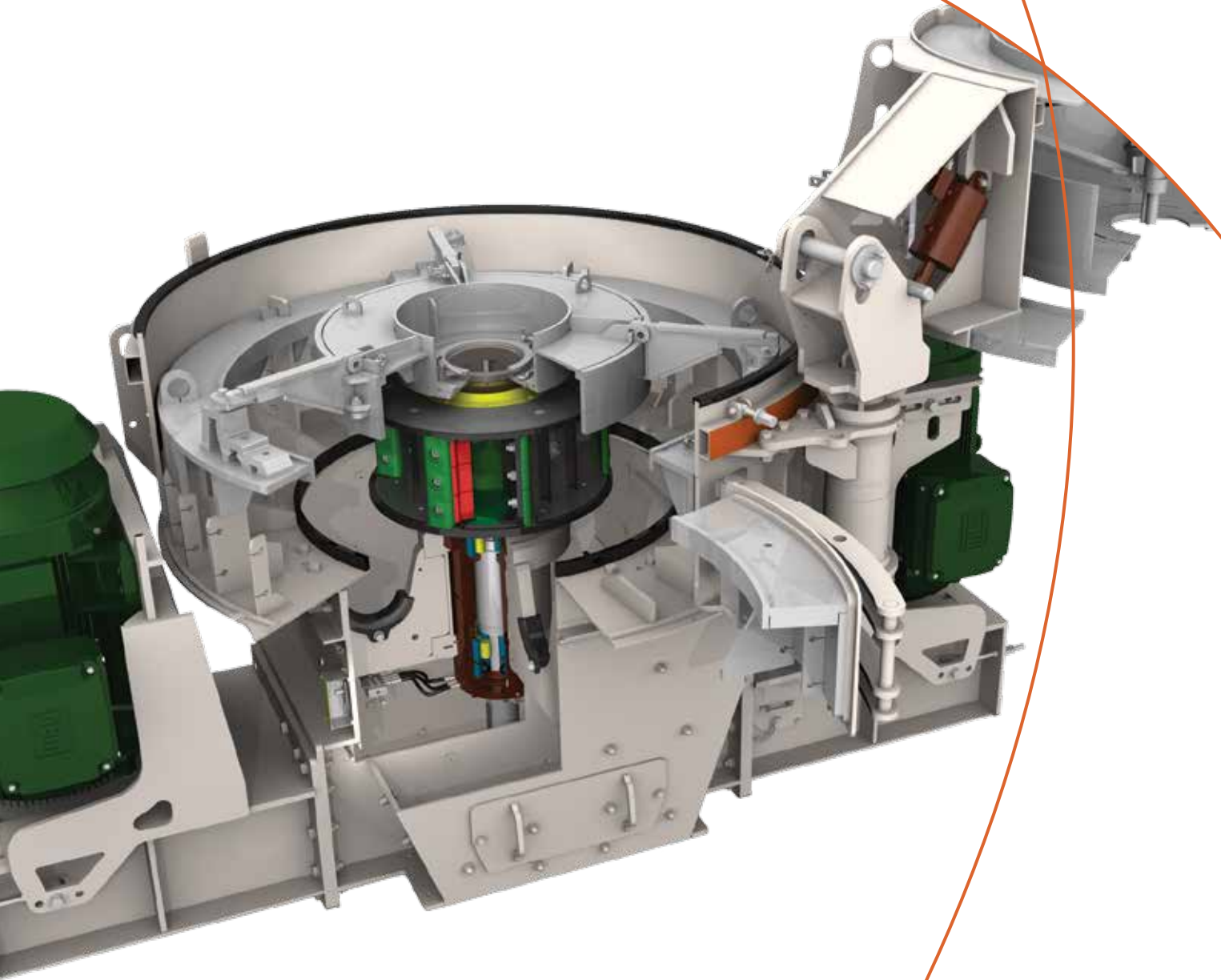


Barmac B-series VSI

Wear parts application guide





Wear parts application guide - Barmac B-series VSI

Barmac VSI and basic concepts

Crusher components

The main components of the Barmac B-Series VSI are:

- Base assembly (including vertical shaft line assembly)
- Crushing chamber (including Rotor)
- Top assembly (including all feed control options)

Barmac B 1100SE series models (2011)

The crushers capacity will vary depending on feed material characteristics when working in the following applications:

- Shaping
- Sand production
- General aggregate production

There are 4 different crusher models/sizes:

- The "B" indicates that the crusher is from the Barmac B-Series range of crushers
- The first two numbers after B indicate the size of the crushing chamber in the machine in inches. E.g. B5100 = crushing

chamber 51 inches in diameter

- The last two numbers indicate the version of the model, if they is a 00 then the model had not changed, if it is 50 then the model has changed since the 1100 series (previous series)

Setting the Rotor Speed (RPM)

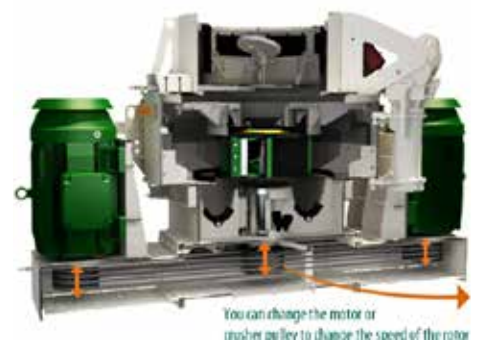
Unlike compression based crushers the Barmac does not have closed and open side settings to specify what size the product will be once it has gone through the crusher.

The main way to adjust the reduction ratio of the Barmac is by adjusting the Rotor Tip speed. This can be done by a Variable speed drive, or by changing the motor/crusher pulleys. At a Rotor Tip speed of 45m/s crushing is at its lowest, but we have a high capacity, at 75m/s crushing is at its highest, but we have a lower capacity.

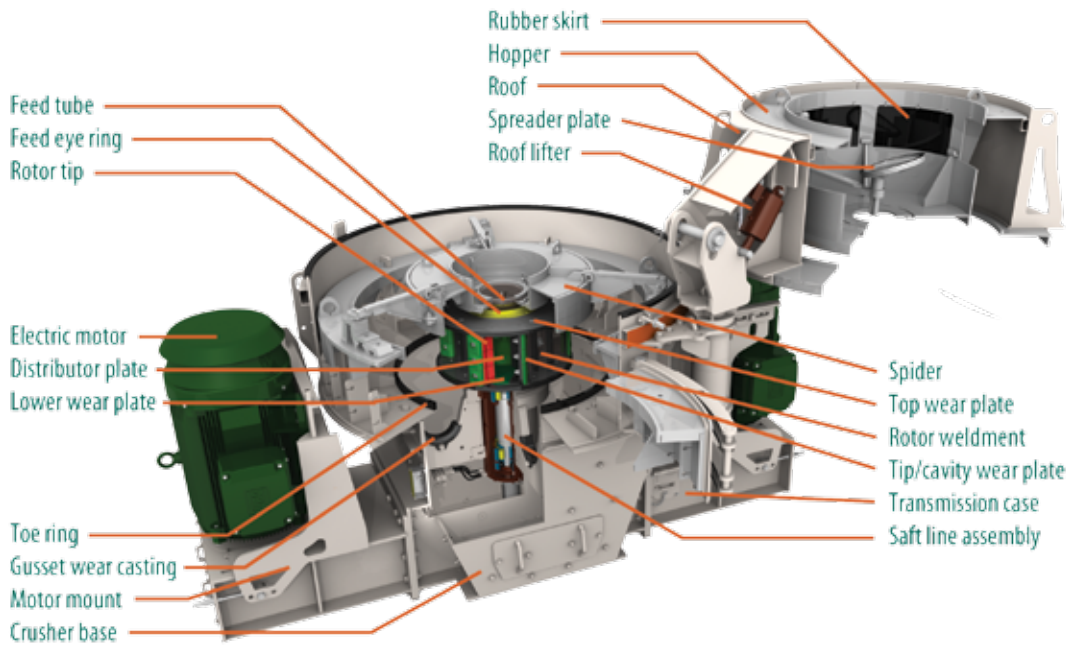
The size of the crusher product also depends on the feed size, throughput, the crushability of the material and whether or

not the cascade feature is used.

If any of these things are adjusted it will change the grading of the product.



Barmac model	Max feed size (square mesh)	Speed range	Power range	Throughput
B5100SE	30 mm	45 - 75 m/s (2000-3400 RPM)	37 - 55 kW (50 - 70 hp)	15 - 60 tph
B6150SE	37 mm	45 - 75 m/s (1500-2500 RPM)	75 - 150 kW (100 - 200 hp)	60 - 200 tph
B7150SE	45 mm	45 - 75 m/s (1250-2100 RPM)	185 - 220 kW (250-300 hp) Single drive 260 - 300 kW (350 - 400 hp) Dual drive	110 - 420 tph
B9100SE	50 mm	840 Rotor: 45 - 65 m/s (1250-1800 RPM) 990 Rotor: 45 - 75 m/s (1250-1700 RPM)	370 - 600 kW (500 - 800 hp) Dual drive	180 - 700 tph



Calculating the rotor/tip speeds

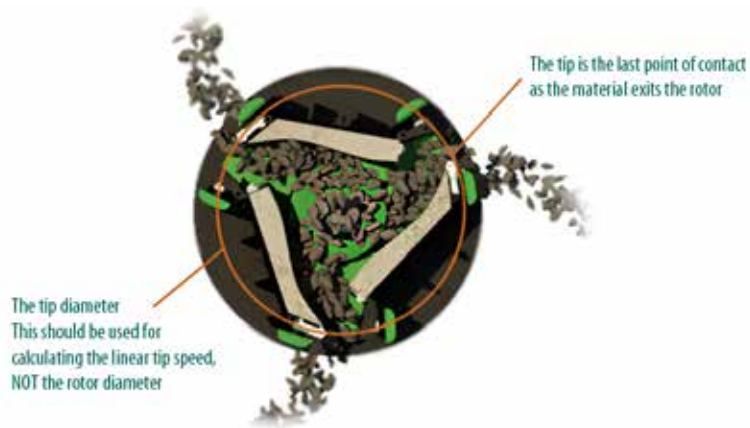
Rotor speed is the rate in RPM that the rotor is spinning in the crushing chamber. We calculate the Rotor speed (RPM) using the following formula:

$$\text{Motor RPM} \times \text{Motor Pulley diameter (mm)} / \text{Crusher Pulley diameter (mm)}$$

Tip speed is the speed in metres per second that the rotor tip is spinning on the outside of the rotor. We calculate the Rotor Tip speed (m/s) using the following formula:

$$(\text{Rotor RPM} \times \text{Pi}) \times \text{Rotor Centre to Tip Measurement (Tip Radius) (m)} / 60$$

Once the speeds are calculated it is possible to adjust the speed by changing the crusher or motor pulley. Capacity range for the different speeds is referenced in the previous chart on **Page 2**.



Rotor size	Tip diameter
300	STD - 0.115m TILE - 0.14m
500	STD - 0.21m TILE - 0.235m
690	0.28m
760	0.34m
840	0.35m
990	0.425m

	Feed material characteristics		Operating parameters		
	Easy crushability	High abrasiveness	Rotor speed	Cascade increase	Choke feed
Capacity	→	→	↓	↑	↑
Cubicity of product	↑	→	↑	↓	↑
Specific power consumption	↓	↑	↑	↓	↓
Wear costs	↓	↑	↑	→	↓

How to operate Barmac VSI

The basic principles of operating with a VSI crusher, is to accelerate stones to break against each other in a crushing chamber.

There are a number of factors that will effect the operation:

- Feed Size, Gradation and capacity
- Material type
 - Hard/Medium/Soft (crushability)
 - Low or High abrasiveness
 - Wet or Dry
 - Pre-Crushed or natural rock
 - Bad or Good shape characteristics
- Speed of rotor
 - Exit velocity from rotor from 45 – 75m/s
 - At a slow rotor speed you will achieve:
 - Lower reduction ratio
 - Less rotor wear
 - Higher capacity for set power
 - Good shaping factors
 - At a fast rotor speed you will achieve:
 - Higher reduction ratio
 - More rotor wear
 - Lower capacity for set power
 - Excellent shaping

The speed and throughput of the rotor will determine the power needs for the particular application.

The advantages of crushing by impact

1. No residual fracture:
If the stone is very laminated, crushing by impact will reduce the residual fracture.
2. The shape of the aggregates:
Material that is crushed by using impact has a much more cubical shape than that of material crushed using compression.



Flat and elongated aggregates Cubical aggregates

- This is due to impact breaking the material along its weakest planes to give sound, solid and cubical particles
- Compression crushing produces more flaky and elongated particles that are not always acceptable for modern concrete and asphalt specifications

The Barmac B-Series crushing action also involves grinding as well as impact, and therefore improves the shape of the final product even more.

3. With a VSI the reduction ratio depends on the following factors:

- Top feed size
- Speed of Rotor
- Material characteristics
- In open circuit the reduction ratio is not important as the product grading will be changed relative to the rotor speed
- In closed circuit reduction ratio can be from 1 to 15

4. Impact crushing causes immediate fracture with no residual stress. This stress free condition is very valuable to construction materials. This property is one of the reasons why impact crushing is widely used in the quarrying industry.



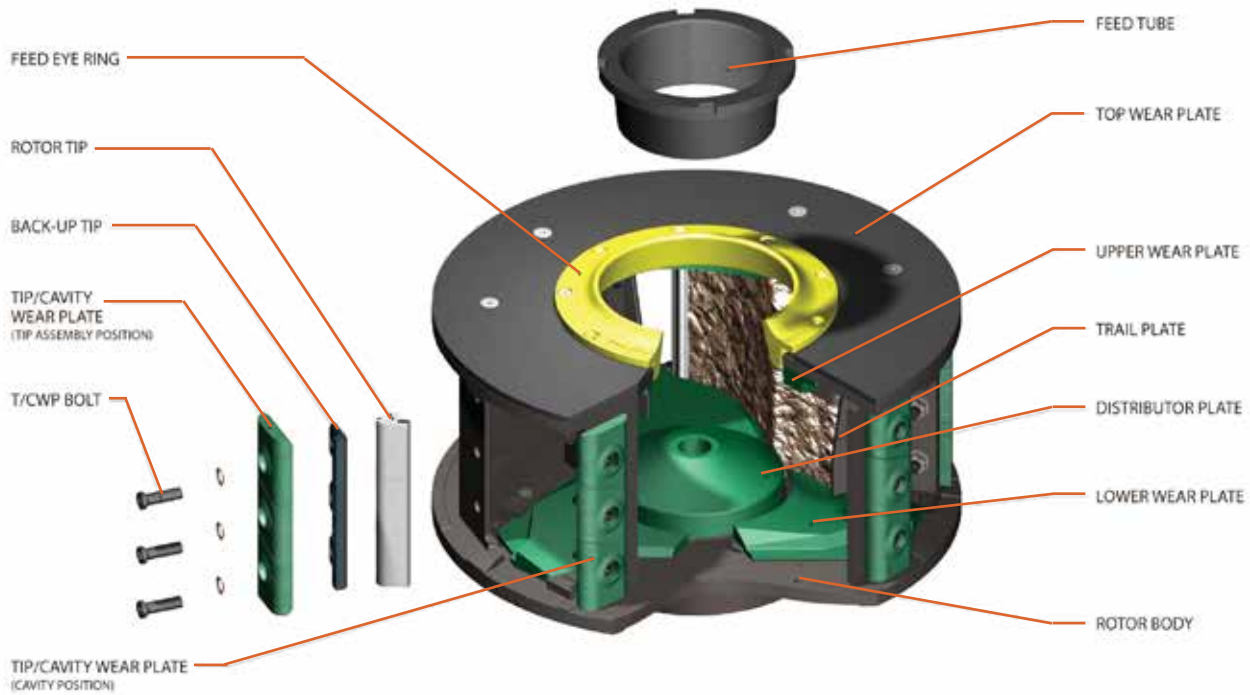
Particle before crushing



Particle after crushing by compression



Particle after crushing by impact



Barmac B-Series VSI wear parts

The wear parts for a Barmac B-Series VSI are contained both within and on the outer surfaces of the rotor. Different parts have material technology to resist either impact or abrasive wear.

Selection of the correct wear parts for the application required is fundamental to ensure the desired performance. Parts must be chosen according to the feed material characteristics of abrasiveness and crushability, Feed size and Rotor speed to suit the product requirements.

In using rock-on-rock VSI equipment it is essential that wear parts allow stone beds to form to prevent wear on steelwork and exposed edges of the rotor.

It is important to choose material that under normal operating conditions offers the best performance.

Barmac B-Series VSI crushers have many different wear parts inside the Rotor. Including:

- Rotor Tips, Back-up Tips, Tip / Cavity Wear Plates to protect all areas of the exit ports
- Upper and Lower internal wear plates to protect the inner body of the rotor
- Internal distributor plate to receive initial entry impact and distribute the material to each port
- Feed Tube and Feed Eye Ring to guide the material centrally into the rotor
- Internal Trail plates to maintain rotor stone beds formed during operation

Wear evaluation

The wear parts that are worn the most inside the rotor are the Distributor plate, Rotor Tips, Lower wear plates and Feed tube. This happens because these parts have direct contact with the feed material at all times as it passes through the rotor.

The distributor plate is worn in two ways, firstly by impact as the material falls vertically into the rotor and then abrasion as is sent horizontally out of the rotor.

The Rotor tips are the last thing to touch the feed material as it exits the rotor. They have a Tungsten insert that improves wear life. We often use the life of the tips as a reference point for the other rotor wear parts.

The lower wear plates generally wear more than the upper wear plates due to under utilisation of the rotors maximum throughput and the use of an incorrectly shaped trail plate.

The feed tube is worn as it guides/funnels the feed material into the rotor opening as it comes down from the hopper.



Metso rotor tips

There are 4 different shapes and 3 grades of Tungsten Carbide inserts for our Rotor tips for 6 different sizes of rotor. We will explain how the different shapes, sizes and colours affect the wearing rate and crushing action, and why we use different grades of Tungsten.



3 Different grades of tungsten carbide (WC)

Hard Tungsten

This Tungsten grade has a high resistance to impact and a lower resistance to abrasion. It should be used in applications where processing hard materials with a large feed size.

Extra Hard Tungsten

This Tungsten grade has a high resistance to abrasion and a lower resistance to impact. It should be used in applications processing fine materials whether hard or soft.

- It can be used for wet feeds as it will offer better wear resistance
- There is some limitation on feed size when using this grade of Tungsten

XX Hard Tungsten

- Very high abrasion resistance
- Low impact resistance

Large Rotors (sizes 690, 840, 990mm)

Hanger shape/style

This Rotor tip shape promotes good material build-up inside the rotor. We recommend that it is used with dry, bony feeds or when moisture in the feed tends to wash the build-up out.

- Available in both Hard Tungsten (coloured Red) and Extra Hard Tungsten (coloured Yellow)



Large Rotors (sizes 690, 760, 840, 990mm)

Extended Hanger shape/style

This Rotor tip shape promotes less material build-up in the rotor than the hanger style tip. The tungsten insert is repositioned to cope with more wear on the outer edge of the tip assembly. We normally recommend the Hard Tungsten Tip for any new crusher in most applications.

- Available in both Hard Tungsten (coloured Silver) and Extra Hard Tungsten (coloured White)
- **Extra life. A larger tungsten insert. Hard (purple), Extra hard tungsten (Brown) and XX Hard (Orange)**



Small Rotors (size 500mm)

Hanger shape/style

This Rotor tip shape promotes good material build-up inside the rotor. We recommend that it is used with dry, bony feeds or when moisture in the feed tends to wash the build-up out.

- Available in Extra Hard Tungsten (coloured Green)
- **Extra life. A larger tungsten insert. XX Hard (Orange)**

Tile shape/style:

This Rotor tip shape promotes less build-up inside the rotor. It has been designed for use in highly abrasive applications. The tungsten inserts have been repositioned onto the outside edge of the tip assembly to give improved life and protection against abrasion in the crushing chamber.

- Available in both Hard Tungsten (coloured Silver) and Extra Hard Tungsten (coloured White)



Large Rotors (sizes 690, 760, 840, 990mm)

Laminated shape/style

This Rotor Tip shape has proved successful in extending tip life in applications where large feed material or tramp steel results in chipping or breaking of the Tungsten inserts. This tip contains two Tungsten inserts enabling the tip to protect against both impact and abrasion from feed material at the same time.

- Available in both Hard Tungsten (coloured White) and Hard/Extra Hard Tungsten (coloured Black)



Small Rotors (size 300mm)

Hanger shape/style:

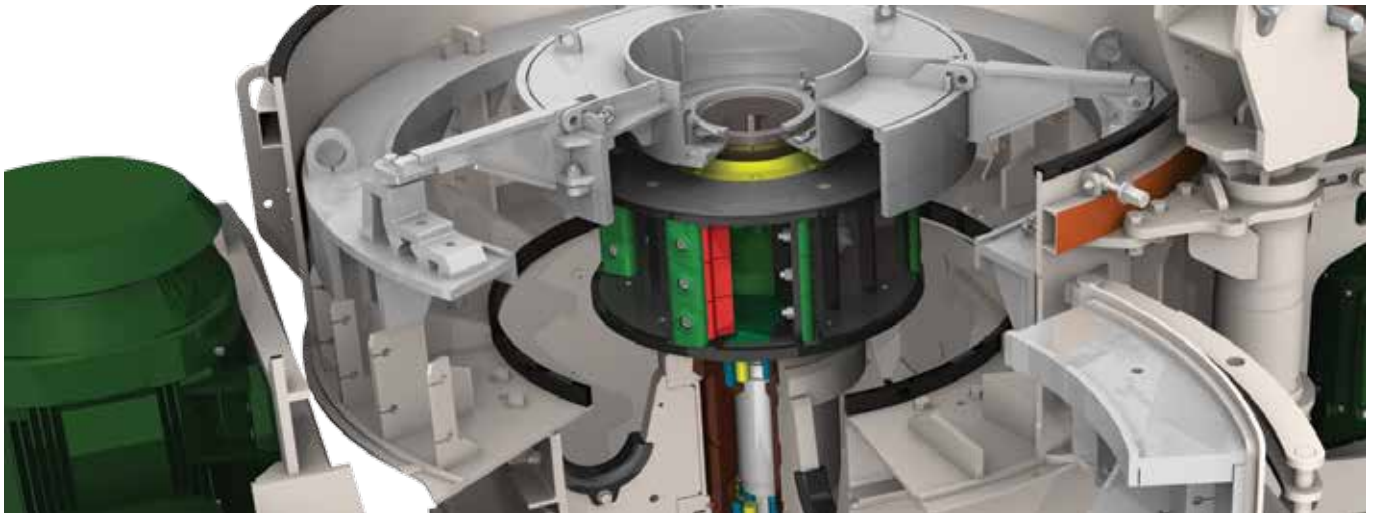
This Rotor tip shape promotes good material build-up inside the rotor. We recommend that it is used with dry, bony feeds or when moisture in the feed tends to wash the build-up out.

- Available in Extra Hard Tungsten (coloured Green)
- **Extra life. A larger tungsten insert. XX Hard (Orange)**

Tile shape/style:

This Rotor tip shape promotes less build-up inside the rotor. It has been designed for use in highly abrasive applications. The tungsten inserts have been repositioned onto the outside edge of the tip assembly to give improved life and protection against abrasion in the crushing chamber.

- Only available in Extra Hard Tungsten (coloured Yellow)



Other rotor wear parts

Back-up Tip

The back-up tip is designed to protect the rotor if and when a rotor tip gets broken or worn out. When this happens the Tungsten insert in the rotor tip has split and is now letting feed material run against the Tungsten insert of the back-up tip.

The back-up tip has a small Tungsten insert in it that will last for about 8 -10 hours of wear in normal operation. If this backup is broken again, or it wears out then the feed material can seriously damage the rotor due to abrasion.

The back-up tip is positioned behind the Rotor Tip and the Tip Cavity Wear plate on the outside edge of the rotor.

- Some competitors do not offer this wear part, so if their rotor tips break, they have no protection for their rotor against serious damage
- There is one back-up tip for every tip on a dressed rotor (one line per port)
- There are no options for different wear materials for this wear part



Tip / Cavity Wear Plates

Tip / Cavity Wear plates are designed to protect the outside edges of the rotor against excited particles in the crushing chamber. As the rotor spins, it impacts against particles that have rebounded from the chamber build-up after their initial exit from the rotor. As the TCWP are the furthest wear part from the centre, and on the leading faces of the rotor, then they are most susceptible to this type of wear.

These parts are positioned in two places on the rotor, firstly they are put on top of the Rotor tips to protect the vulnerable areas of the parts, and secondly on the other side of the rotor port to protect this leading edge from wearing away and compromising the rotors efficiency.

- Metso offers reversible TCWP that can be turned round once they have been worn on one side. This doubles the life of this part, but relies on an operator who checks the Rotor wear parts often, and knows how to get the most life out of the parts
- There are 18 TCWP on a dressed deep 840/990 rotor in total (6 around each port)
- There are no options for different wear materials for this wear part



Upper and lower Wear Plates

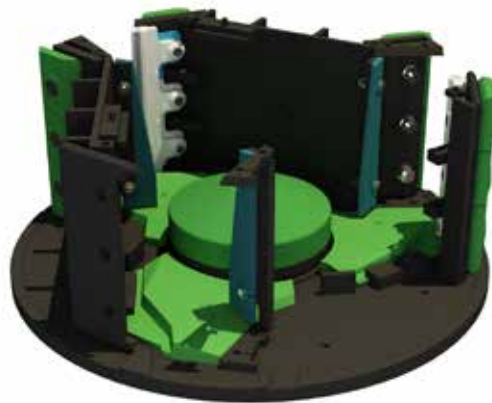
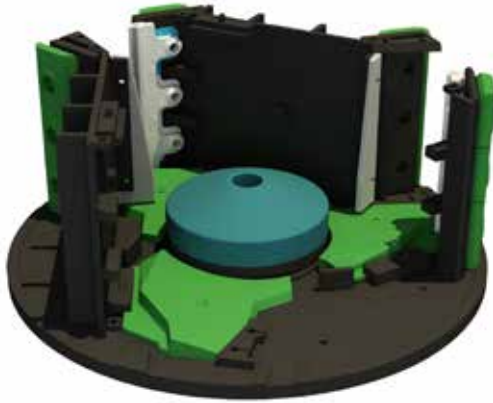
These wear plates are designed to protect the upper and lower faces of the inside of the rotor from the feed material as it passes through the rotor (the material build-up protects the sides).

Wear plates are kept in place using the centrifugal force of the rotor as it is spinning, there are no nuts and bolts, only some clips for the plates to slide under. This makes them easy to change and remove.

The lower wear plates generally wear more than the upper wear plates due to under utilisation of the rotors maximum throughput and the use of an incorrectly shaped trail plate.

- There are 3 upper and 3 lower wear plates in each dressed rotor
- There are no options for different wear materials for this wear part





Distributor plate

The Distributor plate is designed to protect the plate that joins the Rotor, Rotor Boss and Shaft together from feed material falling into the rotor from the hopper.

This part is subject to wear from both the feed material falling onto it (impact) and it also being "distributed" to the three ports in the rotor (abrasive).

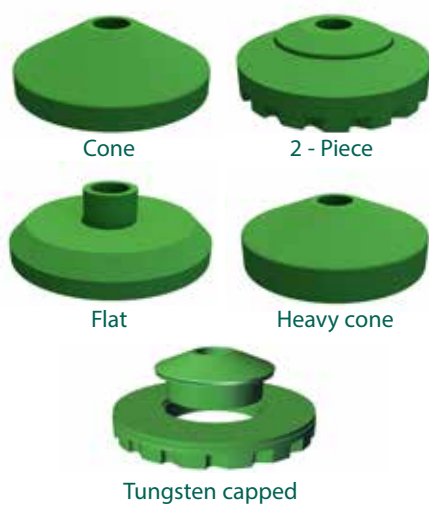
It is attached to the rotor using one bolt that screws into the top of the shaft. (HELPFUL TIP) - This bolthole must be protected by stuffing a cloth in the hole and either letting stone build up on top of the cloth to protect it, or filling the gap with silicone. This must be done, or it can be very difficult to remove the bolt when needed.

The distributor is the wear part that receives the most impact wear, and will normally wear out the fastest in standard applications. There is only 1 distributor plate in each dressed rotor.

Distributor plates come in the following types:

- Flat – For gravel and rounded feeds
- Cone – Standard for most applications
- Heavy Cone – Thicker than cone for use with deep rotors
- 2 – Piece – Thicker with extra wear life, easier to lift and turn-able
- Tungsten capped – For extra-long wear life

• Not all sized Rotors have all these choices for the Distributor plate, but will have one or more of the above



Trail plates

The Trail plates are designed to hold in the material build-up inside the rotor behind the rotor tips. They can be the least expensive wear part in a rotor, but as they are responsible for keeping the build-up in place, they are very important.

The rotor build-up size and shape can affect the wear on all the parts inside the rotor. The easiest way to change this size and shape is by adjusting the Trail plate's width and angle. In most applications it is neces-

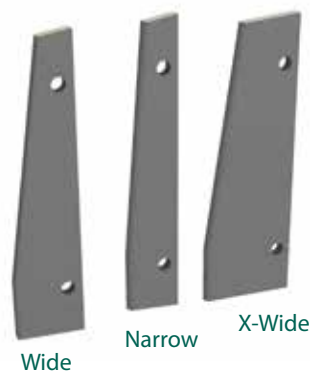
sary to do this.

Under normal operating this part should not be subjected to much wear. Although when processing fines feeds, or low tonnages some material may run the opposite way down the rotor build-up and escape through another port. This is called back-dooring, and can wear the trail plates down affecting the rotor build-up.

The Trail plates are fixed inside the rotor in each port opposite the tips. There are 3 Trail plates in each dressed rotor.

On the larger Rotors, Trail plates are available in Narrow, Wide and Extra Wide sizes, with the option to have a Tungsten insert in any of them.

- Tungsten edged – For extra-long wear life



- Not all sized Rotors have all these choices for trail plates, but will have one or more of the above



Other rotor wear parts

Top and bottom wear plates

The Top and Bottom wear plate are designed to protect the top and bottom outside surfaces of the rotor.

The top surface can get worn when the feed tube and feed eye ring are worn letting material through the gap created in the rotor feed opening. The bottom surface can get worn when material build-up in the crusher base becomes excessive and starts pushing upwards against the rotor.

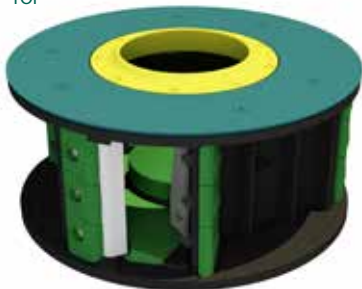
- These plates are attached to the rotor using 6 countersunk bolts that attach to the top and bottom plate of the rotor body.
- The Top wear plate will wear faster if other parts have failed.
- The Bottom wear plate is underneath the active area of the crushing chamber, so depending on the level of build-up in the crusher base it can last a long time.
- There is 1 Top and 1 Bottom wear plate for each dressed rotor. These wear plates are available with or without a hardened steel bis-alloy lip around their edge to protect the top and bottom perimeters of the rotor.

low throughput option has a smaller opening into the Rotor.

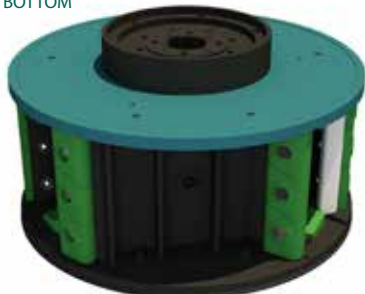
Feed Eye Ring

- The Feed eye ring is subject to minimal wear in normal operating conditions, and in some rotors can be turned 3 times to maximise wear life.
- The Feed eye ring is secured to the feed opening of the rotor either with bolts or by dropping into slots and rotating to lock. This part spins with the rotor.
- The Feed tube and Feed eye ring will wear out when excessive build-up in the rotor is present. This build-up will push up into the gap between the Feed eye ring and Feed tube and wear both away, as one is spinning, and one is not.
- If the Feed tube and Feed eye ring are worn out, feed material will spill out on top of the rotor causing wear problems.
- There is only one Feed Tube and one Feed eye ring in each dressed rotor/crusher.

TOP



BOTTOM

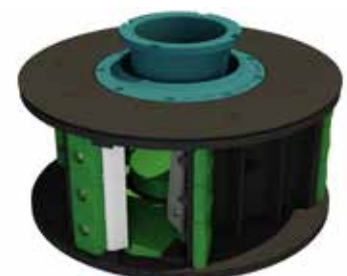


Feed tube and feed eye ring

The Feed tube and Feed eye ring are designed to guide the feed material into the rotor after it has been through the hopper.

Feed Tube

- The Feed tube is subject to high abrasive wear as all of the feed material going through the rotor will pass through it.
- The Feed tube is secured into the Spider assembly of the crusher using a clamp plate and spring handle. This does not spin.
- In some rotors there are different feed tubes for high and low throughputs, the





When to change wear parts

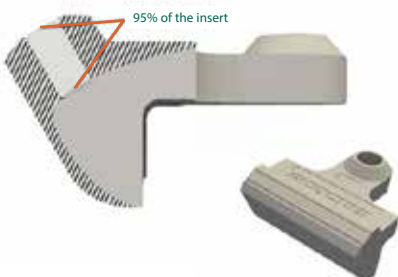
Rotor tips

The Rotor tip should be replaced once 95% of the Tungsten insert has been worn away (at any point along its length) or it has been broken by large feed or tramp steel. This is the same across all tips for all rotors.

The Rotor tips must be replaced using the packaged sets of 3 (one for each port, not all on one port) to make sure that the Rotor is kept in balance. If a tip is broken try and replace that one with a stored tip of similar wear to the others on the rotor.

Removal

- Open the inspection door
- Shock the T/CWP using copper or rubber mallet
- Remove taper bolts and T/CWP plate
- Refit the tip bolt into tip
- Use a hammer to break the tip away from the Rotor build-up on the inside by hitting the head of the tip bolt
- Remove the tip bolt and Rotor tips



Back up tips

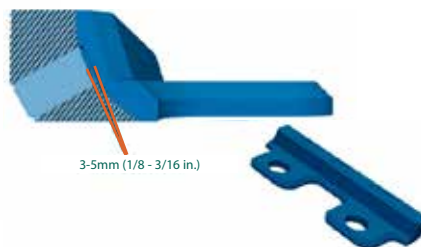
The Back-up tip should be replaced when there is only 3 – 5mm of depth left of the Tungsten insert.

They are designed to protect the rotor against a failure in the Rotor Tips and not for prolonged use!! Once these are worn through, the mild steel Rotor body will wear away very fast!

These must also be replaced in sets of three to keep the rotor in balance. An out of balance rotor will damage the Shaft Line assembly over time.

Removal

- Open the inspection door
- Shock the T/CWP using copper or rubber mallet
- Remove taper bolts and T/CWP plate
- Refit the tip bolt into tip
- Use a hammer to break the tip away from the Rotor build-up on the inside by hitting the head of the tip bolt
- Remove tip bolts, Rotor tips and Back-up tip from rotor



Cavity Wear Plates + Tip CWP

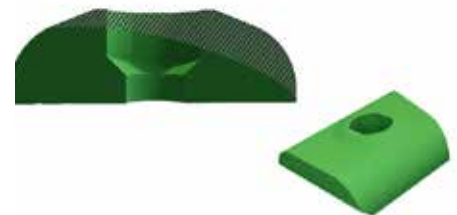
The Tip Cavity & Cavity Wear Plates should be replaced as wear starts to appear on the bolt head (holding them on). If they are reversible plates they can also be reversed at this time to give double the life.

If the bolt head in the TCWP position is worn away it can become difficult to remove the plate, so regular inspection is essential.

The T/CWP must be replaced in sets of 3 (1 for each port) to make sure that the Rotor is kept in balance. If a plate is broken try and replace it with a stored plate with similar wear to the others on the rotor.

Removal

- Open the inspection door
- Shock the plate with a copper or rubber mallet
- Remove taper bolts and then the plate





When to change wear parts

Upper + Lower wear plates

Replace the Upper and Lower wear plates when there is 3–5 mm of plate remaining at the centre of the wear path.

The lower wear plates generally wear more than the upper wear plates due to under utilisation of the rotors maximum throughput and the use of an incorrectly shaped trail plate.

These plates must be replaced in sets of three to make sure that the Rotor is kept in balance.

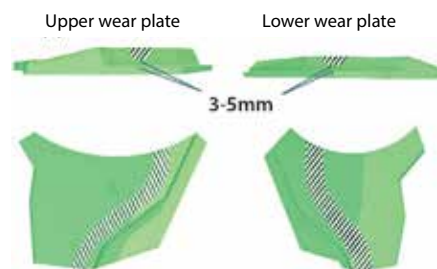
Removal of Upper wear plates

- Remove Roof and Hopper, or use the rooflifter to swing them out of the way
- Remove wedges and hinge the feed kit out of the way
- Remove Feed eye ring
- Remove rotor tips and T/CWPs
- Tap wear plate towards centre of rotor to release from keepers
- Withdraw plate through the feed hole

Removal of Lower wear plates

- Remove Roof and Hopper, or use the rooflifter to swing them out of the way.
- Remove wedges and hinge the feed kit out of the way.
- Remove Feed eye ring
- Remove rotor tips and T/CWPs
- Remove distributor plate

- Remove Trail plates
- Tap wear plate towards centre of rotor to release it from the keepers
- Withdraw plate through the feed hole



Distributor Plate

The Distributor plate should be replaced when there is only 3-5 mm left at the most worn point (normally around the edge), or the Distributor bolt has started to wear.

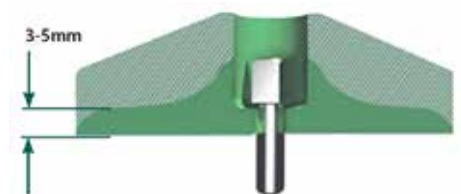
The Distributor bolt has a high profile and will take some wear, but care must be taken to protect it. A cloth or silicone should be used to fill the bolt hole for protection.

Two-piece Distributor plates can be turned to give added life. This can be done through a port without removing the Roof of the machine.

Removal

- Remove roof and hopper, or use the rooflifter to swing them out

- of the way
- Remove wedges and hinge the feed kit out of the way
- Remove Feed eye ring
- Remove the distributor bolt and lift the distributor plate out of the Rotor



CAUTION: On some applications the distributor plate can wear more in the center than the outside



Feed Eye Ring and Feed Tube

The Feed eye ring should be replaced or rotated when there is 3 – 5mm left of the Upper wear plate at its most worn point.

The Feed tube must be replaced when its bottom lip wears past the top of the Feed eye ring. The new Feed tube should extend past the top of the FER by at least 25mm.

If the Rotor build-up is too high these parts will be worn much faster, and will let material spill out onto the top of the Rotor. It is important that this does not happen.

The Feed eye ring can be rotated up to 3 times when worn.

Change when the bottom of the feed tube is level with the top of the feed eye ring



Feed eye ring Removal

- Remove roof and hopper, or use the rooflifter to swing them out of the way.
- Remove feed kit.
- Loosen build-up and shock bolts loose by hitting feed eye ring with a copper or rubber hammer while undoing screws.
- Remove all screws and lift the Feed eye ring out.

Feed tube Removal

- Remove roof and hopper, or use the rooflifter to swing them out of the way.
- Remove build-up.
- Remove spring handle.
- Remove feed clamp plate.
- Lift Feed tube out.

Trail Plates

The Trail plates need to be replaced when either the Hard facing or Tungsten insert on the leading edge has been worn away.

If they are not replaced at this point it will affect the Rotor build-up, which can reduce the life of the other Rotor wear parts.

Although these parts are the most inexpensive, they are often called one of the most important.



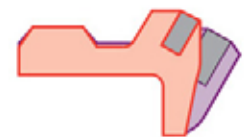
Removal

- Open the inspection door
- Remove Rotor build-up
- Remove the Trail plate bolts. (You may need to knock the bolt out with a hammer and punch)

Tip selection quick reference guide

TYPE OF HOLDER:	HARD Tungsten Medium abrasion resistance, High impact resistance.	EXTRA HARD Tungsten High abrasion resistance, Medium impact resistance.	XX HARD Tungsten Very High abrasion resistance, Low impact resistance.
690, 760, 840, 990 Rotors			
Hanger (Not available for 760 rotors) Promotes good build-up inside the rotor. Use with dry, bony feed or when moisture in the feed tends to wash the build-up out.	RED	YELLOW	
Extended Hanger Promotes less build-up than hanger style. Silver best first selection. Repositions the tungsten insert to cope with wear on the periphery of the tip assembly.	SILVER	WHITE	
Extended Hanger Extra Life Allows the use of extra life tungsten inserts.	PURPLE	BROWN	ORANGE
300 Rotor			
Hanger Promotes good build-up inside the rotor. Best first selection. Use with dry, bony feed or when moisture in the feed tends to wash the build-up out.		GREEN	ORANGE
Tile For use in high abrasive applications. Repositions the tungstens to give improved life and protection to the periphery of the tip assembly.		YELLOW	
500 Rotor			
Hanger Promotes good build-up inside the rotor. Best first selection. Use with dry, bony feed or when moisture in the feed tends to wash the build-up out.		GREEN	
Hanger Extra Life Allows the use of extra life tungsten inserts.			ORANGE
Tile For use in high abrasive applications. Repositions the tungstens to give improved life and protection to the periphery of the tip assembly.	SILVER	WHITE	

The examples below show how rotor tip shape varies, which can affect build-up in rotor.

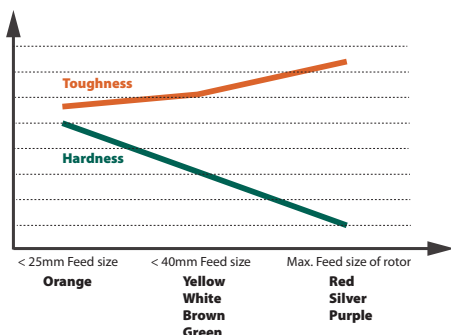


HANGER (Red)
EXTENDED HANGER -
EXTRA LIFE (Purple)

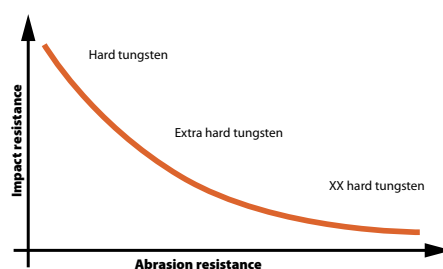


TILE (Yellow)
HANGER (Green)

Tip comparison



Material properties



This tip selection quick guide contains only indicative guidelines, not strict rules. Selecting correct set of tips is an application-specific process.



Additional features regarding tip selection

Tip selection is always applications bound:

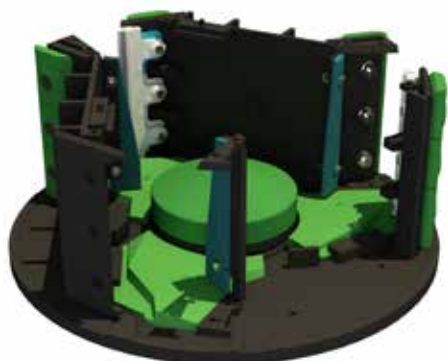
- Knowledge of feed material; what rock type, size distribution, moisture content, clay content
- Rotor speed
- Foreign particles presence in feed; nuts, bolts etc

Good first choices to start:

- Red
- Silver

Evaluate rotor and wear parts performance:

- Monitor the wear on feed tube, feed eye ring, trail plate, tips and other wears
- Crusher product is the main target (shape and distribution)



Continuous development:

- In such a case red tip gives certain life and you recognize wear in the outside of the rotor you need to look into using an extended hanger in the color of silver or white.
- In another case you may observe tip breakage; first you need to find the source (oversize material, tramp metal), remove it, and/or change the grade of tip (hard, extra hard, xx hard).

A good way forward:

- General good practice in optimizing performance and economy is to go one step at a time when changing the wear parts configuration.
- Change either the tip profile or tungsten grade first - never at the same time. Observe the wear pattern and wear rates before taking the next step. This will ensure that you will always know what affect your change has had.
- To get the optimum tip life, always keep the trail plates in good condition, changing them on a regular basis.

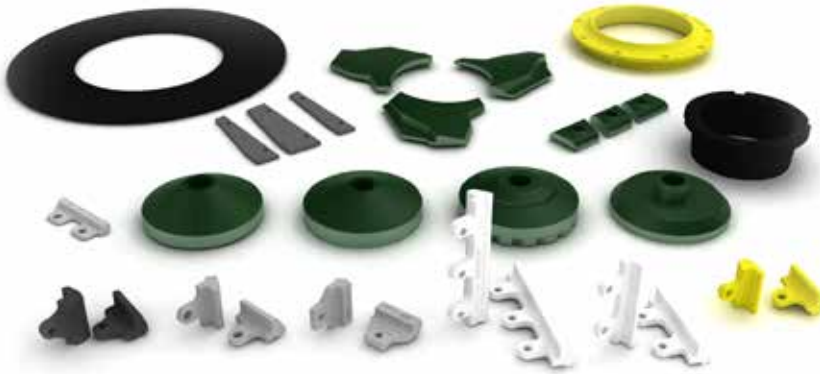
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