



# COMPOSITE Liners

Our Innovation. Your Advantage.



Registered Trademarks.

All company names, logos, product names, and identifying marks used throughout this publication are the property of their respective trademark owners. They are used for descriptive purposes only and are protected by the relevant laws of the countries in which the trademarks are registered.

# Our Lima Facilities

3,000 m2 facility to manufacture wear protection solutions with a focus on safety, sustainability and innovation



- Presses
- Autoclave
- Extruder
- Laminator
- Grit blasting hall
- Metal machinery

We are committed to sustainability; using a closed circuit water, cooling and condensers to reduce water and energy consumption on site.

We are committed to composites, expanding our Lima facility and building global capacity with a new composite plant in India on the same site as our world class foundry.

## Experience

Our Lima facility has more than 10 years of experience designing and manufacturing composite liners. We have manufactured more than 35,000 pieces for installation across all sizes and all types of mills. This accumulated experience, knowledge and expertise allows us to offer optimized liner designs that maximize the operating efficiency and performance of customers' mills by extracting the maximum value from their mills and crushers.

## Innovation

We remain at the forefront of mill liner development through our commitment to innovation, continuous improvement and the development of new technologies. We have innovative designs and patents that support mining operations in meeting their operational challenges in efficiency and productivity.

## Capability

With a global network of facilities around the world, we are able to offer wear resistant composite liner solutions, technical assistance and advice, as well as exemplary service to customers worldwide.

# Composite Liners



## Benefits:

Is differentiated by its geometry, materials and experience that results in:

Energy savings	- 3%	-	- 7%
Tonnage increase	+ 5%	-	+ 10%
Life span	+ 30%	-	+ 50%
Reduction of stoppages	- 25%	-	- 50%
Particle reduction (Balls)	- 5%	-	- 10%

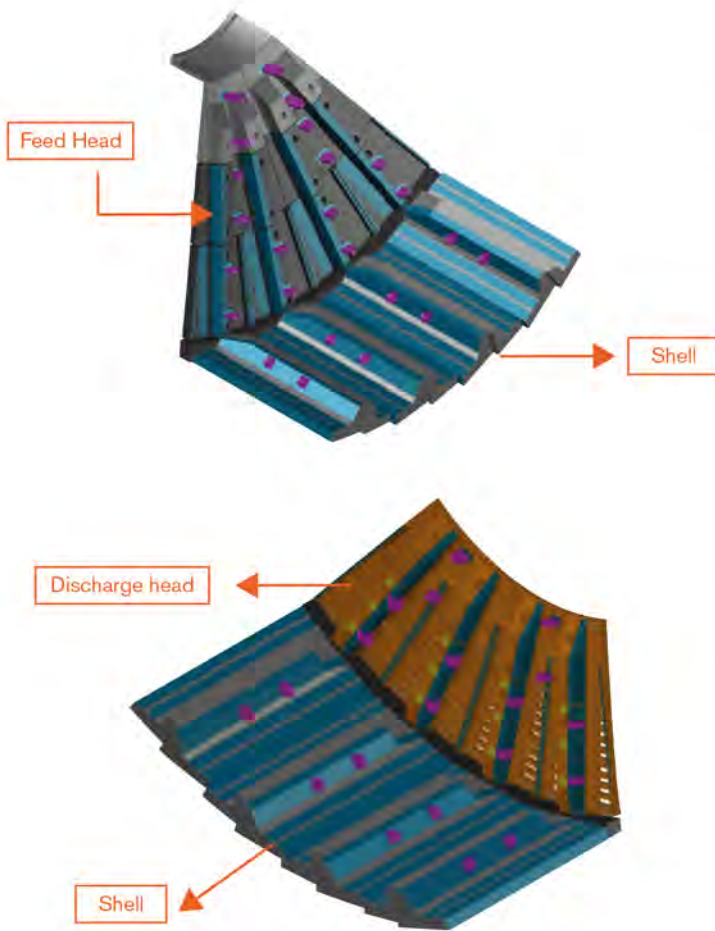
\* Customized designs that contribute to lower costs per ton processed

\* The values and results vary according to the operating conditions of each plant. However, the values presented are an average of the improvements our customers achieved.



# Composite Liners

Bradken Mill liners are designed to meet customers expectations



Mill liners fulfill two main functions; they protect the mill shell from wear caused by the grinding process and creates more efficient grinding with optimised designs.

Composite liners use materials such as rubber, steels and cast inserts; they offer different advantages against a variety of wear mechanisms such as corrosion, abrasion and impact.

Through multiple simulations, our engineering team select the right profile for the most efficient mechanics inside the mill.

**Note:** These products are referential and will be customized according to our customers' objectives.

## Composites offer the opportunity to save weight which can:

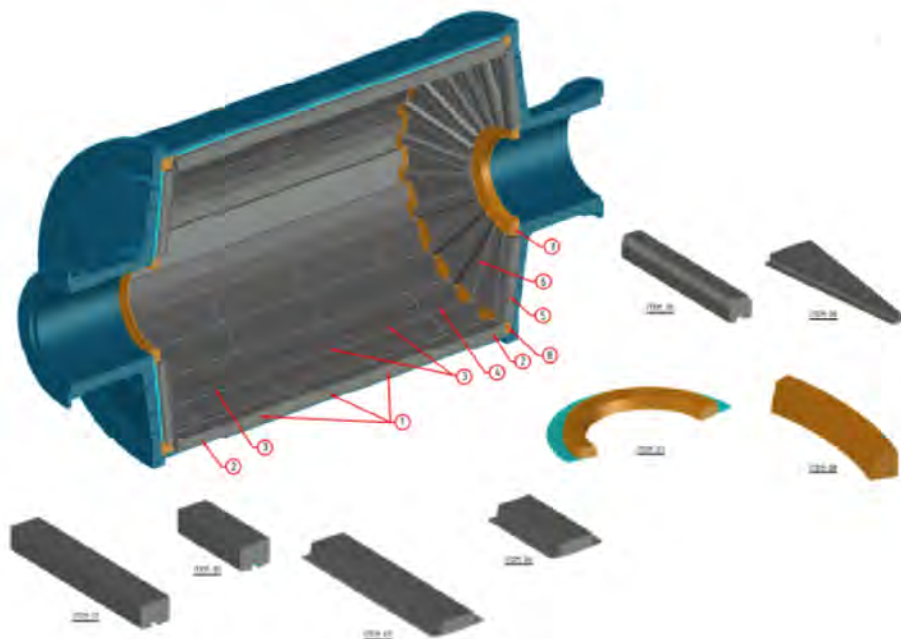
- Reduce power draw
- Increase charge in the mill
- Strategically move weight around the mill through design
- Increase size and reduce parts in the mill
- Can extend campaign life
- Can reduce ball requirements to achieve grind
- Match with steel to optimize wear life and maintenance shuts

## Products:

- Linings Polywear R60A
- Linings Polywear SC
- Linings Polywear SCL

# Linings Polywear R60A

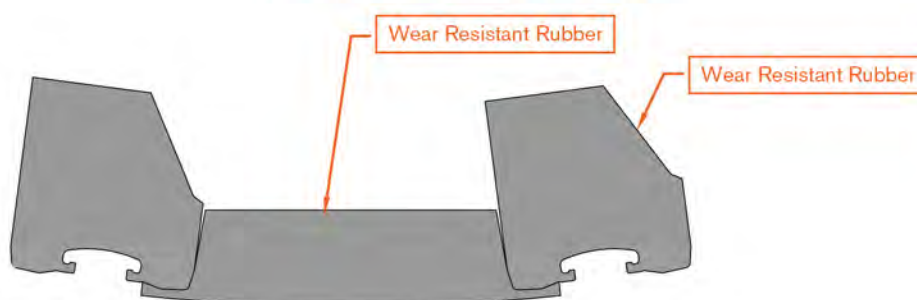
SAG and Ball Mills Liners: Shell, Head liners.



## Rubber lining:

Mainly used for in ball mills in the classic plate bar design.

## General Reference Drawing



## Rubber compound: NR/BR or NR

### Specification (Pass/Fail)

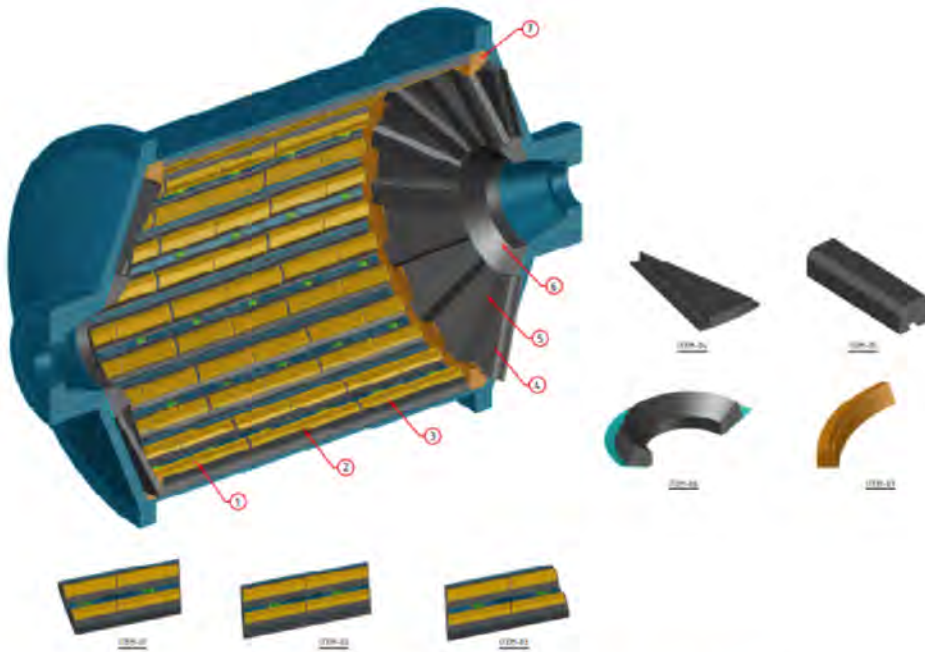
Property	Specification (Pass/Fail)		Test method
Density	Kg/l	1.05-1.15	ISO 2781
Hardness	Shore A	60-70	ISO 7619
Tensile strength	MPa	min 17.0	ISO 37
Elongation at break	%	min 450	ISO 37
Tear resistance	kN/m	min 50	ISO 34 C
Abrasion	mm <sup>3</sup>	max 40	ISO 4649
<b>Ageing 7 days at 70°C</b>			ISO 188
Change hardness	Shore A	max +8	ISO 48
Change Tensile Str	%	max -25	ISO 37
Change Elong at br	%	max -40	ISO 37

### Structured Steel : ASTM- A36

Property	Grade B				
	C	Mn	P	S	Si
Chemical composition	0.25	0.8 - 1.2 máx	0.040 máx	0.050 máx	0.40 máx
Mechanical	F	R	A	Equivalent	
	Kg/mm <sup>2</sup>	Kg/mm <sup>2</sup>	%	DIN 17100 St 37-2	
	24 min	41 min	18 min		

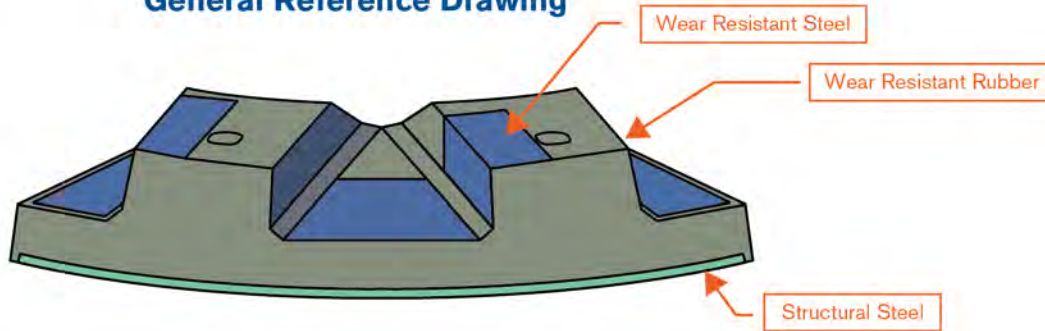
# Linings Polywear SL

SAG and Ball Mill Liners: Shell, End Liners.



Composite rubber liners with high resistance laminated insert (500 to 550Hb).  
Mainly used for SAG mill liners and balls: Shell, feed cover.

## General Reference Drawing



### Metallic Insert: 500 HBW WEAR RESISTANT STEEL

Property	C	Mn	Si	Ni	Cr
Chemical composition	Máx 0.3%	Máx 1.6%	Máx 0.7%	Máx 1.5%	Máx 1.4%
	Mó	B	P	S	
Hardness	Máx 0.6%	Máx 0.004%	Máx 0.025%	0.01 %	
		Brinell	500 ± 40	Test Method ISO 6506-1	

### Structured Steel : ASTM- A36

Property	Grade B				
	C	Mn	P	S	Si
Chemical composition	0.25	0.8 - 1.2 máx	0.040 máx	0.050 máx	0.40 máx
Mechanical	F	R	A	Equivalent	
	Kg/mm <sup>2</sup>	Kg/mm <sup>2</sup>	%	DIN 17100 St 37-2	
	24 min	41 min	18 min		

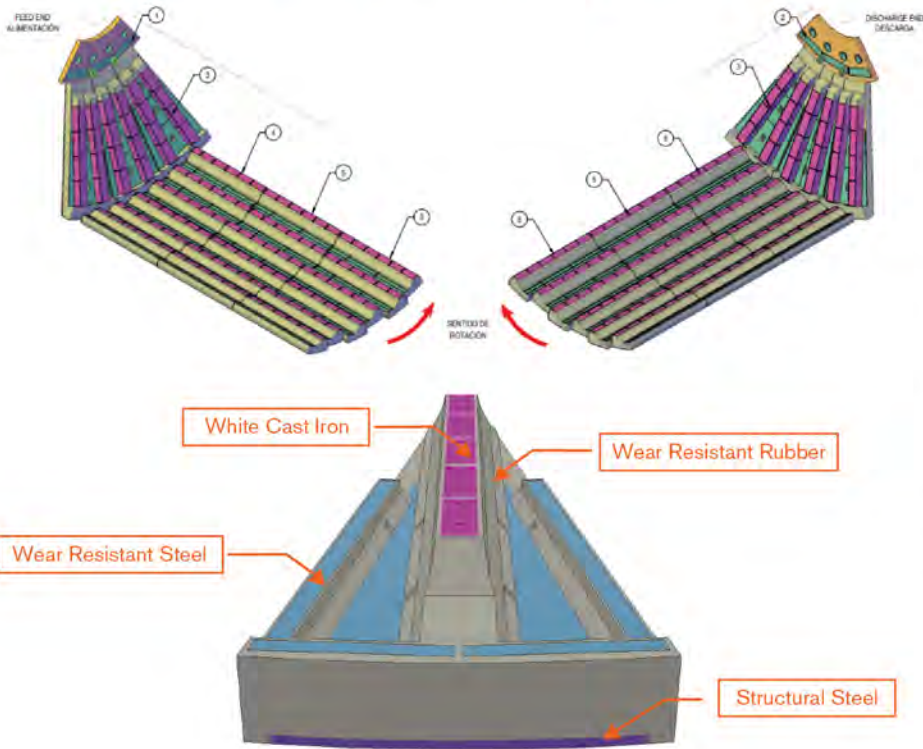
### Rubber Compound: NR/BR or NR

	Property	Specification (Pass/Fail)	Test method
Density	Kg/l	1.05-1.15	ISO 2781
Hardness	Shore A	60-70	ISO 48
Tensile strength	MPa	min 17	ISO 37
Elongation at break	%	min 450	ISO 37
Tear resistance	kN/m	min 70	ISO 34 C
Abrasion dry	mm <sup>3</sup>	max 40	ISO 4649



# Linings Polywear SCL

Increase lifespan of liners and grinding campaigns.



Rubber composite liners with high resistance laminated steel inserts (500 to 550 HB) and high chrome cast inserts (650 HB) have demonstrated longer wear life and uniform wear than CrMo castings in high abrasion grinding.

These composite liners are an ideal solution when you are looking to increase the lifespan of the liners and the grinding campaign.

## Metallic Insert: ASTM A532 White Cast Iron IID

Property	Designation	Chemical composition				
		C	Mn	Si	Ni	Cr
Chemical composition	20% Cr	2.0-3.3	2 máx	1.0 -2.2	2.5 máx	18 -23
		Mo	Cu	P	S	
Hardness		3.0 máx	1.2 máx	0.1 máx	0.060 máx	
Weld repair		Not permitted				
Heat Treat		Hardened and Stress Relieved				
Requirements						
Microstructure		Carbides, martensite, bainite, austenite: and in exceptional cases minor amounts of graphite or pearlite				

## Metallic Insert: 500 HBW Wear Resistant Steel

Property	Chemical composition				
	C	Mn	Si	Ni	Cr
Chemical composition	Máx 0.3%	Máx 1.6%	Máx 0.7%	Máx 1.5%	Máx 1.4%
	Mo	B	P	S	
Hardness	Máx 0.6%	Máx 0.004%	Máx 0.025%	Máx 0.01%	
		Brinell	500 ± 40	Test Method ISO 6506-1	

## Rubber Compound: NR/BR or NR

Property	Specification (Pass/Fail)	Test method
Density	Kg/l	1.05-1.15
Hardness	Shore A	60-70
Tensile strength	MPa	min 17
Elongation at break	%	min 450
Tear resistance	kN/m	min 50
Abrasion dry	mm <sup>3</sup>	max 40

## Structured Steel : ASTM- A36

Property	Grade B				
	C	Mn	P	S	Si
Chemical composition	0.25	0.8 - 1.2 máx	0.040 máx	0.050 máx	0.40 máx
Mechanical	F	R	A	Equivalent	
	Kg/mm <sup>2</sup>	Kg/mm <sup>2</sup>	%		
	24 min	41 min	18 min	DIN 17100 St 37-2	

# Experience



## Customer Story: Feed End Outer Liner - SAG MILL 36'x 26.5'

Location: Peru

- Complete set of Outer Feed Head Liners (36 Liners in total).
- These originally CrMo parts had a duration of 4.5 months, which forced the company to make plant shutdowns outside of its scheduled program (every 6 months). Faced with this problem, the client initially requested a 7-month Liners.
- We developed a liner that exceeded the required duration of 7 months, reaching projections of up to 9.5 months.
- Currently the client changes Liners every 6 months, aligning within its annual program.



## OEM Client: Feed and Shell Liners - SAG MILL 38'x 27'

Location: Spain

- Complete set of Feed Head and Shell Liners.
- In this mill, the configuration of Cr-Mo steel casting was changed to hybrid rubber liners with laminated steel inserts, reducing the weight by approximately 40%.

## OEM Client: Feed and Shell liners - SAG MILL 24'x 14'

Location: Peru

- We supplied feed end and shell liners.
- In this mill the mill liner design improved the quality and eliminated the problems of detachment of inserts seen by the customer previously.
- The weight was reduced, extending the life to 5 months.
- In the feed end liner, improvements were made to include both an outer and inner liner, and the outer Liners were reinforced in high wear areas, moving weight to where it was needed.



## Customer Story: Feed Cover – Ball Mill 26' x 41'

Location: Peru

- Life projection 12 months.
- Design is sought to reach 18 months.



## Customer Story: Shell Liners – Ball Mill 26' x 44.5'

Location: Chile

- Set of Shell Liners 1 and 2 feed rings.
- Response in 3 weeks. Shell Liner Sets are produced in rubber configuration with 500 HB rolled steel inserts.
- We exceeded the duration expectations of these Liners, which were removed after 9 months, achieving an even better performance than the Cr-Mb cast steel liners that they were using in their mill with a duration of 7 months.



## Customer Story: Shell Liners – Ball Mill 11' x 18.8'

Location: Mexico

- Reduction in cylinder liner weight by -60%.
- Energy savings due to the loss of liner weight.
- Change of design from "Bar-Plate" to "Double Wave", having liners with less volume than the design used before.
- Reduction in P80 size -31% (from 590  $\mu\text{m}$  to 406  $\mu\text{m}$ ).



## Customer Story: Retainer Ring - Ball Mill 26' x 41'

Location: Peru

- Customer needed to increase the load of the ball mill.
- A design was proposed with a rubber ring configuration with 500 HB rolled steel inserts.
- A minimum warranty duration of 6 months was provided, which was exceeded, exceeding the 12 month warranty duration.



# Contact Bradken globally to find a solution for your business.



**Our Innovation. Your Advantage.**



**BRADKEN**

[bradken.com](http://bradken.com)