NSK QUICKSTOP BEARINGS

ULTRA-HIGH ROTATION SPEEDS, ULTRA-LOW STOP TIMES

DELIVERING SUPERIOR HANDPIECE PERFORMANCE AND RESPONSE

NSK air turbine bearings offer extremely accurate revolution with minimized vibration at astounding speeds - eclipsing 400,000 rpm - to provide safe and comfortable dental treatment.

With our QuickStop bearings, NSK augments handpiece performance and patient experience with an integrated brake ring that optimizes stop time and provides a barrier to contaminant ingress.

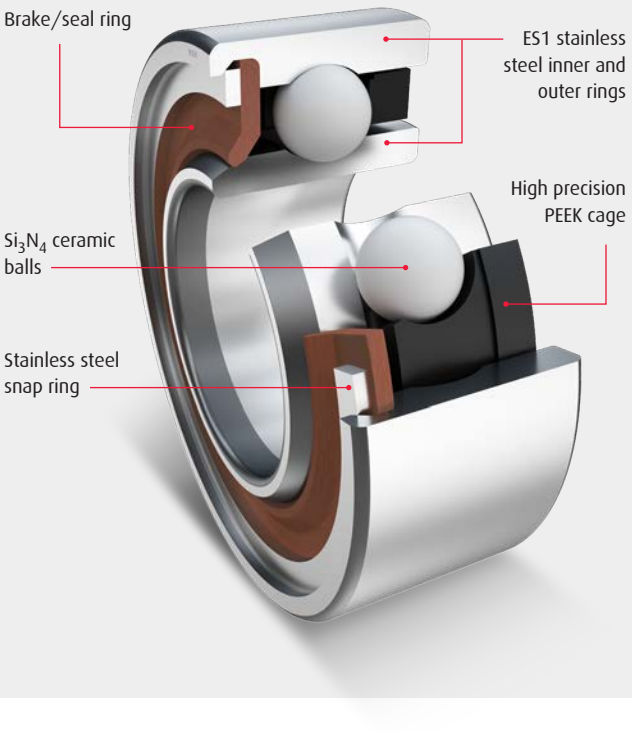
OPERATING ADVANTAGES

- Outstanding stopping time response - allowing for more precise and fluent procedures with less risk of injury
- Turnkey handling - compact, drop-in design solution with integrated braking and sealing requiring no additional components or assembly
- Contamination resistance - with prevention of debris “suckback”, mitigating bacteria growth within the bearing and upstream internal handpiece parts
- Long-life performance - with NSK’s ES1 stainless steel delivering 10 times higher corrosion resistance than conventional SUS440C stainless steel bearings under constant exposure to disinfectant and sterilization

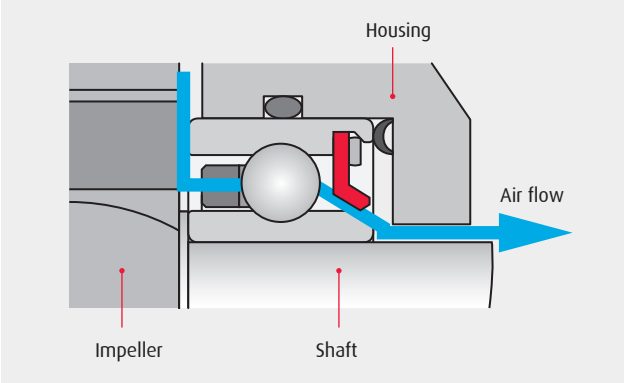
CONTACT NSK

DESIGN FEATURES

- Innovative integrated brake / seal ring - delivering superior handpiece stop time response, as well as contaminant "suck back" prevention
- NSK exclusive ES1 stainless steel inner and outer rings - with long-life corrosion resistance, dramatically exceeding that of conventional stainless steel
- Silicon nitride (Si_3N_4) ceramic balls - for outstanding speed and accuracy with low heat generation and high resistance to seizing
- High precision PEEK cage - for stable ultra-high speed operation, as high as 400,000 rpm
- Available in single row deep groove and angular contact ball bearing designs
- Dimensionally equivalent to conventional dental handpiece bearing design types



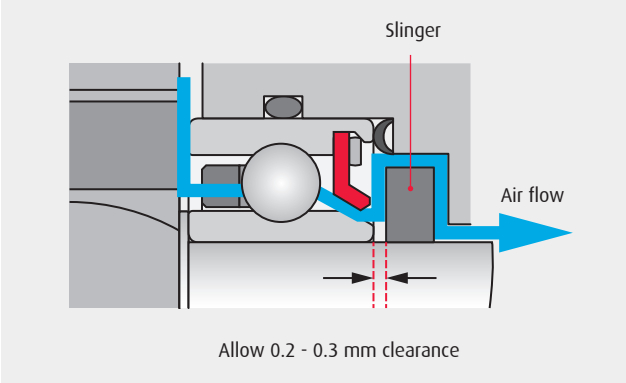
BEARING MOUNTING AND HANDLING



Recommended installation / advantages

- Airflow can exit the turbine undisturbed

Note: The air amount passing and discharging through one bearing should be less than 10 *l*/min. Please contact NSK engineering if it exceeds 10 *l*/min.



Slinger installation / observations

- Exiting airflow is redirected
- For optimal performance, adequate clearance between bearing and slinger must be observed

INTEGRATED FUNCTIONALITY: SUPERIOR BRAKING WITH SUCK-BACK PREVENTION

With NSK's QuickStop bearings, a braking / sealing ring is integrated within the bearing structure on its outboard side. At standstill, the braking ring contacts the bearing inner ring and applies a brakeforce to the bearing (see Stage 1).

At start up, continuous and clean air flows through bearing and creates pressure against the inner side of the braking ring. The pressure difference inside / outside the ring leads to elastic deformation of the brake lip, opening the contact zone and creating an escape channel for the continuous air flow (see Stage 2).

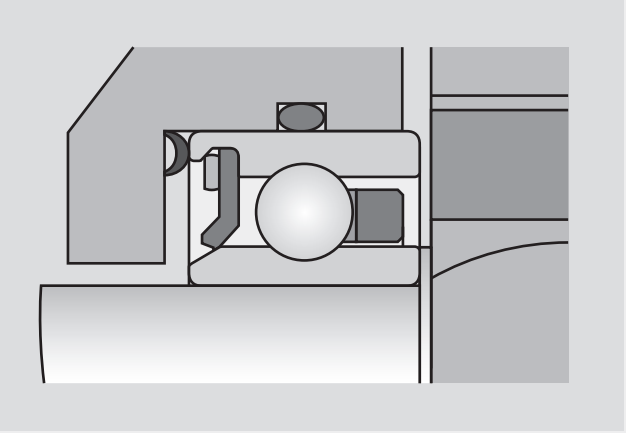
After power shut off (where airflow = 0), the braking / seal lip assumes its original state of contact with the bearing inner ring, acting as both stopping brake and contact seal. No contaminated air can be sucked back into the air turbine upstream of the QuickStop seals (see Stage 3).

BRAKING PERFORMANCE:

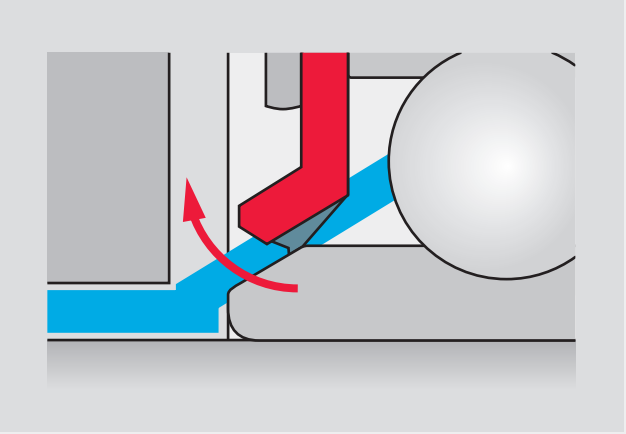
Effective braking can be achieved with a single NSK QuickStop bearing. However installing sets is recommended to achieve optimal results.

SUCK-BACK PREVENTION:

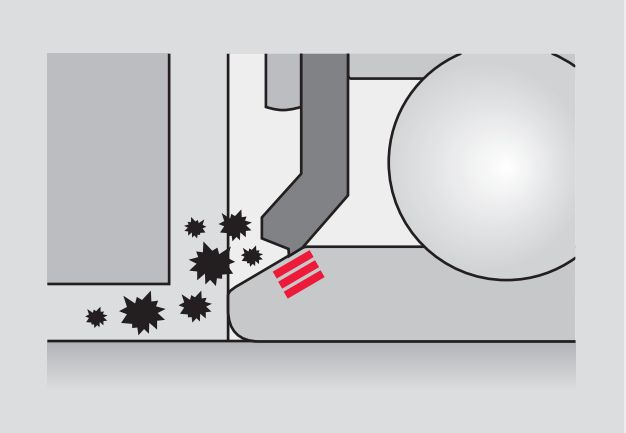
Using a set of NSK QuickStop bearings mitigates contamination and bacteria growth within the bearing as well as upstream internal handpiece components. As such, handpiece sterilization is simplified with potential for reduction in the use of chemicals.



Stage 1: Autoclaved
The braking ring applies a brakeforce to the bearing inner ring



Stage 2: Start-up / airflow
Pressure creates elastic deformation of the brake lip and opens the contact zone, creating an escape channel for the continuous air flow



Stage 3: Shut off / suck-back prevention
The braking / seal lip assumes its original state, acting as a stopping brake and a contact seal against contaminant ingress

SUPERIOR STOP TIME

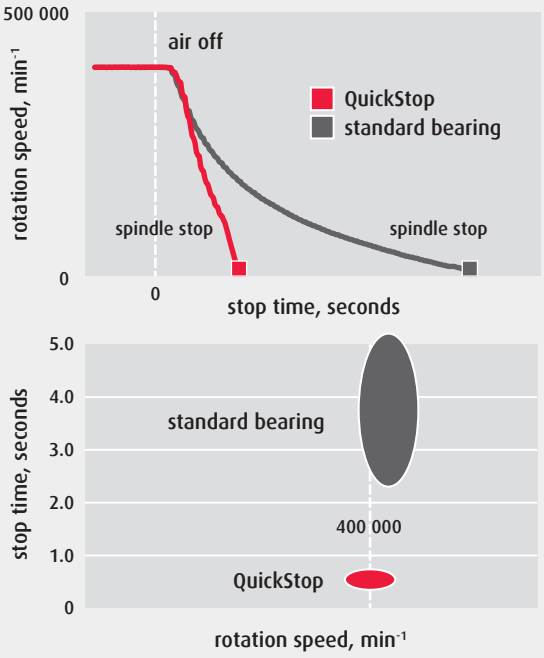
Achievable stop times among handpieces may vary depending on the handpiece's head size, its internal design and the rotational speed at the moment of air shut off. In testing to evaluate stop time performance NSK neutralized handpiece design influence, selecting standard off-the-shelf turbines and modifying them with a set of NSK QuickStop bearings.

With NSK QuickStop bearings, stop time was reduced to 0.7 seconds or less compared to approximately 3.0 seconds for the handpiece equipped with standard bearings (Figure 1).

Test conditions:

- Off-the-shelf industrial turbine v. off-the-shelf industrial turbine modified
- Bearings in modified turbine: 1 set of corresponding NSK QuickStop bearings (2 pieces)
- Input air to turbine: 0.2 ~ 0.25 MPa, 30 ~ 40 *l* / min
- Discharged air flow from turbine head: 5 ~ 20 *l* / min

Fig. 1: Stop time performance testing



ENDURING PERFORMANCE

QuickStop bearings are field-proven with our customers and under rigorous NSK testing. A standard off-the-shelf industrial turbine equipped with a set of QuickStop bearings was subjected to NSK's 1 Million Cycle endurance test. Over the duration of evaluation, neither achievable maximum speed nor stop time performance demonstrated appreciable deterioration (Figure 2).

Test conditions:

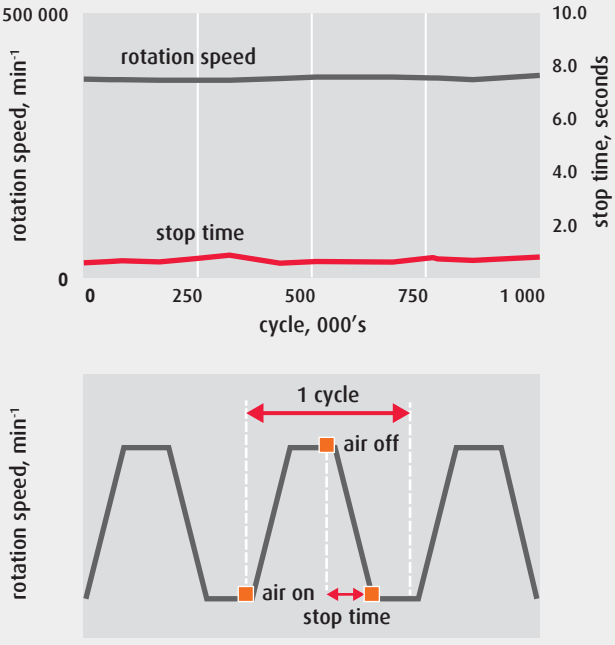
- Off-the-shelf industrial turbine modified
- Bearings: 1 set of NSK QuickStop B3Z-77 (2 pieces)
- Preload: 3 - 5 N
- Lubricant: Oil *
- Relubrication interval: 30 min.
- Test duration: 1 million cycles

Measurements every 100k cycles:

- Stop time
- Rotation speed

* This product cannot be used with lubricants containing ester oil

Fig. 2: Endurance testing



WITHSTANDING HARSH OPERATING CONDITIONS

In testing that replicated the severity and the impact of sterilization in autoclaves, NSK QuickStop bearings demonstrated undeterred performance with consistently high rotational speed and ultra-low stop time (Figure 3).

Test conditions:

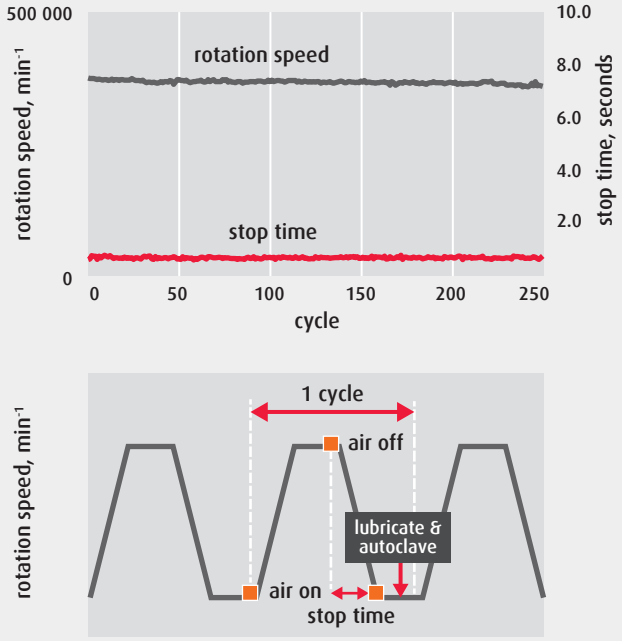
› Off-the-shelf industrial turbine modified
› Bearings: 1 set of NSK QuickStop B3Z-77 (2 pieces)
› Preload: 3 - 5 N
› Lubricant: Oil *
› Relubrication interval: 1 cycle
› Test duration: 250 cycles
› Autoclave Class B

Measurements every cycle:

› Stop time › Rotation speed

* This product cannot be used with lubricants containing ester oil

Fig. 3: Autoclave testing



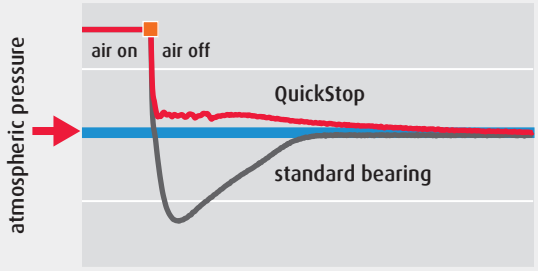
MITIGATING HANDPIECE CONTAMINATION

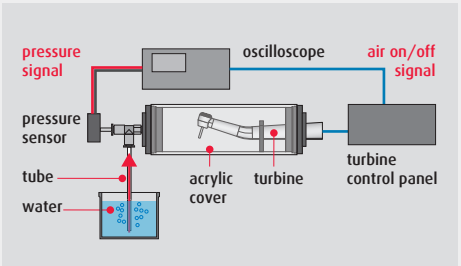
In testing replicating conditions surrounding suck-back occurrence, an idling turbine equipped with standard bearings created an underpressure that would equate to contaminated water and saliva, tooth and burr debris being sucked into the handpiece (Figure 4). When equipped with NSK QuickStop bearings, no such underpressure was experienced in the acrylic cover and no water was sucked up the tube. With pressure maintained at or above atmospheric pressure after shut off, no fluid or particle contamination is sucked back into the handpiece.

Test conditions:

› Off-the-shelf industrial turbine v. off-the-shelf industrial turbine modified
› Bearings in modified turbine: 1 set of corresponding NSK QuickStop bearings (2 pieces)
› Preload: 3 - 5 N

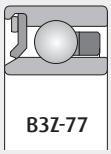
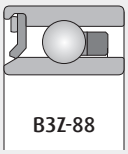
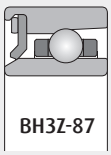
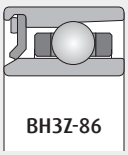
Fig. 4: Suck-back performance testing

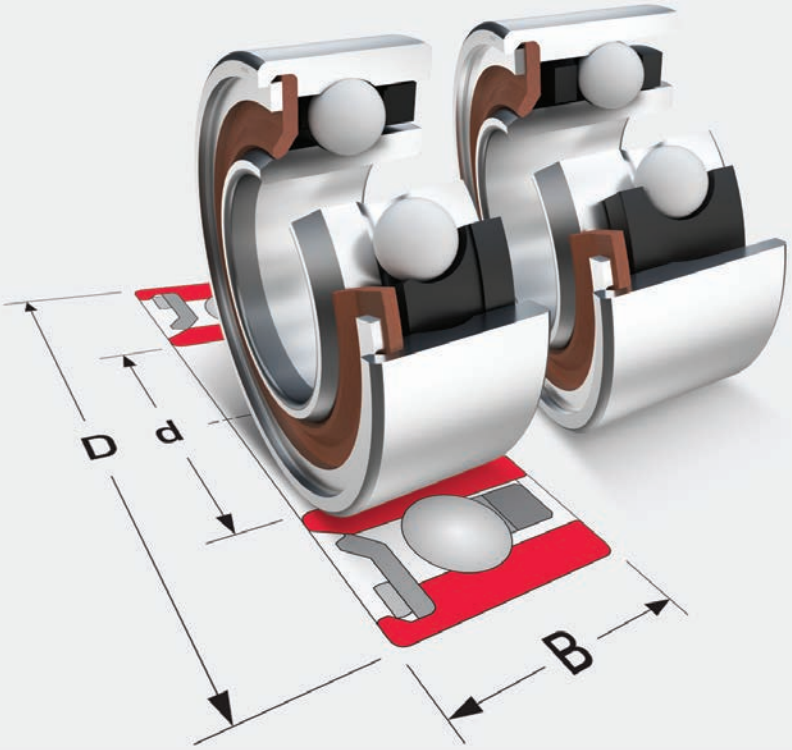




Above: suck-back test rig configuration

BEARING TYPES AND DIMENSIONS

Deep groove ball bearings	 B3Z-77	 B3Z-88
Bore diameter (d)	3.175 mm / 0.125 in	3.175 mm / 0.125 in
Outside diameter (D)	6.350 mm / 0.250 in	6.350 mm / 0.250 in
Width (B)	2.380 mm / 0.094 in	2.779 mm / 0.109 in
Angular contact ball bearings	 BH3Z-87	 BH3Z-86
Bore diameter (d)	3.175 mm / 0.125 in	3.175 mm / 0.125 in
Outside diameter (D)	6.350 mm / 0.250 in	6.350 mm / 0.250 in
Width (B)	2.380 mm / 0.094 in	2.779 mm / 0.109 in



NSK QuickStop bearings are dimensionally equivalent to conventional dental handpiece bearing design types.

Learn more about NSK rolling bearings, linear motion components and integrated system solutions for life sciences.

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