

LHC: Cold Mass Longitudinal Welding

Production test plates on Cold Mass 2016

1. Non destructive tests

- 1.1 *Visual Inspection*
See document ASG MA033785
- 1.2 *X-Ray examination*
See document SIGE 03052-146
- 1.3 *Dye penetrant test*
See document ASG MA033785

2. Destructive tests

- 2.1 *Transverse tensile test*
See document SSM/2646 on 20/10/2003
- 2.2 *Longitudinal tensile test*
See document SSM/2646 on 20/10/2003
- 2.3 *Charpy V-Notch test (4.2 K)*
See document LINDE TRT 03 So 024 Page 2 (1)
- 2.4 *Bending test*
See document SSM/2646 on 20/10/2003
- 2.5 *Macrograph*
See document SSM/2646 on 20/10/2003
- 2.6 *Micrograph*
See document SSM/2646 on 20/10/2003
- 2.7 *Magnetic permeability*
See document ASG MA0339114

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 from both sides of the magnet.

NOTES:

- (1) Only two samples in HAZ could be machined



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CONTROLLO RADIOGRAFICO
RADIOGRAPHIC EXAMINATION REPORT

PAG/SH. 1 / DI/CF. 1
CERTIFICATO N. / CERTIFICATE N.
R.T. 03052-14.6

CLIENTE - CUSTOMER: **SPER. LE ANSALDO SUPERCONDUTT. TALLONI PRODUZIONE**
OGGETTO - OBJECT: **TALLONI PRODUZIONE**
COMMESSA - JOB: **052**

DOCUMENTI DI RIFERIMENTO - APPLICABLE CODE: **UNI EN 1435**
ACCETTABILITÀ - ACCEPTANCE: **UNI EN 25817**
TECNICA ESPOS. - EXP. TECH.:
 DIREZIONALE / DIRECT.
 PARETE SING. / SINGLE WALL
 PARETE DOPPIA / DOUBLE WALL
 PANORAMICA / PANORAMIC

TIPO SORGENTE - TYPE OF SOURCE: **Rx**
DIM MACCHIA FOCALE - EFF SIZE: **1.8 x 3.5**
DISTANZA F.F. - DIST. F.F.: **700 mm**

TEMPO ESPOSIZ. - EXP. TIME: **180 KV 4 mA 2'15"**
MATERIALE - MATERIAL: **AISI 316 LN**
I.Q.I. - PENETR.: **10 Fe EN**
SCHERMI - SCREEN: **0.1 mm Pb**

APPARECCHIO - EQUIPMENT: **GILARDONI MHF 200 D**
SISTEMA PELLICOLA - FILM SYSTEM: **AGFA D3**
SVILUPPO - DEVELOP.: **MANUALE**

IDENTIFICAZIONE IDENTIFICATION	POSIZIONE POSITION	Ø DIAM. Ø DIAM.	SPESORE THICK.	SOFIATURE BLOW HOLES	POROSITÀ POROSITY	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. LACK OF FUSION	ECESSO PEN. EXCESS PENETR.	INSELLAMENTO INT. CONCAVITY	INCISIONI MARG. UNDERCUT	OSSIDAZIONE OXIDATION	SVELLAMENTO MISALIGNMENT	INCL. TUNGST. TUNG. INC.	DIFETTO FILM FILM DEFECT	DENSITÀ DENSITY	ESITO RESULT
1	H2016	W1	0-1		X																A
2	"	W2	1-0		X									X							A
3	H2016	W1	0-1		X																A
4	"	W2	1-0		X																A
5	H2017	W1	0-1																		A
6	"	W2	0-1									X									RIP
7	H2026	W1	0-1		X																A
8	"	W2	1-0								X										RIP
9	H2029	W1	0-1					X													RIP
10	"	W2	1-0					X													RIP
11	H2030	W1	0-1		X																RIP
12	"	W2	1-0		X																A
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: **17-09-03** OPERATORE - OPERATOR: **Teodoro D**
RESPONSABILE - CHIEF: **GIUSEPPE ROSSI** ISP. - SURV.
SINT. OPER. - LEVEL: **II**



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 - MMF - RINA - 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

CLIENTE CUSTOMER ANSALDO SUPERCONDUTTORI SPA GENOVA

GE

COLLAUDO / INSPECTION SSM	SAGGIO SSM / TEST N. 1531	DATA / DATE 20/10/2003	CERTIFICATO / CERTIFICATE N. 2646	PAGINA / PAGE N. 1
ORDINE / ORDER N° AS6/1812 dated 19/06/2003		SAGGIO / TEST N. 2016		

SENSO E POSIZIONE ORIENTATION	SPESSORE LARGHEZZA DIAMETRO mm	AREA DELLA SEZIONE SECTION mm ²	LUNGHEZZA UTILE GAGE LENGTH mm	PROVA DI TRAZIONE / TENSION TEST				STRIZIONE REDUCT OF AREA %	PIRGA BEND TEST α - 180 d = 4t	RESILIENZA IMPACT TEST TIPO TEMPERATURA °C min. sing. min. for 1. min. medio min. aver. J
				SNERVAMENTO YIELD STRENGTH N/mm ² min. max.	ROTTURA TENSILE STRENGTH N/mm ² min. max.	ALLUNGAMENTO ELONGATION % min. max.				

L	8,00	50,26	40,0	19,20	382	31,80	633	55,6	39,0	Weld zone (RxA = 24687)
T	10,25 x 25,25	258,81				167,90	649			(Broken in weld metal)
T	10,24 x 25,40	260,09				171,15	658			(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
Esito: SATISFACTORY

Esito: NOT REVEALED
Esito: SATISFACTORY

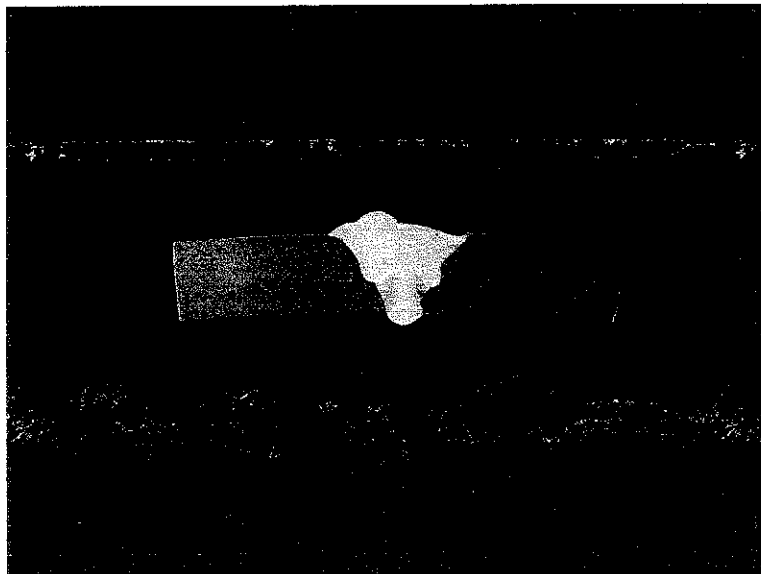
NOTE REMARKS THIS TESTS HAVE BEEN PERFORMED AFTER FIVE THERMAL CYCLES IN LIQUID NITROGEN.

IL LABORATORIO / THE LABORATORY
Capitano 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 "2016"

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.303

Pag./Page
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Saggio/Test SSM
1531

Saggio/Test
2016

Cliente/Customer

ANSALDO SUPERCONDUTTORI SpA GENOVA

Ordine/Order

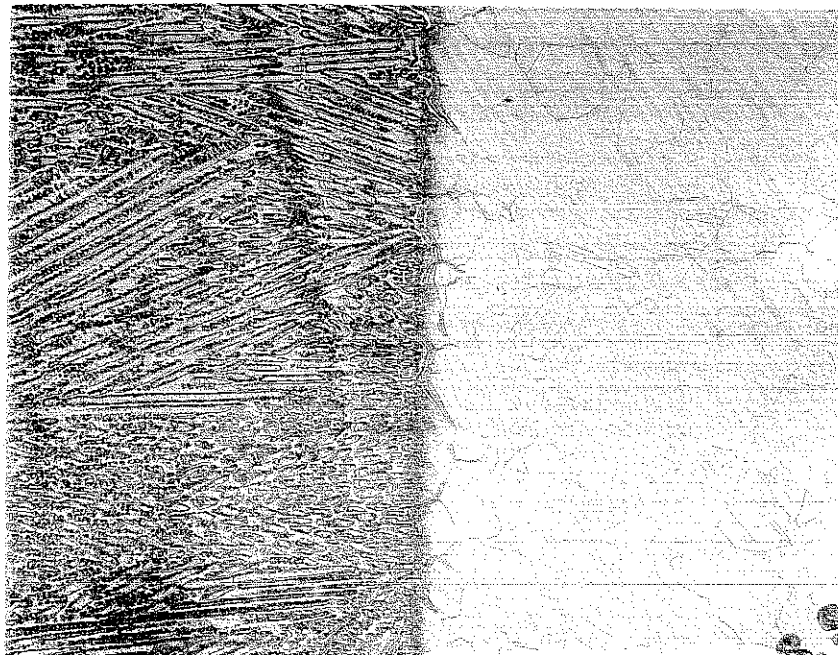
No ASG/1812 dtd 19/06/2003

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

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

LINDE AG VA TAW

 <p>Geschäftsbereich Linde Engineering Werkstofftechnik / TAW Linde Engineering Division Materials Technology / TAW</p>		<p>Prüfbericht Kerbschlagbiegeprüfung Test Report Impact Test</p>		Blatt-Nr. / Sheet-No.: Dokument Nr. / Document No.: Seite 2 von 3 TRT 03 So 024 page 2 of 3	
Besteller, Bestell-Nr. / Customer, Order-No.: Mr. Doft Drago / Ansaldo Superconduttori spa		Hersteller / Manufacturer: Ansaldo Superconduttori spa		Projekt / Project: 7854 3531 - Genua	
Order No.: ASG/ 698 of 16.06.2003		Prüfgegenstand, Kennzeichnung / Item, Marking: 1 welded test plate (210 x 70 x 10,6 mm³) Marking : 2016 - 153 I		Probenform / Specimen Type: Charpy-V, specimens capsuled acc. to LINDE-design	
Werkstoff, Regelwerk / Material, Specification: • base metal: 1.4429 (Tp316 LN) • filler metal: Lincoln LNM 4455		Prüfgrundlagen / Test Specification: EN 10 045-1 EN 875		Kerbschlagzähigkeit Impact Toughness (J/cm ²)	
Proben-Nr. Specimen-No.	Probenbreite Width (mm)	Kennzeichnung der Probenlage Denomination	Prüftemperatur Test Temperature (°C/K)	Kerbschlagarbeit Impact absorbed Energy (J)	Remark
Anforderungen / Requirements					
		4,2 K			
Ergebnisse / Results:					
1	9,95	9,99	114	143	weld metal (VWM)
2	9,95	10,02	117	146	
3	9,96	10,00	118	148	
4	9,91	10,02	102	129	heat affecting zone (HAZ)
5	9,93	10,01	151	191	
Abkürzungen zur Probenlage / Abbreviations regarding 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, 20.10.03	01	Hr. Böckl / TAW	Hr. Böckl / TAW	Hr. Mitterbacher / TAW
Ort, Datum / Place, date	Ausgabe / Issue	erstellt / prepared	geprüft / reviewed	freigegeben / approved

		RAPPORTO DI CONTROLLO Test Report			N° MAC33944	
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
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.2016		
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)	Val. rif. / Ref. value
	(min - max)	

- su materiale base / on raw material : 1.0034 < 1.01
- vicino saldatura / near weld : 1.0040
- 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 <i>Name</i>	SANDULLI				
FIRMA <i>Signature</i>	Sandulli				
DATA <i>Date</i>	23/09/03				
ENTE <i>Department</i>	PRC				



Ansaldo Superconduttori

RAPPORTO DI CONTROLLO Test Report

N° MA033785

Ansaldo Superconduttori s.p.a.

IN APPROVVIGIONAMENTO
on purchasing

IN FABBRICAZIONE
on manufacturing

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COMMESSA / Job 0209 LHC cold masses	COMPONENTE / Component Production test plate	DISEGNO / Drawing 683RM08450	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 & 2.0	N. DI SERIE COMPONENTE / Component Serial Nr. COLD MASS C.M.2016		
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.

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

Liquidi penetranti / Dye penetrant

OK / OK

COGNOME Name	SANDULLI				
FIRMA Signature	<i>Sandulli</i>				
DATA Date	10.09.2003				
ENTE Department	PRC				