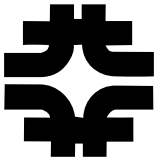


Fermi National Accelerator Laboratory
Batavia, IL 60510

TEVATRON BEAM SEPARATOR SUB-ASSEMBLY & FINAL ASSEMBLY TRAVELER

Reference Drawing(s)
Final Assembly
2214-ME-261545 Horizontal
2214-ME-261546 Vertical

Project: TEVATRON	**Magnet/Device Series: TES**
Budget Code: RTT	**Project Code: 0179**
Released by:	**Date:**
Date Closed:	**Scan Pages:**
Prepared by: B. Jensen	

Title	Signature	Date
TD / E&F Process Engineering	**Bob Jensen / Designee**	
TD / E&F Assembly	**Dean Sorenson / Designee**	
TD / E&F Project Engineer	**Rodger Bossert / Designee**	
TD / E&F Fabrication Manager	**John Carson / Designee**	

Revision Page

Revision	Step No.	Revision Description	TRR No.	Date
None	N/A	Initial Release	N/A	01/01/XX

Ensure appropriate memos and specific instructions are placed with the traveler before issuing the sub traveler binder to production.

1.0 General Notes

1.1 White (Lint Free) Gloves (Fermi stock 2250-1800) or Surgical Latex Gloves (Fermi stock 2250-2494) shall be worn by all personnel when handling all product parts after the parts have been prepared/cleaned.

1.2 All steps that require a sign-off shall include the Technician/Inspectors first initial and full last name.

1.3 No erasures or white out will be permitted to any documentation. All incorrectly entered data shall be corrected by placing a single line through the error, initial and date the error before adding the correct data.

1.4 All Discrepancy Reports issued shall be recorded in the left margin next to the applicable step.

1.5 All personnel performing steps in this traveler must have documented training for this traveler and associated operating procedures.

1.6 Personnel shall perform all tasks in accordance with current applicable ES&H guidelines and those specified within the step.

1.7 Cover the product/assembly with Green Herculite (Fermi stock 1740-0100) when not being serviced or assembled.

2.0 Parts Kit List

2.1 Attach the completed Parts Kit for this production operation to this traveler. Ensure that the serial number on the Parts Kit matches the serial number of this traveler. Verify that the Parts Kit received is complete.

_____ _____

Process Engineering/Designee Date

3.0 Vacuum Tank

3.1 Acquire one Vacuum Vessel Assembly (ME-261551) Kit, consisting of:

1 ea – Vacuum Vessel (ME-261551)
1 ea – Adjustable Mounting Stand Stationary End (MD-276770)
1 ea – Adjustable Mounting Stand Sliding End (MD-276771)

Visually inspect the Vacuum Vessel for damage. Visually inspect all flanges and their sealing surfaces for damage, and not limited to scratches, gouges, nicks, etc., which will affect proper gasket/flange sealing.

Lead Person _____ Date _____

3.2 Polish the inside surface of the Vacuum Vessel if necessary.

Technician(s) _____ Date _____

3.3 Perform a Vacuum Leak Check and record results below

PART NO.		SCALE UNITS BEFORE HELIUM PROBE	SCALE UNITS WHILE ENCLOSURE FLOODING	DETERMINATION OF MINIMUM DETECTABLE LEAK				
DATE TIME	OPERATOR'S LAST NAME			MDS ÷ ((Response -Bckgnd) ÷ Leak Value) = MDL				

Inspector _____ Date _____

3.4 Ultrasonic cleaning of the Vacuum Vessel. Follow Cleaning Procedure ES-XXXXXX. ❒

3.5 Transport the Vacuum Vessel into the clean room. ❒

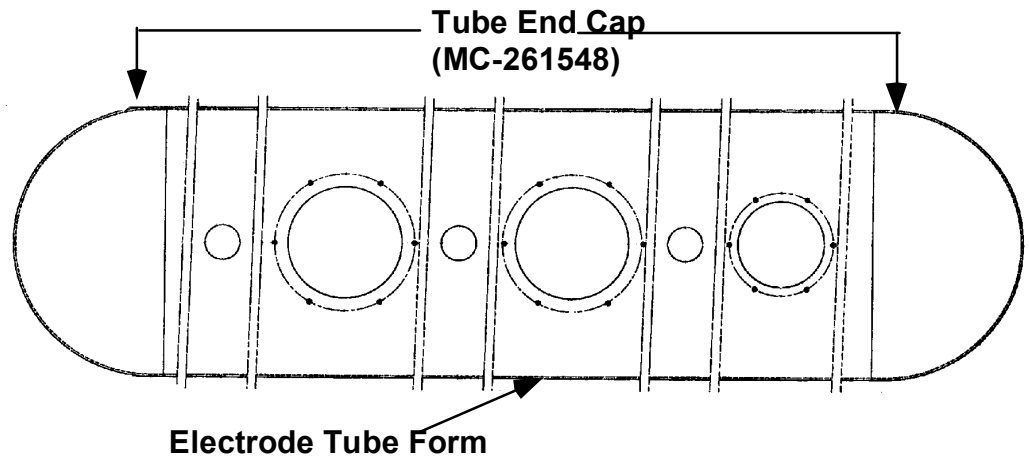
3.6 Clean the Vacuum Vessel Mounting Stands with KPC820 (or equivalent) to remove all dirts, dust and other contaminants.. ❒

3.7 Mount the Vacuum Vessel onto the Mounting Stands and attach.

3.8 Mount vacuum vessel on appropriate table in clean room in the "vertical" position as shown in figure 3.1. Using support stands MX-XXXXXX and MX-XXXXXX. Level the electrode support flanges to be level with the world in the horizontal plane shown in the figure 3.1. For a "vertical separator", the fixed end support is at the non-high voltage end, and for a "horizontal separator, the fixed end support is at the high voltage end. ❒

Figure 3.1.

4.0 H.V. Electrode Tube (ME-261547)



H.V. Electrode Tube Assy
(2214-ME-261547)

X 4.1 Acquire two (2) H.V. Electrode Tube (ME-261547) Kits consisting of:

1 ea - Electrode Tube Form Assembly	ME-261547
2 ea – Electrode Insulator Cone Assembly	MC-261591
6 ea – H.V Electrode Tube Contact Spring	MB-261832
12 ea – 6-32 X ¼" Lg Binder HD Screw S.S.	MA-XXXXXX

4.2 Inspect Electrode Tube for surface finish and polish if necessary.

4.3 Ultrasonic clean Electrode Tube. Follow Cleaning Procedure ES-XXXXXX. ❒

4.4 Label electrodes (electrode #1 and electrode #2).

4.5 Set electrode #1 on the granite table for measurement, with flat side (side without holes) of electrode down.

4.6 (Mapping the electrode surface) Using a feeler gauge, measure the gaps and points of contact between underside of electrode #1 and granite table. Measure both sides as shown in Figure 4.1. Take measurements at the places shown in Figure 4.2. Record values in the appropriate places on Figure 4.2.

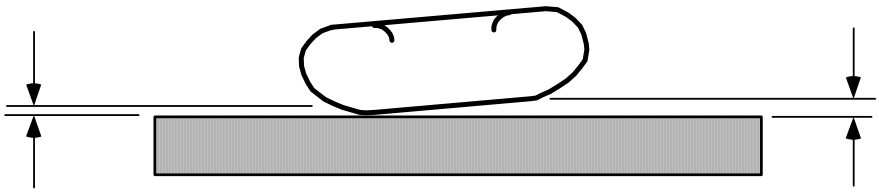


Figure 4.1

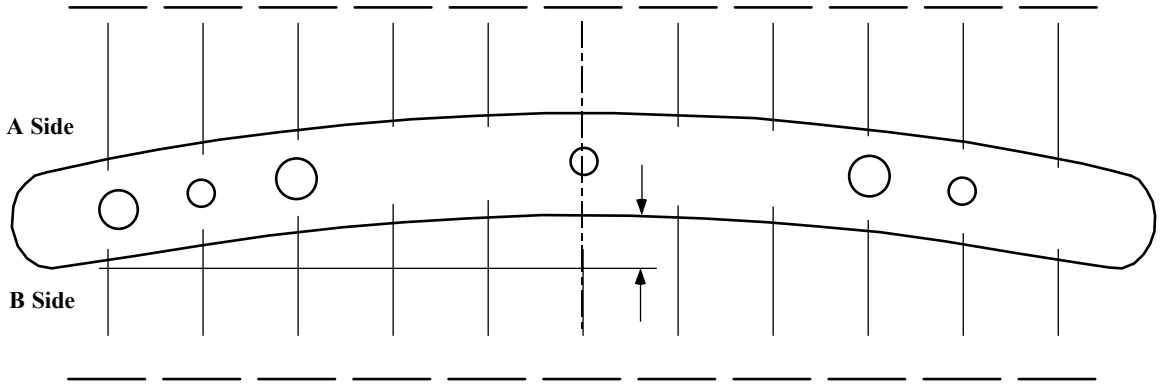


Figure 4.2. Mapping of Electrode #1

4.7 (Identifying the "reference points") Find two points on the underside of Electrode #1 that are touching the table, and are less than 23 ½ inches from the ends of the electrode. These will be the reference points for aligning the electrode inside the vacuum vessel. Mark the position of these points and their values in Figure 4.3.

Note: It is preferable that the two reference points are "0-0" points, that is, that both the A and B sides of the electrode are touching the table. If two such points cannot be found within 23 ½ inches of the ends of the electrode, then use "0-xx" points or "xx-xx" points, and mark the numbers as measured in Figure 4.3. If the reference points are something other than "0-0", these points will need to be shimmed appropriately, both when setting the support assemblies on the parallel bars and when aligning with the scales during the electrode alignment process in the vacuum vessel. (Section 5).

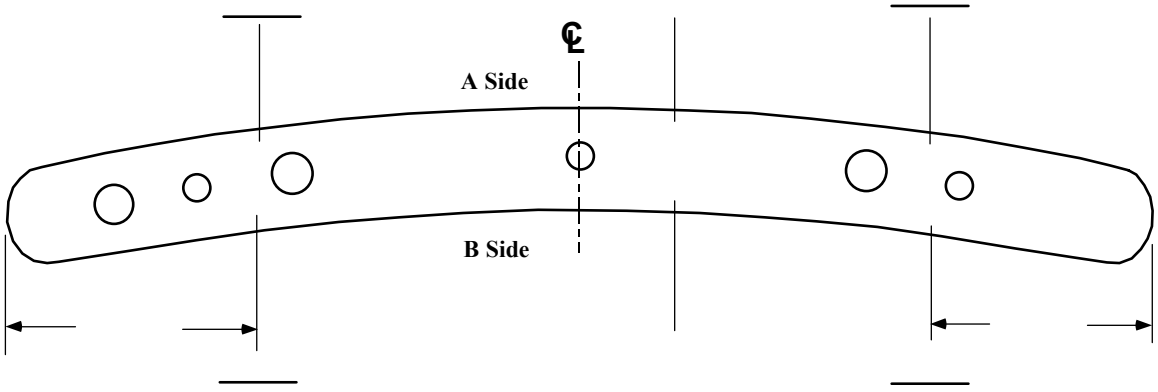


Figure 4.3. Reference points of Electrode #1

4.8 Move electrode #1 into clean room.

4.9 Set Electrode #2 on Granite Table for measurement, with flat side (side without holes) of electrode down.

4.10 Using a feeler gauge, measure the gaps and points of contact between underside of electrode #2 and granite table at the places shown in Figure 4.4. Record values in the appropriate places on Figure 4.4

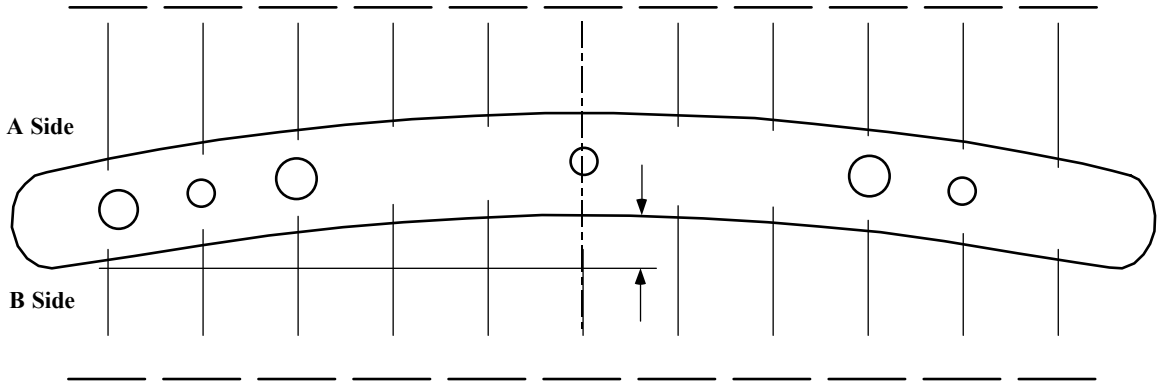


Figure 4.4. Mapping of Electrode #2

4.11 Identifying the "reference points") Find two points on the underside of Electrode #2 that are touching the table, and are less than 23 ½ inches from the ends of the electrode. These will be the reference points for aligning the electrode inside the vacuum vessel. Mark the position of these points and their values in Figure 4.5.

Note: It is preferable that the two reference points are "0-0" points, that is, that both the A and B sides of the electrode are touching the table. If two such points cannot be found within 23 ½ inches of the ends of the electrode, then use "0-xx" points or "xx-xx" points, and mark the numbers as measured in Figure 4.3. If the reference points are something other than "0-0", these points will need to be shimmed appropriately, both when setting the support assemblies on the parallel bars and when aligning with the scales during the electrode alignment process in the vacuum vessel. (Section 5).

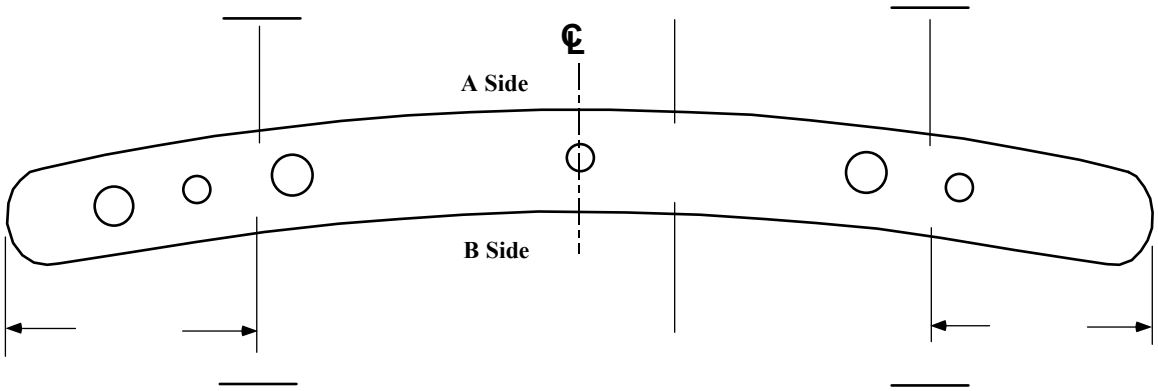
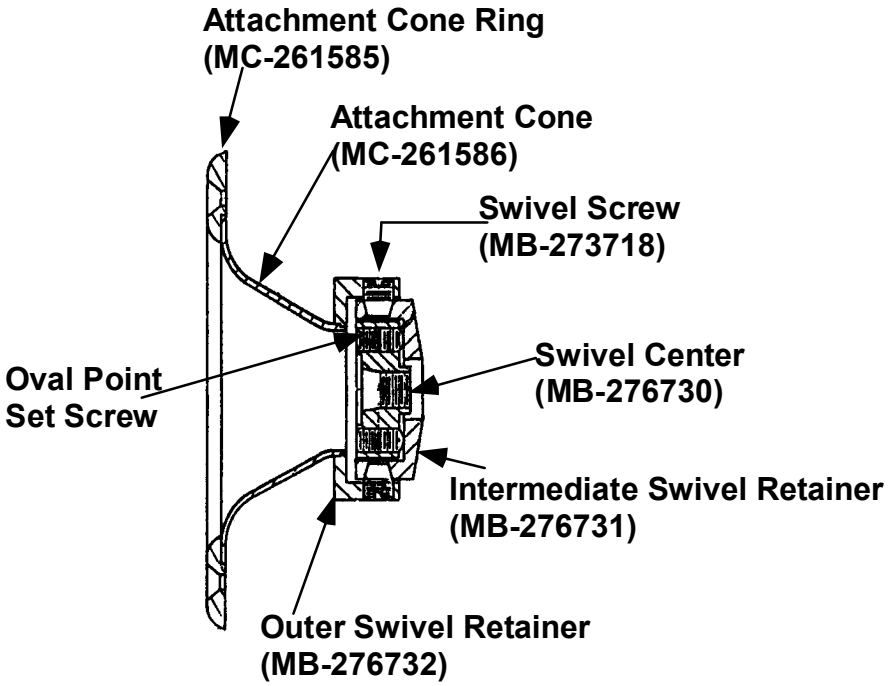


Figure 4.5. Reference points of Electrode #2

4.12 Move electrode #2 into clean room.

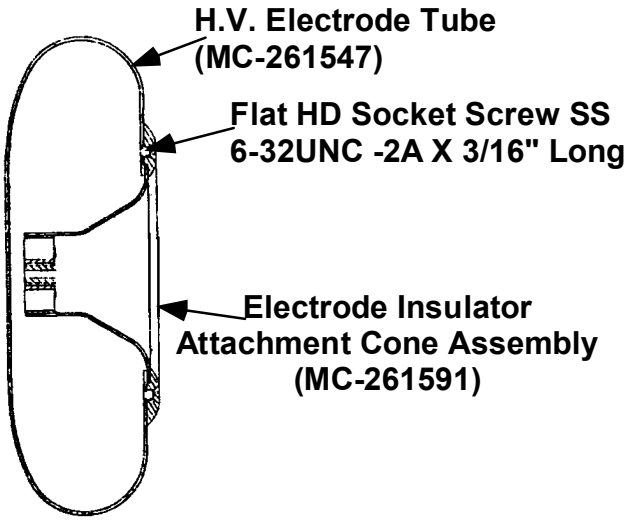
_____ _____

Technician Date



Electrode Insulator Attachment Cone Assembly (2214-MC-261591)

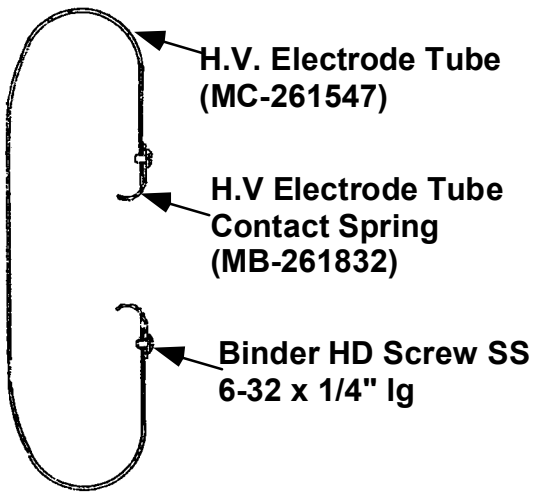
4.13 Ultrasonic clean the Electrode Attachment cones. Follow Cleaning Procedure ES-XXXXXX ❒



4.14 Transport Electrode Attachment Cones to the clean room

4.15 Ultrasonic clean the Tube Contact Springs ❒

4.16 Transport Tube Contact Springs to the clean room.

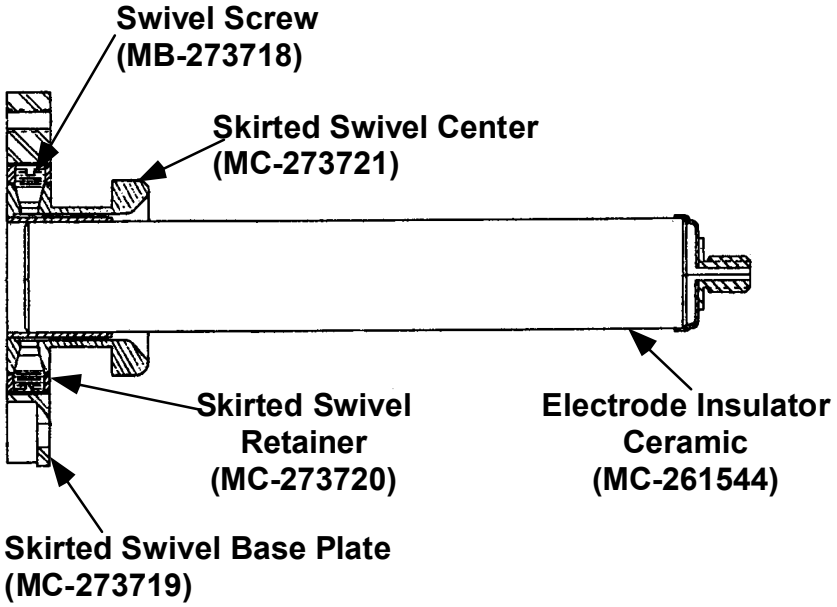


Technician _____ Date _____

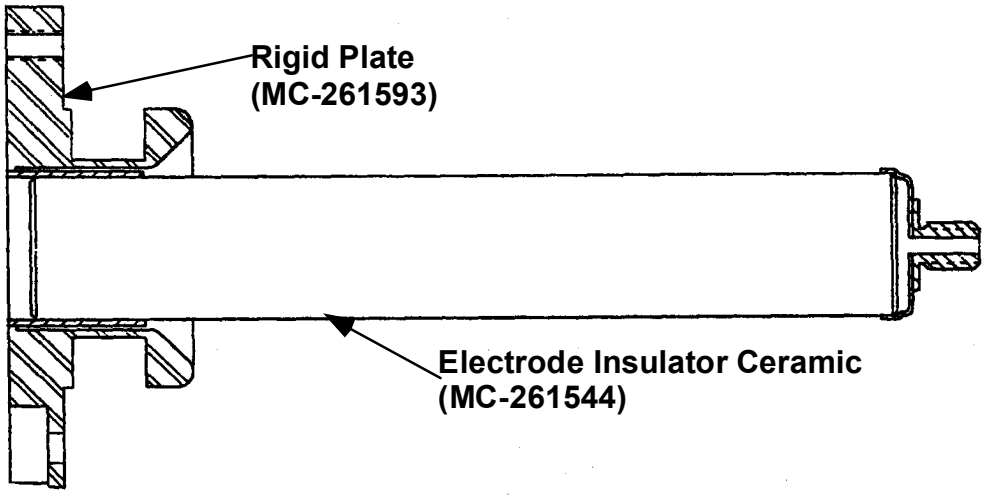
5.0 Pre-Installation Adjustment of Ceramic Support Assemblies

X 5.1 Acquire Support Assembly kit, consisting of:

2 ea – Rigid Support Assembly MC-261592
2 ea – Flexible Support Assembly MC-261579



H.V. Support Ceramice Assembly - Flex
(2214-MC-261579)



Electrode Insulator Assembly - Rigid
(2214-MC-261592)

Lead Person _____ Date _____

5.2 Check the male 3/8 – 24 threads on the standoffs for burrs by running a die over the thread using isopropyl alcohol as a lubricant. Clean off all metal chips and flush area with ethyl alcohol. Check the fit into the swivels by screwing the ceramic standoffs into them. ❒

5.3 Ultrasonically clean the Rigid and Flexible Support Assemblies. ❒

5.4 Cover the steel table with a clean, wrinkle free piece of 0.010" inch thick Mylar plastic to prevent scratching of the electrode. ❒

5.5 Set electrode #1 on parallel bars (on steel table) in clean room that have been previously leveled to the world. Verify that parallel bars are level. ❒

5.6 Ensure that parallel bars are at locations of electrode at the reference points previously established in section 4. The reference points now define a "reference plane" for the surface of the electrode. Shim reference points, if necessary, per data from section 4. ❒

5.7 Designate specific fixed and rigid support assemblies and attachment cones for electrode #1. Screw the support assemblies into their respective attachment cones to ensure no burrs are present. Blow out any burrs and clean with a dry cloth. ❒

5.8 Install electrode attachment cones to the electrode assemblies so that the swiveling motion is back and forth along the length of the electrode using (6) #6-32 gold plated flat head socket screws each. ❒

5.9 Rough level the swivel in each cone assembly by eye and tighten the adjustment set screws. ❒

5.10 Taking care not to soil the ceramic, screw the rigid support assembly into the attachment cone that will be at the high voltage feed-thru end. Adjust the set screws in the attachment cone swivel center until the ceramic support is perpendicular with the surfuce of the parallel bars as defined in step 5.5. Since the support assembly must be removed to adjust the set screw , this may require several insertions and removals of the ceramic support assembly. ❒

Note: Be careful not to put a torque on the electrode while tightening the standoffs as this will bend the threaded tips of the standoffs and make the alignment procedure impossible. If the threaded tips are bent they must be straightened before assembly. This runout can be checked by putting a 3/8-24 nut vise. Screw the standoff into the nut. Check the runout with a magnetic base dial indicator. Total indicated runout at the mounting flange (the opposite end from the treaded tip) should be less than 0.010 inches as the standoff is rotated.

5.11 Check the hole pattern on the support assembly flange to ensure that it will line up with the hole ❐
Pattern on the mating vacuum flange. If it does not, then remove the support assembly and add shim between the front face of the ceramic and the attachment cone until if does. Shim position in Figure 5.1. Use the supplied 0.375" ID x 0.750" OD stainless steel shims.

Example: If the hole pattern on the ceramic standoff is offset one sixth of a revolution form The "nominal" flange hole pattern on the vessel, add 0.007" inch of stainless steel shim washer.

Figure 5.1

5.12 Remove the supports from electrode #1, tag with proper identification, and set aside (in clean room). ❐

5.13 Attach tube contact springs to the electrode tube assembly #1. ❐

5.14 Remove electrode #1 from parallel bars. ❐

5.15 Set electrode #2 on parallel bars (on steel table) in clean room that have been previously leveled ❐
to the world. Verify that parallel bars are level.

5.16 Ensure that parallel bars are at locations of electrode at the reference points previously established in section 4. The reference points now define a "reference plane" for the surface of the electrode. Shim reference points, if necessary, per data from section 4 ❐

5.17 Designate specific fixed and rigid support assemblies and attachment cones for electrode #2 ❐
Screw the support assemblies into their respective attachment cones to ensure no burrs are present. Blow out any burrs and clean with a dry cloth.

5.18 Install electrode attachment cones to the electrode assemblies so that the swiveling motion is ❐
back and forth along the length of the electrode using (6) #6-32 gold plated flat head socket screws each.

5.19 Rough level the swivel in each cone assembly by eye and tighten the adjustment set screws. ❐

5.20 Taking care not to soil the ceramic, screw the rigid support assembly into the attachment cone that will be at the high voltage feed-thru end. Rigid goes into non-high voltage end for vertical separator and high voltage end for horizontal separator. Adjust the set screws in the attachment cone swivel center until the ceramic support is perpendicular with the surface of the parallel bars as defined in step 5.5. Since the support assembly must be removed to adjust the set screw , this may require several insertions and removals of the ceramic support assembly. ❐

5.21 Check the hole pattern on the support assembly flange to ensure that it will line up with the hole pattern on the missing vacuum flange. If it does not, then remove the support assembly and add shim between the front face of the ceramic and the attachment cone until it does. Shim position is shown in Figure 5.1. Use the supplied 0.375”ID x 0.750”OD stainless steel shims. ❐

5.22 Remove the supports from electrode #2, tag with proper identification, and set aside (in clean room. ❐

5.23 Attach tube contact springs to the electrode tube assembly #2.

5.24 Remove electrode #2 from parallel bars.

6.0 Electrode Installation and Alignment

6.1 Slide electrode #1 into vacuum vessel in the "bottom" position (the position opposite the TSP ports). The orientation of the vacuum vessel, TSP ports and electrodes is shown in Figure 6.1. ❒

Figure 6.1

Three of four people are required to insert an electrode. All should be wearing nylon gloves. One person should cover one end of the electrode with a sleeve from a Tyvek lab coat or some cushioning lint free fabric to keep it from getting scratched or scratching the shell interior when it is fed through the inside of the separator. The second person should be waiting on the opposite side of the shell, and should lift up the end of the shell. The electrode will be installed so that the flat side of the electrode is horizontal. Do not let the electrode touch the shell. The third person will insert and attach the standoffs (support assemblies) while the other two hold the electrode in the proper place. Each electrode will need the two standoffs that were aligned to that particular electrode and tagged per sections 5.12 and 5.22.

6.2 Attach both standoffs (fixed and flexible supports) of the bottom electrode by screwing them into their matching cone assemblies on the electrode. Screw the ¼-28 gold plate hex nuts (support nuts) onto studs to loosely support the bottom electrode by standoffs. ❒

6.3 Rough position the bottom electrode by turning nuts until support base is 1 inch from Vacuum Vessel flange counterbore and parallel to flange as shown in Figure 6.2. ❒

Figure 6.2

6.4 Cover the bottom electrode with plastic sheet.

6.5 Slide electrode #2 into vacuum vessel in the "top" position toward the TSP ports). The orientation of the vacuum vessel, TSP ports and electrodes is shown in Figure 6.1. ❒

6.6 Attach the standoffs of the top electrode by screwing them into their matching cone assemblies on the electrode. Screw the ¼-28 gold plated into the proper holes to loosely support the top electrode by the standoffs. ❒

Figure 6.3

6.7 Rough position the top electrode by turning set screws until support base is 1 inch from Vacuum Vessel flange counterbore and parallel to flange as shown in Figure 6.3. ❒

6.8 Verify that the vacuum vessel is level. The top high voltage feedthru flange should be level within 0.001 inches per foot in both the X and Z axis.. Use two Wild N3 (or equivalent) optical levels and two survey rules to level the shell's z axis to within 0.002 inch TIR using the two 16 ½ inch flange diameters as datums. The shell is now level on the X and Z axis. ❒

6.9 Place the dual optical scale fixture at the High voltage feedthru end of the bottom electrode (on the flat side) so that the fixture is touching at a reference point. Shim the fixture so the scales are perpendicular to the world. According to the data in section 4. ❒

6.10 Adjust the bottom support nuts until the flat face of the bottom electrode (hv end) is 2 ½ cm (0.987 inches) below the vacuum vessel centerline. (Tolerance is +0.010/0.000 inches at the "zero point", or reference plane, of the electrode). This should require only that the nuts are adjusted evenly, not in a way that would change the angular position of the electrode. ❒

Note: Vacuum vessel centerline is defined as the calculated center of the outside diameter of the 16 ½ inch diameter flange at the end of the vessel.

Note: Monitor the optical scales when performing steps 6.10-6.16 to ensure that the Electrode does not move in an undesirable way (either angular or sideways).

6.11 Place the dual optical scale fixture at the High voltage feedthru end of the bottom electrode (on the flat side) so that the fixture is touching at a reference point. Shim the fixture so the scales are perpendicular to the world. According to the data in section 4. ❒

6.11 Adjust the bottom support nuts until the flat face of the bottom (non-hv-end) electrode is 2 ½ cm. (.984 inches) below the vacuum vessel centerline. (Tolerance is +0.010/0.000 inches at the "zero point, or reference plan, of the electrode). This should require only that the nuts are adjusted evenly, not in a way that would change the angular position of the electrode. ❒

6.12 Tighten the set screws in the non-hv- end bottom support until they just make contact with the support flange on the vacuum vessel. ❒

6.13 Tighten the nuts on the not-hv end bottom support studs (***Should we have specified torque here, or use a torque wrench to achieve it?)***

6.14 Tighten the set screws in the hv end bottom support until they just make contact with the support flange on the Vacuum Vessel. ❒

6.16 Tighten the nuts on the hv end bottom support studs. **(*Should we have specified torque here, or use a torque wrench to achieve it?)*** ❒

6.17 Re-check positioning of non-hv end. ❒

6.18 Verify that the bottom support ceramics are level to the world. ❒

6.19 Place the dual optical scale fixture at the High voltage feedthru end of the top electrode (on the flat side) so that the fixture is touching a "zero" point on the electrode that is at least 9 inchesfrom the end of the electrode. Shim the fixture so the scales are perpendicular to the world. ❒

6.20 Adjust the top support set screws until the flat face of the top electrode (hv end) is 2 ½ cm. (0.984 inches) above the vacuum vessel centerline. (Tolerance is +0.010-0.000 inches at the "zero point", or the reference plane, of the electrode). This should require only that the set screws are adjusted evenly, not in a way that would change the angular position of the electrode. ❒

Note: Vacuum vessel centerline is defined as the calculated center of the outside diameter of the 16 ½ inch diameter flanges at the ends of the vessel.

Note: Monitor the optical scales when performing steps 6.20-6.26 to ensure that the electrode does not move in an undesirable way (either angular or sideways).

6.21 Place the dual optical scale fixture at the non-High voltage feedthru end of the top electrode (on the flat side) so that the fixture is touching a "zero" point on the electrode that is at least 9 inches from the end of the electrode. Shim the fixture so the scales are perpendicular to the world. ❒

6.22 Adjust the top support set screws until the flat face of the top (non-hv end) electrode is 2 ½ cm. (0.984 inches) below the vacuum vessel centerline. (Tolerance is +0.010-0.000 inches at the "zero point, or reference plane, if the electrode). This should require only that the set screws are adjusted evenly, not in a way that would change the angular poison of the electrode. ❒

6.22 Tighten the nuts in the non-hv end top support until they just make contact with the support flange on the vacuum vessel. ❒

6.22.1 Tighten the set screws on the non-hv end top support studs. ***(Should we have specified torque here, or use a torque wrench to achieve it?)*** ❒

6.25 Tighten the nuts in the hv end top support until they just make contact with the support flange on the vacuum vessel. ❒

6.26 Tighten the set screws on the hv end top support studs. ***(Should we have specified torque here, or use a torque wrench to achieve it).*** ❒

6.27 Re-check positioning on non-hv end. ❐

Technician(s) Date

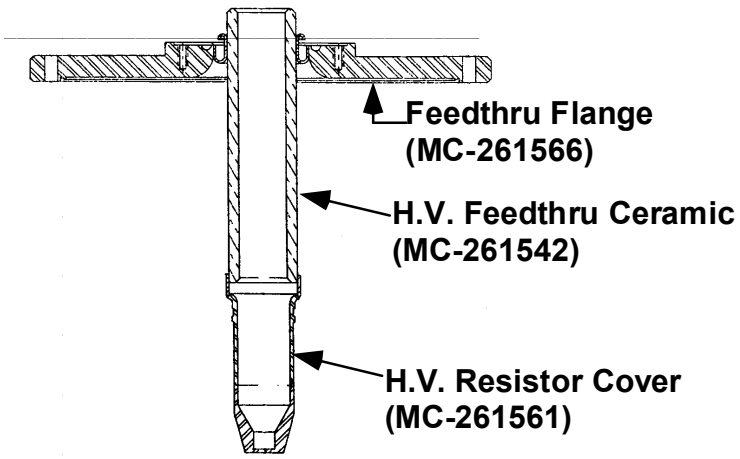
6.28 Verify that the top support ceramics are level to the world. ❐

Lead Person Date

7.0 HV Feed-thru Assembly Installation

X 7.1 Acquire HV Feed-Thru Assembly Installation Kit, which consists of:

2 ea – HV Feed-Thru Flange Assembly w/ceramic	MC-26570
2 ea – HV Feed-Thru Shield Assembly	MX-XXXXX



H.V. Feedthru Flange Assy w/Ceramice
(MC-261570)

7.2 Check the ceramic tube for any smudges, nicks, scratches, or flaws in the material. Use a bright small light to illuminate the tube from the inside to help see interior flaws easier. Clean off any impurities or scratches using an ultra clean, small nozzle sandblaster loaded with 50 micron aluminum oxide powder. ❒

7.3 Ultrasonically clean parts.

7.4 Set the assembly in the wash tank so that it rests on the flange and the resistor cone. Do not let the ceramic tube touch the wall of the washing tank. Rinse the assembly off with distilled water and allow to dry thoroughly. ❒

7.5 Install a clean Bal-Seal spring on the resistor cover by gently stretching the spring over the cover and laying it in the groove. ❒

7.6 Install the HV Feed-Thru Shield onto the HV Feed-Thru Flange Assembly. The assembly is now ready to be installed on the separator. ❒

7.7 Repeat Steps 7.2-7.5 for the other HV Feed-Thru Shield Assembly ❒

7.8 Attach HV Feed-Thru flanges onto the HV Feed-Thru 13.25" Vacuum Vessel Port. Using X bolts (list size of bolts). Tighten nuts until edges of flanges mate. Use gasket #xxx. ❒

7.9 Repeat Step 8.7 for the other HV Feed-Thru Flange.

8.0 Vacuum Vessel Orientation

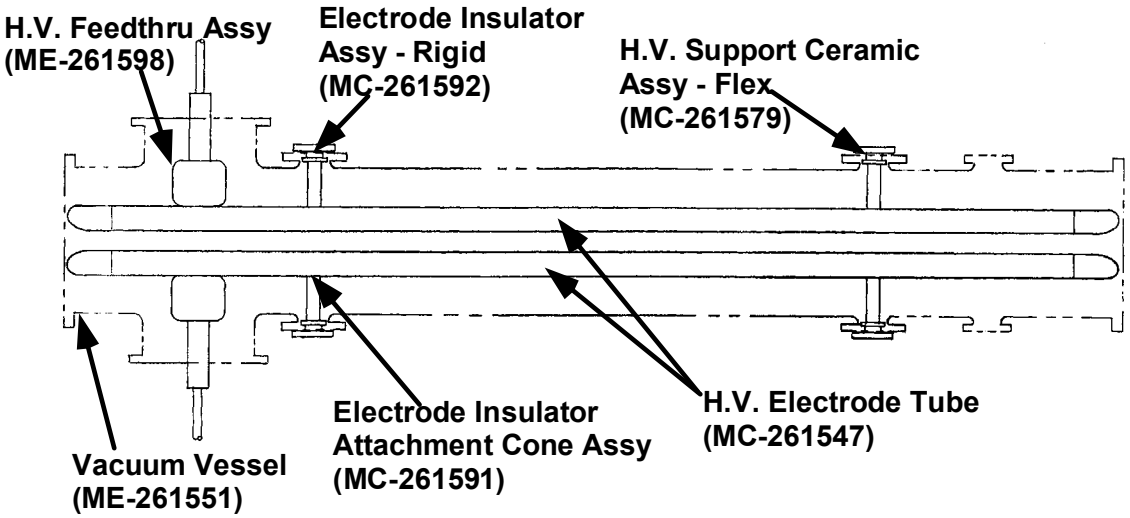
8.1 Once the electrodes have been properly aligned and tightened down into place, install the separator stands in the proper position, which will depend on whether the separator will be vertical or horizontal. For the vertical position, the fixed end support is at the non-high voltage end, and for the horizontal position, the fixed end support is at the high voltage end. If the separator is vertical, this step has already been completed in 3.8. If horizontal, the stands need to be moved as shown in figure. Rotate the vessel if necessary to the horizontal position. Add figure showing separator with stands shown in vertical and horizontal positions.

_____ _____

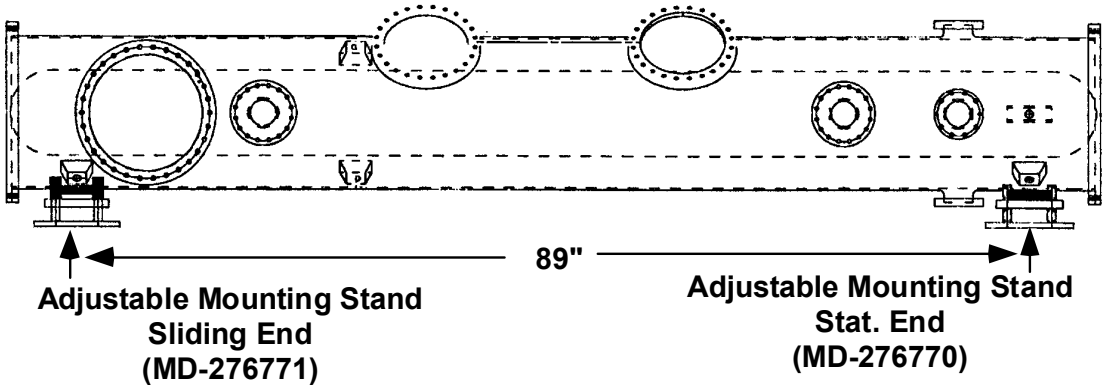
Technician(s) Date

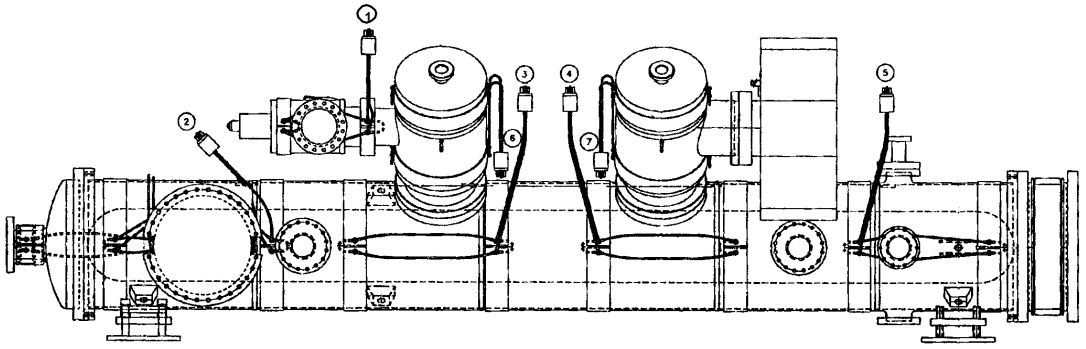
Figure 8.1

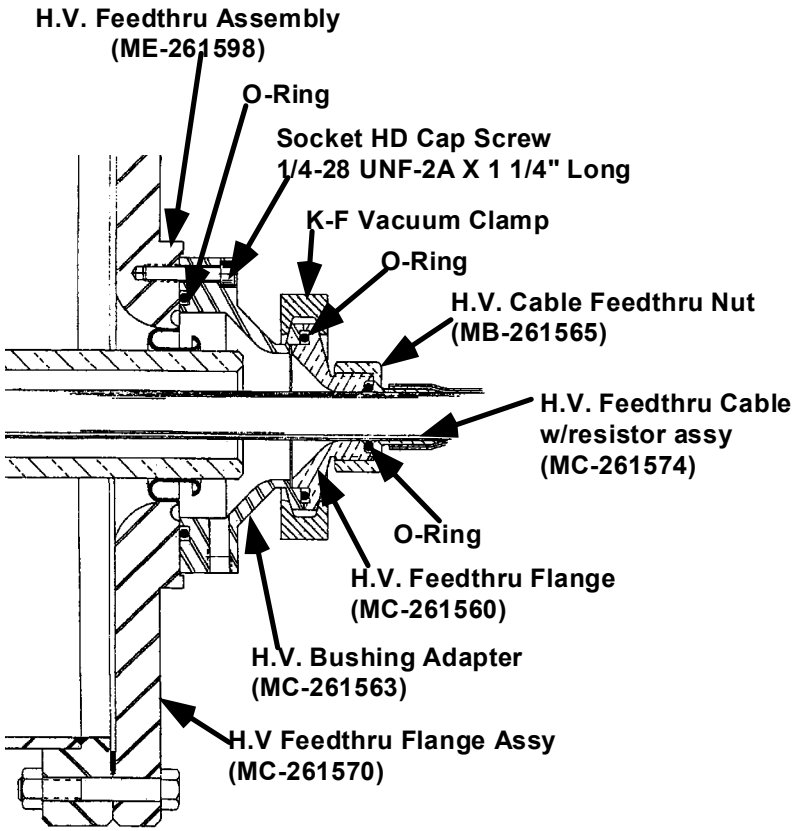
9.0 Beam Separator Pre-Bakeout Assembly



Tevatron Beam Separator







TeV Beam Separator
H.V. Feedthru Assembly

X 9.1 Acquire Vacuum Flange Cover Kit, including all covers needed to completely enclose the vacuum Vessel.

2 ea – Bake-Out Caps for HV Plate
2 ea – Rigid Support Covers
2 ea – Flex Support Covers
2 ea – TSP's (One with 6" port and one with 4" port)
1 ea – Ion Pump
1 ea – Ion Gauge
1 ea - Right angle Ion Gauge Housing
1 ea - Ion Gauge Screen
1 ea – 4" Right Angle Pump Out Valve
x ea - Blank off end dome (for high voltage end on vertical) and (non high voltage end on Horizontal).
x ea - End dome with small bellows (High Voltage end on Horizontal and non high voltage end on vertical).
x ea – Small bellows (high voltage on Horizontal and non-high voltage on vertical).
x ea – Bake-out valve assembly.

9.2 Clean all parts ultrasonically.

_____ _____
Lead Person Date

9.3 Blow out the separator with high pressure, dry nitrogen to remove lint, metal chips, and slivers. Visually inspect for cleanliness. ❒

Note: Blow down the tank from the HV end so no dust gets caught in any of the parts.

Note: Remember to take care that no metal is scraped off the copper seals, and that the flange bolts get tightened down evenly. Go around the flange many times, tightening the bolts a little more each time.

9.4 Install blank off covers on rigid & flex supports ❒

Install Ion Gauge house. ❒

Install blank off for unused parts. ❒

Install High voltage bake-out caps. ❒

Install TSP's (TSP with 4 " port goes on high voltage end), (shows figure with TSP's installed giving flange orientation. ❒

9.5 Another blow-down & inspection.

9.6 Install end domes.

9.7 Move separator out of clean room.

9.8 Install Ion pump. Feed through port should be pointing upward and be perpendicular to the TSP body.

9.9 Install bake-out valve assembly.

10.0 Pre-Bake Leak Check

10.1 Perform a Post Assembly Leak Check. Once all of the components have been installed on the separator shell, a leak check is needed to make sure all of the copper gaskets have sealed up properly and the welds don't leak. To make sure you are looking for all possible leaks, make sure you hit every possible seam and weld with helium. Be sure to check the leak grooves on every flange to test the copper gasket. There shall be no leak detectable using a helium mass spectrometer with a minimum sensitivity of 5Ex10-9 std. c.c./sec.helium. If a leak is found after a high temperature bake, or during high voltage testing, the shell will have to be taken apart, fixed, and re-baked; a time consuming process. Record the leak check results below.

PART NO.		SCALE UNITS BEFORE HELIUM PROBE	SCALE UNITS WHILE ENCLOSURE FLOODING	DETERMINATION OF MINIMUM DETECTABLE LEAK				
DATE TIME	OPERATOR'S LAST NAME			MDS ÷ ((Response -Bckgnd) ÷ Leak Value) = MDL				

Inspection _____ Date _____

10.2 Perform RGA (Residual Gas Analysis). Pass ❒
Fail ❒
Not Performed ❒

11.0 Bake-Out Procedure

Note: Section 11.0 assumes that a leak detector with an oil-free pump is used.

11.1 Remove all plastic parts from the separator. (IE: Heater, Connectors, Ion Pumps, Plastic Covers, Etc).

11.2 Hook up both TSP's to the three TSP transformers. Each TSP has 3 filaments. One is connected to each transformer. Refer to schematic shown in Figure 11.1

11.3 Hook up a turbo pump, connect all sublimation wires to the TSP's. Remove the ion pump high voltage connector from the ion pump, and make sure that there are no plastic plugs or insulators on the heaters in the ion pump.

11.4 Hook up the turbo pump to the all metal pump out valve on the separator. Leak check the entire system. Record sensitivity below. MDL should be less than 5 X10-9 atm cc/sec. Monitor the turbo pump ion gauge. Should be less than 3x10-6 torr.

11.5 Place additional insulation blankets over the seams between blankets on the outside of the oven, and around the turbo pump port.

11.6 Place oven over the separator.

11.7 Turn separator temperature up to 300 degrees C. Target temp between 280 to 300C.

11.8 Bake at a flattop of 300 +/- 20 degrees C for 72 hours minimum. Monitor the vacuum level, and record every 2 hours during the day, and at the beginning and end of each work day. At the end of the flattop bake, vacuum should be less than 5X10-6.

11.9 After the flattop bake, turn temperature down to 150 degrees C.

11.10 Maintain the 150 degrees C temperature during the degas of the TSP's.

11.11 Make sure both jumper cables (one red and one black) on all three sublimator transformers are plugged in. Ensure that the controller is in 'degas' mode.

11.12 Start one hour degas on sublimator pumps by pressing degas buttons. Wait until degas stops. Monitor the current o the readout on the front panel of the sublimation chassis, with a DVM. Current should be 45A +/- 5 Amperes.

11.13 Remove red jumper cables on sublimator transformers.

11.14 Switch controller to 'sublimation' mode.

11.15 Sublimate TSP's five times each. Monitor the current on the front of the panel of the sublimation chasis with a DVM. Current should be 45 +/- 5 Amperes.

Note: Each cycle takes 90 seconds.

11.16 Remove the black jumper cables from the transformers, and replace with the red cables.

11.17 Sublimate TSP's five times each. Monitor the current on the front of the panel of the sublimation chasis with a DVM. Current should be 45 +/- 5 Amperes.

Note: Each cycle takes 90 seconds.

11.18 Shut Off temperature on oven and let cool to 40 C. This should take a few hours or overnight.

11.19 Remove oven from the separator.

11.20 Connect cable to separator's ion gauge, and turn gauge on.

11.21 Degas ion pump. This takes 15 minutes. Monitor the manifold pressure during degassing. Pressure should increase, then come down to below 5 X10-6 torr. Record the pressure before and after degas below.

11.22 Connect high voltage adaptor and high voltage cable to the ion pump.

11.23 Turn on ion pump.

Note: Ensure that the controller reads greater than 5 KV.
It should take a few minutes to get to 5 KV.

11.24 Shut off the ion pump.

Any diffusion pumped vacuum systems, like DuPont leak checker, should be avoided while the separators are at room temperature because of oil back-streaming. having the separators above 200^{o} C helps reduce the back-streaming. Some diffusion pump oil will backstream past both turbo pumps and cold traps.

12.0 Post-Bake

12.1 Leak check of the separator. The high temperature bake can cause new leaks to appear in the welds, gaskets, and the ceramics.

Record results below. Sensitivity should be better than 5 X10-6 atm cc/sec.

_____ _____

Technician(s) Date

12.2 Turn on ion pump. Ensure ion gauge is reading 5 X10-7 torr or less.

12.3 Close the all-mteal valve between the turbo pump and separator.

12.4 Monitor pressure on ion gauge periodically until separator is ready for conditioning. Before conditioning, pressure should be below 1 X10-9 torr.

12.5 Deliver separator for conditioning.

13.0 Transport to Conditioning Cave

13.1 Transport TeV Beam Separator to conditining cave using approved lifting methods.

_____ _____

Technician(s) Date

14.0 Receive after conditioning.

Pass ❒

Fail ❒

If pass, go to step 15.0

15.0 Heater Installation

16.0 Blanket Installation.

17.0 Final Inspection.

18.0 Ship to storage.

19.0 Production Complete

19.1 Process Engineering verify that the Tevatron Beam Separator Sub-Assembly &Final Assembly Traveler (5520-TR-333XXX) is accurate and complete. This shall include a review of all steps to ensure that all operations have been completed and signed off. Ensure that all Discrepancy Reports, Nonconformance Reports, Repair/Rework Forms, Deviation Index and dispositions have been reviewed by the Responsible Authority for conformance before being approved.

Comments:

_____
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_____ _____
Process Engineering/Designee Date