



**MATHESON**

ask. . .The Gas Professionals™

# SwitchPro™

## Automatic Switchover System



### Operation Instructions

*READ AND COMPLY WITH THESE INSTRUCTIONS BEFORE  
INSTALLING, OPERATING, OR SERVICING*



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## I. SERVICE

### General Service

A unit which is not functioning in a normal manner should be removed from service until such time that repairs or replacement can be made. Upon completion of repair, full testing should be performed to assure the user that the unit has been returned to its original operating parameters. MATHESON can repair or replace equipment. To arrange for repair or replacement service, call 1-800-828-4313 and ask for the Warranty Administrator. **No product will be received by MATHESON without indication of gas service and without proper return material authorization provided by the warranty administrator. (All repairs must be made by MATHESON or an assigned and approved facility to maintain any warranties or guarantees).**

If the unit is under an applicable warranty, return the unit to MATHESON for repair or replacement. To arrange for warranty service, call 1-800-828-4313 and ask for the Warranty Administrator. **No product will be received by MATHESON without indication of gas service and without proper return material authorization provided by the warranty administrator.**

If advised by the Warranty Administrator to return the product to MATHESON, prepare the product for shipment and write, in large lettering the RMA Number assigned by the Warranty Administrator on the outside of the box. Also, if required by the Warranty Administrator, supply the completed RMA form with the product. Make sure that the product is adequately packaged, in the original shipping container if possible, and shipped prepaid (MATHESON will not accept COD freight) with a description of the observed deficiency to the attention of the:

Warranty Administrator  
MATHESON  
166 Keystone Drive  
Montgomeryville, PA 18936

The user is expected to periodically inspect the product for leaks, loose or worn parts, broken or non-functioning components and to address those situations immediately. If the user would require verbal assistance in ascertaining the potential of a problem with any MATHESON product, contact the local MATHESON branch for assistance or your MATHESON Sales Representative.

## II. LIMITED WARRANTY

This equipment is sold by MATHESON under the warranties set forth in the following paragraphs. Such warranties are extended only with respect to the purchase of this equipment directly from MATHESON or MATHESON's Authorized Agent as new merchandise and are extended to the first Buyer thereof other than the purpose of resale.

For a period of one year from date of original delivery (ninety 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 this equipment is properly operated under the conditions of normal use and that regular and periodic maintenance and service is performed or replacements are made in accordance with the instructions provided. Expendable parts of this equipment are similarly 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. The foregoing warranties shall not apply if the equipment has been repaired other than by MATHESON or a service facility designated by MATHESON, or if this equipment has not been operated and maintained in accordance with written instructions provided by MATHESON, or has been altered by anyone other than MATHESON, or if the equipment has been subject to abuse, misuse, negligence or accident.

MATHESON's sole and exclusive obligation and the Buyer's sole and exclusive remedy under the above warranties is limited to repairing or replacing, free of charge, at MATHESON's sole discretion, the equipment or part which is telephonically reported to be a problem to the local MATHESON Branch Location, and which if so advised, is returned with a written statement of the observed deficiency, not later than seven days after the expiration of the applicable warranty, to the MATHESON Gas Equipment Technology Center during normal business hours, transportation charges prepaid, and which, upon examination, is found to comply with the above warranties. The Buyer shall pay for return trip transportation charges for the equipment or part.

**MATHESON 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 that extend beyond the warranties hereinabove set forth. MATHESON makes no warranty of merchantability or fitness for a particular purpose with respect to the equipment or parts thereof.**

**Acceptance of the equipment by the final buyer indicates the final buyer's acceptance of all warranties and limitations set forth above.**

### **III. USER RESPONSIBILITY**

This equipment will perform in conformity with the description thereof 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, with the frequency of such inspections depending upon the scope of use. Damaged, worn or contaminated equipment should not be used. Parts that are broken, missing, plainly worn, distorted or contaminated should be replaced immediately. Should such repair or replacement become necessary, MATHESON recommends that a telephonic or written request for service advice be made to the MATHESON Equipment Engineering Group in Montgomeryville Pennsylvania or to the nearest MATHESON branch location.

This equipment or any of its parts should not be altered without the prior written approval of MATHESON Equipment Engineering Group. The user of this equipment shall have the sole responsibility for any malfunction, which results from improper use, faulty maintenance, damage, improper repair or alteration by anyone other than MATHESON or a service facility designated by MATHESON. Further, the ultimate user of the equipment is responsible for the training and safe operation of the equipment by personnel in his/her employ.

#### IV. SAFETY PRECAUTIONS

1. Many Specialty Gases are hazardous in nature. It is important that the user of the equipment carefully review the hazards associated with the gas to be used with the switchover system. **BEFORE INSTALLING THE SWITCHOVER SYSTEM WITH ANY CYLINDER OF COMPRESSED OR LIQUEFIED GAS, REFER TO THE MSDS THAT WAS SHIPPED WITH THE GAS, OR ON FILE IN YOUR FACILITY, AS TO THE SPECIFIC HAZARDS ASSOCIATED WITH THE GAS TO BE USED. ALSO, REFER TO ALL APPLICABLE INSERTS CONTAINED WITH THE EQUIPMENT FOR ADDITIONAL PRECAUTIONS AND OPERATING INSTRUCTIONS.**
2. Before using any switchover system on toxic, flammable or other type of hazardous gas, test the leak integrity of the switchover system using an inert gas. The SwitchPro™ Automatic Switchover System is not recommended for use with acetylene, corrosive or pyrophoric gases.
3. Make certain that the switchover system purchased is suitable for the application intended. All equipment supplied by MATHESON has a model number, and a pressure limitation label and/or stamping. Carefully review this information to establish the switchover system fit for service in the desired application.
4. Make certain that the equipment purchased or delivered to the ultimate end user conforms to the specifications of the user. The user is responsible for selecting equipment compatible with gases that are to be used, physical parameters of operation and performance and normal material compatibilities. Selection information can be found in MATHESON Catalogs, MATHESON Tech Briefs and in the MATHESON Gas Data Book. In addition, any MATHESON representative would be pleased to aid in the selection of specific equipment.
5. Before installation of the switchover system for use with cylinders of compressed or liquefied gas, carefully inspect the switchover system for visible signs of damage or contamination. Close attention should involve visual inspection of all exposed and connecting threads for visible signs of wear and abuse. Also examine the switchover system for any loose parts outside of those that must swivel for connection to the gas cylinder or outlet lines. Also examine the switchover system for signs of contamination with dirt, grease or any other foreign material. Close attention should be given to the external appearance and the view of the switchover system from the inlet and the outlet. If any foreign materials are present and cannot be removed from the switchover system easily with a cloth, or if the threads on any components of the switchover system appear to be abused as indicated above, or any of the components appear to be loose, return the switchover system immediately for service.
6. Before installation of the SwitchPro™ Automatic Switchover System onto the cylinder of compressed or liquefied gas, move the cylinder(s) to the work location and secure the cylinder before removing the cylinder valve cap. Check the cylinder valve as in step 5 for possible contamination and defective or loose parts. If for any reason the cylinder appears to be faulty as noted here,



return the cylinder cap to the top of the cylinder, tighten down and remove the cylinder from the work area and call the supplier of the cylinder for immediate pick-up.

7. When using any hazardous gas, the cylinder of the gas should be placed under an exhaust hood or be placed in a suitable safety enclosure.
  
8. Before installation of the switchover system for use with cylinders of compressed or liquefied gas, make certain that the CGA connection on the cylinder matches the CGA connection attached to the pigtail. CGA connections are fitted to the pigtails to limit the services in which the switchover system can be used. **THE USE OF ADAPTORS OR ALTERATIONS TO THE SWITCHOVER SYSTEM TO CHANGE SERVICES CAN BE EXTREMELY DANGEROUS AND SHOULD NOT BE ATTEMPTED.** If a conversion of a product is required, consult MATHESON before attempting.

## V. GENERAL INFORMATION

The switchover regulator provides primary regulation and switchover capability on the SwitchPro™ Automatic Switchover System. The SwitchPro™ Automatic Switchover System is designed for laboratory use and relatively moderate flow rates of gas. The switchover may be used with one or two cylinders on each side or with a multi-cylinder manifold bank on each side.

The SwitchPro™ Automatic Switchover System will switch over from one bank of cylinders to the opposite bank of cylinders automatically upon depletion of gas in the original Primary side of the system. However, some delivery pressure deviation (decrease after switchover) from the set point will occur after the switch from the Primary to the Reserve bank. The use of a secondary line regulator downstream eliminates this delivery pressure deviation. While these units are designed to provide a continuous supply of gas to a common outlet, the ability to remotely monitor when one side of the switchover has been exhausted may be necessary to determine when to replenish that side. Optional features for monitoring the supply pressures are available and include indicating pressure switches along with a PM-22 pressure monitor.

The SwitchPro™ Automatic Switchover System can be configured with many available options. When complete purging is required, optional high pressure vent (HPV) and high pressure isolation (HPI) valves can be ordered as options to the switchover system. A low pressure isolation (LPI) valve provides system isolation from the down stream process. Three foot long flexible hoses are standard but can be substituted by six foot long hoses if the user wants flexibility when using cumbersome dewars or six/twelve packs of cylinders. Various outlet fittings are also available.

For additional information contact your local MATHESON Sales Representative.

### Specifications

Maximum Supply Pressure	3000 psig
Switchover Pressure	180-220 psig (typical)
Maximum Flow Rate	5 scfm - nitrogen

## VI. SWITCHOVER SYSTEM INSTALLATION

### **BEFORE ATTACHMENT OF THE SWITCHOVER SYSTEM TO THE CYLINDER, READ CAREFULLY THE "USER RESPONSIBILITY" AND "SAFETY PRECAUTIONS" SECTIONS OF THIS MANUAL**

1. Unpack the SwitchPro™ Automatic Switchover System and carefully check for damages, which might have occurred during transportation. If there is any evidence of damage, a claim must be filed with the shipper. If there is no damage, discard the wrapping.
2. Without cracking (opening) any of the seals of the switchover system, hang the switchover system at a height that will allow the pigtailed to be connected easily to the cylinders/containers. The ability to read the gauges of the system and adjust the pressures should also be considered before mounting, preferably to compatible unistrut.
3. The pigtailed (typically flexible hoses) should be attached to the system, if not already attached, with open ended wrenches. Rigid pigtailed should NEVER be bent or repositioned more than a few inches from its original shape. Excessive bending will cause unnecessary stresses in the metal resulting in failure of the rigid pigtail.
4. Connect the process line directly to the fitting on the outlet of the switchover system. This is typically a compression fitting on the right hand side of the line regulator. These connections are for use with rigid tubing. Choose the material of the tubing such that the fittings are of the same or harder material than the tubing. Do not use Teflon tape or other sealant in making a compression fitting connection.

**WARNING: BRASS COMPRESSION FITTINGS WILL NOT WORK PROPERLY WITH STAINLESS STEEL TUBING.**

**WARNING: COMPRESSION FITTING FERRULES ARE TO BE USED FOR ONE CONNECTION ONLY.**

5. Connect the vent line directly to the HPV valve (if supplied).

## VII. PROCESS CYLINDER INSTALLATION INSTRUCTIONS

1. Before removing the cylinder cap, move the cylinder of process gas to the panel.
  - 1.1. Secure the cylinder as to prevent accidental toppling.
  - 1.2. Remove the cylinder cap.
  - 1.3. Make certain that the cylinder valve is tightly closed.
  - 1.4. Remove the cylinder plug, if present. If there is any sign of gas leaking through the closed cylinder valve, replace the plug and contact THE GAS SUPPLIER IMMEDIATELY to arrange for disposal.
  - 1.5. Inspect the cylinder valve for contamination or abuse.
2. The user should then put on appropriate safety apparel such as, but not limited to, safety glasses and gloves.
3. Close the line regulator of the switchover system (if provided) by rotating the adjusting knob in a counterclockwise direction until no more resistance is felt. As the knob is turned, the movement of the assembly should be easier.
4. Close the High Pressure Isolation (HPI) valves (if supplied) at the inlet of the switchover system.
5. Following the procedures outlined below, make the connection of the pigtail to the cylinder valve. Always use an open ended or adjustable wrench. Always use a backup wrench on CGA connections
  - 5.1. **DO NOT FORCE.** The connection should be made easily. If it cannot be made easily, most likely the user has the wrong panel for the gas service.
  - 5.2. **LEFT HAND THREADS** are used on some CGA connections. Notches in the middle of the hex nut usually identify left hand threads.
  - 5.3. **GASKETS** are used in conjunction with some CGA connections. If the connection requires a gasket, one has been supplied with the panel. Inspect the gasket for signs of contamination and abuse. Do not over-tighten a connection with a gasket, as this will force the gasket to extrude into the gas stream.
  - 5.4. **NEVER USE LUBRICANTS OF ANY TYPE** on the CGA connection or cylinder valve to aid in connection.
  - 5.5. **NEVER USE TEFLON TAPE** to aid in the sealing of the CGA connection to the cylinder valve.

## VIII. OPERATING INSTRUCTIONS

WARNING: THE USER SHOULD PUT ON APPROPRIATE SAFETY APPAREL SUCH AS, BUT NOT LIMITED TO, SAFETY GLASSES AND GLOVES.

1. The line regulator control knob should be closed as described in "INSTALLATION" sections above. All valves should also be in the closed position as described in the "INSTALLATION" sections above.
2. Choose one supply side of the switchover system to be the Primary supply source and the other side to be the Reserve. If the right side cylinder(s) (facing the front of the SwitchPro™ Automatic Switchover System) is chosen as primary then rotate the switchover regulator knob fully clockwise until it hits the stop. The large arrow on the front of the knob should be pointing towards the right side cylinder. If the left side is chosen to be the primary side, then rotate the switchover regulator knob fully counterclockwise until the knob stops and the arrow points to the left side cylinder.
3. The user should then be positioned with the cylinder between themselves and the switchover system. **DO NOT REST HANDS ON OR APPLY FORCE TO THE PIGTAIL DURING THE FOLLOWING CHARGING OPERATIONS.**
4. To avoid damage to the switchover system's internal parts, open the cylinder valve(s) SLOWLY on the Primary side of the switchover system. If there is an inlet shutoff valve on the switchover system, open it slowly. Observe the high pressure gauge, on the switchover system, for a rise in pressure to full cylinder pressure.
5. Observe all high pressure connections in the pressurized system for leaks.
  - 5.1. An approved soap solution, if compatible with materials and applications in use, can be used to check connections for leaks.
  - 5.2. An approved leak detecting device can be used to check for leaks. Consult the manufacturer's instructions for applications and hazards associated with the gas to be used in the system.
  - 5.3. If neither method above can be utilized, re-close the cylinder valve for a minimum of five minutes and observe the high pressure gauge for a drop in pressure.
  - 5.4. If a leak is indicated, by any of the methods listed above, recheck the CGA connection to the cylinder and all other high pressure connections.
  - 5.5. If all of the connections indicate no leak and the regulator and outlet are still closed, and the pressure continues to fall on the inlet gauge, reduce the pressure in the system as outlined in the "SHUTDOWN PROCEDURES". Return the switchover system for replacement or repair (if new) or repair (if out of warranty) by following the procedure in the "WARRANTY REPAIR" section.

6. If the system has been leak checked on one side as in steps 5.1 to 5.5 and is found to be acceptable, repeat the procedure for the Reserve side of the switchover system.
7. If both sides of the system have been leak checked on the high pressure side and found to be acceptable, open the cylinder valves completely in order to form a good seal within the cylinder valve. Keep the hand wheel or wrench (if required for this particular cylinder valve type) available at all times to allow for prompt shut-off in emergency situations.
8. Most models of the SwitchPro™ Automatic Switchover System are equipped with a secondary line regulator. For models so equipped with a secondary line regulator, follow the instructions in Section 9.1 below. Some models of this product are not equipped with a secondary line regulator. For those units use the procedure outlined in Section 9.2. To determine if the product delivered is one type or the other, refer to the original packing list and any sales or marketing literature available.
  - 8.1. **MODELS WITH A SECONDARY LINE REGULATOR.** Slowly turn the regulator knob clockwise to increase the pressure and counterclockwise to decrease the pressure, while observing the pressure gauge on the line regulator. If the delivery line is dead-ended or closed the delivery pressure cannot be relieved by turning the knob counterclockwise and a flowing condition must be established to reduce the delivery pressure. All final delivery pressure adjustments should be made with the final system flow rate established.
  - 8.2. **MODELS WITHOUT SECONDARY LINE REGULATION.** The delivery pressure on these systems is preset at the factory. The delivery pressure will vary between 180 and 220 psig depending on the position of the switchover regulator knob. If the knob position is full clockwise, with the arrow pointing down and to the right, the outlet pressure will be approximately 200 to 220 psig. If the knob position is full counterclockwise, with the arrow pointing down and to the left, the outlet pressure will be approximately 180 to 200 psig.
9. The system is now operating. Observe all low pressure connections in the pressurized system for leaks.
  - 9.1. Check all connections for leaks with an approved soap solution, if compatible with materials and applications in use.
  - 9.2. An approved leak detecting device can be used to check for leaks. Consult the manufacturer's instructions for applications and hazards associated with the gas to be used in the system.
  - 9.3. If neither of the above methods can be utilized and the system has a line regulator, close off the system as close to the switchover system as possible, including the line regulator, and observe the pressure gauges for a drop in pressure.
10. If the system is to put into service immediately, make sure that the switchover is properly connected to the line and has been fully leak tested. Then open all cylinder valves and isolation valves and adjust the line regulator to the desired working pressure.
11. If the system will not be used immediately, close all cylinder valves and vent the system through the outlet of the system in a suitable manner consistent with safe handling procedures.

## IX. CYLINDER CHANGEOUT

After the switchover has occurred, determined by the depletion of original cylinder pressure to the switchover pressure (typically 180-200 psig) as indicated on the respective high pressure gauge, perform the following steps for cylinder(s) replacement.

1. Turn the switchover regulator knob 270 degrees away from the cylinder that has been depleted. If the right side was the primary supply and is now depleted turn the switchover regulator knob in the counterclockwise direction until the arrow on the knob points at the left side cylinder and hits the stop. If the left side was the primary supply and is now depleted turn the switchover regulator knob in the clockwise direction until the arrow on the knob points at the right side cylinder and hits the stop.
2. Close the depleted side High Pressure Isolation (HPI) valve (if supplied) by turning the knob fully clockwise.
3. Close the process gas cylinder valve(s) on the depleted side of the switchover system.
4. Open the High Pressure Vent (HPV) valve (if supplied) on the depleted side of the switchover system for 10 seconds, then close. Verify cylinder pressure is zero (0) psig.
  - 4.1. Wait 60 seconds minimum and again verify cylinder pressure indication is zero (0) psig. If pressure has increased, then the cylinder valve is leaking past the seat. If the cylinder valve is leaking, open the cylinder valve and close again tightly; then return to step 4. Do not proceed if the cylinder valve continues to leak; contact your GAS SUPPLIER for assistance.
  - 4.2. Open the HPV valve for 10 seconds then close. Verify cylinder pressure indication is zero (0) psig.
5. Disassemble the pigtail(s) from the cylinder(s) by slowly loosening the cylinder connection. Listen for continuous gas seepage. If leaking is evident, re-tighten the cylinder connection immediately and check the cylinder valve for proper closure. If the cylinder valve is in the closed position, and the switchover system has been drained of all gases, contact your GAS SUPPLIER immediately and notify him of the situation.
6. Replace plug into the cylinder valve outlet (where applicable). Replace the cap on the cylinder over the valve. Remove the cylinder from the work place and put the cylinder into a safe storage area.
7. Inspect the cylinder connection sealing surface on the pigtail for dirt, scratches, dents, pits, or corrosion. Clean or replace parts if needed.
8. Move the cylinder of gas to the work site before removing the cap. Fasten the safety strap and/or chain. Remove the cylinder cap. Make certain that the cylinder valve is tightly closed then remove the cylinder plug, if present.
9. Inspect the cylinder valve sealing surface for dirt, scratches, dents, pits, or corrosion. Clean as indicated. Do not attempt to connect a cylinder that is any way defective.

10. Following the procedures outlined below, make the connection of the pigtail to the cylinder valve. Always use an open ended or adjustable wrench. Always use a backup wrench on CGA connections
  - 10.1. **DO NOT FORCE.** The connection should be made easily. If it cannot be made easily, most likely the user has the wrong panel for the gas service.
  - 10.2. **LEFT HAND THREADS** are used on some CGA connections. Notches in the middle of the hex nut usually identify left hand threads.
  - 10.3. **GASKETS** are used in conjunction with some CGA connections. If the connection requires a gasket, one has been supplied with the panel. Inspect the gasket for signs of contamination and abuse. Do not over-tighten a connection with a gasket, as this will force the gasket to extrude into the gas stream.
  - 10.4. **NEVER USE LUBRICANTS OF ANY TYPE** on the CGA connection or cylinder valve to aid in connection.
  - 10.5. **NEVER USE TEFLON TAPE** to aid in the sealing of the CGA connection to the cylinder valve.
11. If the switchover system is supplied with a High Pressure Vent (HPV) valve then:
  - 11.1. Close the HPI valve (if supplied).
  - 11.2. Close the HPV valve (if supplied).
  - 11.3. **SLOWLY** open the process gas cylinder valve(s) of the newly attached cylinder(s).
  - 11.4. Close the process cylinder valve(s).
  - 11.5. Open the HPV valve to allow all of the gas in the system to be evacuated through the vent line.
  - 11.6. Close the HPV valve as soon as the pressure is gone.
  - 11.7. Repeat steps 11.3 to 11.6 a minimum of five and a maximum of 25 times dependent upon the user's experience with purging techniques and recommendations.
12. **SLOWLY** open the process gas cylinder valve(s) of the newly attached cylinder(s).
13. Open the High Pressure Isolation (HPI) valve (if supplied)
14. Wait five seconds minimum or until cylinder pressure indication stabilizes. Verify full cylinder pressure indication then close the cylinder valve(s).
15. Wait for five minutes minimum and monitor cylinder pressure display. A drop in pressure indicates a potential leak. Ensure that the HPV (if supplied) is full closed. Leak check the inlet section of the switchover system. Repair any leaks before proceeding.
16. The process cylinders are now in service.

## X. SHUTDOWN PROCEDURES

1. Temporary Shutdown
  - 1.1. Close the High Pressure (HPI) valves (if supplied). If HPI valves are not supplied then close the process cylinder valves
2. Extended Shutdown
  - 2.1. Close the process gas cylinder valves.
  - 2.2. Shut down any additional gas supplies that may be supplying gas to the system.
  - 2.3. Open the regulators and the isolation valves to drain the contents of the switchover system through the line using the gas supplied by the unit. All gauges should descend to zero.
  - 2.4. When using a toxic or other hazardous gas, run an inert gas through the switchover system and the line using the switchover system as a means to purge the toxic or hazardous gas out of the system before breaking any of the system connections.
  - 2.5. After venting (and purging when necessary), close all of the regulators and the valves of the switchover system.
  - 2.6. Isolate the switchover system from line system and downstream equipment.
  - 2.7. Disassemble the pigtails from the cylinders by slowly loosening the cylinder connection. Listen for continuous gas seepage. If leaking is evident, re-tighten the cylinder connection immediately and check the cylinder valve for proper closure. If the cylinder valve is in the closed position, and the switchover system has been drained of all gases, contact the GAS SUPPLIER immediately and notify him of the situation.
  - 2.8. Replace plug into cylinder valve outlet (where applicable). Replace the cap on the cylinder over the valve. Remove the cylinder from the work place and put the cylinder into a safe storage area.
  - 2.9. Cap or plug exposed ports to prevent contamination.



## **XI. TROUBLESHOOTING**

1. Gauges should always read zero when all gas is drained from the switchover system. If they do not read zero they may have to be replaced.
2. No gas should be coming out of the outlet when the switchover system or valves are in the closed position. If there is gas flow, this is an indication of regulator or valve seat failure or imminent seat failure.
3. The delivery pressure of the regulators within the switchover system should not rise with the cylinder valves open, the regulators set at a given delivery pressure and the outlet valves closed for five to ten minutes. If there is a pressure rise, this is an indication of regulator seat failure or imminent seat failure.
4. Gas leakage should never occur from the bonnet (end of the regulator with adjusting knob or handle). If there is gas leakage, it is possible that the diaphragm or diaphragm seal is deficient.
5. All joints and connections on the switchover system should be periodically checked for leaks. Presence of leaking seals is indicative of deficient switchover system performance.
6. There should be no excessive periodic drop in flow from the outlet of the switchover when in service. If this occurs, there is most likely a blockage or occlusion in the flow path.
7. To ensure long life of the switchover system, on a schedule consistent with user experience, regulators within the switchover system should be reconditioned for full service.

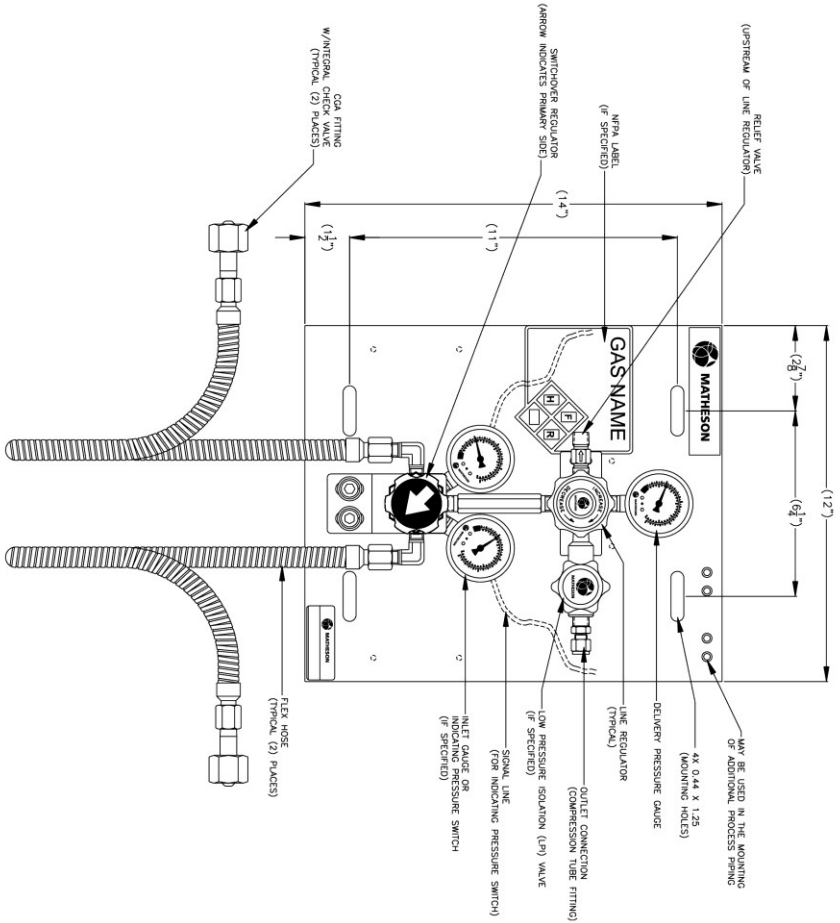
**IF ANY OF THE ABOVE NOTED DEFICIENCIES ARE OBSERVED BY THE USER, THE UNIT SHOULD IMMEDIATELY BE REMOVED FROM SERVICE AND ARRANGEMENTS MADE FOR REPAIR OR REPLACEMENT OF THE DEFICIENT PRODUCT.**

## XII. APPENDIX – FITTINGS

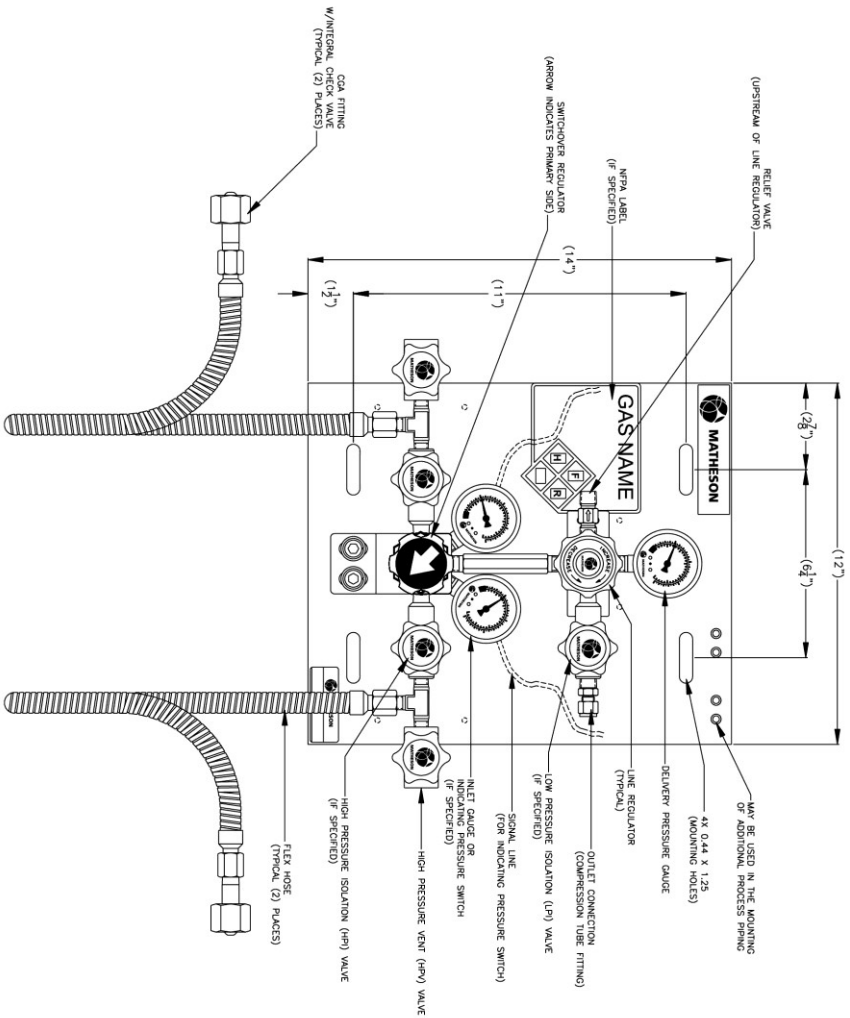
1. **COMPRESSION TUBE FITTINGS** are supplied as connections on most MATHESON SwitchPro™ Automatic Switchover Systems. These connections are for use with 1/4" OD rigid metal tubing. Dependent upon the application, the tubing material will either be Brass, Copper, Stainless Steel or Monel. Connect the rigid tubing to the outlet of the Panel and then to the equipment utilizing the manufacturer's instructions for making compression tube connections. **WARNING: MOST APPROVED AND RELIABLE COMPRESSION TUBE CONNECTIONS UTILIZE FERRULES FOR COMPRESSION OF THE FITTING ONTO THE TUBE. THESE FERRULES ARE TO BE USED FOR ONE (1) CONNECTION ONLY AND MUST NOT BE USED ON ANOTHER PIECE OF TUBING. NEVER USE TEFLON TAPE IN MAKING A COMPRESSION TUBE CONNECTION.**
  
2. VCR or FACE SEAL CONNECTIONS are supplied as inlet and/or outlet connections on some MATHESON Panels. Standard connections provided are either 1/4" or 1/2" male or female dependent upon customer order. Connections are to be made only to compatible connections within the User's system. VCR or VCR-Type connections utilize an expendable gasket for sealing which may or may not be supplied. **WARNING: VCR AND FACE SEAL CONNECTIONS USE EXPENDABLE GASKETS. THESE GASKETS ARE TO BE UTILIZED ONLY FOR ONE ATTEMPT AT SEALING AND SHOULD NEVER BE REUSED. MAKE CERTAIN THAT THE GASKETS TO BE EMPLOYED ARE COMPATIBLE WITH THE GAS SERVICE INTENDED.**
  
3. CGA connections are supplied on pigtails for the connection of the process gas cylinder to the panel.
  - a. **DO NOT FORCE.** The connection should be made easily. If it cannot be made easily, most likely the user has the wrong panel for the gas service.
  - b. **LEFT HAND THREADS** are used on some CGA connections. Notches in the middle of the hex nut usually identify left hand threads.
  - c. **GASKETS** are used in conjunction with some CGA connections. If the connection requires a gasket, one has been supplied with the panel. Inspect the gasket for signs of contamination and abuse. Do not over-tighten a connection with a gasket, as this will force the gasket to extrude into the gas stream.
  - d. **NEVER USE LUBRICANTS OF ANY TYPE** on the CGA connection or cylinder valve to aid in connection.
  - e. **NEVER USE TEFLON TAPE** to aid in the sealing of the CGA connection to the cylinder valve.

### XIII. APPENDIX – DIAGRAMS

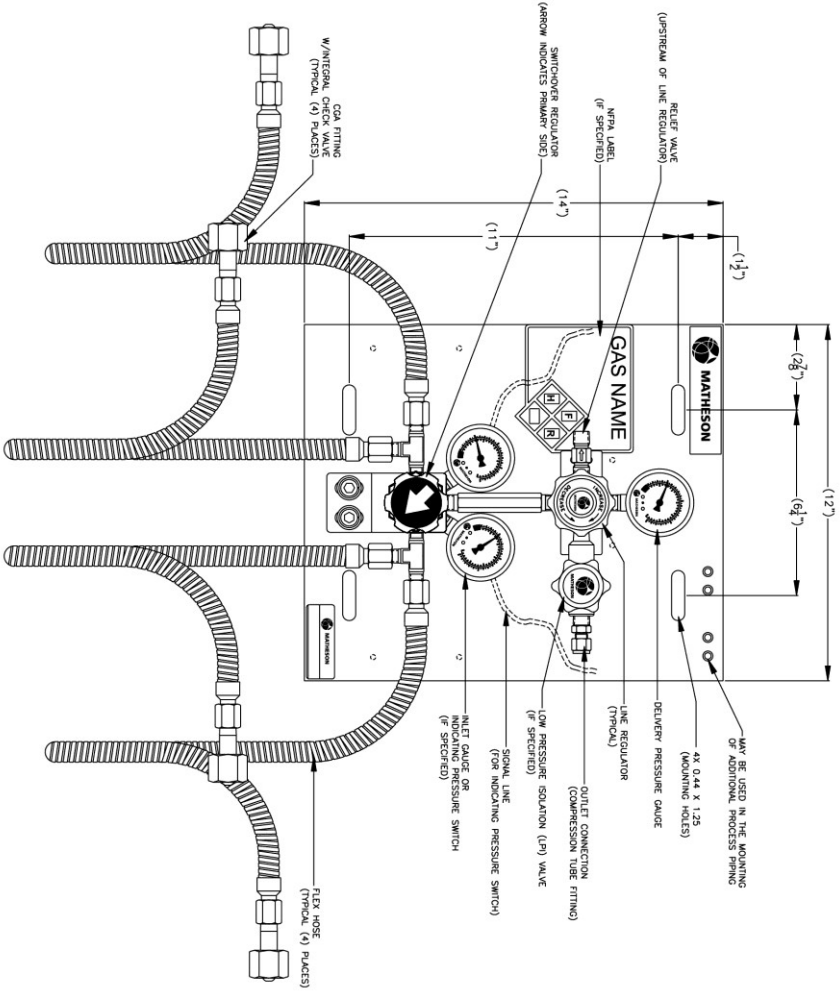
## SwitchPro™ Standard 2 Cylinder



# SwitchPro™ 2 Cylinder with HPI and HPV Valves



# SwitchPro™ Standard 4 Cylinder





# XIV. APPENDIX – PART NUMBERS

## SwitchPro Automatic Switchover Systems

Material

Line Reg

# Cyls

Gas/CGA

Option 1

Option 2

Option 3

Option 4

- 0 None
- A 300 psig
- B 100 psig
- C 150 psig

- 2 (1 X 1)
- 4 (2 X 2) ..... opt N or Q
- 6 (3 X 3)
- 8 (4 X 4)
- A (5 X 5)
- B (6 X 6)

- B 590
- F 346
- N 326
- P 540
- T 580
- V 560
- W 320

IPS - Indicating Pressure Switch  
(Gauge with Pressure Switch)

Option 5

Option 6

Option 7

Option 8

Option 9

Standard for 4 Cylinder Switchover

- Typical
- 1/4" od compression outlet
- 3 ft long flexible hose
- CGA's with integral check valve
- No NPT-A, label
- No handles on CGA fittings
- 200 psig (+/- 20 psi) switchover pressure
- 5 scfm max flow rate

1	Rigid Pigtails
2	No check valve in CGA fitting (reed option #7)
3	6 ft Flex Hose
4	Cylinder Holder w/Strap
5	Cylinder Holder w/Strap & Chain (Flammables)
6	Certified Leak Test - Inboard
7	HP1 - High pressure (inlet) isolation valve
8	.....
9	Auxiliary Inlet Valve
A	HPV - High Pressure Vent valve (needs option # 7)
B	3/8" Compression Fitting - Outlet
C	1/2" Compression Fitting - Outlet
D	IPS - Inlet (3000 psig)
E	.....
F	IPS - Inlet (600 psig) - dewars
G	IPS - Outlet (200 psig)
H	Add handles to CGA fittings
I	.....
J	PM-22 Annunciator Box (reed D, F and/or G)
K	Certified Leak test - Inboard & Outboard
L	1/8" low pressure (outlet) isolation valve
M	1/8" Compression Fitting - Outlet
N	No Manifolds for 4 Cyl. Switchover
O	.....
P	PM-22 Annunciator Box (reed D or F, QTY=2)
Q	Add Manifolds for 4 Cyl. Switchover
R	Add NFPA Label (must specify gas)
S	1/4" Swagelok, Inlets (No hoses) - (2 cyl only)
T	.....
U	.....
V	1/4" VCR outlet fitting
W	.....
X	.....
Y	1/4" FFP Inlets (No hoses) - (2 cyl only)
Z	Quick Coupler CGA's (Not CGA 350) (Not SS)



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