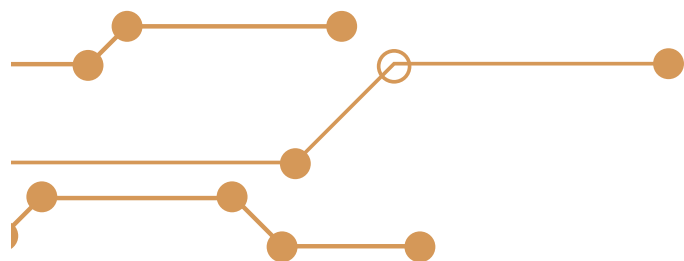




THE BEARING OF THE FUTURE

a study by Kurt and Marc Grunewald



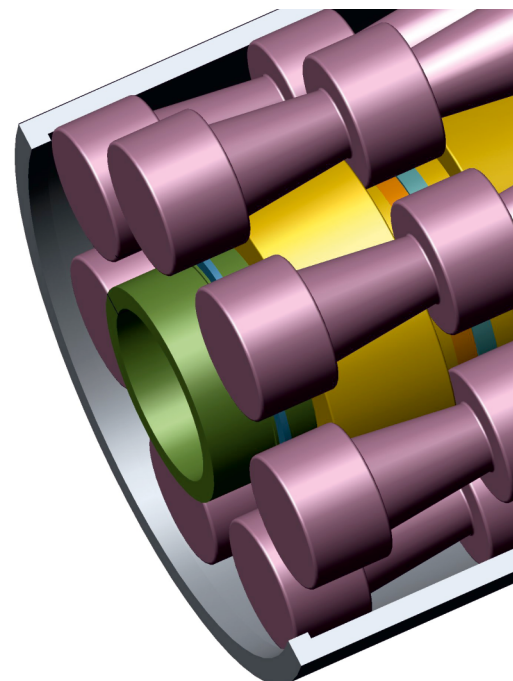
A new family of roller bearings in which the radial play is eliminated, offers a lot of advantages and possibilities in nearly every application field.

Active compensation of variations of temperature, elimination of uncontrolled behavior of the rollers in the radial clearance zone, support of all composing parts of the bearing offering more stability, dimensioning possibilities of the revolution speed of the components of the bearing because of the off set contacts of the rollers on the inner and outer ring, traction possibilities in applications with inertia forces, new strong lay out for reductions, planet gear systems etc...

The rollers of this new technologic bearing are running totally synchronized on the inner and the outer rings. Check out the comparison between actual bearings and the bearing of the future!

THE BEARING OF THE FUTURE

a study by Kurt and Marc Grunewald



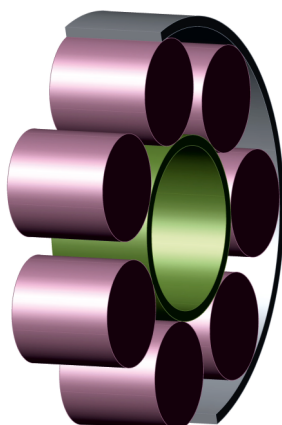
► ACTUAL BEARINGS / ROLLERBEARINGS WITH SLIP AND PLAY PREVENTING MEANS

Concept | GEOMETRY

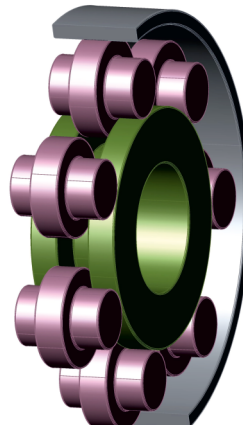
ACTUAL BEARINGS

The roller bearing consists of an inner ring, an outer ring and a plurality of rollers disposed between the outer and the inner ring.

The rollers can be spherical, cylindrical, tapered or toroidally.



Picture 1



Picture 2

SRB NSNP

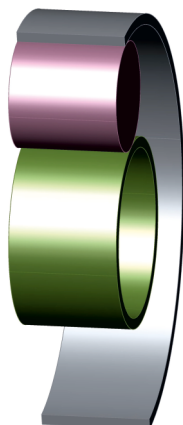
The roller bearing consists of an inner ring, an outer ring and a plurality of rollers disposed between the outer and the inner ring.

The roller has a fragmented shape. The roller makes her contact with the inner ring in a different plane than the plane wherein the contact of the roller with the outer ring is situated. The local radius of the roller in contact with the inner ring differs from the local radius of the roller in contact with the outer ring.

The rollers can comprise different shapes so as spherical, cylindrical, tapered or toroidally surfaces..

ACTUAL BEARINGS

The roller makes her contact with the inner ring and the outer ring in the same plane.



Picture 3



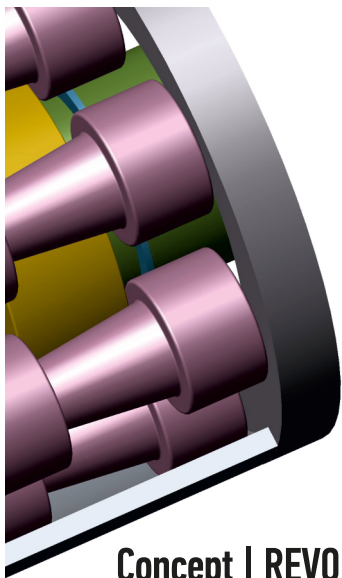
Picture 4

SRB NSNP

Synchronized Roller Bearing No Slip and No Play

The roller makes her contact with the inner ring in a different plane than the plane wherein the contact of the roller with the outer ring is situated.

The outer tracks and the inner tracks are mutually axially offset.

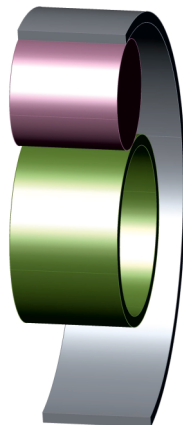


For more information about the Bearing of the Future, Contact:
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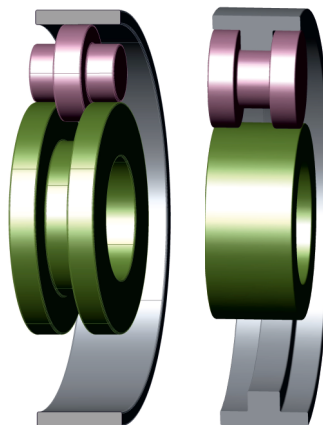
Concept | REVOLUTION SPEEDS

ACTUAL BEARINGS

The ratio of the rotation speed of the roller to the inner and outer ring are determined by the difference in radius of inner and outer ring only.



Picture 5



Picture 6

SRB NSNP

Synchronized Roller Bearing No Slip and No Play

In dimensioning the ratio between the local radius of the roller on the outer ring and the local radius of the roller on the inner ring we can achieve the most optimal rotation speeds of the components. When the inner ring is fixed the local radius of the roller on the inner ring will be smaller compared to this radius on the outer ring offering higher speed limits of the outer ring.

In case of a fixed outer ring we design the bearing with a smaller local radius of the roller on the outer ring than on the inner ring offering highspeed limits of the inner ring.

Concept | GEARING

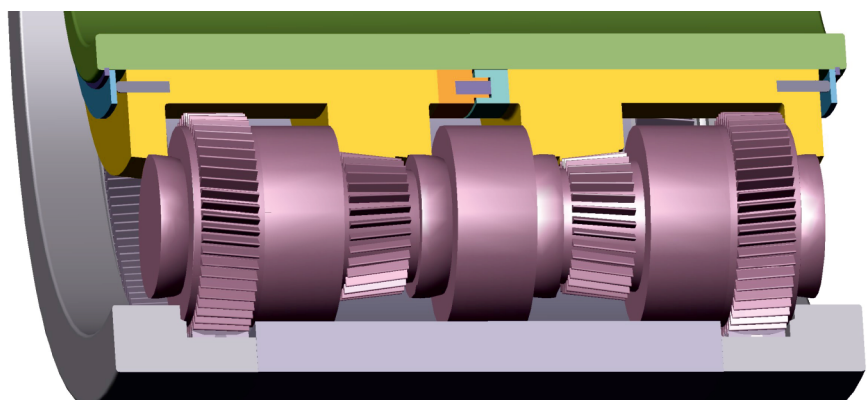
ACTUAL BEARINGS

Because of the radial play toothed pinion on the rollers meshing with a ring gear on the inner or outer track is not obvious and not common.

SRB NSNP

Synchronized Roller Bearing No Slip Inertia and No Play

Elimination of radial clearance offers also gearing possibilities. When the roller bearing is exposed to strong accelerations (positive or negative) the bearing can be equipped with slip preventing means with a toothed pinion on the rollers meshing with a ring gear on the inner or outer track.



Concept | PLAY

ACTUAL BEARINGS

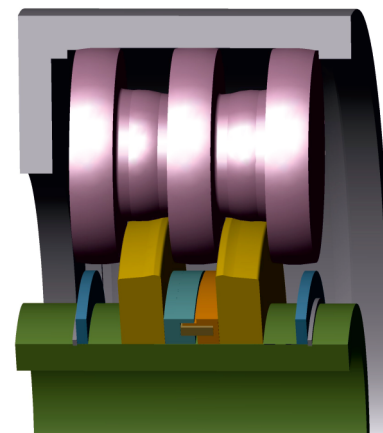
The radial play in most common bearings causes uncontrolled behaviour of the rollers in the clearance zone and parasitic slip.

Temperature fluctuations can decrease this radial clearance causing excessive wear and serious damage to the bearing.

SRB NSNP

Synchronized Roller Bearing No Slip Inertia and No Play

In those bearings means are provided in order to eliminate radial clearance. So the bearing can adapt itself to fluctuations of temperature and radial loads.

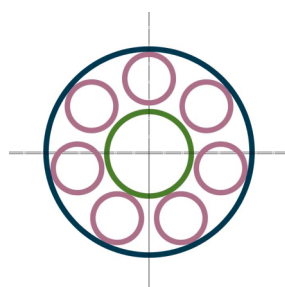


Picture 8

ACTUAL BEARINGS

When radial clearance exists, no matter how small, the outer and inner rings will take up an eccentric position relative to each other, causing not all the rollers being simultaneously in contact with the outer and inner rings of the bearing and causing the radial load of the bearing to be supported by only two rollers.

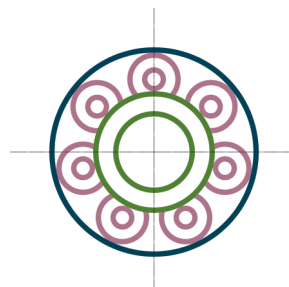
Sometimes they try to create more supporting rollers by a local variation of the diameter of the tracks.



SRB NSNP

Synchronized Roller Bearing No Slip Inertia and No Play

Because the play is completely eliminated the bearing rings are always supported by all the rollers and not only by two rollers.



▶ ADVANTAGES / DISADVANTAGES

Advantages/Disadvantages | ADVANTAGES GEOMETRICAL

ACTUAL BEARINGS

Not relevant.

SRB NSNP

Synchronized Roller Bearing No Slip Inertia and No Play

Design freedom in dimensioning the local diameter of the rollers.

Advantages/Disadvantages | DISADVANTAGES SLIP / GEOMETRICAL

ACTUAL BEARINGS

Less design freedom. The difference in radius between inner and outer ring determines directly the radius of the rollers. Those rollers have to be designed strong enough because the rings are not supported by all of the rollers simultaneously.

SRB NSNP

Synchronized Roller Bearing No Slip Inertia and No Play

Depending on the expected radial loads the diameter of the rollers must be large enough in preventing bending of them which is partially compensated by the supporting aspect of all the rollers simultaneously on both rings.

Advantages/Disadvantages | ADVANTAGES SYNCHRONICITY

ACTUAL BEARINGS

Not relevant.

SRB NSNP Synchronized Roller Bearing No Slip Inertia and No Play

High revolution speed can be achieved.
Big radial loads are possible.
Higher lifetime of the bearing during its use.
Lubrication less critical.

Without play, all rollers move synchronously together and keep their mutual distances apart from each other. Therefore, the need for a cage is not critical as with known bearings to keep the rollers apart for preventing that the rollers get in contact with each other and thus causing frictional losses.

Advantages/Disadvantages | DISADVANTAGES DUE TO A LOCK OF SYNCHRONICITY

ACTUAL BEARINGS

Limited revolution speeds.
Limited radial loads.
Reduced lifetime.
Lubrication is critical.
Cage is critical.

SRB NSNP Synchronized Roller Bearing No Slip Inertia and No Play

Not relevant.

Advantages/Disadvantages | ADVANTAGES DUE TO PLAY ELIMINATION

ACTUAL BEARINGS

Not relevant.

SRB NSNP Synchronized Roller Bearing No Slip Inertia and No Play

Outer and inner ring are perfectly centred to each other and supported by all of the rollers simultaneously. This aspect decreases vibration and increases precision facilities.

Advantages/Disadvantages | DISADVANTAGES DUE TO RADIAL PLAY

ACTUAL BEARINGS

When radial clearance exists, no matter how small, the outer and inner rings will take up an eccentric position relative to each other, causing not all the rollers being simultaneously in contact with the outer and inner rings of the bearing and causing the radial load of the bearing to be supported by only two rollers which have to be stronger dimensioned.
Radial play also causes vibration, shorter lifetime and less precision facilities.

SRB NSNP

Synchronized Roller Bearing No Slip Inertia and No Play

Not relevant.

► DESCRIPTION ROLLER BEARING WITH SLIP AND PLAY PREVENTING MEANS

COMPOSITION

We consider one roller disposed between the inner and outer ring. (see picture 11)

The bearing consists of the parts:

- Outer ring, grey
- Inner ring, green
- Rollers, purple
- Radial play adjusting rings, yellow
- Actuators, one orange, one blue

COMPOSITION OF THE ROLLERS / OFFSET CONTACT ROLLERS

The rollers (purple) consists of parts with a large diameter and parts with a smaller diameter. In case of high speed applications of the outer ring the large diameters (in this case cylindrical) make contact with the outer ring but not with the inner ring and vice versa, the small diameters (in this case light conical) make their contact with the inner ring (yellow) without making any contact with the outer ring.

In case of high speed applications of the inner ring the small diameters (in this case cylindrical) make contact with the outer ring but not with the inner ring and vice versa, the large diameters (in this case light conical) make their contact with the inner ring (yellow) without making any contact with the outer ring.

In determining the ratio of those radius we can define the ratio between the revolution speed of the roller, inner and outer ring depending on the desired effects on the application.

COMPOSITION OF THE ROLLERS / OFFSET CONTACT ROLLERS

The bearing is equipped with one or more conical rings (yellow) that can be shifted axially by means of actuators .

This shifting lift up the rollers which eliminates the radial play.

Depending on the application those rings can be installed on the outer ring (in case of rotation of the inner ring) or on the inner ring (in case of fixed inner ring and rotation of the outer ring).

In order to keep a clear understanding picture we didn't draw the return springs used in combination with one way directed actuators. We also, for demo reasons, show a conical angle that's larger than in practice because the radial play corrections are very small.

ACTUATORS

Active processed actuators can be assisted by measurement sensors in more complex applications.

Depending on the specific application the shifting force of the actuator can be generated by piëzo-elements, temperature controlled insulated expanding rings, pneumatic or hydraulic cylinders.

ADVANTAGES SUMMARY

- Design freedom geometrical
- A lot of different materials like synthetics are possible
- Higher lifetime of the bearing during its use
- Less frictional losses of energy
- No parasitic slip
- Gearing implementation possible
- High revolution speed can be achieved.
- Big radial loads possible
- No radial play
- High precision
- Much reduced vibrations
- Applications for conducting electrical current possible
- Outer and inner ring are perfectly centred
- All rollers are supported by the inner and outer ring
- Lubrication less critical
- Cage less critical
- Monitoring possibilities

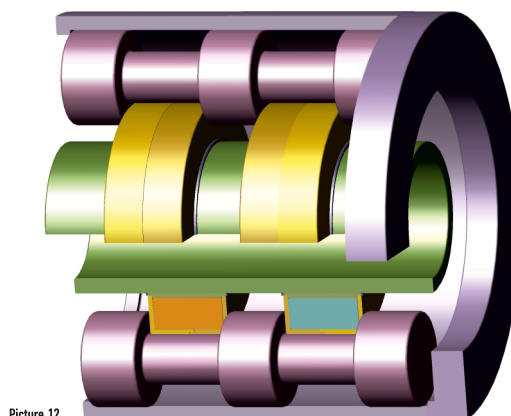
SENSORS

Active processed actuators are assisted by one or more sensors measuring the play in the roller bearing for compensating this. (see patent)

► RADIAL OPERATING CLEARANCE COMPENSATION

In claim 8 of the patent another method for eliminating radial clearance is explained by warming up or cooling inner or outer ring in order to expand or to shrink in function of the measurement of the radial clearance by one or more sensors. In those bearings the rollers have also an offset lay out in their contacts on the inner or outer ring of the bearing. There is also a possibility to implement a gearing system in it.

Those bearings are able to support high radial loads in an environment with temperature fluctuations like in steel or glass industry.



Picture 12

► REDUCTIONS / DIFFERENTIALS WITH INTEGRATED ROLLER BEARING FUNCTION

Those bearings equipped with radial play compensation and off set rollers act like planet gear systems which can be applied as reductions or differentials.

Only the axle in the sun gear has to be supported by the housing and thus planet gear and sun gear are also supported on each other.

This makes the design less complex with more freedom.

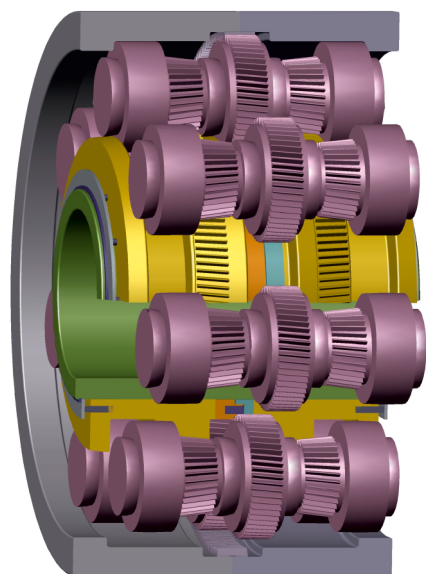
There is no more need for concentric supported axles.

The outgoing axle connected to the outer gear of the annulus has not to support the outer ring.

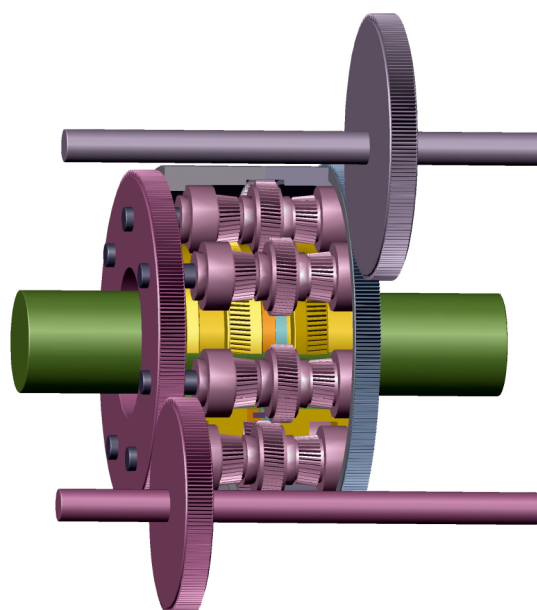
Also the planet gear can be directly supported by the shafts of the rollers without any need to support it by the housing.

You only need to have a hole in this wheel to let the sun axle pass.

An outgoing shaft can be connected on this planet gear by another gearwheel on this shaft.



Picture 14



Picture 13

► TECHNICAL DEVELOPMENT RANGE PROTECTED BY THE PATENT

Based on the claims of the patent a wide range of roller bearings, reductions and differentials for a lot of applications can be developed for exclusive use.

- Geometrical design freedom: the number of alternating contact points on the inner and outer ring
- Geometrical design freedom in dimensioning the local radius of the rollers
- The roller can contain different local contact shapes: spherical, cylindrical, toroidally, tapered
- Freedom in dimensioning the diameters of the rollers, inner ring or outer ring
- Wide range of different materials possible
- Gearing between the rollers and inner ring possible
- Gearing between the rollers and the outer ring possible
- Gearing between the rollers and both rings possible
- Radial operated radial play compensation on the inner or outer ring
- Axial operated radial play compensation on the inner or outer ring
- Actuators, piëzo, temperature, pneumatic, hydraulic controlled
- Sensors, placed on inner or outer ring
- Different type of sensors possible, depending on the specific application

► APPLICATION FIELDS ROLLER BEARING WITH SLIP AND PLAY PREVENTING MEALS

ELECTRIC MOTORS

- Less radial play and vibrations results in a more precisely dimensioned air gap between stator and rotor. Increased efficiency.
- Higher lifetime of the bearing at the traction side of the motor, especially in cases of traction with belts causing higher radial loads.
- Much reduced vibrations.
- Servo motors with dynamic behaviour (variation of rpm) have to cope with inertia forces on the rollers and can be equipped with a gearing in the bearing.

WIND TURBINES

- The propeller shaft : SRBNSNP combined with a thrust bearing will increase lifetime and reduce maintenance cost.
- Integrated sensors offering monitoring possibilities and better maintenance efficiency.
- Less radial play and vibrations results in a more precisely dimensioned air gap between stator and rotor of the generator.
- Increased efficiency.

STEAM TURBINES

- Less radial play and vibrations results in a more precisely dimensioned gap between turbine and its housing. Increased efficiency.
- Higher lifetime of the bearing and reduced maintenance cost.
- Higher lifetime of shaft seals
- Temperature fluctuation compensation of radial play
- Monitoring aspect possible / better maintenance efficiency.

MEASURING MACHINES

- Less play on the axles
- Less vibration
- Higher precision standards (resolution, tolerances)
- Longer lifetime / reliability

AIRCRAFT AND HELICOPTER TURBINES

- Less radial play and vibrations results in a more precisely dimensioned gap between turbine and its housing. Increased efficiency.
- Higher lifetime of the bearing and reduced maintenance cost.
- Temperature fluctuation compensation of radial play
- Monitoring aspect possible/ better maintenance efficiency.

HYDRO TURBINES

- Less radial play and vibrations results in a more precisely dimensioned gap between turbine and its housing. Increased efficiency.
- Higher lifetime of the bearing and reduced maintenance cost.
- Higher lifetime of shaft seals
- Monitoring aspect possible/ better maintenance efficiency.

PAPER MILLS

- Longer lifetime of bearings used in press waltz, calender rolls (high radial loads).
- Longer lifetime of shaft seals of suction rolls and steam rolls.
- Temperature fluctuation compensation of radial play
- Monitoring aspect possible / better maintenance efficiency.

MACHINING: DRILLING, TURNING, DRIFTING, GRINDING

- - Less vibration
- - Higher precision standards (resolution, tolerances)
- - Longer lifetime / reliability

OPEN END SPINNING MACHINES

- - Alternative for air bearings, used for the rotors
- - Less energy waste (compressed air)

ROTATIVE PUMPS

- Less radial play and vibrations results in a more precisely dimensioned gap between propeller, gear (gear pumps) and its housing. Increased efficiency.
- Higher lifetime of the bearing and reduced maintenance cost.
- Higher lifetime of shaft seals
- Temperature fluctuation compensation of radial play
- Monitoring aspect possible / better maintenance efficiency.

CENTRIFUGAL COMPRESSORS

- Less radial play and vibrations results in a more precisely dimensioned gap between propeller, gear, screw and its housing.
- Increased efficiency.
- Higher lifetime of the bearing and reduced maintenance cost.
- Higher lifetime of shaft seals
- Temperature fluctuation compensation of radial play
- Monitoring aspect possible / better maintenance efficiency.

MARINE / SUBMARINES

- Less vibrations of the propeller, less risk to be detected (sub marines) by sonar
- Higher lifetime of shaft seal of the propeller
- Monitoring aspect possible / better maintenance efficiency.

ROTATIVE THERMIC ENGINES

- For Wankel, rotary vane (toroidal) engines
- Better efficiency
- Better sealing (between toroidal piston, rotor, axles and housing)
- Longer lifetime / reliability
- Temperature fluctuation compensation of radial play
- Monitoring aspect possible / better maintenance efficiency
- Less vibrations

OPEN END SPINNING MACHINES

- Alternative for air bearings, used for the rotors
- Less energy waste (compressed air)

AMUSEMENT PARK (TROLLEYS, THRILL RIDES, FERRIS WHEELS...)

- Less play on the axles
- Less vibration
- Higher precision standards
- Less wear of the gearing
- Longer lifetime / reliability
- Better shaft sealing
- Monitoring aspect possible / better maintenance efficiency.
- Conducting electrical current possible (pantographs with slip free drive unit for contact on the upper wiring)

ELEVATORS / CABLE CARS

- Less play on the axles
- Less vibration
- Higher precision standards
- Less wear of the gearing
- Longer lifetime / reliability
- Better shaft sealing
- Monitoring aspect possible / better maintenance efficiency.
- Conducting electrical current possible (pantographs with slip free drive unit for contact on the upper wiring)

ROBOTS

- Less vibration
- Higher precision standards (resolution, tolerances)
- Longer lifetime / reliability
- Geared bearings to control inertia forces
- Better shaft sealing

CENTRIFUGES (NUCLEAR, SEPARATORS, LAB, DOMESTIC USE)

- Higher revolution speed
- Less vibrations
- Longer lifetime / reliability

POINTING SYSTEMS (LASER, RADAR, TELESCOPE, WEAPON...)

- Less play on the axles
- Less vibration
- Higher precision standards (resolution, tolerances)
- Longer lifetime / reliability

GEARBOXES / REDUCTORS/ PLANETGEARS

- Less play on the axles
- Less vibration
- Higher precision standards
- Less wear of the gearing
- Longer lifetime / reliability
- Better shaft sealing
- Simple design opportunities

TRAINS

- Less play on the axles
- Less vibration
- Higher precision standards
- Less wear of the gearing
- Longer lifetime / reliability
- Better shaft sealing
- Monitoring aspect possible / better maintenance efficiency.
- Conducting electrical current possible (pantographs with slip free drive unit for contact on the upper wiring)

HEAVY DUTY, CRANES, MANIPULATING, MINING MACHINES, BOAT LIFTS...

- Sustainable to high radial loads
- Less play on the axles
- Less vibration
- Higher precision standards
- Less wear of the gearing
- Longer lifetime / reliability
- Better shaft sealing
- Monitoring aspect possible / better maintenance efficiency.
- Conducting electrical current possible (pantographs with slip free drive unit for contact on the upper wiring)

For 40 years JESA has been offering tailored and customized solutions for tough challenges! Today the company is known as “The Specialist” in tailored bespoke solutions, containing ball bearings, machine parts and stampings, often in combination with engineering polymers.





The Perfect Bond Between Bearings And Plastic

