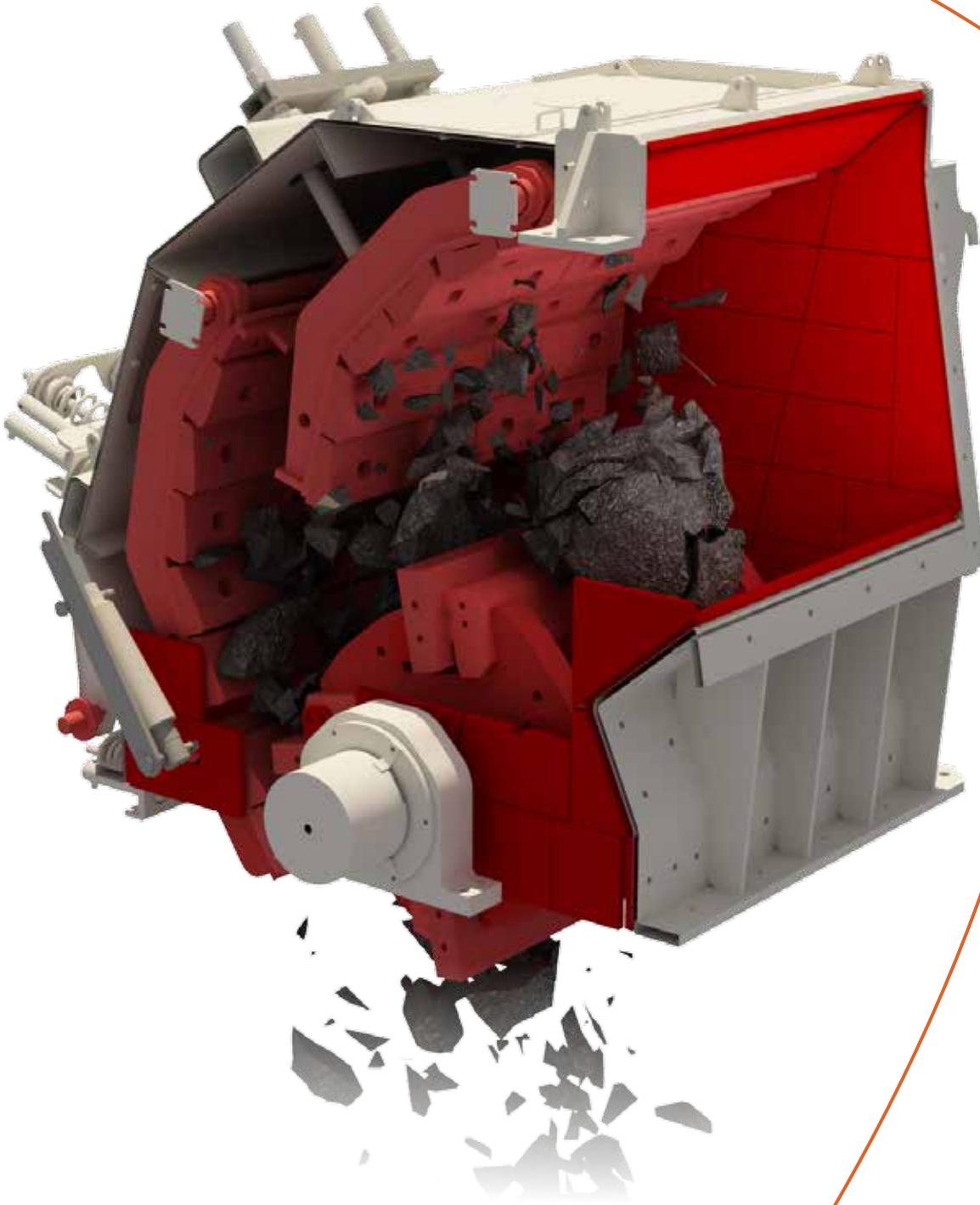
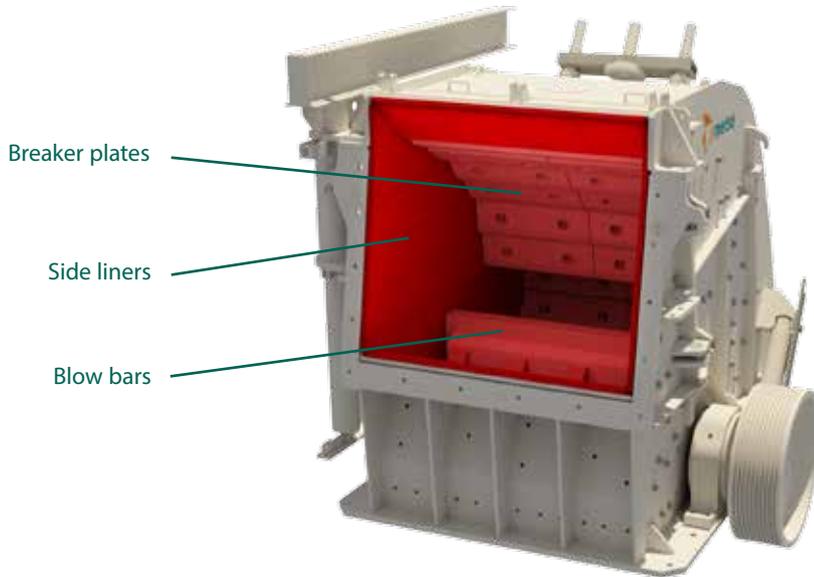


# Nordberg NP series impact crushers Wear parts application guide





## Wear parts application guide - Nordberg NP series impact crusher

# NP impactor and basic concepts

There are many different feed materials, each with its own characteristics. Some are easy to crush, some disintegrate into powder, some are very abrasive. Therefore according each type of material and each application it exists different type of crusher.

In compression crushing (primary gyratory, jaw crusher and cone crusher) the material is squeezed between 2 surfaces which get closer to each others. The crushing movement speed is between 0,5 m/s up to 1,5 m/s.

In impact crushing (Horizontal Shaft Impactor - HSI, Vertical Shaft Impactor – VSI) the material is subject to shocks given by rotating parts (rotor equipped with blow bars, etc.) and thrown against metal surfaces. The movement speed is from 30 up to 80 m/s.

- Good shape end product
- Low initial investment
- High reduction ratio

Feed material is reduced by :

- Initial impact with blow bar (60 %)
- Impact with breaker plates (30 %)
- Inter-particle collisions

NP Model	Feed opening	Maximum feed size	Maximum speed	Nominal installed power	Maximum installed power
NP1110	1020 x 820 mm / 40" x 32.3"	600 mm / 24"	800 RPM	160 kW / 220 HP	200 kW / 250 HP
NP1213	1320 x 880 mm / 52" x 34.6"	600 mm / 24"	700 RPM	200 kW / 250 HP	250 kW / 350 HP
NP1315	1540 x 930 mm / 60.6" x 36.6"	600 mm / 24"	700 RPM	250 kW / 350 HP	315 kW / 400 HP
NP1520	2040 x 995 mm / 80.3" x 39.2"	700 mm / 28"	600 RPM	400 kW / 500 HP	500 kW / 700 HP
NP1313	1320 x 1200 mm / 52" x 47.2"	900 mm / 36"	700 RPM	200 kW / 250 HP	250 kW / 350 HP
NP1415	1540 x 1320 mm / 60.6" x 52"	1000 mm / 40"	600 RPM	250 kW / 350 HP	315 kW / 400 HP
NP1620	2040 x 1630 mm / 80.3" x 64.3"	1300 mm / 52"	500 RPM	400 kW / 500 HP	500 kW / 700 HP
NP2023	2310 x 1920 mm / 91" x 75.6"	1500 mm / 59"	520 RPM	1000 kW / 1300 HP	1000 kW / 1300 HP

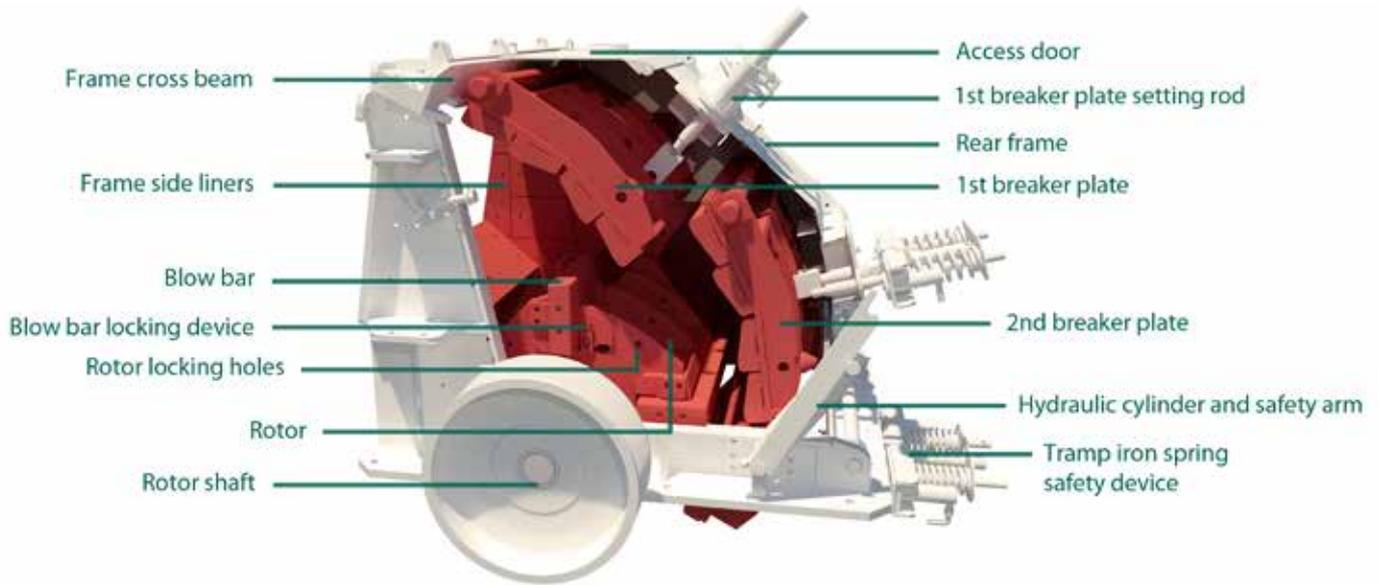
### Crusher sizes

There are many different crusher sizes: The first two figures indicate the diameter of the rotor. The last two figures indicate the feed opening width. For example, NP1415 has a rotor diameter of 1.4 m (55 in.) and a feed opening width of 1.5m (60 in.).

### NP impact crusher components

The main components of the NP Impact crusher are the rotor, rotor shaft, frames, blow bars and breaker plates.

In small mobile machines (NP1110 and NP1213), there is only one breaker plate.



### Setting

The space between the breaker plates and the blow bars only permits sized material to exit from the crusher. Materials that are larger in dimension remain in the crushing cavity until the correct size is obtained. Then they are discharged. Normally the crushing cavity is limited by two adjustable breaker plates, which control crushed product size and capacity.

The closer the breaker plates are to the blow bars, the smaller is the product size and the lower the capacity through the crusher. The smaller the setting is, wearing is naturally faster.

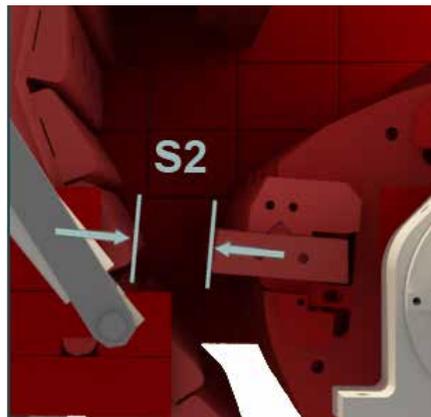
The further the breaker plates are from the blow bars, the higher is the throughput of the crusher, and the larger the product size.

The setting is the distance between the tip of the blow bar and the breaker plate when the blow bar is facing the bottom breaker plate liner. The measurement of the setting is obtained through the side access doors with the frame closed.

The minimum operation setting depends on the size, the nature of the feed material and the capacity through the machine.

Adjustment of the second breaker plate defines the size of the product discharged from the crusher. Knowing the setting of the second breaker plate  $S_2$  and the feed material size (the largest dimension), the setting for the first breaker plate  $S_1$  can be calculated using the following formula:

$$S_1 = (S_2 + \text{Feed Material size}) / 4 + 20 \text{ mm}$$





# How to operate an NP impact crusher

Basic principle of operating with NP impact crusher is quite simple. There are however many things that all have an impact on machines output. Feeding, speed, feed material, water content, wear part selection and settings are just examples of all the possible factors affecting through put optimization.

Following table gives you some hints how to adjust NP impact crusher in order to optimize power consumption, product gradation and product shape to suit desired purposes.



	Effect		
	Specific power consumption	Product gradation fineness	Product shape
Decrease the setting	↑	↑	↗
Decrease the feeding	↓	↗	↗
Increase the speed	↑	↑	↗
Soften the feed material	→	↑	↗



# Wear part selection

The selection of the liner type and material for Impact crushers is fundamental to ensure its desired performance. The liners must be chosen according to the material type, abrasion, foreign elements and size at the feeding and the required product, so that best properties of different metallic alternatives may be used.

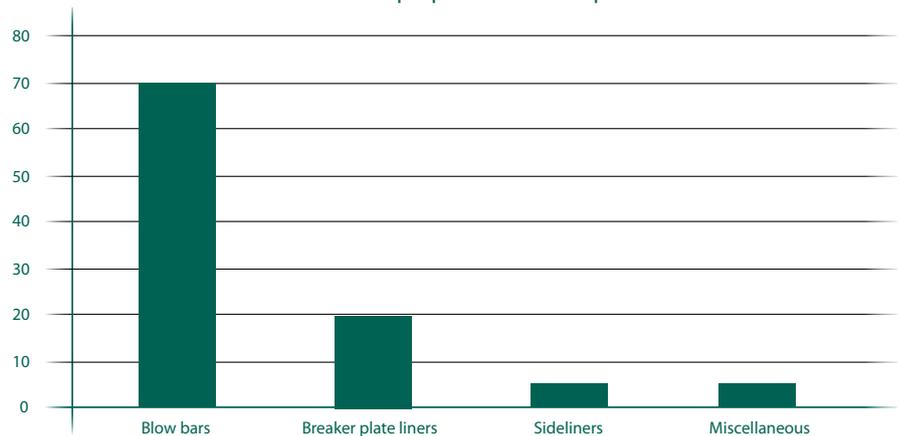
Choices for material are manganese steel, martensitic steel and white chromium iron. Also a metal matrix composite products have been added to the selection and their importance is remarkable.

Continuous impact resistance is vital for finer crushing applications and shock resistance is needed in primary applications and cases in recycling crushing area where metal scrap is entering the crushing chamber. Wear parts have been designed using sophisticated simulation methods and based on long experience in wear part design.

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

NP Impact crusher contains mainly three different groups of wear parts: Blow bars,

Indicative chart of the proportion of wear per element



Breaker plate liners and Side wear plates. Feed liners and Discharge lip for conveyor in Mobile applications can be considered as a wear parts.

The blow bar is the component of an impact crusher most strongly subjected to mechanical stress. It accounts for 60 to 70% of the wear costs.

The proportion of wear per elements corresponds more or less to contribution of each of them to the crushing action. Therefore the wear is the most important on blow bars because the most reduction work takes place when the particle are struck by the blow bars. See the attached table for indicative wear lives.

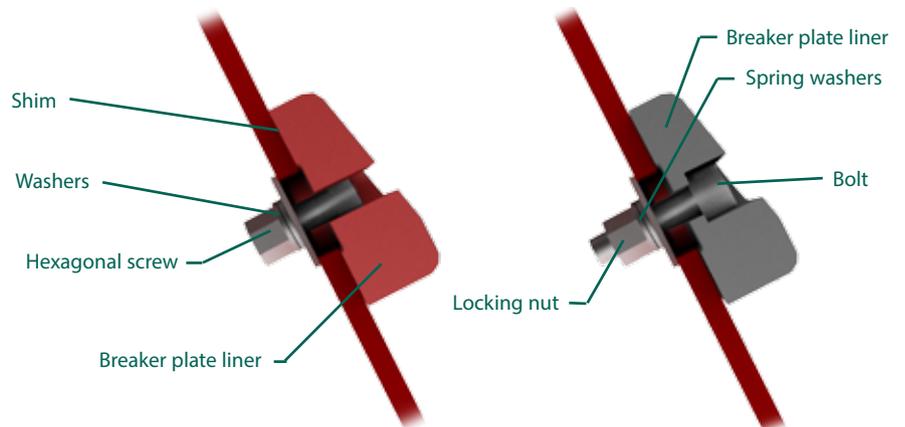


# Metso liners

## Breaker plate liners

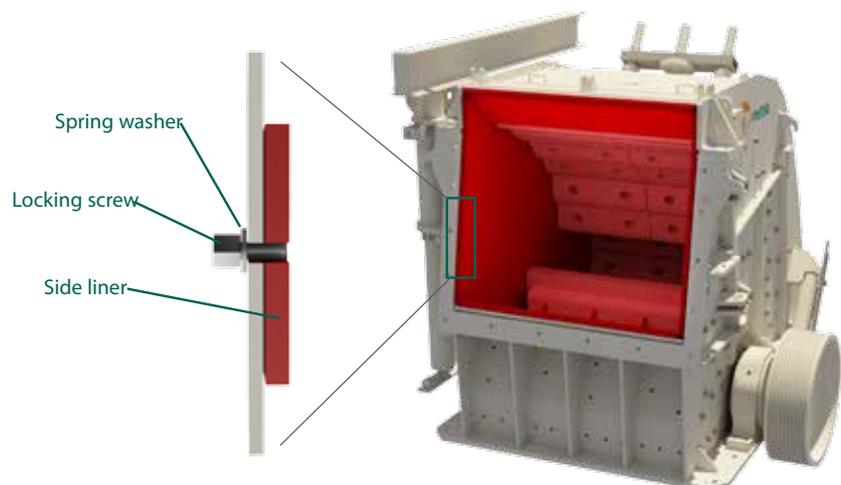
Attaching system depends on the liner material.

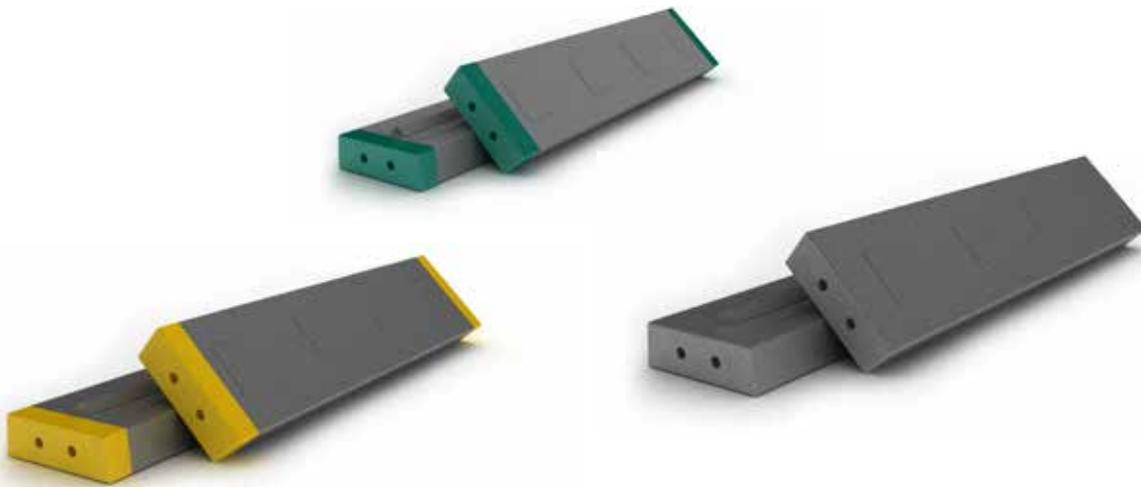
- In the Manganese liners, the attaching system contains a bolt that is at the wear side of the liner.
- In the Chromium iron liner the hexagonal screw is attached directly from the opposite side to the liner.



## Side liners

The side liners protect the frame and 2 types of hardness are available (400 HB and 520 HB). There are also 2 thicknesses available (20 mm and 30 mm)





# Metso blow bars

In general, two cases of stress are distinguished at the blow bars: rim impact and central impact. Favorable energy conditions for crushing are achieved with central impact if the particle can penetrate with its center of gravity into the orbit of the blow bar. The portion of rim impacts is higher than for central impacts. The consequence is a strong rounding of the blow bar edge. An improvement of the central impact can be achieved by an extension of blow bar height and rotor speed adjusted to the conditions.

Rotor speed plays an important role in the crushing effect but in an other way on the wear of the blow bars. In fact increasing the speed increase the kinetic energy distributed to the material, then we create more surfaces able to wear the blow bars.

The red bloc presents six faces. Now considering increasing the rotor speed would increase the kinetic energy to break the red block into the two green blocks. We easily see that compared with the red blocks we have created two new faces, each equivalent to on face of the red block. If the speed was even higher so that the red block breaks into the three yellows blocks, we can see that we would have created four new faces, each equivalent to on face of the red block. Each new face is a new opportunity to increase the blow bar wear. So that we can distinctively associate the speed with the wear.

The relation between speed and wear can be summarized by the following formula :

$$L = K * W^2$$

Where L represents the blow bar wear, K represents the specific wear factor and W represents the rotor speed.

It appears that the wear doesn't increase proportionally with the speed, it is a function of the square of the speed. We have then to consider the life length in hours of the blow bar depending on abrasivity of the material.

Some other parameters like adjustment setting can have an influence on the wear. It appears that a smaller crushing chamber (small setting) contributes to less wear on the blow bars than a larger one. The reason is assumed to be in the shorter trajectories of the particles in the process zone, which contributes to an improvement of the discharge behavior of rock particles from the impact chamber.

The inclination of the blow bar to 15 ° in direction of rotation of rotor presents a lesser wear than an inclination of 15 ° in opposite direction of rotor rotation. This is due to sliding effect of material on the blow bars. But this can be neglected compared with the speed effect and material effect.

When the blow bars are new and present

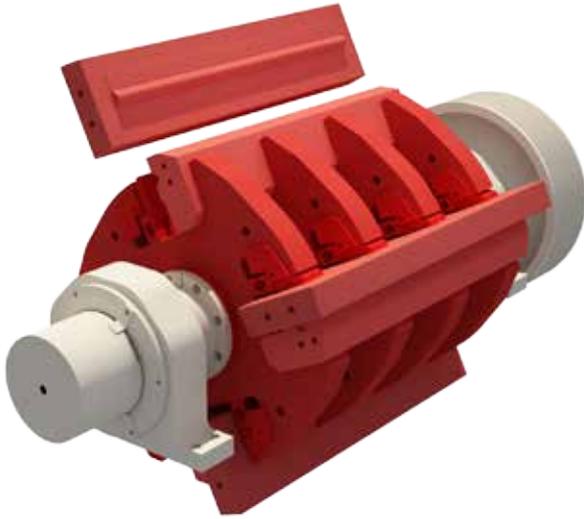
a plane surface and a sharp edge, the impact is more violent, the energy explodes the stones in many pieces. When the blow bars are worn and rounded, the stones are only scuffed by the blow bar edges. They are less fragmented and the energy of the impact is lower.



New blow bar



Worn out blow bar

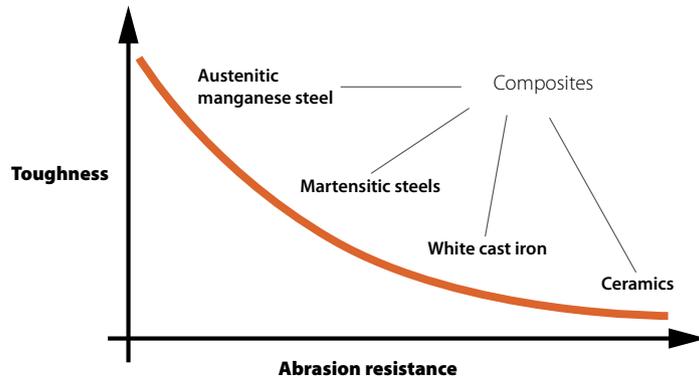


# Blow bar material selection



## Manganese

This is mainly Metso XT510 manganese. This alloy is used in primary crushers or crushers that have tramp iron in the feed. Manganese steels will be used whenever very high shock resistance or some elongation is needed. The blow bar life is not easily predictable and depends on many factors.



## Martensitic (Alloy) Steel

Martensitic steel will be used whenever hardness and impact resistance are both needed, i.e. in all the applications where usage of white (chromium) irons can lead to breakage. Generally, martensitic steel have a higher lifetime than Mn steels in more abrasive applications when the feed size is below 900mm. It is used in primary and recycling applications.



## White Cast Iron (Chromium)

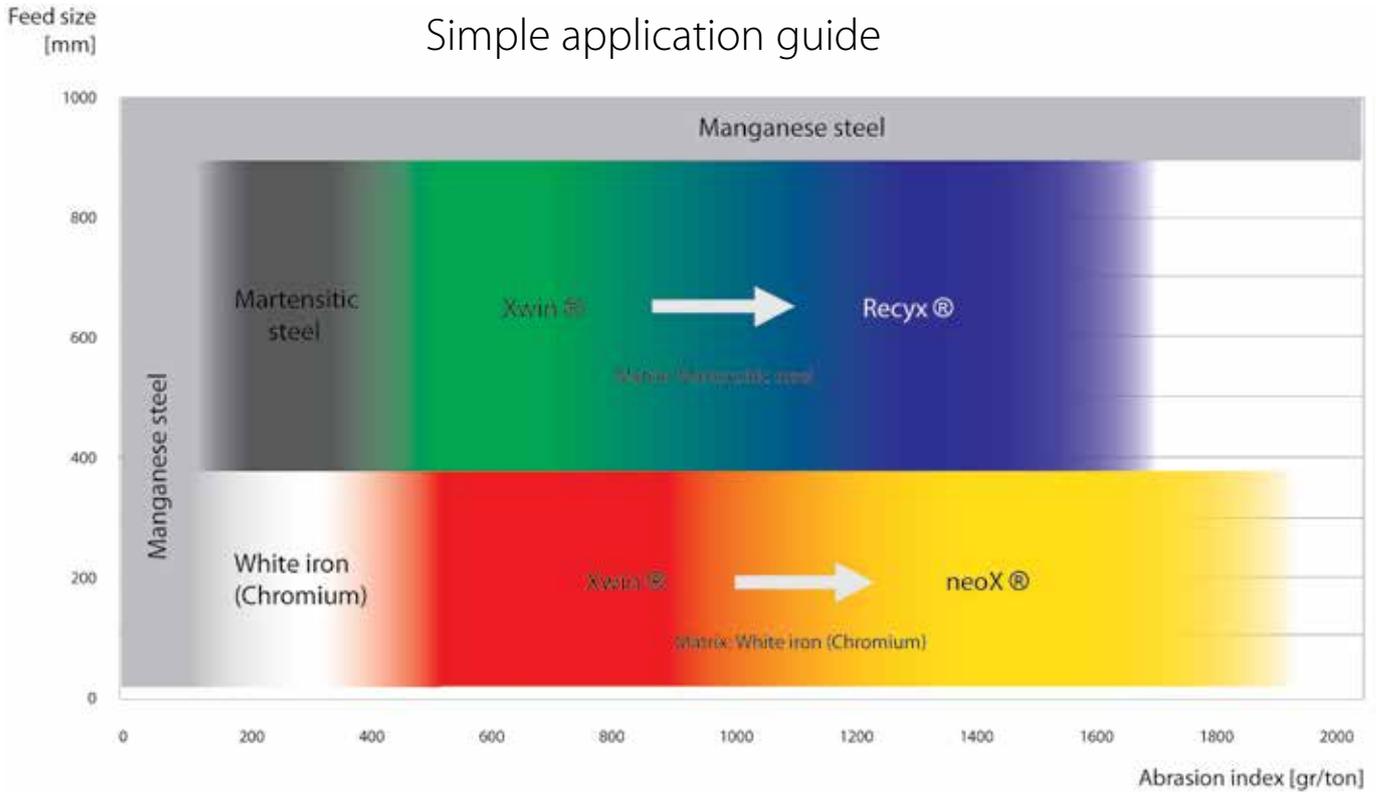
White irons are used when the shock level is rather low and the castings rather thick. Feed to the crusher must be well prepared as far as top size and must be free of tramp iron. Because of the brittle nature of this alloy, tramp iron will cause catastrophic failure of the blow bars. This material is used in secondary, tertiary and asphalt recycle applications where there is no tramp iron.

## Composite solution

Metal Matrix Composite (MMC), consisting of metallic matrix (steel or cast iron) and ceramic alloy. The ceramic part consists of particles spread across the wear surface. These composites have the effect of combining the very hard surface of ceramic with the useful mechanical properties of cast iron or steel. This combination makes the whole structure sufficiently tough to resist to breakage during service.

Compared with standard alloys, this solution considerably increases the parts' life span and the tonnage crushed by each set of parts especially in more abrasive conditions. Metso MMC offering includes Xwin<sup>®</sup> martensitic, Xwin<sup>®</sup> white iron (chromium), Recyx<sup>®</sup> and neoX<sup>®</sup>.

# Simple application guide



## Xwin® Martensitic Steel/Ceramic

This is a MMC blow bar consisting of hard ceramic particles on the wear surface in a martensitic steel matrix. This composite has the effect of combining the very hard surface of ceramic with the useful mechanical properties of steel. These (martensitic/ceramic) blow bars can have two to four times the life of standard mono-alloy blow bars.

- Recycling industries (primary)
- Concrete
- Asphalt
- Quarries (primary)
- NOT suitable for slag recycling (too abrasive) or limestone (lifetime too long, risk of metal stress)

new martensitic steel matrix. Ceramic inlay is deeper and wider than standard Xwin and will provide higher lifetime. These are high performance blow bars for recycling applications.

- Recycling industries (primary)
- Concrete
- Asphalt
- Quarries (primary)
- NOT suitable for slag recycling (too hard), or limestone (lifetime too long, risk of metal stress)



## Xwin® White iron (chromium)/Ceramic

This is a MMC blow bar consisting of hard ceramic particles on the wear surface in a chromium iron matrix. This composite has the effect of combining the very hard surface of ceramic with the useful mechanical properties of chromium iron. These (chromium/ceramic) blow bars can have two to four times the life of standard mono-alloy blow bars.

- Secondary application in quarries and gravel pits.
- Asphalt (when no risk of unbreakable parts)
- NOT suitable for primary crushers or

extreme abrasive/hard materials. Carbide based matrix accepts near to no shocks.



## neoX® (Xwin® III) High Chromium Iron/Ceramic

This is a MMC blow bar consisting of hard ceramic particles on the wear surface in a chromium iron matrix. The quality of the ceramic inlay has a more durable wear resistance than standard Xwin®. Designed specially for the gravel pit or quarry applications.

- Secondary application in very abrasive working conditions (quarries and gravel pits, steel slag,..).
- Asphalt in some cases (when no risk of unbreakable parts)
- Main target is in applications where Xwin® white iron gains no lifetime improvement against monoalloy solution
- NOT suitable for primary crushers or low to middle abrasive conditions



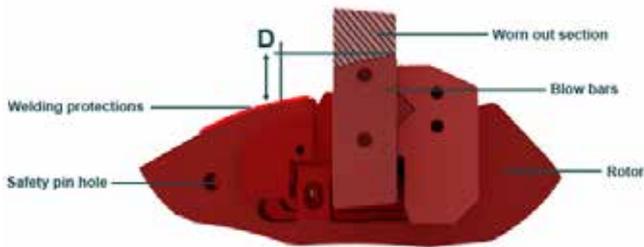
## Recyx® Martensitic steel/Ceramic

This is a MMC blow bar consisting of hard ceramic particles on the wear surface in a



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	NP1110	NP1213	NP1315	NP1520	NP1313	NP1415	NP1620	NP2023
Dimension D in the illustration	55 mm 2.2 in	60 mm 2.4 in	70 mm 2.8 in	70 mm 2.8 in	60 mm 2.4 in	70 mm 2.8 in	80 mm 3.2 in	50 mm 2.0 in



# When to change wear parts

## When Blow bars should be changed

In order to avoid damage to the rotor, blow bars should be replaced before they are worn through. The wear limit "D" is shown in the illustration above. When changing and turning around blow bars, follow the instructions in the Nordberg NP Series Impact crusher instruction manual.

## Blow bar replacement

Blow bars are reversible. When one face is used, the blow bar can be turned around to use the other face. This procedure can only be done once.

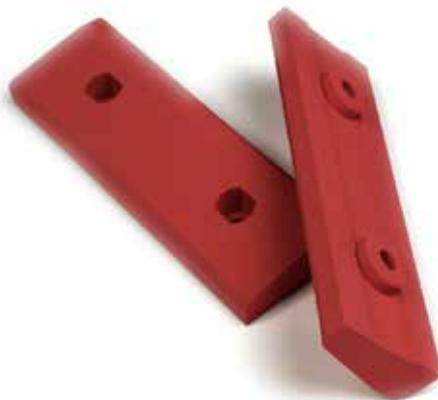
Blow bars may need to be changed or turned around earlier if wear profile is distorted. Unevenly worn blow bars may decrease production. Reasons for distorted wear profiles might be incorrect feeding or feed gradation.

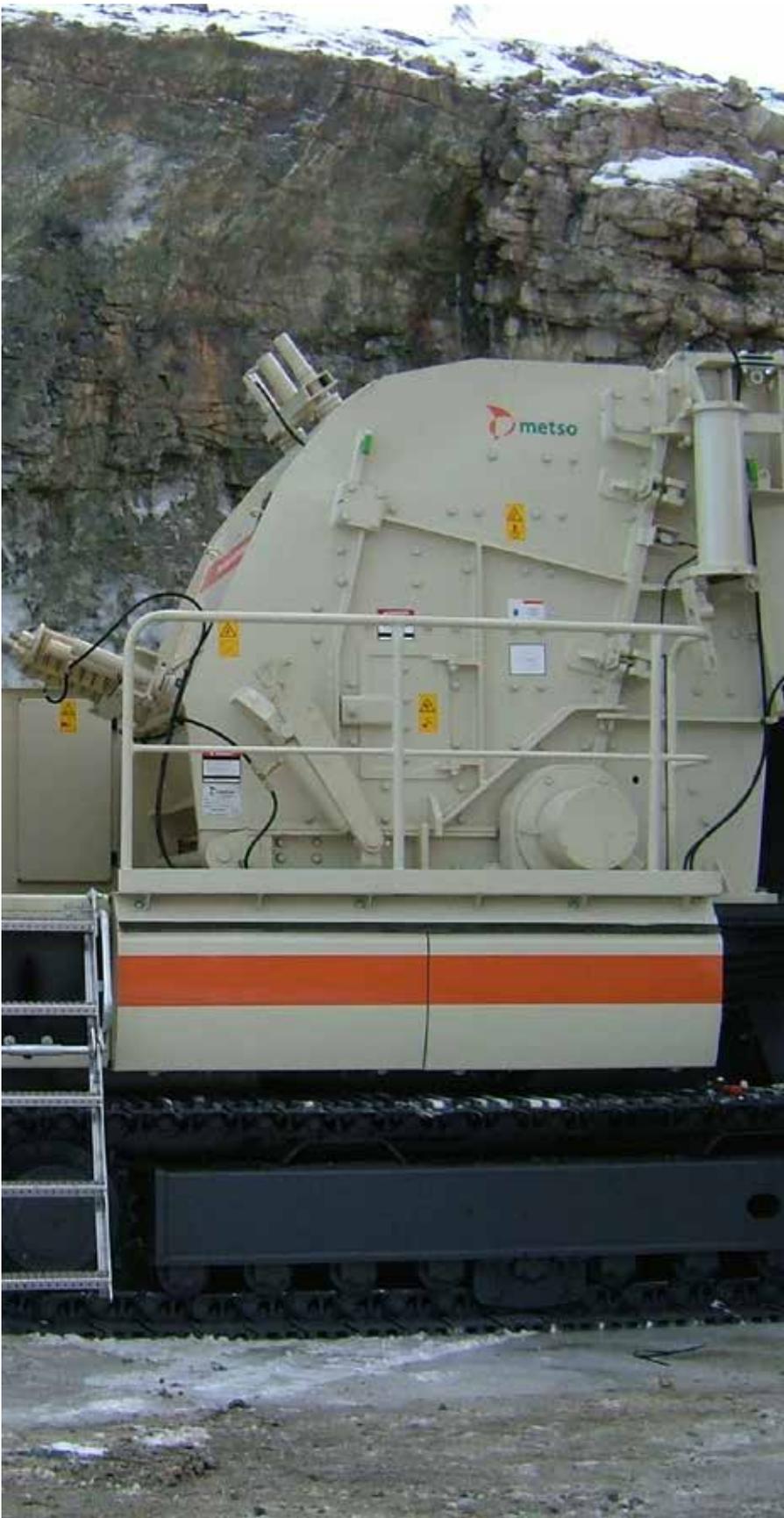
Recommendation is to change all 4 blow bars simultaneously. However in some applications can be used the slotted configuration. The slotted configuration (two worn blow bars and two new blow bars diametrically opposed) will produce a discharge curve with a smaller amount of fines.

## Breaker plate replacement

In order to maximize the lifetime of the breaker plates, Metso's machines breaker plates are protected against wear by several same sized breaker plate liners. Because wear profile isn't same in the whole crushing chamber, breaker plate liner positions can be rotated. Wear is higher on the bottom of the chamber.

If a few liners are worn, you are not obliged to change whole set of the liners. You can either change liners places or change just the worn ones.





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Metso's Mining and Construction Technology