1. INSTALLATION

1.1 INSTALLATION GUIDE EPS 500, 500T, 2000, 2000T (120/220V VAC)

Please note that all electrical work must be in compliance with your city/county codes and executed by a licensed electrician. In no event will Eurocom be liable for any damages from or related to its products, misuse, or nonconformity to city/county codes.

PLEASE READ ALL INSTRUCTIONS PRIOR TO BEGINNING INSTALLATION!
INSTALLATION MUST BE ACCORDING TO THE VOLATGE OF YOUR EPS & BOMBARDING SYSTEM. PLEASE CHECK CAREFULLY!

1. **Check service lines:**
   22 KVA Bombarding system: 100 Amps, 120/220 VAC
   15 kVA Bombarding system : 70 Amps, 120/220 VAC
   Eurocom Pumping System: 20 Amps,120/220 VAC

2. **Check spacing:**
   EPS 2000: required opening 28” wide
   EPS 500: required opening 28” wide

3. **Contactor & Enclosure** to be wired to Primary by Local Licensed Electrician according to your City/County Codes.
   22KVA system: 2 pole 100 amp single-phase contactor with a 120/220VAC coil
   15KVA system : 2 pole 70 amp single-phase contactor with a 120/220VAC coil
   These items may be purchased locally, however, **Eurocom** offers them at a low cost.

4. **Choke and Bombarder** to be connected through the contactor as per drawing
   # 1 (100 Amps) and **# 1A (70 Amps)** – **page 4 & 5**
   Please also see instructions under **1.2 “The Electrical Connection” – page 3**

5. **Safety Package**: please see **# 2 Safety Package Flowchart** – **page 6** -for your information. If purchased, the Safety Package is already installed in your system – no additional installation is required. **If you choose not to purchase a Safety Package, please note, that this will void your warranty on your choke, variac and bridge rectifier**

6. **Overhead Trolley** (Optional): Installation: see encl. **1.3 Overhead Trolley Installation** as well as **# 3 Sample Layout, # 3A Top & Side view Trolley Package, # 3B- page 7-11**

7. **Installation of the Pump Station:**
   The dimensions of the pump station top are, 28" x 28". There should be two 10' tables, one on each side, and the pump station in the middle. The pump station cabinet has adjustable feet on the bottom for leveling. The sides and back should be kept clear, to allow for airflow. The pump station is 38" tall and the tables should be 36" tall. This will allow for a 2" drop to help contain mercury and debris from entering the Y-section and collecting in the grounding electrode and on the mercury filter. When you receive your pump station, the Y-sections will need to be installed using the mercury filter centering ring and the pertinax (clear) clamp. The grounding electrodes will need to be connected according to the enclosed instructions (**1.2 Electrical – Connections** – **page 3**). Remove all boxes and any loose contents from the cabinet and remove the aluminum pump hold-down bracket. This bracket must be returned to EUROCOM. Look over the complete system for any signs of damage, which may have occurred during shipment. If damage is observed, you must notify EUROCOM immediately, so damaged parts may be repaired or replaced. The power supply for the cabinet will plug into the lower left-hand side (Electrical Connections).

1.2. THE ELECTRICAL CONNECTION

The electrical connections of the choke and bombarder must be completed according to (**Drwg.# 1**), for a 22KVA system or **(Drwg# 1A**), for a 15KVA system. As the drawing indicates, the power must be 120/ 220VAC, single phase, and either 100 Amp for a 22KVA system, or 70 Amp for a 15KVA system. The customer will need to provide a fused or circuit breaker disconnect and an appropriately sized contactor with a **120/220VAC coil.** These appropriately sized contactors are available from **EUROCOM**, Inc., at a reduced price. The contactor must be mounted in an NEC approved enclosure.

There must be a ground wire run with this supply circuit. This ground must be going to an identifiable ground rod in the earth. Do not use metal beams or metal conduit for a ground. If flash-back occurs, this ground will carry a potential of 12,000VAC. In addition, if you are not grounded properly, this 12,000VAC will pass through your gauges and destroy them. This could be both dangerous and very expensive.

The power lines and ground will run from the main contactor to the choke and bombarder. One line will go directly to the bombarder (22KVA-Terminal-2) or (15KVA-Bare wire splice) and the other line will go directly to the choke (Bare wire splice). There will be an additional line coming out of the choke (Other Bare wire splice), and going to the bombarder (22KVA-Terminal-5) or (15KVA- Other Bare wire splice). The ground should be run to both the choke and bombarder and may be connected in series. The ground will be terminated on the 1/4" grounding post in the J-boxes on the chokes and the 15 KVA bombarder and the green/yellow ground terminal on the 22KVA bombarder. The bare wire splices should be made with #4 copper split bolts and rubber splicing tape.

The control for the choke is the **10Amp Variac**. The power cord on the choke with the standard plug on the end should be plugged directly into the Variac receptacle. The coil for the main contactor (120/220VAC) should be wired with a 2-conductor cord, with a standard plug on the end. This plug will go into the fluorescent colored duplex receptacle, in the pump station cabinet. Power (Voltage) for the coil will be supplied by this cord plugged into the pump station, and will be controlled by the red push button and the key switch on the top of the cabinet. Power for the pump station, must be 120/ 220VAC, 20amp, and supplied from a receptacle and power cord running to the lower left-hand side of the cabinet.

The pump station is equipped with a 15Amp circuit breaker in the receptacle box inside the cabinet. The high voltage leads, coming out of the bombarder should be GTO-wire, and should be run in 3/4" sched. 80 PVC conduit (gray). One of the high voltage leads should be run along the wall and directly to one side of the overhead trolley and terminate in the split bolt connection. The other high voltage lead, should be run along the wall behind the pump station and pass through the mA meter mounted on the wall at approx. 5’ off the ground. From the mA meter, it should then be run to the overhead trolley and connect on the opposite end and the opposite #6 copper wire, from the first run. (*See overhead trolley installation instructions*). The grounding electrodes on the Y sections of the glass manifold, must be wired with GTO and run to the grounding post of either the choke or the bombarder. All other electrical appliances should already be plugged into the receptacle box in the pump station. If you desire to have some sort of warning device for the high voltage output while bombarding, you may wire into the coil terminals on the main contactor and connect to a 120/ 220VAC light or audible alarm.

Picture # 1

Picture # 1A

Picture # 2 Safety Package Flow Chart

1.3. OVERHEAD TROLLEY INSTALLATION

Mounting brackets for the trolley system must be constructed according to (Drwg. 3a). These brackets should be mounted, no more than 25' apart and as high as possible, without interfering with the overhead. The insulators should be mounted to the brackets as per (Drwg. 3), and the high voltage lines coming from the bombarder should be in 3/4" sched. 80 PVC (gray), and should be ran neatly to the top of each bracket and extend to the insulator of the #6 wire that it will terminate with. Next, you will need the #6 bare copper wire, (2) 1" pulleys, (4) #4 copper split bolts, and (2) 8" turnbuckles. Stretch out the #6 copper wire and cut into two pieces of equal length. Connect one end of a piece of copper wire to an insulator eye bolt, using the method shown in (Drwg. 3b), use this wrap method for all split bolt connections on the overhead trolley. Connect the other piece of copper to an insulator eyebolt on the opposite end and the opposite side, as the first wire. As you make these connections, strip back about 1" of insulation on the GTO leads and insert them in the split bolts. At this point, install one pulley on each line and tape in place with electrical tape or some other type of tape, to keep them from falling off. This tape should be removed upon completion of installation. Take both turnbuckles and turn them out until they are fully extended (Maximum length). Hook the turnbuckles on the two remaining insulator eyebolts. Run the #6 bare copper wire through the eye of their respective turnbuckles and pull tightly, (2 people may be needed), and then install the split bolts and terminate using the wrap method shown in (Drwg. 3b). Install both lines this way and then slowly tighten the turnbuckles, sometimes the brackets may be pulled inwards from too much strain of over tightening.

Note: Observe that tightening one line will cause slack in the other line. Balance the tension and tighten slowly.

Connect GTO leads to the pulleys and let them drop about 6" below the top of the table. Alligator clamps should be installed on the ends of the GTO for a safe and quick connection to the electrodes.

Picture # 3 Sample Lay Out Trolley Package

Picture # 3A Top & Side View Trolley Package

Picture # 3B

2. START-UP – ALL SYSTEMS:

Once all connections have been made and the installation is properly completed, the **EUROCOM PUMPING SYSTEM** is ready to operate. Insure that all stopcocks, including the main stopcock going to the pump, are closed before switching on power to the pump station. The red and yellow safety switch located on the door of the cabinet controls power for the pump station. Turn the switch to the "ON" position (clockwise), and the green indicator light above the red pushbutton, should come on. At this same time, all other electrical appliances, including the pump, will be switched on. If the main switch is turned ON and no power is supplied; check to make sure the circuit breaker inside the cabinet is in the on position, also check all power cord connections and make sure power is being supplied from the shop receptacle. Once the pump station has been switched on and the pump is running, wait approximately 1 minute, before opening the main stopcock. Once the main stopcock is open, you can monitor the evacuation of the main body of the manifold by watching the gauges.

Note: If your system is equipped with a DVR 2 pressure gauge, it will have to be switched on manually and switched off at shut down every evening.

Allow the pump to evacuate the manifold for approximately 20-30 minutes before processing tubes. This two-sided manifold design allows for a more efficient operation, by closing off one side of the manifold while working with atmospheric pressure. This may be accomplished by using one, of the two 16mm stopcocks at the front of the manifold main-body. The other side will be cooling down in the high vacuum range for later filling. There is one 9mm stopcock on each Y-section. These 9mm stopcocks are used for venting to atmosphere and for your blow-hose connection.

BOMBARDING CONTROLS

The high voltage bombarder is controlled by a two-hand actuation of both the key switch and the red push button. To actuate the high voltage bombarder, turn the key switch clockwise and hold that position while depressing the red push button. Once the bombarder is actuated, you may release the key switch and maintain the red push button in the depressed position. If you wish to stop the bombarder, simply remove your hand from the red push button. To re-start the bombarder you must repeat the actuation process. Once the bombarder is actuated and you have removed your hand from the key switch, you are then free to use that hand for adjusting the Variac control of the choke. Remember to execute the high voltage bombarding with the main stopcock closed. The stopcock may be opened during bombarding, to make minor adjustments to the pressure level.

GAUGES

1. DVR 2/5: Capacitive ceramic positive pressure gauge. This gas independent instrument is used to monitor pressure during bombarding and backfilling gas on finished tubes. This gauge covers the range from atmospheric pressure to one Torr.
2. VAP 5: Pirani high vacuum gauge. This gauge is used to monitor the evacuation process in the range below one Torr. It is also accurate in identifying problems in your system. This gauge covers the range from one Torr to one millitorr.
3. Gas Transfer System: Gas pressure gauge. This gauge is used to monitor the amount of gas remaining in a canister. To check this, simply close the center valve below the gauge and open the valve for whichever canister you wish to check. For best results, wait about one minute to check the final pressure. A full canister is approximately 170 psi.

METERS:

1. MA Meter: AC milliamp meter. This meter is used during bombarding, to monitor the amount of current going to the electrodes.
2. Hour meter. This meter will help you monitor the use of your system and allow you to schedule maintenance accordingly.

TURBOMOLECULAR PUMP (available with 2000T or as an upgrade)

The turbo molecular pump (turbo), will automatically start-up with the rest of the system, when the power is switched on. The amber light indicates the turbo is in the acceleration mode. Once the turbo reaches full running speed (70,000 RPM), the green light will come on and the amber light will go off. If the turbo

should experience a failure, the red light will come on and the green light will go off. Failure may result from prolonged exposure to atmospheric pressure or a bad cable connection. The turbo cannot operate in atmospheric pressure, however, under normal operating conditions it can evacuate atmosphere from the manifold and tubes, with no leaks in the system and the stopcocks closed to atmosphere.

SHUT-DOWN

1. The EPS 2000 and 2000T is equipped with an automatic venting valve, which will actuate when the power is switched off.

2. Standard equipment on the EPS 500 is a manual vent valve – when turning off the system – open (turn counter clockwise) manual vent valve to ventilate between RZ5 pump and manifold.

3. To shut down for the evening:

- close all stopcocks
- switch off the power switch on the door/ front panel
- switch off the DVR 2 pressure gauge if applicable

3. PROCEDURES

3.1 BOMBARDING AND PUMPING PROCEDURE FOR OPTIMAL PERFORMANCE

CURRENT LEVELS STATED ARE FOR 80mA ELECTRODES ON 15mm OR LARGER TUBES

Adjust Current for other electrode sizes accordingly. Convert electrode emitter at current level of ten times the electrode rating.

OVERVIEW: Reduce pressure in system to 2 to 3 Torr (determined by tube length) and using 1st stage current level; heat the tube for 30 to 45 seconds. Open stopcock and evacuate the system below 10 millitorr. With the input part of the blow hose stopcock blocked, open and close the valve quickly to admit only the small amount of air in the horizontal tube of the stopcock. This step will have removed most of the condensation from within the tube, thus allowing more control and prevent damage to the electrodes.

STAGE 1 (duration of approximately 15 to 20 seconds)

a) Open main stopcock, reduce the pressure to approximately 2 to 3 Torr and close stopcock.
b) Switch on bombarder and set current at 200mA.
c) Begin bombarding and heat tube slightly/switch off bombarder and apply thermocrayon to this slightly warmed tube.
d) Switch on bombarder and continue heating tube until crayon begins to emit vapor and proceed to stage 2.

STAGE 2

a) Open stopcock and reduce pressure again to approximately 2 to 3 Torr and CLOSE STOPCOCK.
b) Increase current to 325mA, heat tube until crayon color shift is ALMOST complete.
c) Reduce pressure to 1 Torr (or very slightly below) and increase current level to 800mA.

STAGE 3

a) Bring electrode shells to a bright cherry-red color (BE CAREFUL NOT TO OVERPROCESS). When shells are of uniform color, conversion is complete. They have reached approximately 900 to 1000 degrees Centigrade. Maintain pressure in this stage at, or slightly less than 1 Torr (critical).
b) Open the main stopcock to the pump or pumps and evacuate the tubes to a few millitorr and continue pumping until the tube cools to approximately 50 degrees Centigrade.
c) Release accumulated moisture in the tubulation at this time with the aid of hair dryer or hand torch. This prevents transfer of moisture to the finished tube during backfilling of the gas.
d) Backfill the tube to designated pressure with the desired gas utilizing the gas independent positive pressure diagram or Piezo vacuum gauge on the system.

EXECUTE THIS PROCEDURE WITH A CLOSED STOPCOCK, EXCEPT FOR PRESSURE ADJUSTMENT. THIS PROMOTES UNIFORM HEATING OF THE TUBES AND ELECTRODES (CRITICAL TO CONSISTENT QUALITY PRODUCTION OF GAS DISCHARGE TUBES)

This established procedure is based on years of extensive research and application by industry physicists and technicians, and is taught throughout Europe in apprenticeship programs. When practiced with a reasonable degree of accuracy and the use of high grade updated components, this procedure yields extremely fine quality gas discharge tubes. It should also be noted that a fine control of the bombarding transformer current is of paramount importance, which can be accomplished with a DC reactance choke

3.2. PUMPING SUGGESTIONS

1. Long tubes (8ft or more) processed together produce a significant trade-off of quality due to inadequate evacuation and inability to establish an arc in the tube at required pressure levels. This causes loss of control of the process and electrode damage translating ultimately to premature dimming in part of the tubes as well as increasing the voltage demands of the tubing. When two tubes are pumped together, the total length should not really exceed about ten feet. This allows complete control during bake out of the tubes and prevents over-processing and electrode damage.

2. The vacuum pump performs at an optimum when operating within a specific temperature range. This can be witnessed at an early morning reading and again late in the day, when air temperatures are higher and the pump body is at an elevated level as well. The addition of two (2) small squirrel cage type fans, such as those available from Grainger or other such equipment houses, will not only improve pump performance, but, will increase the life of the pump and the longevity of the oil.

3. If the vacuum pump presently connected to your manifold system is one of the higher grade direct drive types capable of bringing the manifold to 5 millitorr or under while the tubes are quite warm and the electrodes employed are well engineered, you are probably producing a fine finished product.

4. When the time comes that you are asked to produce 25mm tubes to operate on 120mA transformers, you may consider adding a turbo molecular finish pump to the system. This will allow faster evacuation to a considerably higher vacuum level in these tubes and your standard tubes as well, which will elevate your product quality to another new plateau. A turbo pump is ready to begin pumping within two minutes after switching it on and you may leave the area immediately after turning it off without concern. It operates without water-cooling, has no oil to back stream and vents automatically upon switching it off.

3.3 Pumping Suggestions for Humidity

1. The preheat portion mentioned previously is, of course, a good approach to processing any gas discharge tube regardless of the gas type or presence of phosphor. This is especially true in humid areas of the country, which create high levels of condensed water vapor in the tubes during bending and welding.

2. Use of a hair dryer to remove water vapor from the tubulation and outer portion of the manifold before closing the main stopcock to backfill the gas is advisable. When this is omitted, as in most shops, portions of this condensed water are whisked into the tube by the in-rush of gas into the vacuum just created. It is just one more factor that degrades the product.

3.4 EURO-BRITE ELECTRODES

DESIGN APPLICATION SPECIFICATIONS

30 Milliamp Electrodes:
This small electrode is designed for use with 8, 9, 10, 12 and 13mm tubing, operates on 20mA or 30mA transformers. One important factor to remember when working with these smaller diameter tubes is that the current levels used in processing should be as low as possible to avoid damaging phosphors. Emitter conversion of this electrode takes place easily with 300mA current.

50 Milliamp Electrodes:
This electrode, designed for use on 12 and 13mm diameter tubing, operates well on 30mA transformers. It tolerates up to 50mA current, HOWEVER, NOT ON 12 OR 13mm TUBING. The higher current levels in this diameter tubing is very damaging and produces extremely unpleasant results. Also, this electrode should NEVER be used on smaller diameter tubing such as 8, 9 or 10mm tubes because of the high current level of 500mA required for emitter conversion. Also available in Pyrex!

45 Milliamp Electrodes:
This electrode, designed for 15mm tubing or larger, operates on 30mA or less. The conversion of emission coating occurs at 450mA. Since the vast majority of gas discharge tubes in North America are 15mm operating on 30mA transformers, this type would be a mainstay in most neon productions shops.
NOTE: Although this electrode, due to its heavy-duty design, tolerates higher current levels than 30mA for a short period, IT IS NOT RECOMMENDED FOR USE WITH 60mA TRANSFORMERS.

80 Milliamp Electrodes:
This electrode, first of the series developed many years ago, is popular throughout Europe. It may be used with any tube diameter 15mm or larger and operates with current levels up to 80mA (such transformers exist in Europe). It is NOT recommended for use on smaller tube diameters because the 800mA current level required to convert the emitter would damage the phosphors in the smaller tube and could elevate the glass temperature too much. Also available in Pyrex.

120 Milliamp Electrodes:
This type designed for use on 20 to 25mm tubing, operates on 100 to 150mA. The use in North America would be for the “cold cathode” lighting industry. Conversion of emission coating should be executed at 1000 to 1200mA.

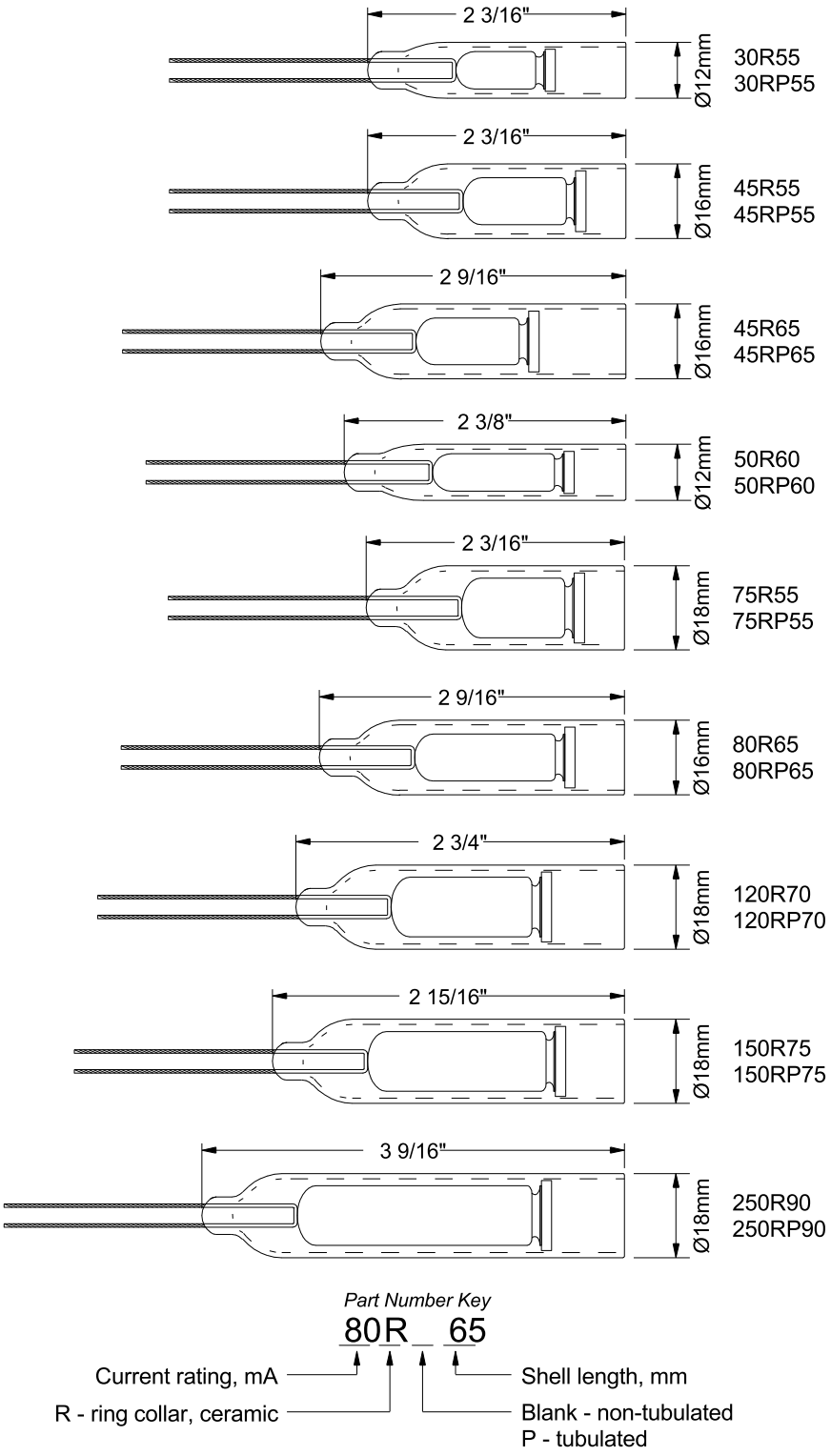
150 Milliamp Electrodes:
This electrode, designed for use on 20 to 25mm tubing, operates on 100 to 150mA. The use in North America would be for the “cold cathode” lighting industry. Conversion of the emission coating should be executed at 1200 to 1500mA, which requires a large bombarding transformer to process the tubes. Complete conversion of the emitter is extremely important.

250 Milliamp Electrodes:
This electrode may be used on 20 to 25mm diameter tubing and will operate on up to a 200mA transformer. Conversion of the emitter takes place at 1500 to 2000mA. This electrode will require a large bombarding transformer to completely convert the emitter.

For a complete list of all Euro Brite Electrodes,
please refer to the enclosed Eurocom Product Guide!

3.5 EURO•BRITE Electrodes

The finest product of an international design and manufacturing team.



3.6 CURRENT LEVELS & PRESSURES FOR PROCESSING EURO-BRITE ELECTRODES

TYPE	STAGE	CURRENT	PRESSURE
30RB/RPB 55	1st	75mA	2 Torr
(8, 9, 10mm tubes)	2nd	125mA	2 Torr
	3rd	300mA	1 Torr
45RB/RPB 50, 55, (I)	1st	150mA	2 Torr
(15mm tubes)	2nd	225mA	2 Torr
	3rd	450mA	1 Torr
50RB/RPB 60	1st	150mA	2 Torr
(12 & 13mm tubes)	2nd	225mA	2 Torr
	3rd	500mA	1 Torr
80RB/RPB 60, 65, 70 (I)	1st	200mA	2 Torr
(15 & 18mm tubes)	2nd	325mA	2 Torr
	3rd	800mA	1 Torr

When processing EURO-BRITE ELECTRODES the above current and pressure levels produce the best results.

Pressure in the first two (2) stages is, of course, relative to tube length and bombarder power. Always consider tube length as it applies to quality of the finished product. Excessively long tubes are a trade off. We recommend you work within two (2) to eight (8) foot ranges as much as possible.

3.7 REMOVAL OF THE FINISHED TUBE FROM THE MANIFOLD TIP-OFF PROCEDURE

Removal of the tube (tip-off) from the pumping manifold (last step prior to burn-in) is no less important than steps preceding it. Quite often, this aspect is treated too lightly and the person given this responsibility is not educated thoroughly enough. Careful execution of the tip-off is critical to the production of a permanent seal that does not crack later, which would allow escape of the inert gas. To prevent this and create a good strain free tip-off, a slight adjustment in procedure is all that is required.

This envelope of the EURO-BRITE electrode is somewhat different in composition from those the industry has been accustomed to in the past. It is a European lead glass, which reacts to the torch in a slightly different way. The following technique is, of course, applicable to any electrode type, not just the EUROCOM product.

The torch for use at the manifold for this purpose should be a tipping torch with the small round head, adjusted to a soft flame; not a splicing torch, which is very hot. Although many seasoned veterans in the trade have adjusted to a splicing torch for tip-off, it is much easier and less risky, especially for a beginner, to use the tipping torch.

During this procedure, it is essential to maintain control of the molten glass or the vacuum in the tube will pull it inward and form a ball inside the finished tubulation tip. This mass of glass cools at a different rate from the remaining wall of the tubulation, which creates considerable strain in the tip. Depending on the degree of strain created, the tip can crack in the shop, or worse still, in the field after installation. Either scenario is disappointing and expensive, especially when the tube contains mercury.

RECOMMENDED PROCEDURE

Approach the tubulation with the small torch turned down to a low level and begin to heat the tubulation rotating the torch around it evenly. When a slight pulling pressure of the unit has been applied at the outset, the tubulation will quickly close as soon as the softening temperature of the glass is reached. At this instant, as the tube begins to collapse, the torch may be raised removing the flame and allowing the tubulation to seal to a uniformly shaped point inside. Then, the torch may be applied again, slightly away from that sealed point preventing it from again reaching the molten state, which would form the troublesome ball inside the tip.

Finally, the remaining glass should not be pushed into a mass on the outside of the finished tip, which can create significant strain in the tip as well. The wiping technique used in laboratory glass production, which requires a little practice, can be used here to remove the excess glass. Execute this by heating that remaining glass until red, touching it with a piece of tubing and pulling it away.

4. GAS

4.1 Eurocom H-Gas Technology

The following represents a detailed explanation of the production of Argon/ mercury gas discharge tubes for installation in colder climates. The intent is to clarify some aspects that have been misunderstood relative to this subject and cover some of the older practices used by the industry that produce costly problems.

Europeans have produced tubes for decades that function in sub-zero temperatures with minimal light loss. This is accomplished with special mixtures of inert gases, a more efficient electrode technology together with updated processing equipment and techniques. This technology, not previously known in North America, was introduced to the industry in 1984 by Eurocom, Inc. Prior to the availability of our technology Argon/ Mercury tubing installations in North America suffered major loss of light output in the middle of the tubes as the ambient temperature drops, followed by dimming at the ends.

Controlled discharge of the EURO BRITE ELECTRODE coupled with Eurocom H-Gas gives the Argon/ Mercury tubes the added characteristics of functioning in lower temperatures with uniform light output from end to end. The use of a 30 mA transformer will produce satisfactory results in temperatures as low as 10 to 20 degrees above zero (F), depending on some variables (i.e. wind, north or south exposure, exposed or behind plastic, etc.) The use of higher current (60mA) will produce exceptional results and function well at temperatures below zero. IT SHOULD BE NOTED THAT AS TEMPERATURES DECREASES, LIGHT OUTPUT DECREASES, REGARDLESS OF THE CURRENT LEVEL EMPLOYED. However, the increased level of performance of the EUROCOM SYSTEM over the older technology is significant.

Many sign companies in the United States, particularly those in Minnesota, Wisconsin, Illinois and Michigan quickly adopted this technology several years ago, when they recognized the claims were, in fact, valid. In the mid-1980's one major firm used EURO_BRITE ELECTRODES and Eurocom H-Gas on a number of downtown high rise building signs and the BUD LIGHT neon display, approximately 150 ' above the highways in Chicago. Most neon production firms in the above mentioned states have been using this technology for several years in order to successfully combat their frigid climate conditions.

Be aware that the tube quality also impacts the function of the gas discharge process at these lower ambient temperatures. A lower voltage drop promotes a slighter higher current flow, resulting in a slightly higher temperature in the tube.

CURRENT LEVELS RELATIVE TO THE TUBE DIAMTERS

Understanding the relationship between current levels (mA) and the tube diameters is of significant importance. Lack of this knowledge has, and still is, costing the industry and the consumer considerable sums of money annually. It also damages the image of the product, causing loss of accounts and future business opportunities as well.
A number of major national sign programs, which incorporated gas discharge tubing, have been produced in recent years without full understanding of the effect of current relative to tube diameter. Smaller tube diameters of Argon/Hg operating on higher current (i.e. 60mA on 12 or 13mm) are installed in an attempt to deal with colder climates with the belief that the higher temperature in the tube is the complete solutions. Yes, elevated temperature within the tube is a partial solution, however, not to counteract sub zero temperatures. When the surface area of the tube is incapable of dissipating the heat generated by higher currents, a number of other negative conditions will develop. The tube must be, at least, 15mm or greater to effectively dissipate the heat created by 60mA current, to provide more favorable conditions in the tube and avoid damage to the phosphors. With higher temperatures above 50 degrees C in the tube there is a drastic reduction of UV radiation produced by the mercury vapor discharge and the light output from the phosphors is also diminished above 60 degrees centigrade. Prolonged exposures of the phosphors, particularly calcium tungstate types, to these high temperatures causes permanent damage and darkening.

This subject has many facets, all of which should be considered when designing gas discharge tube installations, particularly those containing the heat sensitive phosphors and Mercury. We suggest that some level of awareness of this area of the discipline be established among the designers and sales personnel involved with projects incorporating higher current levels. The technicians at EUROCOM, INC. have been educated and/or trained in Germany where the parent company is located and much of the technology

originated. They are happy to offer any technical assistance you may require on future projects or make suggestions relative to an update of your neon production equipment, including training of your personnel.

4.2. Eurocom 100 % Neon Gas

Color shift problems in uncoated tubes filled with 100% neon gas have plagued the industry for a little over three years. **They are caused by release of various gases from the wall of the tube, after the tube has been processed and sealed.** Tubing delivered to the neon industry in North America today is deplorable. At one time, this same tubing was clean and sealed with corks at both ends. Now, it is delivered without so much as a plastic bag tied at the end. If it were properly processed and sealed at the factory, the problems would be somewhat alleviated.

The same scenario occurs on a greater scale with uncoated colored “classic glasses”, which requires a special processing technique. When entrapped gases are not removed during the bake out and electrode conversion process, they will either release during burn-in, or worse, after installation. A tube filled with neon gas may produce a bright red color when removed from the manifold, however, the color shift due to the gases released from the glass can be apparent soon after being placed on the ageing table (burn-in table). Tubes without phosphor coating filled with argon gas and mercury may cause the same thing to occur, but will not be recognized as easily as with the neon tube. One exception is the uncoated clear tube with argon and mercury, which operates with a continuous spiraling discharge referred to as “snaking”. In some instances the neon tube that changes color on the burn-in table may later return to the normal bright red hue. This, however, does not alter the fact that the presence of the gases being emitted may at a later date to impact the performance of the tube.

To alleviate the problem, preheat the tube for about 30 seconds and evacuate the condensed water

a) Heat uncoated tubing to full temperature (350 C)
b) Evacuate to remove remaining water and other released vapors
c) Re-admit air and complete the normal three step pumping procedure, bringing the tube to full temperature again and convert the electrode emitter.
d) Place tube on the ageing table (burn-in table) on a **30mA transformer**. When gases remain in the glass at this time (not completely removed during the pumping process), the higher current level of a 60mA transformer produces higher electron bombardment of the glass tube to further compound the problem.

No benefit is derived by using a 60mA transformer on the ageing table (burn-in table), however, there are several negative results that can be generated.
12 and 13mm tubing connected to 60mA current damages the phosphors severely (i.e. Interfirst Bank building in downtown Dallas, the entire Chevron program nationwide and the previous BP program are classic examples of the devastating results of this combination). Worse still, 10mm tubes could accidentally be placed on this table and connected to this high current. The small diameter tubes cannot dissipate the heat generated by these higher current levels fast enough to prevent excessive damage to phosphors and, of course, to the smaller electrodes not rated for this level of current. The addition of a flasher to the burn-in transformer does little aid to this process. The ageing of the tube is in reality the establishment of the emitter coating in the electrodes, which requires a few hours depending on the establishment of the emitter coating in the electrodes, which requires a few hours depending on the size. This process can only take place while current is flowing in the tube and consequently nothing is happening in the periods during which the flasher is in the “off” mode.

4.3 Eurocom Flushing Procedures- **for gas discharge tubing**

This process is a quality control step, which could be added to the basic pumping procedure for any tube. When executed carefully, it increases the quality level of the product dramatically. It is used without exception in Central Europe for removal of entrapped gases from uncoated colored tubing (referred to in North America as "classic glass") and verifies complete conversion of emission coating of the electrodes.

PROCEDURE

a) Complete the basic pumping procedure with air or dry nitrogen and evacuate the tube allowing it to cool to approximately 60 to 70 degrees C and a vacuum of a few millitorr.

b) Back-fill with 4 to 6 Torr of FLUSHING GAS (slightly more for very short tubes).

c) Establish an arc and begin heating the tube with a current level relative to the diameter of the tube being processed. When the tube is 25mm in diameter, five times the current rating of the electrode would be the maximum. When the tube is 10mm or smaller, reduce current proportionately to about twice the electrode rating. Execute with a closed stopcock to allow uniform heating of the tube.

d) Direct your attention to the areas of the tube near the electrodes to make sure they do not change color from red to blue-white. If this occurs, open the main stopcock to the pump, lower the pressure to one (1) Torr, increase the current to ten (10) times the electrode rating and with a closed stopcock heat the electrodes just until they begin to glow. Refill with flushing gas and continue to heat the tube at the current level relative to the tube diameter. Continue this for one to one and a half minutes. Evacuate the tube to a few millitorr and repeat the process for the same length of time. The higher-pressure level and lower current levels prevent the electrodes from reaching the high temperature of emitter conversion.

Allow the tube to cool to about 20 degrees Centigrade and back fill with the desired inert gas, or if the ultimate vacuum has been reached while the tube is at a higher temperature, the technician may calculate for the filling pressure accordingly. Connect it to a transformer of appropriate current relative to the tube diameter and allow the electrodes to "burn-in" to establish the electrode emitter. Classic glass tubes should be allowed to burn-in for at least eight (8) hours or longer to be certain they will not begin to release impurities and develop undesirable dark areas, usually in the middle of the tube. If the tubes are to operate on Mercury vapor, it is advisable to burn in with the Mercury remaining in trap for a brief period in order to evaluate the discharge within the tube. Switch off unit and allow the electrodes to cool to room temperature, after which the mercury may be dumped and the tubulation sealed off. The unit, then, may be placed on the burn-in rack for eight to ten hours to completely establish the electrode emitter.

5. Maintenance Schedule

5.1 Eurocom Pumping System - Maintenance

The below schedule represents the *minimum* recommended frequency. The importance of hygiene in the pumping system cannot be overemphasized. Production of quality luminous tubes requires scrupulous attention to maintaining a clean system.

A. Daily:
1. Check atmospheric pressure
2. Check Gauge Calibration.

B. Weekly:
1. Check oil mist filter – if applicable
2. Check pump oil level (Look on sight glass on side of pump)
3. In-Line Mercury Filter check & clean up
4. Gas Ballast vacuum pump for 30 minutes (see manual), more frequently during periods of high humidity

C. Monthly:
1. Remove & clean Y-piece.

D. Quarterly:
1. Check for oil in back stream filter (lower port). Clean filter if oil is detected.
2. Change vacuum pump oil (or every 500 hrs).
3. Clean inside of fan cover on vacuum pump. Remove build-up of oil and dirt deposits.

E. Every 6 months:
1. Replacement of In-Line Mercury filter (more frequently if using a lot of coated tubing).

F. Annually:
1. Manifold maintenance
2. Vacuum Fitting s & Hose Bellows
3. **VAP 5/ DVR 5**

Notes:
- See the maintenance section of your system manual for specific information.
- After draining the oil from your rotary vane pump, fill to the minimum mark, run for five minutes, drain & fill to maximum mark. The use of flushing oil is not recommended.
- Keep the work surfaces around your pump stand clean at all times. Clean up mercury immediately. Mercury is an extremely toxic substance and freely releases dangerous vapor to the atmosphere. Mercury clean up kits are available from EUROCOM.
- **When changing out Gas canisters on the Gas Transfer Unit, check upper & lower O-rings for cracks or deformation. Replace if needed.**
- VAP-5 Pirani Sensor requires NO maintenance.
- Any questions you may have, EUROCOM will gladly answer. We are here to serve the industry and help it achieve and maintain the highest standards.

A. Daily Maintenance

1. Vacuum Gauge DVR 5

ADJUSTMENT AT ATMOSPHERIC PRESSURE
Admit air to the vacuum gauge. Make sure that the vacuum connection at the vacuum gauge is at atmospheric pressure. **Note: Determine exact actual atmospheric pressure**, (25.4 x Barometric Pressure) inches/mercury e.g. by using an accurate barometer, e.g. call local airport or weather station, etc. (take into account the difference in altitude between e.g. airport and laboratory).
Refer to Operation Manuals for DVR2/DVR5 calibration.

ADJUSTMENT UNDER VACUUM - OPTIONAL
Evacuate the vacuum gauge to a pressure<0.5 mbar (<0.4 Torr)(e.g. by applying a good rotary vane pump). Press key UP/DOWN simultaneously with key ON/OFF. The vacuum gauge then switches to the **adjustment mode** (indicated by a warning triangle). The reading is adjusted automatically to "zero". **Note**: *Adjustment under vacuum with an actual pressure higher than 0.5 mbar (0.4 Torr) reduces the accuracy of measurement. If the pressure is significantly higher than 0.5 mbar (0.4 Torr), adjustment to a **reference** pressure is recommended.* Press key ON/OFF to confirm adjustment and to terminate mode. Press key UP/DOWN to increase the reading to actual atmospheric pressure. To reduce the reading: Press key MODE to change arrow direction to the left. Then press key UP/DOWN to reduce the reading. Press key ON/OFF to confirm adjustment and to terminate mode. Refer to Vap5 Operation Manual for additional info.

ADJUSMENT AT REFERENCE VACUUM
Evacuate the vacuum gauge to an exactly known reference pressure within the range of 0….20 mbar (0….15 Torr). Switch vacuum gauge to adjustment mode (see "Adjustment Under Vacuum"). Press key UP/DOWN to adjust the display from "0" ("zero") to the actual reference pressure in the vacuum line in the range of 0 to 20 mbar (0 to 15 Torr). Press key ON/OFF to confirm adjustment and to terminate mode. **Note**: *The accuracy of the value of the reference pressure will directly affect the accuracy of the adjustment. IF the nominal ultimate vacuum of a diaphragm pump is used as a "reference" vacuum, the accuracy of adjustment of the vacuum gauge might be doubtful. The diaphragm pump may not achieve the specified value (due to condensate, poor state, failure of the valves or the diaphragm).*

2. Recalibration VAP 5

READJUSTMENT "ATMOSPHERIC PRESSURE" – OPTIONAL
Vent vacuum system resp. gauge head – make sure, that gauge head is exposed to atmospheric pressure. Status indication "atmospheric pressure" is displayed. Push key at the side of the housing with a pencil tip or a small screwdriver. Status indication readjustment is displayed. Push key again in order to adjust pressure reading to atmospheric pressure. Status indication readjustment vanishes

READJUSMENT "VACUUM"
Evacuate gauge head to a pressure<1.10-3 mbar. Status indication "vacuum" is displayed. Push key at the side of the housing with a pencil tip or small screwdriver. Status indication readjustment is displayed. Push key again in order to adjust pressure reading to 1.10-3 mbar. Status indication readjustment vanishes. Readjustment "vacuum" at a pressure greater than 1.10-3 mbar reduces the accuracy of measurement.

B. Weekly Maintenance

1. CHECK OIL MIST FILTER - IF APPLICABLE

2. CHECK PUMP OIL LEVEL (LOOK ON SIGHT GLASS ON SIDE OF PUMP)

3. IN-LINE MERCURY FILTERS

It is recommended to remove and clean these filters as detailed in the previous pages at the end of each week when there is continuous daily usage of the system. Powdered glass and phosphors will quickly accumulate in these filters to reduce their flow rate and the quality of evacuation. Please remember that the vacuum displayed on the Pirani is sensed in the manifold where the gauge tube is located. The pads in these filters should also be replaced at least two or three times each year, again determined by use. Always install them in the system the same way, with the retaining c-washer facing away from the manifold. In this way the technician will always know which direction the debris entered the filter therefore he cannot accidentally drive the phosphors deeper into the filter. In addition, the retaining ring or the filter components must not be allowed to enter the manifold, particularly with a turbomolecular pump.

The in-line centering ring filters (frequently referred to as “mercury filters”) in your **EUROCOM MANIFOLD SYSTEM** are there to perform many important functions to protect and maintain cleanliness within the system:
a) To block mercury vapor from reaching the vacuum gauges, manifold, and pumps.
b) To block glass particles from entering the rotary pump which degrades the vanes.
c) To block loose phosphors from reaching the gauges and pumps in the system.
d) To protect the turbomolecular pump from glass particles and other debris.

However, if the filters themselves become blocked by phosphors and glass splinters, the pump cannot evacuate the tubes well and will adversely affect the quality of the tubing.

Blow out with dry compressed air or dry nitrogen to remove accumulated debris. Naturally, the air should be blown in the direction opposite that which the debris entered the filter. **Be aware that material in the filter may contain trace amounts of mercury**. Handle it accordingly. When in doubt, please call our office for further information on this subject. **Please be aware that what you see on the Pirani gauge is only an indication of the vacuum level in the manifold. When there is a partially blocked filter it is entirely another story in the tube being pumped**. This filter performs a very important task, however it must remain clean and open at all times, much the same as the oil filter in your automobile. Replacement pads are available for this filter from **EUROCOM** and should be replaced about every three to six months depending on usage. Always install the filter in the manifold with the retaining c-washer facing outward away from the manifold. Additional data on the subject is available from our corporate office at any time by calling **1-800-888-0932**.

4. GAS BALLAST PROCEDURE

Accumulation of water vapor in the pump oil requires the gas ballasting procedure, which should be done at least every month or more frequently during periods of high activity and in areas of the country with high levels of humidity. Water with oil in the vacuum chamber of the pump adversely affects efficiency and backstreams along with the oil into the system and will accelerate degradation of the pump as well. PROCEDURE: Disconnect exhaust filter (if one is connected) from the pump and switch pump into gas ballast mode for approximately 10-20 minutes, which allows moisture to expel from the gas port. DO NOT EXECUTE THIS WHILE PROCESSING TUBES OR WITH THE MAIN STOPCOCK OPEN. Connect a hose to direct this vapor away from working area, as it will contain oil as well as water.
When this is completed, switch the pump to operating mode (make sure the sound of the pump returns to normal and vapor from exhaust port has ceased). THIS ROUTINE SHOULD NOT BE EXECUTED DURING TUBE PROCESSING. Each tube that is heated and welded together has a significant amount of condensed water inside which is converted to vapor when heated during pumping and collects in the oil reservoir of the pump. A vane pump depends on the oil to produce a seal between the vanes and the wall of the vacuum chamber. Water does not make a good seal and therefore must be continually removed from the pump. The RZ5 has been engineered for easy removal of the water from the pump. The small black rubber cap on top of the pump must be turned so the hole aligns with the hole in the back of the metal tube allowing outside air into the pump. This elevates the temperature within the pump causing the water to vaporize and exit through the exhaust port.

C. MONTHLY- MAINTENANCE

1. THE GLASS MANIFOLD “Y” SECTIONS

This portion of the glass manifold system is not protected by the filters therefore is subject to contamination sooner. It would be desirable to remove and clean these sections about every two or three months or as required to maintain a clean visual appearance. An advantage to a manifold constructed of glass as opposed to metal is that the operator can see an unclean condition and remedy it sooner.

Depending on operation conditions, type of application and accuracy requirements, an inspection and readjustment may become necessary.

D. QUATERLY - MAINTENANCE

1. BACKSTREAM & EXHAUST FILTERS

These filters contain mediums or cartridges that accumulate oil vapor and other debris and therefore hamper the flow rate or backstream if not changed periodically. A decrease in the ultimate vacuum on the Pirani Vacuum Gauge may be a symptom of this accumulation. Frequency of change of cartridges or mediums depends on activity. Discarded filters may contain trace amounts of mercury, so handle accordingly.

2. ROTARY VANE PUMP - OIL CHANGES

INITIAL OIL CHANGE (break in): 100 HOURS after start up and approximately every three months or 500 hours, relative to use. Use only the high-grade oil (available from **EUROCOM**), specifically designed for the pump. The use of low-grade oils, often not suitable for the pump is a point commonly overlooked and is false economy. Better quality oils engineered for your pump perform better and last longer. Frequency of oil change should be determined by usage and ambient temperature. **Note**: Color change of the oil and gradual decrease in ultimate vacuum achieved on the Pirani Gauge. DO NOT USE FLUSHING OIL because it is a much thinner lower grade oil with a higher vapor pressure, some of which will surely remain in the pump to mix with and degrade your oil. RECOMMENDED PROCEDURE: Disconnect the pump from the system, preferably at the union of the hose bellows to the Tee with the manual venting valve or hose bellows from the turbo pump exhaust port. Remove the entire component assembly from above the pump. Disconnect pump from Backstream Filter or Hose Bellow. Remove the cap from the oil fill port on top of the pump at the front. Place a container underneath and remove the drain plug allowing the oil to flow out. Replace the drain plug. Pour just 50cc of new oil into the vacuum intake port of the pump as you switch it on, allowing it to run for no more than 10 seconds. This flushes the accumulation of debris from the working parts that have entered the pump. Using a clean funnel, refill the pump with new oil to just below the maximum level line adjacent to the sight glass on the front of the pump. DO NOT OVER FILL! When the oil change is overdue and the oil has turned very dark, it is advisable to add just a small amount of new oil into the filling port at the front of the pump and allow it to run for a brief period to cleanse the pump interior, drain this oil out and then fill as described above.

3. **CLEAN INSIDE OF FAN COVER ON VACUUM PUMP. REMOVE BUILD-UP OF OIL AND DIRT DEPOSITS**

E. EVERY 6 MONTHS

1. REPLACE MERCURY FILTERS (MORE FREQUENTLY IF USING A LOT OF COATED TUBING).

F. ANNUALLY

1. MANIFOLD MAINTENANCE

Disconnect T's or Crosspieces from manifold to avoid breakage.
Uncouple the two (2) stainless steel hose bellows connecting the pump and vacuum gauges to manifold. Disconnect cables connected to grounding electrodes in "Y" section (BE CERTAIN TO WRITE YOURSELF A MEMO AND TAPE IT TO THE TABLE REMINDING YOU TO RECONNECT THEM AGAIN) **GAUGE WARRANTIES VOID IF GROUNDING CABLE IS DISCONNECTED AND FLASHBACK OCCURS**.
Disassemble the connection between the gas port of the manifold and gas transfer system.
Remove screws in upper portion of the acrylic manifold stands making sure to mark each portion for correct reassembly (avoids misalignment, which may cause mechanical strain or breakage to the manifold).
Uncouple and separate the glass manifold; carefully remove stopcock spindles and wipe clean with lint free paper towel. DO NOT USE ANY SOLVENTS, AS IT WILL DESTROY O-RINGS. Apply a very small amount of the lubricant to the o-rings and wipe off any excess. Place them on a clean paper towel until you are ready to install them. EXCESSIVE AMOUNTS OF LUBRICANT WITHIN MANIFOLD ENTRAPS DEBRIS EXITING THE TUBES, SOME OF WHICH MAY BE LATER ENFORCED BACK INTO THE TUBES. If silicone high vacuum lubricant has been used, remove all traces of this material from STOPCOCK INTERIORS at this time with a soft, clean cotton cloth, a wooden dowel and xylene (Xylol). METAL OBJECTS MAY SCRATCH INTERIOR SURFACE OF STOPCOCK. Remove any mercury that may have lodged in the grounding electrodes. Check condition of the o-rings on centering rings at all unions in the system for cracks. They do dry out with time. Simply remove them from the metal or plastic ring and twist to inspect them. When cracks are found these rings should be replaced to insure a proper seal. These replacement o-rings are available from **EUROCOM**. When the temperature in the shop reaches very high levels, especially in the summer months, Apiezon or other lubricants that do not tolerate the heat should be avoided.
Clean the interior of the entire glass manifold, hose bellows, and metal components with Methanol (available through local commercial solvent distributor) or isopropyl alcohol 99.9%. Methanol would be preferable when available. If methanol is unavailable use this series of products:
For stopcocks (where oil, grease, or silicon grease has been used) clean first with XYLOL or XYLENE (available at hardware stores or chemical companies).
If manifold has a milky white film, a build up of phosphors which neither Xylol nor alcohol will remove, use WINDEX to clean the phosphors away.
Finally clean all areas even those previously cleaned as above with 99.99 IPA (100% pure isopropyl alcohol), which can be bought from industrial chemical companies or medical supply companies. Pure isopropyl alcohol has a proper evaporation to clean and not to contaminate your manifold system. **Xylene, Xylol, Methanol, and Alcohol must be used only in a well-ventilated area with no open flames and stored where highly flammable liquids are kept. KEEP OUT OF REACH OF CHILDREN AND EXCESSIVE HEAT. Avoid inhalation of the fumes. When using Apiezon the Xylene step is unnecessary.**

C-RING MERCURY FILTERS see weekly maintenance for check & clean up or 6 months maintenance for replacement

During **re-assembly**, inspect the condition of the centering rings for any scratches, cracks, or imperfections. The o-rings will dry out and crack after a period of time causing an imperfect seal. Apply a liberal amount of the silicone high vacuum lubricant to THE THREADS ON THE OUTSIDE OF THE STOPCOCKS. Reassemble manifold making sure each connection is absolutely clean and dry (NO GREASE). Pertinax acrylic clamps should be snug, but not over-tightened. Install manifold on the acrylic supports exactly as originally mounted to avoid strain as previously mentioned. DO NOT DRAW THE SCREWS DOWN TIGHTLY IN THE TOP OF THE PLASTIC MANIFOLD SUPPORTS AS THIS MAY PUT THE GLASS UNDER A STRAIN CONDITION CAUSING IT TO CRACK LATER. THE TOP OF THE SUPPORT SHOULD BE VERY SLIGHTLY MOVABLE WHEN COMPLETELY ASSEMBLED.

2. VACUUM FITTINGS & HOSE BELLOWS

Though these portions of the system will remain relatively clean, they too require cleaning with methanol in order to remove anything that might be there. It is part of a methanol conditioning to keep the system functioning at an optimum level. SEE BACKSTREAM & EXHAUST FILTERS

3. VAP-5/DVR-5

Do not clean the sensor head (Gauge Tube).

4. NOTES

ULTIMATE VACUUM LEVELS BETWEEN 1 AND 6 MILLITORR (MICRONS) ACHIEVED IN THE MANIFOLD WHILE THE TUBE REMAINS ABOVE APPROXIMATELY 150 DEGRESS CELSIUS, PRODUCES A GOOD QUALITY GAS DISCHARGE TUBE, THAT WILL OPERATE FOR MANY YEARS, (providing other factors are at an optimum level). Without question, when a turbo molecular pump is connected to attain a higher level of vacuum in the same time frame or less, it will be a decidedly higher-grade product.

OIL DIFFUSION PUMPS ARE NOT RECOMMENDED FOR THIS APPLICATION. The use of an oil diffusion pump (condensation pump) for the production of gas discharge tubing was abandoned long ago in scientific communities where this device was originally conceived. Total suppression of backstreaming oil vapor into the manifold can NEVER be attained. Adequate vacuum levels required for tube diameters up to 15 or 18mm of reasonable length (eight feet or under) operating on current levels of 60mA or less can be easily achieved with a good upscale design direct drive rotary vane pump.

REMEMBER: Three (3) major factors to determine quality of a finished gas discharge tube:

1. THE ELECTRODE TECHNOLOGY
2. PUMPING SYSTEM WITH REGULAR SCHEDULUED MAINTENANCE
3. CORRECT PROCESSING PROCEDURE BY A TECHINICIAN WITH A GOOD UNDERSTANDING AND APPLICATION OF THE RELEVANT SCIENCES.

Other contributing factors: Cleanliness of the tubing and electrodes (free of dust and moisture), prompt processing after bending (same day is ideal), clean and uncontaminated mercury, specific mixture and quality of noble gases and general cleanliness in the work area. Last but not least, AVOIDING EXCESSIVELY LONG TUBING.

5.2 EUROCOM GAS TRANSFER SYSTEM & MAINTENANCE

The EUROCOM **Gas Transfer System** is unique in its all welded stainless steel construction and its use of disposable 12-liter canisters of high purity, laboratory grade gas. Besides our standard H-gas and 100% neon EUROCOM offers argon, helium, krypton, spul (flushing) gas, and xenon. EUROCOM gas canisters are self-sealing and can be removed without loss of gas.

To attach the canisters to your gas transfer system:

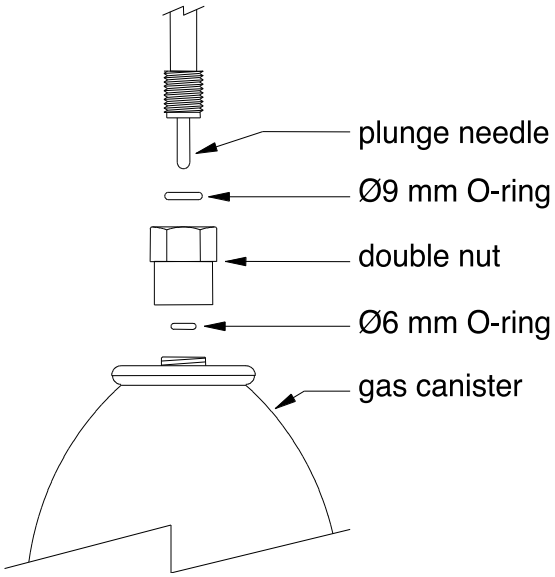
1. Ensure that the valves are closed.

2. Check that the upper and lower O-rings are in place. (See drawing below). Always inspect O-rings for damage and replace if necessary. **It is highly recommended to replace the O-Rings each time a new canister of gas is installed.** Replacement O-rings are available from EUROCOM.

3. Thread the double nut *lightly* finger tight onto the canister.

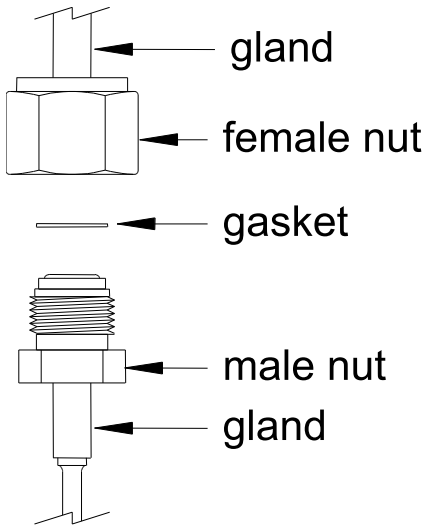
4. Thread the canister and nut onto the plunge needle, male thread. After the canister is fully threaded on, tighten approximately an additional 1/6 turn. Do not over-tighten.

5. When removing canisters, hold double nut stationary and fully remove canister, then remove nut and inspect O-rings.



When pumping tubes, have the red and blue valves closed and the black valve open so that the gas manifold can be evacuated. If you will be filling several tubes with the same gas, you may leave the black valve closed for subsequent tubes. After the tube is processed and ready to fill there are two approaches to filling. You may carefully open the appropriate gas valve to bleed gas into the tube system. Alternatively, you may close the black valve then bleed gas into the gas manifold. You may then use the black valve to bleed gas into the processed tube. Monitor the fill gage and fill to the recommended pressure. Never attempt to use a Pirani gage to fill, as the Pirani sensor is gas sensitive and will give inaccurate readings. If you should ever have to remove the gas line from your gas transfer system it will be necessary to replace the gasket in your VCR® fitting. This gasket is designed to be conformed to match the sealing beads on the glands. Replacement gaskets are available from EUROCOM or from **Swagelock** distributors.

To remake the VCR fitting, install the gasket centered between the sealing beads. Holding the male nut stationary tighten the female nut finger tight. While holding the male nut stationary with a wrench, tighten the female nut 1/8 turn past finger tight. The drawing below is provided as a reference.



With proper care and use your EUROCOM gas transfer system can provide years of trouble free service.

- Never over-tighten the valves. They are face seal valves with an elastomer bead, which can become permanently deformed if over-tightened.

- Should the valves begin to feel too loose, you may need to tighten the valve packing nuts. This should be done with the valve slightly open so as not to damage the stem. Tighten the packing nut just to the point that you feel a slight drag or dampening on rotation of the valve.

- Valves are rebuild-able. Replacement packing kits and stems are available from EUROCOM or a **Swagelock** distributor.

FLOW-THROUGH CONTROL DURING FILLING:

1. Direct filling can be accomplished utilizing the valve above the tank with the common valve open. The stainless-steel tube from the transfer system to the manifold evacuates each time a tube is processed, which assures a clean fill.

2. The stainless steel-sealing washers for the VCR fittings on the system must be replaced each time the connection is opened to assure a positive vacuum tight condition.

3. The double **Gas Transfer System** accepts two canisters and has a VCR fitting for connection of a **Single Gas Transfer** unit and a third gas with an adapter from VCR to KF.

4. This gas Transfer System design permits a high degree of control, which initially requires some practice. When you begin to open the valve above the tank, observe the initial movement of the Pirani gauge indicator, which signals the valve has begun to open. Then, transfer your attention to the positive pressure gauge in order to complete the fill.