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# A SIMPLE MAINTENANCE PROCEDURE FOR NMR SPINNER TURBINES

Virtually all NMR spinner turbines rely on o-rings to hold the NMR sample tube securely in place. Depending on the design, most spinner turbines employ one or two o-rings for this purpose. The o-rings, made from an elastomer or rubber material, allow the spinner turbine to hold the sample tube reliably even when small size differences occur between the spinner turbine and sample tube.

These differences in size will arise when the spinner turbine/sample tube combination is exposed to temperatures above or below ambient. A smaller amount of deviation from the ideal match of the spinner turbine and sample tube sizes can also arise from variations in the manufacturing process of both the spinner turbines and sample tubes.

The o-rings, however, can weaken or stretch and become less resilient with age and use. Because the inside diameter of the spinner turbine must, of necessity, be larger than the diameter of the sample tube, as explained above, weakened or worn o-rings can allow the sample tube to slip through the spinner turbine, and should therefore be replaced with new ones.

The two most commonly used o-ring materials for spinner turbines are silicone rubber (usually a red or orange color) and fluoroelastomer (usually black, but sometimes a brown color). These materials possess excellent chemical and temperature resistance, but do not have the best mechanical qualities such as abrasion, tear and fatigue resistance. As such, they can weaken, and if it becomes apparent that sample tubes seem to slip into the spinner turbine more easily than usual, it is advisable to replace the O-rings.

Many factors can influence the life expectancy of the o-rings, such as frequency of use, environmental conditions (heat, humidity, corrosive atmospheres) and exposure to common NMR solvents. Storing spinner turbines with sample tubes inserted into them for extended periods of time can also cause premature weakening of the o-rings.

Therefore, to avoid any unexpected problems, a preventive maintenance program for the spinner turbines can be instituted. As a general rule, o-rings should be replaced once yearly, but individual experience may dictate shorter or longer change intervals.

During the process of replacing o-rings, the inside bore of the spinner turbines should also be cleaned thoroughly to remove any surface film or contamination resulting from hand contact, spilled sample, etc. especially at the points where the o-rings compress the spinner turbine into contact with the sample tube.

A slight amount of a tacky or adhesive-like contaminant at these contact points can cause a "stick-slip" condition, in which the sample tube resists insertion into the spinner turbine. Applying more force to overcome this resistance can cause the sample tube to suddenly or unexpectedly slip into the spinner. This can result in broken sample tubes and injuries.

At the other extreme, a contaminant with lubricating qualities, if present on the contact points of the spinner, can cause the sample tube to shift position or slide downward in the spinner turbine, especially during handling or transferring into or out of the magnet.

The cleaning procedure should be performed at least as often as the o-ring replacement, but a monthly procedure is recommended.

Replacing the o-rings on most spinner turbines is very easy and straightforward. For some designs, the worn o-ring is simply pried or rolled off from the end of the spinner turbine. The replacement o-ring, of the correct size, is then easily pushed or rolled onto the spinner turbine until it snaps into the grooved recess (if present) on the end of the spinner turbine.

The o-rings on other designs of spinner turbines are positioned inside the bore, near the end, of the spinner turbine, where they contact and grip the surface of the sample tube itself. These o-rings are also easily replaced, requiring only the use of a small pointed tool such as a small jewelers' screwdriver, toothpick, precision tweezers, etc., to pry or pull the worn o-ring from the recessed groove of the spinner turbine. The replacement o-ring, of correct size, can be inserted by folding or squashing the o-ring until part of it can be inserted into the groove. At this point the remainder can be pushed in, a portion at a time, using a small, round, blunt tool with no sharp edges, such as a piece of plastic, glass or metal rod.

The cleaning procedure for all spinner turbines is very simple and easy. As explained above, it is particularly important to clean the inside bore of the spinner turbine near the o-rings, at the points where the spinner turbine contacts and grips the outer surface of the sample tube, but all other surfaces, inside and out, should be cleaned as well.

*NOTICE: THE FOLLOWING PROCEDURE SHOULD BE PERFORMED IN A LABORATORY FUME HOOD WHILE WEARING APPROPRIATE PERSONAL PROTECTION EQUIPMENT INCLUDING SOLVENT RESISTANT GLOVES AND ADEQUATE EYE PROTECTION, SUCH AS LABORATORY SAFETY GOGGLES!*

The inside bore of the spinner turbine can be cleaned using a swab mounted on a handle long enough to reach through the inside of the spinner turbine. The swab should be moistened with isopropanol, and all inside surfaces of the spinner turbine can then be easily reached and wiped clean.

Isopropanol is an excellent solvent for removal of most contaminants, is safe for spinner turbine materials, and is relatively nontoxic. Methanol can also be used as a cleaning solvent. It is an excellent solvent, is safe for use on spinner turbines, but it has a higher level of toxicity than isopropanol.

A lint-free or fiber-free swab is recommended, such as polyurethane foam, polyester fiber or microfiber, mounted on a polypropylene or other plastic handle. These swabs will not leave any fibers or lint inside of the spinner turbine, but must be used only with isopropanol or methanol, as other solvents can soften or dissolve the swab material and leave a residue inside of the spinner turbine.

Cotton swabs mounted on wooden handles can be used, but they may release cotton or wood fibers that may become lodged inside of the spinner turbine. Cotton and wood, however, are impervious to almost all common solvents likely to be found in a laboratory.

# Optimizer Inserts™ for 5mm Spinner Turbines

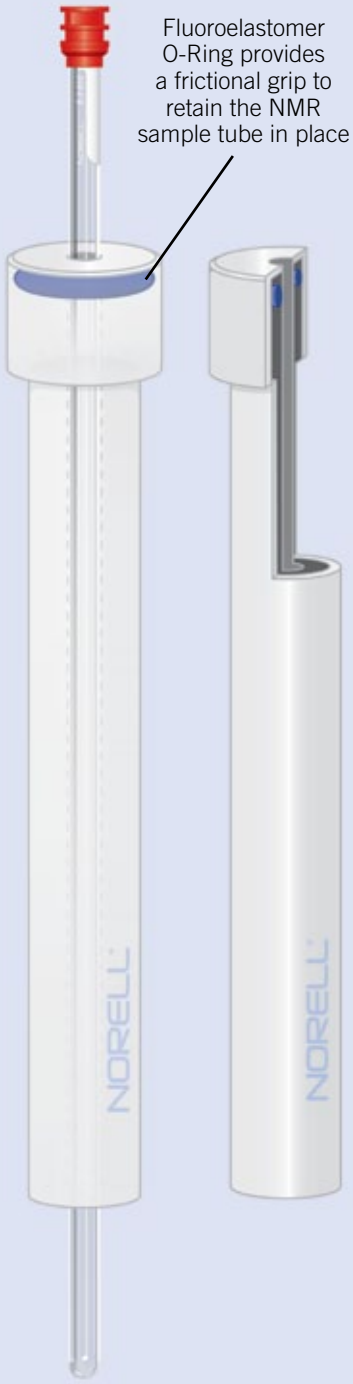
Precision adapter, made from a proprietary formulation of acetal homopolymer resin, holds 1.5mm, 1.7mm, 2.0mm, 2.5mm, 3mm, 4mm or 4.25mm NMR tubes in 5mm spinner turbine. Available for Agilent/Varian, Bruker & Jeol spectrometers. Does not include spinner turbine. U.S. Patent #7,728,593.

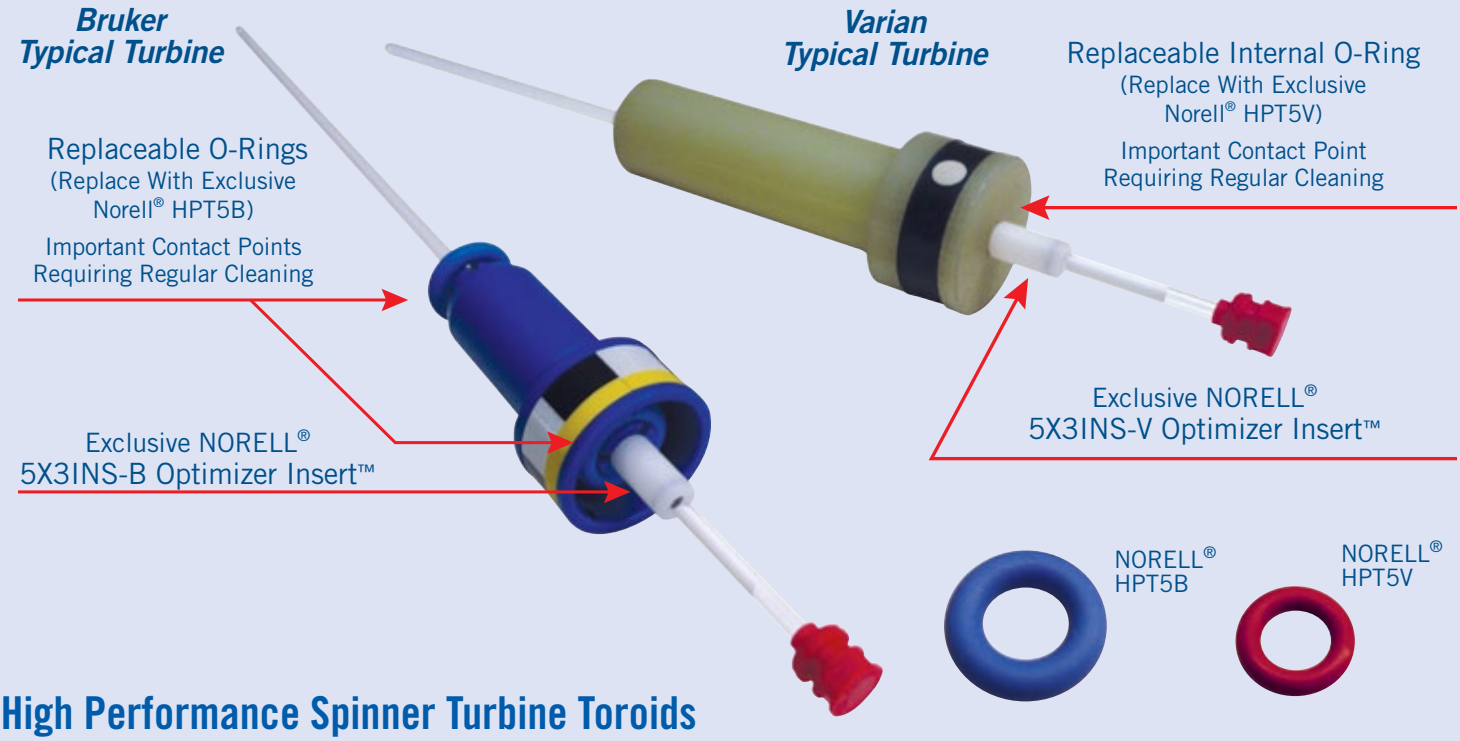
- Individual precision adapters hold 1.5mm, 1.7mm, 2.0mm, 2.5mm, 3mm, 4mm or 4.25mm NMR tubes in 5mm spinner turbine
- Suited for method development to optimize sensitivity and resolution of NMR Spectra
- Ideal for analyzing biological samples or buffered solutions with high salt concentration
- Run sample in seven NMR tube sizes to determine optimal sample volume without purchase of new Spinner Turbines
- Available for Agilent/Varian, Bruker and Jeol Spinner Turbines
- Inserts are suitable for near room temperature use from 0° - 65°C.

| Item No. | Tube Size (mm) | Spinner Type |
|---|---|---|
| 5X1.5INS-B | 1.50 | Bruker |
| 5X1.5INS-J | 1.50 | JEOL |
| 5X1.5INS-V | 1.50 | Agilent/Varian |
| 5X1.7INS-B | 1.70 | Bruker |
| 5X1.7INS-J | 1.70 | JEOL |
| 5X1.7INS-V | 1.70 | Agilent/Varian |
| 5X2INS-B | 2.00 | Bruker |
| 5X2INS-J | 2.00 | JEOL |
| 5X2INS-V | 2.00 | Agilent/Varian |
| 5X2.5INS-B | 2.50 | Bruker |
| 5X2.5INS-J | 2.50 | JEOL |
| 5X2.5INS-V | 2.50 | Agilent/Varian |
| 5X3INS-B | 3.00 | Bruker |
| 5X3INS-J | 3.00 | JEOL |
| 5X3INS-V | 3.00 | Agilent/Varian |
| 5X4INS-B | 4.00 | Bruker |
| 5X4INS-J | 4.00 | JEOL |
| 5X4INS-V | 4.00 | Agilent/Varian |
| 5X4.25INS-B | 4.25 | Bruker |
| 5X4.25INS-J | 4.25 | JEOL |
| 5X4.25INS-V | 4.25 | Agilent/Varian |
| 10X1.5INS-AV | 1.50 | Agilent/Varian |
| 10X1.7INS-AV | 1.70 | Agilent/Varian |


5mm O.D. Insert for use with a Varian Spinner Turbine

10mm O.D. Insert for use with a Varian Spinner Turbine

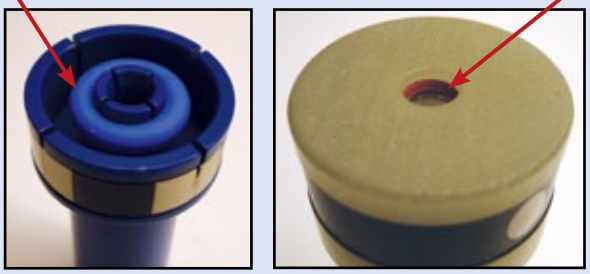





## High Performance Spinner Turbine Toroids

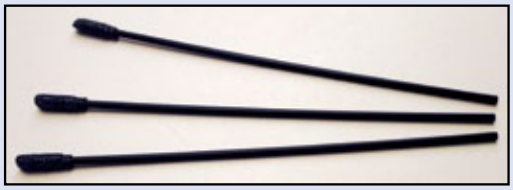
For your spinner turbine maintenance and repair, Norell, Inc. offers superior, high performance replacement components for the standard o-rings as supplied by the spinner turbine manufacturer. The Norell high-performance components are precision toroids manufactured from fluorosilicone elastomer, an advanced aerospace material having enhanced properties. Fluorosilicone elastomer maintains low temperature flexibility without sacrificing high temperature capability or chemical and solvent resistance as compared to other standard materials of construction. Additionally, fluorosilicone elastomer displays superior resistance to sunlight and ozone degradation, two common causes of failure of other elastomeric materials.

| Item No. | Spinner Size (mm) | Spinner Type | Packed In Lots Of |
|---|---|---|---|
| HPT5B-2PK | 5 | Bruker POM RT | 2 |
| HPT5B-10PK | 5 | Bruker POM RT | 10 |
| HPT5BC-2PK | 5 | Bruker Ceramic VT | 2 |
| HPT5BC-10PK | 5 | Bruker Ceramic VT | 10 |
| HPT5V-2PK | 5 | Varian | 2 |
| HPT5V-10PK | 5 | Varian | 10 |
| HPT3B-2PK | 3 | Bruker POM RT | 2 |
| HPT3B-10PK | 3 | Bruker POM RT | 10 |
| HPT3V-2PK | 3 | Varian | 2 |
| HPT3V-10PK | 3 | Varian | 10 |




## SB-5 Spinner Brush

The spinner brushes consist of a polyurethane foam tip mounted on a polypropylene plastic handle. The foam tip resists shredding and lint generation. Both the foam tip and handle have excellent chemical and solvent resistance, allowing use with a wide range of common solvents. The brush, having a generous 6 inch length, can easily access the entire length of the inner bore of a Varian style spinner turbine. The foam tip is 1/4 inch in diameter and nearly an inch long, providing excellent contact and cleaning action within the slightly smaller bore of 5mm spinner turbines.



| Item No. | Description | Packed In Lots Of |
|---|---|---|
| SB-5 | 5mm Spinner Brush | 1 |

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