CERN
CH-1211 Geneva 23
Switzerland

the **Large Hadron Collider** project

LHC Project Document No.
LHC-LQN-ES-0001.00 rev. 2.1

CERN Div./Group or Supplier/Contractor Document No.
AT-CRI-SSA/MS/cc

EDMS Document No.
383921

Date: 2005-05-18

Engineering Specification

SHORT STRAIGHT SECTION TYPES IN THE DISPERSION SUPPRESSORS

Abstract

This Engineering Specification defines equipment codes in the LHC Dispersion Suppressors for the Cold Mass (CM) mechanical assemblies, cryostats and Short Straight Section (SSS DS) types from Q11 to Q8.
A total of 20 different types of CM mechanical assemblies, 16 cryostat types and 34 different SSS types are identified.

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History of Changes

Rev. No.	*Date*	*Pages*	*Description of Changes*
0.1-draft	2003-05-05	All	Version 0.1-draft prepared by Lars Nielsen.
0.2–draft	2003-05-09	All	Version 0.2-draft checked by V. Parma, H. Prin, K-M. Schirm and sent for approval to the LHC Short Straight Section list. **Deadline: 23 May 2003**.
1.0	2003-06-20		In total 3 new cryostat types added (QQDOS, QQDPS and QQDQS) taking into account the difference of the IFS connection tube depending on the IFS type (see tables 2, 3, 4). Version 1.0 released.
2.0	2005-02-23	All	Update to optics version 6.5 (no change). In total 4 new SSS types added (QQNCE, QQNJF, QQNJG and QQNJI) taking into account the difference beam screen types.
2.1	2005-05-18	All	Version 2.1 released without any modification.

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1. INTRODUCTION

This Engineering Specification defines the equipment codes of the Cold Mass (CM) mechanical assemblies, cryostats and SSS types in the LHC Dispersion Suppressors, Q11 to Q8.

The magnet configuration in the present Engineering Specification is based on LHC optics version 6.5. The cryogenic parameters are based on the Engineering Specification LHC-Q-ES-0001 [1], which specifies all cryogenic parameters including phase separators and QQS types.

The electric power scheme is defined by the Engineering Specification LHC-DCC-ES-0003 [2], which, together with the diode layout and naming given by CEA, defines the scheme for the bus-bar plugs.

2. EQUIPMENT CODE NAMES

2.1 EQUIPMENT CODES FOR CM ASSEMBLIES

The general equipment codes for the SSS DS Cold Mass (CM) assemblies are:

- LMQM_ Cold mass assembly for quadrupole magnet MQM_
- LMQT_ Cold mass assembly for quadrupole magnet MQ and MQT.

In total 20 different types of SSS DS cold mass assemblies are identified; their equipment codes are listed in Table 1. In addition to the different types of MQ quadrupole and corrector magnets, the assigned cold mass equipment codes also takes into account the different assembly types given by the diode type and the front cover.

A diode in installed at cold masses of type MQ, depending of the electrical power scheme I can be of the types, according to the naming given by CEA:

- A: Type (FA, DB)
- B: Type (FB, DA).

The front cover type, depending on the QQS type, is specified as:

- A: Front cover with one quench/cool-down and warm-up pipe connector.
- B: Front cover with pressure restriction plug and two quench/cool-down and warm-up pipe connectors.
- Z: Front cover without quench/cool-down and warm-up pipe connectors.

The cold mass of all Q11 magnets contains a welding flange for installation of an insulation vacuum barrier, which is shown in Table 1, although this does not cause additional cold mass types.

Table 1 - Cold Mass equipment codes

EQUIPMENT CODE	QUANTITY	QUADRUPOLE MQ		CORRECTOR	DIODE TYPE	VACUUM BARRIER	FRONT COVER
LMQMC	3	MQML	(F/D)	MCBCA	None	No	Z
LMQMD	19	MQML	(D/F)	MCBCB	None	No	Z
LMQMO	1	MQML	(F/D)	MCBCA	None	No	A
LMQMP	1	MQML	(D/F)	MCBCB	None	No	A
LMQMH	9	MQMC+MQM	(F/D)	MCBCA	None	No	A
LMQMI	1	MQMC+MQM	(D/F)	MCBCB	None	No	A
LMQMQ	1	MQMC+MQM	(F/D)	MCBCA	None	No	Z
LMQMR	1	MQMC+MQM	(D/F)	MCBCB	None	No	Z
LMQTA	2	MQ+MQTL	(F/D)	MCBCC	A	No	Z
LMQTM	2	MQ+MQTL	(F/D)	MCBCC	B	No	Z
LMQTB	2	MQ+MQTL	(D/F)	MCBCD	A	No	Z
LMQTN	2	MQ+MQTL	(D/F)	MCBCD	B	No	Z
LMQTC	6	MQ+MQTL	(F/D)	MSCBA	A	Yes	B
LMQTK	6	MQ+MQTL	(F/D)	MSCBA	B	Yes	B
LMQTD	2	MQ+MQTL	(D/F)	MSCBB	A	Yes	B
LMQTL	2	MQ+MQTL	(D/F)	MSCBB	B	Yes	B
LMQTG	1	MQ+MQTL+MQTL	(F/D)	MCBCC	A	No	A
LMQTO	1	MQ+MQTL+MQTL	(F/D)	MCBCC	B	No	A
LMQTH	1	MQ+MQTL+MQTL	(D/F)	MCBCD	A	No	A
LMQTP	1	MQ+MQTL+MQTL	(D/F)	MCBCD	B	No	A

2.2 EQUIPMENT CODES FOR CRYOSTATS

The general equipment code for SSS DS cryostat assemblies is: QQD_S.

16 different types of SSS DS cryostats are identified; their equipment codes are:

Table 2 - Equipment codes for SSS DS cryostats

EQUIPMENT CODE	NO.	VACUUM BARRIER	LENGTH	PHASE SEPARATOR TYPE	JUMPER	NO. OF BPM FEED-THROUGHS	CRYOGENIC TUBING	IFS TYPE [3]
QQDAS	18	NO	6935	NONE	NONE	2		MQM
QQDOS	8	NO	6935	NONE	NONE	2		MQ
QQDBS	1	NO	6935	N	A	2	SPECIAL [1]	MQM
QQDCS	8	YES	6935	N	B	2		MQ
QQDDS	6	YES	6935	P	B	2		MQ
QQDES	2	YES	6935	P	B(HIGH)[2]	2		MQ
QQDFS	2	NO	8335	N	A	2		MQM
QQDPS	2	NO	8335	N	A	2		MQ
QQDGS	4	NO	8335	P	A	2		MQM
QQDQS	2	NO	8335	P	A	2		MQ
QQDHS	2	NO	8335	P	A(HIGH)[2]	2		MQM
QQDJS	1	NO	8335	NONE	NONE	2	SPECIAL [1]	MQM
QQDKS	4	NO	6935	NONE	NONE	4		MQM
QQDLS	2	NO	8335	N	A	4		MQM
QQDMS	1	NO	6935	N	A	2	SPECIAL [1]	MQM
QQDNS	1	NO	8335	NONE	NONE	2	SPECIAL [1]	MQM
TOTAL	**64**							

1) See drawings no. LHCLSQR_R0030 and LHC LHCLSQR_R0031 [3].
2) Jumper types A(HIGH) and B(HIGH) are +280 mm higher than the standard jumper types.
3) IFS connection tube depending on the IFS type MQ-type or MQM-type.

2.3 EQUIPMENT CODES FOR SHORT STRAIGHT SECTIONS

The general equipment codes for the SSS DS types are:

- LQN__ SSS DS with quadrupole MQM_.
- LQT__ SSS DS with quadrupole MQ + MQTL.

Table 3 - Equipment codes for SSS DS types

SSS DS equipment code	Cryostat equipment code	Cold Mass equipment code	Beam Screen Line V1	Beam Screen Line V2	Total Quantity
LQNCA	**QQDAS**	**LMQMC**	HCVSSB_05	HCVSSB_05	**1**
LQNCB	**QQDAS**	**LMQMD**	HCVSSB_05	HCVSSB_05	**8**
LQNCC	**QQDKS**	**LMQMC**	HCVSSB_05	HCVSSB_05	**2**
LQNCD	**QQDKS**	**LMQMD**	HCVSSB_05	HCVSSB_05	**2**
LQNCE	**QQDAS**	**LMQMD**	HCVSSB_05	HCVSSB_05	**9**
LQNEA	**QQDMS**	**LMQMO**	HCVSSB_05	HCVSSB_05	**1**
LQNEB	**QQDBS**	**LMQMP**	HCVSSB_05	HCVSSB_05	**1**
LQNJA	**QQDFS**	**LMQMH**	HCVSSB_07	HCVSSB_07	**1**
LQNJB	**QQDGS**	**LMQMH**	HCVSSB_07	HCVSSB_07	**2**
LQNJC	**QQDLS**	**LMQMH**	HCVSSB_07	HCVSSB_07	**1**
LQNJD	**QQDLS**	**LMQMI**	HCVSSB_07	HCVSSB_07	**1**
LQNJE	**QQDHS**	**LMQMH**	HCVSSB_07	HCVSSB_07	**1**
LQNJF	**QQDGS**	**LMQMH**	HCVSSB_07	HCVSSB_07	**2**
LQNJG	**QQDFS**	**LMQMH**	HCVSSB_07	HCVSSB_07	**1**
LQNJI	**QQDHS**	**LMQMH**	HCVSSB_07	HCVSSB_07	**1**
LQNKA	**QQDJS**	**LMQMQ**	HCVSSB_07	HCVSSB_07	**1**
LQNKB	**QQDNS**	**LMQMR**	HCVSSB_07	HCVSSB_07	**1**
LQTBA	**QQDOS**	**LMQTA**	HCVSSB_05	HCVSSB_05	**2**
LQTBB	**QQDOS**	**LMQTB**	HCVSSB_05	HCVSSB_05	**2**
LQTBD	**QQDOS**	**LMQTN**	HCVSSB_05	HCVSSB_05	**2**
LQTCA	**QQDCS**	**LMQTC**	HCVSSB_05	HCVSSB_05	**2**
LQTCB	**QQDCS**	**LMQTL**	HCVSSB_05	HCVSSB_05	**1**
LQTCC	**QQDDS**	**LMQTC**	HCVSSB_05	HCVSSB_05	**3**
LQTCD	**QQDES**	**LMQTC**	HCVSSB_05	HCVSSB_05	**1**
LQTCE	**QQDES**	**LMQTK**	HCVSSB_05	HCVSSB_05	**1**
LQTCG	**QQDDS**	**LMQTK**	HCVSSB_05	HCVSSB_05	**2**
LQTCH	**QQDCS**	**LMQTK**	HCVSSB_05	HCVSSB_05	**3**
LQTCL	**QQDCS**	**LMQTD**	HCVSSB_05	HCVSSB_05	**2**
LQTCM	**QQDDS**	**LMQTL**	HCVSSB_05	HCVSSB_05	**1**
LQTCO	**QQDOS**	**LMQTM**	HCVSSB_05	HCVSSB_05	**2**
LQTEA	**QQDQS**	**LMQTG**	HCVSSB_07	HCVSSB_07	**1**
LQTEB	**QQDPS**	**LMQTH**	HCVSSB_07	HCVSSB_07	**1**
LQTEC	**QQDPS**	**LMQTO**	HCVSSB_07	HCVSSB_07	**1**
LQTED	**QQDQS**	**LMQTP**	HCVSSB_07	HCVSSB_07	**1**
				Total	**64**

Beam Screens are defined in drawings LHCVSSB_0081, 83, 84, 85, 120, 121, 122 and 123 [4].

3. SSS DS, CRYOSTAT AND COLD MASS LOCATIONS

Table 4 - SSS DS types and locations

	LEFT					RIGHT			
Equipment codes	Q11L	Q10L	Q9L	Q8L	LS	Q8R	Q9R	Q10R	Q11R
					IR1				
CM	LMQTC	LMQMD	LMQMH	LMQMD		LMQMD	LMQMH	LMQMD	LMQTK
Cryostat	QQDES	QQDAS	QQDHS	QQDAS		QQDAS	QQDHS	QQDAS	QQDES
SSS DS	LQTCD	LQNCB	LQNJE	LQNCB		LQNCE	LQNJI	LQNCE	LQTCE
					IR2				
CM	LMQTK	LMQMD	LMQMH	LMQMD		LMQMD	LMQMH	LMQMD	LMQTC
Cryostat	QQDDS	QQDAS	QQDGS	QQDAS		QQDAS	QQDGS	QQDAS	QQDDS
SSS DS	LQTCG	LQNCE	LQNJF	LQNCE		LQNCB	LQNJB	LQNCB	LQTCC
					IR3				
CM	LMQTC	LMQTN	LMQTG	LMQTN		LMQTA	LMQTP	LMQTA	LMQTL
Cryostat	QQDDS	QQDOS	QQDQS	QQDOS		QQDOS	QQDQS	QQDOS	QQDDS
SSS DS	LQTCC	LQTBD	LQTEA	LQTBD		LQTBA	LQTED	LQTBA	LQTCM
					IR4				
CM	LMQTL	LMQMC	LMQMI	LMQMC		LMQMD	LMQMH	LMQMD	LMQTC
Cryostat	QQDCS	QQDKS	QQDLS	QQDKS		QQDKS	QQDLS	QQDKS	QQDCS
SSS DS	LQTCB	LQNCC	LQNJD	LQNCC		LQNCD	LQNJC	LQNCD	LQTCA
					IR5				
CM	LMQTC	LMQMD	LMQMH	LMQMD		LMQMD	LMQMH	LMQMD	LMQTK
Cryostat	QQDCS	QQDAS	QQDFS	QQDAS		QQDAS	QQDFS	QQDAS	QQDCS
SSS DS	LQTCA	LQNCB	LQNJA	LQNCB		LQNCE	LQNJG	LQNCE	LQTCH
					IR6				
CM	LMQTK	LMQMP	LMQMQ	LMQMD		LMQMC	LMQMR	LMQMO	LMQTD
Cryostat	QQDCS	QQDBS	QQDJS	QQDAS		QQDAS	QQDNS	QQDMS	QQDCS
SSS DS	LQTCH	LQNEB	LQNKA	LQNCE		LQNCA	LQNKB	LQNEA	LQTCL
					IR7				
CM	LMQTD	LMQTM	LMQTH	LMQTM		LMQTB	LMQTO	LMQTB	LMQTK
Cryostat	QQDCS	QQDOS	QQDPS	QQDOS		QQDOS	QQDPS	QQDOS	QQDCS
SSS DS	LQTCL	LQTCO	LQTEB	LQTCO		LQTBB	LQTEC	LQTBB	LQTCH
					IR8				
CM	LMQTK	LMQMD	LMQMH	LMQMD		LMQMD	LMQMH	LMQMD	LMQTC
Cryostat	QQDDS	QQDAS	QQDGS	QQDAS		QQDAS	QQDGS	QQDAS	QQDDS
SSS DS	LQTCG	LQNCE	LQNJF	LQNCE		LQNCB	LQNJB	LQNCB	LQTCC

4. REFERENCE

[1] Dimensions, Pressures, Temperatures and Sizing of Valves and Piping in the LHC machine Cryostat and Cryogenic Distribution Line, LHC-Q-ES-0001, G. Riddone.

[2] Powering Layout of the SSS Correction Scheme, LHC-DCC-ES-0003, P. Burla.

[3] Drawings LHCLQMAP0002, LHCLSQR_R0030, LHCLSQR_R0031.

[4] Drawings LHCVSSB_0081, LHCVSSB_0083, LHCVSSB_0084, LHCVSSB_0085, LHCVSSB_0120, LHCVSSB_0121, LHCVSSB_0122 and LHCVSSB_0123