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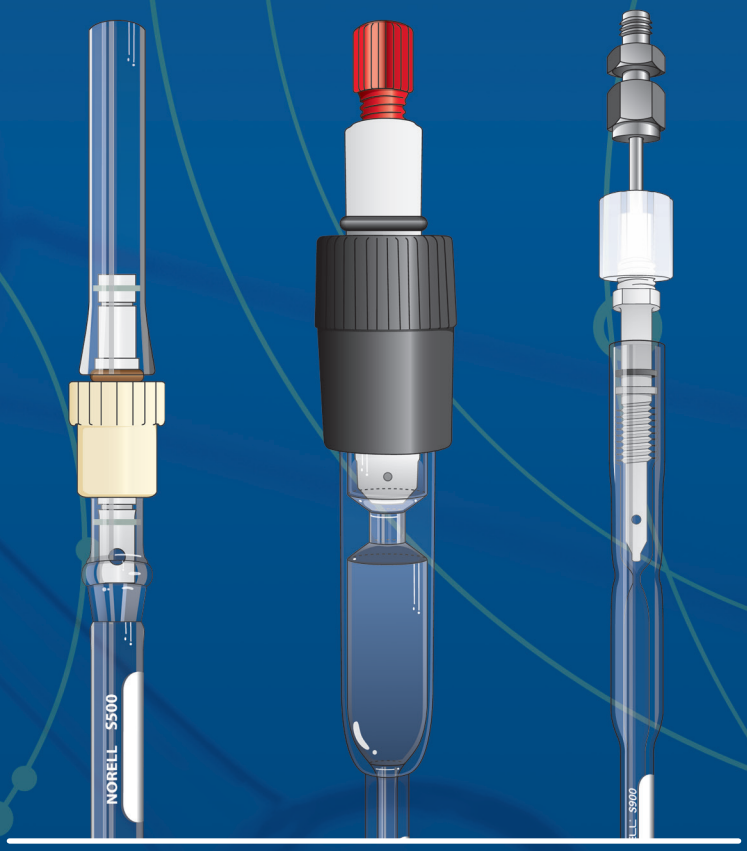
NORELL®

19
67



20
18

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ORDERING AND GENERAL INFORMATION

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Sales ..... sales@nmrtubes.com

Placing an Order

Our Customer Service Department is open from 8:30 A.M. to 5:00 P.M. Eastern Time. Call us at 1.828.584.2600. Orders may be placed by FAX at 1.828.584.2604 24 hours a day or at our online store at nmrtubes.com. Please help us expedite shipment of your order by including the following information:

- Purchase Order Number
- Your name and phone number
- Shipping address
- User name and phone number
- Billing address
- Special shipping/packing instructions
- Catalog number where applicable

Payment Terms

Net 30 days from invoice date with prior credit approval. Past due invoices will be subject to a 1.5% per month service charge; 18% per annum. We reserve the right to request payment in advance or COD terms on initial orders. We also accept Visa, MasterCard and American Express.

FOB Point

Morganton, NC 28655 USA

Any damage to the package or product in transit is the buyer's responsibility to adjust with the carrier. Shipping and handling charges will be added to invoices unless collect shipment is requested. Handling charges still apply.

Method of Shipment

Whenever possible, we will ship by the method specified in your order. However, we reserve the right to change the method specified. Within continental United States, most shipments are made by United Parcel Service.

Prices

Prices are subject to change without notice. The inventory of some products listed may become depleted. Replacement of stock may be subject to minimum order sizes. You may check stock and confirm prices by contacting Norell, Inc. Customer Service at 1.828.584.2600.

Returns

Returns may be made within 30 days of shipment with the prior approval of Norell, Inc. We reserve the right to impose restocking charges when a return is at the sole option of the buyer. The buyer is responsible for approving the quality and quantity of any product within the 30-day period stated above. If an error by Norell, Inc. results in an incorrect or duplicate shipment, a replacement will be sent or the appropriate credit allowed. We request return of the original product. Product returns must reference the original purchase order number, Norell, Inc. invoice number, the date Norell, Inc. authorized the return and the name of authorizing employee.

Warranty

We claim only that Norell, Inc. products are as described upon shipment. Norell, Inc. makes no other warranty, expressed or implied, with respect to our products, including any warranty of merchantability or fitness for any particular purpose. Norell's maximum liability for any reason shall be replacement of product or refund of the purchase price.

TABLE OF CONTENTS

NOTES

SECURE SERIES™

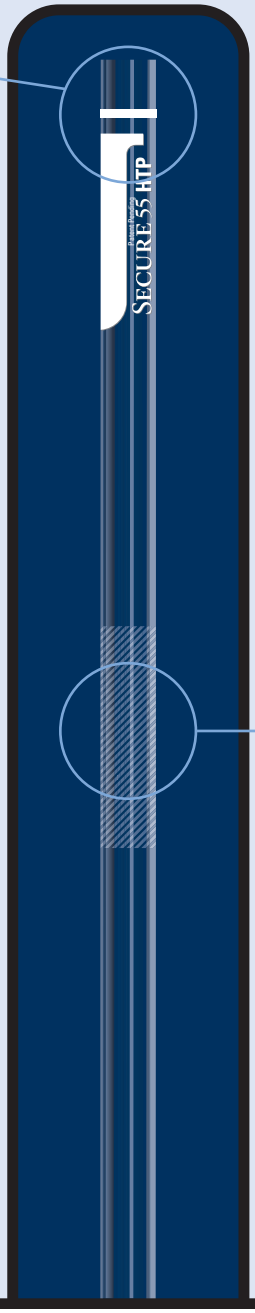
Norell, Inc. is pleased to introduce the newest innovation in 5mm and 3mm OD NMR tubes and closures: the NORELL® Secure Series™ line of NMR tubes paired with the NORELL® NorLoc II Security Cap™.

The Secure Series™ NMR tubes feature several Patent Pending design elements that add a superior level of sample containment and isolation, safeguarding the integrity of precious or critical NMR samples and assuring secure retention of the NMR tube in the spinner turbine.

The NORELL® Secure Series™ NMR Sample Tubes Include:

- A Patent Pending Security Band™ that engages and locks into the NorLoc II Security Cap™, securely joining the cap to the NMR tube.
- The edge of the Security Band™ also denotes a stop position for partial, temporary cap placement, allowing quick and easy access to the NMR tube.
- A Patent Pending proprietary surface treatment with a unique textured surface ensures precise and positive retention in Bruker, Agilent/Varian and Jeol spinner turbines.
- A Patent Pending marking or label area that also functions as a clear visual indicator, defining the limit for full and complete closure with the NorLoc II Security Cap™.

See Page 43 for more information about NorLoc Generation II Caps.



- The Secure Series™ NMR tubes are available in two types: the Secure 33 Series™ and the Secure 55 Series™ in both 178mm and 203mm lengths.
- The Secure 33 Series™ NMR tubes are made from ASTM Type I Class A borosilicate glass (Pyrex® 7740 or equivalent) and have comparable glass properties to the Norell Select Series™ NMR tubes.
- The Secure 55 Series™ NMR tubes are made from ASTM Type I Class B borosilicate glass (N-51A or equivalent) and have comparable glass properties to the Norell Standard Series™ NMR tubes.
- The Secure Series™ NMR tubes remain completely compatible with standard, classic NMR tube caps in both 5mm and 3mm sizes.

The Secure 55 Series™ NMR Sample Tubes for Routine NMR

The Secure 55 Series™ NMR tubes are made from ASTM Type I Class B borosilicate glass ("high expansion" borosilicate glass such as Kimble N-51A or equivalent) and parallel the properties of the Standard Series™ NMR tubes from Norell. These tubes are ideal for near room temperature analyses of routine samples exposed only to slight thermal gradients. Due to the larger coefficient of thermal expansion of this glass type, we do not recommend fusing these NMR tubes to glass vacuum manifolds or other glass laboratory apparatus, because these are usually constructed from low expansion borosilicate glass such as Pyrex® 7740. The dissimilar thermal expansion rates of the two glass types can result in cracking or breaking of the glass-to-glass seal.

5mm Ultra-Precision, High-Precision & Precision NMR Sample Tubes

Item No.	Spinner Turbine	MHz	O.D. (mm)	I.D. (mm)	Concentricity (mm)	Camber ±(mm)	Length (mm)	Packed In Lots Of
S55-1000-050-1780	Bruker	1,000	4.97 ± 0.004	4.20 ± 0.006	0.003	0.004	178	5
S55-1000-050-2030	Agilent/Varian	1,000	4.97 ± 0.004	4.20 ± 0.006	0.003	0.004	203	5
S55-0800-050-1780	Bruker	800	4.97 ± 0.005	4.20 ± 0.012	0.004	0.005	178	5
S55-0800-050-2030	Agilent/Varian	800	4.97 ± 0.005	4.20 ± 0.012	0.004	0.005	203	5
S55-0600-050-1780	Bruker	600	4.97 ± 0.006	4.20 ± 0.012	0.004	0.006	178	5
S55-0600-050-2030	Agilent/Varian	600	4.97 ± 0.006	4.20 ± 0.012	0.004	0.006	203	5
S55-0500-050-1780	Bruker	500	4.97 ± 0.013	4.20 ± 0.025	0.005	0.013	178	5
S55-0500-050-2030	Agilent/Varian	500	4.97 ± 0.013	4.20 ± 0.025	0.005	0.013	203	5
S55-0400-050-1780	Bruker	400	4.97 ± 0.013	4.20 ± 0.025	0.007	0.019	178	5
S55-0400-050-2030	Agilent/Varian	400	4.97 ± 0.013	4.20 ± 0.025	0.007	0.019	203	5
S55-0300-050-1780	Bruker	300	4.97 ± 0.025	4.20 ± 0.025	0.007	0.025	178	25
S55-0300-050-2030	Agilent/Varian	300	4.97 ± 0.025	4.20 ± 0.025	0.007	0.025	203	25
S55-00GS-050-1780	Bruker	300	4.97 ± 0.025	4.20 ± 0.025	0.010	0.038	178	25
S55-00GS-050-2030	Agilent/Varian	300	4.97 ± 0.025	4.20 ± 0.025	0.010	0.038	203	25
S55-0200-050-1780	Bruker	200	4.97 ± 0.030	4.20 ± 0.030	0.010	0.040	178	25
S55-0200-050-2030	Agilent/Varian	200	4.97 ± 0.030	4.20 ± 0.030	0.010	0.040	203	25

5mm Economy High-Throughput NMR Sample Tubes

Item No.	Spinner Turbine	MHz	O.D. (mm)	I.D. (mm)	Concentricity (mm)	Camber ±(mm)	Length (mm)	Packed In Lots Of
S55-0HTP-050-1780	Bruker	HT^{PLUS}	4.97 ± 0.050	4.20 ± 0.050	0.020	0.070	178	50
S55-0HTP-050-2030	Agilent/Varian	HT^{PLUS}	4.97 ± 0.050	4.20 ± 0.050	0.020	0.070	203	50
S55-00HT-050-1780	Bruker	HT	4.97 ± 0.050	4.20 ± 0.050	0.025	0.075	178	100
S55-00HT-050-2030	Agilent/Varian	HT	4.97 ± 0.050	4.20 ± 0.050	0.025	0.075	203	100

The Secure 33 Series™ NMR Sample Tubes for High Resolution NMR

The Secure 33 Series™ NMR tubes are made from ASTM Type I Class A borosilicate glass ("low expansion" borosilicate glass such as Corning Pyrex® 7740 or equivalent) and match the properties of the Select Series™ NMR tubes from Norell. Because of the low coefficient of thermal expansion, Secure 33 Series™ NMR tubes show a high degree of thermal shock resistance, a necessary attribute to prevent breakage when large temperature variations are expected in variable temperature studies, degassing samples through freeze-pump-thaw cycles, etc.

5mm Ultra-Precision NMR Sample Tubes

Item No.	Spinner Turbine	MHz	O.D. (mm)	I.D. (mm)	Concentricity (mm)	Camber ±(mm)	Length (mm)	Packed In Lots Of
S33-1000-050-1780	Bruker	1000	4.97 ± 0.003	4.20 ± 0.006	0.0018	0.0027	178	5
S33-1000-050-2030	Agilent/Varian	1000	4.97 ± 0.003	4.20 ± 0.006	0.0018	0.0027	203	5
S33-0900-050-1780	Bruker	900	4.97 ± 0.004	4.20 ± 0.006	0.0020	0.0030	178	5
S33-0900-050-2030	Agilent/Varian	900	4.97 ± 0.004	4.20 ± 0.006	0.0020	0.0030	203	5
S33-0800-050-1780	Bruker	800	4.97 ± 0.005	4.20 ± 0.012	0.0025	0.0038	178	5
S33-0800-050-2030	Agilent/Varian	800	4.97 ± 0.005	4.20 ± 0.012	0.0025	0.0038	203	5
S33-0600-050-1780	Bruker	600	4.97 ± 0.006	4.20 ± 0.012	0.0040	0.0060	178	5
S33-0600-050-2030	Agilent/Varian	600	4.97 ± 0.006	4.20 ± 0.012	0.0040	0.0060	203	5
S33-0500-050-1780	Bruker	500	4.97 ± 0.013	4.20 ± 0.025	0.0050	0.0130	178	5
S33-0500-050-2030	Agilent/Varian	500	4.97 ± 0.013	4.20 ± 0.025	0.0050	0.0130	203	5
S33-0400-050-1780	Bruker	400	4.97 ± 0.013	4.20 ± 0.025	0.0070	0.0190	178	5
S33-0400-050-2030	Agilent/Varian	400	4.97 ± 0.013	4.20 ± 0.025	0.0070	0.0190	203	5
S33-0300-050-1780	Bruker	300	4.97 ± 0.025	4.20 ± 0.025	0.0070	0.0250	178	5
S33-0300-050-2030	Agilent/Varian	300	4.97 ± 0.025	4.20 ± 0.025	0.0070	0.0250	203	5
S33-0200-050-1780	Bruker	200	4.97 ± 0.030	4.20 ± 0.030	0.0090	0.0350	178	5
S33-0200-050-2030	Agilent/Varian	200	4.97 ± 0.030	4.20 ± 0.030	0.0090	0.0350	203	5

3mm Ultra-Precision NMR Sample Tubes

Item No.	Spinner Turbine	MHz	O.D. (mm)	I.D. (mm)	Concentricity (mm)	Camber ±(mm)	Length (mm)	Packed In Lots Of
S33-1000-030-1780	Bruker	1000	2.99 ± 0.003	2.41 ± 0.006	0.0018	0.0027	178	5
S33-1000-030-2030	Agilent/Varian	1000	2.99 ± 0.003	2.41 ± 0.006	0.0018	0.0027	203	5
S33-0900-030-1780	Bruker	900	2.99 ± 0.004	2.41 ± 0.006	0.0020	0.0030	178	5
S33-0900-030-2030	Agilent/Varian	900	2.99 ± 0.004	2.41 ± 0.006	0.0020	0.0030	203	5
S33-0800-030-1780	Bruker	800	2.99 ± 0.005	2.41 ± 0.010	0.0025	0.0038	178	5
S33-0800-030-2030	Agilent/Varian	800	2.99 ± 0.005	2.41 ± 0.010	0.0025	0.0038	203	5
S33-0600-030-1780	Bruker	600	2.99 ± 0.006	2.41 ± 0.012	0.0040	0.0060	178	5
S33-0600-030-2030	Agilent/Varian	600	2.99 ± 0.006	2.41 ± 0.012	0.0040	0.0060	203	5
S33-0500-030-1780	Bruker	500	2.99 ± 0.010	2.41 ± 0.015	0.0050	0.0130	178	5
S33-0500-030-2030	Agilent/Varian	500	2.99 ± 0.010	2.41 ± 0.015	0.0050	0.0130	203	5
S33-0400-030-1780	Bruker	400	2.99 ± 0.013	2.41 ± 0.020	0.0070	0.0190	178	5
S33-0400-030-2030	Agilent/Varian	400	2.99 ± 0.013	2.41 ± 0.020	0.0070	0.0190	203	5
S33-0300-030-1780	Bruker	300	2.99 ± 0.025	2.41 ± 0.025	0.0070	0.0250	178	5
S33-0300-030-2030	Agilent/Varian	300	2.99 ± 0.025	2.41 ± 0.025	0.0070	0.0250	203	5
S33-0200-030-1780	Bruker	200	2.99 ± 0.030	2.41 ± 0.030	0.0100	0.0380	178	5
S33-0200-030-2030	Agilent/Varian	200	2.99 ± 0.030	2.41 ± 0.030	0.0100	0.0380	203	5

NorLoc™

PAT8054080

The NORELL® NorLoc™ Generation II Security Cap™ Includes:

- An internal Patent Pending Security Seal™ that provides superior hermetic sealing capability on all 5mm and 3mm NMR tubes.
- The NorLoc II Security Cap™ requires much less force to place on or remove from an NMR tube, thereby greatly advancing the level of safety when capping NMR tubes.
- When combined with a Secure Series™ or other Norell NMR tube, the Security Band™ and Security Seal™ interlock to form a positive physical restraint system, preventing tube and cap separation, especially with troublesome NMR solvents such as chloroform-d.

STAGE I

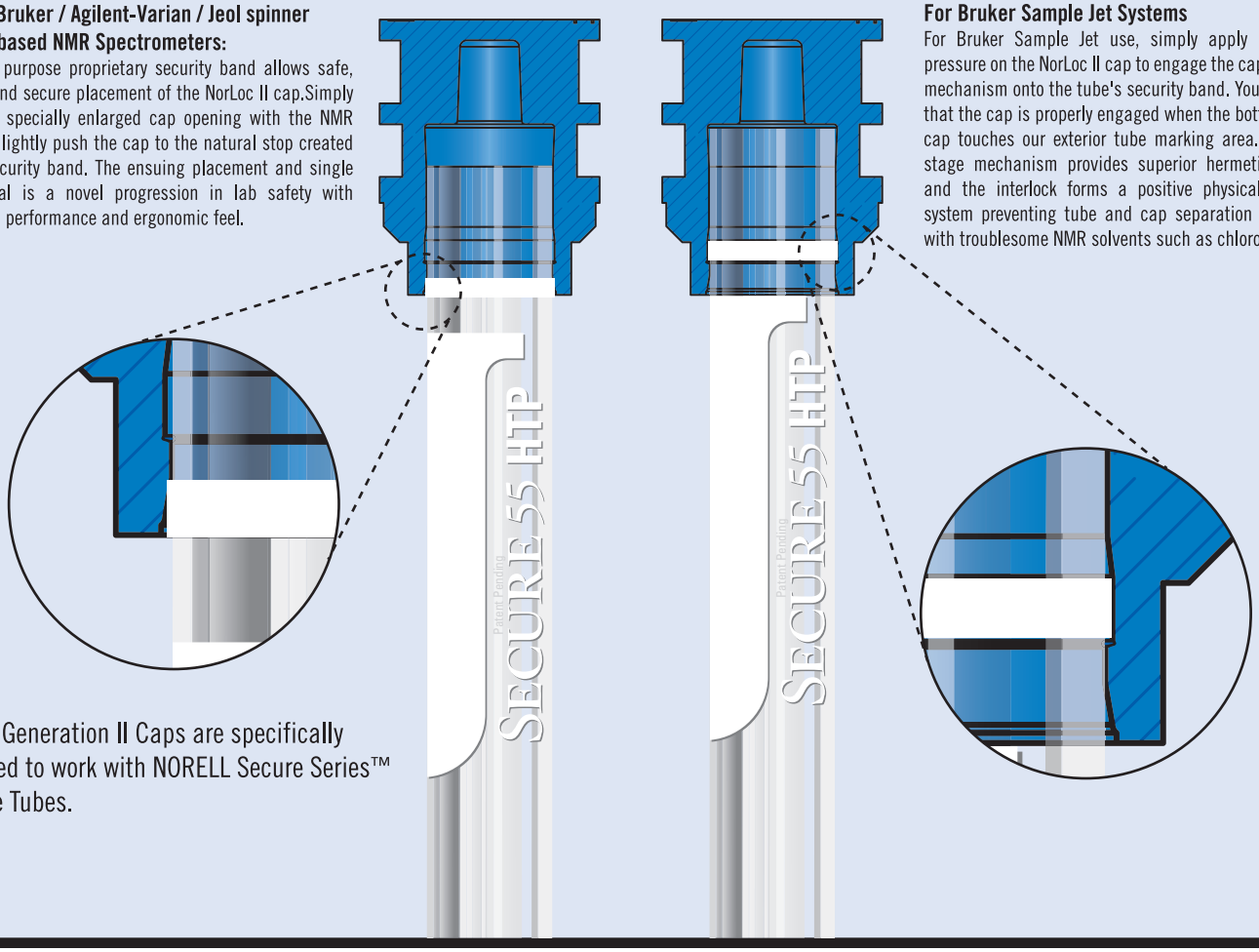
For all Bruker / Agilent-Varian / Jeol spinner turbine based NMR Spectrometers:

Our dual purpose proprietary security band allows safe, reliable and secure placement of the NorLoc II cap.Simply align the specially enlarged cap opening with the NMR tube and lightly push the cap to the natural stop created by the security band. The ensuing placement and single stage seal is a novel progression in lab safety with enhanced performance and ergonomic feel.

STAGE II

For Bruker Sample Jet Systems

For Bruker Sample Jet use, simply apply additional pressure on the NorLoc II cap to engage the cap's locking mechanism onto the tube's security band. You will know that the cap is properly engaged when the bottom of the cap touches our exterior tube marking area. Our dual stage mechanism provides superior hermetic sealing and the interlock forms a positive physical restraint system preventing tube and cap separation especially with troublesome NMR solvents such as chloroform-d.

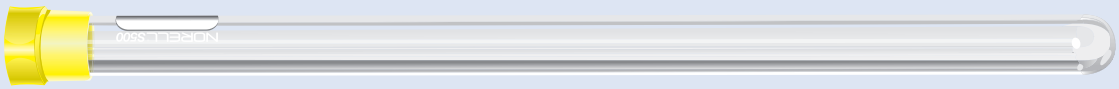


NorLoc Generation II Caps are specifically designed to work with NORELL Secure Series™ Sample Tubes.

Manufactured from ASTM Type 1 Class A Glass, Commonly Referred to as Pyrex®

Our "Select Series" NMR tubes are manufactured out of ASTM Type 1 Class A glass, commonly referred to as Pyrex® 7740 (Corning), Duran® (Schott Glass), or Kimax® KG-33 (Kimble) glass. Key properties that make this glass type desirable for NMR are its high degree of thermal shock resistance and low expansion coefficient. This allows for a greater margin of safety from breakage when used in variable temperature applications and freeze/thaw cycling, or under any other application where large temperature variations are required in the experiment. Each NMR tube is checked for concentricity and camber specifications utilizing the latest computer technology. At Norell we have taken NMR tube manufacturing to a new level of science.

10mm Ultra-Precision NMR Sample Tubes



Item No.	MHz	O.D. (mm)	I.D. (mm)	Concentricity (mm)	Camber ±(mm)	Length (mm)	Packed In Lots Of
S-10-600-7	600	10.00 ± 0.006	8.76 ± 0.012	0.004	0.006	178	5
S-10-600-8	600	10.00 ± 0.006	8.76 ± 0.012	0.004	0.006	203	5
S-10-500-7	500	10.00 ± 0.013	8.76 ± 0.025	0.005	0.007	178	5
S-10-500-8	500	10.00 ± 0.013	8.76 ± 0.025	0.005	0.007	203	5

5mm Ultra Precision NMR Sample Tubes

Item No.	MHz	O.D. (mm)	I.D. (mm)	Concentricity (mm)	Camber ±(mm)	Length (mm)	Packed In Lots Of
S-5-1000-7	1000	4.97 ± 0.003	4.20 ± 0.006	0.0018	0.0027	178	5
S-5-1000-8	1000	4.97 ± 0.003	4.20 ± 0.006	0.0018	0.0027	203	5
S-5-900-7	900	4.97 ± 0.004	4.20 ± 0.006	0.0020	0.0030	178	5
S-5-900-8	900	4.97 ± 0.004	4.20 ± 0.006	0.0020	0.0030	203	5
S-5-800-7	800	4.97 ± 0.005	4.20 ± 0.012	0.0025	0.0038	178	5
S-5-800-8	800	4.97 ± 0.005	4.20 ± 0.012	0.0025	0.0038	203	5
S-5-600-7	600	4.97 ± 0.006	4.20 ± 0.012	0.0040	0.0060	178	5
S-5-600-8	600	4.97 ± 0.006	4.20 ± 0.012	0.0040	0.0060	203	5
S-5-500-7	500	4.97 ± 0.013	4.20 ± 0.025	0.0050	0.0130	178	5
S-5-500-8	500	4.97 ± 0.013	4.20 ± 0.025	0.0050	0.0130	203	5
S-5-400-7	400	4.97 ± 0.013	4.20 ± 0.025	0.0070	0.0190	178	5
S-5-400-8	400	4.97 ± 0.013	4.20 ± 0.025	0.0070	0.0190	203	5
S-5-300-7	300	4.97 ± 0.025	4.20 ± 0.025	0.0070	0.0250	178	5
S-5-300-8	300	4.97 ± 0.025	4.20 ± 0.025	0.0070	0.0250	203	5
S-5-200-7	200	4.97 ± 0.030	4.20 ± 0.030	0.0090	0.0350	178	5
S-5-200-8	200	4.97 ± 0.030	4.20 ± 0.030	0.0090	0.0350	203	5

3mm & 4mm Ultra-Precision & High-Throughput NMR Sample Tubes

Item No.	MHz	O.D. (mm)	I.D. (mm)	Concentricity (mm)	Camber ±(mm)	Length (in)	Packed In Lots Of
S-3-1000-7	1000	2.99 ± 0.003	2.41 ± 0.006	0.0018	0.0027	178	5
S-3-1000-8	1000	2.99 ± 0.003	2.41 ± 0.006	0.0018	0.0027	203	5
S-3-900-7	900	2.99 ± 0.004	2.41 ± 0.006	0.0020	0.0030	178	5
S-3-900-8	900	2.99 ± 0.004	2.41 ± 0.006	0.0020	0.0030	203	5
S-3-800-7	800	2.99 ± 0.005	2.41 ± 0.010	0.0025	0.0038	178	5
S-3-800-8	800	2.99 ± 0.005	2.41 ± 0.010	0.0025	0.0038	203	5
S-3-600-7	600	2.99 ± 0.006	2.41 ± 0.012	0.0040	0.0060	178	5
S-3-600-8	600	2.99 ± 0.006	2.41 ± 0.012	0.0040	0.0060	203	5
S-3-500-7	500	2.99 ± 0.010	2.41 ± 0.015	0.0050	0.0130	178	5
S-3-500-8	500	2.99 ± 0.010	2.41 ± 0.015	0.0050	0.0130	203	5
S-3-400-7	400	2.99 ± 0.013	2.41 ± 0.020	0.0070	0.0190	178	5
S-3-400-8	400	2.99 ± 0.013	2.41 ± 0.020	0.0070	0.0190	203	5
S-3-300-7	300	2.99 ± 0.025	2.41 ± 0.025	0.0070	0.0250	178	5
S-3-300-8	300	2.99 ± 0.025	2.41 ± 0.025	0.0070	0.0250	203	5
S-3-200-7	200	2.99 ± 0.030	2.41 ± 0.030	0.0100	0.0380	178	5
S-3-200-8	200	2.99 ± 0.030	2.41 ± 0.030	0.0100	0.0380	203	5
S-3-HT-7	HT	2.99 ± 0.030	2.41 ± 0.030	0.0110	0.0400	178	25
S-3-HT-8	HT	2.99 ± 0.030	2.41 ± 0.030	0.0110	0.0400	203	25
S-4-600-7							
S-4-600-8							

NMR tubes are manufactured with round bottoms and are available with flat bottoms upon request.
We manufacture all NMR tubes in any length upon request.

Select Series NMR Sample Tubes for Ceramic Turbines

Ceramic spinner turbines, often relied upon for variable or high temperature applications, are manufactured to extremely precise dimensional specifications.

Unlike conventional room temperature turbines made from polymers such as POM (acetal, or polyoxymethylene) and Kel-F (PCTFE, or polychlorotrifluoroethylene) or even variable temperature turbines made from PEEK (polyetheretherketone) which can flex and accommodate larger diameter tubes to a certain degree, most ceramic turbines will not tolerate even a slightly larger diameter tube.

Ceramic turbines, composed of a very hard, rigid and brittle refractory substance, cannot flex in the slightest degree, and many of the ones currently available do not incorporate any design features permitting some degree of flexure.

To compensate for this inability, the inner diameter of ceramic turbines must be very precise and uniform from one to another, ensuring consistent performance across multiple turbines and tubes.

Accordingly, the NMR sample tubes used with ceramic turbines must meet stringent dimensional specifications as well.

When working under variable temperature conditions, the tube diameter specifications narrow and tighten even more to take account of any slight thermal expansions or contractions that can result.

To meet this stringent diameter requirement, Norell has developed a new line of NMR sample tubes, including both 5mm and 3mm O.D. sizes, that adhere to strict outside diameter specifications that are very tightly controlled.

Item No.	MHz	O.D. (mm)	I.D. (mm)	Concentricity (mm)	Camber ± (mm)	Length (mm)	Packed In Lots Of
CTS-5-900-7	900	4.93 +0.000 –0.008	4.16 ±0.006	0.0020	0.0030	178	5
CTS-5-900-8	900	4.93 +0.000 –0.008	4.16 ±0.006	0.0020	0.0030	203	5
CTS-5-800-7	800	4.93 +0.000 –0.010	4.16 ±0.012	0.0025	0.0038	178	5
CTS-5-800-8	800	4.93 +0.000 –0.010	4.16 ±0.012	0.0025	0.0038	203	5
CTS-5-600-7	600	4.93 +0.000 –0.012	4.16 ±0.012	0.0040	0.0060	178	5
CTS-5-600-8	600	4.93 +0.000 –0.012	4.16 ±0.012	0.0040	0.0060	203	5
CTS-5-500-7	500	4.93 +0.000 –0.026	4.16 ±0.025	0.0050	0.0130	178	5
CTS-5-500-8	500	4.93 +0.000 –0.026	4.16 ±0.025	0.0050	0.0130	203	5
CTS-3-900-7	900	2.95 +0.000 –0.008	2.37 ±0.006	0.0020	0.0030	178	5
CTS-3-900-8	900	2.95 +0.000 –0.008	2.37 ±0.006	0.0020	0.0030	203	5
CTS-3-800-7	800	2.95 +0.000 –0.010	2.37 ±0.010	0.0025	0.0038	178	5
CTS-3-800-8	800	2.95 +0.000 –0.010	2.37 ±0.010	0.0025	0.0038	203	5
CTS-3-600-7	600	2.95 +0.000 –0.012	2.37 ±0.012	0.0040	0.0060	178	5
CTS-3-600-8	600	2.95 +0.000 –0.012	2.37 ±0.012	0.0040	0.0060	203	5
CTS-3-500-7	500	2.95 +0.000 –0.020	2.37 ±0.015	0.0050	0.0130	178	5
CTS-3-500-8	500	2.95 +0.000 –0.020	2.37 ±0.015	0.0050	0.0130	203	5

Manufactured from ASTM Type 1 Class B glass, commonly referred to as N-51A

Our "Standard Series" NMR tubes are manufactured out of ASTM Type 1 Class B glass, commonly referred to as N-51A. Applications that are suited for using this type of glass are routine NMR where samples are run under room temperatures with no thermal gradients. It is therefore not recommended to fuse this glass with standard vacuum manifolds and the like, since these are generally made out of Type 1 Class A glass. Each NMR tube is checked for concentricity and camber specifications utilizing the latest computer technology. At Norell we have taken NMR tube manufacturing to a new level of science.

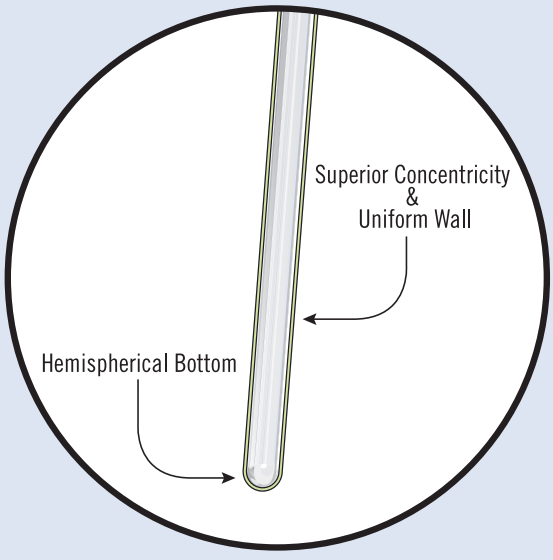
5mm Ultra-Precision, High-Precision & Precision NMR Sample Tubes

Item No.	MHz	O.D. (mm)	I.D. (mm)	Concentricity (mm)	Camber ±(mm)	Length (mm)	Packed In Lots Of
5020-USP-7	1000	4.97 ± 0.004	4.20 ± 0.006	0.003	0.004	178	5
5020-USP-8	1000	4.97 ± 0.004	4.20 ± 0.006	0.003	0.004	203	5
5010-USP-7	750	4.97 ± 0.005	4.20 ± 0.012	0.004	0.005	178	5
5010-USP-8	750	4.97 ± 0.005	4.20 ± 0.012	0.004	0.005	203	5
509-UP-7	600	4.97 ± 0.006	4.20 ± 0.012	0.004	0.006	178	5
509-UP-8	600	4.97 ± 0.006	4.20 ± 0.012	0.004	0.006	203	5
508-UP-7	500	4.97 ± 0.013	4.20 ± 0.025	0.005	0.013	178	5
508-UP-8	500	4.97 ± 0.013	4.20 ± 0.025	0.005	0.013	203	5
507-HP-7	400	4.97 ± 0.013	4.20 ± 0.025	0.007	0.019	178	5
507-HP-8	400	4.97 ± 0.013	4.20 ± 0.025	0.007	0.019	203	5
506-P-7	300	4.97 ± 0.025	4.20 ± 0.025	0.007	0.025	178	25
506-P-8	300	4.97 ± 0.025	4.20 ± 0.025	0.007	0.025	203	25
XR-55™-7	300	4.97 ± 0.025	4.20 ± 0.025	0.010	0.038	178	25
XR-55™-8	300	4.97 ± 0.025	4.20 ± 0.025	0.010	0.038	203	25
505-P-7	200	4.97 ± 0.030	4.20 ± 0.030	0.010	0.040	178	25
505-P-8	200	4.97 ± 0.030	4.20 ± 0.030	0.010	0.040	203	25

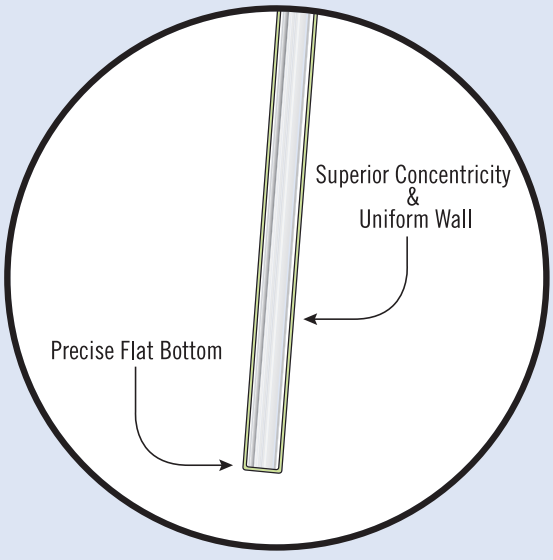
5mm Economy High-Throughput NMR Sample Tubes

Item No.	MHz	O.D. (mm)	I.D. (mm)	Concentricity (mm)	Camber ±(mm)	Length (mm)	Packed In Lots Of
502-7	HT^{PLUS}	4.97 ± 0.050	4.20 ± 0.050	0.020	0.070	178	50
502-8	HT^{PLUS}	4.97 ± 0.050	4.20 ± 0.050	0.020	0.070	203	50
552-7	HT^{PLUS}	4.97 ± 0.050	4.20 ± 0.050	0.020	0.070	178	5
552-8	HT^{PLUS}	4.97 ± 0.050	4.20 ± 0.050	0.020	0.070	203	5
ST500-7	HT	4.97 ± 0.070	4.20 ± 0.070	0.025	0.075	178	100
ST500-8	HT	4.97 ± 0.070	4.20 ± 0.070	0.025	0.075	203	100
ST550-7	HT	4.97 ± 0.070	4.20 ± 0.070	0.025	0.075	178	5
ST550-8	HT	4.97 ± 0.070	4.20 ± 0.070	0.025	0.075	203	5

NORELL® Round Bottom NMR Tube



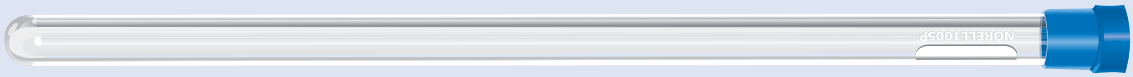
NORELL® Flat Bottom NMR Tube



Through our advanced manufacturing process, the NMR tube bottoms are uniformly hemispherical and consistent, thereby minimizing shimming and susceptibility differences among samples. This uniformity extends throughout the wall thickness of the tubes, maximizing the concentricity among tubes and lots. This translates to more consistent placement of the contained sample volumes in today's advanced, highly homogeneous, high field NMR magnets.

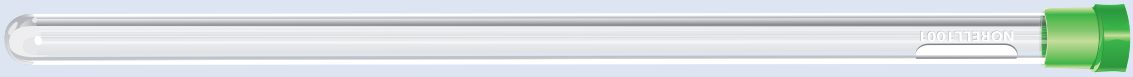
NMR tubes are manufactured with round bottoms and are available with flat bottoms upon request.
We manufacture all NMR tubes in any length upon request.

10mm Ultra-Precision & Precision NMR Sample Tubes



Item No.	MHz	O.D. (mm)	I.D. (mm)	Concentricity (mm)	Camber ±(mm)	Length (mm)	Packed In Lots Of
1008-UP-7	400	10.00 ± 0.013	8.76 ± 0.025	0.005	0.070	178	5
1008-UP-8	400	10.00 ± 0.013	8.76 ± 0.025	0.005	0.070	203	5
1005-P-7	300	10.00 ± 0.013	8.76 ± 0.025	0.020	0.013	178	5
1005-P-8	300	10.00 ± 0.013	8.76 ± 0.025	0.020	0.013	203	5

10mm Economy NMR Sample Tubes

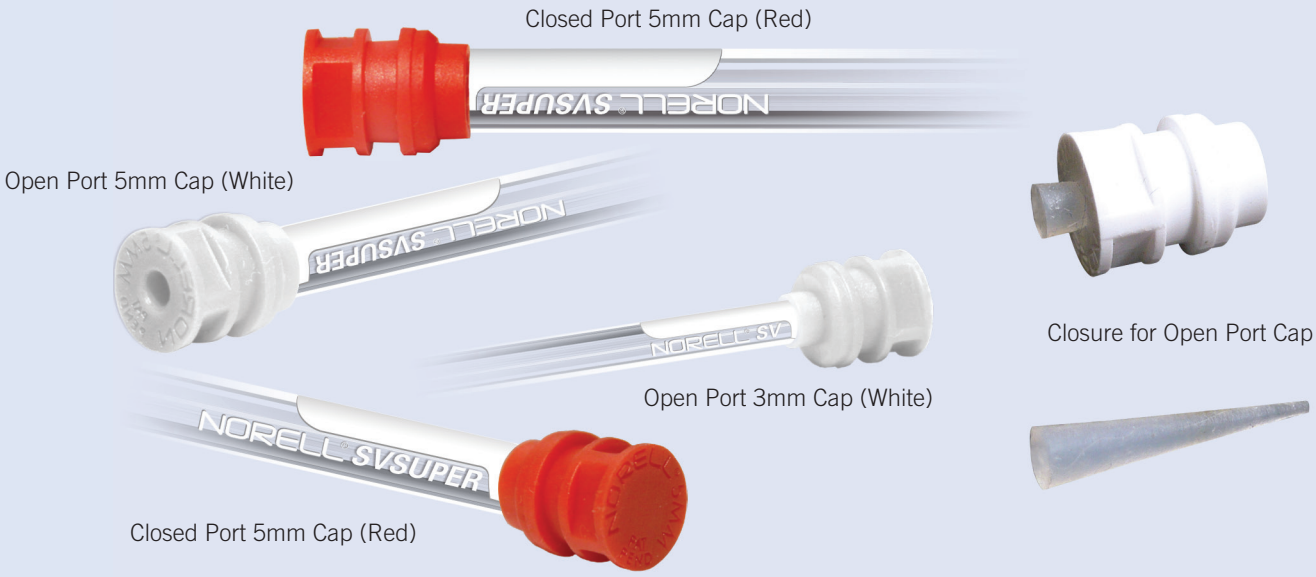


Item No.	MHz	O.D. (mm)	I.D. (mm)	Concentricity (mm)	Camber ±(mm)	Length (mm)	Packed In Lots Of
1001-7	200	10.00 ± 0.013	8.76 ± 0.025	nominal	nominal	178	100
1001-8	200	10.00 ± 0.013	8.76 ± 0.025	nominal	nominal	203	100

NMR tubes are manufactured with round bottoms and are available with flat bottoms upon request.
We manufacture all NMR tubes in any length upon request.

Integrated Closure System

Introducing our new Sample Vault™ Series NMR tubes with Sample Vault™ caps (U.S. Patent No. 8,054,080), engineered for a new generation of high-throughput lab automation systems, including the Bruker SampleJet™. Designed to be used with 96 position carriers using 103.5mm (about 4") long NMR tubes with open port caps, or 178mm (7") long NMR tubes with closed port caps, Sample Vault™ caps have superior holding and sealing capabilities which eliminate cap / tube failure in your instrument. Our patented design incorporates a white band positioned on the NMR tube that aligns with the base of the cap, indicating a properly locked position. Together, our Sample Vault™ caps and Sample Vault™ tubes form an integrated closure system for fail-safe delivery of your sample into the magnet. We offer Sample Vault™ tubes in both 3mm & 5mm outer diameters for use up to 700 MHz and 950 MHz. Our proven quality and innovative engineering speaks for itself.



- Engineered for a new generation of high-throughput lab automation systems, such as the SampleJet™ system from Bruker.
- Two precision types available for up to 700 MHz and 950 MHz spectrometers.
- Superior Sample Vault™ cap (U.S. Patent No. 8,054,080) attaches semi-permanently for multiple uses and for critical applications.
- Choice of two Sample Vault™ cap styles: either closed port or open port, giving you the ultimate in choice of sample sealing.
- Closures are available to seal the Sample Vault™ Open Port caps. They are made of a soft, resilient silicone rubber that forms a very effective seal, with a high degree of inertness, solvent resistance and high temperature capability (up to 200°C). The closures are easily removed, and may be trimmed to length with a knife blade or scissors.
- Safe for cold refrigeration storage, works with cryo-probes and variable temperature studies.

Sample Vault™ Series NMR Tube Specifications

Packed in Lots of 96 with Caps. Choose Open or Closed Port.

Item No.	MHz Rating	Cap Type	OD	Wall Size	Concentricity	Camber	Length
SVCP-5-103.5-96	Up to 700 MHz	Closed	5 mm	0.38 mm	40 µm	60 µm	103.5 mm
SVOP-5-103.5-96	Up to 700 MHz	Open	5 mm	0.38 mm	40 µm	60 µm	103.5 mm
SVCP-5-178-96	Up to 700 MHz	Closed	5 mm	0.38 mm	40 µm	60 µm	178 mm
SVOP-5-178-96	Up to 700 MHz	Open	5 mm	0.38 mm	40 µm	60 µm	178 mm
SVCP-3-103.5-96	Up to 700 MHz	Closed	3 mm	0.38 mm	40 µm	60 µm	103.5 mm
SVOP-3-103.5-96	Up to 700 MHz	Open	3 mm	0.38 mm	40 µm	60 µm	103.5 mm
SVCP-3-178-96	Up to 700 MHz	Closed	3 mm	0.38 mm	40 µm	60 µm	178 mm
SVOP-3-178-96	Up to 700 MHz	Open	3 mm	0.38 mm	40 µm	60 µm	178 mm
SVCP-Super-5-103.5-96	Up to 950 MHz	Closed	5 mm	0.38 mm	20 µm	30 µm	103.5 mm
SVOP-Super-5-103.5-96	Up to 950 MHz	Open	5 mm	0.38 mm	20 µm	30 µm	103.5 mm
SVCP-Super-5-178-96	Up to 950 MHz	Closed	5 mm	0.38 mm	20 µm	30 µm	178 mm
SVOP-Super-5-178-96	Up to 950 MHz	Open	5 mm	0.38 mm	20 µm	30 µm	178 mm
SVCP-Super-3-103.5-96	Up to 950 MHz	Closed	3 mm	0.38 mm	20 µm	30 µm	103.5 mm
SVOP-Super-3-103.5-96	Up to 950 MHz	Open	3 mm	0.38 mm	20 µm	30 µm	103.5 mm
SVCP-Super-3-178-96	Up to 950 MHz	Closed	3 mm	0.38 mm	20 µm	30 µm	178 mm
SVOP-Super-3-178-96	Up to 950 MHz	Open	3 mm	0.38 mm	20 µm	30 µm	178 mm

Medium Wall and Heavy Wall Sample Vault™ NMR Tubes

Packed in Lots of 5 with Caps. Choose Open or Closed Port.

Item No.	MHz Rating	Cap Type	OD (mm)	ID (mm)	Wall (mm)	Length (mm)	Concentricity	Camber
SVCP-Super-5-MW-103.5-5	Up to 950 MHz	Closed	4.97 ± 0.013	3.43 ± 0.025	0.8	103.5	20 µm	30 µm
SVOP-Super-5-MW-103.5-5	Up to 950 MHz	Open	4.97 ± 0.013	3.43 ± 0.025	0.8	103.5	20 µm	30 µm
SVCP-Super-5-HW-103.5-5	Up to 950 MHz	Closed	4.97 ± 0.013	2.20 ± 0.025	1.4	103.5	20 µm	30 µm
SVOP-Super-5-HW-103.5-5	Up to 950 MHz	Open	4.97 ± 0.013	2.20 ± 0.025	1.4	103.5	20 µm	30 µm

Sample Vault™ Caps

Packed in Lots of 96. Choose Open or Closed Port.

Item No.	Cap Type	Cap Color	Size
SVCP-SAMPLEVAULT-3-96PK	Closed Port	Red	3 mm
SVOP-SAMPLEVAULT-3-96PK	Open Port	White	3 mm
SVCP-SAMPLEVAULT-5-96PK	Closed Port	Red	5 mm
SVOP-SAMPLEVAULT-5-96PK	Open Port	White	5 mm

Closures to Seal the Sample Vault™ Open Port Caps

This closure will fit both the 3mm and 5mm Sample Vault™ Open Port caps.

Item No.	Description	Color	Packed in Lots of
SVC-SAMPLEVAULT-SRS	Tapered Silicone Rubber Plug	Clear Translucent	50 100

5mm Natural Quartz NMR Sample Tubes

Recommended for Boron NMR [< 0.1 ppm Boron] and/or UV catalyzed reactions in the region above 210nm [90%T @ 210nm]. Medium and heavy wall NMR tubes are now available, in addition to standard, thin wall NMR tubes, as shown in the tables below.

S-5-600-QTZ

5mm Thin Wall Natural Quartz NMR Sample Tubes

Item No.	MHz	O.D. (mm)	I.D. (mm)	Length (mm)	Packed In Lots Of
S-5-200-QTZ-7	200	4.97 ± 0.030	4.20 ± 0.030	178	5
S-5-200-QTZ-8	200	4.97 ± 0.030	4.20 ± 0.030	203	5
S-5-500-QTZ-7	500	4.97 ± 0.013	4.20 ± 0.025	178	5
S-5-500-QTZ-8	500	4.97 ± 0.013	4.20 ± 0.025	203	5
S-5-600-QTZ-7	600	4.97 ± 0.006	4.20 ± 0.012	178	5
S-5-600-QTZ-8	600	4.97 ± 0.006	4.20 ± 0.012	203	5

5mm Medium Wall Natural Quartz NMR Sample Tubes

Item No.	MHz	O.D. (mm)	I.D. (mm)	Length (mm)	Packed In Lots Of
S-5-200-QTZ-MW-7	200	4.95 ±0.030	3.40 ±0.030	178	1
S-5-200-QTZ-MW-8	200	4.95 ±0.030	3.40 ±0.030	203	1
S-5-500-QTZ-MW-7	500	4.95 ±0.013	3.40 ±0.025	178	1
S-5-500-QTZ-MW-8	500	4.95 ±0.013	3.40 ±0.025	203	1
S-5-600-QTZ-MW-7	600	4.95 ±0.006	3.40 ±0.012	178	1
S-5-600-QTZ-MW-8	600	4.95 ±0.006	3.40 ±0.012	203	1

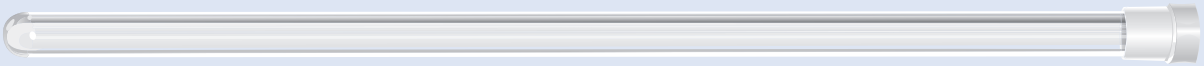
5mm Heavy Wall Natural Quartz NMR Sample Tubes

Item No.	MHz	O.D. (mm)	I.D. (mm)	Length (mm)	Packed In Lots Of
S-5-200-QTZ-HW-7	200	4.95 ±0.030	2.15 ±0.030	178	1
S-5-200-QTZ-HW-8	200	4.95 ±0.030	2.15 ±0.030	203	1
S-5-500-QTZ-HW-7	500	4.95 ±0.013	2.15 ±0.025	178	1
S-5-500-QTZ-HW-8	500	4.95 ±0.013	2.15 ±0.025	203	1
S-5-600-QTZ-HW-7	600	4.95 ±0.006	2.15 ±0.012	178	1
S-5-600-QTZ-HW-8	600	4.95 ±0.006	2.15 ±0.012	203	1

Natural Quartz EPR Sample Tubes

Norell EPR tubes produce lower background signals and have better resistance to breakage than competitor brands. Our special annealing process reduces background noise along with the benefit of protecting against tube breakage. Additionally, we have designed a new fluoropolymer closure system around our fire-polished tube ends that prevents sample loss during temperature gradients. Available in both standard and ultra precision. Supplied with tapered fluoropolymer caps.

S-4-2-EPR-250S



Item No.	O.D. (mm)	I.D. (mm)	Wall (mm)	Length (mm)	Packed In Lots Of
S-4-2-EPR-250S	4.0	2.0	1.00	250	5
S-4-EPR-250S	4.0	3.0	0.50	250	5
S-4-EPR-250P	3.98 ± 0.015	2.95 ± 0.025	0.51	250	5
S-5-EPR-250S	5.0	4.0	0.50	250	5
S-5-EPR-250P	4.97 ± 0.013	4.14 ± 0.008	0.41	250	5

5mm Suprasil® Quartz NMR Sample Tubes

Recommended for Boron NMR [< 0.01 ppm Boron] and/or UV catalyzed reactions in the region above 190nm [90%T @ 190nm].

Item No.	MHz	O.D. (mm)	I.D. (mm)	Length (mm)	Packed in Lots of
S-5-200-SQTZ-7	200	4.97 ± 0.030	4.20 ± 0.030	178	1
S-5-200-SQTZ-8	200	4.97 ± 0.030	4.20 ± 0.030	203	1
S-5-500-SQTZ-7	500	4.97 ± 0.013	4.20 ± 0.025	178	1
S-5-500-SQTZ-8	500	4.97 ± 0.013	4.20 ± 0.025	203	1
S-5-600-SQTZ-7	600	4.97 ± 0.006	4.20 ± 0.012	178	1
S-5-600-SQTZ-8	600	4.97 ± 0.006	4.20 ± 0.012	203	1

S-5-500-SQTZ

Suprasil® Quartz EPR Sample Tubes

Recommended for UV catalyzed reactions in the region at and above 190nm. Provides greater reduction of background noise than natural quartz and is used primarily in studies where greater signal sensitivity is needed. Supplied with tapered fluoropolymer caps.

Item No.	O.D. (mm)	I.D. (mm)	Wall (mm)	Length (mm)	Packed in Lots of
S-4-EPRSQ-250S	4.0	3.0	0.50	250	1
S-4-EPRSQ-250P	3.98 ± 0.015	2.95 ± 0.025	0.51	250	1
S-5-EPRSQ-250S	5.0	4.0	0.50	250	1
S-5-EPRSQ-178P	4.97 ± 0.013	3.98 ± 0.08	0.50	178	1
S-5-EPRSQ-200P	4.97 ± 0.013	3.98 ± 0.08	0.50	200	1
S-5-EPRSQ-250P	4.97 ± 0.013	3.98 ± 0.08	0.50	250	1

Valved NMR Tubes for Vacuum & Reduced Pressure

Handle your NMR sample without flame-sealing your tubes. Fluoropolymer covered o-ring eliminates material incompatibilities. Completely greaseless fluoropolymer assembly, which is easy to use and to disassemble for cleaning. Includes female joint for quick attachment to your vacuum rack.

A vacuum level of 10-7 kPa (10-6 torr) can be attained with this valve. While this valve can also withstand an internal positive pressure to 500 kPa (5 bar, 72 psi), the VT Valved NMR Tube series is intended principally for vacuum work. When pressurizing internally (by heating the NMR tube, for instance), the valve must be fully closed, so that the female vacuum adapter joint (the short glass tube that slips over the top of the PTFE valve stem, sealing against the upper o-rings) cannot be used to apply or be exposed to a positive pressure.

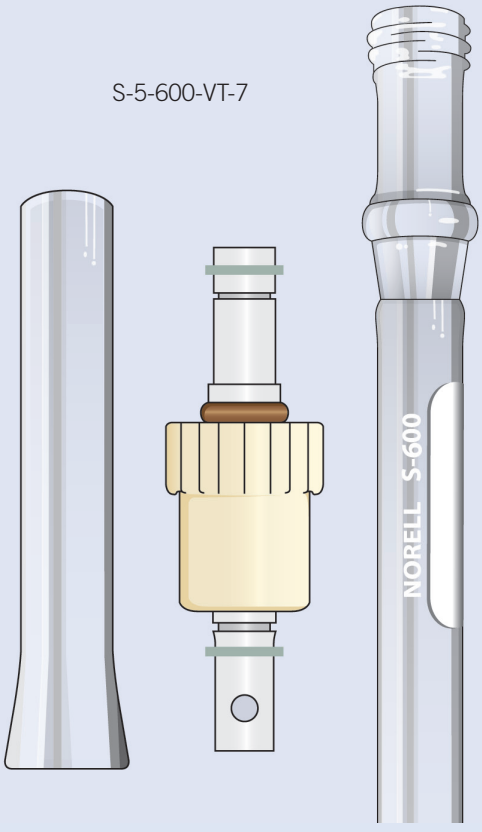
The adjoining tables present a selection of 3 and 5 mm O.D. NMR tubes joined to the VT style valves. However, other tube diameters, lengths, additional MHz ratings and tube materials (such as quartz) are available. Please feel free to request a quote on your custom requirements, as we are continually striving to provide the utmost service and satisfaction to our customers!

5mm Valved NMR Tubes for Vacuum & Reduced Pressure

Item No.	MHz	Length (mm)	I.D. mm (Volume µL/cm)
S-5-300-VT-7	300	178	4.20 (138)
S-5-300-VT-8	300	203	4.20 (138)
S-5-400-VT-7	400	178	4.20 (138)
S-5-400-VT-8	400	203	4.20 (138)
S-5-500-VT-7	500	178	4.20 (138)
S-5-500-VT-8	500	203	4.20 (138)
S-5-600-VT-7	600	178	4.20 (138)
S-5-600-VT-8	600	203	4.20 (138)

3mm Valved NMR Tubes for Vacuum & Reduced Pressure

Item No.	MHz	Length (mm)	I.D. mm (Volume µL/cm)
S-3-300-VT-7	300	178	2.41 (46)
S-3-300-VT-8	300	203	2.41 (46)
S-3-400-VT-7	400	178	2.41 (46)
S-3-400-VT-8	400	203	2.41 (46)
S-3-500-VT-7	500	178	2.41 (46)
S-3-500-VT-8	500	203	2.41 (46)
S-3-600-VT-7	600	178	2.41 (46)
S-3-600-VT-8	600	203	2.41 (46)



INTERMEDIATE PRESSURE VALVED NMR SAMPLE TUBES

Norell, Inc. is pleased to announce the introduction of a new NMR sample tube product line, featuring a glass/ PTFE pressure valve permanently joined to your choice of a wide selection of available NMR sample tubes.

*This valve incorporates an advanced seal design that is superior to alternative valves currently available from other manufacturers. A fluoroelastomer o-ring imparts resilience and a high degree of chemical resistance. A PTFE sheath, forming the primary seal, completely covers the fluoroelastomer o-ring, creating the ultimate barrier against aggressive, reactive substances while providing a totally inert surface.

These pressure tubes facilitate experiments requiring conditions such as pressurized inert atmosphere blanketing, addition of reactive gaseous reagents under pressure, containment of low boiling point solvents or samples at elevated temperatures, and so on.

We recommend that the maximum operating pressure should be limited to 600 kPa (6 bar, 87 psi) when using a thin wall pressure tube, up to 1200 kPa (12 bar, 175 psi) if using a heavy wall pressure tube. (Please see accompanying table for complete details).

Cautionary Note: Glass can be an unpredictable material, especially if it has been scratched or subjected to rough handling. As such, EXTREME CAUTION should be exercised when using glass at elevated pressure or temperature, because it has the potential to fail suddenly and catastrophically. Therefore, anyone attempting to use glass components, such as NMR sample tubes at elevated or reduced pressures and/or temperatures should ensure that adequate personal protection, such as explosion shields, full face coverage shields, heavy gloves, etc., are employed to protect oneself against flying glass fragments if a glass component fails explosively.

The valve accepts 1/16 inch O.D. PTFE tubing, a common laboratory instrumentation pressure line. The required components, a 1/16 inch ferrule and matching compression nut, are included with the valve assembly. The valve easily and quickly connects and disconnects by means of the single compression nut.

All components of the valved pressure tube consist of either glass or polymer, as described in more detail below, allowing safe use in high magnetic field environments.

The sample tube portion, manufactured from ASTM Type 1 Class A glass (Pyrex® or an equivalent) tolerates a maximum temperature of about 230°C, and resists sudden temperature changes, or thermal shock, very well without breakage, but sudden temperature changes should be restricted to a range of 120°C or less.

INTERMEDIATE PRESSURE VALVED NMR SAMPLE TUBES (Cont.)

The pressure valve portion possesses superior chemical and corrosion resistance. The glass shell, also formed from ASTM Type 1 Class A glass, matches that of the sample tube, thereby minimizing breakage of the joint caused by internal strain or thermal shock.

5mm Intermediate Pressure Valved NMR Sample Tubes

Item No.	MHz	Tube Length (mm)	I.D. mm (Volume µL/cm)	Tube Wall	Recommended Maximum Operating Pressure		
					kPa	bar	psi
S-5-300-IPV-7	300	178	4.20 (138)	thin	600	6	87
S-5-300-MW-IPV-7	300	178	3.43 (92)	medium	900	9	130
S-5-300-HW-IPV-7	300	178	2.20 (38)	heavy	1200	12	175
S-5-300-IPV-8	300	203	4.20 (138)	thin	600	6	87
S-5-300-MW-IPV-8	300	203	3.43 (92)	medium	900	9	130
S-5-300-HW-IPV-8	300	203	2.20 (38)	heavy	1200	12	175
S-5-400-IPV-7	400	178	4.20 (138)	thin	600	6	87
S-5-400-MW-IPV-7	400	178	3.43 (92)	medium	900	9	130
S-5-400-HW-IPV-7	400	178	2.20 (38)	heavy	1200	12	175
S-5-400-IPV-8	400	203	4.20 (138)	thin	600	6	87
S-5-400-MW-IPV-8	400	203	3.43 (92)	medium	900	9	130
S-5-400-HW-IPV-8	400	203	2.20 (38)	heavy	1200	12	175
S-5-500-IPV-7	500	178	4.20 (138)	thin	600	6	87
S-5-500-MW-IPV-7	500	178	3.43 (92)	medium	900	9	130
S-5-500-HW-IPV-7	500	178	2.20 (38)	heavy	1200	12	175
S-5-500-IPV-8	500	203	4.20 (138)	thin	600	6	87
S-5-500-MW-IPV-8	500	203	3.43 (92)	medium	900	9	130
S-5-500-HW-IPV-8	500	203	2.20 (38)	heavy	1200	12	175
S-5-600-IPV-7	600	178	4.20 (138)	thin	600	6	87
S-5-600-MW-IPV-7	600	178	3.43 (92)	medium	900	9	130
S-5-600-HW-IPV-7	600	178	2.20 (38)	heavy	1200	12	175
S-5-600-IPV-8	600	203	4.20 (138)	thin	600	6	87
S-5-600-MW-IPV-8	600	203	3.43 (92)	medium	900	9	130
S-5-600-HW-IPV-8	600	203	2.20 (38)	heavy	1200	12	175

3mm Intermediate Pressure Valved NMR Sample Tubes

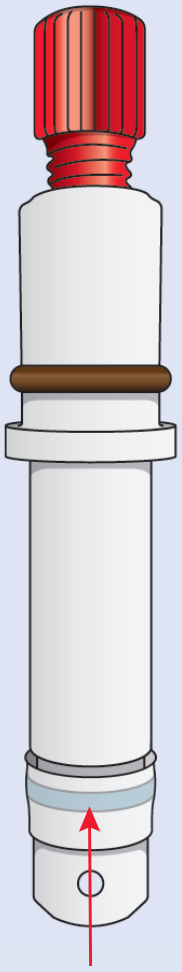
Item No.	MHz	Tube Length (mm)	I.D. mm (Volume µL/cm)	Tube Wall	Recommended Maximum Operating Pressure		
					kPa	bar	psi
S-3-300-IPV-7	300	178	2.41 (46)	thin	860	8.6	125
S-3-300-IPV-8	300	203	2.41 (46)	thin	860	8.6	125
S-3-400-IPV-7	400	178	2.41 (46)	thin	860	8.6	125
S-3-400-IPV-8	400	203	2.41 (46)	thin	860	8.6	125
S-3-500-IPV-7	500	178	2.41 (46)	thin	860	8.6	125
S-3-500-IPV-8	500	203	2.41 (46)	thin	860	8.6	125
S-3-600-IPV-7	600	178	2.41 (46)	thin	860	8.6	125
S-3-600-IPV-8	600	203	2.41 (46)	thin	860	8.6	125

The valve stem, composed of PTFE fluoropolymer (polytetrafluoroethylene) is completely inert and resists virtually all solvents, reactive chemicals and reagents, and deterioration induced by corrosive conditions.

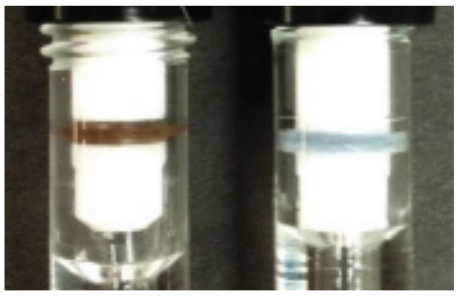
The ferrule, or sealing nut (included with the valve), used to seal the pressure supply tubing to the valve, also displays excellent corrosion and chemical resistance. Constructed from ETFE (ethylene-tetrafluoroethylene) fluoropolymer, this material combines excellent mechanical properties, such as toughness, high impact strength, long flex life, medium stiffness and good abrasion resistance with nearly the same level of chemical resistance shown by the fully fluorinated polymers such as PTFE.

The compression nut (also included with the valve) is machined from PEEK (polyether ether ketone). This material is an advanced, high-performance polymer having excellent mechanicalproperties, ensuring long life and reliable performance throughout numerous connecting and disconnecting operations. It is a very hard material, with a very high degree of tensile strength, stiffness and dimensional stability, along with excellent chemical resistance.

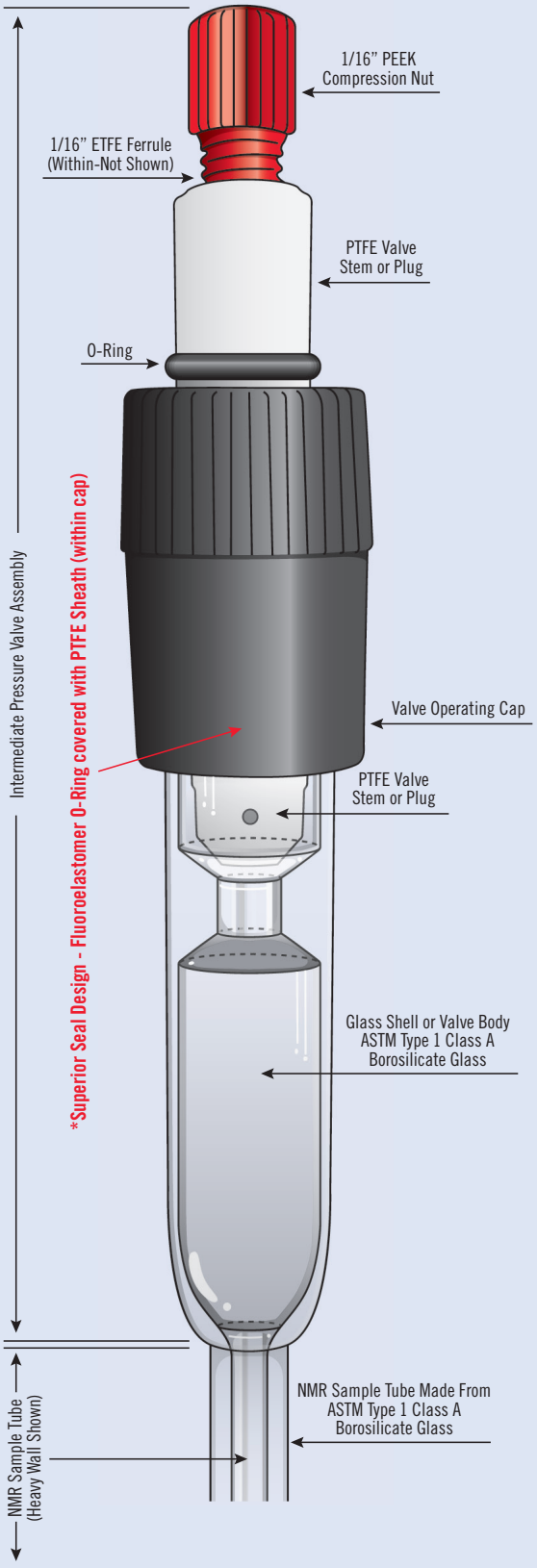
INTERMEDIATE PRESSURE VALVED NMR SAMPLE TUBES (Cont.)



*Fluoroelastomer O-Ring covered with PTFE Sheath



Intermediate Pressure Valve shown with a typical 5mm heavy wall tube, such as Item Number S-5-600-HW-IPV-8



HIGH PRESSURE VALVED NMR SAMPLE TUBES

Norell, Inc. is pleased to introduce another addition to the Valved NMR Sample Tubes product line. This latest addition, featuring a High Pressure Valve constructed entirely from glass and fluoropolymer, can be permanently joined to your choice of a wide array of NMR sample tubes.

These pressure tubes facilitate experiments requiring conditions such as pressurized inert atmosphere blanketing, addition of reactive gaseous reagents under pressure, containment of low boiling solvents or samples at elevated temperatures and so on.

The valve design includes significant improvements not found in similar versions from other manufacturers. The Norell High Pressure Valve requires no special tools or tubing preparation procedures prior to use. Secure, leak-free connections to standard 1/8" O.D. laboratory instrumentation pressure tubing need only be made finger-tight, unlike competitor's versions that often leak at this connection point even after tightening with a wrench.

We supply the necessary components of the compression tube fitting (consisting of a compression nut, ferrule and gripper) with the High Pressure Valve assembly, whereas other manufacturers do not. The special compression fittings do not permanently attach to the pressure line. This permits removal and reuse in other locations or connection to different gas supplies without installing dedicated metallic double ferrule fittings at each point of use.

We also include a short length of 1/8" O.D. Type 316 stainless steel tube to provide versatility when making pressure connections.

For instance, the tube may be inserted into a flexible 1/8" I.D. braid-reinforced PVC or other pressure hose, and secured with a small worm-drive hose clamp.

The supplied tube can also be permanently attached to an optional 1/8" Type 316 stainless steel union (shown in the accompanying illustration, not included with the basic valve purchase but available separately as Item Number HPV-1/8X1/8-UNION) to form a secure, leak-proof transition to metallic double ferrule or Swagelok type fittings, such as may be present on an existing pressure line.

Lastly, a new 1/8" O.D. pressure supply line, having no permanently affixed fittings or ferrules, may be coupled directly to the High Pressure Valve utilizing the supplied compression nut and components.

The included compression fitting components seal equally well on both metallic and non-metallic tubing, permitting use with stainless steel, brass or other metallic tubing as well as highly inert and chemically resistant non-metallic tubing such as heavy wall PTFE.

Likewise, the valve stem, or piston, of the High Pressure Valve, also composed of PTFE fluoropolymer, is completely inert and resists virtually all solvents, reactive chemicals and reagents, and deterioration induced by corrosive conditions. The PTFE stem incorporates a wiper portion that serves as the primary seal, while a fluoroelastomer o-ring forms a secondary backup seal, protected by the primary PTFE wiper seal.

The sample tube portion, manufactured from ASTM Type 1 Class A glass (Pyrex® or an equivalent) tolerates a maximum temperature of about 230°C, and resists sudden temperature changes, or thermal shock, very well without breakage, but sudden temperature changes should be restricted to a range of 120°C or less.

The glass shell of the high pressure valve, also formed from ASTM Type 1 Class A glass, matches that of the sample tube, thereby minimizing breakage of the joint caused by internal strain or thermal shock

The Norell High Pressure Valve remains compatible with and can be connected to existing metallic double ferrule compression tube fittings, such as Swagelok®, Parker A-LOK®, Yor-Lok®, Let-Lok® and other brands, but completely leak-free connections cannot be guaranteed when used with these types of metallic fittings.

We have found that metallic double ferrule fittings cannot seal well to softer materials such as PTFE. Normally this should not present a problem when using innocuous gases such as argon or nitrogen, for instance, but a potential problem arises when using corrosive, toxic, flammable or otherwise hazardous gases.

Therefore, with the basic valve purchase, we include the special sealing components to ensure an effective seal when working with potentially hazardous materials.

We recommend that the maximum operating pressure should be limited to 1400 kPa (14 bar, 200 psi) when using this valve with a 5 mm O.D. heavy wall tube. (Please see accompanying table for complete details.)

Cautionary Note: Glass can be an unpredictable material, especially if it has been scratched or subjected to rough handling. As such, EXTREME CAUTION should be exercised when using glass at elevated pressure or temperature, because it has the potential to fail suddenly and catastrophically. Therefore, anyone attempting to use glass components, such as NMR sample tubes at elevated or reduced pressures and/or temperatures should ensure that adequate personal protection, such as explosion shields, full face coverage shields, heavy gloves, etc., are employed to protect oneself against flying glass fragments if a glass component fails explosively.

The accompanying tables present a selection of 3mm, 5mm and 10mm O.D. NMR tubes joined to the High Pressure Valve, but other lengths, additional MHz ratings and tube materials (such as quartz) are available. Please feel free to request a quote for your custom requirements, as we are continually striving to provide the utmost service and satisfaction to our customers!

HIGH PRESSURE VALVED NMR SAMPLE TUBES (Cont.)

5mm High Pressure Valved NMR Sample Tubes

Item No.	MHz	Tube Length (mm)	I.D. mm (Volume µL/cm)	Tube Wall	Recommended Maximum Operating Pressure		
					kPa	bar	psi
S-5-300-HPV-7	300	178	4.20 (138)	thin	700	7	100
S-5-300-MW-HPV-7	300	178	3.43 (92)	medium	1050	10.5	150
S-5-300-HW-HPV-7	300	178	2.20 (38)	heavy	1400	14	200
S-5-300-HPV-8	300	203	4.20 (138)	thin	700	7	100
S-5-300-MW-HPV-8	300	203	3.43 (92)	medium	1050	10.5	150
S-5-300-HW-HPV-8	300	203	2.20 (38)	heavy	1400	14	200
S-5-400-HPV-7	400	178	4.20 (138)	thin	700	7	100
S-5-400-MW-HPV-7	400	178	3.43 (92)	medium	1050	10.5	150
S-5-400-HW-HPV-7	400	178	2.20 (38)	heavy	1400	14	200
S-5-400-HPV-8	400	203	4.20 (138)	thin	700	7	100
S-5-400-MW-HPV-8	400	203	3.43 (92)	medium	1050	10.5	150
S-5-400-HW-HPV-8	400	203	2.20 (38)	heavy	1400	14	200
S-5-500-HPV-7	500	178	4.20 (138)	thin	700	7	100
S-5-500-MW-HPV-7	500	178	3.43 (92)	medium	1050	10.5	150
S-5-500-HW-HPV-7	500	178	2.20 (38)	heavy	1400	14	200
S-5-500-HPV-8	500	203	4.20 (138)	thin	700	7	100
S-5-500-MW-HPV-8	500	203	3.43 (92)	medium	1050	10.5	150
S-5-500-HW-HPV-8	500	203	2.20 (38)	heavy	1400	14	200
S-5-600-HPV-7	600	178	4.20 (138)	thin	700	7	100
S-5-600-MW-HPV-7	600	178	3.43 (92)	medium	1050	10.5	150
S-5-600-HW-HPV-7	600	178	2.20 (38)	heavy	1400	14	200
S-5-600-HPV-8	600	203	4.20 (138)	thin	700	7	100
S-5-600-MW-HPV-8	600	203	3.43 (92)	medium	1050	10.5	150
S-5-600-HW-HPV-8	600	203	2.20 (38)	heavy	1400	14	200

3mm High Pressure Valved NMR Sample Tubes

Item No.	MHz	Tube Length (mm)	I.D. mm (Volume µL/cm)	Tube Wall	Recommended Maximum Operating Pressure		
					kPa	bar	psi
S-3-300-HPV-7	300	178	2.41 (46)	thin	960	9.6	140
S-3-300-HPV-8	300	203	2.41 (46)	thin	960	9.6	140
S-3-400-HPV-7	400	178	2.41 (46)	thin	960	9.6	140
S-3-400-HPV-8	400	203	2.41 (46)	thin	960	9.6	140
S-3-500-HPV-7	500	178	2.41 (46)	thin	960	9.6	140
S-3-500-HPV-8	500	203	2.41 (46)	thin	960	9.6	140
S-3-600-HPV-7	600	178	2.41 (46)	thin	960	9.6	140
S-3-600-HPV-8	600	203	2.41 (46)	thin	960	9.6	140

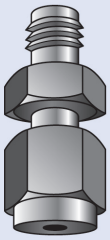
10mm High Pressure Valved NMR Sample Tubes

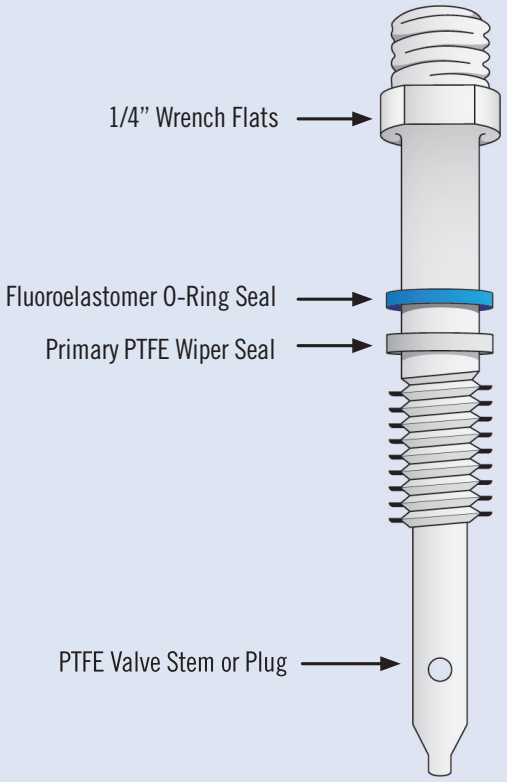
Item No.	MHz	Tube Length (mm)	I.D. mm (Volume µL/cm)	Tube Wall	Recommended Maximum Operating Pressure		
					kPa	bar	psi
S-10-500-HPV-7	500	178	9.10 (650)	thin	520	5.2	75
S-10-500-HPV-8	500	203	9.10 (650)	thin	520	5.2	75
S-10-600-HPV-7	600	178	9.10 (650)	thin	520	5.2	75
S-10-600-HPV-8	600	203	9.10 (650)	thin	520	5.2	75

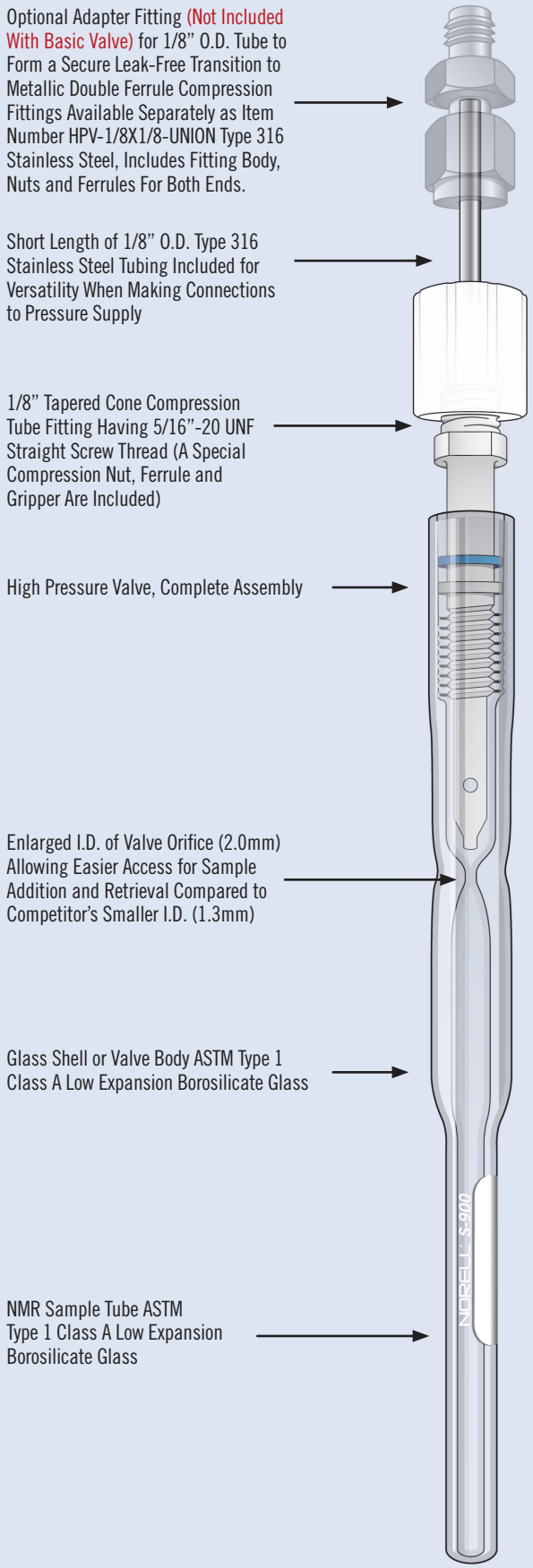
HIGH PRESSURE VALVED NMR SAMPLE TUBES (Cont.)

Accessories for High Pressure Valved NMR Sample Tubes

Item Number	Description
HPV-1/8X1/8-UNION	Optional Union Adapter, Type 316 Stainless Steel, for 1/8" metallic double ferrule line termination
HPV-1/4-WRENCH	Wrench, ¼" double open-end, 15° and 75° angled openings, forged steel







S-5-600-SC

Screw-Cap NMR Sample Tubes

Convenient screw cap access with the security of a fluoropolymer seal. Supplied with open top cap & fluoropolymer / silicone septum for quick and clean access with a 22 gauge standard point needle.

Item No.	MHz	Length (in)
S-5-300-SC-7	300	7
S-5-300-SC-8	300	8
S-5-400-SC-7	400	7
S-5-400-SC-8	400	8
S-5-500-SC-7	500	7
S-5-500-SC-8	500	8
S-5-600-SC-7	600	7
S-5-600-SC-8	600	8

Screw Cap NMR Tube Caps

Supplied with a fluoropolymer backed silicone septum for clean, easy access with a 22 gauge standard point needle. Available with solid screw cap and no septum.

Item No.	Description	Thread	Packed In Lots Of
S-5-SC	5mm Screw Cap Tube Cap With Septum	8-425	12
S-5-SSC	Solid 5mm Screw Cap Tube Cap No Septum	8-425	12

S-5-SC

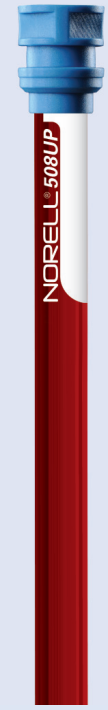
Bruker Microbore NMR Sample Tubes

BMT-S-5-800-8

New ultra-precision NMR tubes for Bruker's microprobes offer complete reliability and reproducibility over other brands. Features include a selection of smaller diameter lower stems, shown in the accompanying table, mounted on a high-precision 800 MHz rated 5mm Select Series™ NMR tube that performs perfectly even under severe temperature gradients. Data integrity is completely assured thanks to our high quality manufacturing standards.

Item No.	Stem O.D. (mm)	Stem I.D. (mm)	Stem Length (mm)	Overall Length (mm)	Capillary Volume (µl)
BMT-S-5-800-8-W/1.0mm Stem	1.0 ± 0.025	0.58 ± 0.013	50	203	13
BMT-S-5-800-8-W/1.7mm Stem	1.7 ± 0.025	1.3 ± 0.013	50	203	65
BMT-S-5-800-8-W/2.0mm Stem	2.0 ± 0.025	1.6 ± 0.013	50	203	100
BMT-S-5-800-8-W/2.5mm Stem	2.5 ± 0.025	2.1 ± 0.013	50	203	175
BMT-S-5-800-8-W/3.0mm Stem	3.0 ± 0.025	2.41 ± 0.013	50	203	215

Amberized NMR Sample Tubes



Amberized

Amberized NMR tubes offer photosensitive materials protection from visible and ultraviolet radiation. Typical optical transmittance values at 650nm to 300nm range from 0% to 50% (this region includes the visible spectrum). From 300nm to 190nm, in the UV region, the optical transmittance is virtually 0%, due primarily to the intrinsic opacity of glass to UV radiation.

Most borosilicate glass NMR tubes can be amberized, including all those from 3mm to 10mm O.D within our Select Series™ or Standard Series™ product lines. In addition, special purpose NMR tubes, such as valved tubes (having vacuum & reduced pressure, intermediate pressure or high pressure valve assemblies), screw-cap, constricted and medium or heavy wall NMR tubes amberize readily.

The coloration produced within the glass through the high temperature amberizing process arises from an exchange of metal atoms in the glass structure, resulting in a strong, permanent tint unaffected by exposure to chemicals or solvents and physical abrasion. Strongly heating amberized glass during subsequent glassblowing or forming operations can, however, greatly weaken or destroy the amber color.

Unlike borosilicate glass NMR tubes, however, quartz NMR and EPR tubes consist of pure silica, and so cannot be amberized, because quartz contains none of the readily displaced metallic elements normally added when manufacturing glass from silica sand.

Ordering Information

To order an item to be amberized, please state "Amberized" after the desired Item Number or in the product description. Please note that amberizing will incur an additional charge.

High-Throughput NMR Sample Tubes

S-3-HT

Recommended for use with our Optimizer Inserts™ (pages 28, 29)

Ideal for reducing salt effects when running buffered solutions for bio-samples. Only Norell can satisfy the many customer requests for a high-throughput NMR tube that features both high-precision, as required in today's high-field spectrometers, and economy in price. Made from ASTM Type 1 Class A borosilicate glass for reproducibility and durability. Specially designed for one-time use for routine NMR, our high-precision NMR tubes will outperform more expensive competitor brands. See for yourself. Available in packs of 25.

Item No.	O.D. (mm)	I.D. (mm)	Concentricity (mm)	Camber ± (mm)	Length (mm)	Packed In Lots Of
S-3-HT-7	2.99 ± 0.030	2.41 ± 0.030	0.011	0.040	178	25
S-3-HT-8	2.99 ± 0.030	2.41 ± 0.030	0.011	0.040	203	25
S-4-HT-7	3.99 ± 0.030	3.20 ± 0.030	0.011	0.040	178	25
S-4-HT-8	3.99 ± 0.030	3.20 ± 0.030	0.011	0.040	203	25
S-4.25-HT-7	4.24 ± 0.030	3.34 ± 0.030	0.011	0.040	178	25
S-4.25-HT-8	4.24 ± 0.030	3.34 ± 0.030	0.011	0.040	203	25

Constricted NMR Sample Tubes

Constricted NMR tubes offer a convenient way to seal your sample from air or other contaminants. Simply heat the constricted portion using a suitable heat source (e.g. a small butane torch) then gently twist and pull on the open end to seal. Also allows samples to be stored under vacuum or inert gas. (Please note: constricted tubes are specified and ordered by the required finished length, as shown in the table below, and are measured from the tube bottom to the center of the constriction.)

Constricted

OD of NMR Tube (mm)	ID at Constriction (mm)	Finished Length (After Sealing, mm)	Overall Length (Before Sealing, mm)
3 – 10	1.5 – 2.0	178 nominal	203 ± 2.0
3 – 10	1.5 – 2.0	203 nominal	228 ± 2.0

Heavy Wall NMR Sample Tubes

Heavy wall (1.4 mm) NMR tubes offer the ultimate protection from breakage, either through rapid changes in temperature or pressure, or from mishandling. Recommended for use with hazardous or radioactive samples, where sample containment is critical. Available either constricted and/or amberized.

Item No.	MHz	O.D. (mm)	I.D. (mm)	Wall (mm)	Length (mm)	Packed In Lots Of
S-5-500-HW-7	up to 500	4.97 ± 0.013	2.20 ± 0.025	1.4	178	5
S-5-500-HW-8	up to 500	4.97 ± 0.013	2.20 ± 0.025	1.4	203	5
S-5-500-HW-9	up to 500	4.97 ± 0.013	2.20 ± 0.025	1.4	228.6	5
S-5-400-HW-7	up to 400	4.97 ± 0.013	2.20 ± 0.025	1.4	178	5
S-5-400-HW-8	up to 400	4.97 ± 0.013	2.20 ± 0.025	1.4	203	5
S-5-400-HW-9	up to 400	4.97 ± 0.013	2.20 ± 0.025	1.4	228.6	5
S-5-300-HW-7	up to 300	4.97 ± 0.025	2.20 ± 0.025	1.4	178	5
S-5-300-HW-8	up to 300	4.97 ± 0.025	2.20 ± 0.025	1.4	203	5
S-5-300-HW-9	up to 300	4.97 ± 0.025	2.20 ± 0.025	1.4	228.6	5

S-5-500-HW-7

Medium Wall NMR Sample Tubes

Medium wall (0.8 mm) NMR tubes offer a considerable increase in the margin of safety against breakage while keeping 65% of the sample volume. Can be used for student use or in auto-sampling systems. Available either constricted and/or amberized.

Item No.	MHz	O.D. (mm)	I.D. (mm)	Wall (mm)	Length (mm)	Packed In Lots Of
S-5-500-MW-7	up to 500	4.97 ± 0.013	3.43 ± 0.025	0.8	178	5
S-5-500-MW-8	up to 500	4.97 ± 0.013	3.43 ± 0.025	0.8	203	5
S-5-500-MW-9	up to 500	4.97 ± 0.013	3.43 ± 0.025	0.8	228.6	5
S-5-400-MW-7	up to 400	4.97 ± 0.013	3.43 ± 0.025	0.8	178	5
S-5-400-MW-8	up to 400	4.97 ± 0.013	3.43 ± 0.025	0.8	203	5
S-5-400-MW-9	up to 400	4.97 ± 0.013	3.43 ± 0.025	0.8	228.6	5
S-5-300-MW-7	up to 300	4.97 ± 0.025	3.43 ± 0.025	0.8	178	5
S-5-300-MW-8	up to 300	4.97 ± 0.025	3.43 ± 0.025	0.8	203	5
S-5-300-MW-9	up to 300	4.97 ± 0.025	3.43 ± 0.025	0.8	228.6	5

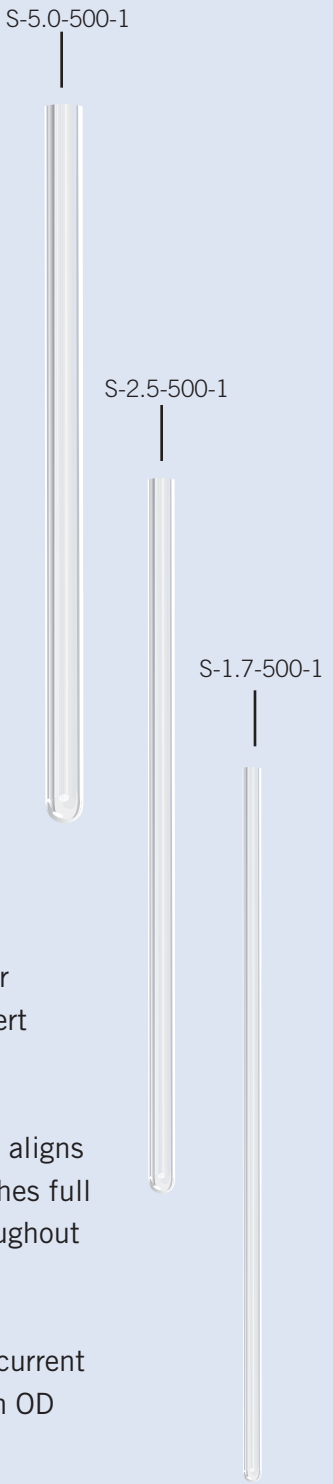
S-5-500-MW-7

Bruker MATCH™ System NMR Sample Tubes

We have recently introduced a new line of ultra-precision machined NMR tubes specifically made for the Bruker MATCH™ System. Featured are eight different tube sizes you can choose from, depending on sample volume. For added convenience, we have color-coded caps to match tube sizes.

*Recommended sample volumes by Bruker Biospin™. Use 3.0mm to 5.0mm OD tubes for 5mm RT probe, and 1.0mm to 3mm OD tubes for 3mm Cryo-Probe. 1.0mm size not recommended for dedicated 1mm Bruker Probe.

Item No.	O.D. (mm)	I.D. (mm)	Length (mm)	Sample Volume (µl)*	Packed In Lots Of
S-1.0-500-1	1.00 +0.010 -0.025	0.58 ± 0.010	100mm	12	5
S-1-0.73-500-1	1.00 +0.010 -0.025	0.73 ± 0.010	100mm	19	5
S-1.7-500-1	1.70 +0.010 -0.025	1.30 ± 0.010	100mm	45	5
S-2.0-500-1	2.00 +0.010 -0.025	1.60 ± 0.010	100mm	70	5
S-2.5-500-1	2.50 +0.010 -0.025	2.10 ± 0.010	100mm	120	5
S-3.0-500-1	2.99 +0.010 -0.025	2.41 ± 0.010	100mm	160	5
S-4.0-500-1	3.99 +0.010 -0.025	3.20 ± 0.010	100mm	310	5
S-4.25-500-1	4.25 +0.010 -0.025	3.43 ± 0.010	100mm	370	5
S-5.0-500-1	4.97 +0.010 -0.025	4.20 ± 0.010	100mm	490	5



Tapered Fluoropolymer Caps for Bruker MATCH™ Tubes

The Bruker MATCH™ tube caps, specially machined from PTFE fluoropolymer, are color coded by tube size, and correspond to the color of the tube clamp in the MATCH™ Insert Assembly, allowing quick identification of matching components.

The MATCH™ tube cap incorporates a slightly tapered inner diameter. Initially, the cap aligns and pushes easily onto the tube. It then becomes progressively tighter as the tube reaches full depth within the cap, creating a positive seal to preserve volatile sample solutions throughout short or long term storage.

Cap Item No.	Tube Item No.	Color	Packed In Lots Of
TCM100	S-1.0-500-1	Black	5
TCM170	S-1.7-500-1	Natural	5
TCM200	S-2.0-500-1	Yellow	5
TCM250	S-2.5-500-1	Red	5
TCM300	S-3.0-500-1	Green	5
TCM400	S-4.0-500-1	Blue	5
TCM425	S-4.25-500-1	Natural	5
TCM500	S-5.0-500-1	Black	5

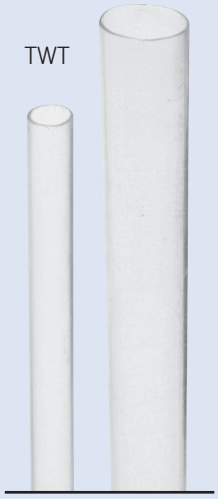
The accompanying table includes caps for all current MATCH™ tube sizes, as well as for the 1.0mm OD size contained in older MATCH™ Tube Kits.

Tapered Fluoropolymer Caps

Thin-Wall Transparent Fluoropolymer FEP Tubing

Our thin-wall transparent fluoropolymer FEP tubing is manufactured from special virgin grade DuPont thermoplastic FEP fluoropolymer. Unlike PTFE tubing, this material can be heat sealed. This property offers extremely large possibilities for packaging and/or storage of samples (corrosives, liquids, solids, etc.). Our fluoropolymer tubing can also be used where snug and tight fit over glass or metal tubing is required. Sold in sections of 305mm (12") long. There are 4 sections contained in each package. The number after "TWT" indicates i.d. size in mm. (For example, TWT-5 has an inside diameter of 5 mm).

Item No.	O.D. (mm)	I.D. (mm)	Length (mm)	Packed In Lots Of
TWT-3	3.52	3	305	4
TWT-4	4.91	4	305	4
TWT-5	5.60	5	305	4
TWT-6	6.55	6	305	4
TWT-7	7.68	7	305	4
TWT-8	8.54	8	305	4
TWT-9	9.55	9	305	4
TWT-10	10.63	10	305	4
TWT-12	12.78	12	305	4
TWT-312	(3-12mm inside diameter)*		305	1 set



* This package contains 1 of each size 3mm through 12mm (9tubes)

PTFE Tubing (PolyTetraFluoroEthylene)

If your temperature requirements range up to 500° F (260° C), PTFE Tubing (PolyTetraFluoroEthylene) is the recommended choice. It resists "melt-off" by soldering irons when making terminations. Because of its excellent dielectric properties, it is widely used in electronics and electrical service. Another key advantage of PTFE Tubing is its non-stick properities that allow the transport of materials with minimal fluid resistance. Please do be aware, however, that PTFE reacts with fluorine, molten sodium hydroxide and molten alkali metals.

We have a full line of extruded PTFE Tubing used for protecting wiring or transporting fluids in critical applications. PTFE Tubing comes in various configurations as well as custom designs. PTFE Tubing outperforms glass and graphite by its inherent superior chemical resistivity and low coefficient of friction, making it an ideal material for fluid transfers. PTFE Tubing can be used with virtually all industrial solvents, chemicals, and corrosive materials, and can be used in processes at elevated temperatures. It can be steam sterilized without effecting its physical properties, such as surface hardness, elongation, flex life or deformation under load. PTFE Tubing is normally translucent white in color, however, the degree of whiteness varies from lot to lot, and with dimensional wall thickness. Colored PTFE tubing is also available and is generally used to simplify tube routing during system installations.

PTFE Fractional Sizes

O.D. (in)	I.D. (in)	Wall (in)	Nominal O.D.	O.D. Tolerance (in)	Wall Tolerance (in)	Working Pressure PSIG (bar)	Burst Pressure PSIG (bar)	Minimum Bend Radius (in)
1/8	1/16	0.031	0.125	+/- 0.004	+/- 0.003	300 (21)	1500 (103)	1/2
3/16	1/8	0.031	0.188	+/- 0.005	+/- 0.003	192 (13)	961(66)	1/2
1/4	3/16	0.031	0.25	+/- 0.005	+/- 0.003	140 (9.7)	700 (48)	1
1/4	5/32	0.047	0.25	+/- 0.005	+/- 0.003	219 (15)	1095 (75)	3/4
1/4	1/8	0.062	0.25	+/- 0.005	+/- 0.003	300 (21)	1500 (103)	1/2
5/16	1/4	0.031	0.313	+/- 0.005	+/- 0.003	110 (7.6)	549 (38)	3/4
5/16	3/16	0.062	0.313	+/- 0.005	+/- 0.003	235 (16)	1176 (81)	1/2
3/8	5/16	0.031	0.375	+/- 0.005	+/- 0.003	90 (6.2)	450 (31)	2-1/2
3/8	1/4	0.062	0.375	+/- 0.005	+/- 0.003	192 (13)	962 (66)	1
1/2	7/16	0.031	0.5	+/- 0.006	+/- 0.003	66 (4.6)	332 (23)	4
1/2	3/8	0.062	0.5	+/- 0.006	+/- 0.003	140 (9.7)	700 (48)	2

PVDF Tubing (Polyvinylidene Fluoride)

PVDF Tubing (Polyvinylidene Fluoride) is an abrasion resistant fluoropolymer suitable for use in applications requiring chemical resistance with low permeability. PVDF Tubing is often referred to by its trade name, KYNAR®, and is designed prmarily for applications requiring excellent chemical resistance, high levels of purity and superior mechanical properties. PVDF Tubing is often used as a lining or protective barrier in chemical industry applications and is just as useful in ultra pure water systems and ground water monitoring.

PVDF Tubing Offers:

- Excellent abrasion resistance
- Excellent resistance to creep and fatigue
- Low permeability
- Good chemical resistance
- Excellent thermal stability
- Excellent radiation resistance
- Excellent resistance to cut-through

PVDF Tubing Applications:

Aerospace & Transportation Technology, Electronics, Components & Insulators, Chemical & Pharmaceutical Manufacturing, Food Processing, Environmental Sciences, Air Sampling, Fluid Transfer Devices and Water Processing Systems

PVDF Industrial Wall Fractional Sizes

O.D. (in)	I.D. (in)	Wall (in)	Nominal O.D.	O.D. Tolerance (in)	Wall Tolerance (in)	Working Pressure PSIG (bar)	Burst Pressure PSIG (bar)	Minimum Bend Radius (in)
1/8	1/16	0.031	0.125	+/- 0.004	+/- 0.003	600 (41)	3000 (207)	1/2
3/16	1/8	0.031	0.188	+/- 0.005	+/- 0.003	385 (27)	1923 (133)	1/2
1/4	3/16	0.031	0.25	+/- 0.005	+/- 0.003	280 (19)	1400 (97)	1
5/16	1/4	0.031	0.312	+/- 0.005	+/- 0.003	220 (15)	1098 (76)	1-3/4
3/8	5/16	0.031	0.375	+/- 0.005	+/- 0.003	180 (12)	902 (62)	2-1/2

PVDF Heavy Wall Fractional Sizes

O.D. (in)	I.D. (in)	Wall (in)	Nominal O.D.	O.D. Tolerance (in)	Wall Tolerance (in)	Working Pressure PSIG (bar)	Burst Pressure PSIG (bar)	Minimum Bend Radius (in)
1/4	5/32	0.047	0.25	+/- 0.005	+/- 0.003	438 (30)	2191 (151)	3/4
1/4	1/8	0.062	0.25	+/- 0.005	+/- 0.003	600 (41)	3000 (207)	1/2
3/8	1/4	0.062	0.375	+/- 0.005	+/- 0.003	385 (27)	1923 (133)	3/4
1/2	3/8	0.062	0.5	+/- 0.005	+/- 0.003	280 (19)	1400 (97)	2-1/2
5/8	1/2	0.062	0.625	+/- 0.006	+/- 0.003	220 (15)	1098 (76)	3
3/4	5/8	0.062	0.75	+/- 0.006	+/- 0.003	180 (12)	902 (62)	6
1	7/8	0.062	1	+/- 0.010	+/- 0.003	133 (9)	664 (46)	16

PVDF Metric Sizes

O.D. (mm)	I.D. (mm)	O.D./I.D. Tolerance (mm)	O.D. (in)	I.D. (in)	O.D./I.D. Tolerance (mm)	Working Pressure PSIG (bar)	Burst Pressure PSIG (bar)	Minimum Bend Radius (in)
4	2	+/- 0.11	0.157	0.078	+/- 0.004	600 (41)	3000 (207)	1/2
6	4	+/- 0.13	0.236	0.157	+/- 0.005	385 (27)	1923 (133)	1/2
8	6	+/- 0.13	0.315	0.236	+/- 0.005	280 (19)	1400 (97)	1-3/4
10	8	+/- 0.13	0.393	0.315	+/- 0.005	220 (15)	1098 (76)	2-1/2
12	10	+/- 0.15	0.472	0.393	+/- 0.006	180 (12)	902 (62)	3-1/2

FEP Tubing (Fluorinated Ethylene Propylene)

FEP Tubing (Fluorinated Ethylene Propylene) is the preferred material in production of small diameter tubing of continuous lengths. While some temperature resistance is sacrificed with FEP (to 400° F), its chemical and dielectric properties are similar to those of PTFE. FEP tubing is a clear tubing that is an economical choice for applications requiring chemical resistance and a broad temperature exposure. FEP Tubing offers excellent clarity which makes it ideal for sight glass/flow monitoring applications. FEP Tubing has a slightly higher coefficient of friction, lower continuous service temperature, and is more transparent then PTFE. FEP Tubing also has better gas and vapor permeability properties and excellent UV transmission ratings.

FEP Tubing comes in a wide range of standard sizes and custom sizes are available upon request. FEP Tubing is also available in coiled tubing that can be ordered in various sizes, lengths, special sizes and colors to meet your needs.

FEP Tubing Offers:

Chemically inert to most industrial chemicals and solvents
Non-flammable
Available in coiled, convoluted and heat-shrink construction
High thermal stability

FEP Tubing Applications:

Aerospace &Transportation Technology, Electronics, Components & Insulators, Chemical & Pharmaceutical Manufacturing, Food Processing, Environmental Sciences, Air Sampling, Fluid Transfer Devices and Water Processing Systems

FEP Fractional Sizes

O.D. (in)	I.D. (in)	Wall (in)	Nominal O.D.	O.D. Tolerance (in)	Wall Tolerance (in)	Working Pressure PSIG (bar)	Burst Pressure PSIG (bar)	Minimum Bend Radius (in)
3/32	1/32	0.031	0.094	+/- 0.004	+/- 0.003	480 (33)	2400(165)	1/2
1/8	1/16	0.031	0.125	+/- 0.004	+/- 0.003	360 (25)	1800 (124)	1/2
5/32	3/32	0.031	0.157	+/- 0.005	+/- 0.003	282 (19)	1412 (97)	1/2
3/16	1/8	0.031	0.188	+/- 0.005	+/- 0.003	231 (16)	1154 (80)	1/2
3/16	1/16	0.062	0.188	+/- 0.005	+/- 0.003	480 (33)	2400 (165)	1/2
1/4	3/16	0.031	0.250	+/- 0.005	+/- 0.003	168 (11.6)	840 (58)	1
1/4	5/32	0.047	0.250	+/- 0.005	+/- 0.003	263 (18)	1315 (91)	3/4
1/4	1/8	0.062	0.250	+/- 0.005	+/- 0.003	360 (24.8)	1800 (124)	1/2
5/16	1/4	0.031	0.313	+/- 0.005	+/- 0.003	132 (9.1)	359 (24.8)	3/4
5/16	3/16	0.062	0.313	+/- 0.005	+/- 0.003	282 (19.4)	1412 (97.4)	1/2
3/8	5/16	0.031	0.375	+/- 0.005	+/- 0.003	109 (7.5)	541 (37.3)	2-1/2
3/8	1/4	0.062	0.375	+/- 0.005	+/- 0.003	231 (15.9)	1154 (79.6)	1
7/16	3/8	0.031	0.438	+/- 0.005	+/- 0.003	92 (6.3)	459 (31.6)	8
7/16	5/16	0.062	0.438	+/- 0.005	+/- 0.003	195 (13.4)	973 (67.1)	12
1/2	7/16	0.031	0.500	+/- 0.006	+/- 0.003	80 (5.5)	398 (27.4)	4
1/2	3/8	0.062	0.500	+/- 0.006	+/- 0.003	168 (11.6)	840 (57.9)	2
9/16	1/2	0.031	0.562	+/- 0.006	+/- 0.003	70.3 (4.8)	352 (24.3)	4-1/2
5/8	9/16	0.031	0.625	+/- 0.006	+/- 0.003	63 (4.3)	315 (21.7)	5-1/2
5/8	1/2	0.062	0.625	+/- 0.006	+/- 0.003	132 (9.1)	659 (45.4)	3
11/16	5/8	0.031	0.688	+/- 0.006	+/- 0.003	57 (3.9)	285 (19.7)	4
3/4	11/16	0.031	0.750	+/- 0.006	+/- 0.003	52 (3.6)	260 (17.9)	8
3/4	5/8	0.062	0.750	+/- 0.006	+/- 0.003	108 (7.4)	541 (37.3)	6
7/8	3/4	0.062	0.875	+/- 0.007	+/- 0.003	92 (6.3)	459 (31.6)	12
1	7/8	0.062	1.000	+/- 0.010	+/- 0.003	80 (5.5)	398 (27.4)	16
1.1	1	0.040	1.100	+/- 0.010	+/- 0.004	57 (3.9)	285 (19.7)	
1-1/8	1	0.062	1.125	+/- 0.015	+/- 0.003	70 (4.8)	352 (24.3)	
1-1/4	1-1/8	0.062	1.250	+/- 0.015	+/- 0.004	63 (4.3)	315 (21.7)	
1-3/8	1-1/4	0.040	1.375	+/- 0.015	+/- 0.004	57 (3.9)	285 (19.7)	

PFA Tubing (Perfluoroalkoxy)

PFA Tubing (Perfluoroalkoxy) offers excellent crack and stress resistance and is used when more demanding mechanical characteristics are required. PFA Tubing is the product of choice for applications involving extreme chemical resistance combined with high temperature exposure. PFA Tubing is preferred when additional clarity, flexibility, and a higher continuous service temperature are required. PFA Tubing provides stiffness and long flex-life (up to 500° F) and has all the general properties of PTFE.

In the semiconductor and pharmaceutical industries, PFA HP (High Purity) Tubing is used for fluid handling applications requiring an extremely low level of chemical extractables.

PFA Tubing Offers:

- Higher thermal stability than FEP
- Working temperature of up to 500° F (260° C)
- Non-flammable
- Lower permeability than FEP
- Combines attributes of PTFE and FEP
- Translucent
- Maintains mechanical strength at high temperatures
- Moisture absorption close to zero
- Superior high purity properties
- Availabe in coiled hose and convoluted constructions
- FDA compliant for food contact
- Suitable for use with flare or conventional fittings

PFA Fractional Sizes

O.D. (in)	I.D. (in)	Wall (in)	Nominal O.D. (in)	O.D. Tolerance (in)	Wall Tolerance (in)	Working Pressure PSIG (bar)	Burst Pressure PSIG (bar)	Minimum Bend Radius (in)
3/32	1/32	0.031	0.094	+/- 0.004	+/- 0.003	480 (33)	2400(165)	1/2
1/8	1/16	0.031	0.125	+/- 0.004	+/- 0.003	360 (25)	1800 (124)	1/2
5/32	3/32	0.031	0.157	+/- 0.005	+/- 0.003	282 (19)	1412 (97)	1/2
3/16	1/8	0.031	0.188	+/- 0.005	+/- 0.003	231 (16)	1154 (80)	1/2
3/16	1/16	0.062	0.188	+/- 0.005	+/- 0.003	480 (33)	2400 (165)	1/2
1/4	3/16	0.031	0.250	+/- 0.005	+/- 0.003	168 (11.6)	840 (58)	1
1/4	5/32	0.047	0.250	+/- 0.005	+/- 0.003	263 (18)	1315 (91)	3/4
1/4	1/8	0.062	0.250	+/- 0.005	+/- 0.003	360 (24.8)	1800 (124)	1/2
5/16	1/4	0.031	0.313	+/- 0.005	+/- 0.003	132 (9.1)	359 (24.8)	3/4
5/16	3/16	0.062	0.313	+/- 0.005	+/- 0.003	282 (19.4)	1412 (97.4)	1/2
3/8	5/16	0.031	0.375	+/- 0.005	+/- 0.003	109 (7.5)	541 (37.3)	2-1/2
3/8	1/4	0.062	0.375	+/- 0.005	+/- 0.003	231 (15.9)	1154 (79.6)	1
7/16	3/8	0.031	0.438	+/- 0.005	+/- 0.003	92 (6.3)	459 (31.6)	8
7/16	5/16	0.062	0.438	+/- 0.005	+/- 0.003	195 (13.4)	973 (67.1)	12
1/2	7/16	0.031	0.500	+/- 0.006	+/- 0.003	80 (5.5)	398 (27.4)	4
1/2	3/8	0.062	0.500	+/- 0.006	+/- 0.003	168 (11.6)	840 (57.9)	2
9/16	1/2	0.031	0.562	+/- 0.006	+/- 0.003	70.3 (4.8)	352 (24.3)	4-1/2
5/8	9/16	0.031	0.625	+/- 0.006	+/- 0.003	63 (4.3)	315 (21.7)	5-1/2
5/8	1/2	0.062	0.625	+/- 0.006	+/- 0.003	132 (9.1)	659 (45.4)	3
11/16	5/8	0.031	0.688	+/- 0.006	+/- 0.003	57 (3.9)	285 (19.7)	4
3/4	11/16	0.031	0.750	+/- 0.006	+/- 0.003	52 (3.6)	260 (17.9)	8
3/4	5/8	0.062	0.750	+/- 0.006	+/- 0.003	108 (7.4)	541 (37.3)	6
7/8	3/4	0.062	0.875	+/- 0.007	+/- 0.003	92 (6.3)	459 (31.6)	12
1	7/8	0.062	1.000	+/- 0.010	+/- 0.003	80 (5.5)	398 (27.4)	16
1-1/4	1-1/8	0.062	1.250	+/- 0.015	+/- 0.004	63 (4.3)	315 (21.7)	
1-3/8	1-1/4	0.040	1.375	+/- 0.015	+/- 0.004	57 (3.9)	285 (19.7)	

H-PH-1

Hamilton® pH Electrodes for NMR Sample Tubes

For uncompromising quality in precision pH measurements, the Model H-PH-1 combination electrode measures the pH potential against a reference, covering a pH range of 0 to 14. With a stem diameter of only 3mm and a length of 180mm, this pH electrode is ideal for measuring small sample volumes contained within 5mm OD, or larger, NMR tubes, as it requires only 7mm immersion depth for accurate measurements. The electrode includes a standard S7 connector. Additional quantities of electrolyte solutions are sold separately.

pH electrodes do not come with connecting cables.
These need to be ordered separately.

Item No.	Description	pH Range	Temp. Range	Frit	Electrolyte
H-PH-1	pH electrode for standard solutions	0-14	0-80 C	Ceramic	3M KCl
H-KCl-1	3M KCl electrolyte for H-PH-1 electrode, 100ml	-	-	-	-
H-KCl-2	3M KCl electrolyte for H-PH-1 electrode, 500ml	-	-	-	-

BNC-1

Hamilton pH Electrode Meter Connecting Cables

BNC Connectors (USA)	Length (m)
BNC-1	1
BNC-3	3
BNC-5	5

DIN Connectors (EUROPE)	Length (m)
DIN-1	1
DIN-3	3
DIN-5	5

Long Tip Pasteur Pipettes Designed for NMR Tubes

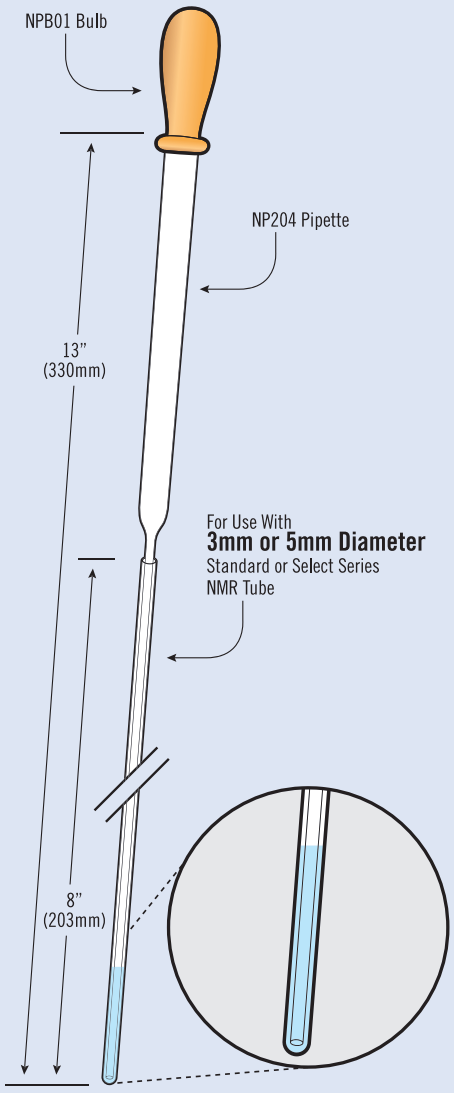
• Our new pipettes display a uniformly drawn tip that can easily access the bottom of our 8" (203mm) long 5mm NMR tubes.

• Manufactured from borosilicate glass that meets the requirements of both the USP (United States Pharmacopeia) Type I specification and the Type I Class B specification for the ASTM E438 standard (formerly known as the American Society for Testing and Materials, now ASTM International). Glass meeting these specifications possesses superior chemical resistance, and is the least reactive glass available, exhibiting a very low level of extractable material which can otherwise contaminate very sensitive or highly purified samples. This type of glass also withstands thermal shock very well because of its comparatively low coefficient of thermal expansion.

• In addition to being ideally suited for use in all 5mm NMR tubes, including our medium wall NMR tubes with walls up to 0.8mm, our pipettes also accommodate our 3mm NMR tubes of 7" (178mm) length with walls up to 0.38mm in our Select Series and Sample Vault Series.

• Our pipettes can contain a total volume of 2.5ml. Because NMR tubes of 5mm diameter and less generally require no more than 1ml sample volume, our pipettes provide ample volume while allowing a margin of safety resulting from the large remaining headspace.

• The uppermost part, or body, of our pipette measures 7mm in outer diameter, permitting use with most rubber bulbs and other pipetting devices commonly stocked in a typical laboratory.



Item No.	Description	Packed In Lots Of
NP204	long tip, 8" (203mm) point	100
NPB01	1ml Rubber Pipette Bulb	12

Optimizer Inserts™ for 5mm Spinner Turbines

Fluoroelastomer O-Ring provides a frictional grip to retain the NMR sample tube in place

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

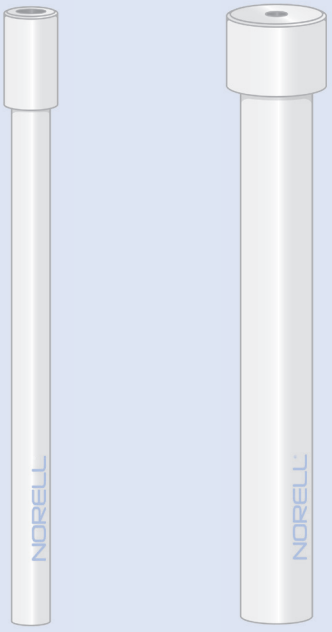
10mm O.D. Insert for use with a Varian spinner turbine

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.

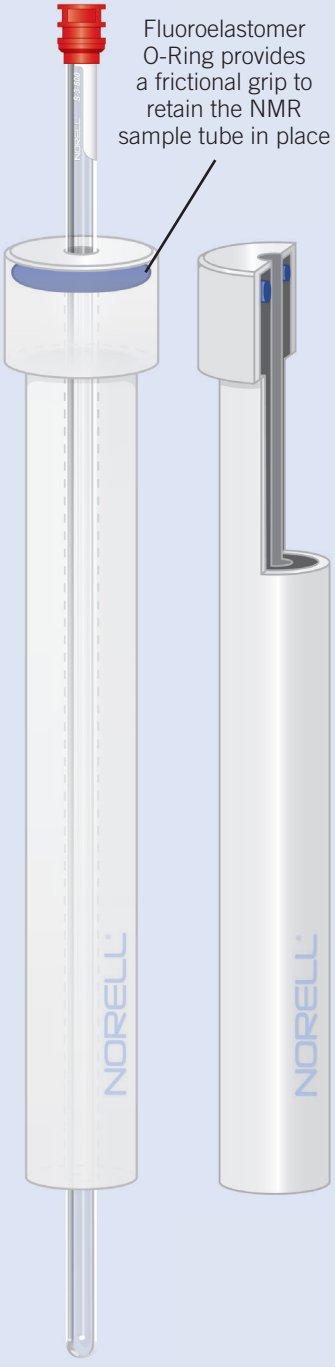
Optimizer Inserts™ for 5mm Spinner Turbines

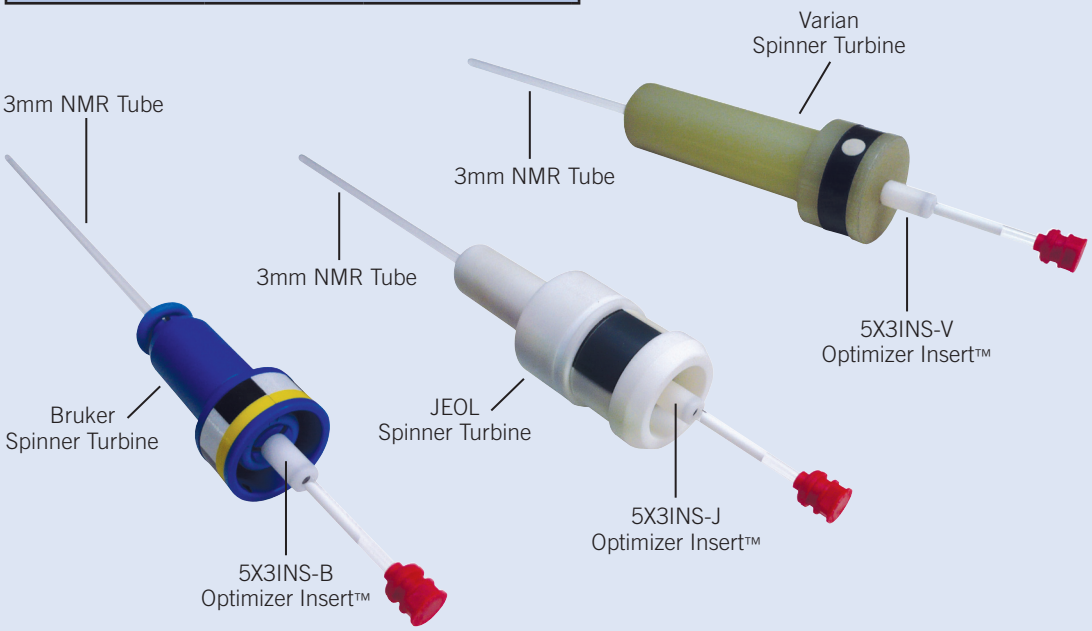
Item No.	Tube Size (mm)	Spinner Type
5X1.5INS-B	1.50	Bruker
5X1.5INS-J	1.50	JEOL
5X1.5INS-V	1.50	Agilent/Varian
5X1.7INS-B	1.70	Bruker
5X1.7INS-J	1.70	JEOL
5X1.7INS-V	1.70	Agilent/Varian
5X2INS-B	2.00	Bruker
5X2INS-J	2.00	JEOL
5X2INS-V	2.00	Agilent/Varian
5X2.5INS-B	2.50	Bruker
5X2.5INS-J	2.50	JEOL
5X2.5INS-V	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 Bruker Spinner Turbine

10mm O.D. Insert for use with a Bruker 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.

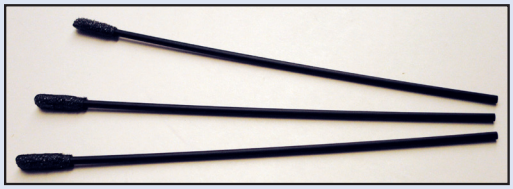
Item No.	Spinner Size (mm)	Spinner Type	Packed In Lots Of
HPT5B-2PK	5	Bruker POM RT	2
HPT5B-10PK	5	Bruker POM RT	10
HPT5BC-2PK	5	Bruker Ceramic VT	2
HPT5BC-10PK	5	Bruker Ceramic VT	10
HPT5V-2PK	5	Varian	2
HPT5V-10PK	5	Varian	10
HPT3B-2PK	3	Bruker POM RT	2
HPT3B-10PK	3	Bruker POM RT	10
HPT3V-2PK	3	Varian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

Exclusive NORELL® HPT5B

Exclusive NORELL® HPT5V

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

Fluoropolymer NMR Tube Liners

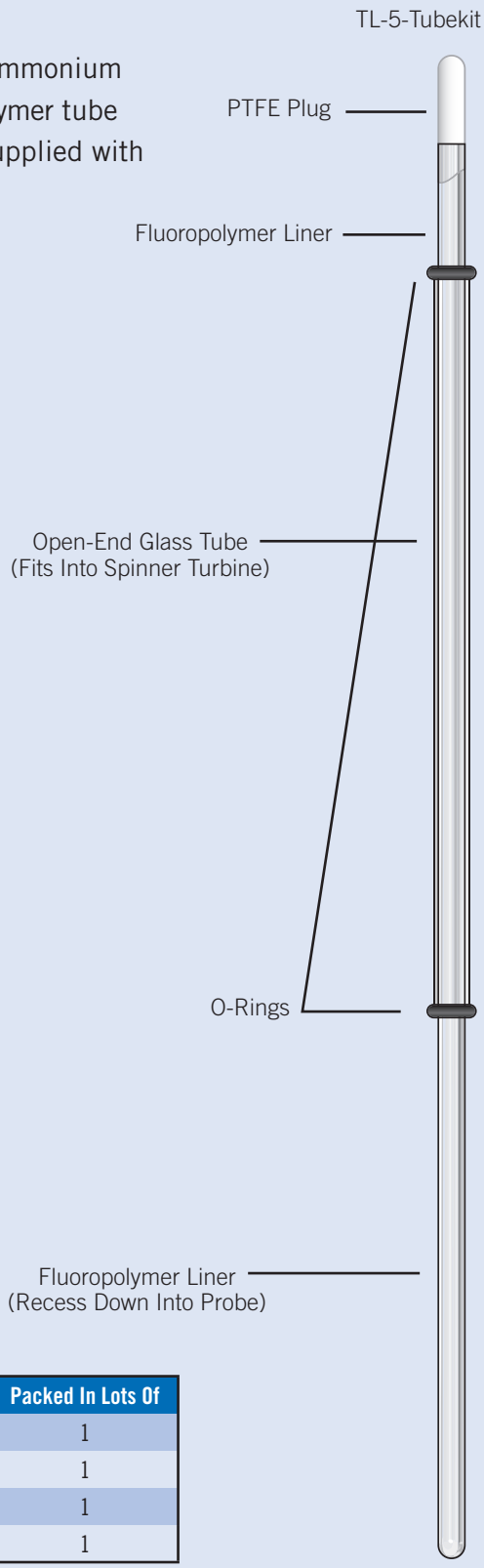
For NMR studies where chemical compounds such as hydrofluoric acid, ammonium bifluoride and concentrated hydroxide solutions are present. Our fluoropolymer tube liners have a thin-wall construction that minimizes filling-factor losses. Supplied with a PTFE plug closure.

Item No.	Tube Size	Volume at 50mm
TL-5-7	5mm	approx. 0.35ml
TL-10-7	10mm	approx. 2.00ml

Fluoropolymer Liner Tube Kits for 29Si and 11B

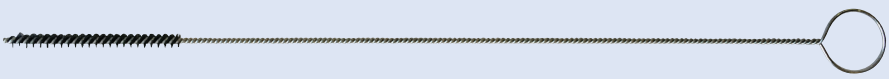
For Silicon and Boron NMR, we recommend the use of either TL-5-TUBEKIT for 5mm probes or TL-10-TUBEKIT for 10mm probes. Kit is designed for either Varian, Bruker, or JEOL spinners as a holding device for the fluoropolymer liner. Probe only "sees" fluoropolymer, allowing for excellent ^{29}Si and ^{11}B spectra.

Item No.	Contents
TL-5-TUBEKIT	two o-rings & one 5mm open-end tube
TL-10-TUBEKIT	two o-rings & one 10mm open-end tube



NORELL 3mm & 5mm NMR Tube Brushes

Designed For Manual Cleaning of 3mm OD X 7" Long Thin Wall NMR Tubes. This hand-held NMR tube brush can thoroughly clean and dislodge even stubborn contaminants from the inner surface of 3mm thin wall NMR tubes up to 7" long. The brush diameter of 1/8" fits tightly within the NMR tube, while the soft nylon bristles will not scratch or abrade the interior glass surface. The stem of the brush is ruggedly constructed from galvanized steel wire wound as a single spiral for secure retention of the bristles. The brush is 8" in overall length, formed with a wire loop handle at the end for easy gripping during use.



Item No.	Description	Packed In Lots Of
NTB-3X8	NMR Tube Brush for 3mm Tubes - Nylon Bristle Brush with Loop Handle - Overall Length 8"	1
NTB-3X4	NMR Tube Brush for 3mm Tubes - Nylon Bristle Brush with Loop Handle - Overall Length 4"	1
NTB-5X12	NMR Tube Brush for 5mm Tubes - Nylon Bristle Brush with Loop Handle - Overall Length 12"	1
NTB-10x12	NMR Tube Brush for 10mm Tubes - Nylon Bristle Brush with Loop Handle - Overall Length 12"	1

72 Position NMR Tube Rack

This sturdy rack made from polypropylene has 3 decks to offer ultimate support for NMR tubes. The sides have carrying handles. Dimensions are 21cm wide x 11cm deep x 22cm high.

Item No.	Description
TR500-3	for 5mm NMR tubes

TR500-3

5mm NMR Tube Carrier

Carrier can be clipped to your pocket. Provides safe transport of NMR samples.

Item No.	Color	Packed In Lots Of
PTC-5-7R	Red	1
PTC-5-7W	White	1
PTC-5-7B	Blue	1
PTC-5-7-RWB	1 of each	1 of each

PTC-5-7

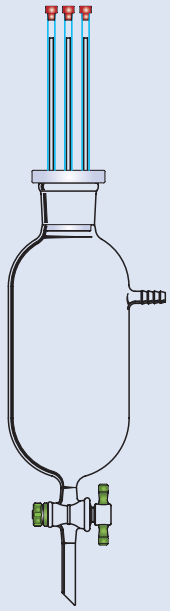
Redesigned Fluoropolymer NMR Tube Caps

Redesigned tapered fluoropolymer closure system that works together with our fire-polished tube ends, offering superior sealing and sample integrity, preventing sample loss even during temperature gradients.

Item No.	Description
TC-3-PTFE	3mm White Tube Cap
TC-4-PTFE	4mm White Tube Cap
TC-5-PTFE	5mm White Tube Cap
TC-10-PTFE	10mm White Tube Cap

TC-3 TC-4 TC-5 TC-10-PTFE

U505



NMR Tube Cleaner, 5 Position

Comprised of an all glass and fluoropolymer design, the U505 will clean five NMR tubes of the same, or various, lengths and diameters. Fluoropolymer adapter has five positions with flexible 1/8" fluoropolymer tubing supplied in 9" lengths that can be cut to desired height. The NMR tube is placed over the tubing and seats in the adapter, leaving a small space between the end of the fluoropolymer tubing and the inside bottom of the NMR tube. With the stopcock in the closed position, the reservoir is connected to a low vacuum source. Cleaning solvent is added into the adapter followed by air drying to complete the process in seconds. Flexible tubing and adapter design reduces breakage. Stopcock permits easy draining of solvent. Hose connection is 10mm at the largest serration.

Item No.	Description
U505	for 5mm - 10mm NMR tubes

NRS-250

NRS-250 Surfactant

For clean & residue-free NMR sample tubes & labware NRS-250, the "NO RESIDUE SURFACTANT" is the ultimate in cleanliness for your NMR sample tubes, glassware and equipment. It leaves no residue after rinsing. NRS-250 removes silicone oils and greases, cedar oil, tar, blood, apiezon oils and greases, Canada Balsam, polyethylene resins, distillation residues, organic materials, and many other stubborn contaminants.

Item No.	Size (kg)	Packed In Lots Of
NRS-250	1	1

U500

Tube Washing Unit

Our NMR Sample Tube Washing Unit is made of borosilicate glass. It is a "must" for anyone confronted with the tedious task of cleaning NMR sample tubes. Wash, rinse and dry your NMR tubes - all in one single step!

Item No.	Description
U500	for 5mm NMR tubes

NorLoc™ Generation II Security Caps™ for 5mm & 3mm NMR Tubes

PAT8054080

The Next Generation of NorLoc™ NMR Tube Caps In A Rich Palette Of Fresh, Vibrant Colors

Advance to the next level of sample security, personal safety and time savings. Combine Norell NorLoc™ II Security Caps™ with Norell Secure Series™ NMR tubes and experience the ultimate sample containment system.

The standard 5mm and 3mm NMR tube cap designs have existed for decades. Many users can attest to the significant flaws inherent in the traditional NMR tube caps, especially when faced with the chore of capping numerous sample tubes.

The NorLoc™ II Security Caps™ feature an internal patent pending design improvement that not only addresses many of the flaws in the traditional NMR tube caps, but the superior design of the NorLoc™ II Security Cap introduces many substantial improvements not found in any other NMR tube caps.

The NorLoc™ II Security Cap™ can be applied much more easily and quickly, thereby increasing personal safety and saving valuable time. It incorporates an advanced dual seal design, conferring superior sealing and holding capabilities, especially when combined with a Secure Series™ or other Norell NMR tube having the Security Band™ which interlocks with the NorLoc™ II Security Cap™.

This interlocking capability results in superior retention of the cap to the NMR tube, forming a “vaulted seal” that not only increases the barrier capability when used with any NMR tube, but the locking interaction prevents the occurrence of NMR tube and cap separation, safeguarding precious or critical samples, even during refrigerated cold storage, variable temperature cycling or repeated cap removals and reapplications.

The patent pending design of the NorLoc™ II Security Cap™ includes an expanded entryway, or guide section, in the opening of the cap, to help align and start the placement of the cap on the NMR tube. Adjacent to this, a constriction within the cap forms a tight, effective seal against the wall of the NMR tube, followed by a second constriction that functions in a like manner to form a dual seal. Finally, the innermost region expands slightly in diameter, allowing the NMR tube to slip easily through to the end, creating a positive indication of proper placement and “lock”, ensuring a “vaulted seal” every time.

In addition, the upper, straight edge of the patent pending marking or label area on Secure Series™ or other Norell NMR tubes functions as a clear visual indicator, defining the limit for full and complete closure with the NorLoc II Security Cap™.

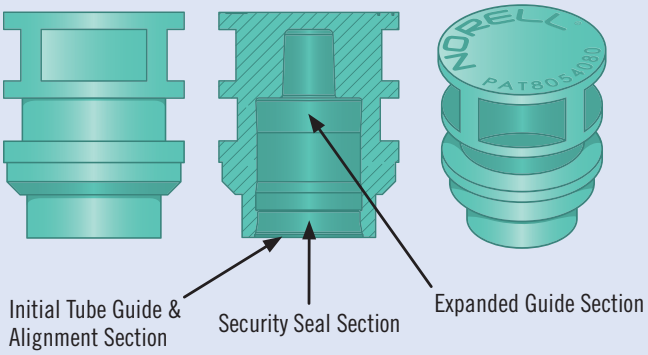
When preparing dozens, or even hundreds, of samples for analysis, tube capping can consume a significant amount of time. The traditional cap must first be held at an angle to the NMR tube to start placement of the cap, and then must be stretched and twisted onto the tube. This becomes a tedious exercise after capping a few dozen tubes, and often results in caps that are tilted and misshapen afterwards, promoting poor seals and split caps. This process also creates significant mechanical stress in the glass NMR tube, and can frequently lead to broken tubes, spilled sample and worse, including cuts or other injuries.

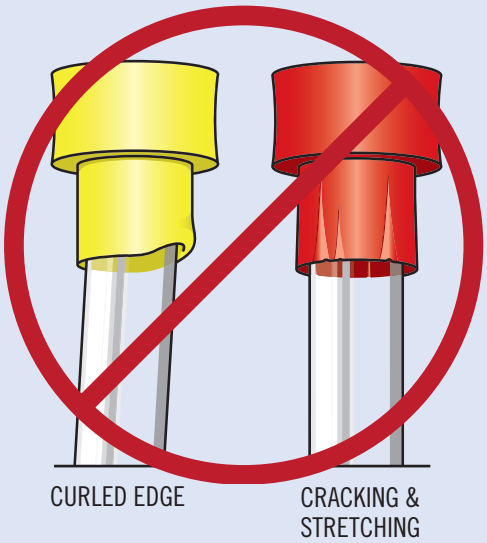
With the NorLoc™ II Security Cap™ however, the NMR tube easily enters the expanded guide section, and thereafter becomes self-aligning, allowing the cap to be simply pushed straight onto the tube. This method takes advantage of the compressive strength of glass, while minimizing the common causes of glass fracture from radial and torsional stresses induced in the glass from stretching and twisting traditional caps onto the NMR tube at an angle.

Proper, trouble-free closure of NMR tubes is ensured by the combination of NorLoc™ II Security Caps™ with Secure Series™ or other Norell NMR tubes, creating a “vaulted seal” that resists tube and cap separation even with troublesome NMR solvents such as chloroform-d, providing precise, uniform cap positioning and seal integrity, safeguarding critical and precious samples against losses caused by evaporation, contamination or degradation due to atmospheric exposure.

NorLoc™ Generation II Series... Ingenuity, Precision, Proven Results

Patented Design with Superior Holding & Sealing Capabilities

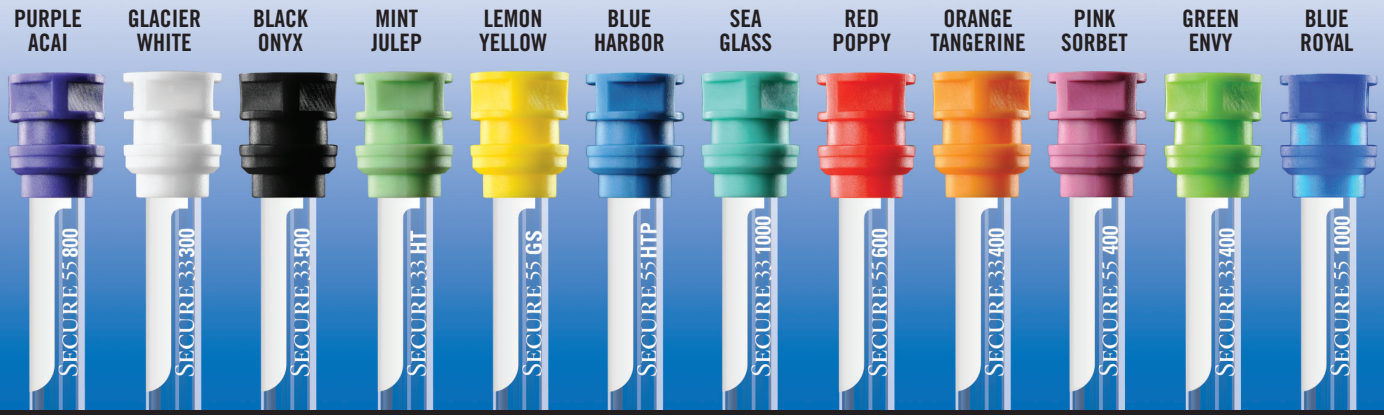




NorLoc™ The New Standard for NMR Tube Caps

Item No.	Cap Color	Size	Available in Lots of
NORLOC2-5-PA	Purple Acai	5 mm	100, 500, 1000
NORLOC2-5-GW	Glacier White	5 mm	100, 500, 1000
NORLOC2-5-BO	Black Onyx	5 mm	100, 500, 1000
NORLOC2-5-MJ	Mint Julep	5 mm	100, 500, 1000
NORLOC2-5-LY	Lemon Yellow	5 mm	100, 500, 1000
NORLOC2-5-BH	Blue Harbor	5 mm	100, 500, 1000
NORLOC2-5-SG	Sea Glass	5 mm	100, 500, 1000
NORLOC2-5-RP	Red Poppy	5 mm	100, 500, 1000
NORLOC2-5-OT	Orange Tangerine	5 mm	100, 500, 1000
NORLOC2-5-PS	Pink Sorbet	5 mm	100, 500, 1000
NORLOC2-5-GE	Green Envy	5 mm	100, 500, 1000
NORLOC2-5-BR	Blue Royal	5 mm	100, 500, 1000
NORLOC2-3-PA	Purple Acai	3 mm	100, 500, 1000
NORLOC2-3-GW	Glacier White	3 mm	100, 500, 1000
NORLOC2-3-BO	Black Onyx	3 mm	100, 500, 1000
NORLOC2-3-MJ	Mint Julep	3 mm	100, 500, 1000
NORLOC2-3-LY	Lemon Yellow	3 mm	100, 500, 1000
NORLOC2-3-BH	Blue Harbor	3 mm	100, 500, 1000
NORLOC2-3-SG	Sea Glass	3 mm	100, 500, 1000
NORLOC2-3-RP	Red Poppy	3 mm	100, 500, 1000
NORLOC2-3-OT	Orange Tangerine	3 mm	100, 500, 1000
NORLOC2-3-PS	Pink Sorbet	3 mm	100, 500, 1000
NORLOC2-3-GE	Green Envy	3 mm	100, 500, 1000
NORLOC2-3-BR	Blue Royal	3 mm	100, 500, 1000

Now in 12 Vibrant Colors!



Economy NMR Tube Caps

MORE Cap colors FOR BETTER SOLVENT LABELING CAPABILITIES

Our economy NMR tube caps are now available in 12 different colors for better solvent labeling capabilities. We are happy to present these caps to you in order to make your experiments easier and more efficient. TC-5-EVA is available in the following colors: Assorted (AS), Sky (S), Red (R), Pink (PK), Aqua (A), Fuchsia (F), Green (G), Blue (B), Yellow (Y), Purple (P), Orange (O), White (W), Black (BK). When placing an order, simply add a hyphen and the corresponding lot amount.

TC-5-EVA

TC-10-LPE

Item No.	Description	Material	Color
TC-3-LPE-R	3mm Tube Cap	Low Density Polyethylene	RED
TC-4-EVA-Y	4mm Tube Cap	Ethylene-Vinyl Acetate	YELLOW
TC-4.25-EVA-Y	4.25mm Tube Cap	Ethylene-Vinyl Acetate	YELLOW
TC-5-EVA-AS	5mm Tube Cap	Ethylene-Vinyl Acetate	ASSORTED
TC-5-EVA-S	5mm Tube Cap	Ethylene-Vinyl Acetate	SKY
TC-5-EVA-PK	5mm Tube Cap	Ethylene-Vinyl Acetate	PINK
TC-5-EVA-A	5mm Tube Cap	Ethylene-Vinyl Acetate	AQUA
TC-5-EVA-F	5mm Tube Cap	Ethylene-Vinyl Acetate	FUCHSIA
TC-5-EVA-R	5mm Tube Cap	Ethylene-Vinyl Acetate	RED
TC-5-EVA-G	5mm Tube Cap	Ethylene-Vinyl Acetate	GREEN
TC-5-EVA-B	5mm Tube Cap	Ethylene-Vinyl Acetate	BLUE
TC-5-EVA-Y	5mm Tube Cap	Ethylene-Vinyl Acetate	YELLOW
TC-5-EVA-P	5mm Tube Cap	Ethylene-Vinyl Acetate	PURPLE
TC-5-EVA-O	5mm Tube Cap	Ethylene-Vinyl Acetate	ORANGE
TC-5-EVA-W	5mm Tube Cap	Ethylene-Vinyl Acetate	WHITE
TC-5-EVA-BK	5mm Tube Cap	Ethylene-Vinyl Acetate	BLACK
TC-10-LPE-R	10mm Tube Cap	Low Density Polyethylene	RED
TC-10-LPE-B	10mm Tube Cap	Low Density Polyethylene	BLUE
TC-10-LPE-G	10mm Tube Cap	Low Density Polyethylene	GREEN
TC-10-LPE-Y	10mm Tube Cap	Low Density Polyethylene	YELLOW

TC-3LPE-R

PTFE Syringe Tubing

These 12" lengths of PTFE syringe tubing offer an excellent means to access the bottom of small inner diameter NMR tubes, allowing void-free filling with viscous solvents such as DMSO- d6 or deuterium oxide.

Likewise, this syringe tubing permits easy retrieval of sample solutions from small diameter NMR tubes, or through the narrow orifice of valved NMR tubes, for example.

The flexible, totally inert and chemically resistant PTFE tubing is supplied with a female Luer-lock hub on one end and a raw cut on the opposite end. The tubing can easily be cut and shortened to any desired length.

The Luer-lock hub fits the syringes on page 48, or any other syringes having a male Luer taper connection, whether of the locking type or slip-tip type.

The Luer-lock hub, made from Kel-F® (also known as PCTFE, or polychlorotrifluoroethylene), has excellent chemical resistance, mechanical strength and deformation resistance.

The PTFE and Kel-F® materials of construction are virtually impervious to all common solvents, making the assembled syringe tubes washable and reusable many times over.

In the table below, several different gauge diameters of PTFE tubing are presented, allowing use with all Norell NMR tubes except 1mm O.D. The individual sizes may be purchased separately, or as a kit containing one of each size. Please note that, upon request, other gauge sizes from 30 to 7 are available, as well as custom lengths having a female hub on one end only or on both ends.

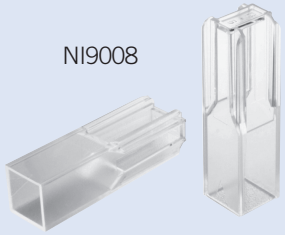
PTFE Syringe Tubing, 12 Inches Long, Kel-F® Female Luer-lock Hub on One End

Item No.	Recommended Minimum Size NMR Tube	Tubing Size (Gauge Number)	Nominal O.D.		Nominal I.D.	
			inch	mm	inch	mm
NDL-PTFE-28X12	1.5mm O.D. thin wall tubes	28	0.033	0.84	0.015	0.38
NDL-PTFE-24X12	1.7mm O.D. thin wall tubes	24	0.040	1.02	0.022	0.56
NDL-PTFE-22X12	2.0mm O.D. thin wall tubes	22	0.046	1.17	0.028	0.71
NDL-PTFE-17X12	2.5mm O.D. thin wall tubes, High Pressure Valved tubes	17	0.071	1.80	0.047	1.19
NDL-PTFE-16X12	3.0mm O.D. thin wall tubes, 5.0mm O.D. heavy wall tubes	16	0.077	1.96	0.053	1.35
NDL-PTFE-12X12	5.0 and 4.0mm O.D. thin wall, 5.0mm O.D. medium wall, all larger size tubes	12	0.109	2.77	0.085	2.16
NDL-PTFE-KITX12 (contains one each of the above items)	Suitable for all above sizes (except 1.0 mm O.D.)	One each of the above sizes	As per above	As per above	As per above	As per above

Standard 3.5ml & Semi-Micro 1.5ml Cuvettes for UV-Visible Optical Spectroscopy

Two sizes are available; 3.5ml (standard) and 1.5ml (semi-micro). All cuvettes have a 10mm path length and are 45mm high. Internal width of the semi-micro size is 4mm. We also have cuvette caps made from polyethylene which are easy to insert and remove. The caps seal liquid tight, suitable for mixing and storage. Sold in lots of 500. Call for other custom sizes.

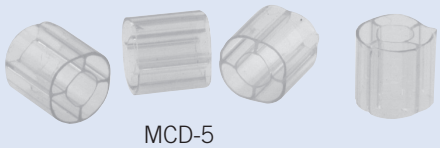
Item No.	Size	Packed In Lots Of
NI9007	3.5ml	500
NI9008	1.5ml	500
NI9010	cap for cuvette	500



Fluoropolymer FEP Multi-Channel™ Distillation Column Packing

This unique, lightweight, efficient distillation column packing was developed in our chemical R&D laboratories in the process of separation of H_2O from D_2O (heavy water) by distillation. Being chemically inert, with large contact surface area, it proved to be an excellent distillation column packing in the process of upgrading and separation by distillation of our deuterated solvents. We have determined the HETP (Height Equivalent to a Theoretical Plate) to be approximately 14.2 cm when using a standard test solution in a carefully controlled experimental apparatus, and we estimate that 100g of 5mm o.d. individual Multi-Channel™ units consists of 880 pieces, occupies 200 cm^3 in volume and offers about 2720 cm^2 in total surface area.

Item No.	Weight	Approx. Volume	Size	Approx. Pieces Per Pack	Surface Area
MCD-5	250g	500cm^3	5mm	2200	6800cm^2
MCD-8	250g	500cm^3	8mm	876	6800cm^2

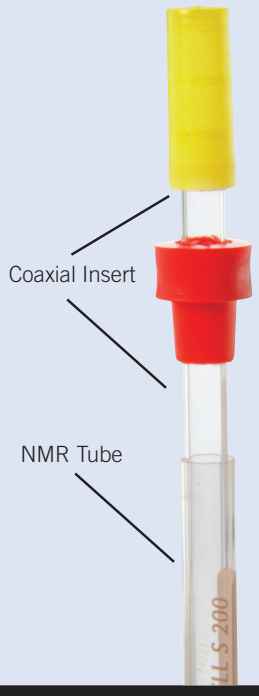


Coaxial Inserts for NMR Sample Tubes

(5mm & 10mm) for external lock & reference solvents. Precision inner cell for use with 5mm & 10mm thin wall NMR tubes. Available for Bruker & Varian spectrometers.

Item No.	Tube	Probe	Stem O.D. (mm)	Stem Length (mm)	Stem Capacity (µl)	Sample Capacity
NI5CCI-B	5mm	Bruker	2	50	100	490µL
NI5CCI-V	5mm	Varian	2	60	120	590µL
NI10CCI-B*	10mm	Bruker	3	50	215	2.61ml
NI10CCI-V*	10mm	Varian	3	60	260	3.14ml
NI5CCI-B-QTZ	5mm	Bruker	3	50	175	285µL
NI5CCI-V-QTZ	5mm	Varian	3	60	210	340µL

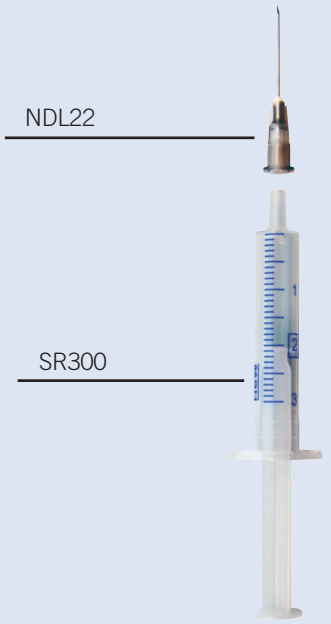
*10mm insert for Bruker & Varian includes our 1008-UP 7" NMR tube



Polypropylene Syringes

These syringes are latex free, contain no rubber, no silicone oil, or styrene. Manufactured only from laboratory grade polypropylene and polyethylene, a positive safety stop is incorporated to prevent accidental spills. Packed in lots of 100.

Item No.	Description	Packed In Lots Of
SR100	1ml with 0.01ml graduations	100
SR300	3ml with 0.1ml graduations	100
SR500	5ml with 0.5ml graduations	100
SR1000	10ml with 0.5ml graduations	100
NDL22	hypodermic needle for use with disposable syringes (stainless steel, translucent hub 22 guage x 1")	100



5mm & 10mm NMR Tube Septa

These precision molded natural rubber septa for 5mm and 10mm NMR sample tubes seal against both the inner and outer surfaces of standard, thin wall NMR tubes, providing the ultimate protection for sensitive or reactive samples, isolating them from contact with air, moisture and other ambient contaminants.

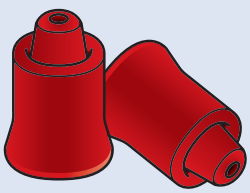
This dual seal septum likewise protects personnel against exposure to samples that may pose health or safety hazards, while still allowing easy access through the septum, using a syringe, to add, transfer or retrieve samples from the NMR tube.

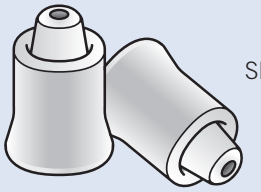
The septa are molded from one certified raw material formulation, ensuring consistency in all sizes, from one lot to another. This soft, resilient natural rubber compound pushes easily onto NMR tubes and ampules, without breaking or cracking fragile, thin wall tubes.

The soft rubber material of the septum tolerates multiple penetrations without losing sealing capability, especially if successive penetrations are made at the same spot using a sharp, noncoring point needle.

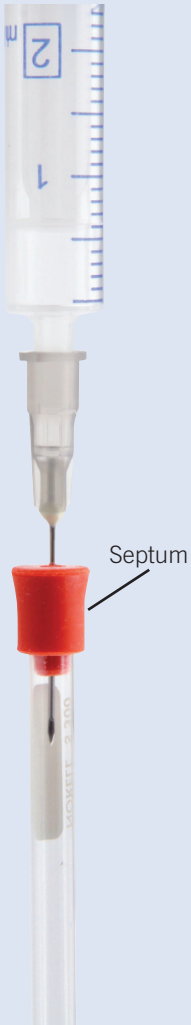
Septa should be stored in a sealed plastic bag, away from sunlight, to inhibit “blooming”, a process producing a harmless, whitish film or powder on the surface of natural rubber. Surface bloom does not affect performance, and can be removed by wiping or washing.

Item No.	Color	Packed In Lots Of
SEPTA-5-W	White	100
SEPTA-5-R	Red	100
SEPTA-10-W	White	100
SEPTA-10-R	Red	100





SEPTA-5-R



Bruker MATCH™ System Tube Rack

Designed by Bruker Biospin™, offers convenient and secure bench top placement of MATCH™ NMR tubes, tube holders, and Bruker spinner turbines. Can hold up to 10 of each in rack.

Item No.
BTR1000

BTR1000

Permanent Ink Ultra Fine Point Markers

Use this high quality, permanent ink, ultra fine point marker to clearly mark & organize all of your NMR Tube samples.

Item No.
MARKER-RED, MARKER-BLUE, or MARKER-BLACK

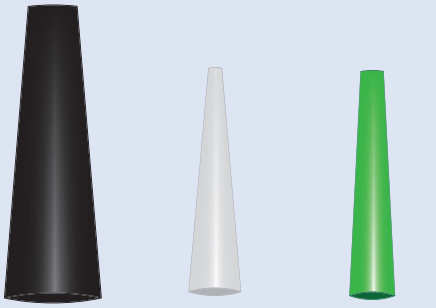
MARKER

Silicone Rubber Stoppers for NMR Sample Tubes

These stoppers can provide a solution for those difficult situations when a standard tube cap cannot be used, as, for instance, when space is a limiting factor. This problem occurs most often in solid state NMR work, when unique, compact or experimental probe designs may be encountered. The stoppers seal within the inner surface of the sample tube, and therefore do not extend beyond the outer periphery of the sample tube as does a standard tube cap.

They are made of a soft, resilient silicone rubber that forms a very effective seal without applying excessive force to the glass sample tube, thereby minimizing tube breakage. If desired, the stoppers can be easily trimmed to length with a knife blade or scissors. Being made from silicone rubber, they have a high degree of inertness, solvent resistance and high temperature capability (up to 200°C).

Item No.	Description	Color	Packed in Lots of
TS-1.5-3-SR	Will fit our thin wall tubes having an O.D. of 1.5mm to 3mm. (1.2mm to 2.4mm I.D.)	clear translucent	50
TS-2.5-3-SR	Will fit our thin wall tubes having an O.D. of 2.5mm to 3mm. (2.1mm to 2.4mm I.D)	light green	50
TS-4-SR	Will fit our thin wall tubes having an O.D. of 4mm. (3.2mm I.D.)	pink	50
TS-4-5-SR	Will fit our thin wall tubes having an O.D. of 4mm to 5mm. (3.2mm to 4.2mm I.D)	black	50
TS-10-SR	Will fit our thin wall 10mm O.D. tube. (8mm to 11.5mm I.D.)	clear translucent	10



TS-4-5-SR TS-1.5-3-SR TS-2.5-3-SR

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.

Continued Pg. 49

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.

Continued Pg. 50

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!

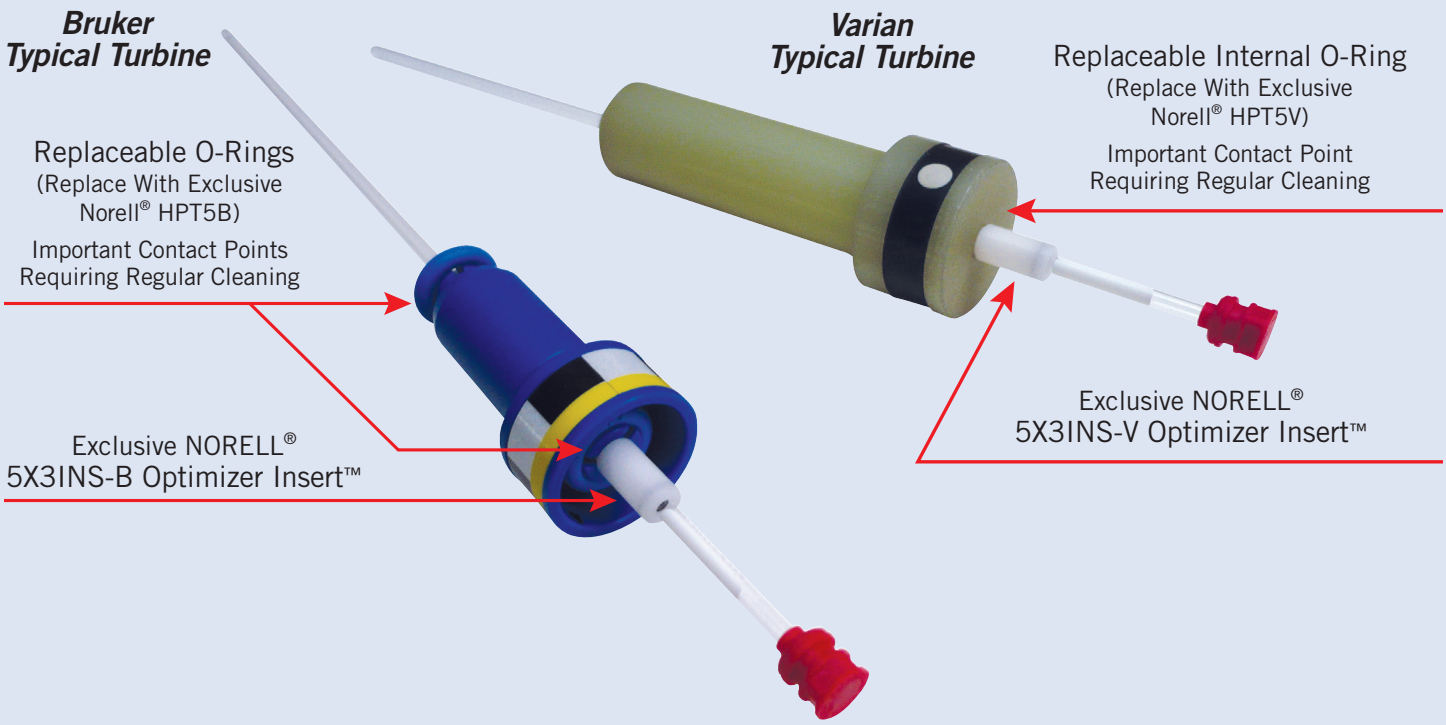
The inside bore of the spinner turbine can be cleaned using a swab mounted on a handle long enough to reach through the inside of the spinner turbine. The swab should be moistened with isopropanol, and all inside surfaces of the spinner turbine can then be easily reached and wiped clean.

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.

Continued Pg. 51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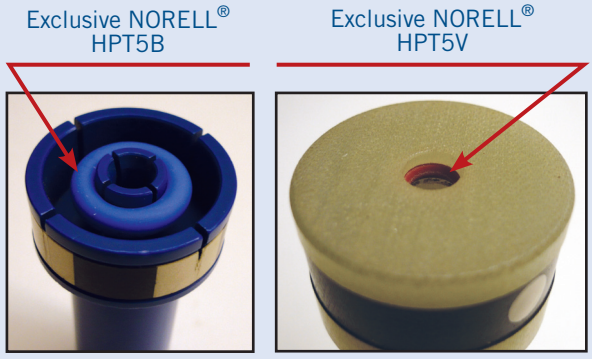
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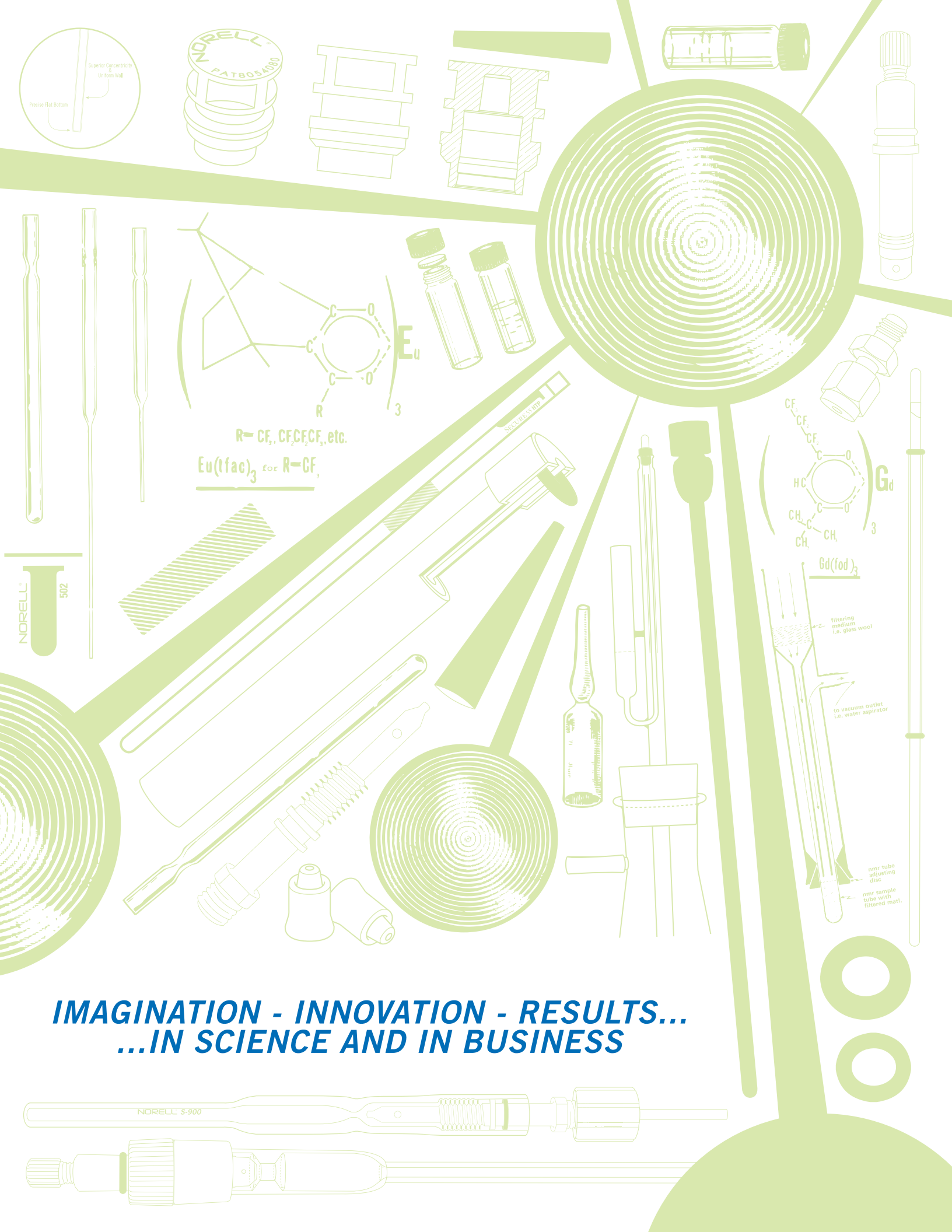

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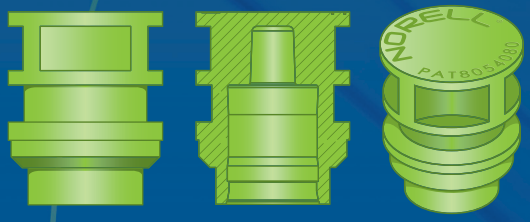

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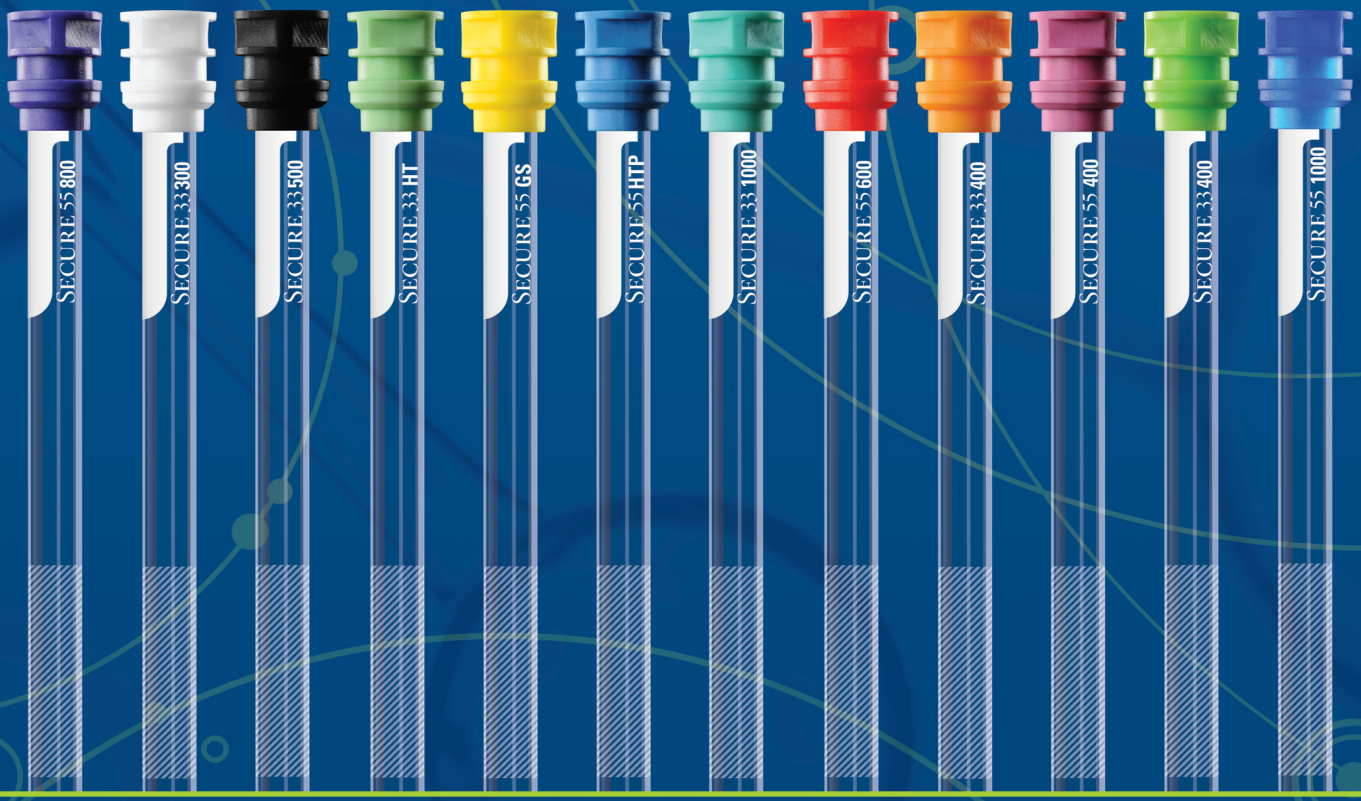

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