

Laboratory Sunbeam Auto Pvt. Ltd., Testing Research & Development Centre,  
38/6 KM Stone, Delhi Jaipur Highway, Narsingpur, Gurgaon, Haryana

Accreditation Standard ISO/IEC 17025: 2005

Certificate Number TC-6764 Page 1 of 16

Validity 12.01.2018 to 11.01.2020 Last Amended on --

| Sl. | Product / Material of Test | Specific Test Performed | Test Method Specification against which tests are performed | Range of Testing / Limits of Detection |
|-----|----------------------------|-------------------------|-------------------------------------------------------------|----------------------------------------|
|-----|----------------------------|-------------------------|-------------------------------------------------------------|----------------------------------------|

**CHEMICAL TESTING**

| I.  | METALS & ALLOYS            |                   |                        |                    |
|-----|----------------------------|-------------------|------------------------|--------------------|
| 1.  | (Low Alloy & Carbon Steel) | Carbon            | IS 228 (Part 1): 2008  | 0.014 to 1.00 %    |
|     |                            | Manganese         | IS 228 (Part 2): 2008  | 0.06 % to 1.70 %   |
|     |                            | Silicon           | IS:228 (Part 8): 2009  | 0.05 % to 2.0 %    |
|     |                            | Sulphur           | IS 228 (Part 9): 2009  | 0.010 % to 0.25 %  |
|     |                            | Phosphorus        | IS 228 (Part 3): 2008  | 0.010 % to 0.40 %  |
|     |                            | Chromium          | IS 228 (Part 6): 2009  | 0.01 % to 1.5 %    |
|     |                            | Nickel            | IS 228 (Part 5): 2009  | 0.05 % to 3.5 %    |
|     |                            | Molybdenum        | IS 228 (Part 10): 2009 | 0.01 % to 3.0 %    |
|     |                            | Arsenic           | IS 228 (Part 13): 2009 | 0.05 % to 0.10 %   |
|     |                            | Copper            | IS 228 (Part 15): 2009 | 0.03 % to 1.5 %    |
|     |                            | Nitrogen          | IS 228 (Part 19): 2010 | 0.02 % to 0.50 %   |
|     |                            | Carbon            | ASTM E415:2017         | 0.04 % to 1.5 %    |
|     |                            | Manganese         | ASTM E415:2017         | 0.02 % to 2.0 %    |
|     |                            | Silicon           | ASTM E415:2017         | 0.01 % to 2.0 %    |
|     |                            | Sulphur           | ASTM E415:2017         | 0.005 % to 0.30 %  |
|     |                            | Phosphorus        | ASTM E415:2017         | 0.005 % to 0.20 %  |
|     |                            | Chromium          | ASTM E415:2017         | 0.03 % to 5.0 %    |
|     |                            | Nickel            | ASTM E415:2017         | 0.010 % to 5.0 %   |
|     |                            | Molybdenum        | ASTM E415:2017         | 0.005 % to 1.3 %   |
|     |                            | Aluminium         | ASTM E415:2017         | 0.007 % to 0.212 % |
|     |                            | Arsenic           | ASTM E415:2017         | 0.002 % to 0.10 %  |
|     |                            | Cobalt            | ASTM E415:2017         | 0.01 % to 0.25 %   |
|     |                            | Copper            | ASTM E415:2017         | 0.004 % to 0.10 %  |
|     |                            | Vanadium          | ASTM E415:2017         | 0.005 % to 0.55 %  |
|     |                            | Tungsten          | ASTM E415:2017         | 0.010 % to 0.50 %  |
|     |                            | Lead              | ASTM E415:2017         | 0.0003 % to 0.50 % |
| Tin | ASTM E415:2017             | 0.002 % to 0.15 % |                        |                    |

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**Certificate Number** TC-6764

Page 2 of 16

**Validity** 12.01.2018 to 11.01.2020

Last Amended on --

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|-----------|----------------------------|-------------------------|-------------------------------------------------------------|----------------------------------------|
|           |                            | Titanium                | ASTM E415:2017                                              | 0.01 % to 0.15 %                       |
|           |                            | Neobium                 | ASTM E415:2017                                              | 0.007 % to 0.06 %                      |
|           |                            | Boron                   | ASTM E415:2017                                              | 0.0003 % to 0.0030 %                   |
|           |                            | Nitrogen                | ASTM E415:2017                                              | 0.003 % to 0.0160 %                    |
| <b>2.</b> | <b>Stainless Steel</b>     | Carbon                  | IS 228 (Part 1): 2008                                       | 0.014 % to 0.25 %                      |
|           |                            | Manganese               | IS 228 (Part 2): 2008                                       | 0.06 % to 2.50 %                       |
|           |                            | Silicon                 | IS 228 (Part 8): 2009                                       | 0.10 % to 2.0 %                        |
|           |                            | Sulphur                 | IS 228 (Part 9): 2009                                       | 0.010 % to 0.30 %                      |
|           |                            | Phosphorus              | IS 228 (Part 3): 2008                                       | 0.010 % to 0.30 %                      |
|           |                            | Chromium                | IS 228 (Part 6): 2009                                       | 9.0 % to 25.0 %                        |
|           |                            | Nickel                  | IS 228 (Part 5): 2009                                       | 5.0 % to 20.0 %                        |
|           |                            | Molybdenum              | IS 228 (Part 10): 2009                                      | 0.01 % to 3.0 %                        |
|           |                            | Copper                  | IS 228 (Part 15): 2009                                      | 0.03 % to 2.5 %                        |
|           |                            | Nitrogen                | IS 228 (Part 19): 2010                                      | 0.02 % to 0.50 %                       |
|           |                            | Carbon                  | ASTM E1086:2014                                             | 0.020 % to 0.25 %                      |
|           |                            | Manganese               | ASTM E1086:2014                                             | 0.40 % to 2.5 %                        |
|           |                            | Silicon                 | ASTM E1086:2014                                             | 0.23 % to 2.0 %                        |
|           |                            | Sulphur                 | ASTM E1086:2014                                             | 0.008 % to 0.25 %                      |
|           |                            | Phosphorus              | ASTM E1086:2014                                             | 0.008 % to 0.05 %                      |
|           |                            | Chromium                | ASTM E1086:2014                                             | 5.0 % to 30.0 %                        |
|           |                            | Nickel                  | ASTM E1086:2014                                             | 5.0 % to 25.0 %                        |
|           |                            | Molybdenum              | ASTM E1086:2014                                             | 0.05 % to 3.0 %                        |
|           |                            | Aluminium               | ASTM E1086:2014                                             | 0.004 % to 0.070 %                     |
|           |                            | Arsenic                 | ASTM E1086:2014                                             | 0.002 % to 0.05 %                      |
|           |                            | Cobalt                  | ASTM E1086:2014                                             | 0.01 % to 0.20 %                       |
|           |                            | Copper                  | ASTM E1086:2014                                             | 0.010 % to 2.5 %                       |
|           |                            | Vanadium                | ASTM E1086:2014                                             | 0.005 % to 0.15 %                      |
|           |                            | Lead                    | ASTM E1086:2014                                             | 0.0007 % to 0.010 %                    |
|           |                            | Tin                     | ASTM E1086:2014                                             | 0.002 % to 0.15 %                      |
|           |                            | Titanium                | ASTM E1086:2014                                             | 0.005 % to 0.50 %                      |
|           |                            | Neobium                 | ASTM E1086:2014                                             | 0.002 % to 1.0 %                       |
|           |                            | Boron                   | ASTM E1086:2014                                             | 0.0003 % to 0.005 %                    |

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Accreditation Standard ISO/IEC 17025: 2005

Certificate Number TC-6764

Page 3 of 16

Validity 12.01.2018 to 11.01.2020

Last Amended on --

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|     |                            | Nitrogen                | ASTM E1086:2014                                             | 0.005 % to 0.06 %                      |
| 3.  | Tool Steel                 | Carbon                  | IS 228 (Part 1 & Part 4): 2008                              | 0.25 % to 1.50 %                       |
|     |                            | Manganese               | IS 228 (Part 2): 2008                                       | 0.06 % to 1.00 %                       |
|     |                            | Silicon                 | IS 228 (Part 8): 2009                                       | 0.10 % to 2.0 %                        |
|     |                            | Sulphur                 | IS 228 (Part 9): 2009                                       | 0.010 % to 0.2 %                       |
|     |                            | Phosphorus              | IS 228 (Part 3): 2008                                       | 0.010 % to 0.2 %                       |
|     |                            | Chromium                | IS 228 (Part 6): 2009                                       | 2.0 % to 6.0 %                         |
|     |                            | Nickel                  | IS 228 (Part 5): 2009                                       | 0.010 % to 0.5 %                       |
|     |                            | Molybdenum              | IS 228 (Part 10): 2009                                      | 0.05 % to 11.0 %                       |
|     |                            | Copper                  | IS 228 (Part 15): 2009                                      | 0.03 % to 0.5 %                        |
|     |                            | Carbon                  | SOP/SAPL/CHEM/11                                            | 0.009 % to 0.740 %                     |
|     |                            | Manganese               | SOP/SAPL/CHEM/11                                            | 0.0007 % to 0.210 %                    |
|     |                            | Silicon                 | SOP/SAPL/CHEM/11                                            | 0.0009 % to 0.271 %                    |
|     |                            | Sulphur                 | SOP/SAPL/CHEM/11                                            | 0.0006 % to 0.022 %                    |
|     |                            | Phosphorus              | SOP/SAPL/CHEM/11                                            | 0.0008 % to 0.030 %                    |
|     |                            | Chromium                | SOP/SAPL/CHEM/11                                            | 0.007 % to 4.55 %                      |
|     |                            | Nickel                  | SOP/SAPL/CHEM/11                                            | 0.007 % to 0.22 %                      |
|     |                            | Molybdenum              | SOP/SAPL/CHEM/11                                            | 0.007 % to 5.20 %                      |
|     |                            | Cobalt                  | SOP/SAPL/CHEM/11                                            | 0.008 % to 0.88 %                      |
|     |                            | Copper                  | SOP/SAPL/CHEM/11                                            | 0.0007 % to 0.435 %                    |
|     |                            | Vanadium                | SOP/SAPL/CHEM/11                                            | 0.007 % to 1.82 %                      |
|     |                            | Tungusten               | SOP/SAPL/CHEM/11                                            | 0.009 % to 5.79 %                      |
|     |                            | Tin                     | SOP/SAPL/CHEM/11                                            | 0.0008 % to 0.014 %                    |
| 4.  | Cast Iron                  | Carbon                  | IS 12308 (Part 11): 1997                                    | 1.5 % to 4.0 %                         |
|     |                            | Manganese               | IS 12308 (Part.10): 1991                                    | 0.02 % to 3.0 %                        |
|     |                            | Silicon                 | IS 12308 (Part.6): 1991                                     | 0.01 % to 4.0 %                        |
|     |                            | Sulphur                 | IS 12308 (Part 2): 1997                                     | 0.003 % to 0.25 %                      |
|     |                            | Phosphorus              | IS 12308 (Part 5): 1991                                     | 0.005 % to 0.50 %                      |
|     |                            | Chromium                | IS 12308 (Part 8): 1997                                     | 0.03 % to 5.0 %                        |
|     |                            | Nickel                  | IS 12308 (Part 7): 1991                                     | 0.04 % to 5.5 %                        |
|     |                            | Molybdenum              | IS 12308 (Part 9): 1993                                     | 0.010 % to 1.0 %                       |

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**Certificate Number** TC-6764

Page 4 of 16

**Validity** 12.01.2018 to 11.01.2020

Last Amended on --

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|     |                            | Copper                  | IS 12308 (Part 12): 1992                                    | 0.01 % to 0.5 %                        |
|     |                            | Manganese               | IS 12308 (Part 13): 1992                                    | 0.002 % to 0.1 %                       |
|     |                            | Carbon                  | ASTM E1999:2011                                             | 1.75 % to 3.8 %                        |
|     |                            | Manganese               | ASTM E1999:2011                                             | 0.02 % to 2.0 %                        |
|     |                            | Silicon                 | ASTM E1999:2011                                             | 0.01 % to 3.50 %                       |
|     |                            | Sulphur                 | ASTM E1999:2011                                             | 0.003 % to 0.30 %                      |
|     |                            | Phosphorus              | ASTM E1999:2011                                             | 0.005 % to 0.50 %                      |
|     |                            | Chromium                | ASTM E1999:2011                                             | 0.03 % to 3.0 %                        |
|     |                            | Nickel                  | ASTM E1999:2011                                             | 0.04 % to 5.5 %                        |
|     |                            | Molybdenum              | ASTM E1999:2011                                             | 0.010 % to 2.5 %                       |
|     |                            | Aluminium               | ASTM E1999:2011                                             | 0.003 % to 0.20 %                      |
|     |                            | Arsenic                 | ASTM E1999:2011                                             | 0.006 % to 0.10 %                      |
|     |                            | Cobalt                  | ASTM E1999:2011                                             | 0.01 % to 0.22 %                       |
|     |                            | Copper                  | ASTM E1999:2011                                             | 0.002 % to 3.0 %                       |
|     |                            | Vanadium                | ASTM E1999:2011                                             | 0.005 % to 0.50 %                      |
|     |                            | Tungsten                | ASTM E1999:2011                                             | 0.010 % to 0.15 %                      |
|     |                            | Lead                    | ASTM E1999:2011                                             | 0.002 % to 0.040 %                     |
|     |                            | Tin                     | ASTM E1999:2011                                             | 0.005 % to 0.15 %                      |
|     |                            | Titanium                | ASTM E1999:2011                                             | 0.004 % to 0.20 %                      |
|     |                            | Neobium                 | ASTM E1999:2011                                             | 0.003 % to 0.07 %                      |
|     |                            | Boron                   | ASTM E1999:2011                                             | 0.0003 % to 0.02 %                     |
| 5.  | Aluminium & Its Alloys     | Copper                  | IS 504:2002                                                 | 0.02 % to 20.0 %                       |
|     |                            | Magnesium               | IS 504:2002                                                 | 0.01 % to 15.0 %                       |
|     |                            | Silicon                 | IS 504:2002                                                 | 0.05 % to 30.0 %                       |
|     |                            | Iron                    | IS 504:2002                                                 | 0.02 % to 3.0 %                        |
|     |                            | Manganese               | IS 504:2002                                                 | 0.01 % to 2.0 %                        |
|     |                            | Nickel                  | IS 504:2002                                                 | 0.02 % to 4.0 %                        |
|     |                            | Zinc                    | IS 504:2002                                                 | 0.01 % to 12.0 %                       |
|     |                            | Tin                     | IS 504:2002                                                 | 0.03 % to 1.0 %                        |
|     |                            | Titanium                | IS 504:2002                                                 | 0.01 % to 0.30 %                       |
|     |                            | Chromium                | IS 504:2002                                                 | 0.02 % to 1.0 %                        |
|     |                            | Copper                  | ASTM E34:1994                                               | 0.001 % to 10.0 %                      |

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**Certificate Number** TC-6764

Page 5 of 16

**Validity** 12.01.2018 to 11.01.2020

Last Amended on --

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|     |                                  | Magnesium               | ASTM E34:1994                                               | 0.001 % to 10.0 %                      |
|     |                                  | Iron                    | ASTM E34:1994                                               | 0.002 % to 3.0 %                       |
|     |                                  | Manganese               | ASTM E34:1994                                               | 0.001 % to 2.0 %                       |
|     |                                  | Nickel                  | ASTM E34:1994                                               | 0.001 % to 4.0 %                       |
|     |                                  | Lead                    | ASTM E34:1994                                               | 0.005 % to 1.0 %                       |
|     |                                  | Chromium                | ASTM E34:1994                                               | 0.002 % to 1.0 %                       |
|     |                                  | Copper                  | ASTM E1251:2017a                                            | 0.005 % to 15.0 %                      |
|     |                                  | Magnesium               | ASTM E1251:2017a                                            | 0.001 % to 15.0 %                      |
|     |                                  | Silicon                 | ASTM E1251:2017a                                            | 0.020 % to 30.0 %                      |
|     |                                  | Iron                    | ASTM E1251:2017a                                            | 0.005 % to 3.0 %                       |
|     |                                  | Manganese               | ASTM E1251:2017a                                            | 0.005 % to 2.0 %                       |
|     |                                  | Nickel                  | ASTM E1251:2017a                                            | 0.005 % to 4.0 %                       |
|     |                                  | Zinc                    | ASTM E1251:2017a                                            | 0.01 % to 3.0 %                        |
|     |                                  | Lead                    | ASTM E1251:2017a                                            | 0.005 % to 0.5 %                       |
|     |                                  | Tin                     | ASTM E1251:2017a                                            | 0.003 % to 0.5 %                       |
|     |                                  | Titanium                | ASTM E1251:2017a                                            | 0.005 % to 0.30 %                      |
|     |                                  | Chromium                | ASTM E1251:2017a                                            | 0.004 % to 0.3 %                       |
|     |                                  | Calcium                 | ASTM E1251:2017a                                            | 0.0005 % to 0.020 %                    |
|     |                                  | Phosphorus              | ASTM E1251:2017a                                            | 0.0005 % to 0.01 %                     |
|     |                                  | Vanadium                | ASTM E1251:2017a                                            | 0.004 % to 0.05 %                      |
|     |                                  | Strontium               | ASTM E1251:2017a                                            | 0.0005 % to 0.05 %                     |
| 6.  | <b>Tin &amp; Tin base Alloys</b> | Tin                     | IS 998 (Part 1 & Part 3) (RA 2008)                          | 1.0 % to 96.0 %                        |
|     |                                  | Antimony                | IS 999:1959 (RA 2008)                                       | 0.10 % to 16.0 %                       |
|     |                                  | Arsenic                 | IS 8097:1976 (RA 2010)                                      | 0.001 % to 0.5 %                       |
|     |                                  | Bismuth                 | IS 7255 (Part 1 & Part 3) (RA 2009)                         | 0.001 % to 0.5 %                       |
|     |                                  | Cadmium                 | IS 999:1959 (RA 2008)                                       | 0.01 % to 5.0 %                        |
|     |                                  | Copper                  | IS 7255 (Part 1): 2009                                      | 0.005 % to 2.0 %                       |
|     |                                  | Iron                    | IS 999:1959 (RA 2008)                                       | 0.005 % to 1.0 %                       |
|     |                                  | Lead                    | IS 999:1959 (RA 2008)                                       | 0.10 % to 40.0 %                       |
|     |                                  | Copper                  | IS 11123:1984 (RA 2010)                                     | 0.005 % to 1.0 %                       |

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Certificate Number TC-6764

Page 6 of 16

Validity 12.01.2018 to 11.01.2020

Last Amended on --

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| 7.        | Copper & Copper Alloys     | Lead                    | IS 12074:1987 (RA 2010 )                                                                        | 0.001 % to 0.5 %                       |
|           |                            | Tin                     | IS 440:2006<br>IS 4027 (Part 5): 2006<br>IS 3685:2006                                           | 0.05 % to 20 %                         |
|           |                            | Lead                    | IS 440:2006<br>IS 4027 (Part 1): 2006<br>IS 3685:2000<br>IS 4027 (Part 6): 2006<br>IS 3685:2000 | 0.05 % to 27 %                         |
|           |                            | Zinc                    | IS 440:2006<br>IS 4027 (Part 8): 2003<br>IS 3685:2000                                           | 0.05 % to 50 %                         |
|           |                            | Iron                    | IS 440:2006                                                                                     | 0.05 % to 5.0 %                        |
|           |                            | Nickel                  | IS 4027 (Part 4): 2006                                                                          | 0.05 % to 5.0 %                        |
|           |                            | Aluminium               | IS 4027 (Part 9): 2003                                                                          | 0.05 % to 13 %                         |
|           |                            | Silicon                 | IS 3685:2000<br>IS 4027 (Part 10): 2000<br>IS 3685:2000                                         | 0.05 % to 5 %                          |
|           |                            | Arsenic                 | IS 440:2006<br>IS 3685:2000                                                                     | 0.005 % to 1.0 %                       |
|           |                            | Manganese               | IS 4027 (Part 2): 2006<br>IS 3685:2000                                                          | 0.005 % to 6.0 %                       |
|           |                            | Bismuth                 | IS 440:2006<br>IS 4027 (Part 3): 2006                                                           | 0.05 % to 0.1 %                        |
|           |                            | Phosphorus              | IS 3685:2000                                                                                    | 0.05 % to 1.2 %                        |
|           |                            | Silver                  | IS 4667:1968<br>By AAS                                                                          | 0.05 % to 0.1 %                        |
|           |                            | 8.                      | Pure Copper                                                                                     | Lead                                   |
| Nickel    | IS 12122:1987              |                         |                                                                                                 | 0.001 % to 5.0 %                       |
| Manganese | IS 12046:1987              |                         |                                                                                                 | 0.001 % to 6.0 %                       |
| Tin       | BS:EN 15079:2015           |                         |                                                                                                 | 0.001 % to 0.10 %                      |
|           |                            | Lead                    | BS:EN 15079:2015                                                                                | 0.005 % to 0.10 %                      |

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Accreditation Standard ISO/IEC 17025: 2005

Certificate Number TC-6764

Page 7 of 16

Validity 12.01.2018 to 11.01.2020

Last Amended on --

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|           |                            | Zinc                    | BS:EN 15079:2015                                            | 0.002 % to 0.2 %                       |
|           |                            | Iron                    | BS:EN 15079:2015                                            | 0.005 % to 0.15 %                      |
|           |                            | Nickel                  | BS:EN 15079:2015                                            | 0.002 % to 0.10 %                      |
|           |                            | Aluminium               | BS:EN 15079:2015                                            | 0.001 % to 0.10 %                      |
|           |                            | Silicon                 | BS:EN 15079:2015                                            | 0.001 % to 0.10 %                      |
|           |                            | Arsenic                 | BS:EN 15079:2015                                            | 0.001 % to 0.10 %                      |
|           |                            | Manganese               | BS:EN 15079:2015                                            | 0.001 % to 0.10 %                      |
|           |                            | Bismuth                 | BS:EN 15079:2015                                            | 0.001 % to 0.10 %                      |
|           |                            | Phosphorus              | BS:EN 15079:2015                                            | 0.002 % to 0.01 %                      |
|           |                            | Chromium                | BS:EN 15079:2015                                            | 0.002 % to 1.0 %                       |
|           |                            | Silver                  | BS:EN 15079:2015                                            | 0.001 % to 0.05 %                      |
|           |                            | Sulphur                 | BS:EN 15079:2015                                            | 0.002 % to 0.07 %                      |
|           |                            | Beryllium               | BS:EN 15079:2015                                            | 0.0002 % to 2.25 %                     |
|           |                            | Antimony                | BS:EN 15079:2015                                            | 0.001 % to 0.07 %                      |
|           |                            | Magnesium               | BS:EN 15079:2015                                            | 0.001 % to 0.07 %                      |
|           |                            | Cadmium                 | BS:EN 15079:2015                                            | 0.001 % to 0.07 %                      |
| <b>9.</b> | <b>Brass &amp; Bronze</b>  | Tin                     | BS:EN 15079:2015                                            | 0.005 % to 16.0 %                      |
|           |                            | Lead                    | BS:EN 15079:2015                                            | 0.005 % to 12.0 %                      |
|           |                            | Zinc                    | BS:EN 15079:2015                                            | 0.005 % to 45.0 %                      |
|           |                            | Iron                    | BS:EN 15079:2015                                            | 0.01 % to 5.0 %                        |
|           |                            | Nickel                  | BS:EN 15079:2015                                            | 0.002 % to 7.0 %                       |
|           |                            | Aluminium               | BS:EN 15079:2015                                            | 0.001 % to 11.0 %                      |
|           |                            | Silicon                 | BS:EN 15079:2015                                            | 0.002 % to 0.40 %                      |
|           |                            | Arsenic                 | BS:EN 15079:2015                                            | 0.001 % to 0.10 %                      |
|           |                            | Manganese               | BS:EN 15079:2015                                            | 0.001 % to 4.0 %                       |
|           |                            | Bismuth                 | BS:EN 15079:2015                                            | 0.001 % to 0.10 %                      |
|           |                            | Phosphorus              | BS:EN 15079:2015                                            | 0.002 % to 1.5 %                       |
|           |                            | Chromium                | BS:EN 15079:2015                                            | 0.002 % to 0.2 %                       |
|           |                            | Silver                  | BS:EN 15079:2015                                            | 0.001 % to 0.02 %                      |
|           |                            | Sulphur                 | BS:EN 15079:2015                                            | 0.002 % to 0.20 %                      |
|           |                            | Beryllium               | BS:EN 15079:2015                                            | 0.0002 % to 0.0025 %                   |
|           |                            | Antimony                | BS:EN 15079:2015                                            | 0.001 % to 0.05 %                      |

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Certificate Number TC-6764

Page 8 of 16

Validity 12.01.2018 to 11.01.2020

Last Amended on --

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|      |                                       | Magnesium               | BS:EN 15079:2015                                            | 0.001 % to 0.05 %                      |
|      |                                       | Cadmium                 | BS:EN 15079:2015                                            | 0.001 % to 0.05 %                      |
| 10.  | Zinc & Zinc Alloys                    | Copper                  | ASTM E536:2016                                              | 0.002 % to 6.0 %                       |
|      |                                       | Magnesium               | ASTM E536:2016                                              | 0.001 % to 0.4 %                       |
|      |                                       | Lead                    | ASTM E536:2016                                              | 0.0005 % to 1.6 %                      |
|      |                                       | Cadmium                 | ASTM E536:2016                                              | 0.0005 % to 0.5 %                      |
|      |                                       | Iron                    | ASTM E536:2016                                              | 0.0005 % to 0.1 %                      |
|      |                                       | Aluminium               | IS 2599:1983 (RA 2000)                                      | 0.001 % to 5.0 %                       |
|      |                                       | Copper                  | IS 2599:1983 (RA 2000)                                      | 0.002 % to 6.0 %                       |
|      |                                       | Magnesium               | IS 2599:1983 (RA 2000)                                      | 0.001 % to 0.4 %                       |
|      |                                       | Lead                    | IS 2599:1983 (RA 2000)                                      | 0.0005 % to 1.6 %                      |
|      |                                       | Cadmium                 | IS 2599:1983 (RA 2000)                                      | 0.0005 % to 0.5 %                      |
|      |                                       | Tin                     | IS 2599:1983 (RA 2000)                                      | 0.0005 % to 0.1 %                      |
|      |                                       | Nickel                  | IS 2599:1983 (RA 2000)                                      | 0.0005% to 0.014 %                     |
|      |                                       | Iron                    | IS 2599:1983 (RA 2000)                                      | 0.0005 % to 0.1 %                      |
| 11.  | Ferro Alloys                          |                         |                                                             |                                        |
| a.   | Ferro Silicon                         | Silicon                 | IS 1559:1961 (RA 2007)<br>Section-I                         | 10 % to 75 %                           |
| b.   | Ferro Manganese                       | Manganese               | IS 1559:1961 (RA 2007)<br>Section-I                         | 65 % to 90 %                           |
| c.   | Ferro Chromium                        | Chromium                | IS 1559:1961 (RA 2007)<br>Section-I                         | 50 % to 90 %                           |
| d.   | Ferro Vanadium                        | Vanadium                | IS 1559:1961 (RA 2007)<br>Section-I                         | 35 % to 90 %                           |
| II.  | METTALIC COATING & TREATMENT SOLUTION |                         |                                                             |                                        |
| 1.   | Mettalic Coating & Treatment Solution | Salt Spray Test         | ASTM B117 BS AU 148,<br>IS 9844                             | Qualitative                            |
|      |                                       | Cass Test               | ASTM B368                                                   | Qualitative                            |
| III. | BUILDING MATERIAL                     |                         |                                                             |                                        |



Laboratory

Sunbeam Auto Pvt. Ltd., Testing Research & Development Centre,  
38/6 KM Stone, Delhi Jaipur Highway, Narsingpur, Gurgaon, Haryana

Accreditation Standard ISO/IEC 17025: 2005

Certificate Number

TC-6764

Page 9 of 16

Validity

12.01.2018 to 11.01.2020

Last Amended on --

| Sl. | Product / Material of Test    | Specific Test Performed                      | Test Method Specification against which tests are performed | Range of Testing / Limits of Detection |
|-----|-------------------------------|----------------------------------------------|-------------------------------------------------------------|----------------------------------------|
| 1.  | Cements (OPC & PPC)           | Loss on Ignition                             | IS 4032:1985                                                | 0.1 % to 7 %                           |
|     |                               | Insoluble Residue                            | IS 4032:1985                                                | 0.10 % to 35 %                         |
|     |                               | Sulphuric Anhydride (as SO <sub>3</sub> )    | IS 4032:1985                                                | 0.1 % to 5 %                           |
|     |                               | Alumina (Al <sub>2</sub> O <sub>3</sub> )    | IS 4032:1985                                                | 0.1 % to 15 %                          |
|     |                               | Iron Oxide (Fe <sub>2</sub> O <sub>3</sub> ) | IS 4032:1985                                                | 0.10 % to 10 %                         |
|     |                               | Calcium Oxide(CaO)                           | IS 4032:1985                                                | 30 % to 70 %                           |
|     |                               | Magnesia (MgO)                               | IS 4032:1985                                                | 0.10 % to 10 %                         |
|     |                               | Chlorides (As Cl )                           | IS 4032:1985                                                | 0.002 % to 0.5 %                       |
| 2.  | Cement Concrete               | Silica(As SiO <sub>2</sub> )                 | IS 4032:1985                                                | 15 % to 50 %                           |
|     |                               | Sulphate                                     | IS 4032:2009                                                | 0.1 % to 5 %                           |
| 3.  | Sand, Coarse & Fine Aggregate | Chloride                                     | IS 14959 (Part 2): 2001                                     | 0.01 % to 0.5 %                        |
|     |                               | Alkali Reactivity                            | IS 2386 (Part 7): 2007                                      | 5 mmoles/ltr to 300 mmoles/ltr         |
| 4.  | Clays & Soil                  | Reduction in alkalinity                      |                                                             |                                        |
|     |                               | Silica released                              |                                                             |                                        |
|     |                               | pH                                           | IS 2720 Pt. 26:2007                                         | 4 to 12                                |
|     |                               | Chloride                                     | IS 14959:2001                                               | 0.002 % to 0.5 %                       |
|     |                               | Sulphate                                     | IS 2720:2010 Pt. 27                                         | 0.1 % to 5 %                           |
| 5.  | Fly Ash                       | Organic Matter                               | IS 2720:2010 Pt. 22                                         | 0.05 % to 2 %                          |
|     |                               | Silica(SiO <sub>2</sub> )                    | IS 1727:1967                                                | 20 % to 70 %                           |
|     |                               | Alumina (Al <sub>2</sub> O <sub>3</sub> )    | IS 1727:1967                                                | 10 % to 40 %                           |
|     |                               | Iron Oxide(Fe <sub>2</sub> O <sub>3</sub> )  | IS 1727:1967                                                | 0.1 % to 10 %                          |
|     |                               | Magnesium Oxide (MgO)                        | IS 1727:1967                                                | 0.1 % to 5 %                           |
| 6.  | Admixture                     | Sulphuric Anhydride (as SO <sub>3</sub> )    | IS 1727:1967                                                | 0.1 % to 10 %                          |
|     |                               | Loss on Ignition                             | IS 1727:1967                                                | 0.1 % to 5 %                           |
|     |                               | Dry Materials Content                        | IS 9103:1999                                                | 0.005 % to 60 %                        |
|     |                               | Ash Content                                  | IS 9103:1999                                                | 0.1 % to 50 %                          |
|     |                               | Relative Density                             | IS 9103:1999                                                | 0.7 to 2.0                             |
|     |                               | Chloride Ion Content                         | IS 6925:1973                                                | 0.002 % to 0.5 %                       |

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**Laboratory** Sunbeam Auto Pvt. Ltd., Testing Research & Development Centre,  
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**Accreditation Standard** ISO/IEC 17025: 2005

**Certificate Number** TC-6764

**Page 10 of 16**

**Validity** 12.01.2018 to 11.01.2020

**Last Amended on --**

| Sl. | Product / Material of Test | Specific Test Performed                                                                                              | Test Method Specification against which tests are performed | Range of Testing / Limits of Detection |
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|     |                            | pH                                                                                                                   | IS 9103:1999                                                | 4 to 12                                |
| 7.  | Tiles                      | Resistance to Acid                                                                                                   | IS 13630 (Part 8): 1993                                     | Qualitative                            |
|     |                            | Resistance to Alkali (Unglazed Tile) & (Glazed Tile)                                                                 | IS 13630 (Part 7): 1993                                     | Qualitative                            |
| IV. | WATER                      |                                                                                                                      |                                                             |                                        |
| 1.  | Construction Purpose       | Alkalinity (Volume of 0.02H <sub>2</sub> SO <sub>4</sub> required to Neutralize 100 ml sample using mixed indicator) | IS 3025 (Part 23): 1986 (RA2014)                            | 0.5 ml to 50 ml                        |
|     |                            | Acidity (Volume of 0.02N NaOH required to Neutralize 100ml sample using phenolphthalein)                             | IS 3025 (Part 2): 1986 (RA2014)                             | 0.5 ml to 50 ml                        |
|     |                            | Inorganic Solids                                                                                                     | IS 3025 (Part 18): 1984 (RA 2012)                           | 50 mg/L to 5000 mg/L                   |
|     |                            | Sulphates (As SO <sub>3</sub> )                                                                                      | IS 3025 (Part 24): 1986 (RA2014)                            | 5 mg/L to 500 mg/L                     |
|     |                            | Chlorides As Cl                                                                                                      | IS 3025 (Part 32): 1988 (RA 2014)                           | 15 mg/L to 2500 mg/L                   |
|     |                            | Suspended Matter                                                                                                     | IS 3025 (Part 17): 1984 (RA 2012)                           | 25 mg/L to 2500 mg/L                   |
|     |                            | Organic Matter                                                                                                       | IS 3025 (Part 18): 1984 (RA2012)                            | 10 mg/L to 300 mg/L                    |
|     |                            | pH                                                                                                                   | IS 3025 (Part 11): 1983 (RA 2017)                           | 4 to 10                                |
| 2.  | Drinking Purpose           | Turbidity                                                                                                            | IS 3025 (Part 10): 1984 (RA 2017)                           | 1 NTU to 10 NTU                        |

**Laboratory** Sunbeam Auto Pvt. Ltd., Testing Research & Development Centre,  
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**Accreditation Standard** ISO/IEC 17025: 2005

**Certificate Number** TC-6764

**Page 11 of 16**

**Validity** 12.01.2018 to 11.01.2020

**Last Amended on --**

| Sl. | Product / Material of Test | Specific Test Performed                | Test Method Specification against which tests are performed | Range of Testing / Limits of Detection |
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|     |                            | pH Value                               | IS 3025 (Part 11): 1983 (RA 2017)                           | 4 to 10                                |
|     |                            | Total Hardness (As CaCO <sub>3</sub> ) | IS 3025 (Part 21): 2009 (RA 2014)                           | 2 mg/L to 100 mg/L                     |
|     |                            | Chloride(As Cl)                        | IS 3025 (Part 32): 1988 (RA 2014)                           | 5 mg/L to 500 mg/L                     |
|     |                            | Residual Chlorine                      | IS 3025 (Part 26): 1986 (RA 2014)                           | 1 mg/L to 10 mg/L                      |
|     |                            | Iron (Fe)                              | IS 3025 (Part 53): 2003 (RA 2014)                           | 0.1 mg/L to 50 mg/L                    |
|     |                            | Sulphate (As SO <sub>4</sub> )         | IS 3025 (Part 18): 1984 (RA 2012)                           | 20 mg/L to 400 mg/L                    |
|     |                            | Copper (As Cu)                         | IS 3025 (Part 42): 1992 (RA 2014)                           | 0.1 mg/L to 50 mg/L                    |
|     |                            | Manganese (As Mn)                      | IS 3025 (Part 59): 2006 (RA 2017)                           | 0.1 mg/L to 50 mg/L                    |
|     |                            | Sodium (As Na)                         | IS 3025 (Part 45): 1993 (RA 2014)                           | 10 mg/L to 400 mg/L                    |
|     |                            | Calcium (As Ca)                        | IS 3025 Part 40): 1994 (RA 2014)                            | 5 mg/L to 500 mg/L                     |
|     |                            | Magnesium (As Mg)                      | IS 3025 (Part 46): 1994 (RA 2014)                           | 5 mg/L to 500 mg/L                     |
|     |                            | Zinc (As Zn)                           | IS 3025 (Part 49): 1994 (RA 2014)                           | 0.2 mg/L to 10 mg/L                    |
|     |                            | Total Dissolved Solid                  | IS 3025 (Part 16): 1984 (RA 2014)                           | 10 mg/L to 2000 mg/L                   |
|     |                            | Fluoride (As F)                        | IS 3025 (Part 60): 2008 (RA 2013)                           | 0.2 mg/L to 20 mg/L                    |

**Laboratory** Sunbeam Auto Pvt. Ltd., Testing Research & Development Centre,  
38/6 KM Stone, Delhi Jaipur Highway, Narsingpur, Gurgaon, Haryana

**Accreditation Standard** ISO/IEC 17025: 2005

**Certificate Number** TC-6764

Page 12 of 16

**Validity** 12.01.2018 to 11.01.2020

Last Amended on --

| Sl. | Product / Material of Test | Specific Test Performed | Test Method Specification against which tests are performed | Range of Testing / Limits of Detection |
|-----|----------------------------|-------------------------|-------------------------------------------------------------|----------------------------------------|
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### MECHANICAL TESTING

| <b>I. MECHANICAL PROPERTIES OF METALS</b> |                                           |                                       |                        |                                                      |
|-------------------------------------------|-------------------------------------------|---------------------------------------|------------------------|------------------------------------------------------|
| <b>1.</b>                                 | <b>Metal Alloy (Ferrous/ Non-Ferrous)</b> | Tensile Strength                      | IS 1608:2005 (RA 2017) | 50 MPa to 3000 MPa                                   |
|                                           |                                           | 0.2% Proof Stress                     | ASTM E-8/E-8M-16a      | 20 MPa to 2800 MPa                                   |
|                                           |                                           | Yield Stress                          |                        | 20 MPa to 2800 MPa                                   |
|                                           |                                           | Elongation %                          |                        | 0.5 % to 80.0 %                                      |
|                                           |                                           | Reduction Area                        |                        | 0.5 % to 85.0 %                                      |
| <b>2.</b>                                 | <b>High Strength Deformed Steel Bars</b>  | Tensile Strength                      | IS 1786:2008 with      | 100 MPa to 1500 MPa                                  |
|                                           |                                           | 0.2% Proof Stress                     | Amendment No.1         | 20 MPa to 1400 MPa                                   |
|                                           |                                           | Yield Stress                          |                        | 20 MPa to 1400 MPa                                   |
|                                           |                                           | % Elongation                          |                        | 0.5 % to 65.0 %                                      |
|                                           |                                           | Mass Per Meter                        |                        | Upto 9.2 kgs.                                        |
|                                           |                                           | Deformation & Surface Characteristics |                        | 0.15 mm <sup>2</sup> /mm to 10.0 mm <sup>2</sup> /mm |
| <b>3.</b>                                 | <b>Tube</b>                               | Bend Test                             | IS 2329:2005 (RA 2011) | 15 mm to 50 mm (Qualitative)                         |
|                                           |                                           | Flattening Test                       | IS 2328:2005 (RA 2011) | Upto 300mm Dia                                       |

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**Accreditation Standard** ISO/IEC 17025: 2005

**Certificate Number** TC-6764

**Page 13 of 16**

**Validity** 12.01.2018 to 11.01.2020

**Last Amended on** --

| Sl. | Product / Material of Test | Specific Test Performed                             | Test Method Specification against which tests are performed                     | Range of Testing / Limits of Detection                                                                                                |
|-----|----------------------------|-----------------------------------------------------|---------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|
|     |                            |                                                     |                                                                                 | (Qualitative)                                                                                                                         |
|     |                            | Drift Expansion Test                                | IS 2335:2005 (RA 2011)                                                          | Upto 65mm Dia<br>(Qualitative)                                                                                                        |
| 4.  | <b>Metallic Metal</b>      | Bend Test                                           | ASTM E-290-14<br>IS 1599:2012 (RA 2017)                                         | Qualitative<br>Mandrel Dia: 18, 20, 24, 25, 32, 36, 40, 42, 44, 48, 54, 56, 60, 64, 80, 88, 100, 112, 128, 140, 144, 160, 180, 200 mm |
| 5.  | <b>Metallic Material</b>   | Impact Testing<br>Charpy V Notch<br>(Upto - 40 °C ) | IS 1757 (Part 1): 2014                                                          | 0 to 300 joule/2 JOULE                                                                                                                |
|     |                            | Charpy U Notch<br>(Upto -40 °C )                    | IS 1499:1982 (RA 2015)                                                          | 0 to 300 joule/2 JOULE                                                                                                                |
|     |                            | Izod Impact                                         | IS 1598:1977 (RA 2015)                                                          | 0 to 168 J                                                                                                                            |
| 6.  | <b>Sheet</b>               | Cupping Test                                        | IS 10175:2012 (RA 2017)                                                         | 0.2 mm to 2 mm                                                                                                                        |
| 7.  | <b>Metallic Material</b>   | Brinell Hardness                                    | IS 1500 (Part 1): 2013<br>ASTM E-10-2017                                        | (Load 187.5 Kgf/Ø2.5 mm)<br>(100 HBW to 350 HBW)<br>(Load 62.5 Kgf/Ø2.5mm)<br>(50 HBW to 200 HBW)                                     |
|     |                            | Rockwell Hardness                                   | ASTM E-18-2016<br>IS 1586 (Part 1): 2012                                        | 40 HRBW to 100 HRBW<br>20 HRC to 70 HRC                                                                                               |
|     |                            | Vicker Hardness                                     | IS 1501:2013<br>ASTM E-384-2016                                                 | 50 (HV5) to 1000 (HV5)                                                                                                                |
|     |                            | Microstructure                                      | ASM Handbook VOL-7<br>ASM Handbook VOL-9<br>ASTM E 407-07(2015)<br>ASTM E3-2011 | 50 X to 1000X                                                                                                                         |
|     |                            | Grain Size                                          | ASTM E-112-2013<br>IS 4748:2009<br>(Intercept & Comparison method)              | ASTM 1 to 10<br>(Qualitative)                                                                                                         |
|     |                            | Inclusion Rating                                    | ASTM E-45-2013 Method-A<br>IS 4163:2004 Method-A                                | Qualitative                                                                                                                           |

Laboratory Sunbeam Auto Pvt. Ltd., Testing Research & Development Centre,  
38/6 KM Stone, Delhi Jaipur Highway, Narsingpur, Gurgaon, Haryana

Accreditation Standard ISO/IEC 17025: 2005

Certificate Number TC-6764

Page 14 of 16

Validity 12.01.2018 to 11.01.2020

Last Amended on --

| Sl.        | Product / Material of Test | Specific Test Performed        | Test Method Specification against which tests are performed | Range of Testing / Limits of Detection           |
|------------|----------------------------|--------------------------------|-------------------------------------------------------------|--------------------------------------------------|
|            |                            |                                | IS 6416:1988 (RA2012)                                       |                                                  |
|            |                            | Case Depth                     | (Microscopic & Hardness Survey)                             | Upto 10 mm                                       |
| <b>II.</b> | <b>BUILDING MATERIALS</b>  |                                |                                                             |                                                  |
| <b>1.</b>  | <b>Cement</b>              | Consistency                    | IS 4031 (Part 6): 2014                                      | 20 % to 40 %                                     |
|            |                            | Initial Setting Time           | IS 4031 (Part 5): 2014                                      | 10 minutes to 250 minutes                        |
|            |                            | Final Setting Time             | IS 4031 (Part 5): 2014                                      | 30 minutes to 600 minutes                        |
|            |                            | Soundness (L.C)                | IS 4031 (Part 3): 2014                                      | 0.5 mm to 10 mm                                  |
|            |                            | Soundness (Autoclave)          | IS 4031 (Part 3): 2014                                      | 0 to 8 %                                         |
|            |                            | Fineness (Blaine's)            | IS 4031 (Part 2): 2013                                      | 200 m <sup>2</sup> /kg to 600 m <sup>2</sup> /kg |
|            |                            | Compressive Strength           | IS 4031 (Part 6): 2014                                      | 0.1 MPa to 70 MPa                                |
| <b>2.</b>  | <b>Coarse Aggregate</b>    | Sieve Analysis                 | IS 2386 (Part 1): 2016                                      | 0.1 % to 100 %<br>(2.36 mm to 80 mm)             |
|            |                            | Materials Finer than 75 Micron | IS 2386 (Part 1): 2016                                      | 0 to 15 %                                        |
|            |                            | Flakiness Index                | IS 2386 (Part 1): 2016                                      | 5 % to 45 %                                      |
|            |                            | Elongation Index               | IS 2386 (Part 1): 2016                                      | 5 % to 45 %                                      |
|            |                            | Water Absorption               | IS 2386 (Part 3): 2016                                      | 0.5 % to 5 %                                     |
|            |                            | Specify Gravity                | IS 2386 (Part 3): 2016                                      | 2.0 % to 3.5                                     |
|            |                            | Bulk Density                   | IS 2386 (Part 5): 2016                                      | 1.2 kg/L to 1.5 kg/L                             |
|            |                            | Soundness                      | IS 2386 (Part 4): 2016                                      | 0.01 % to 20 %                                   |
|            |                            | Crushing Value                 | IS 2386 (Part 4): 2016                                      | 5 % to 45 %                                      |
|            |                            | Ten Percent Fine Value         | IS 2386 (Part 4): 2016                                      | 50 kN to 250 kN                                  |
|            |                            | Impact Value                   | IS 2386 (Part 4): 2016                                      | 5 % to 45 %                                      |
|            |                            | Abrasion Value                 | IS 2386 (Part 4): 2016                                      | 5 % to 50 %                                      |
| <b>3.</b>  | <b>Fine Aggregate</b>      | Sieve Analysis                 | IS 2386 (Part 1): 2016                                      | 0.1 % to 100 %<br>(10 mm to 75 micron)           |
|            |                            | Water Absorption               | IS 2386 (Part 3): 2016                                      | 0.5 % to 5.0 %                                   |
|            |                            | Specify Gravity                | IS 2386 (Part 3): 2016                                      | 1.5 % to 3.0 %                                   |

Laboratory Sunbeam Auto Pvt. Ltd., Testing Research & Development Centre,  
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Accreditation Standard ISO/IEC 17025: 2005

Certificate Number TC-6764

Page 15 of 16

Validity 12.01.2018 to 11.01.2020

Last Amended on --

| Sl. | Product / Material of Test              | Specific Test Performed                 | Test Method Specification against which tests are performed | Range of Testing / Limits of Detection      |
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|     |                                         | Bulk Density                            | IS 2386 (Part 3): 2016                                      | 1.4 kg/L to 1.8 kg/L                        |
|     |                                         | Soundness                               | IS 2386 (Part 5): 2016                                      | 0.01 % to 20 %                              |
|     |                                         | Mortar Making Properties                | IS 2386 (Part 6): 2016                                      | 0.1 MPa to 70 MPa                           |
|     |                                         | Material Finer than 75 Micron           | IS 2386 (Part 1): 2016                                      | 0 to 20 %                                   |
| 4.  | Concrete                                | Comp. Strength (by accelerating curing) | IS 9013:2013                                                | 1 MPa to 70 Mpa                             |
|     |                                         | Setting time                            | IS 8142:2016                                                | 0 to 600 minutes                            |
| 5.  | Bricks                                  | Comp. Strength                          | IS 3495 (Part 1): 2016                                      | 0.1 MPa to 35 MPa                           |
|     |                                         | Water Absorption                        | IS 3495 (Part 2): 2016                                      | 0 to 20%                                    |
|     |                                         | Efflorescence                           | IS 3495 (Part 3): 2016                                      | Qualitative                                 |
|     |                                         | Dimension                               | IS 1077:2016                                                |                                             |
|     |                                         | Length                                  |                                                             | 4400 mm to 4700 mm                          |
|     |                                         | Width                                   |                                                             | 2100 mm to 2250 mm                          |
|     |                                         | Height                                  |                                                             | 1300 mm to 1450 mm                          |
| 6.  | Cement Flooring & Cement Chequered Tile | Resistance to wear                      | 1237:2017 & 13801:2013                                      | 0.3 mm to 2.5 mm                            |
|     |                                         | Flexural Strength                       | 1237:2017 & 13801:2013                                      | 2 N/mm <sup>2</sup> to 20 N/mm <sup>2</sup> |
|     |                                         | Water Absorption                        | 1237:2017 & 13801:2013                                      | 0 to 20 %                                   |
| 7.  | Admixture                               | Setting time                            | IS 9103:2013                                                | 0 to 600 minutes                            |
|     |                                         | Comp. Strength                          | IS 9103:2013                                                | 0.1 MPa to 70 Mpa                           |
|     |                                         | Flexural Strength                       | IS 9103:2013                                                | 0.1 MPa to 70 Mpa                           |
|     |                                         | Length Change                           | IS 9103:2013                                                | 0 to 12.7 mm                                |
|     |                                         | Air Content                             | IS 9103:2013                                                | 0 to 10 %                                   |
|     |                                         | Workability                             | IS 9103:2013                                                | 0 to 160 mm                                 |
| 8.  | Water Proofing Compound                 | Consistency                             | IS 2645:2017                                                | 10 % to 45 %                                |
|     |                                         | Setting time                            | IS 2645:2017                                                | 10 minutes to 600 minutes                   |
|     |                                         | Comp. Strength                          | IS 2645:2017                                                | 70 Mpa                                      |
| 9.  | Bitumen                                 | Specific Gravity at 27 °C               | IS 1202:2014                                                | 0.70 to 1.2                                 |
|     |                                         | % OF BINDER Content                     | IRC SP-11                                                   | 3 % to 8 %                                  |
|     |                                         | Water percent by weight                 |                                                             |                                             |

Laboratory Sunbeam Auto Pvt. Ltd., Testing Research & Development Centre,  
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Accreditation Standard ISO/IEC 17025: 2005

Certificate Number TC-6764

Page 16 of 16

Validity 12.01.2018 to 11.01.2020

Last Amended on --

| Sl.         | Product / Material of Test | Specific Test Performed                               | Test Method Specification against which tests are performed | Range of Testing / Limits of Detection                  |
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|             |                            | Flash Point (Closed Type °C)                          | IS 1211:2014                                                | 0.1 % to 10 %                                           |
|             |                            | Penetration at 25 °C<br>5 Second in 1/10 mm           | IS 1209:2014                                                | 25 °C to 100 °C                                         |
|             |                            | Ductility at 27 °C<br>Loss on Heating, % by<br>Weight | IS 1203:2014                                                | 25 Div. to 100 Div.<br>(1/10mm)                         |
|             |                            | Matter Soluble in<br>Carbon disulphide                | IS 1208:2014                                                | 0 to 100 cm                                             |
|             |                            | % by wt                                               | IS 1216:2014                                                | 0.1 % to 100 %                                          |
|             |                            | Softening Point °C                                    | IS 1216:2014                                                | 0.1 % to 100 %                                          |
|             |                            |                                                       | IS 1205:2014                                                | 25 °C to 100 °C                                         |
| <b>III.</b> | <b>SOIL &amp; ROCK</b>     |                                                       |                                                             |                                                         |
| <b>1.</b>   | <b>Soil</b>                | Liquid Limit                                          | IS 2720 (Part 5): 2015                                      | 20 % to 40 %                                            |
|             |                            | Plastic Limit                                         | IS 2720 (Part 5): 2015                                      | 20 to 40                                                |
|             |                            | Moisture Content                                      | IS 2720 (Part 2) 2015                                       | 0.5 % to 30 %                                           |
|             |                            | Sieve Analysis                                        | IS 2720 (Part 6) 2015                                       | 0.1 % to 100 %                                          |
|             |                            | Proctor Compaction                                    | IS 2720 (Part 7) 2016                                       | MDD 1.5 gm/cm <sup>3</sup> to<br>1.9 gm/cm <sup>3</sup> |
|             |                            | (Light Compaction)                                    |                                                             | OMC 9 % to 18 %                                         |
|             |                            | Proctor Compaction                                    | IS 2720 (Part 8): 2016                                      | MDD 1.8 gm/cm <sup>3</sup> to<br>2.4 gm/cm <sup>3</sup> |
|             |                            | (Heavy Compaction)                                    |                                                             | OMC 9 % to 15 %                                         |
|             |                            | Laboratory CBR                                        | IS 2720 (Pt 16): 2011                                       | 0.0 to 100 %                                            |
|             |                            | Sp. Gravity                                           | IS 2720 (Part 3 & Sec.1):<br>2015                           | 1.5 to 3.0                                              |
|             |                            | Linear Shrinkage                                      | IS 2720 (Part 20): 2011                                     | 0.0 % to 10.0 %                                         |