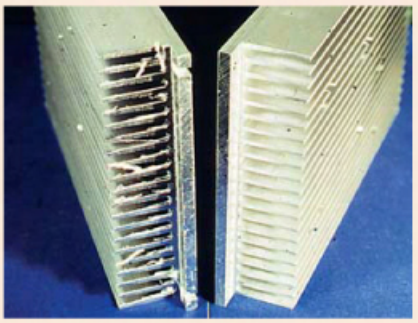
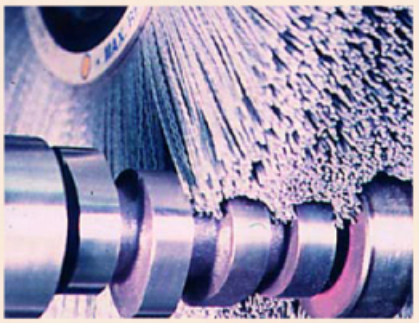
Operational Advantages of Nylox® Brushes

The One-Step Brush



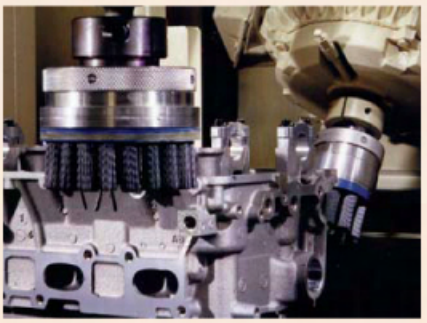
Nylox® Brushes deburr and finish in one set-up, saving users time and money.

Work Like A Powered Flexible File



Filaments composed of nylon and abrasive grain act like flexible files deburring and edge blending as they wipe. Nylox brushes are compliant deburring and finishing tools with a unique combination of aggressiveness and flexibility. While their aggressiveness allows them to be effective in demanding applications like deburring steel gears, the conformability of the individual filaments permits them to deburr and finish complicated part shapes.

Ideal for Automated Processes



Nylox Brushes are non-loading and better suited for automated processes than most other brushing and abrasive tools. Because Nylox brushes are more conformable, they can normally be used without ultra-precise programming and fixturing. This makes set-ups easy and ensures that parts remain within specification in spite of process variation. Nylox brushes are also ideal for use in CNC machining centers.

Construction Advantages of Weiler Nylox Brushes

Weiler's Nylox Composite Hub Construction

- Molded hub construction eliminates filament breakage.
- Uniform distribution of fill material and superior balance.
- High fill density provides more aggressive brushing and longer life.
- Consistent performance as the brush wears.

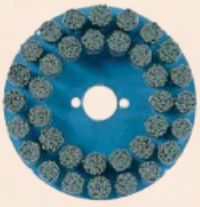
Weiler's Nylox Composite Metal Hub Construction

- Filaments retained using the latest polymer technology to prevent filament breakage.
- Metal retaining components add impact resistance and dimensional stability.
- The highest filament density in the market ensures lowest cost-per-part.
- All NMX brushes have 2" arbor holes for easy mounting without adapters.

Competitor's Metal Hub Construction

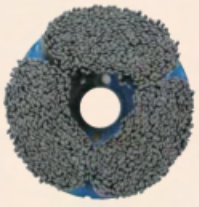
- ¥ Metal hub components are assembled under high pressure, damaging the nylon filaments, causing premature filament breakage.
- Inner wire wrap displaces filament material creating a void in the center of the brush face.
- Less filaments result in reduced brush life.
- Inconsistent performance as the brush wears.

Weiler's Nylox Tufted Construction



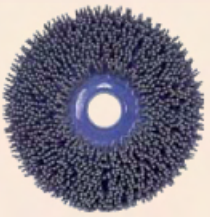
Weiler's construction offers increased aggression due to added filament density. This enables processing of severe burrs or generating larger edge radii in shorter cycle times. Our longer trim length allows for greater conformability and increased life, producing more parts-per-brush.

Weiler's Nylox Burr-Rx Construction



Burr-Rx brushes are uniquely suited for demanding applications characterized by large burrs and rapid feed rates. The brush filaments are specially designed to maximize aggression, and the brushes are manufactured with a high packing density, which extends life.

Competitor's Monofilament Construction



This construction is less aggressive due to lack of filament density. This hinders processing of severe burrs or generating larger edge radii in shorter cycle times. The short trim length results in less conformability and decreased brush life, resulting in fewer parts-per-brush.

Product Attributes

Brush Terminology

Abrasive Filament

- Abrasive grain extruded throughout the filament
- Good toughness
- Excellent fatigue properties
- Chemical resistant
- Moisture resistant
- Heat resistant
- 90% bend recovery

A microscopic view shows abrasive grain impregnated Nylox® filaments.

Abrasive Grains

Silicon Carbide

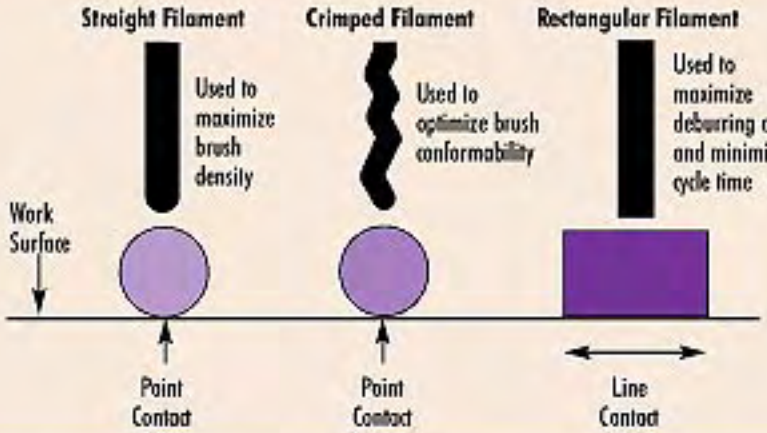
- Used in the majority of applications
- Most cost-effective grain type
- Less than 0.1% Iron Oxide and no free Iron

Aluminum Oxide

- Produces finish with more luster
- Use on soft and precious metals
- Prevents discoloration on certain alloys of titanium, aluminum and stainless steel
- Use for wood applications

Filament Shape

Note: All Straight and Crimped Filaments have a round cross section.



Filament Size

Smaller filaments = better conformability

Larger filaments = higher aggression

Filament Diameter	.010	.012	.018	.022	.030	.035	.040	.040	.060
Grit Size	1000 1200	600	500 600	120 320	240	180	120	80	46

Starting point for most aluminum deburring applications.

Starting point for demanding applications, especially on cast iron and other ferrous materials.

Nylox® Brush Operating Information

Operating Speed

Nylox® abrasive brushes work with a wiping and filing action. Think of them as flexible files. They work best when operated at speeds that allow fairly deep penetration of the work-piece into the brush filaments. **Usually, faster speeds do not work as well as slower speeds. The maximum RPM marked on the brush is not the optimum working speed. A good rule of thumb is to stay under 3,500 SFPM.**

Operating Speeds - Nylox Wheel Brushes

The maximum RPM for Nylox wheel brushes is not the recommended operating speed. In some cases, the maximum RPM is almost double the optimum operating speed. *For best results,* Nylox wheels should be operated at speeds below 3,500 SFPM (Surface Feet Per Minute). Below are recommended *starting* speeds.

Diameter	RPM
2"	4,000 - 6,000*
3"	3,000 - 4,000*
4"	2,000 - 3,000*
6"	1,500 - 2,000
8"	1,200 - 1,500
10"	1,000 - 1,200
12"	800 - 1,000
14"	800 - 900

* Recommended speeds for single-brush operation. If brushes are ganged for bore deburring, the recommended starting speed range is 750-3,500 RPM depending on brush diameter and application requirements.

Operating Speeds - Nylox Disc Brushes

The maximum RPM for Nylox disc brushes is not the recommended operating speed. In some cases, the maximum RPM is almost double the optimum operating speed. *For best results,* Nylox discs should be operated at speeds below 3,500 SFPM (Surface Feet Per Minute). Below are recommended *starting* speeds.

Diameter	RPM
1-3/4" & 2"	1,750 - 2,000
3"-4"	1,500 - 1,750
5" - 6"	1,250 - 1,500
8"	800 - 1,000
10"	700 - 800
12"	600 - 700
14"	500 - 600

Wheel Brush Penetration

When using nylon abrasive wheel brushes, optimum aggression is obtained and wheel life maximized when the work-piece penetrates into the face of the brush approximately 1/8 of the trim length. The sides of the Nylox filament actually do the work. To achieve a maximum edge radius and complete burr removal, parts should be buried into a slow running brush face.

Disc Brush Penetration

When using nylon abrasive disc brushes, a good starting point for a depth of penetration between the brush face and work surface is 0.100". This depth of interference produces the best compromise between aggression and brush life. The feed rate starting point of Nylox disc brushes is 18"/minute. This feed rate should then be adjusted faster or slower to achieve optimum operating conditions. On soft materials and parts with small burrs, much higher feed rates can normally be achieved.

Spindle Diameter and Horsepower Requirements:

The Spindle Diameter and Horsepower Requirements for Power Brushes should also be used for Nylox Brushes. See pg. 18 for more information.

Lubricut™ Lubricant

Prevents Smearing. Improves the Finish. Lowers Costs.

Lubricut™ is a lubricant that can be used with Nylox wheels operating above the recommended surface speed. Directing a light spray of Lubricut into the face of the wheel permits the wheel to be operated at higher surface speeds and up to twice the normal load without smearing - while improving the finish.

1. Turn off machine.

2. Slowly rotate wheel by hand.

3. While rotating, direct a light spray of Lubricut into the wheel face.

CNC Operating Parameter Selection

The need to simultaneously improve deburring consistency and reduce direct labor input has created a new machining catch-phrase - "in-machine deburring". Weiler provides a wide assortment of deburring products that can be readily adapted to CNC equipment and other automated processes. By combining these products with Weiler's technical application experience, users are able to achieve better part-to-part consistency and lower direct labor costs without increasing maintenance costs or damaging CNC equipment.

Parameter Summary

Brush Diameter	Disc Brush Spindle Speed (RPM)	Wheel Brush Spindle Speed (RPM)	* Wheel Brush Depth of Penetration	** Disc Brush Depth of Penetration
1-3/4" - 2"	1750 - 2000	4000 - 6000	10% of trim length	.040" - .150"
3" - 4"	1500 - 1750	2000 - 4000	10% of trim length	.040" - .150"
5" - 6"	1250 - 1500	1500 - 2000	10% of trim length	.040" - .150"
8"	800 - 1000	1200 - 1500	10% of trim length	.040" - .150"
10"	700 - 800	1000 - 1200	10% of trim length	.040" - .150"
12"	600 - 700	800 - 1000	10% of trim length	.040" - .150"
14"	500 - 600	800 - 900	10% of trim length	.040" - .150"

NOTE

For operating parameters for Burr-Rx brushes, see page 83.

For operating parameters for Bore-Rx brushes, see page 85.

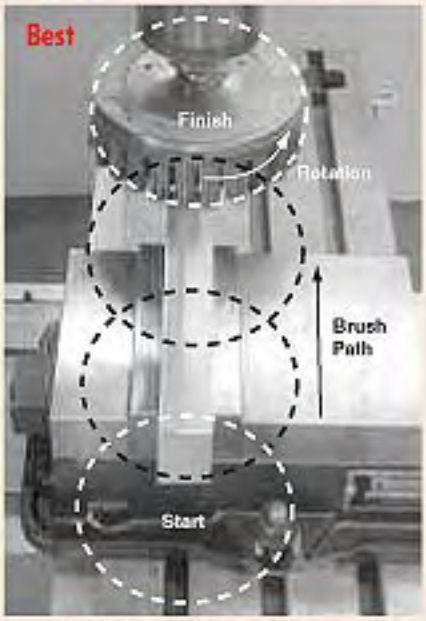
* Call Weiler's Application Engineering Department at 888-299-2777 if this depth of penetration is not aggressive enough.
** Set depth of penetration when the brush is rotating at the operational speed. Use .100" depth of penetration as a starting point for all disc brush applications.

See Applications Solutions Guide on page 74 for troubleshooting information.

Tool Path - The ideal tool path for a Nylox® Disc brush is very similar to the path of the face mill that produced the burr. However, three differences exist:

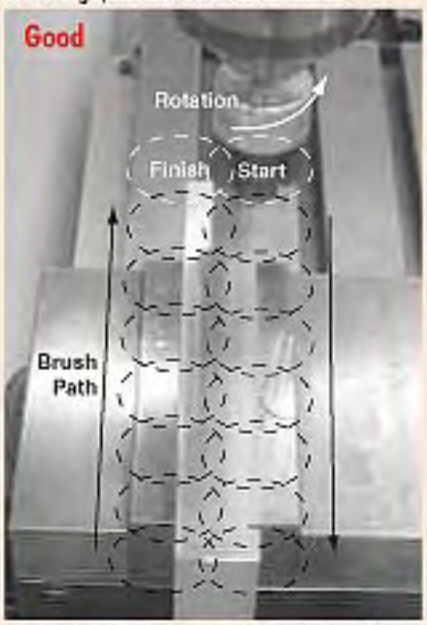
- The rotation direction of the brush should be opposite of the cutting tool that created the burr.
- The length of the path must be longer than the part. Unlike a cutter path that can stop when the leading edge of the cutter reaches the end of the part, the tool path of a brush should continue until the trailing edge of the brush reaches the end of the part.
- The centerline of the brush may need to be off-set from the center of the part in order to maximize the number of filaments that strike the part at a perpendicular angle. This is especially important when the diameter of the brush is similar to the width of the part.

A The part is deburred in the shortest cycle time with the lowest consumable cost-per-part.



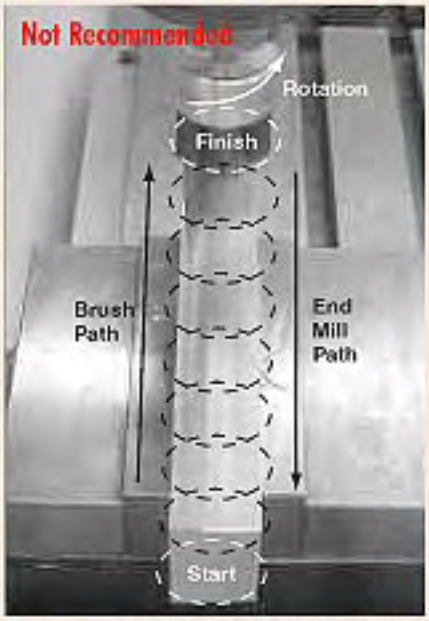
If a large diameter brush can be used, the centerline of the brush should be positioned on the center of the part. Ideally, the brush should be 3-4" wider than the part.

B The part is deburred, but requires a longer cycle time. When a large brush will not fit in the tool changer, this method is recommended.



If a small diameter brush must be used, the centerline of the brush should be positioned on the edge of the part. This maximizes aggression by increasing the amount of perpendicular contact between the brush filaments and the burred edge.

C Produces less deburring than A & B.



Positioning a small diameter brush with its centerline on the center of the part is not recommended. This configuration will not allow perpendicular contact of the filaments against the burred edge.

CNC Operating Parameter Selection (Continued)

Feed Rate Recommendations

Feed rate is determined by the amount of deburring, edge radiusing or surface finishing required, and the type of material that is being processed. It is generally application specific. Slower feeds result in a more aggressive brushing action. Based on the brushing action desired for a specific application, the feed rate can be increased or decreased.

Material	Feed Rate
Non-Ferrous	50 in./min.
Cast Iron	30 in./min.
Mild Steel and Ductile Iron	25 in./min.
Stainless and Alloy Steels	15 in./min.

Coolants

Nylox® brushes can be run dry, without coolants. However, certain deburring conditions, such as higher speeds, material properties and greater depth of penetration can create excessive heat buildup, causing the nylon filaments to melt and smear on the work surface. If the speed or depth of penetration cannot be changed, coolants are recommended to overcome heat smear. Coolants will also help produce finer finishes.

Wear Compensation

On dedicated equipment, it is possible to automate wear compensation by using electronic controls to monitor the load on drive motors and adjust the position of the brushing tool to maintain a relatively consistent amount of interference or pressure. Since this is typically not possible with standard CNC machine tools, there are three other possible methods of compensating for tool wear for "in-machine" implementations of Nylox brushes.

Automatic Indexing:
Most CNC controllers allow tool wear compensation to be accomplished by programming a "macro" - routine to periodically adjust the position of the tool based upon the number of parts produced. Some experimentation may be required to determine the frequency and the amount of adjustment that will result in the most consistent performance and maximum brush life.

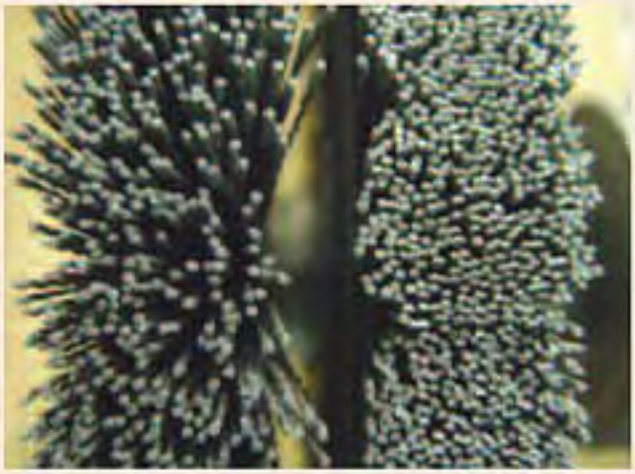
Probing:
If the machining center has the capability to probe the face of the brush, this feature can be used to gauge the true position of the filament tips. Adjustments to the brush position can then be made to maintain a consistent amount of interference between the tool and the part.

Manual:
If the other methods cannot possibly be used, machine operators can adjust the brush position based on either statistical process control data or visual inspection of completed parts.

Product Selection

Filament Density vs. Trim Length

Proper selection of brush density and trim length is a critical element in optimizing the output of a brushing operation. While high density/short trim brushes offer better cycle times and longer brush life, they are not effective in operations requiring a high degree of brush conformability. The following illustration highlights the differences between Weiler's 10" x 2" arbor hole wheel brushes versus the 10" x 5-1/4" arbor hole version.



Low density/long trim wheel brushes are best suited for operations requiring a high degree of conformability.

High density/short trim wheel brushes are ideal for users who need minimum cycle times and maximum brush life.

Nylox® Brush Selection Chart

	Surface Finishing (Functional, Aesthetic, Decorative, Satin)	Deburring & Edge Blending	Automated Equipment Applications
Wheel	● ● ●	● ● ●	●
Disc	●	●	●
Cup	●	●	●
Stem-Mounted	●	●	●
Tube	● ●	● ●	●

Product & Application Key

● Right Angle Grinder *
● Straight Grinder *
● Hand Drill/Drill Press
● Bench/Pedestal Grinder *
● CNC's, Milling & Automatic Machines

* *Due to the recommended low operating speeds of Nylox products, they cannot typically be used on common power tools. However, they are suitable for less common low-speed/high-torque tools or variable-speed equipment.*

Application Solutions Guide

There are many variables in Nylox applications. If the Nylox brush you are using does not accomplish the desired results, select a solution from the suggestions below for your specific application or call Weiler's **Application Engineering Hotline at 888-299-2777.**

Problem	Recommended Solutions
Brush not aggressive enough	• Increase filament diameter and/or grit size • Increase filament density by using round straight rather than round crimped • Increase surface contact by using rectangular rather than round • Increase pressure/depth of interference • Increase surface speed by increasing spindle RPM • Use a larger diameter brush • Reduce trim length or feed rate
Brush too aggressive	• Reduce filament diameter and/or grit size • Reduce filament density by using round crimped rather than round straight • Reduce surface contact by using round rather than rectangular • Reduce pressure/depth of interference • Reduce surface speed by reducing spindle RPM • Use a smaller diameter brush • Increase trim length or feed rate
Brush not conformable enough	• Increase trim length • Reduce filament diameter • Reduce filament density by using round crimped rather than round straight or rectangular • Reduce surface speed by reducing spindle RPM • Reduce feed rate
Finer final finish required	• Increase surface speed by increasing spindle RPM • Use a larger diameter brush • Use a brush with a coolant
Coarser final finish required	• Reduce surface speed by reducing spindle RPM • Use a smaller diameter brush • Increase grit size • Use brush without a coolant
Filaments melt/smear on workpiece	• Reduce surface speed by reducing spindle RPM • Use a smaller diameter brush • Use brush with a coolant
Short brush life	• Increase filament density • Reduce pressure/depth of interference