SPRING-END GRINDING

ABRASIVE TECHNOLOGICAL EXCELLENCE SINCE 1885
SPRING-END GRINDING SOLUTIONS

Spring-end grinding represents a significant part of the total cost of production of compression springs. To help reduce this cost it is essential to use the best grinding tools available.

Norton offers a range of solutions for spring grinding operations.

Our engineers provide the expertise to maximize application productivity by specifying the right combination of grain types with the most appropriate bonds.

NORTON TECHNOLOGY

Norton offers 3 different types of product lines to adjust to all requirements, from cost effectiveness to high performance products. All proposals are based on Resinoid products with Aluminium Oxide and Silicon Carbide grains. They comprise conventional and Ceramic grains and utilise the latest ‘Norton Quantum’ technology for maximum efficiency.

Ranking by Technology
WHY CHOOSE CERAMIC ALUMINA?

Ceramic grains comprise thousands of micro crystals. This micro structure allows a controlled fracture during grinding and provides continual exposure of new cutting edges, allowing the wheel to remain sharp and be more durable than conventional grains that lose macro grains while re-sharpening.

The resulting wheels made with the Norton ceramic grains are the most effective solution for spring-end grinding, permitting lower pressures to be used, whilst maintaining high metal removal rates and low wheel consumption.

Within the family of ceramic grains, Norton Quantum is the latest innovation in grinding technology, designed for maximum performance and unrivalled precision, providing the fastest, finest grinding solution available.

Main Characteristics of Norton Quantum

- A new ceramic alumina grain chemistry and shape developed from the Saint Gobain patented Seeded-Gel Technology
- This revolutionary ceramic grain multiplies the cutting efficiency by controlling the grain breakdown at the micro-metric level
- A perfect blend between sharpness (free cutting) and toughness (life)
- Newly developed bonds to optimize the grain-to-bond adhesion and improve grain retention.

Norton Quantum wheels have demonstrated improved wheel life, lower dressing frequency, higher production rate and cooler cutting when compared to standard ceramic grain.
Below is a guidance table for first selection of Norton products

<table>
<thead>
<tr>
<th>ABRASIVE SELECTION GUIDE</th>
<th>SILICA CARBON STEEL SPRINGS (Heat Sensitive)</th>
<th>SILICA CARBON STEEL SPRINGS (General Purpose)</th>
<th>STAINLESS STEEL SPRINGS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Price/performance ranking</td>
<td>Good - Conventional Grain 88A, 40A 57A 88AC, 40AC, 57AC</td>
<td>Better - Standard Ceramic Grain nXGJ, nXGR nXGA nXGJC, nXGRC, nXGAC</td>
<td>Best - Norton Quantum nNQJ, nNQR nNQA nNQJC, nNQRC, nNQAC</td>
</tr>
</tbody>
</table>

C: Silicon Carbide

88A (J)*: Very friable pure white aluminium oxide
40A (R)*: Pure friable pink aluminium oxide, more durable than 88A
57 (A)*: Semi-friable aluminium oxide

nXGJ, nXGR, nXGA, nNQJ, nNQR, nNQA (n= 1,2,3,4 and refers to premium grain %)
nXGJC, nXGRC, nXGAC, nNQJC, nNQRC, nNQAC (n= 1,2,3,4 and refers to premium grain %)

* When used with diluent abrasive.

<table>
<thead>
<tr>
<th>GRIT AND GRADE SELECTION GUIDE</th>
<th>TYPICAL MACHINE TYPES (1)</th>
<th>RIGID SPRINGS</th>
<th>ELASTIC SPRINGS</th>
</tr>
</thead>
<tbody>
<tr>
<td>WIRE DIAMETER</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.5mm &lt; Ø &lt; 3mm</td>
<td>single pass</td>
<td>30 - 36 - 46</td>
<td>30 - 36 - 46</td>
</tr>
<tr>
<td></td>
<td>or continuous downfeed</td>
<td>D - S</td>
<td>P - R</td>
</tr>
<tr>
<td>4mm &lt; Ø &lt; 9mm</td>
<td>single pass</td>
<td>20 - 24 - 30</td>
<td>20 - 24 - 30</td>
</tr>
<tr>
<td></td>
<td>or continuous downfeed</td>
<td>P - S</td>
<td>O - R</td>
</tr>
<tr>
<td>10mm &lt; Ø</td>
<td>continuous downfeed</td>
<td>16 - 20</td>
<td>16 - 20</td>
</tr>
<tr>
<td></td>
<td></td>
<td>N - Q</td>
<td>M - P</td>
</tr>
</tbody>
</table>

(1) For single pass machines, choose a hard grade, for down-feed grinding select a soft grade

(2) For wet applications, choose a softer grade

**APPLICATION INFORMATION**

When contacting your local sales representative please provide the following data to enable us to provide you with our best product to suit your application.

<table>
<thead>
<tr>
<th>Wheel</th>
<th>Machine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheel dimensions (diam x thickness x hole)</td>
<td>Name &amp; Power (kW)</td>
</tr>
<tr>
<td>Working zone thickness</td>
<td>Machine type : continuous, downfeed or single pass</td>
</tr>
<tr>
<td>Dimensional tolerances (if any)</td>
<td>Coolant Type (if any)</td>
</tr>
<tr>
<td>Nut layout (if any)</td>
<td></td>
</tr>
<tr>
<td>Spring</td>
<td></td>
</tr>
<tr>
<td>Nut type</td>
<td>Wire and spring diameter (mm)</td>
</tr>
<tr>
<td>working zone pattern (perforated, plain..)</td>
<td>Wire composition and EU classification</td>
</tr>
<tr>
<td>Maximum Operating speed (m/s)</td>
<td>Spring hardness</td>
</tr>
</tbody>
</table>

**Main customer requirement**

Please specify any other parameter(s) to be improved.
All regular wheel dimensions and shapes are available for both “single pass” and “downfeed” machines in wet or dry applications.

Resinoid wheels can be provided with nuts (ISO shape 36) or without any fixture, to be mounted on metallic plates (ISO shape 35).

The grinding zone can be compact, compact with porosity inducer or with perforations (partial or throughout). For the most effective cooling, it is recommended the usage of throughout perforations (available on diameters 450/660/915mm).

This table highlights the most popular wheel dimensions available for spring-end grinding. The list is not exhaustive and dimensions can be provided for most applications. Contact your local Norton representative for more information.

<table>
<thead>
<tr>
<th>Dimensional Availability</th>
</tr>
</thead>
<tbody>
<tr>
<td>355 x 50 x 150</td>
</tr>
<tr>
<td>355 x 60 x 140</td>
</tr>
<tr>
<td>355 x 60 x 152.4</td>
</tr>
<tr>
<td>400 x 60 x 80</td>
</tr>
<tr>
<td>450 x 60 x 0</td>
</tr>
<tr>
<td>450 x 65 x 0</td>
</tr>
<tr>
<td>450 x 70 x 200</td>
</tr>
<tr>
<td>455 x 50 x 250</td>
</tr>
<tr>
<td>457 x 83 x 150</td>
</tr>
<tr>
<td>450 x 90 x 0</td>
</tr>
<tr>
<td>450 x 90 x 40</td>
</tr>
<tr>
<td>450 x 90 x 50</td>
</tr>
<tr>
<td>450 x 90 x 90</td>
</tr>
<tr>
<td>508 x 63 x 152.4</td>
</tr>
<tr>
<td>557 x 74 x 89</td>
</tr>
<tr>
<td>600 x 40 x 215</td>
</tr>
<tr>
<td>600 x 50 x 304.8</td>
</tr>
</tbody>
</table>
**EFFECTIVE COST REDUCTION - CASE STUDIES**

**STANDARD CERAMIC GRAIN XG**

**Wheel**
- **Norton Specification:**
  - Rough grinding: 3XGJ24520B98 - 30% Ceramic
  - Finish grinding: 3XGJ24M20B98 - 30% Ceramic
  - Competitor Spec: 30% ceramic
  - Dimensions: 660x80x150 mm
  - Shape 36 with perforation
  - MOS: 45m/s

**Material**
- Material composition: CrSi Steel
- Hardness of material ground: Hard
- Spring diameter: 25 mm
  - Wire diameter: 4 mm

**Machine**
- Name: Self made machine
- Cooling system: dry
- Infeed system: continuous downfeed
- Number of springs/charger [pcs]: 240 - 280
- Cycle time: 3 min

**Customer requirement**
- Decrease overall abrasive cost per spring

**Results**
- Despite similar amounts of ceramic grain, Norton specifications outperform competitor specifications without changing working parameters and maintaining burn free quality

![Graph showing comparison between competitor and Norton specifications](image-url)
**Wheel**
- Norton Specification: 3NQJ24PBQN
  - 30% Ceramic - Quantum
- Competitor Spec: 30% ceramic
- Dimensions: 660x100x150 mm
- Shape 36 with perforations
- MOS: 50m/s

**Machine**
- Name: Wafios
- Cooling system: dry
- Infeed system: continuous downfeed
- Number of springs/charger: 60 (CrSi)
- Cycle time: 3.5 min (CrSi) and 20 min (Stainless)

**Material**
- Material type: CrSi Steel & Stainless Steel
- Hardness of material ground: Various
- Spring diameter: 59 mm
  - Wire diameter: 8 mm (range 2-8 mm)

**Customer requirement**
- Increase wheel life and productivity

**Results**
- CrSi steel: Norton Quantum grinds more than 3 times the number of parts before dressing versus the leading competitor specification.
- Stainless steel: Equal performance to the leading competitor specification.
Wheel
- Norton Specification: 3NQ24MBQN
  - 30% Ceramic - Quantum
- Competitor Spec: - 35% ceramic grain
- Dimensions: 915x120x200 mm
- Shape 36 with perforations
- MOS: 35m/s

Material
- 1) Type CrSi Din 17223-2 FDSiC
  - 2) Type piano wire - Din 17223-1 Class C
- Hardness of material ground: high strength oil hardened valve spring steel.
- Spring Type1: Wire diameter: range 12-14 mm
  - Spring Type2: Wire diameter: range 10-11.5 mm

Machine
- Name: OMD
- Cooling system: dry
- Infeed system: continuous downfeed
- Number of springs/charger: 15 (CrSi) , 24 (piano wire)

Customer requirement
- Improve efficiency whilst maintaining quality

Results
- Norton Quantum showed a 20% faster grinding process