SAFETY INSTRUCTIONS

Read this manual carefully to learn how to safely install and operate your pump. Throughout this manual there are a number of SAFETY HAZARDS that must be read and adhered to in order to prevent possible personal injury and/or damage to the equipment.

Three keywords, “DANGER”, “WARNING”, and “CAUTION”, are used to indicate the potential severity of the hazard, and are preceded by a SAFETY ALERT SYMBOL. Failure to follow the safety-related instructions may result in a safety hazard.

**DANGER** Indicates an imminently hazardous situation which, if not avoided, WILL result in serious injury or death.

**WARNING** Indicates a potentially hazardous situation which, if not avoided, COULD result in serious injury or death.

**CAUTION** Indicates a potentially hazardous situation which, if not avoided, MAY result in minor or moderate injury.

THOROUGHLY REVIEW ALL INSTRUCTIONS AND WARNINGS PRIOR TO PERFORMING ANY WORK ON THIS PUMP.

**Introduction:**

Shippco® .03 DA, .03 DA-CI, .03 DA-CI-2T and .03 DA-2T Deaerating Boiler Feed Units are designed to remove the dissolved oxygen in boiler feed water to a level of .03 cc/liter of feed water. The unit consists of a receiver (tank), water make-up assembly, spray manifold, vent condenser, direct injection steam heating assembly, boiler feed pumps, and an electrical control panel.

Standard receiver accessories usually include gauge glass, dial thermometer, magnesium anode, inlet for returns, overflow connection with overflow loop, vent, suction tappings for pumps, and a drain.

The unit may be furnished with one or more boiler feed pumps. Two or three pumps are the normal configuration.

Because pump installations are seldom identical, this manual cannot possibly provide detailed instructions and precautions for each specific application. Therefore, it is the responsibility and the duty of all personnel involved in the installation, operation and maintenance of the equipment to ensure that applications not addressed in this manual are performed only after establishing that neither operator safety nor pump integrity is compromised by the installation.

**Pre-Installation Check:**

Open all cartons and inspect for shipping damage. Report any damage to your shipping carrier or Shippco® sales representative immediately.

Always verify that the pump nameplate Voltage, Phase, and Horsepower ratings as well as Amps rating on motor match your control panel and power supply. Warranty does not cover damage caused by connecting pumps and controls to an incorrect power source (i.e., voltage and phase).

**Site Inspection:**

The unit should be of the proper size and capacity for the proposed installation. Refer to nameplate for rated capacities. Check motor voltage against available power supply.

**Installation:**

Electrical connections are to be made by a qualified electrician in accordance with the National Electrical Code (NEC) or the Canadian Electrical Code, as well as all national, state and local codes. Code questions should be directed to your local electrical inspector. Failure to follow electrical codes and OSHA safety standards may result in personal injury or equipment damage. Failure to follow manufacturer's installation instructions may result in electrical shock, fire hazard, personal injury or death, damaged equipment, provide unsatisfactory performance, and may void the manufacturer's warranty.

Operating personnel should be trained in the operation of the pump and any associated system.
Unit and/or Pump Location:

CAUTION

If pump and motor are operating at extremely high or low temperatures, insulate and ventilate as required.

Units are furnished with motors classified as either Open Drip Proof (ODP) or Totally Enclosed Fan Cooled (TEFC) motors. Controls can be NEMA 1, NEMA 2, NEMA 4, etc. Other classifications are available upon request. Locate unit only in areas of the proper classification based on motor data and NEMA classifications of the equipment purchased.

A high ambient temperature will cause thermal overload protection to shut off the pump. To facilitate maintenance, place unit for easy access to all parts. Allow adequate space for servicing.

Seal Flush Line (or Bleed Line):

WARNING

Shipco® pumps are manufactured with provisions for a seal flush line. This line helps prevent the pump from vapor binding and allows the pump to operate against a dead shut-off for periods of time without burning the seals. The bleed line must remain open.

If pumps run continuously, condensate temperature is 212°F or higher, and motor horsepower is 7½ or larger, then a bypass orifice is typically required.

Vent Connection:

Install a full sized vent to atmosphere from the receiver. Do not install any shut-off valves or other type of valves in the vent line. Do not plug vent to test system for leaks. Receiver is not made to be pressurized. The vent should be piped to an area suitable for a small steam plume (trace amounts).

Overflow:

Install overflow piping to drain.

Water Make-Up:

Provide a water supply (50 PSIG) to the modulating water make-up valve. If a manual bypass was not included with the DA, one should be field installed.

Steam Supply:

The unit is equipped with a direct injection heating assembly below the water line in the main tank. Install the main steam valve per the manufacturer's instructions. Be sure to select the proper size for the required steam flow; a good rule of thumb is to install a steam line at least one pipe size larger than the inlet of the main steam valve. Caution: Do not restrict the valve by installing an undersized steam line.

Provide a shut-off valve in the steam supply line. A steam strainer and pipe union should be installed in the steam main, ahead of the steam regulator valve. The regulators should be adjusted to maintain a constant DA tank temperature of 211°F (at sea level). The regulator should be adjusted to maintain a small steam plume from the vent. To simplify adjusting the regulator, install a tee in the vent line under the roof line, in easy access. In the branch leg of the tee, install an observation 1" gate valve or ball valve. Open the valve to witness the slight trace of steam in the vent. Once the regulator valve has been set, close the observation valve.

Return Piping:

Properly pitched gravity return lines are piped to the unit as shown in the Typical Piping Diagram (Figure 1). An isolation valve should be installed for servicing. An inlet strainer should be installed to remove foreign material in the return line(s). Pumped returns should be piped to the spray manifold on the unit as shown in the Typical Piping Diagram (Figure 1). An isolation valve should be installed prior to the unit for servicing.

Suction Piping:

A spring-loaded check valve should be installed in the discharge piping near to the pump to prevent backflow into the unit. Next, a manual flow control valve (e.g., ball valve, globe valve, or steam cock) must be installed after the spring-loaded check valve and near to the pump discharge flange or union (see IOM for pump Model supplied with DA) to "balance the pump" (i.e., adjusting discharge flow of the pump to keep it running at the design operating conditions for flow rate and discharge pressure). A gate valve should not be used as a manual flow control valve. Note that some people refer to the term "balancing the pump" as either "throttling the pump" or "choking the pump".

If pump discharge is rated for 75 PSIG or greater, the pump may be equipped with an automatic flow control valve that functions as the balancing valve. When an automatic flow control valve is included, it must be installed in the discharge piping immediately after the pump's discharge flange or union and before any other valves (see IOM for pump Model supplied with DA). The automatic flow control valve is used to set the pump at the design operating conditions to prevent motor overload and pump cavitations. Note that the sequence of piping when using an automatic flow control valve is different from the manual flow control valve piping.

Notes on Piping:

1. When installing the pump, if the discharge flange of the pump does not include a tapping for a discharge pressure gauge port, a gauge port should be installed in the discharge piping.

2. The piping should include isolation valves on both the suction and discharge sides of the pump and have a drain valve in the suction line.

When installing the suction and discharge connections to a threaded pump housing, a Teflon tape sealer or a high quality thread sealant is recommended.

For specific instructions on installation, operation and maintenance of pump/motor assemblies fitted to receiver, refer to IOM Manual for appropriate pump model depending on which pump model that the unit is furnished with (e.g., Model D Series, Model P Series, Model AW/AWF/AWF-B Series, etc.).
WARNING: The manufacturer will not be liable for any malfunction, damage, or destruction of the equipment if the equipment is not installed properly or is not installed by professionals, licensed and registered as required. Failure to follow and install the equipment according to job specific drawings, made by professionals who are licensed and registered as required and are familiar with the equipment, and failure to have the equipment installed by professionals, who are licensed and registered as required, in accordance with local, state, and federal codes will void all warranties and will void any liability upon the manufacturer. In addition, all warranties, including warranties of merchantability and fitness for a particular purpose are null and void for failure to follow job specific drawings made by professionals who are licensed and registered as required and are familiar with the equipment, and failure to have the equipment installed by professionals, who are licensed and registered as required, in accordance with local, state, and federal codes.
Electrical Wiring:
Units are furnished with single-phase or three-phase motors. Single-phase motors are usually furnished as dual 115/230/1/60. Three-phase motors are usually furnished as tri-voltage 208/230/460/3/60. Motors should be connected according to manufacturer’s instructions for correct voltage.

If control panel is furnished, confirm that the nameplate data on the control panel(s) matches the supply current. If the nameplate data does not match the power source, consult factory.

Verify controls such as motor wiring, starter coils, transformers, etc., match the control voltages before installing. The secondary side of transformer is the control circuit.

Wire in accordance with the National Electrical Code, state and local codes where applicable. See typical wiring diagrams (Figure 2).

<table>
<thead>
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<th>Maximum HP</th>
<th>Maximum Volts</th>
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<th>Class K1 or J Fuse (Ampere)</th>
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PUTTING THE DA AND PUMPS INTO SERVICE:

A. Inspect the installation to insure the units are installed in accordance with the manufacturer's IOMs and any and all State and Local codes.

B. Check the electrical panel name plate for the proper incoming line voltage. Compare this to the actual incoming line voltage. If they are the same, you may proceed. If they are different, consult the factory for any changes required for the actual line voltage.

C. Flush unit to drain to remove any debris from total system (i.e., pipes, radiators, receivers, etc.). Make sure all debris has been removed from inlet strainer after start-up of system. Reinstall drain plug.

D. Remove shipping brackets on all the external float switches. Per instructions on tag attached to float switch, remove shipping bracket (See Figure 3) from each float switch as per manufacturer's instructions. The float switches have been factory set for maximum capacity of the receiver. Should an alternate setting be required, refer to the float switch manufacturer's instructions. If needed, reference Technical Articles section on the SHIPCO® website (www.shipcopumps.com) for detailed instructions on how to adjust a float switch (Adjusting a Nema 1 Square-D, 9037 Series Float Switch).

E. Check to insure the available steam pressure to the regulator(s) matches the design operating conditions.

F. Prime the unit by filling the receiver approximately one-third (1/3) full of water with the automatic make-up. If two tank system with surge tank, add water to the surge tank via the solenoid valve/float switch; otherwise add water into the DA tank and skip to Step L.

G. As the unit is filling check the operation of all floats on the surge tank.

H. Prime each transfer pump. Refer to IOM Manual for particular pump model supplied with unit.

I. If two tank design with surge tank, turn the power on to the transfer pumps. Bump start each pump to check pump rotation. Correct any pump rotation problems that are found.

J. Adjust the throttling valve (closed) installed in pump discharge to balance each transfer to the design operating conditions. If pump(s) furnished with automatic flow control valves, refer to Discharge Piping Section above.

K. After fully checking out the DA, start a transfer pump on surge tank and allow it to fill the DA.

L. While the DA is filling check the float switch operations on the DA to insure they are right. When the tank is about 1/3-1/2 full, stop filling the DA.

M. Slowly open the main isolating valve(s) in stages to the steam regulator(s). Do this in stages.

N. Gradually bring the DA up to temperature of 211°F at sea level.

O. Adjust the steam regulator(s), per the IOM from regulator manufacturer, to set the temperature/pressure of the DA.

P. Prime each boiler feed pump. Refer to IOM Manual for particular pump model supplied with unit.

Q. Once DA is up to temperature, bump start each boiler feed pump to check pump rotation. Correct any pump rotation problems that are found.

R. If two tank system with surge tank, add water to the surge tank and allow it to fill the DA. Bump start each pump to check pump rotation. Correct any pump rotation problems that are found.

S. Motor Lubrication: If the pump is a close-coupled centrifugal unit, the pump has no internal bearings. Refer to IOM Manual for appropriate pump model for additional information.

T. Bleed line shut-off valve and bypass line (if present) MUST REMAIN OPEN unless pump is being serviced.

U. Should pump sound noisy, it may not be operating at design conditions. Adjust throttling valve to operate at the proper discharge pressure.

Single-phase drip proof motors up to and including 1 HP have built-in thermal overload protection. But, the amp draw on most boiler feed level controls can handle only the amp draw of a 1/3 HP, single-phase motor. An electrical control panel is required for all other power sources and horsepower motors.

Short Circuit Protection:
According to the National Electrical Code, branch circuit over-current protection must be provided for each contactor or starter. The following table is provided as a guide. DO NOT EXCEED MAXIMUM PROTECTIVE DEVICE RATINGS. (See Figure 2.)

Boiler Level Controls:
Follow boiler and control manufacturer's recommendations for interconnected wiring of controls. Codes will require cut-off and safety controls in addition to the required pump controls.

Figure 2
Special Startup Considerations:

a. **Filling “Cold” Boiler With Feed Pumps:** When centrifugal pumps are being used on either a boiler feed unit or deaerator, the pumps should not be used to fill a high pressure (i.e., operating pressure of 15 PSIG or higher) with water when the boiler is cold. When boiler is started up, there is no back-pressure on the pump. Without any back-pressure, the pump will “run out the curve,” causing pump cavitations that will severely damage the pump. However, if boiler feeds are used to fill a boiler, then the pump must be manually balanced to keep the pump at the design operating conditions and prevent pump cavitations. Manual balancing is required even if the pump is fitted with an automatic flow control valve. The automatic flow control valve is rated for a particular pressure range that allows the operating pressure in the boiler to fluctuate. However, the difference in operating pressure between boiler startup and the design operating pressure typically will exceed the pressure range of the automatic flow control valve, rendering it ineffective at startup.

b. **Chemical Injection:** Any chemicals injected into the steam system should be added after the pumps—preferably into the pump discharge piping. Otherwise, chemical residuals will contribute to the premature failure of a pump's mechanical seal. This scenario frequently occurs on boiler feed and deaerator applications.

c. **Freezing Conditions:** Avoid freezing conditions after receiver of unit has been filled with condensate. Frozen water may cause the suction housing to crack.

**Float Switches:**

- Float switch and/or displacer switches, standard or proportional, are provided to meet system requirements.
- Floats are locked in place during shipment by a shipping bracket to prevent damage. Shipping brackets must be removed before startup. Check factory settings.

**WARNING!**

Switch is shipped with a bracket attached to the mounting plate to prevent the float from moving in the tank during shipment. When installing the unit, this bracket, clearly marked with a tag, MUST be removed for float switch to operate.

The pressure limit within the closed tank must not exceed 50 pounds per square inch (psi).

**Description of Operation**

**SHIPCO® .03 DA, .03 DA-CI, .03 DA-CI-2T and .03 DA-2T Deaerating Boiler Feed Units** are designed for atmospheric operation using a spray system. The units liberate the dissolved oxygen and carbon dioxide.

On a two-tank design (2T), the returns are piped to the boiler feed/surge tank. The returns and makeup are blended together in the boiler feed/surge tank and then piped through a **modulating transfer valve** on the DA entering the deaeration area of the DA through a spring loaded spray nozzle.

On a single-tank design, the returns and makeup are piped through a **modulating makeup valve** on the DA and enter the deaeration area of the DA through a spring loaded spray nozzle.

Below the waterline is a preheat tube constantly injecting steam into the condensate to maintain design operating temperature. The steam passes up through the condensate in the holding tank through the mist from spray nozzle in the deaeration area. The steam and escaping gases heat the incoming makeup water as the gases escape through the vent condenser.

**Mechanical Seal Replacement Instructions for Pumps**

When it is necessary to replace a mechanical seal, refer to the procedures in the Installation, Operation, and Maintenance Manual (IOM) for appropriate pump model (e.g., Model D Series, Model P Series, Model AW/AWF/AWF-B etc.) depending on what pump model was furnished.

**Note:** Seals will be damaged if operated dry.

**Troubleshooting Checklist**

**Pump Will Not Run**

1. Power supply has been interrupted. Disconnect switch is open or selector switch improperly positioned.
2. Improper voltage supplied to motor. Check voltage and wiring with motor characteristics.
3. Incorrect starter coil for power supply.
4. Overload relays in starter have tripped out and must be reset. Ambient temperature may be excessive.
5. Wiring to power source is incorrect or connections may be loose.
6. Control signals are for pump to be “off.”

**Pump GPM Capacity is Reduced**

1. Pump is running backwards. Rotation should be clockwise looking down upon motor toward the pump. Rotation of three-phase motors can be corrected by interchanging any 2 of the 3 wires. (Note: A qualified electrician should perform any electrical service.)
2. Pump is not throttled to the design condition for the pump.
3. Total pressure at pump discharge is greater than that which the pump was designed for. Check pressure requirements, which include system back pressure, and friction and static head.
4. Excessive suction lift, incorrect piping or undersized piping from the pump.
5. A valve in the pump suction line or discharge line is closed or throttled too much. Check valve in the pump discharge piping is installed backwards.
6. The impeller eye is blocked with trash or debris.
7. Pump is undersized for the system.
8. A strainer is dirty, causing a reduction in flow.
9. Pump has lost its prime. Release trapped air in the pump and reprime.
10. Steam traps are blowing through, causing the condensate to return at excessive temperatures. Depending on the unit and type of pump furnished, this could greatly reduce the capacity of the pump below its stated rating. Traps should be repaired or replaced.

**Excessive Pump Noise**

1. Pump is running backwards. Check rotation by bumping the motor. Rotation should be clockwise while looking down at the rear of the motor.
2. Pump is working against a lower pressure than it was designed for. (The pump is not balanced or throttled.) Install a balancing valve, plug cock or steam cock in the discharge line following the gate valve. Do not use a gate valve for balancing the pump. The seats in the valve will wear over time, causing the valve to lose its design condition point. Throttle the balancing valve until the operating pressure at the pump discharge approaches the rated pump pressure.
3. Magnetic hum or bearing noise in motor. Consult the motor manufacturer's authorized service technician.
4. Starter chatters. Trouble is caused by low line voltage, poor connections, defective starter coil, or burned contacts.
5. Excessive ambient temperature. Correct the system conditions.
SYSTEM IS NOISY
1. The return piping is sized too small to drain properly.
2. A defective trap is holding condensate in steam supply line.
3. Banging in the steam mains is usually caused by steam bubbles “imploding” in condensate lying in low points in lines. These situations can be resolved by dripping low points, providing proper supports for the piping or by repitching the lines.
4. Steam mains and/or risers improperly dripped: where there is a rise in the steam main, or where it branches off into a riser, a drip trap must be installed in the drain line.
5. A defective check valve is permitting steam to vent through the pump into the boiler feed tank.

UNIT IS OVERFLOWING
1. Receiver is sized too small to accommodate surges in the system.
2. City water make-up valve is leaking.
3. City water make-up valve stuck open or float switch is set too high.

Representative Servicing:
If trouble occurs that cannot be rectified, contact your local Shipco® representative who will need the following information in order to provide assistance:
1. Provide all information on pump and motor from Shipco® nameplate (see example).
2. Suction and discharge pipe pressure gauge readings.
3. Ampere draw of the motor.
4. A sketch of the pump hook-up and piping.

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<tr>
<th>UNIT MODEL</th>
<th>MANUFACTURED BY</th>
<th>PHONE</th>
<th>FAX</th>
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<tr>
<td></td>
<td>Shipco® Pumps</td>
<td>(717) 532-7321</td>
<td>(717) 532-7704</td>
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**TERMS AND CONDITIONS OF SALE**

**AGREEMENT**
By entering your order or requesting a quote, you confirm that the following terms and conditions of sale are the legal agreement governing your purchase, and that no changes or additional or different terms will apply unless you have previously established a different written contract for these purchases with Shippensburg Pump Company, Inc., hereafter referred to as the Seller.

**ORDER ACCEPTANCE**
All orders are subject to acceptance by Seller at its general office in Shippensburg, Pennsylvania. Acceptance will be evidenced by Seller issuing its Sales Acknowledgement Form. The Sales Acknowledgement Form, together with any documents incorporated therein, shall constitute the entire agreement and may not be changed except in writing signed by Seller and Buyer. Publication and circulation of current price lists, catalogues and related literature by Seller shall not be deemed an offer to sell, but rather an invitation for offers to buy. Acceptance by Seller of the Buyer’s order is expressly limited to the Terms and Conditions stated herein; any additional, inconsistent or different terms and conditions contained in the Buyer’s purchase order or other documents supplied by Buyer are expressly rejected.

**PAYMENT TERMS—PRICES**
Payment terms are as follows: If the Buyer is a Credit Card Customer, the Buyer agrees to pay at the time of purchase the price, shipping and handling charges, taxes and duties quoted by the Seller. If the Buyer is an Account Holder, the Buyer agrees to pay invoices with payment terms of net thirty (30) days after date of invoice unless otherwise specifically agreed to in writing. If the Seller believes that the Buyer’s financial condition requires it, the Seller reserves the right to require full or partial payment prior to manufacture or shipment. If the Buyer fails to make any payment when due, (1) the Seller reserves the right to suspend performance and the Buyer agrees that any charges incurred prior to the suspension will be assessed to the Buyer and payable to the Seller; (2) the Buyer further agrees to pay a charge on the outstanding invoice at the rate of 1% per month on the open commercial account; (3) all accounts are subject to interest at the rate of 1% per month on the open commercial account; and (4) any infringement arising from the use of a Product with any adjacent or device added by the Buyer without Seller’s written permission.

**DELIVERY—DELAYS**
Shipping dates represent estimates only and are based on projected production schedules and commitments to suppliers. Seller shall not be liable for failure or delay in manufacturing or shipping Products, nor shall such failure or delay constitute grounds for cancellation if such failure or delay is directly or indirectly due to shortages of fuel or energy, acts of omissions of the Buyer; acts of God; war, riot, civil disturbances; labor difficulties; accident; inability to reasonably obtain materials; actions of transportation companies; or other causes of any kind whatever beyond the control of Seller. In the event of such delays, Seller reserves the right to make adjustments in price and delivery schedules.

**FREIGHT TERMS**
Prices are f.o.b. factory unless otherwise stated. Seller’s responsibility ceases upon delivery to the transportation company at shipping point. It is the Buyer’s responsibility to examine shipment upon arrival to ascertain if in good order. Any shortages or damage claims must be made by the Buyer. All weights shown on the product invoice, literature and shipping box are approximate. All packaging is standard domestic boxing, slat and wire crating and/or skidding. An additional charge will be made for full wooden crating or special packaging when specified on the order. Seller will make every effort to consolidate orders and backorders wherever possible. Seller will not be responsible for excess charges due to their inability to consolidate shipments.

When requested by Buyer, shipments may be routed using premium carriers such as express or airfreight. Premium shipping and handling charges are quoted in the product invoice, shipping literature and at the time of quotation. In such cases the shipment will be made on a “collect” basis and where applicable the freight allowance will appear as a separate line item on the product invoice. Seller reserves the right to select the transportation company where freight is allowed.

**TAXES**
In addition to the price stated, the amount of any present or future sales, use, excise or other similar tax applicable to the production, sale, use or transportation of the Products shall be paid by Buyer. In lieu of paying such taxes to Seller, Buyer may furnish Seller a Tax Exemption Certificate or Certificates acceptable to the proper taxing authorities at any time prior to Seller’s shipment of the Products.

**CANCELLATIONS**
Any order placed with Seller may be cancelled by the Buyer only upon payment of reasonable cancellation charges that shall include but not be limited to expenses already incurred, as well as material and labor costs committed by Seller.

**SHIPMENT—TITLE—RISK OF LOSS**
Shipment terms are F.O.B. Seller’s facility, unless otherwise specifically agreed to in writing. Notwithstanding the granting of any allowances for shipping, title to and risk of loss for Products will pass to the Buyer when delivered to the Common carrier at the Seller’s facility.

**BACK CHARGES**
All invoices due Seller shall be due and payable when submitted for payment in accordance with the provision entitled “Payment Terms—Prices.” No withholding of funds, back charges, or credits against amounts otherwise due Seller will be permitted unless specifically agreed to in writing by Seller. Settlement of any account due Buyer will be negotiated as separate items and not as offsets against amounts otherwise due Seller from Buyer for Products sold hereunder.

**RETURNED GOODS**
Unused material of current manufacture can only be returned for credit with the written consent of Seller, under return goods policies existing at the date of the return. Products that are obsolete or made to special order cannot be returned for credit with the written consent of Seller, and any such claim, action or suit through counsel of Seller’s own choice and under its sole direction, and at its sole expense, and provided that in the event Seller elects to take over, defend or settle any such claim, action or suit, Seller agrees to defend any such claim, action or suit through counsel of Seller’s own choice and under