



**MinebeaMitsumi**  
**AEROSPACE**

## Development and Qualification Testing

Ball and Roller Bearing Assemblies for  
Main Shaft and Gearbox Applications



**We support leading aero engine manufacturers with state-of-the-art bearing development and qualification testing.**

MinebeaMitsumi Aerospace companies NHBB and CEROBEAR partner with leading aero engine manufacturers to engage in new product development and qualification testing of advanced ball and roller bearing solutions for main shaft and gearbox applications. Supported by a culture that values customer-focused innovation, this value-added service enables us to develop – and ultimately verify – proven solutions to your demanding bearing system requirements.

## Ball and Roller Bearing Development and Testing Capabilities

We provide comprehensive product development and testing support for aero engine manufacturers — from concept to commercialization.

**Our testing capabilities cover everything from aerospace industry standards to the specific parameters you define for your project.**

### Elemental Testing | TRL 2-3\*

We routinely conduct elemental testing to determine the feasibility of new materials, materials processing techniques, and advanced machining methods. Specialized instruments enable us to quickly gather data on a material's strength characteristics and tribological properties, so we can determine whether a given solution shows enough promise to initiate further testing at subscale.

### Accelerated Endurance (Subscale) Testing | TRL 4-6\*

The testing of complete bearing assemblies under nonspecific operating conditions is an essential intermediate development phase en route to full-scale qualification testing. We typically conduct accelerated endurance testing on either our axial endurance or radial endurance test rigs (see tables on next page). These rigs include two parallel stations, which allow us to compare the life of an existing bearing design versus a new concept under the exact same conditions.

### Full-Scale Qualification Testing | TRL 7\*

We have the requisite capabilities to validate the performance of a complete bearing assembly, at full scale, under the specified operating conditions of the target application. Qualification testing is conducted on our high-speed test rigs, which are highly configurable to a wide cross section of pitch diameters, rotational speeds, and oil delivery schemes. They also contain numerous built-in sensors that provide a complete picture of bearing performance (see table on next page).



Complex Ball Bearing with Vibration Damping Flange for Main Shaft Application.

### Customer-Centered Approach to Test Plan Development

You'll receive detailed bearing engineering support directly from our applications engineers, who are experts in ball and roller bearing design and production. Test plan development is led by our product development and test engineers, who are highly trained and experienced in bearing engineering, test protocol design, test rig design/build, testing, data analysis, and project management. It's an integrated, customer-centered approach designed to meet your need for improved bearing system performance.

### Learn More

Contact a sales office near you (see back page) or send an inquiry to [info@minebeamitsumi-aerospace.com](mailto:info@minebeamitsumi-aerospace.com)

\*The TRL identified above is based on our bearing development process. It may differ slightly from your TRL scales.

## High-Speed Test Rig (HSTR) Features

Numerous component options offer flexible test protocol development; built-in sensors offer extensive data gathering capabilities.

### Load Cylinders

Flexible design enables varying axial and radial load profiles and ratings.

### Flexible Oil Delivery System

Configurable to any type of oil supply: inner ring, face, oil mist, flood, oil jet, scoop, etc. Adjustable temperature range from 120°F to 390°F; oil-out condition simulation is also possible.

### Test Article Housing

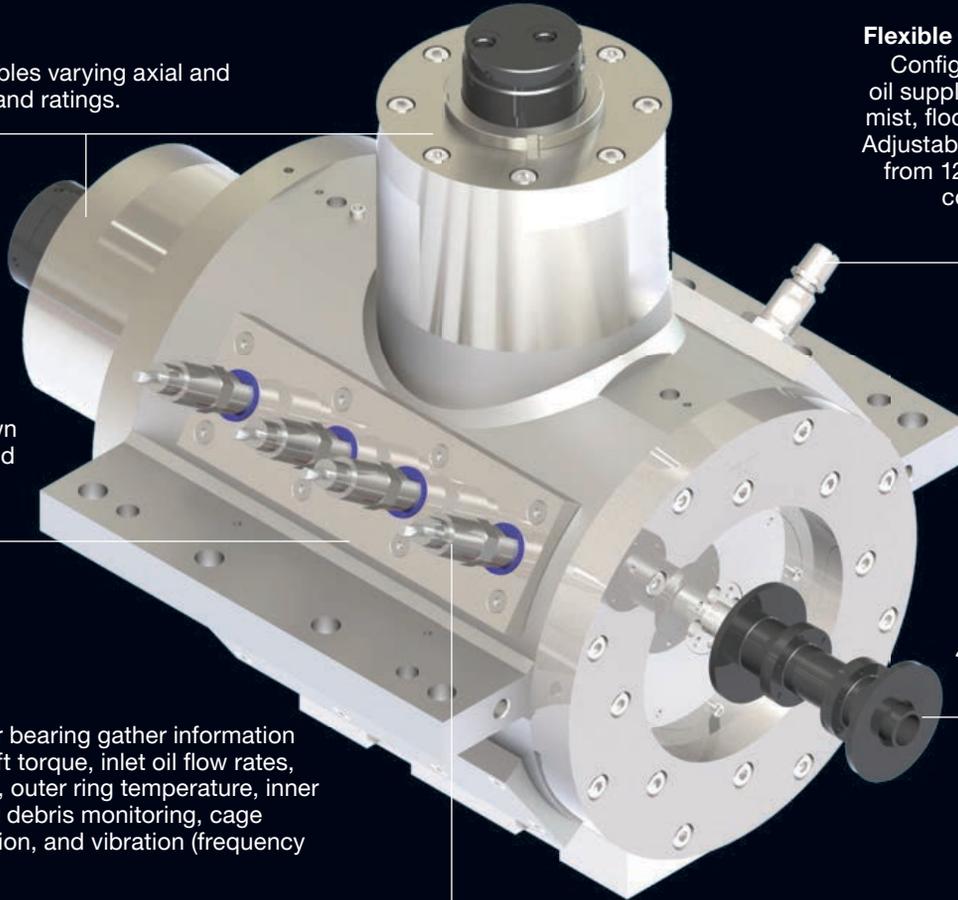
Accommodates multiple housing options to support shaft diameters down to 10 mm (0.3 in.) and bearing ODs up to 305 mm (12 in.).

### High-Speed Drive System

Powerful enough to rotate the test article housing shaft up to 45,000 rpm. dN of 4+ million is achievable.

### Built-In Sensors

Multiple sensors per bearing gather information on load, speed, shaft torque, inlet oil flow rates, inlet oil temperature, outer ring temperature, inner ring temperature, oil debris monitoring, cage speed, shaft deflection, and vibration (frequency and amplitude).



## Elemental Testing Capabilities

Reliable finished products often begin with an investigation of fatigue life of new materials.

A primary location for elemental testing of new bearing materials, as well as advanced production methods, is CEROBEAR's test facility. It contains the test rigs, software, measurement hardware, and protocols to conduct the following investigations:

- Comparison of materials fatigue life
- Qualification of new materials
- Testing under defined test parameters
- Testing under ambient conditions

By adhering to a standardized procedure using a consistent set of parameters, CEROBEAR can gather reliable data to accurately forecast material fatigue life (see test parameters on the next page).

## Examples of Test Rig Specifications

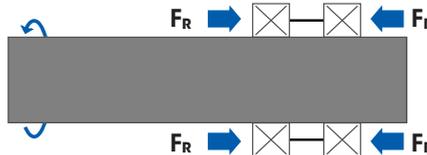
We have the resources to support everything from studies of new materials to simulation testing of full-scale designs.

### Elemental Test Rig (Material Fatigue Life)

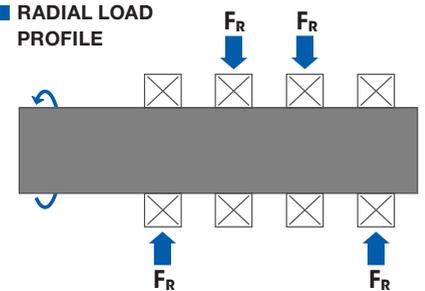
TEST PARAMETER	VALUE
Speed	2,575 rpm
No. of specimen	>=12 pcs.
Lubrication	Grease
Duration	Until failure of test plate
Hertzian stress	4,136 MPa (600 ksi)
Preload	By calibrated spring

Load profiles shown refer to the endurance and high speed test rig tables shown below.

#### AXIAL LOAD PROFILE



#### RADIAL LOAD PROFILE



### Endurance Test Rigs (Radial and Axial)

TEST PROTOCOL	SPECIFICATIONS	RADIAL TEST RIG	AXIAL TEST RIG	DATA
Subscale Comparison tests	No. stations	2 independently controlled		Temperature Vibration Oil in/out temp. Load Speed
	No. bearings	8 (4 per station)	4 (2 per station)	
	Lubrication	Oil flood, contamination (optional)		
	Load direction	Radial	Axial	
	Max. load capacity	25,000 lb.	40,500 lb.	
	Speed range	400–4,000 rpm		
	Max. OD	130 mm (5.1 in.)	200 mm (7.9 in.)	

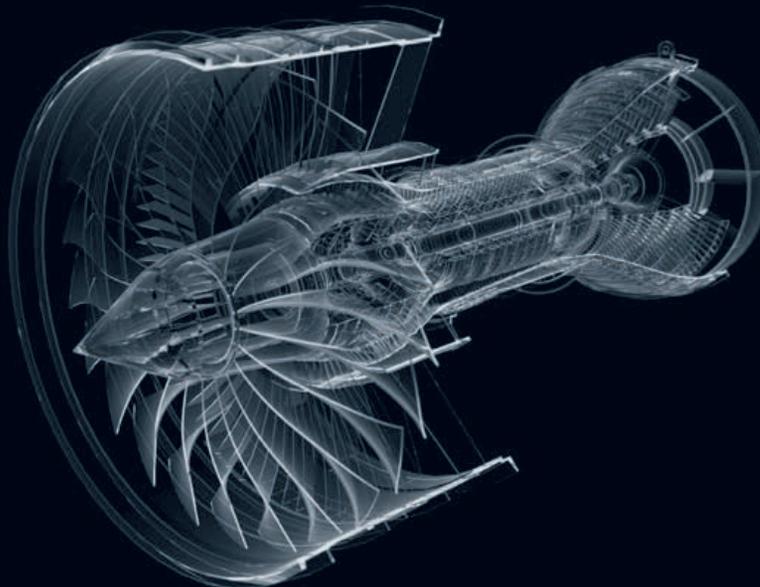
### High-Speed Test Rig (Two Test Article Housings)

TEST PROTOCOL	SPECIFICATIONS	TEST ARTICLE HOUSING 1	TEST ARTICLE HOUSING 2	DATA
Full scale Application Simulation	Number of stations	1		Temperature Vibration Oil flow rate Oil in/out temp. Cage speed Shaft deflection Load Speed Particle detectors Torque telemetry Inner ring temp.
	Number of bearings	2-4		
	Lubrication	Oil jet (up to 311°F inlet temp.)		
	Radial load*	3,200 lbf	20,000 lbf	
	Axial load*	8,800 lbf	15,000 lbf	
	Speed range	1,000-45,000 rpm		
	Max. OD	>152 mm (6.0 in.) current	305 mm (12.0 in.) target	
	Load direction	Axial, Radial, Combined Axial and Radial		

\*Based on current test rig parameters. Other load specifications are possible.

# MinebeaMitsumi

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