EvoQuip supplies a complete range of genuine crushing and screening spare parts that are designed specifically for use in EvoQuip equipment. Using genuine EvoQuip parts is proven to enhance performance and reliability, helping maximise machine uptime.

This guide has been developed to help you expand your knowledge of crusher wear parts and guide you when selling wear parts to your customers.

You will find information on the following topics:

1. Wear Parts Overview
2. Jaw Crusher Wear Parts
3. Impactor Crusher Wear Parts
WEAR PARTS OVERVIEW

METALLURGY OPTIONS

JAW LINERS

18% Manganese
Standard fit on all jaw crushers.
This is a liner suitable for all applications.

22% Manganese
Optional fit for all jaw crushers.
Hardens quicker in abrasive applications.

14% Manganese
This is an option and is ordered in on demand.
For use in soft low abrasion applications.

WEAR PARTS OVERVIEW

METALLURGY OPTIONS

JAW & CONE LINERS

18% Manganese
Standard fit on all jaw & cone crushers.
This is a liner suitable for all applications.

22% Manganese
Optional fit for all jaw & cone crushers.
Hardens quicker in abrasive applications.

14% Manganese
This is an option & is ordered in on demand.
For use in soft low abrasion applications.

CRUSHABILITY
How easy is product broken into smaller fragments

ABRASIVENESS
It is very important to know the abrasive qualities of the material you are looking to crush. Materials can be soft but abrasive. The abrasive nature of the material will dictate the estimated wear life of your wear parts and what metallurgy should be utilized. The 3 main abrasives found in rock are listed below:

- SiO₂: Silica Dioxide
- FeO₂: Iron Oxide
- Al₂O₃: Aluminium Oxide

HARDNESS OF MINERALS
Some minerals are very soft; others are very hard. The degree of hardness is an aid in identifying the minerals. Diamonds are harder than quartz and will therefore, scratch quartz; quartz will scratch calcite; calcite will scratch gypsum and so on. An easy way of estimating the hardness of a mineral in the field is by trying to scratch it with such common objects as a fingernail, a copper penny, a pocket knife blade, and a piece of window glass. Glass the hardest of the four, will scratch the most minerals, the knife is next in hardness; then in order comes the copper cent, and the fingernail.

BOND WORK INDEX
The amount of energy required by plant to crush material

LOS ANGELES VALUE
The Los Angeles test is commonly used to evaluate the hardness of aggregates to find the suitability of aggregates for use in road construction. Therefore, the road aggregates should be hard enough to resist abrasion.

UCS (UNIAXIAL COMPRESSIVE STRENGTH)
Predicting the strength and brittleness of rocks from a crushability index

FRENCH ABRASIVENESS TEST
The Abrasivity Coefficient (ABR) is defined as the ratio of the plates weight loss to the mass of tested material. The index is given in grams per ton and varies between 0 to over 2000, depending on whether the rock is respectively little or highly abrasive.

ROCK TYPES

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>14% Manganese</td>
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</tr>
<tr>
<td>18% Manganese</td>
<td>■</td>
<td>■</td>
<td>■</td>
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<td></td>
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<tr>
<td>22% Manganese</td>
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</tr>
</tbody>
</table>
WEAR PARTS OVERVIEW

MANGANESE

Manganese is added to steel to improve strength, durability and toughness.

The strength of a jaw liner is the ability to withstand crushing forces without failure and is dependent on the microstructure. Manganese steel has high-hardness properties and is wear resistant.

Work hardening

Work hardening of a jaw liner, is the strengthening of the liner as it is pounded by rock forces inside the crushing chamber. This strengthening occurs because of permanent changes within the microstructure of the material on the liner surface.

Before work hardening, the molecular structure of the liner is a regular, defect-free pattern. As the liner is pounded by rock, the microstructure dislocates and the structure becomes denser. The denser structure provides more resistance to forces and is observed as strengthening or work hardening.

Through hardening

Through hardening is when the core of the manganese loses its ductility. For manganese to work the skin has to be very hard and abrasive resistant but the core needs to be as ductile and as soft as chewing gum. If manganese is misapplied, there is a serious risk of losing this innate ductility that must be at the core.

Manganese liner facts:

- Manganese liners are used because of their ability to work harden while crushing, which extends their wear life dramatically.
- Liners work harden by compressive forces and at any given time the work hardened face is only about 2-3mm.
- The speed at which the liner work hardens increases as the percentage of manganese content increases. For example, 12-14% of manganese content work hardens slower than 20-24% of manganese content.
- The work hardened face has a higher Brunel value if the percentage of manganese content is lower. For example, once work hardened, steel with 12-14% manganese content will be more wear resistant than steel with 16-18% content.

How do I optimize liner wear life?

- Reduce the amount of fine and wet material allowed into the crushing chamber by using a correct choice of feeder.
- Run the chamber at an optimum speed. Running it too fast will hinder the liners ability to ‘bite’ the material and pull it into the chamber, resulting in material rubbing against the liners, promoting premature wear.
- Tight Closed Side Settings (CSS) can hinder the liners ability to sufficiently work harden. By initially running the chamber at a larger CSS for a day or two this could help increase liner wear life.
- Rotating jaw liners prematurely allows the crushing faces to work harden more effectively.

WEAR LIFETIME

What is wear?

Wear is produced when two elements press against each other, such as a jaw liner and crushing material. During this process, small materials from each element become detached, causing the surface to wear away.

A primary factor in wear for crushing applications is abrasion. Material fatigue is also a factor as the jaw liners are subject to numerous pressure and impact stresses.

The diagram below summarizes factors that affect the wear lifetime of crusher wear parts.
WEAR PARTS OVERVIEW

WEAR COSTS

Wear occurs in all crushers but costs can be controlled by selecting the correct crusher type for the abrasive content of the material to be crushed. The figure below demonstrates how a relatively small increase in abrasive content can result in wear costs increasing. Exact wear cost is a function of feed size, reduction ratio, moisture content, capacity friability and grain size.

The same logic can be applied when selecting the correct wear liner for your application. For example, if it is a highly abrasive application then 22% manganese content would be considered a better option over 18% manganese content.

MATERIAL PROPERTIES TABLE

<table>
<thead>
<tr>
<th>MATERIAL PROPERTIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>ROCK NAME</td>
</tr>
<tr>
<td>Amphibolite</td>
</tr>
<tr>
<td>Basalt</td>
</tr>
<tr>
<td>Diabase</td>
</tr>
<tr>
<td>Diorite</td>
</tr>
<tr>
<td>Dolomite</td>
</tr>
<tr>
<td>Gabbro</td>
</tr>
<tr>
<td>Gneiss</td>
</tr>
<tr>
<td>Granite</td>
</tr>
<tr>
<td>Gravel</td>
</tr>
<tr>
<td>Limestone</td>
</tr>
<tr>
<td>Rhyolite</td>
</tr>
<tr>
<td>Sandstone</td>
</tr>
<tr>
<td>Quartzite</td>
</tr>
</tbody>
</table>

The 3 main abrasives found in rocks are listed below:

- **SiO₂**: Silica Dioxide
- **Fe₂O₃**: Iron Oxide
- **Al₂O₃**: Aluminium Oxide
WEAR PARTS OVERVIEW

HARDNESS: COMPRESSIVE STRENGTH OF MATERIALS

The hardness of a material is a major consideration when selecting the type of crusher to use. Hardness is a factor in the amount of wear and tear crushers and screens experience. In most cases the hardest materials are:

- Igneous formations (granite)
- Metamorphic formations (quartzite)

Softer materials are usually sedimentary formations such as limestone. As there are always exceptions, testing of material is recommended.

### COMPRESSIVE STRENGTH

<table>
<thead>
<tr>
<th>VERY SOFT</th>
<th>SOFT</th>
<th>MEDIUM</th>
<th>HARD</th>
<th>VERY HARD</th>
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<tbody>
<tr>
<td>4400 - 10,000 psi (27 - 69 MPa)</td>
<td>10,000 - 20,000 psi (69 - 138 MPa)</td>
<td>20,000 - 30,000 psi (138 - 207 MPa)</td>
<td>30,000 - 40,000 psi (207 - 276 MPa)</td>
<td>&gt; 40,000 psi (&gt;310 MPa)</td>
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<tr>
<td>Lime Rock</td>
<td>Asbestos Rock</td>
<td>Limestone</td>
<td>Granite</td>
<td>Iron Ore</td>
</tr>
<tr>
<td>Caliche</td>
<td>Gypsum Rock</td>
<td>Dolomite</td>
<td>Quartzite</td>
<td>Granite</td>
</tr>
<tr>
<td>Diatomite</td>
<td>Slate</td>
<td>Sandstone</td>
<td>Iron Ore</td>
<td>Granite Gravel</td>
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<td>Talc</td>
<td>Gneiss</td>
<td>Gravel</td>
<td>Trap Rock</td>
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<td>Gabbro</td>
<td>Basalt</td>
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<tr>
<td></td>
<td></td>
<td>Marble</td>
<td>Serpentine</td>
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</table>

### MOHS SCALE OF HARDNESS

<table>
<thead>
<tr>
<th>SCALE</th>
<th>MINERAL</th>
<th>EXAMPLES</th>
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<tbody>
<tr>
<td>1</td>
<td>TALC</td>
<td>Baby Powder</td>
</tr>
<tr>
<td>2</td>
<td>GYPSUM</td>
<td>Finger Nail , Gold</td>
</tr>
<tr>
<td>3</td>
<td>CALCITE</td>
<td>Concrete , Limestone</td>
</tr>
<tr>
<td>4</td>
<td>FLUORITE</td>
<td>Marble , Copper Penny</td>
</tr>
<tr>
<td>5</td>
<td>APATITE</td>
<td>Window Glass</td>
</tr>
<tr>
<td>6</td>
<td>FELDSPAR</td>
<td>Steel Blade Knife</td>
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<tr>
<td>7</td>
<td>QUARTZ</td>
<td>Granite , Sand</td>
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<tr>
<td>8</td>
<td>TOPAZ</td>
<td>Topaz</td>
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<tr>
<td>9</td>
<td>CORUNDUM</td>
<td>Ruby , Sapphire</td>
</tr>
<tr>
<td>10</td>
<td>DIAMOND</td>
<td>Diamond</td>
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</table>

### SIDE LINER / CHEEK PLATES

- Terex provides a full range of Jaw and Impactor side liners
- Manufactured to 450 Brinell steel hardness
- Industry standard 400 Brinell or less

**INCREASED WEAR LIFE**

**WEAR LIFE COMPARED TO STEEL HARDNESS**

**TEREX STANDARD - 450 HARDNESS**

**INDUSTRY STANDARD - 400 HARDNESS**

**STANDARD MILD STEEL**

**STEEL HARDNESS**
JAW CRUSHER TERMINOLOGY

Open Side Setting (OSS)
Maximum distance between jaw plates for a given setting (the distance when the jaw is at rest).

Close side setting (CSS)
Minimum distance between jaw plates derived from the OSS and the stroke.

Drive Side
Drive side of Crusher. With grooved pulley for drive belts.

Non Drive Side
Opposite side of the crusher from the drive side.

Flywheel
Large wheels used as part of the crusher drive and to store inertia.

Nip Angle
Angle between jaw plates which is indicative of the crushers ability to crush and draw rock.

Jaw Plates
Replaceable liner plates available with different profiles for certain applications. They help achieve required output grading whilst protecting jaw stocks from wear.

Fixed Jaw
Replaceable liner plate attached to the fixed frame.

Swing Jaw
Replaceable liner plate attached to the jaw stock.

Cheek Plates
Wear plates used to protect the crusher frame side plates.

Wedges
The design of some jaw crushers requires wedges, to ensure that the jaw plates are held firmly in position. These are also a wear part that can be replaced when worn down.
JAW CRUSHERS

JAW CRUSHER TERMINOLOGY

There are a few key points that you need to consider when selecting the correct liners for an application:

1. Feed Material Type
2. Feed Material Hardness / Abrasiveness
3. Feed Size
4. Required Output
5. Potential of uncrushable material in the chamber
6. Required Output

### S-Tooth
- Medium to Hard rock applications
- Recycling applications
- Grips material to allow better crushing
- Available in 18% and 22%

### Multi-Tooth
- Recycling applications
- Good grip on smooth flat surfaces
- Available in 18%

### Standard / Shallow Tooth
- Recycling and Soft Rock applications
- Not available for all Models
- Available in 18%

### APPLICATIONS

<table>
<thead>
<tr>
<th>Jaw Plate Profile</th>
<th>Recycling</th>
<th>Soft-Med Rock</th>
<th>Hard Rock</th>
<th>River Gravel</th>
<th>Asphalt</th>
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<td>Super Tooth</td>
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<tr>
<td>Multi Tooth</td>
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</table>

Recycled Concrete  
Primary Limestone  
Secondary Limestone
**JAW WEAR COMPARISON**

The graph below shows comparison of wear life between:

- Fixed Jaw
- Swing Jaw
- Upper Liners
- Middle / Lower Liners

**CORRECT SETTING MEASUREMENT**

When a jaw is at rest, the setting that will be measured is the Open Side Setting (OSS).

To calculate the Closed Side Setting (CSS), the stroke must be deducted.

The stroke of the machine is stated in ‘Technical Information’ in the manual.

A tight CSS will lead to higher wear on jaw plates.

NB: The crusher must not be operated at a CSS using below measurement guidelines smaller than stated in the ‘Technical Information’ section of the manuals.
MAXIMUM ACCEPTABLE WEAR

A jaw should not run any longer once the tooth profile has reduced to below 90% of its profile height (if the face is smooth this will result in high loadings) in the crushing zone.

IN ALL CASES A MINIMUM OF 10MM VARIANCE BETWEEN THE PEAK AND VALLEY OF A SINGLE JAW FACE MUST BE PRESENT.

IF ANY OF THE JAW FACE PRESENTS LESS THAN 10MM, THE JAW LINER MUST BE REPLACED.

EXAMPLES OF WEAR ON A JAW LINER

JAW CRUSHERS

FEEDING A JAW CRUSHER

All crushers work best with a uniform feed gradation and a wide range of material size. Fines do not need to be crushed and so it is normal to use a Vibrating Grizzly Feeder (VGF) so that material smaller than the grizzly aperture bypasses the crushing chamber. This reduces wear on the jaw liners and can improve overall plant performance. However it is good practice not to have grizzly aperture any larger than jaw CSS. This is to ensure there are some smaller materials to help the jaw grip and crush the larger rocks.

Too many fines in feed

VGF to remove Fines
## Jaw Liner Part Codes

<table>
<thead>
<tr>
<th>JAW</th>
<th>BISON 280</th>
<th>BISON 35</th>
<th>BISON 100</th>
<th>BISON 120</th>
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<tr>
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<td>SUPERTOOTH</td>
<td>TOOTHED JAW</td>
<td>TOOTHED JAW</td>
<td>TOOTHED JAW</td>
</tr>
<tr>
<td></td>
<td>MULTI TOOTH</td>
<td>18% FIXED</td>
<td>18% FIXED</td>
<td>18% FIXED</td>
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<tr>
<td></td>
<td>STANDARD TOOTH</td>
<td>22% FIXED</td>
<td>18% FIXED</td>
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<td>JAWS</td>
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<td>EVM30005</td>
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<td>SWING</td>
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### Jaw Liner Part Codes

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<th>IMPACT CRUSHERS</th>
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<tr>
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<td>600/8022M</td>
<td>N.A</td>
</tr>
</tbody>
</table>
IMPACT CRUSHERS

IMPACT CRUSHER TERMINOLOGY

**Rotor**
This is the main part of the HSI crusher. It holds the blow bars and rotates at a high speed, being driven by a pulley connected directly to the engine.

**Blow bar / Hammers**
Wear parts inserted into the rotor which impact the rock to cause breakage. These can be replaced when they are worn down.

There are two different options:
- 4 high blow bars
- 2 high and 2 low blow bars

Some older design crushers had a 3 bar rotor.

**Aprons**
Primary and Secondary aprons are used to reduce rock down to the required product size.

**Apron Settings**
This is the measurement the aprons are set at to achieve the product gradings. There are general rules of what the settings should be.

**Apron Liners**
Liners that are generally fitted to the end of aprons (which are replaceable wear parts) to ensure the apron settings can be maintained.

**Side Liners**
Sometimes called frame liners, these are used on the inside of the impactor body to protect it from wear.

**ROTOR CONFIGURATIONS**

2 Bar is Standard fit from the Factory
4 Bar is an option – Only used when feed size small

- **X2Short X2 Long Blow Bars**
  - Better penetration
  - Higher Tonnage for a given speed
  - Reduced blow bar wear
  - Less fines produced
  - Suitable for more applications
  - Time between blow bars is doubled improving penetration on material

- **X4 Long Blow Bars**
  - Reduce oversize
  - More fines produced
  - Good for secondary applications where shape and size outweigh throughput
  - High reduction on softer feed material
IMPACT CRUSHERS

METALLURGY OPTIONS - BLOW BARS

Martensitic
- Good for hardness and impact resistance
- Used in primary and recycling applications
- Can accommodate large feed size
- Can tolerate steel in feed

Martensitic Ceramic
- Martensitic bar that has a got a ceramic matrix running through the blow bar for extra wear life
- Maintains impact resistance of martensitic bar
- Increases wear life
- Used in primary and recycling applications

Chrome
- High wear resistance
- Feed size needs controlled due to risk of breakages
- Will not tolerate steel in feed
- Available as Medium Chrome and High Chrome
- Used in secondary, tertiary & asphalt applications (providing there is no unbreakable in feed)

Chrome Ceramic
- Chrome bar that has a got a ceramic matrix running through the blow bar for extra wear life
- Feed size needs controlled due to risk of breakages
- Will not tolerate steel in feed
- Used in secondary, tertiary & asphalt applications (providing there is no unbreakable in feed)

NB: Medium Chrome
Medium Chrome & Medium Chrome Ceramic will offer better impact resistance over High Chrome variants but will have less wear resistance for more abrasive applications. They will therefore accommodate larger feed sizes than High Chrome.

Medium Chrome & Medium Chrome Ceramic lie between Martensitic variants and High Chrome variants as an added option.

CERAMIC INSERTS

Ceramic inserts can be provided for both Martensitic and Chrome Blow bars

These examples show ceramic inlays in the basic material of Martensitic or Chrome:

Benefits:
- High wear resistant over standard blow bars
- Increased service life
- Increased uptime

NB: The ceramic inlay will not be visible when the blow bar is new
IMPACT CRUSHERS

IMPACTOR WEAR COMPARISON

The graph below shows the comparison of wear life between:
- Blow bars
- Apron plate liners
- Side liners

![Impactor Wear Comparison Graph]

WEAR LIMITS

Blow bar needs changed or rotated when the wear limit "Z" is reached otherwise considerable damage will occur to rotor.

Always refer to Machine Specific Operational manual for Correct Wear Limits

New blow bar, full wear life

Half worn, turn needed

Fully worn, replacement required
EXCESSIVE WEAR

- In the case of excessive wear on the blow bars, there can be detrimental effects on the rotor.
- If the bar is not turned before the recommended specified limit, then once changed the bar will not be in a stable position when working.
- This may lead to the bar becoming loose and falling out of the rotor.
- The figure below shows how a blow bar has been worn excessively past its recommended limit.

Due to excessive wear to the blow bar, the locking wedge has now come in contact with material resulting in its dislodgement from its seat.

- The result of this negligence has led to the blow bar not being able to be turned
- More severely is the fact that the machine will now need a new rotor

INFLUENCING FACTORS ON BLOW BAR WEAR

Feed Material is the most important factor for selecting the correct blow bar.

To increase the life of blow bars the following guidelines should be adhered to:
- Maintain and clean chamber daily
- Inspect blow bars for premature wear or damage
- Select correct blow bars depending on application
- Adjust machine parameters
IDEAL WEAR PATTERN

• A gentle radius on the blow bar shows that the feed material is the correct size
• It shows that the rotor penetration and rotor speed are correct
• The correct blow bar for the feed material is being used
• The machine parameter is correctly set up

The result of all this?
The blow bar life is optimized

OVER PENETRATION

Problem
Excessive penetration on the blow bar

Causes & Issues
• The rotor speed is too slow
• Increases risk of blow bar breakage
• The blow bar is under-utilized before changing
• Increased rotor wear

Solution
• Increase the rotor speed
• Change to 4 high blow bars
POOR PENETRATION

Problem
Poor penetration on the blow bar means the top of the blow bar is worn down flat

Causes & Issues
• The rotor speed is too high
• Wear rates will be excessive
• Reduced output
• Creates lot of fines

Solution
• Reduce the rotor speed
• Change configuration to 2 high and 2 low blow bars

EXCESSIVE WEAR AT CENTRE OF BLOW BAR

Problem
The blow bar is wearing towards the centre

Causes & Issues
• A trickle feed gives uneven wear
• Reduces the life of the blow bar

Solution
• Increase feed to crusher (E.g. A larger excavator is required to feed machine)
• Increase the speed on the feeder
EXCESSIVE WEAR AT BOTH ENDS

Problem
Wear on the sides of the blow bar

Causes & Issues
• High percentage of fines in the feed or overfeed causing fines to be pushed to outside
• Crusher chamber contaminated with caked material causing friction wear

Solution
• Reduce speed of feeder so wear becomes even across the surface of the blow bar
• Clean chamber daily after each shift

EXCESSIVE WEAR AT ONE END

Problem
Blow bar wearing excessively to one side

Causes & Issues
• Machine on uneven ground – material falling to one side
• Machine isn’t choke fed
• Feed dropped onto one side of feeder when using recirculating option

Solution
• Ensure the machine is on level ground
• Continuous loading
BLOW BAR DAMAGE

Problem
Blow bar is damaged or broken

Causes & Issues
• Incorrect blow bar for application (E.g. Chrome)
• There is steel or rebar in feed
• Feed size is too large

Solution
• Select correct blow bar
• Control feed size
• Remove steel or rebar

KEY POINTS TO REMEMBER WHEN CHANGING BLOW BARS

• Make sure all blow bars are in matched pairs pertaining to weight
• The weight difference of paired blow bars should not exceed 0.5kg and matched pairs should be installed on opposite sides of the rotor
• Ensure that all the mounting surfaces of the blow bar are cleaned of any debris and build-up, as well as the rotor backing bar and locating key
• Check and ensure that any deformities found on the blow bar mounting area are dressed properly to allow the blow bars to sit square in the rotor
• Ensure that all blow bars are pulled up square in the rotor
# Blowbar Selection

There are a few key points that you need to consider when selecting the correct blow bar for an application:

1. **Feed Size**
   This has a direct link to what blow bars should be selected for each application.

2. **Uncrushable Material**
   This is material such as steel/rebar that can cause blow bar breakages.

3. **Feed Material**
   The type of feed material can have a large impact due to the different abrasiveness of materials.

<table>
<thead>
<tr>
<th>Blow Bar Type</th>
<th>Recommended For</th>
<th>Not Recommended For</th>
<th>Risk Of Breakage</th>
</tr>
</thead>
</table>
| Martensitic         | • Primary blasted quarry rock  
                      • Building rubble & Concrete  
                      • Limestone  
                      • Larger feed sizes        | • High Abrasive Material          | • Very large feed size               |
| Chrome              | • Secondary Crushing  
                      • Smaller feed sizes  
                      • Abrasive Materials   | • Low Abrasive Material           | • Large feed size  
                      • Medium abrasive material | • Steel content            |
| Martensitic Ceramic | • Asphalt  
                      • Natural stone  
                      • Building rubble & concrete with small to medium iron content  
                      • Medium abrasive material | • Low Abrasive Material           | • Large feed size               |
| Chrome Ceramic      | • Secondary crushing with natural stone  
                      • Asphalt in the case of small feed size without any iron content | • Low Abrasive Material           | • Large feed size  
                      • Medium abrasive material   | • Steel content               |

### Examples of Applications for Chrome / Chrome Ceramic

- **Ceramics**
  - Tiles, basins, pans etc.

- **Asphalt**
  - Secondary quarry
  - Limestone, basalt, granite, Limited feed size

### Examples of Applications for Martensitic / Martensitic Ceramic

- **Concrete recycle with Steel**
- **Primary limestone**
- **Light demolition Bricks, blocks etc.**
**IMPACT CRUSHERS**

**BLOW BAR GUIDE**

**BLOW BAR GUIDE**

**IMPACTOR WEAR PART CODES**

Always refer to Operations Manual for Maximum Feed Size Limitations per Crusher Model

**Key Factors**
- Type material being crushed
- Size of feed
- Material shape - Cubic or Plate like
- Abrasiveness

**Note**
- Above Guide provides an Overview for selecting Appropriate blow bar for your application.
- Martensitic steels offer good Impact resistance for Larger feed sizes.
- Chrome Steels offer good Abrasiveness properties for High wear applications.