



## **DO NOT EXCEED**

R.D.P. – RATED DISCHARGE PRESSURE: 1400PSI  
(MAX. OPERATING PRESSURE)

MAXIMUM SAFETY RELIEF VALVE SETTING: 1500PSI  
(M.A.W.P.)

# **OPERATION MANUAL**

## **BOOSTER MODEL KDS-EAB GD SERIES**



This manual contains important safety information.  
Do not destroy this manual.

This manual must be available to the personnel who operate and maintain this equipment.

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# TABLE OF CONTENTS

## OPERATION AND MAINTENANCE MANUAL

<b>FOREWORD .....</b>	<b>5</b>
<b>INFORMATION .....</b>	<b>6</b>
<b>SAFETY .....</b>	<b>9</b>
<b>SAFETY PRECAUTIONS .....</b>	<b>10</b>
<b>COMPRESSED AIR .....</b>	<b>11</b>
<b>ELECTRICAL .....</b>	<b>12</b>
<b>MATERIALS.....</b>	<b>12</b>
<b>TRANSPORT .....</b>	<b>13</b>
<b>DECALS .....</b>	<b>13</b>
<b>GENERAL DATA .....</b>	<b>31</b>
<b>GENERAL DATA INFORMATION .....</b>	<b>32</b>
<b>OPERATING INSTRUCTIONS .....</b>	<b>35</b>
<b>OPERATING CONTROLS AND INSTRUMENTS .....</b>	<b>36</b>
<b>CONTROL PANEL.....</b>	<b>36</b>
<b>PANELVIEW .....</b>	<b>37</b>
<b>AUTOMATIC MODE (DEFAULT) SCREEN .....</b>	<b>37</b>
<b>SYSTEM STATUS .....</b>	<b>37</b>
<b>BREAKER STATUS .....</b>	<b>37</b>
<b>COMPRESSOR DATA.....</b>	<b>38</b>
<b>OPERATING INDICATORS .....</b>	<b>38</b>
<b>INTERACTIVE CONTROLS.....</b>	<b>39</b>
<b>MANUAL MODE SCREEN .....</b>	<b>39</b>
<b>OPERATING INDICATORS .....</b>	<b>40</b>
<b>MANUAL CONTROLS .....</b>	<b>40</b>
<b>ALARM SCREEN .....</b>	<b>41</b>
<b>VFD CONTROLLER.....</b>	<b>42</b>
<b>STAGE SELECTION SWITCH .....</b>	<b>42</b>
<b>SPEED BUTTONS.....</b>	<b>42</b>
<b>BREAKERS .....</b>	<b>43</b>

EMERGENCY STOP .....	44
RECEPTACLES, POWER SUPPLY .....	45
BOOSTER SAFETY INFORMATION .....	46
Hazardous Substance Precaution .....	50
RUNNING THE BOOSTER .....	51
UNIT PREPARATION .....	51
ELECTRICAL.....	51
MECHANICAL.....	51
SUPPLY CABLES.....	52
SERVICE AIR CONNECTION .....	52
AIR HOSE RESTRAINT .....	53
BREAKERS .....	54
AIR OUTLET .....	54
BOOSTER OPERATION .....	54
STARTING PROCEDURE.....	56
AUTOMATIC MODE .....	56
MANUAL MODE .....	57
VALVE SEQUENCE .....	58
MONITOR AND CONTROL .....	60
PARAMETERS.....	60
SHUTTING DOWN .....	61
START-UP (POSITION OF VALVES) .....	62
SINGLE STAGE OPERATION (POSITION OF VALVES) .....	63
TWO-STAGE OPERATION (POSITION OF VALVES) .....	64
BY-PASS OPERATION (POSITION OF VALVES).....	65
SHUT-DOWN (POSITION OF VALVES).....	66
PROCEDURE FOR CHANGING MODE OF OPERATION .....	67



## FOREWORD

## INFORMATION

The contents of this manual are to be considered proprietary and confidential to Keystone Drill Services, Inc. (herein referred to as “Keystone Drill”) and should not be reproduced without the prior written permission of Keystone Drill.

Nothing contained in this document is intended to extend any promise, warranty, or representation, expressed or implied, regarding the Keystone Drill products described herein. Any such warranties or other terms and conditions of sale of products shall be in accordance with the standard terms and conditions of sale for such products, which are available upon request.

This manual contains instructions and technical data to cover all routine operation and scheduled maintenance tasks by operation and maintenance staff. Major overhauls are outside the scope of this manual and should be referred to an authorized Keystone Drill Service department.

All components, accessories, pipes, and connectors added to the compressed air system should be:

- of good quality, procured from a reputable manufacturer and, wherever possible, be of a type approved by Keystone Drill.
- clearly rated for a pressure at least equal to the booster safety valve setting.
- compatible with the airend oil.
- accompanied with instructions for safe installation, operation, and maintenance.

Details of approved equipment are available from the Keystone Drill Service department. The use of repair parts other than those included within the approved parts list may create hazardous conditions over which Keystone Drill has no control. Therefore, Keystone Drill cannot be held responsible for equipment in which non-approved repair parts are installed.

Keystone Drill reserves the right to make changes and improvements to products without notice and without incurring any obligation to make such changes or add such improvements to products sold previously.

The intended uses of this booster are outlined below, and examples of unapproved usage are also given. However, Keystone Drill cannot anticipate every application or work situation that may arise. If in doubt, consult supervision.

This booster has been designed and supplied for above ground operation to be used for compression of normal ambient air containing no additional gases, vapors, or particles within the ambient temperature range specified in the General Data section of this manual.

This booster should NOT be used:

- for direct or indirect human consumption of the compressed air.
- outside the ambient temperature range specified in the General Data section of this manual.
- when an actual or foreseeable risk of hazardous levels of flammable gases or vapors exists.
- with other than Keystone Drill approved components.
- with guards, controls, or switches missing or disabled.
- for storage or transportation of materials inside or on the enclosure.

Keystone Drill accepts no responsibility for errors in translation of this manual from the original English version.

You, as the customer, are expected to provide certain service and maintenance items. Your Keystone Drill dealer will provide all other more detailed service and maintenance items on a special preventive maintenance schedule for each booster. It is very important that the minimum service and maintenance requirements explained in this manual be performed at the required intervals. Exceeding these intervals may reduce the reliability of the booster.

The purpose of this manual is to train the operator with functions, operation, and basic service and maintenance requirements of the booster. During the preparation of this manual, every effort was made to ensure the adequacy and accuracy of the contents.

Your Keystone Drill dealer will assist with setup and initial startup of the booster. They will also provide brief operating and service instructions. Before starting the booster, this manual and instructions should be carefully read to obtain a thorough knowledge of the duties to be performed. Please take pride in the booster, keep it clean, and in good mechanical condition.







## SAFETY

## SAFETY PRECAUTIONS

Never operate the booster without first observing all safety warnings and carefully reading the Operation and Maintenance Manual shipped from the factory with this booster.

Ensure the operator reads and understands the decals and consults the manuals before operation or maintenance.

Ensure maintenance personnel are adequately trained, competent, and have read the manuals.

Ensure all protective covers are in place and panel doors are closed during operation.

A weekly visual check must be made of all fasteners/fixing screws securing mechanical parts. In particular, safety-related parts.

All components which are loose, damaged, or unserviceable must be rectified without delay.

Air discharged from this booster may contain carbon monoxide or other contaminants which will cause serious injury or death. Do not breathe discharged air.

This booster can produce loud noises when the service valve is vented. Always wear hearing protection.

Never inspect or service the booster without first disconnecting the electric supply cables, however, ensure there is no power to the cables prior to disconnecting. The 600 volt supply must be de-energized (with Approved Lock Out/Tag Out Protection) until the service and/or maintenance procedure is completed.

Do not use petroleum products (solvents or fuels) under high pressure as this can penetrate the skin and result in serious illness. Wear eye protection while cleaning the booster with compressed air to prevent debris from injuring eye(s).

Rotating fan blade can cause serious injury. Do not operate without fan guard in place.

Use care to avoid contacting hot surfaces (air receiver, air discharge piping, etc.)

Never operate the booster with guards, covers, or screens removed. Keep hands, hair, clothing, tools, blow gun tips, etc. away from moving parts.

## COMPRESSED AIR

Compressed air can be dangerous if incorrectly handled. Prior to performing any maintenance or service on the booster, ensure all pressure is vented from the system and the booster cannot be started accidentally.

Ensure the booster is operating at the rated pressure and the rated pressure is known to all relevant personnel.

All air pressure equipment installed in, or connected to, the booster must have safe working pressure ratings of at least the booster safety valve setting.

If more than one booster is connected to one common downstream plant, effective check valves and isolation valves must be fitted and controlled by work procedures, to ensure one booster cannot accidentally be pressurized or over pressurized by another.

Compressed air must NOT be used for a direct feed to any form of breathing apparatus or mask.

Compressed air can cause serious injury or death. Relieve pressure before removing filler plugs/caps, fittings, valves, hoses, or covers.

Air pressure can remain trapped in air supply line which can result in serious injury or death. Always carefully vent air supply line at tool or vent valve before performing any service or maintenance.

If the discharged air is to be ultimately released into a confined space, adequate ventilation must be provided.

When using compressed air, always use appropriate personal protective equipment.

All pressure containing parts, especially flexible hoses and their couplings, must be regularly inspected, be free from defects, and be replaced according to the manual instructions.

Avoid bodily contact with compressed air.

The safety valves located on the cylinders must be checked periodically for correct operation.

Whenever the booster is stopped, air will flow back into the booster from downstream devices or systems unless the service valve is closed. Install a check valve at the booster service valve to prevent reverse flow in the event of an unexpected shutdown when the service valve is open.

Disconnected air hoses whip and can cause serious injury or death. Always attach a safety flow restrictor to each hose at a source of supply or branch line in accordance with OSHA Regulation 29CFR Section 1926.302(b).

Never allow the booster to sit shutdown with pressure in the cylinders or piping.

## ELECTRICAL

Be sure the machine is properly grounded/earthed in accordance with site and National Code requirements.

The main circuit breaker on this machine has a 1000A rating. Connect to appropriate power source.

The opening of the branch-circuit protective device may be an indication that a fault current has been interrupted. All current-carrying parts and other components protected by this device should be examined and replaced if damaged.



**The booster contains a Variable Frequency Drive. When it is switched off and the motor is stopped, the capacitors store a potentially lethal voltage. DO NOT REMOVE COVERS FROM DRIVES and attempt any service work unless properly trained. There are no user serviceable components under the individual drive covers. Wait at least 10 minutes after disconnecting power before servicing or troubleshooting Variable Frequency Drive component fuses or connections within the control panel.**

## MATERIALS

Ensure that adequate ventilation of the cooling system is maintained at all times.

The following substances are used in the manufacture of this booster and may be hazardous to health if used incorrectly:

- airend oil
- preservative grease, lubricating grease
- rust preventative
- thread sealant
- thread locking compound



**Avoid ingestion, skin contact, and inhalation of fumes.**

Should airend oil come into contact with the eyes, irrigate with water for at least 5 minutes. Should airend oil come into contact with the skin, wash off immediately. Consult a physician if large amounts of airend oil are ingested or if airend oil is inhaled. Never give fluids or induce vomiting if the patient is unconscious or having convulsions.

Safety data sheets for airend oils should be obtained from the oil supplier.

Do NOT start or operate this booster in a confined area.

This booster may include such materials as oil and oil/air filters which may require proper disposal when performing maintenance or service tasks. Contact local authorities for proper disposal of these materials.

## TRANSPORT

When loading or transporting the booster, ensure that the specified lifting and tie down points are used, and that the booster is loaded or transported by the end designated on the booster.

When loading or transporting the booster, ensure that the towing vehicle, its size, weight, towing hitch, winch, and electrical supply are all suitable to provide safe and stable towing. Do not exceed gross vehicle weight rating. Do not exceed the capabilities of the towing vehicle for loading, unloading, or towing.







Before transporting the booster, ensure:






- the panel doors are closed and secure.
- all ancillary equipment is stored and in a safe and secure manner.
- all electrical connections and air hoses are properly disconnected.





## DECALS

Decals are located on the booster to point out potential safety hazards. Read and follow these instructions. If you do not understand these instructions, inform your supervisor.


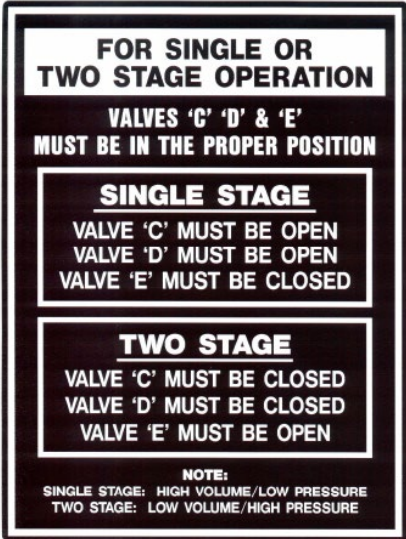


If decals are illegible or missing, please contact Keystone Drill for a replacement. Ensure that all of the following decals are present on the booster.







PART #	Decal #	DECAL	QTY
606791	1002	 A black rectangular decal with the text "AIR INLET" in white, bold, sans-serif font. Below the text is the number "1002" in a smaller font.	4
606792	1003	 A black rectangular decal with the text "AIR OUTLET" in white, bold, sans-serif font. Below the text is the number "1003" in a smaller font.	1
606807	1024	 A yellow rectangular decal with a black border. Inside, the word "CAUTION" is in large, bold, black, sans-serif font. Below it, the words "ROTATING PARTS" are in large, bold, black, sans-serif font. At the bottom is the number "1024" in a smaller font.	4
606808	1025	 A black rectangular decal with the text "COMPRESSOR CRANK CASE DRAIN" in white, bold, sans-serif font. Below the text is the number "1025" in a smaller font.	1
606811	1027	 A black rectangular decal with the text "CONDENSATE DRAIN" in white, bold, sans-serif font. Below the text is the number "1027" in a smaller font.	2
606812	1028	 A white rectangular decal with a black border. The text is in black, sans-serif font. It reads: "CONDENSATE DRAIN" followed by "MUST BE CRACKED/OPEN DURING OPERATION TO ALLOW ALL CONDENSATE TO BE REMOVED". Below this is a horizontal line, then the word "WARNING" in white text on a red background, followed by "FAILURE TO DRAIN CONDENSATE TANKS MAY RESULT IN SEVERE BOOSTER DAMAGE!!". At the bottom is the number "1028" in a smaller font.	2

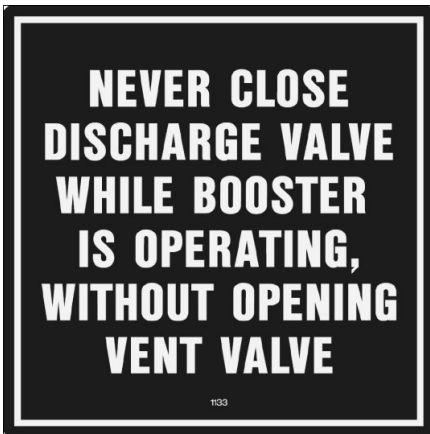
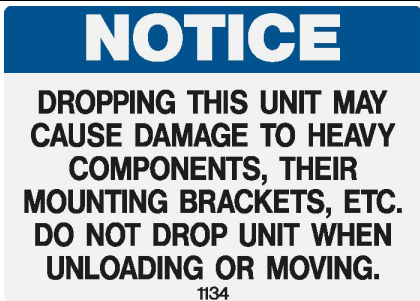



PART #	Decal #	DECAL	QTY
606816	1030	 <p><b>CRANK CASE</b>  <b>RECOMMENDED</b>  <b>MOBIL RARUS 827</b></p> <p>1030</p>	2
606804	1031	 <p><b>CAUTION</b>  <b>MAKE CERTAIN</b>  <b>LUBRICATION PUMP</b>  <b>IS SET AT PROPER</b>  <b>LUBRICATION RATE</b></p> <p>1031</p>	3
606819	1041	 <p><b>DANGER</b>  <b>HIGH PRESSURE AIR</b></p> <p>1041</p>	4
606820	1042	 <p><b>DANGER</b>  <b>HOT</b></p> <p>1042</p>	2
606831	1046	 <p><b>DO NOT EXCEED</b>  <b>RATED DISCHARGE PRESSURE (R.D.P.) 1400 PSI</b>  <b>MAX. OPERATING PRESSURE</b></p> <p>1046</p>	2




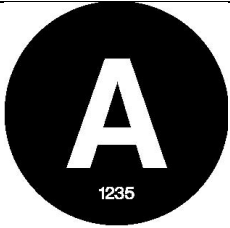
PART #	Decal #	DECAL	QTY
609549	1053		1
606845	1063		2
606846	1064		2
617935	1067		2

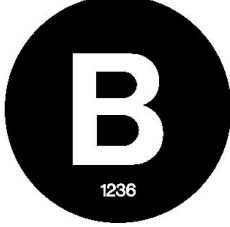










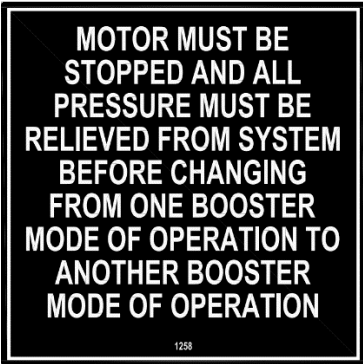

PART #	Decal #	DECAL	QTY
606849	1075	 <p><b><i>FOR <u>COLD WEATHER</u> OPERATION</i></b>  <b><i>ADDITIONAL MEASURES ARE REQUIRED</i></b></p> <ul style="list-style-type: none"> <li>• HEAT TRACE TAPE <b>ALL</b> LINES/VALVES WHICH MAY BE SUBJECT TO FREEZING</li> <li>• AIR FLOW ACROSS BOOSTER COOLER MAY NEED TO BE RESTRICTED DURING COLD WEATHER OPERATIONS TO PREVENT FREEZING/ICING IN COOLER</li> <li>• MAKE CERTAIN <b>ALL</b> FLUIDS ARE APPROPRIATE FOR COLD WEATHER</li> <li>• DRAIN <b>ALL</b> CONDENSATE AS NECESSARY TO PREVENT FREEZING</li> </ul> <p>1075</p>	1
606850	1076	 <p><b>FOR SINGLE OR TWO STAGE OPERATION</b></p> <p><b>VALVES 'C' 'D' &amp; 'E' MUST BE IN THE PROPER POSITION</b></p> <p><b>SINGLE STAGE</b></p> <p>VALVE 'C' MUST BE OPEN  VALVE 'D' MUST BE OPEN  VALVE 'E' MUST BE CLOSED</p> <p><b>TWO STAGE</b></p> <p>VALVE 'C' MUST BE CLOSED  VALVE 'D' MUST BE CLOSED  VALVE 'E' MUST BE OPEN</p> <p><b>NOTE:</b>  SINGLE STAGE: HIGH VOLUME/LOW PRESSURE  TWO STAGE: LOW VOLUME/HIGH PRESSURE</p>	1
606854	1086	 <p><b>GEAR BOX OIL – 85W140</b></p> <p>1086</p>	1
606856 606858	1088 1090A	 <p><b>GUARD MUST BE IN PLACE WHEN OPERATING</b></p> <p>1088</p>	4 13


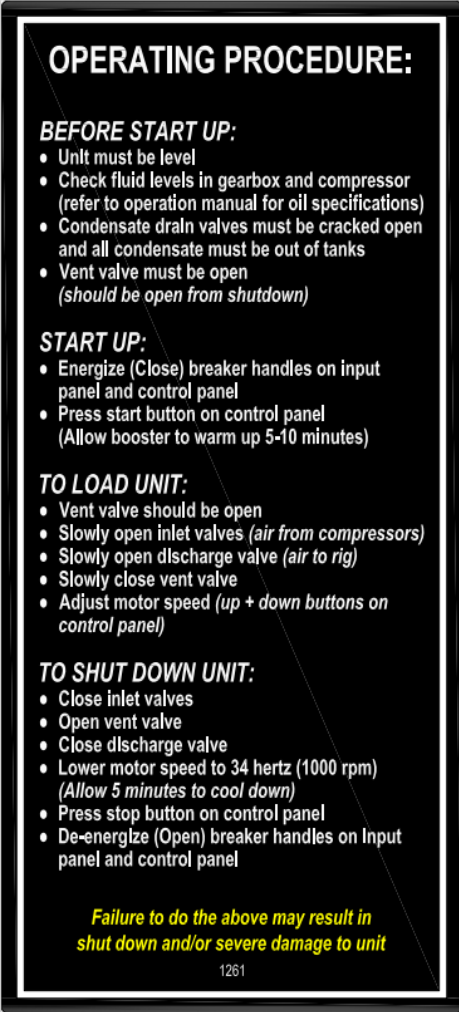
PART #	Decal #	DECAL	QTY
619884	1093	 1093	1
606861	1098	 1098	2
606862	1099	 1099	2
606869	1108B	 1108B	2
606876	1111	 1111	3
606878	1112	 1112	1

PART #	Decal #	DECAL	QTY
606887	1133		1
606889	1134		4
609548	1166		1
606922	1207		1
606929	1219		2

PART #	Decal #	DECAL	QTY
606930	1220		1
606932	1222		2
619180	1225		2
606788	1235		1





<b>PART #</b>	<b>Decal #</b>	<b>DECAL</b>	<b>QTY</b>
<b>606796</b>	<b>1236</b>		<b>1</b>
<b>606802</b>	<b>1237</b>		<b>1</b>
<b>606817</b>	<b>1238</b>		<b>1</b>
<b>606836</b>	<b>1239</b>		<b>1</b>
<b>606847</b>	<b>1240</b>		<b>1</b>
<b>606853</b>	<b>1241</b>		<b>1</b>






PART #	Decal #	DECAL	QTY
606859	1242		1
606860	1243		1
606865	1244		1
635166	1258		1
635164	1259		4






PART #	Decal #	DECAL	QTY
635165	1260	 <p>LIFT FROM TRANSFORMER END ONLY</p>	2
635168	1261	 <p><b>OPERATING PROCEDURE:</b></p> <p><b>BEFORE START UP:</b></p> <ul style="list-style-type: none"> <li>• Unit must be level</li> <li>• Check fluid levels in gearbox and compressor (refer to operation manual for oil specifications)</li> <li>• Condensate drain valves must be cracked open and all condensate must be out of tanks</li> <li>• Vent valve must be open (should be open from shutdown)</li> </ul> <p><b>START UP:</b></p> <ul style="list-style-type: none"> <li>• Energize (Close) breaker handles on input panel and control panel</li> <li>• Press start button on control panel (Allow booster to warm up 5-10 minutes)</li> </ul> <p><b>TO LOAD UNIT:</b></p> <ul style="list-style-type: none"> <li>• Vent valve should be open</li> <li>• Slowly open inlet valves (air from compressors)</li> <li>• Slowly open discharge valve (air to rig)</li> <li>• Slowly close vent valve</li> <li>• Adjust motor speed (up + down buttons on control panel)</li> </ul> <p><b>TO SHUT DOWN UNIT:</b></p> <ul style="list-style-type: none"> <li>• Close inlet valves</li> <li>• Open vent valve</li> <li>• Close discharge valve</li> <li>• Lower motor speed to 34 hertz (1000 rpm) (Allow 5 minutes to cool down)</li> <li>• Press stop button on control panel</li> <li>• De-energize (Open) breaker handles on Input panel and control panel</li> </ul> <p><i>Failure to do the above may result in shut down and/or severe damage to unit</i></p>	1




PART #	Decal #	DECAL	QTY
635169	1262	<div><div>TO BYPASS BOOSTER:</div><div><div>• OPEN VENT VALVE "G"</div><div>• TURN BOOSTER MOTOR OFF</div><div>• CLOSE VALVE "A"</div><div>• OPEN VALVE "B"</div><div>• CLOSE VENT VALVE "G"</div></div><div><div>BOOSTER MOTOR MUST BE SHUT DOWN WHEN</div><div>BOOSTER IS IN BYPASS MODE OF OPERATION</div><div>1262</div></div></div>	1
635170	1263	<div><div><div><div>!</div></div><div>WARNING</div></div><div><div>BOOSTER MOTOR MUST</div><div>BE SHUT DOWN WHEN</div><div>BOOSTER IS IN BYPASS</div><div>MODE OF OPERATION</div></div></div>	1
635172	1264	<div><div>BOOSTER PERFORMANCE</div><div><div><div>HERTZ</div><div>MOTOR RPM</div></div><div><div>34</div><div>1000</div></div><div><div>37</div><div>1100</div></div><div><div>40</div><div>1200</div></div><div><div>44</div><div>1300</div></div><div><div>47</div><div>1400</div></div><div><div>50</div><div>1500</div></div><div><div>53</div><div>1600</div></div><div><div>57</div><div>1700</div></div><div><div>60</div><div>1800</div></div></div><div>1264</div></div>	1
635175	1267	<div><div>GROSS WEIGHT 46,000 LB.</div><div>1267</div></div>	2



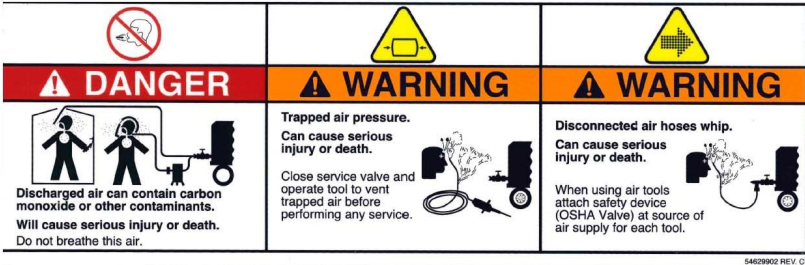


PART #	Decal #	DECAL	QTY
635155	4001	 <p><b>TOWER LIGHT:</b></p> <p><b>RED:</b></p> <ul style="list-style-type: none"> <li>• A LOW OR HIGH LEVEL PARAMETER HAS BEEN REACHED</li> <li>• FAULT CODE PRESENT (MAIN DISPLAY)</li> </ul> <p><b>AMBER:</b></p> <ul style="list-style-type: none"> <li>• MACHINE OPERATION IS APPROACHING A HIGH OR LOW LIMIT PARAMETER</li> </ul> <p><b>GREEN (STEADY):</b></p> <ul style="list-style-type: none"> <li>• MACHINE RUNNING</li> <li>• ALL PARAMETERS ARE WITHIN SAFE OPERATING LIMITS</li> </ul> <p><b>GREEN (FLASHING):</b></p> <ul style="list-style-type: none"> <li>• MACHINE IS IN STARTUP OR SHUTDOWN SEQUENCE</li> </ul> <p>4001</p>	1
635156	4002	 <p><b>WARNING</b></p> <p>EMERGENCY STOP <b>DOES NOT</b> KILL INPUT POWER</p> <p>4002</p> <p><b>WARNING</b></p> <p>EMERGENCY STOP NOT TO BE USED FOR NORMAL SHUTDOWN</p> <p>4002</p>	2
635157	4003	 <p><b>WARNING</b></p> <p>ELECTRIC PANEL CONTAINS EXPOSED CONNECTIONS</p> <p>4003</p>	2
635158	4004	 <p><b>WARNING</b></p> <p>ASSUME ALL CONNECTIONS ARE ENERGIZED</p> <p>4004</p>	2

PART #	Decal #	DECAL	QTY
635159	4005		1
635148	4006		4
635149	4007		2
635150	4008		2
635151	4009		2

PART #	Decal #	DECAL	QTY
635152	4010		2
635153	4011		2
635154	4012		4
635160	4013		1
635161	4014		1

PART #	Decal #	DECAL	QTY
635221			2
635350			2
634719	46622761A		1

PART #	Decal #	DECAL	QTY
604853	54568787C		1
634720	54604996C		1
604838	54629902C		1





# GENERAL DATA

## GENERAL DATA INFORMATION

MODEL	KDS-EAB GD 6.5" X 5" TWO STAGE
<b>BOOSTER</b>	
Make	Gardner Denver
Frame	JY-500 (Joy WB-12)
Type	Two Stage "Y" Frame
Max. Operating Speed	700
Stroke (in)	7
Max Rated Rod Load (lb)	15,000
<b>1<sup>ST</sup> STAGE CYLINDER</b>	
Make	Gardner Denver
Style	Double Acting
M.A.W.P. (psi)	1650
Cylinder Bore (in)	6.5
<b>2<sup>ND</sup> STAGE CYLINDER</b>	
Make	Gardner Denver
Style	Double Acting
M.A.W.P. (psi)	2035
Cylinder Bore (in)	5
<b>COOLERS</b>	
Construction	Steel Tube and Fin
Precooler M.A.W.P. (psi)	600
Intercooler M.A.W.P. (psi)	1200
Aftercooler M.A.W.P. (psi)	2200
ASME Code Stamp and National Board Registered	



SCRUBBER BOTTLES	
1 <sup>st</sup> Stage M.A.W.P. (psi)	600
2 <sup>nd</sup> Stage M.A.W.P. (psi)	1200
ASME Code Stamp and National Board Registered	
PULSATION BOTTLES	
1 <sup>st</sup> Stage M.A.W.P. (psi)	1200
2 <sup>nd</sup> Stage M.A.W.P. (psi)	1900
ASME Code Stamp and National Board Registered	
MAIN MOTOR	
Operating Speed (rpm)	1789
Nominal Horsepower of package (kW)	600 (440)
Full Load Amps at 480Vac (A)	665
AMBIENT TEMPERATURE RANGE	
With Standard Features, °F (°C)	-4 to 104 (-20 to 40)
MAIN POWER SERVICE REQUIREMENTS	
Nominal Supply Voltage (Vac)	600
Operating Frequency (Hz)	60
Operating Voltage (Vac)	480
Input Panel Circuit Breaker Rating (A)	1000
VFD Circuit Breaker Rating (A)	800
Three Phase with Ground	L1-White/Black, L2-Red, L3-Blue, GND-Green
TRANSFORMER	
Primary Voltage (Vac)	600 Delta
Secondary Voltage (Vac)	480/277 Wye
KVA	700
Type	Isolated, Dry-type
Conductor	Aluminum

MEASUREMENTS/WEIGHTS	
Overall Length – feet (meters)	28 (8.5)
Overall Width – feet (meters)	8 (2.4)
Overall Height – feet (meters)	9.5 (2.9)
Operating Weight, with Compressor Oil, lb (kg)	46,000 (20,865)

PERFORMANCE IN TWO-STAGE OPERATION MODE				
ENGINE RPM	BOOSTER RPM	SUCTION PRESSURE (PSI)	DISCH. PRESSURE (PSI)	FLOW (SCFM)
1800	600	350	800	3311
1800	600	350	1000	3296
1800	600	350	1200	3282
1800	600	350	1400	3270
PERFORMANCE IN SINGLE-STAGE OPERATION MODE				
ENGINE RPM	BOOSTER RPM	SUCTION PRESSURE (PSI)	DISCH. PRESSURE (PSI)	FLOW (SCFM)
1800	600	350	600	5100
1800	600	350	800	4900
1800	600	350	1000	4700
BOOSTER RATED DISCHARGE PRESSURE (RDP) = 1400PSI				

 **CAUTION**

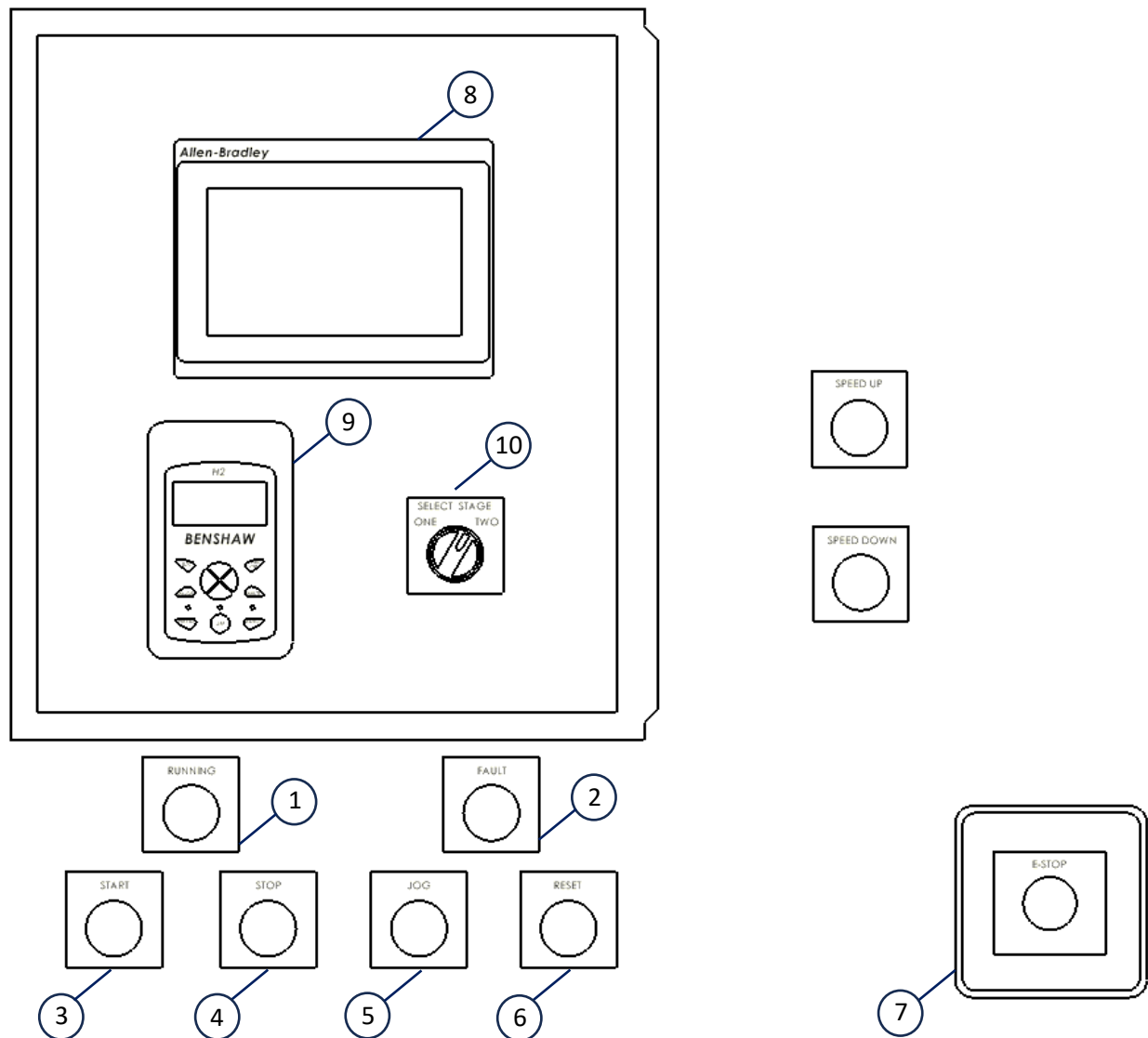
**Any departure from the specifications may make this equipment unsafe.**



# OPERATING INSTRUCTIONS

## OPERATING CONTROLS AND INSTRUMENTS

## CONTROL PANEL



- |                               |                                    |
|-------------------------------|------------------------------------|
| 1. RUNNING LIGHT (GREEN)      | 7. EMERGENCY STOP BUTTON (RED)     |
| 2. FAULT LIGHT (RED)          | 8. PANELVIEW TOUCH-SCREEN DISPLAY  |
| 3. START BUTTON (BLACK)       | 9. VFD CONTROLLER (FAN MOTOR)      |
| 4. STOP BUTTON (RED)          | 10. STAGE SELECTION SWITCH (BLACK) |
| 5. JOG BUTTON (BLACK)         | 11. SPEED UP BUTTON (BLACK)        |
| 6. FAULT RESET BUTTON (BLACK) | 12. SPEED DOWN BUTTON (BLACK)      |

## PANELVIEW

The PanelView 800 Display is a touch-screen device that is used for displaying booster data, warnings, and to control different features. The display defaults to the automatic screen on start-up and does not require interaction for running the equipment. If necessary, the machine can be started or stopped in automatic mode from the screen shown in Figure 1 by pressing the corresponding buttons on the display. The following information is to familiarize the operator with the PanelView and its different features. Understanding how to operate will be explained later in the Chapter.

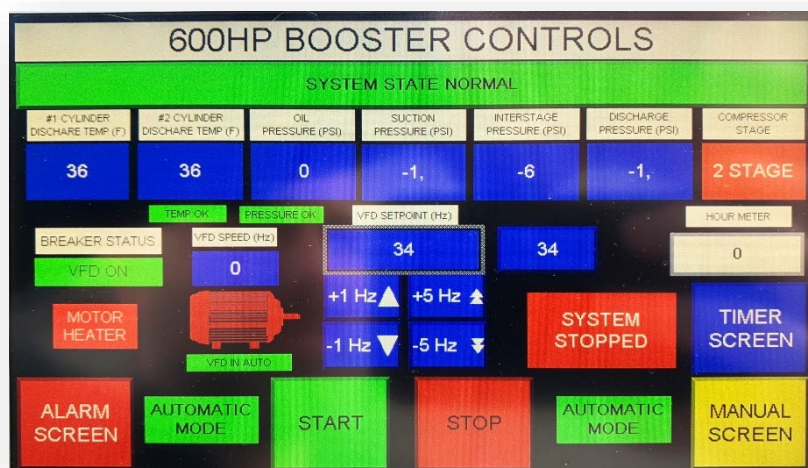


Figure 1- Display in AUTOMATIC MODE, no warnings, control panel breakers CLOSED

## AUTOMATIC MODE (DEFAULT) SCREEN

### SYSTEM STATUS

The top of the display indicates the system status by text and color. A normal status is shown in Figure 1 with a green ribbon across the top of the screen. Below are the different status designations:

Color	Status	Meaning
Green	Normal	All readings are within normal parameters
Yellow	Warning	Data is approaching the limits of set parameters
Orange	Pre-start Warning	Current parameters are outside of automatic mode starting parameters
Red	Alarm	A reading is outside of set parameters. System shuts down

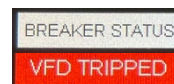
### BREAKER STATUS

The breaker status indicates whether the breakers on the control panel are open (tripped) or closed (on).

Text (Color)	Status
VFD ON (green)	VFD circuit is closed, energized



Text (Color)	Status
VFD TRIPPED (red)	VFD circuit is open, de-energized



## ⚠ WARNING

**Although the Breaker Status may indicate that the breakers are tripped (open), there is still power being supplied to the Control Panel.**

### COMPRESSOR DATA

The compressor information is displayed across the top half of the screen, just below the System Status bar. The parameters displayed are #1 Cylinder Discharge Temperature, #2 Cylinder Discharge Temperature, Oil Pressure, Suction Pressure, Interstage Pressure, Discharge Pressure, and the Compressor Stage. The values listed in the image below are reference only.

#1 CYLINDER DISCHARGE TEMP (F)	#2 CYLINDER DISCHARGE TEMP (F)	OIL PRESSURE (PSI)	SUCTION PRESSURE (PSI)	INTERSTAGE PRESSURE (PSI)	DISCHARGE PRESSURE (PSI)	COMPRESSOR STAGE
36	36	0	-1,	-6	-1,	2 STAGE

### OPERATING INDICATORS

The various blocks and images across the center of the screen show the operating status via their symbol color. A red icon/symbol indicates that the operation is off or stopped. A green icon/symbol indicates that the operation is on or running. These icons/symbols are not interactive (in AUTOMATIC MODE) and are only displaying feedback from the automated process.

Text/Symbol	Description	Color	Meaning
MOTOR HEATER	Heater for main motor	Red / Green	Off / On
REG HEATER	Regulation orifice heater	Red / Green	Off / On
TEMP OK	Temperature parameters for starting	Blue / Red / Green	Low / High / OK
PRESSURE OK	Pressure parameters for starting	Blue / Red / Green	Low / High / OK
SYSTEM STOPPED	System is not running, status	Red	Off
SYSTEM RUNNING	System is running (or in process), status	Green	On
AUTOMATIC MODE	Automatic mode controls	Green	Automatic
MANUAL MODE	Manual mode controls	Amber	Manual
VFD IN AUTO	VFD operations are process controlled	Green	Automatic
VFD IN MANUAL	VFD is manually controlled	Amber	Manual
MOTOR IMAGE	600HP compressor motor	Red / Green	Off / On

### INTERACTIVE CONTROLS

Some of the buttons in AUTOMATIC MODE are interactive to allow the operator to control the unit from the screen and monitor different aspects of the process. Below are the buttons that are interactive on the AUTOMATIC MODE screen.

**NOTE:** Some of these controls navigate you to different screens within the program. Review the full Operations section of this manual to understand how to properly navigate the program prior to pressing any interactive buttons.

Text	Description
ALARM SCREEN	Navigates to the Alarm Screen to review a log of Alarms and ability to reset
START	Starts the automatic process for running the compressor
STOP	Stops the process for running the compressor and enters shut-down process
TIMER SCREEN	Navigates to Timer Screen to adjust parameters for operations *see below*
MANUAL SCREEN	Navigates to Manual Screen for controlling the unit manually

\*Timer Screen is password protected to limit access to parameter controls.

### MANUAL MODE SCREEN

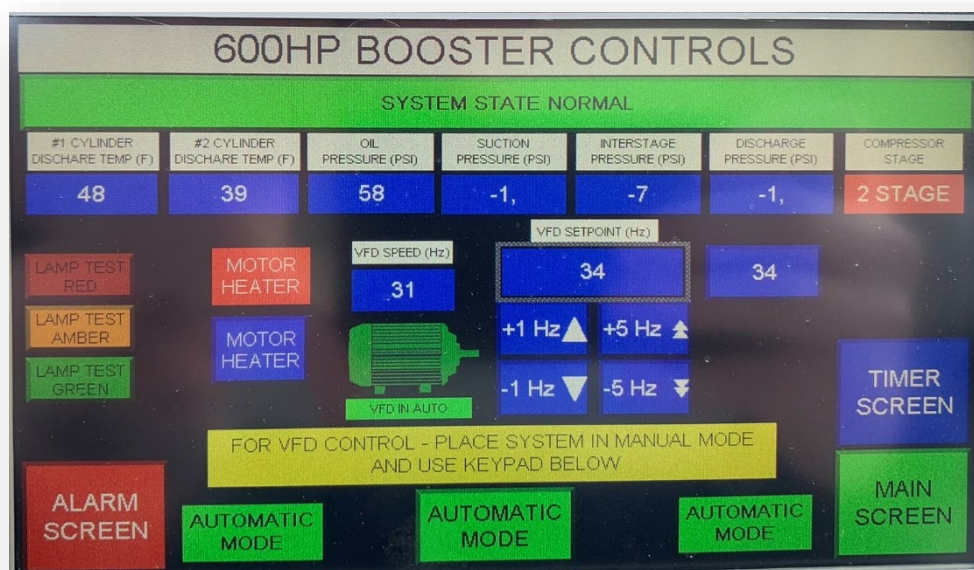


Figure 2 – Display on MANUAL SCREEN, no warnings, system running, in AUTOMATIC MODE

The MANUAL SCREEN is similar to the AUTOMATIC SCREEN with system status, compressor data and operating indicators but adds the ability to manually control different parts of the machine independently.

### OPERATING INDICATORS

Various blocks and images across the screen show the operating status via their symbol color. A red icon/symbol indicates that the operation is off or stopped. A green icon/symbol indicates that the operation is on or running. These specific icons/symbols are not interactive and are only displaying feedback from the manual controls.

NOTE: The main 600HP motor icon is feedback from the VFD controller external to the PanelView controls.

<b>Text/Symbol</b>	<b>Description</b>	<b>Color</b>	<b>Meaning</b>
MOTOR HEATER	Heater for main motor	Red / Green	Off / On
AUTOMATIC MODE	Automatic mode controls are active	Green	Automatic
MANUAL MODE	Manual mode controls are active	Amber	Manual
VFD IN AUTO	VFD operations are process controlled	Green	Automatic
VFD IN MANUAL	VFD is manually controlled	Amber	Manual
MOTOR IMAGE	600HP compressor motor	Red / Green	Off / On

### MANUAL CONTROLS

The purpose of the MANUAL SCREEN is to operate different features independently from the automated process. Below are the buttons that are interactive on the MANUAL SCREEN.

<b>Text</b>	<b>Description</b>	<b>Color</b>
MOTOR HEATER	Operates the main motor heater	Blue
START	Starts the 500HP compressor motor	Green
STOP	Stops the 500HP compressor motor	Red
LAMP TEST RED	Operates the red tower light	Red
LAMP TEST AMBER	Operates the amber tower light	Amber
LAMP TEST GREEN	Operates the green tower light	Green
AUTOMATIC MODE	Places the unit into Automatic Mode	Green
MANUAL MODE	Enables manual controls and disables automated processes	Amber
ALARM SCREEN	Navigates to the Alarm Screen to review a log of Alarms and ability to reset	Red
TIMER SCREEN	Navigates to Timer Screen to adjust parameters for operations	Blue
MAIN SCREEN	Navigates to Main Screen for controlling the unit automatically	Green



### ALARM SCREEN

If there is a machine fault or the Emergency Stop switch was pressed, the screen will display a System Status message notifying the operator that an alarm is present. \*Booster and Compressor alarm notification and screens are identical\* (Compressor screen shown below)

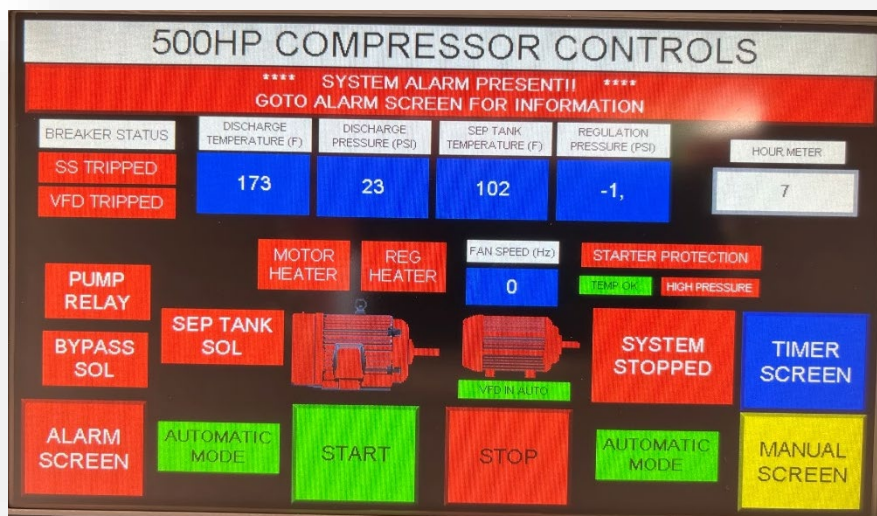


Figure 3 - Main display showing Alarm Status

The Alarm Screen shows the operator what caused the machine to fault and logs the information with a timestamp. The Alarm Screen is accessible from both the Automatic and the Manual Screen by pressing the Alarm Screen button in the lower left portion of the screen.

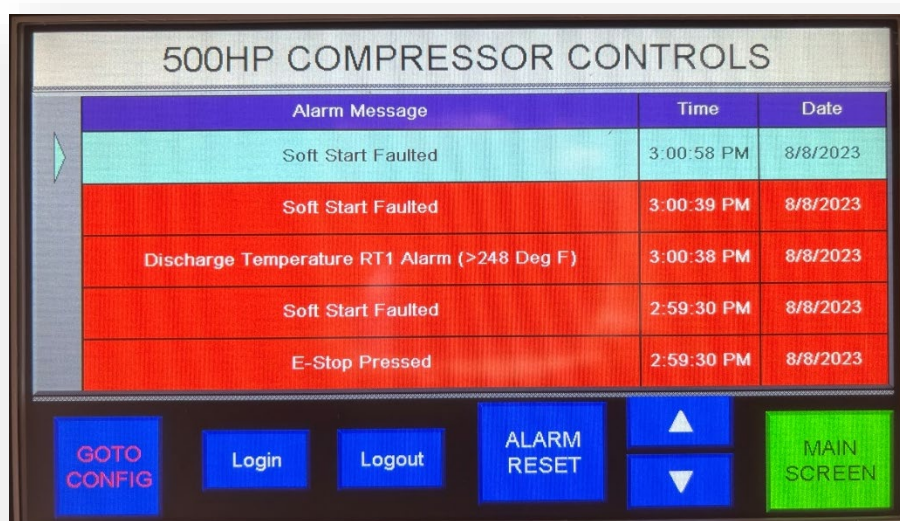


Figure 4 - Alarm Screen showing faults

All of the buttons across the bottom of the screen are interactive. To return to the Main Screen, press the green button in the lower right corner of the screen.

## VFD CONTROLLER

The VFD (Variable Frequency Drive) operates the main motor for the booster. When the PanelView is in AUTOMATIC MODE with the VFD controller set to AUTO (default setting upon startup), the controller does not need to be monitored or controlled for operation.

Text	Description
ESC	Escape
PROG/ENT	Selection button for different operations
MODE	Navigate through different modes
MULTI	Refer to VFD manual
HAND	Operates the VFD manually
OFF	Stops the VFD when running
AUTO	Allows the program to run automatically
ARROWS	Navigate the cursor within the display



## STAGE SELECTION SWITCH

The switch is used to select which stage the booster is being operated on. The selection determines the pressure setting for an overpressure situation for safety.



## SPEED BUTTONS

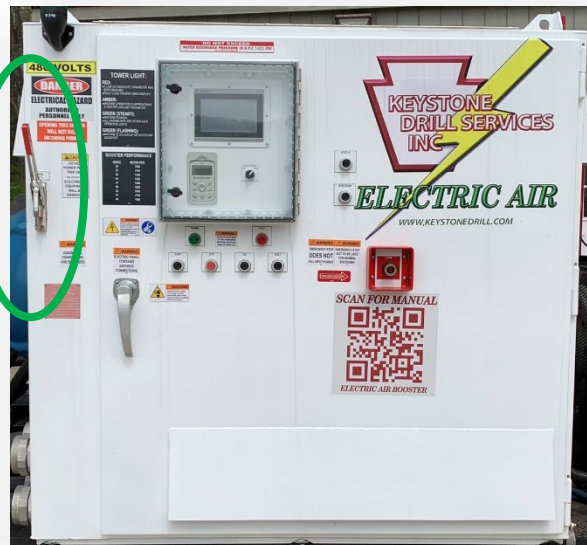
The speed buttons are to control the rotational speed of the 600hp motor. A single press of the button will adjust the speed by 1Hz. Keeping the button depressed will adjust the speed by 5Hz. A decal is provided on the control panel for Hz to RPM conversion.



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## BREAKERS

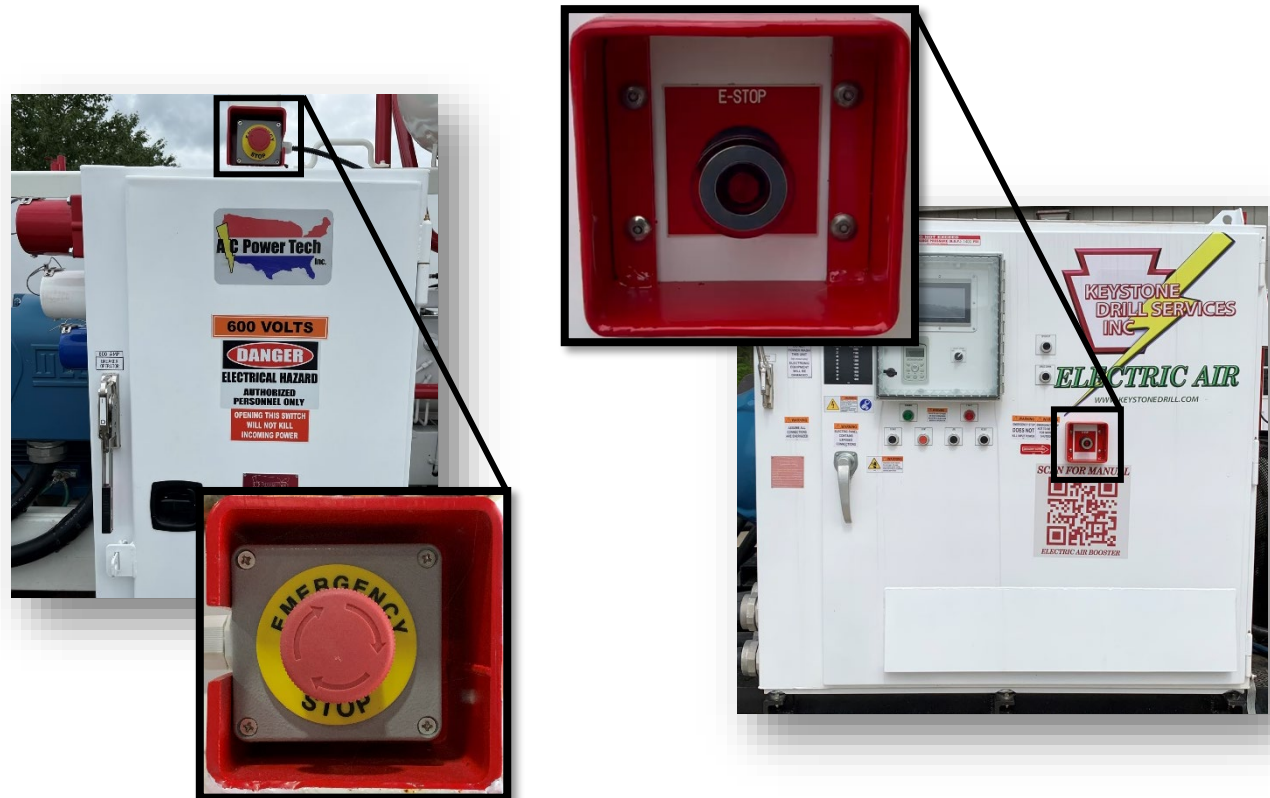
Each booster is equipped with two breakers: 1000A input breaker, and an 800A VFD breaker. The input breaker is located on the input panel (lower left image), while the VFD breaker is located on the control panel (lower right image). When the breaker handles are down, with the black cover exposed, they are open (off). When the breaker handles are up, with the red cover exposed, they are closed (on).



## EMERGENCY STOP

There are two E-STOP switches on each booster, and on opposite sides of the unit. One switch is located on the front of the control panel (lower right image) and the other switch is located on the top of the input panel (lower left image).

Each E-STOP switch is enclosed in a red box to easily identify the location.

**⚠ WARNING**

Pressing the E-STOP switch does not kill incoming power.

**⚠ CAUTION**

Do not press the E-STOP switch to shut down the machine under normal conditions.

## RECEPTACLES, POWER SUPPLY

The supply power will be connected to the unit at the input panel using the Eaton Roughneck connections located on the left side of the panel (image below). This configuration is designed to accept three single-feeders of 600VAC supply power, and a single equipment ground.

Cable receptacles will be male and the Panel receptacles will be female.

Color	Phase/Line
White/Black	L1
Red	L2
Blue	L3
Green	Ground



**Be sure that supply lines are de-energized before connecting or disconnecting cables.**



When the cables are installed into the receptacles, be sure to utilize the locking device that retains the cable within the receptacle. Between use, install the weather caps into the receptacles to protect the connections from wear.



## BOOSTER SAFETY INFORMATION

Read, understand and follow this information before proceeding to “RUNNING THE BOOSTER”.

- Ensure that the operator, maintenance/service and all relevant personnel read, understand and follow all information that is provided in all manuals before operating, servicing and/or maintaining the unit.
- Ensure that operator and maintenance personnel are competent and have been adequately trained.
- Never operate unit without first observing all safety warnings and decals. Operators, maintenance/service and all relevant personnel must understand all decals and safety warnings.
- Ensure that the operator(s), all maintenance/service personnel and all relevant personnel reads and understands all information provided by the engine manufacturer and also the booster manufacturer.
- Do not paint over safety warnings or instructional decals. If safety warning decals become illegible or missing, immediately order replacements from the factory.
- All federal, state, local and site ordinances, rules and regulations must be followed.
- Compressed air can be dangerous if incorrectly handled. Before doing any work on the unit, ensure that all pressure is vented from the system and that the machine can not be started accidentally. Slowly open “vent to atmosphere” valve and scrubber bottle(s) drain valve(s). All engines (booster and primary air) must be shutdown and not operating before any maintenance is performed.
- Never allow booster to sit stopped with pressure in the booster system. As a precaution, slowly open vent to atmosphere valve, and the condensate drain valve(s) on all scrubber bottles to relieve pressure.
- Ensure that all lock-out and tag-out procedures are followed.
- Do not attempt to do any service work while machine is operating.
- Never inspect or service unit without first turning off battery disconnect switch to prevent accidental starting.
- High Pressure air can cause serious injury or death. Relieve pressure before removing filler plugs/caps, fittings or covers or performing any maintenance or service work.
- Air pressure can remain trapped in air supply line which can result in serious injury or death. Always carefully vent air supply line at tool.
- During booster operation, condensate is produced in scrubber bottle(s). Use extreme caution when removing condensate as it is under high pressure and high temperature.

- All scrubber bottle condensate must be disposed of in accordance with local, state and federal regulations.
- This machine may include such materials as oil, diesel fuel, antifreeze, oil/air filters and batteries which may require proper disposal when performing maintenance and service tasks. Contact local authorities for proper disposal of these materials.
- Air discharged from this machine can contain carbon monoxide, oil or other contaminants which will cause serious injury or death. Do not breathe this air.
- Compressed air must not be used for a feed to any form of breathing apparatus or mask.
- If the discharged air is to be ultimately released into a confined space, adequate ventilation must be provided.
- When using compressed air, always use appropriate personal protective equipment.
- Avoid bodily contact with compressed air.
- The discharged air contains a very small percentage of compressor lubricating oil and care should be taken to ensure that downstream equipment is compatible.
- Wear eye protection, hearing protection, hard hat, steel toe shoes and any other safety equipment as required at all times when working on or operating this machine.
- This machine produces loud noise during operation and with the “vent to atmosphere” valve vented. Extended exposure to loud noise can cause hearing loss. Always wear hearing protection.
- Use care to avoid contacting hot surfaces (engine exhaust manifold and piping, scrubber and/or pulsation bottles and air discharge piping, etc.).
- Do not remove the pressure cap from a HOT radiator. Allow radiator to cool down before removing pressure cap. Hot pressurized fluid can cause serious burns.
- Do not use petroleum products (solvents or fuels) under high pressure as this can penetrate the skin and result in serious illness. Wear eye protection while cleaning unit with compressed air to prevent debris from injuring eye(s). Do not clean machine with gasoline or volatile fluids.
- A battery contains sulfuric acid and can give off gases which are corrosive and potentially explosive. Avoid contact with skin, eyes and clothing. In case of contact, flush area immediately with water.
- Jump starting unit is not advised. See engine manufacturer manual. Severe damage, explosion and/or personal injury may result.
- Never operate the engine of this machine inside a building without adequate ventilation. Avoid breathing exhaust fumes when working on or near the machine.

- Do not alter or modify this machine.
- The specification of this machine is such that the machine is not suitable for use in flammable gas risk areas. If such an application is required, then all local regulations, codes of practice and site rules must be observed. To ensure that the machine can operate in a safe and reliable manner, additional equipment such as gas detection, exhaust spark arrestors, and intake (shut-off) valves may be required, dependent on local regulations or the degree of risk involved.
- Do not inject any type of flammable or explosive gas or liquid into the booster or piping. Serious injury, death, and severe damage to equipment can occur.
- Do not operate booster with safety devices bypassed or disconnected.
- Make sure that all protective covers and guards are in place before starting and during operation.
- Never operate unit with guards, covers or screens removed. Keep hands, hair, clothing, tools, blow gun tips, etc. well away from moving parts.
- Rotating fan blade can cause serious injury. Do not operate without guard(s) in place.
- All pressure containing parts, especially flexible hoses and their couplings, etc. must be regularly inspected, be free from defects and be replaced according to manufacturers recommendations.
- Disconnected air hoses whip and can cause serious injury or death. Always use approved whip check/cable on hose ends to prevent whipping.
- Booster must be on level ground to operate, not to exceed 5° in any direction.
- Do not set booster within 10' of other machinery, buildings or any other obstructions that may hamper cooling air flow to booster.
- This booster will be able to operate in one mode of operation at a time.
  - Possible modes of operation are: Two Stage Operation, Single Stage Operation and Bypass Operation.
- **When changing from one booster mode of operation to another booster mode of operation (ex. going from "Single Stage Operation" to "Bypass Operation"), it is necessary to stop the engine (go through the shut down procedure) and relieve all pressure from the system. Then place valves in "Start-Up" position, start engine (see Starting Procedures) then move valves into the new mode of operation (see "Operation Charts" and "Sequence Charts").**
  - Booster engine MUST be shutdown when booster is in Bypass Mode of Operation.



- Do not operate the booster at pressures in excess of its Rated Discharge Pressure (R.D.P.) rating as indicated on the booster serial number/unit number plate. The R.D.P. (Rated Discharge Pressure) of the booster should be known to all relevant personnel.
- All air pressure equipment installed in or connected to the booster must have safe working pressure ratings of at least the applicable suction, intermediate or final discharge safety valve rating and designed for the application being utilized in. Equipment installed on the final discharge side of the Booster must be of adequate design and have safe working pressure rating of at least the Booster final discharge safety valve rating. Equipment installed on the suction side of the Booster must be of adequate design and have safe working pressure rating of at least the Booster suction safety valve rating.
- Whenever the booster is stopped, air will flow back into the booster system from devices or system downstream of the booster unless the booster discharge valve is closed. A check valve at the booster discharge valve is required to prevent reverse flow in the event of an unexpected shutdown when the booster discharge valve is open.
- If more than one booster is connected to one common downstream connection, effective check valves and isolation valves must be fitted and controlled by work procedures, so that one machine can not accidentally be pressurized or over pressurized by another.
- Never shut booster down while loaded unless it is an emergency. See “shutdown procedure” and “emergency shut down” in “booster operation” manual.
- Booster must be relieved of all pressure prior to starting engine and valves must be in “start up” position.
- Never close booster discharge valve while booster is operating without first opening the “vent to atmosphere” valve.
- Pressure vessels (Scrubber/Pulsation Bottles, Precoolers, Aftercoolers, Intercoolers,) may require ASME code stamping to meet local codes. Investigate code requirements before operation to make sure all requirements have been met.
- Never install a shut-off valve in the discharge line without installing a safety relief valve of the proper pressure rating and flow capacity in the line between the shut-off valve and the booster discharge. Air pressure sufficient to rupture the lines can be caused by such a valve when the booster is operated with the valve closed. Failure to comply with warnings can cause property damage and/or serious bodily harm or death.
- “Cold Weather” operation requires additional measures to prevent “Freeze Up” such as heat trace tape on lines, valves, etc. restrict airflow across coolers, drain all condensate, etc. Operation in “Cold Weather” may result in booster damage if preventative measures aren’t taken.
- Do not inject any type of flammable or explosive gas or liquid into the booster or piping as a means of thawing frozen components or preventing “freeze up”. Serious injury, death, and severe damage to equipment can occur.

- Welding on unit may cause severe damage to unit. Consult engine manufacture manual for proper procedures.
- Use proper welding procedures when welding on rotating equipment.
- When replacement parts are required for this booster, Keystone recommends using genuine parts from the original manufacturer or parts with equivalent specifications including, but not limited to physical dimensions, type, strength and material. Failure to heed this warning can lead to premature failures, product damage, and/or personal injury or death.
- During reassembly be sure parts are replaced in their original positions. Be sure inlet valves are placed in inlet valve ports and discharge valves are placed in discharge ports. Incorrect positioning of valves is *extremely dangerous*.
- Ether is an extremely volatile, highly flammable gas. Follow engine manufacturer recommendations. Do not use ether if engine has an air inlet heater or glow plug starting aid. Engine damage will result.
- Condensate must be drained from scrubber bottles hourly or continuously.
- **CAUTION** - Excessive amounts of lubrication and/or the use of the wrong kind of lubricating oil may create an atmosphere or mixture that could result in auto-ignition thus creating an explosion. In addition, the introduction of a spark or electric charge to a mixture of air and lubricating oil can result in an explosion. Keystone recommends that the booster lubrication rates be checked daily to assure the correct amount of lubrication is being applied.
- **CAUTION** - Make certain lubrication pump is set at proper lubrication rate.

#### *Hazardous Substance Precaution*

The following substances are used in the manufacture of this machine and may be hazardous to health if used incorrectly:

- **Precaution:** Avoid ingestion, skin contact and breathing fumes for the following substances: Antifreeze, Compressor Oil, Engine Lubricating Oil, Preservative Grease, Rust Preventative, Diesel Fuel, Battery Electrolyte and Scrubber Bottle Condensate.

The following substances may be produced during the operation of this machine and may be hazardous to health:

- Avoid build-up of Engine Exhaust Fumes in confined spaces.
- Avoid breathing Exhaust Fumes.
- Avoid contact with scrubber bottle condensate.

## RUNNING THE BOOSTER

The following section will inform the operator on the proper procedures for unit preparation and starting the booster. The steps are intended to be followed in order.

### UNIT PREPARATION

Prior to connecting the supply power or starting the unit, the operator must inspect the electrical and mechanical components to ensure safe operation.

Open the Input Panel Breaker, and VFD Breaker prior to inspecting the unit.



**All steps within this section must be done prior to connecting supply power. Failure to comply may result in serious injury or death. If any discrepancies are identified, lock out/tag out the unit per site SOP until the issue is corrected.**

### ELECTRICAL

- Check the grounding straps from the transformer, motor, and panels to the skid to ensure connections are tight and that the straps are intact.
- Ensure the receptacle locking devices are operating and that the locking pins are present.
- If the unit was stored outdoors, check inside the panels for any standing water that may need to be evacuated.
- Check any exposed cables for worn or damaged insulation.
- Ensure all guards, clamps, and supports are in place for cables.
- Check panels and enclosures for any damage.

### MECHANICAL

- Check the belts on the fan motor for any damage and for proper tension.
- Check the fan guard for missing hardware or damage.
- Check compressor piping and hoses for any loose connections or damage.
- Ensure the coupling guard is in place and secure.
- Check for fluid leaks and ensure compressor oil level is within operating limits.

## SUPPLY CABLES

Connect the power supply electric cables to the Input Panel receptacles. Once the cables are installed into the receptacles, be sure to utilize the locking device and pin to retain the cables. Cable color and receptacle color should match the proper phase.

Connect the supply ground to the equipment ground receptacle on the Input Panel.

When routing the cables, be sure to reduce the amount of strain on the cables and compressor equipment.



**Be sure that supply lines are de-energized before connecting or disconnecting cables.**

## SERVICE AIR CONNECTION



**All air pressure equipment installed in or connected to the booster must have safe working pressure ratings of at least the safety valve setting, and materials compatible with the compressor oil.**

**Do not connect the air discharge on this booster onto a common header with any other unit of any description, or any other source of compressed air, without first making sure a check-valve is used between the header and the booster. If this booster is connected in parallel with another booster of higher discharge pressure and capacity, a safety hazard could occur in a back-flow condition.**

**Unrestricted air flow from a hose will result in a whipping motion of the hose which can cause serious injury or death. A safety device must be attached to the hose at the source of supply to reduce pressure in case of hose failure or other sudden pressure release. Reference: OSHA regulation 29 CFR Section 1926.302 (b).**

## AIR HOSE RESTRAINT

Safety devices such as hose restraints (whipchecks or whipsocks) must be properly sized and used to prevent hose whipping if a connection fails.

The mounts and/or shackles are to be of the same or greater strength as the restraint. An engineer should be consulted about suitability of whipchecks, whipsocks, mounts, mounting points, shackles, and fittings as well as strength rating of materials. Restraints must be used at the hose origination, termination, and each hose-to-hose connection.

Hoses can fail in areas other than at connecting points and require daily inspection of hoses for:

- Cuts, cracks or kinks
- Weakened clamps due to rust and corrosion
- Damaged connections
- Deformity
- Incorrect or incompatible components or fittings
- Any visible damage

Hoses must be selected that are rated for the application as to the maximum pressure and temperature to be encountered as well as compatible with the materials being conveyed inside the hose. Hoses must be compatible with the compressor oil.

The booster is equipped with tie-down lugs at the discharge pipe that are designed to accept shackles for restraining the hose.



## BREAKERS

Prior to closing the breakers, the supply electric cables may be energized.



**Follow site PPE guidelines and SOP for energizing/de-energizing systems. Do not open or close a breaker while the unit is under load.**

Close the Input Panel Breaker. Close the Soft Start Breaker and the VFD Breaker on the Control Panel.



**With the Breakers closed (ON), the system is considered energized.**

## AIR OUTLET

With the panel prepared to run, the booster will need to be configured to minimize the initial load on the electric motor.

Open the manual blowdown valve to ensure the separator tank has been vented of all pressure. Once all pressure is vented, close the valve.

Close the discharge ball valve to isolate the booster.

## BOOSTER OPERATION

**If this is the first time running the booster with this configuration, i.e., new site, different generator, different distribution panel, etc., the booster rotation will need to be confirmed prior to running. There is a potential for the phases to be misconfigured between the power source and the booster. Once correct rotation is confirmed, start-up may proceed. If incorrect rotation was observed, notify site management.**

- This booster requires a trained person to operate it. It is not designed to run unattended.
- Make certain all relevant personnel (operator(s), maintenance personnel, etc.) must read, understand and follow the procedures, rules and guidelines provided in the BOOSTER SAFETY INFORMATION sheets provided in this manual before proceeding.
- Never operate booster at a pressure that exceeds the Rated Discharge Pressure (R.D.P.) of the booster.
- The Rated Discharge Pressure (R.D.P.) must be known to all relevant personnel (operator(s), maintenance, etc.). The Rated Discharge Pressure of the booster is found on the unit number/serial number plate located on the side of the cooler. It is also displayed on the control panel of the booster and also listed in the parts and operation manual provided with the unit.
- This booster is capable of operating in several different operational modes depending upon the position of the valves (Two Stage, Single Stage, and Bypass). In addition, there are valve positions listed for START-UP and SHUT DOWN. See charts which show valve positions for each of the above conditions.
- Booster engine MUST be shutdown when booster is in Bypass Mode.
- Make certain you understand the charts and valve positions for Two Stage Operation, Single Stage Operation, Bypass Operation, Start-Up and Shut Down.
- It is also imperative that the valve(s) be put in its position in the proper sequence. Please see SEQUENCE CHARTS.
- Make certain you understand the SEQUENCE CHARTS before proceeding.
- Failure to put valves in their proper position and in the proper sequence will affect booster performance.
- Excessive amounts of lubrication and/or the use of the wrong kind of lubricating oil may create an atmosphere or mixture that could result in auto-ignition thus creating an explosion. In addition, the introduction of a spark or electric charge to a mixture of air and lubricating oil can result in an explosion. Keystone recommends that the booster lubrication rates be checked daily to assure the correct amount of lubrication is being applied.
- Make certain lubrication pump is set at proper lubrication rate.

### STARTING PROCEDURE

This section contains important operation instructions that reference different sequences and valve positions. Prior to start-up, review this section to properly identify the referenced information and understand the proper sequence for operation.

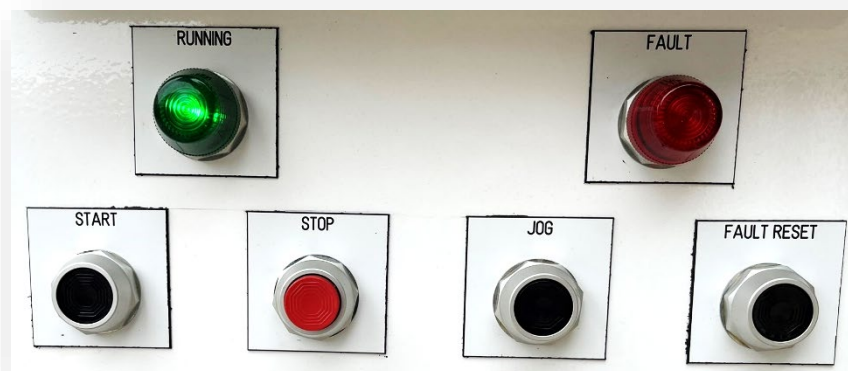
Prior to start-up:

- Unit must be level.
- Check all fluid levels:
  - Gear box (gear oil)
  - Booster (crankcase oil and coolant)
  - Lubricator Box (oil)
- Make certain there is no air pressure in the system (see START-UP valve positions).
- Condensate drain valves must be open and all condensates must be out of tanks.
- Vent valve must be open.
- Make certain that condensate drain valves (H-1 and H-2) and vent to atmosphere valve (G) are not blocked with ice if unit is in cold environment.
- See START-UP valve position sheet and place all valves in the START-UP position.

The Operator may observe and monitor parameters displayed on the PanelView. If feedback is within start-up parameters, the unit is ready to run in AUTOMATIC MODE.

### AUTOMATIC MODE

Press the START button on the Control Panel.



When the machine enters the start-up process, the control panel monitors several parameters prior to starting, which may cause a delay in the starting process. Depending on the ambient temperature, the process may take up to 5 minutes if below 25°F.



## ! CAUTION

**The suction pressure of the booster must be below 20psi in order for the control panel to allow the booster to start.**

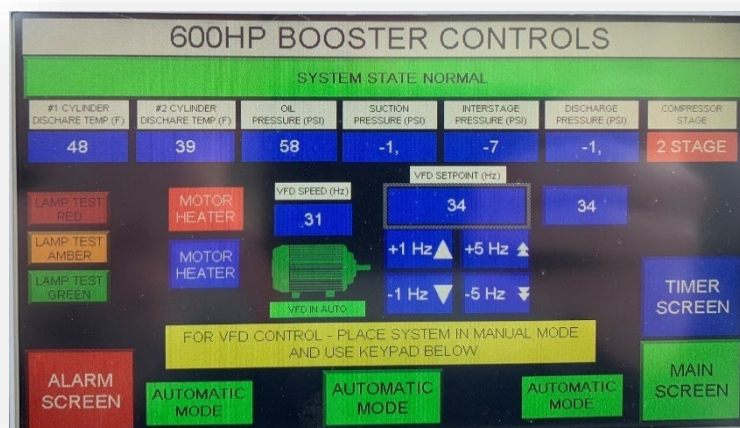
When the unit enters the running process, the green indicator will illuminate (RUNNING).

In the event the controller detects a parameter outside of normal starting limits, the PanelView will display the cause. Depending on the cause, the starting process may enter a time-delayed process or may be unable to be run in AUTOMATIC MODE. If the unit fails to run in AUTOMATIC MODE, and the cause for being outside starting parameters is deemed safe for equipment and personnel to be run manually, proceed to starting the booster in MANUAL MODE.

### MANUAL MODE

Starting the booster manually eliminates the automated process involved with different functions of the starting procedure. In order to properly start the compressor, this procedure needs to be conducted manually per the following:

1. Navigate to the MANUAL SCREEN on the PanelView controller.
2. Enter MANUAL MODE
3. Press the blue BYPASS SOL button (icon above button will turn from red to green)
4. Press the blue PUMP RELAY button (icon above button will turn from red to green)
5. Pause for five seconds
6. Press the green START button above the large motor image (image will turn from red to green)
7. Once the motor reaches full speed, press the blue PUMP RELAY button (icon above button will turn from green to red)
8. Press the blue BYPASS SOL button (icon above button will turn from green to red)
9. Using the VFD Controller, press the HAND button to enter MANUAL MODE
10. Using the arrows on the VFD Controller, navigate the cursor on the screen to adjust the speed of the cooling fan



## VALVE SEQUENCE

To load the booster:

- Vent valve should be open.
- Slowly open inlet valves (air from primary compressors).
- Slowly open discharge valve (air to rig).
- Slowly close vent valve.
- Booster should be turning, but no air is going through it.
- Adjust engine speed to desired setting.
- See SEQUENCE CHARTS for proper valve positions:
  - For Single Stage Operation (see A)
  - For Two Stage Operation (see B)
  - For Bypass Operation (see C)
  - For Shut Down (see D)
  - For Emergency Stop (see E)

## NOTES:

- **DISCHARGE VALVE ON BOOSTER SHOULD NEVER BE CLOSED WHILE BOOSTER IS OPERATING UNLESS VENT VALVE IS OPENED**
- **MAKE SURE THAT ALL REPLACEMENT HOSES ARE COMPATIBLE WITH SYNTHETIC OIL (HYDRAULIC HOSES ARE NOT COMPATIBLE)**
- **FAILURE TO DO THE ABOVE MAY RESULT IN SHUT DOWN AND/OR SEVERE DAMAGE TO UNIT.**

**BOOSTER MOTOR MUST BE STOPPED AND ALL PRESSURE MUST BE RELIEVED FROM SYSTEM BEFORE CHANGING FROM ONE BOOSTER MODE OF OPERATION TO ANOTHER BOOSTER MODE OF OPERATION.**

For **SINGLE STAGE OPERATION**, move the following valves from the START-UP position into the SINGLE STAGE OPERATION position in this order:

A

Sequence	Valve Name	Letter	Position
1 <sup>st</sup>	Discharge Valve	I	Open
2 <sup>nd</sup>	Condensate Drain/Vent Valve	H1 - H2	Partially Close
3 <sup>rd</sup>	Vent to Atmosphere Valve	G	Close
4 <sup>th</sup>	Valve E	E	Close
5 <sup>th</sup>	Valve D	D	Open
6 <sup>th</sup>	Valve C	C	Open
7 <sup>th</sup>	Air Inlet Valve(s)	F	Open
8 <sup>th</sup>	Increase Motor RPM to Handle the Load		
Air is now flowing into booster and booster is compressing and discharging air.			

For **TWO STAGE OPERATION**, move the following valves from the START-UP position to the TWO STAGE OPERATION position in this order:

**B**

Sequence	Valve Name	Letter	Position
1 <sup>st</sup>	Discharge Valve	I	Open
2 <sup>nd</sup>	Condensate Drain/Vent Valve	H1 - H2	Partially Close
3 <sup>rd</sup>	Vent to Atmosphere Valve	G	Close
4 <sup>th</sup>	Air Inlet Valve(s)	F	Open
5 <sup>th</sup>	Increase Engine RPM to Handle the Load		
Air is now flowing into booster and booster is compressing and discharging air.			

For **BYPASS OPERATION**, move the following valves from the START-UP position into the BYPASS OPERATION position in this order:

**C**

Sequence	Valve Name	Letter	Position
1 <sup>st</sup>	Turn Booster Engine Off		
2 <sup>nd</sup>	Discharge Valve	I	Open
3 <sup>rd</sup>	Valve A	A	Close
4 <sup>th</sup>	Valve B	B	Open
5 <sup>th</sup>	Vent to Atmosphere Valve	G	Close
6 <sup>th</sup>	Air Inlet Valve(s)	F	Open
Air is now bypassing booster and is being discharged. Booster motor <u>MUST</u> be shut down when booster is in bypass mode of operation.			

#### SHUTDOWN PROCEDURE

**D**

Sequence	Valve Name	Letter	Position
1 <sup>st</sup>	Close Inlet Valve(s)	F	Close
2 <sup>nd</sup>	Open Vent to Atmosphere Valve	G	Open
3 <sup>rd</sup>	Close Discharge Valve	I	Close
4 <sup>th</sup>	Reduce Booster RPM		
5 <sup>th</sup>	Press the STOP button on Panel		

## EMERGENCY STOP



If an emergency situation should arise that would require stopping the booster immediately, stop the engine first and open Vent to Atmosphere valve (Valve G). Additional controls/valves may be moved to the unload/vent positions and the booster relieved of pressure afterwards.

## MONITOR AND CONTROL

With the booster started and operating, review the parameters on the PanelView display. The Operator should conduct a walk-around inspection of the unit to ensure that the booster is running safely. The visual inspection should include:

- Check for fluid leaks
- Check for signs of air leaks and bad connections
- Check for excessive vibration
- Check for loosening hardware

## PARAMETERS

The equipment's status is indicated by the tower lights on the control panel and provides a general idea on the health of the compressor from a distance.

When the green tower light is illuminated, all parameters are within normal operating ranges. If parameters reach the warning limit, the amber tower light will illuminate, but the compressor will continue to run. If the upper limits are reached, the red tower light will illuminate, and the compressor will shut down in a fault status. The alarm will need to be reviewed and cleared prior to restarting the compressor.

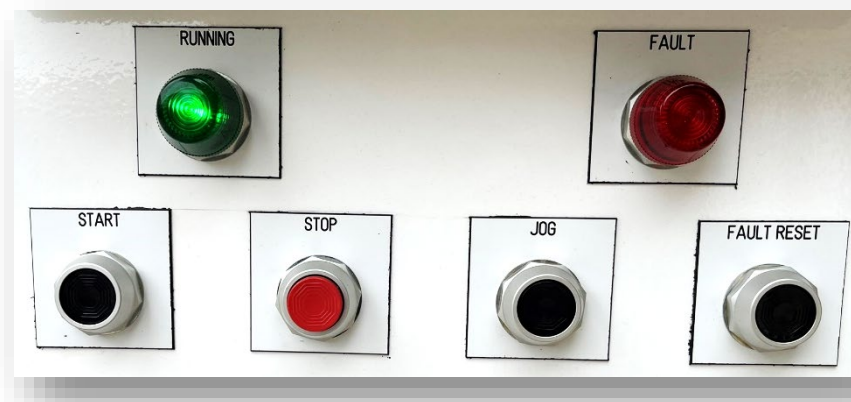
## SHUTTING DOWN

When the demand for air is complete, the shutdown sequence is to be followed in order to properly shut down the equipment.

**⚠ WARNING**

**The E-STOP switches located on the booster are not to be used for normal shut-down procedures. The E-STOP switches are for Emergency shut-down only. Repeated use may cause damage to the equipment.**

- Close the inlet valves.
- Open vent valve.
- Close the discharge valve.
- Lower motor speed to idle and allow for 5-minute cool down.
- Press the STOP button on the Control Panel.

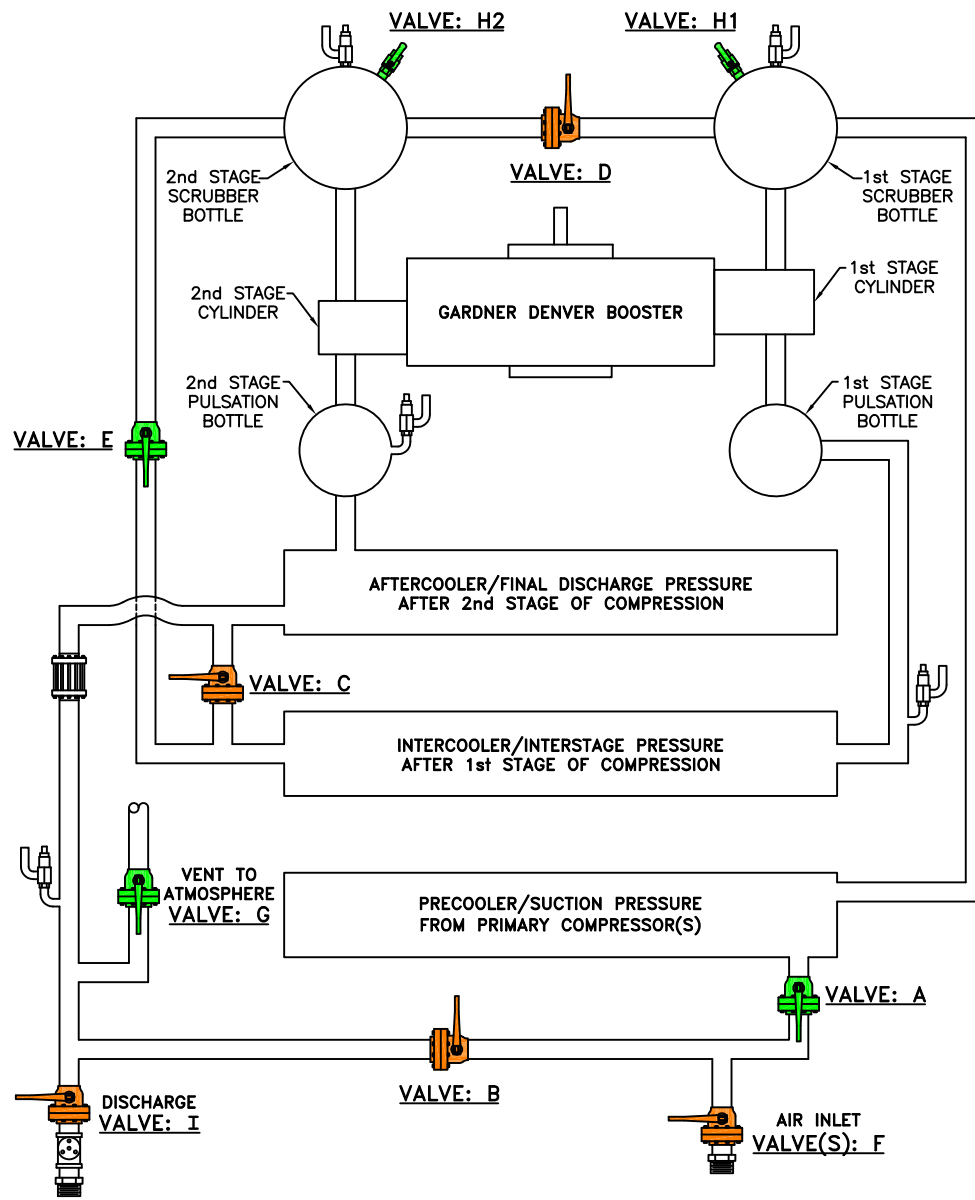


The booster will enter the shutdown process and the green indicator on the Control Panel “RUNNING” and the green tower light will begin to flash during the process. The shutdown process may take up to 90 seconds and is dependent on feedback within the system.

**⚠ WARNING**

**Even after pressure is relieved from the booster piping system, any air supply line from the compressors could remain under pressure and cause serious personal injury or death. Use caution when working with supply hoses as they may still be pressurized following booster shut down.**

# START-UP (POSITION OF VALVES)



## LEGEND:

- VALVE (OPEN POSITION)
- VALVE (CLOSED POSITION)
- WAFER CHECK VALVE
- CHECK VALVE
- SAFETY RELIEF VALVE
- CONDENSATE DRAIN/VENT VALVE (OPEN POSITION)

## START-UP - POSITION OF VALVES

THE VALVES ARE IN THE FOLLOWING POSITIONS WHEN BOOSTER IS BEING STARTED:

VALVE-A: OPEN  
 VALVE-B: CLOSED  
 VALVE-C: CLOSED  
 VALVE-D: CLOSED  
 VALVE-E: OPEN  
 VALVE(S)-F: CLOSED  
 VALVE-G: OPEN  
 VALVE-H1: OPEN  
 VALVE-H2: OPEN  
 VALVE-I: CLOSED

NEVER CLOSE BOOSTER DISCHARGE VALVE WHILE BOOSTER IS OPERATING WITHOUT FIRST OPENING THE VENT TO ATMOSPHERE VALVE








BOOSTER ENGINE MUST BE STOPPED AND ALL PRESSURE MUST BE RELIEVED FROM SYSTEM BEFORE CHANGING FROM ONE BOOSTER MODE OF OPERATION TO ANOTHER BOOSTER MODE OF OPERATION

START-UP (POSITION OF VALVES)  
GARDNER DENVER BOOSTER / EASTERN STYLE COOLER

DRAWN: C.A.B.	SCALE: NONE	REV NO. 00	DWG. NO. GDBOOSTER-E
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# SINGLE STAGE OPERATION (POSITION OF VALVES)

## LEGEND:

-  - VALVE (OPEN POSITION)
-  - VALVE (CLOSED POSITION)
-  - WAFER CHECK VALVE
-  - CHECK VALVE
-  - SAFETY RELIEF VALVE
-  - CONDENSATE DRAIN/VENT VALVE (CRACKED/OPEN)
-  - ARROWS INDICATE DIRECTION OF AIR FLOW

## SINGLE STAGE OPERATION - POSITION OF VALVES

THE VALVES ARE IN THE FOLLOWING POSITIONS WHEN BOOSTER IS RUNNING IN SINGLE STAGE OPERATION:

VALVE-A: OPEN  
 VALVE-B: CLOSED  
 VALVE-C: OPEN  
 VALVE-D: OPEN  
 VALVE-E: CLOSED  
 VALVE(S)-F: OPEN  
 VALVE-G: CLOSED  
 VALVE-H1: CRACKED/OPEN  
 VALVE-H2: CRACKED/OPEN  
 VALVE-I: OPEN

BLUE- SUCTION  
PRESSURE

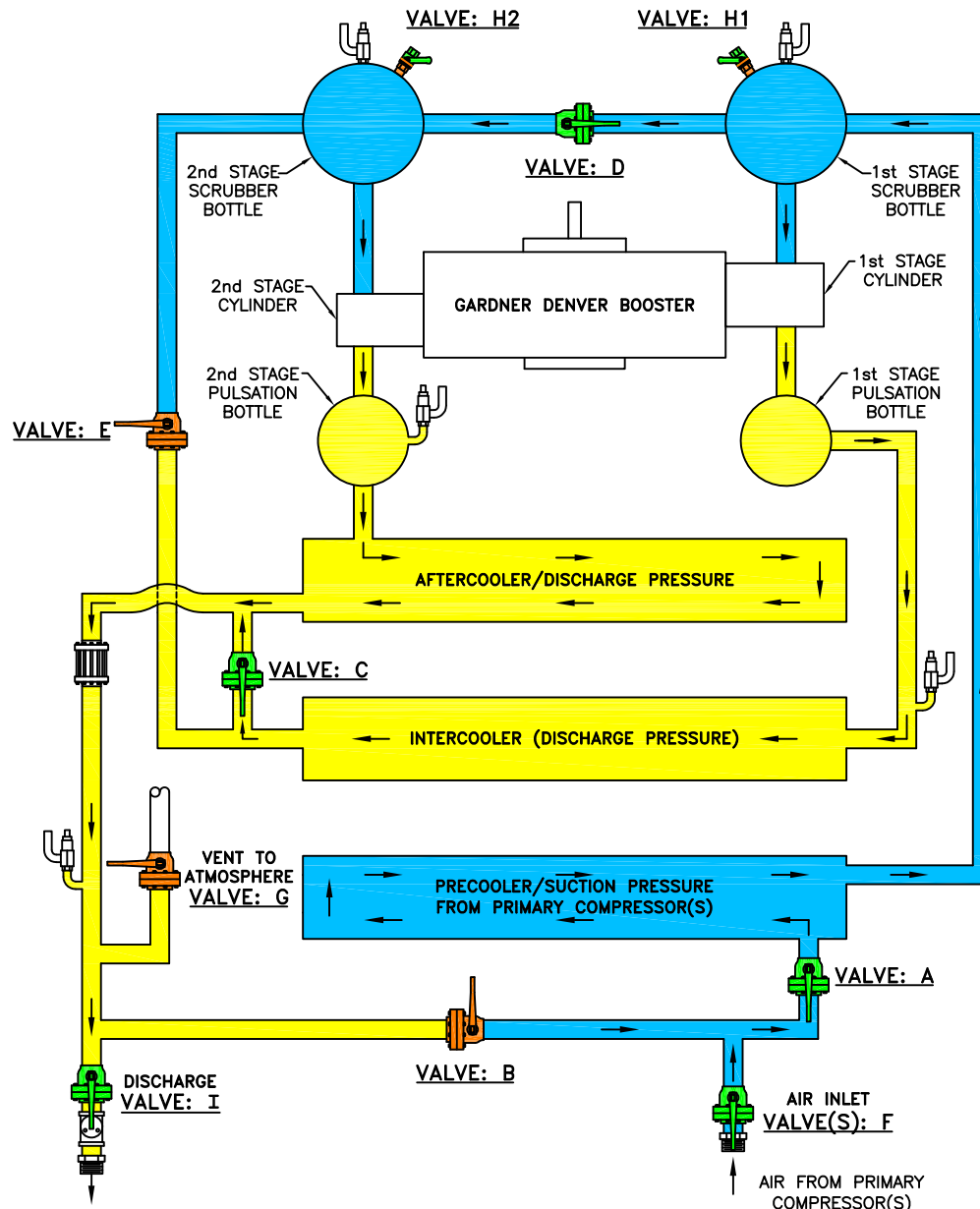
YELLOW- DISCHARGE  
PRESSURE

NEVER CLOSE BOOSTER DISCHARGE VALVE  
WHILE BOOSTER IS OPERATING WITHOUT FIRST  
OPENING THE VENT TO ATMOSPHERE VALVE

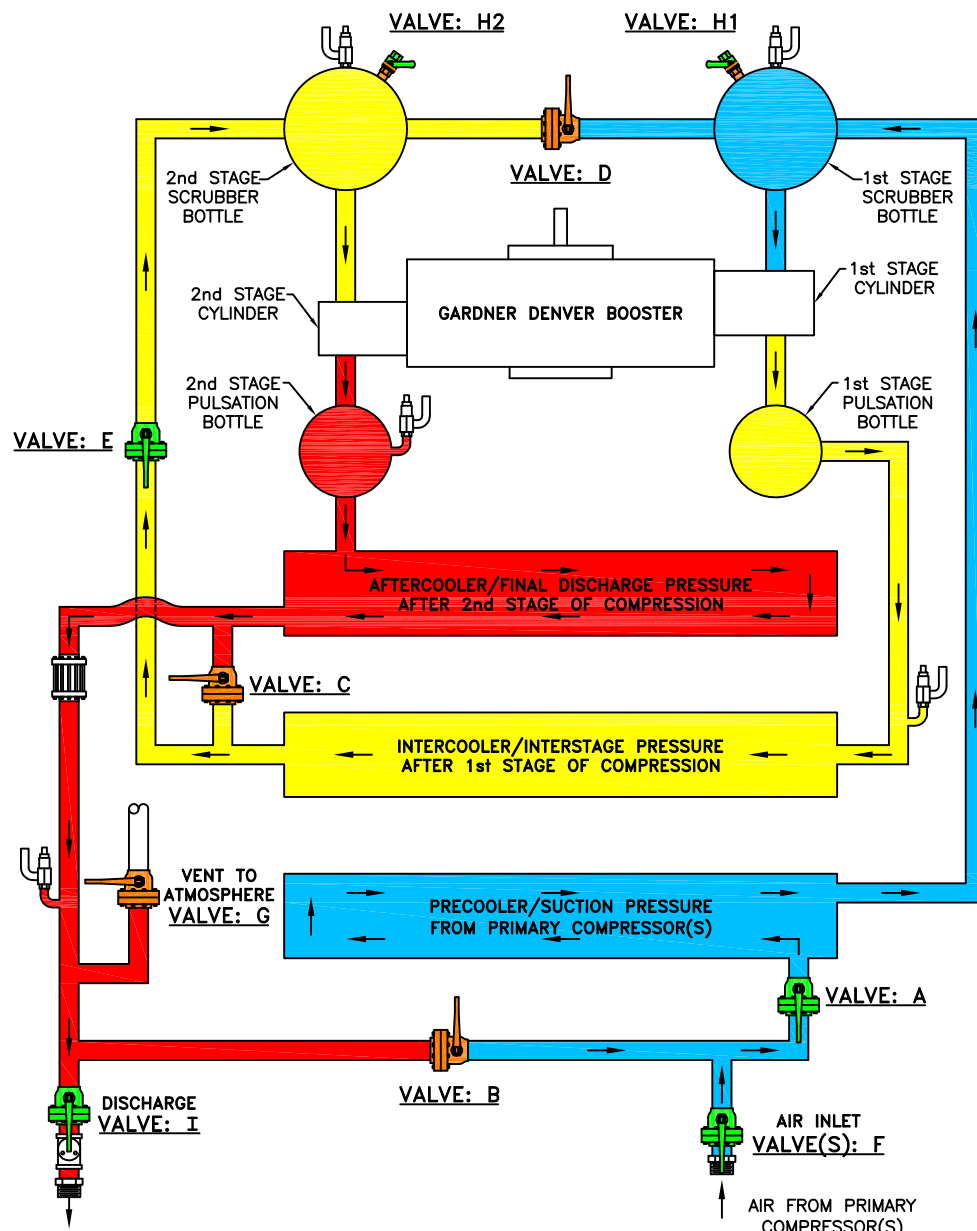
BOOSTER ENGINE MUST BE STOPPED AND ALL PRESSURE MUST BE  
RELIEVED FROM SYSTEM BEFORE CHANGING FROM ONE BOOSTER  
MODE OF OPERATION TO ANOTHER BOOSTER MODE OF OPERATION

MODE: SINGLE STAGE OPERATION (POSITION OF VALVES)  
GARDNER DENVER BOOSTER / EASTERN STYLE COOLER

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CHECKED: R.P.S.	DATE: 07-23-08	SHEET 2 of 6	



# TWO-STAGE OPERATION (POSITION OF VALVES)



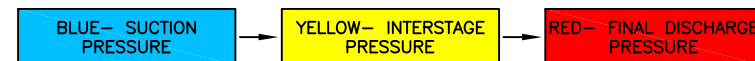
## LEGEND:

- VALVE (OPEN POSITION)
- VALVE (CLOSED POSITION)
- WAFER CHECK VALVE
- CHECK VALVE
- SAFETY RELIEF VALVE
- CONDENSATE DRAIN/VENT VALVE (CRACKED/OPEN)
- ARROWS INDICATE DIRECTION OF AIR FLOW

## TWO-STAGE OPERATION - POSITION OF VALVES

THE VALVES ARE IN THE FOLLOWING POSITIONS WHEN BOOSTER IS RUNNING IN TWO-STAGE OPERATION:

VALVE-A: OPEN  
 VALVE-B: CLOSED  
 VALVE-C: CLOSED  
 VALVE-D: CLOSED  
 VALVE-E: OPEN  
 VALVE(S)-F: OPEN  
 VALVE-G: CLOSED  
 VALVE-H1: CRACKED/OPEN  
 VALVE-H2: CRACKED/OPEN  
 VALVE-I: OPEN



NEVER CLOSE BOOSTER DISCHARGE VALVE WHILE BOOSTER IS OPERATING WITHOUT FIRST OPENING THE VENT TO ATMOSPHERE VALVE

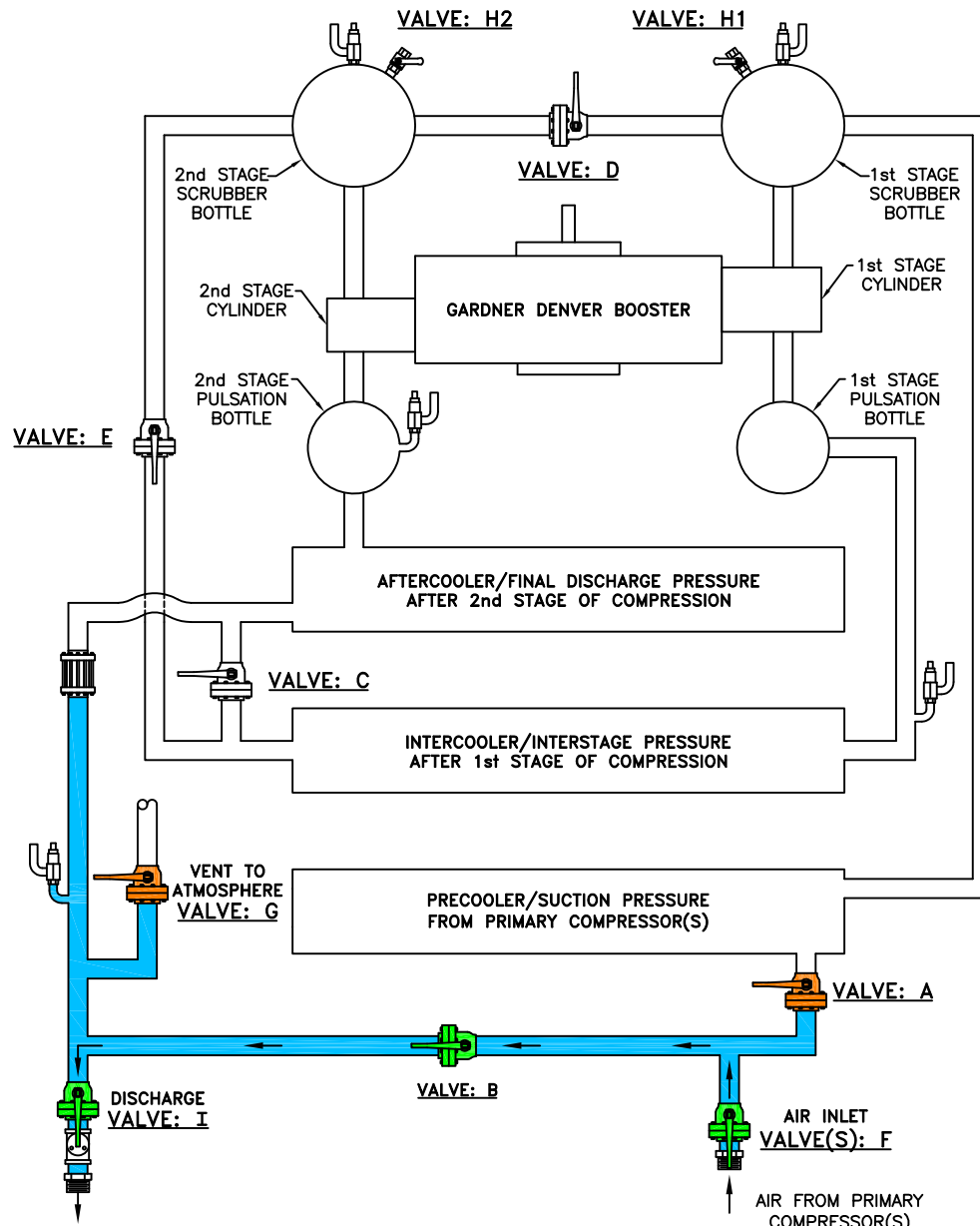
BOOSTER ENGINE MUST BE STOPPED AND ALL PRESSURE MUST BE RELIEVED FROM SYSTEM BEFORE CHANGING FROM ONE BOOSTER MODE OF OPERATION TO ANOTHER BOOSTER MODE OF OPERATION

MODE: TWO-STAGE OPERATION (POSITION OF VALVES)  
GARDNER DENVER BOOSTER / EASTERN STYLE COOLER

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CHECKED: R.P.S.	DATE: 07-23-08	SHEET 3 of 6	



# BY-PASS OPERATION (POSITION OF VALVES)



## LEGEND:

- VALVE (OPEN POSITION)
- VALVE (CLOSED POSITION)
- WAFER CHECK VALVE
- CHECK VALVE
- SAFETY RELIEF VALVE
- CONDENSATE DRAIN/VENT VALVE (CRACKED/OPEN)
- ARROWS INDICATE DIRECTION OF AIR FLOW

## BY-PASS OPERATION - POSITION OF VALVES

THE VALVES ARE IN THE FOLLOWING POSITIONS WHEN BOOSTER IS RUNNING IN BY-PASS OPERATION:

VALVE-A: CLOSED  
 VALVE-B: OPEN  
 VALVE(S)-F: OPEN  
 VALVE-G: CLOSED  
 VALVE-I: OPEN

BLUE- DISCHARGE PRESSURE  
 FROM PRIMARY COMPRESSOR(S)

BOOSTER ENGINE MUST BE SHUT DOWN WHEN  
 BOOSTER IS IN BYPASS MODE OF OPERATION

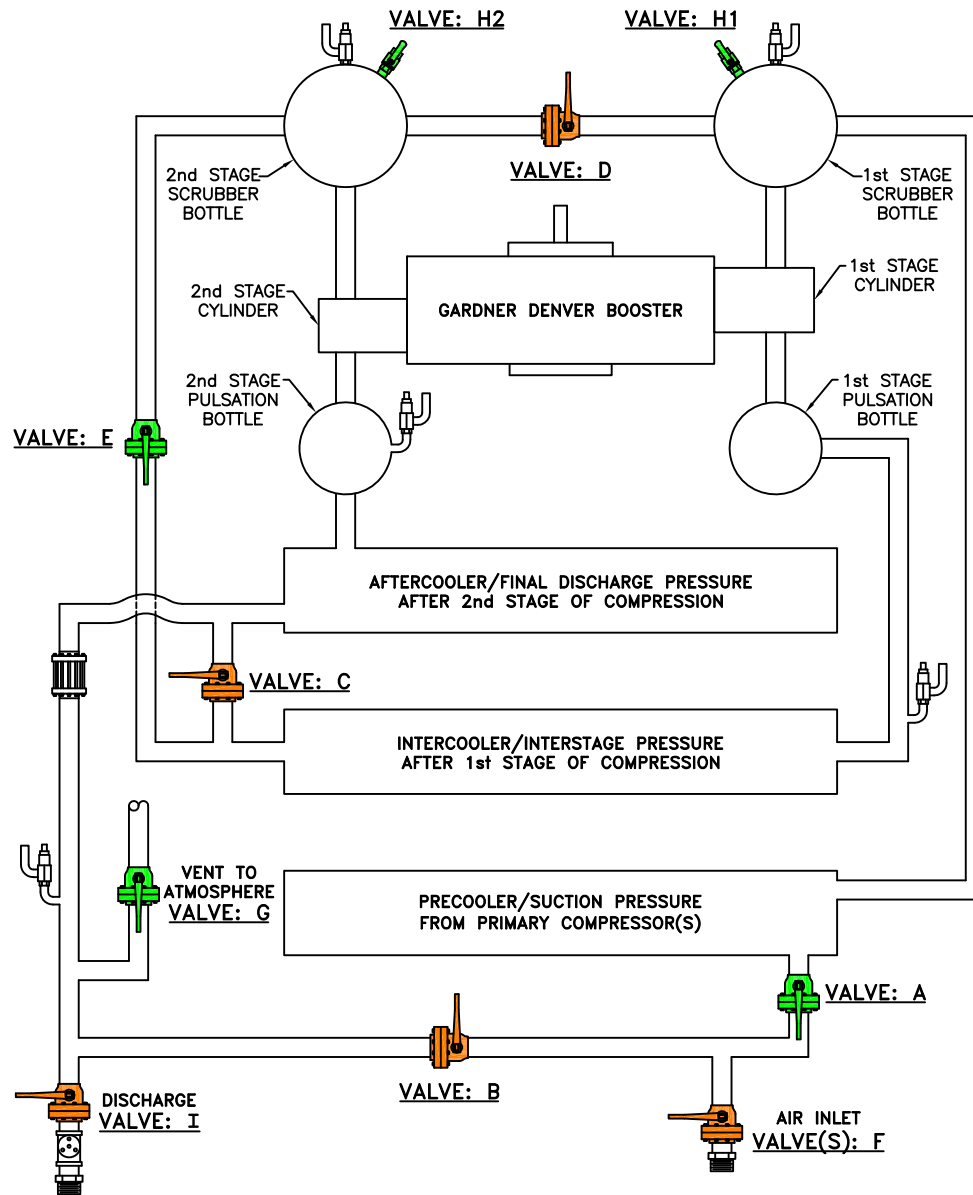
NEVER CLOSE BOOSTER DISCHARGE VALVE  
 WHILE BOOSTER IS OPERATING WITHOUT FIRST  
 OPENING THE VENT TO ATMOSPHERE VALVE

BOOSTER ENGINE MUST BE STOPPED AND ALL PRESSURE MUST BE  
 RELIEVED FROM SYSTEM BEFORE CHANGING FROM ONE BOOSTER  
 MODE OF OPERATION TO ANOTHER BOOSTER MODE OF OPERATION







MODE: BY-PASS OPERATION (POSITION OF VALVES)  
 GARDNER DENVER BOOSTER / EASTERN STYLE COOLER

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# SHUT-DOWN (POSITION OF VALVES)



## LEGEND:

-  - VALVE (OPEN POSITION)
-  - VALVE (CLOSED POSITION)
-  - WAFER CHECK VALVE
-  - CHECK VALVE
-  - SAFETY RELIEF VALVE
-  - CONDENSATE DRAIN/VENT VALVE (OPEN POSITION)

## SHUT-DOWN \_ POSITION OF VALVES

THE VALVES ARE IN THE FOLLOWING POSITIONS WHEN BOOSTER IS SHUT-DOWN:

VALVE-A: OPEN  
 VALVE-B: CLOSED  
 VALVE-C: CLOSED  
 VALVE-D: CLOSED  
 VALVE-E: OPEN  
 VALVE(S)-F: CLOSED  
 VALVE-G: OPEN  
 VALVE-H1: OPEN  
 VALVE-H2: OPEN  
 VALVE-I: CLOSED

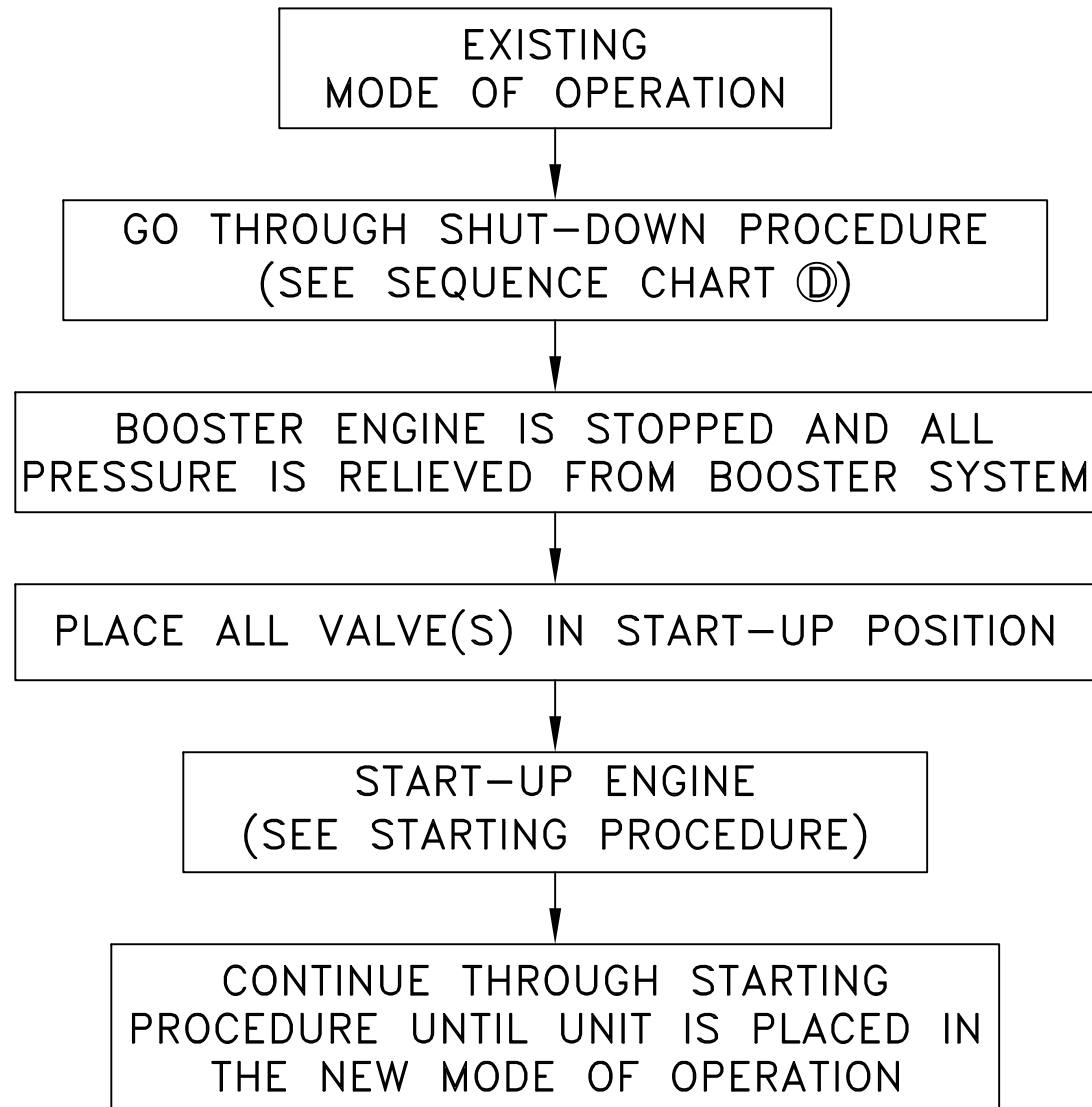
NEVER CLOSE BOOSTER DISCHARGE VALVE WHILE BOOSTER IS OPERATING WITHOUT FIRST OPENING THE VENT TO ATMOSPHERE VALVE

BOOSTER ENGINE MUST BE STOPPED AND ALL PRESSURE MUST BE RELIEVED FROM SYSTEM BEFORE CHANGING FROM ONE BOOSTER MODE OF OPERATION TO ANOTHER BOOSTER MODE OF OPERATION

SHUT-DOWN (POSITION OF VALVES)  
GARDNER DENVER BOOSTER / EASTERN STYLE COOLER

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# PROCEDURE FOR CHANGING FROM EXISTING MODE OF OPERATION TO A NEW MODE OF OPERATION



PROCEDURE FOR CHANGING MODE OF OPERATION  
GARDNER DENVER BOOSTER / EASTERN STYLE COOLER

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