

[Vector Home](#)

[Reports](#) | [DRs \(0\)](#) | [Attachments \(0\)](#) | [Notes \(0\)](#)

<div>RF Tuner Assembly (PRFTA)</div> <div>464120 Rev. F</div> <div>by Sherry Baketz</div>						
Series	Serial No.	Job No.	Task No.	Released By	Released Date	Status
PRFTA	PRFTA019-0	508	2103A/2103A.2.1.6	Larry Mitcham	6/20/2016 10:52:07 AM	Closed

- [1.0 General Notes](#)
- [2.0 Parts Kit List](#)
- [3.0 Tooling Kit List](#)
- [4.0 Tuner Body and Ferrite Weldment Assembly](#)
- [5.0 Tuner Assembly](#)
- [6.0 Final Inspection](#)
- [7.0 Production Complete](#)

1.0 General Notes [Top](#)

- 1.1 Electronically attach all appropriate memos, digital photographs, discrepancy reports and other documentation in the appropriate step in this traveler.

Booster RF Cavity Ferrite Tuner Assembly: [F00496038](#)
[Hazard Analysis 598](#)
- 1.2 Surgical Latex Gloves (Fermi stock 2250-2494), or equivalent, shall be worn, as required, by all personnel when handling all product parts after the parts have been prepared/cleaned.
- 1.3 All personnel must review and have understanding of the traveler and any associated operating procedures.
- 1.4 Personnel shall perform all tasks in accordance with current applicable ES&H guidelines and those specified within the step.
- 1.5 Cover entire assembly with green Herculite (Fermi stock 1740-0100) when not being serviced.

2.0 Parts Kit List [Top](#)

- 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.

Parts Kit List: [Link](#)

Process Engineering/Designee: **Larry Mitcham**

Date: **7/25/2016**

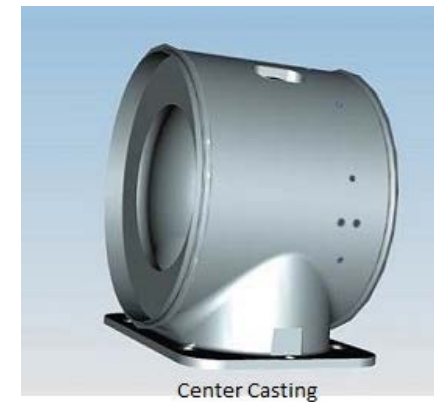
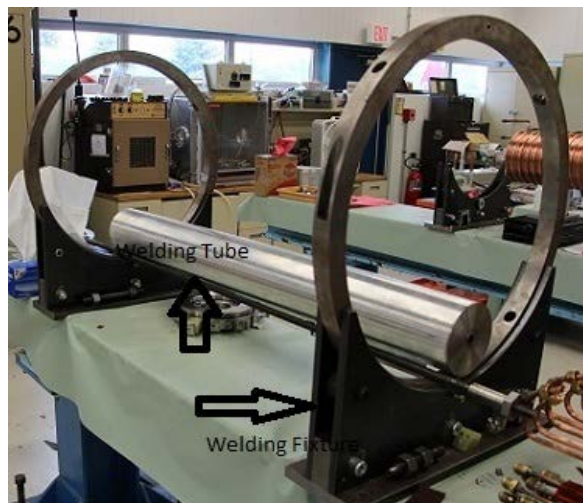
3.0 Tooling Kit List [Top](#)

- 3.1 Tooling Kit List.

Scissor Jacks
Alignment Fixture
Welding Fixture
Leveling Jacks
Compression Plug (2)
Threaded Rod
Compression Nut (2)
Testing Bar (Electrical/Hydro)
Welding Tube

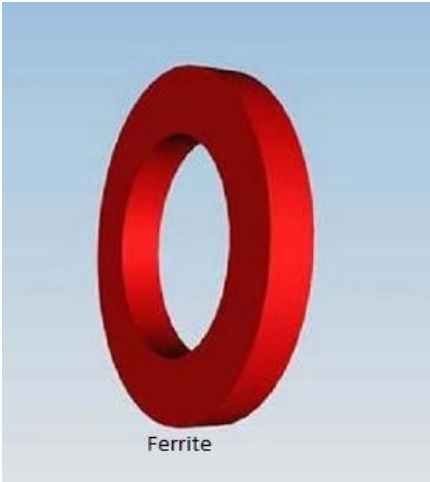
4.0 Tuner Body and Ferrite Weldment Assembly [Top](#)

4.1 Clean and prepare welding fixture, welding tube, scissor jack and Center Casting (F10029331), clean with alcohol and lint free wipes before assembly. Place center casting on scissor platform and bolt down. Insert welding tube (long aluminum cylinder).

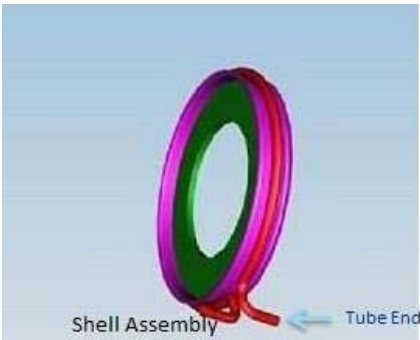




4.1.1 Ferrites are fragile use caution while handling ferrites. Wipe all ferrites with alcohol and lint free wipes before assembly. Use care not to wipe any identifying marks off of ferrite.



4.1.2 Prepare tube ends. Ensure each end is cleaned and brushed internally with a pipe cleaner brush. Note: Flux should only be applied right before brazing to minimize oxidation before brazing.

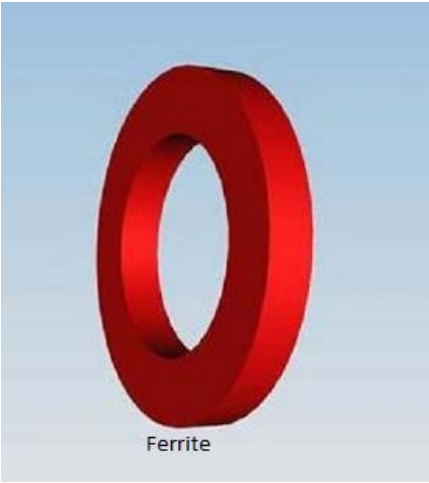
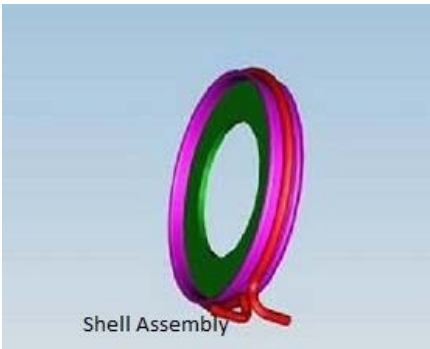


4.1.3 Working from Center Stem start with number 14 Ferrite Stack Pole (496033) and Ferrite Stem Coined Assembly (394823) 1 each install ferrites and shell assemblies in decreasing order per stacking recipe and per shell assembly drawing MD-496037. Complete end by adding on Air Cooled Copper Ring (394821) Repeat process on other side of shell assembly. Attach the ferrite stacking recipe.

NOTE: Ferrites are fragile, use caution while assembling ferrites onto welding fixture to avoid chips/damage.

Ferrite Stacking Recipe: [Link](#)

NOTE: Per Ferrite Stacking Recipe From Center Stem install number 14 Ferrite decreasing down to number 1. Duplicate for the other side starting with ferrite number 14 decreasing down to number 1



NOTE: 1D or 1L = Downstream 1U or 1R = Upstream

Tuner Position	Torrid S/N	Tuner Position	Torrid S/N
1D	M4-2013-199	1U	M4-2013-196
2D	M4-2016-445	2U	M4-2016-439
3D	M4-2016-400	3U	M4-2016-415
4D	M4-2016-413	4U	M4-2016-426
5D	M4-2016-387	5U	M4-2016-417
6D	M4-2016-434	6U	M4-2016-404
7D	M4-2016-385	7U	M4-2016-389
8D	M4-2016-393	8U	M4-2016-384

9D	M4-2013-152	9U	M4-2013-150
10D	M3-2015-281	10U	M3-2015-242
11D	M3-2015-311	11U	M3-2015-308
12D	M3-2015-278	12U	M3-2015-266
13D	M3-2015-187	13U	M3-2015-235
14D	M3-2015-191	14U	M3-2015-185

Downstream

Upstream

-01D	-02D	-03D	-04D	-05D	-06D	-07D	-08D	-09D	-10D	-11D	-12D	-13D	Pos -14D	CENTER	Pos -14U	-13U	-12U	-11U	-10U	-09U	-08U	-07U	-06U	-05U	-04U	-03U	-02U	-01U
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Technician: Charles Pribyl

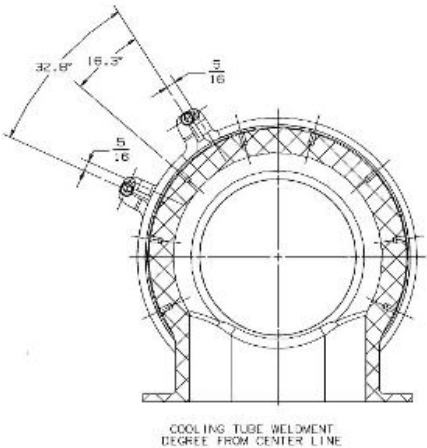
Date: 6/22/2016

4.1.4 Verify stacking recipe implemented per diagram

Inspector: Elpidio Garcia

Date: 6/28/2016

4.2 Align cooling tubes during assembly using approved tooling to verify alignment.



Alignment Fixture.

Technician: Steve Sorenson

Date: 6/30/2016

4.3 Responsible Authority verify alignment and approve before proceeding.

☒ Approved.

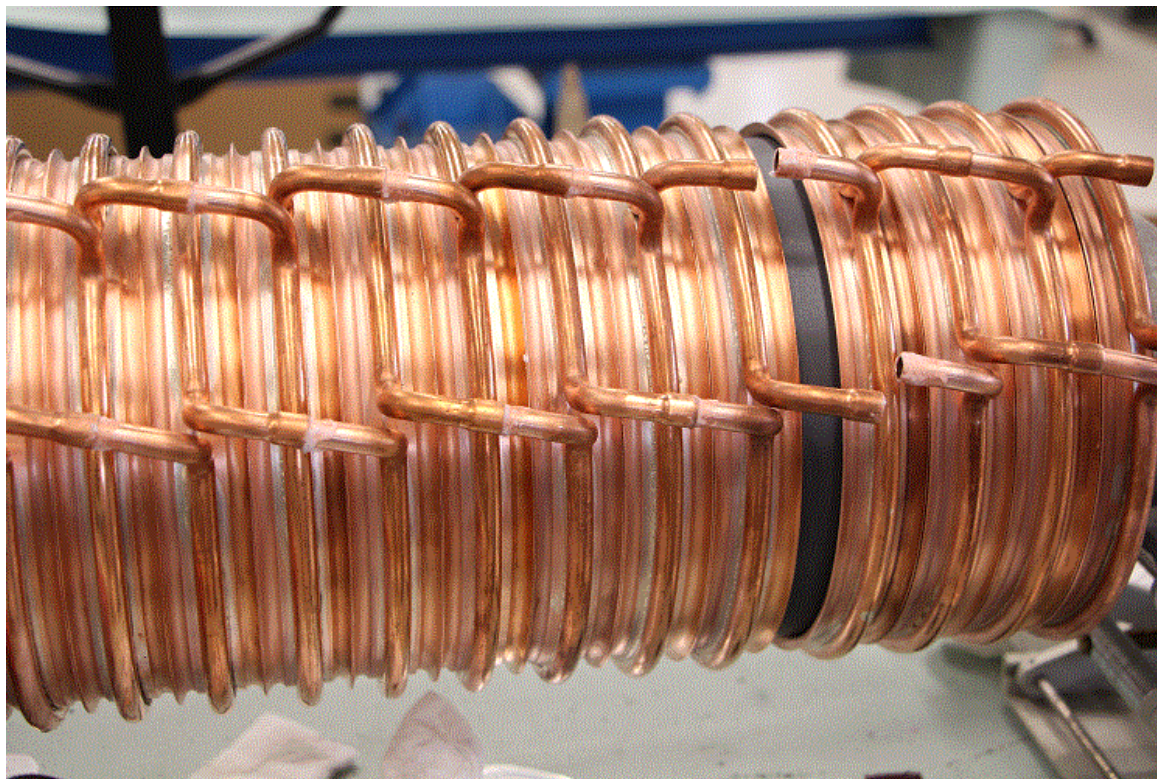
Comments: *N / A*

Responsible Authority/Designee: *William Robotham*

Date: *6/30/2016*

4.4 Braze all cooling loops together.

Note: Ensure work area is safe for brazing: remove bottles of alcohol or spray cans and any other objects around the work table as the heat may come in contact with the table. Ensure that the propane tubing does not interfere around the work area.

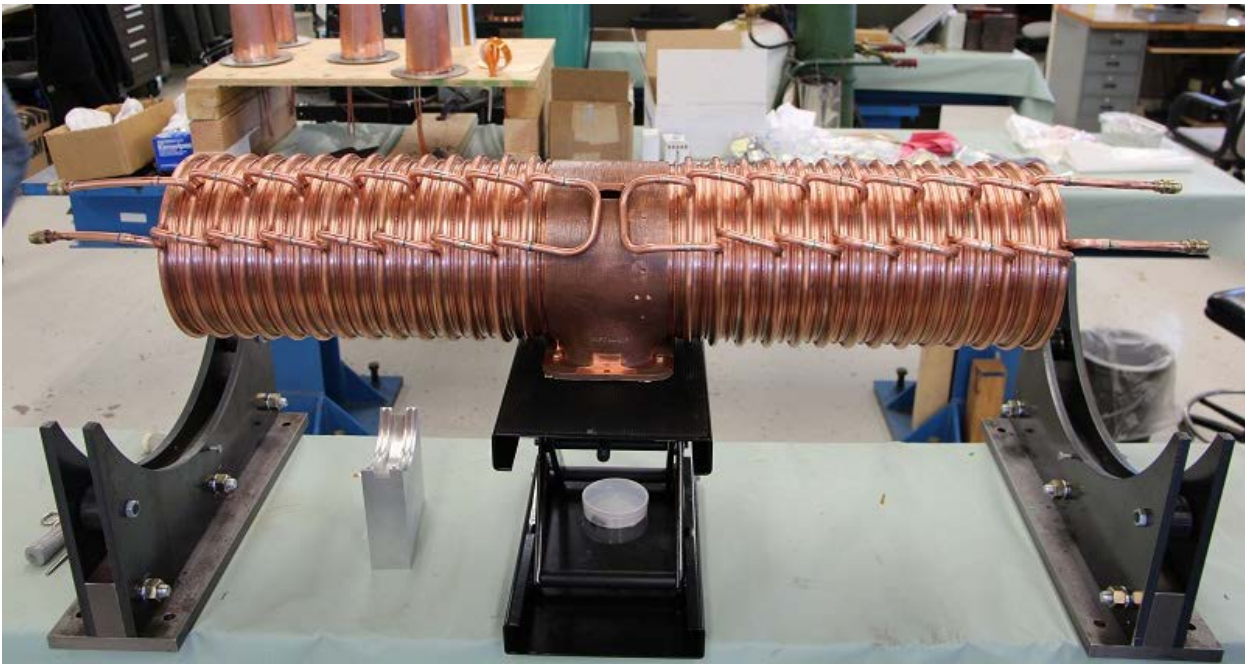


NOTE: Technician that performs this step shall be trained on proper brazing techniques.

Technician: *Steve Sorenson*

Date: *6/30/2016*

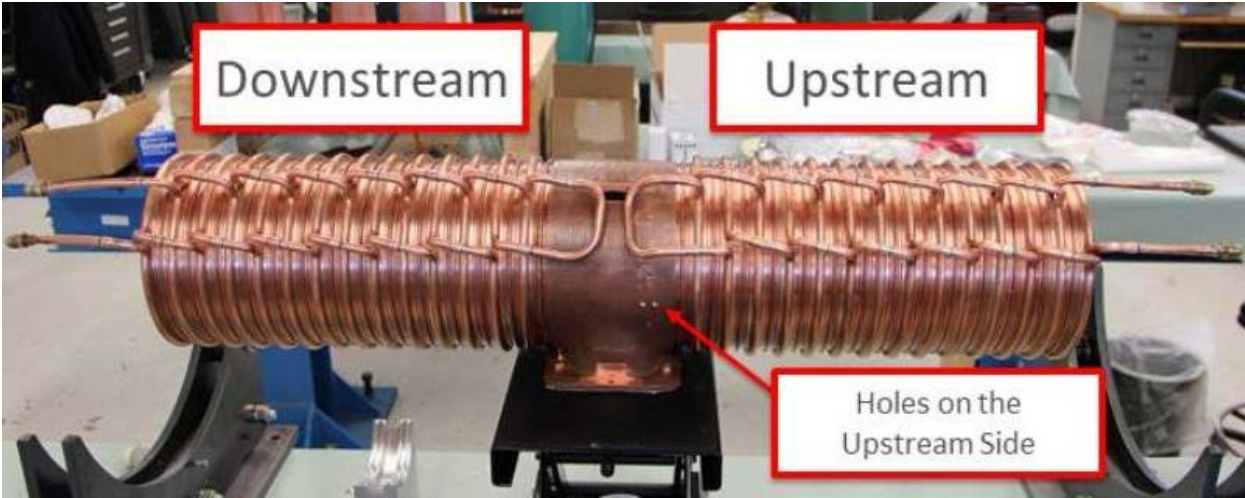
4.5 Braze 4" copper tube extensions (F10001516) and fittings (F10049845) onto shell as shown in shell assembly F00496037.



Technician: *Steve Sorenson*

Date: *7/1/2016*

4.6 Leak check both upstream and downstream paths with 100psi air pressure and snoop. Note: No water shall be used. Prevent Snoop from contacting ferrites. Contact Project Engineer if any leaks detected.



Technician: *Steve Sorenson*

Date: *7/1/2016*

4.7 Tack weld edges of the hoop assemblies with water flowing through the cooling paths. Use Caution: Do not allow water to come in contact with ferrites.

Note: After tack welding is complete, put the assembly on the mounting fixture for welding. (See photos.) Raise the assembly on the scissor platform. Tighten ends to support the assembly.

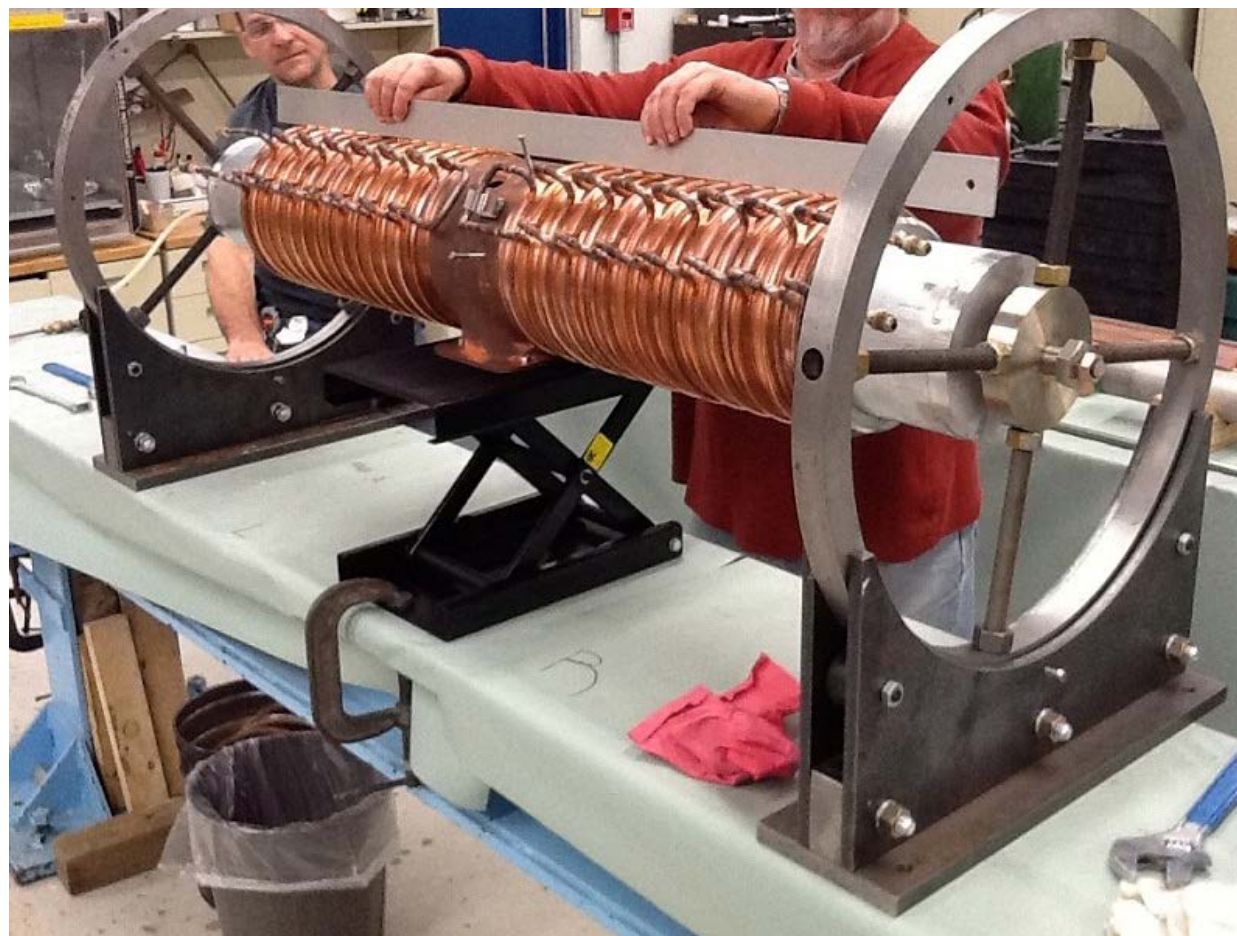
Technician: *Steve Sorenson*

Welder: *Michael Cooper*

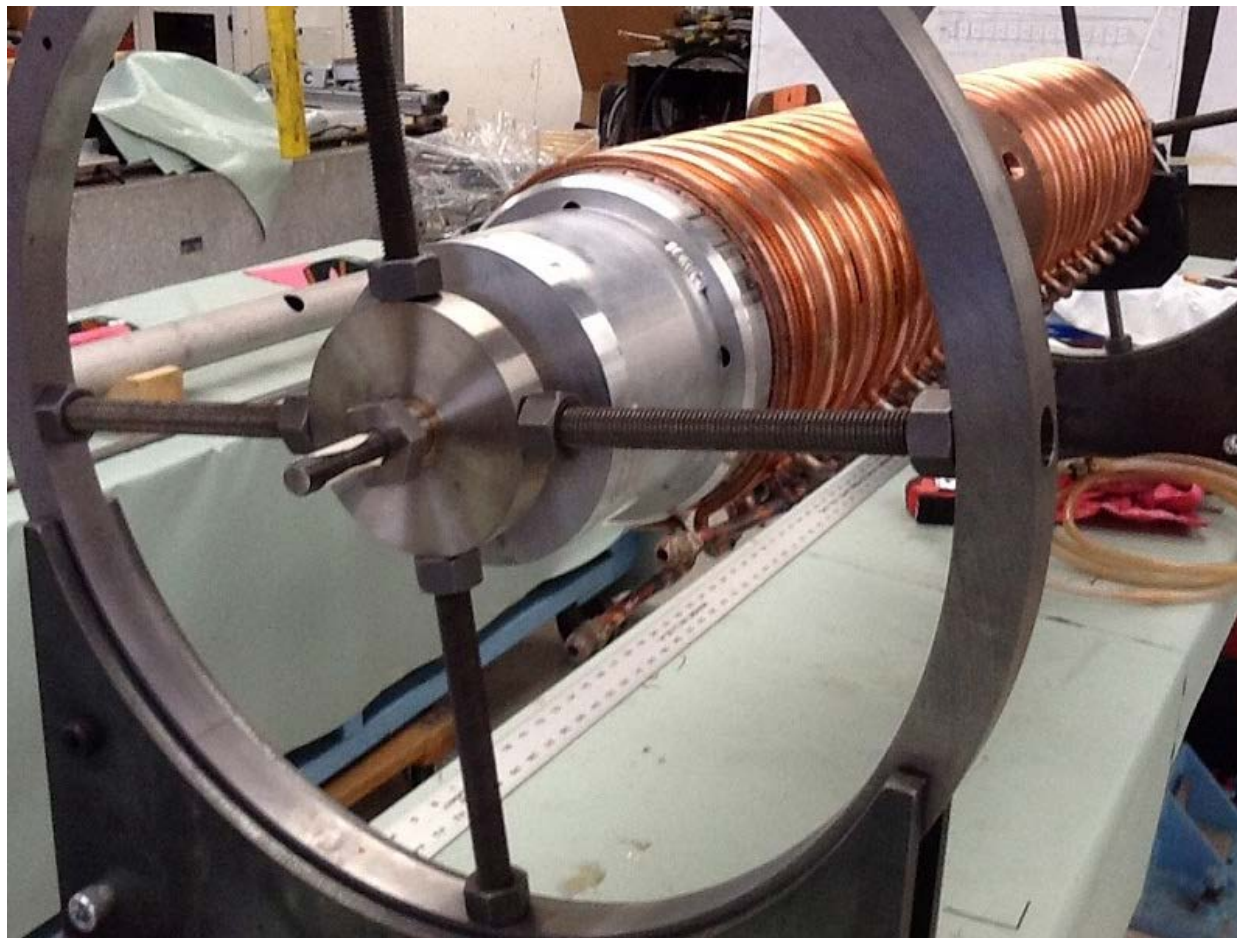
Date: *7/12/2016*

Date: *7/12/2016*

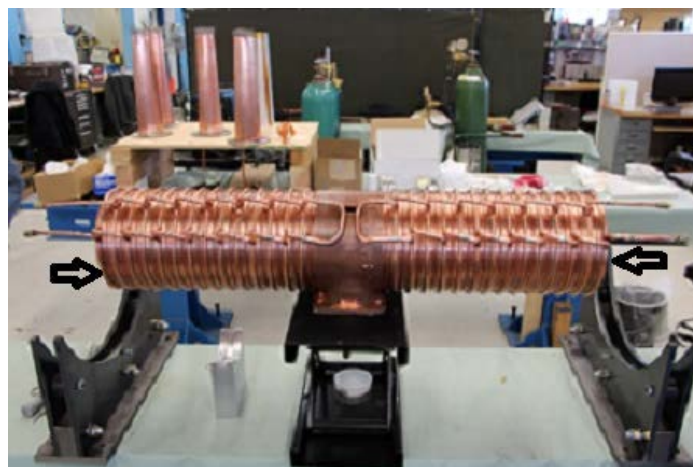
4.7.1 Assemble the welding fixture using the scissor table and two leveling jacks to adjust and achieve alignment. Use a straight edge to determine all parts are even as shown.



4.7.2 Tighten end nuts until there is firm resistance. Remove the scissor tables and leveling jacks from the casting. Check with a straight edge to determine if there is any sagging in the assembly.



4.7.3 Using tape measure or equivalent measure and record nominal length of assembly. Note: 40 3/16 dimension is for reference only.



40 3/16 +/- 1/16 End to end

Nominal Length: 40.187 in

Technician: Steve Sorenson

Date: 7/11/2016

4.7.4 Support the cooling line extensions as shown, attach cooling hoses and pump. Water temperature should be checked periodically during the welding process. Repeat procedure on the other end of the tuner after welding first side.



NOTE: Complete one side welding before starting weld on opposite side. After first side is completed add new water to bucket before welding other side

Welder: Michael Cooper

Date: 7/12/2016

4.7.5 Clean and remove oxide and flux.

NOTE: Welder please remain until weld passes inspection by TD inspector.

Technician: Steve Sorenson

Date: 7/12/2016



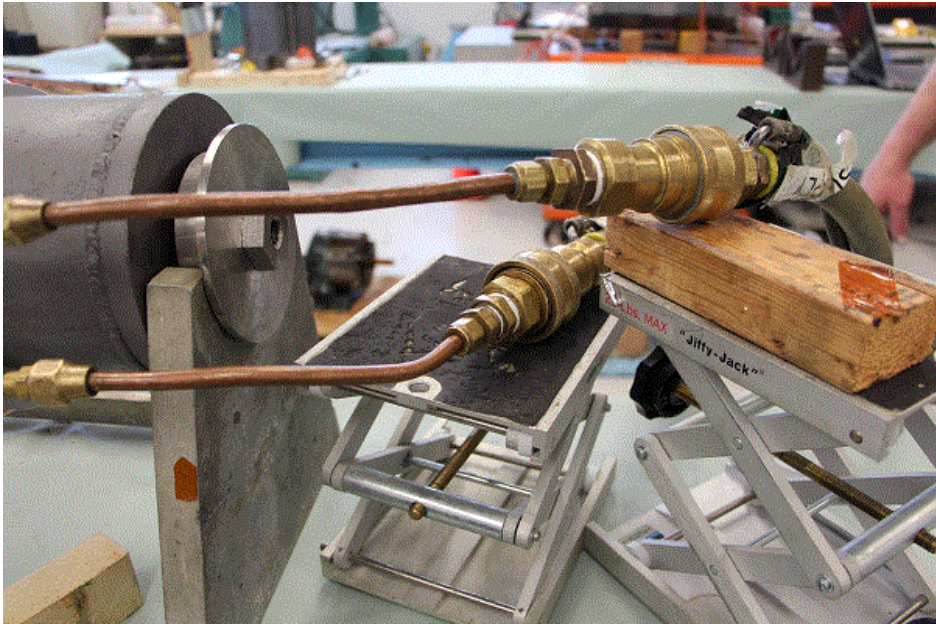
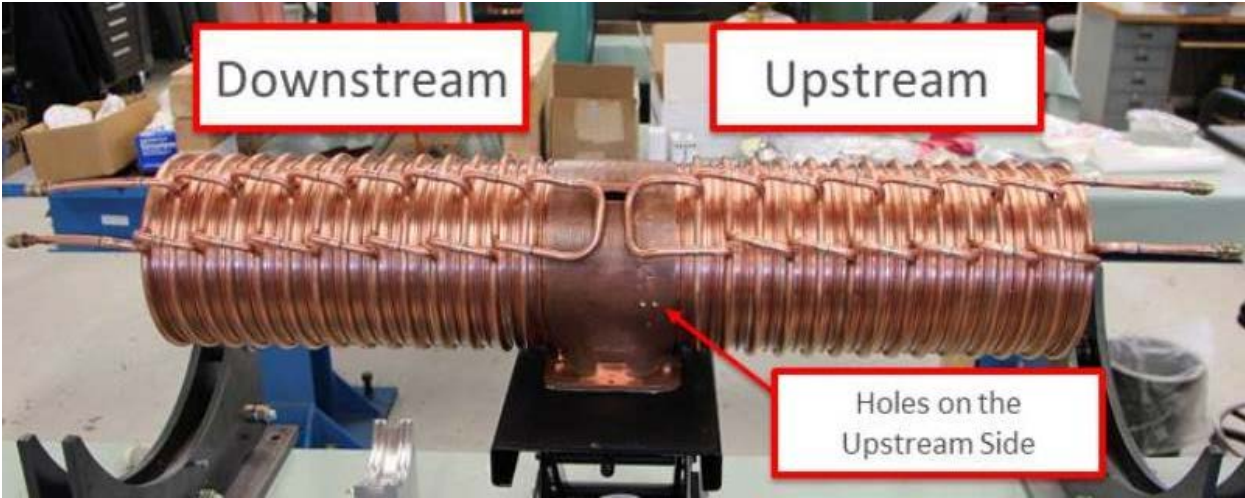
4.8 Visually inspect the quality of the weld.

Comments: N / A

Inspector: Douglas Howard

Date: 7/13/2016

4.9 Perform an upstream and downstream flow test and hydro.



Note: Support fittings so they do not weigh down tubes.

4.9.1 Perform an upstream flow test and hydro.

Flow Test	Flow Cart Serial Number	Limit	Actual Measurement
?P 60 PSI	WFC-3	.	3.23 GPM
?P 100 PSI	.	.	4.31 GPM

Perform a hydro static test at 500 psi for 30 min.

☒ Pass

☐ Fail

Inspector: *Douglas Howard*

Date: *7/13/2016*

4.9.2 Perform a downstream flow and hydro.

Flow Test	Flow Cart Serial Number	Limit	Actual Measurement
?P 60 PSI	WFC-3	.	3.27 GPM
?P 100 PSI	.	.	4.28 GPM

Perform a hydro static test at 500 psi for 30 min.

☒ Pass

☐ Fail

Inspector: *Douglas Howard*

Date: *7/13/2016*

4.10 Mask all contact surfaces and holes. Clear coat outer surfaces with a single layer of Krylon. Let dry per manufacturer directions.

Technician: *Steve Sorenson*

Date: *7/13/2016*

5.0 Tuner Assembly [Top](#)

5.1 Support the Tuner Body and Ferrite Weldment (496037) on assembly table.

Technician: *Steve Sorenson*

Date: *7/14/2016*

5.2 Perform Hipot 500VDC and Capacitance measurements for each cone assembly.

5.2.1 Perform Hipot 500VDC and Capicitance measurement on the first cone assembly.

Cone Assembly Serial Number: *PRFTA-CSA-083*

Electrical Test	Equipment Serial Number	Limits	Measurement
Hipot @500VDC	AR0503	<10 µA	0.2 µA
Capacitance	3145J02056	8.5-15 nF	13.065 nF

Inspector: *Elpidio Garcia*

Date: *6/27/2016*

5.2.2 Perform Hipot 500VDC and Capacitance measurement on the second cone assembly.

Cone Assembly Serial Number: *PRFTA-CSA-035*

Electrical Test	Equipment Serial Number	Limits	Measurement
Hipot @500VDC	AR0503	< 10 µA	0.1 µA
Capacitance	3145J02056	8.5-15 nF	9.123 nF

Inspector: *Elpidio Garcia*

Date: *6/27/2016*

5.3 Perform a flow test and hydro on each cone assembly. If flow test and hydro data already exist, record the data below.

5.3.1 Perform a flow test and hydro on the first cone assembly.

Cone Assembly Serial Number: **PRFTA-CSA-083**

Flow Test	Flow Cart Serial Number	Limit	Actual Measurement
?P 60 PSI	WFC-3	.	3.29 GPM
?P 100 PSI	.	.	4.26 GPM

Perform a hydro static test at 500 psi for 30 min.

☒ *Pass*

☐ *Fail*

Inspector: **Elpidio Garcia**

Date: **6/27/2016**

5.3.2 Perform a flow test and hydro on the second cone assembly.

Cone Assembly Serial Number: **PRFTA-CSA-035**

Flow Test	Flow Cart Serial Number	Limit	Actual Measurement
?P 60 PSI	WFC-3	.	2.72 GPM
?P 100 PSI	.	.	3.6 GPM

Perform a hydro static test at 500 psi for 30 min.

☒ *Pass*

☐ *Fail*

Inspector: **Elpidio Garcia**

Date: **6/27/2016**

5.4 Insert two Cone assemblies (496031) and the Center Tube (394871) into the Tuner body (496037), the hole in the Center Tube should be centered in the casting aperture of the Tuner Body (496037).

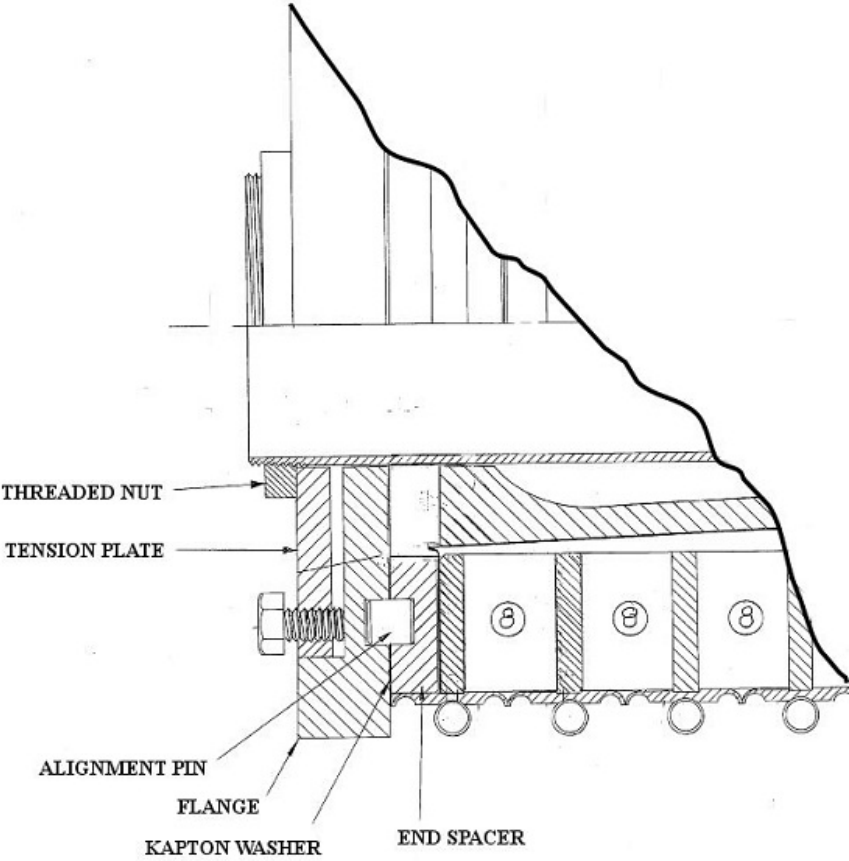
Downstream Cone Assembly: **PRFTA-CSA-083**

Upstream Cone Assembly: **PRFTA-CSA-035**

Technician: **Steve Sorenson**

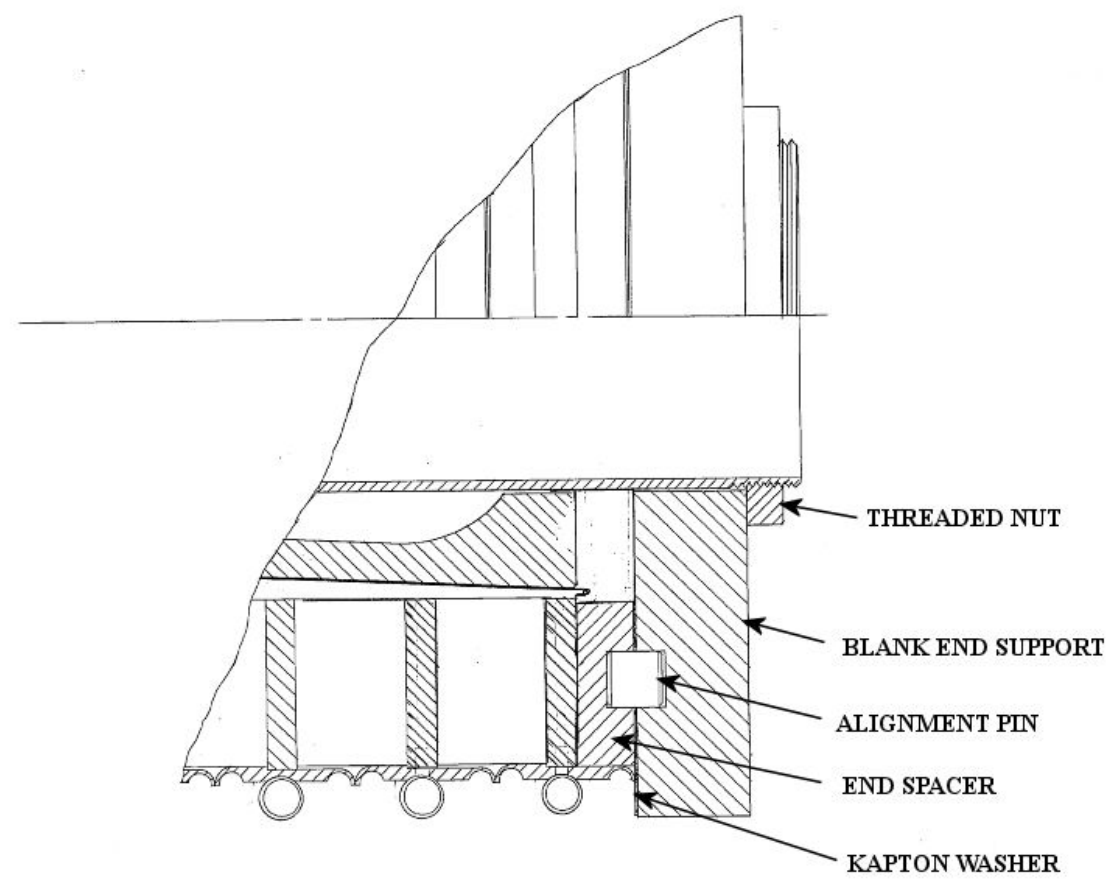
Date: **7/14/2016**

5.5 On the downstream end of the Tuner Body (496037), loosely assemble the SS End Spacer (394834), Alignment Pins (394825), (2) Kapton Washers (394831), End SS Flange (394835), Tension Plate (394836), and End Tube Threaded Nut (394826).



NOTE: Kapton Washers should be 5mil

- 5.5.1 For each end: assemble (4) G10 alignment pin and (2) kapton washers onto end flange. Then assemble end spacer (tension plate upstream). Then assemble subassembly onto tuner, and tighten end tube threaded nut.
- Technician: *Steve Sorenson* Date: *7/15/2016*
- 5.6 On the upstream end of the Tuner Body (496037), loosely assemble the SS End Spacer (394834), Alignment Pins (394825), (2) Kapton Washers (394831), Blank End Support (394824), and End Tube Threaded Nut (394826).



NOTE: Kapton washers should be 5mil

5.6.1 For each end: assemble (4) G10 alignment pin and (2) kapton washers onto end flange. Then assemble end spacer (tension plate upstream). Then assemble subassembly onto tuner, and tighten end tube threaded nut.

Technician: *Steve Sorenson* Date: *7/15/2016*

5.7 Using spanner wrench take up slack in the End Tube Threaded nuts (394826).

5.7.1 Align and adjust tension plate/spacer so it assembles into air cooled ring. When tightening nuts, ensure equal thread lengths upstream and downstream.

Technician: *Steve Sorenson* Date: *7/15/2016*

5.8 Align flanges with respect to the mounting face of the tuner body. 3/4 tapped holes can be used to check alignment with threaded rods and torpedo level.

5.8.1 Apply anti-seize on bolts for tension plate. Install bolts prior to inspection to lock location. Tighten bolts in star pattern.

Technician: *Steve Sorenson* Date: *7/15/2016*

5.9 Check flange alignment with respect to tuner body casting mounting surface. Flanges shall be square within 90 +/- 1 deg and parallel to each other within 1/16". Record findings below.

Comments: *Flanges are square.*

Inspector: *Elpidio Garcia*

Date: *7/18/2016*

5.10 Responsible Authority verify flange alignment before proceeding.

☒ Pass

☐ Fail

Comments: *N / A*

Responsible Authority/Designee: *William Robotham*

Date: *7/18/2016*

5.11 Using the tension plate screws, tighten the assembly until the length of the body is equal to or less than the length recorded in 4.7.3, and all the bolts are equally torqued.



Nominal Length: *40.188 in*

Technician: *Steve Sorenson*

Date: *7/18/2016*

5.12 Install tuner assembly in rotating ring fixture.

Technician: *Steve Sorenson*

Date: *7/18/2016*

5.13 Slide Inner Package Assembly (F00496030) into the Center Tube (394871) containing one insulating washer (F00394811).

Inner Bus Serial Number: [PRFTA-IB-018](#)

Technician: *Steve Sorenson*

Date: *7/18/2016*

5.13.1 Identify downstream side as containing fingers numbered 1-10

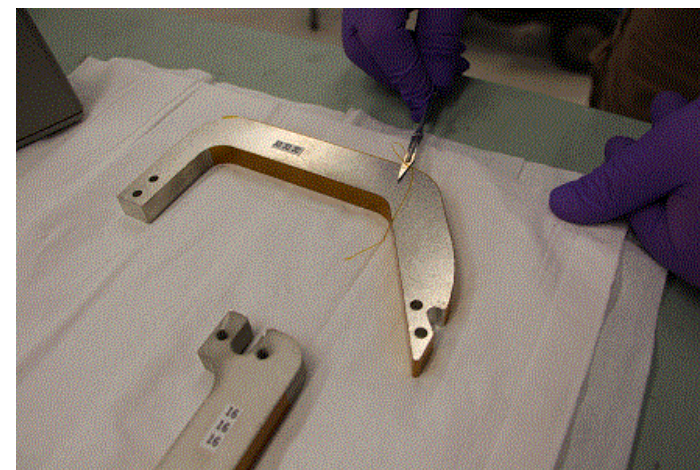
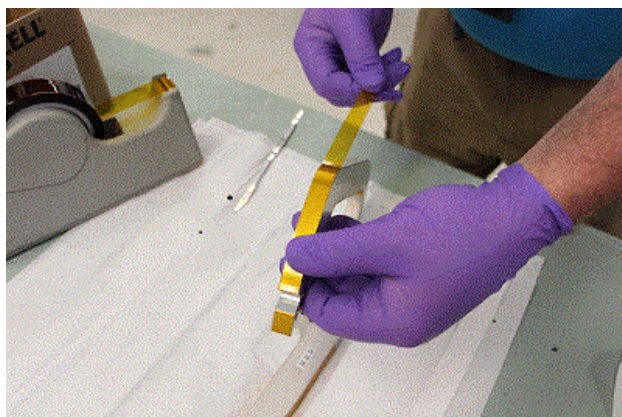
5.13.2 Identify upstream side as containing fingers numbered 11-20

NOTE: Ensure that Inner Bus is installed according to the upstream/downstream designation which ensures that fingers line up correctly

5.14 Place the second Insulating Washer (F00394811) on the other end.

5.15 Clean contact points with a wire brush before attaching fingers.

5.15.1 Place Kapton on side of each finger refer to attached picture . Attach to all points where fingers may touch each other. Use a razor to trim the excess Kapton if it sticks over the edge.

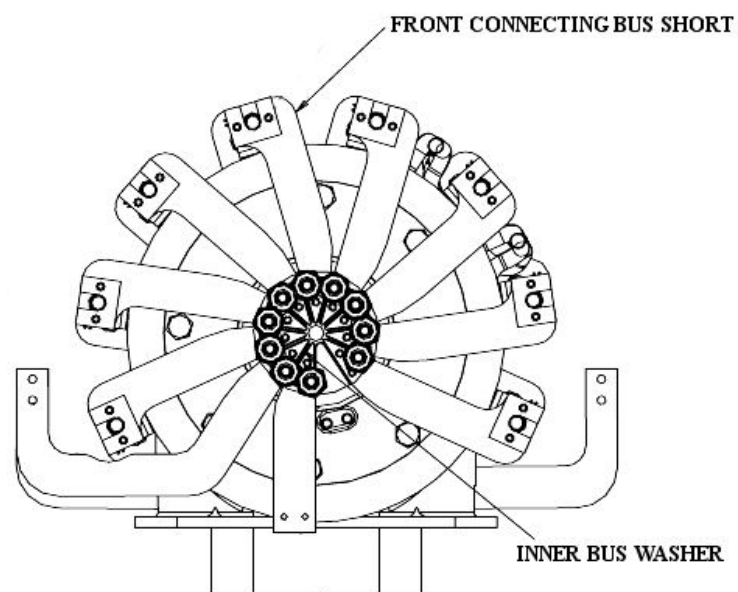


Note: Each finger should be labeled with a number (1-10 on one end / 11-20 on the other).

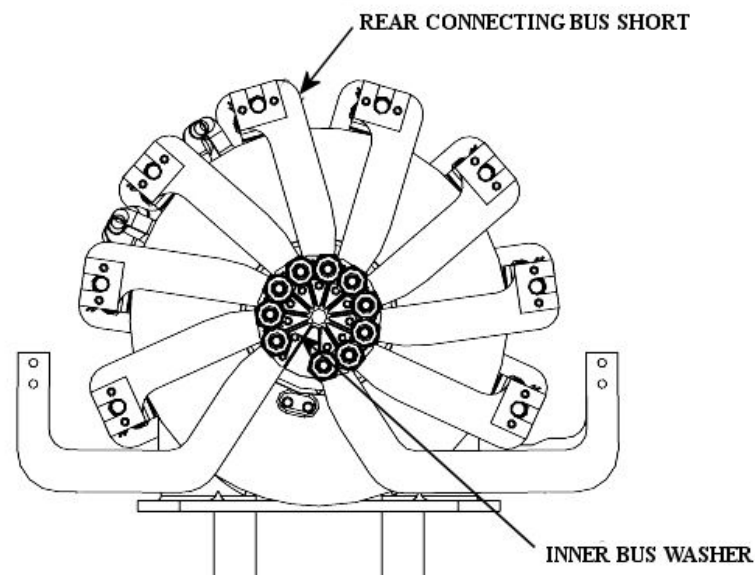
Technician: *Charles Pribyl*

Date: *7/18/2016*

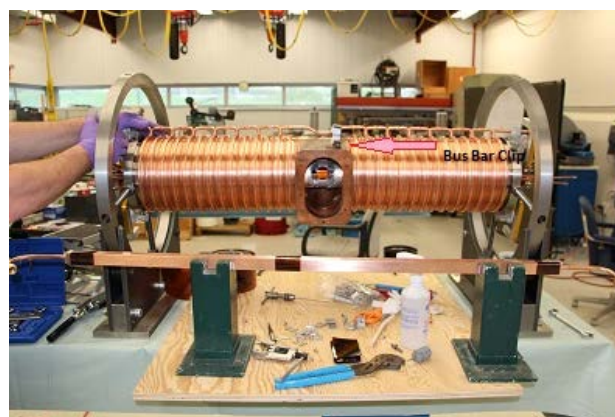
5.15.2 Install the Front Connecting Bus Short (394932) and Inner Bus Washers (394867) on the downstream end of the assembly.



- 5.16 Install the Rear Connecting Bus Short (394933) and Inner Bus Washers (394867) on the upstream end of the assembly.



- 5.17 Install the Bus Bar Clips (394829), Bus Bar Standoff (394857), Outer Bus Bar Support Brackets (394832), and Tuner Support Brackets (394839).



- 5.18 Verify measurements from previous flange measurements (step 5.11) have not changed. Record any adjustments needed. Do not proceed until flange alignment is acceptable.

Inspector: *Elpidio Garcia*

Date: *7/18/2016*

5.19 Outer Bus Bar Prep

5.19.1 Perform a flow and hydro static test at 500 psi for 10 min against each outer bus bar. Must have a min flow value of 1.5GPM using hydro line

☒ Pass

☐ Fail

Inspector: *Elpidio Garcia*

Date: *7/18/2016*

5.19.2 Clean with Scotch Brite/Alcohol

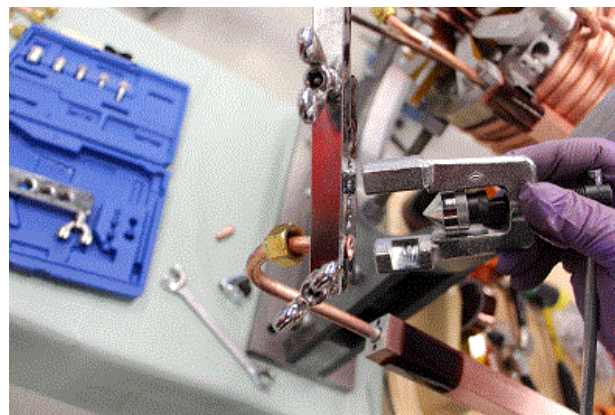
5.19.3 Electroplate ends

5.19.4 Chase connection threads

5.19.5 Krylon Base Bar

NOTE: Protect ends from being sprayed

5.19.6 Install flare nuts, and flare both ends



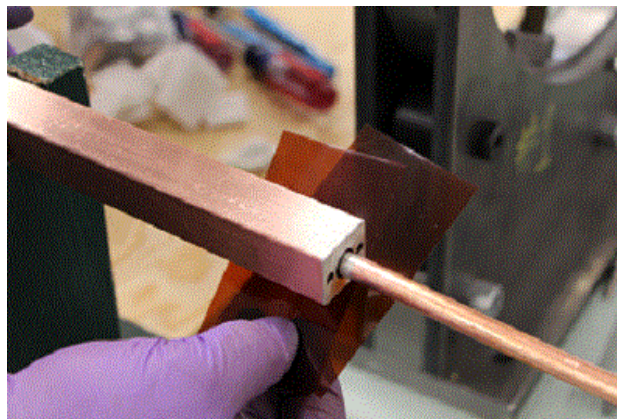
5.20 Bend and terminate cooling lines on the ends of the Outer Bus Bar- new style (394940) by dry fitting.

Technician: *Charles Pribyl*

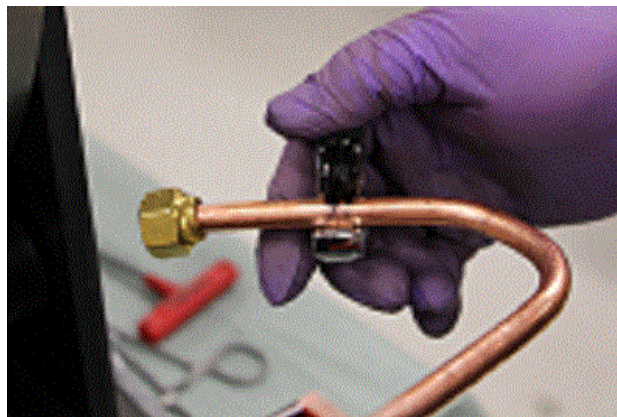
Date: *7/19/2016*

5.20.1 Outer Bus Bar Installation

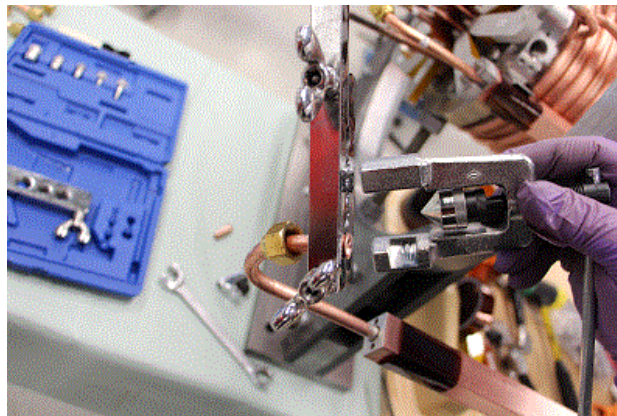
Kapton at each place the bar connects to a clip. Use 3 pieces 5mm each piece



Cut tube to length by dry fitting and marking tube at place to cut.



Install nut and then flare end.



Wipe tin plated ends.

Install Outer Bus Bars- new style (394940) and Outer Bus Washer- new (394868), with kapton in the Bus Bar Clips (394829)

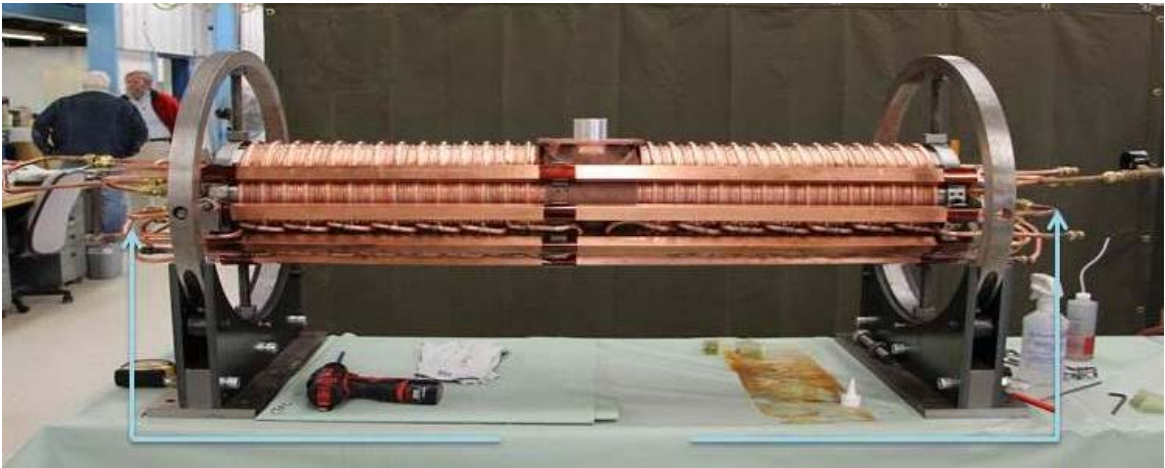
Install OBB onto clips, use a mallet to gently install the OBB flush against the assy.

Technician: Charles Pribyl

Date: 7/19/2016

5.21 Check overall length. Record the maximum length.

Maximum Length: 55 in



End to end

Inspector: Elpidio Garcia

Date: 7/21/2016

5.22 Stem Assembly (394639). Will be installed at MI60

☒ Yes

☐ No

6.0 Final Inspection [Top](#)

6.1 Complete the final electrical inspection. Refer to [Hazard Analysis 598](#).

Electrical Test	Equipment Serial Number	Typical Values	Actual Measurement
DC Resistance @ 100 Amps	3114A12151	1.20 - 1.25 mOhm	1.1642 mO
Hipot @ 500VDC	AR0503	< 3.3 µA	0.9 µA

☒ Pass

☐ Fail

NOTE: If Resistance test fails complete Resistance Worksheet

[Resistance Worksheet](#)

Downstream

Upstream

Resistance Worksheet [Upload File](#)

Inspector: Elpidio Garcia

Date: 7/22/2016

6.2 Perform flow test and hydro on all water lines in the Tuner Assembly.

6.2.1 Perform a flow test and hydro on the Downstream Cone Assembly.

Flow Test	Flow Cart Serial Number	Limit	Actual Measurement
?P 60 PSI	WFC-4	.	3.17 GPM
?P 100 PSI	.	.	4.16 GPM

Perform a hydro static test at 500 psi for 30 min.

☒ Pass ☐ Fail

Inspector: Elpidio Garcia

Date: 7/22/2016

6.2.2 Perform a flow test and hydro on the Upstream Cone Assembly.

Flow Test	Flow Cart Serial Number	Limit	Actual Measurement
?P 60 PSI	WFC-4	.	3.34 GPM
?P 100 PSI	.	.	4.43 GPM

Perform a hydro static test at 500 psi for 30 min.

☒ Pass ☐ Fail

Inspector: Elpidio Garcia

Date: 7/22/2016

6.2.3 Perform a flow test and hydro on the Inner/Outer Bus Package.

Flow Test	Flow Cart Serial Number	Limit	Actual Measurement
?P 60 PSI	WFC-4	.	0.799 GPM
?P 100 PSI	.	.	1.02 GPM

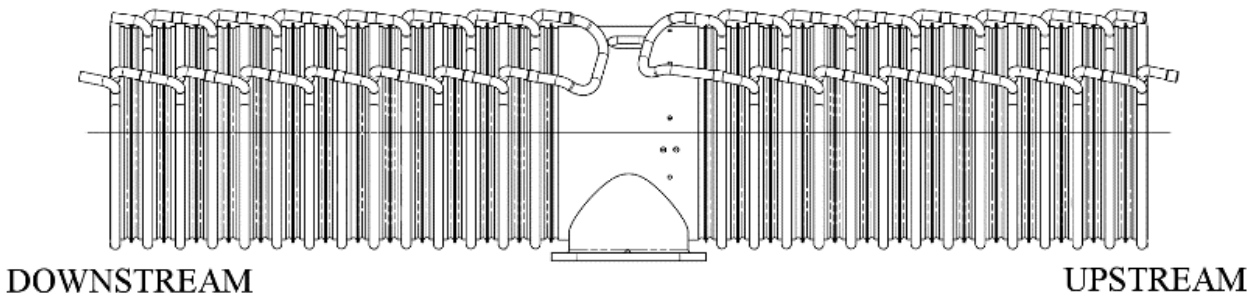
Perform a hydro static test at 500 psi for 30 min.

☒ Pass ☐ Fail

Inspector: Elpidio Garcia

Date: 7/22/2016

6.2.4 Perform a flow test and hydro on the Upstream cooling path.



Flow Test	Flow Cart Serial Number	Limit	Actual Measurement
?P 60 PSI	WFC-4	.	3.15 GPM
?P 100 PSI	.	.	4.2 GPM

Perform a hydro static test at 500 psi for 30 min.

☒ Pass ☐ Fail

Inspector: Elpidio Garcia Date: 7/22/2016

6.2.5 Perform a flow test and hydro on the Downstream cooling path.



Flow Test	Flow Cart Serial Number	Limit	Actual Measurement
?P 60 PSI	WFC-4	.	3.16 GPM
?P 100 PSI	.	.	4.05 GPM

Perform a hydro static test at 500 psi for 30 min.

 *Pass*

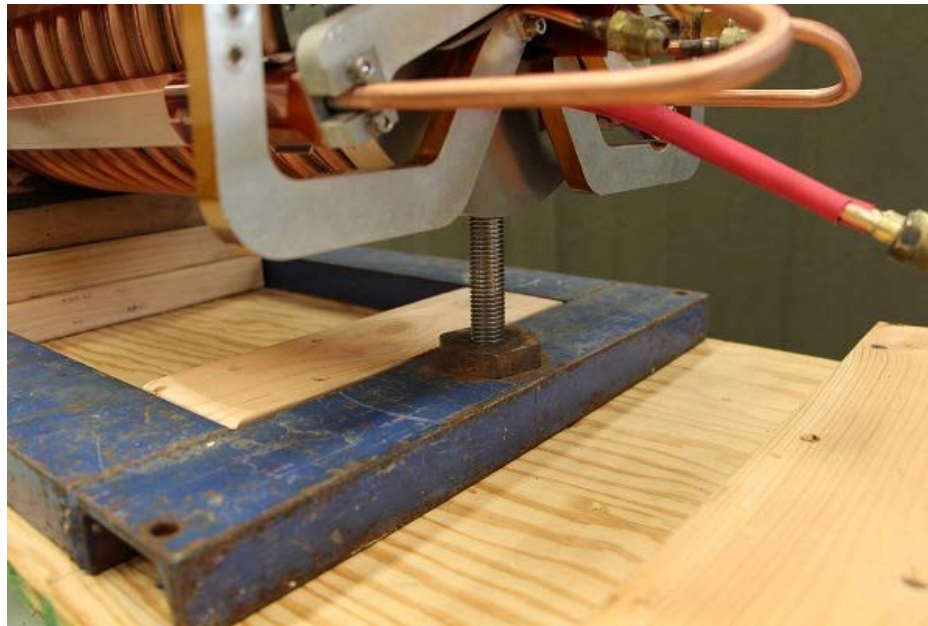
 *Fail*

Inspector: Elpidio Garcia

Date: 7/22/2016

6.3 Shipping Preparation

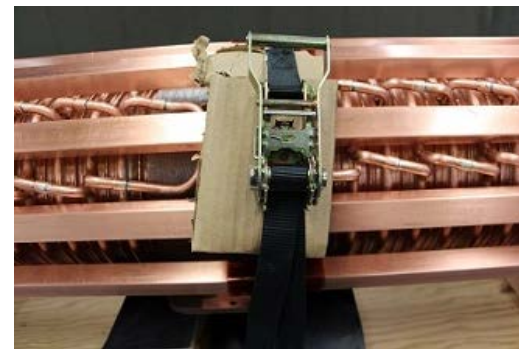
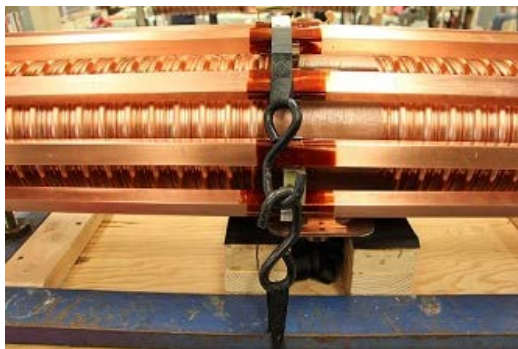
6.3.1 Remove bolts from box lid



6.3.2 Secure cavity to base

6.3.2.1 Align bolts on both ends screw in rods and lock down.

6.3.2.2 Using (2) S hooks interlock S hooks and secure cavity to base plate with ratchet belt.



6.3.2.3 Attach ID tag to cavity



6.3.2.4 Replace lid cover and secure with screws



Technician: *Steve Sorenson*

Date: *7/25/2016*

7.0 Production Complete [Top](#)

7.1 Process Engineering verify that the traveler 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: *Accurate and Complete*

Process Engineering/Designee: *Larry Mitcham*

Date: *8/2/2016*