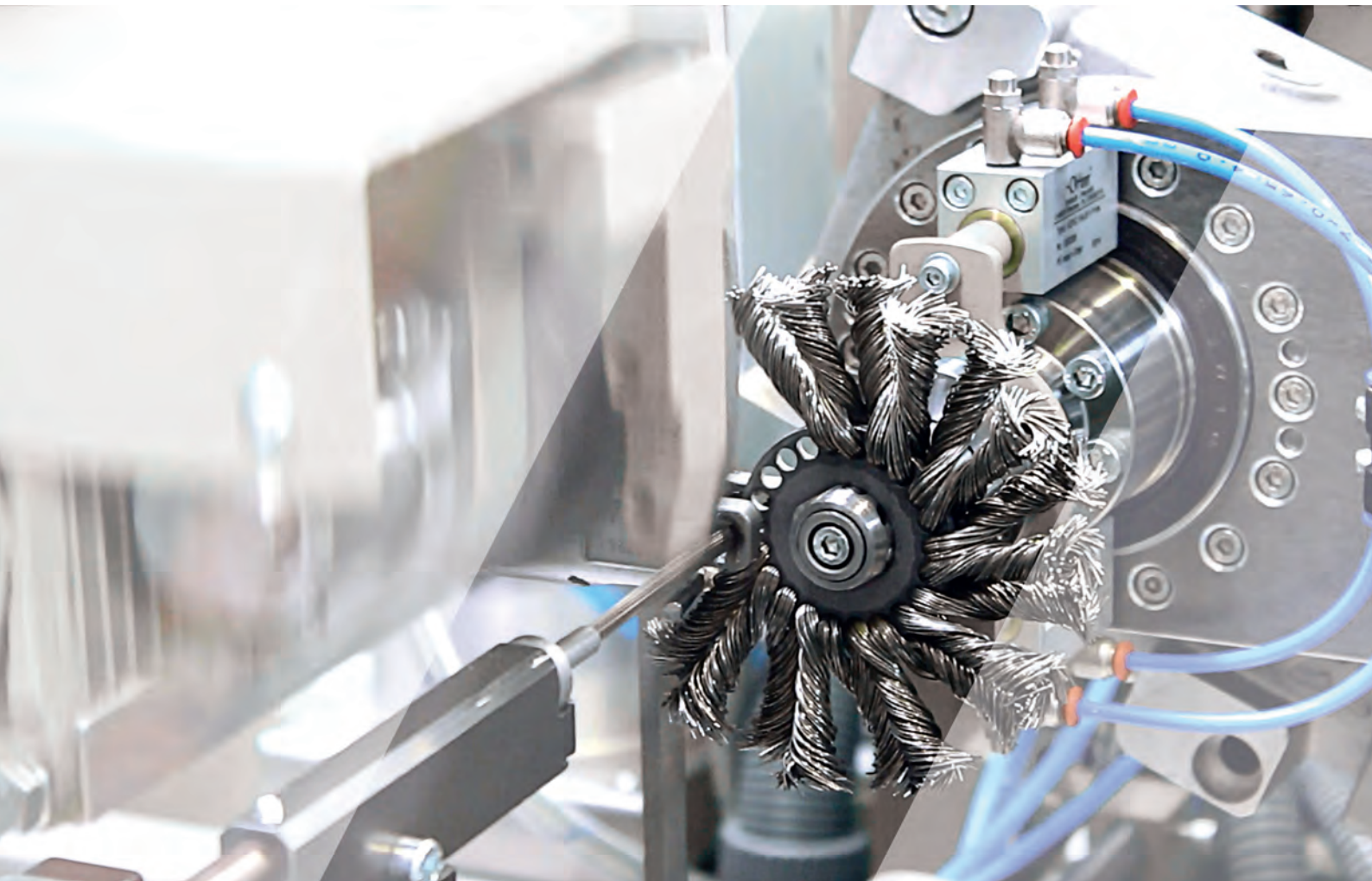


**WÖHLER**



the World of **PowerBrush** Machines





Creative concepts and guaranteed highest quality with optimum service – that is what **Wöhler** stands for since over **80 years** in the brush industry.

We approach our challenges differently giving us access to unique solutions, which remain unobtainable to others. Countless customers worldwide are inspired by our fascination, inventiveness and quality **Made in Germany**.

**Always a step ahead**

Our smart expertise and flexible, modular engineering allow us to provide our customers with compact, custom solutions for boosting their production performance and efficiency, always under careful consideration of their specific individual requirements.

These are generally specialty machines and complete production systems for all kinds of industrial and technical brushes.

In our research, development and design departments our inventiveness, expertise and the longstanding experience of our skilled team go to form a unique innovation pool that can be readily accessed.

Here in our test workshops for trials and new product development we live our philosophy of thinking differently each and every day.

We have made customised solutions a standard, as

every client has his own specific demands to be met. We serve these demands with market orientated specialty machines and system solutions.

On over 10,000 square meters of our modern facility we are outfitted with the last state-of-the-art machines – from metal cutting, chipping, grinding and turning machines to milling centres – the very best available on the market today.

Worldwide patents testify that a large number of innovations and significant breakthroughs made in the special machinery sector are the result of our work.



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Individual small series production – fast and easy

Highlights

- + highest flexibility
- + low investment costs
- + up to 10 knots/min
- + programmable twist knot styles
- + up to 200 brush programs



Production of twist knot brush segments



Samples of wheel, cup and end brushes produced from ZL 300 twist knot brush segments

The semi-automatic **ZL 300** is designed for the production of twist knot brush segments.

The pre-punched disc is fed manually. The operator turns the disc to the required position, feeds the wire through the twisting head and disc and activates twisting by pressing the start button. The two-hand-operation ensures maximum safety.

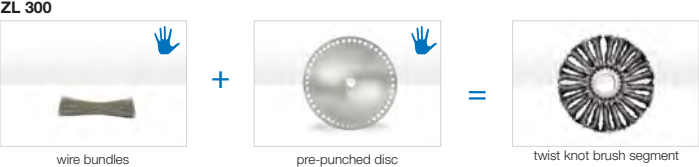
The **ZL 300** allows twisting at different linear speeds and numbers of revolutions over the entire length. This achieves good qualities rose end knots or cable twists.

The control system can store up to 200 programs for different kinds of brush types.

A wire picker is optionally available.

The produced twist knot brush segments form the basis for twist knot disc brushes, cup brushes or end brushes.

Material feed / Degree of automation



Optional components

- Fill material production**
- Roller cutter **GR 90**
  - Wire cutting machine **SWC 950**
- Wire picker

- Mounting & Assembling**
- Wheel brush assembly tool **WMON**
  - Cup brush assembly tool **TMON**
  - End brush assembly tool **EMON**

Technical data <sup>1</sup>

Production speed:	6 - 10 knots/min
Fill material:	wire
Fill material length:	2,75" - 11.0" (70 - 280 mm)
Fill material diameter:	0.014" - 0.04" (0.35 - 1.0 mm)
Disc diameter:	1.0" - 17.7" (25 - 450 mm)
Disc thickness:	0.06" - 0.12" (1.5 - 3.0 mm)
Hole diameter:	round: 0.15" - 0.28" (3.5 - 7.0 mm) oval: 0.1" x 0.2" - 0.1" x 0.2" (2.5 x 5.0 mm - 4.0 x 6.0 mm)
Brush segment diameter (untrimmed):	3.5" - 23.6" (90 - 600 mm)
Air pressure   air consumption (ISO 8573-1):	min. 6 bar   2 m³/h
Power supply   Power input:	400 Volt / 50 Hz   3 kW
Dimensions (W x L x H):	3.3 x 3.9 x 4.6 ft (1.0 x 1.2 x 1.4 m)

<sup>1</sup> Guideline values – these may vary considerably depending on material specifications

ZVA 320

Features

- punching integrated
- disk changing under 1 second
- enhanced output up to 130%
- up to 30 knots/min
- outer brush diameter up to 12.6" (320 mm)
- integrated spining-station for perfect alignment and fewer steps before mounting
- knot shape freely programmable in three sections

Unique twist knot forms – extraordinary speed

The fully automatic, CNC-controlled twist knot brush machine **ZVA 320** with hank feeding and powerful punching tool produces unique twist knot brush forms. This flexibility combined with the high power and the use of inexpensive naturally hard drawn wire make the **ZVA 320** into a highly efficient twist knot brush machine.

Hank feeding and integrated hole punching enable a fully automated series production. The wire is fed through one to four finished coiled hanks or single coils.

The blank disks are automatically transferred from the magazine to the 2-station turntable.

Production of twist knot power brushes

Punching and twisting at the same time

After twisting the segments are automatically passed to the spining station or transported from the machine.



The mechanical adjustment parameters are recorded and displayed on the touch screen of the compact operator terminal. The production parameters can be entered manually or retrieved from the internal memory as a program. The **ZVA 320** has a USB port for backup, management and transfer of program data.

Touch screen and user-friendly interface help the operator to concentrate on the essentials. Maintenance and service can be quickly and easily done with the integrated remote maintenance module.



Optional components

- Wire coil holder **SDA 2** or **SDA 4**
- Wire coil holder **DAZ 80**

Technical Data <sup>1</sup>

Production speed:	simultaneous punching and twisting: up to 30 knots/min
Wire length:	3.15" - 12.6" (80 - 320 mm)
Wire diameter:	0.01" - 0.03" (0,25 - 0,80 mm)
Disk diameter:	1.97" - 5.91" (50 - 150 mm)
Disk thickness:	0.06" - 0.12" (1.5 - 3.0 mm)
Ø Hole round:	0.12" - 0.28" (3.0 - 7.0 mm)
Ø Hole oval:	0.08" x 0.20" (2.0 x 5.0 mm) - 0.16" x 0.28" (4.0 x 7.0 mm)
Ø Center bore round or hexagonal:	0.63" - 1.0" (16 - 26 mm)
Brush outer diameter (untrimmed):	3.54" - 12.6" (90 - 320 mm)

Wire quality:	oil tempered, hard drawn, brass coated, stainless
Set-up time:	15 - 45 minutes
Weight:	3968 lbs (1800 kg)
Dimensions (W x L x H):	11.8 x 6.2 x 7.2 ft (3.6 x 1.9 x 2.2 m)
Compressed air   Air consumption (ISO 8573-1):	min. 6 bar   11 m³/h
Power supply   Power input:	400 Volt / 50 Hz   18 kW

<sup>1</sup> Guideline values – these may vary considerably depending on material specifications



ZVA 322

Features

- up to 200% output
- up to 60 knots/min
- brush diameter up to 12.6" (320 mm)
- automatic disk feeding

High output twist knot machine

The twist knot brush machine **ZVA 322** produces unique twist knot brush forms.

The wire is fed through one to eight finished coiled hanks or single coils.

The punched disks are automatically transferred from the magazine the twisting station.

The mechanical adjustment parameters are recorded and displayed on the touch screen of the compact operator terminal. The production parameters can be entered manually or retrieved from the internal memory as a program. The **ZVA 322** has a USB port for backup, management and transfer of program data.

Production of twist knot brushes



The twisting unit is able to generate many different shapes of knots. Such as Stringer Bead Twist, Cable Twist, Rose Bud Twist and Stringer Bead with Tight Rose Bud. Even individual knot forms are possible. Moreover it convinces with minimal wire loss.

Touch screen and user-friendly interface help the operator to concentrate on the essentials. Maintenance and service can be quickly and easily done with the integrated remote maintenance module.



Optional components

- Wire coil holder **SDA 2** or **SDA 4**
- Wire coil holder **DAZ 80**

Technical data <sup>1</sup>

Production speed:	twisting: up to 60 knots/min punching (optional): up to 440 holes/min
Wire length:	3.15" - 11.8" (80 - 300 mm)
Wire diameter:	0.01" - 0.04" (0.25 - 1.00 mm)
Disk diameter:	1.0" - 17.7" (25 - 450 mm)
Disk thickness:	0.06" - 0.12" (1.5 - 3.0 mm)
Ø Center bore:	individual
Outer brush diameter (untrimmed):	3.5" - 23.6" (90 - 600 mm)

<sup>1</sup> Guideline values – these may vary considerably depending on material specifications

Wire quality:	oil tempered, hard drawn, brass coated, stainless
Set-up time:	15 - 45 minutes
Dimensions (W x L x H):	13.5 x 5.5 x 7.2 ft (4.1 x 1.7 x 2.2 m)
Compressed air   Air consumption (ISO 8573-1):	min. 6 bar   16 m³/h
Power supply   Power input:	400 Volt / 50 Hz   22 kW

ZVA 600

Features

- high production capacity
- ideal for operating in production cells
- brush size from 6-hole disks up to OD 600 mm
- automatic disk feeding
- integrated hole punching (optional)

Flexible in large and small series

Highly flexible, fully automatic twist knot machine for everything from small production lots up to large series. Knot filling and punching is done on one station, to ensure exact positioning of the twist knot holes. The machine covers the full range of brush sizes from large to small. Disks up to 150 mm in diameter can be automatically fed from magazine, larger disks can be fed by hand. Disks up to 450 mm diameter can be processed.

By default the use of pre-punched disks is required. With the additional option of hole punching on the machine, the knotting and punching takes place at one station. This ensures an exact positioning of the holes.

The mechanical adjustment parameters are recorded and displayed on the touch screen of the compact operator terminal. The production parameters can be entered manually or retrieved from the internal memory as a program. The **ZVA 600** has a USB port for backup, management and transfer of program data.

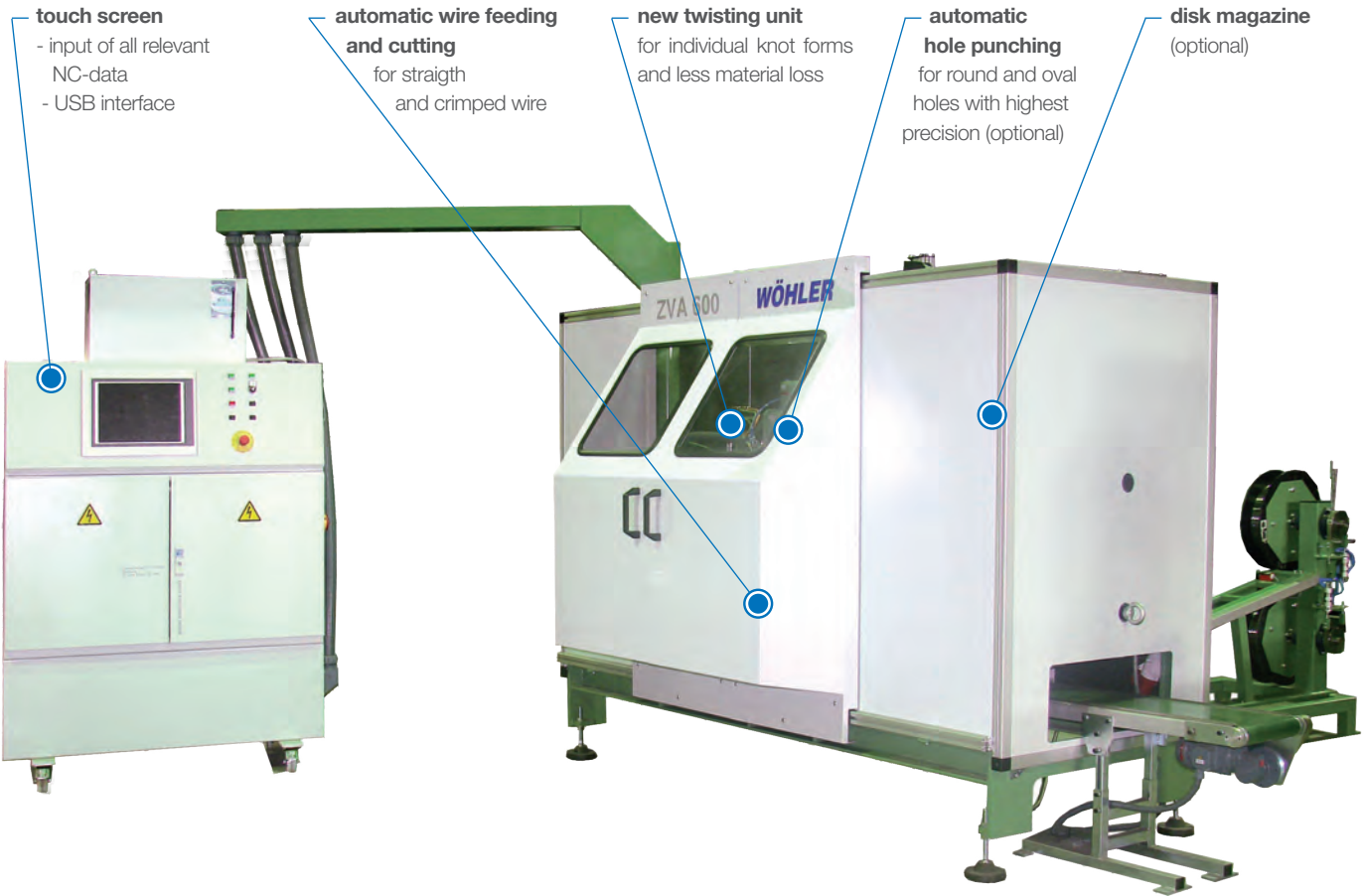
Production of twist knot power brushes



The twisting unit is able to generate many different shapes of knots. Such as Stringer Bead Twist, Cable Twist, Rose Bud Twist and Stringer Bead with Tight Rose Bud. Even individual knot forms are possible. Moreover it convinces with minimal wire loss.

The material is fed through the automatic wire feeding. Also a multi-spool feeding is possible.

Once the brush has been completed, it is automatically ejected.



Optional Components

- Wire coil holder **SDA 2** or **SDA 4**
- Wire coil holder **DAZ 80**
- Hole punching unit
- Disk magazine

Technical Data <sup>1</sup>

Production speed:	twisting: up to 30 knots/min punching (optional): up to 220 holes/min
Wire length:	3.15" - 11.8" (80 - 300 mm)
Wire diameter:	0.01" - 0.04" (0.2 - 1.0 mm)
Disk diameter:	1.0" - 17.7" (25 - 450 mm)
Disk thickness:	0.06" - 0.12" (1.5 - 3.0 mm)
Ø Center bore:	individual
Brush outer diameter (untrimmed):	3.5" - 23.6" (90 - 600 mm)

<sup>1</sup> Guideline values – these may vary considerably depending on material specifications

Wire quality:	oil tempered, hard drawn, brass coated, stainless
Set-up time:	15 - 45 minutes
Dimensions (W x L x H):	7.9 x 6.6 x 6.2 ft (2.4 x 2.0 x 1.9 m) Cabinet: 3.3 x 2.0 x 6.2 ft (1.0 x 0.6 x 1.9 m)
Compressed air   Air consumption (ISO 8573-1):	min. 6 bar   9 m³/h
Power supply   Power input:	400 Volt / 50 Hz   15 kW



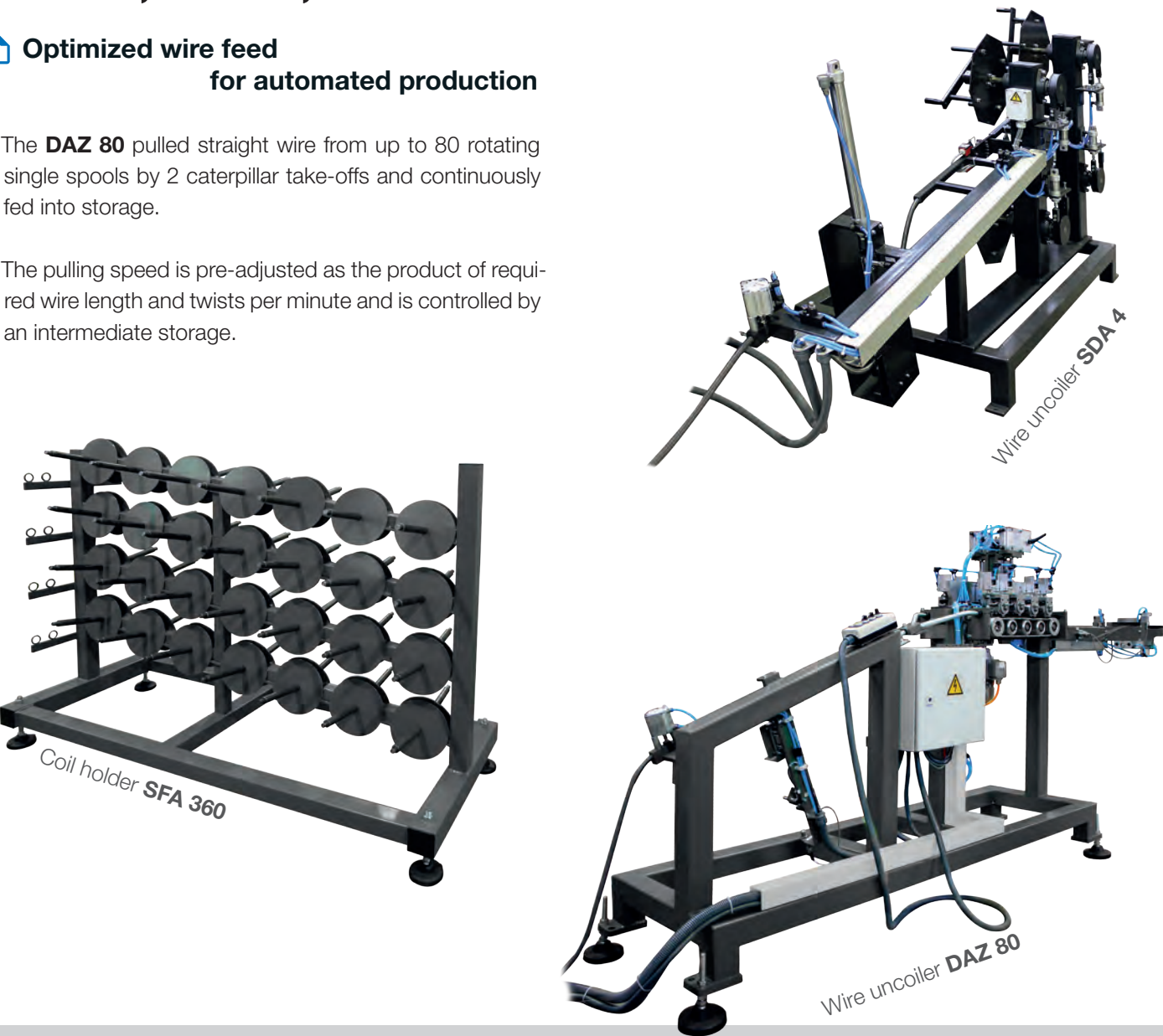
Uncoiler

SDA 2, SDA 4, DAZ 80 + SFA 360

Optimized wire feed  
for automated production

The **DAZ 80** pulled straight wire from up to 80 rotating single spools by 2 caterpillar take-offs and continuously fed into storage.

The pulling speed is pre-adjusted as the product of required wire length and twists per minute and is controlled by an intermediate storage.



Technical data <sup>1</sup>

	SDA 2	SDA 4	DAZ 80
Production speed:	up to 2 spools	up to 4 spools	up to 80 spools
Withdrawal speed:			up to 39.4 f/min (12 m/min)
Dimensions (W x L x H):	5.9 x 2.6 x 4.6 ft (1.8 x 0.8 x 1.4 m)	5.9 x 2.6 x 4.6 ft (1.8 x 0.8 x 1.4 m)	7.2 x 2.6 x 5.2 ft (2.2 x 0.8 x 1.6 m)
Compressed air   Air consumption (ISO 8573-1):	min. 6 bar   - m³/h	min. 6 bar   - m³/h	min. 6 bar   - m³/h
Power supply   Power input:	400 Volt / 50 Hz   - kW	400 Volt / 50 Hz   - kW	400 Volt / 50 Hz   1.5 kW

<sup>1</sup> Guideline values – these may vary considerably depending on material specifications

Hank spooling device

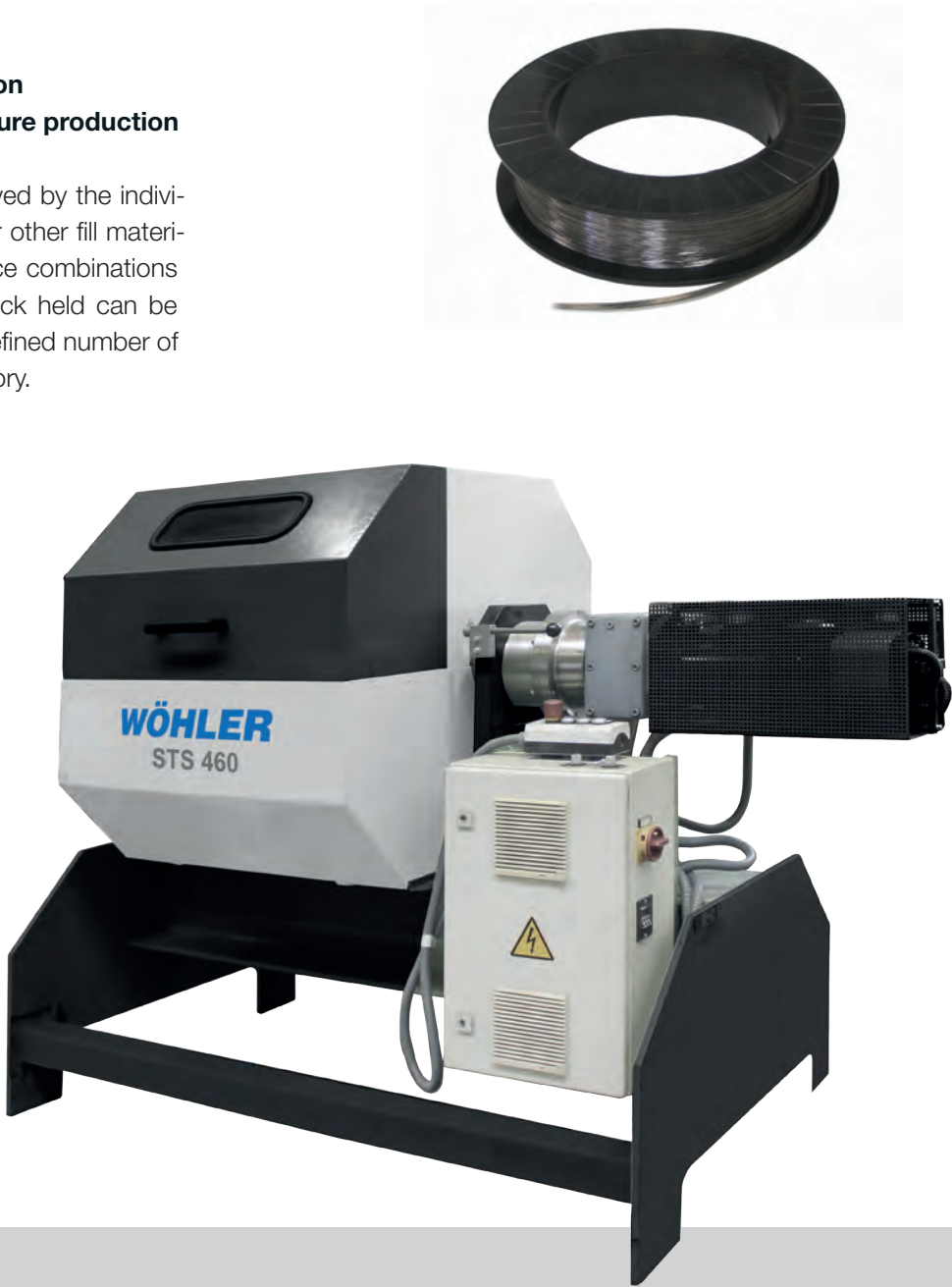
STS 460

Individual and flexible coil excitation  
for a brush to-measure production

The highest degree of flexibility is achieved by the individual spooling together of single wires or other fill materials to a hank for brush production. Since combinations of spooled hanks can also be fed, stock held can be limited to a minimum of spools with a defined number of ends, thus allowing an optimised inventory.

Possible materials:

- Twist knot brush wire  
– oil tempered, hard drawn
- Cotton for twisted brushes and dental brushes
- Nylon filaments
- Crimped wire



STS 460	
Wire diameter:	0.006" - 0.03" (0.15 - 0.80 mm)
Max. numbers of wire fed:	40
Wire spool type:	SH 460 K
Winding cores:	460 / 305 x 105 Typ K 305 x 200 Typ Cardboard
Dimensions (W x L x H):	6.6 x 3.3 x 5.9 ft (2.0 x 1.0 x 1.8 m)
Power supply   Power input:	400 Volt / 50 Hz   3.0 kW



Full-automatic brush segment machine

# BSM 320 + STM 320



Fully automatic brush segment production with quality control

Highlights

- + high production capacity up to 11 segments/min
- + segment diameter up to 12.6" (320 mm)
- + perfect fill distribution with high density
- + trimming unit with long service life
- + balancing test device and spinning station (optional)



Brush segments produced on the BSM 320 + STM 320

Production of powerbrush segments



Powerbrush samples made from BSM 320 brush segments

The high performance brush segment machine **BSM 320** fully automatically produces ready pressed brush segments with wire fill.

The wire is fed from a spool rack holding up to 22 spools directly to the cutting tool of the **BSM 320**. Once cut, the fill is transferred to the 3-station rotary table.

Eyelet and ring are automatically picked and fed to the **BSM 320**, allowing fully automatic production without operator. The machine can run for some time without refilling eyelets and rings, thanks to the bulk material reservoir.

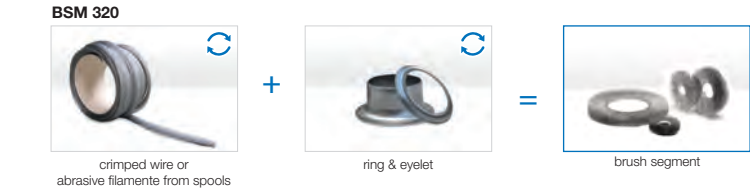
The wire filling and eyelet pressing technology of the **BSM 320** ensure highest performance and best wire distribution with optimal radial alignment of the fill.

If combined with the optional trimming station **STM 320**, ready pressed brush segments can also be transferred and trimmed to the required final diameter without operator.

The optional balance quality control and spinning station with automatic scrap sorting allow total control of the finished brush segment quality.

The brush segments can be directly further processed, the individual configuration of fill density and fill length making them the ideal base product for a great diversity of brushes.

Material feed / Degree of automation



Optional components

- Fill material production**
- Wire crimping and winding machine **STW 87** or **STW 96**
  - Wire crimping machine **USTW 6000** and Hank spooling device **STS 460**
- Fill material feeding**
- 8 or 16 stations coil holder **SFG 91**
- Trimming, spinning, balancing**
- Trimming machine **STM 320**  
-> balancing quality inspection  
-> spinning station

Technical data <sup>1</sup>

Production speed:	11 brush segments/min
Fill material:	crimped wire
Fill material diameter:	0.006" - 0.02" (0.15 - 0.5 mm)
Nominal width:	1.1" - 3.15" (28 - 80 mm)
Segment diameter (trimmed):	3.1" - 12.6" (80 - 320 mm)
Fill material feeding:	12 - 22 hanks
Spinning station: <sup>2</sup>	max. 6000 rpm
Balancing test station: <sup>2</sup>	balancing standard G1
Air pressure   Air consumption (ISO 8573-1):	min. 6 bar   16 m³/h
Power supply   Power input:	400 Volt / 50 Hz   36 kW
Dimensions (W x L x H)   Weight:	14.8 x 9.8 x 9.8 ft (4.5 x 3.0 x 3.0 m)   3970 lbs (1800 kg)

<sup>1</sup> Guideline values – these may vary considerably depending on material specifications

<sup>2</sup> Dependent on the degree of automation



Semi-automatic brush segment machine

# BSM 83 + SPR 86



Highlights

- + high flexibility
- + brush segment diameter up to 14.2" (320 mm)
- + production speed up to 5 brush segments/min
- + large dimensional range



## Production of powerbrush segments



Brush segments produced on the BSM 83 + SPR 300



Powerbrush samples made from BSM 83 brush segments

The **BSM 83** and **SPR 300** produce pressed brush segments with crimped wire or abrasive fill.

Fill material is fed automatically from spools. The operator manually places ring and eyelet in the **BSM 83** and starts the production process. The **BSM 83** inserts the fill material between ring and eyelet and cuts the wire to the set length. Initial pressing clamps the wire firmly between ring and eyelet.

The wire feeding is specially designed for an even wire distribution in the segment, ensuring a good balance quality of the finished brush. Wire usage is actively cut by setting the cut length precisely for each brush size. The prefabricated segment is taken out of the **BSM 83** and placed in the **SPR 300** for automatic final pressing and trimming.

The combination of the two machines makes an efficient production line for brush segments ready for assembly. The roller cutter station is specially designed for trimming brush segments and ensures an even round trim for a good balance quality. Various different outer diameters can be easily set on the **SPR 300**.

Technical data <sup>1</sup>

BSM 83	
Production speed:	4 - 5 brush segments/min
Fill material:	crimped wire
Fill material length:	3.1" - 9.4" (80 - 240 mm)
Fill material diameter:	0.006" - 0.02" (0.15 - 0.6 mm)
Nominal width:	1.1" - 4.7" (28 - 120 mm)
Segment diameter (trimmed):	3.15" - 14.2" (80 - 360 mm)
Fill material feeding:	max. 16 hanks
Air pressure   air consumption (ISO 8573-1):	min. 6 bar   11 m³/h
Power supply   Power input:	400 V / 50 Hz   13 kW
Dimensions (W x L x H):	8.5 x 5.2 x 6.4 ft (2.6 x 1.6 x 2.0 m)
SPR 300	
Press force:	20 t
Air pressure   air consumption (ISO 8573-1):	min. 6 bar   6.5 m³/h
Power supply   Power input:	400 V / 50 Hz   3.7 kW
Dimensions (W x L x H):	5.9 x 3.3 x 7.5 ft (1.8 x 1.0 x 2.3 m)

<sup>1</sup> Guideline values – these may vary considerably depending on material specifications

Material feed / Degree of automation



■ manual feeding    ⚙ automatic feeding

Optional components

- Fill material preparation**
- Wire crimping and winding machine **STW 87** or **STW 96**
  - Wire crimping machine **USTW 6000** and Hank spooling device **STS 460**
- Fill material feeding**
- 8 or 16 stations coil holder **SFG 91**



Semi-automatic brush segment machine

# BSM 83 HD + SPR 300



Brush segments with extra high density

Highlights

- + high variation – from normal to high density segments
- + perfect fill distribution – high balancing
- + minimum loss of material
- + manual or automatic fill material feeding
- + nominal diameters from 1.1" to 7.1" (28 - 180 mm)
- + outer segment diameter up to 15.75" (400 mm)



The **BSM 83 HD** and **SPR 300** produce pressed brush segments with crimped wire or abrasive fill in normal to high densities.

In the first process step, fill material is cut to the required length and density on the roller cutter GR 90 and filled in fill material cartridges. The use of cartridges allows the processing of various different fill materials.

The operator places the filled cartridges in the magazine of the **BSM 83 HD**. The ring and eyelet are also manually placed in the **BSM 83 HD** and the production process started.

The **BSM 83 HD** inserts the fill material evenly distributed between ring and eyelet, clamping it firmly by initial pressing.

The wire feeding is specially designed for an even wire distribution in the segment, ensuring a good balance quality of the finished brush. The prefabricated segment is taken from the **BSM 83 HD** and placed in the **SPR 300** for final pressing and trimming.

The combination of the two machines makes an efficient production line for brush segments ready for assembly. The roller cutter station is specially designed for trimming brush segments and ensures an even round trim for a good balance quality. Various different outer diameters can be easily set on the **SPR 300**.

The homogeneity of the **BSM 83 HD** and the **SPR 300** offers a great lead in efficiency.

The brush segments can be directly further processed, the individual configuration of fill density and fill length making them the ideal base product for a great diversity of brushes.

Technical data <sup>1</sup>

BSM 83 HD	
Production speed:	4 brush segments/min
Fill material:	crimped wire, abrasive
Fill material length:	3.1" - 9.8" (80 - 250 mm)
Fill material diameter wire:	0.006" - 0.02" (0.15 - 0.6 mm)
Fill material diameter abrasive:	0.03" - 0.08" (0.8 - 2.0 mm)
Nominal width:	1.1" - 7.1" (28 - 180 mm)
Segment diameter (trimmed):	3.1" - 15.75" (80 - 400 mm)
Fill material feeding:	max. 24 catridges   manual
Air pressure   air consumption (ISO 8573-1):	min. 6 bar   9 m³/h
Power supply   Power input:	400 V / 50 Hz   19 kW
Dimensions (W x L x H):	8.5 x 5.2 x 6.4 ft (2.6 x 1.6 x 2.0 m)
SPR 300	
Press force:	20 t
Air pressure   air consumption (ISO 8573-1):	min. 6 bar   6.5 m³/h
Power supply   Power input:	400 V / 50 Hz   3.7 kW
Dimensions (W x L x H):	5.9 x 3.3 x 7.5 ft (1.8 x 1.0 x 2.3 m)

<sup>1</sup> Guideline values – these may vary considerably depending on material specifications

Material feed / Degree of automation



Optional components

- Fill material preparation**
- Roller cutter **GR 90**
  - Bundle cutter **BC 100**
  - Wire crimping and winding machine **STW 87** or **STW 96**
  - Wire crimping machine **USTW 6000** and Hank spooling device **STS 460**
  - Wire cutting machine **SWC 950**
- Fill material feeding**
- Tube filling device **TFD 290**
  - > Picker **AAB 937**
  - > 2 stations coil holder **SFG 91**



Semi-automatic brush segment machine

# BSM 83 HD + TFD 290 + SPR 300



Brush segments with extra high density and automatic wire feeding

Highlights

- + high variation – from normal to high density segments
- + perfect fill distribution – high balancing
- + minimum loss of material
- + manual or automatic fill material feeding
- + nominal diameters from 1.1" to 7.1" (28 - 180 mm)
- + outer segment diameter up to 15.75" (400 mm)



Brush segments produced on the BSM 83 HD + TFD 290 + SPR 300

Powerbrush samples made from BSM 83 HD brush segments

The **BSM 83 HD** together with **TFD 290** and **SPR 300** produce pressed brush segments with crimped wire or abrasive fill in normal to high densities.

The **TFD 290** cuts hanks to the required length from spool, feeds the fill material into cartridges and transports these to the **BSM 83 HD**. Brushes of different fill lengths in the same nominal size can be easily selected and produced thanks to the recipe management.

The **BSM 83 HD** automatically loads the revolver with the fill material cartridges. The ring and eyelet are manually placed and the production process started.

The **BSM 83 HD** inserts the fill material very evenly distributed between ring and eyelet and clamps the wire firmly by initial pressing.

The wire feeding is specially designed for an even wire distribution in the segment, ensuring a good balance quality of the finished brush. Wire usage is actively cut by setting the cut length precisely for each brush size. The prefabricated segment is taken from the **BSM 83 HD** and placed in the **SPR 300** for automatic final pressing and trimming.

The roller cutter station is specially designed for trimming brush segments and ensures an even round trim for a good balance quality. Various different outer diameters can be easily set on the **SPR 300**.

The combination of the **BSM 83 HD** with the automatic fill feeding **TFD 290** and the **SPR 300** for final pressing and trimming offers a great lead in efficiency in the batch production of brush segments ready for assembly.

The brush segments can be directly further processed, the individual configuration of fill density and fill length making them the ideal base product for a great diversity of brushes.

Technical data <sup>1</sup>

BSM 83 HD + TFD 290	
Production speed:	4 brush segments/min
Fill material:	crimped wire, abrasive
Fill material length:	3.1" - 9.8" (80 - 250 mm)
Fill material diameter wire:	0.006" - 0.02" (0.15 - 0.6 mm)
Fill material diameter abrasive:	0.03" - 0.08" (0.8 - 2.0 mm)
Nominal width:	1.1" - 7.1" (28 - 180 mm)
Segment diameter (trimmed):	3.1" - 15.75" (80 - 400 mm)
Fill material feeding:	max. 24 catridges   automatically from 2 spools    automatically through picker
Air pressure   air consumption (ISO 8573-1):	min. 6 bar   11 m³/h
Power supply   Power input:	400 V / 50 Hz   19 kW
Dimensions (W x L x H):	8.5 x 5.2 x 6.4 ft (2.6 x 1.6 x 2.0 m)
SPR 300	
Press force:	20 t
Air pressure   air consumption (ISO 8573-1):	min. 6 bar   - m³/h
Power supply   Power input:	400 V / 50 Hz   3.7 kW
Dimensions (W x L x H):	5.9 x 3.3 x 7.5 ft (1.8 x 1.0 x 2.3 m)

<sup>1</sup> Guideline values – these may vary considerably depending on material specifications

Material feed / Degree of automation



Optional components

- Fill material preparation**
- Bundle cutter **BC 100**
  - Wire crimping and winding machine **STW 87** or **STW 96**
  - Wire crimping machine **USTW 6000** and Hank spooling device **STS 460**
- Fill material feeding**
- Picker **AAB 937**
  - 2 stations coil holder **SFG 91**



Full-automatic disc and cup brush production line

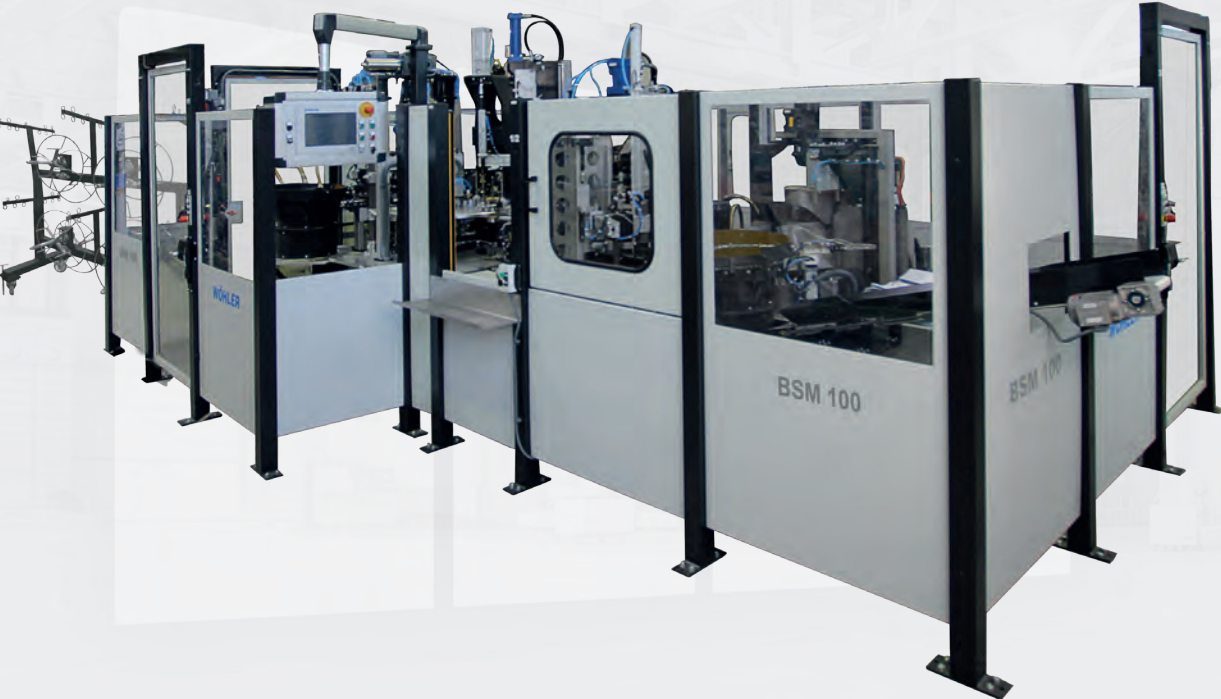
# BSM 100 + RS 100 + AWC 100



Increase production output with ease of use

Highlights

- + higher production capacity
- + higher quality
- + high balancing
- + easiest operation



Production of powerbrushes



Brush segments produced with BSM 100



Samples of disc and cup brushes produced with BSM 100 + RS 100 + AWC 100

The fully automatic production line for wheel and cup brushes consists of three interlinked machines: The **BSM 100** for production of ready pressed brush segments with crimped wire or abrasive fill, the roller cutter **RS 100** for trimming and the assembly machine **AWC 100** for automatic assembly of the brush segments as wheel or cup brushes.

The **BSM 100** automatically draws fill material from spools in the required quantities. In the following step, the ring is filled with material and the segment automatically pressed. Automatic ring and eyelet feeding ensures an efficient production of segments.

The ready pressed segment is transferred to the second station – the **RS 100** – for roller cutter trimming.

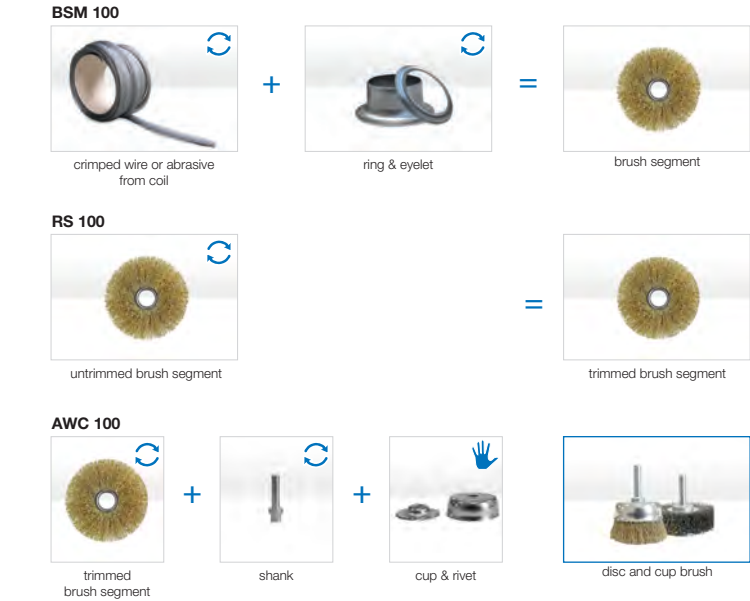
The final step in the production process is the assembly of the brush segments as wheel or cup brushes on the assembly machine **AWC 100**.

The automatic transfer between the individual production line components guarantees an efficient production process.

Part feeding can be made either via an operator feeding station or optionally by fully automatic feeding of all parts.

Rapid change components and recipe management with parameter settings for every brush type minimise change-over times and allow a more frequent product change in the interest of demand-driven production.

Material feed / Degree of automation



Optional components

- Fill material preparation**
- Wire crimping and winding machine **STW 87** or **STW 96**
  - Wire crimping machine **USTW 6000** and Hank spooling device **STS 460**

- Besatzmaterialzufuhr**
- 8 station coil holder **SFG 91**

Technical data <sup>1</sup>

Production speed:	11 brush segments/min
Fill material:	crimped wire, abrasive
Fill material diameter:	0.004" - 0.01" (0.10 - 0.35 mm)
Fill material length:	2.75" - 5.9" (70 - 150 mm)
Nominal width:	0.3" - 1.1" (8 - 28 mm)
Segment diameter (trimmed):	1.6" - 5.9" (40 - 150 mm)
Fill material feeding:	6    8 coils
Air pressure   air consumption (ISO 8573-1):	min. 6 bar   70 m³/h
Power supply   Power input:	400 Volt / 50 Hz   - kW
Dimensions (W x L x H)   Weight:	20.7 x 13.1 x 8.2 ft (6.3 x 4.0 x 2.5 m)   - lbs (- kg)

<sup>1</sup> Guideline values – these may vary considerably depending on material specifications



Features

- high efficiency
- operating both downstream and incorporated into existing process
- automatic ejection (optional)
- parallel pressing and cutting

Parallel pressing and trimming

The Segment press SPR 86 with its heavy duty roller cutter RS 83 can be used either in connection to the BSM 83 HD or integrated in an existing process. The hydraulic and electrical supply is normally made through the BSM 83 HD.

Pre-pressed segments are laid on the 3-station turntable either automatically or by the operator. Pressing and trimming of the segments is carried out automatically.

Automatic ejection is optionally available.

Technical data<sup>1</sup>

Production speed:	6 brushes/min
Press force:	20 t
Dimensions (W x L):	5.9 x 2.3 ft (1.8 x 0.7 m)
Compressed air   Air consumption (ISO 8573-1):	min. 6 bar   - m³/h
Power supply   Power input:	400 Volt / 50 Hz   3.7 kW

<sup>1</sup> Guideline values – these may vary considerably depending on material specifications



Optional components

- automatic ejection

SHF 400



Produce economically from lot size 1

Highlights

- + each segment size can be produced in any sequence with minimum setup effort
- + lowers your inventory
- + only one sheet instead of ring and eyelet
- + integrated disc punching
- + freely adjustable fill material length reduces wire consumption
- + optimally balanced segments through best wire distribution
- + up to 25% higher stocking density
- + securely fixed fill material



Production of powerbrush segments



Discs with mounting lug



SHF 400 brush segment



Powerbrushes produced with SHF 400 brush segments

The highly flexible **SHF 400** produces conventional brush segment disks economically from single piece production.

Material input is reduced to a single wire hank and a simple metal disk.

Comprehensive recipe management and the integrated punching station for fill hole and assembly lugs allow the economic production of various different segment sizes in arbitrary sequence and individual fill material lengths.

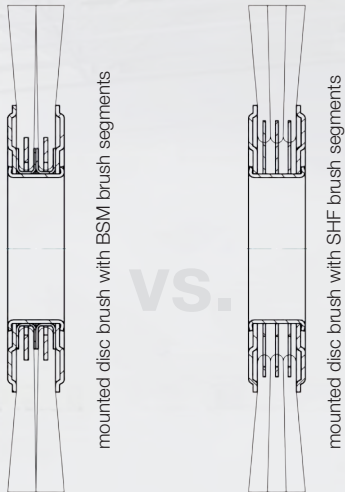
The disk can be manually placed for single piece production and is taken from the integrated magazine for batch production.

The **SHF 400** draws the wire from spool and cuts it to the freely determined length.

Assembly lug punching and filling/lug closing are made in parallel sequence.

The fill material is distributed evenly in the filling hole. Simple closing of the assembly lug secures the wire firmly in filling position and in perfect radial alignment. This optimal and even wire distribution creates a brush segment of exceptional balance quality.

Compared to conventional segment production, no prefabricated metal parts (inner ring and eyelet) are required. This effectively cuts both costs and the overall weight of the brush segment.



+25%

Material feed / Degree of automation



manual feeding automatic feeding

Optional components

- Fill material preparation**
- Wire crimping and winding machine **STW 87** or **STW 96**
  - Wire crimping machine **USTW 6000** and Hank spooling device **STS 460**

- Fill material feeding**
- Coil holder **SFG 91**

Technical data <sup>1</sup>

Production speed:	0,75 - 2 brush segments/min (30 filament bundles/min)
Fill material:	crimped wire
Fill material diameter:	0.006" - 0.014" (0.15 - 0.35 mm)
Disc diameter:	3.7" - 8.1" (95 - 205 mm)
Nominal width:	2.0" - 6.5" (52 - 164 mm)
Mounting lug diameter:	0.4" (11 mm)
Segment diameter:	7.9" - 15.75" (200 - 400 mm)
Fill material feeding:	1 hank
Disc magazine:	for 100 discs, maximal Ø 7.0" (180 mm)
Air pressure   air consumption (ISO 8573-1):	min. 6 bar   9 m³/h
Power supply   Power input:	400 Volt / 50 Hz   15 kW
Dimensions (W x L x H):	11.8 x 9.2 x 6.6 ft (3.6 x 2.8 x 2.0 m)

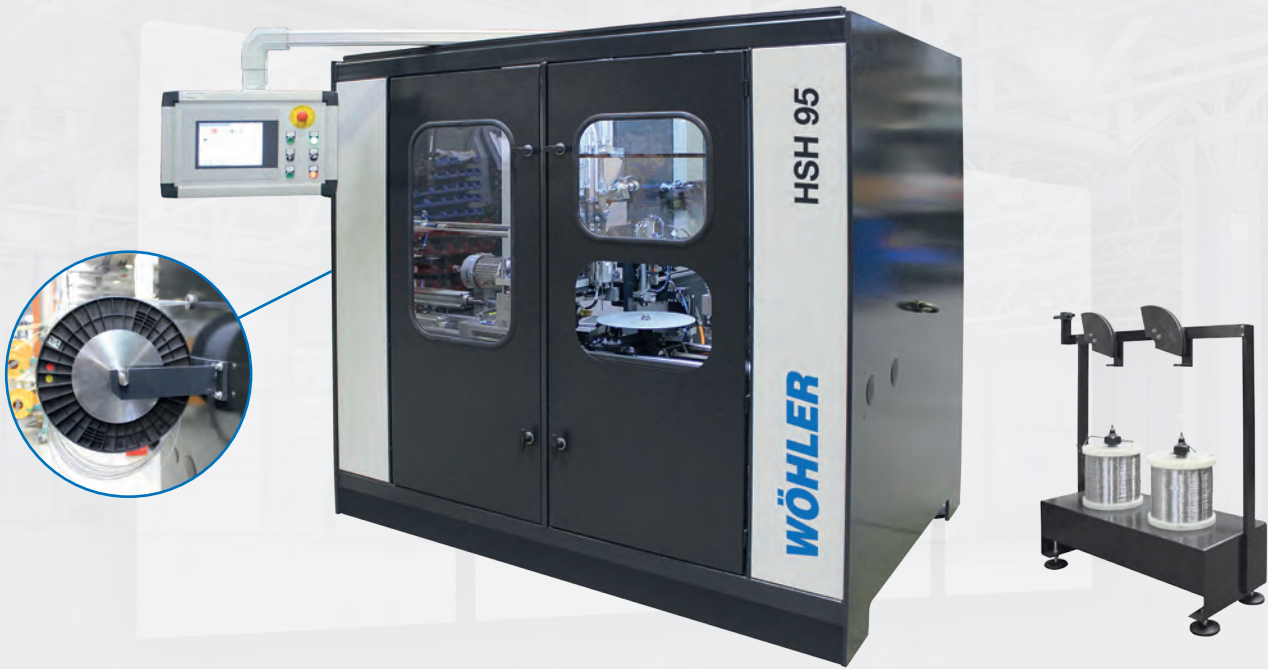
<sup>1</sup> Guideline values – these may vary considerably depending on material specifications



„Hotani Style“ brush segment production and refill

Highlights

- + automatic production of so-called Hotani discs
- + including hole punching
- + controlled bundle fixing with consistent force
- + clean cutting and bending of the binding wire
- + fast change-over for different disc sizes and bundle lengths



Production of powerbrush segments



Samples of HSH 95 brush segments



HSH 95 brush segments assebled to a roll brush

With the **HSH 95** individual brush segments with synthetic fill material are produced fully automatic.

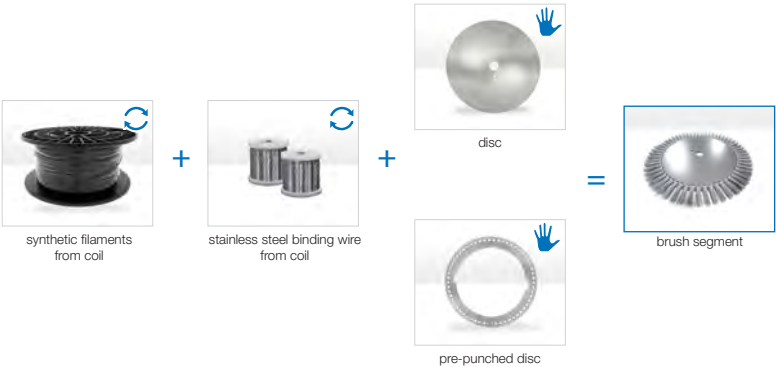
The flexibility of the machine makes it possible to produce a wide range of brush segments, since the disc diameter and the number of trimming holes is adjustable.

The machine achieves the maximum performance in operation with pre-punched discs. After the manual insertion of the pre-punched disc, the filling process can be started directly. The fill material, which is fed from coil into the machine, is cut to the set fill length and fixed in the fill hole by means of a binding wire. The constant control of this process step ensures that the fill material bundles are securely integrated with constant strength.

With an additional punching tool, built on the **HSH 95**, segment discs can also be punched directly on the machine.

Material feed / Degree of automation

HSH 95



Optional components

Technical data <sup>1</sup>

Production speed:	punching: 120 holes/min filling: 10 holes/min
Fill material:	synthetic
Fill material length:	3.9" - 5.5" (100 - 140 mm)
Disc diameter:	9.8" - 15.2" (250 - 385 mm)
Mounting hole diameter:	max. 0.5" x 0.3" (12 x 8 mm)
Segment diameter:	12.8" - 19.7" (325 - 500 mm)
Fill material feeding:	1 hank
Air pressure   air consumption (ISO 8573-1):	min. 6 bar   9 m³/h
Power supply   Power input:	400 Volt / 50 Hz   8 kW
Dimensions (W x L x H)   Weight:	7.2 x 6.8 x 7.2 ft (2.2 x 2.1 x 2.2 m)   2560 lbs (1160 kg)

<sup>1</sup> Guideline values – these may vary considerably depending on material specifications

Features

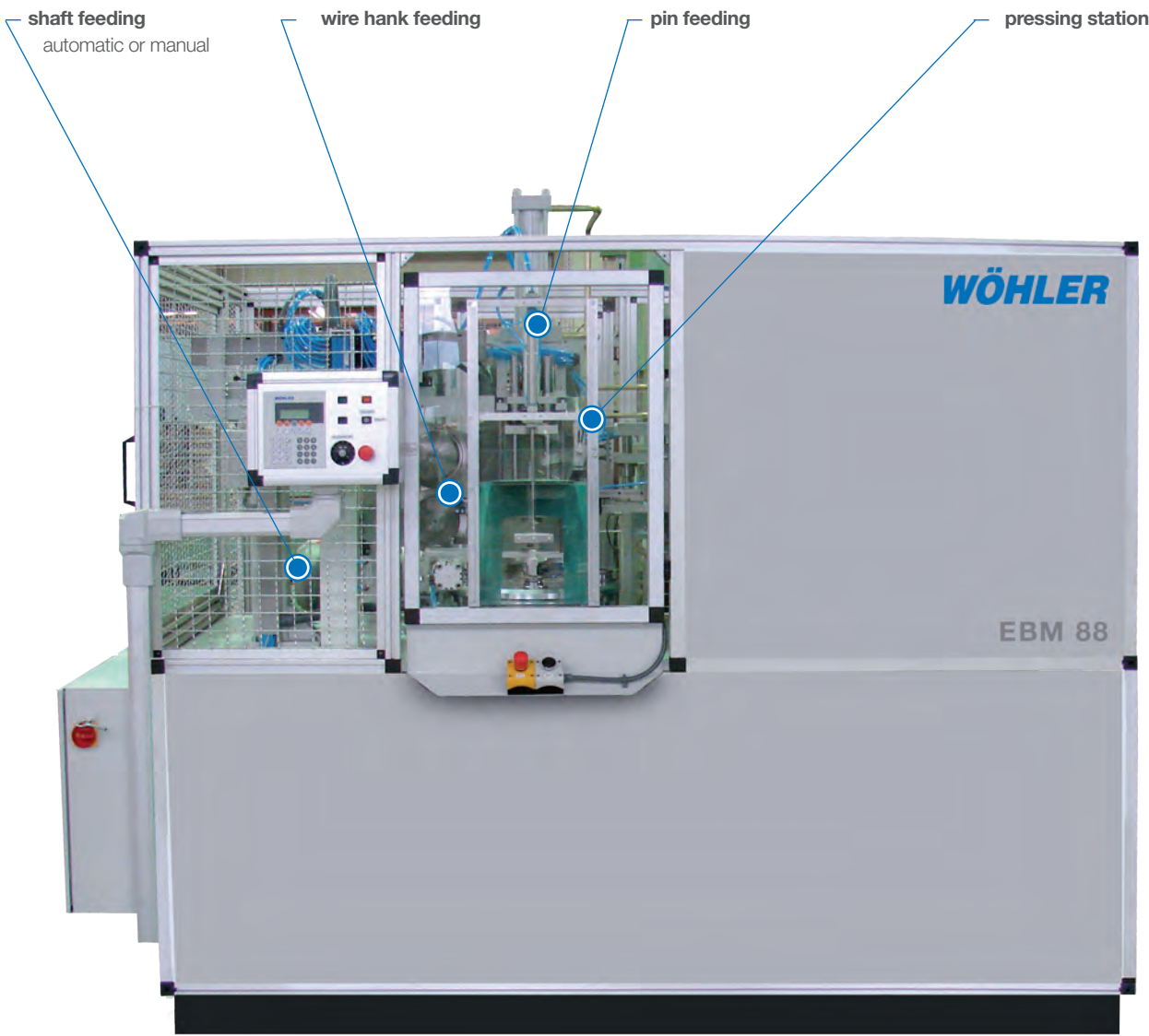
- high production capacity
- semi to fully automatic production possible
- for all fill materials from hank
- with and without support elements
- labeling of shafts optionally possible

Fully automatic production  
of end brushes

For the highly efficient, fully automatic production of end brushes in large series.

The machine is fitted with a 4-station turntable, automatic shaft feeding, wire feeding from spool, pin feeding from coil or magazine and automatic transfer in a closed trimming station in order to contain cut remnants.

End brush production



Technical data <sup>1</sup>

Production speed:	8 pcs/min
Brush outer diameter:	0.47" - 1.30" (12 - 32 mm)
Wire diameter:	0.003" - 0.02" (0.08 - 0.50 mm)
Diemensions (W x L x H):	5.9 x 4.6 x 6.6 ft (1.8 x 1.4 x 2.0 m)
Air pressure   air consumption (ISO 8573-1):	min. 6 bar   - m³/h
Power supply   Power input:	400 Volt / 50 Hz   9 kW

<sup>1</sup> Guideline values – these may vary considerably depending on material specifications

Optional components

- Support element feeding
- Trimming unit
- Shaft labeling unit



Roller cutter

RS 83 DB | RS 83 EB

Features

- carbide roller cutting blades
- sturdy construction
- large range of products

Trimming brushes

in line or stand-alone

The **RS 83 EB** and **RS 83 DB** are roller cutters, which can be used in an operation cell together with a brush production machine.

Depending on machine version the brush can be trimmed directly in both directions (DB) or turned and trimmed again in a second cycle.

The rotational speed of the brush can be individually set for ensuring an optimal trim quality.

The heavy duty roller cutter is fitted with carbide blades, which ensure a particularly long blade service time.



Technical data <sup>1</sup>

Production speed:	2 cycles/min
Diameter range:	4.0" - 17.5" (100 - 450 mm)
Single twist knot diameter:	max. 0.3" (8 mm)
Wire diameter:	max. 0.04" (1 mm)
Roller cutting blades:	Ø 7,7" (195 mm ) different blade types available in HSS and carbide
Dimensions (W x L x H):	RS 83 DB: 3.3 x 7.5 ft (1.0 x 2.3 m) RS 83 EB: 3.9 x 7.9 ft (1.2 x 2.4 m)
Power supply   Power input:	RS 83 DB: 400 Volt / 50 Hz   3 kW RS 83 EB: 400 Volt / 50 Hz   4.5 kW

<sup>1</sup> Guideline values – these may vary considerably depending on material specifications

Roller cutter

GR 90

Features

- HSS or carbide cutting blades
- various different models and fittings

Cutting hanks of wire manually or automatically

Machine for cutting hanks of wire either manually or automatically, as well as for trimming brush segments from 1.2" (30 mm) in diameter up to street sweeper rings of 3.3 ft (1.0 m) and more.

Manual and automatic feeding devices for wire hanks, rotary tables for segments and an automatic lubricator are optionally available.

The roller cutter is supplied with HSS blades, slightly toothed for securely catching the fill material and feeding it through the blades. Various other blade types are optionally available for specific applications.

A further optional extra on the machine is the wire mat feeding unit MFF 320. This is used for safety reasons when extremely short wire lengths are to be cut.



Technical data <sup>1</sup>

Roller cutting blades:	Ø 7.7" x 0.2" (195 x 5 mm), HSS (optionally carbide) tooth count (Z): 240, 120, 40, untoothed, tipped
Dimensions (W x L x H):	5.25 x 2.3 x 4.6 ft (1.6 x 0.7 x 1.4 m)
Anschlusswerte   Anschlussleistung:	400 Volt / 50 Hz   0.75 kW

<sup>1</sup> Guideline values – these may vary considerably depending on material specifications

Optional components

- Manual or automatic feeding devices
- Wire mat feeding unit **MFF 320**
- Rotary tables for segments
- Automatic lubricator



FVT 1000

Features

- high economic efficiency
- easy cleaning
- cup, wheel and end brushes
- rapid clamping system for brush insertion

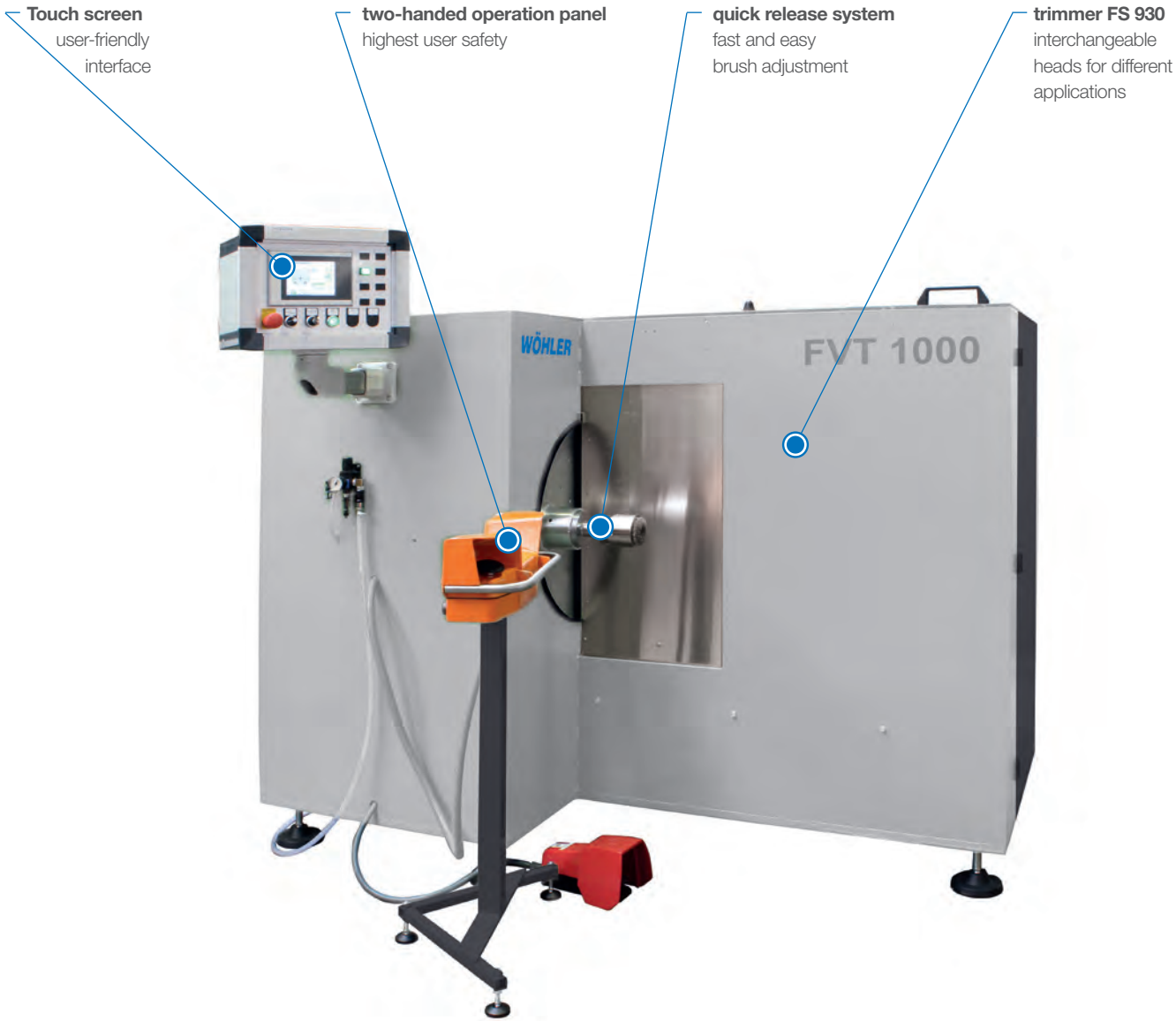
Economically trimming  
with maximum security

The brush trimming machine **FVT 1000** provides two loading stations for high performance. It is suitable for the trimming of cup brushes, wheel brushes and end brushes. Thanks to the flexible settings, special formats can be trimmed with simple adjustments.

For consistently high quality and process reliability the trimming programs can be saved and loaded.

The quick release system is adapted to the individual brush shape. The brush which should be trimmed can be inserted quickly and easily.

Brush trimming



Technical Data <sup>1</sup>

Production speed:	6 cycles/min
Ø max. brush (outer):	cup brush: 5.90" (150 mm) wheel brush: 15.75" (400 mm) end brush: 1.18" (30 mm)
Cutting head (Trimmer FS 930):	standard HSS, Hartmetall und diamantbesetzt
Compressed air   air consumption (ISO 8573-1):	min. 6 bar   2.0 m³/h
Dimensions (W x L x H)   Weight:	6.2 x 7.2 x 5.9 ft (1.9 x 2.2 x 1.8 m)   3086 lbs (1400 kg)
Power supply   input:	400 Volt / 50 Hz   3.75 kW

<sup>1</sup> Guideline values – these may vary considerably depending on material specifications

Continuous trimming without stopover

While a brush is trimmed in the machine, the operator adjusts a further brush for the next cycle at the same time.



Insert the first brush in the quick release system



Start of trimming and parallel inserting of the next brush



After the trimming process, the engine stops and the door opens automatically



Without interrupting the cycle begins again

Trimming bench for circular and roller brushes

TU 500

Features

- fast product change
- rapid brush changing in the production cycle
- start-up programm for diameter control
- easy cleaning
- durable guide systems
- brush holder for rollers and segments
- 29.5" (750 mm) length and 15.7" (400 mm) diameter
- CNC contour cut (optional)

Fully automatic working cycle for minimal start-up times at product changing

The TU 500 is a trimming bench for circular and roller brushes.

The quick-release system with a maximum of 7.5" (190 mm) usable stroke is based on an optimum pressure which guarantees the ideal torque for the brush rotation. Together with the manually movable tailstock, these features are only a few elements which makes the operation of the machine very efficient and simple.

The ability to configures the flow and the return flow at different speeds provides various types of applications. For example, the realization of a coarse and fine cut.

The TU 500 can be also equipped with an additional out-comping unit and an electrically operated tailstock.

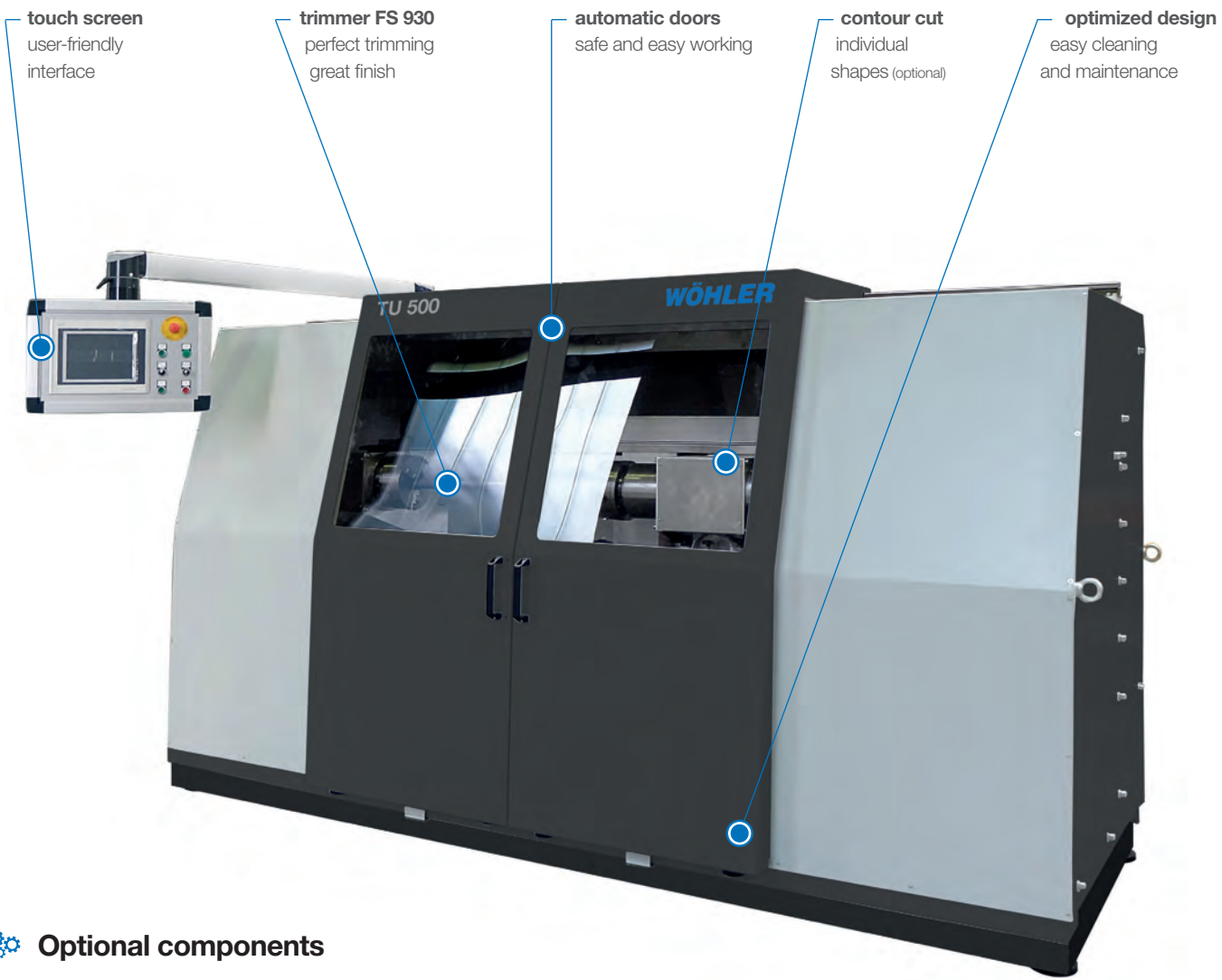


An servo-controlled, movable infeed of the cutter, which is available as a special equipment, implemented the options for contour cuts with start- and endphases and konvex and koncav forms.

The central waste collection enables easy and quick cleaning of the machine.

At the end of the cutting operation, the doors open automatically. This ensures maximum safety at work. Furthermore, it is a optical mark at the end of the trimming process.

A touch screen and a user-friendly interface helps the operator to concentrate on the essential tasks. Main-tenance and service can be performed quickly and easily via the integrated remote control module.



Optional components

- Contour cut equipment
- Out-combing unit

Technical Data <sup>1</sup>

Production speed:	up to 15.75"/min (400 mm/min)
Max. brush diameter:	15.75" (400 mm)
Max. brush length:	roller brush: 29.53" (750 mm) circular brush on shaft: 19.67" (500 mm)
Brush rotation speed:	trimming mode: 0 to 500 min <sup>-1</sup> out-combing mode: 1000 min <sup>-1</sup>
Shaft height:	47.24" (1200 mm)
Compressed air   air consumption (ISO 8573-1):	min. 6 bar   0.2 m³/h
Dimensions (W x L x H)   Weight:	11.5 x 6.6 x 6.9 ft (3.5 x 2.0 x 2.1 m)   5510 lbs (2500 kg)
Power supply   input:	400 Volt / 50 Hz   10 kW

<sup>1</sup> Guideline values – these may vary considerably depending on material specifications

One machine – many possibilities

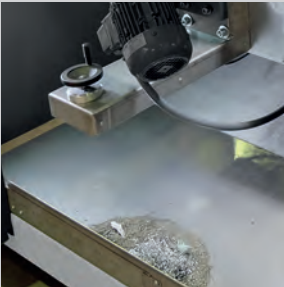
With its application-optimized design and settings thoughtful optimized for circular and roller brushes the TU 500 provides a great variety of possibilities.



Roller brushes with length of up to 29.5" (750 mm)



Several segments can be clipped to on one brush holder



Thoughtful machine design  
Maschinendesign allows fast and easy cleaning



Safety first – the doors unlock automaticly after the trimming process is finished



Trimmingbench for roll and disc brushes

MTB 1000

Features

- up to 39.4" (1000 mm) diameter
- trim length 3.0 to 12.5 ft (1.0 bis 4.0 m)
- CNC contour trimming
- fast change of the complete trimmer
- tube processing possible



Innovative machine design – any contours

The machine concept of the MTB 1000 has been optimised for brush manufacturers providing a particularly easy operation. Roll brushes can be loaded in the machine either by crane from above or from the front.

The cut waste is collected easily emptied waste trays.

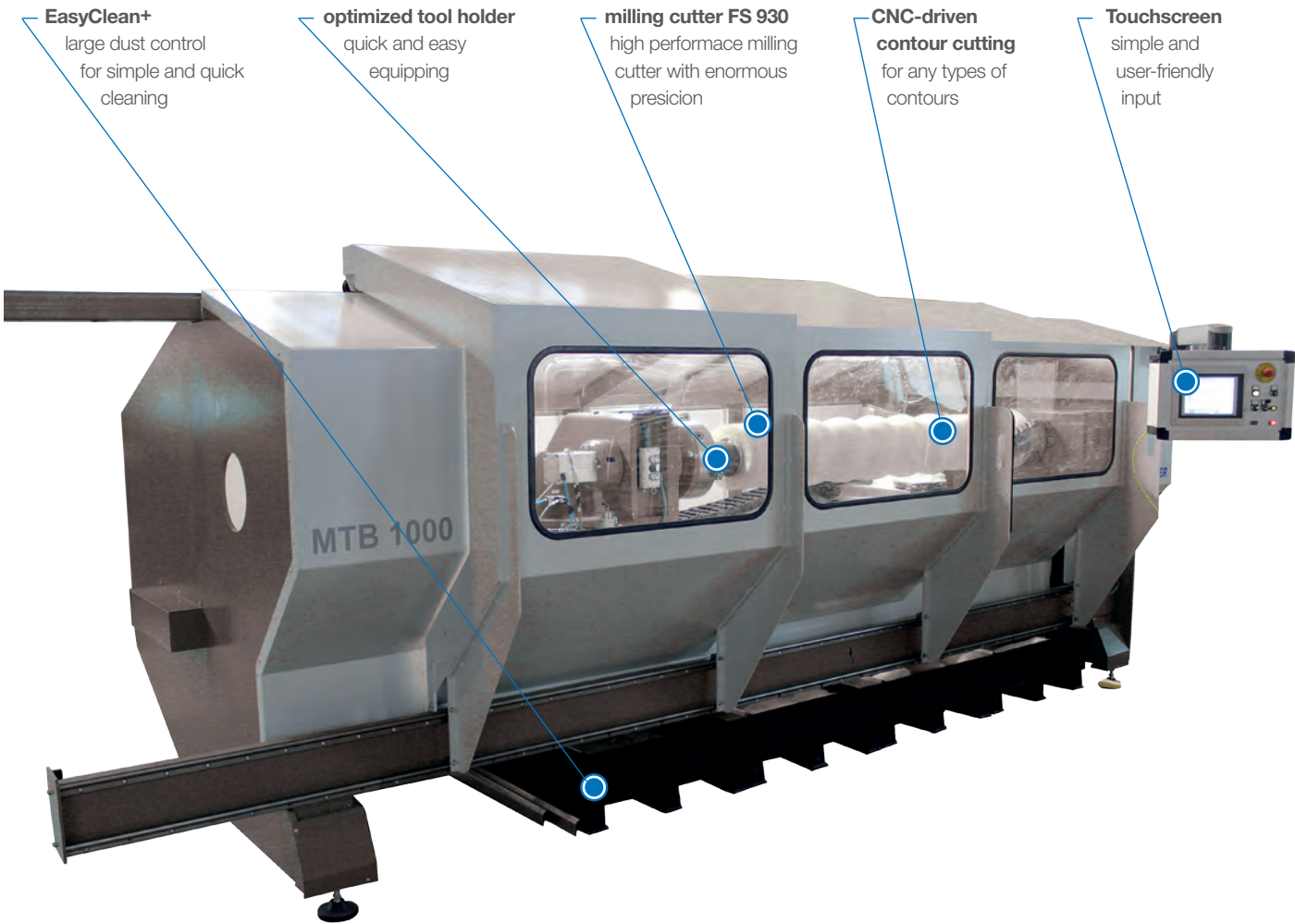
The optional template trimming allows the brushes to be trimmed in virtually any required contour.

In addition to the SPC control with operating panel a CNC control with touch screen can optionally be integrated, allowing CNC data (so-called G-function) to be processed and any required contour trimmed.

User-friendly software for creating the required CNC data on an external PC is also optionally available.

Processing plastic tubes:

- Tube lengthening by friction welding
- Inner calibration over the complete length with additional TDU module
- Internal turning of the tube ends



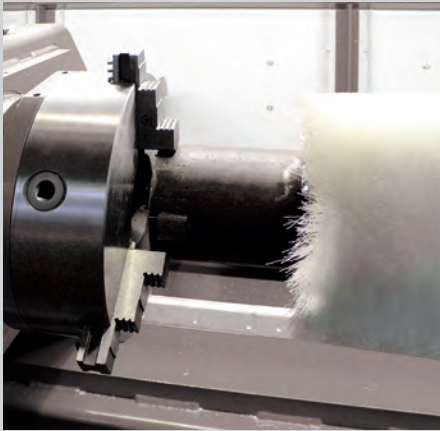
Optional components

- Balancing device **WUM 200**
- Calibration tool **TDU**

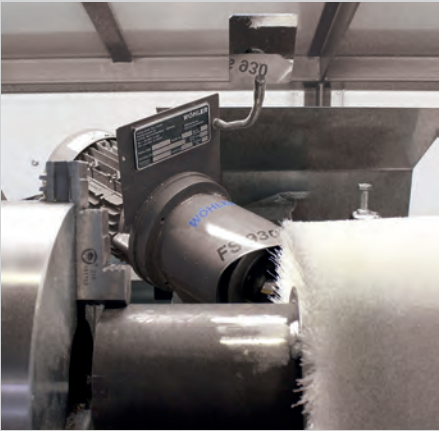
Technical data <sup>1</sup>

Brush outer diameter:	39.4" (1000 mm)
Trim length:	3.0 - 12.5 ft (1.0 - 4.0 m)
Core length:	4.1 - 13.9 ft (1.25 - 4.25 m)
Shaft length:	4.9 - 14.8 ft (1.5 - 4.5 m)
Compressed air   air consumption (ISO 8573-1):	min. 6 bar   - m³/h
Power supply   power input:	400 Volt / 50 Hz   4.5 kW
Dimensions (W x L x H):	18.7 x 7.9 x 6.6 ft (5.7 x 2.4 x 2.0 m)

<sup>1</sup> Guideline values – these may vary considerably depending on material specifications



Optimised roller mount



Milling cutter FS 930



Example of a rolling contour cut

Manually fed dies

A pre-cut piece of sheet metal (e.g. a disk) is placed manually into the die, a press cycle started and the readily formed or cut piece taken out. These dies are preferably used on eccentric presses with controls and protective covers.

Single step dies

Sheet metal band is fed to the die either automatically from coil or manually in strips. Waste cut outs and produced parts are collected separately and on automatic feeding the remaining band cut into pieces. Our latest range of single stroke combination dies effectively reduces waste and production costs by simultaneously punching various nominal sizes of the same part (e.g. 3 ring sizes with RSW, 2 eyelet sizes with DZWR) or two different parts (e.g. inner cup and support ring for twist knot brushes with SRW).

Multi step dies

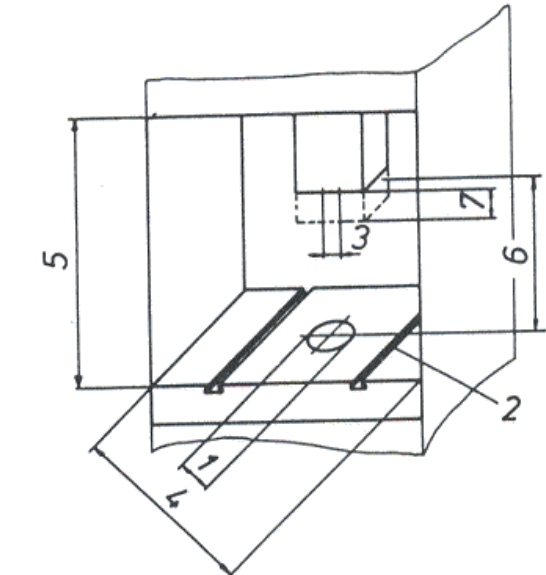
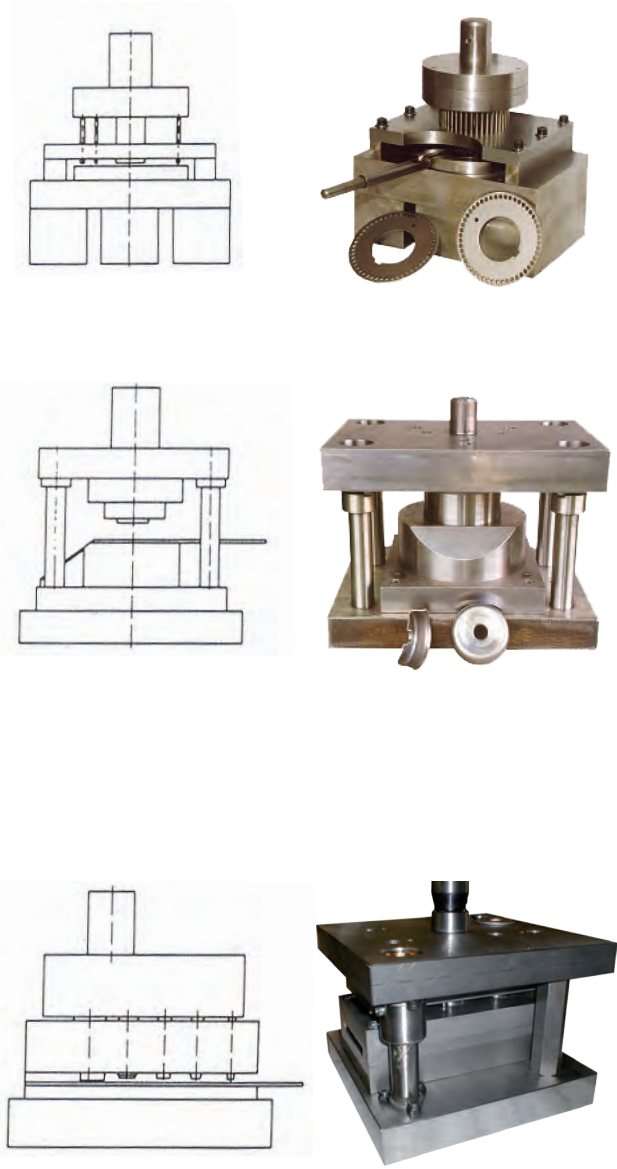
Sheet metal band is fed continuously from a coil to the die and the press runs continuously with practically no supervision at all. Waste cut outs and produced parts are collected separately and the remaining band is cut into pieces. Deep drawing (e.g. for cups for dental brushes) is possible on an eccentric press, as is fully automatic and trouble free operation, suited for larger series from around 10,000 pieces. The sheet metal band has to be fed from coils and the press be fitted with a roller feeder.

Custom order tools and dies

Apart from our standard range of punching tools and dies we also design and build tools and dies to custom order. Whatever your specific requirements are together we will find the right solutions.

Punching presses

For design purposes the following press data is required: force, speed: stroke/min., throughlet width (4) and height (5) (mm), upper turning point (6) (mm) above plate, stroke (7) (mm), sketch of table grooves (2) and hole (1) pinion (3) diameter and depth (mm), sketch of the fixture and the type of feeder. Alternatively Wöhler can always supply reliable, low-cost used presses in which case the press tools are designed accordingly.



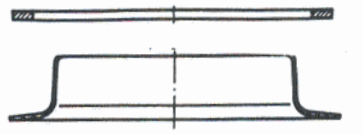
Metal parts

Single segment:

inner ring  
eyelet

Tool type

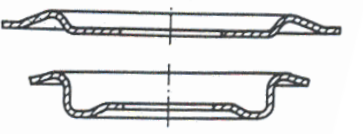
RSW/FRSW  
ZWR/DZWR



Wheel brushes:

cover plate  
adapter

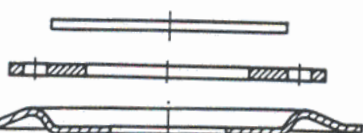
DSW  
ADW



twist knot brushes:

disk  
hole plate  
cover plate

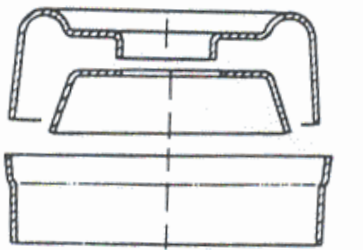
ROW/CPT  
LSW/FLSW  
ADW



Cup brushes:

outer cup  
inner cup  
support ring

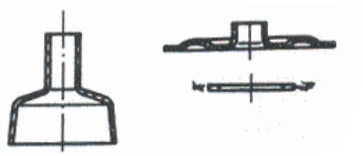
GTZW (A)  
GTZW (I)  
SRW



Dental and polishing brushes:

inner ring  
cover plate  
cup

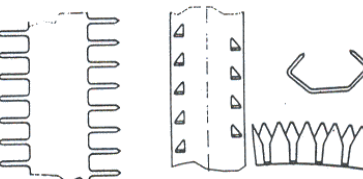
RSD  
DSD/NZD  
CZD



Strip and roll brushes:

indented band  
toothed band  
fixing clamps

ZBW  
ZBW  
STK





Features

- high production capacity
- cut lengths 100 - 325 mm
- integrated straightening, crimping and bundling possible

Wire cutting  
with high speed

This high capacity machine is specially designed for the automatic cutting of straight, oil tempered wire with cut lengths from 100 to 325 mm.

The wires are drawn off from spools and cut to the required length. Wire length, number of cuts and wire feed can all be freely programmed. The ready cut wires drop through shafts parallel onto a conveyor belt and are laid onto a storage belt, where any lateral mismatch is aligned by a centring device.

From time to time the wires have to be removed from the storage belt by the operator. Wires to be cut should be oil-free and fed without load.



Therefore it is recommended to use a spool rack from which the wires can be easily drawn off.

Wire cutting



Optional components

- Straightening, crimping and bundling unit

Technical data <sup>1</sup>

Production speed:	192 cuts/min
Wire diameter:	0,35 - 0,90 mm
Number of wires:	ca. 10 - 12
Cut length:	100 - 325 mm
Dimensions (W x L):	1,5 x 1,2 m
Power supply   Power input:	400 Volt / 50 Hz   3 kW

<sup>1</sup> Guideline values – these may vary considerably depending on material specifications

Easy assembly of wheel, cup and end brushes

Production of wheel, cup and end brushes

**TMON**

- Highlights**
- + adaptable for assembly with shaft, nut or metal sleeve
  - + optionally integrated in automatic assembly lines with other brush production processes

The **TMON** is an assembly tool for the assembly of cup brushes from twist knot or crimped wire brush segments.

The compact tool is used to press the pre-assembled twist knot brush segments with the cup, the inner plate and optionally the shank, nut or sheet metal sleeve under a hydraulic or eccentric press to the finished cup brush.

**Technical data**<sup>1</sup>

Number of segments:	max. 2 segments
Capacity:	3 brushes/min
Height:	approx. 10.0" (250 mm)
Press force required:	approx. 20 t
Press table:	max. 20.0" x 12.0" (500 x 300 mm)
Opening width:	min. 17.5" (450 mm)
Dimensions (W x L):	5.5" x 5.5" (140 x 140 mm)

<sup>1</sup> Guideline values – these may vary considerably depending on material specifications

**WMON**

- Highlights**
- + simple fitting in a press
  - + easy variation of the brush width
  - + direct flanging of the assembly tubes
  - + integrated cover plate pressing (optional)
  - + components can also be integrated in an automatic assembly line

The **WMON** is an assembly tool for the assembly of disc brushes from twist knot or crimped wire brush segments.

With the compact tool, the pre-assembled twist knot brush segments are pressed with one-piece and multi-row wheel brushes with cover plate pressing.

**Technical data**<sup>1</sup>

Number of segments:	2 - 8 segments
Capacity:	3 brushes/min
Height:	approx. 15.75" (400 mm)
Press force required:	approx. 20 t
Press table:	max. 20.0" x 12.0" (500 x 300 mm)
Opening width:	min. 17.5" (450 mm)
Dimensions (W x L):	11.8" x 15.75" (300 x 400 mm)

<sup>1</sup> Guideline values – these may vary considerably depending on material specifications

**EMON**

- Highlights**
- + additional flanging of mounting tube possible
  - + typical number of knots: 8, 10 or 12

The **EMON** is an assembly tool for the assembly of end brushes with flanged head and flanged inner mounting tube from twist knot brush segments.

It is suitable for installation in a hydraulic press with a pressing force of 10 tonnes.

**Technical data**<sup>1</sup>

Number of segments:	1 segment
Capacity:	4 brushes/min
Height:	19.7" x 11.8" (500 x 300 mm)
Hub, einstellbar:	3.15" - 5.5" (80 - 140 mm)
Press force required:	approx. 10 t
Press table:	max. 19.7" x 11.8" (500 x 300 mm)
Opening width:	15.75" - 20.5" (400 - 520 mm)
Dimensions (W x L):	19.7" x 7.9" x 15.75" (500 x 200 x 400 mm)

<sup>1</sup> Guideline values – these may vary considerably depending on material specifications



Material und Aufbau Topfbürstenproduktion mit **TMON**

Material und Aufbau Scheibenbürstenproduktion mit **WMON**



