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GRADIENT COIL REPLACEMENT FOR BRM, BRM-D, & CRM IN CX, LCC, & WIDEOPEN ENCLOSURE MAGNETS

Note

It is strongly recommended that the 38 minute video tape (#EVT624) of an actual BRM replacement be reviewed before attempting this complex procedure. The replacement of a CRM or BRM-D is identical to the BRM except where noted in this procedure. The video tape (titled "New BRM Installation Procedure For Conquest CX Magnet") will be shipped with the BRM Insertion Tool Kit required to perform this replacement. Please contact your MAC Team representative for your zone to identify an individual trained to assist you with this procedure.

1- DESCRIPTION

This procedure describes the removal and replacement of the combined RF and gradient body coils in the various Signa Horizon systems **with** Cx, LCC, and WideOpen Enclosure Magnets. If you do not have a Cx, LCC, or WideOpen Enclosure Magnets please use the procedure for Non-Cx magnets.

Note

There are 2 revisions of Gradient Insertion tools. The original kit (2164744) is used to replace a BRM coil. The upgraded kit (2164744-2) can be used to replace BRM, coils, CRM coils and BRM-D coils.

2- LIST OF EQUIPMENT & PARTS

Item #	Description	Quantity	Part Number
1.	Gradient Insertion Tool Kit	1	2164744-2
	Kit contents:		
	Tube Support Plate Assembly	1	2164685
	Male Support Tube Assembly	1	2164690
	Female Support Tube Assembly	1	2164697
	Tube Guide Roller Assembly	2	2164707
	Tube Jacking Assembly	1	2164735
	Crate	1	2172196
	M10 x 80 stainless steel bolts	10	2109866-26
	M10 x 120 stainless steel studs	4	2180498
	M10 stainless steel nuts	4	2109875-4
	M10 stainless steel flat washers	4	2109878-4
	BRM Roller/Bracket Assemblies	2	2121111
	CRM Roller/Bracket Assemblies	2	2187590
	BRM-D Roller/Bracket Assemblies (Pat. End)	1	2213270
	BRM-D Roller/Bracket Assemblies (Svc. End)	1	2213270-2
	Bolts for BRM Rollers	10	2109866-24
	Rope (10 ft long with snap clips)	1	2188986
2.	BRM/BRM-D/CRM Cart	1	2134810
3.	Aluminum Cradle	1	2134810-2
4.	Cable Crimper/Stripper Kit	1	2134776
5.	Poron Seal, for air cover	1	2185175
6.	Poron Seal,	4	2181231
7.	Poron Seal	8	2181231-2
8.	Red Loctite # 271	1	46-170686p3
9.	Blue Loctite # 242	1	46-170684p2
10.	Alcohol	1	Field Supplied
11.	Ty-wraps	5	Field Supplied
12.	Splice kit	1	2241521

List of Non-Magnetic Tools

1. 3/8 inch T-bar allen wrench
2. 5/16 inch right angle allen wrench
3. 8 mm allen wrench
4. 8 inch adjustable wrench
5. 17 mm open end wrench
6. 13 mm socket
7. 17 mm socket
8. 19 mm socket
9. 24 mm socket
10. 3/8 inch drive ratchet
11. 1/2 inch drive ratchet
12. 3 inch long extension for 1/2 inch drive
13. 3 Foot Long Level

3- PRE-REQUISITE PROCEDURES

Signa Horizon Enclosure

1. Rear Enclosure Cover Removal
2. Front Enclosure Cover Removal
3. Patient Comfort Module Removal
4. Bridge and Cradle Removal
5. RF & Gradient Cables Disconnected
   A. Cut and Terminate Gradient Cables
6. BRM Water Lines Disconnected
7. Rear Pedestal Removal
8. Alignment Lights Removal
9. Warm Bore Cone Removal
10. Front Bridge Support Removal
11. RF Assembly Removal from BRM
12. RF Assembly Removal from CRM

Signa MR/i & CV/i WideOpen Enclosure

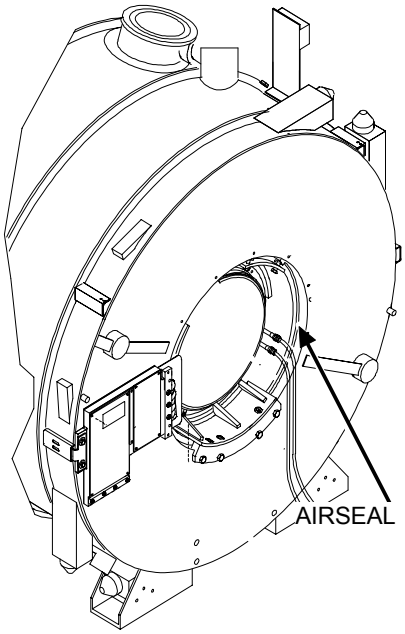
1. Top, Bottom Trim , & Side Arc Cover Removal
2. Rear Pedestal Cover Removal
3. Bridge and Cradle Removal
4. RF & Gradient Cables Disconnected
   A. Cut and Terminate Gradient Cables
6. Rear Pedestal Removal
7. BRM Water Lines Disconnected
8. Rear Endbell Removal
9. Front Endbell Removal
10. RF Assembly Removal from BRM
11. Removal of Gradient Cable Routing

4- DEFECTIVE GRADIENT REMOVAL PROCEDURE

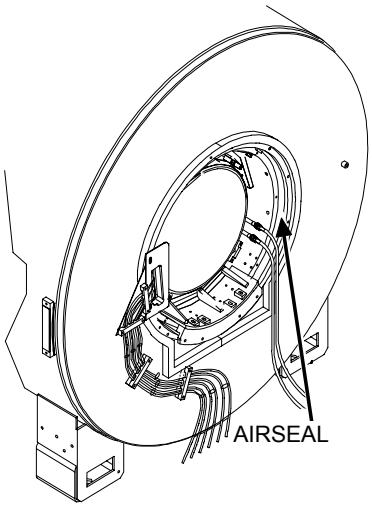
Note

The following procedure requires 3 field engineers and assumes the prerequisite procedures have been performed.

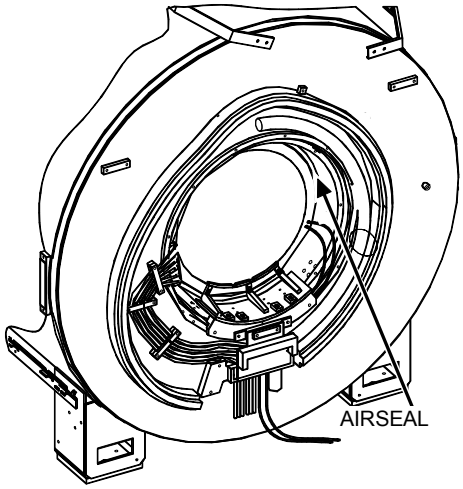
1. Remove air seal from around the Gradient coil. See Illustration 4-1.



CX MAGNET



LCC-HORIZON ENCLOSURE CONFIGURATION



LCC-WIDEOPEN ENCLOSURE CONFIGURATION

REMOVE AIRSEAL
ILLUSTRATION 4-1

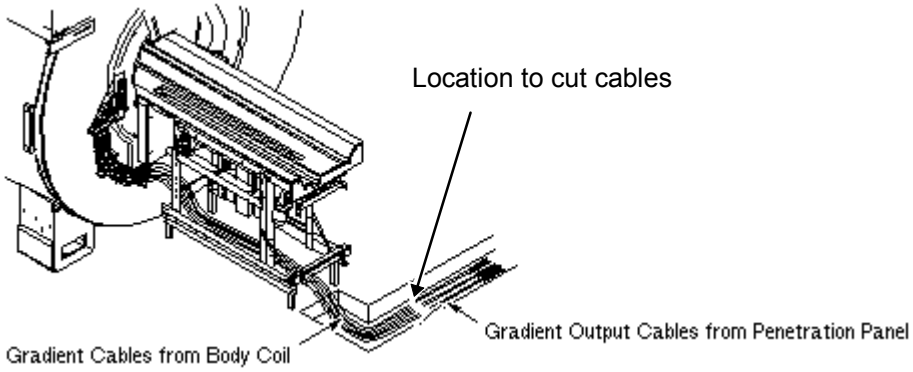
4- DEFECTIVE GRADIENT REMOVAL PROCEDURE (continued)

2. Remove the Terminal Block located on the rear flange of the magnet. See Illustration 4-2. (The Terminal Block is not used with the BRM-D and MR/*i* & CV/*i* WideOpen systems)

3. Loosen and remove the Gradient Coil radial support blocks and support brackets from both ends of the Gradient Coil Assembly. Tool to use: 24 mm socket and ratchet.

REMOVE TERMINAL BLOCK
ILLUSTRATION 4-2

4. Verify Gradient Cables from Body Coil have been cut and terminated per Direction 2220423. See Illustration 4-3.



LOCATION TO CUT CABLES
ILLUSTRATION 4-3

Note
Save these parts for installing onto the new Gradient Coil assembly later.

CAUTION

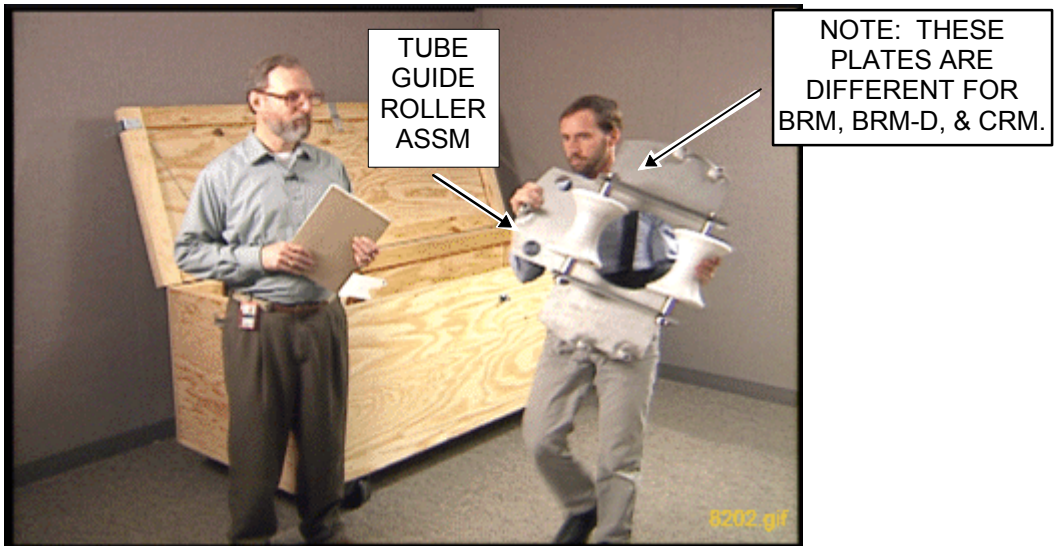
Be careful not to bend the RF cables and bias cables. A bend radius less than 6 inches (152.4 mm) will damage the cables.

4- DEFECTIVE GRADIENT COIL REMOVAL PROCEDURE (continued)

5. Remove the two Tube Guide Roller Assemblies from the crate. You may need to exchange the rollers to the appropriate Plate Assembly (BRM, BRM-D, or CRM). Install one Assembled Tube Guide Roller Assembly onto each end of the Gradient Coil. See Illustration 4-4. The kit contains 2 M10 x 120 studs. Use these studs at the top hole location. The stud will support the Tube Guide Roller Assembly and will assist the alignment of the remaining bolts. Use the M10 x 80 bolts supplied in the kit. Tool to use: 17 mm socket and ratchet. See Illustration 4-5.

Note

When using the BRM-D Plate Assemblies, the M10 x 120mm studs must be used.



TUBE GUIDE ROLLER ASSEMBLY
ILLUSTRATION 4-4

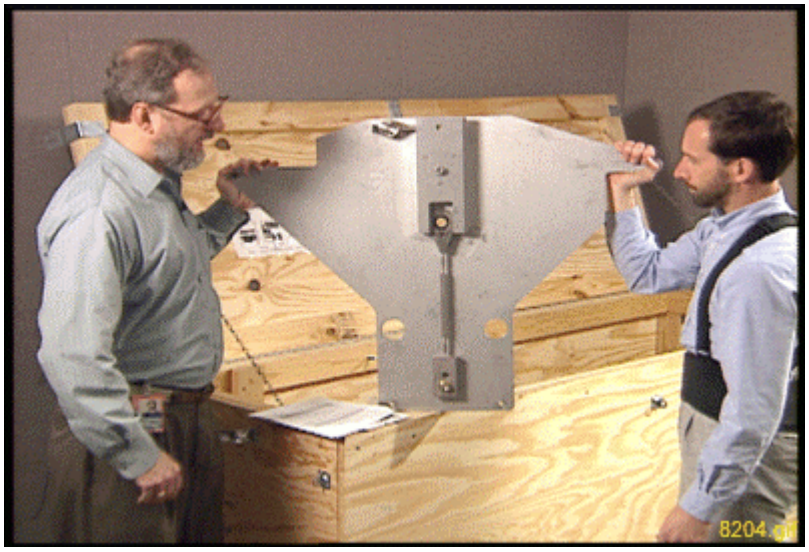
INSTALL TUBE GUIDE ROLLER ASSEMBLY
ILLUSTRATION 4-5

4- DEFECTIVE GRADIENT COIL REMOVAL PROCEDURE (continued)

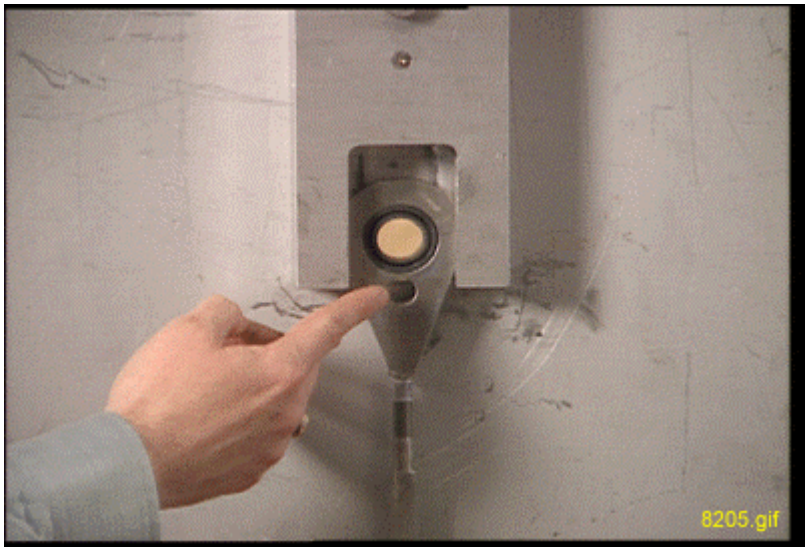
Note

Each assembly requires 4 bolts and 1 stud.

6. Remove the Tube Support Plate Assembly from the crate. See Illustration 4-6A. Adjust the alignment bearing for center position as viewed from the side with the round cut out. See Illustration 4-6B.



TUBE SUPPORT PLATE ASSEMBLY
ILLUSTRATION 4-6A



ALIGNMENT BEARING TO CENTER POSITION
ILLUSTRATION 4-6B

Note

For the vertical adjustment a clockwise rotation results in the alignment bearing moving down. Use an adjustable wrench for the vertical adjustment. For the horizontal adjustment a clockwise rotation results in the alignment bearing moving to the left. Use the 3/8 inch T-bar allen wrench for the horizontal adjustment.

4- DEFECTIVE GRADIENT COIL REMOVAL PROCEDURE (continued)

CAUTION

Do NOT use force on any stud or bolt used to secure the insertion tool hardware to the magnet interface ring or Gradient Coil. The potential exists for a stud or bolt to gall the threads on the interface ring or Gradient Coil.

7. Go to the rear of the magnet and Install the Tube Support Plate onto the end flange.

Note

For magnets with a Horizon Enclosure use the existing enclosure end bell studs and nuts for securing the plate to the end flange. For magnets with a Wide Open Enclosure use the M10 X 25 studs supplied with the insertion tool. Make sure the plate does not crimp or pinch the gradient cables. See Illustration 4-7A.

SECURE TUBE SUPPORT PLATE TO END FLANGE
ILLUSTRATION 4-7A

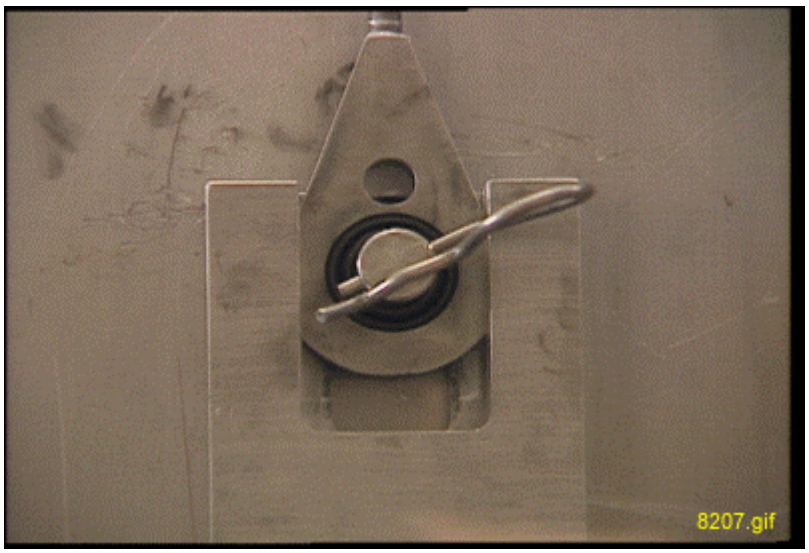
4- DEFECTIVE GRADIENT COIL REMOVAL PROCEDURE (continued)

8. Remove the Male Tube Assembly from the crate and remove the cotter pin from the shaft. Slowly install the tube, shaft end first, through the front Tube Guide Roller Assembly, then through the rear Tube Guide Roller Assembly and finally guide the shaft through the alignment bearing. View video of tub insertion.

Note

Be very careful not to force the shaft through the alignment bearing. Make vertical or horizontal adjustments to bring the alignment bearing in alignment with the tube shaft.

9. Install the cotter pin after the shaft is in place. See Illustration 4-7B



INSTALL COTTER PIN
ILLUSTRATION 4-7B

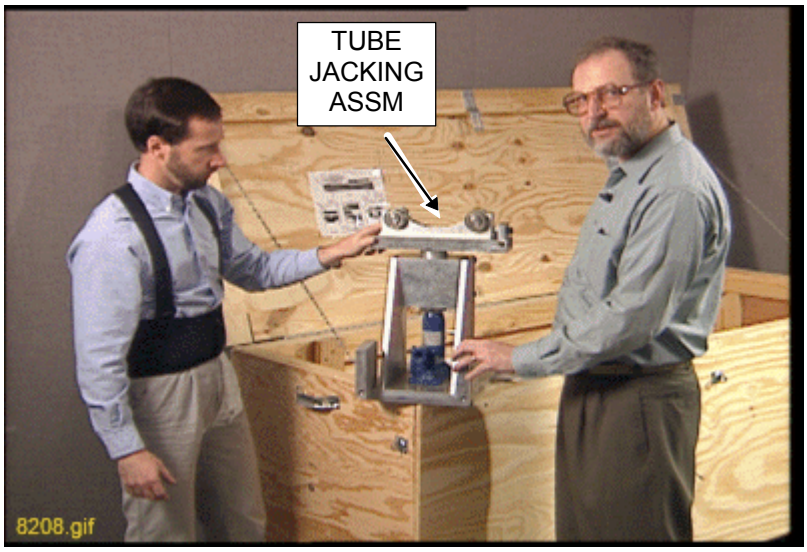
10. Remove the Female Tube Assembly from the crate. Support the Female Tube Assembly on the Tube Jack Assembly, then thread it onto the Male Tube Assembly.

CAUTION

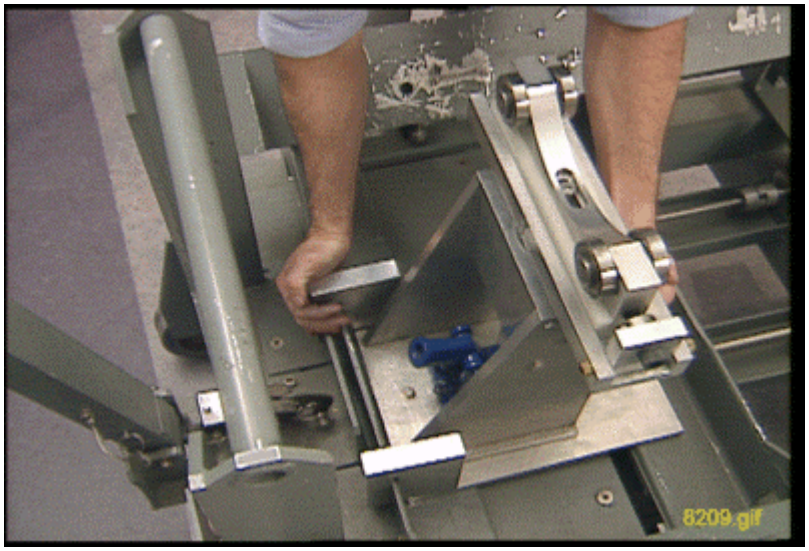
The jack on the Tube Jacking Assembly is ferrous. Personal injury or equipment damage may result if taken too close to the magnet. Always keep the Tube Jacking Assembly mounted and screwed to the aluminum coil cradle when used in the magnet room.

4- DEFECTIVE GRADIENT COIL REMOVAL PROCEDURE (continued)

11. Remove the Tube Jacking Assembly from the crate. See Illustration 4-8A. Install it onto the empty cradle/cart assembly outside of the magnet room. Secure with bolt through Tube Jack Assembly Base Plate. See Illustration 4-8B.



TUBE JACKING ASSEMBLY
ILLUSTRATION 4-8A

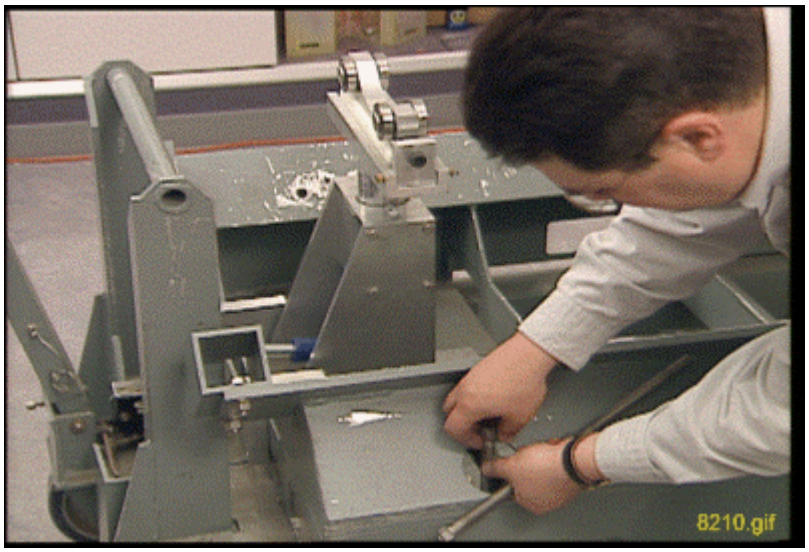


SECURE TUBE JACKING ASSEMBLY
ILLUSTRATION 4-8B

12. Move the empty cradle/cart assembly into the magnet room. Position the cart in front of the magnet and center the cart left/right in respect to the patient bore. Lift the Tube Assembly and set it onto the Tube Jack Assembly. Make sure the Tube Jack Assembly is physically centered and the left/right adjustments are at a nominal setting before starting the next step. Use a 5/16 inch right angle allen wrench to tighten the Tube Jack Assembly to the cart.

4- DEFECTIVE GRADIENT COIL REMOVAL PROCEDURE (continued)

13. Remove the Gradient Coil cradle fasteners, two per side, from the cradle. See Illustration 4-9.

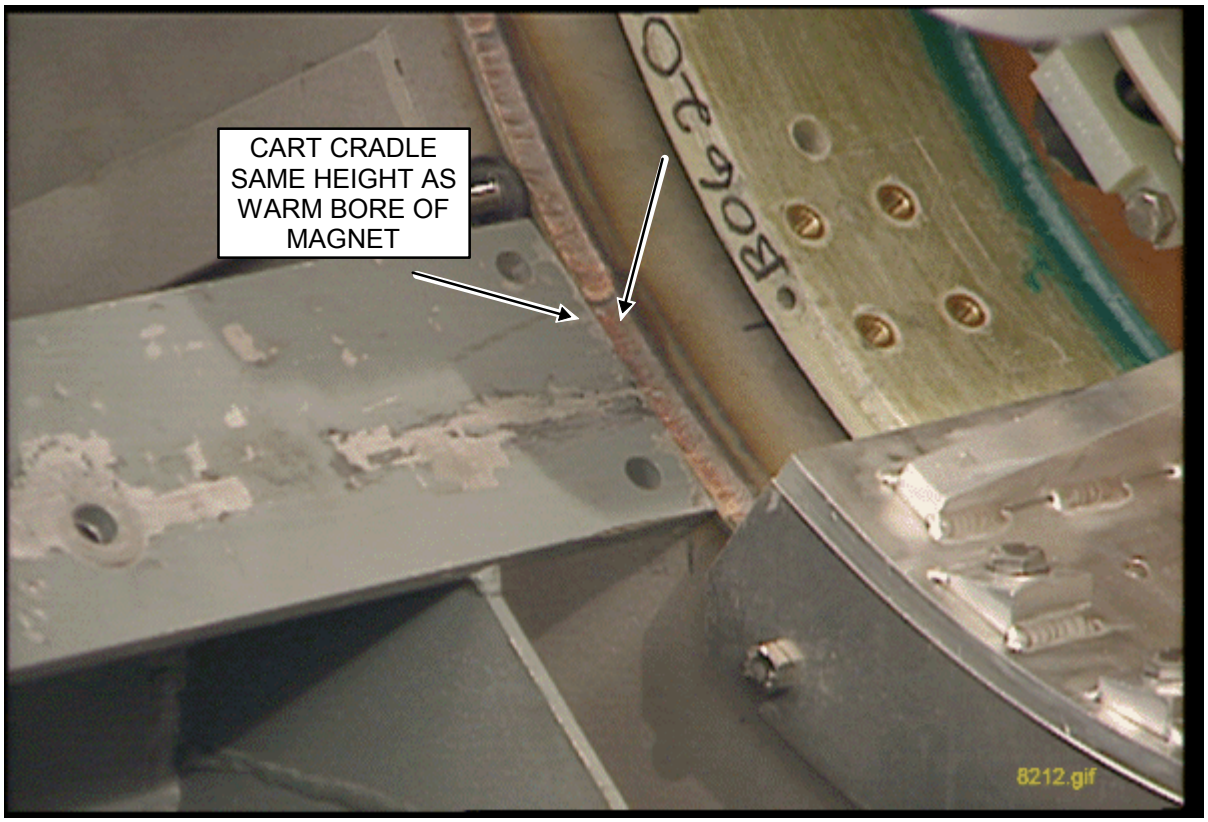


REMOVE GRADIENT COIL CRADLE FASTENERS
ILLUSTRATION 4-9

14. Adjust the height of the cart as shown in Illustration 4-10A. Tool to use: 19mm socket. Adjust height so the end of the cradle is the same height as the warm bore of the magnet and flush against the end flange See Illustration 4-10B.

ADJUST CART HEIGHT
ILLUSTRATION 4-10A

4- DEFECTIVE GRADIENT COIL REMOVAL PROCEDURE (continued)



ADJUST CART HEIGHT TO WARM BORE HEIGHT
ILLUSTRATION 4-10B

15. Release the hand lever on the cart handle to set the brakes so the cart will not move after the cart is aligned to the magnet bore.

CAUTION

For the next two steps, the coil is still attached to the end flanges of the magnet with the brackets. Do not attempt to raise the coil with the jack. The next two steps prepare the roller assemblies to take the Gradient Coil weight when transferred from the magnet to the rollers. Do not attempt to loosen any of the bracket bolts when the Gradient Coil is supported by the tool. Damage to the bolts will result.

16. Operate the jack to raise the tube and watch for the tube to make contact to the upper roller on the front Tube Guide Roller Assembly.

Note

Make sure there is a small amount of resistance to the upward movement of the tube. The top roller should not be able to rotate.

4- DEFECTIVE GRADIENT COIL REMOVAL PROCEDURE (continued)

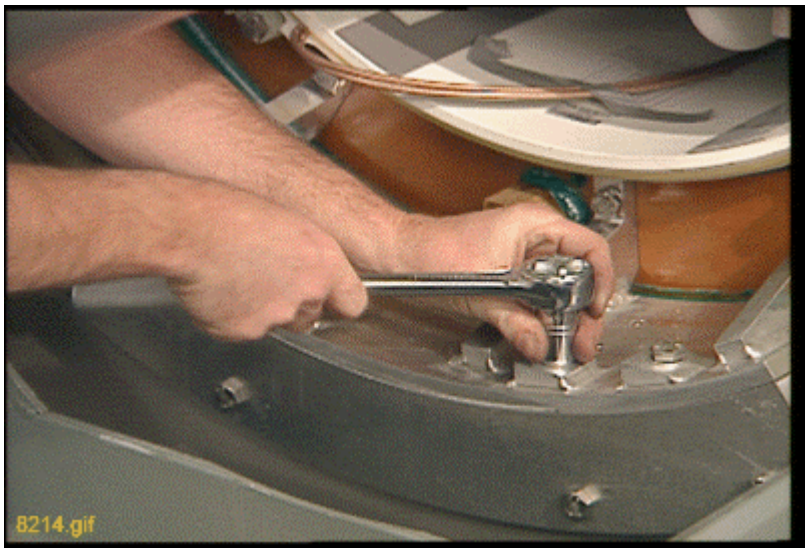
17. Go to the rear of the magnet. Adjust the Alignment Bearing in the vertical direction and watch for the tube to make contact to the upper roller on the rear Tube Guide Roller Assembly. See Illustration 4-11.

ADJUST ALIGNMENT BEARING
ILLLUSTRATION 4-11

Note

Make sure there is a small amount of resistance to the upward movement of the tube. The top roller should not be able to rotate.

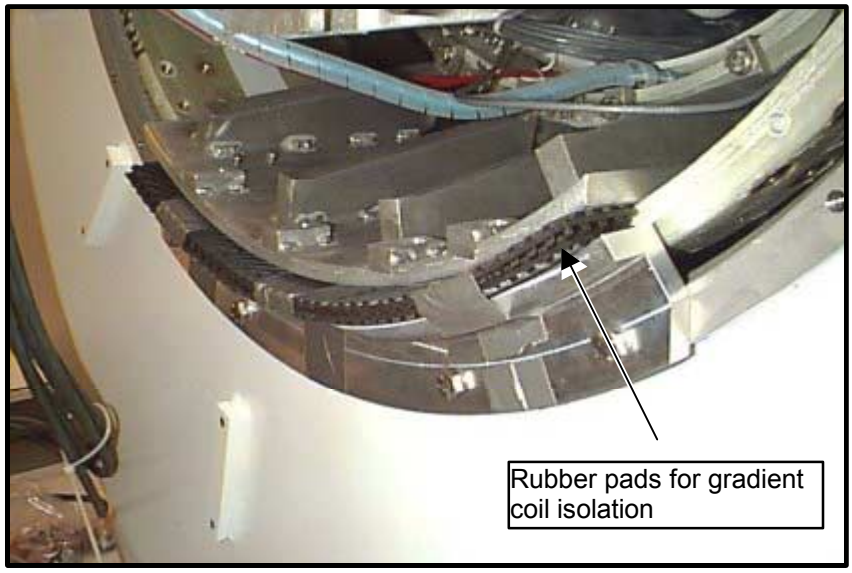
18. Go to the front of the magnet. Perform this step only if the bolts are present. Loosen and remove the 4 bolts from the Gradient Coil bracket which attaches it to the end flange bracket. Tool to use: 17 mm socket and ratchet. See Illustration 4-12.



REMOVE BOLTS FROM GRADIENT COIL BRACKET
ILLUSTRATION 4-12

Note

Some magnets have rubber pads installed between the Gradient Coil bracket and the Magnet End Flange bracket. This configuration utilizes special hardware and does not use the mounting bolts mentioned in Steps 18 and 20. See Illustration 4-13.



GRADIENT ISOLATION CONFIGURATION
ILLUSTRATION 4-13

19. Check tube with a level on top of Female Tube Assembly. Make any adjustments with either the jack in the front or the Alignment Bearing in the rear.

20. Go to the rear of the magnet. Perform this step only if the bolts are present. Loosen and remove the four bolts from the Gradient Coil bracket which attaches it to the end flange bracket. Tool to use: 17 mm socket and ratchet.

21. Go to the front of the magnet. Operate the jack to raise the tube and watch for the Gradient Coil bracket to raise up off of the end flange bracket. A gap of 1/8 inch or 2 mm is sufficient. Make sure there is no contact with the warm bore or in bore passive shims.

22. Remove the end flange bracket from the front end of the bore. Tool to use: 17 mm socket and ratchet.

4- DEFECTIVE GRADIENT COIL REMOVAL PROCEDURE (continued)

23. Go to the rear of the magnet. Adjust the Alignment Bearing in the vertical direction and watch for the Gradient Coil bracket to raise up off of the end flange bracket. A gap of 1/8 inch or 2 mm is sufficient. Make sure there is no contact with the warm bore or in bore passive shims.

24. If this site has the gradient isolation kit remove the rubber pads between the Gradient Coil bracket and the end flange bracket.

Note

Do not remove the end flange bracket on the rear of the magnet.

25. Go to the front of the magnet. Verify there is sufficient clearance all around the Gradient Coil for removal onto the cradle and cart.

CAUTION

Make sure the brakes are set on the cart before performing the next step. Personal injury or equipment damage may result if the brakes are not set properly. Make sure to watch and guide all cables attached to the BRM during the removal process. Damage to cables or Gradient Coil may occur if a cable is pinched, cut or snagged.

26. Slowly pull the Gradient Coil forward on the tube and watch the clearance around the coil to make sure it is concentric and level with the bore. This step requires 3 FE's; one in rear to push the coil and guide cables through the bore and two in front to pull on the coil.

CAUTION

Minimize the rotation of the coil on the tube. Damage to the roller assemblies could result.

4- DEFECTIVE GRADIENT COIL REMOVAL PROCEDURE (continued)

27. Continue to move the coil over the cart until it is 1/2 of the way out, just before the cradle gusset near the Jack Assembly. Remove the Gradient Coil Support Bracket from the front end of the Gradient Coil. Access to the 8 allen head bolts is from below the Gradient Coil. Tool to use: 17 mm socket and 8 mm allen wrench. See Illustration 4-12. Then remove the 3 bolts that hold the bracket to the coil.

28. Remove the Gradient Coil Roller assemblies, quantity 2, from the tool crate. See Illustration 4-14.

GRADIENT COIL ROLLER ASSEMBLIES
ILLUSTRATION 4-14

29. Prepare the Gradient Coil Roller assemblies by removing the roller and pin.

30. Install the Gradient Coil Roller assemblies, provided in the kit, onto the front end of the Gradient Coil. Tool to use: 17 mm socket.

Note

The rollers will be used to transfer the load from the Support Tube to the Gradient Coil and Cart at this end of the Gradient Coil. The load at the other end of the Gradient Coil will still be supported by the Support Tube and Tube Support Plate Assembly.

31. Make sure the roller brackets are in line with the shipping bracket holes on the cradle. This alignment is necessary for installing the shipping blocks later in the procedure.

CAUTION

Watch for tube deflection when adjusting the jacking screws in the next step. Any tube deflection indicates the Gradient Coil is in contact with the warm bore thereby resisting free motion. Personal injury or damage to the tool could result.

4- DEFECTIVE GRADIENT COIL REMOVAL PROCEDURE (continued)

32. Adjust the jacking screws on the roller block to raise the coil high enough for installation of the rollers.

33. Install the rollers onto the brackets.

34. Slowly lower the jack to allow the Gradient Coil weight to transfer to the Gradient Coil rollers.

CAUTION

The jack on the Tube Jacking Assembly is ferrous. Personal injury or equipment damage may result if taken too close to the magnet. Keep as far away from magnet bore as possible when removing from magnet room.

35. Remove the bolt from the Tube Jack Assembly baseplate, remove the jack and take it out of the magnet room. The cradle is now clear to allow the Gradient Coil to move forward on the cart.

36. With 3 FE's pulling from the front, move the Gradient Coil over the cradle so it is centered from front-to-back on the cradle.

Note

It may be necessary to lower the cart to allow the back end of the Gradient Coil to clear the cradle.

4- DEFECTIVE GRADIENT COIL REMOVAL PROCEDURE (continued)

37. ***CRITICAL STEP!*** Make sure the shipping bracket holes for the gradient coil will line up with the holes on the cradle of the cart before removing the rollers. See Illustration 4-15. The BRM, BRM-D, and CRM each have unique holes in the cart for shipping, be sure to align the BRM, BRM-D, or CRM to the respective holes on the shipping cart. You may have to rotate the Gradient Coil and/or move forward or back on the cradle to align the holes. See Illustration 5-2 for picture of shipping bracket installed.

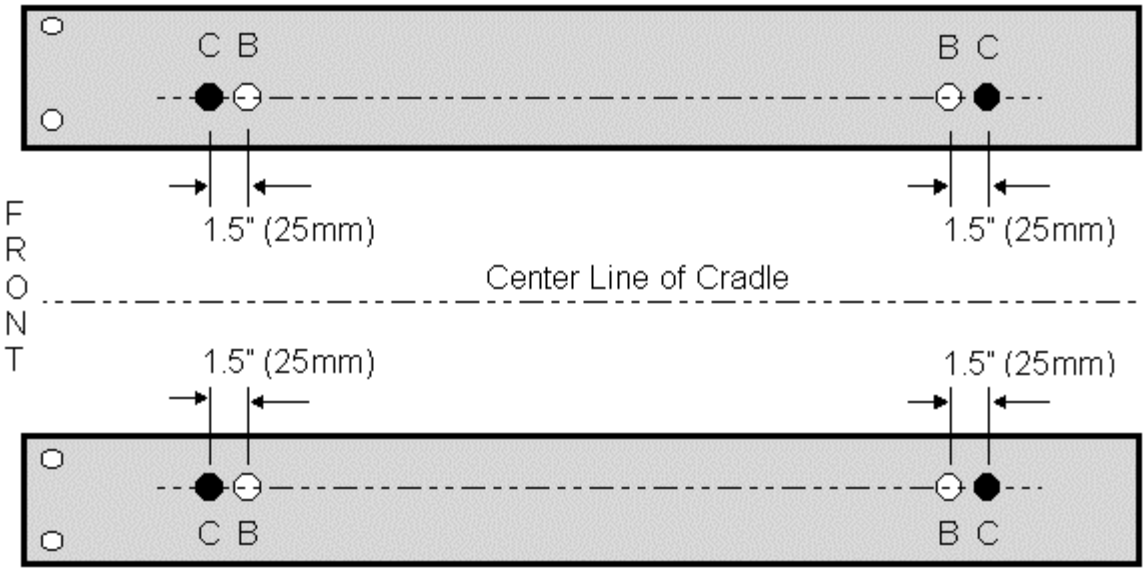
Note

The Aluminum Cradle for BRM (2134810-3) used to replace a BRM in a CX magnet must be modified for the longer CRM. Additional front and rear stop block mounting holes (labeled “C” for “CRM”) are being added to the aluminum cradles that are sent with BRM and CRM FRU’s from headquarters. Field cradles returned with failed BRM’s and CRM’s will also be upgraded by manufacturing as necessary. If an unmodified service aluminum cradle will be used to return a failed CRM, it must be field modified, per Illustration 4-15, before shipment.

① Mark the center on four holes labeled "C" (each end; both sides).

② Drill four 0.625 inch (16mm) diameter holes for CRM mounting.

③ Temporarily mark "B" and "C" holes using a marking pen (manufacturing will stamp permanent identifiers when the cradles are returned).



C = CRM Mounting Holes; B = BRM/BRM-D Mounting Holes

COIL CRADLE MOUNTING HOLES
ILLUSTRATION 4-15

38. Slowly lower the back end of the Gradient Coil onto the cradle by lowering the alignment bearing at the back end of the magnet.

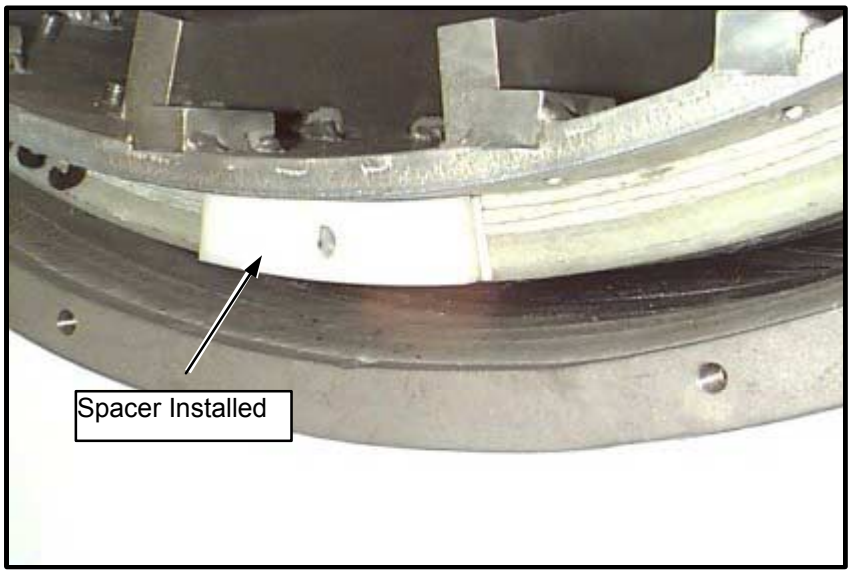
4- DEFECTIVE GRADIENT COIL REMOVAL PROCEDURE (continued)

CAUTION

Make sure the weight of the Gradient Coil has transferred from the tube to the cradle/cart before proceeding to the next step. Personal injury or equipment damage may result if the load was not transferred.

39. Adjust the jacking screws on the roller block for wheel removal, remove the rollers and pins then lower adjust the jacking screws to lower the Gradient Coil to the cradle.

40. Perform this step only if the Gradient Coil has the Isolation Hardware installed. Remove the front and rear spacer's on the gradient coil and be careful not to interchange. The front spacer must go on the front location of the replacement coil. See Illustration 4-16 for the location of the spacer.



SPACER LOCATION
ILLUSTRATION 4-16

41. Remove the Gradient Coil Roller Bracket assemblies. See Illustration 4-17.

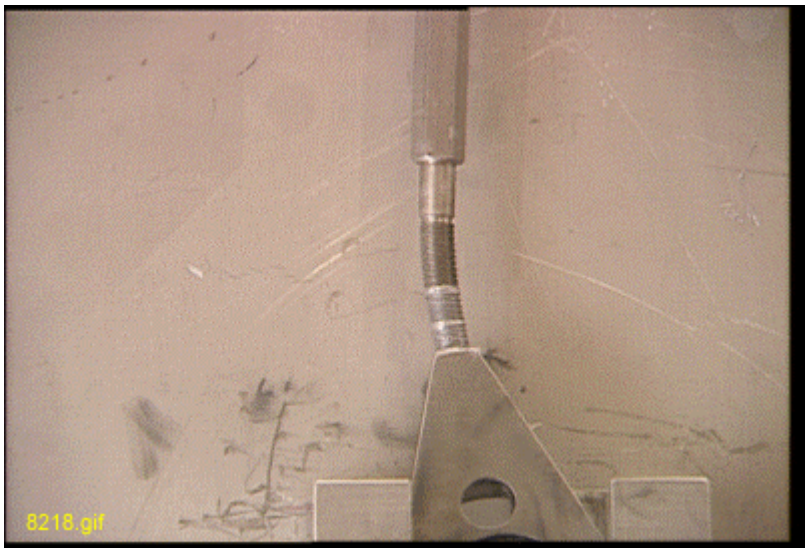
REMOVE BRM ROLLER BRACKET ASSEMBLIES
ILLUSTRATION 4-17

42. Adjust the cart height and the vertical adjustment of the Alignment Bearing to remove the load from the top rollers inside the Gradient Coil.

4- DEFECTIVE GRADIENT COIL REMOVAL PROCEDURE (continued)

CAUTION

The support tube must not be lowered or rotated off horizontal when the shaft on the support tube is installed in the Support Tube Plate Assembly. Damage will occur to the vertical adjustment rod on the Support Tube Plate Assembly. See Illustration 4-18 for example of what damage can occur.



DAMAGED ALIGNMENT BEARING
ILLUSTRATION 4-18

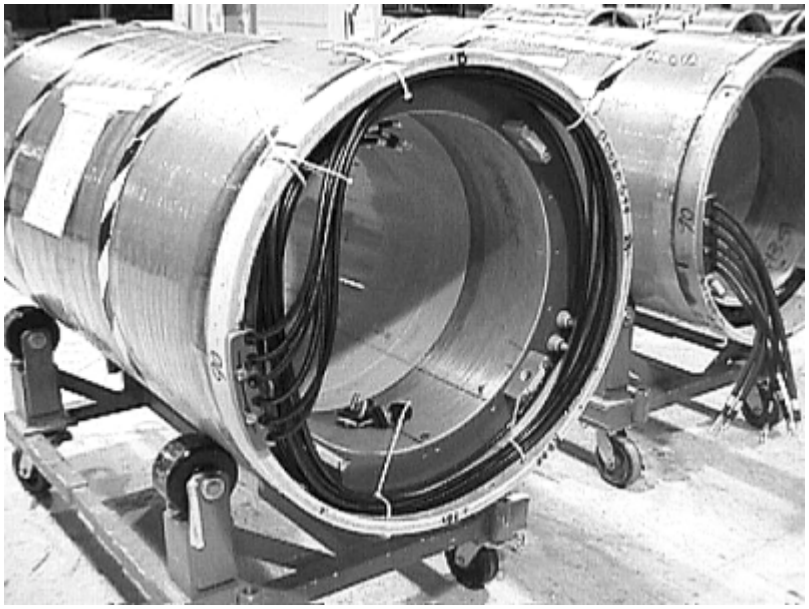
43. Get the rope supplied in the kit and route it under the support tube between the end flange of the magnet and the Gradient coil. Attach the rope the enclosure frame brackets on the cryostat. Adjust the height of the rope so it will provide support for the tube during the disassembly process.

44. The 3 FE's required for this step are positioned as follows: #1 is in the rear of the magnet to remove the cotter pin and to support the tube as it is removed from the Alignment Bearing. #2 is between the coil cart and the magnet, to unthread the tube sections as #1 supports the back part of the section in the bore after the shaft is removed from the Alignment Bearing. #3 is in the front of the coil cart and pulls on the cart after #1 removes the cotter pin; pulling just enough for the shaft of the tube to pull free from the Alignment Bearing.

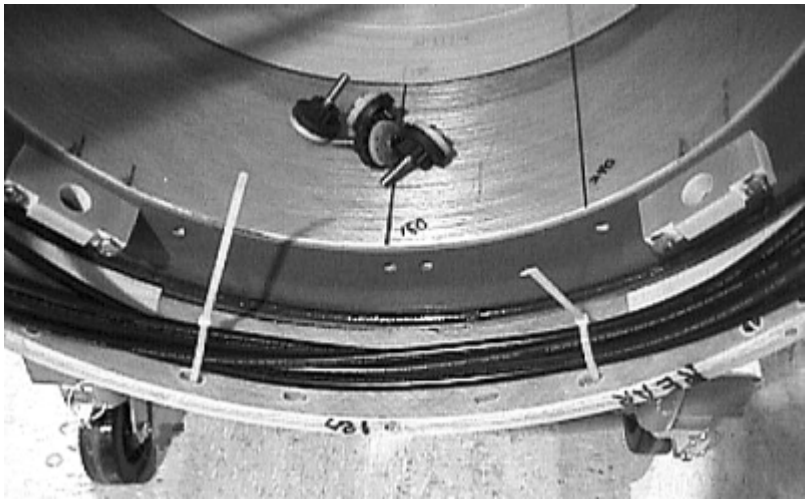
45. Unthread the tube leaving one section in the bore (supported by the rope and Tube Support Plate Assembly) and leave the other section in the Gradient coil on the cart.

4- DEFECTIVE GRADIENT COIL REMOVAL PROCEDURE (continued)

46. For the BRM-D and CRM coils, the long gradient cables need to be looped inside the gradient and ty-wrapped to prevent damage during shipping. See Illustration 4-19 and Illustration 4-20.



CABLES TY-WRAPPED IN GRADIENTS
ILLUSTRATION 4-19



TY-WRAPPED CABLES
ILLUSTRATION 4-20

47. Release the brake on the cart and slowly back the cart with the coil out of the room.

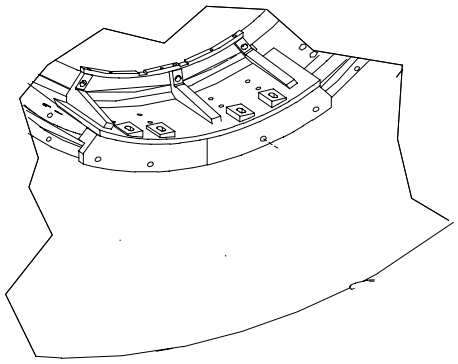
5- NEW GRADIENT COIL PREPARATION PROCEDURE

1. Remove the Tube and the two Tube Guide Roller Assemblies from the defective Gradient coil and install one onto each end of the new Gradient Coil Assembly.

2. Remove the Gradient coil brackets from the defective Gradient coil and install one onto each end of the new Gradient coil Assembly.

Note

The brackets in the WideOpen Enclosure differ from the Cx and LCC Magnets. See Illustration 5-1.



WIDEOPEN BRM-D BRACKETS
ILLUSTRATION 5-1

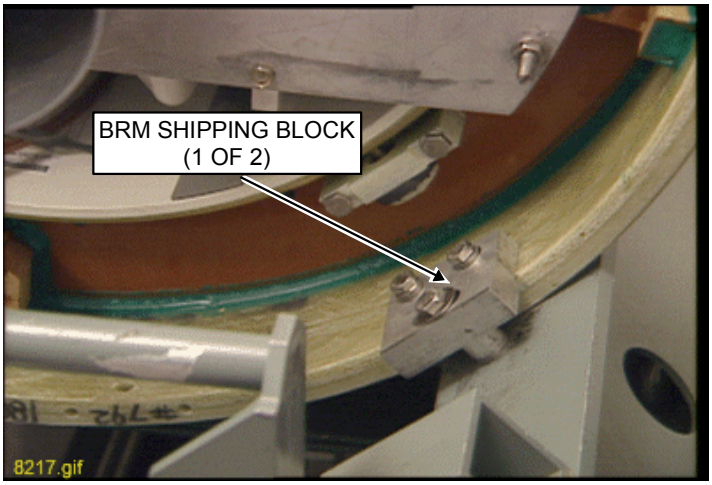
a) Make sure all mounting locations are clear of debris (threaded and unthreaded).
b) Clean all threaded openings and mounting bolts with alcohol.
c) Place two drops of Red Loctite # 271 (p/n 46-170684p2) onto the bottom two to three threads of the M10 x 25 mm hex head bolts. Install the bolt and hand tighten only. There are 3 bolts for each bracket.
d) Place two drops of Blue Loctite # 242 (p/n 46-170686p3) onto the bottom two to three threads of the M10 x 40 mm button head screws. Install the screw from the bottom of the coil and hand tighten only. There are 8 screws for each bracket.
e) Tighten the M10 x 25 mm hex head bolts.
f) Tighten the M10 x 40 button head screws.

3. Remove the shipping blocks from the new Gradient coil and cradle.

4. Remove the Gradient Coil roller assemblies from the defective Gradient coil and install onto the front end of the new Gradient coil.

5- NEW GRADIENT COIL PREPARATION PROCEDURE (continued)

5. Install the shipping blocks onto the defective Gradient coil cradle one on each end. See Illustration 5-2.



INSTALL GRADIENT COIL SHIPPING BLOCKS
ILLUSTRATION 5-2

Note

Lift the defective Gradient coil and cradle from the cart using a fork lift, or other lifting method that is capable of lifting 4000 lbs (1815 kg), and place on the ground. Lift the new Gradient Coil and cradle onto the cart using the same method

6. Wash the threaded holes on the end flange of the magnet with alcohol to make it ready for the mounting bracket.

6- NEW GRADIENT COIL INSTALLATION PROCEDURE

1. Move the new Gradient coil and cradle/cart assembly into the magnet room. Position the cart in front of the magnet and center the cart left/right in respect to the patient bore. Provide enough room for an FE to stand between the cart and the magnet So the FE can thread the support tube sections together.

2. Release the handle to set the cart brakes so the cart will not move after the cart is aligned to the magnet bore.

3. Adjust the height of the cart so the end of the Tube is the same height as the Tube in the warm bore of the magnet.

4. Slowly thread the Tube sections together.

Note

Be very careful not to force the threads. Make vertical or horizontal adjustments, as necessary, to the alignment bearing or cart for an easy fit.

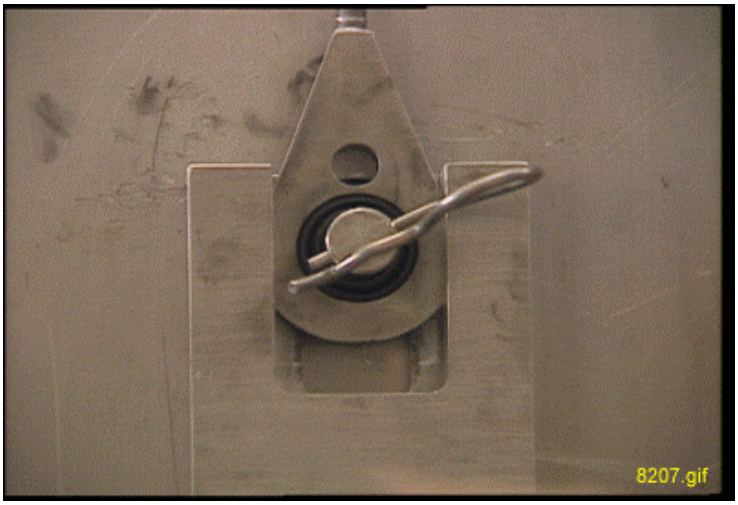
6- NEW GRADIENT COIL INSTALLATION PROCEDURE (continued)

5. Slowly install the tube, shaft end first, through the front Tube Guide Roller Assembly, then through the rear Tube Guide Roller Assembly and finally guide the shaft through the alignment bearing.

Note

Be very careful not to force the shaft through the alignment bearing. Make vertical or horizontal adjustments to bring the alignment bearing in alignment with the tube shaft.

6. Install the cotter pin after the shaft is in place. See Illustration 6-1.



INSTALL COTTER PIN
ILLUSTRATION 6-1

7. Remove the rope from the enclosure frame bracket.

8. Go to the rear of the magnet. Adjust the Alignment Bearing in the vertical direction and watch for the tube to make contact to the upper roller on the rear Tube Guide Roller Assembly. Continue to raise the Alignment Bearing until the back end of the Gradient coil starts to raise off of the cradle.

Note

When this happens the load at the back end of the Gradient coil is transferred from the cradle to the Support Tube and magnet.

9. Slowly push the Gradient coil toward the magnet on the rollers until there is enough clearance to install the Tube Jacking assembly.

10. Install the Tube Jacking assembly and align it, Left/Right, to the center of the Tube.

11. Operate the jack to raise the tube to allow for the removal of the Gradient coil Roller assemblies.

12. Remove the Gradient coil Roller Assemblies and return these parts to the shipping case.

6- NEW GRADIENT COIL INSTALLATION PROCEDURE (continued)

13. Check for proper clearance around the Gradient coil assembly in respect to the magnet bore opening. Make adjustments to the jack and alignment bearing to produce a fit that is symmetrical and level to the bore.

14. Slowly push the Gradient coil into the magnet bore and watch the clearance at both ends. Make sure the Gradient coil is elevated high enough in order for the Gradient coil support bracket to clear the End Flange Bracket at the back end of the magnet. Continue to install until the Gradient coil is centered from front to back in the bore.

CAUTION

Failure to use the correct length bolt for the end flange brackets could result in damage to the vacuum vessel.

15. Before installing the End Flange Bracket, clean the M10 x 25 mm bolts with alcohol.

16. Install the End Flange Bracket on the front of the magnet. Make sure to use the M10 x 25mm bolts and do not force the bolts when threading into the end flange.

17. Align the Gradient coil Support Bracket holes to the End Flange Bracket holes using the the M10 x 40 bolts. Do Not tighten the bolts until the Gradient coil Support Bracket is flush against the End Flange Bracket. This is accomplished in step 19.

18. If this site has the Gradient Isolation Kit make sure the rubber pads are inserted between the BRM bracket and the end flange bracket. Make sure the coil has the proper rotation by aligning the bracket on the gradient coil to the bracket on the magnet. Make sure the weight of the gradient coil is transferred to the end flange bracket, not the spacer.

19. Slowly lower the BRM until the BRM weight has transferred from the Support Tube to the Support Brackets. Make sure the outer diameter of the BRM is concentric to the inside diameter of the warm bore. In other words the measured gap is the same between the BRM coil and the warm bore at all accessible points on the circle.

20. Remove the Female Support Tube and return this part to the shipping case.

21. Remove the Male Support Tube with cotter pin and return this part to the shipping case.

22. Remove the cart/cradle from the magnet room. Remove the Tube Jacking Assembly from the cradle and return this part to the shipping case.

23. Remove the Tube Support Plate Mounting Hardware from the rear end flange and return these parts to the shipping case.

24. Remove the two Tube Guide Roller Assemblies from the Gradient coil and return this part including the mounting hardware to the shipping case.

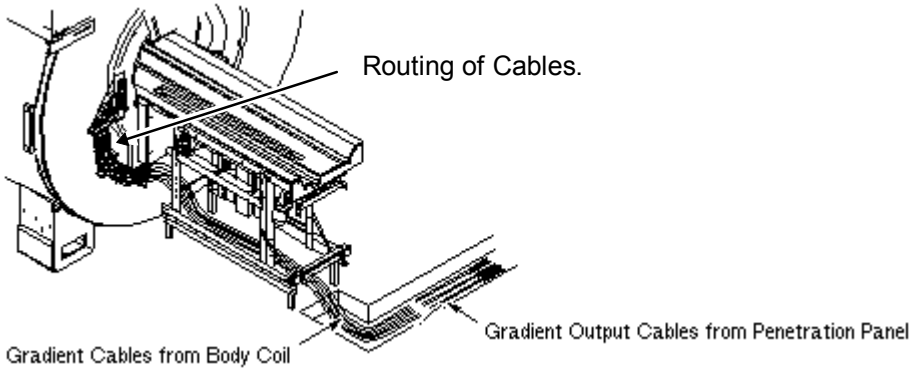
25. Perform this step only if one coil cart is used. Lift the defective Gradient coil and cradle from the ground to the cart and secure in place in preparation for shipment.

6- NEW GRADIENT COIL INSTALLATION PROCEDURE (continued)

26. Install Radial Support Blocks. If your system has the Gradient Isolation kit the Radial Support Blocks are not used.

27. Install the air seals around the Gradient Coil.

28. Install the Terminal Block on CX Magnets. (The Terminal Block is not used on an LCC Magnet, cables are routed as shown in Illustration 6-2.)



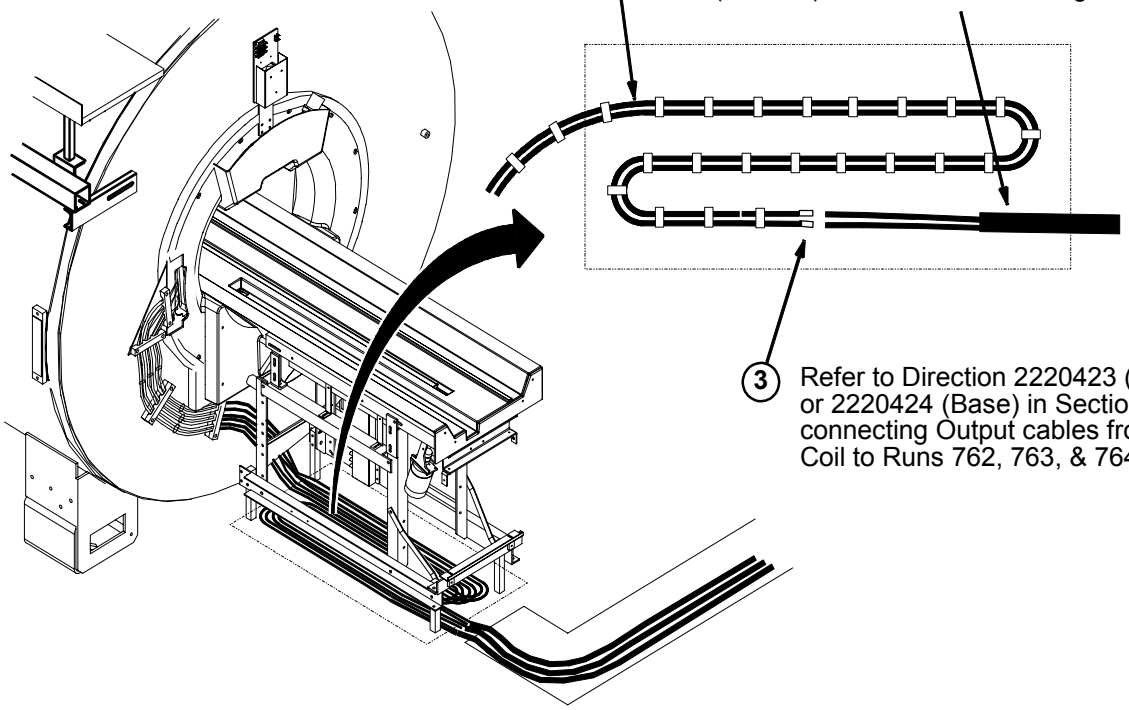
ROUTING OF CABLES
ILLUSTRATION 6-2

Note

Illustration 6-2 shows a typical cable routing for connection of the gradient output cables within an enclosed cable trough. If Site does not have enclosed cable trough, cables must be routed in serpentine manner and connected within Rear Pedestal as shown in Illustration 6-3.

6- NEW GRADIENT COIL INSTALLATION PROCEDURE (continued)

NOTE:Gradient output cables should be routed and connected within Rear Pedestal if enlosed cable trough is not available. For clarity, only one of the three sets of Gradient Output cables is shown below.

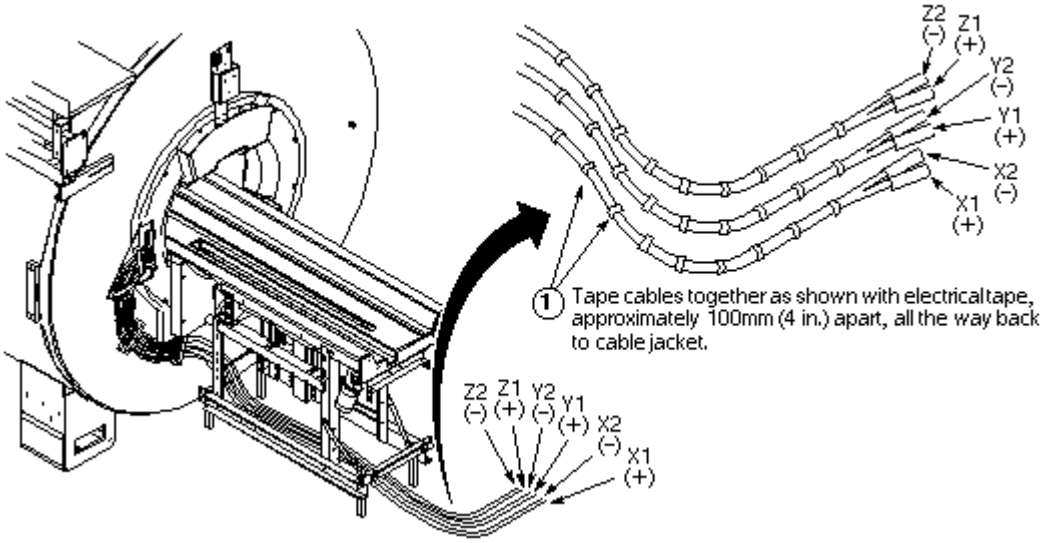


SERPENTINE CABLE ROUTING
ILLUSTRATION 6-3

30. Attach the water lines to the Gradient coil.

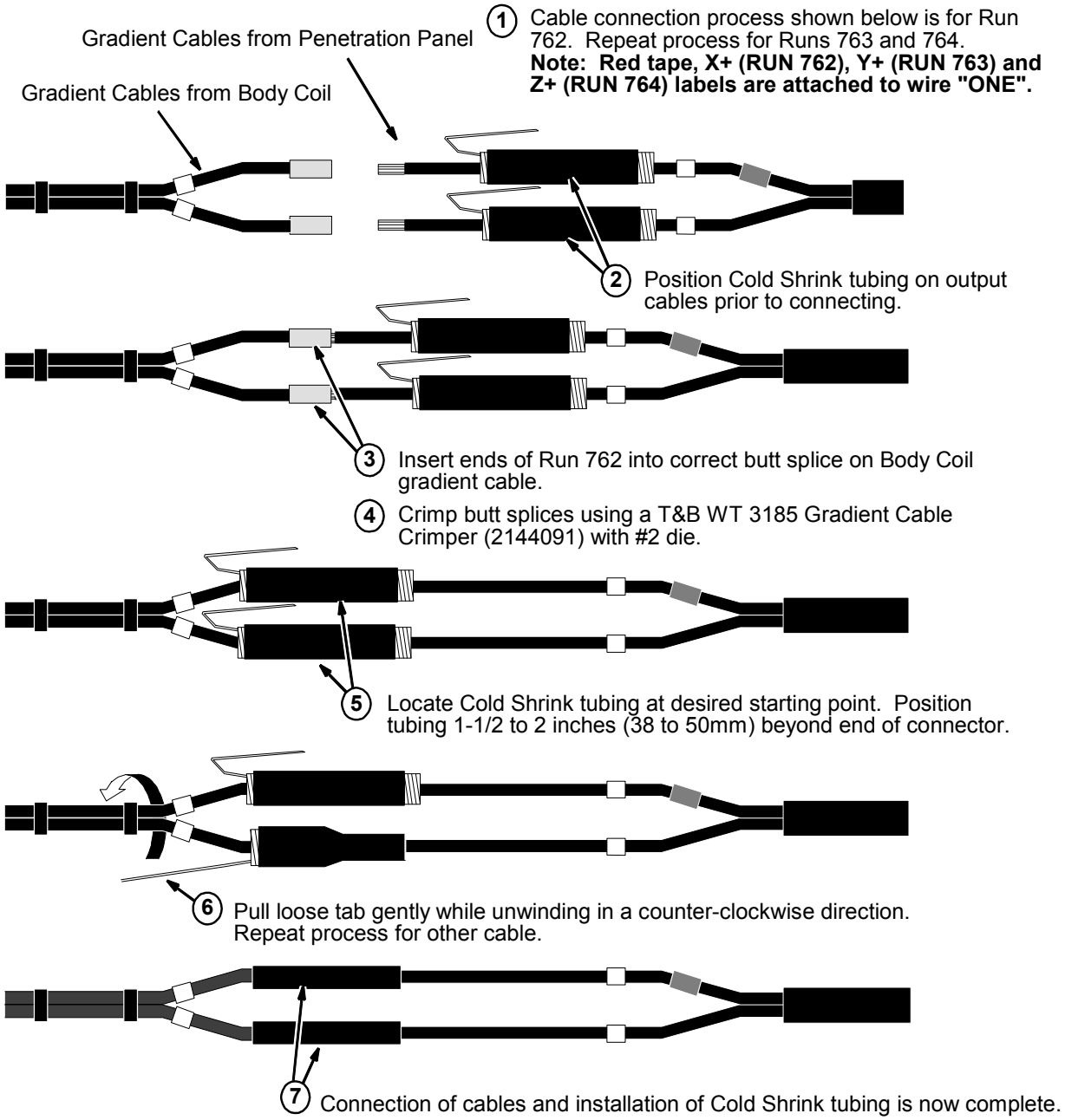
6- NEW GRADIENT COIL INSTALLATION PROCEDURE (continued)

31. Connect spliced cables. See Illustration 6-4 and Illustration 6-5.



CABLE PREPARATION
ILLUSTRATION 6-4

6- NEW BRM INSTALLATION PROCEDURE (continued)



CONNECTING SPLICED CABLES
ILLUSTRATION 6-5

31. Install RF Tube Assembly, refer to RF Body Coil Replacement procedures

32. Attach RF and bias cables.

33. Re-install the remaining patient handling and enclosure parts.

32. Perform Pre-requisite (Section 3) procedures in reverse order.

33. Finished

7- GRADIENT COIL REPLACEMENT IN A MOBILE

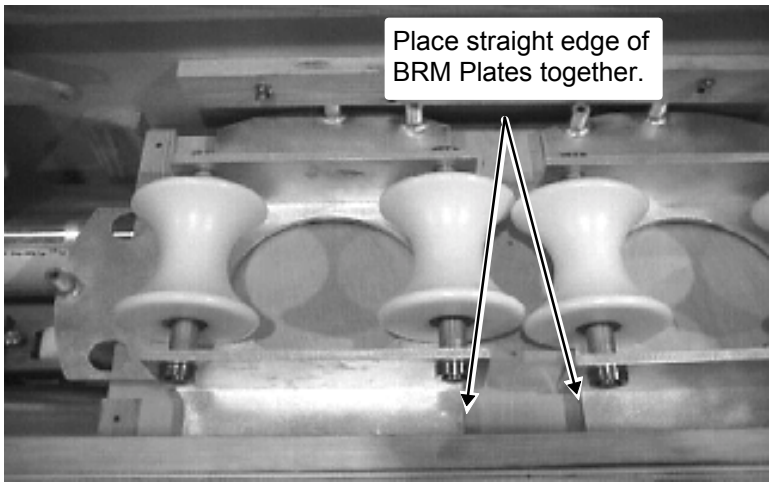
Additional Requirements for Gradient coil Replacement in a Mobile include:

- Total of 4 Field Engineers vs. 3 for fixed site
- Forklift with side-to-side fork motion ability
- Experienced forklift driver (precise movement of the forklift is required)
- 4 x 8 sheet of plywood cut to fit on the floor behind the magnet

The procedure is essentially the same, however the Gradient coil is removed from the rear of the magnet vs. from the front for a fixed site.

8- RETURNING PLATES TO GRADIENT INSERTION TOOL KIT

1. BRM plates with the rollers attached (spacers pointing up) are placed in the crate. See Illustration 8-1.

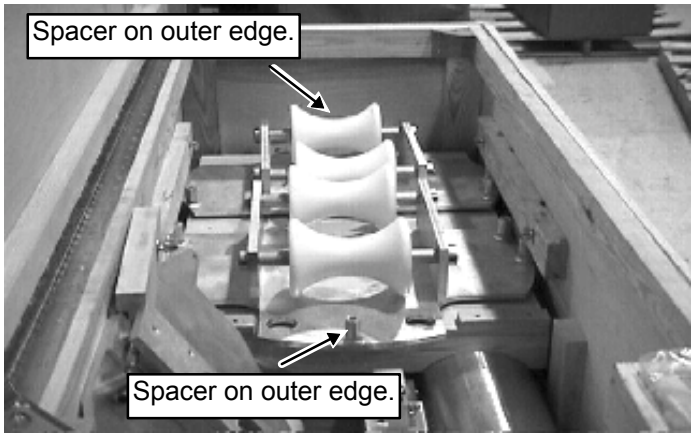


PLACEMENT OF BRM PLATES
ILLUSTRATION 8-1

2. Install threaded rod through spacer on the outer edge of the BRM plate (see Illustration 8-2) and secure with washer and nut on bottom of BRM plate (see Illustration 8-3).

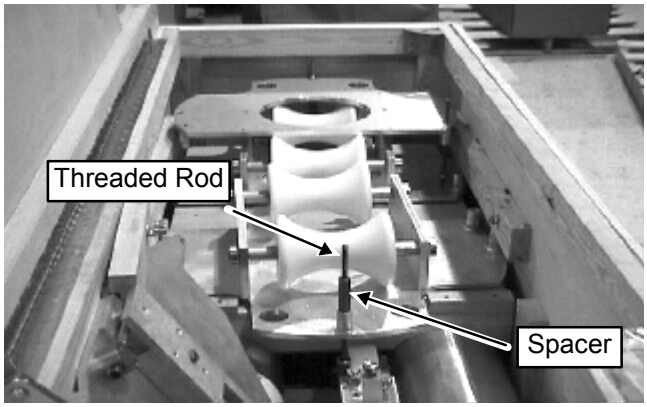
Note

Slide threaded rod with washer and nut attached on end through the bottom of the spacer.



BRM PLATE SPACER LOCATIONS
ILLUSTRATION 8-2

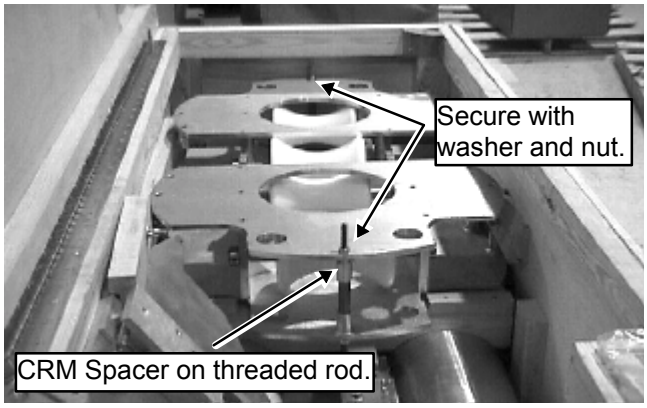
8- RETURNING PLATES TO GRADIENT INSERTION TOOL KIT (continued)



THREADED ROD AND SPACER ATTACHED TO BRM PLATE
ILLUSTRATION 8-3

3. Install spacer on both threaded rods. See Illustration 8-3.

4. Install CRM plates (labeled *55cm Plate*) onto BRM plates and rollers by placing CRM spacer on the threaded rod. See Illustration 8-4.



PLACEMENT OF CRM PLATES
ILLUSTRATION 8-4

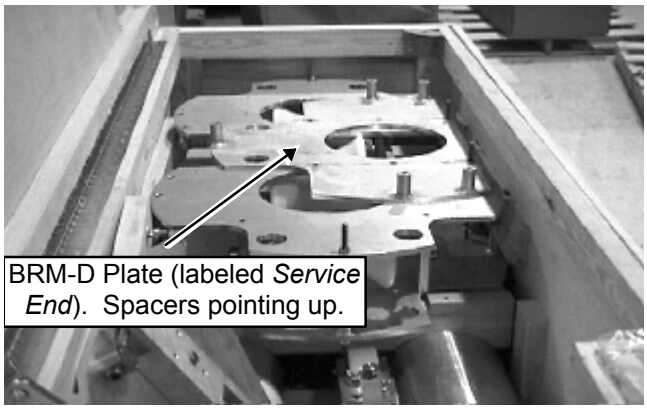
5. Place washer and nut on threaded rod and tighten to secure plates on both ends. See Illustration 8-4.

8- RETURNING PLATES TO GRADIENT INSERTION TOOL KIT (continued)

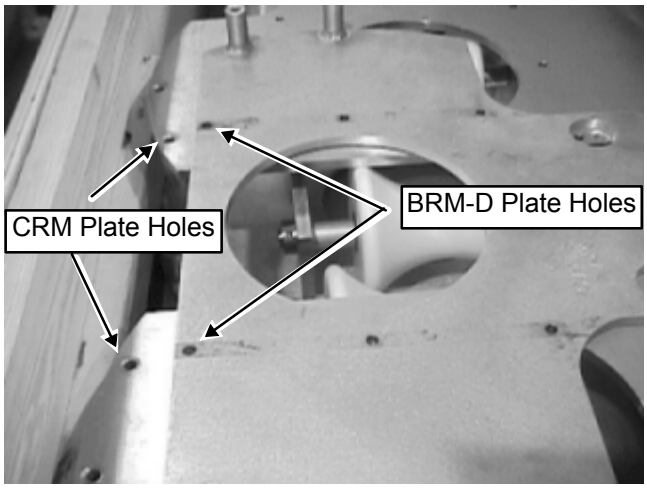
6. Place BRM-D plate labeled *Service End* on CRM plates (see Illustration 8-5). Line up holes on BRM-D plate and CRM plates (see Illustration 8-6).

Note

BRM-D Plate labeled *Service End* has the short spacers.



PLACEMENT OF BRM-D (SERVICE END) PLATE
ILLUSTRATION 8-5



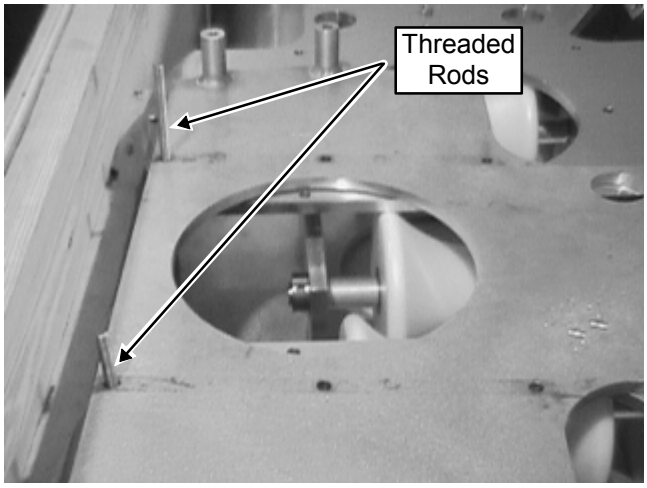
BRM-D PLATE ALIGNMENT
ILLUSTRATION 8-6

7. Move BRM-D plate to wall of crate with holes in Illustration 8-6 aligned.

8- RETURNING PLATES TO GRADIENT INSERTION TOOL KIT (continued)

8. Put washer and nut on one end of both threaded rods.

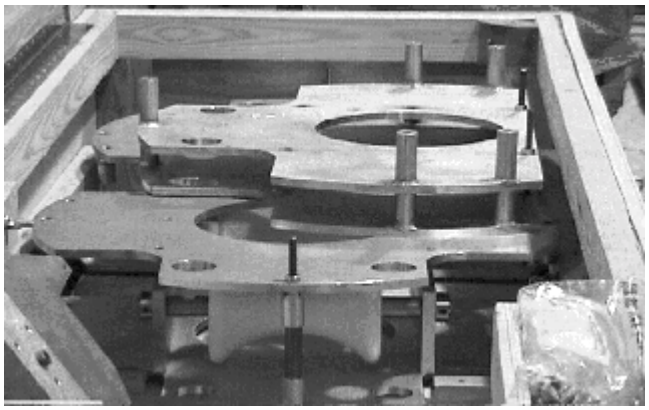
9. Underneath the CRM plates slide the threaded rods through the aligned holes of the CRM and BRM-D plates. See Illustration 8-7.



PLACEMENT OF THREADED RODS IN CRM & BRM-D PLATES
ILLUSTRATION 8-7

Note
Allow the threaded rods to rest on the BRM plates while performing next step.

10. Place the BRM-D plate, labeled *Patient End*, on top of the *Service End* BRM-D plate. Threaded rods will go through the same holes as on the *Service End* BRM-D plate. See Illustration 8-8.



PLACEMENT OF THE PATIENT END BRM-D PLATE
ILLUSTRATION 8-8

11. Place washers and nuts on the threaded rods and secure both ends of rods to plates. Verify all threaded rods are fastened securely so plates do not move during shipping.

REVISION HISTORY

REV	DATE	AUTHOR	PRIMARY REASONS FOR CHANGE
0	May 19, 1997	P. Senski	Initial version released Cx Magnet clinicals in toolbook format
1	Sept. 19, 1997	J. Wolak	Corrected some referencing typos
2	Oct 8, 1997	J. Wolak	Added illustrations and video clips for Cx production release
3	May 6, 1998	B. Schmidt	Added Notes to include CRM installation
4	July 7, 1998	K.Keshena	Added BRM-D information to procedure.
5	August 3, 1998	K.Keshena	Added note stating longer studs need to be used with BRM-D plates.
6	March 31, 1999	K.Keshena	Added illustrations and Procedures for the WideOpen Enclosure.
7	Jan 12, 2000	P. Kargard	Added Illustrations and Procedures for the Gradient Isolation kit.