PACER Centerless Grinding Wheels

"NT" Resin Bond for Roughing
Cork Filled, Rubber Bond for Finishing
Resin / Cork Combination for Doing Both

NT Resin Bond Wheels

Pacer "NT" (New Technology) resin bond wheels are designed for centerless grinding. These patented wheels are bonded with a new type resin having greater tensile strength, elongation, and adhesion to the abrasive grain. The new wheels are tough but don't act hard on the work.

The advantages of the improved resin for centerless wheels are several. The wheels generally are found to be smoother acting. They remove heavy stock or light stock with a quiet, non-chattering, non-glazing efficiency. This is due to the ability of the bond to elongate or give a little under pressure. Some resilience is a characteristic of most resin wheels. Because of the patented resin and other formula characteristics, NT wheels are more so.

Bond resilience but toughness is an advantage when grinding long bars. The wheel stays on the work even though a bar may be somewhat bowed, out of round or above center. It still can hold close tolerances because it breaks down in a moderate but steady manner. By the right choice of NT wheel, machine settings and coolant, most work can be roughed with little if any redressing. Self-dressing should be a goal with thrufeed centerless grinding applications because of the time savings as well as greater tolerance and finish control.

Customized Wheels for Special Jobs

Pacer specializes in centerless grinding wheels. It is able and willing to customize wheels for a particular job but still ship within a very short period of time. Contact the factory for sales or application info. **1-800-225-0315**

For example, a one piece wheel can be made having a layer of 60 grit for roughing and a layer of 80 for semi-finishing. This does not give the polish of a resin/cork combination but can provide results not possible with either a 60 or 80 grit alone. Other grits can be chosen. For wide machines, coarse, medium and fine grit wheels can be combined. Very fine grit wheels are available.

Stainless Steel - A Better Way

A type of centerless grinding that NT wheels handle very well is stainless steel. Stainless has always been a difficult family of steel to grind, especially the austenitic 300 series. It heats up easier and can lose straightness. It is relatively gummy and tends to load wheels. Stainless is more difficult to finish smoothly and tear free.

A traditional wheel for stainless is either vitrified bond having silicon carbide grain or resin bond having 50% silicon carbide/aluminum oxide grain. Vitrified wheels are insensitive to rising work temperature and tend to load more than do resin bond types. A vitrified finish on long bar may be somewhat rough. Typical resin bond wheels are usually better on long bar but have their own problems. The tearing action of stainless on abrasive grains requires a relatively hard resin bond. The high resin/filler content limits the space available for chips to form - possibly causing cutting or loading problems.

Pacer NT wheels having 100% silicon carbide perform well on stainless. The special NT resin and sharper abrasive enable the wheel to be more free cutting - just what is needed for stainless steel. Since NT resin has more tensile strength and grit adhesion, less bond is needed in the wheel. More space is available for chip

formation. Wheel pressure often is less as is the heat generated. Long bar thus tends to remain straighter. The finish from moderate to light passes is excellent - bright and smooth. SiC/AlO (CA) mixed grains are available.

For high thrufeed rates, Ampco 18 or 21 bronze blades are recommended. Carbide can gall at high thrufeed. Bronze often is used flat. A 6" wide C60P7NT wheel can remove .005" from 3/8" dia, 303 ss bars at 40 ft/min while loosing only .0004" per 12' bar. Call for details.

Cork Filled, Rubber Bond Wheels

The Pacer cork wheel can do work that would be very difficult with any other type grinding wheel. It is made up of fine abrasive grain, a hard rubber bond and a high concentration of small cork wood granules. The abrasive grain is evenly distributed throughout the entire wheel to promote consistent finishes for the life of the wheel.

The rubber bond is very important. Some wheels are referred to as being cork wheels but have a resin or epoxy bond. They do not polish as do Pacer hard rubber wheels. Rubber is best for resilience and smoothness.

Other than the light tan color and cork specks on the surface, Pacer cork wheels appear little different from traditional wheels. There is, however, a considerable difference in performance. The combination of the slightly resilient bond and unique cork material allows the abrasive grain to be cushioned during grinding. The effect is that the grain acts less aggressively on the work. This plus a mild polishing action by the cork/bond combination generates a bright finish of fine quality.

Gives The Finish Wanted

Depending on the choice of grain size, results vary from mirror finish with virtually no removal to very good with several thousandths removal. The actual results are determined by conditions that vary with each application. The following table may serve as a guide for centerless grinding. More removal per pass is possible but the finish may be less good and wheel life may be shorter.

Abrasive Grain	**Finish** (Ra)	**Removal** (max)
A120	16 to 20	.002"
A180	12 to 15	.001"
A240	8 to 11	.0005"
A320	5 to 7	.0002"
A500	2 to 4	.0001"

More Grinding - Less Dressing

The difficulty with fine finishing is that very light cuts produce little pressure on a grinding wheel. Wheels well suited for heavy stock removal tend to glaze and load on light removal. The grinding pressure is insufficient to dislodge the flattened, worn abrasive grains. When the wheel glazes badly, it is ready to be dressed. Depending on the job characteristics, this may occur from every several hours to as often as every several pieces.

In order for a standard wheel to polish, it should be slow dressed. A wide wheel may require minutes just for the diamond to pass one way. After dressing the wheel properly, it and the part are gradually are brought together again. Measurements are made in order to reset the size. Add all these plus other associated steps and it is apparent that considerable machine time can be lost.

True Ground Finish - Not Burnished

An important aspect of centerless polished parts is that of surface quality. Microscopic analysis has shown that a wheel-burnished surface, although appearing bright and with a low Ra reading, actually may be unsatisfactory. This is because the peaks have been forced into the valleys. Should the part then be chrome plated, trapped chemicals and oxidation of folded but rough edges may later appear on the job. Unplated parts would have the same potential to stain and rust. Parts subjected to linear wear may show premature surface degradation.

An advantage of the cork wheel over a harder grinding wheel is that the abrasive grains are not held after their useful cutting life. When grains dull and start to burnish, the force dislodges them from the wheel surface. The finish generated is a result of very fine cutting rather than burnishing. Additionally, cork wheels grind more coolly.

Speed Roughing - Speed Finishing

The goal of an efficient grinding operation is to keep the parts moving through it as quickly as possible. Wheels should be chosen such that the machine speeds are at their practical maximum and downtime is at its minimum. If a compromise standard wheel is used for both heavy stock removal and fine finishing, extra time very likely will be spent on each operation.

The wheel may not be coarse and hard enough to remove maximum stock per pass. It probably would be too hard to polish without frequent dressing. Utilizing a cork wheel for finishing, however, would speed the secondary operation as has been discussed. It also would allow use of the fastest cutting wheel for the first operation.

Minimizes Undersize Rejects

The possibility of going undersize is frequently a concern when performing a finishing operation. The fine dressed, standard wheel requires significant grain pressure against the part. A sudden breakdown of its surface due to grain being ripped out may cause deep scratches and the wheel to cut more deeply. Since the finishing operation typically has little tolerance to spare, this could take the part undersize.

The cork wheel, being designed for the job, breaks down gradually and in a predictable manner. The wheel pressure is lighter for this final pass. Parts being finished by a cork wheel may be done so with the confidence that going undersize is very unlikely.

Handles the Tough Jobs

Tube polishing presents a special problem. Excessive wheel pressure tends to deflect a thin wall. The cork wheel, however, can cut with light pressure. As a result, it more easily generates proper dimensions and finish.

Stainless steel, because of its stringy chips, can cause wheel loading and workpiece galling. Cork wheels effectively polish stainless due to their free cutting ability. Their low surface porosity prevents chip loading.

Aluminum and brass are even harder to polish than stainless. Their low tensile strength exerts little force on dull abrasive grain in a hard wheel. The wheel can become glazed and loaded. Pacer cork wheels have been used on both materials and with excellent results.

Machine condition is an important factor in quality of finish. Worn spindle bearings, vibration and less than perfect set-up can cause problems for a hard wheel. Cork wheels are slightly resilient. They can absorb some effects related to machine condition and still polish as expected. Operators like cork wheels because they are easy to use and can handle work that would be a real struggle with hard wheels. Some job shops make frequent use of cork wheels as their signature of quality.

Typical Applications

Hydraulic piston rods - pre and post chrome plating
Turned, ground and polished barstock
Stainless bars
Tubing - from .010" to 10" diameter
Linear bearing bars
Shock absorber rods and struts
Roller or needle bearings and races
Automotive wrist pins, rocker arm shafts, valve stems
Carbide rods and punches
Chrome, brass, aluminum for decorative finish

Operating Recommendations

Cork wheels must be run wet. The nozzle should be full width and positioned close to the grinding nip. The coolant flow should be high and directed into nip. If the flow is merely into the general area, it may be blown from the nip by wheel air turbulance. A cork wheel not adequately coolant covered will soon load as evidenced by a noticeable black layer where it is running dry.

Coolant type and concentration are very important. Too much oil loads cork wheels. Synthetics usually are best but solubles are satisfactory if concentrations are 2% maximum. Too much oil produces a thick black layer on the wheel face. The wheel will not cut properly. Heat, poor finishes and erratic dimensions will result.

The feed wheel must be dressed and angled so that the work will entrance grind instead of exit grind. If the work first contacts the wheel toward the exit end, it is exit grinding, a condition that usually gives poor finish and wheel life. Correct the feed wheel and guides so the work first contacts the cork wheel at the entrance.

Since cork wheels are slightly resilient, the feed wheel initially will need to move in more than the amount to be removed. Carbide blades usually are suitable but for fine finishes, other types often are used such as aluminum-bronze, thermoplastic or hard wood. Wood imparts an extra shine on the work. It could be one piece or a pad bonded to a steel blade. A small or no angle works well.

Start by maximizing the rotational speed and minimizing the traverse speed. This gives the work more exposure time with the wheel. The rotational speed should be less than that which whips the work or vibrates the machine. Gradually increase traverse to find optimum speed/finish.

Resin/Cork Combination Wheels

A resin/cork combination wheel consists of an NT resin section and a cork section. The sections are separate wheels that mount on the spindle in a sandwich manner. For wide machines, there can be two resin sections and a cork or one resin and two cork sections. The resin and cork sections are specially formulated to work together. They wear at the same rate in order to maintain the same roughing/finishing performance hour after hour.

As the bar or piece travels past the combination wheel, the resin section removes most of the stock. The cork section then removes the rest including roughing marks and spiral lines from the first. Because the resin wheel is hard, thrufeed can be higher than with a cork wheel alone. Because the cork wheel is soft, the finish can be better than with a resin wheel alone at the higher thrufeed rate.

A typical combination wheel is equal widths of 120 grit resin and 240 grit cork. Other grit or width combinations are available. Removal by the NT resin is surprisingly good as is the finish by the cork. The surface is uniformly polished from end to end; often including low areas, if any. It is a finely ground surface, not burnished.

Applications of Combination Wheels

Reducing two pass operations to one pass.
Work presently needing both a roughing and a finishing pass might need only one combination pass. This applies if the purpose of the second pass is mainly to improve finish. The NT resin section roughs while the cork section finishes. Total removal should be moderate.

Improving the finish of one pass operations.
Work presently needing only one pass might be done with a combination wheel. The finish could be better. As above, the removal should be moderate. Too much would break down the wheel excessively. Size would be more difficult to hold and the finish would be affected.

Improving the finish of secondary operations.
Work presently needing heavy removal on previous passes and only light removal on the final pass could use a combination wheel on the final pass instead of a roughing wheel. It is better suited for light removal because it can gradually wear instead of gradually glaze.

Replacing cork wheels in some cases.
For certain work, cork wheels used alone are the best choice. They are easy to use, produce excellent finishes and always are smooth acting on difficult jobs. For high thrufeed rates, heavier removals or very close tolerances, they are limited because of faster wear. The resin section of a combination, however, wears slowly. The cork section finishes similarly to a cork wheel used alone.

Operating Recommendations

Because the cork section wears little, it is more prone to loading with soluble oil. Synthetic may be necessary. If reducing two passes to one, the thrufeed rate may need to be lower than previously set. Pass some work through until the two sections develop the necessary taper for simultaneous roughing/finishing. The following must be correct to avoid excessive cork wear and poor finishes:

feed wheel swing angle (set to avoid exit grinding)
feed wheel tilt angle (depends on thruspeed wanted)
feed wheel truing angle (depends on tilt angle)
feed wheel diamond setover (depends on work height)
work blade height and condition (level, no gouges)
work guide position (set to avoid a wheel/work angle)

Improper use of grinding wheels can be dangerous. Follow the instructions set forth in the ANSI B7.1 American Standard Safety Code for "The Use, Care and Protection of Abrasive Wheels."

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