

**USHA MARTIN LIMITED**  
**(STRAIGHT BAR & WIRE MILL DIVISION)**

P.O. GAMHARIA, DIST. SARAIKELA KHARASWAN, JAMSHEDPUR-832108 JHARKHAND. PHONE 0657-3295772/773

**QUALITY ASSURANCE TEST CERTIFICATE**

Customer/SP	<b>RAMKRISHNA FORGINGS LTD</b>				PO No/ Date	Sep'17/	
TC No	50000001607	Tax invoice No	9010005968	Quantity	25.020 MT	Rolling Input	150 X 150 mm
Batch No.	B2416101 <span style="color: blue;">+ 4.22 MT + 3.25 MT = 32.49 MT</span>						
Heat No	B24161	Grade	20MNCr5		Product	ROUND BAR FINISHED	
Spec code	RF/14/D-4 01 /15D	Date	06-02-2017	Issue No: 0	Rev: 3	Condition	AS ROLLED
Prod Dt	04-OCT-2017	Nom Size	50.00 mm		Colour Code	BLUE	

**CHEMICAL COMPOSITION**

Elements	%C	%Mn	%Si	%P	%S	%Cr	%Ni	%Cu	%Mo	%Al	%Pb	%V	%Ti	%Ca
Min.	0.17	1.10	0.15	-	0.010	1.00	-	-	-	0.020	-	-	-	-
Max.	0.22	1.40	0.40	0.035	0.040	1.30	0.25	0.35	0.060	-	-	-	-	0.0020
Actual	0.18	1.22	0.25	0.012	0.024	1.12	0.01	0.01	0.001	0.030	-	-	-	0.0004

**OTHER ELEMENTS**

Elements	%Sn	%As	%Sb	%Nb	%B	%Te	%W	CARBON EQV	GAS LEVEL		
									O2 PPM	H2 PPM	N2 PPM
Min.	-	-	-	-	-	-	-	-	-	-	-
Max.	-	-	-	-	-	-	-	-	20	2.0	80
Actual	-	-	-	-	-	-	-	-	16	1.7	69

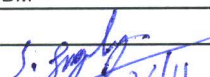
**MECHANICAL PROPERTIES**

Requirement	Hardness BHN	Impact Strength (IZOD/CHARPY) (Joule)	Yield Strength (Kg/mm2)	UTS (Kg/mm2)	%E	%RA	JOMINY HARDENABILITY (HRC)				
Min.	-	-	-	-	-	-	J- 4/16"				
Max.	250	-	-	-	-	-	Min.	36.0	-	-	-
Act.Min.	162.00	-	-	-	-	-	Max	38.0	-	-	-
Act.Max.	165.00	-	-	-	-	-	Act.	38.0	-	-	-

**METALLURGICAL PROPERTIES**

						INCLUSION RATING AS PER ASTM E-45							
Specific ation	Depth of Decarb (mm)	Macro Etch (ASTM E381)	Max. Depth of Surface Defect(mm)	Grain Size (ASTM E112)	Spheroidised (%)	A		B		C		D	
						T	H	T	H	T	H	T	H
	-	-	-	5	-	-	-	-	-	-	-	-	-
Max	0.50	C2R2S2	-	8	-	3	2	3	2	1	1	2	1.5
Actual	0.22	C2R1S1	NIL	6-7	-	1.5	0	1	0	0	0	1	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	11.45 : 1	PROCESS ROUTE	BF>EAF>LRF>VD>CCP>SBM	
Remarks: DIMENSION +0.27/-0.10 , OVALITY 0.37				
LENGTH OF BAR- 5.00 MTRS. TO 6.00 MTRS.		Test certificate meets TDC Results based on sample testing	 USHA MARTIN LIMITED (USHA ALLOYS & STEELS DIVISION)	
MATERIAL IS FREE FROM RADIOACTIVE ELEMENTS				
Corporate Office: 2 A, Shakespeare Sarani, Kolkata: 700 016. Email ID: uasdaq_hod@ushamartin.co.in				

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