T3 HX Balun PISEMA 800-MHz Probe

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Varian NMR Spectrometer Systems

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Safety Precautions



This symbol might be used on warning labels attached to the equipment. When you see this symbol, refer to the relevant manual for the information referred to by the warning label.

- **WARNING:** Dangerous high rf voltage at the probe can cause serious injury or death. To avoid electrical shock, completely turn off rf and disconnect all rf cables before removing the probe or coils.
- **WARNING:** Shock hazard can result in death or serious injury. Disable acquisition in Spinsight by clicking Standby in the Display icon bar whenever opening the probe or connecting cables. Disabling acquisition limits the possibility of accidental discharge of current or RF while working with the probe. Remember to click Enable before continuing with testing.
- **CAUTION:** Probe damage can occur if the probe is dropped onto the tuning shafts. Hold the probe or keep at least one lock screw tightened to prevent the probe from slipping down the stand.
- **CAUTION:** Magnet and probe stand damage can result from a sudden loss of pressure in the TMC antivibration legs if the probe stand nylon bolts are extended. For systems with TMC antivibration legs, do not lower the nylon bolts of the probe stand to the floor.

Installing the Probe

The probe includes a probe stand (assembly required) designed to facilitate positioning and installation of the probe within the magnet, see Figure 1. In addition, the stand allows the sample to be positioned at the same field location repeatedly, regardless of how many times the probe has been removed from the magnet.

- Assembling the Probe Stand, this page.
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Assembling the Probe Stand

The probe stand is composed of a top ring, bottom ring, three legs, and two probe stops. Assembly of the probe stand requires a Phillips head screw driver. Refer to Figure 2 as necessary.

- 1. Attach the three stand rods to the stand base using 3 of the 6 Phillips head, flat head screws provided.
- 2. Thread the 3 large white plastic bolts through the three holes in the stand base, leaving them flush with the bottom of the base plate.



Figure 1. Probe and Stand

- 3. Slide one of the brass probe stops onto one of the stand rods and tighten the screw in the stop to temporarily fasten it to the stand rod.
- 4. Slide the probe onto the three stand rods. There is only one orientation in which the three stand rods will line up with the plastic sliders in the base of the probe, so do not force the stand rods to align with the base.
- 5. Slide the probe down until the longest knob in the base is approximately 1/2 inch (1.0 cm) from the bottom of the base plate. Thread the stand lock screws into the plastic sliders through the side panels of the probe base and tighten to lock the probe in position.
- 6. Loosen the probe stop (step 3) and slide it up against the base of the probe. Tighten the stop in place. This stop prevents the probe from hitting the floor when lowering it out of the magnet. Sharp blows (such as what might occur if the probe is lowered quickly and allowed to contact the floor) to the tuning knobs in the probe base will damage the probe.
- 7. Slip the second probe stop over the same stand rod as before and fasten it approximately 3/8 inch (1 cm) from the top of the stand rod.
- 8. Attach the stand top plate to the three stand rods using the remaining 3 Phillips, flat head screws.
- 9. After the probe position in the magnet has been determined, lower the probe stop of step 8 to meet the top of the probe base. This stop ensures that the probe is returned to the same position in the magnet after each change of sample.



Figure 2. Probe Stand Assembly

Mounting the Probe Stand and Probe to the Magnet

The steps below describe how to install and remove the narrow bore probe.

1. Screw the three lock screws into the base of the probe. Do not tighten.

The lock screws thread into the plastic bushings which allow the probe to slide on the stand. If the threads are not visible in the plastic bushings, rotate the bushings for proper alignment.

2. Position the probe with the tuning shafts just above the base plate. Tighten one lock screw to prevent the probe from slipping on the stand. Position the lower probe stop against the bottom of the probe; tighten the probe stop.

CAUTION: Probe damage can occur if the probe is dropped onto the tuning shafts. Hold the probe or keep at least one lock screw tightened to prevent the probe from slipping down the stand.

3. Place the assembly under the magnet. Look at the placement of two holes in the shim flange that will line up with the top plate holes.

Alignment is usually easier if you raise the probe part way into the magnet before attaching the bolts.

- 4. Raise the whole assembly until the top plate is flush with the room temperature shim flange. Rotate the probe stand so that the RF power connections are oriented conveniently for the user.
- 5. Rotate the probe stand slightly so that the two holes in the top plate of the stand align with holes in the shim flange.
- 6. Screw the top plate of the stand into the RT shim flange with stainless steel bolts.
- 7. Loosen the lock screws and raise the probe until the top of the probe is just inside the magnet. Tighten one of the lock screws to prevent the probe from slipping on the stand.
- 8. Reposition the lower probe stop against the bottom of the probe; tighten the probe stop.

CAUTION: Magnet and probe stand damage can result from a sudden loss of pressure in the TMC antivibration legs if the probe stand nylon bolts

are extended. For systems with TMC antivibration legs, do not lower the nylon bolts of the probe stand to the floor.

- 9. For systems without TMC antivibration legs, you can lower the nylon bolts against the floor.
- 10. Raise the probe to its approximate operating position and lock in place using the lock screws on the probe.

Connecting Purge Gas

Connect the purge gas line to the probe, see Figure 3.



Figure 3. Connecting Purge Gas

Variable Temperature

The 800-MHz Balun Pisema probe is equipped for variable temperature (VT) operation. Operating temperature range is -75° C to $+100^{\circ}$ C. Sample changing is performed by lowering the probe from the magnet following the instructions in "Sample Insertion and Removal," page 6 and raising the probe back into the magnet. The VT stack does not transition the full length of the magnet bore and is left inside the magnet during sample changes.

WARNING: Do not disconnect the probe from the VT stack during VT operation. VT gas exhaust entering the magnet bore may damage both the magnet and liquids upper barrel.

Sample Insertion and Removal

- 1. Lower the probe from the magnet.
- Remove the probe top as follows: 2.
 - a. Remove the two Nylon 8-32 screws from the top of the probe, see Figure 4 A.
 - b. Hold the probe body and gently push up on the probe top using your thumb and forefinger until the grounding fingers disengage, see Figure 4 B.
 - c. Pull the probe top from the probe, see Figure 4 B.
- 3. Remove the coil platform from the probe as follows, see Figure 4 C.
 - Remove the three 2-56 a. screws from the coil platform.
 - b. Separate the coil platform from the probe top.
- 4. Place the sample in the probe as follows: see Figure 4 D.
 - c. Slide the sample gently into the coil.
 - d. Keep all grease and debris away from the sample region.
 - e. Clean the area with isopropyl alcohol prior to reassembly.
 - Mount the coil platform to f. the probe top probe using the three 2-56 screws removed in step a.
- 5. Install the probe top into the probe as follows: see Figure 4 E.

 - a. Align the groove in the coil platform with the alignment pin in the probe.
 - b. Slide the probe top into the probe.



.Nylon 8-32 screws







Figure 4. Sample Insertion and Removal

Secure the top with the tow 8-32 screws removed in step 2. 6.

Installing and Removing Tuning Tubes

Refer to the sheet supplied with the probe for selecting the correct tuning wands. Install them as follows and refer to Figure 5.

- 1. Select the tuning element, from the table supplied with the probe, with a tuning frequency appropriate for the X nucleus. If two tune tubes cover the desired frequency then choose the longer of the two, as it will allow a greater range of match coupling.
- 2. Remove the X-Cap from the base of the probe:
 - a. Push the cap against the base of the probe and rotate ~90 degrees.
 - b. Release the cap and slide it out of the probe base.

If it does not come out of the probe, rotate the cap back and forth slightly until it comes out.

- 3. Pull the X match knob down to remove the tune tube from the probe.
- 4. Insert the new tune tube into the probe.
- 5. Install the X-cap:
 - a. Place the new X-cap over the match knob.
 - b. Engage the tabs on the X-cap into the base of the probe.
 - c. Push up.
 - d. Rotate the X-cap approximately 90 degrees.
 - e. Release the cap.



Figure 5. Installing Tune Tube and X-Cap

Tuning and Matching the X Channel of T3 Probes

After installing the appropriate X- tune tube, tune the channel using a reflection bridge or equivalent. Adjust the tune and match using the X-tune and X- match knobs, see Figure 5, for minimal reflected power.

A specialized screwdriver is provided for the tune adjustment, this screwdriver has a small pin to maintain alignment of the screwdriver, see Figure 6.



Low gamma tuning box

NSLG box

Custom

shorting tube

Low Gamma Tuning

Tuning the T3 double resonance probe for observing nuclei with a low gamma, ⁴⁹Ti and lower, requires the following low gamma tuning accessories:

- Custom shorting tube, see Figure 7. The shorting tube connects the low gamma box to the probe head.
- Low gamma tuning box, see Figure 7.
 Fixed capacitors for course tuning and variable capacitors for fine tuning and matching are contained within the low gamma tuning box.
- NSLG box, see Figure 7.
 Required for tuning from ⁴⁹Ti to ¹⁰⁹Ag.

Probe tune and match adjustments are not used to tune the low channel of the probe. The low gamma box contains fixed and variable capacitors for tune and match adjustments.

⁴⁹Ti to ¹⁰⁹Ag

- 1. Install the shorting tube into the low channel of the probe, see Figure 8.
- 2. Connect the NSLG box to the low channel port of the probe.
- 3. Connect the low gamma tuning box to the NSLG box.

Figure 7. Low Gamma Accessory

- 4. Connect the X channel tune cable to the low gamma tuning box.
- 5. Set the switches on the low gamma tuning box according to the tuning chart provided with the probe.
- 6. Adjust the low gamma box tune knob to tune the resonance.
- 7. Adjust the low gamma box match knob to match the resonance.



¹⁰⁹Ag to ²³⁵U

- 1. Install the shorting tube into the low channel of the probe, see Figure 8.
- Connect the low gamma tuning box to the probe — the NSLG box is not used.
- 3. Connect the X channel tune cable to the low gamma tuning box.
- 4. Set the switches on the low gamma tuning box according to the tuning chart provided with the probe.
- 5. Adjust the low gamma box tune knob to tune the resonance.



Figure 8. Tuning Low Gamma Nuclei

6. Adjust the low gamma box match knob to match the resonance.

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