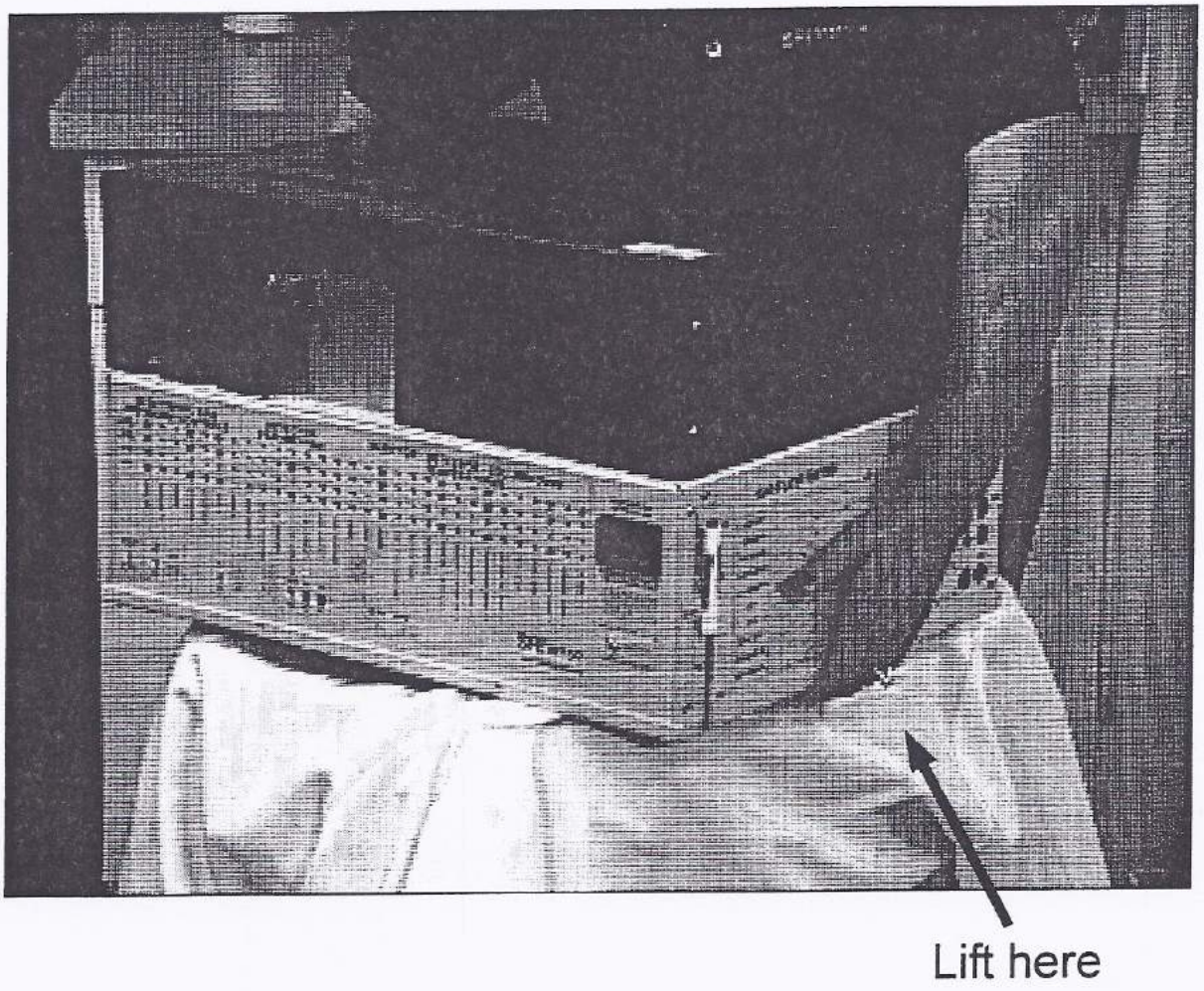
Chapter: Installation:

Topic: Lifting the 8610C and 310 GCs




As illustrated by the photo above, lift the 8610C and 310 GCs by grasping the GC under each side. Before lifting, check to make sure the bottom cover is securely attached to the chassis with six screws, and that the power cord, gas line connections and serial port cable are disconnected.

Upon receiving the chromatograph and data system from the freight carrier, immediately inspect the containers for visible signs of damage. If any external damage is observed, notify the delivery person immediately. If no external signs of damage are present, proceed to inspect the contents of the containers. If the materials appear to have been damaged in shipping, immediately contact the carrier and submit a written report describing the extent of the damage. All packing materials and containers should be retained if damage is discovered until the carrier has been able to inspect the damaged goods. If no damage is discovered, packing should be retained until proper unit operation has been established. The chromatograph, serial data interface cable and manual are shipped in one container, along with the GC accessory kit. This container is a reusable plastic shipping container. These containers are rugged and shipped easily via freight carriers. Most importantly, the plastic container protects larger, more complex and delicate instruments from costly damage to external accessories. Save the packing materials after removing the chromatograph, for future transportation.

The contents of the containers should be checked against the packing slip accompanying the shipment. Verify that all specified accessory items ordered such as columns, syringes and the like have actually been shipped. If any items have been omitted or are missing from the shipment, contact SRI Instruments for location and/or replacement of the item.

The SRI model 8610C gas chromatograph requires either 110 VAC at 60 Hertz or 220 VAC at 50 Hertz, dependent on which AC power supply was specified when ordered. Both AC power supplies support the 3-prong grounded outlet. Proper grounding is required to minimize AC line interference and eliminate ground loops. The 220 VAC plug is keyed so that it cannot be inserted into a 110 VAC receptacle. A generator or high-current inverter may be used for operation from a vehicular power source. If an AC power generator is used, as is done in the field, line voltage and/or current may fluctuate. Appropriate steps should be taken to minimize any inconveniences caused by line noise or an irregular AC waveform.

A standard model 8610C gas chromatograph measures approximately 18.5" x 14.5" x 12.5" and requires a counter surface space of about 32" x 22". Eight inches of clearance are needed in front of the left side control panel for the fan, gas line access and the AC power switch. Another six inches of clearance are suggested in front of the right control panel and to the rear of the unit for safe operation and ease of access during routine service. The red oven cover requires a clearance of at least 24" (measured from the counter top) in order to provide adequate access to the column oven for service. If the chromatograph is equipped with optional accessories such as the 10 station purge and trap autosampler for the optional built-in EPA Style purge and trap, the access to the left side of the chromatograph must be increased by a minimum of an additional 12". The compact footprint of the system is economical on lab counter space and is ideal for mobile environmental installations.

Prior to placing the chromatograph into service, the gas supply and related plumbing should be installed and routed. The gas cylinders should be located outside the lab where possible, with only the lines plumbed inside to the chromatograph. Gas cylinders should be secured in place with chain or nylon strap to prevent a cylinder from falling and snapping off the valve. **A gas cylinder contains up to 2700psi and can become a deadly projectile if the valve stem were snapped off.** A regulator should be used to set the supply a gas pressure reduced to a value appropriate for introduction into the GC. Gas pressures at each cylinder pressure regulator should be maintained reasonably above the carrier gas regulator setting in order to provide a range of control (a supply pressure set to no more than 20psi greater than the EPC setpoint is recommended). A block valve should be inserted on the output side of the regulator to permit line service when needed, and to permit immediate shut-off in case of emergency.

Refrigeration-grade copper tubing may be used for all of the gas supply lines to the chromatograph. Plastic tubing should never be used as it permits contaminants, includung oxygen, to permeate and this can cause damage to thermal conductivity detectors (TCDs) and capillary columns, in addition to degrading the performance of the electron capture detector (ECD) system. Except in the case of the ECD detector, copper tubing destined for gas supply lines may be rinsed out with methylene chloride, followed by methanol. If the tubing is destined for use with the ECD, do not use methylene chloride or any other halogenated solvent as this would wreak havoc upon the detector indefinitely. It is preferrable to switch to 1/16" stainless steel tubing, if available, for the ECD gas lines. It is also a good idea to flame the tubing with a torch while running clean carrier gas through it so that any possible pre-existing contaminants will be eliminated from the tubing run. The tubing is heated until it changes color.

In order to eliminate moisture from the gas supply lines, it is recommended that molecular sieve filters be installed in all of the gas supply lines. SRI 8610C gas chromatographs are factory-equipped with electrically heated 1/8" x 3" molecular sieve-filters on the carrier and sparge gas lines. Although not indispensable, an oxygen filter is a worthwhile optional addition to an ECD carrier gas supply line. Extremely pure gas should be used exclusively on the ECD detector (99.9995% purity).

When routing the gas lines, care should be taken to avoid creating spots where moisture can gravitate and accumulate. Also, gas lines should not be routed near electrical outlets due to the potential for short circuiting created if the bare tubing were to come into contact with exposed electrical contacts, instantly melting the tubing at the short circuit site and releasing gas into the area. If the gas were flammable, a torch-like flame might be produced. If the gas did not ignite immediately, an explosion hazard would be created.

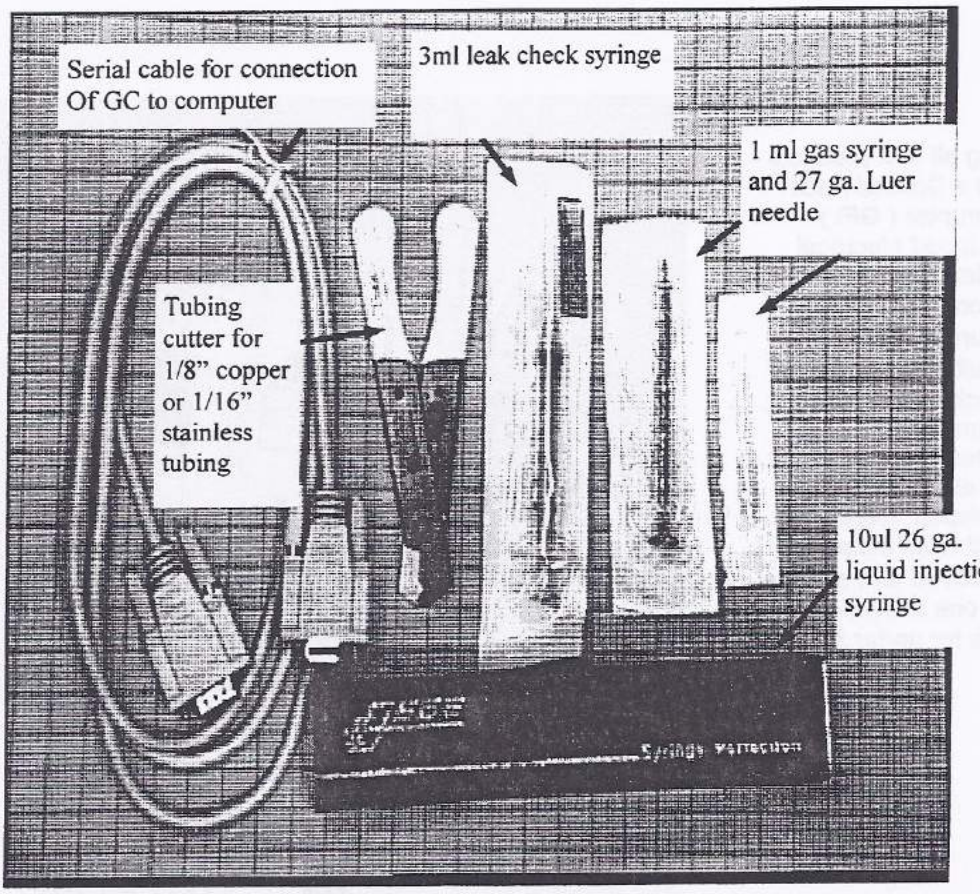
Once the gas line connections have been made and leak-tested, and the gas chromatograph has been located in the counter-top position where it will be used, plug the GC into a properly grounded AC outlet, and energize the unit. Gas pressures may then be adjusted to proper operating conditions by means of the gas pressure setpoint trimpots located under the red protective oven cover. Please review the section regarding the setting of these setpoints for specific information regarding their use. Connect the 6' DB-9 serial cable to the RS-232 connector on the left side control panel of the GC, and connect the opposite end of the cable to the COM port to be used for communications on the PC. At this point, start the PeakSimple program and wait for the main chromatogram screen to appear.

Once the PeakSimple program is running, select the FILE- CONTROLS - CHANNELS menu (CONTROLS - CHANNELS - DETAILS menu in the MS-DOS version) and observe what temperature the default temperature is programmed to. This temperature should also be displayed on the chromatograph's LED display when digital display has been toggled on to OVEN ACTUAL position. If these two figures do not match within two degrees after a few minutes, select the CHANNELS - TEMPERATURE menu again and verify that if there is a temperature program loaded into memory, that it meet your requirements. Otherwise you may edit, replace or clear the displayed temperature program. Return to the main screen. If the temperatures match, then the data system is communicating with the chromatograph.

If there is no response from the chromatograph data system to the PC, the port address (and/or data acquisition type in the MS-DOS version) information may be set incorrectly in the OVERALL screen (DETAILS screen in MS-DOS) for each channel. This will typically produce the "Channel 1 not functioning" message. Verify that the proper hardware settings have been implemented. Once this has been done, communication between the chromatograph and the data system is typically established by activating the channel in the CHANNELS screen. Now the system may be adjusted to operating conditions.

# Chapter: INSTALLATION

## Topic: Contents of Accessories Kit included with GC




Contents of accessories kit shipped with new SRI GCs.

1) 6' DB-9 serial cable for connection of GC to computer ( Student model without data system will not have this item ).

2) Tubing cutter for easy installation of 1/8" copper or 1/16" stainless steel tubing

3) 3ml leak check syringe ( fill with alcohol/water mix to check fitting for leaks )

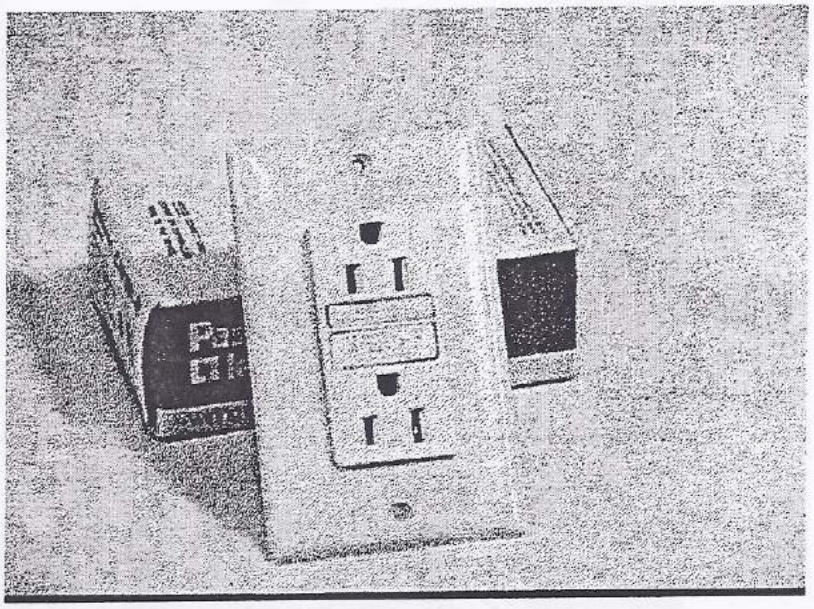
4) 1ml gas syringe and needle for injection of gas samples into GC

5) 10ul liquid injection syringe

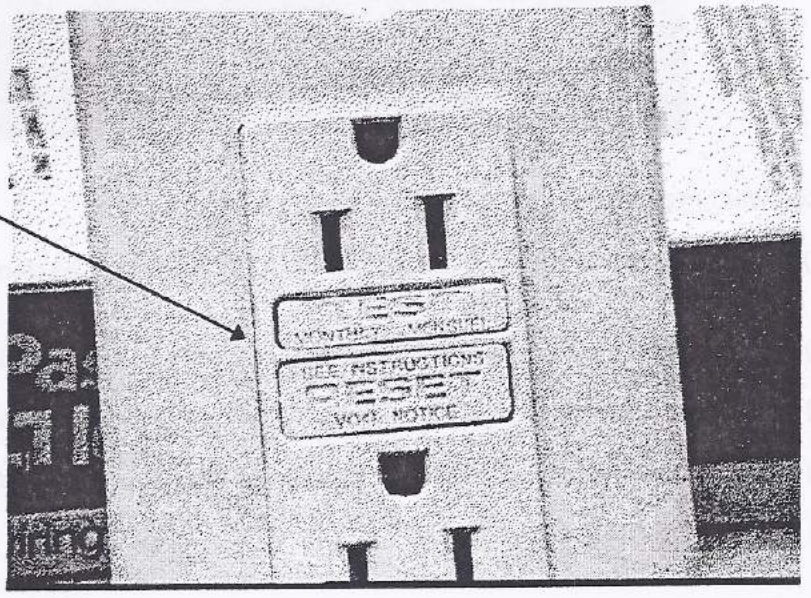
# INSTALLATION:

# ELECTRICAL POWER REQUIREMENTS

Plug all SRI products into a Ground Fault Interupter ( GFI ) equipped electrical outlet. The GFI will trip before a electrical failure in the GC can result in a dangerous shock to the operator, an important safety feature. If your outlet is not already GFI equipped, have your electrician install an approved GFI such as the one shown which sells for under $10.



The GFI has a Test and Reset button. If the GFI trips, you must re-activate the GFI by pressing the Reset.



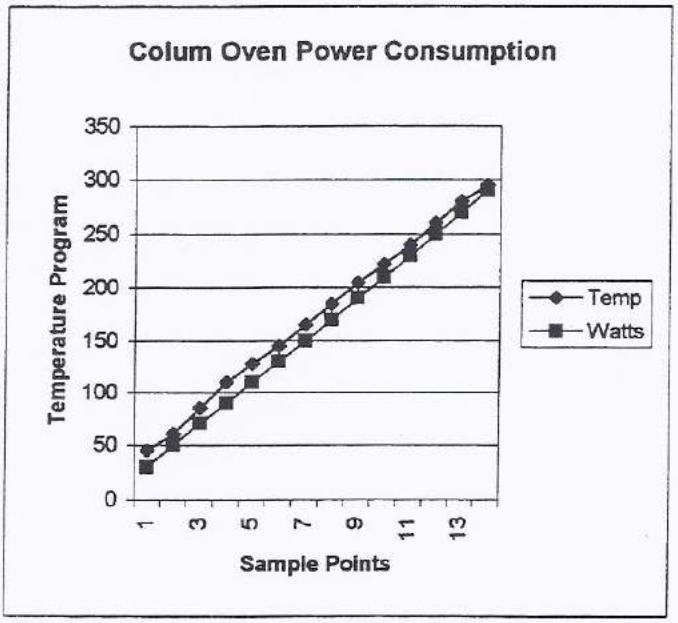
# 8610C Power Consumption

7/16/2002

**Basal Power**
With no zones heating, Power Usage = 50W
With 2 Detector zones heating = 150W
With Detector Zones Stabilized, Total Basal Power = 100W

**Column Oven**
Temperature Program 40C to 300C @ 5C/min

| Average Temp | Watts | Temp Range |
|---|---|---|
| 45 | 30 | 40-50 |
| 60 | 50 | 50-70 |
| 85 | 70 | 70-100 |
| 110 | 90 | 100-120 |
| 127.5 | 110 | 120-135 |
| 145 | 130 | 135-155 |
| 165 | 150 | 155-175 |
| 185 | 170 | 175-195 |
| 205 | 190 | 195-215 |
| 222.5 | 210 | 215-230 |
| 240 | 230 | 230-250 |
| 260 | 250 | 250-270 |
| 280 | 270 | 270-290 |
| 295 | 290 | 290-300 |




**Maximum Power Usage**
Ballistic Heating to 300C = 675W
Total Power = (Basal + Detector + Column Oven) = 825W

**Isothermal Power Usage**
Column Oven Stabilized @ 300C
2 detectors @ 150C
Total Power = (Basal + Detectors + Column Oven) = 400W

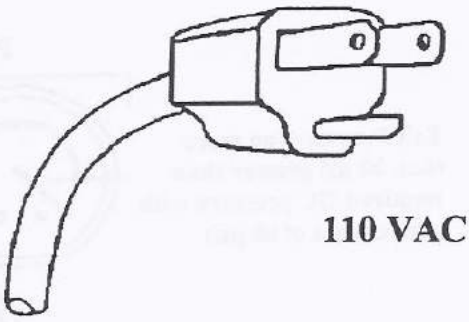
Chapter: INSTALLATION

Topic: Power Supplies and Space Requirements

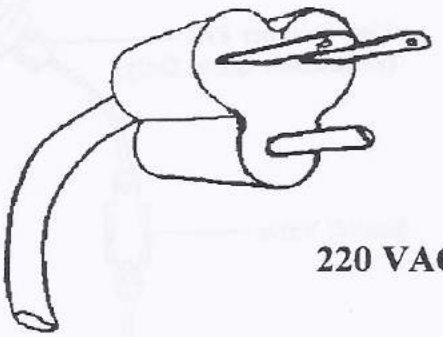
Once the equipment has been removed from all the packing material, check the contents of the container against the packing slip and make sure everything listed is included. If any item(s) have been omitted or are missing, contact SRI Instruments for location and or replacement of the item(s).

The SRI model 8610C gas chromatograph requires AC power at either 110 VAC at 60 Hertz or 220 VAC at 50 Hertz, depending on the AC power ordered. Both AC power supplies are equipped with a three prong grounded outlet (see diagrams to the right). Proper grounding is required for safe operation. Do not disable the ground prong under any circumstance. These plug configurations are for EIA standard U.S. outlets. It may be necessary to replace the plug provided with a local standard plug.

A standard SRI 8610C GC measures 18.5" X 14.5" X 12.5" and requires a minimum counter space of 28" X 22" X 23.5" for proper operation (see diagram to the right). Roughly 8" of clearance beside the left side control panel is needed for data cable, gas line and power switch access. 6" of clearance to the rear of the GC and 11" of clearance above the GC is required. This will provide adequate access to the column oven for maintenance and provide space for proper GC ventallation. To the front and right side, 1.5" of clearance should be adequate to prevent the GC from coming into contact with surrounding objects or falling off the counter. The right side of the GC does contain general information on your instrument and some operators may want additional clearance for easy reference. The front control panel of the GC should be easily accessible in order to properly monitor digital display and control operating conditions, as well as providing access to the injection port for sample injections.

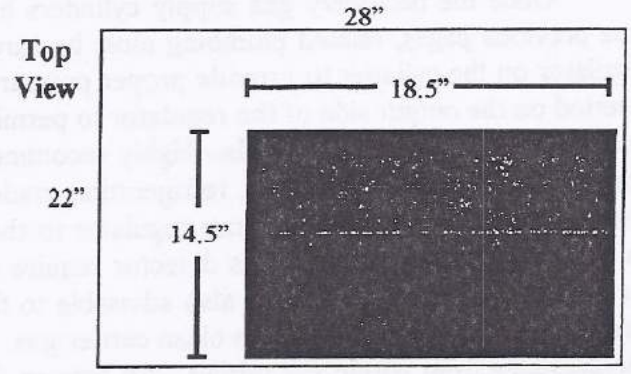


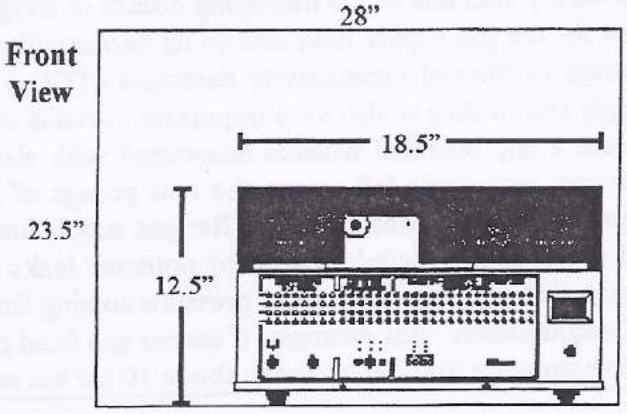
**110 VAC**



**220 VAC**

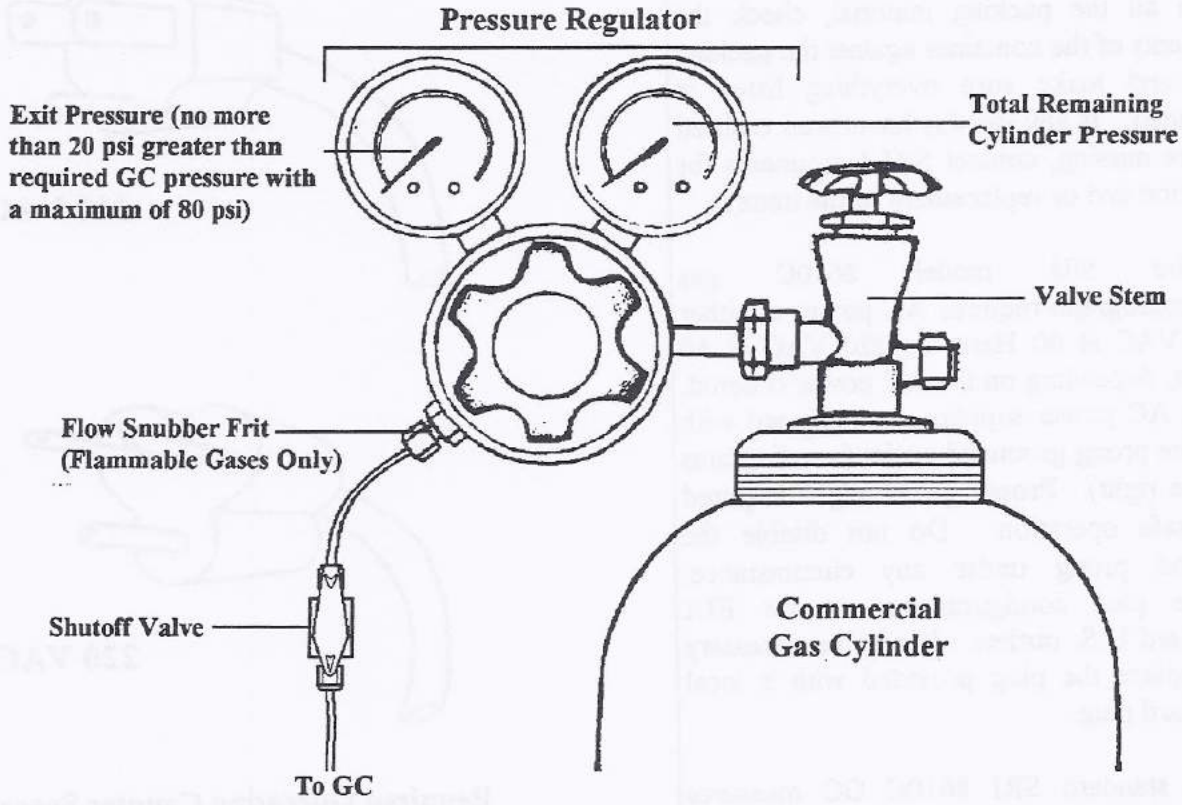
**Required Operating Counter Space**



Chapter: INSTALLATION

Topic: Installing Gas Supply




Once the necessary gas supply cylinders have been properly secured to a strong foundation (see previous page), related plumbing must be carefully installed and routed. Always use a pressure regulator on the cylinder to provide proper pressure regulation to the GC. A shutoff valve should be inserted on the output side of the regulator to permit line service when needed. A flow snubber on the output side of the regulator is also highly recommended for hydrogen and all other flammable gases. Unless you are utilizing an ECD, refrigeration grade 1/8" copper tubing is recommended for all of the gas lines from the cylinder pressure regulator to the GC. Due to the exceptionally high sensitivity of an ECD, GCs equipped with this detector require 1/16" stainless steel tubing to reduce the potential for gas line contamination. It is also advisable to flame the stainless steel tubing with a torch until it changes color while flushing with clean carrier gas. This will help to remove any potential preexisting contaminants from within the tubing. An oxygen filter is also a worthwhile option for ECD carrier gas supply lines due to the damaging effects of oxygen on the detector. Plastic tubing should never be used for the gas supply lines due to its permeability to contaminants such as oxygen which can cause damage to thermal conductivity detectors (TCDs) and capillary columns as well as ECDs. Proper supply line routing is also very important. **Avoid routing gas supply lines near electrical outlets** to eliminate any potential hazards associated with electrical shorts and/or flammable gases. Metal gas lines can very easily fall across the two prongs of any plugged in electrical device and start a fire if routed near an electrical outlet. After gas supply lines have been properly installed, pressurize the lines and check all associated fittings for potential leaks. In order for electronic pressure control units to operate properly, do not set gas pressure coming from the cylinders any more than 20 psi greater than GC requirements. For example, if carrier gas head pressure is set to 10 psi at the GC, then set carrier supply pressure from the cylinder above 10 psi but no greater than 30 psi.

Chapter: INSTALLATION

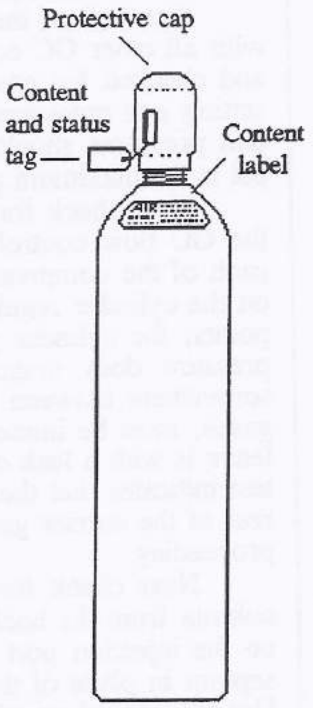
Topic: Gas Supply Selection

Helium is the recommended carrier gas for all standard SRI installed detectors. These detectors include: TCD, FID, PID, ECD, DELCD, FPD, and NPD. If helium is unavailable, nitrogen is an acceptable carrier gas alternative. If nitrogen is used with a TCD, the filament current switch must be set to low to avoid filament damage. **Do not use hydrogen or any other flammable gas as a carrier gas** for any SRI 8610C GC. These units have electronic pressure control and a simple column or injection port leak could release dangerously high levels of flammable gases. Some detectors and accessories require additional gas supply types for proper operation. Argon/methane or nitrogen is required for ECDs as make-up gas. The recommended make-up gas is argon/methane which provides the best sensitivity and largest dynamic range for the ECD, but nitrogen is a readily available, cost effective alternative (see the manual section on the ECD for more details). FIDs, FPDs, and NPDs all require hydrogen and air in order to create the combustible fuel mixture for the detector flame. Hydrogen is an extremely flammable gas and must be handled appropriately. Always consult local safety regulatory agencies for proper procedures for handling compressed and/or flammable gases. An internal air compressor is an available SRI GC option as a source of air. GCs with a purge and trap accessory also require some type of sparge gas. Generally helium can be used as both a carrier and a sparge gas supply. Methanizer accessories require hydrogen gas as a reactant in the catalytic reduction of CO and $CO_2$ to $CH_4$.

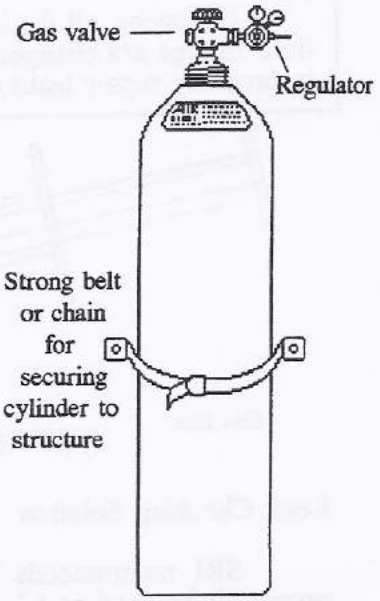
We recommend the use of medium to high quality gas sources for all required gases in order to prevent any operational problems associated with low quality gas. ECDs require an extremely pure carrier gas source of 99.9995% or higher. SRI GCs are equipped with small internal molecular sieve polishing filters on the carrier gas plumbing only to filter low levels of contaminants. If the quality of gas available is questionable, an larger external filter may be necessary to filter excess contaminants such as moisture. Please call SRI technical support with any additional questions on gas supplies or specialized applications.

## IMPORTANT SAFETY NOTE

When handling gas cylinders, remember - never transport or move a gas cylinder without its protective cap securely in place. Gas cylinders can contain up to 2700 psi of compressed gas. If the cylinder were to suffer an accident causing the unprotected valve stem to be broken off, the force of the escaping gas could convert the cylinder into a lethal projectile capable of travelling hundreds of feet and penetrating structural walls. Once the gas cylinder has been placed in the location where it will be stored or utilized, it should be secured by means of a chain or belt securely fastened to the wall or other foundation. One strap may or may not be adequate depending on the installation - consult local safety regulations. Once the cylinder is in place and secured, the cap may be removed so that the gas pressure regulator may be attached for use.




Typical gas cylinder shown. Note that the protective cap is in place, protecting the valve from damage. Cylinders are clearly labelled and tagged when delivered for use. In some areas, cylinders are color-coded for handling safety




The protective cap is removed only after cylinder is in place and secured by at least one chain or belt

Chapter: INSTALLATION

Topic: Checking for Gas Leaks

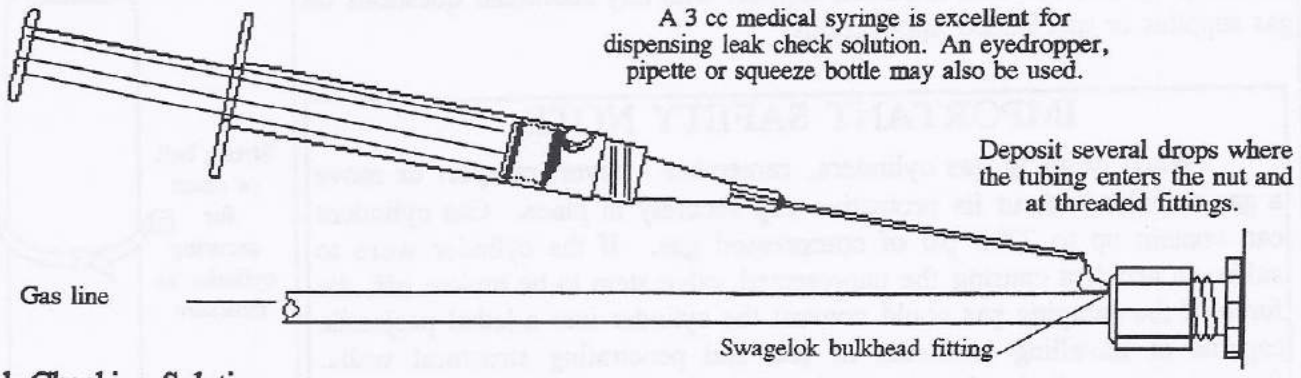
Once all of the appropriate gas supply sources and lines have been properly installed, along with all other GC columns and connections, the entire system should be systematically pressurized and checked for possible leaks. Begin by opening all of the compressed gas cylinder valves and setting exit pressures to the appropriate value for each cylinder regulator. Remember that cylinder exit pressures should never exceed the required GC pressure settings by more than 20 psi and 80 psi is the maximum pressure that the GC can safely handle.

First check for leaks in the lines and connections between the compressed gas cylinder and the GC flow control fluistors. With the system pressurized and the GC power turned off, close each of the compressed gas cylinder valves one at a time and closely watch the pressure indicator on the cylinder regulator to see if pressure decreases. If the system is leak free between these two points, the cylinder pessure indicator should not noticeably decrease for at least five minutes. If pressure does noticably decrease over this time period, then it indicates a significant leak somewhere between the cylinder output and the GC fluistor. Any leak, especially with flammable gases, must be immediately located and repaired. The best way to check specific connections for leaks is with a leak check solution (see section below on Using Leak Check Solution). If pressure test indicates that the system is leak free from the cylinder to the fluistor, then proceed to check the rest of the carrier gas system for leaks. If the system does have a leak, locate and repair prior to proceeding.

Next check for leaks between the fluistor and injection port. Begin by disconnecting the column from the back side of the injection port. Next insert some type of pressure blocking fitting on the injection port where the column was attached. A standard Swagelok nut with an injection septum in place of the ferrule will work quite well. Turn the GC power and gas supply back on. Use the control panel to see what the actual carrier pressure value is and write it down. Now turn off the carrier gas supply at the cylinder once again. Wait 5 minutes and then use the GC control panel to view the actual carrier pressure once again. If this value has decreased in the 5 minute time frame and the previous test results were negative, it indicates that there is a significant leak somewhere in the interal GC carrier gas lines between the fluistor and the injection port. Once again immediately locate and repair any leaks using a leak check solution as described below.

After all of the leaks upstream from the column have been eliminated and confirmed by the two pressure tests described above, properly attach your column to the injection port. Use leak check solution to check all of the fittings within the column oven for leaks and repair any that you find.

Following all the instructions above will assure the operator that the system is leak free. Any time fittings are changed or the GC is relocated, the system should be rechecked for leaks. Failure to properly repair leaks can cause safety risks as well as operational malfunctions.



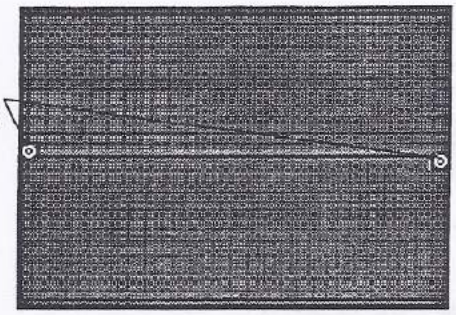

**Leak Checking Solution**

SRI recommends that a solution of 50% water and 50% alcohol (methanol, ethanol, or propanol) be used as a leak check solution. The water-alcohol mixture leaves no residue which could leak through the fittings and cause system contamination. Furthermore, water, when used alone and due to its high surface tension, tends to bead rather than flow into spaces between the tubing and the connectors where leaks may occur. A leak will show up as a stream or froth of tiny bubbles. Inspect any leaking fitting for damaged threads and reversed, missing, or damaged ferrules.

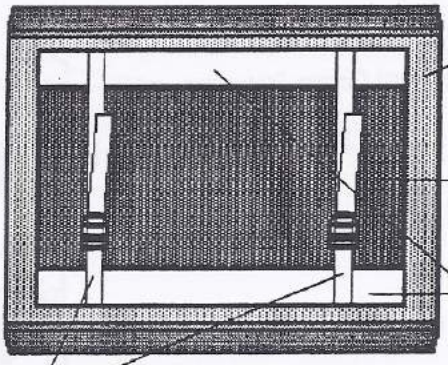
Chapter: INSTALLATION

Topic: Removing The Chromatograph From The Shipping Container

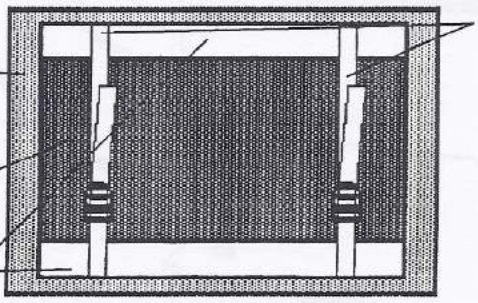
Top view of container, lid closed

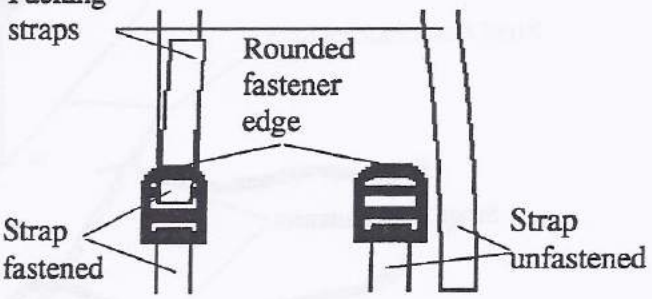



Top view, lid open, GC in container




Top view, GC out of container

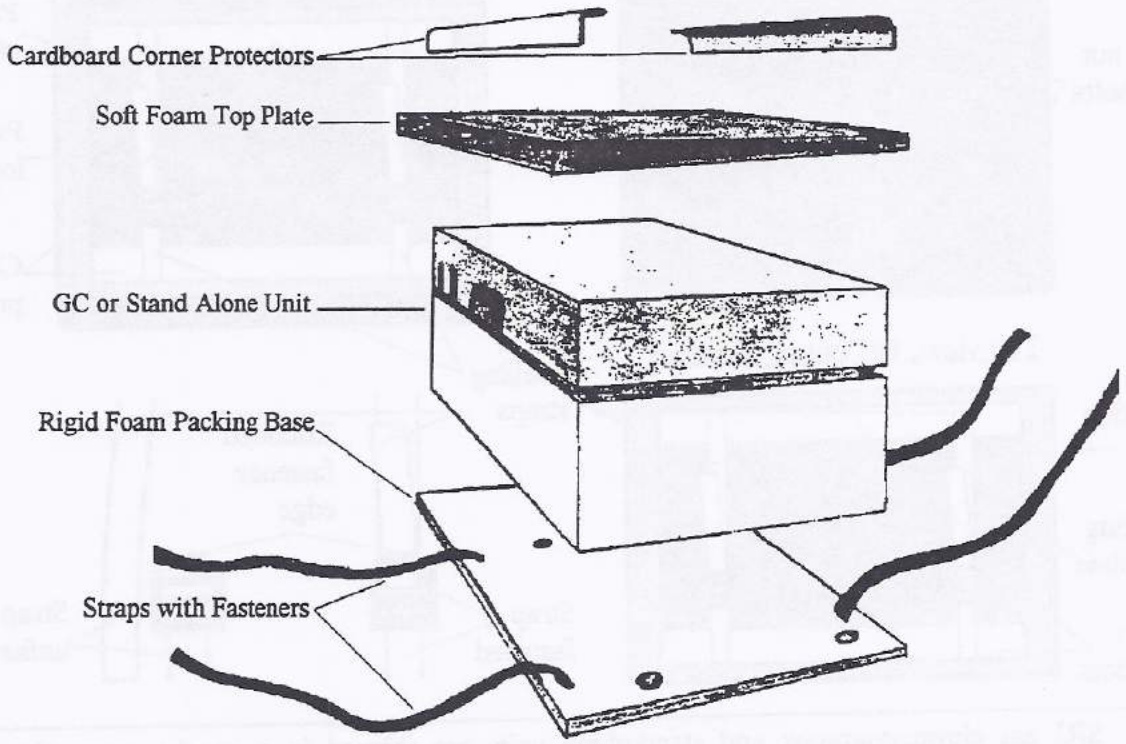



SRI gas chromatographs and stand-alone units are shipped in a sturdy, protective shipping container. The molded gray plastic container is reinforced and resistant to blows and crushing pressures typically encountered while en route to the customer or job site. Upon receipt, check to see that there is no obvious damage to the exterior of the shipping container. Notify the delivery person immediately of any such damage. The lid of the shipping container is secured closed by a 1/2" nut and bolt set each located on either side of the container. To open the lid of the shipping container, completely remove the two nut and bolt set and simply open lid. Screw the nuts back onto the bolts and place in shipping container for future use. The GC is held in place within the shipping container in custom packing material consisting of (1) rigid foam bottom packing base, (1) soft foam top plate, (2) cardboard corner protectors, and (2) straps with fasteners to bind GC within packing material. Some SRI GCs can weigh more than 70 pounds, and care must be taken to prevent injury when removing from shipping container. To properly remove the GC from within the shipping container, firmly grasp the two visible straps running across the soft foam top plate between the two cardboard corner protectors. Being careful to properly bend your knees, lift the entire GC, still contained within the packing material, straight up and out of the shipping container. To remove the packing material from around the GC, begin by removing the two straps holding it all in place. Place your fingers beneath the rounded strap fastener edge and pull up and back. When the strap loosens up, pull the free end of the strap completely through the fastener. Once both straps have been unfastened, remove the two cardboard corner protectors along with the soft foam top plate and place back in the empty shipping container for safe keeping. Next, slide your fingers between the metal GC base plate and the rigid foam bottom packing base, and firmly grasp the bottom of the GC with both hands. Once again being careful to properly bend your knees, lift the GC up and out of the packing base. Place the packing base, with straps still attached, in the shipping container with the other packing materials. Be sure to save all packing materials along with the shipping container for all future shipping needs.

Chapter: *Installation*

Topic: Repacking Your Gas Ghromatograph or Stand Alone Unit For Safe Shipping




When reshipping an SRI GC or stand alone unit, be sure to use the original shipping container and all of the original packing material to minimize the potential for damage during shipment. First, make sure that you have all of the primary packing pieces: (1) molded gray shipping container, (1) rigid foam bottom packing base with (2) straps and fasteners, (1) soft foam top plate, and (2) cardboard corner protectors. To properly pack your GC or stand alone unit, begin by placing the bottom packing base flat on the floor with the straps coming up through the surface of the base as shown in the diagram. Place your GC on top of the base with the legs inserted in the appropriate cutouts. Next, place the soft foam top plate on top of the GC and place the cardboard corner protectors over the soft foam top plate. Pull the straps coming through the packing base up and around the GC, as well as all the other packing material and secure the two strap ends together. It may be helpful to straddle the GC and use your knees to squeeze all the packing material together as you firmly tighten the straps. Be sure the straps firmly secure the GC or stand alone unit in the packing material to properly protect your instrument. When you are sure the straps are firmly and securely fastened, grasp the two straps running across the soft foam top plate between the two corner protectors. Properly bend your knees and lift up the entire GC, contained within the packing material, and gently place into the molded gray shipping container. Place bubble-wrap in the remaining empty spaces within the container to prevent any potential shifting during shipment. Also, include a packing slip inside, as well as one on the outside of the container, and then close the lid. Lastly place the 1/2" bolts in the two holes each side of the top surface and properly secure the lid closed with the 1/2" nuts. It is also important to properly insure your GC with the shipping company due to its high value. Your GC is now ready for safe shipping.

Chapter: INSTALLATION

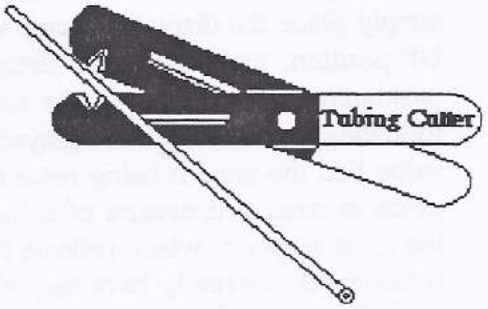
Topic: Tubing Cutter - For Facilitating Gas Connections

Included in the optional gas line installation kits that may be purchased with each SRI Instruments gas chromatograph is a disposable tubing cutter. This tool is capable of producing clean, fast cuts in chromatography tubing that rival more time-consuming tubing cutting methods. The hardened, beveled cutting surface of the tool enables the user to effect a through-and-through cut upon the tubing in one motion, cutting copper and stainless steel tubing with ease. The cut obtained allows both metal and graphite ferrules to slide onto the tubing without the normal filing or reaming necessary after cutting tubing using other methods. No smearing or burring is produced if this tool is used as directed.

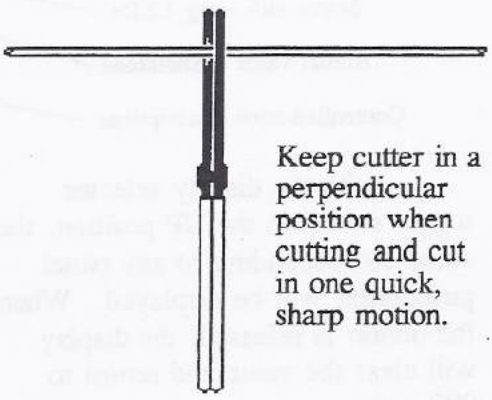
Users can make up to ten connections in the time that it took to cut, file, ream and connect one single tubing connection. Since the tubing is sheared and not twisted or stressed, the inside passage is not deformed or restricted, enabling the user to cut very small internal diameter stainless steel tubing (such as 1/16" O.D. x 0.005" I.D.) that would likely collapse or otherwise become restricted when cut by any other tool. Cuts on very small tubing is seldom attempted due to the difficulty encountered using ordinary methods. By using this tool, delicate tubing cuts become as easy and routine as larger tubing cuts.

Tubing cuts in tight or hard-to-reach locations can be performed without difficulty with the use of this tool. Since the cutting head is practically flat and requires relatively little clearance, it can be inserted into otherwise difficult spots to perform high precision cuts. As an example, if gas tubing routed through a hard-to-reach area inside the gas chromatograph required cutting for the insertion of an adapter or other special fitting, the cutter head could be inserted to the location and the cut acheived without having to dissassemble and relocate or remove the adjacent hardware blocking access to the tubing. Once cut, the tubing ends could be reached with another tool, such as a needle-nosed plier, and pulled to gain accessibility for the installation of the fitting.

When making cuts, the tubing should be located between the two "jaws" of the cutter, making sure that the cutter grabs the tubing in the "V" notches located on the blades. The cutter should be held completely perpendicular to the tubing at the time the cut is made, to avoid obtaining a bad angle on the tubing end. Care should be exercised to avoid pinching the fingers or hand when operating this tool, as with any other hand-held cutting tool.




TO USE: Locate the tubing to be cut between the beveled cutting surfaces while maintaining the cutter at an angle completely perpendicular to the tubing. Holding the cutter steadily, cut the tubing in one quick, hard motion. Do not hesitate during the cut to prevent any possible twisting of the blades or the tubing. This cutter cuts 1/8" and 1/16" copper and stainless steel with ease. After extended use, especially when used to cut stainless steel tubing, the cutter blade will become dull. Discard and replace the tubing cutting tool when this occurs to prevent damage to any future tube cuts.



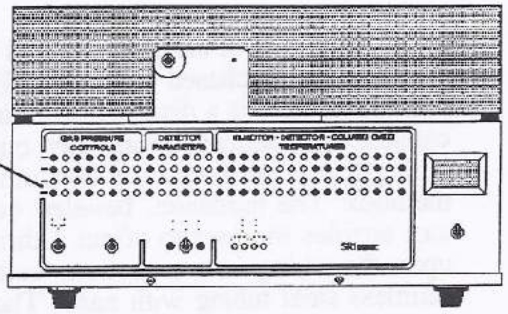
Keep cutter in a perpendicular position when cutting and cut in one quick, sharp motion.

Chapter: INSTALLATION

Topic: Setting and Adjustment of Controlled Heated / Cooling Zones on 8610C GC

The 8610C gas chromatograph permits easy display and adjustment of all controlled zone setpoints. To view a controlled zone, simply place the display selector switch in the UP position, and depress the desired feature pushbutton. Depending on the zone, the following values may be displayed: the actual value that the zone is being measured at, such as the current temperature of column oven 1; the local setpoint, which reflects the adjustable setpoint you currently have set, which, in the case of column oven 1, would be an offset value that could be summed with the temperature signal being sent from the data system; and the total setpoint, which is the sum of any signal being sent from the data system to the controlled zone, in addition to any local setpoint value you have set (for example, if column oven 1 has a local setpoint of 50 degrees, and the data system is instructing the GC to heat the column oven to 100 degrees, the total setpoint should display 150 degrees). Most zones will only display the local setpoint and actual value. Each zone also displays its status via a light-emitting diode (LED) that glows when the zone is active.

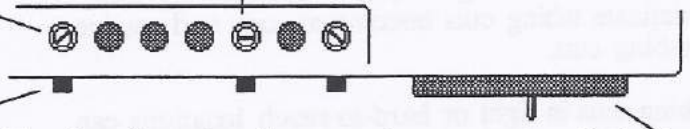
"At-a-glance" display panel also permits viewing of actual and setpoint values



A small blade scewdriver (provided) is used to adjust the setpoint potentiometer while the desired local setpoint display pushbutton is depressed

Adjustable potentiometer located immediately above controlled zone on top front of GC chassis

Display pushbutton viewed from above



Top view of setpoint adjustments above temperature display

Bright red digital LED panel meter displays temperatures, pressures, and voltages

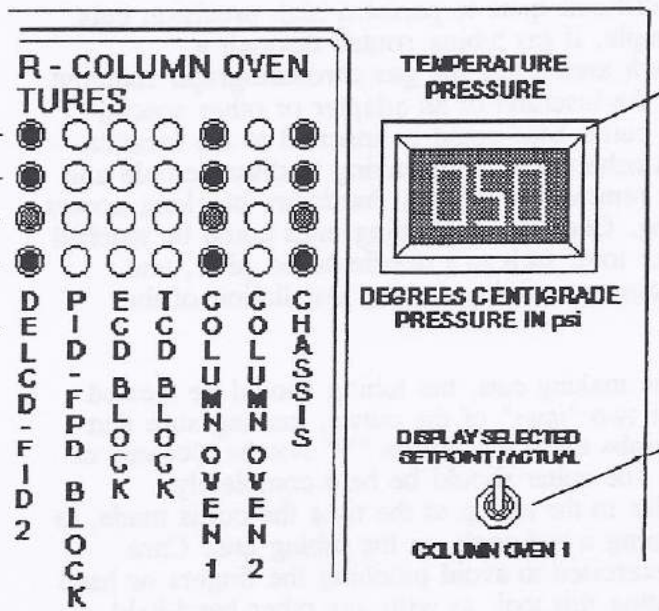
Local setpoint pushbuttons

Total setpoint pushbuttons

Status indicating LEDs

Actual value pushbuttons

Controlled-zone descriptions



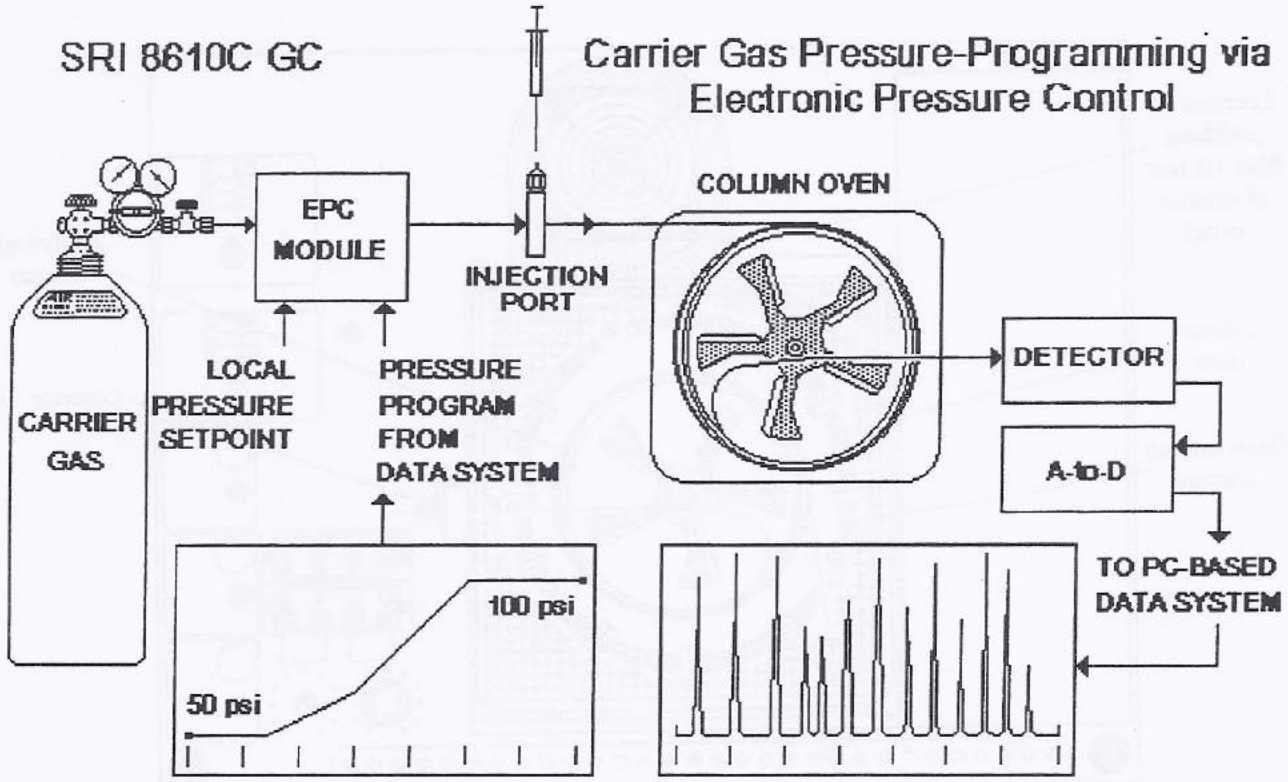

Front view of column oven temperature display

Toggle switch selects display of setpoint and actual values in UP position, or constant column oven 1 temperature display in DOWN position

With the display selector toggle switch in the UP position, the value corresponding to any panel pushbutton will be displayed. When the button is released, the display will clear the value and return to 000 units.

Chapter: INSTALLATION

Topic: Pressure-Programmed Carrier Gas Operation Using EPC System



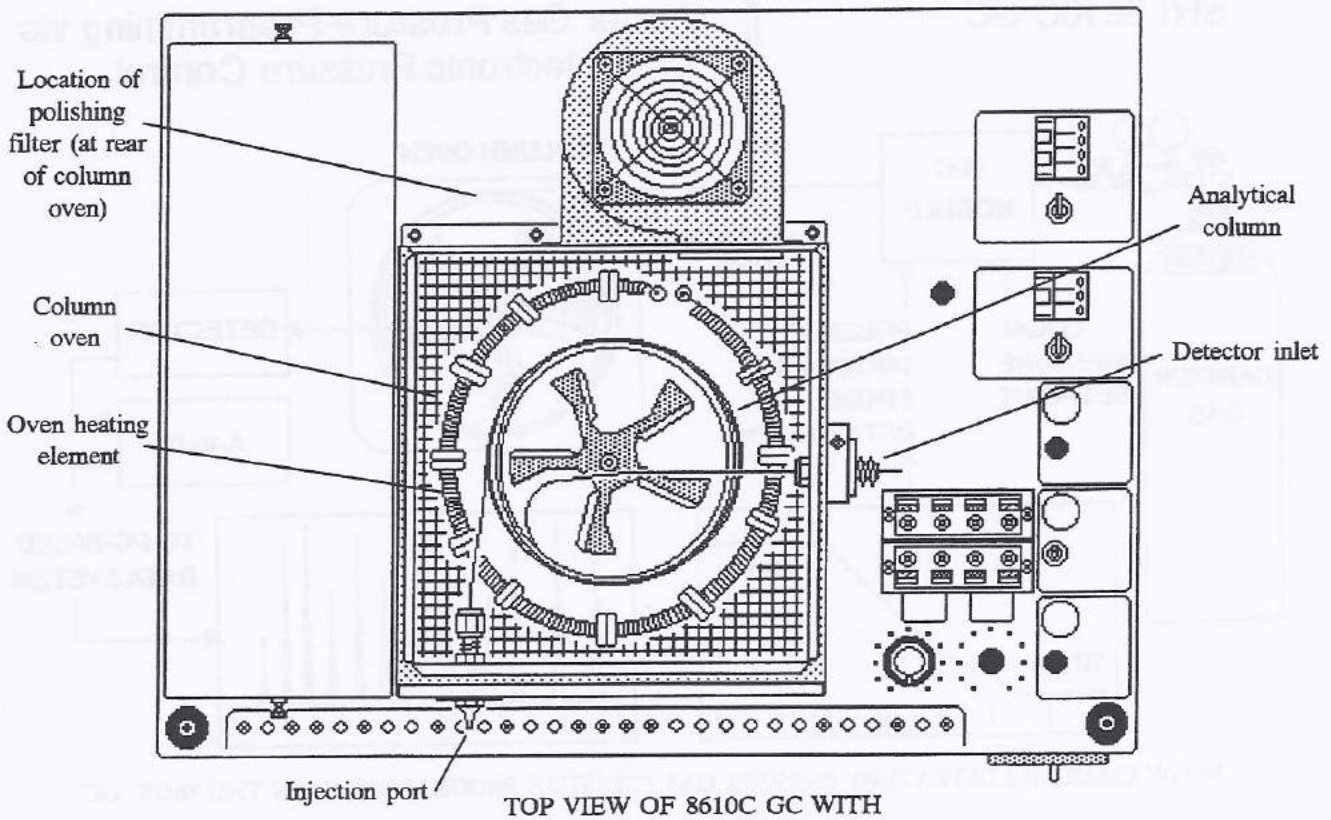

FLOW CHART ILLUSTRATING CARRIER GAS PRESSURE PROGRAMMING ON THE 8610C GC

All SRI 8610C gas chromatographs are equipped with Electronic (or Pneumatic) Pressure Control (EPC) of all system gases. Each gas, from the carrier gas, to the specific detector gases, such as FID hydrogen and FID compressed air, in the case of an FID detector, are controlled by a dedicated solid-state EPC module that electronically monitors and instantaneously adjusts the pressure being supplied to the particular feature. This electronic control facilitates extreme precision of gas flows to the various functions. Each EPC module features a local, user-adjustable setpoint accessed by a trimpot (variable potentiometer) located just above the particular function on the "at-a-glance" panel display. The carrier gas is among these adjustable setpoints. The term "local" refers to the fact that the "local" setpoint is set manually at the trimpot on the GC chassis. As in the case of the column oven temperature setpoint, the carrier gas pressure setpoint may be set "locally" (manually on the GC chassis), or from the computer via a pressure program. Created in the same format as a PeakSimple temperature program, the program signal is sent to the data system interface and converted to a control voltage that can increase, maintain, or decrease the carrier gas pressure automatically at the user's command.

The PeakSimple serial data system interface offers two rampable voltage outputs - one to program the column oven, and the other to program carrier gas pressure. Outputting a 0 to 5VDC variable signal, the EPC module will permit an output pressure of from 0 to 100psi (the carrier pressure shown is actually the column head pressure). Please note that any local setpoint value will be summed to this signal, resulting in the "total" setpoint value on the panel display. The carrier gas pressure regulator at the gas cylinder should be set 10psi higher than the highest programmed carrier gas head pressure desired for proper control. Ramping permits the head pressure to be varied, to speed or slow the elution of peaks from the analytical column as needed by the application or user.

Chapter: INSTALLATION

Topic: Analytical Column Installation

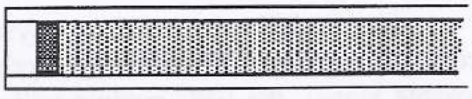



TOP VIEW OF 8610C GC WITH COLUMN INSTALLED

The column oven in the SRI 8610C GC measures approximately 7.8" x 8.0" x 3.0" (19.8 x 20.3 x 7.2cm). A column wound into a coiled form with a maximum diameter of 7" and a height of 3" may be installed in the interior space available. Standard 6" diameter or 3" diameter SRI-wound columns are installed with ease. Either capillary type (0.25 to 0.53mm I.D.) or packed columns (1/8" to 1/4") may be used, dependent on the application. Capillary columns may be made of either fused silica or stainless steel, and are coated on the inside with a fine film of stationary phase between 0.1 and 5.0 microns thick. This phase, specific to the application, permits the sample components to be properly separated for analysis. The packing material in a packed column serves the same purpose. For wide-bore capillary applications, metal capillary columns are recommended, as they are virtually indestructible and can withstand much physical abuse, unlike the fused silica variety, which can be broken with ease if handled improperly. SRI recommends the use of metal capillary columns when available for the application.

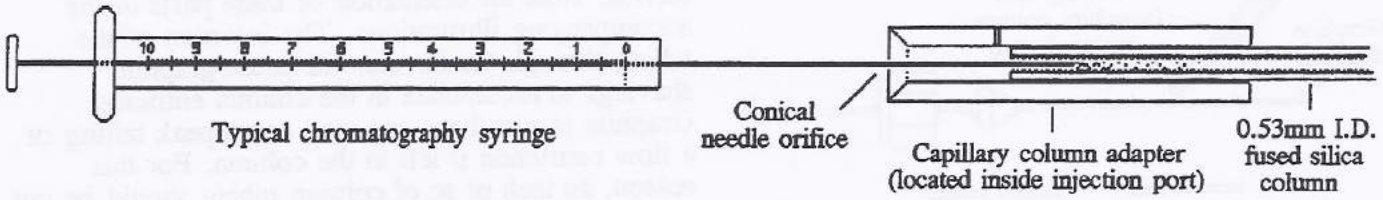
0.25 to 0.32mm I.d fused silica tubing coated on inside surface with stationary phase film 0.1 to 1.0 microns thick

0.53mm I.D. fused silica or fused silica-lined stainless steel tubing coated on the inside surface with a stationary phase film 0.1 to 5.0 micron thick



1/8" to 1/4" O.D. stainless steel or glass tubing packed with granular support particles. These support particles may have a stationary phase coating. Glass tubing is specified for pesticide analysis, as some pesticide components react with stainless steel. A metal frit or glass woll plug retains the packing inside the tubing

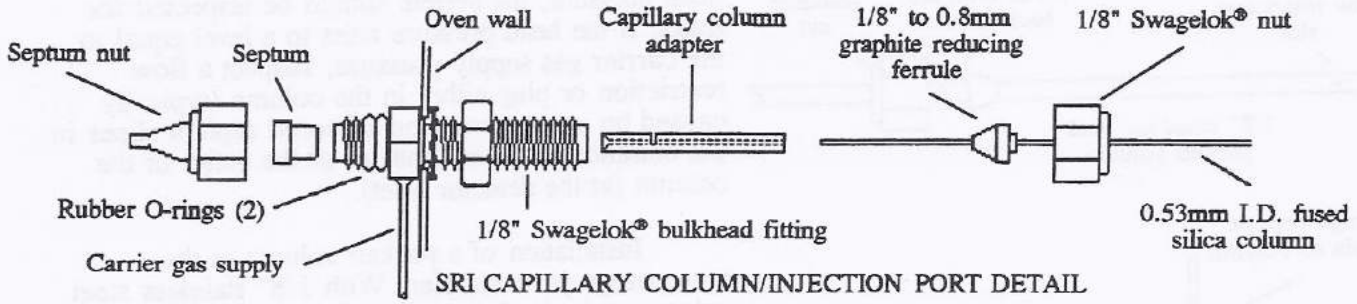
The injection port of the SRI chromatograph is designed specifically for direct injection onto a 0.53mm I.D. wide-bore capillary column. A sample, injected using a chromatography syringe equipped with a 26 gauge needle, is deposited directly into the column. The injector is supplied with a 1/8" O.D. stainless steel 0.53mm capillary column adapter that guides the syringe needle into the capillary column entrance. The sample is then injected onto the column. The user's sample injection technique (sample loading, needle insertion and injection) should be quick, precise and reproducible.




DIRECT INJECTION INTO A CAPILLARY COLUMN

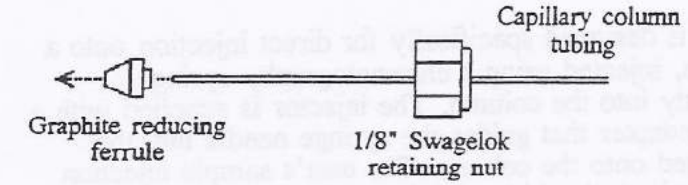
The wide-bore capillary column adapter is machined from 1/8" stainless steel and accepts the insertion of 0.8mm O.D. tubing (the outer dimension of 0.53mm I.D. capillary column tubing). The injection end of the adapter is conical and "funnels" the needle into the column tubing inserted into the adapter from the column end. A slot cut in the adapter prevents carrier gas flow restrictions caused by overtightened septa. By guiding the injection needle well into the analytical column tubing, the sample may be deposited as a liquid onto the stationary phase of the column without exposing the sample to contact with hot metal or glass surfaces.

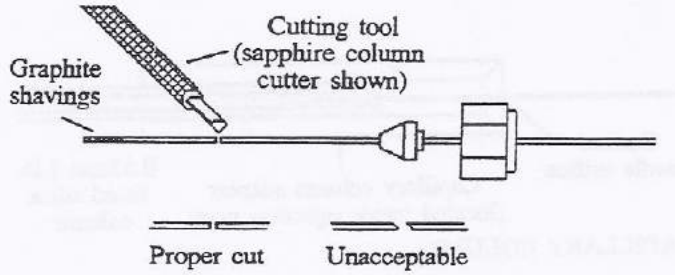
The capillary column adapter is located within the assembly that forms the injection port when a 0.53mm I.D. column is in use. The injection port is constructed from a 1/8" stainless steel Swagelok® bulkhead fitting that has been modified to permit the connection of a gas source directly into the fitting through the hexagonal flange at the bulkhead. This modification permits the introduction of carrier gas into the injector. The end of the injector bulkhead fitting located in the oven compartment accepts a 1/8" Swagelok® nut and graphite reducing ferrule (Alltech RF200/0.8-G) used to secure the capillary column in the injector. At the other end of the bulkhead fitting, facing the user, a 1/8" septum nut is used to secure a formed silicone septum in place in front of the column, sealing the injection port. The septum nut should be finger-tightened. Two rubber O-rings are installed on the injector where the septum nut is attached. The septum nut should never be tightened beyond the point where the nut contacts the outer O-ring.

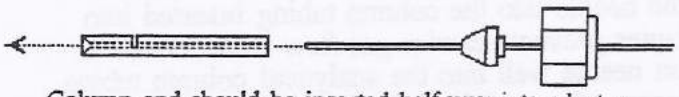


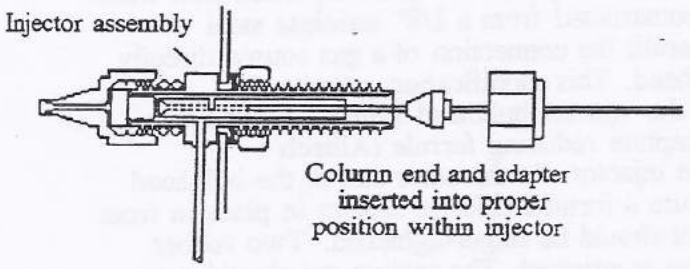

SRI CAPILLARY COLUMN/INJECTION PORT DETAIL

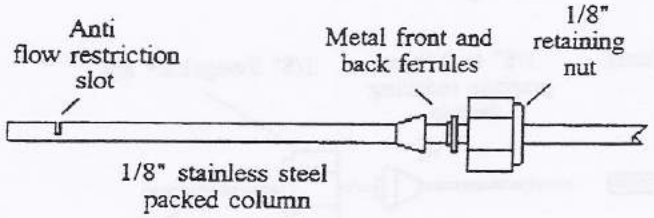
The injection port is compact and has a low thermal mass. Since most of the injector body is located within the column oven, the injector and oven temperatures are always equal (the standard injector is not supplied with any provision for independent heating. Heated on-column injection is available as an option). Resultant sample component peaks are sharp and exhibit minimal or no tailing. This is due to the injection of the sample directly onto the column and at a temperature below the sample solvent boiling point. Decomposition of thermally-sensitive sample compounds does not occur and artifact formation is minimized because the sample is not subjected to vaporization and recondensation, as occurs in high temperature injectors.

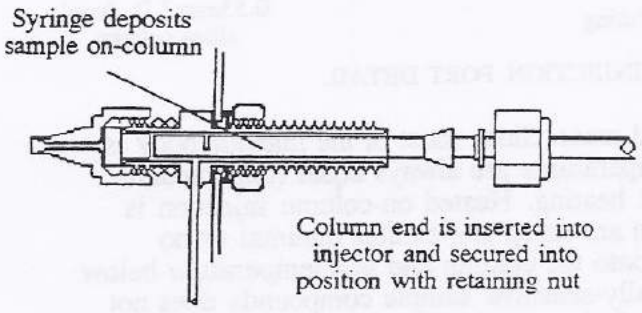


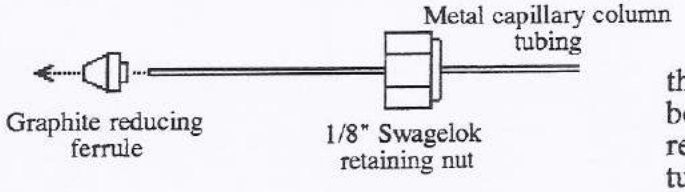



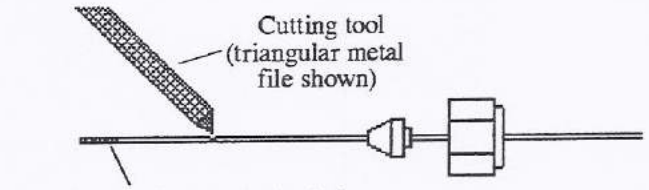



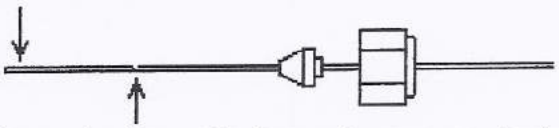




When installing a capillary column in the chromatograph, a graphite reducing ferrule must be used to secure the capillary tubing in the 1/8" retaining nut (Alltech RF200/0.8-G for 0.53mm tubing, RF200/0.5-G for 0.32mm tubing and RF200/0.4-G for 0.25mm tubing). The column is inserted first through the nut, and then through the ferrule. Note the orientation of these parts in the accompanying illustrations. The insertion of the tubing through the ferrule will cause graphite shavings to accumulate in the column entrance. Graphite is adsorbent and may cause peak tailing or a flow restriction if left in the column. For this reason, an inch or so of column tubing should be cut from the column tip after it has been passed through a graphite ferrule. A sapphire tool, a diamond scribe or a razor blade may be used to cut the column, in that order of preference. When the polyimide coating of the tubing has been scored, the tubing snaps apart cleanly. Check the cut end prior to use; it should be flat-ended, not jagged or with the polyimide coating peeling. The capillary column may now be inserted half-way into the capillary column adapter for installation into the injector. Once that the adapter and column end have been located in the injector as shown, the ferrule and nut are connected and tightened to secure the column in the injector. Note that the adapter does not contact the septum. If the septum nut were overtightened, the septa would be forced deeper into the injection port, sealing against the adapter. The slot cut in the adapter permits carrier gas to reach the column even if the septum is overtightened, so that column flow is unaffected. When the column is properly installed, a head pressure reading of between 4 and 12 psi should be observed. If there is little or no head pressure, the system should be inspected for leaks. If the head pressure rises to a level equal to the carrier gas supply pressure, suspect a flow restriction or plug either in the column (typically caused by an accumulation of cored septum slices in the entrance to the column) or at the outlet of the column (at the detector inlet).

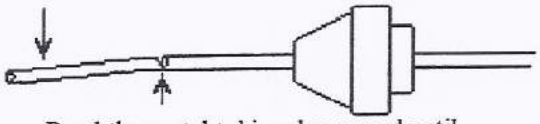
Installation of a packed column in the chromatograph is simpler. With 1/8" stainless steel columns, standard metal ferrules are used to secure the column at the retaining nut. The ferrules are placed onto the column end as shown, and then the column end is inserted into the injector. The capillary column adapter is not used with packed columns and should be stored in the adapter holder under the red protective oven cover for future use. Columns manufactured by SRI include a slot in the injector end for carrier gas flow assurance.



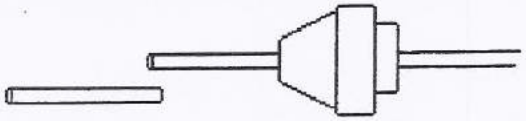



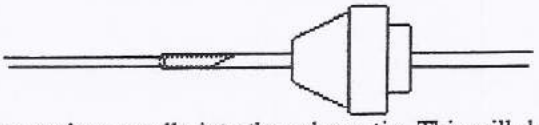
After scoring the metal column, wipe away any shavings and apply force to the tubing at the score



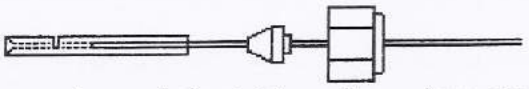
Bend the metal tubing downward until the score opens into a break in the metal
Stop and apply force in the opposite direction



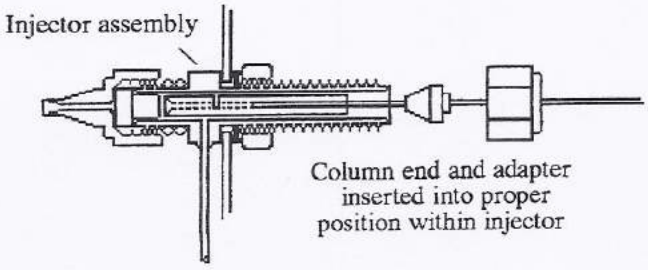
The front piece of tubing should break away cleanly



Insert a syringe needle into the column tip. This will debur the tip and permit the needle to slide in during injection



Column end properly located in capillary column adapter




When installing a metal capillary column in the chromatograph, a graphite reducing ferrule must be used to secure the capillary tubing in the 1/8" retaining nut (Alltech RF200/0.8-G for 0.53mm I.D tubing, RF200/0.5-G for 0.32mm I.D. tubing and RF200/0.4-G for 0.25mm I.D. tubing). The column is inserted first through the nut, and then through the ferrule. Note the orientation of these parts in the accompanying illustrations. *The insertion of the tubing through the ferrule will cause graphite shavings to accumulate in the column entrance. Graphite is adsorbent and may cause peak tailing or a flow restriction if left in the column.* For this reason, an inch or so of column tubing should be cut from the column tip after it has been passed through a graphite ferrule. A fine-cut triangular metal file is provided with all SRI metal capillary columns. Normal column cutting tools designed for use on fused silica will not work with metal columns. Metal columns are coated inside with fused silica and column phase. They offer the same performance, and are practically immune to breakage or rough handling damage. Score and cut the column tubing as indicated and the tubing snaps apart cleanly. Check the cut end prior to use; it should be flat-ended, not jagged or with metal covering the column orifice. The capillary column may now be inserted half-way into the capillary column adapter for installation into the injector. Once that the adapter and column end have been located in the injector as shown, the ferrule and nut are connected and tightened to secure the column in the injector. Note that the adapter does not contact the septum. If the septum nut were overtightened, the septa would be forced deeper into the injection port, sealing against the adapter. The slot cut in the adapter permits carrier gas to reach the column even if the septum is overtightened, so that column flow is unaffected. Of corse, septa should never be overtightened. A finger-tight septum nut is adequate for proper sealing of the silicone against the injection port. When the column is properly installed, a head pressure reading of between 4 and 12 psi should be observed. If there is little or no head pressure, the system should be inspected for leaks. If the head pressure rises to a level equal to the carrier gas supply pressure, suspect a flow restriction or plug either in the column (typically caused by an accumulation of cored septum slices in the entrance to the column) or at the outlet of the column (at the detector inlet). When plugged column inlets are encountered, cut off another inch or two of the column and reinstall the column in the injector. The capillary column adapter is not used with packed columns and should be stored in the adapter holder under the red protective oven cover for future use.