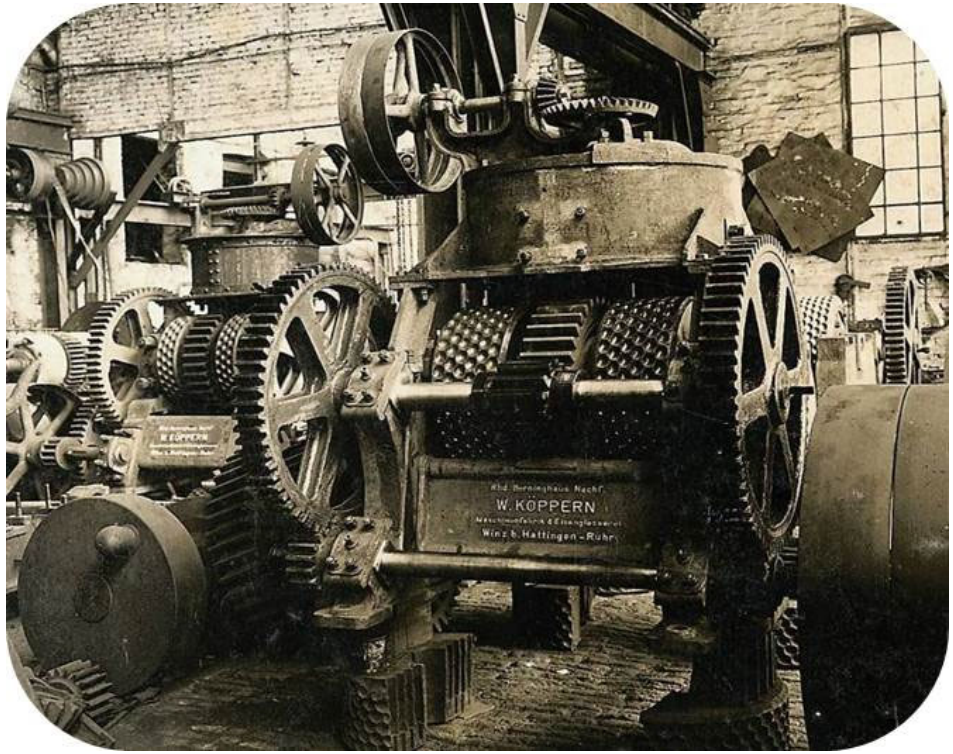
Köppern

Introduction- Hexadur wear solution & HPGR upgrades

Köppern in short

- Formed in 1898 from the Berninghaus-Hütte in Hattingen
- Family owned ever since
- Production of roller presses and briquetting plants since the early 20th century
- More than 900 roller presses and briquetting machines supplied so far
- Customers in more than 50 countries
- Testwork in own laboratory and pilot plants for evaluation and optimization of processes
- More than 2.000 materials examined so far
- Development of best processes and layouts in economical and technical aspects
- Komarek (USA) and Euragglo (France) became part of Köppern Group in 2018

Köppern in short



Roller press for coal briquetting at the beginning of the 20th century

Roller press for cement clinker grinding in the 21st century

Employees

Hattingen

176 employees

» 40 engineers
» 9 apprentices
» 23 administration
» 17 service
» 72 production

Freiberg

23 employees

Worldwide

277 employees

Office and Workshop Hattingen

Head Office Hattingen, Germany

Workshop Hattingen, Germany

Workshop Hattingen, Germany

Tradition and modern spirit

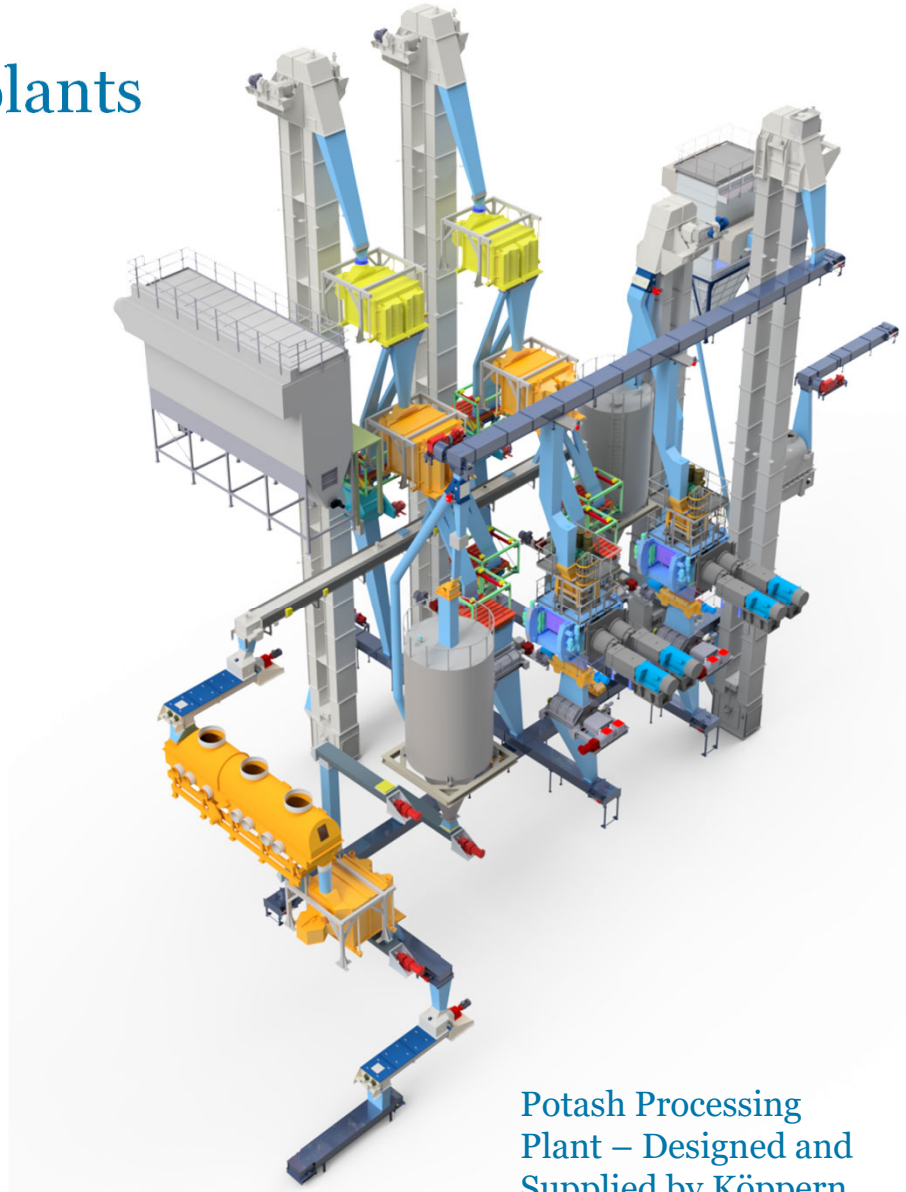
Workshop Hattingen

Assembly Floor Hattingen

Plant Design

From individual machines to full-scale plants

- Köppern does not just supply single roller presses for briquetting, compaction and comminution.
- We also design and supply complete or partial plants incorporating roller presses.
- R&D in the field of process design is essential in order to be able to give our customers the top-class solutions they expect from Köppern.



Potash Processing Plant – Designed and Supplied by Köppern

Reference List*

Customer	Country	Location	Material	Roller size D x W [mm]	HPGR Supplier [-]	Operation Hours [h]	Hexadur Installations [-]	Start up Hexadur [Year]
Europe								
Heidelberg	Norway	Brevik	Clinker	1.000 x 930	Köppern	75.000	1	1996
LafargeHolcim	Germany	Dortmund	Slag (23% Slag)	1.000 x 500	KHD	25.000	1	1998
LafargeHolcim	Austria	Mannersdorf	Clinker (35% Slag)	1.000 x 630	KHD	43.000	1	2001
Cemex	Germany	Rüdersdorf	Clinker	1.400 x 1.200	KHD	76.000	2	2001
Colacem	Italy	Gubbio	Clinker	1.400 x 660	Polysius	> 35.000	1	2003
Colacem	Italy	Rassina	Clinker	1.400 x 660	Polysius	> 26.000	1	2006
Colacem	Italy	Galatina	Clinker	1.400 x 660	Polysius	> 25.000	1	2007
AKW	Germany	Amberg	Feldspat/Kaolin	532 x 400	Alpine	8.630	1	2008
Schretter	Austria	Vils	Clinker	1.000 x 380	Polysius	37.300	1	2008
PCLA	Slovakia	Ladce	Clinker (35% Slag)	1.500 x 1.300	Köppern	> 24.464	1	2011
CRH	Slovakia	Turna	Clinker (75% Slag)	1.500 x 1.300	Köppern	> 19.500	1	2012
LafargeHolcim	Suisse	Eclepens	Clinker	1.150 x 630	KHD	> 48.500	1	2012
Buzzi/Dyckerhoff	Germany	Amöneburg	Clinker	1.400 x 530	Polysius	14.000	1	2012
LafargeHolcim	France	Réunion	Clinker (56% Slag)	1.000 x 380	Polysius	25.600	1	2014
Baumit	Austria	Wopfing	Clinker	1.400 x 800	KHD	25.500	1	2016
LafargeHolcim	Germany	Duisburg	Clinker (Slag 30%)	1.450 x 1.000	Polysius	> 5.500	1	2020
LafargeHolcim	Croatia	Koramacno	Clinker (Slag 20%)	1.400 X 1.400	KHD	> 4.700	1	2020
North America								
Heidelberg	USA	Nazareth (PA)	Clinker	1.150 x 1.000	KHD	> 39.000	1	2009
Heidelberg	USA	Speed	Clinker	1.400 x 800	KHD	> 27.000	1	2012
LafargeHolcim	Mexico	Acapulco	Limestone	1.000 x 380	Polysius	22.000	1	2012
LafargeHolcim	Mexico	Acapulco	Clinker	1.400 x 525	Polysius	> 32.000	1	2013
Cemex	USA	Victorville	Limestone	1.400 x 1.100	KHD	> 26.000	1	2016

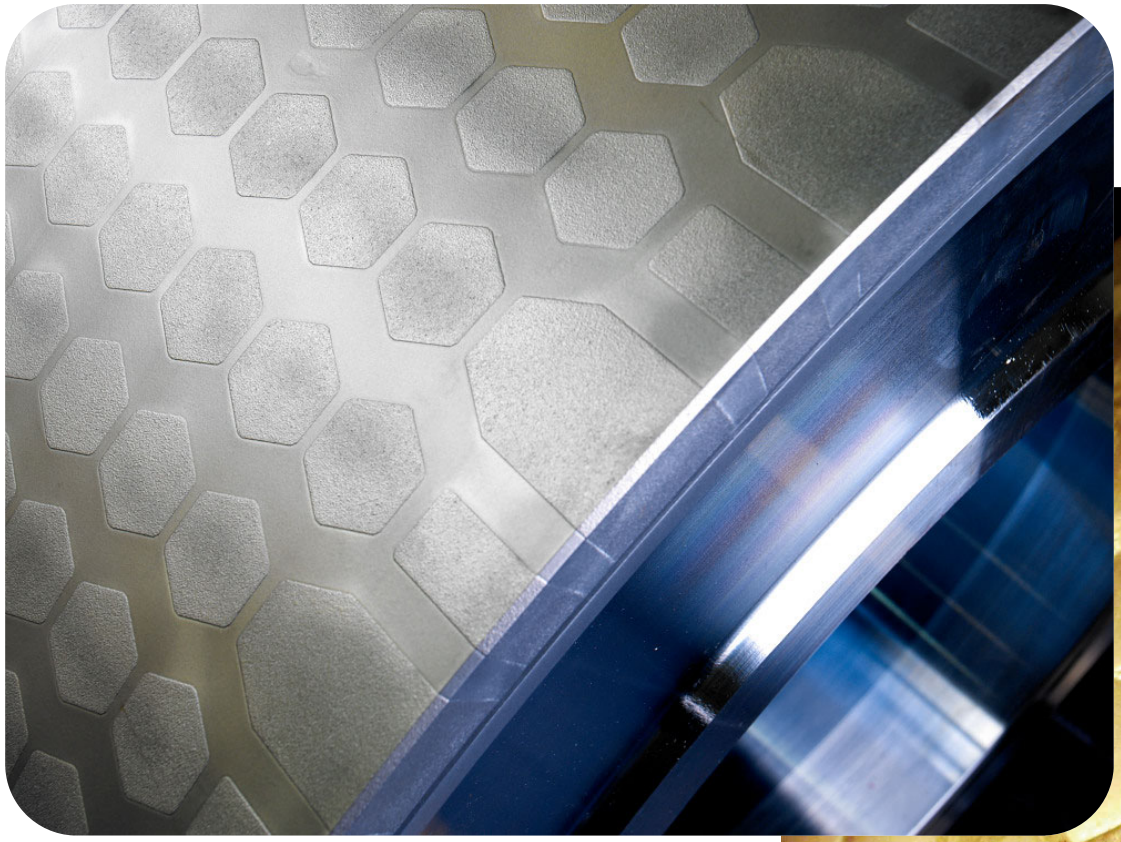
*** Excerpt, dated Nov'2020**

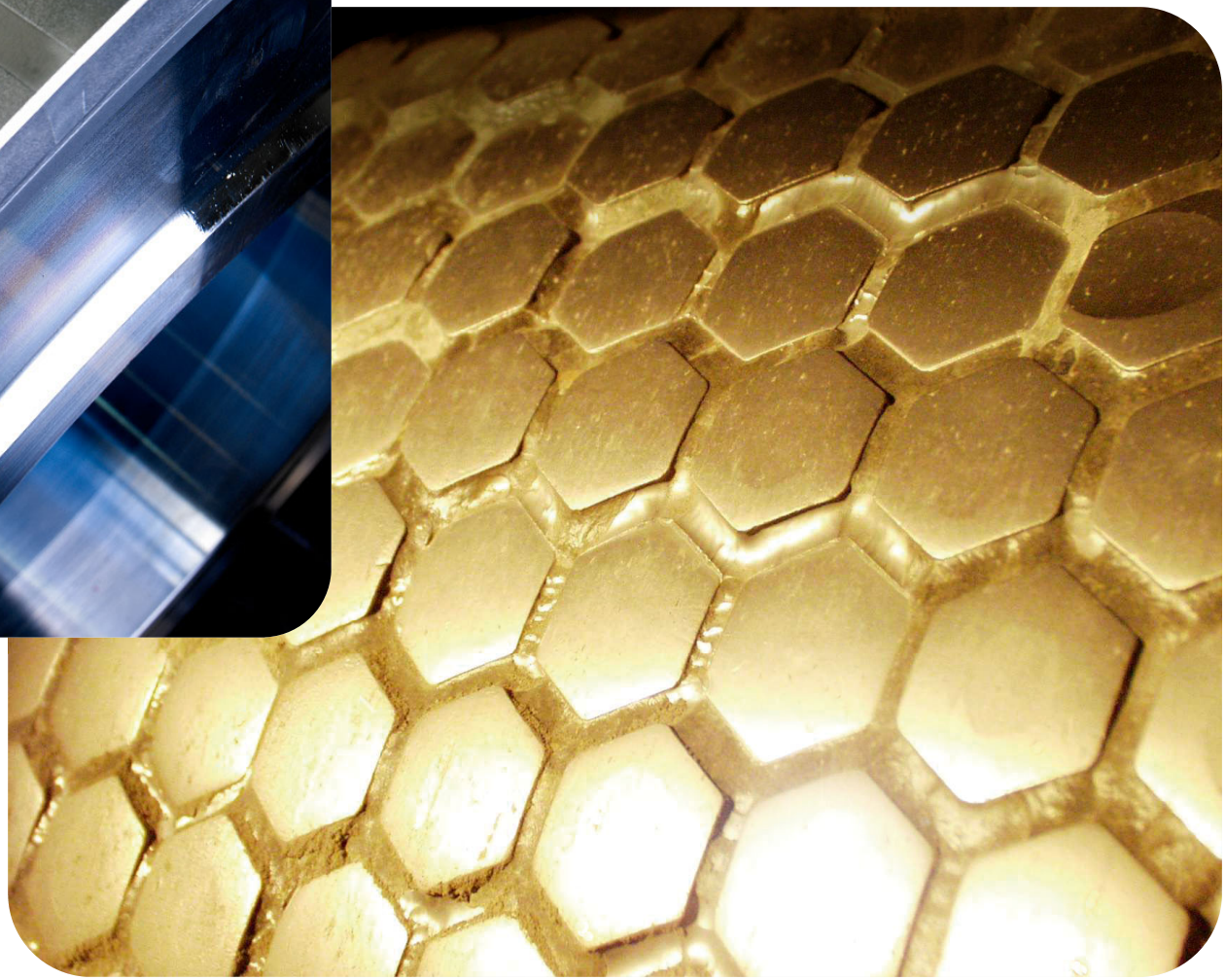
Reference List*

Customer	Country	Location	Material	Roller size D x W [mm]	HPGR Supplier [-]	Operation Hours [h]	Hexadur Installations [-]	Start up Hexadur [Year]
South America								
UNACEM	Peru	Condorcocha	Clinker	1.150 x 1.000	KHD	> 9.000	1	2013
Cemex	Colombia	Ibague	Clinker	1.700 x 1.400	KHD	27.000	1	2014
Cemex	Trinidad	Claxton Bay	Clinker	1.400 x 1.400	KHD	> 16.200	1	2017
Votorantim	Brazil	Sobral	Clinker (14 % Riolito Quarzporphyr)	1.740 x 1.000	Polysius	> 10.400	1	2018
Argos	Colombia	Rio Claro	Limestone	1.200 x 630	KHD	Delivered	1	2019
Cementos Tequendama	Colombia		Clinker	1.200 x 450	Jiangshu	Ordered	1	2021
Asia								
Prism I	India	Satna	Clinker	1.200 x 1.200	Köppern	40.500	2	1999
Ultratech APCW	India	Tadipatri	Clinker (35% Slag)	1.200 x 1.200	Köppern	43.000	2	2002
Ultratech GCW	India	Rajula	Clinker	1.200 x 1.200	Köppern	> 27.800	1	2003
Prism II	India	Satna	Clinker	1.500 x 1.300	Köppern	44.500	2	2010
Semen Padang	Indonesia	Padang	Clinker	1.000 x 765	Köppern	> 45.600	4	2011
Chettinad Cement	India	Kallur	Clinker	1.500 x 1.300	Köppern	> 38.500	1	2012
City Cement	Saudi Arabia	Marat	Clinker	1.500 x 1.300	Köppern	33.973	3	2013
LafargeHolcim	Philippines	Bulacan	Clinker	1.500 x 800	Polysius	> 42.500	2	2014
Heidelberg	Thailand	Saraburi	Clinker	1.220 x 760	Fuller	> 35.500	1	2015
Heidelberg	Thailand	Saraburi	Clinker	2.120 x 1.300	Köppern	> 5.500	1	2020
Siam Cement	Thailand	Khao Wong	Clinker	1.524 x 965	Fuller	> 13.340	1	2015
Siam City Cement	Thailand	Saraburi	Clinker	1.200 x 1.200	Köppern	> 13.000	2	2015
Siam City Cement	Thailand	Saraburi	Clinker	1.000 x 930	Köppern	> 23.500	3	2015
Siam Cement	Thailand	Kaeng Khoi	Clinker	1.000 x 765	Köppern	> 24.571	2	2016
LafargeHolcim	Philippines	Davao	Clinker	1.500 x 800	Polysius	> 16.000	1	2016
Semen Bima	Indonesia	Purwokerto	Clinker (Trass 23%)	1500 x 1300	Köppern	> 2.500	2	2020
Chettinad Cement	India	Kallur	Limestone	1730 x 1500	Köppern	Delivered	1	2020

*** Excerpt, dated Nov' 2020**

HEXADUR®

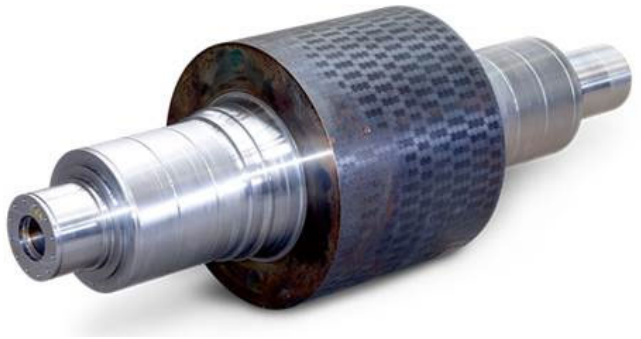




Design Features

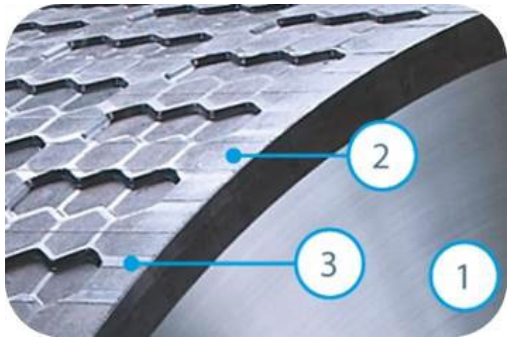
» **HEXADUR® Two-Part Roller Design**

Consisting of a roll core and a wear-protected tire



» **HEXADUR® Multi-Material Wear Protection System**

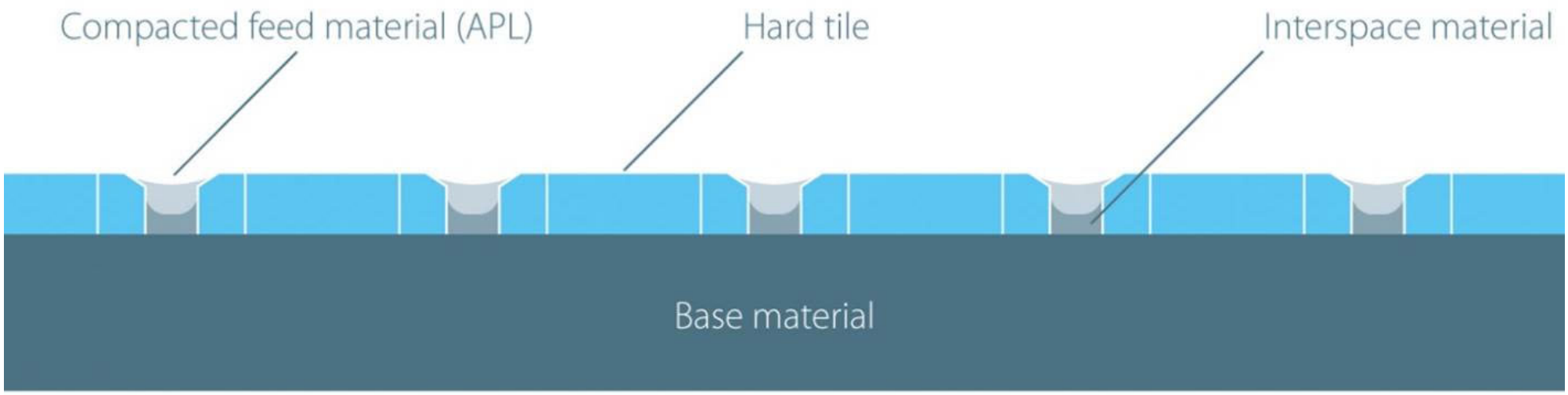
Consisting of a base material (1), wear resistant HEXADUR® tiles (2) and tough interspace filler material (3)



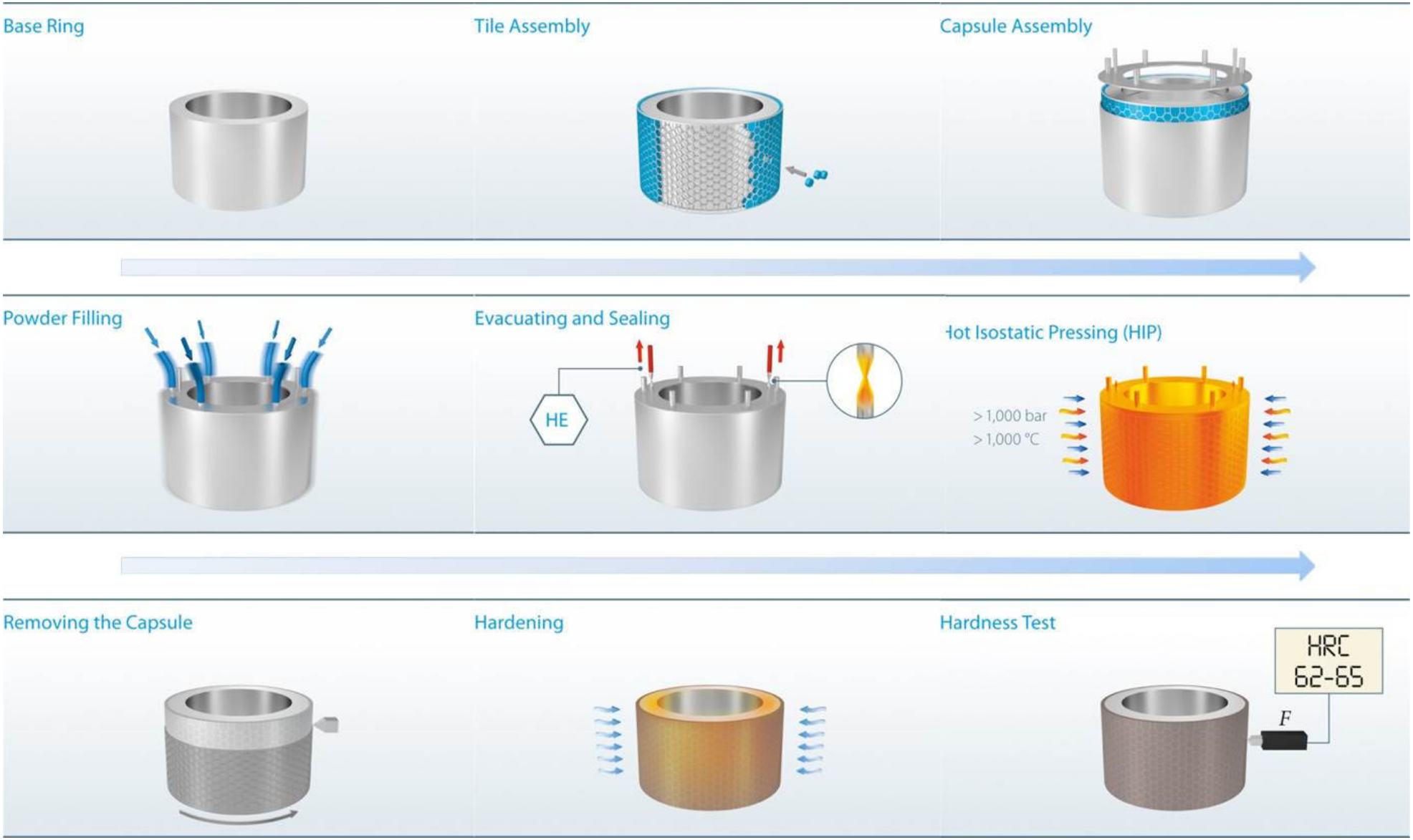
» **HEXADUR® Pattern**

The use of tool steel or carbide-rich metal matrix composites (MMC) for the hexagonal tiles gives strong wear resistance when grinding abrasive materials

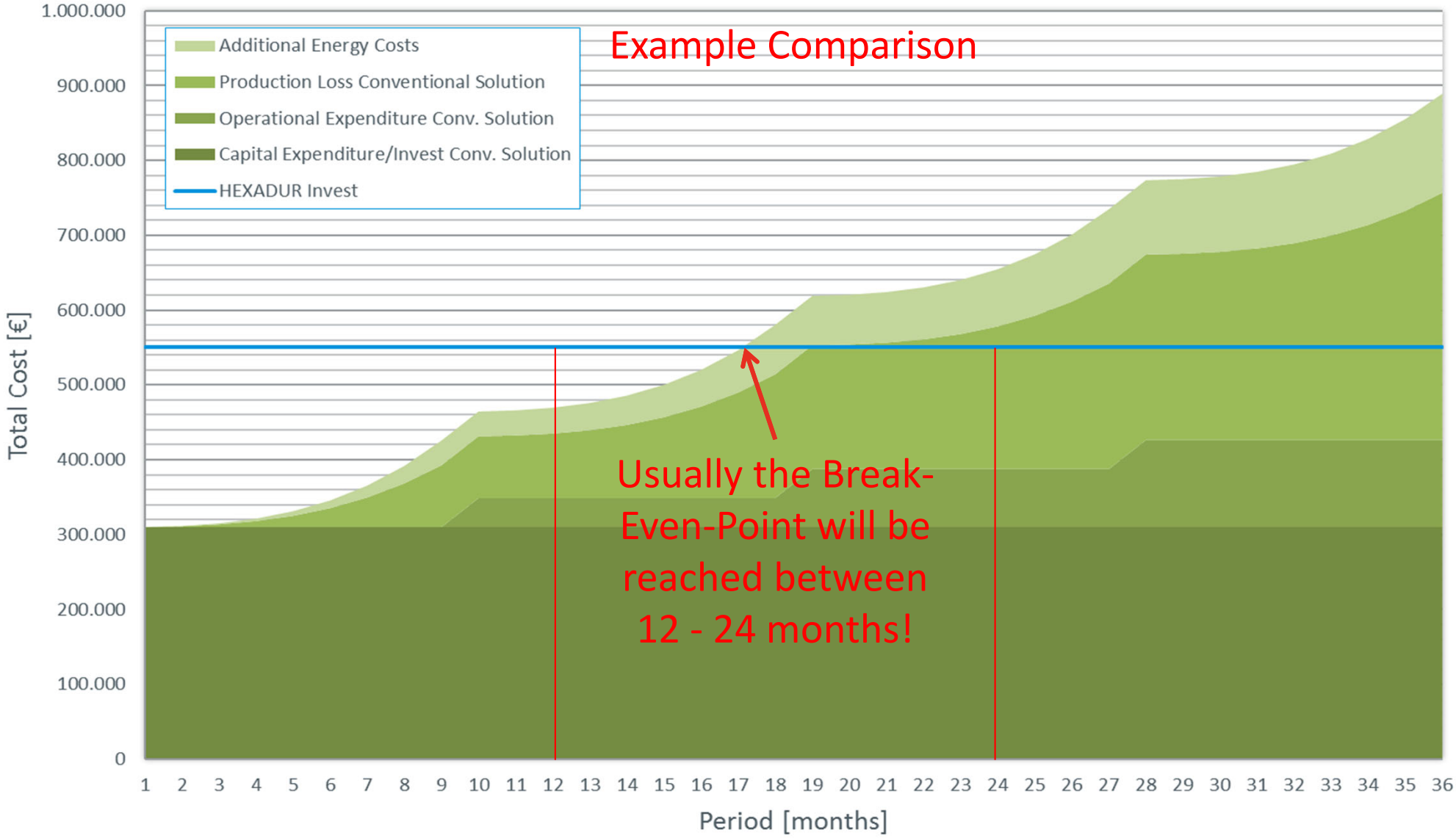
Design Features



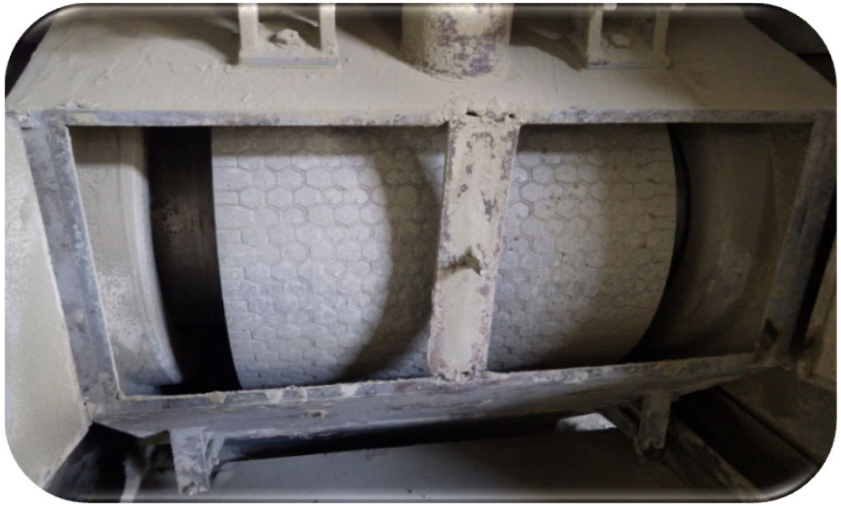
Manufacturing Process



HEXADUR® vs. Welded

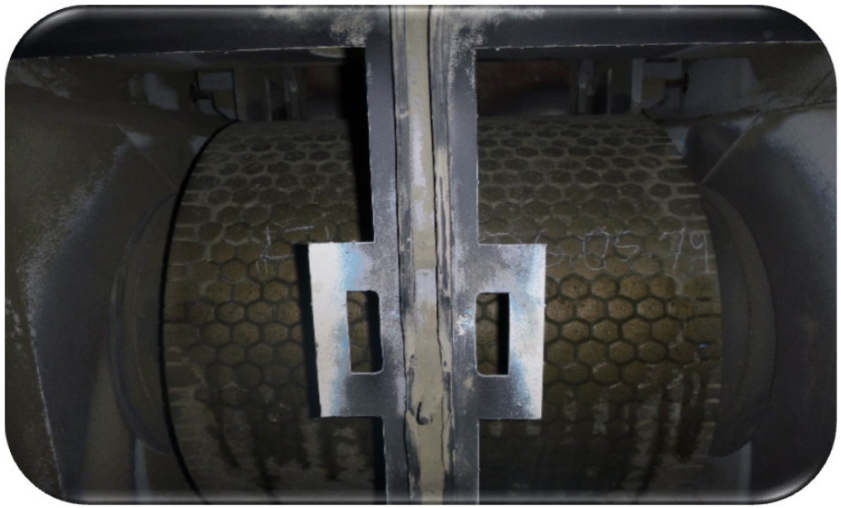


Hexadur Roller Surfaces

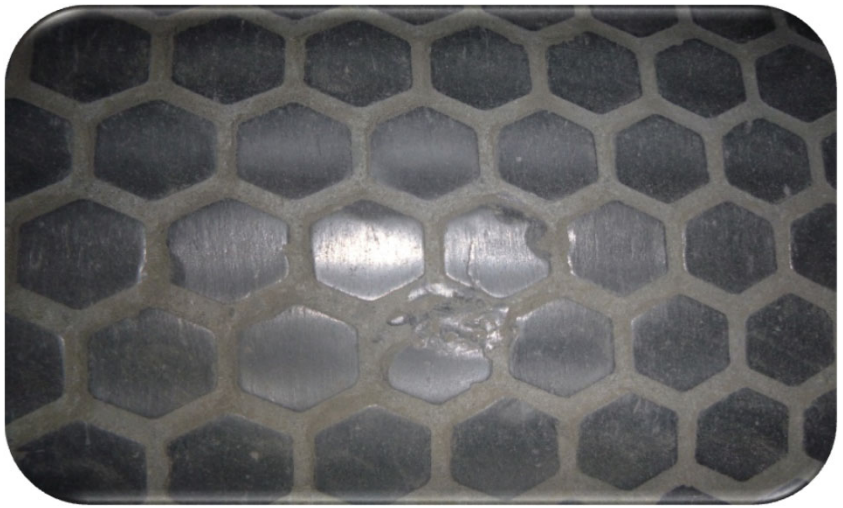


After 2000 hours

After 22000 hours, wear rate 1,5 to 1,8 mm per 10000 hours of operation

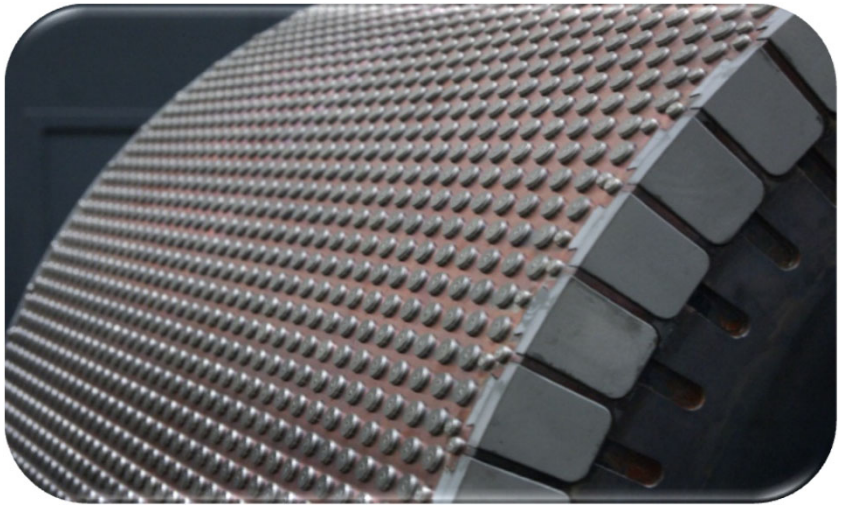


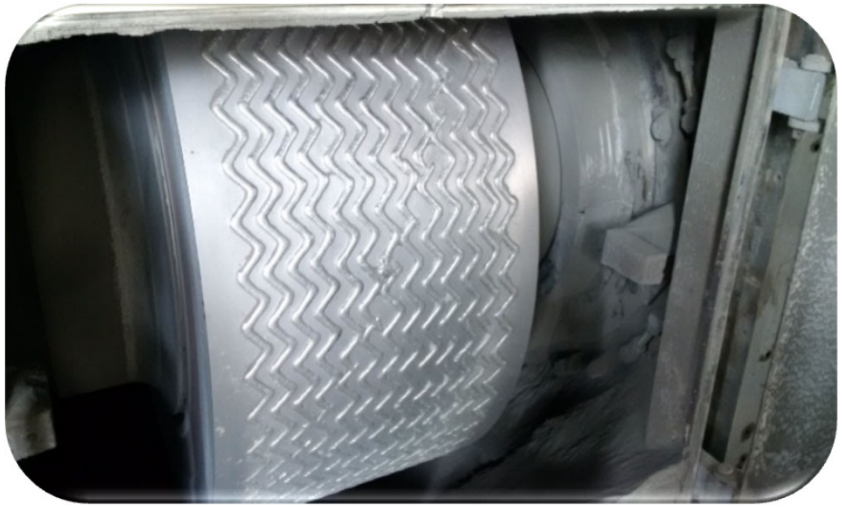
After 33600 hours, wear rate 1,0 to 1,3 mm per 10000 hours of operation



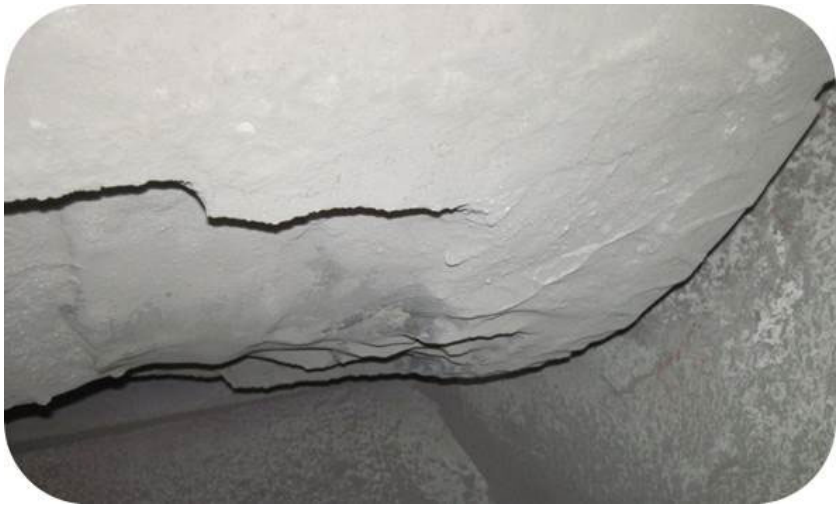
After 12400 hours, wear rate 1,3 to 1,8 mm per 10000 hours of operation

New/Refurbished Conventional Roll Surfaces





Wear Effects



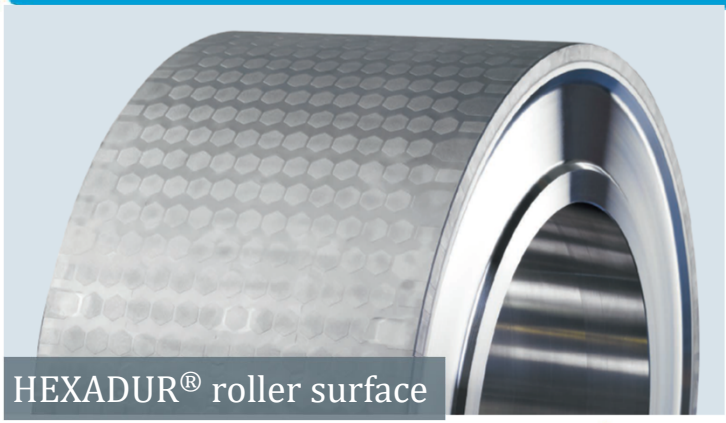
Advantages of HEXADUR®

- Customized tile composition
- Profiled surface for better nip
- Constant intake and throughput
- Production increase
- Constant grinding pressure
- Resistant against tramp metal
- No maintenance required

Upgrading of Grinding systems

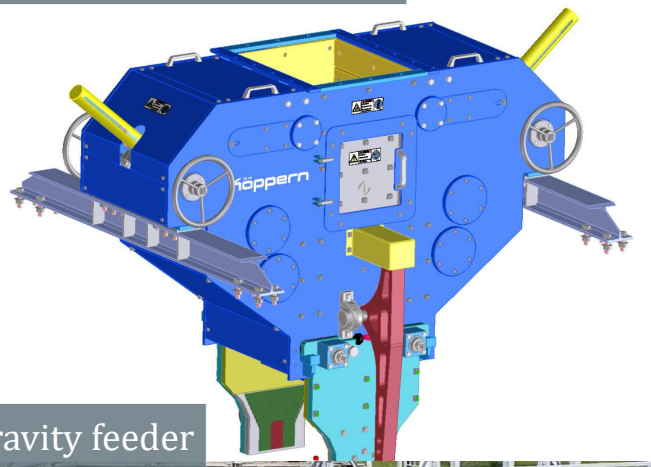
Why to upgrade?

- Faster
- Low investment
- Easy implementation
- Quicker ROI


HEXADUR® roller surface

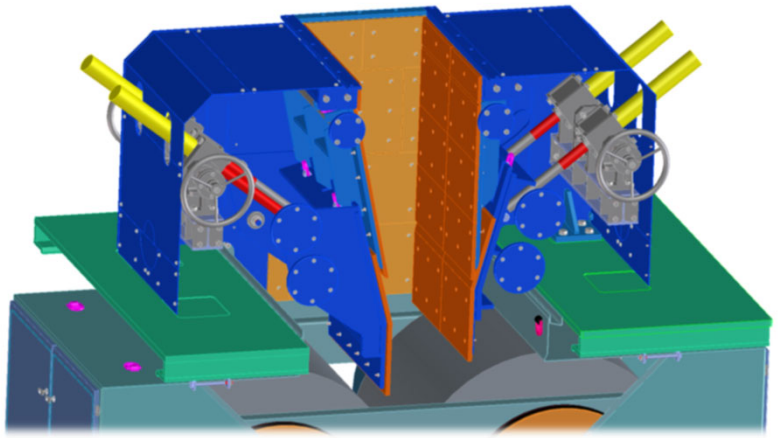
What could be upgraded?

- Rollers with HEXADUR®- zero maintenance wear protection system.
- From closed loop hydraulic system to open loop hydraulic system.
- Feeding system adaptable to different types of feed materials.
- Combination separator to change from pre-grinding/flake recycling system to semi finish system.


Gravity feeder

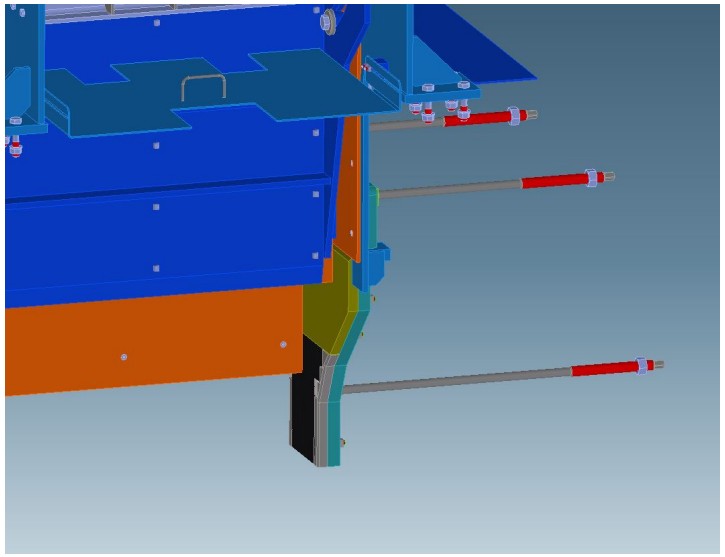

Koesep® Separator

HPGR upgrades



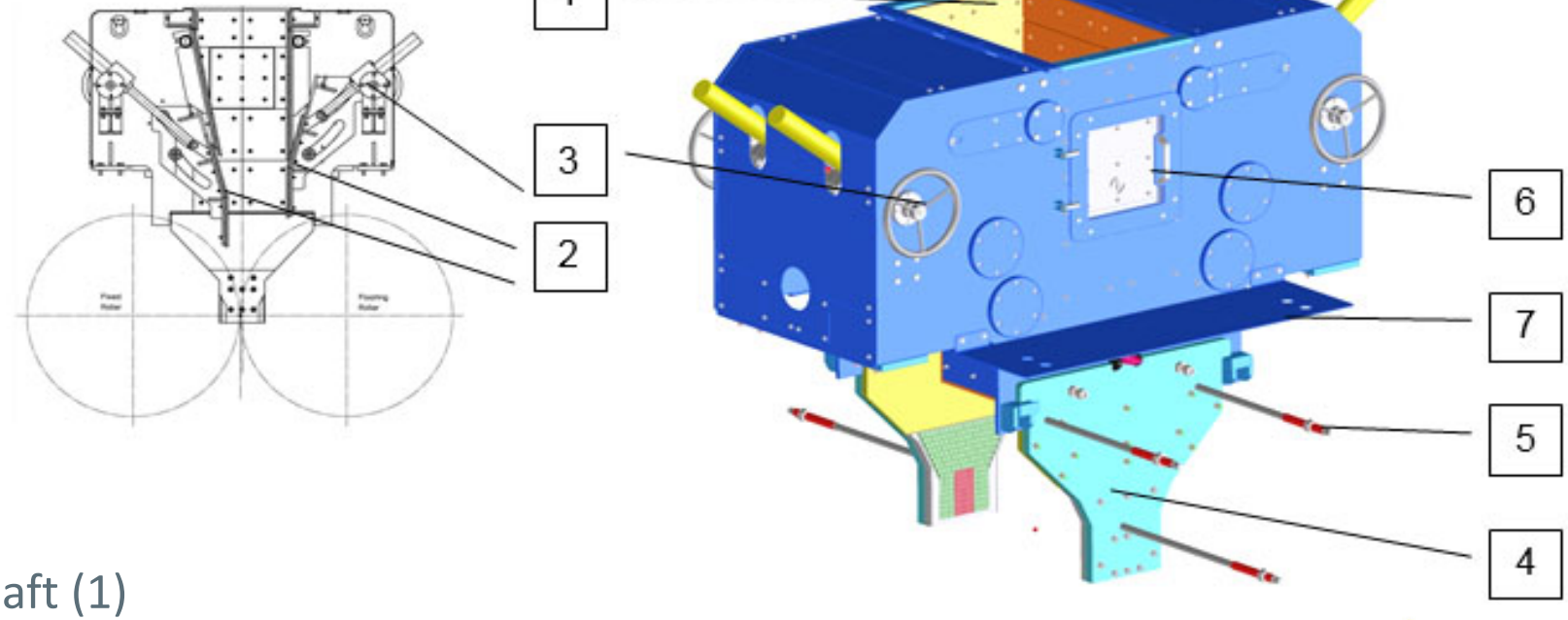
Feeding system

Hydraulic system

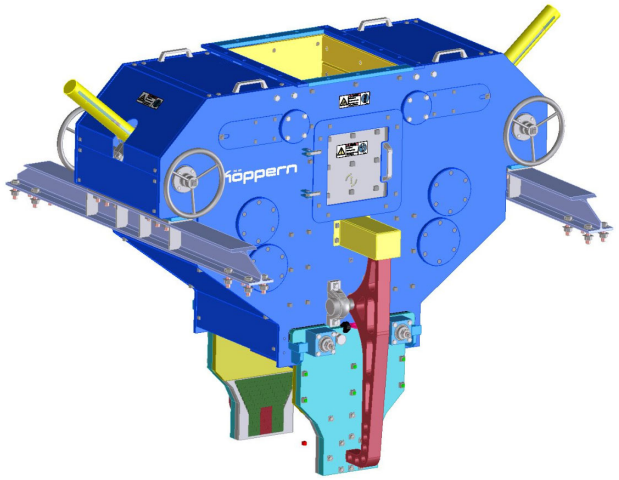


Hardmetal cheek plates

Feeding system

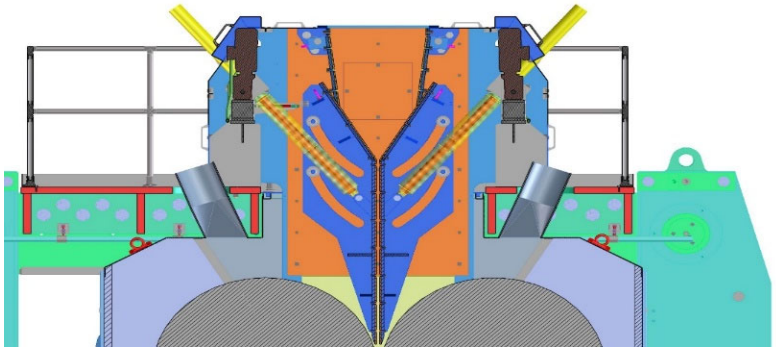


- Inlet shaft (1)
- Adjustable face walls (2)
- Regulating devices (3)
- Lateral cheek plates* (4)
- Thrust bolts* (5)
- Openings for inspection (6)
- Cover plates (7)

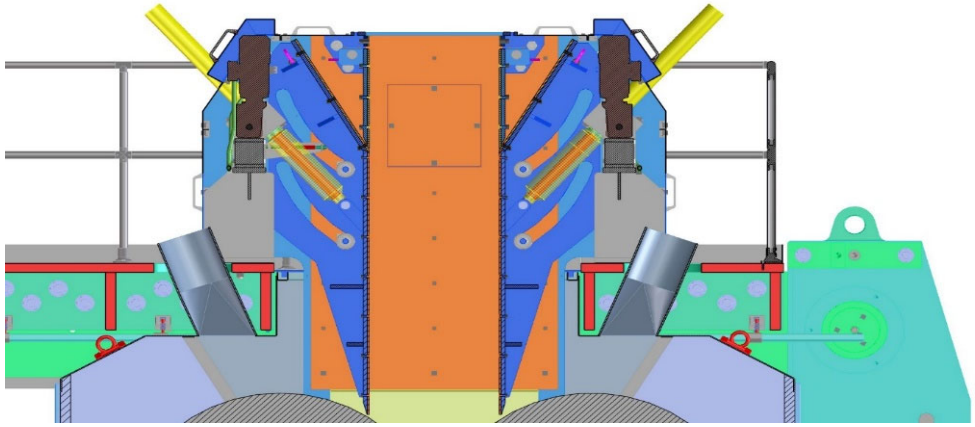


* - not part of the feeding system

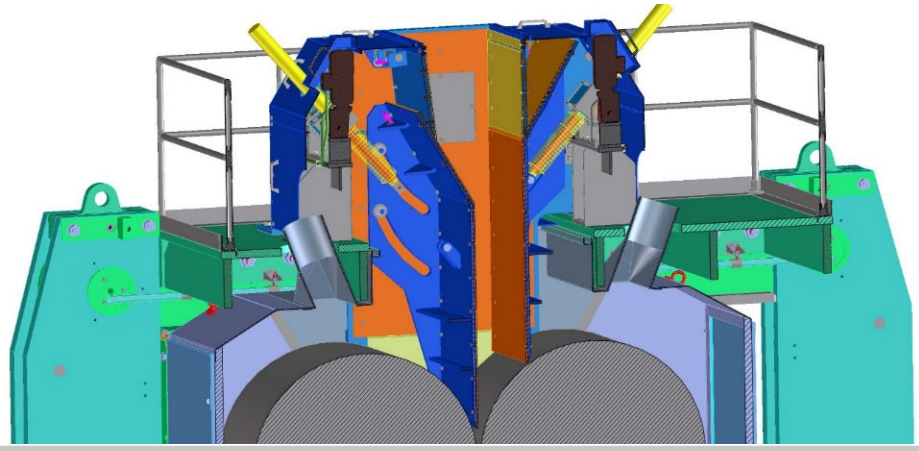
Motorised feeding system



Minimum



Maximum



Arbitary

Feeding system- Advantages

- → Flexibel adjustment of the gravity feeder opening according to process requirement (Standard version: manually or motorised: automatically with geared motor).
- → **Optimizing of roller press throughput and power consumption.**
- → Easy adjustment and maintenance.
- → Cheek plates with installed hard metal → lifetime > 5 years without maintenance.
- → Position of cheek plates is fixed with spring loaded thrust bolts → possibility to move out in case of back pressures from the rollers or material.
- → Bottleneck of production or quality loss due to side-leakage through the cheek plate area is very much reduced.

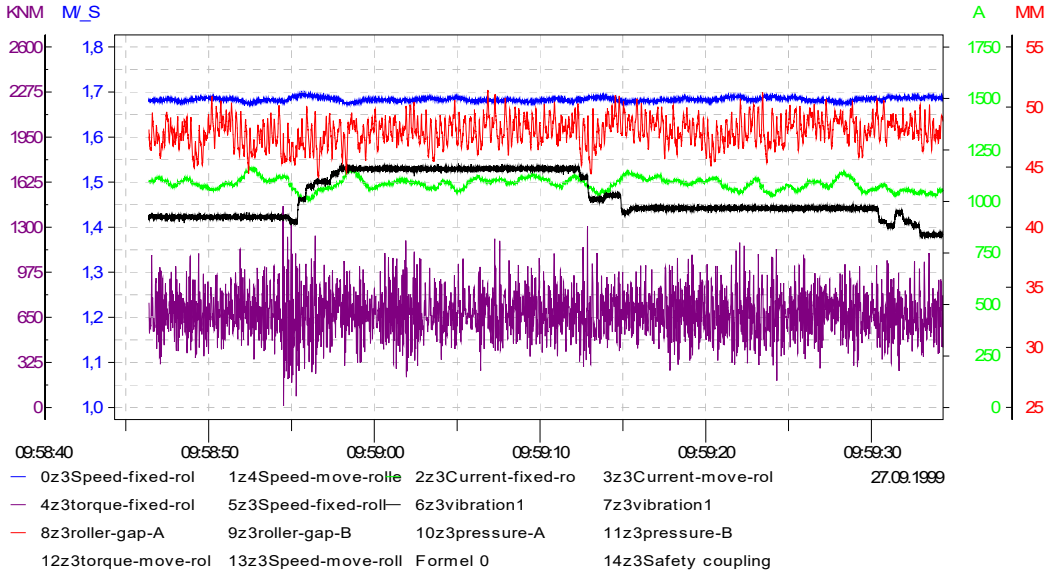
Hydraulic system

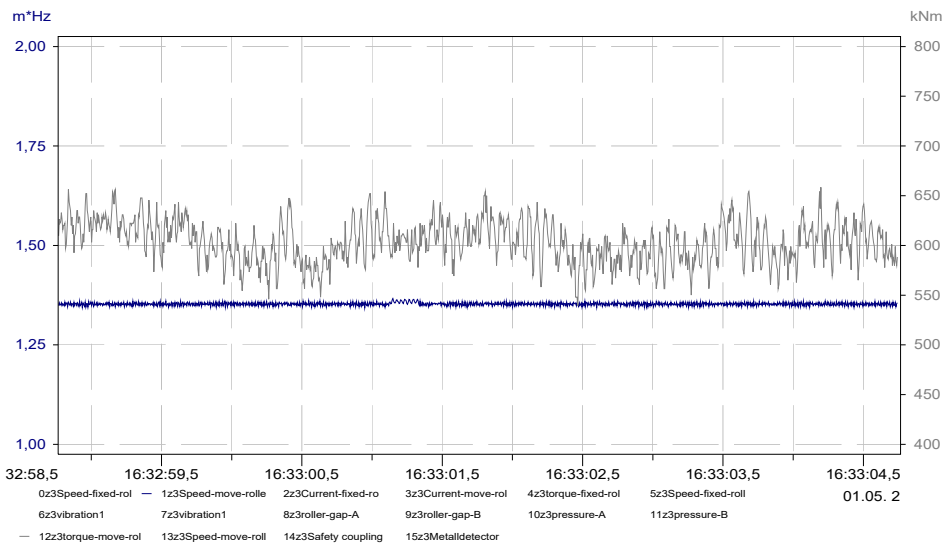
Hydraulic Unit

Hydraulic system

Comparision of operation curves

Conventional system (closed hydraulic) vs. Köppern system (open hydraulic)





Hydraulic System

Major advantages to conventional systems (closed systems)

→ More stability of grinding pressure, which could be changed during operation as per the process requirement.

→ Reduced torque fluctuations in drive train.

→ Skew controller for stable grinding bed.

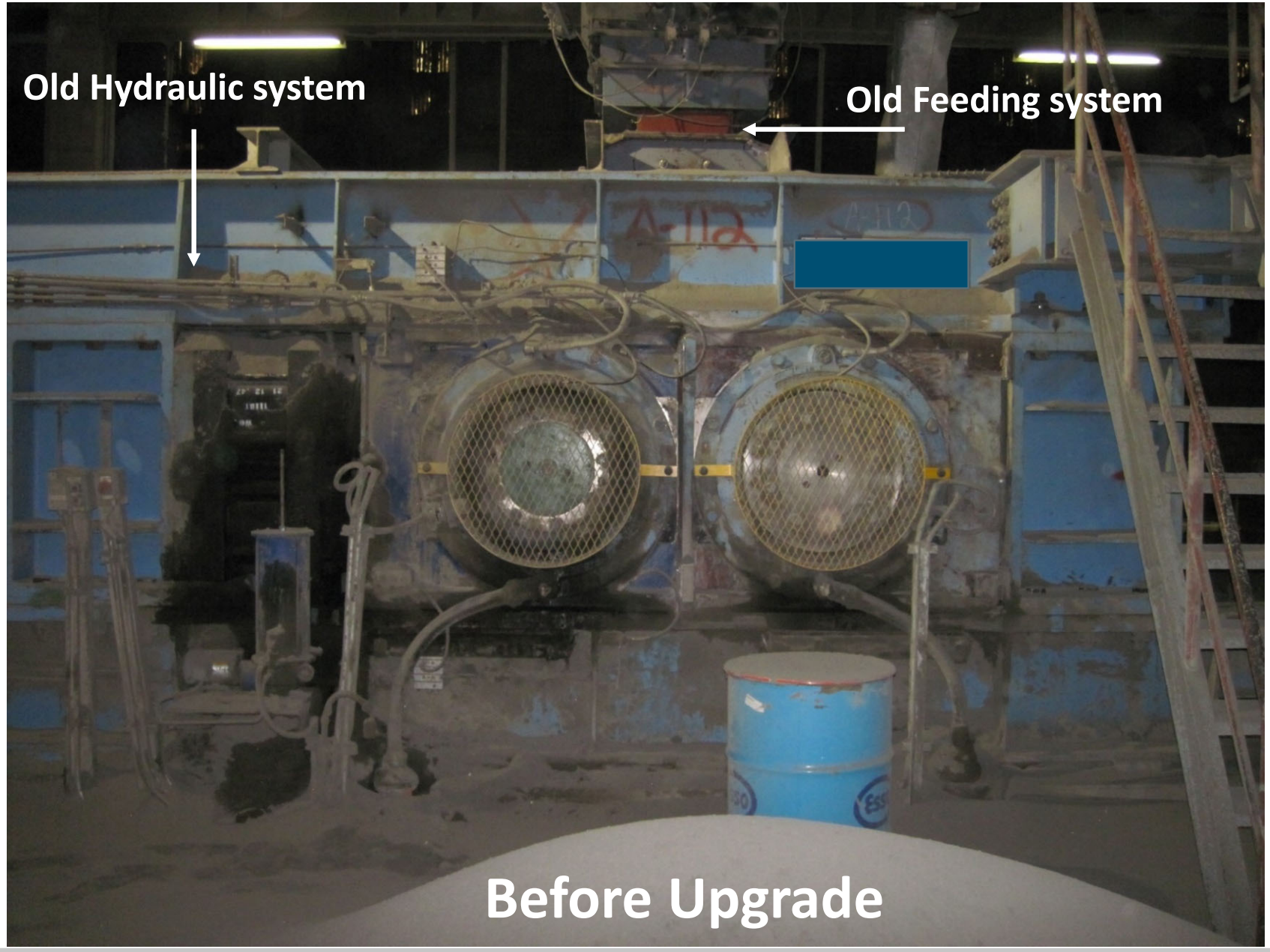
→ Bigger Nitrogen accumulator serving as an oil reservoir in case of rapid roller movement.

→ Pendulum piston cylinders with improved design (no vertical loads).

→ Easy adjustment and maintenance.

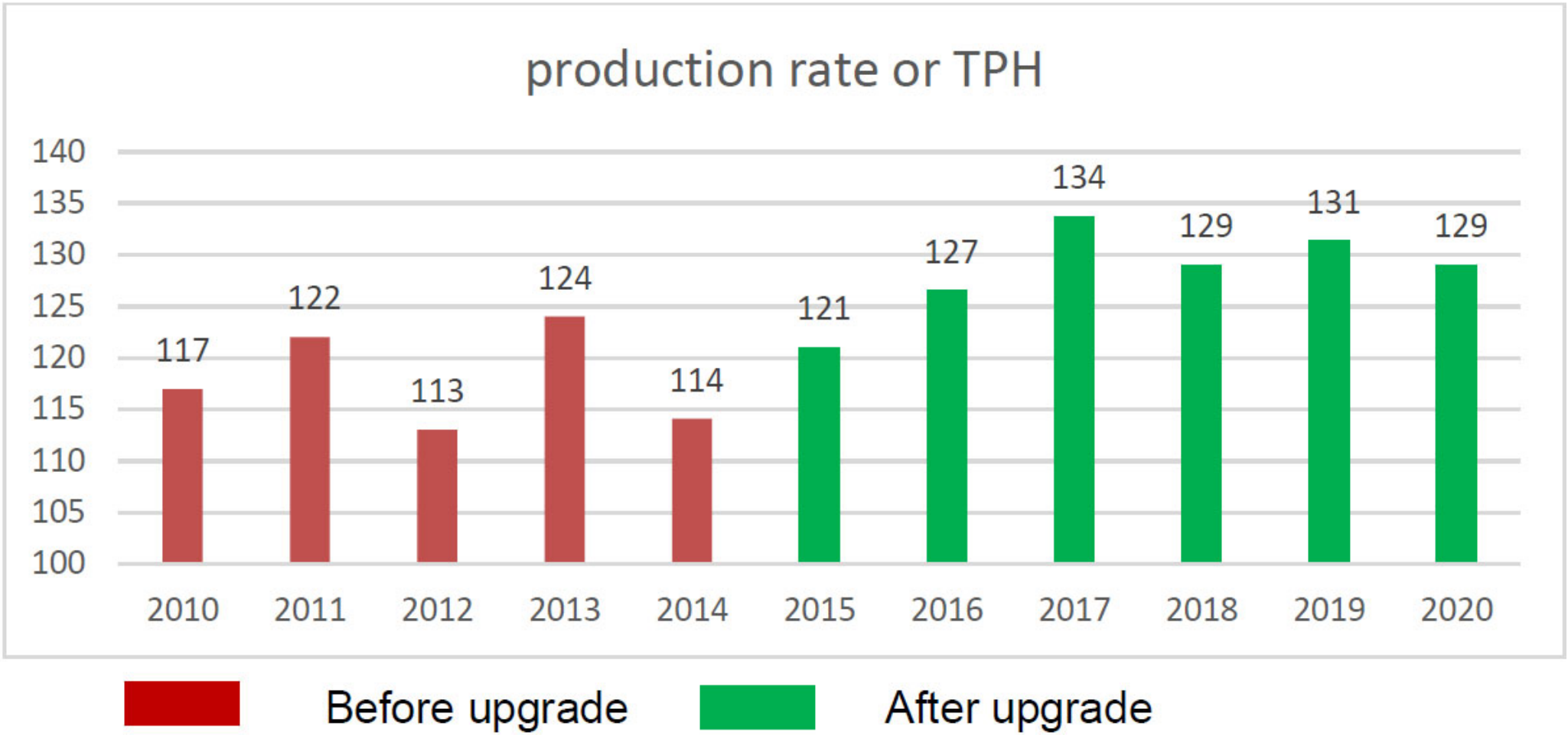
→ Emergency operation with single pump and single valve possible.

Case Study -Customer‘s pain visa vis Köppern‘s solutions



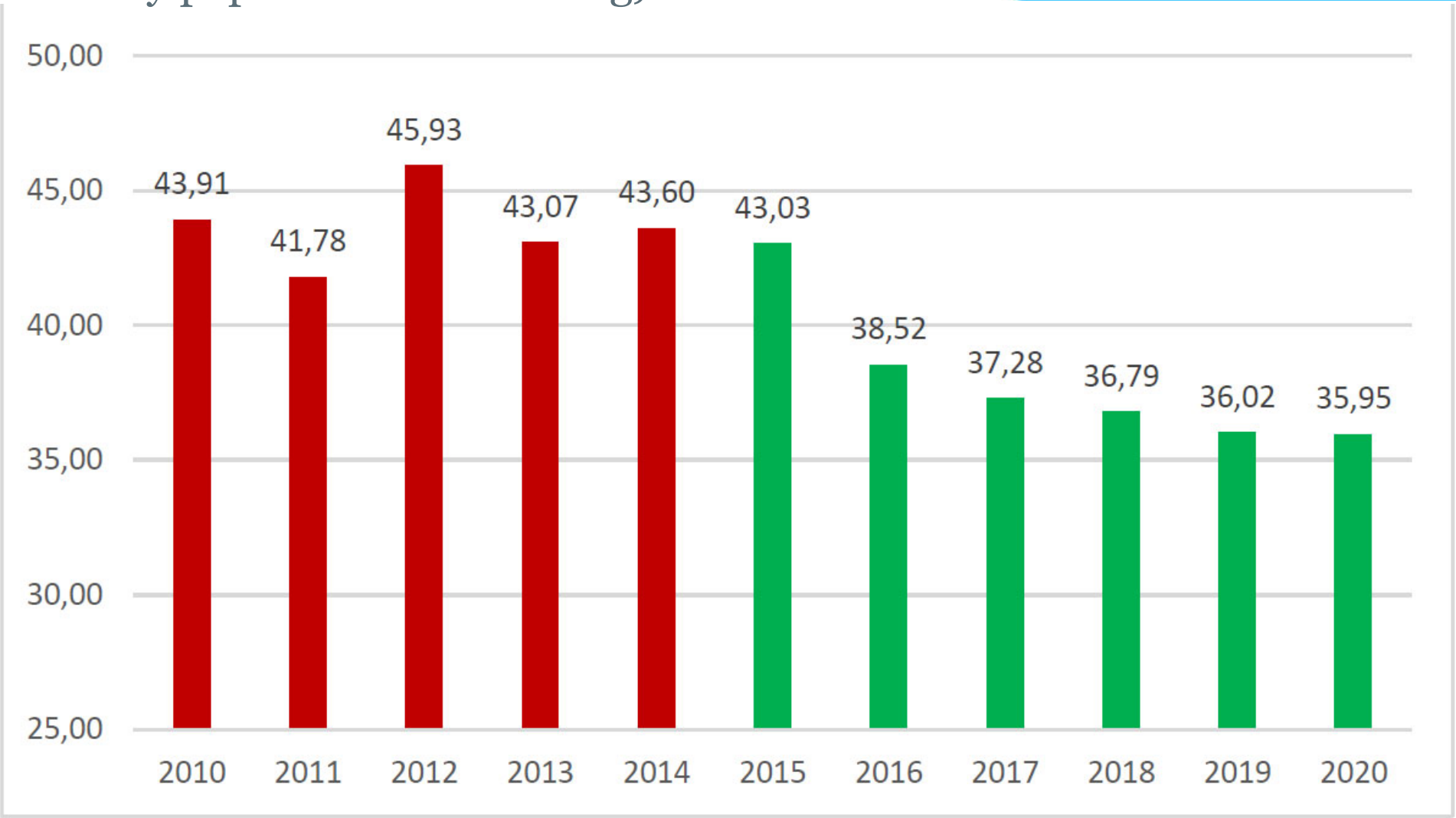
Case Study -Customer‘s pain visa vis Köppern‘s solutions

Case Study Asia Cement – Result (Excerpt from Case study paper from Heidelberg)



Average increase of production from 118 tph to 128.5 tph which is approx. 9%

Case Study Asia Cement – Result (Excerpt from Case study paper from Heidelberg)



Average reduction of power consumption from 43.66 kWh/t to 37.93 kWh/t which is approx. 14 %

Case Study Asia Cement – Result (Excerpt from Case study paper from Heidelberg)

Result - Not only saving of production costs but higher lifetime of machine components.

6.4 Cost calculation

Cost calculation can calculate from the electric cost multiply with saving power consumption and Total production in each year as below

power consumption 2010-2015 AVG	Kwh/t 43.55	saving	production	electric cost/euro	total saving euro	Machine cost 771,000
2016	38.52	5.03	871,521	0.0815	357,276	-413,724
2017	37.28	6.27	925,658	0.0815	473,016	59,292
2018	36.79	6.76	930,972	0.0815	512,910	572,201
2019	36.02	7.53	933,886	0.0815	573,121	1,145,322
2020	35.95	7.6	526,095	0.0815	325,863	1,471,186
total cost saving					2,242,186	

From the calculation the pay back cost can cover the investment cost in 2 years.

- Audit of existing Plants
- Feasibility study of existing Plants
- Upgrades of existing grinding circuit and Roller Press
- Transfer of more than 30 years of Know – How
- Supply of spare parts for other makes.
- Service Support

Thank you for your attention.

Excellence is not a destination; it is a continuous journey that never ends!

(Brian Tracy)