THE ULTIMATE SLURRY SOLUTION

EagleBurgmann.
Rely on excellence

EagleBurgmann's HRS/321 Product Lubricated Seal

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The HRS & Cartridge Slurry Seal Product Family

HRS222
Single Seal

HRKS-D
Double Seal

HRS321
Single seal

HRS326
Single Seal +
Flush

EagleBurgmann's
Recommended Slurry Seal

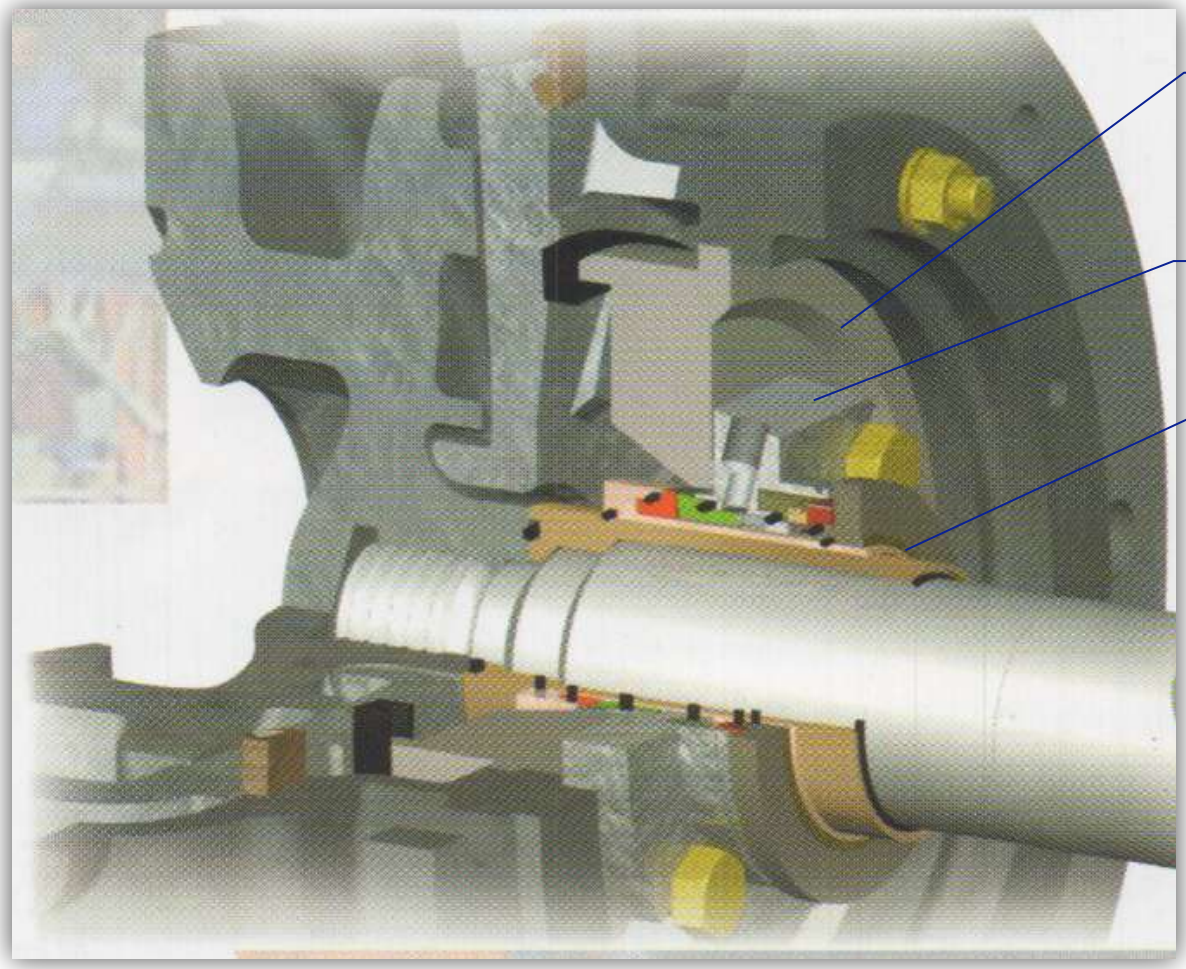
Cartridge
Seals

HRS321 Slurry Seal Operating Parameters

Medium	= Various Mineral Ore Slurries
Medium Density (sg)	= up to 1.8 kg/dm3 (#)
Operating Pressures (P)	= 16 bar (230psi))
Seal Face Sliding Velocity (Vg)	= 10 m/s (12m/s) – 32ft/s (39 ft/s)
Operating Temperature (t)	= - 20 to 180 ° C – (53° F to 356° F)
pH Values (pH)	= 1 to 14

(#) Higher densities can be handled however will be dependent on P.Vg ratios and other design factors (contact EagleBurgmann for more information)

The HRS 321 Mechanical Slurry Seal



Basic Slurry Seal Components

HRS 321

Cartex

1. Slurry Seal

The choice of a HRS or Cartex mechanical seal is dependent on the slurry composition and pump size.

These seals offer:

- easy and trouble free installation
- reduced downtime during maintenance
- increased MTBF's of the plant due to their robustness
- a decrease in utility spend by offering water and electricity savings when compared to the use of gland packing and component seals

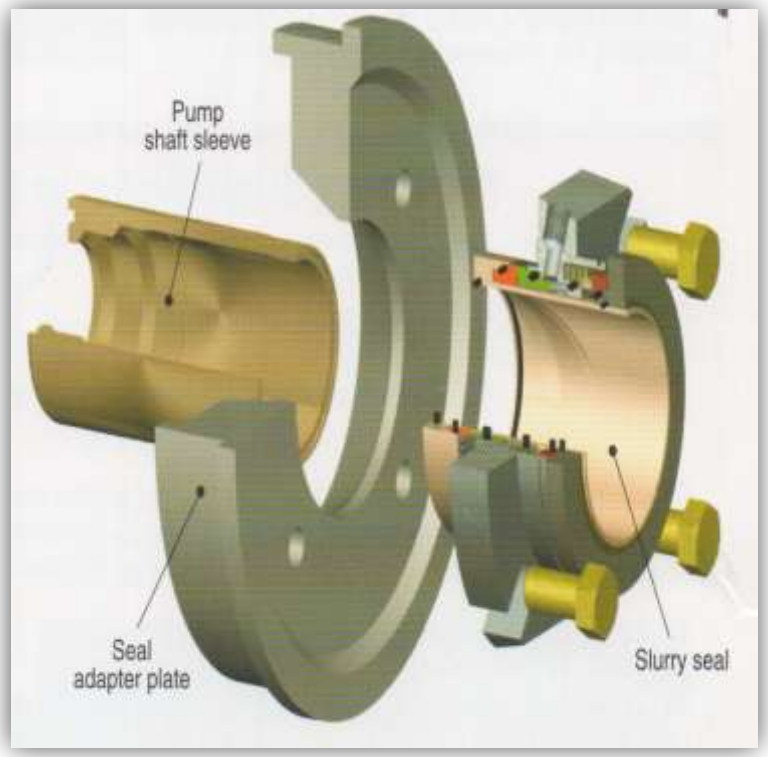
Basic Slurry Seal Components

2. Adapter Plate

Designed by EagleBurgmann in conjunction with leading slurry pump manufacturers.

The Adapter plate is designed to replace the stuffing box, offering the following advantages:

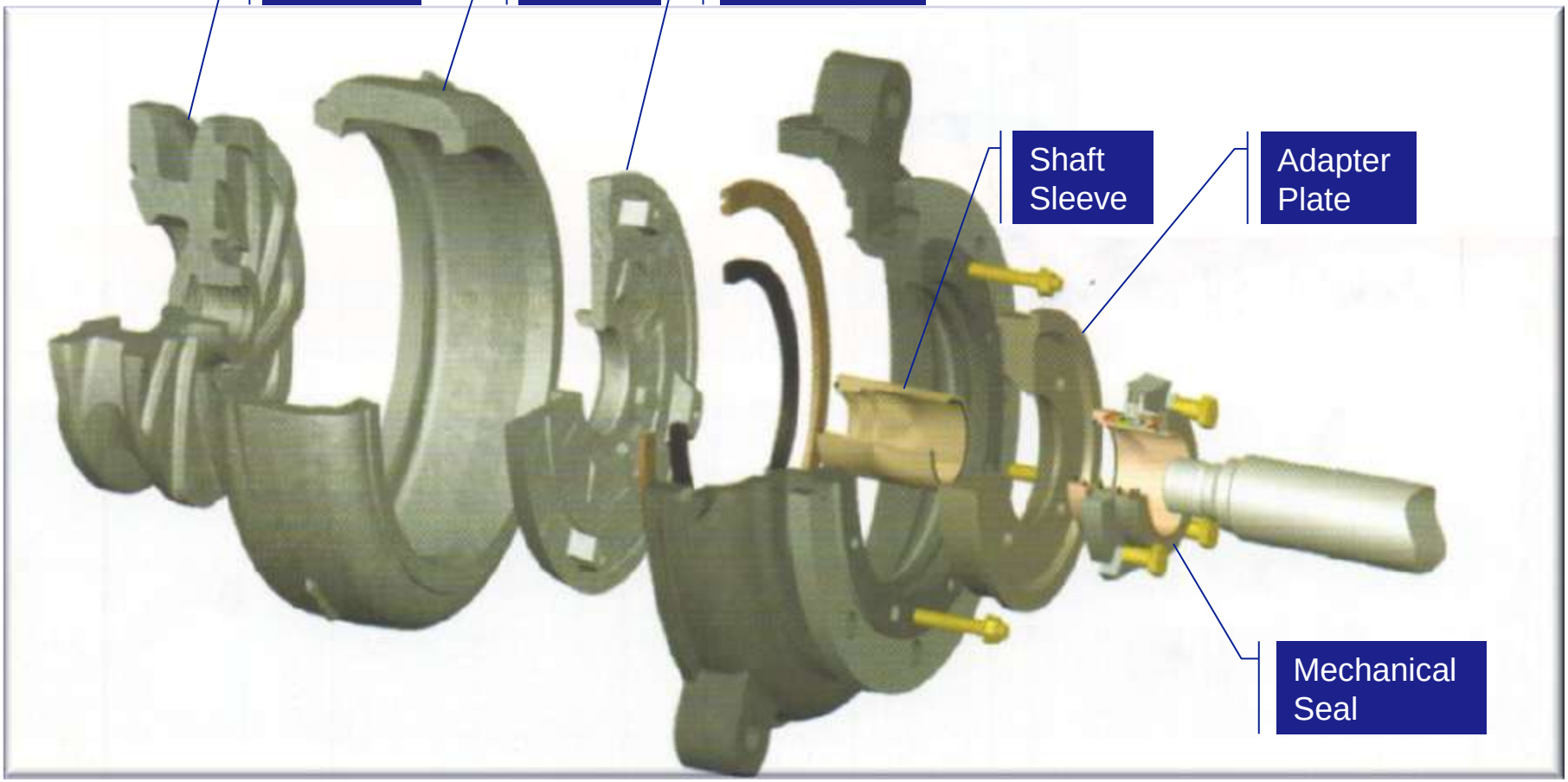
- No pump modifications are necessary. Weir Minerals has approved the EagleBurgmann adapter plate.
- The liner inserts of both metal and rubber lined pumps do not impede on the seal's installation or operation.
- The adapter plate and seal have been designed for optimum fluid dynamic conditions.



3. Shaft Sleeve

Two piece shaft sleeve and spacer are integrated into one unit to allow seal to slide axially without hindrance during operation, as well as for axial float purposes.

Mechanical Seal into Pump Assembly

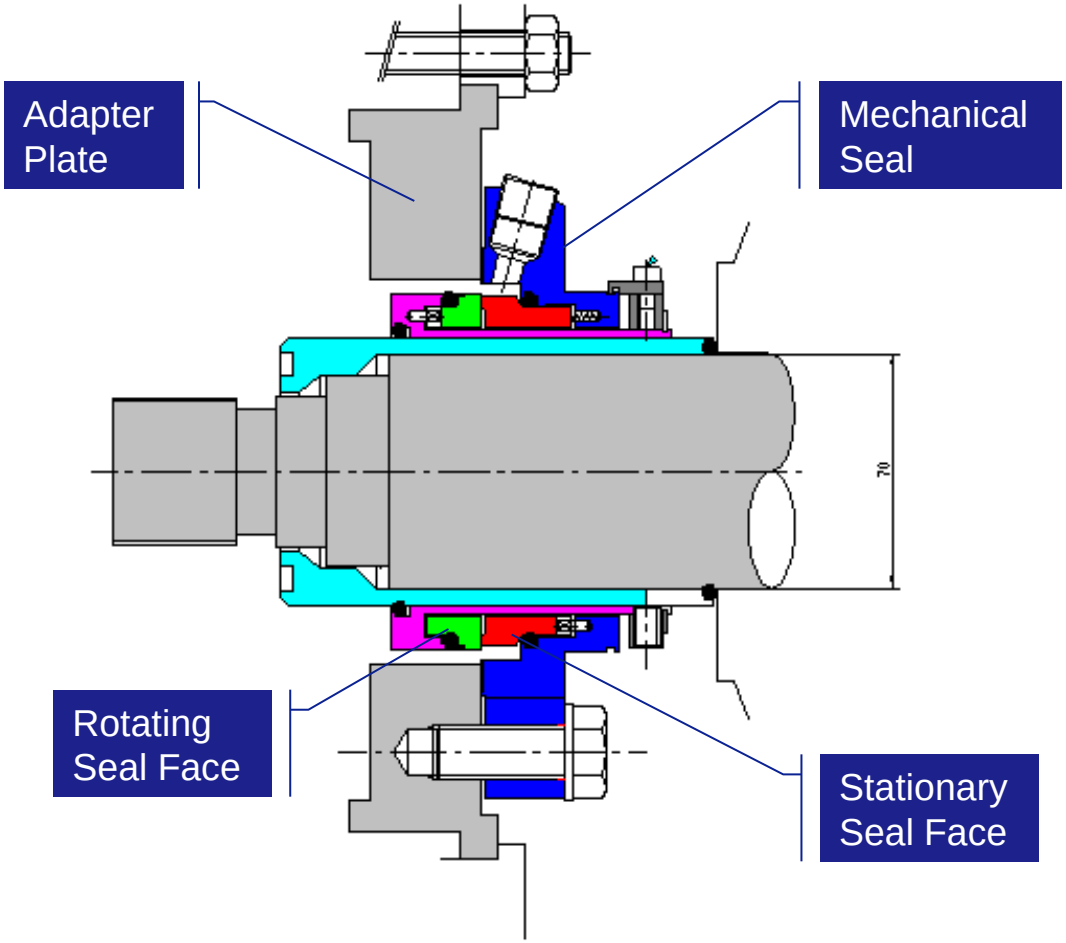


EagleBurgmann Slurry Seals for Warman Pump Range

Warman AH Pump Models			
No	Pump	Shaft sleeve diameter	Frame
1	1.5/1B	45.33	B
2	2/1.5B	45.33	
3	3/2C	58.72	C
4	4/3C	58.72	
5	4/3 D	82.55	D
6	6/4D	82.55	
7	6/4E	101.35	E
8	8/6E	101.35	
9	8/6F	130.18	F
10	10/8F	177.80	
11	12/10F	177.80	
12	14/12F	177.80	
13	10/8G	177.80	G
14	12/10G	177.80	
15	14/12G	177.80	
16	16/14G	177.80	
Slurry solutions are provided for all the above			

- EagleBurgmann Slurry Seals are designed to fit individual pumps
- Adapters are designed to replace stuffing boxes onto which mechanical seals are bolted
- Slurry Seals have been designed for certain pump ranges such as the Warman AH pump range
- Slurry Seals are specifically selected to suit each particular application in order to provide for best performance

The HRS/321 Single Product Lubricated Slurry Seal

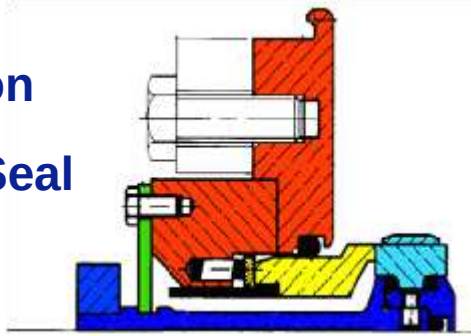


Basic Seal Componentry

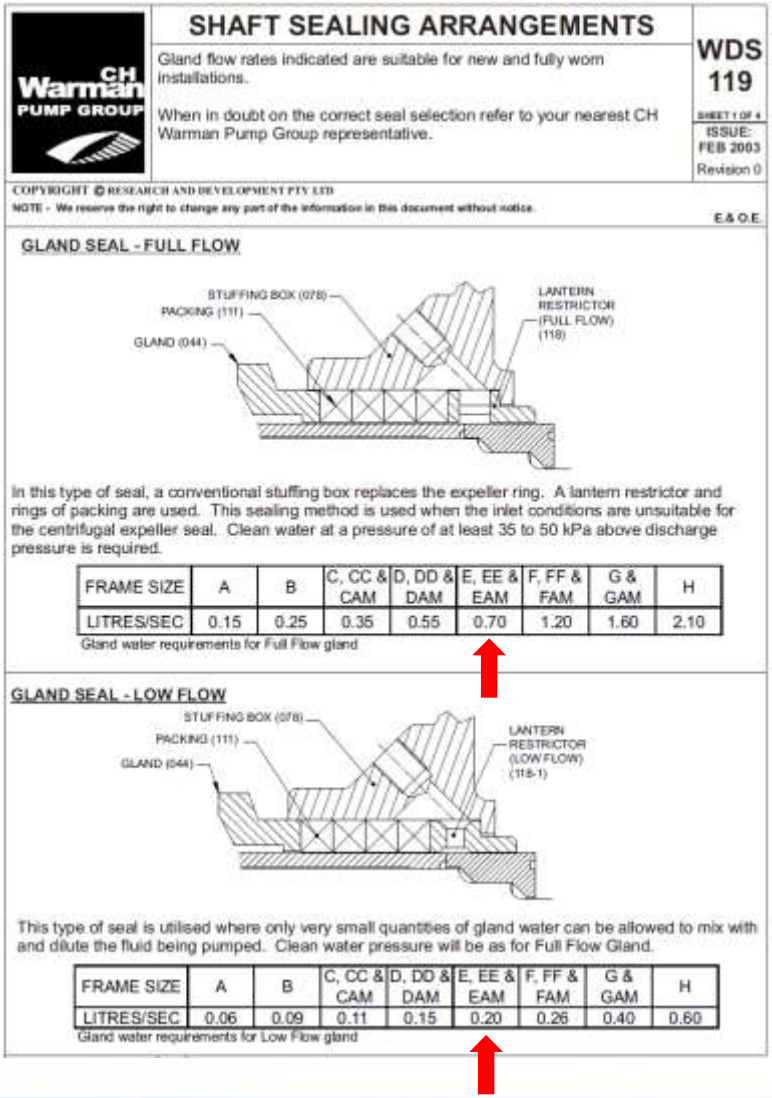
Recommended Slurry Seal – HRS321

SUPERIOR FEATURES OF THE HRS321

- The HRS single seal is a product lubricated mechanical seal.
- The cooling and lubrication of the faces are undertaken by the product itself.
- No Barrier Fluid systems; No Maintenance or supervision required.
- No flush water or quench water needed.
- No water treatment required.
- The normal flushing of seals prior to pumpshut-down is sufficient
- No risk of product dilution or contamination
- Can also be supplied with Diamond Face Seal Faces for more extreme conditions



Water Saving - Warman 6/4 E-AH



CH Warman PUMP GROUP

SHAFT SEALING ARRANGEMENTS

WDS 119

Gland flow rates indicated are suitable for new and fully worn installations.

When in doubt on the correct seal selection refer to your nearest CH Warman Pump Group representative.

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GLAND SEAL - FULL FLOW

In this type of seal, a conventional stuffing box replaces the expeller ring. A lantern restrictor and rings of packing are used. This sealing method is used when the inlet conditions are unsuitable for the centrifugal expeller seal. Clean water at a pressure of at least 35 to 50 kPa above discharge pressure is required.

FRAME SIZE	A	B	C, CC & CAM	D, DD & DAM	E, EE & EAM	F, FF & FAM	G & GAM	H
LITRES/SEC	0.15	0.25	0.35	0.55	0.70	1.20	1.60	2.10

Gland water requirements for Full Flow gland

GLAND SEAL - LOW FLOW

This type of seal is utilised where only very small quantities of gland water can be allowed to mix with and dilute the fluid being pumped. Clean water pressure will be as for Full Flow Gland.

FRAME SIZE	A	B	C, CC & CAM	D, DD & DAM	E, EE & EAM	F, FF & FAM	G & GAM	H
LITRES/SEC	0.06	0.09	0.11	0.15	0.20	0.26	0.40	0.60

Gland water requirements for Low Flow gland

Water Saving on HRS321 Slurry Seal

- Pump – Warman 6/4 E-AH
- Recommended Gland Seal Water Flow
  - Full Flow = 42 Liters/minute
  - Low Flow = 12 Liters/minute
  - Let say Flow Average = 22 Liters/minute
  - Let say Water Cost = R 21.00/kL
  - Let say Pump Utilisation = 85%
- Gland Water Cost per Pump
  - Water Usage/Annum = 9,828,720 L
    (L/min X 60 X 24 hours X 365 X Utilisation)
  - Water Cost/Annum = R 206,403
    (L/Year X R/kL)

Saving/Annum/Pump = R 206,403
(100%)

Electricity Saving - Warman 6/4 E-AH

Calculation: Power Consumption - Packing

Equipment: Warman 6/4 E-AH Pump

D	101	mm	*Shaft diameter*
p	2.5	N/mm^2	*working pressure of the medium (not considered in calculation)*
b	16	mm	*packing width*
p_B	1	N/mm^2	*surface pressure of gland*
Rings	4	pcs	*number of rings*
L	60	mm	*Origin length of sealing set*
µxk	0.05		*µxK - value (dry)*
l	64	mm	*compressed length of the sealing set*
n	960	min^{-1}	*RPM*

F_R	836.9	N (exponential funcition)
F_R	1015.4	N (easy function)
M_R	46.47	Nm
P_R	4.67	kW

Electricity Saving on HRS321 Slurry Seal

- Pump – Warman 6/4 E-AH
- Cost & Utilisation
  - Let say Electricity Cost = R 0.5/kWh
  - Let say Pump Utilisation = 85%
- Note that On Average Gland Packing consumes Six Times the Power of a Mechanical Seal
- Power Consumption Cost/Pump/Annum
  - Using Gland Packing = R 17,393 (Power X 24 X 365 hours X Utilisation)
  - Using Mecanical Seal = R 2,899 (Elec. Cost for Gland Packing ÷6)

Saving/Annum = R 14,494 (83%)

Capital Investment versus Savings

CAPITAL INVESTMENT VERSUS SAVINGS

Mechanical Seal Type:	HRS321/120-E6-WN	
Purchase Price:	R 62,500.00	
Total Actual Operating Cost:	R 223,795.83	per Annum (Using Gland Packing)
	VERSUS	
Total Realised Cost Saving:	R 220,897.05	per Annum (Using an EagleBurgmann Mechanical Seal)
Saving including Capital Investment:	R 158,397.05	per Annum
	=	
	71%	

Note the reflected cost saving numbers exclude labour, down-time, material and other related costs incurred during maintenance and operating activities which when included will inflate reflected operating costs and further improve the current reflected cost savings.

Current Reference

- Anglo American Amandulbult Operations
  - EagleBurgmann convinced management at Anglo American's Amandulbult operations to trial it's single seal low maintenance slurry solution, the HRS321
  - These seals were initially specified to be supplied with diamond faced seal faces; however due to long delivery lead times for these a decision was made to install sacrificial silicon carbide seal faces in the meantime that would be replaced with diamond faced seal faces once these arrived
  - The performance of the silicon carbide seal faces surpassed all expectations in that these withstood the aggressive operating conditions they were exposed to
  - Taking into account the excellent performance results we experienced with the silicon carbide seal faces, it was decided not to replace these with diamond faces, but to run these in parallel to the diamond seal faces to compare performance

Reference - Anglo's Amandulbult Operations

SUCCESSFUL SEAL RUN TIME TO DATE

HRS321 - Silicon Carbide Faced Seals	*13 months going on 14*
HRS321 - Diamond Faced Seals	*12 months going on 13*

Competitor's Double Seal & Pod

Before

EagleBurgmann's HRS321 Slurry Seal

After