

Model 3007 Condensation Particle Counter

Operation and Service Manual

*1930035, Revision C
August 2002*

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U.S.

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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 1-800-874-2811 (USA) or (651) 490-2811.

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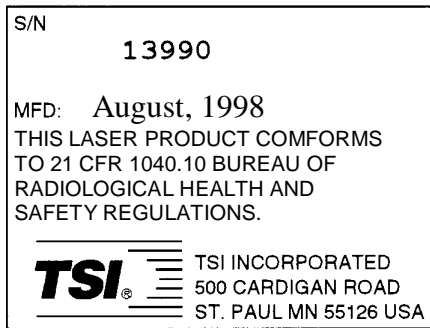
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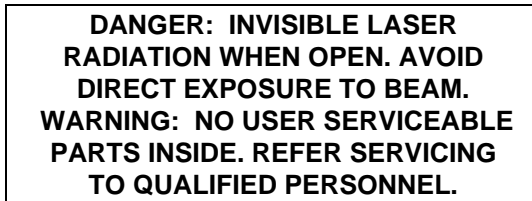


Safety Information

When operated according to the manufacturer's instruction, this device is a Class I laser product as defined by U.S. Department of Health and Human Services standards under the Radiation Control for Health and Safety Act of 1968. A certification and identification label like the one shown below is affixed to each instrument.



There are no user-serviceable parts inside this instrument. Performing services other than those described in this manual may result in exposure to harmful (invisible) laser radiation. A warning label like the one shown below is affixed to the internal laser device.



Chapter 1

Unpacking and Parts Identification

Unpacking the Condensation Particle Counter

Carefully unpack the Model 3007 Condensation Particle Counter (CPC) from the shipping container. Use the tables and illustrations below to make certain that there are no missing components. Contact TSI immediately if anything is missing or damaged.



Figure 1-1: Model 3007 Condensation Particle Counter With Inlet Probe Assembly, Battery Pack, and Batteries

Quantity	Item Description	Part/Model	Reference
1	Condensation Particle Counter	N/A	1
1	Aerosol Inlet Fitting (installed)	N/A	2
1	Battery holder	801623	3
6	Battery, AA, alkaline	N/A	4
1	Carrying case	801613	(not shown)



Figure 1-2: Alcohol Fill Capsule with Storage Cap, Alcohol Cartridge, Alcohol Bottles and Shoulder Strap

Quantity	Item Description	Part/Model	Reference
1	Alcohol fill capsule and storage cap.	1083070	1
1	Alcohol cartridge	801624	2
16	30 ml alcohol bottles (1 shown)	2918011	3



Figure 1-3: Mesh Storage Bag with Spare Wicks, Computer Cable, Zero Filters and DB9/DB25 Adapter

Quantity	Item Description	Part/Model	Reference
1	Mesh bag	1380031	1
2	Spare wick kit	1081479	2
1	Computer cable, RJ45/DB9	800563	3
1	HEPA zero filter, with adapter	1030314	4

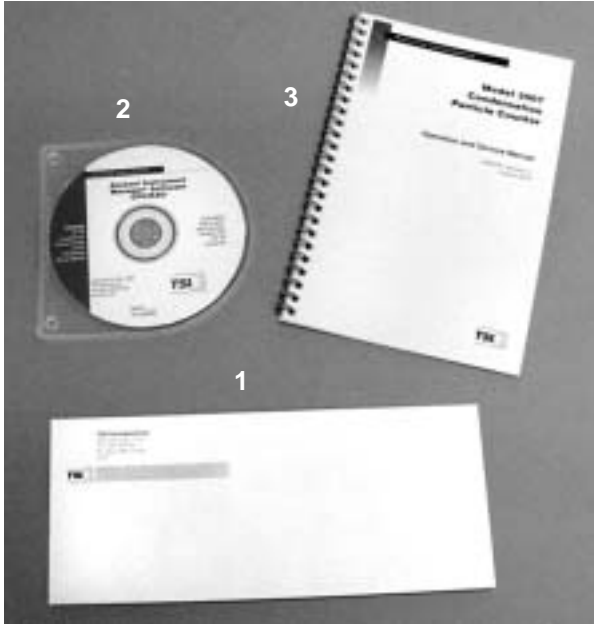


Figure 1-4: Calibration Certificate, Operation and Service Manual, Aerosol Instrument Manager® Software

Quantity	Item Description	Part/Model	Reference
1	Calibration Certificate	N/A	1
1	Aerosol Instrument Manager® Software	N/A	2
1	Operation and Service Manual	1930035	3

Spare/Replacement Parts

The following items may be purchased as spare or replacement parts.

Item Description	Part Number
Alcohol wicks with screens (Pkg. of 10)	8023
Filter, internal, 2 qty.	801614
Alcohol, 16 qty., 30 ml bottles	2918011

Chapter 2

Setting Up

Supplying Power to the Instrument

The Model 3007 Condensation Particle Counter (CPC) may be powered in one of two ways. The standard configuration instrument is sold with a battery holder containing 6, AA alkaline batteries and an AC adapter to power the instrument when operating in a fixed location.

Installing the Batteries

To install the battery holder, first install the 6 individual AA batteries into the pack, noting the battery polarity as marked on the inside of the battery holder. Remove the battery compartment door by pressing in and pulling out on the two locking tabs. Next, install the battery pack (battery side down) into the battery compartment as shown in Figure 2-1, putting the top of the pack (the side with the two contacts extending from the body of the pack) down first and snapping the rest of the pack in place. Finally, replace the battery compartment door.

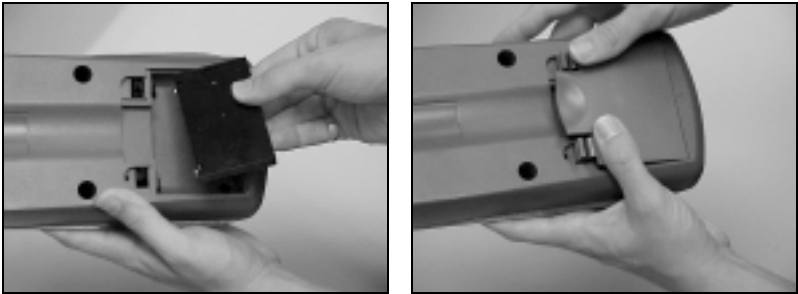



Figure 2-1: Install Battery Pack into Battery Compartment

	CAUTION
	Avoid forcing the battery pack into place. The battery pack fits correctly in only one orientation. When installed properly, the batteries will face <i>down</i> into the compartment.

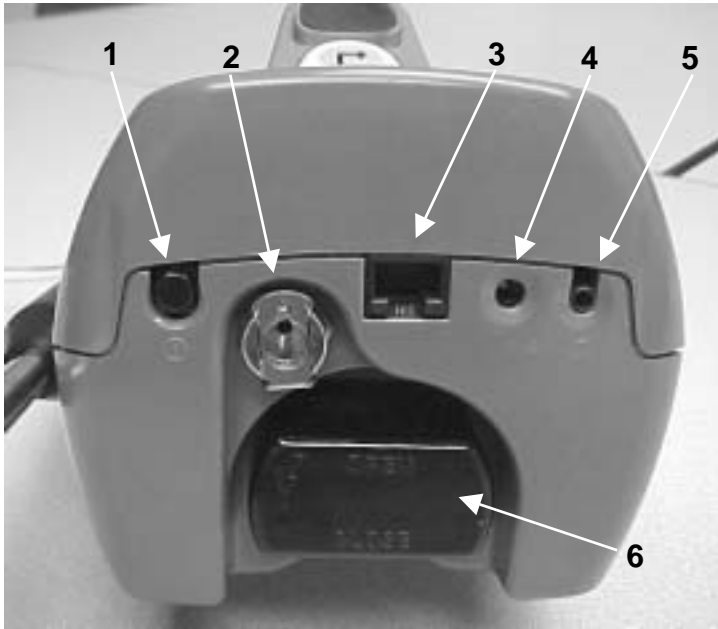


Figure 2-2: The Back of the Instrument

1. On/Off switch	4. AC Adapter socket
2. Inlet quick-connect fitting	5. Headphone jack
3. Communications port	6. Alcohol cartridge

Using the AC Adapter

When using the AC adapter, the batteries (if installed) will be bypassed. The AC adapter will not charge the batteries.

The CPC has an internal, non-user accessible battery that is used for battery back-up of logged data when the instrument is turned off. Removing/changing the alkaline batteries or disconnecting the AC adapter will not cause data to be lost. This backup battery will last for years. TSI will install a new battery, if necessary, when the unit is returned to the factory for service.

Charging and Installing the Alcohol Wick

Cautions Before Proceeding



WARNING

Isopropyl Alcohol is 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 and in Appendix C of this manual for handling precautions and first aid procedures.

Note: *Always recap alcohol containers immediately to prevent absorption of moisture and the escape of fumes.*

The CPC consumes high-purity isopropyl alcohol at a rate of about 1 ml per hour. The alcohol is used to grow microscopic particles in the air into larger droplets that are easier to detect and count.

The isopropyl alcohol that is required to properly operate the CPC must be very high purity "reagent grade" alcohol. Isopropyl alcohol that is available from pharmacies, drug stores, or other consumer outlets is low purity and usually contains significant percentages of water and other substances that can damage the CPC.

Note: *It is essential to use isopropyl alcohol that is 99.5% pure or better. Do **not** use isopropyl alcohol from any source other than TSI or a TSI-approved supplier. Problems caused by the use of unapproved alcohol are **not** covered under warranty.*

Maintaining an adequate alcohol supply inside the Condensation Particle Counter is critical to its operation and requires strict adherence to the directions that follow.

Locating and Identifying Components

To add alcohol to the CPC you must first identify and locate the alcohol related components and accessories that are included with the instrument (refer to Figure 1-2, for more information). You will need the following items:

- Isopropyl Alcohol
- Alcohol Fill Capsule
- Storage Cap
- Alcohol Cartridge

Isopropyl alcohol is supplied by TSI in 30 ml plastic bottles. The alcohol fill capsule is located in the carrying case. The alcohol cartridge will also be either in the CPC cartridge cavity or in the alcohol fill capsule, whichever one is **not** holding the storage cap. The storage cap should be either sealing the alcohol fill capsule or inserted into the CPC cartridge cavity.

Filling the Alcohol Fill Capsule

1. Turn the CPC off.
2. Open the alcohol fill capsule by twisting the storage cap (or alcohol cartridge) $\frac{1}{8}$ turn counter-clockwise. Set the storage cap (or alcohol cartridge) down on a clean surface, with the end standing up, as shown in Figure 2-3.



Figure 2-3: Alcohol Cartridge and Storage Cap

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

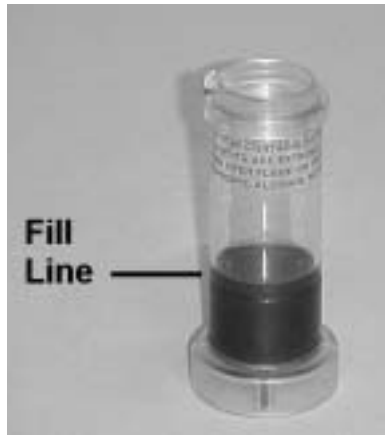


Figure 2-4: Alcohol Fill Capsule

4. Squeeze alcohol into the alcohol fill capsule until the liquid level is even with the scribed fill-line near the base (Figure 2-4). Recap the alcohol bottle.
5. *Make certain the alcohol cartridge is clean!* Insert the alcohol cartridge into the alcohol fill capsule by aligning the groove with the pin and turning $\frac{1}{8}$ turn (clockwise) until it locks into place (Figure 2-5).

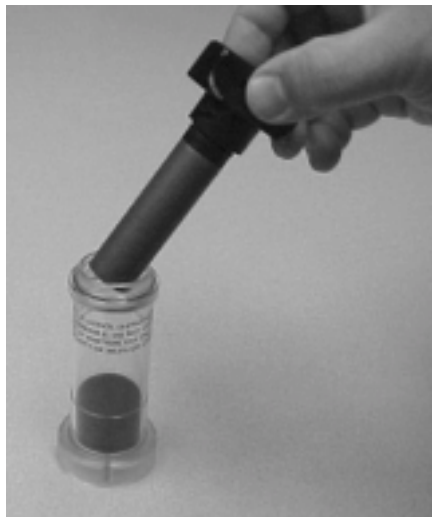


Figure 2-5: Insert Alcohol Cartridge into Fill Capsule

6. Set the alcohol fill capsule down and wait a few minutes while the wick inside the cartridge soaks up alcohol.

Installing the Cartridge into the Condensation Particle Counter

1. Remove the alcohol cartridge from the fill capsule and gently shake it to allow excess alcohol to drain back into the capsule. Stop when excess alcohol is no longer dripping. It is not necessary to wait until the outside surface of the alcohol cartridge is dry.
2. Insert the cartridge into the cartridge cavity on the CPC. It should slide in easily with little effort. **Do not force it!** Align the tab on the alcohol cartridge with the corresponding tab on the CPC, located just above the cartridge cavity.
3. As you approach full insertion, firmly twist the alcohol cartridge clockwise about $\frac{1}{8}$ turn. It should snap into position.



Figure 2-6: Insert Alcohol Cartridge into Condensation Particle Counter

Cleaning Up and Final Cautions

1. Recap the alcohol fill capsule using the storage cap.

Note: *Always recap the alcohol fill capsule and other containers immediately to prevent absorption of moisture and the escape of fumes. Dispose of any alcohol which is visibly contaminated.*

2. When the CPC is stored in the carrying case, you should store the alcohol cartridge 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 indefinitely. Also, install the storage cap into the cartridge cavity to prevent dirt or lint from getting inside the CPC.
3. **Never** transport or store the CPC with the alcohol cartridge inside it. Flooding of the optics could occur.
4. **Always** keep the alcohol cartridge clean.
5. **Never** leave the cartridge cavity open longer than necessary. Use the storage cap to cover the cartridge cavity when the CPC is transported or stored.
6. Keep the storage cap and alcohol cartridge clean. Always set them down with the end standing up. These precautions prevent dirt or debris from entering the instrument and causing operational problems.

Chapter 3

Operation

Overview

The Condensation Particle Counter (CPC) has two main modes of operation, Survey and Data Log.

Survey mode: When the CPC is first turned on, it will be in Survey mode which is used to display real-time particle concentration readings, in particles per cubic centimeter (pt/cc). The instrument will update the displayed concentration once each second.


Data Log mode: The Data Log mode is used to record particle concentration readings over a period of time, and store these readings in the instrument memory. Data files may be downloaded to a computer for later analysis.

Turning the Instrument On

Press the ON/OFF switch (located at the back of the instrument) and hold for 2–3 seconds to turn on the CPC. A screen will be displayed identifying the instrument model number and the firmware revision level. The instrument immediately begins a warm-up, countdown sequence, which takes about 600 seconds to fully warm-up the instrument.

To detect particles over the full range of 10 nm to >1 micron, you must wait the full 600 seconds for warm-up. To allow quick tests, it is possible to bypass the warm-up sequence by pressing “↵” after about 60 seconds. This will allow detection of particles down to 50 nm with 100% efficiency. The warm-up will continue and the countdown is shown on the lower left corner on the display.

Tilting the Instrument

	CAUTION
	To prevent false counts and/or a temporary loss of counting efficiency, the Condensation Particle Counter must be held in a substantially level position during operation. Prolonged operation while tilted can cause alcohol within the instrument to flood the optics. This may result in the need for factory cleaning and servicing.

The CPC contains liquid isopropyl alcohol, which is absorbed into a porous wick. Under most operating conditions, the alcohol remains absorbed in the wick. However, if the instrument is tilted for a period of time, the alcohol will slowly seep out of the wick. This liquid alcohol may be drawn into the optical chamber, causing false particle counts and possibly flooding the optics. This will not permanently damage the instrument, but may result in a temporary loss of performance. To avoid this problem, please observe the following cautions:

- Do *not* tilt the instrument up (into a vertical position) to observe the display. If the instrument is tilted for more than 4 seconds: a tilt error message will be displayed, the beeper will sound, the displayed particle concentration will “blank out” and the pump will be stopped.
- After restoring the instrument to level operation, the tilt error condition will correct itself (the pump will restart and the display will reset).
- If the instrument is tilted during data logging, the instrument may shut down and discontinue logging.
- If the instrument is tilted during the Sample mode, the data point will be discarded.

Daily Zero Check

Before beginning to sample with the CPC, it is important to verify that the instrument is operating normally. This Daily Zero Check should be performed at least once a day.

1. Turn on the instrument and let it warm up (approximately 600 seconds).
2. Attach the supplied zero filter assembly (item #4, Figure 1-3) to the inlet screen assembly.
3. The particle concentration should go to zero in approximately 5 to 10 seconds. Leave the zero filter attached to the instrument for 30 seconds, to make sure the zero reading is stable.

Note: *If the instrument does not go to zero, please refer to Chapter 5, Troubleshooting, for more information.*

4. Remove the zero filter. The instrument is now ready for operation.

Keypad

The CPC is controlled using a simple, 4-way keypad, with Up, Down, Left, and Right keys along with an Enter key. These keys are used to move between menu items, to increase or decrease selected values and to select the desired item/value. When pressing the keys on the front panel, the CPC beeps to confirm the function. See Figure 3-1.



Figure 3-1: Keypad and Display

Main Menu

After the instrument has completed its warm-up countdown, the CPC will automatically go into the Survey mode and the Main Menu will be displayed.

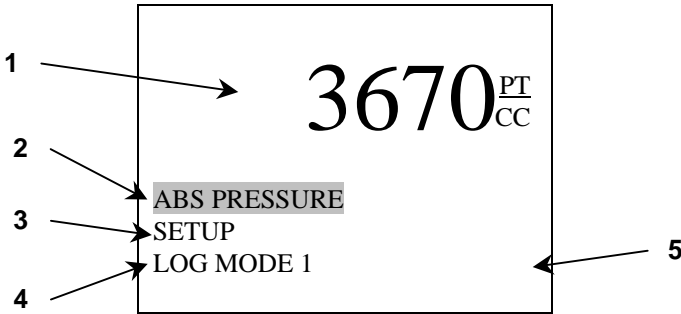


Figure 3-2: Main Menu Screen (sample)

Ref	Description
1	Particle concentration, in units of particles per cubic centimeter.
2	Absolute Pressure mode.
3	Setup mode. Used for reviewing logged data, single data points, statistics. Used for changing date/time, log interval, backlight interval, audio function. Used for clearing memory.
4	Log mode (recording data files). Displays current log mode (1, 2, or 3). Used for changing mode and starting data logging.
5	Status area of Main Menu. Used for displaying status and error messages.

Particle Concentration

The CPC displays the measured particle concentration in units of particles per cubic centimeter (pt/cc). The display updates once per second. The instrument range is from 0 to 100,000 pt/cc.

Absolute Pressure

When **ABS PRESSURE** is selected and “↵” is pressed, the program opens the Absolute Pressure screen. In this screen, the CPC displays the particle concentration in particles per cubic centimeter (pt/cc) and the absolute pressure of the aerosol inlet in units of milliBar. Here, the displayed particle concentration range is 0 to 500,000 pt/cc. For particle concentration up to 100,000 pt/cc, coincidence is low and no correction is necessary. At higher concentrations, correction of coincidence is

required and the internal microprocessor does not automatically correct for coincidence.

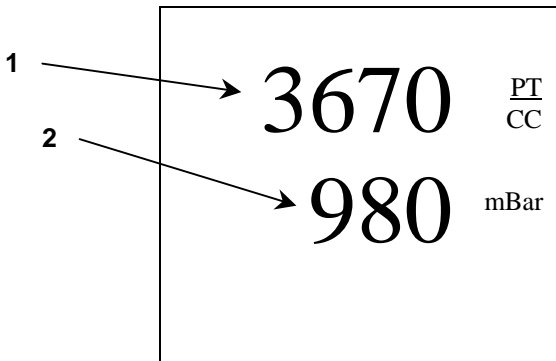


Figure 3-3: Absolute Pressure Screen

Ref	Description
1	Particle concentration, in units of particles per cubic centimeter.
2	Absolute Inlet Pressure in milliBar.

Setup Mode

The Setup mode gives you access to a wide range of options for reviewing data, examining statistics and changing operational parameters. When **SETUP** is selected and “↵” is pressed, the program opens the Setup menu, as shown below:

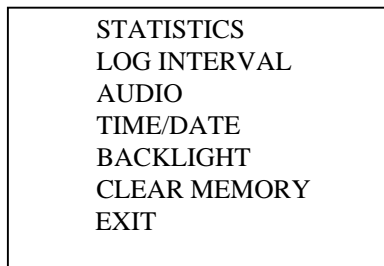


Figure 3-4: Setup Menu

Statistics

The STATISTICS selection gives you access to a sub-menu, which provides a choice of either Logged Test Statistics or Single Point Statistics.

Logged Test Statistics

The Logged Test Statistics screen allows you to review a statistical summary of each data logged test. When the screen is first displayed, it will show the statistics for the most recent test. You may page through and review the statistics for each test in memory. A sample screen is shown below.

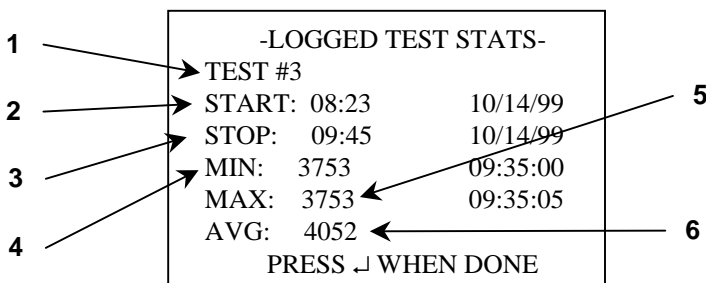


Figure 3-5: Logged Test Statistics

Ref	Description
1	Test number (not user adjustable).
2	Start time and date.
3	Stop time and date.
4	Minimum value during test, along with time at which minimum occurred.
5	Maximum value during test, along with time at which maximum occurred.
6	Average value during logged test, in pt/cc.

Log Interval

The Log Interval menu allows you to view the current logging interval used during LOG MODE 1 (see “Log Mode 2 and 3” section, later in this chapter, for more information about data logging). It also allows you to adjust the log interval to a different value. The menu screen is shown below.

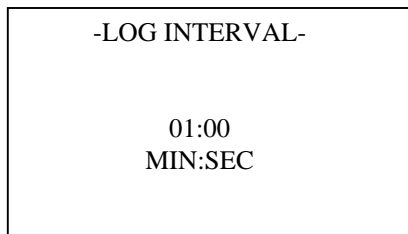


Figure 3-6: Log Interval

The default values for log intervals are set at 1 second, 1 minute, 5 minutes, 15 minutes and 30 minutes. When “↵” is pressed, the program retains the current setting and returns to the Setup menu.

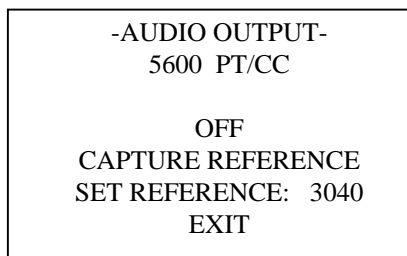
The log interval is both a frequency and an averaging period. For example, when the log interval is set to 5 minutes, readings will be recorded at 5-minute intervals. Each reading will be the average value measured over that 5-minute interval.

The log interval options for LOG MODE 1 may also be programmed using the Aerosol Instrument Manager[®] software.

Note: *This log interval only applies to Log 1 mode, initiated from the instrument keypad. The log interval for Log 2 and Log 3 modes is adjustable only within the Aerosol Instrument Manager software.*

Audio

The Audio Output feature on the CPC provides an audible feedback which is proportional to the measured particle concentration. When this feature is turned On, you will hear an audio signal which will give you an indication of changing particle concentrations. A sample screen is shown below.



The screenshot shows a rectangular display area with the following text centered within it:

```
-AUDIO OUTPUT-  
5600 PT/CC  
  
OFF  
CAPTURE REFERENCE  
SET REFERENCE: 3040  
EXIT
```

Figure 3-7: Audio Output

The Audio menu allows you to turn the audio output feature OFF/ON and to adjust characteristics of this feature. Note the following characteristics of this function:

- The current, real time particle concentration is displayed at the top of the display.
- The Audio function is turned OFF by default. To turn it ON, use the left/right arrow keys.
- To adjust the reference value to the same as the current ambient concentration, highlight the CAPTURE REFERENCE

selection, and press “↵”. You will notice that the real time value and reference value become essentially equal.

- To adjust the reference value manually, move the selection highlight to SET REFERENCE. Then, use the right arrow key to move the highlight to the reference value. Use the up/down arrow to adjust the reference values in increments of 100. When satisfied with the new reference value, use the left arrow key to return to SET REFERENCE.
- When all adjustments are completed, highlight the EXIT selection and press “↵”. This will return you to the SETUP menu.

Time/Date

The CPC has an internal clock that keeps track of the time of day and the date. The format is HH:MM:SS where HH is the hour in 24-hour format, along with minutes and seconds. It is very important for the CPC to have the time and date correctly set; otherwise, time and date stamping of recorded data will not be correct.

The time clock is set correctly at the factory (for U.S. Central Standard Time). If it requires adjustment, it may be changed by selecting TIME/DATE from the Setup menu. The following screen is displayed:

```
-TIME/DATE-  
USE <> FOR POSITION  
USE ^v FOR VALUE  
  
HH:MM:SS   08:25:32  
  
MM/DD/YY   10/14/99
```

Figure 3-8: Time/Date

When first entering this screen, the first character in the hour (HH) field will have a cursor underneath it. Use the up/down arrows to increment and/or decrement values. Use the left/right arrows to move to the required field. When all adjustments are complete, press the “↵” key to accept the changes and return to the Setup menu.

Backlight

The BACKLIGHT option on the Setup menu allows you to adjust how long the display backlight stays on after a key is pressed or an alarm occurs. After the delay, the backlight automatically turns off. To change the backlight delay, use the Up/Down arrows. The options are: No Backlight; 5, 10 and 30 seconds. Press “↵” to select the value and return to the Setup Menu.

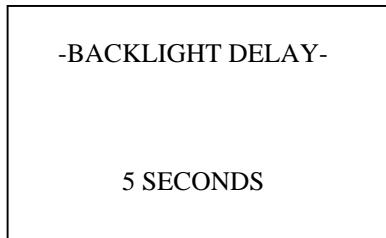


Figure 3-9: Backlight Delay

Note: *Prolonged use of the backlight may severely reduce the overall battery life.*

Clear Memory

The CLEAR MEMORY option on the Setup menu allows you to clear the instrument memory. To preserve data integrity, the CPC does not automatically erase the “older” data files. It requires a deliberate step, on your part, to clear the memory.

Note: *Performing this step will erase all logged data files from the instrument memory. There is no reversing this step, once it is performed!*

To clear the memory, select the CLEAR MEMORY option on the Setup menu. After pressing “↵”, the following screen is displayed.

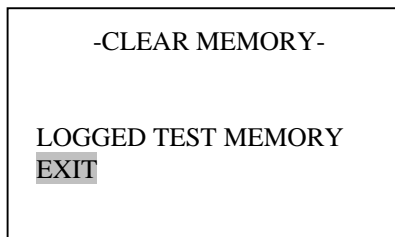


Figure 3-10: Clear Memory Select Screen

The highlighted default selection is Exit. To erase the logged data, highlight the menu selection **LOGGED TEST MEMORY** and press “↵”.

LOG MODE

The third selection on the Main menu allows you to select which data logging mode to use and then to initiate a data logging session. To make changes to the LOG MODE, simply scroll Up/Down to the **LOG MODE 1** selection and then adjust the mode using the Left/Right arrows. You may select LOG MODE 1, 2, or 3 (please see the section on “Log Mode 2 and 3,” later in this chapter, for more information about these programmable log modes).

The logging interval for LOG MODE 1 must be adjusted, from the Setup menu, before beginning the logging session. To begin a data logging session, select the LOG MODE and press “↵”. The CPC will begin recording logged data into the instrument memory. If LOG MODE 1 was selected, the following screen will be displayed:

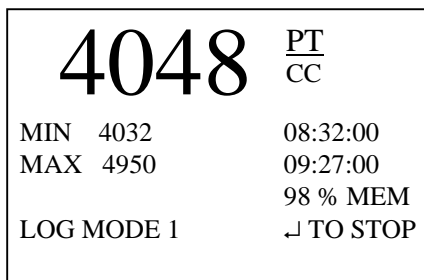


Figure 3-11: Log Mode 1

If LOG MODE 2 or 3 was selected, the CPC may or may not begin logging immediately, depending upon the setup parameters. See “Log Mode 2 and 3,” in this chapter, for more information.

Log Mode 2 and 3

The CPC may be programmed for more sophisticated data logging modes, using the Aerosol Instrument Manager software and Log Modes 2 and 3. With Log Modes 2 and 3, you can set the start date, start time, test length, logging interval, number of tests, and the time delay between tests. You program the logging protocols into the CPC using the power and simplicity of the Aerosol Instrument Manager software.

After programming the CPC with the Aerosol Instrument Manager software, take the CPC to the desired location and turn it on. After warm-up, put it into LOG MODE 2 or LOG MODE 3 (whichever you programmed) using the Left/Right arrow keys. Press the “↵” key to initiate the program.

The following things will happen, depending upon the protocol:

If....	Then....
If you have <i>not set a start time...</i>	...the CPC will begin logging immediately after the “↵” is pressed. This will happen no matter what is entered for the start date.
If you have set a test start time, but <i>no start date...</i>	...the CPC will begin at the specified time, regardless of the date.
If you have set a start time and start date which are in the future...	...the CPC pump (and other internal systems) will power down to save battery power, pending the correct starting time and date. The display will remain on.
If the test start time is greater than ten minutes away...	...the CPC powers down, as noted above. The green, “power” LED remains lit, to indicate the instrument is turned on. The display shows the current time/date and the start time/date. 600 seconds before the start time, the pump (and other internal systems) will turn on, to begin the warm-up period. At the exact start time, the instrument will begin logging data.
If the test start time is less than ten minutes away...	...the pump and internal systems do not power down. The current time/date and start time/date are displayed. The instrument begins logging at the correct time.
If the test start date and/or time has passed...	...pressing the “↵” key has no impact. The program will never execute (no data will be logged).
If no test length is set...	...the Condensation Particle Counter samples continuously until the “↵” key is pressed or until the memory is full.

If....	Then....
If you press the “⏏” key during sampling...	...the program stops data logging.
When a pre-programmed test sequence ends...	...the Condensation Particle Counter automatically returns to the Survey Mode.

Memory Considerations

The CPC has a great deal of memory and you will not normally have to be concerned with running out.

The CPC can store approximately 1000 hours (41 days) of logged tests, when recording at 1 minute logging intervals (the number of hours of logged tests may be more or less, depending upon the logging interval). Those 1000 hours may be separated into as many as 141 tests.

The total test time should be considered when selecting a logging interval. Shorter logging intervals use memory more quickly than longer intervals. The logging interval and the available memory determine the maximum possible duration of a data logging session.

Chapter 4

Maintenance

You can perform routine maintenance on the Condensation Particle Counter (CPC) using the instructions below. However, you are not able to perform field calibration of the instrument. For this reason, TSI recommends that you return your CPC to the factory for annual cleaning and calibration. For a reasonable fee, we will quickly clean and calibrate the unit and return it to you in “as new” working condition, along with a Certificate of Calibration. This “annual checkup” helps ensure that the CPC is always in good operating condition.

Note: *There are no user-serviceable parts inside this instrument. Opening the instrument case may void the warranty. TSI recommends that you return the Condensation Particle Counter to the factory for any required maintenance or service not described in this manual.*

Maintenance Schedule

Your Model 3007 Condensation Particle Counter needs very little required maintenance. The few items that are suggested, however, should be done regularly, to ensure reliable operation. The following table lists the factory recommended maintenance schedule.

Some maintenance items are suggested each time the CPC is used. Other items are performed based upon usage level, calendar or done as needed.

Item	Frequency
Daily zero check	Daily (or before each use)
Recharge the alcohol wick	Daily (or before each use)
Change the alcohol wick	As needed (see Chapter 5, “Troubleshooting”)
Return to factory for cleaning and calibration	Annually

Daily Zero Check

The Daily Zero Check ensures that the instrument and alcohol cartridge are properly assembled and free from leaks. Please see the beginning of Chapter 3, “Operation,” for detailed instructions on performing the Daily Zero Check.

Recharging the Alcohol Wick

The alcohol wick should be recharged with alcohol at least once a day (depending upon usage). Please see Chapter 2, “Setting Up,” for detailed instructions on recharging the alcohol wick.

Alcohol Cartridge

The alcohol cartridge holds a reservoir of isopropyl alcohol. A porous wick inside the cartridge is soaked with alcohol. Because the alcohol cartridge gets inserted into the cartridge cavity of the CPC, it is critically important to keep it clean. Any dirt or debris that gets into the CPC may plug the small internal nozzle and prevent operation. Do **not** allow the black part of the alcohol cartridge to make contact with any surface that may be dirty.

Note: *Keep the storage cap and alcohol cartridge clean. Always set them down with the end standing up.*

Changing the Alcohol Wick

The wick and screen inside the alcohol cartridge may be changed in the field. Two spare wicks and screens are included with the instrument. Normally, the wick will not need to be changed unless one of the following problems develops:

1. Moisture accumulates in the wick and causes the “Low Alcohol” message to come on even when there is an adequate alcohol supply. This may happen when the CPC is used extensively for long periods of time, especially in high humidity areas.
2. The wick becomes contaminated with dirt, oil, or other foreign substances. This does not normally happen. However, if the instrument is used to sample particles other than those normally found in ambient air, the wick may become contaminated and need replacement.
3. The fine mesh screen inside the Alcohol Cartridge becomes plugged with foreign material.

When moisture accumulation occurs, the alcohol wick can be removed, allowed to dry, and then re-installed into the alcohol cartridge. If the alcohol wick or screen is contaminated, it should be discarded and replaced with a new one (if it is *not* contaminated, it *may* be reused). Each new wick has a new screen with it. Note that some discoloration is normal and will not influence performance.

Removing the Wick from the Cartridge

To remove the alcohol wick from the cartridge, grasp the cartridge with both hands, with your thumbs near the seam, and firmly apply pressure as if you wanted to break it into two pieces. The cartridge will snap apart exposing the end of the white Alcohol Wick. See Figure 4-1.



Figure 4-1: Snap Apart Cartridge

After separating the two halves, push the alcohol wick and screen out of the wick retainer cap from the opposite end with the wick removal tool (wood dowel) provided with each new alcohol wick. Do **not** use a pencil point because bits of lead could break off. Allow the small, circular, fine-mesh screen to fall out on the table. See Figure 4-2.

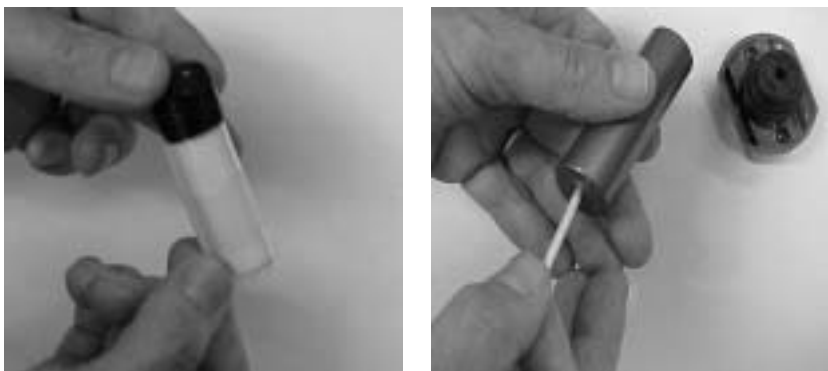


Figure 4-2: Remove Wick and Screen Using Dowel

Hold the screen up to the light and look through it to make sure it is clean. All openings in the mesh should be clear. If any of the openings are blocked, clear them by blowing air through the screen. If the screen cannot be 100% cleaned, replace it with a new one. A new screen is included with each new wick.

Examine the white alcohol wick. Some light brownish-yellow discoloration of the wick is normal. If the wick is severely discolored, discard it. If the wick is in good condition, see the section on “Drying the Wick” later in this chapter.

Re-assembling the Alcohol Cartridge

Before re-installing an alcohol wick, you must make certain that all parts are clean. Small bits of the wick or lint can cause serious problems if they get into the CPC.

Inspect the inside surfaces of the alcohol cartridge and the wick retainer cap. If necessary, blow air into them to make certain that there are no dust particles present. Blow air onto all surfaces of the Alcohol Wick that will be used, to make certain that any loose particles that may have shed from the wick are removed.

Drop a clean screen into the wick retainer cap and make sure it lies flat on the bottom. Examine both ends of the wick. You will notice that one end is smoother than the other. Slide the smooth end of the wick into the wick retainer cap and push firmly until the wick hits bottom. Blow everything off again. See Figure 4-3.

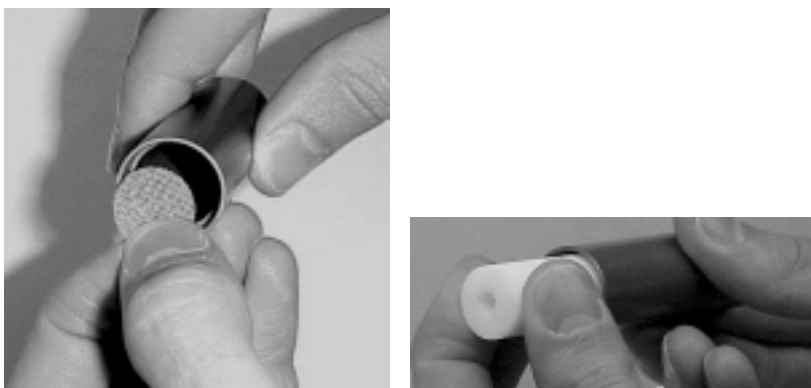


Figure 4-3: Install Screen and Wick into Retainer

Re-assemble the cartridge. Align the two halves of the alcohol cartridge and press firmly until they snap together. The cleaning/replacement procedure is complete.

Chapter 5

Troubleshooting

The table below lists the symptoms, possible causes, and recommended solutions for common problems encountered with the Condensation Particle Counter (CPC).

Symptom	Possible Cause	Corrective Action
Unable to obtain zero count (using HEPA zero filter)	Optics are flooded with alcohol (caused by multiple or prolonged tilting of instrument).	Let instrument run overnight (using AC adapter) with storage cap installed in CPC (<i>not</i> alcohol wick). This will dry out the optics and should restore proper operation.
	Inlet fitting is missing O-ring.	Make sure O-ring is in place on inlet fitting.
	Alcohol cartridge is loose.	Tightly install the alcohol cartridge into instrument.
	Bad HEPA filter (uncommon).	Try using a different filter. Or try using two filters inline.
	Internal leak inside instrument (very uncommon).	Must be diagnosed and serviced at factory.

Symptom	Possible Cause	Corrective Action
Counts seem too low (below expected values).	<p>Low on alcohol.</p> <p>Particle count in area really <i>is</i> low.</p> <p>Moisture buildup inside alcohol cartridge.</p> <p>Pump problem causing low (or no) flow. Instrument is being operated in wrong environment: too hot, too cold, too humid.</p> <p>Inferior or contaminated alcohol.</p> <p>Unit needs calibration and/or servicing.</p>	<p>Replenish alcohol in wick.</p> <p>N/A</p> <p>Change alcohol wick inside alcohol cartridge.</p> <p>Listen for pump operation. Check pump flow with flowmeter: should be approx. 0.7 lpm. Operate in specified environment only.</p> <p>Change alcohol wick inside alcohol cartridge. Use only approved alcohol.</p> <p>Return to factory for service.</p>
Does not turn on.	<p>Not pressing on/off switch properly.</p> <p>Batteries are dead.</p> <p>AC adapter is not plugged into unit.</p>	<p>Press and hold on/off switch for one second.</p> <p>Replace batteries.</p> <p>Connect AC adapter.</p>
No keypad response.	Keypad defective.	Return to factory for service.
“LO ALC” message	Alcohol wick is depleted.	Refill alcohol cartridge.
“TILTED” message	Instrument has been tilted during operation.	<p>Hold instrument level during operation!</p> <p>Condition will normally correct itself. Tilt condition may cause data logging or Sample Mode problems.</p>
“PUMP BLOCKED” message	Sample inlet is blocked.	Remove obstruction. Press <Enter> to reset.

Symptom	Possible Cause	Corrective Action
<p data-bbox="131 147 256 201">“LO BATT” message</p> <p data-bbox="131 297 261 380">“LASER PROBLEM” message</p>	<p data-bbox="305 147 458 172">Low batteries.</p> <p data-bbox="305 204 533 285">AC adapter is malfunctioning or not plugged in.</p> <p data-bbox="305 297 536 321">Possible laser failure.</p>	<p data-bbox="619 147 815 172">Replace batteries.</p> <p data-bbox="619 204 846 228">Connect AC adapter.</p> <p data-bbox="619 297 924 321">Return to factory for service.</p>

Appendix A

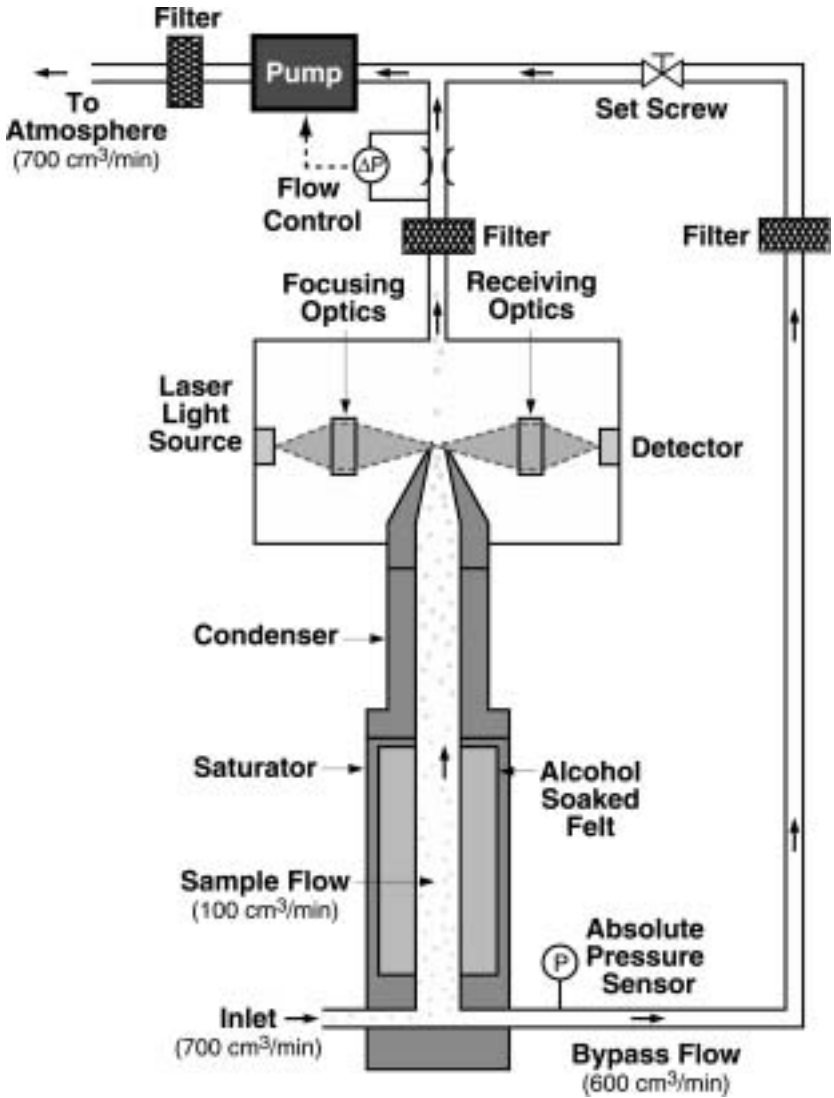
Specifications

Specifications are subject to change without notice.

Concentration Range	0 to 1 x 10 ⁵ particles/cm ³
Particle Size Range	0.01 to greater than 1 micrometer
Temperature Range Operation Storage	50 to 95°F (10 to 35°C) –40 to 160°F (–40 to 70°C)
Flow Rate Sample Total	Approx. 100 cm ³ /min Approx. 700 cm ³ /min (nominal)
Absolute Pressure Sensor	0 to 1400 milliBar
Power Requirement Battery type Battery life	6 AA Alkaline 5 hrs @ 70°F (21°C)
Alcohol Requirement Type Hours per charge	100% reagent grade isopropyl 6 hours at 70°F (21°C)
RS232 Output	Baud rate 9600 (8-N-1)
Size	11.5 in. x 5.5 in. x 5.5 in. (29.2 cm x 14 cm x 14 cm)
Carrying Case Size	21 in. x 14 in. x 8.3 in. (53 cm x 36 cm x 21 cm)
Weight Instrument with batteries Instrument with accessories in case Shipping weight	3.8 lbs (1.7 kg) 16.8 lbs (7.7 kg) 23 lbs (10.5 kg)
Factory Service Interval	One year
Warranty	Two years on workmanship and material

Appendix B

Model 3007 Flow Schematic



Appendix C

Material Safety Data Sheet: Isopropyl Alcohol

1 - PRODUCT IDENTIFICATION

Product Name.....	Isopropyl Alcohol
Formula	CH ₃ CHOHCH ₃
Formula Wt	60.10
CAS No.	67-63-0
NIOSH/RTECS No.	NT805000
Common Synonyms	2-Propanol; Isopropanol; SEC-Propyl Alcohol; IPA; Dimethylcarbinol
Product Codes	U298, 5082, 9080
Effective	09/03/86 Revision #02

Precautionary Labeling (Baker Saf-T-Data™ System)

Health	1 Slight
Flammability	3 Severe (Flammable)
Reactivity	1 Slight
Contact	1 Slight

Hazard Ratings are 0 to 4 (0 = No Hazard; 4 = Extreme Hazard).

Laboratory Protective Equipment:

Safety glasses; lab coat; vent hood; proper gloves; Class B extinguisher

Precautionary Label Statements:

Warning: Flammable

Causes Irritation.

Harmful if Swallowed or Inhaled.

Keep Away From Heat, Sparks, Flame.

Avoid Contact With Eyes, Skin, Clothing.

Avoid Breathing Vapor. Keep in Tightly Closed Container. Use With Adequate Ventilation.

Wash Thoroughly After Handling.

In Case of Fire, use Alcohol Foam, Dry Chemical, Carbon Dioxide - Water May Be Ineffective.

Flush Spill Area With Water Spray.

SAF-T-DATA™ Storage Color Code: Red (Flammable)

2 - HAZARDOUS COMPONENTS

<u>Component</u>	<u>%</u>	<u>CAS No.</u>
Isopropyl Alcohol	99.5	67-63-0

3 - PHYSICAL DATA

Boiling Point	82°C (180°F)
Vapor Pressure (mm hg).....	33
Melting Point	-89°C (-128°F)
Vapor Density (air=1).....	2.1
Specific Gravity:.....	0.79 Evaporation Rate 2.83 (Butyl Acetate=1)
Solubility (H ₂ O).....	Complete
Volatiles by Volume	100
Appearance and Odor	Colorless liquid with slight odor of rubbing alcohol.

4 - FIRE AND EXPLOSION HAZARD DATA

Flash Point (closed cup).....	12°C (53°F)
NFPA 704M Rating	1-3-0
Flammable Limits, Upper: ...	12.0 %
Lower:...	2.0 %

Fire Extinguishing Media:

Use alcohol foam, dry chemical or carbon Dioxide (water may be ineffective)

Special Fire-Fighting Procedures:

Firefighters should wear proper protective equipment and self-contained breathing apparatus with full facepiece operated in positive pressure mode.

Move containers from fire area if it can be done without risk. Use water to keep fire-exposed containers cool.

Unusual Fire and Explosion Hazards:

Vapors may flow along surfaces to distant ignition sources and flash back. Closed containers exposed to heat may explode. Contact with strong oxidizers may cause fire.

Toxic Gases Produced:

Carbon monoxide, carbon dioxide.

5 - HEALTH HAZARD DATA

Threshold Limit Value (TLV/TWA)	980 mg/m ³ (400 ppm)
Short-Term Exposure Limit (STEL).....	1225 mg/m ³ (500 ppm)
Permissible Exposure Limit (PEL)	980 mg/m ³ (400 ppm)
Toxicity: LD50 (oral-rat) (mg/kg).....	5045
LD50 (IPR-mouse) (mg/kg)	933
LD50 (SKN-rabbit) (g/kg)...	13
LD50 (IV-mouse) (mg/kg) ..	1863

Carcinogenicity: NTP: no IARC: no Z List: No OSHA Reg: no

Effects of Overexposure:

Inhalation of vapors may cause headache, nausea, vomiting, dizziness, drowsiness, irritation of respiratory tract, and loss of consciousness.

Inhalation of vapors may cause pulmonary edema.

Liquid may be irritating to skin and eyes.

Prolonged skin contact may result in dermatitis.

Eye contact may result in temporary corneal damage.

Ingestion may cause nausea, vomiting, headaches, dizziness, and gastrointestinal irritation.

Ingestion may cause central nervous system depression.

Target Organs:

Eyes, skin, respiratory system.

Medical Conditions Generally Aggravated By Exposure:

None identified.

Routes of Entry:

Inhalation, ingestion, eye contact, skin contact.

Emergency and First Aid Procedures:

Call a physician.

If swallowed, do **not** induce vomiting.

If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen.

In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Flush skin with water.

6 - REACTIVITY DATA

Stability	Stable, hazardous.
Polymerization	Will not occur.
Conditions to Avoid.....	Heat, flame, other sources of ignition.
Incompatibles.....	Strong oxidizing agents, aluminum, nitric acid, sulfuric acid, amines and ammonia, halogen acids and halogen compounds.
Decomposition products	Carbon monoxide, carbon dioxide.

7 - SPILL AND DISPOSAL PROCEDURES

Steps to be Taken in the Event of a Spill or Discharge:

Wear suitable protective clothing. Shut off ignition sources; no flares, smoking, or flames in area. Stop leak if you can do so without risk. Use water spray to reduce vapors. Take up with sand or other non-combustible absorbent material and place into container for later disposal. Flush area with water.

J. T. Baker SOLUSORB[®] solvent adsorbent is recommended for spills of this product.

Disposal Procedure:

Dispose in accordance with all applicable federal, state, and local environmental regulations.

EPA hazardous waste number: D001 (ignitable waste)

8 - PROTECTIVE EQUIPMENT

Ventilation:

Use general or local exhaust ventilation to meet TLV requirements.

Respiratory Protection:

Respiratory protection required if airborne concentration exceeds TLV. At concentrations up to 1000 ppm, a chemical cartridge respirator with organic vapor cartridge is recommended. Above this level, a self-contained breathing apparatus is recommended.

Eye/Skin Protection:

Safety goggles, uniform, apron, neoprene gloves are recommended.

9 - STORAGE AND HANDLING PRECAUTIONS

SAF-T-DATA™ Storage Color Code: red (flammable)

Special Precautions:

Bond and ground containers when transferring liquid. Keep container tightly closed. Store in a cool, dry, well-ventilated, flammable liquid storage area.

10 - TRANSPORTATION DATA AND ADDITIONAL INFORMATION

Domestic (D.O.T.):

Proper Shipping Name	Isopropanol
Hazard Class	Flammable liquid
UN/NA	UN1219
Labels	Flammable liquid

International (I.M.O.):

Proper Shipping Name	Isopropanol
Hazard Class	3.2
UN/NA	UN1219
Labels	Flammable liquid



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