

SPEC-MASTER MANIFOLD INSTALLATION & OPERATING INSTRUCTIONS

Warning : An appropriately sized pressure relief device downstream of the regulator should be installed in your system to prevent damage to equipment and/or injury to personnel should an internal failure of the regulator occur.

Warning : For regulators with tube fittings, select the appropriate tubing. Use seamless tubing with the proper consideration given to wall thickness and material. Please contact your gas supplier for more information.

This instruction sheet is to be read in conjunction with the Spec-Master regulator installation and operating instructions (LAB11054) and the Spec-Master purge valves installation and operating instructions (LAB11059).

USER RESPONSIBILITY

This equipment will perform in conformity with the description contained in this manual and accompanying marking, labels and/or inserts when installed, operated and maintained in accordance with the instructions provided. This product is designed to supply and/or protect piping of a nominal diameter of less than 25mm and therefore meet the PED criteria "Sound Engineering Practice" and will not be CE marked. It is the users responsibility to ensure that the manifold is suitable for the gas being used. 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. Gas-Arc recommends that a telephone or written request for service advice be made to Gas-Arc Customer Service, Vincennes Road, Diss Norfolk, IP22 4WW UK Telephone + 44 1379 652263.
E-Mail enquiries@gas-arc.co.uk

This equipment or any of its parts should not be altered without prior written approval by Gas-Arc. 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 Gas-Arc or a service facility designated by Gas-Arc.

CUSTOMER SERVICE

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

Things to consider before removing the manifold from the box....

1. Know the properties and special handling requirements of the gas being used. Many gases are quite dangerous (flammable, simple asphyxiate or oxidisers). Equipment failure or misuse may lead to problems such as a release of gas through the relief valve or regulator diaphragm. Proper safety measures should be established to handle these and other component failures.

Be sure that the assembly purchased is suitable for the gas and type of service intended. The regulator marking and labelling provides information on the product type and the maximum inlet pressure.

Be sure that the equipment received conforms to the order specifications. The user is responsible for selecting equipment compatible with the gas in use, and conditions of pressure, temperature, flow etc. Selection information can be found in Gas-Arc technical data sheets. In addition, Gas-Arc representatives are trained to aid in the selection process.

2. Inspect the assembly upon receipt to be sure that there is no damage or contamination. Pay particular attention to connecting threads. While Gas-Arc assembles system components to exacting leak tight standards, the customer should also inspect for any loosening of parts that may occur in shipping or installation. Loose parts may be dangerously propelled from an assembly. If there are adverse signs (leakage or other malfunction), return the assembly to the supplier.
3. Before system start-up, it is recommended that all systems be pressure tested, leak tested and purged with an inert gas such as nitrogen.

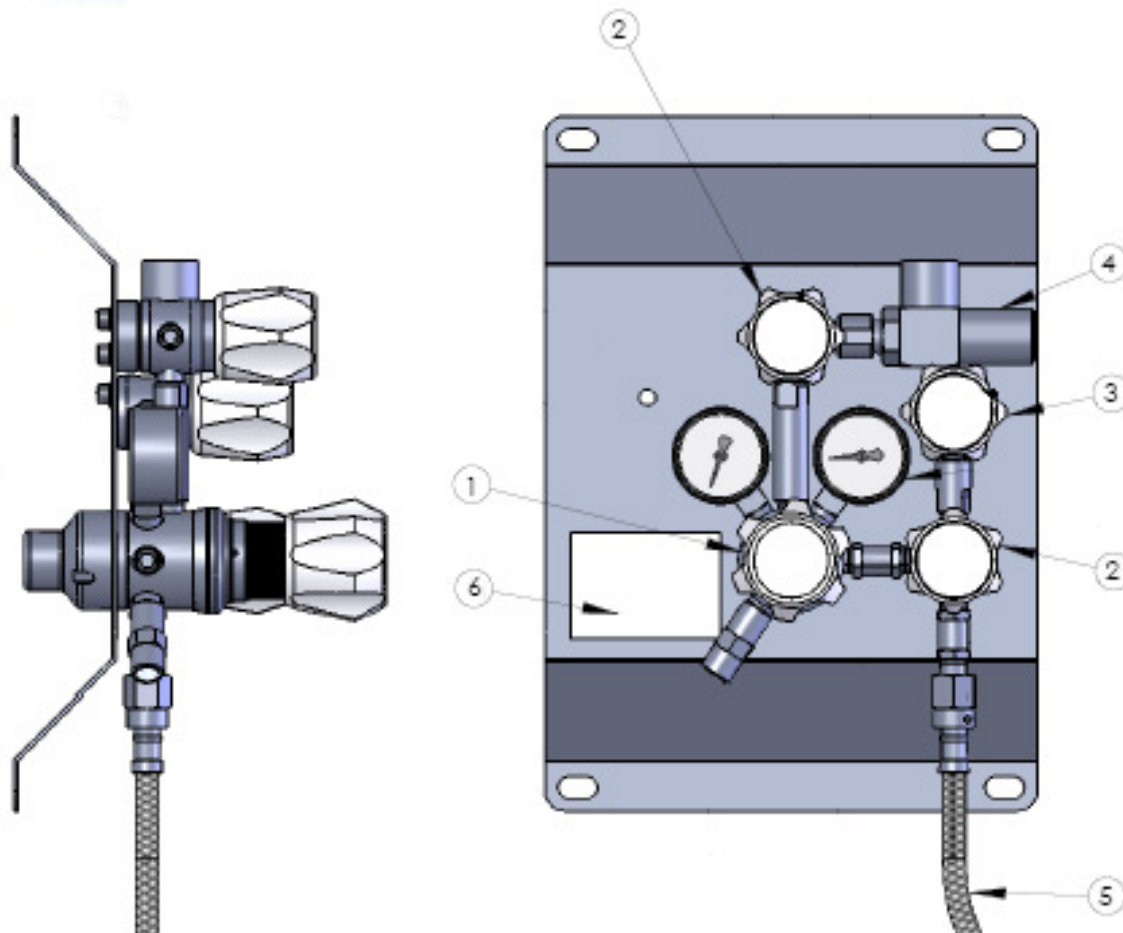
If the regulator or cylinder connection hose includes gas specific inlet connections, their purpose is to prevent usage on the wrong gases. Adaptation or alteration for use on gases can be dangerous, and is not recommended.

GENERAL SAFETY PRACTICES

1. Comply with precautions listed in B.C.G.A Codes of Practice
2. Consult the gas/cylinder supplier for the proper use of cylinders and for any restrictions on their use (such as flow rate and temperature requirements).
3. Never use an open flame when leak testing.
4. Always open valves slowly when high-pressure gases are being used.
5. Always be sure that a cylinder contains the correct gas before connecting to any regulator.
6. Always leak-test any manifold or distribution pipeline before using.
7. Always be sure that the gas in the system is the correct gas for the intended use.

TYPICAL MANIFOLD LAYOUT

Version shown is a single cylinder multistage manifold, depending on specification, manifolds may have different features to those shown.



- 1 Regulator
- 2 Pipeline Isolation Valve
- 3 HP Purge Valve
- 4 Pipeline Safety Relief Valve
- 5 Cylinder Connection Hose (not attached for ease of shipping)
- 6 Service Pressure Identification Plate

INSTALLATION & COMMISSIONING INSTRUCTIONS

It is the installer's responsibility to label the installation with the correct gas service name.

The manifold is usually commissioned in conjunction with the distribution pipeline by a responsible engineer, who will ensure that:

- the manifold area is clear of all foreign material
- relevant instruction cards and warning notices are displayed
- the manifold has been tested satisfactorily.

The following instructions for commissioning the manifold should be read in conjunction with BCGA Codes of Practice CP4 & CP18, HSE Guidance Note CS4 and The Highly Flammable Liquids & Liquid Petroleum Gases Regulations 1972.

1. Stand a full cylinder in place in each position on the manifold and fasten with the securing chain.
2. Screw the bull nose connector of each tailpipe into the cylinder valve of the adjacent cylinder and tighten firmly using a spanner.
3. Check that all tail pipes are connected and tightened.
4. Check that both high pressure isolating valves LH and RH are closed.
Note! Earth yourself in close proximity to the installation before proceeding with fuel gas systems.
5. Open the cylinder valves one at a time very slowly.
6. As each valve is opened, check the bull nose connection for any sign of leakage, with an approved leak test solution. If bubbles form, tighten further but not beyond 70 N.m (50 lb.ft) when leakage should be cured.
7. Check that:
 - (i) Low pressure distribution pipework is connected to the outlet of the pressure reduction package.
 - (ii) All outlet point valves are closed.
 - (iii) All connections and joints are leaktight, using an approved leak test solution.
8. Open one valve in the distribution pipe work system, ensuring that any gas discharge will be safe and create no hazards.
9. Screw the high pressure regulator adjusting screw fully out (anti clockwise).
10. Open the LH manifold high pressure isolation valve slowly. The whole of the LH system and the regulator are now fully pressurised.
11. Screw in the regulator adjusting knob very slowly and monitor the regulator low pressure gauge. The low pressure will slowly increase and when the desired controlled low pressure has been achieved, make no further adjustment to the adjusting knob.
12. Close LH cylinder valve and close LH manifold isolation valve.
13. Repeat this procedure from 5 for RH side of system.
14. The controlled low pressure at the regulator gauge should be the same as when the LH bank was working.

15. Close the outlet point valve which was opened at step 8.
16. Open each outlet point in turn to ensure that the pipeline is thoroughly purged. Appropriate safety precautions must be taken to avoid dangerous concentrations of gas in the atmosphere. The system is now ready for operation.
17. Purging - It is critical that all high purity equipment be thoroughly purged before use to ensure that any residual moisture is removed from the system. The following procedure should be carried out:
 Pressurise the manifold/regulator assembly to its maximum outlet operating pressure and then with the inlet pressure isolated, reduce the outlet pressure to 1 bar.
 Repeat this process 3 times.
 Finally at a minimum operating pressure of approximately 1 bar, purge the regulator until the operating pressure falls to 0.5 bar and hold for a period of 2/3 minutes.
 Note! To avoid Oxygen depletion or enrichment of the local environment, ensure all purging gases are safely vented.
18. Prepare two notices marked 'WORKING' and 'STANDBY', which can be hung over the cylinder banks, ensuring that they are correctly positioned and changed whenever the banks are changed over. Suitable instruction cards, explaining correct operation of valves and controls, are also recommended.
 The installation must generally conform to the minimum requirements of BCGA Codes of Practice CP4 & CP18.
 The following also give guidance and instructions for keeping of LPG in cylinders:
 - The Highly Flammable Liquids and LPG Regulations 1972 (Statutory Instrument 917)
 - Home Office Code of Practice for keeping LPG in cylinders and similar containers
 - LPG ITA Code of Practice CP7 and CP22
 - HSE Guidance Note CS4 .Siting of manifold and routing of pipework in a safe area. .Correct identification of gas service in accordance with BS1710. .Anti-confusion check, if cross-connection of gas service is possible. .Purging into service with an inert gas. Testing for leaks, strength and pressure variation by pneumatic or hydraulic means. .Checking stop valves, non-return valves, changeover valves and cut-off devices for leak-tightness, security of attachment and correct operation.
 Now refer to the Operating Instructions.

Operating

The manifold should be operated in accordance with the following instructions and the requirements of BCGA Codes of Practice CP4 & CP18.

The manifold should preferably be put into operation immediately after commissioning.

1. The manifold after commissioning was left with one bank of cylinders, with valves open, as the working bank. The other bank was left on standby with cylinder valves closed.
2. Operations can now commence at all outlet points.
3. At the end of each working period check that all outlet point valves are fully closed.
4. Monitor the high pressure gauges if fitted, to establish the rate of pressure fall.
5. When the pressure falls to within 2 bar of the regulated low pressure, open all cylinder valves on the standby bank slowly (ease the valve gently until you hear gas begin to flow, do not open further until audible flow has ceased then continue to open the valve slowly to a minimum of 1½ turns).
6. Open the standby bank high pressure isolation valve slowly (ease the valve off its seat [anti-clockwise] until gas begins to flow, do not open further until audible flow has ceased, then continue to open the valve slowly until fully open, now close a ¼ turn). Back flow into the empty bank of cylinders is prevented by the non-return valve.
7. Close the high pressure isolating valve on the empty bank of cylinders.
8. Change the 'WORKING' label to the full bank of cylinders, then change the empty cylinders.
9. Close the cylinder valves of all cylinders on the empty bank.
10. Disconnect all tailpipes from the empty cylinders by unscrewing bull nose connectors.
 Note! Use a spark proof spanner for all fuel gases, these connections have a LH thread.
11. Mark all cylinders on the empty bank with chalk to show that they are 'EMPTY'.
12. Remove one cylinder at a time, by unhooking the chain, and transfer to the empty cylinder storage position.
13. Place a full cylinder in each empty position on the manifold, correctly orientated to connect to the tailpipe, and fasten the retaining chain as tightly as is practicable.
14. Connect each tailpipe to the adjacent cylinder by tightening the bull nose connector into the cylinder valve, with a spanner.
15. When all connections have been made, open each cylinder valve slowly.
16. As each valve is opened, check the bull nose connection for leakage, using an approved leak test solution. If bubbles form, tighten further but not beyond 70Nm (50 lbf) when leakage should be cured.
17. Check the high pressure gauge to ensure the reading is in accordance with the pressure shown on the gas cylinder label.
18. Close all cylinder valves and leave closed until the next cylinder bank changeover.

Maintenance

Weekly checks may be done by an operator instructed in the tasks. Six-monthly and annual maintenance should be performed by a competent person, who fully understands the operation of the cylinder manifold and the hazards involved.

A record of all maintenance should be kept.

When maintaining fuel gas systems, always earth yourself in close proximity to the installation before commencing work, by touching the manifold.

Weekly Inspection (by the user)

Check that:

1. visually, equipment is in good order, is being correctly used and all the required equipment is fitted.
2. manifold, framework and chains are in good condition.
3. pigtails and flexible hoses are not corroded or damaged.
4. valves shut off and open correctly.
5. regulators are identified as being suitable for the gas and pressures and are not damaged.
6. the system is operating normally, i.e. report if the system is using more gas than normal, if there is an unusual drop in pressure or if there is a smell of gas which could indicate a malfunction or leak.
7. the manifold house is free from oil and combustible materials and is not used as a store room.

Annual Inspection (by a person with appropriate experience and knowledge)

Check that:

1. all repairs and modifications (including removals and additions of components) and extensions carried out conform to this Code of Practice.
2. changes in the vicinity of the installation do not affect its operation or safety.
Examples are location of heat sources or burners, moving of machines or work places, occurrence of vibrations, use of a pipeline as an electrical earth or as a support for other items, proximity to electrical installations and to other piping systems.
3. there is adequate identification of above ground pipework/pipelines and route markers for buried pipework/pipelines.
4. the system is free from leaks by testing at the designated operating pressure.
5. buried pipelines are in ground which is free from encroachment by other services, buildings or civil structures.
6. filters are in good condition and are not blocked. Clean or replace them where necessary.

GAS SAFETY

OXYGEN: USE NO OIL OR GREASE, ENSURE ADEQUATE VENTILATION

FLAMMABLE GAS: CONTROL IGNITION SOURCES, ENSURE ADEQUATE VENTILATION

INERT GAS: ENSURE ADEQUATE VENTILATION

SERVICE

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.

Test regulator for leaks on a routine schedule.

TROUBLE SHOOTING

Symptoms	Probable Causes
Gas leakage at the regulator outlet when the adjusting screw is turned fully anti clockwise.	Seat leak or creep, have regulator repaired.
With no flow through the system (downstream valve closed), outlet pressure increases steadily above the set pressure.	Seat leak or creep, have regulator repaired.
Gas leakage from ring assembly or bonnet	Diaphragm failure, have regulator repaired.
Excess drop in outlet pressure with regulator flow open.	Blockage in seat assembly or inlet filter. Have regulator repaired.
Gas leakage from any pipe thread joint.	Loose fitting - remove connection, clean, re-apply PTFE tape and re-tighten.
Gas leakage from relief valve.	Possible faulty relief valve, replace. Possible seat leak or creep, have regulator repaired.
Inconsistent repeat reading.	Seat sticking, have regulator repaired. Possible bad pressure gauge.
Inlet or outlet pressure gauge does not return to zero with no pressure applied to the regulator.	Gauge has suffered physical damage, replace gauge.

WARRANTY INFORMATION

Gas-Arc Group Ltd sells this equipment under the warranties set forth in our Standard Terms & Conditions of Sale (available on request).

Gas-Arc Group Ltd'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 Gas-Arc Groups option, the equipment or part, which is reported to its Authorised 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 pre-paid, and which upon examination, is found not to comply with the above warranties. The Buyer shall pay return trip transportation charges for the equipment or part.

GAS-ARC GROUP LTD 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.

THERE ARE NO EXPRESS OR IMPLIED WARRANTIES WHICH EXTEND BEYOND THE WARRANTIES HEREIN ABOVE SET FORTH. GAS-ARC GROUP LTD MAKES NO WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE WITH RESPECT TO THE EQUIPMENT OR PARTS THEREOF.



Spec-Master High Purity (99.9999%) Regulator Operating Instructions

**Gas-Arc Group Ltd
Vinces Road
Diss, Norfolk
UK, IP22 4WW**

It is important that only experienced and properly trained persons should handle these compressed gases. They should be conversant with the relevant safety instructions including the current British Compressed Gases Association code of practice CP4 and the gas safety instructions from the gas supplier. To help maintain the purity integrity of the product, prior to use these regulators should be stored in a clean dry and warm environment. The regulator should be kept in its sealed protective plastic packaging until use.

Markings

The regulator is marked with the following:-

- Maximum inlet pressure (pressure service)
- Rated outlet pressure

Fitting the regulator

Before fitting the regulator, ensure all connections are clean and free from contaminants including dirt, oil and water and if fitted, fully release the regulator adjusting knob by winding anticlockwise. Right hand thread is employed for oxygen and permanent gas cylinders and left hand thread is used for fuel gas cylinders. Use only the correct size of spanner and finally tighten by applying two blows to the end of the spanner with the heel of the hand.

Purging

It is critical that all high purity equipment be thoroughly purged before use to ensure that any residual moisture is removed from the system. The following procedure should be carried out:

- Pressurise the regulator to its maximum outlet operating pressure and then with the inlet pressure isolated reduce the outlet pressure to 1 bar. Repeat this process 3 times.
- Finally at a minimum operating pressure of approximately 1 bar, purge the regulator until the operating pressure falls to approximately 0.5 bar and hold for a period of 2 to 5 minutes.

Note! To avoid Oxygen depletion or enrichment of the local environment, ensure all purging gases are safely vented.

Operating

After fitting of the downstream equipment, open the cylinder or inlet isolation valve slowly, this is a critical operation and must be done slowly to be safe. If fitted, adjust the regulator knob to the required outlet pressure and purge hoses, make the final adjustments when the gas is flowing. It is vital to ensure that any audible vibration or freezing of the regulator is avoided during operation. Check for leaks at all joints with a leak detection spray.

NEVER:

- Use a regulator showing any signs of damage
- Allow cylinders to become heated
- Use pressure gauges that are damaged, not smooth in operation or not zeroing
- Remove or change any component parts of a regulator

ALWAYS:

- Check the whole system for damage and leaks at frequent intervals
- Comply with BCGA codes of practice. To purchase copies, telephone 01491 825533

SPEC-MASTER PURGE VALVES INSTALLATION & OPERATING INSTRUCTIONS

Before installing or operating, read and comply with these instructions

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. GAS-ARC GROUP LTD recommends that a telephone or written request for service advice be made to GAS-ARC GROUP LTD Customer Service Phone : 01379 652263, Fax : 01379 644235 or E-mail : mail@gas-arc.co.uk.

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CUSTOMER SERVICE

In the event of equipment failure, call GAS-ARC GROUP LTD 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

1. Comply with precautions listed in B.C.G.A Codes of Practice.
2. Consult the cylinder distributor for the proper use of cylinders and for any restrictions on their use (such as flow rate and temperature requirements).
3. Never use an open flame when leak testing.
4. Always open valves slowly when high-pressure gases are being used.
5. Always be sure that a cylinder contains the correct gas before connecting it to any regulator.
6. Always leak-test any manifold or distribution pipeline before using.
7. Always be sure that the gas in the system is the correct gas for the intended use.

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 vapour contamination from their system. Purging has applicable benefits in processes such as pollution control calibration, doping modules and chromatography.
 2. To prevent dangerous gases (e.g. flammable) from getting into a workplace area
 3. 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.

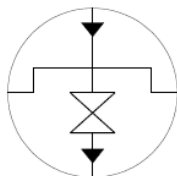
TYPES OF PURGES

GAS-ARC GROUP LTD has three types of purges:

1. Deep Purge (used with the positive displacement purging) – The deep purge is the most effective and versatile group. 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 system.

INSTALLATION

Please refer to the schematic below (as marked on the rear of the valve) and observe the previously mentioned safety precautions before actual installation.



When installing NPT connections, use an open-end spanner not a pipe spanner to install fittings. 1/4 NPT connections require the use of PTFE 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 PTFE 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 the 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.

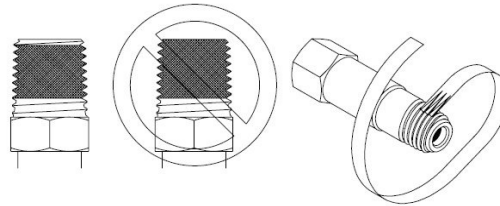


Figure 1. Tape Installation procedures.

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 (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 (1/4 female NPT port).
Note: Glands without spanner 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 spanner; do not use a pipe wrench.
2. Install the Deep Purge or Tee Purge into the regulators female 1/4 NPT inlet port (marked HP) as shown below.
3. **Deep Purge:** The purge inlet is located on the bottom of the Deep Purge: it is a 1/4" compressed tube fitting. Using 1/4" tubing, connect the Deep Purge to a high purity purge gas regulator.
4. 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 high purity purge gas regulator or flowmeter as described in the paragraph above.
5. 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%.

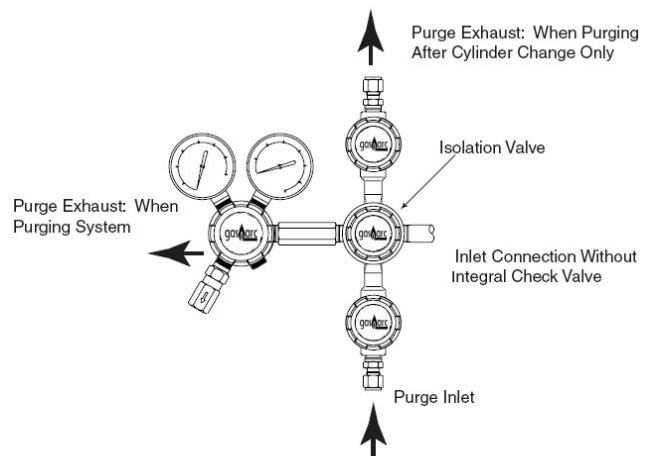


Figure 2. Deep Purge.

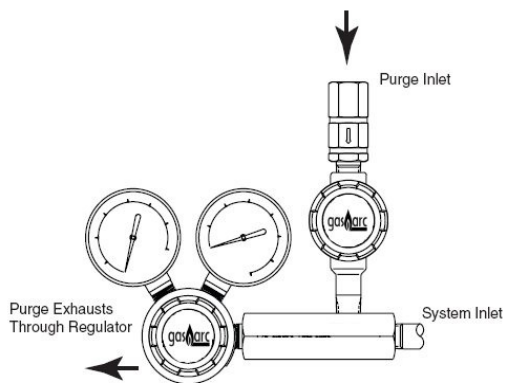


Figure 3. Tee Purge.

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 centre 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 2 to 5 minutes to reach the desired level of purity.
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 equalise in the system. This may take 15 seconds or more. Once the pressure has equalised close the purge gas valve on the Straight or Tee Purge. Wait an additional 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.

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 TROUBLE SHOOTING). 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.

TROUBLE SHOOTING

Typical symptoms listed below indicate malfunctions needing rectification. Replace system components immediately.

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

WARRANTY INFORMATION

Gas-Arc Group Ltd sells this equipment under the warranties set forth in our Standard Terms & Conditions of Sale (available on request).

Gas-Arc Group Ltd'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 Gas-Arc Groups option, the equipment or part, which is reported to its Authorised 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. The Buyer shall pay return trip transportation charges for the equipment or part.

GAS-ARC GROUP LTD 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.

THERE ARE NO EXPRESS OR IMPLIED WARRANTIES WHICH EXTEND BEYOND THE WARRANTIES HEREIN ABOVE SET FORTH. GAS-ARC GROUP LTD MAKES NO WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE WITH RESPECT TO THE EQUIPMENT OR PARTS THEREOF.

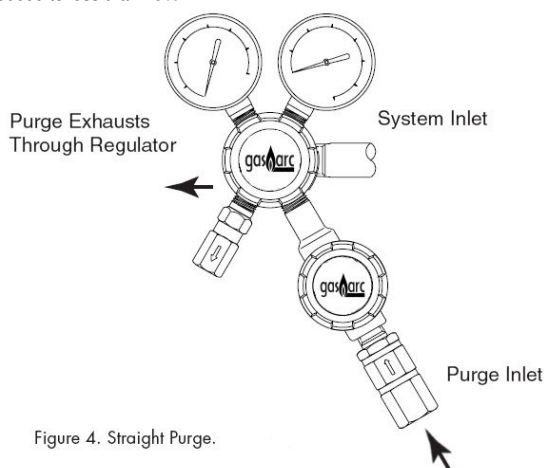


Figure 4. Straight Purge.

INSTALLING STRAIGHT PURGES

1. If necessary, remove the pipe plug from the high pressure port (typically marked HP) 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 female, 1/4" NPT port. Connect the Straight Purge to a high purity gas regulator.
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%.

PURGE OPERATION

These instructions cover methods commonly used with GAS-ARC GROUP LTD speciality 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 centre 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 2 to 5 minutes 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