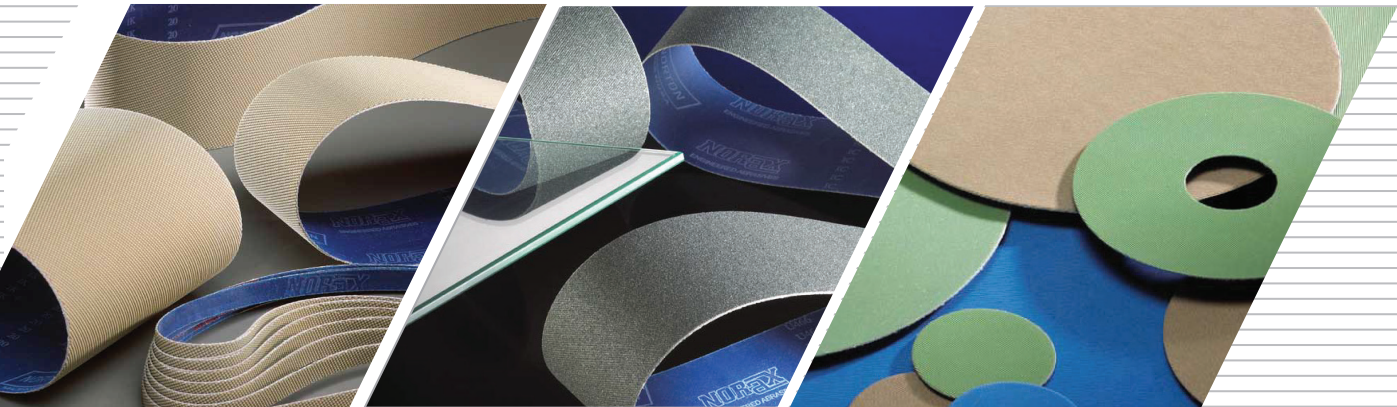


NORTON NORAX COATED ABRASIVE

ENGINEERED
ABRASIVE
SOLUTIONS
FOR POLISHING
APPLICATIONS



NORTON
SAINT-GOBAIN®

NORAX

What is NORaX?

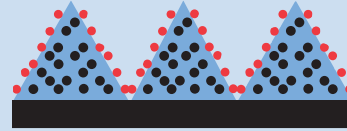
NORaX is an engineered 3-dimensional coated abrasive product that offers high performance in finish, cut and consistency. With special pattern technology, NORaX can offer the optimal product for a wide variety of applications to increase productivity, quality and repeatability, while reducing cost, scrap and inventory.



CONVENTIONAL COATED ABRASIVE PRODUCTS



AGGREGATE COATED ABRASIVE PRODUCTS

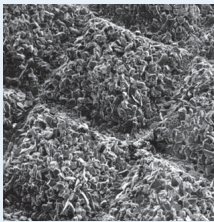


ENGINEERED COATED ABRASIVE PRODUCTS

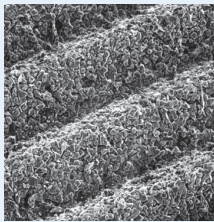
- Conventional and Aggregate products randomly place grain on the surface of the backing
- Control of contact area and erosion are very difficult.
- Inconsistent polishing results from belt to belt and throughout belt life
- NORaX utilizes evenly spaced erodable structures
- Multiple layers of abrasive grain for extended belt life
- Unique grinding aid on the surface to increase cut rate and reduce heat generation
- Sharp abrasives available throughout belt life

Patterns:

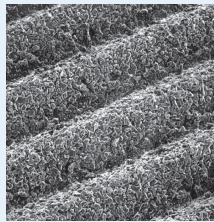
The NORaX product offering includes 4 distinct patterns. Each pattern provides superior performance for a wide range of applications.



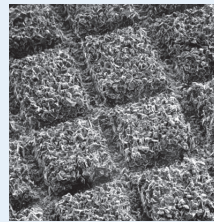
PYRAMID SHAPE
(0 – 8 PSI)



TRI-HELICAL SHAPE
(8 – 15 PSI)



FINE TRI-HELICAL SHAPE
(8 – 15 PSI)
where additional flexibility
is needed



QUAD SHAPE
(15+ PSI)

NOTE: All finishes in this catalogue were created using the trihelical pattern except in the case of X4 where the fine trihelical pattern is the only offering for that grit. The NORaX pattern was not changed because varying the pattern will not have a huge effect on the finish. Pattern should instead be picked based upon application parameters e.g. pressure.

NORaX Targets:

Materials:

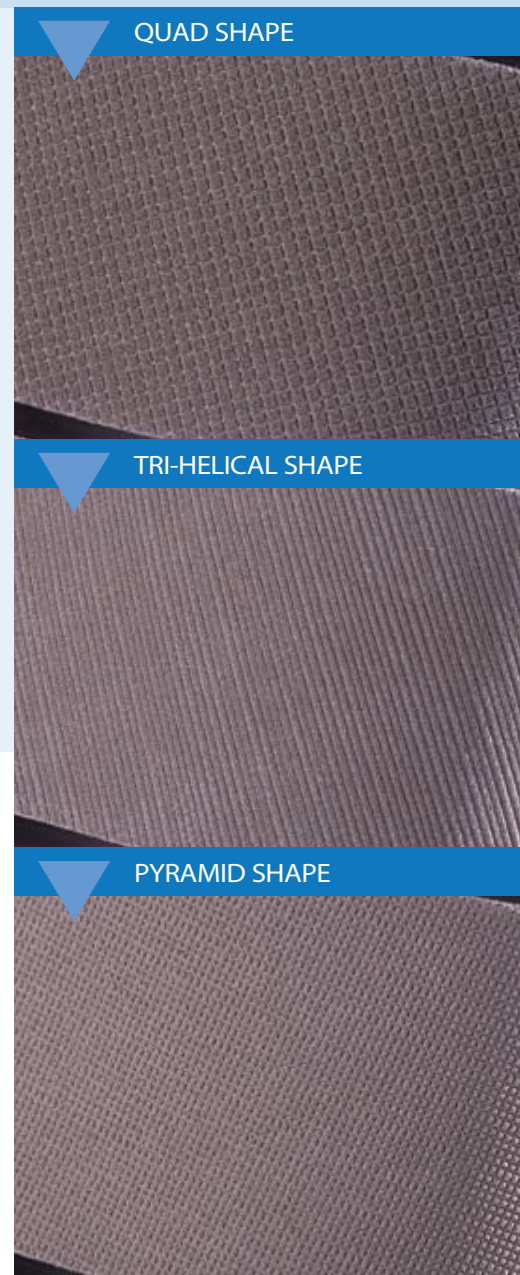
Carbon Steel
Stainless Steel
Titanium
Cobalt Chromium
Aerospace Alloys
Composites (e.g. graphite)

Main Markets:

Aerospace
Automotive
Engineered Distribution
Foundry
Medical Implants
Hand Tools
Leisure (e.g. golf clubs)

Applications:

Off-hand
Robotic
Centerless
Roll Grinding
Automated machinery
Portable file belts



Selling Points:

- Productivity gains
 - Faster cut rates
 - Eliminate steps from polishing sequence
 - Longer life - use to the backing
- Cooler cutting
- Easier part handling
- Reduces possible thermal damage
- Consistency of finish and cut rate throughout belt life
 - Reduces scrap rates
 - Increases first time throughput

Product Designation and Availability

EXAMPLE:

U 3 6 6

UV

First character denotes UV resin system and distinguishes Engineered Abrasive products from other coated abrasive products.

Grain

Second character same as conventional system
 2 = aluminum oxide
 3 = waterproof aluminum oxide
 4 = silicon carbide

Pattern

Third character refers to pattern
 3 = Quad
 4 = Fine Tri-helical
 5 = Pyramid
 6 = Tri-helical

Backing

Fourth character refers to backing type
 2 = J-weight cotton
 4 = Flexible cotton
 6 = Y-weight polyester

Abrasive

Aluminum Oxide: X200, X100, X80, X65, X45, X30, X22, X16, X5, X4

Silicon Carbide: X210, X110, X90, X70,

Backings

Flexible cotton: good combination of strength and flexibility

Semi-flexible polyester: strong and durable backing suitable for wet and dry applications

Patterns

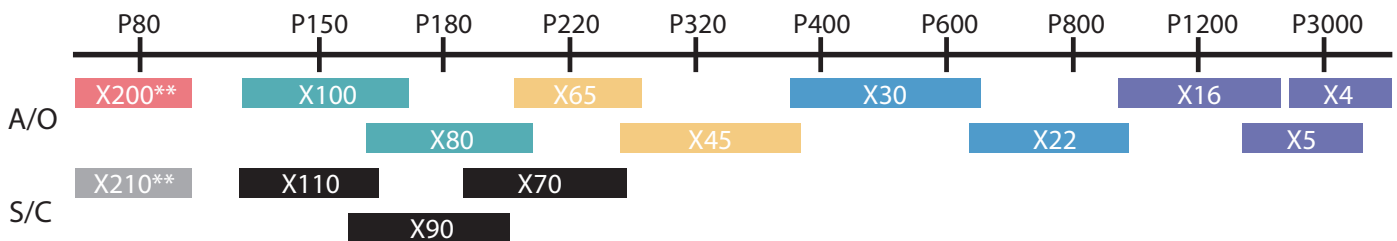
Pyramid: low pressure grinding; extremely flexible

Tri-helical: middle pressure grinding; consistent cut rate

Fine Tri-helical: where additional flexibility is needed

Quad: middle to high pressure grinding; long life; uniform cut rate

▼ Fepa Grading System



**AVAILABLE IN WATERPROOF DESIGN

▲ NORaX Engineered Abrasive Grading System

**THE PRECISE FLEXIBLE DESIGN
FOR CONSISTENT FINE FINISHES.**

Longer life, higher quality finishes, faster cut rates, and the ability to skip finishing steps, drive costs out of your finishing processes.

FEATURES

- New, fine 3D tri-helical pattern
- Engineered, high-performance micron-graded aluminum oxide abrasive
- Heat-reducing grinding aid
- New, very flexible J-wt. backing

BENEFITS

- The pattern wears away consistently, exposing sharp abrasive grains to prolong cutting performance, lasting 2-5 X longer, with faster cut rate and consistency vs. conventional polishing belts
- Quickly removes grit scratches, part defects, and steps from your polishing process
- Prevents wild scratches; produces a more repeatable consistent finish from the first to the last part
- Cooler cutting, ensures exceptional part integrity
- Conforms to intricate part contours

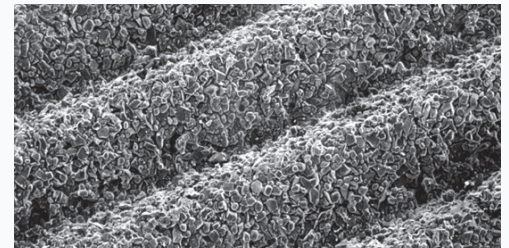
APPLICATION/MARKETS

- Plate and polish
- Prosthesis, medical and surgical equipment
- Golf clubs
- Auto and motorcycle parts
- Sinks and faucets
- General metal

AVAILABILITY

- SHAPES: Belts up to 12" wide
- GRIT SIZES: X80 (P180), X65 (P220), X45 (P320), X30 (P600), X22 (P1000), X16 (P1200), X9 (P2400), X4 (P3000)
- JOINTS: Butt Joint
- MATERIALS: Stainless Steel, Carbon Steel, Nickel, Chrome, Cobalt Chrome
- MACHINES: Backstand, Pneumatic drum, Robotic, Roll grinder (dry), Stroke sander

FINE TRI-HELICAL PATTERN



CASE STUDY

KNEE JOINT PROSTHESIS

Material: Cobalt Chrome

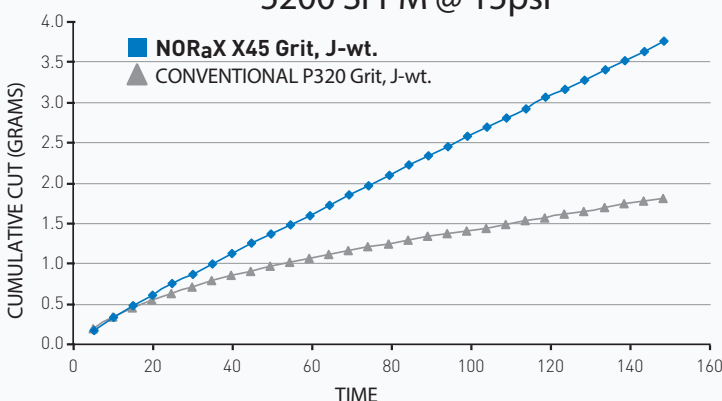
Sequence used in NORaX:

- U243 X65 – Intermediate grinding to remove casting skin
- U243 X30 – Finishing of the joint

Main advantages VS Competition:

- The casting skin does not smear and is removed
- Finishing is better and more consistent
- Life time is higher

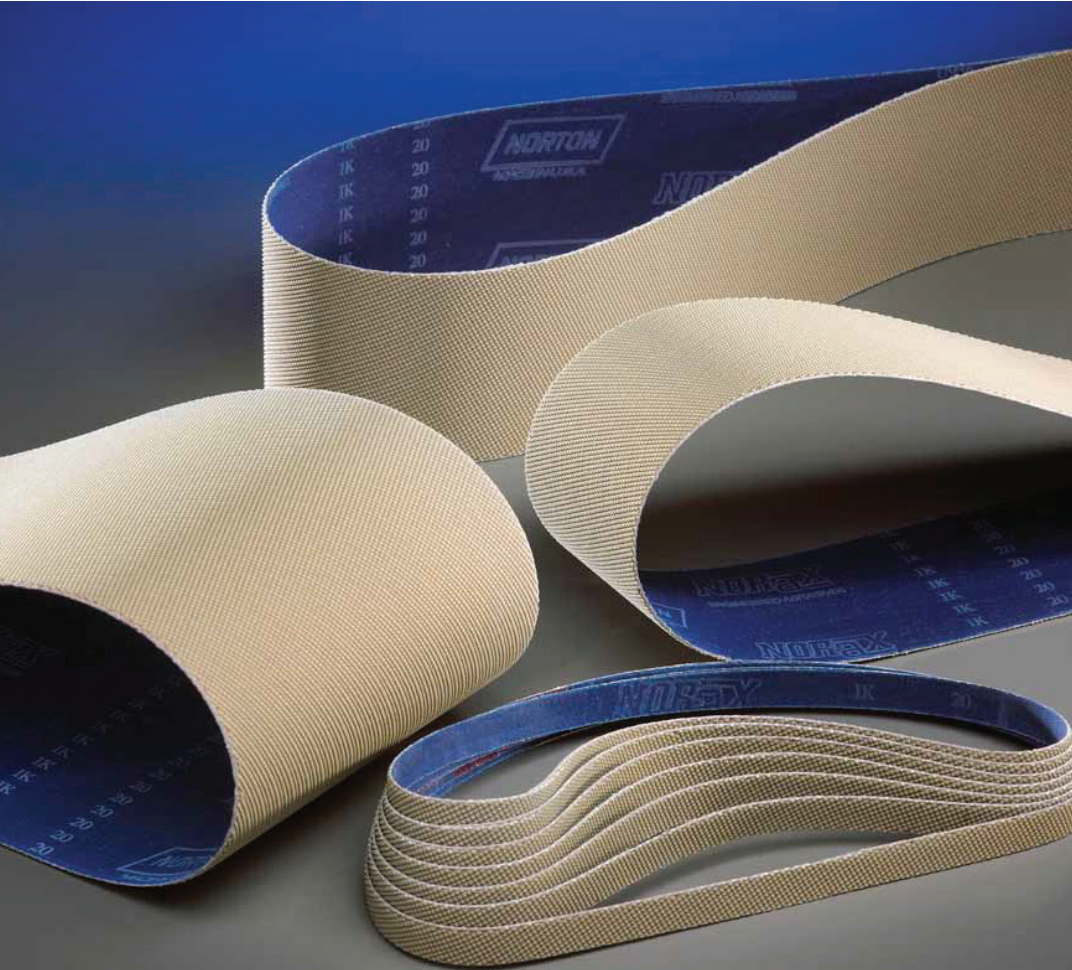
**PERFORMANCE ON STAINLESS STEEL
5200 SFPM @ 15psi**



Wet Centerless | Flat Finishing | Foundry | Investment Cast | Metal Fab | Industrial Manufacturing

Engineered abrasive solutions for polishing applications.

- Outlast conventional abrasives with 2 - 5x longer life.
- Multiple abrasives layers with an engineered pattern provide superior, consistent finishes on all types of materials: specialty metals, composites, and glass.
- Longer product life, higher quality finishes, faster cut rates, and the ability to skip steps drive down your finishing costs.



THE FIRST NORTON SC CERAMIC NORFLEX ENGINEERED ABARSIVES BELTS

100% Norton SG ceramic grain, unique engineered quad pattern, premium Y-weight polyester cloth waterproof backing, and durable resin bond technology, make this first NORaX ceramic belt the best choice for high-pressure precision applications.

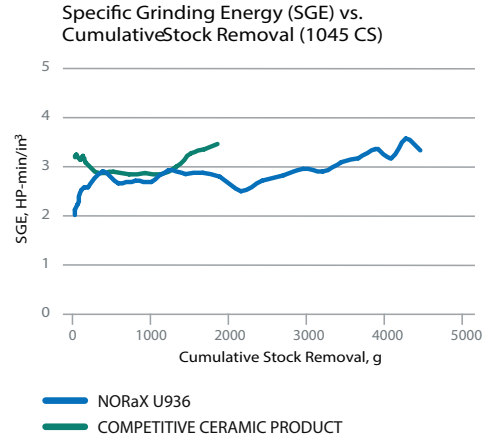
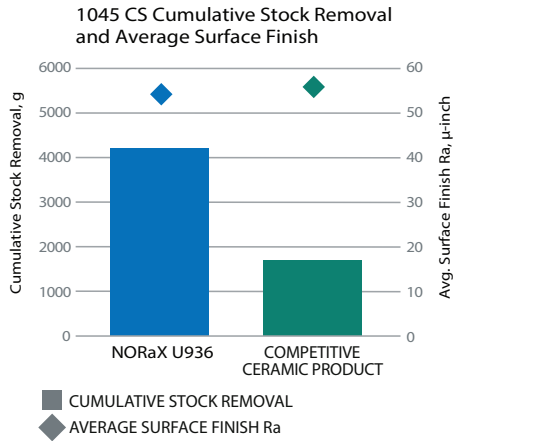
FEATURES

- 100% high-performance, micron-graded Norton SG ceramic grain
- Unique, engineered quad pattern
- Premium, Y-weight polyester cloth waterproof backing
- High-performance, durable resin bond technology
- Excellent choice on multi-head machines
- Available in coarse and medium grits: X200 (P80), X100 (P150) and X65(P220)

BENEFITS

- Higher cut rates while maintaining more consistent finishes, cool cutting
- Up to more than 2X the life vs. competitive engineered ceramic belts
- Lower specific grinding energy
- More abrasive contact area makes this ideal for high-pressure applications
- No "break-in" period as with competitive engineered ceramic belts
- Durable; stands up to high-pressure, coolant applications
- Minimal, consistent wear across belt results in consistent part finishing (reduces barber pole effect)
- Reduced downtime, belt changes, and scrap; improved productivity
- Lower cost per part
- Ideal grit range for dimensioning centerless and similar applications
- Excellent finishing belt to follow a Norton SG BLAZE Plus R980P belt in a multi-step process

The Best Choice for High-Pressure Precision Application



NORaX U936 case histories

10V45 CARBON STEEL

BELTS: 9" x 120" X100 and X65 grit NORaX U936 vs. competitive engineered ceramic belts

APPLICATION: Centerless grinding hydraulic cylinders after heat treat

MACHINE: 6-head, 40 hp centerless grinder

CONTACT WHEEL: 12.5" dia. 90D 2/1 serrated (X100) – 90D smooth (X65)

RPM: 1,925 RPM; SFPM = 6,300

RESULTS: NORax belts ran 69 parts; the competitive belt ran 32 parts

STAINLESS STEEL AIRFOILS

BELTS: NORaX U936 X100 vs. competitive engineered ceramic X100 belt

APPLICATION: Automatic polishing after milling

MACHINE: 6-axis belt grinder

CONTACT WHEEL: 4.7" dia. 45D 2/1 serrated

RPM: 3,024; SFPM = 3,720

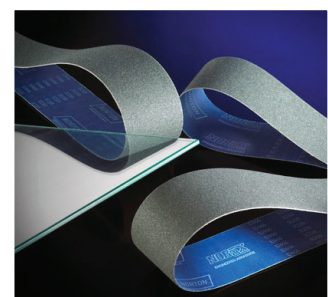
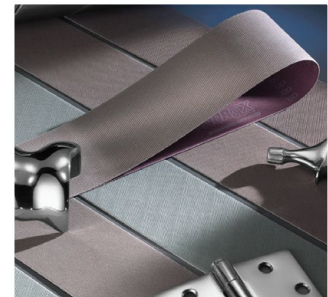
RESULTS: NORax U936 had twice the life of the competitive belt
The NORax belt finished the entire airfoil (front and back)
The competitive belt finished only the front

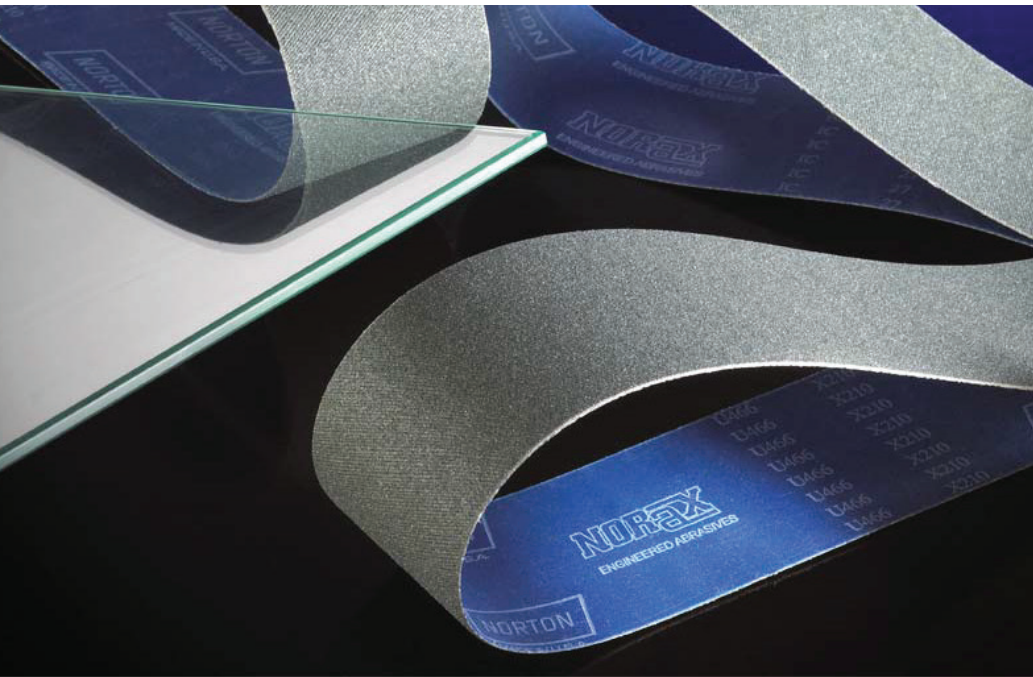
NORaX U936 AVAILABILITY

- All NORaX U936 belts are non-stock items at this time
- The popular-size non-stock UPC numbers shown here have been created to help you easily order
- Numerous other sizes and grits are available
- Contact your distributor with your specific requirements

SIZE W X L	UPC NO. X200	UPC NO. X100	UPC NO. X65
1/2" x 18"	66254475241	66254475242	66254475243
2" x 132"	66254475244	66261094281	66254412716
3" x 132"	66254405123	66254405122	66254405121
6" x 132"	66254475245	66254475246	66254474196
6" x 138"	66254475247	66261095723	66261095724
9" x 120"	66254414738	66254414738	66254414739

STANDARD FLEX = CF / OPTIONAL FLEX = LF / STANDARD JOINT (ONLY) = PLYWELD





NORaX engineered abrasive belts are the first choice for seaming, grinding, dubbing and chamfering the edges of tempered and laminated, flat or curved glass – in both automotive and non-automotive glass applications.

NORaX multi-layered abrasive works like a grinding wheel on a coated backing. As the belt wears, dull abrasive particles are continually lifted out of the belt and a new layer of sharp abrasive is exposed to the glass edge – resulting in longer belt life, higher cut rates and a more consistent surface finish.

FEATURES

- Multi-layered, tri-helical-patterned silicon carbide abrasive incorporates a continuous replacement of dulled abrasive grains with new, sharper ones
- Grinding aid enhanced
- Last up to four times longer than conventional silicon carbide belts
- Higher cut rates at significantly lower pressures
- Semi-flexible, waterproof, Y-weight, polyester backing
- Excellent consistency and location for robotic and automated operations

BENEFITS

- Superior and consistent finish and part quality
- More consistent edge finishing resulting in increased furnace yields, improved fit, and higher edge durability
- Cooler operating temperatures; minimal burning of parts
- Reduced cycle time; most parts per belt
- Lowest abrasive cost per part; maximum productivity
- Lowest specific grinding energy
- Longest product life
- Excellent flexibility for manual operations
- Resistant to edge fray
- Suitable for manual and robotic, directional and oscillating seaming applications

CASE Study

Finishing/blending glass edges in an off-hand slack-of-belt application with U466 NORaX belts

Dry operation on interior automotive rearview mirrors

A mirror is manually introduced into a slack-of-belt operation to polish both its front and back edges, to avoid chips and cracks, and impart an acceptable finish. Polishing the edges improves the efficiency of the assembly operation at the next stage, when operators need to fit the mirrors into molded, plastic housings.

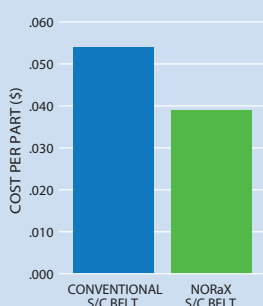
Results:

The U466 NORaX belts outperformed conventional silicon carbide belts:

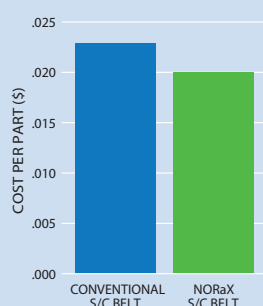
- Finished 3-1/2 times the number of parts
- With 20% less total cost/part
- In 1/3 less cycle time

U466 NORaX Belts vs. Conventional Silicon Carbide Belts – Glass Edge Finishing

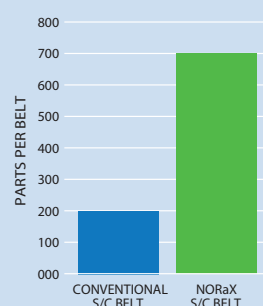
Total Cost Per Part



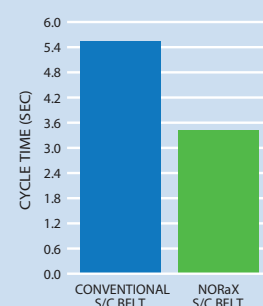
Abrasive Cost Per Part



Parts Per Belt



Cycle Time



Produce Better Finishes With
the New Long-Life NORaX
U381 Advanced Engineered
Abrasives System

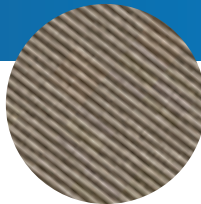
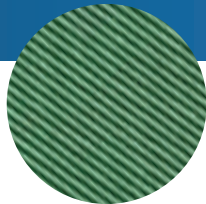
NORaX U381 Discs From Norton Outperform the Competition on the Surface Finishing of Solid Surfaces, Composites, Plastics and When Priming Prior to Painting

For moist surface finishing applications on solid surfaces, composites, plastics and paints/primers, NORaX U381 discs outlast and outperform conventional abrasives by providing superior finishes without sacrificing cut rate. Overall, NORaX U381 will reduce the number of discs required and downtime associated with disc changes, to maximize productivity and lower total process finishing costs.

Superior Economy With Superior Finish

NORaX U381 discs feature a flexible, lightweight, super-smooth waterproof paper backing. This advanced-technology backing combined with a premium white aluminum oxide grain and advanced resin system, provide a superior finish on both flat and contoured surfaces. The new NORaX discs' enhanced design also offers improved base adhesion of the engineered structured grain, and resistance to edge chipping. The engineered structured grain stays in place until it is worn down to maximize grain usage and extend disc life. Operators can produce finer finishes in less time while minimizing costly downtime changing discs.

The Velcro/PSA adhesion has also been improved to ensure these long-lasting discs stay in place on the back-up pad throughout their extended life.



NORaX U381 Disc Stock Availability:

SIZE	GRIT	MIN./STD PKG.	PSA TABBED UPC	SPEED-GRIP UPC
5" blank	X45	25/100	69957350040	69957350002
	X35		69957350039	69957350000
	X10		69957350038	69957349999
6" blank	X45	25/100	69957350043	69957350007
	X35		69957350042	69957350005
	X10		69957350041	69957350003



AVAILABILITY

DRY / WET USAGE	BACKING WEIGHT	GRAIN	CAP CODE	GRIT OFFERING									
DRY	J-wt.	A/O	U243			X80	X65	X45	X30	X22	X16		
	X-wt.	A/O	U234		X100	X80	X65	X45	X30		X16		
	X-wt.	A/O	U254		X100	X80	X65	X45	X30	X22	X16		
	X-wt.	A/O	U264	X200	X100	X80	X65	X45	X30	X22	X16		X5
	X-wt.	S/C	U464		X110	X90	X70						
WET	B-wt. Paper	A/O	U381							X35		X10	
	Y-wt.	A/O	U336				X65	X45	X30	X22	X16		X5
	Y-wt.	A/O	U366		X100		X65	X45	X30	X22	X16		X5
	Y-wt.	S/C	U466	X210	X110	X90	X70						
	Y-wt.	Ceramic	U936	X200	X100		X65	X45	X30			X16	X9

Backing Cloth Flexibility

	Low (1-8 psi)
	Medium (8-15 psi)
	High (15+ psi)

CAP Code Recommended Pressure

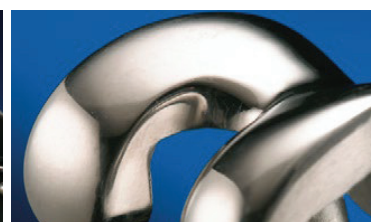
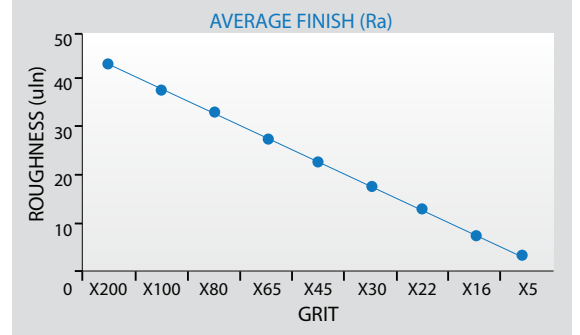
	High
	Medium
	Low

PRODUCT SELECTION BY MACHINE/MATERIAL

MATERIAL/MACHINE TYPE	SPECIFICATION RECOMMENDATION	ROBOTIC	PORTABLE FILE BELT	PNEUMATIC DRUM	ROLL GRINDER			STROKE SANDER	PLATEN SANDER	BACKSTAND	CENTERLESS		
					Slack	Dry	Wet				Slack	Dry	Wet
CARBON STEEL	Starting Spec	U243	U936	U243	U254	U336	U936	U243	U264	U243	U254	U936	U936
	Optional Spec	U264	U336	U264	U243	U234	U336	U264		U264		U336	U336
STAINLESS STEEL	Starting Spec	U243	U936	U243	U254	U336	U936	U243	U264	U243	U254	U936	U936
	Optional Spec	U264	U336	U264	U243	U234	U336	U264		U264		U336	U336
CHROME	Starting Spec	U243	U936	U243	U254		U936	U243	U264	U243	U254	U936	U936
	Optional Spec	U264	U336	U264	U243		U336	U264		U264		U336	U336
COBALT CHROME	Starting Spec	U243	U936	U243	U254		U936	U243	U264	U243	U254	U936	U936
	Optional Spec	U264	U336	U264	U243		U336	U264		U264		U336	U336
GRAPHITE	Starting Spec	U366	U366	U366	U366			U366	U366	U366	U366	U366	
NICKEL	Starting Spec	U243	U936	U243	U254		U936	U243	U264	U243	U254	U936	U936
	Optional Spec	U264	U336	U264	U243		U336	U264		U264		U336	U336
TITANIUM	Starting Spec	U464	U464	U464	U464		U466	U464	U464	U464	U464	U466	
CERAMIC	Starting Spec		U464	U464	U464	U464	U466	U464	U464	U464	U464	U466	
GLASS	Starting Spec		U464	U464	U464	U464	U466	U464	U464	U464	U464	U466	

CROSS REFERENCE GUIDE

TRIZACT CAP CODE	TRIZACT AVAILABILITY	RECOMMENDED NORAX CAP CODE	NORAX AVAILABILITY	KEY MARKETS
217EA	J-wt. A6-A100	U243	J-wt. X16-X80	Medical, Plate/Polish
237AA	X-wt. A6-A160	U264/U254	X-wt. X5-X200	Medical, Plate/Polish
253FA	X-wt. A6-A100	U336/U366	Y-wt. X5-X100	Centerless
268XA	3-mil film disc A5-A35	U381	B-wt. paper X10-X35	Composites
272LA	5-mil film belt A5-A35	Consult PM		Auto Parts
305EA	J-wt. A3-A5	U254	X-wt. X5	Golf
307EA	J-wt. A6-A100	U243/U254	X-wt./J-wt. X5-X100	Medical, Plate/Polish
310EA	J-wt. A5-A45	U243/U254	X-wt./J-wt. X5-X100	Medical, Plate/Polish
327DC	X-wt. Trizact CF A30-A300	U254	X-wt. X5-X100	Turbine Blades
337DC	X-wt. Trizact CF A30-A300	U264	X-wt. X5-X200	Turbine Blades
347AC	X-wt. Trizact CF A30-A300	U234	X-wt. X16-X100	Turbine Blades
363FC	X-wt. A35-A300	U936	Y-wt. X9-X200	Centerless
407EA	J-wt. A20-A110	U464	X-wt. X70-X110	Nonferrous Materials (dry)
443SA	Foam-backed disc P800-P5000	Consult PM		AA Clear Coat
463FC	X-wt. A35-A300	U466	Y-wt. X70-X210	Nonferrous Materials (wet)
466LA	3-mil film disc A3, A5, and A7	Consult PM		Prime Automotive Clear Coat
568XA	3-mil disc CeO2	Consult PM		Glass Polishing
661XA	Diamond film 0.5, 2, and 9µm	Consult PM		Electronics
663FC	X-wt. 20, 40, and 70 microns	Consult PM		Roll Grinding
677XA	Diamond tile 3, 6, and 9µm	Consult PM		Electronics
953/963FA	Y-wt. A6-A500	U936	Y-wt. X9-X200	Centerless





Mapping: Advancing the Science of Abrasive Selection

The abrasive selection process considers the grinding equipment, stock removal requirements, surface finishing objectives, belt speed, the pressure applied to the part, and many other factors. To minimize the trial and error of determining which abrasive belt maximizes performance, Norton has developed Performance Mapping. This system utilizes Norton Abrasives' extensive library of grinding data to fit the best abrasive pattern to your process. Performance Mapping also takes much of the guesswork out of testing by recommending optimal speeds and pressures.

Why use ENGINEERED ABRASIVES?

- Higher cut rates at lower pressures
- Longer product life
- Superior and consistent finishes
- Cooler operating temperatures
- Lower specific grinding energies
- Highly flexible
- Lower cost per part
- Lower total inventory
- Less material in process
- Less pollution
- Reduction in number of sequence steps

Where can ENGINEERED ABRASIVES be used?

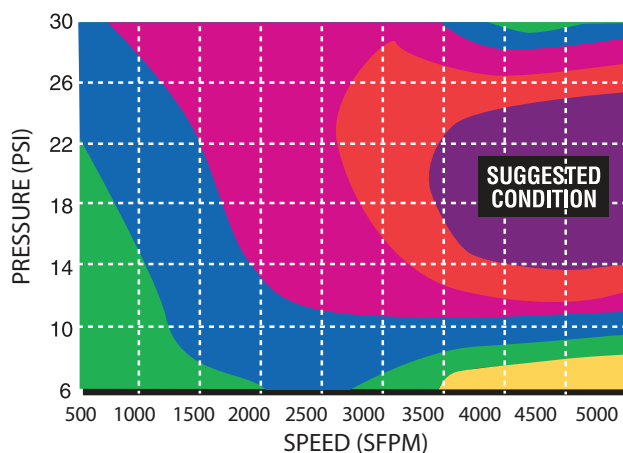
Offhand, Automatic, Centerless and Robotic finishing applications, including:

- Golf club finishing
- Pre-plating applications
- Hand tools
- Medical prostheses
- Turbine blades
- Metal fabrication

Mapping for Performance Optimization

By grinding over a wide range of speeds and pressures, a single combined chart can be produced.

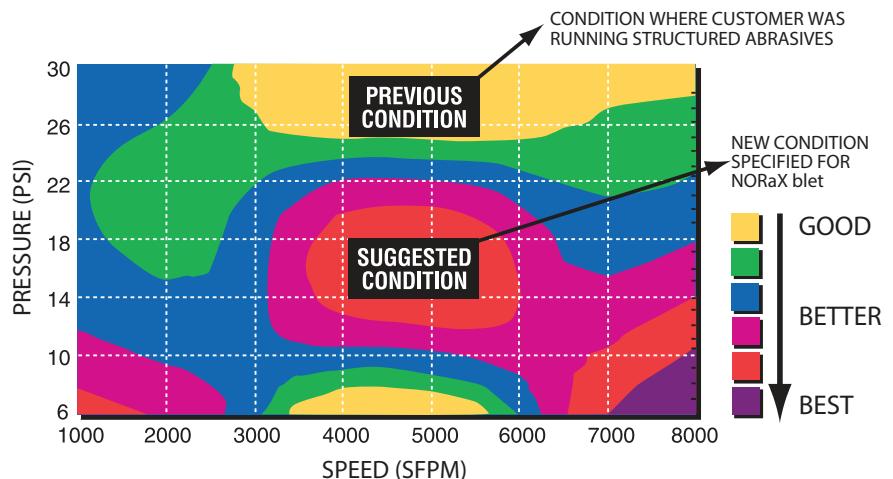
ENGINEERED ABRASIVES MAPPING EXAMPLE



This chart is a Performance Map for a NORaX belt grinding titanium. Norton uses Performance Mapping to optimize grinding conditions and product selection.

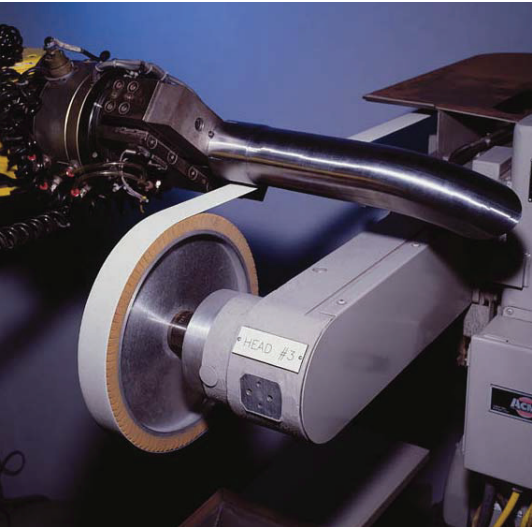
CASE HISTORY: MAPPING GOLF CLUB FINISHING

NORaX U264 X80 vs. STRUCTURED ABRASIVE ON STAINLESS STEEL



Competitor:	RESULTS BEFORE MAPPING	RESULTS AFTER MAPPING
NORaX U264 (X80):	120 – 130 parts per belt 95 – 100 parts per belt	130 parts per belt 188 parts per belt

44% IMPROVEMENT!



The NORaX Engineered Abrasive Advantage

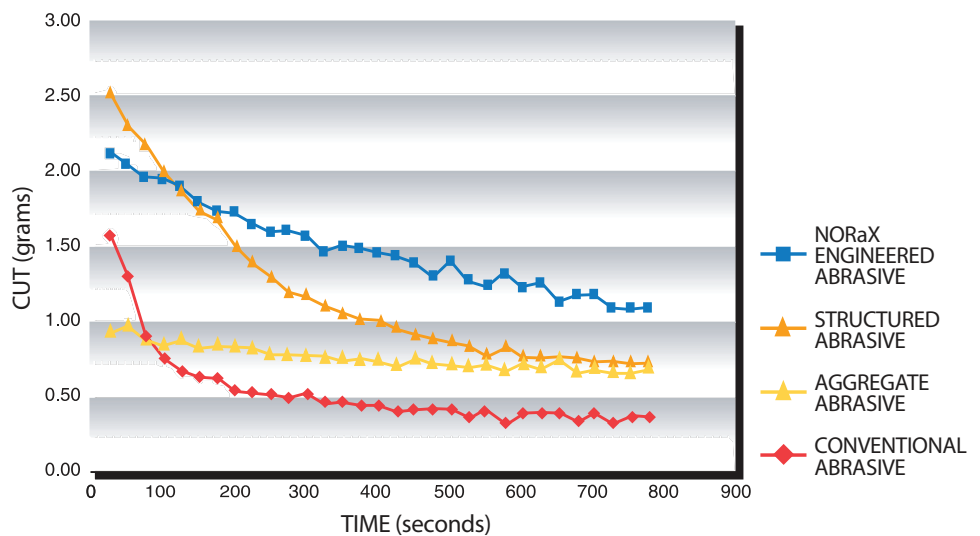
NORaX Engineered Abrasives work like a grinding wheel on a coated backing. As the belt wears, dull abrasive particles are lifted out of the belt and a new layer of sharp abrasive is exposed to the work surface. The continuous replacement of dulled abrasive particles results in longer belt life, higher cut rates, and a more consistent surface finish.

To add to the performance advantage of NORaX Engineered Abrasives, a surface powder grinding aid is incorporated into all NORaX belts. The surface powder increases initial belt aggressiveness and decreases grinding temperature.

Increase in Cut Rate Over Conventional Abrasives

- Ability to remove finishing steps
- No sacrifice in surface finish

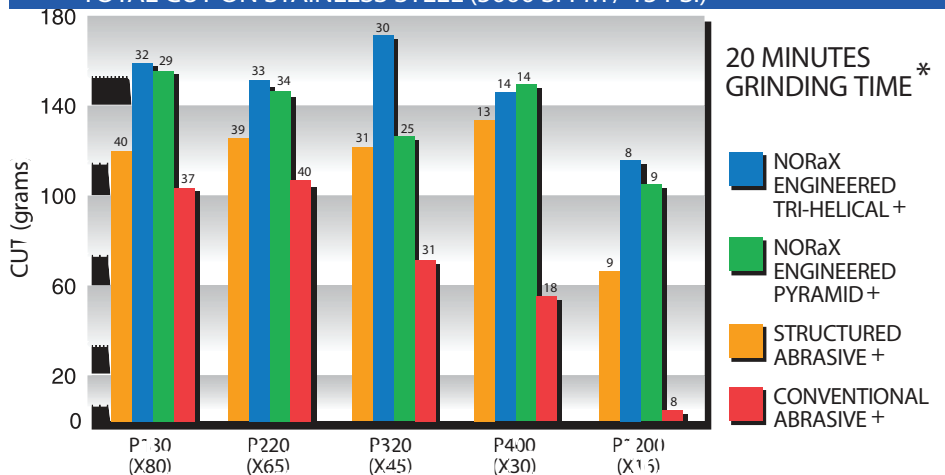
ALUMINUM OXIDE CUT VS. TIME ON STAINLESS STEEL (4632 SFPM / 15 PSI)



Prolonged Life

- 3 to 10 times the life of a conventional belt
- More aggressive than fine grit aggregate and conventional products

TOTAL CUT ON STAINLESS STEEL (5000 SFPM / 15 PSI)

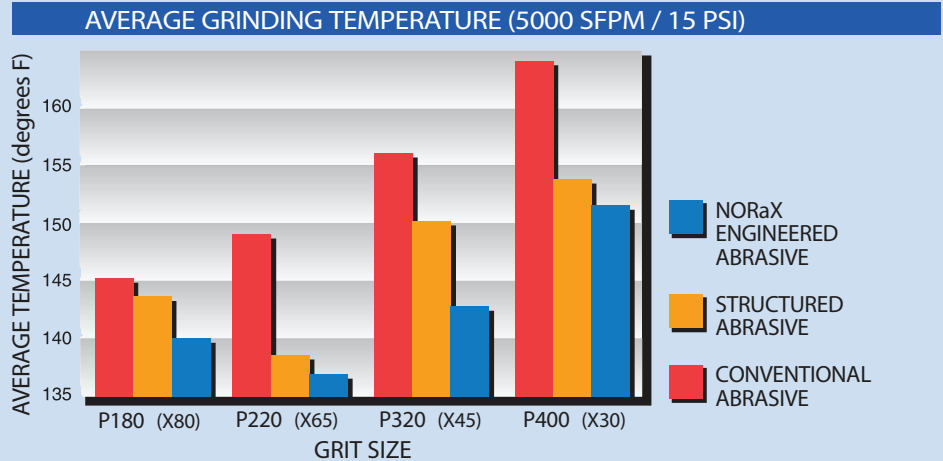


* After 20 minutes of grinding, NORaX belts have removed the most material and are still going strong.

+Value on top of colored bar represents surface finish measured in average Ra.

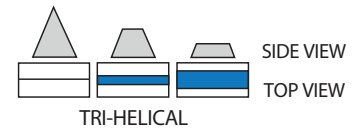
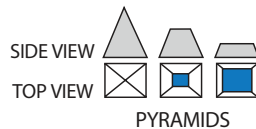
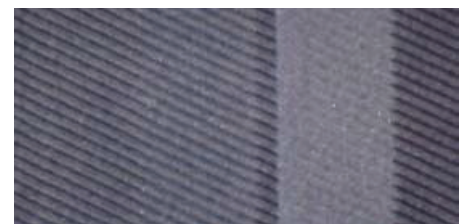
Cooler Cutting

- Less grinding energy
- Easier for operator to handle part



Consistent Cut Throughout Abrasive Life

- Less finish variation
- Fresh abrasive grains constantly exposed



Field test results

APPLICATION	COMPETITION	NORaX PRODUCT	RESULTS
Offhand polishing and plating of steel pipes	Structured abrasive aluminum oxide	U266 – X30	20 – 30% increase in life with equal cut rate and finer finish
Automated plunge grind on zinc castings	Structured abrasive aluminum oxide	U264 – X80	20 – 25% increase in belt life
Offhand polishing of stainless steel golf clubs (irons)	Conventional P220 – J-weight	U264 – X80	200 – 250% better performance than conventional abrasive with lower grinding temperature
Offhand polishing of stainless steel tanks	Conventional P120, P240, P400	U264 – X45	Reduced process to one step with more uniform surface finish and lower temperatures
Robotic polishing of prosthetic knee joints	Structured abrasive aluminum oxide in various grit sizes	U254 – X45, X30 U264 – X16	65% increase in life 220% increase in life



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