



## **LHC: Cold Mass Longitudinal Welding**

### **Production test plates on Cold Mass 2017**

#### **1. Non destructive tests**

- 1.1 *Visual Inspection*  
See document ASG MA0339117
- 1.2 *X-Ray examination*  
See document SIGE 03052-156
- 1.3 *Dye penetrant test*  
See document ASG MA0339117


#### **2. Destructive tests**

- 2.1 *Transverse tensile test*  
See document SSM/2647 on 20/10/2003
- 2.2 *Longitudinal tensile test*  
See document SSM/2647 on 20/10/2003
- 2.3 *Charpy V-Notch test (4.2 K)*  
See document LINDE TRT 03 So 024-2 Page 2
- 2.4 *Bending test*  
See document SSM/2647 on 20/10/2003
- 2.5 *Macrograph*  
See document SSM/2647 on 20/10/2003
- 2.6 *Micrograph*  
See document SSM/2647 on 20/10/2003
- 2.7 *Magnetic permeability*  
See document ASG MA0339121

#### **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:

 <b>Ansaldo Superconduttori</b>		<b>RAPPORTO DI CONTROLLO</b> <b>Test Report</b>			N° MA0339117	
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 /
COMMESSA / Job <b>0209 LHC cold masses</b>		COMPONENTE / Component <b>Production test plate</b>		DISEGNO / Drawing <b>683RM08450</b>		POS./Item  
IMPIANTO / Plant <b>LHC</b>		CLIENTE / Customer <b>CERN</b>		CERN Part Id.		
SPECIFICA / Specification <b>PWPS ASC 11/02</b> <b>LHC-MMS / 98 - 198</b>			REV. / Rev. / <b>1.1 &amp; 2.0</b>		N. DI SERIE COMPONENTE / Component Serial Nr. <b>COLD MASS C.M.2017</b>	
CONTROLLO / Check <b>Controllo visivo &amp; liquidi penetranti / visual check &amp; dye penetrant</b>						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	SANDULLI				
FIRMA Signature	<i>Sandulli</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-ge.it

CONTROLLO RADIOGRAFICO  
 RADIOGRAPHIC EXAMINATION REPORT

PAG/SH 1 DI/OF 1

CERTIFICATO N.  
 CERTIFICATE N.

R.T. 03052-156

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.  
 PARETE SING. / SINGLE WALL  
 PARETE DOPPIA / DOUBLE WALL  
 PANORAMICA / PANORAMIC

TIPO SORGENTE - TYPE OF SOURCE: R x      DIM MACCHIA FOCALE - EFFSIZE: 1,8 x 2,5      DISTANZA F.F. - DIST. F.F.: 700 mm  
 TEMPO ESPOSIZ. - EXP. TIME: 2'40" - 180KV - 4mA      MATERIALE - MATERIAL: A131 316 LN      I.Q.I. - PENETR.: 10 Fc EN      SCHERMI - SCREEN: Pb 0,1 mm

APPARECCHIO - EQUIPMENT: GILKARDON MHF200      SISTEMA PELLICOLA - FILM SYSTEM: AGFA D3      SVILUPPO - DEVELOP.: MANUALE

IDENTIFICAZIONE IDENTIFICATION	POSIZIONE POSITION	Ø DIAM. Ø DIAM.	SPESORE THICK.	SOFFIATURE BLOW HOLES	POROSITÀ PROSOTITY	NIDO DI POROSITÀ CLUSTER POROSITY	TARLI ELONG. GAS. CAV.	INCLUS. SCORIA SLAG INCLUSION	INCL. SC. ALLUNG. LINEAR INCLUS.	MANC. DI PEN. LACK OF PENETR.	CRICCA CRACK	MANC. DI FUS. LACL OF FUSION	ECESSO PEN. EXCESS PENETR.	INSELLAMENTO INT. CONCAVITY	INCISIONI MARG. UNDERCUT	OSSIDAZIONE OXIDISATION	SIVELLAMENTO MISALIGNMENT	INCL. TUNGST. TUNG. INC.	DIFFETTO FILM FILM DEFECT	DENSITÀ DENSITY	ESITO RESULT
M2011 w1	0-1				X																A
M2011 w2	0-1				X																A
M2012 w1	0-1				X																A
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]      ISP - 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 - DNV - IIS - ISPEL - LRS - MMI - RINA - TÜV

COLLAUDO / INSPECTION SSM	SAGGIO SSM / TEST N. 1541	DATA / DATE 20/10/2003	CERTIFICATO / CERTIFICATE N. 2647	PAGINA / PAGE N. 1
ORDINE / ORDER N° AS6/1812 dated 19/06/2003		SAGGIO / TEST N. 2017		

CLIENTE CUSTOMER ANSALDO SUPERCONDUTTORI SPA GENOVA GE

**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

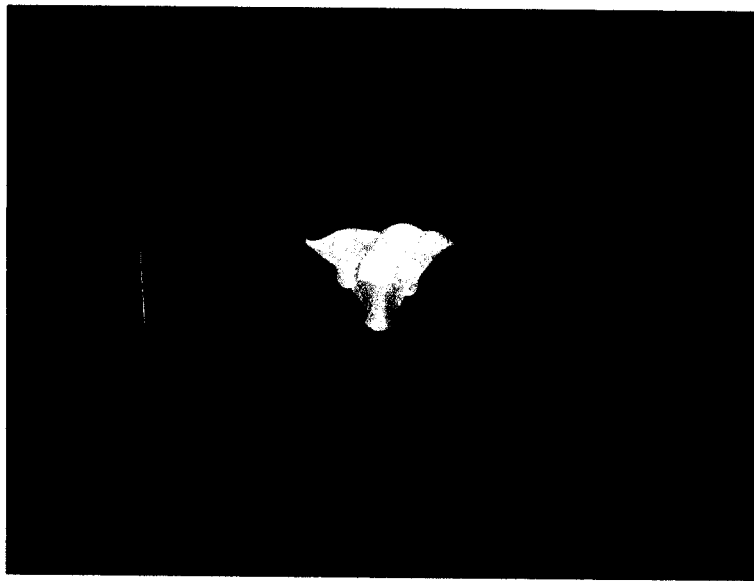
PLACCA / PLATE COLATA / HEAT DIMENSIONI DEL MATERIALE / DIMENSIONS OF MATERIAL mm. Thickness 11

SENSO E POSIZIONE ORIENTATION	SPESSORE LARGHEZZA DIAMETRO THICKNESS and WIDTH or DIAMETER mm	PROVA DI TRAZIONE / TENSION TEST						PIEGA BEND TEST	RESILIENZA IMPACT TEST				
		SNERVAMENTO YIELD STRENGTH		ROTTURA TENSILE STRENGTH		ALLUNGAMENTO ELONGATION				STRIZIONE REDUCT OF AREA %	TIPO TYPE		
		TOTALE TOTAL KN	N/mm <sup>2</sup>	TOTALE TOTAL KN	N/mm <sup>2</sup>	TOTALE TOTAL mm	%						
L	8,00	50,26	40,0	20,20	402	32,80	653	55,0	37,5	Weld zone (RxA = 24487,5)			
T	10,38 x 25,50	264,69				168,50	636			(Broken in weld metal)			
T	10,37 x 25,35	262,87				169,05	643			(Broken in weld metal)			
T	11,0 x 20,0	FACE BEND											
T	11,0 x 20,0	FACE BEND											
T	11,0 x 20,0	ROOT BEND											
T	11,0 x 20,0	ROOT BEND											
		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  
**Casano 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 "2017"

Regia

1 X

Sezione trasversale del giunto.

*Esame macroscopico: soddisfacente*

Data/Date

20/10/2003

L'Operatore/The Operator

Maurizio Michellini

P.I. Chimico

L'Ispettore/The Inspector



STUDIO SPERIMENTALE METALSIDERURGICO s.r.l.  
Via degli Artigiani, 80 - 16162 Ge/Bolzaneto  
Tel. (010) 710259 - Telefax 710365

**ESAME MICROSCOPICO**  
**MICROSCOPIC EXAMINATION**  
UNI EN 1321:97

Cert./Cert.  
N./N.304

Pag./Page  
1di/of

Saggio/Test SSM  
154I

Saggio/Test  
2017

**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 Michelini


P.I. Chimico

**L'Ispettore/The Inspector**

 Geschäftsbereich Linde Engineering Werkstofftechnik / TAW Linde Engineering Division Materials Technology / TAW		<b>Prüfbericht</b> <b>Kerbschlagbiegeprüfung</b> <b>Test Report Impact Test</b>				Blatt-Nr. / Sheet-No.: Seite 2 von 4 page 2 of 4	Dokument Nr. / Document No.: <b>TRT 03 So 024 - 2</b>
Besteller, Bestell-Nr. / Customer, Order-No.: <b>Mr. Drago / Ansaldo Superconduttori spa</b> <b>Order No.: ASG / 698 of 16.06.2003</b>		Hersteller / Manufacturer: <b>Ansaldo Superconduttori spa</b>		Prüfgegenstand, Kennzeichnung / Item, Marking: <b>1 welded test plate (250 x 80 x 10,8 mm<sup>3</sup>)</b> <b>Marking : CM 2017</b>			
Werkstoff, Regelwerk / Material, Specification: • <b>base metal: 1.4429 (Tp 316 LN)</b> • <b>filler metal: Lincoln LNM 4455 (G20 16 3 Mn L)</b>		Prüfgrundlagen / Test Specification: <b>EN 10 045-1</b> <b>EN 875</b>		Probenform / Specimen Type: <b>Charpy-V, specimens capsuled acc. to</b> <b>LINDE-design</b>			
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 <sup>2</sup> )	Remark	
<b>Anforderungen / Requirements</b>							
			4,2 K				
<b>Ergebnisse / Results:</b>							
1	9,91	9,88	4,2 K	107	135	weld metal (WWM)	
2	9,93	9,99		114	144		
3	9,91	9,95		118	149		
4	9,96	9,94	VHT 0/0	157	196	heat affecting zone (HAZ)	
5	9,95	9,99		139	174		
6	9,98	9,95		139	174		
Abkürzungen zur Probenlage / Abbreviations regarding denomination according to EN 875: <span style="float: right;">                     G...Grundwerkstoff / base metal; VWT...Schweißnahtmitte / weld centre;                      VHT...Warme beeinflusster Bereich / heat affected zone.                 </span>							

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

 <b>Ansaldo Superconduttori</b>		<b>RAPPORTO DI CONTROLLO</b> <b>Test Report</b>			N° MA0339121													
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 / 1 di / of 1 / 1												
COMMESSA / Job <b>0209 LHC cold masses</b>		COMPONENTE / Component <b>Production test plate</b>		DISEGNO / Drawing		POS. / Item REV. / Rev												
IMPIANTO / Plant <b>LHC</b>		CLIENTE / Customer <b>CERN</b>		CERN Part Id.														
SPECIFICA / Specification <b>PWPS ASC 11/02</b> <b>LHC-MMS / 98 - 198</b>			REV. / Rev. / <b>1.1 &amp; 2.0</b>		N. DI SERIE COMPONENTE / Component Serial Nr. <b>COLD MASS C.M.2017</b>													
CONTROLLO / Check <b>Misura di permeabilità magnetica / Magn. permeability measurement</b>						ITP No. /												
<p><u>Condizioni operative/operating parameters</u></p> <p>Campione di rif. per calibrazione fine / sample for fine calibration</p> <ul style="list-style-type: none"> <li>• ref. value = 1.0035</li> <li>• meas. value = 1.0035</li> </ul> <p>Fondo Scala / full range scale : 1.0100</p> <p>Temperatura / temperature : T ambiente / room T</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Posizione di misura / Meas. point</th> <th style="text-align: left;">Permeabilità / Permeabilità (μ) (min - max)</th> <th style="text-align: left;">Val. rif. / Ref. value</th> </tr> </thead> <tbody> <tr> <td>• su materiale base / on raw material</td> <td>: 1.0032</td> <td>&lt; 1.01</td> </tr> <tr> <td>• vicino saldatura / near weld</td> <td>: 1.0034</td> <td></td> </tr> <tr> <td>• sulla saldatura / on weld</td> <td>: 1.0044</td> <td></td> </tr> </tbody> </table>							Posizione di misura / Meas. point	Permeabilità / Permeabilità (μ) (min - max)	Val. rif. / Ref. value	• su materiale base / on raw material	: 1.0032	< 1.01	• vicino saldatura / near weld	: 1.0034		• sulla saldatura / on weld	: 1.0044	
Posizione di misura / Meas. point	Permeabilità / Permeabilità (μ) (min - max)	Val. rif. / Ref. value																
• su materiale base / on raw material	: 1.0032	< 1.01																
• vicino saldatura / near weld	: 1.0034																	
• sulla saldatura / on weld	: 1.0044																	
Strumentazione / instruments: Foerster Magnetoscope mod. 1.068 + permeability gauge mod. 1522																		
Esito/Result: conforme/conforming <input checked="" type="checkbox"/> - non conforme/non-conforming <input type="checkbox"/>						RNC No.												
COGNOME Name	SANDULLI																	
FIRMA Signature	<i>Sandulli</i>																	
DATA Date	24/09/03																	
ENTE Department	PRC																	