

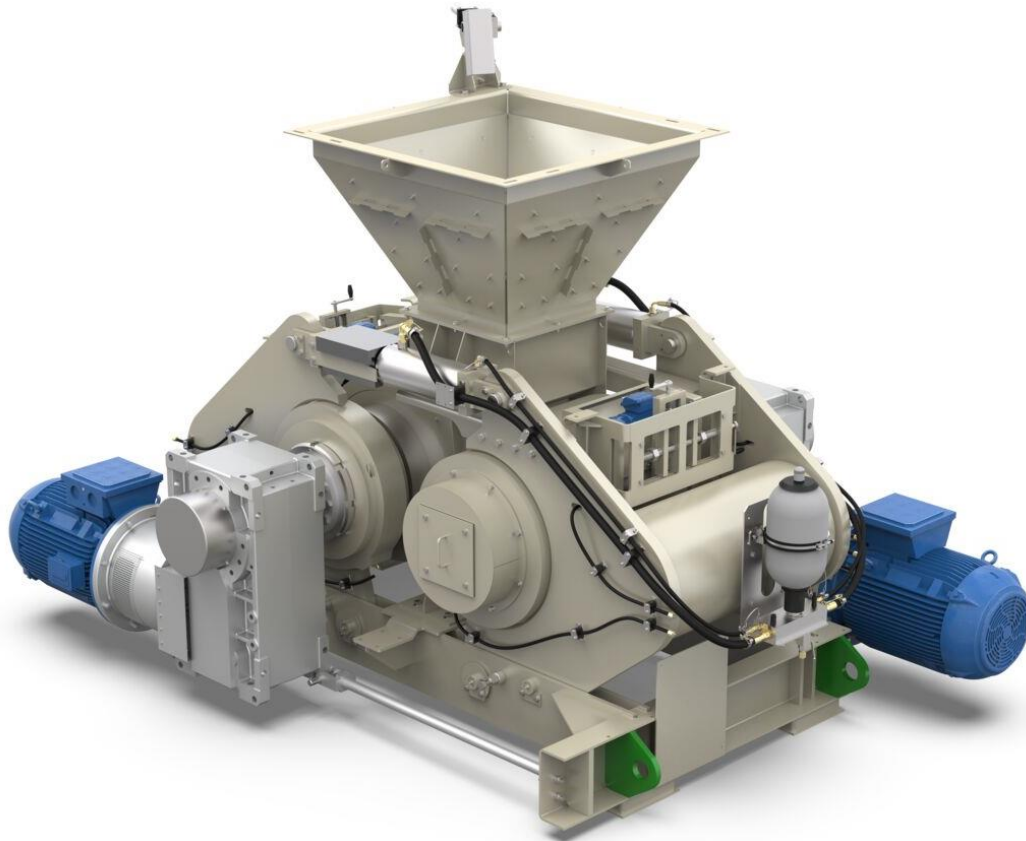


12 July, 2023

Manufactured Sand from HRC™ Crusher

For High-quality aggregate and manufactured
sand production.

Metso HRC8 High Pressure Grinding Rolls



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Introducing HPGR to the Aggregates Industry

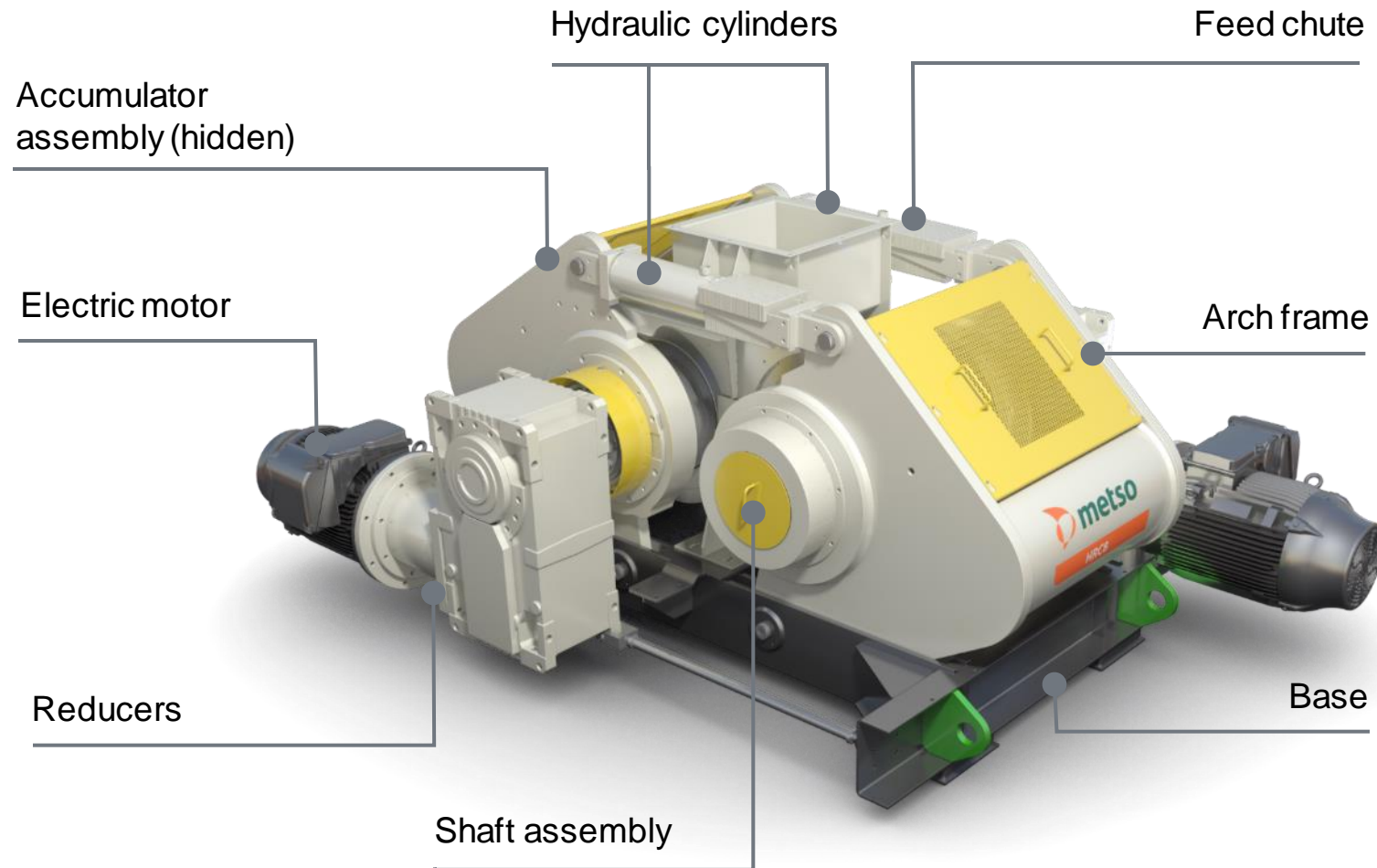
	Roll Dimensions (D x W)	Installed Power	Unit Weight	Maximum Roll Speed	Typical Capacity	Maximum Press Force	Crusher Dimensions (L x W x H)
HRC8	800 x 500 mm	2 x 75 kW	12.9 t	30.2 rpm	60 – 90 tph	2.5 N/mm2	2.8 x 3.9 x 1.7 m
HRC800	800 x 500 mm	2 x 110 kW	18 t	30.2 rpm	70 – 110 tph	4.5 N/mm2	2. X 4.3 x 2.5 m



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HRC Simple Design Maximum Performance

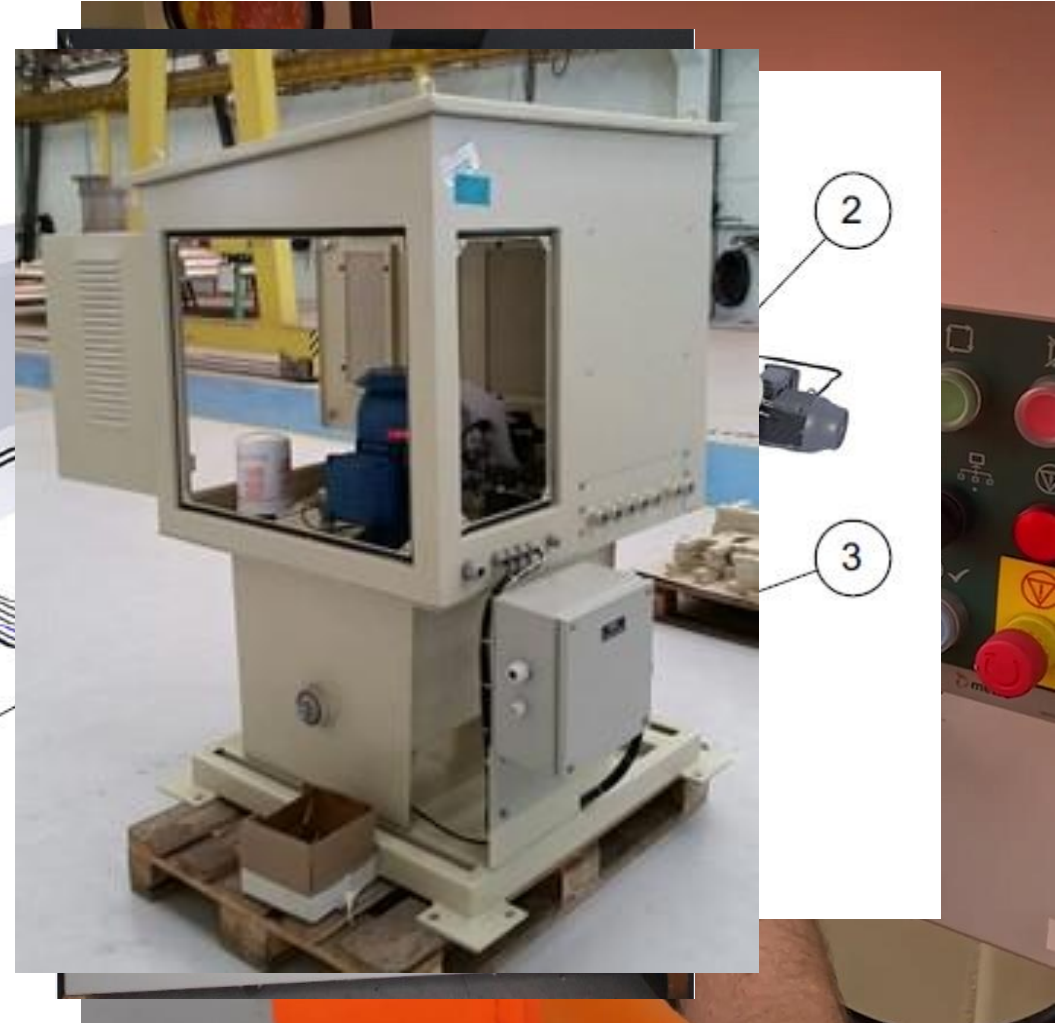


- The **feed chute** guide material to the rolls
- The **Motors** and **reducers** turn rolls, drawing bed of rock into crushing zone
- The **Arch frame** pivots in the base frame, maintaining alignment
- All loads are internal to the machine so **base frame** and base skid only need to support weight of machine

Rapid Installation on Site

HRC delivered with full operation and automation panel

- The **HRC™ operation panel** controls the HRC™ parameters during operation.
- The **crusher panel** connects between the instruments and the operation panel.
- The VFDs connect to the **HRC™ MCC** and controls each motor.
- The **hydraulic unit panel** connects between the instruments and the hydraulic unit motor.



Optimisation of crushing process

IC80c automation control the crusher parameters



- Main operation screen (shown)
 - Review cavity level, pressure and power
- Feeder
 - Adjust target cavity level or feeder speed
- Crusher
 - Adjust pressure and roll speed
- Hydraulic unit
- Alarms
- Production logs
- Parameters

Each icon gives access to a separate screen to control and/or monitor settings.

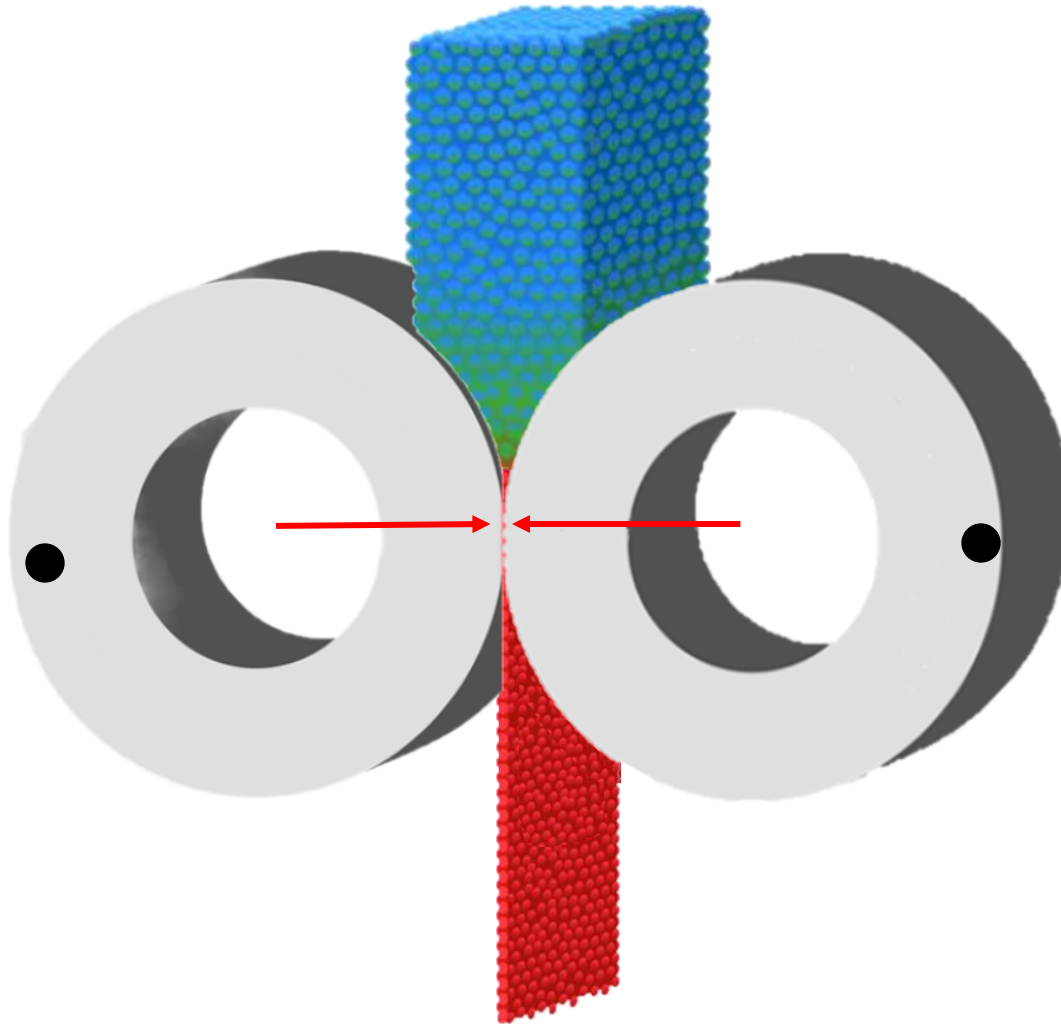


HRC

How does it work

HRC Concept

Compression Crushing



- Inter-particle comminution
- Bed of material formed between two rotating tires
- Pressure builds until distance between two tires is least
- HRC operating parameters,
 - *Pressure* influences reduction ratio
 - *Speed* influences capacity

HRC Concept

Compression Crushing



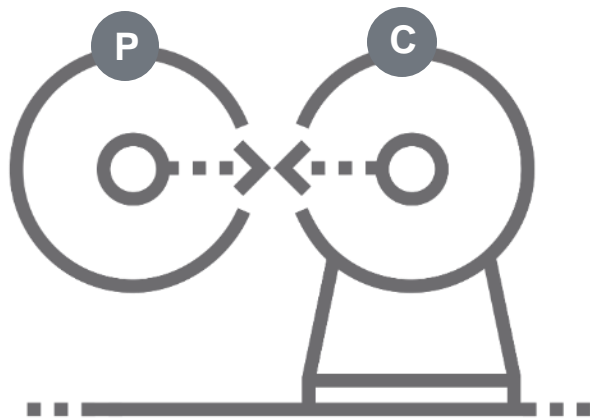
- The HRC is **NOT** similar to old roll crushers
- Hydraulic cylinders controlled by automation, generate high and consistent crushing force
- Unlike old roll crushers where crushing force is applied by springs

HRC Concept

Compression Crushing

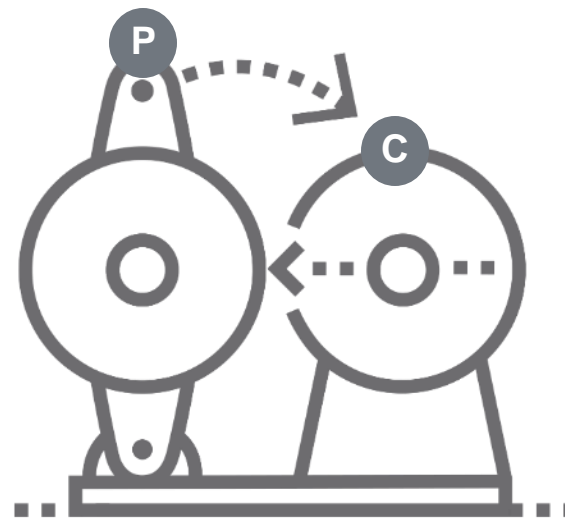
Achieves double crushing force

Traditional



Crushing Force (C)
= Applied Force (P)

Metso's Concept



Crushing Force (C)
= 2 x Applied Force (P)

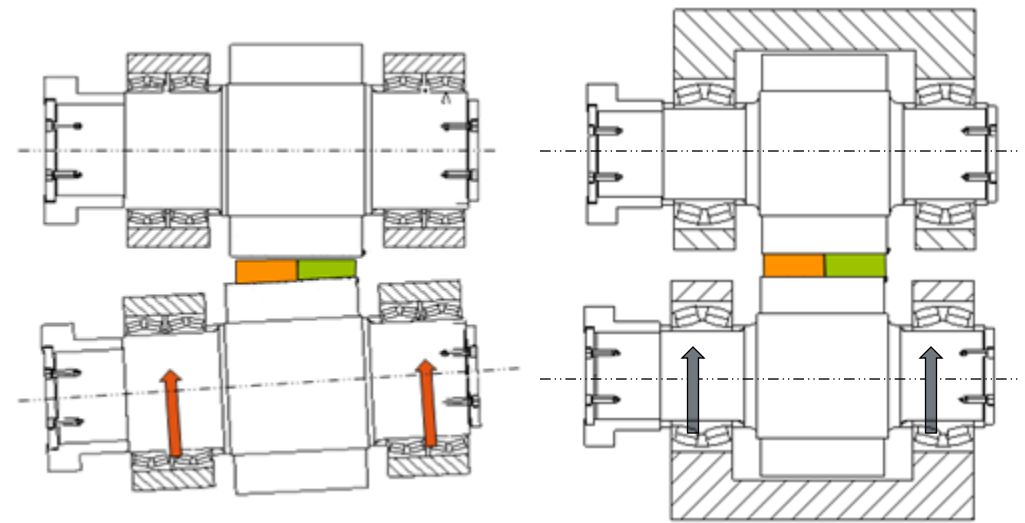
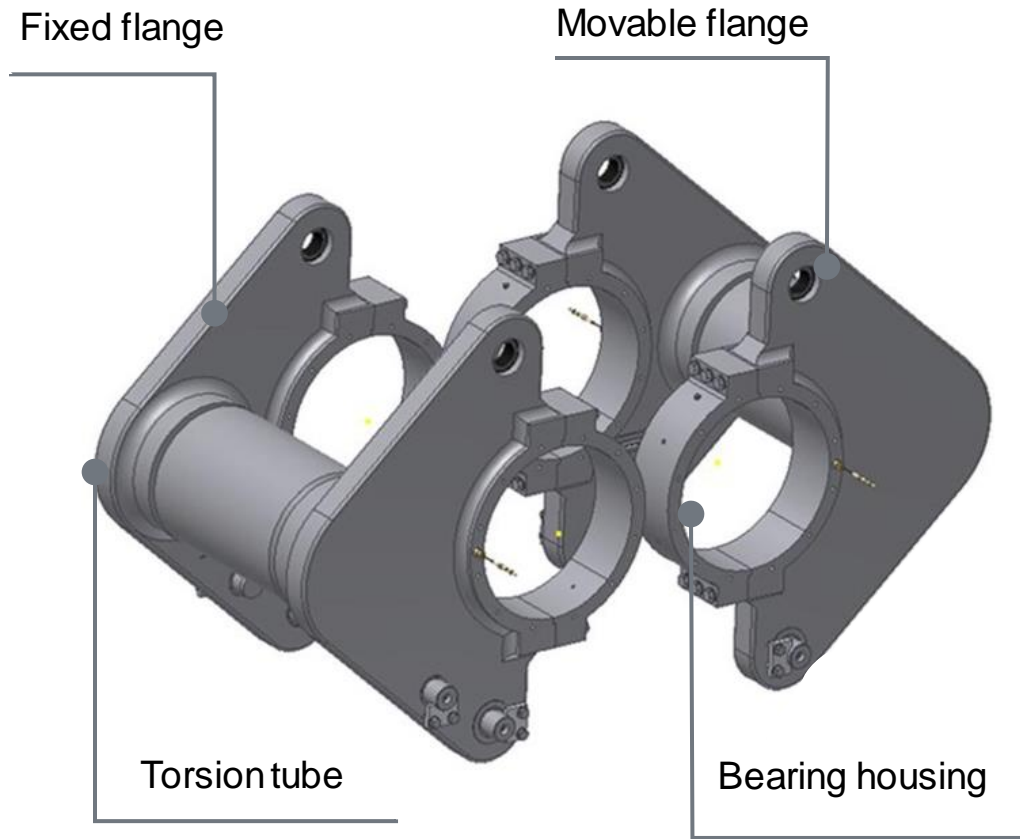


The crushing force
of Metso HRC can be
compared to a nut cracker

HRC Concept

Compression Crushing

Consistent End Product Quality



Uneven gap setting

Even gap setting



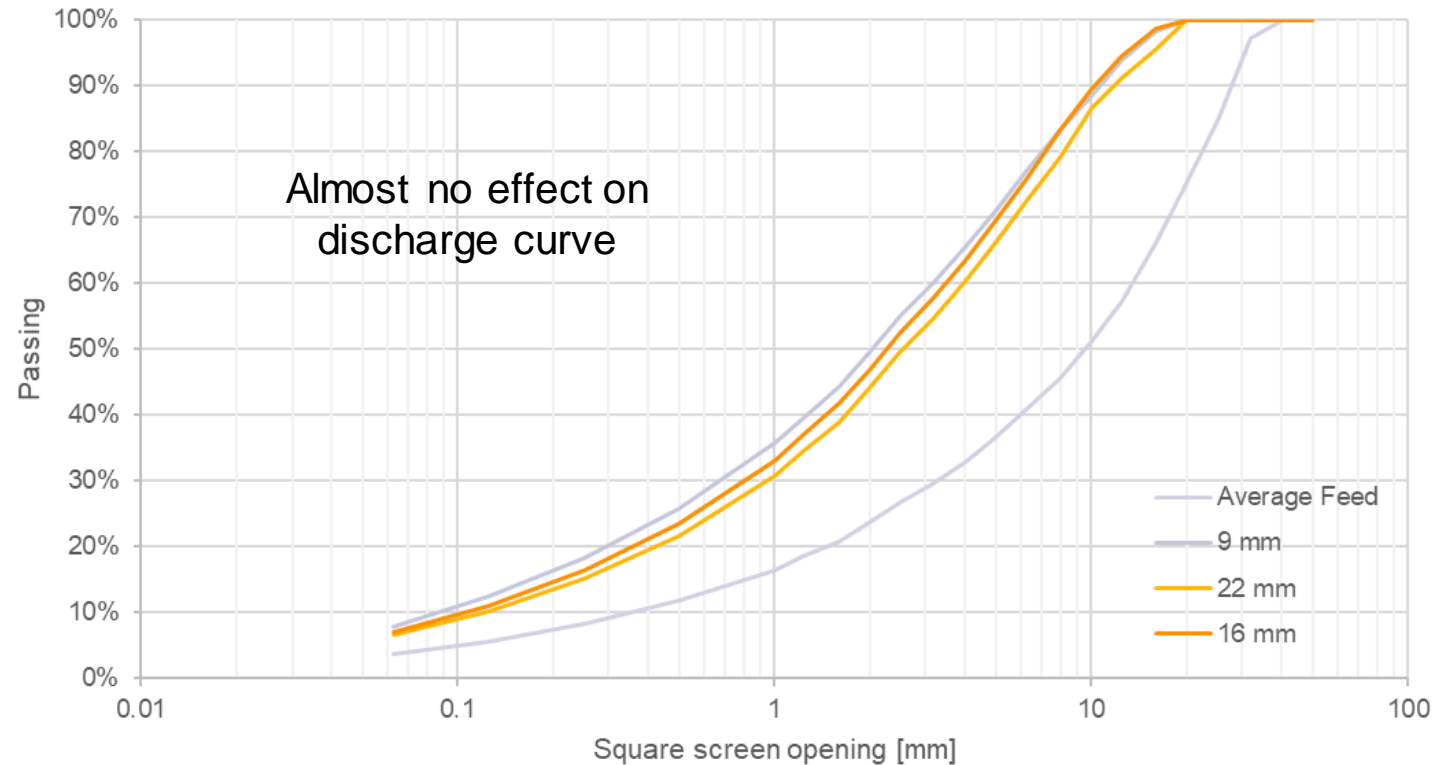
HRC

Operating Parameters

Starting Gap

Feed Material: 0/32mm

Starting Gap: 9mm, 16mm and 22mm



Initial gap setting : 50 to 60 % of top feed size

Operating gap adjusts while operating



Shims for starting gap adjustment

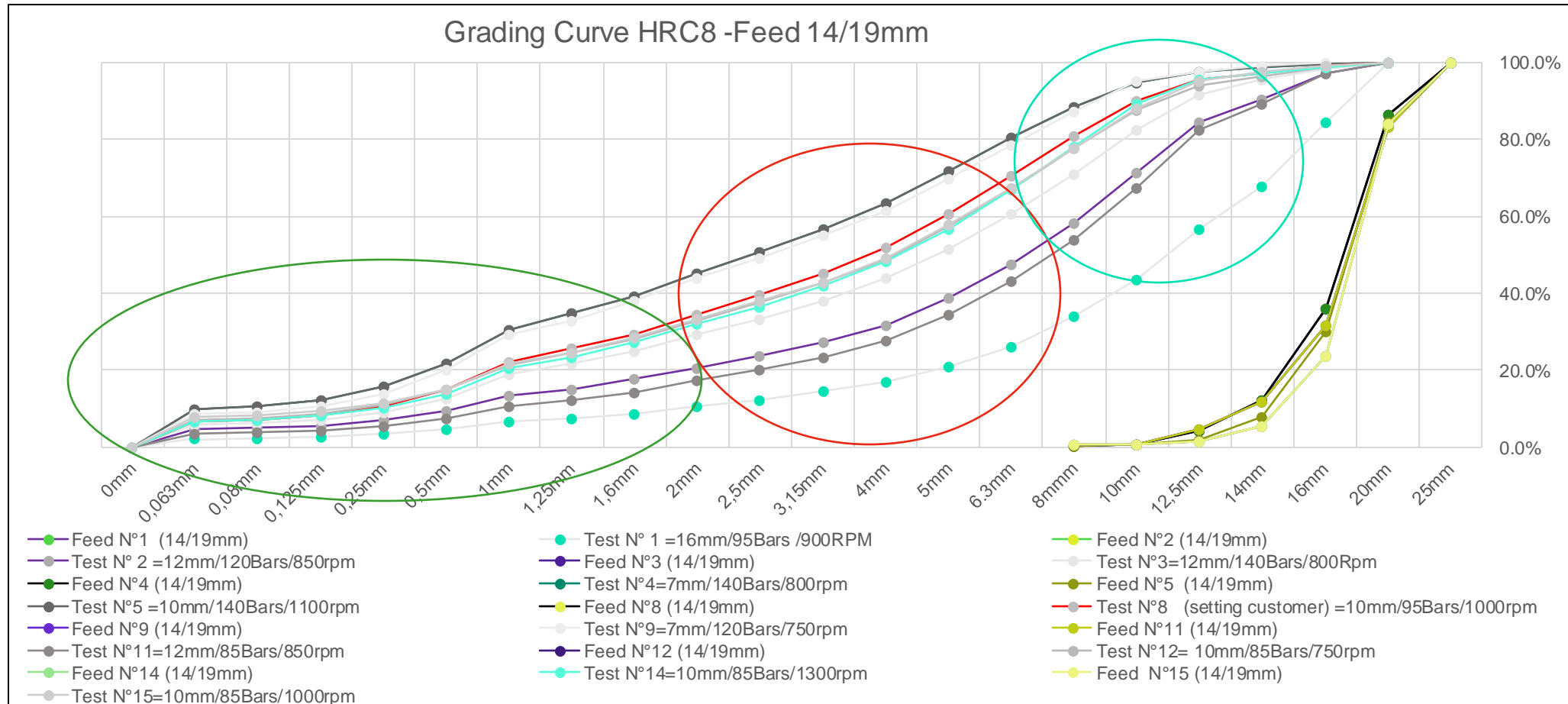


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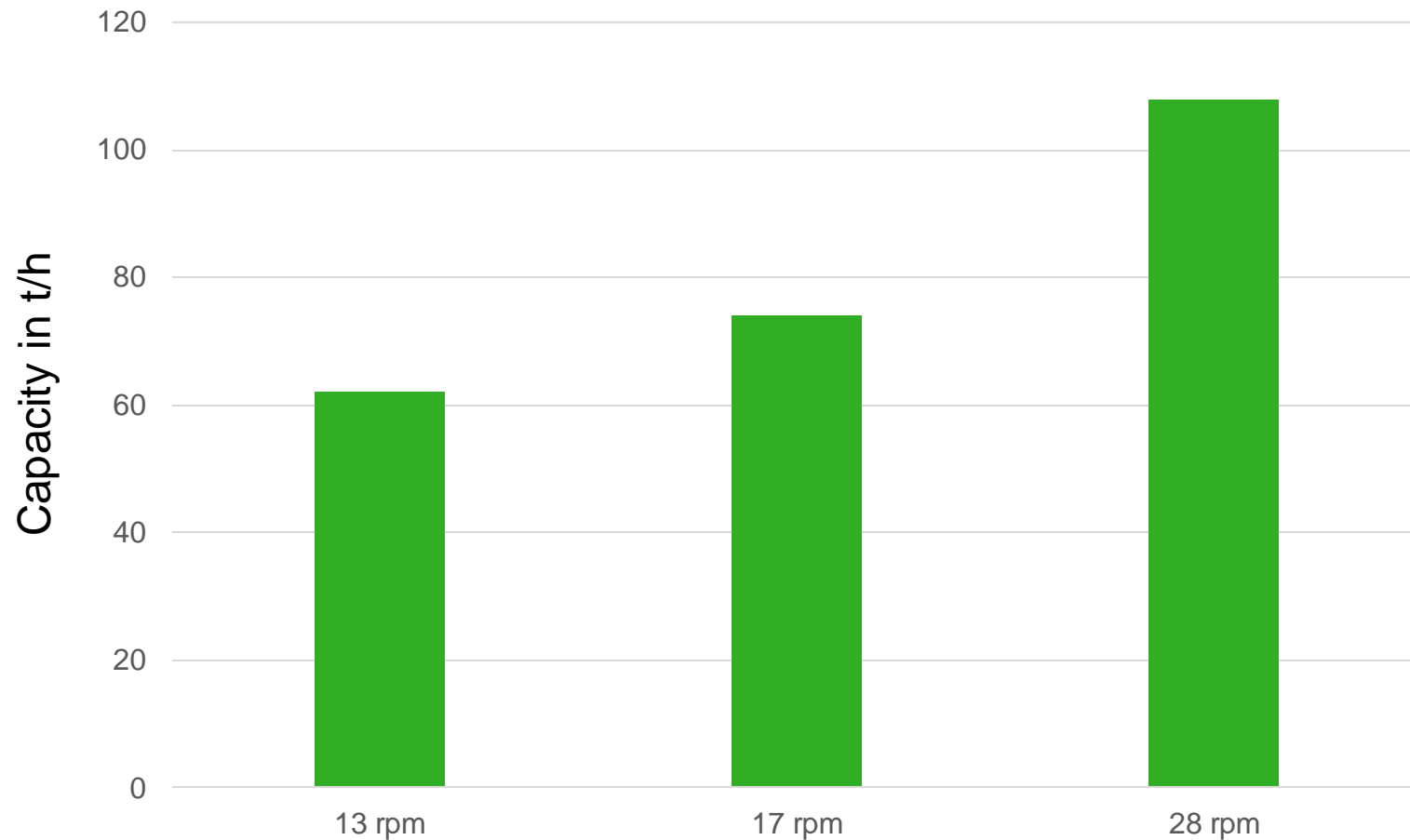
Pressure Versus Gradation

Balance production with pressure adjustment



Variable Capacity

Roll speed adjusted with VSD



Feed material: Granodiorite

Feed size: 0/32 mm

Crushability: 35%

Speed :

13 rpm (0.5 m/s)

17 rpm (0.7 m/s)

28 rpm (1.2 m/s)

Energy to Crush

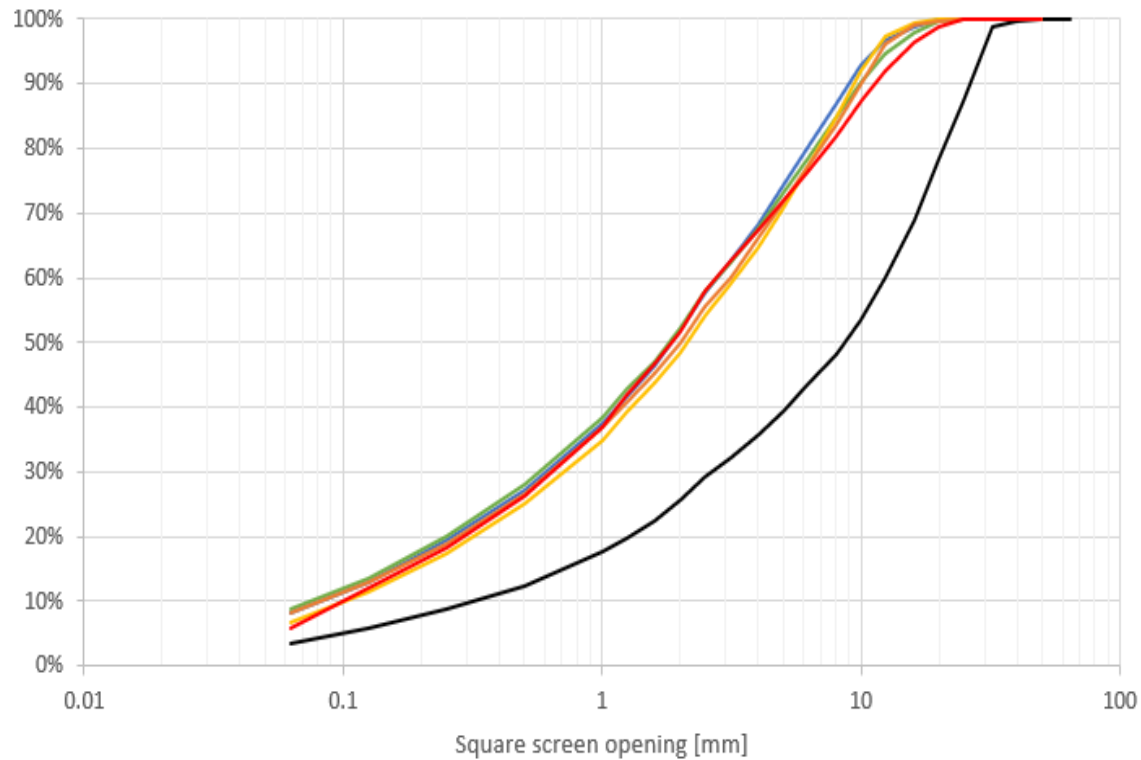
Keep same gradation and vary capacity

Feed material: Granodiorite

Feed size: 0/32mm

Crushability: 35%

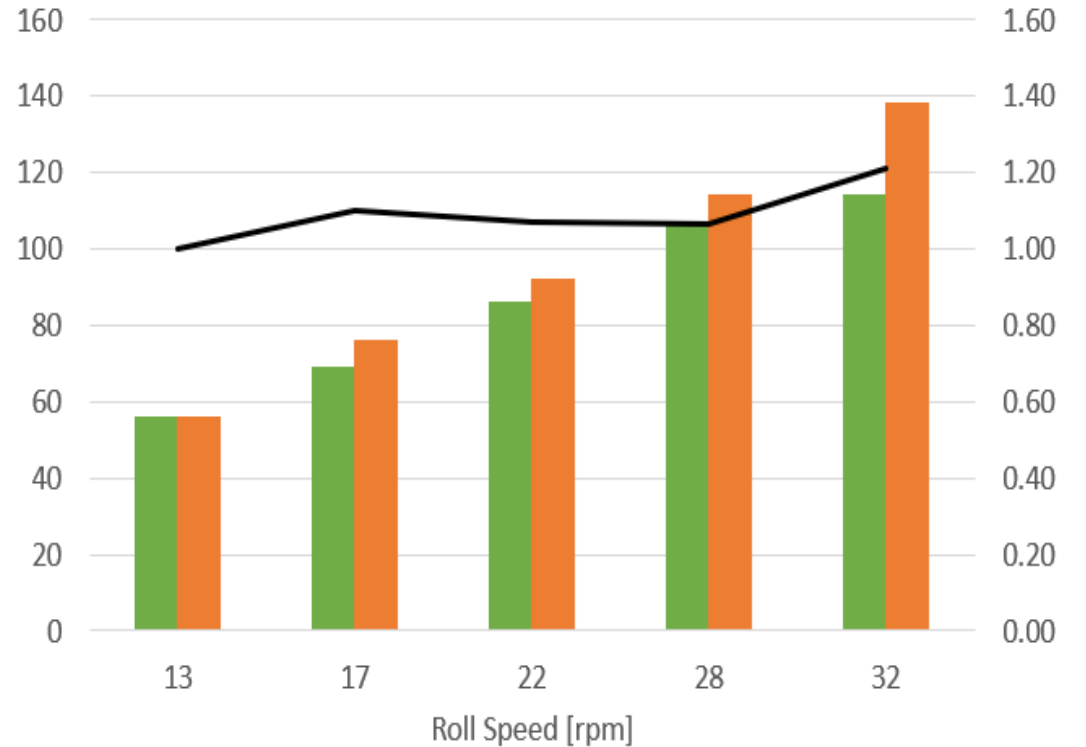
Passing



— Average Feed — 13 rpm — 17 rpm — 22 rpm — 28 rpm — 32 rpm

Capacity/
Power draw

Specific energy



■ Capacity [t/h] ■ Power draw [kW] — Specific Energy [kWh/t]

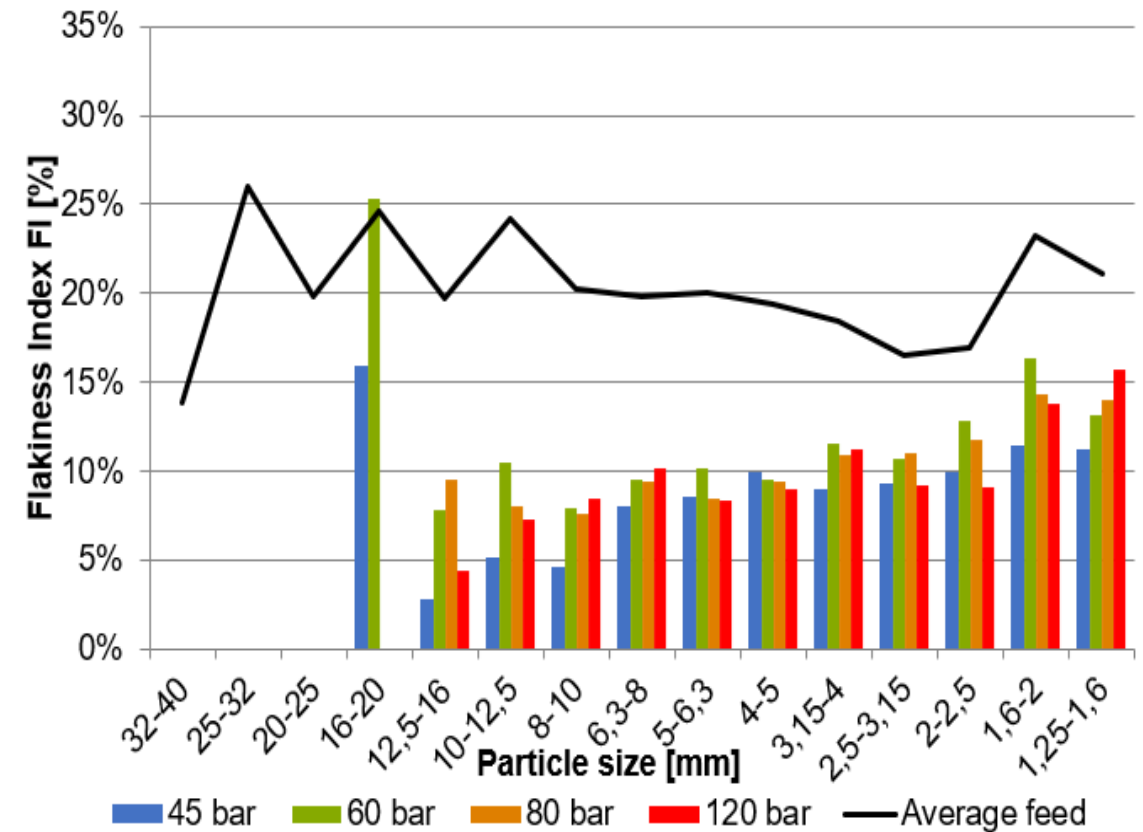
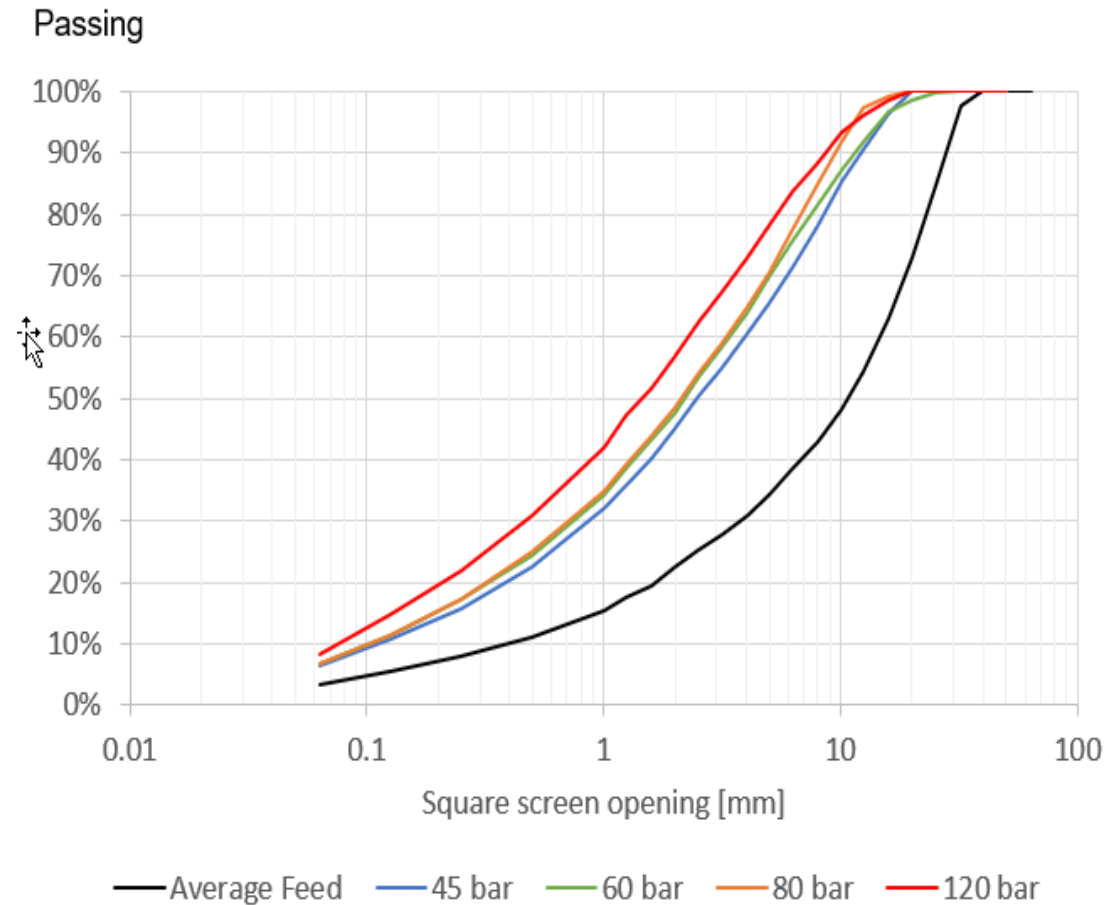
High Quality Aggregates

Pressure adjustment had no significant impact on product shape

Feed material: Granodiorite

Feed size: 0/32mm

Crushability: 35%





HRC

Applications

Application Areas For Manufactured Sand

Concrete sand

- Concrete products (pipes, blocks and pre casts) of all kind
- Plasters and mortars, where sand has a full role as aggregate

Spec sand (below 6mm with out FM control)
Spec sand (below 4.75mm with FM control)

Asphalt sand

- Different types of mixes
- Several spec gradings

Spec sand (below 5, 6 or 10mm with FM control)

Industrial sands

Foundry sand
Frac sand
Filter sand
Safety sand for playgrounds
Golf course sand
Horse track sand

Fine sand (0/4.75mm or 0/2mm)

Agriculture sands

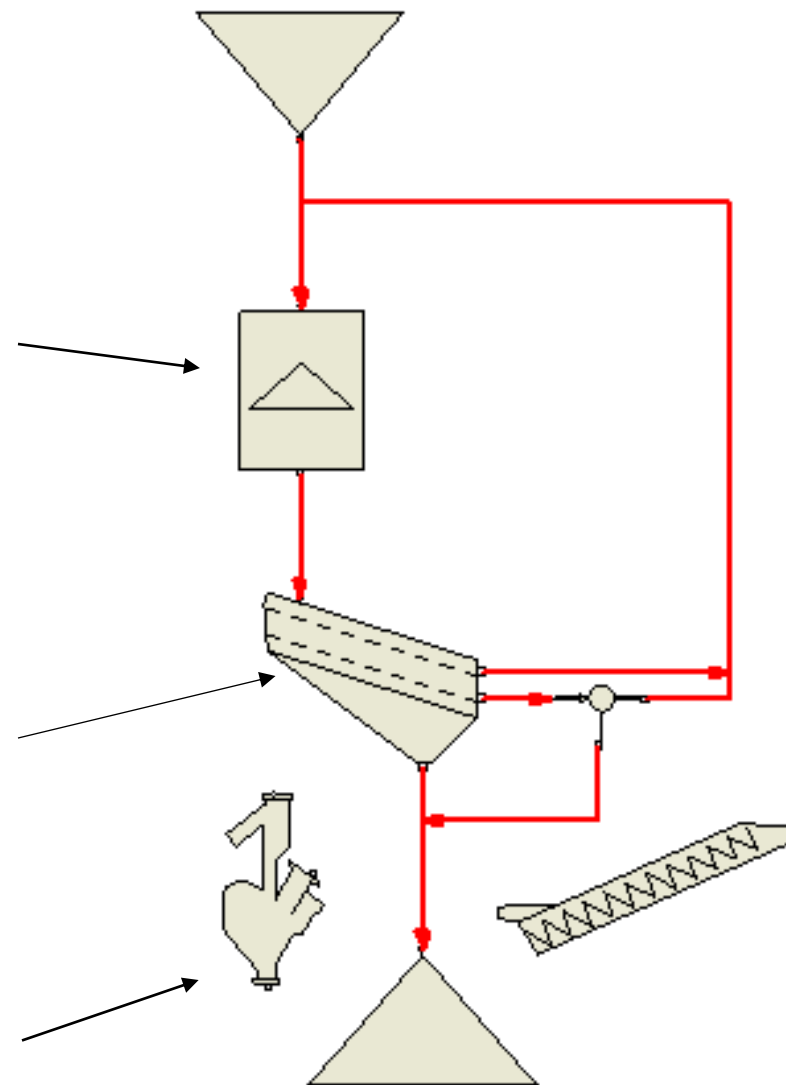
- Soil improvement
- Soil mineralization
- Fertilizers

Spec sand (0/2 mm)

Typical Sand Processing Circuit



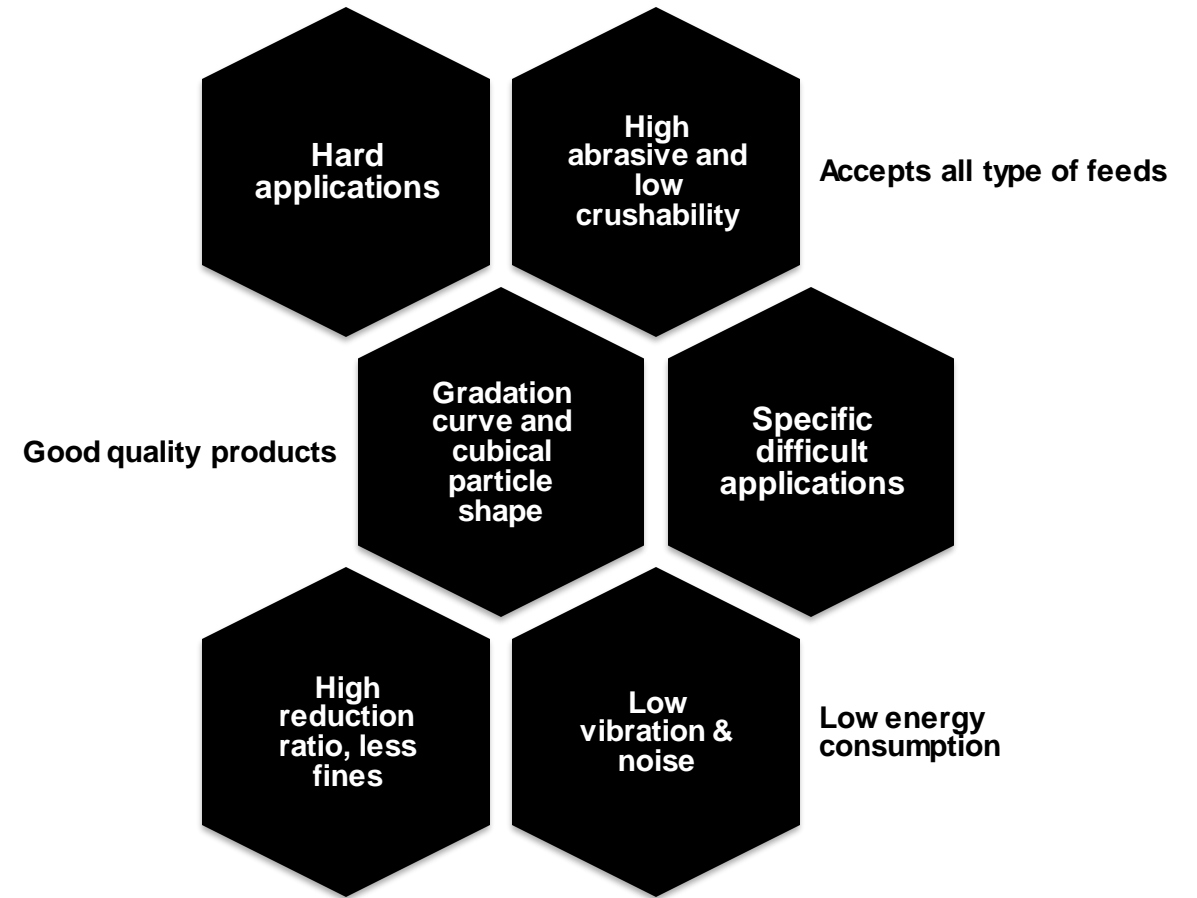
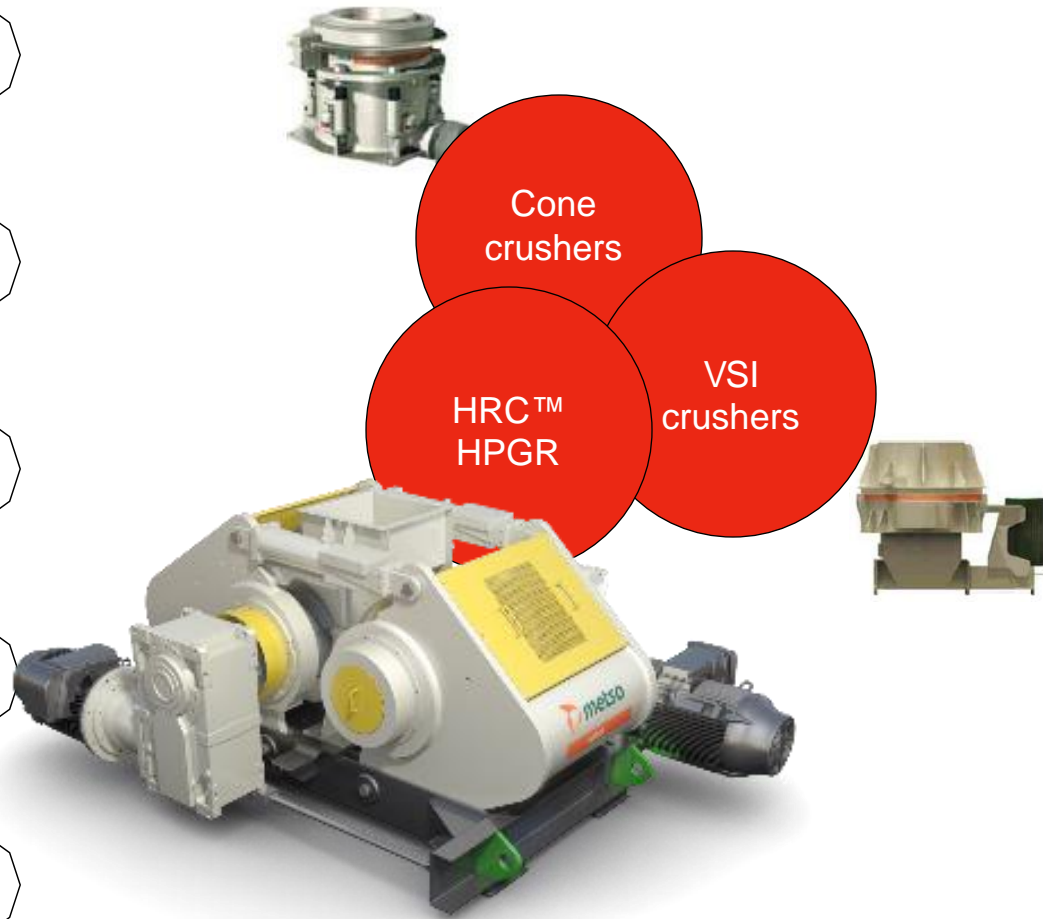
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Solution To Turn Difficult Feed Into Valuable Product

HRC works in applications where other crushers cannot



Wet Process With HRC8. Re-Crush Into High Quality Manufactured Sand



HRC8 For Plant and Specification Optimisation

- Optimise plant production
- Balance production
- Improve screen efficiency
- Optimise gradation to match specification



Advantages of HRC versus Other Crushers

		HSI NP Range	Barmac VSI	HP Cone Crusher	HRC High Pressure roll crusher
<u>Operation</u>	Installation	+++	+++	+	+++
	Maintenance	++	++	+++	+++
	Feed size	+++	++	+++	++
	Humidity in the feed	++	++	++	+++
	Fines in feed	++	++	+	+++
	Noise	++	++	+	+++
	Dust generation	+	+	++	+++
<u>Performance</u>	Fine feed (<10 mm)	-	++	-	+++
	Coarse (>32 mm)	+++	++	+++	+
	Reduction ratio	+++	+	++	+++
	Cost Ton	++	+	+++	+++
	Hard and abrasive materials	+	+	+++	+++
	Fine high spec sand	+	++	+	+++
	Low circulating load (m. sand)	+	+	+	+++
<u>Quality</u>	Shape (no sharp edges)	++	+++	+	++
	Extra fines (<0.074mm)	+	+	+++	++
	Cubical	++	++	+	+++
<u>Cost</u>	Energy efficiency	++	+	++	+++
	Wear	+	+	++	+++
	Investment	+++	+++	+	+



HRC Crusher



HSI Crusher



VSI Crusher



Cone Crusher

Energy Efficiency

Quaternary Crushing

Material – Andesite

Feed size – 4/25mm

B7150SE (250 kW), HP3 (250 kW) and HRC800 (220 kW)

Power utilization
for higher net product
generation, higher
efficiency.

	VSI	Cone	HRC
Capacity (tph)	175	190	135
KW/tph	1,45	1,15	1,65
% 0- 4 mm	25%	45 %	65%
t/h 0- 4 mm	45 t/h	85 t/h	87 t/h
KW/Tph 0 – 4mm	5,5	2,95	2,6

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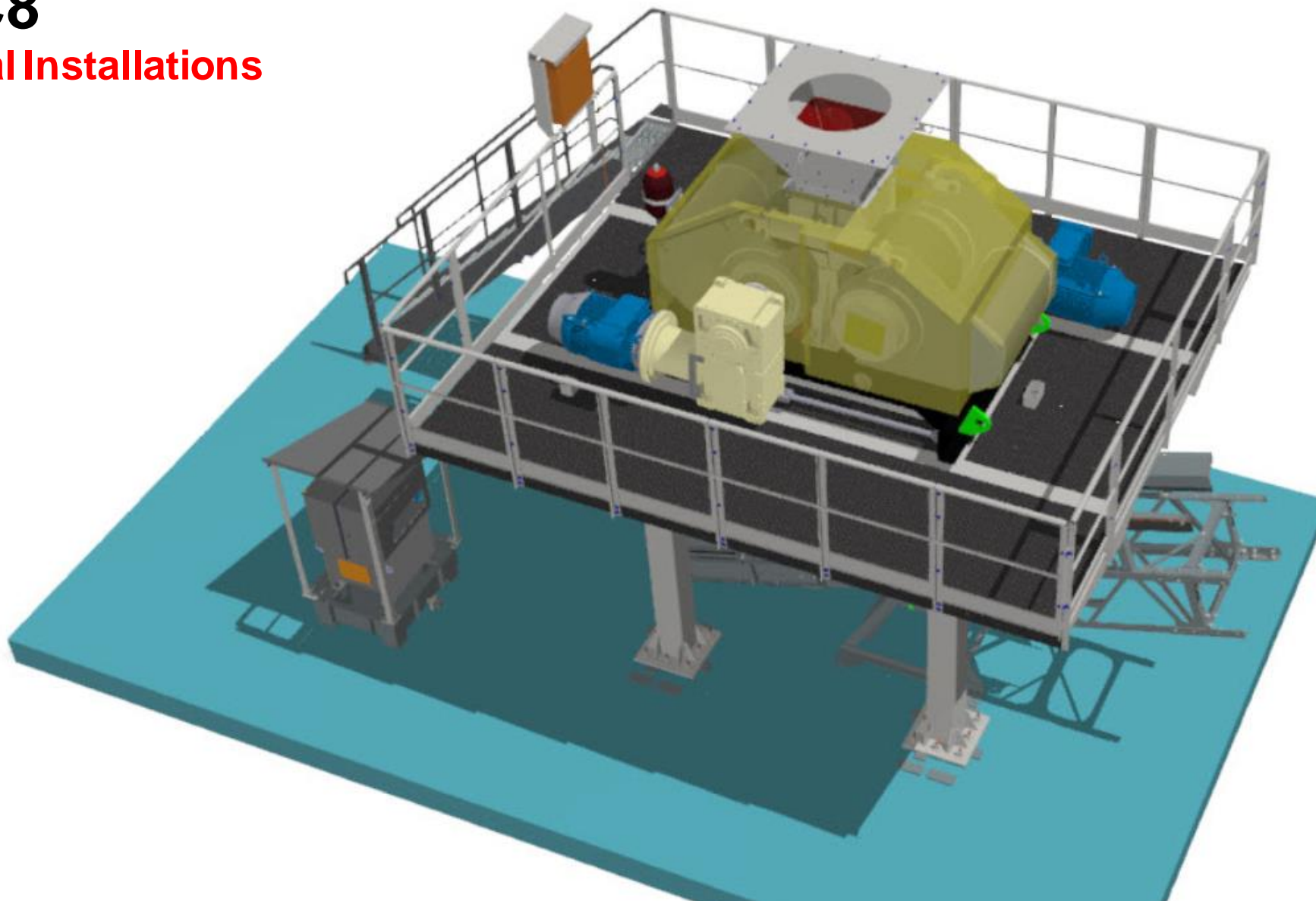


HRC

Installations

HRC8

Typical Installations

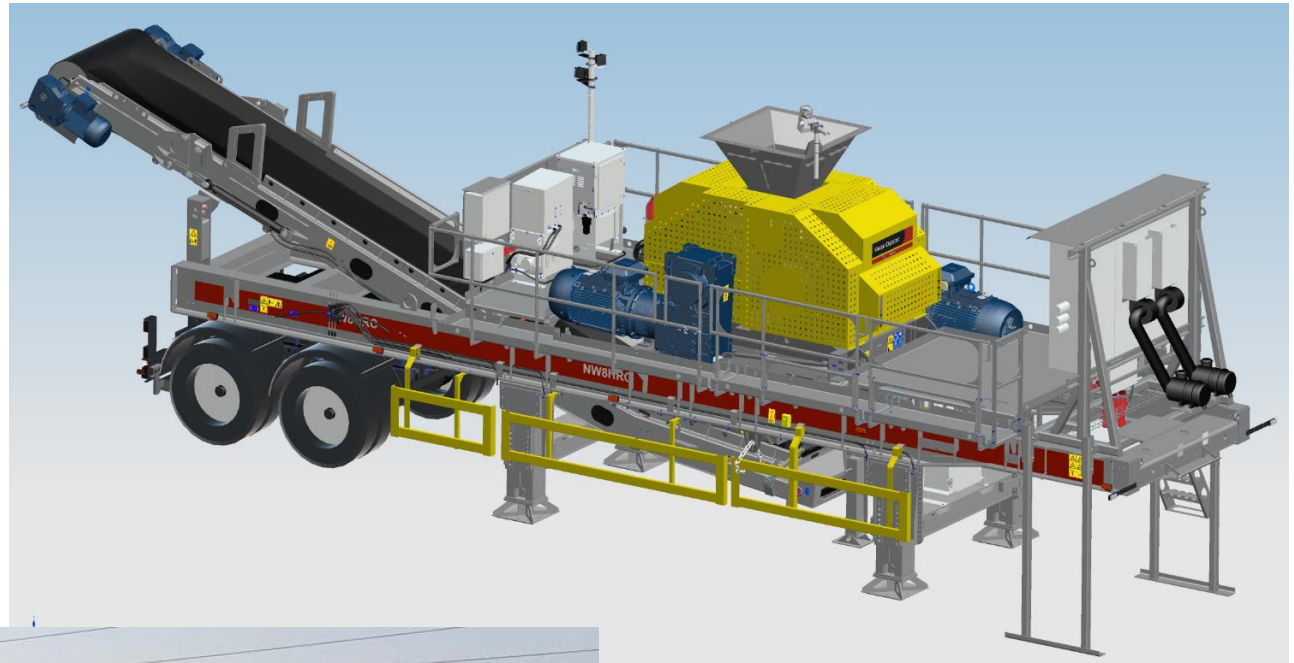


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Portable Installations

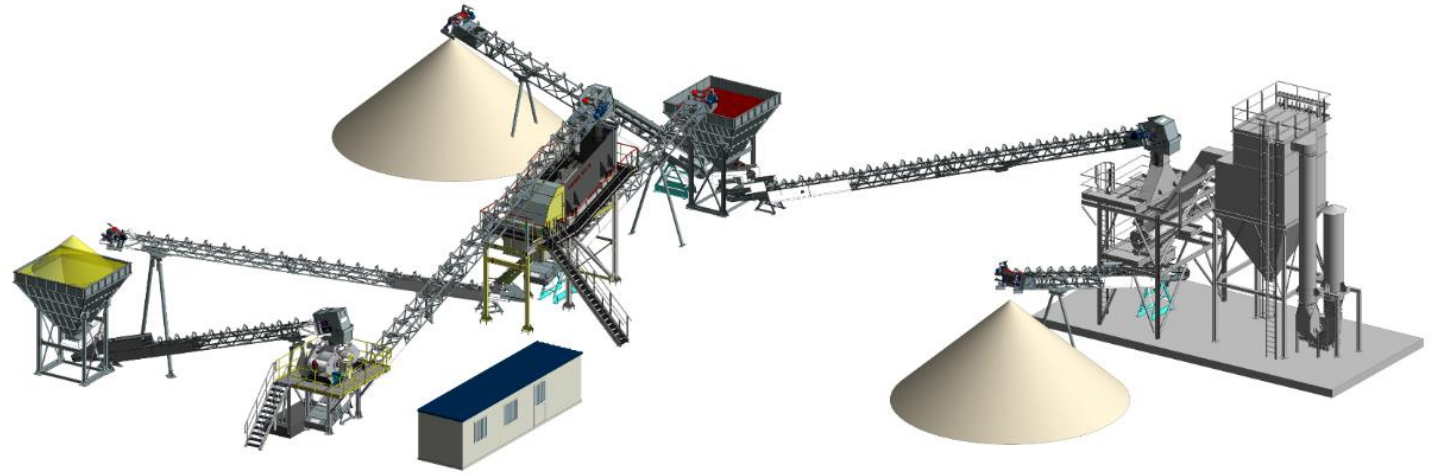


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Fixed Installations



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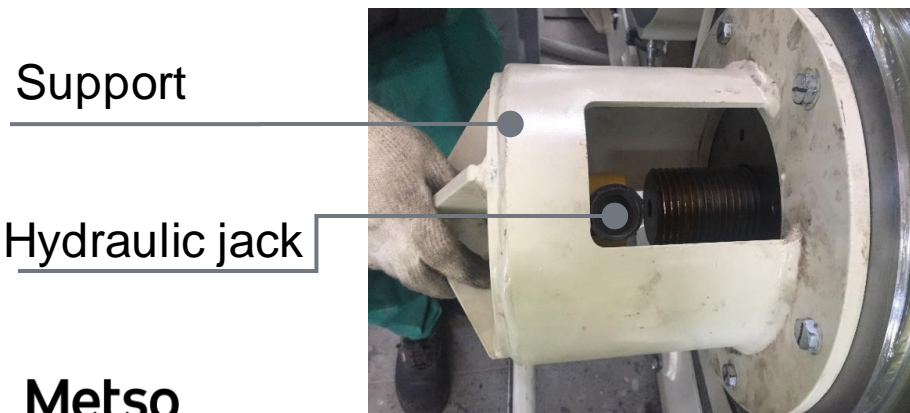
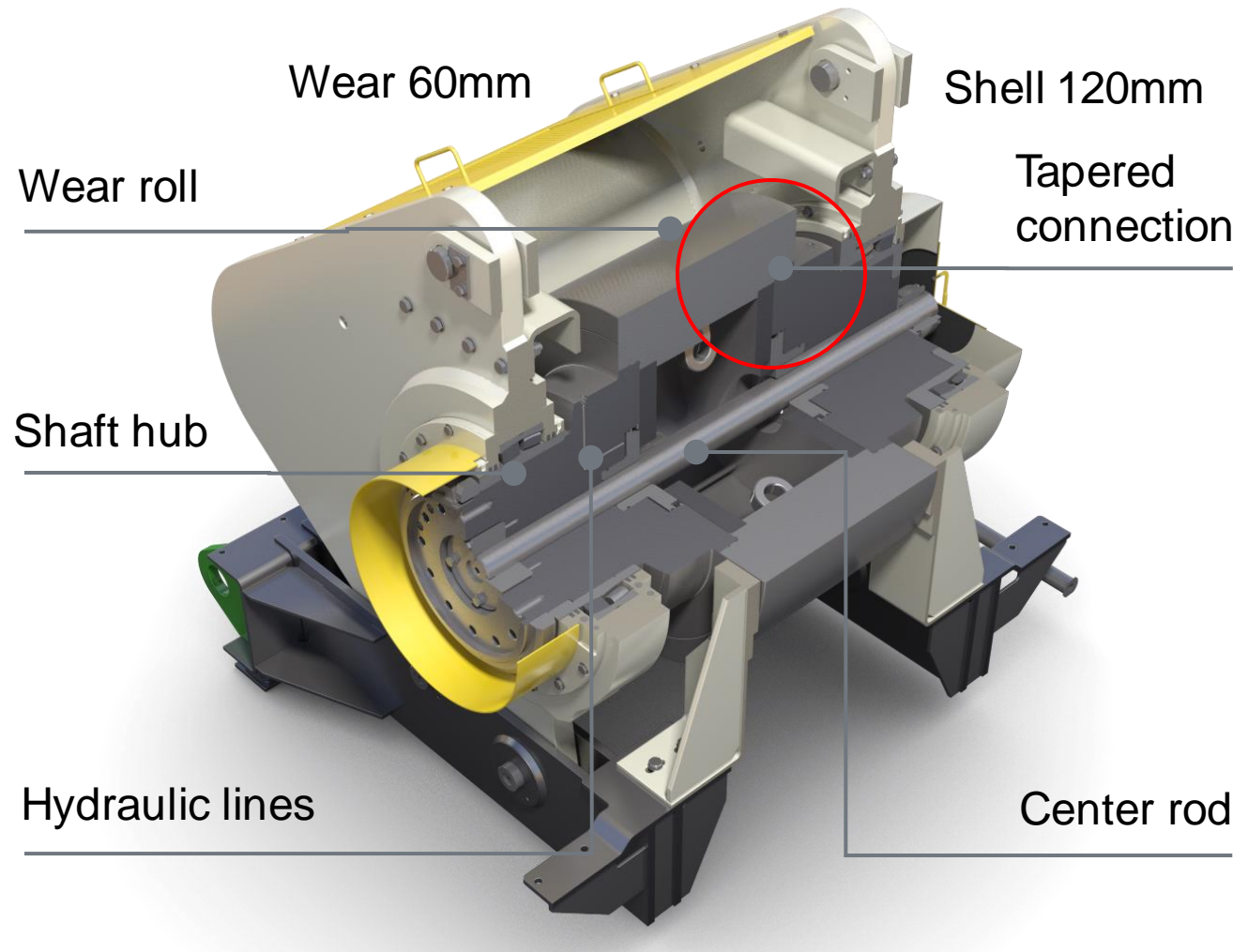
HRC

Maintenance

Roll Maintenance

Split shaft (patented) for quick roll replacement without full machine disassembly

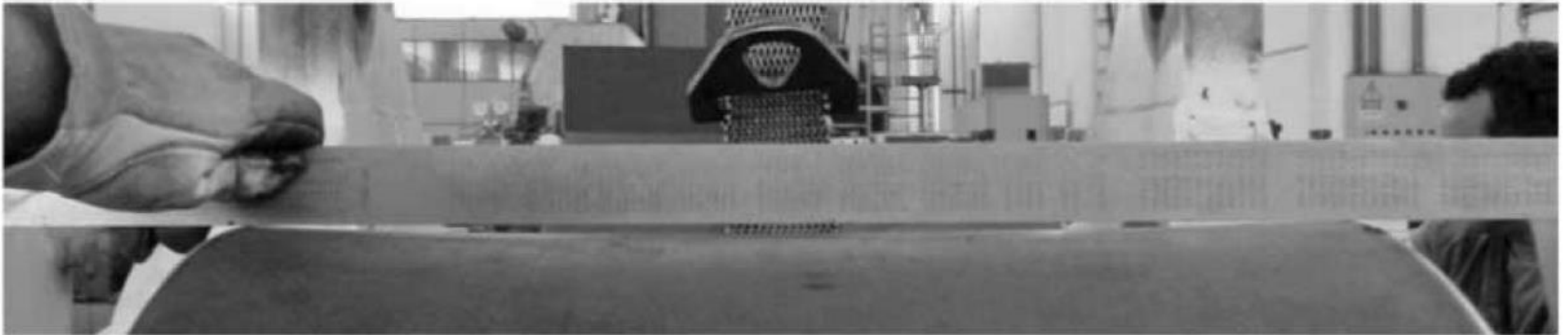
- Rolls are change not full shaft line
- Maintenance time reduced versus typical rolls crushers
- A specific tool is supplied with crusher for easy roll changes



Roll Maintenance

Pre checks for grinding

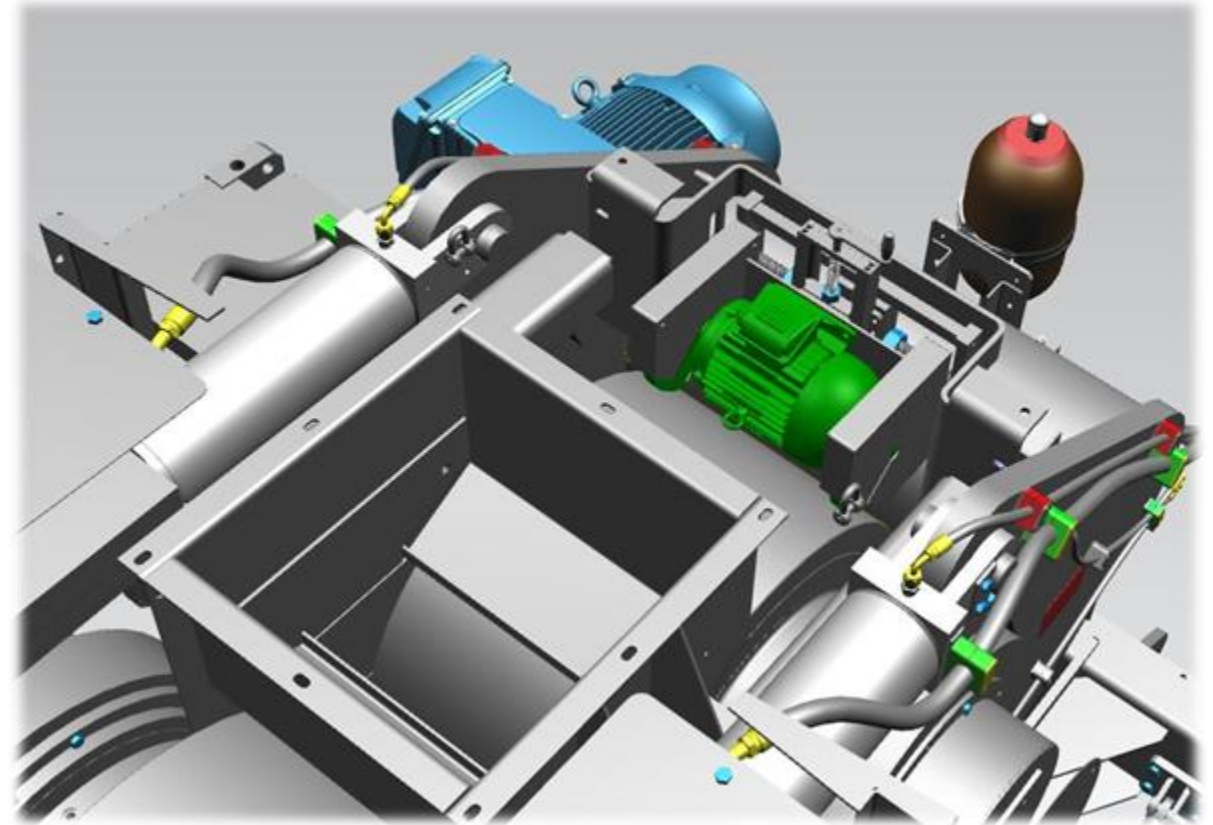
- Measure hollows depth on the rolls every 200 hours (depending on material to be crushed)
- When the difference between the external diameter and the deepest point of the hollow is larger or equal to 5mm, roll dressing is required



Using a ruler to check the wear pattern

Roll Maintenance

Grinding tool is provided to align the rolls wear profile



Roll Maintenance

Roll Wear Life

Abrasion (g/ton)	Crushing Hours
0 - 250	10,000
250 - 600	8,000
600 – 1,000	5,000
1,000 – 1,300	3,500
1,300 – 1,500	2,000
1,500 – 1,800	1,500 – 2,000





HRC

Customer Cases

Customer Case Study

Hawaiian Cement – Halawa Quarry

- Hawaiian Cement operates two central mix concrete plants with aggregate supplied by their local quarry
- Customer had been operating a wash plant for four years washing concrete aggregates and sand on site
- Manufactured sand from existing crushing plant produced an imbalance of coarser fractions versus finer fractions
- Many solutions has been tried to reprocess the excess 2/6mm size fraction however due to high moisture content these solution were not successful

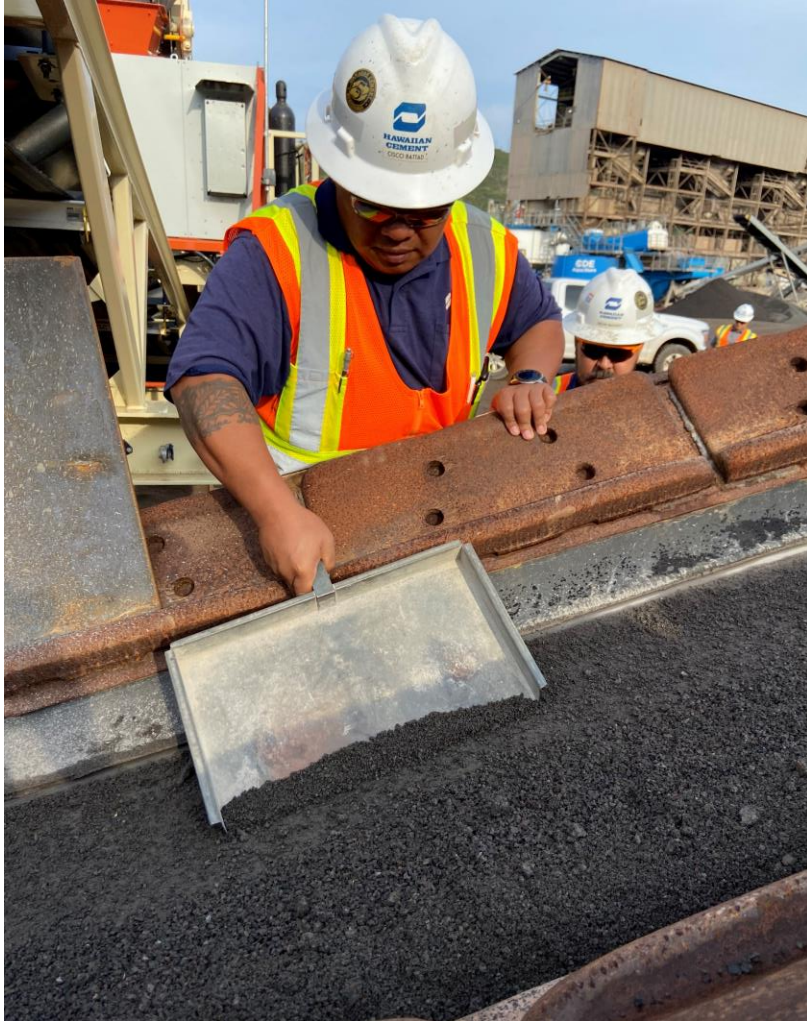


RDO CRUSHING PLANT

980M CAT

Customer Case Study

Hawaiian Cement



HRC8

Customer Case Study

Hawaiian Cement

Daily Summary Report

Date Wednesday, December 7, 2022

Sample Id	60210809	63416547	65188919	55963640
Plant	452010 Halawa Quarry	452010 Halawa Quarry	452010 Halawa Quarry	452010 Halawa Quarry
Product	451061 CDE 4X8	451070 HRC SAND	451070 HRC SAND	451070 HRC SAND
Specification	ASTM C33 No. 8	ASTM C33 Sand	ASTM C33 Sand	ASTM C33 Sand
Sample Type	Investigative	Investigative	Investigative	Investigative
Time	08:00	12:45	12:45	12:45
3/4" (19mm)	100.0	100.0	100.0	100.0
1/2" (12.5mm)	100.0	100-100	100.0	100-100
3/8" (9.5mm)	100.0	85-100	100.0	100-100
#4 (4.75mm)	90.9	10-30	94.9	95-100
#8 (2.36mm)	27.3	0-10	73.2	80-100
#16 (1.18mm)	4.3	0-5	48.6	50-85
#200 (75µm)	1.02	0-1.5	14.60	0-1.5
Pan	0.00	0.00	0.00	0.00
FM	4.69	2.88	3.10	3.16
Total Moisture	8.34	9.76	9.13	10.14



Partner for positive change



HRC

A revolutionary technology that works
where the others cant!



mogroup.com

Metso:Outotec