

Technology · Precision · Innovation

Fluid Dynamic Bearing



TPI[®]
BEARINGS

Professional FDB Manufacturer

Company Profile

1966.8.25 Company Established

Main Products:

- Ball/Roller Bearings
- Angular Contact Ball Bearings
- Needle Bearings
- Fluid Dynamic Bearings



www.tpi.tw

Fan Requirements

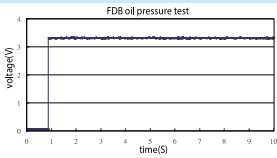
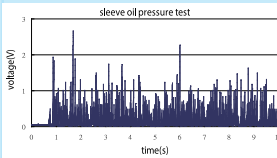
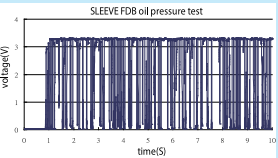
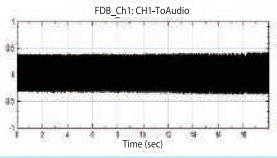
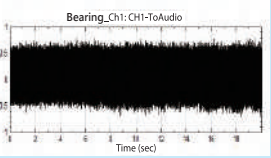
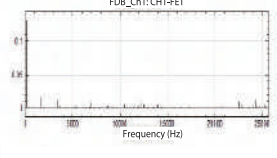
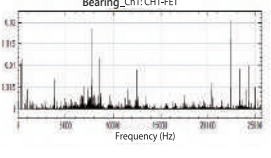
Trending

| Fan Requirements | Bearing Requirements | Copper FDB | Deep Groove Ball Bearing | Powder Metallurgy Bearing | Powder Metallurgy FDB | Main Applications |
|------------------|----------------------|------------|--------------------------|---------------------------|-----------------------|-----------------------------------|
| Thinning | Thinning | ● | △ | ○ | ○ | Application end thinning |
| Large Blade | High Load | ● | ● | △ | △ | High flow demand |
| High RPM | Stability | ● | ● | △ | △ | High flow demand |
| Impact Resistant | Impact Resistant | ● | △ | △ | ○ | Application end use requirements |
| Quiet | Silent | ● | △ | ○ | ○ | Application end use requirements |
| Reliability | Non-contact | ● | △ | △ | △ | Product service life requirements |
| Customization | Design Flexibility | ● | △ | △ | △ | Customization |

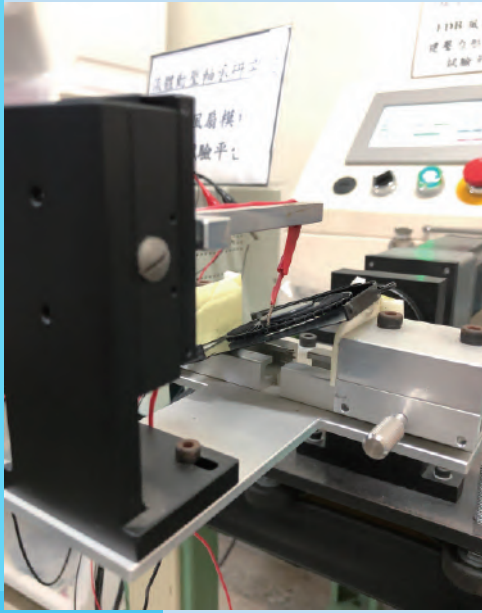
Symbols ● =Excellent ○ = Good △ = General

Bearing Systems

Comparison

| | Copper FDB | Deep Groove Ball Bearing | Powder Metallurgy Bearing | Powder Metallurgy FDB |
|--|---|---|--|---|
| Product Features | Precision turning (one-piece molded) | | Powder sintering (porous, permeable) | Powder sintering (porous, permeable) |
| Materials | Lead-free copper | | Sintered powder metallurgy | Sintered powder metallurgy |
| Lubrication Conditions | Full lubrication (non-contact) | | General | Boundary lubrication (contact) |
| Service Life | Excellent | | General | General |
| Vibration Resistance | Excellent | | General | General |
| System Noise Elimination | Excellent | | General | General |
| Customization Extent | Excellent | | General | General |
| Oil Film Formation Test |  | |  |  |
| Oil Film Formation Rate | 100% | | 0% | 40% |
| Vibration resistance comparison original vibration signal (acceleration gauge) |  |  | | |
| Vibration resistance comparison after filtration |  |  | | |

1.Wobble Test



2.Room Temperature Durability Test



3.Constant High-temperature Test



4.Programmable Stepped Temperature-control Test



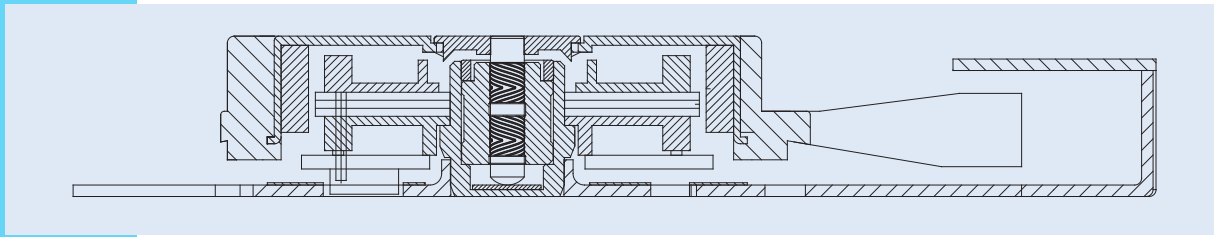
5.DC Variable Speed Test



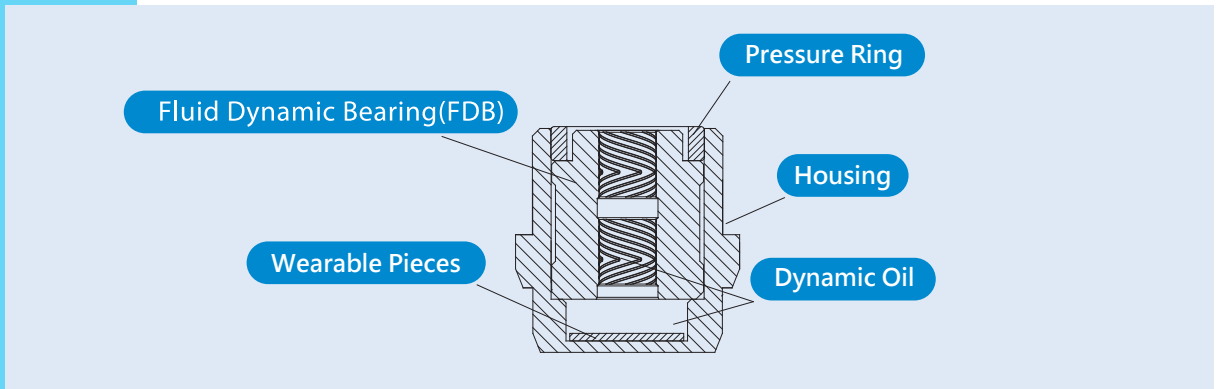
6.Constant-temperature Constant-humidity Fatigue Test



FDB Fan System

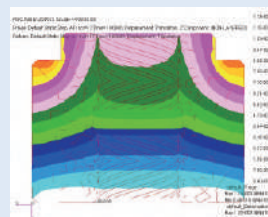
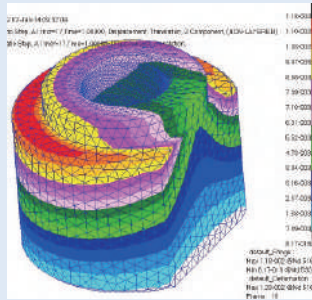
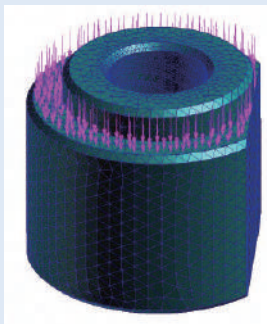


FDB Bearing System



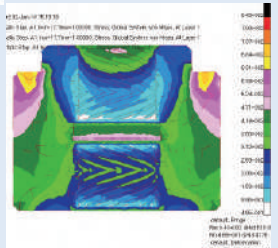
FDB Oil Film Pressure And Bearing System Finite Element Analysis

Structural Analysis Analysis Software: MSC, MARC



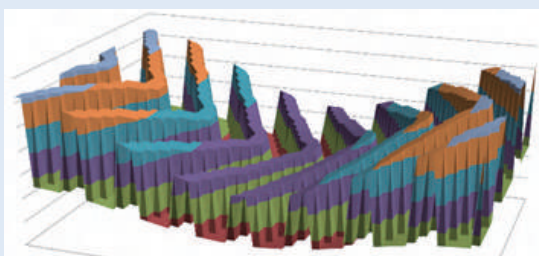
Displacement

Stress

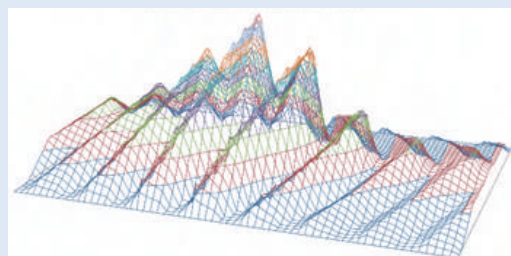


Oil Film Simulation Analysis Software: TPI Own

1. FDB – Herring-bone Grid Design

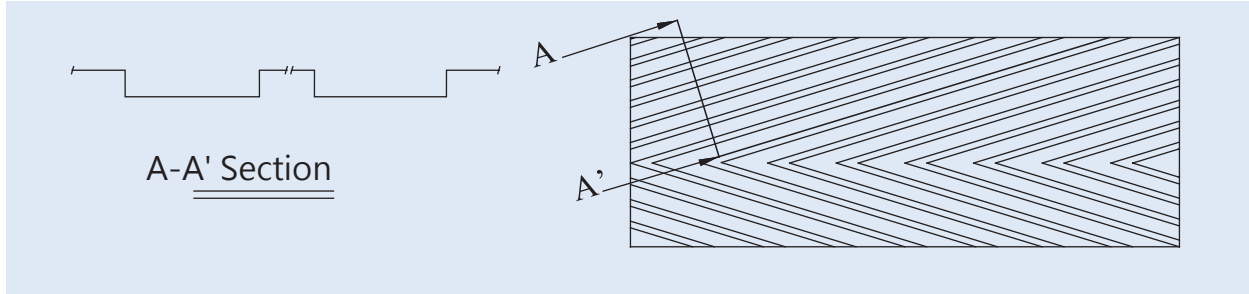


2. FDB – Pressure Field Calculation

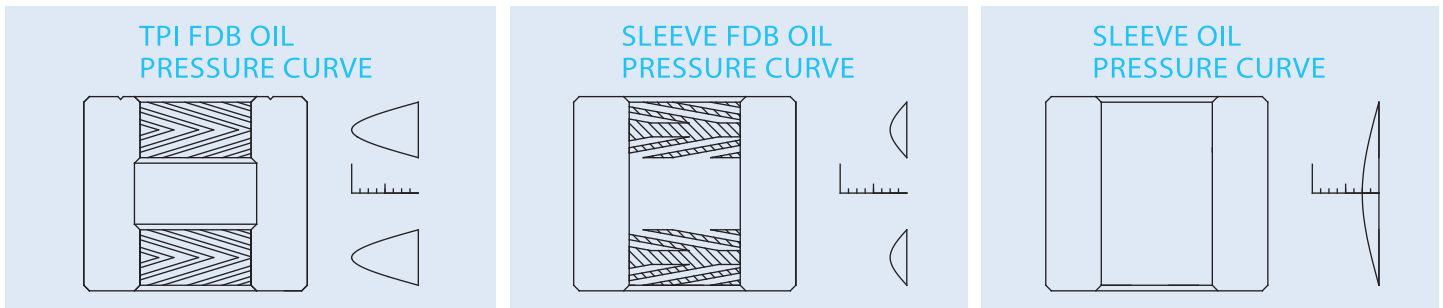


Groove Function:

- Store dynamic oil pressure
- Establish high-pressure shaft-supporting rotation center
- Prevent leakage of dynamic oil (surrogated pressure field characteristics)
- Increase oil film rigidity



Comparison of Pressure Curve Establishment [Theoretical Simulation]:



TPI FDB Application Realms



TPI FDB Application Test Results

| Inner Diameter (mm) | Φ1.2 | Φ1.5 | Φ2.0 | Φ3.0 |
|--|-------|-------|-------|-------|
| Conditions | | | | |
| Max. speed (RPM) (Customer End Application Results) | 15000 | 15000 | 10000 | 23000 |

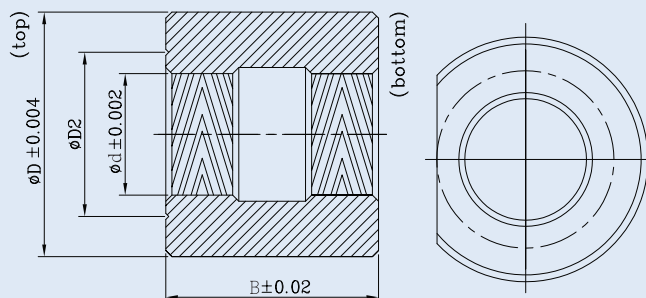
TPI FDB ID Specifications and Standard Bearing Dimensions

Unit: mm

| ID Specifications | Φ1.5 | Φ2.0 | Φ3.0 |
|-------------------|---------|---------|---------|
| Diagram | | | |
| 2 DGBB Design | BB 4015 | BB 5020 | BB 8030 |

Groove Direction:
 Clockwise CW (from top view)
 Counterclockwise CCW (from bottom view)

Materials: Copper
 Number of grooves: upper and lower grooves, 8 each



| Model Name Meanings | H | 15 | X | 040 | X | 045 | / | LT43 |
|---------------------|--------------------|----------|-----|-------------------------------|---------------------------------|--------------|---|------|
| Features | Rotation Direction | ID | OD | Broad(Height) | Special Requirement | Oil Type | | |
| Notation | F (CCW) | 15 | 040 | 016 020 025 030 ⋮ | N Forward and Backward Rotation | LT43 LT44 | | |
| | H (CW) | 20 30 | 080 | | | | | |

Unit: mm

| d ID | D OD | B Broad (Height) | Standard Model Name | D2 (CW identification symbol and dimension) | D-cut | Fan Height | Corresponding Rotation (rpm) |
|------|------|------------------|---------------------|---|-------|------------|--|
| 1.2 | 4.0 | 2.0 | H12X040X020N | 2.7 | 2.9 | 4~6 | LT43: below 6000rpm LT44: above 6000rpm |
| | | 2.5 | H12X040X025N | | | 4~6 | |
| 1.5 | 4.0 | 2.0 | H15X040X020N | 2.7 | 2.9 | 4~6 | LT43: below 6000rpm LT44: above 6000rpm |
| | | 2.5 | H15X040X025N | | | 4~6 | |
| | | 3.0 | H15X040X030N | | | 6~10 | |
| | | 4.0 | H15X040X040N | | | 6~10 | |
| 2 | 4.0 | 1.6 | H20X040X016N | 2.7 | 2.9 | 3~4 | LT43: below 6000rpm LT44: above 6000rpm |
| | | 2.0 | H20X040X020N | | | 3~4 | |
| | | 3.0 | H20X040X030N | | | 5~6 | |
| | | 4.0 | H20X040X040N | | | 7~10 | |
| 3 | 8.0 | 7.5 | H30X080X075N | 5 | 5.4 | 15~25 | LT43: below 6000rpm LT44: above 6000rpm |
| | | 8.5 | H30X080X085N | | | 15~25 | |
| | | 9.5 | H30X080X095N | | | 25~40 | |
| | | 10.5 | H30X080X105N | | | 25~40 | |

Note: Contact TPI for special requirements.

Lubricators Frequently Used in TPI FDB

| Lubricator | Applicable Scenario |
|------------|--|
| LT 43 | General Purpose and wear-resistant dynamic oil, applicable temperature is: -40 °C – 150 °C |
| LT 44 | Low-rpm and wear-resistant dynamic oil, applicable temperature is: -40 °C – 150 °C |
| LXT23 | Automotive lubricant, featuring low-temperature start-up dynamic oil, applicable temperature is: -40 °C – 200 °C |

Note: Contact TPI for special requirements.



FDB

Patents

Dynamic Bearing Structure

Dynamic Bearing Air Escape Structure

Non-directional Dynamic Bearing Structure

Fluid Dynamic Bearing Structure

Dynamic bearing structure used for bearing heat dissipation fan, and its assembly method

Dynamic Bearing and Manufacturing Method

Formation Method of Fluid Dynamic Bearing and Air Escape Groove

Fan Device and Its Bearing component

Dynamic Bearing

Dynamic bearing structure used for bearing heat dissipation fan

Fluid Dynamic Bearing Structure

Dynamic Bearing Structure

A Dynamic Bearing Structure

Double Edge Dynamic Bearing Structure

Bearing and Fan using Dynamic Bearing Structure Structure and Assembly Method of Dynamic

Formation of Air Escape Groove and Fluid Dynamic Bearing

Fan Device and Its Bearing Component

Dynamic Bearing Parts

Fluid Dynamic Bearing

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BEARINGS

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