

 **Sajas GROUP**

Industrial & special brushes

Designing brushes

Efficient Problem Solving

Highly developed brush manufacturing techniques, diverse material options, our skilled staff and our extensive network of partners all make it possible for an increasing number of technical problems in industrial processes and products to be solved with a brush. A brush is often an even simpler, more affordable and technically better solution to a problem that has already been solved. Nowadays there are very few industries where a technical brush made by us is not already in use for some task.

New Innovations

In addition to industrial problem solving, the technical brush has countless other uses. Brushes are used in fish cultivation, land treatment, agriculture, peat lifting, water treatment and oil destruction, for example. New innovations are constantly being created.

At Your Service

If none of the thousands of brush options we offer provides our customer with a ready solution, we will work with the customer to design one. Our service concept is about project management, with one part of it being the manufacturing of brushes. It includes visiting the factory, planning, the production programme as well as taking care of customers' ongoing needs. We also refurbish old brush bodies. We offer customers our know-how together with affordable, high quality products – with 65 years' experience.

This brochure provides the technical information needed for designing brushes.

The Purpose and Function of the Brush

Factors Affecting the Design and Function of the Brush

The body and bristle materials of a brush, as well as measurements and their tolerances, are chosen based on the purpose of the brush and the conditions in which it will be used. Before starting on the design of the brush, the following things should be clarified:



Function of the Brush

The purpose of a technical brush can be, for example:

- | | | |
|------------|-----------------|-------------|
| Dosing | Sorting | Levelling |
| Separating | Spreading | Sealing |
| Brushing | Grounding | Supporting |
| Grinding | Guiding | Dampening |
| Braking | Pressing | Finishing |
| Flouring | Washing | Lubricating |
| Supporting | Deburring | Oiling |
| Roughening | Deflashing | |
| Shedding | Removing dust | |
| Irrigating | Removing static | |
| Polishing | electricity | |
| Fastening | Squeezing | |
| Tightening | Fluffing up | |
| Moistening | Limiting | |
| Drying | Moving | |
| Conveying | Sprinkling | |
| Peeling | Protecting | |

The Movement of the Brush

The brush can remain stationary or its movement can be, for example:

- Spinning
- Back and forth
- Floating

When considering movement, you must also pay attention to the speed or the force of the brush's movement, for example.

Brushing Conditions

Things that should be noted when choosing the materials for a brush include:

- Temperature (°C / °F / °K)
- Humidity (%)
- Possible chemicals
- The suitability of the materials for the surrounding process

The Surface Type of the Object of Brushing

When selecting the correct bristle materials, the nature of the surface on which the brush will be used must often also be determined.

Put simply, the nature of a surface can be, among other things:

- Even – uneven
- Rough – smooth
- Dry – wet
- Clean – very dirty
- Extremely cold – extremely hot
- Frictional – slippery
- Easily scratched
- Statically charged

Brush Placement

The placement of the brush should be:

- Suitable for the process in question
- Suitable for the brush's operation
- Practical from the point of view of maintenance and replaceability





Designing the Brush

If a customer has a ready solution for a brush, we will manufacture it according to the given specifications, drawings or the mock-up provided. In other cases we will design the brush together with the customer. When required, the design process can include visits to the customer as well as cooperation with design agencies. The precondition for finding a successful brush solution is seamless cooperation with the customer and, when necessary, with our foreign partners as well.

Brush Type

There are as many different types of brushes as there are ways to use them. That is why we aspire to group the different brush types according to the method of manufacturing or physical appearance.

Types of brushes include:

- Ring brush
- Brush strip
- Roller brush
- Brush roller
- Sheet brush
- Tassel brush
- Plate brush
- Spiral brush
- Tube brush
- Ball brush
- Belt brush

Sometimes, however, grouping is impossible or unnecessary. In this case a brush is called a special brush.

In addition to the brush types mentioned above, we have tool brushes for pneumatic and electric tools.

Measurements and Tolerances

Depending on the type of brush, you must know, for example, the following measurements:

- Axle length
- Brush body length
- Bristle length
- Total diameter
- Body diameter
- Axle diameter

You must also pay attention to tolerances; for example, wear or thermal expansion must not hamper the brush's action or replacement of the brush.

Body Materials

There are also many choices of materials for the brush's body. The most commonly used materials include:

- Wood
- Plywood
- Leather
- Steel
- Aluminium
- Technical plastics

When choosing the materials for the body, in addition to the conditions in which the brush will be used, it is also good to take into account the possible need to replace the bristles.

Bristle Materials

The choice of bristle materials is determined by both the task for which the brush is intended and the conditions in which it will be used. Our worldwide raw material supplier network gives us access to a comprehensive selection of high quality materials. The most common materials include:

ANIMAL HAIRS

CHG	Chinese pig bristle medium hard – hard
KAC	Indian pig bristle extremely hard
ROS	Horse hair soft – medium hard
MAH	Horse bristle soft

PLANT FIBRES

FIB	Mexico fibre medium hard
UNI	Union fibre mix medium hard – hard
SIS	Sisal fibre medium hard – hard

PLASTIC FIBRES

PA	Polyamide straight/corrugated Ø 0,08 - 3,00 mm (nylon 6) Ø 0,08 - 1,50 mm (nylon 6.6) Ø 0,08 - 3,00 mm (nylon 6.12)
PE	Polyethylene straight, x-profile Ø 0,80 - 1,00 mm
PET	Polyester straight or corrugated Ø 0,20 - 3,00 mm
PP	Polypropylene straight/corrugated Ø 1,50 - 4,00 mm (co-pol.) Ø 0,08 - 4,00 mm (homo-pol.)
PVC	Polyvinyl chloride straight/corrugated Ø 0,15 - 1,50 mm

Heat resistant or electricity conducting bristle materials are also available.

SPECIAL FIBRES

CAR	Carbon fibre straight Ø 0,007 mm
ANA	Aluminium oxide fibre corrugated Ø 0,45 - 1,00 mm grain size 60-800
ANS	Silicone carbide fibre corrugated Ø 0,35 - 1,27 mm grain size 46-800

METAL THREADS

STD	Steel thread unhardened, corrugated Ø 0,06 - 0,80 mm 2000 N/mm ²
ASD	Steel thread hardened, corrugated extremely hard and tough Ø 0,2 - 0,5 mm 2600 N/mm ²
LIT	Steel thread brassed, corrugated, wound spring-like hardness Ø 0,15 - 0,38 mm 2600 N/mm ²
LTE	Steel thread brassed, corrugated spring-like hardness Ø 0,15 - 0,38 mm 2600 N/mm ²
SUP	Steel thread oil-hardened, straight Ø 0,30 - 1,20 mm 2100 N/mm ²
AZD	Steel thread oil-hardened, straight hard and tough Ø 0,35 - 0,80 mm 2600 N/mm ²
ROF	Steel thread stainless, acid resistant straight or corrugated Ø 0,06 - 0,50 mm 2000 N/mm ²

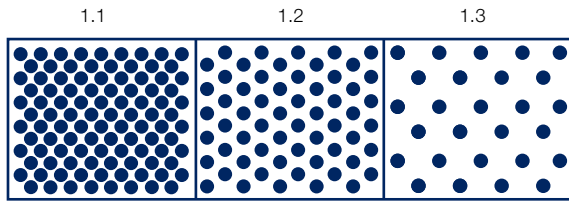
VZN	Steel thread zinc-coated, straight or corrugated Ø 0,45 mm 2000 N/mm ²
BES	Bessemer-Steel thread corrugated Ø 0,06 - 0,25 mm 900 N/mm ²
FLD	Flat bar steel straight spring-like hardness 0,25 x 1,10 - 0,75 x 3,30 mm 2000 N/mm ²
MES	Brass thread straight or corrugated Ø 0,04 - 0,30 mm 900 N/mm ²
PHB	Phosphor bronze thread straight or corrugated Ø 0,05 - 0,50 mm
NSI	Nickel silver thread corrugated Ø 0,06 - 0,25 mm



Please ask about other bristle materials. When required, the bristles can be made from mixes of different bristle materials.

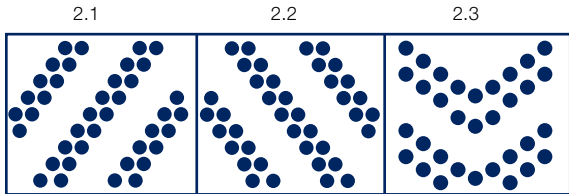
Bristle Patterns

Bristle patterns are chosen according to the intended use. The proper choice can affect both the life and action of the brush.



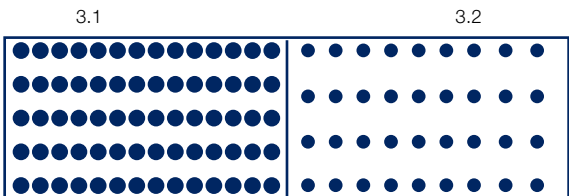
FULL BRISTLES

- 1.1 dense bristles
- 1.2 normal bristles
- 1.3 sparse bristles



SPIRAL BRISTLES

- 2.1 bristles that guide to the left
- 2.2 bristles that guide to the right
- 2.3 bristles that guide in both directions from the centre



STRIPED BRISTLES

- 3.1 dense bristles, striped towards the axle
- 3.2 sparse bristles, striped towards the axle

Other bristle patterns are also possible.

Rotation and Peripheral Speeds

The rotation speed of spinning brushes will be set according to the intended use. If a brush's task requires a high rotation speed, special attention must be paid to the structure of the brush's body, the dimensions of the brush, the choice of bristle material and the need for balancing the brush.

Balancing

Spinning brushes can be delivered balanced for a specific rotation speed.

rotation speed
x1000/min

brush Ø mm

	20	40	50	80	100	125	150	180	200	250	300	350
0.8				3,35	4,19	5,23	6,28	7,53	8,37	10,47	12,56	14,75
0.9			2,35	3,77	4,71	5,88	7,06	8,48	9,41	11,77	14,12	16,47
1.15			3,01	4,81	6,01	7,52	9,02	10,83	12,03	15,04	18,04	21,04
1.2	1,26	2,51	3,14	5,02	6,28	7,85	9,41	11,30	12,55	15,69	18,83	21,97
1.4	1,46	2,93	3,66	5,86	7,32	9,15	10,98	13,18	14,64	18,31	21,97	25,63
1.5	1,57	3,14	3,92	6,28	7,85	9,81	11,77	14,13	15,69	19,61	23,54	27,46
1.8	1,88	3,77	4,71	7,54	9,41	11,77	14,12	16,95	18,83	23,54	28,24	32,95
2.0	2,09	4,19	5,23	8,37	10,26	13,08	15,69	18,84	20,92	26,15	31,38	36,61
2.5	2,62	5,23	6,54	10,47	13,08	16,35	19,61	23,55	26,15	32,67	39,23	45,76
2.8	2,93	5,86	7,32	11,72	14,64	18,31	21,97	26,37	29,29	36,61	43,93	51,25
3.0	3,14	6,28	7,85	12,56	15,69	19,62	23,54	28,26	31,38	39,23	47,07	54,92
3.2	3,35	6,70	8,37	13,40	16,74	20,92	25,10	30,14	33,47	41,84	50,21	58,58
3.5	3,68	7,33	9,15	14,65	18,31	22,89	27,46	32,97	36,61	45,76	54,92	64,07
4.0	4,19	8,37	10,46	16,75	20,92	26,16	31,38	37,68	41,84	52,33	62,76	73,22
4.5	4,70	9,42	11,77	18,84	23,54	29,43	35,30	42,40	47,07	58,84	70,61	82,43
5.0	5,23	10,47	13,08	20,93	26,15	32,70	39,23	47,10	52,33	65,38	78,50	
5.4	5,65	11,30	14,12	22,94	28,24	35,31	42,36	50,67	56,48	70,61	84,78	
6.0	6,28	12,56	15,69	25,12	31,38	39,24	47,07	56,52	62,76	78,50		
7.0	7,33	14,66	18,31	29,31	36,61	45,78	54,92	65,94	73,22	91,58		
8.0	8,37	16,75	20,92	33,94	41,48	52,32	62,76	75,36	83,73			
9.0	9,42	18,84	23,54	37,68	47,07	58,86	70,61	84,78	94,20			
10.0	10,47	20,93	26,17	41,86	52,33	65,40	78,50	94,20				
12.5	13,08	26,17	32,71	52,33	65,42	81,75	98,13					
15.0	15,70	31,40	39,25	62,80								
17.5	18,32	36,63	45,79	73,26								
20.0	20,93	41,87	52,33	83,73								
22.5	23,55	47,10	58,88	94,20								
25.0	26,17	52,33	65,42	104,66								

peripheral speed (m/s)

Trimming the Brush

The bristles can be trimmed, for example:

- Evenly
- Notched
- In a wavy pattern
- Eccentrically

Brushing Pressure

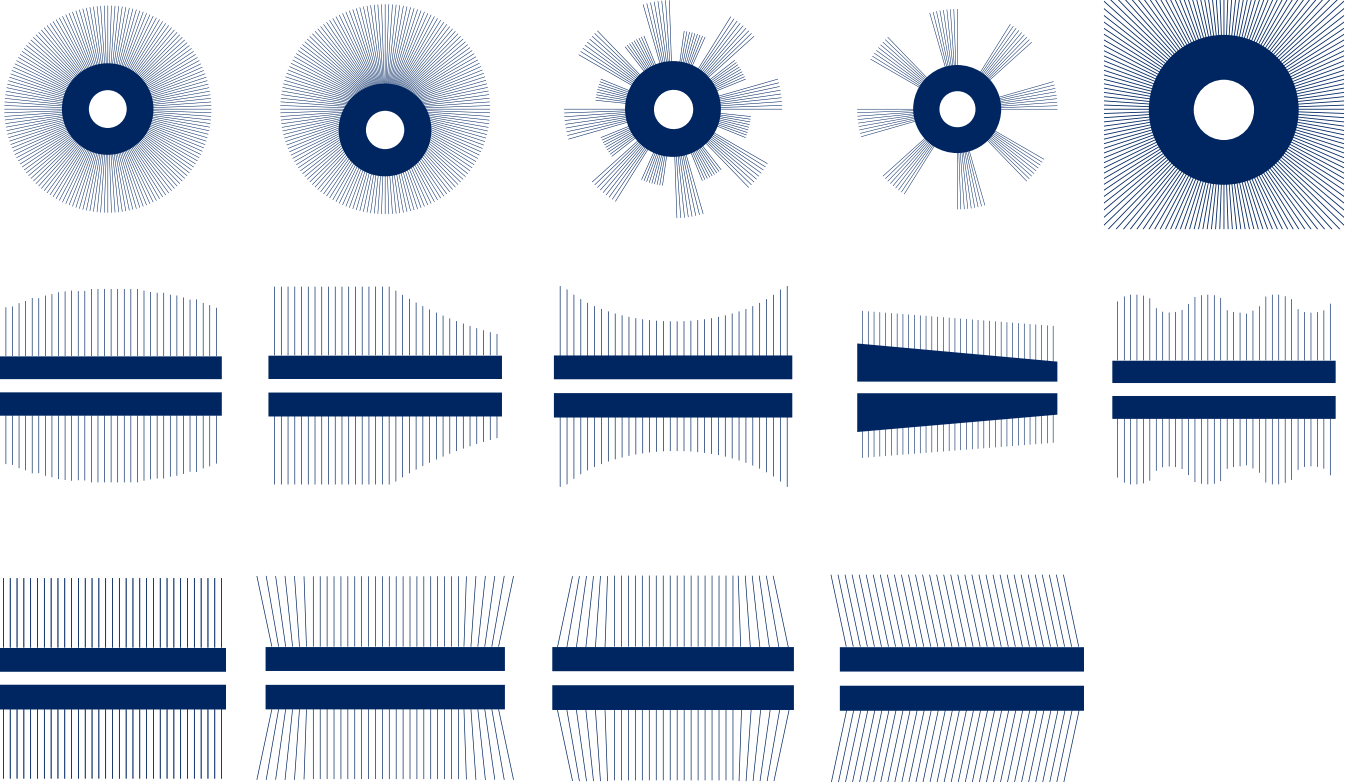
Two things affect brushing pressure: the force with which the brush is being pressed against the surface that is being brushed and the rigidity of the brush.

Options for brushing pressure include:

- Heavy
- Medium
- Light

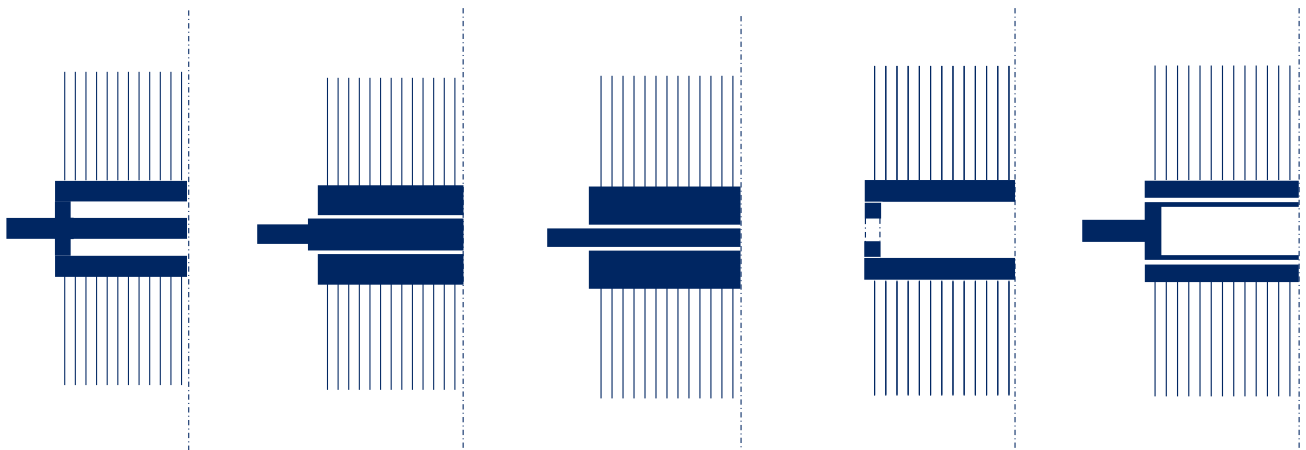
The rigidity of the brush is affected by:

- The quality of the bristle material
- The strength of the bristle material
- The length of the bristle material
- The density of the bristles
- The trimming of the brush



Choices of Axle

Brushes are available with numerous different choices of axle. The body of a brush can function as an axle itself, a brush can be built on an axle or the brushes can be installed on an axle at the place of use.



	PVC	PE	PP	NYL PA 6	NYL PA 6.6	NYL PA 6.10	NYL PA 6.12	ANA ANS	STD ASD LIT	ROF 4301	ROF 4401	MES	PHB	ALU
Specific weight	1,40	0,95	0,91	1,14	1,14	1,08	1,08	1,25	7,85	7,90	7,90	8,50	8,80	2,70
Water absorbtion %	0	0	0	10	8	4	3	4	0	0	0	0	0	0
Resistance to abrasion 0 = low 20 = high	4	2	6	8	9	10	10	14	18 20 20	17	17	14	14	12
Resistance to heat °C (wet conditions)	50	65	90	90	100	100	100	100	-	400-450	400-450	160-180	160-180	160
Resistance to heat °C (Dry conditions incl. frictional heat)	60	70	110	110	140	120	120	120	300	400-450	400-450	160-180	160-180	160
Impervious to cold °C	-5	-50	0	-40	-40	-40	-40	-40	-	-	-	-	-	-
Resistance to chemicals 0 = resistant 1 = practically resistant 2 = limited resistance 3 = not resistant														
Ethyl Acetate CH ₃ CO ₂ H 10%/20 °C	0	0	0	0	0	0	0	0	3	0	0	3	0	1
80%/20 °C	3	0	0	3	3	3	3	3	3	0	0	3	1	0
Nitric Acid HNO ₃ 0,2%/20 °C	1	0	0	3	3	3	3	3	3	0	0	3	3	1
90%/20 °C	3	2	2	3	3	3	3	3	3	3	0	3	3	1
Hydrochloric Acid HSO ₄ 1%/20 °C	1	0	0	3	3	3	3	3	3	1	0	1	1	1
2%/20 °C	1	0	0	3	3	3	3	3	3	3	3	1	1	1
Sulphuric Acid H ₂ SO ₄ 1%/20 °C	0	0	0	3	3	3	3	3	3	1	0	3	1	1
80%/20 °C	3	0	0	3	3	3	3	3	3	1	1	3	1	1
Caustic Potash KOH 20%/20 °C	1	0	0	0	0	0	0	0	3	0	0	0	0	3
50%/20 °C	1	0	0	0	0	0	0	0	3	0	0	0	0	3
Caustic Soda 20%/20 °C	1	0	0	0	0	0	0	0	3	0	0	0	0	3
Benzene	3	2	2	0	0	0	0	0	0	0	0	0	0	0
Petrol	2	2	2	0	0	0	0	0	0	0	0	0	0	0
Trichlorethylene	3	3	2	1	1	1	1	1	0	0	0	1	1	1

The physical and chemical properties of our most important raw materials are listed in the accompanying table.



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