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Last Amended on 01.03.2019 SI. Range/Frequency Quantity Measured / \*Calibration Measurement Remarks Instrument Capability (±) **ELECTRO TECHNICAL CALIBRATION** 1. SOURCE 10 A to 900 A 1. DC Current<sup>\$</sup> 1.37% to 0.70% Using Multifunction calibrator with current coil & 6½ Digital Multimeter by Comparison method 2. AC Current<sup>\$</sup> 10 A to 900 A 0.63% to 0.74% Using Multifunction calibrator with current coil & 6<sup>1</sup>/<sub>2</sub> Digital Multimeter by Comparison method 3. Resistance<sup>\$</sup> 1 Ω to 10 Ω 6.44% to 0.72% Using Decade Resistance (2 Wire & 4 Wire) 10  $\Omega$  to 10 k $\Omega$ 0.72% to 0.13% box by Direct method 10k  $\Omega$  to 100 k $\Omega$ 0.13% 100 k $\Omega$  to 100 M $\Omega$ 0.13% to 1.6% 100 M $\Omega$  to 1000 M $\Omega$ 1.6% to 2.6% Resistance<sup>\$</sup> 1 Ω to 10 Ω 1.21% to 0.29% Using Decade Resistance 4. (2 Wire & 4 Wire) 10  $\Omega$  to 10 k $\Omega$ box by Direct method 0.29% to 0.12% 10k  $\Omega$  to 100 k $\Omega$ 0.12% 100 k $\Omega$  to 100 M $\Omega$ 0.12% to 1.53% 100 M $\Omega$  to 1000 M $\Omega$ 1.53% to 2.61% 100 Hz to 1000 Hz 0.54% to 0.045% 6. Frequency<sup>\$</sup> Using Multifunction Calibrator by Direct

method

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|-----|---|---|--|--|
| 7.  | Temperature<br>Simulation <sup>#</sup><br>Temperature<br>Indicator/Controller/R<br>ecorder/RTD Test<br>kit/Universal<br>calibrator/Temperatu<br>re Calibrator<br>Pt – 100<br>K Type<br>J Type<br>R Type<br>R Type<br>S Type<br>B Type<br>E Type | (-)200 to 800°C<br>(-)200 to 1370°C<br>(-)100 to 1000°C<br>0 to 1750°C<br>(-)160 to 400°C<br>0 to 1750°C<br>600 to 1750°C<br>(-)200 to 1000°C | 0.86°C<br>0.86°C<br>0.86°C<br>1.33°C<br>0.59°C<br>1.33°C<br>2.40°C<br>0.86°C | Using Universal calibrator<br>by Simulation method                                   |
| 11. | MEASURE   |   | •  |  |
| 1.  | DC Voltage <sup>\$</sup>  | 1 mV to 100 mV<br>100 mV to 1000 V  | 5.5% to 0.072%<br>0.072% to 0.071%   | Using Multifunction<br>calibrator & 6½ Digital<br>Multimeter by comparison<br>method |
| 2.  | AC Voltage <sup>≸</sup>   | <b>50/60 Hz</b><br>1 mV to 100 mV<br>100 mV to 1 V<br>1 V to 1000 V   | 5.7% to 0.13%<br>0.13% to 0.12%<br>0.12%                                     | Using Multifunction<br>calibrator & 6½ Digital<br>Multimeter by comparison<br>method |
| 3.  | DC Current <sup>\$</sup>  | 0.2 mA to 1 mA<br>1 mA to 100 mA<br>100 mA to 1 A<br>1 A to 10 A  | 0.30% to 0.48%<br>0.48% to 0.09%<br>0.09%<br>0.09% to 0.20%                  | Using Multifunction<br>calibrator & 6½ Digital<br>Multimeter by comparison<br>method |

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SI. Quantity Measured / Range/Frequency \*Calibration Measurement Remarks Instrument Capability (±) 4. AC Current<sup>\$</sup> 50/60 Hz 0.2 mA to 1 mA 2.49% to 0.58% Using Multifunction calibrator & 6½ Digital 1 mA to 100 mA 0.58% to 0.18% 100 mA to 1 A 0.18% Multimeter by comparison 0.18% to 0.27% 1 A to 10 A method 5. DC Voltage<sup>\$</sup> 1 mV to 100 mV 0.69% to 0.014% Using 6½ Digital 100 mV to 1000 V 0.014% to 0.044% Multimeter by Direct method 6. AC Voltage<sup>\$</sup> 50/60 Hz 1 mV to 100 mV 4.65% to 0.14% Using 6<sup>1</sup>/<sub>2</sub> Digital 100 mV to 1 V 0.14% to 0.11% Multimeter by Direct 1 V to 1000 V 0.11% method Using 6½ Digital 7. DC Current<sup>\$</sup> 0.2 mA to 1 mA 0.10% to 0.32% 0.32% to 0.10% Multimeter by Direct 1 mA to 100 mA 100 mA to 1 A 0.10% method 1 A to 10 A 0.10% to 0.19% AC Current<sup>\$</sup> 50/60 Hz 4. 0.2 mA to 1 mA 0.35% to 0.25% Using 6½ Digital Multimeter by Direct 1 mA to 100 mA 0.25% to 0.18% 100 mA to 1 A 0.18% to 0.24% method 1 A to 10 A 0.24% to 0.73% 5. Frequency<sup>\$</sup> 100 Hz to 1000 Hz 0.54% to 0.045% Using 6½ Digital Multimeter by Direct method

| 6. | High Voltage Tester<br>(AC) <sup>#</sup>        | <b>50 Hz</b><br>1 kV to 27 kV | 12.4% to 5.4%    | Using AC High voltage<br>probe with DMM by Direct<br>method |
|----|---|-------------------------------|------------------|---|
| 7. | Stop<br>Watch/Timer/Hour<br>Meter <sup>\$</sup> | 10 s to 3600 s                | 0.69 s to 2.15 s | Using Digital stop watch<br>by Comparison method            |

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|-----|--|----------------------------------|--|---|--|--|--|
|     | MECHANICAL CALIBRATION   |                                  |  |   |  |  |  |
| Ι.  | DIMENSION (BASIC M   | EASURING INSTRUMEN               | T, GAUGE ETC.)                             |   |  |  |  |
| 1.  | Caliper <sup>s</sup><br>(Vernier/Dial/<br>Electronic)<br>L.C: 0.01 mm  | 0 to 1000 mm                     | 21.00 µm                                   | Using slip gauge set box<br>(0 Grade),Internal micro–<br>checker & Length bars<br>based by comparison<br>method |  |  |  |
| 2.  | External Micrometer <sup>\$</sup><br>(Digital/Plain/Analog/<br>Blade/Pitch/Pointed/<br>Flange/Groove)<br>L.C: 0.001 mm<br>L.C: 0.01 mm | 0 to 150 mm<br>>150 mm to 600 mm | 6.3 μm<br>19.0μm                           | Using slip gauge set box<br>(0 Grade)& Length bars by<br>comparison method                                      |  |  |  |
| 3.  | Micrometer setting<br>rod <sup>\$</sup>  | 25 mm to 575 mm                  | 6.1 μm                                     | Using slip gauge set box<br>(0 Grade),Length bars &<br>Electronic Probe with DRO<br>by comparison method        |  |  |  |
| 4.  | Depth Micrometer <sup>\$</sup><br>L.C: 0.01 mm   | 0 to 300 mm                      | 8.0 µm                                     | Using slip gauge set box<br>(0 Grade),Length bars &<br>surface plate by<br>comparison method                    |  |  |  |

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|-----|---|-----------------|--|--|
| 5.  | Vernier Depth<br>Gauge <sup>\$</sup><br>L.C: 0.02 mm                  | 0 to 300 mm     | 13.1 μm                                    | Using slip gauge set box<br>(0 Grade),Length bars &<br>surface plate based on IS<br>4213 by comparison<br>method |
| 6.  | Height Gauge <sup>®</sup><br>L.C: 0.01 mm                             | 0 to 1000 mm    | 14.0 μm                                    | Using slip gauge set box<br>(0 Grade),Length bars &<br>surface plate by<br>comparison method                     |
| 7.  | Inside Micrometer<br>with Extension Rod <sup>\$</sup><br>L.C: 0.01 mm | 50 mm to 300 mm | 14.3 μm                                    | Using Slip gauge set box<br>(0 Grade),Length bars &<br>Internal Micro–checker by<br>comparison method            |
| 8.  | Dial Indicator <sup>\$</sup><br>(Plunger/Lever)<br>L.C: 0.01 mm       | 0 to 25 mm      | 7.4 μm                                     | Using Dial Calibration<br>Tester by comparison<br>method   |
| 9.  | Dial Calibration<br>Tester <sup>\$</sup><br>L.C: 0.001 mm             | 0 to 25 mm      | 3.7 μm                                     | Using slip gauge set box<br>(0 Grade)& Electronic<br>Probe with DRO by<br>comparison method                      |

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|-----|--|-----------------|--|--|
| 10. | Bore Gauge <sup>®</sup><br>Mechanism Accuracy<br>Check<br>L.C: 0.01 mm | Upto 1 mm       | 5.60 µm                                    | Using Dial Calibration<br>Tester & slip gauge set<br>box (0 Grade) by<br>comparison method |
| 11. | Pistol type Caliper <sup>∛</sup><br>L.C: 0.1 mm                        | 0 to 50 mm      | 71.0 µm                                    | Using Slip gauge set box<br>(0 Grade) by comparison<br>method                              |
| 12. | Digital Coating<br>Thickness Gauge <sup>\$</sup><br>L.C: 0.1/1 µm      | 0 to 1000 µm    | 9.1 µm                                     | Using Standard foils by<br>comparison method   |
| 13. | Ultrasonic Thickness<br>Gauge <sup>\$</sup><br>L.C: 0.1 mm             | 0 to 300 mm     | 108.0 µm                                   | Using Slip gauge set box<br>(0 Grade) & Length bars<br>by comparison method                |
| 14. | Thickness Gauge<br>L.C: 0.01 mm  | 0 to 10 mm      | 6.9 µm                                     | Using Slip gauge set box<br>(0 Grade) by comparison<br>method                              |
| 15. | Measuring Scale <sup>\$</sup><br>L.C :1mm                              | 0 to 1500 mm    | 146 x √L μm<br>(L is in meter)             | Using Tape & Scale<br>calibrator by comparison<br>method                                   |
| 16. | Measuring Tape <sup>\$</sup><br>L.C :1mm                               | 0 to 50 meter   | 146 x √L μm<br>(L is in meter)             | Using Tape & Scale<br>calibrator by comparison<br>method                                   |

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|-----|---|-----------------|--|--|
| 17. | Circumference Tape<br>/Pi Tape <sup>\$</sup>        | 0 to 50 meter   | 146 x √L μm<br>(L is in meter)             | Using Tape & Scale<br>calibrator by comparison<br>method                                     |
| 18. | Feeler Gauge <sup>\$</sup>                          | Upto 1 mm       | 4.0 μm                                     | Using Slip gauge set box<br>(0 Grade) & Electronic<br>Probe with DRO by<br>comparison method |
| 19. | Plain Plug Gauge <sup>⁵</sup>                       | 2 mm to 100 mm  | 4.3 μm                                     | Using Slip gauge set box<br>(0 Grade) & Electronic<br>Probe with DRO by<br>comparison method |
| 20. | Radius Gauge / Fillet<br>Gauge <sup>\$</sup>        | 0.6 to 50 mm    | 17.6 μm                                    | Using Profile Projector by<br>comparison method  |
| 21. | Thickness Foils <sup>⁵</sup>                        | 9 μm to 1 mm    | 4.0 μm                                     | Using Electronic Probe<br>with DRO & Comparator<br>stand by comparison<br>method             |
| 22. | Bevel Protractors <sup>\$</sup>                     | Upto 360 °      | 7.8 min.                                   | Using Profile Projector by<br>comparison method  |
| 23. | Combination Set /<br>Degree Protector <sup>\$</sup> | Upto 180 °      | 18.6 min.                                  | Using Profile Projector by<br>comparison method  |
| 24. | Test Sieves <sup>\$</sup>                           | 32 µm to 5 mm   | 12.5 µm                                    | Using Electronic caliper by<br>comparison method   |
|     |   | 5 mm to 125 mm  | 18.5 µm                                    | Using Profile Projector by<br>comparison method  |
| 25. | Thread Pitch Gauge <sup>\$</sup>                    | 0.4 to 6 mm     | 17.6 μm                                    | Using Profile Projector by<br>comparison method  |

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|------|--|--------------------------------------|--|--|--|
| 26.  | Wire Gauge <sup>®</sup>  | 0.21 to 7.62 mm                      | 17.6 F μm                                  | Using Profile Projector<br>based by comparison<br>method   |  |
| 11.  | ACCELERATION AND   | ) SPEED                              |  |  |  |
| 1.   | Contact type<br>Tachometer / RPM<br>Indicator <sup>\$</sup>      | 60 RPM to 9000 RPM                   | 15.1 RPM                                   | Using Digital Tachometer<br>& RPM Source by<br>comparison method   |  |
| 2.   | Non–Contact type<br>Tachometer / RPM<br>Indicator <sup>\$</sup>  | 60 RPM to 90000 RPM                  | 1.4 RPM to 131.0 RPM                       | Using Digital Tachometer<br>& RPM Source by<br>comparison method   |  |
| 3.   | RPM Measurement<br>of Tachometer / RPM<br>Indicator <sup>#</sup> | 60 RPM to 10000 RPM                  | 1.40 RPM to 15.10 RPM                      | Using Digital Tachometer<br>by comparison method   |  |
| 111. | ACOUSTIC   |                                      |  |  |  |
| 1.   | Sound Level Meter <sup>\$</sup>                                  | <b>1 kHz</b><br>94 dB & 114 dB       | 1.3 dB                                     | Using Acoustic calibrator<br>by comparison method  |  |
| IV.  | HARDNESS TESTING MACHINE   |                                      |  |  |  |
| 1.   | Rubber Hardness<br>Tester <sup>\$</sup>                          | 0 to 100 Shore A<br>0 to 100 Shore D | 1.29 Shore A<br>1.55 Shore D               | Using Dial Calibration<br>Tester with Digital<br>Indicator(indentation<br>depth) by comparison<br>method |  |

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| V.  | WEIGHTS   |  |  |  |
| 1.  | Weights / Mass <sup>\$</sup><br>(F2 and coarser<br>Upto 200 g.)   | 1 mg<br>2 mg<br>5 mg<br>10 mg<br>20 mg   | 0.01 mg<br>0.02 mg<br>0.02 mg<br>0.02 mg<br>0.02 mg  | Using E <sub>2</sub> Class standard<br>weights and Precision<br>Balance of readability:<br>0.01 mg Upto 82 g and,<br>Readability: 0.1 mg Upto<br>200 g   |
|     |   | 50 mg<br>100 mg<br>200 mg<br>500 mg<br>1 g<br>2 g<br>5 g<br>10 g<br>20 g<br>50 g<br>100 g<br>200 g | 0.02 mg<br>0.02 mg<br>0.02 mg<br>0.04 mg<br>0.02 mg<br>0.03 mg<br>0.09 mg<br>0.17 mg<br>0.27 mg<br>0.81 mg<br>0.81 mg<br>3.10 mg | Using Standard Weights of<br>E <sub>2</sub> Class, Substitution<br>Method of Weighing and<br>"ABBA" Weighing Cycle.<br>Procedure based on OIML<br>R–111–1  |
|     | Weights / Mass <sup>\$</sup><br>(M₂ and coarser Upto<br>20000 g.) | 500 g<br>1000 g<br>2000 g<br>5000 g<br>10000 g<br>20000 g  | 10.00 mg<br>20.00 mg<br>40.00 mg<br>90.00 mg<br>0.300 g<br>0.435 g   | Using $F_1$ Class Standard<br>Weights and Mass<br>Comparators, Readability:<br>1 mg up to 1 kg and: 10<br>mg up to 5 kg and 0.1 g<br>from 30 kg Substitution<br>Method of Weighing and<br>"ABBA" Weighing Cycle.<br>Procedure based on OIML<br>R-111-1 |

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| VI. | WEIGHING SCALE AND BALANCE                                 |                                 |  |  |  |
| 1.  | Weighing Balance <sup>#</sup><br>d = 0.01 mg<br>d = 0.1 mg | 1 mg to 80 g<br>>80 g to 200 g  | 0.20 mg<br>0.31 mg                         | Using Standard weights<br>(E <sub>2</sub> ) class calibration of<br>electronic weighing<br>balance of Class I and<br>coarser as per OIML<br>R–76–1   |  |
|     | d = 1 mg   | >200 to 1 kg                    | 10 mg                                      | Using Standard weights<br>(F <sub>1</sub> ) class calibration of<br>electronic weighing<br>balance of Class I and<br>coarser as per OIML<br>R–76–1   |  |
|     | d = 10 mg<br>d = 100 mg                                    | >1 kg to 5 kg<br>>5 kg to 30 kg | 31 mg<br>363 mg                            | Using Standard weights<br>(F <sub>1</sub> ) class calibration of<br>electronic weighing<br>balance of Class II and<br>coarser as per OIML<br>R–76–1  |  |
|     | d = 10 g   | >30 kg to 50 kg                 | 10 g                                       | Using Standard weights<br>(F <sub>1</sub> ) class calibration of<br>electronic weighing<br>balance of Class III and<br>coarser as per OIML<br>R–76–1 |  |

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| VII.  | VOLUME  |  |   |   |  |
| 1.    | Micro–Pipette <sup>\$</sup>   | 10 µl to 100 µl<br>>100 µl to 1000 µl<br>@27 °C                        | 0.67 μΙ<br>0.67 μΙ                            | Using Digital Precision<br>Balance and distilled water<br>of known density.<br>Gravimetric method                     |  |
| 2.    | Glasswares <sup>\$</sup>  | >1 ml to 100 ml<br>>100 ml to 1000 ml<br>>1000 ml to 4000 ml<br>@27 °C | 2.69 μl<br>28.7 μl<br>1.15 ml                 | Using Digital Precision<br>Balance and distilled water<br>of known density.<br>Gravimetric method                     |  |
| VIII. | PRESSURE INDICATING DEVICES   |  |   |   |  |
| 1.    | Hydraulic Pressure<br>Gauge <sup>#</sup><br>(Dial/Digital Pressure<br>Gauges/Indicator/<br>Transducer/<br>Transmitter     | 0 to 2 bar<br>0 to 70 bar<br>0 to 700 bar<br>0 to 1100 bar             | 0.029 bar<br>0.29 bar<br>2.92 bar<br>4.59 bar | Using Digital pressure<br>gauge and using water<br>based comparator pump<br>based on DKD–R6–1 by<br>comparison method |  |
| 2.    | Pressure–<br>Pneumatic <sup>#</sup><br>(Dial/Digital)<br>Gauges/Indicator/<br>/Transducer/<br>Vacuum gauge<br>Transmitter | 0 to (-)0.9 bar  | 0.0077 bar                                    | Using Digital pressure<br>gauge and using water<br>based comparator pump<br>based on DKD–R6–1 by<br>comparison method |  |

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|-----|--|-------------------|---|--|--|--|
|     | THERMAL CALIBRATION  |                   |   |  |  |  |
| I.  | TEMPERATURE  |                   |   |  |  |  |
| 1.  | RTD/Thermocouple<br>with or without<br>indicator/Recorder/<br>Controller/<br>Temperature<br>Gauge/Data<br>Logger/Digital<br>Thermometer/<br>Temperature bath/<br>Calibrator <sup>§</sup> | (-)30 to 50°C     | 0.50°C                                    | Jsing RTD sensor with<br>ndicator, 6½ Digital<br>Aultimeter & Liquid<br>emperature bath by<br>comparison method                        |  |  |
|     |  | >50 to 250°C      | 0.53°C                                    | Jsing RTD sensor with<br>ndicator, 6½ Digital<br>Aultimeter & Solid<br>emperature bath by<br>omparison method                          |  |  |
|     |  | >250 to 1200°C    | 3.47°C                                    | Jsing "S" type thermocouple<br>vith Indicator, 6½ Digital<br>Aultimeter & Dry block<br>urnace temperature bath by<br>comparison method |  |  |
| 2.  | Temperature<br>Transmitter /<br>Transducer <sup>#</sup>  | (-)30 to 50°C     | 0.75°C                                    | Jsing RTD sensor with<br>ndicator, 6½ Digital<br>Aultimeter & Liquid<br>emperature bath by<br>omparison method                         |  |  |
|     |  | >50 to 250°C      | 1.05°C                                    | Jsing RTD sensor with<br>ndicator, 6½ Digital<br>Jultimeter & Solid<br>emperature bath by<br>omparison method                          |  |  |

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|-----|---|---------------------------------------|---|---|
|     |   | >250 to 400°C                         | 6.40°C                                    | Using "S" type thermocouple<br>with Indicator, 6½ Digital<br>Multimeter & Dry block<br>furnace temperature bath by<br>comparison method |
| 3.  | Temperature<br>Indicator of Deep<br>Freezer/Incubator/<br>Environment<br>Chamber/Oven/<br>COD/Furnace <sup>#</sup>  | (-)80 to 250°C                        | 1.59°C                                    | Using RTD sensor with<br>Indicator & 6½ Digital<br>Multimeter by comparison<br>method<br>(Single position )                             |
|     |   | 250 to 1200°C                         | 3.50°C                                    | Using "S" type thermocouple<br>with Indicator & 6½ Digital<br>Multimeter by comparison<br>method<br>(Single position )                  |
| 4.  | Temperature &<br>Humidity Mapping<br>of Deep<br>Freezer/Environme<br>nt Chamber<br>Stability Chamber<br>BOD<br>Incubator(Industrial<br>Purpose only)/<br>Rooms <sup>*</sup> | (-)30 to 70°C<br>20% to 95% Rh(@25°C) | 1.20°C<br>10.16% Rh                       | Using Temperature &<br>Humidity Data Logger<br>(Minimum 12)<br>(Multi Position Calibration)   |

\* Measurement Capability is expressed as an uncertainty (±) at a confidence probability of 95% <sup>\$</sup>Only in Permanent Laboratory

\*Only for Site Calibration \*The laboratory is also capable for site calibration however, the uncertainty at site depends on the prevailing actual environmental conditions and master equipment used.