



# TABLE OF CONTENTS

PAGE i

TOPIC	PAGE
PUMP IDENTIFICATION .....	1
STORAGE OF PUMPS .....	.0 Tw( ) g . 0007 Tw(PAG



**PUMP IDENTIFICATION**

Congratulations! You are the owner of one of the finest pumps commercially available. If you give it the proper care as outlined and recommended by this manual, it will provide you with reliable service and long life.

A large, empty rectangular box with a black border, intended for the user to provide identification information for the pump.A second large, empty rectangular box with a black border, identical to the one above, for additional identification information.

THESE INSTRUCTIONS APPLY TO THE PUMP ONLY. THEY ARE INTENDED TO BE GENERAL AND NOT SPECIFIC. IF YOUR OPERATING CONDITIONS EVER CHANGE, ALWAYS REFER TO THE FACTORY FOR REAPPLICATION. ALWAYS REFER TO THE MANUALS PROVIDED BY MANUFACTURERS OF THE OTHER EQUIPMENT FOR THEIR SEPARATE INSTRUCTIONS.

### **CAUTION IMPORTANT SAFETY NOTICE**

THE INSTALLATION, USE AND OPERATION OF THIS TYPE OF EQUIPMENT IS AFFECTED BY VARIOUS FEDERAL, STATE AND LOCAL LAWS AND THE REGULATIONS CONCERNING OSHA. COMPLIANCE WITH SUCH LAWS RELATING TO PROPER INSTALLATION AND SAFE OPERATION OF THIS TYPE OF EQUIPMENT IS THE RESPONSIBILITY OF THE EQUIPMENT OWNER AND ALL NECESSARY STEPS SHOULD BE TAKEN BY THE OWNER TO ASSURE COMPLIANCE WITH SUCH LAWS BEFORE OPERATING THE EQUIPMENT.

### **STORAGE OF PUMPS**

IF THE EQUIPMENT IS NOT TO BE IMMEDIATELY INSTALLED AND OPERATED, STORE IT IN A CLEAN, DRY, WELL-VENTILATED PLACE, FREE FROM VIBRATION, MOISTURE AND RAPID OR WIDE VARIATIONS IN TEMPERATURE.

#### **SPECIAL INSTRUCTIONS FOR:**

**OIL-LUBRICATED PUMPS:** FILL THE BEARING RESERVOIRS WITH OIL. PRIOR TO START-UP, DRAIN THE STORAGE OIL AND FILL THE RESERVOIRS WITH NEW OIL.

**GREASE-LUBRICATED PUMPS:** ROTATE THE SHAFT FOR SEVERAL REVOLUTIONS AT LEAST ONCE EVERY TWO WEEKS TO:

1. COAT THE BEARING WITH LUBRICANT.
2. RETARD OXIDATION OR CORROSION AND,
3. PREVENT POSSIBLE FALSE BRINELLING.

#### **CONSIDER A UNIT IN STORAGE WHEN:**

1. IT HAS BEEN DELIVERED TO THE JOBSITE AND IS AWAITING INSTALLATION.
2. IT HAS BEEN INSTALLED BUT OPERATION IS DELAYED PENDING COMPLETION OF CONSTRUCTION.
3. THERE ARE LONG PERIODS (30 DAYS OR MORE) BETWEEN OPERATION CYCLES.
4. THE PLANT (OR DEPARTMENT) IS SHUT DOWN FOR PERIODS OF LONGER THAN 30 DAYS.

**NOTE:** STORAGE REQUIREMENTS VARY DEPENDING ON THE LENGTH OF STORAGE, THE CLIMATIC ENVIRONMENT AND THE EQUIPMENT. FOR STORAGE PERIODS OF THREE MONTHS OR LONGER, CONTACT THE MANUFACTURER FOR SPECIFIC INSTRUCTIONS. IMPROPER STORAGE COULD DAMAGE THE EQUIPMENT WHICH WOULD RESULT IN NON-WARRANTY COVERED RESTORATION REQUIREMENTS OR NON-WARRANTY COVERED PRODUCT FAILURES.

## INTRODUCTION

This manual contains information which is the result of carefully conducted engineering and research efforts. It is designed to supply adequate instructions for the safe and efficient installation, operation maintenance of your pump. Failure or neglect to properly install, operate or maintain your pump may result in personal injury, property damage or unnecessary damage to the pump.

Variations exist in both the equipment used with these pumps and the particular installation of the pump and driver. Therefore, specific operating instructions are not within the scope of this manual. The manual contains general rules for installation, operation and maintenance of the pump.

Observe all caution or danger tags attached to the pump or included in this manual.

## INSTALLATION

### 1. GENERAL

**CAUTION: CAREFULLY READ ALL SECTIONS OF THIS MANUAL AND ALL OTHER INSTRUCTION MANUALS PROVIDED BY MANUFACTURERS OF OTHER EQUIPMENT SUPPLIED WITH THIS PUMP.**

Upon receipt of the shipment, unpack and inspect the pump and driver assemblies and individual parts to ensure that none are missing or damaged. Carefully inspect all boxes and packing material for loose parts before discarding them. Report immediately to the transportation company involved, and to the factory, any missing parts or damage incurred during shipment, and file your "damaged and/or lost-in-shipment" claim with the carrier.

Horizontal pump and driver assemblies mounted on a common base are accurately aligned at the factory. However, alignment may be disturbed in transit or during installation. It must be checked after the unit is leveled on its foundation, after the grouting has set and the foundation bolts are tightened, and after the piping is completed.

When the pump and driver are mounted on separate base structures, the pump should be leveled and aligned first, then the driver leveled and aligned with the pump. With separate bases, a flexible shaft between the pump and driver must be used.

### 2. NET POSITIVE SUCTION HEAD (NPSH)

NPSH can be defined as the head (energy) that causes liquid to flow through the suction pipe and enter the eye of the impeller.



**7. GROUTING**

When the alignment is correct, the unit should be grouted using high grade non-shrinking grout. The entire base should be filled with grout. Be sure to fill all gaps and voids. Allow the grout to fully cure before firmly tightening the foundation bolts. Then recheck the alignment before connecting the piping.

**8. PIPING**

**CAUTION: ALL PIPING CONNECTIONS MUST BE MADE WITH THE PIPING IN A FREE SUPPORTED STATE, AND WITHOUT THE NEED TO APPLY VERTICAL OR SIDE PRESSURE TO OBTAIN ALIGNMENT OF THE PIPING WITH THE PUMP FLANGE.**

**CAUTION: AFTER ALL THE PIPING IS CONNECTED, THE PUMP AND DRIVER ALIGNMENT MUST BE RECHECKED.**

All piping should be independently supported near the pump so that pipe strain will not be transmitted to the pump casing. The suction and discharge piping should be



**INSTALLATION (continued)****BEARING HOUSING OIL LEVEL CHART**

PUMP MODEL (PUMP SIZE)	2-441-8A	3-441-9A/C 4-441-8A	4-441-11A/C 4-441-14C 5-441-14A 6-441-12A	5-441-18A 6-441-14A/C 6-441-18C 8-441-14A	5-441-11A 6-441-19A 8-441-18A 10-441-20
Centerline of shaft to oil level	3/4"	7/8"	1-3/16"	1-1/2"	1-13/16"

NOTE: For Fire Pumps, the Model designation changes from "441" to "491."

Adjust the oil level, if necessary, by loosening the setscrews on the side of the dust cap, raising the bottle and tightening the screws. Refer to the oiler manufacturer's instructions for more specific details.

**11. FINAL COUPLING ALIGNMENT**

The alignment of the coupling must be carefully checked during installation and as the last step before starting the pump. If realignment is required, the piping should be disconnected first. After aligning, reconnect the piping in accordance with the previous instructions and again recheck the alignment.

A flexible coupling must not be used to compensate for misalignment resulting from poor installation or temperature changes.

Aurora Pumps are supplied with several different types of commercial couplings. The following instructions apply to units supplied with Woods couplings. If your unit has a different brand coupling, the manufacturer's instructions should be obtained before proceeding.

NOTE: FOR MAXIMUM LIFE, KEEP MISALIGNMENT VALUES AS NEAR TO ZERO AS POSSIBLE.

**MAXIMUM ALLOWABLE MISALIGNMENT – WOODS COUPLINGS (Dimensions in inches)**

Sleeve Size	"G" Dimension	Types E & N		Type H	
		Parallel	Angular	Parallal	Angular
4	1/2	.005	.021	-	-
5	3/4	.007	.028	-	-
6	7/8	.007	.035	.005	.008
7	1	.010	.040	.006	.010
8	1-1/8	.010	.047	.007	.012
9	1-7/16	.012	.054	.008	.014
10	1-5/8	.012	.064	.010	.016
11	1-7/8	.016	.075	.011	.018
12	2-5/16	.016	.087	.012	.021
13	2-11/16	.020	.092	.015	.025
14	3-1/4	.022	.121	.017	.030
16	4-1/4	.031	.165	-	-

The coupling Type is printed on the sleeve.

\* Type H sleeves **SHOULD NOT** be used as direct replacements for EPDM or Hytrel sleeves.

- A. Use a blunt screwdriver to slip the wire ring out of the groove and remove the two-piece sleeve. Check the "G" dimension. If it is not as shown in the preceding table, loosen one flange of the coupling and reposition it to achieve the specified "G" dimension.

NOTE: On a sleeve bearing electric motor, the armature should be at its electrical center when the "G" dimension is measured.

- B. Check parallel misalignment by placing a straightedge across the two coupling flanges and measuring the maximum offset at various points around the periphery of the coupling. **DO NOT ROTATE THE COUPLING.** If the maximum offset exceeds the figure shown under "Parallel" in the preceding table, realign the coupling.

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**14. MECHANICAL SEALS**

**CAUTION: DRY OPERATION OF THE PUMP MAY CAUSE DAMAGE TO THE MECHANICAL SEAL AND IMPELLER.**

Model 441 pumps can be supplied with optional single face mechanical shaft seals. Mechanical seals are installed and adjusted in the factory and require no further adjustments in the field.

For further information, refer to the seal manufacturer's instructions.



Because variations exist in both the equipment used with these pumps and in the particular installation of the pump and driver, specific operating instructions are not within the scope of this manual. However, there are general rules and practices that apply to all pump installations and operation.

**CAUTION: BEFORE STARTING OR OPERATING THE PUMP, READ THIS ENTIRE MANUAL, ESPECIALLY THE FOLLOWING INSTRUCTIONS:**

- A. BEFORE STARTING THE PUMP, INSTALL CLOSED GUARDS AROUND THE COUPLING.
- B. BEFORE STARTING THE PUMP, ROTATE THE UNIT OR ASSEMBLY BY HAND TO ASSURE ALL MOVING PARTS ARE FREE.
- C. OBSERVE ALL CAUTION AND DANGER TAGS ATTACHED TO THE EQUIPMENT.
- D. NEVER RUN THE PUMP DRY AS THE CLOSE RUNNING FITS WITHIN THE PUMP ARE WATER LUBRICATED. RUNNING DRY MAY RESULT IN PUMP SEIZURE.
- E. BEFORE STARTING THE PUMP, FILL THE CASING AND SUCTION LINE WITH LIQUID. THE PUMP MAY BE PRIMED USING AN EJECTOR OR VACUUM PUMP.
- F. BEFORE STARTING A PACKED BOX PUMP, ADJUST THE PACKING GLAND SO THERE IS SUFFICIENT LEAKAGE TO LUBRICATE THE PACKING AND ASSURE A COOL PACKING BOX. (SEE MAINTENANCE INSTRUCTIONS).
- G. *IF EXCESSIVE VIBRATION OR NOISE OCCURS DURING OPERATION, SHUT THE PUMP DOWN AND CONSULT AN AURORA PUMP REPRESENTATIVE.*

## 1. OPERATING AT REDUCED CAPACITY

Although these pumps are applicable over a wide range of operating conditions, care should be exercised when doing so, especially when the actual conditions differ from the sold-for conditions. You should always contact your nearest Aurora Pump sales office before operating the pumps for any condition other than that for which it was sold.

## 2. PRIMING

Since the pump medium is used to lubricate various internal parts, running a centrifugal pump dry can result in extensive damage and possible seizing. It is therefore imperative that the pump be primed prior to initial start-up and that prime be maintained through subsequent start-stop cycles.

The priming method is diff s.6(NTA)5.6(c)9he pu5(tioGH(N)0gh thn)ed t sezi)7(n)-0.3(g)IT371(r(5ubR)-4.8i)7eil[ ofdry cmm310.





**MAINTENANCE (continued)**

**2. INSPECTIONS AND PREVENTIVE MAINTENANCE REQUIREMENTS**

To assure satisfactory operation of the pump, daily inspections and periodic maintenance are required. We suggest that an inspection and maintenance log be kept and that the inspector immediately report any problems. A guide for preventive maintenance for normal applications is given below. Unusual applications, with abnormal heat, moisture, dust, etc. may require more frequent inspections and service.

ITEM	ACTION REQUIRED	FREQUENCY (HOURS OF OPERATION)
Packing Box	Adjust gland, inspect packing for possible replacement	150 Hours
Pump Alignment	Check for change in alignment	ANNUALLY
Vibration	Check for change in vibration	ANNUALLY
Bearings: Grease lubricated	Lubricate	Every 2000 hours of operation, but at least once a year.
Oil lubricated		As required to maintain proper oil level – drain and replace oil every 2000 hours of operation, but at least once a year.

**3. BEARING LUBRICATION**

A. Grease Lubricated Bearings

Under normal operating conditions, the bearings must be lubricated after every 2000 hours of running time, but at least once a year regardless of total operating hours.

**CAUTION: ANY APPLICATION WITH ABNORMAL HEAT, MOISTURE, DUST, ETC. MAY REQUIRE A CHANGE IN THIS SCHEDULE AND YOU SHOULD REFER TO A LUBRICATION ENGINEER OR THE FACTORY FOR SPECIFIC INSTRUCTIONS.**

**CAUTION: THE GREASES RECOMMENDED IN THIS MANUAL WILL PROVIDE SATISFACTORY LUBRICATION OVER A WIDE TEMPERATURE RANGE. THERE IS, HOWEVER, A PRACTICAL LIMIT, AND OPERATION OF THE PUMP SHOULD BE DISCONTINUED AND THE FACTORY CONSULTED IF THE TEMPERATURE, WHEN MEASURED ON THE OUTSIDE OF THE BEARING HOUSING, EXCEEDS 190°F.**

RECOMMENDED GREASE: Chevron SRI grease N.L.G.I. No. 2 multi-purpose with a mineral oil viscosity of 517 SUS at 100°F or equivalent.

Proceed as follows for bearing lubrication:

**WARNING: KEEP HANDS, FINGERS, CLOTHING AND ANY TOOLS AWAY FROM THE COUPLING. FAILURE TO DO SO COULD RESULT IN SERIOUS PERSONAL INJURY.**

1. Stop the pump and remove the pipe plug at the bottom of the bearing housing.
2. Connect a grease gun to the lubrication fitting.
3. Inject grease until it relieves at the bearing housing cover and drain hole.
4. Remove the grease gun.
5. Start the pump. NOTE: Immediately after lubrication, bearing temperatures may rise above the normal level. Continue running the unit until bearing temperatures stabilize at the normal level.
6. Stop the unit, wipe off the relieved grease and replace the drain plug.
7. Start the unit and resume normal operation.

**3. BEARING LUBRICATION (continued)**

Check the oiler setting periodically to be sure it is correct. Refer to the following table for the correct setting.

**RECOMMENDED OILS:** The oil used should be non-detergent type containing rust and oxidation inhibitors, supplied by a reputable manufacturer.

Depending on bearing/pump operating temperature, the grade and viscosity should be as follows:

Below 120°F – ISO Vg Grade 40-70 (SAE 20)

120F to 250°F – ISO Vg Grade 70-100 (SAE 20)

Above 250°F – Consult the factory for a recommendation.

**4. PACKING BOX**

**CAUTION: DO NOT TIGHTEN THE GLAND TO STOP ALL LEAKAGE. LEAKAGE IS NECESSARY TO ENSURE THE COOLING, FLUSHING AND LUBRICATION OF THE PACKING AND TO PREVENT SHAGs0.8(D T1A)3.2HCA 3Tj.7964 -1.1497 TD0564.0601 Tm-0.00042(ow007 Tw[3A)3.2(UTIO)C**



## 5. PACKING REPLACEMENT (continued)

	PUMP MODEL (PUMP SIZE)				
	2-441-8A	3-441-9A/C 4-441-8	4-441-11A 4-441-14C 5-441-14A 6-441-12A	5-441-18A 6-441-14A/C 6-441-18A 8-441-14A	6-441-19A 10-441-20
PACKING BOX					
Sleeve O.D.	1-5/8	2	2-1/2	3	3-1/2
Packing Box I.D.	2-7/16	2-15/16	3-9/16	4-3/16	4-13/16
Packing Box Depth	2-15/16	2-7/8	3-7/8	4-5/16	4-3/4
PACKING SIZE	3/8	3/8	1/2	9/16	5/8
Qty. of Rings per Box (Without Lantern Ring)	7	7	7	7	7
Lantern Ring Width	3/4	3/4	1	1-1/8	1-1/4
PACKING ARRANGEMENT WITH LANTERN RING (Packing Rings-Lantern Ring-Packing Ring)*	2-L-3	2-L-3	2-L-3	2-L-3	2-L-3

\* See Sectional Drawings on pages 23 & 24.

NOTE: For Fire Pumps, the Model designation changes from "441" to "491."

## 6. PUMP DISASSEMBLY

**CAUTION: READ THIS ENTIRE DISASSEMBLY PROCEDURE AND REFER TO THE SECTIONAL DRAWINGS IN THIS MANUAL BEFORE PROCEEDING.**

Major maintenance will require disassembly of the pump. Following are step-by-step instructions.

- A. Lock out the power to the driver and close the suction and discharge valves. Drain the pump, disconnect and remove the coupling or flexible shafting. Disconnect and remove all auxiliary piping to the upper casing (3) and bearing housings (C158 and D158) (packing box flush line, lubricators on oil lubricated pumps, cooling water lines on pumps with water-cooled bearings, etc.).
- B. Remove the capscrews (2A) securing the upper casing half (3) to the lower half (2). Remove the gland nuts (31B) and slide the glands (A31 or B31) off the gland studs (31A). Install jack screws in the tapped holes in the upper casing half and use them to separate the flanges. Carefully lift the upper casing half using the long shank eyebolts in the tapped holes in the upper casing half.

**CAUTION: USE OF A CRANE OR HOIST OF ADEQUATE CAPACITY IS RECOMMENDED. THE LIFTING HOOK SHOULD BE NO LESS THAN 3-4 FEET ABOVE THE EYE OF THE EYEBOLTS TO AVOID BENDING OF THE BOLTS. THE USE OF THE SHORT EYEBOLTS IS NOT RECOMMENDED SINCE THE UPPER CASING HALF WILL TEND TO TIP WHILE BEING LIFTED, RESULTING IN POSSIBLE DAMAGE OR PERSONAL INJURY.**

- C. Remove the capscrews (158B) and pins (158A) that secure the bearing housings (158) to the lower casing. The pins may be removed using the threaded holes in the pins.
- D. Lift the rotor assembly from the casing using a double rope sling.

**WARNING: BE CAREFUL WHEN POSITIONING THE ROPES TO AVOID THE ROTOR SLIPPING AND CAUSING POSSIBLE SERIOUS PERSONAL INJURY.**

**6. PUMP DISASSEMBLY (continued)**

- E. Remove the capscrews (159D) that secure the bearing housing covers (159) to the bearing housings and remove the housings from the rotating assembly.
- F. Remove the outer snap ring (345) from the outboard bearing end of the rotating assembly, and use a wheel/bearing puller to remove the outboard (168) and inboard (163) bearings.

**WARNING: TO PREVENT POSSIBLE SERIOUS PERSONAL INJURY, EXTREME CARE SHOULD BE EXERCISED TO SELECT THE PROPER**

**7. PUMP ASSEMBLY**

**CAUTION: READ THIS ENTIRE PROCEDURE BEFORE CONTINUING.**

Following are step-by-step instructions for assembly of the pump and are essentially the reverse order of the instructions for disassembly.

- A. Thoroughly clean all parts to remove oil, grease and foreign material. Inspect for wear or damage and replace if required. Remove all parts to a clean and dust-free location for assembly. Gaskets, grease

**7. PUMP ASSEMBLY (continued)**

**Sleeves Secured With Loctite Only:** Clean the shaft, the bore of the sleeves and the bore of the

**7. PUMP ASSEMBLY (continued)**

- M. Attach the bearing housings to the lower casing using the appropriate dowel pins (158A) and capscrews (158B).

CAUTION: BE SURE BEARING HOUSING/CASING MATING SURFACES ARE CLEAN AND FREE FROM BURRS, AS THIS WILL AFFECT THE ALIGNMENT OF THE ROTOR/CASING.

- N. Inspect the upper casing (3) to assure that the water passage is clean and free from foreign material. Apply a light coat of grease to the upper and lower casing mating surfaces and install a new casing gasket (157) on the lower casing, making sure the holes are aligned. Position the pins in the casing wearing rings to align with the slots in the lower casing. Lower the upper casing into position. Install the casing alignment pins (2B) and securely bolt the upper and lower casing together using the capscrews (2A).
- O. Install the packing (212), lantern rings











11

