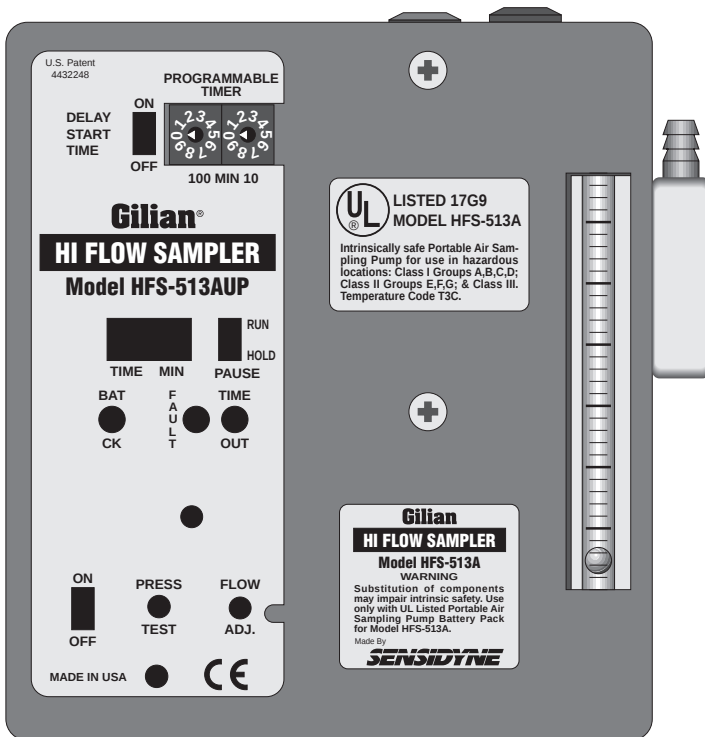


Gilian[®]

HFS-513 Air Sampling System

Operating Manual for Models:

HFS-513A
HFS-513AT
HFS-513AC
HFS-513AP
HFS-513AU
HFS-513AUT
HFS-513AUC
HFS-513AUP



Operating Manual For The HFS-513 Air Sampling System

1.0 INTRODUCTION

The HFS Air Sampling System is the first system truly designed with the user in mind. Many of its features have been incorporated after evaluation of current sampler technology and extensive contact with its users. It is the intent of the HFS system to provide a versatile, rugged, reliable, compact sampler employing modular design concepts and to allow the unit to be upgraded to the needs of the user. The modular stack construction concept reduces repairs and maintenance, resulting in minimum down time and maximum flexibility.

This manual contains operation, maintenance and spare parts information for the Gilian HFS Constant Flow air Sampling System. Model designations are as follows:

TIMING AND PROGRAMMABILITY OPTIONS						
MODELS & # DESIGNATION		FLOW		TIMING		
		LOW	HIGH	TIME DISPLAY FAULT	PROGRAMMABLE	
					STOP	START/STOP
HIGH FLOW	HFS-513A		X			
	HFS-513AC		X	X		
	HFS-513AT		X	X	X	
	HFS-513AP		X	X	X	X
HIGH & LOW FLOW	HFS-513AU	X	X			
	HFS-513AUC	X	X	X		
	HFS-513AUT	X	X	X	X	
	HFS-513AUP	X	X	X	X	X
Consult "Flow" section to select high and/or low flow capabilities Consult "Timing" section to select optional time display and/or programmable start/stop features.						

All HFS series pumps are UL approved intrinsically safe for use in hazardous locations Class I, Division 1, Groups A, B, C, D; Class II Division 1, E, F, G; and Class III (UL Listed 17G9). Temperature code T3C.

2.0 GENERAL DESCRIPTION

The sampler is composed of the Pneumatic System, Control System, and Rechargeable Battery Pack, all housed in a sturdy 1/8" Lexan case.

2.1 PNEUMATIC SYSTEM

This assembly consists of the pump, damper assemblies (2) and regulator assembly, all stacked and held together by two retaining screws. This stacking construction technique allows easy removal and replacement of any defective assembly. The Pneumatic System also includes the filter assembly, flowmeter and interconnect tubing assembled to allow the entire Pneumatic System to be tested as a complete subassembly (refer to Figures 3 and 3A).

2.1.1 Pump

The Pump is a DC motor driven dual piston unit that utilizes the patented Gilian pre-loaded valving system. The pump mechanism is sealed to prevent dirt and debris from entering.

2.1.2 Damper Assembly

The Damper Assembly consists of a compression spring sandwiched between 2 silicon diaphragms within a plastic housing which stacks directly above the pump to provide pulsation free flow for close coupling with the flowmeter. An air intake port connects the damper to the pump intake and a through hole passage is provided in the damper body to allow communicating the pump discharge to the pressure regulator stacked above.

2.1.3 Regulator

The Regulator used for low flow sampling, from 1 to 750 cc/min, includes a sensing diaphragm, spring and a valve enclosed in a plastic housing which mounts directly to the top of the damper assembly and communicates the inlet and outlet of the regulator to the suction and discharge of the pump, respectively. Provisions for shutting off the suction side of the regulator are provided. The regulator allows the pump to maintain either suction or discharge at a nominal 25" of water.

2.1.4 Filter Assembly

This assembly includes a see-through housing with an air intake boss mounted to the outside of the case for easy monitoring. The front housing secures the filter membrane and sealing "O"-Ring to the rear housing (mounted within the case) by means of 4 screws that provide an airtight seal for the air passage. The rear housing employs a vertical standpipe for conducting air into the pneumatic system. The transparent housing allows monitoring of the filter condition as well as prevention of water carry-over into the filter housing. The see-through housing allows the user to view the pump filter to determine when changing is necessary. The standpipe within the rear housing prevents water from directly entering the pump (a benefit for those doing impinger or wet sampling work).

2.1.5 Flow Indicator

The Flow Indicator is a rotameter ($\pm 20\%$ accuracy) mounted vertically and visible from the outside of the case which is used to set and monitor pump flows over the operating range of 500 cc to 5 LPM.

2.2.0 Control System

The Control System consists of a control board and 3 optional timer boards of "T", "C", and "P" models.

2.2.1 Control Board

The Control Board incorporates the on-off switch, press-to-test button, flow control system, battery charge indicator, low flow fault indicator, and time out indicator (activated only for "T", "C", "P" models).

2.2.1.1 Flow Compensation Control

This control provides for constant air flow from the pump at any preset flow within the performance envelope. The compensation control includes a sensing resistor mounted in the motor leg which provides a voltage signal proportional to the motor load current which is fed to a comparator which in turn adjusts the motor voltage proportionally to the pump load line curves thereby maintaining constant flow over the operating range.

2.2.1.2 Flow Fault Indication

The flow fault indicator is activated by either an under voltage, over current, or over pressure condition which occurs when the pump is operated beyond its performance envelope. A suitable time delay is incorporated in the system to prevent unnecessary shutdown. Activation of the fault system stops the pump and an LED fault indicator will light. On "C", "T" and "P" models, in addition to the pump shutting off, if a fault condition occurs, elapsed time to shut down is visible on a digital clock display. This feature allows the user to always achieve a valid sample.

2.2.1.3 Visual Battery Charge Indicator

The visual battery charge indicator, activated by the press-to-test button, confirms sufficient battery capacity to run a minimum eight hour sample under any conditions with the instrument's capability.

2.2.1.4 Time Out Indicator

The time out indicator, activated only for timing models "C", "T", "P", indicates that the sampling sequence has ended.

2.2.2.0 Timer Board (Timing Models Only)

The timer board incorporates the timer set switches and the time readout display.

2.2.2.1 Timer Set Switches

Timer set switches are used to stop the pump at a preset time. Two switches provide 10 or 100 minute increments up to 990 minutes (16.5 hours) maximum. The clock which controls the timer automatically stops after approximately 15-30 seconds if the unit is operated beyond its performance capabilities. An illuminated time display reads out directly in minutes, indicating the amount of time of operation prior to pump shutdown. This feature allows the user to always achieve a valid sample even if the total sampling period is not realized.

3.0 OPERATION

3.1.0 HIGH FLOW UNITS (750 CC TO 5 LPM)

3.1.1 (Refer to Figure 1 & Table 1)

- A) Prior to use, charge the unit for a maximum of 16 hours through the Charging Jack (18), located on the case front.
- B) For "U" Models (HFS-513AU, HFS-513AUC, HFS-513AUT, HFS-513AUP) make sure the regulator shut-off valve is completely closed. This is accomplished by removing the Protective Cap (23), inserting the small blade end of the Regulator Adjust Screwdriver through the opening, and engaging the slot of the regulator shut-off valve. Turn clockwise until closed — **DO NOT OVERTIGHTEN**. The user will learn to recognize when the regulator is open since the regulator adjust screw is in the upward position (Protective Cap removed).

- C) Connect the sampling head (cyclone, impinger, filter holder, etc.) to the air intake boss of the filter housing (15).
- D) Use the small screwdriver to remove the Anti-Tamper Cover (7) to expose the control panel. (IF UNIT IS NOT A TIMER MODEL, SKIP TO STEP "F").
- E) Set the programmable timer (1) with the small screwdriver. The Left dial sets in 100 minute increments. The Right dial sets in 10 minute increments. (WHEN USING TIMER MODELS "T", "C", OR "P", PLEASE REFER TO SECTION 3.3.0 FOR DETAILED INSTRUCTION IN THE OPERATION OF INDIVIDUAL TIMER BOARDS.) Reinstall the Anti-Tamper Cover.
- F) Turn on the unit by pushing the ON/OFF Switch (5) upward to the "ON" position with the small screwdriver.
- G) Adjust the Flow Control Pot (9) with the small screwdriver to the desired flow rate on the built-in flowmeter (11). If the flow rate is adjusted below 1 LPM (**WITH NO BACK PRESSURE FROM FILTER, SAMPLING TUBE, ETC.**) oscillation of the flowmeter float will be noted. This is perfectly normal and will stop, or decrease, once an external load (filter, cassette, etc.) is applied to the pump. In order to facilitate setting the flow rate below 1 LPM, a small restrictor (supplied with the sampler) will provide the necessary back pressure. The restrictor may be left in place, but will reduce the maximum back pressure of the sampler. **CAUTION: BE SURE THE RESTRICTOR IS REMOVED WHEN SAMPLING ABOVE 1 LPM.**
- H) Push the Press-to-Test button (6) to determine the battery charge state through illumination of the battery check LED (3B). The LED should light indicating a full charge.
- I) The unit must be turned off manually when the full sampling period is realized. If you are using a Timer model, the unit will stop when the time set on the Programmable timer (1) is read and the Time Out LED (3C) will light. Pushing the Press-to-Test Button (6) will indicate the set programmed time. Should the air supply to the sampler be interrupted for a period of 15–30 seconds, the unit will stop and the Fault Indicator (3A) will light. Actuating the Press-to-Test Button will indicate the time at which the fault occurred.

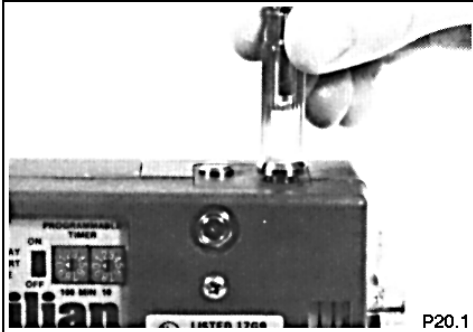
3.2.0 LOW FLOW UNITS (1 CC TO 750 CC/MIN) ["U" MODELS ONLY]

Refer to Figure 1 & Table 1. The Gilian Low flow Regulator Models are designed to permit either single or multiple low flow sampling by using the appropriate Variable flow Controller found in the Universal Tube Holder System. The pump flow is controlled by means of a built-in constant pressure regulator and is adjusted by means of the Variable Flow Controller incorporated into the tube holder assembly.

3.2.1 Preparation for Low Flow Sampling — Single

Turn on the pump and adjust the Flow Control (9) to approximately 1 LPM. Remove the Protective Cap (23) using the Regulator Adjusting Screwdriver supplied with the sampler. Open the regulator Shut-off Valve by turning it counterclockwise approximately 5 turns. Replace the cap. Attach the tube holder containing the Variable Flow Controller to the pump inlet boss (15), using the special adaptor tubing provided (800159). Using a calibrated rotameter, bubble tube, adjust the Variable flow Controller to the desired flow rate. The flow controller adjustment screw is located under the knurled knob protective cover at the end of the unit.

P20.0



P20.1



P20.2



P20.3

P20.0 INSTALLING THE DISCHARGE AIR BOSS

The Discharge Air Boss is used for Bag Sampling media or where a discharge sample is required.

P20.1 Remove the air discharge cover (22).

P20.2 Screw the Discharge Air Boss into the sampler.

P20.3 The Discharge Air Boss is now inserted into the sampler.



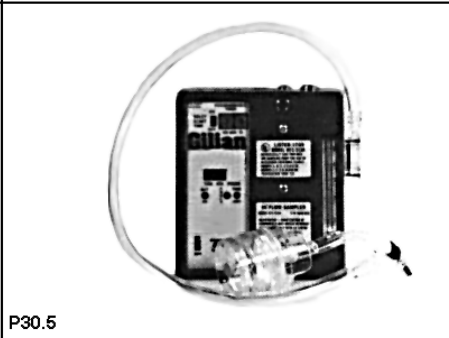
P30.1



P30.4



P30.2



P30.5



P30.3

P30.0 HIGH FLOW OPERATIONS

P30.1 Typical High Flow system.

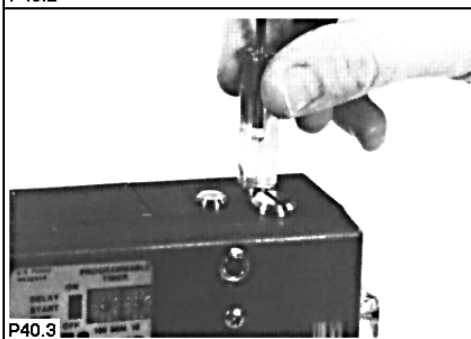
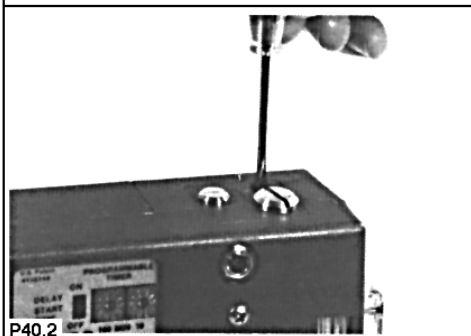
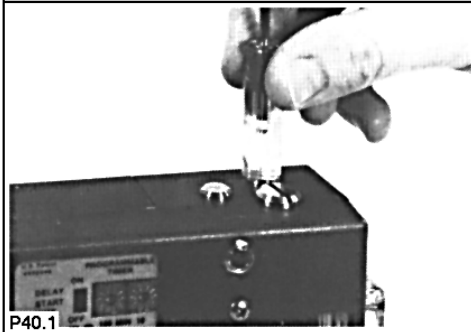
P30.2 Set the Timing Functions (see Section 3.3.0 for specific timing instructions).

P30.3 Set the flow (.5 to 3.5 LPM) and turn on the pump. Refer to Section 3 for specific instructions for setting the flow.

P30.4 Verify the flow with sampling media on line using a Primary Standard.

NOTE: Always be sure to use an impinger trap when doing this procedure. This will prevent liquid from entering the sampling line or sampling pump.

P30.5 Remove the calibrator and sampler is now ready for High Flow Sampling.



LOW FLOW OPERATIONS

P40.0 Typical High Flow System.

CONVERTING TO LOW FLOW MODE

P40.1 To convert to Lowflow, remove the regulator's protective cap screw with the screwdriver supplied with the sampler.

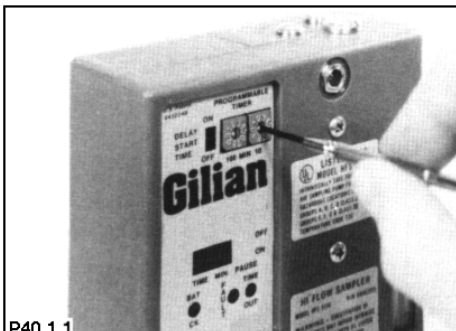
P40.2 Place the end of the regulator screwdriver into the recess and engage the slot of regulator shut-off valve.

To open the valve, turn shut-off valve 4 or 5 turns counterclockwise.

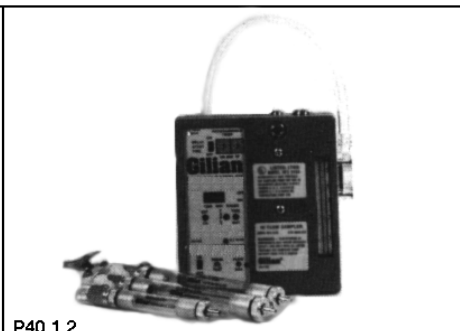
NOTE: DO NOT OVERTURN THE VALVE. IT WILL HAVE NO EFFECT.

To close the valve, turn the shut-off valve 4 or 5 times clockwise. DO NOT OVERTIGHTEN!

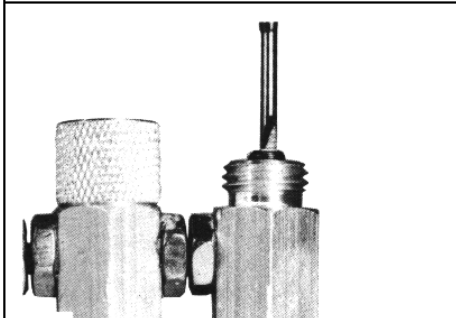
P40.3 Replace the cap.



P40.1.1



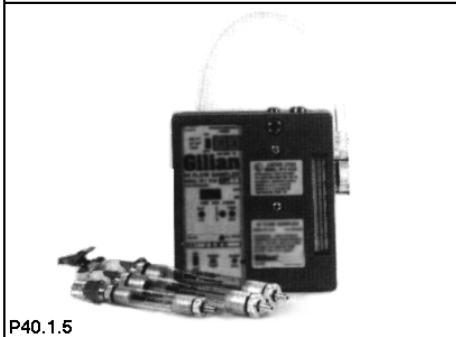
P40.1.2



P40.1.3



P40.1.4



P40.1.5

P40.1.0 LOW FLOW FUNCTIONS

P40.1.1 Set Timing (see Section 3.3.0 for specific timing instructions).

P40.1.2 Attach Multiple Flow Controller Manifold Tube Holder for replicate Low Flow sampling and turn on pump.

P40.1.3 Remove Cap Ends on flow Controller Manifold. To adjust flow turn the Needle Valve with a small screwdriver (counterclockwise for increase, clockwise for decrease).

P40.1.4 Verify the flow of each tube flow rate using a Primary Standard.

P40.1.5 Remove the Primary Standard and the sampler is now ready for Low Flow Sampling.

3.2.2 Multiple Low Flow Sampling

Proceed as in 3.2.1, except in place of the single Variable Flow Controller, connect the sampling manifold to the adaptor tubing. Continue as in 3.2.1 until all stations of the manifold are set to the flow rate that you require. **NOTE: TOTAL COMBINED FLOW THROUGH A FLOW CONTROLLER MANIFOLD MAY NOT EXCEED 750 cc/min.**

TIMING

3.3.0 GENERAL DESCRIPTION

The timer boards described in this section provide the following additional features not available in the HFS-513AT series boards.

1. Programmable start up to 990 minutes prior to desired sampling time.
2. Option to run pump for unlimited time increments.
3. Display clock readout of up to 9999 minutes.
4. Optional remote start/stop with cumulative time available on special order.

3.3.1 Operation of “C” Board

1. This is the board provided with the HFS-513AC and HFS-513AUC.
2. This board is a continuous running board only and has no programming options. Should the pump fault under load or due to low batteries, the timer will latch and maintain the time up to 12 hours or until the pump is reset.

3.3.2 Operation of “P” Board

1. This is the board provided with the HFS-513AP and HFS-513AUP.
2. The programmable run features of this board are functionally identical to the HFS-513AT series board, with the following exceptions:
 - a. When set to 0.0, the pump will run for an indefinite period of time (i.e. until the batteries run out).
 - b. The timer display will read up to 9999 minutes.

3.4.0 USE OF PROGRAMMABLE START TIME

Refer to Figure 1.

1. Switch the delay start time switch (1a) to the “ON” position.
2. Calculate start time delay in minutes and enter on switches (1) (i.e., 2 hours [120 minutes], 4 hours [240 minutes]).
3. Turn on pump (5).
4. Confirm delay time by pressing test button (6). Time remaining to start will be displayed on LED (2). A flashing decimal point in the lower right-hand corner indicates operational timer.
5. Proceed to set run time in a normal manner (i.e., 2 hours [120 minutes], 4 hours [240 minutes]). If run time is uncertain, it is recommended that you set time to 990 minutes.

3.4.1 USE OF PROGRAMMABLE RUN TIME

Refer to Figure 1.

WARNING: IF YOU DO NOT WISH TO USE PUMP IN PRESET START MODE, MAKE SURE THAT THE DELAY START TIME SWITCH IS IN THE “OFF” POSITION.

1. Switch the Delay Start time Switch (1a) to the “OFF” position.
2. Calculate the run time day in minutes and enter on the switches (1).
3. Turn on the pump.
4. To read the accumulated time, press the Test button (6) and the activity indicator will be at the lower right hand side of the LED display.
5. Please note that the programmable timer will not operate for longer than 990 minutes (16.5 hours). Should it be necessary to operate the pump for longer than 990 minutes, the time switch dials should be set to 0/0.

NOTE: These controls do not affect the standard high and/or low flow setting procedures. If review of the flow procedures is necessary, please see Section 3.

4.0 MAINTENANCE

4.1 HFS-513 BATTERY PACK — CHARGING AND MAINTENANCE

The HFS-513 sampler operates using a rechargeable Nickel-Cadmium 6-volt UL listed battery pack system. (UL rated intrinsically safe with highest UL rating available.)

HFS-513 BATTERY PACK REPLACEMENT

TO REMOVE: First, place the pump face down on a soft level surface. Remove the 2 screws which secure the Battery Pack to the case front. Carefully slide the battery pack to the right, out from under the belt clip. Be careful not to damage the wire connection. Stand the battery pack up vertically and gently disconnect the battery pack from the sampler connection. Remove the battery pack completely.

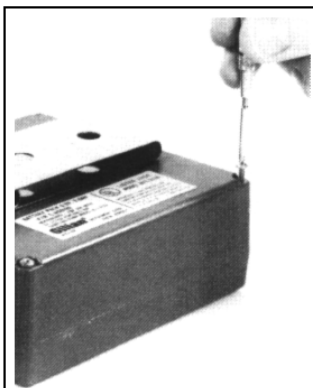
TO REPLACE: Reconnect the plug from the battery pack to the sampler connection. Reposition the battery pack on the sampler and slip the front edge under the belt clip. Be careful not to crimp the wiring in any way. Move the battery pack so the rails engage with the slots on the front case. Push the battery pack to the left until it is located in place. Reinstall the holding screws.

CHARGING & MAINTENANCE

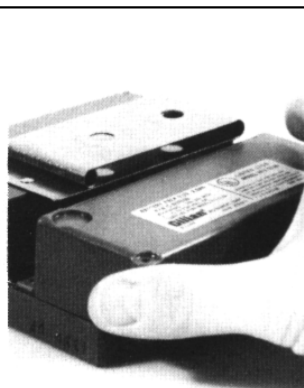
The HFS-513 battery pack may be charged internally through the sampler's built-in charging jack using either a single or multiple station charging unit. It can also be recharged with the use of an external charging adapter (800312). The adapter will be necessary for charging the battery pack when it is not installed in the sampler.

A proper battery maintenance program is essential to insure maximum battery life and performance. Specific charging and discharging procedures will vary with your particular needs and applications. The following is a list of general recommendations that should help to provide efficient battery life and serviceability.

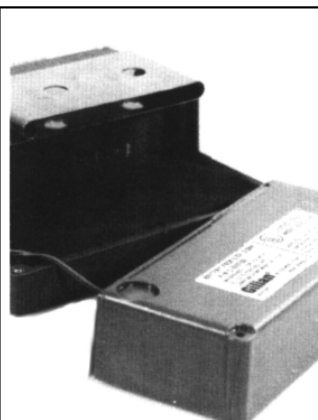
1. Do not short the battery connectors. This will result in irreversible damage to the battery pack.



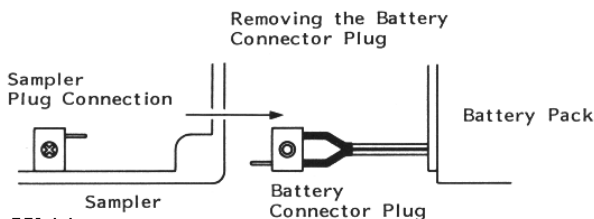
P50.1



P50.2

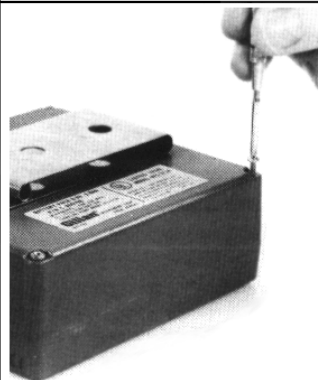


P50.3



Reconnecting the Battery Connector Plug

P50.2.1



P50.1.3

REMOVAL/INSTALLATION & MAINTENANCE

P50.0 This section is to provide the user with a basic knowledge of battery upkeep and installation. When disassembling your sampler, it is recommended that you work on a clean, level surface with a soft cloth underneath.

REINSTALLING THE BATTERY PACK

P50.1 Remove the (2) long screws from the Battery Pack rear.

P50.2 Slide the Battery Pack out slowly from under the Belt Clip. Be careful of the wire connection.

P50.3 Battery Pack removed.

P50.1.1 Gently remove the battery pack plug from the lead connection on the sampler. It is now disconnected and ready for recharging or replacement.

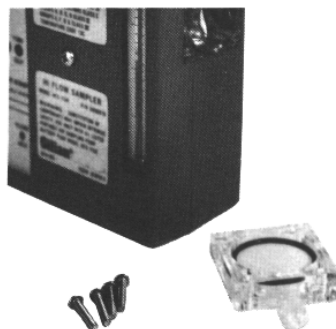
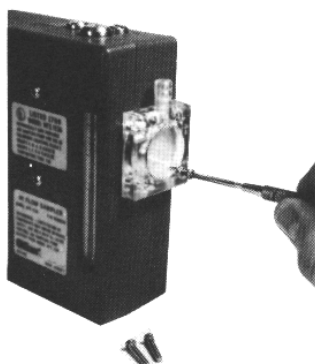
REINSTALLING THE BATTERY PACK.

P50.2.1 Reconnect the Battery Pack plug to the lead connection on the sampler.

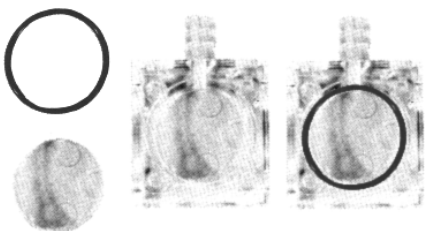
P50.2 Engage the rails of the Battery Pack and slide under the belt clip. The battery will lock into place.

P50.1.3 Reinstall the (2) long screws into the Battery Pack rear. Battery Pack installation is now complete.

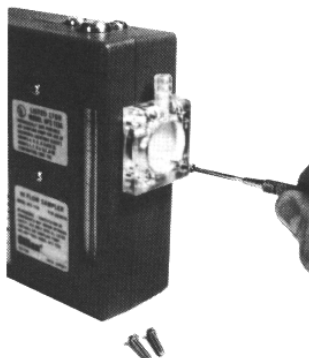
P50.2.1



P50.2.2



P50.2.3



P50.2.4

P50.2 FILTER REPLACEMENT — the filter and o-ring should be replaced when you see discoloration of the filter or a buildup of unknown particulate. Keeping up with this will insure accurate flows and samples as well as keeping the sampler operating efficiently.

P50.2.1 Remove (4) screws from the Filter Housing Front located at the right side of the pump.

P50.2.2 Remove the Filter Housing Front.

P50.2.3 Remove the old filter and o-ring and replace with a new filter and o-ring using a Gilian Pump Filter Kit (800053).

P50.2.4 Replace the Filter Housing Front and reinstall (4) screws. Tighten screws until they stop turning. **DO NOT OVERTIGHTEN.** Filter replacement is now complete.

2. Do not overcharge the batteries. You should not charge battery packs at the high (standard) rate for more than 24 hours. Continuous charging will eventually lead to deterioration in the performance and life of the battery pack. If you must have the batteries on charge for extended periods of time, switch the charger to a low (trickle) rate.
3. Use only HFS-513 single or multi-station chargers. Use of any other charger (including HFS-113 chargers) will result in an improper charge or permanent damage to the battery systems.

DAY TO DAY CHARGING

1. Using a single or multi-station charger, connect the charging connector to the sampler's charging jack and charge the battery for 16 hours prior to operation.
2. Remove the sampler from the charger and operate pump until it shuts down from a low battery.
3. Recharge the batteries for 16 hours or overnight for the next use.

LONG TERM CHARGING & STORAGE

The long term storage of pumps will require some special handling. If pumps are not scheduled to be used for long periods of time (over 2 months), it is recommended that the following procedure be followed on a periodic basis.

1. Charge the battery for 16 hours for a full charge.
2. Run the pump until it shuts down from a low battery.
3. Recharge the batteries only for 16 hours (or overnight) and return to storage. Note: Continuous charging will eventually lead to a deterioration in the performance level of the batter pack. If you must have the batteries on charge for more than 24 hours, switch the charger to a low (trickle) rate.

4.2 CHANGING THE PUMP FILTER

Refer to Figure 3. Under the normal operating conditions, the pump filter should be changed after approximately 250 hours of operation (or sooner). Failure to change the filter as it becomes dirty will decrease the pump back pressure capability and performance envelope. Blow all dust and debris from around the filter housing. Remove the 4 screws (8) and the front filter housing (5). Remove and discard the filter membrane (6) and the O-ring (7). Wash the filter housing in a mild soap and warm water solution, then blow it dry. Insert a new filter membrane and O-ring. Insert the 4 screws (8) and cross tighten until the front filter housing is secured to the rear housing within the case.

LEAK TESTING

Refer to Figure 1. Leakage test the system by removing the screw (22) and installing the discharge air boss. Block the pump inlet boss and apply 20" of suction to the pressure fitting. No leakage should be observed. An alternate procedure to pick up severe leakage is to turn on the pump, block the inlet boss, and then observe that the pump cuts out on a flow fault.

4.4 CALIBRATION

4.4.1 High Flow Calibration

Refer to Figure 1 and Table 1. The constant flow feature of the sampler utilizes load sensing of the pump motor which, through a feedback loop, readjusts the motor speed to maintain constant flow. High Flow Calibration is accomplished by checking and adjusting the flow and Back Pressure Compensation System (BCS) at two points: 1.5 LPM and 4 LPM. This insures that the calibration is accurate at all ranges in the high flow mode.

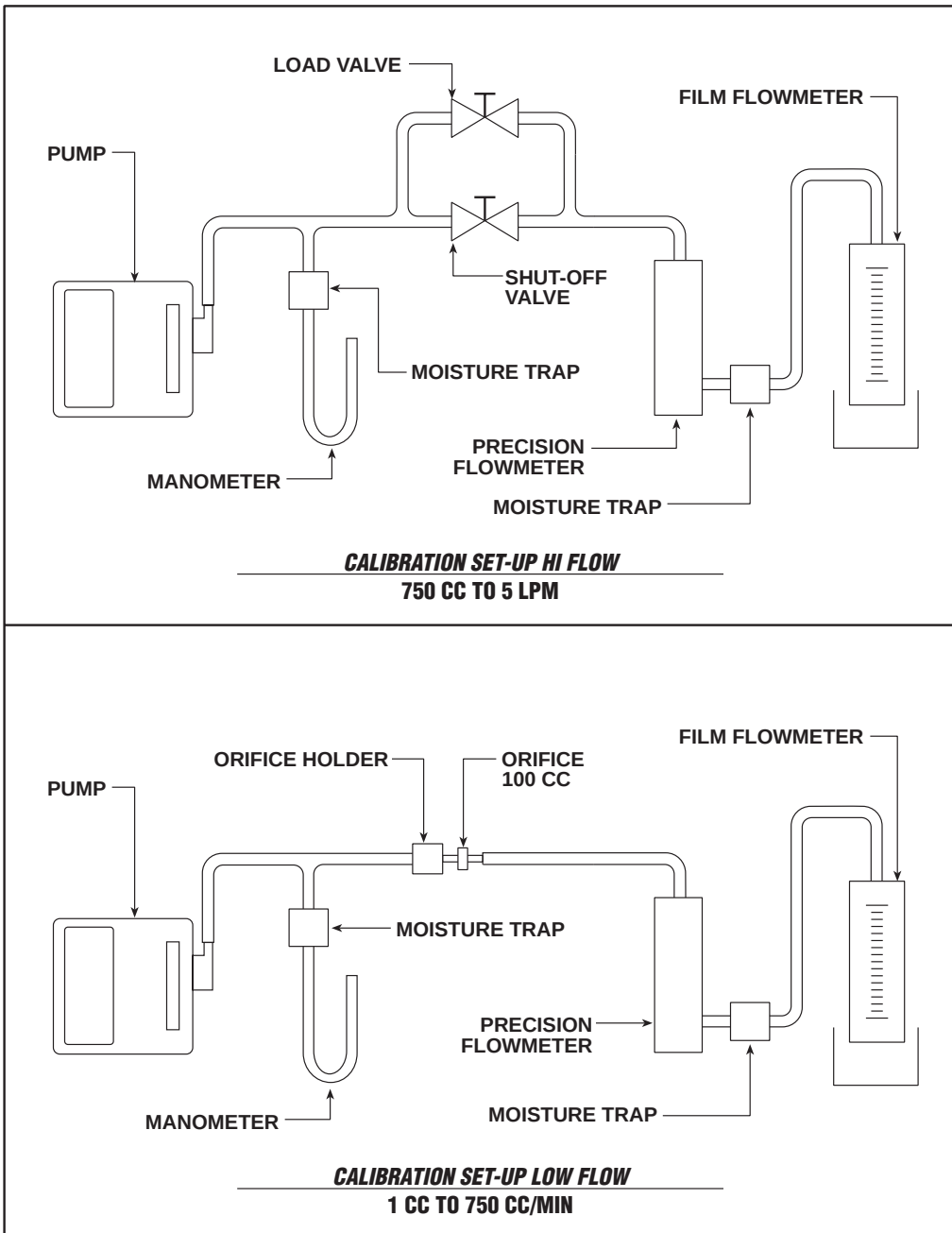


Figure 7
Calibration Set-Up

4.4.2 High Flow Calibration at 1.5 LPM

Set the pump to 1.5 LPM using the Flow Adjust Pot (9). Allow approximately 15 seconds to stabilize. Apply approximately 25" of back pressure by partially restricting the inlet to the pump and note the change in flow on the flowmeter or external flow calibrator. (The pump flowmeter is in the suction side of the pump. Consequently, the flowmeter will read higher as the pressure within the system decreases. An external flow calibrator is not affected by this.)

If the flow decreases (at 25" of back pressure) turn the Flow Calibration Pot (10) slightly counterclockwise to increase the speed of the motor and increase the flow until it is back at 1.5 LPM.

If the flow increases (at 25" of back pressure) turn the Flow Calibration Pot (10) slightly clockwise to decrease the speed of the motor and decrease the flow until it is back to 1.5 LPM. Remove the back pressure. Reset the flow to approximately 1.5 LPM, if necessary. **NOTE:** It is not necessary to set the flow exactly for it is the change in flow which is of importance. Repeat this procedure until the change is within $\pm 5\%$

4.4.3 High Flow Calibration at 4 LPM

Set the pump to 4 LPM using the Flow Adjust Pot (9). Allow approximately 15 seconds to stabilize. Apply approximately 15" of back pressure by partially restricting the inlet to the pump and note the change in flow on the flowmeter or external flow calibrator. (The pump flowmeter is in the suction side of the pump. Consequently, the flowmeter will read higher as the pressure within the system decreases. An external flow calibrator is not affected by this.)

If the flow changes with load (increases or decreases) note the AMOUNT OF CHANGE (differential). Remove the back pressure. Adjust the 4 LPM Flow Calibration Pot (4) to increase or decrease the flow ten times (10x) the differential noted.

Example:

FLOW INCREASES:

Flow at Set Point 4000 cc/min
Flow at 10" Back Pressure 4050 cc/min
Flow at Differential +50 cc/min
10x..... +500 cc/min
Calibration Set Point 4500 cc/min

Example:

FLOW DECREASES:

Flow at Set Point 4000 cc/min
Flow at 10" Back Pressure 3950 cc/min
Flow at Differential -50 cc/min
10x..... -500 cc/min
Calibration Set Point 3500 cc/min

Adjust the Flow Control Pot (9) to bring the flow back to 4 LPM. Reapply the back pressure and note any change in the flow. Repeat this procedure until the change is within $\pm 5\%$.

4.4.4 Low Flow Calibration (1 cc to 750 cc/min)

(HFS-513AU, HFS-513AUC, HFS-513AUT, HFS-513AUP, timing Model only)

Refer to Figure 1 and Table 1.

Low flow calibration consists of simply setting the differential pressure drop of the Low Flow Pressure Regulator. Once set, the regulator should not require frequent readjustment. Turn on the pump and adjust the Flow control Pot (9) to 1,5 LPM.

Remove the Protective Cap (23). With the Regulator Adjust Screwdriver, open the pressure regulator shut-off valve located under the cap (23). By turning it counterclockwise approximately 5 turns (additional turns will have no effect).

Connect a manometer or pressure gauge capable of reading up to 40" H₂O to the pump as shown in Figure 7.

NOTE:

IF A MANOMETER IS USED, MAKE SURE THAT A WATER TRAP IS INSERTED BETWEEN THE MANOMETER AND THE PUMP INLET. THIS WILL PREVENT POTENTIAL DAMAGE CAUSES BY LIQUID ACCIDENTALLY ENTERING THE PUMP.

Attach a Variable Flow Controller tube holder as shown in Figure 7. Remove the Protective Cap (21) and completely block the air entering the tube holder.

Adjust the pump suction pressure to 25" H₂O by turning the pressure regulator adjust screw (located under the Protective Cap [21]) clockwise to increase the pressure. Turn the screw counterclockwise to decrease the pressure.

With the flow between 0 and 200 cc/min, the pressure should not change more than 1 1/4". Replace the protective caps.

This completes Low Flow Calibration.

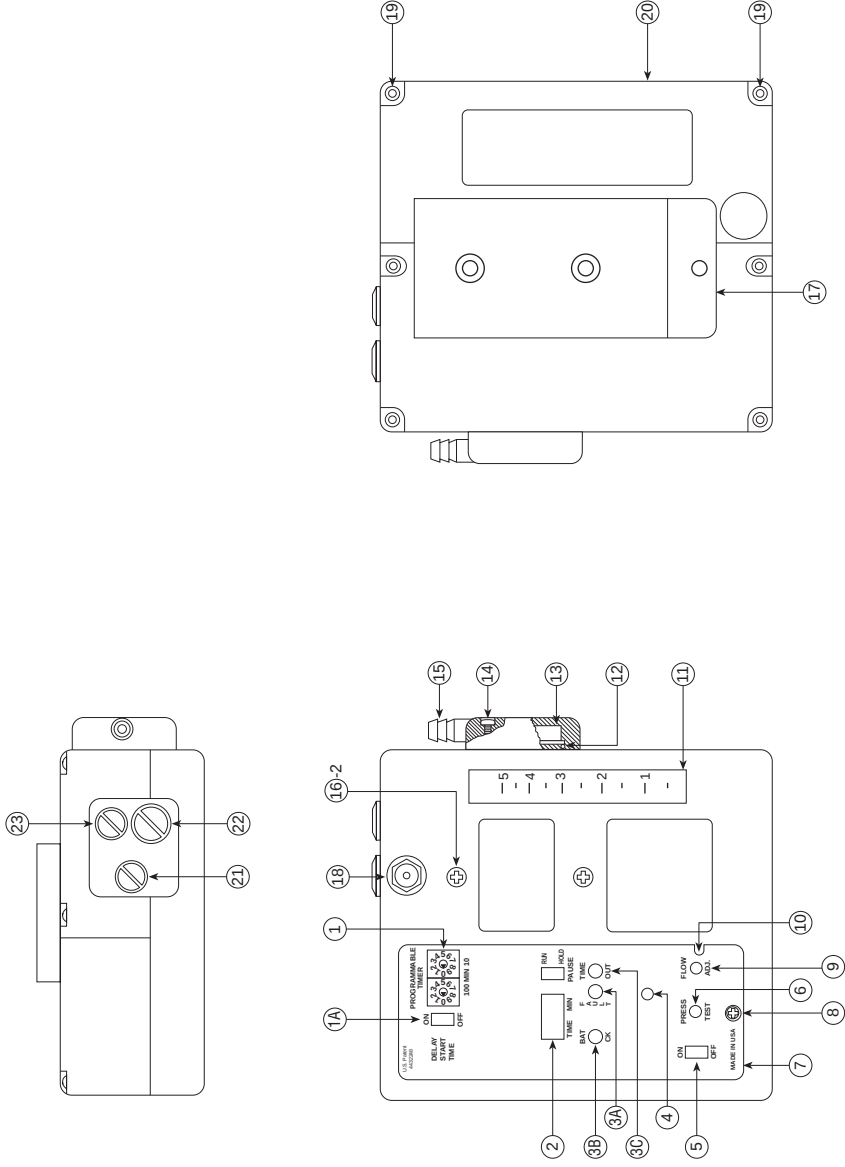


Figure 1
HFS-513 Air Sampling Pump

TABLE 1

HFS 513 FUNCTIONS

ITEM NO.	NOMENCLATURE	DESCRIPTION	ITEM NO.	NOMENCLATURE	DESCRIPTION
1	PROGRAMMABLE TIMER	Allows user to set sample time from 10 minutes to 990 minutes in ten minute increments.	10	1 LPM CALIBRATION ADJUST	Calibrates low flow tracking.
1A	PROGRAMMABLE DELAY START SWITCH	Allows user to delay start of pump.	11	FLOW METER	Show flow; read center of meter ball.
2	TIME DISPLAY	Recorded run time and/or fault time.	12	"O" RING SEAL	Seals Filter (13) into inlet housing (15).
3	TEST AND FAULT DISPLAY		13	FILTER	10 micron nylon.
	A) FAULT	Indicates insufficient battery voltage to continue running flow set point, or indicates pump could not maintain flow performance parameters.	14	SCREWS (4)	Secures filter housing to pump.
	B) BATTERY CHECK	Insures sufficient battery capacity to run performance profile when Press-To-Test Switch is pressed.	15	FILTER HOUSING (AIR INLET)	Provides air inlet boss and visual monitoring of pump inlet filter.
	C) TIME OUT	Indicates programmed time has been completed.	16-2	ACCESSORY MOUNTING SCREWS (2)	Provides means of securing pump accessories.
4	4 LPM CALIBRATION ADJUST	Calibrates hi flow tracking.	17	BELT CLIP	Secures pump to worker.
5	ON-OFF SWITCH	Provides power to unit.	18	CHARGING JACK	Provides means of recharging battery.
6	PRESS-TO-TEST SWITCH	Checks test, fault, and time displays.	19	BATTERY PACK SCREWS (2)	Secures battery pack to pump.
7	ANTI-TAMPER COVER PLATE	Prevents inadvertent adjustment or tampering with pump settings.	20	BATTERY PACK ASSEMBLY	Provides power for sampler.
8	ANTI-TAMPER COVER PLATE SCREW	Secures plate.	21	REGULATOR ADJUST	Removing screw provides access to regulator pressure adjust.
9	FLOW ADJUST	Turned clockwise, increases flow; counterclockwise, decreases flow.	22	DISCHARGE AIR CAP SCREW	Removing provides access to discharge port, for installing air boss.
			23	REGULATOR SHUT-OFF CAP SCREW	Removing screw provides access to the regulator shut-off valve.

WIRING DIAGRAM

Pneumatic Assembly Overhaul Kit
(PN° 800054) consists of Items 9, 10, 12, & 13
Pump Filter Kit (PN° 800053 consists of
Items 6 (Qty 3), 7 (Qty 3), & 8 (Qty 1)

14	1	800048	Regulator Dummy Assembly
13	1	—	Tubing, Inlet, 3/16" ID x 1/16" Wall x 1/2" LG
12	1	—	Tubing, Inlet, 3/16" ID x 1/16" Wall x 2.4" LG
11	1	400410	Flowmeter
10	2	—	Screw, Pan Head, #4-40 x 2 1/4" LG
9	6	—	"O" Ring
8	4	—	Screw, Pan Head #4-40 x 5/8" LG
7	1	—	"O" Ring
6	1	—	Filter
5	1	200023	Housing, Filter Front
4	1	800045	Housing, Filter Rear
3	1	800009	Regulator Assembly
2	2	800008	Damper Assembly
1	1	800302	Pump Assembly
Item No.	Qty Req	Part No.	Description

PNEUMATIC ASSEMBLY

SKA 1616 REV B

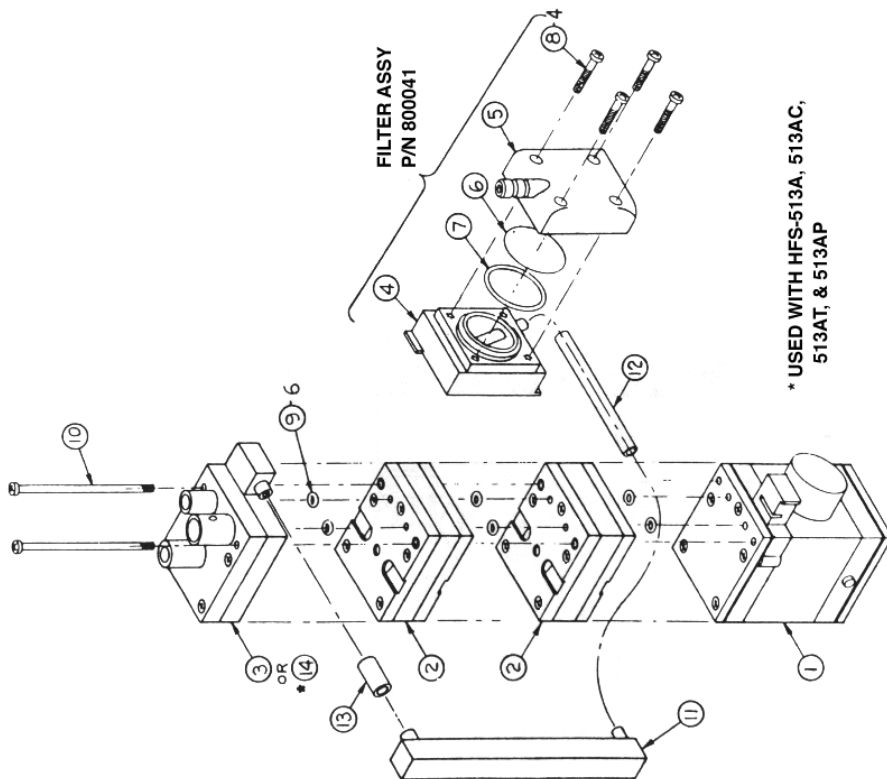


Figure 3
Pneumatic Assembly

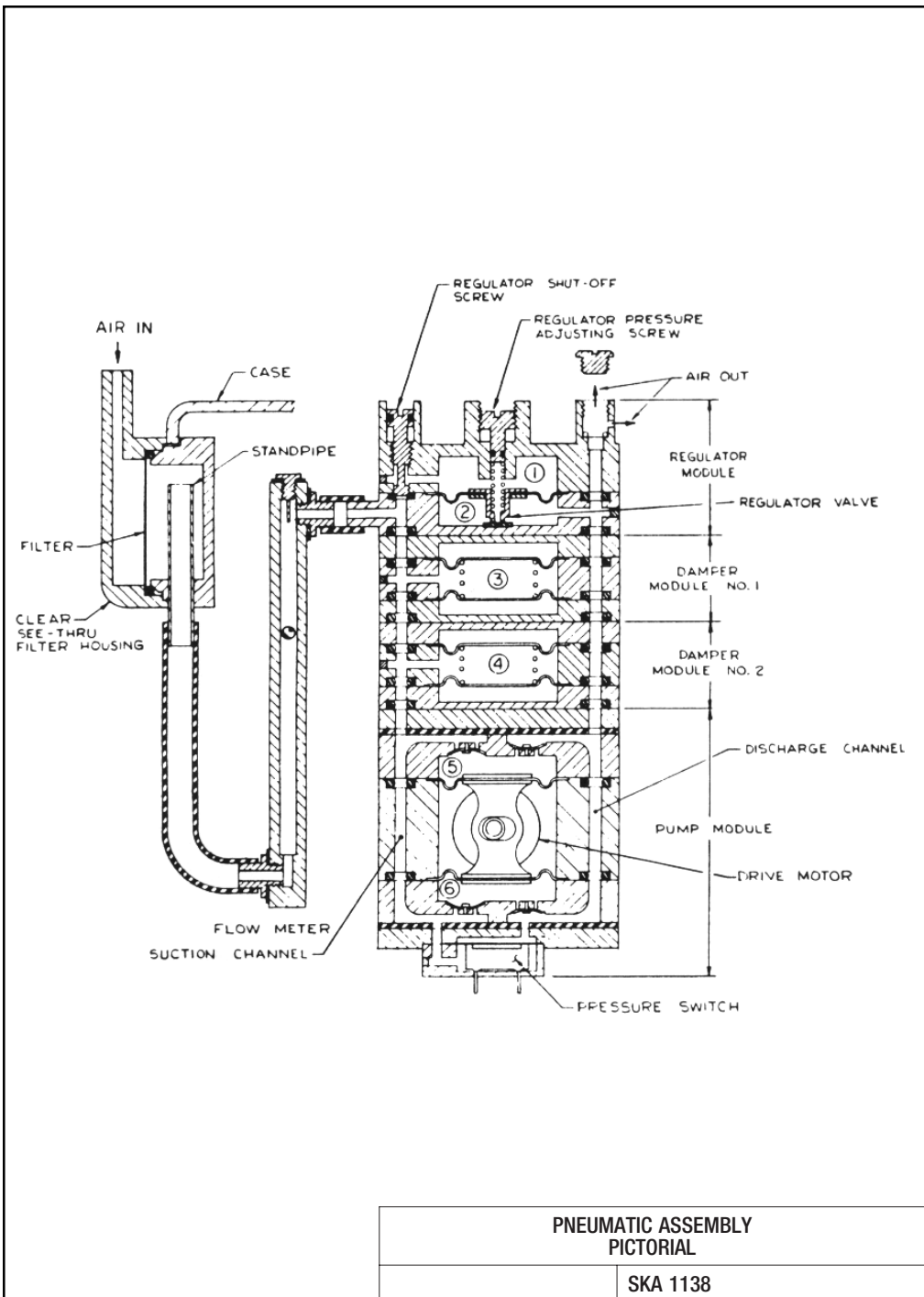
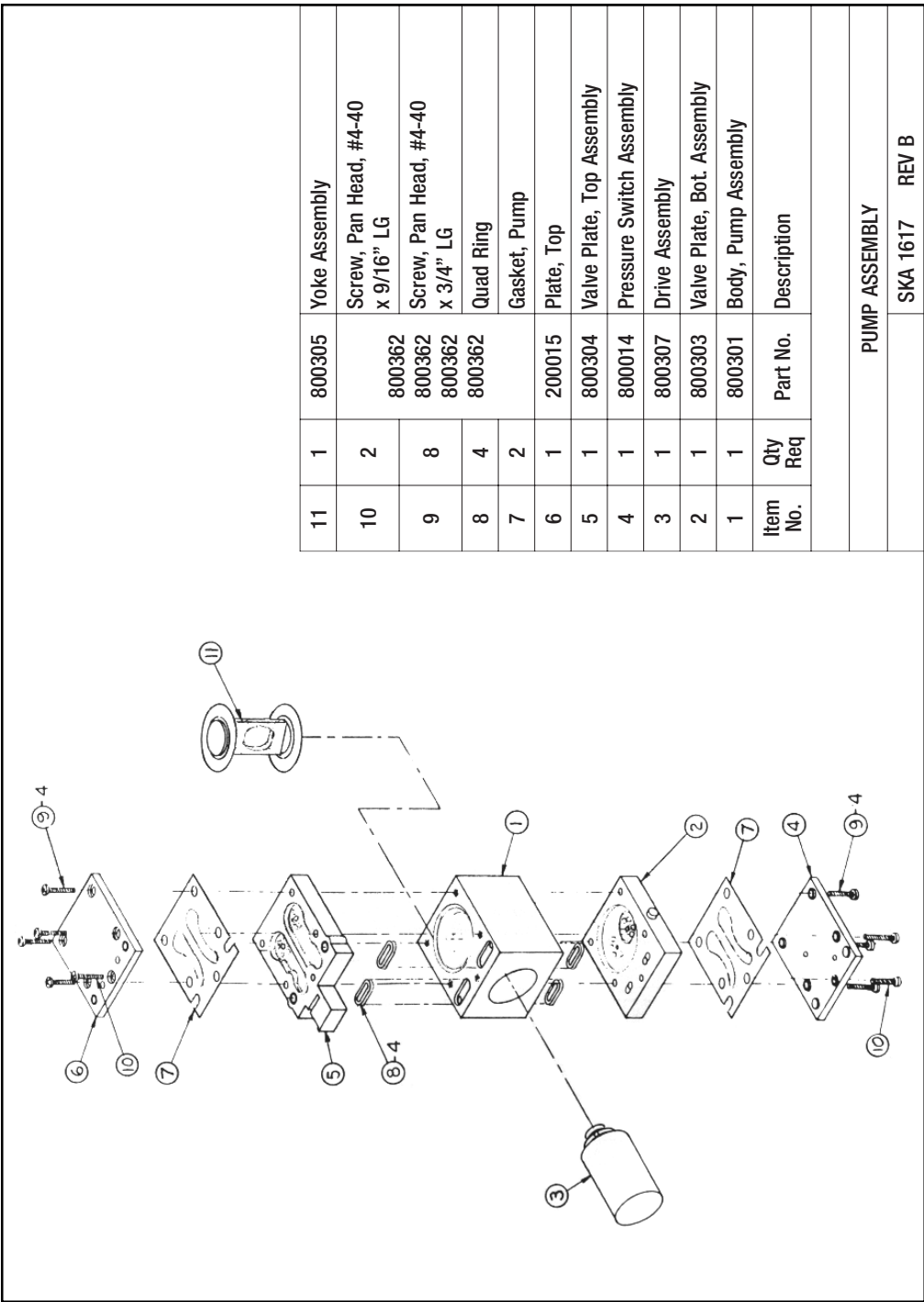
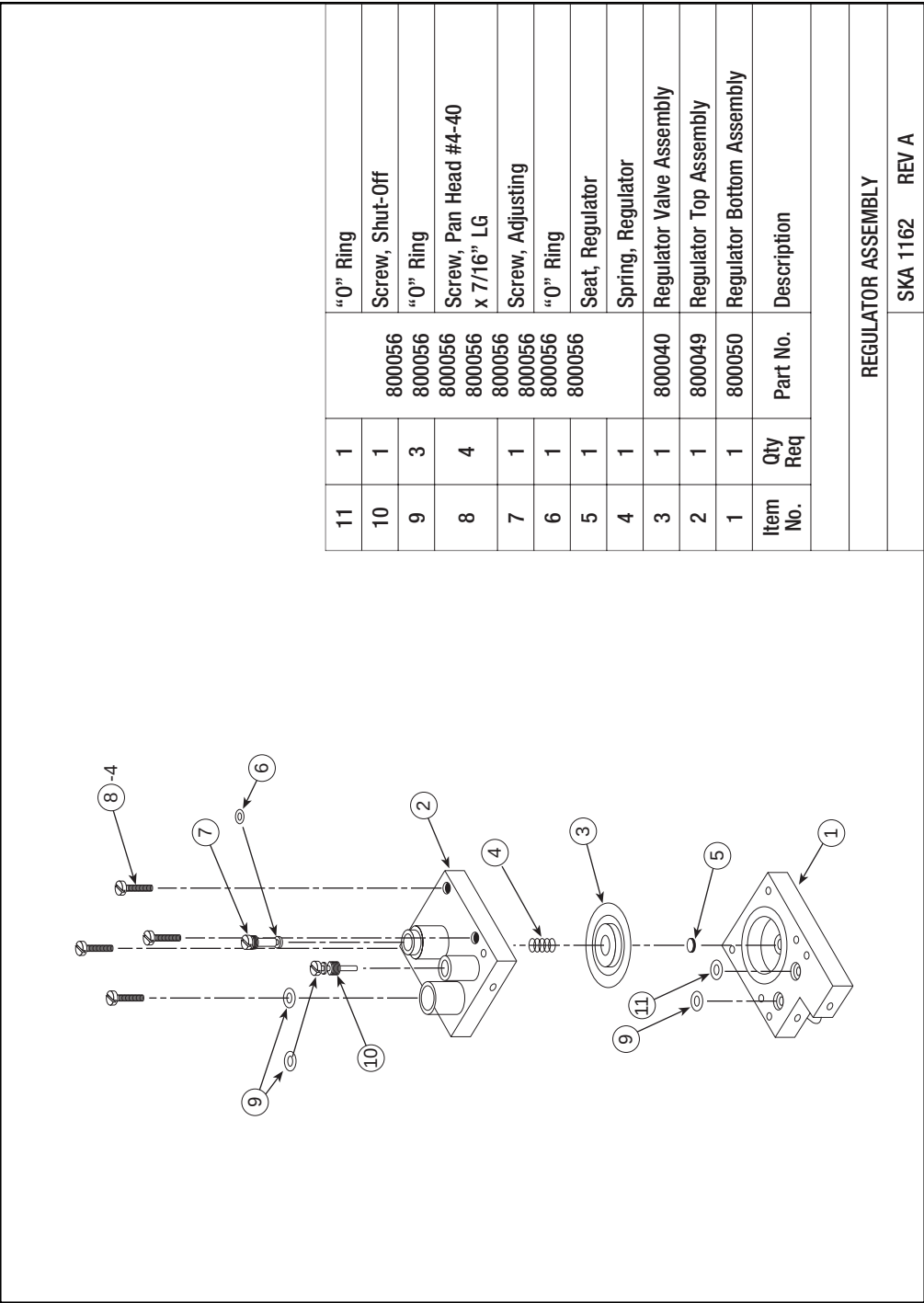


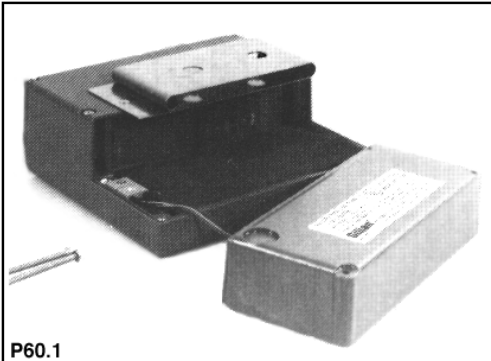
Figure 3A
Pneumatic Assembly Pictorial



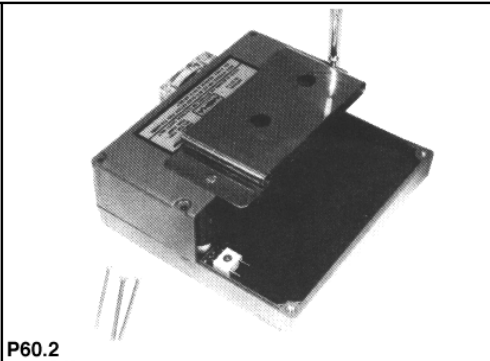
11	1	800305	Yoke Assembly
10	2	800362 800362 800362 800362	Screw, Pan Head, #4-40 x 9/16" LG
9	8		Screw, Pan Head, #4-40 x 3/4" LG
8	4		Quad Ring
7	2		Gasket, Pump
6	1	200015	Plate, Top
5	1	800304	Valve Plate, Top Assembly
4	1	800014	Pressure Switch Assembly
3	1	800307	Drive Assembly
2	1	800303	Valve Plate, Bot. Assembly
1	1	800301	Body, Pump Assembly
Item No.	Qty Req	Part No.	Description
PUMP ASSEMBLY			
		SKA 1617	REV B



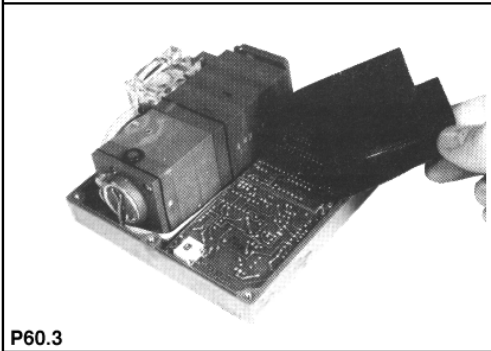
11	1	"O" Ring
10	1	Screw, Shut-Off
9	3	"O" Ring
8	4	Screw, Pan Head #4-40 x 7/16" LG
7	1	Screw, Adjusting
6	1	"O" Ring
5	1	Seat, Regulator
4	1	Spring, Regulator
3	1	Regulator Valve Assembly
2	1	Regulator Top Assembly
1	1	Regulator Bottom Assembly
Item No.	Qty Req	Part No.
Description		
REGULATOR ASSEMBLY		
SKA 1162 REV A		



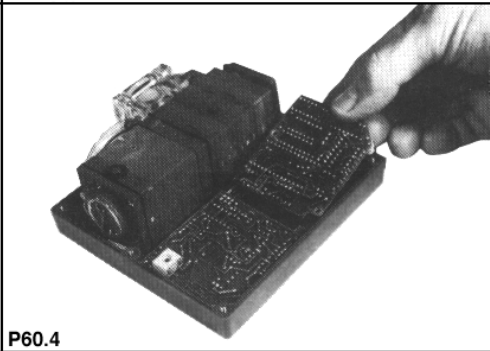
P60.1



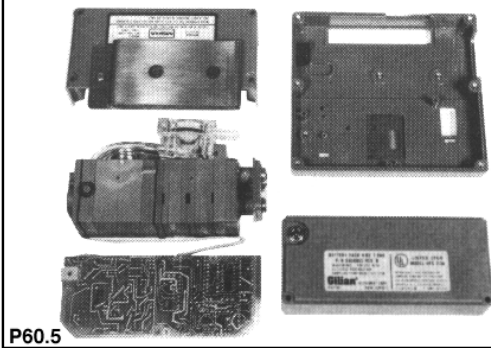
P60.2



P60.3



P60.4



P60.5

P60.0 GENERAL DISASSEMBLY

P60.1 Remove Battery Pack (See Removal of Battery pack Section P50.0). (Photos)

P60.2 Remove (4) long screws from Case Rear. While holding the filter assembly, gently and slowly wiggle the cover upward.

P60.3 Remove protective foam from the electronic system and remove the (4) hold down screws from the Timer/Control Board NOTE: The fourth screw is located in the electrical jack.

P60.4 After hold down screws have been removed, lift gently and slide the Timer Board out of the Control Board.
NOTE: Handle these components gently and place on a soft surface.

P60.5 These are your basic HFS assemblies.

NOTE: If you have problems with the Pneumatic Assembly or have damaged it with water or in a corrosive atmosphere, send the unit to the Sensidyne Service Department. (Please refer to the Return Material Authorization on page 31).

Pump Diagrams and Part Number

(see Figures for revision information)

HFS-513 Air Sampler Parts List

Case Components (Refer to SKA 1615 Rev B, page 21)

	Description	Part#	Qty	Remarks
—	Pneumatic Assy. (basic)	800309	1	
1	Pneumatic Assy. (U)	800199	1	
2	Battery Pack	800198	1	Inc. 2 screws
3	Case Assy. Front	800201	1	Inc. Nameplates
4	Case Assy. Rear	800202	1	Inc. Beltclip
5	Cover Plate Assy.	800034	1	
—	Anti-Tamper Cover Plate	800144	1	
7	Press to Test Button	200045	1	
8	Insert Case	200050	1	
16	Fitting Outlet	200042	1	
—	Screws, Sealing Kit	800109	1	Inc. Items 11, 12
—	Screws & O-ring Kit	800052	1	Inc. Items 13, 14, 15
—	Case Assy. (complete)	800051	1	Inc. Items 3, 4, 5, 7, 8, 11, 12, 13, 14, 15

Electronic Components (Refer to SKA 1615 Rev B, page 21)

6	Wiring Harness	200703		
17	Control Board	400146	1	Inc. Mount Screws
18	Timing Board (C)	400254	1	Inc. Mount Screws
19	Timing Board (T)	400255	1	Inc. Mount Screws
20	Timing Board (P)	200256	1	Inc. Mount Screws

Pneumatic Assembly (Refer to SKA 1616 Rev B, page 22)

—	Pneumatic Assy. (basic)	800309	1	
—	Pneumatic Assy. (U)	800199	1	
1	Pump Assembly	800302	1	
2	Damper Assembly	800008	1	Inc. Mount O-ring
3	Regulator Assembly	800009	1	Inc. Mount O-ring
4	Housing, Filter Rear	800045	1	
5	Housing, Filter Front	200023	1	
—	Pump Filter Assy. (comp)	800041	1	Inc. 4, 5, 6, 7, 8
—	Pump Filter Kit	800053	1	Inc. Items 6, 7, 8
11	Flowmeter	400410	1	
14	Regulator Dummy Assy.	800048	1	
—	Pneumatic Assy. Ovrhaul Kit	800054	1	Inc. 9, 10, 12, 13

HFS-513 Air Sampler Parts List (Cont'd)**Pump Assembly (Refer to SKA 1617 Rev B, page 24)**

	Description	Part#	Qty	Remarks
—	Pump Assy. (complete)	800302	1	
1	Body Assy.	800301	1	
2	Valve Plate (bottom)	800303	1	Assembled/Tested
5	Valve Plate (top)	800304	1	Assembled/Tested
4	Pressure Switch Assy.	800014	1	Assembled/Tested
6	Plate, Top	200015	1	
3	Drive Assy.	800307	1	Bearing, Eccentric
11	Yoke Assy.	800305	1	Diaphragm, retainer
—	Pump Overhaul Kit	800308	1	Inc. Items 7, 8, 9, 10

Damper Assembly

	Damper Assy. (complete)	800008	1	Inc. mount O-rings
	Body, Damper	800047	1	
	Plate, Damper (top)	200019	1	
	Plate, Damper (bottom)	200018	1	
	Damper Overhaul Kit	800055	1	Inc. 4, 5, 6, 7, 8

Regulator Assembly (Refer to SKA 1162 Rev B, page 25)

—	Regulator Assy. (complete)	800009	1	Inc. mount O-rings
1	Regulator Assy. (bottom)	800050	1	Inc. Items 1, 5
2	Regulator Assy. (top)	800049	1	
3	Regulator Valve Assy.	800040	1	Diaphragm, Valve, Ret.
—	Damper Overhaul Kit	800056	1	4, 5, 6, 7, 8, 9, 10, 11
—	Regulator, Dummy	800048	1	Spacer for Non-Reg Models HFS-512A, -513AC, -513AT, -513AP

HFS-513 Air Sampling System Specifications

Operation Range	High Flow: 750–5000 cc/min constant flow sampling. Low Flow: 1–750 cc/min achieved through use with variable flow controller. This unique feature allows very low flows as well as two or more simultaneous, independently set samples.
Pressure Range	750 cc/35" H ₂ O 1000 cc/35" H ₂ O 2000 cc/35" H ₂ O 3000 cc/30" H ₂ O 4000 cc/20" H ₂ O 5000 cc/15" H ₂ O
Flow Control	± 5% of set point
Flow Indicator	Built-in flowmeter, range 0–5 LPM with 500 cc/div. scale marked at 1, 2, 3, 4, & 5 LPM.
Flow Fault Indicator	LED fault indicator will light immediately if the unit is operated out of it's performance envelope. The pump will run for another 15–30 seconds before shutting down, and the LED will remain illuminated.
Battery Test	When the Push-to-Test button is pressed, the Battery LED will illuminate, indicating that battery will provide a minimum of 8 hours of operation over the operating range.
Battery	Plug-in battery pack, rechargeable NiCad, 1.8 Ah, 6.0V, UL listed. Can be charge internally or externally with use of an adaptor.
Intrinsic Safety Ratings	UL listed for Classes 1, 2 & 3, Groups A, B, C, D, E, F and G, for explosive gas and dust atmospheres. SCS (SIRA Certification Service) listed Certificate No. Ex91C2018X, Coding: EEx iB IICT4.
Compact Size	1.87" x 4.62" x 5.12" (44.7 in ³) 4.76 cm x 11.74 cm x 13.02 mm [732 cm ³]

HFS-513 Air Sampling System Specifications (continued)

Weight	2.25 lbs (1.02 kg) • HFS-513A, HFS-513AU, 2.31 lbs (1.05 kg) • HFS Timer Models
Temperature	Operating: -20 to 45 C° (-4 to 113 F°) Storage: -40 to 45 C° (-40 to 113 F°) Charging: +5 to 45 C° (41 to 113 F°)
Additional Features	See-through external filter housing, built-in moisture trap, anti-tamper cover, accessory mounting provisions.
Timer Modules	"C" module provides fault shut down function with elapsed-time clock display. "T" module provides fault shut down, clock display, and programmable stop time. "P" module provides fault shut down, clock display, and programmable start and stop times.
Low Flow Regulator Module ...	Provides low flow capability from 1 to 750 cc/min by using an active pressure regulator which is set to 20" W.C. across variable flow controllers as described above, this allows very low flows as well as multiple, simultaneous samples with independently adjusted samples.
Warranty	The HFS-513 constant flow sampler is guaranteed for one year against any defects in parts and/or workmanship.

RETURNED MATERIAL AUTHORIZATION (RMA)

Sensidyne maintains a factory facility to provide its customers with both warranty and non-warranty repair service. Our policy is to perform all needed repairs to restore the instrument to its full operating condition. *Sensidyne assumes no liability for service performed by personnel other than qualified Sensidyne personnel.* Please contact Sensidyne Service *in advance* if you have a problem which cannot be remedied and/or requires a Returned Material Authorization (RMA). (You need an RMA No. to return the product to the factory). You can reach Sensidyne Service at 727-530-3602 [voice], 727-539-0550 [FAX], or at address below.

There is a minimum fee for all non-warranty repairs (for handling and inspection costs, and for cost of providing an estimate). However, fee is waived, if repair is authorized. State “Not To Exceed \$(dollar amt)” on P.O. if you want to keep repair costs below a certain amount. If you need a price quote before authorizing a repair, state so on the purchase order (this costs more and could delay your repair). Repairs are handled on a “first come–first serve” basis. You can speed up your repair by authorizing an expediting fee. This places your order next in line behind orders currently in process. First time service orders require prepayment or COD shipment. Prices subject to change without notice.

Ship instrument and accessories in original packing (if possible). Enclose your return address, purchase order, shipping & billing information, RMA No., description of problem, and any special instructions. Send to:

Sensidyne, Inc.
ATTN: Service (RMA #_____)
16333 Bay Vista Drive
Clearwater, FL 33760



Certificate No. 970084

SENSIDYNE[®]

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