

**Laboratory** Offshore Testing & Inspection Services (India) Pvt. Ltd., W-147, MIDC, Pawane, Thane Belapur Road, Navi Mumbai, Maharashtra

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

**Discipline** Chemical Testing **Issue Date** 05.06.2014

**Certificate Number** T-0794 **Valid Until** 04.06.2016

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| S.No.                       | Product / Material of Test  | Specific Test Performed | Test Method Specification against which tests are performed | Range of Testing / Limits of Detection |
|-----------------------------|---|-------------------------|---|--|
| <b>I. METALS AND ALLOYS</b> |   |                         |   |  |
| 1.                          | <b>Cast Iron (Pig Iron, Grey Cast Iron, White Cast Iron, Malleable Cast Iron, Ductile Iron)</b>               | C                       | ASTM E 1019-11  | 1.5% to 4.5%                           |
|                             |   | Mn                      | ASTM E 351<br>13/WI/OTIS/CHE/19                             | 0.1% to 1.5%                           |
|                             |   | Si                      | ASTM E 351-13   | 0.1% to 4.0%                           |
|                             |   | P                       | ASTM E 351-13   | 0.02% to 0.60%                         |
|                             |   | S                       | ASTM E 1019-11  | 0.002% to 0.35%                        |
|                             |   | Cr                      | ASTM E 351-13   | 0.006% to 1.0%                         |
|                             |   |                         | ASTM E 351-13   | 0.005% to 4%                           |
|                             |   | Ni                      | ASTM E 351-13   | 0.005% to 1.0%                         |
|                             |   |                         | ASTM E 351-13   | 0.1% to 4.0%                           |
|                             |   |                         | Mo  | ASTM E 351-13                          |
|                             | Cu  | WI/OTIS/CHE/19          | 0.03% to 2%   |  |
| 2.                          | <b>Stainless Steel by Wet Chemical Method (Stainless Steel Heat-Resistant Steel and Other Similar Alloys)</b> | C                       | ASTM E 1019-11  | 0.001% to 1.50%                        |
|                             |   | Mn                      | WI/OTIS/CHE/19  | 0.1% to 2.0%                           |
|                             |   | Si                      | ASTM E 353-93 (Re-2006)                                     | 0.05% to 1.2%                          |
|                             |   | P                       | ASTM E 353-93 (Re-2006)                                     | 0.02% to 0.15%                         |

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|-------|--|-------------------------|---|--|
|       | <b>Stainless Steel by Wet Chemical Method (Stainless Steel Heat-Resistant Steel and Other Similar Alloys)</b>                        | S                       | ASTM E 1019-11  | 0.002% to 0.35%                        |
|       |  | Cr                      | ASTM E 353-93 (Re-2006)                                     | 0.10% to 25.0%                         |
|       |  | Ni                      | ASTM E 353-93 (Re-2006)                                     | 0.10% to 25.0%                         |
|       |  | Mo                      | ASTM E 353-93 (Re-2006)                                     | 1.5% to 4.5%                           |
|       |  | Cu                      | WI/OTIS/CHE/19  | 0.01% to 5.0%                          |
|       |  | Co                      | WI/OTIS/CHE/19  | 0.010% to 0.50%                        |
|       |  | N                       | IS 228 Part-19-1987   | 0.0005% to 0.40%                       |
|       |  | Ti                      | WI/OTIS/CHE/19  | 0.010% to 0.35%                        |
| 3.    | <b>Carbon and Low Alloy Steel by Wet Chemical Method (Carbon Steel and Low Alloy Steel, Silicon Steel, Ingot &amp; Wrought Iron)</b> | C                       | ASTM E 1019-11  | 0.001% to 1.50%                        |
|       |  | Mn                      | ASTM E 350-12/ OTIS/CHE/19                                  | 0.015% to 2.5%                         |
|       |  | Si                      | ASTM E 350-12   | 0.01% to 3.5%                          |
|       |  | P                       | ASTM E 350-12   | 0.02% to 0.25%                         |
|       |  | S                       | ASTM E 1019-11  | 0.002% to 0.35%                        |
|       |  | Cr                      | ASTM E 350-12   | 0.005% to 3.99%                        |
|       |  | Mo                      | ASTM E 350-12   | 0.002% to 1.5%                         |
|       |  | Cu                      | ASTM E 350-12   | 0.005% to 0.60%                        |

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|-------|--|-------------------------|---|--|
|       | <b>Carbon and Low Alloy Steel by Wet Chemical Method (Carbon Steel and Low Alloy Steel, Silicon Steel, Ingot &amp; Wrought Iron)</b> | Ni                      | ASTM E 350-12   | 0.005% to 5.0%                         |
|       |  | Co                      | WI/OTIS/CHE/19  | 0.01% to 0.050%                        |
|       |  | Ti                      | WI/OTIS/CHE/19  | 0.002% to 0.60%                        |
|       |  | N                       | IS 228 Part-19-1987   | 0.0005% to 0.40%                       |
| 4.    | <b>Tool Steel and Other Similar Alloys by Wet Chemical Method</b>  | C                       | ASTM E 1019-11  | 0.001% to 3.00%                        |
|       |  | Si                      | ASTM E-352-13   | 0.10% to 2.5%                          |
|       |  | Mn                      | WI/OTIS/CHE/19  | 0.10% to 2.0%                          |
|       |  | P                       | ASTM E-352-13   | 0.002% to 0.05%                        |
|       |  | S                       | ASTM E 1019-11  | 0.002% to 0.35%                        |
|       |  | Cr                      | ASTM E-352-13   | 0.10% to 14.0%                         |
|       |  | Ni                      | ASTM E-352-13   | 0.10% to 4.0%                          |
|       |  | Mo                      | ASTM E-352-13   | 0.01% to 1.5%                          |
|       |  | Cu                      | WI/OTIS/CHE/19  | 0.01% to 2.0%                          |
|       |  | V                       | ASTM E-352-13   | 0.02% to 5.5%                          |
|       |  | Al                      | WI/OTIS/CHE/19  | 0.005% to 1.5%                         |
|       |  | Co                      | WI/OTIS/CHE/19  | 0.10% to 14.0%                         |
|       |  | W                       | ASTM E-352-13   | 0.01% to 21.0%                         |

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|-------|---|-------------------------|---|--|
| 5.    | <b>Nickel &amp; Cobalt &amp; High Temperature Alloys by Wet Chemical Method</b> | C                       | ASTM E 1019-11  | 0.001% to 1.00%                        |
|       |   | Si                      | ASTM E 1473-2009  | 0.05% to 5.00%                         |
|       |   | Mn                      | WI/OTIS/CHE/19  | 0.05% to 3.00%                         |
|       |   | P                       | WI/OTIS/CHE/17  | 0.002% to 0.080%                       |
|       |   | S                       | ASTM E 1019-11  | 0.002% to 0.35%                        |
|       |   | Cr                      | ASTM E 1473-2009  | 0.10% to 33.0%                         |
|       |   | Ni                      | ASTM E 1473-2009  | 0.10% to 98.0%                         |
|       |   | Mo                      | ASTM E 1473-2009  | 0.05% to 30.0%                         |
|       |   | Al                      | ASTM E 1473-2009  | 0.05% to 7.00%                         |
|       |   | Ti                      | WI/OTIS/CHE/19  | 0.01% to 5.00%                         |
|       |   | Co                      | WI/OTIS/CHE/19  | 0.05% to 75.0%                         |
|       |   | Cu                      | WI/OTIS/CHE/19  | 0.05% to 35.0%                         |
|       |   | Fe                      | ASTM E 1473-2009  | 0.05% to 50.0%                         |
|       |   | Nb                      | ASTM E 1473-2009  | 0.05% to 6.00%                         |
| W     | WI/OTIS/CHE/19  | 0.05% to 18.0%          |   |  |
| V     | WI/OTIS/CHE/19  | 0.05% to 3.25%          |   |  |

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|-------|--|-------------------------|---|--|
| 6.    | <b>Al &amp; Al Base Alloys by Wet Chemical Method</b>                    | Cu                      | ASTM E-34-2011  | 0.01% to 20.0%                         |
|       |  | Si                      | ASTM E-34-2011  | 0.05% to 20.0%                         |
|       |  | Mn                      | ASTM E-34-2011  | 0.005% to 2.0%                         |
|       |  | Mg                      | ASTM E-34-2011  | 0.002% to 12.0%                        |
|       |  | Fe                      | ASTM E-34-2011  | 0.01% to 3.0%                          |
|       |  | Zn                      | ASTM E-34-2011  | 0.003% to 12.0%                        |
|       |  | Cr                      | ASTM E-34-2011  | 0.01% to 1.0%                          |
|       |  | Ti                      | WI/OTIS/CHE/19  | 0.002% to 0.90%                        |
|       |  | Pb                      | ASTM E-34-2011  | 0.01% to 1.0%                          |
|       |  | Bi                      | ASTM E-34-2011  | 0.02% to 1.0%                          |
| 7.    | <b>Copper Alloys (Brass, Bronze, Cupronickel) by Wet Chemical Method</b> | Cu                      | ASTM E 478-2008   | 40% to 99.95%                          |
|       |  | Sn                      | ASTM E 478-2008   | 0.01% to 20.0%                         |
|       |  | Pb                      | ASTM E 478-2008   | 0.002% to 27.0%                        |
|       |  | Zn                      | ASTM E 478-2008   | 0.005% to 50.0%                        |

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|-------|--|----------------------------|---|--|
|       | <b>Copper Alloys (Brass, Bronze, Cupronickel) by Wet Chemical Method</b>   | Fe                         | WI/OTIS/CHE/19  | 0.005% to 6.0%                         |
|       |  | Ni                         | ASTM E 478-2008   | 0.03% to 50.0%                         |
|       |  | P                          | WI/OTIS/CHE/17  | 0.005% to 1.00%                        |
|       |  | Si                         | ASTM E 478-2008   | 0.05% to 5.00%                         |
|       |  | Al                         | ASTM E 478-2008   | 0.05% to 12%                           |
|       |  | Mn                         | WI/OTIS/CHE/19  | 0.005% to 6.0%                         |
|       |  | S                          | ASTM E 1019-11  | 0.002% to 0.35%                        |
|       |  | Co                         | WI/OTIS/CHE/19  | 0.002% to 0.30%                        |
| 8.    | <b>Stainless Steel by Optical Emission Spectrometer (Stainless Steel Heat -Resistant Steel and Other Similar Alloys)</b> | C                          | ASTM E-1086-2008 / IS 9879                                  | 0.01% to 0.20%                         |
|       |  | Si                         | ASTM E-1086-2008 / IS 9879                                  | 0.10% to 1.50%                         |
|       |  | Mn                         | ASTM E-1086-2008 / IS 9879                                  | 0.20% to 2.00%                         |
|       |  | P                          | ASTM E-1086-2008 / IS 9879                                  | 0.008% to 0.050%                       |
|       |  | S                          | ASTM E-1086-2008 / IS 9879                                  | 0.002% to 0.40%                        |
|       |  | Cr                         | ASTM E-1086-2008 / IS 9879                                  | 10.0% to 25.00%                        |
|       | Ni   | ASTM E-1086-2008 / IS 9879 | 0.20% to 20.50%   |  |

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|-------|--|-------------------------|---|--|
|       | <b>Stainless Steel by Optical Emission Spectrometer (Stainless Steel Heat -Resistant Steel and Other Similar Alloys)</b> | Mo                      | ASTM E-1086-2008 / IS 9879                                  | 0.02% to 3.50%                         |
|       |  | Cu                      | ASTM E-1086-2008 / IS 9879                                  | 0.008% to 0.75%                        |
|       |  | Ti                      | ASTM E-1086-2008 / IS 9879                                  | 0.020% to 1.0%                         |
|       |  | Nb                      | ASTM E-1086-2008 / IS 9879                                  | 0.008% to 1.2%                         |
|       |  | Al                      | ASTM E-1086-2008 / IS 9879                                  | 0.010% to 1.0%                         |
|       |  | N                       | ASTM E-1086-2008 / IS 9879                                  | 0.007% to 0.20%                        |
|       |  | Co                      | ASTM E-1086-2008 / IS 9879                                  | 0.010% to 0.50%                        |
|       |  | V                       | ASTM E-1086-2008 / IS 9879                                  | 0.03% to 0.5%                          |
| 9.    | <b>Carbon and Low Alloy steel by Optical Emission Spectrometer</b>   | C                       | ASTM E 415-2008 / IS 8811                                   | 0.05% to 1.1%                          |
|       |  | Si                      | ASTM E 415-2008 / IS 8811                                   | 0.05% to 1.50%                         |
|       |  | Mn                      | ASTM E 415-2008 / IS 8811                                   | 0.01% to 2%                            |
|       |  | P                       | ASTM E 415-2008 / IS 8811                                   | 0.005% to 0.085%                       |
|       |  | S                       | ASTM E 415-2008 / IS 8811                                   | 0.002% to 0.10%                        |
|       |  | Cr                      | ASTM E 415-2008 / IS 8811                                   | 0.005% to 2.25%                        |
|       |  | Ni                      | ASTM E 415-2008 / IS 8811                                   | 0.005% to 2.00%                        |

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|-------|--|-------------------------|---|--|
|       | <b>Carbon and Low Alloy steel by Optical Emission Spectrometer</b>     | Mo                      | ASTM E 415-2008 / IS 8811                                   | 0.002% to 1.5%                         |
|       |  | Nb                      | ASTM E 415-2008 / IS 8811                                   | 0.001% to 0.10%                        |
|       |  | As                      | ASTM E 415-2008 / IS 8811                                   | 0.001% to 0.1%                         |
|       |  | Co                      | ASTM E 415-2008 / IS 8811                                   | 0.002% to 0.50%%                       |
|       |  | Cu                      | ASTM E 415-2008 / IS 8811                                   | 0.005% to 0.5%                         |
|       |  | Ti                      | ASTM E 415-2008 / IS 8811                                   | 0.001% to 0.05%                        |
|       |  | V                       | ASTM E 415-2008 / IS 8811                                   | 0.001% to 0.5%                         |
|       |  | Al                      | ASTM E 415-2008 / IS 8811                                   | 0.002% to 0.10%                        |
|       |  | B                       | ASTM E 415-2008 / IS 8811                                   | 0.0005% to 0.015%                      |
|       |  | N                       | ASTM E 415-2008 / IS 8811                                   | 0.0020% to 0.015%                      |
| 10.   | <b>Aluminium and Aluminium alloys by Optical Emission Spectrometer</b> | Si                      | ASTM E 1251-2011  | 0.007% to 20%                          |
|       |  | Cu                      | ASTM E 1251-2011  | 0.01% to 8.00%                         |
|       |  | Mg                      | ASTM E 1251-2011  | 0.05% to 5%                            |
|       |  | Zn                      | ASTM E 1251-2011  | 0.009% to 6.00%                        |
|       |  | Sn                      | ASTM E 1251-2011  | 0.01% to 0.5%                          |



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|-------|--|-------------------------|---|--|
|       | <b>Aluminium and Aluminium alloys by Optical Emission Spectrometer</b>             | Ni                      | ASTM E 1251-2011  | 0.005% to 4.00%                        |
|       |  | Iron                    | ASTM E 1251-2011  | 0.008% to 3.5%                         |
|       |  | Mn                      | ASTM E 1251-2011  | 0.008% to 2.00%                        |
|       |  | Cr                      | ASTM E 1251-2011  | 0.005% to 0.50%                        |
|       |  | Pb                      | ASTM E 1251-2011  | 0.005% to 0.7%                         |
|       |  | Ti                      | ASTM E 1251-2011  | 0.008% to 0.5%                         |
|       |  | V                       | ASTM E 1251-2011  | 0.002% to 0.030%                       |
|       |  | Co                      | ASTM E 1251-2011  | 0.003% to 0.10%                        |
|       |  | Ca                      | ASTM E 1251-2011  | 0.005% to 0.025%                       |
| 11.   | <b>Copper Alloys (Brass, Bronze, Cupronickel) by Optical Emission Spectrometer</b> | Zn                      | OTIS/TM/01  | 0.10% to 50.00%                        |
|       |  | Pb                      | OTIS/TM/01  | 0.002% to 2.00%                        |
|       |  | Sn                      | OTIS/TM/01  | 0.005% to 3.00%                        |
|       |  | Mn                      | OTIS/TM/01  | 0.01% to 3.00%                         |
|       |  | Ni                      | OTIS/TM/01  | 0.002% to 40.00%                       |
|       |  | Al                      | OTIS/TM/01  | 0.005% to 4.00%                        |

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|-------|--|-------------------------|---|--|
|       | <b>Copper Alloys (Brass, Bronze, Cupronickel) by Optical Emission Spectrometer</b> | Fe                      | OTIS/TM/01  | 0.002% to 4.00%                        |
|       |  | Si                      | OTIS/TM/01  | 0.02% to 0.40%                         |
|       |  | As                      | OTIS/TM/01  | 0.001% to 0.50%                        |
|       |  | S                       | OTIS/TM/01  | 0.003% to 0.10%                        |
|       |  | C                       | OTIS/TM/01  | 0.005% to 0.050%                       |
|       |  | P                       | OTIS/TM/01  | 0.002% to 0.30%                        |
|       |  | Co                      | OTIS/TM/01  | 0.030% to 0.20%                        |
| 12.   | <b>Nickel Alloys by Optical Emission Spectrometer</b>                              | C                       | OTIS/TM/02  | 0.010% to 0.40%                        |
|       |  | Si                      | OTIS/TM/02  | 0.05% to 2.0%                          |
|       |  | Mn                      | OTIS/TM/02  | 0.10% to 2.0%                          |
|       |  | P                       | OTIS/TM/02  | 0.005% to 0.10%                        |
|       |  | S                       | OTIS/TM/02  | 0.002% to 0.10%                        |
|       |  | Cr                      | OTIS/TM/02  | 0.10% to 30.00%                        |
|       |  | Mo                      | OTIS/TM/02  | 0.01% to 30.0%                         |
|       | Co   | OTIS/TM/02              | 0.01% to 5.00%  |  |

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|-------|---|-------------------------|---|--|
|       | <b>Nickel Alloys by Optical Emission Spectrometer</b>     | V                       | OTIS/TM/02  | 0.01% to 1.2%                          |
|       |   | W                       | OTIS/TM/02  | 3.0% to 8.0%                           |
|       |   | Fe                      | OTIS/TM/02  | 0.10% to 35.00%                        |
|       |   | Al                      | OTIS/TM/02  | 0.05% to 4.00%                         |
|       |   | Cu                      | OTIS/TM/02  | 0.10% to 35.00%                        |
|       |   | Nb                      | OTIS/TM/02  | 0.10% to 6.0%                          |
|       |   | Ti                      | OTIS/TM/02  | 0.05% to 2.00%                         |
| 13.   | <b>Tool Steel Alloys by Optical Emission Spectrometer</b> | C                       | OTIS/TM/03  | 0.20% to 2.50%                         |
|       |   | Cr                      | OTIS/TM/03  | 0.10% to 14.0%                         |
|       |   | Co                      | OTIS/TM/03  | 0.010% to 14.0%                        |
|       |   | Cu                      | OTIS/TM/03  | 0.020% to 0.10%                        |
|       |   | Mn                      | OTIS/TM/03  | 0.10% to 1.00%                         |
|       |   | Mo                      | OTIS/TM/03  | 0.010% to 10.0%                        |
|       |   | Ni                      | OTIS/TM/03  | 0.020% to 0.20%                        |
|       | P   | OTIS/TM/03              | 0.002% to 0.050%  |  |

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|            | <b>Tool Steel Alloys by Optical Emission Spectrometer</b> | Si   | OTIS/TM/03  | 0.10% to 2.50%                         |
|            |   | S  | OTIS/TM/03  | 0.002% to 0.010%                       |
|            |   | W  | OTIS/TM/03  | 0.010% to 21.00%                       |
|            |   | V  | OTIS/TM/03  | 0.020% to 2.50%                        |
| <b>14.</b> | <b>PMI Testing</b>  | Fe, Cu, Ni, Al, Co, Ti Bases can be detected and all Alloying elements- except the following C, Si, P, S, Al, Mg can be detected | ASTM E 1916-97(2004)  | Qualitative                            |

~~-X-X-X-X-X-X-X-X-X-X-X-X-~~