

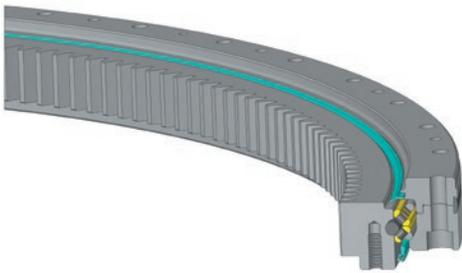
# Section 5 Contents

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# Custom WireX® Wire-Race Bearings

Kaydon WireX® bearings were originally designed for military turret applications, where space and weight are at a premium and corrosion resistance is essential. They consist of wire raceways inserted in lightweight support rings, allowing for a high load capacity and large diameter in a bearing that can be 60% lighter than one made entirely of steel.



## Design Features

The bearing's support rings are typically aluminum, with contoured grooves for supporting, positioning, and alignment of steel wire raceways. The rolling elements are typically stainless steel, with up to three rows of rollers to fit individual requirements. This internal configuration allows WireX® bearings to be more tolerant of non-rigid and out-of-flat mounting structures. Irregularities can be accommodated by the relative movement of the wire inserts in their supporting grooves.

Gear teeth or other drive mechanisms can be provided on the inner or outer support ring, and a variety of hole patterns can be added for bearing retention.

WireX® bearings can often be rebuilt – a substantial savings when compared to complete bearing replacement.

## Availability

WireX® bearings are custom manufactured to fit your design and specification.

## Applications

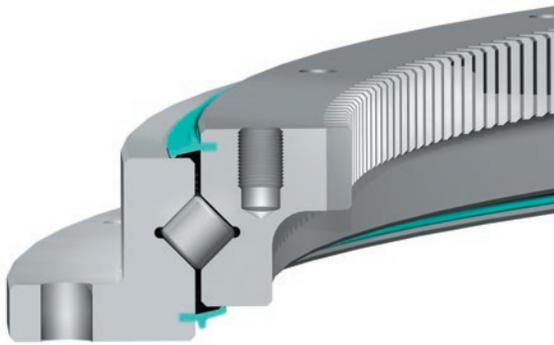
WireX® bearings have been used successfully in applications requiring a lightweight, corrosion-resistant bearing including:

- Turrets
- Radar
- Sonar

# Custom Bearing Capabilities

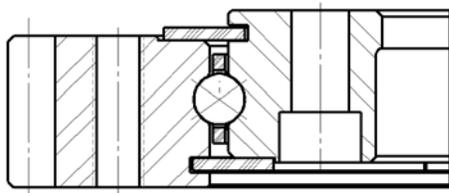
In addition to the more standard bearings shown on earlier pages, Kaydon has extensive experience in the design and manufacture of customized or special bearings and assemblies. This experience allows us to match the product to the requirements.

The ball and roller bearings shown below are only a sampling of our custom capabilities, provided to further inspire your creativity to find the optimum solution.



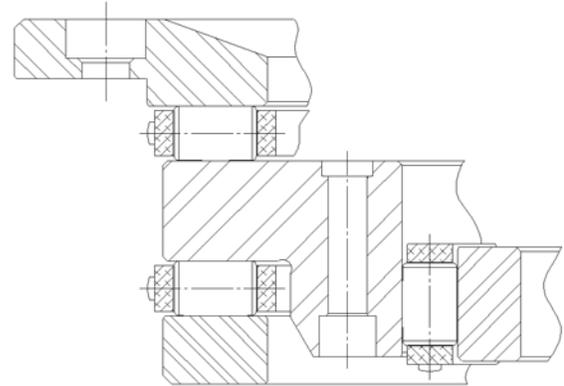
**Figure 5-1**

A thin-sectioned cross roller bearing combines the features of higher stiffness, increased dynamic capacity, and lower turning torque with weight and space savings. Rollers may be oriented as needed to maximum load carrying ability and fatigue life. Designs with similar configurations and features range from 15 inches to over 90 inches.



**Figure 5-2**

A thin-sectioned large diameter bearing with external gear made from special stainless steel rings, plastic rolling elements, and separator for low permeability and to limit out-gassing. Use of plastic rolling elements also permits operation without lubrication. Similar designs and components have been produced for sizes up to 70 inches.



**Figure 5-3**

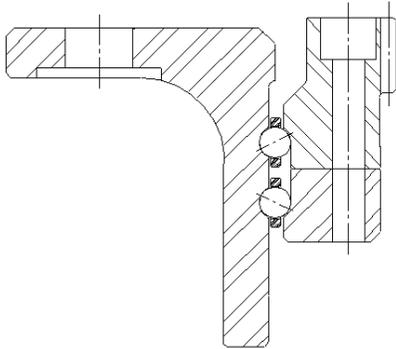
A complex three-row roller bearing with minimal raceway material provides the customer with light weight and space saving opportunities. The thin sections and unusual configurations permit compact overall design. Three separate rows of rollers permit use in applications with simultaneous as well as reversing radial, axial, and moment loads. Roller complement and raceways may be oriented and designed to optimize capacity and fatigue life as well as stiffness. Designs with similar features have exceeded 90°.



**Figure 5-4**

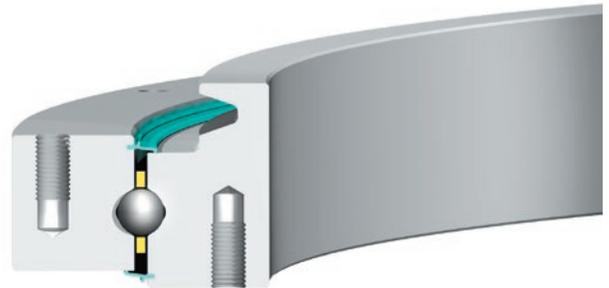
A three ring, two-rolling complement bearing with two integral gears, one on the inner and one on the outer ring is shown. This configuration when combined with precision components permits accurate, smooth, independent, and synchronized rotation of the rings and any attached components. Use of a separator increases the bearing's operating speed capability and, combined with low friction seals, permits minimal rotational resistance. The total package significantly reduces the number of components needed to perform the same functions as this design currently does.

# Custom Bearing Capabilities (continued)



**Figure 5-5**

This flange mounted, thin-sectioned large diameter bearing is light weight, requires minimal space, and fits around existing components. The flanges are scalloped between holes to provide greater weight reduction. The use of double row angular contact rolling complement with separators provides minimal rotational resistance and can be used for high accelerating conditions as well as very high continuous operating speeds. The high precision gear on the inner ring provides for accurate positioning.



**Figure 5-6**

A four-point ball bearing with integrated v-belt groove in one ring permits a simple mechanical drive option at low cost with no lubrication and minimal maintenance.

Belt drive designs, flat or tooth, are potential alternative solutions depending on application conditions. Use of a separator increases the bearing's operating speed capability and, combined with low friction seals, permits minimal rotational resistance.

# A dedicated remanufacturing program



Kaydon infinite® expertise in bearing design and manufacturing has established Kaydon as the world's leading remanufacturer of slewing ring and thin section bearings.

Our approach to bearing remanufacturing mirrors our manufacturing effort, with an experienced remanufacturing staff supported by expert engineers and dedicated, state-of-the-art equipment. Our Bearing Remanufacturing Program is designed to return a bearing to service in the shortest possible time, while ensuring the highest quality workmanship on a very cost-effective basis.

A bearing repaired by Kaydon will perform like a new bearing at a significantly lower cost, yet carry an equal warranty. One example is a big slewing ring bearing remanufactured at the request of a major U.S. mine operator — it easily passed its 35,000-hour inspection (30,000 hours is typical) and is still going strong.

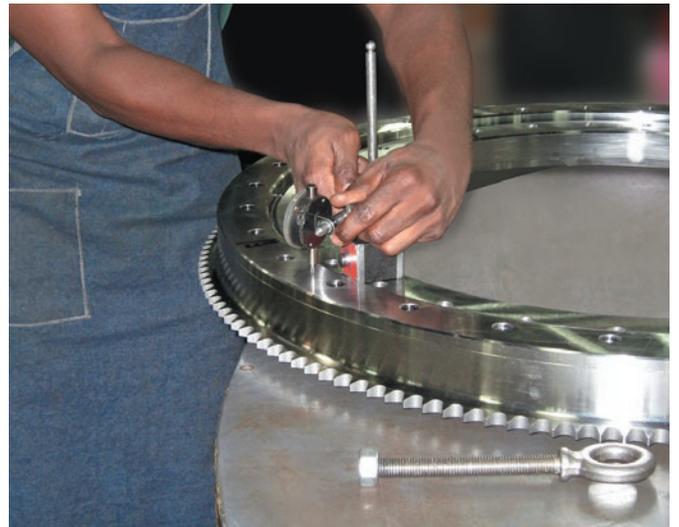
We can remanufacture bearings as small as 10" (25 cm) and as large as 240" (6.1 m). Kaydon infinite® remanufacturing solutions extend to all ball bearings and roller bearings, regardless of the original manufacturer. These include:

- Thrust ball bearings & thrust roller bearings
- Radial ball bearings & radial roller bearings
- Cross roller bearings
- Double row, angular contact bearings
- Three row roller bearings
- Ball bearings
- Multi-row/double-row ball bearings
- Cylindrical roller bearings
- Thin section ball bearings and roller bearings

The Kaydon remanufacturing program is not only dedicated, but comprehensive. It features:

- Free inspection on slewing ring bearings up to 8' in diameter
- Inspection in approximately one week
- Non-destructive testing performed on all bearings
- Engineering analysis
- Analysis reports provided for all inspections
- Four-week turnaround time for bearings 8' and under, and just a few more weeks for bearings 8' to 20' in diameter
- Substantial savings versus the cost of a new replacement bearing
- Stringent ISO 9001:2008 quality program
- Emergency remanufacturing services
- One year warranty for all remanufactured bearings

Kaydon also manufactures new replacement slewing ring bearings that meet original OEM specifications at substantial savings vs. OEM bearing prices. Our proven process features reverse engineering and comprehensive design analysis to maximize dynamic life and static capacity. And our strategically located facilities have the flexibility to fill high-volume and low-volume orders.



# Remanufacturing Program

Kaydon's bearing repair program is designed to provide the best service options available – no matter the brand or size of bearing. Bearings are assessed for remanufacture from 10 inches to 240 inches in outside diameter (OD).

In this program optimized solutions are provided through our experienced sales team, international presence, and process capability. The process begins with the service engineering team partnering with the customer's maintenance or service groups to analyze the bearing.

## Bearing Failure Warning Signs

Perhaps the most difficult task is determining if and when a bearing needs to be serviced. This determination requires much more than a quick visual inspection. Below are a few signs to look for when inspecting bearings that may need to be repaired:

- The bearing is nearing its suggested life expectancy.
- The bearing has exceeded an operating temperature of 200° F (93° C).
- The bearing has been exposed to excessive vibration.
- The bearing experienced a sudden drop or gain in lubrication.
- The bearing has a missing or torn seal.
- The bearing exhibits excessive rotational resistance.
- The structure has excessive movement or rocking during operation.
- The mating structure and hardware is damaged, e.g. cracked, broken, distorted, or even missing.
- The bearing exhibits limited rotation, uncharacteristic vibrations, or noise.
- Visible damage to gear or bearing

Paying attention to these details during regular maintenance checks can help you determine whether a bearing needs maintenance before it causes unnecessary downtime and expense. Careful observation is the first step in creating a program that monitors your bearings and surrounding operations.



**WARNING: Proper maintenance and handling practices are critical. Failure to follow installation, maintenance, and operating instructions can result in equipment failure, creating a risk of bodily injury or death.**

To provide the correct repair solution to the damaged bearing, the cause and extent of the damage must be understood. Environmental issues, such as ingress of contamination and water into the bearing, are the common causes of premature bearing failure. Following are typical causes of damage found on bearings and precautions that can be taken to prolong life.

### ■ Improper Handling:

Cage deformation and nicks or gouges can result from improper installation, handling or removal.

Precautions: Use proper handling practices along with the correct handling, mounting and disassembly tools.

### ■ Inadequate Lubrication:

Scoring of components or severe bearing deformation can result from inadequate or incorrect lubrication.

Precautions: Inspect and replace the lubricant at the manufacturer's recommended interval or as needed, whichever occurs first. If necessary, change or improve lubricant.

### ■ Corrosion and Etching:

Exposure to moisture can lead to etching, pitting, then rusting of bearing components. Spalling may result from bearings that operate after such damage.

Precautions: Check seals regularly, ensure proper sealing and store bearings properly.

### ■ Electric Current:

Passage of electric current while a bearing is rotating may cause fluting or grooving. Improper electric grounding while a bearing is stationary can create small burns.

Precautions: Shunt the current around the bearing with the proper earth connection before welding.

# Remanufacturing Program

## ■ Foreign Material:

Abrasions, bruising and grooving can result from abrasive particle contamination and debris.

Precautions: Remove the debris, change the lubricant, and check/replace the seals.

## ■ Misalignment:

Geometric stress concentration and spalling can result from misalignment, deflections or heavy loading.

Precautions: Machine the bearing seats and shoulders accurately. Check accuracy of shaft and housing seats, ensure proper shaft/housing alignment and confirm or reduce operating forces.

## ■ Overloading:

Improper use for the intended application can lead to overload conditions accelerating wear.

Precautions: Utilize the equipment for the intended application within the load limits defined.

## Kaydon Service Options

The initial analysis covers the cleaning, verification of internal clearances, disassembly, and inspection of the bearing assembly. The engineering team then assesses the damage and provides a quotation based on the most appropriate remanufacturing type to restore the bearing to full operation. The three repair classifications are:

### Class A Repair

To ensure correct geometry and alignment, bearing assemblies require machining of rolling element pathways and the surfaces that interface with the mounting structure for correct installation. Oversize rolling elements are used to restore the desired internal clearance or preload and new spacers and seals are fitted.

### Class B Repair

Bearing assemblies require polishing or other surface alterations to relieve stressed or corroded areas on the raceway or mounting surfaces. The bearing is re-assembled with new rolling elements, spacers, and seals as required.

### Class R Repair

Bearing assemblies require a completely new bearing ring to match an existing repairable ring. The existing raceway is machined to give correct geometry and the new ring and raceway are manufactured to match the repaired component. New rolling elements, spacers, and seals complete the refurbishment.

## Taking the Next Step

1. Contact Kaydon's remanufacturing service for a customized solution:
  - call 800-286-6274 ext. 226
  - or visit [www.kaydonbearings.com/remufacturing.htm](http://www.kaydonbearings.com/remufacturing.htm)
2. The Kaydon representative will work to assess the bearing repair needs.
3. Kaydon will physically assess the bearing's condition and provide a quotation.
4. When the repair is authorized, the plant will perform all necessary repairs and return the bearing within the promised lead time. If it is decided not to proceed with the repair, the damaged bearing will be disposed of or returned disassembled.

# Endurakote® Plating for Corrosion-Resistant Bearings

## Introduction

Endurakote® plating protects bearings from corrosion and provides substantial life improvements in hostile environments. Endurakote® plating is applied over conventional bearing materials and offers the benefit of corrosion resistance normally found only in stainless steel bearings. The coating is applied to each entire bearing race ring, including the paths, thus leaving no area exposed. Other commercial chrome or cadmium coatings normally accepted and used cannot be applied to the path due to the rolling contact stresses. Endurakote® plating is hard chromium, electrodeposited by a proprietary process which achieves a true molecular bond, and will not flake or peel even under the high contact stresses experienced in the bearing paths.

Laboratory and field testing results have proven the benefits of this process. Severe salt spray testing has shown that bearings with Endurakote® plating withstand corrosion as well as or better than AISI 440C stainless steel. The hard, dense exterior surface formed by the coating is extremely wear resistant and is excellent in the retention of the lubricant film. Conventional life testing of bearings with Endurakote® plating has shown that no life derating is necessary. In fact, the extremely hard surface of Endurakote® plating protects the bearing from surface generated damage which can promote premature failure. Since the coating is capable of withstanding extremely high temperatures, the bearings are limited by the bearing materials or lubricant used.

The coating used for Endurakote® plating can be applied to any type of bearing and to most bearing materials. Its primary advantage is to utilize stock materials with their economies, and convert them to wear- and corrosion-resistant bearings. This is particularly beneficial for larger diameter bearings or where quick delivery is critical. Thus, cost savings can be achieved over more exotic or specialized materials. Also, stock bearings can have Endurakote® plating applied for quick delivery.

The net result is that we can offer bearings with the capacity of conventional bearing steels and the corrosion resistance of AISI 440C stainless steel from standard stock components.

## Application

Endurakote® plating provides corrosion resistance and is effective in increasing wear resistance in sliding surface contacts. The micro-surface composition of Endurakote® plating aids in lubricant dispersion, enhancing base metals to the degree of reducing or eliminating galling, seizing, and high friction, over a wide range of installations and environments.

## Advantages

Endurakote® plating effects a buildup of less than .0002 under normal circumstances. Thus, it can often be applied to stock bearing components which have been specially selected. Endurakote® plating is compatible with most ferrous and nonferrous metal, allowing maximum flexibility in selection of base material. Endurakote® plating is normally a final process, and its quality is constant with any given base metal, insuring design reproducibility.

## Properties and Characteristics

### A. Hardness

Endurakote® plating, as deposited, has an equivalent hardness in excess of 70 Rockwell "C." When measured by conventional micro-hardness methods, the host material will modify this measurement to some degree.

### B. Coefficient of Friction

(**Note:** Measurements made at 72°F, using other materials for comparison.)

Material	Against Material	Static — Sliding
Steel	Steel	0.30 — 0.20
Steel	Brass, Bronze	0.25 — 0.20
Steel	Endurakote® plating	0.17 — 0.16
Brass, Bronze	Endurakote® plating	0.15 — 0.13
Endurakote® plating	Endurakote® plating	0.14 — 0.12

# Endurakote® Plating (continued)

## C. Adhesion

Endurakote® plating will not flake, crack, chip, peel or otherwise separate from the base material under standard bend tests or under conditions where severe heat is induced. The adherence is adequate to withstand the extremely high compressive stresses in the contact areas of ball and roller bearings.

## D. Effect On Base

The purity of the chromium surface will not be less than 99% as deposited. A comprehensive testing program at Kaydon established that bearings with Endurakote® plating exhibited load-carrying capacities and life expectancy equal to or better than uncoated steel bearings.

## E. Corrosion Resistance

Endurakote® plating resists attack by most organic and inorganic compounds with a pH within the range of 4 and 11, except sulfuric and hydrochloric acids. Porosity of the base metal, compound concentration and exposure time to the compound become corrosion factors, but Endurakote® plating greatly enhances the base material. In severe salt spray tests as well as tap water immersion tests, bearing steel with Endurakote® plating proved equal to fully hardened AISI 440C stainless steel in resistance to rusting. In many instances, Endurakote® plating is better for corrosion protection than cadmium plate, zinc plate, phosphates, chromates, black oxide or normal chrome plate. We invite inquiries about and will be pleased to arrange tests to qualify Endurakote® plating for specific environments.

## F. Heat Resistance

Bearings with Endurakote® plating are designed to maintain their operating characteristics over a temperature range from -65°F to 250°F.

## G. Surface Quality

Endurakote® plating conforms to the texture of the existing surface. Ra finish will be improved slightly down to about 8 Ra; below 4 Ra there is little change. Endurakote® plating has a matte or micro-orange peel surface with very good lubricant retention qualities.

## H. Food Industries

Endurakote® plating can be used on food processing equipment.

## I. Load Capacity

Endurakote® plating does not affect the static or dynamic load capacity of the bearing.

## Bearing Size Capabilities

Endurakote® plating can be applied to slewing ring bearings up to 45 inches.

## Restrictions

Kaydon does not recommend the use of Endurakote® plating in any low torque or torque-sensitive applications.