



## Purges

### **INSTALLATION AND OPERATION INSTRUCTIONS**

**Before Installing or Operating, Read and Comply with These Instructions**

Controls Corporation of America

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To Order Call 1-800-225-0473 or 757-422-8330 • Fax 757-422-3125

[www.concoa.com](http://www.concoa.com)

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## **USER RESPONSIBILITY**

This equipment will perform in conformity with the description contained in this manual and accompanying labels and/or inserts when installed, operated, maintained, and repaired in accordance with the instructions provided. This equipment must be checked periodically. Improperly working equipment should not be used. Parts that are broken, missing, worn, distorted or contaminated, should be replaced immediately. CONCOA recommends that a telephone or written request for service advice be made to CONCOA Customer Service in Virginia Beach, Virginia, PHONE: 1-800-225-0473, FAX: 1-757-422-3125, or E-MAIL: e-mail@concoa.com.

This equipment or any of its parts should not be altered without prior written approval by CONCOA. The user of this equipment shall have the sole responsibility for any malfunction that results from improper use, faulty maintenance, damage, improper repair, or alteration by anyone other than CONCOA or a service facility designated by CONCOA.

## **CUSTOMER SERVICE**

In the event of equipment failure, call CONCOA Customer Service. Please be prepared to provide the model number and serial number of the equipment involved, in addition to some details regarding its application.

## **GENERAL SAFETY PRACTICES**

Comply with precautions listed in C.G.A. Pamphlet P-1, Safe Handling of Compressed Gases in Containers.

Consult the cylinder distributor for the proper use of cylinders and for any restrictions on their use (such as flow rate and temperature requirements).

Never use an open flame when leak testing.

Always open valves slowly when high-pressure gases are being used.

Always be sure that a cylinder contains the correct gas before connecting it to any regulator.

Always leak-test any manifold or distribution pipeline before using.

Always be sure that the gas in the system is the correct gas for the intended use.

For the United States, some applicable safety rules and precautions are listed below:

1. American National Standards Institute standard Z49.1, Safety in Welding and Cutting, American Welding Society, 2501 NW Seventh Street, Miami, Florida 33125
2. N.F.P.A. Standard 51, Oxygen-Fuel Gas systems for Welding and Cutting, N.F.P.A., 470 Atlantic Avenue, Boston, Massachusetts 02210
3. N.F.P.A. Standard 51B, Cutting and Welding Processes (same address as #2).
4. CONCOA publication ADE 872, Safety Precautions in Welding and Cutting.
5. Local Ordinances
6. O.S.H.A. Standard 29 CFR
7. C.G.A. Pamphlet C-4, American National Standard Method of Marking Portable Compressed Gas Containers to Identify the Material Contained.
8. C.G.A. Pamphlet G-4, Oxygen – Information on the properties, manufacture, transportation, storage, handling, and use of oxygen.
9. C.G.A. Pamphlet G-4.1, Equipment Cleaned for oxygen service.
10. C.G.A. Pamphlet G-4.4, Industrial Practices for Gaseous Oxygen Transmission and Distribution Piping Systems.
11. C.G.A. Pamphlet G-5, Hydrogen – Information on the properties, manufacture, transportation, storage, handling, and use of hydrogen.
12. C.G.A. Pamphlet G-6, Carbon Dioxide – Information on the properties, manufacture, transportation, storage, handling, and use of carbon dioxide.
13. C.G.A. Pamphlet G-6.1, Standard for Low Pressure Carbon Dioxide Systems at Consumer Sites.
14. C.G.A. Pamphlet P-1, Safe Handling of Compressed Gases in Containers.
15. C.G.A. Safety Bulletin SB-2, Oxygen Deficient Atmospheres.

\*C.G.A. pamphlets can be obtained from the Compressed Gas Association, 1235 Jefferson Davis Highway, Arlington, VA 22202-3239, (703) 979-0900. Publications: (703) 979-4341. Fax: (703) 979-0134.

# PURGING

Purges allow users to connect a purge gas to their system. Purging has the following benefits:

1. To start with and maintain a high purity gas stream - Purging allows the user to remove unwanted gases and water vapor contamination from their system. Purging has applicable benefits in processes such as pollution control calibration, doping modules, and chromatography.
2. To prevent dangerous gases (toxic, corrosive, or flammable) from getting into a workplace area.
3. To prevent the mixing of reactive gases – Example: Air, moisture, and intense acid formers may mix after cylinder changes without purging. The resultant acids formed from the mixture may react with the system equipment. Reactions with the equipment may shorten the life of equipment components.
4. To avoid the waste of valuable system gases that might have originally been used for purging.

Note: Be sure that your purge gas is compatible with your application and processes.

## TYPES OF PURGES

CONCOA has three types of purges:

1. Deep Purge (used with the positive displacement purging) – The deep purge is the most effective and versatile purge. This unit has a snorkel design, which forces purge gas into the cylinder valve cavity. This purge is capable of purging the inlet side of a regulator without having to purge through the regulator and system; this method will use less purge gas.
2. Tee Purge (used with pressure cycle purging) – This purge is more economical at purchase than the deep purge. This unit provides effective purging of both cavities upstream and downstream of the regulator. This purge exhausts through the regulator and system.
3. Straight Purge (used with pressure cycle purging) - This purge is connected directly to regulators equipped with an extra high-pressure port. This purge exhausts through the regulator and system.

# INSTALLATION

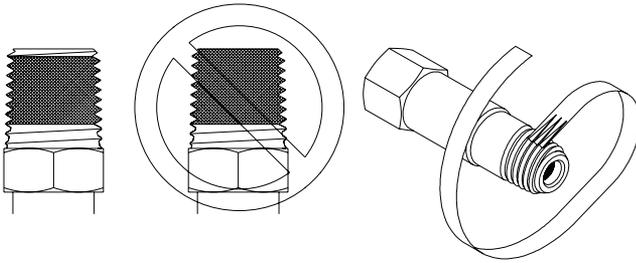


Figure 1. Tape Installation procedures.

Please observe the previously mentioned safety precautions before actual installation.

When installing NPT connections, use an open-end wrench, not a pipe wrench, to install fittings.  $\frac{1}{4}$  NPT connections require the use of Teflon tape on the threads to make a gas tight seal. On stainless steel connections, the thread sealant helps prevent the connections from galling together when tightening or loosening. Inspect the NPT threads and if necessary, clean the fitting to remove any dirt or thread sealant that remains on the threads. Start the Teflon tape on the second thread as shown above; make sure the tape does not overlap the end of the fitting. As the tape is wrapped in the direction of the thread spiral, pull tightly on the end of tape so that the tape conforms to the threads. Wrap the tape around the threads twice. Cut off the excess tape and press the end firmly into the threads.

## Installing Deep and Tee Purges

1. Deep Purge: If necessary, remove the regulator's inlet fitting and carefully remove the brass protector piece from the inlet of the purge. Install the inlet fitting into the purge's system inlet connection ( $\frac{1}{4}$  female NPT port). Do not damage the snorkel tube when installing the inlet connection.

Tee Purge: If necessary, remove the regulator's inlet fitting. Install the inlet fitting into the purge's system inlet connection ( $\frac{1}{4}$  female NPT port).

**Note:** Glands without wrench flats on the gland stem should be removed with a 6 point hex socket to prevent damage to the seating surface of the gland. Otherwise remove and install the gland using an open-ended wrench; do not use a pipe wrench.

2. Install the Deep Purge or Tee Purge into the regulator's female 1/4 NPT inlet port (marked HP or HI) as shown below.
3. Deep Purge: The purge inlet is located on the bottom of the Deep Purge; it is a 1/4" compression tube fitting. Using 1/4" tubing, connect the Deep Purge to a purge gas regulator (402 series brass regulator is recommended). Pipe the purge exhaust (1/4" compression tube fitting) to a safe discharge area.  
Tee Purge: The purge inlet (1/4" female NPT) is located at the top of the Tee Purge. Connect the Tee Purge to your purge gas regulator or flowmeter as described in the paragraph above.
4. Using an inert gas, leak test all connections before use. Note that even inert gases can build up in a confined area to reach hazardous levels when the oxygen in the air is reduced to less than 19%.

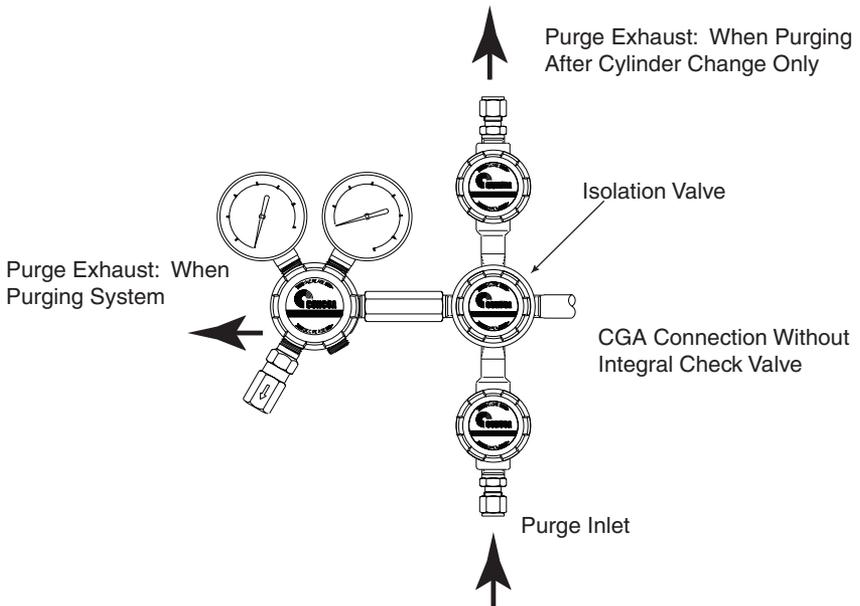


Figure 2. CONCOA Deep Purge.

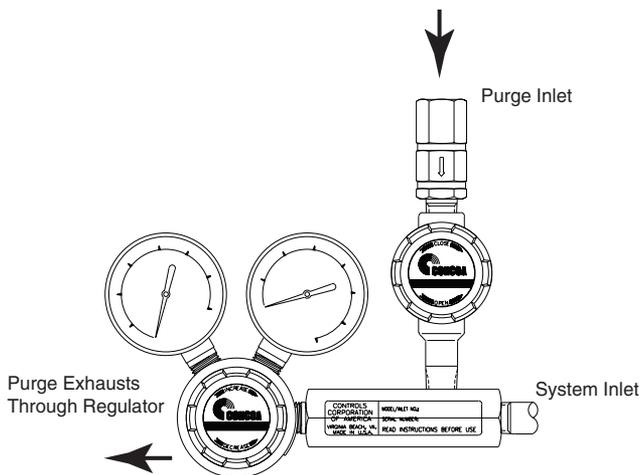


Figure 3. CONCOA Tee Purge.

## Installing Straight Purges

1. If necessary, remove the pipe plug from the high pressure port (typically marked HP or HI) on the regulator. Install the straight purge into the open port.
2. The purge inlet is located at the end of the Straight Purge; the connection is a female,  $\frac{1}{4}$ " NPT port. Connect the Straight Purge to a purge gas regulator (402 series brass regulator is recommended).
3. Using an inert gas, leak test all connections before use. Note that even inert gases can build up in a confined area to reach hazardous levels when the oxygen in the air is reduced to less than 19%.

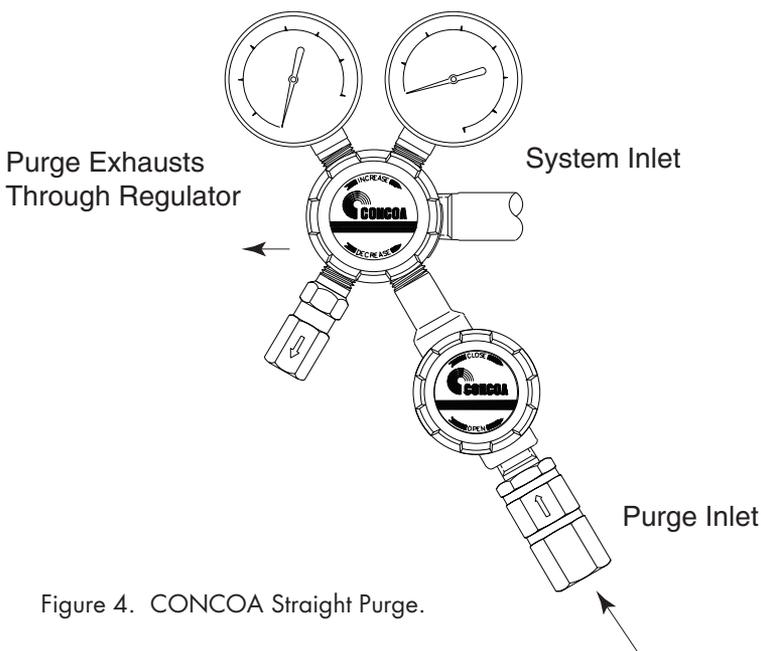


Figure 4. CONCOA Straight Purge.

## PURGE OPERATION

These instructions cover methods commonly used with CONCOA specialty equipment. The next section provides a general guideline of the methods and procedures to follow when venting and purging the gas in a simple system to a safe discharge area. Note: complex systems may require different procedures to remove the unwanted gas, and the procedures need to be evaluated on an individual basis. For higher purity systems and corrosive gases use a pure dry inert gas such as grade 4.5 nitrogen. Do not unnecessarily leave the system open to the atmosphere after purging. Otherwise, additional purging may be required to remove the atmospheric contamination.

**POSITIVE DISPLACEMENT PURGING (deep purge only)** – Positive displacement purging removes unwanted gases and contaminants from the system by physically pushing the gases out the purge exhaust. This method is suitable for systems with long runs of tubing, and little or no dead space. Purge gas flow should be slow to avoid mixing with the system gases to be removed. Positive displacement purging requires the Deep Purge.

## Cylinder change purging:

1. Close the cylinder valve on the supply cylinder.
2. Close the center isolation valve on the Deep Purge. This will shut off the gas supply from the purge to the regulator.
3. Slowly open the purge gas outlet valve. Vent the gas in the system to a safe discharge area.
4. Open the purge gas inlet valve. Allow the purge gas to flow for the calculated period of time (see appendix 1) to reach the desired system purity.
5. Close the purge gas inlet valve and vent the purge gas. Close the purge gas outlet valve after venting the purge gas.
6. Change the process gas cylinder.
7. Repeat steps 2-5 to remove the air trapped in the system after changing the cylinder.
8. If it is necessary to purge the purge gas, open the purge exhaust valve and then open the process gas cylinder valve a small amount. This will allow the process gas to push the purge gas from the system. Close the purge exhaust valve when purging is complete.
9. After all purging has been accomplished, open the isolation valve on the Deep Purge.

## Complete system purging:

For extended periods of shut down, it is recommended that the complete system be purged. The downstream vent valve must be placed so the system can be fully swept with the purge gas. Do not install the vent valve so a dead volume is created when purging. Use the following procedure to perform a positive displacement purge on the entire system with the Deep Purge assembly.

1. Close the cylinder valve on the supply cylinder.
2. Turn the adjusting knob on the regulator clockwise to open the regulator seat.
3. Keep the center isolation valve on the Deep Purge open.
4. Open the downstream vent valve, and vent the system gas to a safe location.
5. After venting the gas in the system, carefully open the purge gas inlet valve. Allow the gas to flow for the calculated period of time to reach the desired level of purity. See appendix 1 for calculating the purge time required.

6. Upon completion of the purge, close the downstream vent valve, the Deep Purge isolation valve, and the purge gas inlet valve. Closing the valves in this order will maintain a positive pressure in the system and prevent back flow of air into the system. This procedure will maintain an inert atmosphere within the system.

PRESSURE CYCLE PURGING (tee purge and straight purge only) - Pressure cycle purging is used on complex systems with dead end passages where a steady flow of gas cannot flush all areas of the system. This method of purging on a regulator is best suited for a Straight or Tee Purge. When these two purges are connected to a regulator with a cylinder connection, the cylinder connection is a dead end passage that can only be purged by pressure cycle purging. A typical system designed for pressure cycle purging will include either a Straight or Tee Purge upstream of the regulator and a block valve and bleed valve downstream from the regulator.

1. Close the cylinder valve on the process gas cylinder.
2. Turn the adjusting knob on the regulator clockwise to open the regulator seat.
3. Close the downstream block valve and carefully open the bleed valve to vent the gas from the system to a safe discharge area.
4. Close the bleed valve and open the purge gas valve on the Straight or Tee Purge. Allow gas pressure to equalize in the system. This may take 15 seconds or more. Once the pressure has equalized close the purge gas valve on the Straight or Tee Purge. Wait an addition 15 seconds to allow the gases in the system to completely mix.
5. Open the bleed valve to exhaust the gases from the system to a safe discharge area.
6. Repeat steps 3-5 as many times as needed to reach the desired gas purity. Use the formulas in appendix 2 to calculate the number of purge cycles required.

Vacuum assisted exhaust purging may be done at the end of each purge cycle to improve the efficiency of the purge process. If a cylinder change is made following the purge cycle, repeat steps 1-6 to remove the atmospheric contamination that has entered the system. Additional purging with the process gas may be required if removal of the purge gas from the system is desired.

## **MAINTENANCE**

At regular intervals, the purge assembly should be checked for leaks and proper function (see TROUBLESHOOTING). Any leaks in the system should be corrected immediately.

A unit which is not functioning properly should not be used until all required repairs have been completed and the unit has been tested to ascertain that it is in proper operating order.

## **SERVICE**

A unit that is not functioning properly should not be used. It is recommended that all servicing be done by a service facility authorized by CONCOA. Prior to returning equipment to CONCOA for warranty or non-warranty repair, contact the Customer Service Department in Virginia Beach, VA.

If so advised, the unit should be sent to a service facility authorized by CONCOA, adequately packaged, in the original shipping container if possible, and shipped prepaid, with a statement of observed deficiency. The gas service that the equipment has been subjected to must be clearly identified. All equipment must be purged before shipment to protect the transporter and service personnel. The purging is especially important if the equipment has been in hazardous or corrosive gas service. Return trip transportation charges are to be paid by Buyer. In all cases other than where warranty is applicable, repairs will be made at current list price for the replacement part(s) plus a reasonable labor charge.

Test for leaks on a routine schedule.

## **TROUBLE SHOOTING**

Typical symptoms listed below indicate malfunctions needing repair. Replace immediately with a clean, repaired and tested, or new system.

1. Gas leakage from any joint.
2. Diaphragm valve(s) fail to cut off gas supply when closed.
3. The system makes a noise or hums..

# APPENDIX 1

## CALCULATING PURGE TIME FOR POSITIVE DISPLACEMENT PURGING:

The purging time depends on the volume being purged, the purge gas flow rate, and the desired purity. Decide on the desired concentration (after purging) of the undesired gas in parts per million ( $C_f$ ).

### Step 1:

Find the dilution ratio (R) as follows:

$C_0$  = initial concentration of gas in parts per million

$C_f$  = final concentration of gas in parts per million

$$R = \frac{C_0}{C_f} = \frac{\quad}{\quad} = \frac{\quad}{\quad}$$

### Step 2:

Plot R on the chart on Page 14, and read off the number (X) for "Number of vessel volumes of inert gas required". When purging down to very low concentrations (less than 1.0 ppm), add at least 5 volumes to X for increased assurance.

$$X = \frac{\quad}{\quad}$$

### Step 3:

Calculate the volume of the system to be purged ( $V_s$ ). This may be done by pressurizing the system to two atmospheres, and then venting into a water column, or positive displacement container, and measuring the displacement of one atmosphere.

$$V_s = \frac{\quad}{\quad}$$

### Step 4:

Multiply the system volume ( $V_s$ ) by (X) for total volume of purge gas required. Be sure your units are the same.

$$\text{Required volume of purge gas (Vr)} = V_s * X$$

$$V_r = \frac{\quad}{\quad} * \frac{\quad}{\quad} = \frac{\quad}{\quad}$$

### Step 5:

Determine a reasonable working flow rate for the purge gas, and divide it into the required volume ( $V_r$ ) to obtain the purging time to achieve the required purity. Be sure the units are the same.

$$V_r$$

$$\text{Purging time} = \frac{\quad}{\text{Flow rate}} = \frac{\quad}{\quad} = \frac{\quad}{\quad}$$

## APPENDIX 2

With pressure cycle purging, dilution of the contaminant occurs approximately in a ratio of the purge exhaust pressure (psia) to the purge applied pressure (psia). Units must be expressed in absolute pressure instead of gauge pressure. The two simple examples below show the advantage of using a vacuum to assist purging. Please note the pressure throughout the system is the same. The purge applied pressure would be 60 psig.

$$\text{Dilution for each cycle} = \frac{\text{Exhaust pressure } .25 \text{ atm (14.7 psig/atm)}}{\text{Purge applied pressure } 60 \text{ psig} + 14.7 \text{ psig}} = .05$$

$$\text{Dilution for each cycle} = \frac{\text{Exhaust pressure } 14.7 \text{ psig}}{\text{Purge applied pressure } 60 \text{ psig} + 14.7 \text{ psig}} = .197$$

If starting with an initial concentration of 1000000 parts per million, the vacuum assist purge method (pulling a vacuum to .25 atm) would yield a concentration of 50000 parts per million after one purge. Without using the vacuum assist, one purge would yield a concentration of 197000 parts per million. To calculate the number of cycles needed for purging use the equation below:

$C_f$  = final acceptable concentration (parts per million)

$C_o$  = original concentration (parts per million)

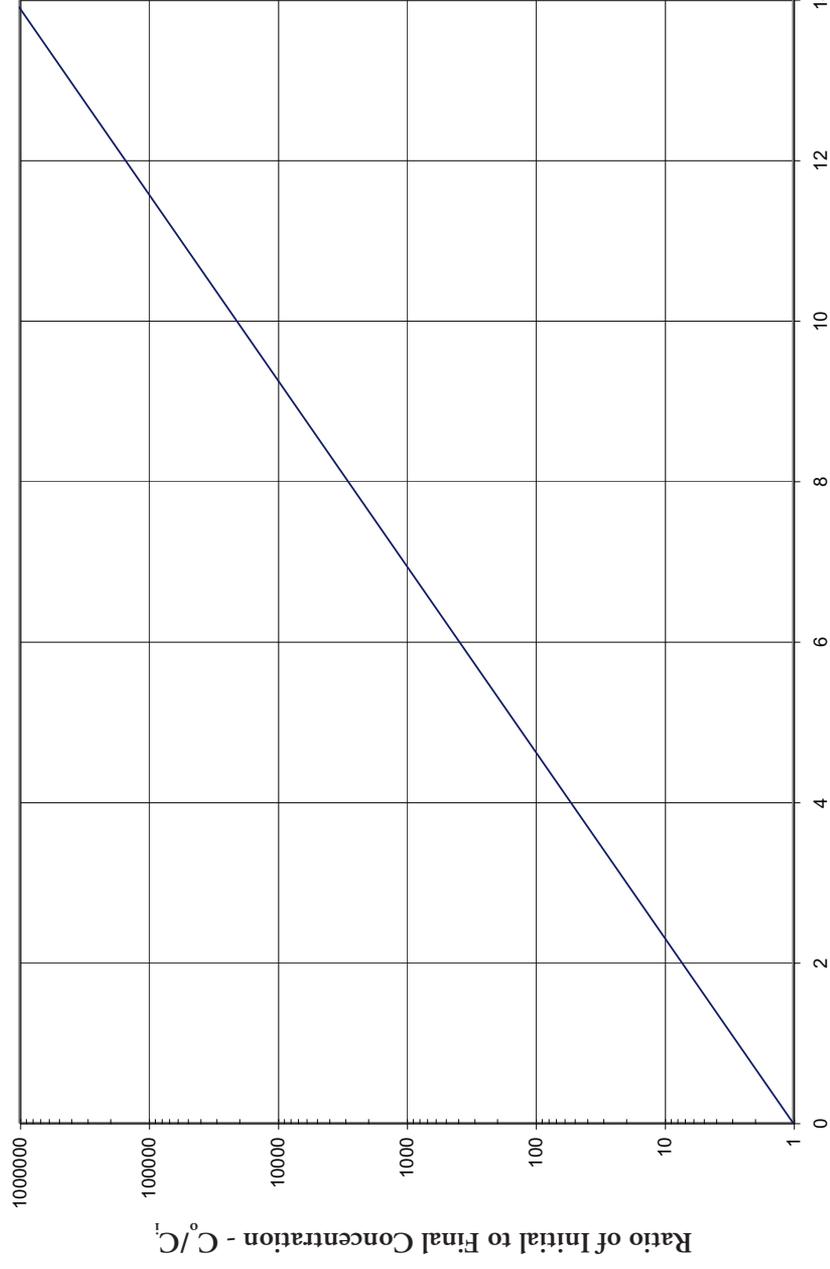
$P_1$  = purge exhaust pressure (psia)

$P_2$  = purge applied pressure (psia)

$n$  = number of cycles required to reach  $C_f$

$$n = \frac{\log_{10} C_f - \log_{10} C_o}{\log_{10} P_1 - \log_{10} P_2} = \frac{\log_{10} \text{ } - \log_{10} \text{ }}{\log_{10} \text{ } - \log_{10} \text{ }} = \text{ }$$

When purging a system where multiple pressures may be present, it will be necessary to separate each pressure region into a separate system when calculating the number of purges required. When purging down to very low concentrations (less than 1.0 ppm), add at least 5 volumes to  $n$  for increased assurance.



Number of Vessel Volumes of Inert Gas Required Flush Flow Purging - Volumes Required

# Warranty Information

This equipment is sold by CONTROLS CORPORATION OF AMERICA under the warranties set forth in the following paragraphs. Such warranties are extended only with respect to the purchase of this equipment directly from CONTROLS CORPORATION OF AMERICA or its Authorized Distributors as new merchandise and are extended to the first Buyer thereof other than for the purpose of resale.

For a period of one (1) year from the date of original delivery (90 days in corrosive service) to Buyer or to Buyer's order, this equipment is warranted to be free from functional defects in materials and workmanship and to conform to the description of this equipment contained in this manual and any accompanying labels and/or inserts, provided that the same is properly operated under conditions of normal use and that regular periodic maintenance and service is performed or replacements made in accordance with the instructions provided. The foregoing warranties shall not apply if the equipment has been repaired: other than by CONTROLS CORPORATION OF AMERICA or a designated service facility or in accordance with written instructions provided by CONTROLS CORPORATION OF AMERICA, or altered by anyone other than CONTROLS CORPORATION OF AMERICA, or if the equipment has been subject to abuse, misuse, negligence or accident.

CONTROLS CORPORATION OF AMERICA's sole and exclusive obligation and Buyer's sole and exclusive remedy under the above warranties is limited to repairing or replacing, free of charge, at CONTROLS CORPORATION OF AMERICA's option, the equipment or part, which is reported to its Authorized Distributor from whom purchased, and which if so advised, is returned with a statement of the observed deficiency, and proof of purchase of equipment or part not later than seven (7) days after the expiration date of the applicable warranty, to the nearest designated service facility during normal business hours, transportation charges prepaid, and which upon examination, is found not to comply with the above warranties. Return trip transportation charges for the equipment or part shall be paid by Buyer.

**CONTROLS CORPORATION OF AMERICA SHALL NOT BE OTHERWISE LIABLE FOR ANY DAMAGES INCLUDING BUT NOT LIMITED TO: INCIDENTAL DAMAGES, CONSEQUENTIAL DAMAGES, OR SPECIAL DAMAGES, WHETHER SUCH DAMAGES RESULT FROM NEGLIGENCE, BREACH OF WARRANTY OR OTHERWISE.**

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