# Wire Brush Selection

## Between the brush (filament) and the surface there must be:

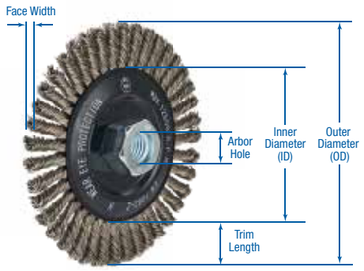
**Mechanical Compatibility**
Relation between the hardness of the tool and the surface to be treated. It's not recommended to use hard carbon steel for light deburring of a soft metal like aluminum. An alternative recommendation is to use synthetic filaments.

**Chemical Compatibility**
The wire must withstand the corrosive attacks from the chemical environment. It's not recommended to use carbon steel brushes in the presence of acid solutions and high salt environments and the contamination of the processed material must be avoided (it's not recommended to use carbon steel brushes on stainless steel surfaces).

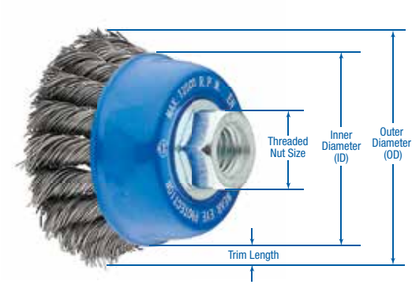
## Choosing the Brush Shape

Brush size and shape must be chosen considering the part shape, the specific brushing operation, the power tool and the working environment. (For example, cup, disc or roller brushes are recommended for working on flat surfaces.)

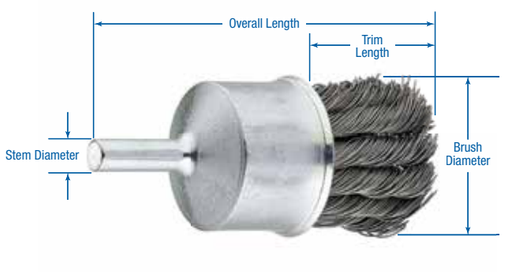
**Wheel Brushes** suitable as cavities cleaning and edges deburring (weld cleaning within chamfers or pipe heads, pipes deburring).




**Cup Brushes** ideal for flat surfaces. They allow to brush wide bands and ease surface finishing operations.




**End Brushes** suitable for holes and cavities cleaning. Filling material can be set inside holes. Once it starts spinning it will spread out allowing the cavity side walls to be brushed. For this same reason end brushes are not suitable for flat surfaces brushing.




## Choosing the Brush Shape

| APPLICATION | STEEL | STAINLESS STEEL | NON FERROUS |
|---|---|---|---|
| Edge Deburring and Radiusing |  |  |  |
| Holes/Bores Deburring and Radiusing |  |  |  |
| Rust/Scale Removal, Weld Cleaning |  |  |  |
| Descaling, Pickling and Coating Removal |  |  |  |

The brush shape is influenced by the mounting on the power tool or machine engine. Many brushes are manufactured with a threaded nut, plain bore or with a shaft depending on the tool, spindle-holder or mandrel they will be mounted on.

## Choosing the Brush Size

Brush Outer Diameter influences peripheral speed. Generally the larger the OD the lower the number of rotations to obtain the surface removal job. So less time to do the same work. In order to improve the efficiency it's recommended to choose the biggest Outer Diameter possible consistent with the tool selected, the tool guards and the tool maximum safe speed.

**Matching between maximum rotating speed and maximum tool diameter for the most common angle grinders available on the market.**

| MAX DIAMETER | 4-1/2"/115mm | 5"/125mm | 6"/150mm | 7"/180mm | 9"/230mm |
|---|---|---|---|---|---|
| MAX FREE SPEED | 12,500 rpm | 11,000 rpm | 9,000 rpm | 8,500 rpm | 6,500 rpm |

Be aware that the Outer Diameter of end brushes and cup brushes increase significantly when they rotate.
For related information, see Power, Speed and Pressure paragraph on page 110.

Select wire brushes with diameters ranging from 1mm - 0.04" to 1000mm - 40".
The products in our catalog provide recommended MAX RPMs.

## Choosing the Wire Diameter

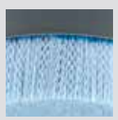
Wire size greatly influences surface brushing aggressiveness and the obtainable finishing.

Thin filaments are more flexible and have higher fatigue resistance but they are less aggressive. A bigger diameter gives higher aggressiveness but is also susceptibility to breakage.

This is why you should always try to use the thinnest filament possible compatibly with the desired finishing.

We offer filling materials with diameters from 0.10mm - 0.004" to 2.5mm - 0.1" and a product range that covers almost all of the possible brushing applications, from a light finishing to a heavy removal. Custom size for special applications are available upon request.

## Choosing the Wire Style

| WIRE STYLE | APPLICATIONS | ADVANTAGES |
|---|---|---|
|  **Crimped Wire** | Ideal for light-duty operations such as paint, rust, scales, light coatings (deburring gear splines) and small burrs removal; light deburring and pipe heads deburring. | High tensile strength<br>Suitable for high rotational speeds<br>Long lifetime<br>Cost/lifetime convenience |
|  **Twist Knots** | More aggressive than crimped wire, suitable for heavy-duty jobs. Weld preparation and cleaning (butt-welded pipes), large pipe heads deburring, heavy burrs removal and foundry applications. | High aggressiveness<br>Long lifetime |
|  **Smooth Synthetic Filament** | Suitable for soft surfaces cleaning, protection and sealing from air, dust, moisture and temperature (Strip linear brushes). | Great finishing<br>Optimal density<br>Dimensional stability (size retention) |
|  **Crimped Synthetic Filament** | Suitable for the removal of heavy dust and debris. | High resistance<br>Great stiffness |

## Choosing the Fill Density

Wire density affects the “hardness” of the brush surface: the thicker the wire, the harder the surface since there is a greater number of individual working tips (for a set area). High density brushes are characterized by lower penetration into the surface and smaller opening during processing. Wire density also affects the service life; distributing the brushing action among multiple tips of wire makes each filament less deformable. On the other hand, high density brushes accumulate greater frictional heat, therefore increasing the risk of overheating the brushed surface.

For example, pipe deburring operations require roller brushes made of different filling density depending on the diameter and the thickness of the pipe. Different sizes and thickness need different levels of interference.

## Choosing the Trim Length

The trim length affects the stiffness of the wires and the hardness of the brushing surface: a longer trim length improves the flexibility and the penetration of the part. A shorter trim length improves the lifetime: there is lower wire deformation which means lower mechanical stress and lower risk of wire breakage.

In case of applications with fixed pressure (constant during the application, as an absolute value, not related to the trim length) choosing a short trim length will require the use of stiff brushes and working with high pressures in order to obtain the desired penetration. The brushing is very aggressive but the filament is susceptible to fatigue breakage.

For a set angular velocity it’s better to choose a longer trim length in order to obtain the desired penetration (interference) with less pressure/load; the brushing will be less aggressive but it will have a longer lifetime and a better performance.


**+ TRIM LENGTH =**

- **+ Flexibility**
- **+ Penetration (Interference)**
- **+ Wire Deformation**
- **+ Peripheral Speed = Energy and Efficiency**
- **+ Vibration and Overheating**
- **+ Applicable Pressure**
- **+ Fatigue Failure Risk**

## Power, Speed and Pressure

Brush selection criteria considered until this point have to be evaluated together with the characteristics (power, speed and pressure) of the source of power since these have a strong influence on the surface finishing. For example, a higher pressure will increase the face width of the brush obtaining a smoother surface finish. Brush characteristics together with operating parameters will determine the output of the surface treatment job. The surface finish has to be evaluated in terms of operational quality and efficiency: they are not always matching.

Unlike a coated abrasive wheel, a wire brush isn't a metal removal tool. Wire brushes are "impact" or "cutting" tools made up of thousands of wire tips attacking and shattering the surface to remove the adherence—be it rust, paint, oxidation, burr or anything else. Also unlike coated, bonded, or nonwoven abrasive tools, power brushes work with lower risk of deeply cutting the part, changing its shape and/or damaging previous finishing.

TABLE 1

**Metallic Wire**

Recommended peripheral speed [m/s or ft/min] for steel wire wheel, cup and bevel brushes.

| M/S | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 | 80 |
|---|---|---|---|---|---|---|---|---|---|---|
| APPLICATIONS FT/MIN | 1,980 | 2,940 | 3,960 | 4,920 | 5,880 | 6,900 | 7,860 | 8,880 | 9,840 | 15,720 |
| Deburring and Radiusing | | - | - | | | | * | * | | |
| Weld Cleaning | | | | | - | - | | | | * |
| Descaling, Pickling, Rust and Paint Removal | | | | - | - | | | | * | |
| Structuring, Forming and Roughening | | | | - | | | | * | | |
| Cleaning, Dusting and Polishing | | | | - | | | | * | | |
| Treating Plastic Surface | - | | | * | | | | | | |

\- Extensions for strong metals (twist knots wire and encapsulated brushes). * Extension for light metals (S-Steel and non-ferrous metals).

TABLE 2

**Synthetic Filament**

Recommended peripheral speed [m/s or ft/min] for synthetic filament wheel brushes.

| M/S | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 | 80 |
|---|---|---|---|---|---|---|---|---|---|---|
| APPLICATIONS FT/MIN | 1,980 | 2,940 | 3,960 | 4,920 | 5,880 | 6,900 | 7,860 | 8,880 | 9,840 | 15,720 |
| Deburring and Radiusing | | | | | + | | | | | |
| Weld Cleaning | | | | | | + | | | ● | |
| Descaling, Pickling, Rust and Paint Removal | | | | | | | | | | |
| Structuring, Forming and Roughening | | | | | | | | | | |
| Cleaning, Dusting and Polishing | | | | | | | | | ● | |

\+ Extensions with coolant. ● Extension over 50m/s - 9840 ft/min with abrasive filaments HT150/250.

See table below to match the desired peripheral speed with the brush angular velocity and recommended diameter.

**Relationship Between Diameter, Peripheral (Angular) Speed and RPM**

$$v\ [m/s] = \frac{\text{Brush Diameter (D)} \cdot \pi \cdot \text{Revolutions Per Minute (RPM)}}{1000 \cdot 60}$$

**SPEED RPM**

| DIAMETER MM | | 40 | 50 | 80 | 100 | 125 | 150 | 180 | 200 | 250 | 300 | 350 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DIAMETER INCHES | | 1.5" | 2" | 3" | 4" | 5" | 6" | 7" | 8" | 10" | 12" | 14" |
| RPM | 800 | 1.7 | 2.1 | 3.3 | 4.2 | 5.2 | 6.3 | 7.5 | 8.4 | 10.5 | 12.6 | 14.7 |
| | 1,000 | 2.1 | 2.6 | 4.2 | 5.2 | 6.5 | 7.9 | 9.4 | 10.5 | 13.1 | 15.7 | 18.3 |
| | 1,200 | 2.5 | 3.1 | 5.0 | 6.3 | 7.9 | 9.4 | 11.3 | 12.6 | 15.7 | 18.8 | 22.0 |
| | 1,500 | 3.1 | 3.9 | 6.3 | 7.9 | 9.8 | 11.8 | 14.1 | 15.7 | 19.6 | 23.6 | 27.5 |
| | 2,000 | 4.2 | 5.2 | 8.4 | 10.5 | 13.1 | 15.7 | 18.8 | 20.9 | 26.2 | 31.4 | 36.6 |
| | 3,000 | 6.3 | 7.9 | 12.6 | 15.7 | 19.6 | 23.6 | 28.3 | 31.4 | 39.3 | 47.1 | 55.0 |
| | 3,500 | 7.3 | 9.2 | 14.7 | 18.3 | 22.9 | 27.5 | 33.0 | 36.6 | 45.8 | 55.0 | 64.1 |
| | 4,000 | 8.4 | 10.5 | 16.7 | 20.9 | 26.2 | 31.4 | 37.7 | 41.9 | 52.3 | 62.8 | 73.3 |
| | 5,000 | 10.5 | 13.1 | 20.9 | 26.2 | 32.7 | 39.3 | 47.1 | 52.3 | 65.4 | 78.5 | 91.6 |
| | 6,000 | 12.6 | 15.7 | 25.1 | 31.4 | 39.3 | 47.1 | 56.5 | 62.8 | 78.5 | 94.2 | 109.9 |
| | 8,000 | 16.7 | 20.9 | 33.5 | 41.9 | 52.3 | 62.8 | 75.4 | 83.7 | 104.7 | 125.6 | 146.5 |
| | 10,000 | 20.9 | 26.2 | 41.9 | 52.3 | 65.4 | 78.5 | 94.2 | 104.7 | 130.8 | 157.0 | 183.2 |
| | 12,500 | 26.2 | 32.7 | 52.3 | 65.4 | 81.8 | 98.1 | 117.8 | 130.8 | 163.5 | 196.3 | 229.0 |
| | 15,000 | 31.4 | 39.3 | 62.8 | 78.5 | 98.1 | 117.8 | 141.3 | 157.0 | 196.3 | 235.5 | 274.8 |

1m = 328ft - 1 m/s = 197 ft/min