

## VARDHMAN SPECIAL STEELS LTD.

C-58, FOCAL POINT, PHASE V, LUDHIANA (PB.) INDIA Ph. No.: 0161-2670707-09

## TEST CERTIFICATE

ISO/TS 16949: 2009 Certificate: 37659-2008

ISO 14001: 2004

QF MSD 4.12.06

Certificate: 177315-2015 OHSAS 18001: 2007 Certificate: 177314-2015

TEST CERTIFICATE NO. \_\_\_ 2018/04/690

DATE. 30/04/2018

To HAPPY FORGINGS LTD (UNIT-II)

We certify that the material described below fully conforms to IS:7283-1992. Chemical Composition and Mechanical Properties of the product tested in accordance with the Scheme of Testing and Inspection contained in the BIS Certification Marks licence No. CM/L-9700028216 are as indicated below against each order No. etc.

(PLEASE REFER TO IS:7283-1992 FOR DETAILS OF SPECIFICATION REQUIREMENTS)

| TEST RESULTS |  |  |
|--------------|--|--|

| Manufacturing Route   EAFL RF-VD-CCP With EMS & AMLC   |                  |  |            |           | Grade     | Heat No<br>(Cast<br>No) | Finished<br>Section<br>(Nominal<br>Size mm) | on Oty   | Finish<br>Shape  | Cast<br>Section<br>(mm)  | Red.<br>Ratio | Supply<br>Cond.  | Color Code |                        | Length of Bar |           | No of<br>Bars |
|--|------------------|--|------------|-----------|-----------|-------------------------|---|--|--|--|---------------|------------------|------------|------------------------|---------------|-----------|---------------|
| C  |                  |  | 1E1120     | 64967     | 56 mm     | 1 45                    | Round                                       | 200*200  | 16.23  | Hot Rolled   |               |                  | 4-6MTR     |                        | 114           |           |               |
| C  | <b>Manufactu</b> | ring Rou   | te         | EAF-LRI   | F-VD-CC   | P With El               | MS & AML                                    |  |  |  |               |                  |            |                        |               |           | 6             |
| Min.   0.19     0.80   0.015       0.45   0.08       0.020   | % CHEMIC         | AL COM   | POSITIO    | N /       |           | <b>A</b> ffect          |   |  |  |  |               |                  |            |                        |               |           |               |
| Max.         0.23         0.18         1.10         0.020         0.020         0.70         0.25         " " " " 0.0000         0.0000         " 0.0000         " 0.000         " 0.0000         " 0.0000         " 0.0000         " 0.0000         0.000   |                  | С  | Si         | Mn        | S         | Р                       | Ni  | Cr   | Мо   | Cu   | Sn            | Al               | Ti         | Ca                     | В             | V         |               |
| Actual 0.215 0.12 0.10 0.010 0.060 0.68 0.10 0.10 0.007 0.026 0.0014 0.0002 0.003    Actual 0.215 0.12 0.12 0.15 0.018 0.010 0.060 0.68 0.10 0.10 0.007 0.026 0.0014 0.0002 0.003   In PPM   | Min.             | 0.19   |            | 0.80      | 0.015     |                         |   | 0.45   | 0.08   | ***  |               | 0.020            |            |                        |               |           |               |
| O2   | Max.             | 0.23   | 0.18       | 1.10      | 0.025     | 0.020                   |   | 0.70   | 0.25   |  | /             |                  |            | 0.0020                 |               |           |               |
| In PPM   | Actual           | 0.215  | 0.12       | 1.05      | 0.016     | 0.010                   | 0.060                                       | 0.65   | 0.10   | 0.10   | 0.007         | 0.026            | 0.0014     | 0.0014                 | 0.0002        | 0.003     |               |
| Min.   |                  | 02   | N2         | H2        |           | Grain Siz               | e   | Tot  | al Decarb (  | (mm)   | D.I.          | Value            |            | Mic                    | ro Struct     | ure       |               |
| Max  |                  |  | In PPM     |           | (IS:4     | 748/ASTN                | / E112)                                     |  | (IS:6396)  | 2.1  | 7.7 × 3.10    |                  |            |                        |               |           |               |
| Actual   14    77    1.2   | Min.             |  |            |           |           | 5                       |   |  |  |  | 43.2 mm       |                  |            |                        |               |           |               |
| No.   No.  | Max.             | -  |            |           | N         |                         |   |  |  |  |               |                  |            |                        |               |           |               |
| Nax.   3.0   2.0   2.0   1.0   0.5   0.5   1.0   1.0   1.0   1.0   1.75   1.0   1. | Actual           | 14   | 77         | 1.2       |           | 6.5/7.5                 |   |  |  |  | 48.           | 26 mm            |            | Action                 |               |           |               |
| Thin   | CLUSION          | N RATING   | 3 - IS:416 | 3 / ASTN  | / E45A/ I | SO 4967,                | Method A                                    | 7  |  | 1  |               |                  | - A        |                        | Hardn         |           | ss BH         |
| Max.   3.0   2.0   2.0   1.0   0.5   0.5   1.0   1.0   |                  | A  |            |           |           |                         |   | D  |  | JIS  |               |                  | DIN        |                        |               |           |               |
| Actual   2.0   - 0.5   1.0   - 1.0   |                  | Thin   | Thick      | Thin      | Thick     | Thin                    | Thick                                       | Thin   | Thick  | A  | B+C           | Total            | КЗ         | K4                     |               | Min       | Max           |
| Actual   2.0     0.5       1.0     1.0     175   1   | Max.             | 3.0  | 2.0        | 2.0       | 1.0       | 0.5                     | 0.5   | 1.0  | 1.0  |  |               |                  |            |                        |               | -         | 220           |
| Max   43   35  | Actual           | 2.0  |            | 0.5       |           |                         |   | 1.0  |  |  |               | 7.57             |            |                        |               | 175       | 195           |
| Min.    |                  | 7 - 1  |            |           |           |                         | JOMINY                                      | HARDE  | NABILITY   | IN HRC) (I   | S 3848)       | AV               |            |                        |               |           |               |
| Min.   43   35   | IM / Inch        | .11/16   | .13/16     | .18/16    |           |                         |   |  |  |  |               | 46.              |            |                        |               |           |               |
| Max  |                  | Contract Con |            |           |           |                         |   |  |  |  | ALC:          |                  |            |                        |               |           |               |
| Actual   44.0   37.0   22.5  |                  |  |            | 29        |           |                         |   |  |  |  |               |                  |            |                        |               |           |               |
| MECHANICAL PROPERTIES (IS 1608)  Test Condition Tensile Strength Yield Strength Elongation Reduction Area Impact Strength  Min.  |                  |  |            |           |           |                         |   |  |  |  |               |                  |            |                        |               |           |               |
| Test Condition Tensile Strength Yield Strength Elongation Reduction Area Impact Strength Min.  | , iotaai         | 11.0   | 01.0       | 22.0      |           | anaman a fi             | MEC   | HANICA   | PROPER   | TIES (IS 1   | 608)          |                  |            |                        |               |           |               |
| Min.  Max.  Actual  Supplementary Requirements  Supplementary Requirements  Supplementary Requirements  Supplementary Requirements  Supplementary Requirements  Surface Defects (Visual /MFLT)  Bend Test (IS1599:19  Test (IS:10138)  Supplementary Requirements  Surface Defects (Visual /MFLT)  Bend Test (IS1599:19  Test (IS:10138)  Supplementary Requirements  Outling Fracture Test (IS:10138)  Supplementary Requirements  Surface Defects (Visual /MFLT)  Bend Test (IS1599:19  Test (IS:10138)  OK  Ultrasonic Test  MFLT  Dimension Tolerance  Ovality / Lobbing  IS:3739  Actual  100% Bars manual ut done & found OK  Supplementary Requirements  Surface Defects (Visual /MFLT)  Bend Test (IS1599:19  Test (IS:1599:19  As per IS 4075  OK  Ultrasonic Test  MFLT  Dimension Tolerance  Ovality / Lobbing  IS:3739  As per IS3739 gr 1  As per IS3739 gr 1  Is:3739  As per IS3739 gr 1  Is:3739  As per IS3739 gr 1  Is:3739 gr 1  Is:3739 gr 1  Is:3739 gr 1   |                  | Tes  | t Conditi  | ion       | Tor       | sile Stro               |   |  |  |  |               | agation          | Poducti    | on Aron                | Imn           | not Stron | orth.         |
| Actual   | Min              | 103  | Contain    | 1011      | 101       | -                       | ngth  |  |  | Annual Control |               | Reduction Area   |            | impact Streng          |               | gtn       |               |
| Supplementary Requirements  Standard Internal Soundness (ASTM E381 / IS11371)  Required C3R3S3 max As per IS 4075 Depth of defect 0.3 mm max.  Actual C3R3S3 max OK As per IS 4075 OK  Ultrasonic Test MFLT Dimension Tolerance Ovality / Lobbing Required Yes IS:3739 IS:3739  Actual 100% Bars manual ut done & found OK  Internal Soundness (ASTM E381 / IS11371)  Step Down (IS 4075) / Blue Fracture Test (IS:10138)  OK As per IS 4075 OK  OK  Ultrasonic Test MFLT Dimension Tolerance Ovality / Lobbing IS:3739  Actual 100% Bars manual ut done & found OK  Asper is 3739 gr 1 As per IS3739 gr 1  Internal Supplied to the Standard rolling Tolerances   |                  |  | -          |           |           |                         |   |  |  |  |               | -                |            | •                      |               |           |               |
| Supplementary Requirements  Standard Internal Soundness (ASTM E381 / IS11371) Step Down (IS 4075) / Blue Fracture Test (IS:10138) Surface Defects (Visual /MFLT) Bend Test (IS1599:19 As per IS 4075) Depth of defect 0.3 mm max.  Actual C3R3S3 max OK As per IS 4075 OK  Ultrasonic Test MFLT Dimension Tolerance Ovality / Lobbing IS:3739 IS:3739  Actual 100% Bars manual ut done & found OK  |                  |  |            |           |           |                         |   |  |  | - 6  |               |                  |            |                        |               |           |               |
| Internal Soundness (ASTM E381 / IS11371)  Step Down (IS 4075) / Blue Fracture Test (IS:10138)  Required C3R3S3 max As per IS 4075  OK  Ultrasonic Test WFLT Dimension Tolerance Required Yes   | Actual           |  |            |           |           |                         |   |  |  |  |               |                  |            |                        |               |           |               |
| Required C3R3S3 max As per IS 4075 Depth of defect 0.3 mm max.  Actual C3R3S3 max OK As per IS 4075 OK  Ultrasonic Test MFLT Dimension Tolerance Ovality / Lobbing IS:3739  Actual 100% Bars manual ut done & found OK  ixup Test 100% Bars Checked by Spark,Metascope, Ni Spot test,Mobile Spectro - OK  The Material Supplied to the Standard rolling Tolerances   | 200              |  |            |           |           |                         |   | The state of the s | and the same of th |  |               |                  |            |                        |               |           |               |
| Actual C3R3S3 max OK As per IS 4075 Depth of defect 0.3 mm max Actual C3R3S3 max OK As per IS 4075 OK  Ultrasonic Test MFLT Dimension Tolerance Ovality / Lobbing Required Yes Actual 100% Bars manual ut done & found OK  Asper is 3739 gr 1 A s per IS3739 gr 1  Ixixup Test 100% Bars Checked by Spark, Metascope, Ni Spot test, Mobile Spectro - OK  The Material Supplied to the Standard rolling Tolerances  | tandard          | Internal   | Soundne    | ss (ASTM  | E381 / IS | 11371)                  | Step Do                                     |  |  | Surface Defects (  |               | Visual /MFLT)    |            | Bend Test ( IS1599:198 |               |           |               |
| Actual C3R3S3 max OK As per IS 4075 OK  Ultrasonic Test MFLT Dimension Tolerance Ovality / Lobbing Required Yes IS:3739 IS:3739  Actual 100% Bars manual ut done & found OK Asper is 3739 gr 1 A s per IS3739 gr 1  Iixup Test 100% Bars Checked by Spark, Metascope, Ni Spot test, Mobile Spectro - OK  The Material Supplied to the Standard rolling Tolerances  | Required         |  | C3         | R3S3 ma   | ax        | -                       |   | The second second  |  | A  | Dept          | h of defect      | 0.3 mm n   | nax.                   |               |           |               |
| Required Yes IS:3739 IS:3739  Actual 100% Bars manual ut done & found OK Asper is 3739 gr 1 A s per IS3739 gr 1  lixup Test 100% Bars Checked by Spark, Metascope, Ni Spot test, Mobile Spectro - OK  The Material Supplied to the Standard rolling Tolerances   | Actual           |  | C3         | R3S3 ma   | ax        |                         |   | OK As p  | er IS 4075   |  |               |                  |            |                        |               |           |               |
| Required Yes IS:3739 IS:3739  Actual 100% Bars manual ut done & found OK Asper is 3739 gr 1 A s per IS3739 gr 1  lixup Test 100% Bars Checked by Spark, Metascope, Ni Spot test, Mobile Spectro - OK  The Material Supplied to the Standard rolling Tolerances   |                  |  | Ultr       | asonic T  | est       | L-0.                    |   | MI   | FLT  |  |               |                  |            |                        |               |           |               |
| Actual 100% Bars manual ut done & found OK Asper is 3739 gr 1 A s per IS3739 gr 1  Ilixup Test 100% Bars Checked by Spark, Metascope, Ni Spot test, Mobile Spectro - OK  The Material Supplied to the Standard rolling Tolerances  | Required         |  |            | Yes       |           |                         |   |  |  |  |               |                  |            | , , ,                  |               |           |               |
| The Material Supplied to the Standard rolling Tolerances   | Actual           | 100%   | Bars mar   |           | ne & four | nd OK                   |   |  |  |  |               |                  |            | -                      |               |           |               |
| The Material Supplied to the Standard rolling Tolerances   |                  |  |            |           |           |                         | cope, Ni Sr                                 | oot test.M   | obile Specti   | ro - OK  | 7.0           | 701 10 0 1 0 0 g |            |                        | to per io     | 3700 gi 1 |               |
|  | emarks:-         |  | Free from  | radioacti | ve materi |                         |   |  | he Standar   | d rolling T  | olerance      | <u>s</u>         |            |                        |               |           |               |

For any Technical Support / Quality related issues please contact -

Mr. Dinesh Singh (Chief Manager - R&D)

Mobile no.: 081466-25586, email: met5.vss@vardhman.com

For any Test Certificate related issues please contact -Mr. K.K.Shukla (Officer - R&D)

Mobile no.: 075080-02659, email: met2.vss@vardhman.com



