

Technical Specification for Testing Equipments Ten. No. 02/2019-20

1

Atomic Absorption Spectrophotometer

| S No | Specification |
|------|--|
| 1 | A compact integrated dual atomizer system with inbuilt flame and furnace atomizers. Changeover from Flame to Furnace mode and vice-versa should be automatic and controlled through the software. |
| 2 | The vertical and horizontal alignment of the flame burner head in the light beam should be Motorized automatic through the software |
| 3 | Separate 10 cm titanium burner head for Air – Acetylene flame and 5 cm titanium burner head for Nitrous oxide – Acetylene flame should be supplied with the system. |
| 4 | Zeeman Background or other suitable background correction for GF to have higher light through put. |
| 5 | The heating of the Graphite Atomizer should be in transverse direction, ensuring the uniform temperature distribution across the graphite tube. |
| 6 | The Graphite Furnace Atomizer must be permanently aligned with no movement, alignment and optimization required. |
| 7 | The Furnace Auto sampler must be integrated to main Spectrometer with a minimum of 50 sample positions and more. |
| 8 | The system should be equipped with an integrated graphite furnace camera for easy auto sampler tip alignment and real time viewing of the process happening in graphite furnace. |
| 9 | The GF system should be supplied with pyrolytically coated graphite tube, integrated platform, rapid furnace heating (up to 2500oC/s). |
| 10 | An imported or local air compressor and an imported or local re-circulating water chiller unit of appropriate capacity for cooling of Graphite Furnace must be quoted by the manufacturer. |
| 11 | Auto sampler for flame should be quoted in option |
| 12 | Lamps |
| | The system should have a minimum 6 lamp holder with a provision of automatic lamp selection and fixed lamp positions. Built-in power supplies for Coded Hollow Cathode Lamps that are used for the analysis of volatile elements like As, Hg, Se, etc. (HCL or other specific lamps should be quoted if required.) |
| | Lamps & Standards for elements Lead, Tin, Arsenic, Cadmium, , Antimony, Mercury |
| 13 | Sample Introduction System |
| | A high sensitivity nebulizer system including impact bead and flow spoiler with corrosion resistant against the acids like 5% hydrofluoric acid, hydrochloric acid and Nitric Acid. Corrosion resistant spray chamber. |
| 14 | Optical System |
| | A double beam spectrometer system with high light throughput. |
| | Monochromator system with a diffraction grating ruling density of atleast 1800 lines/mm blazed in both UV and Visible regions. |

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| | A focal length of minimum above 250 mm and the Reciprocal Linear Dispersion of 1.6nm/mm. Variable slit selection. |
| | Detector - Photomultiplier Tubes (PMT) or Solid State Detector, Wavelength range: 185 – 900 nm |
| | Back Ground Correction Methodolgy |
| | Zeeman Background correction or other suitable background correction for GF to have higher light through put |
| 15 | Gas Flow System |
| | Software controlled flame ignition and automatic changeover of oxidant flow from acetylene to nitrous oxide when switching to or from air-acetylene to nitrous oxide – acetylene flame. |
| 16 | Safety |
| | All safety interlocks built-in and additional feature like Burner Head Interlock, Nebulizer/End Cap Interlock, and Drain Interlock to be built-in. |
| 17 | Sensitivity |
| | Greater than 0.8 absorbance with the precision of <0.5% RSD from 5 second integrations for 5 ppm Cu standard |
| 18 | Hydride Generation Accessory |
| | Continuous Hydride Generation system should be offered and automated Flow injection based Hydride generation system for both flame and furnace atomizers for the analysis for the volatile elements like As, Se, Hg, etc. This system shall have both continuous and fixed quantity of loops should be in position. |
| 19 | Software |
| | Programmed facility with multitasking software should provide complete control of instrument with instrument status display and its various accessories |
| | Provide Accurate and reproducible time averaged, integration, non- averaged integration, multilevel calibration. Software should handle instrument linear absorbance reading, concentration or emission intensity, integration time, built in statistics, calibration equation control, slope of analytical curve using operator selective calibration standard. |

2

Differential Scanning Calorimetry

Preamble: To study the thermal characteristics of polymeric material / product as per test standard ISO, ASTM etc.

| Technical Specifications | | |
|--------------------------|--|-----------------|
| 1 | Tempearture range | -70 C to +700 C |
| 2 | Multiple cooling options for a temperature range | -70 C to +700 C |
| 3 | Calorimeter Sensitivity | 1.0 μ W |
| 4 | Precision | \pm 1% |
| 5 | Dynamic range | \pm 750 mW |
| 6 | Baseline noise | < 1 μ W |
| 7 | Temperature accuracy | \pm 0.1 C |
| 8 | Temperature Precision | \pm 0.05 C |

| | | |
|----|---------------------------|--|
| 9 | Programmable heating rate | Lowest: 0.01 C / min. |
| 10 | Cooling rate | 0.02 to 50 C / min. |
| 11 | Test confirms to | ASTM D 3418, ASTM D 3417, ASTM 3895, etc |
| 12 | Accessories | Sample press, standards for calibration, Aluminium & copper pans with covers, Quench Cooling, etc. |
| 13 | UPS | Suitable UPS system with 30 Minutes Battery Backup facilities should be offered |
| 14 | Other Features: | Computer with suitable configuration to support the software and colour bottled inkjet printers should be provided |
| | | Built in digital flow controller & gas switching assessor |
| | | Copper pans (100 Nos), Aluminium (500 Nos) should be provided |

3

FTIR

| | | |
|--|--------------------------|---|
| | Accepts | ID Accessories; Foundation Accessories; Many standard accessories |
| | Applications | Academic teaching, industrial QA/QC, plastics and polymers, pharmaceuticals |
| | Humidity | Tightly sealed to resist ambient humidity. |
| | Width (English) | 13.5 in. |
| | Width (Metric) | 35 cm |
| | Interface | PC USB 2.0 |
| | Beam Splitter | KBr/Ge mid-infrared optimized |
| | Laser | Temperature controlled solid-state near-IR diode laser |
| | Performance Verification | ASTM E1421 to meet customer ISO/GLP requirements, |
| | Components | User-replaceable: source, desiccant, power supply, sample compartment windows |
| | Power Supply | 100-240V 50/60Hz |
| | Depth (English) | 10.9 in. |
| | Depth (Metric) | 28 cm |
| | Source Type | Mid-infrared Ever-Glo; user replaceable from bottom plate |
| | Detector Type | Fast recovery deuterated triglycine sulfate (DTGS) (standard) |
| | | |

4

Gas Permeability Analyzer (Three Test Chambers using Pressure Differential Method) ASTM D1434

| | | |
|--------|----------------------|---|
| Sr No. | Testing range | 0.02~50000 cm ³ / (m ² · 24h · 0.1MPa |
| 1 | Test accuracy | 0.001 cm ³ / (m ² · 24h · 0.1MPa |

| | | |
|----|-----------------------------|---|
| 2 | Temperature range | 15~60 |
| 3 | Temperature accuracy | ±0.1 |
| 4 | Vacuum degree | <20Pa |
| 5 | Vacuum resolution | 0.01Pa |
| 6 | Gas supply pressure | 0.2~0.8MPa |
| 7 | Test pressure | -0.1~+0.1MPa |
| 8 | Gas port | 1/8 inch rubber tube |
| 9 | Test gas | O2, Co2, N2, etc |
| 10 | Test area | 50.24 cm2 |
| 11 | Sample | size Φ110 mm |
| 12 | Sample thickness | ≤2mm |
| 13 | Power supply | AC 220V, 50Hz |
| 14 | Other | Professional software with simple interface, easy to use and convenient to set test process. ◆ Fully-auto operation , judge and stop automatically. ◆ Vacuum-pumping process, air intake, testing, pressure maintain, constant temperature program automatic control, experimental status are displayed in real time. Curves display of transmission, water vapor concentration, temperature and humidity in real time. The curves with conceal function, support query function for background data. ◆ Configure with color touch screen, can observe temperature, humidity and transmission without external computer. |
| | Calibration | ◆ instrument supports two methods of reference materials and standard gas to certificate and calibrate; |

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|---|---|--|
| 1 | Design | A vertical design with a high sensitivity balance and quick response furnace. The balance is located above the furnace and is thermally isolated from it. A precision hang-down wire is suspended from the balance down into the furnace. At the end of the hang-down wire is the sample pan. The sample pan's position is reproducible. |
| 2 | Balance - Sensitivity | 0.1 µg |
| | Balance - Capacity | 1300 mg |
| | Balance - Accuracy | Better than 0.02% |
| | Balance - Precision | 0.01% |
| 3 | Temperature - Furnace | |
| | Temperature - Range | -20 °C to 1200 °C |
| | Temperature - Scan rates | 0.1 °C/min to 500 °C/min |
| | Temperature - Precision | ±1 °C |
| 4 | Cooling - Method | Forced air cooled with an external fan |
| | Cooling - Cycle time | 1100 °C to 50 °C |
| 5 | Sample Pans | Platinum or ceramic (60 µL) |
| 6 | Volatile Analysis - Optional | AccuPik accessory pierces a hole seconds before the run to avoid evaporation and change in volatiles content |
| 7 | Atmosphere - Sample environment | Static or dynamic, including nitrogen, argon, helium, carbon dioxide, air, oxygen, or other inert or reactive gases. Analyses done at normal or reduced pressures. |
| | Atmosphere - Gas Control | Balance purge (Mass-flow controlled); Sample purge (switch between 2 gases; Mass-flow controlled); Reactive purge |
| | Gas Mixing (optional) | Up to 3 gases |
| | Vacuum | 10-5 Torr |
| 8 | Machine should comply to ASTM E 1131 | |
| 9 | Calibration Certificates should be provided from NABL accredited lab | |

6

UNIVERSAL TESTING MACHINE 50 kN

| | | |
|----|-----------------------------|---|
| 1 | Max. load capacity | 50 kN |
| 2 | Load cell | 50 kN, 5.0 kN, 1.0 kN, 100 N |
| 3 | Load cell accuracy | ≤ 0.5 % |
| 4 | Test speed | 1 mm/min to 500 mm/min. |
| 5 | Speed accuracy | ± 0.2% |
| 6 | Cross head travel | Min 800 mm |
| 7 | Horizontal daylight | Min 400mm |
| 8 | Strain measurement accuracy | 0.5% or better |
| 9 | Load measured | Tension and Compression |
| 10 | Tensile Grips | · Wedge grips Suitable for above loads. |
| | | · Grips suitable for testing of Plastic films (rubber faceted Pneumatic type) |
| | | · Grips for Rigid plastics (opening up to min.12mm) |
| | | · Grips for woven Sacks (50 mm width) . |

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| 11 | Fixtures | · Flexural fixture complies to ASTM D 790 |
| | | · Compressive Fixture complies to ASTM D 695 |
| | | · Shear fixture complies to ASTM D 732 |
| 12 | Extensometer | Contact type Strain gauge |
| 13 | Applicable standards and Conforming to | ISO/R-527, ASTM D 638, 695, 790, 882, 412, and Equivalent standards |
| 14 | Power | 230 Volts, 50 HZ, single phase. |
| 15 | Operating system & Software | Suitable for all functions such as maximum load, strain, modulus etc. Necessary software, Computer & Printer should be provided. |
| 16 | Climatic chamber (Optional) | The cabinet dimension shall be maintained proportionately with the horizontal & vertical opening daylight of the machine. The temperature range shall be -190°C (liquid nitrogen) to +300°C |
| | | To be supplied along with tensile grip of self-tightening type. |

7

UNIVERSAL TESTING MACHINE 25 kN

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|----|--|--|
| 1 | Max. load capacity | 25 kN |
| 2 | Load cell | 25 kN, 5.0 kN, 1.0 kN, 100 N |
| 3 | Load cell accuracy | ≤ 0.5 % |
| 4 | Test speed | 1 mm/min to 500 mm/min. |
| 5 | Speed accuracy | ± 0.2% |
| 6 | Cross head travel | Min 800 mm |
| 7 | Horizontal daylight | Min 400mm |
| 8 | Strain measurement accuracy | 0.5% or better |
| 9 | Load measured | Tension and Compression |
| 10 | Tensile Grips | · Wedge grips Suitable for above loads. |
| | | · Grips suitable for testing of Plastic films (rubber faceted Pneumatic type) |
| | | · Grips for Rigid plastics (opening up to min.12mm) |
| | | · Grips for woven Sacks (50 mm width) . |
| 11 | Fixtures | · Flexural fixture complies to ASTM D 790 |
| | | · Compressive Fixture complies to ASTM D 695 |
| | | · Shear fixture complies to ASTM D 732 |
| 12 | Extensometer | Contact type Strain gauge |
| 13 | Applicable standards and Conforming to | ISO/R-527, ASTM D 638, 695, 790, 882, 412, and Equivalent standards |
| 14 | Power | 230 Volts, 50 HZ, single phase. |
| 15 | Operating system & Software | Suitable for all functions such as maximum load, strain, modulus etc. Necessary software, Computer & Printer should be provided. |

8

Double Beam UV Spectrophotometer

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|---|---------------------|--------------------|
| 1 | Wavelength range | 190-1100 nm |
| 2 | Wavelength Accuracy | ± 0.5 nm or better |

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| 3 | Wavelength reproducibility: | ± 0.1nm or better |
| 4 | Optics | Monochromator with grating and step motor / reference beam |
| 5 | Baseline Flatness | ± 0.001 Abs or better throughout UV-Vis range |
| 6 | Lamp | Tungsten-halogen |
| 7 | Display | Backlit 7" colour display for extensive graphical evaluation |
| 8 | Bandwidth | 4 nm |
| 9 | Measurement | Concentration, absorbance, % transmission, kinetics and spectra in Abs or % transmission, multi-wavelengths and multi-step readings |
| 10 | Scan speed | 700-2000 nm/min, Scans in 1, 2, 5, 10 nm steps of wavelength range |
| 11 | Photometric accuracy/ reproducibility | - 0.003 E for E < 0.600; 0.5 % of values for 0.600 < E < 2.000 |
| 12 | Cuvette | 16 mm round, 10 mm, 20 mm, 50 mm rectangular with automatic detection w/o adapter |
| 13 | Bar code | Automatic method recognition including measurement range for all cuvettes |
| 14 | Data storage | 5000 measurement values, spectra and kinetics approx. 40 MB => 500 spectra (300-900 nm) and 400 kinetics with 150 measurement values |
| 15 | Methods and profiles | > 200 pre-programmed methods, 1000 user-defined methods, 20 profiles for kinetics and spectra, comprehensive programming options |
| 16 | Interface/update | 1 USB-A, 1 USB-B, 1 Ethernet / Update via Internet and USB stick |
| 17 | IP Class | IP 30 including drainage in optical compartment |
| 18 | Power Supply | Universal power supply, optional supply via standard adaptor cable for car batteries |
| 19 | Temperature Range | Operation: +10 °C to +35 °C, Storage: -25 °C to +65 °C |
| 20 | Accessories | Branded PC, Display Screen, Printer and UPS with 4 sets of quartz cuvette to be offered |
| Calibration certificate should be provided from NABL accredited lab | | |

9

UV weathero meter

| | | |
|--|--------------------------------|--|
| | Applications | To simulate, accelerate and correlate the artificial sunlight / weathering atmosphere for polymers, coatings, etc. |
| | Effective radiation area | 4000 cm ² |
| | Components surface temperature | 45°C to 80°C for UV Cycle |
| | | 45°C -60°C for Condensation |
| | Temperature accuracy | ± 0.1°C or better |
| | Temperature resolution | 1°C or better |
| | Temperature controller | Black Panel Temperature |
| | Centre distance of lamp | 5 cm |
| | Humidity | 100% |

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| | Light source | UV-B Fluorescent Lamp |
| | Wavelength | UVB (313 nm) |
| | Minimum sample holder plate | Aluminum Plates 24 sample holders |
| | Conditioning cycle | Light cycle and Condensation cycle |
| | Irradiance Calibration | Irradiance calibration (calibration radiometers for periodical calibration) with NIST traceability (UVA & UVB) |
| | Irradiation Control | Irradiation control (solar eye automatically maintain light intensity through feedback look this controller monitor UV intensity and compensate lamp aging or any other variability by adjusting power to the lamp) with NIST traceability |
| | Conforms to standards | ASTM G151, ASTM G 154, ISO 4892 (1 – 3), SAE J2020 |
| | Warranty | Minimum 3 years of warranty to be provided |
| | Scope of supply | Complete list of items quoted are to be provided |
| | Installation requirements | Bidder to specify the preinstallation requirements |
| | Training | Onsite training for system operation and maintenance as well as application support should be provided by the vendor at its own cost. |
| | Service | Appropriate tool box/kit for routine maintenance should be provided with the equipment |
| | | All documents (i.e. operating & service manuals, drawings etc.) and original softwares relevant to the instrument and its accessories must be supplied. |
| | | In case of any up gradation of software within the period of warranty then the same should be provided free of cost by the supplier/manufacturer. |
| | | Power and receptacle/socket as per Indian Standards should be provided. |
| | | The vendor shall have local service and application office and infrastructure to attend by visit within 48 hours of need. |
| | | The vendor should have technical support in the area of application and service available within the country |

10

WVTR

| | | |
|--------|-----------------------------|---|
| Sr No. | Test range | 0.005~500 g/m ² · 24h (film and sheet) |
| 1 | Test precision | 0.001 g/m ² · 24h (film and sheet) |
| 2 | Temperature range | 15~45 (15~60 optional) |
| 3 | Temperature accuracy | ±0.1 |
| 4 | Humidity range | 30~90%RH, 100%RH |
| 5 | Humidity accuracy | ±1%RH |
| 6 | Test area | 50.24 cm ² |
| 7 | Sample size m | Φ100 m |

| | | |
|----|------------------------------|---|
| 8 | Sample thickness | ≤3mm |
| 9 | Number of test sample | ~3 pieces |
| 10 | Carrier gas | 99.999% N2 |
| 11 | Carrier gas pressure | ≥0.1MPa |
| 12 | Carrier gas flow | 5~120 mL/min |
| 13 | Gas supply port | 1/8 inch metal pipe |
| 14 | Power supply | AC 220V, 50Hz |
| 15 | Other | <p>Professional software with simple interface, easy to use and convenient to set test process.</p> <ul style="list-style-type: none"> ◆ Fully-auto operation, one-button test, judge and stop automatically. ◆ Programmed auto-control, the experiment status display in real time. ◆ Curves display of transmission, water vapor concentration, temperature and humidity in real time. The curves with conceal function, support query function for background data. ◆ Mainframe configure with color touch screen, can observe temperature, humidity and transmission without external computer. |
| 16 | Calibration | <p>instrument supports two methods of reference materials and standard gas to calibrate and certificate; certified reference materials for normal testing,</p> |

11

Comparative Tracking Index

| | | |
|----|-----------------------|--|
| 1 | Test Voltage | 100 to 600 V AC (adjustable), 50 Hz |
| 2 | Trip Current | 0.5 A, Pre settable |
| 3 | Short circuit Current | 2.0 A |
| 4 | Voltage indicator | 1/8 DIN, 3 Digit Voltmeter (100 - 600 V) |
| 5 | Current Indicator | 1/8 DIN, 3 ½ Ammeter (0 to 2 A) |
| 6 | Dropping Unit | Automatic by special positive displacement pump |
| 7 | Drop interval | 30 ± 3 sec. |
| 8 | Drop volume | 20±5 cu.mm |
| 9 | Drop regulation | Mechanical |
| 10 | Drop Count | Pre settable digital counter (0-999) |
| 11 | Drop height | ≤ 40 mm |
| 12 | Load on Sample | 1.0 N |
| 13 | Electrodes | Brass & Platinum (40 mm long, 5 mm width, 2 mm thick and 30 Chisel point edge, 0.05 to 0.1 mm radius at the tip) |

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| 14 | Power Supply | 230V AC, 50 Hz |
| 15 | Test Confirming to | ASTM D 3638, ASTM D 5288, IEC 60112 |
| 16 | Other Features | Transparent Lid should be provided which covers the test area, 4.0 mm thick space bar should be provided to adjust the electrode gap |

12

Abrasion Tester

| | | |
|---|----------------------|---|
| 1 | Type | Taber Abrader with rotating table |
| 2 | Arm Weights | 500 grams & 1000 grams |
| 3 | Test cycles counter | 9999 Nos |
| 4 | Confirm to Standards | ASTM D1044 |
| 5 | Abrading Wheel | Mild to medium action, resilient binder, Aluminum oxide or silicon carbide particles. |
| 6 | Grade of Wheel | CS-17, CS-10, H-18, H-22, CS-10F- Each 2 Sets |
| 7 | Accessories | Diamond Wheel Refacer to clean the abrasion wheel |

13

Izod/Charpy Impact Tester

| | | |
|---|-------------------------|---|
| 1 | Set Up | For Izod & Charpy as per ASTM and ISO standards |
| 2 | Basic pendulum capacity | 2.82J |
| 3 | Additional weights | Weight sets upto 25J capacity or more |
| 4 | Impact velocity | Aerodynamic compound pendulum with facility to increase/decrease pendulum capacity with addition/removal of weights enabling user to change to desired capacity quickly & easily. |
| 5 | Drop Height | 0.61m |
| 6 | Strikers | Izod striker, charpy striker and its anvil, setting gauges. Should include charpy striker, anvils, setting gauges |
| 7 | Notch cutter | Motorised Notch cutter |
| 8 | Optional Accessories | Facility for Zero and Sub Zero testing upto 50°C |

Calibration Certificates should be provided from NABL accredited lab

14

Barcol Hardness Tester

| | | |
|--|---------------|------------------------|
| 1 | Range | 0-100 Points |
| 2 | Least Count | 1.0 Unit |
| 3 | Confirming to | ASTM D2583 |
| 4 | Calibration | 2 x calibration plates |
| Calibration certificate should be provided from NABL accredited lab | | |

15

Bulk Density Apparatus

| | | |
|---|-----------------------|---------------------------------|
| 1 | Baffle Box / Material | 45 mm x 45 mm / Stainless Steel |
| 2 | Bottom Funnel | Stainless Steel |
| 3 | Cylindrical Volume | 100.00 ± 0.03 cm ³ |

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| 4 | Inner Diameter | Ø28.30 ±0.20 mm |
| 5 | Instrument Stand | Level & Vibration free |
| 6 | Disand between bottom funnel lower opening & top of the density cup | 19mm (3/4 in.) |
| 7 | Other | Confirms to IS 4669 |
| Calibration certificate should be provided from NABL accredited lab | | |

16

Burst Strength

| | | |
|--|---|-------------------------|
| | Mullen type of hydro-static digital burst strength tester For film, Aluminum foil, Fabric | |
| | Specifications: Machine designed and working principal as per ASTM D-3786 | |
| 1 | Pressure range | 60 Kg/cm ² |
| 2 | Least Count | 0.05 kg/cm ² |
| 3 | Display | Digital |
| 4 | Rate of Fluid Displacement | 100 cc/minute |
| 5 | Test fluid | Water |
| 6 | Motor | 1/2 HP single Phase |
| 7 | Peak Hold Facility | Yes |
| 8 | Safety Switch | Yes |
| Features | | |
| 1 | Digital Indication Of readings | |
| 2 | Equipment Should be completely Microprocessor based | |
| 3 | Tare facility Should be incorporated | |
| 4 | Peak Hold facility for keeping the maximum value in the memory | |
| 5 | Bright LED display | |
| 6 | Features Touch Control | |
| 7 | single push botton control | |
| 8 | memory to hold upto 10 tests | |
| 9 | Strong Griping clamp | |
| 10 | Grooved structure for test specimen holder to avoid sleepage and intact holding of specimen | |
| 11 | No sleepage in case of specimen tightened uniformly using oprating wheal | |
| Calibration certificate should be provided from NABL accredited lab | | |

17

Climatic Chamber

| | | |
|----------------------------|-----------------------------------|---------------|
| Interior dimensions | | |
| 1 | Width (mm) | 402 |
| 2 | Height (mm) | 402 |
| 3 | Depth (mm) | 330 |
| 4 | Interior volume (l) | 53 or specify |
| 6 | Load per shelf (kg) | 15 |
| 7 | Permitted total load (kg) | 60 |
| Temperature data | | |
| 1 | Temperature range (°C) | - 40 to 180 |
| 2 | Temperature fluctuation (± K) | 0,1 - 0,5 |
| 3 | Recovery time after door was open | 30 sec |

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|---|--|-------|
| 4 | at -10 °C (min.) | 5 |
| 5 | at 70 °C (min.) | 1 |
| 6 | at 150 °C (min.) | 5 |
| 7 | Mean warm-up rate acc. to fa | 4,6 |
| 8 | Mean cooling rate acc. factory standard (°C/min.) 180 °C to -40 °C | 4,1 |
| 9 | Heat compensation, max. (W) | 500 |
| Humidity data | | |
| 1 | Humidity range (%) | 0-99 |
| Electrical data | | |
| 1 | IP protection class acc. to EN 50529 | IP 20 |
| Temperature and Humidity should be microprocessor based Programmable | | |
| Calibration certificate should be provided from NABL accredited lab | | |

18 Co-efficient of Friction Tester - Vertical

| | | |
|---|--|---|
| 1 | Test stands that can be combined | Vertical type |
| 2 | Weight | 200g Approx. (Approx.2N) & 1000g Approx. (Approx.10N) |
| 3 | Allowable thickness of samples | Max. 1.5mm |
| 4 | Allowable stroke of samples | Max. 150mm |
| 5 | Weight of table part | Approx. 1.9kg |
| 6 | Dimensions | Specify |
| 7 | Accessory | Graphing software: Force Recorder Standard-COF |
| 8 | Machine should comply to ASTM D 1894 | |
| 9 | Calibration certificate should be provided from NABL accredited lab | |

19 Co-efficient of Friction Tester - Horizontal

| | | |
|---|--|--|
| 1 | Test stands that can be combined | Horizontal type |
| 2 | Weight | 200g (Approx.2N) & 1000g Approx. (Approx.10N) |
| 3 | Allowable thickness of samples | Max. 1.5mm |
| 4 | Allowable stroke of samples | Max. 150mm |
| 5 | Weight of table part | Approx. 2.0kg |
| 6 | Dimensions | Specify |
| 7 | Accessory | Graphing software: Force Recorder Standard-COF |
| 8 | Machine should comply to ASTM D 1894 | |
| 9 | Calibration certificate should be provided from NABL accredited lab | |

20 Deep Freezer

| | | |
|---|--------------------------|------------------|
| 1 | Temperature Range | Ambient to -20°C |
|---|--------------------------|------------------|

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| 2 | Design | Horizontal and Vertical Shapes |
| 3 | Control Panel | Touch Key Pad w/ LED Display |
| 4 | Temperature Regulation | Microprocessor Controlled |
| 5 | Alarm Type | Audible & Visible |
| 6 | Refrigerant | CFC free refrigerant |
| 7 | Construction | Double Walled w/ PUF insulation |
| 8 | Door | Solid Door |
| 9 | Inner Doors | Single and Double Doors w/ Tempered Glass |
| 10 | Cabinet Housing | MS w/ Powder Coating (SS optional) |
| 11 | Internal Chamber | Stainless Steel (316 / 304) |
| 12 | Optional | Seven days circular chart recorder |
| | | Chart recorder |
| | | Outer chamber Stainless Steel 316 / 304 grades |
| | | Caster Wheels |
| | | Voltage Stabilizer |
| 13 | Power Supply | 220 - 240 Volts, 50 Hz. Single Phase |
| 14 | Certification | ISO and CE Mark |
| Calibration certificate should be provided from NABL accredited lab | | |

21

Arc Resistance

| | | |
|---|---------------------------|--|
| 1 | Voltage range | 5 – 12.5 kV (50Hz)(Max.15 KV) |
| 2 | Auto Transformer | Adjustable to provide operating voltage of 12.5 kV |
| 3 | Current | 5mA – 40mA |
| 4 | Timer Sec. | In-built digital timer with an accurate interval of 1 |
| 5 | Automatic Interrupter | 4 Steps 1/8,1/4,1/2 & 1 |
| 6 | Interrupter Accuracy | ± 1/120 Sec |
| 7 | Safety | <i>Micro-controller based control system.Enclosure with interlock switch for operator safety</i> |
| 8 | Electrode | Tungsten rod electrode Dia.: 2.4 mm, Length: 4.5 mm |
| 9 | <i>Trip Current</i> | <i>0.40mA, Adjustable</i> |
| 10 | Test Confirms to standard | ASTM D 495, IS 10810 |
| 11 | Other | Voltage Indication: KV Voltmeter, 0 to 15KV Current Indication: 1/8 DIN, 31/2 Digit Ammeter, 0 to 2.000A Load on each electrode: 1.0 Newton Supply: 220 – 240V AC, 50-60 Hz, (user national standard if specified) Single Phase Max. Fuse Rating: 3A Rapid |
| Calibration certificate should be provided from NABL accredited lab | | |

22

Elmendorf Tear Tester

| | | |
|---|---------------------|-------------------------------|
| 1 | Capacity | 0-6400 grams |
| 2 | Pendulum Range | 400, 800, 1600, 3200, 6400 |
| 3 | Accuracy | 1.0% of pendulum range |
| 4 | Calibration Weights | 20%, 50% and 90% |
| 5 | Measuring Principle | Hi-resolution digital encoder |

Features:

1. Automatic specimen notching
2. Mechanical-pneumatic clamping avoids sample slippage to ensure repeatable results
3. Automatic pendulum reset with lifting device
4. Tearing force displayed digitally.
5. Safety Hood protects operator from injury while pendulum is in motion.

Calibration Certificates should be provided from NABL accredited lab

23

Gloss meter

| | | |
|----|--|---|
| 1 | Required angle | 20o, 45°, 60° |
| 2 | Range (Gloss Unit) | 0-2000 |
| 3 | Repeatability | 0.2 GU for 0 – 99.9 GU & 0.2% for 100– 2000 GU |
| 4 | Power Supply | 230V & 50Hz |
| 5 | Equipment should meet the test methods | ASTM D-523, D-2457, ISO 2813, 7668, DIN 67530, JIS Z 8741, IS 2508 |
| 6 | Calibration | Automatic, by means of built-in microprocessor |
| 7 | Measurement | Individual measurement & statistical evaluation |
| 8 | Memory | 999 Measurement values with date & time |
| 9 | Digital Display | Alphanumeric LCD |
| 10 | Accessories | Calibration holder and standard tiles for 20°, 45°, 60° angles should be provided |

24

Glow Wire Tester

| | | |
|---|----------------------------|---|
| 1 | Heating element | Nickel/Chromium glow-wire (80:20), 4 mm dia, shaped as specified in standards |
| 2 | Temperature sensor | Sheathed Cr/Al thermocouple, 0.5 or 1.0 mm dia, located in tight fitting pocket hole in glow-wire |
| 3 | Temperature range | Ambient to 999.9°C adjustable |
| | Temperature precision | ± 5°C |
| 4 | Max. output power | 1000 W |
| 5 | Glow wire application time | 0.1-999.9 sec |
| 6 | Sample loading | Test sample moves against glow-wire preloaded to 1.0 ± 0.2N |
| | Sample loading | Test sample moves against glow-wire preloaded to 1.0 ± 0.2N |
| 7 | Sample carriage | Automatic, motorised movement of test specimen |
| 8 | Safety | Emergency stop, PLC interlocks |
| | | Machine should comply to IEC 60695 |
| 9 | | Calibration Certificates should be provided from NABL accredited lab |

25

Hydrostatic Burst Pressure Testing Machine (As per ASTM D 1785)

| | | |
|---|------------------|--|
| 1 | Test Standard | HDPE, PVC, PPR, Lateral pipes as per IS 4985, IS 4984, IS 12786, IS 14333, IS 14151, IS 15328, IS 15801, EN 921:1994, ASTM D 1785 & other relevant standards |
| 2 | No. of Stations | 08 (Min) |
| 3 | Unit of pressure | kg/cm ² , MPa, BAR |

| | | |
|---|----------------------------|--|
| 4 | Pressure Range | 0.00 to 99.99 kg/cm ² |
| 5 | Pressure Resolution | 0.01 kg/cm ² |
| 6 | Resolution of Timer | 999.9 hrs. |
| 7 | Time Range | 0.1 hour/6 minute |
| 8 | Hydraulic Circuit | Made from corrosion-less S.S. 304 tubing and fittings |
| 9 | Compressed air requirement | Min. 3.0 kg/cm ² form compressor unit |
| 10 | Pressure Developing System | Through hydro-pneumatic type reciprocating pump |
| 11 | No. of Pumps | 02 pumps |
| 12 | Pressure control system | Hydro-pneumatic pressure regulating device with individual control of station. |
| 13 | Power Supply | 230V AC, Single phase, 50Hz |
| Accessories: | | |
| Temperature bath of dimensions 500 mm*500 mm*1200 mm ranging -20 o C to 150 o C or | | |

26

MELT FLOW TESTER

| | | |
|--|---|--|
| | Scope : Determination of flow properties of polymer powders & pellets using ISO 1133 (1991) and ASTM D1238, Method A, B & C and other equivalent International standards. | |
| | TECHNICAL SPECIFICATION: | |
| | Ø System should meet ASTM 1238 and ISO 1133-1-2, DIN 53735, BS 2782, IS 2530 | |
| | Ø Temperature range 50 to 400C | |
| | Ø Temperature display resolution: +/- 0.1 C | |
| | Ø Thermal stability: +/- 0.2 C from 50to 400 C | |
| | Ø Thermal fuse protection. | |
| | Ø MVR with up to 40 data points acquisition for a single test (with encoder) | |
| | Ø Barrel Cylinder: Hardened Nitride Steel | |
| | Ø On-board LCD Display with alphanumeric keypad for methods setting and visualization of results. | |
| | Ø Should be equipped with high accuracy encoder and motorized lifting device to allow precise and exact positioning of the lifting device for the masses. | |
| | Ø Automatic Cutting device | |
| | ACCESSORIES: | |
| | - Masses : 1.2, 2.16, 5, 10, 21.6 kg | |
| | - Standard Nozzle as per ISO 1133/ASTM D1238 Diameter 2.095 mm, Length 8 mm,, tungsten carbide; should be supplied with dimensional conformity certificate | |
| | - Cleaning Tools & Cleaning cream | |
| | - Go-No-Go Gauges for dies and piston | |
| | - CRM with NIST traceable certificate | |
| | Optional Accessories: | |
| | - Die Plug | |
| | - Windows based software | |

| | |
|--|---|
| | - Die According to ASTM D1238 Method C (Half Die) , for high flow rate polyolefins, Dia 1.048 mm, Length 4.00 mm, - Made of tungsten carbide; should be supplied with dimensional conformity certificate |
| | Recommended Spares: |
| | - Spare Standard Die/Nozzle and Piston |
| | - Fuses and Thermal Probe |
| | The equipment should be supplied with all the essential accessories to meet the standard methods mentioned above. |

27 Melting Point apparatus (hot stage)

| | | |
|---|-----------------------------|-------------------|
| 1 | Temp Range(Deg. Centigrade) | Ambient to 350° C |
| 2 | Operation Grade | Automatic |
| 3 | Control System | PLC control |
| Other required accessories should be provided | | |
| Calibration Certificates should be provided from NABL accredited lab | | |

28 Notch cutter

| | |
|--|--|
| To cut 'V' Notch over the pipe surface for slow crack growth resistance test. | |
| FEATURES | |
| Machine should meet the requirements of ASTM F-1474-93 and ISO-13479, IS 14885, IS 4984 (Amended). | |
| should be fully equipped with the digital measurement for length & depth of the notch. | |
| Control for 'V' Notch length should be digital and auto reversible. | |
| Control for Depth of 'V' Notch is manual, and measurement should be digital. | |
| Cutting rate should be digitally adjustable. | |

29 Hot Oil Bath

| | | |
|--|-----------------------------|-----------------|
| 1 | Oil Bath Temp | 150°C |
| 2 | Timer | 0-999 min |
| 3 | Timer accuracy | 1 sec |
| 4 | Temp accuracy | 1°C |
| 5 | Dimension L*B*H(min) | 1000*750*750 mm |
| 6 | Should comply with IS 12235 | |
| Calibration certificate should be provided from NABL accredited lab | | |

30 OXIDATION INDUCTION TIME (OIT)

| | |
|---|--|
| 1 | · High Resolution A/D (24bit) with high data sampling to give High Accuracy and Low drift |
| 2 | · DSC signal scale: -200 to 200 mw accuracy of 0.02 mw |
| 3 | · Intelligent Micro-controller based Temperature Controller provides Temperature Accuracy of 0.1 °C even over a long period of time. |

| | |
|----|--|
| 4 | · Numerical Mass Flow Meter with computer control for accuracy of flow as good as 0.2 ml/min. even during Gas Switch it will stabilize the flow quickly. |
| 5 | · Colour LCD Display shows Data of different thermal signals, Determined Temperature, Sample Temperature, Oxygen flow, Nitrogen Flow etc.. |
| 6 | · USB interface with PC. WINDOWS XP to WINDOWS 8 compatible software for both 32 bit as well as 64 bit OS. |
| 7 | · Automatic Temperature Calibration using Software |
| 8 | · Automatic Calculations using Software |
| 9 | · DSC +/- 10, +/-20, +/-40, +/-100, +/-160, +/-200 mW with Auto Ranging Accuracy : 0.02 mW Controlled Temperature Temperature Range : RT to 500 °C Temperature Accuracy : 0.1 °C |
| 10 | · Heating Rate : 1 to 30 °C / min |
| 11 | · Gas Control Gas Flow Range: 0 to 200 ml / min Flow Control Accuracy : 0.2 ml / min |
| 12 | · Gas Pressure 0.2 MPa |
| 13 | · Crucible Material Aluminum |
| 14 | · Operating Condition Room Temperature : 15 °C to 25 °C |
| 15 | · Humidity : 55 to 75% RH |
| 16 | · Standards: IS 4984:2016, ASTM D 3895. |

31

Rockwell Hardness

| | | |
|---|---|--|
| 1 | Motorized | |
| 2 | Automatic | |
| 3 | Digital, OLED display | |
| 4 | Scales A, B, C, D, E, F, G,H, K, L, M, P, R, S and V | |
| 5 | Full color display | |
| 6 | On-line statistics | |
| 7 | USB/RS-232 output | |
| 8 | Machine should comply to ASTM D 785 | |
| 9 | Calibration Certificates should be provided from NABL accredited lab | |

32

Universal Microscope

| | | |
|---|------------------------|--|
| 1 | Microscope Stand | Rigid & stable stand with well contured large modular base, Ball Bearing guideways & slides provided extra smooth movement |
| 2 | Viewing Head | Binocular interchangeable with Trinocular Head for microphotography & CCIV Projection system, with dioptic & interpupillary adjustment |
| 3 | Focussing | Co-axial coarse & fine focusing module |
| 4 | Stage | Large size stage with co-axial low drive for convenient viewing of specimens |
| 5 | Magnification | 40x - 1500x |
| 6 | Diascopic Illumination | Illumination with halogen lamp 6V-20W built in base having transformer and variable control |
| Calibration Certificates should be provided from NABL accredited lab | | |

33**Volume and Surface Resistivity Test**

| | | |
|---|-----------------------------|------------------------|
| 1 | Test Voltage | 10 to 1000 V AC |
| 2 | Insulation Resistance Range | 10e3 Ohm to 10e 20 Ohm |
| 3 | Volume Resistivity Range | 1 x 10e20 Ohm cm |
| 4 | Surface Resistivity Range | 1 x 10e20 Ohm cm |
| 5 | Test Jig | As per ASTM D257 |
| Machine should comply to ASTM D 257 | | |
| Calibration Certificates should be provided from NABL accredited lab | | |

34**Weighing balance (Dharam Kata 40 MT)**

| | | |
|---|--|------------------------------|
| 1 | Weighbridge Platform Size | 9 x 3 mtr. |
| 2 | Maximum Capacity | 40 MT |
| 3 | E-Value/Division | <u>±</u> 10kg |
| 4 | Load Cell Type | Double Ended Shear Beam Type |
| 5 | Load Cell Quantity | 06 Nos |
| 6 | Load Cell Capacity | 20 mtr. each load cell |
| Digitizer Features (Weighing Terminal) | | |
| 7 | Graphical LED Display | |
| 8 | Inbuilt 200000 Memories Storage Facility | |
| 9 | USB Port for Data Entry | |
| 10 | Coding Facility (100 code for 4 entries) | |
| 12 | Multi-level password for security | |
| 13 | USB port for pen drive (Data Backup in Memory stick) | |
| 14 | Power supply- Linear Mode with EMI/RFI Filter and Spike Suppressor | |