on a defined test suspension with high chloride and sulphate contents.

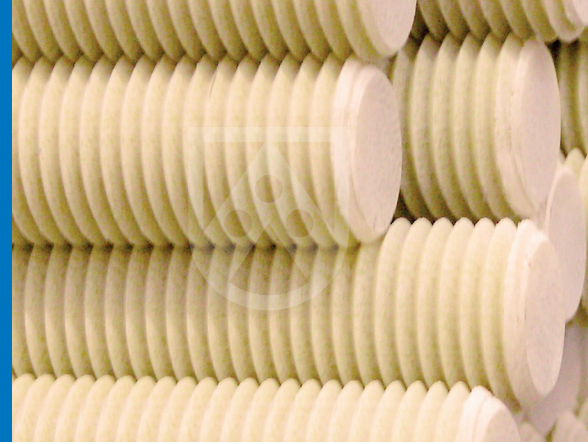
Chemical plants



Onshore/offshore engineering



Durostone® EPR S6



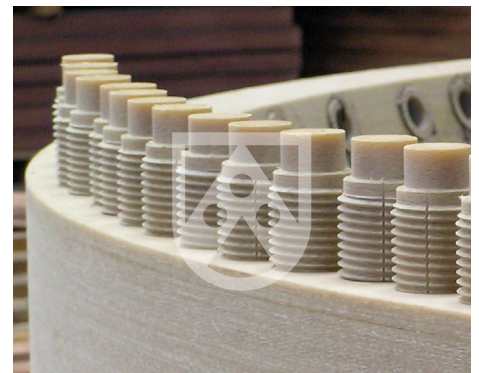
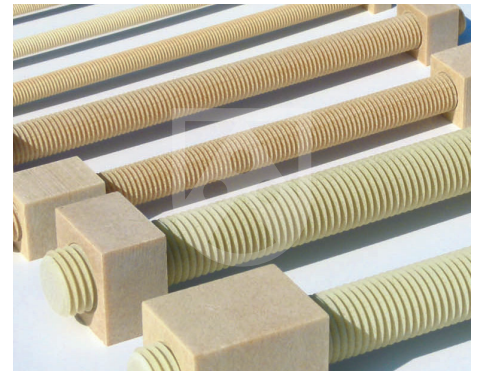
Durostone® EPR S6

Durostone® EPR S6 is a special for threaded rods developed epoxy high pressure laminate with outstanding technical properties.

Features

- High tensile strength and high tensile modulus
- Very high tracking resistance CTI 600
- Flammability V0
- Sizes up to M52* and 5500 mm length are possible

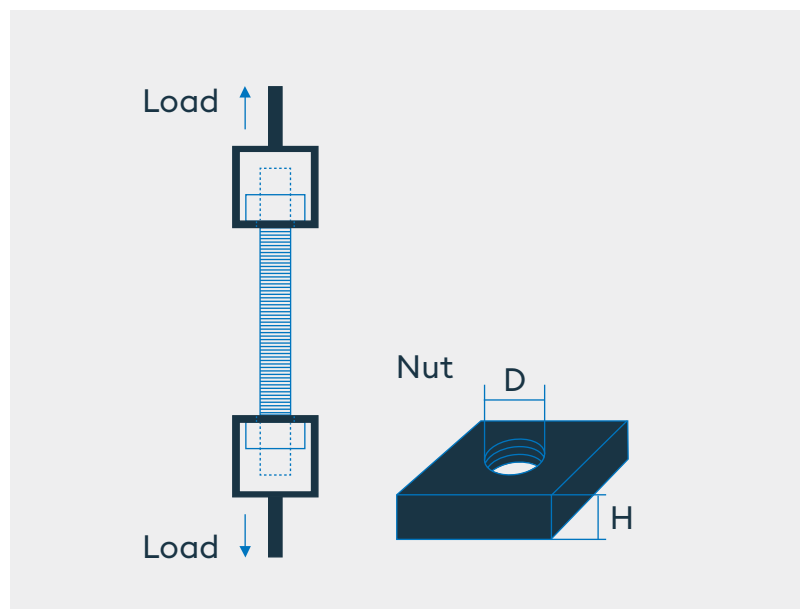
* Larger sizes on request



Breaking load ¹⁾

Threaded rod	Durostone® EPR S6	
Nut	Durostone® EPM S7	
Nominal diameter	Nut height H = D	Nut height H = 2 D
M8	7000 N	12000 N
M10	12000 N	22000 N
M12	17500 N	31000 N
M16	32000 N	58000 N
M20	50000 N	85000 N
M24	67000 N	120000 N
M27	90000 N	150000 N
M30	110000 N	180000 N

¹⁾Average values. Corresponding safety factors should be considered in the design. A constant tensile load should be less than 50 % of the achieved short time breaking load.



Used test set-up, Pulling speed: 5 mm/min,
Clamping length: 250 mm

Durostone® UPR S19



Durostone® UPR S19

Durostone® UPR S19 is a threaded rod made of VE-resin and glass fibres using the Sheet-Molding-Compound-technology (SMC).

Features

- VE-resin for high dielectric requirements
- Partial discharge free up to high electric field strength*
- High tracking resistance CTI 600
- Sizes up to M52 and 5300 mm are possible

* Please contact us for further information

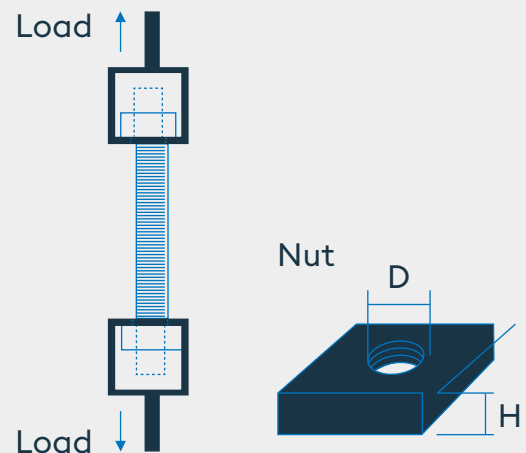


Breaking load ¹⁾

Threaded rod	Durostone® UPR S19	
Nut	Durostone® UPR S19	
Nominal diameter	Nut height H = D	Nut height H = 2 D
M8	5000 N	8000 N
M10	8000 N	15000 N
M12	12000 N	22000 N
M16	20000 N	40000 N



¹⁾ Average values. Corresponding safety factors should be considered in the design. A constant tensile load should be less than 50 % of the achieved short time breaking load.



Used test set-up, Pulling speed: 5 mm/min,
Clamping length: 250 mm

Durostone® EPM S7 Nuts



Durostone® EPM S7 Nuts

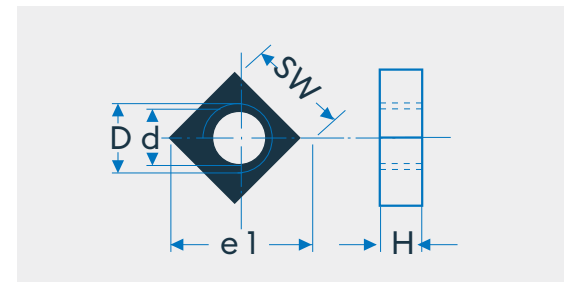
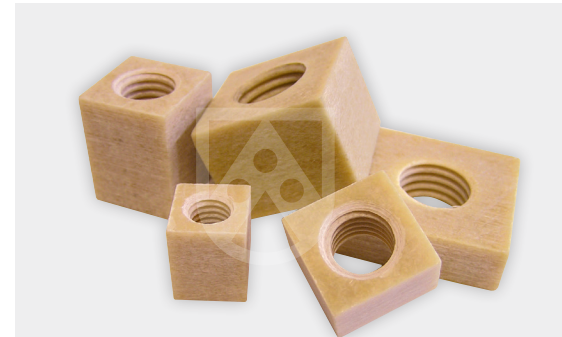
The height of the nut thread is crucial for the tensile strength of Durostone® fasteners. By using nuts with a nut height of $H = D$, the tensile strength of Durostone® threaded rods is not fully utilized. We recommend Durostone® nuts with a nut height $H = 2 D$ or greater.

- Standard size: M8 – M30
- Standard nut height: $H = D$ or $H = 2 D$

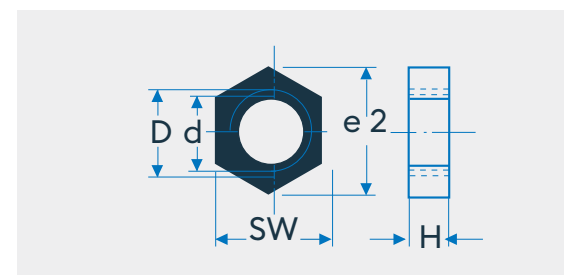
On request, we also manufacture Durostone® nuts in other grades and sizes. In addition to the listed metric sizes, we manufacture Durostone® nuts also in inch thread sizes.

Size	Core diameter d		SW	H = D/2 D	e1	e2
	mm	tol. in mm				
M8	6,6	+0,3/0	13	8/16	18,4	15,0
M10	8,4	+0,3/0	17	10/20	24,0	19,6
M12	10,1	+0,3/0	19	12/24	26,9	21,9
M16	13,8	+0,4/0	24	16/32	33,9	27,7
M20	17,3	+0,5/0	30	20/40	42,4	34,6
M24	20,8	+0,5/0	36	24/48	50,9	41,6
M27	23,8	+0,5/0	41	27/54	58,0	47,4
M30	26,2	+0,5/0	46	30/60	65,0	53,1

Durostone® square nut



Durostone® hexagonal nut

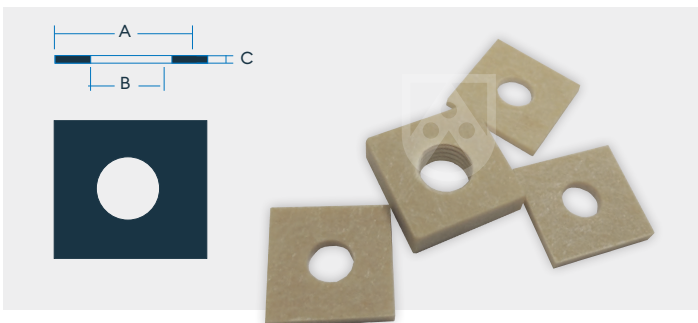


Threads in accordance with ISO 965, tolerance zone 6H, all sizes in mm.

Durostone® EPM S7 Square washer

Size	Edge length	Bore diameter	Thickness
	A	B	C
	mm	mm	mm
M6	25	7	4
M8	30	9	4
M10	30	11	4
M12	30	13	4
M16	40	17	5
M16	50	17	5
M20	50	21	5
M24	50	25	5
M27	50	28	5
M30	50	31	5

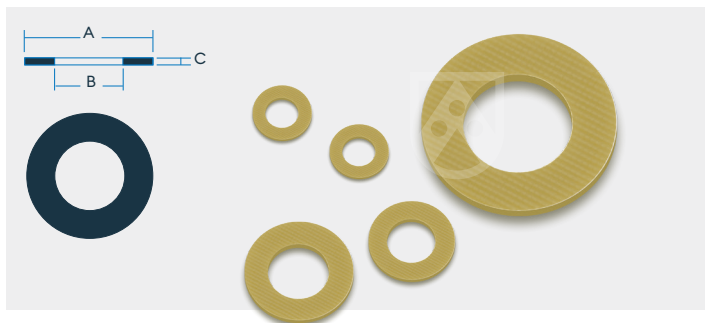
Other sizes and qualities on request.



Durostone® EPC 308 (M8 – M20) Durostone® EPM S7 (M24 – M30) Round washer

Size	Edge length	Bore diameter	Thickness
	A	B	C
	mm	mm	mm
M8	18	9	1,5 ± 0,3
M10	22	11	2 ± 0,3
M12	27	14	2,5 ± 0,4
M14	30	16	2,5 ± 0,4
M16	32	18	3 ± 0,5
M18	36	20	3 ± 0,5
M20	40	22	3 ± 0,5
M24	50	27	4 ± 0,6
M27	55	30	4 ± 0,6
M30	60	33	4. 0,6

Other sizes and qualities on request.



The data stated above are average values verified on the basis of regular statistical tests and controls. All information in this publication is based on current technical knowledge and experience. Due to the large number of possible influences during processing and application, it does not exempt the user/processor from carrying out their own tests and trials. Responsibility for the evaluation of the end product for the intended use and compliance with the applicable relevant legal requirements lies exclusively with the user/processor as well as the distributor of the respective product/end product. Suggested uses do not constitute an assurance of suitability for the recommended purpose.

The information in this publication and our declarations in connection with this publication do not constitute acceptance of a guaranteed or warranted characteristic. Guarantee declarations require our separate express written declaration in

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Our application recommendations do not exempt the user/processor from the obligation to examine and, if necessary, clarify the possibility of infringements of third-party rights. In all other respects, we refer to our General Terms and Conditions (GTC).

These are available at: www.roechling.com/gtc

Technical Data

Durostone® sheet material

		Test method	Unit	EPR S1	EPR S5	EPM S7	EPR S6	UPR S19
Standard color		-	-	red	natural	natural	natural	natural
Type of resin		-	-	epoxy	epoxy	epoxy	epoxy	polyester
Specific gravity	ca. approx.	ISO 1183 meth 1	g/cm ³	1,90	1,90	1,90	2,00	1,95
Flammability		UL 94	-	-	-	-	VO	-
Mechanical properties in main reinforcement sense								
Bending strength	⊥	ISO 178	MPa	500	500	300	650	350
Modulus of elasticity	⊥	ISO 178	GPa	20	20	15	30	20
Compressive strength	⊥	ISO 604	MPa	300	300	550	400	450
Impact strength (Charpy)		ISO 179	kJ/m ²	100	100	200	300	200
Tensile strength		ISO 527	MPa	400	400	250	500	400
Delamination load		DIN 53463	N	4000	4000	4000	4000	4000
Electrical properties								
Volume resistivity		IEC 60093	Ω X cm	10 ¹⁴	10 ¹⁴	10 ¹⁴	10 ¹⁴	10 ¹⁴
Surface resistivity		IEC 60093	Ω	10 ¹³	10 ¹³	10 ¹³	10 ¹⁴	10 ¹⁰
Electric strength at 90 °C	⊥	IEC 60243-1	kV/mm	13	13	10	15	15
Relative permittivity at 48–62 Hz	ca. approx.	IEC 60250	εr	5	5	5	5	5
Comparative tracking index		IEC 60112	CTI	225	225	225	600	600
Thermal properties								
Coefficient of linear expansion		-	10 ⁻⁶ K ⁻¹	10–20	10–20	10–20	10–20	10–20
Thermal conductivity		ISO 8302	W/m K	0,3	0,3	0,3	0,3	0,3
Thermal endurance ¹⁾		IEC 60216	T.I.	180	180	180	180	155
Insulating class		IEC 60085	-	H	H	H	H	F

¹⁾ The temperature limit and insulating class have been specified in accordance with IEC 60216 on the basis of the change in bending strength (50 %) after 20000 h. ⊥ = perpendicular to the lamination
|| = parallel to the lamination

The data mentioned in this brochure are average values ascertained by current statistical returns and tests. The above data is provided purely for information and shall not be regarded as binding unless expressly agreed in a contract of sale.

Durostone® Perma-Bolt®

	Test method	Unit	Guideline value
General properties			
Stud weight		lbs/ft	0.129
Standard color			Gray
Mechanical properties			
Flexural strength	ASTM D 790	psi	55000
Flexural modulus	ASTM D 790		60000
Compressive strength	ASTM D 695	psi	3300
Ultimate transverse shear - double shear	ASTM B 565		7400
Ultimate torque strength			15
Physical properties			
Water absorption	ASTM D 570	% by wt.	1
Thermal properties			
Coefficient of thermal expansion	ASTM D 696	(in./in. °C) x 10 ⁻⁵	3
Max operating temperature		°C	100
Flammability	ASTM D 365		Self extinguishing
Dielectrical properties			
Electrical strength (oil/air)	ASTM D 149	kV/mm	40

* All tested values valid only using Roechling Perma-Bolt® square nut.

All information provided is reference only and believed to be accurate. Design responsibility is the sole responsibility of the end user. No warranty or guarantee is implied or expressed.

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