



## HL-LHC D2 Documentation

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# MBRDS MTF data management

**Equipment Identifier:** HCMBRDM001-02000001  
**Other Identifier:** MBRDS1  
**Description:** HL Recombination Dipole (D2) Model

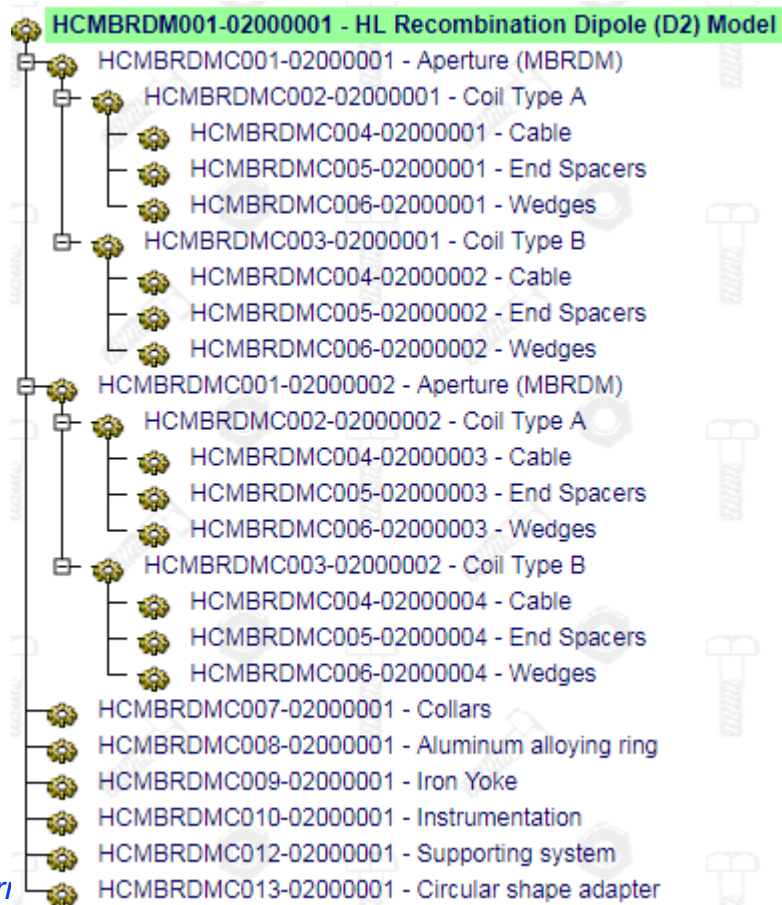
All D2 SM MTF manufacture steps filled by INFN QC team, released

Step ID	R/E	Other name	Description	Status	Result	INC
20			Aperture #1 collaring	Done	Ok	
22			Installation of n.4 Voltage taps on coil end on the connection side of each coil	Done	Ok	
23			Installation of QHs & coil protection sheets	Done	Ok	
24			Poles to collars integration	Done	Ok	
25			Preliminary collaring using provisional clamps	Done	Ok	
26.1			Continuous monitoring of QHs during collaring: R insulation vs ground	Done	Ok	
26.2			Continuous monitoring of QHs during collaring: R insulation vs aperture	Done	Ok	
26.3			Continuous monitoring of QHs during collaring: Electrical continuity	Done	Ok	
27			Electrical test after preliminary collaring & single aperture	Done	Ok	
28			Final collaring of aperture #1	Done	Ok	
29			Final electrical test aperture #1	Done	Not Ok	
29.1			Final dimensional measurements at room temperature of aperture #1	Done	Ok	
29.2			Final magnetic measurements at room temperature of aperture #1	Done	Ok	
29.3	R		Final electrical test aperture #1	Done	Ok	
30			Aperture #2 collaring	Done	Ok	
32			Installation of n.4 Voltage taps on coil end on the connection side of each coil	Done	Ok	
33			Installation of QHs & coil protection sheets	Done	Ok	
34			Poles to collars integration	Done	Ok	
35			Preliminary collaring using provisional clamps	Done	Ok	
36.1			Continuous monitoring of QHs during collaring: R insulation vs ground	Done	Ok	
36.2			Continuous monitoring of QHs during collaring: R insulation vs aperture	Done	Ok	
36.3			Continuous monitoring of QHs during collaring: Electrical continuity	Done	Ok	
37			Electrical test after preliminary collaring & single aperture	Done	Ok	
38			Final collaring of aperture #2	Done	Ok	
39			Final electrical test aperture #2	Done	Ok	
39.1			Final dimensional measurements at room temperature of aperture #2	Done	Ok	
39.2			Final magnetic measurements at room temperature of aperture #2	Done	Ok	
40			Collared apertures assembling	Done	Ok	
42			Installation of instrumentation (step 1): n. 2 thermometers.	Done	Ok	
43			Final electrical test of gauges and QHs	Done	Ok	
44			Insertion of Al rectangular sleeves	Done	Ok	
45			Dimensional check of collared apertures assembly	Done	Ok	
46			Electrical test after collaring - Series connection of apertures	Done	Ok	
47			Magnetic measurements of collared apertures #1 + #2 assembly.	Done	Ok	
50			Iron yoke assembly	Done	Ok	
51			Assembling and dimensional check of half yoke packs.	Done	Ok	
52			Preparation of tie rods with stain gauges	Done	Ok	
53			Iron yoke assembling with stiffening bars and C-clamps	Done	Ok	
54			Welding of stiffening bars & dye penetrant test	Done	Ok	
55			Installation of end flanges and bullet gauges. Insertion of longitudinal tie rod	Done	Ok	
56			Axial pre-compression of the magnet	Done	Ok	
57			Dimensional check.	Done	Ok	
58			Installation of G10 flange on magnet connection side.	Done	Ok	
59			Shaping of the conductor and manufacturing of electrical junctions, inst of V-ta	Done	Ok	
59.1			Installation of plate for electrical connectors and electrical cabling.	Done	Ok	
59.2			Final electrical test after yoke assembly: series connected apertures	Done	Ok	
59.3			Final electrical test of gauges and QHs.	Pending		
59.4			Final Magnetic Measurements at room temperature	Done	Ok	
90			Shipping to CERN	Done	Ok	
100			Reception Tests at CERN	Pending		

Step ID	Step Description	HCMBRDM001
<b>MBRDM</b>		
10	Collaring of apertures	
20	Magnetic measurements. Collared coils in the Al sleeve	
30	Assembly of the two apertures in the iron yoke	
40	Verification of the integrity of the electrical insulation and impedance of various circuits, after integration of the iron lamination	
50	Connection of the two apertures in series and of the instrumentation	
60	Magnetic measurements after final assembly	
70	Shipping to CERN	
<b>Up Coil</b>		
10	Winding coils	
20	Dimensional Control	
30	Electrical Integrity Test	
40	E Modulus measurement	
50	internal V -tap Wires Soldering	
60	Protection heater assembly	
70	Magnetic measurements. Collared coils	
<b>Down Coil</b>		
10	Winding coils	
20	Dimensional Control	
30	Electrical Integrity Test	
40	E Modulus measurement	
50	internal V -tap Wires Soldering	
60	Protection heater assembly	
70	Magnetic measurements. Collared coils	
<b>Cable</b>		
10	Cable insulation	
20	Dimensional Measurement	
30	Electrical Integrity Test	
<b>End Spacers</b>		
10	Reception of asset	
20	Dimensional Control	
<b>Wedges</b>		
10	wedges insulation	
20	Electrical Integrity Test	
<b>Collars</b>		
10	Reception of asset	
20	Dimensional Control	
<b>Aluminum allying ring</b>		
10	Reception of asset	
20	Dimensional Control	
<b>Iron Yoke</b>		
10	Reception of asset	
20	Dimensional Control	
<b>Instrumentation</b>		
10	Reception of asset	
<b>Steel plates</b>		
10	Reception of asset	
<b>Supporting system</b>		
10	Reception of asset	
<b>Circular shape adapter</b>		
10	Reception of asset	

# EDMS D2 short model structure

- Assets and Items have been created and used on MBRDS production by INFN.



# B.O.M complete



2050304 v.1 | LHC-MBRDM-NOT-0001 v.1

● Released

🔒 Restricted access

**BOM D2 SHORT MODEL**

by BEATRIZ ALMEIDA FERREIRA



1	2	3	4	5	A	B	E	F	G	H	L	M	N	O	P	Q
		Item code	Profile	L1	L2	L3	L4	Quantity	Component			Drawing / specification	drawing's version	Controlled	Remark	
1		D2 MODEL														
3		HCMBRDM001	Profile 1	1	0	0	0	1	HL RECOMBINATION DIPOLE (D2) 1.8M MODEL			LHCMBRDMC0117	v.AA	NO	DRAWING FOLDER	
4		HCMBRDMC001		1	1	0	0	2	APERTURE (MBRDM)			LHCMBRDMC0007	First version	NO	DRAWING FOLDER	
5		HCMBRDMC002	Profile 2	1	2	0	0	2	COIL TYPE A			LHCMBRDMC0008	v.AB	NO	DRAWING FOLDER	
6		NO		1	2	1	0	-	SUPPORTO CONDUTTORE USCITA			LHCMBRDMC0009	First version	NO		
7		NO		1	2	2	0	-	SUPPORTO CONDUTTORE			LHCMBRDMC0010	v.AA	NO		
8		HCMBRDMC004	Profile 3	1	2	3	0	4	CABLE			LHCMBRDMC0011	First version	NO		
9		HCMBRDMC005	Profile 4	1	2	4	0	4	END SPACERS						DRAWING FOLDER	
46		HCMBRDMC006	Profile 5	1	2	5	0	4	WEDGES						DRAWING FOLDER	
49		HCMBRDMC014		1	2	6	0	4	INSULATION AND COIL PROTECTION						DRAWING FOLDER	
78		HCMBRDMC003	Profile 2	1	3	0	0	2	COIL TYPE B			LHCMBRDMC0050	v.AA	NO	DRAWING FOLDER	
79		NO		1	3	1	0	-	SUPPORTO CONDUTTORE USCITA			LHCMBRDMC0009	First version	NO		
80		NO		1	3	2	0	-	SUPPORTO CONDUTTORE			LHCMBRDMC0010	v.AA	NO		
81		HCMBRDMC004	Profile 3	1	3	3	0		CABLE			LHCMBRDMC0011	First version	NO		
82		HCMBRDMC005	Profile 4	1	3	4	0		END SPACERS						DRAWING FOLDER	
119		HCMBRDMC006	Profile 5	1	3	5	0		WEDGES						DRAWING FOLDER	
122		HCMBRDMC014		1	3	6	0		INSULATION AND COIL PROTECTION						DRAWING FOLDER	
151		HCMBRDMC007	Profile 4	1	2	0	0	1	COLLARS						DRAWING FOLDER	
175		HCMBRDMC008	Profile 4	1	3	0	0	1	ALUMINUM ALLOYING RING			LHCMBRDMC0006	v.AD	NO		
176		HCMBRDMC009	Profile 4	1	4	0	0	1	IRON YOKE						DRAWING FOLDER	
177		NO		-	-	-	-	-	Yoke Sheet			LHCMBRDMC0102	v.AB	YES		
178		NO		-	-	-	-	-	Half Yoke ASM			LHCMBRDMC0103	v.AB	NO		
179		NO		-	-	-	-	-	Half Yoke Head			LHCMBRDMC0104	v.AA	NO		
180		NO		-	-	-	-	-	Plate Head Yoke			LHCMBRDMC0105	v.AB	NO		
181		NO		-	-	-	-	-	Yoke Plate			LHCMBRDMC0106	v.AA	NO		
182		NO		-	-	-	-	-	C-Clamp			LHCMBRDMC0107	v.AB	NO		
183		HCMBRDMC010	Profile 6	1	5	0	0	1	INSTRUMENTATION							
184		HCMBRDMC011		-	-	-	-	-	STEEL PLATES						CANCELLED, INCLUDED IN IRON YOKE	
185		HCMBRDMC012	Profile 6	1	6	0	0	1	SUPPORTING SYSTEM						DRAWING FOLDER	
186		NO		-	-	-	-	-	M16 Tie Rod			LHCMBRDMC0108	v.AC	NO		
187		NO		-	-	-	-	-	M24 Tie Rod			LHCMBRDMC0109	v.AA	NO		
188		NO		-	-	-	-	-	M33 Tie Rod			LHCMBRDMC0110	v.AA	NO		
189		NO		-	-	-	-	-	Coil Plate LC			LHCMBRDMC0111	v.AB	NO		
190		NO		-	-	-	-	-	Mezzelune LC			LHCMBRDMC0112	v.AA	NO		
191		NO		-	-	-	-	-	Mezzelune L. O.C			LHCMBRDMC0113	v.AA	NO		
192		NO		-	-	-	-	-	Grano M16 L50			LHCMBRDMC0114	First version	NO		
193		NO		-	-	-	-	-	Grano M12 L40			LHCMBRDMC0115	First version	NO		
194		NO		-	-	-	-	-	Grano M12 L30			LHCMBRDMC0116	First version	NO		
195		HCMBRDMC013	Profile 6	1	7	0	0	1	CIRCULAR SHAPE ADAPTOR							



International review of D2 Superconducting Magnet for HL-LHC, 11<sup>st</sup> March. 2019, CERN.

# Manufacture steps profiles

- Manufacture steps and control points created, experienced on first MBRDS

Profile 1 ASSEMBLY			Profile 2 COIL		
20	()	Aperture #1 collaring	20	()	Coil Winding
22	()	Installation of n.4 Voltage taps on coil end on the connection side of each coil	21	()	Layer jump shaping and brazing of Cu stabilizer and Dimensional check
23	()	Installation of QHS & coil protection sheets	23	()	Visual and Dimensional check of coil ends during winding
24	()	Poles to collars integration	24	()	Length measurement of coil at the end of the winding
25	()	Preliminary collaring using provisional clamps	26.1	()	Electrical Test - coil resistance
26.1	()	Continuous monitoring of QHS during collaring: R insulation vs ground	26.2	()	Electrical Test - Inductance measurements at f=10Hz, 100Hz, 1kHz
26.2	()	Continuous monitoring of QHS during collaring: R insulation vs aperture	30	()	Polymerization : check of process and record parameters
26.3	()	Continuous monitoring of QHS during collaring: Electrical continuity	41	()	Dimensional Check of coil after polymerization
27	()	Electrical test after preliminary collaring & single aperture	42	()	E Modulus measurement @ 70MPa
28	()	Final collaring of aperture #1	43.1	()	Electrical test - coil resistance
29	()	Final electrical test aperture #1	43.2	()	Electrical Test - Inductance measurements at f=10Hz, 100Hz, 1kHz
29.1	()	Final dimensional measurements at room temperature of aperture #1	43.3	()	Electrical Test - Inter-turn insulation test
29.2	()	Final magnetic measurements at room temperature of aperture #1	50	()	Coil Finishing
30	()	Aperture #2 collaring	51	()	Impregnation of coil ends: record of parameter and visual check
32	()	Installation of n.4 Voltage taps on coil end on the connection side of each coil	90	()	Coil Acceptance
33	()	Installation of QHS & coil protection sheets			
34	()	Poles to collars integration			
35	()	Preliminary collaring using provisional clamps			
36.1	()	Continuous monitoring of QHS during collaring: R insulation vs ground			
36.2	()	Continuous monitoring of QHS during collaring: R insulation vs aperture			
36.3	()	Continuous monitoring of QHS during collaring: Electrical continuity			
37	()	Electrical test after preliminary collaring & single aperture			
38	()	Final collaring of aperture #2			
39	()	Final electrical test aperture #2			
39.1	()	Final dimensional measurements at room temperature of aperture #2			
39.2	()	Final magnetic measurements at room temperature of aperture #2			
40	()	Collared apertures assembling			
42	()	Installation of instrumentation (step 1): n. 2 thermometers.			
43	()	Final electrical test of gauges and QHS			
44	()	Insertion of Al rectangular sleeves			
45	()	Dimensional check of collared apertures assembly			
46	()	Electrical test after collaring - Series connection of apertures			
47	()	Magnetic measurements of collared apertures #1 + #2 assembly.			
50	()	Iron yoke assembly			
51	()	Assembling and dimensional check of half yoke packs.			
52	()	Preparation of tie rods with stain gauges			
53	()	Iron yoke assembling with stiffening bars and C-clamps			
54	()	Welding of stiffening bars & dye penetrant test			
55	()	Installation of end flanges and bullet gauges. Insertion of longitudinal tie rod			
56	()	Axial pre-compression of the magnet			
57	()	Dimensional check.			
58	()	Installation of G10 flange on magnet connection side.			
59	()	Shaping of the conductor and manufacturing of electrical junctions, inst of V-ta			
59.1	()	Installation of plate for electrical connectors and electrical cabling.			
59.2	()	Final electrical test after yoke assembly: series connected apertures			
59.3	()	Final electrical test of gauges and QHS.			
59.4	()	Final Magnetic Measurements at room temperature			
90	()	Shipping to CERN			
Profile 3 CABLE			Profile 4 END SPACE COLLARS		
10	()	Cable insulation	10	()	Reception of asset
20	()	Dimensional Measurement	20	()	Dimensional Control
30	()	Electrical Integrity Test			
Profile 5 WEDGES			Profile 6		
10	()	Dimensional Check	10	()	Reception of asset
20	()	Wedges insulation			
30	()	Electrical Integrity Test			

# MIP coils type A-B

## All applicable MIP templates and MBRDS manufacturing ones approved on MTF

- <https://edms.cern.ch/document/1959718/1>
- <https://edms.cern.ch/document/2010190/1>

ASG		QUALITY CONTROL PLAN (QCP)		DOC. n. PCQ 9020390/A-01		Rev. 1	
Piano Controllo Qualità (PCQ)		ASG ID (drawing N./serial N.) 652RM20390		Customer ID / ID Cliente: MBRDS1 Coil manufacturing		Sheet/Fg. 3/4	
JOB / Commessa: 2135		COMPONENT / Componente: COIL A - #04		DATE / SIGNATURE DATA / FIRMA		REPORT N. / REMARKS RAPPORTO N. / NOTE	
ITEM N.	DESCRIPTION / DESCRIZIONE	REFERENCE DOCUMENT OR ACCEPTANCE CRITERIA OR ACCETTAZIONE CRITERIA	ASG	INFN	CERN		
2.4	Misura della lunghezza della bobina a fine avvolgimento Length measurement of coil at the end of winding	652RM20390 r=125 m (rif. indicativo/ref. only)	R			26/03/18 P. P. P.	L = 118 m MA 18 1201
2.5	Controllo corretto posizionamento dei riempitivi a fine avvolgimento Check of correct positioning of fillers at the end of winding	652RM20390	V			03/04/18 P. P. P.	A = R = N.A. B = N.A. x PASSOZZA PRODUCO
2.6	Test elettrici: a) resistenza bobina b) misura di induttanza a f=10Hz, 100Hz, 1kHz Electrical test: a) coil resistance b) inductance measurement at f=10Hz, 100Hz, 1kHz	a) R(20°C)=178.75 mOhm R(20°C)=1.43 mOhm/m b) L=0.862mH @ f=10Hz	R			17/4/18 P. P. P.	MA 18 1608
3	POLIMERIZZAZIONE BOBINA / COIL POLYMERIZATION	T=190 (-0/+5°C) / 30min	R				
3.1	Polymerization: control of cycle and registration of parameters Polimerizzazione: controllo del ciclo e registrazione dei parametri	652RM20390	R			04/05/2018 P. P. P.	MA 18 1802
4	TEST SU BOBINA / TEST OF COIL		R				
4.1	Controllo dimensionale della bobina dopo polimerizzazione Dimensional check of coil after polymerization	651RM20540	R			04/05/2018 P. P. P.	MA 18 1801
4.2	Misura modulo di elasticità a 70MPa E-modulus measurements @ 70MPa	a) R(20°C)=178.75 mOhm R(20°C)=1.43 mOhm/m b) L=0.862mH @ f=10Hz c) Discharge test @ 43V/turn (V <sub>iso</sub> =1333V)	R				
4.3	Test elettrici: a) resistenza bobina b) misura di induttanza a f=10Hz, 100Hz, 1kHz Electrical test: a) coil resistance b) inductance measurement at f=10Hz, 100Hz, 1kHz c) interturn insulation test		R				

ASG		QUALITY CONTROL PLAN (QCP)		DOC. n. PCQ 9020542		Rev. 1	
Piano Controllo Qualità (PCQ)		ASG ID (drawing N./serial N.) 6008M20542		Customer ID / ID Cliente: MBRDS1 Magnet Assembly		Sheet/Fg. 1/30	
JOB / Commessa: 2135		COMPONENT / Componente: MBRDS1 Magnet Assembly		DATE / SIGNATURE DATA / FIRMA		REPORT N. / REMARKS RAPPORTO N. / NOTE	
ITEM N.	DESCRIPTION / DESCRIZIONE	REFERENCE DOCUMENT OR ACCEPTANCE CRITERIA OR ACCETTAZIONE CRITERIA	ASG	INFN	CERN		
1.1	Preparazione bobine di resistenza componete Preparation of resistance components		R				
1.2	Controllo di resistenza e induttanza dei componenti Resistance and inductance control of components		R				
1.3	Controllo di induttanza e resistenza dei componenti Inductance and resistance control of components		R				
1.4	Controllo di induttanza e resistenza dei componenti Inductance and resistance control of components		R				
1.5	Controllo di induttanza e resistenza dei componenti Inductance and resistance control of components		R				
1.6	Controllo di induttanza e resistenza dei componenti Inductance and resistance control of components		R				
1.7	Controllo di induttanza e resistenza dei componenti Inductance and resistance control of components		R				
1.8	Controllo di induttanza e resistenza dei componenti Inductance and resistance control of components		R				
1.9	Controllo di induttanza e resistenza dei componenti Inductance and resistance control of components		R				
1.10	Controllo di induttanza e resistenza dei componenti Inductance and resistance control of components		R				
1.11	Controllo di induttanza e resistenza dei componenti Inductance and resistance control of components		R				
1.12	Controllo di induttanza e resistenza dei componenti Inductance and resistance control of components		R				
1.13	Controllo di induttanza e resistenza dei componenti Inductance and resistance control of components		R				
1.14	Controllo di induttanza e resistenza dei componenti Inductance and resistance control of components		R				
1.15	Controllo di induttanza e resistenza dei componenti Inductance and resistance control of components		R				
1.16	Controllo di induttanza e resistenza dei componenti Inductance and resistance control of components		R				
1.17	Controllo di induttanza e resistenza dei componenti Inductance and resistance control of components		R				
1.18	Controllo di induttanza e resistenza dei componenti Inductance and resistance control of components		R				
1.19	Controllo di induttanza e resistenza dei componenti Inductance and resistance control of components		R				
1.20	Controllo di induttanza e resistenza dei componenti Inductance and resistance control of components		R				

ASG		QUALITY CONTROL PLAN (QCP)		DOC. n. PCQ 9020542		Rev. 1	
Piano Controllo Qualità (PCQ)		ASG ID (drawing N./serial N.) 6008M20542		Customer ID / ID Cliente: MBRDS1 Magnet Assembly		Sheet/Fg. 2/10	
JOB / Commessa: 2135		COMPONENT / Componente: Magnet Assembly		DATE / SIGNATURE DATA / FIRMA		REPORT N. / REMARKS RAPPORTO N. / NOTE	
ITEM N.	DESCRIPTION / DESCRIZIONE	REFERENCE DOCUMENT OR ACCEPTANCE CRITERIA OR ACCETTAZIONE CRITERIA	ASG	INFN	CERN		
1.1	Controllo di resistenza e induttanza dei componenti Resistance and inductance control of components		R				
1.2	Controllo di resistenza e induttanza dei componenti Resistance and inductance control of components		R				
1.3	Controllo di resistenza e induttanza dei componenti Resistance and inductance control of components		R				
1.4	Controllo di resistenza e induttanza dei componenti Resistance and inductance control of components		R				
1.5	Controllo di resistenza e induttanza dei componenti Resistance and inductance control of components		R				
1.6	Controllo di resistenza e induttanza dei componenti Resistance and inductance control of components		R				
1.7	Controllo di resistenza e induttanza dei componenti Resistance and inductance control of components		R				
1.8	Controllo di resistenza e induttanza dei componenti Resistance and inductance control of components		R				
1.9	Controllo di resistenza e induttanza dei componenti Resistance and inductance control of components		R				
1.10	Controllo di resistenza e induttanza dei componenti Resistance and inductance control of components		R				
1.11	Controllo di resistenza e induttanza dei componenti Resistance and inductance control of components		R				
1.12	Controllo di resistenza e induttanza dei componenti Resistance and inductance control of components		R				
1.13	Controllo di resistenza e induttanza dei componenti Resistance and inductance control of components		R				
1.14	Controllo di resistenza e induttanza dei componenti Resistance and inductance control of components		R				
1.15	Controllo di resistenza e induttanza dei componenti Resistance and inductance control of components		R				
1.16	Controllo di resistenza e induttanza dei componenti Resistance and inductance control of components		R				
1.17	Controllo di resistenza e induttanza dei componenti Resistance and inductance control of components		R				
1.18	Controllo di resistenza e induttanza dei componenti Resistance and inductance control of components		R				
1.19	Controllo di resistenza e induttanza dei componenti Resistance and inductance control of components		R				
1.20	Controllo di resistenza e induttanza dei componenti Resistance and inductance control of components		R				



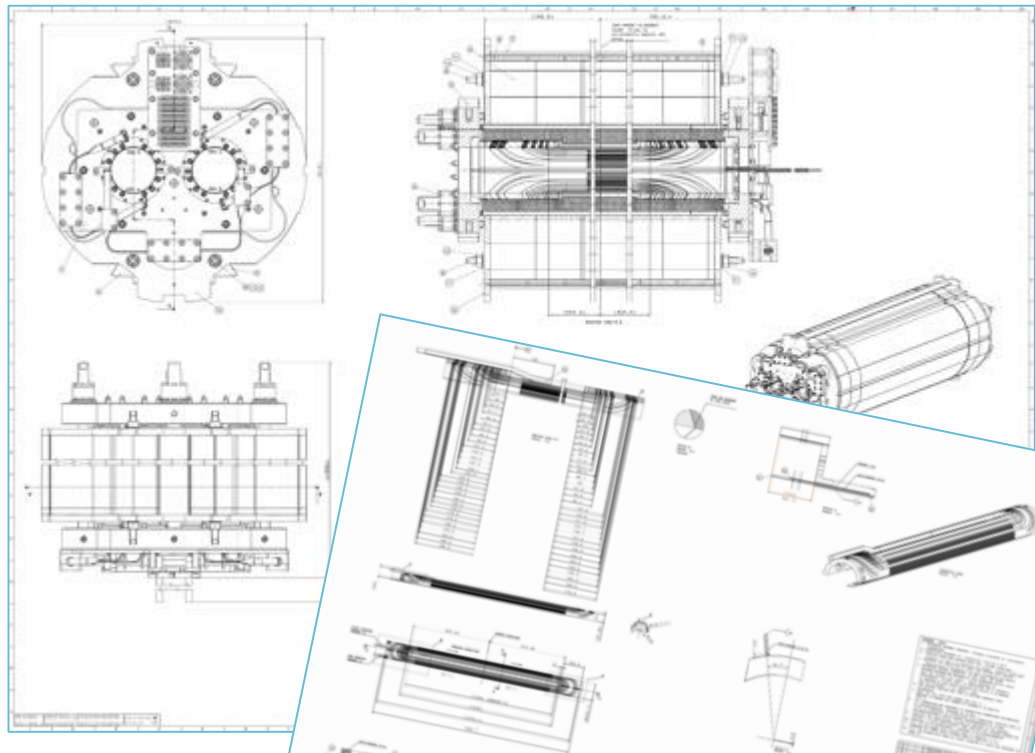
International review of D2 Superconducting Magnet for HL-LHC, 11<sup>st</sup> March. 2019, CERN.

# What is the situation for the drawings - are they in CDD?

## Directly related drawings

Query returned 117 item(s) :

- ✓ LHCMBRDMC0001 alias d2drv0011-9-1\_rev3 SHORT MODEL DIPOLE D2 - LONGITUDINAL WE
- ✓ LHCMBRDMC0002 alias d2drv0011-9-11\_rev1 SHORT MODEL DIPOLE D2 - CONDUCTOR AND
- ✓ LHCMBRDMC0003 alias d2drv0011-10 SHORT MODEL DIPOLE D2 - SOME INSULATIONS PRO
- ✓ LHCMBRDMC0004 alias d2drv0011-11 SHORT MODEL DIPOLE D2 - COIL WINDINGS
- ✓ LHCMBRDMC0005 alias d2drv0011-10-2\_rev6 SHORT MODEL DIPOLE D2 - QUENCH HEATER
- ✓ LHCMBRDMC0006 alias 671RM21018 ALUMINUM SLEEVE
- 
- ✓ LHCMBRDMC0007 alias 600RM20546 ASSEMBLED AND POLYMERISED COILS
- 
- ✓ LHCMBRDMC0008 alias 652RM20390 ASSEMBLY COIL TYPE A
- 
- ✓ LHCMBRDMC0009 alias 652RM20696 SUPPORTO CONDUTTORE USCITA
- 
- ✓ LHCMBRDMC0010 alias 652RM20970 SUPPORTO CONDUTTORE
- 
- ✓ LHCMBRDMC0011 alias LHCMBRDMC0090 alias 651RM21198 PIASTRA COLLARE SALTO STRATO AVVOLGIMENTO TIPO B1
- ✓ LHCMBRDMC0012 alias LHCMBRDMC0091 alias 651RM21199 PIASTRA COLLARE SALTO STRATO AVVOLGIMENTO TIPO B2
- 
- ✓ LHCMBRDMC0013 alias LHCMBRDMC0092 alias 651RM21200 ASM COLLARE SATO STRATO AVVOLGIMENTO B SEMI-PACCO
- 
- ✓ LHCMBRDMC0014 alias LHCMBRDMC0093 alias 651RM21201 ASM COLLARE SATO STRATO AVVOLGIMENTO
- 
- ✓ LHCMBRDMC0015 alias LHCMBRDMC0094 alias 651RM21202 PIASTRA COLLARE SALTO STRATO TESTA TIPO A3
- ✓ LHCMBRDMC0016 alias LHCMBRDMC0095 alias 651RM21203 PIASTRA COLLARE SALTO STRATO TESTA TIPO A4
- 
- ✓ LHCMBRDMC0017 alias LHCMBRDMC0096 alias 651RM21204 ASM COLLARE SALTO STRATO TESTA A SEMI-PACCO
- 
- ✓ LHCMBRDMC0018 alias LHCMBRDMC0097 alias 651RM21205 PIASTRA COLLARE SALTO STRATO TESTA TIPO B3
- 
- ✓ LHCMBRDMC0019 alias LHCMBRDMC0098 alias 651RM21206 PIASTRA COLLARE SALTO STRATO TESTA TIPO B4
- 
- ✓ LHCMBRDMC0020 alias LHCMBRDMC0099 alias 651RM21207 ASM COLLARE SALTO STRATO TESTA B SEMI-PACCO
- 
- ✓ LHCMBRDMC0021 alias LHCMBRDMC0100 alias 651RM21208 ASM COLLARE SALTO STRATO TESTA
- 
- ✓ LHCMBRDMC0022 alias LHCMBRDMC0101 alias 651RM21215 COLLAR KEY
- 
- ✓ LHCMBRDMC0023 alias LHCMBRDMC0102 alias 671RM21234 YOKE SHEET
- 
- ✓ LHCMBRDMC0024 alias LHCMBRDMC0103 alias 600RM21435 HALF YOKE ASM
- 
- ✓ LHCMBRDMC0025 alias LHCMBRDMC0104 alias 671RM21437 HALF YOKE HEAD
- 
- ✓ LHCMBRDMC0026 alias LHCMBRDMC0105 alias 670RM21465 PLATE HEAD YOKE
- 
- ✓ LHCMBRDMC0027 alias LHCMBRDMC0106 alias 671RM21576 YOKE PLATE
- 
- ✓ LHCMBRDMC0028 alias LHCMBRDMC0107 alias 600RM21574 C-CLAMP
- 
- ✓ LHCMBRDMC0029 alias LHCMBRDMC0108 alias 670RM21461 M16 TIE ROD
- 
- ✓ LHCMBRDMC0030 alias LHCMBRDMC0109 alias 670RM21462 M24 TIE ROD
- 
- ✓ LHCMBRDMC0031 alias LHCMBRDMC0110 alias 670RM21463 M33 TIE ROD
- 
- ✓ LHCMBRDMC0032 alias LHCMBRDMC0111 alias 660RM21467 COIL PLATE LC
- 
- ✓ LHCMBRDMC0033 alias LHCMBRDMC0112 alias 660RM21621 MEZZELUNE L.C
- 
- ✓ LHCMBRDMC0034 alias LHCMBRDMC0113 alias 660RM21622 MEZZELUNE L. O.C
- 
- ✓ LHCMBRDMC0035 alias LHCMBRDMC0114 alias 600RM21623 GRANO M16 L50
- 
- ✓ LHCMBRDMC0036 alias LHCMBRDMC0115 alias 600RM21624 GRANO M12 L40
- 
- ✓ LHCMBRDMC0037 alias LHCMBRDMC0116 alias 600RM21625 GRANO M12 L30
- 
- ✓ LHCMBRDMC0038 alias LHCMBRDMC0117 alias 600RM20542 GENERAL ASSEMBLY



All the 117 ASG manufacturing DWG's for components, coils, magnet are in CDD  
In released state, comments by CERN in EDMS



# NC management

## Follow up of NCR by ASG (D2)

EDMS 1987890

Mis à jour le 17/01/2019

N° EDMS	Title	External ID	Date d'émission	Class	Main Cause	Critical Non critical	Action	Status	Comments	Fermé par
1982035	NC Wedges Dimensions	RNC180123B	23/01/2018	Mechanical	Materials	Non critical	Concession	Closed		
1982035	NC Wedges Dimensions	RNC180228A	28/02/2018	Mechanical	Materials	Non critical	Concession	Closed		
2030233	NC Final Electrical Test aperture #1	RNC180920C	29/09/2018	Electrical	Process-Methods	Critical	Repair	Actions Underway		
2059742	NC Interference Al Sleeve-Apertures assem	RNC181102B	13/11/2018	Mechanical	Process-Methods	Non critical	Repair	Closed		
2059754	NC Coil B01 - Strain Gauges detachment	RNC181019A	19/10/2018	Electrical		Non Critical	Concession	Closed		

All NCs archived, last electrical NC to be closed. [1987890 v.1](#)

- HCMBRD001-0200001 - HL Recombination Dipole (D2) I/r
- HCMBRD001-0200001 - Apperture (MBRD)
- HCMBRD002-0200001 - Top Coil
- HCMBRD004-0200001 - Cable
- HCMBRD005-0200001 - End Spacers
- HCMBRD006-0200001 - Wedges
  - 1982035 (v.1) Dimensional Check - HCMBRD006-0200001
  - 1982035 (v.1) NC wedges
  - 1981202 (v.1) Winding coils - HCMBRD002-0200001
  - 1981215 (v.1) Polymerization - HCMBRD002-0200001
  - 1981217 (v.1) E Modulus measurement - HCMBRD002-0200001
  - 1981220 (v.1) Electrical Integrity Test - HCMBRD002-0200001
- HCMBRD003-0200001 - Down Coil
  - 1959716 (v.1) MIP D2 Model (coil type A)
  - 1959718 (v.1) MIP D2 (coil type B)
- HCMBRD007-0200002 - Apperture (MBRD)
  - HCMBRD007-0200001 - Collars
  - HCMBRD008-0200001 - Aluminum alloying ring
  - HCMBRD009-0200001 - Iron Yoke
  - HCMBRD010-0200001 - Instrumentation
  - HCMBRD011-0200001 - Steel plates
  - HCMBRD012-0200001 - Supporting system

Info

Description: Non Conformities of the wedges involved in MBRDGM External reference: Keywords:

Local administrators: List of Administrators Equipment code: HL-NCR

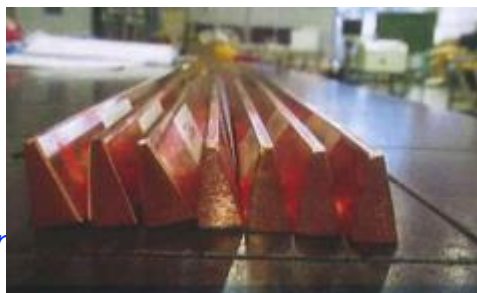
Context: HL-LHC-WP3-MBRD-MTF Release procedure: HL-NCR

Associated Links: HL Recombination Dipole (D2) Model & Prototype Release procedure for HL-LHC NCRs

This page <https://edms.cern.ch/document/1982035/1>

Files

Name	Size	Last modified date	Last modified by
NC-wedges-1-3-8.pdf	344.2 KI	2018-06-04 18:29:40	FASQUALE FABBRICATORE
NC-wedges-2-4-5-6.pdf	319.7 KI	2018-06-04 18:29:40	FASQUALE FABBRICATORE



ASG RAPPORTO DI NON CONFORMITA' / NON-COMPLIANCE REPORT

ASG 2130 Impresa/Client: ISTITUTO NAZIONALE DI FISICA - New Customer: RNC: RNC180123B

Commissario: ASG 2130 Designe assunzione: ASG 2130

Descrizione del prodotto NC / Defect: Non-conformity product description: ASG 2130

Formulare: SIDER ENGINEERING S.P.A. B - FORNITORE: SIDER ENGINEERING S.P.A.

Tipi di NC / NC type: Dimensional

Classifica NC / NC Class: C - DESCRIZIONE NON CONFORMITA' E CODIFICAZIONE

Preparato (Elaborato): [Signature] Verificato (Esaminato): [Signature]

Approvato (Approvato): [Signature]

Preparato (Elaborato): [Signature] Verificato (Esaminato): [Signature]

Approvato (Approvato): [Signature]

F - RISULTATO FINALE: [Signature]

Approvato (Approvato): [Signature]

# Prototype documentation preparation

- MTF structure with manufacture control points on prototype shall follow experienced MBRDS one. **To be agreed with INFN, implemented by next April**

Profile 1	ASSEMBLY	Profile 2	COIL
20	( ) Aperture #1 collaring	20	( ) Coil Winding
22	( ) Installation of n.4 Voltage taps on coil end on the connection side of each coil	21	( ) Layer jump shaping and brazing of Cu stabilizer and Dimensional check
23	( ) Installation of QHs & coil protection sheets	23	( ) Visual and Dimensional check of coil ends during winding
24	( ) Poles to collars integration	24	( ) Length measurement of coil at the end of the winding
25	( ) Preliminary collaring using provisional clamps	26.1	( ) Electrical Test - coil resistance
26.1	( ) Continuous monitoring of QHs during collaring: R insulation vs ground	26.2	( ) Electrical Test - inductance measurements at f=10Hz, 100Hz, 1kHz
26.2	( ) Continuous monitoring of QHs during collaring: R insulation vs aperture	30	( ) Polymerization : check of process and record parameters
26.3	( ) Continuous monitoring of QHs during collaring: Electrical continuity	41	( ) Dimensional Check of coil after polymerization
27	( ) Electrical test after preliminary collaring $\angle$ single aperture	42	( ) E Modulus measurement @ 70MPa
28	( ) Final collaring of aperture #1	43.1	( ) Electrical test - coil resistance
29	( ) Final electrical test aperture #1	43.2	( ) Electrical Test - Inductance measurements at f=10Hz, 100Hz, 1kHz
29.1	( ) Final dimensional measurements at room temperature of aperture #1	43.3	( ) Electrical Test - inter-turn insulation test
29.2	( ) Final magnetic measurements at room temperature of aperture #1	50	( ) Coil Finishing
30	( ) Aperture #2 collaring	51	( ) Impregnation of coil ends: record of parameter and visual check
32	( ) Installation of n.4 Voltage taps on coil end on the connection side of each coil	90	( ) Coil Acceptance
33	( ) Installation of QHs & coil protection sheets		
34	( ) Poles to collars integration		
35	( ) Preliminary collaring using provisional clamps		
36.1	( ) Continuous monitoring of QHs during collaring: R insulation vs ground		
36.2	( ) Continuous monitoring of QHs during collaring: R insulation vs aperture		
36.3	( ) Continuous monitoring of QHs during collaring: Electrical continuity		
37	( ) Electrical test after preliminary collaring $\angle$ single aperture		
38	( ) Final collaring of aperture #2		
39	( ) Final electrical test aperture #2		
39.1	( ) Final dimensional measurements at room temperature of aperture #2		
39.2	( ) Final magnetic measurements at room temperature of aperture #2		
40	( ) Collared apertures assembling		
42	( ) Installation of instrumentation (step 1): n. 2 thermometers.		
43	( ) Final electrical test of gauges and QHs		
44	( ) Insertion of Al rectangular sleeves		
45	( ) Dimensional check of collared apertures assembly		
46	( ) Electrical test after collaring - Series connection of apertures		
47	( ) Magnetic measurements of collared apertures #1 + #2 assembly.		
50	( ) Iron yoke assembly		
51	( ) Assembling and dimensional check of half yoke packs.		
52	( ) Preparation of tie rods with stain gauges		
53	( ) Iron yoke assembling with stiffening bars and C-clamps		
54	( ) Welding of stiffening bars $\angle$ dye penetrant test		
55	( ) Installation of end flanges and bullet gauges. Insertion of longitudinal tie rod		
56	( ) Axial pre-compression of the magnet		
57	( ) Dimensional check.		
58	( ) Installation of G10 flange on magnet connection side.		
59	( ) Shaping of the conductor and manufacturing of electrical junctions, inst of V-ta		
59.1	( ) Installation of plate for electrical connectors and electrical cabling.		
59.2	( ) Final electrical test after yoke assembly: series connected apertures		
59.3	( ) Final electrical test of gauges and QHs.		
59.4	( ) Final Magnetic Measurements at room temperature		
90	( ) Shipping to CERN		
		Profile 3	CABLE
		10	( ) Cable insulation
		20	( ) Dimensional Measurement
		30	( ) Electrical Integrity Test
		Profile 4	END SPACER COLLARS
		10	( ) Reception of asset
		20	( ) Dimensional Control
		Profile 5	WEDGES
		ep	Other name
		10	( ) Dimensional Check
		20	( ) Wedges insulation
		30	( ) Electrical Integrity Test

# MBRDP Assets

- Assets and items structure of **prototype** shall follow MBRDS ones. To be agreed, implemented by next April

	A	B	E	F	G	H	I	J	K	L	M	N
	Item code	Profile	L1	L2	L3	L4	Quantity	Component	Drawing / specification	drawing's version	Controlled	Remark
1	D2 MODEL											
2	HCMBRDM001	Profile 1	1	0	0	0	1	HL RECOMBINATION DIPOLE (D2) 1.8M MODEL	LHCMBRDMC0117	v.AA	NO	DRAWING FOLDER
4	HCMBRDMC001		1	1	0	0	2	APERTURE (MBRDM)	LHCMBRDMC0007	First version	NO	DRAWING FOLDER
5	HCMBRDMC002	Profile 2	1	2	0	0	2	COIL TYPE A	LHCMBRDMC0008	v.AB	NO	DRAWING FOLDER
6	NO		1	2	1	0	-	SUPPORTO CONDUTTORE USCITA	LHCMBRDMC0009	First version	NO	
7	NO		1	2	2	0	-	SUPPORTO CONDUTTORE	LHCMBRDMC0010	v.AA	NO	
8	HCMBRDMC004	Profile 3	1	2	3	0	4	CABLE	LHCMBRDMC0011	First version	NO	
9	HCMBRDMC005	Profile 4	1	2	4	0	4	END SPACERS				DRAWING FOLDER
46	HCMBRDMC006	Profile 5	1	2	5	0	4	WEDGES				DRAWING FOLDER
49	HCMBRDMC014		1	2	6	0	4	INSULATION AND COIL PROTECTION				DRAWING FOLDER
78	HCMBRDMC003	Profile 2	1	3	0	0	2	COIL TYPE B	LHCMBRDMC0050	v.AA	NO	DRAWING FOLDER
79	NO		1	3	1	0	-	SUPPORTO CONDUTTORE USCITA	LHCMBRDMC0009	First version	NO	
80	NO		1	3	2	0	-	SUPPORTO CONDUTTORE	LHCMBRDMC0010	v.AA	NO	
81	HCMBRDMC004	Profile 3	1	3	3	0		CABLE	LHCMBRDMC0011	First version	NO	
82	HCMBRDMC005	Profile 4	1	3	4	0		END SPACERS				DRAWING FOLDER
119	HCMBRDMC006	Profile 5	1	3	5	0		WEDGES				DRAWING FOLDER
122	HCMBRDMC014		1	3	6	0		INSULATION AND COIL PROTECTION				DRAWING FOLDER
151	HCMBRDMC007	Profile 4	1	2	0	0	1	COLLARS				DRAWING FOLDER
175	HCMBRDMC008	Profile 4	1								NO	
176	HCMBRDMC009	Profile 4	1									DRAWING FOLDER
183	HCMBRDMC010	Profile 6	1									
184	HCMBRDMC011											CANCELLED, INCLUDED IN IRON YOKE
185	HCMBRDMC012	Profile 6	1									DRAWING FOLDER
195	HCMBRDMC013	Profile 6	1									

	Profile	L1	L2	L3	L4	L5	Quantity	Component	Drawing / specification	drawing's version
2	Profile 1	1	0	0	0	0	1	HL RECOMBINATION DIPOLE (D2) PROTOTYPE (MBRDP1)		
3	Profile 1	1	1	0	0	0	2	APERTURE		
4	Profile 2	1	1	1	0	0	2	COIL TYPE A		
5	Profile 1	1	1	1	1	0	Batch	INSULATED CABLE		
6	Profile 6	1	1	1	1	1	Batch	BARE CABLE		
7	Profile 6	1	1	1	1	2	Batch	POLYIMIDE TAPE		
8	Profile 4	1	1	1	2	0	Batch	END SPACERS		
9	Profile 1	1	1	1	3	0	Batch	Insulated WEDGES		
10								Bare Wedges		
11								Polyimide Tape		
12	Profile 1	1	1	1	4	0	Batch	INSULATION AND COIL PROTECTION		
13	Profile 2	1	1	2	0	0	2	COIL TYPE B		
14	Profile 1	1	1	2	0	0	Batch	INSULATED CABLE		
15	Profile 1	1	1	2	0	1	Batch	BARE CABLE		
16	Profile 1	1	1	2	0	2	Batch	POLYIMIDE TAPE		
17	Profile 4	1	1	2	1	0	Batch	END SPACERS		
18	Profile 1	1	1	2	2	0	Batch	Insulated WEDGES		
19								Bare Wedges		
20								Polyimide Tape		
21	Profile 1	1	1	2	3	0	Batch	INSULATION AND COIL PROTECTION		
22	Profile 1	1	1	3	0	0	Batch	INSTRUMENTATION		
23	Profile 4	1	1	4	0	0	Batch	COLLARS		
24	Profile 1	1	1	5	0	0	Batch	QUENCH HEATERS		
25	Profile 1	1	3	0	0	0	Batch	ALUMINUM ALLOY SLEEVES		
26	Profile 1	1	4	0	0	0	Batch	IRON YOKE		
27	Profile 1	1	5	0	0	0	Batch	INSTRUMENTATION		
28	Profile 1	1	6	0	0	0	Batch	LONGITUDINAL PRECOMPRESSION SYSTEM		
29	Profile 1	1	6	1	0	0	Batch	TIE RODS		
30	Profile 1	1	6	2	0	0	Batch	BULLET GAUGES		
31	Profile 1	1	6	3	0	0	2	END PLATES		
32	Profile 1	1	6	4	0	0	Batch	FLANGE SYSTEM		
33								SUPERBOLTS		
34								C Clamps		
35								C Clamp Welded Plate		



Int

# Conclusions

- All **D2 MBRDS short model manufacture files** are in MTF, released status.
- The **manufacture drawings by ASG** have been commented by CERN DO after release as baseline remarks for next prototype.
- **MTF folders** for MBRDS are fulfilled, and **released**
- **NC list is archived** and being closed
- **MBRDP MTF shall follow structure of MBRDS**. ASG company will fill QA documents, inspection sheets, INFN shall feed the MTF throughout production after approval for CERN release. Implementation from April 2019.

# Thank you for your attention

