

LHC: Cold Mass Longitudinal Welding

Production test plates on Cold Mass 2011

1. Non destructive tests

- 1.1 *Visual Inspection*
See document ASG MA0339116
- 1.2 *X-Ray examination*
See document SIGE 03052-156
- 1.3 *Dye penetrant test*
See document ASG MA0339116


2. Destructive tests

- 2.1 *Transverse tensile test*
See document SSM/2649 on 20/10/2003
- 2.2 *Longitudinal tensile test*
See document SSM/2649 on 20/10/2003
- 2.3 *Charpy V-Notch test (4.2 K)*
See document LINDE TRT 03 So 024-2 Page 1
- 2.4 *Bending test*
See document SSM/2649 on 20/10/2003
- 2.5 *Macrograph*
See document SSM/2649 on 20/10/2003
- 2.6 *Micrograph*
See document SSM/2649 on 20/10/2003
- 2.7 *Magnetic permeability*
See document ASG MA0339120

3. Remarks

Even using the support ring inside the half shells it was not possible to obtain enough welded seam for the execution of separate test for the two welded sides (the longitudinal tensile test requires 150 mm long samples); for this reason the samples were extracted where possible.

NOTES:

 Ansaldo Superconduttori		RAPPORTO DI CONTROLLO Test Report			N° MA0339116	
Ansaldo Superconduttori s.p.a.		<input type="checkbox"/> IN APPROVVIGIONAMENTO <i>on purchasing</i>		<input checked="" type="checkbox"/> IN FABBRICAZIONE <i>on manufacturing</i>		Pag. / Pg: 1 / of
COMMESSA / Job 0209 LHC cold masses		COMPONENTE / Component Production test plate		DISEGNO / Drawing 683RM08450		POS./Item
IMPIANTO / Plant LHC		CLIENTE / Customer CERN		CERN Part Id.		
SPECIFICA / Specification PWPS ASC 11/02 LHC-MMS / 98 - 198			REV. / Rev. / 1.1 & 2.0		N. DI SERIE COMPONENTE / Component Serial Nr. COLD MASS C.M.2011	
CONTROLLO / Check Controllo visivo & liquidi penetranti / visual check & dye penetrant						ITP No. /

Controllo visivo / visual check :

Le estremità dei talloni sono da scartare causa disallineamento dei semigusci.

The end portion of the production plates have to be scraped, due to the mismatch on the chamfer.

Liquidi penetranti / Dye penetrant

OK / OK

COGNOME Name	SANDOLI					
FIRMA Signature	<i>Sandoli</i>					
DATA Date	22.09.2003					
ENTE Department	PRC					



Via Castel Morrone 15H - 16161 GENOVA-Rivarolo
 Tel. 010.7406583 (6 linee) - Fax 010.7406584
 Codice Fiscale e Partita I.V.A.: it 02687740106
 E-mail: segreteria@sige-ga.it

CONTROLLO RADIOGRAFICO
 RADIOGRAPHIC EXAMINATION REPORT

PAG/SH 1 DI/CF 1

CERTIFICATO N.
 CERTIFICATE N.

R.T. 03052-356

CLIENTE - CUSTOMER: SPET. ANSALDO S.C. OGGETTO - OBJECT: TALLONI M2011 M2012
 COMMESSA - JOB: 052

DOCUMENTI DI RIFERIMENTO - APPLICABLE CODE: U ACCETTABILITÀ - ACCEPTANCE: TECNICA ESPOS.-EXP. THEC.
 DIREZIONALE / DIRECT.

TIPO SORGENTE - TYPE OF SOURCE: R x DIM MACCHIA FOCALE - EFFSIZE: 1,8 x 2,5 DISTANZA F.F. - DIST. F.F.: 700 mm
 PARETE SING. / SINGLE WALL
 PARETE DOPPIA / DOUBLE WALL
 PANORAMICA / PANORAMIC

TEMPO ESPOSIZ. - EXP. TIME: 2'40" - 180KV - 4mA MATERIALE - MATERIAL: AISI 316 LN I.Q.I. - PENETR.: 10 Fc EN SCHERMI - SCREEN: Pb 0,1 mm

APPARECCHIO - EQUIPMENT: GILARDONI RHP200 SISTEMA PELLICOLA - FILM SYSTEM: AGFA D3 SVILUPPO - DEVELOP.: MANUALE

IDENTIFICAZIONE IDENTIFICATION	POSIZIONE POSITION	DIAM. DIAM.	SPESORE THICK.	SOFIATURE FLOW HOLES	PROSITA PROSITY	NDO DI POROSITA CLUSTER POROSITY	TARLI LONG. GAS. CAV.	INCLUS. SCORIA SLAG INCLUSION	INCL. SC. ALLUNG. LINEAR INCLUS.	MANC. DI PEN. LACK OF PENETR.	CRICCA CRACK	MANC. DI FUS. LACK OF FUSION	ECESSO PEN. EXCESS PENETR.	INSELLAMENTO INT. CONCAVITY	INCISIONI MARG. UNDERCUT	OSSIDAZIONE OXIDISATION	SIVELLAMENTO MISALIGNMENT	INCL. TUNGST. TUNG. INC.	DEFETTO FILM FILM DEFECT	DENSITA DENSITY	ESITO RESULT
1 M2011 w1	0-1				X																A
2 M2011 w2	0-1				X																A
3 M2012 w1	0-1				X																A
4 M2012 w2	0-1				X																A
5																					
6																					
7																					
8																					
9																					
10																					
11																					
12																					
13																					
14																					
15																					
16																					
17																					
18																					
19																					
20																					

A: ACCETTABILE - ACCEPTABLE R: RIPARARE - REPAIR T: TAGLIARE - CUT RF: RIFARE FILM - REPEAT FILM

LUOGO - PLACE: GENOVA DATA - DATE: 24/9/03 OPERATORE - OPERATOR: P. [Signature] RESPONSABILE - CHIEF: [Signature] ISR - SURV.:



STUDIO SPERIMENTALE METALSIDERURGICO S.r.l.
Via degli Artigiani, 80 - 16162 GENOVA Bolzaneto
Tel. 010 710259 - 010 713751 - Fax 010 710365

Laboratorio autorizzato ABS - BV - DMV - IIS - ISPEL - LRS - MMI - RIINA - TÜV

PROVE MECCANICHE ESEGUITE SU
MECHANICAL TESTS ON

LONGITUDINAL WELD OF SHRINKING CYLINDER -
Base material: ASTM A 240 Tp 316LN
Standard Nr LHC-MMS/98-198 Rev.1.1 annex B31

PLACCA / PLATE COLATA / HEAT DIMENSIONI DEL MATERIALE / DIMENSIONS OF MATERIAL mm. Thickness 11

COLLAUDO / INSPECTION SSM	SAGGIO SSM / TEST N. 1561	DATA / DATE 20/10/2003	CERTIFICATO / CERTIFICATE N. 2649	PAGINA / PAGE N. 1
ORDINE / ORDER N° ASG/1812 dated 19/06/2003		SAGGIO / TEST N. 2011		

CLIENTE CUSTOMER ANSALDO SUPERCONDUTTORI Spa GENOVA GE

SENSO E POSIZIONE ORIENTATION	SPESSORE LARGHEZZA DIAMETRO THICKNESS and WIDTH or DIAMETER mm	PROVA DI TRAZIONE / TENSION TEST						PIEGA BEND TEST	RESILIENZA IMPACT TEST			
		AREA DELLA SEZIONE mm ²	LUNGHEZZA UTILE GAGE LENGTH mm	SNERVAMENTO YIELD STRENGTH	ROTTURA TENSILE STRENGTH		ALLUNGAMENTO ELONGATION			STRIZIONE REDUCT OF AREA %	TIPO TYPE	
				TOTALE TOTAL KN	N/mm ²	TOTALE TOTAL KN	N/mm ²	TOTALE TOTAL mm	%	min. max.	min. max.	TEMPERATURA °C min. sing. min. for 1. J

L	8,00	50,26	40,0	20,60	410	32,80	653	54,2	35,5	Weld zone (RxA = 23181,5)		
T	9,91 x 25,07	248,44				155,85	627			(Broken in weld metal)		
T	9,95 x 25,10	249,74				155,85	624			(Broken in weld metal)		
T	11,0 x 20,0	FACE BEND										SATISFACTORY
T	11,0 x 20,0	FACE BEND										SATISFACTORY
T	11,0 x 20,0	ROOT BEND										SATISFACTORY
T	11,0 x 20,0	ROOT BEND										SATISFACTORY
		CND										
		MACRO										

MICRO Esito: NOT REVEALED MICROSCOPIC CRACKS
Esito: SATISFACTORY

NOTE REMARKS THIS TESTS HAVE BEEN PERFORMED AFTER FIVE THERMAL CYCLES IN LIQUID NITROGEN.

IL LABORATORIO / THE LABORATORY
Gaetano Rossini
IL CLIENTE / THE CUSTOMER
L'ISPETTORE / THE INSPECTOR

Questo certificato di prova non può essere riprodotto parzialmente salvo approvazione scritta del Laboratorio.
This test certificate cannot be reproduced other than in full unless written approval is given by the Laboratory.

SAGGIO/TEST "2011"

Regia

1 X

Transversal section:

*Macro examination according to EN 25817 Lev.B and C:
satisfactory (magnification 10 x)**This test have been performed after five thermal cycles in
liquid nitrogen.***Data/Date**

20/10/2003

L'Operatore/The Operator
Maurizio Michelin
P.I. Chimico**L'Ispettore/The Inspector**



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ESAME MICROSCOPICO
MICROSCOPIC EXAMINATION
UNI EN 1321:97

Cert./Cert.
N./N.306

Pag./Page
1di/of

Saggio/Test SSM
156I

Saggio/Test
2011

Cliente/Customer

ANSALDO SUPERCONDUTTORI SpA GENOVA

Ordine/Order

No ASG/1812 dtd 19/06/2003

Descrizione/Description

LONGITUDINAL WELD OF SHRIKING CYLINDER
Base material: ASTM A 240 Tp 316LN
Standard Nr. LMC-MMS/98-198 Rev.1.1 annex B31



Regia

100x

S.S.M.

Transverse section of welded joint:

Austenitic structure of weld metal on the left and base material on the right ;no presence of residual delta-ferrite or sigma phase (400 magnification).

This test have been performed after 5 thermal cycles in liquid nitrogen.


Data/Date

20/10/2003

L'Operatore/The Operator
Maurizio Michelin

P.I. Chimico

L'Ispettore/The Inspector

 Geschäftsbereich Linde Engineering Werkstofftechnik / TAW Linde Engineering Division Materials Technology / TAW		Prüfbericht Kerbschlagbiegeprüfung Test Report Impact Test				Dokument Nr. / Document No.: TRT 03 So 024 - 2	
Besteller, Bestell-Nr. / Customer, Order-No.: Mr. Drago / Ansaldo Superconduttori spa Order No.: ASG / 698 of 16.06.2003		Hersteller / Manufacturer: Ansaldo Superconduttori spa				Projekt / Project: 7854 3531 - Genua	
Werkstoff, Regelwerk / Material, Specification: base metal: 1.4429 (Tp 316 LN) filler metal: Lincoln LNM 4455 (G20 16 3 Mn L)		Prüfgrundlagen / Test Specification: EN 10 045-1 EN 875				Probenform / Specimen Type: Charpy-V, specimens capsuled acc. to LINDE-design	
Proben-Nr. / Specimen-No.	Probenbreite / Width (mm)	Kennzeichnung der Probenlage / Denomination	Prüftemperatur / Test Temperature (°C/K)	Kerbschlagarbeit / Impact absorbed Energy (J)	Kerbschlagzähigkeit / Impact Toughness (J/cm ²)	Remark	
Anforderungen / Requirements							
			4,2 K				
Ergebnisse / Results:							
1	7,40	9,90	4,2 K	71	120	weld metal (WM)	
2	7,46	9,92		VWT 0/2	76		127
3	7,43	9,97		76	129		
4	7,49	9,93	VHT 0/2	87	145	heat affecting zone (HAZ)	
5	7,40	9,93		100	169		
6	7,40	9,93		85	144		

Abkürzungen zur Probenlage / Abbreviations reg9,93arding denomination according to EN 875: G...Grundwerkstoff / base metal; VWT...Schweißnahtmitte / weld centre; VHT...Wärme beeinflusster Bereich / heat affected zone.

Die Anforderungen sind / The requirements are erfüllt / satisfied nicht erfüllt / not satisfied nicht definiert / not defined

Höllriegelskreuth, 10.11.03	01	Hr. Böckl / TAW	Hr. Böckl / TAW	Hr. Mitterbacher / TAW
Ort, Datum / Place, date	Ausgabe / issue	erstellt / prepared	geprüft / reviewed	freigegeben / approved



Ansaldo Superconduttori

RAPPORTO DI CONTROLLO Test Report

N° MA0339120

Ansaldo Superconduttori s.p.a.

IN APPROVVIGIONAMENTO
on purchasing

IN FABBRICAZIONE
on manufacturing

Pag. / Pg:

1

di / of

1

COMMESSA / Job

0209 LHC cold masses

COMPONENTE / Component

Production test plate

DISEGNO / Drawing

POS./Item

REV./Rev

IMPIANTO / Plant

LHC

CLIENTE / Customer

CERN

CERN Part Id.

SPECIFICA / Specification

PWPS ASC 11/02

LHC-MMS / 98 - 198

REV. / Rev.

1

1.1 & 2.0

N. DI SERIE COMPONENTE / Component Serial Nr.

COLD MASS C.M.2011

CONTROLLO / Check

Misura di permeabilità magnetica / Magn. permeability measurement

ITP No.

/

Condizioni operative/operating parameters

Campione di rif. per calibrazione fine / sample for fine calibration

• ref. value = 1.0035

• meas. value = 1.0035

Fondo Scala / full range scale : 1.0100

Temperatura / temperature : T ambiente / room T

Posizione di misura / Meas. point	Permeabilità / Permeabilità (μ) (min - max)	Val. rif. / Ref. value
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• su materiale base / on raw material : 1.0030 < 1.01

• vicino saldatura / near weld : 1.0032

• sulla saldatura / on weld : 1.0044

Strumentazione / instruments: Foerster Magnetoscope mod. 1.068 + permeability gauge mod. 1522

Esito/Result: conforme/conforming - non conforme/non-conforming

RNC No.

COGNOME Name	SANULLI				
FIRMA Signature	<i>Sanulli</i>				
DATA Date	24/09/03				
ENTE Department	PRC				