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ENGINEERING NOTE		P41001	M5644	1 of 9																										
AUTHOR P. Purgalis 1/81	DEPARTMENT Mechanical Engineering	LOCATION Berkeley	DATE December 8 1980																											
PROGRAM - PROJECT - JOB PEP-4																														
COIL CRYOSTAT																														
TITLE CRYOSTAT INSTALLATION AND ALIGNMENT																														
<p>INTRODUCTION</p> <p>A procedure is given for installing and aligning the cryostat. Tables, views or details referred to in this note are shown on Drawing 19Q3326, Cryostat Installation.</p> <p>The cryostat will be installed from the north end, with the north pole tip assembly removed. Cross hairs will be stretched across the north and south ends of cryostat. A scope will be sighted along the centerline of the pole tips and the cryostat will be shimmed to line up the cryostat cross hairs with the scope line of sight within + .020 in. The axial position tolerance shall be + .060 in. The cryostat supports will then be doweled to the magnet legs.</p> <p>REFERENCE DRAWINGS</p> <table> <tbody> <tr> <td>19Q3326</td> <td>Cryostat Installation</td> </tr> <tr> <td>19C6843</td> <td>Support Spacer</td> </tr> <tr> <td>19C4176</td> <td>External Support Machining</td> </tr> <tr> <td>19C9966</td> <td>Cryostat Assembly As Made</td> </tr> <tr> <td>20C4106</td> <td>Pole Tip Installation and Alignment</td> </tr> <tr> <td>19Q2416</td> <td>Positioning Mechanism and Transfer Carriage</td> </tr> <tr> <td>20C4156</td> <td>Pole Base Alignment Jig Plate</td> </tr> <tr> <td>19C7626</td> <td>External Support Details</td> </tr> <tr> <td>20C9336</td> <td>Lifting Fixture</td> </tr> <tr> <td>19Q2652</td> <td>Support Spacer Clamp</td> </tr> <tr> <td>19Q2671</td> <td>Locating Bushing</td> </tr> <tr> <td>19Q2663</td> <td>Support Spacer Shims Type I</td> </tr> <tr> <td>19Q3313</td> <td>Support Spacer Shims Type II</td> </tr> </tbody> </table> <p>A. PREPARATION</p> <ol style="list-style-type: none"> Each support spacer (19C6843-1 thru-12) is numbered to match numbers on supports (19C4176) and cryostat (19C9966). Bolt support spacers to magnet legs in position shown. Torque 3/4-10 bolts to 100 ft-lb. 					19Q3326	Cryostat Installation	19C6843	Support Spacer	19C4176	External Support Machining	19C9966	Cryostat Assembly As Made	20C4106	Pole Tip Installation and Alignment	19Q2416	Positioning Mechanism and Transfer Carriage	20C4156	Pole Base Alignment Jig Plate	19C7626	External Support Details	20C9336	Lifting Fixture	19Q2652	Support Spacer Clamp	19Q2671	Locating Bushing	19Q2663	Support Spacer Shims Type I	19Q3313	Support Spacer Shims Type II
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3. Match drill, ream, and dowel support spacer as shown in View C-C and D-D.
4. If support spacer extends into leg cutout, as for example, north No. 5 scribe line on spacer so protruding part can be later cut off.

B. SCOPE SETUP

1. Cryostat will be installed from north end.
2. Remove north pole tip assembly by placing on transfer carriage per Dwg 20C4106 and 19Q2416.
3. Bolt south pole base to legs using at least six bolts equally spaced.
4. Fit south end pole base alignment jib (20C4156) on south pole base using existing dowels and bolts.
5. Stretch wire between vertical punch marks on north end of hex frame.
6. Set up scope on south end by sighting on south alignment jig cross hairs and hex frame wire of above paragraph. Record position of north and south wall target in Table III for future reference.
7. Unbolt and roll back south pole base.
8. Stretch wires across south end of magnet legs 12 to 6 o'clock and 3 to 9 o'clock.

C. CRYOSTAT

1. Attach supports (19C4176) to cryostat at locations 3, 5, and 7 north and south, insert the prefitted dowels and bolts (View A-A and Support Detail. Also see Dwg 19C7626.)
2. Install cross hairs on cryostat using wires lined up with scribe marks at 12, 3, 6 and 9 clock positions on both north and south ends.
3. Attach lifting fixture (see Dwg 20C9336).

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INSTALLATION

1. Position cryostat in magnet legs.
2. Attach supports (19C4176) at remaining locations.
3. Make axial adjustment by measuring from wire to cryostat as shown in Support Detail. Distance between wire and cryostat shall be 9.30 \pm .060 inches.
4. Shim between supports (19C4176) and support spacer (19C6843) at location 5,7, & 3 north and south using type I shims (19Q2663) until cryostat cross hairs line up with scope line of sight within \pm .020. Record readings in Table III. Record number of shims used and shim thickness in Table I.
5. Clamp base of support to support spacer as shown in Clamp Detail.
6. Roll in south pole base and bolt to legs using at least six bolts equally spaced.
7. Check distance between pole base and cryostat record readings in Table IV, adjust cryostat if required. After adjustment retighten clamp.
8. For supports at location 5, 7, and 3 north and south match drill and ream through support base into support spacer (see View B-B). Drilling and reaming at other locations will be done later.
9. Install dowel pins at locations 5, 7, and 3 north and south (see View D-D).
10. Measure gap between support base and support spacer at all 12 locations. Measure gap at eight points for each location (see Support Detail and View B-B). The expected gap size is 0 for .010 in. for location 5, 7, and 3. For locations 9, 11, and 1, the possible gap is 0 to .375 in.
11. Record the gap measurements in Table II.
12. Match drill 1/4 in. diameter pilot holes into the support spacer four places at each of the 12 locations. Use locating bushing (19Q2671) when drilling pilot holes.
13. Remove supports at locations 1, 11 and 9 north and south.
14. Remove dowels from supports at locations 5, 7, and 3 north and south.
15. Remove cryostat.
16. Remove support spacers (19C6843-1 thru-12) and take to shop to drill .6562 diameter and tap 3/4-UNC thru spacer at the four .25 in. pilot hole locations for each spacer.

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17. Make Type II shims (19Q3313) for locations 1, 9, and 11, both north and south end, using dimensions from Table II.
18. Reinstall support spacers, bolt and dowel to magnet legs. Torque bolts to 200 ft-lb.
19. Reinstall cryostat by installing Type I shims and dowels at locations 3, 5, and 7. Note that shim thicknesses used before had been recorded in Table I.
20. Reinstall supports at locations 1, 11, and 9 north and south.
21. Install Type II shims at locations 1, 9, and 11.
22. Bolt all supports to support spacers using 3/4-10-unc bolts. Torque to 200 ft-lb.
23. Drill and ream through supports into support spacers for locations 1, 9, and 11 and install dowels (View E-E).
24. Recheck cryostat alignment and record wall target and cryostat cross-hair location in Table III.
25. The cryostate tooling balls, two on each end, will be surveyed as shown in Dwg 19Q3426.

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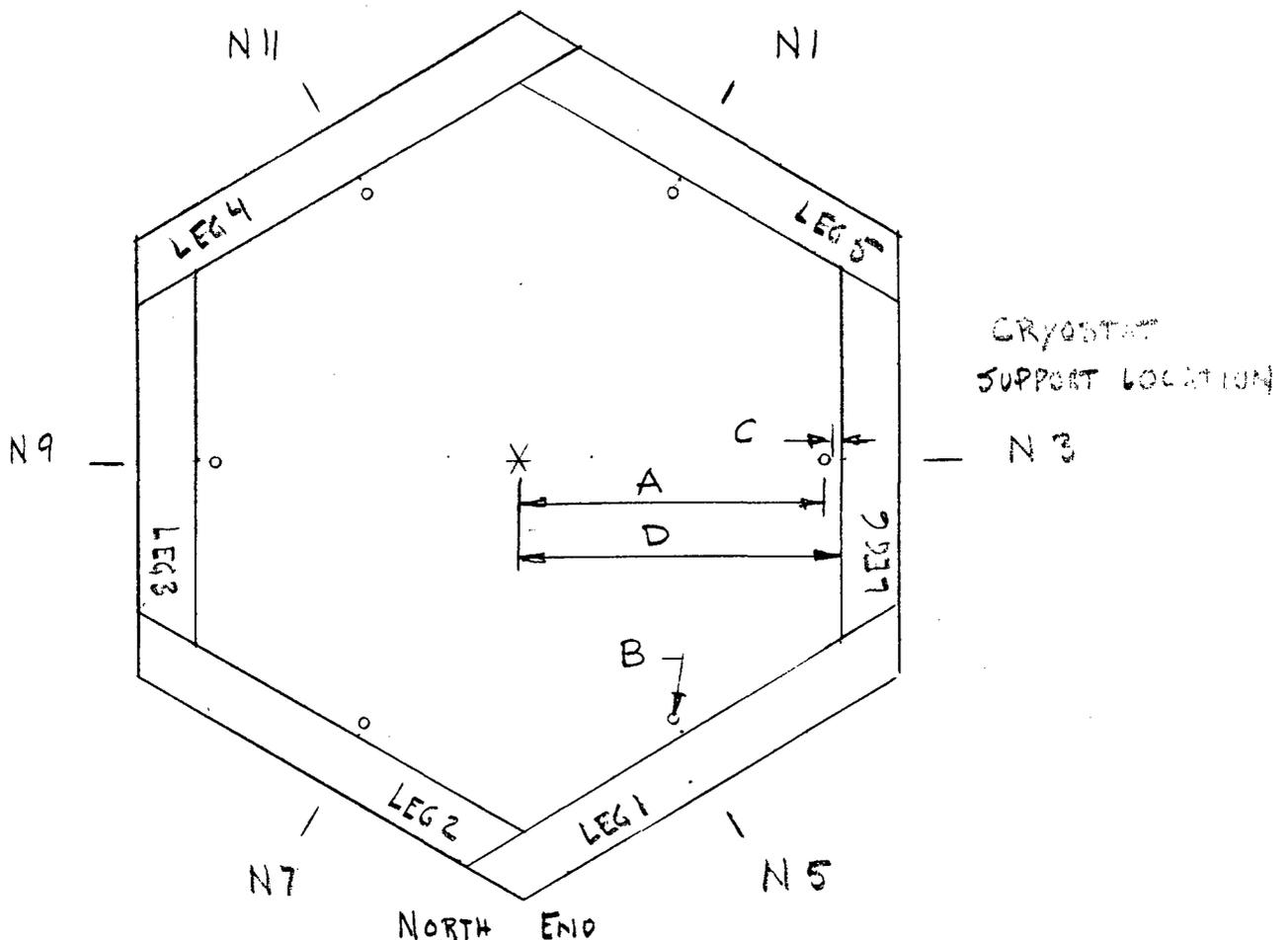
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MEASUREMENTS USED IN CRYOSTAT INSTALLATION

DURING THE MAGNET CORE MACHINING SIX DOWELS WERE ACCURATELY LOCATED ON EACH POLE BASE AT A DIAMETER OF 135.040 IN (DWG 1903186 & 1902306)



WITH NORTH POLE BASE ASSEMBLY REMOVED LOOKING THROUGH MAGNET LEGS AT INSIDE OF SOUTH POLE BASE

A - DISTANCE FROM CENTER OF POLE TIP ASSY TO CENTER OF DOWEL PIN

B - DOWEL PIN DIA

C - MEASURED GAP

$\frac{B}{2} + C =$ DOWEL PIN CENTER TO MAGNET LEG

$D = A + \frac{B}{2} + C =$ DISTANCE FROM CENTER OF POLE TIP ASSEMBLY TO MAGNET LEG

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GAP MEASUREMENTS WERE MADE BETWEEN THE MAGNET LEG AND THE DOWEL PINS. THE MEASUREMENTS WERE MADE 10-1-80 AFTER THE FINAL ALIGNMENT CHECK. THE VALUES ARE SHOWN IN TABLE A

TABLE A

LEG No	SUPPORT LOCATION	A IN	B IN	C IN	$\frac{B}{2} + C$ IN	D IN
5	NORTH 1	67.518	.491	.169	.415	67.933
6	3	67.520	.749	.099	.474	67.994
1	5	67.525	.490	.094	.339	67.864
2	7	67.524	.491	.153	.399	67.923
3	9	67.520	.749	.168	.543	68.063
4	11	67.522	.749	.165	.540	68.062
5	SOUTH 1	67.517	.491	.182	.428	67.945
6	3	67.514	.491	.200	.446	67.960
1	5	67.525	.499	.066	.316	67.841
2	7	67.524	.489	.099	.344	67.868
3	9	67.523	.491	.170	.416	67.939
4	11	67.524	.749	.113	.487	68.012

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THE DISTANCE BETWEEN OPOSITE MAGNET LEGS WAS ALSO MEASURED USING A ROD WITH A MICROMETER ON ONE END (SEE 20C7316) THE TWO MEASUREMENTS ARE COMPARED IN TABLE B

TABLE B

LOCATION	MEASURED WITH ROD & MICROMETER - IN	FROM COL. "D" TABLE A IN	Δ
NORTH 1 to 7	135.855'	135.856	-.001
3 to 9	136.007'	136.057	-.050
5 to 11	135.926'	135.926	.000
SOUTH 1 to 7	135.811'	135.813	-.002
3 to 9	135.875'	135.899	-.024
5 to 11	135.858'	135.853	.005

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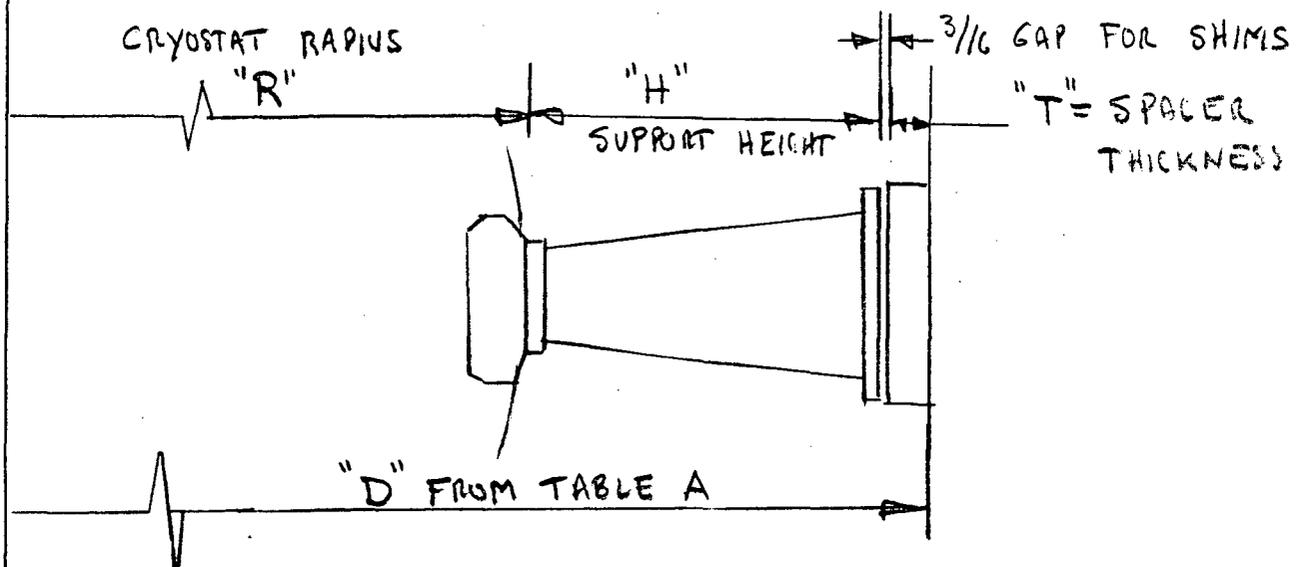
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CRYOSTAT O.D. CHECKED BY J. NICHOLLS WITH A
TAPE 12-12-80

NORTH END	3 TO 9	96.03 ± .03	IN
	12 TO 6	96.00 ± .03	IN
SOUTH END	3 TO 9	96.00 ± .03	IN
	12 TO 6	96.00 ± .03	IN

CRYOSTAT OVERALL LENGTH FROM R. GARFINKLE NOTES
 $L = 150.755$ IN

SUPPORT HEIGHT SEE DWG 19C4176. WHERE
THE SUPPORT HEIGHT WAS MEASURED BY J. NICHOLLS
11-80. THE SPACERS WERE THEN MACHINED TO
THE PROPER THICKNESS SO THAT THERE WILL BE
A $3/16$ GAP BETWEEN SUPPORT BASE AND SPACER
WHEN CRYOSTAT CENTERLINE IS LINED UP WITH
POLE BASE CENTERLINE. THE GAP WILL BE FILLED WITH
SHIMS.



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THE SUPPORT HEIGHT & SPACER THICKNESS IS
SHOWN IN TABLE C

TABLE C

LEG No	SUPPORT LOCATION	R IN	H IN	GAP IN	T IN	R+H+ GAP+T IN
5	NORTH 1	48.00	17.995	.1875	1.751	67.933
6	3		17.993		1.814	67.994
1	5		18.001		1.676	67.864
2	7		17.990		1.746	67.923
3	9		18.000		1.876	68.063
4	11		17.983		1.892	68.062
5	SOUTH 1		17.994		1.764	67.945
6	3		17.986		1.787	67.960
1	5		17.993		1.661	67.841
2	7		17.997		1.684	67.868
3	9		17.988		1.764	67.939
4	11	48.00	17.985	.1875	1.840	68.012

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