

ON-LINE VISCOSITY INDEX MONITOR

44960D NEC Purge • 44960E CENELEC Purge

PROCESS/ON-LINE

Determine viscosity index quickly, accurately and completely on-line!

The PSPI 44960 Viscosity Index Monitor is the world's only on-line instrument that measures the absolute viscosity of petroleum products at two different user-selected temperatures and automatically calculates the viscosity index. Average cycle time of less than five minutes. And because the spent sample is returned directly to process, no atmospheric drain or sample recovery system is needed. The 44960 Viscosity Index Monitor is completely microprocessor controlled, with self-test and diagnostic capabilities.

- Measurement range of 5 to 5000 Centipoise with repeatability of $\pm 0.5\%$
- Calculates viscosity results at any desired temperature
- Extremely high bath temperature capabilities of 50° to 250°C (122° to 482°F)
- Results correlate with ASTM D 445 Viscosity and D 2270 Viscosity Index
- Typical applications are locations where automatic on-line composition analysis for verifying product quality and performance specifications is required:
 - *lube oil manufacturing and blending*
 - *fuel oil blending*
 - *controlling the dilution of residual fuels, heavy fuels and bitumen to constant viscosity specifications*



THEORY OF OPERATION

The PSPI Viscosity Index Monitor is a sophisticated on-line instrument that continually measures viscosity of petroleum fractions and calculates viscosity index. The instrument produces an output signal proportional to viscosity and viscosity index over a range of 1 to more than 5000 Centipoise. *NOTE:* The Monitor inherently measures absolute viscosity and must correct for sample density to calculate Kinematic viscosity. Optional input for a separate densitometer is available for highest accuracy conversion to Kinematic units.

Sample is drawn directly from the process line into the first oven, which is normally operated at the process temperature. The sample passes through a heat exchanger as it enters the first oven to ensure that the sample temperature is as near as possible to the exact temperature of the oven. The sample then passes through the gear pump, which maintains sample flow at a constant rate. After passing through the pump, sample flows through the first capillary (range tube). Pressure and temperature are sensed as sample enters and leaves the capillary. Reading the temperature at the entrance and exit of the range tube permits use of an average temperature in the viscosity calculation to eliminate the effect of any deviation from the ideal temperature.

The sample flows into the second (high temperature) oven, where another heat exchanger brings the sample temperature up near the oven temperature. For utmost accuracy, the temperature of the second oven should be at least 30°C (55°F) higher than the temperature of the first oven. This temperature difference provides sufficient separation of the data points on the viscosity-temperature curve. Because viscosity is less at the higher temperature, the second range tube has a smaller bore to achieve an adequate pressure drop. The computer may be programmed to time delay the low temperature pressure measurements so the calculations will be performed comparing two data points from the same "segment" of sample. Timing the measurements in this way eliminates a possible error to non-uniform sample. When sample leaves the second range tube, it returns to the process line.

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SPECIFICATIONS

Performance

- **Measurement Temperature:** 50° to 250°C (122° to 482°F) accurate to $\pm 0.1^\circ\text{C}$ ($\pm 0.2^\circ\text{F}$); temperature measurement stability $\pm 0.2^\circ\text{C}$ ($\pm 0.04^\circ\text{F}$)
- **Accuracy:** Comparable to kinematic laboratory determinations (ASTM D 445) with respect to viscosities of Newtonian fluids; Correlations within $\pm 0.5\%$ are typical
- **Response Time:** 2 to 5 minutes
- **Ambient Temperature Limits:** 0°C to 40°C (32° to 104°F); weather protection required; no direct sunlight

Sample Requirements

- **Flow Rate:** 126 cc/minute minimum (60 Hz); 105 cc/minute minimum (50 Hz)
- **Pressure:** 3.5 kg/cm² (50 psig) min, 35 kg/cm² (500 psig) max
- **Temperature:** 0° to 250°C (32° to 482°F) at sample inlet
- **Return Pressure:** Direct to process; no sample recovery requirements

Utility Requirements

- **Electrical:** 44960D—115/230 VAC ($\pm 10\%$), 50/60 Hz, single-phase, 30 Amps; 44960E—380 VAC ($\pm 10\%$), 50/60 Hz, three phase, 20 Amps
- **Air:** Instrument-grade compressed air; Must be supplied at a pressure 4.0 to 7.0 kg/cm² (60 to 100 psig); The air supply system must be capable of delivering 560 SLPM (20 SCFM)
- **Compressed Air Cylinder:** Required for Model 44960E; Minimum of 10 liters of air at a pressure of at least 170 kg/cm² (2400 psig) is required to operate the Auxiliary Air Backup System

Signal Outputs

- **Analog Output:** Three continuous 4-20 mAdc outputs (standard); Viscosity at 2 different user-selectable temperatures and Viscosity Index
- **Serial Output:** RS-232 or current loop available (standard)
- **Analog Output:** One SPST fail-safe critical alarm relay (standard)

Area Classification

- **44960D:** NEC Class 1, Div 1, Group D
- **44960E:** CENELEC EExd IIB T2 certified; **CE** compliant

Dimensions & Weight

Uncrated:	H	W	D	units
• 44960D	1930	1700	710	mm
114 kg (250 lbs)	76	67	28	inches
• 44960E	1930	1575	710	mm
136 kg (300 lbs)	76	62	28	inches

Crated:	H	W	D	units
• 44960D	2083	1803	813	mm
182 kg (400 lbs)	82	71	32	inches
• 44960E	2083	1675	813	mm
204 kg (450 lbs)	82	66	32	inches

Optional Signal Inputs

- **Densitomer Input:** Terminals available for customer-supplied densitomer input (4-20mA); Allows density compensation for Centistoke output
- **Process Temperature Input:** Terminals available for customer-supplied RTD temperature probe or a fixed resistor (if a temperature compensated densitomer is installed)

Optional Accessories

- **Fast Loop Filter** continuously cleans filter, removing particulates down to 38 microns

Due to PSPI's commitment to continual product development, specifications are subject to change without notice.



44960E

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