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MARSHALL STABILITYTEST

BE 83

The Marshall Stability Test, conducted using the Marshall Apparatus, is the most widely used method by highway departments, contractors, engineers, testing laboratories, and governmental agencies to evaluate the strength and quality of bituminous paving mixtures. This test measures the resistance to plastic flow of cylindrical specimens of hot mix asphalt (containing asphalt or tar and aggregate up to 25.4 mm in size) when loaded on their lateral surface. It helps determine the mixture's stability (maximum load it can withstand) and flow (deformation under load), ensuring the asphalt mix is suitable for road construction and can withstand traffic loads without excessive deformation

FOLLOWING STANDARD

EN 12697-34, 12697-23, 12697-12 (Method A); ASTM D1559, D5581, D 6927, D 6931; AASHTO T245

DESCRIPTION

Marshall Machine load frame is available two speeds and also two segments digital and manual two type test mould normal and modified.

MODEL	COMPONENT	DETAILS
BE 83-01-A	Marshall Load Frame	Capacity 50 kn both are used normal and modified (single speed 50.8mm/min)
BE 83-01-B	Marshall Load Frame	Capacity 50 kn both are used normal and modified (Two speed 50.8mm/min & 61mm/min)
BE 83-02-A	Breaking Head Stability Mould Normal (fitting 4")	with a dial gauge (having 25 mm travel and 0.01 mm least count), for flow measurement
BE 83-02-B	Breaking Head Stability Mould Modified (fitting 6")	with a dial gauge (having 25 mm travel and 0.01 mm least count), for flow measurement
BE 83-03-A	Compaction Mould with base plate, 4-inch (101.6 mm) diameter x 2.5-inch (63.5 mm) height	Steel, cylindrical (3 nos)
BE 83-03-B	Compaction Mould with base plate, 6-inch (152.4 mm) diameter x 3.75-inch (95 mm) height	Steel, cylindrical (3 nos)
BE 83-04-A	Compaction Pedestal NORMAL MARSHALL	Manual Operation, comprising a Steel Plate capped on a wooden post. A Mould Clamp is fitted to the top of the plate
BE 83-04-B	Compaction Pedestal MODIFIED MARSHALL	Manual Operation, comprising a Steel Plate capped on a wooden post. A Mould Clamp is fitted to the top of the plate
BE 83-05-A	Compaction Hammer Normal Marshall	weight 4.5 kg with a free fall of 457 mm (2 Nos)
BE 83-05-B	Compaction Hammer Modified Marshall	weight 10.21 kg with a free fall of 457 mm (2 Nos)
BE 83-06-A	Load Transfer Bar Normal	(4-inch/101.6 mm)
BE 83-06-B	Load Transfer Bar Modified	(6-inch/152.4 mm)
BE 83-06	Proving Ring (for Manual)	50 kN
BE 83-07	Dial Gauge (for Manual)	25 mm and 0.01 mm
BE 83-07	Load Cell (for Digital)	50 kN
BE 83-08	LVDT Used for Digital	25 mm and 0.01mm least count
BE 83-09	Digital Display	Used for Digital machine
BE 83-10	Software	All data come to pc see graph and data saved

AUTOMATIC COMPACTOR FOR BITUMIN MIXES

BE 84

An Automatic Compactor for Bituminous Mixes is a laboratory testing device used in civil engineering and materials science to prepare uniform asphalt (bituminous) samples for quality control and performance testing. It simulates the compaction process of road paving, replacing manual labor with automated, repeatable drops of a hammer (rammer) to achieve consistent density and eliminate variability in specimen preparation. This equipment is essential for standards like ASTM D6926/D6927 (Marshall Method) and is widely used in mix design, stability, and flow testing of hot mix asphalt (HMA).

Compacts bituminous mixtures into cylindrical molds (typically 4-inch or 6-inch diameter) to create test specimens for evaluating properties like voids in mineral aggregate (VMA), air voids, stability, and flow resistance. It ensures even compaction, which is critical for accurate test results, as factors like compactive energy directly impact mixture properties such as density and durability

FOLLOWING STANDARD

ASTM D6926/D6927, ASTM - D5581:1996, EN 12697-30

DISCRIPTION

FEATURE	DETAILS
Hammer Weight	4.5 kg (Normal Marshall) 10.2 kg (Modified Marshall)
Drop Height	457 mm (Normal Marshall) 475 mm (Modified Marshall)
Mold Compatibility	4" or 6" diameter (102 mm or 152 mm)
Blows per Test	Programmable (35–75 per layer)
Counter	Digital automatic with auto-stop
Base Pedestal	300 mm x 300 mm steel plate on oak block

BITUMIN MIXER WITH HEATING JACKET

BE 85

A **bitumen mixer with heating jacket** (often referred to as an asphalt or bituminous mixer) is specialized laboratory equipment designed for preparing homogeneous samples of bituminous mixtures. It's commonly used in civil engineering, road construction, and materials testing labs to blend bitumen (asphalt) with aggregates, ensuring uniform coating at controlled temperatures. The 5-liter capacity makes it ideal for small-batch testing, such as Marshall Stability tests (ASTM D6927 or EN 12697-35 standards), where the mix must be heated to reduce viscosity without degrading aggregates.

The heating jacket (typically an electric or thermostatically controlled mantle) surrounds the mixing bowl, allowing precise temperature regulation (e.g., 140–180°C for bitumen). This prevents overheating and ensures consistent results. These mixers feature planetary or epicyclical motion for thorough blending, with stainless steel components for durability and corrosion resistance.

FOLLOWING STANDARD

ASTM D6927 or EN 12697-35

DISCRIPTION

FEATURE	DETAILS
Capacity	5 liters (stainless steel bowl with handle for easy removal and cleaning)
Mixing Mechanism	planetary and revolving motion via stainless steel paddles/beaters; 2–3 speeds (e.g., low: 140 ± 5 RPM, medium: 285 ± 10 RPM)
Heating System	500W electric heating jacket with energy regulator or digital thermostat for uniform heating; compatible with ISO Mantle for asphalt samples

Power	230V AC, single-phase electric motor (0.5–1 HP)

BE 86-02

FLASH & FIRE POINT

BE 86

The Flash and Fire Point Apparatus is a laboratory instrument used in petroleum testing to determine the **flash point** and **fire point** of liquids, such as fuels, oils, lubricants, and bituminous materials. These properties are critical for assessing flammability, safety during storage, transportation, and handling, as well as compliance with industry standards.

FOLLOWING STANDARD

IS 1209, IS 1448: Part 21, IS 1448: Part 66, ASTM D92, ISO 2592, IP 36, AASHTO T48, ASTM D93, ISO 2719, IP 34

DISCRIPTION

Types of Apparatus

There are two primary types based on the test method: **Open Cup** (Cleveland) and **Closed Cup** (Pensky-Martens). Open-cup methods typically yield higher flash point values than closed-cup due to differences in vapor containment and exposure to air.

BE 86-03

BE 86-01	Open Cup	Cleveland Open Cup (COC)	Petroleum products, bituminous materials, lubricants (flash > 79°C)	Up to 400°C
BE 86-01	Closed Cup	Pensky-Martens	Fuel oils, solvents, chemicals (higher precision for regulations)	Up to 405°C

Another two type latest model for flash & fire point.

BE 86-03	Semi Automatic Abel flash point
BE 86-04	Fully Automatic Cleveland Flash Point Apparatus

BE 86-01

BE 86-04

(with adaptations). Not suitable for very soft, low-viscosity materials like tars.

FOLLOWING STANDARD

IS 1448 (Part 60), IS 1203, ASTM D 5, IP 49, ASTM D1321, ASTM D 2884, ASTM D1403, IP 310, BS 1377, BS:2000-(Part 49), BS:4691, BS:4698, ASTM D 937, ISO 2137, IP 50, IP 179, ASTM D 217, AASHTO T49

DISCRIPTION

Base	Accurately machined aluminum with a built-in spirit level and adjustable feet for leveling over a wide sample area.
Vertical Rod and Head Support	Adjustable height for positioning the needle above the sample.
Rack & Pinion Assembly	Allows fine adjustments of the needle or cone tip to the sample surface.
Plunger and Needle	Stainless steel needle (2.5g) with a brass ferrule; total weight with plunger is 50g for bituminous tests (100g load applied).
Dial Gauge or Digital Timer	For measuring penetration depth and timing the 5-second penetration period.
Weights	Additional 50g and 100g weights for varying loads
Sample Containers	Aluminum dishes (55mm diameter x 35mm or 53mm height) for holding the bitumen sample.

Two models are available Manual models feature a slipping clutch for easy resetting, while automatic versions use a button release with a digital timer.

BE 87-01	Manual models feature a slipping clutch for easy resetting,
BE 87-02	While Electric versions use a button release with a digital timer.
BE 87-03	Fully automatic bitumen Pentrometer

BITUMIN PENETERO METER

BE 87

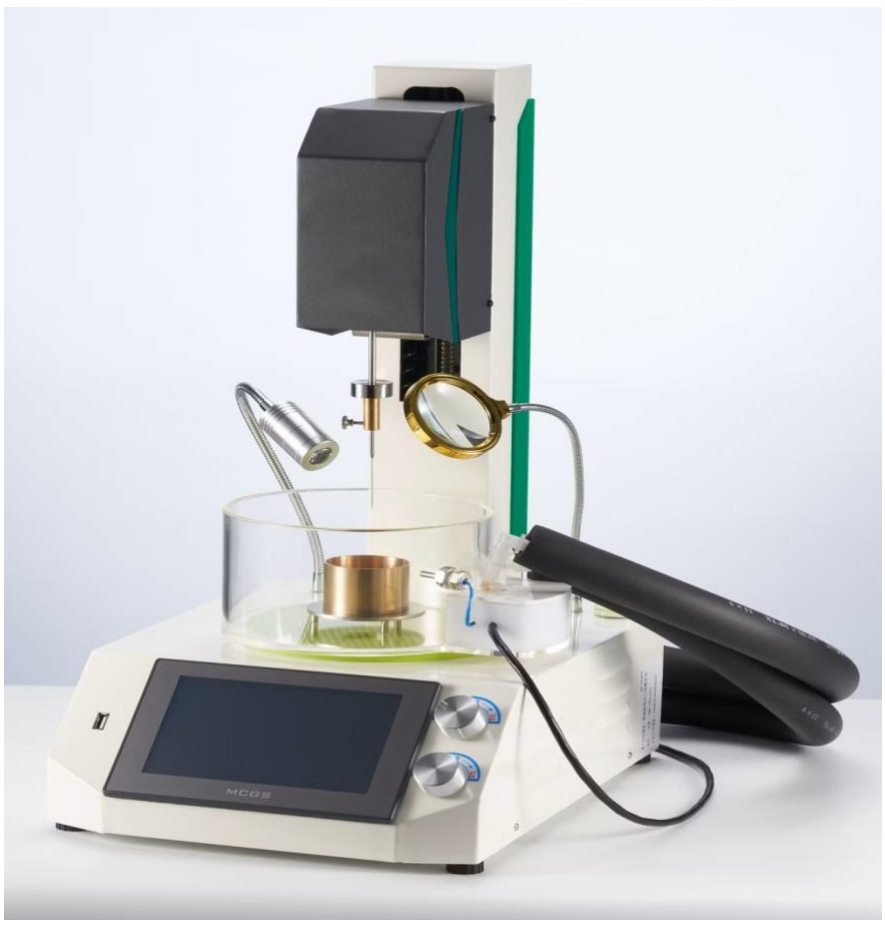
The bitumen penetration apparatus, also known as a penetrometer, is a laboratory instrument used to measure the consistency (hardness or softness) of bituminous materials like asphalt or bitumen. This test determines how deeply a standard needle penetrates into a bitumen sample under specified conditions of load, time, and temperature, providing a penetration value in tenths of a millimeter (0.1 mm units). It's essential for classifying bitumen grades, ensuring suitability for road construction, and assessing performance in different climates—e.g., softer bitumen (higher penetration) for cold weather to prevent cracking, and harder grades for hot conditions.

Grades bitumen based on penetration values (30/40, 60/70, 80/100), as per standards like ASTM D5, AASHTO T49, and IS 1203. Values range from 40–300, grouped into hardness categories. Tests pure bitumen, oxidized bitumen, and residues from emulsions; also used for tars, waxes, greases, and soils

BE 87-01

BE 87-02

BE 87-03



IS 1208, ASTM D113, AASHTQ T 51

DUCTILITY TEST APPARATUS

The ductility testing machine is designed to hold and pull three briquette samples simultaneously for efficiency and consistency. It maintains a uniform water bath temperature and ensures vibration-free operation. Key components include

COMPONENT	DETAIL
Water Bath	Stainless steel tank with thermostatic heater, stirrer, and circulating pump to maintain homogeneous temperature (25°C). Often includes digital PID controllers/Thermostatic controller for precise control (±0.1°C). Refrigerated models are available for lower temperatures.
Briquette Molds	Three brass molds (standard size per ASTM D113) to form the sample into a dumbbell shape (10 mm thick at center, 100 mm gauge length). Includes a base plate for casting.
Pulling Mechanism	Motor-driven carriage with clips to grip mold ends, pulling at 10/50 mm/min speed. Three-unit models allow simultaneous testing.
Measurement System	Ruler or digital scale to measure elongation (up to 100 cm or more). Advanced models have graphic displays for load-length graphs.

Ductility is three types available.

BE 88-01	Manual Thermostatic controller
BE 88-02	Digital Ductility PID controllers
BE 89-03	data logging software for recording results

BE 88-01

BE 88-02

BE 88-03

DUTILITY TEST APPARATUS

BE 88

The ductility test for bitumen (also known as asphalt binder) measures the ability of the material to stretch or elongate without breaking under controlled conditions. This property is crucial for assessing the flexibility and cohesive strength of bitumen, which helps predict its performance in road pavements, especially in resisting cracking due to temperature changes or traffic loads. Bitumen with high ductility is more suitable for flexible pavements in varying climates, while low ductility indicates brittleness, often unsuitable for cold regions.

The test is standardized under ASTM D113 (Standard Test Method for Ductility of Asphalt Materials) and similar specifications like IS 1208 in India. It involves forming a standard briquette-shaped sample of bitumen and pulling it apart at a constant speed until it breaks, recording the elongation distance in centimeters.

FOLLOWING STANDARD

ASPHALT MIXER THEORETICAL DENSITY APPARATUS

BE 89

The Asphalt Mixer Theoretical Density Apparatus, also known as the Theoretical Maximum Specific Gravity and Density Meter for Asphalt Mixtures, is a specialized laboratory instrument used in civil engineering and road construction to determine the theoretical maximum specific gravity (Gmm) and density of uncompacted bituminous paving mixtures (e.g., hot mix asphalt or warm mix asphalt). This measurement is essential for asphalt mix design, calculating air voids in compacted mixtures, assessing asphalt binder absorption by aggregates, and ensuring quality control in road construction, including porosity and compactness evaluations.

This equipment is used for determination of theoretical density of asphalt mixer by vacuum method for application such as asphalt mixer design, road condition investigation, calculation of porosity and compactness in road construction quality management.

FOLLOWING STANDARD

ASTM D2041/D2041M, AASHTO T 209 or California Test 309.

KEY APPLICATIONS

- Asphalt mixture design and optimization.
- Road condition investigations.
- Calculation of voids in mineral aggregate (VMA) and air voids (Va).
- Quality assurance for pavement durability and performance.

The test is typically conducted at 25°C (77°F) on samples with fully coated aggregates to achieve optimal precision.

BITUMIN CENTRIFUGE EXTRACTOR

BE 90

A centrifuge extractor is a laboratory device used to determine the bitumen content in bituminous mixtures, such as asphalt used in road construction, by separating bitumen from aggregates using a solvent and centrifugal force. Below is a concise overview based on standard practices and available information.

Bitumen, a viscous, black semi-solid form of petroleum, is a key binder in asphalt mixtures used for road paving and construction. Determining its exact percentage in these mixtures is essential for quality control, ensuring durability and performance. The centrifuge extractor is a specialized laboratory device designed for this purpose, using centrifugal force to separate bitumen from aggregates (like sand and gravel) via a solvent.

FOLLOWING STANDARD

ASTM D2172, AASHTO T164, EN 12697-1

DISCRIPTION

MODEL	TYPES	DETAIL	USE CASE	KEY FEATURE
BE 90-01	Standard Motorized	Electric, 0–3,600 rpm, digital controls	Lab testing	Variable speed, high precision
BE 90-02	Hand-Operated	Manual crank, portable	Field use	No power needed, basic testing
BE 90-03	Automatic/Filterless	No filter discs, integrated sieving	High-throughput labs	Faster, solvent recovery option

BE 90-01

BE 90-02

BE 90-03

RING & BALL (SOFTNING POINT) APPARATUS

BE 91

The Ring and Ball apparatus (often referred to as the Ring and Ball test or method) is a standard laboratory tool used in civil engineering and materials testing to measure the softening point of bitumen (also known as asphalt or tar). Bitumen is a viscoelastic material that doesn't have a sharp melting point; instead, it gradually softens as temperature increases. The softening point indicates the temperature at which the material becomes sufficiently fluid for applications like road construction, helping assess its temperature susceptibility and suitability for different climates

FOLLOWING STANDARD

IS 1205 1985 & ASTM D 36, IS 334-1982

KEY COMPONENTS

The apparatus consists of:

- **Two brass rings**: Shouldered rings (diameter 15.9 mm, depth 6.4 mm) to hold the bitumen sample.
- **Two steel balls**: Standard size (9.5 mm diameter, 3.5 g weight) placed on the sample.
- **Glass beaker or bath**: Filled with a liquid medium (distilled water for softening points <80°C; glycerin or ethylene glycol for >80°C).
- **Thermometer**: To monitor temperature precisely.
- **Ball guides and support**: To position the rings and allow balls to drop 25 mm (1 inch) to the bottom.
- **Heating source**: For controlled heating (Bunsen burner or electric heater).

These are two type models available.

BE 91-01	**Electrical Ring & ball Apparatus**
BE 91-02	**Fully automatic Ring & Ball Apparatus**

BE 91-01

BE 91-02

STRIPPING VALUE APPARATUS

BE 92

The Stripping Value Apparatus is a specialized testing device used in civil engineering and materials science, particularly for evaluating the adhesion properties of bituminous (asphalt) mixtures with aggregates in road construction. It measures the stripping value, which quantifies the resistance of the bitumen coating on aggregates to being stripped away by water. This test is crucial for assessing the durability of asphalt pavements, as poor adhesion can lead to moisture-induced damage like potholes or surface cracking.

FOLLOWING STANDARD

IS 6241-1971

PURPOSE OF THE TEST

- **Definition of Stripping Value**: It is the ratio of the uncovered (stripped) area of aggregates to the total surface area, expressed as a percentage. Lower values indicate better adhesion and higher resistance to stripping.
- **Why It Matters**: Bitumen adheres well to clean, dry aggregates, but water can cause "stripping" (disbanding), reducing pavement life. The test helps select suitable aggregates and anti-stripping additives (e.g., amines or lime).

KEY COMPONENTS OF THE APPARATUS

- **Rotating Tray/Disc**: A circular stainless steel tray or disc that rotates in a vertical plane at approximately 100-120 RPM. It holds 4 glass or heat-resistant bottles (capacity 400-500 ml each), mounted at 90° angles with mouths facing the center for even agitation.
- **Bottles/Beakers**: 500 ml heat-resistant glass beakers or bottles to hold the aggregate-bitumen-water mixture.
- **Motor and Drive**: Electric motor for rotation, often with a speed controller.
- **Timer**: A time switch for precise agitation duration (15 minutes).
- **Power Supply**: Operates on 230V AC single phase.

ABSOLUTE & KINEMATIC VISCOMETER BATH

BE 93

A kinematic viscometer bath is a specialized laboratory instrument designed to maintain a precise, constant temperature environment for measuring the kinematic viscosity of fluids, particularly petroleum products like oils, lubricants, and fuels. Kinematic viscosity measures a fluid's resistance to flow under gravity, expressed in units such as mm^2/s (centistokes), and is critical for quality control.

FOLLOWING STANDARD

IS 1206 (Part II) and (Part III), ASTM D445

PRODUCTS DETAILS

Determination of Absolute and kinematic Viscosity with the following components:

1. Constant Temperature Bath - A suitable bath for immersion of 2 vacuum capillary viscometer tubes with a digital temperature controller. The accuracy of the temperature in the bath will be ± 0.2°C throughout the bath. **(resolution of 0.01°C available at extra cost)**
2. Silicone bath oil suitable up to 150°C - 15 Liters
3. Vacuum System - The system will consist of vacuum pump, moisture trap, vacuum regulator, bleed valve, all interconnecting tubing / piping, and any other accessories as needed to complete the vacuum system.
4. Built in Digital Timing Device - A stop watch capable of reading up to 0.01 second.
5. Indian Make Cannon - Manning Vacuum Viscometer Tubes of Size 12 and 13 Supplied with manufacturers' calibration certificate, viscometer tube holder and silicone cork. This will cover the Viscosity range from 800-3200 poise.
6. Indian Make Reverse flow Viscometer to cover Viscosity range of 250-400 cst (1 Nos.)

- **Stopper and withdrawal tube**: To control flow start/stop and remove air bubbles.
- **Timer**: For precise measurement of efflux time in seconds.

The two types saybolt viscosity available & ALSO AVAILABLE One tubes, two tubes & four tubes.

BE 94-01- Single Tubes Viscometer

BE 94-02 –Two Tubes Viscometer

BE 94-03 – Four Tubes Viscometer

Type	Saybolt Universal (SU)	Saybolt Furol (SF)
Orifice Size	Small (0.176 cm dia.)	Larger (0.122 cm dia., longer tube)
Typical Test Temperature	38°C (100°F) or 40°C (104°F)	49°C (122°F) or 50°C (122°F)
Application	Less viscous fluids (light oils, kerosene)	More viscous fluids (heavy fuels, road oils)
Result Unit	Saybolt Universal Seconds (SUS or SSU)	Saybolt Furol Seconds (SFS or SSF); ~1/10 of SUS

SAYBOLT VISCOSITY METER

BE 94

The Saybolt viscosity apparatus, commonly known as the Saybolt viscometer, is a standardized device used to measure the kinematic viscosity of petroleum products, such as oils, fuels, and bitumen emulsions. It operates on the principle of efflux time, where viscosity is determined by timing how long it takes for a fixed volume (typically 60 ml) of fluid to flow through a calibrated orifice under controlled temperature conditions. This empirical method is outlined in ASTM D88 and is particularly useful for field testing and quality control in the petroleum industry.

FOLLOWING STANDARD

ASTM D88

KEY COMPONENTS

The apparatus typically includes:

- **Receiving flask**: A graduated container to collect the effluxes fluid (60 cc volume).
- **Viscosity cup**: A metal cup with a precisely sized orifice at the bottom (for Saybolt Universal: 0.176 cm diameter, 1.225 cm length).
- **Temperature-controlled bath**: A thermostatically regulated oil or water bath (up to 240°C) to maintain the sample at the test temperature, often using a heating tube and automatic controller.
- **Thermometer**: Specialized Saybolt thermometers (e.g., ASTM 17C, 18C, or 21C) for accurate temperature monitoring within ±0.1°C.

BE 94-01

BE 94-02

BE 94-03

STANDARD TAR VISCOSITY METER

BE 95

The Standard Tar Viscometer (often abbreviated as STV) is a specialized laboratory instrument used in civil engineering and materials testing to measure the viscosity of cut-back bitumen, road oils, and fluxed bituminous binders. It operates on the principle of efflux time, determining how long it takes for a fixed volume (typically 50 ml) of the sample to flow through a standardized orifice under controlled temperature conditions. This helps assess the flow properties of tars and bitumen's for applications like road construction and paving.

FOLLOWING STANDARD

IS 1206, BS 2000, (Part72)

DISCRIPTION

Component	Material/Feature	Purpose
Bath	Stainless steel or chrome-plated copper	Holds temperature-controlled fluid (water/oil)
Test Cup	Brass with orifice (4 mm or 10 mm)	Contains sample for efflux measurement
Valve	Ball-ended rod	Seals orifice during filling
Stirrer	Motorized with clip or glass rod	Ensures uniform bath temperature
Heater	1000W immersion	Maintains test temperature (25–60°C)
Controller	Digital thermostat	Precise temperature regulation with alarm

REDWOOD VISCOSITY METER

BE 96

A Digital Redwood Viscometer is a laboratory instrument used to measure the kinematic viscosity of petroleum products, such as oils, fuels, and bitumen's, by determining the time it takes for a liquid to flow through a standardized orifice under gravity. It adheres to international standards like IP 70 (Institute of Petroleum) and IS 1448, ensuring consistent results for quality control in oil refineries, research labs, and educational institutions. The "digital" aspect refers to modern enhancements like electronic temperature controllers, indicators, and regulators, which provide precise control and readout compared to traditional analog models.

FOLLOWING STANDARD

IS 1448

DISCRIPTION

KEY TYPES AND SPECIFICATIONS

There are two primary adaptations:

- **Redwood No. 1**: For liquids with flow times of 20–2000 seconds (lighter oils).
- **Redwood No. 2**: For liquids with flow times exceeding 2000 seconds (heavier bitumen's or tars).

	BE 95-01	BE 95-02
Model Variant	Redwood No. 1 with Digital Indicator	Redwood No. 2 with Digital Indicator
Flow Time Range	20–2000 seconds	>2000 seconds
Heating Type	Electric with regulator	Electric with rheostat
Key Digital Features	Digital temp controller & display; optional stirrer	Digital thermostat; immersion heater; cooling coil
Typical Use	Light petroleum products like lubricating oils	Heavy tars, bitumen's, road oils

Model	Engine Specs	Core Capacity	Weight/Portability	Key Features
BE 97-01	31cc, 4-cycle Honda, 1.5 HP	Up to 7" (178 mm) dia., vertical/horizontal	22 lbs, ultra-lightweight, hand-held	For concrete/asphalt/soil; includes water swivel; ideal for road/bridge contractors
BE 97-02	11.5 HP petrol	Up to 200 mm dia., 500 mm depth	110 kg, pickup truck portable	Rugged for all materials; fixed coupling bits; Superpave compatible
BE 97-03	Not specified (petrol assumed)	Up to 200 mm dia.	Portable	For concrete/asphalt; vertical support column
BE 97-04	Honda 5.5/6 HP	Up to 200 mm dia. x 450 mm depth	Portable	For asphalt/concrete/reinforced structures; EN/ASTM compliant
BE 97-05	5 HP petrol with pulley	25–150 mm dia., up to 700 mm depth	Rigid base, leveling feet	Low vibrations; speeds 475/800 RPM; for roads/runways
BE 97-06	6.5 HP, 4-stroke, 190cc	Up to 200 mm dia	Height 1300 mm, base 625x900 mm	Two speeds (350/900 RPM); includes core barrel and bits
BE 97-07	Not specified (gasoline)	Up to 6" (152 mm) dia	Portable, truck-mountable	Fast setup; low bit wear; for slabs/pavements
BE 97-08	17.5 HP, 4-cycle with electric start	Up to 16" (406 mm) dia., 300–1100 RPM	Trailer/van mountable	For concrete/asphalt/rock; battery charger included

PEVENT CORE DRILLING MACHINE

BE 97

Pavement core drilling machines with petrol (gasoline) engines are specialized tools designed for extracting cylindrical core samples from asphalt, concrete, roads, bridges, and similar hard materials. These machines are essential in construction, civil engineering, and quality control testing (for super pave programs or standards like EN 12697-27 and ASTM D5361). Petrol engines provide portable, independent power, making them ideal for field use where electricity isn't available. They typically feature vertical drilling capabilities, water cooling systems to flush debris, and diamond-tipped bits for durability.

FOLLOWING STANDARD

EN 12697-27 and ASTM D5361

DISCRIPTION

KEY ADVANTAGES INCLUDE

- **Portability**: Many models are lightweight (e.g., 22 lbs for hand-held units) and can be carried in a pickup truck or mounted on hitches for quick setup.
- **Power Range**: Engines from 4 HP to 17.5 HP, allowing for efficient drilling in various materials.
- **Core Capacity**: Up to 200 mm diameter and 700 mm depth, with speeds adjustable (e.g., 350–1100 RPM) for soft or hard samples.
- **Ease of Use**: One-person operation, minimal vibrations via pulley mechanisms, and quick bit changes.

FOLLOWING STANDARD

AASHTO T256, CNR No. 141, and NF P98-200-2

KEY COMPONENTS

The apparatus is lightweight (often made of aluminum alloy for portability) and typically weighs around 15-20 kg. Here's a breakdown of its main parts:

Component	Description	Typical Specifications
Beam Arm	Long, rigid lever (fulcrum ratio usually 4:1 or 1:4 for amplification). One end contacts the pavement; the other measures deflection.	Length: 2.5 m (250 cm) Pivot in center.
Fulcrum/Pivot	Central support point that balances the beam, allowing it to rock freely	Adjustable height with stabilizing feet.
Dial Gauge/Indicator	Precision instrument to read vertical deflection at the beam's end.	Resolution: 0.01 mm; Digital or analog (horizontal/vertical reading).
Probe/Tip	Pointed end that rests on the pavement surface between vehicle tires.	Extendable; Back extension 1.22 m
Spirit Levels	Two bubble levels for ensuring the beam is horizontal during setup.	Integrated for alignment accuracy
Accessories	Carrying case, adjustable feet, and sometimes a vehicle load frame	Optional: Bearing plate for sub grade testing

BENKELMAN BEAM TEST APPARAUS

BE 98

The Benkelman Beam is a widely used, portable device in civil engineering for evaluating the structural integrity of flexible pavements (such as asphalt roads) by measuring deflection under simulated traffic loads. Developed in the 1950s during the Western Association of State Highway Organizations (WASHO) Road Test, it operates on a simple lever-arm principle to quantify how much the pavement rebounds after a load is applied and removed. This helps assess pavement strength, identify weak spots, and inform maintenance or rehabilitation decisions.

PURPOSE

- **Primary Use**: Measures rebound deflection of pavement surfaces under a standard wheel load (typically from a heavy vehicle like a truck) and tire pressure. This deflection data indicates the pavement's load-bearing capacity and potential for fatigue cracking or rutting.
- **Applications**: Non-destructive testing for roads, highways, and airport runways. It's cost-effective for field surveys but is labor-intensive compared to modern automated devices like Falling Weight Deflectometers (FWD).
- **Limitations**: Provides only a single-point deflection measurement (not a full deflection basin) and requires manual operation, making it slower for large-scale testing.

MERLIN TEST APPARAUS

BE 99

The MERLIN (Machine for Evaluating Roughness using Low-cost Instrumentation) is a simple, cost-effective device designed to measure road surface roughness, which is critical for assessing road conditions and vehicle operating costs. Below, I address your queries about its features and provide a detailed explanation of its operation based on the provided information.

ADDRESSING YOUR QUERIES

- **Easy to use**: MERLIN is user-friendly, requiring minimal training. It can be used for direct roughness measurement or to calibrate other instruments like the Vehicle Mounted Bump Integrator, making it versatile and accessible.
- **Self-calibrating**: The device is designed to be self-calibrating, eliminating the need for frequent external calibration, unlike many other complex instruments, which simplifies its operation.
- **Robust**: Constructed with a sturdy 1.8-meter metal frame and readily available components, MERLIN is durable and capable of withstanding field conditions.
- **Easily maintained**: Its simple design and use of common, readily available components make maintenance straightforward and cost-effective.
- **No complex calculations**: MERLIN's operation does not involve intricate calculations. The roughness is indicated by the spread of pointer positions on a chart with 5 mm wide columns, providing a simple, visual representation of road unevenness.
- **Measures displacement to less than a millimeter**: The device is highly precise, with a probe that measures vertical displacement to less than a millimeter. The arm's pivot amplifies this displacement, so a 1 mm vertical movement of the probe results in a 1 cm movement of the pointer, ensuring accurate readings.

PRINCIPLE OF OPERATION

MERLIN consists of a 1.8-meter-long metal frame with a wheel at the front and a metal foot at the rear, with handles above the rear foot for easy movement. A probe, positioned midway between the wheel and foot, is attached to a weighted arm that keeps it in contact with the road surface. The arm is pivoted near the probe, amplifying vertical displacement: a 1 mm vertical movement of the probe translates to a 1 cm movement of a pointer at the other end of the arm. This pointer moves across a chart with 5 mm wide columns, providing a visual record of the probe's position relative to an imaginary line connecting the wheel and foot.

By recording the pointer's position at multiple points along a road, the spread of readings indicates the road's roughness. A greater spread corresponds to a rougher road surface, and this spread has been shown to correlate well with standard roughness scales, ensuring reliable measurements.

BUMP INTEGRATOR

BE 100

A **bump integrator** (also known as a rough meter, shock integrator, or automatic road unevenness recorder) is a specialized device used in civil engineering and road maintenance to quantitatively measure the surface roughness or unevenness of pavements. It assesses how "bumpy" a road is by capturing vertical deflections caused by irregularities, providing a key indicator of ride quality, safety, and structural integrity. This tool is particularly valuable for unpaved roads, highways, and remote areas where advanced laser-based systems might be impractical due to cost or accessibility.

Developed decades ago, the bump integrator remains a low-cost, reliable Class 3 response-type roughness meter, widely adopted in countries with diverse climates and road conditions (e.g., India, as per Indian Roads Congress guidelines). It helps calculate metrics like the **International Roughness Index (IRI)**, which standardizes roughness measurements globally for maintenance planning.

WORKING PRINCIPLE: A DEEP DIVE

The bump integrator operates on the principle of **dynamic response measurement**, integrating (summing) vertical displacements over a distance traveled. Unlike static profilometers that scan surfaces without motion, it relies on the physical interaction between a vehicle's axle and the road. Here's a step-by-step breakdown:

1. **Mechanical Setup**:
   - The core component is a **single-wheeled trailer** (often called a "fifth-wheel" or axle-mounted unit) towed behind a vehicle, such as a jeep or survey truck.
   - The wheel is connected to the trailer's frame via a pivoting arm or linkage that allows free vertical movement. This arm is typically spring-loaded or uses pneumatic damping to mimic a vehicle's suspension response.
   - A pneumatic tire (e.g., with specific air pressure, often 30-40 psi) is used for consistent contact with the road surface. The tire's deflection absorbs and transmits "bumps" (upward jolts) and "dips" (downward drops).
2. **Sensing Vertical Motion**:
   - As the vehicle moves at a constant speed (standard: 32 km/h or 20 mph to simulate typical traffic), the wheel encounters surface irregularities.
   - These cause **relative vertical displacements** between the axle (wheel) and the chassis (frame). Upward bumps push the axle up relative to the frame; downward dips do the opposite.
   - A mechanical or electronic linkage converts these bidirectional vertical oscillations into **unidirectional rotations** of a counting mechanism. This is often achieved via a rack-and-pinion system or a similar transducer:
     - Upward motion rotates a gear in one direction.
     - Downward motion is rectified (e.g., via a one-way clutch) to add to the same rotational tally, ensuring all irregularities contribute positively to the total "bump" count.

3. **Integration and Measurement**:
    - The rotations are "integrated" electronically: A counter (digital LCD or microprocessor-based) accumulates the total deflections.
    - Distance is tracked via the wheel's revolutions (e.g., using an odometer or encoder). A preset facility allows testing over fixed segments (e.g., 100m or 1km).
    - Raw output: Cumulative counts (e.g., in arbitrary units). These are converted to the **Unevenness Index (UI)** in cm/km using a calibration formula:
      UI = B×C / N×D
    - Where:
        - B = Bump integrator reading (cumulative counts).
        - C = Calibration constant (from lab tests on known rough surfaces).
        - N = Number of wheel revolutions in the test section.
        - D = Wheel circumference or distance per revolution.
    - Modern variants integrate with GPS for real-time mapping and minimal operator input.
4. **Calibration and Standards**:
    - Before use, the device is calibrated on a reference surface with known IRI (e.g., via laser profilometer). This ensures accuracy within ±5-10%.
    - Standards like IRC:SP 16-2004 (India) or ASTM E1926 classify it as a response-based meter, suitable for IRI calculations up to 10 m/km.

Component	Function	Typical Tech
Wheel/Tire	Contacts road; transmits vertical forces	Pneumatic, 10-12" diameter
Linkage/Arm	Converts up/down motion to rotation	Rack-and-pinion or pendulum
Counter/Display	Integrates and shows counts	Digital LCD or microprocessor
Distance Tracker	Measures path length	Wheel encoder or odometer
Trailer Frame	Mounts to towing vehicle	Lightweight steel/aluminum

How It's Used in Practice

- **Survey Process**:
    1. Mount the trailer to a vehicle (e.g., at the rear axle for stability).
    2. Drive along the wheel path (right or left lane) at 32 km/h, avoiding acceleration/braking.
    3. Record readings every 100-500m; reset counter as needed.
    4. Post-process data with software (e.g., ROMDAS) for IRI, GIS mapping, or video correlation.
- **Output Interpretation**:
    - **Unevenness Index (cm/km)**: <200 = Excellent; 200-380 = Good; 380-650 = Fair; >650 = Poor.
    - Correlates to IRI (m/km): Roughly UI/100 ≈ IRI for moderate roughness.
    - Factors affecting readings: Speed variance (±2 km/h tolerance), tire pressure, vehicle load.

Integration with Modern Systems:

- Often paired with ROMDAS (Road Surface Management Systems) for automated data logging, event rating (e.g., potholes), and export to GIS tools.
- In remote surveys, it's battery-powered and requires no internet, making it ideal for developing regions.

REFLUX EXTRACTOR 400 GMS

BE 101

You're referring to a simpler apparatus that operates on the same principle as the Reflux Extractor 4000 GMS, which is used for bitumen content determination in asphalt mixtures through solvent reflux extraction. The simplified version you described includes a cylindrical glass jar, two metal cones made of stainless steel cloth, a metal condenser, 100 filter papers, a wire gauge, and a hot plate. Below is a concise explanation of this apparatus and its operation

FOOLOWING STANDARD

ASTM D2172, AASHTO T164

APPARATUS DESCRIPTION

- **Cylindrical Glass Jar**: Typically made of borosilicate glass (3-4 liter capacity) to withstand heat and allow observation of the extraction process.
- **Two Metal Cones**: Stainless steel wire mesh cones (e.g., 2000 g capacity each) lined with filter paper to hold the asphalt mixture sample.
- **Metal Condenser**: Sits atop the jar with water inlet/outlet for cooling solvent vapors, enabling reflux (condensation and recycling of solvent).
- **Filter Papers (100 included)**: Used to line the cones, preventing fine particles from escaping during extraction.
- **Wire Gauge**: Placed between the hot plate and jar to diffuse heat and prevent direct contact, ensuring uniform heating.
- **Hot Plate**: Provides controlled heating to boil the solvent (e.g., trichloroethylene or toluene), typically without advanced thermostatic controls in simpler models.

APPLICATIONS

- **Asphalt Quality Testing**: Determining binder content in hot-mix asphalt for road paving.
- **Pavement Analysis**: Evaluating existing road samples for maintenance or forensic studies.

- **Research and Compliance**: Used in labs for R&D in bituminous materials and regulatory testing.

HARDNESS TESTER MASTIC ASPHALT

BE 102

Mastic asphalt is a dense, impermeable mixture of asphalt binder and fine aggregates, commonly used in flooring, waterproofing, bridge decks, and road surfaces due to its durability and workability. Testing its hardness is essential for quality control, ensuring it meets performance standards for consistency and resistance to deformation under load. The hardness number quantifies the material's resistance to penetration, which is critical for applications where the asphalt must withstand traffic or environmental stresses.

FOOLOWING STANDARD

IS 1195-1968

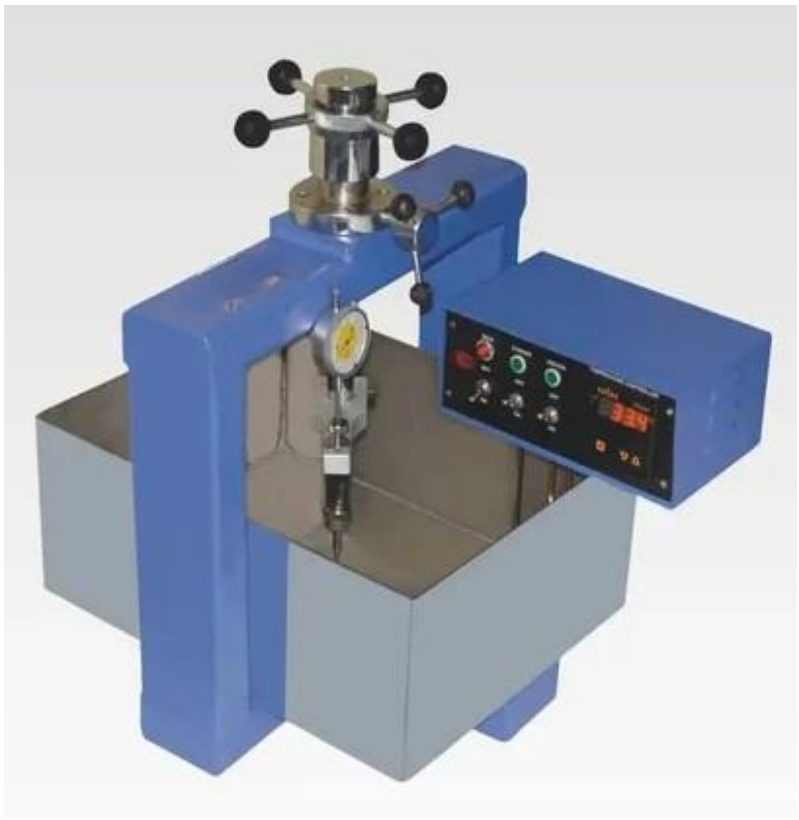
KEY FEATURES OF COMMERCIAL TESTERS

Hardness testers for mastic asphalt are robust, bench top units designed for civil engineering labs. Common specifications include.

FEATURE	DISCRIPTION
LOAD	31.7 kg (fixed weight)
PIN DIAMETER	6.35 mm (flat-ended steel rod)
TEMPERATURE	Control Thermostat-controlled water bath (35°C ± 0.5°C); immersion heater
MEASUREMENT	Dial gauge (0.01 mm resolution); some digital variants available
Construction	Internally insulated cabinet; stainless steel components for durability
ACCESSORIES	Indenter pin, loading weights, sample holder, thermometer

APPLICATIONS AND IMPORTANCE

- **Road Construction**: Ensures mastic asphalt's workability for impermeable layers in highways or runways.
- **Building Materials**: Verifies hardness for flooring to prevent cracking or indentation.
- **Quality Control**: Helps comply with project specs, reducing failures in waterproofing or load-bearing uses.



PARTICALE CHARGE TESTER

BE 103

A Particle Charge Tester (also known as a Particle Charge Meter) is a specialized laboratory instrument primarily used in materials testing, especially for identifying the electrical charge of particles in bituminous emulsions (like asphalt or bitumen used in road construction). It determines whether the emulsion is cationic (positively charged) or anionic (negatively charged) by measuring the migration of charged particles toward electrodes under an applied electric field. This helps ensure compatibility in paving and sealing applications.

FOOLOWING STANDARD

ASTM D244

HOW IT WORKS

- **Basic Principle**: A small sample of the emulsion is placed between two electrodes. A DC voltage (typically 0-10V) is applied, causing charged particles to move and generate a measurable current (via a milliammeter). Positive deflection indicates cationic charge; negative indicates anionic.
- **Key Components** (from standard models like ASTM D244-compliant testers):
  - Millimeter (0-10 mA scale).
  - Variable resistor for voltage control.
  - Electrode assembly (often glass or plastic cells).

- Support base for stability.

- **Test Procedure** (simplified):
  1. Prepare a diluted emulsion sample.
  2. Insert into the test cell.
  3. Apply voltage and observe deflection.
  4. Record results (e.g., >0.1 mA for cationic).

Applications

- **Road Construction**: Essential for quality control of emulsified asphalts.
- **Other Uses**: Advanced models (Particle Charge Analyzers) extend to water/wastewater treatment for optimizing coagulant dosing by measuring colloidal particle charge.

RESILIENT MODULUS ASPHALT TESTING SYSTEM

BE 104

The resilient modulus (Mr) is a critical material property in pavement engineering that measures the stiffness of asphalt concrete (also known as hot mix asphalt or HMA) under repeated loading conditions, simulating traffic loads. It represents the recoverable (elastic) deformation response of the material after unloading, analogous to Young's modulus in linear elastic models. This parameter is essential for predicting pavement performance, including fatigue cracking, rutting, and overall structural capacity, and is incorporated into design guides like the 1986 AASHTO Guide for Design of Pavement Structures.

For asphalt specifically, Mr values typically decrease with increasing temperature and frequency, while Poisson's ratio (a measure of lateral strain) increases with temperature and is higher for less viscous binders (AC-10 vs. AC-20 asphalt cements). Testing reveals that denser-graded mixtures with finer aggregates show lower variability in Mr compared to those with coarser aggregates.

FOOLOWING STANDARD

AASHTO T307, ASTM D7369, AASHTO T307

IMPORTANCE IN PAVEMENT DESIGN AND EVALUATION

Resilient modulus testing supports mechanistic-empirical pavement design by providing data for layer stiffness, structural coefficients, and performance predictions under varying moisture, temperature, and stress conditions. It's used in systems like the Asphalt Aggregate Mixture Analysis System (AAMAS) to evaluate mixture design, fatigue life, and field corroboration via nondestructive testing. No significant differences in Mr Computation arise from loading systems (pneumatic vs. hydraulic), but sample size and recovery time influence results, with coefficients of variation up to 20-30% in coarser mixes.

TESTING SYSTEMS AND EQUIPMENT

Commercial systems automate these tests under triaxial conditions, often with closed-loop control for axial load/displacement and confining pressure. Examples include

KEY FEATURES	SPECIMEN SIZES	TEMPERATURE CONTROL
Computer-controlled software with AASHTO/SHRP sequences, real-time Mr calculation, dynamic waveforms (up to 50 Hz), optional environmental chamber (-30°C to +150°C). Supports indirect tension and dynamic modulus fixtures.	2.8", 4", 6" diameter	Yes, with liquid N2 boost
Measures recoverable axial deformation for subgrade/base/asphalt under repeated loading	Varies (triaxial cells)	Optional
Tests permanent deformation and Mr of unbound/asphalt materials; quiet operation under high pressure/temperature.	Up to 150 mm	Yes
Automated for permanent deformation and Mr of soil/aggregate/asphalt; user-defined protocols.	Standard triaxial	Optional
Triaxial setup without loading frame; high-pressure/high-temp capable.	Varies	Yes

These systems use electro-hydraulic or pneumatic servo control, external/internal transducers, and export data for model fitting.

For implementation, consult ASTM D7369 for bituminous mixtures or AASHTO T307 for aggregates/soils, adaptable to asphalt.

ASPHALT CONTENT TESTER

BE 105

An Asphalt Content Tester, also known as an Asphalt Binder Ignition Furnace or Analyzer, is a laboratory instrument used to

determine the percentage of asphalt binder (bitumen) in hot mix asphalt (HMA) samples. It operates on the principle of loss on ignition (LOI), where the asphalt is burned off at high temperatures (typically around 538°C or 1,000°F), and the weight loss is measured to calculate the binder content. This method is faster, more environmentally friendly, and cost-effective compared to traditional solvent extraction techniques, as it avoids the use of hazardous chemicals.
This process typically takes 30–45 minutes for standard samples, allowing for up to 5,000g at longer durations.

FOOLOWING STANDARD

ASTM D6307, AASHTO T308.

KEY FEATURES

- **Automation and Safety**: Automatic door locking during operation, programmable endpoints, and temperature compensation for accurate results.
- **Versatility**: Supports automatic or manual modes; user-entered correction factors for aggregate types.
- **Efficiency**: Internal balance boosts productivity; 24/7 preheating timer.
- **Durability**: Modular refractory heating elements for easy maintenance; low-emission afterburner.
- **Data Handling**: RS-232 port for PC integration and graphical reporting.

SPECIFICATION	DETAILS
Temperature Range	392°–1,202°F (200°–650°C)
Sample Capacity	Up to 5,000g (standard: 1,200–1,800g)
Chamber Dimensions	14 x 14 x 14 in (356 x 356 x 356 mm) WxDxH
Overall Dimensions	25.75 x 21.75 x 36.75 in (654 x 553 x 933 mm) WxDxH
Weight (Net)	280 lb (127 kg)
Electrical (Model AP-20)	220–240V, 60Hz, 20/27 Amps, 4,879/6,379 Watts
Electrical (Model AP-20L)	208V, 60Hz, 28 Amps, 5,757 Watts
Accuracy	±0.11%

DYNAMIC SHEAR RHEOMETER

BE 106

Dynamic Shear Rheometer (DSR) is a specialized laboratory instrument used to measure the rheological properties—specifically the viscoelastic behavior—of materials like asphalt binders, polymers, and other fluids or semi-solids. It applies controlled oscillatory shear stress or strain to a sample and analyzes its response to determine parameters such as the complex shear modulus (G*, which combines elastic and viscous components) and phase angle (δ, which indicates the balance between elasticity and viscosity). The DSR is particularly vital in asphalt testing under standards like AASHTO T 315 for Superpave performance-graded (PG) binder specifications, simulating real-world pavement stresses at various temperatures (typically 3–88°C) and frequencies (e.g., 10 rad/s to mimic traffic loading).

FOOLOWING STANDARD

AASHTO T 315

KEY COMPONENTS

The DSR apparatus typically includes the following modular components, often integrated into a single unit for precision and automation

COMPONENT	DETAILS
Parallel Plates	Upper and lower metal disks (25-mm diameter for unaged/RTFO-aged asphalt; 8-mm for PAV-aged). Gap: 1 mm (25-mm plates) or 2 mm (8-mm plates). Apply shear to the sample
Environmental Chamber	Air- or liquid-filled enclosure (Peltier device or water bath) for precise temperature control (±0.1°C) from -20°C to 150°C.
Loading Device	Electromagnetic or pneumatic actuator for applying oscillatory shear stress/strain. Supports stress- or strain-controlled modes.
Control & Data Acquisition System	Software-driven interface for automation, calibration, and real-time analysis. Includes transducers for torque, displacement, and normal force.
Sample Preparation Tools	Silicone molds, heated trimming tools, and cleaning solvents (toluene, acetone) for specimen handling
Optional Accessories	Tool master for quick geometry swaps, Quick Connect for fast setup, and reference fluids for calibration

SETUP AND OPERATION

1. **Calibration**: Verify loading device and temperature system every 6 months using standard reference fluids and thermometers.
2. **Sample Preparation**: Heat binder to pourable state (e.g., 163°C), pour between preheated plates, trim excess, and set gap (e.g., 1 mm).
3. **Testing**: Stabilize at test temperature for 10 minutes in the chamber. Run 10 conditioning cycles, then 10 data cycles at specified frequency/strain. Software auto-computes G* and δ.
4. **Cleanup**: Wipe plates with solvents to prevent contamination.


DSR
DYNAMIC SHEAR RHEOMETER
TESTED