



**Liquid Ring
Medical Vacuum System**

SIGNAL 1₉₂

**Installation
Operation and
Maintenance
Manual
1.5 - 20 Hp**



Liquid Ring Medical Vacuum System

Model Number:	
Serial Number:	
Date Purchased:	
Purchased from:	

For further technical assistance, service or replacement parts, please contact:

Patton's Medical
3201 South Boulevard
Charlotte, NC 28209

Customer Service: 1-866-960-0087
Phone: 704-529-5442
FAX: 704-525-5148

www.pattonsmmedical.com

Please include the unit serial number located on the control panel with all inquiries.

Patton's Medical reserves the right to make changes and improvements to update products sold previously without notice or obligation.

Issue Date: March 26, 2013



Liquid Ring Medical Vacuum System

Table of Contents

Section:	Page Number:
1.0 Safety	4
2.0 Intended Use	5
4.0 Technical Data	6
6.0 Installation	8
7.0 Start-Up	10
8.0 Shut-Down	10
9.0 Operation	10
10.0 Controls	11
11.0 Long Term Shut-Down	12
12.0 Servicing	12
13.0 Maintenance	12
14.0 Warranty	13
Maintenance Chart	14
Trouble Shooting Chart	16
Exhaust Piping Chart	18
Parts Diagrams	
1.5 HP	19
3 HP	20
4 HP	21
5 HP	22
7.5 HP	23
10 HP	24
15 HP	25
Maintenance Record	38

1.0 Safety

Safe operation of the vacuum system requires strict adherence to all local and national codes. In addition to these requirements, specific dangers are identified within this manual and should be considered when installing and operating your Patton's Medical vacuum system.

General Safety Precautions

Improper operation or installation of the equipment could result in serious injury or death. These instructions should be read and understood before attempting to install or operate the equipment.

The system must be operated within the stated limits in this manual to avoid serious damage to the equipment.

This system consists of rotating equipment that could cause injury including loss of limb or severe cutting if normal safety precautions are not followed. Only personnel trained in proper installation and operating procedures should attempt to operate this equipment.

Hair and clothing can be pulled into this equipment during start-up and precautions should be taken to prevent same.

This equipment is designed to work on 3 Phase, 200-230/380-460 Volt, 50/60Hz AC current. Appropriate caution must be taken, including ensuring that the power is off and locked out prior to connecting or disconnecting the motor or making other electrical adjustments. Only a trained electrician should attempt to connect this equipment to the power source.

Surfaces within the vacuum system can cause burns or scalding. Do not touch internal surfaces within the system.

The system can produce vacuums to 29 inches Hg vacuum. Be sure that the vacuum has been vented to atmosphere before working on the system.

Only operate the system if the inlet piping is fully connected. The vacuum produced by the system can cause injury, especially to the eyes if looking into the system inlet when the system is energized.

2.0 Intended Use

The vacuum system contains a liquid ring vacuum pump as indicated below.

Pump Identification

Model Number	HP
3AL2041	1.5
3AL2061	3
3AL2101	4
3AL2141	5
3AL2251	7.5
3AL2281	10
3AL2341	15

Operating liquid should be tap water with a pH of 6 to 9, free of solids in the approximate quantity shown in table 2-2. Do not use de-ionized or distilled water.

Operating Liquid Sump Capacity

Model Number	Water Capacity US gal
3AL2041	4.0
3AL2061	5.5
3AL2101	5.5
3AL2141	16.3
3AL2251	16.3
3AL2281	16.3
3AL2341	16.3

Care must be taken to ensure that the operating liquid is not exposed to freezing conditions during periods of inactivity. Addition of up to 30 percent ethylene or propylene glycol by volume is acceptable and will protect from freezing at temperatures as low as 0 F.



Liquid Ring Medical Vacuum System

4.0 Technical Data

Weight

Model	Empty lbs/Kg	Filled with Water lbs/Kg
3AL2041 (1.5 HP)	105/47.7	138.4/62.9
3AL2061 (3 HP)	150/68.2	195.9/89.1
3AL2101 (4 HP)	190/86.4	235.9/107.2
3AL2241 (5 HP)	360/163.6	495.9/225.4
3AL2251 (7.5 HP)	380/172.7	515.9/234.5
3AL2281 (10 HP)	470/213.6	605.9/275.4
3AL2341 (15 HP)	580/263.6	715.9/325.4
3AL2430 (20 HP)	620/281	755/342

Quantity of Anti-liming Agent

Use granulated citric acid or 10% ethanoic acid in the quantity shown in the operating liquid sump filled with the normal amount of water as noted in below.

Model	Granulated Citric Acid	10% Ethanoic Acid
	lbs/Kgs	(US Gal/Liter)
3AL2041 (1.5 HP)	4.4/2	0.16/0.6
3AL2061 (3 HP)	8.8/4	0.26/1.0
3AL2101 (4 HP)	8.8/4	0.26/1.0
3AL2241 (5 HP)	17.6/8	1.4/5.5
3AL2251 (7.5 HP)	17.6/8	1.4/5.5
3AL2281 (10 HP)	17.6/8	1.7/6.3
3AL2341 (15 HP)	17.6/8	1.85/7
3AL2430 (20 HP)	17.6/8	1.85/7

Quantity of Corrosion Protection Agent

Use ethylene glycol without additives. Run the system briefly on the glycol water mixture to ensure all areas of the system are exposed to the glycol.

Model	Approximate Amount US Gals
3AL2041 (1.5 HP)	0.2
3AL2061 (3 HP)	0.3
3AL2101 (4 HP)	0.3
3AL2241 (5 HP)	1.4
3AL2251 (7.5 HP)	1.4
3AL2281 (10 HP)	1.7
3AL2341 (15 HP)	1.8
3AL2430 (20 HP)	1.8



Liquid Ring Medical Vacuum System

The system is an air cooled unit and therefore sufficient space as noted in this table must be allowed around the unit to ensure adequate air flow for cooling and proper operation. Front refers to the air inlet through the heat exchanger; back refers to the air outlet through the perforated metal grid and side refers to any other side of the unit.

Model	Front (Electrical Panel)	Back	Sides
3AL2041 (1.5 HP)	3'	2'	2'
3AL2061 (3 HP)	3'	2'	2'
3AL2101 (4 HP)	3'	2'	2'
3AL2241 (5 HP)	3'	2'	2'
3AL2251 (7.5 HP)	3'	2'	2'
3AL2281 (10 HP)	3'	2'	2'
3AL2341 (15 HP)	3'	2'	2'
3AL2430 (20 HP)	3'	2'	2'

Approximate noise level of the unit is described below for a system with the inlet and outlet piped to a remote location and corrected for local conditions to a free field value. Measurement is taken at 3 feet (1 meter) from any surface of the unit. Readings are taken at 60 Hz operation, units operating at 50 Hz will be approximately 3 dBA less in all cases. Values shown are for one pump running.

Model	Sound Pressure Level (dBA)
3AL2041 (1.5 HP)	66
3AL2061 (3 HP)	70
3AL2101 (4 HP)	74
3AL2241 (5 HP)	74
3AL2251 (7.5 HP)	71
3AL2281 (10 HP)	73
3AL2341 (15 HP)	76

The liquid ring vacuum system using ambient air as the coolant. The reported performance curves assume basic operating parameters as noted. Should local conditions vary significantly from these values, performance may be affected.

Condition Value	Value
Ambient Temperature	60 F /15 C
Barometric Pressure	14.7 psia /1013 mbar
Air Humidity	50%
Maximum Operating Liquid Temperature	160 F/ 71C
Minimum Ambient Temperature	40 F/ 5 C
Maximum discharge pressure	5 PSI

6.0 Installation

Install the unit in a location that allows for the consistent maintenance of the clearances around the unit as noted in Section 4 of this manual. Do not install the unit in areas where these clearances cannot be maintained. Do not stack material in the area immediately around the unit that may restrict cooling air flow into and out of the unit.

The system must be installed on a flat level surface that is stationary when the machine is operating.

Consult the factory for installations at altitudes above 3000 feet (1000 m) above mean sea level.

Ensure that the load bearing capacity of the installation surface will bear the weight of the unit filled with water as shown in Section 4 of this manual.

Any suitable fastener can be used to secure the system to the floor.

Securing the unit to the floor is only necessary when local conditions require it to ensure operation inside the vibration limits.

Install the electrical connections in accordance with all local and national codes.

Only a qualified electrician should electrically install this equipment.

Observe the voltages and frequency data on the nameplate. Ensure that the power supply is adequate to operate the unit. Voltage variations of plus or minus 5 percent and frequency variations of plus or minus 2 percent must not be exceeded. Before making the piping connection to the system, briefly jog the system (<10 sec) by turning it on and off to check direction of rotation. With a piece of paper, check the direction of air flow through the system. The paper should be held against the radiator when the system is operating in the proper direction. If the paper is blown away from the radiator, then the system is operating in the incorrect direction and two of the leads must be exchanged in the motor terminal box.

Ensure the power is de-energized before switching leads inside the terminal box to change motor direction.

Fill the system with water in the approximate amount as shown in Section 2.

Remove the plastic plug in the top of the water sump. Add water to the sump through this connection until the level reaches the level of the overflow on the back of the unit. Do not use high pressure water to fill

Check the water level by observing the liquid level sight glass installed near the operating liquid overflow connection on the back of the unit.

6.0 Installation (Continued)

If this is the first time the unit is being installed or run, add water to the inlet of the system to prime the pump. For the 1.5 HP through 5 HP add 0.4 gallons; for larger systems add 1.3 gallons.

Connect the inlet of the system to the vacuum header or source requiring the vacuum of the unit.

Ensure that no pipe stress is present on the system; application of stress to the inlet can cause the system to leak, malfunction, or fail.

Remove the pipe plug before connecting the inlet. The pipe plug is inserted prior to shipment to keep foreign bodies out of the operating liquid sump.

An inlet check valve is included with each system and additional check valves are not required.

Connect a 3/8" inch water supply line to the anti-siphon valve unit near the bottom of the perforated metal grid.

Connect a drain hose to the overflow water connection on the back of the unit. Failure to connect the overflow to a drain will result in operating liquid spilling onto the floor.

When installing discharge piping, ensure that the piping is large enough to keep the operating discharge pressure below 5 psig and that no pipe forces are allowed to be exerted onto the system (See chart page 17)

Add accessories as recommended by your Patton's Medical representative. The following items are available and commonly applied depending on the local circumstances.

Add an electronic level switch if remote monitoring of the liquid level in the operating liquid sump is desired.

Add a temperature gauge if monitoring of the operating liquid sump temperature is required.

7.0 Start-up

Visually check the operating liquid level in the operating sump on the liquid level gauge on the back of the unit. Add or remove water as necessary to achieve a level of water just below the level of the overflow connection.

Ensure the cover plate is mounted and secured properly.

Set the H-O-A switches are to "O" (OFF).

Check all voltages supplied to the system to ensure they are the required value and phases needed by the control panel.

Open the inlet isolation valve on each vacuum pump.

Open the receiver isolation valves.

Close the receiver bypass valve.

Apply power to the system and turn the disconnect switches to "Auto".

8.0 Shut Down

In general, the system may be shut down at any operating condition (pressure, temperature, etc.), but this will obviously affect the dependant processes.

To shut the system down, de-energize the power (turn it off).

If the system is not to be started for a long period of time, please follow the instructions in Section 10 of this manual.

9.0 Operation

Continuous operation at a maximum vacuum is possible. The power consumption of the vacuum system is at its lowest at this operating condition. In case of no load operation, we recommend operation at this condition (e.g. with the inlet blanked off from the process) rather than open flow to atmosphere.

In the case of liquid loss due to operation on dry air, the make-up water supply solenoid will replace the water if operating properly. The amount of makeup water is a constant 0.06 gallons per minute.

In the case that operating liquid builds up in the separator, the water will flow out of the overflow connection located on the back of the unit.

10 Controls

During normal operation, all H-O-A switches should be turned to the “Auto” position so the PLC can control the system. The PLC monitors the system Vacuum settings, starts and stops the Vacuum pumps depending on changing vacuum levels, and automatically alternates the lead position between pumps.

Any pump with the HOA in the Hand position will start and run continuous.

In a **simplex** system with the HOA in the Auto position the pump will start and stop based on the vacuum switch in the control panel. When the vacuum switch closes the pump will start and a minimum run timer will start timing. If the vacuum switch is open when the minimum run timer expires the the pump will turn off. Pump will restart when the vacuum switch recloses.

In a **duplex** system, one pump will be able to handle the system load. The PLC will signal the lead pump to start when the vacuum transducer (TDS-1) senses the receiver vacuum level falls below the lead cut in setting. If one pump can carry the load, then the pump will run until it's minimum run timer has expired, the PLC will then turn off the lead pump. When the system vacuum level drops again, the PLC will start the next pump and automatically sequence the pumps to maintain equal run time. If the lead pump runs continuously in lead for more than 15 minutes, the PLC will automatically switch to the other pump evenly distribute the run time among both compressors. If the pressure drops below the lag cut in setting the lag pump will turn on in addition to the lead pump, the PLC will turn on the “Lag Alarm” and display a visual flashing indication on the HMI and an audible alarm.

11.0 Long term Shut-down

When shutting down the system for long periods (greater than approximately one week), the system must be drained and protected from corrosion.

Remove and lock out the power from the system. Disconnect the power in such a way to ensure the system cannot be accidentally restarted during the period of storage.

Shut off the water to the 3/8” inch make-up connection at the bottom of the unit.

Open the drain valve on the operating liquid sump and remove all of the water from the sump.

Remove the sheet metal top and side (one or two pieces, depending on size).

Drain the liquid ring vacuum pump by removing the bottom drain connections and collecting the water in a suitable container.

Replace the pump drain plugs.

11.0 Long term Shut-down

Close the operating water sump drain valve.

Replace the sheet metal top and side.

If shutting down for very long periods (greater than 4 weeks) additional precautions must be applied.

Add a small amount of ethylene glycol to the inlet of the pump (see Section 4 of this manual).

Ensure the system is stored in a clean, dry location and is not exposed to extremes of temperature or weather.

To re-commission after a long storage period, add the following to the standard commissioning procedures outlined in Sections 6 and 7 of this manual.

Remove the anti-corrosion agent from the pump by draining it from the pump casing. Ensure proper disposal of the anti-corrosion agent.

Clean the system by adding water to the operating liquid sump and priming the pump as described in Section 6.

Briefly run the system.

Shut the system off and drain the system operating water from the sump.

Repeat this procedure until the system is free of debris or foreign matter.

12.0 Servicing

Do not attempt to service the system without consulting Pattons' Medical. For assistance. Normally, no service is required and the need for service may indicate a process problem that must be addressed prior to re-commissioning.

13.0 Maintenance

If hard water is used to operate the system, then the water should be softened or the entire unit must be de-calcified at regular intervals. Use the anti liming agent recommended in Section 4 of this manual.

Periodically check the hoses and fittings for leaks. If leaks are found, de-energize the system and tighten or replace the leaking fittings. If dirt or other foreign matter enters the system, it must be cleaned regularly



Liquid Ring Medical Vacuum System

Patton's Medical Systems Warranty

Patton's Medical warrants that all systems to be free of defects in material and workmanship under normal use for a period of twenty-four months from start-up, not to exceed thirty months from date of shipment. This warranty covers all necessary parts used in repair as well as all reasonable labor expense. Normal consumable parts as well as parts requiring calibration as part of routine scheduled maintenance (such as filters, Dewpoint/CO sensors/monitors) are not covered under this warranty.

This warranty does not apply to products that are damaged by external causes, or are improperly warehoused, used, installed, serviced, misapplied or maintained by the customer. The sole liability for **Patton's Medical** under this warranty is limited to repairing, replacing, or crediting, at its election, any such products provided that:

- **Patton's Medical** is notified promptly within the warranty period above of any warranty claim.
- The examination of such items by an authorized representative of **Patton's Medical** will disclose to their reasonable satisfaction that claimed products defect has not been caused by misuse, neglect, improper handling, installation, repair, alteration, or accidents.
- **Patton's Medical** requires that systems above 5 Hp simplex be commissioned by an authorized **Patton's Medical** distributor and requires a start-up report to be filed within 30 days of equipment start-up. Failure to submit a start-up report to **Patton's Medical** will void the warranty.
- **Replacement Parts** including pumps and motors carry a limited warranty based upon manufacturer specific terms. Parts carry a 90 day warranty unless the manufacturer's stated warranty is different. Labor for these warranties is not included or implied and is at the sole discretion of Patton's Medical.
- Simplex units 5Hp and below as well as retrofit dryer packages do not include factory assisted start-up in their base price unless specifically noted otherwise.

Product modification performed by the customer without prior written approval by **Patton's Medical** will invalidate the above warranty.

This warranty is given in lieu of all other warranties, expressed or implied, including implied warranties of fitness for a particular purpose and merchantability. In no event shall Patton's Medical be liable for damages in excess of the value of the defective product or part, nor shall Patton's Medical be liable for any indirect, special or consequential damages, loss of profits of any kind, or for loss of use of the products.

Patton's Medical shall not be liable to the customer for any claims, loss of damage of any kind whatsoever arising from the nonperformance of **Patton's Medical** of any part of this agreement occasioned by acts of God, fire, war, labor difficulties, governmental regulations, or action of government. **Patton's Medical** shall not be liable to the customer for any other cause, whether of a similar or dissimilar nature beyond its reasonable control.

Maintenance Chart

Problem	Probable Cause and Solution
Water consumption increases as indicated by reduction of liquid level in the operating liquid sump.	Clogged or obstructed cooler. Clean the cooler by blowing compressed air through it, taking reasonable and necessary safety precautions.
Ambient air highly contaminated.	Clogged or obstructed cooler. Clean the cooling fins with compressed air.
Dirt builds up in the system due to introduction with the suction gas or makeup water.	Clean the unit as described in Section 12 of this manual. Add an inlet filter or water filter as required.
Sand or other fine grain particulate enters system with make-up liquid.	Clean the system periodically (intervals dependant on contamination level, but at least once a year) as described in Section 12 of this manual. In addition, you can briefly run the system with the operating liquid drain closed to flush out any water existing in the pump. Take care to avoid contact with the cooling fan during this operation; it is recommended to reinstall the housing panels prior to operation of the system.
No vacuum due to jammed impeller	Turn the shaft by hand to free up. Turn off the electrical power supply and lock out power to the unit. Remove the sheet metal covers to the unit. Remove the shroud covering the fan (note: cooler may need to be removed to remove the shroud). Turn the fan by hand (do not use leverage). If the shaft will not come free, the unit must be serviced by an authorized service center. Please contact Patton's Medical for assistance.
Extreme hard water used as the operating and makeup liquid (Lime content greater than 15 degrees of hardness)	Soften the water or clean with 10% ethanoic acid on a periodic basis. To clean with ethanoic acid: Drain and clean the system as described in Sections 10. Lock out the power to the unit. Wear protective gloves (10 percent ethanoic acid can cause severe burns, handle with care). Disconnect the pipe/hose from the liquid ring pump to the top of the cooler at the cooler. Fill the interior of the unit with 10 percent ethanoic acid, taking all necessary precautions to avoid skin contact with the acid. Fill the pump by adding the proscribed amount (see Section 4) of ethanoic acid through the disconnected supply hose using a plastic funnel. Let the ethanoic acid sit in the pump for 30 minutes. Do not allow to sit for more than 45 minutes, as the acid can damage the seals of the pump. During the 30 minute period, occasionally turn the impeller by hand (using the cooling fan to turn the impeller).

Maintenance Chart (Continued)

Extreme hard water used as the operating and makeup liquid (Lime content greater than 15 degrees of hardness)	Drain the ethanoic acid from the pump by removing the drain plug and collecting the acid in a suitable container. Reconnect the drain plug, hose and reassemble the system. Fill with water and clean as described in Section 10. Recommission the unit as described in Section 6. Or decalcify the entire system using granular citric acid. If lime build-up is experienced in the entire system, it may be necessary to de-calcify the entire system. Do so as follows: Add the prescribed amount (Section 4) of citric acid to the sump (dissolve first in water and pour the resulting solution into the operating liquid sump). Operate the system for approximately 10 hours on the citric acid solution. Drain and clean the system as described in Section 10, taking care to dispose of the resulting citric acid solution properly. Re-commission the unit as described in Section 6.
---	--

Troubleshooting Chart

Fault	Cause	Remedy
Motor does not start, no noise.	Two or more power legs Interrupted	Check fuses, terminals, etc.. For source of interruption and correct.
Motor does not start, Humming noise.	One power supply lead interrupted	Check fuses, terminals, etc.. For source of interruption and correct.
	Impeller Jammed	Free by hand (see Maintenance Chart) or declassify unit if procedure is not successful and contact Patton's Medical for assistance.
Trip of motor starter at start-up	Incorrect starter setting	Ensure starter setting is correct (check current on nameplate)
	Discharge pressure too High	Measure discharge pressure if possible or disconnect any discharge piping and attempt to run while discharging into the room. Unclog piping or increase discharge piping size to eliminate pressure drop.
	Impeller Jammed	Free by hand (see Maintenance Chart) or declassify unit if procedure is not successful and contact Patton's Medical for assistance.
Excessive Power Consumption	Lime or other deposits	Decalcify or clean unit as required (see Maintenance Chart)
No vacuum	No operating liquid	Check liquid level in separator. Add as required to achieve proper level.
	Severe leak in system	Close off pump and run deadheaded to confirm pump is operating properly. If so, find and fix leak in the system.
	Wrong direction of Rotation	Check air flow direction and change direction of rotation if necessary.

Troubleshooting Chart

Insufficient Vacuum	System too small	Use larger system
	Inlet piping too long or too small.	Increase pipe diameter to reduce pressure loss in inlet piping. Contact Patton's Medical for assistance in determining correct pipe size.
	Leak at connection to vacuum system.	Check for leaks and repair if necessary.
	Operating liquid flow too low.	Check flow of water through the clear hoses. Remove any clogs or contamination.
	Operating liquid too warm	Cooling fins of unit clogged. Clean with compressed air as described in the Maintenance chart.
	Inlet filter clogged.	Change filter element; remove clog.
	Vacuum relief valve incorrectly set.	Close vacuum relief valve located on the pump in some units. Contact Patton's Medical for assistance.
Liquid water being expelled from separator	Baffles not installed.	Check installation of baffles in the operating liquid sump by removing the baffle cover plate and physically verifying their installation.
	Build up of water in the operating liquid sump.	Check sump level and remove obstructions from drain. Drain water off of sump to recommended level.
Abnormal screeching noise	Pump is operating in cavitation range.	Check cavitation protection connection and hose for clogging.



Liquid Ring Medical Vacuum System

Exhaust Piping

NFPA 99 requires that the exhaust line must be piped outside of the building. Size the piping according to the following chart. All pipe must be either seamless copper tubing or other corrosion-resistant metallic tubing, such as galvanized steel or stainless steel, as detailed in NFPA 99. A flexible connector (shipped loose) must be installed on each exhaust port of the vacuum pump before connecting to the main exhaust line leading outdoors. A drip leg must be installed at each exhaust port connection to drain any accumulated moisture. The outside pipe must be turned down and screened to prevent contamination.

WARNING: The vacuum exhaust vent must be located away from medical air intakes, doors and openings in the buildings to minimize possible contamination to the facility, in accordance with NFPA 99.

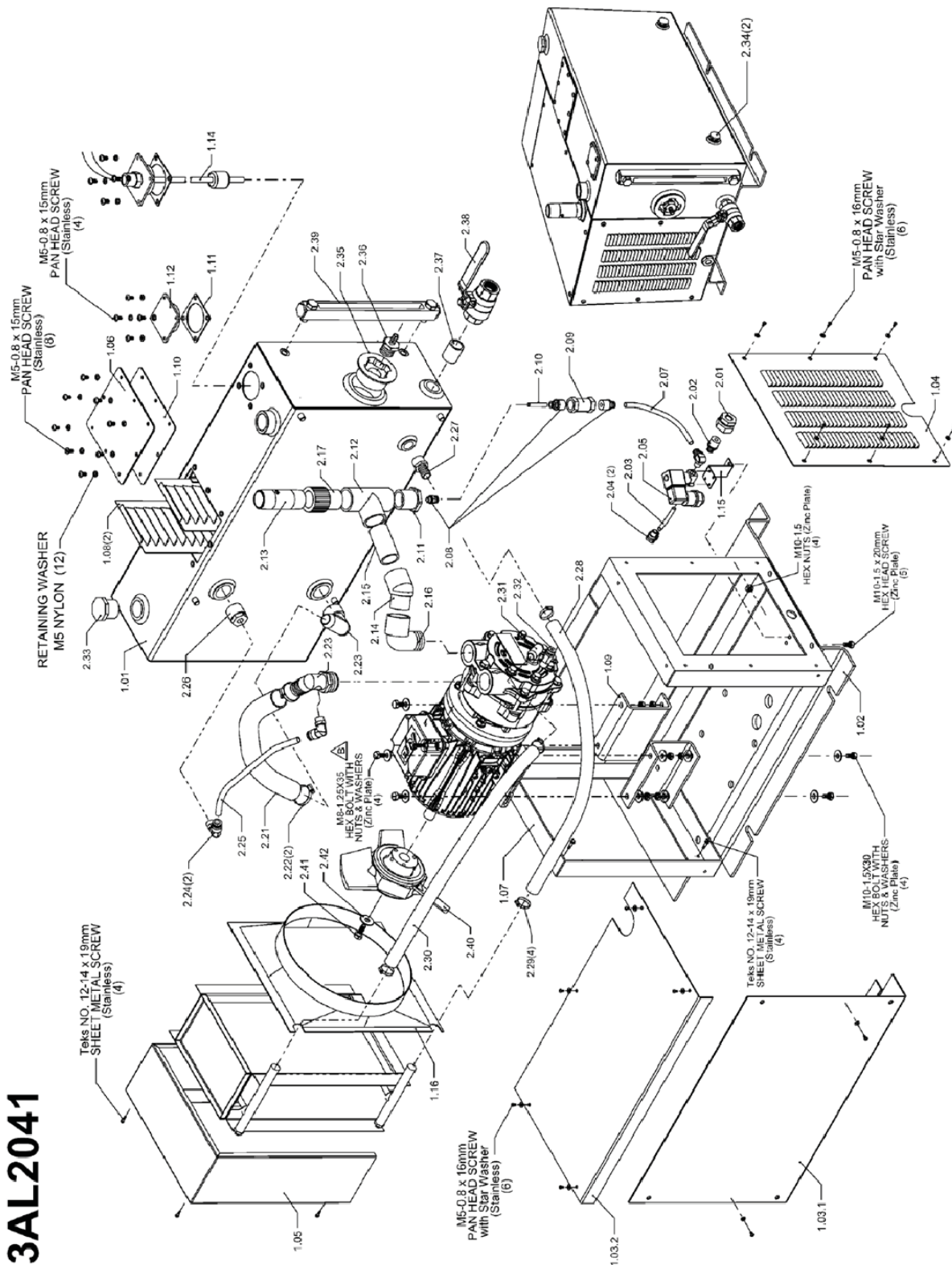
Unit Size HP	System Exhaust Pipe Length (ft) – See Notes											
	25	50	75	100	150	200	250	300	350	400	450	500
Simplex 1.5-2	1.50	1.50	1.50	1.50	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Simplex 3-5	2.00	2.00	2.00	2.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Simplex 7.5-10	2.00	2.00	2.00	2.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Duplex 1.5-2	2.00	2.00	2.00	2.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Duplex 3-5	2.00	2.00	2.00	2.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Duplex 7.5	3.00	3.00	3.00	3.00	3.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
Duplex 10	3.00	3.00	3.00	4.00	4.00	4.00	4.00	5.00	5.00	5.00	5.00	5.00
Duplex 15-20	4.00	4.00	4.00	5.00	5.00	5.00	5.00	6.00	6.00	6.00	6.00	6.00
Triplex 10	4.00	4.00	4.00	4.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
Triplex 15	5.00	5.00	5.00	5.00	6.00	6.00	6.00	6.00	6.00	6.00	8.00	8.00

- Notes:** 1. All pipe sizes are based on the following: copper pipe (Type L), 14.7 psia, 70°F.
 2. The minimum pipe size must be maintained for the total length of the exhaust pipe. Use the next larger size pipe in the event the minimum size is not available.
 3. When determining the total pipe length, add all the straight lengths of pipe together in addi-

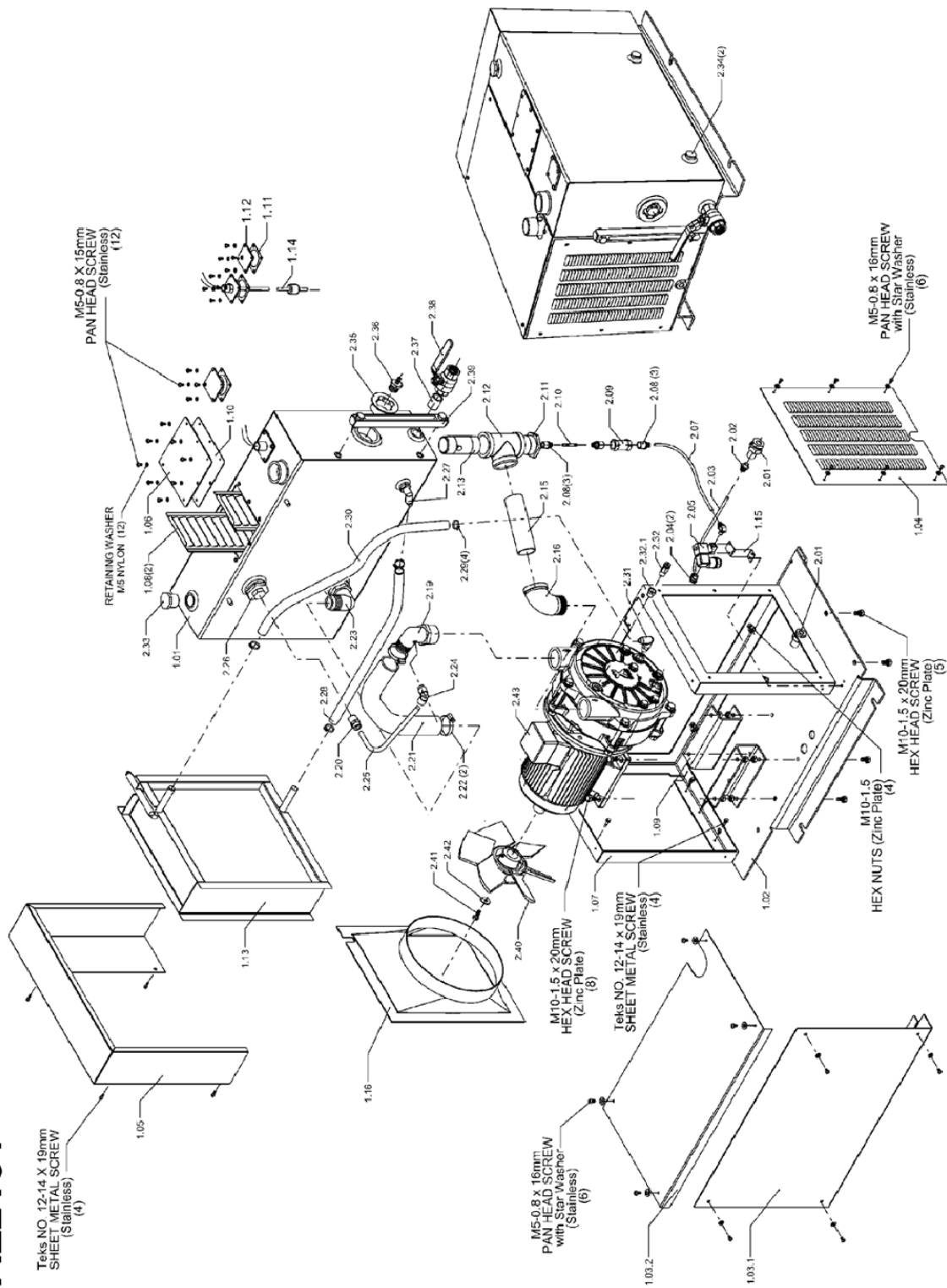
Effective Pipe Length Equivalent to each 90 degree Elbow										
Pipe Size (in.)	1.50	2.00	2.50	3.00	3.50	4.00	5.00	6.00	8.00	
Eff. Pipe Length (ft)	3.6	4.9	6.4	7.9	9.4	10.0	11.9	13.2	14.5	

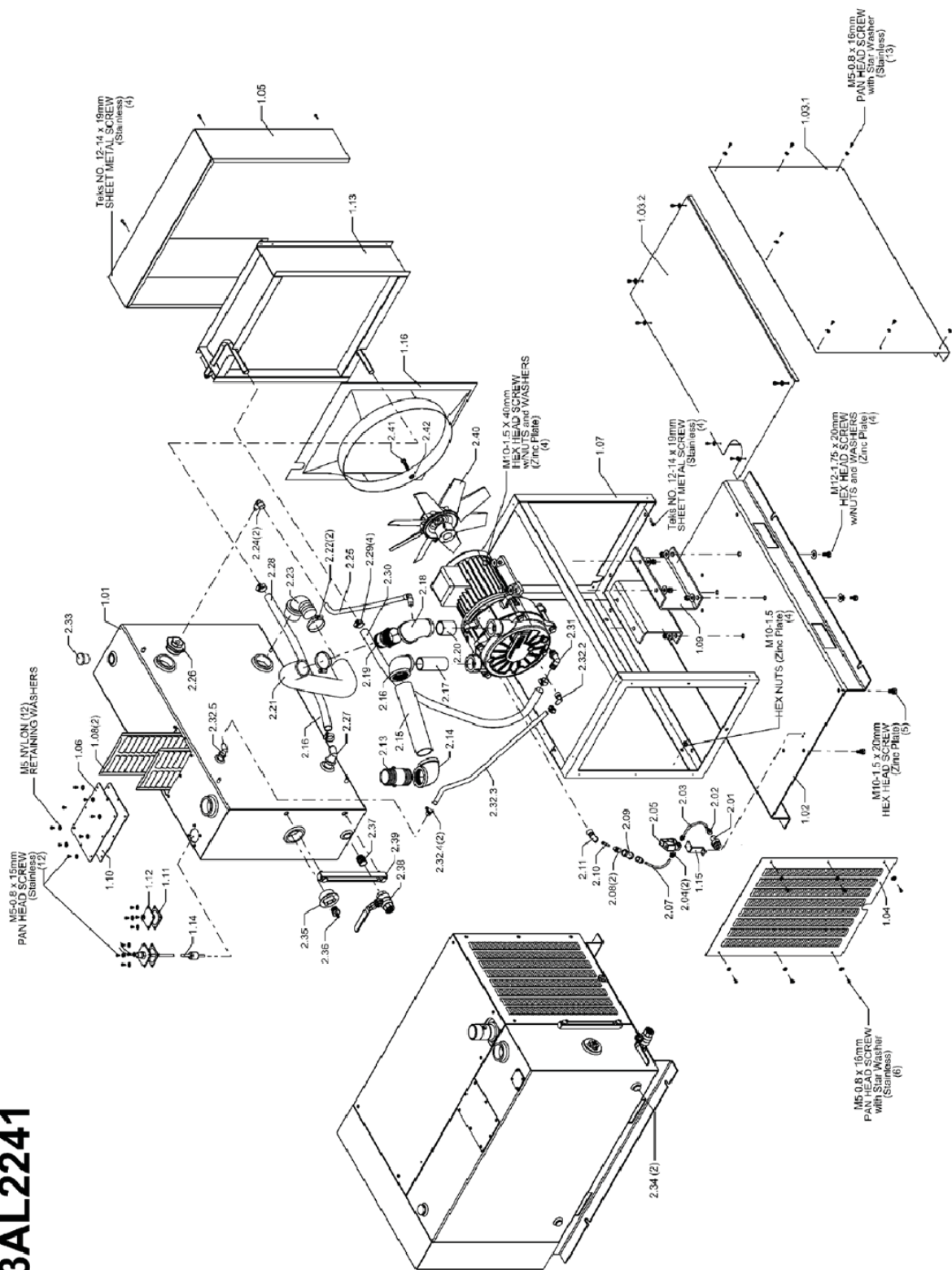
tion to the number of elbows times the effective pipe length for that pipe size. (See the table below.)

3AL2041



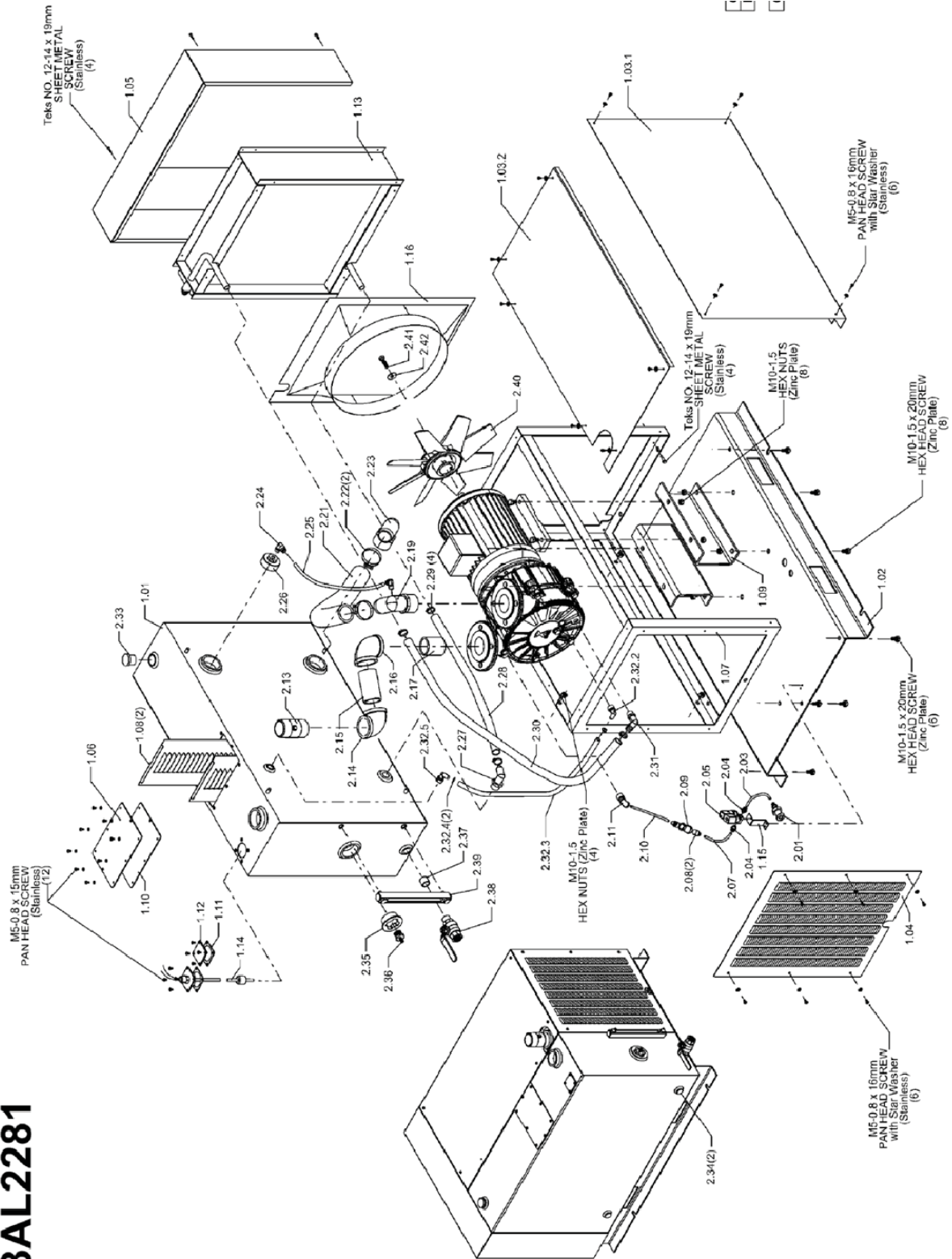




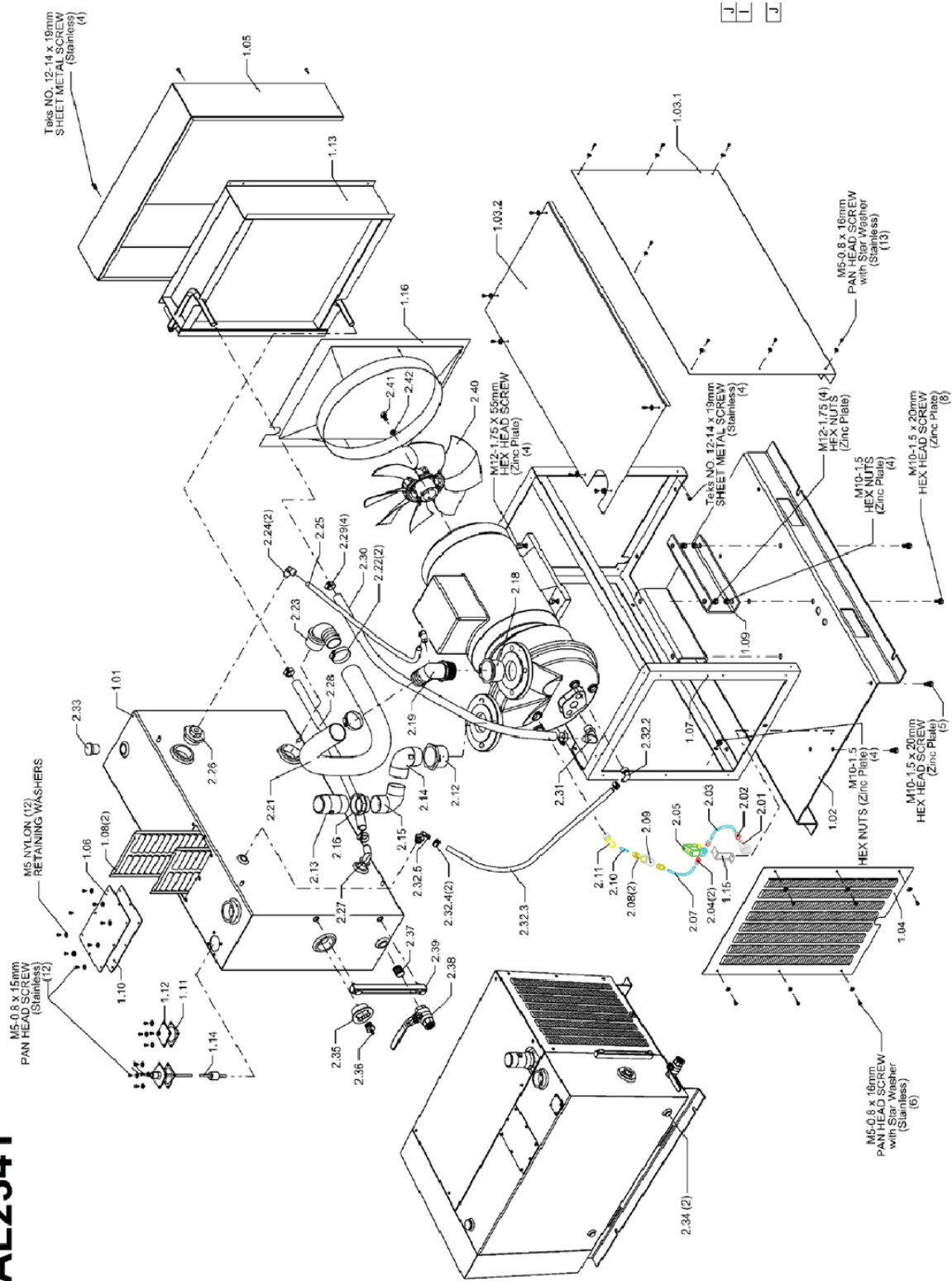


[illegible]

3AL2281



3AL2341

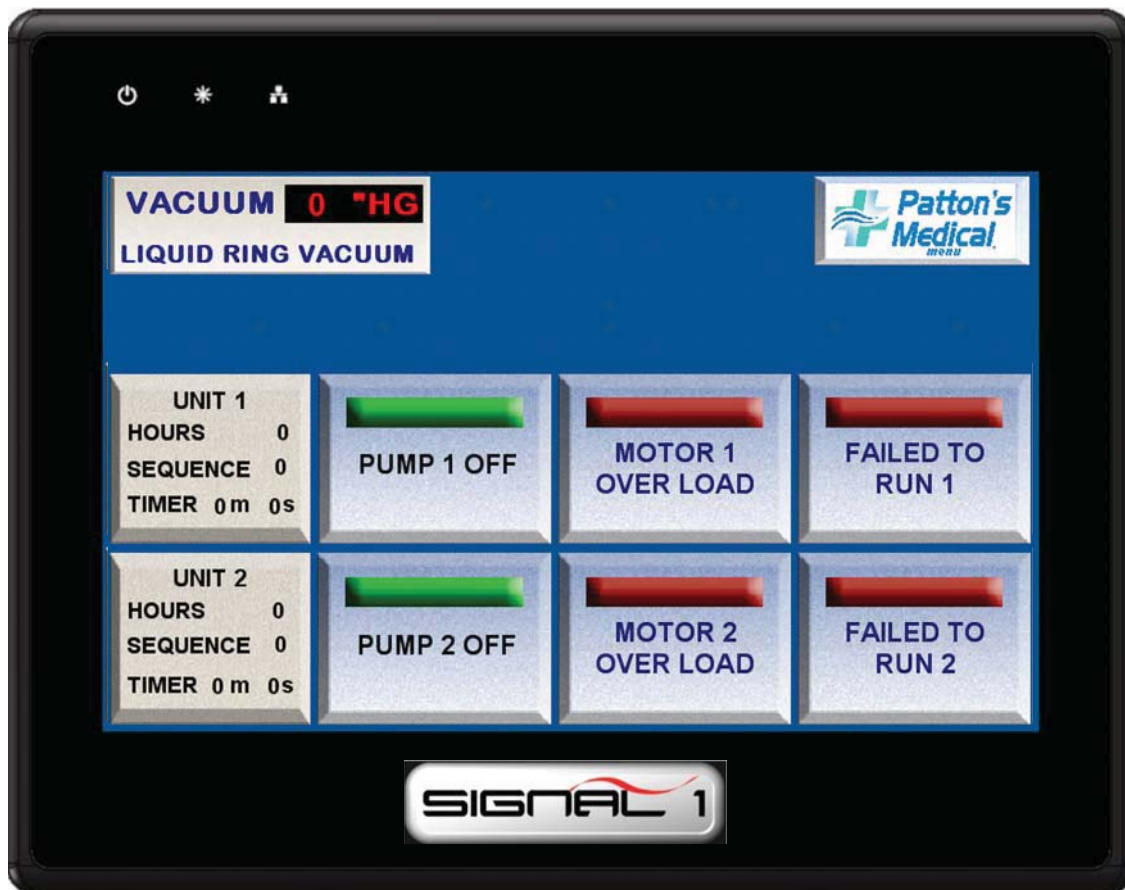


3.0 Control Panel (continued)

3.1 Signal 1 System touch screen gateway

The Lubricated Vane Medical Vacuum system has a touch screen gateway to control and monitor the complete system operation as well as record service and alarm history of the unit and change pressure setting levels.

3.2 Signal 1 Main Display Screen The main screen for systems will monitor and display the air receiver vacuum level, run sequence, individual unit total run hours and run status (HOA switch position). Included on this screen is a service due alarm, transducer fault alarms and lag alarm for the system as well as individual alarms for each compressor unit (motor overload, and high discharge air temperature). The “MENU” button in the upper right corner will allow the operator to navigate through the screens to view the system alarm history, service schedule and records, and vacuum trends, basic troubleshooting, vacuum settings, and system general information. When the **Signal 1** is powered up the main control window will appear on the display screen. This screen displays the systems current vacuum level, total hours run for each module, run sequence, HOA switch setting and status of service schedule and alarm conditions.



Main Screen (Duplex System shown)

3.0 Control Panel (continued)

3.2 HMI Main Display Screen (Continued)

1. MENU: Displays menu screen which allows the operator to access the systems operating history, service requirements, and vacuum trends, troubleshooting info and main system info.
2. VACUUM (inches Hg): Display's the current vacuum level inside the air receiver.
3. SERVICE DUE: Service intervals and types of service are preprogrammed into the HMI. The button will flash yellow when service is due. Pressing the "service due" button when flashing will display the service schedule screen.
4. TDC FAULT: Indicator will flash red and horn will sound if the transducer fails. Vacuum reading on the display screen will default to "30" hg. Selecting the indicator when flashing red will open a trouble shooting window.
5. LAG ALARM: Indicator will flash red and horn will sound when last available vacuum unit comes on. Press the reset button to silence the alarm. If the condition is corrected both the alarm and indicator will turn off. If a lag condition remains the indicating light on the HMI will remain on. Selecting the indicator when flashing red will open a trouble shooting window. Once the lag condition is corrected, press the reset button again to turn off alarm light.
6. UNIT RUN HOURS: Displays total run hours for each vacuum module.
7. HAND-OFF-AUTO: Displays status of each vacuum module. The green "HAND" displays when the vacuum is running and the HOA selector switch is in the HAND setting. The green "AUTO" displays when the vacuum is running in the normal sequencing mode. The "OFF" indicator is displayed when the HOA selector switch is in the "OFF" position for the pump that is not running.
8. MOTOR OVLD: Display will flash red and sound an alarm when overload switch is tripped in the control panel. The vacuum in question will not re-start until the reset button on the starter inside the main control cabinet is reset. Press the reset button on front panel to silence the alarm. Selecting the indicator when flashing red will open a trouble shooting window. The indicator on the HMI will remain on until motor starter is reset.
9. FAILED START: Display will flash red if the vacuum module failed to start/run when signaled to start. This alarm will also activate when a Motor Overload Shutdown occurs. Press the reset button on the front panel to silence the alarm. Selecting the indicator when flashing red will open a trouble shooting window. The indicator light on the HMI will remain on until the problem has been resolved and the reset button pushed again.

3.0 Control Panel (continued)

3.3 Control Buttons

3.3.1 MENU

The MENU button in the upper right corner on the main screen when selected will display the “MENU” window that will allow the operator to access information shown on screen below. Each button will be explained in detail in this section.

3.3.2 – “MAIN” Button

The main button can be found on many of the screens within the *Signal 1* Controller. At any time when the “MAIN” button is selected, the *Signal 1* display will return to the Main Display Screen.



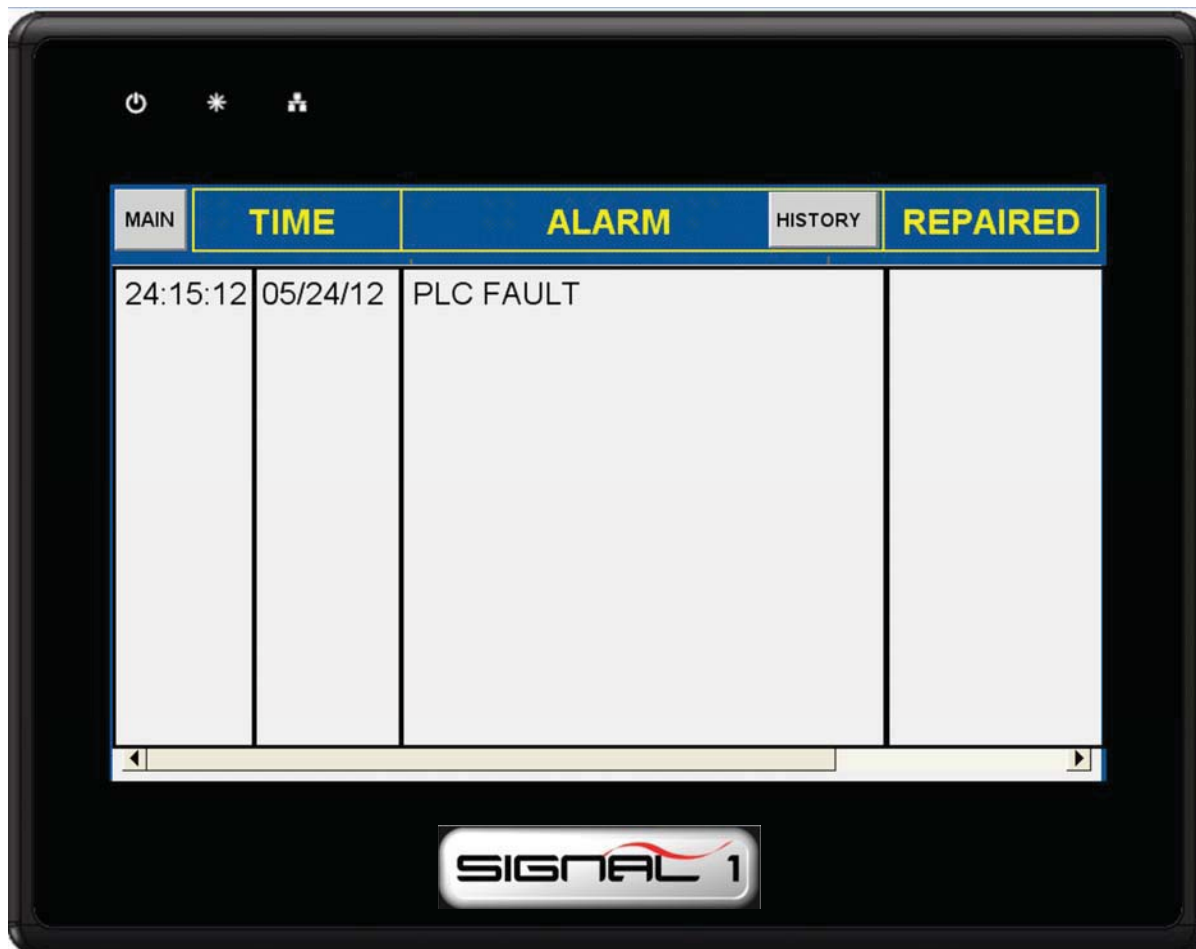
3.0 Control Panel (continued)

3.3 Control Buttons (Continued)

3.3.3 – “ALARM HISTORY” Button

The “ALARM HISTORY” button on the “Menu” screen will open a new window listing all the alarm conditions that have occurred as well as routine maintenance alerts. The list will show the date and time of the incident, type of incident and when the condition was cleared/corrected. This creates a permanent record of the history of the unit and cannot be reset.

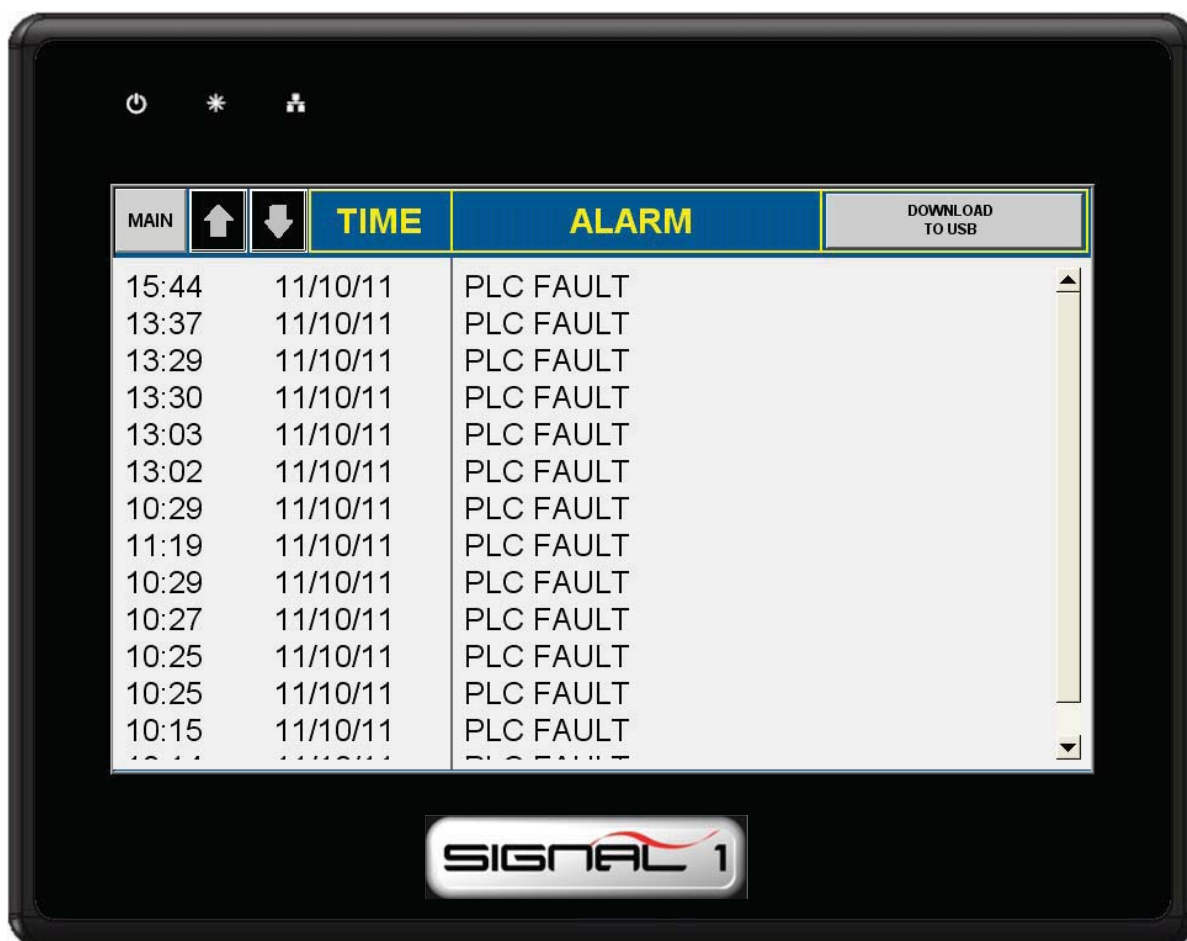
1. “MAIN” button will return you to the main screen.
2. “HISTORY” button will open a new History screen shown on the next page.



3.0 Control Panel (Continued)

3.3 Control Buttons (Continued)

3.3.4 – “HISTORY” screen displayed from pressing “History” button on “Alarm History” screen shown below. Pressing the up and down arrows will display alarm/maintenance history one day at a time. History can be down loaded to a USB memory stick by inserting the memory stick into the USB slot on the back of the *Signal 1* and pressing the “Download To USB” button on the screen. Files can be saved to PC and viewed in an excel format.

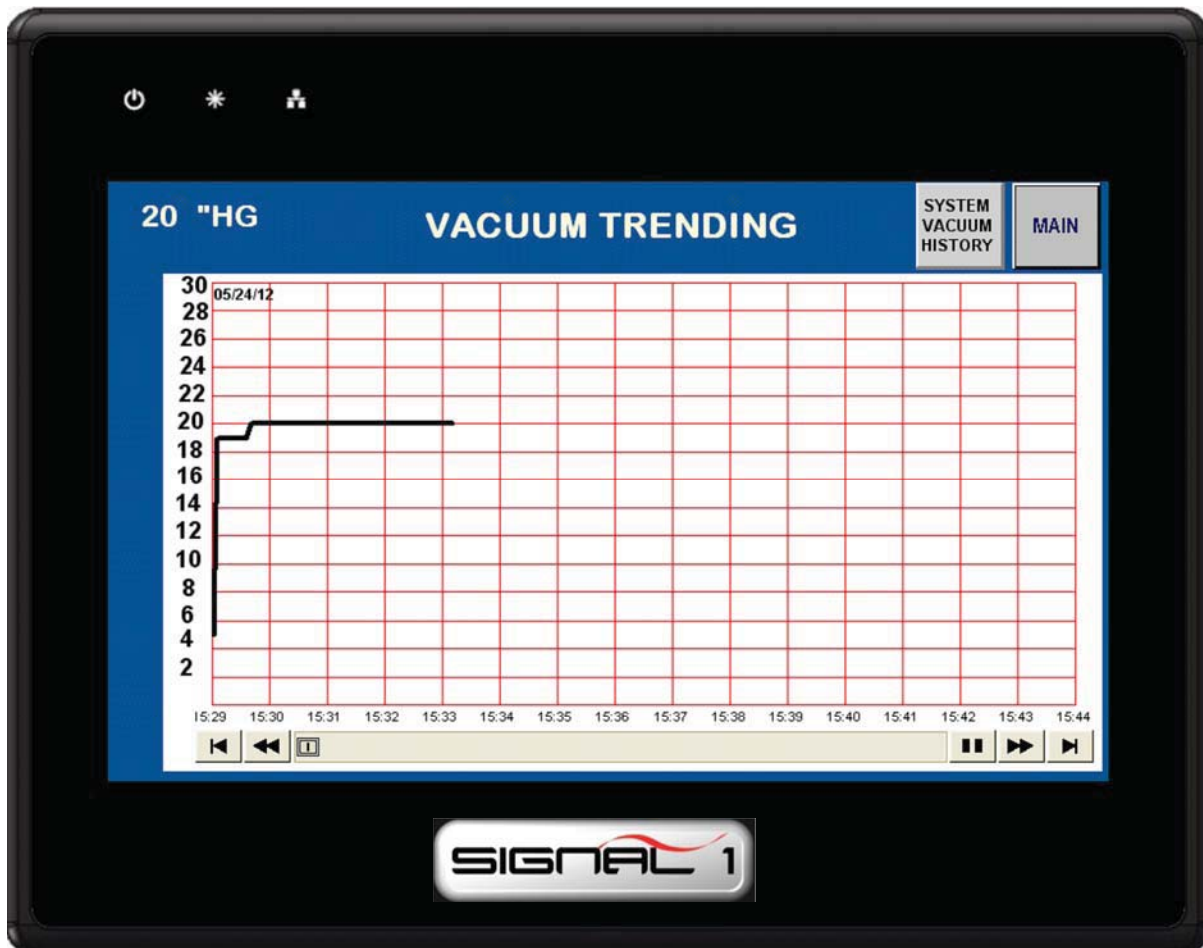


3.0 Control Panel (Continued)

3.3 Control Buttons (Continued)

3.3.5 – “VACUUM TREND” Pressing the “Vacuum Trend” button on the “Menu” screen will display the screen below. Screen displays 15 minutes of trending and has a scroll bar on the bottom of screen to scroll to different time frame.

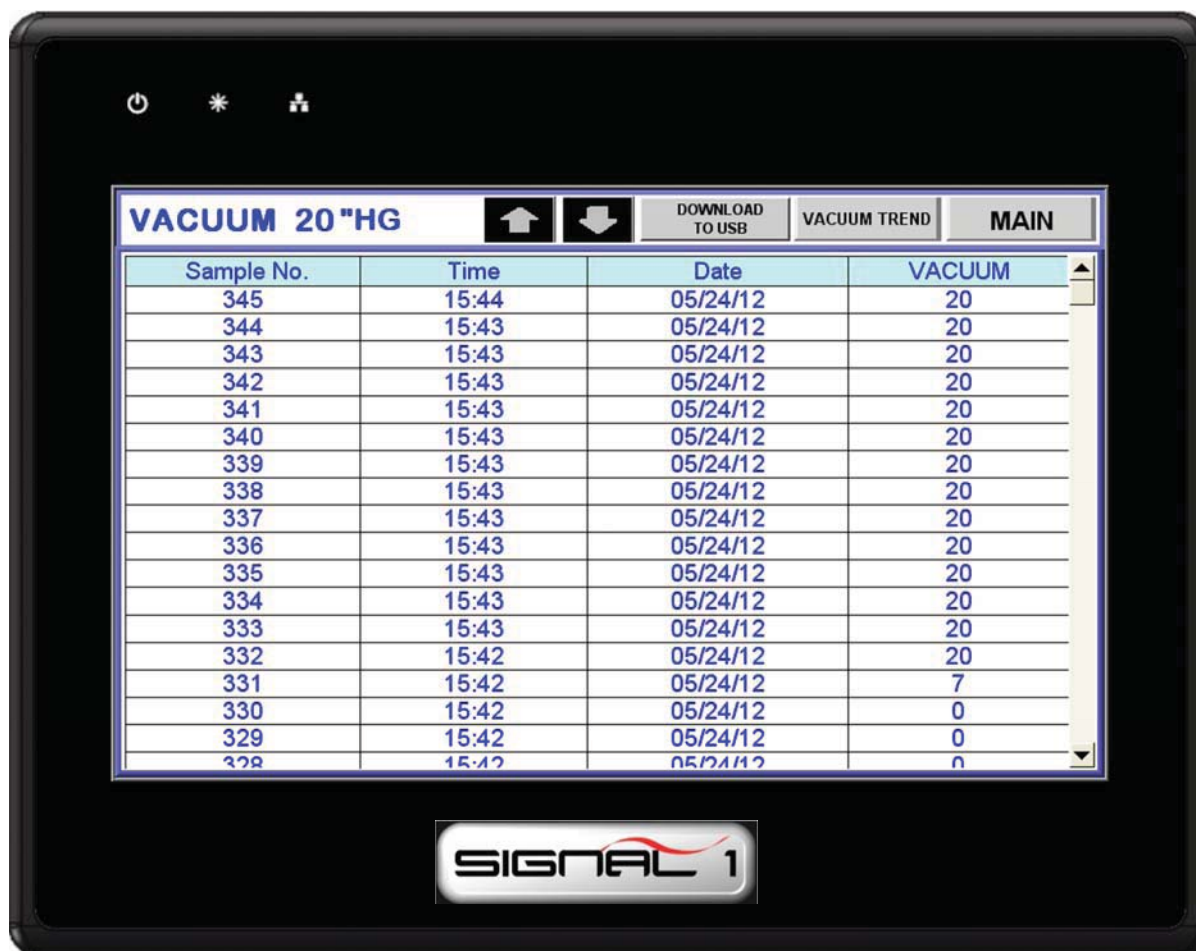
1. “MAIN” button will return you to the main screen.
2. “SYSTEM PRESSURE HISTORY” button will open a new screen shown on the next page.



3.0 Control Panel (Continued)

3.3 Control Buttons (Continued)

3.3.6 – “VACUUM TREND HISTORY” screen shown below. Pressing the up and down arrows will display pressure trending history one day at a time. History can be down loaded to a USB memory stick by inserting the memory stick into the USB slot on the back of the *Signal 1* and pressing the “Download To USB” button on the screen. Files can be saved to PC and viewed in an excel format.

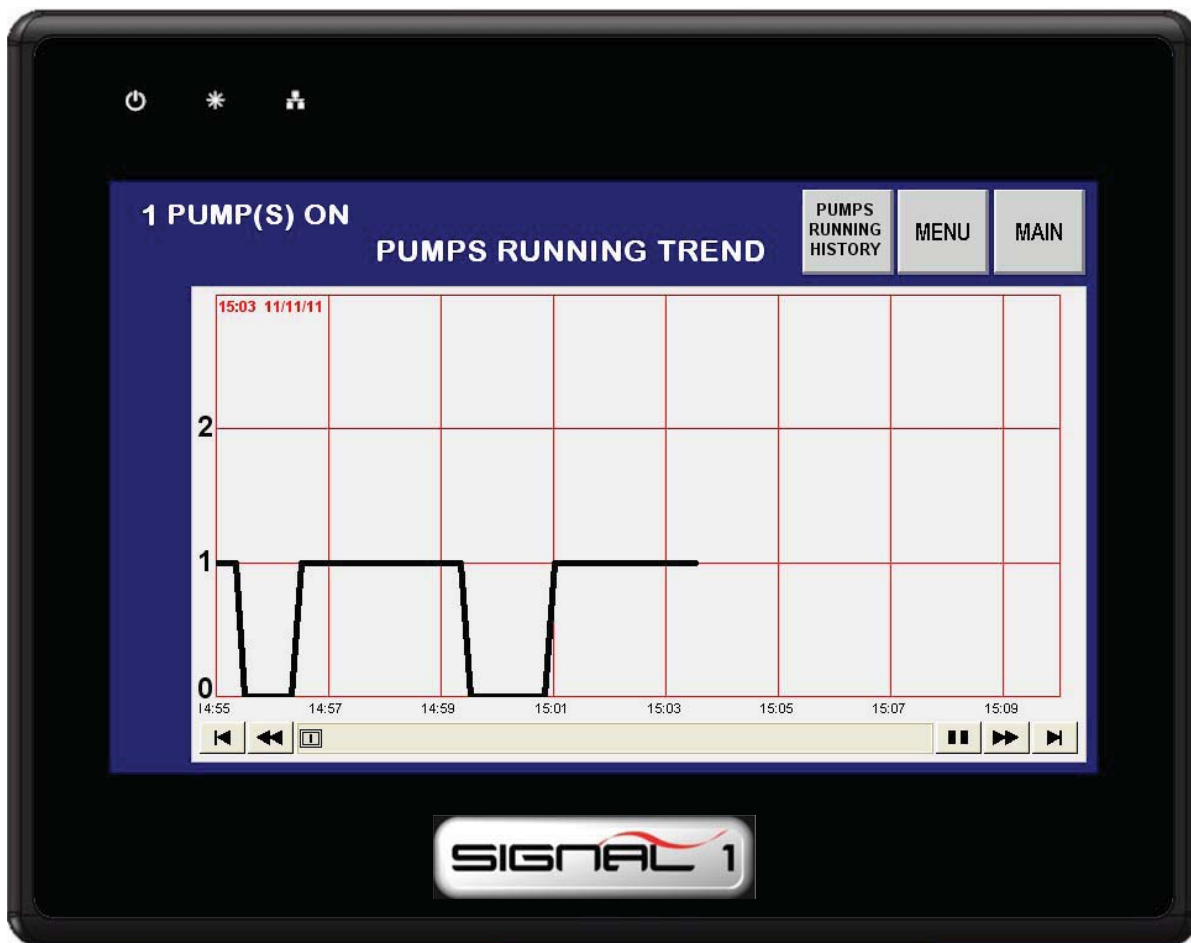


3.0 Control Panel (Continued)

3.3 Control Buttons (Continued)

3.3.7 – “NUMBER PUMPS RUNNING TREND” Pressing the “NUMBER PUMPS RUNNING TREND” button on the “Menu” screen will display the screen below. Screen displays 15 minutes of trending and has a scroll bar on the bottom of screen to scroll to different time frames.

1. “MAIN” button will return you to the main screen.
2. “PUMPS RUNNING HISTORY” button will open a new screen shown on the next page.



3.0 Control Panel (Continued)

3.3 Control Buttons (Continued)

3.3.8 – “PUMPS RUNNING HISTORY” screen shown below. Pressing the up and down arrows will display number of pumps running trending history one day at a time. History can be down loaded to a USB memory stick by inserting the memory stick into the USB slot on the back of the *Signal 1* and pressing the “Download To USB” button on the screen. Files can be saved to PC and viewed in an excel format.

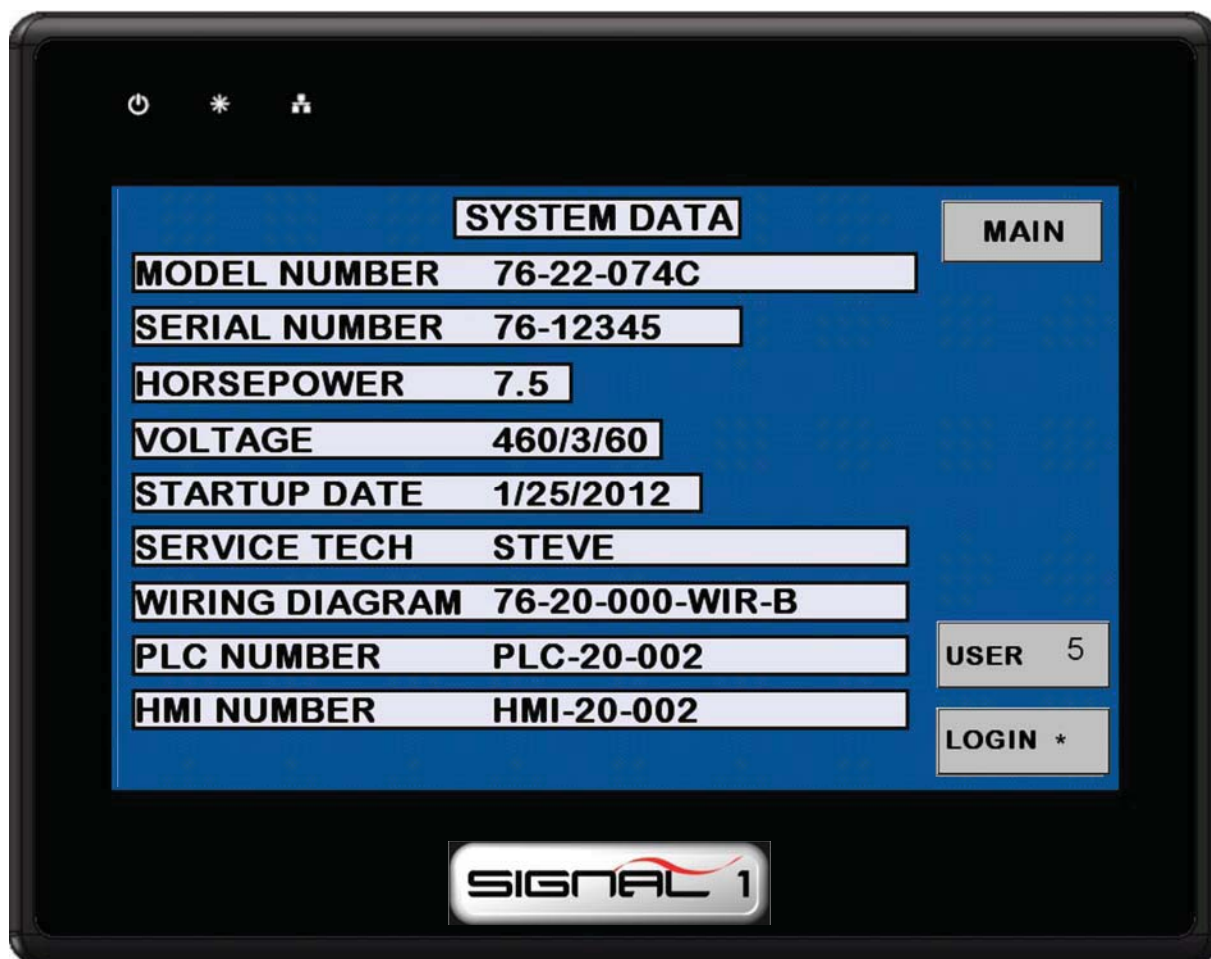


3.0 Control Panel (Continued)

3.3 Control Buttons (Continued)

3.3.9 “SYSTEM DATA” Button

The “System Data” button displays all the system information required when scheduling maintenance or purchasing spare parts from Patton’s Medical. The information includes model number, serial number, horsepower, system voltage, and unit start up date. This information will be programmed into the *Signal 1* at startup by a Patton’s Medical authorized technician.

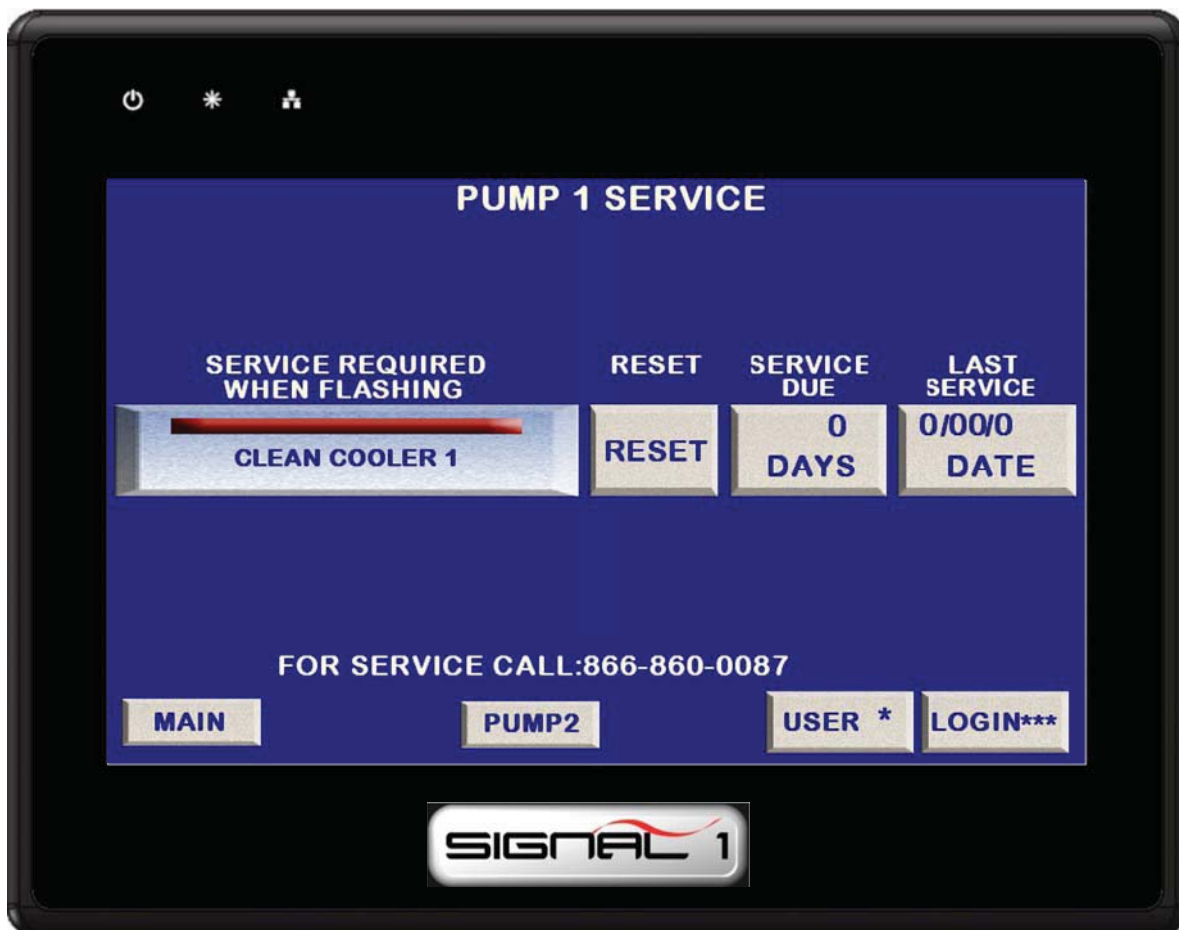


3.0 Control Panel (Continued)

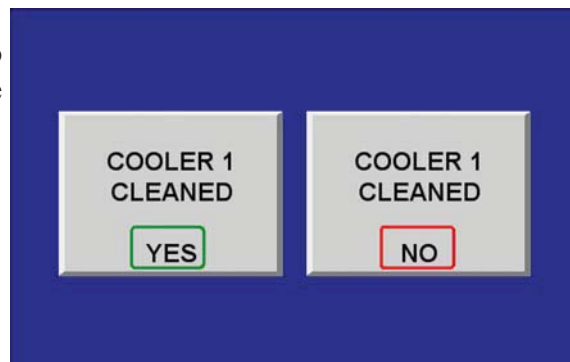
3.3 Control Buttons (Continued)

3.3.11 – “PUMP SERVICE” Buttons

1. Select “USER #” button and enter “3” and press “enter”.
2. Select “LOGIN” button and enter “350” and press “enter”.
3. Press “RESET” button next to item requiring maintenance red light will be flashing.



4. Screen to right will display press “YES” to reset maintenance performed. Service due date and Last Service date will reset.



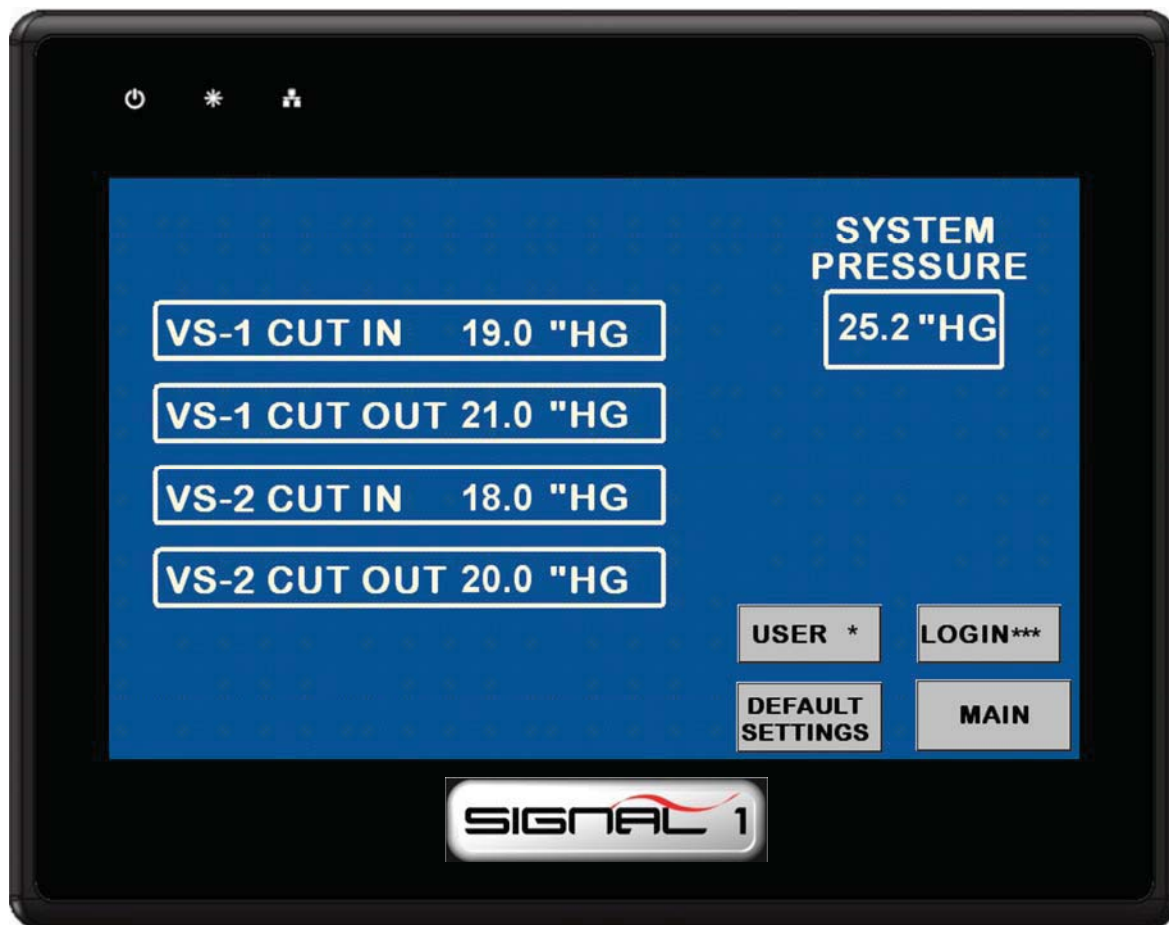
3.0 Control Panel (Continued)

3.3 Control Buttons (Continued)

3.3.12 – “VACUUM SETTING” Button

1. Select “USER #” button. Enter “2” and select “enter”.
2. Select “LOGIN” button. Enter “327” and select “enter”.
3. Press setting to be changed and screen to right will display.
Enter pressure setting desired then “ENT”.
4. Pressing “RESTORE DEFAULTS” at anytime will change all settings to original factory settings.

.	/	-
1	2	3
4	5	6
7	8	9
ENT	0	CLR





Liquid Ring Medical Vacuum System

Maintenance Record

Model Number

Serial Number

Installation Date

Notes:

Date of Service					
Hours					
Load					
Ambient Temp.					
Inlet Filter					
Misc.					
Serviced By:					



Liquid Ring Medical Vacuum System

Maintenance Record

Model Number

Serial Number

Installation Date

Notes:

Date of Service					
Hours					
Load					
Ambient Temp.					
Inlet Filter					
Misc.					
Serviced By:					



Liquid Ring Medical Vacuum System

Maintenance Record

Model Number

Serial Number

Installation Date

Notes:

Date of Service					
Hours					
Load					
Ambient Temp.					
Inlet Filter					
Misc.					
Serviced By:					



Liquid Ring Medical Vacuum System

Maintenance Record

Model Number

Serial Number

Installation Date

Notes:

Date of Service					
Hours					
Load					
Ambient Temp.					
Inlet Filter					
Misc.					
Serviced By:					



3201 South Boulevard
Charlotte, NC 28209
1-866-960-0087
www.pattonsmmedical.com