Q501A"Quick Pump" - Transfer

serial #Q501A-092717-01

Molten Metal Pump Installation and Operation Manual

"BULLDOG SERIES"

HIGH TEMPERATURE SYSTEMS

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www.hitemp.com

Air Supply Considerations for Air Motors on Molten Metal Pumps

Our pumps are offered with air motor options. Air motor benefits include:

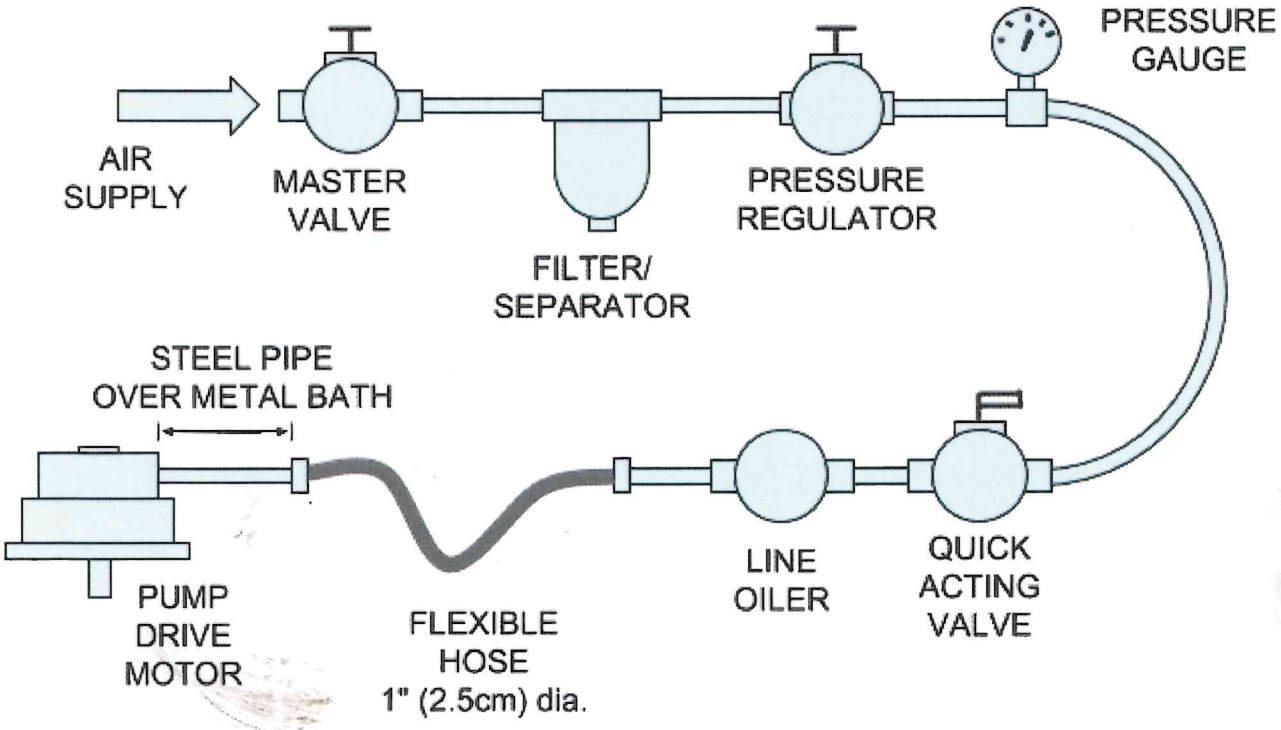
- No electrical connections and associated complexities.
- Pump speed is easily controlled by regulating the air pressure.
- The pump can be run from a nitrogen bottle during maintenance or emergencies.
- Air motors generally run cooler than ambient temperatures.
- Air motors are generally lighter weight than their equivalent horsepower electric motor.

Air Pressure - All our pumps use air motors with a maximum recommended air pressure of 100 psi (690 kpa). A combination of pressure and volume determines motor speed. In most cases, maximum motor speed is not desirable so a regulator is required to moderate the pump speed.

Air Volume - The required volume of air (cfm/lpm) is a function of the horsepower rating of the motor. This table provides reasonable guidelines:

Horsepower	1	2	4	5	10
cfm (lpm)	30 (850)	80 (2265)	130 (3681)	175 (4955)	275 (7787)

The illustration below shows an ideal air supply setup for an air motor used in a high temperature application:



Some additional considerations:

- The master valve is used to cut off the air supply for servicing the air supply components including the filter, regulator, oiler, etc.
- The master valve location may be selected based on safety considerations. Closing the master valve or the quick acting valve will stop the operation of the pump.

- The factory air supply may be "CDA" or clean dry air. If this is the case, eliminating the filter/separator is acceptable.
- The quick acting valve is typically a simple quarter turn ball valve located for ease-of-use and operator safety.
- A flow meter may be installed in series with the pressure regulator to provide additional operating information.
- The line oiler provides lubricant to the air motor. Due to the high temperatures of this application, the oiler must be located away from the molten metal bath.
- In most applications, it is desirable to use a flexible air hose between the oiler and the air motor. We recommend a 1/2" air hose.
- The flexible air hose should not be subjected to convective heat flow from the metal bath, so a length of steel pipe is used to span the molten metal bath.

TABLE OF CONTENTS

1 GENERAL

1.1 INTRODUCTION

- The information in this operating manual is intended for the use of all persons responsible for this pump. These persons are expected to have read and understood the information and observe it in all aspects.

- The complete technical documentation should be kept accessible for anyone using the pump.

- Henceforth, this operating manual is referred to as "the manual"; the pump as "the pump".

- If you have any questions, please contact our customer service department or your representative.

- In the interests of technical improvements to the pump, we reserve the right to carry out any modifications which may render certain illustrations or information contained in this manual out of date on the Data Sheet.

- Seller's products are carefully inspected for manufacturing defects; however it is not always possible to detect hidden defects. Said products are warranted only to the extent that Seller will replace without charge, products proved to have manufacturing defects within 6 months of the date of delivery thereof and provided Seller has been given an opportunity to inspect the product alleged to be defective and the installation of use thereof.

- NO WARRANTY IS INCLUDED AGAINST ANY EXPENSE FOR REMOVAL, REINSTALLATION OR OTHER CONSEQUENTIAL DAMAGES ARISING FROM ANY DEFECT. THE WARRANTIES SET OUT ABOVE ARE THE ONLY WARRANTIES MADE BY SELLER AND ARE EXPRESSLY IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING THE WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

1.2 APPLICATION RANGE OF THE PUMP

- The present version of the pump has a certain specification. For other applications different design features may modify this specification.
- The pump may be used only for the specified application. We, the manufacturer accepts no responsibility for any damage resulting from improper usage.

1.3 COPYRIGHT ON THIS OPERATING MANUAL

- The copyright on this manual is owned by High Temperature Systems, Inc..
- This manual is intended for the use of the personnel responsible for installation, operation and maintenance of the pump. The regulations and drawings it contains may be neither fully nor partially reproduced nor distributed, nor without authorization made available to third parties.

HIGH TEMPERATURE SYSTEMS, INC.

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2 SAFETY PROCEDURES

2.1 INSTRUCTIONS FOR SAFETY AT WORK

The following safety instructions are particularly important:

- The pump is designed according to latest technology and is essentially safe to operate. Nevertheless, the environment the pump is used is dangerous and situations may arise if untrained operators use it or for purposes for which it is not intended.
- All persons occupied in the factory with the installation, start-up, operation, repair and maintenance of the machine, must previously have read and understood the manual completely, and in particular the present chapter 2 "Safety".
- The pump is intended for transfer of molten metal only. We the manufacturer accepts no responsibility for any damage resulting from improper usage.
- The user should carry out any repair work on the pump, dismantling, and replacement of parts and adjustments following and complying with the instructions provided with the pump.
- The pump may be operated, serviced and repaired only by skilled, trained personnel who have been authorized to perform the work.
- The pump should be installed, operated, adjusted, and maintained. The responsibilities of the personnel concerned must be clearly defined, so as to prevent any danger arising due to competency misunderstandings.
- As the operator, it is your job to ensure that no unauthorized person uses the pump.
- It is your duty to report immediately any irregularity in the running of the pump, which could cause danger.
- Check and maintain regularly, that the pump is always in faultless condition.

  It is the responsibility of the User Company to issue instructions and assure a checklist of procedures for cleanliness around the pump and pump well. As operator, always observe these instructions.
- Never modify the pump in any way, which could affect the operation of how the pump works; this may affect the safety of the pump in operation.
- Always wait until the machine has stopped before any intervention on the machine (set-up, adjustments, etc.)
- Always wear the proper gear and use the proper tools when working with the pump.
- After initial installation and start-up after any repair or replacement of parts, check that the pump is operating as usual.

- Flow valves must be mounted in a safe area an adequate distance from piping.
- Pump must be completely dry upon immersion, void of moisture.
- At pump start up, stand clear of furnace to avoid the possibility of being splashed with molten metal.
- Wear proper protective clothing when handling hot pump.
- Fluxing should be avoided while pump is submerged in well.
- Upon initial start up, check all piping connections for leaks.
- Caution: Pipe will reach temperatures hot to the touch. Avoid contact with pipe during use.
- Avoid walking under piping while piping is in use.
- Periodically check piping for hot spots. Eventually hot metal will wear through the pipe liner. A red hot spot will appear on the pipe. Remove this piece of pipe, as the molten aluminum will very quickly burn through the pipe.

3 INSTALLATION

3.1 PRIOR TO INSTALLATION

3.1.1 INSPECTION OF PUMP

- Inspect pump for transit damage and remove extraneous material such as air motor port plugs and packaging material. Install accessories such as air motor mufflers and if transferring, molten metal transfer pipe.

- The pump will come to you either fully assembled or partially assembled in which case the shaft and impeller or Penteller™ needs to be assembled and put into the pump.

> **CAUTION:** CONSIDERATION SHOULD BE GIVEN TO THE EXPOSURE OF THE PUMP TO MECHANICAL DAMAGE OR ABUSE PRIOR TO INSTALLATION. IF IT WILL BE EXPOSED TO A HIGH RISK OF IMPACT FROM PORTIONS OF THE CHARGE OR FROM MOVING EQUIPMENT, SUITABLE PROTECTION SHOULD BE PROVIDED.

3.1.2 REQUIRED HAND TOOLS

See Chapter 6.1

3.1.3 INSTALLATION CONTROLLER

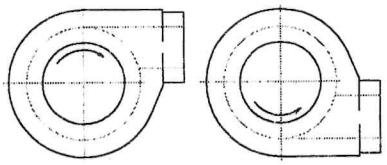
3.1.3.1 ELECTRIC VERSION

1) Connect Controller-Unit as shown in Schematics (Chapter 6). High Temperature Systems recommends a proper power connection for the controller.

> **CAUTION:** DO NOT CONNECT THE CONTROLLER TO THE SAME SUPPLY AS THE BURNERS.

2) Mount the Blower Assembly in a clean place away from the heat. It is imperative that the blower intake is kept free of dirt, chips and other debris at all times.

3) Turn the controller on and check following things:
   ✓ Rotation-direction of Motor and Blower Assembly.
   View from top of the pump:



Right-handed pump: Direction has to be clockwise!

Left-handed pump: Direction has to be counter clockwise!

   ✓ RPM of Motor-Assembly (MAX 900 RPM, it varies with the application).

CAUTION: PRIOR TO IMMERSION NEVER TURN CONTROLLER ON WITH INSERTED SHAFT AND PENTELLER™. → THIS WILL DAMAGE THE PUMP!

NEVER LET PUMP RUN DRY!

3.1.3.2 AIR VERSION

1) Connect control unit as shown in Schematics (Chapter 6).
2) The Air-Supply-Unit needs an integrated lubricator, a pressure regulator, a filter element, and a quick acting valve. WARNING-DO NOT USE QUICK-COUPLINGS ON AIR-SUPPLY-LINE. AIR FLOW WILL BE INSUFFICIENT!
3) Locate the item in point 2) on a protected and safe place from molten metal splash and mechanical damage.
4) Turn the Air-motor on and check Rotation-direction of the motor. ***See Chapter 3.1.3.1-3*** (MAX 120psi)

CAUTION: PRIOR TO IMMERSION, NEVER TURN CONTROLLER ON WITH INSERTED SHAFT AND PENTELLER™. → THIS WILL DAMAGE THE PUMP!

NEVER LET PUMP RUN DRY!

3.1.4 SUPPORT OF PUMP

High Temperature Systems recommends two different support systems, on a chain hoist or supported on the motor mount plate.

3.1.4.1 SUPPORT WITH CHAIN HOIST

A chain hoist on an overhead rail provides a simple means for installation, positioning, lifting for cleaning and removal for repair. All the pumps have a bracket for lifting the pump with a hook.

> CAUTION: SECURE THE PUMP AGAINST TWISTING, WHEN UTILIZING A CHAIN HOIST.

3.1.4.2 SUPPORT WITH THE MOTOR MOUNT PLATE

Channels or angle irons may support the pump by resting on the walls of the furnace well attached by bolts to the pump motor mount plate.

See Drawing of the motor mount plate Chapter Drawings

> CAUTION: CAUTION MUST BE OBSERVED WHEN ATTACHING STEEL TO MOTOR MOUNT PLATE TO PREVENT INTERFERENCE WITH PUMP OPERATION AND TO ALLOW PUMP DISMANTLING DURING REPAIR.

3.2 INSTALLATION OF PUMP

3.2.1 ASSEMBLING OF A NEW MOLTEN METAL PUMP

Confirm the following has been completed in the event that the pump was not shipped as a complete assembled unit.

1) Bolt the motor with the 4 existing bolts to the motor mount.
2) Loosen the clamp assembly, put the cartridge in place and tighten the clamp assembly afterwards. ***Make sure the groove of the clamp assembly fits the groove of the cartridge exactly to be sure that the graphite-cartridge does not get damaged.***
3) Screw impeller or Penteller™ on shaft.

> CAUTION: TAKE CARE WHEN THREADING THE IMPELLER ONTO THE SHAFT TO ENSURE PROPER ORIENTATION. INCORRECT IMPELLER ORIENTATION (UPSIDE DOWN) WILL RESULT IN DAMAGE TO THE PUMP.

FOR MORE INFORMATION CALL YOUR REPRESENTATIVE.

4) Check if the coupling is placed on the motor shaft correctly and the 2 set screws are tight.

5) Lift the pump with a hoist chain, that you have enough clearance underneath the pump to insert the shaft-Penteller™-unit from the bottom of the pump. Push the shaft all the way up into the coupling.

6) Turn the coupling until the hole in the shaft lines up with the hole in the coupling. Insert the safety sheer pin into the coupling. ***There should be no force necessary to assemble, don't use any tools at all!***

7) Place wire in groove around the safety coupling. Tighten with safety tool by catching loops on wire in tool and twisting.

8) Check if the Penteller™ or impeller is flush with the bottom of the base. Should this not be the case, adjust it with the coupling. (It is possible that the coupling moved during shipment).

Adjustments vertically with coupling: 2 set screws on the coupling

CAUTION: MAKE CERTAIN THAT THE SHAFT, PENTELLER™, AND COUPLING ARE SUPPORTED BEFORE YOU LOOSEN THE SET SCREWS ON COUPLING TO PREVENT THE ASSEMBLY FROM FALLING OUT OF THE PUMP. FAILURE TO DO SO WILL LIKE RESULT IN DAMAGE TO THE PENTELLER™ AND SHAFT.

9) Check if the shaft-impeller-unit rotates free. If not, loosen the bolts that hold the clamp assembly together with the motor mount plate. The play you have now with the cartridge is to adjust the shaft-Penteller™-unit until it spins free. After the adjustment, tighten the holding bolts of the clamp assembly.

For transfer pumps:

10) Check the entire pipe segments for clearance.

11) Bolt all the pipe sections together, except the first section from the pump. The first section from the pump you bolt direct to the pump.

CAUTION: HIGH TEMPERATURE SYSTEMS RECOMMENDS THE USE A HIGH TEMPERATURE FIBER GASKET BETWEEN EACH PIPE SEGMENT. THESE GASKETS ARE CUT TO THE EXACT FORM OF THE FLANGE FOR A NOMINAL SEAL BETWEEN FITTINGS.

DO NOT OVERTIGTHEN!

12) Confirm your pipe layout. ***The pipe must be supported at every 4' section.*** The supports have to hold the following weight:

Pipe Diameter:	Weight of a 4' Section (incl. Aluminum)	Weight of a 4' Section (incl. Zinc)
2"	~28 LB	~41 LB
3"	~54 LB	~79 LB
4"	~81 LB	~127 LB
5"	~117 LB	~191 LB
6"	~160 LB	~256 LB

CAUTION: NOT SUPPORTED PIPE SECTIONS MAY BEND WITH HEAT AND TIME AND MAY NOT BE RELINED. PIPE CAN NOT BE USED FOR PUMP SUPPORT. THE BOLTS MAY BREAK AND CAUSE ACCIDENTS!

3.2.2 CONNECTIONS OF THE MOTOR-UNIT

3.2.2.1 ELECTRIC MOTOR

Connect the existing hose with the clamps to the blower and to the air inlet on the top of the electric motor.

Remark: ***Confirm that the electric motor and blower connections to the control-unit were checked for the correct rotation-direction. See Chapter 3.1.3.1-3***

3.2.2.2 AIR MOTOR

1) Connect air supply hose to the motor.

Remark: ***Confirm that the air motor was checked for the correct rotation-direction. See Chapter 3.1.3.1-3***

2) Connect the muffler to the outlet of the air motor. (Normally pre-mounted by HIGH TEMPERATURE SYSTEMS.)

3.3 PREHEATING AND START THE PUMP

3.3.1 PREHEATING OF A MOLTEN METAL PUMP

CAUTION: MAKE SURE THE PUMP WAS STORED ON A MOISTURE-FREE PLACE THAT THE GRAPHITE CONTAINS NO MOISTURE AT ALL.

GRAPHITE CONTAINING MOISTURE MAY EXPLODE IN MOLTEN METAL!

DANGEROUS!

CAUTION FOR ELECTRIC VERSIONS: COOLING AIR MUST BE PROVIDED ANY TIME THE MOTOR IS OVER OR NEAR THE FURNACE!

TURN ON THE CONTROLLER!

1) Position the ***bottom of the pump base 5" above*** the molten metal in the well and allow the pump to remain in position for ***10 minutes***.
2) Position the ***bottom of the pump base 1" above*** the molten metal in the well and allow the pump to remain in position for ***10 minutes***.
3) Lower the pump until the ***bottom of the base touches*** the molten metal. Hold this position for ***15 minutes***.
4) Lower the pump until the ***half of the base is immersed***. Hold this position for ***15 minutes***.
5) Lower the pump until the ***base is immersed completely***. Hold this position for ***15 minutes***.
6) Lower the pump until the ***metal line is 3" on top of the base***. Hold this position for ***10 minutes***.
7) Lower the pump in ***4" increments every 5 minutes*** to the desired depth.

3.3.2 STARTING THE PUMP

If you have a non-standard application or specific concerns, please consult your representative for additional information regarding startup procedures.

1) Preheat as described in Chapter 3.3.1

2) Check the impeller freedom by rotating the coupling with the rotation tool provided.

3) The pump is now ready for start-up. Be sure to maintain a ***clearance of minimal 3 inches*** from the bottom of the well to the bottom of the pump.

3.3.2.1 FOR AIR MOTOR

WARNING-DO NOT USE QUICK DISCONNECTS FOR AIR SUPPLY LINE!
Do not turn the air on slowly. Turn air valve quickly and then adjust metal discharge by adjusting air pressure at the regulator. This procedure is necessary to prevent first metal from freezing as it slowly flows up pump riser and out discharge pipe.

3.3.2.2 FOR ELECTRIC MOTOR

1. Read out the ampere on the controller during running the pump and limit afterwards the max ampere setup to a 25% higher value than the readout.
2. Start the controller with the RUN button. HTS recommend starting with 800 RPM and then adjust the hertz in the setup of the controller until you have the desired metal discharge. This procedure is necessary to prevent first metal from freezing as it slowly flows up pump riser and out discharge pipe.

3.3.3 STOPPING THE PUMP

Stopping the pump is at any moment in production possible. Just close the air valve for the air motor versions and push the STOP button for the electric motor versions.

4 MAINTENANCE

4.1 GENERAL

- Keep pumps well cleaned and skimmed to prevent pump clogging and reduce pump wear caused by abrasion of oxides and other dross.
- When the pump is removed from the metal bath, thoroughly clean the submerged parts of pump while the metal is molten.
- Shaft and impeller or Penteller™, on pump being removed for repairs, should be removed as a unit ***while residue on pump is still molten***. All bearing surfaces should be cleaned by scraping while metal and dross build up is molten.

4.2 DURING OPERATION

1) Remove pump from molten metal and allow metal remainder to drain into bath.
2) Scrape dross and metal residue from surface prior to solidification.
3) If shaft and Penteller™ are to be removed do so prior to metal solidification inside base around Penteller™.
   Shaft and impeller may be removed as unit through bottom of base after removing the wire and the safety sheer pin.

CAUTION: DO NOT DROP THE SHAFT-IMPELLER-UNIT OR THE BASE ONTO ANY HARD SURFACE. IT MAY RESULT IN BREAKAGE OF AT LEAST ONE AND POSSIBLY BOTH UNITS.

DO NOT PUT THE UNIT OR THE BASE ON A COLD FLOOR. USE SOME INSULATION MATERIAL BETWEEN THE FLOOR AND THE HOT PUMP PARTS.

CAUTON: BEWARE OF THERMOSHOCK!

IT MAY RESULT IN BREAKAGE!

After pump removal and cleaning, allow pump to cool to room temperature.*

4) Carefully remove powdery oxidized graphite, metal- and dross residue.

5) Use a steel rod to carefully clean slots and holes in impeller and cartridges. (only for pumps with impellers and BULLDOG pumps)

6) To put the pump back into the well, see Chapter 3.3.1

***For storage of pump that has been exposed to molten-metal to be re-used at a later date, place pump into a High Temperature Systems, Inc. PRE-HEAT Station (Doghouse) or a hotbox to prevent premature deterioration of pump components. Contact High Temperature Systems, Inc. for further information.**

5 REPAIR

5.1 REQUIRED HAND TOOLS, MATERIALS AND REPLACEMENT PARTS

See Chapter 9)

5.2 REPLACEMENT OF SHAFT AND PENTELLER™ OR IMPELLER

1) Prior to metal residue freezing, remove the shaft-impeller-unit through bottom of base after removing the wire and the safety sheer pin.

2) Immediately after removal of shaft and Penteller™, clean surfaces inside the base and on the Penteller™ of metal residue and dross build up. Use sharp steel such as the back edge of a hacksaw blade.

3) While shaft and Penteller™ are still hot try to twist Penteller™ from shaft and replace the defective part.

4) Clean the thread of the used part and twist it together with the replacement part.

> **CAUTION:** IMPELLERS MAY BE SCREWED ON SHAFT IN TWO DIFFERENT WAYS. MAKE SURE THEY ARE PUT TOGETHER CORRECTLY TO NOT CAUSE DAMAGE TO THE PUMP.
> FOR MORE INFORMATION CALL YOUR REPRESENTATIVE.

5) Insert the new unit from the bottom of the base into the pump. Push the unit all the way up until the shaft rests in the coupling.

6) Turn the coupling until the hole in the shaft lines up with the hole in the coupling. Insert the safety sheer pin into the coupling. ***There should be no force necessary to assemble; don't use any tools at all!***

7) Place wire in groove around the safety coupling. Tighten with safety tool by catching loops on wire in tool and twisting.

8) Check if the Penteller™ or impeller is flush with the bottom of the base. Should this not be the case adjust it with the coupling. (It is possible that the coupling moved during the shipment from HIGH TEMPERATURE SYSTEMS to the customer).
Adjust vertically with coupling: 2 set screws on the coupling

> **CAUTION:** MAKE SURE, THAT THE SHAFT, PENTELLER™ AND COUPLING ARE SUPPORTED BEFORE YOU LOOSEN SET SCREWS ON COUPLING TO PREVENT THE UNIT FROM FALLING.

9) Check if the shaft-impeller-unit rotates free.

10) The pump with the replaced Penteller™ or shaft or both may be immersed with the preheating instructions in Chapter 3.3.1. Should the cartridge still be hot you can preheat in half of the initial time.

5.3 REPLACEMENT OF THE CARTRIDGE

1) Remove shaft-Penteller™-unit as described in Chapter 5.2 (1-2)

2) Remove the bolts holding the clamp assembly to the motor mount plate. Make sure the top part of the pump, motor and motor mount assembly is hanging safely on the chain hoist before you loosen the clamp assembly.

3) Remove the clamp assembly from the cartridge by removing the 4 bolts. Clean the inside of the clamp assembly for residue particles of graphite

4) Put the clamp assembly on the new cartridge. Tighten the clamp assembly and bolt it back to the motor mount plate. Do not tighten these bolts, let them loose one turn, that you are able to move the cartridge horizontally.

5) Insert the shaft-Penteller™-unit from the bottom of the pump. Push the shaft all the way up into the coupling.

6) Turn the coupling until the hole in the shaft lines up with the hole in the coupling. Insert the safety sheer pin into the coupling. ***There should be no force necessary to assemble, don't use any tools at all!***

7) Place wire in groove around the safety coupling. Tighten with safety tool by catching loops on wire in tool and twisting.
8) Check if the shaft-impeller-unit rotates free and the Penteller™ lines up with the hole in the base. In case it's not, use the play you have with the cartridge to adjust

until the shaft-Penteller™-unit spins free. After the adjustment tighten the holding bolts of the clamp assembly.

9) Check if the Penteller™ or impeller is flush with the bottom of the base. Should this not be the case adjust it with the coupling. (It is possible that the coupling moved during the shipment).

Adjust vertically with coupling: 2 set screws on the coupling

> **CAUTION: MAKE SURE, THAT THE SHAFT, PENTELLER™ AND COUPLING ARE SUPPORTED BEFORE YOU LOOSEN SET SCREWS ON COUPLING TO PREVENT THE UNIT FROM FALLING.**

10) Should the coating on any parts become chipped or worn during use of the pump, HTS OXI-X coating can be used for touch-up. Follow directions on the container.

11) The pump with the replaced cartridge may be immersed with the preheating instructions in Chapter 3.3.1.

6 DATA SHEET

6.1 REQUIRED HAND TOOLS

- 1-1/8";15/16";3/4";9/16" Wrench
- 1/4" Allen Wrench
- Safety Tool
- Shaft Ejector #3140-1 (Provided with the pump)
- Coupling Rotation Tool #3140-2 (Provided with the pump)

6.2 MATERIALS

- OXI-X Cement Needed only for touch-up

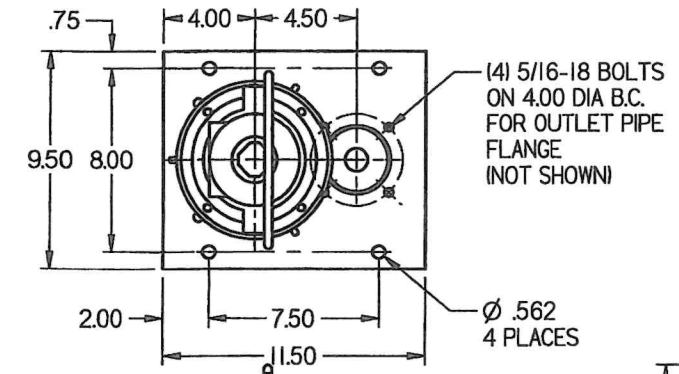
6.3 TECHNICAL DATA - PUMP

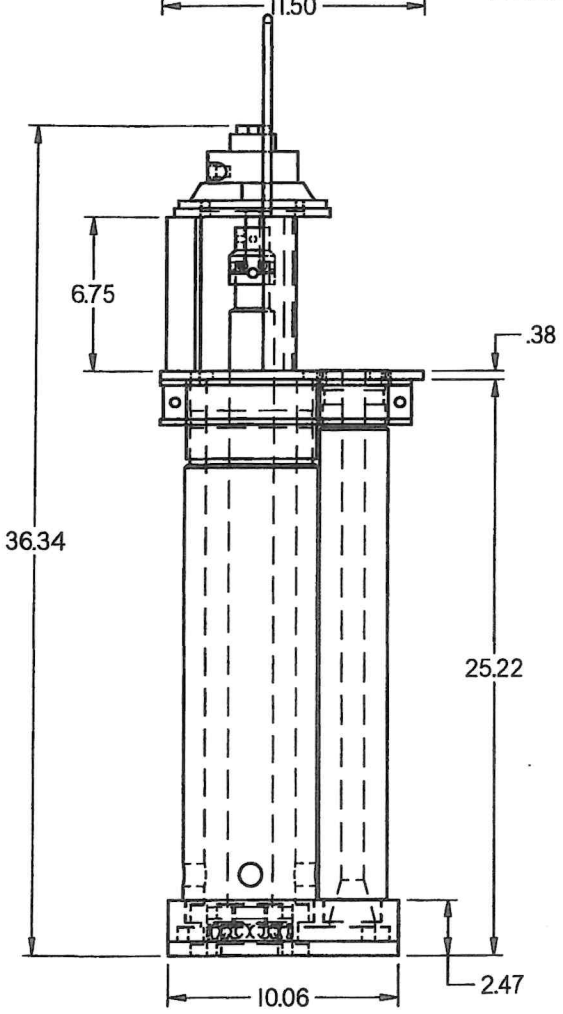
Pump type:	Q501A
Application:	Aluminum Transfer
Serial-No:	Q501A-092717-01
Discharge:	500 lbs/min.(Al)
Motor type:	Air
HP	2.8hp
Air Inlet	1/2" NPT
Operational Speed	1800 rpm
Spares:	
Cartridge -incl. base, riser, sleeve	Q501A.8
Shaft/impeller combo	Q501.4
Impeller	#134
Coupling	2376-625
Gas Injection:	N/A

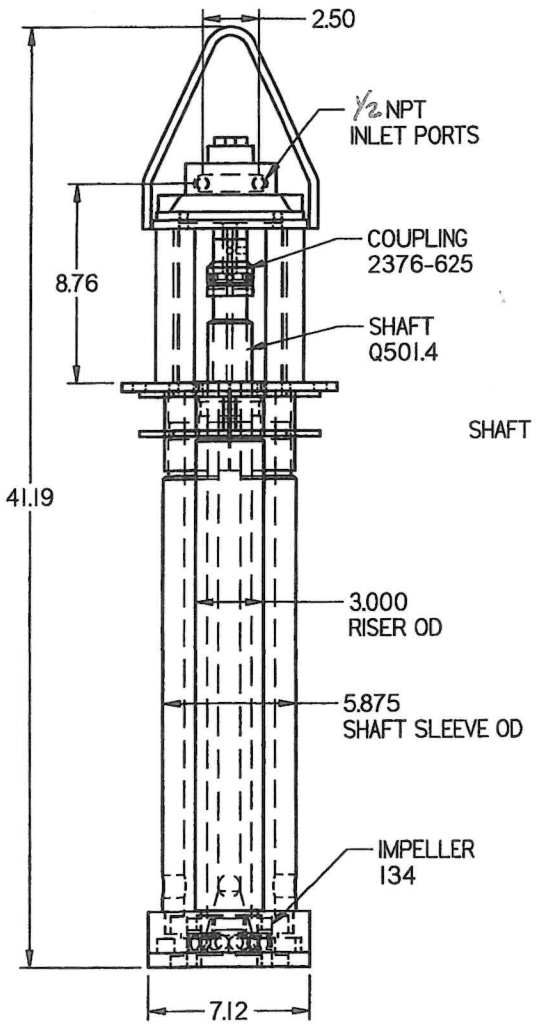
7 SCHEMATICS

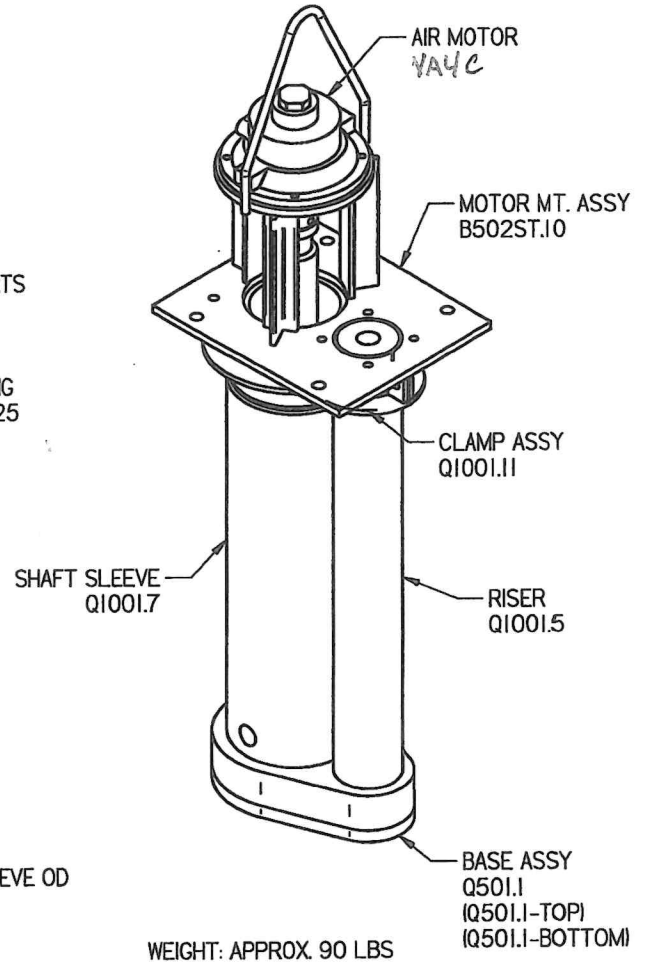
8 DRAWINGS

REVISION HISTORY			
REV	DESCRIPTION	DATE	APPROVED









WEIGHT: APPROX. 90 LBS

MATERIAL: NOTED

	NAME	DATE
DRAWN	K. JONES	03/29/17
CHECKED		
ENG APPR		
MGR APPR		

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
ANGLES ±0.5°
2 PL ±0.01 3 PL ±0.005

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TITLE: PUMP ASSY

SIZE C | DWG NO Q501A | REV

FILE NAME: Q501A.dft

SCALE: | WEIGHT: | SHEET 1 OF 1

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