

# NANOPARTICLE EMISSION TESTER MODEL 3795

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OPERATION AND SERVICE MANUAL

P/N 6007583, REVISION C  
APRIL 2015



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# NANOPARTICLE EMISSION TESTER MODEL 3795

OPERATION AND SERVICE MANUAL

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# Manual History

The following is a history of the Nanoparticle Emission Tester Model 3795 Operation and Service Manual (P/N 6007583).

<b>Revision</b>	<b>Date</b>
A	January 2014
B	January 2015
C	April 2015

# Warranty

<b>Part Number</b>	6007583 / Revision C / April 2015
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# Safety

This chapter provides instructions to promote safe handling and correct operation of the Nanoparticle Emission Tester Model 3795.

There are no user serviceable parts inside the instrument. Refer all repair and maintenance to a qualified technician. All maintenance and repair information in this manual is included for use by a qualified technician.



## WARNING

- The Nanoparticle Emission Tester must be used in the manner described in this manual. Failure to follow all of the procedures described in this manual can result in serious injury to you or can cause irrevocable damage to the instrument.
- The Nanoparticle Emission Tester is a Class I laser-based instrument. During normal operation, you will not be exposed to laser radiation. However, take precautions to avoid any exposure to hazardous radiation in the form of intense, focused, visible light because such exposure can cause blindness. **Do not** remove the instrument cover unless you are a qualified service technician following procedures described in this manual.
- Isopropyl Alcohol may spill when you remove the wick cartridge. Isopropyl Alcohol is a hazardous material. **Do not** ingest or allow alcohol to contact your eyes or skin. Refer to the Material Safety Data Sheet (MSDS) located in the box of alcohol for handling precautions and first-aid procedures.
- Always recap the alcohol fill capsule and other containers immediately after use to prevent absorption of moisture and the escape of alcohol vapors.
- Dispose of any alcohol with visible contamination.



## WARNING

- 110-220V is accessible within the Nanoparticle Emission Tester. Qualified technicians must unplug the power source **before** removing the cover to perform maintenance procedures.
- During operation, hot surfaces are accessible within the Nanoparticle Emission Tester. Qualified technicians must unplug the power source and allow the instrument to cool down **before** removing the cover to perform maintenance procedures.

# Description of Safety Symbols and Labels

This information explains the advisory and identification labels used on the instrument and in this manual to reinforce the safety features built into the instrument.

## Caution Symbols



### C a u t i o n

**Caution** means *be careful*. If you do not follow the procedures described in this manual you may damage the instrument. Caution also indicates important information about the operation and maintenance of this instrument.

## Warning Symbols



### W A R N I N G

**Warning** means that unsafe use of the instrument could result in serious injury to you or cause irrevocable damage to the instrument. Follow the procedures prescribed in this manual to use the instrument safely.

## Caution or Warning Symbols

The following symbols may accompany cautions and warnings to indicate the nature and consequences of hazards:

	Warns you that uninsulated voltage within the instrument may have sufficient magnitude to cause electric shock. Therefore, it is dangerous to make any contact with any part inside the instrument.
	Warns you that the instrument contains a laser and that important information about its safe operation and maintenance is included. Therefore, you should read the manual carefully to avoid any exposure to hazardous laser radiation.
	Warns you that the instrument is susceptible to electro-static discharge (ESD) and ESD protection procedures should be followed to avoid damage.
	Indicates the connector is connected to earth ground and cabinet ground.



## Reusing and Recycling

The following symbols may accompany cautions and warnings to indicate the nature and consequences of hazards:






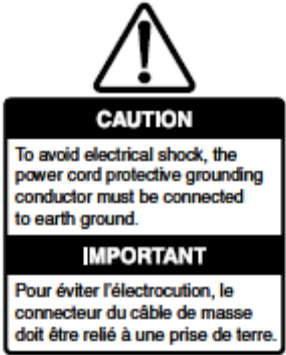


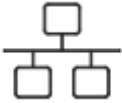


As part of TSI Incorporated's effort to have a minimal negative impact on the communities in which its products are manufactured and used:

- **Do not** dispose of used batteries in the trash. Follow local environmental requirements for battery recycling.
- If instrument becomes obsolete, return it to TSI for disassembly and recycling.

## Safety and Other Labels

Advisory labels and identification labels are attached to the interior and exterior of the Nanoparticle Emission Tester. Labels are described below.

<p><b>Serial Number Label and Conformance Type Approval Mark</b>—displayed on the back panel.</p>	 <p>The label contains the following information:          Model: 3795          Date: DECEMBER 2014          SN: 3795144202          (Barcode)          TSI logo          Model: 3795          CH - K4 - 15001          SN: 3795150101          TSI INCORPORATED, 500 Cardigan Road, Shoreview, MN 55126, USA          CH M 15</p>
<p><b>NRTL TÜV SÜD Mark</b>—displayed on the back panel. This mark identifies the product as meeting safety regulations in the US, Canada and Europe and further identifies the product as one for which ongoing production is monitored for quality.</p>	 <p>The mark features a blue octagonal border with 'Safety tested' on the left and 'Production monitored' on the right. In the center is the TÜV SÜD logo. At the bottom corners are the letters 'C' and 'US'.</p>
<p><b>AC Power Specification Label</b>—displayed on back panel. AC power 100-240 VAC, 50-60 Hz, 200W Max only.</p>	<p>AC Power In          100-240 VAC~          50-60 Hz, 200W Max</p>
<p><b>Power Pushbutton Label</b>—displayed on the back panel, immediately above the lighted power switch.</p>	 <p>The symbol is a standard power button icon: a circle with a vertical line through the top.</p>

<p>Electrical Shock caution and no user serviceable parts – displayed on back panel</p>	
<p><b>Earth Ground Label</b>— displayed on the interior</p>	
<p><b>TSI Address and Service Label</b>— displayed on the back panel.</p>	<p>TSI Incorporated 500 Cardigan Road Shoreview, MN 55126 Made in U.S.A</p> <p>For service and information contact TSI customer service at <a href="http://www.tsi.com">www.tsi.com</a></p>
<p><b>CE Marking</b>—displayed on the back panel</p>	
<p><b>Ethernet Port</b>—denotes an RJ-45 Ethernet port, displayed to the left of the port on the back panel.</p>	
<p><b>USB Port</b>—denotes a USB-A or USB-B port, displayed to the left of the port on the back panel.</p>	
<p><b>European Recycling Label</b>— displayed on the back panel (indicates item is non-disposable and must be recycled).</p>	

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# About This Manual

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## Purpose

This is an operation and service manual for the Nanoparticle Emissions Tester Model 3795.

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## Organization

The following information is a guide to the organization of this manual.

- [Chapter 1: Product Overview](#)  
Contains an introduction to the Nanoparticle Emission Tester, a list of features, and a brief description of how the instrument works.
- [Chapter 2: Unpacking and Setting Up the Nanoparticle Emission Tester](#)  
Contains a packing list and the step-by-step procedures for operating the instrument.
- [Chapter 3: Moving and Shipping the Nanoparticle Emission Tester](#)  
Describes how to prepare the Nanoparticle Emission Tester for moving and shipping.
- [Chapter 4: Instrument Description](#)  
Describes the location and function of labels, controls, indicators, and connectors on the Nanoparticle Emission Tester.
- [Chapter 5: Instrument Operation](#)  
Describes the operation of the Nanoparticle Emission Tester.
- [Chapter 6: Maintenance, Service, and Troubleshooting](#)  
Describes the recommended practices for routine maintenance and service, as well as important troubleshooting procedures.

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## Submitting Comments

TSI values your comments and suggestions on this manual; please use the comment sheet on the last page to send us your opinion on the manual's usability, to suggest specific improvements, or to report any technical errors.

If the comment sheet has already been used, please mail or email your comments to:

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Particle Instruments  
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Shoreview, MN 55126  
Fax: (651) 490-3824  
E-mail Address: [particle@tsi.com](mailto:particle@tsi.com)

# CHAPTER 1

## Product Overview

This chapter contains an introduction to the Nanoparticle Emission Tester and provides a brief explanation of how the instrument operates.

---

### Product Description

The Nanoparticle Emission Tester measures the solid-particle number-concentration in exhaust emissions from vehicles equipped with Diesel Particulate Filters (DPF). Results can indicate whether or not the filters are cracked and should be replaced. The Nanoparticle Emission Tester can be used by a trained mechanic/technician either in the field (such as at construction sites) or in a workshop.

The Nanoparticle Emission Tester consists of a metal sample probe and clamp and an aerosol transport tube connecting the sample probe to the measurement instrument. The measurement instrument contains a pre-treatment and volatile particle remover (VPR); a diluter, a measurement sensor and associated electronics, power supply, pumps and other mechanical support systems, and a thermal management subsystem including fans and a heat exchanger.

Advantages of the Nanoparticle Emission Tester include the following:

- Solid-particle number concentration measurement range from 1,000 to 5,000,000 P/cm<sup>3</sup>.
- Volatile and semi-volatile nucleation-mode particles are evaporated and oxidized and; therefore, not counted.
- Soot particle detection efficiencies, by electrical mobility diameter:
  - 23 nm:  $E < 50\%$
  - 41 nm:  $50\% < E$
  - 80 nm:  $70\% < E < 130\%$
  - 200 nm:  $E < 200\%$
  - 30 nm C-40 droplets:  $E < 5\%$
- Response time:  $T_{10\% \text{ to } 90\%}$  and  $T_{90\% \text{ to } 10\%}$ :  $< 5.0$  seconds.
- Response time:  $T_{0\% \text{ to } 90\%}$ ,  $< 10$  seconds.
- Dedicated for outdoor use. Can be operated at ambient temperatures ranging from  $-10$  to  $40^{\circ}\text{C}$  and pressures ranging from 86.0 kPa to 106.0 kPa.
- Meets class M2 mechanical environment and class E2 electromechanical environment requirements.
- Operated with AC mains power (110-240 VAC, 50-60 Hz, 200W max).
- Can withstand corrosive ( $\text{NO}_x$ , HC,  $\text{H}_2\text{O}$ ,  $\text{H}_2\text{SO}_4$ ) and high-temperature exhaust gas ( $300^{\circ}\text{C}$ ).

- Official Measurement periods incorporate the following:
  - 1 to 15 sec warm-up period when data is collected but not used or displayed.
  - 15 to 20 sec first mean measurement period (Mean #1).
  - 20 to 25 sec idle period when data is collected but not used or displayed.
  - 25 to 30 sec second mean measurement period (Mean #2).
  - 30 to 35 sec idle period when data is collected but not used or displayed.
  - 35 to 40 sec third mean measurement period (Mean #3)
- Printable test report and downloadable data sets.
- 10 Hz data rate for Official Measurements, 1 Hz data rate for General Measurements.



## CHAPTER 2

# Unpacking and Setting Up the Nanoparticle Emission Tester

Use the information in this chapter to unpack and set up the Nanoparticle Emission Tester.



### Caution

The shipping containers and packaging provided with the Nanoparticle Emission Tester are designed to protect the instrument. Use the provided container and packaging to ship the instrument for service; use of other packaging may result in damage to the instrument.

---

## Packing List

The packing list described in Table 2-1 lists the components shipped with the Nanoparticle Emission Tester.

**Table 2-1**  
Nanoparticle Emission Tester Packing List

Qty.	Description
1	Nanoparticle Emission Tester Model 3795
1	Nanoparticle Emission Tester Operation and Service Manual
1	Nanoparticle Emission Tester Software Installation CD
1	Exhaust probe
4	HEPA filter cartridges (2 pre-installed)
2	Desiccant dryer cartridges (1 pre-installed)
2	Alcohol cartridges
1	Fill capsule
1	Storage cap
1	Isopropyl alcohol, 30 mL x 16 bottles
6	Spare cartridge O-rings
2	Spare filter cover plate O-rings
2	High-temperature probe O-rings (white)
4	Wicks (2 installed in alcohol cartridges)
1	Ethernet crossover cable
1	AC power cord

---

# Unpacking

Remove the manual from the shipping container before carefully unpacking the Nanoparticle Emission Tester. Use the [packing list](#) to verify that there are no missing components.

Save the original shipping container and packing materials to use for future shipping.

If anything is missing, or appears to be damaged, contact your TSI representative or TSI Customer Service using one of the following methods:

Telephone: 1-800-874-2811 (within the US)  
001-651-490-2811 (outside the US)  
E-mail: [particle@tsi.com](mailto:particle@tsi.com).

See Chapter 6, [Returning the Nanoparticle Emission Tester for Service](#), for instructions on how to return the instrument to TSI.

---

# Setting Up the Instrument

This section contains instructions for setting up the Nanoparticle Emission Tester. The Nanoparticle Emission Tester contains a wick that must be wetted with Isopropyl Alcohol (IPA) before you begin operation and every two hours during operation.

The dimensions of the Nanoparticle Emission Tester are 52 x 26 x 25.5 cm (20.5 x 10.25 x 10 in), without the probe attached. You will require a space adequate to accommodate these dimensions plus the probe.

Setup procedures include the following:

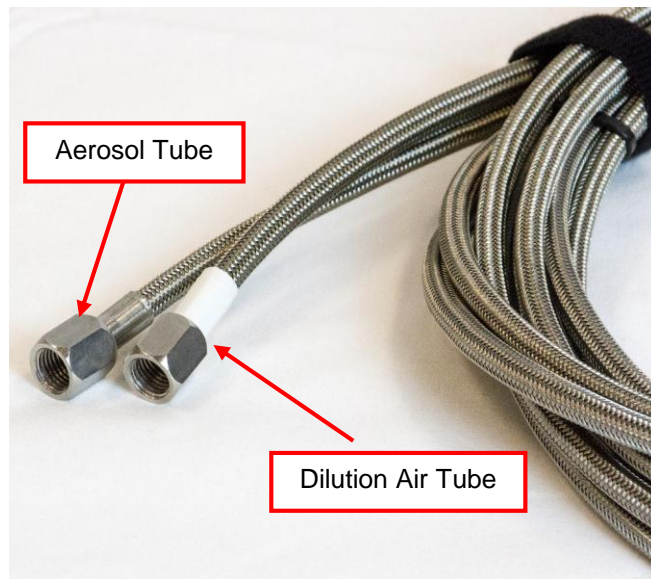
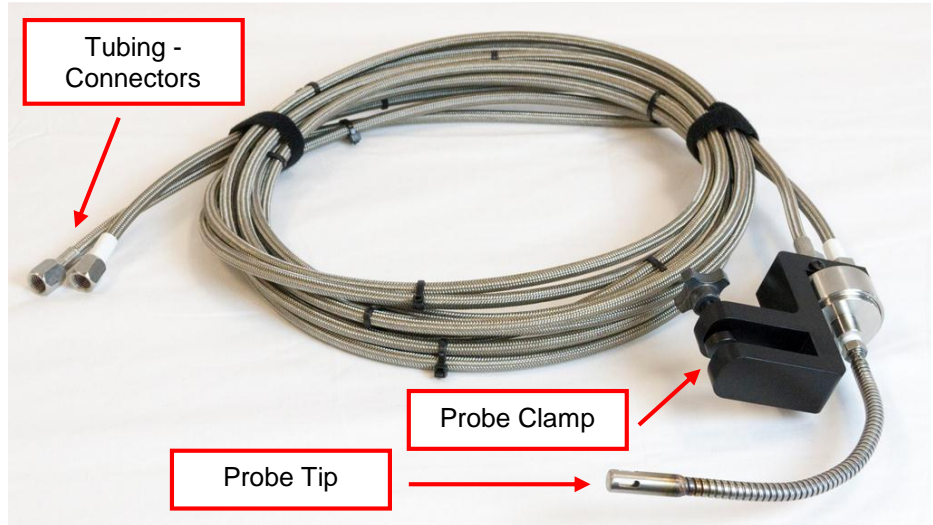
1. [Connecting the probe.](#)
2. [Charging the wick.](#)
3. [Connecting the emission tester to the computer.](#)
4. [Powering on the emission tester.](#)

## Connecting the Probe

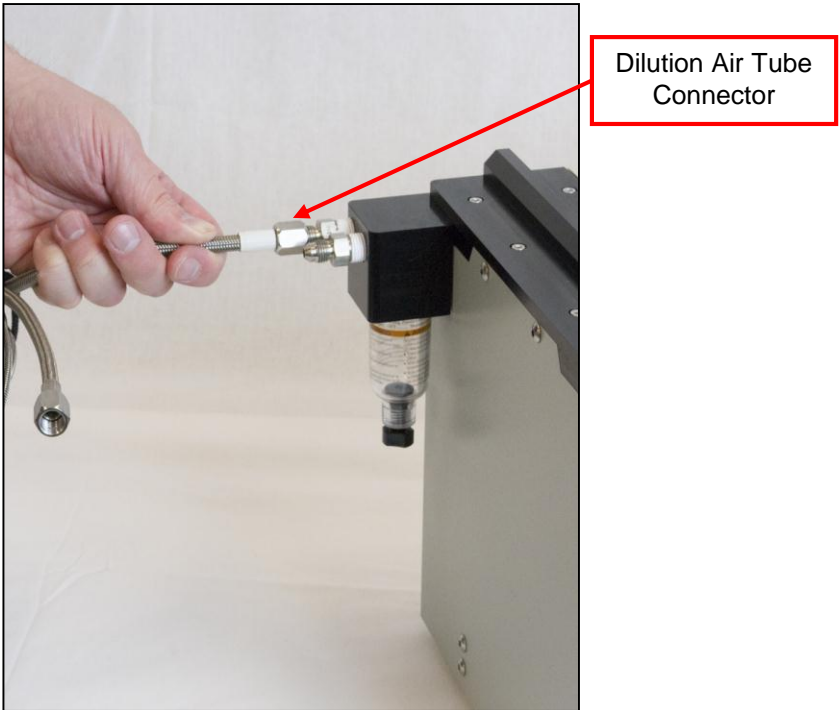
To connect the probe, follow these instructions:

1. Remove the probe and attached flexible hose from the packing materials.

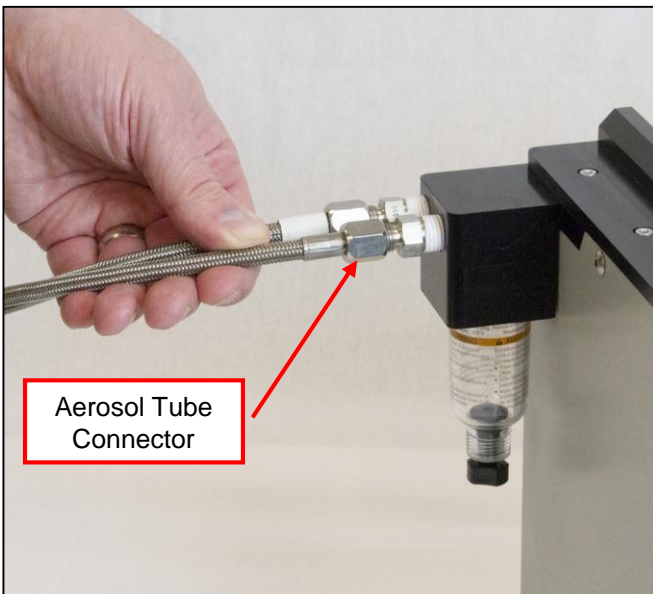
**Note:** *The tube end marked with a white label is for dilution air. The unmarked tube is for the aerosol flow.*



2. Attach the dilution hose tube connector (marked with a white label) to the outermost fitting on the front panel. Using a wrench, tighten the fitting to  $\frac{1}{4}$  turn past finger tight.



3. Attach the unmarked aerosol hose fitting to the innermost fitting. Using a wrench, tighten the fitting to  $\frac{1}{4}$  turn past finger tight.



## Charging the Wick

Before you can use the Nanoparticle Emission Tester, you must charge the wick with reagent grade ( $\geq 99.5\%$ ) Isopropyl Alcohol (IPA). The instrument is shipped with a wick and wick cartridge installed.



### WARNING

- Isopropyl Alcohol may spill when you remove the wick cartridge. Isopropyl Alcohol is a hazardous material. **Do not** ingest or allow alcohol to contact your eyes or skin. Refer to the Material Safety Data sheet (MSDS) located in the box of alcohol for handling precautions and first-aid procedures.
- Always recap fill capsule and other containers immediately to prevent absorption of moisture and the escape of alcohol vapors.
- Dispose of any alcohol with visible contamination.



### Caution

Reagent-grade ( $\geq 99.5\%$ ) Isopropyl Alcohol **MUST BE USED**.

To charge the wick, follow these instructions:

1. Ensure that the Nanoparticle Emission Tester is powered off.
2. Remove the cap from the alcohol fill capsule and set the cap down on a clean surface.



3. Pour IPA into the alcohol fill capsule until it reaches the fill line.

4. Locate the wick cartridge cap on the back of the instrument. Turn the cap in an anticlockwise (counterclockwise) direction and pull out the cartridge.



**WARNING**

**Do not** place the wick cartridge on a dirty surface. If the cartridge becomes contaminated, wipe it clean with a low-lint cloth.



5. Place the clean wick cartridge in the alcohol fill capsule. Turn the wick cartridge in a clockwise direction until it locks in place.



6. Wait for at least two minutes to allow the wick to absorb the IPA. You should see the level drop in the alcohol fill bottle.

7. Remove the wick cartridge from the alcohol fill cartridge and gently shake the wick cartridge to allow the excess alcohol to drip back into the fill cartridge. When no more IPA drips, stop shaking the cartridge.

**Note:** There is no need to wait until the outer surface of the cartridge is dry.

8. Insert the wick cartridge into the Nanoparticle Emission Tester. When the wick cartridge is fully inserted, twist the cartridge in a clockwise direction until it locks in place.



### WARNING

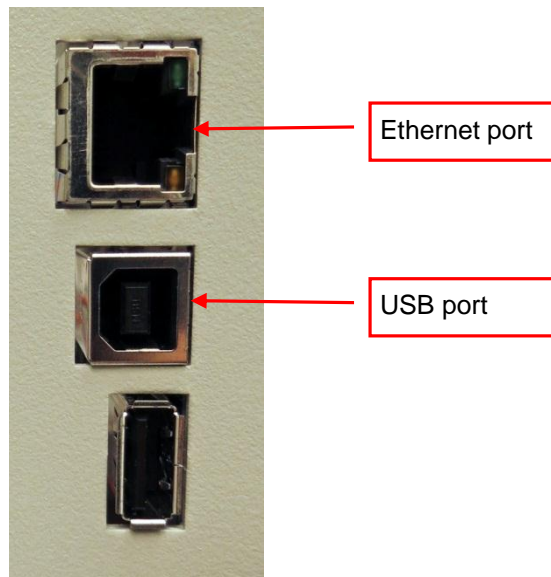
The cartridge should slide easily into place. **Do not** force it.

9. Replace the cap on the alcohol fill capsule.

## Connecting the Emission Tester to the Computer

TSI recommends a computer (PC) or tablet device to operate the Nanoparticle Emission Tester. The tester can be connected to the computer or tablet using the provided Ethernet crossover cable.

**Notes:** *If you are using the TSI-recommended tablet and USB dongle and/or implementing a switch/router network, as opposed to a direct connection to a PC, you may be able to use a standard Ethernet cable (not included). The USB connection is reserved for factory calibration and firmware updates—any other use is not supported.*



To connect the computer to a printer, consult the printer manufacturer's directions.

## Ethernet Communication

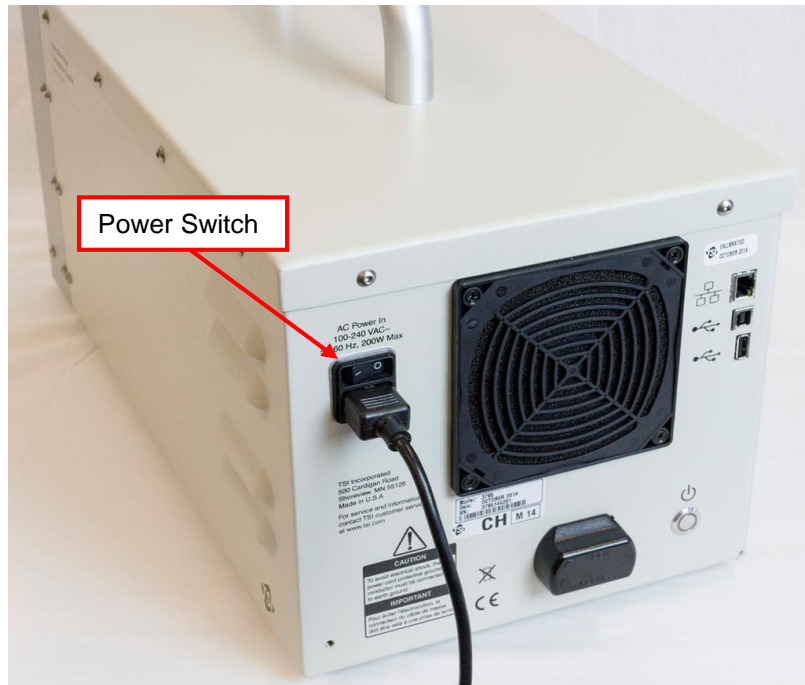
If using an Ethernet connection, connect the supplied Ethernet crossover cable to the Ethernet port on the back panel of the Nanoparticle Emission Tester. Connect the other end of the cable to the PC. **The PC should be configured with a static IP address of 192.168.0.10, a subnet mask of 255.255.255.0, and a default gateway of 192.168.0.1.** Contact your PC operating system manufacturer for assistance with this configuration. Contact TSI technical support for assistance with configuring the Nanoparticle Emission Tester for other network configurations.

## Powering On the Nanoparticle Emission Tester

The emission tester should be connected to an AC power outlet.

To connect the emission tester to a power source, follow these instructions:

1. Plug the supplied power cord into the **AC Power** connection on the back panel of the emission tester.



2. Plug the power cord into your electrical supply. It is not necessary to select the correct voltage; the Nanoparticle Emission Tester accepts line voltage of 85 to 260 VAC, 50 to 60 Hz, 200 W max., single phase.
3. Flip the rocker switch. The instrument powers up automatically.
4. If the instrument has been previously powered off using the lighted power switch and does not power on when flipping the rocker switch to the on position, press the lighted power switch once to complete the powering on of the Nanoparticle Emission Tester.



## CHAPTER 3

# Moving and Shipping the Nanoparticle Emission Tester

Use the information in this chapter to prepare the Nanoparticle Emission Tester for moving, shipping, or storage.



### **C a u t i o n**

The shipping containers and packaging provided with the Emission Tester are designed to protect the instrument. Save and use the provided container and packaging to ship the instrument for service; use of other packaging may result in damage to the instrument.



### **W A R N I N G**

***Do not tilt*** the Nanoparticle Emission Tester > 15° in any direction. If the instrument is tilted, the internal optics may be damaged.



### **W A R N I N G**

***Do not drop*** the Nanoparticle Emission Tester.

## **Preparing for Shipping**

To prepare the Nanoparticle Emission Tester for shipping, follow these instructions:

1. Power off the emission tester and disconnect the power cord from the power supply.
2. Disconnect the power cord from the back of the instrument.

3. Disconnect the emission tester from the PC. Using a wrench, disconnect the probe hose fittings from the dilution and aerosol inlets, at the tubing connectors.



4. Locate the wick cartridge cap on the back of the instrument. Turn the cap in an anticlockwise (counterclockwise) direction and pull out the cartridge.



## WARNING

**Do not** place the wick cartridge on a dirty surface. If the cartridge becomes contaminated, wipe it clean with a low-lint cloth. Store the wick cartridge in the alcohol fill capsule when not in use.

5. Screw the cap from the alcohol fill capsule into position to cap the port.
6. Place the Nanoparticle Emission Tester in the original packing materials. If the original packing materials are not available, pack the instrument tightly in foam or bubble wrap and place into a double walled shipping box, or contact TSI for replacement shipping materials.

The instrument is now ready for shipping.

## **Preparing to Move**

To prepare the Nanoparticle Emission Tester for moving, follow these instructions:

1. Power off the emission tester and disconnect the power cord from the power supply.
2. If the device cannot be moved without tilting more than 15 degrees in any direction, remove the wick and replace with the with the alcohol fill capsule cap, as described in steps 4 and 5 of the previous section.

The instrument is now ready to be moved.

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## CHAPTER 4

# Instrument Description

Use the information in this chapter to become familiar with the location and function of controls, indicators, and connectors on the Nanoparticle Emission Tester.

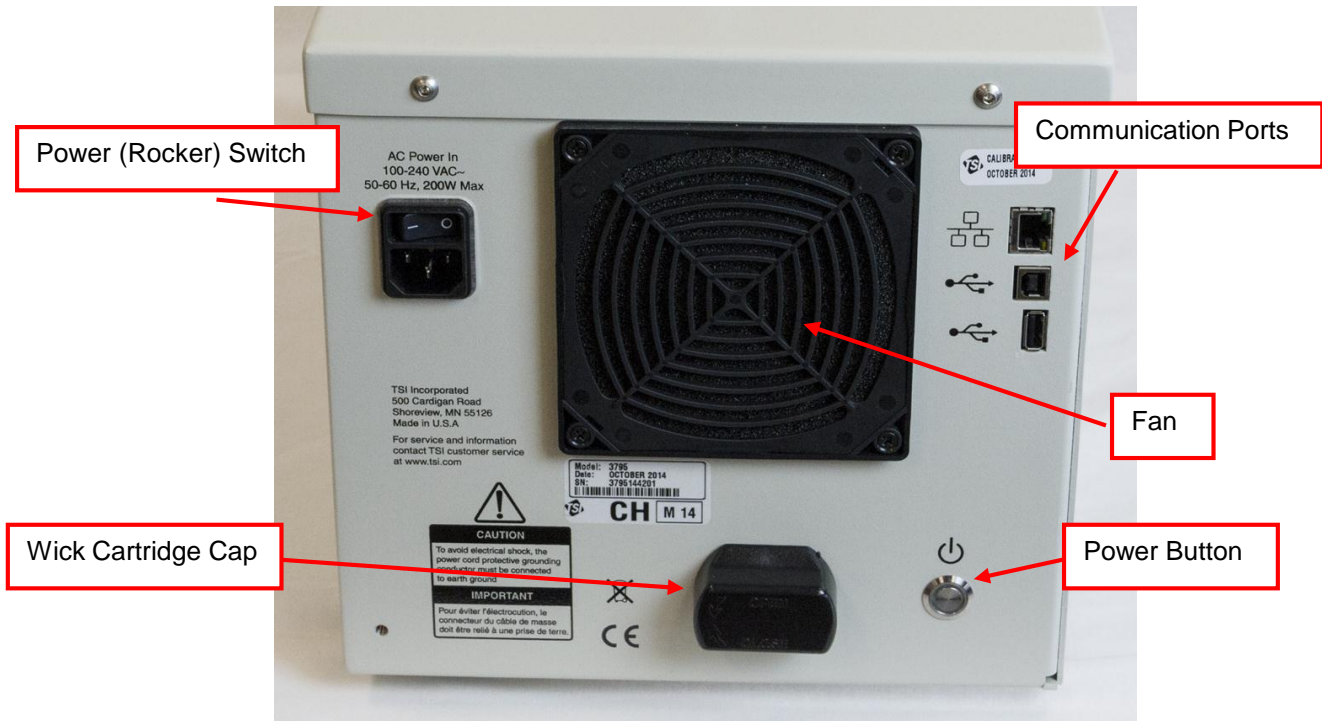


### W A R N I N G

- Unsafe use of this instrument can occur if it not used in a manner described within this manual. Failure to follow all of the procedures described in this manual can result in serious injury to you or cause irrevocable damage to the instrument.
- If the cover is removed from the instrument, you may come into contact with hot surfaces. **Do not** touch any internal components until the instrument has been allowed to cool down.
- If the cover is removed from the instrument and any of the internal components are touched, you may cause a short circuit within the electrical components. **Do not** touch any internal components unless instructed to do so in this manual.

# Back Panel

The main components of the Nanoparticle Emission Tester's back panel are shown in Figure 4-1 below.



**Figure 4-1**  
Nanoparticle Emission Tester Back Panel

# CHAPTER 5

## Instrument Operation

This chapter describes how to operate the Nanoparticle Emission Tester.

---

### Operating Precautions

When using the emission tester, allow the instrument to cool down before touching any internal components or surfaces.



#### W A R N I N G

- If the cover is removed from the instrument, you may come into contact with hot surfaces. The elbow and tube connected to the power supply retain heat. **Do not** touch any internal components until the instrument has been allowed to cool.
- If the cover is removed from the instrument and you touch any of the internal components, you may cause a short circuit within the electrical components. **Do not** touch any internal components unless instructed to do so in this manual.
- **Do not** tilt the Nanoparticle Emission Tester  $> 15^\circ$  in any direction. If the instrument is tilted, damage may occur to the internal optics.
- **Do not** drop the Nanoparticle Emission Tester.
- **Do not** place the Nanoparticle Emission Tester on a vibrating machine or surface.



#### C a u t i o n

If the above operating precautions are not followed, irrevocable damage may occur to the instrument and you may receive inaccurate measurements.

---

# Operating the Nanoparticle Emissions Tester

The Nanoparticle Emission Tester provides the following measurement options:

- Official Measurement: Guides you through a series of steps to create an official measurement, as per Swiss regulation SR 941.242.
- General Measurement: Allows you to customize the measurements you take to meet your needs, such as conducting research and conformance testing.

## Warm-up Period

When you turn on the Nanoparticle Emission Tester, there is a 1 to 2 minute warm-up period before the tester detects the computer. You must wait for up to 10 minutes before performing a measurement so that the instrument can reach the correct operating temperature.

The Nanoparticle Emission Tester software is pre-loaded onto the computer or tablet device. When you open the Nanoparticle Emission Tester software, the following screen appears.



**Figure 5-1**  
Nanoparticle Emission Tester Main Screen



## Status Bar

The status bar lists the current date and time and displays the Diagnostics and Settings buttons. The date and time format depends upon the computer's region and language settings. For example, computers located in the US will display the date and time in the mm/dd/yyyy (where m = month, d = day, y = year) and hh:mm:ss (where h = hour, m = minute, and s = seconds) format.

The Status Bar background color is either blue or red.

- Blue indicates that the instrument is operating correctly.
- Red indicates that errors have been detected. When errors are detected a wrench icon appears in the status bar. Click the wrench icon to see an error list.



**Figure 5-2**  
Nanoparticle Emission Tester Status Bar

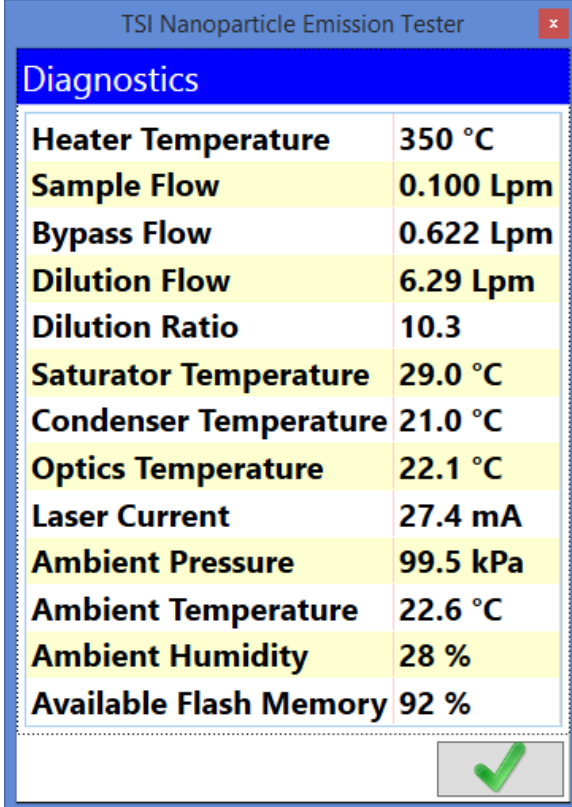
Table 5-1 contains a brief description of possible error messages.

**Table 5-1**  
Nanoparticle Emission Tester Error Messages

<b>Error Message</b>	<b>Description</b>
Application version x.x.x.x is required to run official measurements with this instrument.	The software version does not match the firmware version of the current instrument for the purposes of the official measurement mode and type conformance for Swiss Regulation SR 941.242.
Bypass flow error	The bypass flow is > 5% outside the setpoint, nominally 0.6 L/min.
Dilution flow error	The dilution flow is > 0.2 L/min outside the target of 6.3 L/min.
CPC flow error	The flow through the CPC > 0.005 L/min outside the target of 0.10 L/min.
Laser out of range	The laser current is outside the acceptable range.
Concentration high	The inlet concentration > the maximum specification.
Concentration low	The inlet concentration < limit of detection.
Low pulse	The CPC counter pulse height is too low, indicating either depletion of alcohol vapor or the presence of particles of a size near the detection limit of the device.
Optics temperature error	The optics temperature is too high or too low.
Dilution ratio error	The dilution ratio is out of range.
Saturator temperature out of range	The saturator temperature is outside the acceptable range.
Condenser temperature out of range	The condenser temperature is outside the acceptable range.
Heater temperature out of range	The catalytic stripper heater temperature is outside the acceptable range.
Calibration is past due	One year (or more) has lapsed since the last instrument calibration.

## Diagnostics

To see diagnostic information, click the  button on the main screen. The following Diagnostics screen will display, which is updated every two seconds.



Diagnostics	
Heater Temperature	350 °C
Sample Flow	0.100 Lpm
Bypass Flow	0.622 Lpm
Dilution Flow	6.29 Lpm
Dilution Ratio	10.3
Saturator Temperature	29.0 °C
Condenser Temperature	21.0 °C
Optics Temperature	22.1 °C
Laser Current	27.4 mA
Ambient Pressure	99.5 kPa
Ambient Temperature	22.6 °C
Ambient Humidity	28 %
Available Flash Memory	92 %

**Figure 5-3**  
Nanoparticle Emission Tester Diagnostics

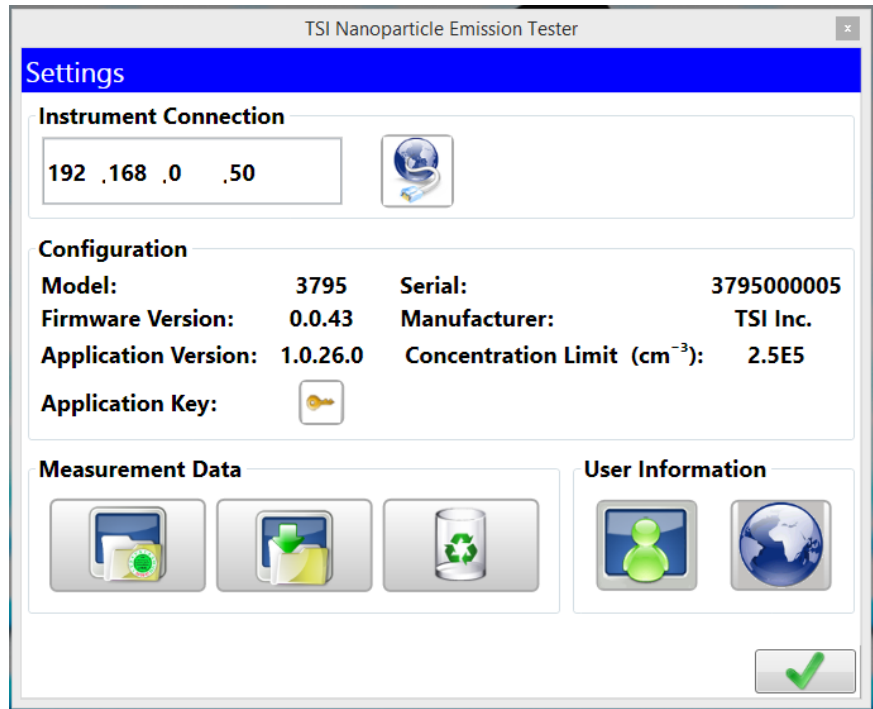
Table 5-2 contains a brief description of the diagnostics.

**Table 5-2**  
Nanoparticle Emission Tester Diagnostics

<b>Diagnostic</b>	<b>Description</b>
Heater Temperature	The surface temperature (in °C) of the heater (used to oxidize volatile and semivolatile particles in the sample stream).
Sample Flow	The sampled flow passing through the detector of the internal CPC
Bypass Flow	The bypass sample flow, the flow used to increase transfer time to the CPC, but that does not pass through the detector of the CPC.
Dilution Flow	The flow of dilution air used to dilute the inlet (exhaust) sample.
Dilution Ratio	The ratio of total flow-sampled aerosol flow in the diluting probe.
Saturator Temperature	The temperature of the saturator in °C.
Condenser Temperature	The temperature of the condenser in °C.
Optics Temperature	The temperature of the optics in °C.
Laser Current	The current supplied to the laser.
Ambient Pressure	The absolute pressure surrounding the outside of the instrument case.
Ambient Temperature	The absolute temperature surrounding the outside of the instrument case.
Ambient Humidity	The absolute humidity surrounding the outside of the instrument case.
Available Flash Memory	The percentage of remaining flash memory (used to store data).


## Settings





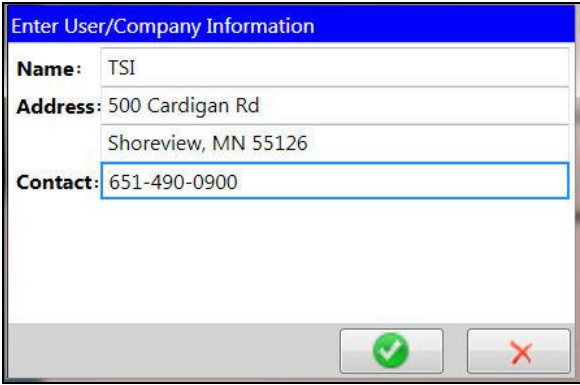

To see settings information, click the  button on the main screen. The following screen will display.



**Figure 5-4**  
Nanoparticle Emission Tester Settings

The following information is displayed on the screen:

<b>Instrument Connection</b>	Connection address (Ethernet). The preferred connection method is with a direct Ethernet connection. Enter the IP address 192.168.0.50 and click the Connection button  to connect to the instrument.
<b>Model</b>	The instrument model number.
<b>Firmware Version</b>	The version number of the firmware.
<b>Application Version</b>	The version number of the application.
<b>Application Key</b>	A unique, secure key that identifies the computer attached to the instrument. The key value is displayed when you hold the cursor over the icon.
<b>Serial</b>	The instrument serial number.
<b>Manufacturer</b>	The maker of the instrument.
<b>Concentration Limit (cm<sup>-3</sup>)</b>	The particle concentration value that the measurement output should not exceed (250,000) during an Official Measurement.

<b>Set Official Reports Folder</b>		Select this button to set the folder location for all Official Reports.
<b>Download General Measurements</b>		Select <b>Download General Measurements</b> to download <b>all</b> of the General Measurement test data from the instrument. A dialog opens to allow you to select the folder location for your data. <b>selected</b> folder. The format of the downloaded data is described below.  <b>Note:</b> <i>Data download may take several minutes to complete (depending on the amount of data stored on the instrument). You cannot close the window or perform other tasks while the data is downloading. See <a href="#">Downloaded Data Format</a> below for details of the data files.</i>
<b>Clear All Logged Data</b>		Select <b>Clear All</b> to remove all the data stored on the instrument.  <b>Note:</b> <i>You cannot close the window or perform other tasks while the data is being deleted.</i>
<b>Enter User/Company Information</b>		Information entered by the operator. Click the User Information button to see or update the information entered by the user during installation (name, address, and contact information). You can change the information on this screen at any time.  
<b>Select Language</b>		Select this button to display an alternate language in the application.

## Downloaded Data Format

Data files for general measurements contain a report header followed by the measurement values collected. The report header includes the following information:

Name	The operator name.
Address	The address entered by the operator.
Contact	Contact information entered by the operator.
Model	The instrument model number.
Serial	The instrument serial number.
Firmware Version	The version number of the firmware.
Manufacturer	The maker of the instrument.
Last Calibration	The date when the instrument was last calibrated.
Application Version	The version number of the application.
Application Key	The unique, secure number key identifying the computer controlling the measurement.
Start Time	The date and time the measurement test was started.
Duration (hmmss)	The length of time taken for the measurement test.
Data Rate (Hz)	The rate at which measurement values were taken.
Min (cm <sup>-3</sup> )	The minimum value.
Max (cm <sup>-3</sup> )	The maximum value.
Mean (cm <sup>-3</sup> )	The mean value.
Std. Dev. (cm <sup>-3</sup> )	The standard deviation.
CV (%)	The coefficient of variance.
Ambient Temperature (°C)	The ambient (air) temperature in °C. The acceptable range is 10 - 40°C.
Ambient pressure (kPa)	The ambient pressure in kPa. The acceptable range is 86 - 106 kPa.
Ambient humidity (%)	The relative humidity in %. The acceptable range is 10 to 85%.
Instrument Errors	A list of errors that occurred during the general measurement.

The measurement concentration data is displayed following the header.

## Taking Official Measurements



The Official Measurement mode, the prescribed test cycle, and the final reporting conforms to Swiss Regulation SR 941.242. An Official Measurement cannot be taken if any of the following conditions exist:

- The program is unable to establish a connection to the instrument.
- The combination of software version and instrument firmware version are not certified as conforming to the regulation.
- The instrument displays errors before you begin the test. If errors are displayed, the Official Measurement button is disabled.
- The instrument calibration is overdue.

The duration of an Official Measurement test is 40 seconds, consisting of the following:

- A 15-second warm-up period when data is collected but not used or displayed.
- A 5-second measurement period when Mean #1 is calculated and displayed.
- A 5-second idle period when data is collected but not used or displayed.
- A 5-second measurement period when Mean #2 is calculated and displayed.
- A 5-second idle period when data is collected but not used or displayed.
- A 5-second measurement period when Mean #3 is calculated and displayed.

## Measurement Results


When the measurement is complete, one of the following results is displayed:

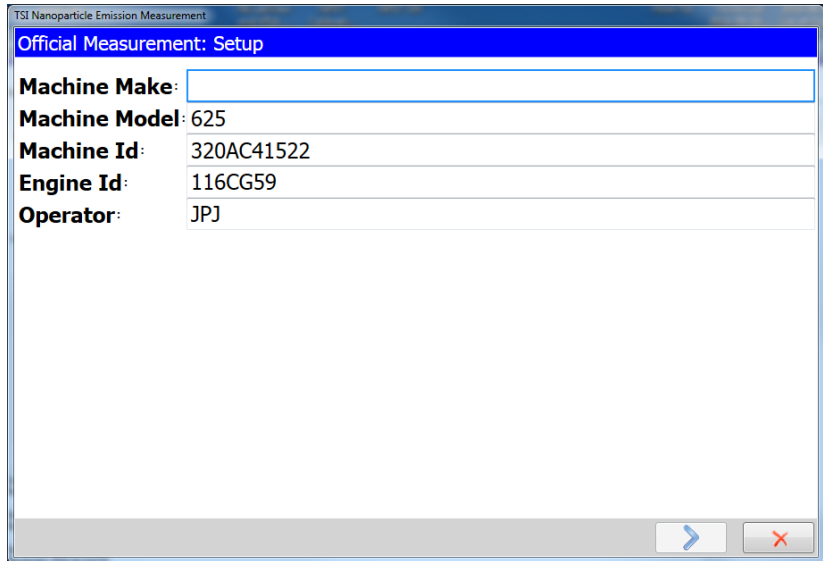
Result	Description
<b>PASS</b>	The overall mean value is less than the legally-specified regulatory threshold, 250000 (2.5E5) cm <sup>-3</sup> .
<b>FAIL</b>	The overall mean value greater than the legally-specified regulatory threshold, 250000 (2.5E5) cm <sup>-3</sup> .
<b>INVALID</b>	One or more of the ambient conditions do not fall within the acceptable range/s, or instrument errors occurred during the measurement.

**Note:** *Once an Official Measurement has begun, the measurement cannot be interrupted or stopped—the measurement completes even if the instrument displays error messages; but the displayed result is INVALID.*





To take an Official Measurement, follow these instructions:


1. Select the **Official Measurement** button . The following screen will display.



<b>Machine Make:</b>	
<b>Machine Model:</b>	625
<b>Machine Id:</b>	320AC41522
<b>Engine Id:</b>	116CG59
<b>Operator:</b>	JPJ


2. Enter the **Machine Make**, **Machine Model**, **Machine Id** (vehicle serial number), **Engine Id** and **Operator** name (name of person conducting the measurement) in the appropriate fields. Click  to continue. The following screen will display.


**Note:** You can only continue when all the required information has been entered. Click  if to cancel the measurement and return to the main screen.

 when ready to begin measurement.' At the bottom right, there are three buttons: a blue arrow pointing left, a blue arrow pointing right, and a red 'X'." data-bbox="398 560 902 836"/>

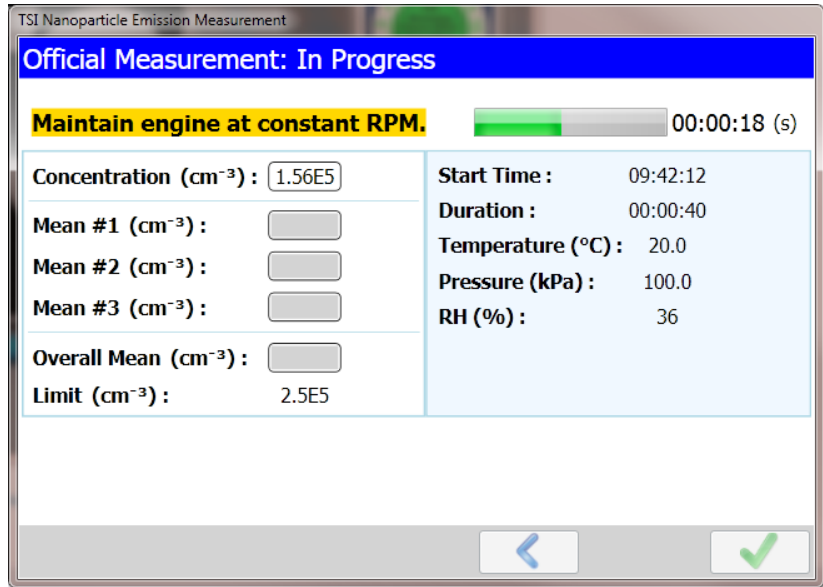
**Instructions:**

- 1) Warm up and condition the engine: 4-6 free accelerations.
- 2) Maintain engine at constant RPM (high idle if possible) for measurement duration.

Press  when ready to begin measurement.


- Follow the on-screen instructions and warm up the engine of the vehicle you are testing. Then click the Continue button  at the bottom of the screen to continue with the measurement. The following screen will display. The on-screen status bar indicates test progress. During the duration of the test, you cannot return to the previous screen, close the software window, or cancel the measurement.

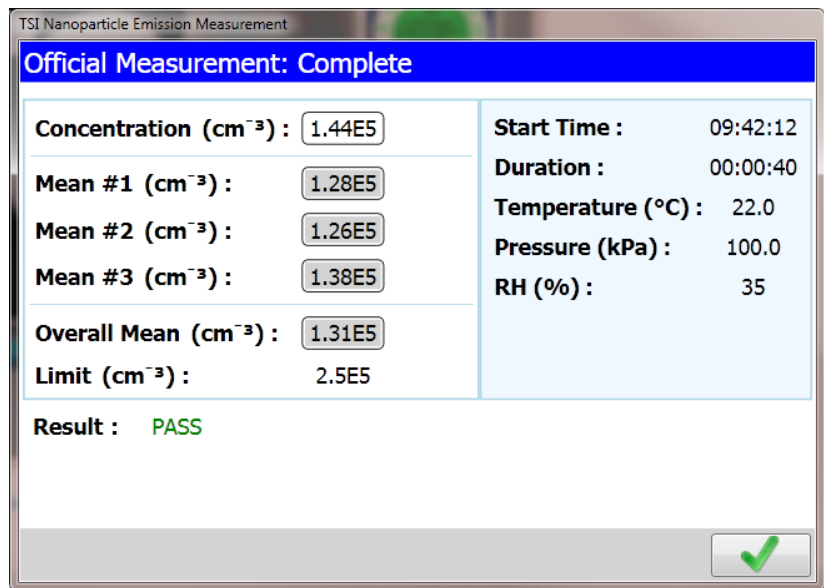
**Note:** See the beginning of this section for details about the [Official Measurement](#) duration.




<b>Concentration (cm<sup>-3</sup>)</b>	This is the current concentration, measured and updated once/second after the 15-second test warm-up period.
<b>Mean # 1 (cm<sup>-3</sup>)</b>	Mean concentration for the first measurement period. Displayed after 20 seconds of measurement time have elapsed.
<b>Mean #2 (cm<sup>-3</sup>)</b>	Mean concentration for the second measurement period. Displayed after 30 seconds of measurement time have elapsed.
<b>Mean # 3 (cm<sup>-3</sup>)</b>	Mean concentration for the third measurement period. Displayed after 40 seconds of measurement time have elapsed.
<b>Overall Mean (cm<sup>-3</sup>)</b>	The mean value of Mean #1, 2, and 3. Calculated and displayed at the end of the measurement.
<b>Limit (cm<sup>-3</sup>)</b>	The upper concentration limit for measured data. Value = 2.5e5. <b>Note:</b> If any of the mean values are > 5E <sup>6</sup> , that field displays > 5E <sup>6</sup> . If any of the mean values < 1000, the relevant Mean field displays < 1000.
<b>Start Time</b>	Displays the measurement start time.

<b>Duration</b>	Displays the total duration of the measurement.
<b>Temp °C</b>	Displays the ambient temperature (the air temperature) and is updated every second during the measurement test.
<b>Pressure (kPa)</b>	Displays the ambient pressure and is updated every second during the measurement.
<b>RH (%)</b>	Displays the relative humidity and is updated every second during the measurement.

4. When the measurement is complete (after 40 sec), the software reads the final measurement record from the instrument, recalculates the three mean values and the overall mean, and displays the final result. Measurement results are: PASS, FAIL, or INVALID. (See the beginning of this section for details about [measurement results](#).) When the test is complete, the checkmark  button at the bottom of the screen is enabled.



5. A report is created in the .PDF file format and stored in the Official Measurements folder.

6. You may view and print the official report by using a PDF file reader such as Adobe® Reader®. Select the Open Official Reports Folder button  on the main screen to locate your report file.

The format of the report file name in the **OfficialReports** directory is:

ID\_xxxx\_yyyy-MM-dd-HH-mm-ss.pdf

where

xxxx = the Machine Id (entered in the first screen)

yyyy = year (such as 2013)

MM = month (such as 11)

dd = day (such as 25)

HH = hours (such as 10)

mm = minutes (such as 10)

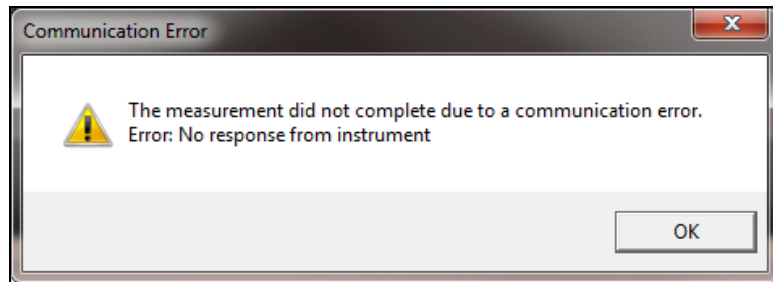
ss = seconds (such as 04)

*Example:* ID\_123456789\_2013-11-25-10-34-04 Represents the report for Vehicle # 123456789, taken on November 25, 2013 at 10:34:04.

2/25/2015 2:43:34 PM			
<b>Model:</b>	3795	<b>Manufacturer:</b>	TSI Inc.
<b>Serial:</b>	3795143001	<b>Last Calibration:</b>	2015-01-26
<b>Firmware Version:</b>	1.02	<b>Application Version:</b>	1.1.0.0
<b>Application Key:</b>	C2AD-EAE5-8BB0-3989-E79F-7264-4162-0B19		
TSI GmbH			
Neuköllner Strasse 4			
52068 Aachen			
+49 241-52303-0			
<b>OFFICIAL MEASUREMENT</b>			
<b>Date/Time:</b>	2015-02-25, 14:42:53	<b>Mean #1 (1/cm³):</b>	1.38E5
<b>Duration:</b>	00:00:40	<b>Mean #2 (1/cm³):</b>	1.17E5
<b>Operator:</b>	JPJ	<b>Mean #3 (1/cm³):</b>	1.20E5
<b>Machine Make:</b>	TSI	<b>Overall Mean (1/cm³):</b>	1.25E5
<b>Machine Model:</b>	625	<b>Limit (1/cm³):</b>	2.5E5
<b>Machine Id:</b>	320AC41522	<b>Result:</b>	<b>PASS</b>
<b>Engine Id:</b>	116CG59		
<i>Ambient Conditions: 22.0 °C, 101.0 kPa, 37 %RH</i>			
<b>SIGNATURE:</b>			


## Taking General Measurements

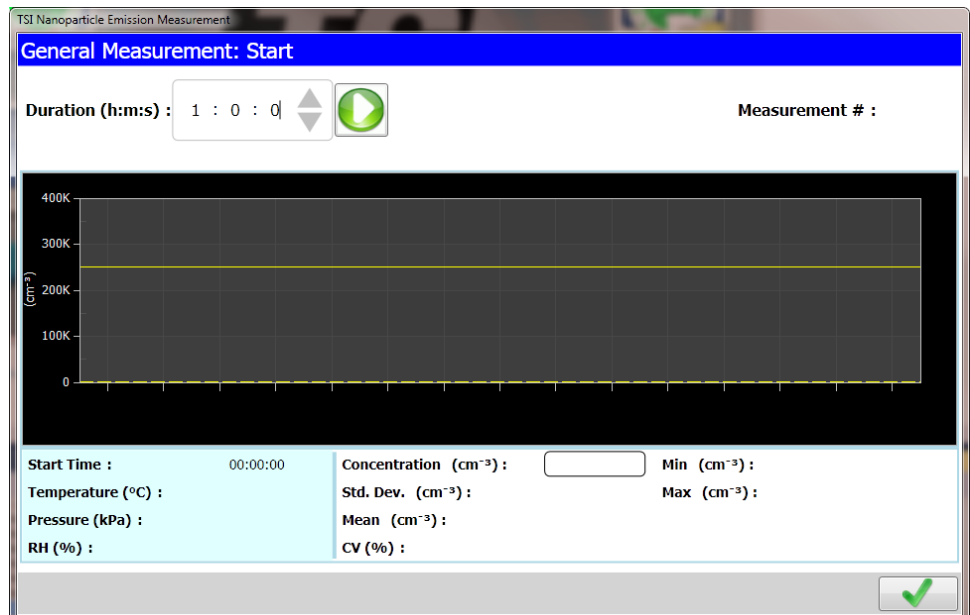
A General Measurement can be taken at any time except during the instrument's warm-up period, even if the instrument displays error messages. The measurement may be stopped before it has concluded. Otherwise, the measurement is only interrupted if you see a non-recoverable communication error message such as the one shown in Figure 5-5 below.



**Figure 5-5**  
Nanoparticle Emission Tester Communication Error


To take a General Measurement, follow these instructions:


1. Select the **General Measurement** button . The following screen will display. A yellow line is displayed on the graph at the concentration limit,  $2.5E5 \text{ cm}^{-3}$ . A red annotation line is displayed at the upper limit of  $5E6 \text{ cm}^{-3}$  when the graph scales up to that range.

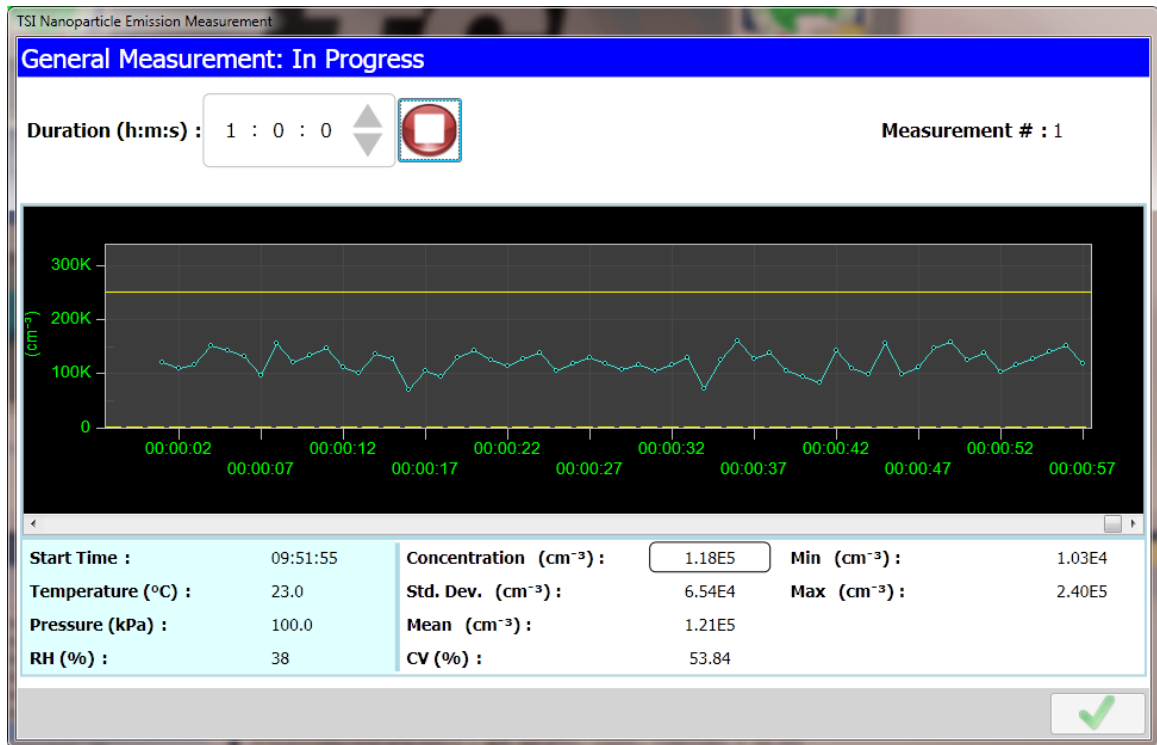


2. Use the **Duration (h:m:s)** ▼ ▲ arrows or enter values to set the hours, minutes, and seconds needed for the test.

**Note:** The default setting is one hour; the maximum setting is 8 hours.

3. Click  to start the measurement. Data is displayed on the screen as soon as the measurement begins and is updated every second. The graph displays particles/cm<sup>3</sup> over the elapsed time. Data is recorded at 1 Hz.


**Note:** The software automatically checks that there is enough memory for the instrument to store the measurement data. The test can be stopped at any time by clicking the stop  button.

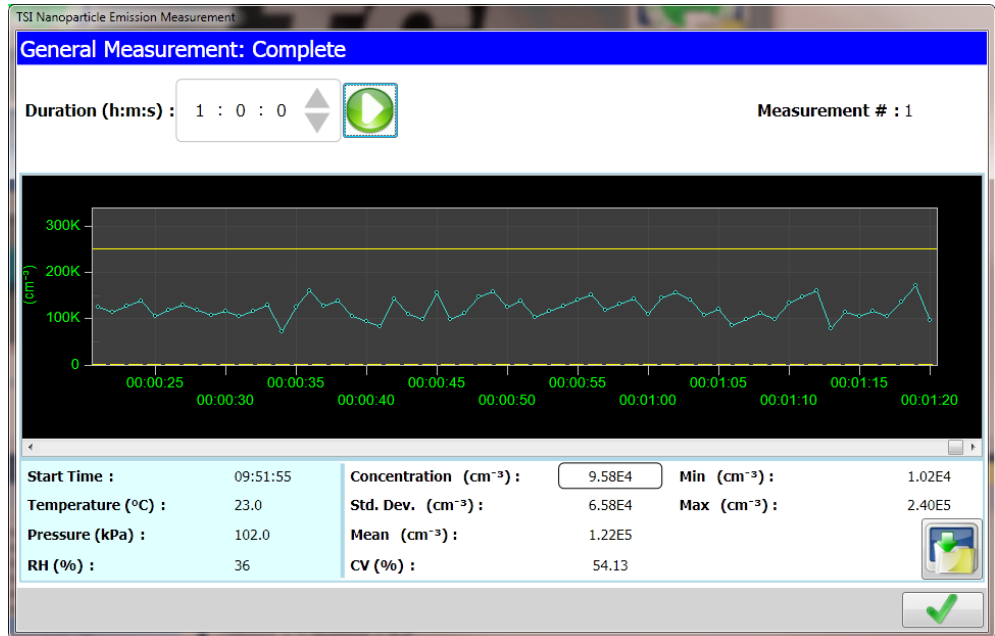



<b>Measurement #</b>	Measurement number.
<b>Start Time</b>	Measurement start time.

The following values are updated every second during the measurement:

<b>Temp °C</b>	Ambient temperature (the air temperature).
<b>Pressure (kPa)</b>	Ambient pressure.
<b>RH (%)</b>	Ambient relative humidity.
<b>Concentration (cm<sup>-3</sup>)</b>	Particle concentration.
<b>Min (cm<sup>-3</sup>)</b>	Current minimum value of particle concentration
<b>Max (cm<sup>-3</sup>)</b>	Current maximum value of particle concentration.
<b>Std. Dev (cm<sup>-3</sup>)</b>	Standard deviation.
<b>CV (%)</b>	Coefficient of variance.

- When the measurement is complete, the following screen is displayed and the data is recorded on the instrument. The Start button and Download buttons are enabled. You can download the data to the connected computer, change the Duration and begin another measurement, or click the  button to close the window.



- To download the test data for a measurement, click . The data file with the .txt extension is downloaded to the selected folder. The data format is described in [Downloaded Data Format](#) under the Settings screen section of this chapter.

### Official Reports Folder

To open the Official Reports folder, select this button from the main screen. A Windows<sup>®</sup> explorer window will open for viewing and printing your reports. The location of this folder may be changed from the Settings screen, Refer to Figure 5-4.

### General Reports Folder

To open the General Reports folder, select this button from the main screen. A Windows<sup>®</sup> explorer window will open for viewing and printing your reports.

---

## Shutting Off and Restarting the Nanoparticle Emission Tester

To power down the Nanoparticle Emission Tester, close the software, then press the power button on the back panel. Once the power button LED begins flashing press the power button once more to confirm shutdown. To completely remove power from the device switch the rocker switch above the AC receptacle to the off position. Disconnect the power cable if desired.

If the AC power switch is in the off position (and has been for greater than 30 seconds), the Nanoparticle Emission Tester can be restarted by switching the AC power switch to the on position.

If the AC power switch remains in the on position after power down, the Nanoparticle Emission Test can be restarted by pressing the power button once.



## CHAPTER 6

# Maintenance, Service, and Troubleshooting

This chapter describes recommended maintenance procedures for the Nanoparticle Emission Tester and is intended to be used by a trained service technician.

The frequency of routine maintenance procedures depends upon the frequency of use of the instrument and the operating conditions.

If you contact TSI for assistance, please have the emission tester close to the telephone when discussing the problem with a TSI technician.



### W A R N I N G

- Service and Maintenance procedures described in this section should only be performed by a qualified, trained service technician.
- If the cover is removed from the instrument you may come into contact with hot surfaces. **Do not** touch any internal components until the instrument has been allowed to cool.
- To avoid causing a short circuit, **Do not touch** any internal components unless instructed to do so in this manual.
- **Do not tilt** the Nanoparticle Emission Tester > 15° in any direction. If the instrument is tilted, damage may occur to the internal optics.

# Maintenance Schedule

A suggested maintenance schedule is listed in Table 6-1 below.

**Table 6-1**  
Maintenance Schedule

Schedule	Suggested Action
Before beginning test and every two hours during testing.	Charge the wick.
Daily (or whenever you see water collecting in the traps)	Empty the water traps, but only if accumulated water is observed, being careful to reseal the drains. Accumulating water may also indicate that the desiccant cartridge should be replaced.
Every three days during testing.	Change the wick.
Weekly	Clean the probe.
Monthly to Quarterly	Replace the filters and desiccant cartridge.
Quarterly, or as needed	Clean the cyclone.
Yearly	Verify the instrument either at METAS or the manufacturer.

## Charging the Wick

The wick must be charged with reagent grade ( $\geq 99.5\%$ ) Isopropyl Alcohol (IPA). Replace the alcohol in the fill bottle every three days during testing.

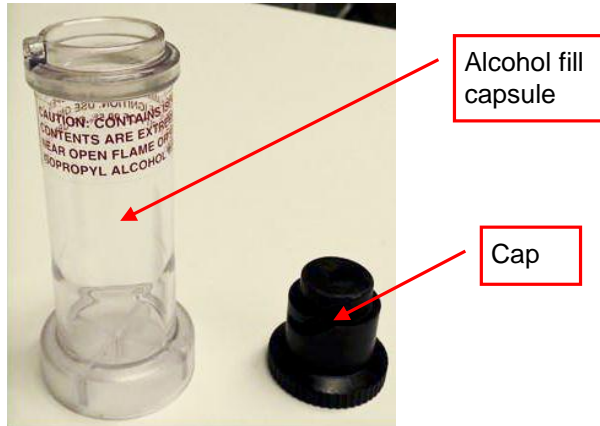


### WARNING

- **Do not** charge the wick in a very dusty environment.
- Isopropyl Alcohol may spill when you remove the wick cartridge. Isopropyl Alcohol is a hazardous material. **Do not** ingest or allow alcohol to contact your eyes or skin. Refer to the Material Safety Data sheet (MSDS) located in the box of alcohol for handling precautions and first-aid procedures.
- Always recap fill capsule and other containers immediately to prevent absorption of moisture and the escape of alcohol vapors.
- Dispose of any alcohol with visible contamination.

To charge the wick, follow these instructions:

1. Remove the cap from the alcohol fill capsule and set the cap down on a clean surface.



2. Pour IPA into the alcohol fill capsule until it reaches the fill line.
3. Turn the wick cartridge cap in a counterclockwise direction and pull out the cartridge.



### WARNING

**Do not** place the wick cartridge on a dirty surface. If the cartridge becomes contaminated, wipe it clean with a low-lint cloth.



4. Place the clean wick cartridge in the alcohol fill capsule. Turn the wick cartridge in a clockwise direction until it locks in place.



5. Wait for at least two minutes to allow the wick to absorb the IPA. You should see the level drop in the alcohol fill bottle.
6. Remove the wick cartridge from the capsule and gently shake the cartridge to allow the excess alcohol to drip back into the fill capsule. When no more IPA drips, stop shaking the cartridge.

**Note:** *There is no need to wait until the outer surface of the cartridge is dry.*

7. Remove the wick cartridge from the alcohol fill capsule and place in the instrument. When the wick cartridge is fully inserted, twist the cartridge in a clockwise direction until it locks in place.



#### WARNING

The cartridge should slide easily into place. **Do not** force it.

8. Replace the cap on the alcohol fill capsule.

## Changing the Wick

To allow the wicks time to dry out, change the wick every three days during testing.

To change a wick, follow these instructions:

1. Turn the wick cartridge in a counterclockwise direction and pull out the cartridge.

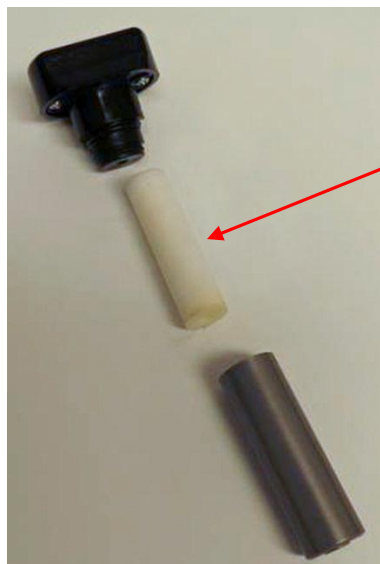


### WARNING

**Do not** place the wick cartridge on a dirty surface. If the cartridge gets contaminated, wipe it clean with a low-lint cloth.



2. Pull the metal cartridge cylinder and the black cap apart.
3. Remove the white wick.



4. Place the wick on a clean, dry surface and allow it to dry out at ambient humidity.

**Note:** *The wick can be placed in the empty alcohol fill capsule, but it will take longer to dry.*

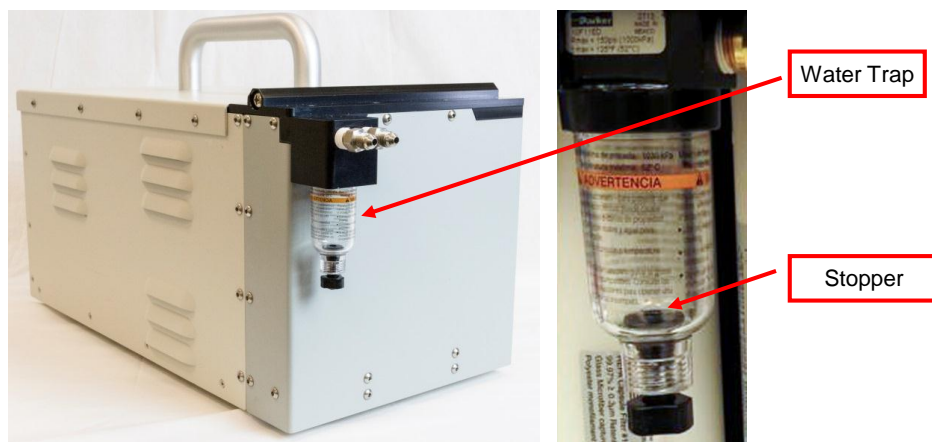
5. Either remove a supplied wick from the packing materials and place in the wick cartridge, or use a wick that has already been dried out.
6. Replace the cap on the wick cartridge.
7. Place the wick cartridge in the instrument.

## Emptying the Water Trap

Empty the water trap whenever you see water collecting in the traps. The presence of water in the trap may indicate that the desiccant dryer cartridge needs to be changed.

To empty a water trap, follow these instructions:

1. Power off the Nanoparticle Emission Tester.
2. The bottle on the front left is a combined water trap and cyclone. Place a container or towel on the work surface beneath the water trap.
3. Turn the black cap in the anticlockwise / counterclockwise direction (when viewed from above) to loosen it. As you turn, the stopper raises and water drains.



4. When all the water has drained, close the cap. Tighten it as much as you can; if a tight seal is not created, you will receive flow errors.

## Cleaning the Cyclone

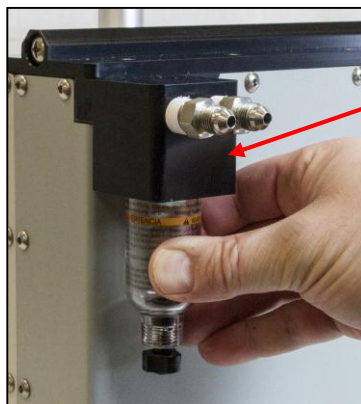
Clean the cyclone whenever you see soot or dirt in it, or quarterly on a routine basis.

To clean the cyclone, follow these instructions:

1. If excessive water is present in the cyclone, power off the Nanoparticle Emission Tester.

**Note:** The tester does not need to be powered off if you are only cleaning it.

2. Turn the black cap in the anticlockwise / counterclockwise direction (when viewed from above) to loosen it. As you turn, the stopper raises and water drains.
3. When all the water has drained, close the cap. Tighten it as much as you can; if a tight seal is not created, you will receive flow errors.
4. Unscrew the bottle from the cyclone head by twisting in a clockwise direction (as viewed from above). The O-ring is fitted into a groove in the metal cyclone head and often comes off with the bottle. **Do not lose** the O-ring when you remove the bottle.

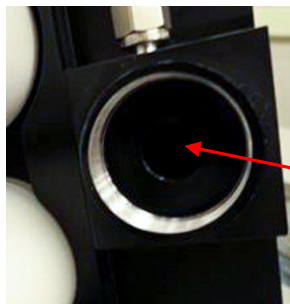


Cyclone



O-ring

5. Take a clean cotton swab or cloth and clean the inside of the metal head.



Cyclone head  
(seen from below)

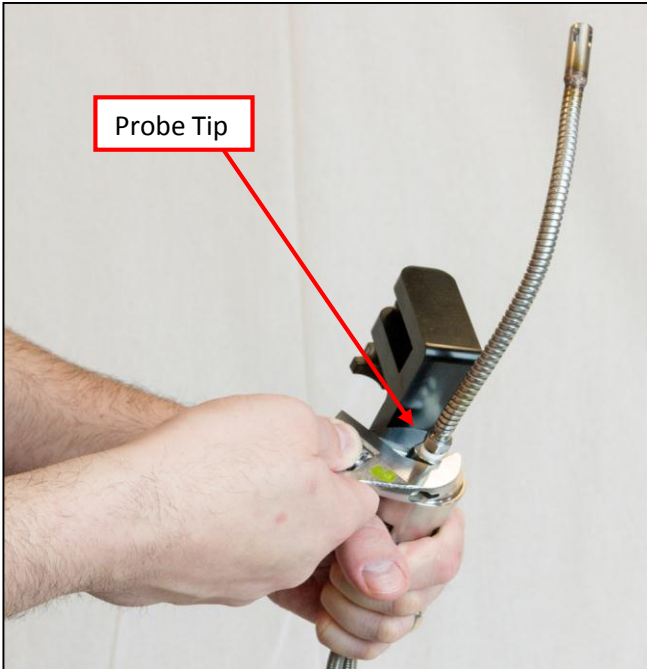
6. Blow out the cyclone head with clean compressed air to remove any remaining dirt.
7. Check the O-ring. If it is damaged, replace it with one of the extra O-rings shipped with the instrument.
8. Screw the bottle back into place in the instrument.

## Cleaning the Probe

Clean the probe once a week.

To clean the probe, follow these instructions:

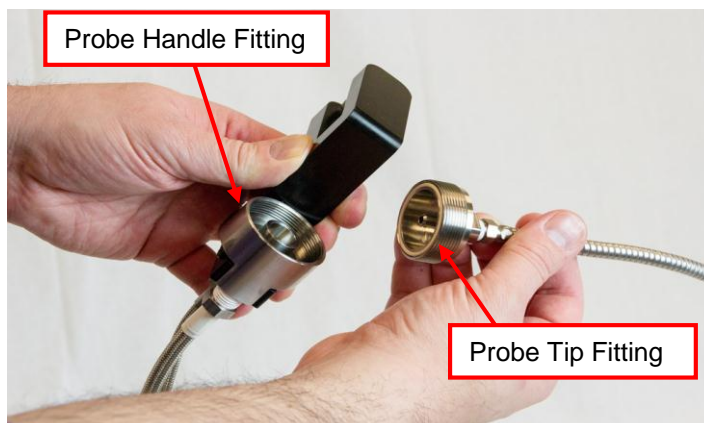
1. Power off the emission tester.
2. Use a wrench to loosen the nuts on the probe tip.



3. Unscrew the probe tip from the probe handle. **Do not** lose the white high-temperature O-ring.
4. Take a clean cotton swab or cloth and clean all the inner surfaces of the probe tip and probe handle.
5. If the high-temperature O-ring is dirty or damaged, insert a replacement supplied with the instrument.



6. With the O-ring in place, screw the probe tip and probe handle back together.



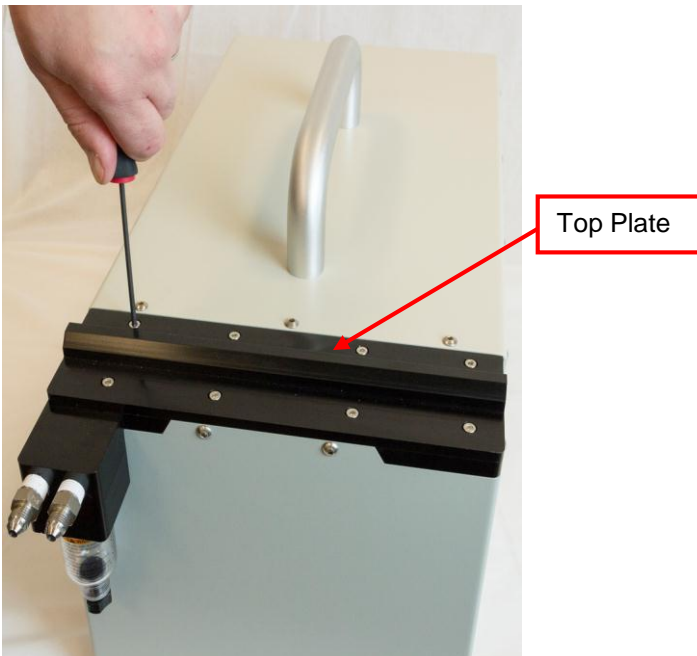
7. Using a wrench, tighten the nut that holds the probe tip in place.

## Replacing the Filters and Desiccant Dryer Cartridge

Replace the filters and desiccant dryer cartridge once every three months or when condensate is observed within the cyclone water trap bottle

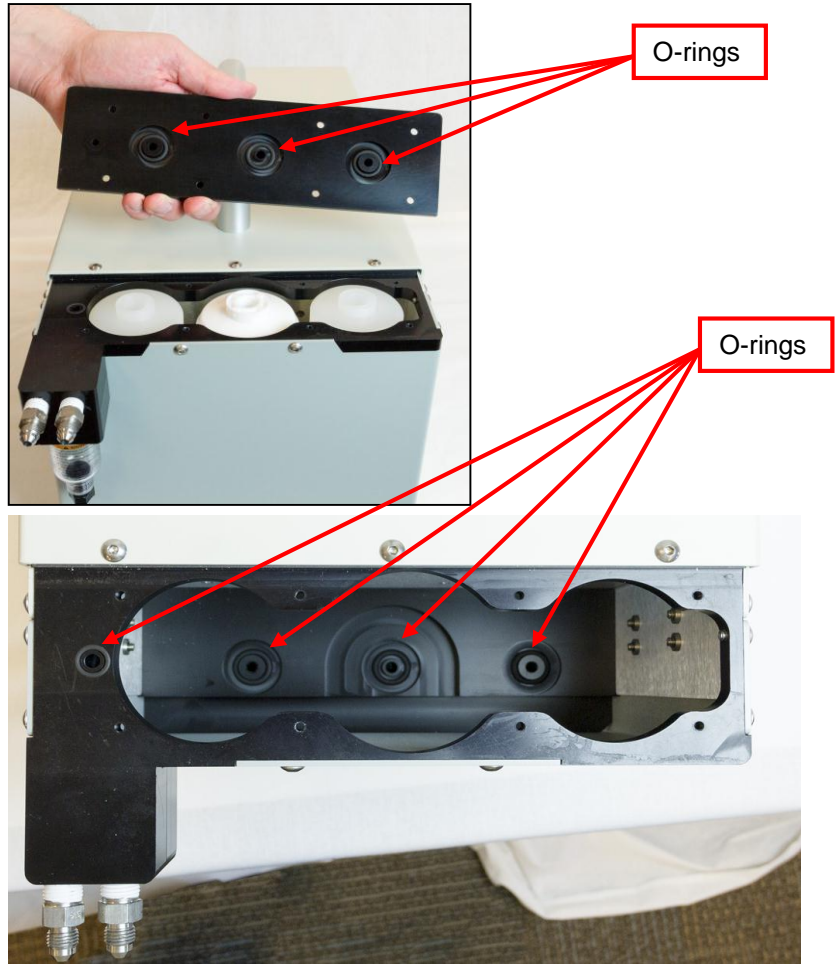
To replace the filters and desiccant dryer cartridge, follow these instructions:

1. Remove two of the HEPA filters and one of the desiccant dryer cartridges (shipped with the instrument) from their packing materials.
2. Unscrew the eight screws holding the black top plate in place. Save the screws.



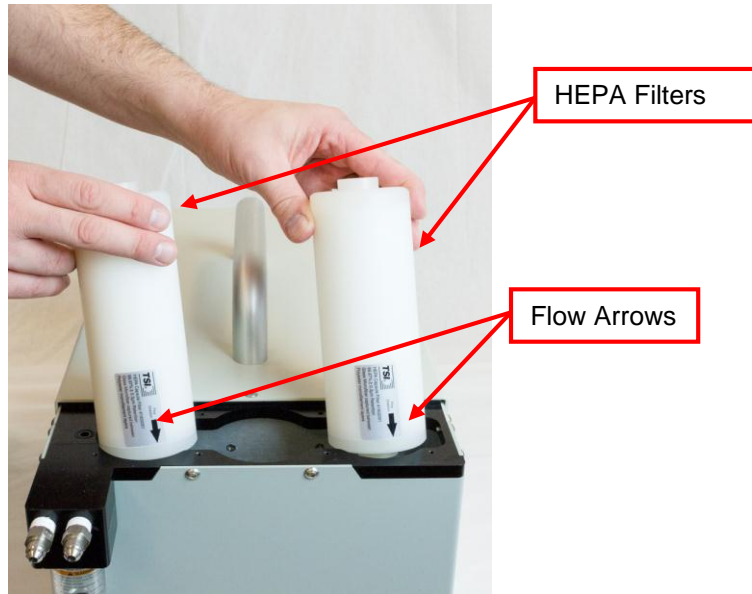
3. Carefully lift off the black top plate.
4. Remove the two HEPA filters and the desiccant dryer cartridge.

5. Check that the six cartridges (three on the top and three on the bottom of the case) and the single filter cover plate O-rings are still in position. Replace any dirty or damaged O-rings.



6. Take two of the supplied replacement filters and one replacement dryer cartridge.

- Drop the two HEPA filters into place and make sure they are seated correctly.



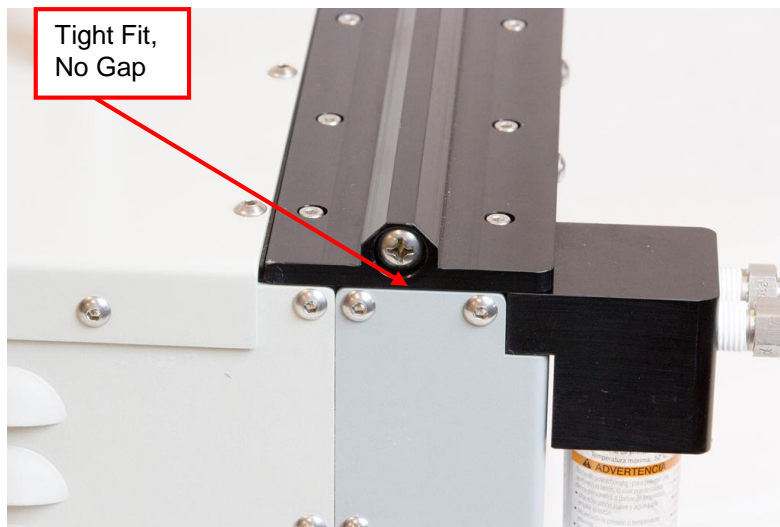
**Note:** The flow arrows should point down.

- Drop one of the provided desiccant filters into place between the two HEPA filters and make sure it is seated correctly.



**Note:** The flow arrow should point up.

9. Fit the black cover in place on the instrument. Using the screws you removed in step 2, insert the corner screws first and tighten. Then insert and tighten the remaining screws. Tighten all the screws until you cannot turn them anymore. Make sure there is no gap when the cover is screwed into place—the fit **must** be tight.



## Verifying the Nanoparticle Emission Tester

The Swiss Government requires that the Nanoparticle Emission Tester is verified every year. Contact TSI to find out where to send your instrument for verification.

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# Troubleshooting

The table below provides information on the errors/problems for the Model 3795 Nanoparticle Emission Tester and suggestions for corrective action.

**Table 6-1**  
Troubleshooting

Problem	Cause	Suggested Action
Instrument does not power on.	Power receptacle rocker switch is in the off position.	Move the rocker switch to the on position.
	Power receptacle rocker switch in the on position following a shutdown with the power switch.	Press the power switch to power on the instrument.
	Power cord incorrectly attached.	Attach included power cord to the back panel of the device and connect the other end to the mains.
	Internal fuse is blown.	Contact TSI Customer Support for directions on resetting the fuse.
Communication with instrument not established.	Cable not connected.	Connect the Ethernet crossover cable to the computer.
	Electromagnetic interference.	If using unsupported USB connection in a noisy environment, switch to the supported Ethernet connection.
	Incorrect IP address in communications software.	Make sure the connection between the instrument and the PC is an Ethernet connection. On the Settings screen, enter 192.168.0.50 under Instrument Connection. And click the connection button. The software indicates when the connection has been established.
	Unknown networking errors on the PC or tablet device.	Reboot the PC/tablet, cycle the power on the device, and retry the connection.
	Invalid IP address on the PC or tablet.	Verify that the PC or tablet is configured with a static IP address (192.168.0.10), subnet mask (255.255.255.0) and default gateway (192.168.0.1).
	Ethernet settings have been changed.	Reboot the instrument.
No concentration is displayed.	Communications failure.	Refer to the instructions above for "Communication with instrument not established."
Memory Full.	Stored data records have exceeded the device's internal storage capacity.	From the Settings screen, choose <b>Clear All</b> .
Cannot open report.	The appropriate PDF reader is not installed.	Access the PC or tablet web browser and update to the latest version of a supported PDF reader. Reinstall software from the included CD/USB drive.
Cannot print report.	No printer attached; incorrect printer driver installed; no connection made.	Consult the printer manual.
Condenser or Saturator temperature out of range	Environmental specifications are exceeded.	Move the device to a new location that meets the environmental specifications (-10 to 40°C).
	Inadequate warm-up time.	Wait additional time for the error to clear, monitoring the condenser and saturator temperatures as they approach 21°C and 29°C respectively. View the diagnostics screen for information.
	Damage to internal heat management.	Contact TSI customer support.

<b>Problem</b>	<b>Cause</b>	<b>Suggested Action</b>
Bypass flow error	Exhaust (outlet) port plugged.	Remove any external blockages or restrictions from the exhaust (outlet) port. Verify that the port is free of liquid and debris.
	Clogs/leak within instrument.	Verify that the sampling probe is connected to the instrument and that the aerosol and dilution air tubes are free of debris. Verify that the water trap and cyclone jars are properly seated and tightened and that the water drains are closed. Verify that the O-rings for the trap and cyclone are undamaged and properly seated. Verify that the filter/dryer cartridges are properly placed and that the inlet and outlet O-rings are present and undamaged.
	Kink/blockage within probe or hose.	Straighten the hose and verify that the flow is not blocked. Clean the probe if necessary.
	Unacceptable differential pressure between ambient conditions and the instrument inlet.	Ensure that the inlet and outlet of the device are placed at, or near, the same ambient pressure (86 to 106 kPa). Equalize the inlet and case pressures.
	Incorrectly installed or leaking water trap.	Verify that the water trap and cyclone jars are properly seated and tightened and that the water drains are closed. Verify that the trap and cyclone O-rings are undamaged and properly seated.
	Water trap valves not closed.	Close the water trap valves and verify that they are sealed with no air leak in or out.
	Clogged dilution filters.	Replace the two HEPA filters.
Dilution flow error	Dirty/clogged dilutor, probe, or dilution hose.	Clean the probe inlet, dilutor, and/or dilution hose with a clean cloth, cotton swabs, and/or isopropyl alcohol. Blow dry with clean compressed air.
	Kink/blockage within the probe and/or hose.	Straighten the hose and verify that the flow is no longer blocked. Clean the probe if necessary.
	Leak or incorrectly installed tube connectors.	Unseat and reapply the tube connectors. Verify that the O-rings are present and undamaged.
	Leak in dilution system or dilution hose.	Verify that the probe hose has no breaks, cracks, or leaks. Verify that the dilutor portion of the probe is properly seated and assembled and that the sealing O-ring is present and undamaged.
	Incorrectly installed or leaking water trap.	Verify that the water trap is seated correctly and the O-ring is in place. Verify that the black cap is closed and sealed.
	Water trap valves not closed.	Close the black cap.
	Clogged dilution filters.	Replace the two HEPA filters.

<b>Problem</b>	<b>Cause</b>	<b>Suggested Action</b>
Dilution ratio error	Dirty or clogged dilutor, probe, or dilution hose.	Clean the probe inlet, dilutor, and/or dilution hose with a clean cloth, cotton swabs, and/or isopropyl alcohol. Blow dry with clean compressed air.
	Kink or blockage within the probe and hose.	Straighten the hose and verify that the flow is no longer blocked. Clean the probe if necessary.
	Leak or incorrectly installed tube connectors.	Unseat and reapply the tube connectors. Verify that the O-rings are present and undamaged.
	Leak in dilution system or dilution hose.	Verify that the probe hose has no breaks, cracks, or leaks. Verify that the dilutor portion of the probe is properly seated and assembled and that the sealing O-ring is present and undamaged.
	Incorrectly installed or leaking water trap.	Verify that the probe hose has no breaks, cracks, or leaks. Verify that the dilutor portion of the probe is properly seated and assembled and that the sealing O-ring is present and undamaged.
	Water trap valves not closed.	Close the black cap.
	Clogged dilution filters.	Replace the two HEPA filters.
CPC flow error	Exhaust (outlet) port plugged.	Remove any external blockages or restrictions from the exhaust (outlet) port. Verify that the port is free of liquid and debris.
	Clogs or leak within instrument.	Inspect the external device connections for leaks or breaks. Then contact TSI Customer Support.
	Kink or blockage within the probe or hose.	Straighten the hose and verify that the flow is no longer blocked. Clean the probe if necessary.
	Unacceptable differential pressure between the ambient air and instrument inlet.	Ensure that the instrument inlet and outlet are placed at/near the same ambient pressure (86 to 106 kPa). Equalize the inlet and case pressures.
	Incorrectly installed or leaking water trap.	Verify that the probe hose has no breaks, cracks, or leaks. Verify that the dilutor portion of the probe is properly seated and assembled and that the sealing O-ring is present and undamaged.
	Water trap valves not closed.	Close the black cap.
Laser power error.	Excessive heat or damage to the laser diode.	Move the instrument to a location where the ambient temperature is lower. Contact TSI Customer Support for repairs.
Concentration high.	Inlet concentration too high.	Reduce inlet particle concentration to $< 5 \times 10^6$ particles/cm <sup>3</sup> .
	Catalytic stripper temperature has not achieved the correct working temperature.	Allow additional warm-up time before beginning a test.



<b>Problem</b>	<b>Cause</b>	<b>Suggested Action</b>
Pulse height error.	Depleted or contaminated working fluid (IPA) or wick.	Recharge the wick with reagent-grade IPA. Repeat if the problem persists.
	Damage to the internal CPC.	Contact TSI customer support.
	Low quality IPA.	Dry or replace the wick. Charge the new wick with reagent-grade IPA.
	Large numbers of very small particles.	The sample contains large numbers of particles of sizes below the instrument's detection limit. Increase the inlet concentration or the size of the inlet particles.
	Incorrect humidity.	Replace the wick with a dry wick. Recharge the wick with reagent-grade IPA. Move the instrument to a location where the ambient humidity is lower. Replace the desiccant dryer cartridge. Drain the water traps.
	Electromagnetic interference.	Move the instrument to a location where the electromagnetic interference is lower.
Optics temperature error.	Inadequate warm-up period.	Allow additional warm-up time. View the diagnostics screen for information.
	Environmental specifications are exceeded.	Move the instrument to a location where temperatures are within the specified range (-10 to 40°C).
Concentration low.	System leaks.	Tighten the probe hose connections to the instrument, probe dilutor, water drain bowl, and/or the water drain valve, after verifying that all appropriate O-rings are in place and undamaged, as per the manual.
	Depleted or contaminated working fluid (IPA) or wick.	Recharge the wick with reagent-grade IPA. Repeat if the problem persists.
	Actual low concentration	Increase the inlet concentration.
	Damage to the internal CPC.	Contact TSI customer support.
	The differential pressure between the instrument and the inlet exceeds specifications.	Increase the inlet pressure.
Tilt error.	Instrument tilted > 15°.	Return the instrument to a horizontal position.
Heater temperature error.	Inadequate warm-up time.	Allow additional warm-up time. View the diagnostics screen for information. If the heater temperature exceeds the ambient temperature, but has begun decreasing, reboot the instrument and the software and verify that the heater temperature is approaching the setpoint of 350°C.
	Environmental specifications are exceeded.	Move the instrument to a location where temperatures are within the specified range (-10 to 40°C).
	Insufficient AC power.	Connect to an AC mains circuit capable of supplying the appropriate current.
	Damage to the heater or catalytic stripper caused by excessive shock and/or vibration,	Contact TSI customer support.

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## Technical Contacts

- If you have any difficulty installing the Nanoparticle Emission Tester, or if you have technical or application questions about this instrument, contact an applications engineer at one of the locations listed below.
- If the Nanoparticle Emission Tester fails, or if you are returning it for service, visit our website at <http://service.tsi.com> or contact TSI at:

### **TSI Incorporated**

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# Returning the Nanoparticle Emission Tester for Service

The Nanoparticle Emission Tester should be serviced at the factory facility. Before returning the emission tester to TSI for service, visit our website at <http://rma.tsi.com> or call TSI at 1-800-874-2811 (USA) or 001 (651) 490-2811 for specific return instructions. When you call, have the following information ready for the Customer Service representative:

- Instrument model number
- Instrument serial number
- A purchase order number (unless under warranty)
- A billing address
- A shipping address

TSI recommends that you keep the original packaging of the emission tester for use whenever the instrument is shipped, including when it is returned to TSI for service. If you no longer have the original packing material, place the instrument inside a plastic bag to protect it, and then package with at least 5" (13 cm) of shock absorbing/packaging material around all sides of the instrument.

See [Chapter 3, "Moving and Shipping the Nanoparticle Emission Tester"](#) for detailed instructions.

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# APPENDIX A

## Specifications

This appendix provides specifications for the Model 3795 Nanoparticle Emission Tester which are subject to change without notice.

<b>Particle Size Range</b>	
Detection Efficiency	<50% at 23 nm >50% at 41 nm
Max. Detectable Particle	Limited to 1 µm by inlet cyclone
<b>Particle Concentration Range</b>	
Single Particle Counting (Nominal 10:1 Dilution)	1,000 to 5 x 10 <sup>6</sup> particles/cm <sup>3</sup>
<b>Particle Concentration Accuracy</b>	
±10% compared to standard	
<b>Response Time</b>	
T <sub>10%-90%</sub> and T <sub>90%-10%</sub>	<5 seconds
T <sub>0%-90%</sub>	<10 seconds
<b>Flow</b>	
Instrument Inlet Flow Rate	0.7 L/min (nominal)
CPC Aerosol Flow Rate	0.1 L/min (nominal)
CPC Bypass Flow Rate	0.6 L/min (nominal)
<b>Condensing Liquid</b>	
Working Fluid	99.5%+ reagent-grade isopropyl alcohol
Filling System	Rechargeable wick
Sample Time Per Fill	4 hours
<b>Catalytic Stripper</b>	
Temperature	350° C
Volatile Particle Removal	>99% of 30 nm, NMD polydisperse C <sub>40</sub> H <sub>82</sub>
<b>Aerosol Medium</b>	
Designed to sample high temperature (up to 300°C), corrosive (NO <sub>x</sub> , HC, H <sub>2</sub> O, H <sub>2</sub> SO <sub>4</sub> ) engine exhaust gas.	
<b>Environmental Operating Conditions (ambient)</b>	
Temperature	-10 to 40°C
Pressure	70 kPa to 106 kPa
<b>Power Requirement</b>	
100 to 240 VAC, 50/60 Hz, 100 W nominal, 200 W peak	
<b>Communications</b>	
Ethernet	8-wire RJ-45 jack, 10/100 BASE-T, TCP/IP
<b>Software</b>	
TSI Nanoparticle Emissions Tester Software. Microsoft® Windows® 7 (32- or 64-bit) compatible; Windows® 8 optimized for touchscreen	

<b>Sampling Interval</b>	
Official Test Mode	10 Hz
General Sampling Mode	1 Hz
<b>Calibration/Service Interval</b>	
Recommended annually	
<b>Physical Features</b>	
Front Panel	Water trap, cyclone, probe connections (sample inlet and dilution air outlet)
Back Panel	Power connector, Ethernet port, wick port
<b>Dimensions (H x W x D)</b>	
10.2" x 13" x 22.4" (26 cm x 33 cm x 57 cm)	
<b>Weight</b>	
13.1 kg (28.9 lbs.)	
<b>Consumables</b>	
HEPA Filters (2x), Cobalt-free silica desiccant cartridge, 99.5%+ reagent-grade isopropyl alcohol	
<b>Optional Accessories</b>	
3795-Tab	Windows® 8 tablet with ruggedized case and Ethernet dongle
1602051	HEPA Filter
6008033	Dryer cartridge
8016	30 ml isopropyl alcohol bottles (16)

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