

NSK PUMP TOUGH™ EP-UR PUMP BEARING

Centrifugal pumps are the most common industrial pumps in the world and come in a variety of configurations and sizes. The bearing system permits the shaft to rotate freely while minimizing mechanical loss.

Centrifugal Pump Design

The pump design typically consists of two or three bearings and a cantilevered impeller configuration. The inboard side (non-drive end) bearing supports part of the radial load caused by the cantilevered impeller and is able to float axially to allow for thermal expansion of the shaft. The outboard side (drive end) bearing also supports the radial load, but it is fixed to minimize the axial shaft movement to maintain an acceptable clearance between the impeller and housing. In order for these bearings to continuously perform their function, it is important to know application parameters of load, speed, environment and how they commonly fail to assure reliability.

There are many causes for bearing failure. The most common causes for bearing failure are contamination, poor lubrication, excessive wear, excessive loading and bearing damage prior to operation caused during assembly or handling.

The Ultimate Pump Bearing Platform

NSK is a world leader in the development of superior ultra clean steels & specialized heat treatments for bearing rings and rolling elements. We continue that tradition with the latest technological offering – NSK Pump Tough™ EP-UR Pump Bearings.

NSK's combination of high purity EP Steel and advanced UR heat treatment technology for pump bearing applications dramatically extends the fatigue life of a conventional process pump bearing.

Industry's need to extend pump life to reduce unplanned maintenance and operational costs drove NSK Research and Development teams to develop the ultimate process pump bearing platform. NSK's Pump



Tough™ Bearing steel technology significantly increases bearing rolling fatigue life far beyond conventional calculated life.

NSK Pump Tough™ Bearings directly replace existing process pump bearings with no design change or re-machining of the housing. NSK's Pump Tough™ Bearing was developed with technological advances to the bearing cage providing improved lubrication with contoured ball pockets and a thicker, high strength steel cage design. NSK's cage handles harsh and adverse conditions such as heavy alternating loads and contaminated or thin film lubrication that pumps are exposed to.

With ISO P6/ ABEC 3 precision tolerances as standard, NSK's Pump Tough™ Bearing features state-of-the-art geometric ring and rolling element design. This delivers stable, smooth operation, reduces potential ball skidding from transient/alternating or no load conditions. Bearing installation is improved with NSK's new chamfer geometry.

NSK's application specific, pump bearing testing, with NSK's Pump Tough™ Bearings delivered up to 5 times the conventional pump bearing fatigue life in a harshly contaminated environment.

Characteristics Of Superior Bearings

- ➔ High purity steel
- ➔ Advanced heat treatment
- ➔ High wear resistance & rolling contact fatigue life
- ➔ Advanced geometry with optimized contact angle and clearance to reduce skidding
- ➔ Advanced cage design for improved lubrication & strength

NSK's Research & Development inspiration for NSK Pump Tough™ Bearings came from application experience from the most severe, high pressure, harsh industrial applications such as the steel, paper and refining industries.

EP-UR Pump Bearing Features

High Purity EP Steel

Contaminants found in steel include silicon, aluminum and sulfur. When combined with oxygen, they form inclusions detrimental to bearing fatigue life. NSK developed EP Steel technology and worked with steel manufacturers to produce steel that has extremely low inclusion levels. NSK EP Steel with revolutionary, high purity homogenous properties significantly extends subsurface fatigue life.

Advanced UR Heat Treatment

Heat treating increases steel's resistance to wear and provides greater life. For bearings this wear resistance helps to prolong life under adverse conditions. NSK's advanced UR heat treatment technology significantly extends surface fatigue characteristics beyond conventional heat treatments, particularly in harshly contaminated environments

Wear Resistance

NSK combined EP Steel & UR heat treatment as part of the DNA for the Pump Tough™ Bearing's superior wear resistance, creating a formidable material foundation. Rolling fatigue life far beyond conventional calculated life is realized with NSK's Pump Tough™ Bearings.

Advanced Geometry and 40° Contact Angle

NSK's Pump Tough™ Bearing is manufactured with ISO P6/ ABEC 3 precision tolerances and 40 degree contact angles for higher axial stiffness. Extensive research and development efforts produced a state-of-the-art geometric ring and rolling element design for NSK's Pump Tough™ Bearings to deliver stable, smooth operation and minimize potential for ball skidding under transient/alternating or no load conditions. NSK's EP-UR Bearings external geometry was shaped to improve bearing installation with an advanced lead in radius.

Advanced Cage Design for Improved Lubrication & Strength

Improved lubrication is realized with contoured ball pockets of a thicker, high strength, advanced steel cage design that handles harsh and adverse conditions, heavy alternating loads, and contaminated or thin film lubrication.

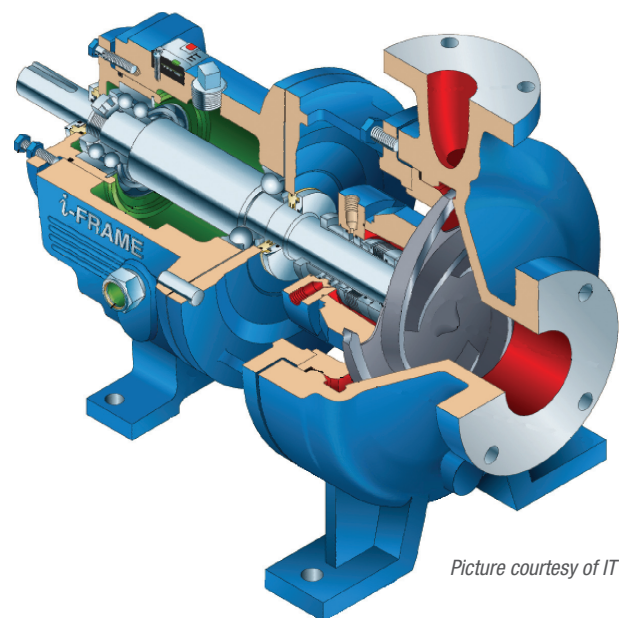


➔ Typical Formed Cage



➔ Superior Formed Cage

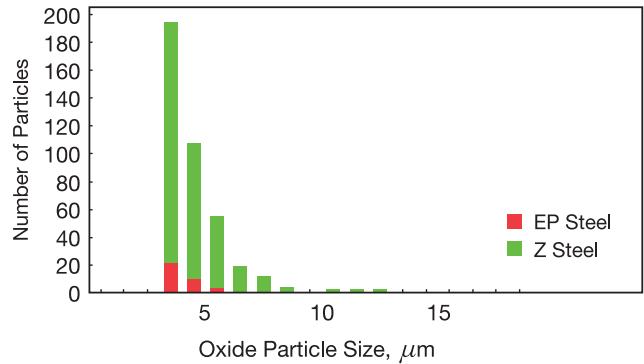
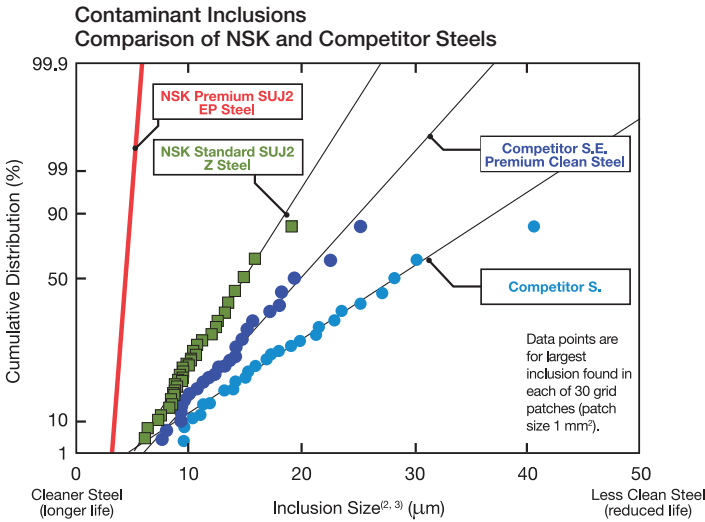
NSK's Pump Tough™ Bearing technology delivers superior wear resistance and extend fatigue life beyond typical theoretical principles. Geometrical advances increase axial load capability, stiffness and assures smooth reliable operation in the most severe conditions. The advanced robust cage design ensures superior lubrication of NSK's Pump Tough™ Bearing.



Picture courtesy of ITT Goulds

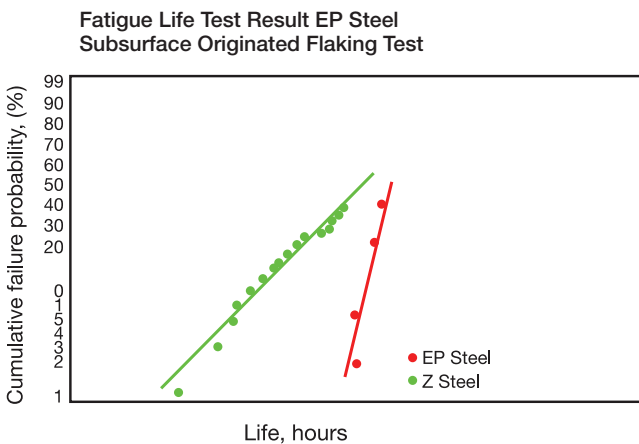
- ➔ NSK's Pump Tough™ Bearings significantly extend pump life in the toughest environments.

CHART A | Steel Purity Comparison Through Image Analysis

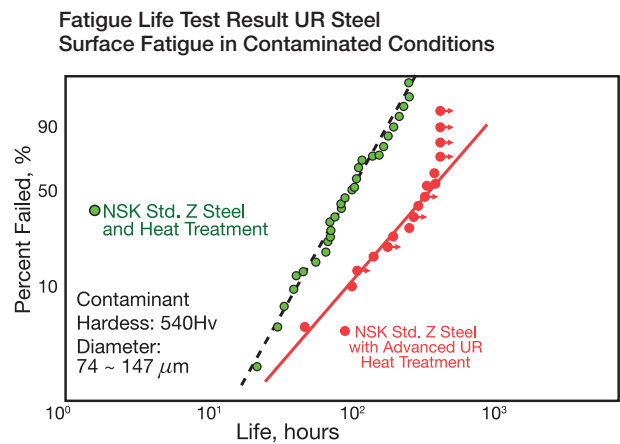


- ➔ Rolling fatigue life of bearing steel is significantly affected by non-metallic inclusions.
- ➔ Life tests show that non-metallic inclusions negatively affect rolling fatigue life.
- ➔ NSK established the ISD2 Method, an image analysis system and special steel making procedure for steel manufacturing that significantly improves purity and reduces non-metallic inclusions.

CHART B | Improved Life With Steel Cleanliness and Advanced Heat



EP Steel Fatigue Life is 2 to 4 times more than Standard NSK Z Steel

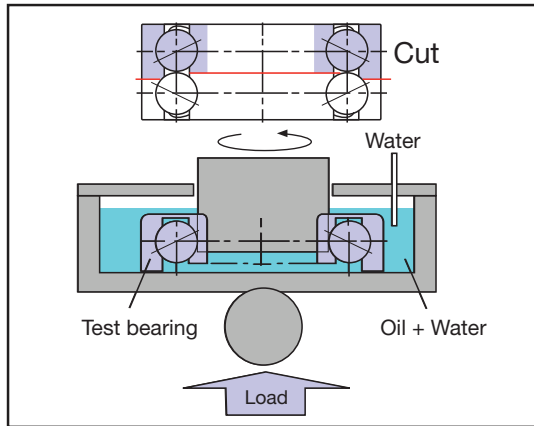


UR Heat Treatment Fatigue Life is more than 2 times that of Conventional Steel Heat Treatment

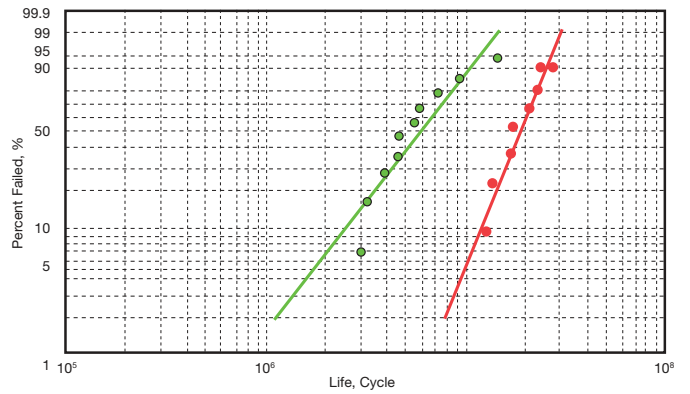
CHART C | NSK Pump Tough™ EP-UR Pump Bearing Performance Testing

Application Specific Pump Bearing Fatigue Life Test

Lubricant Mixed with H2O
3309 Test Bearing

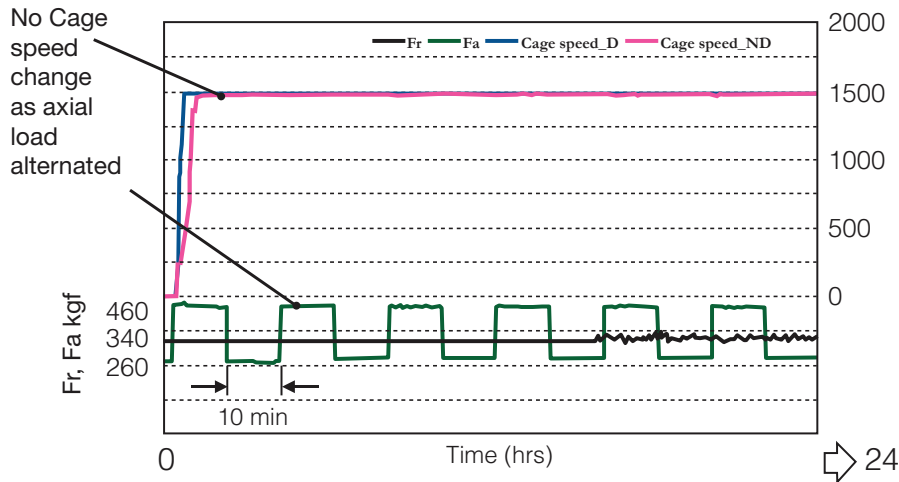


Infiltrated water: 30 ml / 24 hrs (30%)
Contact surface pressure: 321 kg/mm²
Rotation speed: 1000 min⁻¹



- **High Purity Homogeneous Steel with Advanced Heat Treatment** : 4.9
- **High Quality Clean Steel and Heat Treatment** : 1

Skidding Test EP3309UR 40 degree contact angle



No ball skidding from transient, alternating or no load conditions