NSK’s High-Tough Steel (HTF) and Super Tough Steel (STF) series bearings are designed to deliver outstanding durability in contaminated operating environments. Utilizing advanced material engineering and heat treatment technology, they perform with superior resistance to wear, seizure and heat. NSK Tough Steel series bearings provide dramatically longer service life, reduce total maintenance costs from unplanned downtime and improve machinery and equipment output.

PROVEN BENEFITS

› As much as ten times the service life with contaminated lubrication conditions
› Up to four times the service life at 160°C
› Less than one-third the rate of wear
› As much as 40% improvement in seizure resistance

CONDITIONS:

- HL: HIGH LOADS
- CO: CONTAMINATION
- HT: HIGH TEMPERATURE
- LU: LUBRICATION STRESS
- W: WEAR
**Design Features**

- Advanced material composition containing appropriate levels of chrome and molybdenum for increased hardness
- Innovative and patented heat treatment technology to optimize retained austenite and formation of finer carbide and carbonitride particles
- Significantly outperforms standard bearing steel in seizure resistance, rate of wear and service life
- HTF / STF technology can be applied to a wide range of bearing types, in conventional or special designs:
  - Spherical roller bearings
  - Cylindrical roller bearings
  - Tapered roller bearings
  - Deep groove ball bearings
  - Angular contact ball bearings

**Applications**

- Gearbox / gear drives
- Paper machinery
- Mining machinery
- Steel machinery
- Wind turbines

**Tough Steel Approach to Longer Service Life**

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**Approach**

- Heat Treatment
- Toughness / Carburization
- Control of retained austenite

**Solution**

- Hi-TF
- Super-TF

In service life testing conducted under contaminated lubrication conditions, Hi-TF and Super-TF bearings offered over seven times and ten times respectively the $L^{10}$ life of ordinary carburized steel bearings.

In Fig. 1, we observe the sequence of events leading to flaking in contaminated environments:

- **Stage 1**: Dented by foreign debris contamination
- **Stage 2**: Stress concentration around debris dents develop into cracks
- **Stage 3**: Cracks propagate under the load of each passing roller and develop into flaking

Fig. 2 compares the service life ratios of Hi-TF, Super-TF, and ordinary carburized steel under contaminated lubrication conditions.