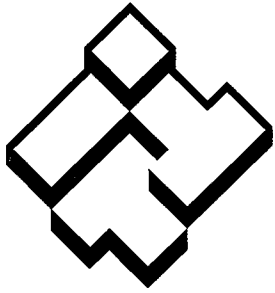


A-C Pump



ITT Industries

INSTRUCTIONS

**Installation
Operation
Maintenance**

**MODEL 500
NSWV
WET PIT PUMPS**

TABLE OF CONTENTS

INTRODUCTION	3
Purpose of Manual	3
Allis-Chalmers Service Organization	3
Warranty	3
Pump Identification	3
Receiving Pump	3
Lift Clearance	3
INSTALLATION	4
Pump Location	4
Foundation	4
Setting Baseplate	4
Leveling Baseplate	4
Suction Pits	5
Short Length Pump Installation	5
Coupling to Driver	5
Solid Shaft Driver	5
Hollow Shaft Driver	5
Impeller Adjustment	5
Vibration Chart	6
Long Length Pump Installation	7
Preparation	7
Enclosed Line Shaft	7
Threaded Construction	7
Flanged Construction	7
OPERATION	8
Pre-Start Check List	8
Starting Pump	8
Shut-Down	8
Freezing Protection	8
MAINTENANCE	9
Inspection Chart	9
Trouble Shooting	10
REMOVING AND REINSTALLING COMPONENTS	10
Assembly View Drawing	12
Parts List	13

NOTE: The information contained in this book is intended to assist operating personnel by providing information on the characteristics of the purchased equipment.
It does not relieve the user of the responsibility of using accepted engineering practices in the installation, operation and maintenance of this equipment.

PURPOSE OF MANUAL

This manual is furnished to acquaint you with some of the practical ways to install, operate and maintain this pump. Read it completely before doing any work on your unit and keep it handy for future reference.

Equipment cannot operate well without proper care. To maintain this unit at top efficiency, follow the recommended installation and servicing procedures outlined in this manual. The Allis-Chalmers service organization is available to expertly guide the installation of the pump for maximum operating life and minimum downtime.

ALLIS-CHALMERS SERVICE ORGANIZATION

Experienced, factory-trained servicemen offer prompt, efficient service at reasonable rates. Costly errors such as: poor grouting, misalignment, pipe stresses transmitted to the pump casing and, improperly cleaned piping are frequently found and corrected by these servicemen. A serviceman may be requested through your nearest Allis-Chalmers Sales Office.

Replacement and spare parts, including special attention to your individual problems, may also be obtained through the same Sales Office.

WARRANTY

See your sales contract for coverage.

PUMP IDENTIFICATION

Allis-Chalmers Vertical Wet Pit Sewage pumps are identified by serial number, model number, size, type and style. Information is stamped on identification plates attached to the motor pedestal.

A permanent record of your pump is maintained at the factory by the pump serial number. Therefore, it must

be listed on all correspondence, including a spare part(s) order.

RECEIVING THE PUMP

Check the pump shipment for shortages and damage immediately upon arrival. Examine the pump for shipping damage; check the pump components against the packing list and bill of lading. Record shortages or damages on the freight bill. Report concealed damage when found, to carrier's agent promptly for satisfactory adjustment.

Short-length pumps (up to 20 feet) are shipped completely assembled except for driver and coupling. Unload and handle by lifting equally at points on the mounting plate.

Pumps over 20 feet long are shipped disassembled. The driver, baseplate, motor pedestal, column pipe, enclosing tube, line shaft, bearings, couplings, and bolts and nuts are crated and shipped separately.

The lower portion of the pump consisting of casing (2-001-0), impeller (4-002-0), suction cover (2-091-0), adapter back cover (2-140-0), pump shaft (1-007-8) and accessories are always assembled. (See Assembly Drawing 52-426-355; Page 12).

Lift Clearance

Lifting devices should have the following above the foundation clearances.

COLUMN LENGTH	CLEARANCE ABOVE FOUNDATION
5 ft.	12 ft.
10 ft.	22 ft.
20 ft.	42 ft.

INSTALLATION

LOCATION OF PUMP

Pump location is very important. Consider the following when determining final location of the pump.

1. Provide working area to service tension bearing assembly, driver coupling, and lubrication of pump.
2. Plan for lifting facilities of sufficient size to install or remove pump components. Provide ample head room and an area near the lifting device to lay out the columns, line shafts, discharge head and driver motor.
3. Check voltage, phase and frequency of power source; It must match motor requirements stamped on motor.

FOUNDATION

A substantial reinforced concrete foundation built on a solid base is preferred. If the pump is to be mounted on steel beams, calculations should be made to check beam deflections and natural frequency (Resonance).

Normally, a two-vane impeller pump will have exciting frequencies of both the rotational speed, and twice the rotational speed of the driver. If other equipment nearby could excite the beams, their exciting frequency should also be considered when sizing the beams. (See Vibration Frequency Chart, Page 6.)

SETTING BASE PLATE

The base plate should be set on leveling shims which rest directly on the concrete foundation. The foundation should be smooth and level to distribute the load evenly on the shims. A thin metal plate leveled in a puddle of mortar or grout is often the easiest way to

achieve this level and smooth surface. Use thick shims wherever possible to reduce number of shims used, and avoid a spongy shim base.

CAUTION

Do not use leveling nuts to maintain level of the plate. Use shims and a sensitive spirit level.

Reliable, trouble free and efficient operation of a vertical pump depends on the correct alignment of motor and driven shafts. The settling of the foundation; or a shifting of driven motor on the foundation can cause misalignment, vibration and bearing failure.

To Level Baseplate (Figure 4-1)

Use a sensitive graduated-tube spirit level reading to 10 seconds per graduation (0.005 in./ft.) and provided with a screw adjustment. The length of the frame of the level has no bearing on its accuracy as this is determined by the shape of the glass tube. During long leveling operations grasp the level by its ends rather than in the middle as the warmth of the operator's hands may affect the bulb's accuracy.

Clean and stone the top of the baseplate and place the level on the top of the baseplate. (See Figure 4-1.) Adjust shims (and/or wedges under baseplate until level reads within .004". Place level in position 2 and level baseplate in this position. Continue moving level around baseplate until it is level within .004" in all directions.

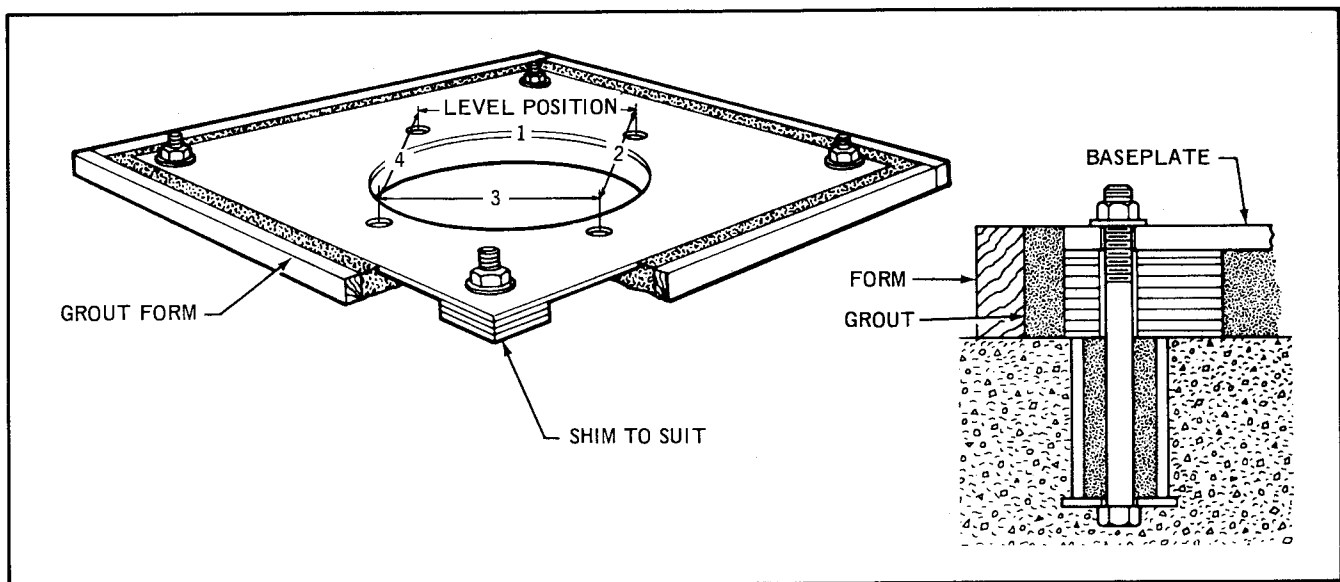


FIG. 4-1 - SETTING THE BASEPLATE

SUCTION PITS

Design of the pump suction pit must produce low velocity and uniform flow to the pump inlet to prevent undesirable flow patterns (vortexing). Such patterns can be broken up by providing baffles in the suction pit.

Install pump as close to one side of suction pit as possible and within half the suction bell diameter from the pit bottom. Prevent foreign objects from being drawn into the pump by installing screens or trash racks at the sump entrance.

SHORT-LENGTH PUMP INSTALLATION (up to 20 feet long)

1. Attach suitable lifting devices to the mounting plate. Lift in a vertical position over foundation and set in place. Level base as previously described.
2. Align shims and secure base elbow on discharge of pump if pump is supplied with one. Refer to assembly drawing 52-426-355 (pages 12-13) and proceed as follows;

COUPLING TO DRIVER

Solid Shaft Driver

1. Install coupling halves (0-031-7) on driver and pump shaft. Install driver onto motor pedestal using screws provided.

CAUTION

Before bolting coupling hubs together, check motor rotation. Normal rotation is COUNTERCLOCKWISE when viewed from top of motor.

2. Bolt coupling hubs together and adjust impeller (SEE IMPELLER ADJUSTMENT).

Hollow Shaft Driver (Figure 5-1)

SCREWED COUPLING — Refer to motor manufacturer's instruction manual for coupling design; self release, bolted or non-reverse. Each has to be assembled in a prescribed manner.

1. Insert pump shaft (3) through hollow motor shaft and slide motor coupling onto shaft (3).
2. Install gib key (4) into keyway of motor shaft (3) and coupling. Screw hexagon nut (1) on motor shaft.
3. Attach a suitable lifting device to lifting lugs on motor, lift it up and align over pump pedestal. Lower motor and shaft (3) onto pedestal and bolt motor (7) to pedestal.
4. Follow motor instructions for initial start-up. Connect electric line from power source to motor. Check and make sure the power source agrees with name-

plate on motor. Check for bearing lubrication. Jog motor and check direction of rotation (counterclockwise looking down on motor shaft).

5. Connect motor shaft (3) to line shaft (6) with coupling (5).
6. Refer to IMPELLER ADJUSTMENT, below, and adjust.

IMPELLER ADJUSTMENT

- 1.) Motor should not be running—take care to lock motor control off line.
- 2.) Remove top cover from the driver, if driver is hollow shaft.
- 3.) Remove locking screw from coupling (see Figure 6-1a or 6-1b).

ADJUST IMPELLER AS FOLLOWS:

- a) Rotate adjusting nut clockwise until impeller is lowered to rest.
- b) Rotate adjusting nut counterclockwise until impeller rotates just free. Turn nut an additional one-quarter turn to provide a running clearance of 0.025 inch. This, in most instances, is adequate and will give maximum performance from pump. If nut is turned beyond, pump performance will diminish.

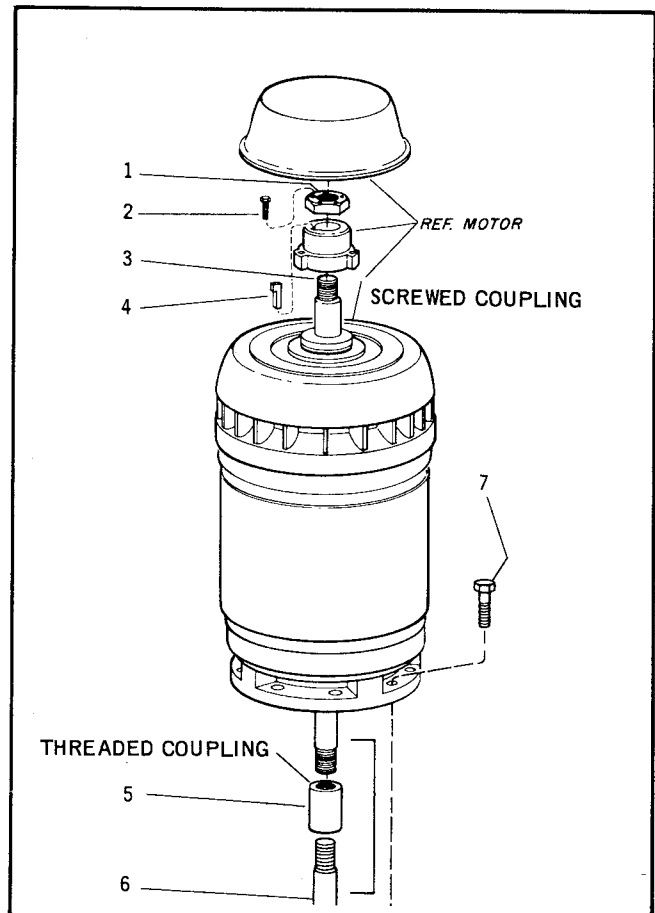


FIG. 5-1

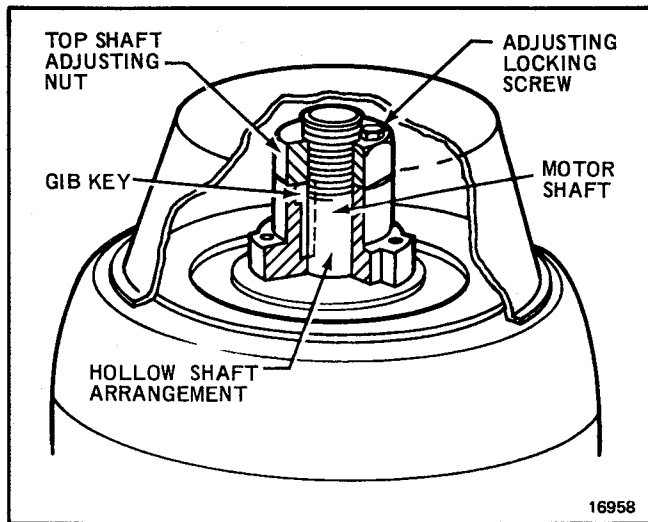


FIG. 6-1a - IMPELLER ADJUSTMENT - HOLLOW SHAFT

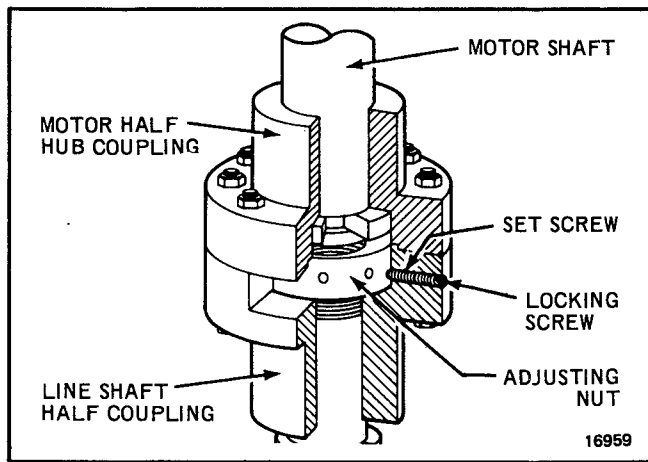


FIG. 6-1b - IMPELLER ADJUSTMENT - SOLID SHAFT

- 3.) After impeller adjustment, replace locking screw in hexagon nut or coupling and replace top cover on hollow shaft motor.
- 4.) Fill enclosing tube with oil (Figure 6-2) and then fill constant level oiler (1-926-0) with oil and connect to tension bearing (6-128-0). If constant level oiler is provided with a solenoid valve, wire valve so that oil is released when driver is energized.

NOTE: SAE 10 oil with a rust inhibitor should be used for lubricating pump.

ENCLOSING TUBE OIL CAPACITY	
SHAFT SIZE (in inches)	OIL CAPACITY (per 10 ft. section)
1 in.	1 qt.
1-3/16 in.	1 qt.
1-1/2 in.	1-1/2 qts.
1-11/16 in.	1 qt.
2-3/16 in.	1 qt.

FIG. 6-2 OIL CAPACITY CHART

5. Rotate shaft by hand to make sure it turns freely.
6. Check submergence in sump to make sure it is adequate. Pump casing should always be completely covered with liquid before starting unit.
7. After vibration check (Figure 6-3) pump is ready for service. **ALWAYS CHECK VIBRATION.**

VIBRATION FREQUENCY CHART

PEAK-TO-PEAK
VIBRATION AMPLITUDE MILS
(MAX. ALLOWABLE IN ANY PLANE)

*FREQUENCY CORRESPONDS TO RPM WHEN DYNAMIC UNBALANCE IS THE CAUSE OF VIBRATION. MEASURE VIBRATION AT LEVEL OF TOP MOTOR BEARING.

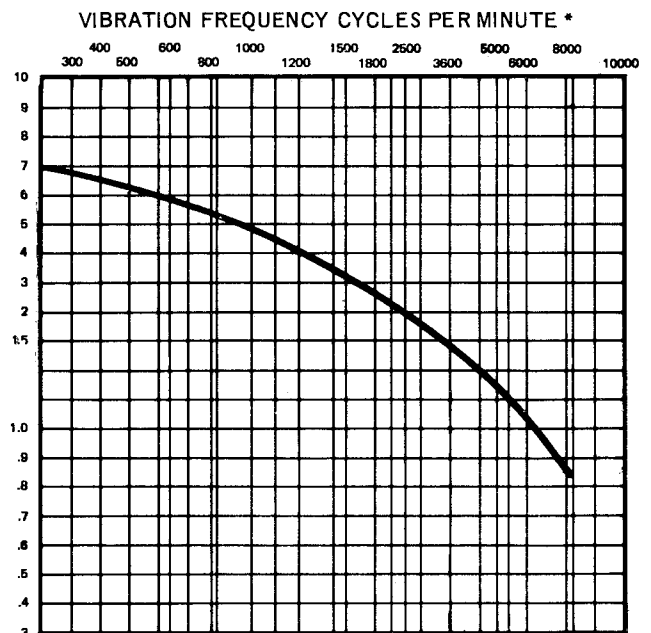


FIG. 6-3 - VIBRATION FREQUENCY CHART

LONG-LENGTH PUMP INSTALLATION

(over 20 feet long)

LINESHAFT AND COLUMN BUILD-UP

Pre-Installation Preparation:

Lay column section on suitable timbers convenient to foundation. Inspect and clean all threaded portions of columns, line shafts and couplings. If threads are damaged or burred, repair with thread file. The odd length column (not an even 5 or 10 foot length) is the top column and is connected to the upper pipe column adapter. (See Assembly Drawing , Item 2-456-7).

Check line shafts for straightness. The shafts must run true within .005" TIR (Total Indicator Runout). Straighten before continuing installation. Butt end of shaft must be clean and free of burrs.

NOTE: DO NOT apply oil to threads of line shaft before screwing to coupling. (Only stainless steel #316 pump shaft is lubricated. Use Loctite anti-sieze compound on stainless steel #316 shafts.) All line shafts have LEFT HAND threads. Use grease on COLUMN threads before screwing sections together.

CAUTION

To prevent damage to the pump during start up, all line shaft faces must butt inside line shaft couplings.

Lower pump casing assembly into sump. Position mounting plate (1-394-0), if provided, onto foundation and raise pump casing assembly through hole in plate. Secure casing so it cannot fall or turn. Start assembly of column pipe, bearings, and shafting as described in the following paragraphs:

ENCLOSED LINESHAFT Threaded Type Construction

(FLANGED TYPE CONSTRUCTION—See Step 9)

1. Screw lower line shaft coupling (1-031-8) and line shaft (1-007-9) to pump shaft (1-007-8). Use Loctite anti-seize compound on STAINLESS STEEL THREADS ONLY.

2. Slide enclosing tube (1-172-8) over pump shaft and screw on to the adapter bearing (1-139-1). Fill enclosing tube section with rust-inhibiting SAE-10 oil. Refer to Oil Capacity Chart 6-2.
3. Slide line shaft bearing (1-130-9) over shaft (1-007-9) and screw into enclosing tube (1-172-8).
4. Slide next section of enclosing tube over line shaft.
5. Attach lifting device to pipe column. Lower column over shaft; do not strike shaft or damage threads while lowering pipe.
6. Screw pipe column (1-223-8) to pipe column adapter (2-456-8) on pump casing assembly.
7. With lifting device still attached to pipe column, disconnect holding device securing pump casing assembly to foundation and lower casing assembly and pipe column into sump until holding device can be attached to pipe column (1-223-8) just below pipe column coupling (1-462-9).
8. Remove lifting device.

Continue assembling line shaft couplings, line shafts, enclosing tubes, bearings, stabilizers, columns and couplings until column and line shaft is complete. (Go to step 10)

ENCLOSED LINESHAFT Flanged Type Construction

9. Assembly is similar to threaded type construction except, column sections are bolted together. Follow previous steps. If column is equipped with welded-on lowering pads, use them to secure column to foundation.
10. After the column and shaft are assembled, the upper pipe column adapter (2-456-7) can be bolted to the motor pedestal (1-207-0) with the screws provided. The motor pedestal in turn can be lowered onto the mounting plate and bolted in place with bolts provided. (See page 5.)
11. Install tension bearing (6-128-0) and tighten securely. The tension on the enclosing tubes tends to hold the assembly in strict alignment. Place oil seal (6-177-0) over shaft and tap into bore of tension bearing. Lock tension bearing in place with clamping lug (6-937-0) provided.

Refer to steps previously described (Page 5 & 6 for Short-Length Pumps), prior to starting unit.

OPERATION

Before starting pump for first time or after removal from storage check all points on the following list:

PRE-START CHECK LIST

1. Check wiring connections to driver with wiring diagram. Check voltage, phase and frequency of line circuit with name plate on driver motor.
2. Check lubrication requirements of driver motor and pump. Refer to lubrication chart and motor manufacturer's instructions.
3. Check impeller adjustment and free rotation of line shaft — refer to page 5 Impeller Adjustment.

CAUTION

Check pump direction of rotation, before connecting driver coupling. Direction of rotation must be in direction of arrow on motor adapter (counterclockwise looking down on shaft). Check rotation every time motor leads have been reconnected.

-
4. Inspect piping to make sure all bolts are tight. Install pressure gage in discharge pipe. Be sure piping support is anchored immediately adjacent to pump to prevent any strain on the pump.
 5. Check liquid level in sump for required submergence of suction nozzle. Be sure sump is free of foreign objects that could obstruct flow to pump.

STARTING PUMP

1. Open Needle valve on oiler (1-926-0); allowing oil to flow to tension bearing (6-128-0).
2. Start pump drive motor.

CAUTION

If repeated trial starts are made, allow sufficient time between starts to permit dissipation of heat from motor.

Inspection After Initial Start-Up

1. Check pump and piping for leaks. Repair leaks promptly.
2. Check and record all pressure gage readings for reference.
3. Check and record voltage, amperage per phase, and kilowatts, if an indicating wattmeter is available.
4. Check and adjust oiler needle valve for correct operation. Check lubrication of all bearings in system.

SHUT-DOWN

Stop driver operation; this procedure will cover normal shutdown of pump.

NOTE: If control device is located away from pump, lock motor off the line.

Make adjustments of process piping, valves, etc., as required. If pump is removed from service for an extended time period, consult storing procedures and protect unit from freezing.

Freezing Protection

Protect pumps shut down during freezing weather by one of following methods.

1. Drain all liquid from pump.
2. Keep liquid moving in pump and insulate or heat to prevent freezing.

CAUTION

If heat is used to keep from freezing, do not allow temperature to rise above 150° F (66° C).

PREVENTIVE MAINTENANCE

General

A properly installed and operated pump will require a minimum of maintenance. Adhere to installation, operation, lubrication, and specific instruction section of this manual for top overall pump performance.

Proper preventive maintenance consists of maintaining records of operating hours, operating data, gage readings and service performed on the pump. Utilizing this information in conjunction with the suggested preventive maintenance schedule will reduce downtime and prevent costly breakdowns.

PREVENTIVE MAINTENANCE INTERVAL INSPECTION CHART

FREQUENCY OF INSPECTION	COMPONENT	INSPECTION AND MAINTENANCE
Weekly	Driver Motor	Clean oil, dust, dirt, water and chemicals from exterior of motor. Make sure motor air intake and outlets (fan cooled motor) are unobstructed.
Monthly	Driver Motor	Check motor bearing temperature with temperature indicator (not your hand). If bearings are running hot, consult motor manufacturer's instructions.
		Inspect motor for accumulation of moisture, insulation resistance, loading corrosion and lubrication. Consult motor manufacturer's instructions and lubrication chart.
Semi-annual (4000 oper. hours)	Pump	Check operating vibration of the pump against curve. (Figure 6-3.) If vibration has changed since last inspection or from initial inspection shut down pump and inspect casing assembly for damage or clogging.
	Pump foundation	Check foundation for settling. It may cause misalignment of pump and strain on discharge and suction piping. Correct for any change in foundation.
	Pump performance	Check discharge and suction pressure readings against initial field test and correct by adjusting impellers if performance has dropped in excess of 10%.
Annual	Pump efficiency	Measure total dynamic head and flow. Take power readings. Compare with initial record of pump efficiency. If efficiency has decreased more than 5%, readjust impeller. If performance does not improve, replace impeller or wear ring as required.

TROUBLE SHOOTING CHART

SYMPTOM	POSSIBLE CAUSES	REMEDY
No liquid delivered	System head too high Speed too low Pump suction clogged	Check discharge valve, it must be open. Check discharge pipe for size and friction. Check motor voltage and frequency. Compare with identification plate on motor. Dismantle pump and clean impeller.
Not enough liquid delivered	Speed too low System head too high Pump suction clogged	Check motor voltage and frequency. Compare with identification plate on motor. Check discharge valve, it must be open. Check discharge pipe for size and friction. Dismantle pump and clean impeller.
Insufficient pressure	Speed too low Obstruction in suction Cavitation (Insufficient NPSH)	Check motor voltage and frequency. Compare with identification plate on motor. Remove and dismantle pump. Remove obstruction. Reassemble and install in sump. Lower pump or raise water level in sump to increase positive suction head.
High power consumption	High head pressure Defective impeller Pump distorted by excessive strains Bent line shaft Improper impeller clearance Speed too high	Decrease motor speed. Remove and dismantle casing assembly. Inspect impeller and replace if damaged or eroded. Check piping alignment. Examine pump for impeller clearance, adjust as required. Replace damaged parts. Dismantle and repair or replace bent line shaft. Inspect for damage caused by bent shaft. Refer to page 5 IMPELLER ADJUSTMENT and adjust as required. Check motor frequency.

REMOVING AND REINSTALLING COMPONENTS

1. Shut off electrical power to motor.

CAUTION

Lock motor off line.

2. Remove top cover from driver if driver is hollow shaft (Figure 6-1a).
3. Remove locking screw and set screw from coupling adjusting nut. (Figure 6-1a, or 6-1b).
4. Rotate adjusting nut clockwise until impeller is lowered to rest.
 - a) Hollow-shaft driver (Figure 5-1); Disconnect coupling (5) from line shaft (6) and motor shaft (3).

- b) Solid-shaft driver (Figure 6-1b); Remove coupling bolts fastening coupling hubs.
5. Unbolt motor from mounting pedestal. Lift motor from pedestal. Build a wood block platform under flange face of motor with opening to protect coupling, or shaft threads from damage. Place motor on a flat surface. Wrap tape around coupling or threads.

LONG-LENGTH PUMP

6. Unbolt discharge piping:
- a. Remove bolts holding base elbow (when supplied) to the foundation. Remove cap screws (1-902-1) holding motor pedestal (1-207-0) to pump mounting plate (1-394-0). Lift pump up through holes in mounting plate until first joint is accessible.
 - b. Secure pipe so it is held vertically and will not turn. Remove upper section of pipe from pipe coupling. Unscrew enclosing tube.

NOTE: These are right hand threads.

- c. Slide off line shaft.
- d. Unscrew line shaft **left hand threads** from line coupling. Continue in the above sequence until all pieces of line shaft are removed.

CAUTION

Protect shaft finish and threads on these components from damage.

- e. Inspect and replace worn or damaged parts (for shaft tolerances and bearing tolerances, measure parts and compare with Chart 11-1).

CHART 11-1

Line Shaft Bearing Diametrical Clearances	
Shaft Diameter	Clearance
1.18	.008-.011
1.50	.009-.012
1.68	.010-.013
2.18	.012-.015

7. Pump casing components disassembly:
- a. Remove clamping lug bolts (2-937-5); suction cover (2-091-0); impeller bolt (4-037-0); and washer (4-909-0).

NOTE: Fourteen inch diameter impellers and smaller have a light interference fit between impeller bore and shaft.

- b. Remove pump shaft (1-007-8) with the impeller on it through the front side of pump casing (2-001-0).
- c. Press shaft out of impeller on an arbor press.
- d. Remove clamping ring bolts (2-902-0); clamping ring (1-127-0); and adapter back cover (2-140-0).
- e. Check surface finish and bore in upper and lower sleeve bearings (2-190-7) and (2-190-8). Compare with dimensions in chart. (See Chart 11-2).
- f. Compare dimensions of throttle bushing bore (6-519-0) against chart. (See Chart 11-3).
- g. If any parts are badly worn, replace them. Always replace lower oil seals (2-177-0) and impeller screw (4-037-0) before reassembly.

SHORT-LENGTH PUMPS

Disassembly is similar to long length pump except pump can be pulled out of sump in one piece, craddled, and disassembled.

FLANGED COLUMN PUMPS

Disassembly is similar to previous discussion, except pump pipe column flanges are unbolted rather than screwed apart.

REASSEMBLY OF PUMPS

Use reverse procedure of disassembly:

- 1. Always use new impeller screw (4-037-0).
- 2. Always replace lower oil seals (2-177-0).

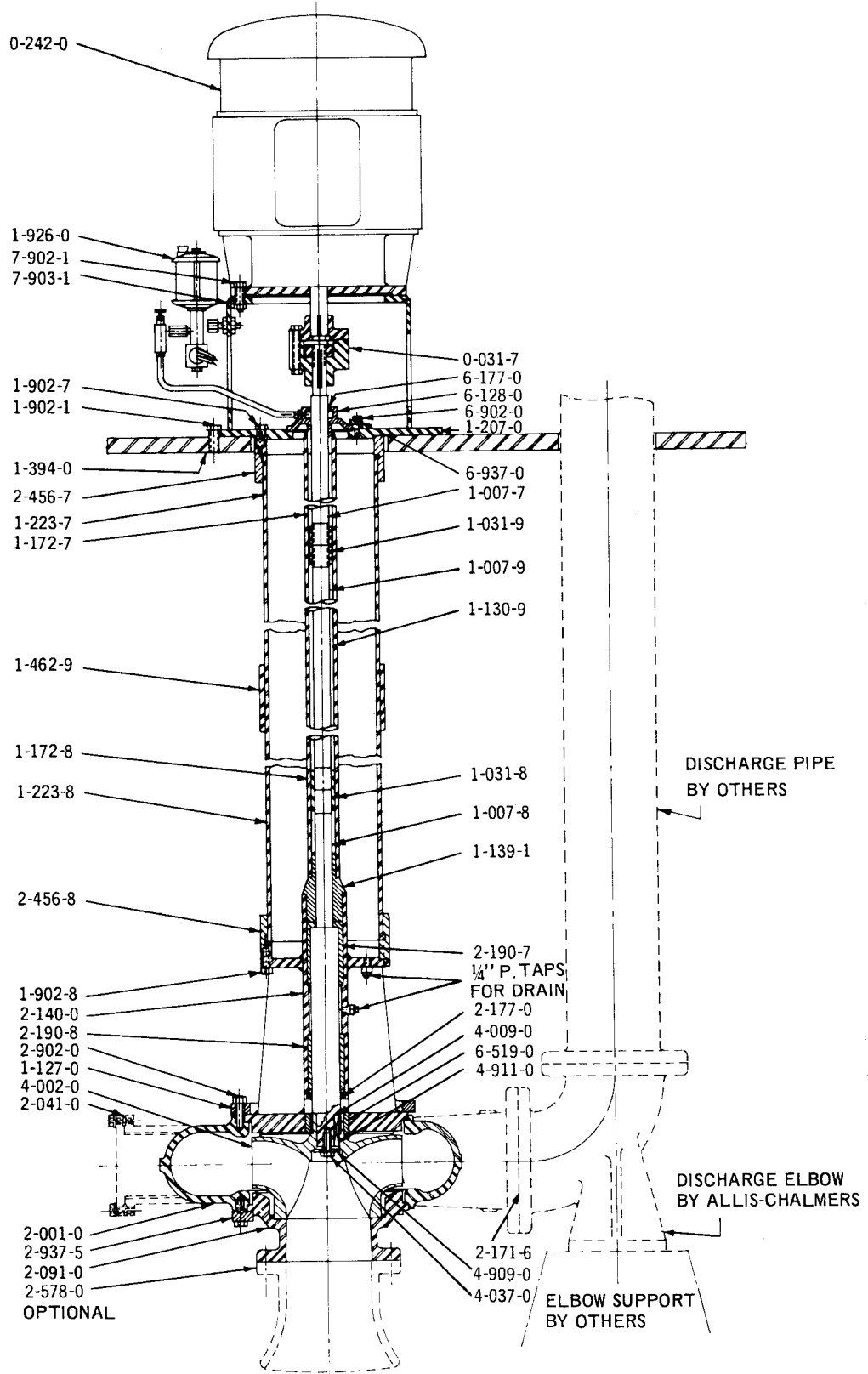
CHART 11-2

Upper & Lower Sleeve Bearing Diametral Clearance	
Shaft Diameter	Clearance
2.18	.006-.010
2.68	.007-.011
3.18	.006-.010
4.18	.007-.011

CHART 11-3

Impeller Sleeve O.D.		Throttle Bushing Bore
Pump Size	Tolerance +000 -002	Tolerance +001 -000
10-12 in.	2.352	2.375
14 in.	2.977	3.000
17 in.	3.477	3.500

ASSEMBLY VIEW DRAWING



52-246-355

FIG. 12-1 TYPICAL NSWV SUMP PUMP, MODEL 500 (8X8X14 SHOWN)

PARTS LIST

CATALOG NO.	PART NAME
0-031-7	Coupling, Motor
0-242-0	Motor
1-007-7	Shaft, Line (upper)
1-007-8	Shaft, Pump
1-007-9	Shaft, Line (interm.)
1-031-8	Coupling, Line Shaft
1-031-9	Coupling, Line Shaft
1-127-0	Clamping Ring
1-130-9	Bearing, Enclosed Line Shaft (interm.)
1-139-1	Bearing, Enclosing Line Shaft-Shoulder
1-172-7	Tube, Shaft, Enclosing (upper)
1-172-8	Tube, Shaft, Enclosing (lower)
1-207-0	Pedestal, Motor
1-223-7	Column Pipe - (upper)
1-223-8	Column Pipe - (lower)
1-394-0	Mounting Plate
1-462-9	Coupling, Pipe Column
1-902-1	Screw, Cap-Mounting Plate
1-902-7	Screw, Cap-Pedestal
1-902-8	Screw, Cap-Column
1-926-0	Oiler, Constant Level
2-001-0	Casing
2-041-0	Handhole Cover, Casing
2-091-0	Suction Cover
2-140-0	Adapter, Back Cover
2-171-6	Elbow, Discharge
2-177-0	Seal, Oil (lower)
2-190-7	Bearing, Sleeve (upper)
2-190-8	Bearing, Sleeve (lower)
2-456-7	Adapter, Pipe Column (upper)
2-456-8	Adapter, Pipe Column (lower)
2-578-0	Suction Bell
2-902-0	Screw, Cap-Casing
2-937-5	Lug, Clamping
4-002-0	Impeller (enclosed)
4-009-0	Sleeve, Impeller
4-037-0	Screw, Impeller
4-909-0	Washer, Impeller
4-911-0	Key, Impeller
6-128-0	Bearing, Tension
6-177-0	Seal, Oil (upper)
6-519-0	Throttle Bushing
6-902-0	Screw, Cap-Tension Bearing
6-937-0	Lug, Clamping
7-902-1	Screw, Cap-Motor to Pedestal
7-903-1	Nut, Motor to Pedestal

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INSMV-500

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