Tekmar 3000

User Manual

Important Notice

This manual informs you that the heater in the MCS (Moisture Control System) can reach a temperature of 400°C. This information is incorrect; the maximum temperature for the MCS heater is 320°C. We apologize for this error.

The maximum temperature for the MCS heater is 320°C.

Tekmar 3000

User Manual

Tekmar

7143 East Kemper Road, Cincinnati, Ohio 45242-9576
(800) 543-4461 • Outside the U.S. (513) 247-7000 • Service (800) 874-2004
Telefax (513) 247-7050

Location: k:\techrite\manuals\3000
V.09.30.94

Essential Instructions

Please read this page before proceeding!

Tekmar designs, builds, and tests its products to meet many national and international standards. Because the Tekmar 3000 is a complex technical product, make sure that you correctly install, use and maintain it; if you do so, the 3000 will continue to operate within specifications. Always follow the safety precautions in this manual. Failure to follow the correct instructions may void the warranty.

- Read all instructions before installing, operating, and servicing the 3000. Follow all warnings, cautions, and instructions that are on the 3000 and in this manual. If you do not understand the instructions, call your Tekmar representative for assistance.
- Educate your personnel in the proper installation, operation and maintenance of the 3000.
- Only qualified persons should install, operate, update, program and maintain the 3000.
- Install the 3000 as specified in the installation sections of this manual and according to applicable local and national codes. Connect all products to the correct electrical and pressure sources.
- When you need replacement parts, make certain that qualified people use only Tekmar-supplied replacement parts. Unauthorized parts and procedures can affect the 3000's performance and jeopardize safety. Using look-alike substitutions may result in fire, electrical hazards, or incorrect operation.
- Keep all protective covers in place, except when qualified persons are performing maintenance, to prevent electrical shock and personal injury.

Section 3.0 Setting Up the 3000

Section 4.0 Understanding Operating Steps

Conventions in the Manual

In this manual, certain typefaces and symbols have specific meanings. Paragraphs containing important safety information are marked with the following symbols:

DANGER

This symbol alerts you to a situation where incorrect operation could cause serious personal injury and damage your equipment.

WARNING

This symbol points out a situation where incorrect operation could result in personal injury and equipment damage.

CAUTION

This symbol points out a situation where incorrect operation could damage your equipment or lead to an error.

Note:

This symbol points out important information.

Section 7.0 Scheduling and Running Samples

Section 8.0 Maintaining the 3000

Section 9.0 Using TURBOCool with the 3000

Section 10.0 Automatic Sample Heater

Read This First!

Section 1.0 Introduction

Section 2.0 Getting Started

Section 3.0 Setting Up the 3000

Section 4.0 Understanding Operating Steps

Section 5.0 Using the Controller Keypad and Screen

Section 6.0 Programming the 3000

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1.1 Overview

This section describes the Tekmar 3000 Purge and Trap Concentrator, defines its basic functions and system configurations, provides technical specifications, and outlines safety considerations for its use.

1.2 Product Description

The Tekmar™ 3000 (Figure 1-1) is a purge and trap concentrator that allows automatic processing of liquid and soil samples for analysis by gas chromatography. The concentrator operates and interfaces with the gas chromatograph (GC) under microprocessor control.

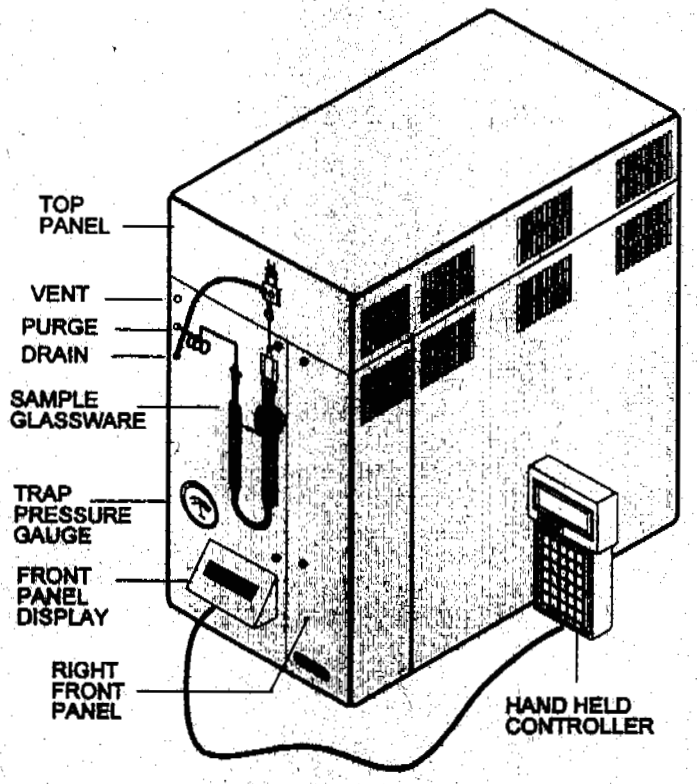


Figure 1-1 Tekmar 3000

The 3000 is equipped with:

- Sample glassware for processing single samples.
- A front panel trap pressure gauge that shows the current system pressure (in psi) for each mode.
- A front panel LCD screen that displays information about the concentrator's current operating step.
- ON/OFF switch on the back panel.
- A hand-held controller (purchased separately). The controller consists of a four-line, 20-character wide, LCD (liquid crystal display) and a 30-button keypad. You communicate with the 3000 microprocessor by using the keypad and display screen on the hand-held controller.

continued

1.2 Product Description, cont.

The 3000 can be set up in several different configurations, as described in Section 1.4 *System Configurations*. You can also program the 3000 to run different methods. Refer to Section 6.0 *Programming the 3000* for information about customizing methods.

1.3 Concentrator Functions

The 3000 purges volatile organic compounds from water or soil onto a sorbent trap. The trap is then rapidly heated; the analytes are swept with GC carrier gas onto the column for separation and detection, as shown in Figure 1-2.

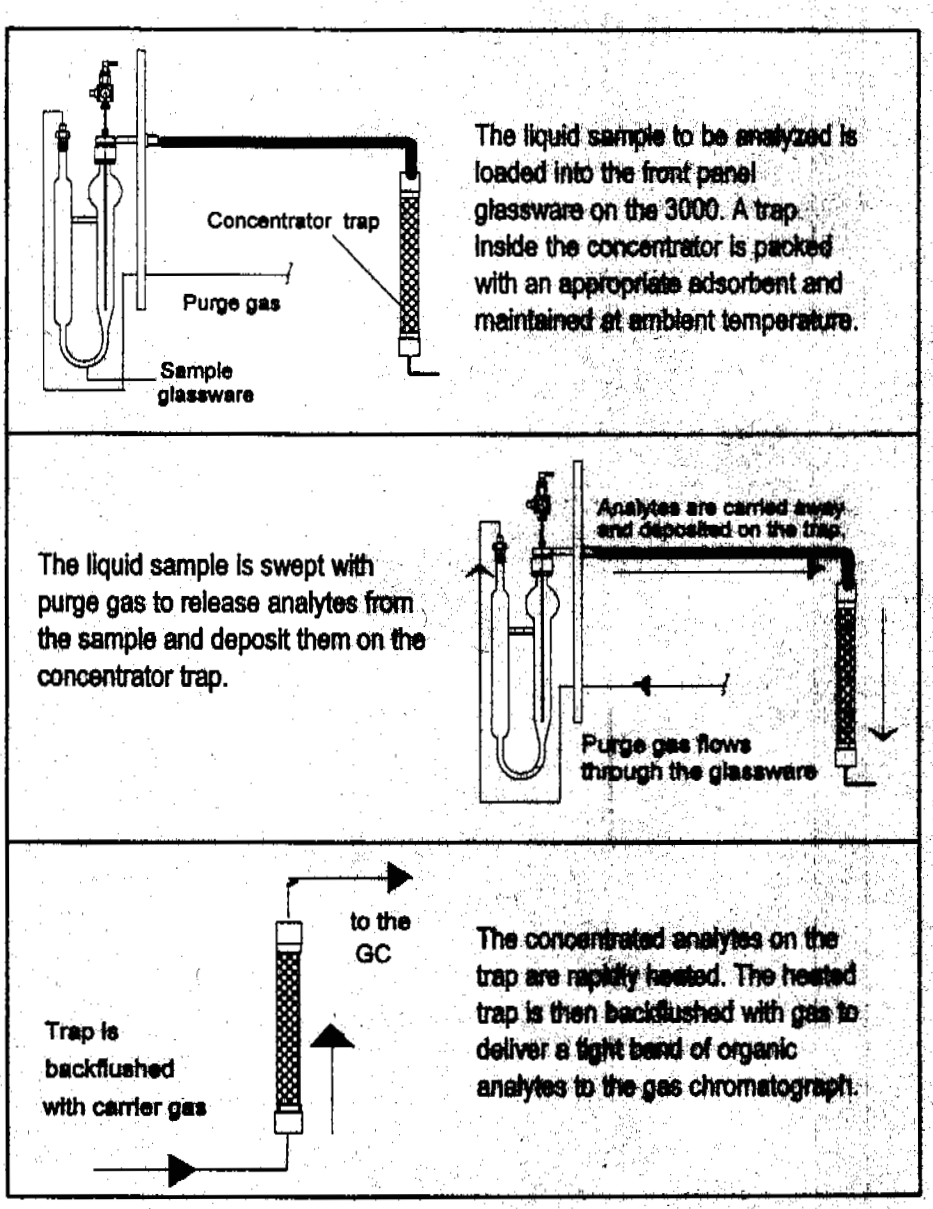


Figure 1-2 3000 Functions

1.4 System Configurations

The 3000 concentrator processes a single sample and delivers the resulting analytes to a gas chromatograph. You may also use the 3000 with other Tekmar accessories which can extend and enhance 3000 functions.

1.4.1 Tekmar 3000 with ALS Autosamplers

The ALS 2016 and 2032 autosamplers make it possible for the 3000 to process up to 32 liquid and soil samples automatically. Connected as shown in Figure 1-3, the 3000 can process up to 16 samples (with the ALS 2016) or up to 32 samples (with the ALS 2016 and 2032).

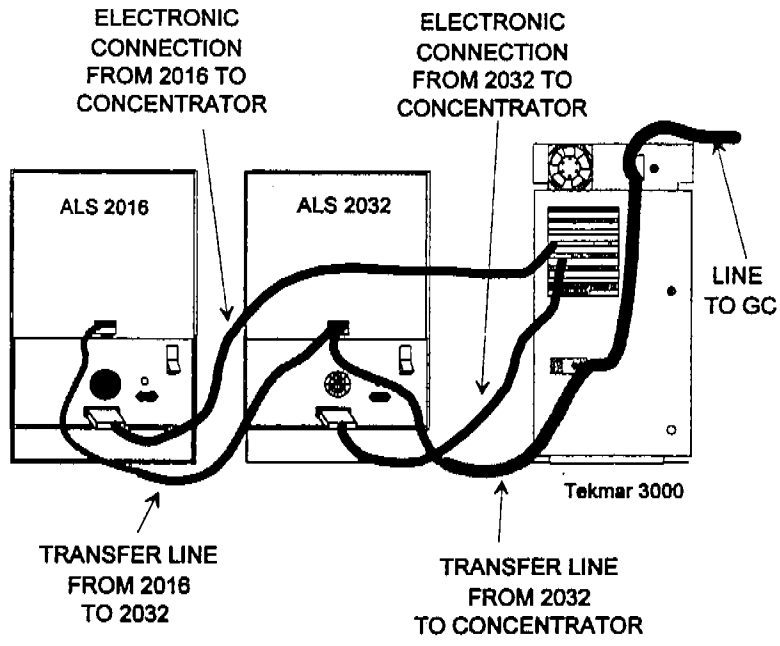


Figure 1-3 Tekmar 3000 with ALS Autosamplers

1.4.2 Tekmar 3000 with AQUATek 50 and 2016

The 3000 and the ALS 2016 autosampler work with the AQUATek 50 autosampler to process drinking and wastewater samples. The 3000 can process up to 15 samples on the 2016 and up to 50 samples on the AQUATek 50.

To connect the 3000 to the AQUATek 50, refer to Figure 1-4 on the next page and follow these steps:

- Turn off and unplug the 3000 and the AQUATek 50.
- Locate the cable (p/n 14-4352-086) in the AQUATek 50 assembly kit.
- Insert the cable's 9-pin connector into the receptacle labeled "Concentrator I/O" on the rear of the AQUATek 50.
- Remove the GC interface cable from the rear of the 3000 and plug the other end of the cable from the AQUATek 50 into the open port. Secure the cable with the two retaining screws.
- Piggyback the GC interface cable onto the connector that is now plugged into the GC I/O port on the back of the 3000. Tighten the retaining screws.

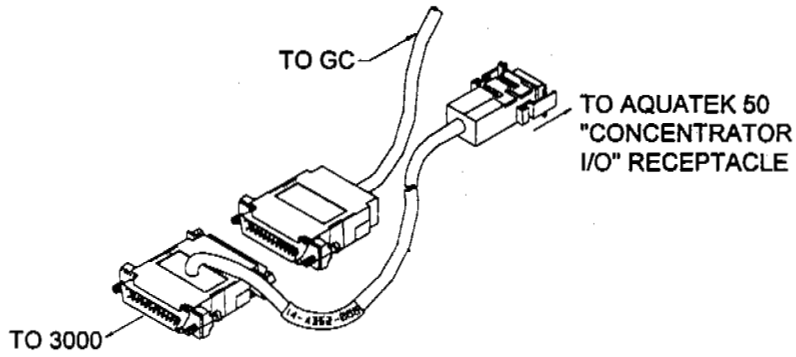


Figure 1-4 3000 and AQUATek 50 Connections

Note: If the ROM (read-only memory) version in your 3000 is prior to 2.13, the optional sample heater accessory will not work with AQUATek 50 methods. If have any problems getting the sample heater accessory to work, please call Tekmar Service.

1.4.3 Tekmar 3000 with AEROTrap Autosamplers

AEROTrap 6016/6032 autosamplers allow the 3000 to process up to 32 air samples automatically. Connected as shown in Figure 1-5, the 3000 can process up to 16 air samples (with the AEROTrap 6016) or up to 32 air and water samples (with the ALS 2016 and the AEROTrap 6032).

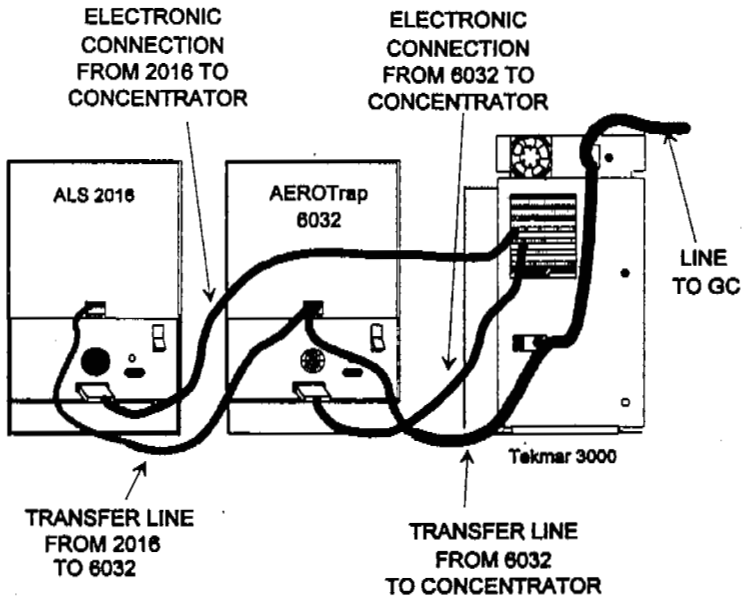


Figure 1-5 Tekmar 3000 with an AEROTrap and an ALS Autosampler

1.4.4 Tekmar 3000 with Cryofocusing Module

For enhanced sensitivity and chromatographic resolution when analyzing highly volatile compounds on a small bore capillary column, Tekmar recommends that you use the Cryofocusing Module with the 3000.

- Highly volatile components desorbed from the internal trap of the 3000 are refocused and condensed in the trapping area of the Cryofocusing

1.4.4 Tekmar 3000 with Cryofocusing Module, cont.

Module as carrier gas goes through the module to the GC.

- The Cryofocusing Module freezes the condensed components in a narrow, cryofocused band on the column.
- The Cryofocusing Module is flash heated and flushed with carrier gas to release the analytes on the GC column.

1.5 Specifications for the 3000

This section gives you specifications for the 3000. Please refer to the appropriate user guide for autosampler specifications.

Utility Requirements:

Voltage: 100/115/230 volts (+/- 10%)
Frequency: 50/60 hertz (+1%)
Current: 5.0/4.0 amps
Power: 550 watts
Btu per hour: 1877

Operating Environment:

The 3000 operates at temperatures between 19°C (66°F) to 60°C (140°F) with humidity levels between 10% and 90%.

Weight:

37 lbs. (16.7 kg.)

Dimensions:

Height: 19" (48.3 cm)
Width: 9" (22.9 cm)
Depth: 18" (45.7 cm) deep

Gas Supply Requirements:

Ultra-high purity (99.999%) helium or nitrogen as purge gas, supplied at 20 psig

Sample Glassware:

The standard sampler is a 5 ml frit sparger, with all-glass construction using a medium-porosity glass frit. Optional glassware is: 25 ml frit sparger, 5 or 25 ml fritless sparger, 5 or 25 ml needle sparger and 25 ml disposable test tubes.

Trap:

12" long; stainless steel tube; 0.010" wall thickness; 0.123" +/- 0.002" OD (maximum OD of 0.125" is the USEPA specified standard)

Trap Furnace:

Controlled temperature range: from 5°C above ambient* to 420°C (-20°C to 420°C with optional TURBOCool); average rise rate: 575°C/min. from 35°C to 225°C (The rise rate is averaged over this temperature span; it is invalid outside this span.)

* temperature of the surrounding air

Trap Pressure Control™:	Variable; set at the factory to maintain a recommended back pressure of 4 psi; flow rate: 35 ml/min.
Valving:	• A 115 VAC motor-actuated, 6-port switching valve with removable rotor; temperature controlled from ambient to 300°C • 12 VDC solenoid-actuated, 2 and 3-port sample, bypass, high rate purge (HRP), drain and vent valves
Sample Path:	• Flow Tuned Tubing (FTT)™ features constant uniform internal diameters on all fittings, valves and tubing; eliminates dead volume and maintains a constant linear velocity during desorption to the gas chromatograph • Transfer line, 72" total length - 60" outside of unit; heated, variable: ambient to 300°C • Optional sample pocket and tube heaters; variable: from ambient to 100°C
Carryover Specifications:	• 3000 concentrator: 0.1% after 1000 ng standard • 2016 autosampler: 0.5 - 1.0% after 1000 ng standard There is no difference between carryover amounts using U-shaped glassware versus needle sparger glassware (with or without drain).
Operating Range of Concentration:	Calibration range: 0.5 ng to 2000 ng System range: low ppt to 10 ppm
LN_2 Consumption:	When using a Cryofocusing Module: Approximately 1 liter to cool the cryofocus trap to -120°C. Then 1/4 liter per minute once the cooldown temperature is reached (total time for Desorb Preheat and Desorb modes.)
Moisture Control System:	Removes moisture from the gas stream going to the GC; operating temperature: 5°C above ambient to ~~400°C~~ 320°C See Notice (in front)
Electronic Control:	Microprocessor - Motorola 68000, running at 12 MHz CPU memory - 128K ROM; 64K RAM (expandable to 128K)
Baud Rate:	9600

Data Input:

The 3000 accepts parameter values that you enter by way of an RS232C serial interface. To enter the parameter values, use one of the following:

- A hand-held controller connected directly to an I/O port
- A personal computer with optional TekLink™ software. To use TekLink, you must have the following:
  1. An 80386 or 80486 SX or DX-based computer running Microsoft® Windows™ version 3.1 or later
  2. Any kind of DOS, as long as it's version 5.0 or greater
  3. A hard drive with at least 2 MB (two megabytes) of free space
  4. 4 meg of RAM (Tekmar recommends that you use 8 meg of RAM.)
  5. A disk drive that can read 3 1/2" 1.44M or 5 1/4" 1.2M diskettes
  6. At least one free serial port for connection to the 3000

Data Display:

The 3000 uses a two-line, 20 character-wide Super Twisted Nematic LCD screen on the front panel and a four-line, 20-character display on the hand-held controller.

Expansion Capability:

The 3000 has four expansion slots on the Mother Board for accessory interfaces.

I/O Signals:

During operation, the 3000 sends and receives the following signals:

- Begin/End Desorb output signal
- Start GC/MS and Data System output signal
- Desorb Ready output signal
- GC Ready/Continue input signal
- Purge Permission input signal
- Purge Ready output signal

GC Interface:

The 3000 works with almost all commercially-available GC instruments. It supplies or accepts GC and Data System start and ready signals by way of a software-selectable GC I/O board.

Column Capability:

All commercially-available columns. Systems with columns that have an I.D. of less than 0.53 mm may require the Cryofocusing Module, depending on the systems' configurations.

Method Storage:

Up to 16 methods, including preprogrammed USEPA methods 502.2, 524.2, 601, 602, 624, 8000, CLP/VOA and Bakeout method.

Method Scheduling:

Up to 12 method changes in any sample order on a single automatic cycle of any Tekmar autosampler

1.6 Safety Precautions

Please read, understand, and follow all the precautions described in this section before you set up, install, or operate the Tekmar 3000 and any of its accessories. Tekmar is not liable for any damage or injury resulting from failure to follow the instructions in this manual or failure to exercise appropriate care and caution in the installation, operation, checking, and adjustment of the equipment described in this User Manual.

1.6.1 Electrical

The 3000 and accessories (Cryofocusing Module, ALS autosamplers, AQUATek 50, etc.) generate hazardous voltage.

WARNING

- **To avoid electrical shock, turn off and unplug the unit before servicing.**
- **Do not operate the unit without protective covers in place.**
- **The three-wire power cord is a safety feature. To avoid electrical shock, plug the power cord into a properly grounded outlet. Do not use an extension cord; the cord can overheat and cause a fire.**

1.6.2 Temperature

The 3000 and accessories contain heaters. The sample heater in the 3000 can be as hot as 420°C when the 3000 is in operation.

WARNING

Sections of the 3000 and accessories are heated during operation. If you touch a heater, you will be burned. Do not touch the heaters.

CAUTION

Some Tekmar™ accessories require the use of liquid CO_2 (carbon dioxide) or LN_2 (liquid nitrogen). These chemicals produce very low temperatures that can damage human tissue. Avoid touching the chemicals or the surfaces that they cool.

1.6.3 Delivery Pressure

CAUTION

Do not exceed maximum pressure ratings for the 3000 or accessories.

1.6.3 Delivery Pressure, cont.

The Cryofocusing Module uses liquid nitrogen coolant.

CAUTION

If coolant delivery pressure exceeds 75 psig, a relief valve on the cryogenic valve assembly will vent the excess pressure.

WARNING

TURBOCool requires a SUPPLY of high pressure liquid $C0_2$ (carbon dioxide) Do not allow the SUPPLY pressure to exceed 1000 psi.

1.6.4 Miscellaneous

WARNING

To avoid any type of interference with the 3000 operation, maintain at least two inches of unobstructed space around the 3000. Move all other equipment outside the two-inch perimeter. The 3000 requires a clear surface area of at least 20" (51cm) deep and 15" (38 cm) wide, with no shelves or overhanging obstructions above. The surface must be able to support at least 40 pounds.

CAUTION

Keep the 3000 away from corrosive gasses, liquids or solids. Corrosive substances will damage outside surfaces and the parts inside.

CAUTION

Operate TURBOCool in a well ventilated area to prevent saturation of the ambient air with carbon dioxide.

1.6.5 Material Safety Data Sheets

If your Tekmar™ instrument was shipped prior to May, 1994, its line heater may contain layers of yellow fiber glass insulation. (The line heater contains the transfer line, which provides a path for desorbed analytes to travel to the gas chromatograph*.) In April of 1994, Tekmar began using Solimide® TA-301 polyimide foam instead of the yellow fiber glass to insulate the transfer line. Two Material Safety Data Sheets (MSDSs), which are reproduced on the following pages, describe the fiber glass and Solimide® TA-301 polyimide foam in detail.

* Because of this, the line heater and transfer line assembly is sometimes called the *transfer line*.

1.6.5 Material Safety Data Sheets, cont.

Material Safety Data Sheet

Imi-Tech Corporation
701 Fargo Avenue
Elk Grove Village, IL 60007
(708) 981-7610

80.0.17

Emergency Phone Number
(504) 344-7147

Product Name
Solimide® TA-301 polyimide foam
80.0.17

Product Identification

Product Name:	Solimide® TA-301 polyimide foam
Chemical Name:	Benzophenonetetracarboxylic imide polymer foam
Cas No:	Proprietary mixture
Chemical Family:	Polyimide

This material is in compliance with the toxic substances control act (15 USC 2601 - 2629).

Solimide® is a registered trademark of Imi-Tech Corporation.

Components

Chemical Name	Cas No.	Note±	Exposure Limit
Benzophenonetetracarboxylic imide polymer foam	Proprietary	NL	Not established by OSHA/ACGIH

Note: Carcinogenicity listing of components at concentrations greater than or equal to 0.1% indicated by: @=NTP; #=IARC; &=OSHA; *=Other; NL=Not Listed

Chemical and Physical Properties

Appearance/Odor:	Beige to yellowish foam/odorless.
Vapor Pressure:	Not applicable.
Solubility in Water:	Insoluble.
Specific Gravity:	0.008-0.011 (range).
Melting Point:	Not established.

10/09/90

1.6.5 Material Safety Data Sheets, cont.

Fire and Explosion Hazards

Flash Point (Method):	Not applicable.
Flammable Limits:	Not applicable.
Extinguishing Media:	Dry chemical, water spray (fog), foam or carbon dioxide.
Hazardous Thermal Decompostion Products:	Include oxides of carbon and nitrogen.
Special Fire Fighting Procedures:	Avoid breathing smoke and vapor.
Unusual Fire and Explosion Hazards:	None known.

Reactivity Data

Stability:	Stable.
Conditions to avoid:	None known.
Materials to Avoid:	Strong alkaline and oxidizing acid solutions.
Hazardous Polymerization:	Will not occur.

Health Hazards

Inhalation:	Not expected to be a primary route of exposure.
Eye Contact:	Not expected to be an eye irritant.
Skin Contact:	Not expected to be a skin irritant.
Ingestion:	Not expected to be acutely toxic.
Chronic Effects of Overexposure:	None known.

Emergency First Aid Procedures

Inhalation:	If inhaled, remove to fresh air.
Eye contact:	Begin immediate eye irrigation with cool water.
Skin contact:	Use good personal hygiene if dust contact is possible.
Ingestion:	If swallowed, give two glasses of water.

Exposure Control Information

Exposure Limits:	Not established by OSHA/ACGIH.
Eye Protection:	Safety glasses.
Protective Gloves:	Not required under normal conditions.

10/09/90

1.6.5 Material Safety Data Sheets, cont.

Exposure Control Information (continued)

Respiratory Protection: NIOSH approved dust/mist respirator, when excessive dusting may occur.

Local Exhaust Ventilation: At source of dust.

Mechanical Ventilation: Recommended.

Environmental Protection

Spills or Leaks: Sweep or shovel spills into appropriate container for disposal.

Disposal Methods: Under the CERCLA/RCRA regulations currently in effect, this product is not regulated as a hazardous waste or material. Therefore, it may be disposed of as an industrial waste in a manner acceptable to good waste management practice and in compliance with applicable local, state and federal regulations.

Storage Requirements: No special storage required.

Issue Date: 10/09/90 **Supersedes: 04/04/86**

MSDS prepared by: Health & Environment Department
Ethyl Corporation

For Additional nonemergency MSDS information, contact:

IMI-Tech Corporation
(A subsidiary of Ethyl Corporation)
701 Fargo Avenue
Elk Grove Village, Illinois 60007

This material safety data sheet contains at least the information required by the federal OSHA Hazard Communication Rule, 29 CFR 1910.1200 (g) (2).

1.6.5 **Material Safety Data Sheets, cont.**

Material Safety Data Sheet

Processor:	Wrap-On Company, Inc.
Address:	5550 W. 70th Place, Chicago, IL 60638
Phone:	For information purposes: 8:00 AM - 5:00 PM Central Time Telephone: (312) 496-2150
Date of Preparation:	September 1, 1986
Product Name(s):	Wrap-on Fiber Glass, Jumbo Fiber Glass, Heavy Duty Fiber Glass, Pipe-Guard Fiber Glass.

Section I - Component Data

Hazardous Ingredients

Common Name	Chemical Name	C.A.S. Number
Fiber glass	Fibrous glass	65997-17-3

Section II - Physical Data

Boiling Point (°F):	NA*
Specific Gravity (H_2O=1)	ND**
Melting Point:	NA
Vapor Pressure (mmHg @ 20°C):	NA
Percent Volatile by Volume:	NA
Vapor Density (Air=1):	NA
Evaporative Rate (Ethyl Ether=1):	NA
Solubility in Water:	Insoluble
pH:	NA
Appearance and Odor:	Yellow insulation/may have faint resin odor.

Section III - Fire and Explosion Hazard Data

Flash Point (°F):	NA
Method Used:	NA
Flammability Limits:	
LEL:	NA

*NA=Not Applicable **= Not Determined

1.6.5 Material Safety Data Sheets, cont.

Section III - Fire and Explosion Hazard Data (continued)

UEL:	NA
Auto-Ignition Temperature (°F):	NA
Extinguishing Media:	NA
Special Fire-Fighting Instructions:	None Required
Unusual Fire and Explosion Hazards:	ND

Section IV - Reactivity Data

Stability (Conditions to Avoid):	Stable (None)
Incompatibility (Materials to Avoid):	None
Hazardous Decomposition Products:	Binder burns or decomposes in a fire; primary combustion products are carbon monoxide, carbon dioxide and water.
Hazardous Polymerization:	Will not occur.

Section V - Health Hazard Data

Primary Route(s) of Entry: Inhalation

Health Hazards (Acute and Chronic):

Inhalation:

Acute: Mechanical irritation of the mouth, nose and throat.

Chronic: Many studies have been conducted to determine the potential long term effects of fibrous glass inhalation. In man, epidemiology studies of workers employed for up to 40 years in fibrous glass manufacturing do not show any consistent evidence of pulmonary disease, either malignant or nonmalignant. Studies in animals using the natural route of exposure - i.e., inhalation - have not shown evidence of a carcinogenic effect. Artificial implantation of large quantities of very fine glass fibers in the chest or abdominal cavities of laboratory animals has caused cancer. One animal study, in which large quantities of very fine diameter glass fibers were injected into the trachea of hamsters, reported cancer.

Skin Contact:

Acute: Transient mechanical irritation.

Chronic: None

1.6.5 **Material Safety Data Sheets, cont.**

Section V - Health Hazard Data (continued)

Eye Contact:

Acute: Direct contact will cause mechanical irritation.

Chronic: None

Ingestion:

Acute: Unlikely to occur. Observe individual; if symptoms develop, consult physician.

Chronic: None known.

Signs and Symptoms of Exposure: Itching and possible irritation of the upper respiratory tract.

Medical Conditions Generally Aggravated by Exposure: Any condition generally aggravated by mechanical irritants in air or on skin.

Exposure Limits:

Hazardous Ingredients	OSHA PEL (mg/M^3)	ACGIH TLV (mg/M^3)	Other Recommended (Source)
Fibrous Glass	15 mg/M^3	10 mg/M^3	3 x 10^6 fibers/M^3 (NIOSH)

Carcinogenicity:

Hazardous Ingredients	NTP Listed	IARC Listed	OSHA Regulated
Fibrous Glass	No	No	No

Section VI - Emergency and First -Aid Procedures

Inhalation: ND

Skin: Wash with soap and water.

Eyes: Flush with running water for at least 15 minutes.

Section VII - Special Handling Information

Ventilation: Ambient

Respiratory Protection: Not normally required. If TLV is exceeded or irritation occurs, use a respirator such as 3M model 8710 or equivalent for protection against nuisance dust.

1.6.5 Material Safety Data Sheets, cont.

Section VII - Special Handling Information (continued)

Protective Clothing:	Gloves, long sleeved, loose fitting cloth ing, long pants. A cap may be useful when handling material overhead.
Eye Protection:	Safety glasses
Work/Hygienic Practices:	Shower at end of work day. Wash work clothes separately and wipe out washer at end of cycle.

Section IIX - Spill, Leak and Disposal Procedures

Action to take for spills (Use (appropriate safety equipment.):	NA
Waste Disposal Method:	Dispose in accordance with federal, state and local regulations. The primary method of disposal is in a municipal or industrial landfill.
EPA Hazardous Waste Number:	NA
	This material is not regulated under the RCRA hazardous waste regulations.

Sections IX - Special Precautions/Additional Information

Precautions to be Taken in Handling and Storage:	Insulation should be stored in a dry place.
DOT Information:	
Hazardous Material Proper Shipping Name:	Not regulated by DOT.
Hazard Class:	Nonhazardous
UN Identification Number:	
Additional Information:	None

2.1 Overview

This section describes:

- The prerequisites and site preparation for a Tekmar 3000 installation.
- Unpacking and checking your Tekmar 3000 shipment.
- The major components of the Tekmar 3000.

Equipment installation and operation will be easier if you use the illustrations to identify and locate the described components on the 3000.

2.2 Getting Ready for Installation

Please read the instructions in this section before you begin to install the 3000. If you have any questions about site requirements for installing and operating the 3000, please call the Tekmar Service Department at (800) 874-2004.

2.2.1 Operating Environment

The Tekmar 3000 operates at temperatures between 19°C to 60°C with humidity levels between 10% and 90%. Generally speaking, an environment with temperature and humidity that are reasonably constant and comfortable for an operator is an environment in which the concentrator will perform reliably.

⚠ CAUTION

Keep the concentrator away from corrosive substances -gas, liquid, or solid - to avoid material and/or component damage.

The 3000 requires a clear surface area at least 18" (46 cm) deep and 15" (38 cm) wide, with no shelves or overhanging obstructions above. The surface must be able to support at least 40 pounds.

⚠ WARNING

To avoid any type of interference with 3000 operation, maintain at least two inches of unobstructed space around the unit. Move all other equipment outside the two-inch perimeter.

2.2.2 Power Requirements

After selecting and clearing a location for the concentrator, check the availability of the required grounded outlets. The Tekmar 3000 uses 115V/230V (± 10%) power at 50/60 (±1%) Hz, with one grounded, three-pronged receptacle for the main power cord. Each additional accessory you plan to use may also require one or more grounded outlets.

2.2.3 Gas Supply Requirements

Concentrator operation requires the availability of ultra-high purity helium (as purge gas). Check the following items:

1. Helium purity must be 99.999%, 0.5% hydrocarbon tested.
2. Gas pressure at the source must be high enough to:
   - Allow at least 20 psi pressure drop at every flow or pressure regulator.
   - Travel the distance from the source to the concentrator.
   - Provide the required gas pressure at the concentrator. Operation of the 3000 requires helium at an incoming (supply) pressure of 20 to 60 psig.
3. Gas supply tubing diameter depends on the maximum pressure drop allowable for your setup. If the helium supply is close to the concentrator, you may use ⅛" diameter tubing. However, you may want to use larger diameter supply lines, typically ¼", to reduce pressure drop under the following circumstances:
   - The gas supply is a long way from the concentrator.
   - A single source supplies several instruments.
   - A single source will be subjected to high demand for gas.
4. Gas supply tubing lengths must be adequate. Be generous when cutting lengths of tubing for local supply lines; a relatively long coil of tubing between the supply and the 3000 allows you to move the instrument (to reach rear cover panels, for example) without disconnecting the plumbing.
5. Gas line fittings and regulators must be the correct size and type. Consult your local gas supplier for type and size of cylinder valves; then select compatible pressure regulators based on the required valves. Keep these considerations in mind:
   - To reduce high source pressures to the pressure required by the concentrator, use high-quality pressure regulators with stainless steel diaphragms. Tekmar recommends using a single, two-stage regulator, rather than two single-stage pressure regulators to meet the concentrator's pressure specification.
   - On/off valves, while not essential, are very useful when mounted on the outlet fitting of a two-stage regulator.
   - Avoid pipe thread connections in your gas supply lines. If you must use them, seal them with instrument-grade Teflon® tape.

⚠ CAUTION

Always use instrument-grade Teflon® tape to seal thread connections. Do not use pipe dope or lower grades of Teflon® tape; volatile materials in the dope and/or low-grade tape will contaminate the tubing.

2.3 Unpacking the Concentrator

Please read the instructions in this section before you begin to set up the 3000. If you have any questions about the set up, please call the Tekmar Service Department at (800) 874-2004.

CAUTION

Failure to follow these instructions may void your warranty for components damaged in shipment.

1. Remove the Tekmar 3000 kit box and the concentrator from the shipping carton. Each concentrator is shipped with a kit box. An optional installation kit with additional parts needed to set up and install the 3000 is available from Tekmar (P/N 14-5092-100).

2. Compare the contents of the kit box and/or installation kit against the packing list that accompanies your shipment. Check for each listed item.
   - If an item is missing, call the Tekmar Customer Service Department toll-free at (800) 543-4461; outside the US and Canada, call (513) 247-7000.
   - If any shipped item is damaged, immediately notify the shipping carrier and the Tekmar Customer Service Department of its condition.

3. Examine the concentrator carefully. If it is damaged, notify the shipping carrier and Tekmar immediately. Do not continue installation until a Tekmar representative authorizes you to do so.

4. Save all shipping materials until you verify that the instrument operates correctly.

5. Do not return the concentrator unless authorized to do so by a Tekmar representative.

WARNING

For the safety of everyone concerned, Tekmar will not service returned instruments that are shipped with needles or any other sharp objects installed on their exteriors; Tekmar will promptly return these instruments to customers.

This policy mainly applies to returned purge and trap autosamplers, which are shipped with stainless steel needles or glass dip tubes installed.

To receive prompt, reliable service, and reduce the risk of injury, please remove all sharp objects from the exterior of any Tekmar instrument before shipping.

2.4 Major Components

The Tekmar 3000 (Figure 2-1) consists of a concentrator with a front-panel sample glassware assembly and an optional hand-held controller.

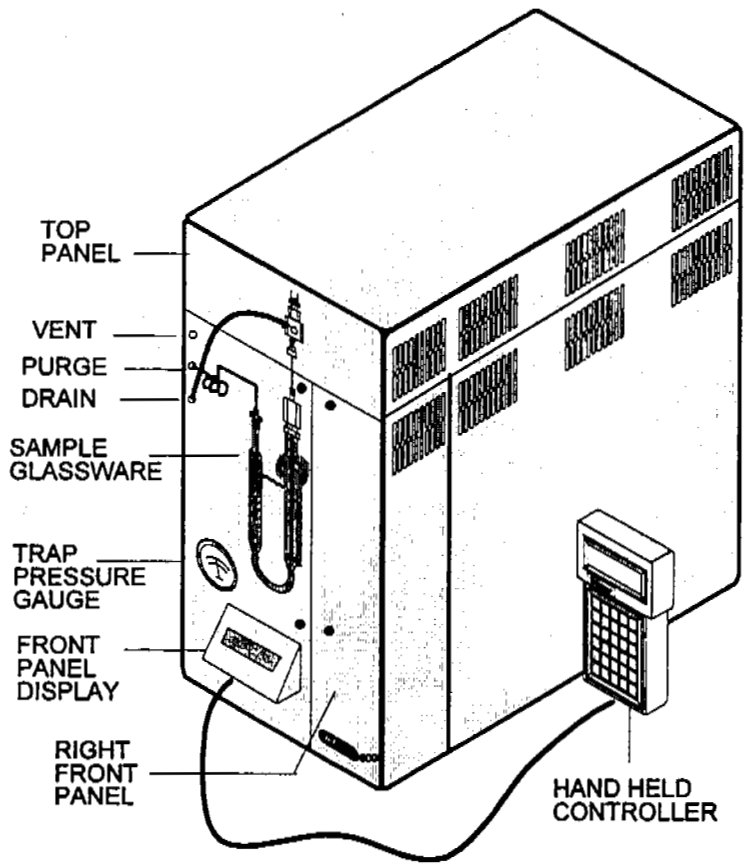


Figure 2-1. Tekmar 3000

2.4.1 Hand-held Controller

The hand-held controller is a four-line, 20-character wide, LCD (liquid crystal display) and a keypad. The display consists of *data entry screens* for programming and entering data, *menu* and *action screens* for selecting options and commands, and *status screens* for viewing during operation.

Section 5.0, *Using the Controller Keypad and Screen* describes the keypad and screen in greater detail.

2.4.2 Front Panel Display

The front-panel display provides status information during concentrator operation.

- The Trap Pressure gauge shows the current sample gas pressure (in psig).
- The LCD screen displays information about the concentrator's current operating step. The first line displays the step name, the number of the currently active method (or operating sequence), and the number for the position of the currently active sample. The bottom line displays the current reading for the most significant operating step parameter.

2.4.3 Front Panel Glassware

The front panel holds a single sample sparger assembly, as illustrated in Figure 2-2.

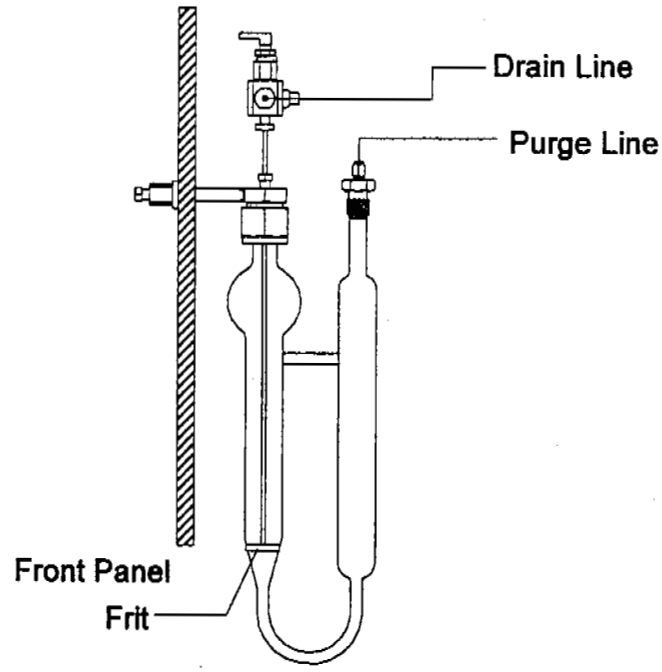


Figure 2-2 . Sample Glassware Assembly

The 3000 can accommodate a 5 ml or 25 ml sample sparger. The sampler mount is attached to the front panel; the sample valve assembly and the glassware are shipped separately for you to attach when you set up the 3000.

2.4.4 Concentrator Trap

Figure 2-3 shows a partial right side view of the Tekmar 3000 with the outer panels cut away to show the trap and the electronic components.

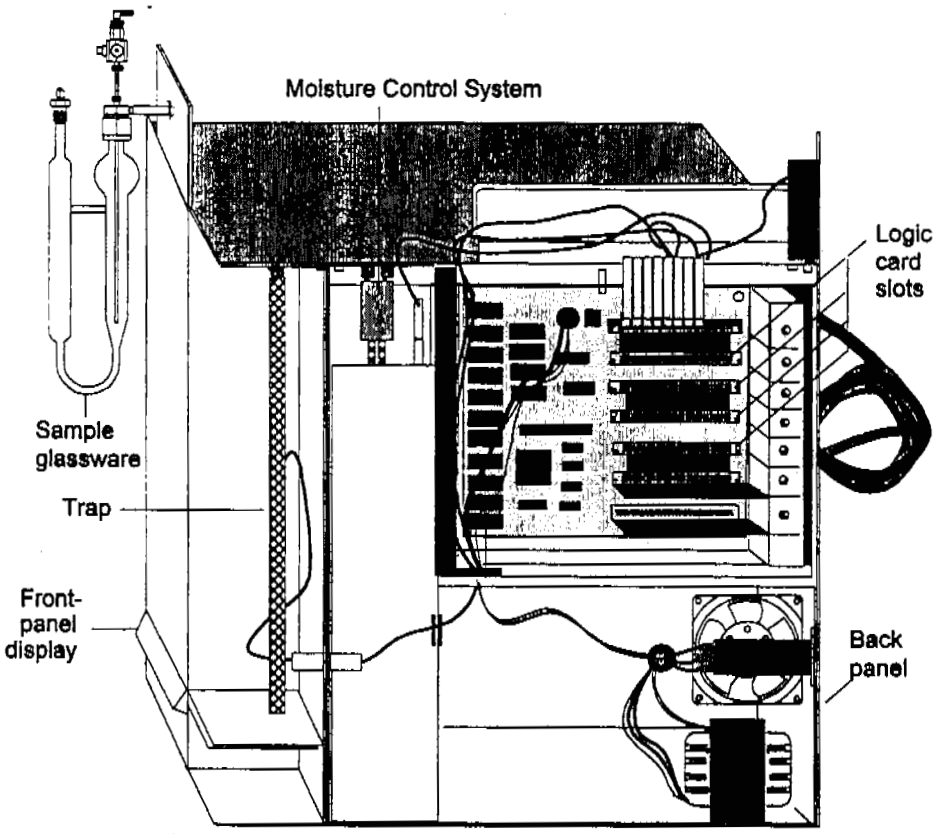


Figure 2-3. Tekmar 3000 (Right Side)

The 3000's right compartment holds the 12-inch long, ⅛" diameter, sorbent-packed trap.The 3000 ships with a blank #0 trap which needs to be replaced with the appropriate packed trap. Analytes in the sample stream coming from the sparger are adsorbed onto the packing material.

2.4.5 Electronic Components

Concentrator operations are controlled by a group of logic cards mounted in the rear half of the 3000 (see Figure 2-4). The main logic card holding the controlling ROM (read-only memory) chips is in the bottom slot. The board in the top slot uses thermocouples to read temperatures. The other five slots accommodate logic cards that make it possible for the Tekmar 3000 to communicate with a personal computer and to operate with one or more autosamplers or other accessories.

2.5 Gas Inlets and Outlets

Figure 2-4 illustrates the concentrator's rear panel, showing the gas inlets for sample/purge and carrier gas.

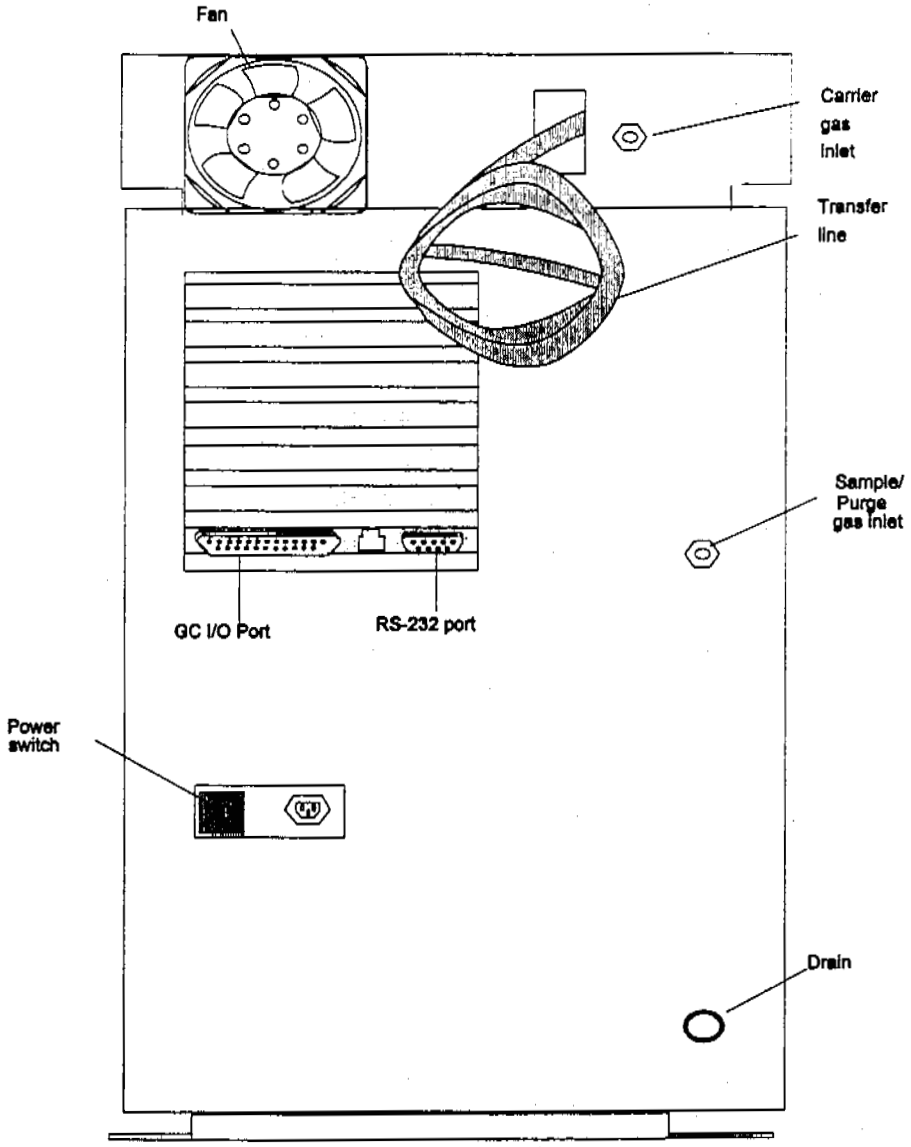


Figure 2-4 Tekmar 3000 Rear Panel

2.5.1 Sample/Purge Gas Inlet

Sample gas (ultra-high purity helium) flows through the sparger to carry organic analytes onto the trap. (Nitrogen can be used as sample gas, but it may contain more impurities.) The helium or nitrogen enters the back panel at the opening labeled "Sample".

Depending on the concentrator's operating mode, sample gas flows through the sample sparger (to carry analytes to the trap), or it bypasses the sparger to circulate in a passive circuit and flows out the front panel vent.

Tekmar recommends a sample gas flow of 35 ml/min ± 5 ml for 11 minutes to achieve a 385 ml purge volume.

2.5.2 Carrier Gas Inlet

Carrier gas is high purity helium (or nitrogen) used to desorb volatile analytes off the internal trap and carry them through the transfer line back to the GC. Carrier gas enters the back panel at the opening labeled "Carrier". Depending on the concentrator's current operating mode, carrier gas flows through the trap and carries volatile analytes over to the GC, or it makes a passive circuit through the concentrator and returns, unchanged, to the GC through the transfer line.

2.6 3000 Valves and Lines

The valves visible from the top of the unit are:

- Two adjustable *regulating valves* near the back of the 3000. They control the sample pressure and sample flow of gas entering the 3000 through the sample gas inlet.
- The *sample* and *bypass valves*. Sample gas flows from the flow controller to the sample valve. When the sample valve is closed, sample gas flow is cut off. An open sample valve directs flow to the bypass valve, which routes it either to the sample sparger or to the sample tee.
- The *sample tee* accepts flow from the sample sparger or from the bypass valve and directs it to the six-port valve.
- The *six-port valve* inside the valve oven has two settings that control the direction of sample and carrier gas flow through the concentrator.
- The *trap pressure control (TPC) valve* controls back pressure on the concentrator trap.

Figure 2-5 shows a top view of the 3000, with the top panel removed to show the sample flow and sample pressure regulating valves, the valve oven, six-port valve, sample tee, and transfer line to the GC.

2.6 3000 Valves and Lines, cont.

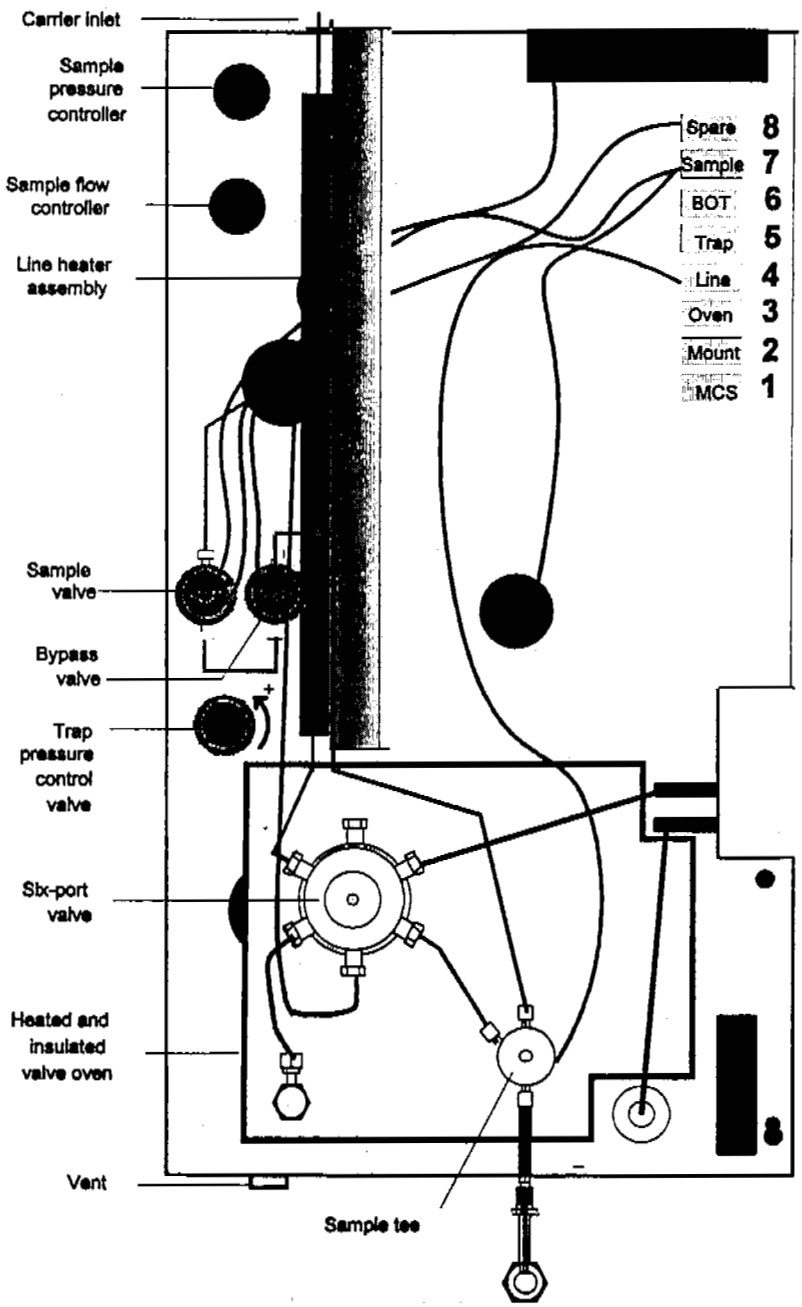


Figure 2-5. Tekmar 3000 (Top View)

Please refer to Chapter 4, *Understanding Operating Steps*, for a description of steps that control operation of the valves and lines that direct sample/purge and carrier gas flow.

2.7 Autosamplers

- The 3000 can work with the ALS 2016/2032 to process up to 32 liquid and soil samples.
- The 3000 can work with the AQUATek 50 vial autosampler to process up to 50 drinking and wastewater samples.
- The 3000 can process up to 65 drinking and wastewater samples with the 2016 and AQUATek 50 (up to 15 on the 2016 and up to 50 on the AQUATek 50).
- The 3000 can work with the AEROTrap 6016/6032 to process up to 32 air samples.
- The 3000 can process up to 16 air samples (with the AEROTrap 6016) or up to 32 air, liquid and soil samples (with the AEROTrap 6032 and the ALS 2016).

For further instructions, see the manuals shipped with the autosamplers.

2.8 Cryofocusing Module

If you plan to run samples that contain highly volatile components on a small bore capillary column, Tekmar recommends using a Cryofocusing Module (available as a separate purchase) with the Tekmar 3000. For more information, see the manual shipped with the Cryofocusing Module.

2.9 TURBOCool

TURBOCool is an optional accessory to the 3000. The TURBOCool accessory keeps the trap at a uniform temperature and permits purging onto a subambient* trap. This minimizes breakthrough and improves resolution of the lighter, early eluting gases in gas chromatography.

For more information on TURBOCool, see Chapter 9.

* temperature that is lower than the surrounding air

2.10 TekLink™

TekLink™ software makes it possible for you to use a personal computer (PC) running Microsoft® Windows™ to monitor, schedule and control the operation of one, two, three or four concentrators. At the PC keyboard, you can:

- define custom methods or operating sequences that meet your analytical requirements.
- set up schedules for running certain methods at specified positions on an autosampler.
- start, interrupt and/or reset a run in progress.

To use TekLink™, you must have the following:

1. An 80386 or 80486 SX or DX-based computer running Microsoft® Windows™ version 3.1 or later
2. Any kind of DOS, as long as it's version 5.0 or greater
3. A hard drive with at least 2 MB (two megabytes) of free space
4. 4 meg of RAM (Tekmar recommends that you use 8 meg of RAM.)
5. A disk drive that can read 3 1/2" 1.44M or 5 1/4" 1.2M diskettes
6. At least one free serial port for connection to the 3000

3.1 Overview

This section provides instructions for the following:

- Connecting the Tekmar 3000 to the GC (electronically and pneumatically)
- Installing accessories
- Leak checking the installation

3.2 Making Pneumatic Connections

The 3000 requires two independent gas flows:

- Carrier gas flows from the GC to the carrier gas inlet on the 3000, through the 3000, and back to the GC by way of a heated transfer line.
- Sample gas flows from the sample gas source to the 3000 sample inlet, through the sparger, over the trap, and out the 3000 vent.

You may use a single gas supply as the source for both sample and carrier gas; however, the flows must be independent of each other. Figure 3-1 illustrates a GC connected to a carrier gas supply. You can tap into the carrier gas supply line to provide carrier and sample gas for the 3000.

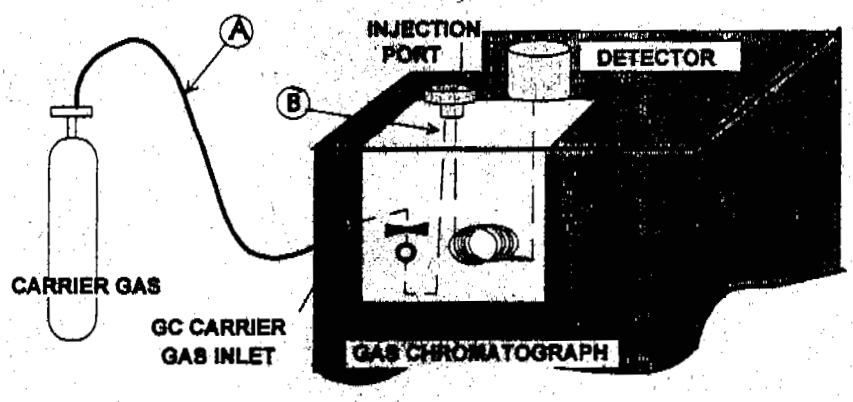


Figure 3-1. Gas Chromatograph Connections

The following sections tell you how to connect the 3000 and the GC pneumatically:

- To provide sample gas to the 3000, tee off the supply line at point A (Figure 3-1). Follow the instructions in the next section.
- To install a fused silica transfer line, follow the instructions in the section titled *Installing a Fused Silica Transfer Line* in this chapter.
  - To provide carrier gas flow and connect the 3000 to the GC, cut the gas supply line at point B (Figure 3-1) to divert carrier gas flow through the 3000 and back to the GC via the 3000 transfer line.
  - If you use a Cryofocusing Module or a direct column connection, follow the instructions in the section titled *Making a Direct Column Connection* in this chapter.
  - If you want to keep the GC injection port free for direct injections, follow the instructions in the section titled *Using GC-Regulated Carrier Gas* in this chapter.

continued

3.2 Making Pneumatic Connections, cont.

You can also use a *low volume insert* or *sample needle adapter* to connect the 3000 to the GC. For more information, see the diagrams in the back of this manual.

3.2.1 Connecting the Sample Gas Line

Sample gas is usually supplied through a tee union from the GC carrier gas supply tank.

1. If there is no tee union in the carrier gas supply line to the GC, install one (as illustrated in Figure 3-2).

2. Run the sample gas line from the tee to the fitting marked "Sample" on the concentrator's rear panel.

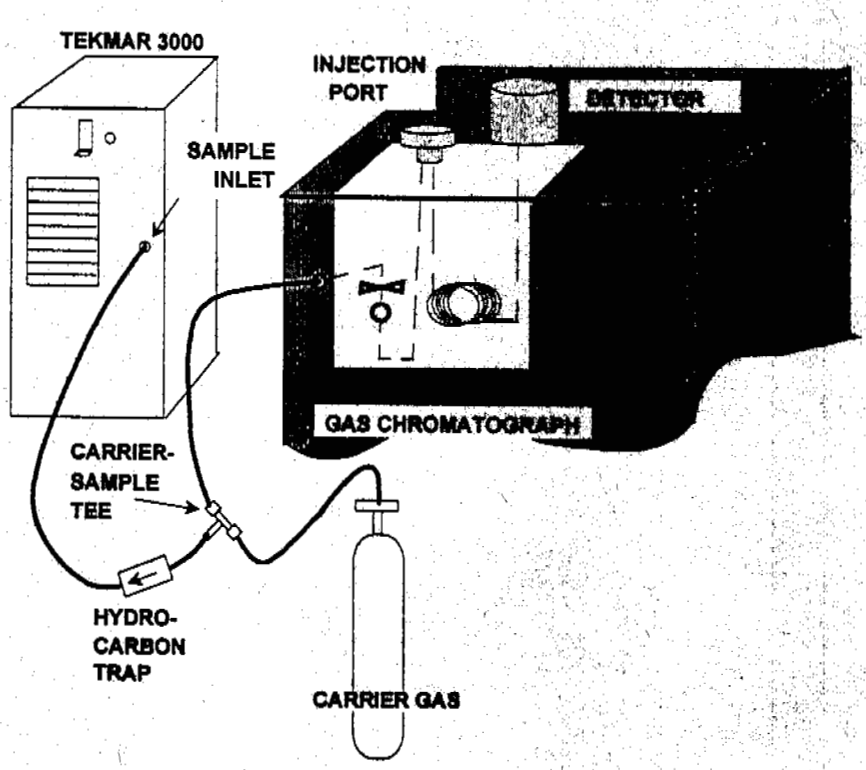


Figure 3-2. Connecting to a Sample Gas Supply

Note: If there is no hydrocarbon trap on the carrier gas supply, install the trap provided in the 3000 kit box, as shown in Figure 3-2.

3.2.2 Installing a Fused Silica Transfer Line

Desorbed analytes are carried from the concentrator trap to the GC via a 1/16" heated transfer line which may be either fused silica or nickel tubing. The fused silica is provided. If you prefer nickel tubing, you can order it from Tekmar.

One set of tubing and five graphitized vespel ferrules are provided in the kit box.

> **⚠ CAUTION**
>
> **Sections of the 3000 are heated during operation. Allow the 3000 to cool before installing the transfer line.**

Note: **If you wish to remove nickel tubing from the line heater, keep this in mind: Heat tape, which wraps around the tubing, contains a glue which melts at high temperatures. As the line heater cools, the glue solidifies. For the sake of safety, try removing the nickel tubing from a cool line heater first. If you cannot remove the tubing, heat the line heater for about one hour at 200°C. Using heat-resistant gloves, remove the tubing from the transfer line while the line is still hot.**

> **⚠ CAUTION**
>
> **If you do not use heat-resistant gloves to remove the tubing from the hot line heater, you will be burned.**

To install fused silica tubing, follow the instructions below.

1. Turn off and unplug the 3000.

2. Loosen the two 1/4 turn screws* on the right front panel. To remove the panel, slide the panel forward, then to the right.

3. Slide the top panel forward; lift it up and off. Loosen the thumb screw on the front of the valve oven. Lift the valve oven cover to remove it.

> **⚠ CAUTION**
>
> **Do not scratch the fused silica tubing; it may break under stress (bending or vibration that does not affect an unscratched line). Do not bend the tubing too sharply; it will fracture.**

4. Uncoil the tubing and **carefully** slide it through the line heater assembly past the end of the line heater. Figure 3-3 on the following page illustrates the positions of the line heater assembly and the valve oven.

* 3000s that have a serial number of 94130001 or greater have swell latches (P/N: 14-4578-008) instead of 1/4-turn screws.

3.2.2 Installing a Fused Silica Transfer Line, cont.

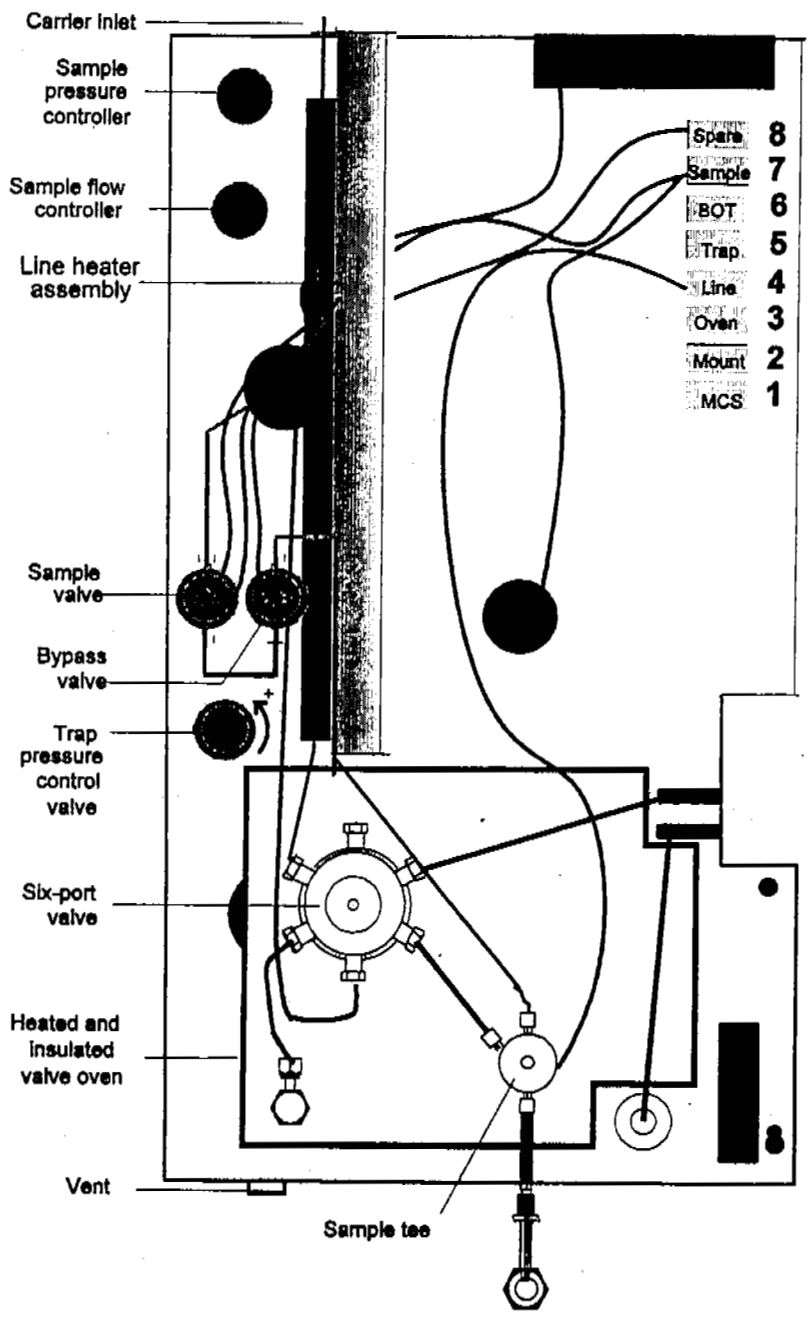


Figure 3-3 Installing a Fused Silica Transfer Line

5. Slide a 1/16" Valco nut and a graphitized vespel ferrule onto the fused silica tubing, as illustrated in Figure 3-4 on the following page.

continued

3.2.2 Installing a Fused Silica Transfer Line, cont.

6. Use a diamond-tipped pencil or razor blade to score the tubing about 1 inch from the end (as shown in Figure 3-4).

7. Bend the tubing from the side opposite the score until it breaks.

> **⚠ CAUTION**
>
> **The cut must be smooth and even. It is important to use a magnifying glass to check for smoothness.**

8. Insert the transfer line into the open port (port 4) of the six-port valve. Slide the fittings into the port and tighten them 1/4-turn past finger-tight.

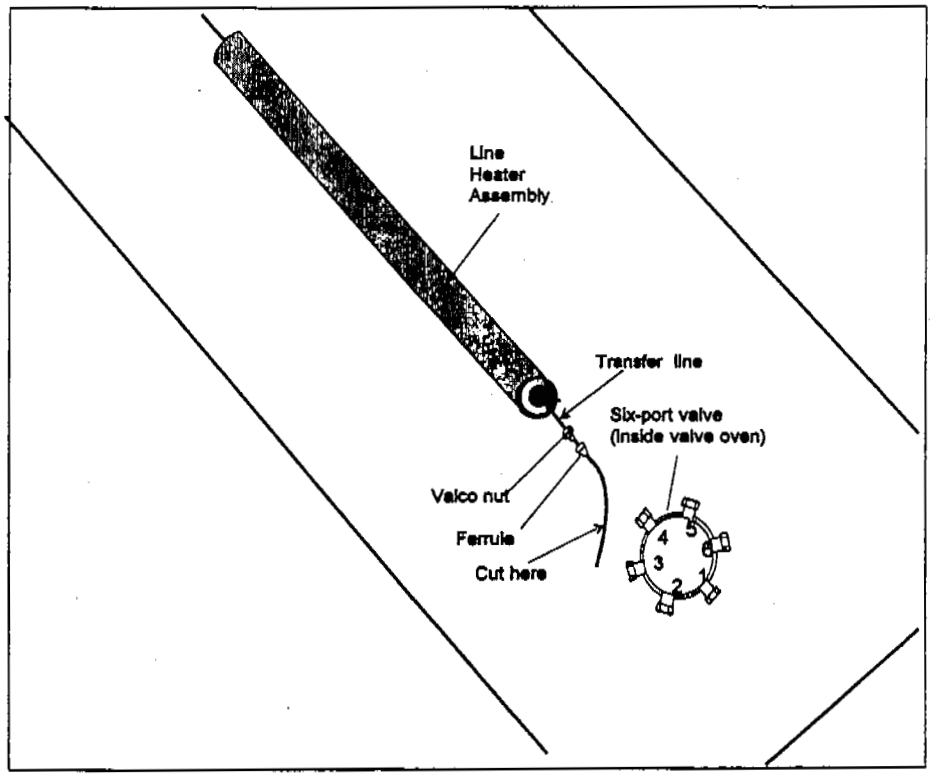


Figure 3-4 Fused Silica Tubing and Fittings

3.2.3 Connecting to the GC and Carrier Gas Supply

When you connect the 3000 to the gas chromatograph, you can:

- Make a direct column connection (using an optional Cryofocusing Module, if desired), or
- Connect to the GC carrier gas inlet and leave the injection port free for direct injections.
- Connect to the GC carrier gas inlet using a Low Volume Insert in the GC injection port. Call Tekmar at 1-(800) 543-4461 for details.

Note: If you plan to use a Cryofocusing Module, you must make a direct column connection to the GC.

3.2.3.1 Using GC Regulated Carrier Gas

When you make the connections illustrated in Figure 3-5, the GC supplies and controls carrier gas flow to the 3000. Using this configuration keeps the GC injection port free for direct sample injections. You cannot use a Cryofocusing Module with the configuration shown in Figure 3-5.

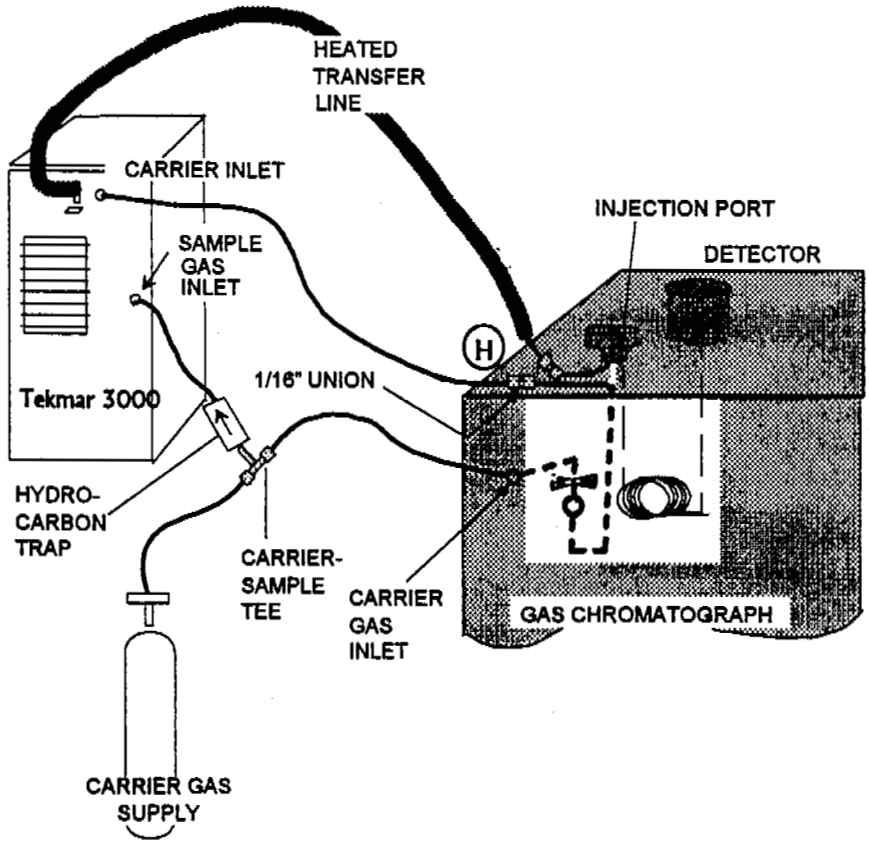


Figure 3-5 GC-Regulated Carrier Gas Connections

continued

3.2.3.1 Using GC Regulated Carrier Gas, cont.

If you have not already done so, follow the instructions in Section 3.2.2 (if you are using a fused silica transfer line).

To make the connections:

1. Make sure the GC is not hot; allow it to cool to room temperature.

2. Select an injection port. You may have to remove the covers around the port to expose the stainless steel line which supplies carrier gas to the port.

> **⚠ CAUTION**
>
> **Some injection ports have multiple pieces of tubing connecting to the injection port. Do not cut any lines unless you are sure which is the carrier line.**

3. Open the line at a point one or two inches from the injector housing (point H in Figure 3-5). If a union connects tubing from the carrier gas supply to the stainless steel injector port inlet, disconnect the union. If there is no union, cut the line.

4. Connect the line coming from the GC control pneumatics to a 1/16" union.

5. Connect a piece of 1/16" nickel tubing to the union; connect the other end to the union labeled "carrier" on the back of the 3000.

6. *If you are using fused silica transfer line tubing*...*
   a. Place a nut and ferrule on the transfer line tubing. Use a stainless steel union and graphitized vespel ferrules from the installation kit. With the 0.32 mm I.D. transfer line, use the 0.5 mm graphitized vespel ferrule. With a 0.53 mm line (for use with a megabore column), use a 0.8 mm ferrule.
   b. When making connections to fused silica tubing, make sure that no ferrule particles remain inside the tubing. Score the tubing (with a diamond-tipped pencil or a razor blade) about two inches from the end. Then bend it from the side opposite the score to snap off the end.
   c. To install a fused silica support tube, see Section 3.2.3.3, *Installing the Fused Silica Support Tube*.
   d. Using the nut and ferrule fitting, connect the transfer line tubing to the injection port inlet (at point H of Figure 3-5). Tighten the fitting about ½-turn past finger tight.

7. *If you are using a nickel transfer line tubing...*
   Connect the tubing to the injection port inlet (at point F of Figure 3-6 on the following page) using a 1/16" Swagelok union.

continued

* Fused silica tubing is provided. If you prefer nickel tubing, you can order it from Tekmar.

3.2.3.1 Using GC Regulated Carrier Gas, cont.

Note: **You may need to secure the center of the union to the column cage to relieve any stress caused by the weight of the union.**

If the injection port is split/splitless, you must cap the split vent and septum purge. Some applications require you to use the split. If this is the case, the split vent and septum purge should remain open.

3.2.3.2 Making a Direct Column Connection Using an External Regulator Assembly

You must use an external pressure regulator (EPR) when the back pressure in the GC's injection port is regulated on the downstream side. The following systems require an EPR:

- Any Hewlett Packard GC that has a 0.2, 0.25, or 0.32 capillary column and a Cryofocusing Module installed.
- Any Varian GC that has a 1077 injector (split/spitless) with a 0.2, 0.25, or 0.32 column and a Cryofocusing Module installed.

Figure 3-6 shows the connections required to make a direct column connection to the GC.

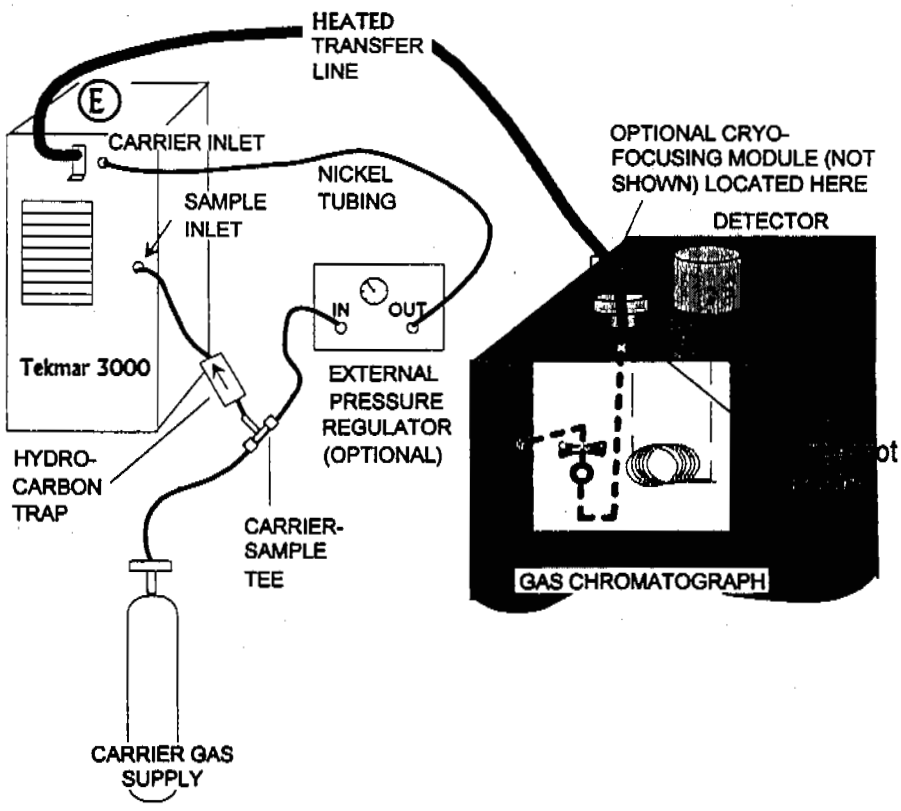


Figure 3-6 Direct Column Connections to the GC

To make a direct column connection:

1. Make sure the GC is not hot; allow it to cool down to room temperature.

continued

3.2.3.2 Making a Direct Column Connection Using an External Regulator Assembly, cont.

2. Since this configuration removes carrier gas flow from the GC pneumatic control, you must install an external pressure regulator (Tekmar P/N 14-3938-000, or equal) between the gas supply source and the carrier gas inlet to the 3000.
   - Disconnect the carrier gas line from the GC and run it to the inlet of the external pressure regulator.
   - Connect the outlet of the regulator to the carrier gas inlet on the 3000 rear panel at point E (see Figure 3-6).

3. Find an opening in the GC to route the transfer line into the GC oven to make the connection to the column (i.e. unused injection port or detector).

4. Using a zero dead volume union, connect the column to the transfer line from the 3000 at point F (see Figure 3-6).

Notes:

1. **If you use the Tekmar 3000 with a Cryofocusing Module, connect the transfer line to the Cryofocusing Module, not directly to the GC. Please refer to the Cryofocusing Module Instruction Manual for installation instructions.**

2. **Be sure that the line heater assembly on the transfer line is as close to the injection port as possible to minimize cold spots. As an alternative, the transfer line can pass through the injection port with the union in the GC oven.**

3.2.3.3 Installing the Fused Silica Support Tube

A support tube (part number: 14-5869-002), which is provided in the kit box, prevents the fused silica from breaking and allows you to handle the fused silica more easily. (See Figure 3-7 below.) To install the support tube:

1. Slide the support tube onto the end of the fused silica. Insert the support tube and fused silica into the metal channel of the end of the transfer line, leaving approximately 1" of the end of the support tube exposed.

2. Slide the graphitized vespel ferrule onto the end of the fused silica.

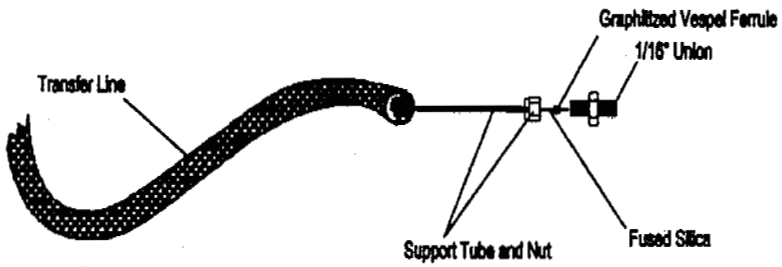


Figure 3-7 Using a Support Tube

continued

3.2.3.3 Installing the Fused Silica Support Tube, cont.

3. If you have not already done so, cut the exposed end of the fused silica by scoring it with a diamond-tipped pencil or a razor blade.

4. Connect the fused silica and support tube to the 1/16" stainless steel Swagelok union to make the connection to the GC injection port or column.

3.3 Installing Sample Glassware

Before shipping the 3000, Tekmar installs a blank (#0) trap in the internal trap area and the sample mount on the front panel. The sample glassware assembly is included in the kit box. **Before you use the 3000, install the glassware assembly and replace the empty trap with a packed one.** (See *How to Change a Trap* in Section 8.)

To install the sample glassware:

1. Attach the sampler body at the bottom port of the sample mount.

2. Slide the neck of the glassware all the way through the nut and ferrule until it comes to the inside lip of the fitting; then back the sampler out about 1/16".

3. Tighten the stainless steel nut and Teflon ferrule into the top of the sampler mount to secure the needle.

⚠ CAUTION

1. **Do not overtighten the ferrules. Overtightening can damage the ferrules, resulting in leak problems.**

2. **Install the sample glassware supplied in the kit box before you leak check the 3000.**

4. Tighten the fitting 1/4-turn past finger-tight. Slide the sample needle into the top of the mount until the tip of the needle just touches the bottom of the sampler.

5. Slide the sample valve bracket assembly over the front panel studs.

6. Tighten the sampler needle into the bottom port of the sample valve.

7. Secure the valve bracket with the two knurled nuts provided.

continued

3.3 Installing Sample Glassware, cont.

8. Attach one end of the nickel purge line to the front panel fitting labeled "purge" that is immediately to the left of the sampler mount.
9. Connect the ¼" fitting on the other end of the nickel purge line to the purge inlet side of the glassware. Finger tighten the nut.
10. Attach one end of the Teflon drain tubing to the fitting labeled "Drain".
11. Connect the other end of this line to the port on the left side of the sample valve.

3.4 Setting Sample Pressure

1. Turn on the 3000 by pressing the power switch on the rear panel.
2. Press ENTER to clear the Start-Up screen. The 3000 performs self tests and goes to Standby.
3. Make sure that Standby Flow is defaulted to ON. (See Section 3.10.3, *Specify Gas Flows.)*
4. Remove the top cover (as described in steps 2 and 3 of Section 3.2.2, *Installing a Fused Silica Transfer Line* to expose the Sample Pressure, Trap Pressure Control (TPC) and Sample Flow controllers on the top left hand side. (See Figure 3-8 on the following page.) **To avoid electrical shock, do not touch any internal parts except the control knobs.**
5. Press and hold SHIFT while you press GO TO.
6. Press <B> Manual Operation.
7. Press <B> Feed Pressure. This closes the vent valve. You will see a flashing P on the display while feed pressure is on.
8. Set the sample gas pressure to 20 psi using the knob marked "Sample Pressure". Read the pressure on the front panel gauge.

3.5 Setting Trap Pressure Control (TPC)

The trap pressure control (TPC) valve is factory set at 4 psi. However, you can change the setting. To do so:

1. Make sure Standby Flow is defaulted to ON. (See Section 3.10.3, *Specify Gas Flows.*)
2. If there is a flashing P, Feed Pressure is on. Turn it off by pressing SHIFT-GOTO, then <B> (Manual Operation), and then <B>, (Feed Pressure). The flashing P should now be off.
3. Read Section 4.4.1.7, *Trap Pressure Control Valve*. Using the knob marked "Trap Pressure Control (TPC)", set the system back pressure. **Do not set the pressure of the TPC valve equal to or higher than the GC column head pressure.**

Note: Anytime you adjust TPC or sample gas pressure, you must recheck the sample gas flow; they are interdependent.

3.6 Setting Sample Gas Flow

1. Make sure Standby Flow is defaulted to ON. (See Section 3.10.3, *Specify Gas Flows*.)

2. Attach a flow meter to the vent fitting on the left front panel of the 3000 to measure the flow rate of the sample gas.

3. Set the sample gas flow to 35-40 ml/min using the knob marked "Sample Flow".

Note: Anytime you adjust TPC or sample gas pressure, you must recheck the sample gas flow; they are interdependent.

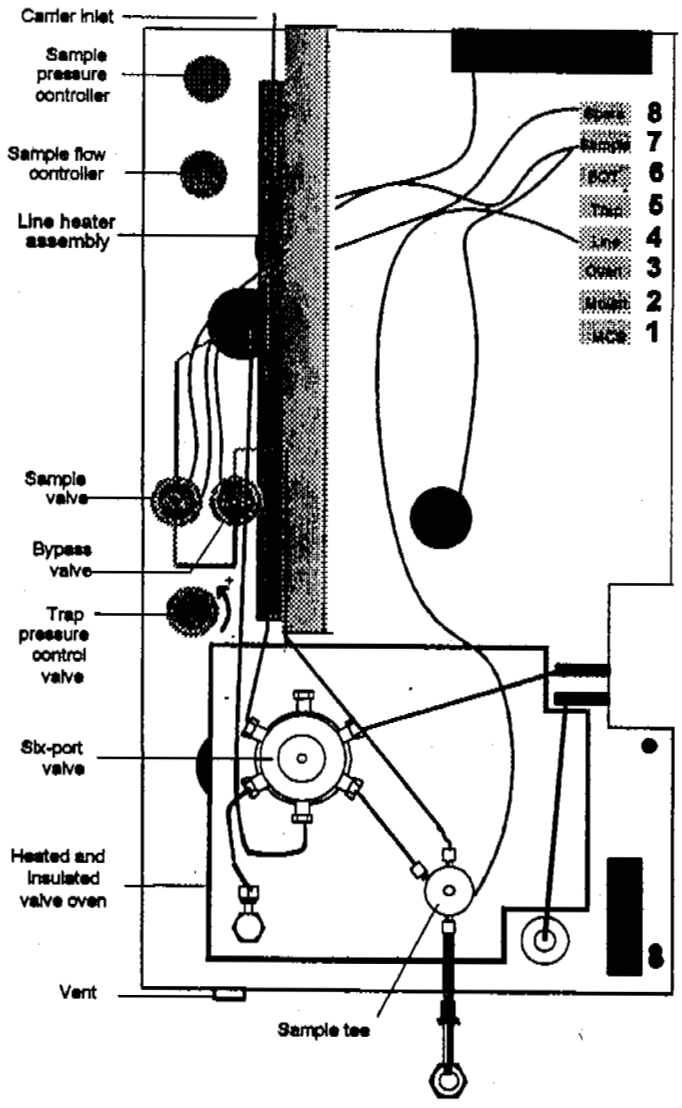


Figure 3-8 Sample Flow and Pressure Controllers

3.7 Installing the Drain Tubing

To install a drain tube for the Tekmar 3000:

1. Attach a length of 1/8" I.D. plastic tubing to the fitting marked "Drain" on the back of the concentrator.
2. Run the drain tube to a sink or waste bottle.

3.8 Making Electronic Connections

If you are using an accessory like an autosampler or a Cryofocusing Module, it must be connected electronically to the 3000 by way of a cable. This cable extends from a port on the accessory to a logic I/O card in the 3000. The 3000 must also be connected electronically to the GC.

3.8.1 Installing Logic Cards

You must install a logic I/O card in one of the 3000's logic card slots for each accessory that you connect to the 3000. (See Figure 3-9 on the following page.)

To access the logic card slots in the 3000:

1. Turn off and unplug the 3000.
2. Loosen the two ¼ turn screws* on the front of the panel.
3. Slide the panel forward and then to the right to remove it.
4. Slide the top panel forward. Then lift it up.
5. Remove the screw holding the top of the right side panel.
6. Lift the right side panel away from the 3000 to expose the logic card slots.

To install a logic card:

1. Loosen the screw on one of the unused card slot covers. Remove the cover.
2. Insert the logic card into the open card slot. Push it in until the back of the board is flush with the other card slot covers and the card seats in the connector.
3. Tighten the screw on the board to secure it.

* 3000s that have a serial number of 94130001 or greater have swell latches (P/N: 14-4578-008) instead of 1/4-turn screws.

3.8.1 Installing Logic Cards, cont.

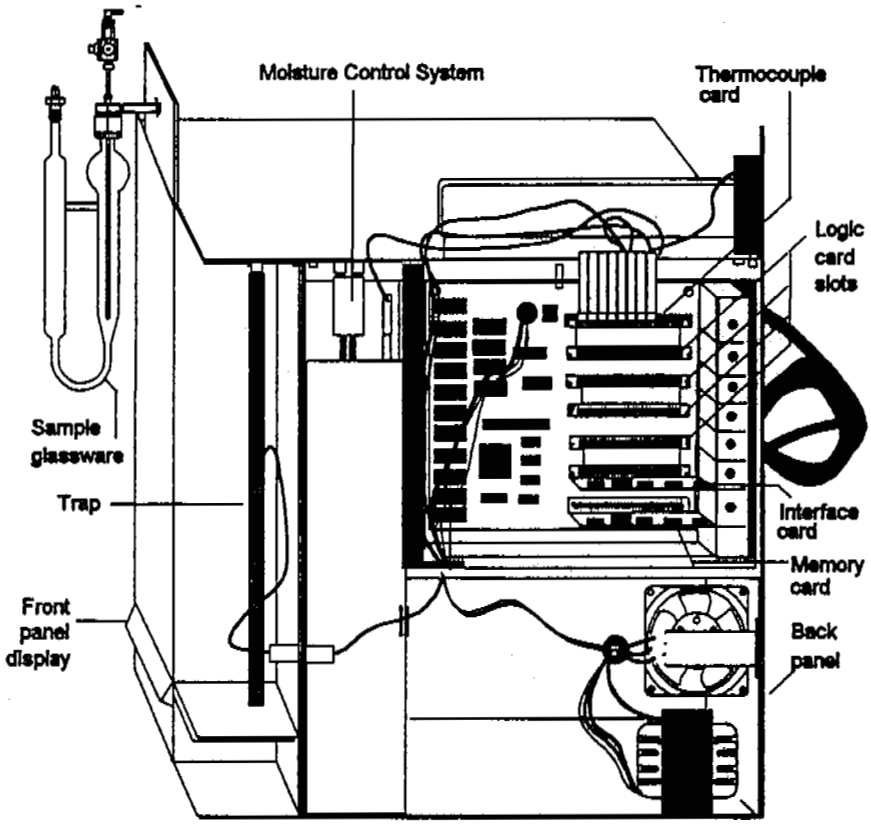


Figure 3-9 Logic Card Slots

3.8.2 Connecting to Accessories (Electronically)

With each accessory, you received an interface cable as well as a logic card. To connect an accessory to the 3000:

1. Insert one end of the cable into the port of the appropriate logic card on the 3000.

2. Connect the other end of the cable to the logic card connector in the accessory, following the installation instructions for the accessory.

3.8.3 Connecting to the GC (Electronically)

The 3000 comes with a GC interface card installed, as shown in the view of the 3000 rear panel in Figure 3-10 on the following page.

Instructions for connecting a 3000 to a specific model of gas chromatograph accompany the interface cable required for your specific 3000-to-GC setup.

Note: If you did not purchase an interface cable, please refer to Section 3.10 for specific configuration instructions for your GC.

continued

3.8.3 Connecting to the GC (Electronically), cont.

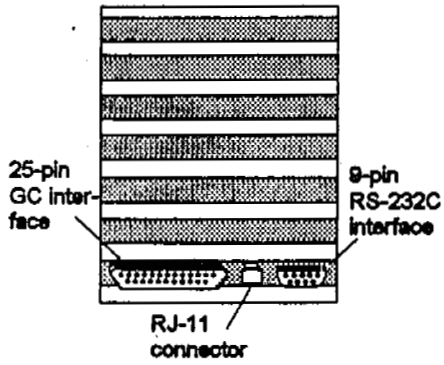


Figure 3-10 GC Interface Card

3.9 Leak Checking Guidelines

⚠ WARNING

To leak check, you must remove the 3000's panels. To avoid electrical shock, do not touch any internal parts except the control knobs. Before you leak check, remove jewelry; it conducts electricity.

To ensure accurate, reproducible results from analytical runs with the 3000, check fittings (pneumatic connections) for leaks. Follow these guidelines when you leak check your 3000 installation:

- Leak check after you have completely assembled the system and made all pneumatic connections.
- Use an electronic thermal conductivity detector (such as a Tekmar Gas Leak Detector, P/N 21-0052-000) to check the fittings.
- Use helium (not nitrogen) as the pressurizing gas. (Electronic leak detectors do not reliably detect nitrogen.)
- If an electronic leak detector is not available, you may use a 1:1 solution of isopropanol and water. Use the solution sparingly to avoid contamination.
- Allow the 3000 to warm up for a least thirty minutes before you leak check. The fittings need time to reach operating temperature and expand; otherwise, they will leak.

⚠ CAUTION

- **Do not use any type of soap solution (for example, Snoop or Detect) to check for leaks. If soap gets into the lines, it will cause background and adsorption.**
- **If you tighten fittings before the 3000 has pressurized and warmed to operating temperature (30 mins.), you could damage the ferrules by overtightening the nuts. You could also strip the threads on the nuts and not be able to remove them.**
- **If you find a leak, finger-tighten the nut, then turn 1/4-turn with a wrench. Recheck. If it still leaks, look for other possible causes; do not overtighten. Leaks can also be caused by a crack in the line or a damaged nut or ferrule. Also, a part may be of incorrect size or material. If a leak problem persists, refer to Chapter 12 and/or call Tekmar Service.**

continued

3.9.1 Leak Checking

To check for leaks in the sample gas flow lines:

1. Follow the instructions in Section 3.4, *Setting Sample Pressure*.
2. Attach a flow meter to the vent fitting on the left front panel of the 3000 to measure the flow rate of the sample gas.
3. Use the knob marked "Sample Flow" to set the sample gas flow to 35 - 40 ml/minute.
4. Put 5 ml of organic-free water in the purge vessel. Step to purge (see 11-7)
5. Do **one** of the following:
   a. Put a 1/16" cap nut on the 3000 vent fitting on the front panel. Tighten the fitting wrench-tight.
   or...
   b. If you have ROM (read-only memory) version 2.10 or greater, you can use the software's Leak Check feature to cap the vent. This feature causes the sample valve to open and the vent valve to close. To start Leak Check, press SHIFT-GOTO, then the B key. Next, choose option C. A flashing "L" on the display indicates that Leak Check is on.
6. Time the bubbling in the purge vessel. If the bubbling stops between three to 14 minutes, the system is leak tight; no further leak checking is necessary.

To diagnose a leak:

1. Make sure the leak is not at the capped vent. The Swagelok nut may be worn.
2. If the bubbling stops before three minutes have elapsed, it is likely that there is a leak upstream of the purge vessel (before the gas flow reaches the purge vessel). If a leak is indicated, leave the system in purge with the vent capped. Capping the vent causes pressure to increase, which exaggerates the leak and makes it easier to find.
3. If the bubbling continues after 14 minutes, a leak exists downstream of the purge vessel (after the gas flow leaves the purge vessel).
4. Using an electronic leak detector, check the fittings at the top and bottom of the trap.
5. Check the fittings inside the valve oven of the 3000.
6. Check these five fittings around the glassware on the front of the 3000:
   a. Purge line fitting (at glassware)
   b. Purge bulkhead (at the 3000)
   c. Sample glassware fitting
   d. Sample needle nut
   e. Sample valve (three-port)

continued

3.9.1 Leak Checking, cont.

7. Check the Swagelok fittings inside the 3000.

After you have installed the 3000 and made all pneumatic connections, the GC column back pressure gauge should show the same reading as before.

- If the gauge reading is higher that its pre-installtion level, check the lines for clogs.
- If the gauge reading is lower than its pre-installation level, there is a leak. Check fittings with a leak detector; tighten as necessary.

For more information, see the chapter titled, *Troubleshooting the 3000* in the back of this manual.

3.10 Configuring the 3000

You can use the Configuration screen (Figure 3-11) to define essential aspects of 3000 operation. Press the CONF key to display the Configuration screen, with the cursor on the first line.

```
     Configuration
<A> =GC I/O Port
 B  =Gas flows
 C  =Installed Option
```

Figure 3-11 Configuration Screen

The Configuration screen (Figure 3-11) displays the following options:

- A =GC I/O Port - specifies the type of GC you are using.
- B =Gas Flows - indicates whether or not the sample pathway is swept with gas during the Standby step.
- C =Installed Option - indicates whether a cooling accessory is installed.

The following sections describe the configuration options and tell you how to use them.

3.10.1 Specify the GC Port Type

Note: You must specify a GC Port or the 3000 may not work with your GC.

On the Configuration screen, select the option on the first line (if necessary); the selected option letter appears with brackets (<A>). Press ENTER to display the GC Configuration screen (Figure 3-12).

```
GC Port          Standard
Handshaking            On

more...
```

Figure 3-12 GC Configuration Screen

continued

3.10.1 Specify the GC Port Type, cont.

From the GC Configuration screen, you can specify the type of GC you are using. The first line displays *GC Port*, a classification based on the input-output characteristics of the GC as it interacts with the 3000.

Note: The GC is interfaced to the 3000 via an interface cable, which runs from the GC to the 25-pin connector on the 3000's GC I/O card. Table 3-1 lists the available GC Port options.

Standard	A standard GC (all input and output signals from a standard GC are normally-open relay closures or TTL active-low signals)
User	The GC supplies or accepts all normally-closed relay closures, all TTL active-high signals, a combination of normally-open and normally-closed relays or a combination of TTL active-low and TTL active-high signals.

Table 3-1 Available GC Port Types

The instructions shipped with your 3000-to-GC interface cable tells you how to specify the type of GC you are using. If you do not have these instructions, refer to table 3-2 on the next pages. Find your GC and the corresponding GC Port on the table and follow the steps below. If you do not have interface cable instructions and you cannot find your GC on the table, see the next section.

1. *If your GC is Standard...*
   Press ENTER to select Standard as the GC Port. The 3000 is now configured to operate with your GC. (Most GCs operate using Standard as the GC Port.) Skip the next steps and go to Section 3.10.2, *Specify Handshaking*.

2. *If your GC is not standard...*
   a. Select User. Press any number key to select User as the GC Port.
   b. Press the NEXT PAGE key to display the Special GC Type screen (Figure 3-13).

```
        Special GC Type

User GC Type          0
See Manual for Help
```

Figure 3-13 Special GC Type Screen

continued on page 21

Tekmar Part Number for the Interface Cable	Description of the Interface Cable and the GC that it Interfaces to	GC Port	GC Type Number
14-2991-000	Hewlett-Packard 5890 GC	Standard	63
14-4830-086	2 Tekmar 2000's on one HP 5890 (GC only. 2000's must hook up to separate columns)	Standard	63
14-4188-086	Hewlett-Packard 5890 w/5970 MSD and Unix or Pascal-based software	Standard	63
14-4652-086	Hewlett-Packard 5890 w/5970 MSD and Unix-B or MS-DOS software, HP 5890/5971 MSD and Unix-B or MS-DOS software and HP 5890/5989 MS Engine	User	31
14-2993-000	Hewlett-Packard 5995/96/95/85/87/88/92 GC/MS with HP-1000/RTE GC/MS software, HP 5890 w/5970 MSD and RTE (RTE-A, RTE-6, or REV F)	User/Slave Mode Standard/Master Mode	31 63
14-2976-000	Hewlett-Packard 5710/30/90 GC w/5970 MSD with Chemstation using Quicksilver Software	User	31
14-2990-000	Hewlett-Packard 5880A/5840A	Standard	63
14-3318-000	Hewlett-Packard 5995/96/87/85/92 with Chemstation-Quicksilver	Standard	63
14-3010-000	Hewlett-Packard 5995/85/93/92 GC/MS (includes I/O box). Requires HP's BATCH or AQUARIUS software and external events relay board to operate with SIDS Data System	Standard	63
14-2968-000	Varian 3300/3400/3500/3600 with or without serial I/O and Saturn GC/MS	Standard	63
14-5044-086	2 Tekmar 2000's to one Varian 3400 GC (2000's must hook up to separate columns)	Standard	63
14-2969-000	Varian 3700	Standard	63
14-2966-000	Kit, Varian Vista (includes I/O box for switching 2000A to 2000B) also Varian 6000	Standard	63

Table 3-2 GC Port Types and User GC Type Numbers

Tekmar Part Number for the Interface Cable	Description of the Interface Cable and the GC that it Interfaces to	GC Port	GC Type Number
14-2972-000	Tracor 560/565/570	Standard	63
14-2992-000	Tracor 540 and Waters Dimension I	Standard	63
14-4655-086	2 Tekmar 2000's to one Tracor 540 (GC only. 2000's must hook up to separate columns.)	Standard	63
14-3430-000	Tracor 585/9000 and Waters Dimension II	Standard	63
14-2970-000	Perkin-Elmer Sigma Series	Standard	63
14-3233-000	Perkin-Elmer 8000 Series/Autosystem	Standard	63
14-5397-086	2 Tekmar 2000's on one Perkin-Elmer 8000 Series/Autosystem	Standard	63
14-2973-000	Schimadzu GC 9A	User	31
14-4610-086	Shimadzu GC 14A/15A, GC 14A w/QP 1000 EX MSD and GC 14A w/QP 2000 MSD	User	31
14-4009-000	Splicer Cable, Finnigan 5100/4000/4500 and OWA	User	31
14-4938-086	Carlo Erba Mega/Vega Series and Fisons 8000	Standard	63
14-3147-000	General Purpose/HNU 301/321/421*	Standard	63

* Valve driver option necessary from HNU.

Table 3-2 GC Port Types and User GC Type Numbers

3.10.1 Specify the GC Port Type, cont.

c. Enter the User GC Type number. If you do not know which number to enter, find your GC on Table 3-2. Enter the number that is in the GC Type Number column.
d. Go to Section 3.10.2, *Specify Handshaking*.

If you wish to understand more about the GC Port Type and the User GC Type Number, see the next section.

3.10.1.1 Determine I/O Signal Characteristics

Read this section if you wish to understand more about the GC Port Type and the User GC Type Number.

During operation, the 3000 sends and receives the following signals:
- A Begin/End Desorb output signal.
- A Start GC/MS and Data System output signal.
- A Desorb Ready output signal.
- A GC Ready/Continue input signal.
- A Purge Ready output signal.
- A Purge Permission input signal.

I/O signal characteristics vary. Some GCs use normally-closed contact closures or active-high TTL; others use normally-open contact closures or active-low TTL. You use the User GC Type field to customize the 3000's input and output signals to operate with your GC.

User GC Type is a number from 0 to 63 that defines the electronic control signals used when the 3000 communicates with the GC. The User GC Type number is the decimal representation of a six-digit binary number in which each digit, or bit, indicates the type of closure supplied or accepted by your GC: 1 for normally-open or TTL active-low; 0 for normally-closed or TTL active-high.

Table 3-3 shows the characteristics that define input and output signals.

Bit No.	Pin no.	I/O	Signal Function	Contact Closure Type
0	19, 20	Output	Begin sample transfer	Specific to your GC
1	21,22 23, 24	Output	Start GC/MS and data system	Specific to your GC
2	17,18	Output	Sample transfer ready	Specific to your GC
3	15,16	Output	Start an accessory during Purge Ready	Specific to your GC
4	2	Input	Start	Specific to your GC
5	4	Input	Ready/Continue	Specific to your GC

Table 3-3 I/O Signal Characteristics for the 3000

continued

3.10.1.1 Determine I/O Signal Characteristics, cont.

For the columns in Table 3-3 on the previous page:

- Column 1 (Bit No.) indicates position in a binary number. Bit 0 is the right-most digit in a binary number; bit 1 is the digit to the left of bit 0; and so on. Bit 5 is the left-most digit in a binary number. For example, the I/O characteristics shown in the table below are represented by the binary number 111011.

Bit Number:	5	4	3	2	1	0
Closure Type:	1	1	1	0	1	1

Each position in the binary number has a place value that is used in calculating the decimal number for the User GC Type.

- Column 2 (Pin No.) of Table 3-3 specifies the pin number(s) (on the 25-pin interface cable through which the signals travel.
- Column 3 (I/O) indicates whether the signal is received by the 3000 (input) or sent by the 3000 (output).
- Column 4 (Signal Function) describes what the signal does.
- Column 5 (Contact Closure Type) indicates the type of signal used by your GC.

To determine the numbers you need to enter in Column 5:

1. Refer to your GC manual to see what type of signal (normally-closed closure, normally-open closure, TTL-high signal, or TTL-low signal) for each of the signaled functions.

2. In the second row of Table 3-4 below, enter 1 or 0 under each bit number designation: enter 1 if the contact closure is normally-open or TTL-low; enter 0 if the contact closure is normally-closed or TTL-high.

Bit Number:	5	4	3	2	1	0
Signal Function:	Ready/ Continue	Start	Start accessory during Purge Ready	Sample transfer ready	Start GC/MS & data system	Begin sample transfer
Closure Type:						

Table 3-4 Blank I/O Signal Characteristics Chart

continued

3.10.1.1 Determine I/O Signal Characteristics, cont.

For example, for a GC using all normally-open contact closures, the completed table will look like the one in Table 3-5:

Bit Number:	5	4	3	2	1	0
Signal Function:	Ready/ Continue	Start	Start accessory during Purge Ready	Sample transfer ready	Start GC/MS & data system	Begin sample transfer
Closure Type:	1	1	1	1	1	1

Table 3-5 Sample I/O Signal Characteristics Table

You can view the LEDs on the GC interface PCB (printed circuit board) to determine I/O signal characteristics. (See the description for the GC Interface PCB in the *3000 Service Manual.*)

3.10.1.2 Convert the Binary Number to a Decimal User GC Type

Table 3-6 is a worksheet to help you calculate the User GC Type field. The first row lists the bit number indicating the position of a digit. The second row shows the 1 or 0 designation for closure type. The third row shows the place value for each bit in the binary number.

Bit Number:	5	4	3	2	1	0
Closure Type :						
Place Value:	32	16	8	4	2	1
(Row 2) x (Row 3):						

Table 3-6 Blank Calculation Table

To calculate the number that you need to enter in the User GC Type field:

1. Enter the closure type designations into the second row of Table 3-6.
2. Multiply each second-row number by the corresponding number in the third row; write each product in the appropriate column in the last row.
3. Add all the numbers in the last row; the total is the User GC Type.

continued

3.10.1.2 Convert the Binary Number to a Decimal User GC Type, cont.

Examples:

- For a GC with the following I/O characteristics:
  Bit 5 = 1, Bit 4 = 1, Bit 3 =1, Bit 2 = 1, Bit 1 = 0, Bit 0 = 1
  The calculation table looks like this one (Table 3-7):

Bit Number:	5	4	3	2	1	0
Closure Type:	1	1	1	1	0	1
Place Value:	32	16	8	4	2	1
(Row 2) x (Row 3):	32	16	8	4	0	1

Table 3-7 Sample Calculation Table 1

The User GC Type is equal to the sum of 32 + 16 + 8 + 4 + 0 + 1, which is 61.

- For a GC with the following I/O characteristics:
  Bit 5 = 1, Bit 4 = 1, Bit 3 =1, Bit 2 = 0, Bit 1 = 0, Bit 0 = 1.
  The calculation table will look like this one (Table 3-8) :

Bit Number:	5	4	3	2	1	0
Closure Type:	1	1	1	0	0	1
Place Value:	32	16	8	4	2	1
(Row 2) x (Row 3):	32	16	8	0	0	1

Table 3-8 Sample Calculation Table 2

The User GC Type is equal to the sum of 32 + 16 + 8 + 0 + 0 + 1, which is 57.

4. Press the PREV PAGE key to return to the screen.

Note: If you have a scientific calculator with a binary-to-decimal conversion mode, you can use it to convert the binary number. Remember that the bit number indicates position in the binary number, with Bit 0 in the right-most position and Bit 5 in the left-most position. The input/output characteristics shown in the table below are represented by the binary number 111011.

Bit Number:	5	4	3	2	1	0
Closure Type:	1	1	1	0	1	1

3.10.2 Specify Handshaking

To access the Configuration screen, press the CONF key. The second line on the Configuration screen displays the 3000-GC handshaking characteristics - whether or not the 3000 will wait for a signal from the GC (a handshake) before sending a sample. The available options are:

- On - the GC interface port operates normally.
- Off - the GC interface port operates with no input or output signals between the 3000 and the GC. The 3000 will cycle continuously.

1. Press any number key to toggle the option ON or OFF.

2. Press ENTER to accept the currently-displayed option.

3.10.3 Specify Gas Flows

To access the Configuration screen, press the CONF key. On the Configuration screen, select the option on the second line; the selected option letter appears with brackets (<B>). Press ENTER to display the Gas Flows Configuration screen (Figure 3-14).

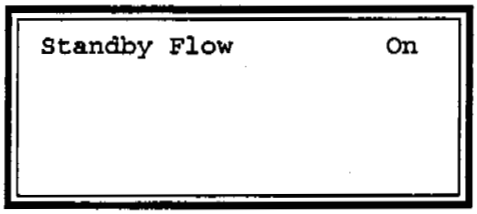


Figure 3-14 Gas Flows Configuration Screen

The screen illustrated above indicates that Standby Flow is turned on. This setting forces sample gas flow through the sample pathway, bypassing the sample vessel (bypass valve ON) in the Standby mode. You can shut off flow through the sample pathway by selecting the OFF option for Standby Flow. This closes the sample, bypass, and vent valves.

3.10.4 Specify Installed Options

On the Configuration screen, select the option on the third line; the selected option letter appears with brackets (<C>). Press ENTER; the Installed Options Configuration screen appears (Figure 3-15) with the Trap Region field set to Ambient.

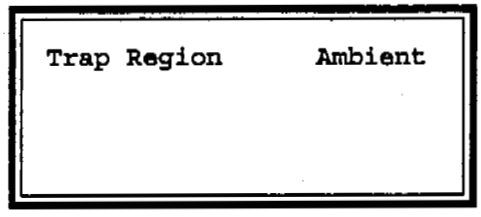


Figure 3-15 Installed Options Configuration Screen

continued

3.10.4 Specify Installed Options, cont.

Select one of the following values for the Trap Region field:

- Ambient - the 3000 uses the standard internal trap at ambient temperature.
- TurboCool -the 3000 operates at cryogenic temperatures with a TurboCool accessory installed.
- Cryo - this option will be included in future versions of the 3000 operating software.

Note: If your ROM (read-only memory) version is prior to 2.13, TURBO-Cool will lower the trap temperature if it exceeds the setpoint. This action occurs in Desorb mode. For example, if you program the 3000 to maintain the temperature of the trap at 230°C in Desorb mode, and the temperature rises to 238°C, TURBO-Cool will cool the trap to 230°C.

4.1 Overview

An analytical run on the Tekmar 3000 consists of a programmed sequence of steps, called a *method*. At the factory, the Tekmar 3000 is programmed with the 16 methods listed in Table 4-1.

Method #	Sample Location	Analytical Protocol
1	3000 front panel	Tekmar default
2	2016/2032 autosamplers	Tekmar default
3	3000 front panel	USEPA 502.2/524.2
4	2016/2032 autosamplers	USEPA 502.2/524.2
5	3000 front panel	USEPA 602
6	2016/2032 autosamplers	USEPA 602
7	3000 front panel	USEPA 601/624
8	2016/2032 autosamplers	USEPA 601/624
9	3000 front panel	USEPA 8000 series
10	2016/2032 autosamplers	USEPA 8000 series
11	3000 front panel	USEPA CLP-VOA
12	2016/2032 autosamplers	USEPA CLP-VOA
13	2016/2032 autosamplers	Bakeout (to clean out sample pathway)
14	AQUATek 50 to 3000 front panel	Tekmar default
15	AQUATek 50 to 2016/2032 autosamplers	Tekmar default
16	6016/6032 autosamplers	Tekmar default

Table 4-1 Tekmar 3000 Default Methods

Section 6.0 *Programming the 3000* defines the parameters for these default methods and tells you how to customize methods by changing certain operating parameters to meet your analytical requirements.

This section, *Understanding Operating Steps*, performs the following functions:

- Describes the operating steps used by the 3000 in various analytical configurations and defines the default values assigned to parameters in each step.
- Tells you which parameters you can program to create customized methods.

4.2 Steps in an Operating Sequence

Depending on the system configuration (see Section 1.4, *System Configurations*) and installed accessories, the 3000 goes through a programmed sequence of operating steps. Table 4-2 lists the operating steps in order of their occurrence. If an operating step is active only under certain conditions (with a specific system configuration or when a specific accessory is installed), the second column in the table defines the conditions. The third column in the table describes each step.

Note: If the ROM (read-only memory) version in your 3000 is prior to 2.13, the Turbo Cooldown step occurs after the Sample Fill step. Also, the GC Synchronize step occurs after the Purge Ready step.

Step	When Present	Purpose
Standby	All configurations	The main preparatory step for each run; it establishes initial conditions on power up, restart, or after a run. When the 3000 powers up or returns to its starting conditions after a run, this step is active. Press START to begin a run.
GC Synchronize	All configurations	Adds enough time to the 3000 operating cycle to synchronize it with the GC cycle. When the 3000 is connected to an autosampler and running multiple samples, this step replaces Purge Ready between samples.
Turbo Cooldown	When a TURBOCool accessory is installed	Cools the trap to its low temperature setpoint for trapping analytes.
Purge Ready	All configurations	Waits for a start signal from the user (via the START key on the keypad) or from an accessory before proceeding to the next step. The Purge Ready screen displays the message "Press start to begin" and the number of the current method.
Sample Fill	When an AQUATek 50 autosampler is used	Opens the vent valve in the 3000 to allow sample transfer from the AQUATek 50 to the 3000 or to the 2016/2032 autosampler.
Prepurge	When a sample heater is installed and activated	Sends gas flow through the sample glassware to remove oxygen and to blanket the sample with inert gas. The inert gas prevents oxidation during the Purge step.
Preheat	When a sample heater is installed and activated	Heats the sample before the Purge step.
Purge	All configurations	Flushes the sample with purge gas for a specified length of time.
Dry Purge	All configurations	Sweeps dry gas through the 3000 trap to remove moisture.
MCS Cooldown	All configurations	Cools the Moisture Control System to its Desorb setpoint before desorption.

Table 4-2 Tekmar 3000 Operating Steps

4.2 Steps In an Operating Sequence, cont.

Step	When Present	Purpose
Desorb Ready	All configurations	During this step, the concentrator sends a DESORB READY signal to the GC and waits for the GC READY signal.
Cryo Cooldown	When a Cryofocusing Module is installed	Cools the Cryofocusing Module to its low temperature setpoint for trapping analytes before desorption onto the column.
Desorb Preheat	All configurations	Heats the concentrator trap to a specified preheat temperature before desorbing the analytes.
Desorb	All configurations	Backflushes the analytes off the heated concentrator trap onto the Cryofocusing Module (if present) or directly onto the GC and gives the GC a START signal.
Inject	When a Cryofocusing Module is installed	Transfers the sample from the Cryofocusing Module to the GC. Used only if a Cryofocusing Module is installed.
Bake	All configurations	Turns the MCS and the concentrator trap heaters up to Bake temperatures, turns on the sample bypass and vent valves, and sends clean gas through the unit to sweep residual moisture and organic contaminants from the lines.

Table 4-2 Tekmar 3000 Operating Steps, cont.

4.3 Operating Cycle Time

Operating cycle time is important for system configurations in which a TurboCool accessory is installed. Figure 4-1 illustrates relative operating cycles for the 3000 and the GC. Each unit has a fixed *cycle time,* or number of minutes required to complete an operating sequence.

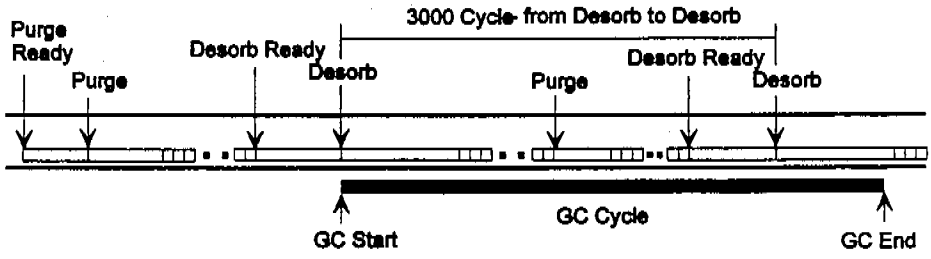


Figure 4-1 GC and 3000 Cycle Times

If the time from GC Start to GC End (including time for the GC to cool down) is longer than the uninterrupted 3000 cycle time from Desorb to Desorb, the 3000 waits in Desorb Ready until it receives a GC READY signal from the GC. To minimize the length of time in Desorb Ready (and reduce cryogenic usage), a GC Synchronize step is added between samples for all multiple sample runs, as illustrated in Figure 4-2.

4.3 Operating Cycle Time, cont.

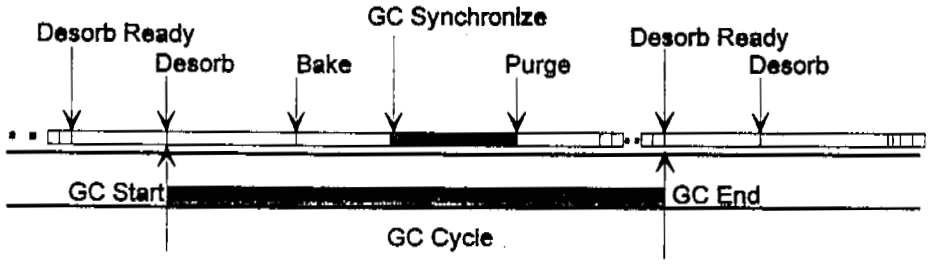


Figure 4-2 Synchronizing 3000 and GC Cycle Times

4.4 Operating Step Parameters

Purge and trap operations are controlled by valve configurations that determine gas pressure and flow for carrier gas and sample gas. Figure 4-3 shows the drain lines, vent lines, and flow paths for carrier gas and sample gas in the 3000.

4.4.1 Valve Settings

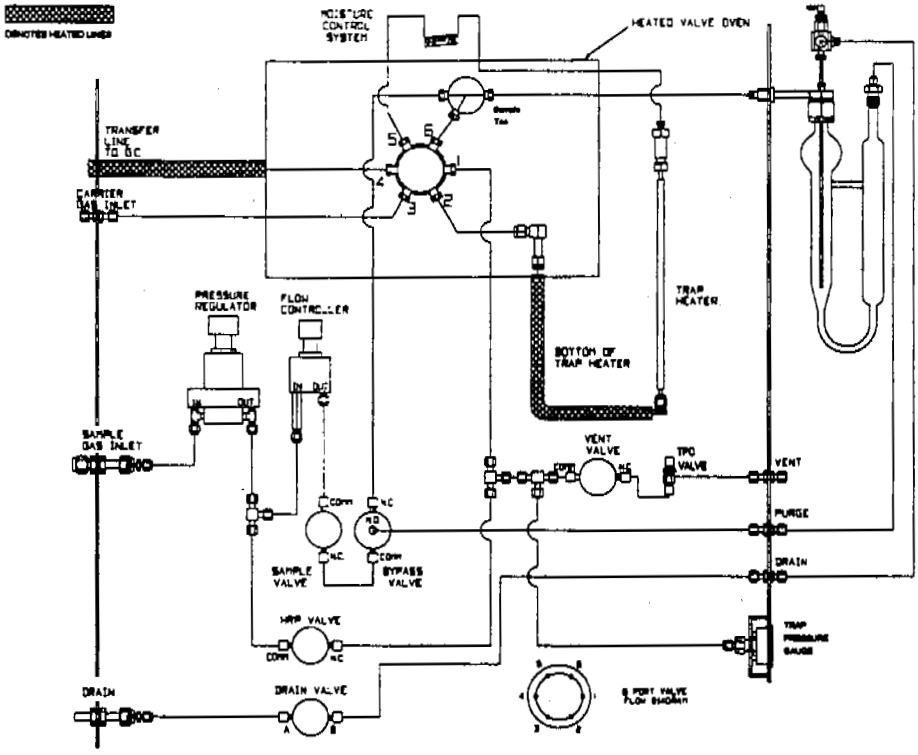


Figure 4-3 3000 Flow Paths

Note: See the full-size, color-coded flow path diagrams in the back of this manual.

4.4.1.1 Sample Valve

The flow controller and pressure regulator control the flow rate and pressure of the gas coming into the 3000. Gas flows to the normally closed sample valve. If Standby flow is turned on through the software (See *Specify Gas Flows* in Section 3.), gas flows through the sample valve during Standby, Purge Ready, Purge, Desorb Ready, Desorb with Drain and Bake. If Standby flow is turned off, gas flows through the sample valve during Purge, Dry Purge and Bake. Also, when you use Desorb without the drain, the sample valve is closed. (See *Manual Drain* in Section 7.)

4.4.1.2 Bypass Valve

When the sample valve is open, sample gas flows to the three-way bypass valve. During the Standby, Purge Ready, Dry Purge, and Bake (with Bake Gas Bypass) steps, the bypass valve directs flow from the sample valve to the sample tee, bypassing the sample glassware. During the Purge, Desorb Ready, Desorb Preheat, Desorb, Desorb with Drain, and Bake steps, the bypass valve directs flow from the sample valve to the sample glassware on the front panel of the 3000.

4.4.1.3 Drain Valve

The drain valve opens to allow liquid to flow from the sample glassware to exit at the 3000 drain at the rear of the concentrator.

4.4.1.4 HRP Valve

The high rate purge (HRP) valve is normally closed. It works with the drain valve. When the HRP and drain valves are open during the Desorb step (when autodrain is on), incoming sample gas is split, allowing flow to pressurize the sample glassware and force liquid up through the needle, out of the glassware through the drain on the rear of the 3000.

4.4.1.5 Vent Valve

The vent valve opens to allow pass-through flow during the Standby, Purge Ready, Purge, Dry Purge, Bake, and Bake with Bake Gas Bypass steps. When it is open, gas flows through the sample pathway and out the vent on the front of the 3000.

4.4.1.6 Six-Port Valve

The six-port valve (located inside the valve oven) has two positions that control the direction of sample and carrier gas flow through the concentrator. The concentrator operates with two separate gas flows:

- Sample gas enters through the sample gas inlet at the back of the unit and exits through the front panel vent valve.
- Carrier gas enters through the carrier gas inlet at the back of the unit and proceeds through the transfer line to the gas chromatograph.

The six-port valve controls the route traveled by the sample and carrier gas during each step in the operating sequence. Figure 4-4 shows the initial six-port valve setting, called the *Standby configuration*.

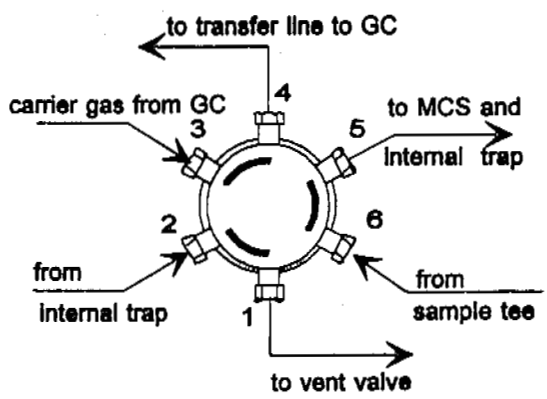


Figure 4-4 Six-port Valve Standby Setting

4.4.1.6 Six-Port Valve, cont.

The Standby configuration for the six-port valve is in effect during all operating steps except Desorb (with or without drain). In Standby:

- Carrier gas enters the six-port valve and exits immediately through the transfer line to the gas chromatograph.
- Sample gas enters the six-port valve from the sample tee and flows over to the trap; from the trap it returns to the six-port valve and exits out the vent valve.

Figure 4-5 shows the six-port valve Desorb configuration.This configuration is in effect during Desorb. Carrier gas enters the six-port valve and flows over to the bottom-of-the-trap area, backflushes the trap, returns to the six-port valve, and exits through the transfer line to the gas chromatograph.

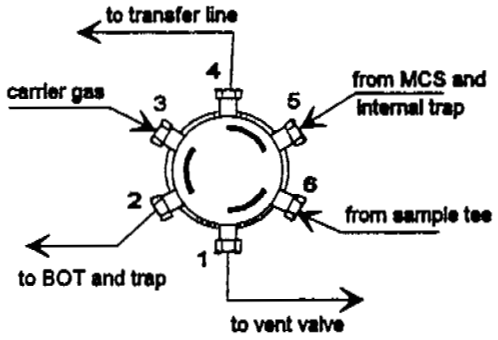


Figure 4-5. Six-port Valve Desorb Setting

4.4.1.7 Trap Pressure Control Valve

The trap pressure control (TPC) valve is a needle valve located between the vent valve and the front panel vent opening. The TPC valve regulates back pressure on the trap. Increasing pressure on the trap shifts the partitioning of volatile analytes between the vapor phase and stationary phase, allowing the analytes to have increased interaction with the adsorbent. They do not travel as far into the adsorbent, and, as a result, are released in a tight band upon desorption. This improves peak shape and sensitivity.

The TPC valve is not under program control; you adjust it manually. At the factory, the TPC valve is set to maintain the recommended back pressure of 4 psi. **Do not set the pressure of the TPC valve equal to or higher than the GC column head pressure.** As a rule, the difference between the TPC valve and feed pressure settings should be greater than 10 psi. (See Section 7.5 for more information on feed pressure.) For example, if the feed pressure is 20 psi, set the pressure of the TPC valve less than 10 psi. While TPC valve pressure can be beneficial at the correct level, setting it too high can cause carryover.

See Section 3.5 for instructions on setting the TPC valve pressure.

4.4.2 Time and Temperature Parameters

An operating step can define the temperature setpoint for heating or cooling and the length of time during which the temperature will be maintained at setpoint. Depending on your system configuration and installed accessory options, you can program methods that specify required time and temperature values for heating and/or cooling the following parts:

4.4.2 Time and Temperature Parameters, cont.

- Sample heater on the front panel (optional).
- Six-port valve and tee in the valve oven.
- Transfer line heater from the 3000 to the GC.
- Moisture Control System (MCS) just behind the trap.
- Adsorbent trap during Standby, Desorb, and Bake.
- Bottom-of trap (line from the six-port valve to the bottom of the trap).
- Cryofocusing Module at the injection port of the GC (if used).
- Valve and line temperatures of optional autosampler(s).

4.5 Understanding Operating Steps

Before beginning a run, the 3000 is in Standby. Standby is active until heated (and/or cooled) parts reach their setpoints.

Note: If your ROM version is 2.13 or greater, the trap temperature equilibrates to Purge Ready temperature in the Standby step and to Purge temperature in the Purge Ready step. These actions occur whether or not TURBOCool is installed. The temperature screen calls the TURBOCool trap "ambient" in the Purge Ready step, even if TURBOCool is activated.

4.5.1 Purge Ready

On the first run in a schedule, this step pauses to wait for a start signal. If the 3000 is operating with an autosampler, the autosampler rotates through sample positions until it reaches the starting position specified in the current operating sequence. Figure 4-6 and Table 4-3 show valve configurations during Standby and Purge Ready.

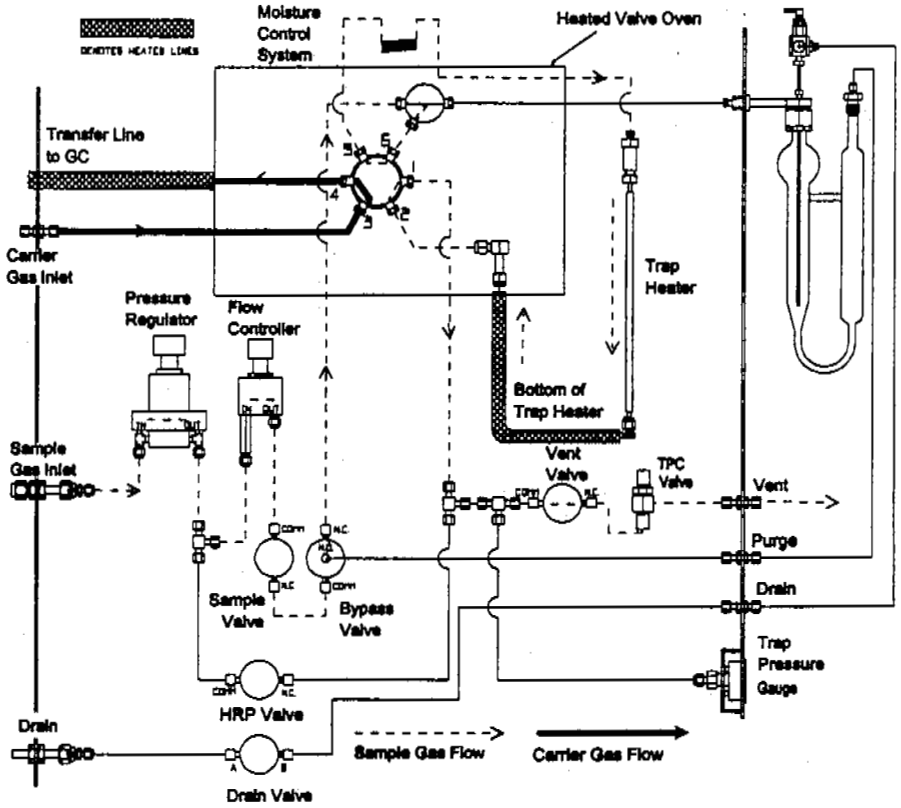


Figure 4-6 Gas Flow during Standby and Purge Ready

Valve Designation:	Sample	Bypass	Vent	HRP	Drain	6-port
Position:	open[1]	on[1]	open[1]	closed	closed	Standby

[1] Only if Standby Flow is on.

Table 4-3 Valve Configuration during Standby and Purge Ready

4.5.2 GC Synchronize

If you have installed a TURBOCool accessory, a GC Synchronize step replaces Purge Ready between runs on a multiple sample sequence. During GC Synchronize, the 3000 waits before proceeding to the next step. The 3000 calculates the length of the delay (up to 1000 minutes), based on the GC cycle time parameter. Valve settings during this step do not change.

4.5.3 Sample Fill

If your configuration includes an AQUATek 50 automatic sampler, during the Sample Fill time specified for this step, the sample volume is transferred into the sample glassware on the 3000 or on the ALS autosampler. For more information, refer to the AQUATek 50 User Manual.

4.5.4 TURBO Cooldown

If you have installed a TURBOCool accessory, this step cools the TURBOCool trap to its low temperature setpoint (TURBOCool Temp).

4.5.5 Prepurge and Preheat

If you installed and turned on a sample heater, the 3000 can operate with Prepurge and Preheat steps. During Prepurge, the bypass valve allows purge gas to flow through the sample glassware for a programmed time (Prepurge Time) before the sample is heated. The flow of gas blankets the sample with inert gas to avoid heat-induced sample oxidation. See Section 6.4.2 to determine Prepurge Time.

During Preheat, the sample is heated to the programmed sample temperature setpoint (Sample Temp) for a programmed time (Preheat Time). This step should be just long enough to heat the sample to temperature. It is best to avoid long preheat times. There is no Purge flow during Preheat.

4.5.6 Purge

During Purge, the sample is purged with sample gas for the time specified in the Purge Time parameter. Table 4-4 and Figure 4-7 show the change in valve configurations for Prepurge and Purge.

Valve Designation:	Sample	Bypass	Vent	HRP	Drain	6-port
Position:	open	off	open	closed	closed	Standby

Table 4-4 Valve Configuration during Purge

Gas enters the sample gas inlet, flows through the pressure and flow regulators, through the sample and bypass valves, to the sample glassware.

4.5.6 Purge, cont.

Analytes are released from the sample. They flow through the sample line and the six-port valve. Then they are adsorbed on the concentrator trap.

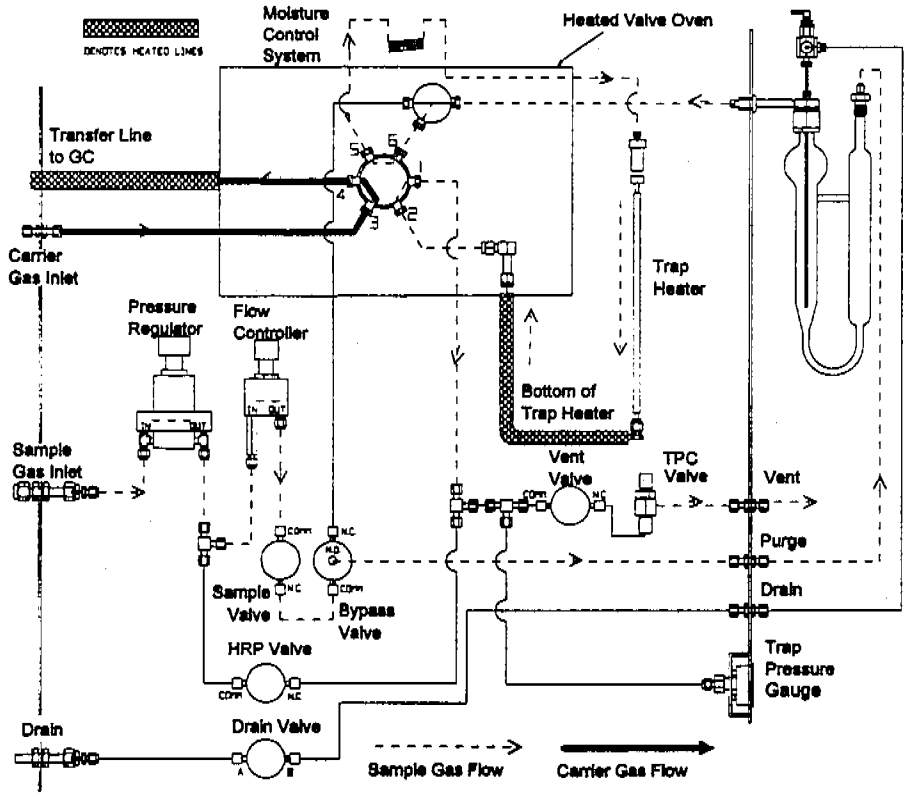


Figure 4-7 Valve Configuration during Prepurge and Purge

4.5.7 Dry Purge

During Dry Purge, the bypass valve closes, as indicated in Table 4-5.

Valve Designation:	Sample	Bypass	Vent	HRP	Drain	6-port
Position:	open	on	open	closed	closed	Standby

Table 4-5 Valve Configuration during Dry Purge

Dry Purge sweeps dry gas through the concentrator trap for a programmed time (Dry Purge Time), normally 4 - 6 minutes. If the trap is packed with a hydrophobic adsorbent like Tenax, the flowing gas removes water. If the trap contains silica gel or charcoal, this step does not remove water.

4.5.8 MCS Cooldown

This step cools the MCS (Moisture Control System) to its moisture removal setpoint (MCS Des Temp) for the Desorb step.

4.5.9 Desorb Ready

During Desorb Ready, valve configurations change, as shown in Table 4-6.

Valve Designation:	Sample	Bypass	Vent	HRP	Drain	6-port
Position:	closed	off	closed	closed	closed	Standby

Table 4-6 Valve Configuration during Desorb Ready

The 3000 outputs a Desorb Ready signal to the GC and waits for a GC Ready signal in return. There is no Purge gas flow. Temperature setpoints are maintained, unless the MCS and Cryofocusing Module are cooling to their setpoints (MCS Des Temp and CryoFocus Temp).

4.5.10 Cryofocusing Module Cooldown

The Cryofocusing Module cools desorbed analytes and focuses them on the head of the column before they are introduced into the GC. Every operating sequence does not use a Cryofocusing Module; this step is not required unless a Cryofocusing Module is installed. Setting the CryoFocuser parameter to "off" eliminates the cryofocusing steps from the operating sequence. The Cryofocusing Module will go to the Cryo Standby temperature. During Cryofocusing Module Cooldown, the unit is cooled to its setpoint (CryoFocus Temp).

4.5.11 Desorb Preheat

During Desorb Preheat, the concentrator trap is heated to a specified temperature (Desorb Preheat) in preparation for analyte transfer from the trap to the GC. There is no flow through the concentrator trap during Desorb Preheat.

4.5.12 Desorb

During Desorb, the six-port valve rotates and the concentrator trap heats to a temperature setpoint (Desorb Temp) for the time specified in Desorb Time. Figure 4-8 and Table 4-7 show the valve configurations in the 3000 during Desorb.

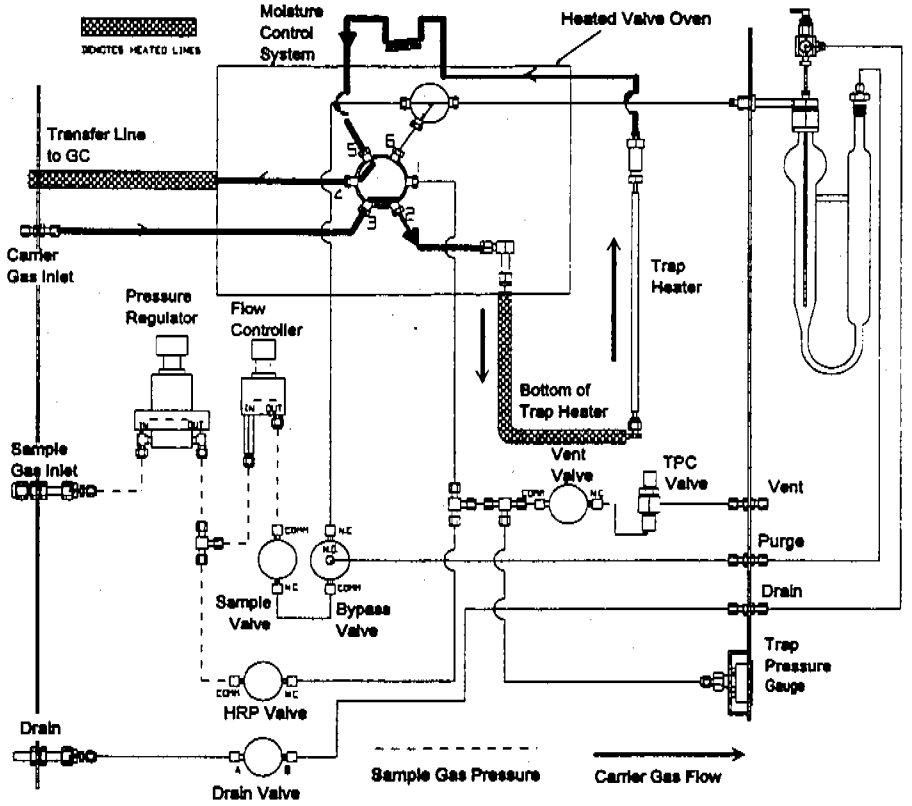


Figure 4-8 Valve Configuration during Desorb

Valve Designation:	Sample	Bypass	Vent	HRP	Drain	6-port
Position:	closed	off	closed	closed	closed	Desorb

Table 4-7 Valve Configuration during Desorb

Gas enters the 3000 at the carrier inlet, flows through the six-port valve, backflushes the concentrator trap through the MCS (where the water is trapped), and flows back to the six-port valve, where it exits through the transfer line to the GC. As the gas backflushes the trap, it carries released analytes over to the GC.

4.5.13 Desorb with Drain

If the 3000 is set to drain during Desorb, the HRP, sample, and drain valves are open, as shown in Table 4-8.

Valve Designation:	Sample	Bypass	Vent	HRP	Drain	6-port
Position:	open	off	closed	open	open	Desorb

Table 4-8 Valve Configuration during Desorb with Drain

4.5.14 Cryofocusing Inject

This is a timed step (specified by the Inject Time parameter) during which the Cryofocusing Module is heated to a programmed setpoint (Cryo Inj Temp). Heat releases the analytes that had been immobilized on the Cryofocusing Module column.

Note: Bake and Cryofocusing Inject begin at the same time.

4.5.15 Bake

Bake cleans out the sample pathway by heating the MCS and the concentrator trap to their programmed bake out setpoints (MCS Bake Temp and Trap Bake Temp) and blowing clean gas through the 3000 for the length of time specified in the Bake Time parameter.

During Bake with Bake Gas Bypass (BGB) off, gas follows the Purge flow path through the concentrator and glassware to sweep out all moisture and residual analytes. If the autodrain is on (i.e., drinking water samples), BGB should be off. This allows gas to dry out the glassware. If the autodrain is off (i.e., soils and wastewater samples), BGB should be on. With BGB on, there is no flow through the sample glassware. This prevents additional analytes being "purged" onto the trap during the Bake mode.

5.1 Overview

With the 3000's hand-held controller, you can program and run analytical methods. This section tells you how to:

- Use the 3000's hand-held controller.
- Read status screens on the hand-held controller and the front panel screens.
- Power up the 3000 and run self tests.
- Configure the 3000 to operate with your gas chromatograph (GC).

5.2 Using the Hand-Held Controller

The hand-held controller consists of a four-line, 20-character wide, LCD (liquid crystal display) and a 30-key keypad (Figure 5-1).

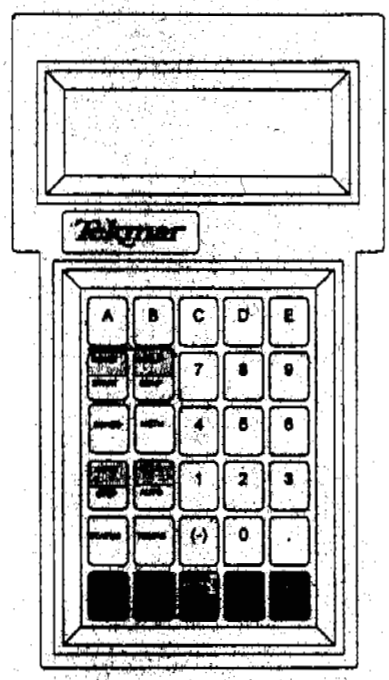


Figure 5-1 Tekmar 3000 Hand-held Controller

You use the keypad and display screen to communicate with the 3000.

- The four-line *controller screen* displays data entry fields for programming, menus for selecting commands, and status information for viewing during operation.
- The *controller keypad* consists of five variable-function keys, 13 control keys, and 12 numeric keys. You can use the keys to monitor the 3000's operational status and program it to run different operating sequences.

5.2.1 Installing the Hand-held Controller

The hand-held controller comes with an interface cable. To connect the controller to the 3000, refer to Figure 5-2.

1. Locate the jack on the bottom of the front panel display housing.
2. Plug the end of the cable into the front panel jack.
3. Plug the other end of the cable into the jack on the bottom of the controller.

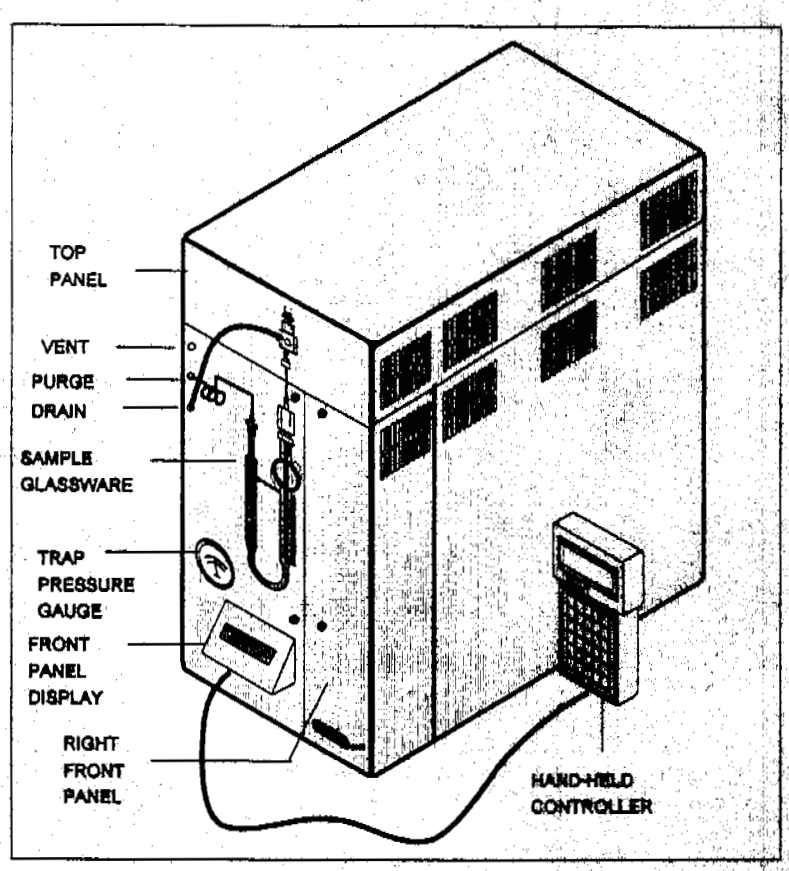


Figure 5-2 Concentrator and Hand-held Controller

5.2.2 Variable Function Keys

Keys in the first row (labeled A - E) are used to select options from a screen menu. Their function varies, depending on the options displayed on the current screen. For example:

- From the Setup screen, press the A key to display system information.
- From the Reset screen, press the A key to abort a schedule.

5.2.3 Control Keys

The *control keys* consist of:

- Action keys (RESET, START, AUTO, HOLD, STEP, and GO TO). These keys start, control, and stop analytical runs.
- Screen keys (SETUP, CONF, STATUS, SCHED, METH, and TEMPS). These keys display screens that enable you to define operating parameters, set up schedules, and review status and temperature.
- Special keys (NEXT/PREV PAGE, BKSP, CLEAR, and SHIFT). These keys let you scroll through displays or manipulate and save data.

Keys with two-part labels have two functions. To use the function on the lower half of the label, press the control key. To use the function on the upper half of the label, press and hold SHIFT while you press the control key.

5.2.3.1 Action Keys

Table 5-1 defines *action key* functions and refers to the section of the *User Guide* that provides instructions for using the function.

This key:	Performs this function:	Section
RESET	RESET lets you abort a acheduled run, abort the processing of a single sample, rerun a sample, or reset the microprocessor to start-up status. Press and hold SHIFT while you press RESET.	7.6.2
START	START moves the 3000 to the first step in an operating run (usually Purge).	7.3.1
GO TO	GO TO lets you stop an operating run and immediately go to Standby, Desorb Preheat or Bake. Press and hold SHIFT while you press GO TO.	7.6.1
STEP	STEP moves the 3000 to the next operating step in a program.	7.6.1
HOLD	HOLD prevents the 3000 from advancing to the next step. Press and hold SHIFT while you press HOLD.	7.6.1
AUTO	AUTO resumes normal operation after the 3000 has been in HOLD.	7.6.1

Table 5-1 Action Key Functions

5.2.3.2 Screen Keys

Table 5-2 defines *screen key* functions and refers to the section of the *User Guide* that provides instructions for using the function.

This key:	Performs this function:	Section
SETUP	SETUP allows you to access basic system information, set the time and date, and adjust contrast for the status screen. Press and hold SHIFT while you press SETUP.	5.4.4 5.4.5
CONF	CONF displays the Configuration screens that allow you to configure the 3000 to run with your GC (gas chromatograph).	3.10
SCHED	SCHED displays the Scheduling screen that allows you to edit and enable *method schedules* (processing timetables that define sample positions and the order in which selected methods will be run) and review the current status of scheduled runs.	7.2.2 7.2.3 7.2.4
METH	METH displays the Select Method screen that allows you to select a method and change its parameters.	6.3.1
STATUS	STATUS displays a Status screen that shows the current operating step and its controlling parameters.	5.3.2
TEMPS	TEMPS displays the Temperatures screens, which show temperature setpoints and actual readings for all actively controlled temperature zones.	7.7

Table 5-2 Screen Key Functions

5.2.3.3 Special Keys

Table 5-3 defines *special key* functions.

This key:	Performs this function:	Section
NEXT PAGE	For screens that contain more than one screen of data, NEXT PAGE scrolls down to display the next screen of data.	N/A (non-applicable)
PREV PAGE	For screens that contain more than one screen of data, PREV PAGE scrolls up to display the previous screen of data.	N/A
CLEAR	CLEAR erases an entry completely. Press and hold SHIFT while you press CLEAR.	N/A
BKSP	BKSP deletes the character beneath the cursor.	N/A
ENTER	ENTER saves your entry and moves the cursor to the next data entry field.	N/A
SHIFT	SHIFT activates the light gray labeled functions on two-part control keys. Press SHIFT, hold it down, and press the selected key to execute the shifted function.	N/A

Table 5-3 Special Key Functions

5.2.4 Numeric Keys

You use the numeric keys 0 through 9, . (decimal point) and - (negative sign) for entering numeric data such as time or temperature parameters.

To enter numeric data:

1. Press the desired numeric keys, including the decimal place and the negative sign, if required.

2. Press the ENTER key.

To clear the last character, press BKSP.

To clear an entry completely, press and hold SHIFT while you press CLEAR.

5.3 Using Screens

The 3000 uses several types of display:

- A two-line, front panel status display.
- Status screens (on the hand-held controller).
- Menu screens (on the hand-held controller).
- Action screens (on the hand-held controller).
- Data entry screens (on the hand-held controller).

5.3.1 Front Panel Status Display

During each operating step of a run, the front panel screen continuously displays two lines of status information.

5.3.1.1 Temperature Parameter Display

When the temperature setpoint is the controlling parameter for the step, the front panel screen displays the information illustrated in Figure 5-3.

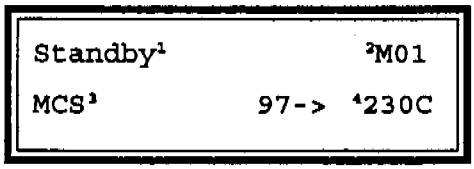


Figure 5-3 Front Panel Status Screen

Each part of the screen above is labeled with a number. See the matching numbers below to find out more about each part of the screen.

1 - The name of the operating step appears on the first line, at the left margin.

continued

5.3.1.1 Temperature Parameter Display, cont.

2 - The number of the currently-active method appears on the first line, at the right margin. If the 3000 is running a method schedule, this position shows the currently-active method number and currently-active sample position. For example, M7P04 indicates that method 7 is running on sample position 4.

3 - The name of the heated or cooled zone and its current measured temperature appear at the left on the second line. The display updates this value continuously as the temperature changes.

4 - The temperature setpoint for the step appears at the right on the second line.

5.3.1.2 Time Parameter Display

When a time setpoint is the controlling parameter for the step, the front panel screen displays the information illustrated in Figure 5-4.

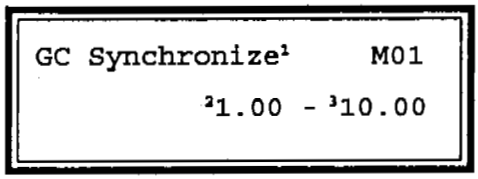


Figure 5-4 Front Panel Timer Screen

1 - The name of the operating step appears on the first line, at the left margin.

2 - The elapsed time appears on the second line. The display updates this value continuously.

3 - The total time setpoint appears at the right on the second line.

5.3.2 Status Screens

A status screen may display:

- A listing of temperatures for all the actively-controlled heated or cooled zones in the 3000. Please refer to Section 7.7 for a full description of the Temperature Status screen.
- Information about the current status of a run. Each operating step has a corresponding Operating Status screen. You can check the progress of the run by reviewing the current Operating Status screen. This section describes the Operating Status Screens.

5.3.2.1 Displaying Operating Status Screens

To display an operating status screen at any point during operation, press the STATUS key. The 3000 displays an Operating Status screen like the one in Figure 5-5.

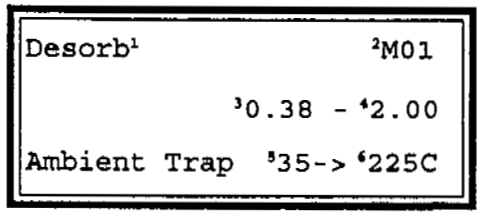


Figure 5-5 Desorb Screen

5.3.2.2 Reading the Fields

Operating Status screens display the following information:

1 - The name of the operating step appears on the first line, at the left margin.

2 - The number of the currently-active method appears on the first line, at the right margin. If the 3000 is running a method schedule, this position shows the currently-active method number and currently-active sample position. For example, M7P04 indicates that method 7 is running on sample position 4.

3 - For timed steps, the elapsed time appears on the third line. The display updates this value continuously.

4 - For timed steps, the total time setpoint appears at the right on the third line.

5 - For temperature-dependent steps, the name of the heated or cooled component and its current measured temperature appears at the left on the fourth line. The display updates the temperature value continuously.

6 - For temperature-dependent steps, the temperature setpoint appears at the right on the fourth line.

5.3.3 Menu Screens

Menu screens offer lists of variable-function key options. You press the indicated key to make a selection. Table 5-4 on the following page shows some of the menu screens and the keys which access them.

continued

5.3.3 Menu Screens, cont.

Press this key:	to display these menu screen choices:	Described in:
SETUP	A = System Info B = Time/Date	Section 5.4.5 Section 5.4.4
SCHED	A = Sample Status C = Commands E = Edit Schedule	Section 7.6.3 Section 7.2.3 Section 7.2.2
METH	Select Method C = Commands E = Edit	Sections 6.4 - 6.7
C (from the Select Method screen)	Commands: Method A = Change Type C = Restore Default E = Copy Method	Section 6.3.2 Section 6.9 Section 6.3.3

Table 5-4 Menu Screens

5.3.4 Action Screens

An action screen presents a choice of variable function keys. It looks like a menu screen, but there is a difference: pressing a variable function key from a menu screen displays another screen. Pressing a key from one of the action screens shown in Table 5-5 on the following page initiates an action.

continued

5.3.4 Action Screens, cont.

Press this key:	to display these choices:	Described In:
RESET	A = Abort Schedule B = Abort Sample C = Rerun Sample D = Complete and Abort	Section 7.6.2
STEP (from a Self-test Screen)	A = Continue Testing B = Ignore Self-test C = Restore Previous	Section 5.4.2
C (from the Scheduling Screen)	A = Run Schedule B = Update* Schedule C = Clear Schedule	Section 7.2.3 Section 7.2.4 Section 7.2.5
GO TO	A = GoTo Mode B = Manual Operation	Section 7.6.1
Various keys from various screens	A = Abort (cancel action) E = Execute (perform selected action)	Non-applicable

Table 5-5 Action Screens

5.3.5 Data Entry Screens

A data entry screen can display fields like the ones shown in Figure 5-6.

- A - fields that allow you to select one of several available options.
- B - fields into which you enter numbers.

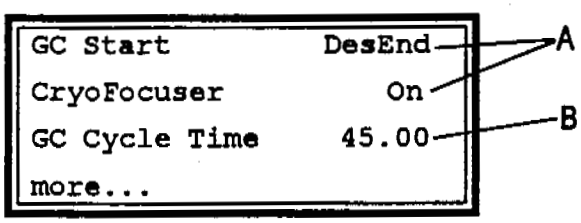


Figure 5-6 Data Entry Screen

* or "build" if the ROM version is prior to 2.10

5.3.5.1 Option Selection Fields

To review available options and select one:

1. If the cursor is on the option to be changed, press any number key to toggle the status field. Each time you press a number key, the field displays the next available option. When the desired option is displayed, press ENTER to select it. The cursor moves to the next line.

2. If the cursor is not on the option you wish to change, press ENTER to move the cursor, one line at a time. When the cursor reaches the bottom of the screen, press ENTER to move it back to the top of the screen.

3. Press any number key to toggle the status field, as described in step 1.

5.3.5.2 Data Entry Fields

To enter a number into a data entry field:

1. If the cursor is on the desired field, type the appropriate numbers in the field; then press ENTER.

2. If the cursor is not on the desired field, press ENTER to move the cursor, one line at a time. When the cursor reaches the bottom of the screen, press ENTER to move it back to the top of the screen.

3. Type the numbers in the field; then press ENTER.

5.4 Getting Started

To begin 3000 operation:

1. Turn on the 3000. (The switch is on the rear panel.) The 3000 loads program data into memory, performs initialization tasks, and briefly displays the message, "Initialization successful" on the front panel screens.

2. The screen on the front panel (Figure 5-7) shows the date and time of the last power loss.

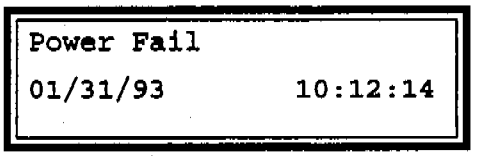


Figure 5-7 Initial Front Panel Screen

The screen on the controller (Figure 5-8 on the following page) shows the same date and time.

continued

5.4 Getting Started, cont.

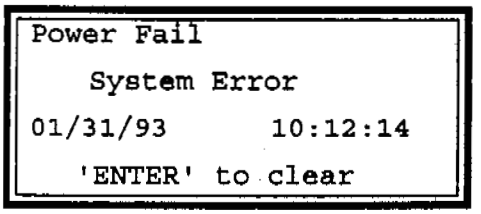


Figure 5-8 Start-up Screen

3. Press ENTER. The screen shown in Figure 5-9 appears briefly.

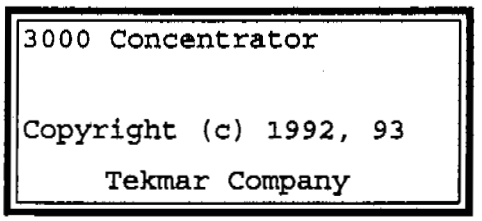


Figure 5-9 Tekmar Identification Screen

5.4.1 Performing Self Tests

The Identification screen is followed almost immediately by the first Self Test screen (Figure 5-10).

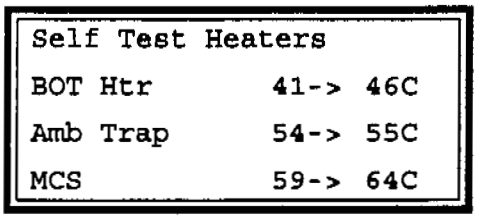


Figure 5-10 Self Test Screen 1

The screen lists the heaters being tested. To test its heaters:

- The 3000 activates and establishes an incremental setpoint for each heater: 3°C above its current temperature for the valve oven heater and 5°C above current temperature for the other heaters.
- When a listed heater reaches the test temperature, it disappears from the listing. As heaters drop off the listing, the last line shows elapsed time as it progresses to a two-minute limit.

5.4.2 Exiting the Self Tests

At any point during the self tests, you can suspend self testing. When you press STEP, the 3000 displays the Self Test Status screen (Figure 5-11).

```
Self Test Status
<A> =Continue Testing
 B  =Ignore Self test
 C  =Restore Previous
```

Figure 5-11 Self Test Status Screen

The Self Test Status action screen offers three options for handling pending (uncompleted) self tests. You can:

- Press the A key to return to the previous screen and complete all pending tests.
- Press the B key to skip the pending self tests and position the unit to run the first sample of the schedule.
- Press the C key to restore previous self test results for the pending tests. This option accepts the results of the self tests that were run the last time the unit was powered up.

5.4.3 Clearing a Self Test Error

1. If a component fails to reach the setpoint within the time limit, the 3000 displays an error message on both screens. The screen on the front panel (Figure 5-12) specifies the region that failed.

```
Self test Fail
Region:          Sample
```

Figure 5-12 Front Panel Message Screen

2. The screen that appears on the hand-held controller (Figure 5-13) lists the region that failed and provides instructions for clearing the error.

```
Self Test Fail
      System Error
01/31/93        10:30:00
   'ENTER' to Clear
```

Figure 5-13 Controller Message Screen

continued

5.4.3 Clearing a Self Test Error, cont.

3. After you have corrected the problem, press ENTER to clear the error message. The 3000 displays the Reset screen.
4. Press SHIFT + RESET; the Tekmar Identification screen appears briefly, followed by the System Reset screen (Figure 5-14).

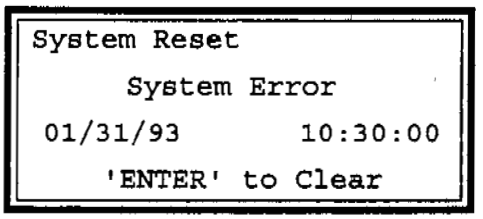


Figure 5-14 System Reset Screen

5. Press ENTER. The 3000 performs the self tests again. If you have not corrected the problem, the same region will fail again. The unit will not run until it passes the self tests.
6. When the self tests are complete, the hand-held controller displays the Standby status screen for the current method.

5.4.4 Setting the Date and Time

Use the SETUP key to establish or confirm the system clock setting.

1. From any screen, press and hold the SHIFT key; then press SETUP. The 3000 displays the Setup screen (Figure 5-15).

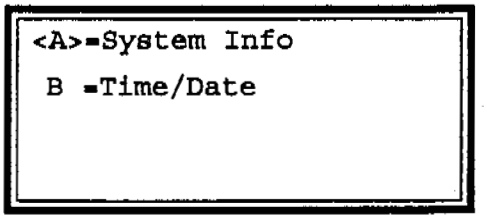


Figure 5-15 Setup Screen

2. From the Setup screen, press the B key. The Date and Time screen (Figure 5-16) appears.

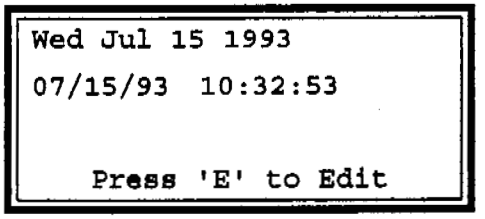


Figure 5-16 Date and Time Screen

continued

5.4.4 Setting the Date and Time, cont.

- The first line on the Date and Time screen shows the day of the week, the month, the date and the year.
- The second line shows date (MM/DD/YY) and time (HH:MM:SS).

3. Press the E key. The Date and Time Editing screen (Figure 5-17) appears, with the cursor on the last character in the third line.

```
Use '.' as separator

Date:              01/27/93
Time:              10:53:41
```

Figure 5-17 Date and Time Editing Screen

4. Type the date, using numerals to indicate month, day, and year. Use the period (.) to mark each separation between them. For example, Enter January 23, 1993 as 01.23.93. Press ENTER. The cursor moves to the end of the next line.

5. Repeat step 4 for the time line, using hours, minutes, and seconds, in military time. For example: Enter 3:13 p.m. as 15.13. Press ENTER.

5.4.5 Checking the Unit Type and ROM Version

1. From any screen, press and hold the SHIFT key; then press SETUP. The 3000 displays the Setup screen (Figure 5-15).

2. From the Setup screen, press the A key. The System Information screen (Figure 5-18) appears.

```
Unit Type          3000
ROM Ver:  2.11

UpTime -    0:01:47.15
```

Figure 5-18 System Information Screen

- The first line gives the model number of the instrument.
- The second line shows the version of the ROM chip currently installed in the 3000.
- The last line shows the time since power up or since the last system reset.

3. After reviewing the system information, you can press STATUS to exit the System Information screen and display the current status screen.

6.1 Overview

After you have installed and configured the 3000, you can create customized methods (operating sequences) for sample processing that meet your analytical requirements.
This section tells you how to:
- Use pre-defined methods with default, factory-installed parameters.
- Define time and temperature parameters for custom methods.
- Restore default parameters.

6.2 Understanding Default Methods

At first power up, the 3000 is scheduled to run Method 1. The concentrator automatically performs self tests and displays the Standby screen for Method 1. When the heaters and coolers have reached the default temperature setpoints for Method 1, the hand-held controller displays a screen with the prompt, "Press START to Begin". At this point, you can:
- Press START to run Method 1 with its default parameters.
- Follow the instructions in Chapter 7, *Scheduling and Running Samples* to change the method schedule and run another default method.

The 3000 stores 16 methods, each with a predefined set of default parameters.

⚠ CAUTION

Temperatures above 230°C will damage Tenax traps. You may need to edit the method(s) so that the temperature will not exceed the maximum allowable temperature for your traps. See *Editing 3000 Methods* in this section.

6.2.1 Default Methods for Front Panel Samples

Default methods 1, 3, 5, 7, 9, and 11 define parameters for processing front panel samples on the 3000. Table 6-1 shows the analytical protocols and defines default parameters for each front panel method.

Note: If your ROM (read-only memory) version is prior to 2.13, Sample Preheat time and Prepurge time default to three and five minutes, respectively. ROM version 2.13 changes these values to zero (when you are using default methods that turn off the sample heater). This allows for a more accurate calculation of GC Synchronize time.

6.2.1 Default Methods for Front Panel Samples, cont.

Parameter	Mth 1	Mth 3	Mth 5	Mth 7	Mth 9	Mth 11
Protocol	Tekmar default	USEPA 502	USEPA 602	USEPA 601/624	USEPA 8000[1]	USEPA CLP-VOA
Line Temp	100°C	100°C	100°C	100°C	100°C	100°C
Valve Temp	100°C	100°C	100°C	100°C	100°C	100°C
Mount Temp	40°C	40°C	40°C	40°C	40°C	40°C
MCS Line Temp	100°C	100°C	100°C	100°C	100°C	100°C
Purge Ready	30°C	30°C	30°C	30°C	30°C	30°C
Purge Temp	30°C	30°C	30°C	30°C	30°C	30°C
TurboCool Temp	-20°C	-20°C	-20°C	-20°C	-20°C	-20°C
Sample Heater	Off	Off	Off	Off	On	Off
Prepurge Time	0.00	0.00	0.00	0.00	3.00	0.00
Preheat Time	0.00	0.00	0.00	0.00	5.00	0.00
Sample Temp	40°C	40°C	40°C	40°C	40°C	40°C
Purge Time	11.00	11.00	12.00	11.00	11.00	11.00
Dry Purge Time	0.00	0.00	6.00	0.00	0.00	0.00
MCS Des Temp	50°C	50°C	50°C	50°C	50°C	50°C
GC Start	DesStart	DesStart	DesStart	DesStart	DesStart	DesStart
Cryo Focuser	Off	Off	Off	Off	Off	Off
GC Cycle Time	0.00	0.00	0.00	0.00	0.00	0.00
Cryo Standby	100°C	100°C	100°C	100°C	100°C	100°C
Cryo Focus Temp	-150°C	-150°C	-150°C	-150°C	-150°C	-150°C
Inject Time	1.00	1.00	1.00	1.00	1.00	1.00
Cryo Inject Temp	180°C	180°C	180°C	180°C	180°C	180°C
Desorb Preheat	220°C	175°C	175°C	175°C	175°C	175°C
Desorb Time	2.00[2]	4.00	4.00	4.00	4.00	4.00
Desorb Temp	225°C	180°C	180°C	180°C	180°C	180°C
Sample Drain	Off	Off	Off	Off	Off	Off
Bake Time	10.00	10.00	10.00	10.00	10.00	10.00
Bake Temp	225°C	225°C	225°C	225°C	225°C	225°C
BGB	On	On	On	On	On	On
BGB Delay	2.00	2.00	2.00	2.00	2.00	2.00
MCS Bake Temp	180°C	180°C	180°C	180°C	180°C	180°C

Table 6-1 Default Methods for Front Panel Samples

[1] This is an extraction method; USEPA 5030 gives the purge and trap parameters.
[2] Desorbing for two minutes at 225°C gives results as good as, or better than, EPA protocols; and it transfers less water to the GC.

6.2.2 Default Methods for ALS Autosamplers

Default methods 2, 4, 6, 8, 10, 12, and 13 define parameters for processing autosampler samples on the 3000. Table 6-2 shows the protocols and defines default parameters for each of the ALS autosampler methods.

Note: **If your ROM (read-only memory) version is prior to 2.13, Sample Preheat time and Prepurge time default to three and five minutes, respectively. ROM version 2.13 changes these values to zero (when you are using default methods that turn off the sample heater). This allows for a more accurate calculation of GC Synchronize time.**

Parameter	Mth 2	Mth 4	Mth 6	Mth 8	Mth 10	Mth 12	Mth 13
Protocol	Generic	USEPA 502	USEPA 602	USEPA 601/624	USEPA 8000[3]	USEPA CLP-VOA	Bake-out
Line Temp	100°C	100°C	100°C	100°C	100°C	100°C	200°C
Valve Temp	100°C	100°C	100°C	100°C	100°C	100°C	200°C
20XX Line	100°C	100°C	100°C	100°C	100°C	100°C	175°C
MCS Line Temp	100°C	100°C	100°C	100°C	100°C	100°C	180°C
Purge Ready	30°C	30°C	30°C	30°C	30°C	30°C	225°C
Purge Temp	30°C	30°C	30°C	30°C	30°C	30°C	30°C
TurboCool Temp	-20°C	-20°C	-20°C	-20°C	-20°C	-20°C	225°C
Sample Heater	Off	Off	Off	Off	On	Off	Off
Prepurge Time	0.00	0.00	0.00	0.00	3.00	0.00	0.00
Preheat Time	0.00	0.00	0.00	0.00	5.00	0.00	0.00
Sample Temp	40°C	40°C	40°C	40°C	40°C	40°C	40°C
Purge Time	11.00	11.00	12.00	11.00	11.00	11.00	0.00
Dry Purge Time	0.00	0.00	6.00	0.00	0.00	0.00	0.00
MCS Des Temp	50°C	50°C	50°C	50°C	50°C	50°C	180°C
GC Start	DesStart	DesStart	DesStart	DesStart	DesStart	DesStart	Disabled
Cryo Focuser	Off	Off	Off	Off	Off	Off	Off
GC Cycle Time	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cryo Standby	100°C	100°C	100°C	100°C	100°C	100°C	100°
Cryo Temp	-150°C	-150°C	-150°C	-150°C	-150°C	-150°C	100°C
Inject Time	1.00	1.00	1.00	1.00	1.00	1.00	0.00
Cryo Inj Temp	180°C	180°C	180°C	180°C	180°C	180°C	100°C
Desorb Preheat	220°C	175°C	175°C	175°C	175°C	175°C	225°C
Desorb Time	2.00[4]	4.00	4.00	4.00	4.00	4.00	0.00
Desorb Temp	225°C	180°C	180°C	180°C	180°C	180°C	225°C
Sample Drain	Off	Off	Off	Off	Off	Off	Off
Bake Time	10.00	10.00	10.00	10.00	10.00	10.00	5.00
Bake Temp	225°C	225°C	225°C	225°C	225°C	225°C	225°C
BGB	On	On	On	On	On	On	Off
BGB Delay	2.00	2.00	2.00	2.00	2.00	2.00	2.00
MCS Bake Temp	180°C	180°C	180°C	180°C	180°C	180°C	180°C

Table 6-2 Default Methods for ALS Autosamplers

[3] This is an extraction method; USEPA 5030 gives the purge and trap parameters.

[4] Desorbing for two minutes at 225°C gives results as good as, or better than, EPA protocols; and it transfers less water to the GC.

6.2.2 Default Methods for ALS Autosamplers, cont.

6.2.3 Default Methods for the AQUATek 50 and ALS Autosampler

Method 13 is a bakeout method. It allows a clean bake of the discrete autosampler before or after purging a new set of samples. Tekmar recommends using this method with the sample spargers empty.

Default methods 14 and 15 define parameters for processing AQUATek 50 samples on the 3000 and on an ALS autosampler with the 3000. Table 6-3 shows the analytical protocols and defines default parameters for each of the AQUATek 50 methods.

Program Parameter	Method 14	Method 15
Line Temp	100°C	100°C
Valve Temp	100°C	100°C
20XX Line	NA	100°C
20XX Valve	NA	100°C
Purge Ready	30°C	30°C
Purge	30°C	30°C
TurboCool Temp	-20°C	-20°C
MCS Line Temp	100°C	100°C
MCS Des Temp	50°C	50°C
Sample Fill	1.75	1.75
Purge Time	11.00	11.00
Dry Purge Time	0.00	0.00
GC Start	DesStart	DesStart
Cryo Focuser	Off	Off
GC Cycle Time	0.00	0.00
Cryo Standby	100°C	100°C
Cryo Focus Temp	-150°C	-150°C
Inject Time	1.00	1.00
Cryo Inj Temp	180°C	180°C
Desorb Preheat	175°C	175°C
Desorb Time	4.00	4.00
Desorb Temp	180°C	180°C
Sample Drain	On	On
Bake Time	10.00	10.00
Bake Temp	225°C	225°C
BGB	Off	Off
BGB Delay	2.00	2.00
MCS Bake Temperature	180°C	180°C

Table 6-3 Default Methods for AQUATek 50 and ALS Autosampler

6.2.4 Default Method for AEROTrap Autosamplers

Default method 16 defines parameters for processing AEROTrap 6016/6032 samples on the 3000. Table 6-4 shows analytical protocols and defines default parameters for the AEROTrap 6016/6032 method.

If you are using a 3000 with the 6016 and/or 6032 and do not have TURBOCool installed, you must indicate the correct installed option and trap cooldown temperature. See Section 6.7, *Editing 60XX Methods.*

Program Parameter	Default Value
Line Temp	200°C
Valve Temp	200°C
MCS Line Temp	200°C
Trap Standby	35°C
60XX Valve	200°C
60XX Line	200°C
Trap Cooldown	-20°C
Sample Sweep	Pre-Cool
Sample Sweep Time	2.00 minutes
Sample Desorb Time	10.00 minutes
Sample Desorb	220°C
MCS Desorb Temp	50°C
GC Start	DesStart
Cryo Focuser	Off
GC Cycle Time	0.00 minutes
Cryo Standby	100°C
Cryo Focus Temp	-150°C
Inject Time	1.00 minute
Cryo Inject Temperature	180°C
Desorb Preheat	220°C
Trap Des Time	4.00 minutes
Trap Des Temp	225°C
Sample Bake	250°C
Trap Bake Time	11.00 minutes
Trap Bake Temperature	225°C
MCS Bake Temperature	180°C

Table 6-4. Default Method for AEROTrap Autosamplers

6.3 Creating Custom Methods

For each supported system configuration, the 3000 displays a different set of method editing screens. The method editing screens list the parameters associated with the operating steps for the selected method. You can create a customized method by using the method editing screens to modify parameters to meet your analytical requirements.

To edit a method, follow these steps:
- Specify the method (from 1 - 16) that you wish to change.
- Indicate the system configuration for the selected method.
- Change parameters to customize the method.

6.3.1 Select a Method

To select a method for editing:

1. Power up the system (as described in Section 5.4 *Getting Started*). The 3000 displays the Standby screen for Method 1.

2. Press the METH key. The 3000 displays the Method screen (Figure 6-1), with the cursor at the last position on the second line.

```
      Select Method
Method                  1
Type                 3000
<C>=Commands       E=Edit
```

Figure 6-1 Method Screen

   - Line 2 shows the number of the active method (1 through 16). The active method (the startup default) is Method 1.
   - Line 3 indicates the system configuration for the currently-active method (see Section 6.3.2 *Indicate the System Configuration*). The default type for Method 1 is 3000.

3. At the Method field, enter the number of the method to be changed; then press ENTER.

6.3.2 Indicate the System Configuration

To indicate the system configuration to be supported by the selected method:

1. Press the C key to display the Method Commands screen (Figure 6-2).

```
Commands: Method     1
<A>=Change Type
 C =Restore Method
 E =Copy Method
```

Figure 6-2 Method Commands Screen

continued

6.3.2 Indicate the System Configuration, cont.

2. Press the A key (or press ENTER when A is highlighted with <> brackets) to display the Change Method Type screen (Figure 6-3), with the cursor on the third line.

```
   Change Method Type
Method                  1
Type                 3000
<A>=Abort      E=Execute
```

Figure 6-3 Change Method Type Screen

3. Press any number key. The value in the Type field toggles each time you press a number key. The available options are:
   - **3000** - Front panel sample position only.
   - **20XX** - ALS 2016/2032 autosampler with the 3000.
   - **AQUATek 50** - AQUATek 50 with the 3000.
   - **AQUATek XX** - AQUATek 50 and ALS autosampler with the 3000.
   - **60XX** - AEROTrap autosampler with the 3000.

4. When the screen shows the correct value for the Type field, press the E key to accept the value and return to the Select Method screen.

Note: To exit the Method Commands screen without making any changes, press the A key. The 3000 ignores any changes you may have entered on the Method Commands screen and displays the Select Method screen.

6.3.3 Copy an Existing Method

If the new method will differ from an existing method in only a few parameter values, you can copy the parameters for an existing method into memory and use them as the basis for a new method.

1. On the main Method screen (Figure 6-1), press the C key to display the Method Commands screen (Figure 6-2).

2. Press the E key to display the Copying Method screen (Figure 6-4), with the cursor at the end of the second line.

```
    Copying Method
Source                  1
Destination             1
<A>=Abort      E=Execute
```

Figure 6-4 Copying Method Screen

- Line 2 shows the number of the method to be copied (Source).
- Line 3 shows the number of the method into which the Source method will be copied (Destination).

continued

6.3.3 Copy an Existing Method, cont.

3. Type the number of the method to be copied; then press ENTER. The cursor moves to the last position on the next line.
4. Type the number of the method to receive the copy. Press ENTER.
5. Press the E key to execute the copy and return to the Select Method screen.

Note: To exit the Copying Method screen without making any changes, press the A key to abort. The 3000 ignores any changes you may have entered on the Copying Method screen and displays the Select Method screen.

6.4 Editing 3000 Methods

To begin editing the selected method, press the E key from the Method screen. For methods 1, 3, 5, 7, 9, and 11, the screen displays the sequence of editing screens for front panel sample methods (Type 3000) shown in Table 6-5.

6.4.1 Using the Editing Screens

Line Temp	100	— setpoint for transfer line
Valve Temp	100	— setpoint for the valve oven and BOT
Mount Temp	40	— setpoint for sample mount heater (optional)
MCS Line Temp	100	— setpoint for the Moisture Control System line.
Purge Ready Temp	30	— trap temperature must fall below setpoint
TurboCool Temp	-10	— setpoint for cooling the trap when a TurboCool accessory is installed.
more . . .		
Sample Heater	Off	— whether the sample heater is activated or not.
PrePurge Time	0.00	— how long the sample is swept with purge gas before being purged.
PreHeat Time	0.00	— how long the sample is heated before purge.
Sample Temp	40	— setpoint for the sample heater (optional)
Purge Time	11.00	— how long the sample is purged.
DryPurge Time	0.00	— how long gas flows through the trap, but not through the sample glassware.
MCS Des Temp	50	— setpoint for the MCS during the Desorb step
more. . .		

Table 6-5 Editing Screens for 3000 Methods

continued

6.4.1 Using the Editing Screens, cont.

GC Start	DesStart	— tells when the GC receives its START signal.
Cryo Focuser	Off	— whether a Cryofocusing Module (CM) is installed.
GC Cycle Time	0.00	— length of time required for the GC to process a sample.
more . . .		
Cryo Standby	100	— temperature of the inactive CM.
CryoFocus Temp	-150	— low-temperature setpoint for trapping analytes.
Inject Time	1.00	— how long the cryo heater remains at inject temp.
Cryo Inj Temp	180	— cryo heater temp. when analytes are released.
Desorb PreHeat	220	— temperature trap is heated to before trap desorb.
Desorb Time	2.00	— length of the trap Desorb step.
Desorb Temp	225	— trap temperature during the Desorb step.
Sample Drain	Off	— whether automatic drain is ON or OFF.
Bake Time	10.00	— duration of the Trap Bake step.
Bake Temp	225	— trap temperature during the Bake step.
BGB On Delay	2.00	— whether Bake Gas Bypass is ON or OFF and length of BGB delay.
MCS Bake Temp	180	— MCS temperature during Bake step.

Table 6-5 Editing Screens for 3000 Methods, cont.

6.4.2 Selecting Parameters

If your analytical procedures dictate the use of parameters other than the defaults, Table 6-6 on the following pages gives you guidelines for selecting appropriate values; you can use it as a worksheet to help you define method parameters. Also see Section 6.8, *Moisture Control System Parameters (MCS).*

continued

6.4.2 Selecting Parameters, cont.

Parameter	Selection Guidelines	Selected Value
Valve Temp Line Temp	Set the six-port valve and transfer line of the 3000 at a temperature high enough to prevent cross contamination but not high enough to decompose analytes; 100°C minimum.	____
Mount Temp	Set the temperature of the sample mount heater equal to the sample temperature for oil samples.	____
MCS Line Temp	The MCS temperature during Standby and Purge.	
Purge Temp	Trap temperature during Purge.	____
TurboCool Temp	Functional only when a TurboCool accessory is installed. Depends on the nature of the compounds to be analyzed.	____
Sample Heater	ON or OFF. Set to OFF if the method will not use a sample heater. Eliminating the heater also eliminates Prepurge and Preheat.	____
Prepurge Time	Should allow a volume of Prepurge gas equal to three times the sample glassware volume (3 x 11 ml for a 5 ml sparger, 3 x 34 ml for a 25 ml sparger) at a purge flow rate of 50 ml/min: $\frac{3x11ml}{50ml/min}$ = 0.66 min for a 5 ml sparger; $\frac{3x34ml}{50ml/min}$ = 2.04 min for a 25 ml sparger	____
Preheat Time	Allows the sample to reach equilibrium at its temperature setpoint before beginning purge. For every 25° above ambient, allow one minute preheat time.	____
Sample Temp	Depends on the nature of the sample to be analyzed.	____
Purge Time	Set between 10 and 15 minutes.	
Dry Purge Time	Allow enough time for 20 to 250 ml of gas to pass through the trap.	____

Table 6-6 Parameter Selection Table

continued

6.4.2 Selecting Parameters, cont.

Parameter	Selection Guidelines	Selected Value
MCS Desorb Temp	Moisture-trapping temperature during the Desorb step.	____
GC Start	Available options are: • DesStart - at the beginning of the Desorb step. • Select DesStart if you are not using a Cryofocusing Module. • DesEnd - at the end of the Desorb step. Select DesEnd if you are using a Cryofocusing Module. • Both - at both the beginning and the end of the Desorb step. • Disabled - no START signal sent.	____
Cryo Focuser	Select ON if you have installed a Cryofocusing Module; select OFF if you have not.	____
GC Cycle Time	See Section 4.3 *Operating Cycle Time* for an explanation of the relationship between a GC cycle and an operating cycle on the 3000.	____
Cryo Standby	Set the Cryofocusing Module at a temperature high enough to prevent cross-contamination but not high enough to decompose analytes; 100°C minimum.	____
Cryo Focus Temp	Depends on the lightest compound to be analyzed, the column diameter, film thickness, flow rate and whether or not a precolumn is used. Typical values range from -190° to -90°C. To save coolant, set the temperature to the highest value at which peak shapes are still good.	____
Inject Time	The cryotrap heats at about 800°C/min. Choose about 0.25 minutes longer than necessary to reach the setpoint. Typical values are 0.50 to 1.00 minute.	____
Cryo Inj Temp	Choose a temperature high enough to drive the least volatile component out of the cryofocusing area, but not high enough to break down either the stationary phase or the polyimide outer coating of the column.	____

Table 6-6 Parameter Selection Table, cont.

continued

6.4.2 Selecting Parameters, cont.

Parameter	Selection Guidelines	Selected Value
Desorb Preheat	Set to 5° below the Desorb temperature to deliver the sample to the GC in the tightest slug possible.	____
Desorb Time	Set to two minutes for environmental samples. Mass flow control usually requires times of up to eight minutes.	
Desorb Temp	Set between 150° and 225°C depending on the nature of the sample compounds and the trap type (sorbent): 150°C for volatile compounds purged from ambient samples; higher temperatures for samples with less volatile compounds.	____
Sample Drain	ON opens the automatic drain to empty the sample glassware during the Desorb step. Use auto drain only with samples that are particulate-free to avoid clogging the drain system.	____
Bake Time	Choose 7 to 10 minutes. You may use longer times - up to 20 minutes for highly-concentrated samples or non-volatile compounds.	____
Bake Temp	Set to 225°C for any trap containing Tenax or to the temperature required for that trap type. Higher temperatures do not increase the bake efficiency and can shorten the adsorbent's lifetime.	____
BGB (Bake Gas Bypass)	ON or OFF. If the sample glassware has not been drained, turn BGB ON to bypass the sample glassware and avoid purging additional volatiles from the undrained sample onto the trap. If Sample Drain is ON, turn BGB OFF and vice versa.	____
BGB Delay	A two-minute delay allows back pressure in the unit to equilibrate before the bypass valve is turned on, keeping the sample from being pushed up into the needle and contaminating valves and internal lines.	____
MCS Bake Temp	Temperature to clear out any residual water from the MCS.	____

Table 6-6 Parameter Selection Table, cont.

6.5 Editing 20XX Methods

6.5.1 Using the Editing Screens

To begin editing the selected method, press the E key from the Method screen. For methods 2, 4, 6, 8, 10, and 12, the screen displays the sequence of editing screens for ALS autosampler methods (Type 20XX) shown in Table 6-7.

Line Temp	100	— setpoint for transfer line.
Valve Temp	100	— setpoint for the trap and valve oven.
20XX Line	100	— setpoint for autosampler transfer line.
20XX Valve	100	— setpoint for autosampler valve oven.
MCS Line Temp	100	— setpoint for MCS during Purge.
Purge Ready	30	— trap temperature must fall below setpoint
Purge Temp	30	— trap temperature during Purge.
TurboCool Temp	-20	— setpoint for cooling the trap when a TurboCool accessory is installed.
Sample Heater	Off	— whether the sample heater is activated or not.
PrePurge Time	0.00	— how long the sample is swept with purge gas before being heated.
Preheat Time	0.00	— how long the sample is heated before purge.
Sample Temp	40	— setpoint for the sample heater.
Purge Time	11.00	— how long the sample is purged.
DryPurge Time	0.00	— how long gas flows through the trap, but not through the sample glassware.
MCS Des Temp	50	— setpoint for the MCS during the Desorb step
more. . .		
GC Start	DesStart	— tells when the GC receives its START signal.
Cryo Focuser	Off	— whether or not a Cryofocusing Module is installed.
GC Cycle Time	0.00	— length of time required for the GC to process a sample.
more . . .		
Cryo Standby	100	— temperature of the inactive Cryofocusing Module.
CryoFocus Temp	-150	— low-temperature setpoint for trapping analytes.
Inject Time	1.00	— how long the cryo heater remains at inject temp.
Cryo Inj Temp	180	— cryo heater temperature when analytes are released.

Table 6-7 Editing Screens for 20XX Methods

continued

6.5.1 Using the Editing Screens, cont.

Desorb Preheat	220	— temperature trap is heated to before trap desorb.
Desorb Time	2.00	— length of the Desorb step.
Desorb Temp	225	— trap temperature during the Desorb step.
Sample Drain	Off	— whether automatic drain is ON or OFF.
Bake Time	10.00	— duration of the Trap Bake step.
Bake Temp	225	— trap temperature during the Bake step.
BGB On Delay	2.00	— Bake Gas Bypass and length of BGB delay.
MCS Bake Temp	180	— MCS temperature during Bake step.

Table 6-7 Editing Screens for 20XX Methods, cont.

6.5.2 Selecting Parameters

If your procedures dictate the use of parameter values other than the defaults, follow the guidelines in the previous section (in Table 6-6) to select appropriate values; you can use it as a worksheet to help you define method parameters.

Note: Set the 20XX Valve Temp and Line Temp high enough to prevent cross-contamination, but not high enough to decompose analytes (100°C minimum for 20XX methods).

6.6 Editing AQUATek 50 Methods

To begin editing the selected method, press the E key from the Method screen. For Method 14 (an AQUATek 50 method), the screen displays the sequence of editing screens shown in Table 6-8.

6.6.1 Using the Editing Screens for Method 14

Line Temp	100	— setpoint for transfer line.
Valve Temp	100	— setpoint for BOT and valve oven
Purge Ready	30	— trap temperature must fall below setpoint
Purge Temp	30	— trap temperature during Purge.
TurboCool Temp	-20	— setpoint for cooling the trap when TurboCool accessory is installed
MCS Line Temp	100	— setpoint for the MCS during Purge.
MCS Des Temp	35	— MCS temperature during Desorb
more . . .		
Sample Fill	1.75	— time for sample transfer.
Purge Time	11.00	— how long the sample is purged.
DryPurge Time	0.0	— how long gas flows through the trap but not through the sample glassware
more. . .		
GC Start	DesStart	— tells when the GC receives its START signal.
Cryo Focuser	Off	— whether a Cryofocusing Module (CM) is installed.
GC Cycle Time	45.00	— length of time required for the GC to process a sample.
more . . .		
Cryo Standby	100	— temperature of the inactive Cryofocusing Module.
CryoFocus Temp	-150	— low-temperature setpoint for trapping analytes.
Inject Time	1.00	— how long the cryo heater remains at inject temp
Cryo Inj Temp	180	— cryo heater temperature when analytes are released.
Desorb Preheat	220	— trap temperature before trap desorb.
Desorb Time	2.00	— length of the Desorb step.
Desorb Temp	225	— trap temperature during the Desorb step.
Sample Drain	ON	— whether automatic drain is ON or OFF.
Bake Time	10.00	— duration of the Trap Bake step.
Bake Temp	225	— trap temperature during the Bake step.
BGB On Delay	2.00	— Bake Gas Bypass and length of BGB Delay.
MCS Bake Temp	180	— MCS temperature during Bake step.

Table 6-8 Editing Screens for Method 14

6.6.2 Using the Editing Screens for Method 15

Table 6-9 shows the first two editing screens for Method 15 (the AQUATek XX method for using an ALS autosampler and an AQUATek 50 with the 3000). The last five editing screens are the same as the last five screens for Method 14.

Line Temp	100	— setpoint for bottom-of-trap area and transfer line.
Valve Temp	100	— setpoint for the valve oven.
20XX Line	100	— setpoint for autosampler transfer line.
20XX Valve	100	— setpoint for autosampler valve oven.
Trap Standby	30	— setpoint for MCS line.
TurboCool Temp	-20	— setpoint for cooling the trap when a TurboCool accessory is installed.
MCS Line Temp	100	— trap temperature between runs.
MCS Des Temp	50	— MCS temperature during Desorb.

Table 6-9 Editing Screens for Method 15

6.6.3 Selecting Parameters

If your analytical procedures dictate the use of parameter values other than the defaults, follow the guidelines in the previous section (in Table 6-6) to select appropriate values; you can use the table as a worksheet to help you define method parameters.

Note: Set the Sample Fill time (not included in Table 6-6) to 1.75 minutes (Tekmar default).

6.7 Editing 60XX Methods

To begin editing the selected method, press the E key from the Method screen. For Method 16, the screen displays the sequence of editing screens for an AEROTrap 60XX autosampler shown in Table 6-10.

If you are using a 3000 with a 6016 and/or 6032 and do not have TURBOCool installed, you must do the following:

1. Access the Configuration screen by pressing the CONF key.
2. Press the C key (Installed Option).
3. If the screen does not display *TURBOCool* in the Trap Region field, press any numeric key until it is displayed.
4. Press ENTER.
5. Change Method 16's parameter *Trap Cooldown* from -20°C to ambient temperature (temperature of surrounding air) +5°.

6.7.1 Using the Editing Screens

Line Temp 200	— setpoint for transfer line.
Valve Temp 200	— setpoint for BOT and valve oven.
MCS Line Temp 200	— setpoint for the MCS during Sample Desorb.
Trap Standby 35	— trap temperature between runs.
60XX Valve 200	— setpoint for the valve oven.
60XX Line 200	— setpoint for the transfer line.
more . . .	
Trap Cooldown -20	— setpoint for the Internal trap.
Smpl Sweep Pre-Cool	— when the Sample Sweep step occurs.
Sample Swp Time 2.00	— duration of the Sample Sweep step.
more . . .	
SampleDes Time 10.00	— duration of the Sample Desorb step.
Sample Desorb 220	— temperature of the sample tube during the Sample Desorb step.
MCS Des Temp 50	— temperature of the MCS during Internal Trap Desorb.
more . . .	
GC Start DesStart	— when a START signal is sent to the GC.
Cryo Focuser Off	— whether a Cryofocusing Module is installed.
GC Cycle Time 0.00	— how long it takes for the GC to process a sample.
more . . .	
Cryo Standby 200	— Cryofocusing Module temperature when it is inactive.
CryoFocus Temp -150	— temperature when trapping analytes.
Inject Time 1.00	— duration of the Cryo Inject step.
Cryo Inj Temp 225	— cryo heater temperature during Cryo Inject.
Desorb Preheat 220	— Internal trap temperature before Trap Desorb.
Trap Des Time 4.00	— duration of the Trap Desorb step.
Trap Des Temp 225	— Internal trap temperature during Trap Desorb.
Sample Bake 225	— sample tube temperature during the Bake step.
Bake Time 11.00	— duration of the Bake step.
Trap Bake Time 225	— Internal trap temperature during the Bake step.
MCS Bake Temp 180	— MCS temperature during the Internal Bake step.

Table 6-10 Editing Screens for AEROTrap Autosampler Method

6.7.2 Selecting Parameters

If your analytical procedures dictate the use of 60XX parameters other than the defaults, Table 6-11 gives you guidelines for selecting appropriate 60XX values; you can use it as a worksheet to help you define method parameters.

Parameter	Selection Guidelines	Selected Value
Valve Temp Line Temp 60XX Valve Temp 60XX Line Temp	Set the six-port valve and transfer line of the 3000 and the autosampler at a temperature high enough to prevent cross-contamination, but not high enough to decompose analytes (200°C minimum for 60XX methods). Use the sample temperature if sample is heated.	_____
MCS Line Temp	Temperature of the MCS during Sample Desorb.	_____
Trap Standby	Temperature at which the trap is maintained between runs.	_____
Trap Cooldown	The setpoint for the internal trap depends on the nature of the compounds being analyzed.	_____
Sample Sweep	Pre-Cool or Post-Cool. Select Pre-Cool to remove water and oxygen from the sample pathway before desorbing the sample tube. Select Post-Cool to remove oxygen from the sample pathway and allow any water in the path to freeze in the trap.	_____
Sample Swp Time	Set a time long enough to remove all oxygen from the tube.	_____
Sample Des Time	Set a time long enough to transfer all the sample from the tube.	_____
Sample Desorb	The setpoint temperature for the sample tube during the Sample Desorb step varies with the nature of the compounds being analyzed.	_____
MCS Desorb Temp	Set the temperature low enough to trap water and prevent its blow-through to the GC.	_____

Table 6-11 Parameter Selection Table

continued

6.7.2 Selecting Parameters, cont.

Parameter	Selection Guidelines	Selected Value
GC Start	Available options are: • DesStart - at the beginning of the Desorb step. Select DesStart if you are not using a Cryofocusing Module. • DesEnd - at the end of the Desorb step. Select DesEnd if you are using a Cryofocusing Module. • Both - at both the beginning and the end of the Desorb step. • Disabled - no START signal sent.	_____
CryoFocuser	Select ON if you have installed a Cryofocusing Module; select OFF if you have not.	_____
GC Cycle Time	See Section 4.3 *Operating Cycle Time* for an explanation of the relationship between a GC cycle and an operating cycle on the 3000.	_____
Cryo Focus Temp	Depends on the lightest compound to be analyzed, the column diameter, film thickness, flow rate and whether or not a precolumn is used. Typical values range from -190° to -90°C. To save coolant, set the temperature to the highest value at which peak shapes are still good.	_____
Cryo Standby	Set the Cryofocusing Module at a temperature high enough to prevent cross-contamination, but not high enough to decompose analytes; 200°C minimum, or sample temperature if sample is heated.	_____
Inject Time	The cryotrap heats at about 800°C/min. Choose a about 0.25 minutes longer than necessary to reach the setpoint. Typical values are 0.5 to 1.00 minute.	_____
Cryo Inj Temp	Choose a temperature high enough to drive the least volatile component out of the cryofocusing area, but not high enough to break down either the stationary phase or the polyimide outer coating of the column. Use the same temperature as the final oven temperature.	_____

Table 6-11 Parameter Selection Table, cont.

continued

6.7.2 Selecting Parameters, cont.

Parameter	Selection Guidelines	Selected Value
Desorb Preheat	Set to 5° below the Desorb temperature to deliver the sample to the GC in the tightest slug possible.	_____
Trap Des Time	Set to two minutes for environmental samples. Mass flow control usually requires times of up to eight minutes.	_____
Trap Des Temp	Set between 150° and 225°C, depending on the nature of the sample compounds: 150°C for volatile compounds purged from ambient samples; higher temperatures for samples with less volatile compounds.	_____
Bake Time	Choose 7 to 10 minutes. You may use longer times - up to 20 minutes, for heavily-loaded traps or relatively non-volatile compounds.	_____
Trap Bake Temp	Set to 225°C. Higher temperatures do not increase the bake efficiency and can shorten the absorbent's lifetime.	_____
MCS Bake Temp	The temperature of the MCS during the Bake step.	_____

Table 6-11 Parameter Selection Table, cont.

6.8 Moisture Control System (MCS) Parameters

The table below lists recommended parameter values for the MCS.

Desorb Flow	MCS Desorb	MCS Line	MCS Bake	Line Temp	Valve Temp
0.5-4 ml/min	50°C	150°C	310°C	150°C	150°C
7-12 ml/min	35-50°C[1]	150°C	310°C	150°C	150°C
12-20 ml/min (no split)	35°C	150°C	310°C	150°C	150°C
> or = 20 ml/min (split only)[2]	bypass[3]	35°C	35°C	150°C	150°C

Table 6-12 Recommended Parameter Values for the MCS

[1] If you are looking for xylenes and heavier compounds, specify 50°C for MCS Desorb.
[2] If not splitting (i.e., packed column), specify 35°C for MCS Desorb.
[3] This can be achieved by using the MCS jumper - Tekmar Part Number: 14-6011-002

6.8 Moisture Control System (MCS) Parameters, cont.

A Desorb Preheat temperature of 175°C and a Desorb temperature of 180°C will not efficiently release compounds that are heavier than xylenes. Use a Desorb Preheat temperature of 220°C and a Desorb temperature of 225°C (except when using the Vocarb 3000 trap) to release all compounds.

6.9 Restoring Default Parameters

You can undo changes made to default parameters for any method.

1. Press METH on the keypad.
2. At the the method field, enter the number of the method with the defaults you wish to restore; then press ENTER.
3. Press the C key to display the Method Commands screen (Figure 6-5).

```
Commands:        Method 1
<A>=Change Type
 C =Restore Default
 E =Copy Method
```

Figure 6-5 Method Command Screen

4. Press the C key to display the Restore Default screen (Figure 6-6).

```
     Restore Default
Method                  1

<A>=Abort        E=Execute
```

Figure 6-6 Restore Default Screen

5. Press the E key to execute the command. The 3000:
   - Erases any custom parameter values that have been programmed for the current method.
   - Restores the default values.
   - Returns to the Select Method screen display.

Note: To exit the Restore Default screen without making any changes, press the A key to abort. The 3000 ignores any changes or commands you may have entered on the Restore Default screen and displays the Select Method screen.

7.1 Overview

After you create customized methods, you must define a *method schedule* that specifies samples, operating sequences, and the order in which they will run.

This section tells you how to:

- Set up method schedules which define the order in which the 3000 runs methods.
- Specify the samples on which each method will run.
- Load a sample and make an analytical run with the 3000.

7.2 Creating a New Schedule

You must set up a *method schedule*, or processing timetable, to "tell" the 3000 which method(s) will be run on which sample(s). This is true regardless of whether you are using a single position unit or a unit with an autosampler attached. When you use the 3000 without an autosampler, you can specify the number and sequence of methods to be run on a single sample. When you use the 3000 with one or more autosamplers, a method schedule defines:

- The method(s) to be run.
- Start and stop positions for each method.
- A sequential order for each sample to be run.
- The number of runs per sample.

Briefly, here is how you can create and activate a method schedule:

1. Establish a desired method schedule.
2. Enter the desired schedule parameters.
3. Run the schedule.

7.2.1 Establishing a Method Schedule

Before you set up your method schedule, consider:

- The number and type of samples to be run.
- The method required for each sample.
- The preferred sequence in which to run the samples.

7.2.1 Establishing a Method Schedule, cont.

Use a worksheet (Table 7-1) to help you define your schedule.

For this set of samples	Use this method	Beginning with this sample position	Ending with this sample position	This many times on every sample
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				

Table 7-1 Schedule Worksheet

Use your worksheet as the basis for entering schedule parameters into the 3000.

7.2.2 Entering Schedule Parameters

1. From any screen, press the SCHED key. The Scheduling screen (Figure 7-1) appears.

```
Scheduling
<A>=Sample Status
 C =Commands
 E =Edit Schedule
```

Figure 7-1 Scheduling Screen

2. At the Scheduling screen, press E to display the Schedule Editing screen (Figure 7-2), with the cursor on the first position in the Start column.

7.2.2.1 Review Default Schedule Parameters

The schedule in figure 7-2 shows the default schedule parameters for the 3000. The Schedule Editing screen has four columns and up to 12 rows.

	Start	Stop	Meth	RPS
1)	0	0	1	1
2)	0	0	0	1
3)	0	0	0	1

Figure 7-2 Schedule Editing Screen

Each row specifies:

- The number of a method to be run (in the Meth column). The default method is Method 1.
- The position of the first sample (in the Start column) and the last sample (in the Stop column) to be run according to the specified method. The default sample start and stop positions are 0, which is the number assigned to the sample that is run on the 3000.

Note: **A Type 3000 method has only one position: 0, on the front panel.**

A Type 20XX or 60XX method can have from 1 to 32 sample positions: 1 through 16 for a primary autosampler (ALS 2016 or AEROTrap 6016), and 17 through 32 for a secondary autosampler (ALS 2032 or AEROTrap 6032).

An AQUATek 50 method has one position: 0, on the front panel.

An AQUATek XX method can have from 1 to 32 sample positions.

- The number of times each sample will be run (in the RPS, Runs per Sample column).

7.2.2.2 Changing the Schedule

You can change the schedule in several ways. You can:

- Specify a different method to be run by changing the number in the Meth column.
- Specify different start and stop positions for a given method by changing the numbers in the Start and Stop columns.
- Indicate that a sample position should be run more than once by changing the number in the RPS column.

To make changes in the method schedule:

1. Type the desired parameters into each field, pressing ENTER after each entry. The cursor moves to the next field in the row. When you reach the end of a row, the cursor moves to the first field in the next row.

7.2.2.2 Changing the Schedule, cont.

2. If necessary, press NEXT PAGE to display succeeding screens of Schedule Edit parameters: Rows 4-6, 7-9, and 10-12.
3. When you have entered the complete schedule, press the SCHED key to return to the Scheduling screen.

7.2.2.3 Sample Schedules

Figure 7-3 shows a typical schedule, for running two Type 20XX methods (2 and 4) on specified sample positions.

	Start	Stop	Meth	RPS
1)	1	8	2	2
2)	9	12	4	1
3)	0	0	0	1

Figure 7-3 Schedule Editing Screen

To enter this schedule:

1. On the first row, enter 1, 8, 2, and 2 in their respective columns. These entries specify that:
   - The samples in positions 1 through 8 will be run according to Method 2, with each sample being run twice.
   - Method 2 is a Type 20XX method; if you schedule position 8 for a method that has no position 8 (a Type 3000 method, for example), the 3000 displays an error message when you try to run the schedule.
2. On the second row, enter 9, 12, 4, and 1 in their respective columns. These entries specify that samples 9 through 12 will be run according to Method 4, with each sample being run through the method once.

Figure 7-4 shows a sample schedule for running a Type 3000 Method 3.

	Start	Stop	Meth	RPS
1)	0	0	3	3
2)	0	0	0	1
3)	0	0	0	1

Figure 7-4 Sample Schedule Editing Screen

To enter this schedule:
On the first row, enter 0, 0, 3, and 3 in their respective columns. These entries specify that Method 3 (a 3000 method) will be run on the 3000's front panel sample. The sample will be run three times.

Note: **If you are setting up a schedule to be run on an autosampler, be sure to specify methods that are the correct type for your system configuration.**

If you have ROM (read-only memory) version 2.10 or greater, a stop position that is less then the start position will cause the 3000 to run sample #1 on the autosampler after the last sample is run.

7.2.3 Running the Schedule

To run a schedule:

1. From the Scheduling screen (Figure 7-1), press the C key to display the Schedule Commands screen (Figure 7-5).

```
   Schedule Commands
 <A>=Run Schedule
  B =Update Schedule
  C =Clear Schedule
```

Figure 7-5 Schedule Commands Screen

2. Press A (Run Schedule). The 3000 starts the current schedule and displays the Standby Status screen (Figure 7-6) for the first sample.

```
Standby          M1P01
BOT Htr        97->200C
MCS             30->100C
XferLine      150->250C
```

Figure 7-6 Standby Status Screen

During Standby, the 3000 establishes initial conditions.

7.2.4 Changing the Schedule During a Run

You can edit a schedule in the middle of a run. From the operating step Status screen press SCHED. Follow the instructions in Sections 7.2.1 and 7.2.2 to make the desired changes. Then you can:

1. Allow the current schedule to run its course. After the 3000 completes the currently-running schedule, it automatically builds and runs the new schedule (the one you just entered).

   or

2. Build the new schedule and run it from the beginning by following these steps:
   a. Press the SCHED key to display the Scheduling screen.
   b. Press C to display the Schedule Commands screen.
   c. Press A (Run Schedule). The new schedule is built, and the 3000 goes into Standby as it prepares to start running the new schedule.

   or

3. If your changes affect only those parts of the schedule that have not yet been run, combine the new schedule with the old and continue to run from your current position.
   a. Press the SCHED key to display the Scheduling screen.
   b. Press C to display the Schedule Commands screen.
   c. Press B (Update* Schedule). The 3000 incorporates the new schedule into the old and continues to run.

* or "Build", if the ROM (read-only memory) version is prior to 2.10.

7.2.5 Restoring the Default Schedule

To restore the default schedule (Method 1 for a front panel sample on the 3000), press C (Clear Schedule) on the Schedule Commands screen (Figure 7-5).

7.3 Running a Sample

While the 3000 is operating, it shows a status screen indicating the current operating step and its active parameters. The operating steps vary, depending on the type of method you are using. This example shows the operating steps for running default Method 1.

7.3.1 Purge Ready

When all Standby setpoints have been reached, the Purge Ready screen (Figure 7-7) appears.

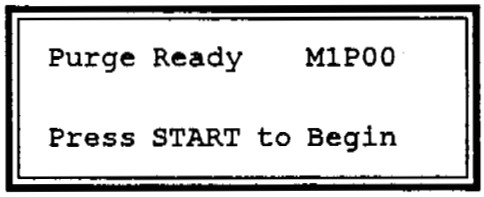


Figure 7-7 Purge Ready Screen

Note: If you have not leak checked the 3000, follow the instructions in Section 3.9 to check for leaks before you start a run.

Purge Ready waits for a start signal from the user (via the START key on the keypad), or from an accessory, before proceeding to the next step.

- To begin a run, press START on the terminal keypad.

The 3000 proceeds to the next step in the scheduled method. As the 3000 goes through a run, it displays a status screen for each step.

Note: You can always display a status screen by pressing STATUS on the keypad. For example, if you are editing one method while running another, you can press STATUS to review conditions for the currently active operating step. You can also review this information on the 3000's front panel display.

7.3.2 Purge

Figure 7-8 shows the Purge screen.

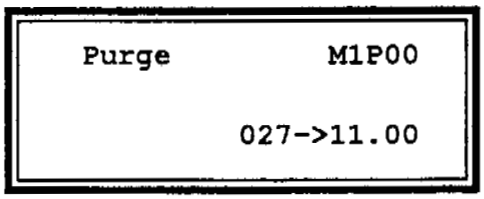


Figure 7-8 Purge Screen

The Purge step sends sample gas through the sample glassware for a specified time. The gas flow removes analytes from the sample and sends them to the internal trap.

7.3.3 MCS Cooldown

MCS Cooldown (see Figure 7-9) lowers the temperature of the moisture control system to its moisture removal setpoint. This prepares it for gas flow from the trap to the GC.

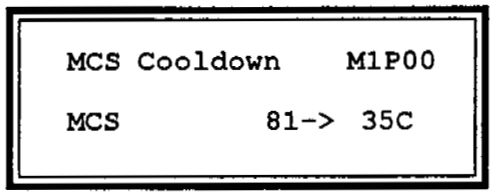


Figure 7-9 MCS Cooldown Screen

7.3.4 Desorb Ready

This step (see Figure 7-10) allows the 3000 to wait for a GC READY signal from the gas chromatograph.

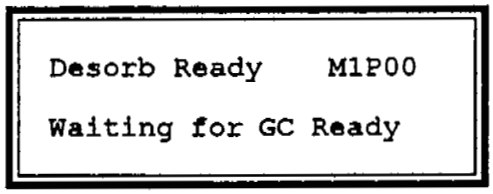


Figure 7-10 Desorb Ready Screen

7.3.5 Desorb Preheat

This step (see Figure 7-11) heats the trap to a specified temperature before desorbing analytes.

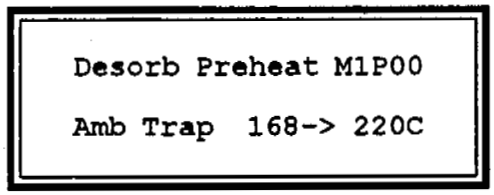


Figure 7-11 Desorb Preheat Screen

7.3.6 Desorb

This step (see Figure 7-12) backflushes the trap onto the GC (or onto the Cryofocusing Module, if installed).

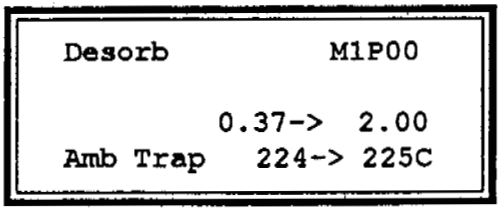


Figure 7-12 Desorb Screen

7.3.7 Bake

This step (see Figure 7-13) heats the trap and MCS; then it sends clean gas through the sample pathway to sweep it clear of residual moisture and organic contaminants.

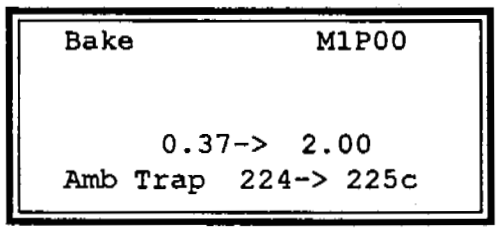


Figure 7-13 Bake Screen

7.4 Making Subsequent Runs

If the schedule calls for another run at the end of the Bake step, the 3000:

- Loads the required method into memory while displaying the screen in Figure 7-14.

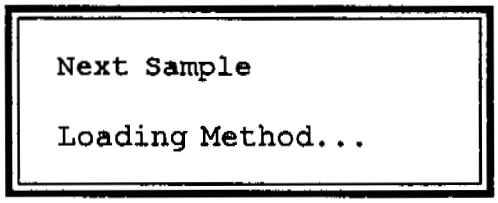


Figure 7-14 Loading Method Screen

- Displays the Standby screen while establishing initial conditions for the next run.
- Enters a GC Synchronize step (see Figure 7-15) that adds enough time to the 3000 operating cycle to synchronize it with the GC cycle. (When the 3000 is running multiple samples or multiple runs on the same sample, GC Synchronize replaces Purge Ready between runs.)

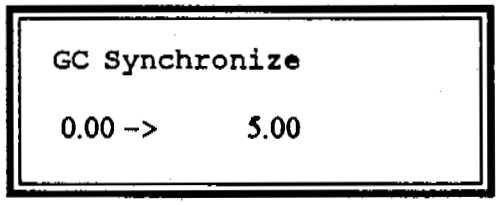


Figure 7-15 GC Synchronize Screen

- Instructs the autosampler to activate its multi-position valve and switch to the correct sample position while displaying the screen in Figure 7-16.

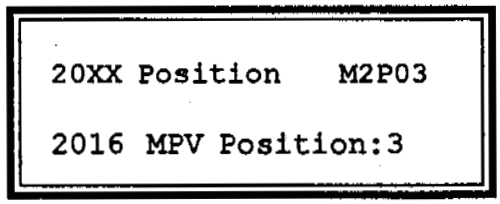


Figure 7-16 MPV Positioning Screen

7.5 Controlling Manual Operations

At any point during a run, you can display a Manual Operations screen that allows you to:

- Toggle the position of the drain valve to control the flow of liquid draining from the sample.
- Toggle the position of the vent valve to control back pressure on the sample gas feed.

To display the Manual Operations screen:

1. Press SHIFT-GO TO. The 3000 displays the screen in Figure 7-17.

```
Goto Commands

 A =Goto Mode
<B>=Manual Operation
```

Figure 7-17 Go To Commands Screen

2. Press B. The Manual Operations screen (Figure 7-18) appears.

```
Manual Operations

<A>=Drain
 B =Feed Pressure
```

Figure 7-18 Manual Operations Screen

7.5.1 Manual Drain

The drain valve allows the sample glassware to be emptied. When it is open, liquid and gas can be forced out of the sample glassware into the drain system and out the back panel drain. If your ROM (read-only memory) version is prior to 2.10, you can drain only during Standby, Purge Ready, and Desorb.

To toggle the drain open or closed:

1. From the Manual Operations screen, press A to open the drain valve.
2. The letter D flashes in the upper right of the screen, in front of the method number.
3. To close the drain valve and turn off the flashing D, repeat step 1.

7.5.2 Feed Pressure Setting

The vent valve allows sample gas to exit the sample pathway through a front panel vent. When it is closed, pressure builds up in the sample pathway. This is used to set the feed pressure (it eliminates TPC effects). If your ROM (read-only memory) version is prior to 2.10, you can select feed pressure only during Standby and Purge Ready.

To toggle the vent open or closed:

1. From the Manual Operations screen, press B to close the vent valve.
2. P flashes in the upper right of the screen, in front of the method number.
3. To open the vent valve and turn off the flashing P, repeat step 1.

7.6 Interrupting a Run

At any point during a run, you can use control keys on the terminal keypad to:

- Change the normal sequence of operating steps,
- Abort part or all of the scheduled runs, or
- Review the current status of a method schedule.

7.6.1 Change the Normal Step Sequence

To change the normal progression through an operating sequence, you can use one of the following keys:

- Press STEP to step through an operating sequence, regardless of the setpoints for the currently-active method. Pressing STEP ends the current operating step and moves the 3000 to the next step specified in the active method.
- Press SHIFT-GOTO. The 3000 displays the screen shown in Figure 7-19.

```
        Goto Commands


<A>=Goto Mode
 B =Manual Operation
```

Figure 7-19 Go To Commands Screen

a. Press A at the Goto commands screen to display the Goto Mode screen (Figure 7-20).

```
        Goto Mode
    <A>=Standby
     B =Desorb Preheat
     C =Bake
```

Figure 7-20 Go To Mode Screen

b. Press A to display the Reset screen (Figure 7-21). Follow the instructions in the next section *Reset the Schedule* to select one of the Reset options and return to the Standby step.

c. Press B to for the Desorb Preheat operating step. This prepares the 3000 to desorb the internal trap.

d. Press C to go to the Bake operating step. This cleans out the concentrator.

- Also, to change the the normal progression through an operating sequence, press Shift-Hold. The concentrator goes into HOLD mode and does not advance to the next operating step. While the system is in HOLD, (1) the letter H flashes in the upper right corner of the screen,

7.6.1 Change the Normal Step Sequence, cont.

just in front of the method designation, (2) active timers continue to advance, allowing you to monitor the duration of a particular step, and (3) when the timer times out, the concentrator remains in the current operating step.

- Press AUTO to resume normal step progression.

7.6.2 Reset the Schedule

At any point during the running of a method schedule, you can skip or rerun the current sample, restart the schedule, or completely abort it.

- From any screen, press and hold the SHIFT key while you press RESET. The Reset screen (Figure 7-21) appears.

```
<A>=Abort Schedule
 B =Abort Sample
 C =Rerun Sample
 D =Complete & Abort
```

Figure 7-21 Reset Screen

- To restart the current method schedule, press A. The 3000 interrupts the run and returns to the Standby screen for the first sample and first method in the schedule.
- To skip the rest of a run for the current sample, press B. The 3000 interrupts its processing on the current sample, moves to process the next scheduled sample, and returns to the Standby screen for the next scheduled sample.
- To rerun the current sample, press C. The 3000 interrupts the current run, goes back to the beginning of the method to reprocess the current sample, and displays the Standby screen for the current sample.
- To reset the microprocessor to start-up status, press and hold the SHIFT key while you press RESET. The 3000 restarts and enters self-test status.
- To finish the current sample and abort the rest of the schedule, press D. The 3000 finishes the current run, goes back to the beginning of the schedule, and displays the Standby screen with the letter A flashing. The screen is shown in Figure 7-22.

```
Standby     A M01

VlvOven     104->200C
```

Figure 7-22 Standby Screen after an Abort Command

7.6.2 Reset the Schedule, cont.

- To cancel an attempted abort:
  1. Press SHIFT-RESET on the keypad to display the Abort Schedule screen.
  2. Press D. The 3000 picks up the once-aborted schedule at the point where it was discontinued.

7.6.3 Review Current Status

You can review the currently-active schedule. When you press A from the Scheduling screen, the Schedule Status screen (Figure 7-23) appears.

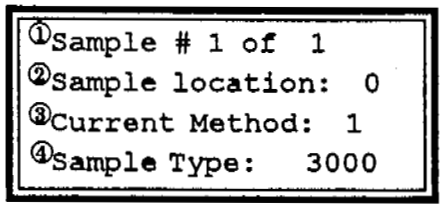


Figure 7-23 Schedule Status Screen

The Schedule Status screen is display-only; to change any parameters of the method schedule, press the SCHED key to display the Scheduling screen and refer to Section 7.2.2.2 *Changing the Schedule*.

- Line 1 displays the current sample position and the total number of samples to be run according to the current method.
- Line 2 shows the location of the *currently-active* sample. (If the 3000 is running a method, the currently-active sample is being processed. If the 3000 is not running a method, the currently-active sample is the one that will be processed next.) Sample locations are:

  0 - the single sample location on the front panel of the 3000.

  1 to 16 - the sample positions on an 2016/6016 Autosampler.

  17 to 32 - the sample positions on an 2032/6032 Autosampler.
- Line 3 lists the number of the method that is currently being run, or the method that will be run when processing starts. Method values range from 1 to 16.
- Line 4 indicates whether or not the current method includes parameters for autosamplers.The available options are:

  3000 - includes parameters for the 3000 front panel single sample.

  60XX, 20XX, or AQUATek 50, and AQUATek XX - includes parameters for an autosampler sample.

7.7 Reviewing Temperature

The Temperature screens are a multiple-screen listing of all heated zones, their current temperatures, and setpoints.

To display the Temperature screens:

- Press TEMP on the keypad. Temperature Screen 1 (Figure 7-24) appears.

```
CryoTrap  30C->  30C
Sample    30C->  30C
XferLine  98C-> 200C
BOT Htr   98C-> 100C
```

Figure 7-24 Temperature Screen

To display the next Temperature screen, press NEXT PAGE.

To display the previous Temperature screen, press PREV PAGE.

8.1 Overview

This section describes routine maintenance procedures for the 3000 and tells you how to:

- Prepare and load standards.
- Prepare and load samples.
- Install or change the trap.
- Clean and condition the trap.

8.2 Using Standards

The accuracy of your analytical results depends on the careful storage and use of accurately-prepared analytical standards. Purge and trap concentrator analyses are usually run on samples with low analyte concentrations. The low-level standards required for such analyses must be of high quality; small errors that would be insignificant in a high level standard contribute to a large percentage of error in a low-level standard.

You can purchase commercially-prepared standards. A2LA-certified solutions are produced to A2LA/EPA specifications. To ensure that a standard is certified and that it meets your specifications, ask the manufacturer. Suppliers include AccuStandard, Inc. in New Haven, CT; Chem Service Inc. in West Chester, PA; Restek in Bellefonte, PA; Supelco in Bellefonte, PA; or Ultra Scientific in North Kingstown, RI. If you do not wish to buy standards, you can prepare your own.

Because the compounds usually being analyzed for are water-insoluble and unstable in aqueous dilution, you cannot prepare an appropriate standard by dissolving the compounds directly in water. The steps commonly used to prepare methanol solutions containing known amounts of the desired compounds are listed here:

- Prepare blank (reagent, or organic-free) water.
- Prepare a standard methanol solution at the specified concentration.
- Spike the methanol standard into a flask of blank water.

The following paragraphs describe each step in detail.

8.2.1 Prepare Blank Water

Blank water is water that analyzes as organic-free when run by purge and trap analysis. You can prepare blank water in several ways,

- Pass water through a freshly-charged Millipore Super Q water purifier.
- Pass distilled water through a bed of activated carbon at least 12" deep. Put the supply vessel at a higher elevation than the collection vessel, with the supply line entering the column at the bottom. This configuration allows the water to flow from the bottom to top of the column.
- Boil water; then purge it at 80-90°C with helium or nitrogen for at least one hour.

Note: You may use either of these preparation methods, although the last two are the most common. No matter how you prepare blank water, you must check its purity by analysis before use, and you must use it immediately.

8.2.2 Prepare the Methanol Standard

To prepare a methanol standard according to USEPA-approved procedures, follow these steps:

1. Fill a 10 ml volumetric flask with about 9.8 ml of methanol. Allow the flask to stand unstoppered until all alcohol-wetted surfaces have dried.
2. Weigh the flask and its contents accurately to the nearest 100 µg; this microgram value is W_1.
3. Using a 100 ml syringe, immediately add two drops of neat standard (minimum 75% purity) to the flask. Make sure the drops fall directly into the methanol without touching the neck of the flask.
4. Reweigh the flask with its contents; this microgram value is W_2.
5. Dilute the solution to volume (V_C in milliliters) with methanol; then stopper the flask and invert it several times to mix the solutions.
6. Calculate the concentration in micrograms per milliliter $(W_2 - W_1)/V_C$.
7. Transfer the solution to a 10 ml screw cap bottle with a Teflon cap liner, and store it at 6°C.

Methanol solutions containing 2-chloroethyl vinyl ether are stable for one week. Other solutions prepared in this way are stable for up to four weeks. You can vary the methanol dilution to provide a range of standards.

8.2.3 Prepare the Aqueous Standard

Prepare aqueous standards immediately before analysis. When you are ready to run an aqueous standard:

- Spike a measured quantity of the methanol standard into a 100 ml volumetric flask filled with blank water; or
- Spike a measured quantity of the methanol standard through a microliter syringe into the luer fitting of the sample syringe.

Note: Do not inject more than 20 ml of methanol into 100 ml of water.

8.3 Preparing Samples

Before you make an analytical run, you must select an appropriate sample size and load the selected sample.

8.3.1 Select a Sample Size

Sample size depends on many factors: the physical state and homogeneity of the sample; the concentration and vapor pressure of target compounds; the type of detector used, desired detection limits, and the type of GC column. Size has a major effect on the accuracy of the analysis because:

- Capillary columns require small samples (or split injection) to avoid column overloading.
- Sensitive detectors (like electron capture) require small samples to avoid saturation.
- Less volatile compounds or compounds present in low concentration require larger samples to be detected accurately, although they can overload columns and saturate detectors.

For samples of unknown concentrations, Tekmar recommends that you start small (at 0.25 mg for solids and 0.5 ml for liquids) and increase as needed. It is usually easier to optimize results by increasing sample size rather than decreasing it.

Table 8-1 summarizes the parameters, including sample size, specified in various USEPA procedures and protocols.

Parameter	EPA 501.1	EPA 502.1/601	EPA 503.1/602	EPA 624
Sample Size	5 ml	5 ml	5 ml	5 ml
Purge Time	11 min	11 min	12 min	12 min
Dry Purge Time	Off	Off	6 min	6 min
Purge Flow	40 ml/min	40 ml/min	40 ml/min	40 ml/min
Desorb Time	4 min	4 min	4 min	4 min
Desorb Temp	180°C	180°C	180°C	180°C
Bake Time	Not specified	7 min	7 min	7 min
Bake Temp	Not specified	180°C	180°C	180°C
Trap Material	Tenax	Tenax/Silica Gel/Charcoal	Tenax	Tenax/Silica Gel

Table 8-1 Parameters for USEPA 501.1, 502.1/601, 503.1/602 and 624 Protocols

8.3.2 Load a Sample

You can load samples in either of two ways:

- For solid samples, remove the sample glassware, insert the sample, weigh it in the glassware, and reinstall the glassware.

⚠ CAUTION

If Auto Drain is on and you use U-shaped glassware to run a solid sample, you will damage the instrument. Please refer to Section 7.5.1, *Manual Drain* for instructions on turning off the automatic drain feature.

continued

- For aqueous samples, use a luer-lock syringe to load the sample through the sample valve without unloading the glassware. Follow these steps:
  1. Remove the plunger from the syringe barrel.
  2. Carefully pour the sample into the barrel until the sample overflows.
  3. Insert the plunger and vent any air while adjusting the plunger to the desired volume.
  4. Turn the arrow on the valve stem so that it points toward the syringe. (At other times, when a sample is not being loaded, the arrow on the valve stem should point to the left.)
  5. Insert the syringe and load the sample through the sample valve.

⚠ CAUTION
Load only aqueous (watery) samples through the sample valve.

8.4 Working with Traps

The 3000 is delivered with a blank trap installed. This prevents damage to a packed trap if the instrument was powered up with no purge gas flow present. **You must replace the blank trap with a packed trap before you run a sample.**

This section gives detailed information on traps.

8.4.1 Information on Traps and Adsorbents

Traps can be identified by a number stamped on the nut at the top of the trap. Table 8-2 on the following pages gives detailed information about traps and how to use them. The part numbers for these traps are in Chapter 11 of this manual.

Trap #	What Adsorbents are In It	What it Traps	Can It be Dry Purged?	Dry Purge Time	Desorb Preheat Temp.	Desorb Temp.	Bake Temp.	Bake Time	Cond. Time & Temp. for New Traps	Common Problems with Trap
1	Tenax	Everything from methylene chloride and heavier	Yes	4-6 min.	220°C	225°C	230°C	7-10 min.	225°C 180 min.	Low response on brominated compounds, a high back pressure, an outgassing of benzene, toluene and ethyl benzene
2	Tenax Silica Gel	Everything except freons	No	N/A	220°C	225°C	230°C	10-12 min.	225°C 180 min.	Low response on brominated compounds, a high back pressure, an outgassing of benzene, toluene and ethyl benzene
3	Tenax Silica Gel Charcoal	Everything including freons	No	N/A	220°C	225°C	230°C	10-12 min.	225°C 180 min.	Low response on brominated compounds, a high back pressure, an outgassing of benzene, toluene and ethyl benzene
4	Tenax Charcoal	Traps everything except gasses	No	N/A	220°C	225°C	230°C	7-10 min.	225°C 180 min.	Low response on brominated compounds, a high back pressure, an outgassing of benzene, toluene and ethyl benzene
5	OV-1 Tenax Silica Gel Charcoal	Everything including freons	No	N/A	220°C	225°C	230°C	10-12 min.	225°C 180 min.	Low response on brominated compounds, a high back pressure, an outgassing of benzene, toluene and ethyl benzene

Table 8-2 Information on Traps and Adsorbents

Trap #	What Adsorbents are in it	What it Traps	Can it be Dry Purged?	Dry Purge Time	Desorb Preheat Temp.	Desorb Temp.	Bake Temp.	Bake Time	Cond. Time & Temp. for New Traps	Common Problems with Trap
6	OV-1 Tenax Silica Gel	Everything except freons	No	N/A	220°C	225°C	230°C	10-12 min.	225°C 180 min	Low response on brominated compounds., a high back pressure, an outgassing of benzene, toluene and ethyl benzene
7	OV-1 Tenax	Everything from methylene chloride and heavier	Yes	4-6 min.	220°C	225°C	230°C	7-10 min.	225°C 180 min.	Low response on brominated compounds., a high back pressure, an outgassing of benzene, toluene
8	Carbopak B Carbosieve SIII	Everything including freons	Yes	11 min.	245°C	240°C	260°C	4-10 min.	260°C 90 min.	Loss of carbon tetrachloride. Trap may need up to 11 min. of dry purge time to remove water.
Supelco Vocarb 4000	Carbopak C Carbopak B Carboxen 1000 Carboxen 1001	Everything except 2-chloro-ethyl vinyl ether	Yes	1-3 min.	245°C	250°C	260°C	10 min.	270°C 120 min.	High backpressure and a low response on chlorinated compounds

Table 8-2 Information [illegible]aps and Adsorbents

Trap #	What Adsorbents are in it	What It Traps	Can It be Dry Purged?	Dry Purge Time	Desorb Preheat Temp.	Desorb Temp.	Bake Temp.	Bake Time	Cond. Time & Temp. for New Traps	Common Problems with Trap
Supelco's Vocarb 3000	Carbopak B Carboxen 1000 Carboxen 1001	Everything including freons	Yes 40	1-3 min.	245°C 245	240°C to 250°C 250	260°C 260	4 min. 10	270°C 120 min.	Decomposition of bromoform can occur. To prevent this from happening, reduce Desorb temp. to 240°C
Alltech Tenax GR Graphpac-D	Tenax GR Graphpac-D	Everything including freons	Yes	1-4 min.	245°C	250°C	260°C	12 min.	____	Unknown
Supelco's BTEX	Carbopak B Carbopak C	Everything down to benzene (It does not trap MeOH)	Yes	1-3 min.	245°C	250°C	260°C	4 min.	270°C 120 min.	Unknown

Table 8-2 Information on Traps and Adsorbents

8.4.2 How to Change a Trap

> **⚠ WARNING**
>
> **Make sure the trap is cool before you touch it.**

To remove the trap:

1. Turn off and unplug the 3000.
2. Loosen the two ¼-turn screws* on the 3000's right front panel. Slide the right-front panel forward and then to the right to remove it.
3. Loosen the nut at the bottom of the trap one full turn, but do not remove it completely. (It contains a two-piece Teflon 1/8" ferrule.) If loosening it by hand is not possible, use a 3/8" wrench to hold the bottom fitting in place. Use another 3/8" wrench to turn the nut at the bottom of the trap counterclockwise until the fitting is disengaged. If the nut at the top of the trap does not loosen easily, the ferrule may be deformed and need replacement.
4. Use a 3/8" wrench to turn the nut at the top of the trap clockwise (toward you) until the fitting is disengaged. The top of the trap is designated by a 1/8" gold-plated Valco ferrule.

> **⚠ CAUTION**
>
> **Do not use a Teflon ferrule at the top of the trap. The trap has a one-piece gold-plated ferrule that is preswaged onto the trap. Carryover and contamination may occur if you use a Teflon ferrule at the top.**

5. Push the trap down and out of the top fitting; then **carefully** pull the trap straight up and out of the lower fitting and furnace assembly.

> **⚠ CAUTION**
>
> **An E-clip (Figure 8-1) should be installed at the bottom of the trap to keep the trap from sliding down. If the trap slides down, a cold spot will be created at the top of the trap; the cold spot can hold up heavy compounds and cause lower and inconsistent response.**

Figure 8-1 E-clip

* 3000s that have a serial number of 94130001 or greater have swell latches (P/N: 14-4578-008) instead of 1/4-turn screws.

8.4.2 How to Change a Trap, cont.

To install a trap:

1. Slide a packed trap into the trap furnace sleeve from the top, making sure that the one-piece gold-plated ferrule is at the top of the trap. When installed correctly, the ferrule may be free to spin axially on the tubing, but should have no lateral movement along the tubing.

2. Finger-tighten the top of the trap counterclockwise. While tightening the top, push up on the bottom of the trap so that it is seated all the way up in the top fitting. To prevent gas from leaking at the fitting, use an open end wrench to tighten the nut 1/4 turn (90°) past the point where the ferrule first starts to grab the tubing. **Do not overtighten; too much force will damage the ferrule, causing leaks.**

   Note: Although turning the nut 1/8 turn (45°) past finger-tight is adequate for most fittings, you need to apply more force to this particular fitting. The amount of force applied to fittings can vary, depending on the friction between nuts and threads, as well as the composition and wall thickness of the tubing. For example, fittings larger than 1/8" will require more than 1/4 turn (as much as 120°).

   If turning the nut 1/4 turn fails to eliminate a leak at the top of the trap, look for other possible causes. Make sure that the correct size nut and ferrule are installed properly. (See Step 1.) Also, examine the parts for fractures or deformities. If there are no flaws in the parts or installation, gradually tighten the nut in increments of 1/16 turn only. Do not risk damaging the ferrule; if a leak problem persists, call Tekmar Service.

3. If the bottom 1/8" Teflon ferrule needs to be replaced, remove the nut and ferrule. Slide the bottom nut on the new trap. Then slide the two-piece Teflon ferrule onto the trap (with the cone side down).

4. Finger-tighten the bottom trap. (While tightening, push the trap up from the bottom fitting to make sure the trap is completely nested in the bottom of the trap fitting.)

5. Use a 3/8" wrench to tighten the fitting 1/16 turn past finger-tight. **Do not overtighten; excess force will damage the ferrule.**

8.4.3 When to Replace a Trap

Trap lifetimes range from two weeks to five years, with the average being approximately six months. Tenax has a significantly shorter lifetime than silica gel or charcoal. Silica gel and charcoal normally do not affect trap longevity.

Indicators of trap wear are:

- Increase in background. This usually takes the form of benzene and other aromatics in instrument blanks.
- Losses of brominated compounds while other compounds are constant.
- Increase in back pressure.

8.4.4 Conditioning a Trap

You condition a trap by heating (baking) it in the 3000. The conditioning time and temperature can vary, depending on the type of trap you are using. To find out the correct conditioning time and temperature for a new trap, see Table 8-2, check with the trap manufacturer or call Tekmar Service at (800) 543-4461 or (513) 247-7000.

If organic solvents are present in the ambient atmosphere, Tekmar recommends that you condition the trap for 10 minutes at 225°C at the start of each day. This time and temperature are usually adequate for silica gel and charcoal traps. However, if the trap is heavily loaded or if you are running samples containing compounds of low volatility, you may have to bake the trap longer than 10 minutes. Keep in mind that temperatures above 225°C do not necessarily speed up conditioning and can damage Tenax traps.

To condition a trap:

1. Check the Method. The Bake temperature should be the correct temperature for conditioning the trap.
2. Press SHIFT-GO TO.
3. Press the A key (Go to Mode).
4. Press the C key (Bake).
5. Press SHIFT-HOLD to keep the 3000 in Bake mode for the proper amount of conditioning time.

8.5 Cleaning Sample Lines

The 3000 may become seriously contaminated from a highly concentrated sample or a poor quality gas supply. To avoid contamination, keep the sample lines clean.

To remove sample-caused contamination:

1. Turn Bake Gas Bypass (BGB) OFF and install clean, dry glass ware.
2. Press SHIFT-GO TO. Press the A key (Go To Mode). Press the C key (Bake). Press SHIFT-HOLD.
3. Keep the unit in Bake mode for at least 1 hour. In some cases, longer durations might be required.

If baking does not remove contamination, you may want to backflush the lines with the Tekmar Solvent Flush Kit (P/N 14-5118-100). Call Tekmar at (800) 874-2004 or (513) 247-7000 to order.

8.5 Cleaning Sample Lines, cont.

To remove contamination resulting from the use of poor quality gas:

1. First replace the tank and all hydrocarbon traps on the gas supply line. This process may be sufficient to obtain good blanks. If not, press SHIFT-GO TO. Press the A key (Go To Mode). Press the C key (Bake). Press SHIFT-HOLD.

2. Keep the 3000 in Bake mode for at least 1 hour. In some cases, longer times might be required. If the contamination problem persists, call Tekmar's Service Department for assistance.

8.6 Cleaning Glassware

Clean glassware is essential to interference-free runs. This applies to flasks and cylinders as well as samplers (that is, any vessel used to handle samples, standards, blank water, etc.)

To clean glassware, Tekmar recommends that you use the following:

- Dedicated glassware
- Ultrasonic bath
- Muffle furnace

Dedicated glassware refers to glassware that is used for concentrator work only. Glassware that is used for other procedures such as extractions, often is not clean enough to use in trace applications.

An ultrasonic bath is a time-saver. Instead of heavy scrubbing, a brief scrubbing followed by ultrasonics is more effective and less work. Ultrasonic baths can clean the frits and walls of frit samplers that brushes cannot reach. It is acceptable to use any glassware detergents that are recommended for use in an ultrasonic bath. (We recommend that you use the Tekmar™ Ultrasonic Bath.)

A muffle furnace is excellent for cleaning many samplers that nothing else can touch. Set the temperature to approximately 350-400°C (do not go too high; the glassware may melt) and allow the residues to be oxidized. After the glassware has cooled, you can easily remove the remaining char with a brush and cleaning agent. (We recommend the Tekmar™ Muffle Furnace.)

8.7 Cleaning the Sample Needle

You must clean the sample needle on a routine basis. Frequency of cleaning depends on the kind of samples you are running. If you are running aqueous samples, you do not need to clean the sample needle very often. If you are running oils and other messy samples, you must clean the needle after every run.

To clean the sample needle:

1. Wash the needle with Alconox detergent (or equivalent) and water.

2. Rinse well with blank water.

3. If the needle does not get clean, bake it for about two hours at 65°C (149°F).

9-1 Overview

This section describes how to use TURBOCool with the 3000. To install TURBOCool on the 3000, see the installation instructions shipped with the TURBOCool assembly kit. Also refer to the parts diagram at the end of this chapter.

9-2 Description

TURBOCool, an optional accessory to the 3000, uses liquid CO_2 (carbon dioxide) to permit purging onto a subambient trap. TURBOCool can be installed into the 3000 in one of the following ways:

- By factory personnel before the 3000 is shipped
- By a Tekmar Field Service Representative
- By ordering an installation kit and doing it yourself

The 3000 with TURBOCool is built the same as the 3000 without TURBO-Cool except for:

- A special trap furnace that is inserted into a chamber assembly
- The addition of a 12 VDC coolant valve
- The addition of a bulkhead at the rear of the 3000

The special trap furnace is inserted into an expansion chamber assembly. Then it is connected to the top and bottom trap fittings.

The 12 VDC coolant valve is mounted underneath the MCS (Moisture Control System). It plugs into the connector labeled "A" on the power supply/output card.

The bulkhead, which provides connections for tubing, is mounted to the inlet vent on the rear of the 3000. Coolant flows from the supply cylinder to the 3000 through the tubing.

More detailed installation instructions are shipped with the TURBOCool assembly kit.

Liquid CO_2 enters the expansion chamber in the TURBOCool accessory and spirals downward; it expands and creates a vortex of dry ice on the outside of the trap. (See Figure 9-1 on the following page.) The vortex maintains the trap at a uniform temperature during the purge cycle. This minimizes break-through and improves resolution of the lighter, early eluting gases in gas chromatography. It does this by rapidly cooling the adsorbent trap to a controlled temperature (230°C to -20°C). The trap cooldown time is less than 25 seconds.

The standard liquid CO_2 supply cylinder will provide approximately 45-120 runs with TURBOCool, depending on the application. You can conserve liquid $C0_2$ by allowing the concentrator fans to cool the trap for a while after the bake cycle. Then you can use the liquid $C0_2$ to bring the temperature down to the desired level. (See the section titled *TURBOCool and Operating Cycle Times* in this chapter.)

9-2 Description, cont.

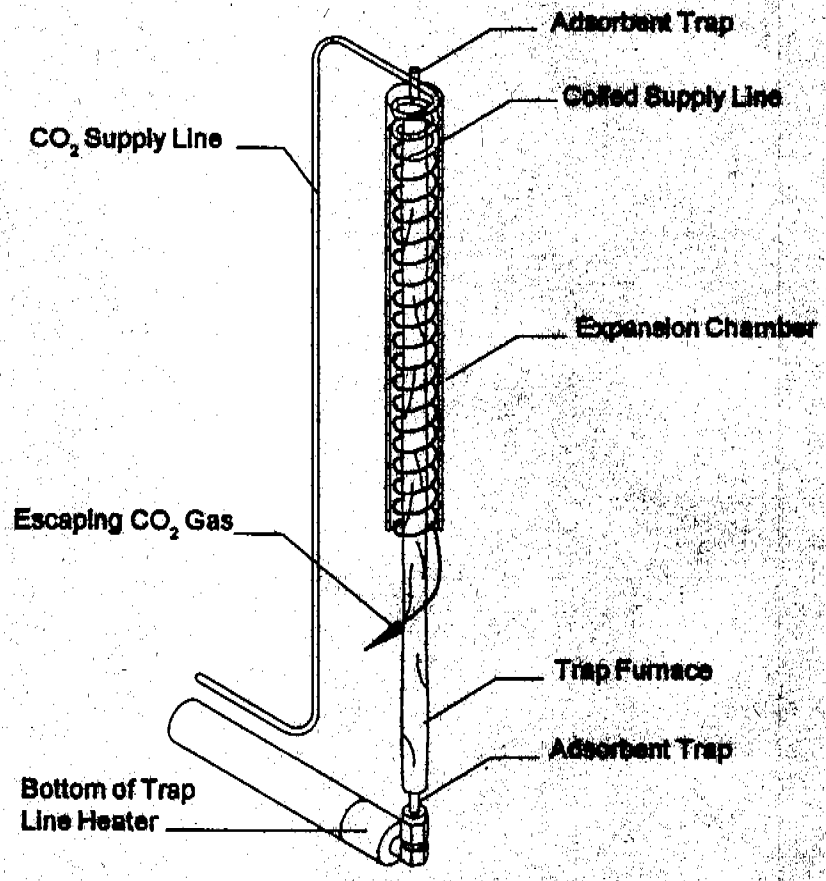


Figure 9-1 TURBOCool Operation

9-3 Applications

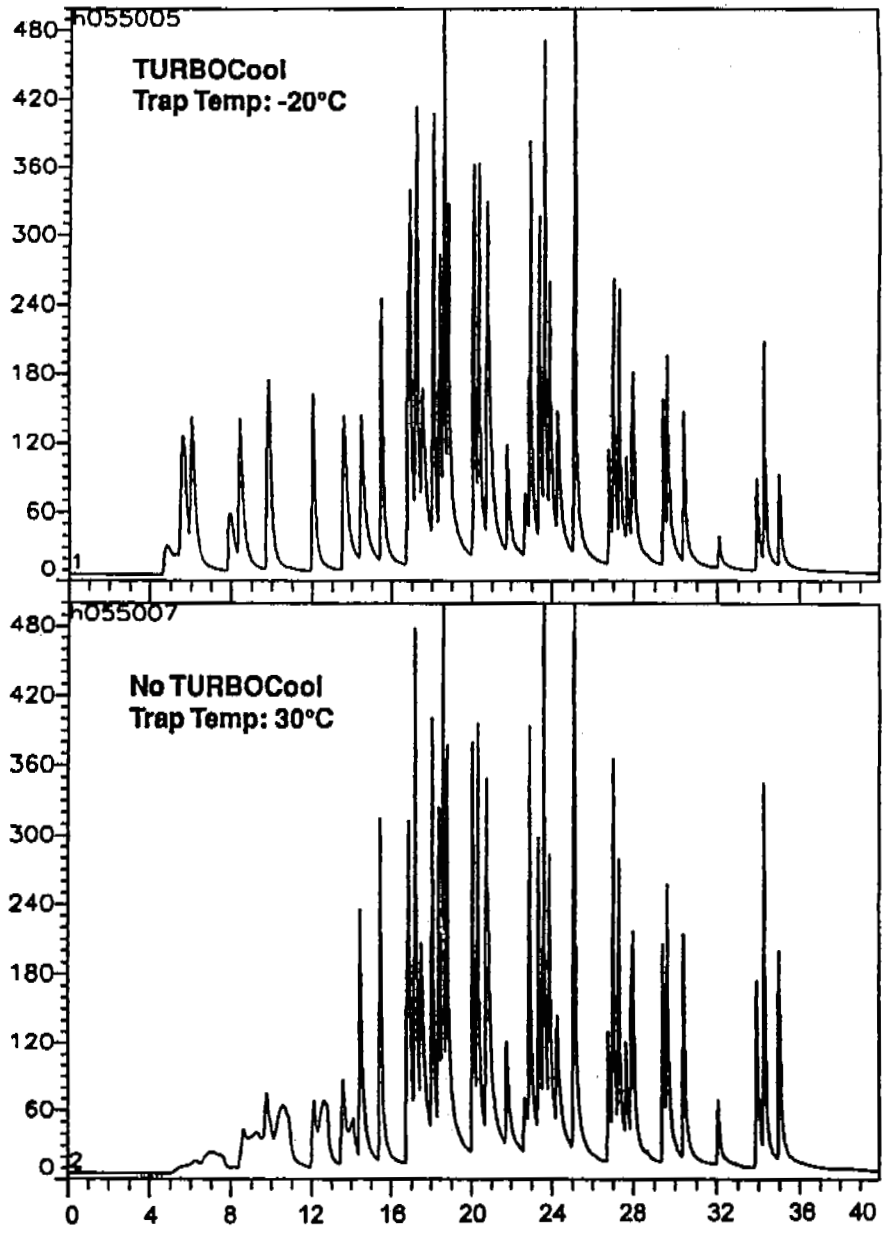
The permanent gases (dichlorodifluoromethane, chloromethane, vinyl chloride, bromomethane, chloroethane and trichlorofluoromethane) are extremely volatile compounds that rapidly migrate through the adsorbent trap on the concentrator. This results in minimal interaction between the analytes and the trap sorbent, leaving a broad band of analytes to enter the chromatographic column. Broad, jagged, poorly resolved peaks are a common result.

TURBOCool improves chromatographic performance in two ways:

- First, it cools the trap to a preset temperature; this increases reproducibility because the trap stays at the same temperature for each analysis.
- Second, at subambient temperatures, the purged analytes stay focused in a narrow band on the trap. When the trap is quickly heated and backflushed in the desorption mode, the compounds stay in a tight band as they deposit on the head of the column. This results in better peak shape, resolution, sensitivity, and reproducibility of the permanent gases. See the sample chromatograms on the following page.

9-3 Applications, cont.

You can use TURBOCool in conjunction with a low volume insert or your GC injection port to permit GC-direct injections. TURBOCool also improves purge and trap gas chromatography when using different column geometries.



Rtx Volatiles: 60m, 0.25mm, 1µ d_f (Restek Corp., Bellefonte, PA)
Oven profile: 35°C for 4 min
8°C/min to 220°C
Detector: Tremetrics 1000 Hall System

Figure 2 Chromatograms

9-4 Specifications and Safety

This section gives you specifications and safety information for TURBOCool.

Furnace: -20C to 375°C. On newer furnaces, rise rate is approximately 700°C/min.; on older furnaces, it is approximately 200°C/min.

Traps: Uses existing Tekmar™ concentrator traps (stainless steel standard):

Length: 12"
Outer Diameter: 0.123" + or - 0.002"
Wall Thickness: 0.010"

Valving: 12 VDC, liquid CO_2 valve, 1000 psi rated

Electronic Control: Via 3000 circuitry and software

Tubing: 1/8" liquid CO_2 supply line, standard 1/8" compression fitting

⚠ WARNING

To avoid electrical shock, turn off and unplug the 3000 before installing or servicing the TURBOCool accessory.

⚠ WARNING

TURBOCool requires a SUPPLY of high pressure liquid $C0_2$ (carbon dioxide) with inductor tube. Do not allow the SUPPLY pressure to exceed 1000 psi.

⚠ CAUTION

TURBOCool temperatures range from extreme highs to lows. To avoid injury, avoid touching hot or cold surfaces. Keep protective covers in place.

⚠ CAUTION

Operate TURBOCool in a well ventilated area to prevent saturation of the ambient air with carbon dioxide.

9-5 TURBOCool and Operating Cycle Times

Some time after the 3000 completes the Bake step, it enters the *Turbo Cooldown step*. During this step, the TURBOCool trap cools to its low temperature setpoint for trapping analytes. The GC cycle time (GC run time plus cooldown time) determines when the Turbo Cooldown step begins. For example, suppose the time to complete one GC cycle is 40 minutes and the time to complete one 3000 cycle is 35 minutes. To coordinate the GC cycle time with its own cycle time, the 3000 waits five minutes after the end of Bake before advancing to Turbo Cooldown. The 3000 clalculates the length of the delay (up to 1000 minutes), based on the GC cycle time. This waiting period is called the *GC Synchronize step.* This step not only provides smooth coordinated operation, it also conserves CO_2 by not allowing Turbo Cooldown to start too soon.

If the GC cycle time is less than the 3000 cycle time, the 3000 will step directly into Turbo Cooldown after bake.

If you have installed a TURBOCool accessory and are running multiple samples, the GC Synchronize step replaces Purge Ready between runs.

For more information on 3000 and GC cycle times, see the section titled *Operating Cycle Time* in Chapter 4 of this manual.

9-6 TURBOCool Method Parameters

Two method parameters are associated with TURBOCool:

- TURBOCool Temperature
- GC Cycle Time

The TURBOCool temperature, which is analyte-specific, is the temperature of the TURBOCool trap. Choose a cooldown temperature that is recommended by the USEPA (United States Environmental Protection Agency).

Program the 3000 to cool the TURBOCool trap to a certain temperature by:

- using a default method that includes the desired temperature.
  or
- editing your own, customized method.

For instructions on methods or method editing, see Chapter 6.

9-6 TURBOCool Method Parameters, cont.

The time at which the 3000 advances to Turbo Cooldown mode is based upon operating cycle times. (See the previous section).

To determine GC cycle time:

1. monitor the time it takes for the GC to cool from its bake temperature to starting temperature.

2. add this time to the GC run time.

Program the 3000 to recognize the GC cycle time by:

- using a default method that includes the desired GC cycle time.
  or
- editing your own, customized method.

The 3000:

1. determines the time needed to complete its modes of operation.

2. subtracts this time from the GC cycle time.

3. uses this quantity to determine the time at which the CO_2 valve activates and Turbo Cooldown begins.

9-7 Ordering Parts or Obtaining Service

This section lists replacement parts for the TURBOCool accessory.

To order parts, ask technical questions, or obtain service, call one of the following numbers:

- (800) 543-4461 - toll-free in the US and Canada
- (513) 247-7000 - outside the US and Canada

Before you call for service or parts:

1. Note the model name, model number, and serial number of the 3000.

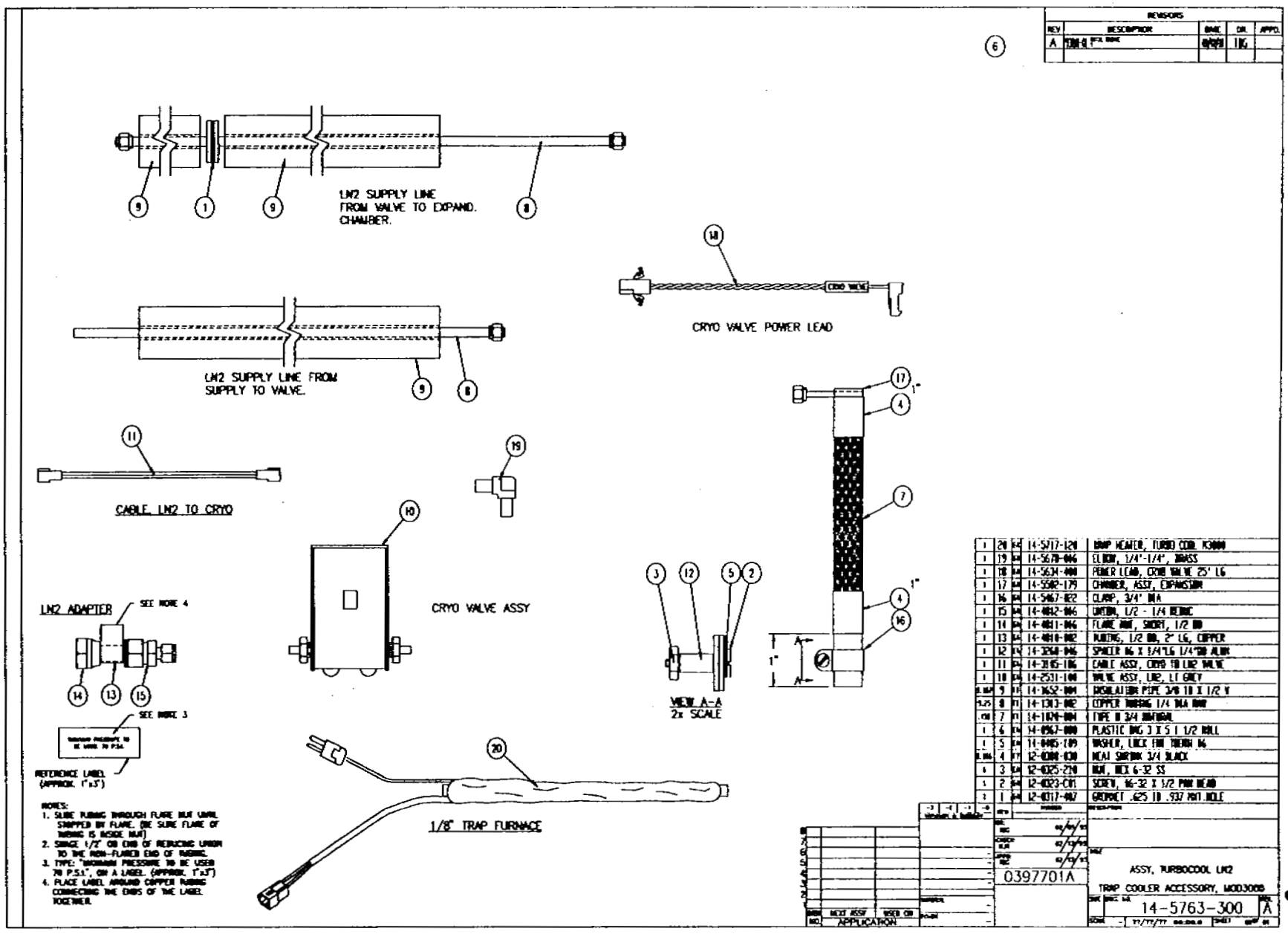
2. If requesting assistance or service, note the type of problem you are having: write down the conditions under which the problem occurred and the display, activity, or result that indicated the existence of a problem.

3. When ordering parts, write down the part number, part name, and quantity needed.

9-7 Ordering Parts or Obtaining Service, cont.

See the TURBOCool parts diagram on the following page.

14-5763-100	TURBOCool assembly kit
14-3000-00T	3000, shipped with TURBOCool installed
14-5717-120	Trap heater, TURBOCool, 3000
14-5678-016	Elbow, 1/4" - 1/4", brass
14-5634-400	Power lead, cryo valve, 25" long
14-5582-179	Assembly, chamber, expansion
14-5467-022	Clamp, 3/4" dia.
14-4812-016	Union, reducing, 1/2" - 1/4"
14-4811-016	Flare nut, short, 1/2 OD
14-4810-002	Tubing, 1/2" OD, 2" long, copper
14-3268-046	Spacer, #6 x 1/4" long, 1/4" OD, alum
14-3105-186	Cable assembly, cryo to LN_2 valve
14-2531-100	Valve assembly, LN2, light grey
14-1652-004	Insulation, pipe, 3/8" ID x 1/2" W
14-1313-002	Tubing, copper, 1/4" dia., raw
14-1070-004	Insulation, varglass, type H, 3/4 natural
14-0485-109	Washer, lock int. tooth, #6
12-0388-030	Heat shrink, 3/4, black
12-0325-210	Nut, hex, 6-32, SS
12-0323-C01	Screw, #6-32 x 1/2, pan head
12-0317-407	Grommet, 0.625 ID, 0.937 mount hole



QTY	ITEM	MAT	PART NUMBER	DESCRIPTION
1	20		14-5717-120	HMP HEATER, TURBO COOL 90000
1	19		14-5678-046	ELBOW, 1/4"-1/4", BRASS
1	18		14-5634-480	POWER LEAD, CRYO VALVE 25' LG
1	17		14-5582-179	CHAMBER, ASST, EXPANSION
1	16		14-5467-822	CLAMP, 3/4" DIA
1	15		14-4832-046	UNION, 1/2 - 1/4 REDUC
1	14		14-4811-046	FLARE NUT, SHORT, 1/2 OD
1	13		14-4810-082	TUBING, 1/2 OD, 2' LG, COPPER
1	12		14-3260-046	SPACER 46 X 3/4"LG 1/4"ID ALUM
1	11		14-3165-186	CABLE ASST, CRYO TO LN2 VALVE
1	10		14-2531-140	VALVE ASST, LN2, LT GREY
AR	9		14-1652-004	INSULATION PIPE 3/8 ID X 1/2 Y
3.25	8		14-1303-082	COPPER TUBING 1/4 DIA RMR
.08	7		14-1024-004	TYPE B 3/4 ARMAFLEX
1	6		14-0967-000	PLASTIC BAG 3 X 5 I 1/2 MIL
1	5		14-0465-189	WASHER, LOCK EXT THERM #6
AR	4		12-4088-030	HEAT SHRINK 3/4 BLACK
6	3		12-4025-210	NUT, HEX 6-32 SS
3	2		12-4023-081	SCREW, 16-32 X 1/2 PAN HEAD
3	1		12-4017-467	GROMMET .625 ID .937 PNT.HOLE

TURBOCool Parts Diagram

10.1 Description

The Automatic Sample Heater is an accessory to the 2016 or 2032. This accessory uses 16 sample heaters to automatically apply heat to each sample while it is in the glassware.

Notes: To operate the Automatic Sample Heater properly, the autosampler must have a serial number that is greater than 92063015. If the serial number is below 92063015, please call Tekmar Service for options.

If the ROM (read-only memory) in your 3000 is not version 2.13 or greater, the sample heater will not work with AQUATek 50 methods. If you encounter this problem, please call Tekmar Service.

Two types of sample heaters are available: *pocket* and *tube*.

Pocket Heater Tube Heater

Figure 10-1 Pocket and Tube Sample Heaters

Pocket heaters, which are pliable, mantle-style heaters, are usually used on 1/2" needle sparger, U-shaped frit and fritless sparger glassware.

Tube heaters are used on 3/4", 25 ml disposable test tube-type and 1/2", 20 ml needle sparger glassware. These silicone insulated heaters fit snug against the glassware and provide temperature uniformity.

10.2 Specifications and Safety

Here are the specifications for the Automatic Sample Heater:

Voltage: 120V + or - 10%
Maximum Current Draw: 1 Amp
Maximum Power Consumption: 120 Watts
Maximum Btu: 409 per hour
Resistance for Pocket Heater: 160 - 175 Ohms
Resistance for Tube Heater: 273 - 302 Ohms

⚠ CAUTION

The Automatic Sample Heater produces hazardous voltage. A qualified person must turn off and unplug the Automatic Sample Heater before servicing. Do not operate the Automatic Sample Heater without the protective covers installed.

10.2 Specifications and Safety, cont.

CAUTION

The sample heaters get very hot; do not touch.

10.3 Installing the Automatic Sample Heater

The following instructions explain how to connect the Automatic Sample Heater to the 2016 or 2032 autosampler.

1. Turn off the 3000 and the autosampler. Do not plug in the Automatic Sample Heater at this time.

2. Set the Automatic Sample Heater near the autosampler on a sturdy table or workbench. Give yourself plenty of room to work.

3. To save lab space, you can place the autosampler on top of the Automatic Sample Heater. To do this safely, you may need to remove plumbing connections, glassware, cables and/or power cords from the autosampler.

CAUTION

To avoid injury or damage to the units, make sure that another person helps you place the autosampler on top of the Automatic Sample Heater.

As you and your co-worker place the autosampler on top of the Automatic Sample Heater, align the four mounting studs on the Automatic Sample Heater with the four holes in the base of the autosampler.

4. Carefully push the autosampler forward until the front edge of the autosampler and the front edge of the Automatic Sample Heater are almost flush. Allow the front of the Automatic Sample Heater to extend about 3/8" from the front edge of the autosampler.

Note: **For the Automatic Sample Heater to work properly, the autosampler must be pneumatically and electronically connected to the 3000. If you have not connected the autosampler to the 3000, follow the instructions in the section titled *Connecting the 2016/2032 to the 3000* in this manual or refer to the *2016/2032 User Manual*.**

5. Locate the 25 conductor cable in the kit box. The cable has a 25-pin connector at each end.

10.3 Installing the Automatic Sample Heater, cont.

6. Connect one end of the 25-conductor cable to the connector labeled "ALS 2016/2032 Sample Heater Accessory Interface" on the rear of the Automatic Sample Heater.

7. Connect the other end of the cable to the connector labeled "Sample Heaters Accessory Interface" on the rear of the autosampler.

8. To attach the power cord:
   a. Plug one end of the power cord to the connection labeled "power" on the rear panel of the Automatic Sample Heater.
   b. Plug the other end of the cord into the connection labeled "Line Voltage Unswitched" on the rear panel of the autosampler.

9. Plug the main power cord from the autosampler into a properly-grounded outlet.

10.3.1 Sample Heater Numbering

For correct operation, you must install the sample heaters in numerical order. On the 2016, install the glassware that is enclosed in the #1 sample heater at position number 1. On the 2032, install the glassware that is enclosed in the #1 sample heater at position number 17. Install the rest of the sample heaters in numerical order.

Sample heater numbering is as follows:

Used with the 2016:

Top Row:	Left to Right	1-8
Bottom Row:	Right to Left	9-16

Used with the 2032:

Top Row:	Left to Right	17-24
Bottom Row:	Right to Left	25-32

10.3.2 Installing the Pocket Heater

If you have not already done so, read Section 10.3.1. Follow these instructions, referring to Figure 10-2 on the following page:

1. Remove the glassware from the autosampler before installing the pocket heater.

2. Slide the glassware into the pocket heater with the purge side of the glassware to the right and the sample side to the left (if you are looking at the front of the autosampler).

3. Position the top of the pocket heater below the foam trap of the glassware.

4. Slide the velcro strap across the top of the pocket heater between the sample and purge sides. Attach the strap to the other side of the pocket heater.

10.3.2 Installing the Pocket Heater, cont.

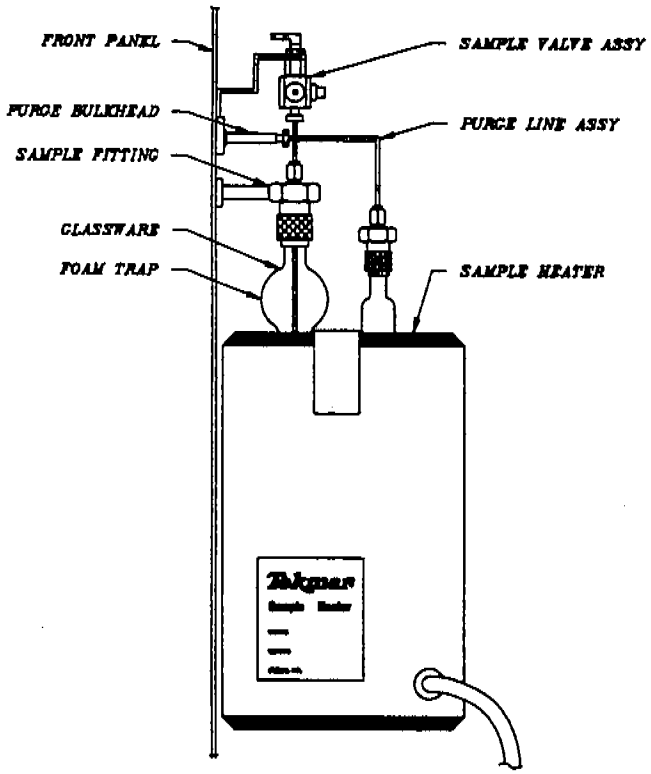


Figure 10-2 Pocket Heater Installed on the Glassware

5. Raise the sample needle until it clears the glassware.
6. Hold the glassware by the end of the purge inlet.
7. Insert the glassware into the sample mount as far as possible. Then back it out approximately 1/16".

CAUTION

Heat from the sample (pocket) heater can cause the glassware to expand. The 1/16" space can prevent the glassware from breaking.

8. Lower the sample needle and finger tighten.
9. Connect the 1/4" purge line union on the autosampler to the purge inlet of the glassware and finger tighten.
10. Check for leaks. (See Chapter 3 in this manual for leak checking instructions.) Use a wrench to tighten leaky fittings only if you cannot eliminate the leak by tightening the fittings with your fingers. Do not overtighten; the glassware may break.
11. To use the sample heaters, include them in your methods. See Section 10.4 in this chapter.

10.3.3 Installing the Tube Heater

If you have not already done so, read Section 10.3.1.

Tekmar recommends that the tube heater be installed only on Tekmar - supplied glassware listed below:

- 25 ml, 3/4" disposable test tube-type glassware (P/N: 12-0507-024)
- 20 ml, 1/2" needle sparger glassware (P/N 14-5256-024)

The outside diameter of the glassware must not exceed 0.752" or be less than 0.741".

To install the tube heaters:

1. Remove the glassware from the autosampler before installing the pocket heater.

2. Slide the glassware gripper (P/N: 14-5271-027) over the glassware. (See the illustration below.)

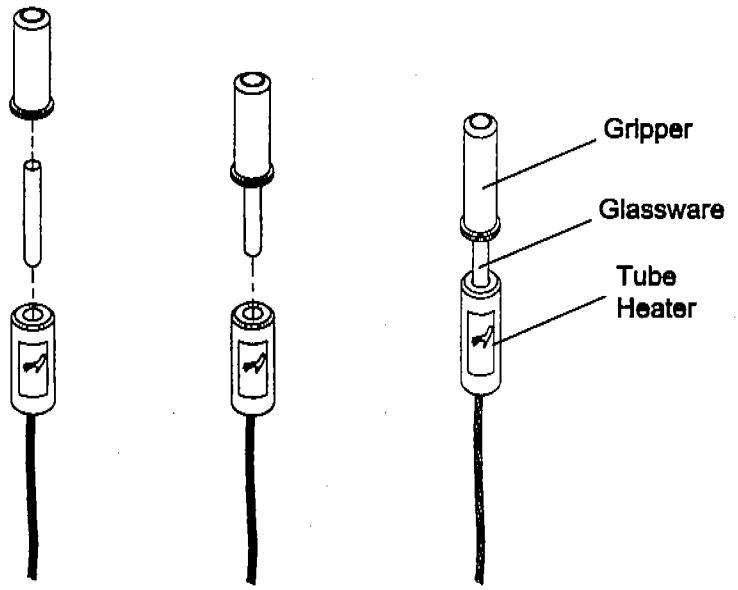


Figure 10-3 Inserting Glassware into the Tube Heater

3. Holding the gripper and glassware vertically, push the glassware as far as it will go down into the tube heater.

10.3.3 Installing the Tube Heater, cont.

4. Insert the glassware into the sample mount as far as it will go, then back the glassware out approximately 1/16"

> **⚠ CAUTION**
>
> **Heat from the sample (tube) heater can cause the glassware to expand. The 1/16" space can prevent the glassware from breaking.**

5. Finger tighten the sample mount.

6. Check for leaks. (See Chapter 3 in this manual for leak checking instructions.) Use a wrench to tighten leaky fittings only if you cannot eliminate the leak by tightening the fittings with your fingers. Do not overtighten; the glassware may break.

7. To use the sample heaters, include them in your methods. See Section 10.4 in this chapter.

10.4 Using the Automatic Sample Heater

To use the Automatic Sample Heater, you must

- Install and turn it on.
- Use default methods that include the sample heaters or program your own methods to include the sample heaters.
- Develop a method schedule.

For more information on methods and method scheduling, see Chapters 6 and 7 in this manual.

The 3000 advances through these two steps only if you have installed and turned on the sample heaters:

- Prepurge - sends gas flow through the sample glassware to remove oxygen and blanket the sample with inert gas. The inert gas prevents oxidation during the Purge step.

- Preheat - Heats the sample before the Purge step

The 3000 associates four parameters with the Automatic Sample Heater:

- Sample Heater - ON or OFF. Turn the heater off if the method will not use a sample heater. Turning off the heater also eliminates the Prepurge and Preheat steps.

10.4 Using the Automatic Sample Heater, cont.

- Prepurge Time - Should allow a volume of Prepurge gas equal to three times the sample glassware volume (3 x 11 ml for a 5 ml sparger, 3 x 34 ml for a 25 ml sparger). To determine Prepurge time, divide the volume by the flow rate. At a purge flow rate of 50 ml/min:

  3 x 11 ml ÷ 50 ml/min = 0.66 min for a 5 ml sparger

  3 x 34 ml ÷ 50 ml/min = 2.04 min for a 25 ml sparger

- Preheat Time - Allows the sample to reach equilibrium at its temperature setpoint before beginning Purge. For every 25 degree increase above ambient temperature, allow one minute Preheat time.

- Sample Temperature - Depends on the nature of the sample that you are analyzing.

Note: The temperature of a sample heater can be viewed in Prepurge and Preheat modes only. If the 3000 is not in Prepurge or Preheat mode, you cannot view the temperature of the sample heater by pressing the TEMPS key.

10.5 Storing Sample Heaters

To insert the sample heater into its storage bin:

1. Carefully slide the sample heater back into the storage bin, holding the cord against the side of the heater.

⚠ CAUTION

- **Do not "bunch" or cram the cord into the back of the bin.**
- **Do not heat the sample heater while it is in the storage bin.**

10.6 Ordering Parts or Obtaining Service

This section lists replacement parts for the Automatic Sample Heater.

To order parts, ask technical questions, or obtain service, call one of the following numbers:

- (800) 543-4461 - toll-free in the US and Canada
- (513) 247-7000 - outside the US and Canada

Before you call for service or parts:

1. Note the model name, model number, and serial number of the instrument.

2. If requesting assistance or service, note the type of problem you are having: write down the conditions under which the problem occurred and the display, activity, or result that indicated the existence of a problem.

3. When ordering parts, write down the part number, part name, and quantity needed.

10.6.1 Electronics

14-3371-000	Sample Heater Mother Board
14-3369-000	Sample Heater Output Board
14-3118-028	Power Switch
14-1282-034	Fuse Holder
14-1283-039	Universal Power Receptacle
14-0065-034	Fuse, 1.0 Amp
14-3642-000	Cooling Fan Assembly
14-3531-000	Pocket Heater Assy, pos. 1-8, before SN 90073001
14-3531-100	Pocket Heater Assy, pos. 9-16,before SN 90073001
14-3531-200	Pocket Heater Assy, pos. 1-8, to include and after SN 90073001
14-3531-300	Pocket Heater Assy, pos. 9-16, to include and after SN 90073001
14-5071-100	Tube Heater Assy, pos. 9-16
14-5071-000	Tube Heater Assy, pos. 1-8
14-3639-000	Wiring Kit

10.6.2 Miscellaneous

14-0094-000	Magnet
14-1646-000	Striker Plate
14-3440-000	Door Pull
14-3240-000	Front Door, Complete
14-3548-000	Sample Heater Shipping Carton
14-3209-000	*2016/2032 Purge and Trap Autosampler User Manual*

11.1 Calling Sales or Service

To order parts, ask technical questions, or obtain service for your Tekmar 3000, call one of the following numbers:

- (800) 543-4461 - toll-free in the US and Canada
- (513) 247-7000 - outside the US and Canada

This section lists part numbers and names for Tekmar 3000 replacement parts. Before you call for service or parts: 9512027

- Note the model name, model number, and serial number of the instrument.
- If requesting assistance or service, note the type of problem you are having: write down the conditions under which the problem occurred and the display, activity, or result that indicated the existence of a problem.
- When ordering parts, write down the part number, part name, and quantity needed.
- If you need to return the instrument to Tekmar for service, please read step 5 and the warning in Section 2.3 before packing the instrument.

11.2 3000 Parts List

Tekmar 3000 parts are listed by type.

Note: To view a list of TURBOCool and Automatic Sample Heater parts, see chapters 9 and 10, respectively.

11.2.1 Glassware

14-2337-024	5ml Frit Sparger (glassware only)
14-2334-024	25ml Frit Sparger (glassware only)
14-2336-024	5ml Fritless Sparger (glassware only)
14-2333-024	25ml Fritless Sparger (glassware only)
14-2052-024	5ml Needle Sparger (glassware only)
14-2053-024	25ml Needle Sparger (glassware only)
14-3096-100	5ml Frit Sparger Kit
14-3095-100	25ml Frit Sparger Kit
14-3094-100	5ml Fritless Sparger Kit
14-3093-100	25ml Fritless Sparger Kit
14-3599-100	5ml Needle Sparger Kit
14-3600-100	25ml Needle Sparger Kit
14-4817-024	5ml Fritless Sparger, right intro stem for use with 2050 or AQUATek 50
14-4818-024	25ml Fritless Sparger, right intro stem for use with 2050 or AQUATek 50
14-3544-024	5ml Frit Sparger, w/left introduction stem for 2050 or AQUATek 50
14-3546-024	25ml Frit Sparger, w/left introduction stem for 2050 orAQUATek 50
14-3544-124	5ml Frit Sparger, w/right introduction stem for 2050 or AQUATek 50
14-3546-124	25ml Frit Sparger, w/right introduction stem for 2050 or AQUATek 50

11.2.2 Sample Handling

14-5684-000	Sample Valve, 3-Port Assembly
14-0216-016	Female Luer Connector for Sample Valve
14-5682-102	Drain Line Assembly
14-5681-102	Purge Line Assembly
14-0036-050	Sample Valve, 3-Port
14-3196-053	Sample Needle, 25ml 9 1/8", for 25ml frit sparger, 25ml fritless sparger
14-3595-053	Needle, 7.75" for 5ml frit sparger, 5ml fritless sparger
14-5186-053	Needle, pointed, 7.75" 16GA, .009" wall, for 5ml needle sparger
14-5186-453	Needle, pointed, 10.25" 16GA, .009" wall, for 25ml needle sparger

11.2.3 Syringes

14-0122-016	Male Luer Fitting for Syringe Valve
14-0069-052	5ml Sample Syringe w/Luer Connector
14-0070-052	25ml Sample Syringe w/Luer Connector
12-0089-052	10 µl Calibration Syringe
14-0114-050	Syringe Valve, 2-port with Luer Connector

11.2.4 Traps

14-2682-000	Tenax 60-80 Mesh, 15 Gram Bottle
14-1168-303	Trap, Blank (O#)
12-0083-303	Trap, Tenax (#1)
12-0084-303	Trap, Tenax /Silica Gel (#2)
14-0124-303	Trap, Tenax /Silica Gel/Charcoal (#3)
14-1457-303	Trap, Tenax/Charcoal (#4)
14-2366-303	Trap, OV-1/Tenax/Silica Gel/Charcoal (#5)
14-1755-303	Trap, OV-1/Tenax/Silica Gel (#6)
14-3347-303	Trap, OV-1/Tenax (#7)
14-3928-303	Trap, Carbo B/Carbo S (#8)
14-5864-303	Trap, VOCARB™3000
14-5865-303	Trap, VOCARB™4000
14-5866-303	Trap, BTEX™

11.2.5 Tubing

14-0539-002	Tubing, Fused Silica 0.32 mm ID
14-2072-002	Tubing, Fused Silica 0.53 mm ID
14-5229-002	Tubing, 1/16", Nickel, Large Bore Purge and carrier gas to BOT pathways
14-5540-002	Tubing, ElectroForm .04 I.D. .06 O.D. (used in sample pathway)
14-5543-002	Tubing, Electroform .02 I.D., transfer line
14-5283-102	Tubing, ElectroForm 1/16 Set (2 pieces - purge lines)
14-5228-002	Tubing, 1/16" Nickel, Small Bore Line between HRP valve and brass tee
14-3845-002	Tubing, 1/16" Nickel, Large Bore Flexible
14-3125-002	Tubing, Hypodermic SS, 16 GA

11.2.6 Fittings

14-5773-016	Ferrule, 1/8", Valco, gold
14-5495-016	Union, 1/4" to 1/16"
12-0064-016	Union, 1/8" to 1/8" stub, brass, bulkhead
14-0241-016	Ferrule, 1/16", SS, single piece Valco
14-0051-016	Union, 1/16", brass
12-0073-016	Union, 1/8", brass
14-3404-016	Union, 1/16" SS, Swagelok, without ferrules
14-4824-116	Union, reducing, 3/4" x 1/2"
14-0050-016	Union, 1/8" to 1/16", SS
14-0264-016	Union, bulkhead 1/16" SS
14-0356-016	Union, bulkhead 1/8" filter assembly
14-5685-016	Union, 1/16" Brass
14-4695-016	Union, tee, 1/16" Brass
14-0241-016	Ferrule, 1/16", SS, single-piece Valco
14-0158-016	Ferrule, 1/16", SS, Swagelok
14-5663-016	Ferrule, 1/16", Teflon
14-1301-016	Ferrule, 1/2", Teflon
12-0041-016	Ferrule, 1/4" Teflon
14-1301-016	Ferrule, 1/2", Teflon
14-0521-016	Ferrule, 0.4 mm I.D. graphite/vespel
14-0540-016	Ferrule, 0.5 mm I.D. graphite/vespel
14-2074-016	Ferrule, 0.8 mm I.D. graphite/vespel
14-2931-016	Ferrule, 1/16" I.D. graphite/vespel
12-0408-016	Ferrule, set 1/8" SS
12-0043-016	Ferrule, Teflon, 1/8" set
14-2931-016	Ferrule, 1/16", graphite/vespel
14-3123-016	Ferrule, 1/16", Upchurch ETFE
12-0405-016	Nut, for 1/8" fitting SS
14-4602-016	Nut, 1/8", SS, Valco
14-3124-016	Nut, short blk, 1/16" Upchurch
14-0159-016	Nut, 1/16", SS, Swagelok
14-0243-016	Nut, 1/16" short
14-3295-016	Nut, 1/16", SS male, Swagelok
14-2792-016	Nut, cap, 1/16" brass
12-0076-016	Nut, plug, 1/8" brass
14-5304-016	Tee, 60 degree side port
14-5302-016	Elbow, 1/8" - 1/16" bulkhead SS
12-0042-016	Reducer, 1/16"-1/8" tube stub
14-5386-016	Fitting, sample mount, unheated 1/2"
14-5686-016	Bulkhead, 1/8" - 1/16" SS, with filter

11.2.7 Heaters

14-5736-000	Kit, pocket sample heater
14-5736-100	Kit, tube heater
14-5717-020	Heater assembly, trap
14-5718-020	Heater assembly, bottom of trap
14-5307-020	Heater, transfer line 72"
14-5687-020	Heater, cartridge assembly (oven)
14-5691-179	Plate, machined, valve oven
14-5555-026	Thermocouple, type K 16" (oven)
14-5654-120	Heater assembly, MCS, with heat sink
14-6108-000	Kit, sample mount, 1/2", heated

11.2.8 Valves and Pneumatics

14-5298-050	Valve, 6-port, 350°C
14-5298-150	Actuator, 6-port valve, 3000/6000 spare
14-5529-050	Valve, assembly, sample 12 VDC
14-5527-050	Valve, assembly, bypass 12 VDC
14-5530-050	Valve, assembly, vent 12 VDC
14-5716-050	Valve, assembly, HRP 12 VDC
14-5526-050	Valve, assembly, drain 12 VDC
14-5675-050	Pressure Regulator 0-30 PSI
14-4570-000	Pressure Gauge assembly, 0-30 PSI
14-5522-050	Flow Controller, 0-100 cc/min
14-5653-067	Loop, MCS, 450-500µl E-form
14-5285-067	Loop, MCS, 600-650µl E-form
14-1362-000	Hydrocarbon Trap Assembly
14-5092-000	Installation Kit
14-5778-050	Valve, Needle (TPC) 1/16" tubes

11.2.9 Electronics

14-5330-090	PC Board Assembly, Cryofocusing Module Logic
14-1719-050	PC Board Assembly, Actuator
14-5233-090	PC Board assembly, Microcontroller
14-5393-090	PC Board assembly, Memory w/Program
14-5235-090	PC Board assembly, Comm/Interface
14-5749-090	PC Board assembly, Output
14-5312-090	PC Board assembly, Interconnect
14-5315-090	PC Board assembly, Thermocouple
14-5329-090	PC Board assembly, Autosampler Card
14-5297-191	Display assembly, LED with connector
14-5439-080	Cover, Display Clear
14-5528-086	Modular Jack with Cable
14-3027-000	Cable, 6-port Valve
14-5260-100	Kit, Hand Held Terminal RS232 with Cable
14-5260-000	Hand Held Terminal RS232
14-5558-086	Cable, 6 pin Modular, Coiled
14-5321-080	Expansion Slot Cover (thermocouple)
14-0298-039	Power Cord, 110V

11.2.9 Electronics, continued

14-5291-038	Transformer assembly, 110V - 24V/8V
14-4957-238	Transformer assembly, 220V - 110V
14-5177-238	Transformer assembly, 100V -110V
14-5634-600	Wiring kit, main, 110V
14-4383-028	Switch, power, 10 amp filtered
14-5634-700	Power lead, trap 25"
14-5634-100	TC Extension, trap 25"
14-5634-200	TC Extension, BOT 13"
14-5634-300	TC Extension, MCS 8 1/2"
14-5634-500	Cable display, 21"
14-5180-034	Fuse, 10A, 250V 5 x 20 mm
14-4961-034	Fuse, 4 amp 5 x 20 mm
14-5757-034	Fuse, 4 amp, sub-min, fast for output module
14-4738-028	Switch, interlock, 125 VAC (trap)
14-5740-058	Output module

11.2.10 Low Volume Inserts

14-4952-000	Low Volume Insert, HP 5890 Packed Injector
14-4952-100	Low Volume Insert, HP 5890 Purged Packed Injector
14-5506-000	Low Volume Insert, HP 5890 Split/Splitless Injector
14-4633-000	Low Volume Insert, Varian (except Varian 1075 Capillary Injector - available soon)
14-4634-000	Low Volume Insert, Perkin Elmer 8000 Series, Sigma 2000 and 2100 GCs (will not work on Autosystems, Sigma Ib-4b and 300 Series GCs)
14-4635-000	Low Volume Insert, Tracor 540, 585
14-4635-100	Low Volume Insert, Tracor 560, 565, 570
14-4635-200	Low Volume Insert, Tremetrics 9000

11.2.11 Septum Needle Adapters*

14-4913-153	Septum Needle Adapter Kit, Varian 1040/1041 Packed Injection Port
14-4913-253	Septum Needle Adapter Kit, Hewlett Packard 5890A Capillary Injection Port
14-4913-353	Septum Needle Adapter Kit, Hewlett Packard 5880A and 5890A Packed Injection Port.
14-4913-453	Septum Needle Adapter Kit, Varian SPI 1075/1077 and Tracor 540 Injection Ports
14-4913-553	Septum Needle Adapter Kit, PE Sigma 2000 Series
14-5009-043	Septum Replacement for Septum Needle Adapter-Pack of 5 Septa

* Also, see Section 11.2.12, *Septum Nuts*.

11.2.12 Septum Nuts

The following septum nuts permit any of the septum needle adapter kits listed in Section 11.2.11 to be adapted to the GC type indicated below:

14-1591-110	Septum Nut, Varian 1040/1041 Injection Port.
14-5036-010	Septum Nut, Hewlett Packard 5890A Capillary Injection Port.
14-5036-110	Septum Nut, Hewlett Packard 5890A Packed Injection Port.
14-1591-410	Septum Nut, Varian SPI 1075/1077 and Tracor 540 Injection Ports
14-1591-510	Septum Nut, Perkin Elmer, all Sigma Series, all 800 Series and Autosystem Injection Ports.

11.2.13 Interface Cables

14-2991-000	Interface, Hewlett-Packard 5890 GC
14-4830-086	Interface, two Tekmar 3000's on one HP 5890 (GC only. 3000's must hook up to separate columns)
14-4188-086	Interface, Hewlett-Packard 5890 w/5970 MSD and Unix or Pascal-based software[1]
14-4652-086	Interface, Hewlett Packard 5890 w/5970 MSD and Unix-B or MS-DOS software, HP 5890/5971/5972 MSD and Unix-B or MS-DOS software, and HP 5890/5989 MS Engine
14-2993-000	Interface, Hewlett-Packard 5995/96/85/87/88/92 GC/MS with HP-1000/RTE GC/MS Software, HP 5890 w/5970 MSD and RTE (RTE-A, RTE-6, or Rev F[2]
14-2974-000	Interface, Hewlett-Packard 5700 Series (exc. 5710/30/90)
14-2976-000	Interface, Hewlett-Packard 5710/30/90 GC w/5970 MSD with Chemstation using Quicksilver Software
14-2990-000	Interface, Hewlett-Packard 5880A/5840A
14-3318-000	Interface, Hewlett-Packard 5995/96/87/85/92 w/Chemstation-Quicksilver
14-3010-000	Interface Kit, Hewlett-Packard 5995/85/9392 GC/MS (includes I/O box). requires HP's BATCH or AQUARIUS Software and external events relay board to operate with SIDS Data System

[1] This cable requires the HP A111 (HP P/N 05990-60111) or A211 (HPP/N 05990-60211) Accessory Card and Internal Accessory cable (HP P/N 05987-60158) if using Pascal software. If using Unix software, the Internal Accessory cable (HP P/N 05987-60158) only is necessary.

[2] Revision F uses both master and slave cables. Use pins 27 and 28 instead of 25 and 26 on the MS Molex plug.

11.2.13 Interface Cables, cont.

14-2968-000	Interface, Varian 3300/3400/3500/3600 with or without serial I/O
14-5044-086	Interface, two Tekmar 2000s to one Varian 3400 GC (2000's must hook-up to separate columns)
14-2969-000	Interface, Varian 3700
14-2966-000	Interface Kit, Varian Vista (includes I/O box for switching 2000A to 2000B) also Varian 6000
14-3052-000	Interface, A & B to Varian Vista I/O Box
14-2972-000	Interface, Tracor 560/565/670
14-2992-000	Interface, Tracor 540 and Waters Dimension I
14-4655-086	Interface, two Tekmar 2000's to one Tracor 540 (GC only. 2000's must hook up to separate columns.)
14-3430-000	Interface, Tracor 585/9000 and Waters Dimension II
14-2970-000	Interface, Perkin-Elmer Sigma Series
14-3233-000	Interface, Perkin-Elmer 8000 Series/Autosystem
14-5397-086	Interface, two Tekmar 2000's on one Perkin Elmer 8000 Series/Autosystem
14-2973-000	Interface, Shimadzu GC9A
14-4610-086	Interface, Shimadzu GC 14A/15A, GC 14A w/QP 1000 EX MSD and GC 14A w/QP 2000 MSD
14-4009-000	Interface Splicer Cable, Finnigan 5100/4000/4500 and OWA
14-4938-086	Interface, Carlo Erba Mega/Vega Series and Fisons 8000
14-3147-000	Interface, General Purpose/HNU 301/321/421[3]

[3] Valve driver option necessary from HNU.

11.2.14 Miscellaneous

14-5118-100	Kit, Solvent Flush
14-5959-000	Kit, Desorb, 1/4" x 7"
14-2805-042	E-clip (retaining clip) for traps
14-5525-019	Blower assembly, 60 CFM 115V
14-5524-219	Fan assembly, 3 1/8" SQ, 14" Leads
14-5524-319	Fan assembly, 3 1/8" SQ, 11" Leads
14-3000-174	*3000 Purge and Trap Concentrator Service Manual*

12.1 Overview

This section gives you basic troubleshooting information. The *Purge and Trap 3000 Concentrator Service Manual* (Tekmar Part Number: 14-3000-174) contains more detailed, advanced troubleshooting information.

This chapter is divided into four parts:

- Calling Tekmar Service
- Safety
- Troubleshooting Electomechanical Problems
- Understanding Error Screens

12.2 Calling Tekmar Service

If you need assistance solving a problem, follow these steps:

9512202?

1. Note the model name, model number, and serial number of the instrument.

2. Note the type of problem you are having: write down the conditions under which the problem occurred and the display, activity, or result that indicated the existence of a problem.

3. Call Tekmar Service at one of the following numbers:

- (800) 874-2004 - toll-free in the US and Canada
- (513) 247-7000 - outside the US and Canada

12.3 Safety

Before you troubleshoot, read the safety information in this section.

CAUTION

Unless the pneumatic lines are badly contaminated, do not flush them with a strong solvent, such as methanol; use water instead. The valve rotor can adsorb strong solvents and become contaminated. If you must use a strong solvent, rinse the lines thoroughly with water after cleaning them.

DANGER

Do not service a Tekmar instrument if you are not qualified to do so. Call Tekmar Service.

Disconnect power before replacing parts.

Do not redesign or modify the equipment in any way. Do not remove equipment grounds. Never replace a fuse with one of a higher rating. Always use the correct replacement parts.

Assume that high current and voltage are on ALL circuits.

Do not place liquids near the area where you are troubleshooting; liquids can spill on live circuits and conduct electricity.

Jewelry conducts electricity; remove jewelry.

Use insulated tools.

Capacitors on electronic circuit boards can hold an electrical charge even after you turn off the unit. Do not touch the capacitors.

Do not troubleshoot when you are tired or taking medication that makes you drowsy.

Work in a well-lighted area.

Do not work alone.

Wear safety glasses.

Follow the manufacturer's directions when using solvent and other chemicals. They may ignite, explode or damage the equipment. Also refer to MSDS (Material Safety Data Sheets) for safety information.

Place a fire extinguisher nearby that is rated for electrical and chemical fires.

Internal parts (especially heaters, heat sinks and some electronic components) can get very hot. When troubleshooting, be careful not to touch these parts. Allow parts to cool before replacing them.

Some Tekmar™ accessories require the use of liquid CO_2 (carbon dioxide) or LN_2 (liquid nitrogen). These chemicals produce low temperatures that can damage human tissue. Avoid touching the chemicals or the surfaces that they cool.

Do not exceed maximum pressure ratings for Tekmar instruments.

12.4 Solving Electro-mechanical Problems

This section will help you troubleshoot electromechanical problems.

No display or erratic display

Check	Action
A. Turn off and unplug the 3000. Check the fuses. Are they good?	A. YES: Proceed to B. NO: Replace and try again.
B. With the power on, press the reset button (located on the rear of the 3000). Does the display appear?	B. YES: System is reset. NO: Call Tekmar Service.

System does not step from Standby to Purge Ready

Check	Action
A. Is the trap temperature below the setpoint?	A. YES: Proceed to B. NO: Wait for the trap to cool past the setpoint.
B. Is the system in Auto?	B. YES: Call Tekmar Service. NO: Press AUTO.

System does not step from Purge Ready to Purge

Check	Action
A. Does the system include an AQUATek 50 or 2050?	A. YES: Proceed to B. NO: Press START.
B. Is the Purge Start LED (LED A) on the GC interface board on*?	B. YES: Call Tekmar Service. NO: Proceed to C
C. Press Start on the AQUATek 50 or 2050. Does the 3000 start?	C. YES: Finished. NO: Check cables between AQUATek 50 and 3000

System does not step out of Purge

Check	Action
A. Is the system in Auto?	A. YES: Proceed to B. NO: Press AUTO.
B. Has the preset time elapsed?	B. YES: Call Tekmar Service. NO: Wait for time to elapse.

System does not step out of Dry Purge

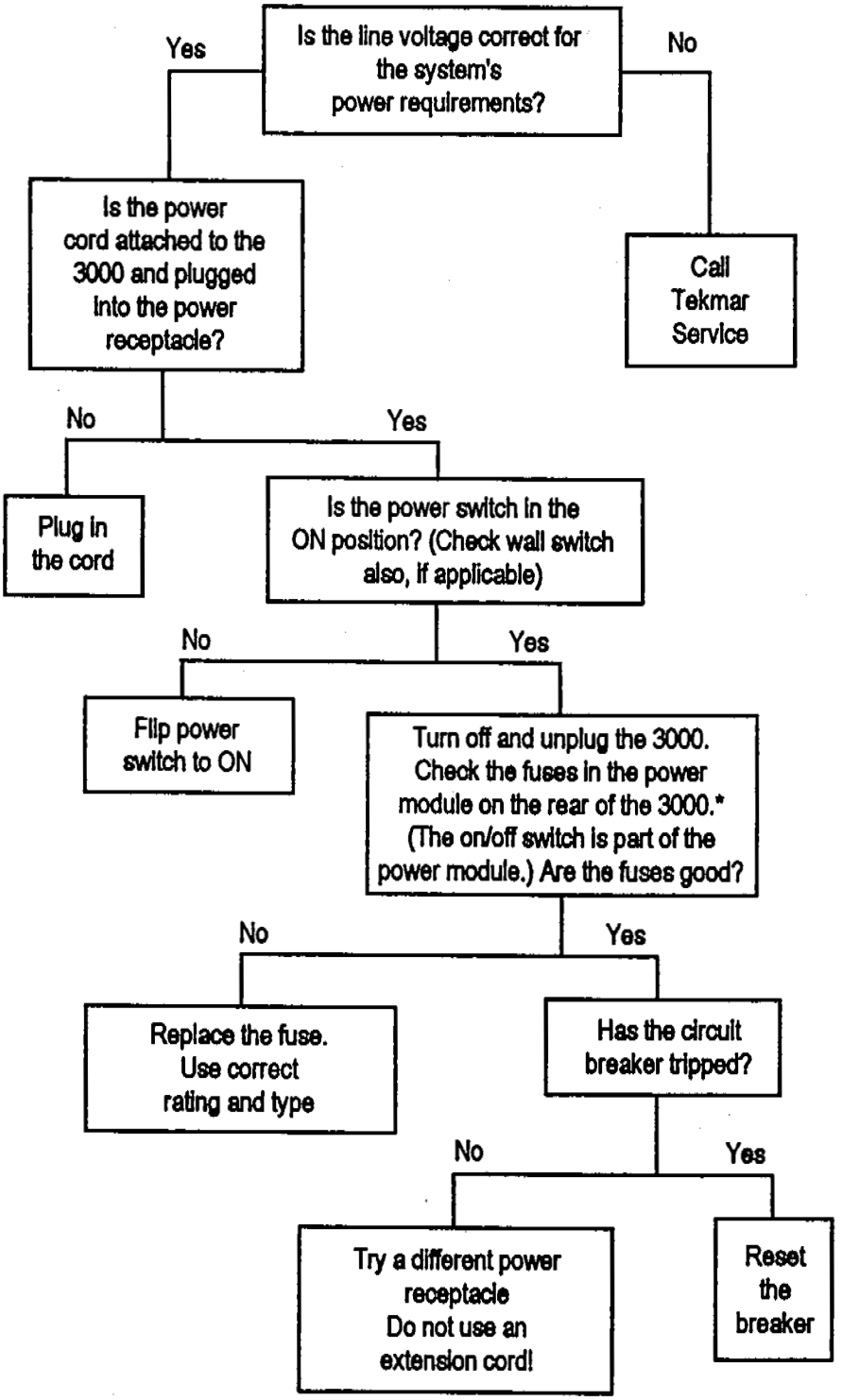
A. Refer to *System does not step out of Purge*.

* There are a row of LEDs (light-emitting diodes) labeled A through K on the GC interface printed circuit board. The board is labeled with the part number, 14-5235-090.

	Check	Action
System does not step out of Desorb Ready	A. Is the system interfaced to a GC?	A. YES: Proceed to B. NO: Press STEP.
	B. Does the GC Ready LED (LED B) on the GC interface board come on when the GC is ready*?	B. YES: Call Tekmar Service. NO: Proceed to C.
	C. Is the 3000 configured to work with your GC?	C. YES: Proceed to D. NO: Configure the 3000. (See Section 3.)
	D. Is the GC providing a Ready signal to the 3000?	D. YES: Call Tekmar Service. NO: Correct the GC problem.
System does not step out of Desorb Preheat	A. Does the trap temp. equal or exceed the set temperature?	A. YES: Proceed to B. NO: Proceed to C.
	B. Is the system in Auto?	B. YES: Call Tekmar Service. NO: Proceed to C.
	C. Is the trap heater temperature rising from ambient?	C. YES: Allow time for it to rise to the set point.
System does not step out of Desorb	A. See *System does not step out of Purge*	
System does not step out of Bake	A. See *System does not step out of Purge*	

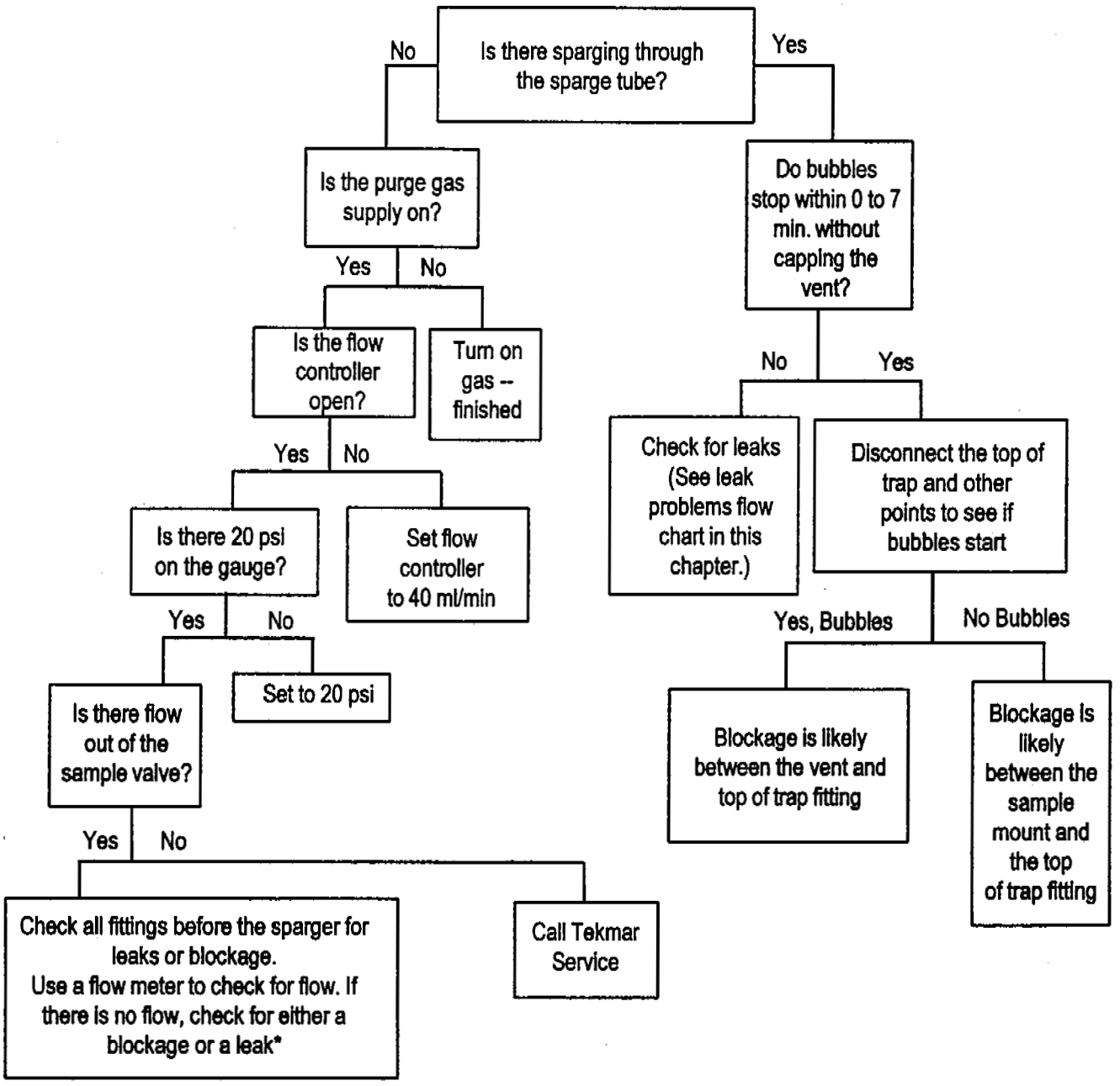
* There are a row of LEDs (light-emitting diodes) labeled A through K on the GC interface printed circuit board. The board is labeled with the part number, 14-5235-090.

No Power to the 3000



* Make sure that the 3000 is off and unplugged. Insert the end of a small, slotted screwdriver into the notch on the power module. With the screwdriver, **gently** pry the fuse holder out of the power module.

No Purge Flow Out of the Vent

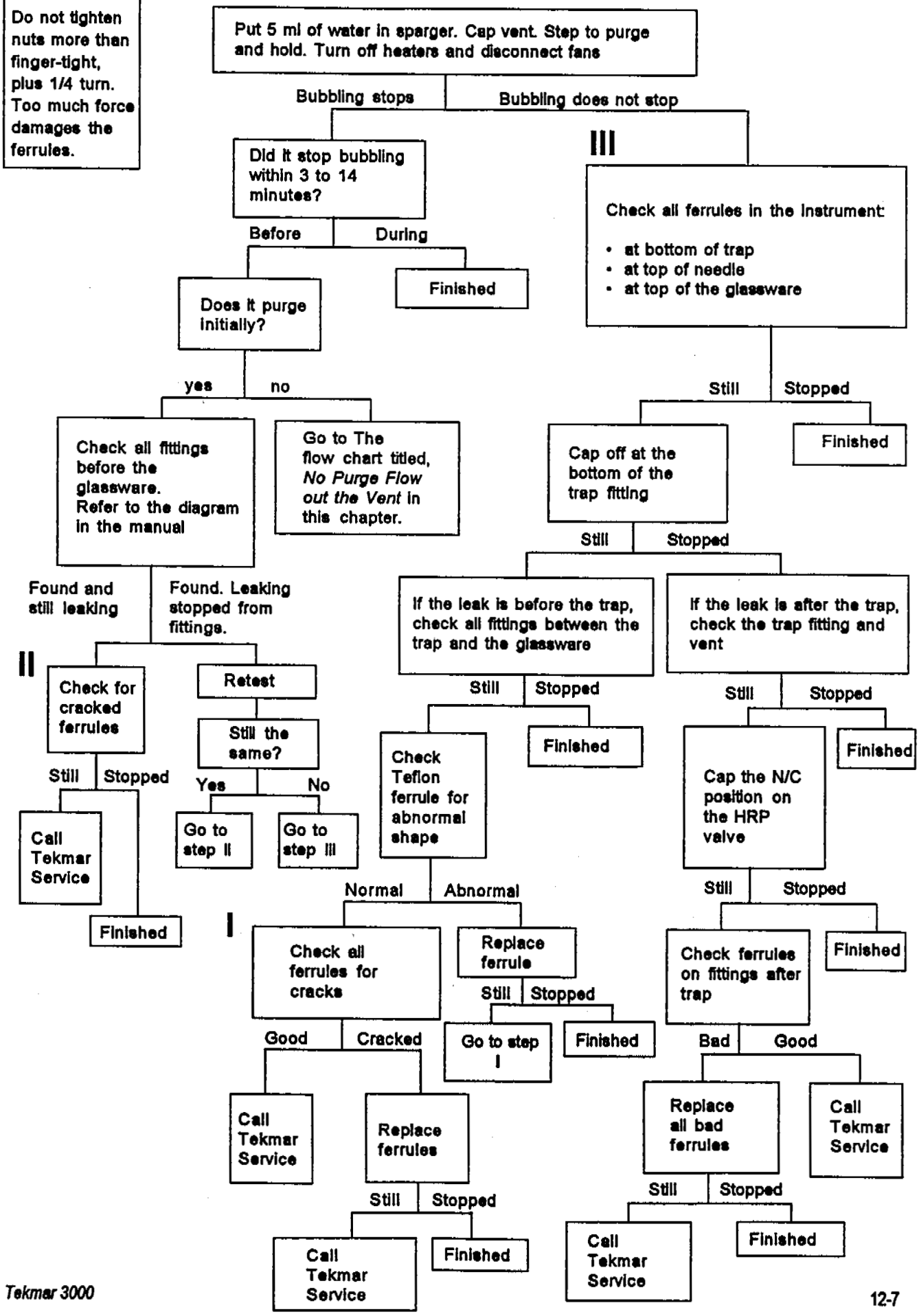


* To check for leaks, see the leak problems flow chart in this chapter. To check for blockage using a flow meter, start at the purge bulkhead and work your way back using the the 3000 flow diagrams in the back of this manual.

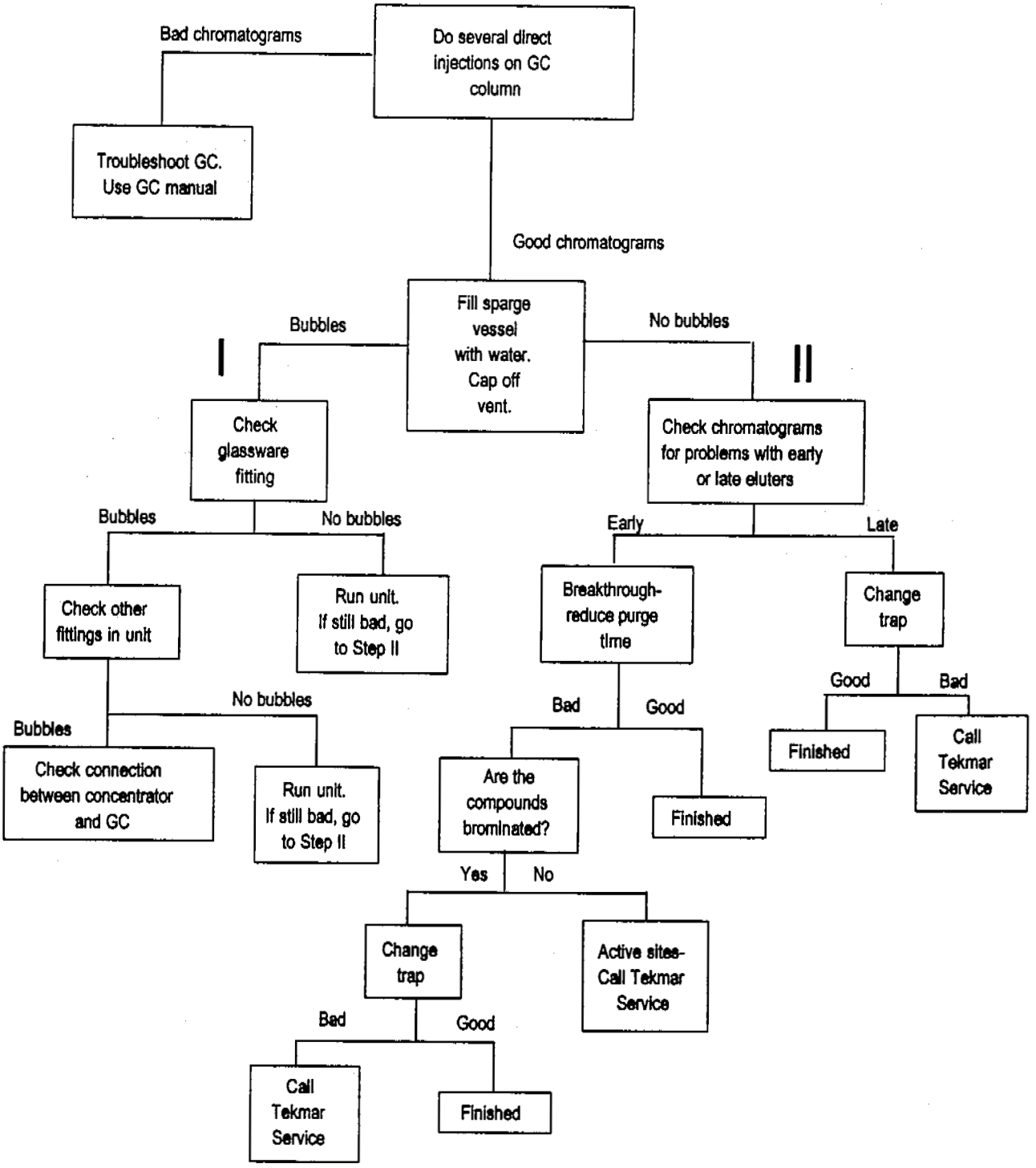
Leak Problems

Caution:

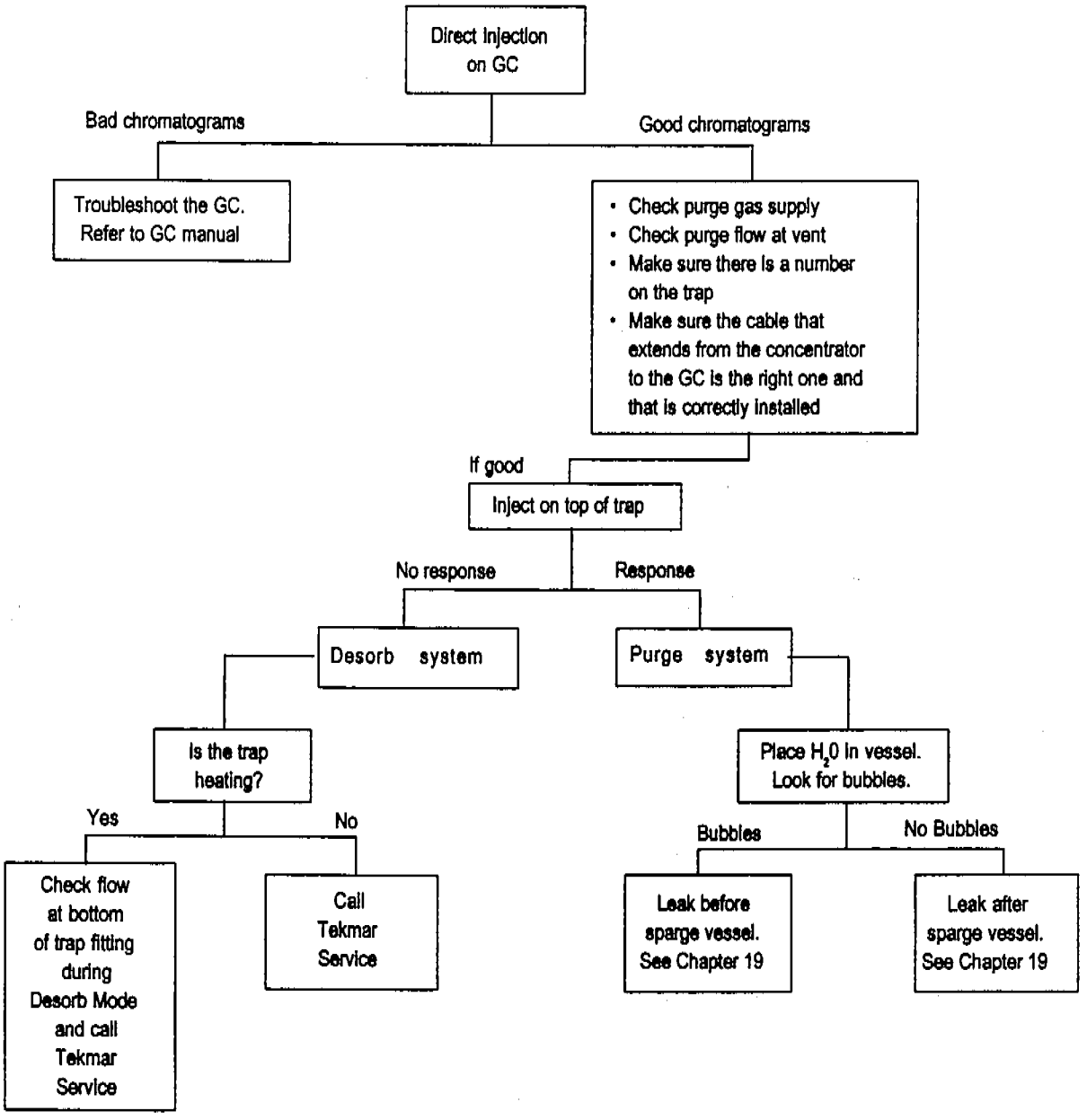
Do not tighten nuts more than finger-tight, plus 1/4 turn. Too much force damages the ferrules.



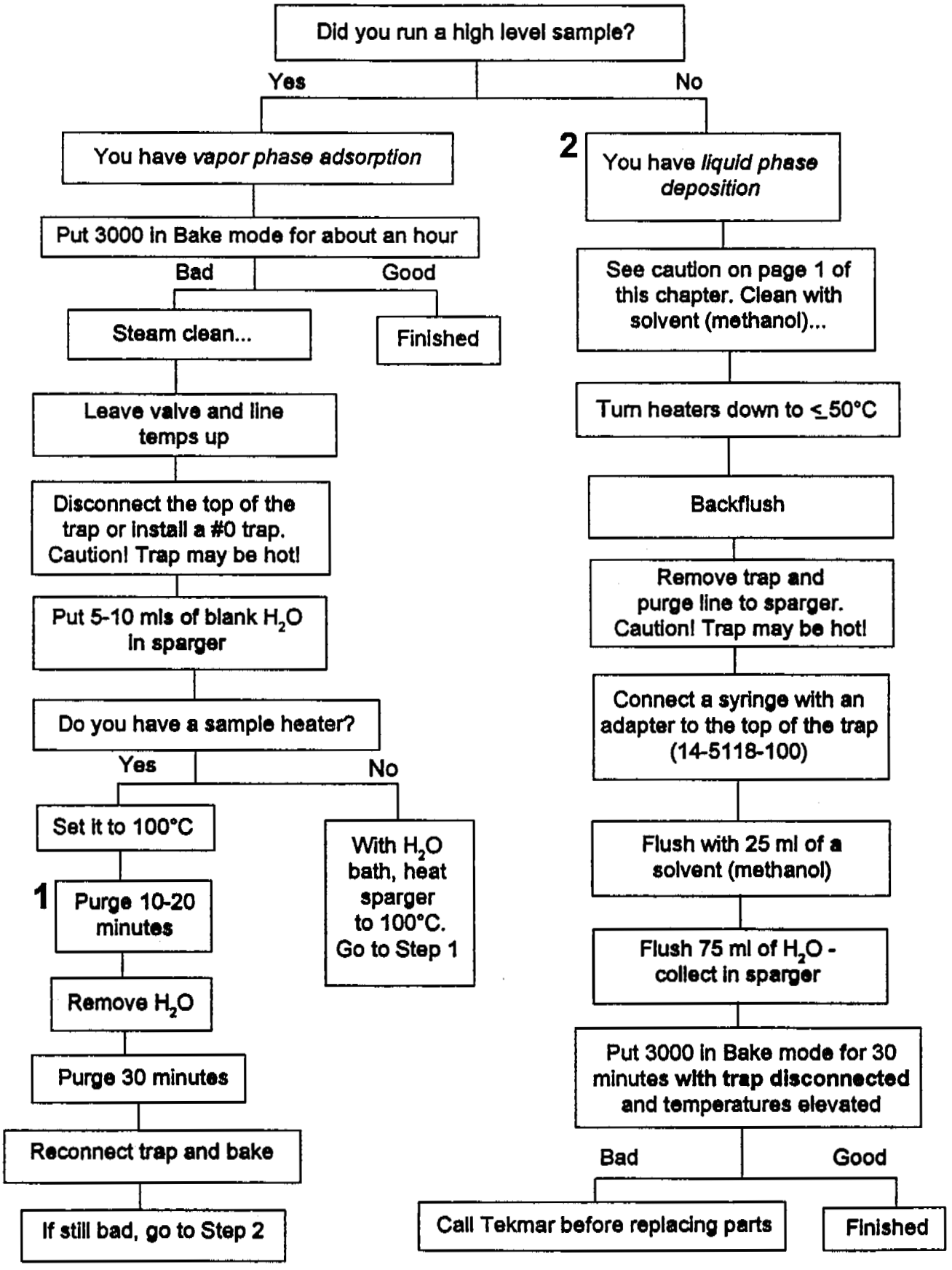
Reduced Sensitivity



Lack of Response



Carryover Contamination



12.5 Understanding Error Screens

This section describes Error screens you may encounter when operating the system. It also has basic information on what to do about the errors. Types of errors described are Operation errors, User Interface errors, Programming errors, and Fatal errors.

12.5.1 Operation Errors

Operation errors indicate problems with a mechanical or electronic system within the 3000. The Operation errors are:

MaxFailsafe Exceeded

This error signals a runaway situation, where a region in the 3000 has exceeded its maximum safe temperature (such as the transfer line or trap region). This type of error will shut down the system.

```
MaxFailsafe Exceeded
     System Error
Xfer Line    310/300
   'ENTER' to Clear
```

Note that the screen shows the actual/maximum temperatures. A MaxFailsafe error may indicate a blown triac on the power supply/output printed circuit board, or a short in the 3000. Call Tekmar Service.

MinFailsafe Exceeded

This error indicates that a region (such as the trap region) is nearing a temperature setpoint below that which is allowed. It could also occur if the 3000 electronics sends back a temperature setpoint that is far below the allowable range. The screen shows the actual/minimum temperatures.

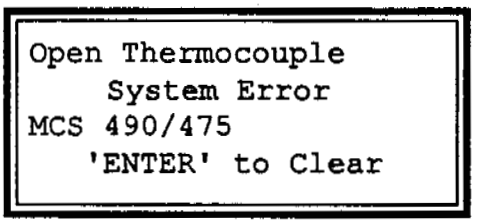
```
MinFailsafe Exceeded
     System Error
Trap      300/310
   'ENTER' to Clear
```

This error may indicate a problem with the 3000 electronics: thermocouple and heater connections, solid state relay or board fuses. Call Tekmar Service.

continued

Open Thermocouple

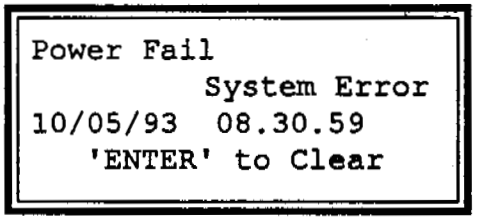
This error indicates that a thermocouple is not properly connected. In the example screen below, the 3000 registers an MCS temperature of 490°, but is checking against a 475° maximum.



Reconnect the thermocouple to the thermocouple conditioner board, install an extension to make the proper connections, or replace the thermocouple if it is bad. (Call Tekmar Service before replacing parts.) Press ENTER to clear and resume operations.

Power Fail

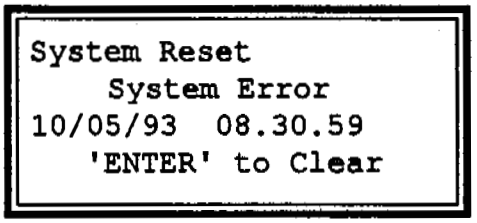
This "error" is routine upon power-up. It confirms that the system was powered down and the time power-down occurred.



Press ENTER to clear and resume operations.

System Reset

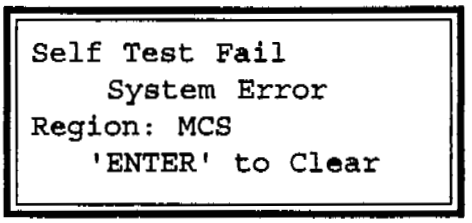
This error appears anytime you hit RESET following a fatal error.



Press ENTER to clear and resume operations.

Self Test Fail

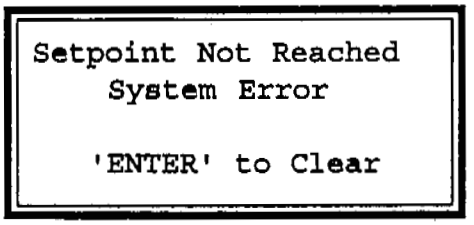
This error occurs when one of the 3000 systems does not pass its self test. If the MCS self test fails, for example, a thermocouple may be open, or a heater may not be plugged in.



Check thermocouple and heater connections, heater resistance, and thermocouple voltage (Call Tekmar Service for assistance.) Press ENTER to clear and resume operations.

Setpoint Not Reached

This error appears anytime the 3000 does not reach a particular setpoint in the appropriate time.



Check thermocouple and heater connections, heater resistance, and thermocouple voltage. (Call Tekmar Service for assistance.) Press ENTER to clear and resume operations.

12.5.2 User Interface Errors

User Interface errors flag discrepancies between what the operator has configured the 3000 to do and what the system is capable of doing. User Interface errors are: Check Method & Sample, Zero-Sample Schedule, and Entry Out of Range.

Check Method & Sample

This error indicates that your method schedule is incorrect for the particular unit you are running. For example, the error will appear if you are trying to run a 2016 sample on position "0" or a 3000 sample on position "10". This is because "0" indicates a single-position unit and a number higher than "0" indicates a multi-position unit, such as a 2016 autosampler. You can think of this error as sample type "mismatch".

```
Check Method & Sample
     System Error
#1:M3000/PO1
   'ENTER' to Clear
```

If you encounter a Check Method & Sample error, check your method scheduling. Make sure it is appropriate for the type of unit you're running. Press ENTER to clear and resume operations.

Zero-Sample Schedule

This error appears when all the method numbers in your schedule are "0".

```
Zero Sample Schedule
     System Error
Schedule Not Used
   'ENTER' to Clear
```

Here is an example of a Method Schedule that will result in the Zero-Sample Schedule error:

Start	Stop	Meth	RPS
1) 1	0	0	0
2) 0	6	0	0
3) 0	0	0	3

If you encounter the error, check your method scheduling. Make sure a method number other than 0 appears somewhere in the schedule. Press ENTER to clear and resume operations.

continued

Entry Out of Range

This User Interface error indicates that a setpoint you have entered for a particular parameter is out of the allowable range. The screen shows the minimum and maximum values for that parameter.

```
Entry Out of Range
    System Error
Trap Cooldown
    -190 to 420
  'ENTER' to Clear
```

If you encounter an Entry Out of Range error, change the setpoint(s) to fall within the allowable range. Press ENTER to clear and resume operations.

12.5.3 Programming Errors

Programming errors indicate problems with the 3000 Purge and Trap Concentrator's software. The Programming errors are: Memory Allocation, Message Queue Full, Setpoint Creation, and Mode Not Found.

If you encounter a Programming error, call Tekmar Service. If possible, write exactly what you were doing when the error occurred, and report that information to Tekmar.

Memory Allocation

This error indicates that the 3000 has insufficient memory to operate properly.

```
Memory Allocation
    System Error


  'ENTER' to Clear
```

Message Q (queue) Full

This is similar to the Memory Allocation programming problem.

```
Message Q Full
    System Error
Queue Entries

  'ENTER' to Clear
```

continued

Setpoint Creation

This error indicates that the 3000 software improperly selected either the region (such as trap) or the variable (such as temperature) for a given setpoint.

```
Setpoint Creation
         System Error
Region:2
   'ENTER' to Clear
```

Mode Not Found

This Programming error indicates that the 3000 is trying to step to a mode that does not exist.

```
Mode Not Found
     System Error
Status: #0
  'ENTER' to Clear
```

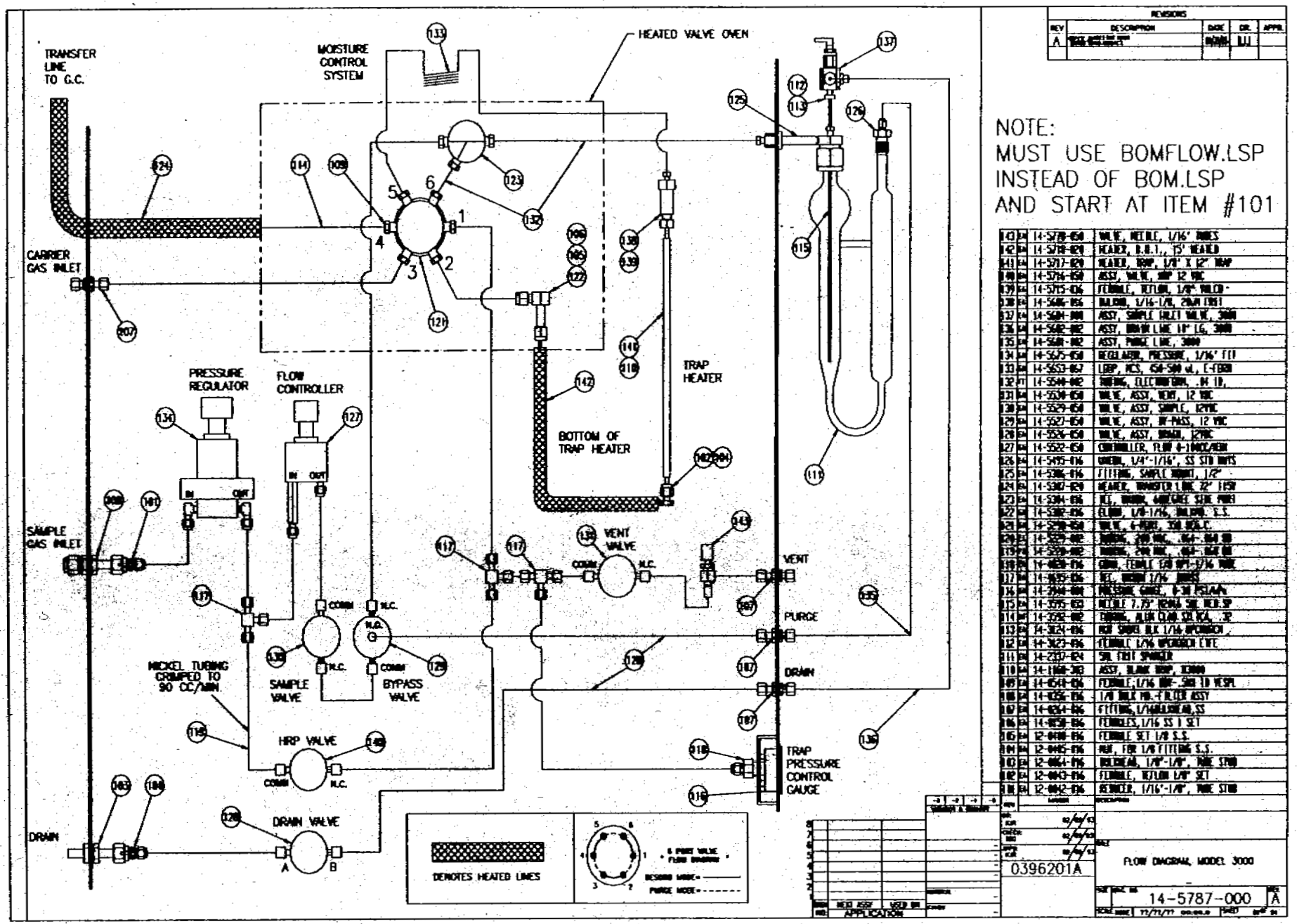
12.5.4 Fatal Errors

The following 13 Fatal errors are "unrecoverable" errors: Errant, Address, Bus, CHK Instruction, Divide by Zero, Illegal Instruction, Unknown Exception, Privilege Violation, Trace Error, TRAPV Instruction, TRAP Instruction, User Interrupt, Spurious Interrupt. Here is a sample of one of the Fatal error screens:

```
Errant Error
     System Error
PC: xxxxxxx  SR: xxxx
  'ENTER' to Clear
```

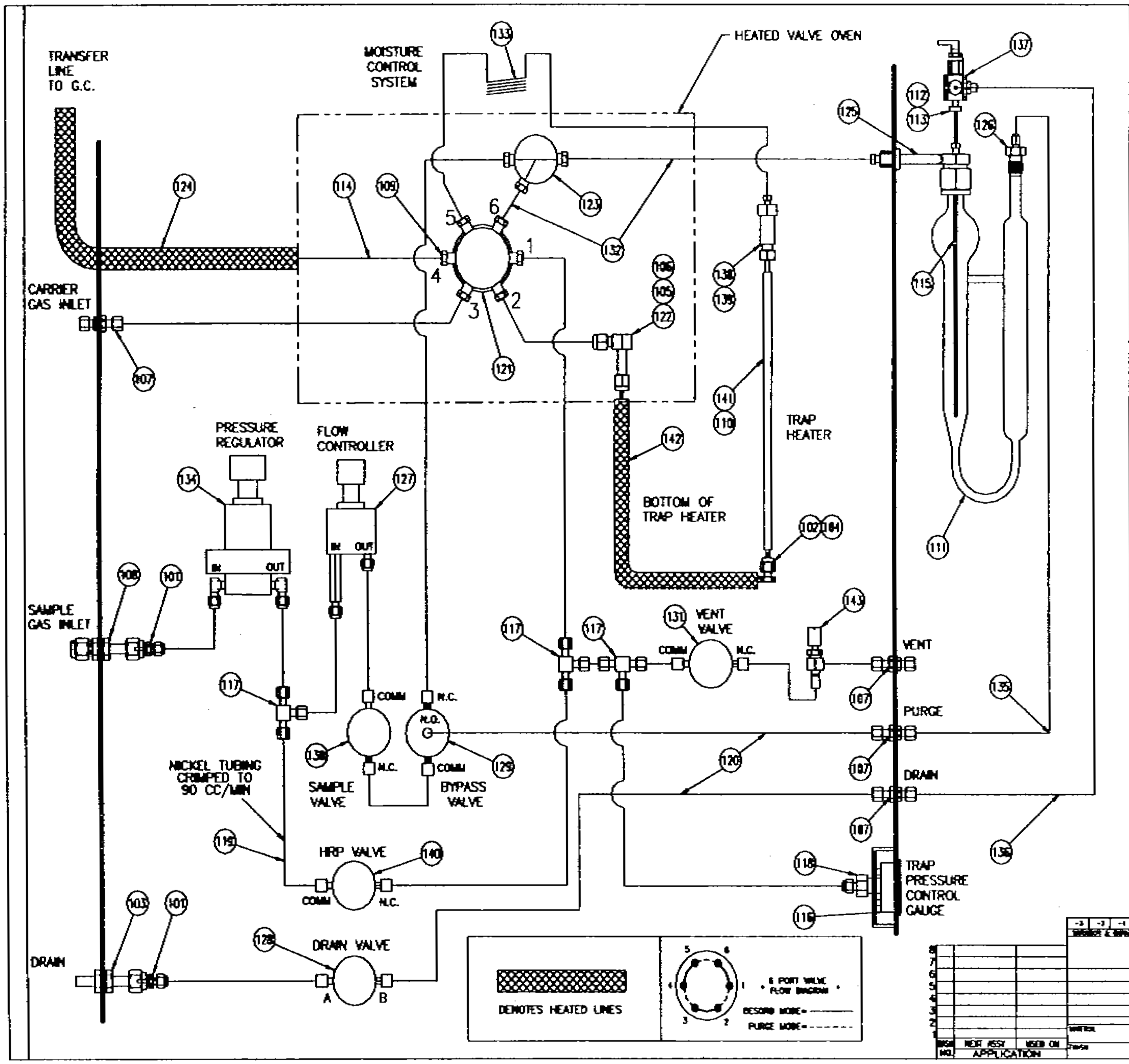
These errors indicate a problem with either the read-only or random-access memory within the system. You can neither cause (nor fix) any of these errors. You can press ENTER to reset the system and start over with a new run. Call Tekmar Service for assistance with any fatal error. If possible, write exactly what you were doing when the error occurred, and report that information to Tekmar.

Tekmar



3000 Flow Diagram

Tekmar



NOTE:
MUST USE BOMFLOW.LSP
INSTEAD OF BOM.LSP
AND START AT ITEM #101

143	EA	14-5770-050	VALVE, NEEDLE, 1/16" TUBES
142	EA	14-5718-020	HEATER, B.U.T., 15" HEATED
141	EA	14-5717-020	HEATER, TRAP, 1/8" X 12" TRAP
140	EA	14-5716-050	ASSY, VALVE, HRP 12 VDC
139	EA	14-5715-016	FERRULE, TEFLON, 1/8" VALCO
138	EA	14-5686-016	BULKHD, 1/16-1/8, 20µ FRIT
137	EA	14-5684-000	ASSY, SAMPLE INLET VALVE, 3000
136	EA	14-5682-002	ASSY, DRAIN LINE 10" LG, 3000
135	EA	14-5681-002	ASSY, PURGE LINE, 3000
134	EA	14-5675-050	REGULATOR, PRESSURE, 1/16" FIT
133	EA	14-5653-067	LOOP, NCS, 450-500 ul, E-FORM
132	FT	14-5540-002	TUBING, ELECTROFORM, .04 ID,
131	EA	14-5530-050	VALVE, ASSY, VENT, 12 VDC
130	EA	14-5529-050	VALVE, ASSY, SAMPLE, 12VDC
129	EA	14-5527-050	VALVE, ASSY, BY-PASS, 12 VDC
128	EA	14-5526-050	VALVE, ASSY, DRAIN, 12VDC
127	EA	14-5522-050	CONTROLLER, FLOW 0-100CC/MIN
126	EA	14-5495-016	UNION, 1/4"-1/16", SS STD NUTS
125	EA	14-5306-016	FITTING, SAMPLE MOUNT, 1/2"
124	EA	14-5307-020	HEATER, TRANSFER LINE 72" 115V
123	EA	14-5304-016	TEE, UNION, 60DEGREE SIDE PORT
122	EA	14-5302-016	ELBOW, 1/8-1/16, BULKHD, S.S.
121	EA	14-5290-050	VALVE, 6-PORT, 250 DEG.C.
120	FT	14-5229-002	TUBING, 200 DEC, .064-.068 [illegible]
119	FT	14-5228-002	TUBING, 200 DEC, .064-.068 [illegible]
118	EA	14-4820-016	CONN, FEMALE 1/8 NPT-1/16 TUBE
117	EA	14-4695-016	TEE, UNION 1/16 BRASS
116	EA	14-3940-000	PRESSURE GAUGE, 0-30 PSI/kPa
115	EA	14-3595-053	NEEDLE 7.75" #2046 SPL NED.SP
114	FT	14-3592-002	TUBING, ALUM CLAD SILICA, .32
113	EA	14-3124-016	NUT SHORT BLK 1/16 UPCHURCH
112	EA	14-3123-016	FERRULE 1/16 UPCHURCH CTFE
111	EA	14-2337-024	SPL FRIT SPARGER
110	EA	14-1160-300	ASSY, BLANK TRAP, #3000
109	EA	14-0540-016	FERRULE, 1/16 BUT-.5MM ID VESPL
108	EA	14-0356-016	1/8 BULK HD.-FILTER ASSY
107	EA	14-0264-016	FITTING, 1/16BULKHEAD, SS
106	EA	14-0158-016	FERRULES, 1/16 SS 1 SET
105	EA	12-0408-016	FERRULE SET 1/8 S.S.
104	EA	12-0405-016	NUT, FOR 1/8 FITTING S.S.
103	EA	12-0064-016	BULKHEAD, 1/8"-1/8", TUBE STUB
102	EA	12-0043-016	FERRULE, TEFLON 1/8" SET
101	EA	12-0042-016	REDUCER, 1/16"-1/8", TUBE STUB

REVISIONS

REV A

NEXT ASSY | USED ON

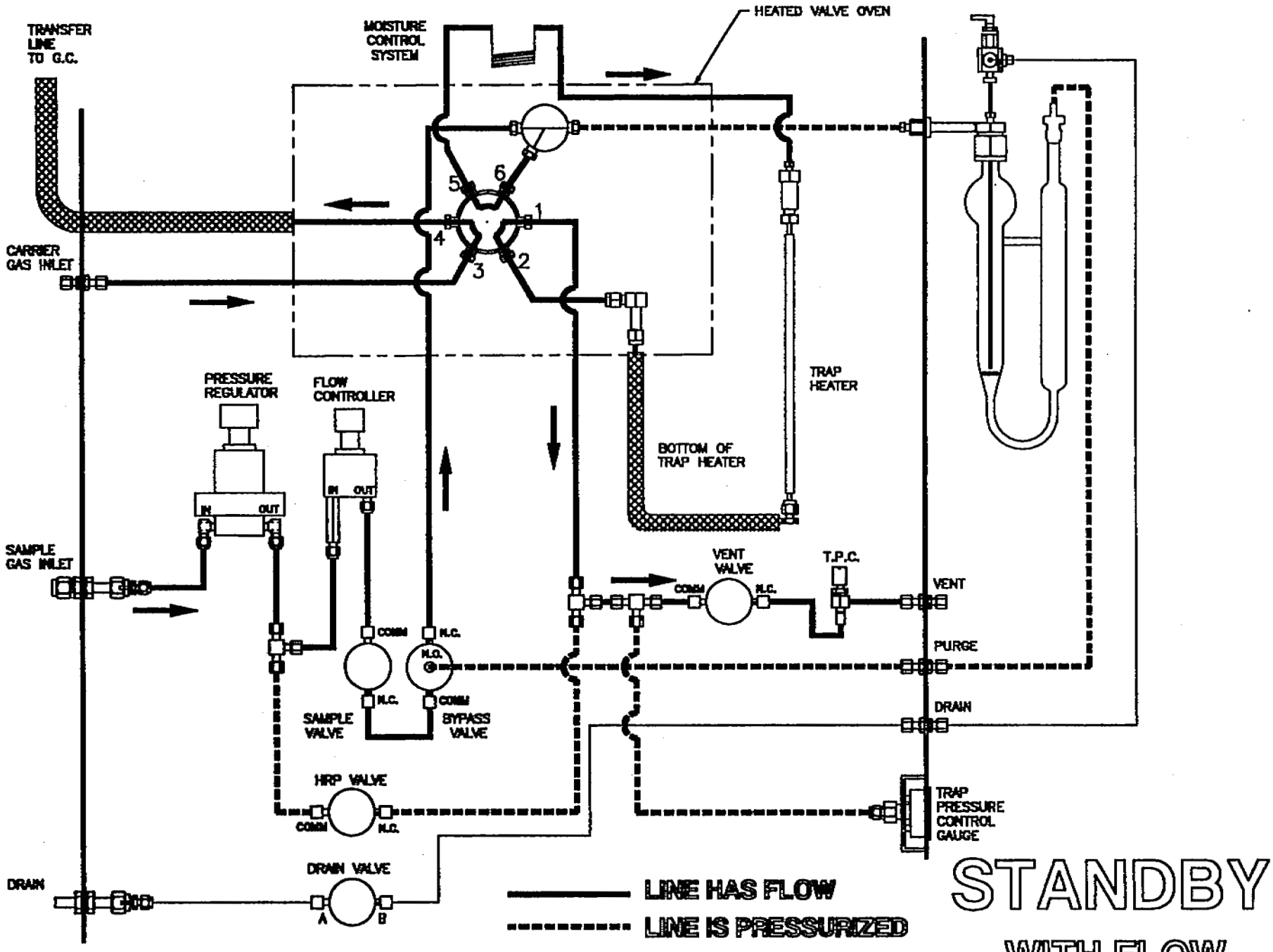
APPLICATION

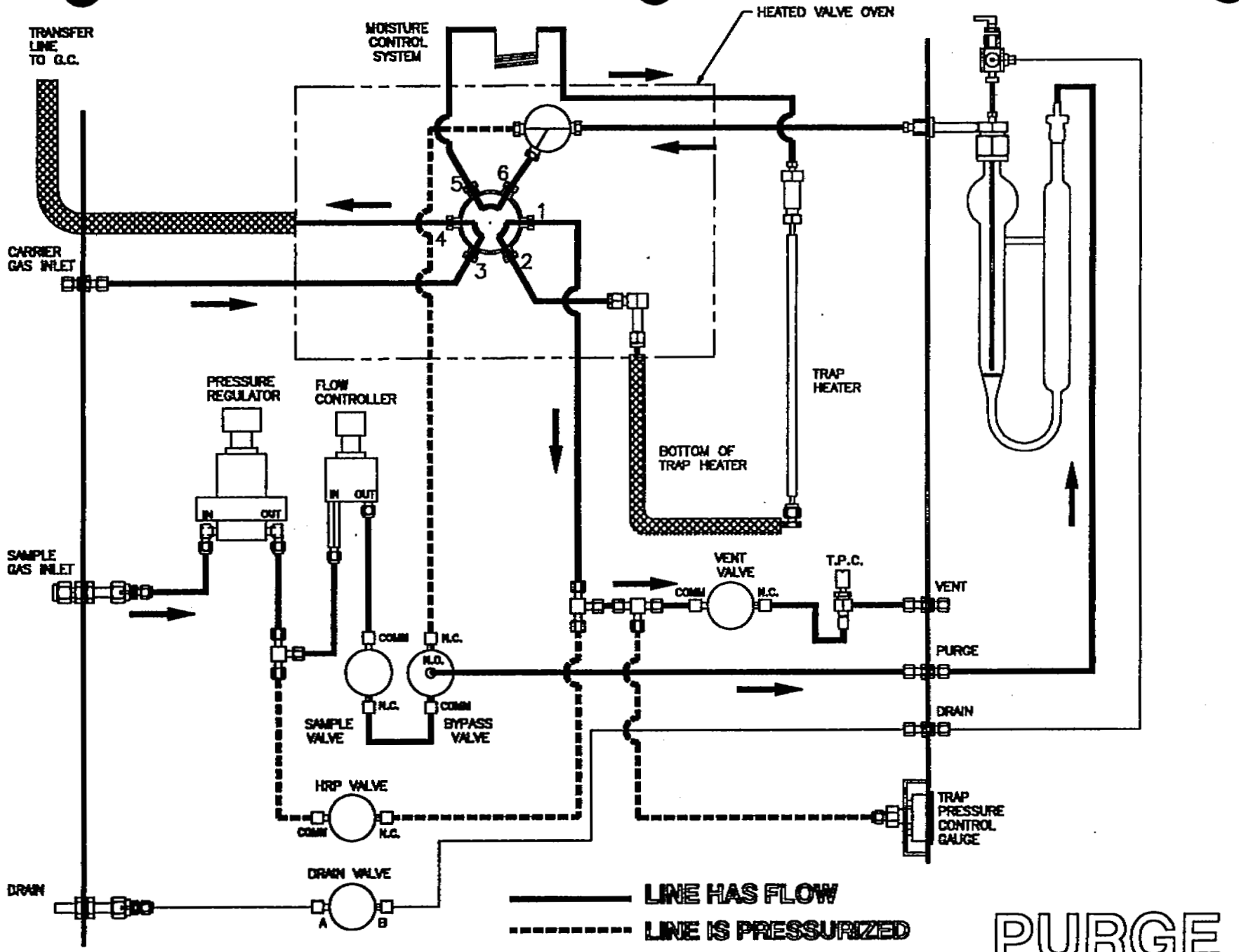
0396201A

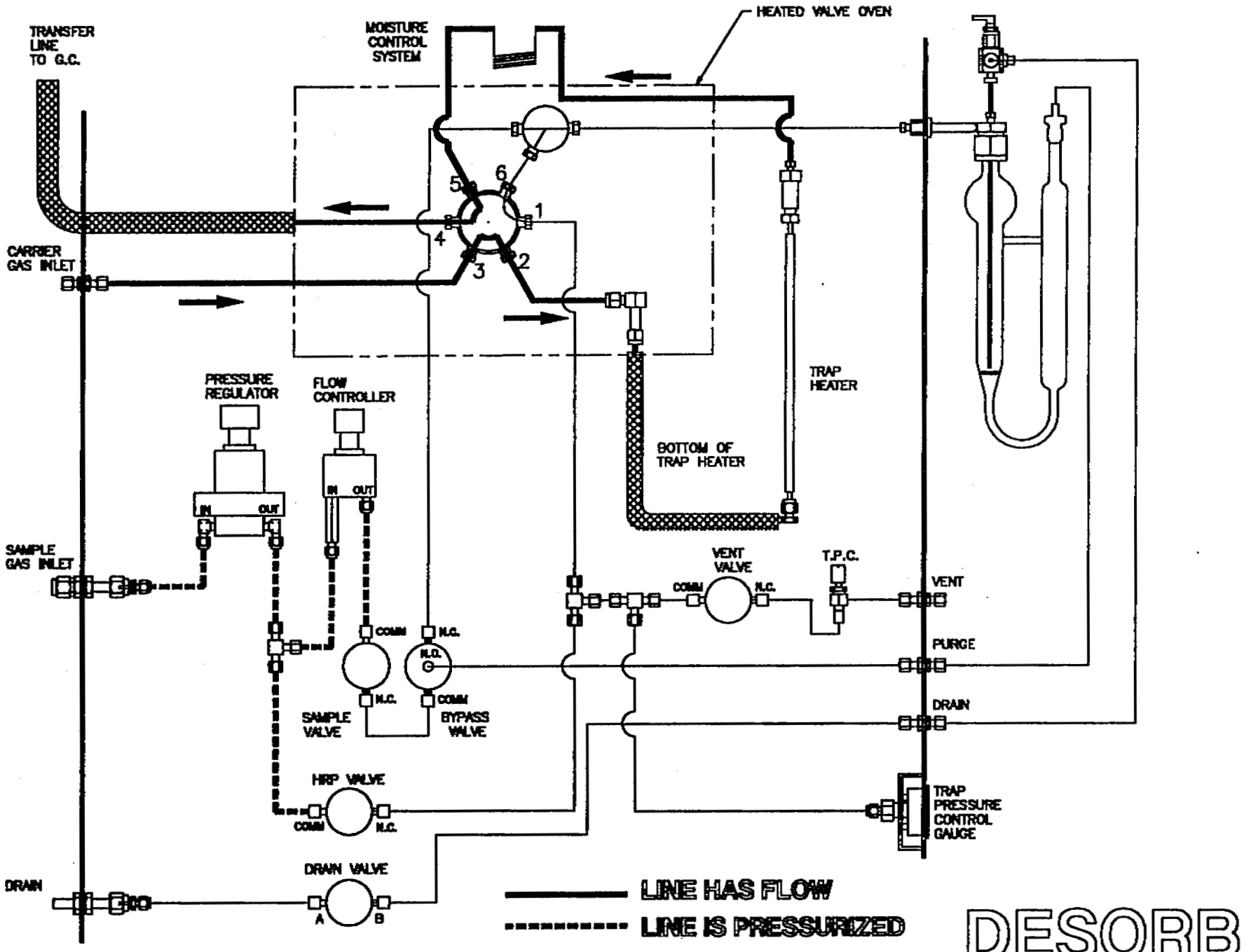
FLOW DIAGRAM, MODEL 3000

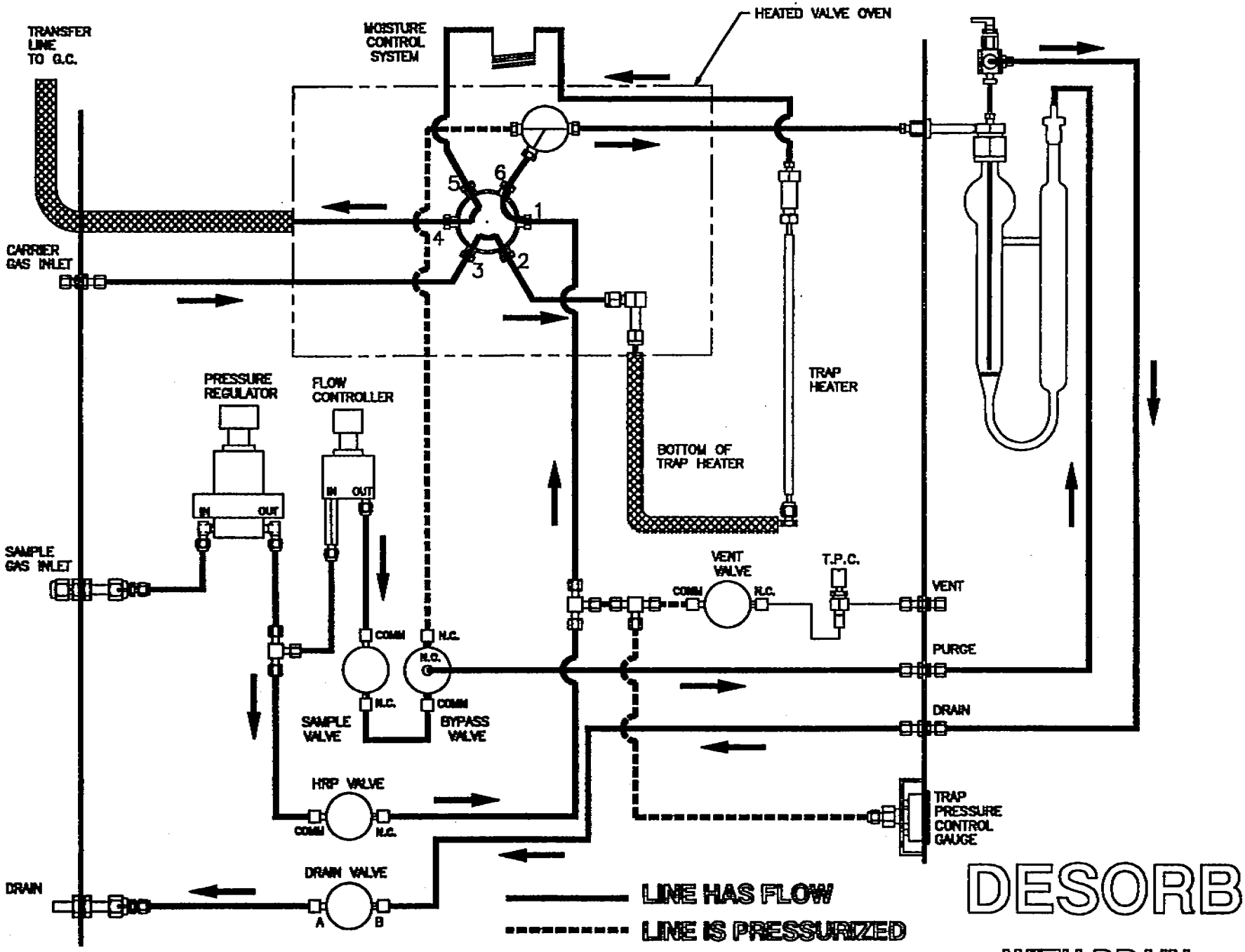
14-5787-000 A

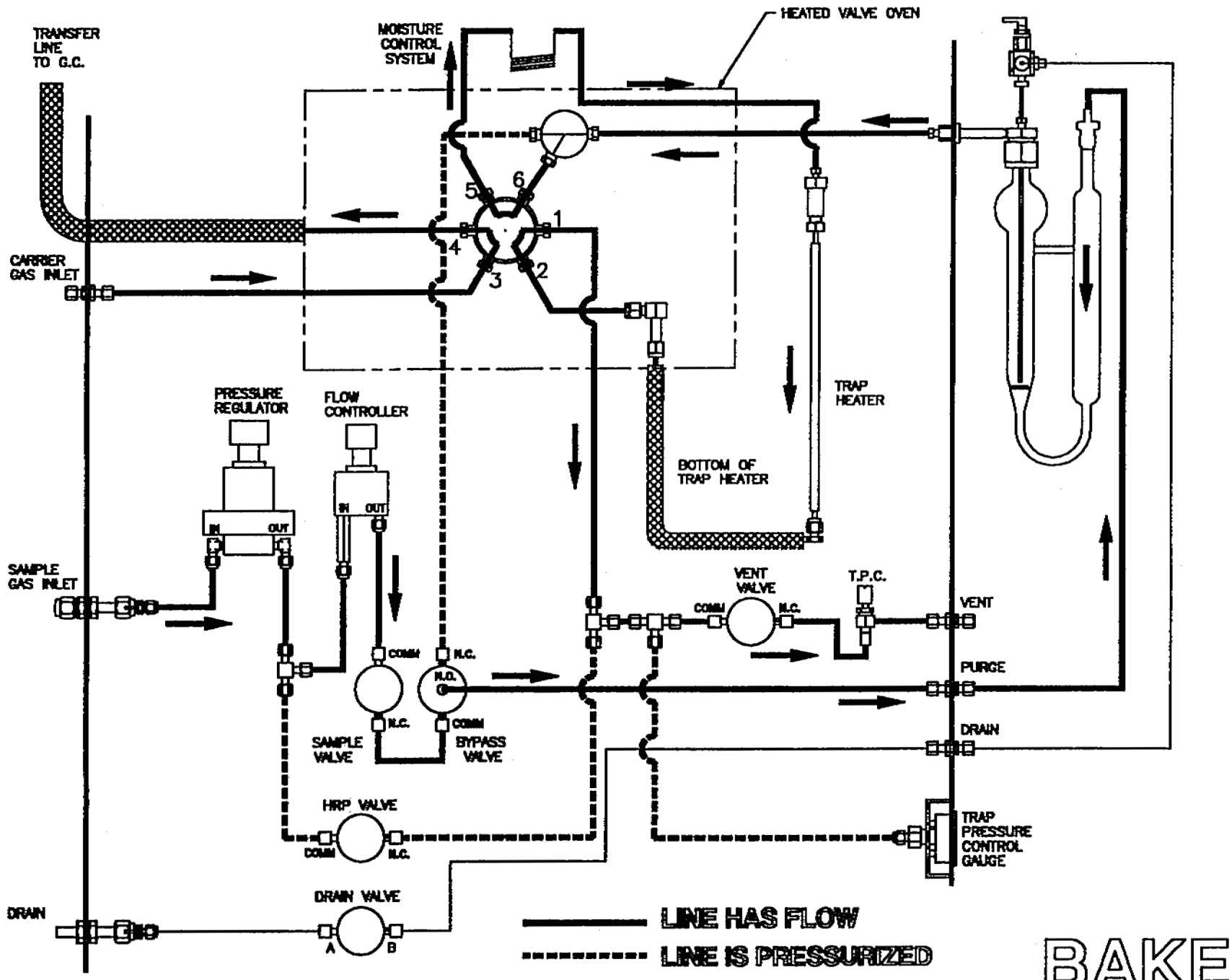
3000 Flow Diagram

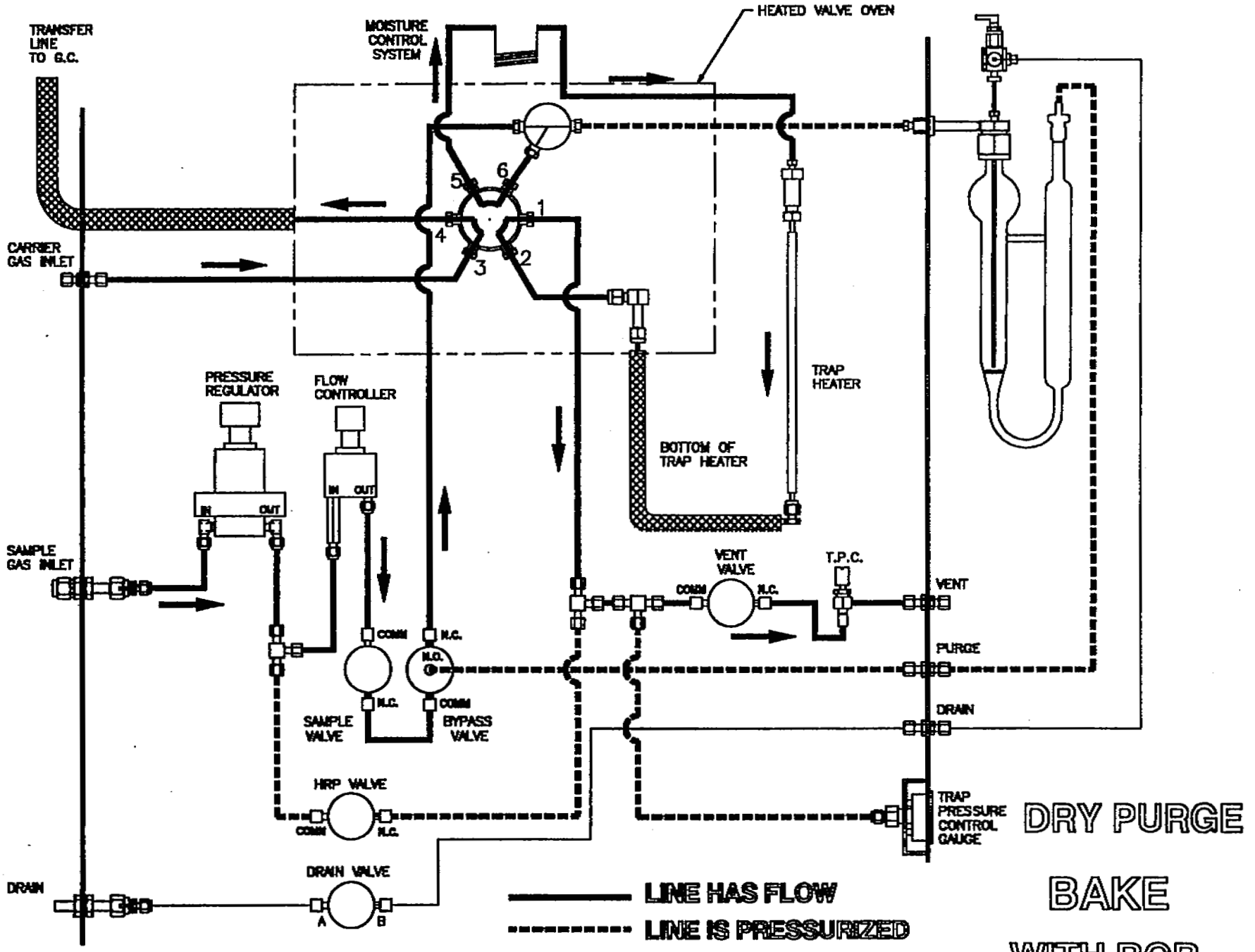

TRANSFER LINE TO G.C.
MOISTURE CONTROL SYSTEM
HEATED VALVE OVEN
CARRIER GAS INLET
PRESSURE REGULATOR
FLOW CONTROLLER
TRAP HEATER
BOTTOM OF TRAP HEATER
SAMPLE GAS INLET
VENT VALVE
T.P.C.
VENT
PURGE
DRAIN
SAMPLE VALVE
BYPASS VALVE
HRP VALVE
TRAP PRESSURE CONTROL GAUGE
DRAIN VALVE
DRAIN
LINE HAS FLOW
LINE IS PRESSURIZED
STANDBY
WITH FLOW


TRANSFER LINE TO G.C.
MOISTURE CONTROL SYSTEM
HEATED VALVE OVEN
CARRIER GAS INLET
PRESSURE REGULATOR
FLOW CONTROLLER
TRAP HEATER
BOTTOM OF TRAP HEATER
SAMPLE GAS INLET
VENT VALVE
T.P.C.
VENT
PURGE
DRAIN
SAMPLE VALVE
BYPASS VALVE
HRP VALVE
TRAP PRESSURE CONTROL GAUGE
DRAIN VALVE
DRAIN
IN
OUT
COMM
N.C.
N.O.
A
B
LINE HAS FLOW
LINE IS PRESSURIZED
PURGE

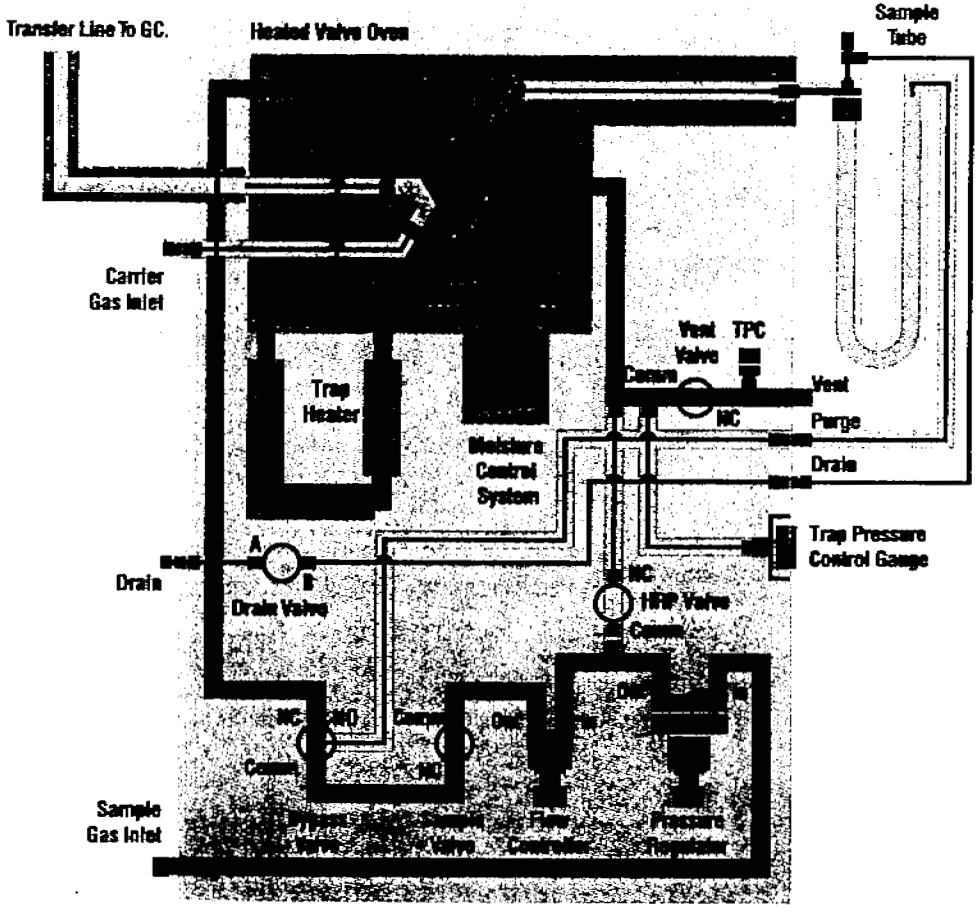

TRANSFER LINE TO G.C.
MOISTURE CONTROL SYSTEM
HEATED VALVE OVEN
CARRIER GAS INLET
PRESSURE REGULATOR
FLOW CONTROLLER
TRAP HEATER
BOTTOM OF TRAP HEATER
SAMPLE GAS INLET
VENT VALVE
T.P.C.
VENT
PURGE
DRAIN
SAMPLE VALVE
BYPASS VALVE
HRP VALVE
TRAP PRESSURE CONTROL GAUGE
DRAIN VALVE
DRAIN
LINE HAS FLOW
LINE IS PRESSURIZED
DESORB


TRANSFER LINE TO G.C.
MOISTURE CONTROL SYSTEM
HEATED VALVE OVEN
CARRIER GAS INLET
PRESSURE REGULATOR
FLOW CONTROLLER
TRAP HEATER
BOTTOM OF TRAP HEATER
SAMPLE GAS INLET
VENT VALVE
T.P.C.
VENT
PURGE
DRAIN
SAMPLE VALVE
BYPASS VALVE
HRP VALVE
TRAP PRESSURE CONTROL GAUGE
DRAIN VALVE
DRAIN
LINE HAS FLOW
LINE IS PRESSURIZED
DESORB
WITH DRAIN

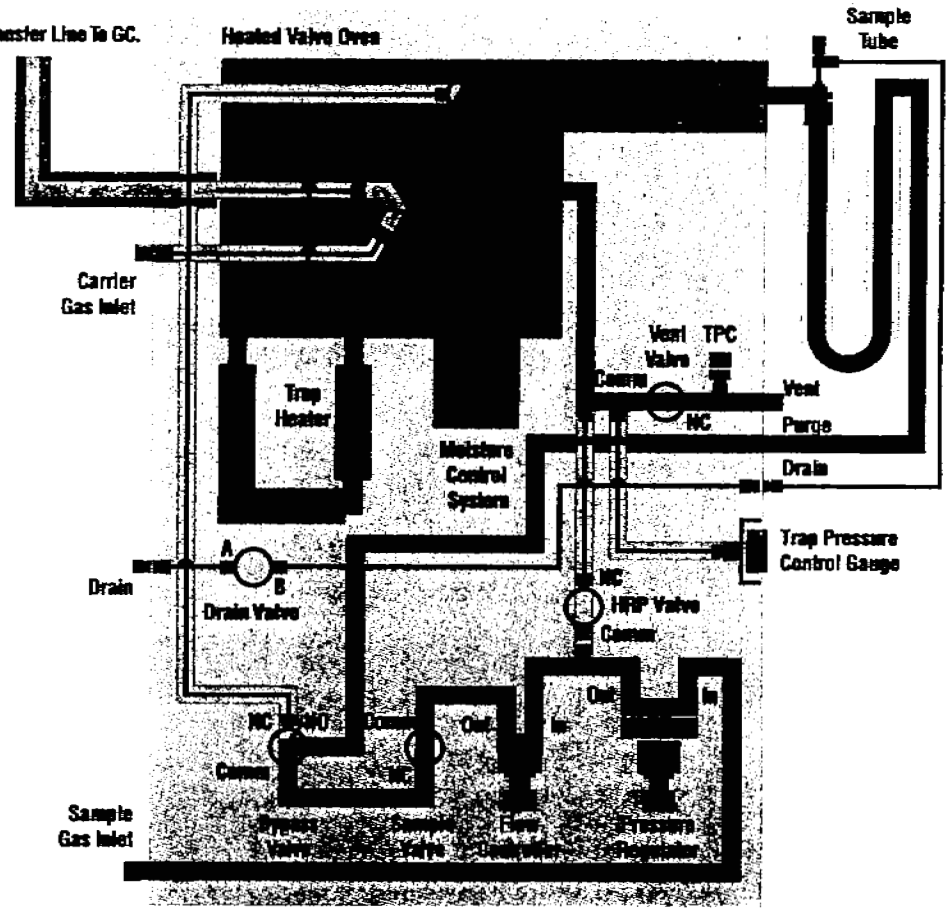

TRANSFER LINE TO G.C.
MOISTURE CONTROL SYSTEM
HEATED VALVE OVEN
CARRIER GAS INLET
PRESSURE REGULATOR
FLOW CONTROLLER
TRAP HEATER
BOTTOM OF TRAP HEATER
SAMPLE GAS INLET
VENT VALVE
T.P.C.
VENT
PURGE
DRAIN
SAMPLE VALVE
BYPASS VALVE
HRP VALVE
TRAP PRESSURE CONTROL GAUGE
DRAIN VALVE
DRAIN
LINE HAS FLOW
LINE IS PRESSURIZED
BAKE


TRANSFER LINE TO G.C.
MOISTURE CONTROL SYSTEM
HEATED VALVE OVEN
CARRIER GAS INLET
PRESSURE REGULATOR
FLOW CONTROLLER
TRAP HEATER
BOTTOM OF TRAP HEATER
SAMPLE GAS INLET
VENT VALVE
T.P.C.
VENT
PURGE
DRAIN
SAMPLE VALVE
BYPASS VALVE
HRP VALVE
TRAP PRESSURE CONTROL GAUGE
DRAIN VALVE
DRAIN
LINE HAS FLOW
LINE IS PRESSURIZED
DRY PURGE
BAKE
WITH BGB

Standby With Flow



Purge

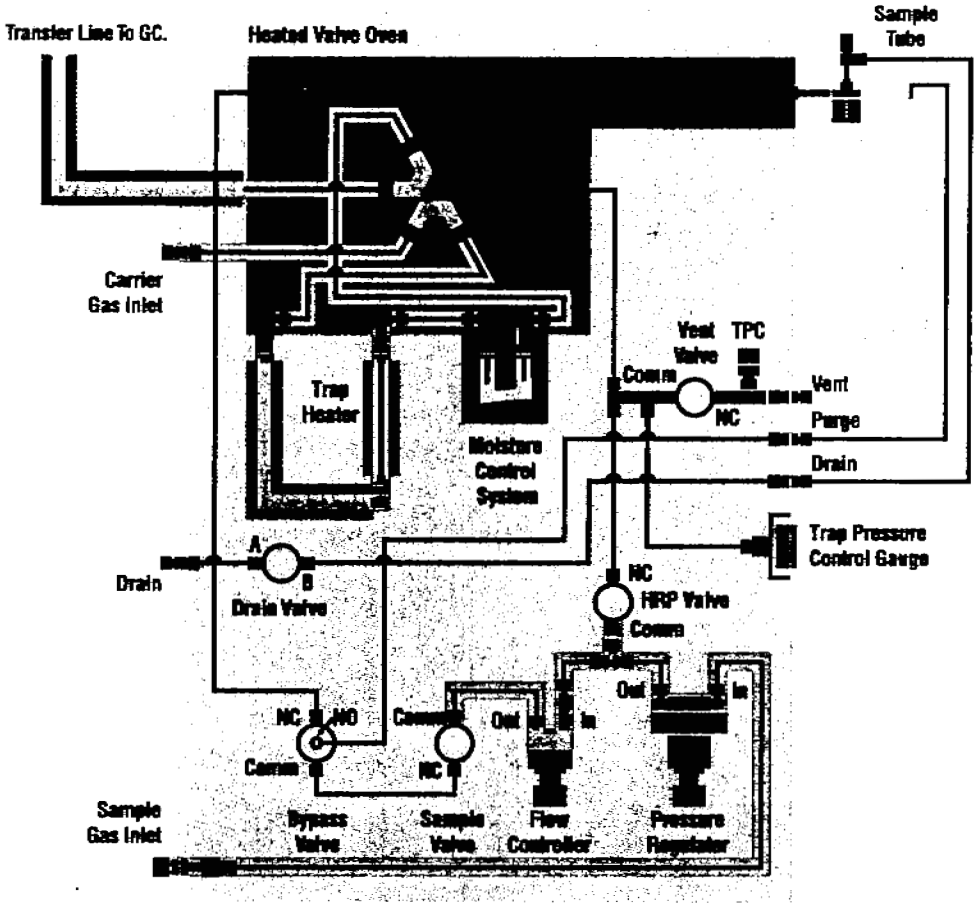


Purge Gas Flow
Carrier Gas Flow
Line Is Pressurized
Heated Zone

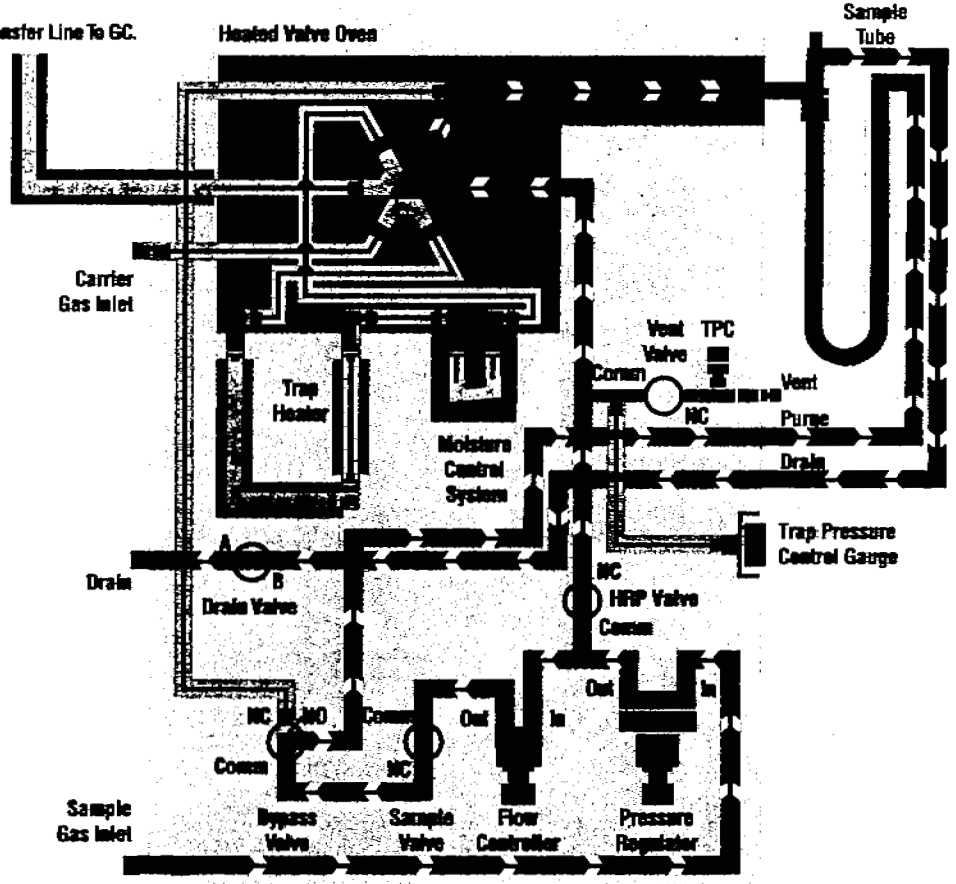
Tekmar

3000 Flow Diagram

Desorb



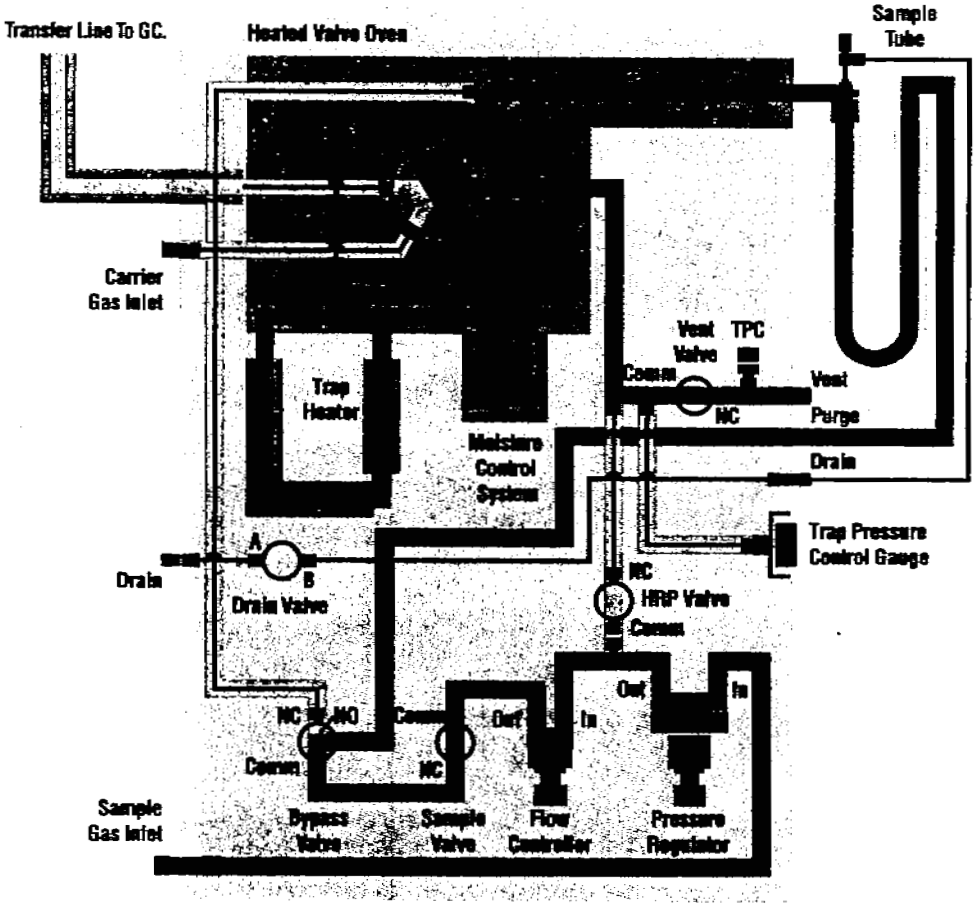
Desorb With Drain



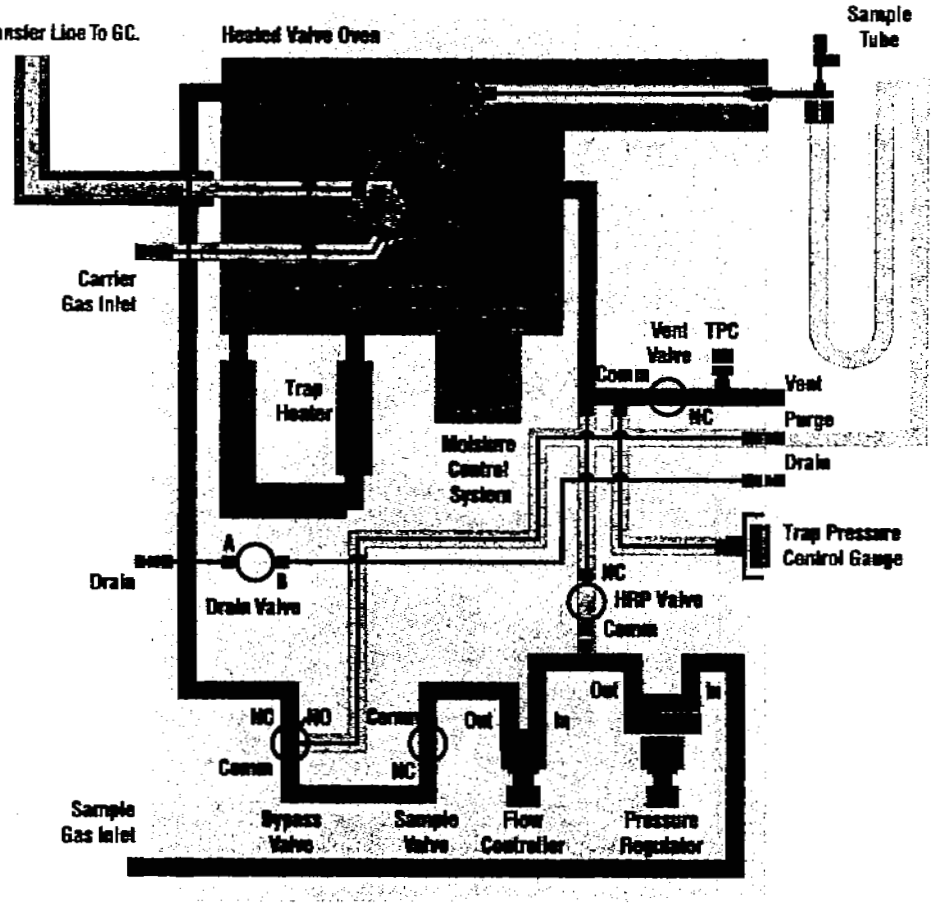
Purge Gas Flow
Carrier Gas Flow
Line Is Pressurized
Heated Zone

Tekmar

Bake With BGB Off



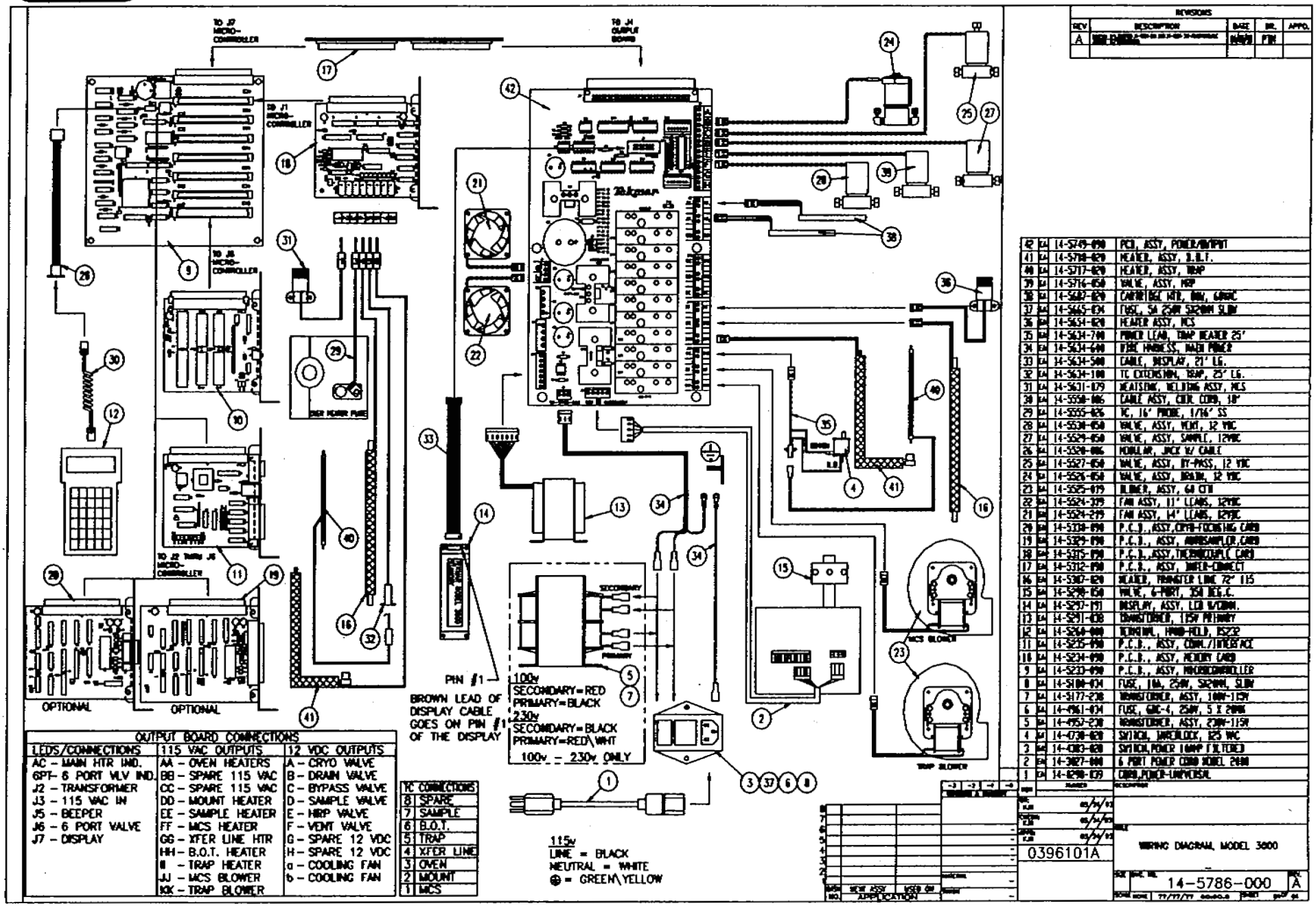
Dry Purge/Bake With BGB On



Purge Gas Flow
Carrier Gas Flow
Line Is Pressurized
Heated Zone

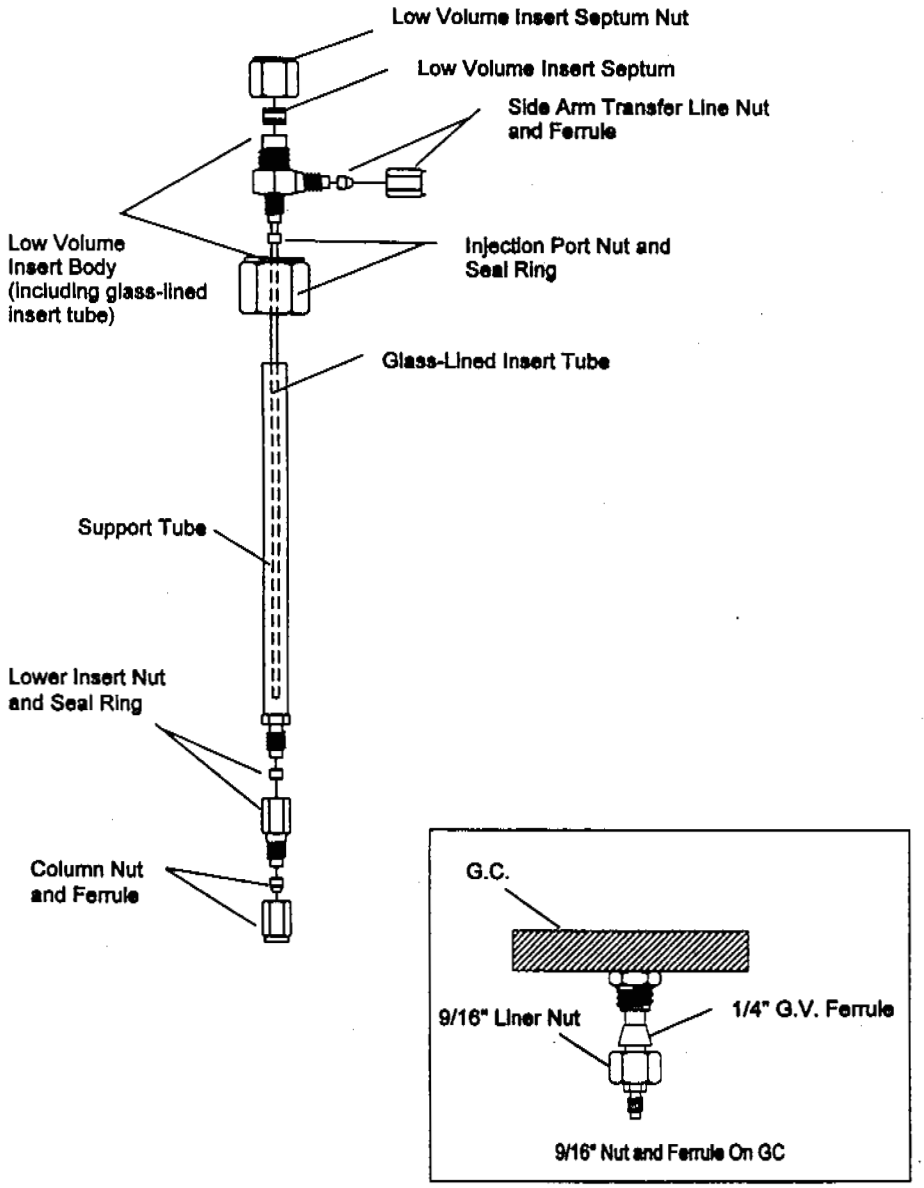
Tekmar

Tekmar



3000 Wiring Diagram

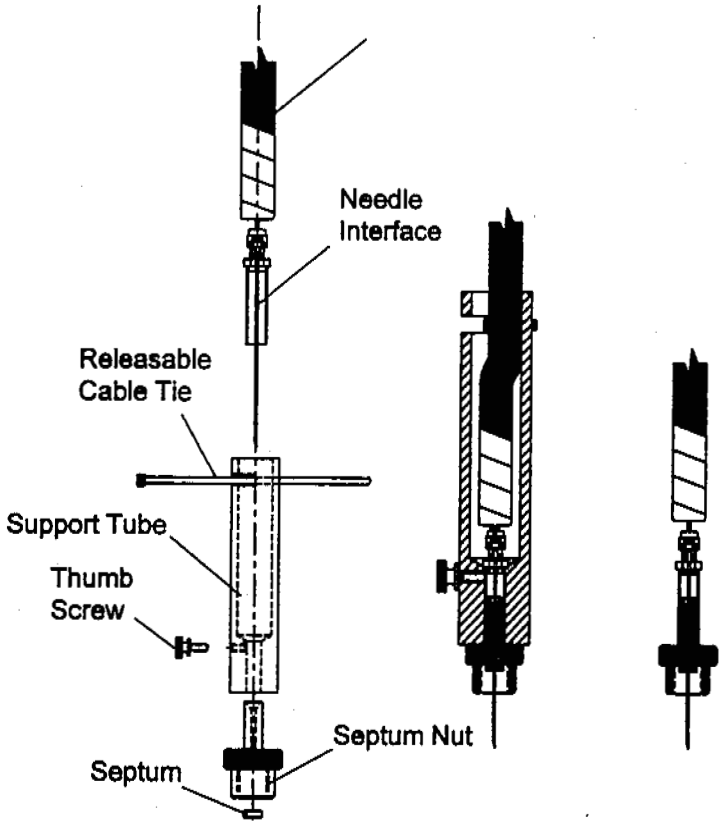
Low Volume Insert



Note: **A low volume insert lowers the volume of a standard GC-packed column injector. This decreases band broadening in the sample and improves chromatography while leaving the septum free for direct injection.**

To order a low volume insert that is compatible with your GC, see chapter 11, *Parts and Service*. To install it, follow the instructions shipped with the low volume insert.

Septum Needle Adapter



Note: **The septum needle adapter allows you to connect the concentrator's transfer line to the GC's injection port through the GC inlet septum.**

The advantage of installing the septum needle adapter is:
It allows for quick disconnect of the transfer line from the GC.

The disadvantage is:
The injection port is no longer available for use with autosamplers.

To order a septum needle adapter that is compatible with your GC, see chapter 11, *Parts and Service.*
To install it, follow the instructions shipped with the septum needle adapter.

Addendum

Connecting the 2016 and/or 2032 to the 3000

Tekmar

7143 East Kemper Road, Cincinnati, Ohio 45242-9576
(800) 543-4461 • Outside the U.S. and Canada (513) 247-7000 • Service (800) 874-2004
Telefax (513) 247-7050

Location: k:\techrite\miscinst\addenda
V.10.12.94

To make it possible for you to hook up the 2016 and/or 2032 to the 3000 and use the system without delay, we have added this addendum to the manual.

This addendum instructs you to do the following:

- Connect the 3000 to the 2016 and/or 2032.
- Leak-check the 3000/autosampler system.
- Indicate to the 3000 that the 2016 and/or 2032 has been installed.

If you need assistance, please call Tekmar Service. In the U.S. and Canada, call (800) 874-2004. Locally or outside the U.S. and Canada, call (513) 247-7000.

1.1 Overview

The Tekmar™ Purge and Trap 3000 Concentrator can operate with the 2016 and/or 2032 for convenient, unattended operation. A 3000 connected to a 2016 will run up to 16 samples. A 3000 connected to a 2016 and 2032 will run up to 32 samples.

This chapter will show you how to connect the autosamplers to the 3000 concentrator. The table below outlines the steps to follow and serves as a quick reference guide.

If you want to:	Read this section:
Understand the autosampler connections and how they work with a concentrator.	1.3 Understanding the Connections
Set up the 3000 for operation with an autosampler.	1.2 Before You Begin
Connect a 2016/2032 to a 3000.	1.4.4 Connecting the Autosampler to the 3000
Connect a 2016 to a 2032.	1.4.5 Connecting Two Autosamplers to the 3000
Configure the 3000 to recognize the autosampler(s) to which it is attached.	1.8 Acknowledging the Autosampler
Check the systems for leaks.	1.6 Checking for Leaks
Complete the installation.	1.7 Replacing the Panels and Covers

Table 1-1 **Installation Instructions**

1.2 Before You Begin

If the 3000 Concentrator is being used for the first time, follow the instructions in the Tekmar™ 3000 User Manual to unpack the unit.

Place the units to be connected on a level surface. If you are using a 2032, place it between the concentrator and the 2016.

1.2 Before You Begin, cont.

This addendum does not discuss the procedures for connecting the 3000 to a GC. Please refer to the 3000 manual for information about GC connections. If you have any questions, please call the Tekmar Service Department.

The 2016/2032 requires 115V or 230V + or - 10% and a frequency of 50 or 60-Hz. Table 1-2 shows current draw and power consumption for both models.

Autosampler Model	Current Draw	Power Consumption
2016	6 amps	720 watts
2032	7 amps	840 watts

Table 1-2 **2016/2032 Specifications**

⚠ CAUTION

You must be thoroughly familiar with these instructions before you install the 2016 or 2032 with the 3000. If you have any questions, call the Tekmar Service Department for assistance.

⚠ WARNING

Sections of the autosamplers and the concentrator are heated during operation. Make sure the units are turned off and allowed to cool before you make connections.

1.3 Understanding the Connections

To connect a 3000 to the autosampler(s) you must make *pneumatic* and *electronic* connections.

The pneumatic (transfer line) connections allow carrier gas and analytes (sample components) to flow between the 3000 and the autosampler(s).

The electronic (circuit board and cable) connections enable the 3000 to control the autosampler(s).

See Figure 1-1 on the following page to note the connections.

1.3 Understanding the Connections, cont.

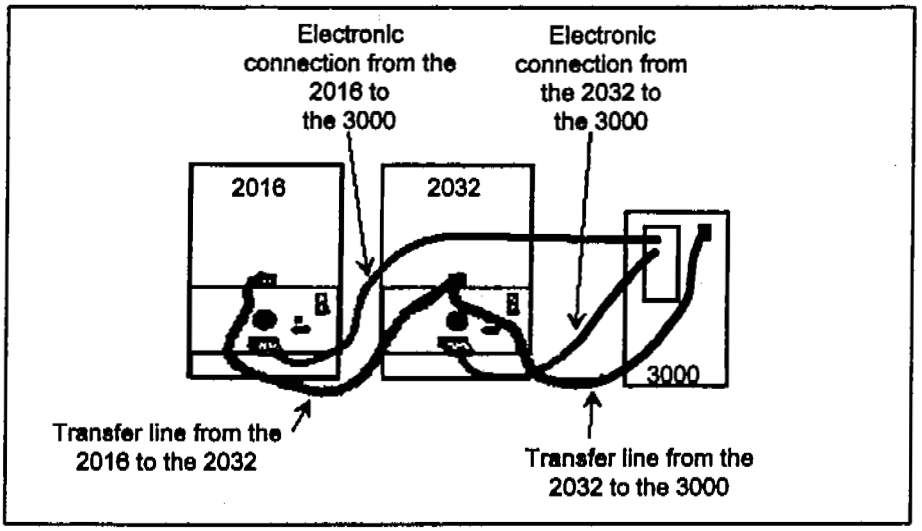


Figure 1-1 **Concentrator-Autosampler Connections**

1.4 Pneumatic Connections

The autosampler's pneumatic connections (transfer line connections) to the 3000 are by way of the purge and sample lines inside its transfer line. These two lines must be connected to a sample tee and bypass valve inside the 3000. Before you can make autosampler connections, you must access the inside of the 3000 and disconnect one line from the sample tee and another line from the bypass valve. To do this, follow the instructions throughout this section.

If both a 2016 and a 2032 are being used with the 3000, pneumatic connections between the 3000 and 2032 (NOT the 2016) are **direct**. See Figure 1-1 above. The transfer line from the 2032 attaches to the 3000, while the transfer line from the 2016 attaches to the 2032.

1.4.1 Removing the Covers and Panels on the 3000

⚠ WARNING

Sections of the autosamplers and the concentrator are heated during operation. Make sure the units are allowed to cool before you make any connections.

⚠ WARNING

Electrical shock hazard inside. Unplug unit before removing panels.

Complete the following steps while looking at the **front** of the 3000.

1. To remove the right corner (trap) panel, loosen (do **not** remove) the

1.4.1 Removing the Covers and Panels on the 3000, cont.

two 1/4-turn screws that hold the panel. Pull the panel forward, then to the right.

2. To remove the top panel, pull the panel forward until it stops, then lift.

3. Locate the square-shaped valve oven cover that sits on top of the unit.

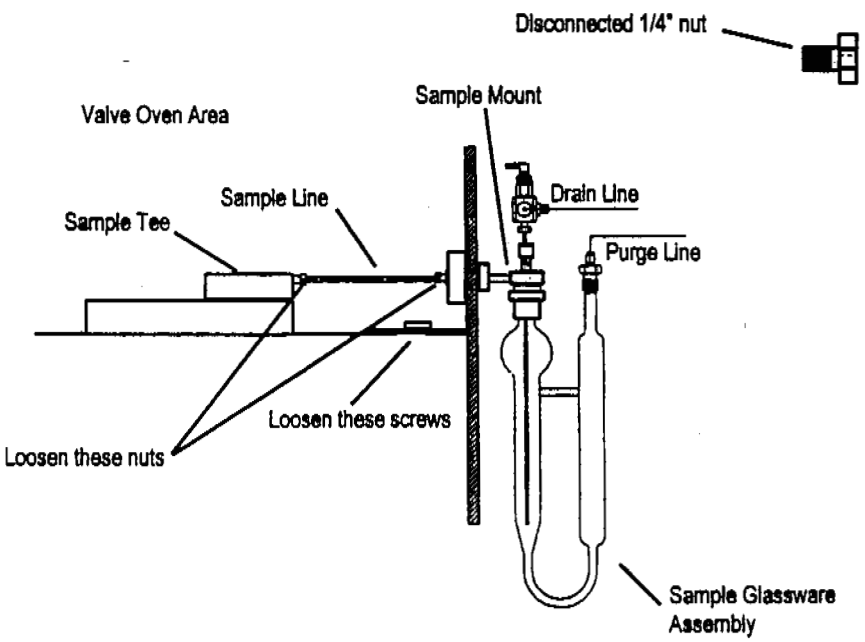
> **⚠ CAUTION**
>
> **The oven may be hot.**

Remove the thumbscrew which attaches to the front of the valve oven cover. Tilt the valve oven cover toward the back of the unit. **Carefully** lift the cover.

1.4.2 Disconnecting the Sample Line

To make pneumatic connections, you need to disconnect the sample line that extends from the sample mount to the sample tee. Refer to Figure 1-2 below.

1. Visually follow the line (sample line) that extends from the sample mount to the sample tee. The sample tee is round in shape with lines extending out of it. Each line is secured to the sample tee with a 1/4" nut. With a 1/4" open-ended wrench, loosen the



Drawing not to scale

Figure 1-2 **The Sample Glassware Assembly and Connections**

1.4.2 Disconnecting the Sample Line, cont.

nut that holds the sample line to the sample tee. Disconnect the **nut** from the sample tee. Do **not** disconnect the sample line from the sample tee at this time.

2. With a 1/4" open-ended wrench, loosen the **nut** at the opposite end of the sample line (at the sample mount). Disconnect the **nut.** Do **not** remove the line at this time.

3. Locate the screws that hold the sample mount. In Figure 1-2, a line points to these screws. Loosen the screws. (Do not remove them; you will need them again.)

4. Carefully pull the sample mount forward. As you pull forward, carefully disconnect the sample line from the sample tee. The line should have a cone-shaped ferrule at its end.

⚠ CAUTION

Completely remove the line and ferrule. Do not leave the ferrule inside.

5. Disconnect the sample line from the sample mount. The line should have a cone-shaped ferrule at its end.

⚠ CAUTION

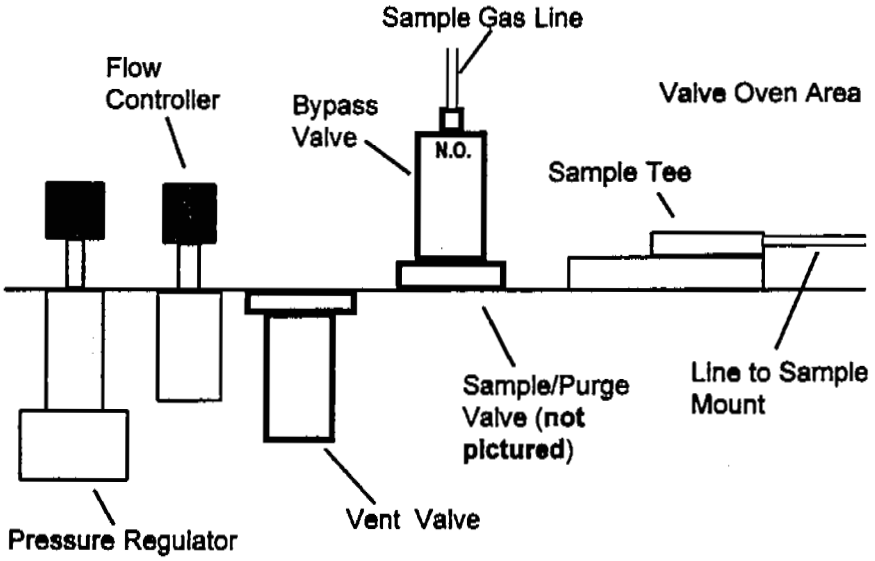
Completely remove the line and ferrule. Do not leave the ferrule inside.

6. If you are using the autosamplers, you will not need the sample glassware assembly. However, you may wish to replace the sample glassware assembly (without the sample line attached) so that it will be available for future use.

1.4.3 Removing the Sample Gas Line from the Bypass Valve

To disconnect the sample gas line from the top of the bypass valve and make room for the autosampler connection:

1. Locate the bypass valve on the top of the 3000 unit. See Figure 1-3 below.



Drawing not to scale

Figure 1-3 **The Bypass Valve and Surrounding Components**

2. The sample gas line enters the top of the valve, where it is labeled "N.O." With a 1/4" open-ended wrench, remove the line and fittings from the bypass valve. Allow this line to hang freely; it does not have to be completely removed from the unit.

⚠ CAUTION

Remove the line and fittings completely from the bypass valve. Do not leave the cone-shaped ferrule inside.

1.4.4 Connecting the Autosampler to the 3000

This section will show you how to make pneumatic connections (transfer line connections) between the 3000 and the autosampler.

Note: If both a 2016 and a 2032 are being connected to the 3000, pneumatic connections between the 3000 and 2032 (NOT the 2016) are direct. See Figure 1-1 on page 1-3. The transfer line from the 2032 attaches directly to the 3000, while the transfer line from the 2016 attaches directly to the 2032. If you are installing two autosamplers, follow the steps in Section 1.4.5 BEFORE you follow the steps in Section 1.4.4.

1.4.4 Connecting the Autosampler to the 3000, cont.

1. If you have not already done so, complete the steps in Sections 1.4.1, 1.4.2 and 1.4.3.

2. If the autosampler is being used for the first time, its transfer line may be attached to the rear panel by cable ties. Cut the ties and uncoil the line. See Figure 1-1 on page 1-3 to view the rear of the autosampler with its transfer line.

> **⚠ CAUTION**
>
> **Gently handle the transfer line to prevent breaking the internal lines.**

3. Inside the autosampler's transfer line there are two separate lines - the heated *sample* line in the center and the unheated *purge* line that runs along the outer edge. See Figure 1-4 below. If the purge line has a female Swagelok nut at its end, you must modify the purge line (as described in Steps a and b below) to connect the autosampler to the 3000. A female Swagelok nut is attached to the end of the purge line in Figure 1-4. **If the nut on the end of the purge line looks like the male Swagelok nut shown in Figure 1-4, DO NOT MODIFY THE PURGE LINE–go directly to Step 4.**
   a. Cut the female Swagelok nut off the end of the autosampler's purge line (**the line on the outer edge of the transfer line**). When cutting the line, keep the opening clean, smooth and circular in shape. Cutters with a diamond-shaped cutting edge work best.
   b. In the kit box for the 3000, you will find a male Swagelok nut (Tekmar part number 14-3295-016) and a ferrule set (Tekmar part number 14-0158-016). Slide the nut onto the purge line (the line on the outer edge of the autosampler's transfer line), making sure that the threads are turned toward the end of the line. Slide on the ring-shaped part of the ferrule set. Next, slide on the cone-shaped part of the ferrule set, making sure that the smallest part of it is toward the end of the line. Allow about 1/8" of space between the smallest part of the ferrule and the end of the line.

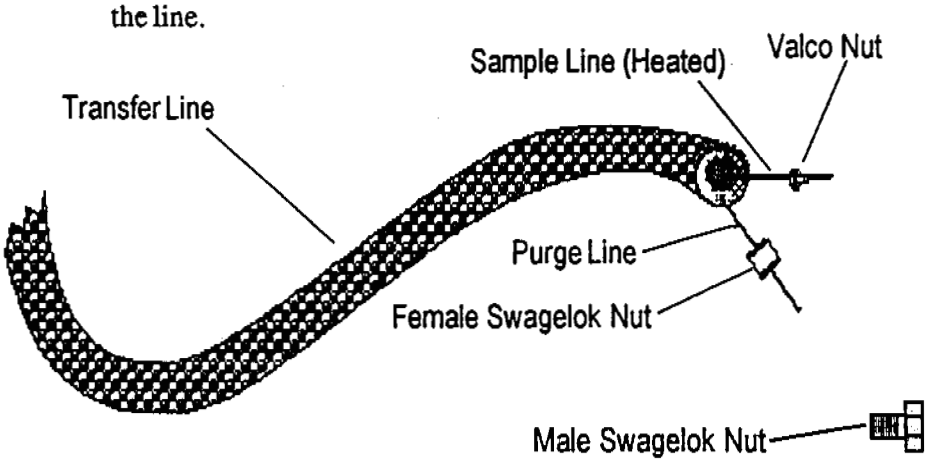
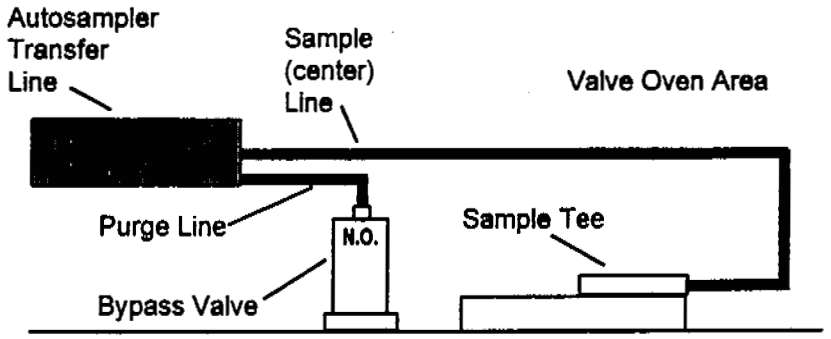


Figure 1-4 **Transfer Line Assembly**

1.4.4 Connecting the Autosampler to the 3000, cont.

4. The 3000 transfer line exits a hole in the top section of the 3000's rear panel. Slide the autosampler's transfer line through this hole, allowing the autosampler's transfer line to rest on top of the 3000's transfer line.

5. Connect the sample and purge lines from the autosampler's transfer line to the 3000 by referring to the illustration below and completing the following tasks:
   a. Locate the sample tee in the 3000. (You should have already removed fittings from the sample tee in Section 1.4.2). **Carefully** bend the sample line with your fingers so that it can reach the sample tee where the original fittings were removed. Check the sample tee to make sure that the ferrule from the original fittings is not inside. With an open-ended wrench, attach the sample line to the sample tee.
   b. Locate the 3000's bypass valve. **Carefully** bend the purge line with your fingers so that it can reach the top of the bypass valve. With an open-ended wrench, attach the purge line from the autosampler's transfer line to the top of the bypass valve, where it is labeled "N.O."



Drawing not to scale

sample/purge valve not pictured

Figure 1-5 **Connecting the Transfer Line to the 3000**

1.4.5 Connecting Two Autosamplers to the 3000

Referring to Figure 1-1 on page 1-3 and Figures 1-6 and 1-7 on the following page, follow these steps:

1. If you have a 2016 attached to the 3000, you need to detach the 2016's transfer line connections from the 3000 to install two autosamplers. To do this, refer to Section 1.4.1 to remove the 3000's panels and covers, then follow the instructions in Step 5 of Section 1.4.4 in reverse.

2. If the autosamplers are being used for the first time, their transfer lines may be attached to their rear panels by cable ties. Cut the ties and uncoil the lines.

1.4.5. Connecting Two Autosamplers to the 3000, cont.

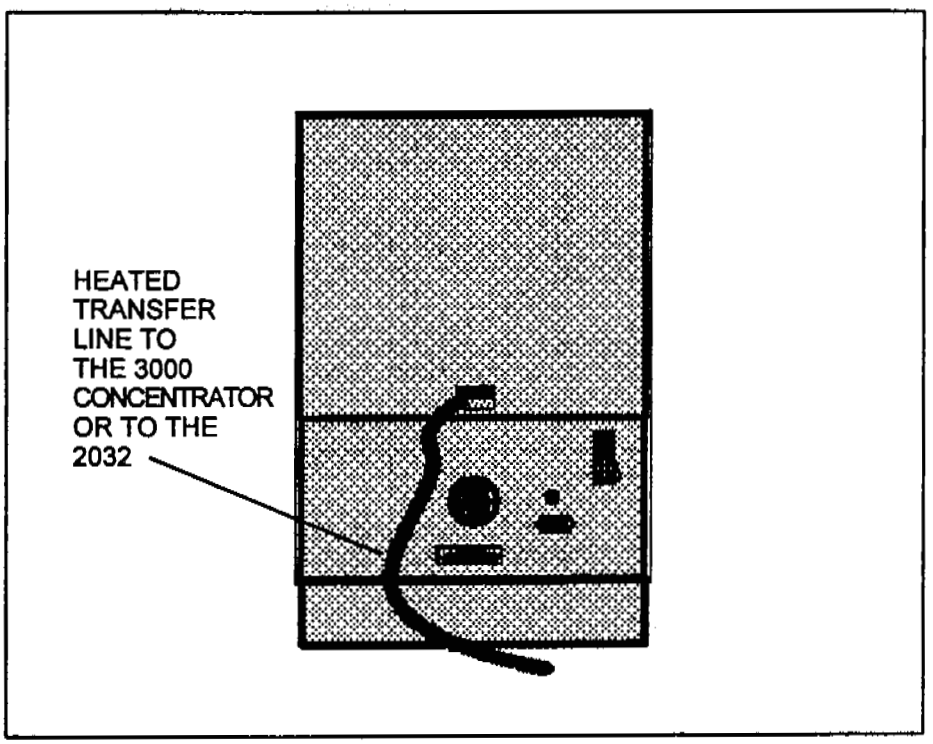


Figure 1-6 **Rear View of the 2016**

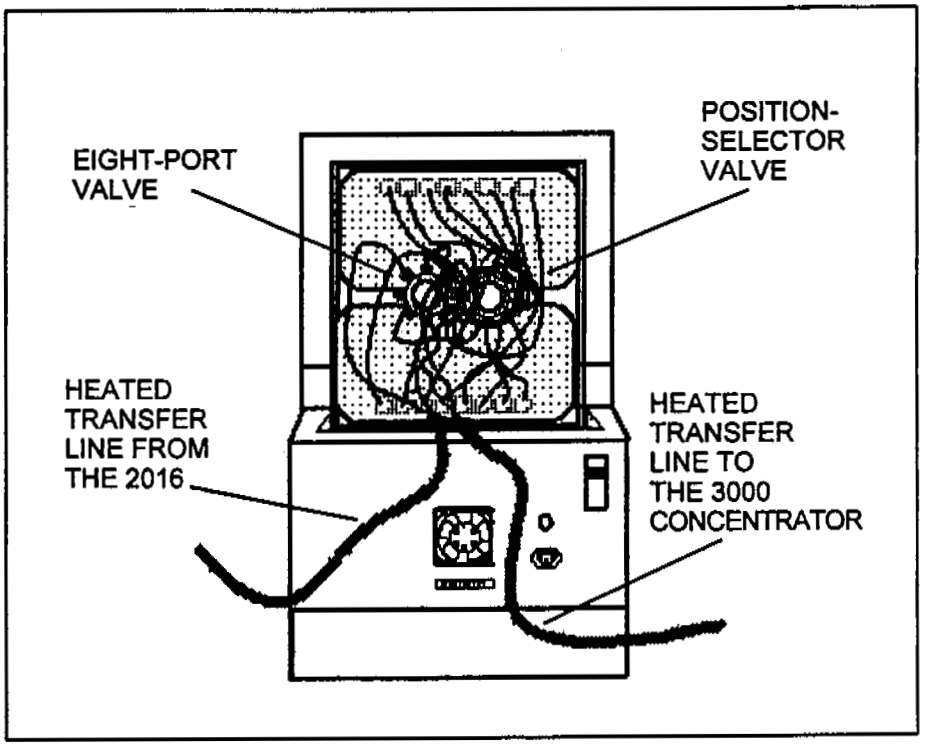


Figure 1-7 **Cutaway Rear View of the 2032**

1.4.5. Connecting Two Autosamplers to the 3000, cont.

3. Remove the ten 1/4-turn screws on the back and side of the rear compartment cover of the 2032. Pull the rear panel up and away from the unit to remove it.

4. With a 3/8" socket wrench, remove the six nuts and bolts from the 2032's rectangular-shaped valve oven cover. Pull the cover up and away from the unit to remove it.

⚠ CAUTION

Gently handle the transfer line to prevent breaking the internal lines.

5. Inside the 2016's transfer line, there is a heated *sample* line running through the center and a *purge* line running along the outer edge. Referring to Figure 1-4 on page 1-7, modify the purge line to connect the 2016 to the 2032.
   a. On the **2016**, cut the Swagelok nut off the end of the transfer line's unheated purge line (**the line on the outer edge of the transfer line**). When cutting the line, keep the opening clean, smooth and circular in shape. Cutters with a diamond-shaped cutting edge work best.
   b. In the kit box for the 2032, you will find a short Valco nut (Tekmar part number 14-0243-016) and a single-piece stainless steel Valco ferrule (Tekmar part number 14-0241-016). Slide the nut onto the purge line from the **2016**'s transfer line, making sure that the threads are turned toward the end of the line. Next, slide on the ferrule, making sure that the smallest part of it is toward the end of the line. Allow about 1/8" of space between the smallest part of the ferrule and the end of the line.

6. Feed the transfer line from the 2016 through the 2032's bracket, which is at the bottom of the open compartment. Keep the transfer line from the 2016 to the left of the 2032's transfer line.

7. Locate the eight-port valve inside the rear compartment on the 2032. See Figure 1-7 on the preceding page to note the location of the eight-port valve. Connect the 2016's sample line (**center** line of the transfer line) to port #8 on the eight-port valve, as illustrated in Figure 1-8 on the next page. (The ports on the eight-port valve are labeled with position numbers.)

8. Connect the 2016's purge line (the line on the outer edge of the transfer line) to port #4 on the 2032's eight-port valve.

1.4.5. Connecting Two Autosamplers to the 3000, cont.

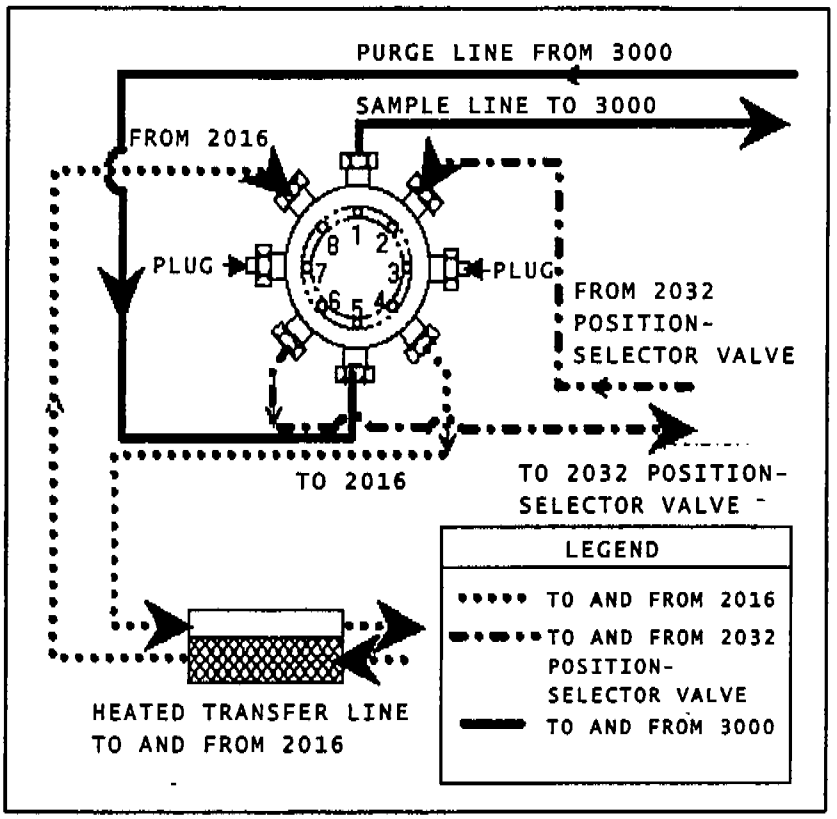


Figure 1-8 **Connecting Primary and Secondary Autosamplers**

9. Now, connect the 2032 to the 3000. To do this, follow the steps in Section 1.4.4, "Connecting the Autosampler to the 3000."

10. Do not replace the covers or panels until you have made the electronic connections and checked the system for leaks. See the following sections.

1.5 Electronic Connections

The autosampler is connected electronically to the 3000 by way of a cable. The cable extends from a connector on the rear of the autosampler to the autosampler logic board in the 3000.

⚠ CAUTION

Hold the autosampler logic board by the bracket or edge of the board only. Avoid touching the parts or connections to prevent damage from static discharge.

1.5.1 Installing the Autosampler Logic Board

⚠ WARNING

Electrical shock hazard inside. Unplug unit before removing panels.

1. If you have not removed the corner and top panels on the 3000, follow the instructions in Section 1.4.1, Steps 1 and 2. After these panels have been removed, locate the screw that fastens the right side panel to the 3000. The screw is at the top of the 3000. Remove the screw, then lift the side panel to expose the electronic circuit boards.

Note: If you have two autosamplers, you need to install two boards—one for the 2016 and one for the 2032. Complete the following steps for each board.

2. Choose any available middle slot in which to insert the autosampler logic board. The top and bottom slots are reserved for other boards. To install the autosampler logic board, you must remove the slot cover. Remove the screw that holds the cover to the unit. Later, you will use this screw to install the autosampler logic board.

3. Hold the board (still wrapped in its anti-static bag) in one hand and touch one of the metal board brackets with the other hand to discharge static electricity. Remove the board from the bag.

4. The autosampler logic board has a connector on it with removable jumpers attached. The jumpers on the board that are used with the 2016 are positioned differently from the jumpers on the board that are used with the 2032. Check the jumper positions before installing the board into the 3000 by following these steps:
   a. Locate the connector labeled "J3" on the board. It has the rectangular-shaped jumpers on it and is close to the large, gray 64-pin connector.
   b. Referring to the illustration on the next page, make sure that the jumpers are set correctly.

1.5.1 Installing the Autosampler Logic Board, cont.

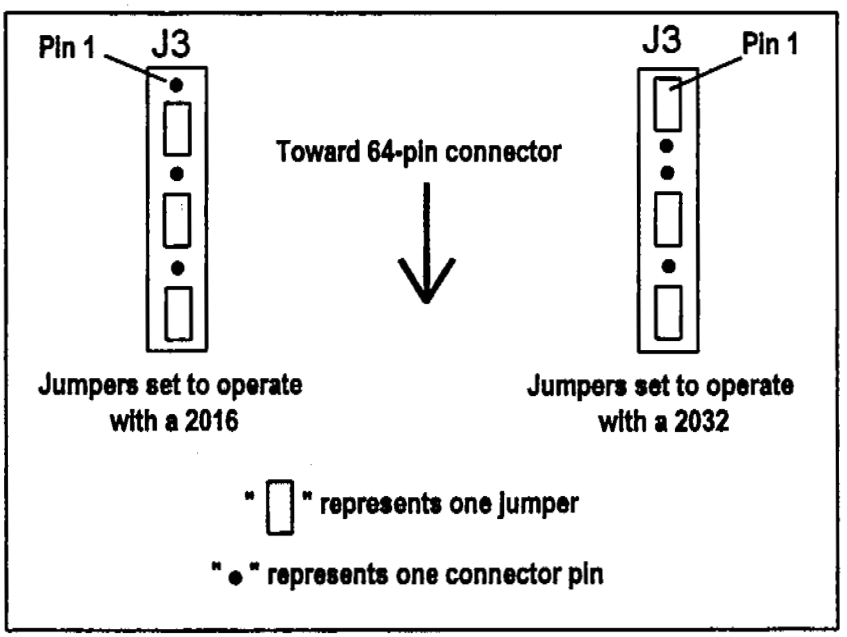


Figure 1-9 **Jumper Settings on the Autosampler Logic Boards**

5. Insert the autosampler logic board into the slot. Make sure that the board is properly seated into its connector. Secure the board to the unit with the screw that you removed in Step 2.

6. Cover the circuit boards by replacing the right side panel. Tighten the screw that secures the right side panel to the unit.

1.5.2 Connecting the Cable

After installing the autosampler logic board, connect it to the autosampler by way of the cable.

Note: If you are using two autosamplers, you will need to install two cables--one for the 2016 and one for the 2032. Follow the steps below for each cable.

1. Insert one end of the cable into the connector on the autosampler logic board.

2. Connect the other end of the cable to the matching connector on the rear of the autosampler. Make sure that the cable is directly connecting a 2016 autosampler logic board to a 2016 autosampler and the 2032 board to a 2032 autosampler. You **cannot** connect a 2016 autosampler logic board to a 2032 autosampler and vice versa.

(Instructions for connecting a 3000 to a specific model of gas chromatograph accompany the interface cable appropriate for your specific 3000-to-gas chromatograph setup.)

1.6 Checking for Leaks

An autosampler-concentrator system is sensitive to leaks. To ensure accurate, reproducible results from analytical runs, the system must be leak-tight.

Leak-check after you have completely assembled the system (except for the panels and covers). The complete assembly includes the concentrator, autosampler(s) and gas connections. See the Tekmar™ 3000 User Manual for instructions on gas connections.

⚠ CAUTION

Do not use any type of soap solution (for example, Snoop or Detect) to check for leaks. If soap gets in the lines, it will cause increased background and adsorption.

Use an electronic thermal conductivity detector to check the fittings. If an electronic leak detector is not available, you may use a 1:1 solution of isopropanol and water. Use the solution sparingly to avoid contaminating the fittings. With a pipette or syringe, put a drop or two of the solution on the fittings that need to be checked. If bubbles appear in the solution after the system is pressurized, there is a leak.

Use helium (not nitrogen) as the pressurizing gas. (Electronic leak detectors do not reliably detect nitrogen.)

Usually, the cause of a leak is a loose nut. It can also be caused by a missing or worn ferrule or a broken line.

If you need assistance in solving a leak problem, please call Tekmar Service at (800) 874-2004. Call (513) 247-7000 locally or outside the U.S.A. and Canada.

⚠ WARNING

When checking for leaks, you are required to turn the power on to the 3000 and autosampler(s) with panels removed. The 3000's side panels that cover the electronic circuit boards are an exception to the rule--they do not have to be removed and should be installed before leak checking the system. To avoid electrical shock, do not touch any of the system's internal parts!

1.6 Checking for Leaks, cont.

⚠ WARNING

Sections of the autosamplers and the concentrator are heated during operation. Do not touch any of the system's internal parts!

1. Turn on the 3000.

2. Referring to the leak checking instructions in Chapter 3 of the *3000 Purge and Trap Concentrator User Manual*, set gas pressure and flow.

⚠ CAUTION

Turn the gas on slowly. A sudden burst of pressure can damage the 3000's pressure gauge.

3. Turn on the autosampler(s).

The information in the following steps is intended to be as thorough as necessary to leak-check the system. However, if you want more information about starting the system, the hand-held terminal keypad or using the software, refer to the *3000 Purge and Trap Concentrator User Manual.*

4. Press the ENTER key when you see the System Error/System Reset Screen.

5. Allow the system to run through the automatic self-tests. The next screen you will see is the Standby Status Screen.

6. For the 3000 to recognize the autosampler(s), you need to do some simple programming. Follow the steps on the next page.

Note: To view ALL the information on any three or four-line screen, refer to the display on the hand-held terminal or PC. The screen on the front of the 3000 unit is capable of displaying only two lines; it will display only the first and third lines of an Operating Status Screen.

1.6 Checking for Leaks, cont.

a. At the Standby Status Screen, press METH on the keypad. The Method Operations Screen will appear on the display. If the number in the Method field is not the number 4, enter the number 4 by pressing the key labeled "4". If you make a mistake, press the BKSP (Backspace) or CLEAR key, then enter the correct number. Press the ENTER key to save the entry.

b. On the Method Operations Screen, "20XX" must appear in the Type field for the 3000 to recognize the 2016 and/or 2032. ("20XX"' is the generic term for "liquid autosampler".) If "20XX" appears in the type field, skip steps **c** and **d** and go to step **e**. If "3000" appears in the Type field, press the C key to access the Method Commands Screen. Proceed to steps **c** and **d**.

c. At the Method Commands Screen, press **A** (or press ENTER when **A** is highlighted with < > brackets). The Change Type Screen will appear on the display.

d. Press any numeric key to cause the display to toggle from "3000" to "20XX". Press **E** to execute the change and return to the Method Operations Screen.

e. Press the SCHED key on the keypad. The Schedule Operations Screen will appear.

f. Press **E** at the Schedule Operations Screen to access the Edit Schedule Screen.

g. Enter the number 1 for the start position. Press ENTER to save the entry. If you realize that you have made a mistake **after** pressing ENTER, press ENTER until the entry is highlighted again, then enter the correct number.

h. Enter the number 16 for the stop position, then press ENTER on the keypad.

i. Enter the number 4 for Meth (method). Press ENTER.

j. Enter the number 1 for RPS (runs per sample), then press ENTER. If you are **not** installing a 2032, skip step **k** and proceed to step **l**.

k. If you have a 2032 connected to the 3000, then 16 more sample positions need to be recognized. On the second line of the Edit Schedule Screen, enter 17 for the start position and 32 for the stop position. Enter 4 for Meth (method) and 1 for RPS (runs per sample).

l. Press the SCHED key. The Schedule Operations Screen will appear on the display. At this screen, press the C key. The Schedule Commands Screen will appear. Choose Run Schedule by pressing **A**.

m. Exit the Schedule Command Screen by pressing STATUS.

1.6 Checking for Leaks, cont.

7. Repeatedly press STEP until you see the Purge Screen appear on the display.

8. Press HOLD; this keeps the system in Purge Mode and causes it to pressurize.

9. Let the system pressurize for about five minutes. During this time, find out which autosampler position is active by pressing SCHED, then the A key. The Sample Status Screen appears. On this screen, the number for the sample location is the number for the currently active sample position. Each sample position must be checked when it is in its **active** state. The Sample Status Screen lets you know which position is currently active. To exit the Sample Status Screen, press STATUS.

10. If you have not removed the panels and covers on the 3000, do so now. Refer to Section 1.4.1 to remove them.

Note: If you are using a new 3000 for the first time, it will need to be fully leak-checked. See the Section entitled "Leak-Checking" in the Tekmar™ 3000 User Manual.

11. Inside the 3000, leak-check the sample and purge line connections from the autosampler's transfer line.

12. If you have not removed the rear compartment covers on the autosampler(s), do so now. Refer to Section 1.4.5, steps 3 and 4 to remove them.

13. Leak-check the fittings for each **active** sample position. (Press SCHED, then choose option **A** to see the number or location of the active sample position.) Allow each position to pressurize. For the active position, check the following:

    - Purge fittings
    - Sample fittings
    - Front panel fittings

14. Using the STEP key or the step switch in the upper right-hand corner of the autosampler(s), advance to the next sample position. Repeat steps 13 and 14 for each position on the autosampler(s). If the 2016 is the only autosampler that you are using, leak-check the 16 sample positions. If you are using a 2016 and a 2032, you need to check all 32 sample positions plus the two transfer line connections on the eight-port valve in the 2032.

1.7 Replacing the Panels and Covers

1. Replace the 3000's valve oven cover, being careful not to pinch the lines. Make sure that the two tabs on the valve oven cover are inserted into the two slots in the unit. Reinsert the thumbscrew into the front of the cover and tighten it finger-tight.

2. If you have not replaced the right side panel that covers the electronic circuit boards, do so now. Tighten the screw to secure the panel to the unit.

3. Replace the 3000's top panel by lining it up with the pear-shaped slots and sliding the panel back until it seats.

4. Replace the 3000's corner (trap) panel by lining the panel up with the slots and sliding the panel toward the unit, then back until it seats. Tighten the two 1/4-turn screws.

5. Replace the valve oven cover(s) on the autosampler(s). Tighten the nuts with a 3/8 inch socket wrench.

6. Replace the panels on the autosampler(s). Tighten the 1/4-turn screws.

1.8 Acknowledging the Autosampler

To enable the 3000 to acknowledge the 2016 and/or 2032:

1. Turn on the autosampler(s).

2. Turn on the 3000.

3. Press ENTER at the System Error/System Reset Screen.

4. Allow the system to run through the automatic self-test.

5. At the Standby Status Screen, press METH to access the Method Operations Screen (Figure 1-10).

```
Select Method
Method                              2
Type                             20XX
< C > = Commands          E = Edit
```

Figure 1-10 **Method Operations Screen**

1.8 Acknowledging the Autosampler, cont.

6. If you wish to use the autosampler(s), the number in the method field (Figure 1-10) should be a number for a method that includes the use of a 2016 and/or 2032. You can use a default method or you can reprogram a method to meet your specific needs. For more information on methods, see the Tekmar™ 3000 User Manual.

7. At the Method Operations Screen, change the number in the method field (if it is necessary) by completing the following tasks:
   a. Press the appropriate numeric key.
   b. If you make a mistake, press the BKSP (Backspace) or CLEAR key, then enter the correct number.
   c. Press ENTER to save your selection.
   d. If you realize that you have made a mistake **after** pressing ENTER, press the ENTER key again. Enter the correct number.

8. Press **C** to display the Method Commands Screen (Figure 1-11).

```
Commands:                          Method 2
< A >    = Change Type
  C      = Restore Default
  E      = Copy Method
```

Figure 1-11 **Method Commands Screen**

9. Press **A** (or press ENTER when **A** is highlighted with < > brackets) to display the Change Type Screen. See Figure 1-12 below.

```
Change Method Type
Method                                    2
Type                                   20XX
< A > = Abort          E   = Execute
```

Figure 1-12 **Change Type Screen**

10. "20XX" is the generic term for "liquid autosampler", so 20XX must appear in the type field in order for the 3000 to recognize the 2016 and/or 2032. If "3000" appears in the type field, press any numeric key to cause the display to toggle from 3000 to 20XX.

1.8 Acknowledging the Autosampler, cont.

11. Press **E** to accept the entry and return to the Method Operations Screen.

12. Steps 7 through 10 must be completed for any stored method that includes the autosampler(s).

13. Set up a *method schedule*. See the Tekmar™ 3000 User Guide for information on method scheduling.

1.9 Bakeout

Method 13 is programmed into the 3000 at the factory. It is called *Bakeout*. Bakeout is used when you want the system to automatically **clean** (bake out) each position on a 2016 and/or 2032.

⚠ CAUTION

Temperatures above 230°C will damage Tenax traps. You may need to edit Method 13 so that temperature settings will not exceed the maximum allowable temperatures for your traps.

Tekmar recommends using Bakeout with the spargers on the autosampler(s) empty. Place a blank trap in the 3000 when using Bakeout.

For more information on time and temperature settings (parameter values) or methods, see the Tekmar™ 3000 User Manual.

Addendum

Connecting the 6016 and/or 6032 to the 3000

Tekmar

7143 East Kemper Road, Cincinnati, Ohio 45242-9576
(800) 543-4461 • Outside the U.S. and Canada (513) 247-7000 • Service (800) 874-2004
Telefax (513) 247-7050

Location: k:\techrite\miscinst\addenda
V.10.12.94

To make it possible for you to hook up the 6016 and/or 6032 to the 3000 and use the system without delay, we have added this addendum to the manual.

This addendum instructs you to do the following:

- Connect the 3000 to the 6016 and/or 6032.
- Leak-check the 3000/autosampler system.
- Indicate to the 3000 that the 6016 and/or 6032 has been installed.

If you need assistance, please call the Tekmar Service Department. In the U.S. and Canada, call (800) 874-2004. Locally or outside the U.S. and Canada, call (513) 247-7000

1.1 Overview

The Tekmar™ 3000 concentrator can operate with the AEROTrap autosampler(s) for convenient, unattended operation. A 3000 connected to a 6016 will run up to 16 samples. A 3000 connected to a 6016 and 6032 will run up to 32 samples.

This section will show you how to connect the autosampler(s) to the 3000. The table below outlines the steps to follow and serves as a quick reference guide.

If you want to:	Read this section:
Understand the autosampler connections and how they work with a 3000	1.3 Understanding the Connections
Set up the 3000 for operation with an autosampler	1.2 Before You Begin
Connect a 6016/6032 to a 3000	1.4.4 Connecting the Autosampler to the 3000
Connect a 6016 to a 6032	1.4.5 Connecting Two Autosamplers to the 3000
Configure the 3000 to recognize the autosampler(s) to which it is attached	1.8 Acknowledging the Autosamplers
Check the systems for leaks	1.6 Checking for Leaks
Complete the installation	1.7 Replacing the Panels and Covers

Table 1-1 **Installation Instructions**

1.2 Before You Begin

If the 3000 is being used for the first time, follow the instructions in the *3000 Purge and Trap Concentrator User's Manual* to unpack the unit.

Place the units to be connected on a level surface. If you are using a 6032, place it between the 3000 and the 6016.

1.2 Before You Begin, continued

This addendum does not discuss the procedures for connecting the 3000 to a gas chromatograph (GC). Refer to the *3000 Purge and Trap Concentrator User's Manual* for instructions on connecting the 3000 to the GC.

The AEROTrap 6016 or 6032 requires 115V or 230V + or - 10%, single-phase, 50 or 60-Hz power. Table 1-2 shows the maximum current draw, power consumption and heat generated for both models.

Autosampler Model	Current Draw	Power Consumption	Heat Generation
AEROTrap 6016	7 amps	840 watts	2688 BTU/hr
AEROTrap 6032	7 amps	840 watts	2688 BTU/hr

Table 1-2 **AEROTrap 6016/6032 Power Requirements**

CAUTION

You must be thoroughly familiar with these instructions to connect the 6016 and/or 6032 to the 3000. If you have any questions, call the Tekmar Service Department for assistance.

WARNING

Sections of the autosamplers and the 3000 are heated during operation. Make sure the units are turned off and allowed to cool before you make any connections.

1.3 Understanding the Connections

Both *pneumatic* and *electronic* connections must be made when connecting a 3000 to the 6016 and/or 6032 autosampler(s).

The pneumatic connections are the transfer line connections. The pneumatic connections allow carrier gas and sample components (analytes) to flow between the 3000 and the autosampler(s).

The electronic connections enable the microprocessor in the 3000 to control the autosampler(s).

Figure 1-1 on the following page illustrates the connections.

1.3 Understanding the Connections, continued

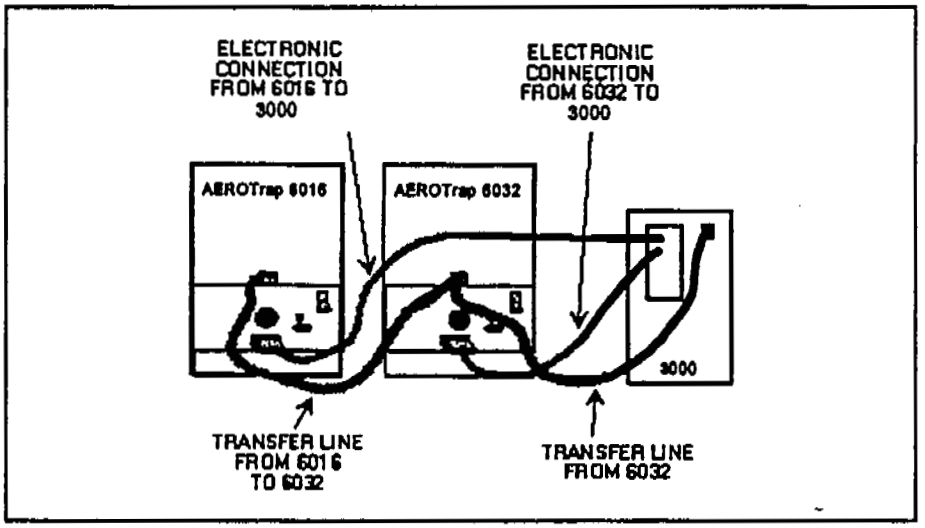


Figure 1-1 **3000-Autosampler Connections**

1.4 Pneumatic Connections

The autosampler's pneumatic connections (transfer line connections) to the 3000 are by way of the desorb and sample lines that are inside the autosampler's transfer line. You must connect these two lines to the sample tee and bypass valve inside the 3000. Before you can connect the lines, you must access the inside of the 3000 and disconnect one line from the sample tee and another line from the bypass valve. To do this, follow the instructions throughout this section.

If both a 6016 and a 6032 are being used with the 3000, pneumatic connections between the 3000 and 6032 (NOT the 6016) are **direct**. See Figure 1-1 above. The transfer line from the 6032 attaches to the 3000, while the transfer line from the 6016 attaches to the 6032.

1.4.1 Removing the Covers and Panels on the 3000

WARNING

Sections of the autosamplers and the 3000 are heated during operation. Make sure the units are allowed to cool before you make any connections.

WARNING

Electrical shock hazard inside. Unplug unit before removing panels.

Complete the following steps while looking at the **front** of the 3000.

1. To remove the right corner (trap) panel, loosen (do not remove) the

1.4.1 Removing the Covers and Panels on the 3000, continued

two 1/4-turn screws that hold the panel. Pull the panel forward, then to the right.

2. To remove the top panel, pull the panel forward until it stops, then lift.

3. Locate the square-shaped valve oven cover that sits on top of the 3000.

⚠ WARNING
The oven may be hot.

4. Remove the thumbscrew from the front of the valve oven cover.

5. Tilt the oven cover back and lift it away from the 3000.

1.4.2 Disconnecting the Sample Line

To make pneumatic connections, disconnect the sample line that extends from the sample mount to the sample tee.

1. Visually follow the line (sample line) that extends from the sample mount to the sample tee. The sample tee is round in shape with lines extending out of it. Each line is secured to the sample tee with a 1/4" nut. With a 1/4" open-ended wrench, loosen the

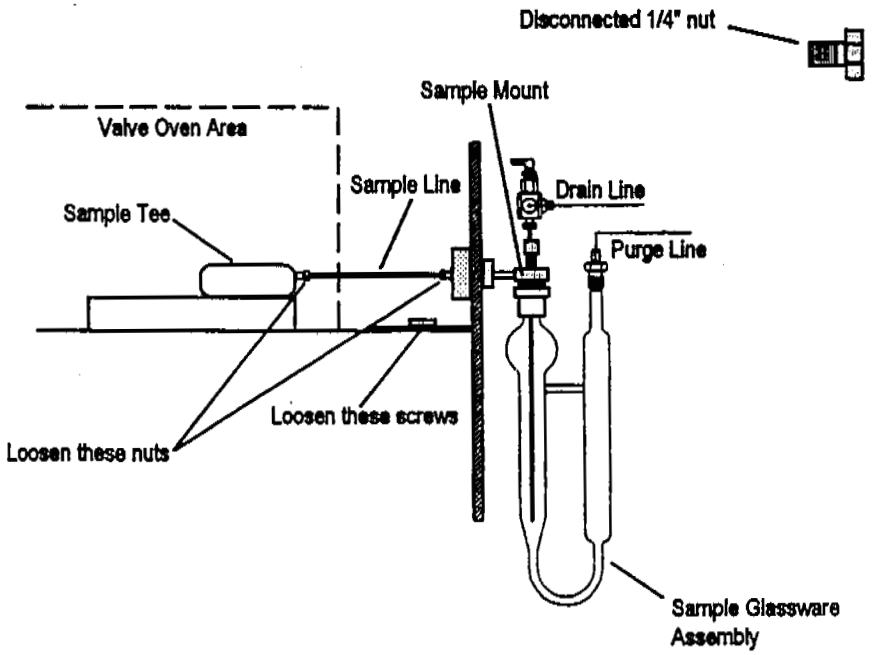


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Figure 1-2 **The Sample Glassware Assembly and Connections**

1.4.2 Disconnecting the Sample Line, continued

nut that holds the sample line to the sample tee. Disconnect the **nut** from the sample tee. Do **not** disconnect the sample line from the sample tee at this time.

2. With a 1/4" open-ended wrench, loosen the **nut** at the opposite end of the sample line (at the sample mount). Disconnect the **nut.** Do **not** remove the line at this time.

3. Locate the screws that hold the sample mount. In Figure 1-2, a line points to these screws. Loosen the screws. (Do not remove them; you will need them again.)

4. Carefully pull the sample mount forward. As you pull forward, carefully disconnect the sample line from the sample tee. The line should have a cone-shaped ferrule at its end.

> **⚠ CAUTION**
>
> **Completely remove the line and ferrule. Do not leave the ferrule inside.**

5. Disconnect the sample line from the sample mount. The line should have a cone-shaped ferrule at its end.

> **⚠ CAUTION**
>
> **Completely remove the line and ferrule. Do not leave the ferrule inside.**

If you are using the autosamplers, you will not need the sample glassware assembly. However, you may wish to replace the sample glassware assembly (without the sample line attached) so that it will be available for future use.

1.4.3 Removing the Sample Gas Line from the Bypass Valve

To disconnect the sample gas line from the top of the bypass valve and make room for the autosampler connection:

1. Locate the bypass valve on the top of the 3000 unit. See Figure 1-3 below.

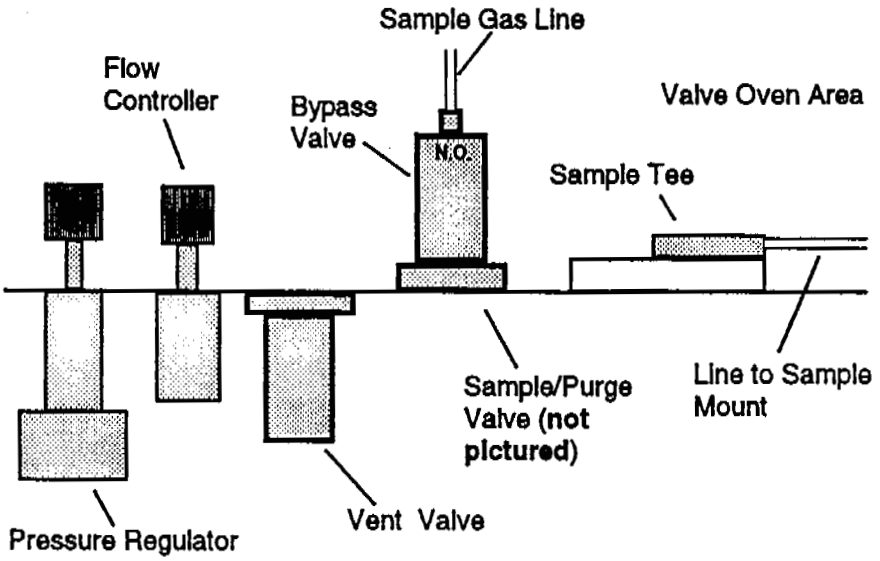

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Figure 1-3 **The Bypass Valve and Surrounding Components**

2. The sample gas line enters the top of the valve, where it is labeled "N.O." With a 1/4" open-ended wrench, remove the line and fittings from the bypass valve. Allow this line to hang freely; it does not have to be completely removed from the 3000.

CAUTION

Remove the line and fittings completely from the bypass valve. Do not leave the cone-shaped ferrule inside.

1.4.4 Connecting the Autosampler to the 3000

This section will show you how to make pneumatic connections (transfer line connections) between the 3000 and the autosampler.

Note: If you are connecting both a 6016 and a 6032 to the 3000, pneumatic connections between the 3000 and 6032 (NOT the 6016) are direct. See Figure 1-1 on page 1-3. The transfer line from the 6032 attaches directly to the 3000, while the transfer line from the 6016 attaches directly to the 6032. If you are installing two autosamplers, follow the steps in Section 1.4.5 BEFORE you follow the steps in Section 1.4.4.

1.4.4 Connecting the Autosampler to the 3000, continued

1. If you have not already done so, complete the steps in Sections 1.4.1, 1.4.2 and 1.4.3.

2. If the autosampler is being used for the first time, its transfer line may be attached to the rear panel by cable ties. Cut the ties and uncoil the line. See Figure 1-1 on page 1-3 to view the rear of the autosampler with its transfer line.

> **⚠ CAUTION**
>
> **Handle the transfer line gently to prevent breaking the internal lines.**

3. Inside the autosampler's transfer line there are two separate lines — the heated *sample* line in the center and the *desorb* line that runs along the outer edge. See Figure 1-4 below. If the desorb line has a female Swagelok nut at its end, you must modify the desorb line (as described in Steps a and b) to connect the autosampler to the 3000. A female Swagelok nut is attached to the end of the desorb line in Figure 1-4. **If the nut on the end of the desorb line looks like the male Swagelok nut shown in Figure 1-4, DO NOT MODIFY THE DESORB LINE - go directly to Step 4.**
   a. Cut the female Swagelok nut off the end of the autosampler's desorb line (**the line on the outer edge of the transfer line**). When cutting the line, keep the opening clean, smooth and circular in shape. Cutters with a diamond-shaped cutting edge work best.
   b. In the autosampler installation kit for the 3000, locate the male Swagelok nut (Tekmar part number 14-3295-016) and the ferrule set (Tekmar part number 14-0158-016).
   c. Slide the male Swagelok nut onto the desorb line (the line on the outer edge of the autosampler's transfer line), making sure that the threads are at the end of the line.
   d. Slide the ring-shaped part of the ferrule set onto the desorb line.
   e. Slide the cone-shaped part of the ferrule set onto the desorb line, making sure that the smallest part of it is at the end of the line. Allow about 1/8" of space between the ferrule and the end of the line.

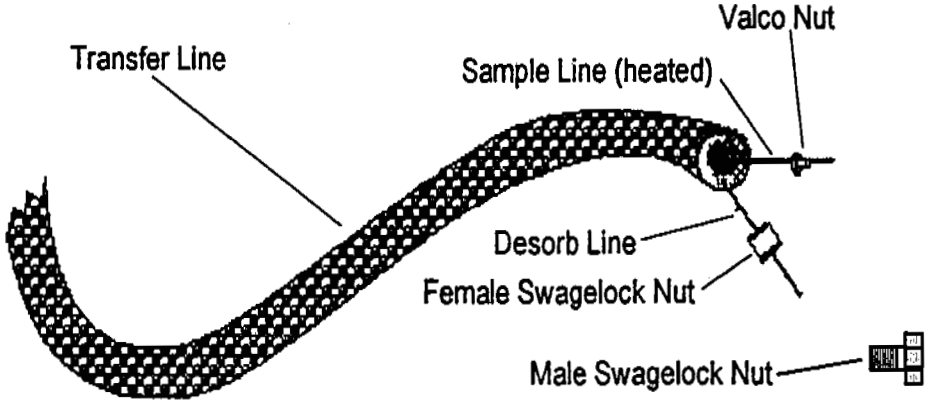
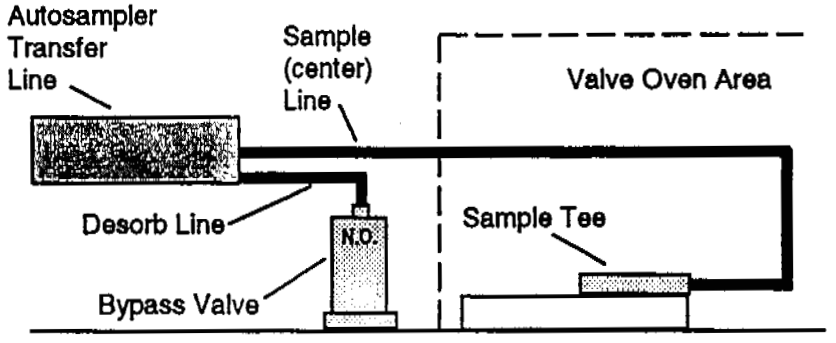


Figure 1-4 **Transfer Line Assembly**

1.4.4 Connecting the Autosampler to the 3000

4. The 3000 transfer line exits an opening in the top section of the 3000's rear panel. Slide the autosampler's transfer line through this opening, allowing the autosampler's transfer line to rest on top of the 3000's transfer line.
5. Connect the sample and desorb lines from the autosampler's transfer line to the 3000 by referring to the illustration below and completing the following tasks:
   a. Locate the sample tee in the 3000. (You should have already removed fittings from the sample tee in Section 1.4.2).
   b. **Carefully** bend the sample line with your fingers so that it can reach the sample tee where you removed the original fittings.
   c. Check the sample tee to make sure that the ferrule from the original fittings is not inside.
   d. With an open-ended wrench, attach the sample line to the sample tee.
   e. Locate the 3000's bypass valve.
   f. **Carefully** bend the desorb line with your fingers so that it can reach the top of the bypass valve.
   g. With an open-ended wrench, attach the desorb line from the autosampler's transfer line to the top of the bypass valve, where it is labeled "N.O."



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sample/purge valve not pictured

Figure 1-5 **Connecting the Transfer Line to the 3000**

1.4.5 Connecting Two Autosamplers to the 3000

Referring to Figure 1-1 on page 1-3 and Figures 1-6 and 1-7 on the following page, follow these steps:

1. If you have a 6016 attached to the 3000, you need to detach the 6016's transfer line connections from the 3000 to install two autosamplers. To do this, refer to Section 1.4.1 to remove the 3000's panels and covers, then follow the instructions in Steps 4 and 5 of Section 1.4.4 in reverse.

2. If the autosamplers are being used for the first time, their transfer lines may be attached to their rear panels by cable ties. Cut the ties and uncoil the lines.

1.4.5. Connecting Two Autosamplers to the 3000, continued

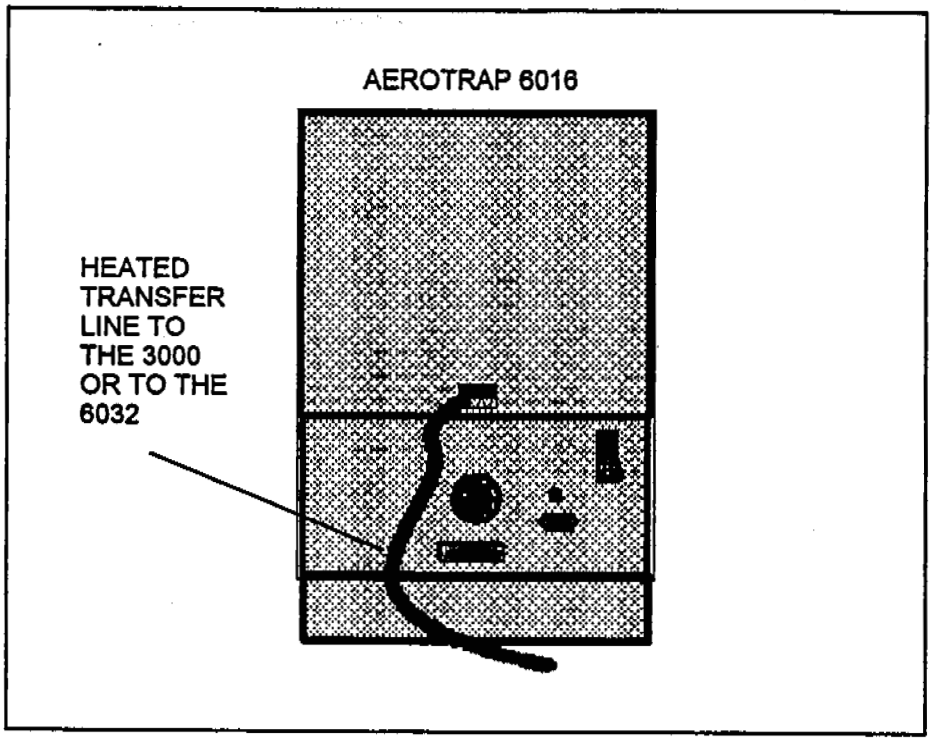

Figure 1-6 **Rear View of the 6016**

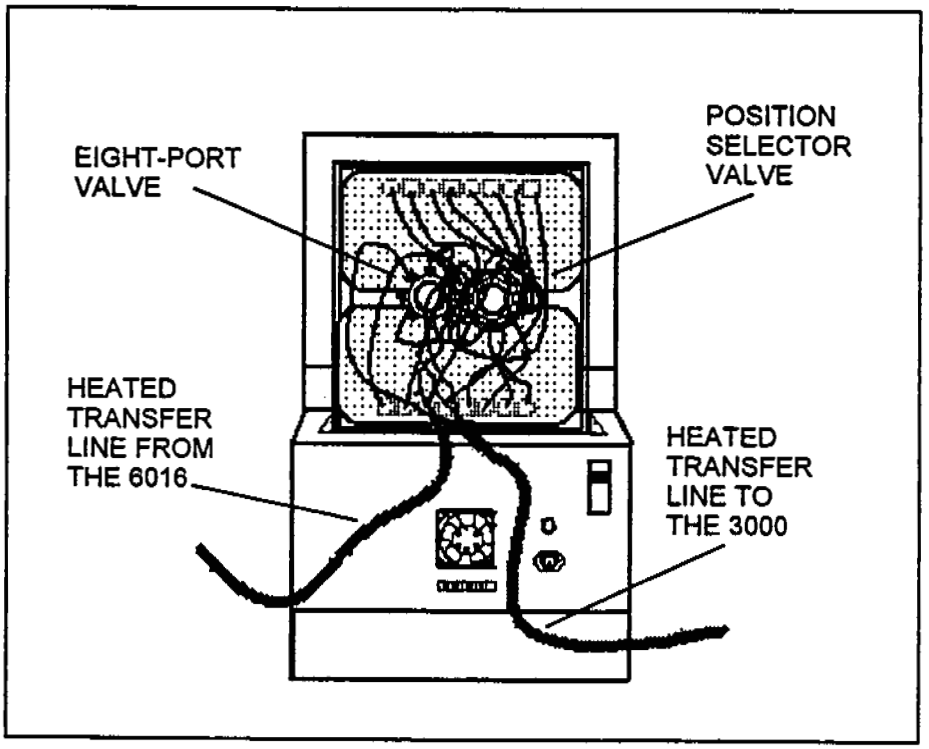

Figure 1-7 **Cutaway Rear View of the 6032**

1.4.5. Connecting Two Autosamplers to the 3000, continued

3. Remove the ten 1/4-turn screws on the back and side of the 6032's rear panel. Pull the rear panel up and away from the unit to remove it.

4. With a 3/8" socket wrench, remove the six nuts and bolts from the 6032's rectangular-shaped valve oven cover. Pull the cover up and away from the unit to remove it.

> **⚠ CAUTION**
>
> **Handle the transfer line gently to prevent breaking the internal lines.**

5. Inside the 6016's transfer line, there is a heated *sample* line running through the center and a *desorb* line running along the outer edge. To connect the 6016 to the 6032, you must modify the desorb line. Follow the steps below, referring to Figure 1-4 in Section 1.4.4.
   a. On the **6016**, cut the Swagelok nut off the end of the transfer line's desorb line (**the line on the outer edge of the transfer line**). When cutting the line, keep the opening clean, smooth and circular in shape. Cutters with a diamond-shaped cutting edge work best.
   b. In the autosampler installation kit for the 6032, locate the short Valco nut (Tekmar part number 14-0243-016) and a single-piece stainless steel Valco ferrule (Tekmar part number 14-0241-016).
   c. Slide the nut onto the desorb line from the **6016**'s transfer line, making sure that the threads are at the end of the line.
   d. Slide the ferrule onto the desorb line, making sure that the smallest part of the ferrule is at the end of the line. Allow about 1/8" of space between the smallest part of the ferrule and the end of the line.

6. Feed the transfer line from the 6016 through the bracket at the bottom of the open compartment on the 6032. Position the 6016's transfer line to the left of the 6032's transfer line (if you are looking at the rear of the 6032).

7. To connect the 6016's transfer line to the 6032's eight-port valve:
   a. Locate the eight-port valve inside the rear compartment on the 6032. See Figure 1-7 on the preceding page.
   b. Connect the 6016's sample line (**center** line of the transfer line) to port #8 on the eight-port valve, as shown in Figure 1-8 on the following page. (The ports on the eight-port valve are labeled with position numbers.)
   c. Connect the 6016's desorb line (the line on the outer edge of the transfer line) to port #4 on the 6032's eight-port valve.

1.4.5. Connecting Two Autosamplers to the 3000, continued

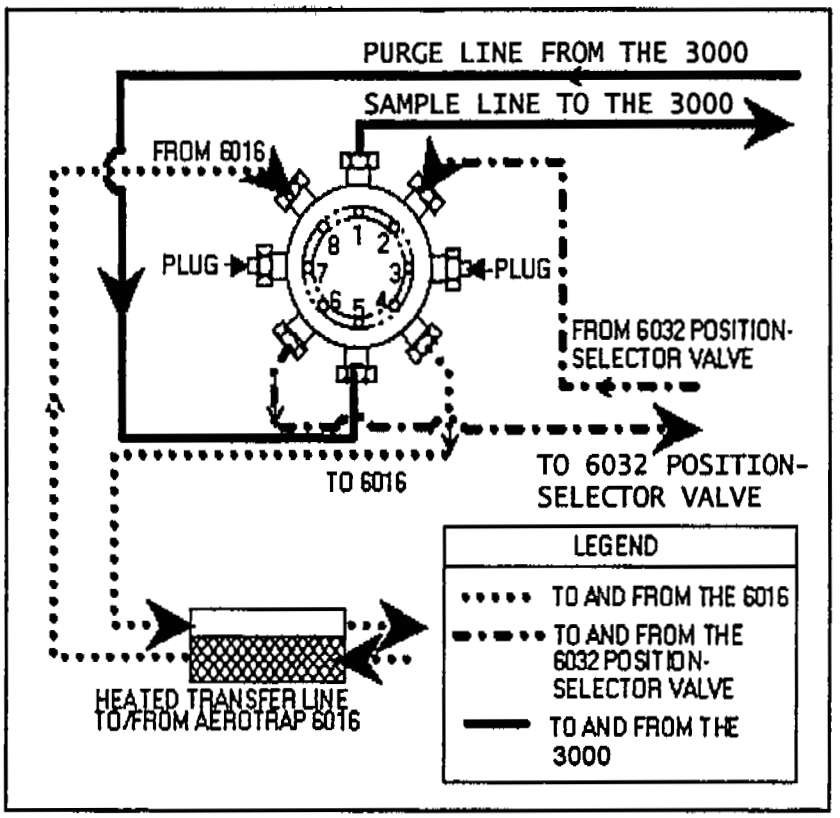

Figure 1-8 **Connecting Primary and Secondary Autosamplers**

8. Now, connect the 6032 to the 3000. To do this, follow the steps in Section 1.4.4, "Connecting the Autosampler to the 3000."

9. Do not replace the covers or panels until you have made the electronic connections and checked the system for leaks. See the following sections.

1.5 Electronic Connections

The autosampler is connected electronically to the 3000 by way of a cable. The cable extends from a connector on the rear of the autosampler to the autosampler logic board in the 3000.

CAUTION

Hold the autosampler logic board by the bracket or edge of the board only. Avoid touching the components or connections to prevent damage from static discharge.

1.5.1 Installing the Autosampler Logic Board

⚠ WARNING

Electrical shock hazard inside. Unplug unit before removing panels.

1. If you have not removed the corner (trap) and top panels on the 3000, follow the instructions in Section 1.4.1, Steps 1 and 2.

2. Locate the screw at the top of the 3000 that fastens the right side panel to the 3000. Remove the screw.

3. Lift the side panel to expose the electronic circuit boards.

Note: If you have two autosamplers, you need to install two boards—one for the 6016 and one for the 6032. Complete the following steps for each board.

4. Choose any available middle slot in which to insert the autosampler logic board. The top and bottom slots are reserved for other boards.

5. Remove the screw that holds the slot cover to the 3000. Keep the screw nearby; you will need it later. Slide the slot cover out of the 3000.

6. Hold the board (still wrapped in its anti-static bag) in one hand and touch one of the metal board brackets with the other hand to discharge static electricity. Remove the board from the bag.

7. The autosampler logic board has a connector on it with removable jumpers attached. The jumpers on the 6016 board are positioned differently from the jumpers on the 6032 board. Check the jumper positions before installing the board into the 3000 by following these steps:
   a. Locate the connector labeled "J3" on the board. It has the rectangular-shaped jumpers on it and sits close to the large, grey 64-pin connector.
   b. Referring to the illustration on the next page, make sure that the jumpers are set correctly.

1.5.1 Installing the Autosampler Logic Board, continued

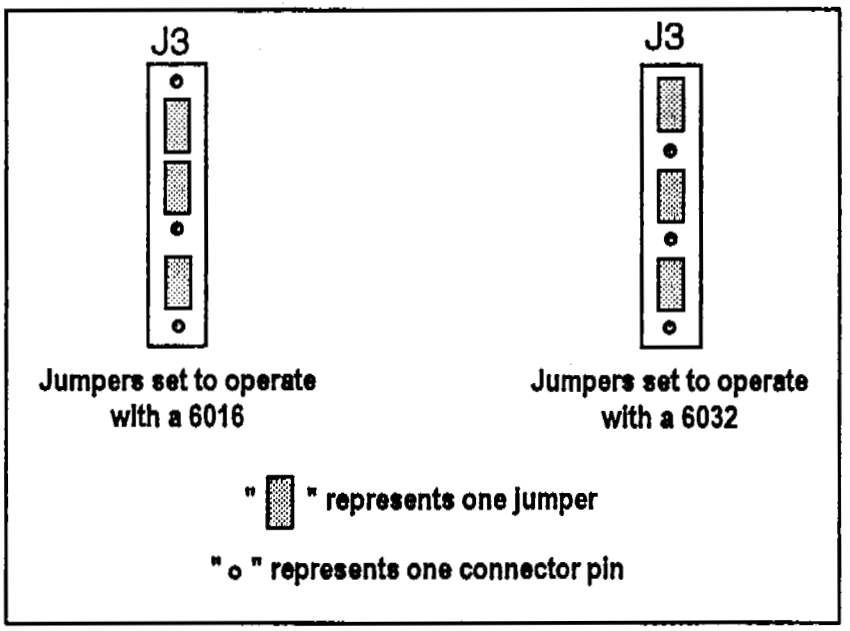

Figure 1-9 **Jumper Settings on the Autosampler Logic Boards**

8. Insert the autosampler logic board into the slot. Secure the board to the 3000 with the screw that you removed in Step 5.

9. Cover the circuit boards by replacing the right side panel. Tighten the screw that secures the right side panel to the 3000.

1.5.2 Connecting the Cable

After installing the autosampler logic board, connect the 3000 to the autosampler by way of the cable.

Note: If you are using two autosamplers, you will need to install two cables–one for the 6016 and one for the 6032. Follow the steps below for each cable.

1. Insert one end of the cable into the connector on the autosampler logic board.

2. Connect the other end of the cable to the matching receptacle on the rear of the autosampler. Make sure that the cable is directly connecting a 6016 autosampler logic board to a 6016 autosampler and the 6032 board to a 6032 autosampler. You **cannot** connect a 6016 autosampler logic board to a 6032 autosampler and vice versa.

(For instructions on electronically connecting the 3000 to your gas chromatograph (GC), see the installation instructions shipped with the 3000-to-GC interface cable.)

1.6 Checking for Leaks

An autosampler/3000 system is sensitive to leaks. To ensure accurate, reproducible results from analytical runs, the system must be leak-tight.

Leak-check after you have completely assembled the system (except for the panels and covers). The complete assembly includes the electronic and pneumatic connections. See Sections 1.4 and 1.5.

⚠ CAUTION

Do not use any type of soap solution (for example, Snoop or Detect) to check for leaks. If soap gets in the lines, it will cause increased background and adsorption.

Use an electronic thermal conductivity detector to check the fittings. Use helium as the pressurizing gas. Do not use nitrogen because electronic leak detectors do not reliably detect nitrogen.

If an electronic leak detector is not available, you may use a 1:1 solution of isopropanol and water. Use the solution sparingly to avoid contaminating the fittings. With a pipette or syringe, put a drop or two of the solution on the fittings that need to be checked. If bubbles appear in the solution after the system is pressurized, there is a leak.

Usually, the cause of a leak is a loose nut. Tighten the nut, but **do not overtighten**: you could damage the ferrule that is inside the nut. A leak can also be caused by a broken line or a missing or worn ferrule.

If you need assistance solving a leak problem, your Tekmar Service Representative can help. In the U.S. and Canada, call (800) 874-2004. Outside the U.S. and Canada, call (513) 247-7000.

⚠ WARNING

When checking for leaks, you are required to turn the power on to the 3000 and autosampler(s) with the panels removed. The 3000's side panels that cover the electronic circuit boards are an exception to the rule–they do not have to be removed and should be installed before leak checking the system. To avoid electrical shock, do not touch any of the system's internal parts!

1.6 Checking for Leaks, continued

⚠ WARNING

Sections of the autosamplers and the 3000 are heated during operation. Do not touch internal parts!

1. Turn on the 3000.
2. Press the ENTER key at the System Error/System Reset Screen.
3. Allow the 3000 to run through the automatic self-test. After the self-test, the Standby Status Screen appears on the display.
4. Referring to the leak checking instructions in Chapter 3 of the *3000 Purge and Trap Concentrator User Manual*, set gas flow and pressure.

⚠ CAUTION

Turn on the gas slowly. A sudden burst of pressure can damage the 3000's pressure gauge.

5. Turn on the autosampler(s).

The information in the following steps is intended to be as thorough as necessary to leak-check the system. However, if you want more information about starting the system, the hand-held terminal keypad or using the software, refer to the *3000 Purge and Trap Concentrator User Manual.*

6. To program the 3000 to recognize the autosampler(s), follow the steps on the next page.

Note: To view all the information on any three or four-line screen, see the display on the hand-held terminal. The screen on the front of the 3000 is capable of displaying only two lines; it will display only the first and third lines of an Operating Status Screen.

1.6 Checking for Leaks, continued

a. At the Standby Status Screen, press METH on the keypad. The Method Operations Screen will appear on the display. If the number in the Method field is not the number 4, enter the number 4 by pressing the appropriate numeric keys. If you make a mistake, press the BKSP (Backspace) or CLEAR key, then enter the correct number. Press the ENTER key to save the entry.

b. On the Method Operations Screen, "60XX" must appear in the Type field for the 3000 to recognize the 6016 and/or 6032. ("60XX" is the generic term for "Autosampler".) If "60XX" appears in the type field, skip Steps **c** and **d** and go to step **e**. If "3000" appears in the Type field, press the C key to access the Method Commands Screen. Proceed to Steps **c** and **d**.

c. At the Method Commands Screen, press **A** (or press ENTER when **A** is highlighted with < > brackets). The Change Type Screen will appear on the display.

d. Press any numeric key to cause the number in the type field to change to "60XX". Press **E** to accept the entry and return to the Method Operations Screen.

e. Press the SCHED key on the keypad. The Schedule Operations Screen will appear.

f. Press **E** at the Schedule Operations Screen to access the Edit Schedule Screen.

g. Enter the number 1 for the start position. Press ENTER to save the entry. If you realize that you have made a mistake **after** pressing ENTER, press ENTER until the entry is highlighted again, then enter the correct number.

h. Enter the number 16 for the stop position, then press ENTER on the keypad.

i. Enter the number 4 for Meth (method). Press ENTER.

j. Enter the number 1 for RPS (runs per sample), then press ENTER. If you are **not** installing a 6032, skip step **k** and proceed to step **l**.

k. If you have a 6032 connected to the 3000, 16 more sample positions need to be recognized. On the second line of the Edit Schedule Screen, enter 17 for the start position and 32 for the stop position. Enter 4 for Meth (method) and 1 for RPS (runs per sample).

l. Press the SCHED key. The Schedule Operations Screen will appear on the display. At this screen, press the C key. The Schedule Commands Screen will appear.

m. Choose Run Schedule by pressing **A**.

1.6 Checking for Leaks, continued

7. Repeatedly press STEP until you see the Sample Desorb Screen appear on the display.

8. Press HOLD; this keeps the system in Sample Desorb Mode and causes it to pressurize.

9. Let the system pressurize for about five minutes. During this time, find out which autosampler position is *active.* An active autosampler position is one that is processing or ready to process a sample. Each autosampler position must be checked for leaks when it is active. Press SCHED, then the A key. The Sample Status Screen appears. On this screen, the number for the sample location is the number for the active autosampler position. To exit the Sample Status Screen, press STATUS.

10. If you have not removed the panels and covers on the 3000, do so now. Refer to Section 1.4.1 to remove them.

Note: If you are using a new 3000 for the first time, it will need to be fully leak-checked also. See the leak-checking section in the *3000 Concentrator Purge and Trap User's Manual.*

11. Inside the 3000, leak-check the sample and desorb line connections from the autosampler's transfer line.

12. If you have not removed the rear compartment covers on the autosampler(s), do so now. Refer to Section 1.4.5, steps 3 and 4 to remove them.

13. Before you leak-check the autosampler position, make sure that it is active. (Press SCHED, then choose option A to find the number or location of the active autosampler position.) Allow the active position to pressurize. For each active position, visually follow the lines to locate all the fittings. Leak-check the fittings and the lines. Do not forget the fittings on the front panel.

14. Using the STEP key on the hand-held terminal keypad or the step switch in the upper right-hand corner of the autosampler, advance to the next autosampler position. When you advance to another autosampler position, that position is automatically made active.

15. Repeat steps 13 and 14 for each autosampler position. If the 6016 is the only autosampler that you are using, leak-check all 16 sample positions. If you are using a 6016 and a 6032, check all 32 sample positions plus the two transfer line connections (fittings) on the 6032's eight-port valve. See Figure 1-7 in Section 1.4.5 to locate the eight-port valve.

1.7 Replacing the Panels and Covers

1. Replace the 3000's valve oven cover, being careful not to pinch the lines. Make sure that the two tabs on the valve oven cover are inserted into the two slots on the top of the 3000. Insert the thumbscrew into the front of the cover and tighten it finger-tight.

2. If you have not replaced the right side panel which covers the electronic circuit boards, do so now. Tighten the screw to secure the panel to the unit.

3. Replace the 3000's top panel by lining it up with the pear-shaped slots and sliding the panel back until it seats.

4. Replace the 3000's corner (trap) panel by lining the panel up with the slots. Slide the panel toward the 3000, then back until it seats. Tighten the two 1/4-turn screws.

5. Replace the valve oven cover(s) on the autosampler(s). Tighten the nuts with a 3/8 inch socket wrench.

6. Replace the panels on the autosampler(s). Tighten the 1/4-turn screws.

1.8 Acknowledging the Autosampler

To cause the 3000 to acknowledge the presence of the 6016 and/or 6032:

1. Turn on the autosampler(s).

2. Turn on the 3000.

3. Press ENTER at the System Error/System Reset Screen.

4. Allow the system to run through the automatic self-test.

5. At the Standby Status Screen, press METH to access the Method Operations Screen (Figure 1-10).

Figure 1-10 **Method Operations Screen**

1.8 Acknowledging the Autosampler, continued

6. If you wish to use the autosampler(s), the number in the method field (Figure 1-10) should be a number for a method that includes the use of a 6016 and/or 6032. A *method* is a programmed sequence of steps. You can use a default (pre-programmed) method or you can reprogram a method to meet your specific needs. For more information on methods, see the *3000 Concentrator Purge and Trap User Manual.*

7. At the Method Operations Screen, change the number in the method field (if it is necessary) by completing the following tasks:
   a. Press the appropriate numeric key.
   b. If you make a mistake, press the BKSP (Backspace) or CLEAR key, then enter the correct number.
   c. Press ENTER to save your selection.
   d. If you realize that you have made a mistake **after** pressing ENTER, press the ENTER key again. Enter the correct number.

8. Press **C** to display the Method Commands Screen (Figure 1-11).

```
Commands:                          Method 2
< A >   = Change Type
  C     = Restore Default
  E     = Copy Method
```

Figure 1-11 **Method Commands Screen**

9. Press **A** (or press ENTER when **A** is highlighted with < > brackets) to display the Change Type Screen (Figure 1-12).

```
Change Method Type
Method                                  2
Type                                 60XX
< A > = Abort          E  = Execute
```

Figure 1-12 **Change Type Screen**

10. "60XX" is the generic term for "air autosampler". For the 3000 to recognize the 6016 and/or 6032, "60XX" must appear in the type field. If "60XX" does not appear in the type field, press any numeric key until it appears.

11. Press **E** to accept the entry and return to the Method Operations Screen.

1.8 Acknowledging the Autosampler, continued

12. Complete Steps 7 through 11 for any method that includes the autosampler(s).

13. Set up a *method schedule*. A method schedule is a timetable that organizes samples into groups and specifies the method to run on each group. It also specifies the number of runs per sample. See the *3000 Concentrator Purge and Trap User's Manual* for more information on method scheduling.

1.9 Bakeout

Method 13 is programmed into the 3000 at the factory. It is called *Bakeout* . Bakeout is used when you want the system to automatically **clean** (bake out) each position on a 6016 and/or 6032.

⚠ CAUTION

Temperatures above 230°C will damage Tenax traps. You may need to edit Method 13 so that temperature settings will not exceed the maximum allowable temperatures for your traps.

To use Bakeout, place blank sample tubes in the autosampler(s) and a blank trap in the 3000.

For more information on time and temperature settings (parameter values) or methods, see the *3000 Concentrator Purge and Trap User's Manual.*

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