

## Technical Specification for Testing Equipments

### Atomic Absorption Spectrophotometer

S No		Specification
Thye machine should be capable to conduct Effect on water test on UPVC pipes and fittigns as per Indian standards IS 4985, IS 7834, IS 12818 etc.,		
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 <b>minimum of 50 sample positions</b> 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 <b>local air compressor</b> and an imported or <b>local re-circulating water</b> chiller unit of appropriate capacity for cooling of Graphite Furnace must be quoted by the manufacturer.
11		Auto sampler for flame
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. (HCL or other specific lamps should be quoted if required.)
		Lamps & Standards for elements Lead, Tin, Cadmium, 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.
		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
		<b>Zeeman Background correction or other suitable background correction for GF to have higher light through put</b>
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.
12	Scope of Supply	Equipment with mentioned specification and standards with calibration certificates . Require accessories like screw vials, Vial caps, Sampling Vials total of 500 Nos. and suitable accessories, PC, Nitrous oxide, Acetylene, Nitrogen and Argon Cylinders with Regulators, Gas purification system, Air compressor, Fume Hood and other safety accessories and UPS. Bidder should supply complete start up package including material necessary to prove the machine and provide training. Other items if any for smooth conduct of test as per requisite standard shall be supplied with the instrument.

#### Arc Resistance

S No	Specification	
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
NIST traceable/NABL accredited calibration certificates to be supplied		
Scope of Supply :		Equipment with mentioned specification and Calibration certificates. Other items if any for smooth conduct of test as per requisite standard

#### **Automized Izod / Charpy Impact Tester with Notch Cutter as per ASTM**

S No	Specification	
	The machine should offer following key features	
1	Machine Design	<p>Microprocessor based instrument to automatically calculate and display impact energy absorbed by a specimen. It should resolve energies less than 0.03% of the capacity of the pendulum.</p> <p>With the proper selection of accessories, machine should perform Izod &amp; Charpy tests in accordance with</p> <p>ASTM D256 &amp; ISO 180 (Izod Impact)</p> <p>ASTM D6110 &amp; ISO 179 (Charpy Impact)</p> <p>Easy switching between tests by choosing appropriate striking bit</p>
2	Pendulum	Aerodynamic compound pendulum with facility to increase/decrease pendulum capacity with addition/removal of weights enabling user to change to desired capacity quickly & easily
3	Display	<p>Should offer simple machine configuration and setting test parameters through display</p> <p>Selectable energy units of J, in.lbf, ft.lbf, kgf.m, kgf.cm</p> <p>Selectable strength calculations in ft.lbf/in, J/m, kgf.m/m, KJ/m<sup>2</sup>, in.lbf/in, kgf.m/m<sup>2</sup></p> <p>Should offer break type input options</p> <p>Should provide real time display of energy</p>

		Simple calibration routine which should automatically calculate the Windage and Friction losses
		Facility to set Upper and Lower Limits for Energy and Strength
		Toss Correction for low energy specimens should be implemented automatically or by keypad entry
4	Technical Specifications	<p>Basic pendulum capacity: 2.82J, with addition of weights, user should be able to change it to 25J (Standard),</p> <p>Drop Height: 0.61m</p> <p>Impact velocity: 3.46m/s</p> <p>Power: 220V/50Hz, single phase</p> <p>Communication: should be provided for the output of test data to a serial printer or computer</p>
5	Charpy setup	
		Should include charpy striker, anvils, setting gauges & supports as per ASTM D6110 & ISO 179
6	Izod setup	
		Should include Izod striker, setting gauges & supports as per ASTM D256 & ISO 180
		Notch Aligning tool for specimen Positioning
7	Add-on Weights	
		Various weight sets upto 25J capacity (ISO & ASTM methods)
8	Certification	
		Calibration/verification certificate issued by UKAS or A2LA or any other international body shall be provided.
9	Accessories	
		should be able to provide automatic specimen notcher to produce a notch in accordance with ISO 179, ISO 180, ASTM D256 & ASTM D6110. It should use single tooth diamond cutter to notch 28 specimens (3.2mm thick) simultaneously. It should feature air cooling system to reduce risk of thermal degradation
Scope of Supply :		Equipment with mentioned specification and calibration certificates
		Basic Equipment, Aerodynamic compound pendulum, Weights for pendulum, Izod and Charpy setup, Specimen notch cutter and other additional items required to carry out Izod and Charpy impact test as per the standard requirements.
		NIST traceable/NABL accredited calibration certificates to be supplied

### Comparative Tracking Index

S No	Specification	
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
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 degree Chisel point edge, 0.05 to 0.1 mm radius at the tip)
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. Provision for Conductivity measurement of the solution should be provided.
Scope of Supply :		Equipment with mentioned specification
17		Basic Equipment, Brass and Platinum electrodes. Other items if any for smooth conduct of test as per requisite standard
18		NIST traceable/NABL accredited calibration certificates to be supplied

### Contour Cutter

S No	Specification	
1	High Cutting Speed.	1600 rpm with speed regulator
2	Standard milling cutter	For tensile, compression, flexural, impact test specimen Preparation from rigid plastics
3	Milling Performance	With depth of cut adjustment (0.05mm) & Easy Operation with dust collector by vacuum method.
4	Power Requirement	Single Phase-15 Amp.
5	Standard templates	as per ASTM & ISO standards.
Scope of Supply :		Equipment with mentioned specification
		Basic Equipment, Templates

### Creep Tester

S No	Specification	
	<b>General</b>	Should meet the requirement of IS 16098
		Shall be capable to carry out testing on DWC pipes upto DN/ID 600 mm
		Capable to operate 3 samples simultaneously as per standard requirement
		Continuous data logging for 48 days or more as per standard requirement
		Software to calculate Creep ratio of Pipe samples
		Supporting system and sample holders and other necessary accessories to be supplied along with machinery for proving the accuracy and working range of Machine.
		NIST traceable/NABL accredited calibration certificates to be supplied

### Deep Freezer

S No	Specification	
1	Temperature Control	Microprocessor
2	Display	LED
3	Internal Volume	500 lt,
4	Type	Horizontal
5	Temperature	Ambient to -10 °C; Accuracy 0.1 C
6	Internal Body Material	Stainless Steel AISI 304 Grade
7	External Body Material	Powder Coated CRCA Steel
8	Insulation	120 mm minimum, CFC free polyurethane foam
9	Noise Level	Less Than 65 db (A)
10	Battery Backup	Sealed Maintenance Free Battery (For display, chart recorder & alarm only)
11	Power Failure Alarm	Audio Visual Alarm
13	Calibration certificate	Calibration certificate should be provided from NABL accredited lab
Scope of Supply :		Equipment with mentioned specification & Calibration certificates
		NIST traceable/NABL accredited calibration certificates to be supplied

### Differential Scanning Calorimetry

Differential Scanning Calorimetry		
S No	Specification	
<b>Preamble:</b> To study the thermal characteristics of polymeric material / product as per test standard ISO, ASTM etc.		
<b>Technical Specifications</b>		
1	Tempearture range	(-70 C to +400 C) or better

2	Multiple cooling options for a temperature range	(-70 °C to +400 °C) or better
3	Calorimeter Sensitivity	1.0 µW
4	Precision	± 1%
5	Dynamic range	±750 mW
6	Baseline noise	< 1 µW
7	Temperature accuracy	±0.1 °C
8	Temperature Precision	±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, IS 4984 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 printers should be provided
		Built in digital flow controller & gas switching assessor
		Copper pans (100 Nos), Aluminium (500 Nos) should be provided
15	Scope of Supply	Equipment with mentioned specification and standards with calibration certificates . Require accessories like Copper and Aluminium pans and suitable accessories for heating and cooling cycle., PC,Cylinders with Regulators, and UPS. Bidder should supply complete start up package including material necessary to prove the machine and provide training.Other items if any for smooth conduct of test as per requisite standard shall be supplied with the instrument.
		CRM with NIST traceable/NABL accredited calibration certificates to be supplied

#### DYNAMIC MECHANICAL ANALYSER (DMA)

S No	Specification	
1	Temperature Range	from -150°C to 500 °C or better on both side
2	Temperature Resolution	0.1 °C
3	Heating Rate	0.1 to 20 °C/min or higher
4	Cooling Rate	0.1 to 20 °C/min or higher
5	Cooling system	Automated cooling system should be provided to achieve the specified low temperature



6	Force Range	18 N (Max) and 0.001N (Min)
7	Force Resolution	0.0005N or better
8	Tan $\delta$ Range	0.0001 to 10
9	Resolution	$1.0 \times 10^{-4}$
10	Sensitivity	$1.0 \times 10^{-3}$
11	Sample Deformation modes	Single and dual cantilevers
		bending modes: 3-point bending mode
		Tension and compression modes
		Shear Mode
		(Fixtures should be provided to all modes)
12	Sample Deformation Range	1 mm to 1 cm or better
13	Amplitude resolution	10 $\mu$ or better
14	Modulus Range	$10^3$ to $10^{13}$ Pa
15	Modulus Resolution	0.01 Pa
16	Frequency Range	0.001 to 300 Hz with minimum of 0.01 Hz increment or better
17	Liquid Nitrogen Dewar	Dewar of capacity of 50 ltr or better should be provided in the system
18	Other	<ul style="list-style-type: none"> <li>Humidity Controller in the chamber</li> </ul>
		<ul style="list-style-type: none"> <li>Provision for control flow of N<sub>2</sub> or Air</li> </ul>
		<ul style="list-style-type: none"> <li>Calibration Standard Kits should be provided</li> </ul>
19	Software	compatible to Windows 10 OS and should have the capabilities to programme stress, strain, amplitude etc.
		capable of collecting data on storage, modulus, loss modulus, tan delta, complex modulus, complex / dynamic viscosity, creep compliance, etc.
20	Workstation	To be provided
21	Installation and commissioning	The vendor should support necessary site preparation for installation. Vendor should carry out installation and commissioning of the machine and its accessories on a turnkey basis
22	Technical support and service	Manufacturer should have established after sales & service network in India. The vendor shall have local service and application office and infrastructure to attend by visit within 48 hours of need. Technical support personnel must have adequate experience in this field. Technical support personnel details should be submitted. Name and address of the authorized service centre/ partner in India along with the certificate of authorization should be attached.

23	Scope of supply	Machine, standard accessories, Fixtures for testing, work station with softwares and other items if any for smooth conduct of test as per requisite standard. Bidder should supply complete start up package including material necessary to prove the machine and provide training.
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#### Elmendorf Tear Tester

S No	Specification	
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
Scope of Supply :		Equipment with mentioned specification and Calibration certificates. Other items if any for smooth conduct of test as per requisite standard
		NIST traceable/NABL accredited calibration certificates to be supplied

#### Environmental Stress Cracking Resistance (ESCR)

S No	Specification	
1	Constant temperature bath with lid.	Inside-SS, Outside : Powder coated MS with heat insulation, Lid: SS.
2	Heating System	Heater with digital temperature controller (PID)
3	Thermometer for bath	Ambient to 100°C ( Digital)
4	Accuracy	±0.10°C
5	To maintain uniformity in temperature throughout the bath	Stirrer should be provided.
6	Blanking die for cutting specimen	38±2.5 mm x 13±0.8mm with ejector
7	Nicking Jig of lever arm with dial gauge	0-10 mm
8	Notch depth adjustment	0.30, 0.40, 0.50, 0.65 mm with notch length 19 mm
9	Bending cum transferring device	1 No.
10	Specimen Holder	SS (10 Nos.)
11	Test Tubes (Glass)	32 mm dia and 200 mm length (10 Nos)
12	Rubber Corks fit to the glass tubes	10 Nos.
13	Interchangeable notching blades	5 Nos.
14	Thermometer	1)50°C (20 to 60°C range) 2)100°C (60 to 105°C)
15	Test Conforms to	ASTM D 1693, IS 8747

16	Other features	Poly-oxyethylated Nonyl-Phenol / IGEPOL CO 630 (1 Lt) should be provided
17	Calibration certificate	Calibration certificate should be provided from NABL accredited lab
Scope of Supply :		Equipment with mentioned specification and Calibration certificates. IGEPOL CO 630 1l, Jig, Specimen holder, Notch depth measurement device, Bending device, Notching Balder, Thermometer. Other items if any for smooth conduct of test as per requisite standard
		NIST traceable/NABL accredited calibration certificates to be supplied

### Falling Weight Impact Tester for Pipe

S No	Specification	
1	Standards	IS 4985, IS 12818, IS 13592, IS 12235
2	Falling weight testing machine	Main frame with guide rail or tube fixed in a true vertical Position
3	Release Mechanism	Release mechanism with free fall from variable height up to at least 2 Meter with an accuracy of $\pm 10$ mm
4	Max. Fall Height With calibrated scale	2050mm $\pm 10$ mm
5	Suitable upto pipe size	630 mm
6	Mass of the Striker (kgs)	0.25,0.5,1.0,1.25,1.6,2.0,2.5,3.2,4.0,5.0,6.3
7	Material of striker	SS
8	Specimen holder for pipes	V Block with adjustable height.
		V' Block base size 300 x 300 mm
		V'Block base thickness 25 mm
		V' Block Angle : 120
9	Other features	Equipment shall have good workmanship and design to facilitate the easy operation with safety.
		The equipment shall operate in such a way that all strikes of a specimen shall be completed within 10 seconds.
17	Calibration certificate	Calibration certificate should be provided from NABL accredited lab
Scope of Supply :		Equipment with mentioned specification and Calibration certificates. Other items if any for smooth conduct of test as per requisite standard
		NIST traceable/NABL accredited calibration certificates to be supplied

### Flex Tester

S No	Specification
1	Stroke : 80 or 155mm
2	Twist : 400° Short stroke

3	Twist : 440° Long stroke
4	Digital Counter for oscillations
5	Totaliser
6	Home Switch
7	Stainless Steel Cutting Template: 280mm x 200mm
8	Machine should comply to ASTM F 392, IS 14611
9	<b>NIST traceable/NABL accredited calibration certificates to be supplied</b>
Scope of Supply :	
Equipment with mentioned specification and Calibration certificates. Other items if any for smooth conduct of test as per requisite standard	

### FT-IR Spectrometer

S No	Specification	
1	Wave number	4000-350 cm <sup>-1</sup>
2	Spectral resolution	0.5 cm <sup>-1</sup> or better
3	Signal to Noise ratio	40000 : 1 or better ( peak to peak)
4	Detector	High performance DTGS
5	Beam splitter	Ge coated KBr with moisture resistant coating on surface
6	Light source	Solid state Mid – infrared / Infra red emitter
7	Sample Interference	ATR – Attenuated Total Reflection ( Monolithisc diamond ) to meet the range
8	Internal Validation	Performance validation through inbuilt calibration with NIST traceability standards
9	Library	Library of Polymeric materials, blends, chemical compounds shall be provided
10	Standard	Shall meet ASTM E 1252
11	Warranty	3 years
12	ACCESSORIES	
		<ul style="list-style-type: none"> <li>• Hydraulic Press for pellet/sample preparation ( 15 ton )</li> <li>• Mortar and pestle</li> <li>• Dies</li> <li>• KBr set for Pellets</li> <li>• KBr Powder</li> <li>• Pellet holder</li> <li>• Diamond ATR</li> <li>• ATR Crystal- Diamond</li> <li>• liquid cell holder</li> <li>• Replacement dessicant</li> <li>• Liquid Cell Window</li> <li>• Liquid Cell Window material</li> <li>CRM with NIST traceable/NABL accredited calibration certificates to be supplied</li> </ul>

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

S No	Specification	
	Testing standard	ASTM D1434, ISO 15105
1	Testing range	0.02~50000 cm <sup>3</sup> / (m <sup>2</sup> · 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
	Number of Stations	3
8	Gas port	1/8 inch rubber tube
9	Test gas	O <sub>2</sub> , Co <sub>2</sub> , N <sub>2</sub> , etc
10	Test area	50.24 cm <sup>2</sup>
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.
		Display to observe temperature, humidity and transmission without external computer.

	Calibration	instrument support to two methods of reference materials and standard gas to certificate and calibrate;
	Scope of Supply :	Machine, standard accessories, work station with softwares and other items if any for smooth conduct of test as per requisite standard. Bidder should supply complete start up package including material necessary to prove the machine and provide training.
		NIST traceable/NABL accredited calibration certificates to be supplied

### Gas Chromatography

S No	Specification	
Preamble: To determine Vinyl Chloride monomer (VCM) content in PVC resin as per IS:10151		
Technical Specifications		
1	Oven	The Column oven has an operating range of ambient to 450 C.
2		Heat up time from 50 C to 450 C within 5 minutes (230VAC Version)
3		Cool down time from 450 deg. C to 50 deg. C in less than 5 minutes.
4		Heating Rate settable from 0.10 deg. C /min to 110 C /minute with at least 9 Rates/10 plateaus.
5	Split / split less Injector – 01 no.	The injector is able to operate with capillary wide bore and packed columns.
6		The injector features an optimized, modular thermal profile for Split and splitless injection with a cold head.
7		The injector allows timed closure/opening of the purge line.
8		Maximum Temperature : 400 C
9		Split Ratio : up to 10,000:1 or better.
10		Pressure Range : 0-100 PSI or better
11		Total Flow Setting
12		Control of Split flow in 1 ml/min from 0 to 125 ml/min
13		Control of Purge Flow 0 to 50ml/min

14	Detector	The GC must have complete integrated control of all parameters for the following detectors FID & TCD - Detector must be fitted with the instruments (Mandatory) NPD, ECD (Optional)
15	Flame Ionization Detector	Flameout detection and automatic re-ignition
16		MDL :1.5pg C/Sor better.
17		Sensitivity : >0.03 Coulombs/gC
18		Linear Dynamic Range : >10 <sup>6</sup>
19		Maximum Temperature : 450 C in steps of 10 C.
20		Data Acquisition Rate : 200 Hz or Better.
21		Signal filtration: 50, 200, 800 m.sec.
22		Input range: -1 to 20
23	Thermal Conductivity Detector	Capillary column compatible
24		Proven Constant current design, Software protection to prevent filament burnout
25		Ideal for series operation
26		1/8-in fittings
27		PPC pneumatics - software flow control of reference gas
28		Operating temperature: 100 C to 450 C in steps of 10 C.
29		Sensitivity : 9µV/ppm nonane at 160 mA at the bridge with a detector temperature of 100 C
30		Minimum Detectable quantity: Typically < 1 ppm nonane
31		Power Supply: Constant current with 4 selectable settings: ±40 mA, ±80 mA, ±120 mA, ±160 mA,
32		Linearity: > 10 <sup>5</sup>
33		Signal filtration: 50, 200, 800 m.sec.
34		Filament protection: Self limiting & resetting after transient overloads in either channel
35		Make up gas: Required for 0.25 mm or smaller. i.e. Columns autosampler independent.
36	Software	Latest 32/64 Bit Software for complete control and data acquisition from GC .
37		It should be able to collect data from 2 detectors simultaneously.
38		It should be upgradable to control 2 or more GC in future.

39		It should have all routine chromatography functionalities like full GC parameter, setting, viewing Chromatograms, calculation based on % area, Area normalization, External standard, internal standard etc. Viewing of calibration curves, addition and subtraction of chromatograms etc., internal standard etc. viewing of calibration etc.
40	Head Space Sampler	Head Space Sampler either by Transfer line technique or heated Syringe base technique.
41		Sample Tray have Capacity of more than 40 Samples.
42		Incubation temperature 200 °C or better with at least 6 Vials or more Simultaneous heating capacity with overlapping mode.
43		Syringe Temperature should be up to 150 °C or transfer line temperature must be 200 °C or better.
44		Head Space sampler with Auto dilution, Standard preparation facility is preferable .
45		It should be compatible with 10 or 20 ml vials.
46		It should have built-in constant temperature mode, multiple Headspace extraction mode and mode for optimization method parameters ( Progressive mode)
47		Injection Volume Range settable from 0.1 to 5 ml
48		Should be capable to connect with MS in future
Scope of Supply :		Machine, standard accessories, work station with softwares and other items if any for smooth conduct of test as per requisite standard. Require accessories like screw vials, Vial caps, Sampling Vials total of 500 Nos. and suitable capillary column, PC,Cylinders with Regulators, Gas purification system and UPS. Bidder should supply complete start up package including material necessary to prove the machine and provide training.

#### Gloss meter

S No	Specification	
1	Required angle	20°, 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
Scope of Supply :		Equipment with mentioned specification and standards with calibration certificates (as mentioned in accessories). Other items if any for smooth conduct of test as per requisite standard
		CRM with NIST traceable/NABL accredited calibration certificates to be supplied

### Glow Wire Tester

S No	Specification	
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 950°C adjustable
4	Temperature precision	± 5°C
5	Max. output power	1000 W
6	Glow wire application time	0.1-999.9 sec
7	Sample loading	Test sample moves against glow-wire preloaded to 1.0 ± 0.2N
8	Sample loading	Test sample moves against glow-wire preloaded to 1.0 ± 0.2N
9	Sample carriage	Automatic, motorised movement of test specimen
10	Safety	Emergency stop, PLC interlocks
	Machine should comply to IEC 60695 and able to conduct test as per IS & ASTM Standards	
11	<b>NIST traceable/NABL accredited calibration certificates to be supplied</b>	
12	Scope of Supply	Equipment with mentioned specification and standards with calibration certificates . Other items if any for smooth conduct of test as per requisite standard

### HDT / VSP Apparatus (Microprocessor Controlled)

S No	Specification	
1	No. of Stations	3 Stations
2	Temperature Range	Ambient to 300 °C
3	Display for temperature & deflection	Digital, LCD
4	Measurement of deflection	Through LVDT
5	Accuracy	±0.1 °C
6	Chamber material	Stainless steel
7	Rate of Heating	120 °C/hr & 50 °C/hr
8	Test Conforms to	ASTM D 648, ASTM D 1525, IS: 4985, IS:12235, IS:12818, ISO:75
9	Load	For fibre stress of 4.6 kg/cm <sup>2</sup> 18.4 kg/cm <sup>2</sup> (HDT test) and 10 N & 50 N (VST test)
10	Other Features:	Water cooling system should be provided to cool the oil after every measurement. Required volume of silicone oil should be provided.
11	<b>NIST traceable/NABL accredited calibration certificates to be supplied</b>	
12	Scope of Supply	Equipment with mentioned specification and standards with calibration certificates. Sufficient quantity of cooling and Heating medium, Weights for HDT/VSP shall be included. Other items if any for smooth conduct of test as per requisite standard

### Hot Air Oven

S No	Specification	
1	Oven capacity ( Chamber volume)	1000 litres or more
2	Temperature range	Ambient to 300 °C
3	Display Resolution	0.1 °C
4	Accuracy / temperature stability	± 1 °C
5	Temperature sensor	Ambient to 300 °C
6	Control	Microprocessor based PID control
7	No of trays	4 or more
8	Air circulation	Flange motor with impeller/blower
9	Construction	Double wall, with insulation, outer door key lockable, inner glass viewing door. Wheels should be provided
10	Calibration certificate	From NABL Accredited lab

### HYDROSTATIC PRESSURE TESTER

S No	Specification	
1	Test Standard	HDPE, PVC, PPR, Lateral pipes as per IS 4985, IS 4984, IS 12786, IS 14333, IS 14151, IS 15328,
2		IS 15801, EN 921:1994, ASTM D 1785 & other relevant standards

3	No. of Stations	05( FOR Long / Short term test) and 01 for Burst test
4	No of ports for each station	3 ( for connecting 3 samples simulatneously) for long / short term
5	Unit of pressure	kg/cm <sup>2</sup> , MPa, BAR
6	Pressure Range	0.00 to 99.99 kg/cm for Long term/Short Term; 250 kg/cm <sup>2</sup> fro Burst tester
7	Pressure Resolution	0.01 kg/cm <sup>2</sup>
8	Resolution of Timer	999.9 hrs.
9	Time Range	0.1 hour/6 minute( 5 stations) ; For Burst tester ( in Seconds)
10	Hydraulic Circuit	Made from corrosion-less S.S. 304 tubing and fittings
11	Compressed air requirement	Min. 3.0 kg/cm <sup>2</sup> from compressor unit
12	Pressure Developing System	Through hydro-pneumatic type reciprocating pump
13	No. of Pumps	02 pumps
14	Pressure control system	Hydro-pneumatic pressure regulating device with individual control of station.
15	Power Supply	230V AC, Single phase, 50Hz
16	Display Regulating accuracy	0.5 % of full scale
17	Accessories	QCPE - 18 nos ; 1/4 Hydraulic hose-18 NOS ( 5 MTR LENGTH EACH) ; Master gauge
18	<b>Equipment should fulfil the following features for Burst Tester ( 1 station)</b>	
19	The instrument must be suitable to carryout Hydro static Pressure Test as per	ASTM D 1785
20	Fine Filter has to be provided for water inlet	
21	01. Provision to record the starting time, Time of failure ( in seconds), over pressure time, pressure compensating time etc. Digital Hydro-static pressure (1Station) 250 Bars FOR Burst Test.	
22	Other Specifications :01. Microprocessor based pressure controller	to maintain the pressure within 0.5% accuracy of full scale.
23	02. Fully hydraulic Pneumatic system with central pressurized water supply.	Reliable high-pressure pneumatic pumps with operating pressure up to 250 bars.
24	03. With help of the digital controller machine can work as a burst tester or single station hydro-static pressure	
25	04. User friendly microprocessor based digital pressure controller .	
26	05. LCD based microprocessor with buzzer output.	
27	06. Maximum pressure range	0-250 bars.
28	07. Air less motorized pumping stations is provided to build the pressure very fast.	

29	08. All stations are provided with the QRC coupling to save preparation time.	
30	09. Auto protection of pressure transducers is also in built feature and a part of machine. Power supply: 3phase+Neutral+Earth with 15Amps power supply are required at customer end.	
31	Data logger	Data logger to monitor pressure variations and Failure analysis.
32	Equipment shall be calibrated	NIST traceable/NABL accredited calibration certificates to be supplied

### MELT FLOW RATE TESTER

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

<p>- <b>Die According to ASTM D1238 Method C (Half Die)</b>, for high flow rate polyolefins, Dia 1.048 mm, Length 4.00 mm, - Made of tungsten carbide; should be supplied with dimensional conformity certificate</p>	
<b>Recommended Spares:</b>	
- <b>Spare Standard Die/Nozzle and Piston</b>	
- <b>Fuses and Thermal Probe</b>	
<p><b>The equipment should be supplied with all the essential accessories to meet the standard methods mentioned above. The Basic start up kit including material for calibration shall be provided by the supplier. NIST traceable Calibration certificates to be provided with equipment</b></p>	

### Melting Point apparatus (Hot stage)

S No	Specification	
1	Temp Range(Deg. Centigrade)	Ambient to 400° C
2	Operation Grade	Automatic
3	Control System	PLC control/ Digital Display
4	Resolution	1 deg C or better
Other required accessories should be provided including magnifying lense		
<b>Calibration Certificates should be provided from NABL accredited/NIST traceable</b>		

### Notch Cutter

S No	Specification
1	The Notch cutter should be capable of cutting Notches on PE Pipe samples as per Indian and International standard requirement
2	Machine should meet the requirements of ASTM F-1474-93 and ISO-13479, IS 14885, IS 4984 (Amended).
3	should be fully equipped with the digital measurement for length & depth of the notch.
4	Control for 'V' Notch length should be digital and auto reversible.
5	Control for Depth of 'V' Notch is manual, and measurement should be digital.
6	Cutting rate should be digitally adjustable.

### Projection Microscope

S No	Specification
1	Suitable for thickness measurement/flow path measurement.
2	suitable for distance measurement between ribs of emitters, fitted in inline emitting pipes, as per IS-13488 standard
	Shall meet the requirements of IS-13487 & IS-13488

### Punching Press

S No	Specification
1	Base to guide - 171mm
2	Centre to back - 114mm

3	Diameter of screw - 46½
4	Hole through base (without ring) - 76mm
5	Hole through base (with ring) - 38mm
6	Stroke - 114mm
7	Hole in ram (Dia.) - 19mm
8	Hole in ram (Depth) - 38mm
9	Diameter of flywheel - 536mm
10	Height of the body - 631mm
11	The press can be hydraulic type with adjustable height; Max. height 500mm;
12	Distance between columns : 300mm Min.
13	Shall be supplied with Punching dies of the following specimen type Dumbell as per ASTM D 638 (Type I,II,III,IV & V), Rectangular as per IS 12818, IS 12701.

### Resistance to Dichloromethane Test Apparatus

S No	Specification
1	The Set up should meet the the requiriement of IS 13592 & AS PER is 12235 part - 11
2	The appartus should be equipped with Thermostat, to maintain the temperature of the dichloromethane at $15 \pm 0.5^{\circ}\text{C}$ . Cooling device to cool the dichloromethane to the specified temperature, Stirrer to homogenize the temperature of the bath

### Rockwell Hardness

S No	Specification
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	CRM with NIST tracebale calibration certificates to be supplied
8	USB/RS-232 output
9	Machine should comply to ASTM D 785
10	<b>Calibration Certificates should be provided from NABL accredited lab</b>

### Shore A & D hardness Tester

S No	Specification
	Shore A & D
1	Measurement range
2	Resolution
3	Accuracy
4	Indenter
5	Memory
6	Standards
7	Accessories

	0 ... 100 Shore A & D Units
	0.1
	$< \pm 1$
	$35^{\circ} \pm 0.25^{\circ}$
	Saves up to 500 measurements
	ASTM D 2240
	CRM with NIST tracebale calibration certificates to be supplied

	NIST traceable calibration certificate as per ASTM D 2240 shall be supplied.
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### TGA Apparatus

Specification		
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.
Balance	Sensitivity	0.1 µg
	Capacity	1300 mg
	Accuracy	Better than 0.02%
	Precision	0.01%
Temperature	Furnace	
	Range	RT to 1200 °C
	Scan rates	0.1 °C/min to 100 °C/min
	Precision	±1 °C
Cooling	Method	Forced air cooled with an external fan
	Cycle time	1100 °C to 50 °C
Sample Pans		Platinum(100 µL)- 5nos , ceramic (100 µL)- 3nos & ceramic (250 µL)- 3nos
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.
	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
Standard weight	For balance calibration	1 mg & 100 mg ( with certificate)
CRM	to be provided with NIST Traceability	Nickel, Calcium Oxalate Monohydrate or equivalent
Spare		Thermocouple; Wire- 3nos
Tools		to be provided
Computer & Printer		to be provided
Software		to be provided

Power Supply		230V 50 Hz
UPS		5KVA
Machine should comply to ASTM E 1131		
<b>Calibration Certificates should be provided from NABL accredited lab</b>		

### Universal Testing Machine \_ 10 tonnes (Fully computerised)

S No	Specification	
1	Control System	Microprocessor controlled
2	Maximum Load Capacity	100 kN
2	Cross head Travel distance	Min 1000 mm
3	Horizontal daylight	Min. 400mm
4	Cross Head Speed	
4.1	Minimum	<b>0.01 mm / min</b>
4.2	Maximum	<b>500 mm/min</b>
4.3	Accuracy for Cross head speed	± 0.1 mm/min
5	Load cells	100 N, 1 kN, 10 kN & 100 kN
6	Load cell Accuracy	≤ 0.5 %
7	Grips & Fixtures	Pneumatic and Manual
		Tensile (suitable for plastics, rubber, film and fibre) compression, flexural fixtures.
		Rigid plastics (self lock wedge grip, opening up to 12mm), plastic/composite rod (upto 12 mm dia) woven sacks (50mm width), rubber, fibre/filament.
		3 point Bend Fixture, Adjustable Span – 40 to 200 mm ,10 mm dia Loading nose and support ,Width 50 mm, Capacity: 1000 Kg
	<b><u>Operating Console</u></b>	
		Backlit LCD Display
		Keypad for easy setup and functions.
		Facility to Calibrate Loadcell
		Useful for Performing Standard Test without PC.
8	Test Conform to	Tensile: ASTM D 638, ASTM D 882, and ISO 527
		Flexural: ASTM D 790 and ISO - 178
		Compression: ASTM D 695
9	Extensometer	<b>Ready to connect LONGTRAVEL .</b>
		Range 800 mm
		Resolution : 0.1 mm
10	Data Acquisition Rate:	24-bit resolution card with data acquisition rate of minimum 500 Hz simultaneously on load, extension, and strain channels.
11	Data Sampling Rate:	<b>more than 1KHz internal conversion</b>



12	Safety lock provisions	Limiting switch for cross head travel should be provided
13	Software	(a) Software for data storage for sample test methods
		(b) Software should automates data acquisition, machine control, analysis, and reporting for a wide range of test requirements.
		(c) In addition, data compilation and provision for stress relaxation and creep shall be provided as per relevant ASTM Standards
		(d) Window's based graphical user interface.
14	Essential Accessories	
15	Computer System	Computer with suitable configuration to support the software and printer
16	Calibration certificate	Calibration certificate for load cells and extensometer traceable to National / International Standards should be provided
17	Scope of supply	Bidder should submit complete scope of supply (Machine, standard acessories, Optional Acessories etc with make model) in the technical bid without price.Bidder should supply complete start up package including material necessary to prove the machine and provide training.
18	INSTALLATION, COMMISSIONING AND TRAINING	
	Installation and commissioning requirements	Bidder should submit the preinstallation requierements such as space etc., . State clearly the specifications of electical requirement.Vendor should carry out installation and commissioning of the machine and its accessories on a turnkey basis.
	Training and documentation	Minimum of 5 days training for five persons which includes basic & advanced level training. Training content and plan to be submitted. Training faculty must have adequate experience in this field.
		The vendor should supply the necessary manuals such as
		• Software instruction
		• Maintenance and trouble manual
		• Training
		• Installation and Commissioning
		• Handling of accessories
		• Software key (if any)
		• Software CDs
		NIST tracebale/NABL accredited calibration certificates to be supplied

### Double Beam UV Spectrophotometer

S No	Specification	
1	Wavelength range	190-1100 nm
2	Wavelength Accuracy	$\pm 0.5$ nm or better
3	Wavelength reproducibility:	$\pm 0.1$ nm or better
4	Optics	Monochromator with grating and step motor / reference beam
5	Baseline Flatness	$\pm 0.001$ 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 2 sets of glass and 2 sets of quartz cuvette to be offered
<b>Calibration certificate should be provided from NABL accredited lab</b>		

### UV weathero meter

S No	Specification	
1	Applications	To simulate, accelerate and correlate the artificial sunlight / weathering atmosphere for polymers, coatings, etc.
2	Effective radiation area	4000 cm <sup>2</sup>
3	Components surface temperature	45°C to 80°C for UV Cycle
		45°C -60°C for Condensation
5	Temperature accuracy	± 0.1°C or better
6	Temperature resolution	1°C or better
7	Temperature controller	Black Panel Temperature
8	Centre distance of lamp	5 cm
9	Humidity	100%
10	Light source	UV-B Fluorescent Lamp
11	Wavelength	UVB (313 nm)
12	Minimum sample holder plates	Aluminum Plates 24 sample holders
13	Conditioning cycle	Light cycle and Condensation cycle
14	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
15	Conforms to standards	ASTM G151, ASTM G 154, ISO 4892 (1 – 3), SAE J2020
16	Warranty	Minimum 3 years of warranty to be provided
17	Scope of supply	Complete list of items quoted are to be provided + 12 UVB lamps+ 1 No. of Calibration sensor/Device
18	Installation requirements	Bidder to specify the preinstallation requirements
19	Training	Onsite training for system operation and maintenance as well as application support should be provided by the vendor at its own cost.
		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.

20	Service	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

**Vibration Table**

S No	Specification	
1	Shall conform to	Standard IS 2798 Clause 6.2
2	Capacity	For testing of containers upto 20 litres
3	Size	Vibration table size 300mm x 300 mm (Approx)
4	Frequency	3,4,6 Hz
5	Digital Accelerometer	0.5 to 1.1 g ( with calibration certificate )
6	Other Features	<ul style="list-style-type: none"> <li>• Spring loaded motorized vibration arrangement</li> </ul>
		<ul style="list-style-type: none"> <li>• RPM indicator, digital sensor</li> </ul>
		<ul style="list-style-type: none"> <li>• VFD incorporated for variable speed</li> </ul>

**Volume and Surface Resistivity Tester**

S No	Specification	
1	Measurement Range	Up to 2.0 Tera Ohms
2	Input Supply	230 V
3	Display	Digital
4	Confirming to Standard	ASTM D 257
5	Electrode	Standard electrodes, Guard ring as per the dimension given the above standard for polymers
	D C Power Supply	10 V, 100 V, 500 V
	Product Description	<ul style="list-style-type: none"> <li>• <b>DC Test Voltages</b></li> </ul>
		<ul style="list-style-type: none"> <li>• <b>Accuracy +- 1%</b></li> </ul>
		<ul style="list-style-type: none"> <li>• <b>Stability +- 0.01%</b></li> </ul>
		<ul style="list-style-type: none"> <li>• <b>Resistance Auto ranging</b></li> </ul>
		<ul style="list-style-type: none"> <li>• <b>Display 4 line LCD display</b></li> </ul>
		<ul style="list-style-type: none"> <li>• <b>Warm Up Time 1 minute</b></li> </ul>
	Machine should comply to ASTM D 257	
	<b>NIST traceable/NABL accredited calibration certificates to be supplied</b>	

## WVTR

S No	Specification	
1	Test range	0.002-100 g/m <sup>2</sup> · 24h (film and sheet) (Unmasked).
2		0.04-2000 g·m <sup>-2</sup> ·24h <sup>-1</sup> (masked)
3	Test precision	0.002 g/m <sup>2</sup> · 24h (film and sheet) or better
4	Measurement Accuracy	±0.01 g·m-224 h-1 or 3% of the measured value( which is greater)
5	Temperature range	10- 50
6	Temperature	±0.1
7	accuracy	
8	Humidity range	30~90%RH, or better
9		
10	Humidity accuracy	±1.5 %RH
11		
12	Test area	50.00 cm <sup>2</sup>
13		
14	Sample size m	Φ100 m
15		
16	Sample thickness	Max 2.5 mm
17		
18	Number of test sample	1 piece
19	Carrier gas	99.999% N <sub>2</sub>
20	Carrier gas pressure	≥0.1MPa
21		
22	Carrier gas flow	10 - 75 mL/min
23		
24	Gas supply port	1/8 inch metal pipe
25		
26	Power supply	AC 220V, 50Hz
27		
28	Other	<b>WINDOWS based Industrial standard Software for complete control and data Acquisition.</b>
29		➤ Create and save setups
30		➤ Automatic Test Sequence from Sensor conditioning to Flushing of system.
31		➤ Graphical indication of TEMPERATURE, RH, OTR or WVTR for Conditioning as well as Testing.
32		➤ Indication for important parameters like, Sensor temperature, flow, Barometric Pressure etc...
33		➤ Display of current ppm values for WVTR .
34		➤ Report generation & printing
35		➤ Review of old tests saved
36		<b>PC &amp; Printer suitable for the Permeation Tester must be offered as part of package.</b>

37		OS : XP or above
38		Monitor : Minimum 17" LCD
39		Preloaded Software with license (backup of software must be provided on CD or PENDRIVE)
40		WINDOWS licensed Software pre-loaded
41		Color Inkjet Printer
42		
43		<b>Power Supply :</b>
44		230V, 50 Hz
45	<b>Calibration</b>	instrument supports two methods of reference materials and standard
46		gas to calibrate and certificate; certified reference materials for normal testing,
47	Instrument must be suitable for testing WVTR as per <b>Standards:</b> ASTM F1249, TAPPI T557, JIS K-1729 and ISO 15106-2	

### Xenon Test Chamber

S No	Specification
Should be completely automated and capable of operating continuously with following facilities:	
Sl. No.	Technical Specifications
1	Light source - Air cooled Xenon Arc Lamps
2	Sample compartment – Approx. 3000 Sq. cm or more
3	Microprocessor control required
4	Touch screen/key pad
5	Irradiance control required
6	Irradiance Sensors at 340nm, 420 nm & TUV range
7	Irradiance Calibration device for quick, easy, error free and automatic calibration
8	Optical Filter system to simulate outdoor / indoor testing
9	Filters should be of non-ageing type to avoid frequent change
10	Black Panel Temperature (BPT) Control
11	Black Standard Temperature (BST) Control
12	Chamber Air Temperature Control
13	Simultaneous control of BST & CAT required
14	Relative Humidity Control required
15	Provision of water spray front & back required
16	Data logging interface along with software
17	Capability of mounting and testing fabric specimens
18	Compliance to various international standards (ISO, ASTM and other standards)
<b>(B) Accessories:</b>	
1	Specimen holder set for Xenon test chamber.
2	One Set of Xenon Arc Lamps for Xenon test chamber
3	Other types of Filters (Window glass, UV/Extended UV) for Xenon test chamber
4	Suitable Radiometer with NIST Traceable calibration certificate for optional filters for Xenon test chamber
5	Black Panel Calibration Thermometer for Xenon test chamber
6	Provision for back spray and dual spray in xenon test chamber

### Karl Fisher Titration Apparatus

S No	Specification	
1	Scope	Microprocessor based Karl Fisher Titrator machine for water content test in Polyethylene Piping Materials and components as per Annexure D of IS: 4984-2016, table 2
2	Range of detection	50 ppm or better to 100% H <sub>2</sub> O as per IS 2362,
		as referred by IS 4984: 2016
3	Burette Precision	Volume 10ml ;Burette discharge $\pm 0.015$ ml ;Repeatability 0.005ml or better
4	Endpoint detection	By polarized potential level detected with a twin platinum electrode or
5	Data storage	500 samples data minimum
6	Calibration	Calibration Certificate from NABL Accredited lab or Traceable to NIST

### Cold water Bath

S No	Specification	
1	Dimension	Inside Dimensions in mm 1500 X 1000 X 800 (L X W X H)
2	Range	0°C to Ambient
3	Controller	Digital temperature Indicator & PID controller
4		Necessary Heating and Cooling System shall be provided
5	Accuracy	0.1°C
6	construction	Inside-SS, Outside : Powder coated MS with heat insulation, Lid: SS with insulation
		Shall be capable to condition pipe samples for HPT testing as per IS standards.
		Calibration certificates shall be provided along with machine

### Hot water Bath

S No	Specification	
1	Dimension	Inside Dimensions in mm 1500 X 1000 X 800 (L X W X H)
2	Range	Ambient to 80°C
3	Controller	Digital temperature Indicator & PID controller
4		Necessary Heating and Cooling System shall be provided
5	Accuracy	0.1°C
6	construction	Inside-SS, Outside : Powder coated MS with heat insulation, Lid: SS with insulation

		Shall be capable to condition pipe samples for HPT testing as per IS standards.
		Calibration certificates shall be provided alongwith machine