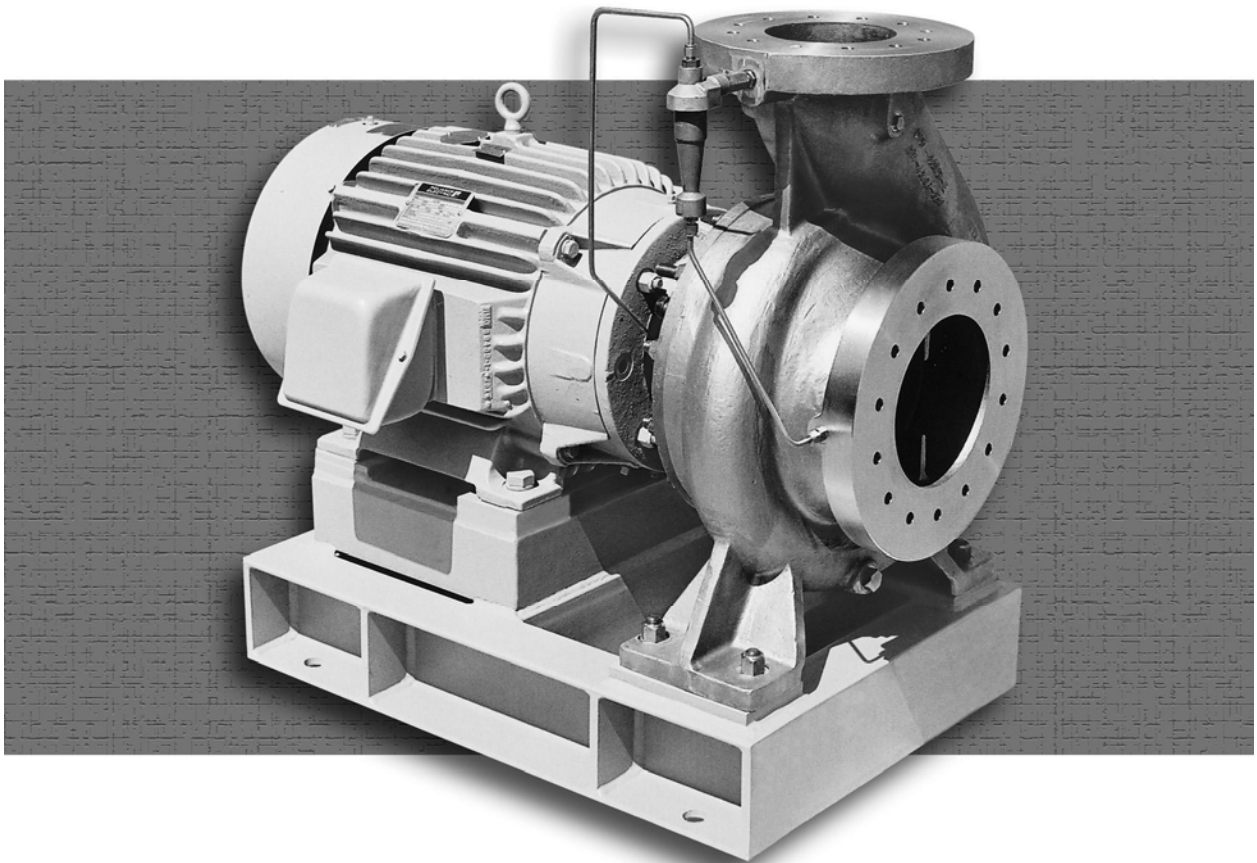


(F998) I-780, Fall 2007

M Series

***Installation, Operation
And Maintenance Manual***



 **Carver[®]**

Creating Value.

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CHAPTER 1

GENERAL INFORMATION

1.1 INTRODUCTION.

The M Series is Carver's end suction, close-coupled pumps for handling fresh water, sea water, potable water and light hydrocarbons in commercial marine and naval (Navy, USCG, MSC) applications. Conforming to the requirements of ASTM F998, including the Navy supplement, hydraulic performance extends to 6000 GPM and 700 feet of head. All models are back pull out design with replaceable wear rings and enclosed impellers. Standard materials are 316 stainless steel with composite internals for fresh and potable water, duplex stainless (CD4MCu) with composite internals for seawater applications, and 316 stainless steel materials for hydrocarbon applications.

Carver Pump Company products are carefully engineered and manufactured and, if properly installed, maintained, and operated, provide long service life. Factory warranty applies to pumps operating under conditions specified on the order acknowledgement, and that are properly installed and maintained, as recommended in this manual.

This manual provides technical information necessary to properly operate, maintain, disassemble, and assemble the pump. To ensure smooth operation of the pump with minimal maintenance, carefully read the information provided and follow the recommended procedures. Additional copies of this manual are available on our website, www.carverpump.com, and upon request from Carver Pump Company.

1.2 CAPABILITIES AND PERFORMANCE.

For specifics of your application, including the performance curve, dimensional drawings, sectional drawing with parts list and for torque values, clearances, etc, refer to Appendix A of this manual. For motor information refer to Appendix B of this manual.

1.3 PUMP IDENTIFICATION.

The type of pump, pump size, operating data, and serial number are stamped on the nameplate attached to the pump. Upon receipt of the pumping unit, record the pump Serial number, part number and other information needed to identify the pumping unit. Table 1-1 provides information on pump size and motor frame size.

1.4 PARTS INVENTORY GUIDE.

To avoid unnecessary delays during maintenance of the pump, spare parts should be readily available for normal service. For every one to three pumps stock one set of spare parts consisting of items listed in Tables 6-2 or 6-3, Recommended Spare Parts. Part numbers in the tables correspond to sectional drawings located in Figures 6.1 and 6.2 of this manual. For actual part numbers for your unit see the sectional assembly drawing located in Appendix A.

1.5 PARTS ORDERING.

Carver Pump Company strives to provide prompt, accurate service. When ordering spare parts (refer to Section 6.1) or requesting information, furnish the nameplate data to Carver Pump Company or its representative. To ensure quality service support, please provide the following information when ordering parts:

- Serial number of pump (located on nameplate)
- Part name (refer to sectional drawing in Appendix A)
- Part Number (refer to sectional drawing in Appendix A)
- Item number (refer to sectional drawing in Appendix A)
- Quantity of parts needed

Carver may ship an interchangeable part that is not identical in appearance. Examine the parts carefully upon receipt before calling the factory or company representative. Never return parts to the factory without a Returned Goods Authorization (RGA) Number from Carver Pump Company.

If an impeller is ordered, specify the diameter across the blade tips. Check to make sure the diameter was NOT trimmed smaller than the diameter shown on the dimensional drawing in Appendix A.

If a driver or driver parts are ordered, specify the name of the manufacturer, pump unit serial number and all other data located on the driver nameplate.

Pump Size	Motor Frame Sizes					
1.25 x 1 x 7	143 to 145 JM	182 to 184 JM	213 to 215 JM	-	-	-
1.5 x 1.25 x 7	143 to 145 JM	182 to 184 JM	213 to 215 JM	-	-	-
2.5 x 2 x 7	143 to 145 JM	182 to 184 JM	213 to 215 JM	254 to 256 JM	-	-
3 x 2.5 x 7	143 to 145 JM	182 to 184 JM	213 to 215 JM	254 to 256 JM	-	-
4 x 3 x 7	143 to 145 JM	182 to 184 JM	213 to 215 JM	254 to 256 JM	284 to 286 JM	-
5 x 4 x 7	143 to 145 JM	182 to 184 JM	213 to 215 JM	254 to 256 JM	284 to 286 JM	324 to 326 JM
1.5 x 1.25 x 10	143 to 145 JM	182 to 184 JM	213 to 215 JM	254 to 256 JM	284 to 286 JM	-
2 x 1.5 x 10	143 to 145 JM	182 to 184 JM	213 to 215 JM	254 to 256 JM	284 to 286 JM	-
2.5 x 2 x 10	182 to 184 JM	213 to 215 JM	284 to 286 JM	324 to 326 JM	-	-
3 x 2.5 x 10	182 to 184 JM	213 to 215 JM	284 to 286 JM	324 to 326 JM	364 to 365 JM	-
4 x 3 x 10	182 to 184 JM	213 to 215 JM	254 to 256 JM	284 to 286 JM	324 to 326 JM	364 to 365 JM
5 x 4 x 10	213 to 215 JM	254 to 256 JM	324 to 326 JM	364 to 365 JM	404 to 405 JM	444 JM
6 x 4 x 10	213 to 215 JM	254 to 256 JM	324 to 326 JM	364 to 365 JM	404 to 405 JM	444 JM
6 x 5 x 10	254 to 256 JM	284 to 286 JM	324 to 326 JM	-	-	-
2 x 1 x 11	182 to 184 JM	213 to 215 JM	254 to 256 JM	284 to 286 JM	324 to 326 JM	-
4 x 2 x 11	213 to 215 JM	254 to 256 JM	284 to 286 JM	324 to 326 JM	364 to 365 JM	-
4 x 3 x 11	213 to 215 JM	254 to 256 JM	284 to 286 JM	364 to 365 JM	404 to 405 JM	444 to 445 JM
5 x 4 x 11	213 to 215 JM	254 to 256 JM	284 to 286 JM	-	-	-
6 x 4 x 11	254 to 256 JP	284 to 286 JP	324 to 326 JP	404 to 405 JP	-	-
8 x 6 x 11	254 to 256 JP	284 to 286 JP	324 to 326 JP	-	-	-
4 x 3 x 13	254 to 256 JP	284 to 286 JP	324 to 326 JP	364 to 365 JP	404 to 405 JP	444 to 445 JP
6 x 4 x 13	284 to 286 JP	324 to 326 JP	364 to 365 JP	404 to 405 JP	444 to 445 JP	447 JP
6 x 6 x 13	284 to 286 JP	324 to 326 JP	364 to 365 JP	404 to 405 JP	-	-
8 x 6 x 13	324 to 326 JP	364 to 365 JP	404 to 405 JP	444 to 445 JP	-	-
10 x 8 x 13	364 to 365 JP	404 to 405 JP	444 to 445 JP	-	-	-
12 x 10 x 13	364 to 365 JP	404 to 405 JP	444 to 445 JP	-	-	-

Table 1-1: Pump Sizing and Motor Frame Information

1.6 SAFETY PRECAUTIONS.

This manual is written with the intent to provide safety instructions for installing, operating, and maintaining the pump. Failure or neglect to properly install, operate, or maintain the pump may result in personal injury, property damage, or unnecessary damage to the pump and/or parts. Variations exist in the equipment used with these pumps. This manual contains general rules for installation, operation, and maintenance of the driver and pump. Contact the driver manufacturer for specific driver operating instructions.

Throughout the manual, note various cautions, which are intended to remind personnel to properly handle of the unit. Cautions may be identified by the following:

CAUTION

Note warnings, which are strategically placed to ensure safety for personnel. Warnings are indicated by the following symbol:



Carefully read ALL warnings to ensure safety of personnel.

Observe and understand all caution or danger tags attached to the equipment or disclosed in the information contained in this manual.

The following general safety precautions do not relate to any specific procedure within this manual but are pertinent to providing a safe working environment for personnel.

CAUTION

Various federal, state, and local laws and the regulations concerning OSHA affect installation, use, and operation of pumping equipment. Compliance with such laws relating to the proper installation and safe operation of pumping equipment is the responsibility of the equipment owner. All necessary steps should be taken by the owner to assure compliance with such laws before operating the equipment.

- a. Prior to working on pump or driver, ensure all switches and circuit breakers have been locked in the open (off) position and tagged, "Out of Service."
- b. All circuits NOT known to be dead must be considered live at all times.
- c. Do NOT wear loose or torn clothing around rotating machines. Do NOT wear jewelry or watches around rotating machines.
- d. While working near electricity, do NOT use metal rules, flashlights, metallic pencils, or any other objects having exposed conducting material.
- e. In general, use only one hand when servicing live electrical equipment.
- f. De-energize all electrical equipment before connecting or disconnecting meters or test leads.
- g. When connecting a meter to terminals for measurement, use a range higher than the expected voltage.
- h. Check to make sure the frame of the driver and starter panel are securely grounded before operating pumping unit or performing any tests or measurements.
- i. If a test meter is held or adjusted while voltage is applied, ground case of meter before starting measurement. Do NOT touch live equipment while holding meter. Some moving vane-type meters should not be grounded nor held during measurements.
- j. Do NOT use test equipment known to be damaged or in poor condition.

1.7 INSPECTION.

Upon receipt of the shipment, check for missing or damaged items. Unpack and inspect the pump, driver assemblies, and individual parts. Carefully inspect all boxes and packing material for loose parts before discarding. Immediately report to the factory, and transportation company, any missing parts or damage incurred during shipment. File a “damage and/or lost in shipment” claim with the carrier.

NOTE

The pump and equipment, as shipped from Carver Pump Company, have appropriate protection for short-term storage. If the equipment is NOT immediately installed and operated, store the equipment in a covered, clean, dry, well-ventilated location, free from vibrations, moisture, and rapid or wide variations in temperature.

The pump is shipped with flange covers to protect flange faces and to prevent foreign matter from entering the pump. Keep flange covers intact until suction and discharge piping are connected to pump flanges.

1.8 STORAGE REQUIREMENTS.

If the equipment is NOT immediately installed and operated, Carver Pump Company recommends rotating each shaft several revolutions at least once every month. This is done to prevent flat spots on ball bearings and indentations in the race of the ball bearing, which is termed “false brinelling.” False brinelling will lead to premature bearing failure. For information regarding bearing lubrication, refer to Section 5.3 and to the Motor Manual found in Appendix B.

Consider a unit to be in storage if any of the following occur:

- The pump has been delivered to the job site and is awaiting installation.
- The pump has been installed but operation is delayed pending completion of construction.
- There are long (30 days or more) periods between operating cycles.
- The plant (or department) is shut down for periods of longer than 30 days.

Storage requirements vary depending on the length of storage, climatic environment, and the equipment. For storage periods of three months or longer, contact a representative from Carver Pump Company for specific instructions. Improper storage will damage the equipment and will require non-warranty restoration and/or non-warranty product failures. For pump disassembly and assembly procedures, refer to Chapter 6, Service and Repair. When disassembling the pump, replace and repair rusted and/or worn parts as necessary.

If the customer anticipates the pump/equipment may be subject to an extended period of storage after installation, (for example, a unit used for seasonal operation), contact a representative from Carver Pump Company for specific instructions.

In general, if a pump is shut down or stored for an extended period, Carver recommends the following steps:

- a. Drain the unit (if applicable). If freezing temperatures are applicable, drain all piping.
- b. Fill unit with mineral oil or suitable non-corrosive protectant compatible with the system.
- c. Lubricate bearings.
- d. Provide pump and motor with a protective cover.

CHAPTER 2

INSTALLATION

2.1 INSTALLATION.

Skilled personnel should install the pump in accordance with proper engineering standards. Faulty installation will cause operating troubles and premature wear of parts.



Lift pumping unit with a hoist or suitable lifting device. Do NOT lift complete unit using the driver, pump shaft, discharge piping, or driver eyebolts. Handle composite parts with care.

Make sure there is enough headroom to perform periodic inspection and maintenance on the pump and driver. Install units in a dry location with adequate drainage. The pump is generally supplied with a motor and a baseplate. The complete unit is assembled at Carver Pump Company. After ascertaining the unit has suffered no damage in transit, install the pumping unit.

2.2 INSTALLATION CHECKS.

Use the following installation checks to ensure proper operation of pump:

2.2.1 LOCATION.

Install the pump close to the fluid. Use a short, direct suction pipe to keep suction losses at a minimum. If possible, locate the pump so fluid will flow by gravity to the suction opening. Direct the discharge piping with as few elbows and fittings as possible. The total net positive suction head available (NPSHA), which includes the suction lift and pipe friction losses, must be greater than the net positive suction head required (NPSHR) by the pump.

2.2.2 FOUNDATION.

Consider the following criteria for a foundation: three to six inches wider and longer than the baseplate, a level surface, with sufficient mass to prevent vibration, that forms a permanent rigid support for the unit.

2.2.3 LEVELING OF UNIT.

Install unit onto foundation. Position base so anchor bolts are aligned in middle of holes in base.

To support the base, place metal shims or metal wedges directly beneath the area of the base which supports the most weight. Space the shims or wedges close enough to give even support and stability.

Adjust metal supports or wedges until suction and discharge flanges are level. Accomplish alignment and leveling corrections by adjusting supports under the base. When proper alignment is obtained, tighten foundation bolts.

2.2.4 DIRECTION OF ROTATION.

An arrow on the backcover of the pump indicates correct rotation. The standard direction of rotation, viewed from the motor end is clockwise.



Check safety codes and always install protective guards or shields as required by various federal, state, or local laws and the regulations concerning OSHA.

2.2.5 PIPING.

CAUTION

Connect piping and gauge lines with pump in a freely supported state. Support all piping to avoid undue pipe strain or weight on the pump. Do NOT force piping. Do NOT use pump as an anchorage point for the piping. Pipe strain causes wear and/or damage to parts.

Take extreme care when connecting new piping lines to ensure no foreign matter such as dirt, chips, tools, etc., is in the piping, tank, or return piping. Debris drawn into the pump may cause excessive damage and imbalance. Ensure discharge piping is one or two sizes larger than pump flange sizes, especially where piping is considerably long. Equip any flexible joints installed in the piping with tension rods to absorb piping axial thrust.

Check to make sure the suction pipe is air tight and sloped upward to pump flange to avoid air pockets, which will impair pump operation. Orient discharge pipe as directly to the application as possible using a minimum number of valves to reduce pipe friction losses.

Never use a straight taper (concentric) reducer in a horizontal suction line because air pockets may form in the top of the reducer and the pipe. Carver recommends using an offset (eccentric) reducer.

Install a check valve and closing valve in discharge line and a closing valve in suction line. The check valve, between the pump and valve, protects pump from liquid hammer and prevents reverse rotation in the event of a power failure. Closing valves are used in priming, starting, and pump shutdown.

CAUTION

Never throttle pump with a valve in the suction line.

2.2.6 MOTOR.

Connect wiring to motor. Due to high voltage required to operate the pumping unit, familiarize personnel handling the equipment with electrical safety practices and modern methods of resuscitation. Refer to the motor manufacturer's specific instructions regarding installation, operation, and maintenance of the driver. The motor manual can be found in Appendix B of this manual.

Since the pumping unit is shipped with bearings packed, initial greasing is not necessary, unless pumping unit has been in storage for an extended period of time. Refer to Section 1.8 Storage, for specific storage information.

CHAPTER 3 **OPERATION**

3.1 INTRODUCTION.

The pumping unit will operate without operator intervention once pump has been energized and system valves have been adjusted to the specified pumping conditions.

3.2 PRE-START CAUTIONS.



Before activating the pumping unit, check to make sure there are no personnel performing maintenance on the unit. Serious injury or death to personnel could occur if unit is activated.

Before starting or operating the pumping unit, read this entire manual and conduct the following checks:

- Before starting the pump, rotate shaft by hand to assure all moving parts are free.
- Before starting the pump, install closed guards around all exposed rotating parts.
- Observe all caution or danger tags attached to the equipment.
- Do NOT run pump dry. Dry running may result in pump seizure.
- Before starting the pump, fill casing and suction line with liquid. Prime the pump with an ejector or vacuum pump.
- Before starting a mechanical seal pump equipped with external flush lines, turn on seal liquid, and confirm the seal liquid is at sufficient pressure.
- If excessive vibration or noise occurs during operation, shut the pump down and consult a Carver representative.
- Use a check valve in discharge piping if there is a high volume of reverse flow.
- Check to make sure fluid in pump is clean, clear, and free of debris.
- Standard grease lubricated pumps are shipped with factory lubrication packed bearings. Lubrication is adequate for a minimum of 1,000 operating hours or six months of continuous operation under normal conditions. After extended storage or exposure to unusually humid or hot environmental conditions, check the bearings and lubricant before operating the unit.
- Reference Appendix A for torque values to avoid equipment damage and injury to personnel.

3.3 PRIMING.

Since the liquid pumped functions to lubricate various internal parts, dry running a centrifugal pump can result in extensive damage and possible seizing. Therefore, it is imperative the pump is primed prior to initial start-up. Maintain prime through subsequent start-stop cycles.

The priming procedure is different for positive and negative suction head systems. Follow the procedures below for the different systems:

Positive Suction Head:

- a. Open vent on the highest point on the pump casing.
- b. Open all suction valves.
- c. Allow liquid to flow from vent hole until all air bubbles are vented. Then, close the vent.
- d. The pump is now primed.

Negative Suction Head:

- a. Install an ejector or vacuum pump on the vent at the highest point on the casing.
- b. Close the discharge valve.
- c. Open the suction valve.
- d. Start the ejector or vacuum pump.
- e. Allow liquid to flow until a continuous flow is exhausted from ejector. Close valve to the vent.
- f. The pump is now primed.

3.4 STARTING THE PUMP.

The pumping unit operates without operator intervention once system valves have been adjusted to the specified pumping conditions. Before starting the unit, refer to Section 1.6, Safety Precautions. Proceed with operation as follows:

- a. Check to make sure personnel are not working on pumping unit.
- b. If the pumping unit has been idle for a period of time, make sure unit is firmly attached to its foundation.
- c. If unit is equipped with seal cooling lines, turn on seal cooling liquid.
- d. Open valves to pressure gauges in system.
- e. Check pump for proper priming and lubrication.
- f. Jog starter switch on motor to check direction of rotation. Correct direction of rotation is shown by a directional arrow on the pump motor bracket. Standard direction of rotation is clockwise when viewed from fan end of motor.
- g. Partially open discharge valve.
- h. Start the pumping unit in accordance with the directions on the electrical power supply.
- i. Slowly adjust discharge valve to operating conditions required. Refer to the pump nameplate for design point condition.
- j. Pumping unit is now in full operation.

3.5 STOPPING THE PUMP.

Stop the pump using the following procedure:

- a. If pump is stopped for overhaul, slowly close discharge valve. Otherwise, leave discharge valve set at condition.
- b. Stop the pumping unit in accordance with the directions on the electrical power supply.
- c. If the pump is stopped for overhaul, close pressure gauge valves.
- d. If unit is equipped with seal cooling lines, turn off external cooling liquid line to seal.
- e. The pumping unit is now in the off position.

3.6 EMERGENCY SHUTDOWN.

- a. Stop the pumping unit in accordance with the directions on the motor electric power supply.
- b. If there is a loss of fluid to the pump, shut down the pump in accordance with the shut down procedure in this chapter.
- c. Isolate the problem in accordance with the Troubleshooting Guide located in this manual. Correct the problem according to applicable correct maintenance procedure.

CHAPTER 4

TROUBLESHOOTING

4.1 INTRODUCTION.

The pump should provide reliable service and long life if the installation and starting procedures outlined in this manual are followed. If operating problems occur, refer to Section 4.2 to eliminate some of the most common causes of those problems.

NOTE

Only qualified maintenance personnel only should perform the corrective action for any malfunction.

4.2 TROUBLESHOOTING PROCEDURES.

Use Table 4-1 as a guide to identify the symptom, probable cause of the problem, and corrective action or remedy.

Symptom	Probable Cause	Remedy
Motor will not start.	<ul style="list-style-type: none"> • No input power. • Improper voltage. • Motor overload. • Mechanical obstruction that prevents rotor from turning. 	<ul style="list-style-type: none"> • Check connections to electrical power source. Check fuses or circuit breakers. Check terminals at source of power input. • Check voltage at motor terminals. • Refer to "Overload on motor" symptom further in table. • Examine and clean pumping unit thoroughly. Check for bearing failure or bent shaft.
Motor overheats.	<ul style="list-style-type: none"> • Motor overload. • Improper voltage. • Obstruction in ventilation. • Insufficient cooling medium. • Overgreased motor bearings. • Improper use or selection of motor grease 	<ul style="list-style-type: none"> • Refer to "Overload on motor" symptom further in table. • Check voltage at motor terminals. • Check ventilation opening of motor. Keep clear of obstructions at all times. • Check ambient temperature. Motor temperature should not exceed ambient temperature plus the rated temperature increase of the unit. • Remove lubricant from bearing chamber until the proper amount of grease is in chamber. • Remove grease and replace with grease in kind and quantity recommended by motor manufacturer.

Table 4-1: Pumping Unit Troubleshooting

Symptom	Probable Cause	Remedy
Failure to deliver fluid.	<ul style="list-style-type: none"> • Pump not primed. • Discharge valve closed. • Discharge head above shutoff. • Suction lift higher than pump rating. • Impeller or suction pipe clogged. • Wrong direction of rotation. • Liquid level in tank too low. • Suction strainer is plugged. 	<ul style="list-style-type: none"> • Prime pump in accordance with Section 3.3. • Check discharge valve. • Consult with nearest Carver Pump Company representative or factory. • Consult with nearest Carver Pump Company representative or factory. • Inspect and clean impeller and suction pipe. • Check power connection to motor and correct as necessary. • Add liquid to system. • Clean suction strainer.
Reduced capacity and/or pressure.	<ul style="list-style-type: none"> • Damaged impeller. • Impeller or suction pipe partially clogged. • Suction pipe too close to bottom of tank. • Liquid level in tank too low. • Total head too high. • Wrong rotation. • Air leak in suction piping, seal housing, or gaskets. • Speed too low. • Impeller clearance between suction cover and/or backcover wear ring(s) is too large. • Suction strainer is plugged. • Incorrect impeller diameter. 	<ul style="list-style-type: none"> • Replace impeller. • Inspect and clean impeller and suction pipe. • Reduce length of pipe. • Add liquid to system. • Consult with nearest Carver Pump Company representative or factory. • Check power connections to motor. • Search for, locate, and isolate air leak and repair. • Consult with nearest Carver Pump Company representative or factory. • Check enclosed impeller clearance in accordance with Chapter 6. • Clean suction strainer. • Trim impeller diameter in accordance with conditions set on pump nameplate.

Table 4-1: Pumping Unit Troubleshooting (Continued)

Symptom	Probable Cause	Remedy
Pump surges.	<ul style="list-style-type: none"> Liquid level in tank too low. 	<ul style="list-style-type: none"> Add liquid to system.
Pump loses prime after starting.	<ul style="list-style-type: none"> Liquid level in tank too low. 	<ul style="list-style-type: none"> Add liquid to system.
Overload on motor	<ul style="list-style-type: none"> Head lower than that for which pump is designed. Mechanical defects of pump or motor such as bent shaft, binding or rubbing rotating element. Liquid handled of higher specific gravity or lower viscosity than intended application. Incorrect impeller diameter. 	<ul style="list-style-type: none"> Consult with nearest Carver Pump Company representative or factory. Replace defective parts or replace pump or motor. Consult with nearest Carver Pump Company representative or factory. Trim impeller diameter in accordance with conditions set on performance curve.
Insulation failure.	<ul style="list-style-type: none"> Oil or water soaked windings. Improper voltage. 	<ul style="list-style-type: none"> Return motor to the motor manufacturer. Check voltage at motor terminals.
Excessive leakage around seal housing or stuffing box.	<ul style="list-style-type: none"> Faulty mechanical seal. Improper adjustments. 	<ul style="list-style-type: none"> Replace mechanical seal in accordance with the procedures set forth in Chapter 6, Service and Repair. Check and adjust seal. Repair and replace, as necessary.
Operation at incorrect speed.	<ul style="list-style-type: none"> Improper line voltage or frequency. Overload. Motor electrical problem. 	<ul style="list-style-type: none"> Check line voltage. Ensure voltage meets requirements set forth on motor nameplate data. Check nameplate rating. Check motor for loose or open connections.

Table 4-1: Pumping Unit Troubleshooting (Continued)

CHAPTER 5 **MAINTENANCE**

5.1 INTRODUCTION.

Generally, these pumps do not require continuous supervision. Occasional visual and performance checks are recommended. Data should be recorded for each pump to keep track of performed maintenance and to note operational problems.

5.2 FIELD INSPECTION.

Shutdown is not required. Perform field inspection at regular intervals and record results. Use the following checks for inspection:

- a. Check and record the suction and discharge pressures to establish differential head. It should conform to the pump requirements.
- b. Check and record power input and speed of driver.
- c. Check and record pumping temperatures.
- d. Check pump for quiet running.
- e. If mechanical seal option is on pump, check seal housing for leakage. When first starting the pumping unit, check the area around the seal housing for leakage. Minor leakage through the seal usually stops after a short time. If leakage continues and there is more than 5 drops per minute at the seal housing, replace mechanical seal with new seal. To replace or install new parts, disassemble/assemble the pump in accordance with Chapter 6, Service and Repair.

5.3 BEARING LUBRICATION.

Lubrication frequency depends on operating conditions. Normal duty calls for lubrication every 1000 hours of operation. See the motor manual in Appendix B for specific instructions.

CAUTION

Do NOT mix greases with differing properties.

CAUTION

Over greasing creates heat and is the cause of many problems requiring repair. Do NOT over grease. To prevent over greasing, use a hand-operated grease gun.

- Never lubricate pump bearings while operating unit. If necessary, shut down pump in accordance with Section 3.5, Stopping the Pump.

CAUTION

Do NOT lubricate bearings with a power grease gun.

- Bearing temperature may rise above normal immediately after lubrication, but should stabilize within four to eight hours.
- Using a hand-operated grease gun on fitting located on top of bearing frame, add approximately one ounce of fresh grease for each bearing. With most hand-operated grease guns, two or three pumps are sufficient. When installing new bearings, pack new bearings only half full with grease.

NOTE

Carver recommends replacing bearings if removed from the shaft. If it is necessary to reuse bearings that are in good condition, use proper bearing lubrication procedures as outlined in this section.

CHAPTER 6

SERVICE AND REPAIR

6.1 PREPARATIONS AND SPARE PARTS.

6.1.1 PREPARATIONS FOR ASSEMBLY AND DISASSEMBLY

- a. Read this entire section and study the applicable sectional drawing found in Appendix A.
- b. Stop pump in accordance with Section 3.5. Disconnect, lock out, and tag electrical power supply to motor. Disconnect wiring from motor.
- c. Shut off and tag all valves controlling flow of liquid to and from pump. Drain volute (1) by removing pipe plug from casing bottom. If necessary, flush pump to remove corrosive, hazardous or toxic pumpage. Install drain plug in casing once fluid has completely drained. Disconnect piping and gauges, as necessary.
- d. During disassembly, mark parts to determine their proper location and orientation for reassembly. When removing capscrews, use socket or box-ended wrenches instead of open-ended wrenches. After prolonged operation, components may adhere to shaft. In such instances, use rust solvent and apply suitable extracting tools, wherever possible. Do NOT use force under any circumstances.



Be sure to adequately support suction and discharge piping prior to disconnecting the pump assemblies. Failure to adequately support piping could result in serious injury or death to personnel and/or damage to equipment or parts.

CAUTION

Use of a hoist with adequate capacity is recommended when handling unit. Do not lift the complete pumping unit using the motor lifting eyes.



If pumping unit is pumping hazardous fluid, take extreme care to ensure safety of personnel when draining pump. Use suitable protective devices and/or wear protective clothing.

NOTE

Prior to assembly, refer to the following paragraphs in this section: Parts Inspection (Section 6.4), and Wear Ring Replacement (Section 6.5). Refer to Table 6-1 for wear ring clearances.

6.1.2 SPARE PARTS

Refer to the appropriate sectional drawing to locate parts followed by an item number. Assemble the pump in accordance with accepted rules of engineering practice. It is recommended to have spare parts available. Tables 6-2 and 6-3 list the recommended spare parts for pumps equipped with JM or JP shafts.

Pump Size	Shaft Extension	Front Wear Ring Clearance (inches)*	Back Wear Ring Clearance (inches)*
1-1/4 X 1 X 7	JM	.012/.016	N/A
1-1/2 X 1-1/4 X 7	JM	.014/.018	N/A
2-1/2 X 2 X 7	JM	.012/.016	N/A
3 X 2-1/2 X 7	JM	.014/.018	N/A
4 X 3 X 7	JM	.014/.018	.012/.016
5 X 4 X 7	JM	.015/.020	.012/.016
1-1/2 X 1-1/4 X 10	JM	.011/.014	N/A
2 X 1-1/2 X 10	JM	.012/.016	N/A
2-1/2 X 2 X 10	JM	.012/.016	N/A
3 X 2-1/2 X 10	JM	.012/.016	.012/.016
4 X 3 X 10	JM	.012/.016	.012/.016
5 X 4 X 10	JM	.012/.016	.012/.016
6 X 4 X 10	JM	.021/.026	.021/.026
6 X 5 X 10	JM	.021/.026	.021/.026
2 X 1 X 11	JM	.012/.015	.012/.015
4 X 2 X 11	JM	.016/.020	.016/.020
4 X 3 X 11	JM	.016/.020	.016/.020
5 X 4 X 11	JM	.016/.020	.016/.020
6 x 4 x 11	JP	.018/.022	.018/.022
8 X 6 X 11	JP	.019/.023	.019/.023
4 X 3 X 13	JP	.017/.021	.017/.021
6 X 4 X 13	JP	.018/.022	.018/.022
6 X 6 X 13	JP	.019/.023	.019/.023
8 X 6 X 13	JP	.020/.024	.020/.024
10 X 8 X 13	JP	.021/.025	.021/.025
12 X 10 X 13	JP	.023/.027	.023/.027

*Verify clearance by checking sectional drawing

Table 6-1: Pump Sizes with Shaft Extension and Wear Ring Clearances.

Quantity Per Pump	Item #	Description
1	2	Impeller
1	7, 7X	Wear Rings for Casing / Backcover (if equipped)
1	14	Shaft Sleeve
1	24	Impeller Bolt
1	28	Impeller Washer
1	32	Impeller Key
As required	73,73X	Gaskets: Impeller Washer and Sleeve
As required	89A,89C,89D, 89F	O-rings
1	90	Mechanical Seal

Table 6-2: Recommended Spare Parts for JM Shaft Pumps

Quantity Per Pump	Item #	Description
1	2	Impeller
1	7, 7X	Wear Rings for Casing / Backcover
1	14	Shaft Sleeve
1	24	Impeller Bolt
1	28	Impeller Washer
1	32	Impeller Key
As required	73,73X	Gaskets: Impeller Washer and Wleeve
As required	89A, 89B, 89D,89E, 89F, 89G, 89H, 89J	O-rings
1	90	Mechanical Seal

Table 6-3: Recommended Spare Parts for JP Shaft Pumps

6.2 DISASSEMBLY AND ASSEMBLY OF PUMPS WITH JM SHAFTS.

6.2.1 Pump Reference Drawings

For assembly and disassembly of the pumping unit, Figure 6-1 and Table 6-4 are provided for reference item numbers. The correct item and part numbers may be obtained by finding the appropriate item number on the pump sectional drawing in Appendix A.

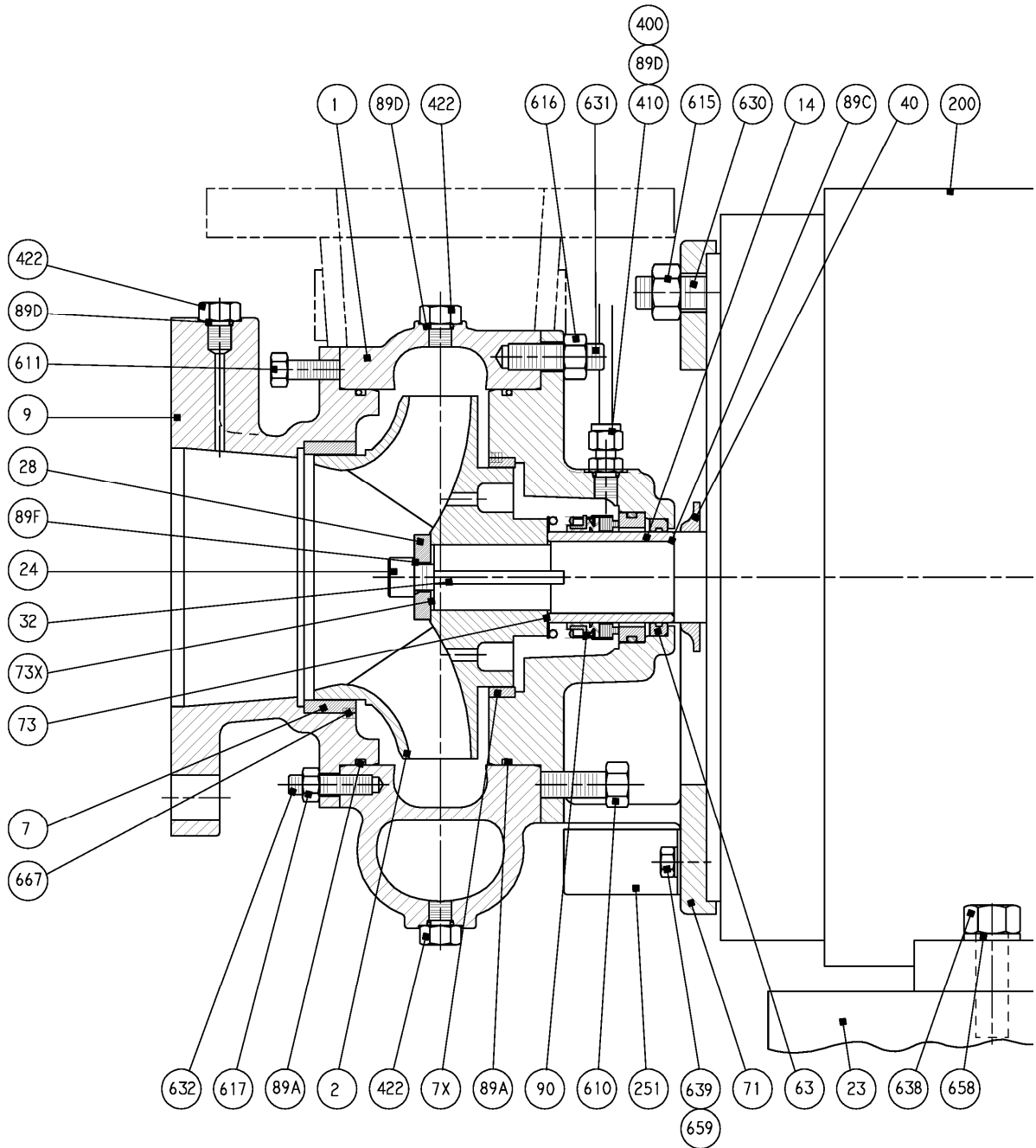


Figure 6-1: Reference Sectional for Pumps with JM Shafts.

Part #	Part Description	Part #	Part Description
1	Volute	89A	O-ring – Backcover/Suction Cover
2	Impeller	89C	O-ring – Shaft Sleeve
7	Wear Ring	89D	O-ring – Plugs and Tube Connectors
7X	Backcover Wear Ring	89F	O-ring – Impeller Bolt
9	Suction Cover	90	Mechanical Seal
14	Shaft Sleeve	400*	Tubing
23	Base	410*	Male Connectors
24	Impeller Bolt	422	Pipe Plug – Casing
28	Impeller Washer	610	Forcing Bolts - Backcover
32	Impeller Key	611	Forcing Bolts – Suction Cover
40	Slinger	615	Nuts – Backcover / Motor
63	Throttle Bushing	616	Nuts – Backcover / Volute
71	Backcover/Adaptor	617	Nuts – Suction Cover / Volute
73	Sleeve Gasket	630	Studs - Backcover / Motor
73X	Impeller Gasket	631	Studs - Backcover / Volute
82A*	Cone Cap	632	Studs - Suction Cover / Volute
82B*	Cone Body	667	Setscrews – Wear Ring(s)

* Optional Equipment

Table 6-4: Parts List for Pumps with JM Shafts

6.2.2 Pump Disassembly.

Check Table 6-1 to see if your pump size has a JM shaft extension. Proceed to Section 6.3 if your pump has a JP shaft extension. During disassembly reference the sectional drawing in Appendix A for the Parts List that corresponds to the part numbers used in this manual. Refer to Section 6-4 for parts inspection.

NOTE

Replace and repair rusted and/or worn parts, as necessary.

- a. Shut down the pumping unit in accordance with Section 3.5.



Before attempting to disassemble the pump, the motor electrical power supply must be locked and tagged in the “OFF” position. This can prevent serious injury or death to personnel.

- b. Turn off, lock off and tag out electrical power supply.
- c. Remove motor terminal box cover. Disconnect motor leads. Re-attach motor terminal box cover.
- d. Drain fluid from pump by removing plug (422) from volute (1). Remove o-ring (89D) from plug (422). If adequate floor drainage is not available drain fluid into a bucket.
- e. Disconnect male tube connector (410) nuts from tubing (400). Remove tubing. Remove male tube connector (410) body. Remove o-rings (89D) from male tube connector (410) body.
- f. If equipped with an abrasive separator, remove abrasive separator assembly from suction cover (9) at union (555) by removing jamnut (834) and o-ring (89G). Refer to Section 6.6 for disassembly and assembly of the abrasive separator if disassembly of the abrasive separator is required.
- g. Remove nuts (616) from studs (631). Tighten forcing bolts (610) to remove volute (1) from backcover / adaptor (71). Take rotary assembly to a suitable work place.
- h. Remove o-ring (89A) from backcover / adaptor (71).

CAUTION

Composite parts should never be struck with a hard tool or foreign object during installation or service. Excessive force should never be used during the installation of composite parts. The use of pullers or similar extraction devices is prohibited for composite parts. Although CPC composite components are dimensionally stable to elevated temperatures, a direct flame should never be applied to these parts.

- i. Remove impeller bolt / nut (24), impeller washer (28), impeller washer gasket (73X), impeller capscrew o-ring (89F) and impeller (2) from motor shaft. Remove impeller key (32).
- j. Remove sleeve gasket (73).
- k. Remove motor shaft sleeve (14) with rotating elements of mechanical seal (90). Remove rotating elements of mechanical seal from motor shaft sleeve (14).
- l. Remove nuts (615) from studs (630). Remove backcover / adaptor (71).
- m. Remove stationary element of mechanical seal (90).
- n. Remove shaft sleeve o-ring (89C) from motor shaft.
- o. Remove throttle bushing (63) from backcover / adaptor (71).
- p. Remove slinger (40) from motor shaft, if necessary.

6.2.3 Pump Assembly

- a. If removed, replace slinger (40) on motor shaft.
- b. Lubricate and install shaft sleeve o-ring (89C) onto motor shaft.
- c. Install throttle bushing (63) into backcover / adaptor (71).
- d. Lubricate stationary element of mechanical seal (90). Install stationary element of mechanical seal into backcover / adaptor (71).
- e. Secure backcover / adaptor (71) to motor with studs (630) and nuts (615). Back out forcing bolts (610) below seating surface.
- f. Lubricate outside of the motor shaft sleeve (14). Install rotating element of mechanical seal (90) on the motor shaft sleeve (14). Clean and dry seal faces.
- g. Install sleeve assembly on motor shaft. Install sleeve gasket (73).

NOTE

If equipped with a composite impeller, it needs to be dynamically balanced in accordance with NAVSEA drawing, 803-7226047. Do not attempt to dynamic balance composite products by removal of material. If found to be out of balance, refer to NAVSEA Reference Material Centrifugal Pump Composite Component Maintenance and Repair Process Manual.

- h. See Section 6.7 for installation of seal retainer ring.
- i. Install impeller key (32), engage into the motor shaft sleeve (14) keyway and in motor shaft keyway. Install impeller washer gasket (73X), impeller washer (28), and impeller capscrew o-ring (89J). Install impeller (2) onto motor shaft. Secure impeller (2) with impeller bolt (24).
- j. Install o-ring (89A) on backcover / adaptor (71).
- k. Secure volute (1) to backcover / adaptor (71) with studs (631) and nuts (616).
- l. Rotate the motor shaft by hand, if accessible, to ensure it rotates freely and no rubbing noises are present.
- m. If removed, install suction cover (9) on volute (1) with studs (632) and nuts (617).
- n. Install abrasive separator assembly if equipped. Refer to Section 5.2.5 for disassembly and assembly procedures for the abrasive separator.
- o. Install o-rings (89G) and (89H) on male tube connector (410) and (411). Install male tube connector (410) and (411). Install tubing (400) and (401). Reconnect male tube connector (410) and (411).
- p. Install o-ring (89D) on plug (422). Reinstall plug (422) in volute (1).
- q. Remove motor terminal box cover. Reconnect motor leads. Re-attach motor terminal box cover.
- r. Start pumping unit using appropriate procedures located in Chapter 3.

