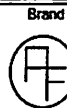


FORONI S.p.A.21055 Goria Minore (VA)
Italia**CERTIFIED MATERIAL TEST REPORT**

Cert. n° 2012/2623

Inspection certificate EN 10204-3.1

Rev. 0
Date 30/8/2012**Customer** HOWCO GROUP PLC
Material: F51; UNS S31803.**Order n°:** EUR - 913621 + *Order confirmation* 2012/120294
Delivery condition: Forged, solution annealed and peeled.**Item:** 6**Specifications:** NORSOK MDS D47 Rev.3 chemistry only, MDS D44 Rev.3 chemistry only; ASTM A182-08a chemistry and mechanical only, A276-08, A479-06a; NACE MR0175/ISO 15156-3:2003/Cor.1:2005/Cor.2:2005/Cir.1:2007.
F51 MDS Rev.3; HG-002 Rev.1 + technical comments dated October 08, 2011.

AOD / VIDP n° 06580	Heat Treatment: Lot n°: 8220 CTT n°: 8220	Description: Round bar	Size 16 inches	Length inches
VAR / ESR n°	- Solution annealing at 1060°C x 7 hrs - W.Q..	N° of pieces 1	Weight 4935 Kg	Bar identification:
Steel making process: E.A.F./A.O.D.	- Furnace calibration in accordance with AMS-H-6875A.			Forging ratio: 4,4

Chemical analysis			Mechanical properties				Other properties			
% w	Heat	Product	Type	Test n°	5021	5021	Specification:	Description:	Results:	
C	0,017		Tensile properties	Position	M.R.		Grain size to	ASTM E112-96	Comparison method	5
MN	1,50			Direction	LNG		Ferrite content to	ASTM E562-05		51 %
SI	0,48			Temperature	°C	20	Corrosion test to	ASTM G48-03 Method A	(30°C x 24 hrs)	No pitting and no weight loss
CR	22,22			Y.S. 0,2%	MPa	484	Macro examination			
NI	5,52			Y.S. 1%	MPa		Microstructure at X500 after etching (40% KOH):	free from grain boundary carbides, sigma, chi and laves.		
MO	3,12			U.T.S.	MPa	700	Inclusional content to	ASTM E45-05	Method A	A= 0 B= 0 C= 0 D= 1,5
S	0,0002			Elongation	%	40 45,4	UT to	ASTM A745-94	QL3	Passed
P	0,0210			Red. of Area	%	79,1	Visual check			Passed
CU	0,14			Hardness	HB	227	Dimensional check			Passed
AL	0,007			as delivered	HRC	<20	P.M.I. check			Passed
N	0,182		Impact properties	Position	M.R.	M.R.	Fatigue testing			
TI	0,003			Direction	LNG	TRV	Remarks:	Material not intended for use in aerospace/aircraft applications.		
NB	0,007			Temperature	°C	-50				
V	0,040			Charpy A	J	72				
PRE	35,43					73				
				Lateral expansion	mm	1,04	0,37			
						0,90	0,34			
				Shear	%	55	33			
						51	32			
				Stress-rupt.	Temperature	°C				
				Load	MPa					
				Load Increm.						
				Duration	hours					
				Elongation	%					



Material made in Italy.

No welds, no mercury and radioactive contamination.

The material is in compliance with the mentioned specifications. Material produced according to the Quality System described in the FORONI S.p.A. MSQ Manual.

Quality System Manual
MSQ Ed. 2003 Rev. 3 (13/12/2010)S.C.Q. Department
M. Gallina

M. Gallina

R.S.Q. Inspector
C. Malara

C. Malara

FORONI S.p.A.
21055 Gorla Minore (VA)
Italia



MICROGRAPHIC EXAMINATION

Cert. n° 2012/2623
Rev. 0
Date 30/8/2012
Annex A

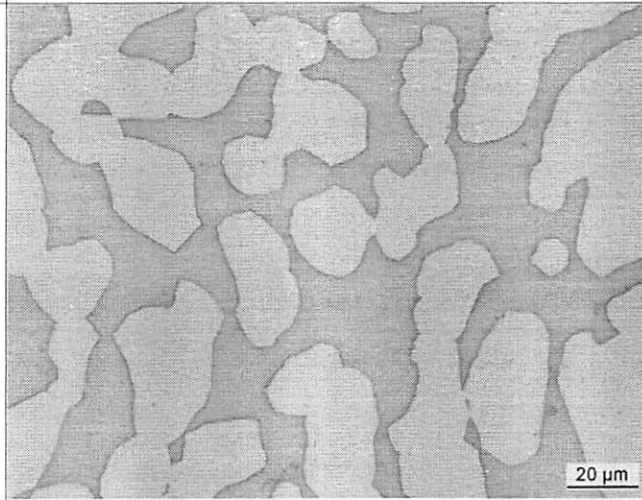
Center

Mid-radius

Surface

100 x

500 x



20 μm

The microstructure is free from intermetallic phases and precipitates.

S.C.Q. Department
S.Pivotto

R.S.Q. Inspector
C.Malara

FORONI S.p.A. 21055 Gorla Minore (VA) Italia	ULTRASONIC TEST CERTIFICATE	Cert. n° 2012/2623 Rev. 0 Date 30/8/2012 Annex B

Order n°: EUR - 913621
Customer: HOWCO GROUP PLC
Material identification: F51; UNS S31803.
 Heat n° 06580 Lot n° 8220
Material condition: Forged, solution annealed and peeled.
Material description: n° 1 Round bar diameter 16 inches.
Specification: ASTM A745-94 QL3.
Technique of examination: contact.
Apparatus: Gilardoni RDG700
Couplant: paste.

Calibration:

Type	Probe			Calibration	Scanning ¹	Reference defect	Scanning Gain dB	Evaluation Gain dB
	Section	MHz	Wedge					
Straight beam	D. 1"	1	No	D.A.C.	A	FBH 1/4"	68	62

¹ A= cylindrical surface; B= cylindrical surface axial test; C= axial test; D= cylindrical surface circumferential test.

Results: - in accordance with specification.

Remarks:

Operator (Level II - SNT TC 1A + EN 473) A. Lavoratomuovo	N.D.E. Chief P. Monti	R.S.Q. Inspector C. Malara
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