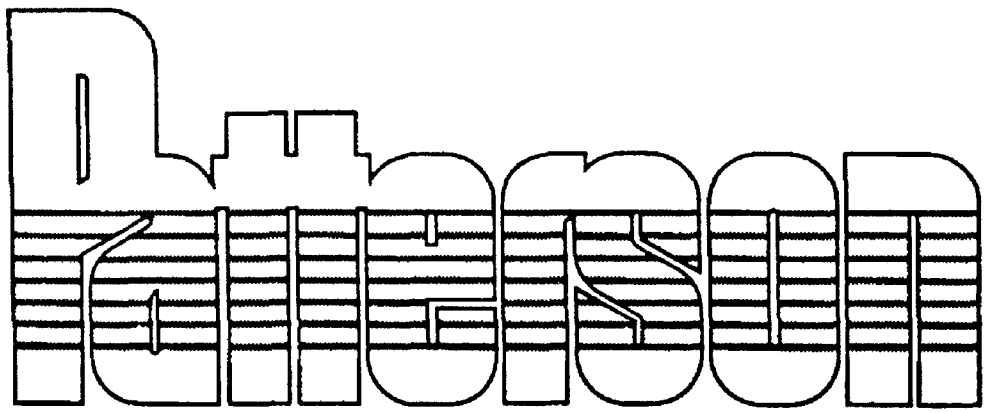

OPERATION & MAINTENANCE MANUAL

for

VERTICAL IN-LINE PUMPS

PATTERSON PUMP COMPANY

Post Office Box 790
Toccoa, Georgia 30577

Phone 706/886-2101
FAX 706/886 0023

SAFETY PRECAUTIONS

WARNING

Do not operate this equipment in excess of its rated speed or other than in accordance with the instructions contained in this manual

The equipment has been found satisfactory for the conditions for which it was sold but its operation in excess of these conditions may subject it to stresses and strains which it was not designed to withstand

For equipment covered by this instruction book it is important to observe safety precautions to protect personnel from possible injury Among the many considerations personnel should be instructed to

- avoid contact with rotating parts
- avoid by passing or rendering inoperative any safeguards or protective devices
- avoid extended exposure in close proximity to machinery with high noise levels
- use proper care and procedures in handling lifting installing operating and maintaining the equipment
- do not modify this equipment – consult factory if modification is deemed necessary
- do not substitute for repair parts which can be provided by the equipment manufacturer

Safe maintenance practices with qualified personnel are imperative

Failure to heed this warning may result in an accident causing personal injury

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SECTION 1

GENERAL INFORMATION

This manual covers the installation operation and maintenance of Patterson Pump Vertical In Line Pumps The pump is a centrifugal single stage close coupled type When properly in stalled and when given reasonable care and maintenance centrifugal pumps should operate satisfactorily for a long period of time Centrifugal pumps use the centrifugal force principal of accelerating the liquid within a rotating impeller and then collecting it and converting it to pressure head in a stationary volute

The pump consists of two assemblies

1) Volute assembly or stationery part
2) Rotating element or moving parts

The back pullout design volute allows removal of the motor and integral pumping element without disconnecting the suction or discharge piping The suction and discharge flanges are on a ccomon centerline 180 deg apart The combination motor bracket and volute configura tion machined with register fits assures positive concentric alignment of pump volute and motor Suction and discharge flanges are drilled and tapped for gauge connections The volute is drilled and tapped on the underside for complete pump drain Volute wear rings are pro vided to minimize internal by passing of the liquid being pumped and to improve efficiency

SECTION II

STORAGE & PROTECTION

All pumps are shop serviced and ready for operation when delivered but there are occasions when considerable time elapses between te delivery date and the time pump is put into opera tion Equipment which is not in service should be kept in a clean dry area If equipment is to be stored for long periods of time (6 months or more) the following precautions should be taken to insure that the equipment remains in good condition

1) Be sure that motor bearings are fully lubricated
2) Unpainted machined surfaces which are subject to corrosion should be protected by some corrosive resistant coating
3) The shaft should be rotated 10 to 15 revolutions by hand periodically in order to spread the lubricant over all the bearing surfaces Suitable intervals are from one to three months depending on atmospheric conditions etc

Section II – Storage and Protection con t

4) Spece heaters on motors and controllers should be connected and fully operable if atmospheric conditions approach those experienced in operation Consult motor and controller instruction manuals for other precautions concerning storage of individual components of pumping unit

5) Fresh lubricant must be applied to bearings upon removal of equipment from stor age Check motor manual

SECTION III
INSTALLATION

3 1 Location

Several factors should be considered when selecting a location for the pumping unit The unit should be accessible for both inspection and maintenance Head room should be provided for the use of crane hoist or other necessary lifting devices The pump should be located as close as possible to the liquid supply so that the suction line is short and direct Location should require a minimum of elbows and fittings in the discharge line to minimize friction losses The unit should be protected against flooding

3 2 Mounting

The pump unit is designed to be installed in the pipe line Standard piping supports on either side of the pump should be used to eliminate pipe stresses If the pump is to be supported the bottom of the pump case has been drilled for a standard 1½ inch flange on the 4 x 3 VIP and 2 inch flange on the 5 x 3 VIP

3 3 Piping

The suction and discharge piping should be installed with the shortest and most direct runs Elbows should preferrablly be of the long radius type Pipes must line up naturally The piping must never be pulled into position by the flange bolts Pipes should be sup ported near the pump Suction piping if not properly installed is a potential source of faulty operation Suction lines should be free of air leaks and arranged so there are no loops or high spots in which air can be trapped Generally the suction line is larger than the pump suction nozzle and eccentric reducers should be used If the liquid supply is located below the pump centerline the reducer should be installed with the straight side up

Most often air enters the suction pipe entrained in the liquid Installations with a static suction lift preferably should have the inlet of the vertical suction piping submerged in the liquid to 4 times the piping diameter A large suction pipe will usually prevent the formation of vortexes or whirlpools especially if th entrance is flared A floating vortex breaker (raft) around the suction piping may be provided if a tendency appears for a vortex to form at the liquid surface A stream of liquid falling into the sump near the intake pipe will churn air into the liquid The supply line should extend down into the sump Liquid supply entering a well perpendicualr to the intake line tends to rotate the liquid which interferes with the flow into the suction line A baffle placed in front of the supply pipe will remedy this situation A short enblow shold never be bolted directly to the pump suction nozzle The disturbance in the flow caused by the sharp

bend so near the pump inlet may result in noisy operation loss in efficiency and capacity and heavy end thrust A long sweep or long radius elbow placed as far away from the pump as practical should be used if a bend is necessary in the suction line If separate suction lines cannot be used for each pump then a tapering header with Y branches should be used A straight branch header should never be used Prior to installing the pump suction piping and pump should be inspected internally cleaned and slushed If a strainer is installed in the suction line the openings in the screen must be checked and cleaned periodically The openings must be smaller than the sphere size allowed by the impeller

Discharge piping should be installed with check valve and gate valve with the check valve being between pump and gate valve The check valve prevents reverse flow and protects the pump from excessive back pressure The gate valve is used to isolate the pump for maintenance priming and starting If a diffuser is used it should be placed between pump and check valve

Stuffing box seal connection is a precision drilled passage in the volute

For Fire Protection Pumps refer to NFPA 20 piping section

SECTION IV
OPERATION

Pump rotation is clockwise when viewed from the driver end Check drive rotation to see that it matches pump rotation For a three phase motor rotation may be reversed if necessary by interchanging any two of the three power leads Rotation of single phase motors is fixed by internal wiring

WARNING Prior to startup check to see that pump turns freely by hand

If pump does not turn freely loosen motor bolts and move slightly until rubbing stops Misalignment will cause damage to shaft bearings and wear rings

4 1 Starting
When possible turn pump shaft by hand to insure that parts do not bind
Check bearing lubricant
Open valve in pump suction line if fitted
Close discharge valve
Prime the pump by venting the suction and discharge piping Vents on suction and discharge piping can be used or installed in the suction and discharge gauge connection

Start driver Open discharge valve slowly when pump is up to speed

CAUTION Overheating and/or loss of prime will result if pump is operated against a closed valve for more than a few minutes

Adjust packing gland until there is a slight leakage from the stuffing box (See Maintenance on Adjustment of Packing)

Note Should pump fail to build up pressure or discharge water when discharge valve is open ed stop pump and read section Locating Operating Difficulties

4 2 Shut Down

The pump may be stopped with the discharge valve open without causing damage How ever in order to prevent water hammer effects the discharge valve should be closed first

A Close discharge valve
B Stop driver
C Close valve in pump suction line if fitted If danger of freezing exists drain pump completely

4 3 Minimum Flow Limitation

All centrifugal pumps have limitations on the minimum flow at which they should be operated The most common limitation is to avoid excessive temperature build up in the pump because of absorption of the input power into the pumped fluid Other less understood reasons for restrictions are

1 Increased radial reaction at low flows in single volute casings

2 Increased NPSHR at low flows

3 Noisy rough operation and possible physical damage due to internal recirculation

4 Increased suction and discharge pulsation levels

The size of the pump the energy absorbed and the liquid pumped are among the considera tions in determining these minimum flow limitations For example most small pumps such as domestic home circulators service water pumps and chemical pumps have no limitations ex cept for temperature build up considerations while many large high horsepower pumps have limitations as high as 40 50% of the best efficiency point capacity The minimum safe flow for these pumps is 20 25 GPM

SECTION V
MAINTENANCE

5 1 Lubrication

Bearings The motors are shipped from factory with grease Refer to motor manufactur er s instruction manual for relubrication

Section V — Lubrication Continued

WARNING !! Proper lubrication is essential to unit operation Do not operate unit if sufficient lubricant is not present in bearing housing or if lubricant is contaminated with excessive dirt or moisture Operation of the unit under these conditions will lead to im paired pump performance and possible bearing failure Do not operate unit with exces sive amount of lubricant Such action will cause bearings to overheat

5 2 Stuffing Box

The purpose of a stuffing box is to limit or eliminate leakage of the pump fluid and to prevent air from entering the suction spaces along the pump shaft Pumps are equipped with packing (limited leakage) Normally the pumped liquid is used to lubricate the stuffing box seal For pumps equipped with packing there must always be a slight leak age from the glands The amount of leakage is hard to define but we recommend a steady dripping of liquid through the gland Stuffing box glands should be adjusted after the pump is started When leakage is excessive tighten gland bolts evenly a little at a time Allow an interval for packing to adjust a new position Never tighten gland to be leakproof as this will cause overheating and undue wear on shaft sleeves

Replace stuffing box packing as follows

1 Shut down pump

2 Take precautions to prevent driver from being inadvertently started

3 Remove gland bolt nuts and gland

4 Remove and discard old packing rings — note location of lantern ring When re packing stuffing box lantern ring must be positioned such that the water seal connection is opposite lantern ring

5 Clean out stuffing box

6 Inspect shaft sleeve for wear — if it is scored or grooved it should be replaced

7 Make sure stuffing box bushing (if furnished) is set at bottom of box

8 Insert rings of packing and tap lightly to seat against bushing Be sure rings are of the proper size and length and installed with cuts staggered Lantern ring must be installed opposite sealing water connection

9 Install gland and tighten finger tight With pump running adjust gland as described previously Care should be taken during the first hour of operation to take up on the packing gradually just enough to maintain the required amount of leakage

If pump is operated daily the stuffing box packing should be renewed about every two to three months before it gets hard and scores the shaft sleeves

5 3 Wear Ring Clearance

Running fits between wear rings is given under pump specifications When these clear ances are doubled or the capacity of the pump is reduced by 5 to 10% the rings should be renewed The purpose of these rings is to keep internal by passing of the liquid being pumped to a minimum Clearances should be checked periodically and whenever pump casing is opened Check by d rect measurement Measure ID of case ring and OD of im peller then compute clearance (ID minus OD)

Diametral clearance for the 4 x 3 VIP and 5 x 3 VIP is 012 014 inches and 016 — 018 inches respectively

SECTION VI
REPAIRS AND REPLACEMENT

WARNING!! Whenever any disassembly work is to be done on pump disconnect power source to drive to eliminate any possibility of starting unit

6 1 To Remove Impeller
(ref Pump Assembly Section)

1) Remove bolting holding volute (1) to volute cover (11)
2) Pull motor and impeller assembly from volute
3) Remove impeller (2) from motor shaft by turning impeller nut (24) counter clock wise
4) Loosen gland bolts and remove packing (13) and lantern ring (29)
5) Remove volute cover (11) to motor bolts and pull motor from cover
6) Shaft sleeve (14) and impeller key (29) can be pulled from motor shaft
7) Flinger (40) and sleeve O ring (38) can now be removed from motor shaft
8) Wear rings (25) are pressed into housings Space has been left at end of wear ring to allow for the use of a puller to remove the wear rings or they can be machined out

Visually inspect parts for damage affecting serviceab lity Check o rings and gaskets for cracks nicks or tears packing rings for excessive compression fraying or shredding and embedded particles Replace if defective in any way Bearing surfaces should be smooth and shoulders square and free of picks

Measure OD of impeller hub or impeller wear rings and ID of casing ID of casing wear ring Compute diametral clearance (ID minus OD) and compare with clearance given under pump specifications Surfaces must be smooth and concentric Examine impeller passages for cracks dents or embedded material Examine shaft sleeves for wear

6 2 Assembly

Assembly is the reverse of the disassembly procedure The following should prove helpful in reassembling pump

1) All parts inside and out should be clean Dirt & grit will cause excessive wear plus needless down time

2) New O rings and gaskets should be used when reassembling pumps

3) Install flinger (40) and sleeve O ring (38) on motor shaft

4) Press fit the wear rings (25) in the volute cover (11) and volute (1) Tap in carefully until flush with surface There should be space behind rings for future removal

5) Bolt volute cover (11) to motor Check concentricity of wear ring to motor shaft Adjust by shifting volute cover as required to get concentricity within 002 to 004 thousands

6) Install shaft sleeve (14) and impeller key (32) to motor shaft

7) Make sure impeller aligns with key and install with impeller nut (24)

8) Replace gasket (73) and bolt volute (1) to volute cover (11)

9) Check to see that pump rotates freely

10) Install packing and lantern ring

11) Be sure packing does not block seal water inlet

LOCATING OPERATING DIFFICULTIES

In the majority of cases operating difficulties are external to the pump and the following causes should be carefully investigated before undertaking repairs

No Water Delivered

a Pump not primed — indicated by no pressure on discharge

b Speed too low — indicated by low pressure on discharge

c Valve closed — indicated by high discharge head

d Impeller completely plugged up — indicated by low discharge pressure

Abnormally Small Quantities Delivered

a Air leaks in suction pipe or stuffing boxes

b Speed too low

c Discharge head higher than anticipated

d Impeller partially plugged up

e Obstruction in suction line

f Mechanical defects casing rings worn impeller damaged casing or seal defective

Insufficient Pressure

a Speed too low Might be caused by low voltage or current characteristics different from name plate reading on motor

b Air in water will cause pump to make a cracking noise

c Mechanical defects worn casing rings damaged impeller defective casing or seal

Intermittent Operation

a Leaky suction line

b Water seal plugged (Hence leaky stuffing box)

c Suction lift too high

d Air gas or vapor in liquid

Pump Overloads Driver

a Speed too high

b Head lower than rated hence pumping too much water (This is valid for low specific speed pumps)

c Mechanical defects stuffing boxes too tight shaft bent rotating element binds

d Rubbing due to foreign matter in pump between case rings & impeller

Pump Vibrates

a Misalignment

b Foundation not sufficiently rigid

c Impeller partially clogged

d Mechanical defects bent shaft rotating element binds bearings worn coupling defective

e Suction and Discharge pipes not anchored

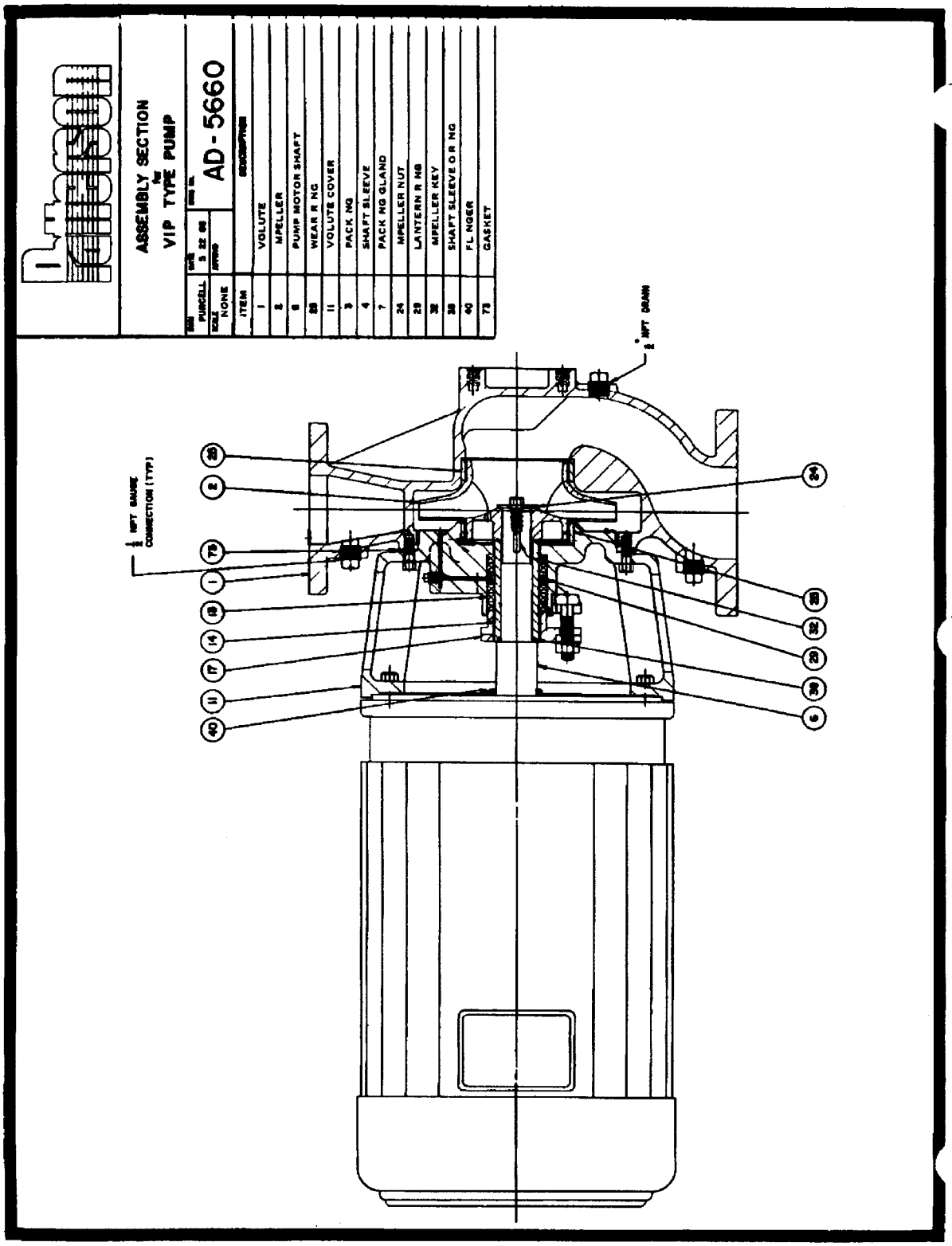
f Pump cavitating from too high a suction lift

g Air entrainment in the pump suction due to low submergence

RECOMMENDED SPARE PARTS FOR IN LINE PUMPS

Ref Assembly Section

ITEM	DESCRIPTION
2	Impeller
25	Wear Rings
13	Packing
14	Shaft Sleeve
26	Impeller Screw
32	Impeller Key
38	Shaft Sleeve O Ring
40	Flinger
73	Gasket
69	Impeller Washer


ASSEMBLY SECTION
for
VIP TYPE PUMP
AD-5660
ITEM
DESCRIPTION
1 VOLUTE
2 IMPELLER
6 PUMP MOTOR SHAFT
8B WEAR R NG
11 VOLUTE COVER
3 PACK NG
4 SHAFT SLEEVE
7 PACK NG GLAND
24 IMPELLER NUT
29 LANTERN R NG
32 IMPELLER KEY
33 SHAFT SLEEVE O R NG
40 FL NGER
73 GASKET
1/2 NPT DRAIN
1/2 NPT GAUGE CONNECTION (TYP.)