PortaCount® Plus Protection Assessment Test Instrument (PATI)

Model 8020M

Operator's Manual

P/N 1980132, Revision Q
July 2022

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Part Number
1980132 / Revision Q / July 2022

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Fax No.
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Seller warrants the goods, excluding software, sold hereunder, under normal use and service as described in the operator's manual, to be free from defects in workmanship and material for **12 months**, or if less, the length of time specified in the operator's manual, from the date of shipment to the customer. This warranty period is inclusive of any statutory warranty. **This limited warranty is subject to the following exclusions and exceptions**:

a. Hot-wire or hot-film sensors used with research anemometers, and certain other components when indicated in specifications, are warranted for 90 days from the date of shipment;

b. Pumps are warranted for hours of operation as set forth in product or operator's manuals;

c. Parts repaired or replaced as a result of repair services are warranted to be free from defects in workmanship and material, under normal use, for 90 days from the date of shipment;

d. Seller does not provide any warranty on finished goods manufactured by others or on any fuses, batteries or other consumable materials. Only the original manufacturer's warranty applies;

e. This warranty does not cover calibration requirements, and seller warrants only that the instrument or product is properly calibrated at the time of its manufacture. Instruments returned for calibration are not covered by this warranty;

f. This warranty is **VOID** if the instrument is opened by anyone other than a factory authorized service center with the one exception where requirements set forth in the manual allow an operator to replace consumables or perform recommended cleaning;

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Disclaimer: The measurement provided by the PortaCount® Plus (Protection Assessment Test Instrument) is an assessment of respirator fit during a fit test only. Respirator fit at other times will vary. The fit factor value is not intended for use in calculating an individual's actual exposure to hazardous substances.

Service Policy

Knowing that inoperative or defective instruments are as detrimental to TSI as they are to our customers, our service policy is designed to give prompt attention to any problems. If any malfunction is discovered, please contact your nearest sales office or representative, or call TSI's Customer Service department at (800) 680-1220 (USA) or (001 651) 490-2860 (International) or visit www.tsi.com.

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Safety

This section provides instructions to ensure safe and proper handling of the 8020M.

W A R N I N G

The instrument 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. There are no user-serviceable parts inside the instrument. Refer all repair to a qualified factory-authorized technician.

Chemical Safety

Isopropyl alcohol is hazardous material. **DO NOT** allow alcohol to get into your eyes. Avoid contact with the skin. **DO NOT** swallow or ingest in any way. Alcohol is extremely flammable. **DO NOT** expose to open flame or sources of ignition. Consuming the alcohol will result in severe illness or death. See Appendix A in this manual for instructions.

The alcohol used with this system is 99.5% pure or greater purity reagent grade isopropyl alcohol. It must be stored, cared for and disposed of properly. See Appendix A in this manual for instructions. The use of other grades/types of alcohol will damage the instrument.

Use the 8020M in a clean area. **DO NOT** use in areas with corrosive or acidic atmospheres.

Laser Safety

The Model 8020M is a Class 1 laser-based instrument. During normal operation, you will not be exposed to laser radiation. However, you must take certain precautions or you may expose yourself to hazardous radiation in the form of intense, focused visible light. Exposure to this light can cause blindness.

Take these precautions:

- **DO NOT** remove parts from the instrument unless you are specifically told to do so in this manual.
- **DO NOT** remove the instrument housings or covers while power is supplied to the instrument.

W A R N I N G

The use of controls, adjustments, or procedures other than those specified in this manual may result in exposure to hazardous optical radiation.

Battery Safety and Disposal

The PATI (Protection Assessment Test Instrument) can be powered using Military UltraLife P/N's BA5347/U, 6135-01-090-5364, 6135-01-455-7946; 6-Volts 11100mAh (11.10Ah) Lithium Manganese Dioxide (Li-MNO2) batteries, or the optional TSI® P/N 803100 8-D Cell Alkaline battery pack instead of the AC power supply. These batteries are not included. Follow the battery manufacturer's instructions for disposal of batteries.

W A R N I N G

- **DO NOT** charge, short circuit, incinerate or mutilate Li-MnO2 batteries.
- The battery **MUST NOT** be abused in any way which may cause the battery to rupture.
- **DO NOT** use equipment if battery becomes hot. **IMMEDIATELY** turn off the equipment if battery becomes hot to the touch.
- **DO NOT** use any battery which shows signs of damage, such as bulging, swelling, a swollen plastic wrap, liquid in the plastic wrap, etc.

Description of Labels and Markings

This section acquaints you with the advisory and identification labels on the instrument and used in this manual to reinforce the safety features built into the design of the instrument. It also identifies instrument markings.

Caution

C A U T I O N
CAUTION means ***be careful***. It means if you do not follow the procedures prescribed in this manual you may do something that might result in equipment damage, or you might have to take something apart and start over again. It also indicates that important information about the operation and maintenance of this instrument is included.

Warning

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.

Serial Number Label (displayed on the bottom)	
WEEE marking (displayed on the bottom) indicates item is non-disposable and must be recycled.	

CONTENTS

INTRODUCTION

PortaCount® Plus Model 8020M Respirator Fit Tester is the manufacturer's name for the equipment discussed in this publication. The term Model 8020M refers to the whole system or kit. When referring to the instrument itself, the nomenclature used is Protection Assessment Test Instrument (PATI)

The measurement provided by this instrument is an assessment of mask fit during a fit test only. Mask fit at other times will vary. The fit factor value is not intended for use in calculating an individual's actual exposure to hazardous substances.

Read this manual carefully before attempting to fit test a mask.

Should any problem arise, consult the Troubleshooting chapter of this manual. **DO NOT** attempt to service the PATI without consulting the troubleshooting section of this manual. If the problem cannot be remedied consulting the troubleshooting section, contact the manufacturer at (800) 680-1220 for further troubleshooting.

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Chapter 1

MODEL 8020M COMPONENT LIST AND PHYSICAL DESCRIPTION

Use the component list below to be sure no items are missing. Next, identify the various parts in the marked photographs. Then follow the setup instructions in Chapter 2 to prepare the instrument for operation.

Model 8020M Basic Issue

The following items are included with the Model 8020M:

Qty	Item
1	PATI (PortaCount® Plus Model 8020M)
1	Carrying case
2	HEPA filters
2	Twin tube assemblies
2	Alcohol fill capsule
2	Alcohol cartridge (with wick)
1	Storage cap
1	115/230 AC adapter
1	North American line cord for AC adapter
1	European line cord for AC adapter
4	Alcohol wick kits
1	Data port plug
1	USB connector plug
1	Model 8020M Operator's Manual (this manual, P/N 1980132)
1	Mask sampling kit
1	USB Cable
1	Li battery adapter cable
1	FitPro+™ Software Installation CD

Mask sampling kit (1040098) consists of:

Qty	Item
4	Drink tube sampling adapters (M50/M53/Avon Masks)
4	Drink tube sampling adapters (M40 Mask)
1	Mesh bag

In addition, the following is needed to operate the PATI:

Qty	Item
1 box	Alcohol, reagent grade, (Quantity of 16, 30 ml bottles)

Replacement Parts and Supplies

Unit of Issue	Item	Mfg. Part No.	NATO Stock No.
Pkg. of 1	Alcohol, reagent grade, (Quantity of 16, 30 ml bottles)	8016M	6810-01-382-2904
Pkg. of 1	Pre-Soaked Isopropyl Alcohol Wicks, Box 50 each	803105	
Pkg. of 1	Model 8020M Operator's Manual (this manual)	1980132	
Pkg. of 1	8020M M41 PATI Power Supply (115/230 AC adapter with North American line cord)	803106	
Pkg. of 1	European line cord for AC adapter	803149	
Pkg. of 1	Twin tube assembly	1081285	4240-01-382-3652
Pkg. of 1	Alcohol wick kit	1081322	9390-01-379-6385
Pkg. of 1	PATS-NL Mask Adapter Kit, replacement	803108	
Pkg. of 1	Carry Case (MDPE), 8020M M41 PATS	803102	
Pkg. of 1	Lower Foam Insert replacement, Carry Case (MDPE)	803103	
Pkg. of 1	Upper Foam Insert replacement, Carry Case (MDPE)	803104	
Pkg. of 1	Alcohol fill capsule	1081397	4240-01-382-3584
Pkg. of 1	Alcohol cartridge (with one wick)	1081282	4240-01-382-3519
Pkg. of 1	Storage cap	1081181	5340-01-378-2291
Pkg. of 1	HEPA filter	1602066M	4240-01-340-3715
Pkg. of 1	Data port plug	803144	
Pkg. of 1	USB port plug	803145	
Pkg. of 1	USB cable	803148	
Pkg. of 1	PATI Battery Pack	803100	
Pkg. of 1	Lithium Military Battery Pack Cable	803101	

Equipment Data

Size	
Instrument	9.3 in. x 6.4 in. x 5.6 in. (24 cm x 16 cm x 14 cm)
Carrying case	16.3 in. x 14.4 in. x 8.3 in. (41 cm x 37 cm x 20 cm)
Weight	
Instrument	3.1 lbs (1.4 kg)
Carrying case	14 lbs (6 kg)
Fit factor range.....	1 to greater than 50,000
Particle concentration range.....	0.01 to 500,000 particles/cm^3
Particle size range	0.02 to greater than 1 µm
Test duration (per exercise).....	40 seconds
Power requirements	
AC	115 VAC or 230 VAC, 50/60 Hz, dual-voltage AC power supply
Battery.....	Optional
Temperature range	
Operation.....	32 to 100°F (0 to 38°C)
Storage.....	-20 to 120°F (-30 to 50°C)
Sample flow rate	0.7 L/min (nominal)
Alcohol	
Hours of operation per charge.....	8 hours at 70°F (21°C)
Alcohol type.....	Reagent grade isopropyl
Recommended factory recalibration interval.....	One year
Warranty	One year on workmanship and materials
Optional accessories and supplies	FitPro+™ Fit Test 3.1 Software PATI battery pack (TSI® P/N 803100) Pre-soaked isopropyl alcohol wicks, box 50 ea. (TSI® P/N 803105)
Items Included With the 8020M.....	1 Protection Assessment Test System Instrument 2 Alcohol cartridge/fill capsule assemblies 1 AC power supply 2 HEPA filters for system check 2 Twin-tube sampling hoses 1 Hard-sided carry case

PATI Physical Description

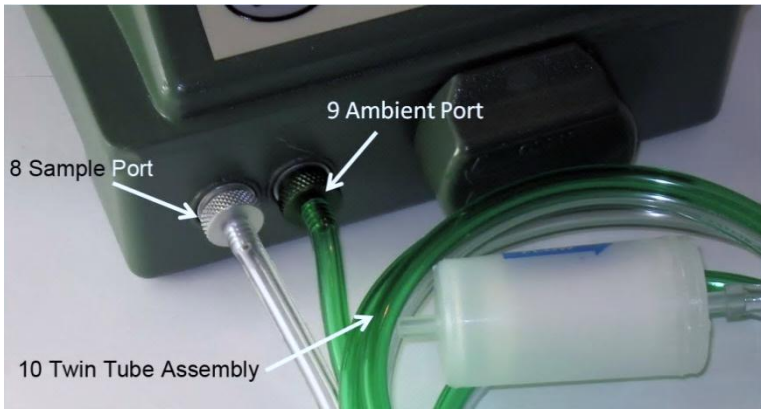
The following figures identify the main parts of the PATI. Become familiar with them before proceeding with the setup.

1. **ON/OFF button** ⏻
   Switches on the instrument and begins the 60 second warm-up cycle. Switches off instrument.
2. **SYSTEM CHECK button**
   Puts the PATI into System Check mode. LED lights to indicate you have selected this operation.
3. **REAL TIME button**
   Puts the PATI into Real Time mode. LED lights to indicate you have selected this operation.
4. **FIT TEST button**
   Puts the PATI into Fit Test mode. LED lights to indicate you have selected this operation.
5. **MENU buttons**
   A series of buttons used to set parameters for the PATI. Refer to Chapter 4.
6. **START/STOP TEST button**
   Starts or stops a test or other operation.
7. **Display**
   The PATI contains a liquid crystal display (LCD) on the front panel.

Front of PATI

8. **Sample Port**
   The Sample port is the inlet used when sampling air from a respirator during a fit test. The sample port fitting is colored silver.

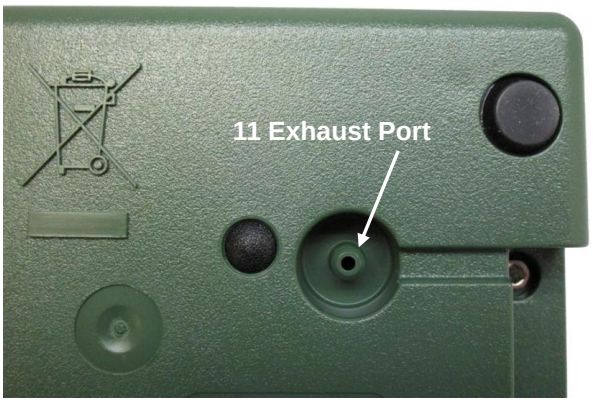
9. **Ambient Port**
   The ambient port is the inlet used when sampling ambient air during a fit test. The ambient port fitting is colored green.



Ports and Twin Tube Assembly

10. **Twin Tube Assembly**
    The twin tube assembly consists of a pair of tubes. The ambient tube is green in color, has the word "AMBIENT" marked on it, and connects to the green colored ambient port. The clear sample tube has the word "SAMPLE" marked on it, and connects to the silver colored sample port. The twin tube assembly is about 5 feet (150cm) long and **MUST NEVER** be lengthened for fit testing. The sample tube is 2.0 inches (51mm) longer than the ambient tube on the end which fits to the mask.

11. **Exhaust Port**
    The pump exhaust exits through the exhaust port on the underside of the PATI. **DO NOT** block this port.

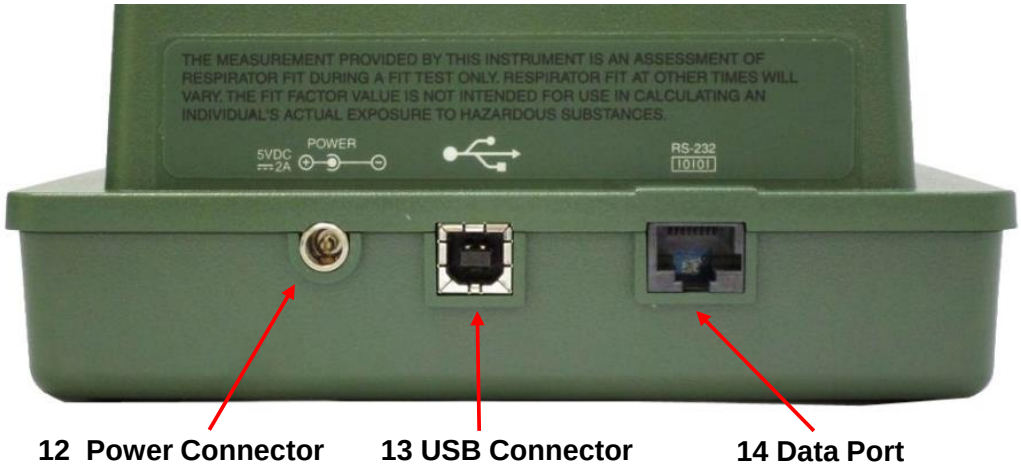


Underside of PATI

12. Power Connector
The power connector is a round metal connector marked with the voltage requirement and polarity just above it.

13. USB Connector
The USB connector allows communication with the PATI. It is used to transmit data to a computer.

14. Data Port
The Data Port allows the PATI to communicate with applications using the RS-232 protocol.



Back of PATI

15. AC Adapter
The AC adapter that is supplied with the Model 8020M plugs into the power connector on the back of the PATI. The AC adapter is a dual voltage type and can be used with either 115 VAC or 230 VAC nominal voltages.

16. Line Cord
The line cord attaches the AC adapter to an external power source.

AC Adapter and Line Cord

17. Cartridge Cavity
The cartridge cavity is where the alcohol cartridge is inserted during use. It is very important to make certain that dirt and lint do not enter the cartridge cavity.

18. Storage Cap
The storage cap is used to cover the cartridge cavity of the PATI when not in use or to cover the alcohol fill capsule when it is not holding the alcohol cartridge.

19. Spare Alcohol Wicks with Screen and Wick Removal Tool
Spare alcohol wicks and screens are included with the Model 8020M. The wick is inserted into the alcohol cartridge to absorb the alcohol, and the screen prevents contaminants from entering the cartridge cavity. A wick removal tool (wood dowel) is included with each wick.

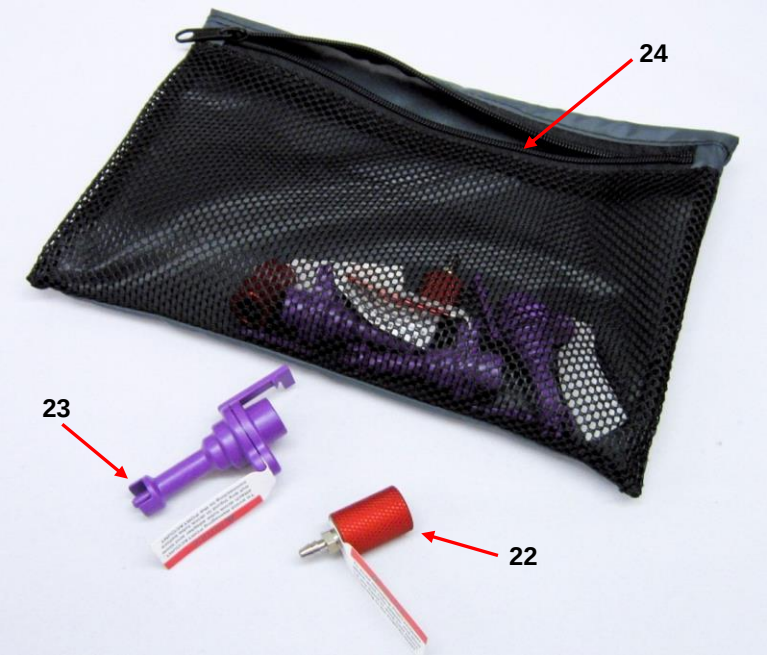
20. Alcohol Fill Capsule
The alcohol fill capsule is used to store and fill the alcohol cartridge.

21. Alcohol Cartridge
The alcohol cartridge consists of an alcohol cartridge cap and a wick retainer which holds the alcohol wick and screen.

Operational Components and Cartridge Cavity

22. Drink Tube Sampling Adapter
The drink tube sampling adapters provided with the Model 8020M allow the instrument to sample air from inside a mask using the drink tube. It is used with masks equipped with drink tubes such as the M40.

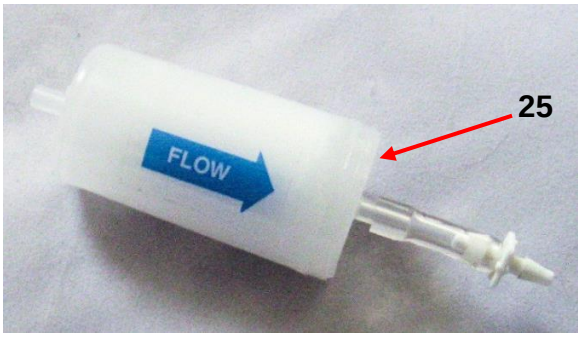
23. Drink Tube Sampling Adapter
The drink tube sampling adapters provided with the Model 8020M allow the instrument to sample air from inside a mask using the drink tube. This adapter is used with masks equipped with drink tubes such as the M53.



Mask Sampling Kit

24. Mesh bag
The mesh bag holds the drink tube sampling adapters which make up the mask sampling kit.

25. HEPA Filter
The HEPA Filter is provided for the purpose of performing a System Check on the PATI.



26. Model 8020M Operator's Manual for Protection Assessment Test System (*this manual*)
The Model 8020M Operator's Manual provides detailed instructions on operating, maintaining and troubleshooting the unit.

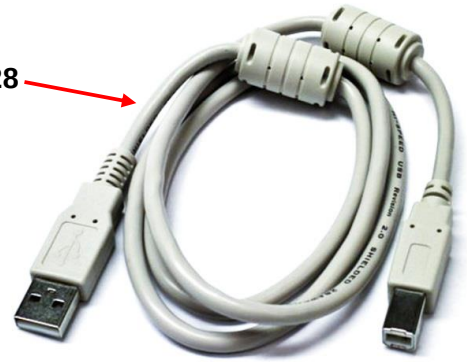
26

27. Model 8020M Software CD
The Model 8020M Software CD includes the FitPro+™ Fit Test Software and files necessary to load and run the software on a personal computer.

27

28. Computer Interface Cable
The Computer Interface Cable connects the PATI to the USB port of a personal computer.

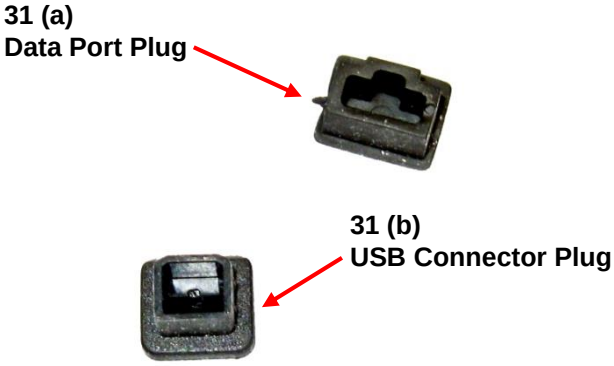
28



29. Lithium Battery Adapter Cable
The Lithium Battery Adapter Cable lets you connect an optional military lithium battery pack to use as a power source for the PATI. The battery pack is not included with the Model 8020M.

30. Carrying Case
The Carrying Case is a rugged case that provides protection and storage for the Model 8020M.

31. (a) Data Port Plug and
(b) USB Connector Plug
The Data Port Plug and USB Connector Plug are used to protect the data port and USB port from contamination or damage when either port is not being used.



Chapter 2

PATI SET UP

Modes of Operation

There are two modes of operation for the PATI: stand-alone mode and external control mode.

Stand-alone Mode

The PATI is operating in stand-alone mode when it is first powered on. It automatically begins a warm-up period and when that is over it displays an idle System Check screen. The PATI is then ready for a system check, fit testing, and other stand-alone operations.

External Control Mode

The PATI is operating in external control mode when it is being controlled by FitPro+™ software running on your computer. The PATI will also be operating in external control mode when using a product such as TSI®'s Mask Integrity Test Accessory (MITA). To start external control mode, place the PATI display on the idle System Check screen. Connect the PATI to the computer using the USB cable supplied with the 8020M and initiate control from the software. When the PATI is in external control mode **Locked** will be the displayed on the screen. Refer to the FitPro+™ Fit Test Software User's Manual located on the CD for more information.

Preventive Maintenance Checks and Services (PMCS)

1) Before

Item No.	Items to be inspected	Procedure	Corrective Action
1	Alcohol Capsule & Cartridge	Check the cartridge for dirt and other foreign matter.	Clean as needed.
2	Alcohol Capsule & Cartridge	Make certain that the capsule is filled with the alcohol when the cartridge is in the capsule.	Refill the cartridge with the reagent grade (≥99.5%) alcohol to the fill line.
3	Twin Tube Assembly	Check the twin tube assembly to make sure there is no condensation on the inside walls.	Refer to "Drying the twin tube assembly" section.
4	Storage Cap	Check the storage cap for dirt and other foreign matter.	Clean as needed.

2) During

Item No.	Items to be inspected	Procedure	Corrective Action
1	Twin Tube Assembly	When the PATI is turned on, but not in use, attach the HEPA filter to the Sample tube to prevent dust and debris from accidentally being drawn into the instrument.	Install HEPA filter to the Sample tube of the twin tube assembly.

3) After

Item No.	Items to be inspected	Procedure	Corrective Action
1	Storage Cap	Make sure that the storage cap is installed on the PATI and the alcohol cartridge is stored in the alcohol fill capsule.	Refer to the storage procedures.

Installing Data Port and USB Connector Plugs

Insert the data port plug into the data port and the USB connector plug into the USB connector if not already installed.	 **Plugs for the USB Connector and the Data Port**

Twin Tube Assembly

Attach the green tube to the green fitting (ambient port) and attach the clear tube to the silver fitting (sample port) as shown.	 **Twin Tube Assembly Connections**

Connecting the AC Power Supply

The PATI may be operated with either the supplied AC adapter or with a military lithium battery. If the AC adapter is to be used, follow the instructions below. If a battery is to be used, refer to the next section in this chapter. The AC adapter supplied with the PATI is a dual-voltage type power supply. It will automatically detect the AC voltage level (nominally 115 or 230 VAC) and adjust itself accordingly.

1. Locate the AC adapter and line cord in the carrying case.
2. Plug the female end of the line cord into the socket on one end of the AC adapter and plug the male end of the line cord into an available AC power outlet.
3. The AC adapter has a cable permanently attached on the opposite side from the line cord socket. Plug the small round connector on the end of this cable into the power connector on the back of the PATI.

Connecting the AC Adapter to the PATI

Connecting the Optional Battery

The PATI may be operated with a military lithium battery. If a battery is to be used instead of the AC adapter, follow the instructions below. Use military battery NSN 6135-01-090-5364 or 6135-01-455-7946 or BA-5347/U Li-MnO_2 (Lithium Manganese Dioxide). The lithium battery is not included with the Model 8020M.

W A R N I N G

- **DO NOT** charge, short circuit, incinerate or mutilate Li-MnO_2 batteries.
- The battery **MUST NOT** be abused in any way which may cause the battery to rupture.
- **DO NOT** use equipment if battery becomes hot. **IMMEDIATELY** turn off the equipment if battery becomes hot to the touch.
- **DO NOT** use any battery which shows signs of damage, such as bulging, swelling, a swollen plastic wrap, liquid in the plastic wrap, etc.

NOTICE

- For handling and disposal precautions, refer to Battery Safety and Disposal of this manual.
- **DO NOT** USE THE PATI IF THE TEMPERATURE IN THE TESTING AREA IS BELOW 32°F OR ABOVE 100°F (0°C or above 38°C).

1. Obtain the battery connector cable from the Model 8020M case. Connect the cable to the battery as shown.
2. Plug the small round connector on the end of this cable into the power connector on the back of the PATI.

Battery with Cable Connected

Adding Alcohol

Maintaining an adequate alcohol supply inside the PATI is critical to its operation and requires strict adherence to the directions that follow. The PATI will consume alcohol at the approximate rate of one ml per hour when the ambient temperature is near 75°F (24°C). At higher temperatures alcohol will be consumed faster and at lower temperatures alcohol will be consumed more slowly.

NOTICE

If using the Presoaked Alcohol Wicks (TSI® P/N 803105, box 50 ea.) the following steps for adding alcohol are not necessary. Simply insert the Presoaked Alcohol Wick into the Alcohol Cartridge.

W A R N I N G

- Isopropyl alcohol is hazardous material. **DO NOT** allow alcohol to get into your eyes. Avoid contact with the skin. **DO NOT** swallow or ingest in any way. Alcohol is extremely flammable. **DO NOT** expose to open flame or source of ignition. Consuming the alcohol will result in severe illness or death.
- Refer to the Safety Data Sheet (SDS) located in Appendix A of this manual for safety precautions.

To add alcohol to the PATI, you will need the following items:

- Reagent grade isopropyl alcohol (99.5% pure or better)
- Alcohol fill capsule
- Storage cap
- Alcohol cartridge

C A U T I O N

- The alcohol used with this system is 99.5% pure reagent grade isopropyl alcohol. The use of other grades of alcohol or the use of contaminated alcohol will damage the instrument. Dispose of any alcohol with visible contamination (refer to Appendix A). Always recap alcohol fill capsule and other containers immediately to prevent absorption of moisture.
- Any dirt or debris that gets into the PATI can plug the small internal nozzle and prevent operation. **DO NOT** allow the Alcohol Cartridge or Storage Cap or Alcohol Capsule to make contact with any surface that may be dirty.

1 Ensure that the PATI is turned off. **Never** install or remove the alcohol cartridge when the PATI is in operation.

2 Open the alcohol fill capsule by twisting the storage cap (or alcohol cartridge) 1/8 turn. Set the storage cap and alcohol cartridge down on a clean surface or with the ends standing up as shown.

Storage Cap and Alcohol Cartridge

3 Open a bottle of alcohol. Invert the bottle and insert the nozzle end into the alcohol fill capsule to make certain that you cannot inadvertently spray alcohol anywhere except down into the capsule.

4 Squeeze alcohol into the alcohol fill capsule until liquid level is even with the fill-line near the base. If the alcohol bottle is not empty you may recap it and store it for later use.

Filling Capsule with Alcohol

5 Make certain that the alcohol cartridge is clean (Chapter 6, "Cleaning the Storage Cap and Alcohol Cartridge"). Insert the alcohol cartridge into the alcohol fill capsule by aligning the groove with the pin and turning 1/8 turn until it locks into place.

6 Set the Alcohol Fill Capsule down and wait at least 2 minutes while the wick inside the Alcohol Cartridge soaks up alcohol. Never leave the cartridge cavity open longer than necessary. For intervals longer than 2 minutes use the storage cap to cover the cartridge cavity when the alcohol cartridge is not installed.

7 Remove the alcohol cartridge from the capsule and gently shake it to allow excess alcohol to drain back into the alcohol fill capsule. Stop when excess alcohol is no longer dripping.

Inserting Cartridge into Capsule

8 Insert the alcohol cartridge into the Cartridge Cavity of the PATI. Twist the alcohol cartridge counterclockwise until the locking pin begins to engage, and then firmly twist it clockwise until it is fully seated. It should snap into position. After installation of the alcohol cartridge, the PATI **MUST ALWAYS** remain in the upright position to prevent flooding.

Inserting Cartridge into PATI

9 Recap the alcohol fill capsule with the storage cap.

Alcohol Cartridge Correctly (Fully) Seated

Short-Term Storage and Shipment

It is important to remove all alcohol from the Model 8020M during transportation and storage. Anytime you put the PATI back into the carrying case you should:

1. Remove the alcohol cartridge from the PATI and store it in the alcohol fill capsule. The alcohol fill capsule is designed to be a safe transportation and storage container for alcohol. The alcohol cartridge can be left soaking in alcohol for up to three months (see long-term storage requirements below). Installing the storage cap into the cartridge cavity prevents dirt or lint from getting inside the PATI.
2. Cover the cartridge cavity with the storage cap.
3. **NEVER** ship the PATI without the carrying case and accessories. Always include basic issue items in the carrying case during transportation.

Alcohol Cartridge Properly Stored in Alcohol Fill Capsule

C A U T I O N

- **NEVER** transport or store the PATI with the alcohol cartridge inside the cartridge cavity. Flooding of the optics may occur.
- **ALWAYS** keep the alcohol cartridge in the alcohol fill capsule during transport and storage.
- **ALWAYS** use the alcohol storage cap to cover the cartridge cavity of the PATI during transport and storage.
- **NEVER** leave the cartridge cavity open.

Long-Term Storage

If the PATI is to be stored for a period of time exceeding three months, follow the instructions below *in addition to* the short term storage instructions outlined above.

1. Remove and properly dispose of all alcohol inside the alcohol fill capsule. See Appendix A.
2. Remove and properly dispose of the used alcohol wick inside the alcohol cartridge. See Appendix A.
3. Install a new, dry wick into the alcohol cartridge. See Chapter 6, "Changing the Alcohol Wick."
4. Remove all alcohol bottles from the Model 8020M carrying case, and store in an authorized storage.
5. Remove all batteries from the Model 8020M carrying case and store in an authorized storage area.

Chapter 3

PERFORMING A MASK FIT TEST

Before any fit testing can be accomplished, the procedures in Chapter 2 must be completed.

Performing a System Check

Every time the PATI is turned on, the system check should be performed.

1. Turn the PATI on by pressing the **ON/OFF** button on the keypad.
2. Wait for the display to warm up (60 seconds). If you encounter any errors, refer to Chapter 5, "Troubleshooting."
3. Verify the **SYSTEM CHECK** button is lit and the display shows **SYSTEM CHECK**. Also check that there is nothing attached to the ends of the sample and ambient tubes, such as a filter or mask.

4. Press the **START/STOP TEST** button to begin the System Check (ambient air check).
5. Check that the display reads "Ambient Check Passed" and displays a particle count of 1000 #/cm^3 or higher. This particle count is necessary to make sure a test can be conducted successfully. If the display reads "Ambient Check Failed" and the reading is lower than 1000 #/cm3, a mask Fit Test cannot be performed. Refer to Chapter 5, "Troubleshooting."
6. Perform a Zero-check by attaching the supplied HEPA filter to the clear sample tube, marked "SAMPLE". Make sure the arrow on the filter is pointing towards the PATI.

Attaching a HEPA Filter

7. Press the **START/STOP TEST** button to perform a Zero Check and watch the display. The display should read near 0.00 /cm^3 within 30 seconds and display "Pass" when the Zero Check and Maximum Fit Factor Tests are complete. If this step fails refer to Chapter 5, "Troubleshooting" to help solve the problem.	SYSTEM CHECK Test Complete: **PASS** Required Fit Factor: 10000 Measured: 53573 (Maximum Fit Factor) Press START/STOP to Exit.

8. Press the **START/STOP TEST** button if the System Check passed.
9. The instrument automatically proceeds to the Fit Testing mode (the **FIT TEST** button LED is lit) and the default mask protocol is displayed. To change the protocol, refer to Chapter 4 SETTINGS MENU. If you want to perform a Real Time Test, press the **REAL TIME** button and refer to Conducting a Real Time Test below.

C A U T I O N

- Always attach the HEPA filter to the sample line marked "SAMPLE" when the PATI is turned on, but not testing a mask. This will extend the life of the instrument by preventing dust and debris from being drawn into the PATI.
- Make certain that the end of the twin tube assembly is never allowed to fall to the ground or any place where dirt or moisture or debris could be drawn into the tubes.

Prepare Mask and Subject for Fit Test

NOTICE

- **No Smoking** in immediate area; test subject should not smoke for at least 30 minutes before test.
- Visually inspect mask inside and outside for dirt, mud, sand, powder, greasy or oily substances.
- Adjust face piece and tighten head harness.
- Ensure face piece is properly fitted and that no hair is under the sealing surface of the face piece.
- Check that canister is attached.

This section is specific to testing masks with a drink tube adapter. Methods for attaching the PATI to other mask systems will differ.

C A U T I O N

It is important that the mask be clean and free of any loose foreign material prior to conducting a fit test. Presence of these substances may affect the face piece seal and result in inaccurate readings.

1. Visually inspect both the inside and outside of the mask for dirt, mud, sand, powder, and greasy or oily substances. The inside of the face piece should be cleaned with a damp sponge and dried with a lint-free cloth. The outlet valve disk should also be carefully inspected to ensure it is clean and seated properly.
2. Attach the drink tube sampling adapter to the drink tube quick disconnect coupling as illustrated. **DO NOT** attach the sample line of PATI to the sampling adapter at this time. Note that different masks use different drink tube couplings.

Drink Tube Sampling Adapter Connected to the Quick Disconnect Coupling

NOTICE

- When using the red sampling adapter: If a distinct "snap action" can no longer be felt when engaging the drink tube quick disconnect coupling to the drink tube adapter, stop using the adapter and discard it. Replace the adapter. The absence of a "snap" indicates that the O-rings are dry from excessive wear.
- When using the purple sampling adapter : Insert the drink tube quick disconnect coupling fully into the adapter and twist such that the “flag” prevents the coupling from pulling out during fit testing.
- Some military masks have a manual drink valve in addition to the quick connect coupling (M17A1 for example). Have the person being fit tested hold the drink valve open during the entire fit test if the mask has a manual drink valve. If the drink valve is left closed, air cannot be drawn from inside the mask and the fit test will result in a false pass.

3. Have the test subject sit down for the mask fit test.

C A U T I O N

All water or foreign material **MUST BE EXPELLED** from the mask drink tube before the PATI sample line is connected so that liquid will not be drawn into the PATI. If liquid is drawn into the PATI, it may become inoperable.

4. Instruct the test subject to blow as hard as possible several times into the internal drink tube mouthpiece to remove any trapped fluids or foreign matter. **THIS IS A CRITICAL STEP.** The drink tube must be cleared so that foreign matter will not be drawn into the PATI and so that the PATI will be able to draw air from inside the mask.

NOTICE
• Make certain the sample tube is not attached while the test subject blows into the drink tube mouthpiece. If the tube is attached, any fluid will be blown into the instrument and make the instrument inoperable. • If the drink tube is obstructed and the blockage cannot be removed, the mask cannot be used for Fit Testing and should be sent for maintenance.

5. Adjust the face piece and tighten the head harness following the instructions outlined in the Operator's Manual for the mask being tested.
6. Ensure that the face piece is properly fitted and that no hair is under the sealing surface of the face piece.
7. Check that the canister is firmly attached.

Conducting a Mask Fit Test

NOTICE
• The measurement provided by this instrument is an assessment of mask fit during a fit test only. Mask fit at other times will vary. The fit factor value is not intended for use in calculating an individual's actual exposure to hazardous substances. • This instrument is designed to operate in an enclosed, sheltered area at ambient temperatures between 32°F and 100°F (0°C and 38°C). TO AVOID INACCURATE READINGS, **DO NOT** USE THE PATI IF THE TEMPERATURE IN THE TESTING AREA IS BELOW 32°F OR ABOVE 100°F (0°C or above 38°C). • It is important that smoking **NOT BE** permitted in the immediate area where the mask fit testing is to be conducted. Also, it is **VERY IMPORTANT** that the test subject not smoke for at least 30 minutes before the test begins. • To achieve proper results the test subject should not talk during the test.

1. Remove the HEPA filter from the PATI twin tube assembly. 2. Attach the end of the clear tube marked "**SAMPLE**" to the barbed fitting on the end of the drink tube sampling adapter as shown.	 **Connecting PATI Sample Line to Drink Tube Sampling Adapter**

NOTICE

Before continuing to the next step, brief the test subject on how to perform the exercises outlined below. The test subject should be instructed to breathe normally during all exercises except the deep breathing exercise. Each time the exercise on the PATI display changes, a "beep" sounds. **IMMEDIATELY** instruct the test subject to start the next exercise.

3. Press the **START/STOP TEST** button. Testing begins immediately.
4. Instruct the test subject to perform the exercises as displayed on the instrument. Each time the exercise changes, a “beep” sounds to prompt the subject to start the next exercise. The exercises may occur in the following order:

   a. Normal breathing; keep the head motionless.

   b. Deep breathing; slowly but deeply inhale through nose and exhale from mouth.

   c. Head movement side to side; look over each shoulder in one-second intervals (see Exercise 3 photos.)

   d. Head movement up and down: look at the ceiling then the floor in one-second intervals (see Exercise 4 photos.)

   e. Rotate chin: move the jaw in a circular pattern with mouth slightly open.

Exercise 3: Moving Head Side To Side, Look Over Each Shoulder

Exercise 4: Move Head Up And Down, Look at Ceiling and Floor

NOTICE

After the pass or fail indication, you will hear a series of three beeps. An overall test result will then be displayed.

5. If the test is a **PASS**, have the test subject remove mask and continue with the next step. If the test is a **FAIL**, follow the directions outlined in step 8.
6. Remove the drink tube sampling adapter from the test subject's mask and attach the HEPA filter to the tube marked "SAMPLE" until you start the next fit test.

7. When finished testing, follow this closing procedure:
   a. Turn the PATI off by pressing the **ON/OFF** button on the keypad
   b. Remove the HEPA filter from the SAMPLE tube.
   c. Remove the storage cap from the alcohol fill capsule.
   d. Remove the alcohol cartridge and place it in the alcohol fill capsule.
   e. Replace the storage cap to the PATI Cartridge Cavity.
   f. Disconnect the AC power supply.
   g. Repack all the basic issue items in the carrying case.
8. If the mask fails the test, do the following:
   a. Check to ensure head harness pad is centered correctly.
   b. Re-tighten straps after adjustment of head harness pad.
   c. Check for hair under face piece sealing surfaces.
   d. Make sure all connections are correct.
   e. The mask may be faulty; verify its condition.
   f. Perform a Real Time Test (see below).
   g. Repeat Fit Test.
   h. Try using a different size mask with the test subject. A smaller size face piece usually seals better than a larger size.

C A U T I O N

It is normal for moisture to be seen in the Model 8020M tube assembly due to condensation from the test subject's breath. It is **IMPORTANT**, however, that the moisture not build up to the point where it drips down into the PATI.

9. If enough moisture builds up in the tubing until it might drip into the PATI, remove the twin tube assembly and replace it with the spare dry twin tube assembly. Dry the twin tube assembly in accordance with the maintenance procedure in Chapter 6.

NOTICE

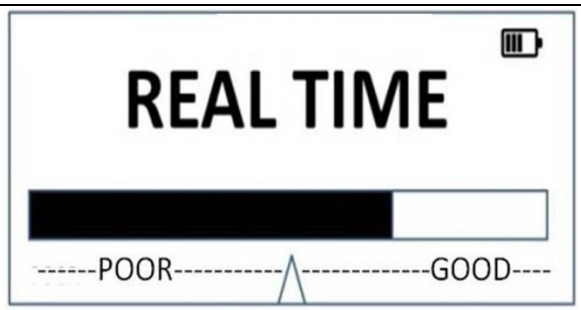
- Eventually, the alcohol wick inside the alcohol cartridge absorbs enough moisture to prevent proper operation. Symptoms of excess moisture are: low particle counts even though there is plenty of alcohol and there are plenty of particles in the room, and the need to frequently replenish the alcohol supply (for example, every hour or even more frequently). Refer to Chapter 5, Troubleshooting.
- The life of an alcohol wick depends on the conditions of use. When the PATI is used heavily (for example: 8 hours a day, day after day), the wick may need to be replaced as often as every 5th day. Lighter use requires less frequent wick changes, possibly months apart.

Performing a Real Time Test

A Real Time Test can be very useful when troubleshooting a mask that fails the fit test. A Real Time Test can also be used to assist in optimizing the fit of a mask in training. It allows a test subject to experiment with strap tension and other adjustments while watching the effect in real time. You can perform a Real Time Test at any time.

To perform a Real Time Test:

1. Have the subject don the mask as if preparing for a Fit Test. See Preparing the Mask for Fit Testing.
2. Press the **Real Time** button on the PATI display. The LED on the button lights to indicate you have selected this mode of operation and the PATI immediately begins to sample the ambient air (for 5 seconds).
3. After sampling the ambient air, the PATI begins to sample the mask air and displays a bar graph indicating how well the mask fits.



4. The Λ indicates the the Pass/Fail protocol setting for the mask. If the fit is “poor” (bar falls short of the Λ indicator) attempt to improve the fit by adjusting the mask. Check the following:
   a. Check to ensure head harness pad is centered correctly.
   b. Re-tighten straps after adjustment of head harness pad.
   c. Check for hair under face piece sealing surfaces.
   d. Make sure all connections are correct.
   e. Try using a different size mask with the test subject. A smaller size face piece usually seals better than a larger size.
5. The PATI runs in this mode for five minutes and then pauses to resample ambient air. Operation then resumes.
6. To end the Real Time Test, press the **START/STOP TEST** button.

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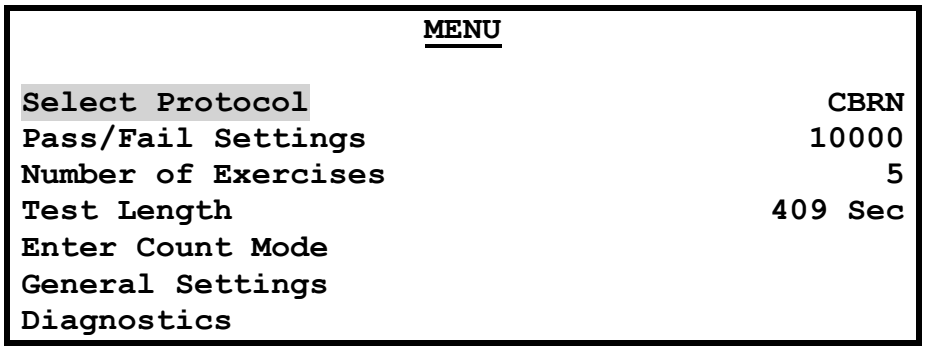
Chapter 4

SETTINGS MENU

The PATI includes a menu that lets you set various parameters and obtain information for diagnostics and other operations. The photo below shows the six buttons along the bottom edge of the display that provide the functionality for navigating the menu.

The menu can be activated by first placing the PATI at an idle screen and then pressing the button marked **1**. Once the menu is activated, the following icons will be displayed.

Icon Displayed	Action
∧	Scrolls up; increases a value (for example when setting time or date).
∨	Scrolls down to the next menu item or option; decreases a value (for example when setting time or date).
<	Scrolls to the left to select available options.
>	Scrolls to the right to select available options.
↵	Selects the current option; returns to the previous screen (and saves changes if changes were made).
ESC	Returns to the previous screen; nothing is saved. Exits the Menu.



The following table lists the options and sub-options available in the Menu.

Menu Item	Options	Description
Select Protocol		Select the protocol to use for the Fit Tests.
Pass/Fail Settings		For information only. The Fit Test fails if the fit factor is below this setting. The number is determined by the protocol selected. No options are available.
Number of Exercises		For information only. The number of exercises in the Fit Test. The number is determined by the protocol selected. No options are available.
Test Length		For information only. The total time a Fit Test will take. The number is determined by the protocol selected. No options are available.
Enter Count Mode		Displays the concentration count (#/cm^3) currently being drawn through the clear sample tube. No options are available. Press ESC to exit when finished using Count Mode.
General Settings		View/change various settings for the instrument.
	Contrast	Sets the contrast for the display: 0 (lowest contrast) 10 (highest contrast).
	Show Fit Factor	Enables/Disables viewing of the Fit Factor while testing. When Enabled, the Fit Factor and pass/fail are displayed. When Disabled, only pass/fail is displayed.
	Set Time	Sets the time used to calculate service interval.
	Set Date	Sets the date used to calcuate service interval.
	Date Format	Sets the date format. Options are MM/DD/YY or DD/MM/YY.
	Number Format	Sets the format of numbers. Options are: XX,XXX.YY or XX.XXX,YY.
	Backlight	Sets the backlighting for the display. Options are Auto, Disable and Enable. Auto turns backlighting off during idle periods. Enable turns backlighting on. Disable turns backlighting off.
	Beeper	Turns the audible beeper on or off. Enabled means the beeper is turned on. Disabled means the beeper is turned off.
Diagnostics		Displays information about the status of the instrument that might be useful when troubleshooting problems. There are no user settings available.

Chapter 5

TROUBLESHOOTING

This chapter lists a series of symptoms, their possible causes and recommended solutions for problems with the PATI. If your symptom is not listed, or if none of the solutions solves your problem, please contact TSI®. Additional help is available from the TSI® website www.tsi.com or by sending e-mail to PortaCount@tsi.com.

ALWAYS perform the System Check as the first troubleshooting step. Passing the System Check usually indicates that the PATI is working properly and that the problem is elsewhere, such as the connection to the respirator and/or the respirator itself.

On-line Troubleshooting Guides

NOTICE
Additional application notes on troubleshooting are located on the FitPro+™ software CD or visit TSI's website at http://fittest.tsi.com.

Symptom	Possible Causes	Solution
"Service is recommended" Message appears after warm-up.	The service interval for your instrument has expired	Return the instrument for service. See PATI Maintenance in Chapter 6.
"Service is required" message appears after warm-up.	A critical operating parameter has been exceeded.	Return the instrument for service.
Ambient Concentration Low message	Low on alcohol. See also: Causes and Solutions for *Low Alcohol Message*	Replenish alcohol.
	Twin Tube Assembly hoses are reversed on instrument.	Verify the hoses are connected to the proper inlet ports on the instrument.
	Wrong hose is connected to respirator.	Connect the proper (clear) tube to the respirator.
	Twin Tube Assembly is kinked, pinched, or blocked.	Straighten out the Twin Tube Assembly or remove the obstruction.
	Particle count in area really is low.	Move to another location or use a particle generator (such as the 8026 Particle Generator).
	Plugged internal nozzle.	See "Clearing The Nozzle" in Chapter 6

Symptom	Possible Causes	Solution
Ambient Concentration Low message *(cont.)*	PATI is flooded with alcohol.	Remove Alcohol Cartridge and install Storage Cap. Run 2 or more hours to dry optics.
	Unit needs recalibration and cleaning.	Return the instrument for service.
Low Alcohol Message	Low on alcohol.	Replenish alcohol
	Excessive moisture build-up inside alcohol cartridge.	Change wick inside alcohol cartridge; dump old alcohol from the Fill Capsule and add fresh alcohol.
	Inferior or contaminated alcohol	Use only approved alcohol (99.5 % or better isopropyl).
		Change wick inside alcohol cartridge; dump old alcohol from the Fill Capsule and add fresh alcohol.
	Operating beyond recommended ambient temperature range.	Move to an environment which meets the instrument's operating temperature range
Does not switch on	AC Adapter not plugged in to unit or AC outlet.	Connect AC Adapter
	If operating instrument from battery power, battery is fully depleted.	Replace batteries
Low Battery message	If operating instrument from battery power, battery is nearly depleted.	Replace batteries
	AC adapter is malfunctioning.	Replace AC adapter.
Zero Check fails (step of the System Check)	Alcohol Cartridge is loose.	Tightly close the Alcohol Cartridge.
	Twin Tube Assembly leaks.	Replace the Twin Tube Assembly.
	Zero check filter leaks.	Repeat the test with a different filter.
	Ends of Twin Tube Assembly are poorly sealed.	Cut off the worn ends on the Twin Tube Assembly.
	Twin Tube Assembly is disconnected from the instrument.	Connect the Twin Tube Assembly to the PATI.
	O-ring on alcohol cartridge is not sealing.	Use the spare alcohol cartridge supplied in the kit.
	Inlet port fittings on PATI are loose.	Hand-tighten fittings.
	Instrument slightly flooded with alcohol.	Remove Alcohol Cartridge and install Storage Cap. Run 2 hours to dry optics.
	Unit needs recalibration and cleaning.	Return the instrument for service.

Symptom	Possible Causes	Solution
Maximum Fit Factor Check fails (step of the System Check)	Alcohol in nozzle	See "Clearing The Nozzle" in Chapter 6.
	Instrument slightly flooded with alcohol.	Remove Alcohol Cartridge and install Storage Cap. Run overnight to dry optics.
	Alcohol level is low.	Replenish alcohol. See "Adding Alcohol" in Chapter 2.
	Unit needs recalibration and cleaning.	Return the instrument for service.
Fit test fails consistently. **NOTICE:** Verify the PATI passes the System Check. Then the problem is with the respirator, not the PATI.	Filters or canister not installed or not installed tightly	Install filters or canister and properly tighten.
	Respirator leaks, has loose filters, or a malfunctioning exhalation valve.	Repair or replace the respirator.
	Twin Tube Assembly is not connected to respirator.	Connect the Twin Tube Assembly (clear tube) to the drink tube sampling adapter.
	Alcohol level is low.	Add alcohol to the PATI.
	Drink tube is blocked	Blow out drink tube.
	Drink tube sampling adapter leaks.	Replace drink tube sampling adapter.
Requires frequent refill of alcohol (every hour or less)	Moisture build-up inside Alcohol Wick.	Change wick inside alcohol cartridge; dump old alcohol from the Fill Capsule and add fresh alcohol.
Alcohol visible in Twin Tube Assembly or coming out of Exhaust Port	PATI is flooded with alcohol.	Remove Alcohol Cartridge and install Storage Cap. Run overnight to dry.
Excessive moisture visible in twin tube assembly.	Condensation from breath or moisture from inside the twin tube assembly.	Replace twin tube assembly with a dry tube. Allow wet tube to dry before using it again (see Drying the Twin Tube Assembly in Chapter 6).

Symptom	Possible Causes	Solution
High Concentration message	A near-by particle generator is elevating ambient concentration levels.	Turn off or turn down any particle generators operating in the vicinity such as humidifiers or the Model 8026 Particle Generator. Keep all forms of particle generation at least 6 ft (1.8 m) from the PATI during fit testing.
	The room ventilation system is reduced or turned off.	Increase room ventilation.
	Ambient concentration is naturally elevated,	In situations where the ambient concentration is elevated through pollution, construction, or other means where it cannot be controlled, the PATI will continue to operate. Note that prolonged exposure to excessive particle concentration levels could degrade the performance of the PATI over time, requiring more frequent maintenance.

Chapter 6

PATI MAINTENANCE

The PATI should be cleaned and recalibrated periodically. If the recommended service interval has expired a “Service is recommended” message will be displayed each time the unit is powered on and the warm-up sequence completes. PATI allows this message to be dismissed and the fit testing to continue. Schedule an instrument clean and calibration with your service provider.

Clearing the Nozzle

In the event that the PATI gets alcohol in the internal nozzle, follow these steps:

1 Remove the alcohol cartridge from the PATI and place it in the alcohol fill capsule.

2 Install the storage cap into the cartridge cavity of the PATI.

3 Turn the PATI on and put it into Count Mode (see Settings Menu in Chapter 4). Make certain that the HEPA filter is not attached to the twin tube assembly.

4 Place your thumb over the end of the sample tube marked "**SAMPLE**" to stop the flow of air into the PATI. Stop the flow for about 10 seconds and then suddenly release it. Repeat these three or four times.

Interrupting the Air Flow to Clear the Nozzle

5 Replace the alcohol cartridge in the PATI and conduct a System Check. If the System Check passes, continue Fit Testing.

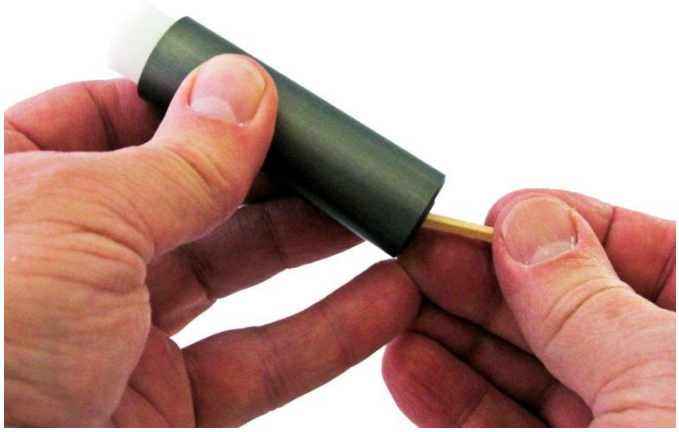
6 If the System Check fails, remove the alcohol cartridge and install the storage cap in the cartridge cavity of the PATI. Allow the PATI to run in Count mode (see Settings Menu in Chapter 4) overnight. Then perform a System check (Chapter 3) to ensure that the system is operational. If the system is not operating, seek higher level support.

Changing the Alcohol Wick

Follow the instructions below to change the PATI alcohol wick. Spare wicks are included with the Model 8020M and are packaged in plastic sleeves. Each sleeve contains one wick and one screen. There is a wick removal tool (wood dowel) attached to each sleeve.

C A U T I O N

ALWAYS install a screen each time you install a new wick. Follow proper procedures when disposing of alcohol and alcohol soaked wicks. See Appendix A.

1 To remove the alcohol wick from the alcohol cartridge, grasp the cartridge with both hands, with your thumbs near the seam toward the cap. Firmly apply pressure to separate the alcohol cartridge into two pieces. The alcohol cartridge will snap apart exposing the white alcohol wick.	 **Separating Alcohol Cartridge**
2 After separating the two parts, push the alcohol wick and screen out of the wick retainer from the opposite end with the wick removal tool.	 **Removing the Alcohol Wick and Screen**

C A U T I O N

Before installing a new alcohol wick, **MAKE CERTAIN THAT ALL PARTS ARE CLEAN**. Small bits of the wick or lint can cause serious problems if they get into the PATI.

3 Inspect the inside surfaces of the alcohol cartridge and the wick retainer. 4 Clean alcohol cartridge and wick retainer. See cleaning procedures. 5 Remove a new wick and screen from the plastic sleeve. Blow air onto all surfaces of the new wick to make certain that any loose particles that may have shed from the wick are removed. 6 Drop the screen into the wick retainer and ***make sure it lies flat on the bottom of the wick retainer.***	 **Inserting Screen**
7 Slide alcohol wick into the wick retainer and push firmly until the alcohol wick is fully inserted. 8 Align the two parts of the alcohol cartridge and press them together firmly until they snap in place. If they do not snap in place easily then inspect the O-ring at the joint. If the O-ring is very dry, wet it with a very small amount of alcohol. It is not necessary to remove the O-ring from the cartridge. 9 Discard the old screen, empty sleeve and wick removal tool. Dispose of the used wick properly. See Appendix A.	 **Inserting Alcohol Wick into Wick Retainer**

Cleaning the Storage Cap and Alcohol Cartridge

C A U T I O N

It is important that the storage cap and alcohol cartridge be kept clean at all times. Dirt, dust, and many other contaminants can have damaging effects on the operation of the PATI. Cleaning must be done with a lint-free applicator and reagent grade isopropyl alcohol.

1 Place several drops of reagent grade isopropyl alcohol on the applicator.	 **Applying Alcohol to Applicator**
2 Wipe the contaminated areas of the storage cap and alcohol cartridge with the applicator until the items are clean. 3 Replace the dirty applicator as required.	 **Cleaning the Alcohol Cartridge and Storage Cap**

Drying the Twin Tube Assembly

C A U T I O N

- During repeated use of the PATI, moisture from the test subject's breath may result in condensation inside the twin tube assembly which could be pulled into the PATI causing damage.
- Be careful **NOT** to lift the twin tube assembly when removing it in order to prevent moisture from draining into the PATI.
- Ensure that the moist twin tube assembly does not touch the ground during removal or drying.

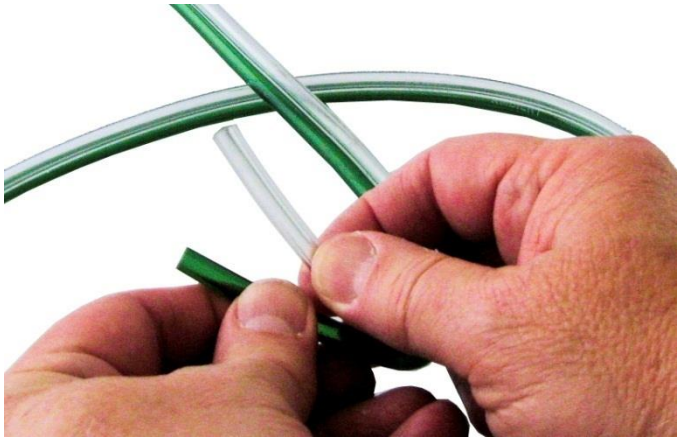
1 Remove the moist twin tube assembly and replace it with a dry twin tube assembly.

2 Drape the moist twin tube assembly over an elevated, protruding object to allow drainage and drying of the moisture buildup inside the twin tube assembly.

Drying the Twin Tube Assembly

Trimming the Ends of the Twin Tube Assembly

NOTICE
The twin tube assembly **MUST NEVER** be shorter than 48 inches. If the twin tube assembly ends become cracked, stretched or deformed, they can be trimmed.

1 Separate the twin tube assembly sample tube from the ambient tube by pulling them apart as far as required.	 **Separating the Twin Tube Assembly**
2 With a sharp instrument, remove the bad ends of the twin tube assembly by trimming an equal amount from the sample and ambient tubes on the damaged ends. 3 Ensure that one end of the twin tube assembly contains evenly trimmed sample and ambient tubes while the opposite end of the twin tube assembly contains a sample tube that is two inches longer than the ambient tube.	 **Trimming the Twin Tube Assembly**

Appendix A

STORAGE, CARE AND DISPOSAL OF ALCOHOL AND WICKS

Unused portions of alcohol can be left in their original plastic bottles, recapped, and stored for later use.

Full or partly filled alcohol bottles which are no longer needed must be properly disposed of using local procedures for disposal of liquid flammable wastes. Waste alcohol should be placed in a suitable, properly marked, flammable waste container and returned to a designated disposal collection area, according to your local standard operating procedure (SOP).

Alcohol soaked wicks must be properly disposed of using local procedures for disposal of liquid flammable wastes. Waste wicks should be placed in a suitable, properly marked, flammable waste container and returned to a designated disposal collection area, according to your local SOP.

W A R N I N G
Isopropyl alcohol is a hazardous material. **DO NOT** allow alcohol to get into your eyes. Avoid contact with the skin. **DO NOT** swallow or ingest in any way. Alcohol is extremely flammable. **DO NOT** expose to open flame or source of ignition. Refer to the Safety Data Sheet (SDS) on the following pages for safety precautions.

SAFETY DATA SHEET

1. Identification

Product identifier: Isopropyl Alcohol

Other means of identification
Product No.: 9088, 5892, 9095, 9084, 9083, 9082, 9079, 9078, 9059, 9055, 9045, 5986, 5978, 5977, 5967, 5873, 5863, 9827, 5373, 9334

Recommended use and restriction on use

Recommended use: For use in the PortaCount® Respirator Fit Tester
Restrictions on use: Not known.

Manufacturer/Importer/Supplier/Distributor information

Manufacturer

Company Name:	TSI Incorporated
Address:	500 Cardigan Road Shoreview, MN 55126
Telephone:	Customer Service: 800-874-2811
Fax:	
Contact Person:	
e-mail:	answers@tsi.com

Emergency telephone number:
24 Hour Emergency: 908-859-2151

Chemtrec: 800-424-9300

2. Hazard(s) identification

Hazard classification

Physical hazards

Flammable liquids	Category 2

Health hazards

Serious eye damage/eye irritation	Category 2A
Specific target organ toxicity - single exposure	Category 3

Label elements

Hazard symbol:

Signal word: Danger

Hazard statement: Highly flammable liquid and vapor.
Causes serious eye irritation. May cause respiratory irritation.
May cause drowsiness or dizziness.

Precautionary statement

Prevention: Keep away from heat/sparks/open flames/hot surfaces. No smoking. Keep container tightly closed. Ground/bond container and receiving equipment. Use explosion-proof electrical/ventilating/lighting/equipment. Use only non-sparking tools. Take precautionary measures against static discharge. Wear protective gloves/protective clothing/eye protection/face protection. Use only outdoors or in a well-ventilated area. Avoid breathing dust/mist/vapors. Wash thoroughly after handling.

Response: In case of fire: Use water spray, foam, dry powder or carbon dioxide for extinction. IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing. Call a POISON CENTER or doctor/physician if you feel unwell. IF ON SKIN (or hair): Remove/take off immediately all contaminated clothing. Rinse skin with water/shower. IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical advice/attention.

Storage: Store in a well-ventilated place. Keep cool. Keep container tightly closed. Store locked up.

Disposal: Dispose of contents/container to an appropriate treatment and disposal facility in accordance with applicable laws and regulations, and product characteristics at time of disposal.

Other hazards which do not result in GHS classification:

Static accumulating flammable liquid can become electrostatically charged even in bonded and grounded equipment. Sparks may ignite liquid and vapor. May cause flash fire or explosion.

3. Composition/information on ingredients

Substances

Chemical identity	Common name and synonyms	CAS number	Content in percent (%)*
ISOPROPYL ALCOHOL	isopropanol 2-propanol, sec-propyl alcohol	67-63-0	98 - 100%

* All concentrations are percent by weight unless ingredient is a gas. Gas concentrations are in percent by volume.

4. First-aid measures

General information: Get medical advice/attention if you feel unwell. Show this safety data sheet to the doctor in attendance.

Ingestion: Call a physician or poison control center immediately. Do NOT induce vomiting. If vomiting occurs, keep head low so that stomach content doesn't get into the lungs.

Inhalation: Move to fresh air. Get medical attention if symptoms persist.

Skin contact: Wash skin thoroughly with soap and water. Get medical attention if symptoms occur.

Eye contact: Immediately flush with plenty of water for at least 15 minutes. If easy to do, remove contact lenses. Get medical attention.

Most important symptoms/effects, acute and delayed

Symptoms:	Harmful if swallowed. Narcotic effect. Irritating to eyes, respiratory system and skin.

Indication of immediate medical attention and special treatment needed

Treatment:	Treat symptomatically. Symptoms may be delayed.

5. Fire-fighting measures

General fire hazards:	Highly flammable liquid and vapour.

Suitable (and unsuitable) extinguishing media

Suitable extinguishing media:	Water spray, foam, dry powder or carbon dioxide.
Unsuitable extinguishing media:	Avoid water in straight hose stream; will scatter and spread fire.
Specific hazards arising from the chemical:	Vapors may cause a flash fire or ignite explosively. Vapors may travel considerable distance to a source of ignition and flash back. Prevent buildup of vapors or gases to explosive concentrations. Vapor from the solvent may accumulate in container headspace resulting in flammability hazard. Thermal decomposition may release oxides of carbon.

Special protective equipment and precautions for firefighters

Special fire fighting procedures:	Use water spray to keep fire-exposed containers cool. Water may be ineffective in fighting the fire. Fight fire from a protected location. Move containers from fire area if you can do so without risk.
Special protective equipment for fire-fighters:	Firefighters must use standard protective equipment including flame retardant coat, helmet with face shield, gloves, rubber boots, and in enclosed spaces, SCBA.

6. Accidental release measures

Personal precautions, protective equipment and emergency procedures:	ELIMINATE all ignition sources (no smoking, flares, sparks or flames in immediate area). Keep unauthorized personnel away. Keep upwind. Use personal protective equipment. Do not touch damaged containers or spilled material unless wearing appropriate protective clothing. Ventilate closed spaces before entering them. See Section 8 of the MSDS for Personal Protective Equipment.
Methods and material for containment and cleaning up:	Eliminate all ignition sources if safe to do so. Take precautionary measures against static discharges. Stop leak if possible without any risk. Use only non-sparking tools. Absorb spill with vermiculite or other inert material, then place in a container for chemical waste. Clean surface thoroughly to remove residual contamination. Dike far ahead of larger spill for later recovery and disposal.
Notification Procedures:	Prevent entry into waterways, sewer, basements or confined areas. Inform authorities if large amounts are involved.
Environmental precautions:	Do not contaminate water sources or sewer. Prevent further leakage or spillage if safe to do so.

7. Handling and storage

Precautions for safe handling: DO NOT handle, store or open near an open flame, sources of heat or sources of ignition. Protect material from direct sunlight. Take precautionary measures against static discharges. Ground/bond container and receiving equipment. Use explosion-proof electrical/ventilating/lighting/equipment. Use only non-sparking tools. Wear protective gloves/protective clothing/eye protection/face protection. Avoid contact with eyes, skin, and clothing. Use only with adequate ventilation. Wash hands thoroughly after handling.

Conditions for safe storage, including any incompatibilities: Keep away from food, drink and animal feeding stuffs. Keep container tightly closed in a cool, well-ventilated place. Ground container and transfer equipment to eliminate static electric sparks. Comply with all national, state, and local codes pertaining to the storage, handling, dispensing, and disposal of flammable liquids.

8. Exposure controls/personal protection

Control parameters

Occupational exposure limits

Chemical identity	Type	Exposure Limit values	Source
ISOPROPYL ALCOHOL	TWA	200 ppm	US. ACGIH Threshold Limit Values (2011)
	STEL	400 ppm	US. ACGIH Threshold Limit Values (2011)
	REL	400 ppm 980 mg/m3	US. NIOSH: Pocket Guide to Chemical Hazards (2010)
	STEL	500 ppm 1,225 mg/m3	US. NIOSH: Pocket Guide to Chemical Hazards (2010)
	PEL	400 ppm 980 mg/m3	US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000) (02 2006)
	TWA	400 ppm 980 mg/m3	US. OSHA Table Z-1-A (29 CFR 1910.1000) (1989)
	STEL	500 ppm 1,225 mg/m3	US. OSHA Table Z-1-A (29 CFR 1910.1000) (1989)

Biological limit values

Chemical identity	Exposure Limit values	Source
ISOPROPYL ALCOHOL	40 mg/l (Urine) (acetone: Sampling time: End of shift at end of work week.)	ACGIH BEL (2011)

Appropriate engineering controls Good general ventilation (typically 10 air changes per hour) should be used. Ventilation rates should be matched to conditions. If applicable, use process enclosures, local exhaust ventilation, or other engineering controls to maintain airborne levels below recommended exposure limits. If exposure limits have not been established, maintain airborne levels to an acceptable level. An eye wash and safety shower must be available in the immediate work area. Use explosion-proof ventilation equipment.

Individual protection measures, such as personal protective equipment

Eye/face protection: Wear safety glasses with side shields (or goggles).

Skin protection

Hand protection:	Wear chemical resistant gloves. See glove manufacturer for chemical compatibility.
Other:	Wear suitable protective clothing.
Respiratory protection:	In case of inadequate ventilation use suitable respirator.
Hygiene measures:	Provide eyewash station and safety shower. Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing to remove contaminants. Discard contaminated footwear that cannot be cleaned.

9. Physical and chemical properties

Appearance

Physical state:	Liquid
Form:	Liquid
Color:	Colorless
Odor:	Odor of rubbing alcohol
Odor threshold:	No data available.
pH:	No data available.
Melting point/freezing point:	-88.5 °C
Initial boiling point and boiling range:	82 °C (101.3 kPa)
Flash Point:	12 °C (Closed Cup)
Evaporation rate:	2.8 n-butyl acetate=1
Flammability (solid, gas):	Class IB Flammable Liquid
Upper/lower limit on flammability or explosive limits	
Flammability limit - upper (%):	12.7 %(V)
Flammability limit - lower (%):	2 %(V)
Explosive limit - upper (%):	No data available.
Explosive limit - lower (%):	No data available.
Vapor pressure:	6.0 kPa (25 °C)
Vapor density:	2.1 AIR=1
Relative density:	0.79 (20 °C)
Solubility(ies)	
Solubility in water:	Miscible with water.
Solubility (other):	No data available.
Partition coefficient (n-octanol/water):	0.05
Auto-ignition temperature:	399 °C
Decomposition temperature:	No data available.
Viscosity:	No data available.
Other information	
Molecular weight:	60.1 g/mol (C3H8O)

10. Stability and reactivity

Reactivity:	No dangerous reaction known under conditions of normal use.
Chemical stability:	Material is stable under normal conditions. Isopropyl alcohol is susceptible to oxidation and can form peroxides. Concentrated peroxides may explode when subjected to heat or shock.
Possibility of hazardous reactions:	Hazardous polymerization does not occur.
Conditions to avoid:	Heat, sparks, flames. Sunlight.
Incompatible materials:	Strong oxidizing agents. Acetylene. Acids. Chlorine. Hydrogen peroxide (H2O2) Ethylene Oxide Sulfuric acid. Isocyanates. Aluminum.
Hazardous decomposition products:	Thermal decomposition may release oxides of carbon.

11. Toxicological information

Information on likely routes of exposure

Ingestion:	Irritating. May cause nausea, stomach pain and vomiting.
Inhalation:	May cause irritation to the mucous membranes and upper respiratory tract.
Skin contact:	Prolonged or repeated skin contact may cause drying, cracking, or irritation.
Eye contact:	Causes serious eye irritation.

Information on toxicological effects

Acute toxicity (list all possible routes of exposure)

Oral
Product: LD 50 (Rat): 5,045 mg/kg

Dermal
Product: LD 50 (Rabbit): 12,800 mg/kg

Inhalation
Product: No data available.

Repeated dose toxicity
Product: No data available.

Skin corrosion/irritation Product:	Prolonged or repeated skin contact may cause drying, cracking, or irritation.
Serious eye damage/eye irritation Product:	Causes serious eye irritation.
Respiratory or skin sensitization Product:	Not a skin sensitizer.

Carcinogenicity
Product: This substance has no evidence of carcinogenic properties.

IARC Monographs on the Evaluation of Carcinogenic Risks to Humans:
No carcinogenic components identified

US. National Toxicology Program (NTP) Report on Carcinogens:
No carcinogenic components identified

US. OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050):
No carcinogenic components identified

Germ cell mutagenicity

In vitro
Product: No data available.

In vivo
Product: No data available.

Reproductive toxicity
Product: No components toxic to reproduction

Specific target organ toxicity - single exposure
Product: Narcotic effect. Respiratory tract irritation.

Specific target organ toxicity - repeated exposure
Product: None known.

Aspiration hazard
Product: May be harmful if swallowed and enters airways.

Other effects: None known.

12. Ecological information

Ecotoxicity:

Acute hazards to the aquatic environment:

Fish
Product: LC 50 (Western mosquitofish (Gambusia affinis), 96 h): > 1,400 mg/l

Aquatic invertebrates
Product: LC 50 (Water flea (Daphnia magna), 24 h): 10,000 mg/l

Chronic hazards to the aquatic environment:

Fish
Product: No data available.

Aquatic invertebrates
Product: No data available.

Toxicity to Aquatic Plants
Product: No data available.

Persistence and degradability

Biodegradation
Product: Expected to be readily biodegradable.

BOD/COD ratio
Product: No data available.

Bioaccumulative potential
Bioconcentration factor (BCF)
Product: No data available on bioaccumulation.

Partition coefficient n-octanol / water (log Kow)
Product: Log Kow: 0.05

Mobility in soil: The product is partly soluble in water. May spread in the aquatic environment.

Other adverse effects: The product components are not classified as environmentally hazardous. However, this does not exclude the possibility that large or frequent spills can have a harmful or damaging effect on the environment.

13. Disposal considerations

Disposal instructions: Discharge, treat, or dispose in accordance with national, state, or local laws.

Contaminated packaging: Since emptied containers retain product residue, follow label warnings even after container is emptied.

14. Transport information

DOT

UN number:	UN 1219
UN proper shipping name:	Isopropyl Alcohol
Transport hazard class(es)	
Class(es):	3
Label(s):	3
Packing group:	II
Marine Pollutant:	No

IMDG

UN number:	UN 1219
UN proper shipping name:	Isopropyl Alcohol
Transport hazard class(es)	
Class(es):	3
Label(s):	3
EmS No.:	F-E, S-D
Packing group:	II
Marine Pollutant:	No

IATA

UN number:	UN 1219
Proper Shipping Name:	Isopropyl Alcohol
Transport hazard class(es):	
Class(es):	3
Label(s):	3
Marine Pollutant:	No
Packing group:	II

15. Regulatory information

US federal regulations

TSCA Section 12(b) Export Notification (40 CFR 707, Subpt. D)

US. OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)

None present or none present in regulated quantities.

CERCLA Hazardous Substance List (40 CFR 302.4):

ISOPROPYL ALCOHOL Reportable quantity: 100 lbs.

Superfund amendments and reauthorization act of 1986 (SARA)

Hazard categories

☒ Acute (Immediate) ☐ Chronic (Delayed) ☒ Fire ☐ Reactive ☐ Pressure Generating

SARA 302 Extremely hazardous substance

None present or none present in regulated quantities.

SARA 304 Emergency release notification

Chemical identity	RQ
ISOPROPYL ALCOHOL	100 lbs.

SARA 311/312 Hazardous chemical

Chemical identity	Threshold Planning Quantity
ISOPROPYL ALCOHOL	500 lbs.

SARA 313 (TRI reporting)

Chemical identity	Reporting threshold for other users	Reporting threshold for manufacturing and processing
ISOPROPYL ALCOHOL	10000 lbs.	25000 lbs.

Clean Water Act Section 311 Hazardous Substances (40 CFR 117.3)

None present or none present in regulated quantities.

Clean Air Act (CAA) Section 112(r) Accidental Release Prevention (40 CFR 68.130):

None present or none present in regulated quantities.

US state regulations

US. California Proposition 65

No ingredient regulated by CA Prop 65 present.

US. New Jersey Worker and Community Right-to-Know Act

ISOPROPYL ALCOHOL Listed

US. Massachusetts RTK - Substance List

ISOPROPYL ALCOHOL Listed

US. Pennsylvania RTK - Hazardous Substances

ISOPROPYL ALCOHOL Listed

US. Rhode Island RTK

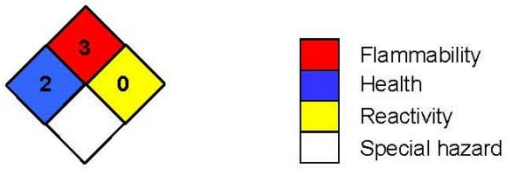
ISOPROPYL ALCOHOL Listed

Inventory Status:

Australia AICS:	On or in compliance with the inventory
Canada DSL Inventory List:	On or in compliance with the inventory
EU EINECS List:	On or in compliance with the inventory
EU ELINCS List:	Not in compliance with the inventory.
Japan (ENCS) List:	On or in compliance with the inventory
EU No Longer Polymers List:	Not in compliance with the inventory.
China Inv. Existing Chemical Substances:	On or in compliance with the inventory
Korea Existing Chemicals Inv. (KECI):	On or in compliance with the inventory
Canada NDSL Inventory:	Not in compliance with the inventory.
Philippines PICCS:	On or in compliance with the inventory
US TSCA Inventory:	On or in compliance with the inventory
New Zealand Inventory of Chemicals:	On or in compliance with the inventory
Switzerland Consolidated Inventory:	Not in compliance with the inventory.
Japan ISHL Listing:	On or in compliance with the inventory
Japan Pharmacopoeia Listing:	Not in compliance with the inventory.

16.Other information, including date of preparation or last revision

NFPA Hazard ID



Hazard rating: 0 - Minimal; 1 - Slight; 2 - Moderate; 3 - Serious; 4 - Severe

Issue date: 03-06-2015

Revision date: H

Version #: 1.2

Further information: No data available.

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