KING REFRIGERATION
LOW TEMPERATURE LABORATORY INSTRUMENTS

King BLB

Liquid Bath

ASTM D2983, D2500, D97 | IP 15, 219, 267, 441 | DIN 51398

Principle

Low-Temperature Viscosity: The low-temperature viscosity of ATF's, gear oils, hydraulic oils and other fluid lubricants is measured by a rotational viscometer after cooling to a predetermined temperature for 16 hours.

King Cloud & Pour Point Bath: The King Cloud & Pour Point Bath measures the low temperature cloud point and pour point of petroleum products—an index of the lowest temperature of its utility for certain applications. There are currently no ASTM methods for automated D97 Pour Point measurements. The BLB offers the manual testing technique and a self-contained refrigeration system with ramp/soak temperature programming ability. This standard King instrument is a cost effective and user friendly alternative to expensive automated devices.

History

With ASTM D2983, low-temperature studies by automobile manufacturers began in the 1950s due to the failure of automatic transmissions in cold temperatures. In 1971, a procedure was written and accepted as ASTM D2983. The original technique used a Balsa wood block to hold samples in a cold air cabinet. The samples were removed from the cabinet and tested with a rotational, bench-top Viscometer. In the mid-1990s, Tannas developed and patented the SimAir® Test Cell for use in a constant temperature liquid bath to dramatically improve the test operation, usability, and precision.

The Cloud Point (ASTM D2500) test method for petroleum products and biodiesel fuels was originally approved in 1966. The cloud point is the temperature of a liquid sample when the smallest observable cluster of hydrocarbon crystals first appears at the bottom of the test jar when cooled under prescribed conditions and examined periodically.

Pour Point method (ASTM D97) was originally approved by ASTM in 1927 and is still used today as the manual technique for pour point testing. The lowest temperature at which movement of the sample is observed is recorded as the pour point.

ASTM D2983
IP 267
Low-Temperature Viscosity

ASTM D2500
Cloud Point

ASTM D97
Pour Point

DIN 51398
Low-Temperature Viscosity
(*German Institute for Standardization Method*)

Features

- Allows sample measurement while remaining in the liquid bath at temperature with a top-mounted viscometer for ASTM D2983 (sold separately).
- Capable of measuring over broad temperature ranges (±0.1°C control):
  BLB 701 Model: +30°C to –40°C (86°F to –40°F)
  BLB 702 Model: +30°C to –70°C (86°F to –94°F)
  BLB-DIN Model: +30°C to –55°C (86°F to –67°F)
- Fully self-contained hermetic refrigeration system—no external units or controllers needed.
- Top heater and internal system provides a continuous blanket of dry air over samples to reduce or eliminate moisture buildup (gas source not included).
- *CE* rated with safety features that include a high pressure cutout, high temperature shutdown, and a low level shutdown.
- Each BLB model offers users a small bench-top footprint, a large illuminated viewing window, and a twelve (12) sample Test Cell Carousel for ASTM D2983 or (4) Cloud + Pour Point Samples at a time.

KING REFRIGERATION

King BLB701 and BLB702 | ASTM D2983

The use of liquid baths has long been accepted as an effective alternative to the original cold air cabinet developed with the procedure in the 1950s. Programmable liquid baths have been utilized but can be problematic due to their sizable refrigeration system requirements, differences observed in higher viscosity fluids caused by rapid & forced cooling rates, and the need to batch process the samples being analyzed.

The development of the patented SimAir® Test Cell allows the 'constant' temperature King BLB baths to closely simulate the sample cooling profiles of a cold air cabinet during the 16-hour soak period. This provides greater adaptability, increased sample through-put and improved precision over air bath and programmable liquid bath techniques. The Viscometer mounted on top of the bath easily attaches to the SimAir® Spindle via a Quick Connector for viscosity measurements at the end of the designated soak period, while the sample remains at temperature in the liquid bath.

Since meniscus levels can fluctuate depending on sample type and temperature, the large viewing window allows the operator to properly align the Spindle immersion mark to the meniscus of the sample according to the test method requirements.

King BLB-DIN | DIN 51398

Similar to ASTM D2983, the German Standard DIN 51398 determines apparent viscosity of gear oils and related fluids at low-temperature with the rotational viscometer. The procedures differ with respect to cooling rates as the ASTM method calls for a rate consistent with the original air bath over a 16-hour period, whereas the DIN method specifies a 1°C/min. cooling rate. There is no established correlation between the two procedures, but viscosity measurements can differ due to these cooling rates.

The King BLB-DIN bath model can be adjusted to run either test method by utilizing the SimAir® Test Cell for ASTM D2983 and the single-wall DIN glassware for DIN 51398. With programmable control and a digital display to 0.01°C, the King BLB-DIN bath meets the 1°C/min. cooling profile down to -55°C.

The DIN glass Stators are available from King Refrigeration. Refer to the DIN method for related hardware and proper usage.

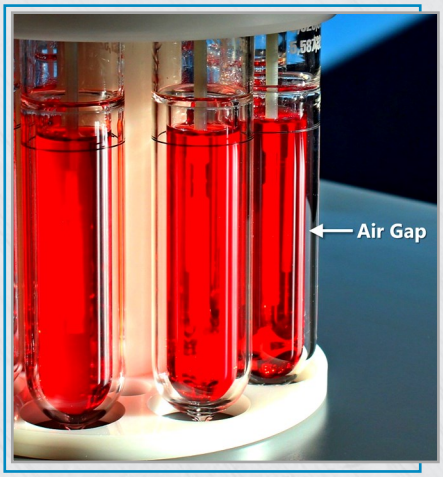
Cloud & Pour Point | ASTM D2500, D97

All King BLB models have the option to measure the low-temperature cloud point and pour point of petroleum products—an index of the lowest temperature of its utility for certain applications.

The Cloud Point (ASTM D2500) of a petroleum product or a biodiesel fuel is an index of the lowest temperature of its utility for certain applications. Chilled at a specified rate and examined periodically, the temperature at which a cloud of wax crystals is first observed at the bottom of the test jar is recorded as the cloud point.

The Pour Point (ASTM D97) method is used today as the manual technique for pour point testing. After preliminary heating, the sample is cooled at a specified rate and examined at intervals of 3°C for flow characteristics. The lowest temperature at which movement of the sample is observed is recorded as the pour point.

SimAir® Test Cell Innovation for ASTM D2983



The use of this low-temperature test procedure for over a half-century highlights the significance of this test on the performance of fluids at low-temperatures. However, a desire to simplify the test procedure arose due to the inherent temperature control problems of cold air cabinets. Heat distribution of the air within the bath created difficulties with sample warming during the transfer from the air bath to the viscometer. This required duplicate sample runs to ensure proper rotor speed determination.

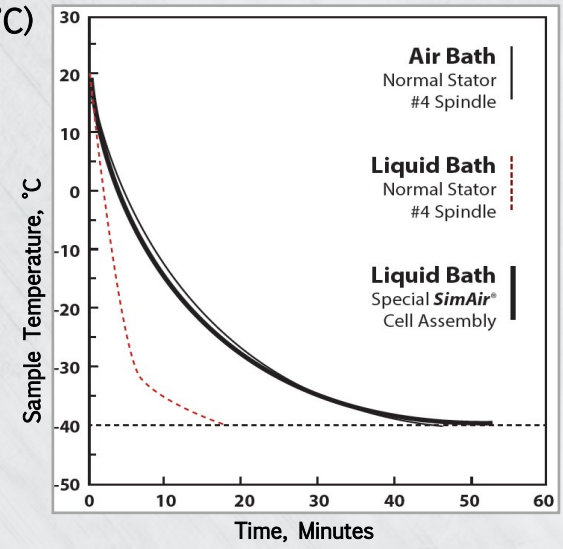
The patented SimAir® Test Cells offer simple, precise, and more efficient data acquisition and are used exclusively in the 'constant' temperature King BLB and Tannas SBT®+2 liquid baths. The SimAir® Glass Stator design incorporates an insulating chamber between two glass walls to simulate the cooling profile of the original cold air cabinet, upon which the method was based. As each Test Cell functions with its own independent cooling profile, they can be added or removed at any time without affecting the other samples, thus increasing productivity, ease-of-use, and eliminating the need to run batch sample tests.

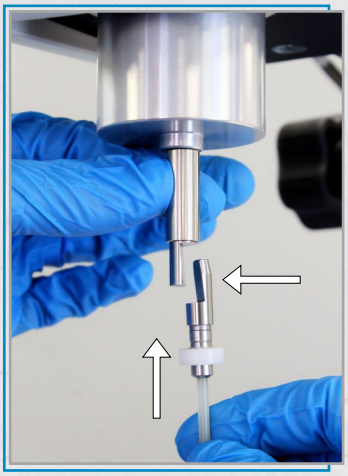
As the use of liquid baths require the top of the Stator and Spindle to be exposed above the liquid bath level, the fully-insulated SimAir® Spindle is constructed of a composite plastic material to prevent any source of heat entering the interior of the stator and thus warming the sample during the soak period which could alter its viscosity.

Air Bath vs. Liquid Bath Cooling Comparison (-40°C)

Using the SimAir® Test Cell, the sample is immersed in a liquid bath held at the precise temperature desired for final analysis. With no bath cooling program, the SimAir® cell modifies heat transfer to the sample and simulates the cooling influence of the air bath – permitting the sample to develop the same viscometric characteristics as in the air bath at cooling rates of greater than 60°C/hour.

As graphed, comparison of a single wall stator and #4 spindle to the SimAir® Cell reveals the effectiveness of a constant temperature liquid bath in simulating air bath results when using the SimAir® Test Cell.





SimAir® Quick Connector

Included with the purchase of the King BLB models and SimAir® Test Cell Assembly are the SimAir® Quick Connectors. The Coupling Top and Sleeve are included with the bath purchase. The Coupling Bottom is included with the SimAir® Spindle.

The design of the Quick-Connect spindle-coupling accessory allows the swift attachment or removal of the Spindle from the viscometer shaft. The benefits include:

- Dramatically reduces fluid disturbance to enhance test precision
- Reduces viscometer wear
- Eliminates cross threading
- User friendly & saves time

Parts & Accessories

BLB 701 Instrument:
170200: 208-230 VAC, 50/60 Hz Power

BLB 702 Instrument:
180100: 208-230 VAC, 50/60 Hz Power

BLB-DIN Instrument:
170400: 208-230 VAC, 50/60 Hz Power

Parts & Accessories:
100235: Tannas D2983 SimAir® Test Cell Assembly
(Includes: SimAir® Glass Stator, Spindle Support, Coupling Bottom, & SimAir® Spindle Assembly)

100236: SimAir® Glass Stator
170018: DIN Glass Stator
100019: LVDV1 M Digital Viscometer
100005: LV-DV2T Viscometer
170033: Spindle Storage Block
170028: Test Cell Holding Rack
350190: Desiccant Assembly
550175: Desiccant Media

Additional SimAir® Parts:
100231: SimAir® Spindle Assembly
(Includes: Spindle, Spindle Sleeve, & Spindle Collar)

100236: SimAir® Glass Stator
100257: Sleeve Coupling
100258: Coupling Top
100256: Coupling Bottom
100226: Spindle Support

ASTM D97 & D2500 Optional Accessories & Parts
100205: Pour Point Insert Module Assembly (4-position)
(*Includes 4-position insert, (4) D97 Test Cell Assemblies & Rubber Stoppers)*

950326: Copper Sleeve
950313: Test Jar Stoppers
950317: Cork Solid
950327: Cork Ring
950321: Test Jar Stopper - Pierced Cork
950322: Test Jar - Glass
350190: Desiccant Assembly
550175: Desiccant Media

Instrument Specifications

Dimensions (W x D x H)	Benchtop: 42 x 53 x 66 cm (16.5 x 21 x 26 inches)
Weight	~68 kg | (150 lbs.)
Voltage	**BLB 701:** 220 VAC, Fused: 15 amp. **BLB 702:** 220 VAC, Fused: (2) 15 amp. **BLB-DIN:** 220 VAC, 15 amp.
Frequency	50 or 60 Hz., Single-Phase
Cooling Capacity	600 Watts at 0°C | 300 Watts at –40°C | 100 Watts at –70°C
Heating Capacity	600 Watts
Temperature Range	**BLB 701:** +30°C to –40°C (86°F to –40°F) **BLB 702:** +30°C to –70°C (86°F to –94°F) **BLB-DIN:** +30°C to –55°C (86°F to –67°F)
Temperature Control	±0.1°C | Digital readout to 0.01°C for BLB-DIN
Bath Cooling Rate	**BLB 701:** 20°C/ hour average **BLB 702:** 30°C/ hour average **BLB-DIN:** 60°C/ hour average
Refrigerant	R410A (BLB701) | R507 HFC / R508B (BLB702 & DIN)
Compressor	1/3 horsepower
Viewing Window	~41 x 23 cm | 16 x 9 inches
Testing Capacity	12 sample carousel (ASTM 2983) 4 sample carousel (ASTM D97 + D2500)
Bath Size	~3.8 liters (1 gallon)
Bath Design	Methanol or Ethanol within Dewar flask
Cabinet Material	Powder Coated Aluminum
Safety	High pressure cutout | High temperature limit Low Level Indicator | Very Low Level Safety Shutdown CE Mark
Shipping Weight	~122 - 136 kg | (270 - 300 lbs.)
Shipping Dimensions (W x D x H)	81 x 76 x 104 cm (32 x 30 x 41 inches)

Additional KING REFRIGERATION Precision Laboratory Instruments

Mini-Rotary Viscometer (MRV TP-1)

- ASTM D3829, D4684, D6821
- Determines borderline pumping temperatures
- Direct Refrigeration Technology
- 10-test cell capacity