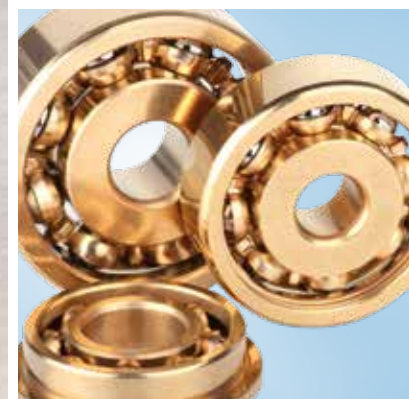




High-Precision Ball Bearings

GRW BEARING MATERIALS



KAMAN

Specialty Bearings & Engineered Products

PREMIER PROVIDER OF HIGH-PRECISION BALL BEARINGS

Precision performance creates opportunities. GRW high-precision ball bearings with a bore of 1 to 35 mm and an outer diameter of 3 to 47 mm perform critically important functions all from the power of their minute sizes.

GRW's tiny bearings stand like giants in their ability to meet the world's increasing demand for maximum performance using minimum space.

At the end of 2015 GRW became a proud member of the KAMAN Speciality Bearings and Engineered Products Group, located in the United States.

Choose GRW as your precision partner to design and manufacture your high precision bearings, either customised for your specific needs or from our comprehensive standard range; whatever your need for precision, GRW is there.



WIDE MATERIAL VARIETY TO MEET HIGH STANDARDS FOR SMALL DIMENSIONS

Perfect performance demands material of the highest quality.

The professional selection of raw materials, parts and components enables us to constantly provide our customers with consistently high quality. Our ball bearings are made of chrome steel (100Cr6), stainless steel (X65Cr13 or X105CrMo17), or high corrosion-resistant steel (X30CrMoN15-1). Similar load ratings are achieved for all these steel types following ISO and AFBMA standards.

It has always been our policy to choose the most advanced material available – for example the alloy SV30. It uses the constituents nitrogen, carbon, chrome and molybdenum in a new type of alloy composition. Ceramic balls, e.g. for hybrid ball bearings with steel rings, can be used in addition to exceed the boundary conditions of ball bearing applications.

The following criteria have to be considered during the selection process:

- Hardness
- Material cleanliness
- Fatigue resistance
- Workability
- Dimensional stability
- Corrosion resistance
- Wear resistance
- Temperature range and capability





Ceramic balls used in conjunction with our **wide variety of bearing materials;** Hybrid Bearings, further extends the solutions GRW can offer. Combine GRW's "know how" with more than 30 different kinds of cage material, hundreds of different lubricants including dry coatings and you can be sure of world class performance from your ball bearings.

Anti-friction bearings belong to the most highly stressed components of mechanical engineering. Therefore extremely high demands are made on the bearing steels, because of the ever increasing need for longer bearing life and improved running costs. In more aggressive environments, **corrosion resistance** is highly desirable.

100Cr6 **Bearing Steel**

In 1901 the first description of the required characteristics and specific composition for balls was given, from which the alloy 100Cr6 was developed; this is still used today worldwide; no other steel has been so thoroughly investigated. Due to this process specification, developments for casting of steels of high purity, for their heat treatment and tools for the direct rolling-contact analysis have been promoted. As a result of developments in the field of the steel 100Cr6, many structural and constructional steels of high quality have evolved.

440C **Bearing Steel S (X105CrMo17)**

Major advances in steel production have occurred beginning in the 1950s by the introduction of vacuum-melting procedures.

Alloy steels with high chromium content, greater than 12 percent, are considered corrosion resistant. However, although the chromium forms a passive chromium-oxide layer at the surface that provides substantial protection, it is not inert and these alloys will corrode in hostile environments. Long proven heritage in aerospace applications is a further advantage of 440C.

X65Cr13

Bearing Steel SS (X65Cr13)

In the 1980s the demand for stainless steel miniature bearings with specific low noise behavior was growing significantly. In 1989 GRW answered their customers needs, especially in the field of instrument bearings, they introduced X65Cr13 as replacement to X105CrMo17. Today it is the most commonly used bearing steel for miniature ball bearings.

X30CrMoN15-1

Bearing Steel SV30

In the mid 90s, a new nitrided bearing steel was introduced. The superior features of high corrosion resistance and wear resistance are achieved by partial substitution of carbon by nitrogen. Its low carbon content provides additionally excellent behavior at mixed friction.



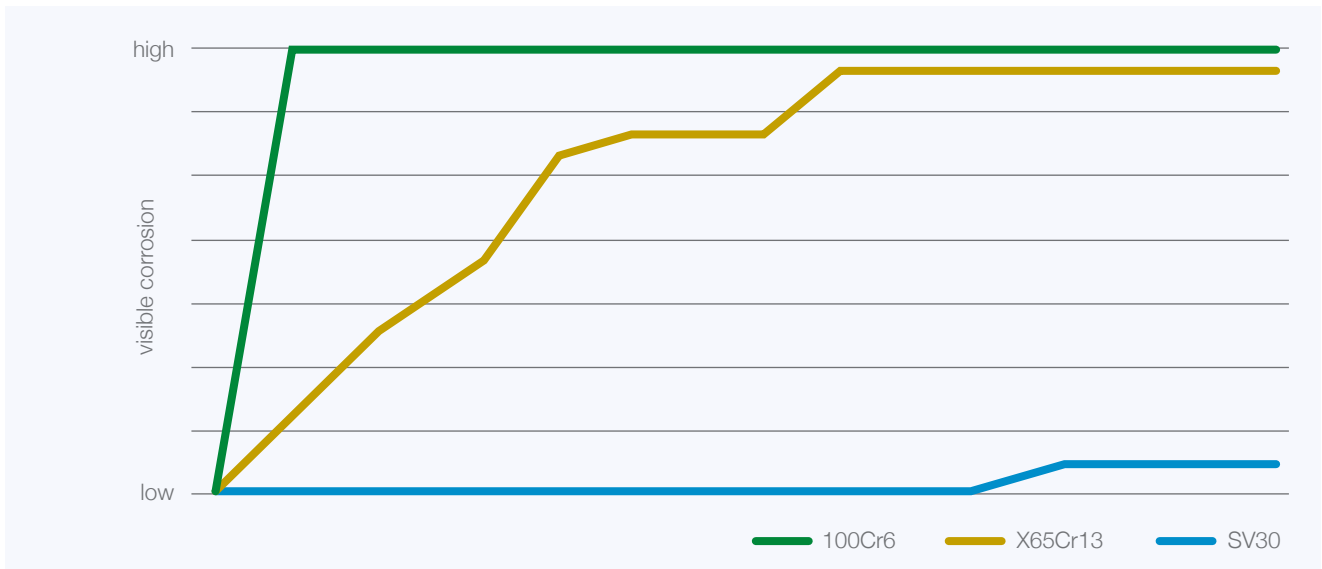
	100Cr6	440C	X65Cr13	X30CrMoN15-1
Density	7.85 g/cm ³	7.70 g/cm ³	7.85 g/cm ³	7.85 g/cm ³
Hardness	> 60 HRc	> 58 HRc	> 58 HRc	> 58 HRc
E-modul	210 GPa	215 GPa	200 GPa	218 GPa
Expansion coefficient	10.9	10.4 x 10 ⁻⁶ K ⁻¹	10.1 x 10 ⁻⁶ K ⁻¹	10.1 x 10 ⁻⁶ K
Temperature resistance	170 °C 338 °F	200 °C 392 °F	200 °C 392 °F	200 °C / 450 °C 392 °F / 842 °F

OUR BEARING MATERIALS EXCEL IN HIGH TEMPERATURE STRENGTH AND CORROSION RESISTANCE

Corrosion Resistance

Test Results for Corrosion Resistance

salt spray test with special probe (after GRW-drwg.-no. 1007 872)





EXAMPLES OF APPLICATIONS

- **Medical**
Surgical Equipment, Blood Pumps, Dental Turbines
- **Aviation and Aerospace Industry**
Measurement and Transport Systems
- **Food Industry**
Stirrers, meat processing, acidic foods
- **Chemical Industry**
Flow Meters, Applications in Hostile Environments
- **Mechanical Engineering**
Spindle Bearings for High-Speed Applications, Turbo Chargers,
High Temperature Coating Units, Vacuum Pumps

GRW Expertise

- Bearing assembly in a clean room class R 10,000 (ISO 14644-1), Class 7
- Fully automated manufacturing for high volume cost effective production
- Technical support
- Customised solutions
- Wide selection of lubricants for all applications
- 100% noise tested



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Gebr. Reinfurt GmbH & Co. KG

Niederhoferstraße 105
D-97222 Rimpar
+49 (0) 93 65/819-0

High-Precision Bearings LP

1330 Blue Hills Avenue
Bloomfield, Connecticut 06002, USA
+1 (860) 243-9704



For more information on our products and services contact us on **+49 (0) 93 65/819-0** or **www.grw.de**

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www.grw.de

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