ONYX-REVOLUTION
Side-Mount Cylindrical
Cathode Manual
Version 4.3

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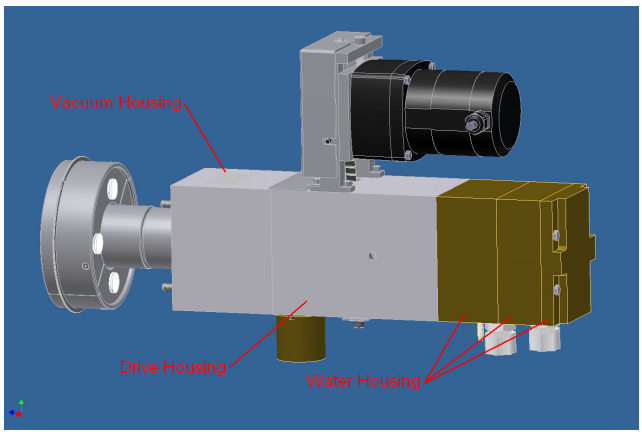
First Installation – Cathode Mounting

Your chamber should already have a mounting flange or port ready to receive the cathode. This should include a 3.00" (73.2 mm) through-hole as well as 4 blind tapped holes (3/8"-16 x 0.650" deep). The following procedure describes the steps necessary to mount the cathode to your chamber for the first time or after maintenance.

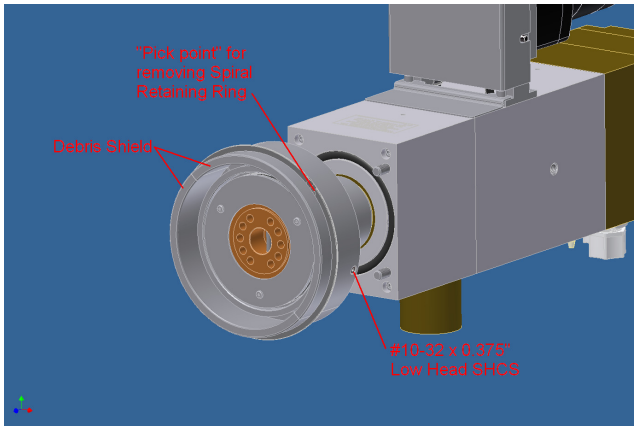
Safety:

- *To avoid electrical shock, disconnect the power supply cable from the cathode.*
- *Be sure to turn off the cooling water supply to the cathode. Remove as much excess water from the cathode as possible by blowing dry air through the water passage. Disconnect the water supply and return hose.*
- *The target assembly should be removed from the cathode assembly.*

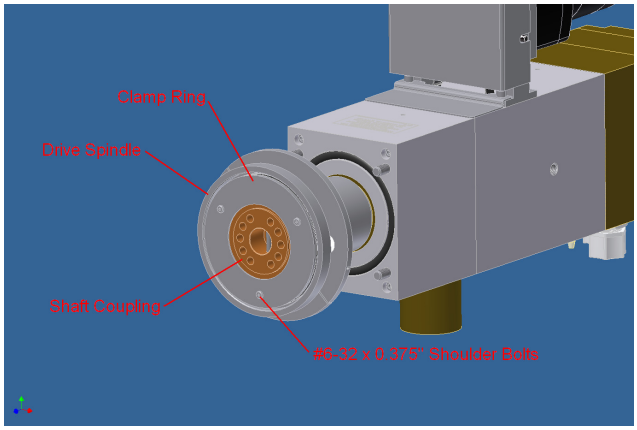
1. The cathode is divided into 3 separate housing units: Vacuum Housing, Drive Housing and Water Housing. The Water Housing is divided into 3 separate components, which must be removed to access the 4 cathode mounting bolts.



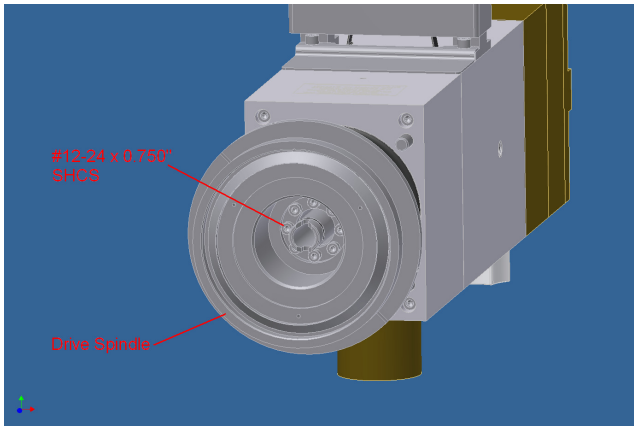
2. If the Debris Shield and Drive Spindle are on, then they will need to be removed before the drive can be mounted. Use a small blade screwdriver to remove the spiral retaining ring from the Debris Shields. Then remove the (4) #10-32 x 0.375" low head shcs in order to take the Debris Shields off.



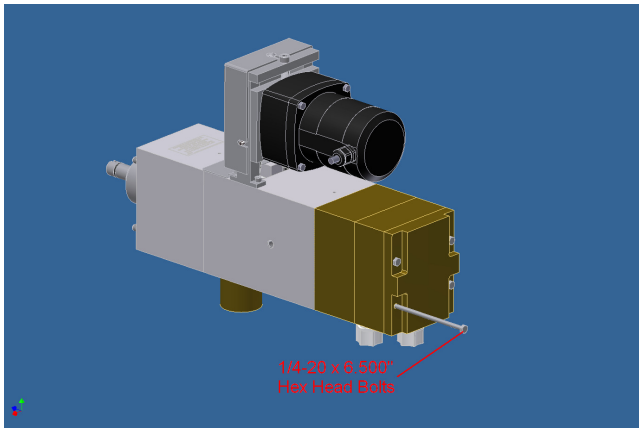
3. The Clamp Ring is used to hold the Shaft Coupling and target o-ring inside of the Drive Spindle. It comes off by removing the (3) #6-32 shoulder bolts and pulling it out.



4. The Drive Spindle is held on with (8) #12-24 x 0.750" shcs. Once these screws are removed, the spindle can be pulled off of the Drive Shaft. It may be a tight fit because of the double radial o-ring seal between the spindle and the shaft.

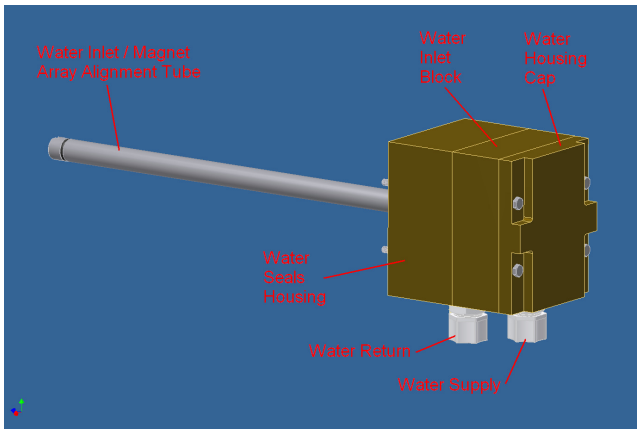


5. The Water Housing is attached to the cathode assembly by (4) ¼-20 x 6.50" length hex head bolts. All 4 of these bolts must be removed and set aside for reattachment once the cathode has been mounted to the chamber.



6. Once the mounting bolts have been removed, the following components will be removed from the cathode assembly. The graphic shows the names of these components as well as where the water inlet and outlet fittings are located.

   For maintenance of the Water Housing and Water Housing seals see the Water Housing Maintenance section.



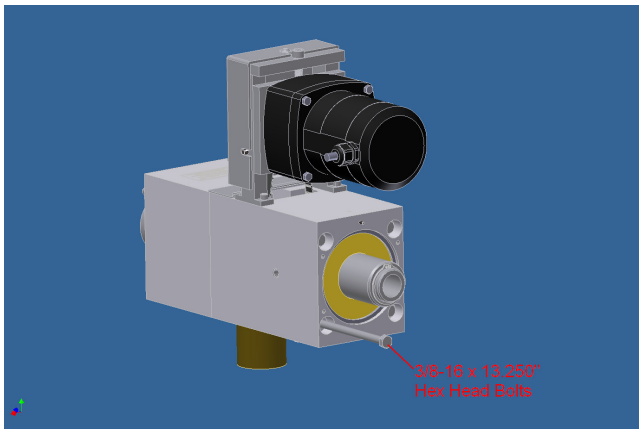
NOTE: The cooling water flow requirements of the cathode are 1 gallon per minute (GPM) for every 4 kW of cathode power. It could also be stated as 0.25 GPM per 1 kW of power. In metric units the requirement would be 1 liter per minute (LPM) for every 1 kW of cathode power. For example, you would need 3 GPM (or 12 LPM) if you were running 12 kW of power.

It is recommended to connect a water flow meter with an alarm to signal when the water flow is too low for the cathode power level. This would be to prevent the cathode from overheating and damaging the unit.

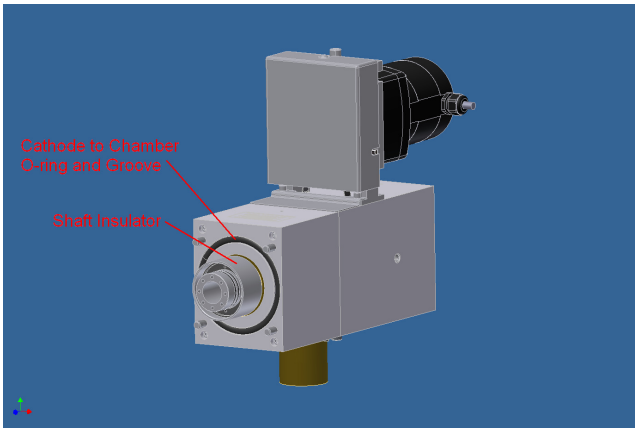
The water connections use compression fittings and mate to ¾" OD tubing. The user my substitute different sized adapters, if necessary, to accommodate other cooling line diameters.

Also, it may be helpful to install a tee fitting with a shutoff valve into the Water Inlet tubing in between the user's water shutoff valve and the inlet compression fitting. This would be used to blow compressed air through the cooling line to remove cooling water from the cathode before disconnecting the target.

7. Now that the Water Housing is removed you should have access to the (4) 3/8-16 x 13.25" cathode mounting bolts. Although the cathode weight is manageable by 1 person, mounting the cathode is awkward and will most likely require an assistant to mount it.



8. Before the cathode is attached to the chamber or flange, the o-ring seat, mating flange and sealing o-ring should be cleaned. The metal surfaces and the o-ring can be wiped clean using a lint-free wipe with a cleaning solvent. After cleaning, the o-ring can be lightly lubricated with vacuum compatible grease.



9. After completing the above procedures, carefully insert the Drive Shaft into the chamber opening and firmly tighten the 4 cathode mounting bolts. The Water Housing can be reattached by reversing steps 5 and 6 above. Be sure that the Shaft Insulator is on the Drive Shaft at this point. The Drive Spindle and Shaft Coupling will then need to be reattached by reversing steps 3 and 4 above. Be sure to align the slot in the Water Alignment Tube with the shoulder bolt going through the Shaft Coupling.

Electrical Connections

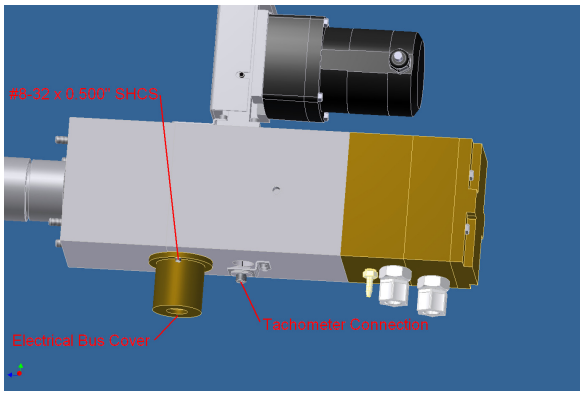
In order for the magnetron to sputter, all of the electrical connections need to be properly made. There are two power connections located on the cathode drive housing. First, the drive motor controller has to be connected in order to rotate the Target. Second, the magnetron power supply needs to be connected to the cathode in order to sputter the Target. Also, the tachometer readout should be connected in order to verify rotation speed.

Safety:

- *To avoid electrical shock, make sure the cathode power supply input power is off.*
- *Be sure that the cooling water supply to the cathode is turned off before making any electrical connections.*

NOTE: The maximum rated isolation voltage of the cathode is 1500VAC.

1. The tachometer cable connects to the supplied digital readout that displays rotation speed. This connection is made by screwing in the readout cable that has the subminiature connection plug to the mating connector located on the drive block. The digital readout will then need to be plugged into a 115/230 VAC, 50/60 Hz power source. If this is not available, a voltage transformer may be necessary, refer to Addendum A for details. Also, the (2) #8-32 SHCS and the Electrical Bus Cover can be removed at this time.



2. Now the cathode power going from the cathode power supply to the Brush Housing can be connected. This connection uses a copper lug to clamp the power cable into place. Be sure to use a cable that is rated to handle the maximum amount of power that will be applied. Multi-stranded and insulated copper wire is recommended. Loosen the (2) #8-32 SHCS that secure the Brush Housing Clamp and insert the power cable and then tighten the clamp again. Also, a connection must be made between the cathode power supply ground or negative terminal and the chamber, which acts as the anode.

3. The other power connection is for drive motor power. This connection is made by first connecting the motor cable to the controller cable and then plugging the supplied motor controller into a 115/230 VAC, 50/60 Hz power source. If this is not available, a voltage transformer may be necessary, refer to Addendum A for details. Also, if a controller was not supplied, then the motor will need to be wired to one and then connected to power according to the motor and controller wiring diagrams. In this case, the motor wiring diagram will be provided with the cathode for your reference.

Water Housing Maintenance

Performing maintenance on the Water Housing does not require removal of the cathode from the chamber. Although the target may not be used for sputtering, vacuum integrity is maintained with the Water Housing removed and the system user can continue processing, if capable, with the cathode to be serviced offline.

Notes on Rotary Shaft Seals:

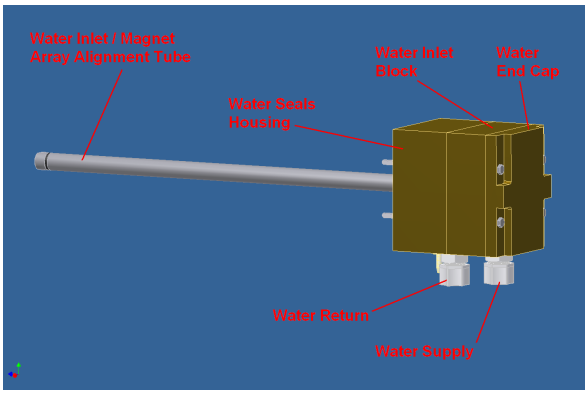
- *The rotary shaft seals used within the Water Housing are expected to maintain service for a minimum of 24 months. The most common mode of failure for these dynamic seals is the lip interface to the shaft, specifically, any debris that might try to pass through the water cooling system. For this reason it is recommended the user install a maximum of 75um water filtration in front of the cathode supply water connection.*
- *Rotary shaft seals such as those used by the Onyx Revolution are energized and maintain their seal by the pressure separating water from air or air from vacuum. When de-energized so that the pressure is equivalent on both sides of the seal, by turning off the water supply or venting the chamber, the seal will slightly relax and in some cases allow a small volume of the high pressure media to pass to the low pressure side. This is evident after venting the chamber, pumping down to HiVacuum, and then turning on the cathode rotation. The volume of media passing through the seals is minor and very temporary. The user will see the base pressure return within seconds of initiating rotation. The same is true for the water seals when first energizing the seal with cooling water pressure.*

Safety:

- *To avoid electrical shock, disconnect the power supply cable from the cathode.*
- *After allowing sufficient time for a sputtered target to cool (< 10 min). Be sure to turn off the cooling water supply to the cathode, remove as much excess water from the cathode by blowing dry air through the water passage and disconnect the water supply and return hose.*

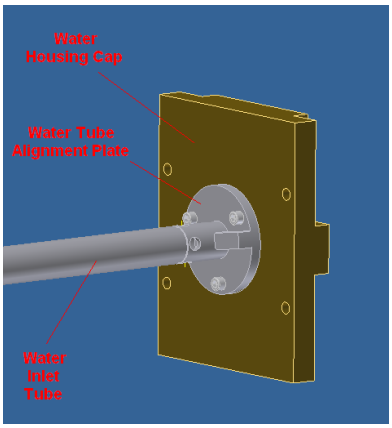
To remove the Water Housing from the cathode assembly, follow steps 5 and 6 of the First Installation procedure above.

1. As depicted in the First Installation procedure, the Water Housing assembly should be moved to a work area to safely and accurately complete the following procedure.



NOTE: All of the seals and o-rings in the Water Housing are only sealing between water and atmosphere. Because there is no exposure to vacuum the best lubrication to safely use is a marine grease. This lubricant is water compatible and will offer a longer service life than vacuum compatible or standard grease.

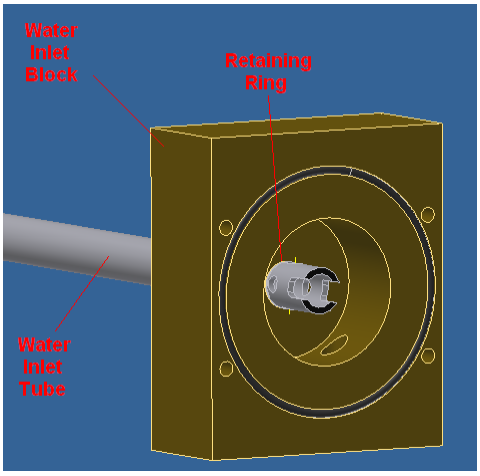
2. The first piece to be removed from the Water Housing Assembly is the Water Housing Cap. The Water Inlet Tube is shown to clarify how the Alignment Plate is keyed to the Water Inlet Tube. The Alignment Plate is where the ultimate magnet array position is defined. Note the Alignment plate is "clocked" by 3 degrees. This accounts for the tolerance stack-up to place the magnet array perpendicular to the substrate while the Target is rotating.



NOTE: Rotating the Water Housing Cap 180 degrees with the Target Assembly attached to the cathode will, in turn, rotate the Magnet Pack as well.

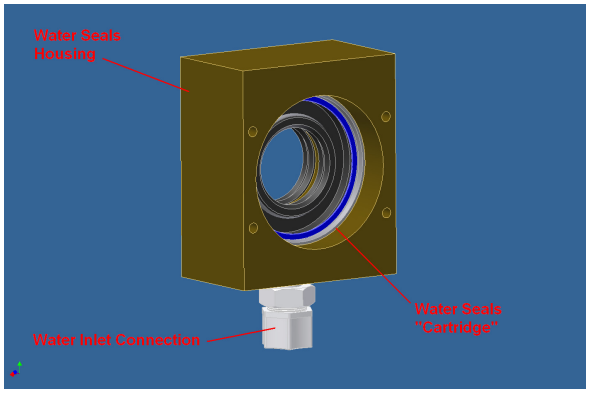
Generally, there is no expected or required maintenance for these components.

3. The 2nd component of the Water Housing assembly is the Water Inlet Block. When this is removed you will find it is attached to the Water Inlet Tube. To remove the Water Inlet Tube, remove the small retaining ring and slide the tube out. Inside the hole where the Water Inlet Tube was removed the user will find a small o-ring. This o-ring serves as a water baffle between water supply and water return. It is not a "hard" seal.



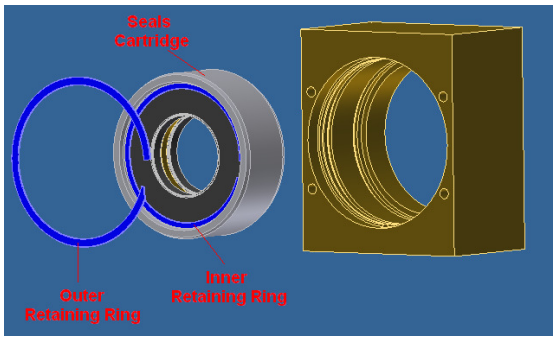
Prior to reassembly the face seal o-ring grooves should be cleaned and the o-rings should be cleaned/inspected for replacement.

4. The Water Seals Housing is the same component for the Water Return connection and for the Water Seals cartridge. To complete maintenance on this component, a small bench press is recommended.



It is important to note that disassembly of the Water Seals cartridge will almost always cause distortion of the rotary shaft seals. So, prior to complete disassembly, be prepared with spare seals for replacement if this unit needs to be immediately returned to service.

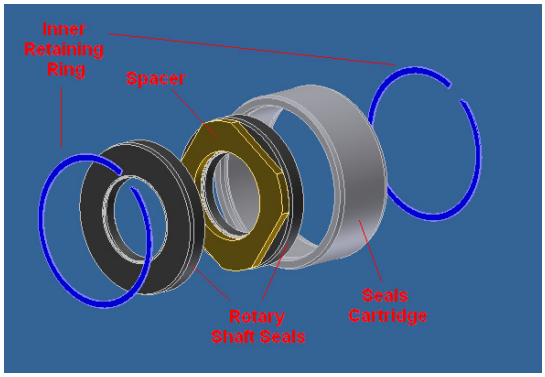
5. To remove the seals cartridge, use a small blade screwdriver to lift out the Outer Retaining Ring. The Seals Housing can then be placed on a small bench press and the seals cartridge pressed out of the Housing.



At this time the 2 o-rings and o-ring grooves inside the seals housing can be cleaned and inspected for wear.

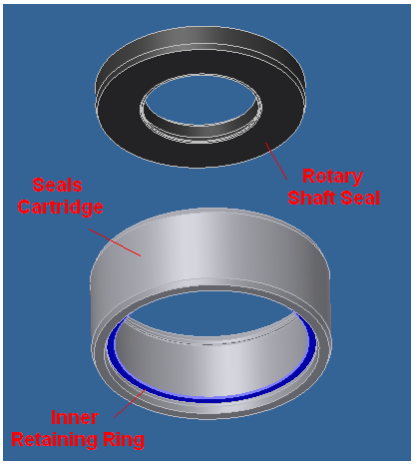
6. The rotary shaft seals inside of the cartridge can now be accessed by first using a small blade screwdriver and removing the 2 Inner Retaining Rings. Return the cartridge assembly to the bench press and remove the rotary shaft seals and spacer.

   The Rotary Shaft seals should be discarded and replaced with new ones. Clean the seals cartridge and spacer.



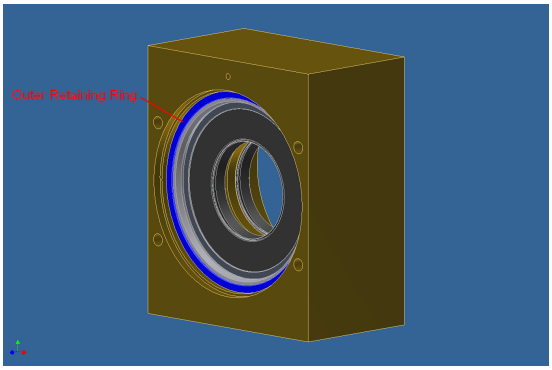
7. After cleaning the individual components, replace one of the Inner Retaining Rings into the Seals Cartridge. Place the cartridge on the bench press and install one of the Rotary Shaft Seals. Use marine grease as the lubricant and assure the seal is pressed in level and all the way down to meet the Inner Retaining Ring.

   The "flat" face of the seal should be against the retaining ring and the open or cupped end of the seal should be facing out. The open or cupped side will be the side filled with water.



6. Drop the spacer into the seals cartridge and use the bench press to install the 2nd rotary seal. Again this pressing process needs to be level and flat until the seal is seated against the spacer.

   After installing the 2nd Inner Retaining Ring the seals cartridge is ready to be inserted into the Water Seals Housing.



NOTE: Make sure to have the flat face of the seals facing the front of the housing (side with dowel pin hole) and the cupped side facing the water return hole.

The remainder of the assembly of the Water Housing can be completed by reversing steps 5 and 6 of the Water Housing Maintenance procedure above.

Cathode Brush Assembly Maintenance

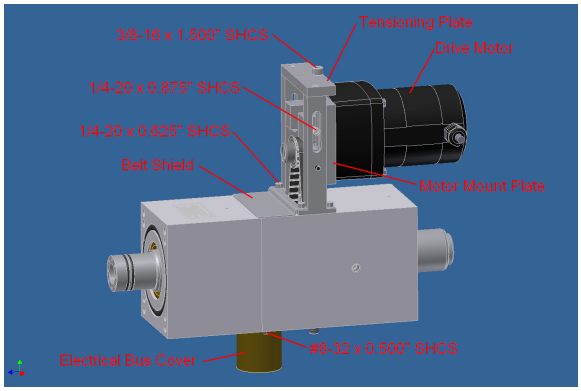
Performing preventive maintenance on the Brush Assembly normally requires removal of the cathode from the chamber. This maintenance should be performed every 12 months, based on usage and operating conditions. The brushes will last longer in a cool, humid environment. If the conditions are warm and dry, the brushes will wear faster from the higher temperatures and a lack of lubrication. The following procedure will tell how to fully maintenance the Brush Assembly, as well as perform intermediate maintenance, as described by the note at the end of this section.

Safety:

- *To avoid electrical shock, disconnect the power supply cable from the cathode.*
- *After allowing sufficient time for a sputtered target to cool (< 10 min). Be sure to turn off the cooling water supply to the cathode, remove as much excess water from the cathode by blowing dry air through the water passage and disconnect the water supply and return hose.*

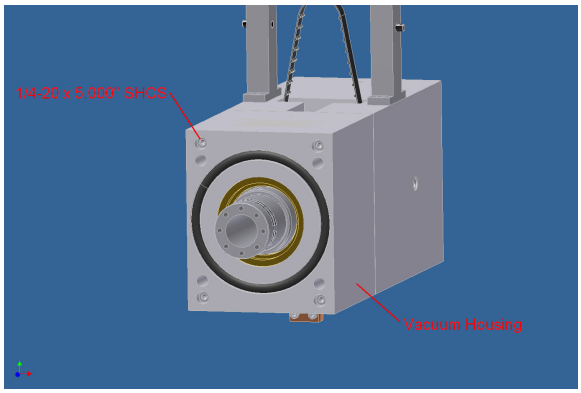
1. If the target is still attached, it will need to be removed as shown in the Target Removal procedure below. Then remove the Water Housing as shown in the First Installation procedure above. This will allow for the Drive Assembly to be unbolted from the chamber and moved to a clean workbench. Next, the Drive Spindle needs to be taken off as shown in the First Installation procedure. The Shaft Insulator assembly will then slide right off.

2. Now loosen the button head screw holding the Motor Cover and take the cover off. Then remove the front (2) ¼-20 x 0.625” SHCS to take the Belt Shield off. On the bottom of the Drive block, take the (2) #8-32 x 0.500” SHCS off and remove the Electrical Bus Cover that they were holding. Next, remove the (2) ¼-20 x 0.875” SHCS on the sides of the motor mount uprights. Now hold the motor securely and remove the 3/8-16 x 1.500” SHCS that is holding it in place. With the screw out, the motor can be taken off and set aside.

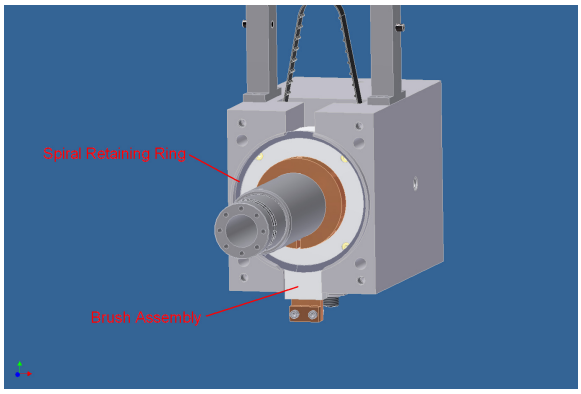


NOTE: When reattaching the motor, lift it up to remove the slack in the belt and place the 3/8-16 x 1.500” SHCS through the Tensioning Plate and tighten it into the Motor Mount Plate until there is very little slack in the belt (it should appear tight at rest, but deflect about ½” to 1” when pressed on by hand). As long as the belt doesn’t slip while rotating the target, it is tight enough.

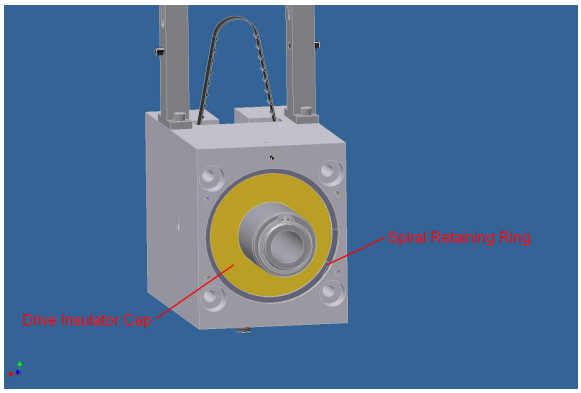
3. On the front of the drive assembly, the (4) ¼-20 x 5.00" SHCS need to be removed so that the Vacuum Housing can be pulled off of the Drive Shaft. The vacuum block may need to be pried apart from the drive block in order to do so.



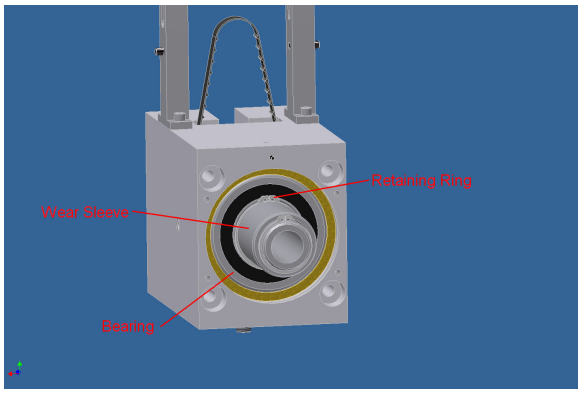
4. With the Vacuum Housing off, the spiral retaining ring that locks the Brush Assembly into the Drive Block can be removed by using a small blade screwdriver.



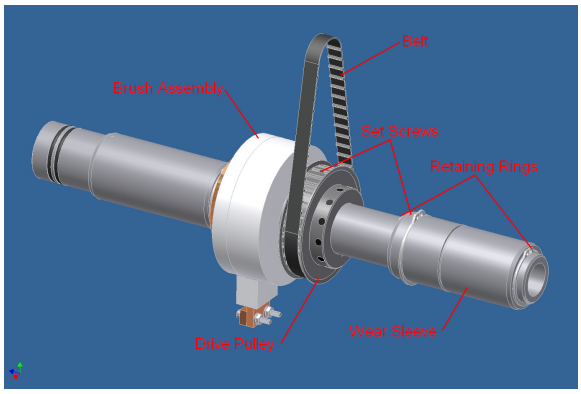
5. On the back of the drive assembly, the spiral retaining ring and Drive Insulator Cap should be taken off.



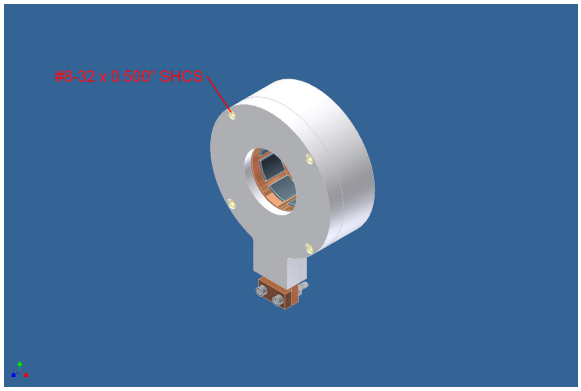
6. Now the retaining ring on the Wear Sleeve should be removed. After this, guide the belt through the slot in the front of the Drive Block while sliding the Shaft Assembly out from inside of the Bearing and Drive Block.



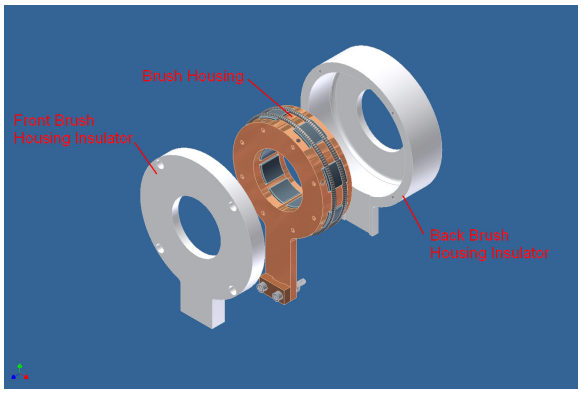
7. With the Shaft Assembly removed from the Drive Block, the Belt can be set aside. Next, loosen the set screw in the Wear Sleeve. The Retaining Ring on the end can be taken off, then slide the Wear Sleeve off and take the other Retaining Ring off of the Drive Shaft. Now loosen the set screw in the Drive Pulley and slide it and the Brush Housing off of the Drive Shaft.



8. Remove the (4) #8-32 x 0.500” SHCS so the Brush Assembly can be opened up.



9. Now the Brush Housing Insulators can be removed from the Brush Housing and any dust can be vacuumed out and then the parts can be wiped down with alcohol. At this time, the brushes should be inspected to make sure they are wearing evenly and that the brush springs are not broken. If everything is good, it can all be reassembled.



NOTE: In between complete tear-down cleanings of the Brush Assembly, it is a good idea to do a quick cleaning to help prevent dust buildup which can lead to arcing. This could be done about every month, once again, depending on operating conditions. To do so, just remove the Motor Cover and Belt Shield, as described above, and vacuum inside the block. It will take a small vacuum attachment to do this. Also, remove the Electrical Bus Cover on the bottom of the Drive Block and vacuum out around the Brush Assembly. Always be sure to disconnect the cathode power before performing this maintenance.

Debris Shield Removal and Cleaning

The Debris Shield's main function is to capture any back-sputtered or gas phase scattered target material that would otherwise return to the target surface. If the Debris Shields were not in place, this scattered material could lead to arcing on the target surface, debris on the substrates, and even conductive electrical paths leading to ground and causing a short.

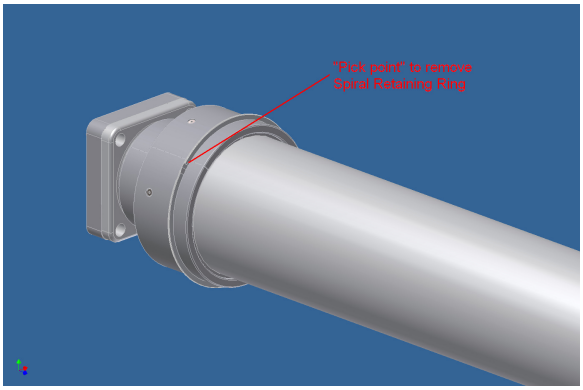
The Debris Shields are designed for easy removal and cleaning without the removal of the Target from the chamber or removal of the Target from the cathode body. Depending upon the amount of use and the deposition rate of the target material, the Debris Shields may need to be cleaned as often as every 1-2 weeks. The following procedure will show how to remove and install the Debris Shield Assemblies.

Safety:

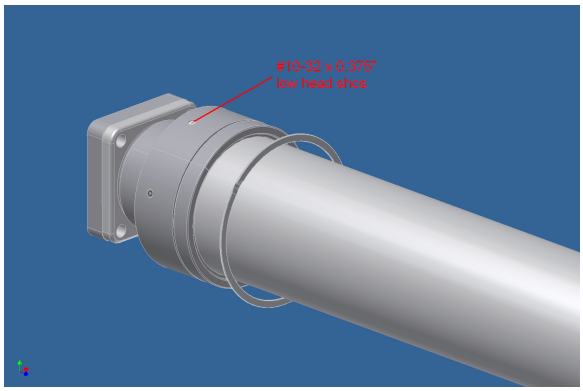
- *To prevent electrical shock, assure that power to the cathode is OFF.*
- *To avoid possible burns from working around a hot target surface, allow the target to rotate for at least 15 minutes, with cooling water flow, AFTER turning the power supply OFF.*
- *To avoid the entrapment of tools, clothing, or other materials that may cause either human or equipment damage, turn the target rotation OFF.*

1. To prevent the possibility of condensation on the target surface and reduce pumping times, turn OFF the cooling water flow through the cathode.

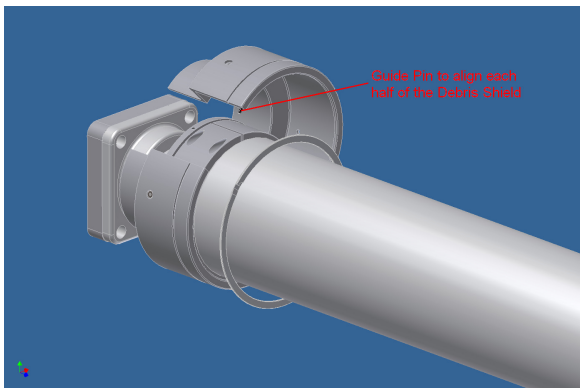
2. If not accessible, rotate the Target so that the Debris Shield spiral retaining rings can be removed. Use of a small blade screwdriver will allow the user to easily remove the retaining ring from the Debris Shields. Unless requiring replacement or cleaning, these retaining rings can rest on the Target. It is recommended to "roughen" the surface of the retaining rings by light bead blasting so they will resist flaking of the deposited target material.



3. If not accessible, rotate the Target so that the Debris Shield mounting screws (#10-32 x 0.375" low head shcs) are facing you and remove all 4 screws on each end of the target. At this time it is best to examine the screws and determine if they will need to be replaced when reattaching the debris shields.



4. With the mounting screws removed, the Debris Shield can be separated and fully detached from the Target Assembly. For separating the Debris Shields, pull each side straight away from the other so as not to bend the guide pins. These pins align and position each side to one another. At this time the Debris Shields can be grit blasted for material removal. Many users have spare replacement Debris Shields Assemblies that can be pre-cleaned and readily installed to reduce system "down-time."

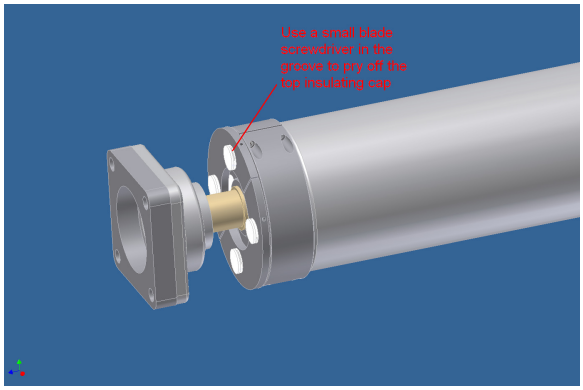


5. For reassembly of the debris shields onto the target assembly, reverse steps 2-4 of the Debris Shield Removal procedure above. To check successful reassembly, use an ohm-meter to check conductivity between the Debris Shield and the Target surface. This should be an OPEN (no contact) circuit. Check each Debris Shield also to the chamber or system ground. This also should be OPEN circuit.

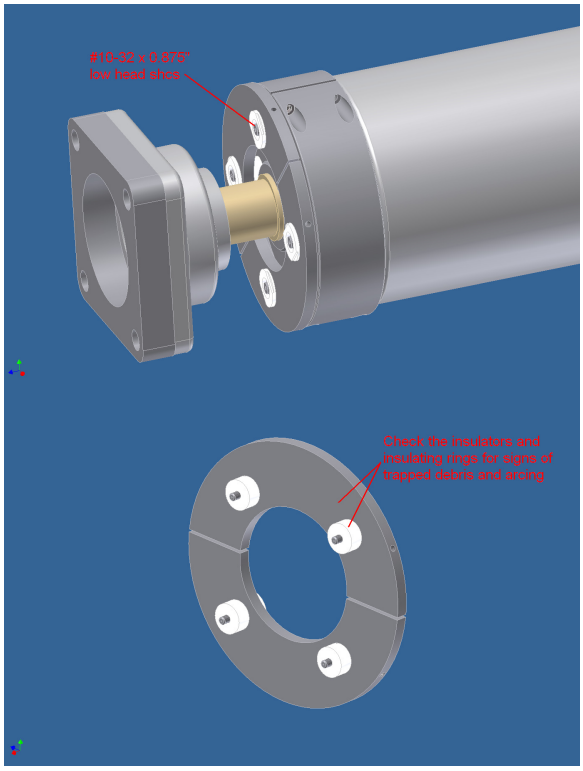
   For normal cleaning of the Debris Shields, the procedure is complete. If there is any conductivity found in step #5, remove the Debris Shield and recheck the conductivity between the Debris Shield Insulating Ring and both the Target/ground.

   Proceed to step 6 if it is desired to clean the Insulating Ring or if electrical conductivity is found between the Insulating Ring and the Target/ground. In order to remove the Debris Shield Insulating Ring it is not necessary to remove the Target from the cathode.

6. The Insulating Ring is attached to the Target End Caps by 4 screws, and electrical isolation is achieved by the use of (PEEK) insulators. Access to the mounting screws is achieved by removing the top PEEK insulator cap by inserting a small blade screwdriver into the groove under the cap and prying it off. Repeat this procedure for all four insulating assemblies. If desired, the PEEK insulator can be cleaned at this time with some sandpaper or scotchbrite.



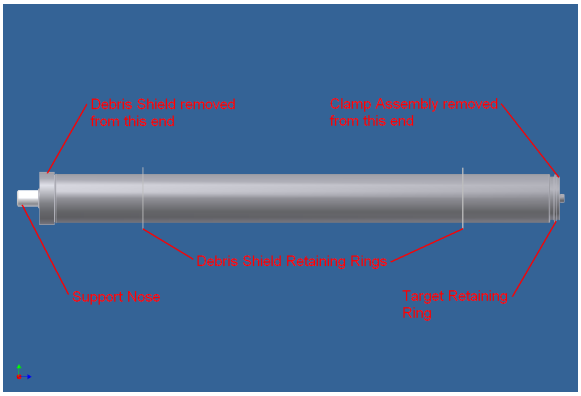
7. The 4 screws (#10-32 x 0.875” low head shcs) can now be removed which will allow full removal of the debris shield insulating rings from the Target Assembly. The Insulating Rings can be cleaned by lightly grit blasting them. If there was an electrical short, check for debris trapped between the Insulating Ring and the Target End Cap. Also, inspect the PEEK insulators to assure there has been no arcing or burning of the material. If signs of arcing or burning are found, replace the insulators as necessary.



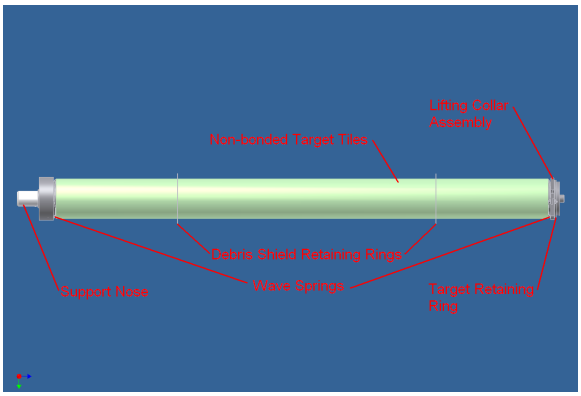
Target Mounting

The Target serves as the source of the material to be sputtered onto the substrate. It is connected to the cathode at one end by a two-piece clamp. The ends of the Target are covered by Debris Shields, which prevent any material from being back-sputtered onto the Target itself. The following procedure will explain how to mount the Target to the Drive Assembly.

1. Prepare the Target Assembly for installation by making sure the Magnet Kit is inside the Backing Tube and the End Cap with Support Nose is attached. Make sure that the inside lip of the open end is clean so it will seal on the o-ring in the Drive Shaft. Also, be sure that the Debris Shield Assembly is removed from the support end.



For a non-bonded target setup, the assembly and installation is slightly different, as shown in the picture to the right. This setup requires a wave spring, target tiles, then another wave spring be slid on to the Backing Tube where the bonded target is otherwise.

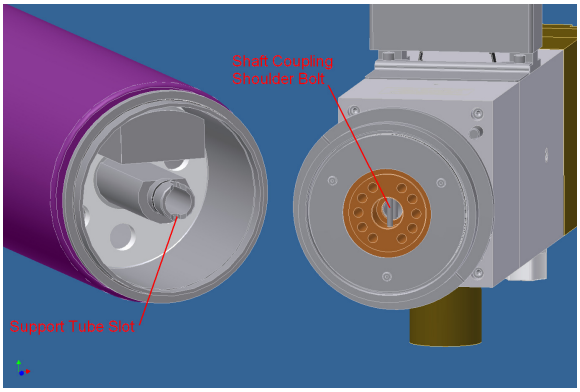


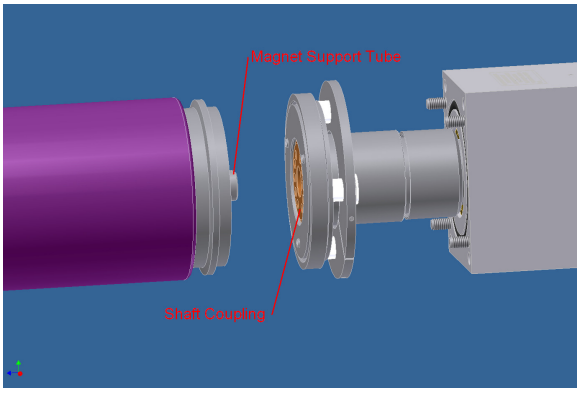
Because of the weight of this assembly and the strength of the target tiles, this Target Assembly cannot be lifted by or supported on the tiles or they could break. Therefore, a Lifting Collar Assembly is bolted onto the open end of the Backing Tube in between the wave spring and Target Retaining Ring. This lifting collar has hooks on it so it can be suspended from a crane and handles for moving it by hand. The opposite end of the Target Assembly must be handled by the Support Nose. Take great care when installing a non-bonded target assembly so the target tiles do not break.

Also, be sure to slide the (2) Debris Shield Retaining Rings onto the Target at this time, as this will make them easier to install later.

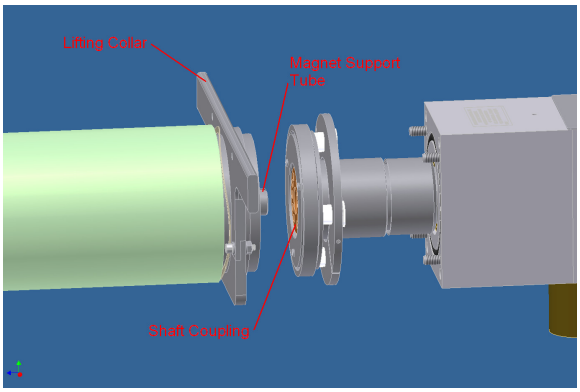
NOTE: On the open end, make sure the Target Retaining Ring is slid over the wire that is located in the groove on the OD of the Backing Tube. This locks the Target Retaining Ring onto the Backing Tube for clamping to the Drive Shaft.

2. Now align the drive-side of the Target so that the Magnet Support Tube will slide into the Shaft Coupling inside of the Drive Shaft. The slot in the Magnet Support Tube should be vertical so that it will fit into the shoulder bolt in the Shaft Coupling and the magnets should be facing the direction of sputtering with respect to the Lid (the Magnet Pack can be located visually or by placing a magnet on the outside of the Target).

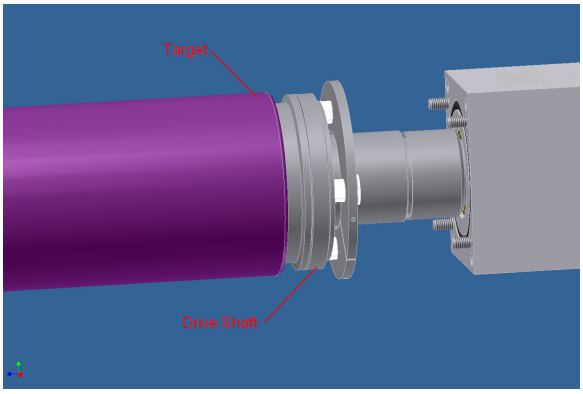




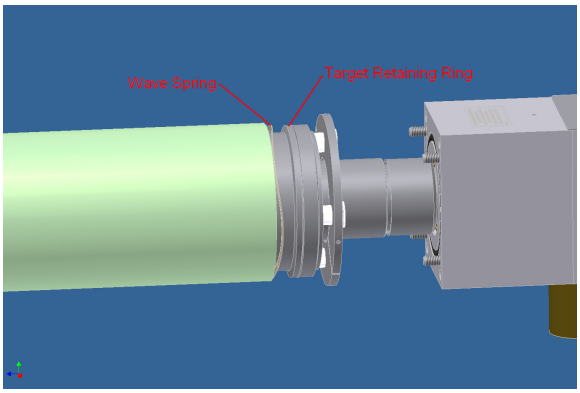
A non-bonded target assembly will require using the Lifting Collar, which is provided with a non-bonded target assembly, to guide the Magnet Support Tube into the Shaft Coupling.



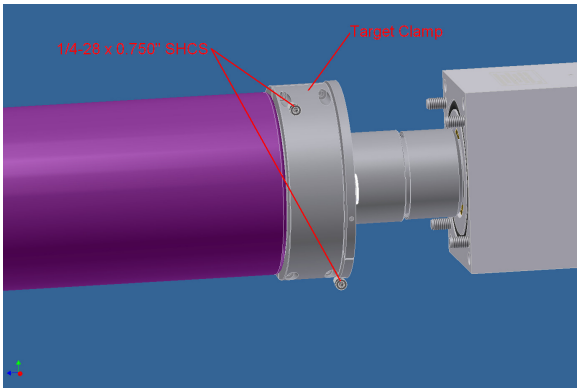
3. With the Target and Magnet Kit aligned, slide it into the Drive Shaft. Depending on the fit, you may need to push on the far end of the Target Assembly until the Backing Tube is seated inside of the Drive Shaft. A small amount of vacuum compatible grease may be applied to the inner lip of the Backing Tube to aid in installation. If it still cannot be assembled, then the o-ring in the Drive Shaft may be stretched and need to be replaced. To do so, remove the Clamp Ring as shown in step 3 of the First Installation procedure above.



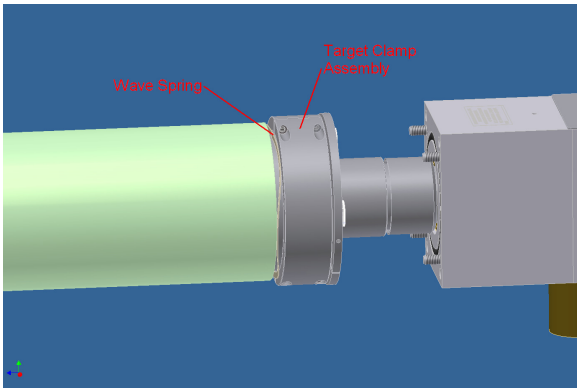
On a non-bonded assembly, the Lifting collar can now be removed. Notice the gap in between the wave spring and Target Retaining Ring, this is where the Target Clamp will be installed.



4. Now install the (2) Target Clamp halves on to the Target/Drive Shaft joint. The Target Clamp fastens together with (2) ¼-28 x 0.750" SHCS located diagonally from each other. Usually, the Clamps can be tapped directly in the center with a soft-faced mallet to seat them onto the Target and Drive Shaft. Or, opposite those holes are 2 counterbored, tapped holes that can accept long ¼-28 SHCS to be used as points for tapping the 2 halves together with a mallet. These holes can also be used as jack-screw holes for removal of the Target Clamp.



For a non-bonded target assembly, the Target Clamp will fill the space left between the wave spring and Target Retaining Ring when installed.



NOTE: When fully tightened, there should be roughly a 0.06” gap between the 2 halves. Try to keep this gap as evenly spaced as possible on both sides, although it does not need to be perfect.

5. The Debris Shields can now be installed on the Target by reversing steps 2-4 of the Debris Shield Removal procedure.

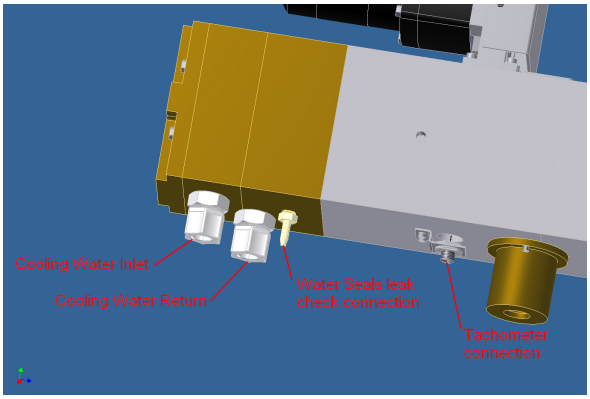
Target Removal

The Target Assembly can only be removed from the cathode by first removing the Debris Shields from it. The following procedure will explain how to remove the Target from the Drive Assembly.

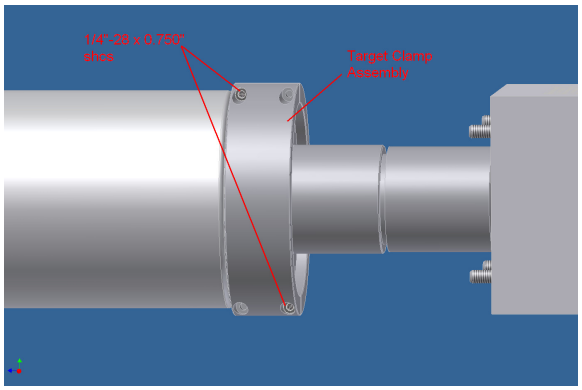
Safety:

- *To prevent electrical shock, ensure that power to the cathode is OFF.*
- *To avoid possible burns from working around a hot target surface, allow the target to rotate for at least 15 minutes, with cooling water flow, AFTER turning the power supply OFF.*
- *To avoid the entrapment of tools, clothing and other materials which may cause either human or equipment damage, turn the target rotation OFF.*

1. Turn off the cooling water flow through the cathode. Disconnect the inlet water tube to the cathode and blow compressed air through it to force the cooling water out of the target. This process will drain most of the water, but a small amount will still remain inside of the target. Once the cooling water is drained from the Target, the inlet water tube may be reconnected.



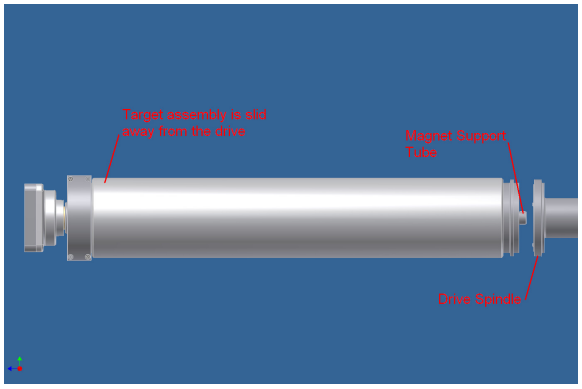
2. In order to access the Target Clamp Assembly, the drive side Debris Shield must be removed, as described in step 2 of the First Installation Procedure above. The support side or free end Debris Shields must also be removed, as described in steps 2-4 and 6-7 of the Debris Shield Removal Procedure above. It is not necessary to remove the drive side Insulating Rings to remove the Target, but they should be inspected and grit blasted if needed.



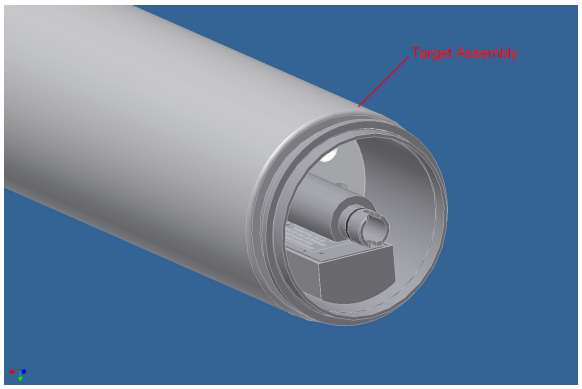
NOTE: For a non-bonded target assembly, the Lifting Collar will be required to support the drive side of the Target Assembly, as shown in the Target Mounting procedure above. Also, the opposite end must be handled by the Support Nose.

If not accessible, rotate the Target so that the (2) ¼-28 x 0.750" target clamp screws can be loosened. If necessary, have another person support the Target while removing the Target Clamp. Depending upon the weight of the Target, this may require a crane/lift and straps attached to the Target. The Target Clamp halves may need to be pried apart and tapped off with a mallet.

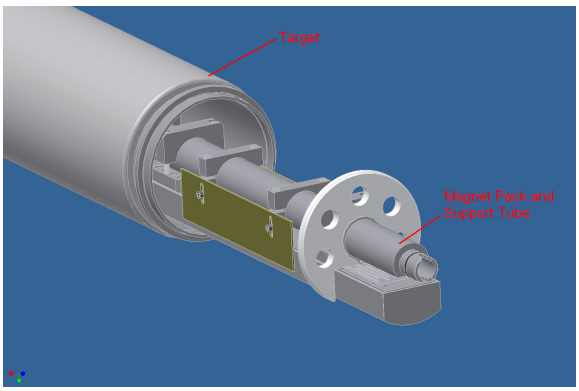
3. Now it is possible to remove the Target from the chamber. Slide the Target Assembly away from the drive until the Magnet Support Tube will clear the Drive Spindle when lifting it out. Take care to keep the open end above the sealed end so that as little as possible of the remaining cooling water spills into the chamber. If the Target is mounted horizontally or above the drive, it is a good idea to have a catch pan under the open end of the Target during this process.



4. The Target Assembly should be moved to a cart or table in order to take the Magnet Pack out. With the Target out of the chamber, it is possible to drain any water that may be left inside of the Target.



5. The Magnet Pack and Support Tube can now be pulled out from inside the Target.



6. For reassembly of the Target into the chamber, reverse steps 2-5 of the Target Removal Procedure above. Be sure to reattach the Debris Shields as well. To check successful reassembly, turn on the cooling water flow and check for water leaks. If a leak is found, disassemble the Target at the source of the leak, check all o-rings and replace if necessary. If there are no leaks, then it is acceptable to proceed.

Target Re-use Recommendations

The following guidelines should be followed for the case of a **horizontally mounted cathode with no bearing support** on the free end of the target assembly. Otherwise, it could damage the target backing tube and lead to target failure over time. In this case, the weight of the target assembly is being cantilevered from the drive and this puts extra stress not only on the drive shaft, but also on the target backing tube mounting location and the target clamp fasteners.

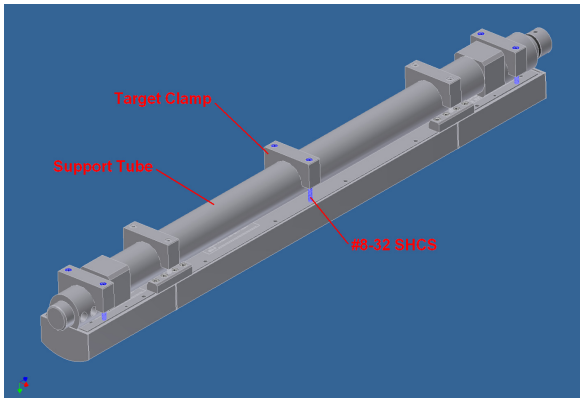
Therefore, during every target change, **new fasteners** should be used on the target clamps (2 per clamp). Also, if the target backing tube is being remounted or has been connected for a long period of time, then it **should be flipped 180°** and connected to the drive from the opposite end than it was previously. This will help reduce the chances of the backing tube end features from stretching and reducing the clamping force, which would lead to a water leak**. It is not recommended to mount the backing tube more than once on each end**, doing so would be at the risk of the end user.

Please note that these guidelines, other than using new fasteners each time, do not apply to cathodes that support the free end of the target assembly with a bearing.

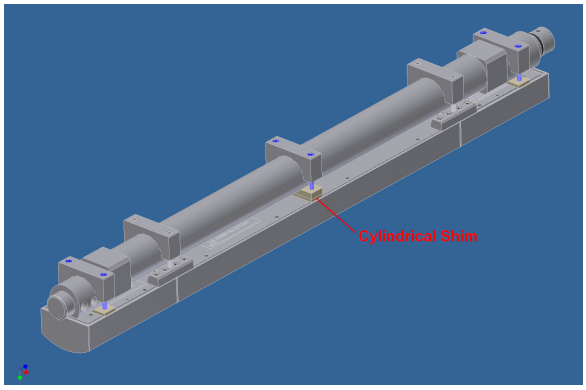
Magnet Kit Shimming

The Magnet Kit may be shimmed at various set locations in order to "dial-in" the uniformity by raising the magnetic field strength. For instance, if the coating thickness is too low at certain spots along the length of the bar, shims may be placed under the bar at the set locations to bring the magnets closer to the target surface and achieve better uniformity. Generally, a "run" is performed and the uniformity data is analyzed to determine the location and thickness of any necessary shims. The shims are then installed and the process is repeated until the desired uniformity is reached.

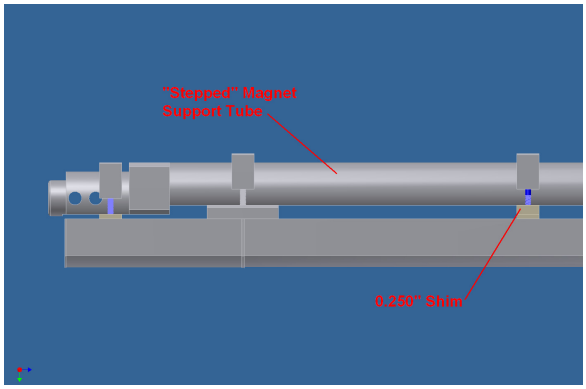
1. Remove the Magnet Kit and Support Tube as shown in the Target Removal Procedure. The shims are located by the #8-32 SHCS that hold the target clamps onto the Support Tube. Remove these #8-32 SHCS and the Target Clamps.



2. Insert the necessary shims as determined by analyzing the uniformity data and replace the Target Clamps and SHCS.



NOTE: For the "stepped" Magnet Support Tube design, an additional 0.250" shim will need to be placed along the center section of the tube if it is not already there. The Magnet Kit is generally designed to be shimmed no more than 0.125" from the Support Tube.

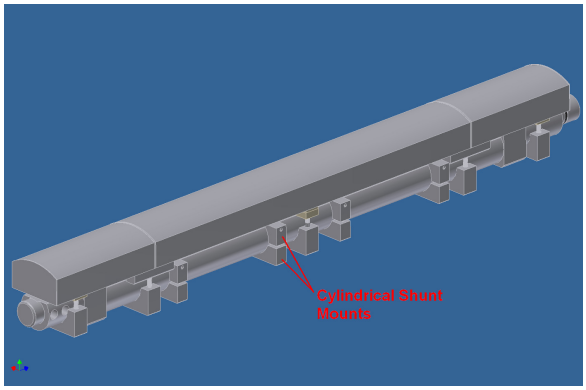


3. The Magnet Kit and Support Tube can now be replaced by reversing steps 2-5 of the Target Removal Procedure. Once the magnet kit is replaced in the target, clearance can be checked by rotating the Target and listening for any rubbing of the Magnet Kit on the inside of the Backing Tube. If no rubbing is detected, it is acceptable to run the target. Otherwise, shims must be removed until clearance is achieved between the Magnet Kit and Backing Tube.

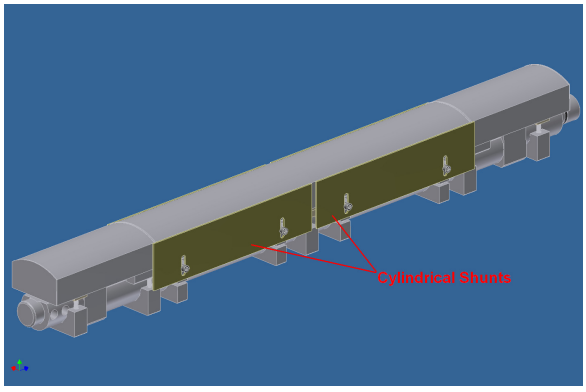
Magnet Kit Shunting

The Magnet Kit may also be shunted in order to "dial-in" the uniformity if the magnetic field needs to be decreased at various locations along the bar. To do so, a "run" is performed and the uniformity data is analyzed to determine the location and strength of any necessary shunting. The shunts are then installed the process is repeated until the desired uniformity is reached.

4. Remove the Magnet Kit as described in the Magnet Kit Shimming Procedure. Install the Shunt Mounts at necessary locations along the support tube.



5. Install the shunts on the mounts at the desired height as determined by the uniformity data.



6. The Magnet Kit can now be replaced as described in step 3 of the Magnet Kit Shimming Procedure.

Maintenance Cycles

The following table lists the periodic maintenance that is recommended for the cathode. For detailed instructions on how to perform the maintenance, refer to that particular section of the manual.

Item	Frequency	Description
Water Seals	Every 24 months	Inspect and replace seals
Vacuum Seals	Every 24 months	Inspect and replace seals
Cathode Brush Assembly	Every 12 months	Clean and inspect assembly
Debris Shields	Every 1-2 weeks	Clean and inspect assembly

Warranty

The magnetron is covered by a 2-year warranty contingent upon regular execution of Drive Housing and Water Housing maintenance procedures. Angstrom Sciences offers "maintenance" options as outlined in the following "Maintenance / Rebuild Options" section.

Maintenance / Rebuild Options

Option A: Standard Rebuild

Suggested Frequency: Every 6 months
Includes:

- Fully tested under pressure, rotation, water, and vacuum seals
- Replacement of all seals and bearings
- Any additional fab components required will be replaced. Any of these components no longer under warranty will be an additional cost under this program

Lead-time: 4 weeks (from receipt of customers unit; includes estimated 1-2 weeks shipping)

Price: $500.00, plus shipping
+ Price of any required fab components no longer under warranty

Option B: Drive Exchange Program

Advantage: 1-2 week lead-time (includes shipping)
Includes:

- Angstrom Sciences will manufacture and inventory a spare drive shaft assembly and electrical buss specific to customer's design
- All other drive assembly components will be kept in stock
- Upon notification from customer that drive assembly is being returned, Angstrom Sciences will build a complete drive assembly including the in-stock drive shaft and electrical buss to be shipped to the customer. Shipment will be released upon receipt of the tracking number for the customer's returned unit.
- Upon receipt of customer's returned assembly, it will be rebuilt/ refurbished for stock
- Includes replacement of all seals and bearings
- Any additional fab components required will be replaced. Any of these components no longer under warranty will be an additional cost under this program

Price: $4,000.00 (1-time Program Fee)
+ $1,000.00 per rebuild, plus shipping
+ Price of any required fab components no longer under warranty

Option C: Inventory Program

Advantage: 100% Uptime

Includes:

- Customer purchases and owns a spare drive assembly will be kept in-stock for immediate delivery and replacement
- Program covers up to 5 exchanges per year (includes multiple assemblies)
- Yearly program renewal option
- Estimated delivery within 4 days (includes shipping)

Price: $20,000.00 (1-time Program Fee)
***Offer valid only at time of initial magnetron order**
+ Shipping cost for each return
Yearly Renewal: $2,500.00/ year

Addendum A – Voltage Transformer

As stated in the Electrical Connections procedure, the motor controller and rotation display must be connected to a 115/230 VAC, 50/60 Hz power source. If this is not available, a voltage transformer can be included with the cathode upon request. Otherwise, it will be necessary to obtain one in order to make the above electrical connections. The voltage transformer must convert to 115/230 VAC at 50/60 Hz. It is preferable to have 2 U.S. style outlets on the transformer or a compatible power strip (115/230 VAC, 10 Amps or greater) will also be needed. With the necessary hardware, it is now possible to connect the power strip to the transformer and then connect the motion controller and rotation display as described in the Electrical Connections procedure.