

## COMPARISON DATA AND TEST RESULTS

Rigorous testing measures how each coating type compares in relation to corrosion resistance, hardness and friction. Each Timken coating is uniquely adapted to the needs and operating conditions of the application.

### CORROSION TESTING<sup>(1)</sup>

#### Polarization and Tafel curves

Corrosion resistance compared to uncoated baseline product:

Baseline	1
TDC	67x
AquaSpexx	10x
Zinc Phosphate	6x
ES200	1.4x
ES300	2.3x
ES302	1.9x

<sup>(1)</sup> Testing performed 3.5% NaCl, with Pt (counter electrode, Ag/AgCl<sub>2</sub> ref electrode, Tafel curve +/- 200 mv). The data is based on Zmod (ohm-cm<sup>2</sup>).

### NANO HARDNESS/ELASTIC MODULUS DATA

A high H/E ratio implies the coating is hard and tough. A low H/E ratio implies the coating is hard and brittle.

#### H/E Ratio

Baseline	3 x 10 <sup>-2</sup>
Zinc Phosphate	2 x 10 <sup>-2</sup>
Black Oxide	4 x 10 <sup>-2</sup>
AquaSpexx	3 x 10 <sup>-2</sup>
TDC	4 x 10 <sup>-2</sup>
ES200	10 x 10 <sup>-2</sup>
ES300	9 x 10 <sup>-2</sup>
ES302	9 x 10 <sup>-2</sup>

### FRICTION COEFFICIENT<sup>(2)</sup>

Baseline	>0.6
ES200	0.26 ± 0.01
ES302	0.29 ± 0.02
Zinc Phosphate	0.17 ± 0.01
Black Oxide	0.51 ± 0.04
TDC	0.49 ± 0.06
AquaSpexx	0.72 ± 0.12

<sup>(2)</sup> Dry (unlubricated), 200 m distance, 100 mm/s rotation speed, 2N load, 6.35 mm uncoated 52100 ball, 4 mm scar radius.

## MAKING A DIFFERENCE.

Find out how Timken coatings add value to your business.

Our custom surface treatment technology solutions combat wear and improve component durability to save you time and money.

Contact your Timken sales representative today.

## TIMKEN

The Timken team applies their know-how to improve the reliability and performance of machinery in diverse markets worldwide. The company designs, makes and markets high-performance mechanical components, including bearings, belts, brakes, clutches, chain, couplings, gears and related mechanical power transmission products and services.

Stronger. By Design.

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# TIMKEN® COATINGS.

CHOICE.  
CONVENIENCE.  
PERFORMANCE.

Extend product life and reduce downtime.

From corrosion resistance to wear protection, surface treatment helps limit bearing and component damage in a diverse range of applications.

Timken coatings meet the high standards for quality and performance that you expect from Timken and our expert tribology team.

Simplify your supply chain process and improve your bottom line with a single source supplier for products and coatings.

### 10 COATING OPTIONS FOR DIVERSE APPLICATIONS:

- Agriculture • Automotive • Cement • Civil Aerospace
- Commercial Vehicles • Construction • Defense • Energy
- Food and Beverage • Industrial Equipment & Machinery
- Metals • Mining • Outdoor Power Equipment • Rail

## TIMKEN

## PVD COATINGS

Benefit from superior wear resistance and friction reduction with the industry-leading line of PVD (Physical Vapor Deposition) hard coatings that won the Engineering Materials Achievement Award from ASM International. These PVD coatings are deposited at temperatures between 150-160°C and designed to operate at temperatures up to 220°C.



### ES200

This coating provides the lowest friction, particularly in moderately loaded sliding applications and has been successfully applied on roller ends for anti-wear applications.



### ES300

- This coating is commonly applied on roller ends.
- For oil out conditions, bearings coated with ES300 last approximately 10 times longer than those with uncoated rollers.
- ES300 coatings prevent approximately half the fretting wear damage of raceway surfaces when compared to an uncoated component.



### ES302

- A specially engineered nanostructure coating designed to provide maximum durability.
- Laboratory tests have shown 6x life improvement under standard conditions and 3x improvement under debris contaminated conditions, when compared with an uncoated bearing.

## ELECTRODEPOSITED COATINGS

Electrodeposited coatings provide outstanding corrosion resistance and wear protection for a wide range of applications.



### AQUASPEXX®

- **ASTM B117 Salt Spray Test:**  
Less than 0.03% surface rusted for 1000 hours test period per ASTM D610-08.



### THIN DENSE CHROME (TDC)

- **Deposition temperature:**  
50-60° C
- **ASTM B117 Salt Spray Test:**  
Less than 0.01% surface rusted for 1000 hours test period per ASTM D610-08.

## TIMKEN COATING PORTFOLIO

Coating	PRODUCT INFORMATION				PROCESS INFORMATION			
	Product	Surface	Key Features	Application	Technique	Coating Thickness (nominal value)	Chemistry	Nano-hardness (GPa)
ES200	Tapered roller bearings, cross (XR) roller bearings	Roller ends	Oil out, adhesive wear mitigation	Aerospace, off-highway, wind	Reactive Physical Vapor Deposition	1-2 µm	TiC/a-C:H	12 ± 1
ES300	Tapered roller bearings, pump shaft	Roller ends, sliding surfaces	Wear resistance, oil out, adhesive wear mitigation	Aerospace, fuel injector pins, automatic transmission pumps	Reactive Physical Vapor Deposition	2-3 µm	WC/a-C:H	12.5 ± 0.8
ES302	Cylindrical roller bearings, tapered roller bearings, thrust bearings	Roller body and ends	Wear resistance, debris resistance, oil out	Wind, oil and gas, mining trucks, gudgeons, axle pinions, pump drives	Reactive Physical Vapor Deposition	1-2 µm	WC/a-C:H	13 +/- 1.5
AquaSpexx®	Tapered roller bearings	Inner and outer rings (all surfaces)	Corrosion, fretting, and galling resistance	Boat trailer bearings, rolling mills, circuit breakers	Electrodeposition	8-10 µm	Zn-Ni	4.4 ± 0.3
Thin Dense Chrome (TDC)	Tapered roller bearings, spherical roller bearings, Survivor™ series ball bearing housed units and wide inner ring ball bearing, inner ring bores, housed units	Inner and outer rings (all surfaces)	Corrosion and wear resistance	Conveyors, ovens, fans, blowers, aerospace	Electrodeposition	1-1.5 µm	Cr	9.5 ± 2
Black Oxide	Cylindrical roller bearings, spherical roller bearings, tapered roller bearings	Inner and outer rings and rollers (all surfaces)	Retains lubricant and increases smear-resistance especially during run-in periods	Wind, industrial, aerospace	Alkaline bath	1-2 µm	Fe <sub>3</sub> O <sub>4</sub>	2.6 ±0.1
Zinc Phosphate	Tapered roller bearings, backing rings, end caps, seal cases	Inner and outer rings, auxiliary components (all surfaces)	Lubrication during fitting; corrosion, galling and wear resistance	Rail	Phosphate bath	1-2 µm	Zn-Phosphate	2.6 ±1.1
E-Coat	Timken® Type E tapered roller bearing housed unit, rail ancillary components, backing rings	Auxiliary components (all surfaces)	Corrosion resistance	Used on all Type E housings	Cathodic epoxy	15-20 µm	Epoxy	N/A
Powder Coat	Housings for ball housed units (Timken® Fafnir® and U series), Timken® spherical roller bearing solid block housed units (excludes bearing surface)	Cast iron housing surface, steel locking collars	Corrosion resistance	Conveyors, ovens, fans, blowers	Electro-static powder coating	90-100 µm	Epoxy mixed with ceramic	N/A
Dielectric Coat	TS/TSF outer ring O.D., ball bearings, cylindrical roller bearings	O.D. surfaces in contact with housings and shafts	Electric insulation	Rail traction motors, electric motor and generator bearings	Plasma spray	220-280 µm	Alumina based dielectric coat	N/A

## SURFACE CONVERSIONS

Conversion coatings combine exceptional wear and corrosion resistance with an ability to withstand false brinelling.



### BLACK OXIDE

Conforming to standard DIN 50938, this treatment provides a surface that retains lubricant and improves smear-resistance, especially during run-in.



### ZINC PHOSPHATE

- **Enhances corrosion resistance**  
Assists breaking-in of bearing surface

## SPRAY COATINGS

Mainly applied to resist corrosion, dielectric coating also inhibits electric arcing.



### E-COAT

- **Available options**  
Cathodic epoxy  
Cathodic epoxy with top coat  
Cathodic epoxy with acrylic coating



### POWDER COAT

- **Enhances appearance and corrosion resistance**  
Applied on housed units, steel castings, rigid compression coupling and quick flex slow speed split covers.



### DIELECTRIC COAT

- **Insulation Resistance:**  
> 50MΩ (at 1000V (DC))