



Overview

Coated abrasives are made from loose abrasive grains bonded to a backing. They are called “coated” because a coating of adhesive is applied to the backing to anchor a single layer of abrasive grain. Coated abrasives are available in sheets, rolls, discs and belts and are used primarily for finishing and light-to-medium grinding.

Most of the hazards associated with the use of coated abrasives can be traced to improper mounting procedures, back-up pad limitations or excessive speeds. Back-up pads may be stiff or flexible, rubber or plastic, smooth-faced for general-purpose finishing, rib-faced for air cooling, and have retaining nuts or speed-locking systems.

IMPORTANT: The maximum RPM at which a coated abrasive disc should be run is generally limited by the maximum RPM rating of the back-up pad.

Backing

Backings include cloth, paper, vulcanized fiber or a combination of these. The backing must be strong enough to withstand grinding pressures and flexible enough to conform to contours.

Paper

The lighter the paper, the greater the degree of flexibility. The heavier the paper, the greater the resistance to tearing. Standard paper weights used in coated abrasives are 40, 70, 90, 130 and 165 lbs. and are indicated by a letter code.

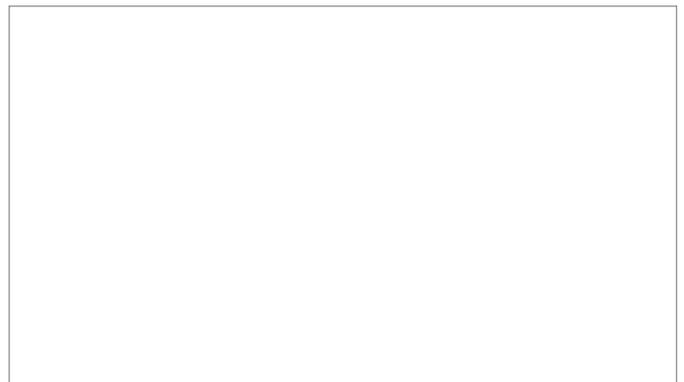
A-Weight (40 lbs.) – Light and flexible, A-weight is used primarily for wet or dry hand finishing operations. Grits 80 and finer.

C-Weight (70 lbs.) – Stronger and less flexible than A-weight. This backing is chosen for wet or dry hand sanding and for use on small portable power sanders. Intermediate through fine sanding. Grits 60 through 180.

D-Weight (90 lbs.) – Stronger and less flexible than C-weight, this backing is also chosen for hand sanding and for use on small portable power sanders. Coarse through intermediate sanding. Grits 36 through 80.

E-Weight (130 lbs.) – Stronger and less flexible than D-weight, this backing is used primarily on roll, belt and disc applications where high resistance to tearing is needed.

F-Weight (165 lbs.) – The strongest, least flexible paper backing used.



Backing (cont.)

Cloth

Cloth backings are more durable than paper, offer greater resistance to tearing and tolerate continual bending and flexing during use. The standard cloth weights used in coated abrasives are indicated by a letter code which appears immediately after the grit size.

J-Weight (Jeans) – The lightest and most flexible cloth backing, it is used where finish and uniformity of the surface are more important than stock removal. Ideal for finishing, blending and where considerable flexibility and conformity are required, such as contour work on curved surfaces.

X-Weight – Stronger and relatively stiff when compared to J-Weight, this backing is used on products designed for coarse grit stock removal applications through fine grit finishing and polishing.

H-Weight (Heavy-Duty) – The strongest cloth backing. It is used on coarse grit products designed for extreme pressure, heavy stock removal operations. Used exclusively with zirconia alumina abrasive.

Fiber (Resin Fiber Discs or RFD)

These fiber backings are made from multiple layers of impregnated paper and are very hard and strong, yet have sufficient flexibility for their intended application. They are primarily used for medium to heavy metal removal.

Adhesive Bond

Coated abrasives use one of two types of adhesives. One is based on animal glue and the other is based on synthetic, heat-hardenable resins.

The adhesive is applied with a minimum of two bonding applications. The first or “maker” coat adheres the abrasive grain to the backing, ensuring proper anchoring and orientation. After drying or curing, the second or “sizer” coat is applied. The sizer adhesive unites with the maker bond to provide final grain anchoring and proper total-adhesive level for the finished product.

Glue Bond

Glue has a tendency to soften from the normal heat of grinding. Glue bond products usually produce a more uniform, less harsh finish which, in the case of fine grits, can be easily buffed out.

Resin Bond

Resins offer greater heat resistance and are more durable in heavy stock removal operations. Resin bond products are the best all-around coated abrasives. However, they have a tendency to produce a harsher, more scratchy finish which, in the case of finer grits, is more difficult to buff out.

Flexing

Flexing is a controlled breaking of the adhesive bond that holds the abrasive grain to the backing with the aim of varying the flexibility and aggressiveness of a specific product. The direction, spacing and severity of the breaks must be closely controlled if the product is to meet the requirements of the application for which it is intended.

Abrasive Grain

The minerals used in the manufacture of coated abrasives are selected on the basis of their hardness, toughness, inertness, resistance to heat, fracture characteristics and particle shape. The ability of the grain or particle to penetrate the surface being abraded depends to a large extent upon the hardness and shape of the abrasive. The ability of the grain to resist breakdown and dulling under the stress of the grinding operation reflects its toughness.

The ideal abrasive grain offers maximum resistance to point wear, yet fractures before serious dulling occurs, thereby satisfying both stock removal and finishing requirements.

Aluminum oxide grains, brown in color, are extremely tough and wedge-shaped for high-speed penetration of tough materials without excessive fracturing or shedding. This grain is particularly well adapted to grinding high-tensile materials such as carbon steel, alloy steels, tough bronze and hard woods.

Zirconia Alumina grains, have a unique self-sharpening characteristic which gives them long life on rugged stock removal operations. Zirconia alumina is well suited for heavy grinding of metals and wood because the controlled fracturing of the grain continuously produces new sharp abrading points.

Ceramic grain, also known as Seeded-Gel or Sol-Gel, is the most costly abrasive grain. It is a premium, long-lasting grain which provides longer life and more consistent finishes. It is often blended with standard grains and engineered for specific applications. This grain is better for use on steel and thin stainless materials where burning or discoloration may be a concern.

Silicon Carbide grains, dark gray to black in color, are the hardest and sharpest of the minerals used in coated abrasives. This makes it the ideal abrasive for sanding non-ferrous metals (aluminum, brass, bronze, magnesium, titanium, etc.), rubber, glass, plastics, fibrous woods, enamel and other relatively soft materials.

Garnet grains, red in color, are made from crushing semi-precious garnet material. Not as hard or durable as synthetic abrasives, garnet fractures along the cleavage lines of the crude crystals, therefore the resulting grains have very sharp edges. Widely used in furniture and woodworking plants, particularly in finishing operations. Garnet dulls too rapidly for use in metalworking.

Emery grains, black in color, are a natural composite of corundum and iron oxide. The particles are blocky in shape and tend to cut slowly, which polishes the material being abraded. Used for general maintenance and polishing of metals and, in very fine grits, for highly technical polishing such as preparing metallurgical specimens requiring very close tolerances.

Crocus consists of iron oxide particles in natural or synthetic form. Used mostly for cleaning corroded surfaces of polished metals where a minimum of stock removal is desired, crocus is also used for polishing gold and other soft metals.

Abrasive Grain or Grit Size

After the crude abrasives have been crushed, the grains are separated (graded) into standard particle sizes with screens. The grit number (mesh number) appearing on the coated abrasive backing represents the approximate number of openings per linear inch in the final screen. Coated abrasives use grain sizes graded from 12 to 600, however not all products are available in the complete range.

The following is an approximate comparison between grit size and mesh numbers.

Extra Fine – 600 to 320	Fine – 180 to 120	Coarse – 60 to 50
Very Fine – 280 to 220	Medium – 100 to 60	Very Coarse – 36 to 25
		Extra Coarse – 20 to 12

Abrasive Grain Treatments

Coated abrasives are generally manufactured in two levels of abrasive grain surface density.

Closed-Coat

The abrasive grains completely cover the coated surface of the backing. The greater number of abrading points per square inch causes faster stock removal during use and produces a better finish than open-coat. Closed-coat is recommended where loading is not a significant problem.

Open-Coat

The abrasive grains cover approximately 50% to 70% of the coated surface of the backing. Open-coat abrasives are the best choice where clogging or filling of the abrasive surface would otherwise be a problem. They offer greater flexibility, but are harsher cutting and do not provide as good a finish as closed-coat. Wood, soft metals and fiberglass sanding are typical applications for open-coat products.

Special Product Treatment

Some products are given additional special treatments during the manufacturing process in order to make them even more suitable for specific applications. Such treatments include No-File and PSA.

No-File Treatment

In order to provide even better resistance to loading, some open-coat paper products are given a special surface treatment of zinc stearate after the sizing operation. These products are ideal for sanding between sealer coats on furniture, sanding after primer coats on automobiles, removing varnish from wood, and numerous other operations where conventional abrasive products fail prematurely due to loading.

PSA (Pressure-Sensitive Adhesive) Treatment

Some paper and cloth products have a special PSA coating applied to the reverse side of the backing. This offers peel-and-stick convenience and eliminates slippage between the sander back-up pad and disc. Discs are mounted on the rotating plates of table top grinders, the back-up pads of portable grinders or the pads of special vibrating sanders.

Coated Abrasive Storage

Stored under proper conditions, coated abrasives will retain their efficacy and usefulness over long periods. Improper or inadequate storage can introduce problems such as weakened bond, curl, brittleness and breakage. Temperature and humidity are the two most important factors influencing coated abrasive performance. Backings and adhesives are sensitive to changes in relative humidity which can cause them to gain or lose moisture.

Excessive humidity may soften some types of adhesive bonds, causing the product to quickly fill and clog during use.

Excessive dryness may cause brittleness, reduced flexibility and distortion. As moisture in the coated abrasive product increases or decreases, dimensional changes can occur. When the backing changes more than the adhesive bond, it causes cupping. High and low humidity can cause concave and convex cupping respectively.

- Constant levels of humidity and temperature should be maintained. Stockroom temperature should be 60°F to 80°F and relative humidity between 35% and 50%.
- Cartons should be kept away from damp or cold walls and floors where they may absorb moisture.
- Store coated abrasives away from heat sources such as steam-heated radiators, steam pipes, hot air inlets, heat ducts or rooms near furnaces or ovens.
- Keep products in their original packages. These packages facilitate handling and practical, convenient stacking.
- Bulk rolls should not be stored on their edges after they have been unpacked. Store flat on shelves or pallets.
- Belts that have been removed from the packing case should be rolled up and stored on edge on a clean shelf. Belts may be draped over a large cylinder such as a gallon can, brake drum, or flanged hanger of the type used for garden hose. Never hang a belt from a nail; the backing will crease and the abrasive may crack.

Portable Disc Grinder

Never use a disc that overhangs the back-up pad by more than 1/4". Some discs are manufactured with an irregular periphery. The overhang should not exceed 1/4" at the smallest radius. Always ease the disc onto the work. Start grinder just off the workpiece and begin grinding immediately. Operate the grinder with disc and pad inclined approximately 5° to 10° from the work surface. Grind depressions, moldings, lips and heavy welds by moving the grinder away from the work area and not into it.

- Do not store or rest the grinder on the disc and pad.
- Always use the proper back-up pad support, one stamped with the maximum RPM.
- Never use another grinding disc as a back-up pad.
- Never use a disc larger than the diameter specified by the grinder manufacturer.
- Never use a back-up pad without first inspecting it for signs of irregularities such as fractures, excessive wear, and nicks or cuts at the edges or in the center hole. Check the pad for concentricity.
- Use only pads with marked maximum RPM and never exceed that maximum RPM.
- Check the spindle for wobble.
- Check the disc retainer nut for thread wear, snug fit and full three-thread contact except when using quick-change or non-wrench systems.

Equipment Precautions

- Most coated abrasive machine hazards are the same as those of machines in general; relatively few arise directly from the use of the abrasive. Since grinding and polishing are often done at high speeds, all machines should be properly adjusted, well lubricated and in good general working order. This is important for the quality of the finished product as well as for safety, since vibration in almost any part of the machine may affect the quality of the finished surface of the workpiece.
- The sparks created by grinding should be directed downward and away from face and body. Do not grind near flammable material. Spark screens of non-flammable material should always be used.
- Electric portable machines are not intended for use in or near water. This includes an operator standing on a wet floor or working around containers of water or other conductive liquids.
- All grinding machines and power tools should be operated in a well-ventilated area. The dust created when some materials are ground or sanded can be harmful. Dust masks are recommended as a practical means of minimizing dust inhalation. Fumes from other sources, such as solvents, can also cause fires or explosions when in contact with grinding sparks. Dust collection bags should be emptied frequently during use to maintain efficiency and to prevent buildup of combustible material.

Abrasive Precautions and Use

Examine tools carefully before use. Never use an abrasive belt with a nicked or cut edge, a crease, or handling damage. Never use discs with nicks, cuts or tears at the edge or at the center hole.

Offhand Abrasive Belt Grinding and Polishing

- Find the arrow on the back of the abrasive belt and install it in the running direction of the contact wheel.
- Make sure that the abrasive belt fully covers the face of the contact wheel. A partially uncovered contact wheel face will cause snagging and throwing of the workpiece.
- Jog machine to start abrasive belt tracking. A sudden full-power start could cause the belt to track off the machine.
- Too much tension can break the abrasive belt. Adjust belt tension to the minimum sufficient to ensure good contact with the drive and idler pulleys so that the belt will track properly under both startup and grinding conditions.

Surface Finish Variables

Changes in any one of many factors can affect the surface finish of a workpiece. The chart below shows the effect on surface finish by changes in single factors of product specifications. Arrows have been used to signify the trend direction. The lengths of the arrows have no significance as the effect of each variable factor is not equal. The chart is meant to show general direction or trend.

Variable Factor	Rough Surface	Smooth Surface
Grit Size	Coarse	Fine
Product Condition	New	Used
Adhesive Bond	Resin	Glue
Coating Method	Open-Coat	Closed-Coat
Belt Speed (SFPM)	Slower	Faster
Grinding Aid	Dry	Grease
Abrasive Mineral Type	Aluminum Zirconia	Emery
Workpiece Hardness	Softer	Harder

Grinding (Cutting) Efficiency of Coated Abrasive Products

The chart below serves as a general guide of the effect that a change in a single given factor in the specification will have on the cutting efficiency of coated abrasive products. Some important machine and set-up parameters have also been included since they have significant impact on product performance.

Variable Factor	Rough Surface	Smooth Surface
Workpiece Feed Speed	Slower	Faster
Coated Abrasive Belt Speed (SFPM)	Slower	Faster
Coated Abrasive Belt Length	Longer	Shorter
Abrasive Product Condition	New	Used
Grit Size	Coarse	Fine
Product Durability	Fiber	Paper
Abrasive Mineral Type	Aluminum Zirconia	Emery
Abrasive Bond	Resin	Glue
Coating Method	Closed-Coat	Open-Coat
Pressure	High	Low
Grinding Aid	Straight Oil	Dry
Workpiece Hardness	Softer	Harder