6100 VOS Sampler

Installation and Operation Guide

Part #60-6003-213 of Assembly #60-6004-059

Revision E, March, 2004

Isco, Inc.

Foreword

This instruction manual is designed to help you gain a thorough understanding of the operation of the equipment. Isco recommends that you read this manual completely before placing the equipment in service.

Although Isco designs reliability into all equipment, there is always the possibility of a malfunction. This manual may help in diagnosing and repairing the malfunction.

If the problem persists, call or email the Isco Customer Service Department for assistance. Contact information is provided below. Simple difficulties can often be diagnosed over the phone. If it is necessary to return the equipment to the factory for service, please follow the shipping instructions provided by the Customer Service Department, including the use of the **Return Authorization Number** specified. **Be sure to include a note describing the malfunction.** This will aid in the prompt repair and return of the equipment.

Isco welcomes suggestions that would improve the information presented in this manual or enhance the operation of the equipment itself.

Isco is continually improving its products and reserves the right to change product specifications, replacement parts, schematics, and instructions without notice.

Contact Information

Phone:	(800) 228-4373	(USA, Canada, Mexico)
	(402) 464-0231	(Outside North America)
Repair Service:	(800) 775-2965	(Analytical and Process Monitoring Instruments)
	(800) 228-4373	(Samplers and Flow Meters)
Fax:	(402) 465-3022	
Email address:	info@isco.com	
Website:	www.isco.com	

Return equipment to: 4700 Superior Street, Lincoln, NE 68504-1398

Other correspondence: P.O. Box 82531, Lincoln, NE 68501-2531

Revised February 12, 2003

6100 Volatile Organic Sampler

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6100 Volatile Organic Sampler

Section 1 Introduction

> **⚠ CAUTION**
>
> Never install the 6100 controller where there is any possibility of submersion. The electronic components are environmentally sealed, but the mechanical components cannot be. The linkages and moving parts inside the controller can be damaged by submersion. Exposure of the mechanical parts to water will void the warranty.

1.1 How the 6100 Works

The 6100 Volatile Organic Sampler consists of two separate units connected by a double plastic tube. The larger unit is the controller and contains the computer, bottle rack, air pump, battery, and filling mechanism. The small metal cylinder is a bladder pump that mounts in the flow stream up to 100 feet from the sampler. The double tube connecting the units supplies air to operate the pump and carries the sample from the pump to the controller.

1.1.1 Pump Operation

The bladder pump, when mounted in the flow stream, works as follows: The pump contains a bladder inside a stainless steel cylinder. The air pump inside the controller applies both vacuum and pressure to the space between the bladder and the pump wall to alternately fill and empty the bladder with the liquid sample. When the controller draws a vacuum around the bladder, a ball check valve allows entry of the sample from the flow stream through a strainer into the bladder. When the controller pumps air into the space between the bladder and the pump wall, the bladder compresses, forcing the sample up the sample line to the controller. The check valve in the pump inlet prevents the sample from returning to the flow stream. Note that with this type of pump there is no contact between the air used to pressurize the pump and the liquid sample drawn from the flow stream.

1.1.2 Controller Operation

The microprocessor in the controller governs the operation of the air pump and the mechanism that selects, opens, fills, and closes the sample bottles. A motor rotates the bottle rack, placing each bottle directly under the fill mechanism. The bottle rack is filled with ice to keep samples cool during the sampling routine.

The fill operation consists of:

- Purging the sample line
- Rotating the bottle rack to place the bottle in position for filling

- Opening the valve on the sample bottle cap
- Lowering the fill needle into the sample bottle
- Filling the sample bottle with the liquid sample
- Withdrawing the fill needle from the sample bottle
- Closing the valve on the sample bottle

When filling the sample bottle, the 6100 actually overflows the bottle by several sample volumes to comply with EPA protocol to fill and dump the sample bottle three times. This overfilling keeps residual air pockets from remaining between the bottle and the lid, thus providing a representative sample. The excess water drains out of the sampler through an overflow tube attached to a fitting on the back of the controller. The controller also determines, through programming, when and how the 6100 takes its samples.

1.2 Quick-Start Operating Procedure

Note that the quick-start procedure assumes you have some familiarity with the unit. If you do not, please do not try to operate the unit without first reading this entire manual.

1. Put a new bottle rack in the unit. Make sure the handles on the bottles are all closed (turned 90° to the bottles). See Figure 1-1. Improperly-oriented handles will jam the unit.
2. Put a charged battery into the unit and connect it to the 2-pin mating connector. Tighten the threaded ring around the battery connector to keep the connection clean and dry.
3. Turn the unit on by pressing the **On/Off** key on the keypad. When the unit is off, the display will be blank. When the unit is on, there will always be something on the display.
4. If you have not previously set up the sampler's operation or if you want to change the setup, press the **Setup** key to access the setup menus.
5. Press the **Program** key to select the type of sample pacing, number of sample events, start time, etc.
6. Place the pump in the flow stream and route the drain line from the sampler.
7. Press the **Run** key to start the sampling sequence you have programmed into the sampler. The sampler cannot run its program until you press **Run**.
8. When the sampler completes the program you entered, the display will read:

   DONE... XX SAMPLES
   (time & date)

9. Press the **Rack Reset** key to move the rack to the home position so you can remove the rack from the sampler.
10. Remove the filled bottle rack from the sampler.

11. Turn the unit off with the **On/Off** key.
12. Remove the battery from the sampler.
13. If you want to run another sampling routine, repeat the process from step 1.

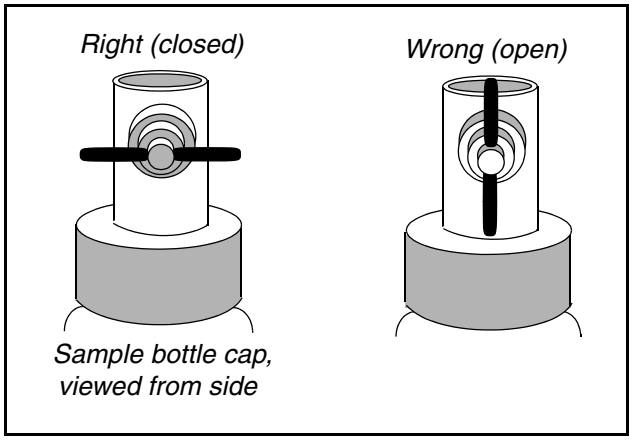


Figure 1-1 Proper Valve Orientation

1.3 Sampler Unpacking and Setup

Isco ships the 6100 in two separate packages, and we suggest keeping all packing materials in case returning the unit for service ever becomes necessary. The larger box contains the controller section of the unit, the pump, the manual, and the tubing bundle.

1. When you open the large box, there is a tray underneath the top cover. The tubing bundle is in this tray.
2. Remove the tubing and cardboard tray. The sampler is underneath. Notice the four triangular stabilizer columns in each corner of the box. The pump is inside one of the triangular stabilizers.
3. You must remove at least two of the triangular stabilizers to remove the sampler. The one with the pump inside is noticeably heavy.
   Do not discard it by accident.
4. The other box contains a smaller box, the power source, and any other accessories you may have ordered. The smaller box contains the bottle rack inside a styrofoam carrier.
   Do not discard the styrofoam carrier or the smaller cardboard box.
   You will use these items to transport the bottle rack and also to ship the samples to the lab for analysis. The bottle rack is shipped with all the bottles installed and held in place under a stainless steel cover.
5. Unpack the boxes carefully, checking for any shipping damage.

1.3.1 Removing the Sampler Cover

The sampler cover attaches to the controller base with three rubber draw catches that lock onto three stainless steel hasps near the base of the controller.

To remove the cover, grasp the top of each rubber catch with your thumb and snap the catch outward, away from the case. The catches will release and you can draw them away from the steel hasps. Lift the cover from the controller with the two handles on top.

1.3.2 Inside the Controller

When you have removed the cover from the controller, the most prominent feature inside is the tower. The keypad and display are on the top face of the tower. You program the sampler using the keypad and prompts from the display.

Beneath the keypad and display housing is a rectangular protrusion with a yellow warning label on it. This is the housing for the fill needle. When the sampler is in operation, the fill needle raises and lowers automatically to inject the liquid sample into the bottles in the rack.

The warning label is to warn you against putting your hand between the tower and the bottle rack. You can be seriously injured by the needle coming down when the sampler is in operation.

⚠ WARNING

Never place your hand or any other body part between the needle assembly and the bottle rack. If the sampler starts unexpectedly and lowers the needle to fill a bottle, you could be caught between the needle and the bottle rack. The needle comes down with enough force to cause serious bodily injury. In order to avoid damage, always make sure the bottle rack is in place, bottles are in all 24 positions, and that the shut-off handles on all bottles are horizontal.

1.3.3 The Bottle Rack

Isco ships the bottle rack separately from the sampler controller for protection. Because of the carrier's insulating properties you can pack the bottle rack with ice (or **gel packs** if you are shipping) to keep the samples cool from when they are gathered to when they are analyzed at the laboratory. (Gel packs are a packaged cooling agent.)

It is very important to keep the samples cool to keep them representative; heat drives volatile organic compounds out of solution. If you don't keep the samples cool, they will degrade, and as a consequence will not be representative.

Note the metal plate holding the bottles inside the bottle rack (see Figure 1-2). This cover keeps the bottles in place during shipment and use, and also holds the cooling ice in place while the sampler is operating. It prolongs the melting time of the ice. The knurled knob with the threaded shaft attaches the bottle rack to the controller. Never operate the sampler without the stainless steel cover in place and the knob securely tightened.

Before installing the bottle rack, look at the tops of the bottles. Note the ends of the valve handles on the bottles. Make sure all the handles are turned so they are at right angles to the standing bottles, or facing 3 and 9 o'clock (see Figure 1-2.)

This is important, not only for proper alignment for sampling, but also to ensure that all bottles are closed and free from contamination. During normal operation, the sampler may occasionally leak a small amount of sample around the O-ring on the tip of the needle. This is generally due to a misalignment between the needle and the bottle. The small leak does not affect sample integrity, as it occurs outside the bottle before the valve is closed. If the leak condition persists or sample is being sprayed out of this connection, consult Isco Customer Service. A leak around the valve stem on the top of the bottle indicates a worn valve. When this occurs, the valve body must be replaced. You will notice that there is one bottle that does not have a valve on top. This is the blank, and you will also notice that the bottle rack looks different behind this bottle. There is no slot in the rack. This bottle marks the home position for the bottle rack. When you reload the bottles after sampling, **always** put the blank bottle back in this position, or the sampler will not work properly.

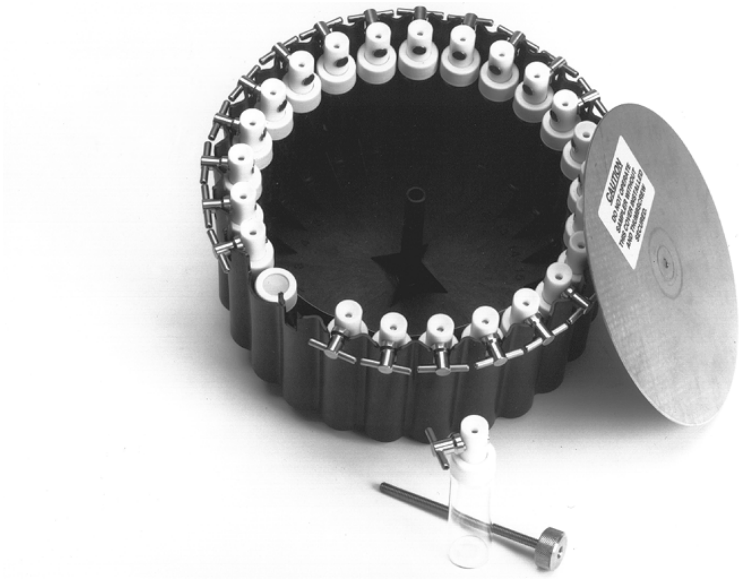


Figure 1-2 Bottle Rack

1.3.4 Cleaning the Bottles (the First Time)

Isco assembles the racks with new clean bottles, as shipped from the bottle manufacturer. Normally, no further cleaning is necessary before first use of the bottles. However, these bottles and valves are not certified clean. If you wish to clean the bottles before using them the first time (for example if you are sampling for extremely low concentration volatile organic compounds), follow EPA guidelines for washing and drying the bottles. After

you have used the bottles for sampling, always wash and dry them according to EPA guidelines.

⚠ CAUTION

Always make sure the rack is in the "home" position before installing or removing the bottle rack. This places the blank bottle under the fill needle. If the rack is not in "home" position, press Rack Reset to return the rack before removing or installing the bottle rack. If you do this, the rack will always be in the right position when you reload it.

1.3.5 Installing the Bottle Rack

Notice the D-shaped steel shaft in the center of the triangle formed by the three knobs. This is the bottle rack rotor. Place the bottle rack over this shaft, rotating it slowly until the D-shape of the shaft lines up with the same D-shape on the bottom of the bottle rack. The rack will easily settle into place. Secure the rack in place by tightening the knurled knob and threaded shaft into the threaded hole on the D-shaped shaft on the controller base. The rack is now ready for sampling.

1.3.6 Connecting a Power Source

You can power the 6100 from a variety of sources. The unit is designed to hold either an **Isco High Capacity Power Pack**, an **Isco Nickel-Cadmium Battery**, or an **Isco Lead-Acid Battery**. You can also power the unit with a separate lead-acid battery mounted outside the sampler case and connected with a special cable. Power requirements for the 6100 are **12 volts DC at 5 amperes**. All above-mentioned power sources are capable of supplying this current. Detailed information about the power sources is in the **Power Products Guide**, shipped with this manual.

The power source mounts in the rectangular well in the base of the controller, at the right of the tower. You will notice a label with two capped and chained connectors and a fuseholder on it. There is also an open connector. This connector has two pins and is the power connector. Secure the power source to the controller base by placing it in the well and pulling the two rubber draw catches up and over the mating hooks on the battery or power supply. Plug the cord with the small two-pin M/S connector into the two-pin connector on the controller base. If you are using an AC-powered source, route the AC power cord out of the sampler through the slot in the cover when you put the cover back on the controller after programming.

1.3.7 Attaching the Sample Tubing

The 6100 uses two different sizes of tubing to run the sample pump. The tubing is skip-bonded together for installation convenience. The larger tube carries air to the pump while the smaller tube brings the liquid from the pump to the sampler. Both tubes are polyethylene; however, the sample tube has a Teflon® liner to meet EPA sampling guidelines for inert surfaces contacting the sample. Connection of the tubing is very simple. Separate the tubes by pulling them gently apart. Locate the two red fittings on the controller. Each fitting will accept only one size of tubing. Make sure the tubing has a clean, even cut on the ends. Use the cutter that is provided. Do not cut the tubing in a welded area or leave any score marks, as this can cause difficulties with insertion and release of the tubing.

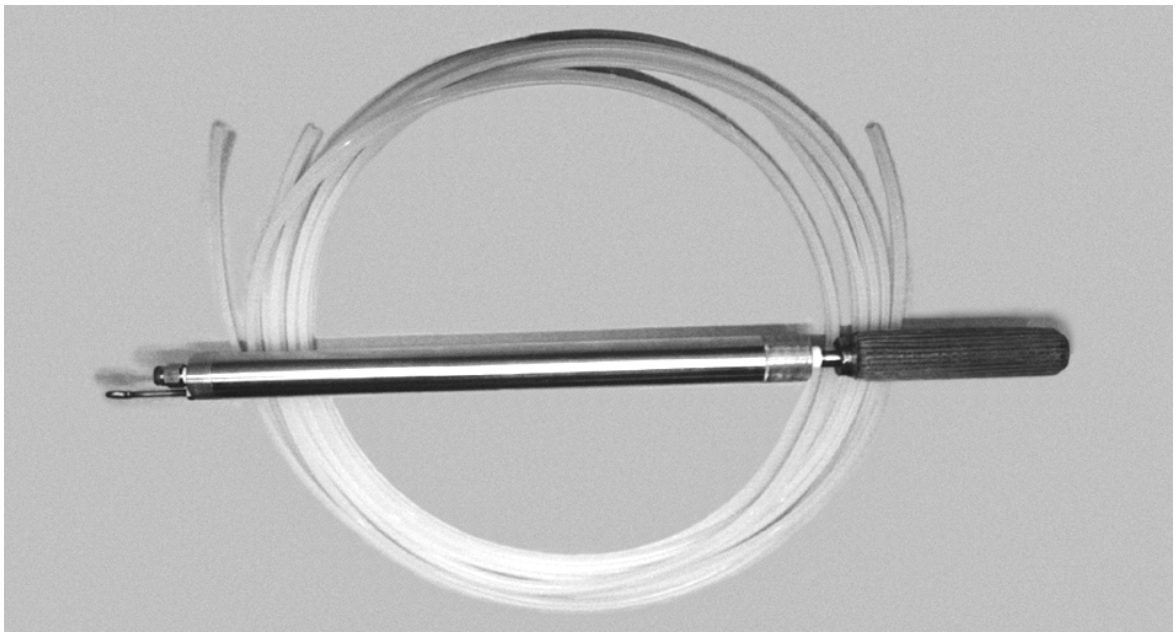


Figure 1-3 Bladder Pump and Tubing

The larger tube attaches to the fitting on the controller base just behind the tower near the connectors. The sample tube attaches to the other red fitting located on the back of the tower about halfway up. These fittings are a special quick-release type.

- To attach the tubing, simply push it in with your hand until it stops at the bottom of the fitting. To get a good fit you will have to press the tubing in firmly.
- To release the tubing, press in on the outer red flange of either fitting with your finger, while pulling on the tubing away from the fitting.

1.3.8 Attaching the Drain Tube

Note the small tubing fitting on the back of the of the sampler. As mentioned, the 6100 overfills the sample bottles by three volumes. This fitting is for a drain hose to carry away the overfill from the needle assembly.

Isco supplies a 10 foot length of 1/4" OD vinyl tubing to drain this overfill. Typically, this is routed back to the flow stream.

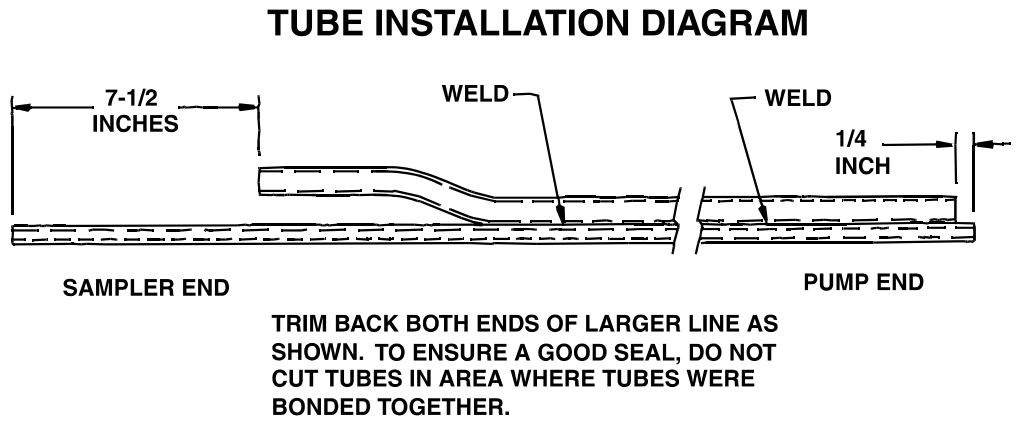


Figure 1-4 Tubing Preparation

1.3.9 Attaching and Mounting the Pump

The pump attaches to the other end of the twin tubing in the same manner as the controller. Press the tubing into the fittings at the end of the pump. Isco does not recommend suspending the pump from the tubing and fittings. For maximum safety and reliability, you should attach a wire to the eyebolt on top of the pump to suspend it. Isco offers a special stainless steel wire for this purpose. You can mount the pump in the flow stream horizontally if the stream is shallow, or vertically if you are sampling from a well. The metal strainer on the bottom of the pump is the main filter for the entire system.

The air supply for the pumping system enters the base through the air inlet fitting at the left rear of the base. If the bladder should fail during a sampling routine, water can get into the air system. From there, the water can be expelled from the air inlet. Inspect the bladder every ten racks. If sharp creases appear, replace it. Bladder life will be approximately 30 racks for tubing lengths of 25 feet or less, and approximately 20 racks for lengths over 25 feet.

Any time the pump is disassembled for any reason, it is recommended that the teflon bladder be replaced. If this is not possible, care should be taken not to damage the bladder by scraping the threads of the body, and to keep it from being twisted during reassembly.

CAUTION

Use extreme caution when disassembling bladder pumps. These pumps operate with air or gas under moderate pressure. Never attempt to disassemble a pump while still connected to the controller and/or the source of compressed air or gas. To avoid injury, follow in order the steps shown below to disassemble the bladder pump.

Your safety is very important to us. If you have questions, please contact Isco Customer Service at 1 (800) 228 4373.

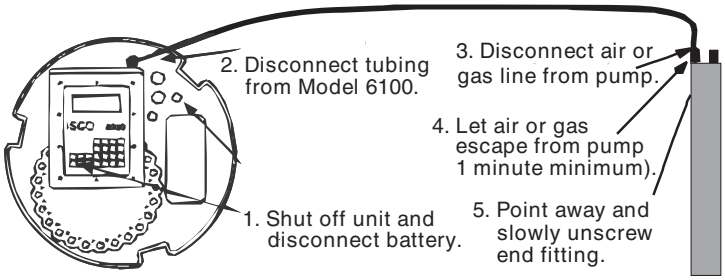


Figure 1-5 Pump Safety Warning

⚠ WARNING

Do not attempt to disassemble the bladder pump without first turning off the sampler and disconnecting both tubes. Disassembly of the pump while it is pressurized could result in serious personal injury.

⚠ CAUTION

Never operate the 6100 without the pump strainer in place. Operation without the strainer could result in pumping sediment or debris that could ruin the bladder pump and clog the fill needle, making the sampler inoperative. Operation of the pump without the strainer will void the warranty.

1.4 Operation, Display, and Keypad

After you have put the sampler together as described in the previous sections, you are ready to program the unit to run a sampling routine. But first you must familiarize yourself with the keypad and display.

The display is a two-line, 20 character-per-line liquid crystal display (LCD). The display is alphanumeric, meaning it can show both letters and numbers. The display has a backlight feature that allows you to read it easily in conditions of low light, such as in a manhole.

Pressing any key will turn the backlight on for approximately one minute. Each time you press a key, the backlight timer is restarted, so the light will ordinarily stay on throughout programming.

When you are programming, in most cases you will select a word choice from the menus appearing on the display. In some instances, you will have to enter a number. The display will provide you with a range of appropriate values. The sampler will reject entry of any numbers outside this range. When you program the sampler, one option for each program step will always be flashing on and off. This flashing indicates the selection currently held in memory.

Pressing either of the **Arrow** keys will cause the option to the left or right of the currently selected option to begin flashing.

Pressing the **Enter** key on the keypad will cause this new choice to be entered into the sampler's memory. The keypad lets you enter menu choices into the sampler's memory.

Various keys also control specific sampler operations. Following is a description of the function for each key on the keypad.

1.4.1 Power Up

When you press the **On/Off** key to turn on the 6100, the unit can respond in several different ways, depending on what was happening when the unit was last turned on. Following are the possible operations the unit can do when you press the **On/Off** key:

- The sampler may **test the tower assembly**. The sampler will move the fill head assembly a short distance up and down and then back up again, coming to rest near the top position.
- The sampler may **test the driver** that turns the valve handles on the sample bottles to open and close them. This sequence consists of four movements clockwise and counterclockwise with short pauses between them. You can see the valve actuator if you look on the inside of the tower, about the height of the bottle rack. It is round and has two pins protruding from it.
- The sampler may **move the bottle rack** to the next bottle position. If the bottle rack is somehow stopped so a bottle is not directly under the fill head, the rack will rotate a few degrees to position a sample bottle directly under the fill head.
- The sampler may **reset the bottle rack**. This consists of rotating the bottle rack until the "home" position of the rack is under the fill head. If the home position of the rack is close to the fill head, the rack may make more than one complete revolution the first time power is applied before the rack stops on the home position.

When you turn the sampler on with the **On/Off** key, it may do some of these things or none of them, and this is normal. When you turn the unit on for the very first time, or if you have done a **hard reset** (see Section 4.3), the sampler will move the bottle rack, if necessary. It will then do a tower test; if that works correctly, it will do a valve driver test; if it passes, it will reset the bottle rack.

Otherwise, when you turn the sampler on, what happens will depend on the condition it was in when you turned it off. First, it will check the positioning of the bottle rack to see that there is a bottle directly under the fill head. If not, the unit will move the bottle rack.

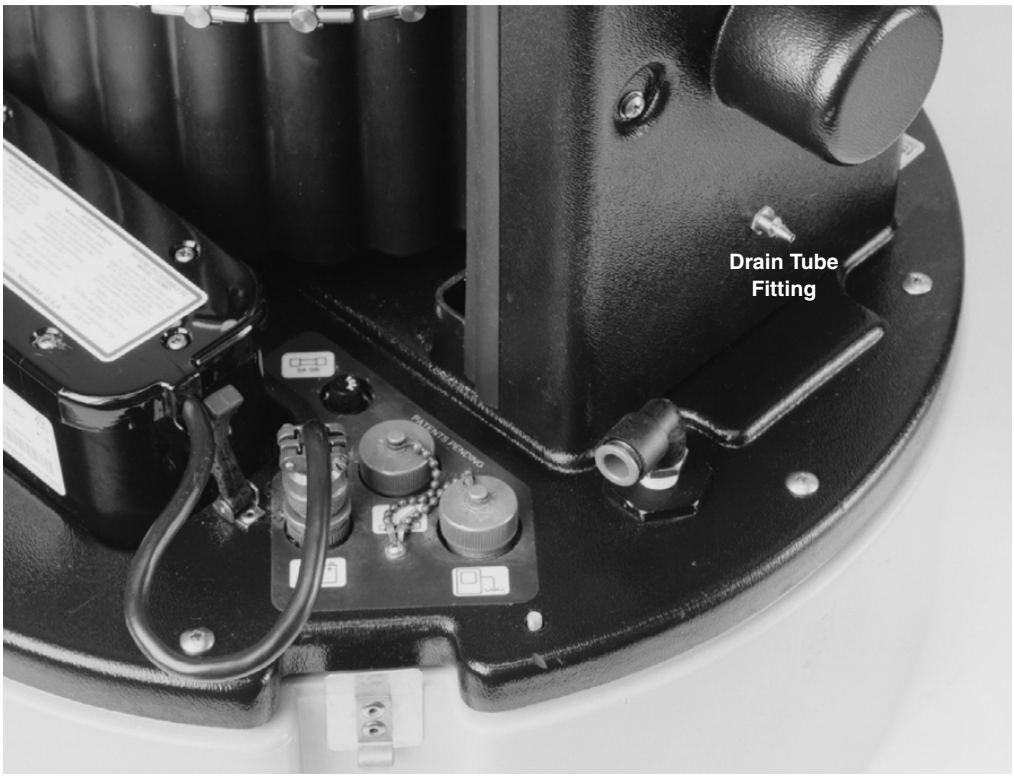


Figure 1-6 Power Source, Connectors, and Drain Tube Fitting

Then the sampler will check the condition of the tower drive (the up and down motion of the fill head). If the tower is not in the "home" position (fully up), or the sampler detected a tower jam on the last attempt to move the tower, it will do a tower test. If the tower was in the “home” position or successfully passes the test, the sampler will then look at the condition of the valve driver. If the valve driver is not in the "home" position or if the sampler detected a valve driver jam the last time it tried to rotate the driver, it will do a driver test. The unit will not reset the rack at this time.

If the sampler was in the process of running a sampling program when it was shut down, a message will appear on the display saying that the program was aborted and cannot be resumed. You will have to start a new program to continue sampling. After the sampler runs these tests, it will be in the standby state, and the standby message will appear on the screen.

At other times when the sampler moves the bottle rack, such as when you press the **Rack Reset** key, or the sampler is taking a sample and must advance the rack to a new bottle, it may do the

tower test or the valve driver test if the associated mechanism is not in the home position as described above, or a jam in was detected during the previous attempt to move that mechanism.

1.4.2 On/Off

This key is the master control for the entire system. When you turn the sampler off, no other key will have any effect, even if you are in the middle of a sampling routine. However, any program choices you have made and entered for the sampler setup and sampling routine will be retained by the unit in battery-backed memory. Note that turning on the sampler does not make it run a program. Turning the sampler on just puts it in the Standby state, where it is ready to receive programming and configuration commands from the keypad.

Figure 1-7 6100 Keypad

1.4.3 Program and Setup Keys

These keys control programming of the sampler. Setup configures the sampler (defines how the sampler will work) while Program defines the specifics of the sampling routine.

Program – This key puts you into the programming mode for the sampler. For the 6100, "program" refers specifically to the sampling routine the unit will run. If you use the sampler at more than one job site, you will very likely change the sampling routine. You do that with the **Program** key. You may change the Program without changing the Setup.

Setup – This key programs the sample for functions that differ from the sampling routine controlled by Program. Setup performs the "housekeeping" functions of the sampler. In Setup you determine the length of tubing line to the pump, set the internal clock, establish a site identification number, etc. You may change Setup without changing items selected in Program.

Run – After you have programmed the sampler with both the Program and Setup menus, you must press **Run** for the sampler to run its program, regardless of when you programmed the routine to begin. The **Run** key starts the program.

Clear/Exit – Pressing this key allows you a way to revert to a previous entry for a menu choice, or to exit the Setup or Program menus.

Enter – You must press the **Enter** key to step through the menu for either the Program or Setup functions. During programming, pressing **Enter** will store the choice or value displayed on the screen and move you to the next choice.

Display Status – The 6100 keeps a record in memory of programming and sampling activity called the History Log. It is possible to view this record screen by screen on the display. If you press this key when the sampler is turned on and in the Standby mode, it will allow you to view this log. More information on the History Log, with several representative screens, can be found in this manual in Section 2.7.

Rack Reset – Pressing this key when the sampler is in the normal operating state will return the bottle rack to the "home" position. This is when the blank bottle is directly under the fill needle. If the sampler previously detected a fault in the tower, it will test the tower before it rotates the rack. The same will occur if the sampler previously detected a fault in the valve actuator, and the valve actuator must be returned to the normal position if it is not. Also if the needle is not fully raised, the sampler will raise it before rotating the rack. The sampler raises the needle and returns the valve actuator to the normal position so they will not interfere with the rotation of the rack.

Cycle Pump – Pressing this key tests the bladder pump. Its primary use is to purge the pump. It draws water as if taking a sample, but does not put the water in a bottle. This key is primarily a setup aid, but you can use it whenever you need to purge the pump.

Manual Sample – This key allows you to take a sample any time you want without interrupting a sampling routine or reprogramming the system. When you press this key, the unit will place a sample in the next bottle.

Always make sure that a bottle rack is installed before starting a manual sample.

⚠ CAUTION

The sampler may be damaged if there is no bottle rack installed when you try to take a sample.

After pressing **Manual Sample**, the following screen will appear:

```
BOTTLE RACK LOADED?
YES  NO
```

NO will always be flashing. To proceed with the manual sample, select YES with the **Arrow** key and then press **Enter**. This screen reminds you to make sure that a bottle rack is in place before you start to take a manual sample.

1.5 Technical Specifications

The following table contains the technical specifications for the 6100 VOS Sampler.

Table 1-1 Technical Specifications for the 6100 VOS Sampler

Dimensions	18” diameter x 29” tall
Weight (Dry)	41 lbs (18.3 kg)
Enclosure	Unit: NEMA 4X, Electronics Enclosure: NEMA 6
Materials: Enclosure Controller Pump Sample Tubing	 ABS ABS, stainless steel, anodized aluminum Stainless steel, Teflon® Internal: FEP-lined Tygon®; External: Teflon®-lined
Maximum Sample Line Distance	100 feet (30.5 m)
Maximum Lift	80 feet (24 m)
Pump Tubing (External)	Polyethylene twin tube, skip-bonded 1/4” and 3/8” outside diameter
Temperatures: Operating Storage	 32° to 120° F (0° to 49° C) -40° to 140° F (-40° to 60° C)
Power Requirements	12 VDC, 20 mA (average) - 5 Amperes (maximum)
Power Sources: AC Batteries	 Isco High Capacity Power Pack Isco Battery-Back Power Pack Isco Nickel-Cadmium Battery Isco Lead-Acid Battery Deep-cycle RV or Marine Battery
Expected Battery Life	1 Sample Rack
Internal Battery	Lithium, 5 year life expectancy, stores programming routines and sample data
Samples: Volume Container Frequency Cooling	24 per rack, 1 blank 40 ml Hard glass, with stainless steel and Teflon® valve. Sampler can be programmed for either time or flow-paced sampling. Rack capacity: 3 1/2 lbs of ICE.
Controls	22-button keypad, momentary contact
Indicators	Alphanumeric LCD 2 rows, 20 characters per row, backlit (with key press)
Connectors	Power (2-pin male M/S) Flow Meter (6-pin male M/S) Printer/Computer (6-pin female M/S)
Sample Data Storage	1,000 Records (Approximately 30 programs of 24 bottles each)
Flow Meter Signal Format (Flow Pulse)	5 to 15 volt DC pulse or isolated contact closure of at least 25 milliseconds duration. (A 4-20 mA control signal can be converted with an optional interface unit.)
Clock Accuracy	1 minute per month
Printer/Computer Data Format	Asynchronous, 2400 baud, 8 data bits, Xon/Xoff control.

6100 Volatile Organic Sampler

Section 2 Programming

2.1 Introduction

In the following section, the words printed in capital letters represent messages the 6100 displays as you work your way through the Setup and Program routines. Note that you do not have to work through Setup if all you want to change is something in Program. Likewise, it is not necessary to work all the way through Program to change something in Setup. You will notice some lines with XXs or other capital letters in them. These letters represent variables, such as amounts, times, and dates. When the sampler is in the standby state, not running a program, the following message will appear on the display:

. . . STANDBY . . .	
HH:MM:SS	DDMMMYY

There are two programming sequences for the 6100. One sequence controls the operation of the sampler and is called Setup. The other sequence is called Program; in Program you define the sampling program you want to run. The first time you use the sampler, you need to work through both sequences to correctly program the sampler to run a sampling routine. After that you may never need to reprogram the Setup section. As the various screens appear, the selected entry (the option currently held in memory) will flash. Use the **Arrow** keys to move from one entry to another. Where the display requests a numeric value, use the **Number** keys to enter the appropriate value. Use the **Enter** key to move to the next menu item.

2.2 SETUP Sequence

1. If you are in standby and see the standby message shown above, press **Setup**. This step requests entry of the length of the air and liquid lines between the 6100 and the bladder pump submerged in the flow stream. Accurate selection of the line length, 15, 25, 50, and 100 feet, is necessary, as the controller calculates air and liquid volumes necessary to purge the lines and take the samples based on the length you enter.
   The following will appear:

SELECT LINE LENGTH
15 25 50 100 (FT)

2. The pump head entry compensates for vertical lift of the sampler as opposed to the line length. The maximum pump head allowed will depend on the line length selected from

the previous screen. The lift is defined as the vertical distance from the top of the bladder pump to the inlet of the sampler.

☑ Note

The pumping head for the 6100 is measured differently than that of other Isco samplers. For other Isco samplers, the pumping head is the vertical distance from the sampler to the liquid level of the sampled liquid. For the 6100 samplers, the vertical distance is measured from the inlet of the sampler to the top of the bladder pump.

ENTER PUMPING HEAD
(0 - 15) 10 FT

3. Press **Enter** to display the following screen:

SITE ID NUMBER
_____

The SITE I.D. NUMBER screen allows you to assign an identifying number to the sampling site for later reference in analyzing results. The number can be anything you select that gives meaning to the sampling site, up to 10 digits. This number will be printed on all records.

4. The next step is setting the internal clock. This clock runs all the time, even when the sampler is turned off, as it is powered by a lithium battery.

SET CLOCK
YES NO

If you select YES for setting the clock, the following screen will appear:

HH:MM	MM/DD/YY
HH:MM	MM/DD/YY

To set the clock, enter the correct time and date with the **Number** keys. The digit that is flashing is the one you can change. Enter the correct number from the keypad and press **Enter**. The flashing cursor will move one number to the right of the display each time you press **Enter**. To

accept a current entry, press **Enter**. NO allows you to skip the clock option and work through other aspects of the Setup menu. You generally will not have to set the clock again (except for the change to and from daylight savings time).

5. A Purge cycle is where the bladder pump completely fills, then completely empties. These purge cycles force liquid through the pump, suction line, and the needle assembly, but not into the sample bottle. The purge cycles occur before the sampler inserts the needle assembly into the bottle. These cycles ensure that the liquid from previous sampling is washed out of the system, thus eliminating cross contamination.

EXTRA LINE PURGE
YES NO

When NO is selected, see Step 7.

6. If YES is selected in the EXTRA LINE PURGE step, then the following screen appears:

EXTRA LINE PURGE
1 PUMP CYCLE (1 - 9)

7. If NO is selected in step 5, the “standard” number of cycles will be used. The standard is one purge cycle for 15, 25, and 50 feet of line and 2 purge cycles for 100 feet of line. For **Manual** samples and the first sample after pressing **Run**, the standard purge cycles are increased: two purge cycles for 15 and 25 foot line length, three purge cycles for 50 foot line, and four cycles for 100 foot lines.

RUN DIAGNOSTICS
YES NO

8. In normal operation, you would select NO. You would RUN DIAGNOSTICS only if you suspected a problem. NO will always be flashing. If you select NO, the sampler advances to Step 19.
9. The ENABLE MANUAL DIAGS menu gives you the capability of manually controlling some of the mechanical functions of the sampler as a diagnostic aid. It provides special functions to some keys on the control panel for a limited period of time. If you need to access the manual diagnos-

tics, select YES at the following menu:

ENABLE MANUAL DIAGS
YES NO

Selecting YES will let you move the tower up and down with the **arrow** keys. It will also let you move the valve driver (opens and closes the valves on the sample bottles) through a sequence with the **0** key, and it also enables you to move the bottle rack through a selectable number of bottle positions (1-24) by entering the number of positions desired with the number keys on the keypad and then pressing **Enter** and **Rack Reset**. Selection of this option (YES) allows you access to these capabilities for only 15 minutes. You will have to re-enter the selection if you want continued access to the manual diagnostics.

10. If you select YES from the ENABLE MANUAL DIAGS, the unit will ask for a pass number on the next screen.

ENTER PASSNUMBER
0000

However, if you have entered the pass number within approximately the last 20 minutes, the ENTER PASSNUMBER screen will not appear.

11. The correct pass number (6100) should be entered with the number keys at this time. An incorrect pass number will cause the machine to again ask for the pass number unless you press the **Clear/Exit** key.

⚠ CAUTION

Some of these manual tests can damage the unit if not done properly, such as running the tower down without having a bottle rack in place or running the tower down without first opening the valve on a bottle. Because of this danger, manual testing should only be done by qualified personnel.

12.

RUN ALL DIAGNOSTICS
YES NO

Selecting YES from the Diagnostics screen will cause the sampler to run the following six diagnostic routines and advance to Step 19. If you do not want to run one of the

routines, select NO. The sampler will then allow you to select each diagnostic individually.

13.

TEST RAM
YES NO

Selecting YES causes the machine to test the RAM (Random Access Memory) by loading and reading back various values.

14.

TEST ROM
YES NO

Selecting YES for TEST ROM causes the sampler to test the ROM (Read Only Memory) by adding all the locations and checking the result.

15.

TEST DISPLAY
YES NO

This option causes the sampler to test the LCD readout, first blanking the display and then displaying various characters.

> ☑ ***Note***
>
> You must have a special plug that loops the transmit and receive signals together to run the TEST PRINTER diagnostic.

16. The next option tests the sampler's serial printer port by sending and receiving data.

TEST PRINTER PORT
YES NO

17. The next option causes the sampler to test the flow meter serial port by sending and receiving data. As for the TEST

PRINTER PORT diagnostic above, you must have a special plug to connect the appropriate pins.

TEST FLOW METER PORT
YES NO

18. The next option tests the mechanical operations of the sampler by moving the tower up and down, operating the valve driver, and rotating the bottle rack one full rotation.

TEST OPERATION
YES NO

19. The SELECT DISABLE MODE menu refers to the treatment of sampling events that occur during the time the sampler is disabled or shut down.

SELECT DISABLE MODE
ERROR SKIP DELAY

- If you select ERROR, the sampler will make an entry into the log of error, meaning that no sample was taken.
- Selecting SKIP also means that no sample was taken, but that the sampler will still take the next scheduled sample at the appointed time, if it is re-enabled.
- DELAY means that the sample will be delayed until the sampler is re-enabled and taken at the time set. You will then be in the STANDBY mode after ERROR, SKIP OR DELAY has been chosen.

2.3 The PROGRAM Sequence

You must have a flow meter connected to the 6100 if you want to use flow pacing. The flow meter supplies the flow pulses, signals to the sampler that indicate volumes of flow.

1. To begin the Program sequence, press the **Program** key. Sample pacing refers to how the sampler determines when to take samples.

SAMPLE PACING
TIME FLOW

- Selecting TIME means samples are taken between specified intervals of time.
- Selecting FLOW means samples are taken only after a specific flow volume has passed. If the flow is variable, the time interval may vary considerably between samples.

2. If you select TIME, the sampler will ask you to enter an interval of time. The smallest amount of time that can be entered is ten minutes. The following screen will appear:

SAMPLE EVERY
XX HOURS XX MINUTES

3. If you selected FLOW, the sampler will ask you to enter the number of flow pulses between samples.

SAMPLE EVERY
XX PULSES (1-9999)

☑ *Note*

The following option, SAMPLE AT START TIME, will only appear if you selected Flow Pacing in Step 1.

SAMPLE AT START TIME
YES NO

4. The choice you make here will determine whether or not the 6100 takes a sample at the time the sampling routine starts. If you select NO, the 6100 will not take the first sample until the interval you program between the start time and the first sample has elapsed.
5. A sample event occurs each time the flow or time interval elapses. This is the number of bottles that will be filled for each sample event. The following display will appear:

BOTTLES/SAMPLE EVENT
XX (1-24)

6. Enter the desired number of bottles per sample and press **Enter**.

OF SAMPLE EVENTS
XX (1- YY)

The number YY will be 24 if you entered "1" in step 5. Otherwise, YY will be 24 divided by the number entered in Step 5, rounded down. For example, if you are filling two bottles each time, YY will be 12. If you fill four bottles, YY will be 6. If you fill 5 bottles, YY will be 4, etc.

7.

ENTER START TIME
YES NO

If you select NO for ENTER START TIME, the sampling program will start immediately after you press the **Run** key. If you prefer to start the program at a specific time, select YES.

8.

START TIME
HH:MM MM/DD

START TIME is the time the sampling routine starts. Enter a time later than the present time, or you will be asked to reenter the Start Time. In **Time** mode, The 6100 will take the first sample at Start Time. In **Flow** mode, the 6100 will only take a sample at Start Time if you enabled that option in the Programming sequence with Flow Pacing selected. If not, the 6100CR will simply begin counting down the flow pulses before the first sample.

> ☑ ***Note***
>
> When you finish programming the 6100, you must press **RUN** for the sampler to run its program. Otherwise, the program will never run, even after the start time passes.

2.4 The RUN Key

1. If you want to start at the beginning of the rack (bottle 1), press **Rack Reset** before pressing **Run**. After you press the **Run** key, the following display will appear:

START AT BOTTLE
X

The value of X will be the next available bottle. If the bottle rack is in the "home" position, this will be bottle 1. If the rack is on the last bottle (24), the sampler will reset the rack to the "home" position and the display will show the bottle "1."

Pressing **On/Off** will turn the sampler off. Pressing **Clear/Exit** will return the sampler to the standby state; the **Run** key must be pressed again to operate the sampler.

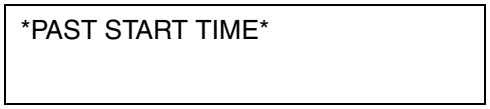
You can press **Enter** to select the displayed bottle to start the sampling routine, or you may enter a higher bottle number. The highest number you can enter is 24. You cannot enter a smaller number than that displayed.

If no entry is made, the sampler will time out and the bottle number will default to the number displayed.

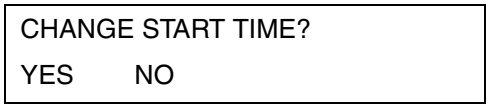
If you chose not to enter a start time in the Program sequence, the sampling program will start immediately after you enter the bottle to start on. The sampler may or may not take a sample at this time, depending on whether you programmed the 6100 to take a sample at the START TIME in the SET UP sequence. See Section 2.5, Active State Displays.

If you chose to enter a start time in the Program sequence and the time you entered has not passed when you press the **Run** key, the program will start at the time you entered.

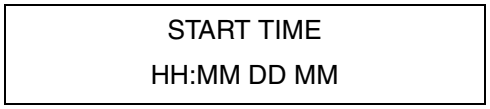
If you entered a start time in the Program sequence but the start time has passed by the time you pressed the **Run** key, the following screen will appear:



Followed by:



2. If you select NO, the start time will become the present time and the program will start immediately. See Section 2.5, Active State Displays. Again, whether a sample is actually taken at this time depends on other choices you made in programming.
3. If you select YES, the sampler will ask you to enter a new start time.



4. The sampler will advance the hour to the next hour after the present time. The day and month will be the current day and month. You can accept this time by pressing **Enter** or enter the start time you choose. After a valid time has been entered, the sampler will run the program. See Section 2.5, Active State Displays.
5.

MUST BE LATER THAN
HH:MM DDMMM

If you enter a time that has passed, the MUST BE LATER THAN screen appears briefly. Enter a valid start time.

2.5 Active State Displays (Run Mode)

After you have programmed the sampler and pressed **Run** to begin the sampling routine, any of the following messages, depending on how you programmed the sampler, can appear during the sampling routine.

If no start time has been programmed, the sampler will start immediately (the screen shown in step 2 below appears).

However, if the sampler has been programmed with a start time, the display that appears will depend on whether the start time is in the current day or not.

1. If the start time is not in the current day, the following display will appear:

START AT HH:MM DDMMM
HH:MM:SS DDMMMYY

2. When the day of the start time is reached, (or the start time is in the current day), the following display will appear:

START AT HH:MM
HH:MM:SS DDMMMYY

3. When the sampler starts (or the start time is reached), the action depends on whether you programmed the sampler to take a sample at the start time or not (only true for flow pacing).

If the sampler was programmed for flow pacing **and** to take a sample at START TIME, it will proceed to take the first sample. Step 4 shows the display that will appear. If the unit is programmed for flow pacing but **not** to take a sample at START TIME, the sampler will initialize its interval counter so that the first sample will occur **one interval** past the start time.

One interval refers to the number of flow pulses you programmed to elapse between sample events. When the start time is reached, the display will change to the following:

- In **time mode**:

SAMPLE X AT HH:MM
HH:MM:SS DDMMMYY

- In **flow mode**:

SAMPLE X
AFTER XX PULSES

4. When the 6100 is taking a sample, during the purging of the air and water lines, the display will show:

TAKING SAMPLE 1
PURGING LINES

5. While the sampler is filling the bottle, if you entered a number greater than 1 for bottles/ sample event, the display will show:

TAKING SAMPLE 1
BOTTLE 1 OF X

6. While the sampler is filling the bottle, if you entered 1 for the number of bottles/sample event, the display will show:

TAKING SAMPLE 1
BOTTLE 1

7. Between samples, if you selected time pacing, the display will show:

SAMPLE X AT HH:MM
HH:MM:SS DDMMMYY

8. Between samples, if you selected flow pacing, the display will show:

SAMPLE X
AFTER XX PULSES

XX (the number of flow pulses) will decrease as the sam-

pler receives each flow pulse from the flow meter. When the sampler is done with its sampling routine, the rack will not be in the home position.

9. If you want to remove the bottle rack, press **Rack Reset** to move the rack to the home position so you can remove it.
10. If you are going to run another sampling program to fill more bottles in the rack, press the **Clear/Exit** key to return to the STANDBY display. The rack will stay where it stopped for the last sample of the program you just ran. When the sampler completes the routine you programmed, the display will show:

DONE. . .XX SAMPLES *(up to 24)*
HH:MM:SS DDMMMYY

11. If you press **On/Off** before a program has finished, the sampler will terminate that program. When you turn the sampler back on, a message will appear to remind you of this. The display PREVIOUS SAMPLING will show:

PREVIOUS SAMPLING
PROGRAM ABORTED

It is not possible to halt a program and resume it later. However, the program is still in memory just as you entered it and you can run it again. The program will not change until you reprogram. While you cannot resume the program where you terminated it, you can press **Run** and the sampler will rerun the same program, starting from the beginning but placing the samples in the next available bottle as outlined in the beginning of this section.

2.6 Error Messages

The possible ERROR types are:

- **RACK JAM**
- **TOWER JAM**
- **RACK FULL**
- **VALVE JAM**
- **POWER FAILURE**

If the RACK JAM message appears, try to clear the problem by pressing **Rack Reset**. If TOWER JAM appears, call Isco Customer Service. RACK FULL means the sampler has filled all 24 bottles, and you will need to replace the bottle rack with a new one. VALVE JAM indicates the sampler was unable to open the valve on the sample bottle. Check the bottle in question and make changes as necessary.

POWER FAILURE means that the power was disconnected during the sampling routine, or that the battery discharged to the point where it could no longer run the sampler. Reconnect or recharge the battery.

If there is some problem and the unit is unable to take a sample two times in a row because of the same error, an ERROR message will appear on the display:

SAMPLING ERROR
(error type)

2.7 Display Status and History Log

1. When you press **Display Status**, the sampler will show you a log of events it has recorded in memory. The first display will ask you to choose from the following:

DISPLAY STARTING AT
BEGINNING LAST SAMP

2. If you select LAST SAMP, the display will only show you the record for the last program the 6100 has run.
3. If you choose BEGINNING, the log will go as far back as the internal memory allows. It will either go to the first entry made or to the oldest entry in memory. (When memory allocated to the log is full, the log will begin overwriting the oldest entries with new ones.) If you choose BEGINNING and the entries are too long or not what you want, you can leave the log by pressing **Clear/Exit**.

> ☑ ***Note***
>
> In general, LAST SAMP is the better choice for viewing the log. Do not select BEGINNING unless you need to look over the entire log. There may be a large number of entries. If the sampler has been running for some time, the log can have as many as 1,000 entries, going back several months. Trying to make sense of all this when you can only see two lines at a time could be difficult. You can use the **Clear/Exit** key to leave the log at any point.

You can move backward and forward through the log with the arrow keys. The **Left Arrow** key moves backward and the **Right Arrow** key moves forward. If you press the **Left Arrow** key to go backward and the display is in a sequence that has two different messages to display, the display will still advance to the second message before reversing and moving through previous displays.

2.7.1 Quick View of Sampling Sequences Only

If you are viewing the log and want to move to the next sampling sequence, press the **Right Arrow** key and then press **Enter**. The display will advance to the next sampling sequence. Continuing to press **Enter** will move the log forward through each successive

sampling sequence. If you want to revert to the previous sampling sequence, press the **Left Arrow** key and then press **Enter**. The display will return to the first screen of the previous sampling sequence. Using this method, you can quickly move through the log, stopping only at the beginning of each sampling sequence.

2.8 The Display Status Screens

The log displays times in military format. One to eleven p.m. will appear as 13:00 to 23:00. Dates appear as day, month, and year. "Day" will be one or two digits. "Month" will appear as a three-letter abbreviation, as "JAN" for January. "Year" will be two digits, as "03."

START OF HISTORY LOG
HH:MM DDMMMYY

1. When you power up the unit, the following display will appear on the log:

POWER RESTORE AT
HH:MM DDMMMYY

2. If you removed power from the unit, the following display will appear on the log:

POWER FAIL AT
HH:MM DDMMMYY

3. When you use the **On/Off** key, the following will appear:

UNIT ON AT
HH:MM:SS DDMMMYY

Or:

UNIT OFF AT
HH:MM DDMMMYY

4. When you activate a sampling program by pressing **Run**, the following display will appear on the log:

PROGRAM ACTIVATED
HH:MM DDMMMYY

When the sampling sequence actually begins, the following

display will appear on the log:

PROGRAM STARTED AT
HH:MM DDMMMYY

The following log entry will display for a sampling event:

SAMPLE: 1 HH:MM
BOTTLE: 1 DD MMM

5. If you press the **Right Arrow** key again, the following log entry will appear:

SOURCE: FLOW

The possible sources are: TIME, FLOW, START, MULTIPLE, and MANUAL.
If there was a problem and the unit was unable to take a sample at that time, this message would appear instead:

SOURCE: FLOW
ERROR: RACK JAM *(example)*

The possible errors are: RACK JAM, TOWER JAM, RACK FULL, UNIT OFF, HALTED, VALVE JAM, DISABLED, and POWER FAIL.
When the sampling sequence ends, the log will display:

PROGRAM FINISHED AT
HH:MM DDMMMYY

When the sampling program has finished (or was stopped) and the 6100 has returned to the standby state, the log will display:

STANDBY STATE AT
HH:MM DDMMMYY

6. If you changed the SETUP section of the program at some point, the log will display the following:
(First screen):

SETUP CHANGED AT
HH:MM DDMMMYY

(Second screen):

LINE LENGTH
XX FT

(Third screen):

SITE ID NUMBER:
12345678980

(Fourth screen):

SET CLOCK
YES NO

(Fifth screen, if clock was changed):

NEW TIME
HH:MM DD MMM YY

(Sixth screen):

RUN DIAGNOSTICS
YES NO

(Seventh screen):

SELECT DISABLE MODE
ERROR SKIP DELAY

7. If you changed the PROGRAM section of the program at some point, the log will display the following:
(First screen):

PROGRAM CHANGED AT
HH:MM DDMMMYY

(Second screen):

SAMPLE PACING:
(flow or time)

(Third screen [flow pacing]):

FLOW INTERVAL:
XXXX PULSES

(Third screen [time pacing]):

TIME INTERVAL:
XX HOURS XX MINUTES

(Fourth screen):

BOTTLES/SAMP EVENT:
X

(Fifth screen):

OF SAMPLE EVENTS
X *(number)*

8. If a start time was entered:
(First screen):

START TIME:
HH:MM DDMMMYY

9. If no start time was entered:

NO START TIME

End of log:

END OF HISTORY LOG
HH:MM DDMMMYY

6100 Volatile Organic Sampler

Section 3 Installation

3.1 Installation Guidelines

⚠ CAUTION

Never install the controller section where there is any possibility of submersion. Water could seriously damage mechanical components inside the controller. Isco will not honor the warranty for any 6100 Sampler that shows evidence of submersion.

There are no other serious restrictions on the installation of the sampler. You must locate the pump and controller no further apart than **100 feet**. Mount the sampler upright, in a stable location so it will not be tipped over. Route the drain hose away from the sampler far enough so the area around the base will not get wet. Avoid placing the controller in very hot locations, as this will speed the melting of the cooling ice in the bottle rack. The sampler cover has two convenient handles you can use to carry the unit and lower it into a manhole. You can suspend the sampler from the ladder in a manhole, or support it on the Isco Equipment Platform. Make installations securely so they will not be at risk from vandals or damage from any other activity in the area.

Figure 3-1 6100 Sampler Suspended With Harness

3.2 Connection to a Flow Meter

If you want to run the sampler in the flow-paced mode (taking samples after a specific volume of flow has passed, as opposed to timed intervals), you must use a flow meter to pace the sampler. Isco offers several models and types of flow meters:

- 4200 Series Flow Meters
- 3000 Series Flow Transmitters
- 4100 Series Flow Loggers
- 2100 Series Flow Modules

The flow meter is designed to send signals to the sampler called flow pulses that indicate a specific volume of flow has passed through the flow stream. You program the flow meter to send one flow pulse to the sampler for whatever volume of flow you have selected. Consult the flow meter instruction manual for information on programming the flow meter. When you program the sampler to take a sample after a specified volume of flow has passed, the sampler will count the flow pulses from the flow meter and take the sample when the proper number of pulses has been received. (You can also take a sample after only one flow pulse.) When the sampler takes a sample, it will send a signal back to the flow meter, indicating a sample event has occurred, and also the bottle number of the sample.

A **flow meter-to-sampler cable** terminated with two, six-pin M/S connectors is available from Isco. Make sure you have the newer flow meter-to-sampler cable. The newer cables have the F pins on the two M/S connectors wired together. Do not use a cable you may have from an earlier application without first checking for continuity between the F pins. Connect either end of the cable to the male six-pin M/S connector on the base of the sampler controller section. This connector has an icon of a flow meter just beneath it. Connect the other end of the cable to the six-pin connector labeled **sampler** on the flow meter.

3.2.1 Power Considerations

It is possible in some instances to power the 6100 and the flow meter from a common power source, thereby eliminating the need for duplicate power supplies. However, you should follow these guidelines:

- The common power source must always be installed on the sampler.
  At times the sampler draws heavy current, so the power source needs to be close to the sampler to deliver the necessary current without significant losses that could occur in the length of a cable. Do *not* attempt to power the sampler from a power source attached to the flow meter.
- Use of a common power source is most practical when you use a deep-cycle battery.
  The best case for the use of a single battery is with an externally-mounted deep-discharge marine or R-V battery. These large batteries have plenty of capacity to run both a 6100 and a flow meter. Though less desirable, you can use the smaller Isco lead-acid or

nickel-cadmium battery in some combinations. However, you should definitely avoid certain combinations.
A **submerged probe** flow meter has the lowest current draw. Next is the **ultrasonic** flow meter. Operation of either of these flow meters with a sampler and a common battery is generally satisfactory, but be aware of the effect of the chart advance speed for the internal plotter. A fast setting for the internal plotter will add significantly to the discharge of the battery.

- Use of a common battery with a **bubbler** flow meter is not recommended, unless you use a deep-discharge R-V battery.
  The bubbler meter has an internal air pump that must run periodically. Thus, it draws a higher average current than the submerged probe or ultrasonic flow meters. Use of a single battery for a 6100 and a bubbler is not recommended, especially if the battery is the nickel-cadmium type, and you have selected a fast setting for the plotter's chart advance. In these instances you should use separate batteries for the sampler and the flow meter.
- Isco does not recommend the High Capacity Power Pack as a common power source.
  Both the sampler and the flow meter contain motors that draw large currents when they start. It is possible in some cases for the initial current to exceed the short-circuit limit inside the regulator of the power supply. Sensing a short, the regulator will limit current, voltage will drop, and this may cause the plotter in the flow meter to jam.
- Isco does not recommend using a common power source with a flow meter of another manufacturer.

3.2.2 Connection to a Non-Isco Flow Meter

You can connect certain non-Isco flow meters directly to a 6100 for flow-paced sampling. The flow meter must have an isolated contact closure of at least 25 milliseconds to provide acceptable flow pulses to the sampler. The frequency of the contact closure must be directly proportional to total flow. Connect the flow meter pulse output to the A and C pins of the Flow Meter connector on the 6100.

Isco also has a six-pin M/S connector wired to a 22-foot cable terminated in two wires. The **black** wire connects to pin **A** and the **white** wire connects to pin **C**. Table 3-1 shows the connections for the Flow Meter connector on the sampler.

Table 3-1 6100 Flow Meter Connector Pins

Pin	Signal
A	+12 VDC
B	Common
C	Flow Pulses In
D	Bottle Number Out
E	Event Mark Out
F	Inhibit In

Note that you will be unable to communicate anything other than the flow pulse contact closure with a non-Isco flow meter. The non-Isco flow meter will not be able to interpret event and bottle number information. If the flow pulse generated by the contact closure on the flow meter is not compatible with Isco's standard, contact Isco's Special Products Department for an appropriate interface device.

Flow Meters with Non-Pulsed Flow Outputs – You can also use the 6100 with flow meters that have outputs other than a flow pulse. One common output type is the 4-20 mA current loop used for many types of industrial control equipment. Of course, you cannot use the 4-20 mA current output directly. You must use the 4-20 mA Sampler Input Interface. This device converts the constant 4-20 mA current into flow pulses acceptable to the 6100.

If you use the 6100 with other manufacturers' flow meters, please note that Isco cannot assume any liability for operation or results obtained with the 6100 and other manufacturers' equipment.

3.3 Event Mark and Bottle Number Timing

The event mark and bottle number are digital signals the sampler generates to send to an Isco flow meter. This digital information is converted by the flow meter to marks and text on the flow meter's plotter chart. Thus, when you review the chart generated by the flow meter, you have a hard copy record not only of level and total flow, but of when the samples were taken (the event marks) and into which bottles the samples were placed (the bottle number).

3.4 Sampling Enable/Disable

As stated, it is possible to enable or disable the sampler from the flow meter. Once the sampler is in the active mode, it is possible to inhibit (disable) it from the flow meter.

You can also disable the sampler externally from the flow meter. Taking the level low on pin F of the sampler's flow meter connector will inhibit the sampler in the active state (running a sampling program). The sampler display will show the following message while the sampler is inhibited:

SAMPLER DISABLED
HH:MM:SS *(time)* DDMMMYY *(date)*

What the 6100 does for a sample event programmed to take place when the sampler is disabled depends on what selection you made in Setup for the following:

SELECT DISABLE MODE
ERROR SKIP DELAY

If the sampler is in the active mode, that is, running a program, and is disabled and then re-enabled between two sampling events, no effect will appear in the sampling. The sampler will take both samples on schedule.

3.4.1 Programming Example for Enable/Disable

The sampler is programmed to take four samples at one-hour intervals starting at 1:00 (13:00). Assume that the sampler is disabled twice during the program, once between 1:50 and 2:30, during which it should take the 2:00 sample, and again between 3:20 and 3:40, before the 4:00 sample. What will happen depends on the DISABLE MODE you select in Setup. The following three sections discuss the effect each of the disable modes will have on the same sampling program.

If you select the Error mode in disable, the following will occur: – The sampler takes its first sample at 1:00, right on schedule. At 1:50, the sampler is disabled, so it does not collect a sample at 2:00, when it is scheduled to take the second sample. Then the sampler is re-enabled at 2:30. It takes a sample at 3:00 because it is enabled. At 3:20 the sampler is disabled until 3:40, at which time it is re-enabled for the rest of the program. It takes a sample at 4:00.

Now, let's go back to 2:00 when the sampler was scheduled to take a sample, but couldn't because it was disabled. Even though no sample is collected, the sampler will log a sample event in the history log at 2:00. An error will be logged also (disabled). Only three bottles will be filled. The second sampler disable occurs between two scheduled sampling events, so it has no effect.

If you select the Skip mode in disable, the following will occur: – Sample one is collected normally. Since the sampler is disabled at the time it is supposed to take sample two, it will skip the 2:00 sample time. Instead it will take the second sample at 3:00 when the next sample is scheduled to be taken. It will go on to take a sample at 4:00, and then because it is programmed to take four samples, it will take the fourth sample at 5:00 rather than at 4:00 because that is the next available time (after the

appropriate interval of one hour between samples has passed). As in the Error mode above, the second sampler disable falls between the sampling events, so it has no effect on the program.

If you select the Delay mode in disable, the following will occur: – Sample one is collected at the normal time. At the time for sample two (2:00), the sampler is disabled. So, sample two is not taken until 2:30, when the sampler is re-enabled. Since sample two was actually taken at 2:30, and the program calls for a one hour interval between samples, the unit will try to take a sample at 3:30. However, remember that between 3:20 and 3:40 the sampler was again disabled. This time the second disabling will have an effect. Since the sampler was still inhibited at 3:30, the third sample will not be taken until 3:40, when the sampler is re-enabled. Again, since the program calls for a one-hour interval between samples, the sampler will take sample 4 at 4:40.

3.4.2 Sample Considerations

There are certain conditions that can affect the quality of the samples gathered by the 6100. Most of these are items of common sense, but they will be discussed here to help ensure that your installation takes accurate and representative samples.

As much as possible, samples should be free of air, other than what is normally dissolved in the stream. Avoid situations that cause the sample to be unrepresentative by either adding or removing air from the stream.

Always install the pump in a place where the flow is neither stagnant nor overly turbulent. Where flow is stagnant, the sample will not be representative. Where flow is too turbulent, the sample will contain much undissolved air, which will bubble out of the solution after the sample is taken.

An example of stagnant water would be a sample from the bottom of the channel directly behind a weir. An example of excessive turbulence would be the outfall from a weir, or any other discharge situation where the water is falling with enough force to create bubbles where it hits the stream.

Always install the pump so the inlet is completely submerged throughout the pumping cycle, or it will pump air along with the sample.

The sample bottles have Teflon® caps. Teflon typically cannot be wetted by liquids with high surface tension. An example of this type of liquid would be laboratory-grade deionized water. If the sample cannot wet the Teflon caps, air bubbles may remain on the surface.

Do not ice the sample rack when you are taking samples from very hot outflows, such as from a laundry. It has been found that the sudden cooling of these hot samples causes gases to bubble out of solution during the cooling process. Instead, let the samples cool to room temperature first, and then ice the sample rack to finish the cooling process.

3.5 Handling the Samples

When you have finished a sample program and all 24 bottles are full, you will need to ship the rack to the laboratory for analysis.

3.5.1 Transporting the Bottle Rack

To preserve the integrity of the samples, you must keep them cold until they reach the lab. Heat readily drives volatile organics from a solution. If you intend to transport the bottle rack to the lab yourself, you can simply drain the bottle rack by turning it on its side and letting the water run out. Hold the stainless steel cover in place while draining the rack to keep the bottles from falling out. Replace the melted ice with new chipped ice and replace the cover to hold the ice in place. Put the bottle rack in the styrofoam carrier and pack ice chips in the area between the bottle rack and the inside walls of the styrofoam carrier.

3.5.2 Shipping the Bottle Rack

To ship the bottle rack to the testing laboratory, follow the same procedure as described above, except for the use of ice. After the samples are collected, drain the melted ice from the bottle rack. Remove the stainless steel cover plate. Pack the inside of the bottle rack with **gel-packs**, a product that absorbs heat like ice, but is packaged in plastic bags that remain flexible and leak-free. Place the bottle rack inside the styrofoam carrier and pack more gel-packs between the bottle rack and the walls of the styrofoam carrier. Replace the stainless steel bottle rack cover. Put the lid on the styrofoam carrier. Place the carrier, with the bottle rack inside, in the cardboard shipping carton Isco originally shipped the carrier in.

> ☑ ***Note***
>
> Do not pack the bottle rack with ice if you need to ship it to a laboratory. The styrofoam carrier cannot be adequately sealed, and the cardboard shipping carton is not waterproof. Use only gel-packs for cooling. Additional bottle racks, styrofoam carriers, and shipping cartons are available from Isco.

3.5.3 Cleaning the Bottles

After the bottle rack has been returned from the testing laboratory, you will need to clean the bottles and reload the rack. Cleaning the bottles is an easy procedure, but you must disassemble them first.

1. Remove the bottles from the bottle rack.
2. Remove the stainless steel valve stem from each bottle. (Hold the bottle in one hand and pull the stem firmly toward you with the other hand. Turn the handle back and forth while you are pulling it toward you.
3. Unscrew the cap from the bottle to free the valve body.
4. Push the valve body out of the cap and remove the O-ring.

☑ Note

The construction of the cap keeps the O-ring from ever contacting the sample. In this application the O-ring serves as a pressure seal. It is not necessary to sterilize the O-ring. Also, some solvents and detergents could attack the O-ring.

5. Clean all parts in an autoclave or with appropriate detergents.

☑ Note

If you use detergent or solvent to clean the bottles, make sure the detergent or solvent is non-residual. Non-residual means that no trace of the detergent will remain on the glass after rinsing and air-drying. Cleaning agents that leave any residues could cause misleading results when you use the bottles to take future samples.

6. After cleaning, allow the bottles, caps, valve bodies, and stems to air dry in a clean, dry environment.
7. Reassemble the bottles, lids, and valves, wearing rubber gloves to avoid contaminating them.
8. Put the O-ring on the top of the valve body.
9. Put the cap over the valve body.

☑ Note

The O-ring must be between the cap and the valve body. Do not place the O-ring between the valve body and the bottle.

10. Screw the cap down onto the bottle.
11. Reinsert the valve stem into the valve body by pressing and twisting the valve stem into the valve body at the same time. Turn the valve stems so their final position is perpendicular (90°) to the bottle.
12. Reassemble the bottle rack with the cleaned bottles. Make sure all the valves are closed. It is very important to keep the valve stems closed to prevent contamination.

⚠ CAUTION

The bottles used in the 6100 are borosilicate (hard) glass, also sometimes known by the trade name of Pyrex. Their capacity is 40 ml. If you use bottles from a source other than Isco, the bottles must have the identical length, diameter, and cap thread as those supplied with the sampler. For safety, they should also be made of hard glass. Failure to use identical bottles may result in crushed bottles or a damaged needle assembly, and will result in an inoperable sampler.

6100 Volatile Organic Sampler

Section 4 Maintenance and Service

4.1 Pump Bladder Replacement

The bladder used in the 6100 pump will eventually break from the repeated pressurization and decompression. You can field-replace the bladder if you purchase a special tool from Isco to release the two metal bands that clamp the bladder to the pump body. The special tool is called the **Oetiker tool**, and it resembles a pair of pliers or crimping tool with a very fine point at the end of each jaw. No other tools should be necessary.

1. Ensure that the unit is turned off.
2. Retrieve the pump from the flow stream.
3. Disconnect the steel support cable from the pump.
4. Remove the tubing from the two fittings on the top of the pump by pulling on each tube, one at a time, as you press in on the outer red flange of each fitting.
5. Wash the pump housing if it is greasy or coated with sediment. Dry it so you can get a good hand grip on the pump body and the two knurled ends.

⚠ WARNING

Never attempt disassembly of the pump while it is connected. If the pump is still pressurized, disassembly could result in serious personal injury. Compressed air remaining inside the pump could make internal parts burst out of the end of pump end with great force. Always point the pump away from you when disassembling it.

6. Holding the pump by the body, unscrew the bottom end. The end pieces are knurled to help you get a firm grip. The ends should only be hand-tightened. There are O-rings that form a seal between the ends of the pump and the body. If sediment or scale have made the ends too tight to break free with hand pressure, you can use a pair of adjustable pliers to release them, but normally this should not be necessary. If you must use tools to disassemble the pump, it means the pump was assembled too tightly in the first place. **When reassembling the pump, never use tools to tighten the ends.**
7. When you remove the bottom piece, note the light coil spring and ball inside. If you need to clean the strainer, set these pieces aside in a safe place where they will not get lost.

8. If the strainer is clean, there is no need to remove the ball and spring. Set the bottom piece aside, upright, with the ball and spring inside. Do not lose the ball and spring; the pump cannot work without them. (The ball and spring form the check valve that keeps water from escaping back into the flow stream when the pump is repressurized.)
9. You can clean the strainer, if necessary, by back-flushing it with hot water through the lower end of the pump. In extreme cases, a grease-dissolving detergent may be helpful. It is not necessary to unscrew the strainer from the bottom end piece of the pump.
10. Unscrew the top end of the pump (pump head) and pull the bladder assembly and pump head out of the pump body. Separate the pump head from the bladder assembly, noting the position of the spring between the bladder assembly and the pump head.
11. When the bladder assembly is free of the pump, pull it out of the pump body from the top.
12. Use the Oetiker tool to release the two stainless steel straps that hold the bladder in place at either end of the pump. This is done by locating a point on the strap where the inner and outer sections of the strap overlap, about 1¼ inches from end of the outer section of the strap. See Figure 4-1.
13. Find a raised cylindrical bump on the inner strap that is slid part way under a similar bump on the outer strap. The jaws of the tool fit into the two holes at the ends of these bumps. This is the only place where the tool jaws will fit properly. If the tool does not seem to fit, you have not found the right place. Fit the tool into the two holes and gently move the tool handles close together. You will see the bump on the inner strap slide further under the bump on the outer strap.
14. Close the handles of the tool and the outer end of the strap will release from the catch that secured it to the inner section. To reattach the strap, hold the strap open with the tool and press the loose end back down over the catch on the inner strap with your finger. Practice this a few times to become familiar with opening and closing the strap.

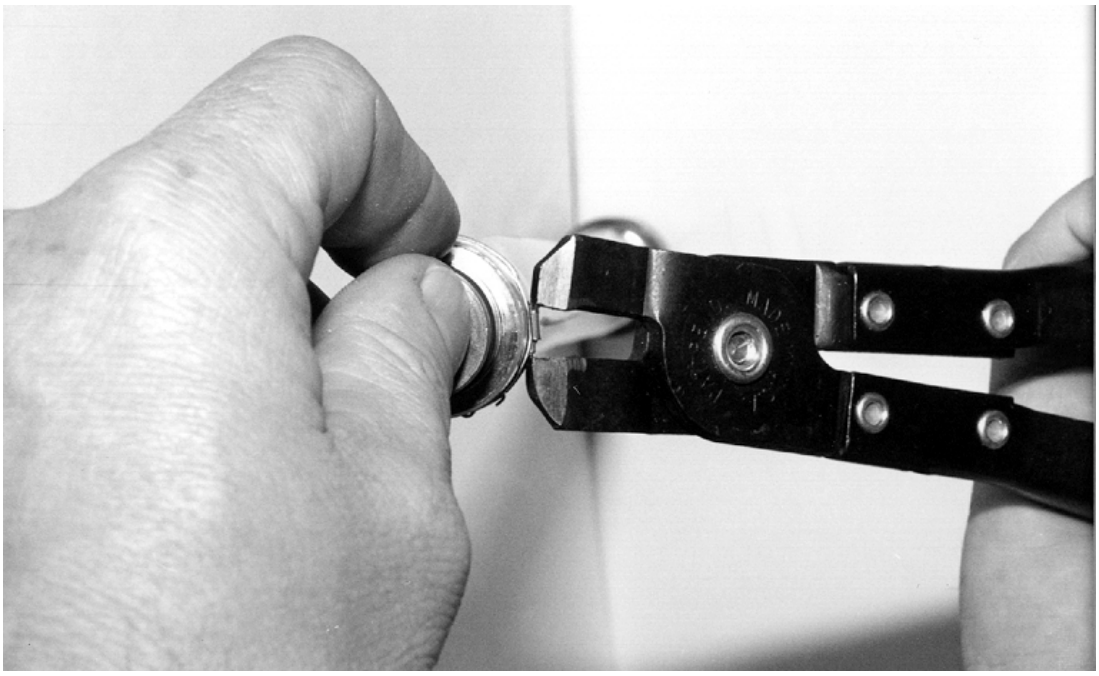


Figure 4-1 Removing the Retaining Ring With the Oetiker Tool

15. After you have released both straps, slide the old bladder off the lower end of the bladder assembly. This may require slicing the bladder to remove it from the upper and lower ends of the assembly. Care should be taken not to damage the O-rings on the bladder ends and not to separate the center tube from the bladder ends. To reassemble, slide the new bladder over the lower end of the center tube assembly until it is flush with the shoulder on the lower end. There is no top or bottom to the bladder, it will work correctly either way. Reinstall the clamps with the Oetiker tool over the top of the O-rings. Trim any excess bladder material that extends beyond the upper shoulder on the bladder end.
16. Slide the repaired bladder assembly back inside the pump body. Install the spring in the upper end of the bladder assembly and screw the pump head into the pump body. Check the bottom end of the pump to see that the check ball and spring are in place. The ball goes over the hole in the bottom section and the spring goes over it. Screw the bottom end into the pump body. **Do not use any tools to tighten the ends of the pump.** The O-rings make this unnecessary. The reassembled pump is now ready to be placed back into the flow stream.

⚠ CAUTION

When reinserting the bladder assembly, avoid scraping the bladder on the threads of the body. Also, keep the bladder from being twisted during reassembly.

17. If you have replaced the bladder after a bladder failure, purge all water out of the air system before resuming operation. Drain the lines. Then, with the air line attached only to the 6100, use the cycle pump control to purge any water that was trapped in the air pump.
18. After reinstalling the pump, run five pump cycles before actual use.

4.2 Replacing the Needle Assembly

It is possible to replace the needle assembly in the field, if necessary. Before attempting this, please read the following warning:

⚠ WARNING

Disconnect power completely before attempting needle replacement. The needle drive mechanism will cause serious injury to your hand if the sampler starts while you are working on it.

1. Remove the bezel. The bezel is the plastic frame that holds the keypad secure. There are ten screws that you must remove.
2. The tower housing below the bezel consists of two pieces that fit together like a clam shell. Remove the front half of the tower housing. The two sections of the tower housing fit together inside an H-shaped molding. There are four screws that hold the front on. You should be able to see the needle assembly clearly after removing the housing.
3. The needle assembly consists of the needle, a heavy coil spring, three long slide rods, and four plastic knurled rings. These rings are the needle mounts.

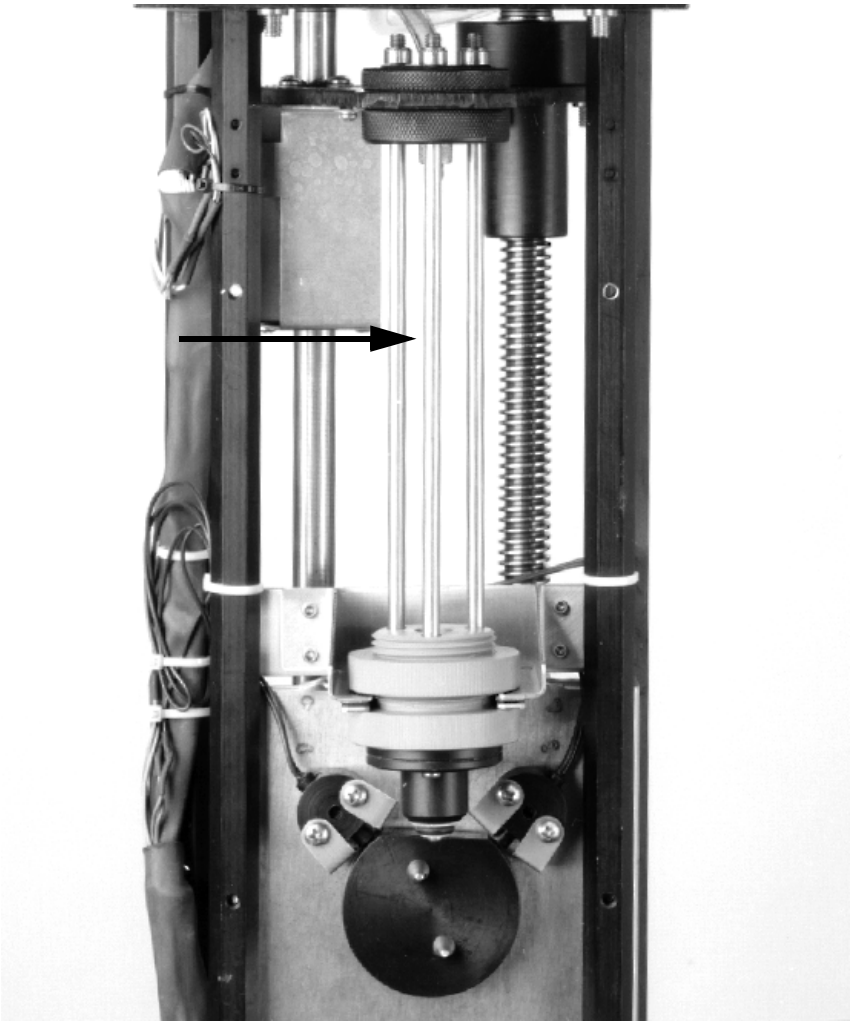


Figure 4-2 Location of Needle Assembly in Tower Mechanism (Needle and Housing Removed)

4. To remove the needle assembly, disconnect the sample hose from the top of the needle and the overflow hose from the bottom. Loosen the guide nut (the top gray plastic ring in the middle of the needle assembly). Push up on the ball on the lower end of the needle assembly to compress the spring and remove the top retaining nut.

☑ Note

There is spring pressure on the assembly forcing it down. Hold the assembly up while removing the nut then release it slowly to prevent damage to the needle assembly. When pressure is released, remove the assembly from the tower.

5. Remove the needle from the assembly by removing the three screws holding the guide rods to the needle on the bottom. DO NOT loosen the retaining nuts on the top end

of the slide rods. Pliers may be required to hold the slide rods while removing the screws. Remove the slide rods and unscrew the needle from the top needle mount, then remove the guide and spring.

6. Reassemble in the reverse order. Ensure that the needle assembly is seated against the top mount before tightening the nut. Tighten the gray guide nut in the middle of the needle assembly until it contacts the mount. The assembly should still be able to move with light pressure applied.

> **☑ Note**
>
> When reassembling the needle and tower, do not use tools to tighten the plastic mounting rings. You only need to finger-tighten them. You can use pliers to tighten the needle into the top mounting ring, but do not apply excessive force.

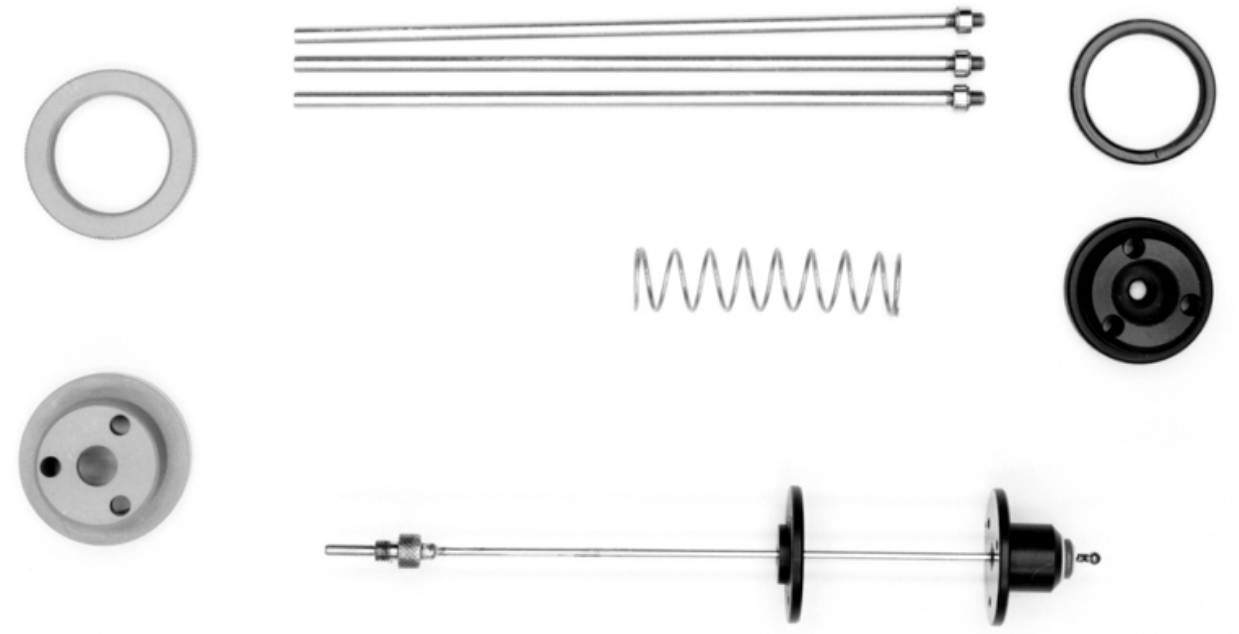


Figure 4-3 Needle Assembly Parts

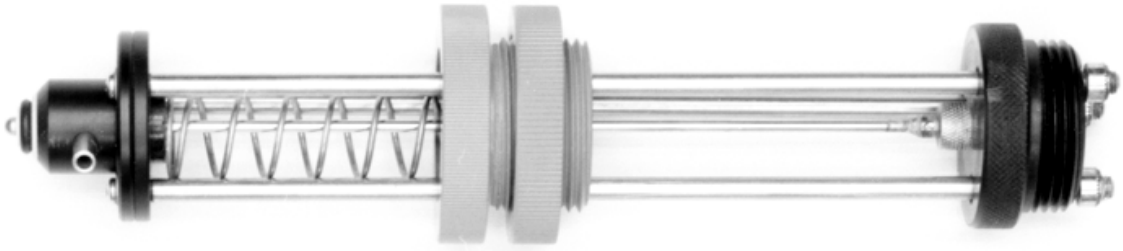


Figure 4-4 Needle Assembly Complete

4.3 Hard Reset

The term *Hard Reset* refers to a feature that allows you to de-program the 6100 to the factory-installed default program. This is the program Isco installs to test the unit at the factory. The usual reason for doing a hard reset is when the microprocessor locks up and you cannot access the program to make changes or run an existing program.

⚠ CAUTION

A hard reset will erase all programming selections you have made. It will also erase all entries made to the history log. Record all program settings and stored data before performing a hard reset.

To Hard Reset the 6100:

1. Turn the unit off with the **On/Off** key.
2. Press and hold the **9** and **Right Arrow** keys at the same time.
3. While still holding the **9** and **Right Arrow** keys down, press and hold the **On/Off** key until the sampler starts to beep.
4. Release the **On/Off** key.
5. Release the other keys.
6. Turn the unit back on with the **On/Off** key.

4.4 Desiccant Bags

The 6100 has two desiccant containers inside to protect the electronics from moisture damage. One is located inside the base of the controller. The other is located beneath the control panel assembly.

Both units are deep inside the unit and will generally last a long time. There is an indicator on the base by the tower, with a window and numbers inside, that shows the condition of the desiccant. The numbers refer to the relative humidity inside the enclosure, with **20** standing for 20%, **30** standing for 30%, etc. As long as the window looks blue, the desiccant is still functioning.

When the window turns pink around all three numbers, the desiccant needs to be replaced, as humidity inside the enclosure has exceeded 40%. Replacement desiccant bags are available from Isco.

⚠ CAUTION

You must disassemble the controller to access the desiccant. Mechanical and electrical components will be exposed in the process. Do not disturb the wiring or change the mechanical linkages in any way or you may cause substantial damage to the sampler.

4.4.1 Replacing the Desiccant Bags

Isco suggests replacing both desiccants at the same time. To replace the desiccant in the base, do the following:

1. Remove the cover from the sampler.
2. Disconnect the power source.
3. Remove the 12 screws around the edge that attach the sampler's chassis and tower to the base.
4. Lift the chassis out of the base and carefully turn it over. The electronics are housed in the rectangular aluminum enclosure on the back side.
5. The desiccant cartridge is located on the side of the rectangular aluminum enclosure opposite the electrical connections. Remove the desiccant cartridge by unscrewing the large hex nut.
6. The cartridge can be regenerated by removing the desiccant and replacing it with new or regenerated desiccant. Remove the desiccant by unscrewing the plastic tube from the hex nut. Never try to regenerate the desiccant while it is still inside the plastic cartridge.
7. Reassemble the cartridge and the sampler in the reverse order.

Isco supplies two different chemicals in the cartridges. Before regenerating them, you must identify the chemical used with your unit. Both chemicals are blue when activated and pale pink to amber when saturated.

- One chemical looks like irregular chips or flakes of tinted plaster. This is anhydrous calcium sulfate and you regenerate it by heating at 400° to 440°F (200°-225°C).
- The other chemical looks like glassy beads or pellets. This is silica gel, and you also regenerate it by heating, but at a lower temperature, 212° to 350° (100° to 175°C)

MSDS (Material Safety Data Sheets) for these chemicals are located in Appendix C.

To replace the desiccant bag under the keypad, do the following:

1. Remove the ten screws attaching the bezel to the keypad and remove the plastic bezel.
2. Lift the keypad assembly out of the tower housing. Do not disconnect any of the wiring.
3. The desiccant bag is in the well beneath the keypad. Remove and replace the bag.
4. Reassemble the unit in reverse order.

4.4.2 Regenerating the Desiccant Bags

You should recharge the desiccant bag when the area marked **30** on the paper humidity indicator turns pink.

⚠ WARNING

Desiccant may produce irritating fumes when heated. (Material Safety Data Sheets for both chemicals are in Appendix C.) Leave the room while heating the desiccant.

1. Remove the bag from the 6100 as described in the previous section.
2. Place a piece of brown paper on a flat metal sheet. You can use a brown grocery sack and an ordinary cookie sheet.
3. Place the bags on the brown paper. Do not stack the bags on top of each other, nor allow them to touch.
4. Place the tray in a vented, circulating forced air, convection oven in a well-ventilated room. Allow two inches of air space between the top of the bags and the next metal tray above the bags.
5. Keep the tray a minimum of 16 inches from the heating element. Heat the bags at a temperature of 240° to 250 °F (116° to 121°C) for 12 to 16 hours.
6. At the end of the time period, remove the bags and place them immediately in an airtight container for cooling.
7. The desiccant will recharge to 80 – 90% of its previous capacity. After several recharges, the desiccant bag may have lost enough capacity to require replacement.
8. Some bags can have the temperature and the recharging time for the desiccant printed on the bag. If the values printed on the bag differ from those given above, use the temperature and time printed on the bag.

4.5 Flash Memory and the UPDATE Disk

Many Isco instruments use the type of memory called a Flash EPROM. Unlike earlier EPROMs that require UV erasure and were not easily field-replaced, the Flash EPROM lets you upgrade the software in the instrument without opening the unit or returning it to the factory. You can now update the software with a disk from Isco, an IBM®-compatible personal computer and a connect cable.

The disk contains UPDATE, a program specifically for flash memories, and a set of software files to update the Flash EPROM.

Each disk is labeled with:

- The instrument series number
- The software revision number for each instrument in the series
- The part number of the disk

4.5.1 Getting Started

The following instructions assume that:

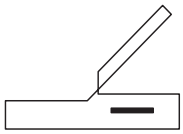
- You have a Computer Connect Cable. If you do not have the cable, order it from your sales representative or the factory. For more detailed information about hardware requirements, see Table 4-1 on page 4-13.
- You are familiar with Microsoft® Windows®. FLASH UPDATE uses the standard Windows user-interface for mouse and keyboard commands. If you are unfamiliar with DOS or Windows, please read your DOS or Windows user manuals.

4.5.2 Before Running FLASH UPDATE

The windows in FLASH UPDATE contain all the instructions you need to update the instrument. However, there are a few things to consider before running the program.

- **Updating your instrument erases the data stored in its memory.** This includes all readings and most of the program settings. FLASH UPDATE replaces most program settings with factory default settings. Before running the program, collect the data and record your program settings. Then, after updating the software, reprogram the instrument.
- **If you have Flowlink, Isco strongly recommends using it to update the 6100.** Flowlink lets you collect the data stored in the instrument before updating the software. It also leaves the program settings in the instrument unchanged, eliminating the need for reprogramming. Then Flowlink updates the software. It uses the update files on the FLASH UPDATE disk and disregards the FLASH UPDATE program. Refer to the Flowlink Help files for more information. Use FLASH UPDATE only if you do not have Flowlink available.
- The instructions in the following section, Running FLASH UPDATE, assume you are running the program from the update disk. However, you may prefer to copy the disk's contents to your hard disk. Before copying the disk, create a new directory for the FLASH UPDATE program and the update files. **The program and the update files must be in the same directory.** Furthermore, that directory must be the current directory when you run the program.
  If you receive several update disks over time, copy the update files and the program when copying the contents of a disk. This ensures that you have a current version of FLASH UPDATE as well as the new update files.
  Depending on your selection in the preferences window, you may see the window in the margin (left) listing all files in the directory. This window appears only when the directory or disk contains more than one version of the update files and the Preferences option for Show Update File is "All Update Files." (See Section 4.5.4 About Preferences.)

4.5.3 Running FLASH UPDATE



Interrogator Port Icon

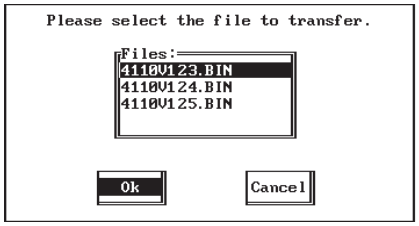
1. Connect the Computer Connect Cable to your computer's serial port and the instrument's interrogator connector (marked with the Interrogator icon).
2. Insert the update disk in the floppy disk drive.
3. Change the DOS prompt to the floppy disk letter prefix.
4. At the DOS command line, type: UPDATE. The first window in FLASH UPDATE will be the Introduction window. Read it carefully before continuing.

4.5.4 About Preferences

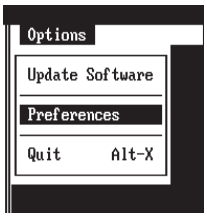
FLASH UPDATE has a set of factory settings that appear in Figure 4-5. Change them when your computer requires different settings.

To change preference settings:

1. Click Cancel in the Introduction window.
2. Select Preferences from the Options menu. The notes in Figure 4-5 explain the selections in the window. When you have selected your preferences, select OK.
3. Select Update Software from the Options menu, and follow the instructions in each window.



This window appears only when the directory or disk contains more than one version of the update files and the Preferences option for Show Update File is “all Update Files.” It lists the update files in the directory. The first four numbers in the file name are the instrument’s model number. The numbers following the “V” are the software version. If several versions appear in the window, select the version with the highest number unless otherwise instructed by Isco Technical Service.



Options Menu

Select the COM port that corresponds to the serial port used for the Computer Connect Cable.

Select Newest Version to see only the most recent update files in a directory. Select All Update Files to see all update files.

Select the color scheme that best matches your monitor.

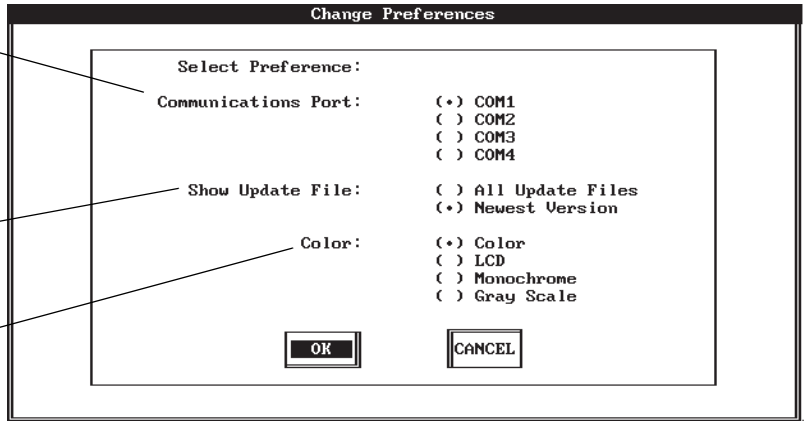


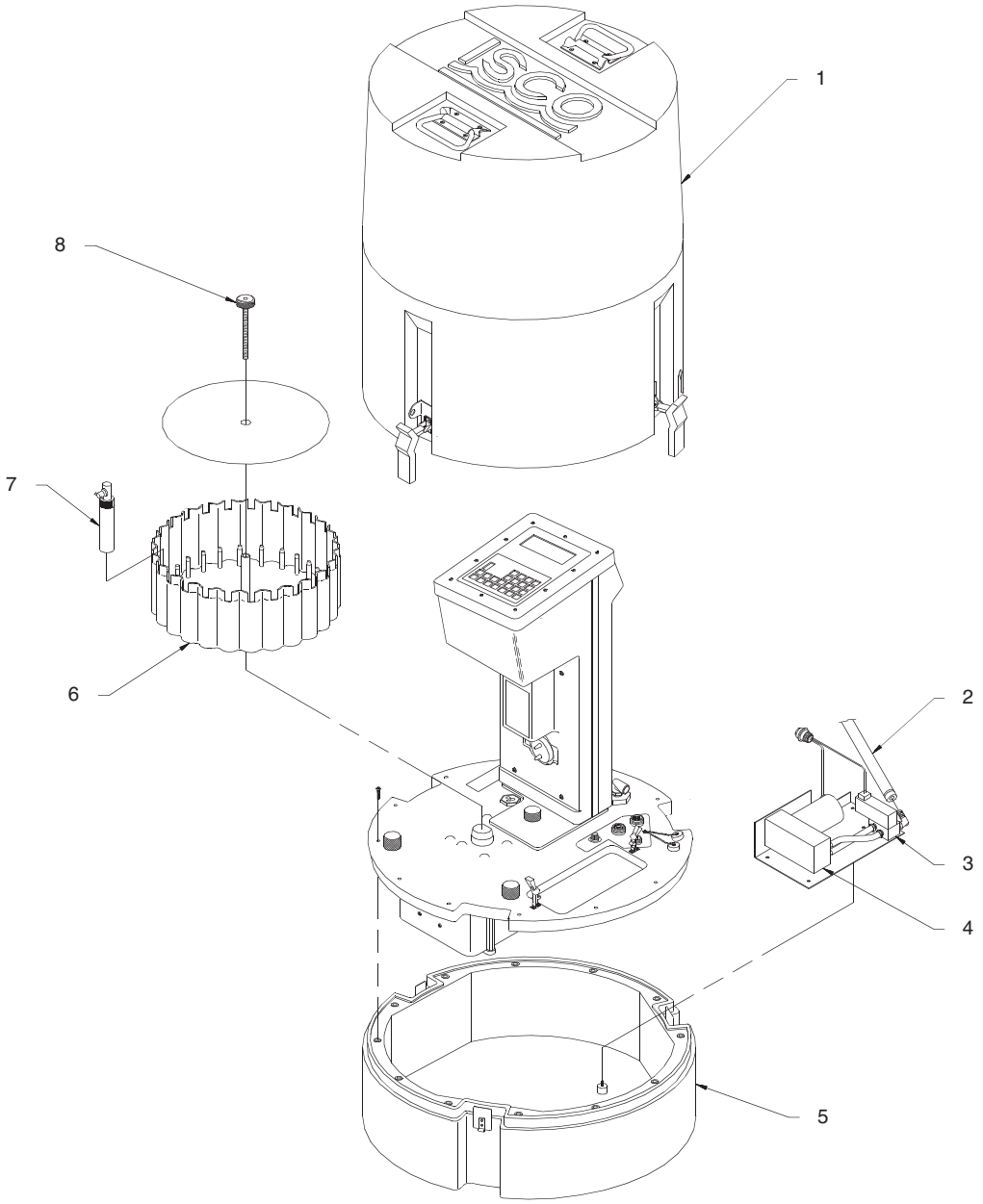
Figure 4-5 Preferences Window

Table 4-1 Minimum DOS and Computer Hardware Requirements for FLASH Update

DOS	DOS 3.3 or later versions	DOS 5.0 or later versions recommended. Microsoft Windows not required.
CPU	80286, 80386, 80486	IBM PC or compatible. 80386 or 80486 recommended. (Must operate at 19,200 baud when communicating through the serial port.)
	640 kilobytes RAM (Random Access Memory), minimum	
	Serial port	For connecting the computer to Isco flow meters, flow loggers, or samplers.
Keyboard	Any compatible keyboard	
Hard disk	Not required.	
Floppy disk	$3^1/_2$-inch floppy drive (1.44 mega bytes)	At least one floppy disk drive.
Monitor	LCD, Gray Scale, Color, or Monochrome	IBM CGA, EGA, or VGA compatible.
Mouse	Microsoft®-compatible mouse	Optional. Mouse recommended.
Cabling	Isco Computer Connect Cable (9-pin: part #60-2544-044) (25-pin: part #60-2544-040)	For connecting the computer to flow meters, flow loggers, or samplers.

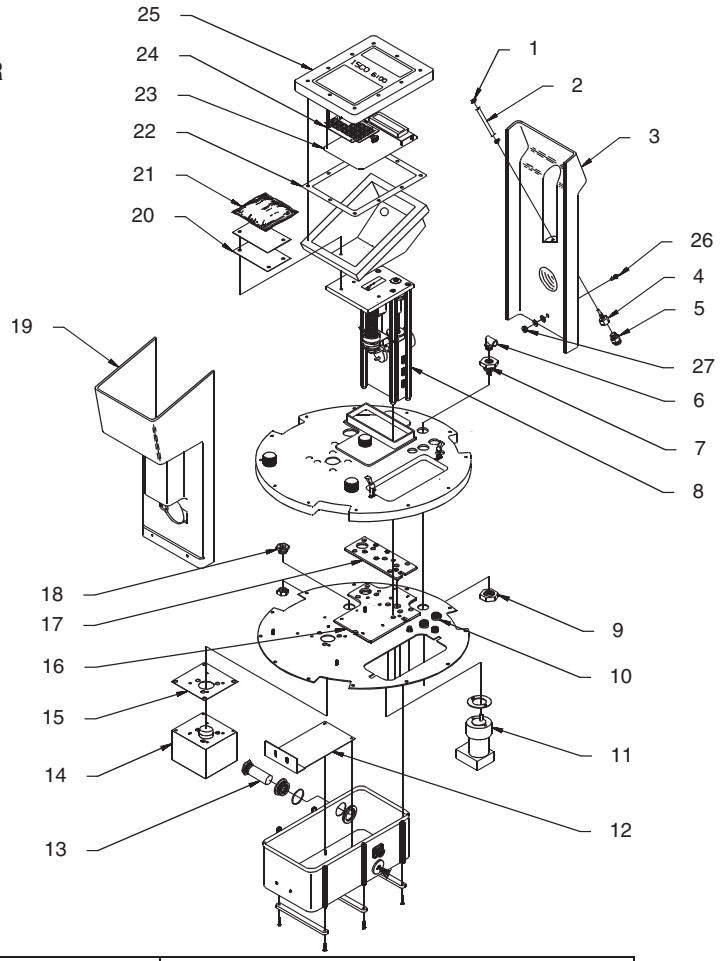
6100 VOS Sampler

Appendix A Replacement Parts List



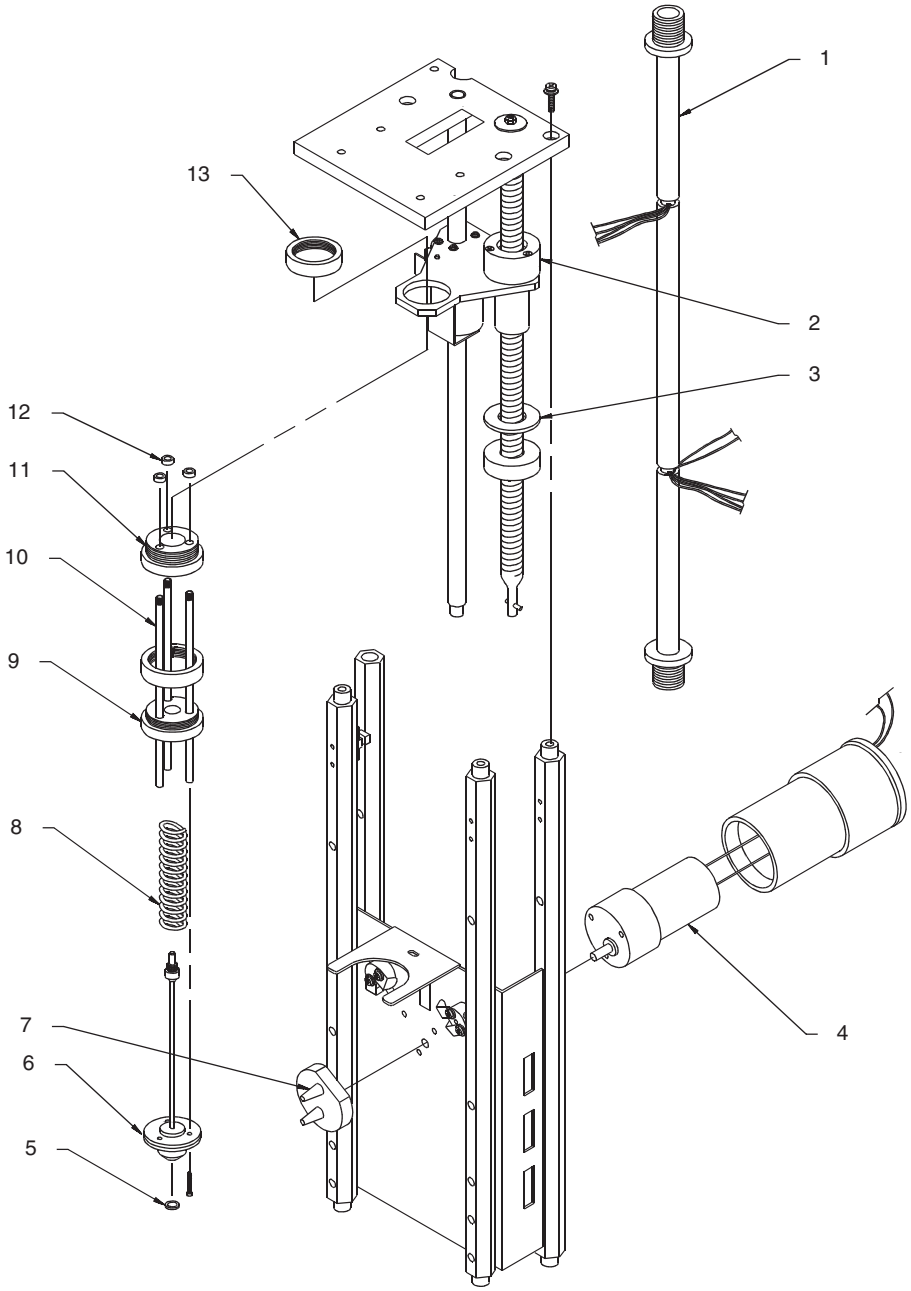
ITEM	INVENTORY NO.	DESCRIPTION
1	606004009	TOP COVER ASSEMBLY
2	090100801	HOSE MULTIPURPOSE 1/4" ID DUROFLEX
3	209009509	VALVE SOLENOID 5 PORT
4	606003089	COMPRESSOR MOD
5	606004056	BASE TUB ASSEMBLY
6	606003011	BOTTLE RACK
7	686000003	REPLACEMENT SAMPLE VIAL VALVE
8	606004033	BOTTLE RACK NUT ASSEMBLY

TOWER & CENTER ASSEMBLIES



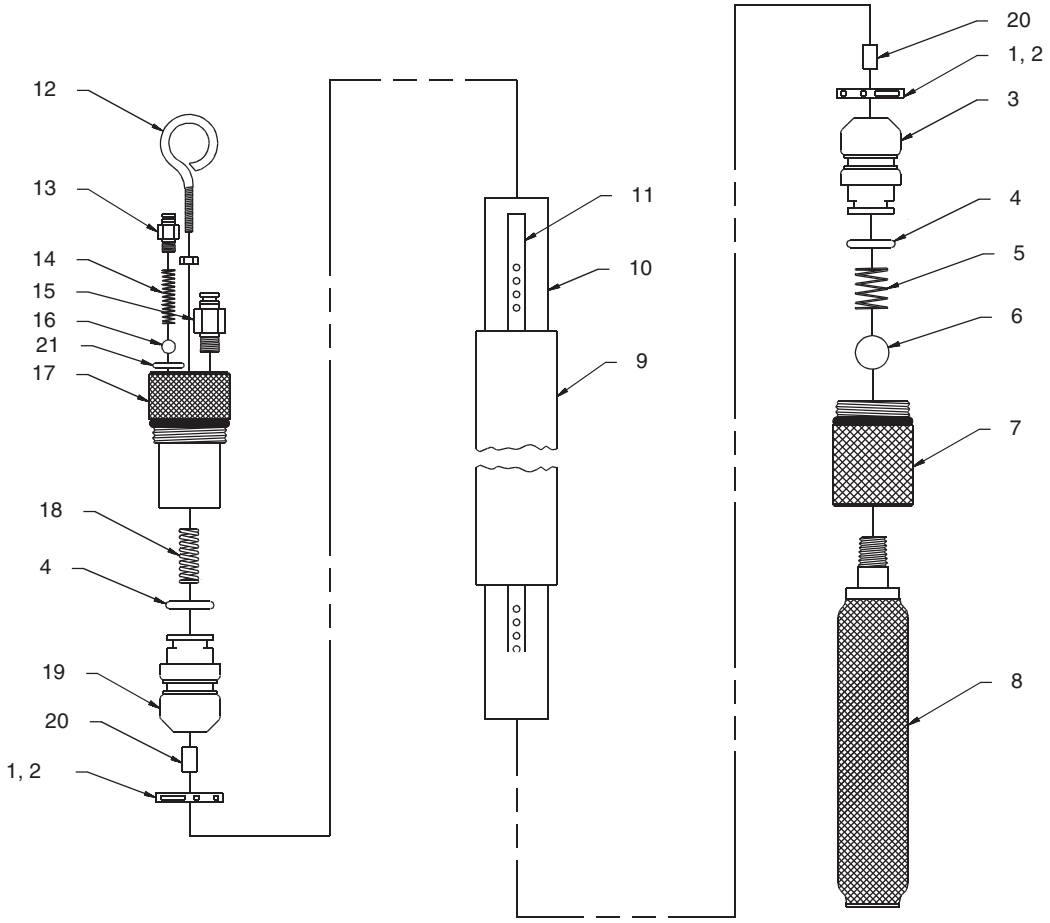
ITEM	INVENTORY NO.	DESCRIPTION
1	149200007	CLAMP HOSE SPRING STL .21 ID
2	606003212	SAMPLE TRANSPORT TUBING INT
3	606003015	TOWER SHELL - REAR
4	606003206	FITTING - SAMPLE IN
5	209016803	CONN. M SST 1/8" MPT X 1/4" OD TUBE
6	209016733	ELBOW MALE BRS 3/8" TUBING X 1/4" NPT
7	616003106	FITTING - AIR OUT - BLACK ANODIZED
8	606004055	TOWER SUB ASSEMBLY
9	616003113	AIR FITTING NUT - BLACK ANODIZED
10	606004011	WIRING ASSEMBLY - BASE
11	606004021	TOWER DRIVE MOTOR ASSEMBLY
12	606004040	DRIVER PCB ASSEMBLY
13	490001001	DESICCATOR 3"
14	606004045	BOTTLE RACK DRIVE ASSEMBLY
15	606003190	DISTRIBUTOR GASKET
16	606003188	BOTTOM TOWER GASKET
17	606003191	TOWER PLATE GASKET
18	490000656	HUMIDITY IND. PLUG PLASTIC
19	606003153	TOWER SHELL - FRONT
20	606003066	BACKING PLATE GASKET
21	099000200	DESICCANT BAG 8 OZ.
22	606003065	BEZEL GASKET
23	606004015	CPU WITH I/O PCB ASSEMBLY
24	606004013	KEYBOARD PCB ASSEMBLY
25	606003012	BEZEL RING - CONTROL PANEL
26	603233014	AIR FITTING
27	603233015	FITTING NUT

NEEDLE & TOWER ASSEMBLY



ITEM	INVENTORY NO.	DESCRIPTION
1	606004043	WIRING ASSEMBLY - PANEL
2	606003170	LEAD DRIVE SCREW NUT
3	606003171	COLLAR WASHER
4	606003217	MOTOR GEAR MOD
5	202300107	O-RING VITON #107
6	606004057	NEEDLE SUB ASSEMBLY
7	606003151	PIN TAPER
8	203015700	SPR COMP SST .72OD .055WD 3.00
9	606003237	NEEDLE GUIDE LOWER
10	606003235	NEEDLE FRAME SLIDE ROD
11	606003076	ROD GUIDE NEEDLE MT
12	606003236	NUT SLIDE ROD
13	606003169	RETAINING NUT NEEDLE GUIDE

BLADDER PUMP



ITEM	INVENTORY NO.	DESCRIPTION
1	202300211	O-RING #211 - VITON
2	489001602	SST EAR CLAMP 28.4MM X 5MM WIDE
3	616003239	CENTER TUBE END LOWER PSVTD
4	202100208	O-RING VITON #208 5/8" ID X 1/8" ID
5	606003097	SPRING - LOWER CHECK BALL
6	004950075	SST BALL 3/4" DIA. T316
7	616003056	PUMP INLET - PASSIVATED
8	606004051	SCREEN ASSY 60 MESH PLEATED
9	616003055	PUMP BODY - PASSIVATED
10	606003059	BLADDER 1-1/8" ID X .020 WALL FEP
11	616003058	CENTER TUBE
12	235919932	SST EYE BOLT 1/4-20 X 2-1/2"
13	209016803	CONN M SST 1/8" MPT X 1/4" OD TUBE
14	606003098	SPRING - UPPER CHECK BALL
15	209016802	CONN M BRS 1/4" MPT X 3/8" TUBE
16	004950025	SST BALL 1/4" DIA. T316 GR 100
17	616003244	PUMP HEAD - PASSIVATED
18	203012401	SPRING COMP SST .360 X .059
19	616003230	CENTER TUBE END UPPER PASS
20	606003238	BUSHING CTR TUBE LARGE
21	202307208	O-RING VITON #009

6100 Volatile Organic Sampler

Appendix B General Safety Considerations

The following procedures are those used by Black & Veatch, a respected consulting firm, and are published here by their kind permission:

"Field personnel must keep safety uppermost in their minds at all times. When working above ground, rules of common sense and safety prevail. However, when entering manholes, strict safety procedures must be observed. Failure to do so could jeopardize not only your own life, but also the lives of other crew members.

B.1 Hazards

There are many hazards connected with entering manholes. Some of the most common hazards are:

1. Adverse Atmosphere
   The manhole may contain flammable or poisonous gases or the atmosphere may be deficient in oxygen. Forced ventilation may be necessary.
2. Deteriorated Rungs
   Manhole steps may be corroded and not strong enough to support a man. It may be difficult to inspect the rungs because of poor lighting.
3. Traffic
   Whenever manholes are located in the traveled way, barricades and warning devices are essential to direct traffic away from an open manhole.
4. Falling Object
   Items placed near the manhole opening may fall and injure a worker in the manhole.
5. Sharp Edges
   Sharp edges of items in or near a manhole may cause cuts and bruises.
6. Lifting Injuries
   Unless proper tools are used to remove manhole covers, back injuries or injuries to hands and feet may result.

B.2 Planning

Advance planning should include arrangements for test equipment, tools, ventilating equipment, protective clothing, traffic warning devices, ladders, safety harness, and adequate number of personnel. Hasty actions may result in serious injuries. Time spent in the manhole should be kept to a minimum.

B.3 Adverse Atmospheres

Refer to Table B-1. Before entering a manhole, tests should be made for explosive atmosphere, presence of hydrogen sulfide, and oxygen deficiency. Since combustible or toxic vapors may be heavier than air, the tests on the atmosphere must be run at least 3/4 of the way down the manhole.

Whenever adverse atmosphere is encountered, forced ventilation must be used to create safe conditions. After the ventilating equipment has been operated for a few minutes, the atmosphere in the manhole should be retested before anyone enters the manhole.

When explosive conditions are encountered, the ventilating blower should be placed upwind to prevent igniting any gas that is emerging from the opening. When a gasoline engine blower is used, it must be located so that exhaust fumes cannot enter the manhole.

If testing equipment is not available, the manhole should be assumed to contain an unsafe atmosphere and forced ventilation must be provided. It should never be assumed that a manhole is safe just because there is no odor or the manhole has been entered previously.

B.4 Entering Manholes

Since the top of the manhole is usually flush with the surrounding surface, there may not be anything for the person who is entering the manhole to grab on to steady himself.

Persons who are entering manholes should not be permitted to carry anything in their hands as they enter the manhole, to ensure that their hands are free to hold on or grab if they slip. A good method for entering a manhole is to sit on the surface facing the manhole steps or ladder, with the feet in the hole and the arms straddling the opening for support. As the body slides forward and downward, the feet can engage a rung, and the back can rest against the opposite side of the opening. If there is any doubt about the soundness of the manhole steps, a portable ladder should be used.

A person should never enter a manhole unless he is wearing personal safety equipment, including a safety harness and hard hat. Two persons should be stationed at the surface continuously while anyone is working inside a manhole, to lift him out if he is overcome or injured. One man cannot lift an unconscious man out of a manhole. The persons stationed at the surface should also function as guards to keep people and vehicles away from the manhole opening. To avoid a serious injury, a person should not be lifted out of a manhole by his arm unless it is a dire emergency.

When more than one person must enter a manhole, the first person should reach the bottom and step off the ladder before the second one starts down. When two men climb at the same time, the upper one can cause the lower one to fall by slipping or stepping on his fingers.

B.5 Traffic Protection

In addition to traffic cones, markers, warning signs, and barricades, a vehicle or heavy piece of equipment should be place between the working area and oncoming traffic. Flashing warning signals should be used to alert drivers and pedestrians. Orange safety vests should be worn by personnel stationed at the surface when the manhole is located in a vehicular traffic area.

B.6 Falling Objects

All loose items should be kept away from the manhole opening. This applies to hand tools as well as stones, gravel and other objects.

B.7 Removing the Covers

Manhole covers should be removed with a properly designed hook. Use of a pick axe, screwdriver, or small pry bar may result in injury. A suitable tool can be made from $^{3}/_{4}$ inch round or hex stock. Two inches of one end should be bent at a right angle and the other end should be formed into a D-handle wide enough to accommodate both hands. Even with this tool, care must be exercised to prevent the cover from being dropped on the toes. The two inch projection should be inserted into one of the holes of the cover, the handle grasped with both hands, and the cover lifted by straightening the legs, which have been slightly bent at the knees.

B.8 Other Precautions

Other precautions which should be taken when entering a manhole are:

- Wear a hard hat.
- Wear coveralls or removable outer garment which can readily be removed when the work is completed.
- Wear boots or non-sparking safety shoes.
- Wear rubberized or waterproof gloves.
- Wear a safety harness with a stout rope attached.
- Do not smoke.
- Avoid touching yourself above the collar until you have cleaned your hands.

B.9 Emergencies

Every member of the crew should be instructed on procedures to be followed in cases of an emergency. It is the duty of each crew chief to have a list of emergency phone numbers, including the nearest hospital and ambulance service, police precinct, fire station, and rescue or general emergency number.

B.10 Field Equipment

The following equipment must be available for use:

- Blowers
- Breathing Apparatus
- Coveralls
- First Aid Kits
- Emergency Flashers
- Flashlights
- Mirrors
- Gas Detectors
- Gas Masks
- Gloves
- Hard Hats
- Harnesses
- Manhole Irons
- Pick Axes
- Rain Slickers
- Ropes
- Safety Vests
- Traffic Cones
- Waders

B.11 Lethal Atmospheres in Sewers

The following is an article written by Dr. Richard D. Pomeroy, and published in the October 1980 issue of Deeds & Data of the WPCF. Dr. Pomeroy is particularly well known for his studies, over a period of nearly 50 years, in the field of the control of hydrogen sulfide and other odors in sewers and treatment plants. He has personally worked in a great many functioning sewers. In the earlier years he did so, he admits, with little knowledge of the grave hazards to which he exposed himself.

"It is gratifying that the subject of hazards to people working in sewers is receiving much more attention than in past years, and good safety procedures are prescribed in various publications on this subject. It is essential that people know and use correct procedures.

It is less important to know just what the hazardous components of sewer atmospheres are, as safety precautions should in general be broadly applicable, but there should be a reasonable understanding of this subject. It is disturbing to see statements in print that do not reflect true conditions.

One of the most common errors is the assumption that people have died from a lack of oxygen. The human body is able to function very well with substantially reduced oxygen concentrations. No one worries about going to Santa Fe, New Mexico, (elev. 2100 m), where the partial pressure of oxygen is equal to 16.2 percent (a normal atmosphere is about 21 percent) oxygen. When first going there, a person may experience a little 'shortness of breath' following exercise. People in good health are not afraid to drive over the high passes in the Rocky Mountains. At Loveland Pass, oxygen pressure is 13.2 percent of a normal atmosphere. At the top of Mt. Whitney, oxygen is equal to 12.2 percent. Many hikers go there, and to higher peaks as well.

After adequate acclimation, they may climb to the top of Mt. Everest, where oxygen is equal to only 6.7 percent.

The lowest oxygen concentrations that I have observed in a sewer atmosphere was 13 percent. It was in a sealed chamber, near sea level, upstream from an inverted siphon on a metropolitan trunk. A man would be foolish to enter the chamber. Without ventilation, he might die, but not from lack of oxygen.

It seems unlikely that anyone has ever died in a sewer from suffocation, that is, lack of oxygen. Deaths have often been attributed to 'asphyxiation.' This is a word which, according to the dictionary, is used to mean death from an atmosphere that does not support life. The word has sometimes been misinterpreted as meaning suffocation, which is only one kind of asphyxiation.

In nearly all cases of death in sewers, the real killer is hydrogen sulfide. It is important that this fact be recognized. Many cities diligently test for explosive gases, which is very important, and they may measure the oxygen concentration, which usually is unimportant, but they rarely measure H_2S. Death has occurred where it is unlikely that there was any measurable reduction in the oxygen concentration. Wastewater containing 2 mg/l of dissolved sulfide, and at a pH of 7.0, can produce in a chamber with high turbulence, a concentration of 300 ppm H_2S, in the air. This is considered to be a lethal concentration. Many people have died from H_2S, not only in sewers and industries, but also from swamps and from hot springs. In one resort area, at least five persons died from H_2S poisoning before the people were ready to admit that H_2S is not a therapeutic agent. Hardly a year passes in the U.S. without a sewer fatality from H_2S as well as deaths elsewhere in the world.

The presence of H_2S in a sewer atmosphere is easily determined. A bellows-and-ampoule type of tester is very satisfactory for the purpose, even though it is only crudely quantitative. When using a tester of this type, do not bring the air to the ampoule by way of a tube, as this may change the H_2S concentration. Hang the ampoule in the air to be tested, with a suction tube to the bulb or bellows.

Lead acetate paper is very useful as a qualitative indicator. It cannot be used to estimate the amount of sulfide, but it will quickly turn black in an atmosphere containing only a tenth of a lethal concentration.

Electrodes or other similar electrical indicating devices for H_2S in the air have been marketed. Some of them are known to be unreliable, and we know of none that have proved dependable. Do not use one unless you check it at frequent intervals against air containing known H_2S concentrations. A supposed safety device that is unreliable is worse than none at all.

Remember that the nose fails, too, when it comes to sensing dangerous concentrations of H_2S.

Various other toxic gases have been mentioned in some publications. It is unlikely that any person has been asphyxiated in a sewer by any of those other gases, except possibly chlorine.

The vapor of gasoline and other hydrocarbons is sometimes present in amounts that could cause discomfort and illness, but under that condition, the explosion hazard would be far more serious. The explosimeter tests, as well as the sense of smell, would warn of the danger. Pipelines in chemical plants might contain any number of harmful vapors. They, too, are sensed by smell and explosimeter tests if they get into the public sewer. Such occurrences are rare.

The attempt to instill a sense of urgency about real hazards is diluted if a man is told to give attention to a long list of things that in fact are irrelevant.

Be very careful to avoid high H_2S concentrations, flammable atmospheres, and hazards of physical injuries. Remember that much H_2S may be released by the stirring up of sludge in the bottom of a structure. Obey your senses in respect to irritating gases, such as chlorine (unconsciousness comes suddenly from breathing too much.) Be cautious about strange odors. Do not determine percent oxygen in the air. There is a danger that the result will influence a man's thinking about the seriousness of the real hazards. Most important, use ample ventilation, and do not enter a potentially hazardous structure except in a good safety harness with two men at the top who can lift you out."

Table B-1 Hazardous Gases

Gas	Chemical Formula	Common Properties	Specific Gravity or Vapor Density Air = 1	Physiological Effect*	Max Safe 60 Min. Exposure ppm	Max. Safe 8 Hour Exposure ppm	Explosive Range (% by vol. in air.) Limits lower/upper	Likely Location of Highest Concentration	Most Common Sources	Simplest and Cheapest Safe Method of Testing
Ammonia	NH_3	Irritant and poisonous. Colorless with characteristic odor.	0.60	Causes throat and eye irritation at 0.05%, coughing at 0.17%. Short exposure at 0.5% to 1% fatal.	300 to 500	85	16 25	Near top. Concentrates in closed upper spaces	Sewers, chemical feed rooms.	Detectable odor at low concentrations
Benzene	C_6H_6	Irritant, colorless anesthetic	2.77	Slight symptoms after several hours exposure at 0.16% to 0.32%. 2% rapidly fatal.	3,000 to 5,000	25	1.3 7.1	At bottom.	Industrial wastes, varnish, solvents.	Combustible gas indicator
Carbon Bisulfide	CS_2	Nearly odorless when pure, colorless, anesthetic. Poisonous.	2.64	Very poisonous, irritating, vomiting, convulsions, psychic disturbance.	—	15	1.3 44.0	At bottom	An insecticide	Combustible gas indicator
Carbon Dioxide	CO_2	Asphyxiant, Colorless, odorless. When breathed in large quantities, may cause acid taste. Non-flammable. Not generally present in dangerous amounts unless an oxygen deficiency exists.	1.53	Cannot be endured at 10% more than a few minutes, even if subject is at rest and oxygen content is normal. Acts on respiratory nerves.	40,000 to 60,000	5,000	— —	At bottom; when heated may stratify at points above bottom.	Products of combustion, sewer gas, sludge. Also issues from carbonaceous strata.	Oxygen deficiency indicator

Table B-1 Hazardous Gases (Continued)

Carbon Monoxide	CO	Chemical asphyxiant. Colorless, odorless, tasteless. Flammable. Poisonous.	0.97	Combines with hemoglobin of blood. Unconsciousness in 30 min. at 0.2% to 0.25%. Fatal in 4 hours at 0.1%. Headache in few hours at 0.02%.	400	50	12.5 74.0	Near top, especially if present with illuminating gas.	Manufactured gas, flue gas, products of combustion, motor exhausts. Fires of almost any kind.	CO ampoules.
Carbon Tetra-Chloride	CCl_4	Heavy, ethereal odor.	5.3	Intestinal upset, loss of consciousness, possible renal damage, respiratory failure.	1,000 to 1,500	100	— —	At bottom.	Industrial wastes, solvent, cleaning	Detectable odor at low concentrations.
Chlorine	Cl_2	Irritant. Yellow-green color. Choking odor detectable in very low concentrations. Non-flammable.	2.49	Irritates respiratory tract. Kills most animals in a very short time at 0.1%.	4	1	— —	At bottom.	Chlorine cylinder and feed line leaks.	Detectable odor at low concentrations.
Formaldehyde	CH_2O	Colorless, pungent suffocating odor.	1.07	Irritating to the nose.	—	10	7.0 73.0	Near bottom.	Incomplete combustion of organics. Common air pollutant, fungicide.	Detectable odor.
Gasoline	C_5H_{12} to C_9H_{20}	Volatile solvent. Colorless. Odor noticeable at 0.03%. Flammable.	3.0 to 4.0	Anesthetic effects when inhaled. Rapidly fatal at 2.4%. Dangerous for short exposure at 1.1 to 2.2%.	4,000 to 7,000	1,000	1.3 6.0	At bottom.	Service stations, garages, storage tanks, houses.	1. Combustible gas indicator. 2. Oxygen deficiency indicator.**
Hydrogen	H_2	Simple asphyxiant. Colorless, odorless, tasteless. Flammable	0.07	Acts mechanically to deprive tissues of oxygen. Does not support life.	—	—	4.0 74.0	At top.	Manufactured gas, sludge digestion tank gas, electrolysis of water. Rarely from rock strata.	Combustible gas indicator.
Hydrogen Cyanide	HCN	Faint odor of bitter almonds. Colorless gas	0.93	Slight symptoms appear upon exposure to 0.002% to 0.004%. 0.3% rapidly fatal.	—	10	6.0 40.0	Near top.	Insecticide and rodenticide.	Detector tube
Gas	Chemical Formula	Common Properties	Specific Gravity or Vapor Density Air = 1	Physiological Effect*	Max Safe 60 Min. Exposure ppm	Max. Safe 8 Hour Exposure ppm	Explosive Range (% by vol. in air.) Limits lower/upper	Likely Location of Highest Concentration	Most Common Sources	Simplest and Cheapest Safe Method of Testing
Hydrogen Sulfide	H_2S	Irritant and poisonous volatile compound. Rotten egg odor in small concentrations. Exposure for 2 to 15 min. at 0.01% impairs sense of smell. Odor not evident at high concentrations. Colorless. Flammable.	1.19	Impairs sense of smell, rapidly as concentration increases. Death in few minutes at 0.2%. Exposure to 0.07 to 0.1% rapidly causes acute poisoning. Paralyzes respiratory center.	200 to 300	20	4.3 45.0	Near bottom, but may be above bottom if air is heated and highly humid.	Coal gas, petroleum, sewer gas. Fumes from blasting under some conditions. Sludge gas.	1. H_2S Ampoule. 2. 5% by weight lead acetate solution.
Methane	CH_4	Simple asphyxiant. Colorless, odorless, tasteless, flammable.	0.55	Acts mechanically to deprive tissues of oxygen. Does not support life.	Probably no limit, provided oxygen percentage is sufficient for life.	—	5.0 15.0	At top, increasing to certain depth.	Natural gas, sludge gas, manufactured gas, sewer gas. Strata of sedimentary origin. In swamps or marshes.	1. Combustible gas indicator 2. Oxygen deficiency indicator.
Nitrogen	N_2	Simple asphyxiant. Colorless, tasteless. Non-flammable. Principal constituent of air. (about 79%).	0.97	Physiologically inert.	—	—	— —	Near top, but may be found near bottom.	Sewer gas. sludge gas. Also issues from some rock strata.	Oxygen deficiency indicator.

Table B-1 Hazardous Gases (Continued)

Nitrogen Oxides	NO N_2O NO_2	Colorless Colorless, sweet odor. Reddish-brown. Irritating odor. Deadly poison	1.04 1.53 1.58	60 to 150 ppm cause irritation and coughing. Asphyxiant. 100 ppm dangerous. 200 ppm fatal.	50	10	—	—	Near bottom.	Industrial wastes. Common air pollutant.	NO_2 detector tube.
Oxygen	O_2	Colorless, odorless, tasteless. Supports combustion.	1.11	Normal air contains 20.8% of O_2. Man can tolerate down to 12%. Minimum safe 8 hour exposure, 14 to 16%. Below 10%, dangerous to life. Below 5 to 7% probably fatal.	—	—	—	—	Variable at different levels.	Oxygen depletion from poor ventilation and absorption, or chemical consumption of oxygen.	Oxygen deficiency indicator.
Ozone	O_3	Irritant and poisonous. Strong electrical odor. Strong oxidizer. Colorless. At 1 ppm, strong sulfur-like odor.	1.66	Max. naturally occurring level is 0.04 ppm. 0.05 ppm causes irritation of eyes and nose. 1 to 10 ppm causes headache, nausea; can cause coma. Symptoms similar to radiation damage.	0.08	0.04	—	—	Near bottom.	Where ozone is used for disinfection.	Detectable odor at 0.015 ppm.
Sludge Gas	—***	Mostly a simple asphyxiant. May be practically odorless, tasteless.	Variable	Will not support life.	No data. Would vary widely with composition.		5.3	19.3	Near top of structure.	From digestion of sludge.	See components.
Sulfur Dioxide	SO_2	Colorless, pungent odor. Suffocating, corrosive, poisonous, non-flammable.	2.26	Inflammation of the eyes. 400 to 500 ppm immediately fatal.	50 to 100	10	—	—	At bottom, can combine with water to form sulfurous acid.	Industrial waste, combustion, common air pollutant.	Detectable taste and odor at low concentration.
Toluene	C_5H_{12} to C_9H_{20}	Colorless, benzene-like odor.	3.14	At 200-500 ppm, headache, nausea, bad taste, lassitude.	200	100	1.27	7.0	At bottom.	Solvent.	Combustible gas indicator.
Turpentine	$C_{10}H_{16}$	Colorless, Characteristic odor.	4.84	Eye irritation. Headache, dizziness, nausea, irritation of the kidneys.	—	100			At bottom.	Solvent, used in paint.	1. Detectable odor at low concentrations. 2.Combustible gas indicator.
Xylene	C_8H_{10}	Colorless, flammable	3.66	Narcotic in high concentrations. less toxic than benzene.	—	100	1.1	7.0	At bottom.	Solvent	Combustible gas indicator.

* Percentages shown represent volume of gas in air.
** For concentration over 0.3%.
***Mostly methane and carbon dioxide with small amounts of hydrogen, nitrogen, hydrogen sulfide, and oxygen; occasionally traces of carbon monoxide.

6100 Volatile Organic Sampler

Appendix C Material Safety Data Sheets

This appendix provides Material Safety Data Sheets for the desiccants used in the 6100 Volatile Organic Sampler.

Specific questions regarding the use and handling of these products should be directed to the manufacturer listed in the MSDS.

101 Christine Drive
Belen, New Mexico 87002
Phone: (505) 864-6691
Fax: (505) 861-2355

SÜD-CHEMIE
Performance Packaging

ISO 9002

MATERIAL SAFETY DATA SHEET -- September 28, 1998
SORB-IT®
Packaged Desiccant

SECTION I -- PRODUCT IDENTIFICATION

Trade Name and Synonyms:	Silica Gel, Synthetic Amorphous Silica, Silicon, Dioxide
Chemical Family:	Synthetic Amorphous Silica
Formula:	$SiO_2.x\ H_2O$

SECTION II -- HAZARDOUS INGREDIENTS

Components in the Solid Mixture

COMPONENT	CAS No	%	ACGIH/TLV (PPM)	OSHA-(PEL)
Amorphous Silica	63231-67-4	>99	PEL - 20 (RESPIRABLE), TLV – 5	LIMIT – NONE, HAZARD - IRRITANT ˝

Synthetic amorphous silica is not to be confused with crystalline silica such as quartz, cristobalite or tridymite or with diatomaceous earth or other naturally occurring forms of amorphous silica that frequently contain crystalline forms.

This product is in granular form and packed in bags for use as a desiccant. Therefore, no exposure to the product is anticipated under normal use of this product. Avoid inhaling desiccant dust.

SECTION III -- PHYSICAL DATA

Appearance and Odor:	White granules; odorless.
Melting Point:	>1600 Deg C; >2900 Deg F
Solubility in Water:	Insoluble.
Bulk Density:	>40 lbs./cu. ft.
Percent Volatile by Weight @ 1750 Deg F:	<10%.

101 Christine Drive
Belen, New Mexico 87002
Phone: (505) 864-6691
Fax: (505) 861-2355

SÜD-CHEMIE
Performance Packaging

ISO 9002

MATERIAL SAFETY DATA SHEET -- September 28, 1998
SORB-IT®
Packaged Desiccant

SECTION IV -- FIRE EXPLOSION DATA

Fire and Explosion Hazard - Negligible fire and explosion hazard when exposed to heat or flame by reaction with incompatible substances.

Flash Point - Nonflammable.

Firefighting Media - Dry chemical, water spray, or foam. For larger fires, use water spray fog or foam.

Firefighting - Nonflammable solids, liquids, or gases: Cool containers that are exposed to flames with water from the side until well after fire is out. For massive fire in enclosed area, use unmanned hose holder or monitor nozzles; if this is impossible, withdraw from area and let fire burn. Withdraw immediately in case of rising sound from venting safety device or any discoloration of the tank due to fire.

SECTION V -- HEALTH HAZARD DATA

Health hazards may arise from inhalation, ingestion, and/or contact with the skin and/or eyes. Ingestion may result in damage to throat and esophagus and/or gastrointestinal disorders. Inhalation may cause burning to the upper respiratory tract and/or temporary or permanent lung damage. Prolonged or repeated contact with the skin, in absence of proper hygiene, may cause dryness, irritation, and/or dermatitis. Contact with eye tissue may result in irritation, burns, or conjunctivitis.

First Aid (Inhalation) - Remove to fresh air immediately. If breathing has stopped, give artificial respiration. Keep affected person warm and at rest. Get medical attention immediately.

First Aid (Ingestion) - If large amounts have been ingested, give emetics to cause vomiting. Stomach siphon may be applied as well. Milk and fatty acids should be avoided. Get medical attention immediately.

First Aid (Eyes) - Wash eyes immediately and carefully for 30 minutes with running water.

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Belen, New Mexico 87002
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Fax: (505) 861-2355

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SORB-IT®
Packaged Desiccant

NOTE TO PHYSICIAN: This product is a desiccant and generates heat as it adsorbs water. The used product can contain material of hazardous nature. Identify that material and treat accordingly.

SECTION VI -- REACTIVITY DATA

Reactivity - Silica gel is stable under normal temperatures and pressures in sealed containers. Moisture can cause a rise in temperature which may result in a burn.

SECTION VII --SPILL OR LEAK PROCEDURES

Notify safety personnel of spills or leaks. Clean-up personnel need protection against inhalation of dusts or fumes. Eye protection is required. Vacuuming and/or wet methods of cleanup are preferred. Place in appropriate containers for disposal, keeping airborne particulates at a minimum.

SECTION VIII -- SPECIAL PROTECTION INFORMATION

Respiratory Protection - Provide a NIOSH/MSHA jointly approved respirator in the absence of proper environmental control. Contact your safety equipment supplier for proper mask type.

Ventilation - Provide general and/or local exhaust ventilation to keep exposures below the TLV. Ventilation used must be designed to prevent spots of dust accumulation or recycling of dusts.

Protective Clothing - Wear protective clothing, including long sleeves and gloves, to prevent repeated or prolonged skin contact.

Eye Protection - Chemical splash goggles designed in compliance with OSHA regulations are recommended. Consult your safety equipment supplier.

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SECTION IX -- SPECIAL PRECAUTIONS

Avoid breathing dust and prolonged contact with skin. Silica gel dust causes eye irritation and breathing dust may be harmful.

* No Information Available

HMIS (Hazardous Materials Identification System) for this product is as follows:

Health Hazard	0
Flammability	0
Reactivity	0
Personal Protection	HMIS assigns choice of personal protective equipment to the customer, as the raw material supplier is unfamiliar with the condition of use.

Material Safety Data Sheet

Indicating Silica Gel

Identity (Trade Name as Used on Label)

Manufacturer : MULTISORB TECHNOLOGIES, INC. (formerly Multiform Desiccants, Inc.)	MSDS Number* : M75
Address: 325 Harlem Road Buffalo, NY 14224	CAS Number* :
Phone Number (For Information): 716/824-8900	Date Prepared: July 6, 2000
Emergency Phone Number: 716/824-8900	Prepared By* : G.E. McKedy

Section 1 - Material Identification and Information

Components - Chemical Name & Common Names (Hazardous Components 1% or greater; Carcinogens 0.1% or greater)	%*	OSHA PEL	ACGIH TLV	OTHER LIMITS RECOMMENDED
Silica Gel SiO_2	98.0	6mg/m^3 (total dust)	10mg/m^3 (total dust)	
Cobalt Chloride	>2.0	0.05mg/m^3 (TWA cobalt metal dust & fume)	.05mg/m^3 (Cobalt, TWA)	
Non-Hazardous Ingredients				
TOTAL	100			

Section 2 - Physical/Chemical Characteristics

Boiling Point	N/A	Specific Gravity (H_20 = 1)	2.1
Vapor Pressure (mm Hg and Temperature	N/A	Melting Point	N/A
Vapor Density (Air =1)	N/A	Evaporation Rate (_____=1)	N/A
Solubility in Water	Insoluble, but will adsorb moisture.	Water Reactive	Not reactive, but will adsorb moisture.
Appearance and Odor	Purple crystals, no odor.		

Section 3 - Fire and Explosion Hazard Data

Flash Point and Methods Used	N/A	Auto-Ignition Temperature	N/A	Flammability Limits in Air % by Volume	N/A	LEL	UEL
Extinguisher Media	Dry chemical, carbon dioxide and foam can be used.						
Special Fire Fighting Procedures	Water will generate heat due to the silica gel which will adsorb water and liberate heat.						
Unusual Fire and Explosion Hazards	When exposed to water, the silica gel can get hot enough to reach the boiling point of water. Flooding with water will reduce the temperature to safe limits.						

Section 4 - Reactivity Hazard Data

STABILITY ☐**Stable** ☐**Unstable**	Conditions To Avoid	Moisture and high humidity environments.
Incompatibility (Materials to Avoid)	Water.	
Hazardous Decomposition Products	Carbon dioxide, carbon monoxide, water	
HAZARDOUS POLYMERIZATION ☐May Occur	Conditions To Avoid	None.

*Optional

Section 5 - Health Hazard Data

PRIMARY ROUTES OF ENTRY	☐Inhalation ☐Skin Absorption	☐Ingestion ☐Not Hazardous	**CARCINOGEN LISTED IN**	☐NTP ☐IARC Monograph	☐OSHA ☐Not Listed
HEALTH HAZARDS	Acute	May cause eye, skin and mucous membrane irritation.			
	Chronic	Prolonged inhalation may cause lung damage.			
Signs and Symptoms of Exposure	Drying and irritation.				
Medical Conditions Generally Aggravated by Exposure	Asthma.				
EMERGENCY FIRST AID PROCEDURES - Seek medical assistance for further treatment, observation and support if necessary.					
Eye Contact	Flush with water for at least 15 minutes.				
Skin Contact	Wash affected area with soap and water.				
Inhalation	Remove affected person to fresh air.				
Ingestion	Drink at least 2 glasses of water.				

Section 6 - Control and Protective Measures

Respiratory Protection (Specify Type)	Use NIOSH approved dust mask or respirator.		
Protective Gloves	Light cotton gloves.	Eye Protection	Safety glasses.
VENTILATION TO BE USED	☐ Local Exhaust	☐Mechanical (General)	☐Special
	☐Other (Specify)		
Other Protective Clothing and Equipment	None.		
Hygienic Work Practices	Avoid raising dust. Avoid contact with skin, eyes and clothing.		

Section 7 - Precautions for Safe Handling and Use/Leak Procedures

Steps to be Taken if Material Is Spilled Or Released	Sweep or vacuum up and place the spilled material in a waste disposal container. Avoid raising dust.
Waste Disposal Methods	Dispose in an approved landfill according to federal, state and local regulations.
Precautions to be Taken In Handling and Storage	Cover promptly to avoid blowing dust. Wash after handling.
Other Precautions and/or Special Hazards	Keep in sealed containers away from moisture. The silica gel will readily adsorb moisture.

*Optional Indicating Silica Gel

*Isco One Year Limited Factory Service Warranty **

Isco warrants covered products against failure due to faulty parts or workmanship for a period of one year (365 days) from their shipping date, or from the date of installation by an authorized Isco Service Engineer, as may be appropriate.

During the warranty period, repairs, replacements, and labor shall be provided at no charge. Isco's liability is strictly limited to repair and/or replacement, at Isco's sole discretion.

Failure of expendable items (e.g., charts, ribbon, tubing, glassware, seals and filters), or from normal wear, accident, misuse, corrosion, or lack of proper maintenance, is not covered. Isco assumes no liability for any consequential damages.

Isco specifically disclaims any warranty of merchantability or fitness for a particular purpose.

This warranty applies only to products sold under the Isco trademark and is made in lieu of any other warranty, written or expressed.

No items may be returned for warranty service without a return authorization number issued from Isco.

This warranty does not apply to the following products: Process Analyzers, SFX 3560 SFE Extractor, 6100 VOC Sampler.

The warrantor is Isco, Inc. 4700 Superior, Lincoln, NE 68504, U.S.A.

*** This warranty applies to USA customers. Customers in other countries should contact their Isco dealer for warranty service.**

In the event of instrument problems, always contact the Isco Service Department, as problems can often be diagnosed and corrected without requiring an on-site visit. In the U.S.A., contact Isco Service at the numbers listed below. International customers should contact their local Isco agent or Isco International Customer Service.

Return Authorization

A return authorization number must be issued prior to shipping. Following authorization, Isco will pay for surface transportation (excluding packing/crating) both ways for 30 days from the beginning of the warranty period. After 30 days, expense for warranty shipments will be the responsibility of the customer.

Shipping Address: Isco, Inc. - Attention Repair Service
4700 Superior Street
Lincoln NE 68504 USA

Mailing address: Isco, Inc.
PO Box 82531
Lincoln NE 68501 USA

Phone: Repair service: (800)775-2965 (lab instruments)
(800)228-4373 (samplers & flow meters)
Sales & General Information (800)228-4373 (USA & Canada)

Fax: (402) 465-3001

Email: service@isco.com

August 2002 P/N 60-1002-040

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