

**JSW STEEL LIMITED - SALEM WORKS**

QR / QA / 54

Works: pottaneri Village, Mecheri Post - 636 453, salem, india

Registered Office: "JSW CENTRE", Bandra Kurla Complex, Bandra (East), Mumbai - 400 051

TEST CERTIFICATE

Certificate No. : 231534				Date : 03.02.2018				Po Number: HAPPY F			
Customer Name: HAPPY FORGINGS LIMITED UNITII				SO No : 400776893				Po date : 03.02.2018			
Cust. Address : BXXIX22541 AND OPP.HINDUSTAN TYRES				SO Date : 03.02.2018				Packing Slip No : 705512465			
LUDHIANA, Punjab-141120, India				Truck No.: TN937477				Invoice No : 7100571868			
Heat No	Grade	Size (mm)	Length (mm)	M/L (mm)	No. of Bundles	No. of PCS	Weight	Billet/Bloom Size			
E72787	20MNCr5	125.0 mm RCS	6,000.00 mm	0 mm	11	33	24.540 MT	340MM 400MM			

TDC NO : HFL_TDC_18_0_5,25,10.2016,GT_QF1001_STD_0_1,30.09.1999,01.04.2015

Process Route : BF_EOF_LRF_VD_CCM_EMS_BM

Reduction Ratio : 8.00 / - 8.81 : 1

CHEMICAL ANALYSIS																			Prod STD No : QDQA06_512		
Element	C%	Si%	Mn%	P%	S%	Cr%	Mo%	Ni%	B ppm	V%	Cu%	Pb%	Sn%	Ti%	Nb%	Zr%	As%	Sb%	Al%	Ca ppm	CE%
MIN	0.1500	0.150	1.000		0.015	1.000													0.0200		
MAX	0.2000	0.400	1.300	0.020	0.0300	1.300	0.100	0.300	5		0.300								0.0500	10	
Actual	0.171	0.231	1.210	0.010	0.018	1.242	0.008	0.024	2	0.001	0.013	0.001	0.001	0.0035	0.001	0.002	0.002	0.001	0.027	6	0.625
Gas Levels :		N ppm : [60 / 120] -61				O ppm : [/ 20] -12.2				H ppm : [/ 2.50] -1.06											

MECHANICAL PROPERTIES :

	Tensile Test (ASTM A370 - 16)				Hardness Test			Impact Test (NA)											
Cond.	Quenched & Tempered				As rolled			Spec.		QT, CHARPY, V									
Spec.	YS	UTS	Elong.	RA	As Rolled	As Quenched		As Q&T	Test Temp	Imp. Value (min)	1		2		3		Avg.		
	MPa	MPa	%	%	BHN				°C	J	°C	J	°C	J	°C	J	°C	J	
Min	930.00	1,230.00	7.00						23	25	23	34	23	34	23	32	23.0	33.3	
Max		1,570.00			240														
Actual	985.610	1280.350	11.500		169.0														

Edge / Corner Radius (mm) : Upset Type : Upsetability :

JOMINY HARDENABILITY (ASTM A255 - 10(2014))																			Ideal Diameter (DI) : [/] -		
Distance	J1.5	J5	J10	J15	J20	J25	J30														
MIN (HRC)	41.0	38.0	32.0	29.0	27.0	25.5	24.5														
MAX (HRC)	46.0	44.0	38.5	35.5	33.5	32.0	31.0														
Actual(HRC)	46.00	43.50	36.00	30.00	28.50	27.50	26.20														

METALLURGICAL PROPERTIES & PHYSICAL INSPECTION

	Surface Inspection		Step Down Test		BFT Test		MPI Test		Segregation Test		Spark Test		Spectra Test		Metascope Test		
Actual	OK		Pass				100 % OK				100 % OK		100 % OK		100% OK		
	Macro Etch Test		Micro Structure		CN		CZ Looser		CZ Closer		GBC Level		DEG. SPH		Distortion		
Spec	C2R3S3		F_P		/		/		/								
Actual	C2R2S2		Ferrite - Pearlite														
	Grain Size	Decarb (mm)	Banding (µm)	A		B		C		D		DOS µm	Ultrasonic Test				
				Thin	Thick	Thin	Thick	Thin	Thick	Thin	Thick						
Spec	5.0 / 8.0	/	/ 100	2.0	1.5	2.0	1.0	0.5	0.5	1.0	1.0	38.1 µm	20% / 80% Back Wall Echo				
Actual	7.00	0.300 mm	60.0	1.50	1.00	0.50	0.00	0.00	0.00	0.50	0.00		100% Pass				
Inclusion Rating Test Standard: ASTM E45 - 13, A Macro Etch Test Standard: ASTM E381 - 17						Grain Size Standard: ASTM E112 - 13 Banding Test Standard: ASTM E1268 - 01(2016)						Decarb Standard: SAE J419_198312 UT Standard: ASTM A388/A388M - 16					

JSW COLOR CODE : HALF BROWN + HALF YELLOW CUSTOMER COLOR CODE :

INSPECTION CERTIFICATE 3.1 ACCORDING TO EN 10204 : 2004

Supply Condition : AS ROLLED

Remarks :

Reference : WE HEREBY CERTIFY THAT THE MATERIAL SHIPPED UNDER THIS TEST CERTIFICATE DID NOT COME IN DIRECT CONTACT WITH ANY MERCURY, CADMIUM HEXAVALENT CHROMIUM CONTAINING DEVICES, FREE FROM RADIOACTIVE CONTAMINATION EMPLOYING A SINGLE BOUNDARY OF CONTAINMENT DURING THE MANUFACTURING PROCESS TESTS.

INSPECTION AND STORAGE

WE CERTIFY THAT CONTENTS OF THIS REPORT ARE CORRECT AND ACCURATE AND MEET THE REQUIREMENTS OF THE PURCHASE ORDER TECHNICAL DELIVERY CONDITION. GENERAL STEEL REQUIREMENTS AND THE MATERIAL CERTIFICATION REQUIREMENTS.	NOTE: 1. THE RESULTS RELATES ONLY TO THE ITEM TESTED. 2. CERTIFICATE SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE WRITTEN APPROVAL OF ISSUING AUTHORITY.	For JSW STEEL LIMITED S. M. KUMAR - AVP (PC & QAD)
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