

# NovAseptic® Mixers, Inspection and Replacement Guidelines for Male/Female Bearings

## OVERVIEW

This procedure is to be referenced during the inspections of the mixer's male and female bearings.

When the mixer and bearing operate under suitable conditions many years of reliable operation can be expected. However, damage to the bearing can result from a sudden impact, dropping, dry running of the mixer or mishandling. Due to the nature of the ceramic bearing it should be routinely inspected to ensure properly running equipment.

NovAseptic Mixers utilize sliding bearings between the mixing head and male bearing. These bearings are manufactured from Silicone Carbide (SiC) which is among the hardest substances known. Due to this hardness, it makes for an excellent long lasting bearing material for rotating equipment in wet environments.

The static male bearing is secured to the vessel's tank plate and the rotating female bearing is integrated and sealed into the mixing head, or rotor, of the mixer. These two components rub against each other as the mixing head rotates. Process fluid lubricates the bearings during operation. The service life of the bearings depends upon several factors;

- How the mixer is used and operates
- Condition of the process fluid
- Handling of the mixer when not in operation



## INSTALLATION OF THE MIXER

### Welding Tank Plate into Tank

When welding the tank plate into the tank, specific procedures must be followed to prevent excessive distortion of the tank plate due to overheating. If the concentricity of the tank plate is out of specification, the mixing head and/or the outer driving head of the drive unit will rub against the tank plate damaging it. If this occurs, the tank plate must be repaired and/or replaced. Millipore offers heat sink welding tools designed to help ensure appropriate welding of the tank plate.

### Measuring Concentricity of Tank Plate

To ensure the tank plate is not damaged during welding, it is recommended to use the NovAseptic Gauge 1 and 2 to measure the concentricity of the tank plate after it has been welded in. See the Installation and User Guide for NovAseptic Mixers for more details.

### Male Bearing and Mixing Head Installation

The male bearing must be secured and tightened at the proper torque to the tank plate. Failure to do so may result in the male bearing to come loose and cause the mixing head to vibrate during operation. Although Silicone Carbide is hard it is also brittle. Excessive vibration can cause the male or female bearing to crack and disintegrate.

When installing the mixing head onto the male bearing care must be taken not to drop the mixing head onto the male bearing. Excessive impact force will result in cracks forming in the bearings. To prevent damage, carefully lower the mixing head onto the male bearing on the tank plate with the proper tools, or install by hand manually.

The drive unit must be mounted after installing the mixer head. This prevents damaging the bearing due to the strong magnetic forces.



## HOW THE MIXER IS USED AND OPERATED

If the user follows the Installation and User Guide for NovAseptic Mixers, the bearing will provide years of service. Below are several precautions to take into account to ensure this occurs.

### Do not Operate the Mixer When Dry

The process fluid lubricates the bearings during operation. If the mixer is used when the vessel is empty it will cause excessive wear and result in the bearings to over heat. This will result in rapid premature wear with a sudden temperature rise causing cracking and failure of the bearings.

### Magnetic De-coupling

Under certain conditions the mixer may operate too fast for the process conditions within the tank. This can result in the mixing head "de-coupling" from the magnetic field of the magnets in the outer driving head of the drive unit. This occurs when the rotating force of the mixing head becomes greater than the attractive magnetic force. If this occurs, excessive vibration, or "shattering", of the mixing head against the bearings can occur. Too much shattering may cause the bearings to chip or crack due to excessive and repetitive impacts. Magnetic de-coupling is avoided by verifying the maximum rpm and an appropriate ramp up/down time for each operation the mixer will be used in. These parameters should be set in the Variable Frequency Drive (VFD) before starting operation.

The maximum motor torque should be limited by setting the max amp in the VFD to the nominal amp of the motor.

### Moving the Mixer in a Mobile Tank or Vessel

NovAseptic Mixers may be installed and used on mobile tanks. When moving the tanks without the drive unit installed it is important to prevent excessive vibration of the mixing head against the male bearing. If this occurs, the bearings could be damaged and crack. Before moving the mobile tank, the mixing head attractor tool should be installed to secure the mixing head and prevent excessive vibration. This tool contains magnets that safely secure the mixing head on the male bearing.

### The Condition of the Process Fluid

The NovAseptic Mixers are designed to operate over a wide range of process conditions. The mixing solution should be free of insoluble, hard and abrasive solids in suspension. Suspended solids may get in between the male and female bearing and cause the surface of the bearings to become scored and abraded. Once the bearing surface is roughened the life of the bearing is significantly reduced.

When under process conditions such as hot WFI or extended CIP/SIP, care should be taken not to damage the surface of the ceramic bearings. Refer to the Installation and User Guide for NovAseptic Mixers for more details.

## MALE AND FEMALE BEARING INSPECTION PROCEDURES

The purpose of these instructions is to guide the user in checking the condition and wear of the male and female bearings. If the male bearing exhibits characteristics that should not exist it should be replaced with a new one. Mixing heads with female bearings that do not meet the tolerances should be sent to Millipore for repair or be replaced with a new mixing head.

### Inspection of Integrity of Male Bearing and O-rings

Visually inspect the ceramic sleeve and stainless ends for any damage (scratches, cracks, gauling, etc).

Inspect the bottom o-ring for splits, wear, swelling, or flaking.

Damage to o-ring may be an indicator of chemical attack.

It is recommended to replace the o-ring each time the male bearing is removed from the tank plate. Ensure the thread of the bearing is not damaged or worn and that each thread is sharp and fully formed. When re-installing the male bearing, ensure it is tightened until there is metal-to-metal contact.

### Dimensional Check of Bearing

Inspections of the male and female bearing ceramic material should be performed to ensure they are in good condition and that the external dimensions are within specifications.

Over time the male bearings will take on a shape similar to Figures 2 and 3 below. Normal wear will not be visible to the human eye.

To determine the condition of the bearings they are to be measured with a precise micrometer.

In Table 2 and 3 are two recommended micrometers. If similar micrometers are unavailable, measurements of the bearings may be subcontracted to a qualified precision measuring company.

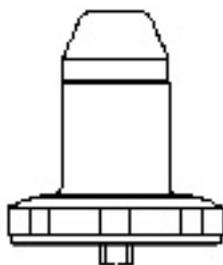


Fig 1

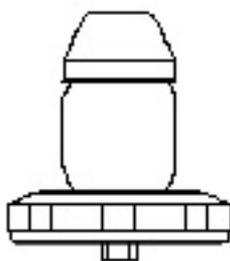


Fig 2

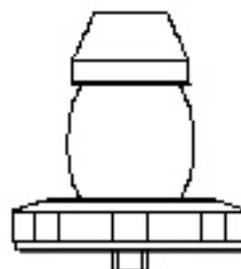


Fig 3

**Table 2. Recommended Tools (Micrometers) and Tolerances for Male Bearing**

Catalogue Number (Explanation)	GM05/24 (GMP50) GM1/24 (GMP100) G20-010 (HS T10)	GM510/24 (GMP500-1000) GM20/24 (GMP2000) G20-005 (HS T60 & HSI T60) G20-008 (USM T60)	GM50300/24 (GMP5000-GMP30000) G20-007 (HS T260) G20-006 (USM T260)	New 
Micrometer Tool (Recommended)				Mitutoyo®: Digimatic Series 395 Mitutoyo®: Digimatic Series 293
Micrometer Tool (Range (mm))	11.5-12.0	19.5-20.0	29.5-30.0	
Male Bearing (Min. Diameter (mm)*)	Min. 11.96	Min. 19.96	Min. 29.96	After Wear 

\*Note: Minimum diameter is noted for the Male bearing

**Table 3. Recommended Tools (Micrometers) and Tolerances for Female Bearing**

Catalogue Number (Explanation)	GM05/12 (GMP50) GM1/12 (GMP100) G10-013 (HS T10)	GM5/120 (GMP500) GM10/120 (GMP1000) GM20/12 (GMP2000) G10-009 (HS T60 & HSI T60) G10-012 (USM T60)	GM50/12 (GMP5000) GM100/12 (GMP10000) GM200/12 (GMP20000) GM300/12 (GMP30000) G10-010 (HS T260) G10-011 (USM T260)	New 
Micrometer Tool (Recommended)				Mitutoyo®: Borematic Series 568 Mitutoyo®: Digimatic Series 468
Micrometer Tool (Range (mm))	12.0-12.5	20.0-20.5	30.0-30.5	
Female Bearing (Max. Diameter (mm)**)	Max. 12.06	Max. 20.06	Max. 30.06	After Wear 

\*\*Note: Maximum diameter is noted for the Female bearing

## MEASUREMENT OF THE BEARING DIMENSIONS

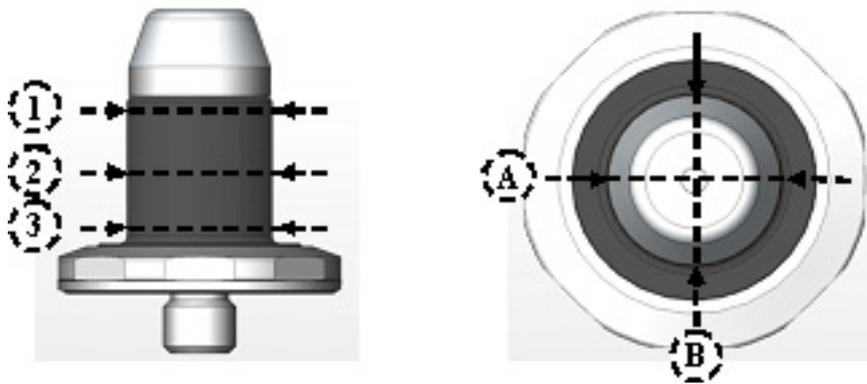
Measuring the dimensions of the Silicone Carbide bearings should be performed on a minimum of 6 different points; ref: graphics below.

Position the micrometer at the top of the bearing and measure 6 separate positions on the bearing surface. To measure the dimensions of the bearing start from the top and rotate 90° at each height. Measurements should be taken using the following pattern: 1A, 1B, 2A, 2B, 3A and 3B. ; ref: graphics below.

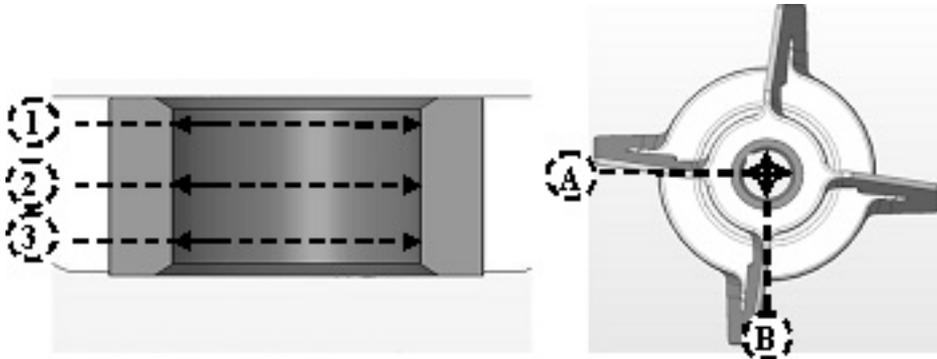
If the bearings are measured at more than 6 points it is recommended to measure at the very top and bottom of the bearing surface. These points are where the most amount of bearing wear is likely to occur, (i.e. points 1 and 3 in graphic below).

To minimize the risk of error, each measurement point should be taken twice.

*Measuring Points for Male Bearing*



*Measuring Points for Female Bearing (Mixing Head)*



### Interpreting Your Results

The male bearing may continue to be used if the measurements for the male bearing are greater than the minimum values in Table 2, and the inspection of the bearing surface does not show evidence of any chips, cracks or damage. If not the male bearing should be replaced or returned to Millipore for repair.

If the measurements for the female bearing within the mixing head (or rotor) is less than the maximum dimension in Table 2 and the surface does not show evidence of any chips, cracks or damaged the bearing may continue to be used. If not the mixing head should be returned to Millipore for repair.



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