

## How-to Choose and Use Non-woven Abrasives.

Abrasive products used for finishing of metal and non-metallic workpieces in the production plant are generally categorized into two main groups: bonded abrasives (usually grinding wheels) and coated abrasives (belts, discs, sheets, etc.). These are the products used to remove stock during the production process. But there is a third category of abrasives that serve a specialized and highly necessary function of preparing and applying the final surface finish, which can be critical to the performance and appearance of the workpiece. These are the non-woven abrasives. These products are manufactured using a “web” of nylon fibers that are bonded together (not woven together – hence the name) with synthetic resins. The fibers are impregnated with abrasive grain, producing a cushioned, three-dimensional material that is pliable, conformable to the workpiece, and long-lasting. Non-woven abrasives can be the ideal grinding products for deburring, cleaning, and imparting the desired finish to a wide variety of materials. A basic understanding of how these products are made, and how they should be selected and used to their maximum benefit, can help the metalworking manufacturer achieve the desired surface finish.

### The Role of Non-Woven Abrasives

It is often said that the job of non-woven abrasives begins where other grinding products leave off. The relatively non-aggressive nature of nylon and the abrasive grit used in non-wovens make them excellent finishing tools. With their open-mesh construction, non-wovens are waterproof, washable, and resilient. They resist loading and rusting, and are not conductive. In the standard non-woven design, abrasive grain is uniformly dispersed throughout the nylon web, providing a continuous supply of new grain as the old grain and fibers wear away during use. While 60 grit to 80 grit abrasives are considered intermediate sizes in other products, they are considered coarse for non-woven products. Non-wovens can be used on a range of metals, including aluminum, brass, copper, nickel, chrome plate, stainless steel, and titanium, as well as other hard-to-grind materials such as ceramics, glass and plastic. Used wet or dry, non-wovens enable the user to achieve a consistent, uniform finish, and conformability to irregular surfaces, with minimal smearing and discoloration of the workpiece.

### Components of Non-Woven Abrasives

While non-wovens are made in a different way than conventional coated abrasives, both types of products use many of the same abrasive minerals. Silicon carbide is sharper, cuts faster and produces finer scratch patterns on most surfaces. Aluminum oxide is more durable and tends to last longer. It is more aggressive on certain applications (such as hardened steel parts), and produces less discoloration on aluminum. When the non-woven supplier talks about grit, he is referring to the size of the abrasive grain impregnated into the nylon web. The lower the number, the larger the grains. Use of large particles (coarse grit) results in a more aggressive cut and a coarser finish. Small size particles result in a non-woven product that produces fine surface finish, if all other conditions are equal. In specifying a conventional bonded or coated abrasive product, the purchaser selects a specific grit size – say, 120 grit. With non-woven abrasives, by comparison, one of the following designations is used:

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## Components of Non-Woven Abrasives (continued)

### Grit Designation and Comparable Grit Ranges

Coarse (C) 50 – 80

Medium (M) 100 – 150

Fine (F) 180 – 220

Very Fine (VF) 240 – 360

Ultra Fine (UF) 600

Micro Fine (SF) 1000 – 1200

Another term used in specification that is probably unfamiliar to the buyer of conventional abrasives is density. This refers to the amount of bonding agents and amount of abrasive grain that have been compressed into the non-woven product. In general, harder density products cut faster, last longer and produce finer finishes than softer density products. However, softer densities offer more conformability to the work surface and less tendency to load or burn the workpiece. Two other factors in the design and manufacture of non-woven abrasives are the sizing of the nylon fibers and the bonding agents used. Fiber size has a significant effect on the product's cutting characteristics, while the type of waterproof resin used to bond the fibers together (and to anchor the abrasive to the web) can alter the characteristics of the product. The non-woven manufacturer selects the appropriate fiber size and bonding agent based on the intended application for the product; therefore, these components are not included in the product offering specifications.

A typical specification on a non-woven abrasive product might look like this: 8 A/O MED. The first symbol – in this example, the “8” – refers to the product's density. This can range from 2 (open/most conformable) to 9 (densest/ most durable).

The second symbol denotes the abrasive used. “A” or “A/O” refers to aluminum oxide, while “S” or “SC” stands for silicon carbide. The final designation – “MED” – denotes the grit size of the product, as outlined above.

## Products Designed for Application Needs

The basic non-woven design lends itself to a variety of product types that have been developed to meet a range of needs for metalworking and finishing. In general, non-woven abrasive products can be categorized into hand pads, rolls, discs, belts and wheels. Hand pads are designed to provide excellent conformability and flexibility when hand finishing the work surface. They are generally available in 6” x 9” sizes, but are easily folded into smaller sizes as needed. Grit sizes range from coarse grit, used for general cleaning, to micro-fine (1000 grit) for light scuffing and blending. In wet applications, many users choose a non-woven hand pad as a replacement for steel wool, because non-wovens are non-metallic and therefore don't rust. For broader applications, the user may select non-woven rolls. Offering a more convenient source of the same cleaning and finishing performance as hand pads, rolls are available in 30-foot lengths and widths of 4 in. and 6 in. The user simply cuts the roll to the required size for hand sanding or jitterbug sanding applications. Non-woven discs come in a variety of designs for many cleaning and finishing applications. Arbor hole discs are used on high-speed grinders. Extra coarse grit products may be used for removal of surface rust and residue, corrosion, light weld splatter and other surface contaminants. These discs can also be ganged with spacers to form a wide wheel used for sharp edge radiusing or deburring a decorative finish. Right-angle discs are used on portable grinders for cleaning, deburring, blending and finishing, as well as for the removal of light rust, oxidation and coatings. The latest advance in grinding for these applications is the development of “see-through” discs for right-angle grinding. These discs feature a uniquely shaped triangular profile and holes in the discs and back-up pads. This provides the operator with a clear view of the cutting surface, resulting in more controlled stock removal and a better surface finish. The holes also serve to disperse heat and loose grinding material, for a cooler finish and less power draw. Non-woven belts are used on portable, bench and pedestal bench machines as an effective alternative to coated abrasive belts for cleaning, buffing and polishing. The conformability of the belts result in minimal gouging of the workpiece, generating a more consistent finish. There are three types of non-woven wheels: Flap wheels are fabricated by mounting sheets of non-woven material around a center hub; the tightly packed pieces form the spokes of a wheel. This is the best choice where conformability to a surface or a long-line brushed finish is required. Convolute wheels are made by wrapping the non-woven material around a center core and bonding the layers together; these wheels can easily be shaped to match preformed parts. Unified wheels are formed by compressing multiple layers of non-woven web material and bonding them together to form a wheel; they are ideal for general purpose cleaning and deburring.

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## Making the Most of Non-Woven Wheels

Of all the non-woven abrasive product types, the wheel family requires the most care in set-up and operation. Maximum wheel life and best surface conditioning can be achieved by following these recommendations:

### **Wheel direction:**

Convolute wheels must always run in the direction indicated by the arrow printed on the side of each wheel. Flap wheels and unified wheels can be run in either direction.

### **Wheel speed:**

The speed at which the wheel is run affects product finish, rate of cut, and wheel life. Fast wheel speed, in general, gives harder action and a finer finish; slower speeds give softer action and a coarser finish. Following are recommended operating speeds for the most common applications.

- Cleaning and upgrading of surface conditions 2200 – 6000 SFPM
- Cut buffing on metal surfaces 6500 – 8000 SFPM
- Deburring 5500 – 8000 SFPM
- Decorative finishing 500 – 3000 SFPM
- Imparting decorative finishes 900 – 3000 SFPM
- Oxide removal 3500 – 6500 SFPM

### **Pressure:**

Light to medium pressure is recommended for most operations. Flap wheels require much lighter pressure to perform properly than other non-woven wheels; unified wheels can withstand much higher pressures in order to perform deburring jobs. In all cases, avoid excessive pressure, which may result in wheel deformation and damage to the work surface.

### **Feed speed:**

Feed speeds directly affect the number of pieces completed over a given time period. Slow feed speed reduces the number of completed pieces, while producing a shorter scratch pattern. Slow feed speed also allows for longer dwell time and permits more work to be done on each piece.

### **Oscillation:**

Oscillation may be used to break up scratch lines and produce a more uniform finish. An increase in cut may also be experienced. A general starting point for oscillation is 3/8 in. amplitude at 200 cycles per minute.

### **Lubricants:**

The use of lubricants such as water, water-soluble oil and straight oil will decrease the heat generated while running, improve the luster, and reduce the surface finish. The higher the viscosity of the lubricant, the lower the surface finish (RMS value) produced.

## Conclusion

This information will assist the user in selecting non-woven abrasives to complement their bonded and coated abrasives arsenal. However, it is important to remember that changes in any one of the many factors discussed here can affect the surface finish in the workpiece. Work in partnership with your abrasives supplier to make the wisest product and application choices by considering every facet of your operation. By taking this “system approach,” you will maximize the productivity of your non-woven abrasives applications.