ENGINEERED ABRASIVE SOLUTIONS FOR POLISHING APPLICATIONS
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.

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

- 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

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)

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

NORaX Targets:

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.
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

<table>
<thead>
<tr>
<th>P80</th>
<th>P150</th>
<th>P180</th>
<th>P220</th>
<th>P320</th>
<th>P400</th>
<th>P600</th>
<th>P800</th>
<th>P1200</th>
<th>P3000</th>
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<tbody>
<tr>
<td>X200**</td>
<td>X100</td>
<td>X65</td>
<td>X30</td>
<td>X45</td>
<td>X22</td>
<td>X16</td>
<td>X4</td>
<td>X5</td>
<td>X4</td>
</tr>
<tr>
<td>A/O</td>
<td>X80</td>
<td>X45</td>
<td>X210**</td>
<td>X110</td>
<td>X70</td>
<td>X90</td>
<td>**AVAILABLE IN WATERPROOF DESIGN</td>
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<td></td>
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</table>

NORaX Engineered Abrasive Grading System
New, fine 3D tri-helical pattern

Engineered, high-performance micron-graded aluminum oxide abrasive

Heat-reducing grinding aid

New, very flexible J-wt. backing

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

AVAILABILITY

SHAPES: Belts up to 12” wide

GRIT SIZES: X80 [P180], X65 [P220], X65 [P320], X30 [P600], X22 [P1000], X16 [P1200], X9 [P2600], X6 [P3000]

JOINTS: Butt Joint

MATERIALS: Stainless Steel, Carbon Steel, Nickel, Chrome, Cobalt Chrome

MACHINES: Backstand, Pneumatic drum, Robotic, Roll grinder (dry), Stroke sander

PERFORMANCE ON STAINLESS STEEL

5200 SFP @ 15psi

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 casing skin does not smear and is removed
• Finishing is better and more consistent
• Life time is higher

CASE STUDY
KNEE JOINT PROSTHESIS
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.

<table>
<thead>
<tr>
<th>FEATURES</th>
<th>BENEFITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>100% high-performance, micron-graded Norton SG ceramic grain</td>
<td>Higher cut rates while maintaining more consistent finishes, cool cutting</td>
</tr>
<tr>
<td>Unique, engineered quad pattern</td>
<td>Up to more than 2X the life vs. competitive engineered ceramic belts</td>
</tr>
<tr>
<td>Premium, Y-weight polyester cloth waterproof backing</td>
<td>Lower specific grinding energy</td>
</tr>
<tr>
<td>High-performance, durable resin bond technology</td>
<td>More abrasive contact area makes this ideal for high-pressure applications</td>
</tr>
<tr>
<td>Excellent choice on multi-head machines</td>
<td>No “break-in” period as with competitive engineered ceramic belts</td>
</tr>
<tr>
<td>Available in coarse and medium grits: X200 (P80), X100 (P150) and X65(P220)</td>
<td>Durable; stands up to high-pressure, coolant applications</td>
</tr>
</tbody>
</table>

THE FIRST NORTON SC CERAMIC NORFLEX ENGINEERED ABRASIVES 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.
The Best Choice for High-Pressure Precision Application

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

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 case histories

SGE, HP-min/in³
Specifc Grinding Energy (SGE) vs. Cumulative Stock Removal (1045 CS)

Cumulative Stock Removal, g
Avg. Surface Finish Ra, µ-inch

NORAX U936 SG CERAMIC ENGINEERED ABRASIVES BELTS

200 1000 2000 3000 4000 5000
0 10 20 30 40 50
0
4000
2000
3000
1000
0
NORAX U936
COMPETITIVE CERAMIC PRODUCT

1045 CS Cumulative Stock Removal and Average Surface Finish

<table>
<thead>
<tr>
<th>SIZE W X L</th>
<th>UPC NO.</th>
<th>UPC NO.</th>
<th>UPC NO.</th>
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<tbody>
<tr>
<td>1/2” x 18”</td>
<td>X200</td>
<td>X100</td>
<td>X65</td>
</tr>
<tr>
<td>2” x 132”</td>
<td>66254475241</td>
<td>66254475242</td>
<td>66254475243</td>
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<tr>
<td>3” x 132”</td>
<td>662544405123</td>
<td>66254405122</td>
<td>66254405121</td>
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<tr>
<td>6” x 132”</td>
<td>66254475245</td>
<td>66254475246</td>
<td>66254474196</td>
</tr>
<tr>
<td>6” x 138”</td>
<td>66254475247</td>
<td>66254441738</td>
<td>6625441738</td>
</tr>
<tr>
<td>9” x 120”</td>
<td>66254441738</td>
<td>66254441738</td>
<td>6625441739</td>
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</table>

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**

<table>
<thead>
<tr>
<th>Total Cost Per Part</th>
<th>Abrasive Cost Per Part</th>
<th>Parts Per Belt</th>
<th>Cycle Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>CONVENTIONAL S/C BELT</td>
<td>.000</td>
<td>100</td>
<td>6.0</td>
</tr>
<tr>
<td>NORaX S/C BELT</td>
<td>.005</td>
<td>180</td>
<td>4.0</td>
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</table>

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.
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/primer, 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:

<table>
<thead>
<tr>
<th>Size</th>
<th>Grit</th>
<th>Min/Std Pkg</th>
<th>PSA Tabbed UPC</th>
<th>Speed-Grip UPC</th>
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<tr>
<td>5” blank</td>
<td>X45</td>
<td>25/100</td>
<td>69957350040</td>
<td>69957350002</td>
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<tr>
<td></td>
<td>X35</td>
<td>69957350039</td>
<td>69957350000</td>
<td></td>
</tr>
<tr>
<td></td>
<td>X10</td>
<td>69957350038</td>
<td>69957349999</td>
<td></td>
</tr>
<tr>
<td>6” blank</td>
<td>X45</td>
<td>25/100</td>
<td>69957350043</td>
<td>69957350007</td>
</tr>
<tr>
<td></td>
<td>X35</td>
<td>69957350042</td>
<td>69957350005</td>
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<td></td>
<td>X10</td>
<td>69957350041</td>
<td>69957350003</td>
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Produce Better Finishes With the New Long-Life NORaX U381 Advanced Engineered Abrasives System
AVAILABILITY

<table>
<thead>
<tr>
<th>DRY / WET USAGE</th>
<th>BACKING WEIGHT</th>
<th>CAP. CODE</th>
<th>GRAIN</th>
<th>GRIT OFFERING</th>
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<tbody>
<tr>
<td>DRY</td>
<td>J-wt.</td>
<td>U243</td>
<td>X80</td>
<td>X65 X45 X30 X22 X16</td>
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<tr>
<td></td>
<td>X-wt.</td>
<td>U234</td>
<td>X100</td>
<td>X80 X65 X45 X30 X16</td>
</tr>
<tr>
<td></td>
<td>A/O</td>
<td>U254</td>
<td>X100</td>
<td>X80 X65 X45 X30 X22 X16 X5</td>
</tr>
<tr>
<td></td>
<td>X-wt.</td>
<td>U264</td>
<td>X200</td>
<td>X100 X80 X65 X45 X30 X22 X16 X5</td>
</tr>
<tr>
<td></td>
<td>S/C</td>
<td>U464</td>
<td>X110</td>
<td>X90 X70</td>
</tr>
<tr>
<td>WET</td>
<td>B-wt. Paper</td>
<td>A/O</td>
<td>X35</td>
<td>X10</td>
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<td>Y-wt.</td>
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<td>X65</td>
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<tr>
<td></td>
<td>X-wt.</td>
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<td>X65 X45 X30 X22 X16 X5</td>
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<tr>
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<td>S/C</td>
<td>U466</td>
<td>X210</td>
<td>X110 X90 X70</td>
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<td>Ceramic</td>
<td>U936</td>
<td>X200</td>
<td>X100 X80 X65 X45 X30 X22 X16 X5</td>
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PRODUCT SELECTION BY MACHINE/MATERIAL

<table>
<thead>
<tr>
<th>MATERIAL / MACHINE TYPE</th>
<th>SPECIFICATION RECOMMENDATION</th>
<th>ROBOTIC</th>
<th>PORTABLE FILE BELT</th>
<th>PNEUMATIC DRUM</th>
<th>ROLL GRINDER</th>
<th>STROKE SANDER</th>
<th>PLATEN SANDER</th>
<th>BACKSTAND CENTERLESS</th>
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<td>TITANIUM</td>
<td>Starting Spec U464 U464 U464</td>
<td>U464</td>
<td>U464 U464 U464 U464 U464</td>
<td>Slack Dry</td>
<td>Medium</td>
<td>Low</td>
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<td>CERAMIC</td>
<td>Starting Spec U464 U464 U464</td>
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<td>U464 U464 U464 U464 U464</td>
<td>Slack Dry</td>
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<td>GLASS</td>
<td>Starting Spec U464 U464 U464</td>
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<td>U464 U464 U464 U464 U464</td>
<td>Slack Dry</td>
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CROSS REFERENCE GUIDE

<table>
<thead>
<tr>
<th>TRIZACT CAP CODE</th>
<th>TRIZACT CAP AVAILABILITY</th>
<th>RECOMMENDED NORAX CAP CODE</th>
<th>NORAX AVAILABILITY</th>
<th>KEY MARKETS</th>
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<tr>
<td>217EA</td>
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<td>U243</td>
<td>J-wt. X16-X80</td>
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<td>U264/U254</td>
<td>X-wt. X5-X200</td>
<td>Medical, Plate/Polish</td>
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<td>253FA</td>
<td>X-wt. A6-A100</td>
<td>U336/U366</td>
<td>Y-wt. X5-X100</td>
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<td>U381</td>
<td>B-wt. paper X10-X35</td>
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<td>5-mil film belt A5-A35</td>
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<td>Auto Parts</td>
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<td>U254</td>
<td>X-wt. X5</td>
<td>Golf</td>
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<td>X-wt. Trizact CF A30-A300</td>
<td>U234</td>
<td>X-wt. X16-X100</td>
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<td>Y-wt. X70-X210</td>
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<td>Prime Automotive Clear Coat</td>
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<td>677XA</td>
<td>Diamond tile 3, 6, and 9µm</td>
<td>Consult PM</td>
<td>Electronics</td>
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</table>
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

Mapping for Performance Optimization

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

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.

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

CASE HISTORY: MAPPING GOLF CLUB FINISHING

NORaX U264 X80 vs. STRUCTURED ABRASIVE ON STAINLESS STEEL

CONDITION WHERE CUSTOMER WAS RUNNING STRUCTURED ABRASIVES

NEW CONDITION SPECIFIED FOR NORaX belt

GOOD

BETTER

BEST

RESULTS BEFORE MAPPING

Competitor: 120 – 130 parts per belt
NORaX U264 (X80): 95 – 100 parts per belt

RESULTS AFTER MAPPING

Competitor: 130 parts per belt
NORaX U264 (X80): 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

Prolonged Life

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

* 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

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<td>20 – 30% increase in life with equal cut rate and finer finish</td>
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<td>Automated plunge grind on zinc castings</td>
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<td>Offhand polishing of stainless steel golf clubs</td>
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<td>U254 – X45, X30</td>
<td>65% increase in life</td>
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<td>aluminum oxide in</td>
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<td>various grit sizes</td>
<td>U264 – X16</td>
<td>220% increase in life</td>
</tr>
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</table>

**NORaX ENGINEERED ABRASIVE**
**STRUCTURED ABRASIVE**
**CONVENTIONAL ABRASIVE**

### Average Grinding Temperature (5000 SFPM / 15 PSI)

**Norton Abrasives SEA**
www.nortonabrasives.com
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