

### **Patented design & detailed engineering**

The Grace Instrument M5600 HPHT Rheometer is a true Couette, coaxial rotational cylinder and high-pressure, high-temperature rheometer, operating at up to 2,000 psi and 500°F. The M5600's unique patented design provides a true direct reading inside of the pressure vessel, instead of a magnetic coupler, thus eliminating moment of inertia errors. The M5600 does not have bob shaft bearings to replace, saving money, time, and allowing for continuous testing of corrosive samples.

### **True rheology measurement under pressure**

The M5600 hardware design incorporates a direct drive between the bob shaft and the torque transducer, which eliminates momentum of inertia errors associated with magnetically coupled torque transducers. Traditional rheometers use magnetic couplers to drive the shaft which causes moment of inertia errors. These errors are often associated with magnetic coupling across a pressure vessel wall in a typical rheometer under high temperature and high pressure conditions. The M5600's innovative design incorporates a direct drive between the bob shaft and torque transducer. The torque transducer responds quickly and consistently to changing bob shaft torque providing true repeatability in your tests.

### **Viscoelastic option available for $G'$ , $G''$ , and phase angle testing**

The M5600 comes in a dynamic option providing oscillatory measurements. The dynamic option allows the researcher to find helpful viscoelastic information in  $G'$ ,  $G''$ ,  $N'$ ,  $K'$ , and phase angle measurements while vastly increasing their ability to predict the behavior of fluids, such as their capacity for suspending and carrying solids (weight material sag, drill cuttings transport, proppant transfer, etc.)

### **Measurement specifications**

Bob Size:	B1, B2, B5 bob
Sample Size:	32 – 78 mL (depending on size of bob)
Speed Range:	0.0001 – 1,100 rpm continuous
Shear Rate Range:	0.00004 – 1870 Sec <sup>-1</sup>
Frequency Range:	0.01 – 5 Hz (optimized at 0.2 to 3 Hz)
Amplitude Range:	0.1% – 500% (optimized at 0.2% to 500%)
Temperature Range:	Ambient to 500 °F
Pressure Range:	Atm to 2,000 psi
Viscosity Range:	0.5 – 5,000,000 Centipoise
Torque Range:	14 $\mu$ N.m to 100 mN.m
Shear Stress Range:	1 to 15,000 dyne/cm <sup>2</sup>
Resolution:	0.01% of full scale range or better
Repeatability:	$\pm$ 0.05% of full scale range or better

### **Mechanical Specifications:**

Dimensions/Footprint: 25.5" tall x 8.5" wide x 12.5" deep  
Weight: 61 lbs (with carbon block heating bath)

### **Utility Requirements:**

Electrical Supply Voltage: 120 VAC or 240 VAC  
Compressed Nitrogen: 2,000 psi



The M5600 Rheometer shown with a carbon block bath



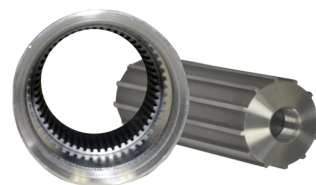
Optional carrying case with extendable handle and wheels for easy portability

Side View

Top View



Clear sample cup



Proppant slurry testing accessory set

### Oscillatory Testing

Standard rotational testing measures fluid viscosity under a constant shear rate (constant speed), which indicates only apparent viscosity, or how thick a fluid is. On the other hand, almost all drilling muds, fracturing fluids and cements have some "gelly" strength that enables them to suspend solid particles. This ability to suspend solids is very important to many oil field operations.

The M5600 HPHT Rheometer oscillatory testing option provides the capability to measure how "gelly" a sample is, in addition to how thick the sample is, by providing  $G'$ ,  $G''$ , and other data. This vastly increases the researcher's ability to predict the behaviors of these fluids, such as capacity for carrying solids (weight material sag, drill cuttings transport, proppant transfer, etc.). Oscillatory testing mode also completely removes measurement errors due to sample climbing.

### Available Oil Bath Option

The M5600 is also available in an oil bath. The oil bath allows for cooling options and an operator can connect tubing to supply water for cooling capabilities.

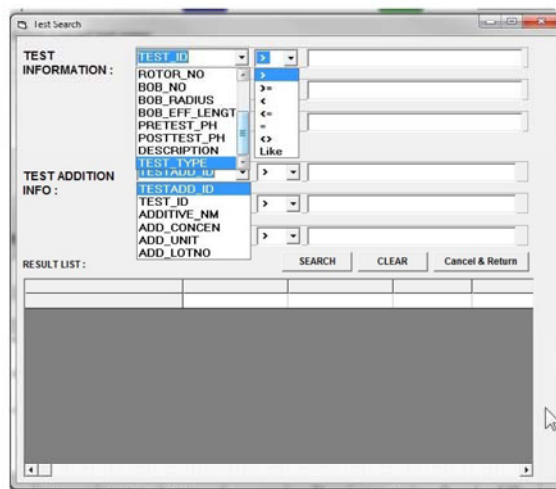


M5600 Rheometer is shown with oil bath option

### Cutting-edge database software enables customized search and data comparison

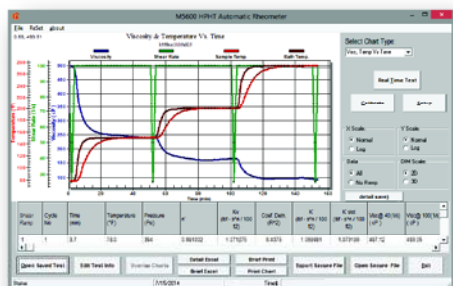
The application software, M5600 PC, includes powerful database tools for searching, categorizing, and comparing test results. The search criteria can include any test result parameter, including additives, descriptions, or other details. M5600 PC also allows you to overlap as many test charts as you like. Each test chart will display with customized graphics to differentiate it from other tests. M5600 PC software is:

- Customizable charts and real-time data are displayed during testing
- Data can be instantly exported into any spreadsheet
- Tests are simple to set up and run
- Customizable charts and real-time data are displayed during tests
- Using the drop-down menu saved tests can be searched by any specified test parameter, including: test name, fluid ID, additive, researcher name, rotor number, bob number, bob radius, and more.



Test search dialog box with drop-down menus

### M5600 PC Software - Standard Test



### M5600 PC Software - Oscillatory Test

