

**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. : 235922

Customer Name: HAPPY FORGINGS LIMITED UNITII

Cust. Address : BXXIX22541 AND OPP.HINDUSTAN TYRES

LUDHIANA,Punjab-141120,India

Date : 28.02.2018

SO No : 400789156

SO Date : 26.02.2018

Truck No.: TN30BE1964

Po Number:HAPPY F

Po date :26.02.2018

Packing Slip No :705619092

Invoice No :7100650261

Heat No	Grade	Size (mm)	Length (mm)	ML (mm)	No. of Bundles	No. of PCS	Weight	Billet/Bloom Size
A5725	20MNCr5	105.00 mm DIA	6,000.00 mm	0 mm	9	54	21.450 MT	280MM 370MM

TDC NO : HFL_TDC_18_0_5,12.09.2009,25.10.2016,GT_QF1001_STD,0_1,30.09.1999,01.04.2015,GT_QF1001_STD

Process Route : BF_EOF_LRF_VD_CCM_EMS_BM

Reduction Ratio : 7.00 / - 11.97 : 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	0.172	0.277	1.191	0.010	0.018	1.234	0.009	0.026	3	0.001	0.017	0.001	0.008	0.0033	0.002	0.002	0.002	0.001	0.024	5	0.622

Gas Levels : N ppm : [60 / 120] -72

O ppm : [/ 20] -11.8

H ppm : [/ 2.50] -1.45

MECHANICAL PROPERTIES :

Tensile Test (ASTM A370 - 16)					Hardness Test			Impact Test (UNI 10002)							
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
Min	930.00	1,230.00	7.00					23	25	23	38	23	40	23	42
Max		1,570.00			240										
Actual	974.550	1278.360	10.500		166.0										

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)	45.00	43.75	36.50	32.00	28.25	27.00	25.00													

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	0.260 mm	40.0	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: UNI 8449

Decarb Standard: SAE J419_198312

UT Standard: ASTM A388/A388M - 16

JSW COLOR CODE :

CUSTOMER COLOR CODE : WHITE BASE + RED DOT

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 & QA)