

# USHA MARTIN LIMITED

## (USHA ALLOYS & STEEL DIVISION)

GAMHARIA, DIST.-SARAIKELA KHARASWAN, JAMSHEDPUR-831001 JHARKHAND. PHONE 0657-3982200

### QUALITY ASSURANCE TEST CERTIFICATE

KRISHNA FORGINGS LTD

PO No/ Date

MARCH/

J00005217

Tax Invoice No

9000076963

Quantity

2000 MT

Rolling Input

300 X 360 mm

C4336001

C43360

Grade

20MNCR5H

Product

ROUND BAR FINISHED

RF/14/D-401/15C/VEC PARTS 7049

Date

12-11-2016

Issue No. 00

Rev. 0

Condition

AS ROLLED

31-MAR-2018

Nom Size

125.00 mm

Colour Code

BLUE+ BLACK DOT &amp; VEC AT CENTE

#### CHEMICAL COMPOSITION

Element	%C	%Mn	%Si	%P	%S	%Cr	%Ni	%Cu	%Mo	%Al	%Pb	%V	%Ti	%Ca
Min.	0.17	1.10	0.15	-	0.020	1.00	-	-	-	0.020	-	-	-	-
Max.	0.22	1.30	0.25	0.020	0.030	1.30	0.25	0.25	0.050	0.035	-	0.020	0.010	-
Actual	0.19	1.26	0.22	0.016	0.025	1.24	0.014	0.017	0.003	0.028	-	0.004	0.001	-

#### OTHER ELEMENTS

#### CARBON

#### GAS LEVEL

Element	%Sn	%As	%Sb	%Nb	%B	%Te	%W	EQV	O2 PPM	H2 PPM	N2 PPM
Min.	-	-	-	-	-	-	-	-	-	-	-
Max.	0.0500	-	-	0.0200	-	-	-	-	20	2.0	80
Actual	0.0015	-	-	0.0010	-	-	-	-	15	1.4	72

#### MECHANICAL PROPERTIES

Requirement	Hardness BHN	Impact Strength (IZOD/CHARPY) (Joule)	Yield Strength (Kg/mm2)	UTS (Kg/mm2)	%E	%RA	JOMINY HARDENABILITY (HRC)					
Min.	-	-	-	-	-	-		J-5 MM	J-11 MM			
Max.	240	-	-	-	-	-	Min.	38.0	32.0	-	-	-
Act. Min.	182	-	-	-	-	-	Max.	43.0	36.0	-	-	-
Act. Max.	186	-	-	-	-	-	Act.	42.0	33.0	-	-	-

#### METALLURGICAL PROPERTIES

#### INCLUSION RATING AS PER ASTM E-45

Classification	Depth of Decarb (mm)	Macro Etch (ASTME381)	Max. Depth of Surface Defect (mm)	Grain Size (ASTME112)	Spheroidised (%)	A		B		C		D	
						T	H	T	H	T	H	T	H
Min	-	-	-	5	-	-	-	-	-	-	-	-	-
Max	0.30	C2R2S2	-	8	-	2.0	1.0	2.0	0.0	2.0	0.0	2.0	0.0
Actual	0.23	C2R1S1	-	7.5	-	1.5	0.5	1.0	0.0	0.0	0.0	1.0	0.0
Micro structure		Ferrite Pearlite											

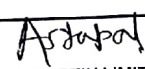
Spark & Spectral Test/PMI	OK	MPI	100 % OK	Blue Fracture	NA	Hardness after Heat treatment of sample.	
Surface Inspection: (as per Spec.)	100% OK	Step Turn	No Streak	Cold Upset	NA	Requirement	
Ultrasonic Test:(as per Spec.)	100 % Satisfactory					Actual in BHN	

REDUCTION RATIO	8.80 : 1	PROCESS ROUTE	BF>EAF>LRF>VD>CCP>BM				
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Remarks: SIZE TOLERANCE-(+1.20) (-0.00), OUT OF ROUNDNESS-0.80,

LENGTH OF BAR- 3.0 TO 6.0 MTRS.

100% BARS CHECKED FOR RADIOACTIVE CONTAMINATION AND FOUND OK.

Test certificate meets TDC  
Results based on sample testing
  
 USHA MARTIN LIMITED  
 (USHA ALLOYS & STEELS DIVISION)

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