



Test Certificate

Daido Steel Co.,Ltd.
Shinagawa Bldg., 6-35, 1-chome
Konan, Minato-ku
Tokyo, Japan
108-8478

REF No
Page
Ord No
Date Tested
Date Printed
Date Received

T 915110 : Issue 1
1 of 6
Wire Transfer - Dr. Namiki
01/06/10
05/15/10
12/21/09

Attn: Dr. Kunio Namiki

Item - MATERIAL SUPPLIER QUALIFICATION: GRADE "DHA-WORLD",
HEAT #1C485, 315 mm Thick x 820 mm Wide x 54 mm Long

Specification - NADCA #207-2008

Chemical Analysis

	C [%]	Mn [%]	P [%]	S [%]	Si [%]	Ni [%]	Cr [%]	Mo [%]	Cu [%]	V [%]		Comments
001:	0.33	0.67	0.011	<0.002	0.51	0.07	5.36	1.17	0.03	0.52		Reference
Analysis by ICP, OES, Combustion and/or Gravimetric Methods. Details available upon request.												

Charpy Test - ASTM E 23

	Position	Dimensions [mm]	Denomination	Test Temp [°F]	Energy Absorbed [ft. lbf]	Average [ft. lbf]	Comments
002:Short Transverse	CVN = 43 HRC	10x10x2V	N/A	-110.0	8, 8, 6	7.3	Reference
003:Short Transverse	CVN = 43 HRC	10x10x2V	N/A	R/T	19, 17, 17	17.7	Reference
004:Short Transverse	CVN = 43 HRC	10x10x2V	N/A	212.0	42, 40, 42	41.3	Reference
005:Short Transverse	CVN = 43 HRC	10x10x2V	N/A	300.0	46, 47, 49	47.3	Reference
006:Short Transverse	CVN = 43 HRC	10x10x2V	N/A	450.0	54, 54, 53	53.7	Reference

Micro Examination - ASTM E 3

	Position	Details	Comments
007:Parent	Banding	NADCA #207-2008	Acceptable
008:Parent	Structure	NADCA Figure AS 4	Acceptable

Micro Examination - ASTM E112-Comparison

	Position	Details	Comments
009:Grain Size	Austenitic	ASTM No. 8.0	Acceptable

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Micro Examination - ASTM E 45-Method A			
	Position	Details	Comments
010:Inclusion Count	Plate 1-r	Type A: 0 T, 0 H	Acceptable
011:Inclusion Count	Plate 1-r	Type B: 0 T, 0.5 H	Acceptable
012:Inclusion Count	Plate 1-r	Type C: 0 T, 0 H	Acceptable
013:Inclusion Count	Plate 1-r	Type D: 1.0 T, 0.5 H	Acceptable

Hardness Test - ASTM E 18				
	Method	Load	Results	Comments
014:As Received Hardness	Rockwell A	60kgf	48, 49, 48	Eqv. ASTM E140 = 144 HB
015:As Quenched Hardness	Rockwell A	60kgf	77, 78, 77	Eqv. ASTM E140 = 53 HRC
Results obtained using carbide ball indenters (as applicable)				

Certificate Comments

CVN hardened @1885F, oil quenched, triple tempered 2hrs @1110F


Mark K Goodyear
 Test Engineer
 For and on behalf of
 Exova Inc.

Daido Steel Co.,Ltd.
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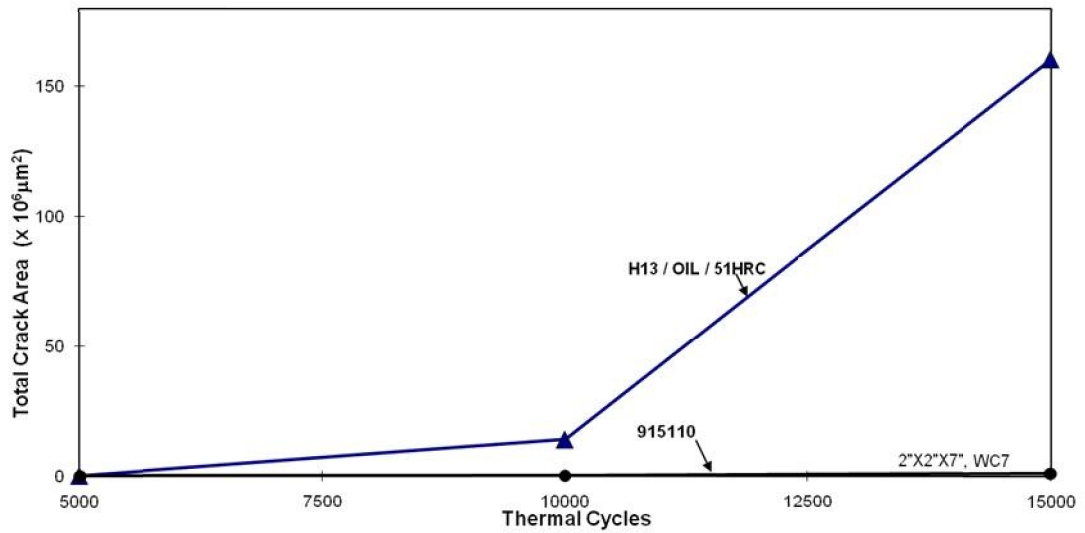
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Attachment - Not Applicable

	Location	Position	Magnification	
016:Subcontract Report	DUNK TEST	Total Crack Area	xN/A	

TOTAL CRACK AREA OF 915110 AND H13



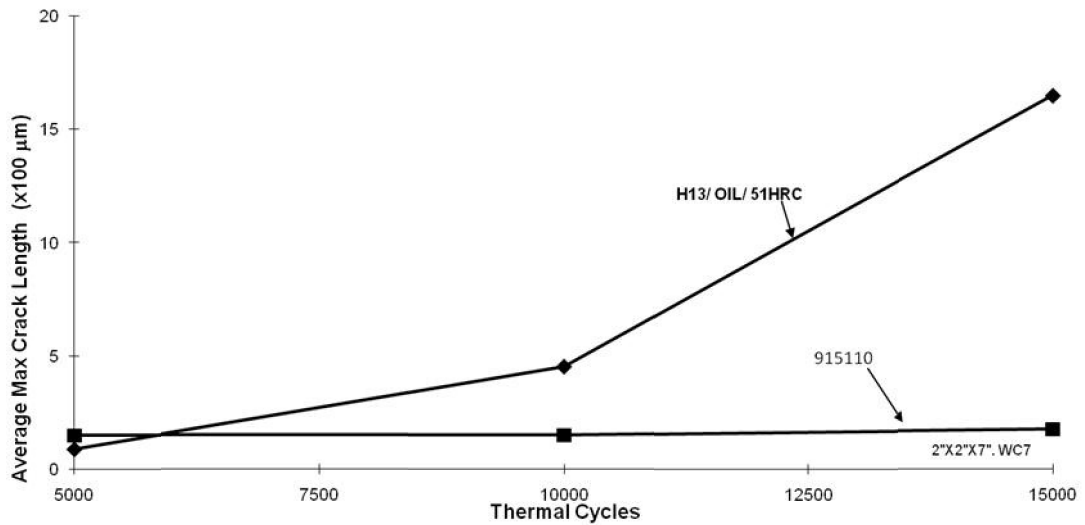
The recording of false, fictitious or fraudulent statements or entries may be punished as a felony under federal law.
 This certificate should not be reproduced other than in full, without the written approval of Exova, 194 Internationale Blvd, Glendale Heights, IL, USA, 60139
 These results pertain only to the item(s) tested as sampled by the client unless otherwise indicated.
 Testing has been conducted to specification revision levels as described in the laboratory's document control procedure.
 Information regarding estimate of measurement uncertainty (where appropriate) available upon request.



Attachment - Not Applicable

	Location	Position	Magnification	
017:Subcontract Report	DUNK TEST	Average Crack Length	xN/A	

AVERAGE MAXIMUM CRACK LENGTH OF 915110 AND H13



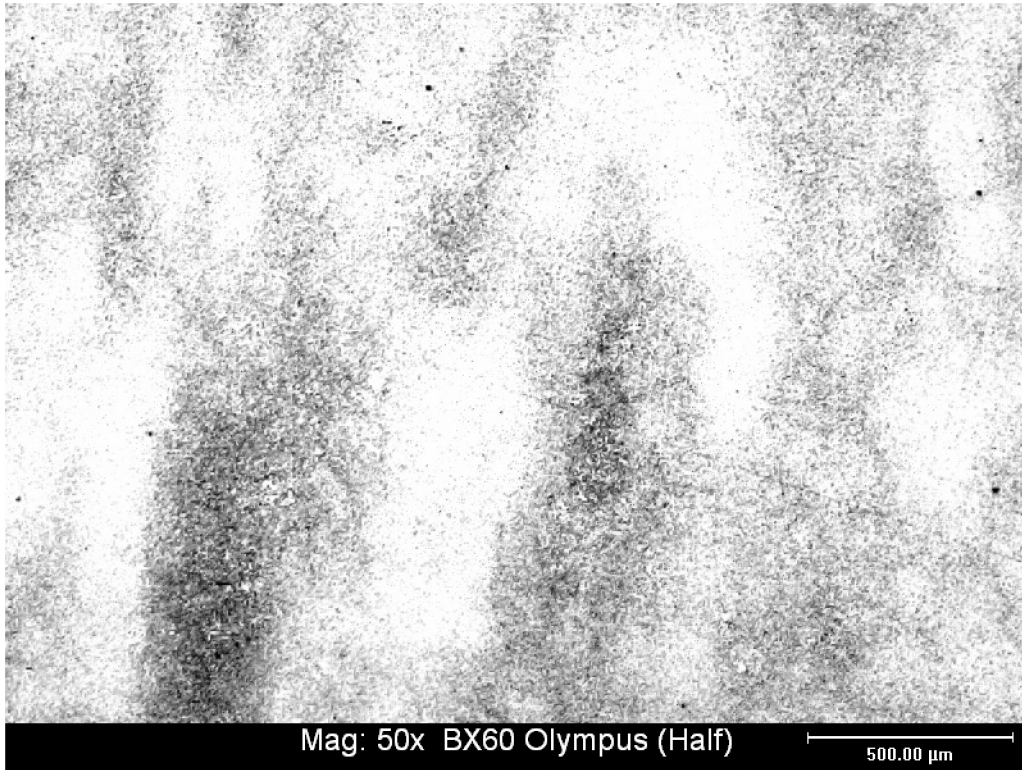
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Photographs - In House Procedure

	Location	Position	Magnification	
018:Micro Section	Etched	Banded Structure	x50	



Stated magnification refers to original capture condition.

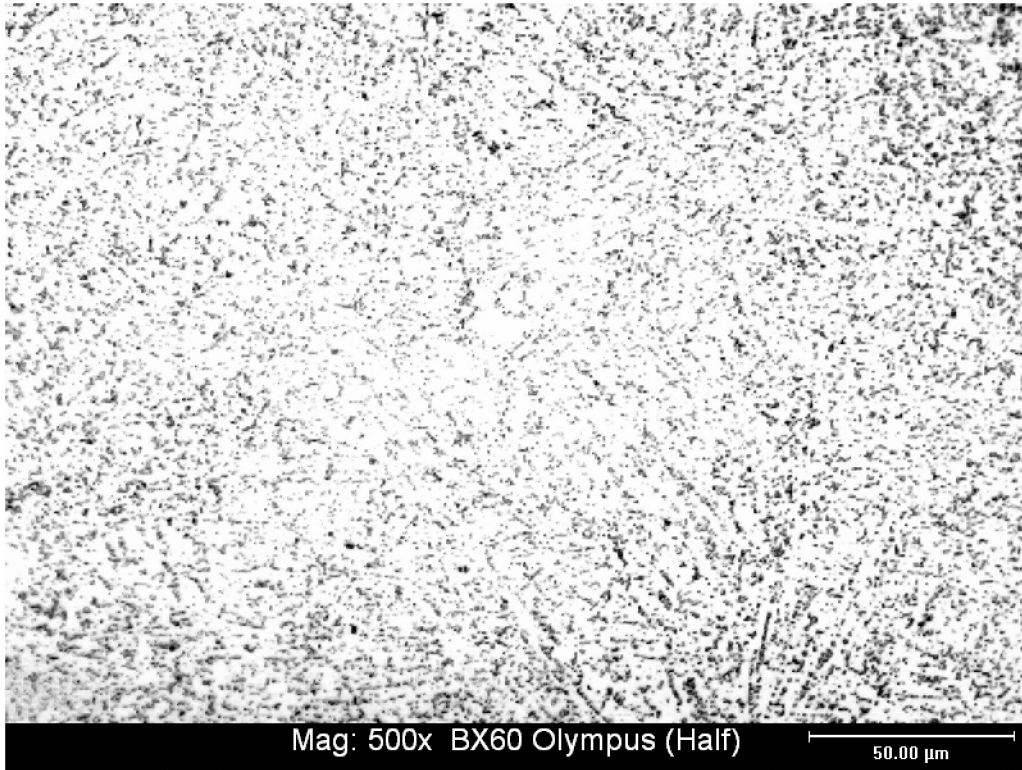
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Photographs - In House Procedure

	Location	Position	Magnification	
019:Micro Section	Etched	Annealed Structure	x500	



Stated magnification refers to original capture condition.