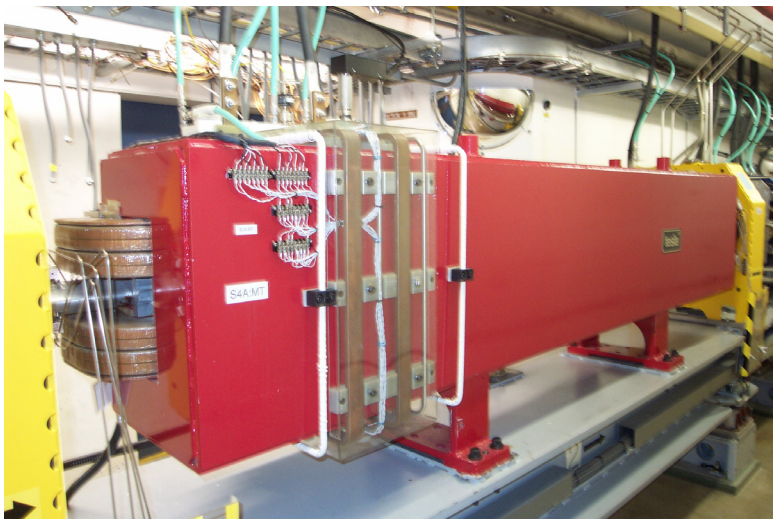
Storage Ring Dipole Magnet

310101-00055 with modification 310101-100100

There are eighty storage ring dipole magnets at the APS. In each sector the storage ring dipoles are on girders 2 and 4 and are identified with the names AM and BM respectively. The original storage ring dipoles were built as shown on drawing 310101-00055. The modification shown on drawing 310101-100100 was implemented in 2001/2002. This was done to eliminate the copper deposit in the manifolds that began after the trim coils started to be used due to implementing the Decker Distortion. The copper deposit would electrically short the trim coil to the main coil.

If a storage ring magnet ever goes bad the whole girder will be replaced.



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November 23, 2004

Storage Ring Dipole Magnet

Parameters for the Storage Ring Dipole Magnet

Number	80 + 1	
Magnetic length	3.06	m
Bending radius	38.9611	m
Field	0.599	T
Beam stay clear		
Horizontal	±35.0	mm
Vertical	±20.0	mm
Dipole trim coils		
Number	80 + 1	
No. of independent power supplies	80	
Magnetic length	3.06	m
Field	0.04	T
Gap Height	60	mm
Total Mass of Magnet	5130	kg
Coils per Pole	2	

Conductor		
Height	22.0	mm
Width	12.2	mm
Hole Diameter	9.0	mm
Number of Turns per Pole	32	
Total Inductance	51	mH
Total Resistance	38	m□
Time Constant	1342	ms
Peak Current	452	A
Current Density in Coil	1.4	A/mm^2
Voltage	17.3	V
Power	7.8	kW
Cooling Water Circuits per magnet	2	
Total Water Flow	2.4*	gpm
Water Pressure Drop	100*	psi
Water Temperature Rise	12*	° C

*Will be redesigned at 80 psi

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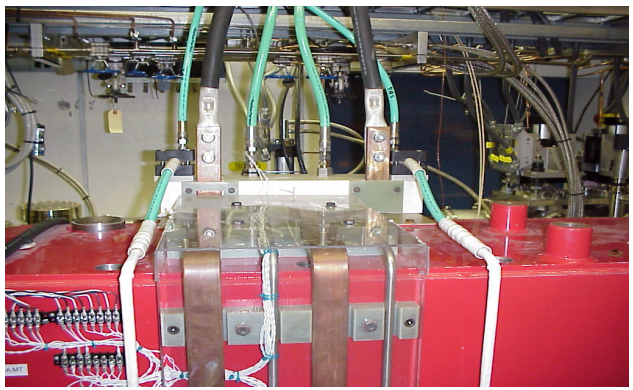
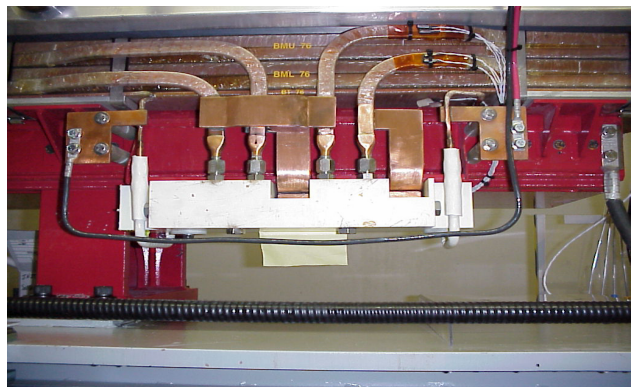
Storage Ring Dipole Magnet

Storage ring dipole magnets in assembly bay.

The last storage ring dipole magnet going into facility



Upper water manifold block installed



Lower water manifold block installed

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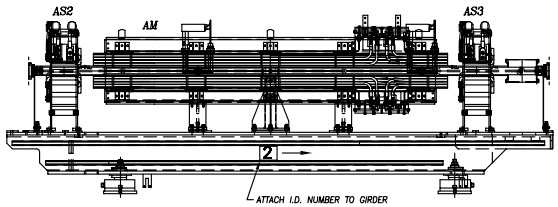
Storage Ring Dipole Magnet

#1 GIRDER PREPARATION	#2 INSTALL CHAMBER SUPPORTS TO GIRDER	#3 INSTALL CHAMBER SUPPORTS (BASE) TO GIRDER	#4 INSTALL RK-4 JACKS TO GIRDER	#5 ATTACH AM MAGNET (DIPOLE) TO GIRDER	#6 LEVEL (TWIST) MAGNET (DIPOLE) TO GIRDER	#7 ATTACH AS2 MAGNET (SEXTAPOLE) TO GIRDER	#8 ATTACH AS3 MAGNET (SEXTAPOLE) TO GIRDER	#9 ALIGN MAGNETS TO GIRDER
-CLEAN GIRDER (MUST BE FREE OF RUST OR DIRT) -CHECK THREADED HOLES -MODIFY FOR DIAGNOSTICS & CHAMBER SEE DWG. # 310701-00040-03 # 310701-00041-04	-SEE DWG. # 310301-00075-00 SHEET #1 & #2, STEPS 1 THRU 4	-SEE DWG. # 310301-00075-00 SHEET #1 & #2, STEPS 5 & 6	-SEE DWG. # 310701-00063-03 # 310701-00040-03 -NOTICE ANCHOR THREADED ROD POSITION -NOTICE DIRECTION OF ANCHOR	-SEE DWG. # 310702-140000-00 # 310701-00149-02 -FIELD RE-WORK IF REQ'D. -NOTICE SHIMS & HEIGHT OF MAGNET SUPPORT	-SEE DWG. # 310702-140000-00 (TO BE REVISED)	-SEE DWG. # 310702-950000-00 # 310702-00149-02 -FIELD RE-WORK IF REQ'D. -NOTICE SHIMS & HEIGHT OF MAGNET SUPPORT	-SEE DWG. # 310702-950000-00 # 310702-00149-02 -FIELD RE-WORK IF REQ'D. -NOTICE SHIMS & HEIGHT OF MAGNET SUPPORT	-SEE DWG. # 310701-00040-03 # 310701-00149-02 -ALSO SEE ALIGNMENT INSTRUCTION DOCUMENT #

#10 PREPARE MAGNETS FOR CHAMBER INSTALLATION	#11 INSTALL AND ALIGN CHAMBER	#12 PIN CHAMBER SUPPORTS TO GIRDER	#13 RE-ATTACH MAGNETS TO GIRDER WITH CHAMBER	#14 ALIGNMENT CHECK	#15 HYDROSTATIC TESTS
-PREPARE PER INSTRUCTIONS TO BE PROVIDED BY SEXTAPOLE COMPONENTS ENGINEER.	-SEE DWG. # 310301-00075-00 SHEET #1 & #2, STEPS 7 THRU 15 -ALSO SEE DWG. # 310701-00149-02 # 310701-00056-02 # 310701-00019-01 # P310-500000-00	-SEE DWG. # 310301-00075-00 SHT. #1 & #2, STEPS 1 THRU 4	-PREPARE PER INSTRUCTIONS TO BE PROVIDED BY SEXTAPOLE COMPONENTS ENGINEER.	-SEE DWG. # 310301-00075-00 SHEET #1 & #2, STEPS 7 THRU 15 -ALSO SEE DWG. # 310701-00149-02 # 310701-00056-02 # 310701-00019-01 # P310-500000-00 -ALSO SEE ALIGNMENT INSTRUCTION DOCUMENT #	-LEAK TEST AT 250 P.S.I. -CHECK FLOW RATE OUTLET FLOW RATE AT 70 P.S.I. INLET FLOW RATE AT 150 P.S.I. -SEE DOCUMENT #



SECTION #2

#16 ELECTRICAL TESTS	#17 CHECK AND INSTALL PARTS TO SUPPORT PEDESTALS	#18 STATE SECTOR NUMBER	#19 CHECK AND INSTALL LOCATING CART	#20 CHECK TRANSPORTER	#21 ALIGNMENT CHECK	#22 ATTACH GIRDER TO TRANSPORTER	#23 INSTALL GIRDER TO PEDESTALS	#24 ALIGN GIRDER TO PEDESTALS
-HI-POT AT 5,000 VOLTS -CHECK D.C. RESISTANCE OF COIL -CHECK POLARITY -SEE DOCUMENT #	-CLEAN PEDESTAL MUST BE FREE OF ANY RUST OR DIRT. -SEE DWG. # 310702-930000-01 # 310701-00040-03 # 310702-910000-01 -ROD END MUST MOVE FREELY ON SHAFT	-COPY SECTOR NUMBER LOCATED ADJACENT TO GIRDER ON INSIDE WALL (RECORD ON TRAVELER) IDENTIFY SECTOR LOCATION PER RING MANAGER -ATTACH I.D. NUMBER TO GIRDER SEE NOTE ON DRAWING -PREPARE GIRDER FOR INSTALLATION SEE DWG. # 310702-930000-01 -NOTICE ADJUSTMENT ROD CAP MUST NOT BE ATTACHED YET	-SEE TRANSPORTER INSTALLATION DOCUMENT -CHECK MAINTENANCE REPORT POINTS OULINED IN SERVICE MANUAL -CENTER & SQUARE CART BETWEEN PEDESTALS -ENERGIZE CART -RAISE UNTILL CASTERS ARE OFF OF FLOOR. -SEE DOCUMENT # 310701-00078-00	-CHECK MAINTENANCE REPORT POINTS OULINED IN SERVICE MANUAL -ATTACH DOLLIES TO TUG TOW BAR AND DRAG IN A STRAIGHT LINE. -SEE DOCUMENT # 310701-00078-00	-SEE ALIGNMENT INSTRUCTION DOCUMENT #	-LIFT GIRDER VIA SPREADER BEAM AND CRADLES TO THE DOLLIES -REMOVE SPREADER BAEM & CRADLES -ATTACH TIE-DOWNS TO GIRDER AND DOLLIES -SEE DOCUMENT # 310701-00078-00	-TRANSPORT GIRDER WITH TUG & DOLLY SYSTEM TO THE DESIGNATED POSITION IN THE STORAGE RING. -DETATCH TIE-DOWNS -REMOVE THE JACK BRACES -REMOVE THE DRAG LINK & TIES -MOVE THE LOCATING CART TRANSVERSELY TO BENEATH THE GIRDERS -RAISE LOCATING CART TO FULL HT. THUS LIFTING THE GIRDER. -IN THE RAISED POSITION PLACE THE SAFTEY PINS IN THE DESIGNATED HOLES -MOVE SYSTEM TRANSVERSLEY TO BETWEEN THE PEDESTALS -REMOVE SAFTEY PINS -LOWER GIRDER TO PEDESTALS -REMOVE LOCATING CART. -SEE ALIGNMENT PROCEDURES -SEE DOCUMENT # 310701-00078-00	-SEE DWG. # 310701-00149-02 # 310701-00058-03 # 310701-930000-01 -NOTICE BASE PLATE THREADED HOLES ARE CENTERED ON THE 2-3/4" PEDESTALS MOUNTING HOLES -NOTICE SET-UP ASSEMBLY DIMENSIONS

#25 DIAGNOSTICS AND CONTROL
-TO BE DETERMINED

NOTE:
PRIOR TO STARTING TASKS THE FOLLOWING MUST BE ACCOMPLISHED
1) ALL RELIVANT DRAWINGS AND INSTRUCTION MANUALS MUST BE PRESENT
2) ALL RELIVANT PARTS MUST BE INSPECTED.

PARTS LIST

ITEM	DWG/PART NUMBER	NOMENCLATURE OR DESCRIPTION	MATERIAL / SPEC	QTY

UNLESS OTHERWISE SPECIFIED: ALL DIMENSIONS ARE IN INCHES
TOLERANCES: DECIMALS X ± .X ± .XX ± .XXX ± ANGULAR ±
SURFACE ROUGHNESS ✓
REMOVE ALL BURRS AND BREAK SHARP EDGES .03 MAX.
SURFACE TEXTURE TO BE IN ACCORDANCE WITH LATEST ANSI B46.1
DIMENSIONING & TOLERANCING IN ACCORDANCE WITH LATEST ANSI Y14.5
MATERIAL

LOG NUMBER A12539
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DRAWN BY K.POTTER	DATE 8/20/03	GP LEADER
CHECKED BY		PROJECT MGR
DESIGNER K.POTTER	8/20/03	APPROVED/RELEASED
RESPONSIBLE ENGINEER		

DATE

TITLE
ADVANCED PHOTON SOURCE
STORAGE RING
GIRDER INSTALLATION
INSTRUCTIONS
SECTION #2

SCALE N.T.S. SIZE D DRAWING NUMBER 310702-520000-00
SHEET OF

SYM	CHANGE DESCRIPTION	BY	CHKD	DATE

REVISIONS
DO NOT SCALE DRAWING

Mark Jaski
Last edited on
November 23, 2004

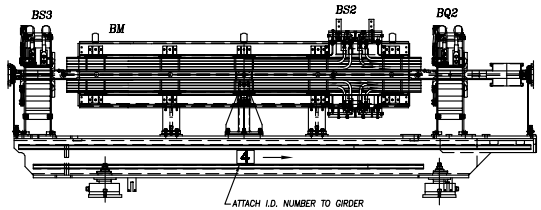
MECHANICAL ENGINEERING GROUP
ACCELERATOR SYSTEMS DIVISION

Advanced Photon Source
Argonne National Laboratory

Storage Ring Dipole Magnet

#1 GIRDER PREPARATION	#2 INSTALL CHAMBER SUPPORTS TO GIRDER	#3 INSTALL CHAMBER SUPPORTS (BASE) TO GIRDER	#4 INSTALL RK-4 JACKS TO GIRDER	#5 ATTACH BM MAGNET (DIPOLE) TO GIRDER	#6 LEVEL (TWIST) MAGNET (DIPOLE) TO GIRDER	#7 ATTACH BS3 MAGNET (SEXTAPOLE) TO GIRDER	#8 ATTACH BS2 MAGNET (SEXTAPOLE) TO GIRDER	#9 ALIGN MAGNETS TO GIRDER
-CLEAN GIRDER (MUST BE FREE OF RUST OR DIRT) -CHECK THREADED HOLES -MODIFY FOR DIAGNOSTICS & CHAMBER SEE DWG. # 310701-00036-03 # 310701-00037-05	-SEE DWG. # 310301-00077-00 SHEET #1 & #2, STEPS 1 THRU 4	-SEE DWG. # 310301-00077-00 SHEET #1 & #2, STEPS 5 & 6	-SEE DWG. # 310701-00063-03 # 310701-00036-03 -NOTICE ANCHOR THREADED ROD POSITION -NOTICE ANCHOR DIRECTION	-SEE DWG. # 310702-140000-00 # 310701-00149-02 -FIELD RE-WORK IF REQ'D. -NOTICE SHIMS & HEIGHT OF MAGNET SUPPORT	-SEE DWG. # 310702-140000-00 (TO BE REVISED)	-SEE DWG. # 310702-950000-00 # 310702-00149-02 -FIELD RE-WORK IF REQ'D. -NOTICE SHIMS & HEIGHT OF MAGNET SUPPORT	-SEE DWG. # 310702-950000-00 # 310702-00149-02 -FIELD RE-WORK IF REQ'D. -NOTICE SHIMS & HEIGHT OF MAGNET SUPPORT	-SEE DWG. # 310701-00036-04 # 310701-00149-02 -ALSO SEE ALIGNMENT INSTRUCTION DOCUMENT #

#10 PREPARE MAGNETS FOR CHAMBER INSTALLATION	#11 INSTALL AND ALIGN CHAMBER	#12 PIN CHAMBER SUPPORTS TO GIRDER	#13 RE-ATTACH MAGNETS TO GIRDER WITH CHAMBER	#14 ALIGNMENT CHECK	#15 HYDROSTATIC TESTS
-PREPARE PER INSTRUCTIONS TO BE PROVIDED BY SEXTAPOLE COMPONENTS ENGINEER.	-SEE DWG. # 310301-00077-00 SHEET #1 & #2, STEPS 7 THRU 15 -ALSO SEE DWG. # 310701-00149-02 # 310701-00056-02 # 310701-00019-01 # P310-500000-00	-SEE DWG. # 310301-00077-00 SHT. #1 & #2, STEPS 1 THRU 4	-PREPARE PER INSTRUCTIONS TO BE PROVIDED BY SEXTAPOLE COMPONENTS ENGINEER.	-SEE DWG. # 310301-00077-00 SHEET #1 & #2, STEPS 7 THRU 15 -ALSO SEE DWG. # 310701-00149-02 # 310701-00056-02 # 310701-00019-01 # P310-500000-00 -ALSO SEE ALIGNMENT INSTRUCTION DOCUMENT #	-LEAK TEST AT 250 P.S.I. -CHECK FLOW RATE OUTLET FLOW RATE AT 70 P.S.I. INLET FLOW RATE AT 150 P.S.I. -SEE DOCUMENT #



SECTION #4

#16 ELECTRICAL TESTS	#17 CHECK AND INSTALL PARTS TO SUPPORT PEDESTALS	#18 STATE SECTOR NUMBER	#19 CHECK AND INSTALL LOCATING CART	#20 CHECK TRANSPORTER	#21 ALIGNMENT CHECK	#22 ATTACH GIRDER TO TRANSPORTER	#23 INSTALL GIRDER TO PEDESTALS	#24 ALIGN GIRDER TO PEDESTALS
-HI-POT AT 5,000 VOLTS -CHECK D.C. RESISTANCE OF COIL -CHECK POLARITY -SEE DOCUMENT #	-CLEAN PEDESTAL MUST BE FREE OF ANY RUST OR DIRT. -SEE DWG. # 310702-930000-01 # 310701-00017-03 # 310702-910000-01 -ROD END MUST MOVE FREELY ON SHAFT	-COPY SECTOR NUMBER LOCATED ADJACENT TO GIRDER ON INSIDE WALL (RECORD ON TRAVELER) IDENTIFY SECTOR LOCATION PER RING MANAGER -ATTACH I.D. NUMBER TO GIRDER SEE NOTE ON DRAWING -PREPARE GIRDER FOR INSTALLATION SEE DWG. # 310702-930000-01 -NOTICE ADJUSTMENT ROD CAP MUST NOT BE ATTACHED YET	-SEE TRANSPORTER INSTALLATION DOCUMENT -CHECK MAINTENANCE REPORT POINTS OULINED IN SERVICE MANUAL -CENTER & SQUARE CART BETWEEN PEDESTALS -ENERGIZE CART -RAISE UNTILL CASTERS ARE OFF OF FLOOR. -SEE DOCUMENT # 310701-00078-00	-CHECK MAINTENANCE REPORT POINTS OULINED IN SERVICE MANUAL. -ATTACH DOLLIES TO TUG TOW BAR AND DRAG IN A STRAIGHT LINE. -SEE DOCUMENT # 310701-00078-00	-SEE ALIGNMENT INSTRUCTION DOCUMENT #	-LIFT GIRDER VIA SPREADER BEAM AND CRADLES TO THE DOLLIES -REMOVE SPREADER BAEM & CRADLES -ATTACH TIE-DOWNS TO GIRDER AND DOLLIES -SEE DOCUMENT # 310701-00078-00	-TRANSPORT GIRDER WITH TUG & DOLLY SYSTEM TO THE DESIGNATED POSITION IN THE STORAGE RING. -DETATCH TIE-DOWNS -REMOVE THE JACK BRACES -REMOVE THE DRAG LINK & TIES -MOVE THE LOCATING CART TRANSVERSELY TO BENEATH THE GIRDERS -RAISE LOCATING CART TO FULL HT. THUS LIFTING THE GIRDER. -IN THE RAISED POSITION PLACE THE SAFTEY PINS IN THE DESIGNATED HOLES -MOVE SYSTEM TRANSVERSLEY TO BETWEEN THE PEDESTALS -REMOVE SAFTEY PINS -LOWER GIRDER TO PEDESTALS -REMOVE LOCATING CART. -SEE ALIGNMENT PROCEDURES -SEE DOCUMENT # 310701-00078-00	-SEE DWG. # 310701-00149-02 # 310701-00058-03 -NOTICE BASE PLATE THREADED HOLES ARE CENTERED ON THE 2-3/4" PEDESTALS MOUNTING HOLES -NOTICE SET-UP ASSEMBLY DIMENSIONS

#25 DIAGNOSTICS AND CONTROL
-TO BE DETERMINED

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PARTS LIST

ITEM	DWG/PART NUMBER	NOMENCLATURE OR DESCRIPTION	MATERIAL / SPEC	QTY

UNLESS OTHERWISE SPECIFIED: ALL DIMENSIONS ARE IN INCHES. TOLERANCES: DECIMALS X ± , XX ± , XXX ± ; ANGULAR ± . SURFACE ROUGHNESS ✓. REMOVE ALL BURRS AND BREAK SHARP EDGES .03 MAX. SURFACE TEXTURE TO BE IN ACCORDANCE WITH LATEST ANSI B46.1. DIMENSIONING & TOLERANCING IN ACCORDANCE WITH LATEST ANSI Y14.5. DO NOT SCALE DRAWING.

REVISIONS: SYM | CHANGE DESCRIPTION | BY | CHKD | DATE

LOG NUMBER A1254100 — THIS DRAWING IS THE PROPERTY OF ARGONNE NATIONAL LABORATORY

DRAWN BY K.POTTER 8/20/93 — CHECKED BY — DP LEADER — DATE — PROJECT MGR — APPROVED/RELEASED — DESIGNER POTTER KERRY 8/20/93 — RESPONSIBLE ENGINEER MANGRA DANNY — MATERIAL

TITLE: ADVANCED PHOTON SOURCE
ACCELERATOR SYSTEMS DIVISION
STORAGE RING
GIRDER INSTALLATION
INSTRUCTIONS
SECTION #4

SCALE N.T.S. — SIZE D — DRAWING NUMBER 310702-540000 — SHEET OF

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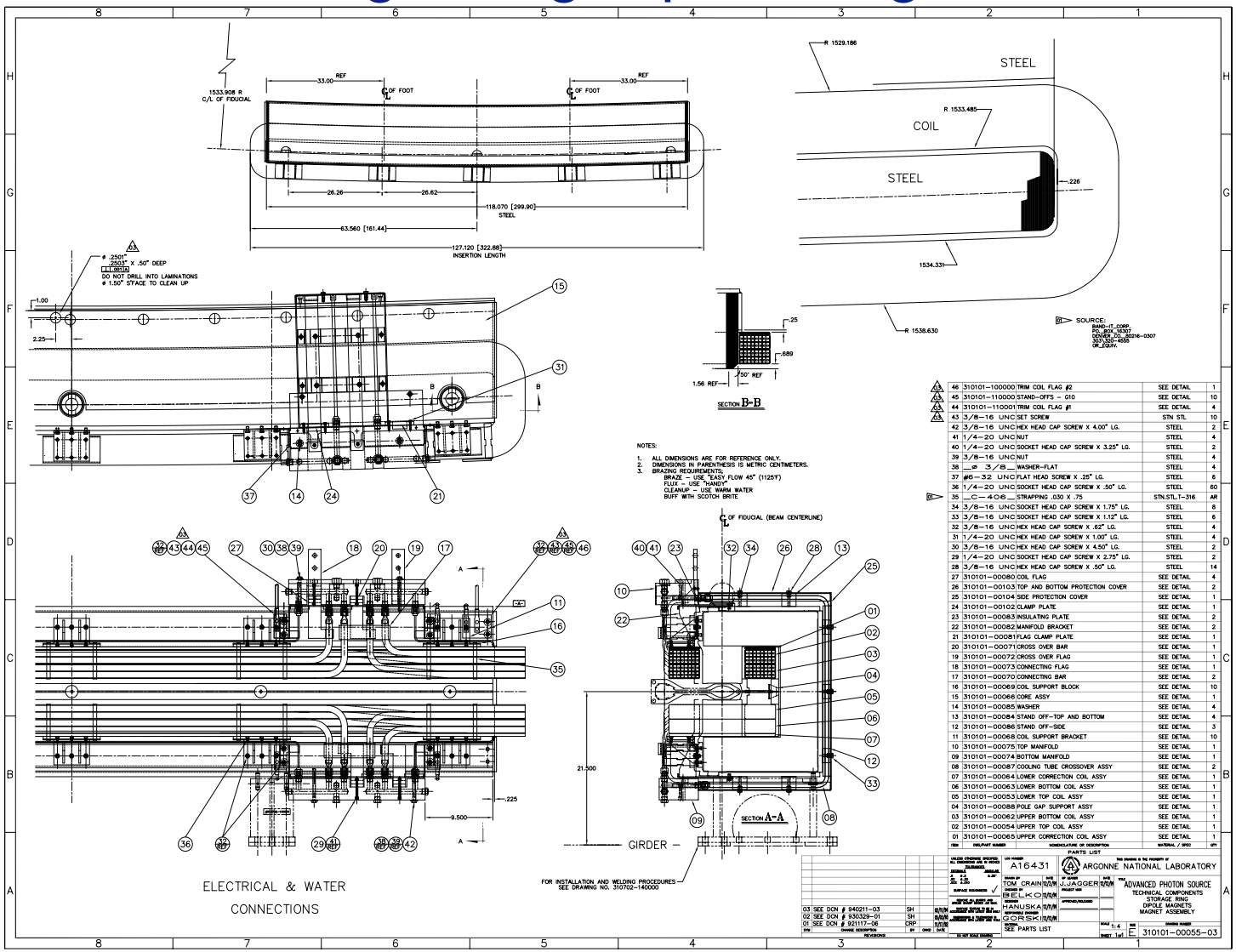
November 23, 2004

MECHANICAL ENGINEERING GROUP
ACCELERATOR SYSTEMS DIVISION

Advanced Photon Source
Argonne National Laboratory

Storage Ring Dipole Magnet



46	310101–100000	TRIM COIL FLAG #2	SEE DETAIL	1
45	310101–110000	STAND–OFFS – G10	SEE DETAIL	10
44	310101–110001	TRIM COIL FLAG #1	SEE DETAIL	4
43	3/8–16 UNC	SET SCREW	STN STL	10
42	3/8–16 UNC	HEX HEAD CAP SCREW X 4.00" LG.	STEEL	2
41	1/4–20 UNC	NUT	STEEL	4
40	1/4–20 UNC	SOCKET HEAD CAP SCREW X 3.25" LG.	STEEL	2
39	3/8–16 UNC	NUT	STEEL	4
38	⌀ 3/8	WASHER–FLAT	STEEL	4
37	#6–32 UNC	FLAT HEAD SCREW X .25" LG.	STEEL	6
36	1/4–20 UNC	SOCKET HEAD CAP SCREW X .50" LG.	STEEL	60
35	C–406	STRAPPING .030 X .75	STN.STL.T–316	AR
34	3/8–16 UNC	SOCKET HEAD CAP SCREW X 1.75" LG.	STEEL	8
33	3/8–16 UNC	SOCKET HEAD CAP SCREW X 1.12" LG.	STEEL	6
32	3/8–16 UNC	HEX HEAD CAP SCREW X .62" LG.	STEEL	4
31	1/4–20 UNC	HEX HEAD CAP SCREW X 1.00" LG.	STEEL	4
30	3/8–16 UNC	HEX HEAD CAP SCREW X 4.50" LG.	STEEL	2
29	1/4–20 UNC	SOCKET HEAD CAP SCREW X 2.75" LG.	STEEL	2
28	3/8–16 UNC	HEX HEAD CAP SCREW X .50" LG.	STEEL	14
27	310101–00080	COIL FLAG	SEE DETAIL	4
26	310101–00103	TOP AND BOTTOM PROTECTION COVER	SEE DETAIL	2
25	310101–00104	SIDE PROTECTION COVER	SEE DETAIL	1
24	310101–00102	CLAMP PLATE	SEE DETAIL	1
23	310101–00083	INSULATING PLATE	SEE DETAIL	2
22	310101–00082	MANIFOLD BRACKET	SEE DETAIL	2
21	310101–00081	FLAG CLAMP PLATE	SEE DETAIL	1
20	310101–00071	CROSS OVER BAR	SEE DETAIL	1
19	310101–00072	CROSS OVER FLAG	SEE DETAIL	1
18	310101–00073	CONNECTING FLAG	SEE DETAIL	1
17	310101–00070	CONNECTING BAR	SEE DETAIL	2
16	310101–00069	COIL SUPPORT BLOCK	SEE DETAIL	10
15	310101–00066	CORE ASSY	SEE DETAIL	1
14	310101–00085	WASHER	SEE DETAIL	4
13	310101–00084	STAND OFF–TOP AND BOTTOM	SEE DETAIL	4
12	310101–00086	STAND OFF–SIDE	SEE DETAIL	3
11	310101–00068	COIL SUPPORT BRACKET	SEE DETAIL	10
10	310101–00075	TOP MANIFOLD	SEE DETAIL	1
09	310101–00074	BOTTOM MANIFOLD	SEE DETAIL	1
08	310101–00087	COOLING TUBE CROSSOVER ASSY	SEE DETAIL	2
07	310101–00064	LOWER CORRECTION COIL ASSY	SEE DETAIL	1
06	310101–00063	LOWER BOTTOM COIL ASSY	SEE DETAIL	1
05	310101–00053	LOWER TOP COIL ASSY	SEE DETAIL	1
04	310101–00088	POLE GAP SUPPORT ASSY	SEE DETAIL	1
03	310101–00062	UPPER BOTTOM COIL ASSY	SEE DETAIL	1
02	310101–00054	UPPER TOP COIL ASSY	SEE DETAIL	1
01	310101–00065	UPPER CORRECTION COIL ASSY	SEE DETAIL	1

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MECHANICAL ENGINEERING GROUP

ACCELERATOR SYSTEMS DIVISION

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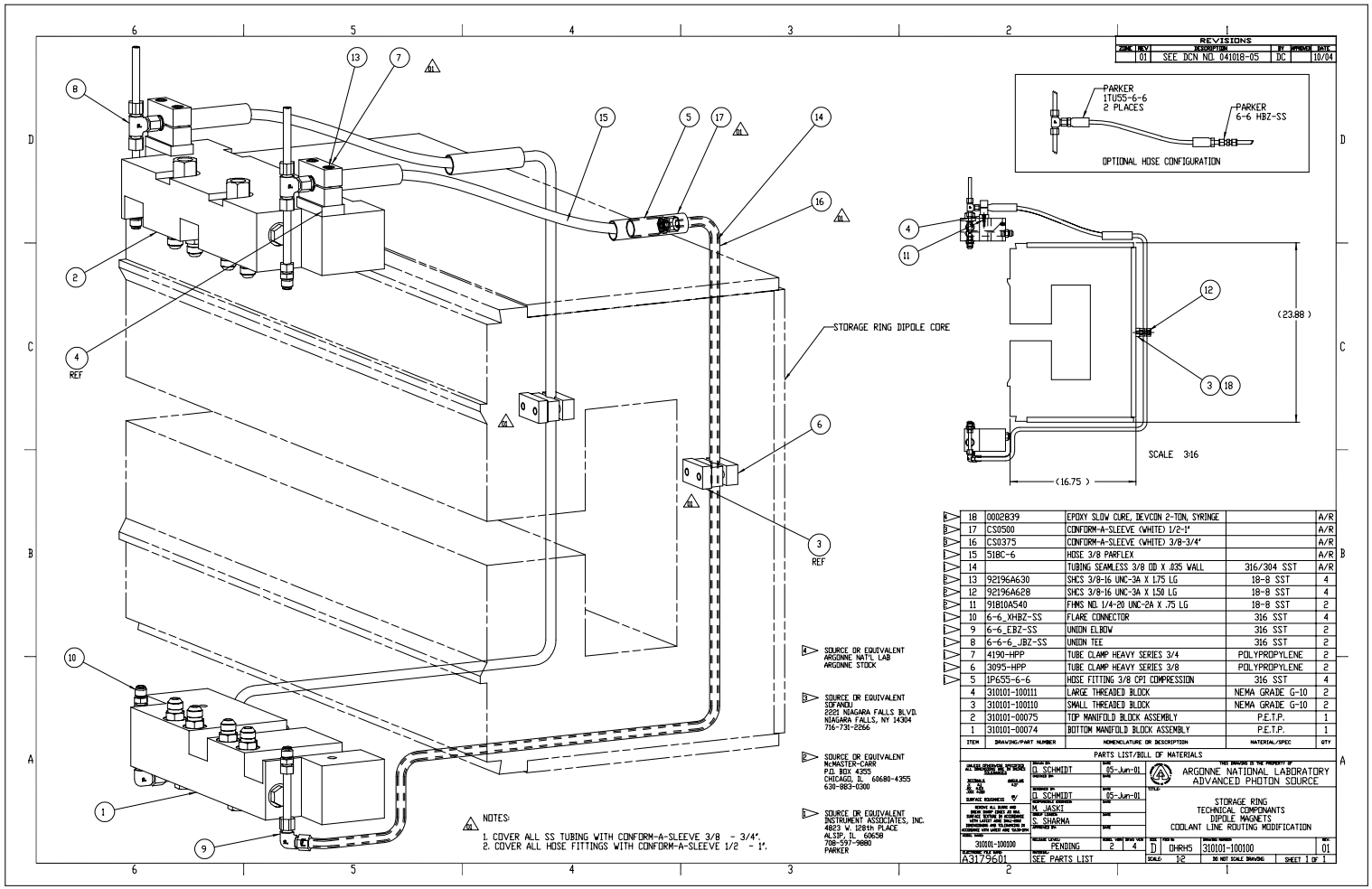
Storage Ring Dipole Magnet



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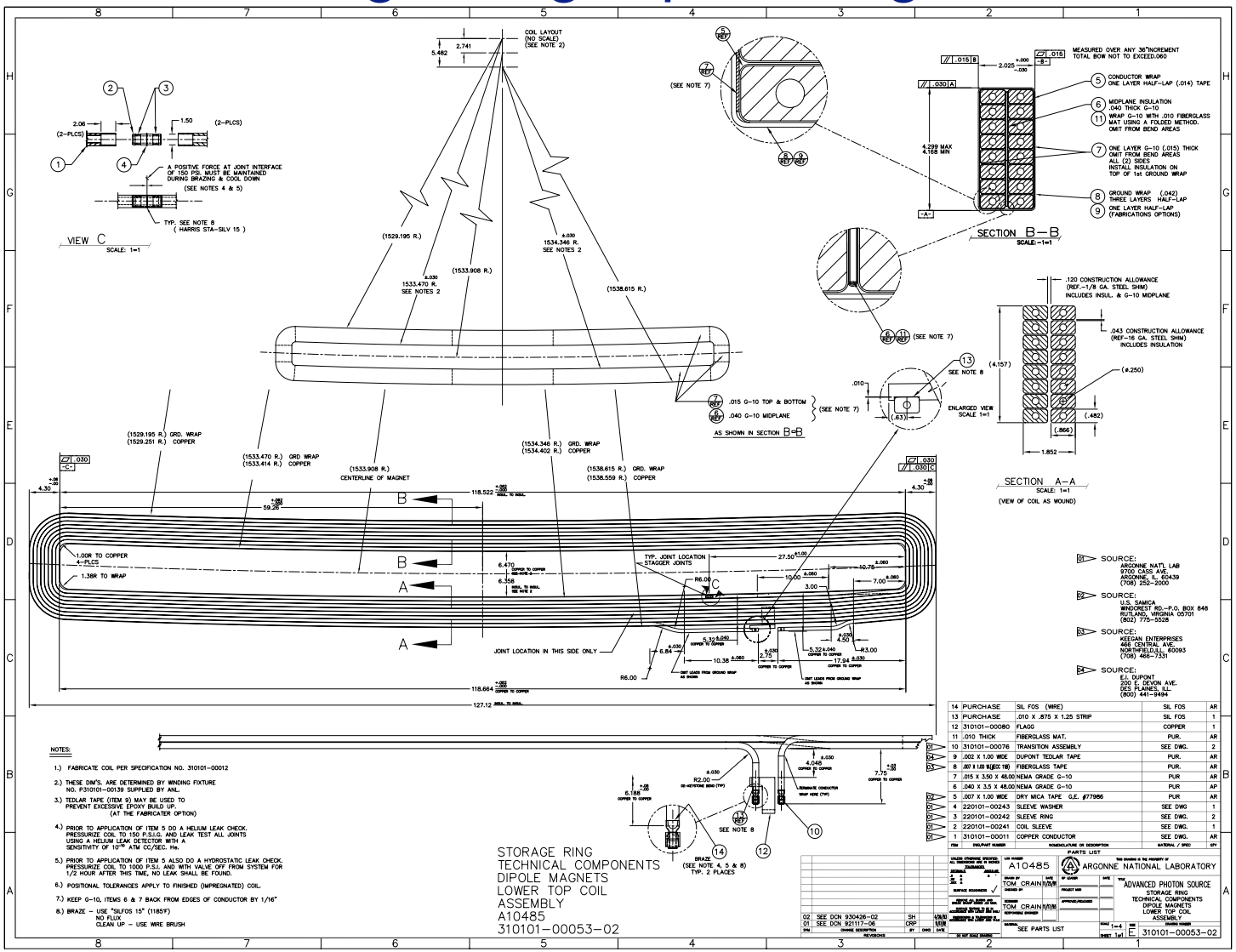

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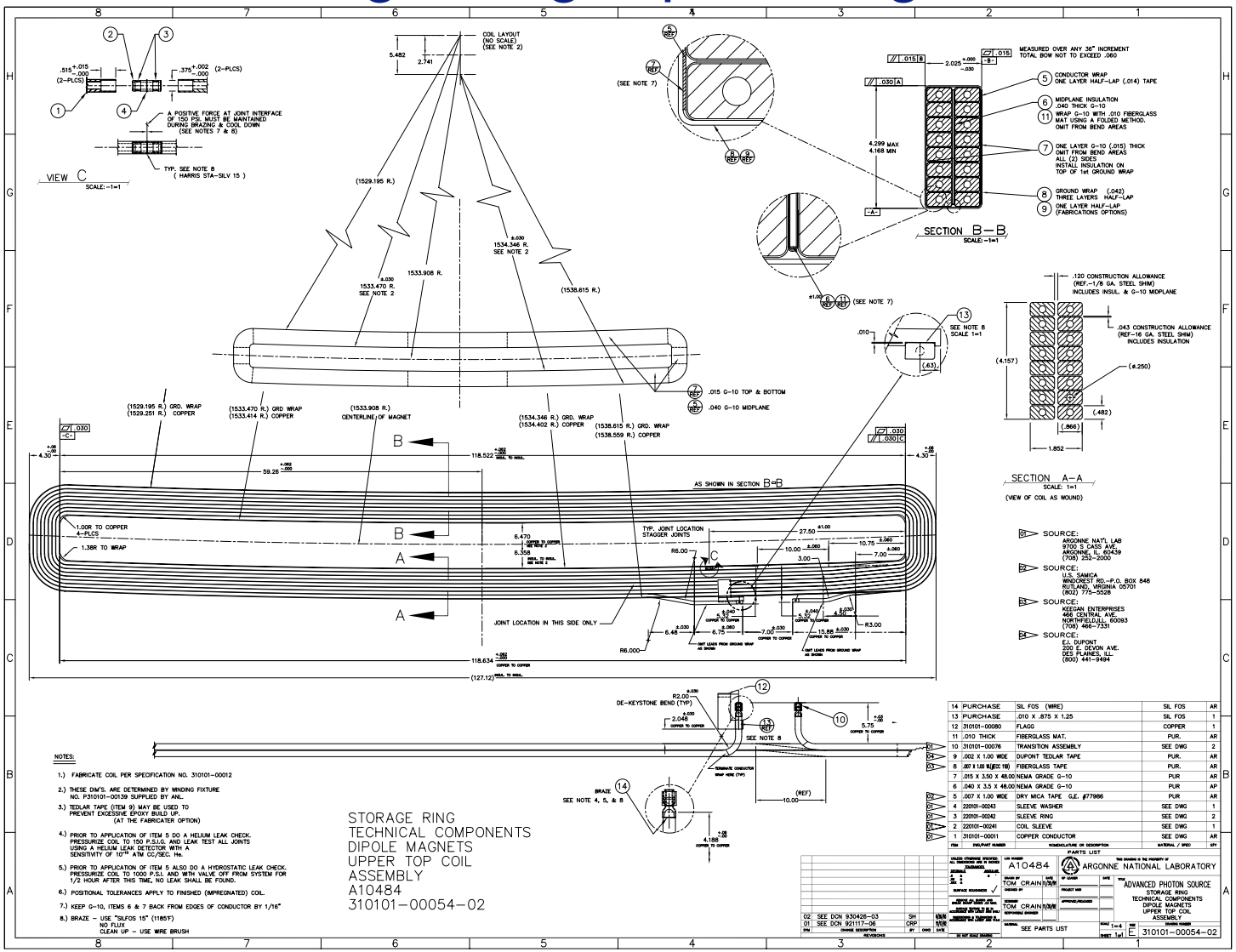
Storage Ring Dipole Magnet



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ACCELERATOR SYSTEMS DIVISION

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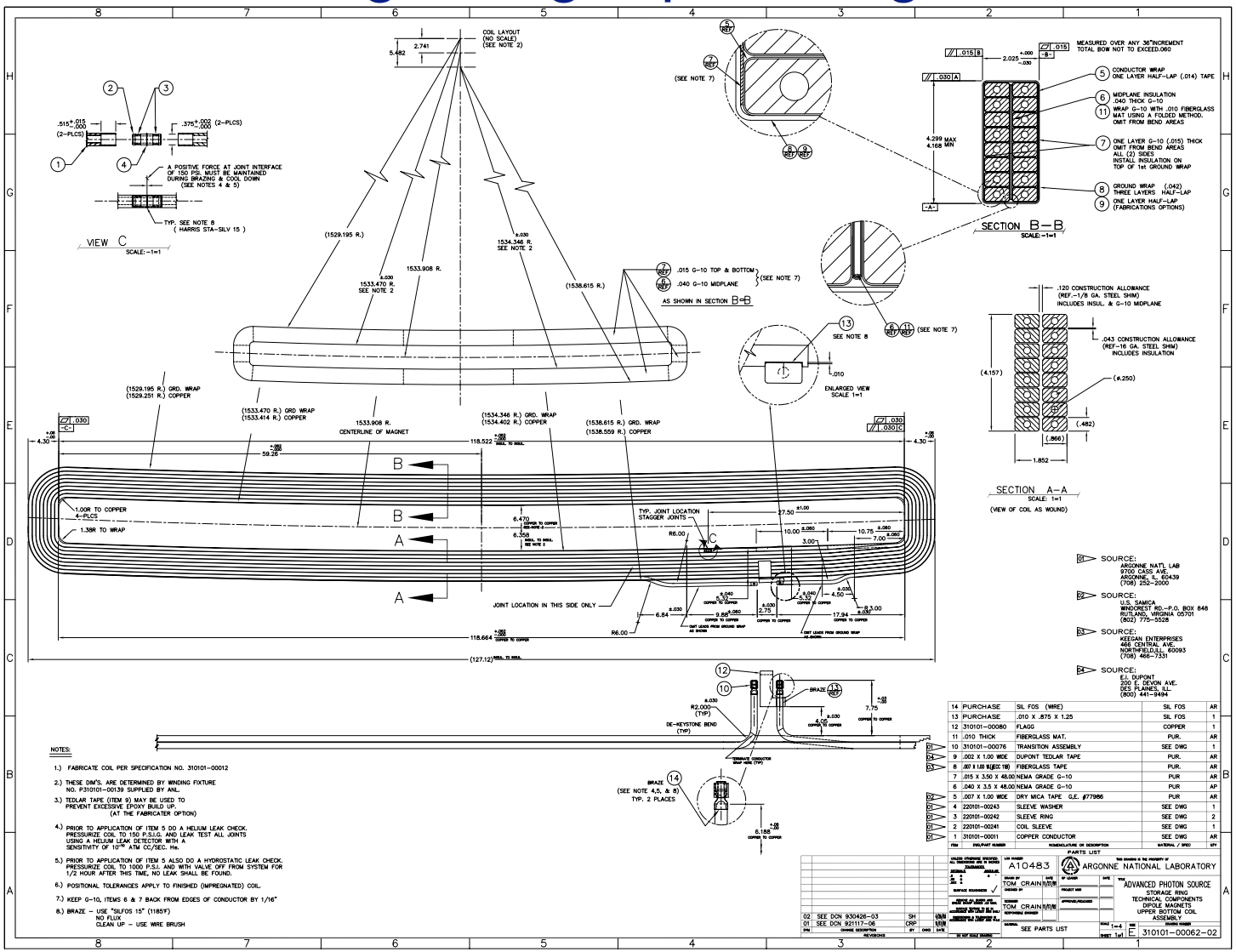
Storage Ring Dipole Magnet



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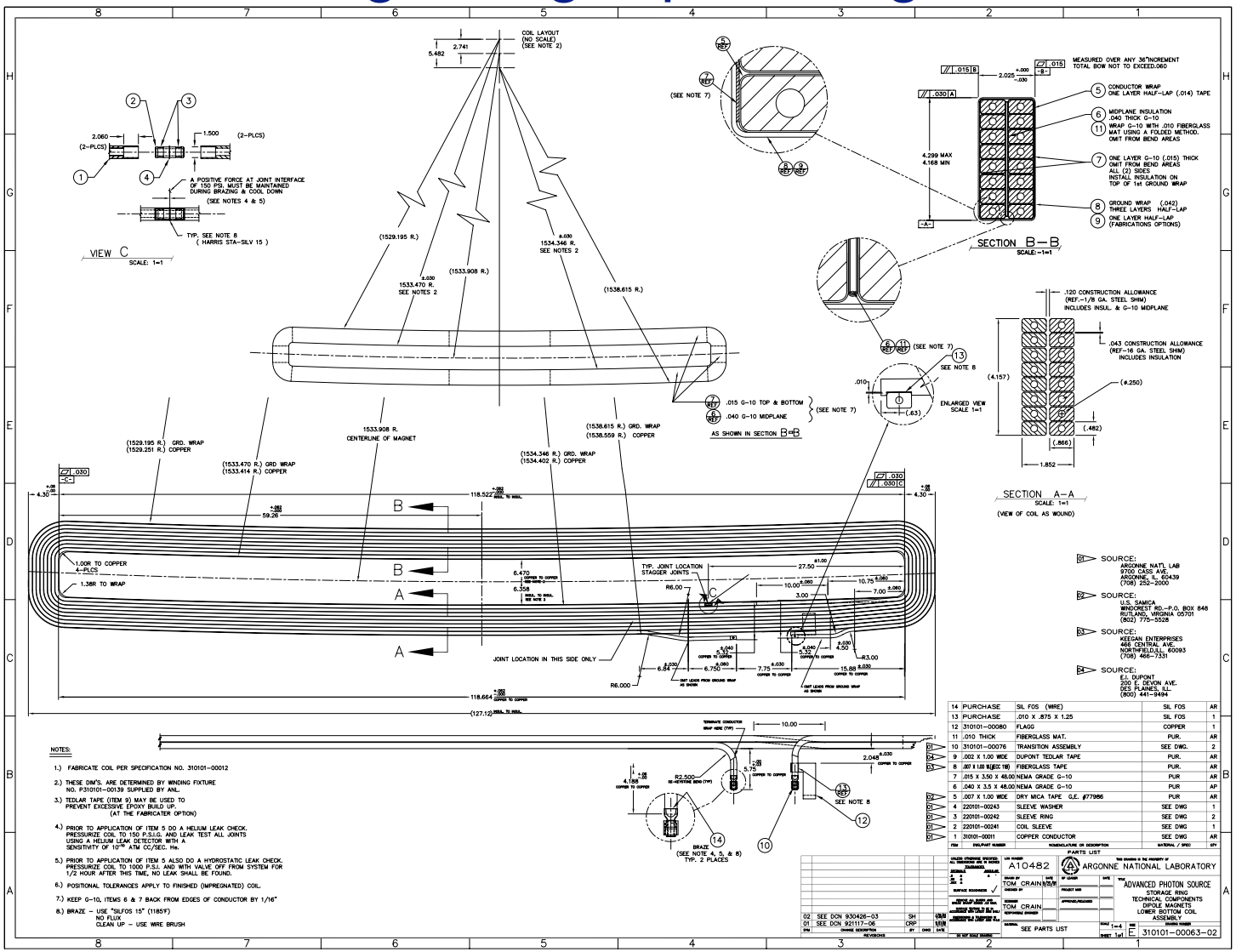

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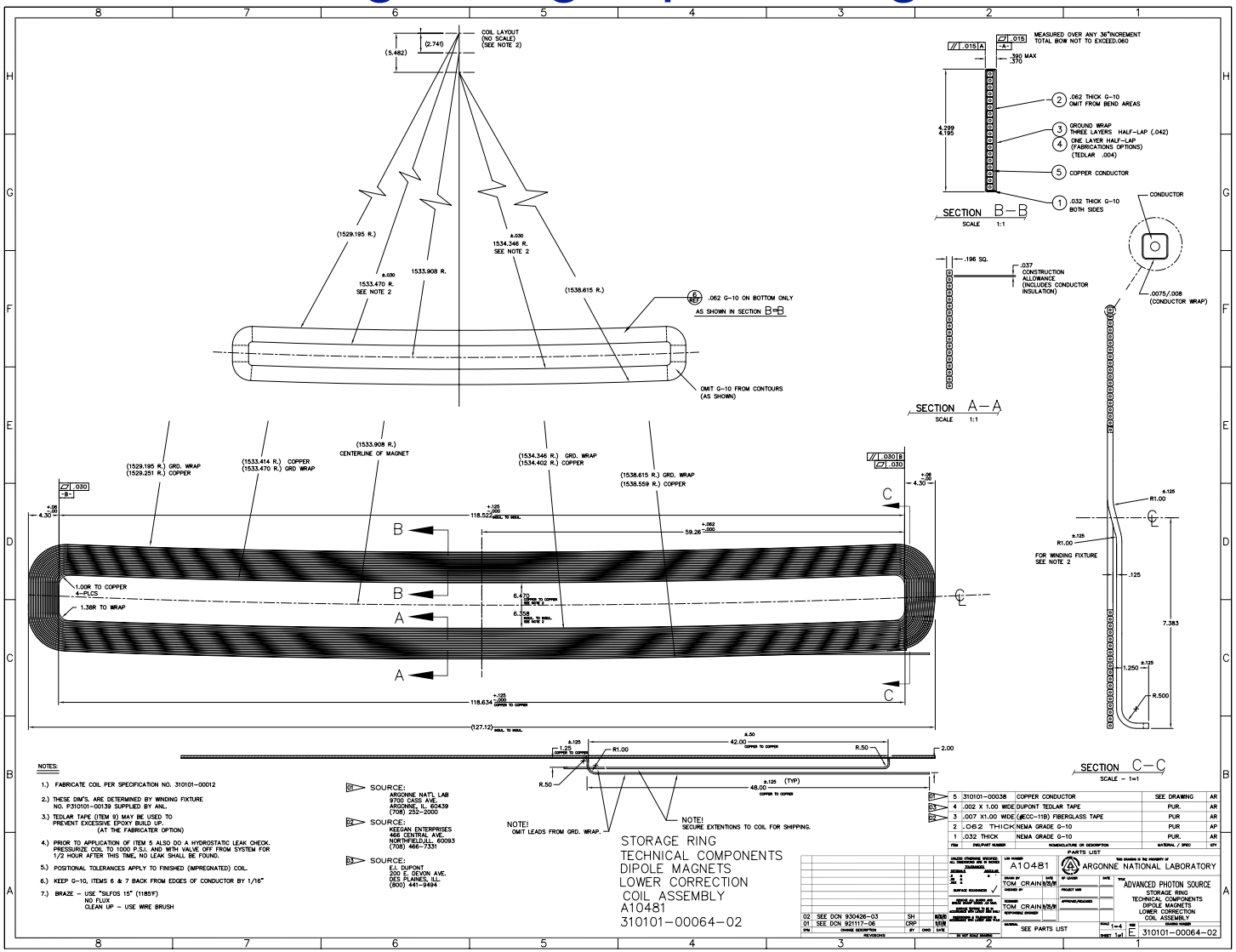
Storage Ring Dipole Magnet



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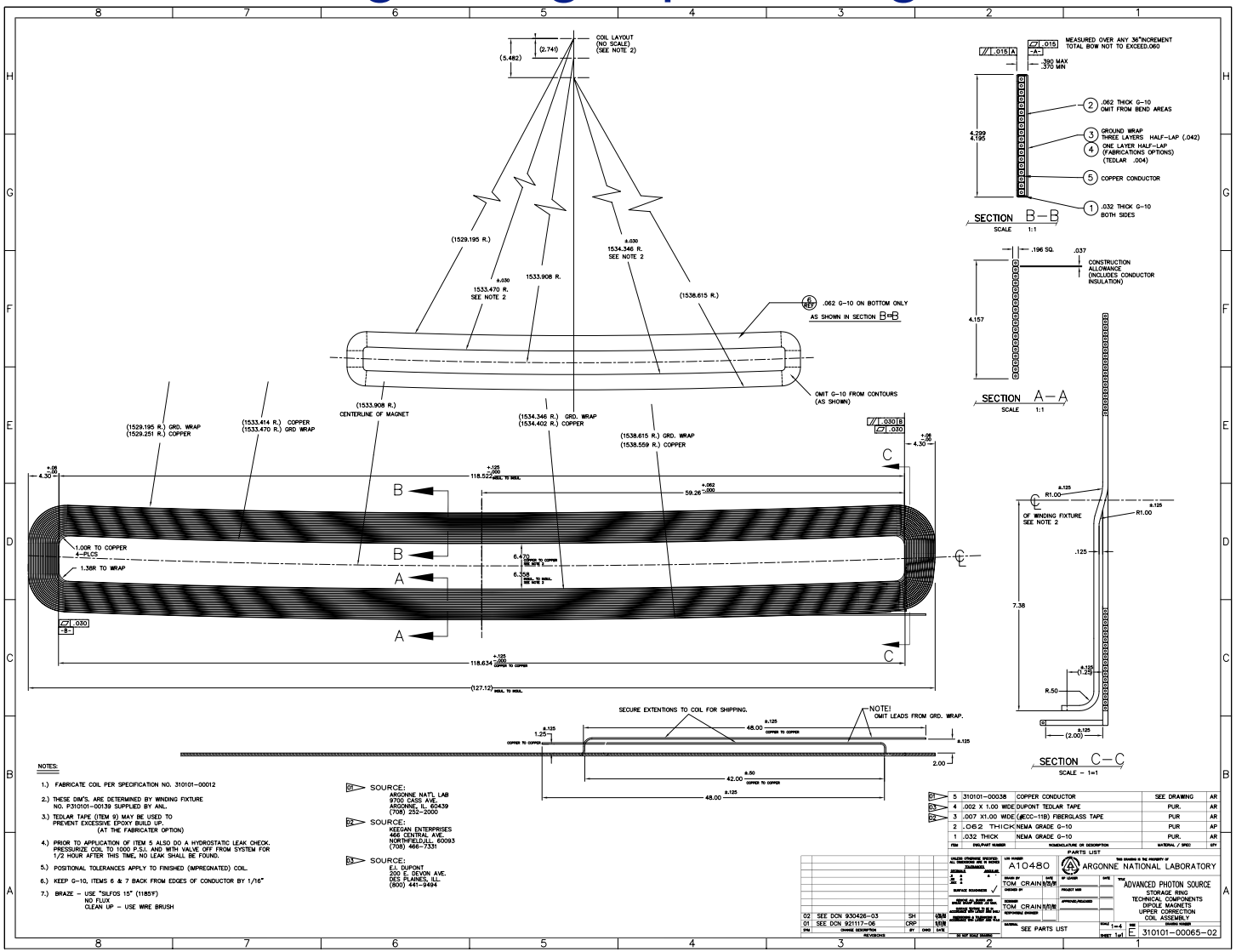
Storage Ring Dipole Magnet



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November 23, 2004

MECHANICAL ENGINEERING GROUP

ACCELERATOR SYSTEMS DIVISION

Advanced Photon Source
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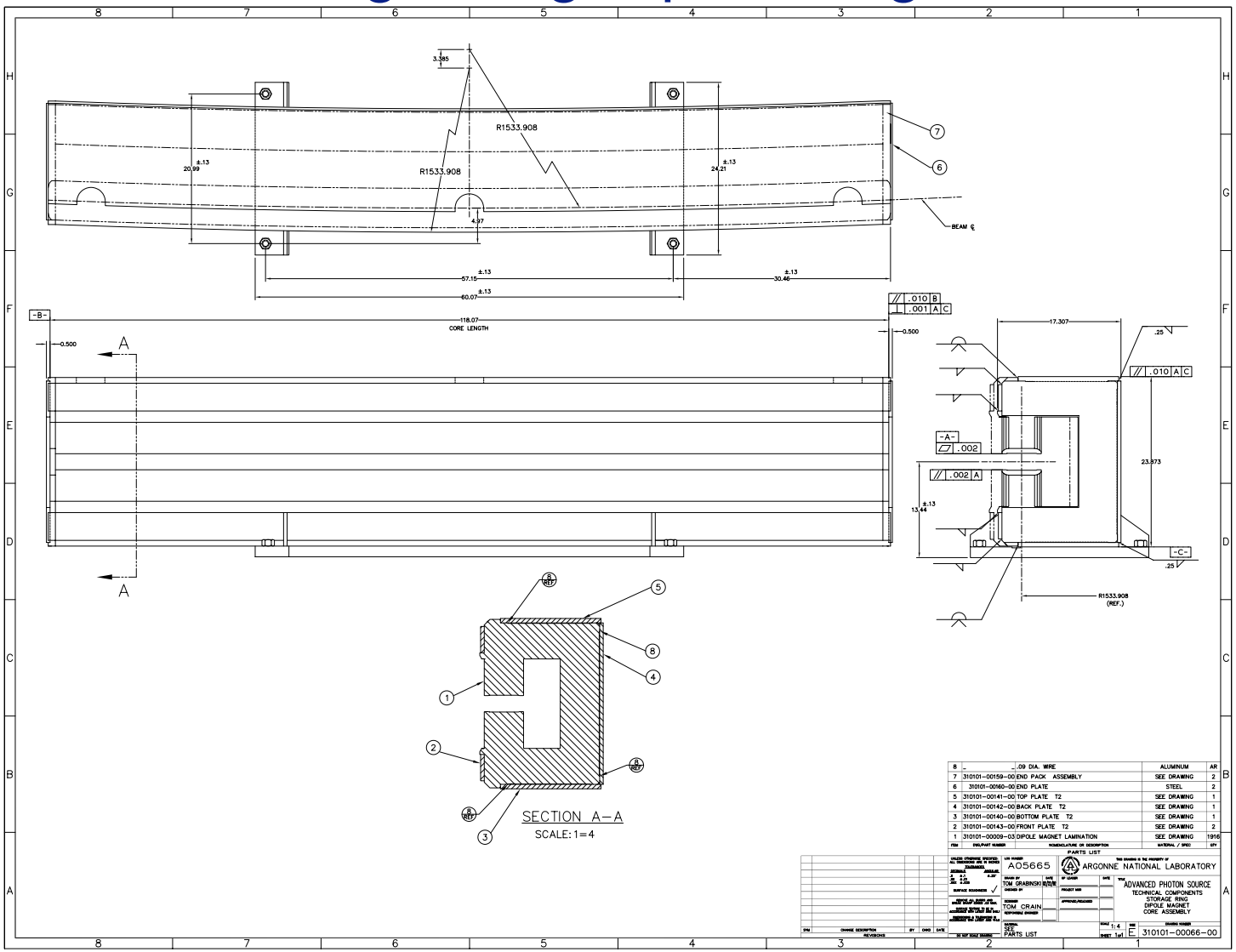
Storage Ring Dipole Magnet



8	_	.09 DIA. WIRE	ALUMINUM	AR
7	310101–00159–00	END PACK ASSEMBLY	SEE DRAWING	2
6	310101–00160–00	END PLATE	STEEL	2
5	310101–00141–00	TOP PLATE T2	SEE DRAWING	1
4	310101–00142–00	BACK PLATE T2	SEE DRAWING	1
3	310101–00140–00	BOTTOM PLATE T2	SEE DRAWING	1
2	310101–00143–00	FRONT PLATE T2	SEE DRAWING	2
1	310101–00009–03	DIPOLE MAGNET LAMINATION	SEE DRAWING	1916
ITEM	PART/PART NUMBER	NOMENCLATURE OR DESCRIPTION	MATERIAL / SPEC	QTY

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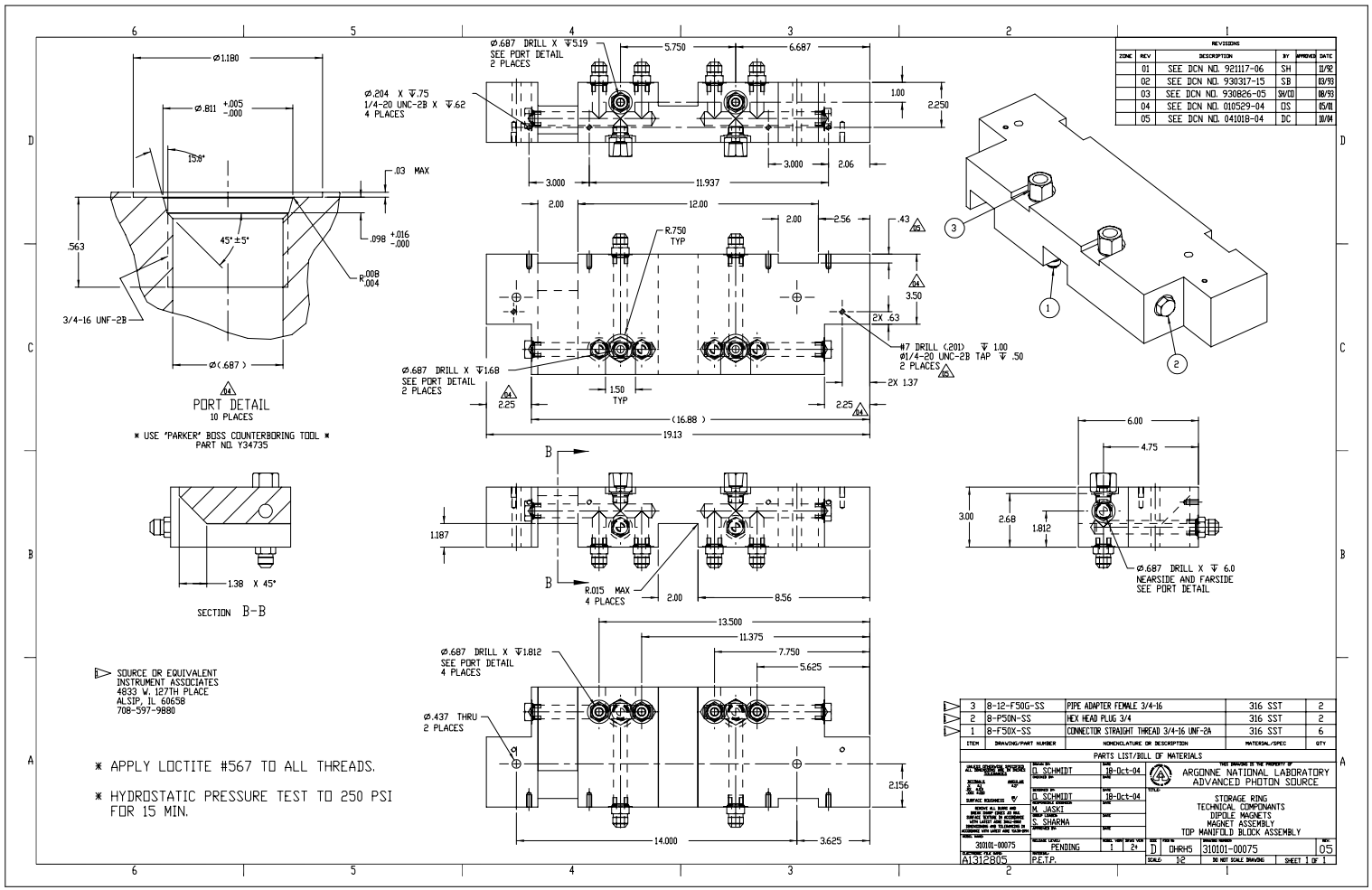

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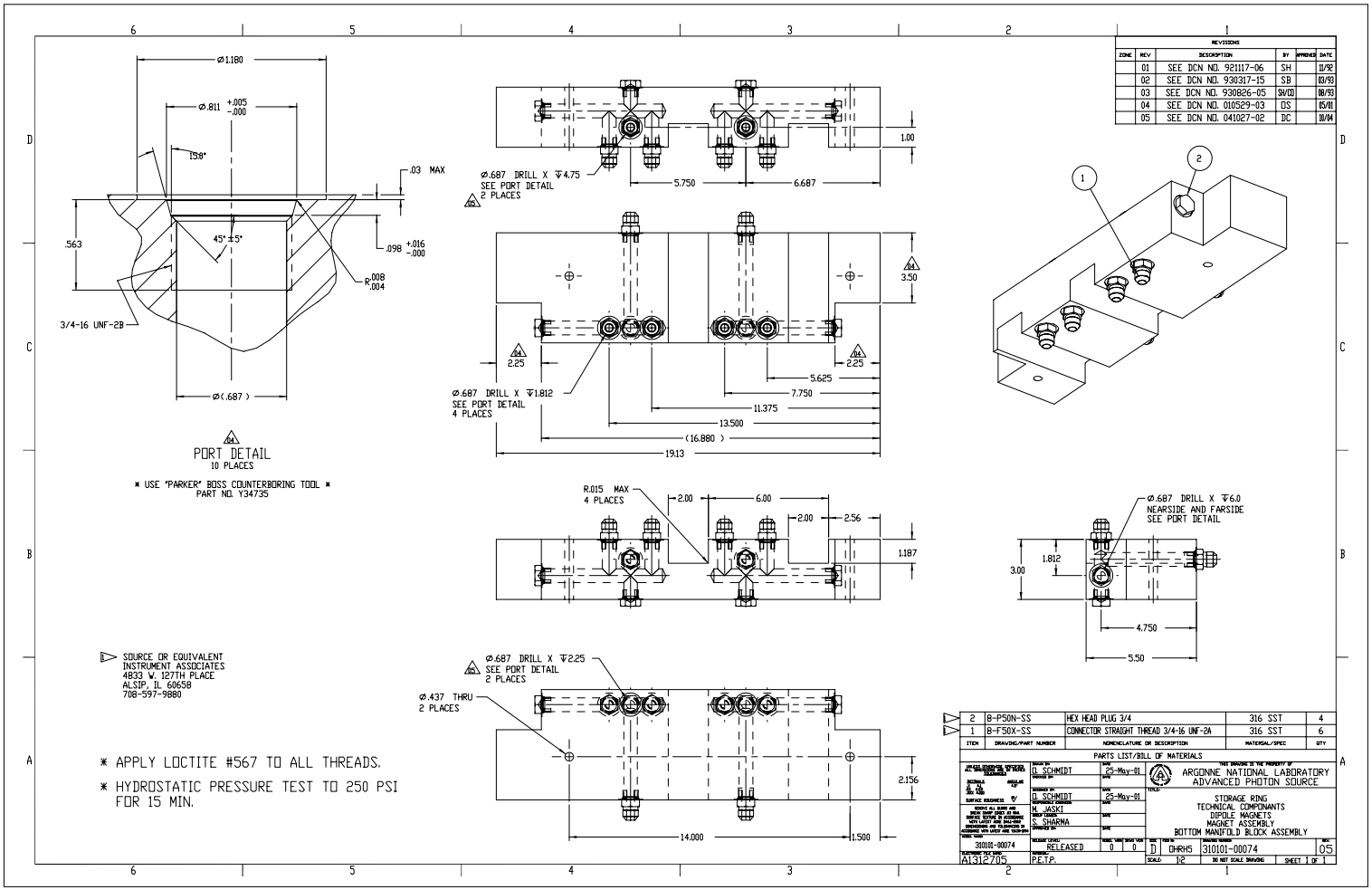

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