

# King MRV TP-1

## Mini-Rotary Viscometer

**ASTM D3829, D4684, D6821, D6896**

### Principle

**Low-Temperature Pumpability & Yield Stress:** A pre-heated oil sample is cooled at a programmed rate to a final test temperature. A series of increasing low torques (weights) are applied to the rotor shafts until rotation occurs to determine the yield stress, if any exhibited. Higher weight applications then determine the apparent viscosity of the samples. The MRV methods are applied to fresh and used engine oils, driveline lubricants, and predict the borderline pumping temperatures (BPT) of oils.

### History

Originally developed in 1979, the D3829 MRV method measures borderline pumping temperature -- the lowest temperature at which an engine oil can continuously flow to the oil pump inlet of an engine. Following significant engine failures during the winter of 1980-81 due to gel formations in oils, the MRV method was modified with a temperature profile (TP-1) and reestablished as D4684 in 1987. Since then, the MRV TP-1 has been included in the SAE J300 Viscosity Classification System and numerous OEM and International Specifications.

### Innovation

The King MRV (D4684, Procedure A) innovated the MRV test by incorporating self-contained, solid-block 'direct refrigeration' technology for both heating and cooling to evenly distribute constant temperature to all (10) Test Cells. This provides cell-to-cell temperature consistency of  $\pm 0.1^\circ\text{C}$  down to  $-40^\circ\text{C}$  and eliminates external pre-heating and cold-temperature circulating baths.

The King MRV utilizes 'removable' test cells for easier test setup and cleaning, carbon fiber rotor shafts and a special design feature for the delivery of pre-cooled, dry air to each Rotor/Stator removing the need for cell caps required by other manufacturers.

### Features

- An internal hermetic refrigeration system for direct, instant cooling with no need for external refrigeration or heat exchangers.
- 10 removable test cells for easy cleaning and sample handling.
- Carbon Fiber Rotor Shafts to minimize test cell heat transfer.
- A quick cool rate and reliable temperature control from  $-5^\circ\text{C}$  to  $-40^\circ\text{C}$  ( $\pm 0.1^\circ\text{C}$ ).



- Built-in pre-heating system to  $80^\circ\text{C}$  to remove oil memory before testing.
- Microprocessor temperature controller to store all MRV TP-1 testing profiles.
- Optical encoder for digital detection of viscosity and yield stress
- Windows based software with customizable cooling profile configurations.
- Internal system to provide a continuous blanket of dry gas over samples to reduce/eliminate moisture accumulation (gas source not included).

The Automated Pulley Wheel uses a laser sensor for precise measurements.



#### ASTM D3829

Predicts the borderline pumping temperatures (BPT) of engine oils over a 16 hour cooling cycle from  $0^\circ\text{C}$  to  $-40^\circ\text{C}$ .

#### ASTM D4684

Determines yield stress and viscosity of engine oils following a cooling profile over a period exceeding 45 hours to a final test temperature between  $-10^\circ\text{C}$  to  $-40^\circ\text{C}$ .

#### ASTM D6821

Measures viscosity of drive line lubricants after preheating and controlled cooling to final test temperatures from  $10^\circ\text{C}$  to  $-40^\circ\text{C}$ .

#### ASTM D6896

Determines yield stress and viscosity of 'used' diesel oils after controlled cooling for 43 to 45 hours to a final test temperature of  $-20^\circ\text{C}$  to  $-25^\circ\text{C}$ .

Required test for :

- SAE J300 Viscosity Classification
- ILSAC GF & dexos™ Specifications
- API 'SL', 'SM' and 'SN' categories for modern engine oils.
- ASTM D4485 | JPI 5S-42-04
- Chinese Standard GB-11121
- OEM Factory Fill

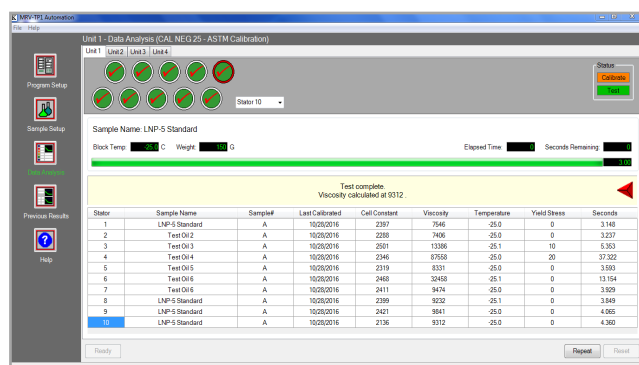
## Parts & Accessories

350501: King MRV Software Package (w/Laptop)  
 350222: MRV Rotor/Stator Set  
 350127: Stator Insertion & Removal Tool (S.I.R.T.)  
 350232: MRV Driveline Rotor (for ASTM D6821)  
 350223: MRV Weight Set - Driveline (for ASTM D6821)  
 950508: Stainless Steel Thumb Nut  
 350128: Moisture Cover  
 170028: Test Cell Holding Rack  
 350129: MRV Weight - 10 gram  
 350153: MRV Weight - 150 gram  
 350417: MRV String  
 350190: Desiccant Assembly  
 550175: Desiccant Media (1 lb. | 0.45 kg)  
 020019: N105B Reference Oil (Pint | 0.47 L)

## Instrument Specifications

<b>Dimensions</b> (W x D x H)	Benchtop: 46 x 46 x 40 cm (18 x 18 x 16 inches)
<b>Weight</b>	~43 kg   (94 lbs.)
<b>Voltage</b>	115 VAC, 15 Amp. (Also available in 220 VAC, 7 Amp.)
<b>Frequency</b>	50/60 Hz.
<b>Heating Capacity</b>	600 Watts
<b>Temp. Range</b>	80°C to -40°C (176°F to -40°F)
<b>Temp. Control</b>	±0.1°C across all test cells   Digital readout
<b>Cooling Rate</b>	5.0°C per minute maximum
<b>Refrigerant</b>	R-507
<b>Compressor Size</b>	1/3 Horsepower
<b>Testing Capacity</b>	10 samples
<b>Cabinet Material</b>	Stainless steel and durable thermoplastic
<b>Bath Design</b>	Solid, direct refrigeration without liquids
<b>Safety</b>	High Pressure cutout High Temperature limit CE Marked
<b>Shipping Weight</b>	~122 - 136 kg   (270 - 300 lbs.)
<b>Shipping Dimensions</b> (W x D x H)	97 x 84 x 61 cm (38 x 33 x 24 inches)

## Automated Software



The King MRV Automation Software Package calculates yield stress, viscosity, and Rotor/Stator Cell Constants. It offers simple user prompts to facilitate the testing process and comes installed on the laptop computer.

## Additional KING REFRIGERATION Precision Laboratory Instruments



### Brookfield Liquid Bath (BLB)

- ASTM D2983 | IP 267 | DIN 51398
- Innovative SimAir® Test Cells
- Models: BLB701, BLB702, BLB-DIN



### Cloud & Pour Point (CP610)

- ASTM D97, D2500, D2500 | IP 15, 219, 441
- ISO 3015, 3016 | DIN 51597 | JIS K2269
- Low-temperature Cloud Point & Pour Point



### Kinematic Viscosity (KV Bath)

- ASTM D445, D2170, D6074 | IP 71
- ISO 3105 | DIN 51550 | JIS K2283
- Low & high temperature models available