

Nano CERTiTEST™ Model 3160 Particle Penetration Tester



TSI's Model 3160 Particle Penetration Tester measures the penetration efficiencies of very high efficiency filter media and cartridges. It also determines the penetration of nano to submicron particles through protective clothing materials.

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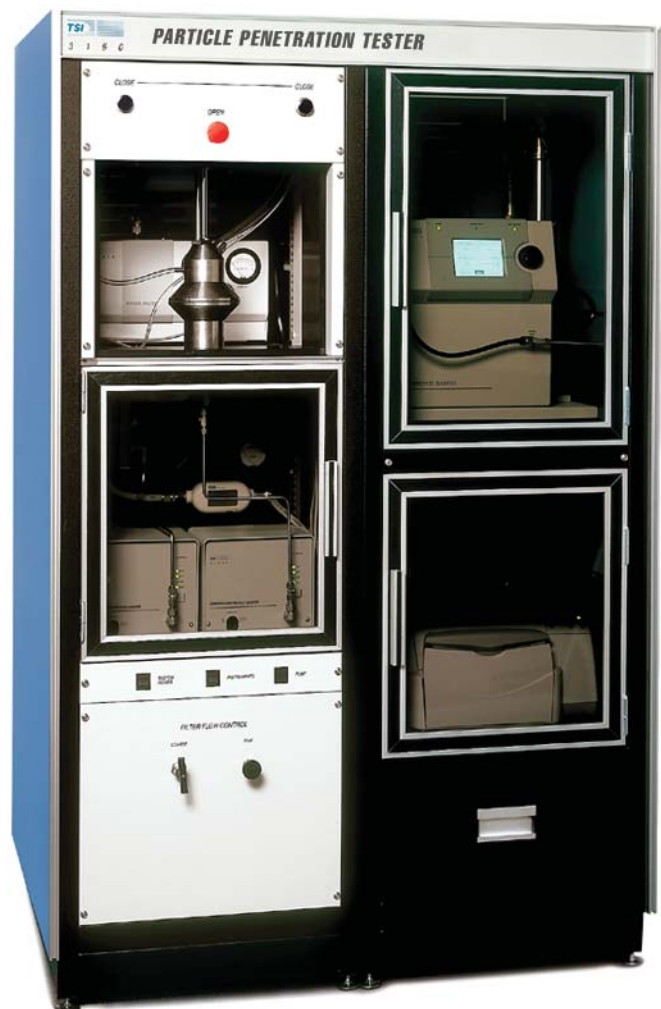
TSI's Model 3160 Particle Penetration Tester determines the most penetrating particle size (MPPS) and the efficiency of a tested material. The Model 3160:

- Conforms to European standard EN 1822, Part 3 for HEPA & ULPA filter media.
- Performs nondestructive tests due to the negligible amount of challenge required
- Produces mono-dispersed liquid or solid "challenge" aerosols for particle penetration testing
- Measures the penetration of as few as one particle in 1,000,000 (or 0.000001%) through the tested material
- Calculates the efficiency of the tested material up to 99.999999% (that's "eight nines")
- Provides airflow rates from 15 to 100 liters per minute (0.18 to 3.53 cfm)
- Accurately measures the airflow resistance of the tested material
- Requires minimal technical expertise since it's fully automated and easy to use
- Provides complete data analysis using an integral computer and menu driven software
- Prints full-page test data sheets with data presented in graphic and tabular form
- Automatically saves data to a database
- Offers a Fast Test Mode for faster testing when only one particle size is required

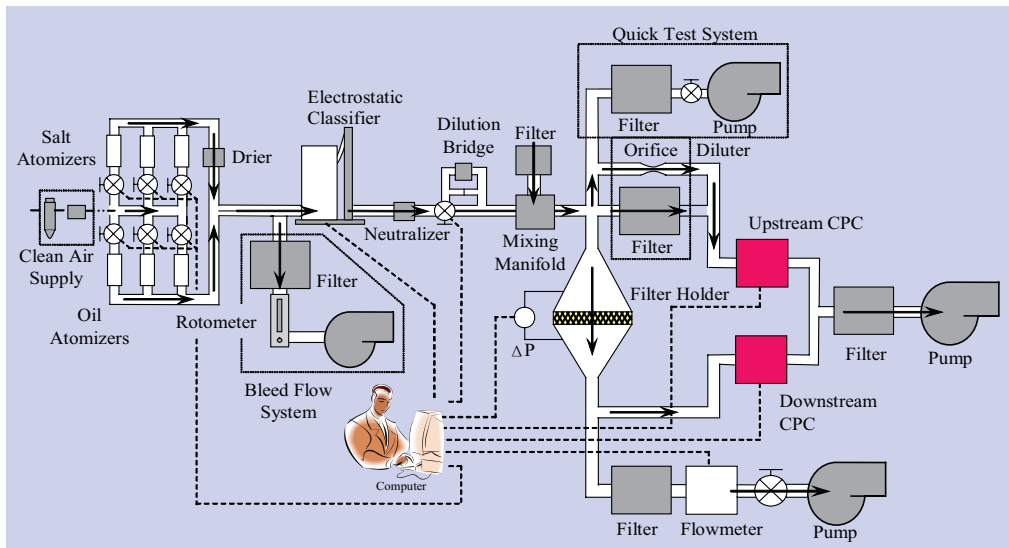
Knowing the size and number, or percentage, of particles that penetrate very-high- and ultra-high-efficiency filters, filter cartridges and hazardous protection materials is critical information for researchers and quality control personnel. With TSI's Nano CERTiTEST Model 3160 Particle Penetration Tester, this data is obtained accurately, easily and quickly.

The Model 3160 tester determines the penetration of solid and oil particles, ranging from 15 to 800 nanometers, through any flat sheet material or filter cartridge. It reports the number and size of particles upstream of the test sample and the number of particles that penetrate it. Even if only one in 1,000,000 nanoparticles penetrates the sample, the Model 3160 will detect that one particle.

Using highly intuitive software, the user merely selects a salt or oil challenge aerosol, selects single or multiple aerosol sizes and specifies the test duration. With the parameters entered, the operator simply selects "OK" and the Model 3160 completes the test automatically and prints a report. It's a powerful tool that is simple to operate.



Operation



Aerosol Generation

Using TSI's custom software, the user selects a salt or oil challenge aerosol and specifies the aerosol size. The Model 3160 generates the correct aerosol type automatically by atomizing a premixed liquid of distilled water and salt or dioctyl phthalate (DOP) and isopropyl alcohol. A TSI Electrostatic Classifier then selects the exact size of challenge particles the user specifies, with a geometric standard deviation less than 1.3. To produce larger particles the airflow into the Electrostatic Classifier is reduced using a bleed flow system.

Aerosol Concentration and Particle Counting

Two TSI Condensation Particle Counters (CPCs) determine the number of challenge particles generated (upstream CPC) and the number of particles penetrating the test material (downstream CPC). To operate correctly these CPCs require the aerosol concentration to be within predetermined limits. For lower efficiency materials, an excessive number of particles could reach the downstream CPC. To prevent this, a dilution bridge operates automatically to reduce the upstream concentration.

Airflow

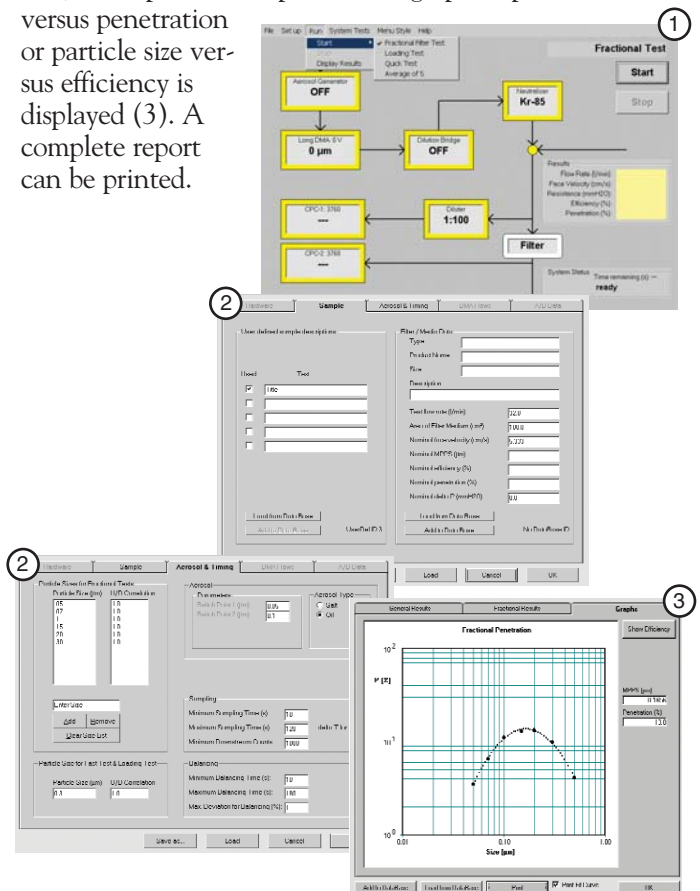
The user selects the amount of air flowing through the test material by opening a valve in the mixing manifold. When the valve opens, filtered air is drawn in and mixed with the test aerosol within the manifold. The airflow is monitored and reported by a TSI thermal mass flowmeter.

Quick Test System

The Model 3160 can run a filter or clothing material test with a duration of only a few seconds. In this "Quick Test Mode" the challenge aerosol is continuously generated and not shut off between tests. To prevent the challenge aerosol from flowing from the media holder when it is opened, a valve automatically opens, drawing the unused aerosol into a filter.

Software

The supplied software is easy to use yet powerful enough to provide full control of all aspects of the test. Salt or oil aerosol, particle size, test duration, and many other parameters can be selected or the operator can simply choose from a recipe of saved test routines. To perform a test, the operator simply selects run from the main screen (1), inputs the title and test material information and selects the aerosol, particle size and test duration (2). The system status, including particle size, airflow rate, face velocity, pressure drop or resistance, efficiency and penetration, is displayed during the test on the main screen (1). At the end, a complete test report with a graph of particle size versus penetration or particle size versus efficiency is displayed (3). A complete report can be printed.



Specifications

CERTITEST Model 3160 Particle Penetration Tester

Efficiency Range	0 to 99.999999% (eight 9s)
Penetration Range	0.000001% to 100%; down to one particle counted per 1,000,000 challenge particles
Challenge Aerosol Generation	
Aerosol Types	Salt (NaCl), DOP, and other oils (consult TSI)
Size Range	Selectable from 0.015 to 0.800 μm
Geometric Standard Deviation	Less than 1.3
Concentration	Varies greatly with particle size and airflow rate; generally 10^3 to 10^5 particles/ cm^3
Challenge Aerosol Detection	
Technique	Two TSI condensation particle counters (CPCs)
Dynamic Range	<0.01 to 10^6 particles/ cm^3
Airflow Through Tested Material	
Technique	TSI thermal mass flowmeter
Range	15 to 100 L/min (0.18 to 3.53 cfm)
Accuracy	$\pm 2\%$ of reading, ± 0.2 L/min (± 0.007 cfm)
Pressure Measurement	
Technique	Solid-state pressure transducer
Range	0 to 1470 Pa (0 to 0.21 psi) (0 to 150 mm H ₂ O); other ranges available
Automation, Data Management	Laptop computer with custom software supplied
Power Requirements	
Model 3160	115 VAC, 60 Hz, 10 A
Model 3160-1	230 VAC, 50-60 Hz, 5 A
Pneumatics	7 m ³ /hr at 415 kPa (4 scfm at 60 psi)
Dimensions (W x D x H)	122 cm x 81 cm x 183 cm (48 in. x 32 in. x 72 in.)
Weight	410 kg (900 lbs)

Specifications are subject to change without notice.

To Order

CERTITEST Model 3160 Particle Penetration Tester

Specify	Description
3160	Particle Penetration Tester, 115 VAC, 60 Hz, 10 A
3160-1	Particle Penetration Tester, 230 VAC, 50-60 Hz, 5 A
8830 OSS	One day of on-site training or service within North America
8830-1 OSS	One day of on-site training or service outside North America
8831	Subsequent day(s) of on-site training or service
813010	Standard test media, 50 sheets
3160-xx	Custom filter holders
8107	External adaptor for filter cartridges with hose type inlet and outlets
1930041	Model 3160 Particle Penetration Tester Manual

TSI can update the Model 3160 Particle Penetration Tester with the latest TSI particle instrumentation. Contact your TSI representative to discuss your needs.



TSI can design and build custom filter holders for a variety of filter elements. Ask your TSI representative for a quotation.



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