

Sitek *Process Solutions*

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CYBOR PUMP

Series 5000

Programmable Metering Pump System

Operation Manual

Sitek Process Solutions

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LAM 480, 490

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Tegal 903 etcher 5"
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CHA SE 600 evaporator
CHA 1000 E-beam evaporator
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Varian 3120 E-beam evaporator
Varian 3125 E-beam evaporator

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Bruce BDF4 Furnace
Tempress 4 stacks

SVG/Thermco 4300 4-stack w/TMX
9001 controller
Thermco MB-71, 80 & 81 Mini-Brutes
Thermco TMX 9000 furnaces
Thermco TMX 9001 4 stack, 5 & 6"

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Eaton Nova 10-160 high current implanters
Eaton Nova 3204/3206 implanter
Varian CF4 and DF4 implanter
Varian CF5 and DF5 implanter
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Varian 120XP

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Triotech 4001-1A-2 fine leak detector
Varian 936-60
Veeco MS-Series

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Cannon PLA 500F aligners
Canon PLA 501F and FA aligners
Canon 521 FA
Canon FPA-1550 MI G-line
KARL SUSS MA56 3" aligner

KARL SUSS MA54 4" GaAs
KARL SUSS MJB-3 aligners
KARL SUSS MJB 55 aligners
Kasper 2001 aligners: 3 or 4"
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Perkin-Elmer 340/341 mask aligners
Perkin-Elmer 552HT
Perkin-Elmer 600HT, 660HT

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R&K 260 and 300 probe stations
R&K 670 Semi Auto prober
Signatone S450 Semi-Auto with
motorized stage/micozoom
probes
Signatone S 250 sub-micron
analytical prober
Teledyne TAC PR-100 prober
Teledyne TAC PR-53 prober
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410, 4100, 8108)

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P5000
System
Applied Materials 7800 and 7810
RP/RPX
ASM PECVD

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Estek WIS-600, 800, 8000, 850, 8500
Nanometrics Nanoline III CD measure
Nanometrics Nanoline IV CD measure

Nanometrics Nanoline V CD measure
Nanometrics Nanoline 50 CD measure
Nanometrics Nanospec AFT 174, 180,
181, 200 & 210

Nikon Optistation 2A & 3A
OSI Microvision VLS-1 CD measure

CSI Microvision VLS-201 inspection
station
Tencor Surfscans 100, 164, 4000,
4500, 5000, 5500, 6200, 7000

Wafer & Mask Scrubbers

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MTI 6700 mask scrubber
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Solitec 1100 scrubber
Solitec 5110 SJ scrubber

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SVG 8120 SSC scrubber
SVG 8620 SSC scrubber
Ultratech 602 mask cleaner
Ultratech 603 mask cleaner

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GCA 8000 stepper, 5x
GCA 8500 in-line stepper, 5x
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Ultratech 900 standard field stepper
Ultratech 1000 standard
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Sloan Dektak IA and IIA

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Tencor Alpha step 200 profilometer
Tencor 100 and 160 Surfscan
Veeco FPP 100, 5000 4-point

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Balzer BAK 600 sputtering system
Balzer LLS 801 sputtering system
Balzer BA 510 sputtering system

CPA 9900 and 9930 sputtering system
CPA 9980 sputtering system

MRC 603 sputtering/vertical-load lock
MRC 643 sputtering system
MRC 902M sputtering system
MRC 903A and 903M sputtering

MRC 942-A-2 CTI cryo
MCR 943 3 target in-line sputtering
Perkin-Elmer 2400 and 2400-8L
sputtering system

Perkin-Elmer 4400
Perkin-Elmer 4410
Perkin-Elmer 4450
ULVAC MCH-9000
Varian 3120 sputtering systems
Varian 3180 sputtering systems
Varian 3190 sputtering systems

Varian 3290

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SECTION 1 INTRODUCTION AND DESCRIPTION

1.1 SCOPE

This manual provides installation, operation, and maintenance instructions for the CYBORPUMP™ Series 5000 Programmable Metering Pump* System. The instructions include a description of the equipment, setup/startup procedures, operating procedures, and detailed maintenance procedures.

1.2 INTRODUCTION

The CYBORPUMP™ Series 5000 System provides a means of dispensing precise amounts of liquids at specific rates. All dispense parameters are in actual physical units and all dispense operations are totally digitally programmable. The pump may be operated from a pump control module (Model 503/504/506) or track pump control and status lines.

The system is capable of controlling the volumes and rates for up to three pumps with a Model 503 or a Model 506 Pump Control Module or four pumps with a Model 504 Pump Control Module. The parameters are stored in recipes, and each pump can have up to eight recipes.

Dispense volume may be programmed from 0.1 ml up to 16.0 ml. The dispense rate is programmable between 0.10 ml/second to 3.00 ml/second. Table 1-1 lists the programmable volume and rate parameters for each operating cycle. The CYBORPUMP™ System does not require mechanical adjustments, which in turn cause repetitive run/adjust/run cycles to determine the correct setup.

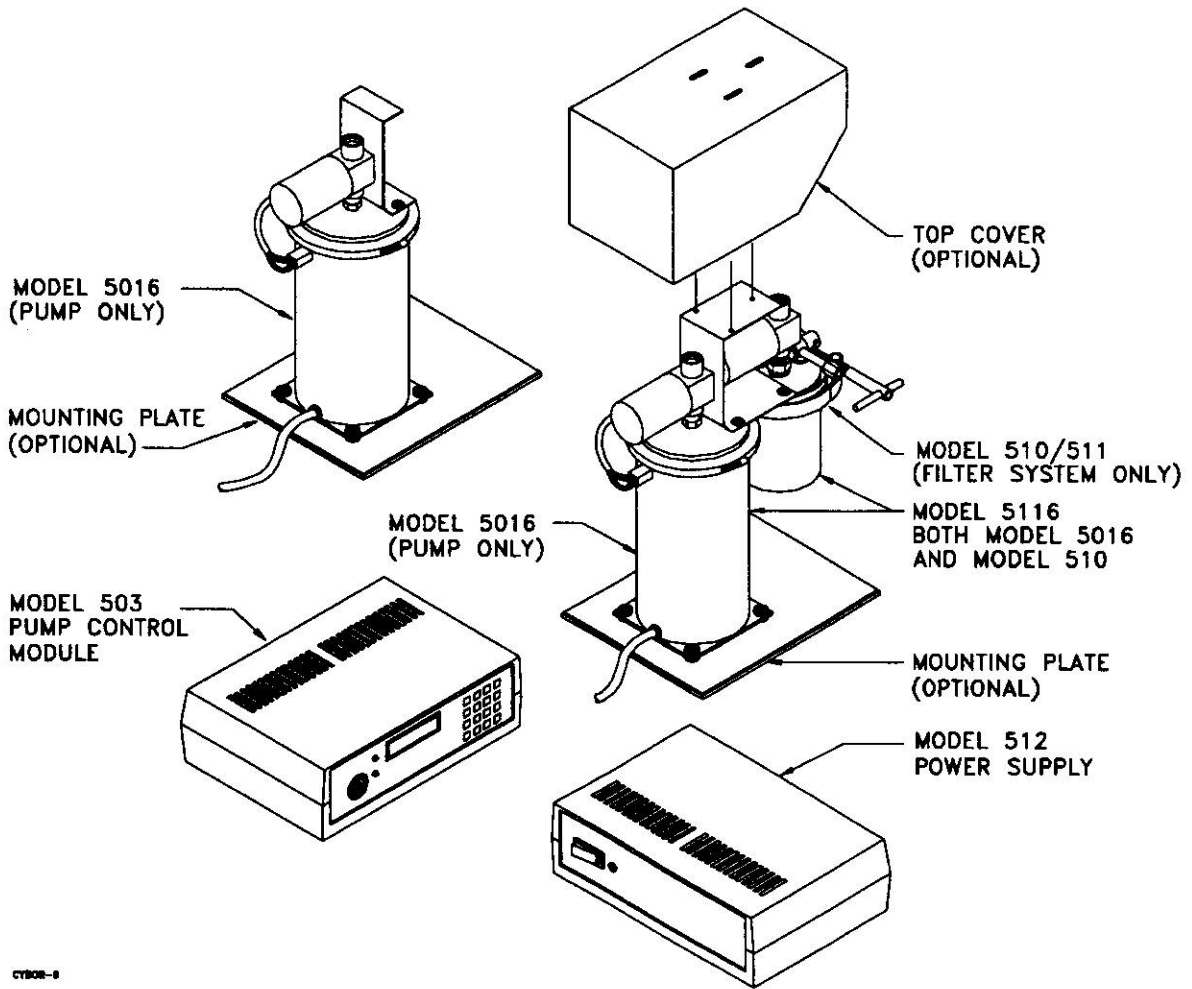
1.3 COMPONENT DESCRIPTION

The CYBORPUMP™ System 5000 consists of from one to four (up to three with a Model 503 or a Model 506 Pump Control Module, up to four with a Model 504 Pump Control Module) Model 5016 pumps or Model 5116 All-Teflon® Path (ATP) Pump and Filter Systems, a Model 503/504/506 pump control module, and a Model 512 power supply (figures 1-1 and 1-2). All wetted surfaces in the chemical flow path of the CYBORPUMP™ System 5000 are made of Teflon®.

Table 1-1. Volume and Rate Specifications

Parameter	Specification	
Programmable volumes	Dispense	0.1 ml min 16.0 ml max
	Suckback	0.0 ml min 1.0 ml max
Programmable volume resolution	Dispense	0.1 ml
	Suckback	0.01 ml
Programmable rates	Dispense	0.1 ml/sec min 3.0 ml/sec max
	Suckback	0.04 ml/sec min 3.00 ml/sec max
	Reload Rate	0.1 ml/sec min 3.0 ml/sec max
Programmable rate resolution	Dispense	0.01 ml/sec
	Suckback	0.01 ml/sec
Long term stability	±0.01 ml over 120,000 cycles	

*U.S. Patent number 4,950,134, and other patents pending.



CYBOR-8

Figure 1-1. Typical CYBORPUMP™ System 5000 Components

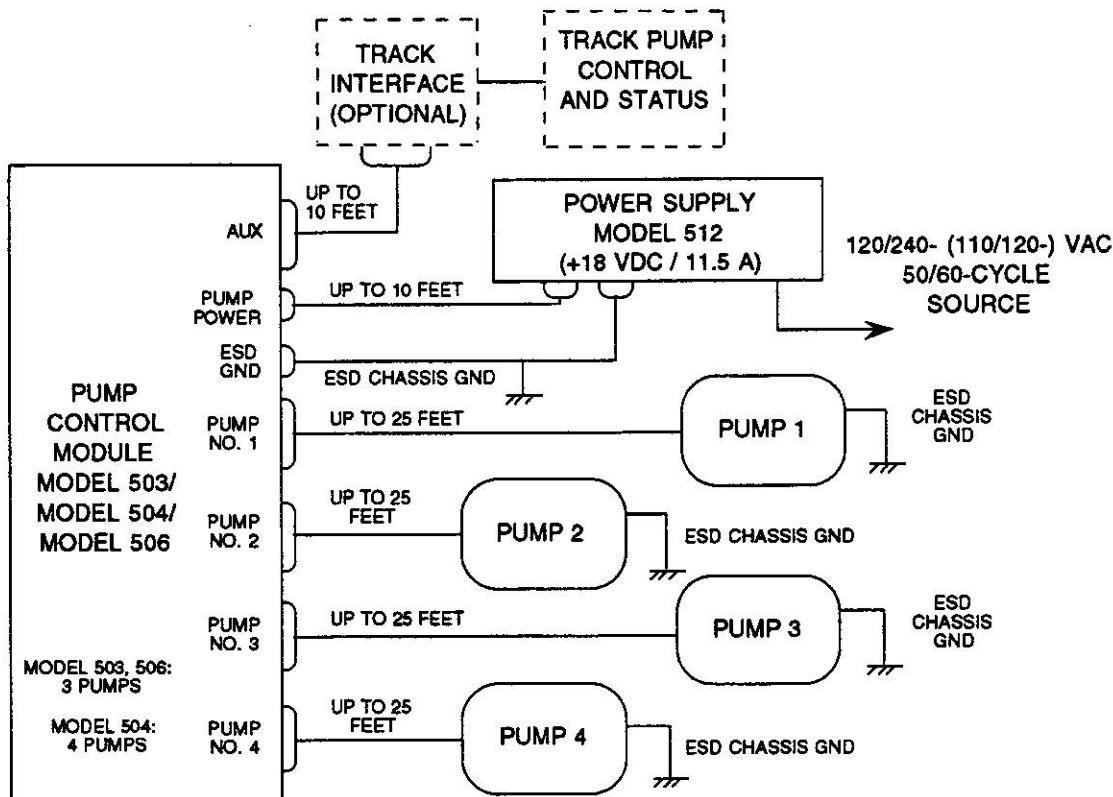


Figure 1-2. Typical CYBORPUMP™ System 5000 Series Block Diagram

1.3.1 Model 5016 Pump

The Model 5016 (16-ml capacity) pump operates from the pump control module. No mechanical or electrical adjustments are required to operate the pump. All pump wetted surfaces are Teflon®. The pump uses an electrohydraulic drive mechanism as a positive displacement device to exert a pressure against a Teflon® diaphragm. Programmed values of the volume and rate of the displacement device cause a precise volume of liquid to be dispensed at a specific rate. The pump provides the means of performing hundreds of thousands of dispense cycles with no negligible change in dispense volume. Table 1-2 lists the recommended tubing size and fluid viscosity and the maximum dispense rates for the pump when used in the CYBORPUMP™ Model 5016 Pump System and the CYBORPUMP™ Model 5116 ATP Pump and Filter System.

To calculate a maximum dispense rate for a viscosity not listed in table 1-2, proceed as follows:

Example:

- a. Select appropriate filter element and tubing OD and ID. Determine viscosity of fluid to be dispensed (desired viscosity).
- b. Refer to table 1-2 and locate nearest listings for filter element, tubing size, and desired fluid viscosity.
- c. Determine nearest viscosity values above and below desired viscosity listed in table 1-2.
- d. Subtract table 1-2 lower viscosity value from upper viscosity value to determine viscosity range.

Filter: 0.1 µ Pall
 Tubing: 3/16-in. OD, 1/8-in. ID
 Desired Viscosity: 30 cs
 20 and 80 cs
 80 cs - 20 = 60 cs

- e. Subtract table 1-2 lower viscosity value from desired viscosity to obtain an offset viscosity value 30 cs – 20 cs = 10 cs
- f. Calculate viscosity ratio by dividing offset viscosity value (obtained in step e) by viscosity range (obtained in step d). 10 cs/60 cs = 0.1667
- g. Determine nearest dispense rate values above and below desired viscosity listed in table 1-2. 1.10 and 0.28 ml/sec
- h. Subtract table 1-2 lower maximum dispense rate value from upper maximum dispense rate value to determine maximum dispense rate range. 1.10 ml/sec – 0.28 ml/sec = 0.82 ml/sec
- i. Calculate a maximum dispense rate delta by multiplying viscosity ratio (obtained in step f) by maximum dispense rate range (obtained in step h). 0.1667 X 0.82 ml/sec = 0.1367 ml/sec
- j. Calculate maximum dispense rate by subtracting maximum dispense rate delta (obtained in step i) from upper maximum dispense rate value. 1.10 – 0.14 ml/sec = 0.96 ml/sec
Maximum dispense rate = 0.42 ml/sec

Table 1-2. Recommended Tubing Size, Viscosity, and Maximum Dispense Rate

Model 5016 Pump System			
Tubing (in.)		Viscosity (CS)	Max Rate (ml/sec)
OD	ID		
1/8 (1)	1/16	5	1.25
		20	0.31
		80	0.08
3/16 (1)	1/8	5	3.00
		20	2.00
		80	0.50
		320	0.13
		1280	0.03
		5120	0.05
1/4 (1)	0.190	20	3.00
		80	3.00
		320	3.00
		1280	1.90
		5120	0.48
		20480	0.12
3/8 (2)	0.225	80	3.00
		320	3.00
		1280	2.40
		5120	0.60
		20480	0.15
3/8 (1)	0.315	80	3.00
		320	3.00
		1280	3.00
		5120	0.75
		20480	0.19

(1) Wall thickness = 0.03 inch

(2) Wall thickness = 0.06 inch

Note:

Flow rates based on 6-foot length.

Doubling the dispense length divides the rate by 2.

Table 1-2. Recommended Tubing Size, Viscosity, and Maximum Dispense Rate (Continued)

Model 5116 Pump and Filter System							
Millipore 0.1 μ Filter Element				Millipore 0.2 μ Filter Element			
Tubing (in.)		Viscosity (CS)	Max Rate (ml/sec)	Tubing (in.)		Viscosity (CS)	Max Rate (ml/sec)
OD	ID			OD	ID		
1/8 (1)	1/16	5	1.00	1/8 (1)	1/16	5	1.00
		20	0.25			20	0.50
3/16 (1)	1/8	5	3.00	3/16 (1)	1/8	5	3.00
		20	1.00			20	1.80
		80	0.25			80	0.45
		320	0.06			320	0.11
1/4 (1)	0.190	20	3.00	1/4 (1)	0.190	20	3.00
		80	3.00			80	3.00
		320	3.00			320	3.00
		1280	0.80			1280	1.60
		5120	0.20			5120	0.40
20480		20480	0.05			20480	0.10
		80	3.00			80	3.00
		320	3.00			320	3.00
		1280	0.75			1280	2.10
		5120	0.19			5120	0.53
20480		20480	0.05			20480	0.13
		80	3.00			80	3.00
		320	3.00			320	3.00
		1280	1.40			1280	2.70
		5120	0.35			5120	0.68
20480		20480	0.09			20480	0.17

(1) Wall thickness = 0.03 inch

(2) Wall thickness = 0.06 inch

Note:

Flow rates based on 6-foot length.

Doubling the dispense length divides the rate by 2.

Model 5116 Pump and Filter System							
Pall 0.1 μ Filter Element				Pall 0.2 μ Filter Element			
Tubing (in.)		Viscosity (CS)	Max Rate (ml/sec)	Tubing (in.)		Viscosity (CS)	Max Rate (ml/sec)
OD	ID			OD	ID		
1/8 (1)	1/16	5	1.00	1/8 (1)	1/16	5	1.25
		20	0.25			20	0.31
3/16 (1)	1/8	5	3.00	3/16 (1)	1/8	5	3.00
		20	1.10			20	2.20
		80	0.28			80	0.55
		320	0.07			320	0.14
1/4 (1)	0.190	20	3.00	1/4 (1)	0.190	20	3.00
		80	3.00			80	3.00
		320	3.00			320	3.00
		1280	1.00			1280	2.00
		5120	0.25			5120	0.50
20480		20480	0.06			20480	0.13
		80	3.00			80	3.00
		320	3.00			320	3.00
		1280	1.20			1280	2.40
		5120	0.25			5120	0.60
20480		20480	0.06			20480	0.15
		80	3.00			80	3.00
		320	3.00			320	3.00
		1280	1.80			1280	3.00
		5120	0.45			5120	0.75
20480		20480	0.11			20480	0.19

(1) Wall thickness = 0.03 inch

(2) Wall thickness = 0.06 inch

Note:

Flow rates based on 6-foot length.

Doubling the dispense length divides the rate by 2.

1.3.2 Model 503/504/506 Pump Control Module

The Model 503/504/506 Pump Control Module is fully programmable from its front panel keypad. Programming parameters are viewed on a two line by 16 character liquid crystal display. The pump control module is capable of controlling up to three pumps in the following modes of operation:

Display Program Active Configure Test

The pump control module provides total program control over all pump operations and provides a means to set up and match identical dispense programs for all pumps in all systems, and obtain true system, process, and track matching. The pump control module also controls the rate of pump refill after dispense, which eliminates or reduces the tendency of outgassing of some chemicals. The pump control module has the capability to set up an offset to compensate for small differences that may exist in each track system, liquid line, or the pump itself.

1.3.3 Model 5116 All-Teflon® Path (ATP) Pump and Filter System

The CYBORPUMP™ Model 5116 ATP Pump and Filter System consists of a model 5016 metering pump and a model 510/511 filter system. All wetted surfaces in the chemical flow path are made of Teflon®. Built-in features are provided in the filter system for air purging and draining. The filter system accepts Millipore 16-stack and 40-stack or Pall 2.5-inch and 5-inch filter elements. The model 510 requires an adapter (CYBOR part number 20012-01) to use the Millipore filter elements.

1.3.4 Model 512 Power Supply

Model 512:

Input: 120/240 V input at 50/60 Hz

Output: +18 V to +24 V at 11.5 amps DC output at 40°C

1.4 SYSTEM DESCRIPTION

1.4.1 CYBORPUMP™ Model 5016 Pump System (See figure 1-3)

The dispense cycle of the pump consists of three modes: dispense, suckback, and reload.

Dispense Mode: After receiving a dispense command from the track system or keypad, the pump 3-way solenoid valve closes the source line and opens the dispense port. The pump starts dispensing the liquid to the dispense line nozzle.

Suckback Mode: Immediately after completing the dispense stroke, the pump starts drawing back the liquid with the preprogrammed suckback volume. The liquid is drawn back from the dispense line to the dispense port of the pump 3-way solenoid valve. After suckback, the 3-way solenoid valve dispense line closes, opening the source line and the pump loads for the next dispense cycle. The fluid path repeats again at each dispense/suckback and reload cycle. Figure 1-4 depicts the pump system initialize, dispense, suckback, and reload cycles.

Reload Mode: The pump is loaded with the programmed dispense volume from the source container through the source line.

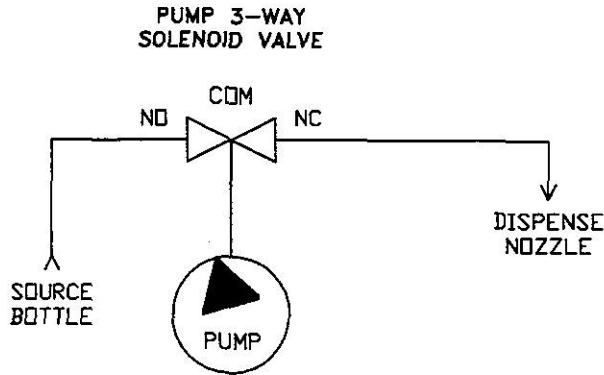
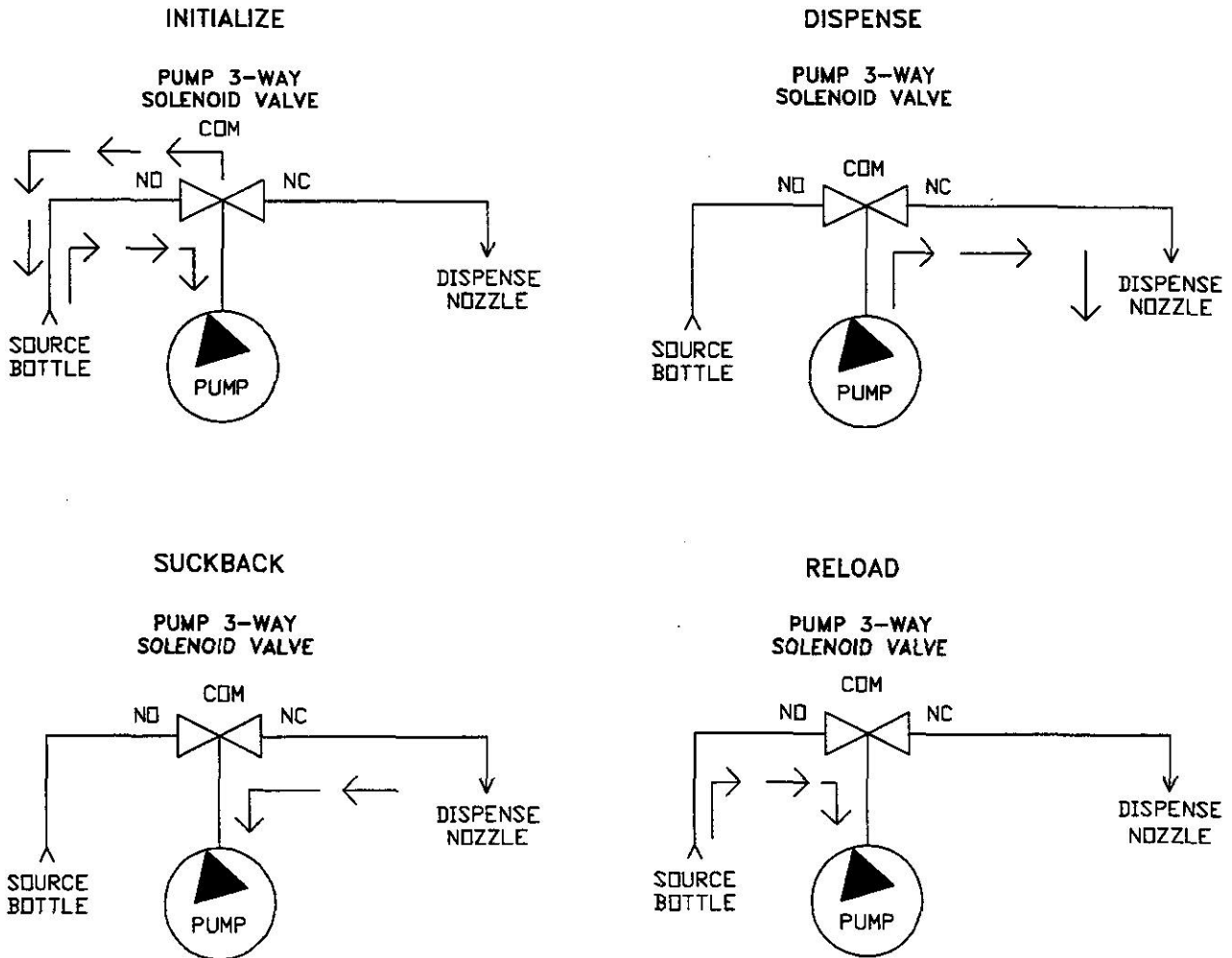


Figure 1-3. Typical CYBORPUMP™ Model 5016 Pump System Fluid Flow



CYBOR-PS

Figure 1-4. Typical CYBORPUMP™ Model 5016 Pump System Fluid Flow Cycles

1.4.2 CYBORPUMP™ Model 5116 All-Teflon® Path (ATP) Pump and Filter System

(See figure 1-5)

Dispense Mode: After receiving a dispense command from the track system or keypad, the pump 3-way solenoid valve closes the source line and opens the dispense port. At the same time, the filter solenoid 3-way valve dispense nozzle line is connected to the filter dispense line via the valve NC port and COM port. The pump starts dispensing the liquid through the dispense check valve, through the filter, and through the filter 3-way solenoid valve to the dispense line nozzle.

Suckback Mode: Immediately after completing the dispense stroke, the filter 3-way solenoid valve connects the dispense nozzle to the valve NO port. The pump then starts drawing back the liquid with the preprogrammed suckback volume. The liquid is drawn back from the dispense nozzle line, through the suckback line via the suckback check valve, and to the dispense port of the pump 3-way solenoid valve into the pump

Suckback is accomplished through the suckback line and not through the filter. The suckback volume is returned to the input of the filter and is refiltered. This prevents the flow direction of the photoresist in the filter from being reversed. The returned liquid from the suckback stroke is again put through the primary filtered dispense line.

Preload Mode: The pump is loaded with the programmed dispense volume from the source container through the source line. The fluid path repeats again at each dispense/suckback and reload cycle. Figure 1-6 depicts the pump and filter system initialize, dispense, suckback, reload, filter vent, and filter drain cycles.

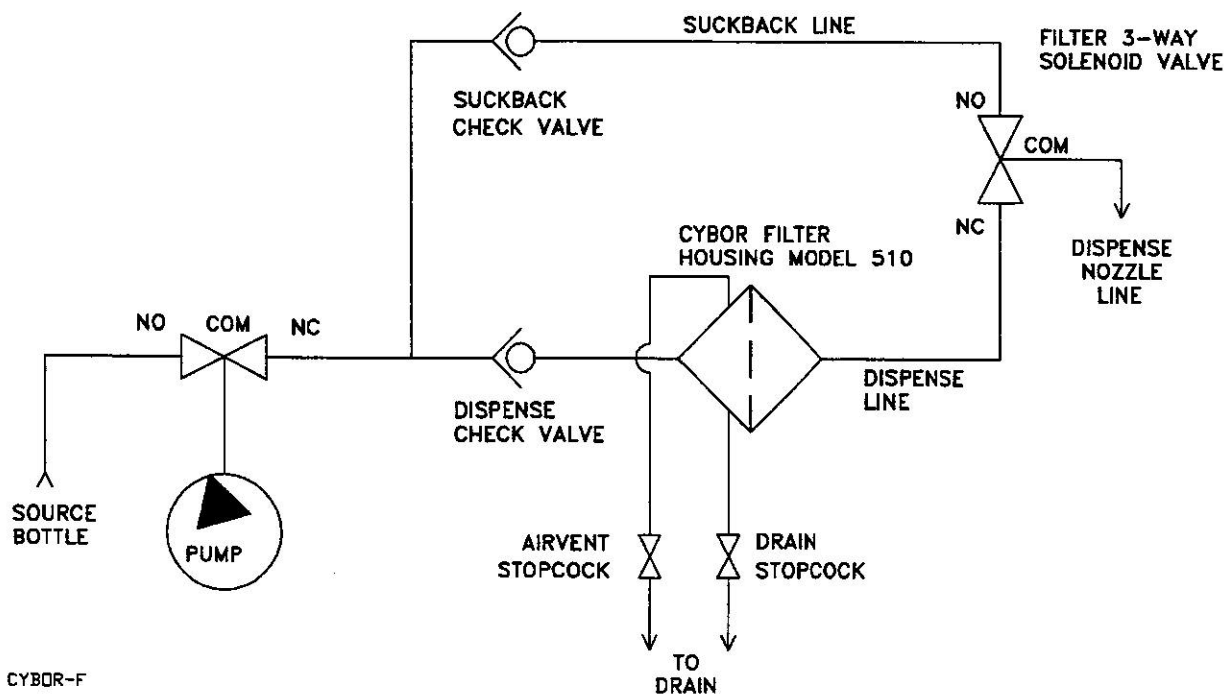
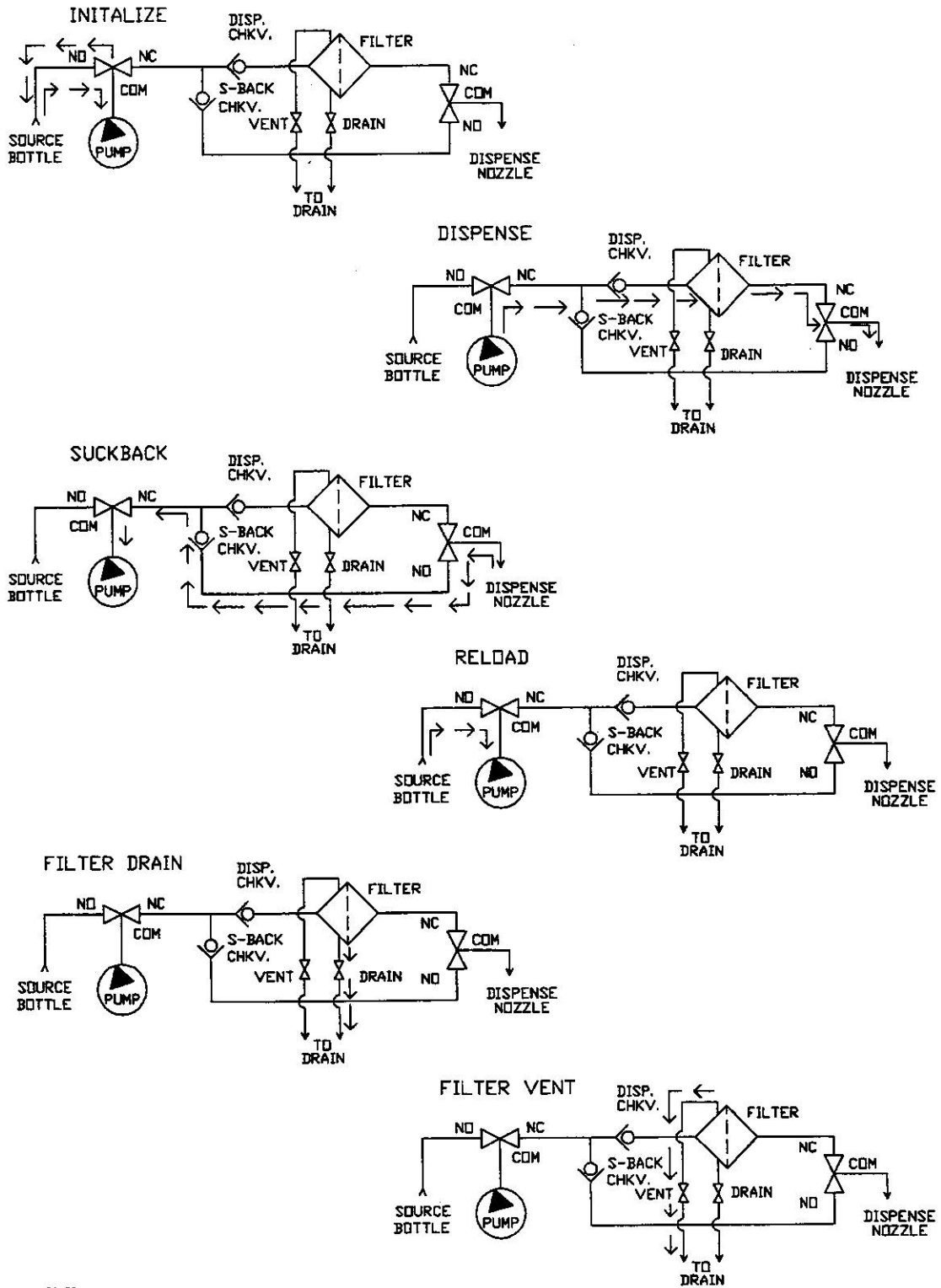


Figure 1-5. Typical CYBORPUMP™ Model 5116 ATP Pump and Filter System Fluid Flow



CYBOR-FS

Figure 1-6. Typical CYBORPUMP™ Model 5116 ATP Pump and Filter System Fluid Flow Cycles

1.5 SYSTEM SPECIFICATIONS

Tables 1-3 through 1-7 list the CYBORPUMP™ System 5000 Series specifications.

Table 1-3. Pump Model 5016 Specifications

Parameter	Specification
Power requirements	+18 VDC, 3.5 amp (max)
Cable length to pump control module	25 feet (max)
Operating temperature Range	10° C (min) to 40° C (max)
Relative humidity	10 to 90 percent, noncondensing
Dimensions:	
Width	5 inches
Height	12.3 inches
Depth	4 inches
Weight	7.25 pounds
Connections	
Input/output:	1/4-in. comp fittings

Table 1-4. Pump and Filter System Model 5116 Specifications

Parameter	Specification
Power requirements	+18 VDC, 3.5 amp (max)
Cable length to pump control module	25 feet (max)
Operating temperature range	10° C (min) to 40° C (max)
Relative humidity	10 to 90 percent, noncondensing
Dimensions:	
Width	5.2 inches
Height	12.3 inches
Depth	10.4 inches
Weight	11.25 pounds
Connections	
Input/output:	1/4-in. comp fittings
Vent and drain	1/4-in. comp fittings

Table 1-5. Filter System Model 510/511 Specifications

Parameter	Specification
Operating pressure	60 psi, max
Connections	
Input/output:	STD 1/4 in.
Vent and drain	STD 1/4 in.
Filter elements	
Millipore	0.1, 0.2, or 0.5 µm
Pall	0.1, 0.2, or 0.5 µm

Table 1-6. Pump Control Module Model 503/504/506 Specifications

Parameter	Specification
Power requirements	+18 VDC, 10.5 amp
Cable length to track pump control and status	10 feet (max)
Input signal requirements (from track pump control and status)	Pull-up or pull-down signal (depending on track)
Output signal requirements (to track pump control and status)	Open collector output pull down (usually simulates pump sensors)
Operating temperature range	10°C (min) to 40°C (max)
Relative humidity	10 to 90 percent, noncondensing
Dimensions:	
Width	10 inches
Height	3.5 inches
Depth	7.5 inches
Weight	2.5 pounds

Table 1-7. Power Supply Module 512 Specifications

Parameter	Specification
Input power requirements	120/240 VAC, 50/60 Hz, 120 V at 3 amp/240 V at 2 amps
Output power	+18 to +24 VDC, 11.5 amps
Operating temperature range	10° C (min) to 40° C (max)
Relative humidity	10 to 90 percent, noncondensing
Dimensions:	
Width	10 inches
Height	4.5 inches
Depth	7.5 inches
Weight	4.5 pounds

SECTION 2 INSTALLATION

2.1 INTRODUCTION

This section provides hardware installation instructions including site planning, module mounting, and power connections.

2.2 WARNINGS, CAUTIONS, AND RECOMMENDATIONS

All applicable codes, local ordinances, and standard practices must be followed during installation. In addition:

- a. All equipment must be mounted with sufficient clearance to allow access for maintenance and removal.
- b. The system should be mounted as close as possible to the equipment being controlled or monitored.
- c. Wiring is not provided with the CYBORPUMP™ System. All wiring should meet applicable electric codes.
- d. Any conduit that carries wiring or signal wiring should be kept separate from all power or control wiring. This wiring should also be kept away from sources of RFI and EMI such as motors, compressors, or high voltage. In installations where sources of RFI and EMI cannot be avoided, use shielded cable.

2.3 SITE PLANNING AND PREPARATION

Installation site planning and preparation should take into consideration the following requirements and recommendations:

- a. The CYBORPUMP™ System is intended to be installed central to the location of the input and output devices. Select a location that meets this recommendation and provides reasonable environmental protection.
- b. Provide 120-VAC (110-VAC) power source (50 or 60 Hz) to the system location. 240-VAC (220-VAC) options can be selected by changing the position of the 110/220 selector switch located on rear of Model 512 Power Supply.
- c. Install all enclosures in such a manner that conduit hubs are facing down to provide drainage.
- d. Mount all enclosures to bolted brackets to facilitate removal for repair. Do not weld enclosures to mounting location.
- e. Make sure that AC ground and chassis are positively connected to earth ground. Earth grounding is essential for safe and reliable operation.

2.4 UNPACKING

The CYBORPUMP™ System is shipped from the factory packaged to avoid damage in transit. Special instructions and auxiliary equipment are included when applicable.

Unpack the shipping container carefully, inspect for shipping damage, and check the contents against the packing slip. If there are any discrepancies, immediately advise the carrier or supplier as appropriate.

2.5 INSTALLATION PROCEDURE

2.5.1 Installation

Install the CYBORPUMP™ System in the selected location in conformance with the recommendations at the beginning of this section. Complete the physical mounting of the pump prior to connection of cables. Connect the system cables in accordance with figure 2-1.

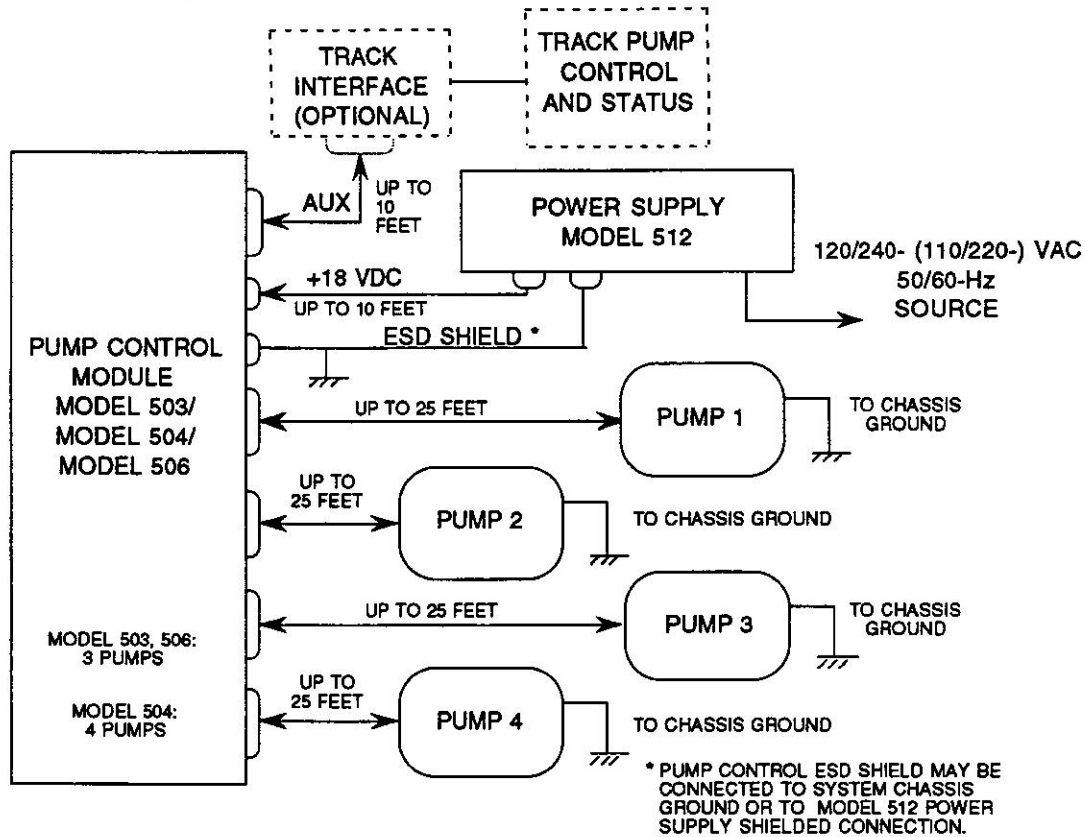
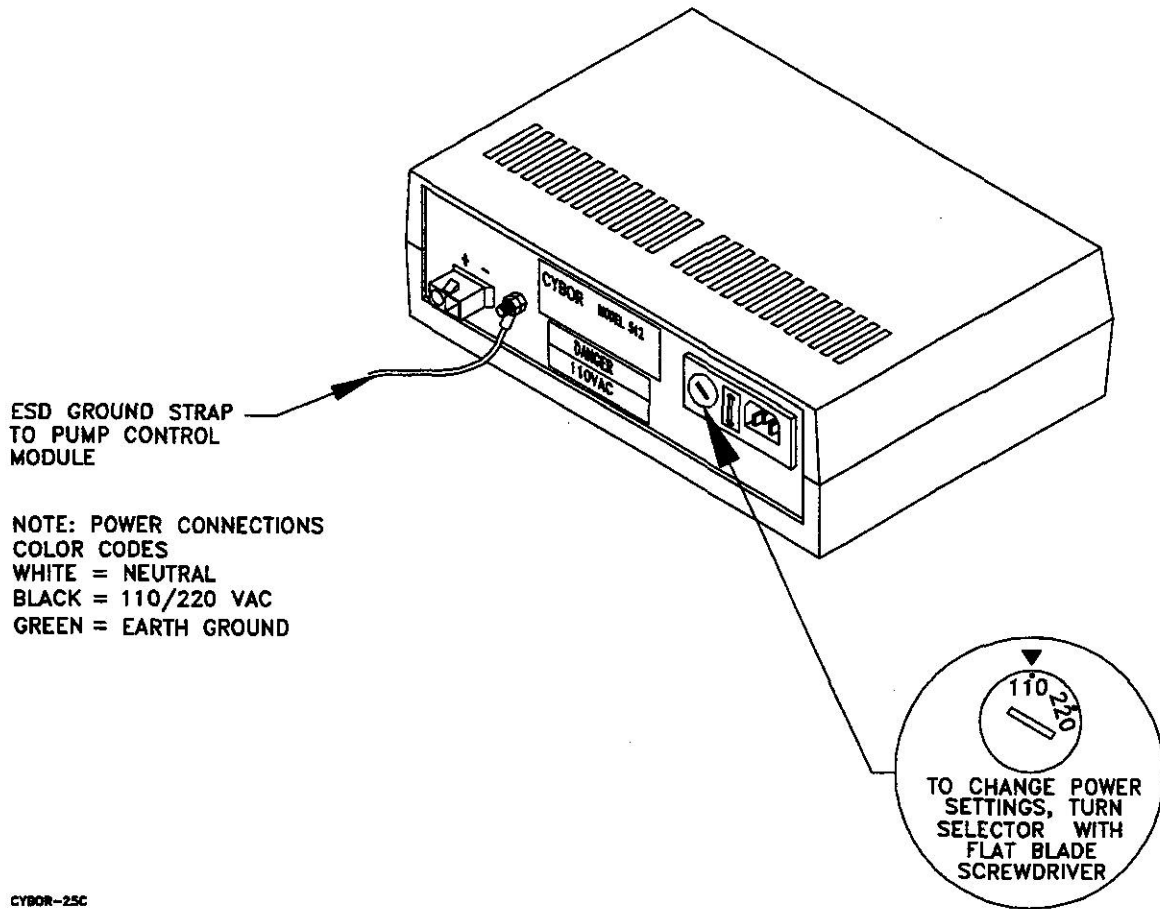


Figure 2-1. CYBORPUMP™ System Interconnecting Cabling Diagram

2.5.2 Power and ESD Ground Connections

The CYBORPUMP™ System operates on 120 or 240 (110 or 220) VAC. Make the appropriate power connections as follows, but do not apply power until all remaining input, output, and communication connections have been completed.

- a. **AC Power Connection.** AC power is to be supplied to the Model 512 Power Supply. The power supply is configured at the factory for 120 (110) VAC. To configure the power supply for 240 VAC (220 VAC), perform the following (see figure 2-2).
 1. Insert flat-blade screwdriver into 110/220 selector switch slot. Turn selector switch to 220 position.
 2. Change power plug as required to accommodate 220-VAC power source.
- b. **DC Power Connection.** DC power (+18 to +24 VDC) is to be connected to the CYBORPUMP™ Model 503/504/506 Pump Control Module.
- c. **ESD Ground Connection.** Connect power supply ESD GND to pump control module ESD ground.



CYBOR-25C

Figure 2-2. Power Supply 240-VAC (220-VAC) Option

2.5.3 Pump Installation

Figure 2-3 illustrates a typical Pump Model 5016 standard mount installation. Figure 2-4 illustrates a typical Pump and Filter System Model 5116. To install the pump, perform the following:

- a. Position pump in place. Secure pump with four, 5/8-inch 8-32 stainless steel screws through the four grommet bushings in base plate. Make certain ground wire is connected with mounting screw to base plate.
- b. Select tubing size to be used from table 1-2. Attach 1/4-inch NPT male adapters to install selected tubing into ports on solenoid.
- c. Connect Teflon[®] input line to solenoid N.O. port fitting of the pump solenoid.
- d. Connect Teflon[®] output line to solenoid N.C. port fitting of the pump solenoid or COM port of the filter solenoid.
- e. Connect 1/4-inch tubing to vent and drain stopcocks (filter system only).
- f. Plug solenoid connector into side of pump housing (Molex, 4-pin, keyed).
- g. Connect pump electrical cable to appropriate connector (PUMP 1, PUMP 2, or PUMP 3) on pump control module.

2.6 INITIAL INSTALLATION AND CHECK-OUT

Before applying power to the CYBORPUMP™ System, use the following checklist to ensure that all connections are correct and that the system is correctly prepared for startup.

- a. Inspect AC power wiring for correct installation to CYBORPUMP™ pump control module.
- b. Before connecting track controller (auxiliary line), run the pump using the different modes in a stand-alone condition without fluids connected to pump. Refer to section 3 for pump operating procedures.

Example:

- Configure pumps.
- Active recipe selection.
- Display changes.
- Test pump by running in stand-alone mode (without connecting auxiliary connectors to track).

- d. After pumps are working correctly in stand-alone mode, connect pump controller auxiliary connections to track.
- e. Test operation of pump using track controller without fluids connected to pump.

Example:

- Configure pumps.
- Active recipe selection.
- Display changes.

- f. Connect pump input to fluid source. Connect pump output to appropriate container to collect pump fluid.
- g. Run approximately 20 purge cycles to clear air from fluid lines (use appropriate startup procedure, paragraph 3.3).
- h. Inspect pump input and output connections for leaks.

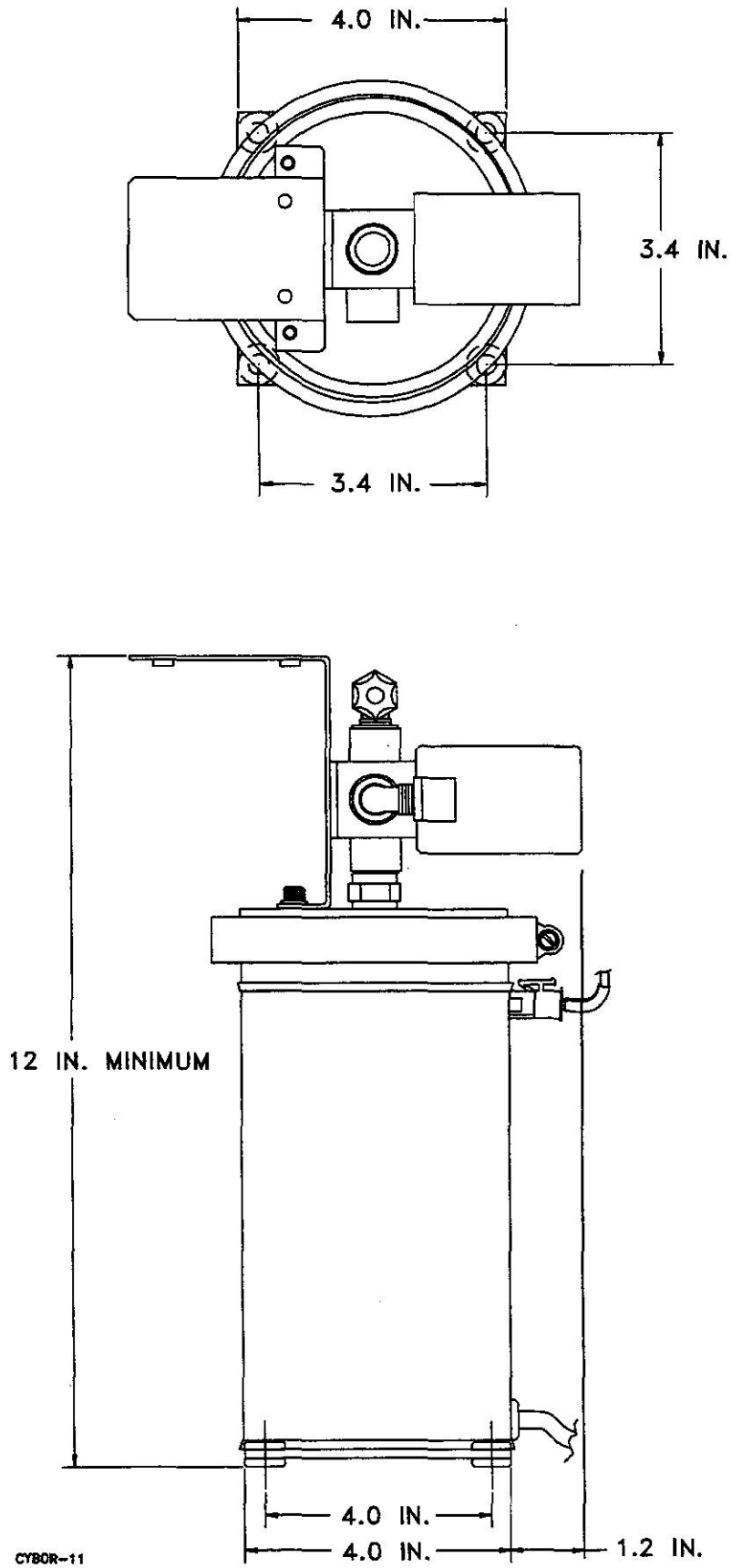
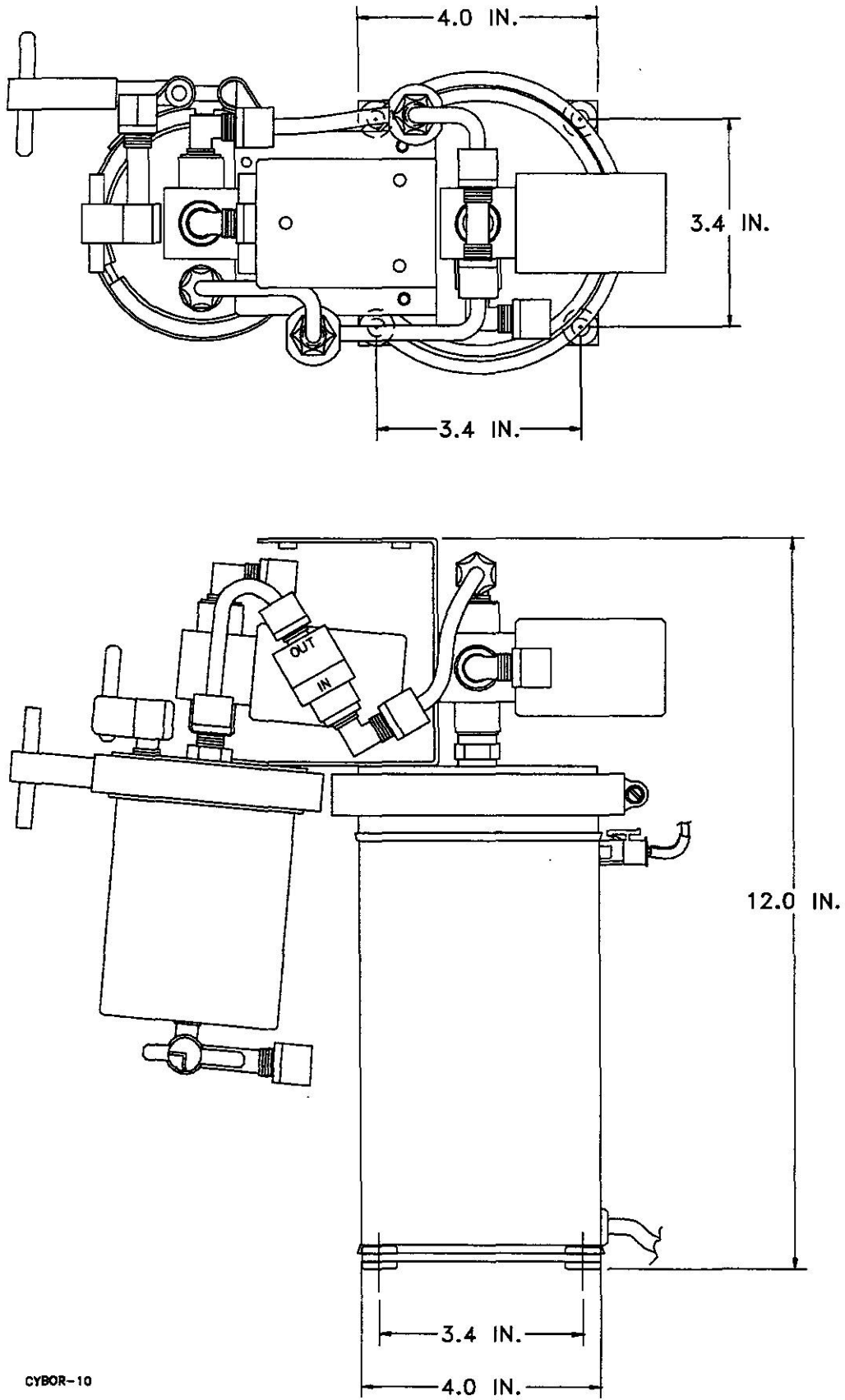
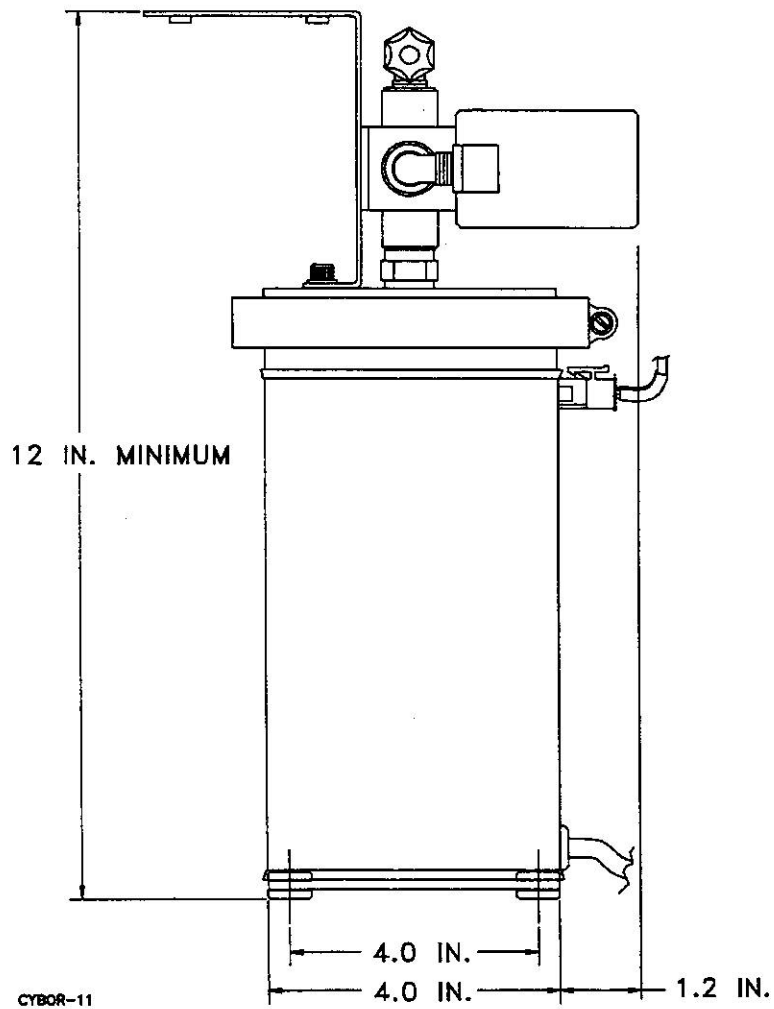
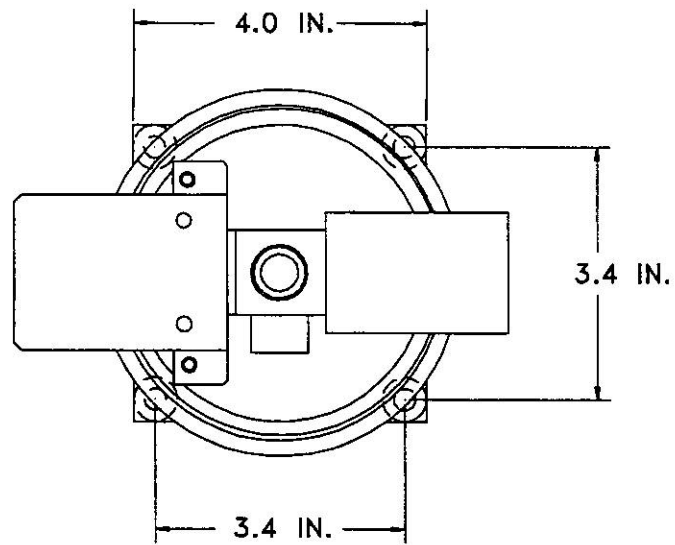


Figure 2-3. Pump Model 5016 Standard Mount Installation



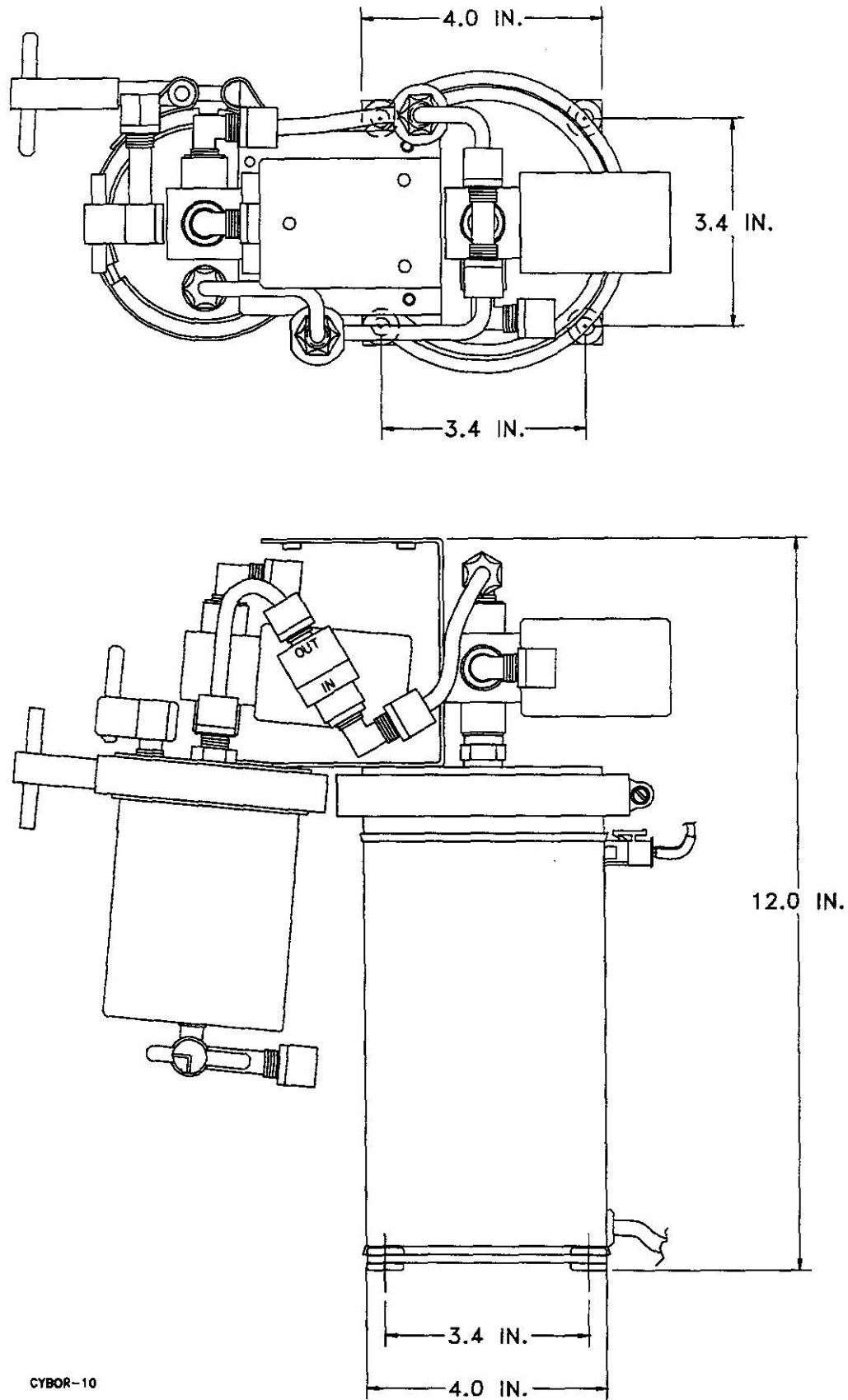
CYBOR-10

Figure 2-4. Pump and Filter System Model 5116 Standard Mount Installation



CYBOR-11

Figure 2-6. Pump Model 5016 Standard Mount Installation



CYBOR-10

Figure 2-7. Pump and Filter System Model 5116 Standard Mount Installation

2.6 INITIAL INSTALLATION AND CHECK-OUT

Before applying power to the CYBORPUMP™ System, use the following checklist to ensure that all connections are correct and that the system is correctly prepared for startup.

- a. Inspect AC power wiring for correct installation to CYBORPUMP™ pump control module.
- b. Before connecting track controller (auxiliary line), run the pump using the different modes in a stand-alone condition without fluids connected to pump. Refer to section 3 for pump operating procedures.

Example:

- Configure pumps.
- Active recipe selection.
- Display changes.
- Test pump by running in stand-alone mode (without connecting auxiliary connectors to track).

- d. After pumps are working correctly in stand-alone mode, connect pump controller auxiliary connections to track.
- e. Test operation of pump using track controller without fluids connected to pump.

Example:

- Configure pumps.
- Active recipe selection.
- Display changes.

- f. Connect pump input to fluid source. Connect pump output to appropriate container to collect pump fluid.
- g. Run approximately 20 purge cycles to clear air from fluid lines (use appropriate startup procedure, paragraph 3.3).
- h. Inspect pump input and output connections for leaks.

**SECTION 3
OPERATION**

3.1 CONTROLS AND INDICATORS

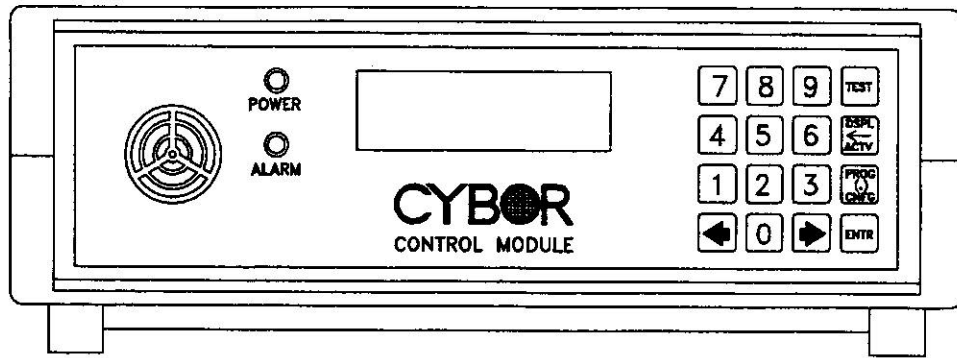
The system controls and indicators are located on the pump control module and the power supply. The pump control module and the power supply controls and indicators are functionally described in tables 3-1 and 3-2, respectively. The pump control module is illustrated in figures 3-1 and 3-2, and the power supply is illustrated in figure 3-3.

Table 3-1. Pump Control Module Controls and Indicators

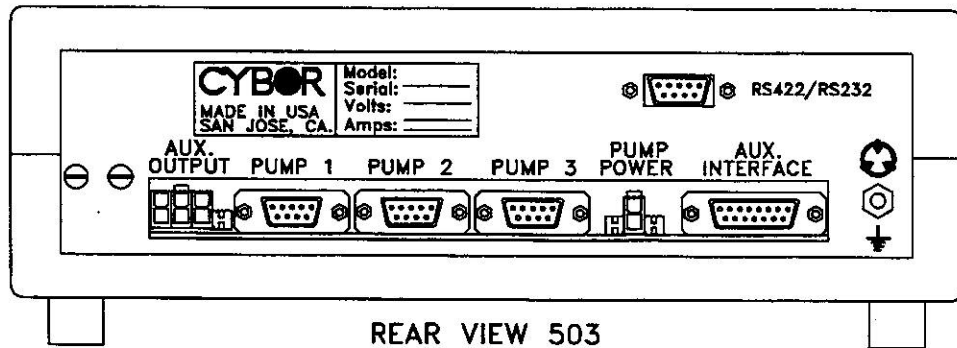
Control/Indicator	Function
Power LED	When lit (GREEN), indicates power switch is in the ON position and power is applied to unit
Alarm LED	When lit (RED), indicates an alarm condition of one of the pumps
Audible alarm	Provides audible tone when an alarm condition exists; pressing any key will silence alarm
Liquid crystal display	Displays system rate and volume parameters for dispense operating cycles; provides system status for each pump and recipe
Keypad	
Numeric Keys 0 – 9	Used to enter numeric values for volume and rate parameters, select pumps, and select recipes
Selection keys	Used in conjunction with specific pump control menu modes; keys have multiple function depending on modes of pump control module.
Cursor keys ← →	Used in conjunction with specific pump control menu modes; keys have multiple function depending on mode of pump control module.

Table 3-2. Power Supply Controls and Indicators

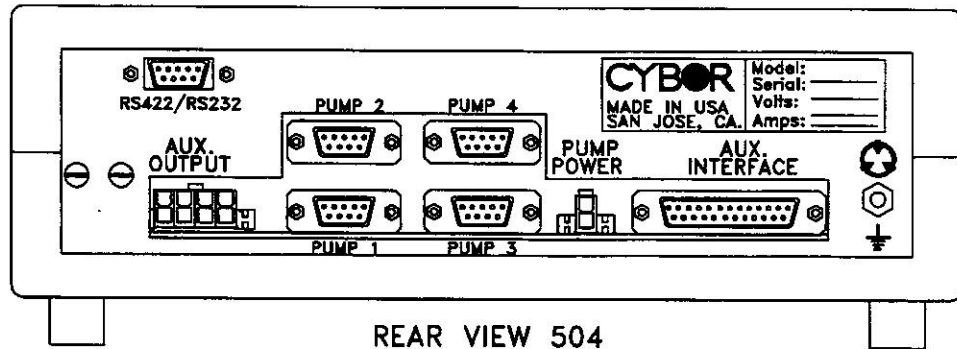
Control/Indicator	Function
Power switch (front)	When in ON position, applies DC power to pump control module
Power LED	When lit (GREEN), indicates power switch is in the ON position and power is applied to unit



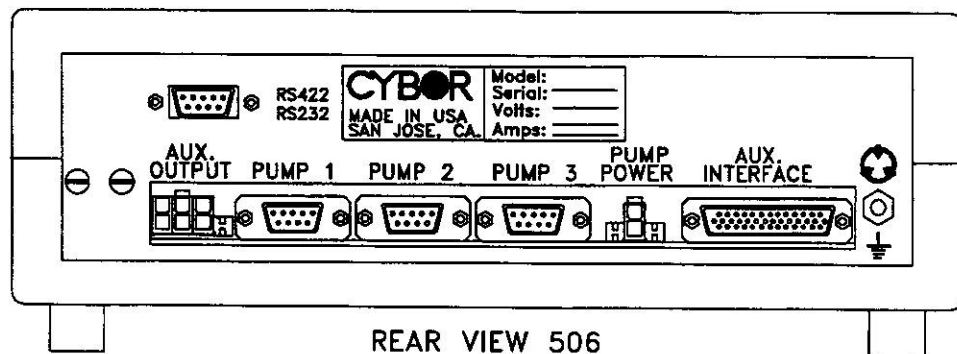
FRONT VIEW ALL MODELS



REAR VIEW 503



REAR VIEW 504



REAR VIEW 506

503-504

Figure 3-1. Pump Control Module Controls and Indicators

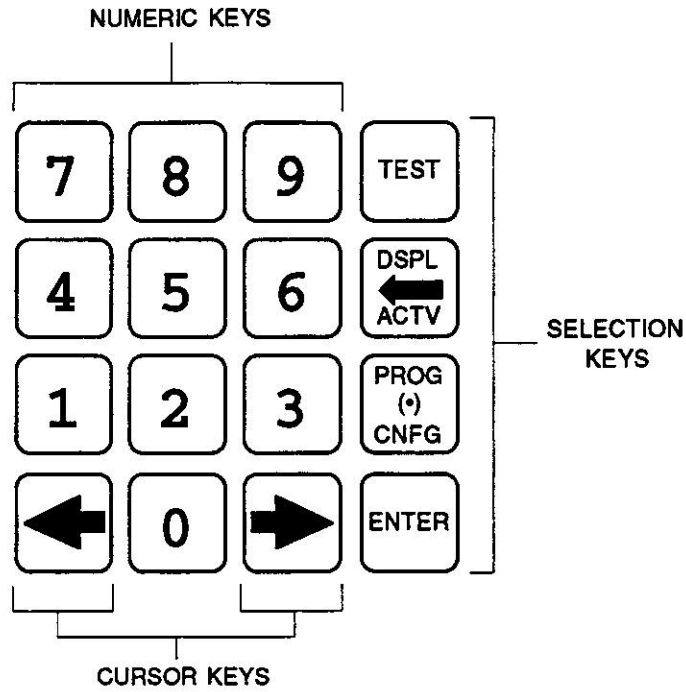
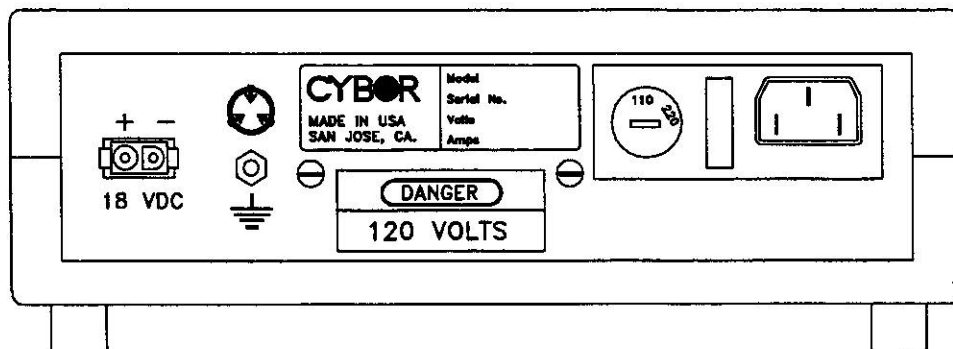
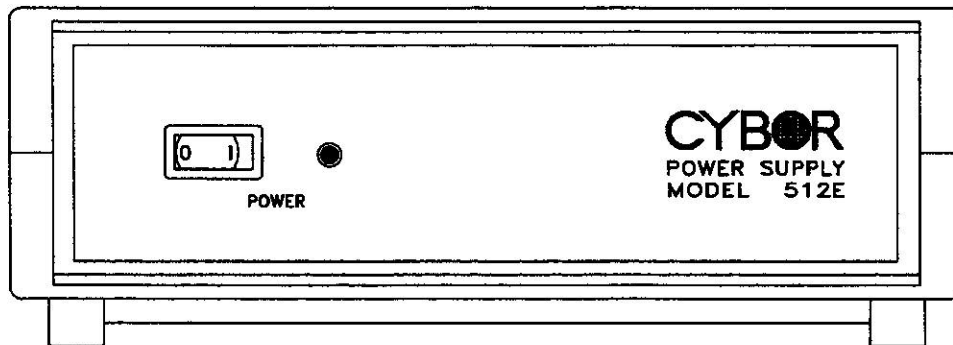


Figure 3-2. Pump Control Module Keypad



512PAN-C

Figure 3-3. Power Supply Controls and Indicators

3.2 PROGRAMMING PROCEDURES

3.2.1 Pump Control Module Operation

The pump control module has five modes of operation:

Test Display Program Active Configure

These five modes will be discussed in the order best suited to determine pump control module settings and perform programming functions. All menu-driven programming functions (2-by-16-character, liquid crystal display) are performed by means of the 16-key keypad. Keys with multiple labels will default to the function that corresponds to the pump control module's mode. Figure 3-4, a menu/display tree, illustrates the pump control module modes.

3.2.2 Select Menu

Turn on power switch on the Model 512 power supply. For the first few seconds after power is turned on, the pump control module undergoes initialization and self test. The following is displayed:

```
INITIALIZATION
IN PROCESS
```

Three possible error messages can be displayed:

```
INITIALIZATION
CHECKSUM ERROR
```

```
INITIALIZATION
IRAM ERROR
```

```
INITIALIZATION
XRAM ERROR
```

Should one of the three error message appear, contact CYBOR for service of the pump control module.

If the control module encounters no errors, the following is displayed:

```
Waiting Pump(s)
INIT        XXX
```

Following initialization, the first Select Menu display appears.

```
Select Menu
TEST-DSPL-PROG
```

In the following pages, the suggested responses will demonstrate typical programming steps.

Press ENTER to toggle to the second Select Menu display.

```
Select Menu
TEST-ACTU-CNFG
```

Select the desired mode by pressing the appropriate key.

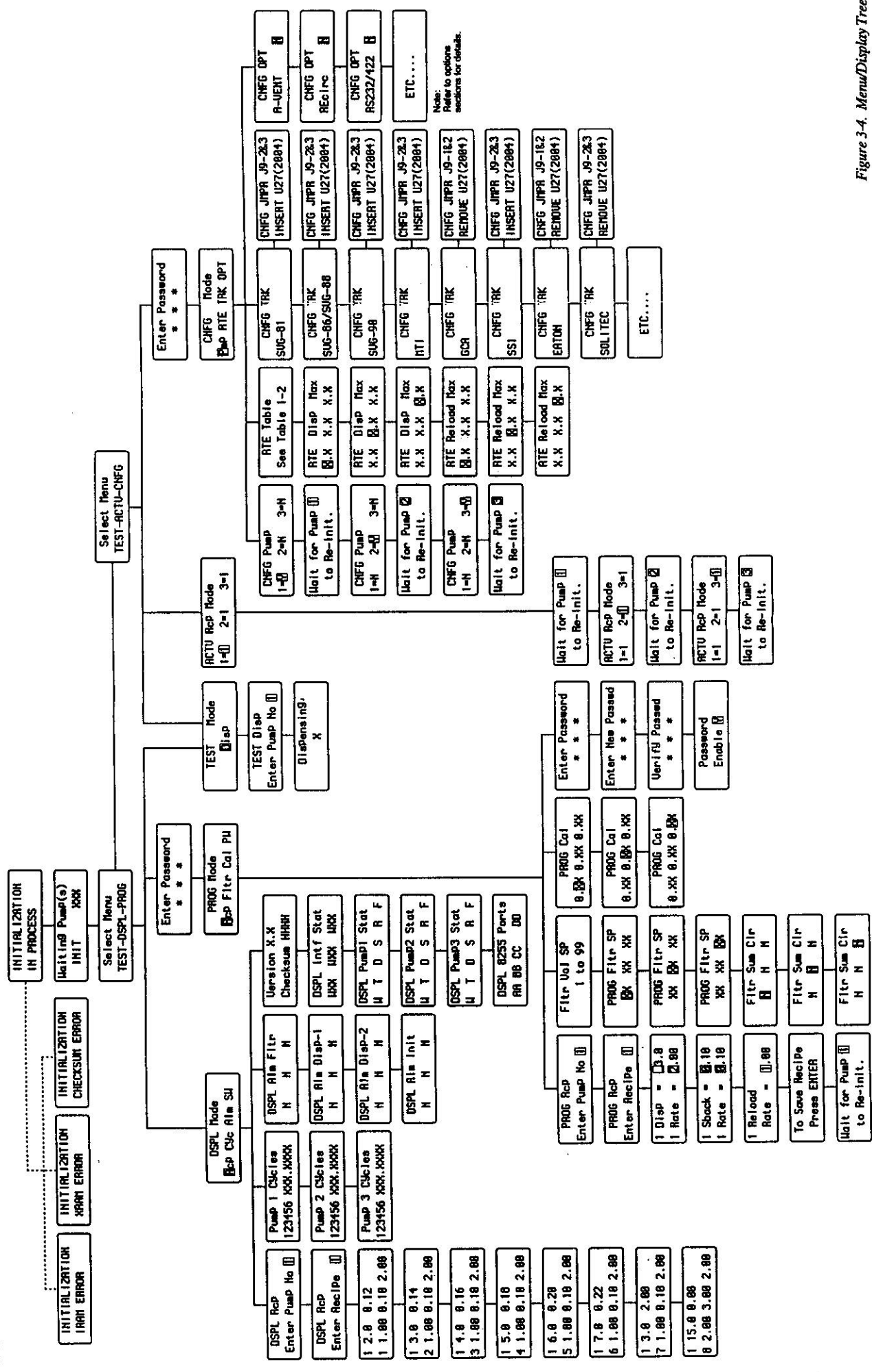


Figure 3-4. Menu/Display Tree

3.2.3 Configure Mode

Description: In this mode, the user establishes the pump(s) that will be active and under the command of the pump control module, the maximum dispense and reload rates, the track configuration, and, if applicable, selects the appropriate options.

- a. In the appropriate Select Menu display, press CNFG

(configure).



Note: Before entering the Configure Mode, if enabled, the Enter Password display appears. The default password is 5, 5, 5. To reprogram the password, refer to step e of paragraph 3.2.5.

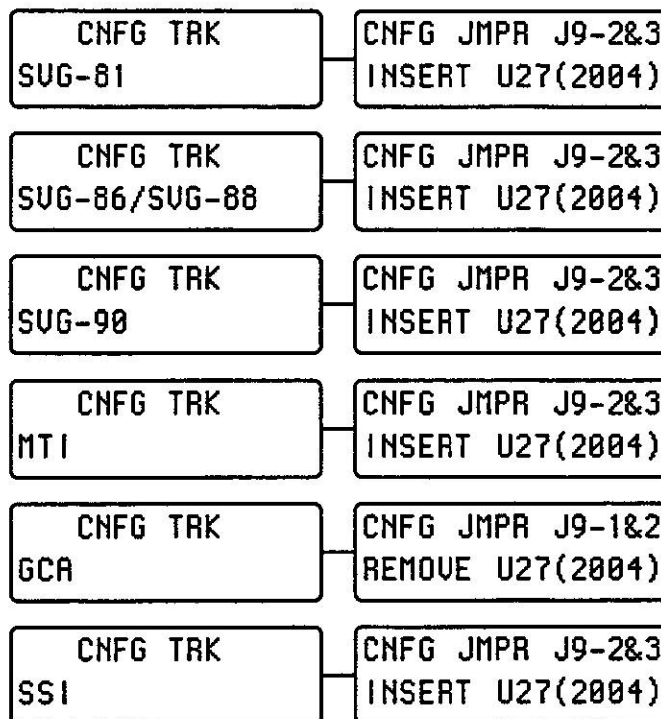
- b. Use the cursor keys to scroll through the selections. Press ENTER to select desired function. Select TRK (track).

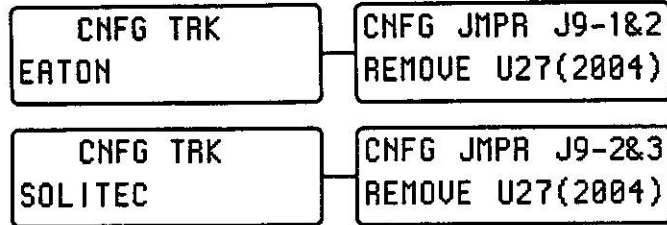


Note: After TRK is selected, the previously selected track configuration display will appear. If no track configuration was previously selected, then the first display (SVG-90) will appear.

Press **▶** to view the next track configuration display.
 Press **◀** to view the previous track configuration display.
 Press ENTER to select a specific track configuration.

The track configuration displays are as follows (the jumper configuration display only appears when a track configuration is accepted):



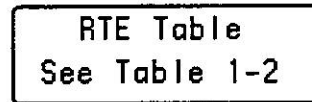


The pump control module returns to the Configure Mode display after the track configuration has been selected.

- c. Use the cursor keys to scroll through the selections. Press ENTER to select desired function. Select RTE (rate).



The first Configure Rate display appears, referencing the rate table from section 1 of this manual.



- 1. Press ENTER to continue to the maximum dispense rate display.

The maximum dispense rate display appears with the rate for pump 1 highlighted.



- 2. Enter value for maximum dispense rate and press ENTER. (Press ENTER alone to accept existing value.)

After ENTER is pressed, the maximum dispense rate display reappears with the rate for pump 2 highlighted.

- 3. Repeat step c.2 for pumps 2 and 3.

The maximum reload rate display appears after pump 3 maximum dispense rate is determined.



- 4. Enter value for maximum reload rate and press ENTER. (Press ENTER alone to accept existing value.)

After ENTER is pressed, the maximum reload rate display reappears with the rate for pump 2 highlighted.

- 5. Repeat step c.4 for pumps 2 and 3.

The pump control module returns to the Configure Mode display after pump 3 maximum reload rate is determined.

- d. Use the cursor keys to scroll through the selections. Press ENTER to select desired function. Select Pmp (pump).

```

CNFG Mode
PmP RTE TRK OPT
    
```

The Configure Pump Mode display appears with Y (or its previously configured condition) highlighted for pump 1.

```

CNFG PUmP
1=Y 2=N 3=N
    
```

To toggle between Y and N.

- 1. Press ← or →.
- 2. To configure pump 1, press ENTER.

The pump control module initializes pump 1.

```

Wait for Pump 1
to Re-Init.
    
```

Following initialization, the Configure Pump Mode display reappears with the Y (or its previously configured condition) highlighted for pump 2.

- 3. Repeat steps b.1 and b.2 for pumps 2 and 3.

If N is selected for a pump, the Configure Mode display reappears with N or its previously configured condition for the next pump highlighted. This allows single pump selection for individual pump testing.

After pump 3 has been configured, the pump control module returns to the Configure Mode display.

- e. Use the cursor keys to scroll through the selections. Press ENTER to select desired function. Select OPT (option).

```

CNFG Mode
PmP RTE TRK OPT
    
```

The Configure Option display appears with N highlighted for the Auto Vent Option.

```

CNFG OPT
A-VENT N
    
```

Note: Refer to the Auto Vent Option section for a complete description of this feature.

- 1. Press ← or →.

To toggle between Y and N.

Selecting Y enables the Auto Vent Option.

Selecting N disables the Auto Vent Option.

- 2. To select either Y or N, press ENTER.

After the Auto Vent Option has been configured, the Configure Option display appears with N highlighted for the Fluid Recirculation Option.



Note: Refer to the Fluid Recirculation Option section for a complete description of this feature.

- 3. Press ← or →.

To toggle between Y and N.

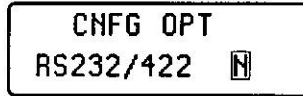
Selecting Y enables the Fluid Recirculation Option.

Selecting N disables the Fluid Recirculation Option.

Note: The Auto Vent Option and the Fluid Recirculation Option cannot be concurrently enabled. If the Auto Vent Option has been enabled and the Fluid Recirculation Option is subsequently enabled, then the Auto Vent Option display will reappear so it can be disabled.

- 4. To select either Y or N, press ENTER.

After the Fluid Recirculation Option has been configured, the Configure Option display appears with N highlighted for the RS232/422 Option.



Note: Refer to the RS232/422 Option section for a complete description of this feature.

- 5. Press ← or →.

To toggle between Y and N.

Selecting Y enables the RS232/422 Option.

Selecting N disables the RS232/422 Option.

- 6. To select either Y or N, press ENTER.

After the RS232/422 Option has been configured, the pump control module returns to the Select Menu display.

- 7. Press TEST.

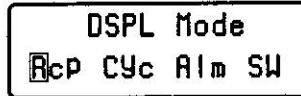
To exit the Configure Option Mode at any time

3.2.4 Display Mode

Description: In this read-only mode, the user reviews a pump's corresponding recipe(s) in the pump control module, the number of cycles and filter volume for each pump, the pump alarms, and the software version and checksum.

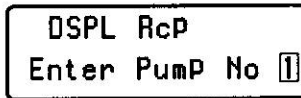
a. In the appropriate Select Menu display, press DSPL (display). The Display Mode display appears.

b. Use the cursor keys to scroll through the selections. Press ENTER to select desired function. Select Rcp (recipe) display.



1. Press number of pump to view (or press ENTER to view default).

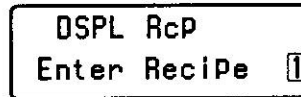
The Display Mode display appears with request for the pump number to be displayed. The default is pump 1.



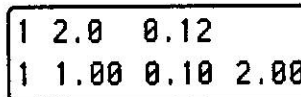
After ENTER or pump number is pressed, the second Display Mode display appears.

2. Press number of recipe to view (or press ENTER to view default). Recipes are 1 through 8.

The Display Mode display appears with a request for the recipe number to be displayed. The default is recipe 1.



After ENTER or recipe number is pressed, the pump and recipe combination selected is displayed (this example is pump 1, recipe 1).



See figure 3-5 for a description of the Display Mode display.

3. Press ←.

To view previous recipe for selected pump.

4. Press →.

To view next recipe for selected pump.

5. Press ENTER at any time.

To exit Display Mode display.

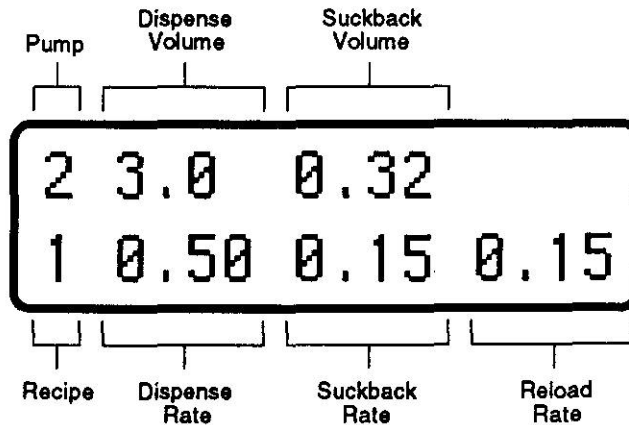
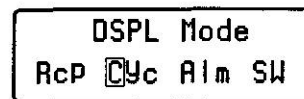


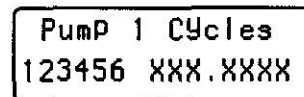
Figure 3-5. Display Mode Display

- c. Enter Display Mode and use the cursor keys to scroll through the selections. Press ENTER to select desired function. Select Cyc (cycles) display.



- The Cycles display shows two numbers.

The Cycles display appears.



The first number is the total pump cycles that the pump control module has commanded for the pump, which is used to schedule maintenance.

The second number is the total amount of fluid pumped through the pump's filter since the last filter sum clear was performed.

- Press **➡**.

To view next pump cycles.

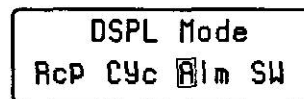
- Press **⬅**.

To view previous pump cycles.

- Press ENTER.

To exit Display Mode at any time.

- d. Enter Display Mode and use the cursor keys to scroll through the selections. Press ENTER to select desired function. Select Alm (alarm) display.



- Press **➡**.

To view next diagnostic display.

- Press **⬅**.

To view previous diagnostic display.

3. Press ENTER.

To exit Display Mode at any time.

The alarm displays, which show whether a particular alarm is active for a particular pump, are as follows:

4. The pump filter alarm alerts user that filter has reached setpoint.

```

DSPL Alm Fitr
  N   N   N
  
```

Refer to paragraph 3.2.5 to program and enable this alarm.

5. The Disp-1 alarm alerts user that a premature sensor was detected during the dispense stroke.

```

DSPL Alm Disp-1
  N   N   N
  
```

6. The Disp-2 alarm alerts user that no sensor was detected during the dispense stroke.

```

DSPL Alm Disp-2
  N   N   N
  
```

7. The Alarm Init indicates no sensor was detected or continuous sensor was detected.

```

DSPL Alm Init
  N   N   N
  
```

e. Enter Display Mode and use the cursor keys to scroll through the selections. Press ENTER to select desired function. Select SW (software) display.

```

DSPL Mode
RcP CYc Alm SW
  
```

1. The Checksum display lists the system program iteration and revision level as well as the PROM checksum.

```

Version X.X
Checksum HHHH
  
```

HHHH = base 16 or hex numbers.

- Press **▶** to view display Interface Status display for all three pumps.

```

DSPL Intf Stat
WXX WXX WXX
    
```

The first character denotes each pump's current state:

- W = waiting for command
- T = timeout
- D = dispense
- S = suckback
- R = reload
- F = finished (not in wait loop)

The next two characters shows the pump's command status whether the pump is busy or in the wait state:

<u>Track Type</u>	<u>X</u>	<u>Y</u>
SVG-90	0	1
SVG-88	0	1
SVG-81	0	0
MTI	0	0
GCA	1	0
Eaton	1	0
SSI	0	0

If character X ceases toggling for more than 500 msec, the pump is triggered.

- Press **▶** again to view history display for pump 1.

```

DSPL Pump1 Stat
W T D S R F
    
```

The six characters show the pump's history:

- W = waiting for command
- T = timeout
- D = dispense
- S = suckback
- R = reload
- F = finished (not in wait loop)

- Press **▶** again to view history display for pump 2.

```

DSPL Pump2 Stat
W T D S R F
    
```

- Press **▶** again to view history display for pump 3.

```

DSPL Pump3 Stat
W T D S R F
    
```


6. Press **▶** again to view Interface Status display.

DSPL	8255	Ports
AA	BB	CC DD

The four numbers show the interface status:

- AA = port A pumps 1 and 2 nibbles
01H, 02H = stepper driver
04H = stepper power enable
08H = solenoid enable
- BB = port B pump 3 nibble (first character not used)
- CC = port C busy/sensor output
filter solenoids
- DD = pump reference 1 - 3
= pump request 1 - 3

7. Press **◀** at any time to view the previous display.

8. Press ENTER.

To exit Display Mode at any time.

3.2.5 Program Mode

Description: In this mode, the user programs the pump(s) and the corresponding recipe(s) to be used by the pump control module. All volumes are in ml and rates are ml/sec.

- a. In the appropriate Select Menu, press PROG (program). The Program Mode display appears.

```

PROG Mode
RcP Filtr Cal PW
    
```

Note: Before entering the Program Mode, if enabled, the Enter Password display appears. The default password is 5, 5, 5. To reprogram the password, refer to step e of this paragraph.

- b. Use the cursor keys to scroll through the selections. Press TEST to exit Program Mode and return to Select Menu. Press ENTER to select desired function. Select Rcp (recipe) display.

The first Program Rcp display with request for the pump number to be programmed. The default is pump 1.

```

PROG Rcp
Enter Pump No 1
    
```

- 1. After the first Program Recipe display appears, press number of pump to be programmed (or press ENTER to program default pump).

Note: Press the backspace key to move back through previously viewed displays for review and to make changes. Move forward through the displays as described in steps b.1 through b.8.

Press TEST to move ahead to the Save Recipe display (step b.7).

After ENTER or pump number is pressed, the second Program Rcp display appears.

- 2. Press number of recipe to be programmed (or press ENTER to program default).

The second Program Rcp display with request for the recipe number to be programmed. The default is recipe 1.

```

PROG Rcp
Enter Recipe 1
    
```

After ENTER is pressed, the Dispense volume and rate display appears.

- 3. Enter value for Dispense volume and press ENTER (Press ENTER alone to accept existing value.).

The Dispense volume and rate display.

```

1 Disp = 3.0
1 Rate = 2.00
    
```

Dispense volume: 16.0 max
0.10 min

4. Enter value for dispense rate and press ENTER.
(Press ENTER alone to accept existing value.)

```
1 Disp = 3.0
1 Rate = 2.00
```

Dispense rate: max configured (refer to 3.2.3)
0.10 min

After ENTER is pressed, the Suckback volume and rate display appears

5. Enter value for Suckback volume and press ENTER.
(Press ENTER alone to accept existing value.)

The Suckback volume and rate display.

```
1 Sback = 0.10
1 Rate = 0.10
```

Suckback volume: 1.00 max
0.00 min

6. Enter value for Suckback rate and press ENTER.
(Press ENTER alone to accept existing value.)

```
1 Sback = 0.10
1 Rate = 0.10
```

Suckback rate: max same as reload configured
(refer to 3.2.3)
0.04 min

After ENTER is pressed, the Reload rate display appears.

7. Enter value for Reload rate and press ENTER. (Press ENTER alone to accept existing value.)

The Reload rate display.

```
1 Reload
Rate = 1.00
```

Reload rate: max configured (refer to 3.2.3)
0.10 min

After ENTER is pressed, the Save Recipe display will appear.

```
To Save Recipe
Press ENTER
```

8. To save the recipe and exit, press ENTER.

After the recipe has been saved, the pump will be reinitialized to its new volume if all of the following conditions exist:

1. If the pump is configured to "Y" in the Configure Mode, and
2. if the active recipe is being edited, and
3. if the dispense volume has been changed, then

the display will show the following message:

```

Wait for Pump 1
to Re-init.
```

Following reinitialization, the Select Menu display appears.

```

PROG Mode
RcP [F]ltr Cal PW
```

- c. Enter Program Mode and use the cursor keys to scroll through the selections. Press ENTER to select desired function. Select Fltr (filter).

Note: Before entering the Program Mode, if enabled, the Enter Password display appears. The default password is 5, 5, 5. To reprogram the password, refer to step e of this paragraph.

The first program Filter setpoint display appears, referencing the setpoint value limits of 1 to 99 liters.

```

Filtr Vol SP
1 to 99
```

1. Press ENTER to continue.

The program filter setpoint display appears with the setpoint for pump 1 highlighted.

```

PROG Filtr SP
[X]X XX XX
```

2. Enter value for filter setpoint and press ENTER. (Press ENTER alone to accept existing value or press zero to disable alarm.)

After ENTER is pressed, the program filter setpoint display reappears with the filter setpoint for pump 2 highlighted.

3. Repeat step c.2 for pumps 2 and 3.

After pump 3 filter setpoint has been programmed, the filter sum clear display appears with pump 1 option highlighted.

```

Filtr Sum Clr
[N] N N
```

4. Press ← or →.

To toggle between Y and N.

5. Press ENTER.

To select Y or N.

If Y is selected, the filter sum is reset to zero.

If N is selected the sum remains intact.

After selection is made, the filter sum clear display reappears with the N highlighted for pump 2.

6. Repeat steps c.4 and c.5 for pumps 2 and 3.

After filter functions are programmed, the Select Menu display appears.

d. Enter Program Mode and use the cursor keys to scroll through the selections. Press ENTER to select desired function. Select Cal (calibration) display.

```

    +-----+
    |  PROG Mode  |
    | RcP Fitr Cal PW |
    +-----+
    
```

Note: Before entering the Program Mode, if enabled, the Enter Password display appears. The default password is 5, 5, 5. To reprogram the password, refer to step e of this paragraph.

The Calibration Mode display appears with the calibration for pump 1 highlighted.

```

    +-----+
    |  PROG Cal  |
    | 0.XX 0.XX 0.XX |
    +-----+
    
```

1. Enter value for calibration and press ENTER. (Press ENTER alone to accept existing value.)

Calibration: 0.50 ml max 0.00 ml min

After ENTER is pressed, the Calibration Mode display reappears with the calibration for pump 2 highlighted.

2. Repeat step d.1 for pumps 2 and 3.

The pump control module returns to the Select Menu display after pump 3 has been calibrated.

e. Enter Program Mode and use the cursor keys to scroll through the selections. Press ENTER to select desired function. Select PW (password) display.

```

    +-----+
    |  PROG Mode  |
    | RcP Fitr Cal PW |
    +-----+
    
```

Note: Before entering the Program Mode, if enabled, the Enter Password display appears. The default password is 5, 5, 5.

1. Enter password. (Default = 5, 5, 5)

```

    +-----+
    | Enter Password |
    | * * *          |
    +-----+
    
```

2. Enter new password if desired, or current password if not.

```

    +-----+
    | Enter New Passwd |
    | * * *           |
    +-----+
    
```

3. Enter new password again
(verifies previous entry).

```
Verify Passwd
* * *
```

Note: If the same password is entered in steps e.2 and e.3, the new password will be stored and Password Enable display will appear.

```
Password
Enable Y
```

Note: At this point the new password is stored.

4. Press **←** or **→**.
5. Press ENTER.

To toggle between Y and N.

To select Y or N. If Y is selected, password is required to enter Program Mode. If N is selected, no password is required to edit in Program Mode. After ENTER is pressed, the Program Mode display reappears.

3.2.6 Active Mode

Description: In this mode, the user reviews the pump(s) and selects the corresponding recipe(s) that will be active when the pump control module is in use.

- a. In the appropriate Select Menu, press ACTV (active). The Active Mode display appears. The selected pump(s) and corresponding recipe(s) are listed.

ACTU	RcP	Mode
1=	1	3=1

The number to the left of the equal sign is the pump number.

The number to the right of the equal sign is the recipe number (Recipes are 1 through 8).

- b. Press ← or →.

To scroll between recipe numbers.

- c. Press Recipe number.

To change the desired active recipe for the selected pump.

- d. Press ENTER.

Accepts the modified recipe number or accepts default.

Note: The default is the previously selected recipe in Active Mode. If, in Configuration Mode, Y is the setting for the selected pump, then the reinitialization message for that pump will appear in the display.

Wait for Pump 1 to Re-Init.

3.2.7 Test Mode

Description: In this mode, the user tests a selected pump to verify operation or selects a pump to be purged.

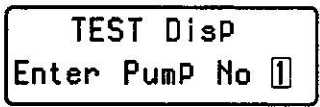
- a. In the appropriate Select Menu, press TEST. The Test Mode display appears with Disp (dispense) default selected.



- b. Press ENTER or a numeric key (1 to 9). Pressing ENTER will enable a single dispense cycle. Pressing a numeric key will enable the number of cycles selected.

Note: To terminate dispense cycling of pump after end of current cycle, press and hold ENTER until pump stops.

The Test Disp display appears with request for the pump number to be tested. The default is pump 1.



- c. Press pump number to be tested (or press ENTER to accept default). The Test Disp Cycle display appears and counts down the number of dispense cycles selected.



After dispense cycling is performed, the Select Menu display appears.

3.3 STARTUP PROCEDURE

Before starting any dispense operation, always check all flow lines, fittings, and components for leaks.

The system is factory tested for leaks at 60 psi. However, due to transportation and storage mishandling, some leaks in the plumbing may occur. Tighten fittings as required.

3.3.1 CYBORPUMP™ Model 5016 Pump System Startup

CAUTION

Refer to table 1-2 for viscosity, tubing, and rate of dispense, etc. The following example is for viscosities from 10 to 60 cs.

The following procedure is recommended when the system is to be put into operation for the first time:

- a. Connect source line to source container with 0.25-in. OD by 0.19-in. ID Teflon® tubing.
- b. Connect dispense port of pump 3-way solenoid valve with 0.25-in. OD by 0.19-in. ID Teflon® tubing. The last 8 to 16 inches of dispense line may be reduced to 3/16-in. OD by 0.12-in. ID Teflon® FEP tubing (or any other desirable size). For proper operation (tubing size, viscosity, and dispense rate) refer to table 1-2.
- c. Program pump control module Model 503/504/506 with dispense line purge recipe of 15 ml dispense at 2.00-ml/second rate with a suckback of 0.00 ml at a rate of 2.00 ml/second (refer to paragraph 3.2.5, Program Mode). These dispense line purge parameters are preprogrammed at the factory as recipe no. 8 (refer to table 3-3). Use Active Mode to make sure that recipe no. 8 is selected (refer to paragraph 3.2.6, Active Mode).
- d. Using Test Mode, start dispensing with dispense line purge recipe (refer to paragraph 3.2.7, Test Mode). The system does not require priming; however, it will require a few strokes for pump to be filled with fluid.
- e. Continue to pump until all fluid lines are filled with fluid.
- f. Monitor system for air bubbles in fluid lines. Even a small amount of air in the system can have an impact on accuracy and repeatability of dispense.
- g. Before setting desired dispense, volume, and suckback, make sure that all air in system has been evacuated during purge/dispense. When no air is observed in fluid lines and components, system is ready for operation. Program desired dispense volume, suckback volume, and rates in Pump Control Module Model 503/504/506 (refer to paragraph 3.2.5, Program Mode).

Table 3-3. Recommended Recipes

Dispense Line Purging	Recipe No. 8 (1)
Dispense volume	15.00 ml
Dispense rate	2.00 ml/sec (3)
Suckback volume	0.00 ml
Suckback rate	3.00 ml/sec (3)
Reload rate	2.00 ml/sec (3)
Suckback Line Purging	Recipe No. 7 (2)
Dispense volume	3.00 ml
Dispense rate	1.00 ml/sec (3)
Suckback volume	2.00 ml
Suckback rate	0.10 ml/sec (3)
Reload rate	2.00 ml/sec (3)

Notes:

- (1) Recipe no. 8 parameters are preprogrammed at the factory.
- (2) Recipe no. 7 parameters are preprogrammed at the factory.
- (3) Refer to table 1-2 for maximum dispense rates. These recipes are for viscosities of 10 to 60 cs.

3.3.2 CYBORPUMP™ Model 5116 All Teflon® Path (ATP) Pump and Filter System Startup

Recipe no. 7 is preprogrammed for suckback line purging. Before performing the startup procedure, use Active Mode to make sure that recipe no. 7 (suckback line purging) is selected (refer to paragraph 3.2.6, Active Mode).

CAUTION

Refer to table 1-2 for viscosity, tubing, and rate of dispense, etc. The following example is for viscosities from 10 to 60 cs.

The following procedure is recommended when the system is made operational for the first time or has been purged of fluid:

- a. Connect source line to source container with 0.25-in. OD Teflon® tubing.
- b. Connect vent/drain line from stopcock valves to drain with 0.25-in. OD ID Teflon® tubing.
- c. Connect dispense port of filter 3-way solenoid valve with 0.25-in. OD Teflon® tubing. The last 12 to 16 inches of dispense line may be reduced to 3/16-in. OD by 0.12-in. ID Teflon® FEP tubing (or any other desirable size). For proper operation (tubing size, viscosity, and dispense rate), refer to table 1-2.
- d. Open air vent stopcock. Refer to marking on hub of valve for flow direction. Make sure drain stopcock valve is closed.
- e. Program Pump Control Module Model 503/504/506 with dispense line purge recipe of 15-ml dispense at 2.00-ml/second rate with a suckback of 3.00 ml (refer to paragraph 3.2.5, Program Mode).

These purge parameters are preprogrammed at the factory as recipe no. 8 (refer to table 3-3). Using Active Mode, enable recipe no. 8 (refer to paragraph 3.2.6, Active Mode).

- f. Using Test Mode, start dispensing with dispense line purge recipe (refer to paragraph 3.2.7, Test Mode). The system does not require priming; however, will require 10 to 12 strokes for filter housing to be filled with fluid.
- g. Continue to pump until fluid is observed in air vent stopcock drain. Close air vent stopcock valve.
- h. Continue to pump until fluid is observed in dispense nozzle line.
- i. Monitor system for air bubbles in dispense line.
- j. Using Active Mode, select suckback line purge recipe no. 7 (refer to table 3-3 and paragraph 3.2.6, Active Mode).
- k. Using Test Mode, continue to dispense until air is purged from suckback line. Vent air with vent stopcock as required (refer to paragraph 3.2.7, Test Mode).
- l. Using Active Mode, select recipe no. 8 (dispense line purge recipe) (refer to paragraph 3.2.6, Active Mode).
- m. Using Test Mode, continue to purge system with approximately 100 to 200 ml of fluid until air is purged from dispense line (100 ml for Pall, 200 ml for Millipore) (refer to paragraph 3.2.7, Test Mode).
- n. Using Active Mode, select recipe no. 7 (suckback line purge recipe) (refer to paragraph 3.2.6, Active Mode). Change parameters as required to achieve normal dispense operation.

Note

Make certain all air is purged from system. Even a small amount of air in the system can have an impact on accuracy and repeatability of dispense.

- o. When no air is observed in fluid lines, system is ready for operation. Program desired dispense, volume, and suckback rates in Pump Control Module Model 503/504/506 (refer to paragraph 3.2.5, Program Mode).



SECTION 4 MAINTENANCE

4.1 INTRODUCTION

This section provides removal and replacement procedures and troubleshooting data for the pump system. This section is provided by CYBOR for the purpose of giving our users a complete background on the CYBORPUMP™ Series 5000 Programmable Metering Pump System. This section should prove to be an invaluable resource for the long-term care of your pump.

IMPORTANT

During the warranty period, the only factory-recommended maintenance to be performed by the user is outlined in paragraph 4.3.1, Filter Cartridge Removal and Replacement. During the warranty period, any other required maintenance is to be performed by CYBOR or a CYBOR-authorized representative. Service, other than filter maintenance, performed by other than the aforementioned personnel, may invalidate your warranty.

4.2 PUMP DRAINING AND CLEANING

Pump draining and cleaning is to be performed prior to disassembling the pump and whenever the pump is shipped or sent back to the factory. Never ship a pump with application fluids or solvents in the pump cavity, filter system, or fluid lines.

IMPORTANT

Always drain and clean a pump before returning the pump to the factory. A cleaning and refurbishment charge will be imposed on pumps received at the factory that have not been drained and cleaned.

4.2.1 Pump Draining And Cleaning With Model 510/511 Filter System Installed

Before draining and cleaning the pump, make certain the pump will not be activated and the host equipment is in an idle mode. Prepare the work area to contain and control any fluid spills that may occur. To drain and clean the pump, perform the following:

- a. Record active recipe volume and suckback.
- b. Program pump control module active recipe volume for 0.2 ml with 0.00-ml suckback (refer to paragraph 3.2.5, Program Mode). Pump will reinitialize and then dispense fluid remaining in pump cavity.

WARNING

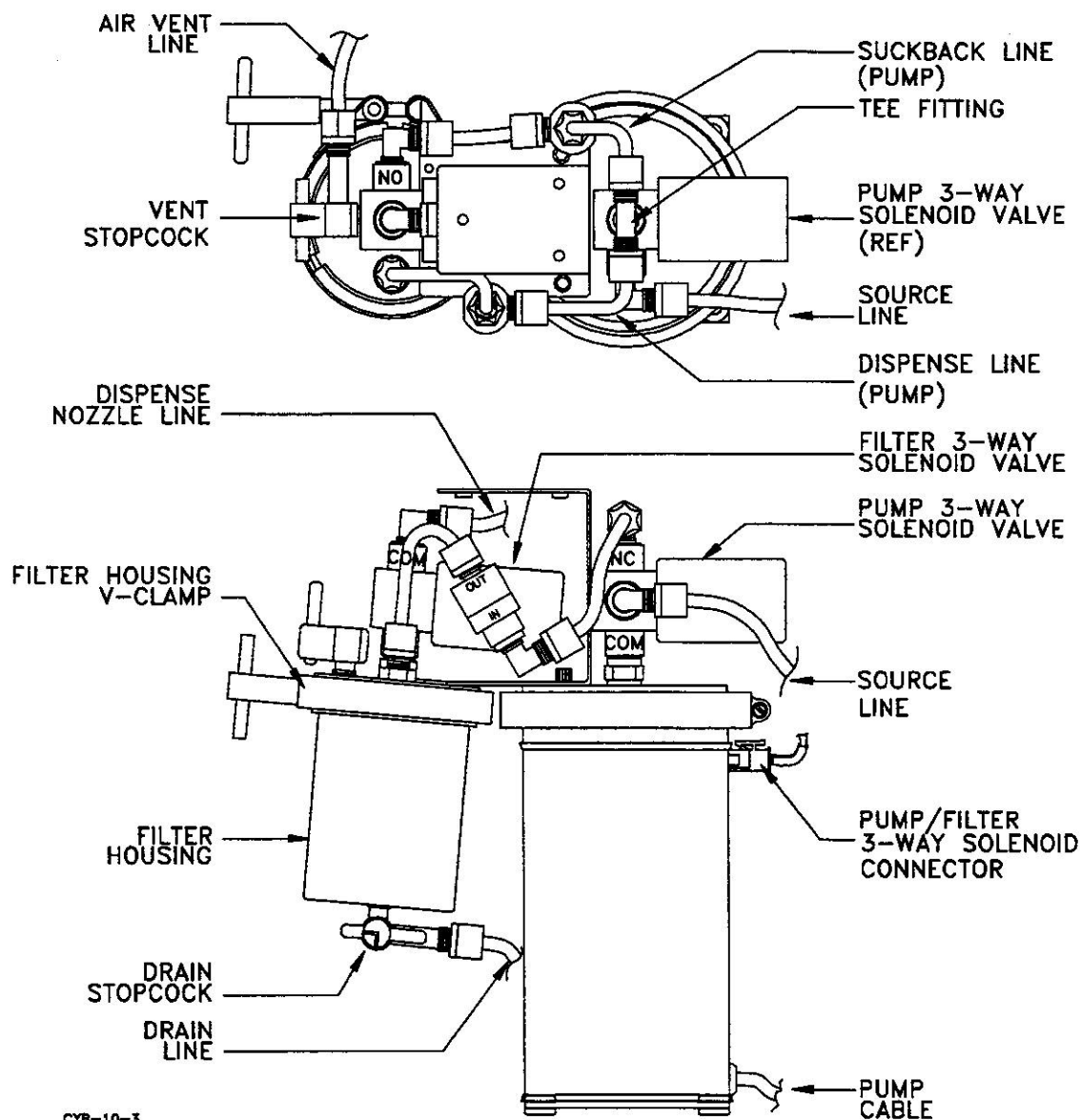
If the pump has been used to dispense or has been purged with volatile and/or corrosive chemicals, observe the proper safety precautions to protect personnel when disconnecting and reconnecting fluid lines. Refer to the fluid and solvent manufacturers' instructions and Material Safety Data Sheet (MSDS) for safe handling procedures.

- c. Remove power by performing the following:
 1. Place POWER switch on front of Model 512 Power Supply to the OFF position.
 2. Remove applicable pump cable at rear of pump control module.
- d. Loosen nut of fluid source line at pump 3-way solenoid valve N.O. port. Remove and plug source line (figure 4-1).
- e. Loosen nut of fluid dispense line at filter 3-way solenoid valve COM port. Remove and plug dispense line (figure 4-1).

Note

If electronic grade Nitrogen is not available, an empty plastic squeeze bottle can be used to force air into the fluid lines.

- f. Open drain stopcock on filter housing (figure 4-1). Refer to marking on hub of stopcock for flow direction.
- g. Connect purge gas line with 0.25-in.-OD tubing to filter 3-way solenoid valve COM port and apply purge gas at 3- to 5-psi maximum pressure.
- h. Drain pump lines and filter housing for 30 to 60 seconds, depending on fluid viscosity.
- i. Shut off purge gas and disconnect purge gas line from filter 3-way solenoid valve COM port.
- j. Fill a plastic squeeze bottle partially full with solvent for use with application fluid.
- k. Place squeeze bottle opening against filter 3-way solenoid valve COM port and squeeze bottle to pass solvent through COM port and out of drain stopcock. Repeat process until application fluid has been rinsed out of lines and check valves with solvent.
- l. Connect purge gas line with 0.25-in.-OD tubing to filter 3-way solenoid valve COM port and apply purge gas at 3- to 5-psi maximum pressure to purge solvent.
- m. Drain pump lines and filter housing for 30 to 60 seconds, depending on solvent viscosity.
- n. Shut off purge gas and disconnect purge gas line from filter 3-way solenoid valve COM port.
- o. Loosen screw of filter housing V-clamp enough to slide V-clamp off filter housing cover and down filter housing (figure 4-1).



CYB-10-3

Figure 4-1. Pump and Filter System Component Locations

WARNING

After draining the filter housing and cartridge, a minimum volume of fluid will remain inside the filter housing, cartridge, and filter 3-way solenoid valve lines. Use caution to prevent spills. Do not inhale vapor and avoid contacting fluids and solvents with skin and eyes. Wear appropriate safety garb, gloves, and eye protection for the fluids and solvents in use. Make certain that ventilation is adequate. Keep materials away from heat, sparks, and open flame. Wipe up spills immediately.

- p. Carefully separate filter housing from filter housing cap by pulling housing down approximately 1 inch (figure 4-3).

- q. Remove Millipore cartridge as follows:
 - 1. Carefully separate adapter with filter cartridge from filter housing cap by pulling adapter with cartridge down into filter housing.
 - 2. Remove adapter with filter cartridge from filter housing.
 - 3. Remove filter cartridge from adapter.
- r. Remove Pall cartridge as follows:
 - 1. Carefully separate filter cartridge from filter housing cap by pulling cartridge down into filter housing.
 - 2. Remove filter cartridge from filter housing.
- s. Using particle-free cleaning materials (Texwipe or equivalent), wipe residue from filter housing cap and inside filter housing.
- t. Clean surfaces with particle-free cleaning materials (Texwipe or equivalent) and appropriate solvent for material being pumped.
- u. Carefully attach filter housing to filter housing cap. Make certain filter housing seats properly with O-ring and filter housing cap.
- v. Slide V-clamp up filter housing onto filter housing cap and housing cover flanges. Tighten V-clamp by hand until snug. Do not over tighten.
- w. Disconnect pump/filter 3-way solenoid connector from pump housing receptacle (figure 4-1).

WARNING

A minimum volume of fluid will remain inside the pump. Use caution to prevent spills. Do not inhale vapors and avoid contacting materials with skin and eyes. Wear appropriate safety garb, gloves, and eye protection for the fluids and solvents in use. Make certain ventilation is adequate. Keep materials away from heat, sparks, and open flame. Wipe up spills immediately.

- x. Clean pump cavity as follows (figure 4-2):
 - 1. Remove V-clamp securing top cap assembly to pump body (figure 4-2).
 - 2. Lift top cap assembly from pump body.
 - 3. Using particle-free cleaning materials (Texwipe or equivalent), wipe residue from pump cavity diaphragm, face seal, cap assembly face seal mating surface, O-ring, and O-ring groove.
 - 4. Clean all surfaces with particle-free cleaning materials (Texwipe or equivalent) and appropriate solvent for material being pumped.
 - 5. Place top cap assembly and filter system on container capable of collecting waste fluid. Make certain container is on stable surface and can support weight as well as balance top cap assembly and filter assembly.
 - 6. Fill a plastic squeeze bottle partially full with solvent for use with application fluid.

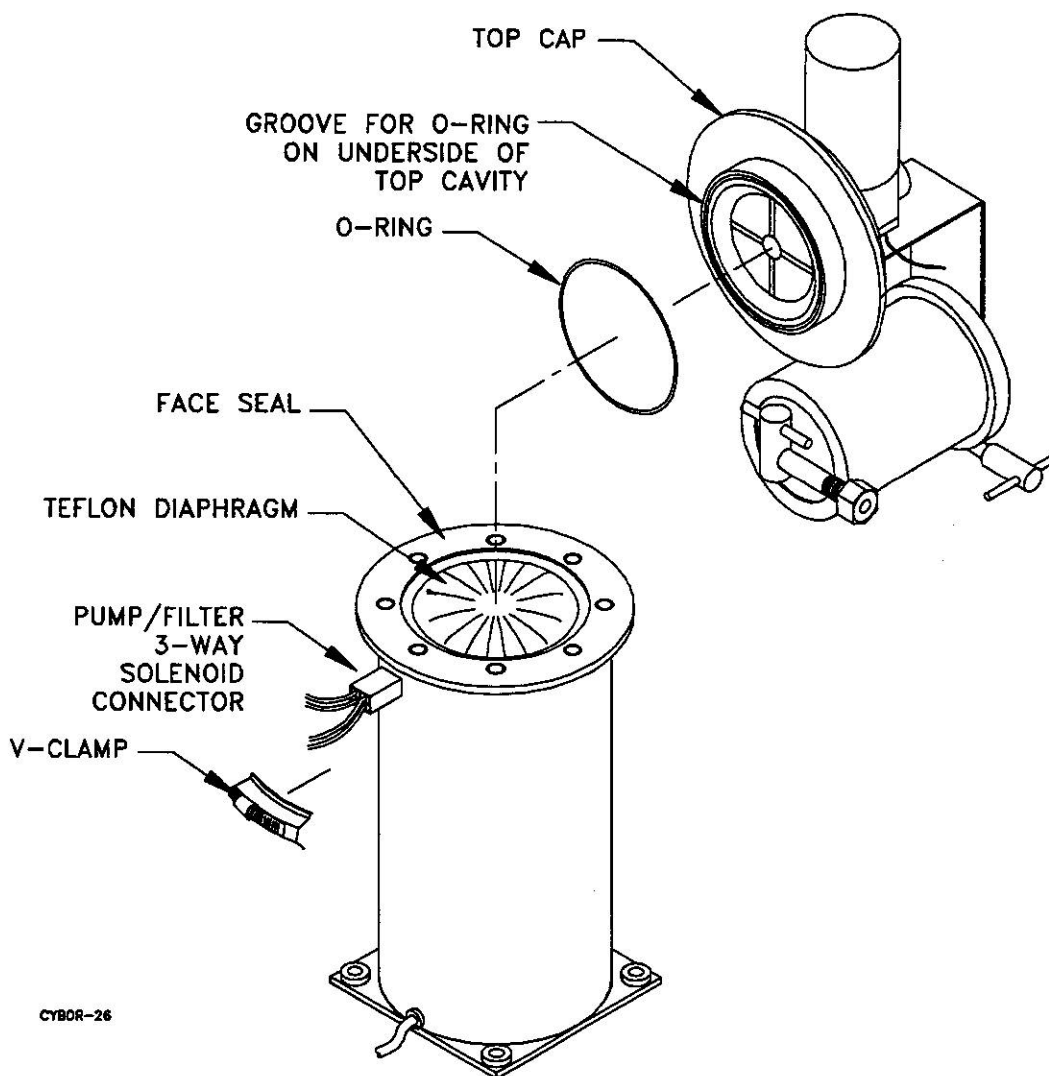


Figure 4-2. Pump Cavity Components

7. Place squeeze bottle opening against pump 3-way solenoid valve N.O. port and squeeze bottle to pass solvent through COM port. Repeat process until application fluid has been rinsed out of lines with solvent.
8. Dry all surfaces with particle-free cleaning materials (Texwipe or equivalent).
- y. Place top cap assembly on pump body. Make certain O-ring is properly seated.
- z. Reinstall V-clamp. Tighten V-clamp by hand until snug. Do not over tighten.

4.2.2 Pump Draining And Cleaning Without Model 510/511 Filter System Installed

Before draining and cleaning the pump, make certain the pump will not be activated and the host equipment is in an idle mode. Prepare the work area to contain and control any fluid spills that may occur. To drain and clean the pump, perform the following:

- a. Record active recipe volume and suckback.
- b. Program pump control module active recipe volume for 0.2 ml with 0.00-ml suckback (refer to paragraph 3.2.5, Program Mode). Pump will reinitialize and dispense fluid remaining in pump cavity.

WARNING

If the pump has been used to dispense or has been purged with volatile and/or corrosive chemicals, observe the proper safety precautions to protect personnel when disconnecting and reconnecting fluid lines. Refer to the fluid and solvent manufacturers' instructions and Material Safety Data Sheet (MSDS) for safe handling procedures.

- c. Remove power by performing the following:
 1. Place POWER switch on front of Model 512 Power Supply to OFF position.
 2. Remove applicable pump cable at rear of pump control module.
- d. Loosen nut of fluid source line at pump 3-way solenoid valve N.O. port. Remove and plug source line (figure 4-1).
- e. Loosen nut of fluid dispense line at pump 3-way solenoid valve N.C. port. Remove and plug dispense line (figure 4-1).
- f. Disconnect pump 3-way solenoid connector from pump housing receptacle (figure 4-1).

WARNING

A minimum volume of fluid will remain inside the pump. Use caution to prevent spills. Do not inhale vapors and avoid contacting materials with skin and eyes. Wear appropriate safety garb, gloves, and eye protection for the fluids and solvents in use. Make certain ventilation is adequate. Keep materials away from heat, sparks, and open flame. Wipe up spills immediately.

- g. Clean pump cavity as follows: (figure 4-2).
 1. Remove V-clamp securing top cap assembly to pump body.
 2. Lift top cap assembly from pump body.
 3. Using particle-free cleaning materials (Texwipe or equivalent), wipe residue from pump cavity diaphragm, face seal, cap assembly face seal mating surface, O-ring, and O-ring groove.
 4. Clean all surfaces with particle-free cleaning materials (Texwipe or equivalent) and appropriate solvent for material being pumped.
 5. Place top cap assembly on container capable of collecting waste fluid. Make certain container is on stable surface and can support weight, as well as balance top cap assembly.
 6. Fill a plastic squeeze bottle partially full with solvent for use with application fluid.
 7. Place squeeze bottle opening against pump 3-way solenoid valve N.O. port and squeeze bottle to pass solvent through N.O. port. Repeat process until application fluid has been rinsed out of lines with solvent.
 8. Dry all surfaces with particle-free cleaning materials (Texwipe or equivalent).

- h. Place top cap assembly on pump body. Make certain O-ring is properly seated.
- i. Reinstall V-clamp. Tighten V-clamp by hand until snug. Do not over tighten.

4.3 FILTER SYSTEM MAINTENANCE

4.3.1 Filter Cartridge Removal and Replacement

Before removing and replacing the filter cartridge, make certain the pump will not be activated and the host equipment is in an idle mode. Prepare work area to contain and control any fluid spills that may occur. To remove and replace the filter element, perform the following:

- a. Record active recipe volume and suckback.
- b. Removal:
 - 1. Loosen nut of drain line at air vent stopcock. Remove and plug drain line (figure 4-1).

Note

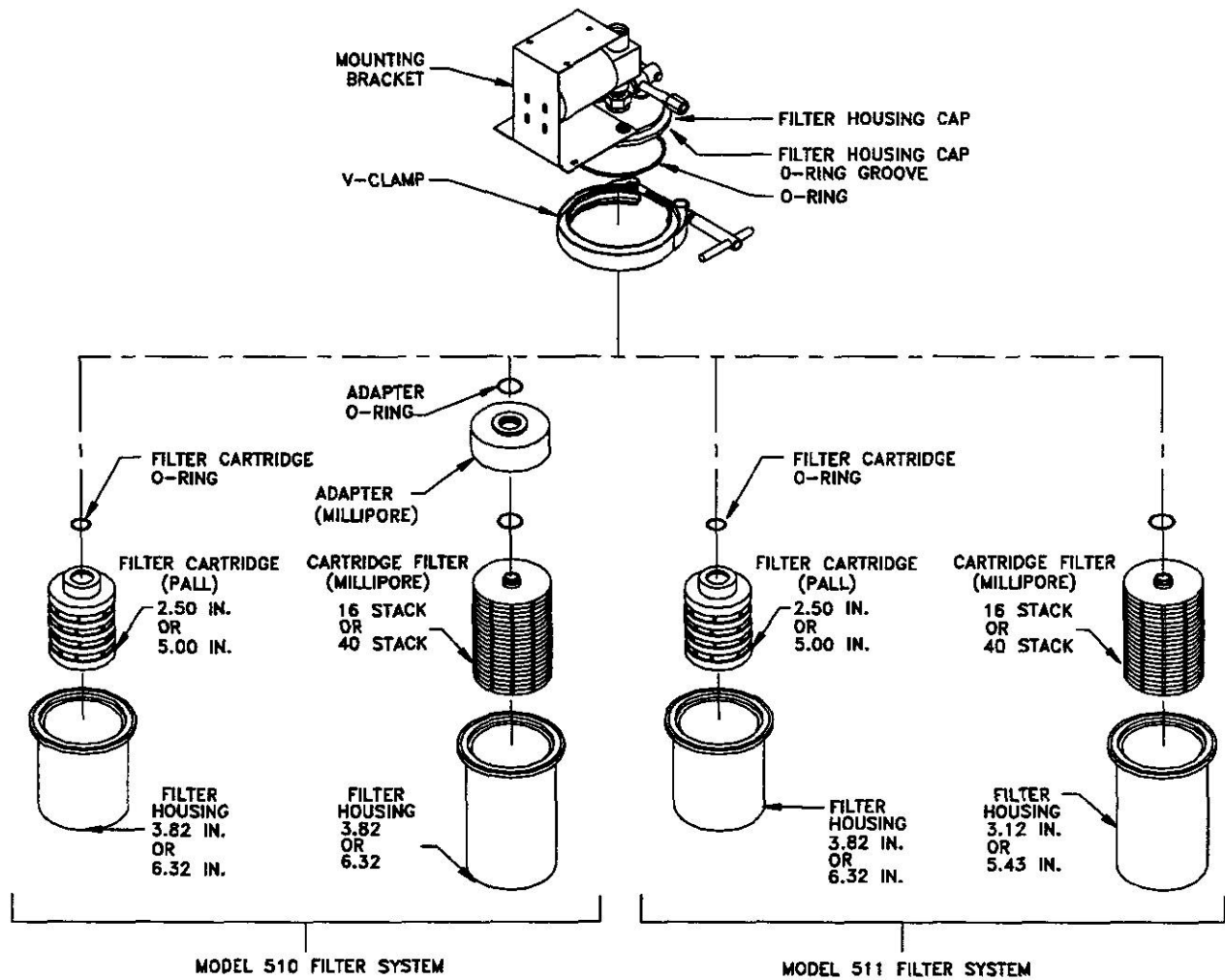
If electronic grade Nitrogen is not available, the drainage of the filter housing is achieved in the same manner. However, because Nitrogen is not connected to air vent stopcock, it will take considerably longer to drain the filter housing depending on the fluid viscosity.

- 2. Connect purge gas line with 0.25-in. OD tubing to air vent stopcock (recommended purge gas is Nitrogen, electronic grade at 3- to 5-psi maximum pressure).

WARNING

If the pump has been used to dispense or has been purged with volatile and/or corrosive chemicals, observe the proper safety precautions to protect personnel when disconnecting and reconnecting fluid lines. Refer to the fluid and solvent manufacturers' instructions and Material Safety Data Sheet (MSDS) for safe handling procedures.

- 3. Open air vent stopcock and drain stopcock on filter housing (figure 4-1). Refer to marking on hub of stopcock for flow direction.
- 4. Apply purge gas at 3- to 5-psi maximum pressure through open port of air vent stopcock.
- 5. Drain filter housing and filter cartridge for 30 to 60 seconds, depending on fluid viscosity.
- 6. Disconnect purge gas line from air vent stopcock.
- 7. Loosen screw of filter housing V-clamp enough to slide V-clamp off filter housing cover and down filter housing (figure 4-3).



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Figure 4-3. Filter Cartridge Removal and Replacement

WARNING

After draining the filter housing and cartridge, a minimum volume of fluid will remain inside the filter housing, cartridge, and filter 3-way solenoid valve lines. Use caution to prevent spills. Do not inhale vapor and avoid contacting materials with skin and eyes. Wear appropriate safety garb, gloves, and eye protection for the fluids and solvents in use. Make certain ventilation is adequate. Keep materials away from heat, sparks, and open flame. Wipe up spills immediately.

- Carefully separate filter housing from filter housing cap by pulling housing down approximately 1 inch.

9. Remove Model 511 Filter System and Model 510 Filter System Pall cartridges as follows:
 - (a) Carefully separate filter cartridge from filter housing cap by pulling cartridge down into filter housing.
 - (b) Remove filter cartridge from filter housing.
 10. Remove Model 510 Filter System Millipore cartridge as follows:
 - (a) Carefully separate adapter with filter cartridge from filter housing cap by pulling adapter with cartridge down into filter housing.
 - (b) Remove adapter with filter cartridge from filter housing.
 - (c) Remove filter cartridge from adapter.
- c. Replacement:

CAUTION

Before replacing the filter cartridge, make certain the material for each O-ring is compatible with the application fluid (e.g., EPR O-ring for positive photoresist, Viton® O-ring for negative photoresist, Kalrez® O-ring for polyimide photoresist, etc.). Failure to use the proper O-ring material could cause O-ring breakdown, which in turn could cause fluid contamination and/or leakage.

1. Inspect filter housing cap seal O-ring for nicks or damage. Replace if damaged. Install O-ring in filter housing cap O-ring groove.
2. Replace Model 511 Filter System and Model 510 Filter System Pall cartridges as follows:
 - (a) Install proper cartridge O-ring on cartridge.
 - (b) Install cartridge and O-ring onto filter housing cap stud. Make certain cartridge is flush against filter housing cap.
3. Replace Model 510 Filter System Millipore cartridge as follows:
 - (a) Inspect adapter O-ring for nicks or damage. Replace if damaged.
 - (b) Install adapter onto filter housing cap stud. Make certain adapter is flush against filter housing cap.
 - (c) Install proper Millipore cartridge O-ring on cartridge.
 - (d) Install Millipore cartridge and O-ring onto adapter.
4. Carefully attach filter housing to filter housing cap. Make certain filter housing seats properly with O-ring and filter housing cap.
5. Slide V-clamp up filter housing onto filter housing cap and housing cover flanges. Tighten V-clamp by hand until snug. Do not over tighten.
6. Remove plug from drain line and connect drain line to air vent stopcock.
7. Open air vent stopcock and close drain stopcock.

8. Perform air purge procedure described in startup procedure (paragraph 3.3) and repeat procedure until all air is purged from system.
9. Use air vent stopcock to vent air from filter housing as necessary.

Note

When replacing the filter element, all lines of system are sealed and protected from contamination. Purging with a solvent is not required unless the fluid type is being changed. However this is left to the discretion of the end user.

10. Clean any fluid drips on filter housing and from work area.
11. Set active recipe to volume recorded in step a.

4.3.2 Model 510/511 Filter System Removal and Replacement

Before removing and replacing the filter system, make certain the pump will not be activated and the host equipment is in an idle mode. Prepare work area to contain and control any fluid spills that may occur. To remove and replace the filter system, perform the following:

- a. Record active recipe volume and suckback.
- b. Perform pump draining and cleaning procedure (refer to paragraph 4.2).
- c. Removal:
 1. Disconnect filter dispense line from tee fitting at pump 3-way solenoid valve N.C. port.
 2. Disconnect filter suckback line from tee fitting at pump 3-way solenoid valve N.C. port.
 3. Disconnect pump/filter 3-way solenoid connector from pump housing receptacle.
 4. Using Molex extractor tool, remove filter 3-way solenoid valve connector pins from pump/filter 3-way solenoid connector.
 5. Rotate filter 3-way solenoid valve approximately 45 degrees counterclockwise (CCW) to gain access to pump 3-way solenoid valve mounting bracket screws.
 6. Remove two socket-head screws securing pump 3-way solenoid valve to mounting bracket (figure 4-4).
 7. Remove two socket-head screws securing mounting bracket to pump top cap and remove filter system.
 8. Clean any fluid drips on filter housing and from work area.

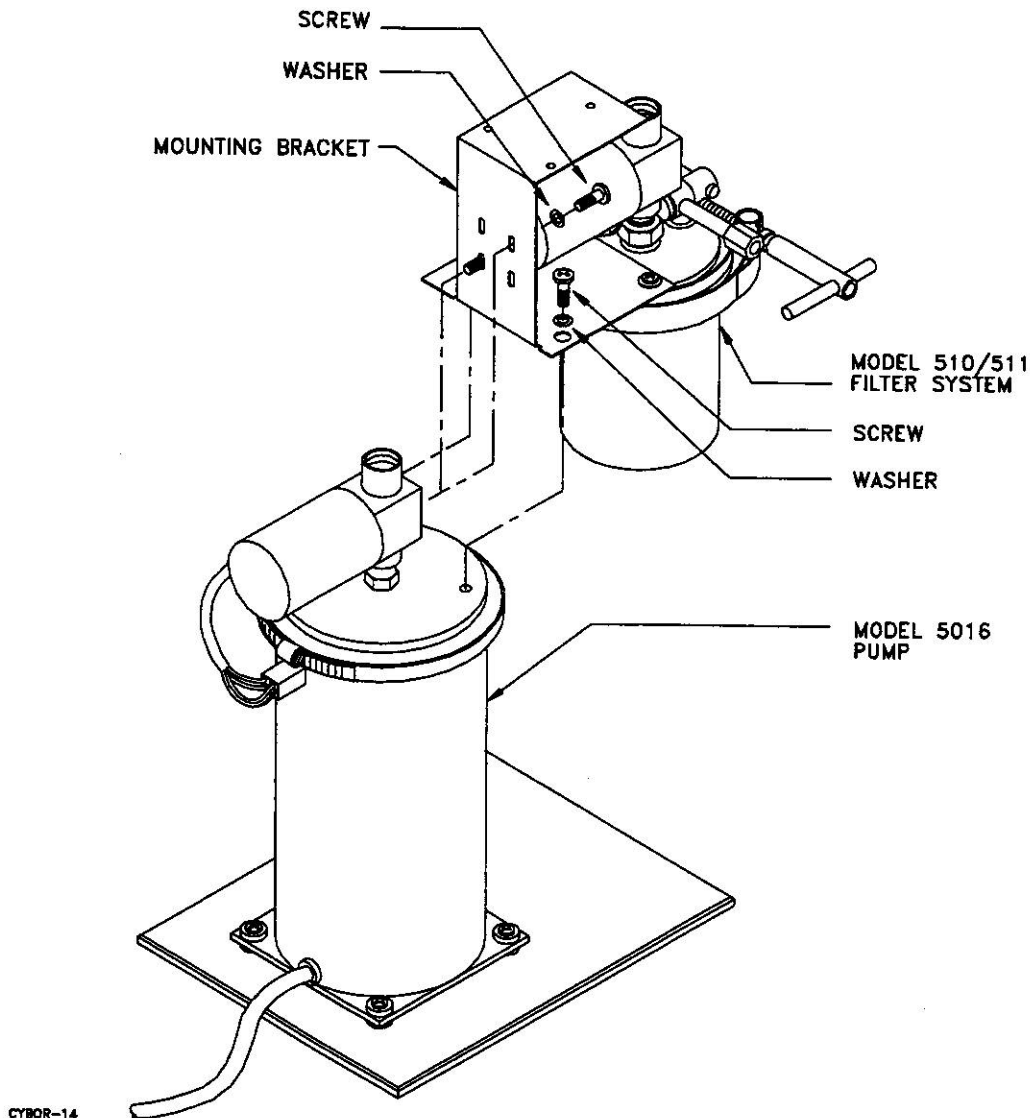


Figure 4-4. Filter System Model 510/511 Removal and Replacement

d. Replacement:

1. Install mounting bracket on pump top cap and secure with two socket-head screws (figure 4-4).
2. Secure pump 3-way solenoid valve to mounting bracket with two socket-head screws (figure 4-4).
3. Realign filter 3-way solenoid valve by rotating valve approximately 45 degrees clockwise (CW).
4. Insert filter 3-way solenoid connector pins into pump/filter 3-way solenoid connector.
5. Connect pump/filter 3-way solenoid connector to pump housing receptacle.
6. Connect filter suckback line to tee fitting at pump 3-way solenoid valve N.C. port (figure 4-1).
7. Connect filter dispense line to tee fitting at pump 3-way solenoid valve N.C. port.
8. Remove plug from dispense line and connect dispense line to filter 3-way solenoid valve COM port.
9. Remove plug from source line and connect source line to pump 3-way solenoid valve N.O. port.

10. Open air vent stopcock and close drain stopcock.

Note

When replacing the filter system, all lines of the system are sealed and protected from contamination. Purging with a solvent is not required unless the type of fluid is being changed. However, this is left to the discretion of the end user.

11. Restore power.
12. Repeat air purge procedure described in startup procedure (paragraph 3.3) until all air is purged from system.
13. Use air vent stopcock to vent air from filter housing as necessary.
14. Clean any fluid drips on filter housing and drip pan and from work area.
15. Set active recipe to volume recorded in step a.

4.3.3 Filter 3-Way Solenoid Valve Removal and Replacement

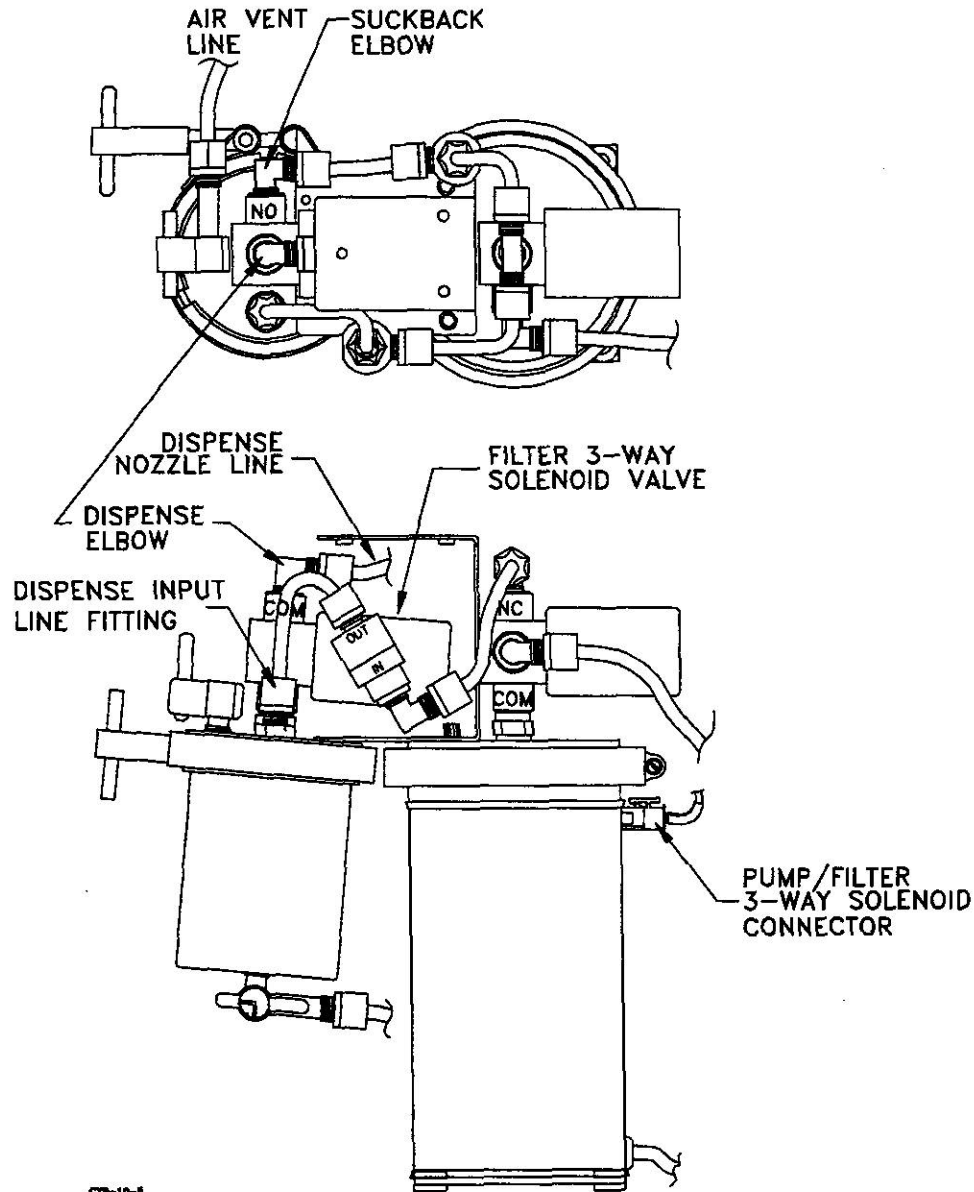
Before removing and replacing the filter 3-way solenoid valve, make certain the pump will not be activated and the host equipment is in an idle mode. Prepare work area to contain and control any fluid spills that may occur. To remove and replace the filter 3-way solenoid valve, perform the following:

- a. Record active recipe volume and suckback.
- b. Perform pump draining and cleaning procedure (refer to paragraph 4.2).
- c. Removal:

WARNING

If the pump has been used to dispense or has been purged with volatile and/or corrosive chemicals, observe the proper safety precautions to protect personnel when disconnecting and reconnecting fluid lines. Refer to the fluid and solvent manufacturers' instructions and Material Safety Data Sheet (MSDS) for safe handling procedures.

1. Disconnect dispense output line from filter 3-way solenoid valve COM port elbow fitting. Plug output line.
2. Disconnect suckback line from filter 3-way solenoid valve N.O. port.
3. Disconnect dispense input line and fitting at filter (figure 4-5).
4. Disconnect pump/filter 3-way solenoid connector from pump housing receptacle.
5. Using Molex extractor tool, remove filter 3-way solenoid valve connector pins from pump/filter 3-way solenoid connector.
6. Connect 5/8-inch wrench to filter 3-way solenoid valve nipple (figure 4-6). Using wrench to keep nipple from turning, turn filter 3-way solenoid valve CCW from nipple and remove filter 3-way solenoid valve. Do not unscrew nipple.



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Figure 4-5. Filter 3-Way Solenoid Valve Component Locations

7. If filter 3-way solenoid valve is not to be replaced immediately, cap the filter nipple with 1/4-inch nut threaded cap or cover nipple opening to keep liquid from spilling out of filter housing.
 8. Remove Teflon[®] elbow fittings from filter 3-way solenoid valve dispense (COM) port and suckback (N.O.) port (figure 4-5).
- d. Replacement:
1. Remove threaded cap or covering from nipple.
 2. Remove existing Teflon[®] tape from nipple threads.
 3. Apply new Teflon[®] tape (three to four turns) to nipple threads (figure 4-6).

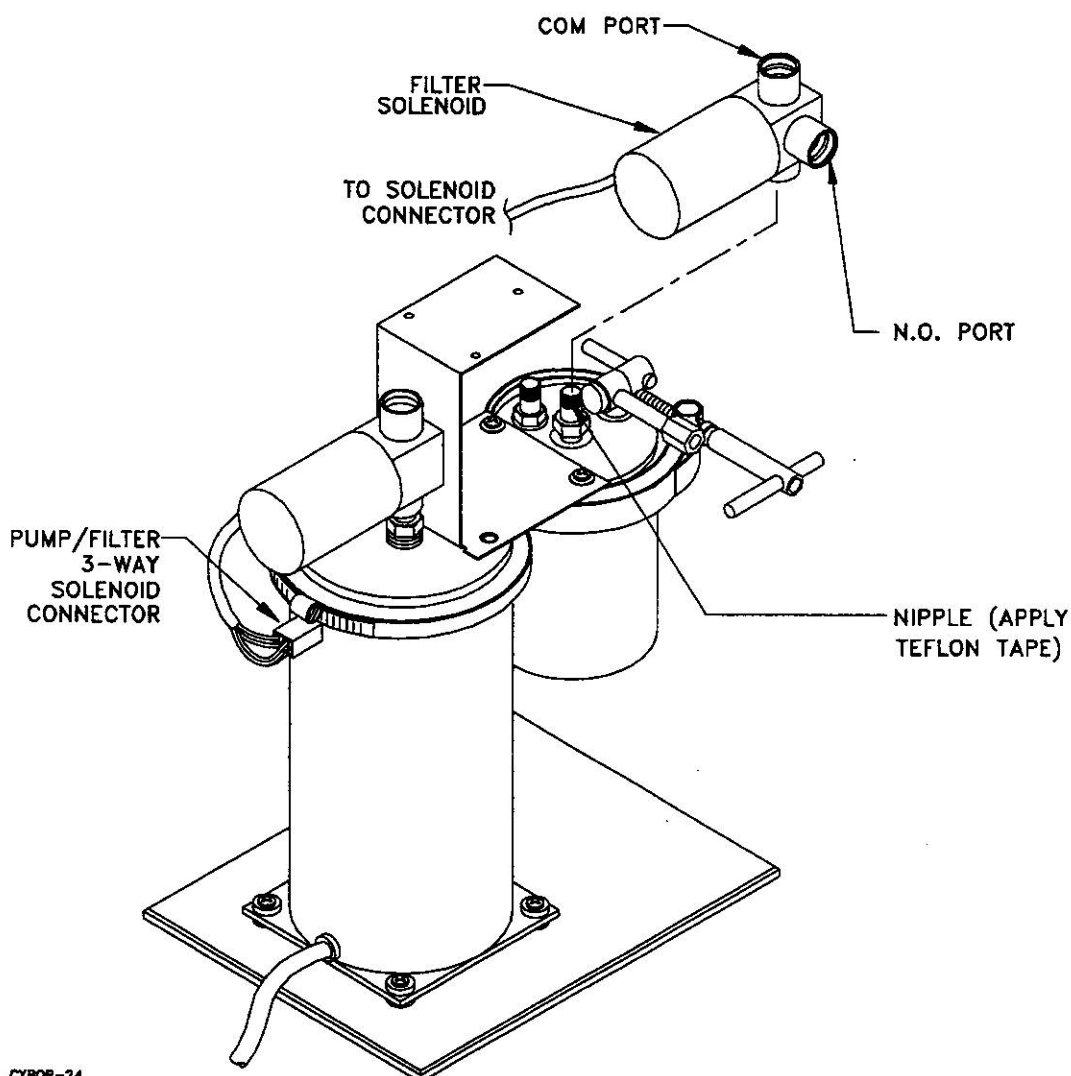


Figure 4-6. Filter 3-Way Solenoid Valve Removal and Replacement

4. Connect 5/8-inch wrench to filter 3-way solenoid valve nipple. Using wrench to keep nipple from turning, install filter 3-way solenoid valve on nipple by turning filter 3-way solenoid valve clockwise onto nipple threads.
5. Remove existing Teflon[®] tape from Teflon[®] elbow fitting threads (figure 4-5).
6. Apply new Teflon[®] tape (three to four turns) to Teflon[®] elbow fitting threads.
7. Install Teflon[®] elbow fittings in filter 3-way solenoid valve dispense (COM) port and suckback (N.O.) port.
8. Install filter solenoid connector pins in pump/filter 3-way solenoid connector.
9. Connect pump/filter 3-way solenoid connector to pump housing receptacle.
10. Connect suckback line to filter 3-way solenoid valve N.O. port.
11. Connect dispense input line and fitting to filter.
12. Remove plug from dispense output line and connect dispense output line to filter 3-way solenoid valve COM port.

13. Remove plug from source line and connect source line to pump 3-way solenoid valve N.O. port.
 14. Clean up any fluid drips on filter housing and from work area.
- d. Restore power.
 - e. Purge system of air using dispense line purge, recipe no. 8 (refer to paragraph 3.3). Use air vent stopcock to purge air from filter housing if filter is used. Purge suckback line using recipe no. 7 (refer to paragraph 3.3).
 - f. Set active recipe to volume recorded in step a.

4.4 PUMP MAINTENANCE

WARNING

Before performing maintenance on the CYBORPUMP™ System, verify other related processes/equipment will not be affected.

WARNING

If the pump has been used to dispense or has been purged with volatile and/or corrosive chemicals, observe the proper safety precautions to protect personnel when disconnecting and reconnecting fluid lines. Refer to the fluid and solvent manufacturers' instructions and Material Safety Data Sheet (MSDS) for safe handling procedures.

WARNING

At the end of the purge cycle, a minimum volume of fluid will remain inside the pump. Use caution to prevent spills. Do not inhale vapors and avoid contacting materials with skin and eyes. Wear appropriate safety garb, gloves, and eye protection for the fluids and solvents in use. Make certain ventilation is adequate. Keep materials away from heat, sparks, and open flame. Wipe up spills immediately.

CAUTION

The pump electrical connectors use locking-type pins. When disconnecting the pump connector, do not pull on the connector wires — pull on the connector housing or body.

4.4.1 Pump 3-Way Solenoid Valve Removal and Replacement With Model 510/511 Filter System Installed

To remove and replace the pump 3-way solenoid valve with a Model 510/511 Filter System installed, perform the following:

- a. Record active recipe volume and suckback.
- b. Perform pump draining and cleaning procedure (refer to paragraph 4.2).

c. Removal:

1. Disconnect pump dispense line from tee fitting at pump 3-way solenoid valve N.C. port (figure 4-1).
2. Disconnect pump suckback line from tee fitting at pump 3-way solenoid valve N.C. port.
3. Disconnect pump/filter 3-way solenoid connector from pump housing receptacle.
4. Using Molex extractor tool, remove pump solenoid connector pins from pump/filter 3-way solenoid connector.
5. Rotate filter 3-way solenoid valve approximately 45 degrees CCW to gain access to pump 3-way solenoid valve mounting bracket screws.
6. Remove two socket-head screws securing pump 3-way solenoid valve to mounting bracket (figure 4-7).
7. Remove two socket-head screws securing mounting bracket to pump top cap and remove filter system.
8. Connect 5/8-inch wrench to pump 3-way solenoid valve nipple. Using wrench to keep nipple from turning, turn pump 3-way solenoid valve CCW from nipple and remove pump 3-way solenoid valve. Do not unscrew nipple or remove any spacers.

Note

Some pump configurations require spacers between the nipple and the top cap. When removing the valve, do not unscrew the nipple or remove the spacers.

9. If pump 3-way solenoid valve is not to be replaced immediately, cap pump nipple with 1/4-inch threaded cap or cover nipple opening to keep liquid from spilling out of upper pump cavity.
10. Remove N.O. Teflon[®] elbow fitting from N.O. port.
11. Remove Teflon[®] tee fitting from N.C. port.

d. Replacement:

1. Remove threaded cap or covering from pump nipple.
2. Remove existing Teflon[®] tape from nipple threads.
3. Apply new Teflon[®] tape (three to four turns) to nipple threads.
4. Remove existing Teflon[®] tape from Teflon[®] tee fitting threads.
5. Apply new Teflon[®] tape (three to four turns) to Teflon[®] tee fitting threads.
6. Install Teflon[®] elbow fitting in pump 3-way solenoid valve N.O. port.
7. Install Teflon[®] tee fitting in pump 3-way solenoid valve N.C. port.

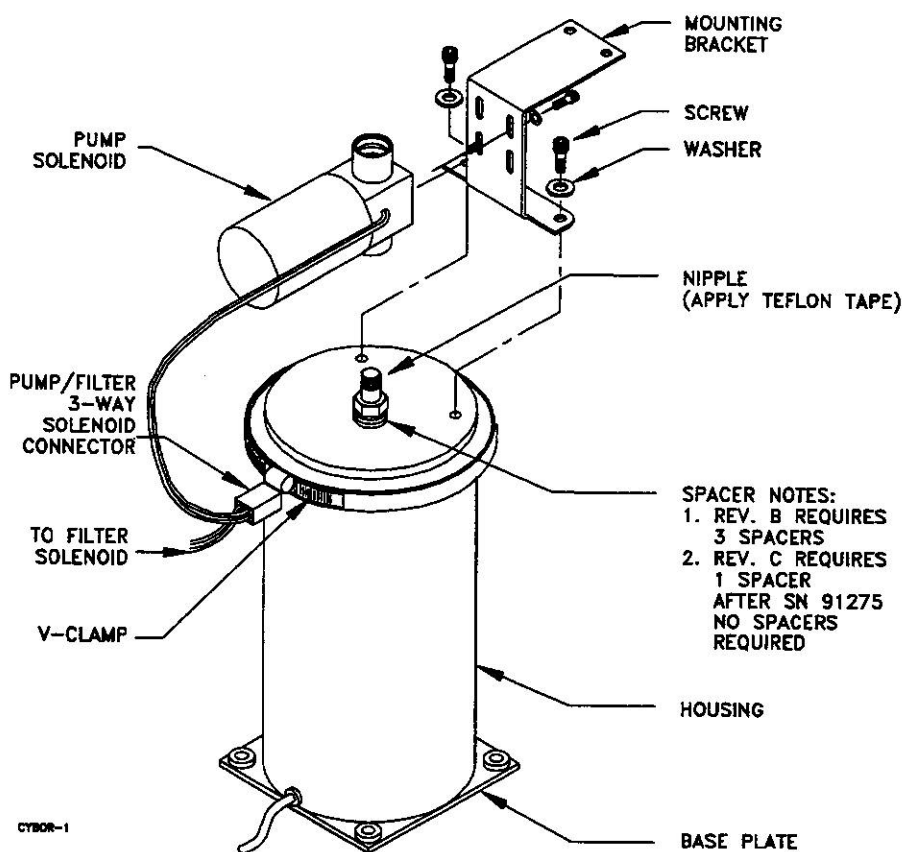


Figure 4-7. Pump 3-Way Solenoid Valve Removal and Replacement

CAUTION

Some pump configurations require spacers between the nipple and the top cap (see figure 4-7). If the nipple is replaced due to wear or damage, make certain any required spacers for the pump configuration are reinstalled. Failure to install spacers where required could cause damage to the diaphragm or erratic pump operation.

8. Connect 5/8-inch wrench to pump 3-way solenoid valve nipple. Using wrench to keep nipple from turning, install pump 3-way solenoid valve on nipple by turning pump 3-way solenoid valve clockwise onto nipple threads.
9. Secure pump 3-way solenoid valve to mounting bracket with two socket-head screws (figure 4-7). Do not tighten screws, allow screws to travel in mounting bracket slots.
10. Install mounting bracket on pump top cap and secure with two socket-head screws (figure 4-7).
11. Tighten two socket-head screws securing pump 3-way solenoid valve to mounting bracket.
12. Realign filter 3-way solenoid valve by rotating valve approximately 45 degrees CW.
13. Connect filter suckback line to tee fitting at pump 3-way solenoid valve N.C. port (figure 4-1).
14. Connect filter dispense line to tee fitting at pump 3-way solenoid valve N.C. port.

15. Remove plug from dispense line and connect dispense line to filter 3-way solenoid valve COM port.
 16. Remove plug from source line and connect source line to pump 3-way solenoid valve N.O. port.
 17. Install pump solenoid connector pins in pump/filter 3-way solenoid connector.
 18. Connect pump/filter 3-way solenoid connector to pump housing receptacle.
- e. Restore power.
- f. Purge system of air using dispense line purge, recipe no. 8 (refer to paragraph 3.3). Use air vent stopcock to purge air from filter housing if filter is used. Purge suckback line using recipe no. 7 (refer to paragraph 3.3).
- g. Set active recipe to volume recorded in step a.

4.4.2 Pump 3-Way Solenoid Valve Removal and Replacement (Without Model 510/511 Filter System Installed)

To remove and replace the pump 3-way solenoid valve (without a Model 510/511 Filter System installed), perform the following (figure 4-1):

- a. Record active recipe volume and suckback.
- b. Perform pump draining and cleaning procedure (refer to paragraph 4.2).
- c. Removal:
 1. Disconnect pump/filter 3-way solenoid connector from pump housing receptacle.
 2. Using Molex extractor tool, remove pump solenoid connector pins from pump/filter 3-way solenoid connector.
 3. Remove two screws and washers securing pump 3-way solenoid valve to mounting bracket (figure 4-7).
 4. Remove two screws and washers securing mounting bracket to pump.

Note

Some pump configurations require spacers between the nipple and the top cap. When removing the valve, do not unscrew the nipple or remove the spacers.

5. Connect 5/8-inch wrench to pump 3-way solenoid valve nipple. Using wrench to keep nipple from turning, turn pump 3-way solenoid valve CCW from nipple. Do not unscrew nipple or remove any spacers.
 6. If pump 3-way solenoid valve is not to be replaced immediately, cap nipple with 1/4-inch threaded cap or cover nipple opening to keep liquid from spilling out of upper pump cavity.
 7. Remove N.O. elbow fitting from N.O. port.
 8. Remove Teflon® elbow fitting from N.C. port.
- d. Replacement:
1. Remove threaded cap or covering from nipple.

2. Remove existing Teflon[®] tape from nipple threads.
3. Apply new Teflon[®] tape (three to four turns) to nipple threads.
4. Remove existing Teflon[®] tape from Teflon[®] elbow fitting threads.
5. Apply new Teflon[®] tape (three to four turns) to Teflon[®] elbow fitting threads.
6. Install Teflon[®] elbow fitting in pump 3-way solenoid valve N.O. port.
7. Install Teflon[®] elbow fitting in pump 3-way solenoid valve N.C. port.

CAUTION

Some pump configurations require spacers between the nipple and the top cap (see figure 4-7). If the nipple is replaced due to wear or damage, make certain any required spacers for the pump configuration are reinstalled. Failure to install spacers where required could cause damage to the diaphragm or erratic pump operation.

8. Connect 5/8-inch wrench to pump 3-way solenoid valve nipple. Using wrench to keep nipple from turning, install pump 3-way solenoid valve on nipple by turning pump 3-way solenoid valve CW onto nipple threads.
 9. Install pump solenoid connector pins in pump/filter 3-way solenoid connector.
 10. Connect pump/filter 3-way solenoid connector to pump housing receptacle
 11. Remove plug from dispense line and connect dispense line to pump 3-way solenoid valve N.C. port.
 12. Remove plug from source line and connect source line to pump 3-way solenoid valve N.O. port.
- e. Restore power.
- f. Purge system of air using dispense line purge, recipe no. 8 (refer to paragraph 3.3). Purge suckback line using recipe no. 7 (refer to paragraph 3.3).
- g. Set active recipe to volume recorded in step a.

4.4.3 Top Cap Assembly O-Ring Removal and Replacement

To remove and replace the top cap assembly O-ring, perform the following (figure 4-8):

- a. Record active recipe volume and suckback.
- b. Perform pump draining and cleaning procedure (refer to paragraph 4.2).
- c. Removal:
 1. Remove V-clamp securing cap assembly to pump body.
 2. Lift cap assembly from pump body.
 3. Remove O-ring from O-ring groove.
- d. Replacement:
 1. Using particle-free cleaning materials (Texwipe or equivalent), wipe residue from the pump cavity diaphragm and face seal.

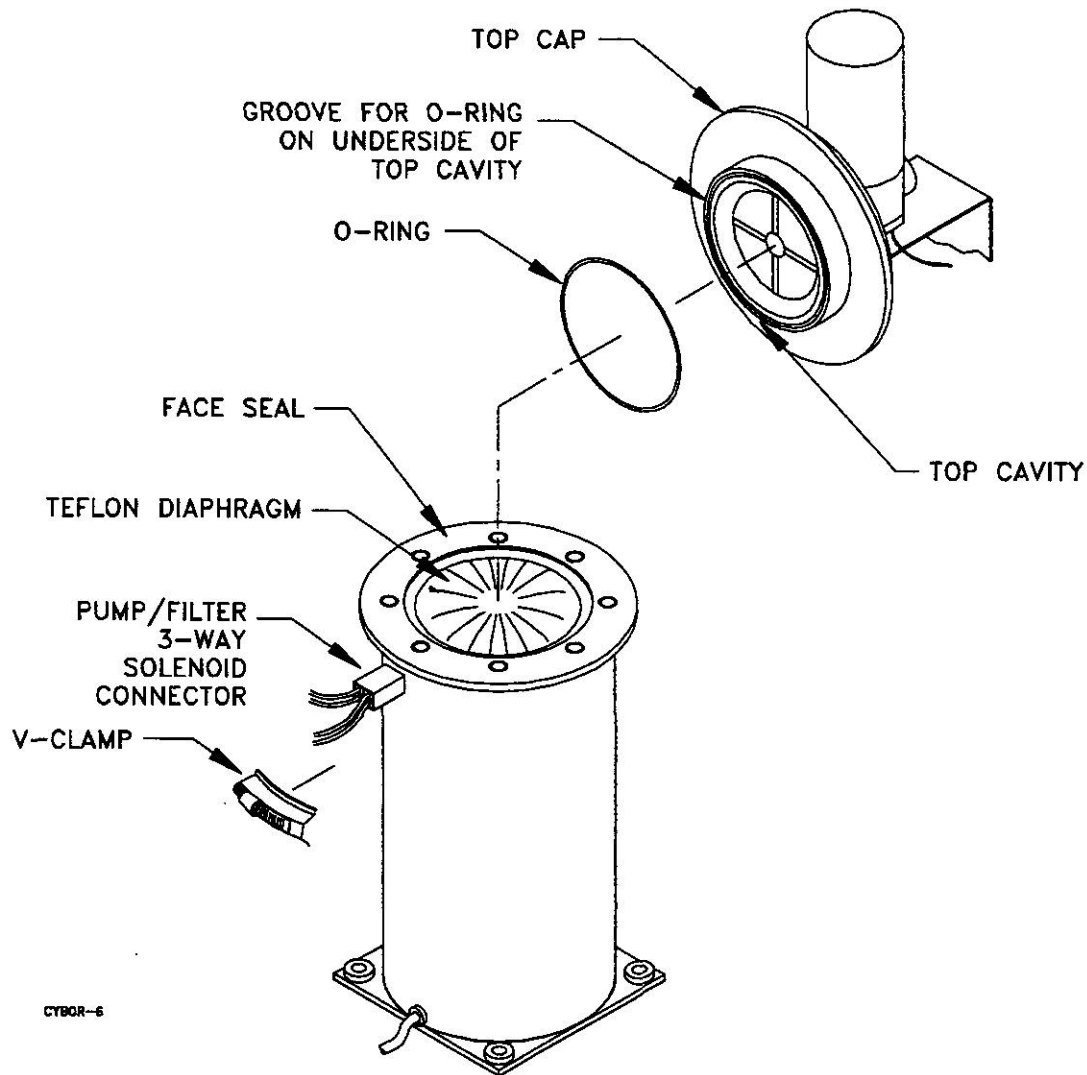


Figure 4-8. Top Cap Assembly O-Ring Removal and Replacement

2. Using particle-free cleaning materials, wipe residue from cap assembly face seal mating surface and O-ring groove.
3. Clean both surfaces with particle-free cleaning materials (Texwipe or equivalent) and appropriate solvent for material being pumped.

CAUTION

Before replacing an O-ring make certain the material for the O-ring is compatible with the application fluid (e.g., EPR O-ring for positive photoresist, Viton® O-ring for negative photoresist, Kalrez® O-ring for polyimide photoresist, etc.). Failure to use the proper O-ring material could cause O-ring breakdown, which in turn could cause fluid contamination and/or leakage.

4. Press new O-ring in top cap assembly O-ring groove.

5. Place top cap assembly on pump body. Make certain O-ring is properly seated.
6. Reinstall V-clamp. Tighten V-clamp until snug. Do not over tighten.
- e. Remove plug from source line and reconnect source line to pump 3-way solenoid valve N.O. port.
- f. Remove plug from dispense line and connect dispense line to filter 3-way solenoid valve COM port.
- g. Connect pump/filter 3-way solenoid connector to pump housing receptacle.
- h. Restore power.
- i. Purge system of air using dispense line purge, recipe no. 8 (refer to paragraph 3.3). Use air vent stopcock to purge air from filter housing if filter is used. Purge suckback line using recipe no. 7 (refer to paragraph 3.3).
- j. Set active recipe to volume recorded in step a.

4.4.4 PC Sensor Board Removal and Replacement

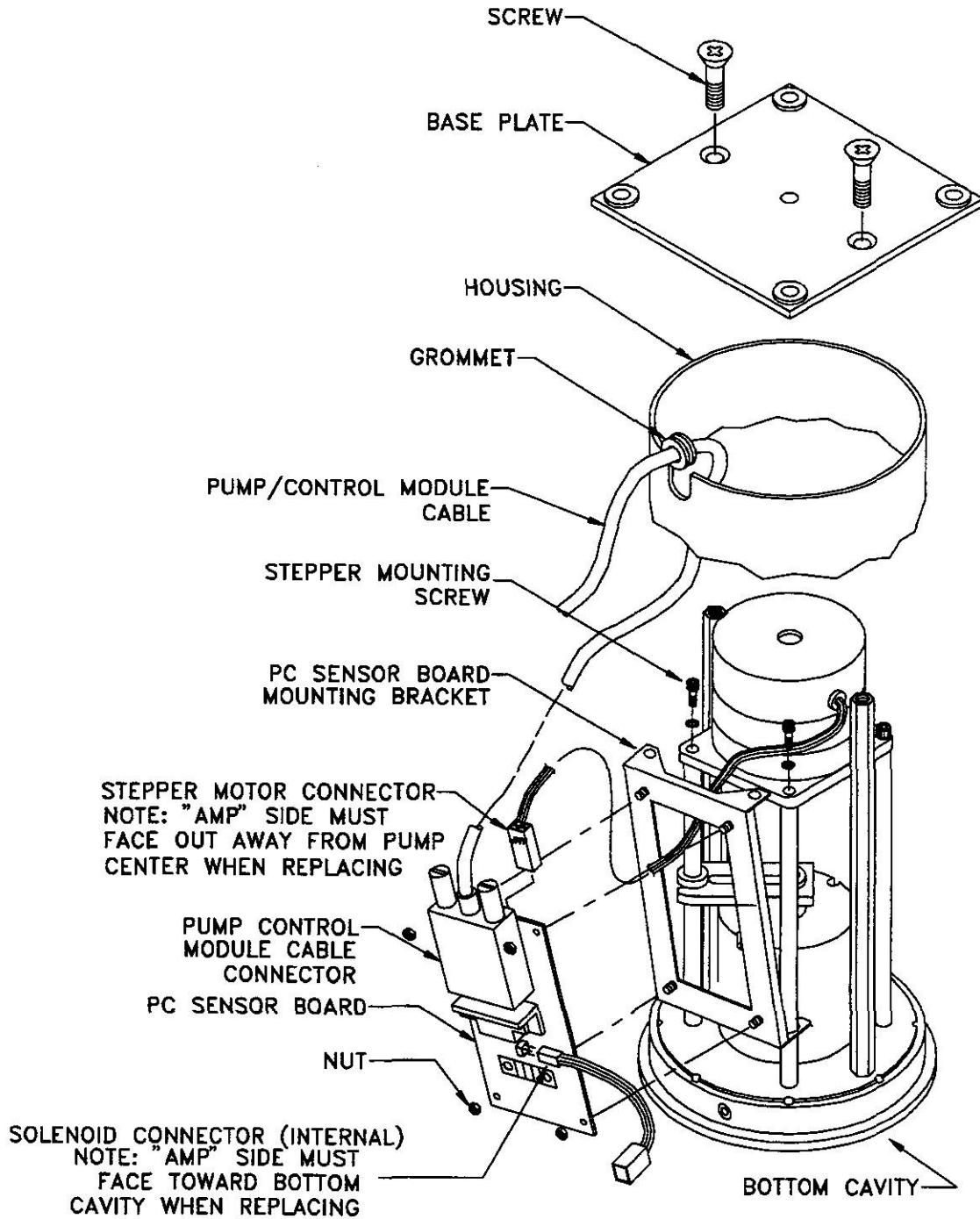
To remove and replace the PC sensor board, perform the following (figure 4-9):

- a. Record active recipe volume and suckback.
- b. Remove power by performing the following:
 1. Place POWER switch on front of Model 512 Power Supply to OFF position
 2. Remove applicable pump cable at rear of pump control module.
- c. Loosen nut of fluid source line at pump 3-way solenoid valve N.O. port. Remove and plug source line (figure 4-1). Cap pump 3-way solenoid valve N.O. port.
- d. Loosen nut of fluid dispense line at filter 3-way solenoid valve COM port. Remove and plug dispense line (figure 4-1). Cap filter 3-way solenoid valve COM port
- e. Removal:
 1. Disconnect pump/filter 3-way solenoid connector from pump housing receptacle.
 2. Remove four screws securing mounting plate and ground lug to baseplate.
 3. Lay pump on side on flat work surface.
 4. Remove baseplate from pump body by removing the two screws on the bottom of the baseplate.
 5. Carefully pull pump control module cable lead from grommet.
 6. Slide pump housing until the internal solenoid 4-pin AMP connector is accessible.

CAUTION

The 4-pin AMP connectors use locking-type pins. When disconnecting the 4-pin AMP connector, do not pull on the connector wires — pull on the connector housing or body.

7. Disconnect 4-pin AMP connector.
8. Remove pump housing from pump assembly.
9. Disconnect pump control module cable connector from PC sensor board.



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Figure 4-9. PC Sensor Board Removal and Replacement

10. Remove two capscrews and lockwashers securing PC sensor board mounting bracket to support rod.
11. Allow PC sensor board assembly to tilt away from pump body.

CAUTION

The 4-pin AMP connectors use locking-type pins. When disconnecting the 4-pin AMP connector, do not pull on the connector wires — pull on the connector housing or body.

12. Disconnect stepper motor connector from PC sensor board.
 13. Remove four nuts securing PC sensor board to mounting bracket and remove PC sensor board.
- f. Replacement:
1. Install new PC sensor board on mounting bracket.

CAUTION

When connecting stepper motor connector to PC sensor board, make certain the connector side marked AMP faces out, away from the pump center.

2. Connect stepper motor connector to PC sensor board.
 3. Tilt PC sensor board assembly back up into place.
 4. Secure PC sensor board to mounting bracket with four nuts.
 5. Reconnect pump control module cable connector to PC sensor board.
 6. Place pump housing over pump assembly.
 7. Center pump housing grommet connection over PC sensor board.
 8. Slide pump housing over pump until 4-pin AMP internal solenoid connector can be connected to PC sensor board. AMP side of connector must face pump bottom cavity.
 9. Slide pump housing over pump until housing grommet contacts bottom cavity.
 10. Install pump control module cable and grommet into housing grommet slot.
 11. Place baseplate on housing and align baseplate mounting holes with pump assembly mounting standoffs.
 12. Secure baseplate to pump body with two mounting screws.
 13. Connect pump/filter 3-way solenoid connector to pump housing receptacle.
 14. Install mounting plate and grounding lug connection to baseplate. Secure with four screws.
- g. Remove plug from source line and cap from pump 3-way solenoid valve N.O. port. Reconnect source line to pump 3-way solenoid valve N.O. port.
- h. Remove plug from dispense line and cap from filter 3-way solenoid valve COM port. Reconnect dispense line to filter 3-way solenoid valve COM port.

- i. Restore power.
- j. Purge system of air using dispense line purge, recipe no. 8 (refer to paragraph 3.3). Use air vent stopcock to purge air from filter housing if filter is used. Purge suckback line using recipe no. 7 (refer to paragraph 3.3).
- k. Set active recipe to volume recorded in step a.

4.4.5 Stepper Motor, Drive Screw, and Bearing Removal and Replacement

To remove and replace the stepper motor, drive screw, and bearing, perform the following (figure 4-10):

- a. Record active recipe volume and suckback.
- b. Perform pump draining and cleaning procedure (refer to paragraph 4.2).
- c. Stepper motor removal (figure 4-10):
 1. Disconnect pump/filter 3-way solenoid connector from pump housing receptacle.
 2. Remove four screws securing mounting plate and ground lug to baseplate.
 3. Remove V-clamp securing top cap assembly to pump body.
 4. Lift top cap assembly from pump body. Store top cap assembly in a clean area.

CAUTION

Use care not to set pump diaphragm on sharp objects that could puncture diaphragm.

5. Invert pump and set on flat, clean work surface.
6. Remove baseplate from pump body by removing two screws.
7. Carefully pull pump control module cable lead from grommet.
8. Slide pump housing until internal solenoid 4-pin AMP connector is accessible.

CAUTION

The 4-pin AMP connectors use locking type pins. When disconnecting the 4-pin AMP connector, do not pull on the connector wires — pull on the connector housing or body.

9. Disconnect 4-pin AMP connector.
10. Remove pump housing from pump assembly.
11. Remove four capscrews and lockwashers securing motor and PC sensor board mounting bracket to support rod.
12. Allow PC sensor board assembly to tilt away from pump body.

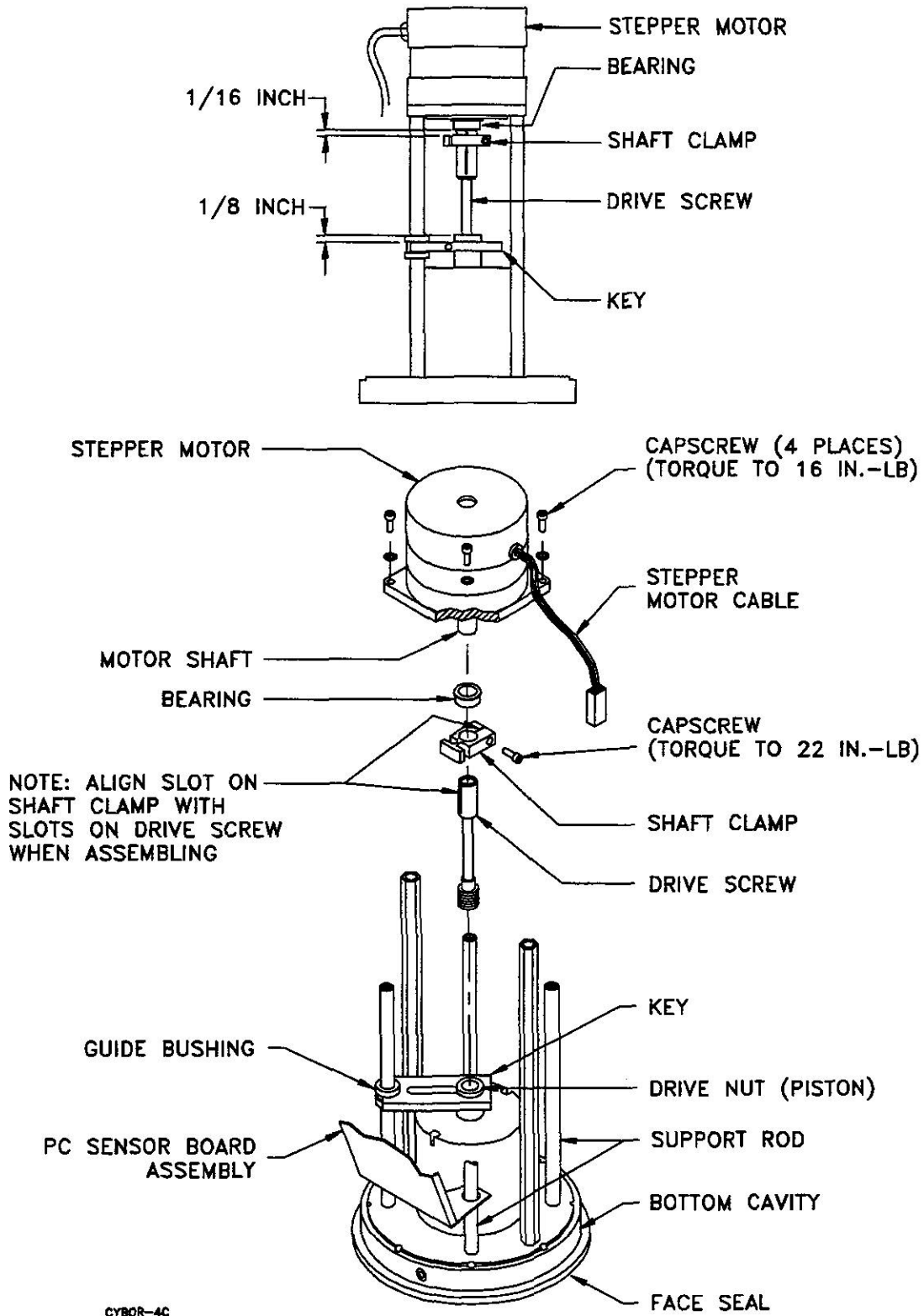


Figure 4-10. Stepper Motor, Drive Screw, and Bearing Removal and Replacement

CAUTION

The 4-pin AMP connectors use locking type pins. When disconnecting the 4-pin AMP connector, do not pull on the connector wires — pull on the connector housing or body.

13. Disconnect stepper motor connector from PC sensor board.
14. Loosen shaft clamp on motor shaft.
15. Lift motor and bearing off drive screw.
16. Remove bearing from motor shaft.
17. Remove shaft clamp from drive screw.

Note

If only the stepper motor is to be removed and replaced, proceed to step h. If drive screw is to be replaced, perform step f.

- f. Drive screw removal: unscrew drive screw from drive nut.
- g. Drive screw replacement (figure 4-10):
 1. Lubricate new drive screw threads with molydisulfide grease.
 2. Turn drive screw into drive nut until screw is fully threaded (nine or ten turns) into drive nut (piston).
- h. Stepper motor replacement (figure 4-10):
 1. Place bearing on new motor shaft with bearing flange side toward motor.
 2. Fully extend drive nut (piston rod).
 3. Place shaft clamp over drive screw.
 4. Place motor and bearing on drive screw. Position motor so that stepper motor cable is on the same side as PC sensor board assembly.
 5. Make certain slot in drive screw is aligned with slot in clamp. Realign if necessary.
 6. With drive nut (piston rod) fully extended and with motor and bearing resting against the end of the drive screw, position shaft clamp on drive nut leaving 1/16-inch gap between bearing housing and shaft clamp.
 7. Tighten shaft clamp. Torque clamp capscrew to 22 inch-pounds.
 8. Carefully push down on stepper motor, causing drive nut (piston rod) to retract, until motor seats on stepper motor support rods.

CAUTION

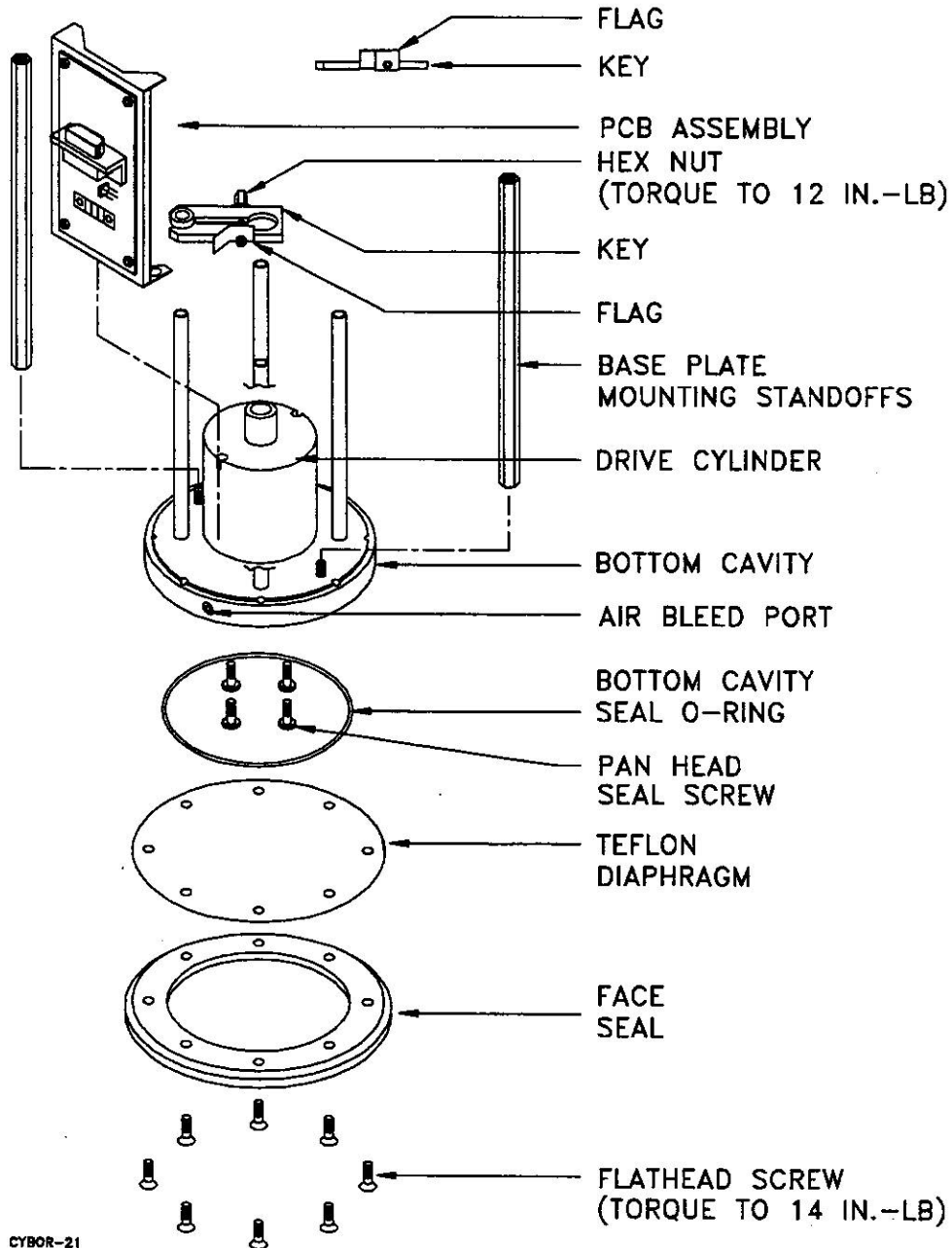
When connecting stepper motor connector to PC sensor board, make certain the connector side marked AMP faces out, away from the pump center.

9. Connect stepper motor connector to PC sensor board.
 10. Tilt PC sensor board assembly back up into place.
 11. Secure motor housing and PC sensor board mounting to support rods with four capscrews and lockwashers. Torque capscrews to 16 inch-pounds.
 12. Reconnect pump control module cable to PC sensor board.
 13. Place pump housing over pump assembly.
 14. Center pump housing grommet connection over PC sensor board.
 15. Slide pump housing over pump until 4-pin AMP internal solenoid connector can be connected to PC sensor board. AMP side of connector must face pump cavity.
 16. Slide pump housing over pump until housing grommet contacts bottom cavity.
 17. Install pump control module cable and grommet into housing grommet slot.
 18. Place baseplate on housing and align baseplate mounting holes with pump assembly mounting standoffs.
 19. Secure baseplate to pump body with two mounting screws.
 20. Connect pump/filter 3-way solenoid connector to pump housing receptacle.
 21. Install mounting plate and grounding lug connection to baseplate. Secure with four screws.
 22. Place top cap assembly on pump body. Make certain O-ring is properly seated.
 23. Reinstall V-clamp. Tighten V-clamp by hand until snug. Do not over tighten.
- i. Remove plug from source line and reconnect source line to pump 3-way solenoid valve N.O. port.
 - j. Remove plug from dispense line and connect dispense line to filter 3-way solenoid valve COM port.
 - k. Restore power.
 - l. Purge system of air using dispense line purge, recipe no. 8 (refer to paragraph 3.3). Use air vent stopcock to purge air from filter housing if filter is used. Purge suckback line using recipe no. 7 (refer to paragraph 3.3).
 - m. Set active recipe to volume recorded in step a.

4.4.6 Drive Cylinder O-Rings Removal and Replacement

To remove and replace the drive cylinder O-rings, proceed as follows (figure 4-11):

- a. Removal:
 1. Remove stepper motor and drive screw (refer to paragraph 4.3.5).
 2. Loosen hex nut on key and remove key flag and bushing assembly.



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Figure 4-11. Drive Cylinder O-Rings Removal and Replacement (Sheet 1 of 2)

3. Remove PC sensor board assembly.
4. Remove baseplate mounting standoffs.
5. Extend drive nut piston to fullest length (approximately 1-1/4 inches).
6. Turn pump right side up.
7. Remove eight flat-head screws securing diaphragm to face seal and remove face seal.

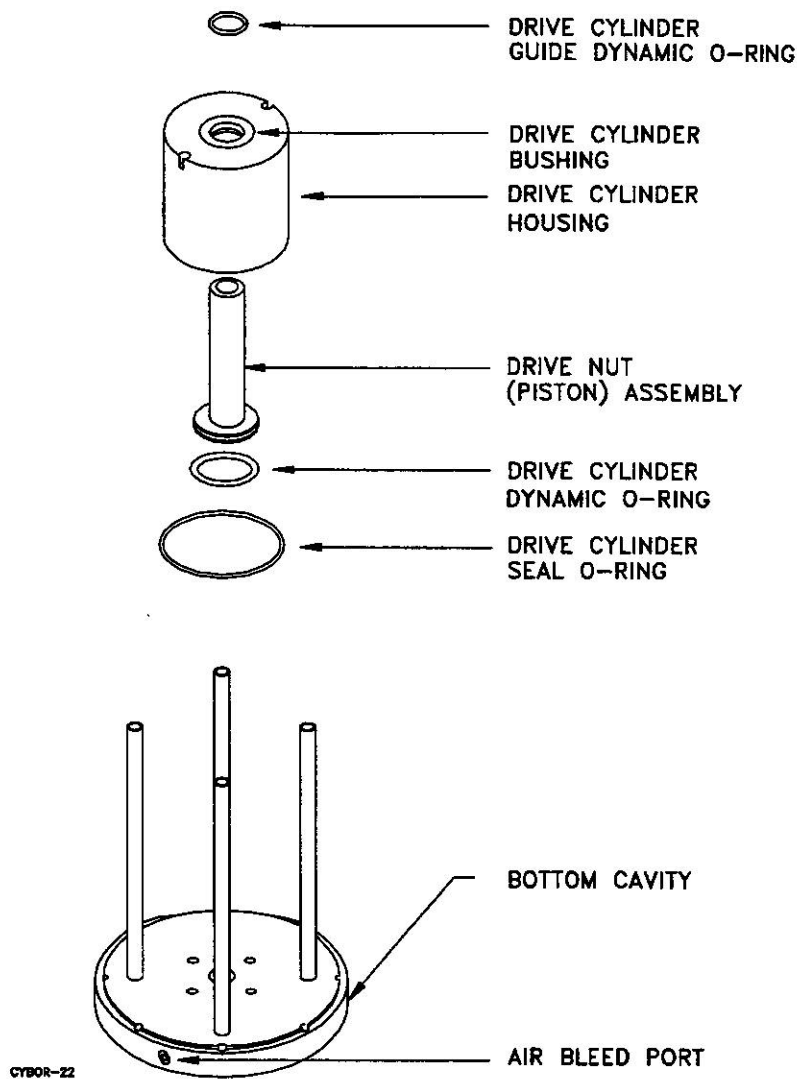


Figure 4-11. Drive Cylinder O-Rings Removal and Replacement (Sheet 2 of 2)

WARNING

The pump cavity drive fluid contains ethylene glycol, which is harmful or fatal if swallowed. If swallowed, induce vomiting immediately. Call a physician. When handling the pump cavity drive fluid, wear gloves and eye protection. Do not store in open or unlabeled containers.

8. Remove Teflon[®] diaphragm. Place diaphragm on particle-free cleaning material (Texwipe or equivalent) and store.
9. Empty pump cavity of drive fluid into appropriate container.
10. Remove bottom cavity seal O-ring.
11. Remove four pan-head seal screws securing drive cylinder to bottom cavity.
12. Remove drive cylinder seal O-ring located on top of drive cylinder.
13. Push drive nut (piston) up through top of drive cylinder housing.

14. Remove drive cylinder dynamic O-ring located on drive nut (piston).
 15. Remove drive cylinder guide dynamic O-ring located in drive cylinder bushing.
- b. Replacement:
1. Install new drive cylinder guide dynamic O-ring in drive cylinder bushing.
 2. Install new drive cylinder dynamic O-ring located on drive nut (piston).
 3. Push drive nut (piston) down through top of drive cylinder housing.
 4. Inspect drive cylinder seal O-ring for damage and replace if necessary. Install drive cylinder seal O-ring in O-ring groove on top of drive cylinder.
 5. Inspect pan-head seal screws for damage and replace if necessary. Secure drive cylinder to bottom cavity with four pan-head seal screws.
 6. Extend drive nut (piston) to fullest length (approximately 1-1/4 inches).
 7. Turn assembly right side up.
 8. Inspect bottom cavity seal O-ring for damage and replace if necessary. Install bottom cavity seal O-ring in O-ring groove in bottom cavity.

WARNING

The pump cavity drive fluid contains ethylene glycol, which is harmful or fatal if swallowed. If swallowed, induce vomiting immediately. Call a physician. When handling the pump cavity drive fluid, wear gloves and eye protection. Do not store in open or unlabeled containers.

9. Fill pump cavity with drive fluid from service kit.
10. Install Teflon[®] diaphragm on face seal.
11. Inspect Teflon[®] diaphragm for damage, nicks, scratches, and excessive deformation. Replace if necessary. Secure face seal and diaphragm to bottom cavity with eight flat-head screws. Torque flat-head screws to 14 inch-pounds.
12. Loosen air vent hex-head screw on side of bottom cavity.

CAUTION

Use care when pushing the diaphragm to prevent deforming and/or excessively stretching the diaphragm.

13. Tilt pump to allow air to escape from pump cavity out of air vent port. Carefully push drive nut piston approximately 1/2 inch into cavity and gently press diaphragm with fingers to move air bubble towards air vent port. When air has been purged from cavity, tighten air vent port screw.
14. Invert pump assembly and reinstall PC sensor board assembly on support rods.
15. Reinstall baseplate mounting standoffs.

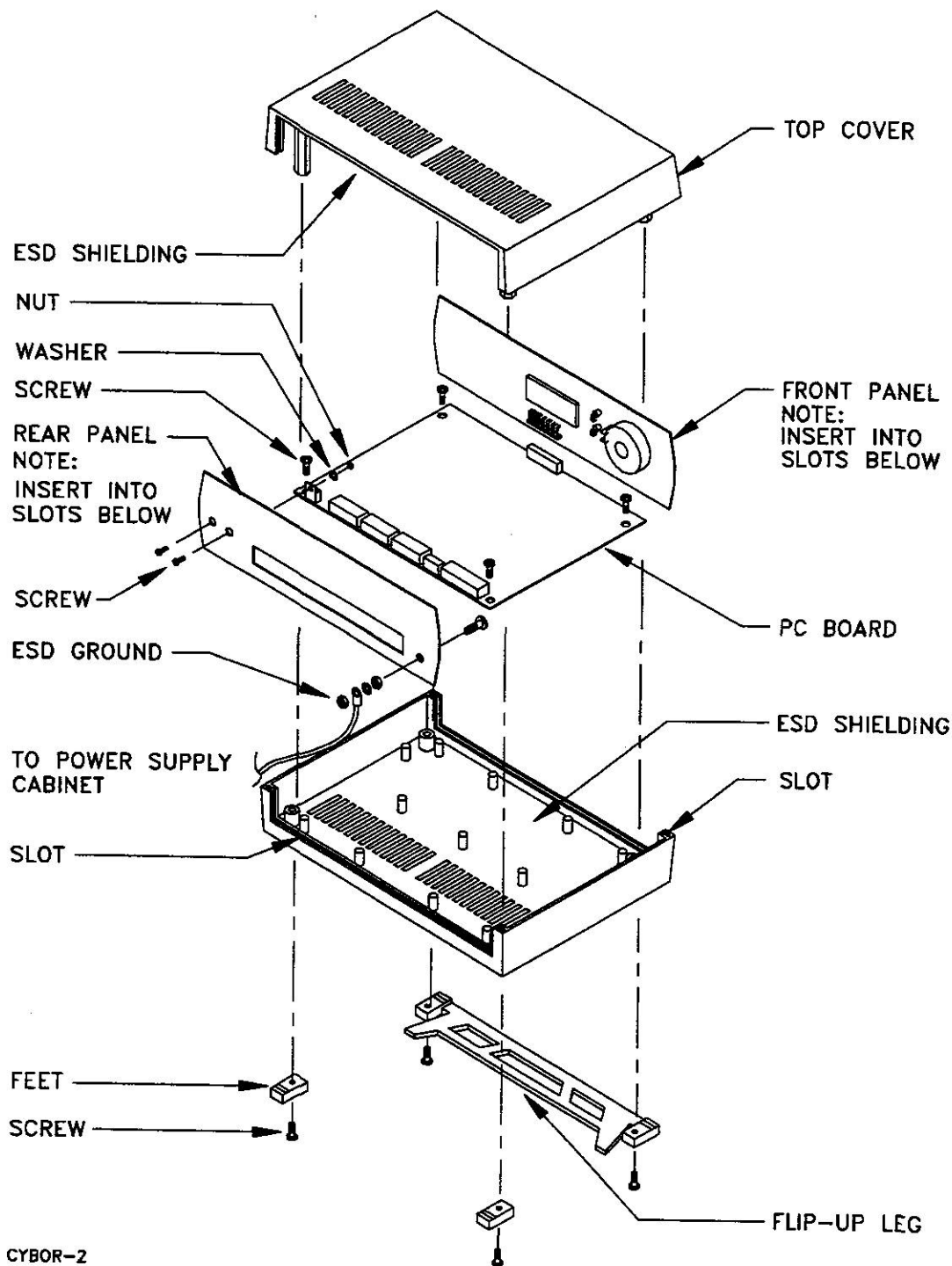
16. Reinstall key flag and bushing assembly. Adjust key to 1/8 inch above bottom of drive nut (piston). Tighten key flag hex-head screw. Torque hex-head screw to 12 inch-pounds.
17. Reinstall stepper motor and drive screw (refer to paragraph 4.3.5).

4.5 PUMP CONTROL MODULE MAINTENANCE

4.5.1 Pump Control Module PC Board Removal and Replacement

To remove and replace the pump control module PC board, perform the following (figure 4-12):

- a. Remove power by performing the following:
 1. Place POWER switch on front of Model 512 Power Supply to OFF position.
 2. Disconnect DC power connection to pump control module.
- b. Removal:
 1. Disconnect pump and auxiliary connectors.
 2. Remove ESD shield wire lug from rear panel.
 3. Invert pump control module and remove four screws, flip-up legs, and feet from bottom cover.
 4. Turn pump control module right side up and remove top cover.
 5. Lift front panel assembly out of bottom cover slot and disconnect from PC board.
 6. Remove four screws securing PC board to bottom cover.
 7. Remove screw, nut, and lockwasher securing rear panel to PC board.
 7. Carefully lift PC board out of bottom cover.
- b. Replacement:
 1. Install PC board in bottom cover.
 2. Make certain rear panel is seated in retaining slot. Secure rear panel to PC board with screw, lockwasher, and nut.
 3. Secure PC board to bottom cover with four screws.
 4. Align front panel assembly with panel retaining slot on bottom cover.
 5. Install front panel assembly in bottom cover and carefully connect front panel assembly to PC board connector. Make certain front panel assembly is seated in retaining slot and connected to PC board.
 6. Place top cover on pump control module. Align front and rear panels with top cover retaining slots.
 7. While holding top and bottom covers together, carefully invert pump control module.
 8. Install four screws, flip-up legs, and feet into bottom cover.
 9. Reconnect DC power connections to pump control module.
 10. Reconnect pump and auxiliary connectors.
 11. Reconnect ESD shield wire lug to rear panel.
 12. Place POWER switch on front of Model 512 Power Supply to ON position.



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Figure 4-12. Pump Control Module PC Board Removal and Replacement

4.5.2 Pump Control Module Program Upgrading

Upgrading of the pump control module program is accomplished by changing the EPROM chip on the pump control module PC board. To remove and replace the PC board EPROM chip, perform the following (figure 4-13):

CAUTION

The EPROM and RAM chips can be damaged by electrostatic discharge. If possible, perform this procedure at a static safeguarded workstation. Do not remove the replacement EPROM from the anti-static packaging until directed.

a. Removal:

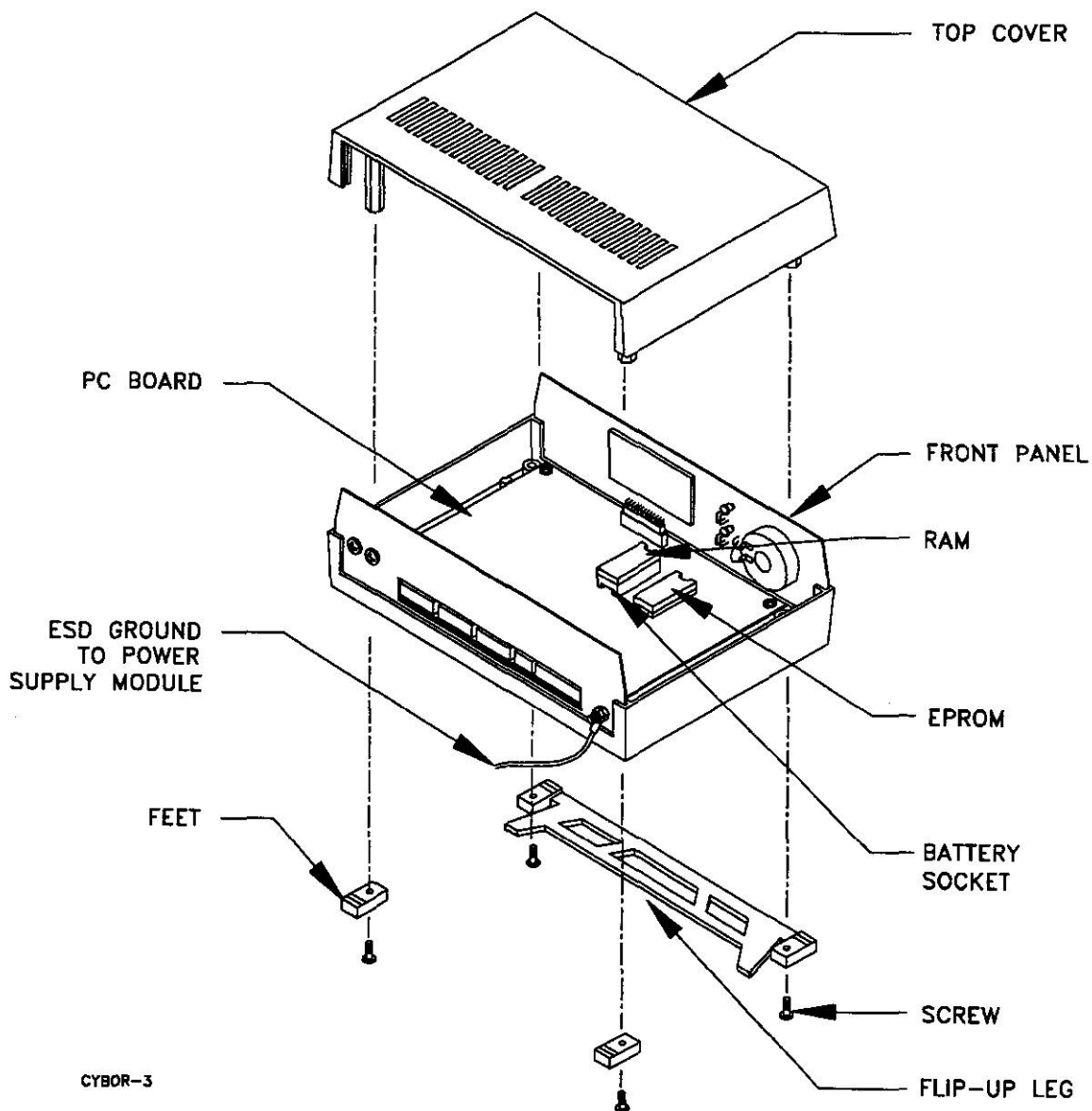
1. Record all pump control module information, including all active recipe settings, track type configuration, and pump configuration.
2. Place POWER switch on front of Model 512 Power Supply to OFF position
3. Disconnect DC power connection to pump control module.
4. Disconnect pump and auxiliary connectors.
5. Invert pump control module and remove four screws, flip-up legs, and feet from bottom cover.
6. Turn pump control module right side up and remove top cover.
7. Using chip removal tool, remove EPROM chip from PC board socket.

b. Replacement:

CAUTION

The EPROM and RAM chips can be damaged by electrostatic discharge. Make certain to remove static electricity from your hands before installing the replacement EPROM chip and handling the RAM chip.

1. Remove replacement EPROM chip from anti-static package.
2. Orient EPROM chip so that notch faces same direction as notch on socket.
3. Make certain EPROM pins line up with corresponding holes in EPROM socket. If pins do not line up, perform the following (figure 4-14A):
 - a. Place EPROM on its side.
 - b. Gently apply pressure on EPROM top edge (not pins) until pins become aligned.
 - c. Turn EPROM on the other side.
 - d. Gently apply pressure on EPROM top edge (not pins) until pins become aligned.
4. Carefully insert one side of EPROM pins halfway into EPROM socket holes (figure 4-14B).
5. Insert opposite side of EPROM pins halfway into EPROM socket holes (figure 4-14C).



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Figure 4-13. EPROM and RAM Chip Removal and Replacement

6. Verify EPROM pins are properly inserted into socket holes. Make certain no pins are bent from misalignment. If bent pins are found (figure 4-14D), remove EPROM from socket, carefully straighten pins, and repeat steps b.4, b.5, and b.6.
7. With EPROM pins fully aligned in socket, gently apply pressure until EPROM is fully seated in socket (figure 4-14E).

CAUTION

EPROM chip is installed in a battery socket. Take care to remove only the EPROM chip. To avoid damage to the EPROM chip and the battery socket, do not disconnect the battery socket from the PC board.

8. Using chip removal tool, carefully remove RAM chip from PC board RAM chip socket.

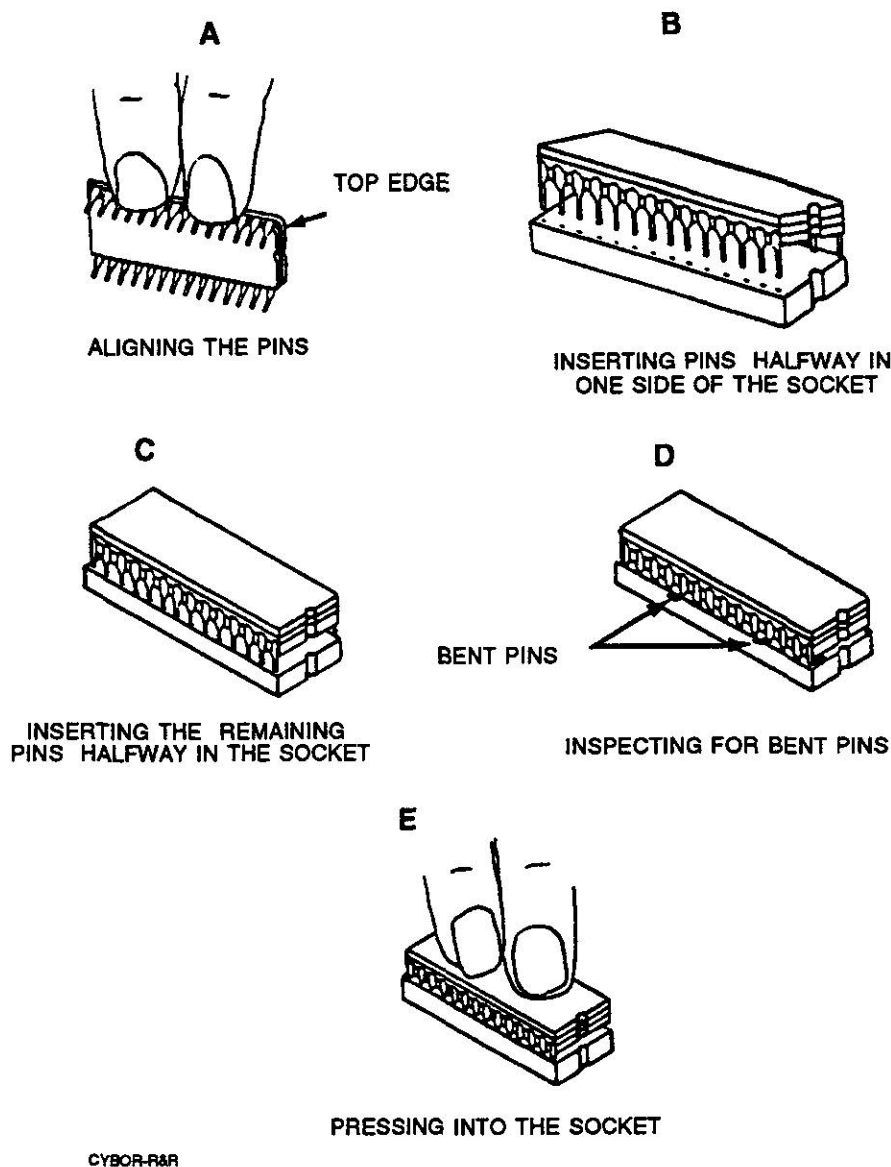


Figure 4-14. EPROM Installation

9. Collapse RAM memory by carefully inserting RAM chip in conductive foam supplied with upgrade kit.
10. Remove RAM chip from conductive foam and carefully install RAM chip in RAM chip socket.
11. Place top cover on pump control module. Align front and rear panels with top cover retaining slots.
12. While holding top and bottom covers together, carefully invert pump control module.
13. Install four screws, flip-up legs, and feet into bottom cover.
14. Reconnect DC power connections to pump control module.
15. Reconnect pump and auxiliary connectors.
16. Place POWER switch on front of Model 512 Power Supply to ON position.
17. Reconfigure track type, pumps, and rates to configurations and values recorded in step a. Set active recipe to volume and suckback recorded in step a.

4.6 TROUBLESHOOTING

Table 4-1 describes typical pump problems and related symptoms. Table 4-2 describes typical pump control module problems and related symptoms. Table 4-3 describes each symptom's probable cause and the recommended corrective action.

Table 4-1. Pump Problems and Related Symptoms

Pump Problem	Related Symptom
Leak in dispense line, or suckback line, or at pump	<ul style="list-style-type: none"> • Air bubble in fluid line • Air bubbles in suckback line
Filter clogged	<ul style="list-style-type: none"> • Pump motor stalls during dispense stroke
Air trapped in suckback line — leaky filter 3-way solenoid valve	<ul style="list-style-type: none"> • Fluid dripping or moving slowly toward dispense nozzle
Leaky suckback checkvalve	<ul style="list-style-type: none"> • Fluid moves up/back down dispense nozzle during idle
Drive screw clamp not tight (bearing not held captive between drive screw and stepper motor)	<ul style="list-style-type: none"> • Suckback and dispense inconsistent • Excessive suckback volume required in controller (suckback volume > 0.4 ml)
Pump 3-way solenoid valve nipple extends below slits in pump Teflon® top cavity	<ul style="list-style-type: none"> • Pump does not initialize/stepper motor stalls during initialization
Air bubble (3/8-inch-diameter or larger) on hydraulic side of pump	<ul style="list-style-type: none"> • Suckback volume control too large (suckback volume > 0.4 ml) • Suckback and dispense inconsistent
Worn or damaged drive cylinder drive O-ring	<ul style="list-style-type: none"> • Glycol leaking from pump drive cylinder
3-way solenoid valve not operational	<ul style="list-style-type: none"> • System does not dispense
Excessive wear on pump cylinder drive O-ring (worn or damaged)	<ul style="list-style-type: none"> • Reload rate too high

Table 4-2. Pump Control Module Problems and Related Symptoms

Pump Control Module Problem	Related Symptom
Dispense rate too high	<ul style="list-style-type: none"> • Pump motor stalls during dispense stroke
Reload rate too high	<ul style="list-style-type: none"> • Pump motor stalls during reload • Alm Disp-1 (dispense alarm no. 1) • Air bubble (3/8-inch-diameter or larger) on backside/hydraulic drive side of Teflon® diaphragm
Suckback rate too high	<ul style="list-style-type: none"> • Pump motor stalls during suckback • Excessive fluid displacement in nozzle at suckback time
Initialization cycle not complete	<ul style="list-style-type: none"> • Alm Init (initialization alarm) • Pump will not initialize
Dispense cycle not complete	<ul style="list-style-type: none"> • Alm Disp-2 (dispense alarm no. 2)
Filter needs changing	<ul style="list-style-type: none"> • Alm Fltr (filter alarm)
Battery backed up RAM corrupted	<ul style="list-style-type: none"> • Erratic and/or meaningless characters displayed on LCD display
Failed solenoid driver	<ul style="list-style-type: none"> • Pump or filter 3-way solenoid valve not activating during dispense cycles

Table 4-3. Symptom Probable Cause and Corrective Action

Symptom	Probable Cause	Corrective Action
Air bubble in fluid line	<ul style="list-style-type: none"> Loose fittings Leaking components High reload rate creating negative pressure Chemical outgassing 	<ul style="list-style-type: none"> Check and tighten all screws, fittings, and connectors Replace/tighten leaking components Decrease reload rate especially in higher elevation areas Replace Teflon[®] tape Reduce reload rate Use fresh chemical/fluid Contact chemical supplier
Pump stalls during dispense stroke	<ul style="list-style-type: none"> Incorrect maximum dispense rates related to viscosity of fluid Improper installation of component or blockage in lines Pump nozzle extending too far into pump top cavity (missing spacers) 	<ul style="list-style-type: none"> Adjust maximum dispense rate. Refer to table 2-1 for maximum rates related to dispense fluid viscosity and tubing size Remove blockage Add spacers — back out nipple
Fluid dripping or moving slowly towards dispense nozzle	<ul style="list-style-type: none"> Air trapped in suckback line 	<ul style="list-style-type: none"> Purge suckback line (refer to table 3-3 for recipe) — vent air using vent stopcock as required
Fluid moves up/back down dispense nozzle during idle	<ul style="list-style-type: none"> Leaky suckback checkvalve 	<ul style="list-style-type: none"> Replace suckback checkvalve <p>Note: Only change if not holding position for less than 5 to 10 minutes because all valves have some leakage</p> <p>Suckback volume may be different for new valve — change recipe suckback volume as required</p>
Suckback and dispense inconsistent	<ul style="list-style-type: none"> Air in system Leak in plumbing Incorrect assembly of hex nipple between pump and solenoid Checkvalve stuck/air in suckback checkvalve Drive screw clamp not tight (separation between drive screw clamp and bearing) 	<ul style="list-style-type: none"> Purge suckback line — vent air using vent stopcock as required (refer to table 3-3 for recipe) Purge dispense line — vent air using vent stopcock (refer to table 3-3 for recipe) Make certain a minimum of 3-1/2 turns of tape have been applied to threaded fittings Correct assembly of nipple requires 0.12 in. between hex and top plate of pump Purge suckback checkvalve with maximum volume and rate Properly align and tighten drive screw (refer to paragraph 3.4.5)
Excessive suckback volume required in controller (suckback > 0.4 ml)	<ul style="list-style-type: none"> Air bubble (3/8-inch-diameter or larger) on hydraulic side of pump diaphragm Drive screw clamp not tight (bearing not held captive between drive screw and stepper motor) 	<ul style="list-style-type: none"> Check by removing pump V-clamp Bleed air using air bleed port (see figure 4-11), if required <p>Note: Pump V-clamp must be removed to bleed air</p> <ul style="list-style-type: none"> Adjust and tighten clamp (see figure 4-10)
Pump does not initialize/stepper motor stalls during initialization	<ul style="list-style-type: none"> Pump 3-way solenoid valve nipple extends below slits in pump top cavity 	<ul style="list-style-type: none"> Add appropriate spacers between nipple and pump top cap (see figure 4-7)

Table 4-3. Symptom Probable Cause and Corrective Action (Continued)

Symptom	Probable Cause	Corrective Action
Glycol leaking from pump drive cylinder	<ul style="list-style-type: none"> • Dispense rate too high • Excessive wear on pump cylinder drive O-ring (worn or damaged) 	<ul style="list-style-type: none"> • Reduce rate (refer to table 1-2) • Replace drive O-ring (refer to paragraph 4.3.6)
System does not dispense	<ul style="list-style-type: none"> • Pump not operational or improperly set • Pump or filter 3-way solenoid valve not operational • No dispense signal from track • Cables/connectors not connected properly to pump control module sensor board 	<ul style="list-style-type: none"> • Refer to paragraph 3.2.3, Configure Mode, for proper settings • Check cables and connectors • Check pump cable (see figure 1-1) • Check solenoid connections (see figures 4-7 and 4-9) • Replace pump control module • Refer to paragraph 2.5.3 • Check cables and connectors (see figures 4-7 and 4-9)
Alm Init (initialization alarm)	<ul style="list-style-type: none"> • Pump not connected • Pump will not initialize 	<ul style="list-style-type: none"> • Check pump connections • Perform the following: <ul style="list-style-type: none"> a. Disconnect pump that will not initialize from pump control module b. Reprogram reload rate c. Reconnect pump to pump control module d. Reinitialize pump
Alm Fitr (filter alarm)	<ul style="list-style-type: none"> • Filter needs to be replaced 	<ul style="list-style-type: none"> • Replace filter
Alm Disp-1 (dispense alarm no. 1)	<ul style="list-style-type: none"> • Dispense rate too high • Filter clogged 	<ul style="list-style-type: none"> • Reduce dispense rate • Replace filter
Alm Disp-2 (dispense alarm no. 2)	<ul style="list-style-type: none"> • Reload rate too high 	<ul style="list-style-type: none"> • Reduce reload rate
Erratic and/or meaningless characters displayed on LCD display	<ul style="list-style-type: none"> • Battery backed up RAM corrupted 	<ul style="list-style-type: none"> • Perform the following: <ul style="list-style-type: none"> a. Set password to 999 b. Select display alarm c. Press 9 d. Follow prompts on LCD display for cold start
Pump or filter 3-way solenoid valve not activating during dispense cycles	<ul style="list-style-type: none"> • Failed solenoid driver 	<ul style="list-style-type: none"> • Replace pump control module

**SECTION 5
RECOMMENDED SPARE PARTS AND ACCESSORIES LIST**

Table 5-1. Recommended Spare Modules

Unit	Number in Service	Recommended Spares
Model 5016 Pump	10	1
Model 503 Pump Control Module	10	1
Model 504 Pump Control Module	10	1
Model 506 Pump Control Module	10	1
Model 512 Power Supply	10	1

*Table 5-2. Recommended Spare Parts List
for CYBORPUMP™ Model 5116*

Item No.	Description	Part No.
1	Check valve 1/4 FNPT to 1/4 tube (Pump Rev C)	888-00011
2	Drive screw	59084-01
3	Pump PCB assembly (Pump Rev C)	35040-01
4	Stepper motor assembly	25035-02
5	Cylinder	790-00003
6	Shaft clamp	670-00003
7	Bearing	608-00002
8	Teflon® solenoid assembly MACE: COM-NO-NC (Pump Rev C)	25040-01
9	Service kit	See tables 5-3 through 5-6

See attached drawing, CYBOR 5116PRTS for above spare components and other options. See attached parts list for options.

*Table 5-3. CYBORPUMP™ Model 5116/Filter System,
EPR, Assembly 21002-01 Service Kit*

Item No.	Description	Part No.	Qty
1	Ethylene glycol (25 ml)	20020-25	3
2	Teflon® diaphragm (10 mils thick)	59081-16	1
3	Moly lube	20025-01	3
4	Seal headscrews	680-18082	4
5	O-ring (cylinder piston guide)	782-12014	3
6	O-ring (cylinder seal)	782-12027	1
7	O-ring (bottom cavity seal)	782-12042	1
8	O-ring (cylinder drive)	782-12119	3
9	PR O-ring (positive PR) (filter)	782-22038	3
10	PR O-ring (positive PR) (pump)	782-22039	3

*Table 5-4. CYBORPUMP™ Model 5116/Filter System,
Kalrez (2 each), Assembly 21002-02 Service Kit*

Item No.	Description	Part No.	Qty
1	Ethylene glycol (25 ml)	20020-25	2
2	Teflon® diaphragm (10 mils thick)	59081-16	1
3	Moly lube	20025-01	2
4	Seal headscrews	680-18082	4
5	O-ring (cylinder piston guide)	782-12014	2
6	O-ring (cylinder seal)	782-12027	1
7	O-ring (bottom cavity seal)	782-12042	1
8	O-ring (cylinder drive)	782-12119	2
9	Kal O-ring (poly PR) (filter)	782-52038	2
10	Kal O-ring (poly PR) (pump)	782-52039	2

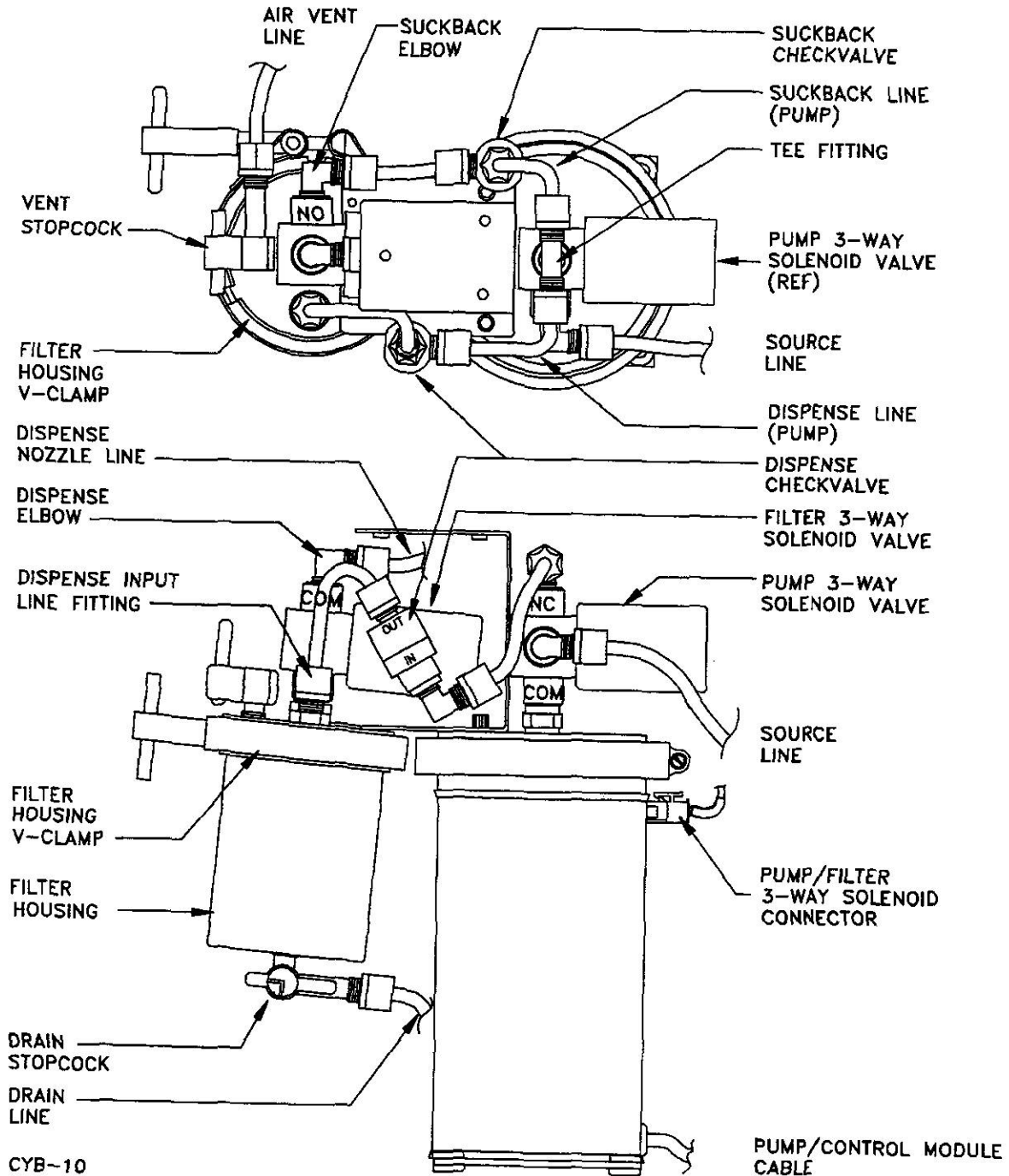
*Table 5-5. CYBORPUMP™ Model 5116/Filter System,
Kalrez (3 each), Assembly 21002-03 Service Kit*

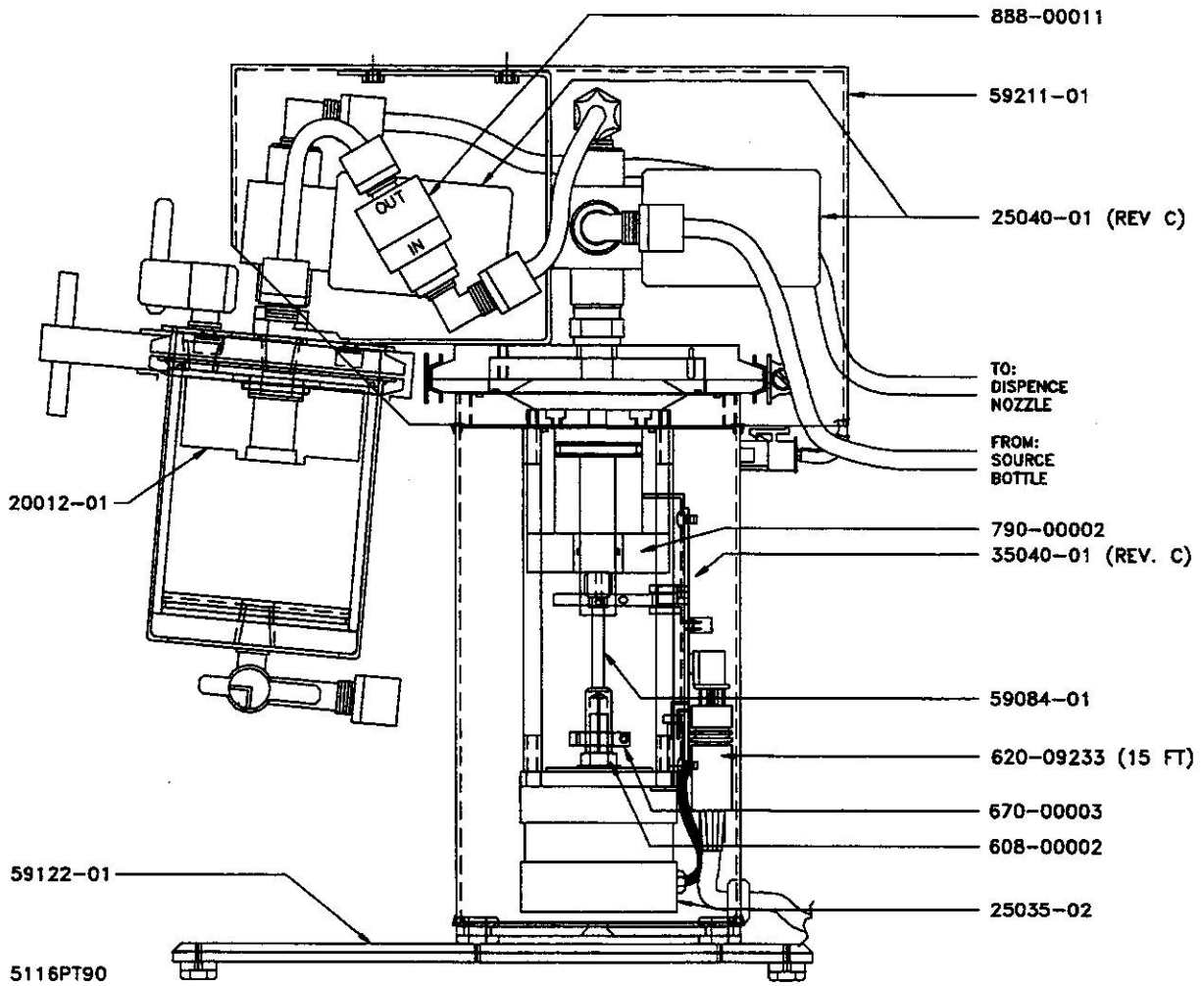
Item No.	Description	Part No.	Qty
1	Ethylene glycol (25 ml)	20020-25	3
2	Teflon® diaphragm (10 mils thick)	59081-16	1
3	Moly lube	20025-01	3
4	Seal headscrews	680-18082	4
5	O-ring (cylinder piston guide)	782-12014	3
6	O-ring (cylinder seal)	782-12027	1
7	O-ring (bottom cavity seal)	782-12042	1
8	O-ring (cylinder drive)	782-12119	3
9	Kal O-ring (poly PR) (filter)	782-52038	3
10	Kal O-ring (poly PR) (pump)	782-52039	3

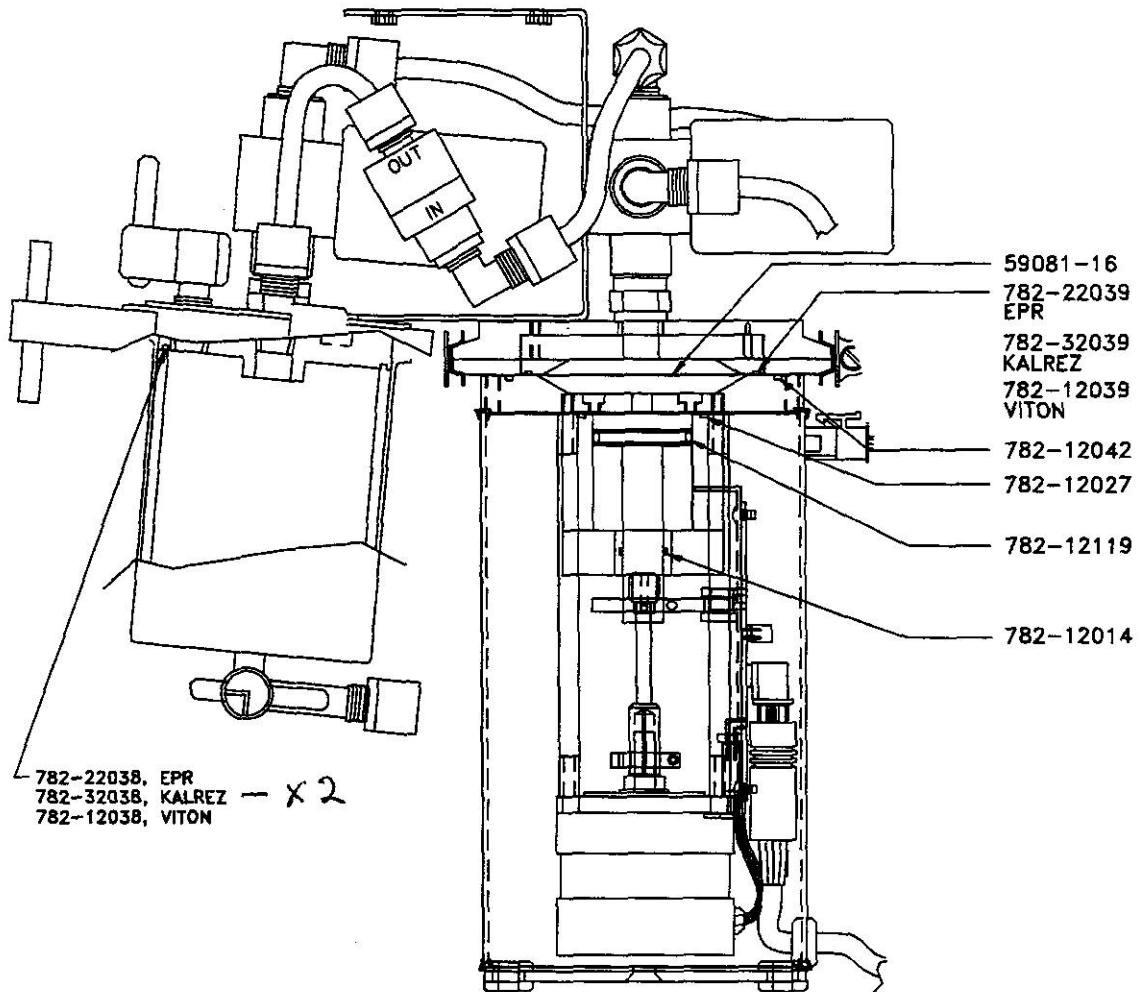
*Table 5-6. CYBORPUMPTM Model 5116/Filter System,
Viton, Assembly 21002-04 Service Kit*

Item No.	Description	Part No.	Qty
1	Ethylene glycol (25 ml)	20020-25	3
2	Teflon® diaphragm (10 mils thick)	59081-16	1
3	Moly lube	20025-01	3
4	Seal headscrews	680-18082	4
5	O-ring (cylinder piston guide)	782-12014	3
6	O-ring (cylinder seal)	782-12027	1
7	O-ring (bottom cavity seal)	782-12042	1
8	O-ring (cylinder drive)	782-12119	3
9	Vitron O-ring (negative PR)(filter)	782-12038	3
10	Vitron O-ring (negative PR) (pump)	782-12039	3

**SECTION 6
MISCELLANEOUS DRAWINGS**







SERVICE KIT - 21001-01
ENOUGH O'RINGS TO SERVICE PUMP 3 TIMES

- 1: 59081-16 = DIAPHRAGM, TEFLON 16ml
- 2: 20025-01 = MOLY LUBRICANT
- 3: 680-18082 = SEAL HEAD SCREW
- 4: 782-22039 = O-RING, EPR
- 782-32039 = O-RING, KALREZ
- 782-12039 = O-RING, VITON
- 5: 782-12042 = O-RING, VITON
- 6: 782-12027 = O-RING, VITON
- 7: 782-12119 = O-RING, VITON
- 8: 782-12014 = O-RING, VITON

SERVICE KIT - 21002-01
ENOUGH TO SERVICE PUMP & FILTER 3 TIMES

- 1: 59081-16 = DIAPHRAGM, TEFLON 16ml
- 2: 20025-01 = MOLY LUBRICANT
- 3: 680-18082 = SEAL HEAD SCREW
- 4: 782-22039 = O-RING, EPR
- 782-32039 = O-RING, KALREZ
- 5: 782-12042 = O-RING, VITON
- 6: 782-12027 = O-RING, VITON
- 7: 782-12119 = O-RING, VITON
- 8: 782-12014 = O-RING, VITON
- 9: 782-22038 = O-RING, EPR
- 782-32038 = O-RING, KALREZ
- 782-12038 = O-RING, VITON

5116SK90