



Dynamic Shear Rheometer Probe

The CANNON® DSR Temperature Probe is designed to measure the temperature in the sample area of dynamic shear rheometers using SHRP binder specifications. The probe consists of a tiny thermistor mounted in a silicone “sandwich” between a thin ceramic disk and an Aramid with SBR rubber disk. A pair of wires is soldered to the thermistor. The wires are long enough to permit a meter to be connected outside the oven that surrounds the sample.

A thermistor was chosen as the sensing element because its change in resistance is large enough to permit use of a relatively inexpensive digital ohmmeter for the measurement. Each probe is calibrated and furnished with a calibration sheet that lists the temperatures at which measurements were made and the value of resistance obtained. This data is then used to obtain the best fit to the typical thermistor equation relating temperature and resistance. The appropriate equation for the probe is contained on the calibration sheet.



Caution: *Do not use silicone grease or immerse the probe in a temperature bath containing a silicone fluid. Silicone compounds are damaging to silicone rubber.*

Measuring Temperature

Measure temperature in a dynamic shear rheometer by placing the wafer-like DSR probe between the platens of the device, ensuring the probe is oriented with the hard, ceramic side of the disk facing down.



Note: *Applying a thin film of petroleum jelly on each surface of the probe improves thermal contact with the plates but is not necessary.*

Move the upper plate until it touches the top surface of the probe. Apply only light pressure to the surface of the probe to prevent damage to the thermistor. If probe placement requires that the leads be bent, make sure to bend the cable only. Do NOT bend the junction between the disk and the cable.

Bring the rheometer to the desired temperature as determined by the instrument’s temperature indicators. Once the temperature has stabilized, measure the resistance of the probe with a digital ohmmeter displaying at least four significant digits. The ohmmeter should be accurate to at least equal to 0.1 percent of the actual reading.

Attach the alligator clips on the two leads of the probe to the leads from the digital ohmmeter. Polarity does not matter in this instance, connect either of the probe leads to either of the ohmmeter leads.

Enter the measured value of resistance into the equation to obtain the actual temperature in the sample area. If the value differs by more than 0.1 °C, adjust the instrument controls to bring the temperature at the sample position to the desired level. Make a note of the changes that are required for this and save the notes for future use.

Range/Accuracy

The DSR Temperature Probe is intended for use in the range of 0 °C to 80 °C. Values outside of these limits are considered suspect. The nominal value of the thermistor is 100K ohms at 25 °C. Individual units may vary from this value by as much as 25 percent. The change in resistance per unit temperature is not linear.

Ohmmeter Specifications

Use a recently calibrated handheld meter, which meets the above accuracy requirements, for the measuring instrument. CANNON recommends a battery-operated meter since most bench-top meters apply very high voltages to unknown resistors to achieve high accuracy. Hence, the resulting current from such high voltages causes the thermistor to self-heat, yielding invalid temperature measurements and results.

Checking Resistance

To guarantee the accuracy of the measuring instrument, check the readings with several precision resistors (values guaranteed to be within 0.1 percent) in the range of 10K to 350K ohms. A 25K ohm silicone-ceramic resistor (measured reading $\pm 1\%$ nominal) is provided with the DSR probe for this purpose. If the resistors are measured to within the stated accuracy, the meter is satisfactory for use with the DSR Temperature Probe.

Calibration Interval

The calibration interval and/or replacement of this probe is left to the discretion of the user.

This device has a stable shelf life and, when handled properly, is expected to measure accurately for at least one year after first use. Thermistors are known to drift with time, but the accuracy of the measurement does not require periodic replacement/recalibration. This type of thermistor has an annual time drift of less than 0.02 °C.

To evaluate performance of the DSR, without a full calibration, verify the ice point. Place the probe into a container of crushed ice/water slurry (distilled water and ice provides the most accurate verification), measure the resistance, calculate the temperature, and compare the result to the 0 °C calculated temperature on the Certificate of Calibration. A determination of acceptance could be based on the temperature accuracy required by the dynamic shear rheometer method for which the DSR probe is being used.

Excessive wear or questionable results may require a replacement.

Order Information

Refer to part number 9728-V95 for the CANNON DSR Temperature Probe.