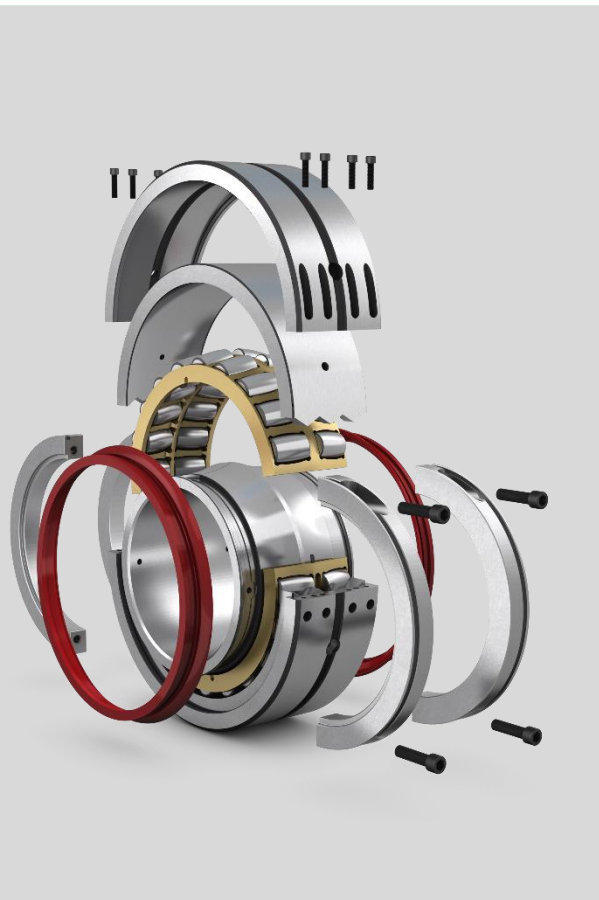


Open and sealed SKF Cooper split spherical roller bearings

March 2019

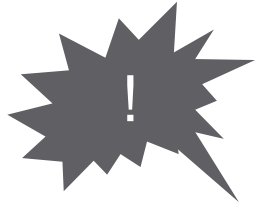


Reduce
mean time to repair
(MTTR)



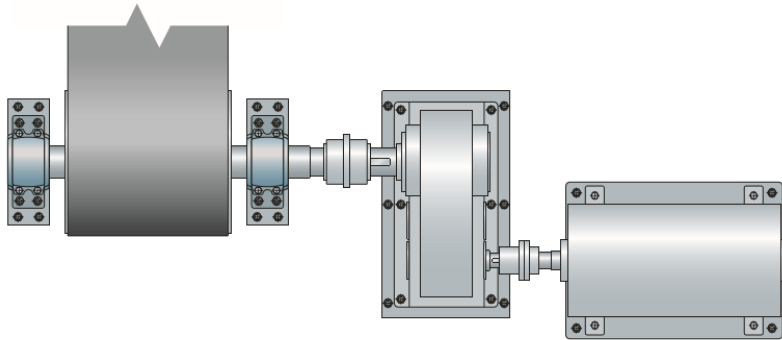
Typical belt conveyor drive system

Pulley, gearbox, motor

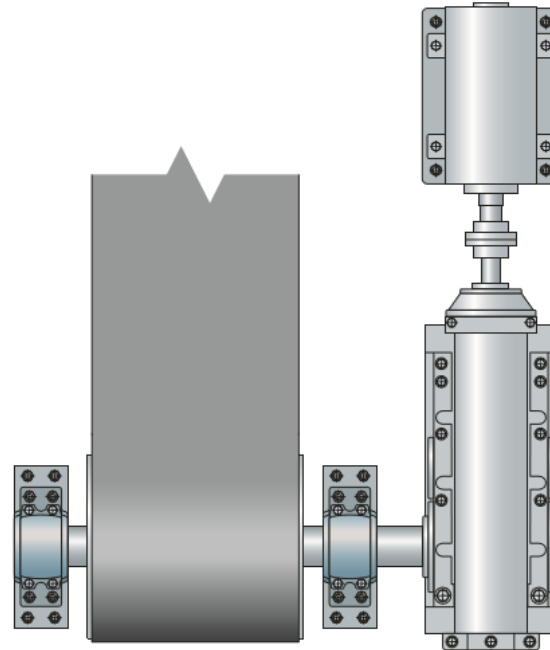


Conveyor!

A recent survey of the mining and cement industry found the conveyor to be the most troublesome asset type



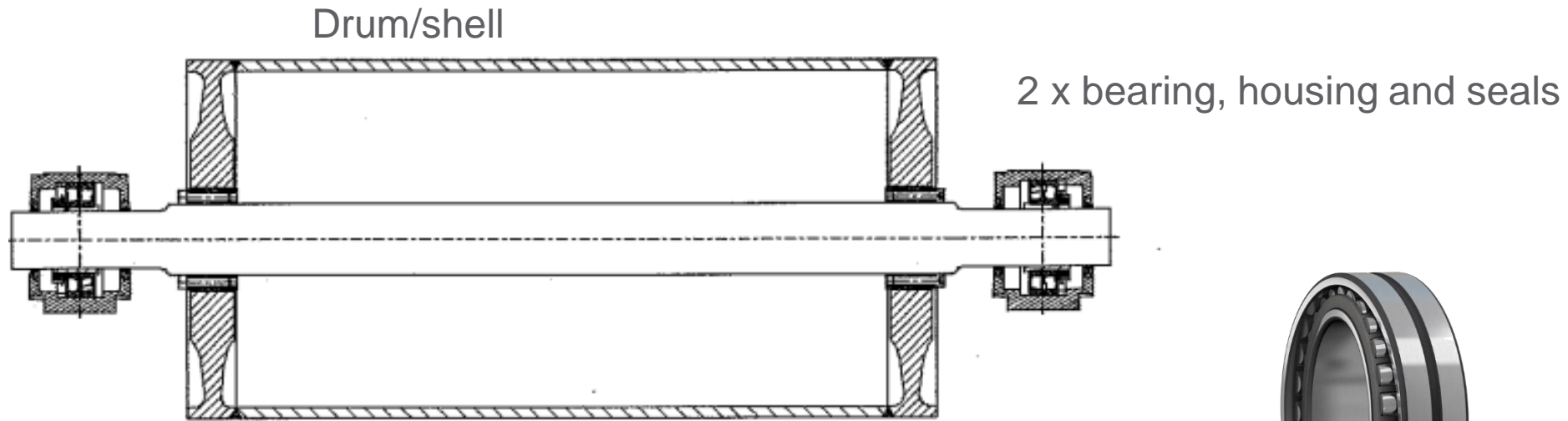
Base mounted parallel shaft gear



Cantilever right angle gear



Typical pulley bearing arrangement



- 222 series K/C3 spherical roller bearings
- 231 series K/C3 spherical roller bearings
- Adapter sleeve mounted
- Split or one piece housings
- Sometime ductile iron or steel required
- Grease lubricated
- Sometimes Taconite seals

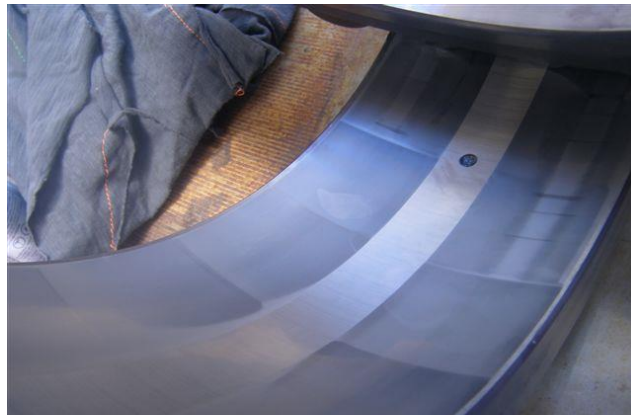


Standard open and more recently sealed bearings are typically used, e.g. SKF Three-barrier solution

Pulley bearings frequently fail due to contamination

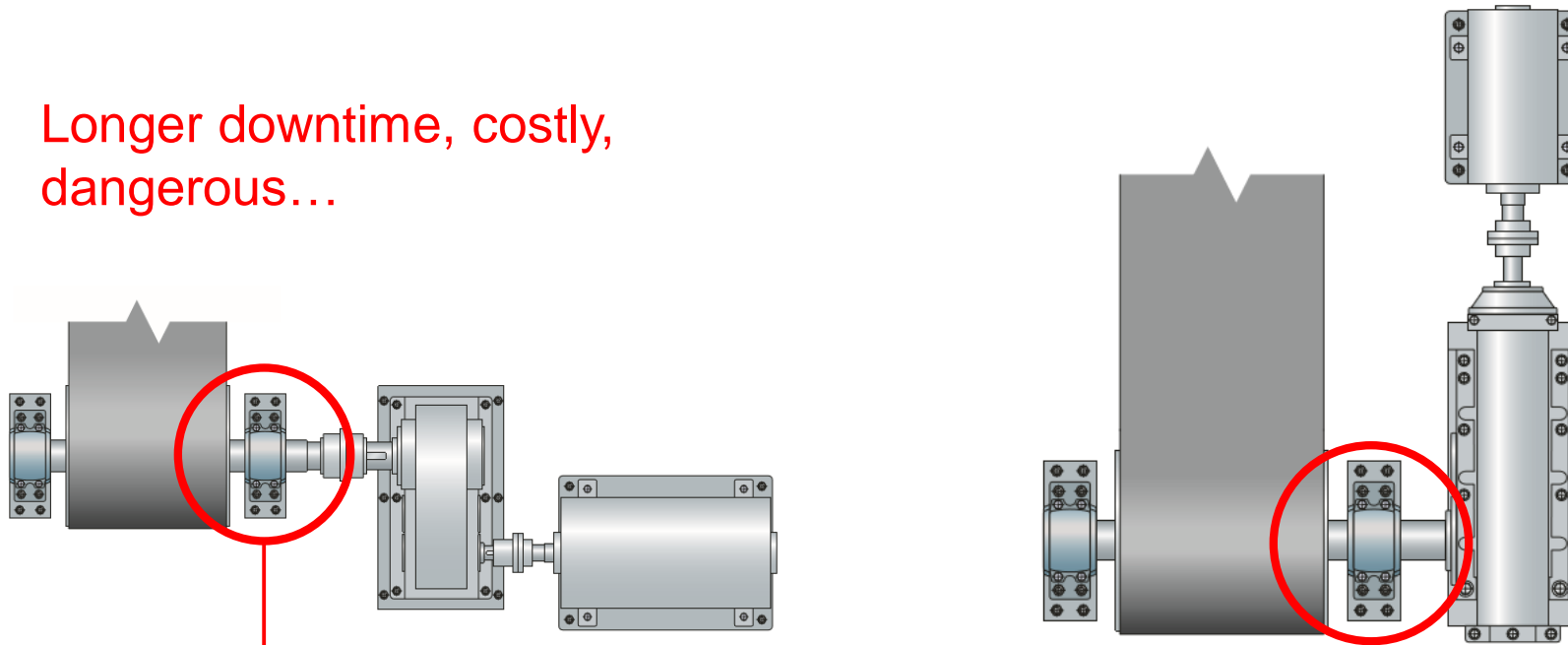
Dirt and moisture contamination causes abrasive wear

- Open bearings do not last as long as the pulley lagging
- Open bearings require large amounts of grease to purge contamination
- Root cause for replacement is poor housing and bearing sealing
- Sealed spherical roller bearings last longer than the pulley lagging
- Taconite seals exclude contamination from housing, especially against high pressure wash downs

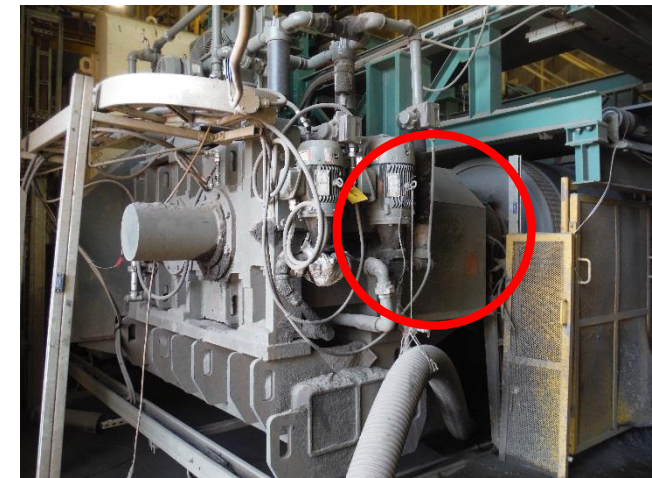


Difficult to replace “trapped” standard bearings

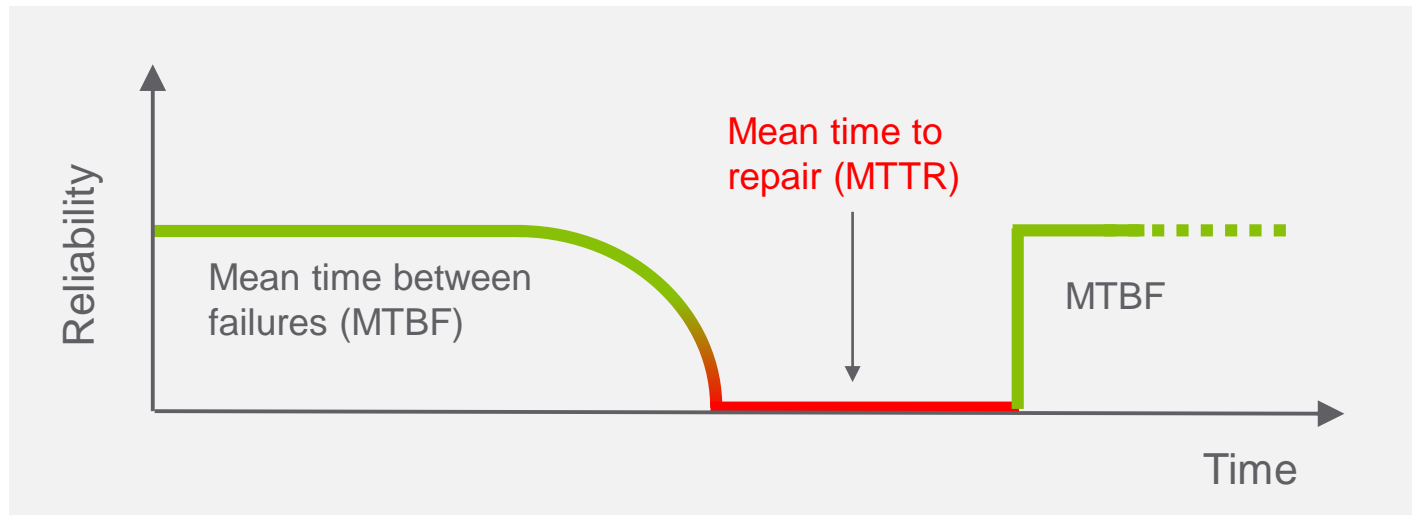
Longer downtime, costly, dangerous...



Bearings “trapped” between gearbox and pulley



Mean time to repair = time needed to make repair



MTTR includes time to...

- Move drive
- Dismount coupling
- Replace bearing
- Mount coupling/drive
- Re-align drive
- Connect electrical
- Connect instrumentation

Repair time causes downtime, lost production, costs money.
“Trapped” positions causes longer MTTR!



Alternatively, standard bearings must be cut from shaft with risk of damaging the shaft

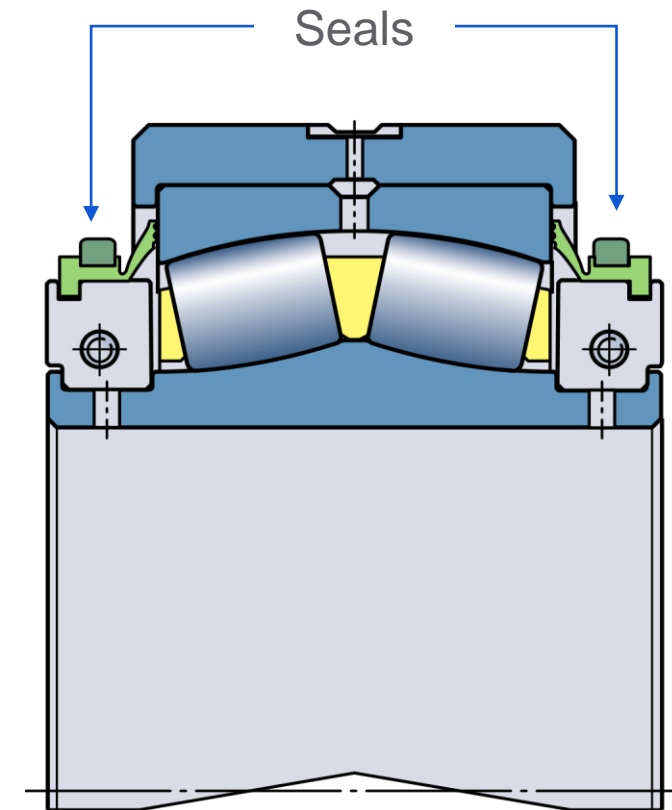
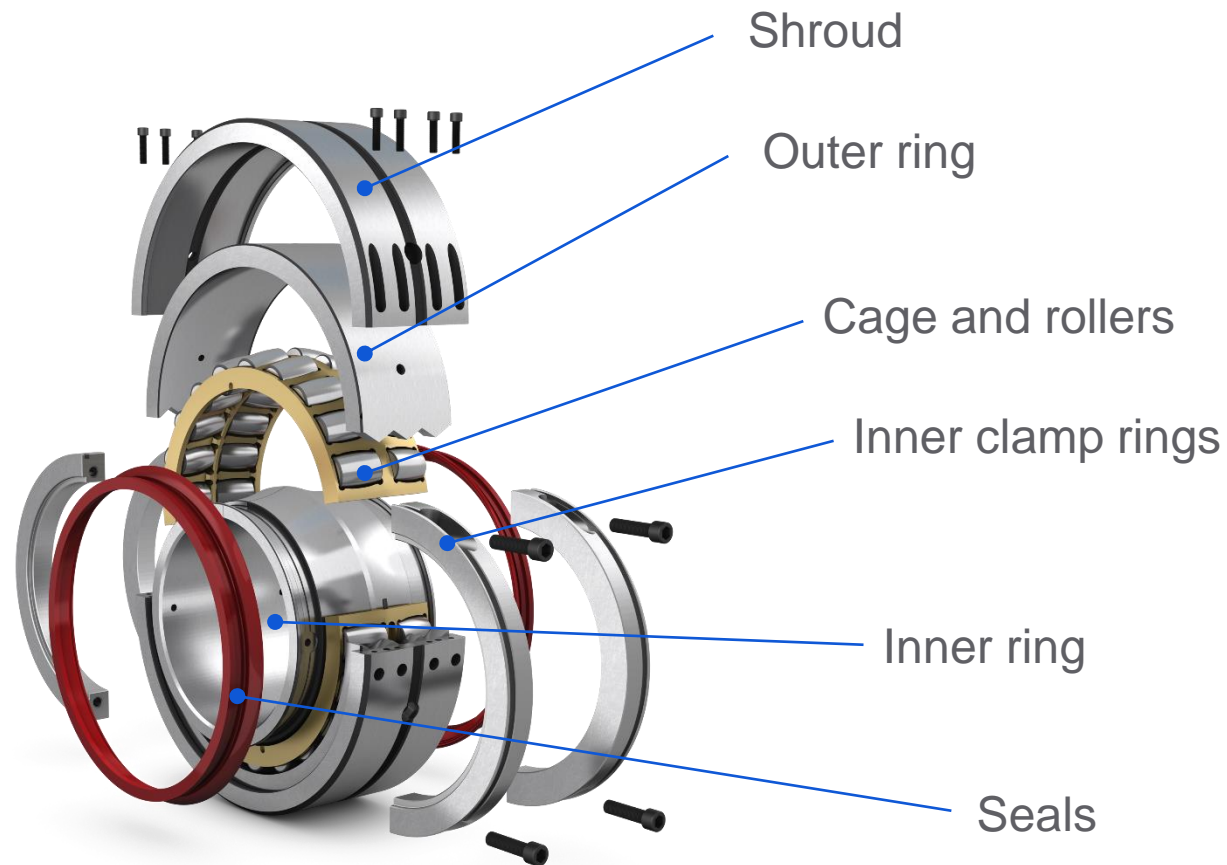
What if there was a better way?

- What if there was a reliable way to reduce mean time to repair (MTTR)?
- Reduce costs?
- Avoid safety risks?



SKF Cooper split spherical roller bearing

Open and sealed versions



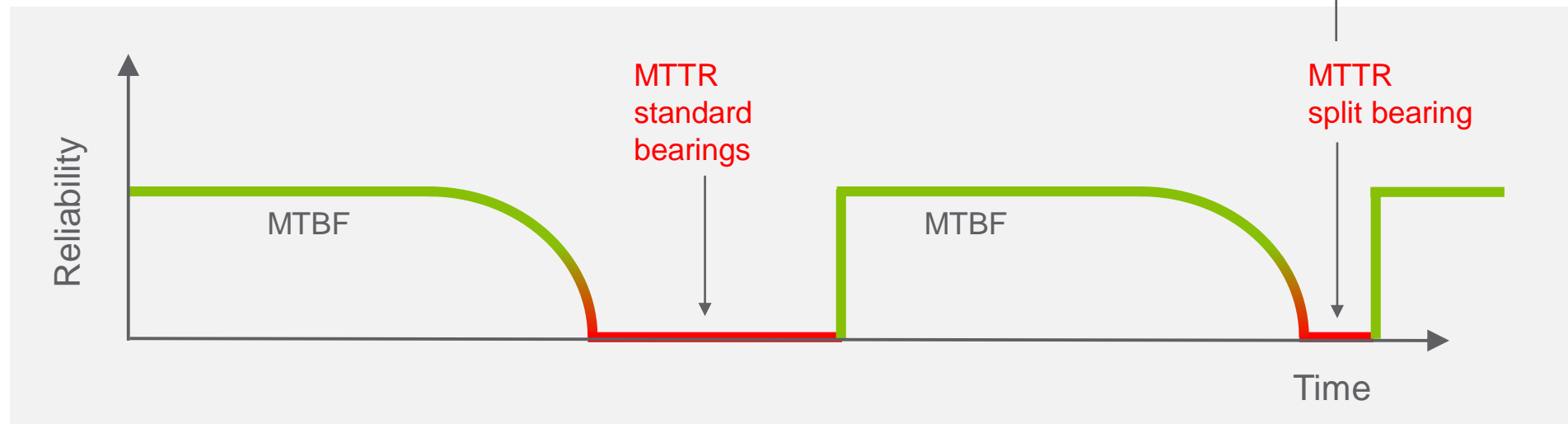
The split bearing outer ring shroud is the same dimensions as a standard spherical roller bearing and can fit into split block housings. The shaft requirements of the split bearing are the same as those needed for a standard spherical bearing mounted on an adapter sleeve (ISO h9 shaft diameter tolerance and IT5 form).

Reduce MTTR with SKF Cooper split bearings

In situ replacement of split bearings in “trapped” position

- 70% reduction in MTTR with SKF Cooper split bearings
- No need to dismount drive coupling or cantilevered drive
- No need to move gearbox
- Avoid realignment

Shorter
MTTR
with split
bearing!



Basic procedures for replacing pulley bearings



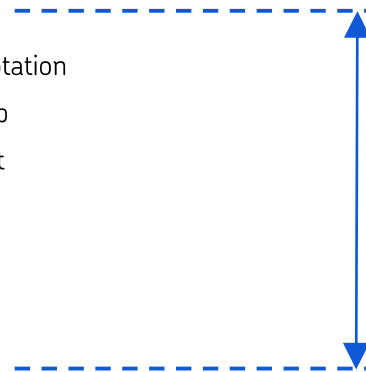
Standard bearing

- Safety lockout/tagout
- Block machine (pulley) from rotation
- Block and move belt to access pulley
- Disconnect gearbox coupling from motor
- Disconnect gearbox coupling from machine
- Remove coupling from machine
- Lift and remove gearbox
- Remove split block housing cap
- Lift and support machine shaft
- Remove and replace bearing
- Replace housing cap
- Reposition gearbox
- Connect gearbox to machine
- Connect gearbox to motor
- Check alignment of motor to gearbox
- Remove machine blocking
- Remove safety lockout/tagout



Split bearing

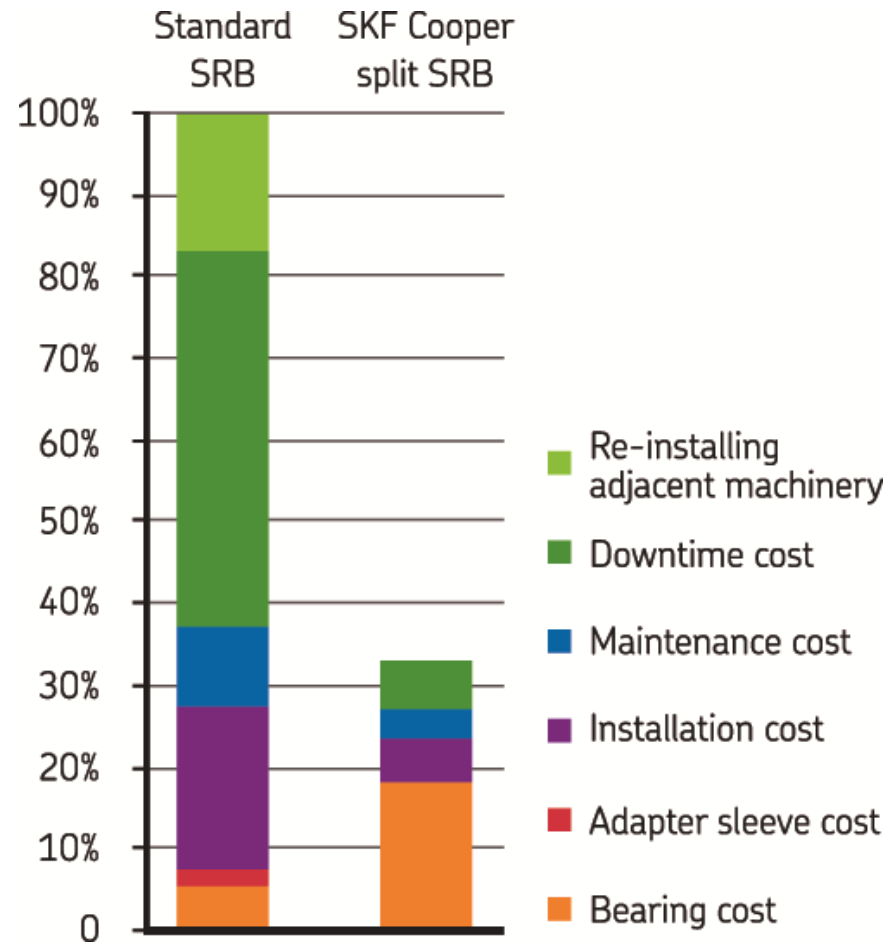
- Safety lockout/tagout
- Block machine (pulley) from rotation
- Remove split block housing cap
- Lift and support machine shaft
- Remove and replace bearing
- Replace housing cap
- Remove machine blocking
- Remove safety lockout/tagout



Far fewer steps with a split bearing!

Procedures

MTTR comparison



8
HOURS TO
REPLACE

SKF Cooper split bearing

Reduced costs with a split bearing:

- Shorter length of production outage (hours)
- Fewer number of workers require to do replacement
- Shorter equipment rental – cranes, alignment tools, etc
- Reduced exposure of workers to accidents

24
HOURS TO
REPLACE

Standard bearing

Reduce safety risks to workers

Solutions that reduce maintenance mean reduced safety risks to workers!

Results of mining industry surveys...

43% of injuries were caused while a worker was performing maintenance or checking a conveyor

24% of fatal mining accidents involved conveyors

Costs of an accident

Direct cost

- Medical costs
- Lost wages
- Higher insurance premiums

Indirect costs

- Lost production
- Clean up time
- Loss of skilled experienced workers
- Training costs for replacement workers
- Paperwork and administration time
- Lower worker morale
- Legal issues and costs
- Product replacement
- Loss of company image



INDIRECT
COSTS CAN BE
5–50
TIMES HIGHER
THAN DIRECT
COSTS!

SKF Cooper bearings have greater shaft clamping

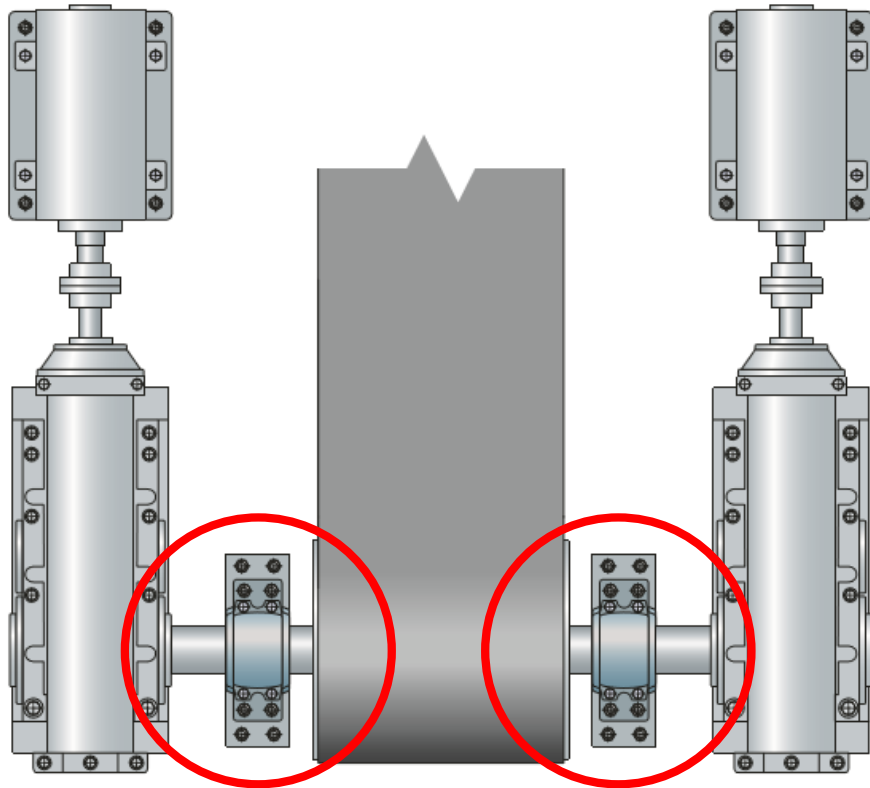
- Better clamping
 - Inner and outer ring ductile steel clamp ring clamp the bearing inner rings to the shaft and hold the outer ring together
- Great axial force without need for additional clamp rings or shoulders
- Less shaft looseness

Shaft diameter, mm	Designation	Permissible axial load*, kN			
		Basic bearing	SKF Cooper (open)	SKF Cooper	FAG
240	23152 K		231S240M	54	32
260	23156 K		231S260M	54	32
280	23160 K		231S280M	98	44
300	23164 K		231S300M	98	44
320	23168 K		231S320M	98	44
340	23172 K		231S340M	98	44
360	23176 K		231S360M	98	44
380	23180 K		231S380M	152	60
400	23184 K		231S400M	152	60
410	23188 K		231S410M	152	
430	23192 K		231S430M	152	
450	23196 K		231S450M	152	

* without inner ring shaft shoulder

Dual drive conveyor pulley

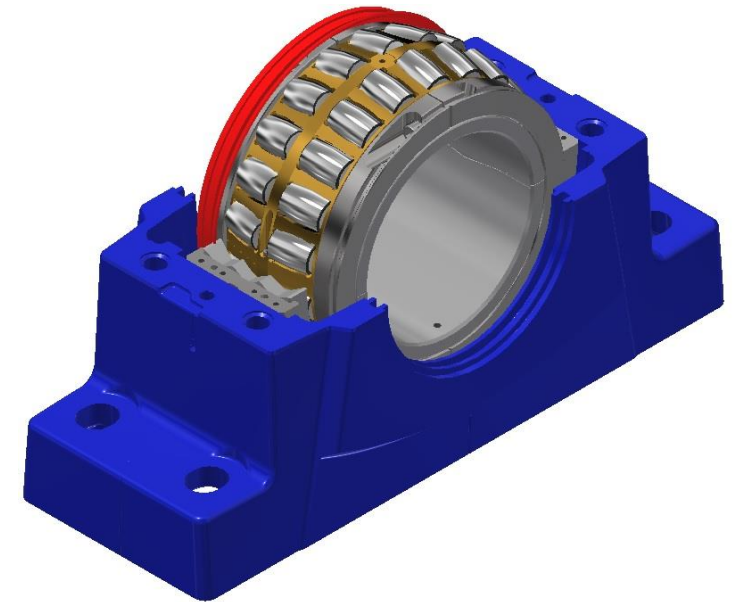
SKF Cooper split bearings especially useful to reduce MTTR



Twice the need to have in situ replacement of trapped bearings

SKF Cooper split spherical roller bearings

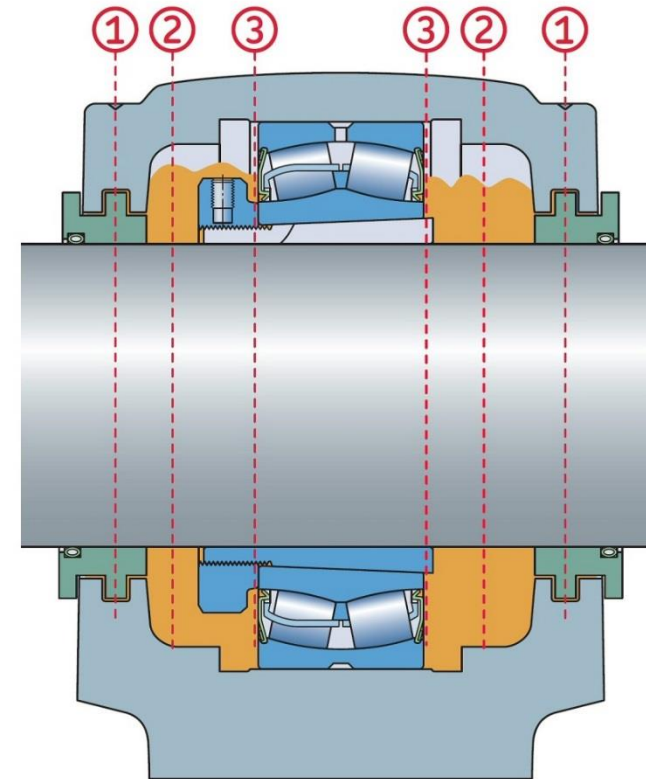
- Replacement for standard 231 series spherical roller bearings
- Fit with SNLD, SMS and SAF / SDAF split block housings
- Allows in situ replacement of bearings
 - No need to disturb shaft alignment, driveline
 - Reduce downtime from days to hours
- Bearing is sealed (optional) for extra protection against contamination – SKF Three-barrier solution
- Bearing has superior fit (clamping) on shaft using steel clamp rings



The SKF Three-barrier solution

Contamination must pass through three barriers to reach the bearing:

- 1st barrier: External housing seal
- 2nd barrier: Housing grease
- 3rd barrier: Sealed SKF Explorer spherical roller bearing

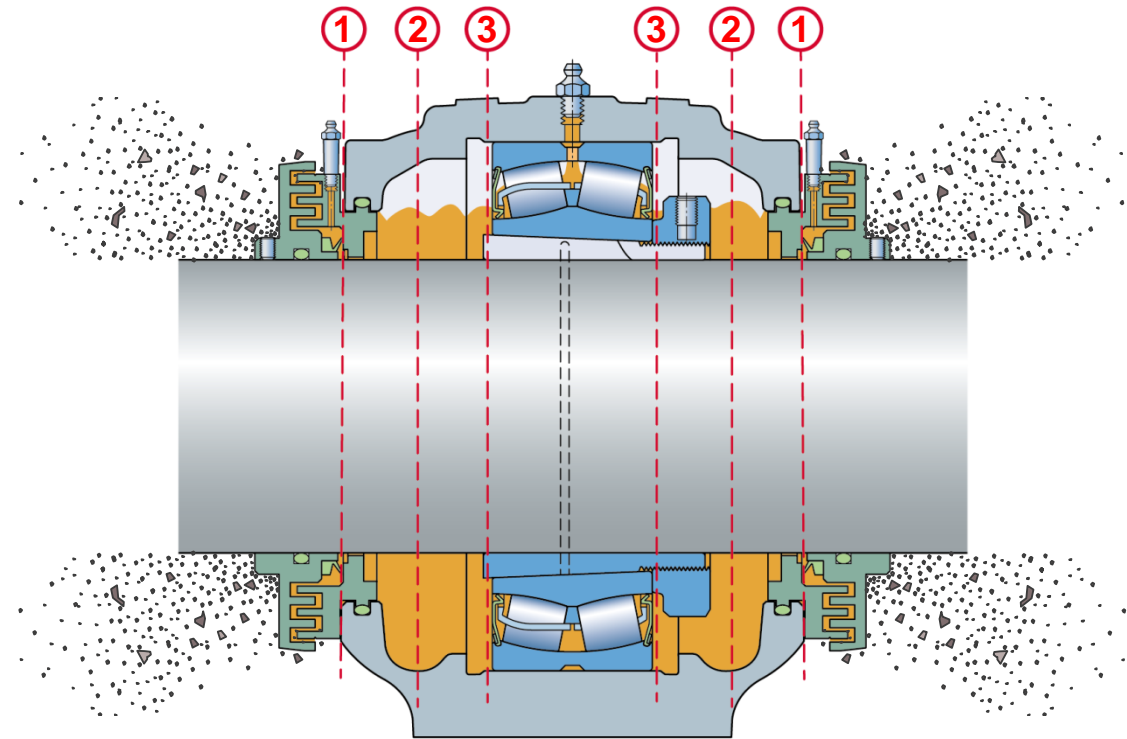


The **ultimate** SKF Three-barrier solution

With SKF Taconite seals

- 1 SKF Taconite seals
- 2 Grease barrier
- 3 Upgraded sealed SKF Explorer spherical roller bearing

3 x improvement in service life
compared to open bearings, even with
high pressure water spray
90% reduction in grease consumption



SKF Three-barrier solution

Combine

Sealed SKF Cooper split spherical roller bearing in the “trapped” position

Sealed SKF Explorer spherical roller bearing in the outboard position

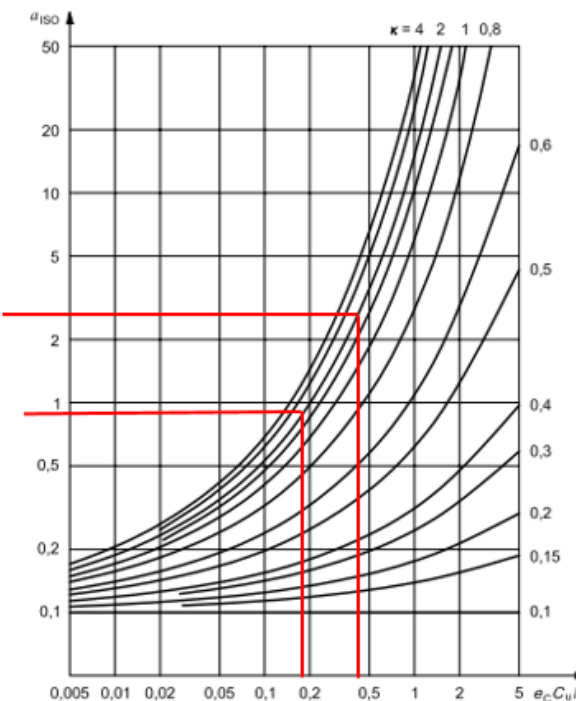
Substantially longer rating life
with a sealed bearing
compared to an open bearing

$$L_{10mh} = a_{ISO} \left(\frac{C_r}{P_r} \right)^{\frac{10}{3}} \frac{1000000}{60n}$$

L_{10mh} modified rating life considering lubrication and contamination according to ISO 281

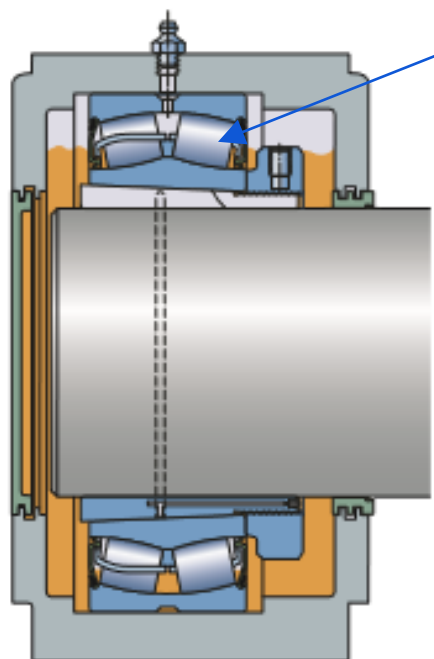
Sealed SKF Cooper

Open SKF Cooper



Recommended arrangement for different positions

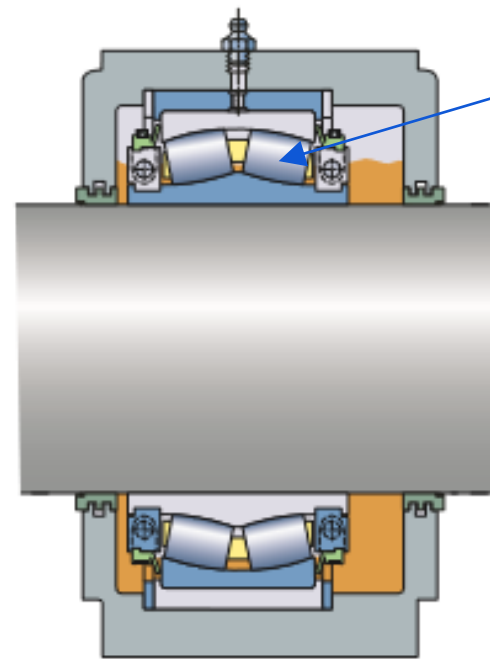
Outboard position



Sealed SKF spherical roller bearing
23164-2CS5K/VT143
OH 3164 H sleeve

SNL 3164 housing
2 x stab rings
TS 64 seal
EPS 64 end cap

“Trapped position”

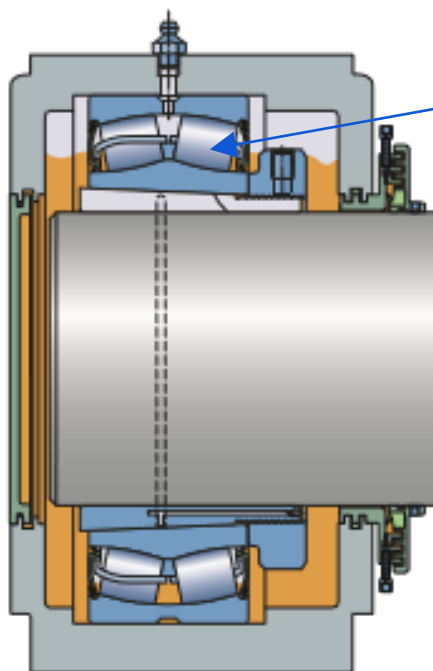


Sealed SKF Cooper split
spherical roller bearing
231S300M-2SRS
LGEP2 grease

SNL 3164 housing
2 x TS 64 seals
2 x FRB 10/540 stab rings
Also available with split housing seals

For severe dirty/wet conditions use SKF taconite seal

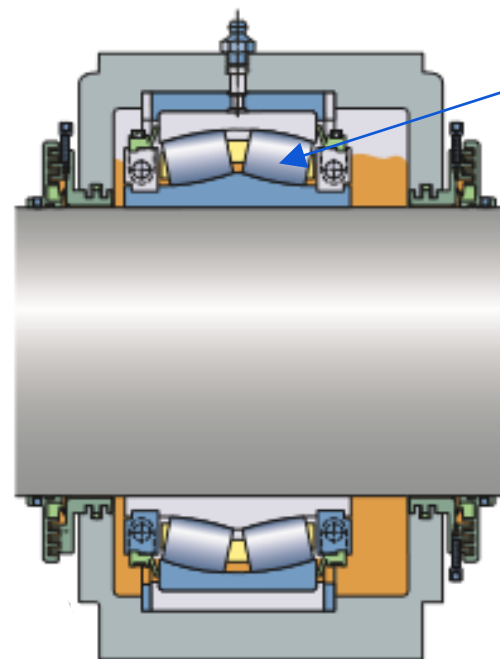
Outboard position



Sealed SKF spherical
roller bearing
23164-2CS5K/VT143
OH 3164 H sleeve

SNL 3164 housing
TK 64 seal
EPS 64 end cap

“Trapped position”

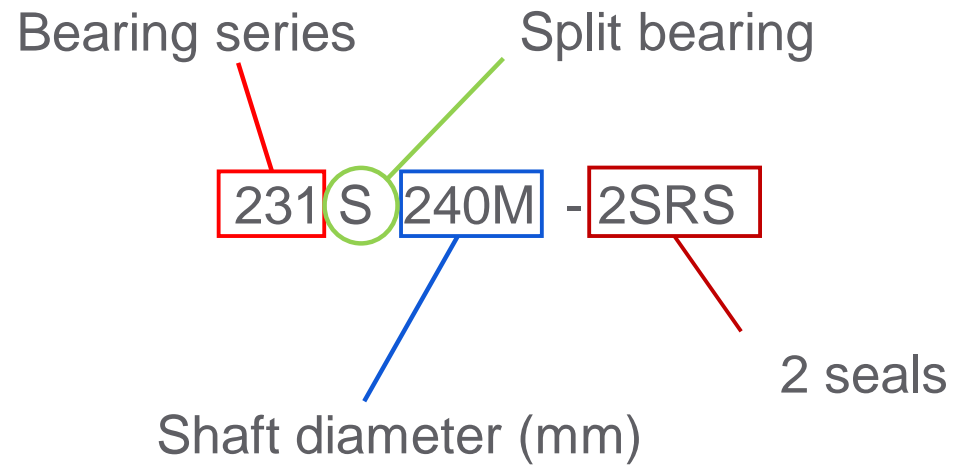


Sealed SKF Cooper split
spherical roller bearing
231S300M-2SRS
LGEP2 grease

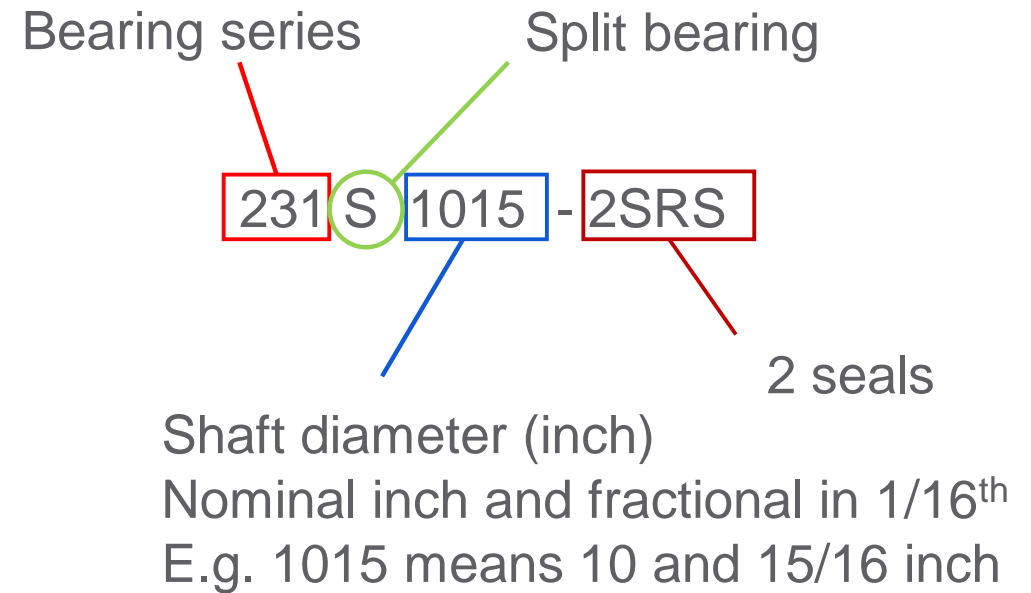
SNL 3164 housing
2 x TK 64 seal
2 x FRB 10/540 stab rings

SKF Cooper split bearing designation

Metric



Inch



Initial size range, mm

Replaces 231 Series bearings and sleeves – shaft diameters 240 to 450 mm

Shaft diameter(mm)	231 series bearing (Tapered bore)	SKF Cooper designation	
		(Open)	(Sealed)
240	23152 K	231S240M	231S240M-2SRS
260	23156 K	231S260M	231S260M-2SRS
280	23160 K	231S280M	231S280M-2SRS
300	23164 K	231S300M	231S300M-2SRS
320	23168 K	231S320M	231S320M-2SRS
340	23172 K	231S340M	231S340M-2SRS
360	23176 K	231S360M	231S360M-2SRS
380	23180 K	231S380M	231S380M-2SRS
400	23184 K	231S400M	231S400M-2SRS
410	23188 K	231S410M	231S410M-2SRS
430	23192 K	231S430M	231S430M-2SRS
450	23196 K	231S450M	231S450M-2SRS

Initial size range, inch

Replaces 231 Series bearings and sleeves – shaft diameters 9.5 to 18 inch

Shaft diameter(inch)	231 series bearing (Tapered bore)	SKF Cooper designation	
		(Open)	(Sealed)
9.5	23152 K	231S908	231S908-2SRS
10	23156 K	231S1000	231S1000-2SRS
10.1/2	23156 K	231S1008	231S1008-2RS2
10.15/16	23160 K	231S1015	231S1015-2SRS
12	23164 K	231S1200	231S1200-2SRS
12.7/16	23168 K	231S1207	231S1207-2SRS
13.7/16	23172 K	231S1307	231S1307-2SRS
13.15/16	23176 K	231S1315	231S1315-2SRS
15	23180 K	231S1500	231S1500-2SRS
15.3/4	23184 K	231S1512	231S1512-2SRS
17	23192 K	231S1700	231S1700-2SRS
18	23196 K	231S1800	231S1800-2SRS

SKF®