CANNON INSTRUMENT COMPANY®
2139 High Tech Road
State College, PA 16803
814-353-8000 • 800-676-6232 • Fax 814-353-8007
cannon@cannoninstrument.com
www.cannoninstrument.com

CERTIFICATE OF ANALYSIS

CANNON® CERTIFIED VISCOSITY/DENSITY TESTING SERVICE

Sample ID: **GRACE 500CP** | *Lot Number:* **H054J6A029** | *Certification/Issue Date:* **01/17/2020**

Temperature		Kinematic Viscosity	Dynamic Viscosity	Density	
°C	°F	mm^2/s (cSt)	mPa•s (cP)	g/cm^3 (g/mL)	
20.00	68.00	573.7	558.3	0.9732	
25.00	77.00	518.6	502.4	0.9687	
30.00	86.00	469.3	452.5	0.9643	
35.00	95.00	427.7	410.5	0.9598	
40.00	104.00	391.0	373.6	0.9554	

Customer Submitted Sample
Tested and certified in the U.S.A.

GENERAL INFORMATION

Sample Condition: The sample was received at CANNON Instrument Company in good condition, unless otherwise noted or communicated to the customer.

Specific Testing Conducted: The received sample was tested as specified in the customer agreement with CANNON Instrument Company.

Sampling Plan and Procedures: Aliquots for testing were taken from the received sample in accordance with the test procedures. The requested test procedures were followed with no additions, exclusions, or deviations.

Validity of Test Results: The sample was tested as received and the results were valid at the time of testing. CANNON Instrument Company makes no guarantee as to the period of validity of the data for the tested sample, since the material's stability and shelf life is unknown. The test results relate only to the provided sample and there is no representation that it applies to similar materials or the remainder of the batch from which it was taken.

ISO/IEC 17025
ilac-MRA A2LA ACCREDITED Calibration Laboratory CERT#1262.01

The inclusion of the A2LA and ILAC MRA logos does not imply certification/approval of the products calibrated or tested.

ISO 9001
Registered by UL-DQS #10002540 QM

Certification Under Supervision of:
D.B. Trowbridge, Ph.D.
J.T. Mastropierro
M.T. Zubler

DISCUSSION OF DATA[1]

Derivation of Certified Values: CANNON Instrument Company certifies that the kinematic viscosities were determined by the Master Viscometer technique reported in the Journal of Research of the National Bureau of Standards, (Vol. 52, No. 3, March 1954, Research Paper 2479) using CANNON® Laboratory Standard viscometers. All temperature measurements were conducted according to The International Temperature Scale of 1990 (ITS-90) using SPRTs with fixed point calibrations. The provided viscosity data are based upon the primary standard, water at 20 °C, with a kinematic viscosity of 1.0034 mm^2/s and an assigned accuracy of ± 0.17% as per ISO 3666. See also ASTM methods D2162, D445, D446, D2161, and ISO methods 3104 and 3105.

Kinematic viscosity (ν) measurements in mm^2/s at temperatures of 20, 25, and 40 °C, and other temperatures as appropriate, were generally made using Cannon-Ubbelohde Laboratory Standard viscometers, as described in ASTM methods D445 and D446.

Density (ρ) in g/cm^3 (g/mL) was generally determined through measurement in an oscillating U-tube digital density meter or modified Bingham pycnometer. See ASTM methods D4052, D1480, and D1217.

Dynamic viscosity (η) in mPa•s was generally determined by measuring the kinematic viscosity and multiplying it by the density at the same temperature [$\eta = \nu \cdot \rho$].

Where appropriate, the kinematic viscosity, dynamic viscosity, or density at certain temperatures was determined through regression of all measured data using industry standard equations. These equations include the linear or quadratic viscosity/density-temperature equation derived from the ASTM viscosity–temperature charts for petroleum products as well as the NBS viscosity-temperature equation for petroleum products. See ASTM method D341 and NBS equation.

Traceability: All data are traceable to intrinsic standards and National Institute of Standards and Technology (NIST) calibration or calculated by ASTM or NIST methods. Kinematic viscosity values are traceable to the viscosity of water. Temperature measurements were conducted with SPRTs that have NIST traceable fixed-point calibrations. A complete traceability statement is available for purchase from CANNON Instrument Company.

Measurement Uncertainty: CANNON Instrument Company has determined and reported the measurement uncertainty of its laboratory capabilities. The expanded uncertainties of the laboratory measurements summarized at the 95% confidence interval are as follows:

Kinematic Viscosity (- 40 °C to + 150 °C)

Range of Kinematic Viscosity (mm^2/s)	Expanded Uncertainty* (%) at Temperatures:		
	<15°C	15 to 45°C	>45°C
<10	0.21	0.16	0.21
10-100	0.26	0.22	0.26
100-1000	0.32	0.29	0.32
1000-10,000	0.47	0.38	0.38
10,000-100,000	0.53	0.44	0.48

Density (- 56 °C to + 150 °C)

Range of Density (g/cm^3)	Expanded Uncertainty* (kg/m^3)
0.7 – 1.2	0.05

** An expanded uncertainty U is determined by multiplying the combined standard uncertainty u_c by a coverage factor k: $U = k\,u_c$ where k=2. See NIST Technical Note 1297, 1994 edition, Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results.*

The expanded uncertainty for dynamic viscosity can be considered equivalent to the expanded uncertainty for kinematic viscosity since the uncertainty contribution of the density measurement is deemed negligible in the calculation of the total expanded uncertainty.

CANNON Instrument Company
2139 High Tech Road
State College, PA 16803 USA
814 353-8000 • 800 676-6232 • FAX 814 353-8007

Laboratory Technical Director:	D.B. Trowbridge, Ph.D.
Deputy Laboratory Technical Director:	J.T. Mastropierro
Director of Quality Assurance:	M.T. Zubler

[1]*Consult www.cannoninstrument.com for additional information.*