

AIRTECH[®] VACUUM

Operating and Maintenance Instructions 3AL Vacuum Systems - Standard Design



INSTALLATION & OPERATING MANUAL 3AL VACUUM SYSTEMS

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1.0 Safety

Safe operation of the 3AL 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 Airtech vacuum system.

1.1 Severity

- 1.1.1 Danger means an immediately hazardous situation that will result in serious injury or death if the recommended actions are not taken.
- 1.1.2 Warning means a hazardous situation that could result in serious injury or death if the recommended actions are not taken.
- 1.1.3 Caution means a hazardous situation that may result in minor or moderate injury if the recommended actions are not taken.
- 1.1.4 Caution – Damage indicates a situation that could result in property damage if the recommended actions are not taken.
- 1.1.5 Note indicates a recommendation for better operation of the equipment.

1.2 General Safety Precautions

- 1.2.1 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.
- 1.2.2 The system must be operated within the stated limits in this manual to avoid serious damage to the equipment.
- 1.2.3 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.
- 1.2.4 Hair and clothing can be pulled into this equipment during start-up and precautions should be taken to prevent same.
- 1.2.5 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.

- 1.2.6 Only a trained electrician should attempt to connect this equipment to the power source.
- 1.2.7 Surfaces within the 3AL vacuum system can be cause burns or scalding. Do not touch internal surfaces within the system.
- 1.2.8 The 3AL can produce vacuums to 29 inches Hg vacuum. Be sure that the vacuum has been vented to atmosphere before working on the 3AL system.
- 1.2.9 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

2.1 The 3AL vacuum system is intended to be used to produce a vacuum. Do not use as a compressor system.

2.2 The 3AL vacuum system contains a Speck liquid ring vacuum pump as indicated in table 2-1.

Table 2-1 Pump Identification

Airtech Model Number	Speck Pump Model
3AL2041	V-30
3AL2061	V-55
3AL2101	V-95
3AL2141	V-130
3AL2251	V-155
3AL2281	V-255
3AL2341	V-330

2.3 Standard 3AL systems are designed to handle non-aggressive and non-explosive vapor or gas mixtures. When handling corrosive, explosive or aggressive gases, please contact Airtech for assistance.

2.4 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, tap water is best.

Table 2-2 Operating Liquid Sump Capacity

Airtech Model Number	Water Capacity US gal/liters
3AL2041	4.0/15.1
3AL2061	5.5/20.8
3AL2101	5.5/20.8
3AL2141	16.3/61.7
3AL2251	16.3/61.7
3AL2281	16.3/61.7
3AL2341	16.3/61.7

2.4.1 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.

3.0 Prohibited uses

3.1 The 3AL should not be used in an environment where explosive gases may exist in the environment. Special modifications of the system may allow operation in these environments, but the standard design is not intended for this purpose and should not be used.

3.2 Do not use the 3AL on process gas environments, which would result in significant build up of corrosive chemicals in the system. Special material versions should be selected for these types of applications.

3.3 Do not use the 3AL on lethal gases. The 3AL is not gas tight and is not intended for these applications.

3.4 Do not operate the 3AL out of its design range.

3.5 Do not operate the 3AL to extract or compress chemicals unless it has been specifically designed for this purpose. Contact Airtech, Inc. for assistance if you are unsure of its applicability to your specific application.

3.6 Maintenance or repair work outside the scope of this manual should only be performed under the direction of an Airtech authorized service center.

4.0 Technical Data

4.1 Weight

Model	Weight (empty) lbs/Kg	Weight Filled with Water lbs/Kg
3AL2041	105/47.7	138.4/62.9
3AL2061	150/68.2	195.9/89.1
3AL2101	190/86.4	235.9/107.2
3AL2241	360/163.6	495.9/225.4
3AL2251	380/172.7	515.9/234.5
3AL2281	470/213.6	605.9/275.4
3AL2341	580/263.6	715.9/325.4

4.2 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 Table 2-2.

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

4.3 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 Gal/Liters
3AL2041	0.16/0.6
3AL2061	0.26/1.0
3AL2101	0.26/1.0
3AL2241	1.4/5.5
3AL2251	1.4/5.5
3AL2281	1.7/6.3
3AL2341	1.85/7

4.4 The 3AL 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 ft/m	Back ft/m	Side ft/m
3AL2041	1.3/0.4	1.3/0.4	1/0.3
3AL2061	1.3/0.4	1.3/0.4	1/0.3
3AL2101	1.3/0.4	1.3/0.4	1/0.3
3AL2241	1.3/0.4	1.3/0.4	1/0.3
3AL2251	1.3/0.4	1.3/0.4	1/0.3
3AL2281	1.3/0.4	1.3/0.4	1/0.3
3AL2341	1.3/0.4	1.3/0.4	1/0.3

4.5 Approximate noise level of the 3AL 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.

Model	Sound Pressure Level (dBA) maximum
3AL2041	66
3AL2061	70
3AL2101	74
3AL2241	74
3AL2251	71
3AL2281	73
3AL2341	76

4.6 Electrical rating of the units is noted on a data plate located on the front of the unit.

4.7 The 3AL is a liquid ring vacuum system using ambient air as the coolant. The reported performance curves of the 3AL assume basic operating parameters as noted. Should local conditions vary significantly from these values, performance may be affected.

Condition	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 (if operating below these temperatures, addition of ethylene glycol will be required)	40 F/ 5 C
Maximum discharge pressure (if operating above this range, please consult factory)	5 psig / 0.344 Bar G

5.0 Transportation and Handling

5.1 The 3AL liquid ring vacuum system is designed to be lifted easily by a forklift; this is the recommended method of transport.

5.2 If lifting the 3AL using a crane, use two lifting belts routed below the system in the area where the forklift would normally lift the unit. Ensure that the belts are positioned to avoid tipping the load.

5.3 After transportation, inspect the unit to ensure no damage has occurred.

6.0 Installation

6.1 Install the unit in a location that allows for the consistent maintenance of the clearances around the unit as noted in Section 4.4 of this manual. Do not install the unit in areas where these clearances can not 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.

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

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

6.4 Ensure that the load bearing capacity of the installation surface will bear the weight of the unit filled with water as shown in Section 4.1 of this manual.

6.5 Consider local installation details to minimize vibration. Maximum vibration allowed is 0.177 inches/sec (4.5 mm/sec). Consult a vibration expert if this value is exceeded. For most applications, a special foundation or base plate is not required to achieve this level of vibration and the unit can simply be bolted to the floor.

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

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

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

6.6.1 Only a qualified electrician should electrically install this equipment.

6.6.2 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.

6.6.3 Use adequately sized, flexible connection cable to install the unit.

6.6.4 Remove the outer metal cover plate of the unit (covers both top and side of the unit).

6.6.5 Insert the cable so that no strain is possible on the cable. Secure the cable to the base plate with an electrical tie.

6.6.6 Connect the cable to the terminal box in accordance with the desired voltage and the motor connection diagram located in the terminal box.

6.6.6.1 The electrical connection must be permanently safe.

6.6.6.2 The electrical connection must not have protruding ends.

6.6.6.3 Clearance between bare live parts and the ground must be maintained at greater than 0.217 inches (5.5 mm) at a nominal voltage of less than UN690.

6.6.6.4 For terminals with clamping strips, the connections should be inserted so that the same clamping height results on both sides of the bar. Individual conductors should therefore be bent into a U shape or connected with a cable lug.

6.6.7 Connect the water supply solenoid valve to the motor control circuit so that the solenoid valve opens when the motor starter is energized and closed when the motor starter is de-energized.

6.6.8 Use of a properly sized magnetic motor starter with heater is required to protect the equipment from electrical failure.

6.7 Once the electrical connections are complete, reattach the junction box cover and then reattach the 3AL metal cover sheets, ensuring that the wire is properly routed through the cut out in the side sheet near the bottom of the unit.

6.8 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.

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

6.9 Fill the system with water in the approximate amount as shown in Section 2.4.

6.9.1 Remove the plastic plug in the top of the 3AL water sump.

6.9.2 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

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

6.9.4 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 3AL2041 through 3AL2141 add 0.4 gallons (1.5 liters); for larger systems add 1.3 gallons (7 liters).

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

6.10.1 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.

6.10.1.1 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.

6.10.2 A check valve is included with each 3AL system and additional check valves are not required.

6.11 Connect a ¼ inch water supply line to the operating liquid make up and spray line located on the back of the unit near the bottom of the perforated metal grid.

6.11.1 Connect a drain hose to the overflow water connection on the back of the unit. While not required for operation, failure to connect the overflow to a drain will result in operating liquid spilling onto the floor.

6.12 In most cases, the exhaust air should be allowed to vent freely from the unit. If 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 3AL system (e.g. adequately support the piping).

6.13 Add accessories as recommended by your Airtech representative. The following items are available and commonly applied depending on the local circumstances.

6.13.1 Add an inlet filter if particulates may be present in the inlet gas stream.

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

6.13.3 Add a temperature switch if shut-down on high discharge temperature is required.

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

6.13.5 Add a discharge pressure switch if connecting the system to a downstream process which could cause excessive back pressure onto the unit.

7.0 Start-up

7.1 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.

7.2 Ensure the cover plate is mounted and secured properly.

7.3 Turn the power on. The unit should produce a vacuum on the upstream equipment.

8.0 Shut Down

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

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

8.3 If the system is not to be started for a long period of time, please follow the instructions in Section 9 of this manual.

9.0 Operation

9.1 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.

9.2 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 make-up water is a constant 0.06 gallons per minute.

9.3 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.

10.0 Long term Shut-down

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

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

10.1.2 Shut off the water to the ¼ inch make-up connection at the bottom of the unit.

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

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

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

10.1.6 Replace the pump drain plugs.

10.1.7 Close the operating water sump drain valve.

10.1.8 Replace the sheet metal top and side.

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

10.2.1 Add a small amount of ethylene glycol to the inlet of the pump (see Section 4.3 of this manual).

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

10.3 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.

10.3.1 Measure the insulation resistance of the motor (<1kOhm per volt of nominal voltage, dry winding).

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

10.3.3 Clean the system by adding water to the operating liquid sump and priming the pump as described in Section 6.9.

10.3.3.1 Briefly run the system.

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

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

11.0 Servicing

11.1 Do not attempt to service the system without consulting Airtech, Inc. 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.

12.0 Maintenance

12.1 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 4.2 of this manual.

12.2 Periodically check the hoses and fittings for leaks. If leaks are found, de-energize the system and tighten or replace the leaking fittings.

12.3 If dirt or other foreign matter enters the system, it must be cleaned regularly according to the procedure outlined in Section 10.3.3.

Maintenance Chart

Problem	Probable Cause and Solution
Water consumption increases as indicated by reduction of liquid level in the operating liquid sump.	<p>Clogged or obstructed cooler.</p> <p>Clean the cooler by blowing compressed air through it, taking reasonable and necessary safety precautions.</p>
Ambient air highly contaminated.	<p>Clogged or obstructed cooler.</p> <p>Clean the cooling fins with compressed air.</p>
Dirt builds up in the system due to introduction with the suction gas or make-up water.	<p>Clean the unit as described in Section 10.3.3 of this manual.</p> <p>Add an inlet filter or water filter as required.</p>
Sand or other fine grain particulate enters system with make-up liquid.	<p>Clean the system periodically (intervals dependant on contamination level, but at least once a year) as described in Section 10.3.3 of this manual.</p> <p>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.</p>
No vacuum due to jammed impeller	<p>Turn the shaft by hand to fee up.</p> <p>Turn off the electrical power supply and lock out power to the unit.</p> <p>Remove the sheet metal covers to the unit.</p> <p>Remove the shroud covering the fan (note: cooler may need to be removed to remove the shroud).</p> <p>Turn the fan by hand (do not use leverage).</p> <p>If the shaft will not come free, the unit must be serviced by an authorized service center. Please contact Airtech for assistance.</p>

<p>Extreme hard water used as the operating and make-up liquid (Lime content greater than 15 degrees of hardness)</p>	<p>Soften the water or clean with 10% ethanoic acid on a periodic basis.</p> <p>To clean with ethanoic acid:</p> <p>Drain and clean the system as described in Sections 10.1 and 10.3.3.</p> <p>Lock out the power to the unit.</p> <p>Wear protective gloves (10 percent ethanoic acid can cause severe burns, handle with care).</p> <p>Disconnect the pipe/hose from the liquid ring pump to the top of the cooler at the cooler.</p> <p>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 4.2) of ethanoic acid through the disconnected supply hose using a plastic funnel.</p> <p>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.</p> <p>During the 30 minute period, occasionally turn the impeller by hand (using the cooling fan to turn the impeller).</p> <p>Drain the ethanoic acid from the pump by removing the drain plug and collecting the acid in a suitable container.</p> <p>Reconnect the drain plug, hose and reassemble the system.</p> <p>Fill with water and clean as described in Section 10.3.3.</p> <p>Re-commission the unit as described in Sections 6.9 to 6.13.</p> <p>Or</p> <p>Decalcify the entire system using granular citric acid.</p> <p>If lime build-up is experienced in the entire system, it may be necessary to de-calcify the entire system. Do so as follows:</p> <p>Add the proscribed amount (Section 4.2) of citric acid to the sump (dissolve first in water and pour the resulting solution into the operating liquid sump).</p> <p>Operate the system for approximately 10 hours on the citric acid solution.</p> <p>Drain and clean the system as described in Section 10.3.3, taking care to dispose of the resulting citric acid solution properly.</p> <p>Re-commission the unit as described in Sections 6.9 to 6.13.</p>
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Troubleshooting Chart

Fault	Cause	Remedy	Responsible Party
Motor does not start, no noise.	Two or more power legs interrupted	Check fuses, terminals, etc.. for source of interruption and correct.	Electrician
Motor does not start, humming noise.	One power supply lead interrupted	Check fuses, terminals, etc.. for source of interruption and correct.	Electrician
	Impeller Jammed	Free by hand (see Maintenance Chart) or de-classify unit if procedure is not successful and contact Airtech for assistance.	Operator
Trip of motor starter at start-up	Incorrect starter setting	Ensure starter setting is correct (check current on nameplate)	Electrician
	Winding short-circuit	Megger motor	Electrician
	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.	Operator
	Impeller Jammed	Free by hand (see Maintenance Chart) or de-classify unit if procedure is not successful and contact Airtech for assistance.	Operator
Excessive Power Consumption	Lime or other deposits	Decalcify or clean unit as required (see Maintenance Chart)	Operator
No vacuum	No operating liquid	Check liquid level in separator. Add as required to achieve proper level.	Operator
	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.	Operator
	Wrong direction of rotation	Check air flow direction and change direction of rotation if necessary.	Operator Electrician

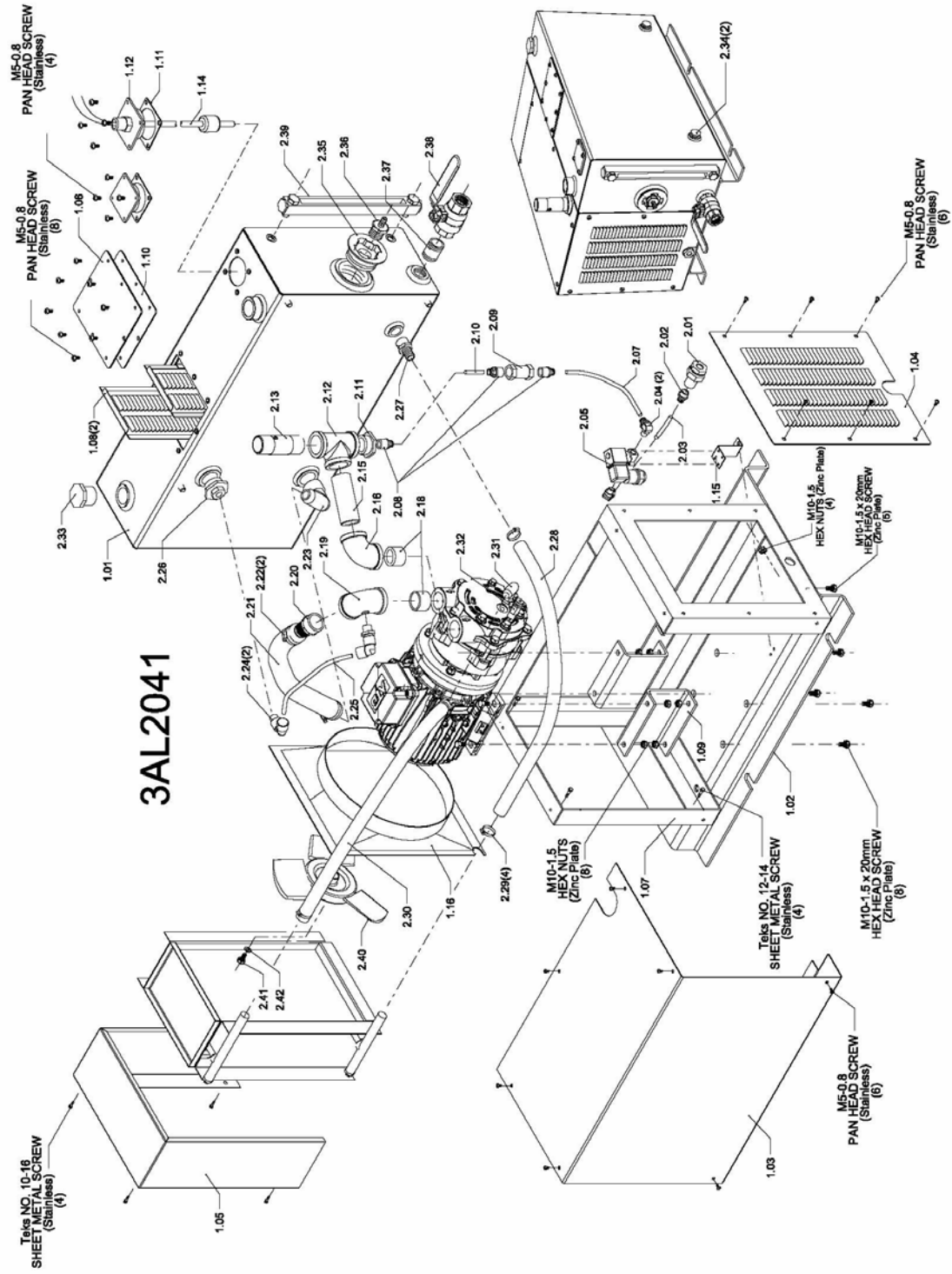
Insufficient Vacuum	System too small	Use larger system	Operator
	Inlet piping too long or too small.	Increase pipe diameter to reduce pressure loss in inlet piping. Contact Airtech for assistance in determining correct pipe size.	Operator
	Leak at connection to vacuum system.	Check for leaks and repair if necessary.	Operator
	Operating liquid flow too low.	Check flow of water through the clear hoses. Remove any clogs or contamination.	Operator
	Operating liquid too warm	Cooling fins of unit clogged. Clean with compressed air as described in the Maintenance chart.	Operator
	Inlet filter clogged.	Change filter element; remove clog.	Operator
	Vacuum relief valve incorrectly set.	Close vacuum relief valve located on the pump in some units. Contact Airtech for assistance.	Operator
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.	Operator
	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.	Operator
Abnormal screeching noise	Pump is operating in cavitation range.	Check cavitation protection connection and hose for clogging.	Operator

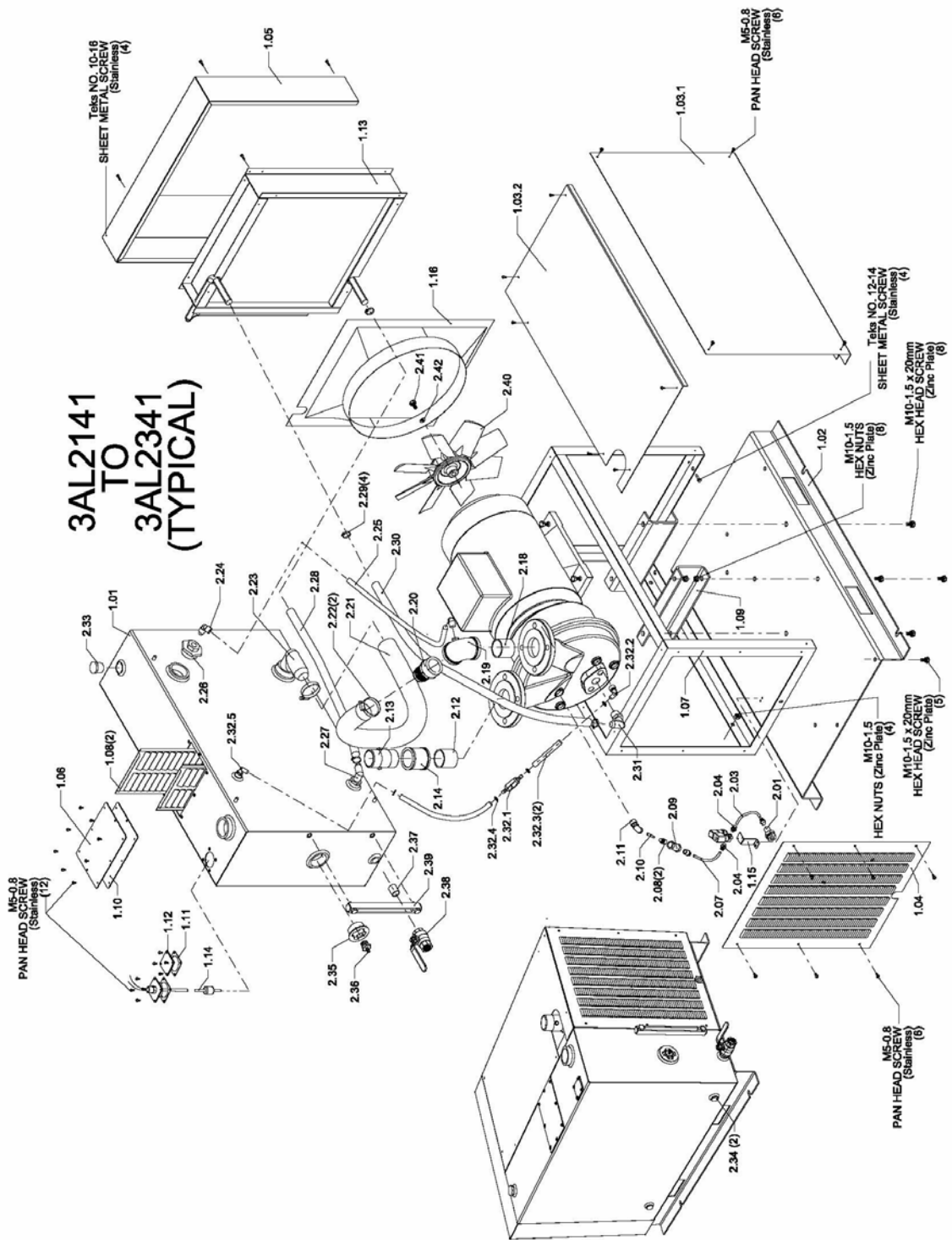
For additional assistance, please contact Airtech, Inc., 150 South Van Brunt Street, Englewood, NJ, 07631. Phone 1-201-569-1173 or via fax at 201-569-1696.

3AL Parts List

Refer to the relevant exploded view drawings for parts positioning.

Reference	Quantity	Description
1.01	1	Separator tank, 304 Stainless Steel
1.02	1	Base, Steel
1.03	1	Cover, Steel (For 3AL2341 order 1.03.1 and 1.03.2 together)
1.04	1	Front Cover, Steel
1.05	1	Radiator Cover, Steel
1.06	1	Baffle Cover, 304 Stainless Steel
1.07	1	Frame, Steel
1.08	2	Baffle, 304 Stainless Steel
1.09	2	Pump Mount, Steel
1.10	1	Baffle Cover Gasket, Polyurethane
1.11	1	Level Switch Gasket, Polyurethane
1.12	1	Level Switch Port Cover, Steel
1.13	1	Operating Liquid Cooler, Copper with Aluminum Fins
1.14	1 (Optional)	Level Switch
1.16	1	Fan guard
2.05	1	Water Purge Solenoid Valve (Specify Voltage)
2.09	1	Purge Water Flow Control Orifice
2.13	1	Inlet Check Valve, Steel/Buna-N
2.21	1	Discharge Hose
2.28	1	Water Supply Hose
2.30	1	Water Supply Hose (same as 2.28)
2.38	1	Drain Valve, Brass
2.39	1	Level Gauge, Glass with Aluminum Housing
2.40	1	Cooling Fan
2.43	1	Vacuum Pump with Motor





Airtech, Inc. (“Company”) Warranty Statement

Company warrants that on the date of shipment to Purchaser the goods will be of the kind and quality described herein, merchantable, and free of all defects in workmanship and materials.

If within one year from the date of initial operation, but not more than eighteen months from date of shipment by the Company, of any item of the goods, Purchaser discovers that such item was not as warranted above and promptly notifies Company in writing thereof, Company shall remedy such defect by, at the Company’s option, adjustment, repair or replacement of the item and any affected part of the good. Purchaser shall assume all responsibility and expense for removal, reinstallation and freight in connection with the foregoing remedy. The same obligations and conditions shall extend to replacement items furnished by the Company hereunder. Company shall have the right of disposal of items replaced by it. Purchaser shall grant Company access to the goods at all reasonable times in order for Company to determine any defect in the goods. In the event that adjustment, repair or replacement does not remedy the defect, the Company and Purchaser shall negotiate in good faith an equitable adjustment in the contract price.

The Company’s responsibility does not extend to any item of the goods which has not been manufactured and sold by the Company. Such item shall be covered only by the express warranty, if any, by the manufacturer thereof. The Company and its suppliers shall also have no responsibility if the goods have been improperly stored, handled or installed, or if the goods have not been operated or maintained according to their ratings or according to the instructions in Company or supplier furnished manuals, or if unauthorized repairs or modifications have been made to the goods.

THIS WARRANTY IS EXPRESSLY IN LIEU OF ALL OTHER WARRANTIES (EXCEPT TITLE) INCLUDING BUT NOT LIMITED TO IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS, AND CONSTITUTES THE ONLY WARRANTY OF COMPANY WITH RESPECT TO THE GOODS.

The forgoing states Purchaser’s exclusive remedy against Company and its suppliers for any defect in the good or for failure of the goods to be as warranted, whether Purchaser’s remedy is based on contract, warranty, failure of such remedy to achieve its essential purpose, tort (including negligence), strict liability, indemnity, or any other legal theory, and whether arising out of warranties, representations, instructions, installations, or defects from any cause.

Neither Company nor its suppliers shall be liable, whether in contract, warranty, failure of a remedy to meet its essential purpose, tort (including negligence), strict liability, indemnity or any other legal theory, for loss of use, revenue or profit or for cost of capital or of substitute use or performance or for indirect, liquidated, incidental or consequential damages or for any other loss or cost of a similar type, or for claims by Purchaser for damages of Purchaser’s customers.

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