

# NSK

## NSK TOUGH STEEL BEARINGS

LONGER LIFE IN HEAVY INDUSTRIES

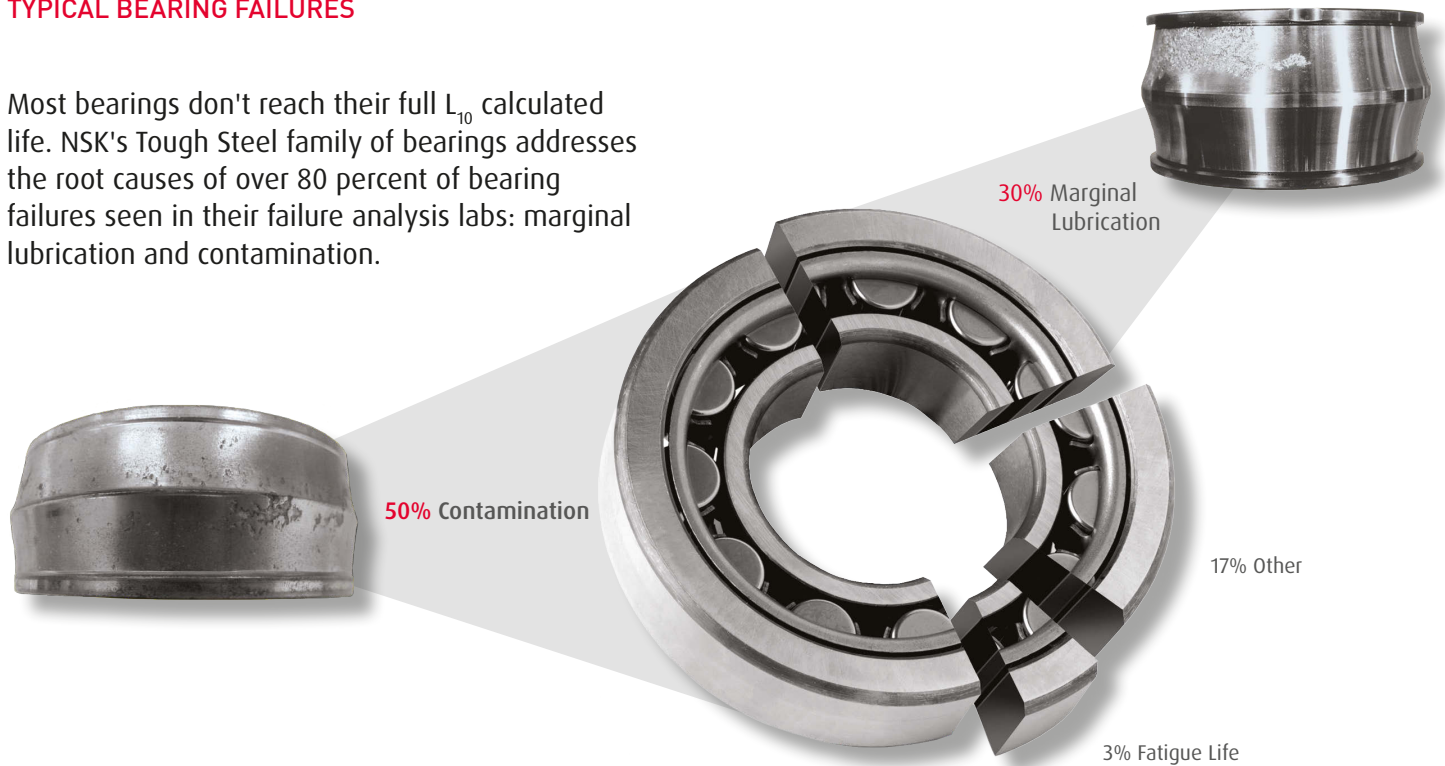


STAY IN MOTION. STAY IN CONTROL.

# TOUGH STEEL: BACKGROUND AND DEVELOPMENT

## TYPICAL BEARING FAILURES

Most bearings don't reach their full  $L_{10}$  calculated life. NSK's Tough Steel family of bearings addresses the root causes of over 80 percent of bearing failures seen in their failure analysis labs: marginal lubrication and contamination.



## NSK MATERIAL RESEARCH AND DEVELOPMENT

NSK's concept of long life in contaminated environments is unique in the bearing industry. NSK's research has enabled it to be the first to recognize the relationship between the retained austenite and rolling fatigue life in contaminated environments.

### Applicable Environments:

- > Contamination
- > Marginal Lubrication
- > Clean Conditions

### Applicable Industries:

- > Mining
- > Cement
- > Steel Mills
- > Paper Mills
- > Wind Turbines
- > Other heavy industries

### Properties of Steel Specification and Innovative Heat Treatment:

- > Higher level of retained austenite (see Figure 1)
  - Increased toughness = Lower stress concentration around dents
- > Large number of fine carbides and carbo-nitrides (see Figure 2)
  - Higher hardness = Longer life in contamination
  - High wear resistance
  - High seizure resistance
  - Better than through hardened and traditional case carburized materials

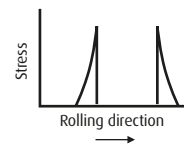
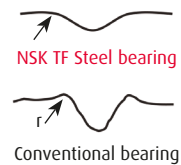
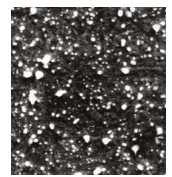
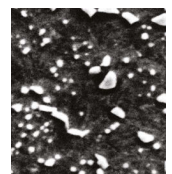


Figure 1



TF Carbides



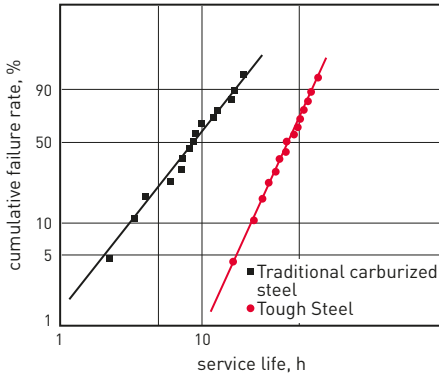
Standard Steel Carbides

Figure 2

## LAB TESTING

The following lab tests show that Tough Steel outlasts carburized and through hardened steel under many different conditions.

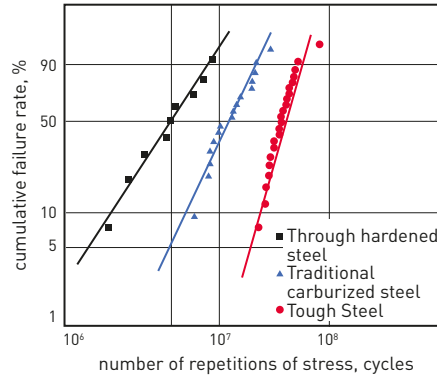
Service life of L446649/10 bearings under **contaminated** lubrication conditions



Test conditions:  
 P/C=0.43, Oil bath  
 Speed: 4000 min<sup>-1</sup>  
 Debris: Hardness HV870  
 Size 74 to 147mm  
 Amount 150 ppm

**7x life over carburized steel**

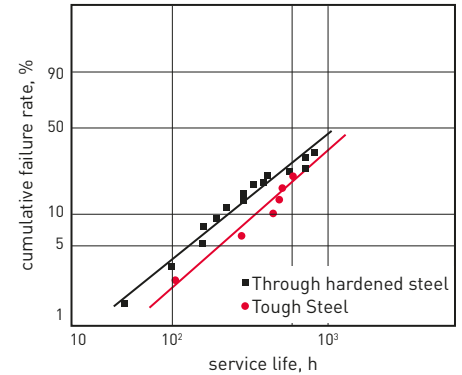
Service life tests of 6206 bearings under **marginal** lubrication conditions



Test conditions:  
 Pmax: 4400 MPa  
 Oil bath,  $\lambda=0.3$   
 Speed: 7800 min<sup>-1</sup>

**4.7x life over carburized steel**

Service life tests of 6206 bearings under **clean** lubrication conditions



Test conditions:  
 P/C=0.71, Oil bath  
 Speed: 3900 min<sup>-1</sup>

**1.5x life over through hardened steel**

## SUCCESS STORIES

### Mining Conveyor Pulley Spherical Roller Bearing

**Issue:** Bearing failures due to contamination on head pulley were causing lost production and increased maintenance time

**Solution:** NSK Tough Steel bearings extended the bearing life to over 6 years (from 18 months)

**Documented Cost Savings:**  
**\$5,050,880**

### Cement Slurry Pump Angular Contact Ball Bearing

**Issue:** A cement plant was experiencing premature bearing failures due to contamination in their slurry pumps

**Solution:** NSK HTF Tough Steel bearings extended the bearing life to over 1 year (from 2-3 months)

**Documented Cost Savings:**  
**\$56,176**

### Steel Cold Rolling Mill Tapered Roller Bearing

**Issue:** Contamination entering the bearings was causing debris denting resulting in premature bearing failures

**Solution:** NSK STF bearings reduced annual usage from 24 to 11 bearings

**Documented Cost Savings:**  
**\$119,600**



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