

LHC: Cold Mass Longitudinal Welding

Production test plates on Cold Mass 2026

1. Non destructive tests

- 1.1 *Visual Inspection*
See document ASG MA033786
- 1.2 *X-Ray examination*
See document SIGE 03052-146 (1)
- 1.3 *Dye penetrant test*
See document ASG MA033786

2. Destructive tests

- 2.1 *Transverse tensile test*
See document SSM/2648 on 20/10/2003
- 2.2 *Longitudinal tensile test*
See document SSM/2648 on 20/10/2003
- 2.3 *Charpy V-Notch test (4.2 K)*
See document LINDE TRT 03 So 024 Page 3 (2)
- 2.4 *Bending test*
See document SSM/2648 on 20/10/2003
- 2.5 *Macrograph*
See document SSM/2648 on 20/10/2003
- 2.6 *Micrograph*
See document SSM/2648 on 20/10/2003
- 2.7 *Magnetic permeability*
See document ASG MA0339115

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 W2 Pos. 1-0 was excluded
- (2) Only two samples in WM and HAZ could be machined



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

CONTROLLO RADIOGRAFICO
RADIOGRAPHIC EXAMINATION REPORT

PAG/SH: 1 DIVOF: 1
CERTIFICATO N. _____
CERTIFICATE N. _____
R.T. 03052-146

CLIENTE - CUSTOMER: **SPELLE ANSALDO SUPERCONAUTI** OGGETTO - OBJECT: **TALLONI PRODUZIONE** COMMESSA - JOB: **058**

DOCUMENTI DI RIFERIMENTO - APPLICABLE CODE: **UNI EN 1439** 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 - EFFSIZE: **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 MHF2000** SISTEMA PELLICOLA - FILM SYSTEM: **AGFA D3** SVILUPPO - DEVELOP.: **MANUALE**

IDENTIFICAZIONE IDENTIFICATION	POSIZIONE POSITION	Ø DIAM. Ø DIAM.	SPESORE THICK.	SOFFIATURE 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 OXIDISATION	SUALLAMENTO 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** ISPR. - SURV.: _____
SNTU _____ 2ND 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 - DWV - IIS - ISPEL - LFS - MMI - 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. 1551	DATA / DATE 20/10/2003	CERTIFICATO / CERTIFICATE N. 2648	PAGINA / PAGE N. 1
ORDINE / ORDER N°ASB/1012 dated 19/06/2003		SAGGIO / TEST N. 2026		

SENSO di POSIZIONE ORIENTATION	PROVA DI TRAZIONE / TENSION TEST										PIEGA BEND TEST	RESILIENZA IMPACT TEST
	SPESORE LARGHEZZA DIAMETRO	AREA DELLA SEZIONE	SNERVAMENTO YIELD STRENGTH		ROTTURA TENSILE STRENGTH		ALLUNGAMENTO ELONGATION		STRIZIONE REDUCT OF AREA %	TIPO TYPE		
			TOTALE TOTAL	N/mm ²	TOTALE TOTAL	N/mm ²	TOTALE TOTAL	%				
	mm	mm ²	KN	min.	max.	KN	min.	max.	min.	max.	min. sing.	min. medio
											min. for 1.	min. aver.

L	8,00	50,26	40,0	17,50	348	31,00	617	54,6	36,5	Weld zone (RxA = 22520,5)		
T	10,29	25,05	257,76			167,25	649			(Broken in weld metal)		
T	10,20	24,89	253,87			166,05	654			(Broken in weld metal)		
T	11,0	20,0	FACE BEND								SATISFACTORY	
T	11,0	20,0	FACE BEND								SATISFACTORY	
T	11,0	20,0	ROOT BEND								SATISFACTORY	
T	11,0	20,0	ROOT BEND								SATISFACTORY	
			CND									
			MACRO									

MICRO

Esito: NOT REVEALED MICROSCOPIC CRACKS
Esito: SATISFACTORY

NOTE

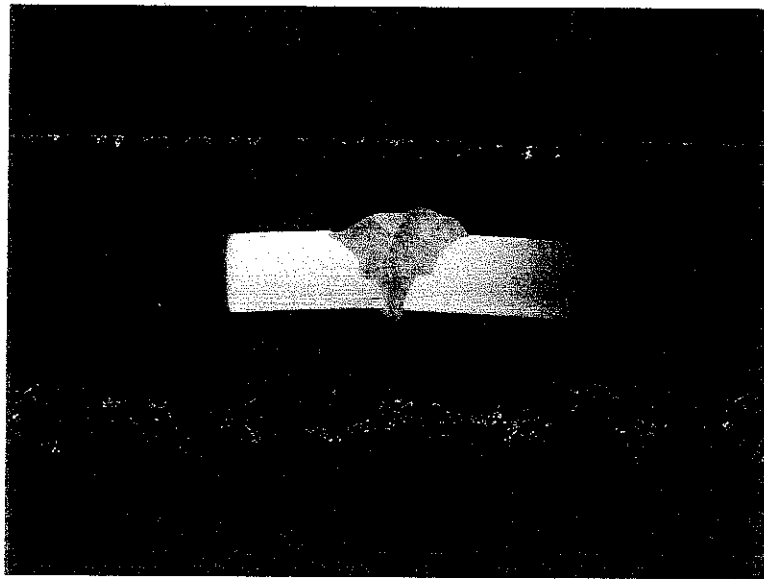
REMARKS THIS TESTS HAVE BEEN PERFORMED AFTER FIVE THERMAL CYCLES IN LIQUID NITROGEN.

IL LABORATORIO THE LABORATORY

Gastano Rossini

IL CLIENTE / THE CUSTOMER

L'ISPETTORE / THE INSPECTOR

SAGGIO/TEST "2026"

Regia

1X

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.*

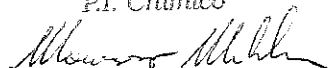
Data/Date

20/10/2003

L'Operatore/The Operator

Maurizio Michelin.

P.I. Chimico



L'Ispettore/The Inspector

Doc.macrofoto-



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. 305

Pag./Page
1 di/of

Saggio/Test SSM
1551

Saggio/Test
2026

Cliente/Customer

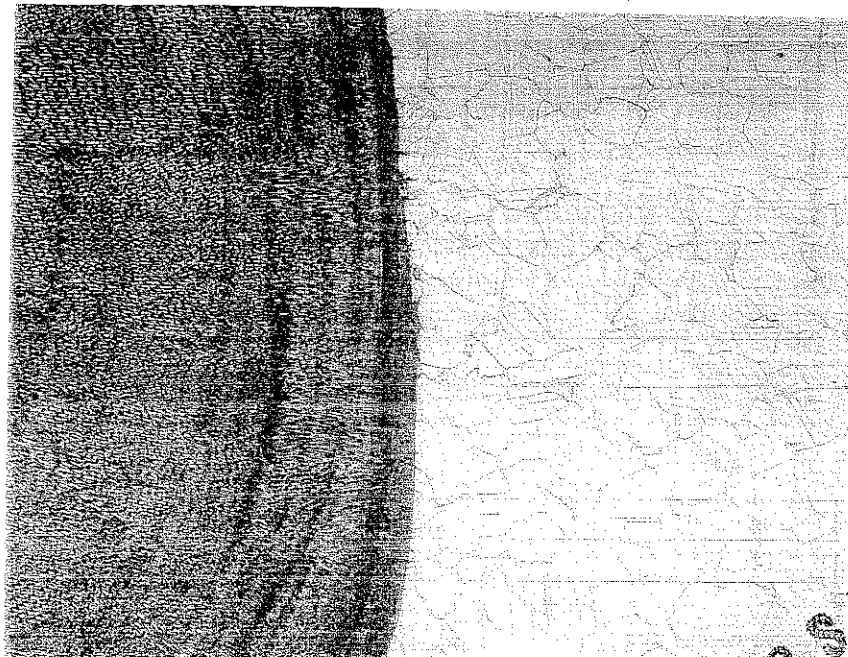
ANSALDO SUPERCONDUTTORI SpA GENOVA

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

SSM

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 Micheli

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			
Blatt-Nr. / Sheet-No.: Seite 3 von 3 page 3 of 3		Projekt / Project: 7854 3531 - Genua					
Hersteller / Manufacturer: Ansaldo Superconduttori spa		Prüfgegenstand, Kennzeichnung / Item, Marking: 1 welded test plate (210 x 60 x 10,6 mm³) Marking : 2026 - 155 I					
Besteller, Bestell-Nr. / Customer, Order-No.: Mr. Dott. Drago / Ansaldo Superconduttori spa Order No.: ASG/ 698 of 16.06.2003		Prüfgrundlagen / Test Specification: EN 10 045-1 EN 875					
Werkstoff, Regelwerk / Material, Specification: <ul style="list-style-type: none"> • base metal: 1.4429 (Tp316 LN) • filler metal: Lincoln LNM 4455 		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/cm ²)	Remark
Anforderungen / Requirements							
				4,2 K			
Ergebnisse / Results:							
1	9,97	9,98	VWT 0/0	4,2 K	114	143	weld metal (VMT)
2	9,96	9,98			111	139	
---	---	---			---	---	
3	9,91	9,99	VHT 0/0	4,2 K	180	228	heat affecting zone (HAZ)
4	9,91	9,99			183	232	
---	---	---			---	---	
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

Hörliegelskreuth, 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° MA0839115

Ansaldo Superconduttori s.p.a.

IN APPROVVIGIONAMENTO
on purchasing

IN FABBRICAZIONE
on manufacturing

Pag. / Pg. di / of
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 & 2.0	N. DI SERIE COMPONENTE / Component Serial Nr. COLD MASS C.M.2026		
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
-----------------------------------	------------------------------------------------	------------------------


- | | | |
|---------------------------------------|----------|--------|
| • su materiale base / on raw material | : 1.0030 | < 1.01 |
| • vicino saldatura / near weld | : 1.0040 | |
| • sulla saldatura/ on weld | : 1.0046 | |

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

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

RNC No.

COGNOME Name	SANSULLI				
FIRMA Signature	Sansulli				
DATA Date	23/09/03				
ENTE Department	PRC				

 Ansaldo Superconduttori	RAPPORTO DI CONTROLLO <i>Test Report</i>		N° MA033786	
	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 di / of
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.2026	
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	SANDULLI				
FIRMA Signature	<i>Sandulli</i>				
DATA Date	12.09.2003				
ENTE Department	PRC				