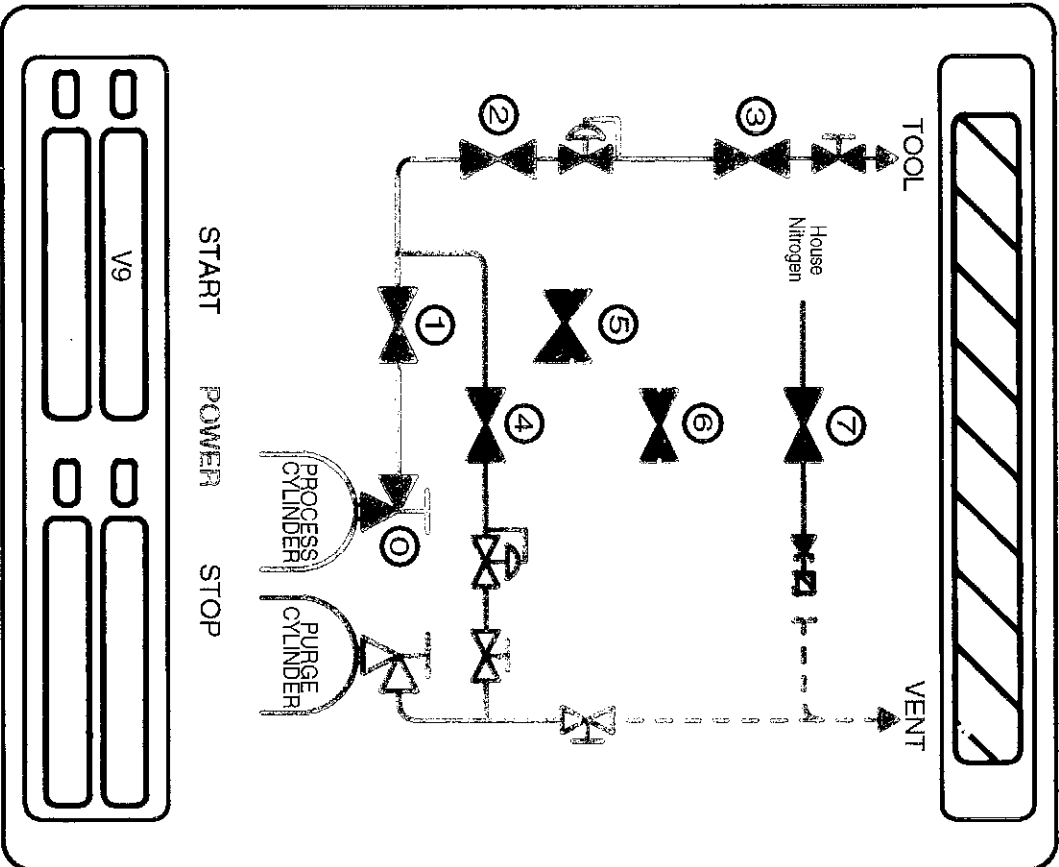


Air Products Gasguard 450 Cylinder Change



SOFTWARE VERSION 1.4

START

POWER

STOP

↑

← SHIFT	K 5	A 1	C 2	E 3	G 4	I ←	ESC MNU
U 9	M 6	B 1	D 2	F 3	H 4	←	ACK
W 0	N 6	L 5	N 6	P 7	R 8	→	RESET
Y Z	O 7	5	O 7	Q 8	S SPACE	↓	ENTER

AIR PRODUCTS GASGUARD 450 CYLINDER CHANGE SEQUENCE

APCI VERSION 1.4 (Rev 1)

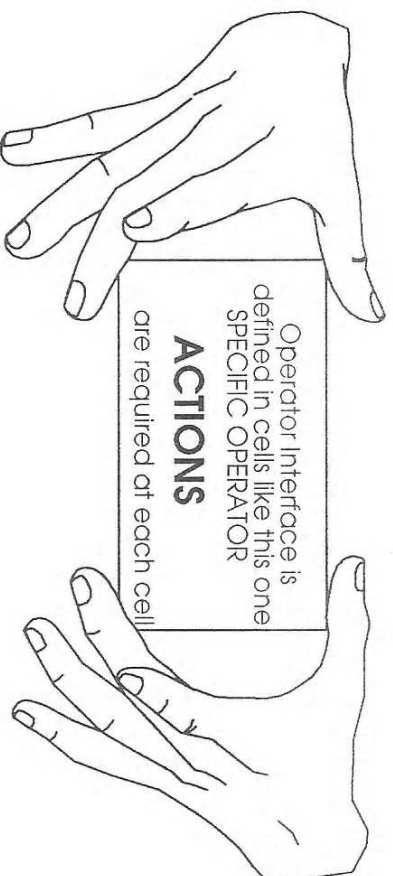
Prerequisites to this course are recommended:

Right-To-Know
GAS PAD ORIENTATION
CYLINDER HANDLING
GASGUARD 450 PANEL OPERATIONS

GASGUARD 450 CYLINDER CHANGE SEQUENCE

This manual presents each step of operator interface with the GasGuard 450 cabinet during a routine cylinder change process. This process is presented through the use of Operator Action Blocks and the associated GasGuard 450 Controller display:

OPERATOR ACTION BLOCK

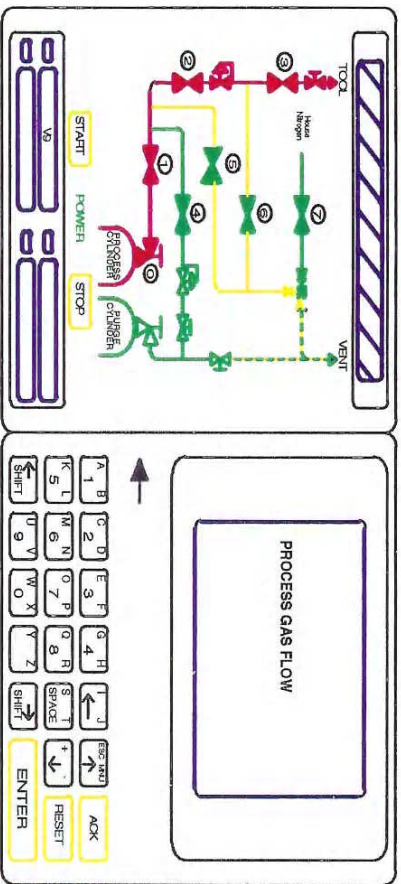


IMPORTANT:

Because Air Products and Chemicals, Inc. software is often "customized" for each customer, customer-specific "Action Blocks" may not be represented here! Your Instructor will inform you of any "Action Prompts" specific to your operations. Please make note of these in this manual and retain for future reference! It is important to follow and respond to ALL Prompts at the GasGuard 450 controller and not just those presented here. Also, be aware of programming changes. Software damage can also occur. If you encounter changes or abnormalities during the course of any cylinder change operation, seek clarification from your Supervisor before proceeding. NEVER ACCEPT A DEVIATION IN THE SOFTWARE THAT IS UNFAMILIAR TO YOU. IT MAY BE THE RESULT OF UNCONTROLLED CHANGES OR SOFTWARE DAMAGE THAT COULD RESULT IN GAS PANEL CONTAMINATION, CORROSION OR OVER-PRESSURIZATION AND CREATE A HAZARDOUS CONDITION!

Gas Guard Cabinet Representations appear on the facing page of each action block. These graphic representations are in actual display colors and look like this:

GRAPHICS DISPLAY



CONTROLLER ACTIONS

BEFORE PROCEEDING WITH THIS TRAINING COURSE:

- 1) Be familiar with ALL safety aspects and Personal Protective Equipment requirements for cylinder change activities.
- 2) Review the *Glossary of Terms* used at the back of this manual.
- 3) Review the *Panel Schematic* at the back of this Manual. Your panel type should be inserted.

DURING THE COURSE:

- 4) Review a few responses to ALARM CONDITIONS. You should be familiar with all aspects of GasGuard 450 Operations from *GasGuard 450 Panel Operations Training* (a pre-requisite for this class).

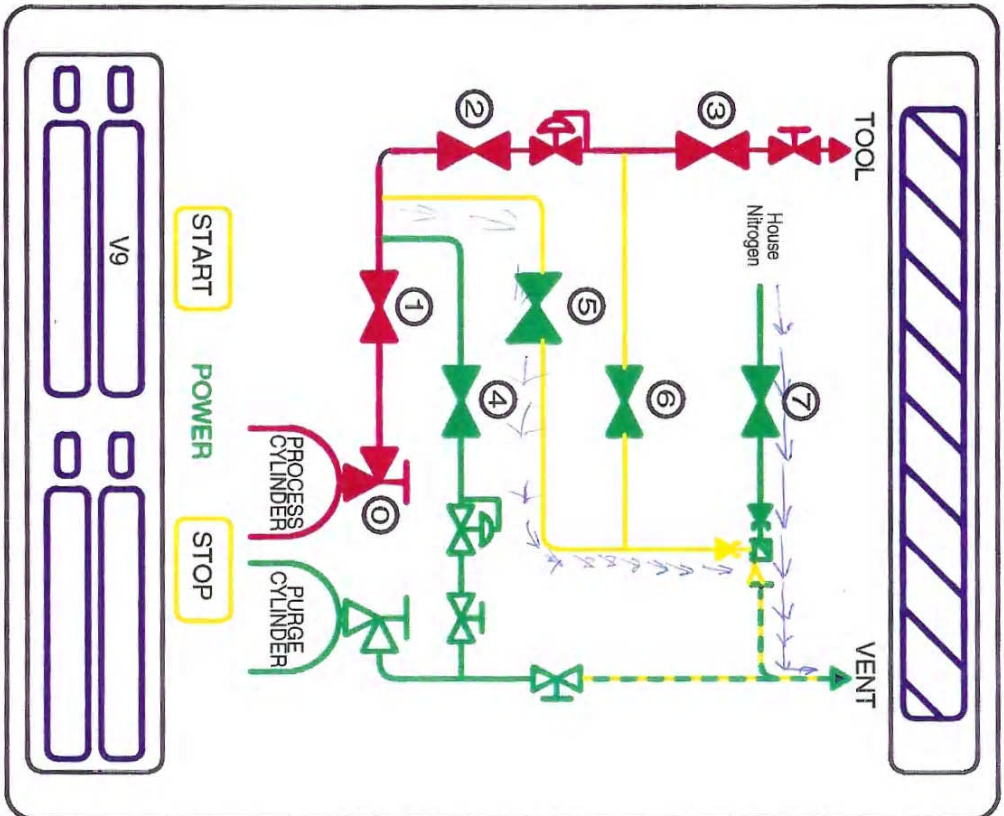
AFTER THE COURSE:

- 5) Retain this manual for future reference. Make notes and forward them to your instructor or supervisor for future manual improvements.

* These actions are generic. ACTUAL displays include pressure and/or weight readings with other customer-specific set point information.

PROCESS GAS FLOW

When you first approach a GasGuard 450 system in the normal operating mode the display will look like this.



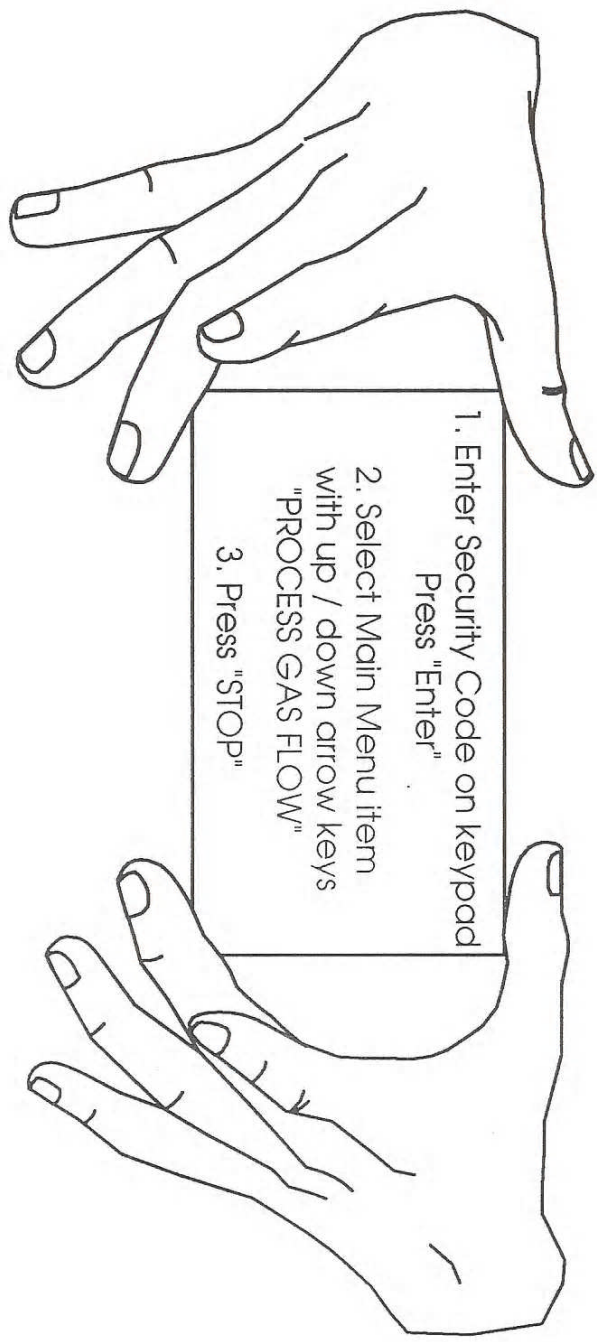
PROCESS GAS FLOW

↑

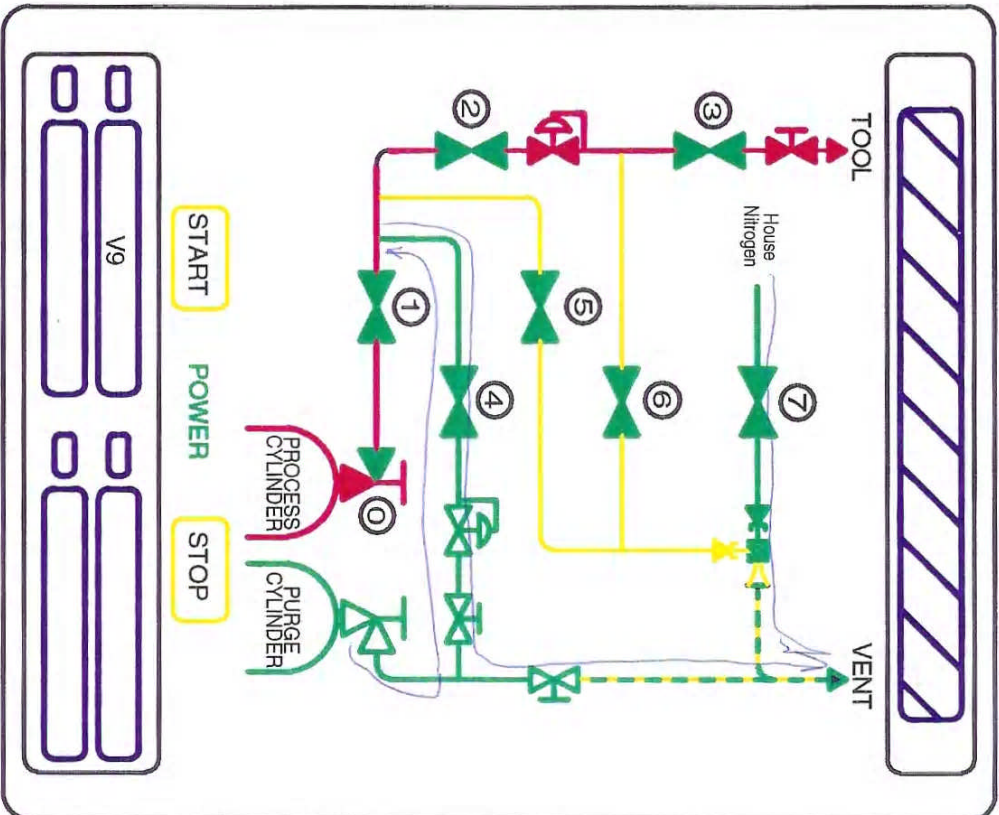
A	B	C	D	E	F	G	H	I	J	ESC. MNU	ACK
1	2	3	4	5	6	7	8	←	→	↑	RESET
K	L	M	N	O	P	Q	R	S	T	+ -	ENTER
5	6	7	8	9	0	X	Y	Z	SPACE	SHIFT	SHIFT
←	SHIFT	U	V	9	0	X	Y	Z	SHIFT	→	SHIFT

STOPPING PROCESS GAS FLOW

To stop gas flow in preparation for a cylinder change perform these actions:



These actions "STOP PROCESS GAS FLOW"



PROCESS GAS STOPPED
CYLINDER VALVE CLOSED

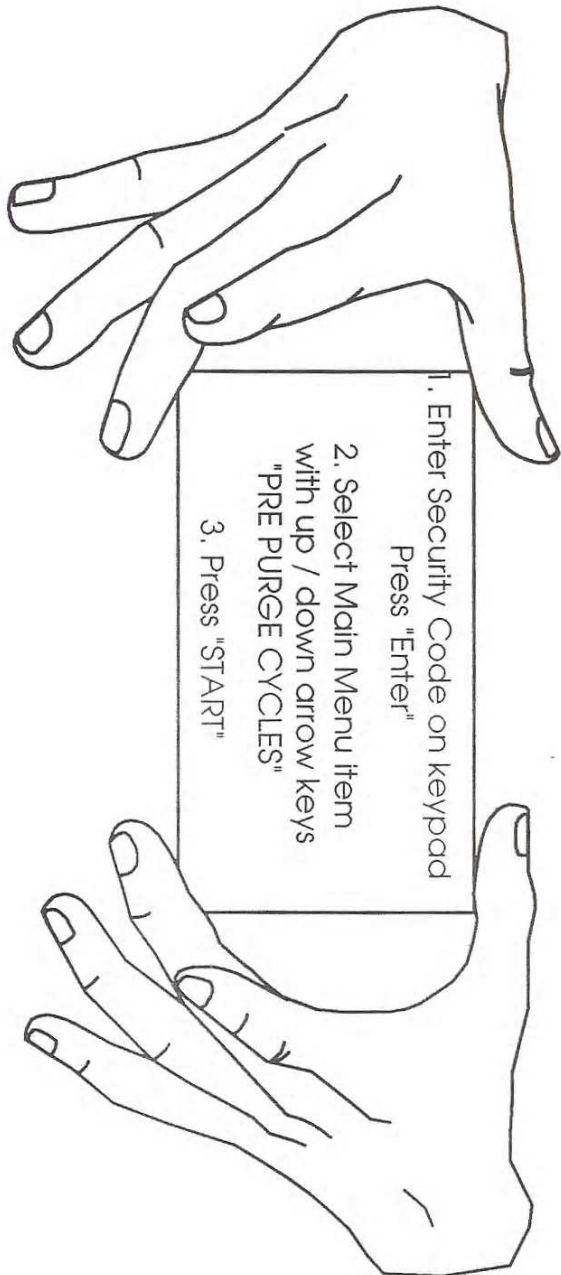
A	B	C	D	E	F	G	H	I	J	ESC
1	2	3	4	5	6	7	8	←	→	MANU
K	L	M	N	O	P	Q	R	S	T	+
5	6	7	8	9	0	Y	Z	SPACE	↓	↑
←	SHIFT	U	V	W	X	Y	Z	→	SHIFT	ENTER

↑

ACK
RESET
ENTER

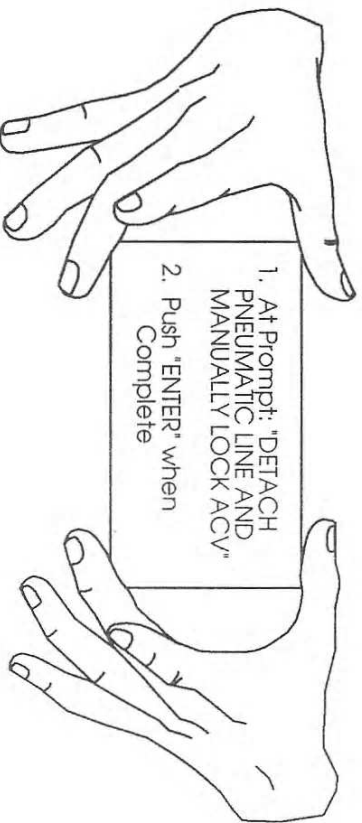
CLOSING CYLINDER VALVE INITIAL PRE-PURGE

Now that process gas flow is stopped, you are ready to CLOSE THE CYLINDER VALVE and PURGE the remaining process gas from the system:

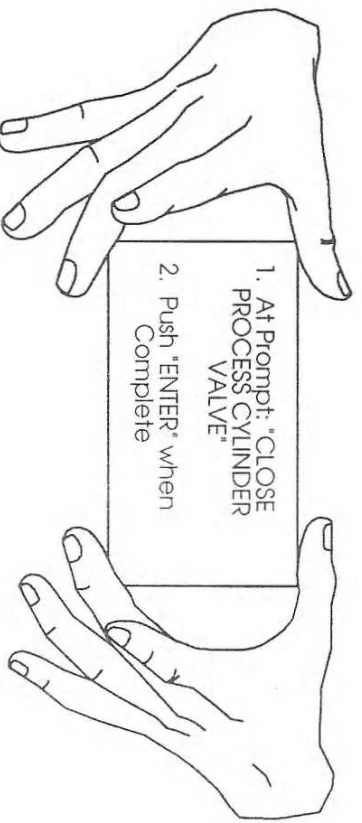


CLOSING CYLINDER VALVE INITIAL PRE-PURGE (continued)

IF YOU HAVE A PNEUMATIC CYLINDER VALVE IT WAS **CLOSED** WHEN YOU "STOPPED PROCESS GAS"



IF YOU HAVE A MANUAL CYLINDER VALVE IT IS **NOT CLOSED** WHEN YOU "STOPPED PROCESS GAS"



PANEL EVACUATION

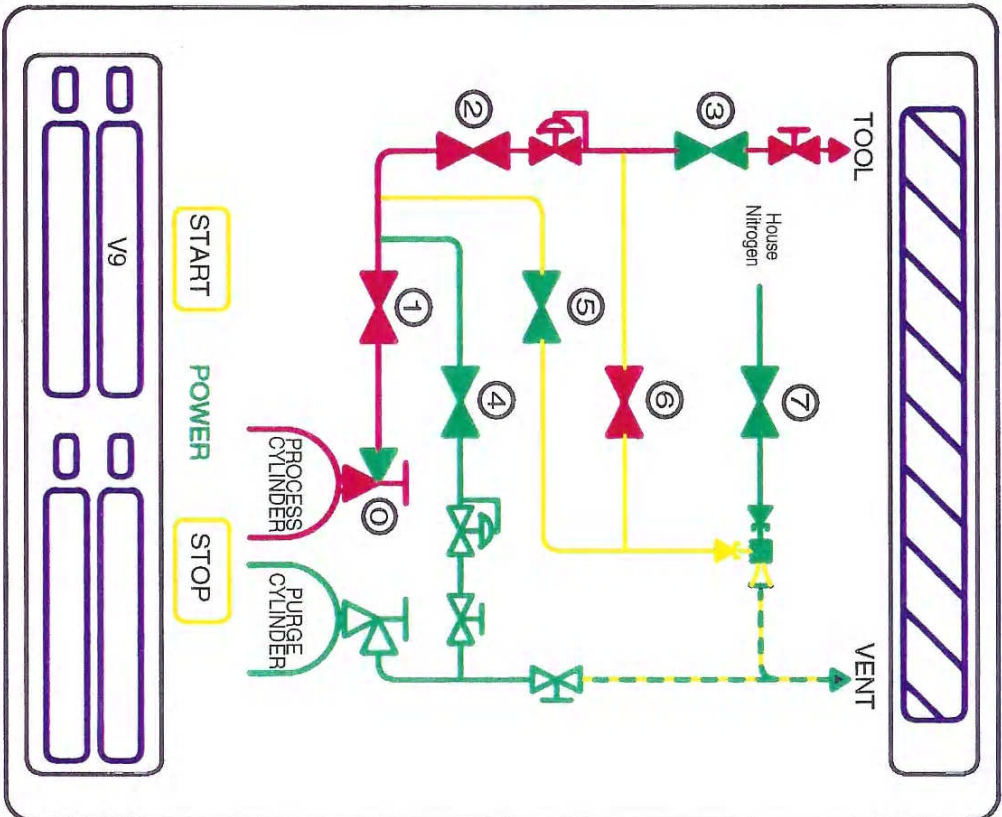
The controller will then begin the process gas evacuation from the panel through the "Low Pressure Vent" AFTER you pushed "ENTER" after you DISCONNECTED the Pneumatic line from the Automatic Control Valve OR CLOSED the manual cylinder valve

If at any time during a "Prompt" for an operator action you do not respond within a user programmed time, the following actions occur:

- Sequence Shuts Down
- Horn Annunciates
- Red Shutdown LED Flashes
- Screen prompts "USER ENTRY TIMEOUT"

Throughout this manual references to this shutdown sequence of events will be made as "USER ENTRY TIMEOUT"

YOU MUST BEGIN THE CYCLE OVER AGAIN WHEN ANY SHUTDOWN OCCURS !



PANEL EVACUATION
THROUGH LOW PRESSURE VENT
PROCESS CYLINDER VALVE (V0)
CLOSED

↑

↓

A	B	C	D	E	F	G	H	I	J	ESC	MANU	ACK
1	2	3	4	5	6	7	8	←	→	↑	↓	RESET
K	L	M	N	O	P	Q	R	S	T	+	-	ENTER
←	5	U	9	V	W	X	0	Y	Z	→	SHIFT	
SHIFT												

PANEL EVACUATION

(continued)

Vacuum Venturi Supply Valve (V7) opens. The controller checks to ensure vacuum exists at pressure transducer #5 (PT5) in the panel vent

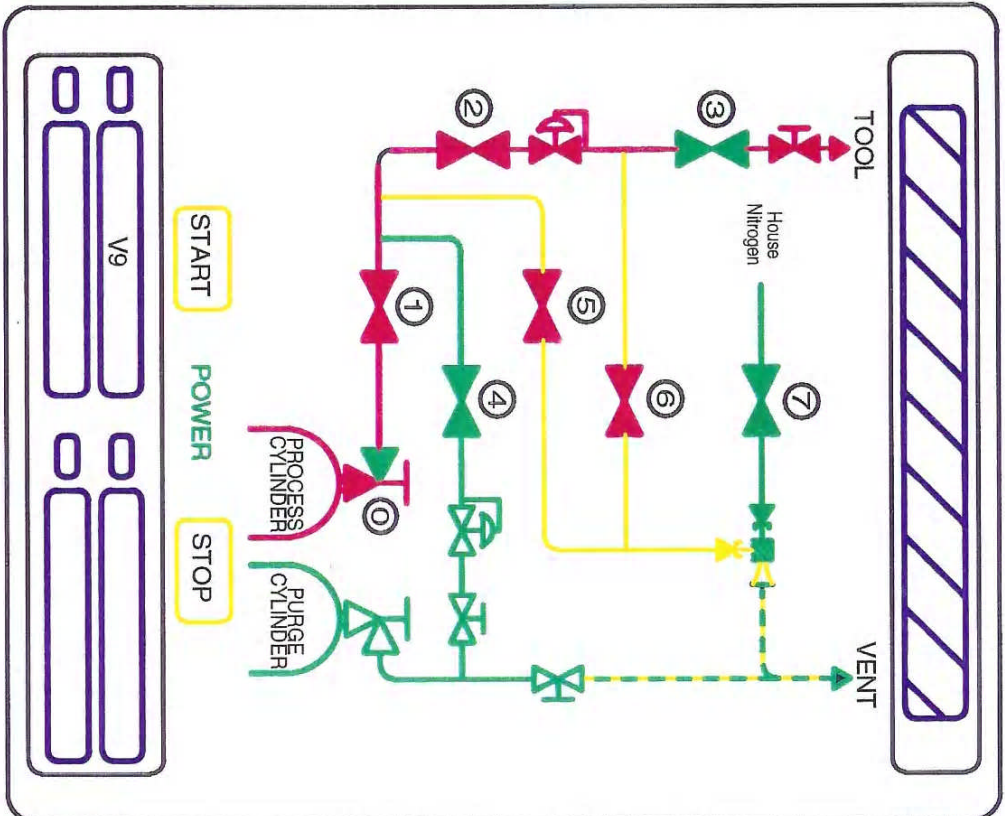
Low Pressure Vent Valve (V6) opens. The controller checks to ensure vacuum exists at pressure transducer #2 (PT2) in the panel process delivery side (low pressure side)

High Pressure Process Valve (V2) and Emergency Shutoff Valve (V1) on the pigtail open. The controller checks to ensure vacuum exists at pressure transducer #1 (PT1) on the pigtail (high pressure side)

High Pressure Vent Valve (V5) opens to remove remaining "trapped" process gas from the high pressure vent side of the panel.

REMEMBER: If any of these checks FAIL - You will receive "LOW VACUUM" prompts

STOP THE CHANGE PROCESS and NOTIFY YOUR SUPERVISOR



PANEL EVACUATION
THROUGH LOW & HIGH PRESSURE
VENT
PROCESS CYLINDER VALVE (V0)
CLOSED

↑

A 1	B 2	C 3	D 4	E 5	F 6	G 7	H 8	I 9	J 0	ESC MANU	ACK
K L	M N	O P	Q R	S T	SPACE	+	-	←	→	RESET	ENTER
← SHIFT	U 9	V 0	W X	Y Z	← SHIFT						

CYLINDER VALVE LEAK CHECK

The "PREPURGE CYCLE" has now evacuated remaining process gas from the panel

Emergency Shut-off Valve (V1), High Pressure Process Valve (V2), Low Pressure Vent Valve (V6), High Pressure Vent Valve (V5) close.

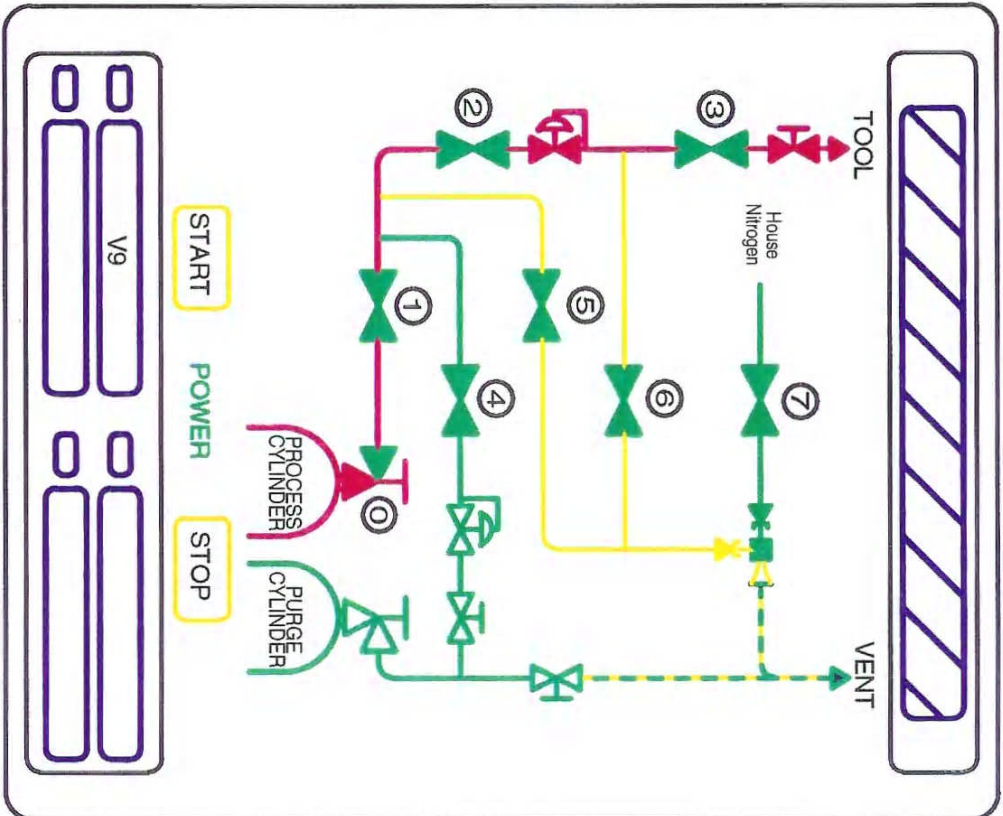
Vacuum Venturi Supply Valve (V7) closes

ALL VALVES ON THE PANEL ARE NOW CLOSED !

Pressure transducer #1 (PT1) is monitored for pressure rise (> 5 psig) for a User-defined period of time (5 minutes is the minimum). A pressure increase would indicate that the cylinder valve is leaking by.

**IF ANY OF THE ABOVE CHECKS FAIL YOU WILL RECEIVE PROMPTS:
"LOW VACUUM" or "CYLINDER LEAKING"
STOP THE CHANGE PROCESS AND NOTIFY YOUR SUPERVISOR**

If Cylinder valve is not leaking by, **Main Purge Cycle** will automatically begin.



CYLINDER VALVE CONNECTION
LEAK CHECK - VACUUM DECAY
CYLINDER VALVE (V0) CLOSED

↑

A	B	C	D	E	F	G	H	I	J	ESC	MANU
1	2	3	4	5	6	7	8	←	→	↩	↪
K	L	M	N	O	P	Q	R	S	T	+	.
5	6	7	8	9	0	X	Y	Z	SPACE	↵	RESET
←	SHIFT	U	V	W	X	Y	Z	→	SHIFT	ENTER	ACK

MAIN PURGE - HIGH PRESSURE SIDE

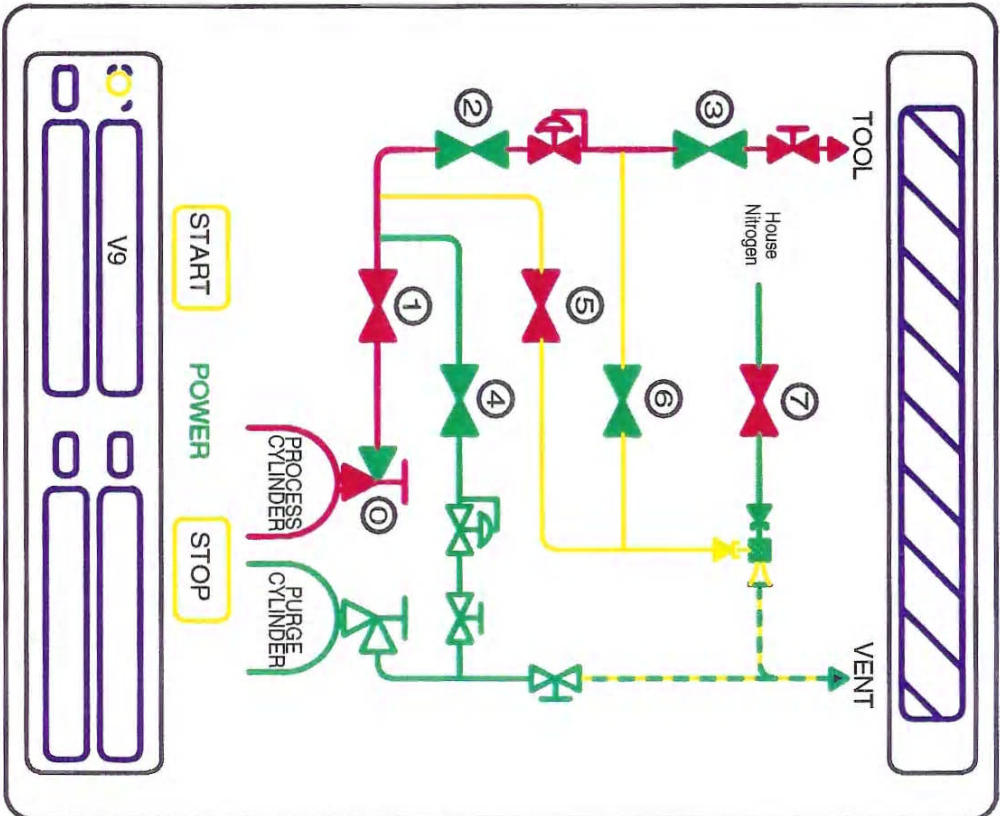
Venturi Vacuum Cycle

Vacuum Venturi Supply Valve (V7) opens. The controller checks to ensure vacuum exists at pressure transducer #5 (PT5) on the pigtail

High Pressure Vent Valve (V5) opens.

Emergency Shutoff Valve (V1) on the pigtail opens.

These actions pull a vacuum to the closed cylinder valve for 15 seconds.



HIGH PRESSURE PURGE
VENTURI VACUUM CYCLE

↑

A 1	B 2	C 3	D 4	E 5	F 6	G 7	H 8	I 9	J 0	ESC (MNU)
K L	M N	O P	Q R	S SPACE	T	Y Z	←	→	↑	↓
← SHIFT	U 9	V 0	W X	Y Z	← SHIFT	ENTER	RESET	ACK		

MAIN PURGE - HIGH PRESSURE SIDE

Purge Nitrogen Cycle

High Pressure Vent Valve (V5) closes. The controller checks to ensure vacuum exists at pressure transducer #1 (PT1) in the pigtail.

High Pressure Vent Valve (V5), Pigtail Purge Gas Inlet Valve (V4), and Pigtail Purge Gas Isolation Valve (V9) open to "draw" purge nitrogen into high pressure side.

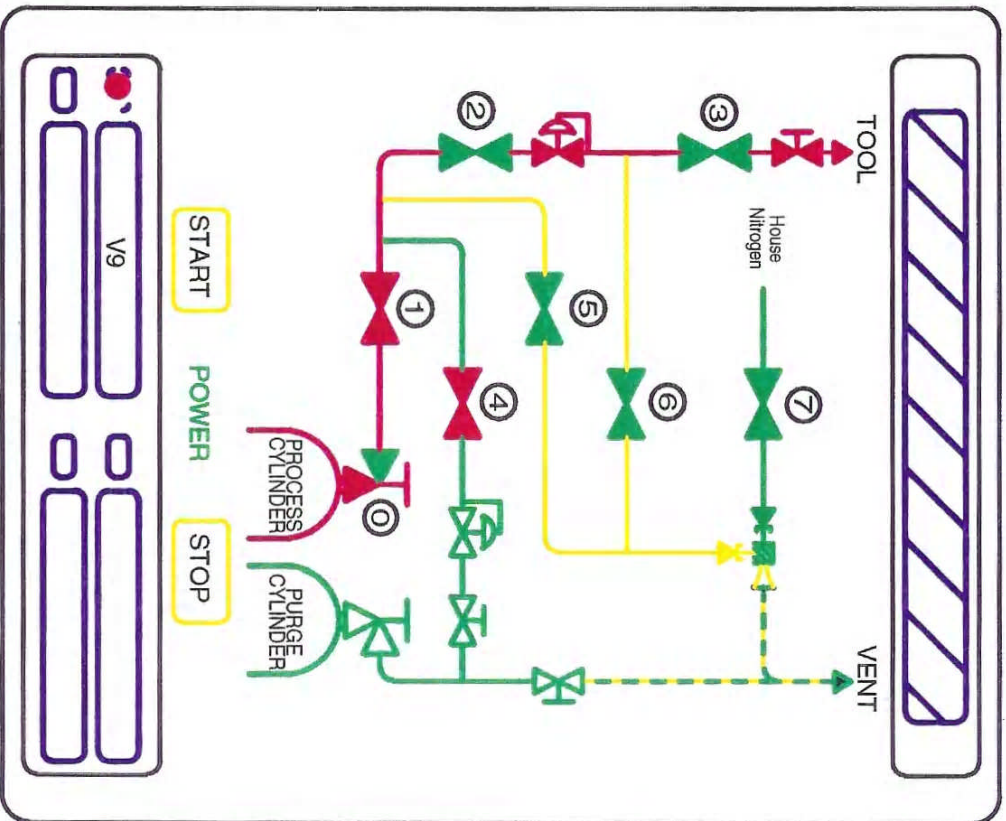
After short delay, High Pressure Vent Valve (V5) closes.

After 5 seconds, Pigtail Purge Gas Inlet Valve (V4), and Pigtail Purge Gas Isolation Valve (V9) close.

The controller checks to ensure that pressure exists (> 70 psig) at pressure transducer #1 (PT1) in the pigtail.

After 5 seconds, V1 and V7 close in preparation for vacuum cycle repeat.

These Vacuum and Purge Nitrogen cycles are called "DEEP PURGE" and repeated a number of times as defined by the user - 20 cycles is minimum.



**HIGH PRESSURE PURGE
PURGE NITROGEN INTRODUCTION**

↑

A	B	C	D	E	F	G	H	I	J	ESC (MNU)	ACK
1	2	3	4	5	6	7	8	←	→	↓	
K	L	M	N	O	P	Q	R	S	T	↑	RESET
5	6	7	8	9	0	X	Y	Z	SPACE	+	
←	SHIFT	U	V	W	X	Y	Z	→	SHIFT	ENTER	

FINAL EVACUATION - PRE PURGE

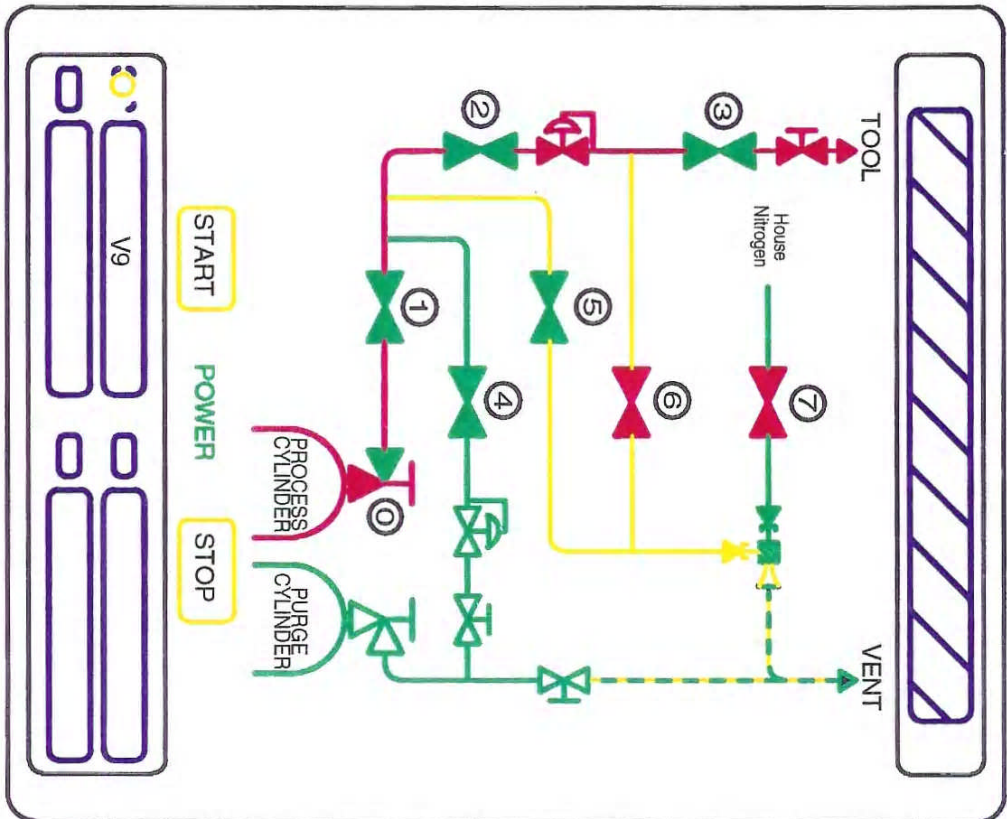
Final Evacuation is a step performed to leave the panel under vacuum after completion of the high pressure purge cycles.

Vacuum Venturi Supply Valve (V7) opens. The controller checks to ensure vacuum exists at pressure transducer #5 (PT5) on the pigtail

Low Pressure Vent Valve (V6) opens.

After 10 seconds, Low pressure Vent Valve (V6) closes.

The controller checks to ensure vacuum exists at pressure transducer #2 (PT2) in the panel process delivery side.



FINAL EVACUATION PRE PURGE
LOW PRESSURE SIDE
VENTURI VACUUM CYCLE

↑

A	B	C	D	E	F	G	H	I	J	ESC (MNU)	ACK
1	2	3	4	5	6	7	8	←	→	↵	RESET
K	L	M	N	O	P	Q	R	S	T	+	ENTER
5	6	7	8	9	0	X	Y	Z	SPACE	↓	
← SHIFT	U	V	W	X	Y	Z	→ SHIFT				

FINAL EVACUATION - PRE PURGE
(Continued)

High Pressure Vent Valve (V5) opens.

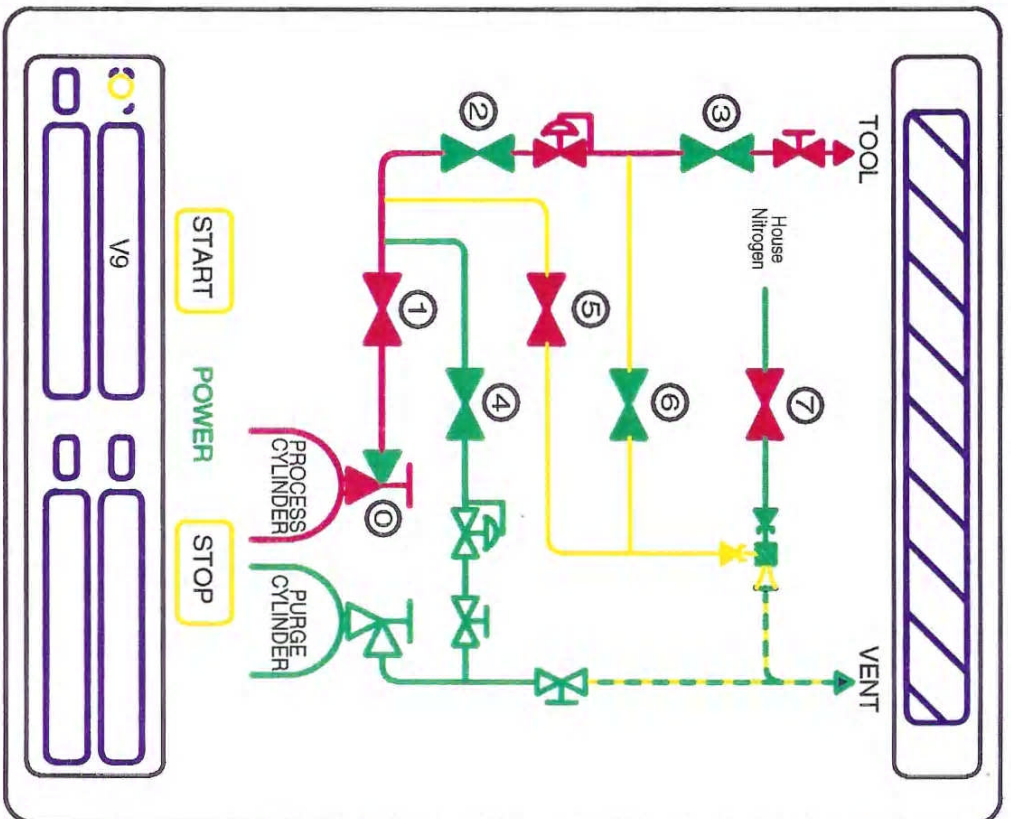
After brief delay, Emergency Shutoff Valve (V1) opens.

After 10 seconds, the controller checks to ensure vacuum exists at pressure transducer #1 (PT1) in the pigtail

After all checks pass, panel is under vacuum.

Valves V1, V5 and V7 close. At this point **ALL VALVES ON PANEL ARE CLOSED.**

Controller will display "BEGIN CHANGE CYLINDER"



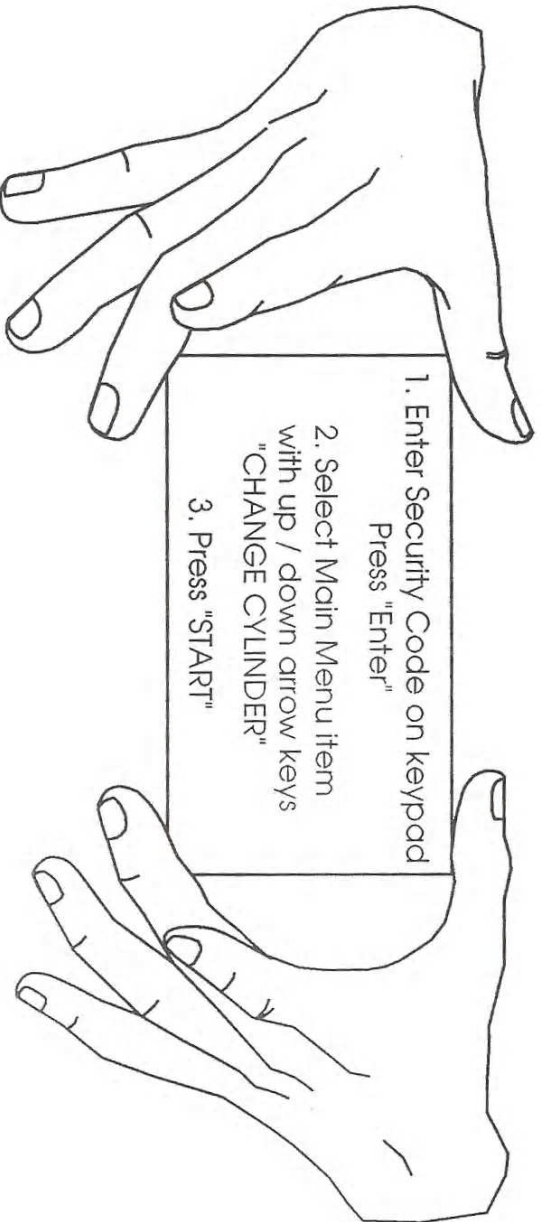
**FINAL EVACUATION PRE PURGE
HIGH PRESSURE SIDE
VENTURI VACUUM CYCLE**

↑

A	B	C	D	E	F	G	H	I	J	ESC MNU	ACK
1	2	3	4	5	6	7	8	←	→	↓	RESET
K	L	M	N	O	P	Q	R	S	T	↑	ENTER
←	5	U	V	W	X	Y	Z	→	SPACE	+	ENTER
SHIFT		9		0				SHIFT			

CHANGE CYLINDER

In these steps the process cylinder will be replaced.

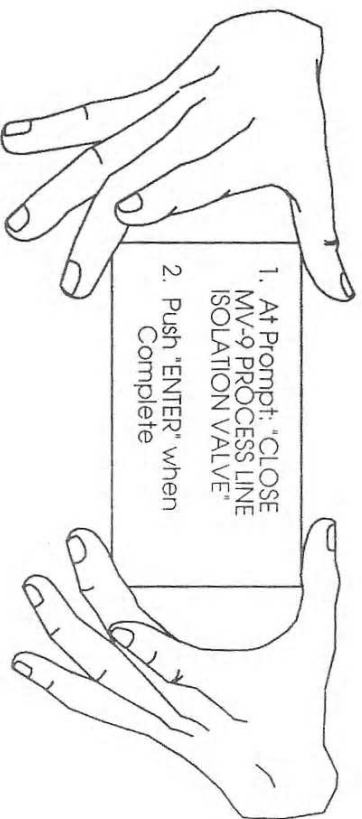


The controller will check pressure transducer #1 (PT1) in the pigtail to ensure vacuum still exists.
This is to ensure that cylinder valve has not leaked by.

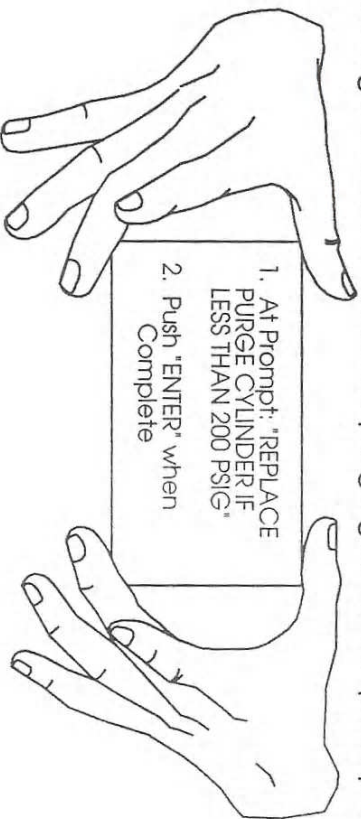
IF THIS CHECK FAILS:

STOP THE CHANGE PROCESS AND NOTIFY YOUR SUPERVISOR

To further protect the process line during cylinder removal, it is recommended that you close the Process Line Isolation Valve (MV9).



You will be prompted to check the nitrogen purge gas cylinder. If it is less than 200 psig, you must change it to have sufficient purge gas to complete purge cycles.



You are allowed 30 minutes to change purge cylinder.

If it takes longer, you will receive "USER ENTRY TIMEOUT" prompt and cycle must be re-started.

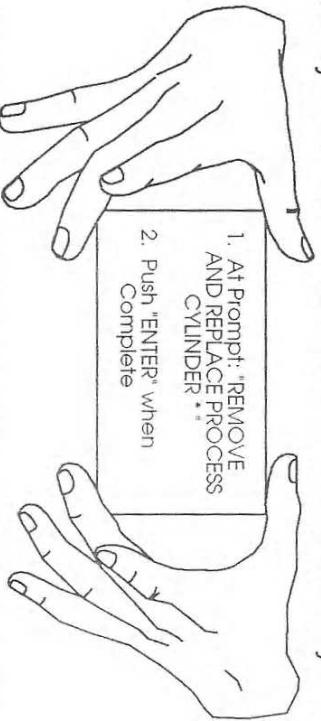
CHANGE CYLINDER (continued)

In this step a nitrogen trickle purge will be introduced to allow continuous nitrogen flow from the pigtail while it is disconnected from the cylinder. This prevents air from getting "back" into the system and potentially contaminating the pigtail with moisture.

Pigtail Purge Gas Inlet Valve (V4) opens. Controller checks to ensure vacuum exists (< -10 psig) at pressure transducer #2 (PT2)

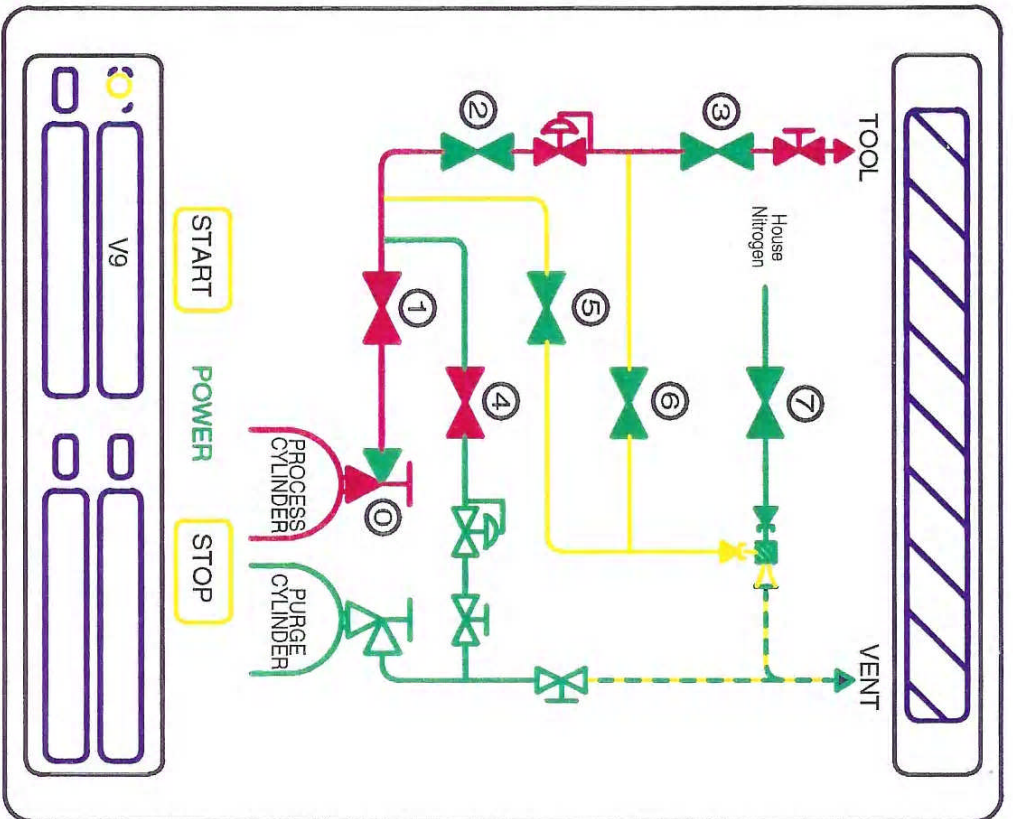
Emergency Shutoff Valve (V1) on the pigtail opens. Controller checks to ensure that pressure exists (> 70 psi) at pigtail transducer #1 (PT1)

If your pigtail is equipped with a pneumatically actuated "Cylinder Safe Flag" it is labeled V10 and opens to allow access to the cylinder connection at this time. Now cylinder can be changed.



* Using two wrenches, one to hold the pigtail and the other to turn the CGA nut, loosen the CGA connection. An outward flow of nitrogen purge gas from the pigtail will be heard. Complete the CGA disconnection by hand. Install dust cap on the cylinder CGA. Install the cylinder valve protector cap and remove the cylinder from cabinet. Ensuring that the new cylinder is the correct gas and valve type, install in reverse order - use new gasket if gasket-type CGA fitting is used, hand connect CGA fitting, tighten with torque wrench while using a second wrench to hold pigtail. Ensure that cylinder strap is fastened. *You are allowed 60 minutes to complete change-out.*

If it takes longer, you will receive "USER ENTRY TIMEOUT" prompt and cycle must be re-started.



CHANGE CYLINDER
TRICKLE NITROGEN PURGE
THROUGH PIGTAIL
PROCESS CYLINDER REMOVED

A	B	C	D	E	F	G	H	I	J	ESC
1	2	3	4	5	6	7	8	←	→	MNU
K	L	M	N	O	P	Q	R	S	T	+
5	6	7	8	9	0	X	Y	Z	SPACE	↓
←	SHIFT									

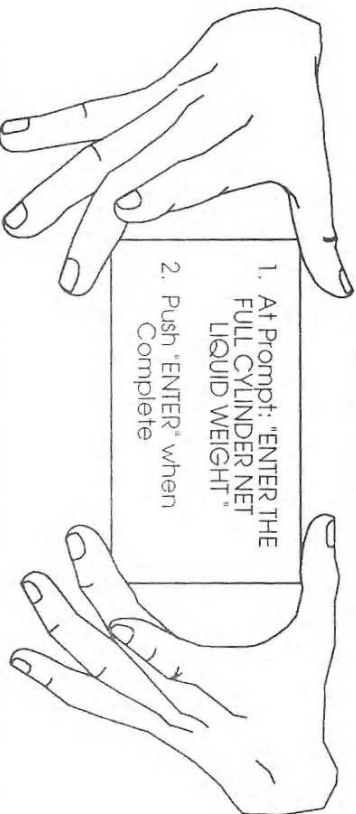
↑

ENTER	RESET	ACK
-------	-------	-----

CHANGE CYLINDER (continued)

If your pigtail is equipped with a pneumatically actuated "Cylinder Safe Flag" (V10), it closes.

ENTRY OF PRODUCT WEIGHT ON LIQUID PRODUCTS ONLY



Full cylinder weight should have been determined prior to starting this change by either:

- 1) Weighing the cylinder on a separate scale. Subtract tare wt. (stamped on cyl.) from gross wt.
- OR
- 2) Reading weight from manufacturer's label on cylinder (where it exists!)

ALWAYS CHECK TO BE SURE YOU KNOW THE WEIGHT OF A LIQUID PRODUCT.

This will ensure correct scale entries and eliminate pre-mature product run-out!

Enter this **NET PRODUCT WEIGHT** as the Full Cylinder Weight.

Pigtail pressure transducer #1 (PT1) is continuously checked for > 70 psig - CGA connection integrity.
Controller closes Pigtail Purge Gas Inlet Valve (V4) and Emergency Shutoff Valve (V1) on the pigtail.

CHANGE CYLINDER (continued)

The panel is now evacuated to validate a Pressure Decay test at the CGA connection.

Vacuum Venturi Supply Valve (V7) opens. Controller checks pressure transducer #5 (PT5) to ensure vacuum exists (< -10 psig)

High Pressure Vent Valve (V5) opens. Pressure transducer #1 (PT1) is monitored for pressure loss (> 70 psig). Lost pressure would indicate an Emergency Shutoff Valve (V1) leak.

High Pressure Vent Valve (V5) and Venturi Supply Valve (V7) close.

Pressure Decay Test #1 is conducted. Controller monitors pressure transducer #1 (PT1) for > 5 psig pressure drop for User-defined amount of time (5 minutes minimum)
This confirms Cylinder Valve closure - No Leak Past Seat !

After Pressure Decay Test #1 passes, panel moves to Final Evacuation prior to Helium Leak Check

Pre-Helium Leak Check Panel Evacuation

Pre Leak Check evacuation is performed to leave the panel under vacuum after completion of the cylinder changeout.

Vacuum Venturi Supply Valve (V7) opens. The controller checks to ensure vacuum exists at pressure transducer #5 (PT5) on the pigtail

Low Pressure Vent Valve (V6) opens.

After 10 seconds, Low pressure Vent Valve (V6) closes.

The controller checks to ensure vacuum exists at pressure transducer #2 (PT2) in the panel process delivery side.

High Pressure Vent Valve (V5) opens.

After brief delay, Emergency Shutoff Valve (V1) opens.

After 10 seconds, the controller checks to ensure vacuum exists at pressure transducer #1 (PT1) in the pigtail

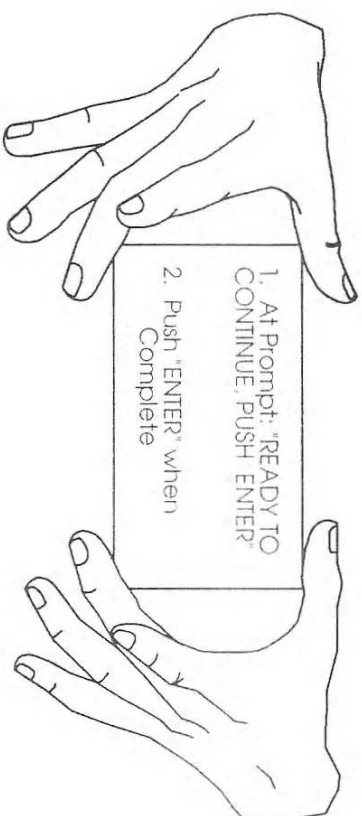
Pre-Helium Leak Check Panel Evacuation (Continued)

Panel is under vacuum.

Valves V1, V5 and V7 close.

ALL VALVES ON PANEL ARE CLOSED.

Controller will prompt "Ready to Continue"



System is ready for Helium Leak Check.

HELIUM LEAK CHECK

At this point, either an Inboard *OR* an Outboard Helium Leak Check cycle will commence.

The leak check type has been pre-selected during the cabinet configuration.

Both Inboard and Outboard Helium Leak Check cycles will be presented here.

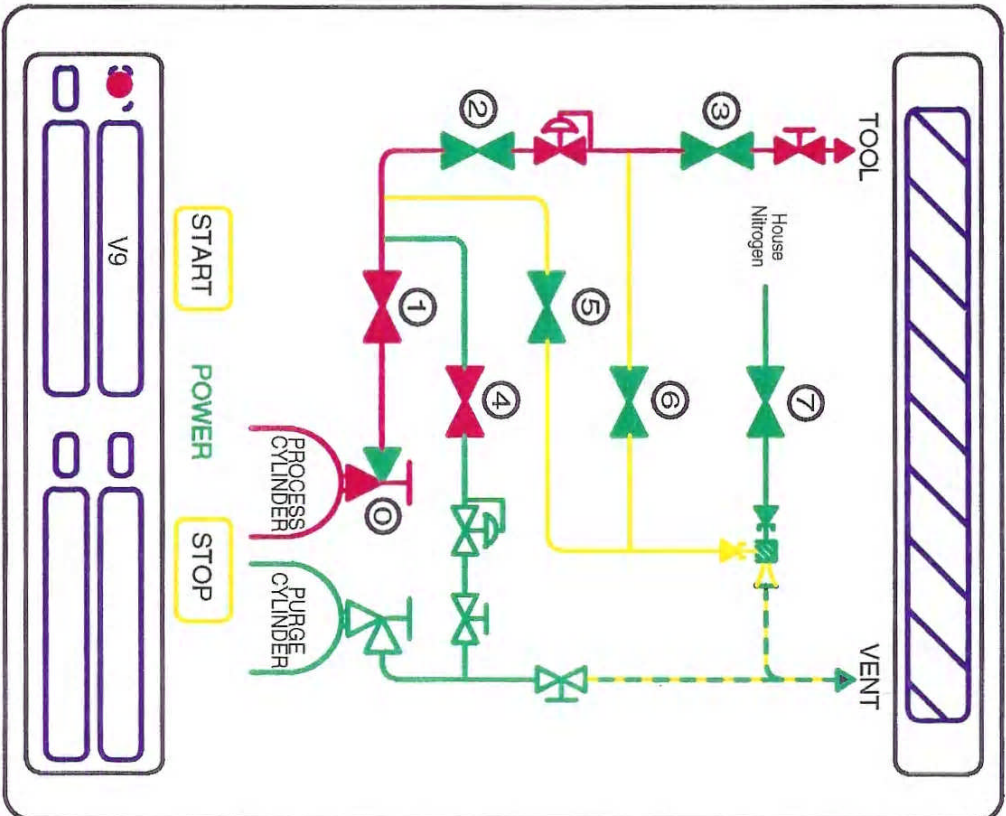
You should have a Helium Leak Detector "warmed up" and ready to go at this time.

You should be trained in helium leak detector operations.

OUTBOARD HELIUM LEAK CHECK

This section will define the controller sequence and operator interface for an Outboard Helium Leak Check. To perform an Outboard leak check a helium source is necessary. Usually helium is mixed with the purge gas (referred to here as nitrogen, but argon can be used)

Pigtail Purge Gas Inlet Valve (V4), Pigtail Purge Gas Isolation Valve (V9), and Emergency Shutoff Valve (V1) open. Controller checks pressure transducer #1 (PT1) to ensure pressure exists (>70 psig)
(to allow Helium/nitrogen mixture to cylinder valve)



OUTBOARD HELIUM LEAK CHECK
 HELIUM, NITROGEN MIXTURE
 TO CYLINDER VALVE CONNECTION

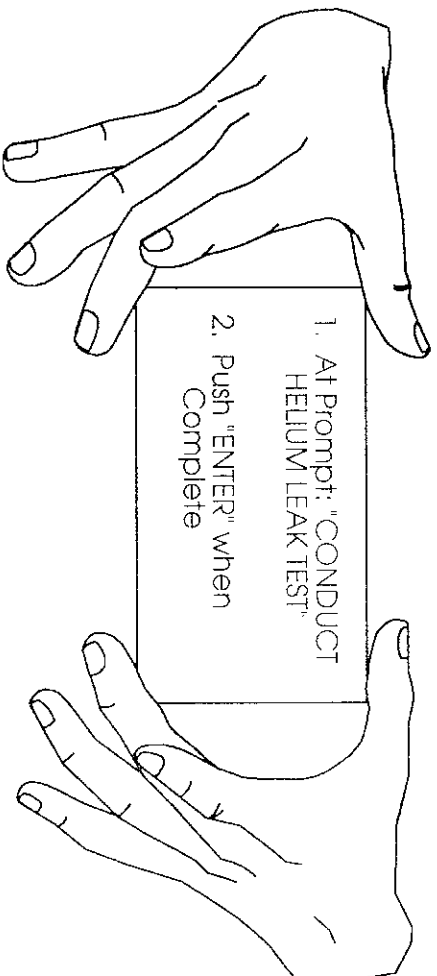
↑

A	B	C	D	E	F	G	H	I	J	ESC	MNU	ACK
1	2	3	4	5	6	7	8	←	→	↑	↓	RESET
K	L	M	N	O	P	Q	R	S	T	+	.	ENTER
←	5	U	V	9	W	X	Y	Z	→	SHIFT	SHIFT	

OUTBOARD HELIUM LEAK CHECK

(continued)

The cylinder valve connection - and any other pigtail mechanical connection in the process flow stream can now be "sniffed" for helium leakage.



Ensure CGA connection is properly "sniffed" for helium !

You are allowed 60 minutes to complete leak test.

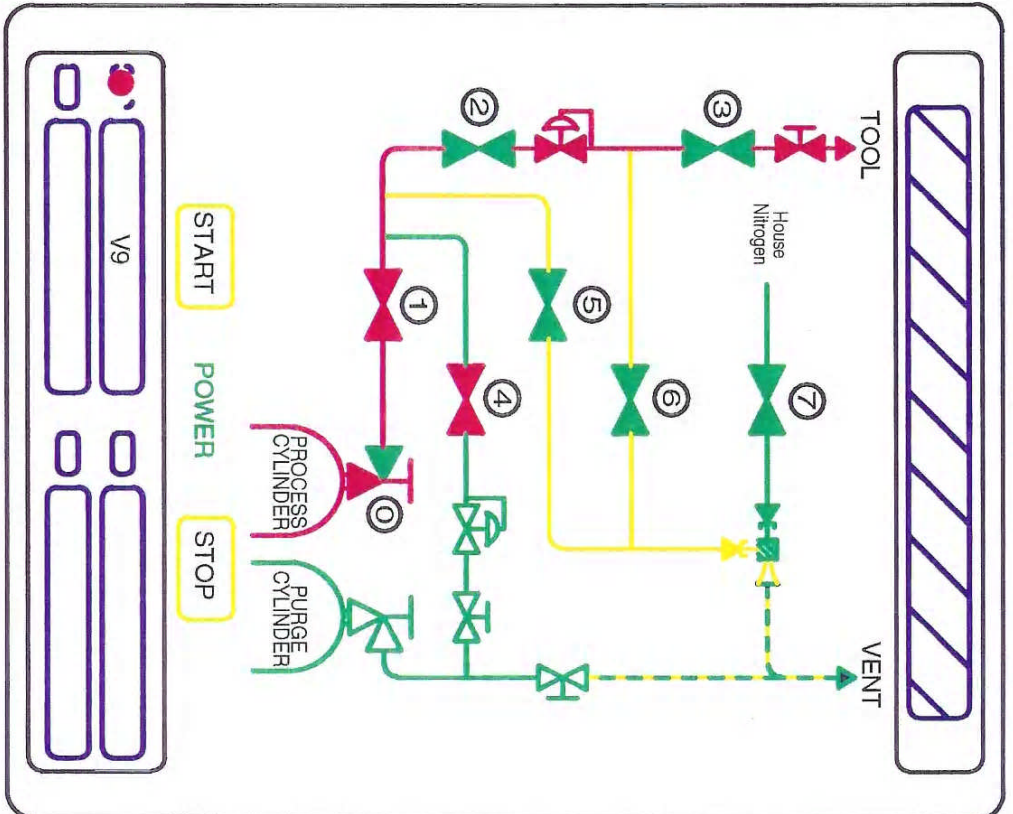
If it takes longer, you will receive "USER ENTRY TIMEOUT" prompt and

Change Cylinder cycle must be re-started.

Emergency Shutoff Valve (V1), Pigtail Purge Gas Inlet Valve (V4), and

Pigtail Purge Gas Isolation Valve (V9) close.

OUTBOARD HELIUM LEAK CHECK is complete, "CHANGE CYLINDER CYCLE" continues



OUTBOARD HELIUM LEAK CHECK
 HELIUM, NITROGEN MIXTURE
 SNIFF CYLINDER VALVE
 CONNECTION

A	B	C	D	E	F	G	H	I	J	ESC	MNU	ACK
1	2	3	4	5	6	7	8	←	→	↑	↓	RESET
K	L	M	N	O	P	Q	R	S	T	+	-	ENTER
5	6	7	8	9	0	X	Y	Z	SHIFT	SHIFT	SHIFT	ENTER

INBOARD HELIUM LEAK CHECK

This section defines the controller sequence and operator interface for an Inboard Helium Leak Check. *There are TWO Versions - One with trickle purge to leak detector during connection and one without. Pay particular attention to the different steps for each !*

INTEL uses NO-trickle purge to avoid possible pressurization and damage to Helium leak detector.

AIR PRODUCTS uses trickle purge to avoid exposing High Pressure Vent Valve seat to atmosphere.

To perform an Inboard leak check a helium source is necessary.

Helium from a small cylinder is used to "spray" in the connection leak-check ports.

Purge Gas Inlet Valve (V4), Pigtail Purge Gas Isolation Valve (V9), and Emergency Shutoff Valve (V1) open. Controller checks pressure transducer #1 (PT1) to ensure pressure exists - > 70 psig.

This ensures that an inert environment exists at CGA connection.

INTEL METHOD (NO TRICKLE PURGE):

Purge Gas Inlet Valve (V4), and Pigtail Purge Gas Isolation Valve (V9) close

High Pressure Vent Valve (V5) opens. Pressure transducer #1 (PT1) is checked for < 5 psig.

High Pressure Vent Valve (V5) closes

INBOARD HELIUM LEAK CHECK

(Continued)

APCI METHOD (TRICKLE PURGE):

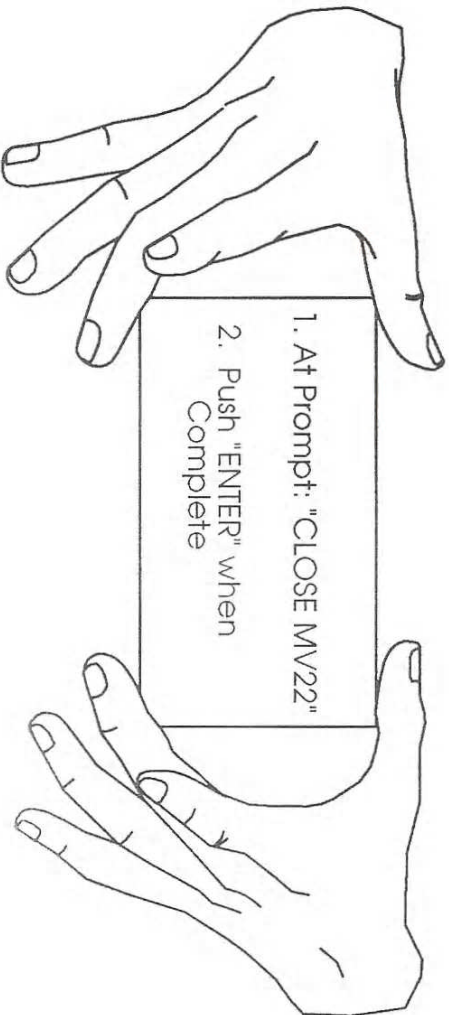
*Pigtail Purge Gas Inlet Valve (V4) and High Pressure Vent Valve (V5) open
- to allow purge nitrogen to high pressure vent side of panel.*

This will allow trickle purge during Helium Leak Detector connection.

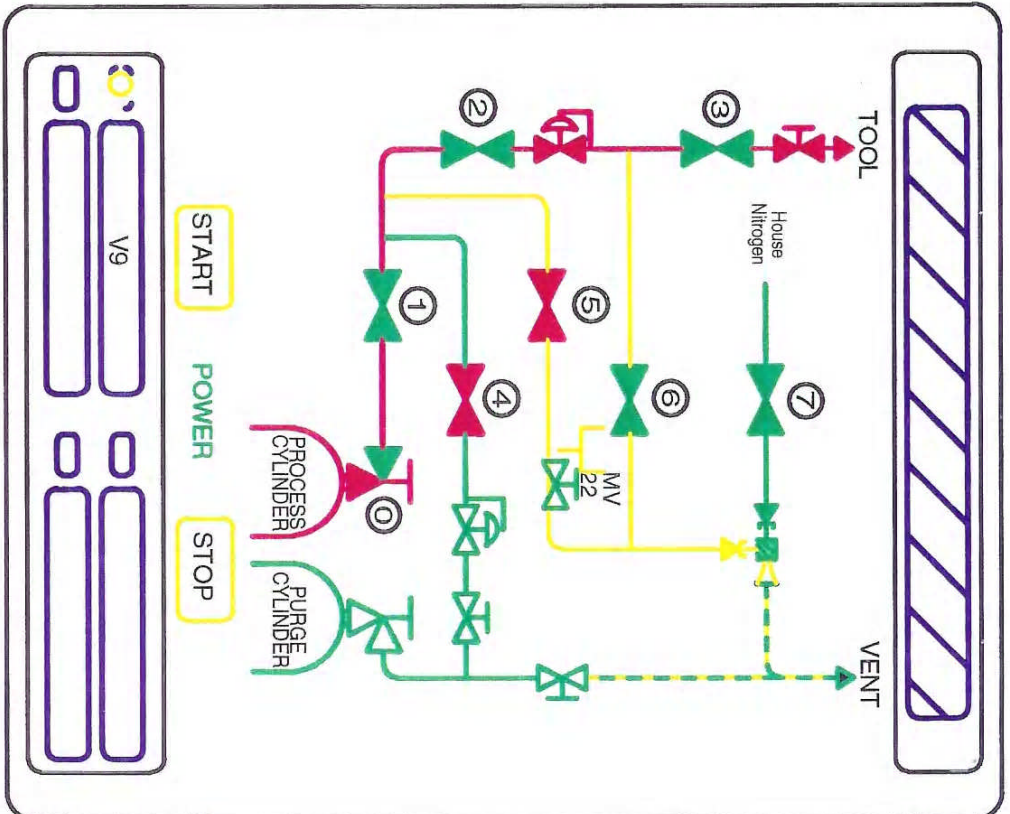
INBOARD HELIUM LEAK CHECK

(Continued)

You will receive a prompt to close Vent Isolation Valve (MV22) to allow connection of the leak detector to the vent side of the panel.



You are ready to connect Leak Detector



INBOARD HELIUM LEAK CHECK
DETECTOR CONNECTION
AIR PRODUCTS

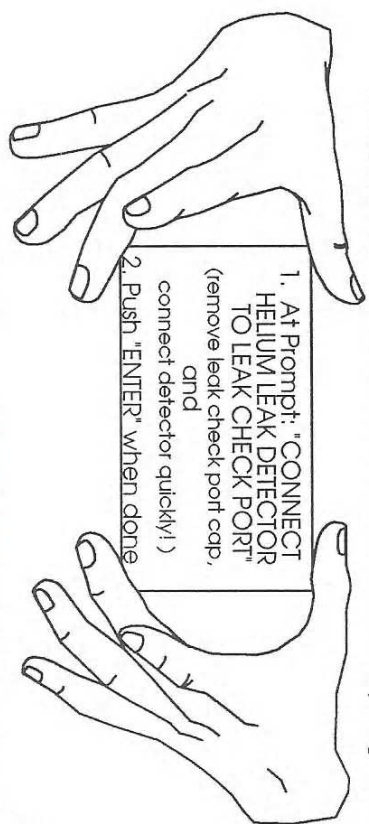
↑

A 1	B 2	C 3	D 4	E 5	F 6	G 7	H 8	I 9	J 0	ESC (MNU)	ACK
K L	M N	O P	Q R	S SPACE	T	←	→	↑	↓	RESET	ENTER
← SHIFT	U 9	V 0	W X	Y Z	← SHIFT	→ SHIFT					

INBOARD HELIUM LEAK CHECK (continued)

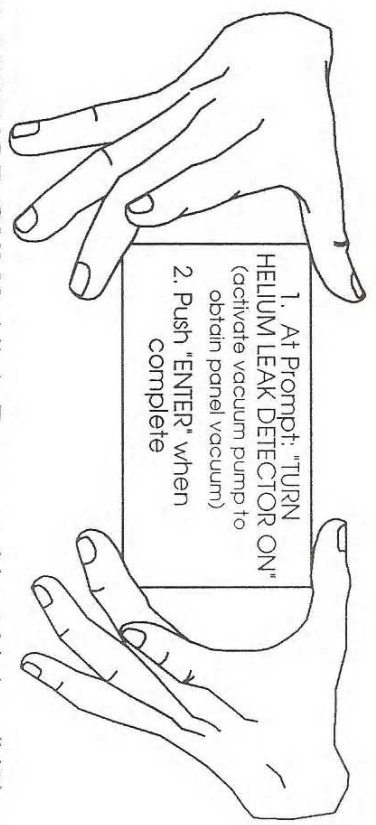
Helium Leak Detector Connection

Air Products METHOD ONLY: *Trickle purge of nitrogen will be felt at this step.*



Remember : USE NEW GASKET !

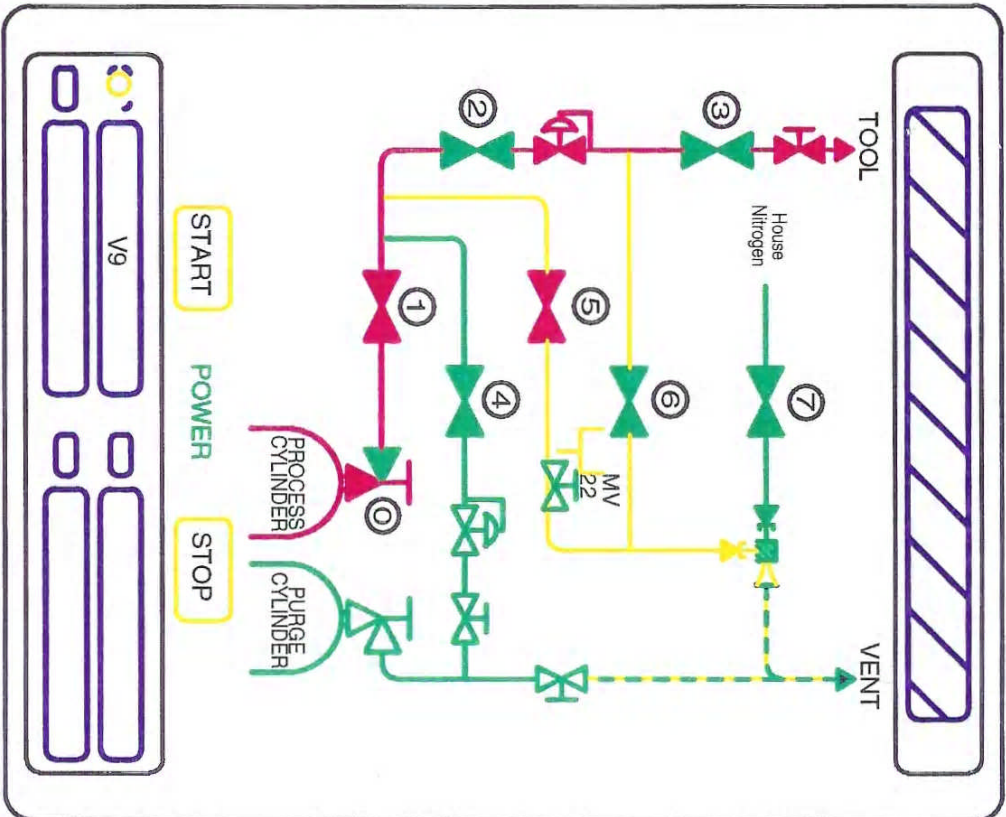
Air Products METHOD ONLY: *Purge Gas Inlet Valve (V4) closes*



INTEL METHOD ONLY: *High Pressure Vent Valve (V5) opens.*

Controller checks pressure transducer #1 to ensure vacuum from pump exists (< -5 psig)
Cylinder Valve Ready to be checked for leakage.

BOTH INTEL and Air Products METHOD at same state.



CYLINDER VALVE CONNECTION READY
FOR INBOARD HELIUM LEAK CHECK
THROUGH LEAK CHECK PORT (MV 22)

A	B	C	D	E	F	G	H	I	J	ESC. MNU
1	2	3	4	5	6	7	8	←	→	↑
K	L	M	N	O	P	Q	R	S	T	+
5	6	7	8	9	0	X	Y	Z	SPACE	↓
← SHIFT									→ SHIFT	ENTER

ACK

RESET

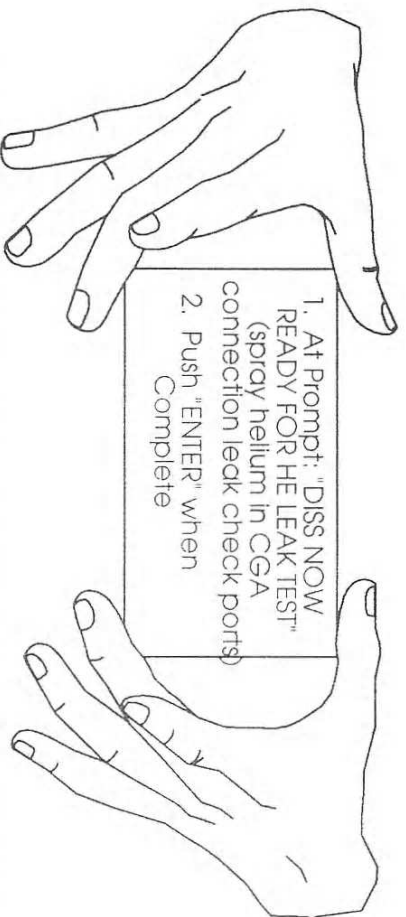
ENTER

INBOARD HELIUM LEAK CHECK

(continued)

At this point you are prompted "Cylinder Valve Connection now ready for Helium Leak Test" (in some cases the acronym "DISS" is substituted for "Cylinder Valve Connection")

AIR PRODUCTS METHOD ONLY: *Be Sure to BYPASS Helium Leak Detector AFTER completing Leak Check and BEFORE pressing enter !! DAMAGE TO PUMP CAN RESULT from pressure surge !*



Ensure CGA connection is properly "sprayed" with helium !

You are allowed 60 minutes to complete leak test. If it takes longer, you will receive "USER ENTRY TIMEOUT" prompt and cycle must be re-started.

INTEL METHOD ONLY: *High Pressure Vent Valve (V5) closes.*

Purge Gas Inlet Valve (V4) opens. PT1 is checked to ensure >70 psig.

Emergency Shutoff Valve (V1) and Purge Gas Inlet Valve (V4) close.

INBOARD HELIUM LEAK CHECK

(continued)

Air Products METHOD ONLY: High Pressure Vent Valve (V5) closes.

Purge Gas Inlet Valve (V4) opens.

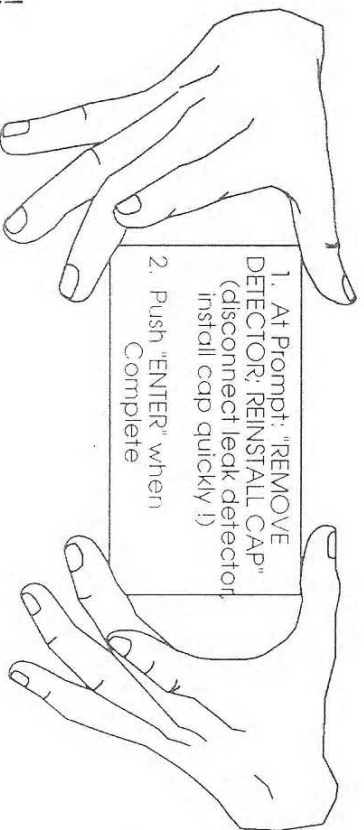
PT1 is checked to ensure > 70 psig.

Emergency Shutoff Valve (V1) closes.

High Pressure Vent Valve (V5) opens.

A nitrogen purge is re-established to helium leak detector port.

You will now disconnect helium leak detector:

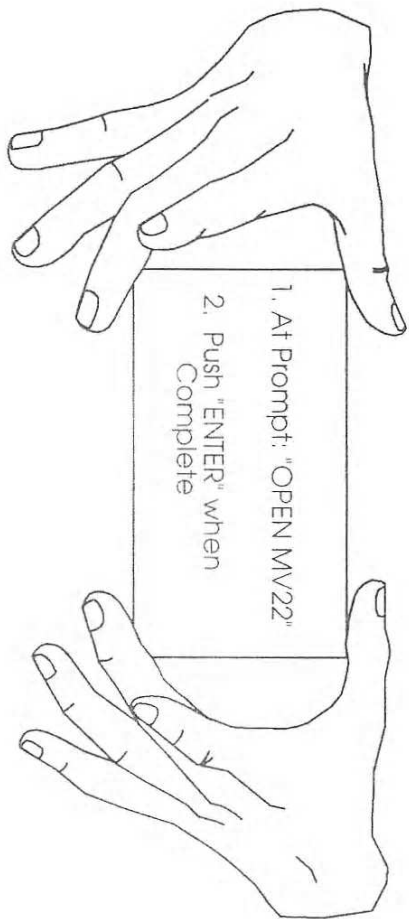


Remember: USE NEW GASKET !

You are allowed 30 minutes to complete leak detector disconnect. If it takes longer, you will receive "USER ENTRY TIMEOUT" prompt and cycle must be re-started.

Air Products METHOD ONLY: High Pressure Vent Valve (V5) and Purge Gas Inlet Valve (V4) close.

You will now re-establish High Pressure Vent by closing MV22.



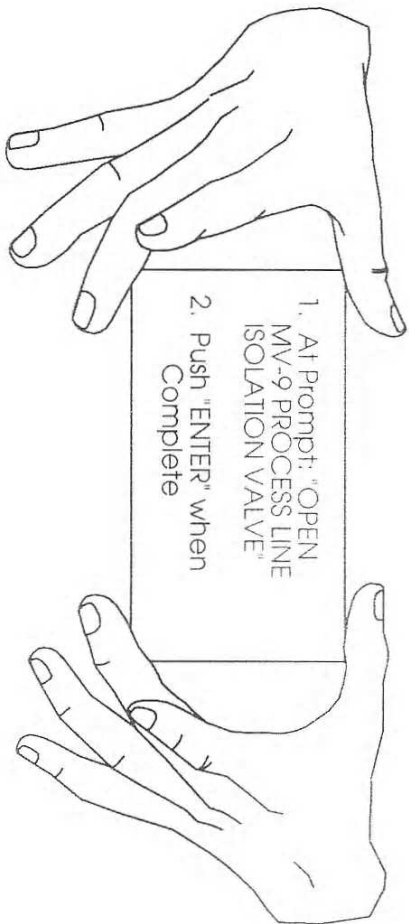
Inboard Helium Leak Check is complete.

"CHANGE CYLINDER CYCLE" Continues

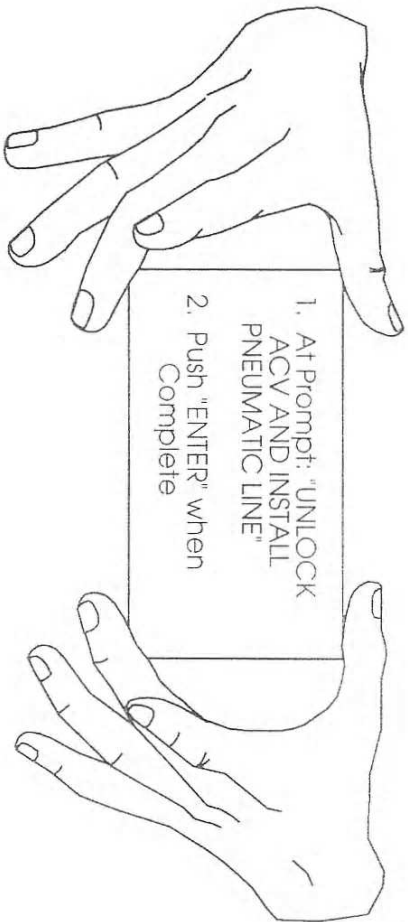
CHANGE CYLINDER (continued)

Continue with the cylinder change
ONLY IF CYLINDER CGA CONNECTION IS NOT LEAKING AND HAS PASSED Helium Leak Check

If you closed the Process Isolation Valve (MV9) earlier, re-open it now:



If You Have a Pneumatic Cylinder Valve, you will connect the pneumatic line now:



Cylinder Connection is complete.

FINAL EVACUATION - CHANGE CYLINDER

Final Evacuation is a step performed to remove any residual purge gas prior to start of purge.

The Vacuum Venturi Supply Valve (V7) opens. The controller checks to ensure vacuum exists at pressure transducer #5 (PT5) on the pigtail

Low Pressure Vent Valve (V6) opens.

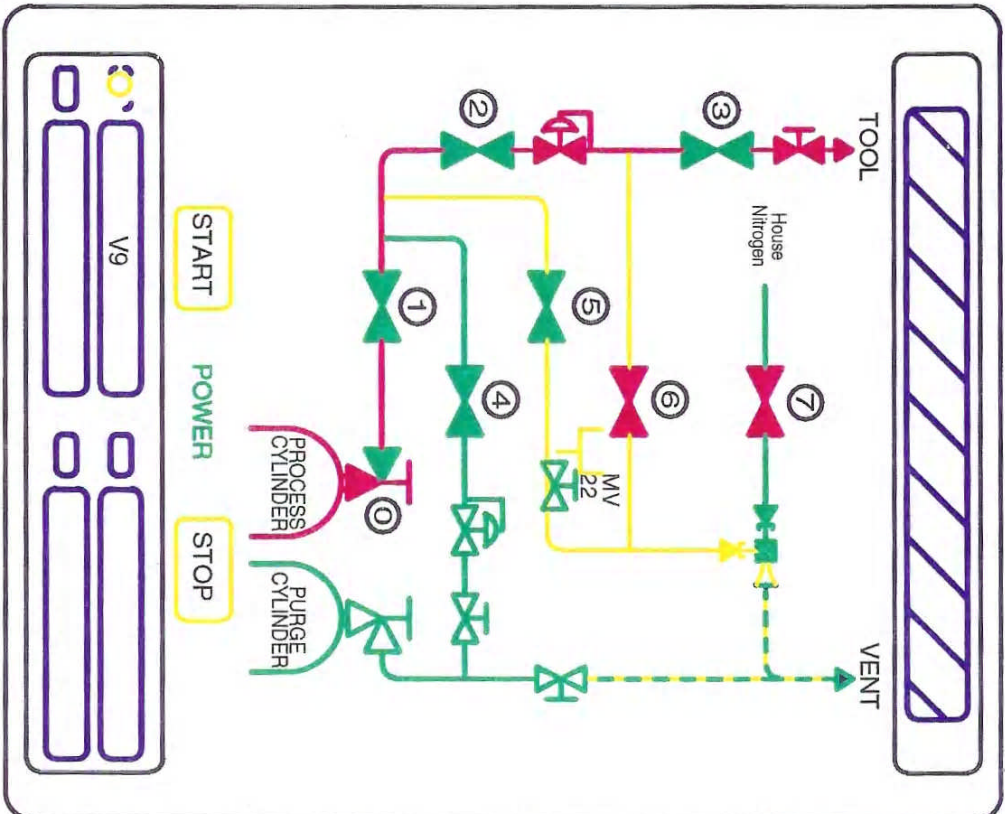
After 10 seconds, Low pressure Vent Valve (V6) closes.

The controller checks to ensure vacuum exists
at pressure transducer #2 (PT2)
in the panel process delivery side.

Remember:

**IF ANY OF THE ABOVE CHECKS FAIL YOU WILL RECEIVE PROMPTS:
"LOW VACUUM"
STOP THE CHANGE PROCESS AND NOTIFY YOUR SUPERVISOR**

YOU MUST BEGIN THE CYCLE OVER AGAIN WHEN ANY SHUTDOWN OCCURS !



FINAL EVACUATION CHANGE CYLINDER
LOW PRESSURE SIDE
VENTURI VACUUM CYCLE

↑

A	B	C	D	E	F	G	H	I	J	ESC. MNU	ACK
1	2	3	4	5	6	7	8	←	→	↑	RESET
K	L	M	N	O	P	Q	R	S	T	+	ENTER
SHIFT	5	U	V	9	W	X	0	Y	Z	SHIFT	

FINAL EVACUATION - CHANGE CYLINDER

(Continued)

High Pressure Vent Valve (V5) opens.

After brief delay, the Emergency Shutoff Valve (V1) opens.

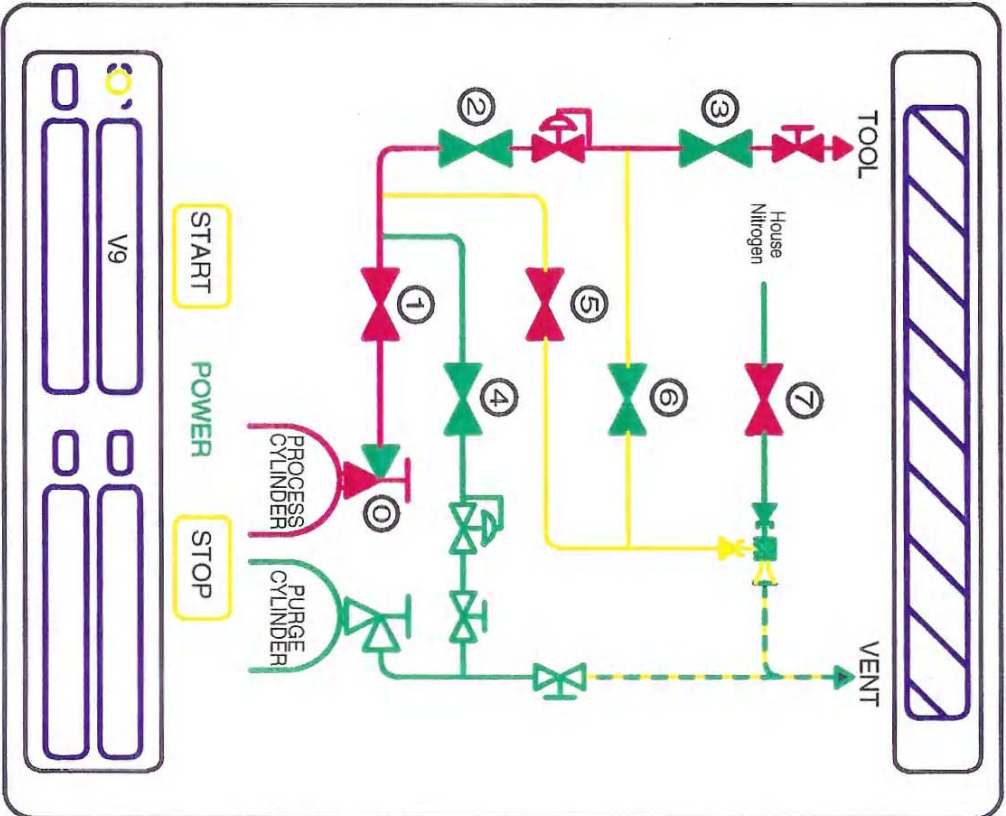
After 10 seconds, the controller checks to ensure vacuum exists at pressure transducer #1 (PT1) in the pigtail

After all checks pass, panel is under vacuum.

Valves V1, V5 and V7 close. At this point **ALL VALVES ON PANEL ARE CLOSED.**

Pressure transducer #1 (PT1) is enabled to monitor cylinder valve for leakage (< -5 psig)

Controller will display "BEGIN POST PURGE"



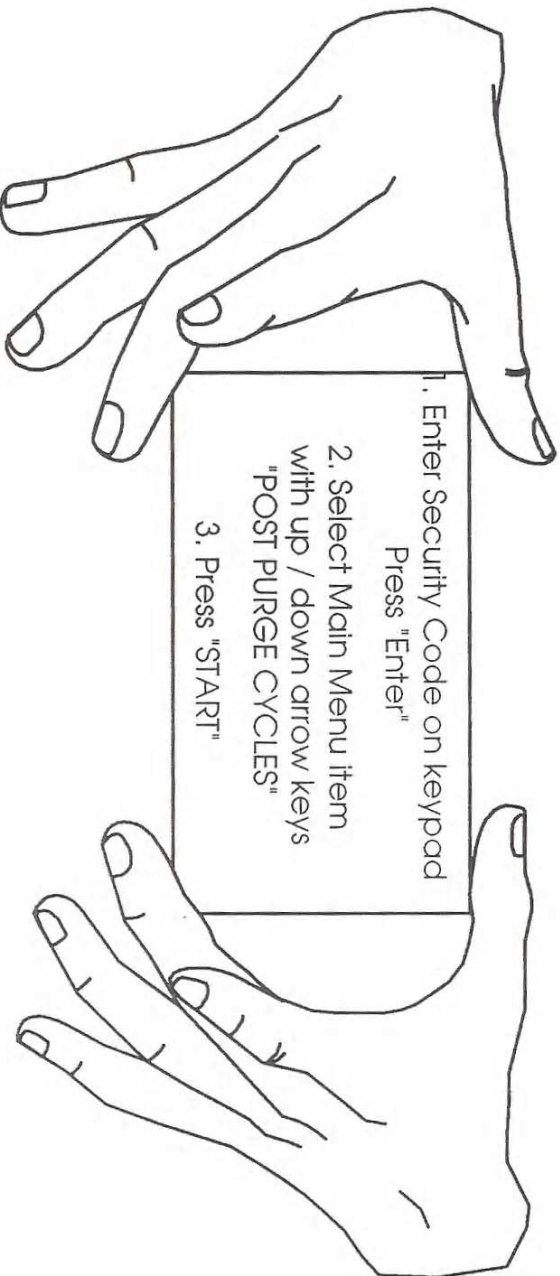
FINAL EVACUATION CHANGE CYLINDER
HIGH PRESSURE SIDE
VENTURI VACUUM CYCLE

← SHIFT	A 1	B 2	C 3	D 4	E 5	F 6	G 7	H 8	I 9	J 0	ESC. MENU
← SHIFT	K 1	L 2	M 3	N 4	O 5	P 6	Q 7	R 8	S 9	T 0	←
← SHIFT	U 1	V 2	W 3	X 4	Y 5	Z 6	SPACE	←	→	→	↑
← SHIFT	ENTER	RESET	ACK								

↑

POST PURGE CYCLE

Now you can begin *Post Purge Cycle* to remove any air from system prior to opening new cylinder:



Controller verifies that vacuum exists (< -5 psig) at pressure transducer #1 (PT1).
To ensure that system has remained at vacuum. (NO cylinder valve leak)

Purge Gas Inlet Valve (V4), Purge Gas Inlet Isolation Valve (V9), and
Emergency Shutoff Valve (V1) open.

The high pressure side of the panel is pressurized to the cylinder valve with purge gas.

Purge Gas Inlet Valve (V4) and Purge Gas Inlet Isolation Valve (V9) close.

Pressure transducer #1 (PT1) and pressure transducer #2 (PT2) are enabled.

(PT1 > 70 psig and PT2 > 10 psig)

This step validates next step "Pressure Decay Test"

(ensures pressure exists)

DECAY TEST for CGA connection integrity performed now:

Controller checks pressure transducer #1 (PT1) for > 5 psig pressure drop for

User-defined period of time - APCl minimum is 10 minutes.

This confirms that cylinder CGA connection
is not leaking under purge gas pressure.

If Check Fails:

STOP CHANGE PROCESS and NOTIFY YOUR SUPERVISOR

POST PURGE CYCLE

(continued)

Vacuum Venturi Supply Valve (V7) opens. Pressure transducer #5 (PT5) is checked for vacuum.

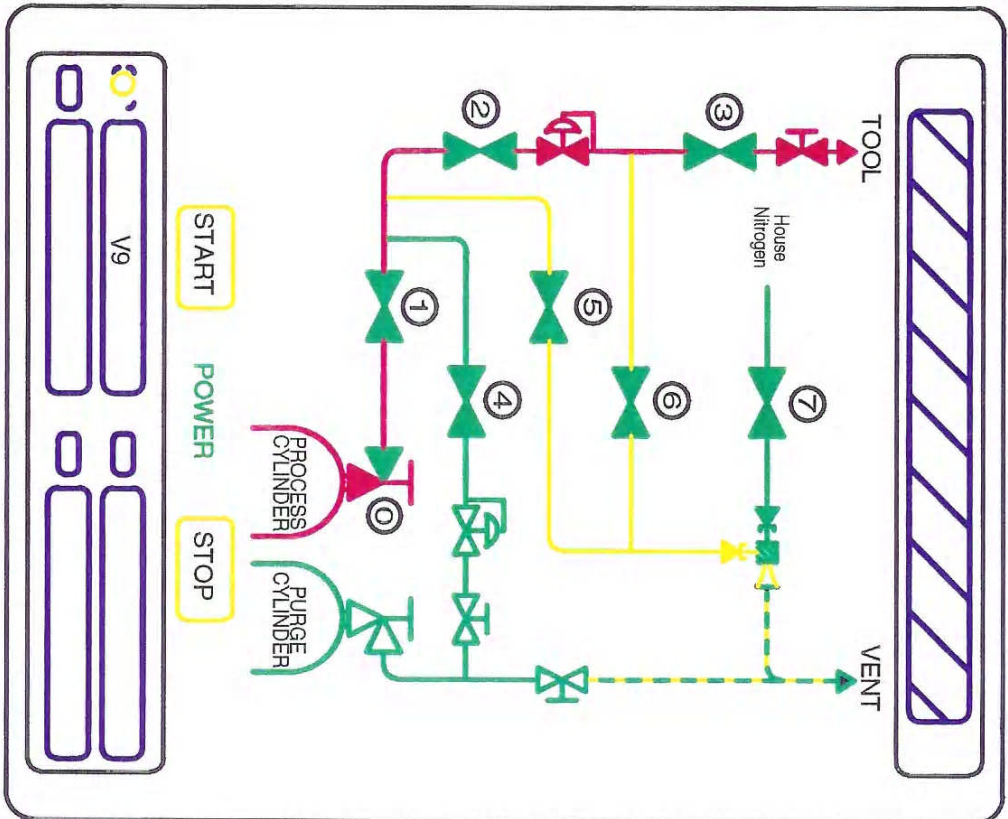
High Pressure Vent Valve (V5) opens.

Pressure Transducer #1 (PT1) is enabled to monitor vacuum (< -10 psig) at CGA connection.

High Pressure Vent Valve (V5), Vacuum Venturi Supply Valve (V7), and
Emergency Shutoff Valve (V1) close

Pressure transducers PT1 and PT2 vacuum checks end.

ALL VALVES ON PANEL ARE CLOSED and HIGH PRESSURE PURGE CYCLE BEGINS



PROCESS GAS STOPPED
ALL VALVES ON PANEL CLOSED

A	B	C	D	E	F	G	H	I	J	ESC
1	2	3	4	5	6	7	8	←	→	MANU
K	L	M	N	O	P	Q	R	S	T	↓
5	6	7	8	9	0	Y	Z	SPACE	+	RESET
←	U	V	W	X	Y	Z	SHIFT	ENTER	ENTER	ACK
SHIFT	9	V	0	X	Z	SHIFT	SHIFT	ENTER	ENTER	ACK

↑

ACK

RESET

ENTER

MAIN PURGE - HIGH PRESSURE SIDE

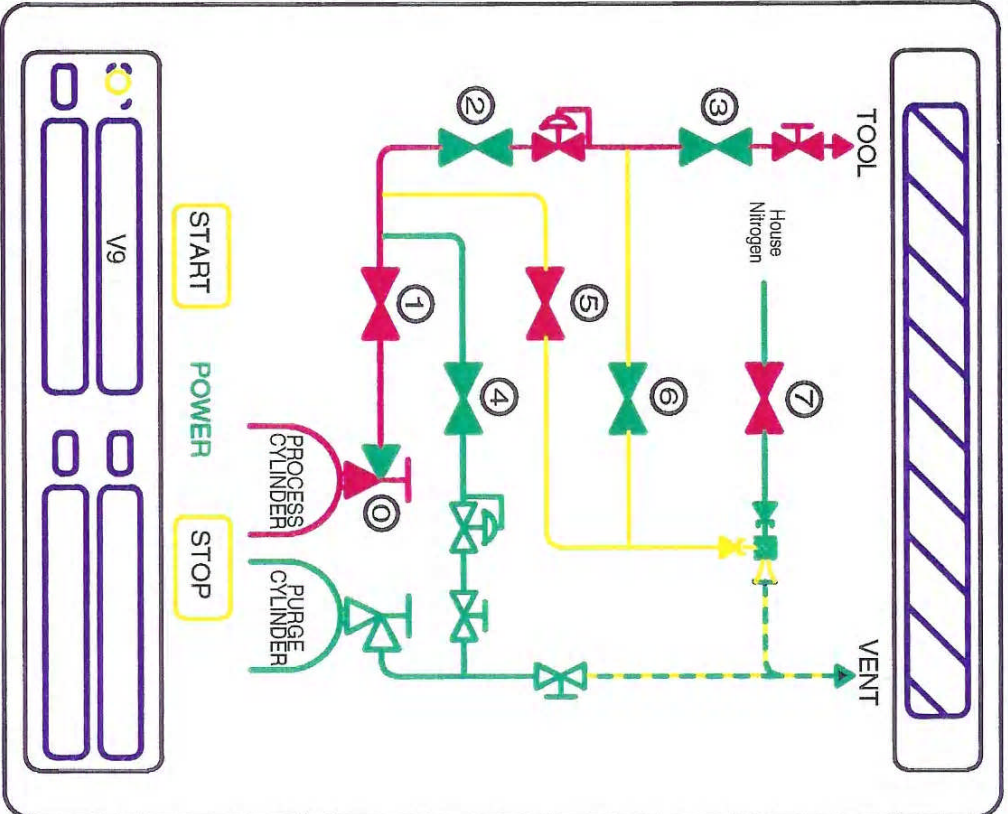
Venturi Vacuum Cycle

Vacuum Venturi Supply Valve (V7) opens. The controller checks to ensure vacuum exists at pressure transducer #5 (PT5) on the pigtail

High Pressure Vent Valve (V5) opens.

Emergency Shutoff Valve (V1) on the pigtail opens.

These actions pull a vacuum to the closed cylinder valve for 15 seconds.



HIGH PRESSURE PURGE
VENTURI VACUUM CYCLE

A	B	C	D	E	F	G	H	I	J	ESC. MNU
1	2	3	4	5	6	7	8	←	→	↑
K	L	M	N	O	P	Q	R	S	T	+
5	6	7	8	9	0	X	Y	Z	SPACE	↓
←	SHIFT	U	V	W	X	Y	Z	SHIFT	→	ENTER

↑

ACK
RESET
ENTER

MAIN PURGE - HIGH PRESSURE SIDE

Purge Nitrogen Cycle

High Pressure Vent Valve (V5) closes. The controller checks to ensure vacuum exists at pressure transducer #1 (PT1) in the pigtail.

High Pressure Vent Valve (V5), Pigtail Purge Gas Inlet Valve (V4), and Pigtail Purge Gas Isolation Valve (V9) open to "draw" purge nitrogen into high pressure side.

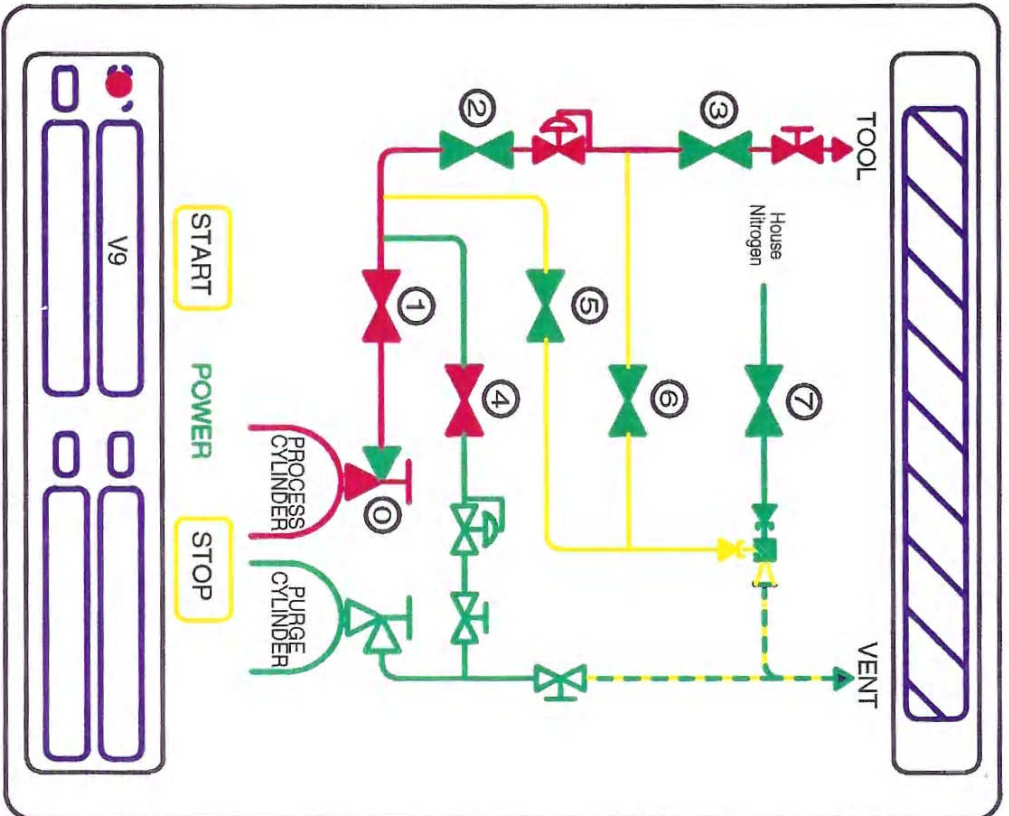
After short delay, High Pressure Vent Valve (V5) closes.

After 5 seconds, Pigtail Purge Gas Inlet Valve (V4), and Pigtail Purge Gas Isolation Valve (V9) close.

The controller checks to ensure that pressure exists (> 70 psig) at pressure transducer #1 (PT1) in the pigtail.

After 5 seconds, V1 and V7 close in preparation for vacuum cycle repeat.

These Vacuum and Purge Nitrogen cycles are called "DEEP PURGE" and repeated a number of times as defined by the user - 20 cycles is minimum.



HIGH PRESSURE PURGE
PURGE NITROGEN INTRODUCTION

A	B	C	D	E	F	G	H	I	J	ESC	MANU
1	2	3	4	5	6	7	8	←	→	↓	↑
K	L	M	N	O	P	Q	R	S	T	+	.
5	6	7	8	9	0	X	Y	SPACE	SHIFT	RESET	ACK
←	SHIFT	U	V	W	X	Y	Z	→	SHIFT	ENTER	

↑

FINAL EVACUATION - POST PURGE

Final Evacuation is a step performed to remove any residual purge gas prior to start of purge.

The Vacuum Venturi Supply Valve (V7) opens. The controller checks to ensure vacuum exists at pressure transducer #5 (PT5) on the pigtail

Low Pressure Vent Valve (V6) opens.

After 10 seconds, Low pressure Vent Valve (V6) closes.

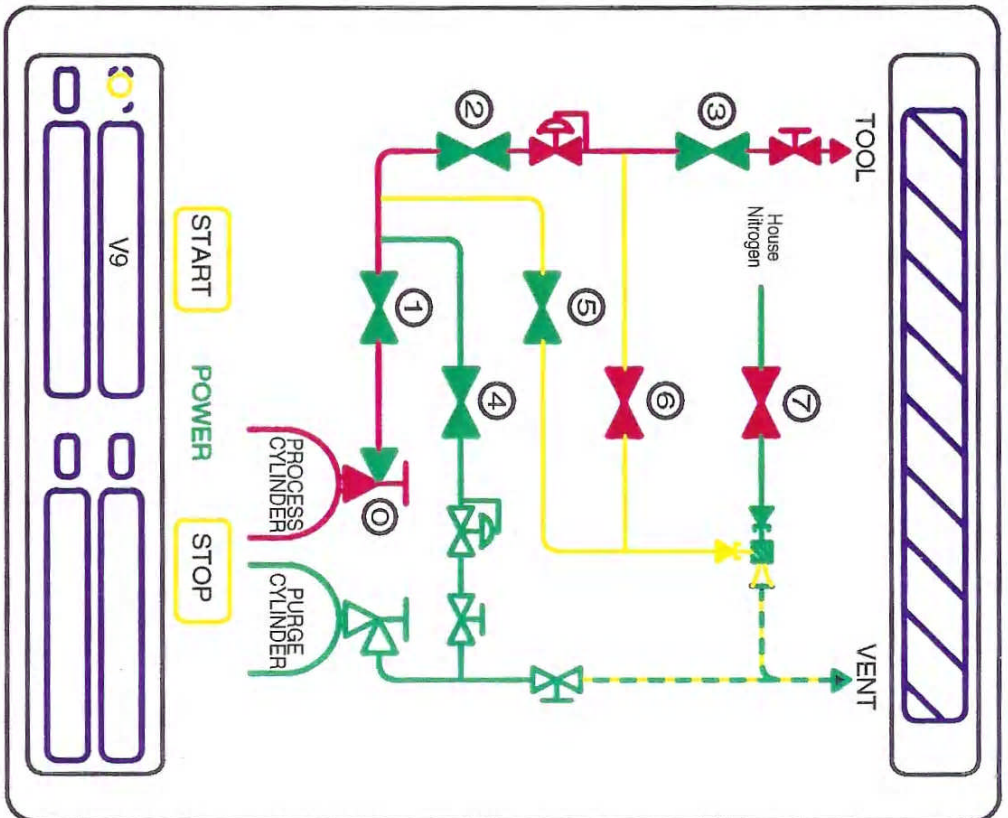
The controller checks to ensure vacuum exists at pressure transducer #2 (PT2) in the panel process delivery side.

Remember:

**IF ANY OF THE ABOVE CHECKS FAIL YOU WILL RECEIVE PROMPTS:
"LOW VACUUM"**

STOP THE CHANGE PROCESS AND NOTIFY YOUR SUPERVISOR

YOU MUST BEGIN THE CYCLE OVER AGAIN WHEN ANY SHUTDOWN OCCURS !



FINAL EVACUATION POST PURGE
LOW PRESSURE SIDE
VENTURI VACUUM CYCLE

A	B	C	D	E	F	G	H	I	J	ESC	ACK
1	2	3	4	5	6	7	8	←	→	↓	↑
K	L	M	N	O	P	Q	R	←	→	+	RESET
5	6	9	V	U	X	W	Z	←	→	ENTER	ENTER
SHIFT								SHIFT			

FINAL EVACUATION - POST PURGE

(Continued)

High Pressure Vent Valve (V5) opens.

After brief delay, the Emergency Shutoff Valve (V1) opens.

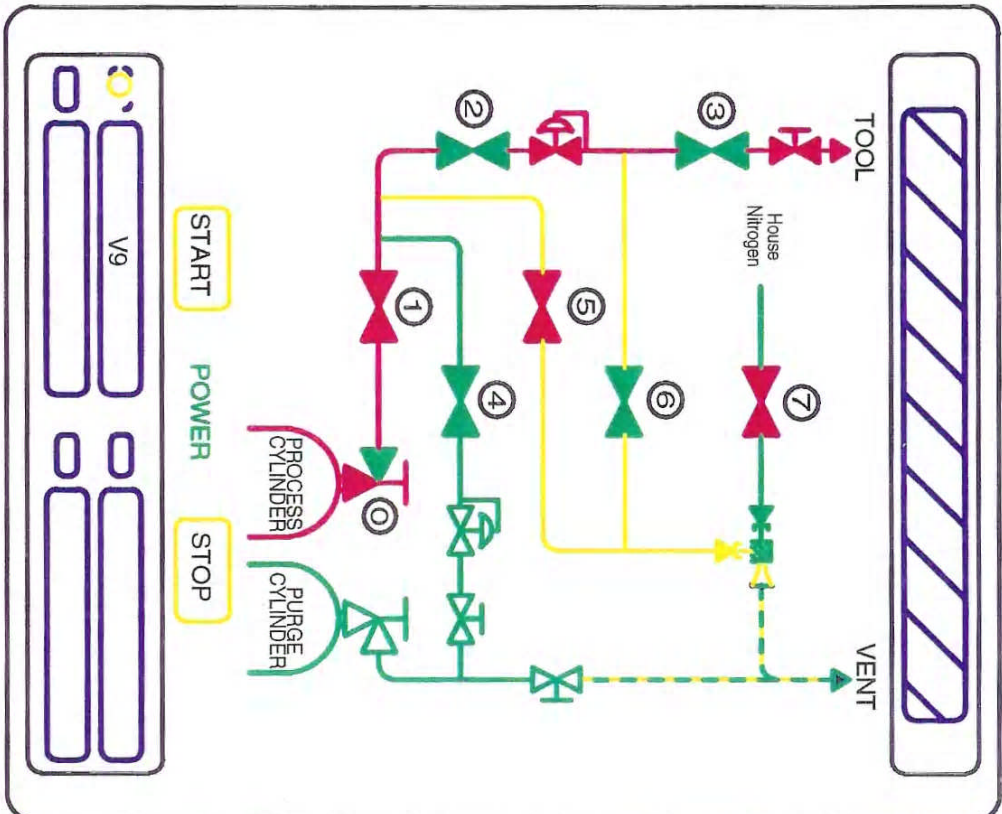
After 10 seconds, the controller checks to ensure vacuum exists at pressure transducer #1 (PT1) in the pigtail

After all checks pass, panel is under vacuum.

Valves V1, V5 and V7 close. At this point **ALL VALVES ON PANEL ARE CLOSED.**

Controller will display "BEGIN PROCESS GAS"

YOU ARE READY TO START "PROCESS GAS FLOW"

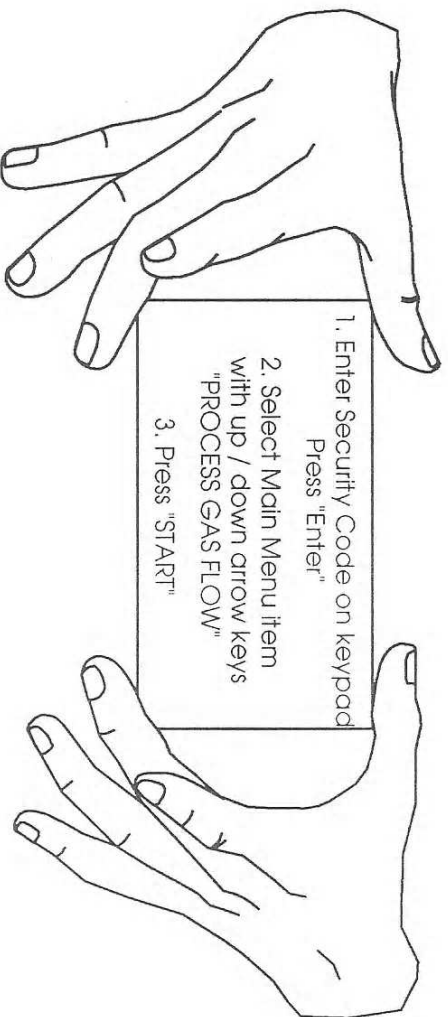


FINAL EVACUATION POST PURGE
HIGH PRESSURE SIDE
VENTURI VACUUM CYCLE

A 1	B 2	C 3	D 4	E 5	F 6	G 7	H 8	I 9	J 0	ESC/MNU	ACK
K 1	L 2	M 3	N 4	O 5	P 6	Q 7	R 8	S 9	T 0	+	RESET
← SHIFT	U 9	V 0	W 0	X 0	Y 0	Z 0	→ SHIFT	ENTER			

STARTING PROCESS GAS FLOW

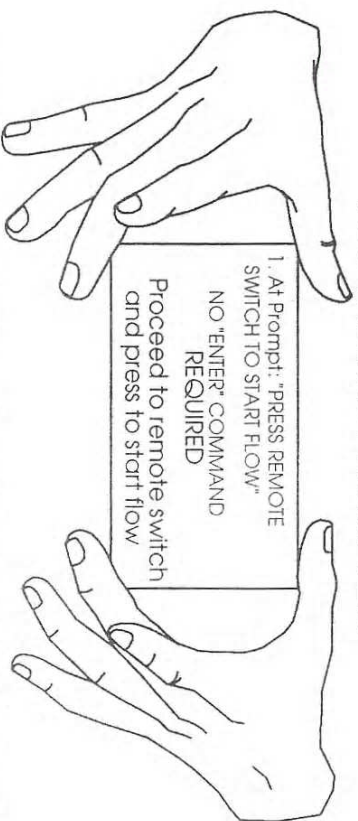
To start gas flow from the new cylinder perform these actions:



The Controller will check to ensure that a Pre or Post Purge Cycle was just completed.
This prevents starting process gas flow into an improperly purged panel !

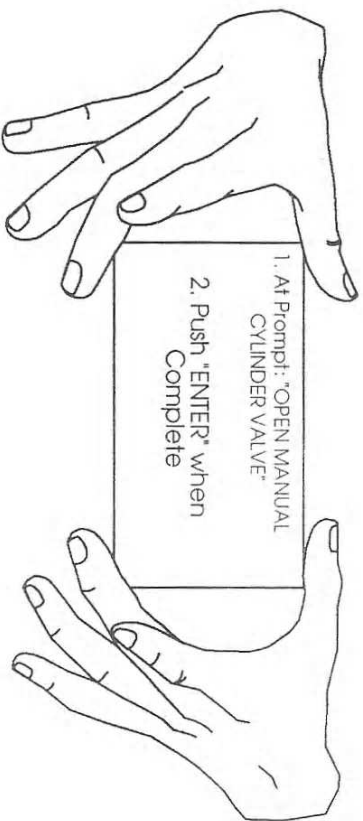
Emergency Shutoff Valve (V1) is opened and closed. Controller checks to ensure vacuum exists at
pressure transducer #1 (PT1) < -5 psig.

IF YOU HAVE A REMOTE START SWITCH WITH A PNEUMATICALLY ACTUATED CYLINDER VALVE YOU WILL BE PROMPTED:



Remote Start is used to remove the operator from the cabinet vicinity during introduction of process gas to a panel that has been disturbed (cylinder change). This is for operator protection in the event of a sudden gas discharge!

IF YOU HAVE A MANUAL CYLINDER VALVE YOU WILL BE PROMPTED:



STARTING PROCESS GAS FLOW

(continued)

PROCESS GAS BEGINS TO FLOW WHEN YOU PUSH "ENTER" for MANUAL CYLINDERS

or

PUSH REMOTE START - FOR Automatic Cylinder Valve (V0) Cylinders
Automatic Cylinder Valve (V0) opens. Controller checks pressure transducer #1 (PT1) to ensure pressure exists (> 0 psig) - verifies cylinder valve open

High Pressure Process Isolation Valve (V2) opens.

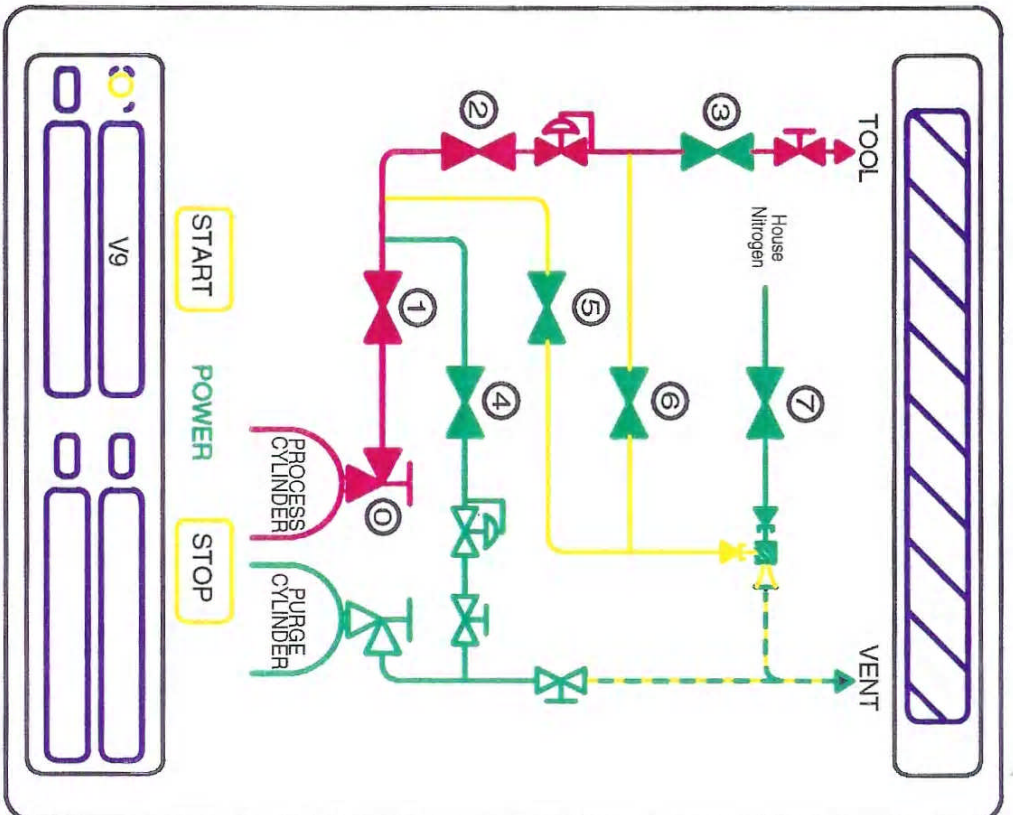
Emergency Shutoff Valve (V1) "Flashes" open (valve cycles on for 3 seconds to slowly introduce process gas to regulator). This avoids regulator "pressure shock".

Emergency Shutoff Valve (V1) opens completely. The controller checks to ensure pressure exists (> 5 psig) at pressure transducer #2 (PT2).

THIS IS A CRITICAL TIME FOR PANEL RE-START.

IF YOU NOTICE ANY ABNORMALITIES:

- 1) PRESS "E-STOP" BUTTON
- 2) CLEAR THE AREA
- 3) REPORT TO SUPERVISOR IMMEDIATELY



START PROCESS GAS FLOW
 FULL CYLINDER PRESSURE AT PT1
 REGULATED PRESSURE AT PT2

↑

A	B	C	D	E	F	G	H	I	J	ESC MANU	ACK
1	2	3	4	5	6	7	8	←	→	↑	RESET
K	L	M	N	O	P	Q	R	S	T	SPACE	RESET
5	6	7	8	9	0	X	Y	Z	←	→	ENTER
SHIFT		U	V	W	X	Y	Z	SHIFT			

STARTING PROCESS GAS FLOW

(continued)

Automatic Cylinder Valve (V0) closes.

*For Auto Switchover: Leave Manual Cylinder Valve **OPEN***

Controller checks to ensure pressure exists at BOTH pressure transducer #1 (PT1) > 0 psig and at pressure transducer #2 (PT2) > 5 psig.

ON MANUAL CYLINDER VALVE SYSTEMS ONLY: Emergency Cylinder Shutoff Valve (V1) closes.

V1 and V2 remain open on Automatic Cylinder Valve System at this point (**V0 closed!**)
Manual Cylinder Valve and V2 remain open on Manual Systems at this point (**V1 closed!**)

IF THIS IS A SWITCHOVER SYSTEM and ADJACENT PANEL IS IN "PROCESS GAS MODE",
THIS PANEL WILL REMAIN IN "STANDBY"

IF NOT A SWITCHOVER or IF ADJACENT PANEL IS NOT IN PROCESS GAS MODE
Pressure transducer #1 (PT1) is checked for > 70 psig and Excess Flow Alarm is disabled.

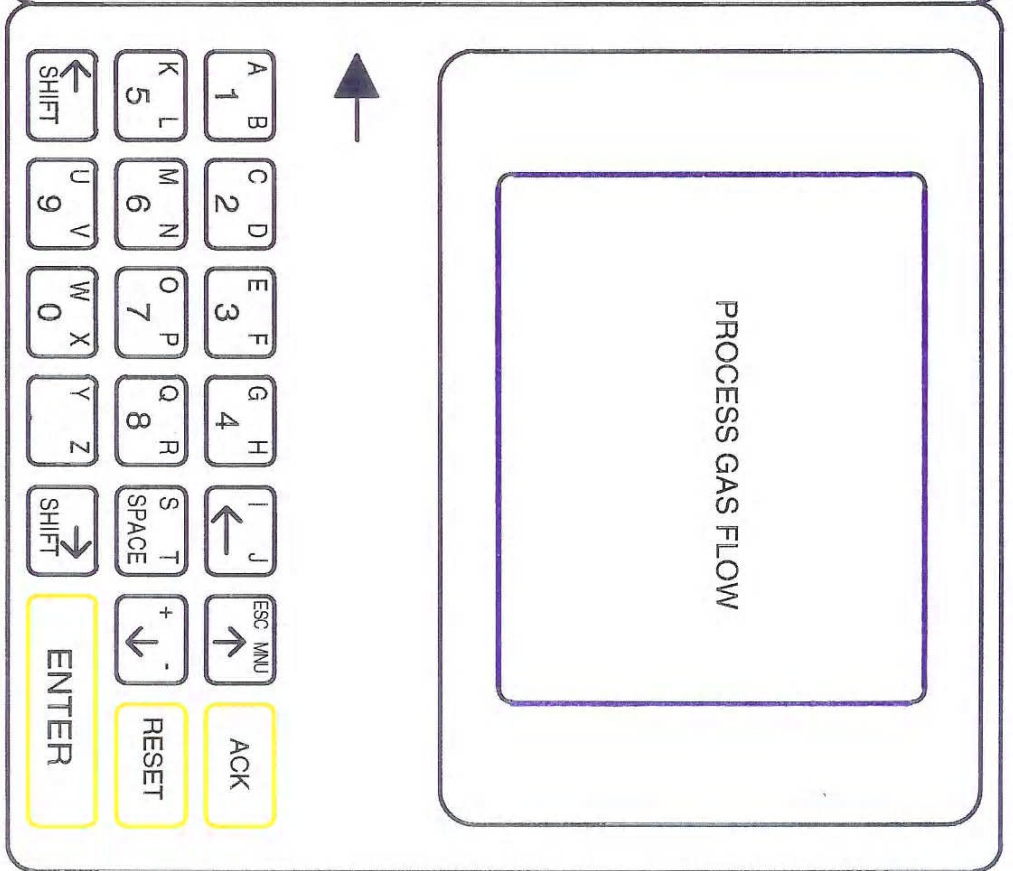
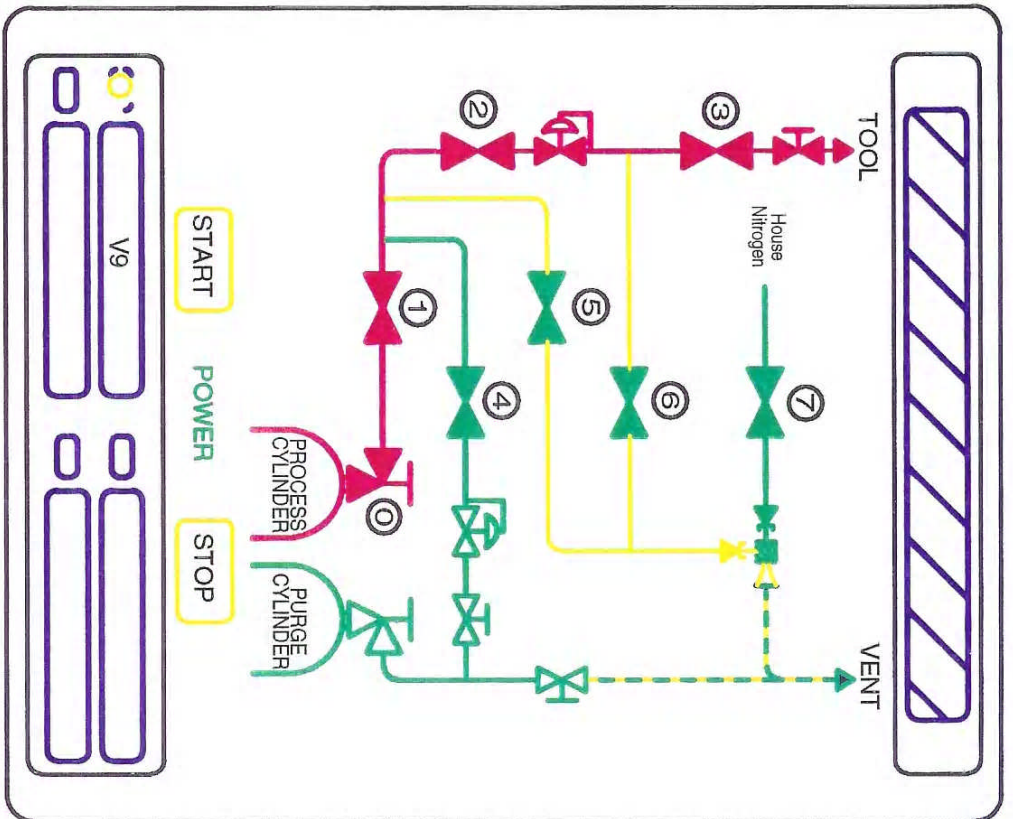
Process Gas flow starts:

ON AUTOMATIC CYLINDER VALVE SYSTEMS: Automatic Cylinder Valve (V0) opens
ON MANUAL CYLINDER VALVE SYSTEMS: Emergency Shutoff Valve (V1) opens

PROCESS GAS IS NOW FLOWING TO TOOL

CHECK AND ADJUST FINAL DELIVERY PRESSURE

Communicate proper "Change Completion" notification if required



ROUGH LINE EVACUATION

This software is equipped with a "Rough Line Evacuation" Program.

This routine is used to remove gross process gas from the process line to the tool through the Low Pressure Vent under venturi vacuum.

THIS IS A ROUGH LINE EVACUATION ONLY

intended to reduce exposure of the tool chamber to process gas during line evacuation and preparation for maintenance.

THIS ROUTINE MUST BE COMBINED WITH A MINIMUM 20-CYCLE PURGE THROUGH THE TOOL

This routine will only briefly be explained here.

To Access this routine:

Select "ROUGH LINE EVACUATION" from main menu using security code for entry

The Controller will lead you through the following prompts:

"Detach Pneumatic Line and Manually Lock ACV"

OR

"Close Manual Cylinder Valve"

"Isolate Purifier and Open Bypass"

"Open MV9"

The system will begin the Pre-purge cycle.

After entire panel is evacuated, Pressure Decay Test at PT1 occurs for a User-defined amount of time (5 minutes is minimum)

The Venturi Vacuum comes on and evacuates the panel low pressure side and process line.
This vacuum step lasts for 60 seconds

Then, the panel high pressure side is evacuated for 15 seconds

During this entire evacuation, pressure transducer PT1 was monitored for vacuum < -5 psig.

The panel and process line are now roughly evacuated ONLY!

The system goes into a Deep Purge cycle "POST PURGE"
Venturi vacuum cycles are alternated with Purge Nitrogen Pressurization Cycles for a User-defined number of times (10 is minimum).

When this cycle is complete:

High pressure side of panel is under nitrogen purge gas pressure !

Low pressure side of panel and process line are under vacuum.

BEGIN PROCESS LINE THROUGH PURGE AT THIS TIME !

*When Maintenance is complete start at "PRE-PURGE" cycles again on Main Menu
Re-run Post Purge Program prior to re-start of process gas !*

Panel Component Descriptions

This section will describe the system components. :

- V1 **Emergency Shutoff Valve (On Pigtail)**
This pneumatic valve isolates the manifold from the process gas cylinder and pigtail.
- V2 **High-Pressure Process Isolation Valve**
This pneumatic valve isolates the pressure regulator and process from the high pressure process gas.
- V3 **Low-Pressure Process Isolation valve**
This pneumatic valve isolates the gas cabinet from the facility process piping.
- V4 **Purge Gas Inlet Valve (On Pigtail)**
This pneumatic valve controls the on/off flow of purge gas to the high pressure process components and piping.
- V5 **High-Pressure Vent Valve**
This pneumatic valve permits flow from the high pressure portion of the panel to vent.
- V6 **Low-Pressure Vent Valve**
This pneumatic valve permits flow from the low pressure portion of the panel to vent.
- V7 **Vacuum Venturi Supply Valve**
This pneumatic valve uses house nitrogen flow to create a vacuum to evacuate the process piping during purge sequences.
- PT1 **Process Cylinder Pressure Transducer**
This transducer measures the process gas pressure at the cylinder outlet. It is also used to check pressures during purge cycles.
- V0 **Process Cylinder Valve**
This pneumatic valve opens or closes the process cylinder valve during process gas flow.
- V9 **Purge Gas Inlet Isolation Valve (On Pigtail)**
This pneumatic valve isolates the purge gas from the panel to the pigtail and provides a trickle purge.
- PT2 **Process Delivery Pressure Transducer**
This transducer measures the process gas pressure on the outlet side of the pressure regulator.
- PT3 **Purge Cylinder Pressure Transducer**
This transducer measures the pressure of the purge gas at the cylinder outlet.
- PT4 **Purge Delivery Pressure Transducer**
This transducer measures the pressure of the purge gas on the outlet side of the purge regulator.

- PT5 Vent Line Pressure Transducer**
This transducer measures the vacuum pressure in the vent piping created by the vacuum venturi.
- MV-9 Process Line Isolation Valve**
This manual valve isolates the process line and downstream equipment from the low pressure process supply. It is used to isolate the cabinet from the process line.
- MV-22 Vent Isolation Valve**
This manual valve isolates the high pressure vent from the high pressure side of the process panel.
- PCV-1 Process Gas Pressure Regulator**
This regulator controls the pressure of the process gas to the process equipment.
- PCV-2 Purge Gas Pressure Regulator**
This regulator controls the purge gas pressure.