Ansaldo Superconduttori

DOC. 3.580/GD Rev. 0

19.11.03

LHC: Cold Mass Longitudinal Welding

Production test plates on Cold Mass 2030

1. Non destructive tests

1.1 Visual Inspection
See document ASG MA0339119

1.2 X-Ray examination
See document SIGE 03052-155 (1)

1.3 Dye penetrant test
See document ASG MA0339119

2. Destructive tests

2.1 Transverse tensile test
See document SSM/2650 on 20/10/2003

2.2 Longitudinal tensile test
See document SSM/2650 on 20/10/2003

2.3 Charpy V-Notch test (4.2 K)
See document LINDE TRT 03 So 024-2 Page 4

2.4 Bending test
See document SSM/2650 on 20/10/2003

2.5 Macrograph
See document SSM/2650 on 20/10/2003

2.6 Micrograph
See document SSM/2650 on 20/10/2003

2.7 Magnetic permeability
See document ASG MA0339123

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:
(1) The defective part of W1 Pos. 0-1 was excluded

Ansaldo Superconduttori	**RAPPORTO DI CONTROLLO** ***Test Report***	N° MA0339119
Ansaldo Superconduttori s.p.a.	☐ IN APPROVVIGIONAMENTO *on purchasing* ☒ IN FABBRICAZIONE *on manufacturing*	Pag. / *Pg.* 1 di / *of*

COMMESSA / *Job*	COMPONENTE / *Component*	DISEGNO / *Drawing*	POS./*Item*	REV./*Rev*
0209 LHC cold masses	***Production test plate***	**683RM08450**		

IMPIANTO / *Plant*	CLIENTE / *Customer*	*CERN Part Id.*
LHC	**CERN**	

SPECIFICA / *Specification*	REV. / *Rev.*	N. DI SERIE COMPONENTE / *Component Serial Nr.*
PWPS ASC 11/02	/	**COLD MASS C.M.2030**
LHC-MMS / 98 - 198	**1.1 & 2.0**	

CONTROLLO / *Check*

Controllo visivo & liquidi penetranti / *visual check & dye penetrant*

ITP No. /

<u>Controllo visivo</u> / *<u>visual check</u>* :

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.

<u>Liquidi penetranti</u> / *<u>Dye penetrant</u>*

OK / *OK*

COGNOME *Name*	SANDUCCI					
FIRMA *Signature*	Sanducci					
DATA *Date*	22.09.2003					
ENTE *Department*	PRC					

SERVIZI INDUSTRIALI GENOVA
SIGE
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. 03052-155

CLIENTE - CUSTOMER	OGGETTO - OBJECT	COMMESSA - JOB
ANSALDO S.C.	M2030 W1/W2 TALLONI	052

DOCUMENTI DI RIFERIMENTO - APPLICABLE CODE	ACCETTABILITÀ - ACCEPTANCE
UNI EN 1435	UNI EN 25817

TECNICA ESPOS.-EXP. THEC.
- [x] DIREZIONALE / DIRECT.
- [x] PARETE SING. / SINGLE WALL
- [ ] PARETE DOPPIA / DOUBLE WALL
- [ ] PANORAMICA / PANORAMIC

TIPO SORGENTE - TYPE OF SOURCE	DIM MACCHIA FOCALE - EFFSIZE	DISTANZA F.F. - DIST. F.F.
RX	1,8 x 2,5	700 mm

TEMPO ESPOSIZ. - EXP. TIME	MATERIALE - MATERIAL	I.Q.I. - PENETR.	SCHERMI - SCREEN
2'40" 180 Kv 4 mA	AISI 316 LN	10 Fe EN	Pb 0,027 mm

APPARECCHIO - EQUIPMENT	SISTEMA PELLICOLA - FILM SYSTEM	SVILUPPO - DEVELOP.
GILARDONI MNF 200	AGFA D3	MANUALE

	IDENTIFICAZIONE / IDENTIFICATION	POSIZIONE / POSITION	Ø DIAM. / Ø DIAM.	SPESSORE / 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	ECCESSO PEN. / EXCESS PENETR.	INSELLAMENTO / INT. CONCAVITY	INCISIONI MARG. / UNDERCUT	OSSIDAZIONE / OXIDISATION	SLIVELLAMENTO / MISALIGNMENT	INCL. TUNGST. / TUNG. INC.	DIFETTO FILM / FILM DEFECT	DENSITÀ / DENSITY	ESITO / RESULT
1	M2030W1	01				X																RP
2	M2030W2	01				X																A
3																						
4																						
5																						
6																						
7																						
8																						
9																						
10																						
11																						
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13																						
14																						
15																						
16																						
17																						
18																						
19																						
20																						

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

LUOGO - PLACE	DATA - DATE	OPERATORE - OPERATOR	RESPONSABILE - CHIEF	ISP. - SURV.
GENOVA	22/09/03			

ORIGINALE

SSM
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 - ISPESL - LRS - MMI - RINA - TÜV

COLLAUDO / INSPECTION	SAGGIO SSM / TEST	DATA / DATE	CERTIFICATO / CERTIFICATE	PAGINA / PAGE
SSM	N. 157I	20/10/2003	N. 2650	N. 1

ORDINE / ORDER	SAGGIO / TEST
N°ASG/1812 dated 19/06/2003 .	N. 2030

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: AREA DELLA SEZIONE SECTION mm²	LUNGHEZZA UTILE GAGE LENGTH mm	SNERVAMENTO YIELD STRENGTH TOTALE TOTAL KN	SNERVAMENTO N/mm² min. 205 max	ROTTURA TENSILE STRENGTH TOTALE TOTAL KN	ROTTURA N/mm² min. 515 max	ALLUNGAMENTO ELONGATION TOTALE TOTAL mm	ALLUNGAMENTO % min. 14,0 max	STRIZIONE REDUCT OF AREA % min. max	PIEGA BEND TEST α=180 d=4t	RESILIENZA IMPACT TEST TIPO TYPE / TEMPERATURA °C TEMPERATURE min. sing. min. for 1. J min. medio min. aver.
L	8,00	50,26	40,0	20,40	406	32,80	653	54,3	35,7			Weld zone (RxA = 23312,1)
T	10,21 x 25,02	255,45				169,20	662	(Broken in base metal)				
T	10,25 x 24,95	255,73				169,95	664	(Broken in base 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			MICRO			Esito: NOT REVEALED MICROSCOPIC CRACKS				
		MACRO						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

SSM

STUDIO SPERIMENTALE METALSIDERURGICO s.r.l.

DOCUMENTAZIONE FOTOGRAFICA

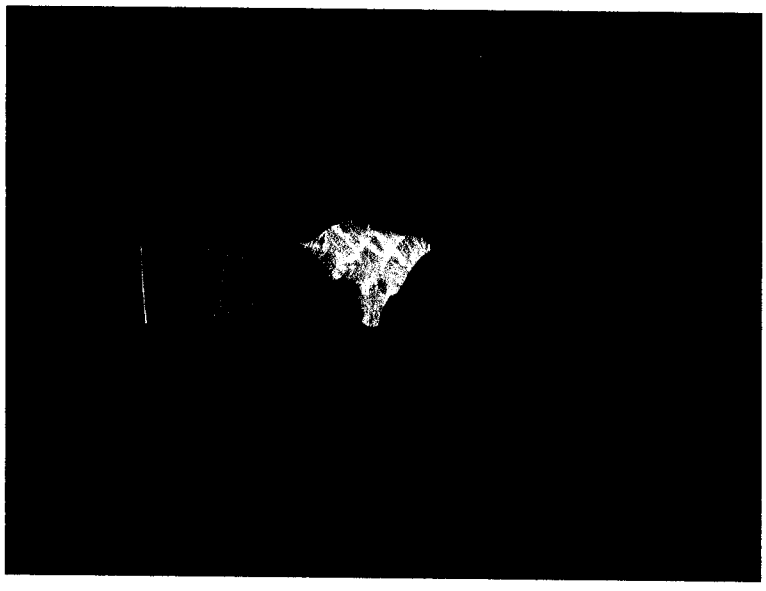
PHOTOGRAPH DOCUMENTATION

UNI EN 1321-97

Allegato/*Enclosed*
Cert./*Cert.* **2650** Pag./*Page* 1 di/*of* 1

N°/*No*

SAGGIO/*TEST* "2030"



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 Michelini
P.I. Chimico

L'Ispettore/*The Inspector*

Doc.macrofoto-

SSM
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Via degli Artigiani, 80 - 16162 Ge/Bolzaneto
Tel. (010) 710259 - Telefax 710365

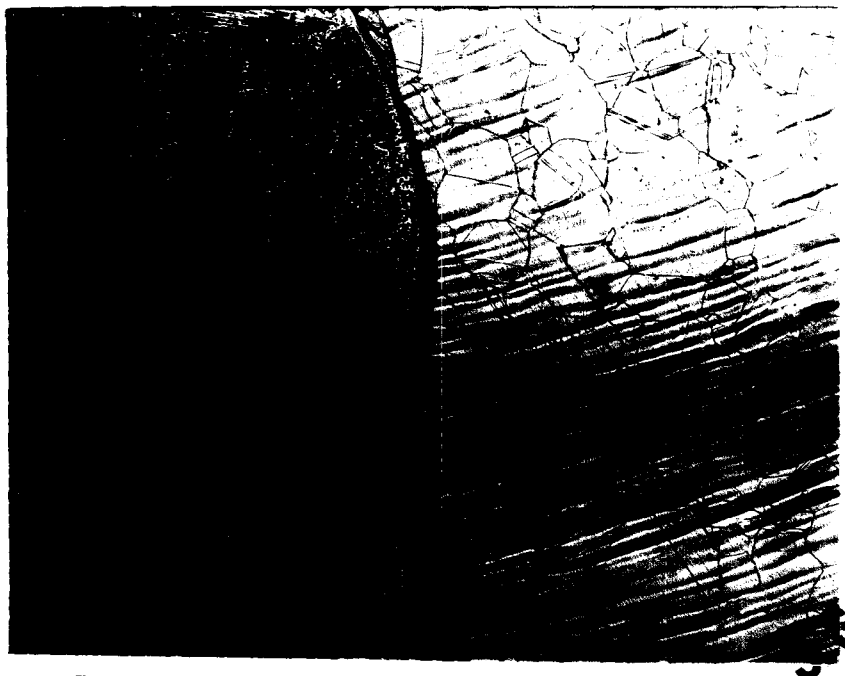
ESAME MICROSCOPICO
MICROSCOPIC EXAMINATION
UNI EN 1321:97

Cert./*Cert.* N./*N.* 307	Pag./*Page* 1di/*of*
Saggio/*Test SSM* 1571	Saggio/*Test* 2030

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*

ORIGINAL

Linde Geschäftsbereich Linde Engineering Werkstofftechnik / TAW *Linde Engineering Division* *Materials Technology / TAW*	**Prüfbericht** **Kerbschlagbiegeprüfung** ***Test Report Impact Test***	Blatt-Nr. /Sheet-No.: Seite 4 von 4 page 4 of 4	Dokument Nr. / Document No.: **TRT 03 So 024 - 2**
		Projekt / Project:	**7854 3531 - Genua**

Besteller, Bestell-Nr. / Customer, Order-No.:	Hersteller / Manufacturer:	Prüfgegenstand, Kennzeichnung / Item, Marking:
Mr. Drago / Ansaldo Superconduttori spa **Order No.: ASG / 698 of 16.06.2003**	**Ansaldo Superconduttori spa**	**1 welded test plate (250 x 80 x 10,6 mm³)** **Marking : CM 2030**
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.	Probendicke Thickness (mm)	Probenbreite Width (mm)	Kennzeichnung der Probenlage Denomination	Prüftemperatur Test Temperature (°C/K)	Kerbschlagarbeit Impact absorbed Energy (J)	Kerbschlagzähigkeit Impact Toughness (J/cm²)	Remark
Anforderungen / Requirements							
				4,2 K			
Ergebnisse / Results:							
1	9,90	9,92	VWT 0/0	4,2 K	95	120	weld metal (WM)
2	9,90	10,00			83	105	
3	9,90	9,96			95	120	
4	9,90	9,84	VHT 0/0		131	166	heat affecting zone (HAZ)
5	9,90	9,95			172	218	
6	9,90	9,98			149	189	

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, 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° MA 0339123
Ansaldo Superconduttori s.p.a.	☐ IN APPROVVIGIONAMENTO *on purchasing* ☒ IN FABBRICAZIONE *on manufacturing*	Pag. / *Pg:* 1 di / *of* 1

COMMESSA / *Job*	COMPONENTE / *Component*	DISEGNO / *Drawing*	POS./*Item*	REV./*Rev*
0209 LHC cold masses	***Production test plate***			

IMPIANTO / *Plant*	CLIENTE / *Customer*	*CERN Part Id.*
LHC	**CERN**	

SPECIFICA / *Specification*	REV. / *Rev.*	N. DI SERIE COMPONENTE / *Component Serial Nr.*
PWPS ASC 11/02	/	**COLD MASS C.M.2030**
LHC-MMS / 98 - 198	**1.1 & 2.0**	

CONTROLLO / *Check*	ITP No.
Misura di permeabilità magnetica / *Magn.permeability measurement*	/

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*
• 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* ☒ - non conforme/*non-conforming* ☐	RNC No.

COGNOME *Name*	SANDOLI					
FIRMA *Signature*	Sandoli					
DATA *Date*	24/09/03					
ENTE *Department*	PRC					