SALES OFFICES

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04. WE ARE TERELION
06. COMPANY MILESTONES
08. SERVICES AND SUPPORT
10. OPTIMIZE YOUR DRILLING
12. PRODUCT BENEFITS
16. RIDGEBACK™
20. D-FORCE™
24. AVENGER™
28. ROTARY PERCUSSION SYSTEM™
30. INDUSTRIAL DRILL BITS
GET READY FOR YOUR BREAK-THROUGH.

Wherever you may look, the world is full of challenging tasks for mankind to solve. At Terelion we specialize in those challenges posed by blasthole drilling in surface mining.

We’ve always been devoted to being the best in our business. We constantly explore new innovative designs, new materials, new manufacturing methods and new engineering tools. All with the aim to making the most hard-wearing, efficient and cost-effective roller cone drill bits available.

Some of our innovations are minor. Others lead to breakthroughs affecting the entire industry. Stay tuned, and you’ll be among the first to know when the next rock-drilling innovation is to be launched by Terelion.
The family business of Varel Manufacturing Company was founded by Daniel W Varel and headquartered in Texas, USA.

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1947
Varel begins volume production of rotary three cone drill bits and fixed cutter drag bits to the Mining, Construction & Seismic industries.

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1950
Inauguration of Varel de Mexico S.A. In the late 80's the entire manufacturing facility moved from Dallas to Mexico, where the majority of products continue to be produced for Terelion.

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1971
Family ownership changed and Varel was sold to a UK/USA Venture capital company. The well-respected Varel name was retained.

1998
Family ownership changed and Varel was sold to a UK/USA Venture capital company. The well-respected Varel name was retained.

1998
Acquisition of Walker Mc Donald, a well-known manufacturer of mining three cone bits from Greenville, Texas.

1999
Launch of the innovative drill bit series Ridgeback™. It introduces the first generation of advanced features to improve hole cleaning and extend bit life. Longer life bearings, improved cutting structures and patented shirntail concept.

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2008
Formation of a new holding company, Varel International Energy Services (VIES), to become parent company of Varel Oil & Gas, Downhole Products, and Varel Mining & Industrial.

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2005
Launch of the D-Force™ drill bit series. Designed for highly abrasive conditions. Combines field-proven and new features, like the high load SP1 bearing package, reinforced gage and shirntail protection.

2011
Varel acquires the RPS Rotary Percussion product line from Renegade Tool, USA.

2012
Launch of the Avenger™ the sealed bearing drill bit series. Combining the best of our patented features, knowledge and experience. Delivering extended bit life and lower Total Drilling Cost.

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2014
Sandvik acquires the holding company, Varel International Energy Services (VIES).

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2016
Launch of the Advanced Modeling Package (AMP) software, enabling a unique drill bit design that’s just right for any specific rock conditions.

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2020
Varel Mining & Industrial is renamed to Terelion.

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Varel Mining & Industrial is renamed to Terelion.
FREE OF CHARGE WITH EVERY BIT.

01. BIT SCHOOLS AND SEMINARS
Getting the most out of our highly engineered drill bits also requires operator skills. We carry out customized schools/seminars for all levels of drilling personnel dealing with the impact of rotary speeds, air flow and pulldown on bit to optimize drilling performance.

02. DRILL BIT PERFORMANCE ANALYSIS
Our highly qualified field engineering team will assist customers to gather performance data, produce detailed reports, and offer suggestions to improve performance based on data analysis.

03. DULL BIT ANALYSIS
Very often much can be learned from analyzing dull drilling bits in an effort to determine end of life causes. These drill bit examinations can be made on site or in our continuous improvement lab, in order to study wear patterns with the potential of improving bit life.

04. CONTINUOUS SITE VISITS
Our team of highly qualified design engineers are frequently visiting mine sites around the globe in order to carry out drill bit inspections, performance studies, and data analysis. This is just a part of the Engineer’s role, and the outcomes of such visits will often lead to customized designs and features specifically geared towards individual mine conditions and circumstances.
OPTIMIZE YOUR DRILLING PERFORMANCE.

The drill bit’s purchase price is only a small part of your operational Total Drilling Cost (TDC). A lower cost, lower performance product ties up drill resources and results in costly productivity losses. By Contrast, a high performance product increases holes per shift, productivity, and overall profitability. Dial up your profitability with Terelion.

$$TDC = \frac{B}{F} + \frac{R}{P}$$

- **B** = total bit price
- **R** = operating cost per hour for the drill rig expressed in dollars per hour
- **F** = total life of the rock bit expressed in either feet or meters
- **P** = penetration rate of the rock bit expressed as feet or meters per hour

01. GET THE MOST OUT OF EACH DRILL BIT
To maximize your bit life and rate of penetration:
- Choose the Terelion drill bit best suited for your specific formation. For guidance, see the Comparison and hardness table on page 40.
- Apply our tips for optimizing drill bit performance, listed on page 38.
- If you have any questions, your Terelion representative will be happy to answer them.

02. REDUCE YOUR CARBON FOOTPRINT
Improving your performance will also allow you to reduce your carbon footprint. More efficient drilling and maximized bit life mean less fuel consumption for your drill rigs and less resources consumed for supplying drill bits. All in all, this enables your operations to cut down on emissions and improve your sustainability report.

03. CUSTOMIZE YOUR TOOL DESIGN
To improve your drilling performance even further, we can create a drill bit design uniquely matched to your rock conditions. By importing your geological data into our digital tool AMP (Advanced Modeling Package), we can virtually design a drill bit that’s ideal for your specific conditions. The design file is then used to manufacture your customized drill bits.

04. LEVERAGE OUR SERVICES AND SUPPORT
Terelion and our distribution/servicing partners provide a range of services for our customers to help you get the full value out of your Terelion drill bits. See the full package on pages 8-9.
SOME ADVANTAGES ARE VISIBLE.
SOME YOU NEED X-RAY TO SEE.
RIDGEBACK™ HARD ROCK DRILLING.

Rotary bits for blasthole drilling in hard rock. Specially designed shirttail to assist in rapid cuttings evacuation. High load open bearings, robust cutting structure and HET carbide treatment provide high penetration rates and long life. Vented cones (9” diameter and up) provide for additional bearing cleaning and heat reduction.

<table>
<thead>
<tr>
<th>DIAMETER</th>
<th>SOFT TO MEDIUM</th>
<th>MEDIUM TO HARD</th>
<th>HARD TO VERY HARD</th>
<th>PIN SIZE</th>
<th>APPROX. WEIGHT</th>
</tr>
</thead>
<tbody>
<tr>
<td>In</td>
<td>mm</td>
<td></td>
<td></td>
<td>inches</td>
<td>lbs</td>
</tr>
<tr>
<td>6.25</td>
<td>159</td>
<td>RB53</td>
<td></td>
<td>3 1/2</td>
<td>42</td>
</tr>
<tr>
<td>6.75</td>
<td>171</td>
<td>RB40 RB50 RB60 RB70</td>
<td></td>
<td>3 1/2</td>
<td>46</td>
</tr>
<tr>
<td>7.375</td>
<td>187</td>
<td>RB40 RB50</td>
<td></td>
<td>3 1/2</td>
<td>58</td>
</tr>
<tr>
<td>7.875</td>
<td>200</td>
<td>RB30 RB40 RB50 RB60 RB63</td>
<td></td>
<td>4 1/2</td>
<td>76</td>
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<tr>
<td>8.5</td>
<td>216</td>
<td>RB40</td>
<td></td>
<td>4 1/2</td>
<td>83</td>
</tr>
<tr>
<td>8.75</td>
<td>222</td>
<td></td>
<td>RB63</td>
<td>4 1/2</td>
<td>83</td>
</tr>
<tr>
<td>9.0</td>
<td>229</td>
<td>RB20 RB30 RB40 RB63</td>
<td></td>
<td>4 1/2</td>
<td>96</td>
</tr>
<tr>
<td>9.875</td>
<td>251</td>
<td>RB35 RB40</td>
<td>RB60 RB63 RB67</td>
<td>5 5/8</td>
<td>143</td>
</tr>
<tr>
<td>10.625</td>
<td>270</td>
<td>RB25 RB35 RB40 RB63 RB67</td>
<td></td>
<td>6 5/8</td>
<td>157</td>
</tr>
<tr>
<td>11</td>
<td>279</td>
<td>RB53 RB60 RB63 RB67</td>
<td></td>
<td>6 5/8</td>
<td>193</td>
</tr>
<tr>
<td>12.25</td>
<td>311</td>
<td>RB40 RB64 RB67</td>
<td>RB63 RB67 RB70</td>
<td>6 5/8</td>
<td>225</td>
</tr>
<tr>
<td>13.75</td>
<td>349</td>
<td>RB43 RB53 RB57 RB67</td>
<td></td>
<td>6 5/8</td>
<td>292</td>
</tr>
<tr>
<td>15</td>
<td>381</td>
<td>RB53 RB60</td>
<td></td>
<td>7 5/8</td>
<td>362</td>
</tr>
<tr>
<td>16</td>
<td>406</td>
<td>RB60*</td>
<td></td>
<td>7 BECO</td>
<td>580</td>
</tr>
</tbody>
</table>

Your Terelion representative can assist you in selecting the proper bits to suit your application and maximize your productivity.

The availability of specific products may change from time to time. All models are available with BECO threads on request.

*R with 7” BECO pin.

NAIL NOZZLE RETENTION Even in the most abrasive conditions, the loss of nozzles is eliminated.

RIDGEBACK™ This patented shirttail feature allows cuttings to be removed from the hole effectively. This means reduced regrinding, faster drilling and lower total drilling costs.

REINFORCED SHIRT TAIL A pattern of tungsten carbide inserts and welded hardmetal resist wear and protect the bearing.

MAXIMUM GAGE PROTECTION Tungsten carbide inserts for superior wear resistance and bit life.

VENTED CONES Standard feature on all 9” and above Ridgeback™ drill bits. Improves bearing airflow, allowing cooler operation. Extends service life in high altitude applications and in areas of excessive groundwater.

HET CARBIDE TREATMENT The patented High Energy Tumbling™ (HET) method produces a unique cutting structure surface toughness that extends bit life and increases drilling rate.

ENHANCED CUTTING STRUCTURE Robust cutting structure providing toughness in transitional ground with high ROP.

SP1 BEARING DESIGN All Ridgeback™ drill bits incorporate advanced bearings designed to minimize over heating. The wear elements feature advanced materials to give the maximum bearing life under a wide variety of operating conditions.
SOFT FORMATION

All soft formation bits are designed with aggressive cutter profiles to provide extremely high penetration rates.

<table>
<thead>
<tr>
<th>RB20</th>
<th>2,000 to 10,000 psi</th>
<th>70 to 120 rpm</th>
<th>JET CIRCULATION</th>
<th>2,000 to 4,000 lbs/inch</th>
</tr>
</thead>
<tbody>
<tr>
<td>All sizes</td>
<td>COMPRESSIVE STRENGTHS</td>
<td>ROTATION SPEED</td>
<td></td>
<td>DRILLING WEIGHTS</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>RB30</th>
<th>2,000 to 10,000 psi</th>
<th>70 to 120 rpm</th>
<th>JET CIRCULATION</th>
<th>2,000 to 4,000 lbs/inch</th>
</tr>
</thead>
<tbody>
<tr>
<td>All sizes</td>
<td>COMPRESSIVE STRENGTHS</td>
<td>ROTATION SPEED</td>
<td></td>
<td>DRILLING WEIGHTS</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>RB40</th>
<th>5,000 to 15,000 psi</th>
<th>70 to 120 rpm</th>
<th>JET CIRCULATION</th>
<th>2,000 to 4,500 lbs/inch</th>
</tr>
</thead>
<tbody>
<tr>
<td>All sizes</td>
<td>COMPRESSIVE STRENGTHS</td>
<td>ROTATION SPEED</td>
<td></td>
<td>DRILLING WEIGHTS</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>RB43</th>
<th>5,000 to 15,000 psi</th>
<th>70 to 120 rpm</th>
<th>JET CIRCULATION</th>
<th>2,000 to 5,000 lbs/inch</th>
</tr>
</thead>
<tbody>
<tr>
<td>All sizes</td>
<td>COMPRESSIVE STRENGTHS</td>
<td>ROTATION SPEED</td>
<td></td>
<td>DRILLING WEIGHTS</td>
</tr>
</tbody>
</table>

MEDIUM FORMATION

Medium formation bits are most commonly used in the mining industry, and provide long bearing life with additional insert strength for consolidated formations.

<table>
<thead>
<tr>
<th>RB47</th>
<th>10,000 to 30,000 psi</th>
<th>70 to 120 rpm</th>
<th>JET CIRCULATION</th>
<th>2,500 to 5,000 lbs/inch</th>
</tr>
</thead>
<tbody>
<tr>
<td>All sizes</td>
<td>COMPRESSIVE STRENGTHS</td>
<td>ROTATION SPEED</td>
<td></td>
<td>DRILLING WEIGHTS</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>RB50</th>
<th>10,000 to 30,000 psi</th>
<th>70 to 120 rpm</th>
<th>JET CIRCULATION</th>
<th>2,500 to 5,000 lbs/inch</th>
</tr>
</thead>
<tbody>
<tr>
<td>All sizes</td>
<td>COMPRESSIVE STRENGTHS</td>
<td>ROTATION SPEED</td>
<td></td>
<td>DRILLING WEIGHTS</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>RB53</th>
<th>12,000 to 30,000 psi</th>
<th>70 to 120 rpm</th>
<th>JET CIRCULATION</th>
<th>2,500 to 5,000 lbs/inch</th>
</tr>
</thead>
<tbody>
<tr>
<td>All sizes</td>
<td>COMPRESSIVE STRENGTHS</td>
<td>ROTATION SPEED</td>
<td></td>
<td>DRILLING WEIGHTS</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>RB60</th>
<th>25,000 to 45,000 psi</th>
<th>60 to 100 rpm</th>
<th>JET CIRCULATION</th>
<th>3,000 to 6,000 lbs/inch</th>
</tr>
</thead>
<tbody>
<tr>
<td>All sizes</td>
<td>COMPRESSIVE STRENGTHS</td>
<td>ROTATION SPEED</td>
<td></td>
<td>DRILLING WEIGHTS</td>
</tr>
</tbody>
</table>
MEDIUM HARD FORMATION
All medium hard formation bits are designed with robust cutting structure providing high Rate of Penetration, especially in transitional formations.

**RB63**
- **Compressive Strengths**: 27,500 to 47,500 psi
- **Rotation Speed**: 60 to 100 rpm
- **Jet Circulation**: All sizes
- **Drilling Weights**: 3,000 to 6,000 lbs/inch

**RB67**
- **Compressive Strengths**: 30,000 to 50,000 psi
- **Rotation Speed**: 60 to 100 rpm
- **Jet Circulation**: All sizes
- **Drilling Weights**: 3,000 to 6,500 lbs/inch

HARD/VERY HARD FORMATION
All hard formation bits are designed with tough, reduced extension cutter profiles to provide maximum durability in hard formations.

**RB70**
- **Compressive Strengths**: 35,000 to 60,000 psi
- **Rotation Speed**: 50 to 90 rpm
- **Jet Circulation**: All sizes
- **Drilling Weights**: 5,000 to 8,000 lbs/inch
**D-Force™**

**DRILLING IN ABRASIVE FORMATIONS.**

Rotary bits for blasthole drilling in abrasive formations. Equipped with Sidewinder shirttail and abrasion resistant carbide inserts to increase wear resistance. High load open bearings, robust cutting structure and HET carbide treatment provide high penetration rates and long life. Vented cones (9” diameter and up) provide for additional bearing cleaning and heat reduction.

**Product Range**

<table>
<thead>
<tr>
<th>DIAMETER</th>
<th>SOFT TO MEDIUM</th>
<th>MEDIUM TO HARD</th>
<th>HARD TO VERY HARD</th>
<th>PIN SIZE</th>
<th>APPROX. WEIGHT</th>
</tr>
</thead>
<tbody>
<tr>
<td>in</td>
<td>mm</td>
<td></td>
<td></td>
<td>inches</td>
<td>lbs</td>
</tr>
<tr>
<td>6.75</td>
<td>171</td>
<td>DF43</td>
<td>DF60</td>
<td>DF67</td>
<td>3 1/2</td>
</tr>
<tr>
<td>7.875</td>
<td>200</td>
<td>DF43</td>
<td>DF60</td>
<td>DF63</td>
<td>4 1/2</td>
</tr>
<tr>
<td>9</td>
<td>229</td>
<td>DF43</td>
<td>DF60</td>
<td>DF70</td>
<td>4 1/2</td>
</tr>
<tr>
<td>9.875</td>
<td>251</td>
<td>DF30</td>
<td>DF60</td>
<td>DF67</td>
<td>6 5/8</td>
</tr>
<tr>
<td>10.625</td>
<td>270</td>
<td>DF30</td>
<td>DF60</td>
<td>DF63</td>
<td>6 5/8</td>
</tr>
<tr>
<td>11</td>
<td>279</td>
<td>DF30</td>
<td>DF60</td>
<td>DF67</td>
<td>6 5/8</td>
</tr>
<tr>
<td>12.25</td>
<td>311</td>
<td>DF53</td>
<td>DF60</td>
<td></td>
<td>6 5/8</td>
</tr>
</tbody>
</table>

Your Terelion representative can assist you in selecting the proper bits to suit your application and maximize your productivity. The availability of specific products may change from time to time. All models are available with BECO threads on request.
### SOFT FORMATION

All soft formation bits are designed with aggressive cutter profiles to provide extremely high penetration rates.

<table>
<thead>
<tr>
<th>Model</th>
<th>Min to Max PSI</th>
<th>Min to Max RPM</th>
<th>Min to Max lbs/inch</th>
</tr>
</thead>
<tbody>
<tr>
<td>DF30</td>
<td>2,000 to 10,000</td>
<td>70 to 120</td>
<td>2,000 to 4,000</td>
</tr>
<tr>
<td>DF43</td>
<td>5,000 to 23,500</td>
<td>70 to 120</td>
<td>2,000 to 5,000</td>
</tr>
</tbody>
</table>

### MEDIUM FORMATION

Medium formation bits are most commonly used in the mining industry, and provide long bearing life with additional insert strength for consolidated formations.

<table>
<thead>
<tr>
<th>Model</th>
<th>Min to Max PSI</th>
<th>Min to Max RPM</th>
<th>Min to Max lbs/inch</th>
</tr>
</thead>
<tbody>
<tr>
<td>DF53</td>
<td>12,000 to 30,000</td>
<td>70 to 120</td>
<td>2,500 to 5,000</td>
</tr>
<tr>
<td>DF60</td>
<td>25,000 to 45,000</td>
<td>60 to 100</td>
<td>3,000 to 6,000</td>
</tr>
</tbody>
</table>

### MEDIUM HARD FORMATION

All medium hard formation bits are designed with robust cutting structure providing high Rate of Penetration, especially in transitional formations.

<table>
<thead>
<tr>
<th>Model</th>
<th>Min to Max PSI</th>
<th>Min to Max RPM</th>
<th>Min to Max lbs/inch</th>
</tr>
</thead>
<tbody>
<tr>
<td>DF63</td>
<td>27,500 to 47,500</td>
<td>60 to 100</td>
<td>3,000 to 6,000</td>
</tr>
<tr>
<td>DF67</td>
<td>30,000 to 50,000</td>
<td>60 to 100</td>
<td>3,000 to 6,500</td>
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</tbody>
</table>

### HARD/VERY HARD FORMATION

All hard formation bits are designed with tough low extension cutter profiles to provide maximum durability in hard formations.

<table>
<thead>
<tr>
<th>Model</th>
<th>Min to Max PSI</th>
<th>Min to Max RPM</th>
<th>Min to Max lbs/inch</th>
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</thead>
<tbody>
<tr>
<td>DF70</td>
<td>35,000 to 60,000</td>
<td>50 to 90</td>
<td>5,000 to 8,000</td>
</tr>
</tbody>
</table>
**AVENGER™**

**HIGH-PERFORMANCE DRILLING.**

Sealed bearing rotary bits for high-performance blasthole drilling. Available in versions with roller (AVL) or journal (AV) bearings to provide longer bearing life. The external features of Avenger™ drill bits are carried over from both Ridgeback™ and D-Force™ drill bit series. Thereby, each Avenger™ drill bit is optimized for drilling in hard rock or abrasive formations, providing maximum Rate of Penetration and wear resistance.

<table>
<thead>
<tr>
<th>DIAMETER</th>
<th>SOFT TO MEDIUM</th>
<th>MEDIUM TO HARD</th>
<th>PIN SIZE</th>
<th>APPROX. WEIGHT</th>
</tr>
</thead>
<tbody>
<tr>
<td>in mm</td>
<td>AVL30</td>
<td>AVL53</td>
<td>AVL53</td>
<td>AVL30/AVL53</td>
</tr>
<tr>
<td>7.875</td>
<td>1/2</td>
<td>76</td>
<td>34.5</td>
<td></td>
</tr>
<tr>
<td>9</td>
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<td>AVL53</td>
<td>AVL53</td>
<td>AVL40/AVL60</td>
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<tr>
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<td>43</td>
<td></td>
</tr>
<tr>
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<td>AVL30</td>
<td>AVL53/AVL53</td>
<td>AVL53</td>
<td>AVL53</td>
</tr>
<tr>
<td>12.25</td>
<td>AVL30</td>
<td>AVL53</td>
<td>AVL53</td>
<td>AVL53/AVL53</td>
</tr>
<tr>
<td>13.75</td>
<td>AVL53</td>
<td>AVL60</td>
<td>AVL63</td>
<td>AVL60/AVL60</td>
</tr>
</tbody>
</table>

Your Terelion representative can assist you in selecting the proper bits to suit your application and maximize your productivity.

The availability of specific products may change from time to time. All models are available with BECO threads on request.

**SIDEWINDER™ CUTTINGS EVACUATION**

The Sidewinder shirttail design eliminates most of the re-cutting of cuttings as they are efficiently lifted up and out of the hole.

**SEAL JOURNAL BEARING (AV)**

Designed for moderate to ultra-high pull-down applications where extended bearing life is required. In addition to the patented conical seal gland, the journal design also features a patented heat shield to prevent thermal degradation of the seal.

**SEALED ROLLER BEARING (AVL)**

Designed for lower to medium pull-down applications where the ground conditions limit the bearing life of standard open bearing bits. The patented conical seal gland extends seal life.

**HET CARBIDE TREATMENT**

The patented High Energy Tumbling™ (HET) method produces a unique cutting structure on face strengthened that extends bit life and increases drilling rate.

**ENHANCED CUTTING STRUCTURE**

Designed to provide the highest penetration rates and the longest life available.
SOFT FORMATION
All soft formation bits are designed with aggressive cutter profiles to provide extremely high penetration rates.

<table>
<thead>
<tr>
<th></th>
<th>2,000 to 10,000 psi</th>
<th>70 to 120 rpm</th>
<th>2,000 to 5,000 lbs/inch</th>
</tr>
</thead>
<tbody>
<tr>
<td>AV30</td>
<td>COMPRESSIVE STRENGTHS</td>
<td>ROTATION SPEED</td>
<td>JET CIRCULATION</td>
</tr>
<tr>
<td>AV40</td>
<td>5,000 to 15,000 psi</td>
<td>70 to 120 rpm</td>
<td>2,000 to 5,000 lbs/inch</td>
</tr>
<tr>
<td>AV43</td>
<td>8,500 to 23,500 psi</td>
<td>70 to 120 rpm</td>
<td>2,000 to 5,000 lbs/inch</td>
</tr>
</tbody>
</table>

MEDIUM FORMATION
Medium formation bits are the most commonly used in the mining industry, and provide long bearing life with additional insert strength for consolidated formations.

<table>
<thead>
<tr>
<th></th>
<th>15,000 to 35,000 psi</th>
<th>70 to 120 rpm</th>
<th>2,000 to 6,000 lbs/inch</th>
</tr>
</thead>
<tbody>
<tr>
<td>AV53</td>
<td>COMPRESSIVE STRENGTHS</td>
<td>ROTATION SPEED</td>
<td>JET CIRCULATION</td>
</tr>
</tbody>
</table>

MEDIUM HARD FORMATION
All medium hard formation bits are designed with robust cutting structure providing high Rate of Penetration, especially in transitional formations.

<table>
<thead>
<tr>
<th></th>
<th>25,000 to 45,000 psi</th>
<th>60 to 100 rpm</th>
<th>3,000 to 7,000 lbs/inch</th>
</tr>
</thead>
<tbody>
<tr>
<td>AV60</td>
<td>COMPRESSIVE STRENGTHS</td>
<td>ROTATION SPEED</td>
<td>JET CIRCULATION</td>
</tr>
<tr>
<td>AV63</td>
<td>27,500 to 47,500 psi</td>
<td>60 to 100 rpm</td>
<td>3,000 to 7,000 lbs/inch</td>
</tr>
<tr>
<td>AV67</td>
<td>30,000 to 50,000 psi</td>
<td>60 to 100 rpm</td>
<td>3,000 to 7,000 lbs/inch</td>
</tr>
</tbody>
</table>
The patented RPS Rotary Percussion System combines the best advantages of rotary drilling and percussive drilling. The rotary cutting action combined with a percussive element allows for formations to fracture more easily. Thereby, RPS can drill efficiently in most formations whether hard or soft, which leads to improved penetration rates and reduced drilling costs. The Plug and play design makes it easy to fit the RPS system on your existing rotary drills.

### Product Range

<table>
<thead>
<tr>
<th>Diameter</th>
<th>Soft to Medium</th>
<th>Medium to Hard</th>
<th>Hard to Very Hard</th>
<th>Pin Size</th>
<th>Approx. Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>in</td>
<td>mm</td>
<td></td>
<td></td>
<td>inches</td>
<td>lbs</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>kg</td>
<td></td>
</tr>
<tr>
<td>6.75</td>
<td>171</td>
<td>RP43</td>
<td>RP50</td>
<td>2 1/2</td>
<td>66</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>RP60</td>
<td></td>
<td>27</td>
</tr>
<tr>
<td>7.875</td>
<td>200</td>
<td>RP43</td>
<td>RP50</td>
<td>2 1/2</td>
<td>76</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>RP70</td>
<td></td>
<td>35</td>
</tr>
<tr>
<td>9</td>
<td>229</td>
<td>RP35</td>
<td>RP40</td>
<td>4 1/2</td>
<td>96</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>RP53</td>
<td></td>
<td>43</td>
</tr>
<tr>
<td>9.875</td>
<td>251</td>
<td>RP35</td>
<td>RP53</td>
<td>6 1/8</td>
<td>145</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>RP63</td>
<td></td>
<td>66</td>
</tr>
<tr>
<td>10.625</td>
<td>270</td>
<td>RP40</td>
<td>RP53</td>
<td>6 1/8</td>
<td>157</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>RP63</td>
<td></td>
<td>72</td>
</tr>
<tr>
<td>12.25</td>
<td>311</td>
<td>RP53</td>
<td>RP60</td>
<td>6 1/8</td>
<td>225</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>RP67</td>
<td></td>
<td>102</td>
</tr>
</tbody>
</table>

AV/AVL products can be modified to run under RPS by special request. Your Terelion representative can assist you in selecting the proper bits to suit your application and maximize your productivity. The availability of specific products may change from time to time.

**PLUG AND PLAY** The plug and play design to fit on your existing rotary drills effectively makes the EPP a broad application tool for the blast hole market. RPS will operate efficiently on any air rotary drilling with 80-100 psi available.

**OPTIMIZE RP DRILL BITS** A high quality, energy focused bit is necessary to maximize the drilling results possible. The RP Series is designed specifically for use with the RPS tool to maximize ROP and minimize TDC. Switching out bits is easy - all RPS tools are built with API bit connections.
A WIDER RANGE OF ROLLER CONE DRILL BITS FOR INDUSTRIAL APPLICATIONS.

Terelion offers more than 100 variants of roller cone drill bits designed for special use in industrial applications. Here you can find the perfect match for your operations, no matter if you’re into construction, water well drilling, mineral exploration or any other industrial drilling business. Our industrial product line includes both tungsten carbide insert (TCI) bits and steel tooth bits for the toughest drilling applications.

01. HORIZONTAL DIRECTIONAL DRILLING
02. PILOT HOLE DRILLING
03. MINERAL EXPLORATION
04. WATER WELL DRILLING
05. PRE-PILED RIVING
06. TOWER ANCHORING ... AND MORE.
GET YOUR DETAILED SPECS UPON REQUEST.

Contact us with your query and we’ll provide you with a drill bit specification that’s just right for the drilling job you’re up to.

TARGET™ HDD SERIES

Designed specifically for horizontal directional drilling (HDD) and trenchless technology applications. Available in both open bearing and sealed bearing configurations.

KEY FEATURES
Available in both open bearing and sealed bearing configurations. Patented EdgeGuard™ shirttail protection. HET treated carbide inserts.

FORMATIONS
Available for soft, medium and hard.

BIT SIZES
3 7/8” through 6 1/2”.

PRODUCT RANGE
UT

PILOT HOLE BITS

A range of sealed journal and roller bearing bits designed for drilling the most demanding raise bore pilot holes and blind bore pilot holes.

KEY FEATURES

FORMATIONS
Available for medium and hard.

BIT SIZES
9” through 15”.

PRODUCT RANGE
PH Sealed journal bearing, PHR Sealed roller bearing

REVERSE CIRCULATION BITS

Deliver exceptional drilling performance in soft to medium formations typically found in mineral exploration. Available with both sealed and open bearings.

KEY FEATURES

FORMATIONS
Available for soft, medium and hard.

BIT SIZES
4 3/4” through 5 3/4”.

PRODUCT RANGE
DW, RX, RC, QMC

EDGEGUARD™ SHIRTTAIL PROTECTION

The patented EdgeGuard™ shirttail protection with solid tungsten carbide microshields significantly increases bit life.
**TCI BITS**

Water well drilling or geothermal/hot spring drilling.

**KEY FEATURES**
- Sealed bearing insert bits.

**FORMATIONS**
- Available for soft, medium and hard.

**BIT SIZES**
- 4 3/4” through 26”.

**PRODUCT RANGE**
- IADC 415 through 625.

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**STEEL TOOTH BITS**

Construction and water well drilling.

**KEY FEATURES**
- Open and sealed bearing.

**FORMATIONS**
- Available for soft, medium and hard.

**BIT SIZES**
- Open bearing – 2 7/8” through 6” for soft, medium and hard formations. Sealed bearing – 9 7/8” through 26” for soft and medium formations.

**PRODUCT RANGE**

Please ask your Terelion representative for the full and detailed product offering for these bits.
TIPS FOR OPTIMIZING DRILL BIT PERFORMANCE.

01. Keep rotating the bit, and turn on the air before the bit touches the ground, and keep the air on until the bit is out of the hole. If the bit is to stay in the hole while adding drill steel, blow the hole clean for 60 seconds prior to turning off the air.

02. When purchasing a new drill specify compressors with adequate capacity. Don’t forget the altitude factor when sizing the compressor. Often 7,000 to 10,000 linear feet per minute in return air velocity is required to properly clean the hole, particularly with heavier or larger cuttings.

03. Inspect the rock bit after each hole and record the condition of the rock bit at regular intervals.

04. Avoid early bit failures by refraining from using bent drill steel and excessively worn drill steel, stabilizers, deck bushings or shock subs.

05. When making up the rock bit use slow rotation and ensure that the drill string and rock bit mate properly shoulder to shoulder. Monitor the process carefully in order to avoid cross threading.

06. Use proper tool joint thread compound to maintain connections.

07. Use the factory recommended weight and rotation speeds to accommodate the formations being drilled.

08. Rotary speed should be decreased as down pressure is increased and down pressure decreased as rotary speed is increased.

09. Accurate information is valuable knowledge. Always record footage drilled, time in the hole, rpm, weight on bit, psi, formation drilled and any unusual drilling conditions. (Water in the hole, broken formations, etc.)

10. Form drilling process improvement teams with your key suppliers. Establish improvement goals and measure progress.
Insert bit comparison and hardness chart.

Steel tooth bit comparison and hardness chart.

Nozzle hole area.

<table>
<thead>
<tr>
<th>HOLE SIZE</th>
<th>AREA 1 HOLE</th>
<th>AREA 3 HOLES</th>
</tr>
</thead>
<tbody>
<tr>
<td>mm</td>
<td>Square in mm²</td>
<td>Square in mm²</td>
</tr>
<tr>
<td>1/4</td>
<td>6.35 0.049</td>
<td>31.62 0.419</td>
</tr>
<tr>
<td>9/32</td>
<td>7.14 0.062</td>
<td>40.00 0.500</td>
</tr>
<tr>
<td>5/16</td>
<td>7.93 0.076</td>
<td>49.04 0.566</td>
</tr>
<tr>
<td>11/32</td>
<td>8.73 0.093</td>
<td>60.00 0.666</td>
</tr>
<tr>
<td>3/8</td>
<td>9.52 0.110</td>
<td>70.97 0.777</td>
</tr>
<tr>
<td>13/32</td>
<td>10.31 0.130</td>
<td>83.88 0.938</td>
</tr>
<tr>
<td>7/16</td>
<td>11.11 0.150</td>
<td>96.78 1.126</td>
</tr>
<tr>
<td>15/32</td>
<td>11.90 0.172</td>
<td>110.97 1.326</td>
</tr>
<tr>
<td>5/8</td>
<td>12.70 0.196</td>
<td>126.46 1.588</td>
</tr>
<tr>
<td>11/16</td>
<td>13.48 0.222</td>
<td>142.25 1.838</td>
</tr>
<tr>
<td>3/4</td>
<td>14.28 0.248</td>
<td>150.01 2.116</td>
</tr>
<tr>
<td>7/8</td>
<td>15.06 0.285</td>
<td>168.78 2.438</td>
</tr>
<tr>
<td>1</td>
<td>15.87 0.335</td>
<td>188.57 2.805</td>
</tr>
<tr>
<td>1 1/8</td>
<td>16.67 0.391</td>
<td>209.35 3.234</td>
</tr>
<tr>
<td>1 1/4</td>
<td>17.46 0.464</td>
<td>231.14 3.732</td>
</tr>
</tbody>
</table>

Nozzle size adjustment for bits with vented cones.

Unique feature at Terelion are vented cones.

Bits with vented cones have significantly more airflow through the bearings than standard bits. The nozzle size should be reduced in order to maintain suitable back pressure for proper cooling and cleaning. This chart gives the proper nozzle sizes to use with bits with vented cones.
In addition to adequate return air velocities, the pressure drop across the bit must be controlled to obtain the optimum bearing life. Pressure drop across the bit should be maintained in excess of 30 psi. Two (2) to ten (10) psi should be added for losses in the system ahead of the bit. For optimum bit life nozzles should be selected to hold pressure near the maximum allowable on the compressor.

This table assumes a new compressor operating at sea level. ACFM should be adjusted for maintenance condition and derated for altitude.

### Helpful hole cleaning information.

For the most effective hole cleaning a minimum bailing velocity of 6000 feet per minute is considered desirable. This volume is calculated for the most common bit and pipe sizes. For dense materials, this volume should be increased in order to yield optimum cleaning efficiency.

The simple formula \( Q = AV \) can be applied to determine the volume flow of air \( Q \) necessary to give the desired velocity \( V \). \( A \) is the area of the hole through which the cuttings-laden air flows. This area is the area of the hole less the area filled by the drill pipe.

### Bailing velocity.

\[
BV = 183.3 \times ACFM
\]

\( BV \) = Bailing velocity (feet per minute)

ACFM = Actual cubic feet of free air per minute delivered

183.3 = Factor for conversion

\( D \) = Diameter of the hole being drilled (inches)

\( d \) = Outside diameter of the drill pipe being utilized (inches)