MODEL THF, TYF, TXF, and HYF HORIZONTAL SPLIT CASE FIRE PUMPS

INSTALLATION, OPERATION, AND MAINTANCE

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Indianapolis, IN 46202

CONTENTS

Our policy is one of continuous improvement and we reserve the right to alter specifications of our products at any time.

INTRODUCTION

1.1 GENERAL

The pumps covered by this manual, when correctly installed and maintained, will give long and reliable service. It is essential therefore that the instructions given here are followed at all times.

1.2 WARRANTY

New equipment manufactured by Peerless Pump Company (Seller) is warranted to be free from defects in material and workmanship under normal use and service for a period of one year from date of shipment, Seller's obligation under this warranty being limited to repairing or replacing at its option any part found to be so defective provided that such part is, upon request, returned to Seller's factory from which it was shipped, transportation prepaid.

This warranty does not cover parts damaged by decomposition from chemical action or wear caused by abrasive materials, nor does it cover damage resulting from misuse, accident, neglect, or from improper operation, maintenance, installation, modification or adjustment.

This warranty does not cover parts repaired outside Seller's factory without prior written approval. Seller makes no warranty as to starting equipment, electrical apparatus or other material not of its manufacture, since the same are usually covered by warranties of the respective manufacturers thereof.

In the event, notwithstanding the terms of this agreement, it is determined by a court of competent jurisdiction that an express warranty has been given by Seller to Purchaser with respect to the head, capacity or other like performance characteristics of said equipment, Seller's liability for breach of the same shall be limited to accepting return of such equipment F.O.B. plant of manufacture, refunding any amount paid thereon by Purchaser (less depreciation at the rate of 15% per year if Purchaser has used equipment for more than thirty (30) days) and canceling any balance still owing on the equipment.

Peerless Pump Company in no event will be liable for indirect or consequential damages.

This warranty is expressly in lieu of any other warranties, expressed or implied, and seller specifically disclaims any implied warranty of merchantability or fitness for a particular purpose.

1.3 PUMP IDENTIFICATION

An identification plate is attached to the body of all pumps and contains the following minimum information: PUMP TYPE, SERIAL No., CAPACITY, SPEED, HEAD.

Additional information may also be given covering impeller details, materials used, sales order line number etc. Reference should be made to this data when reading the manual.

1.4 HEALTH and SAFETY

1.4.1 GENERAL

I. QUALIFICATION AND TRAINING OF PERSONNEL
Personnel responsible for the installation, startup, operation and maintenance of this pump unit must be adequately qualified for their respective tasks. Scope of responsibility must be defined by the operator and appropriate supervision provided. The operator should also ensure that the contents of this manual are fully understood by the personnel.

II NON-COMPLIANCE WITH SAFETY INSTRUCTIONS
Non-compliance with safety instructions may produce a risk to personnel as well as to the environment and the pump unit, and result in loss of any right to claim damages.

Risks may include:

a. Failure of the pump unit.

b. Exposure of people to electrical, mechanical and chemical hazards.

c. Endangering the environment by releasing hazardous substances.

III COMPLIANCE WITH SAFETY AT WORK REGULATIONS
When operating the pump unit, the instructions contained in this manual, the relevant national accident prevention regulations and any other service and safety instructions issued by the operator are to be observed.

IV UNAUTHORIZED ALTERATIONS AND FITTING OF SPARE PARTS
Modifications should not be carried out without consultation with Peerless Pump Company In the interests of safety and reliability only fit spare parts supplied with Peerless Pump Company Failure to comply in these respects could affect warranty.

V. UNAUTHORIZED USE
Pump performance and reliability can only be guaranteed providing that it is used in the manner and for the purpose for which it was intended.

1.4.2 SPECIFIC RECOMMENDATIONS

1.4.2.1 Your safety and that of others must always be the first consideration when working on machines. Safety is a matter of understanding the operations being undertaken and the potential dangers. Be on your guard at all times.

WARNING! The following health and safety recommendations must be strictly observed.

(1) While this pump unit has been designed to be safe under normal operating conditions, there are potential hazards which the operator should be aware of. These can include: rotating components; electrical potentials; high temperature exhaust surfaces and gases (where diesel driven); and hazardous fluids.

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(2) When lifting the unit ensure that all lifting equipment has a safe working load rating, suitable for the operation. Only perform lifting operations using suitably trained personnel, and in line with instructions contained in this manual.

(3) Persons working on the unit should always wear suitable protective clothing and footwear. Loose, frayed or baggy clothing and light footwear can be extremely dangerous. Clothing impregnated with oil or similar can constitute a health hazard through prolonged contact with the skin and may also create a fire risk. Wear protective goggles and gloves when handling battery acid.

(4) Liquids used with some pump units are harmful if taken internally or come into contact with unprotected skin or eyes. In the event of an accident, obtain qualified medical assistance immediately.

(5) Always ensure that all guards supplied are correctly installed following any maintenance operation.

(6) Ensure that the pump unit is not run outside its operational limits. This can put the unit under excessive loads and cause breakdown.

(7) Before starting any repairs disconnect power to the pump driver and place a conspicuous notice is displayed warning that the unit is under repair. If a major overhaul is being carried out it is advisable to have a qualified electrician temporarily disconnect the unit.

1.4.2.2 PUMP HAZARDS

(1) Ensure that the pump has no air in the suction line and casing. The pump rotating components rely on the liquid being pumped for cooling and lubrication. A failure to prime could result in pump failure.

(2) Pump operation with insufficient lubrication to the bearings could result in overheating and seizure, with potentially catastrophic results.

(3) Where soft packed sealing is used it is essential that a small leakage is present. Over tightening of the gland will result in damage to the packing, scoring of the shaft or sleeves and bearing seizure.

(4) Ensure that all pressure has been released before working on the unit.

(5) Always check that the drive shafts are correctly aligned following installation. Failure to do so could result in reduced life or a possible failure of the coupling, or bearings. (see Section 2.7).

1.4.2.3 HAZARDS RELATED TO ENGINE DRIVEN PUMP UNITS

(1) When working with gaseous fuels, ensure that the area is well ventilated and avoid open flames, smoking, sparks etc. A Carbon Dioxide fire extinguisher should be kept close at hand.

(2) Parts of the package, in particular, the exhaust system and engine surfaces can become very hot during and after operation and can cause severe burns.

(3) Beware of the danger of scalding when removing cooling system pressure caps and hoses,

or draining engine oil. Allow the system to cool first, then remove caps slowly.

(4) Rectify all water, oil or fuel leaks immediately and clean up any spillage.

(5) Before carrying out any work on the pump unit confirm that the fuel and electrical supplies to the engine are isolated correctly, and that there is no danger that it can be started. A conspicuous notice should be placed on the unit warning others that the unit is under repair.

1.4.2.4 PUMP UNITS FITTED WITH ELECTRONIC COMPONENTS

CAUTION Damage can occur to the internal components when electric welding or high voltage "Megger" tests are carried out. Electronic components should always be disconnected before carrying out any work of this kind.

2. INSTALLATION

2.1 RECEIVING PUMP

On receipt of pump, a visual check should be made to determine if any damage has occurred in transit. Typical points to look for, are:

a. Broken or cracked equipment e.g. base plate, motor, pump feet and flanges.

b. Bent shafts.

c. Damaged motor end bells, bent eyebolts or damaged boxes.

d. Missing items.

Loose parts are often wrapped individually and/or fastened to the equipment. If any damage or losses have occurred notify the transit company immediately and PEERLESS PUMP COMPANY.

When unloading pump units, only lift using the lifting eyes on the base plate or support frame. DO NOT USE THE LIFTING POINTS ON THE PUMP OR MOTOR

Pump and motor shafts are in alignment when shipped, however the alignment must be re-checked before use.

2.2 TEMPORARY STORAGE

If the pump is not to be installed immediately it should be stored in a clean, dry area, with protection from moisture, dust, dirt and foreign bodies. In particular, the following action should be taken:

a. Ensure the bearings are packed with the recommended grease, to prevent moisture from entering around the shaft.

b. Remove the glands, packing and lantern rings from the stuffing box, where soft packed sealing is used.

c. Check that the pump suction and discharge ports are covered to prevent foreign objects entering.

d. If, for a short period only, the pump has to be stored outside it should be covered to protect it from the effects of the weather.

e. Every 6 weeks, rotate the pump shaft to prevent bearing pitting.

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PREPARATION

Before installing the pump, clean the suction and discharge flanges thoroughly and remove the protective coating from pump shafts, where applicable.

If the pump has been in storage and prepared in the manner as above, the bearing grease should be removed, the bearings cleaned (using an approved cleaning fluid) and then re-lubricated following the procedure detailed in Section 4. It is strongly recommended that this work is carried out by PEERLESS PUMP COMPANY Service. This is a chargeable service; however pump warranty will be protected.

2.4 LOCATION

The pump should be installed as near to the liquid source as possible, with the shortest and most direct suction pipe practical.

Allow sufficient accessibility for inspection and maintenance, and ample headroom should be allowed for the use of an overhead crane or hoist sufficiently strong to lift the unit.

Where pumps are electric motor driven, power source electrical characteristics should be appropriate for those shown on motor data plate.

2.5 FOUNDATION

The foundation should be sufficiently substantial to absorb vibrations and rigid enough to avoid any twisting or misalignment. As a rough guide it should be 12 inches wider on all sides with the weight at least 1-1.5 times as heavy as the pump unit. Depth should be sufficient to achieve the necessary weight and deep enough to accommodate holes for foundation bolts. A suitable concrete mixture by volume is 1:2:3 (Cement : Sand : Aggregate). The foundation should be reinforced with layers of 6 inch square No.8 gauge steel wire fabric, or equivalent, horizontally placed 6 inch apart.

Loose bolt type anchors should be checked for tightness periodically, as there is a tendency to loosen with vibration. Chemical type anchors are a suitable alternative.

2.6 INSTALLATION OF BASE PLATES

Foundation concrete should be poured without interruption to within .5 to 1.5 inch of the finished height. The top surface should be well scored and grooved, before the concrete sets, to provide a bonding surface for the grout. The foundation should be allowed to cure for several days before the base plate is shimmed and grouted.

Chemical Anchor type foundation bolts are recommended as these are less inclined to loosen in service, and generally simplify installation. Manufacturer's instructions for installation and final torque figures should be rigorously followed. Allow enough bolt length for grout, shims, lower base plate flange, nuts and washers. Anchor bolt diameter should be the largest capable of being inserted through the base plate foundation holes.

For installation purposes, base plates can generally be divided into 4 different categories:

a. Channel Section

b. Folded Sheet Metal with side flange

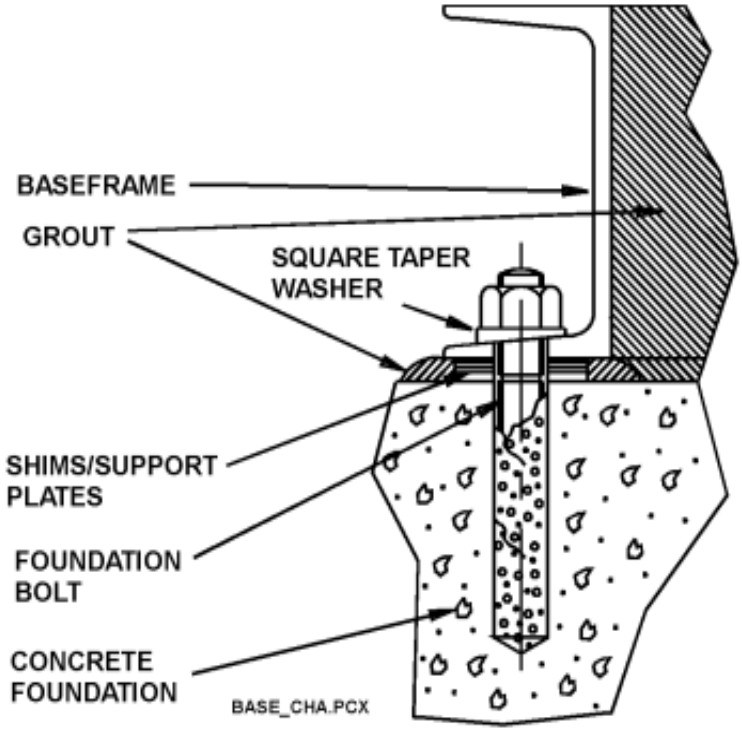
c. Folded Sheet-metal without side flange

d. Box Section, and Cast Iron base plates.

e. Follow the appropriate installation procedure.

2.6.1 INSTALLATION FOR CHANNEL SECTION BASE PLATES

Position pump unit and mark through base plate fixing bolt holes. Move pump unit to one side and drill holes for foundation bolts. Install foundation anchors in line with manufacturers instructions. Reposition pump unit using blocks and shims under the base for support either side of foundation bolts, and midway between the bolts, to locate the base approximately 1 inch above the concrete foundation with the studs extending through the holes in the base plate.



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Add or remove shims under the base to level the pump-shaft of horizontally mounted pump units. The base plate itself does not have to be level.

Torque down foundation nuts tight against the base plate and observe pump and motor shafts or coupling hubs for alignment.

Note: Square tapered washers should be used on the channel section flanges, to ensure that the foundation bolts are not bent.

Grout base plate in completely using non-shrink grout and allow it to dry thoroughly before attaching piping to pump (24 hours is sufficient time with the approved grouting procedure).

The suction and discharge piping should be installed after the pump unit, ensuring that no pipe strain is placed on either flange, and that both pump and pipe flanges are square to each other

GROUTING PROCEDURE

Grouting compensates for uneven foundations, distributes weight of unit and prevents shifting. Use an approved, non-shrinking grout as follows:

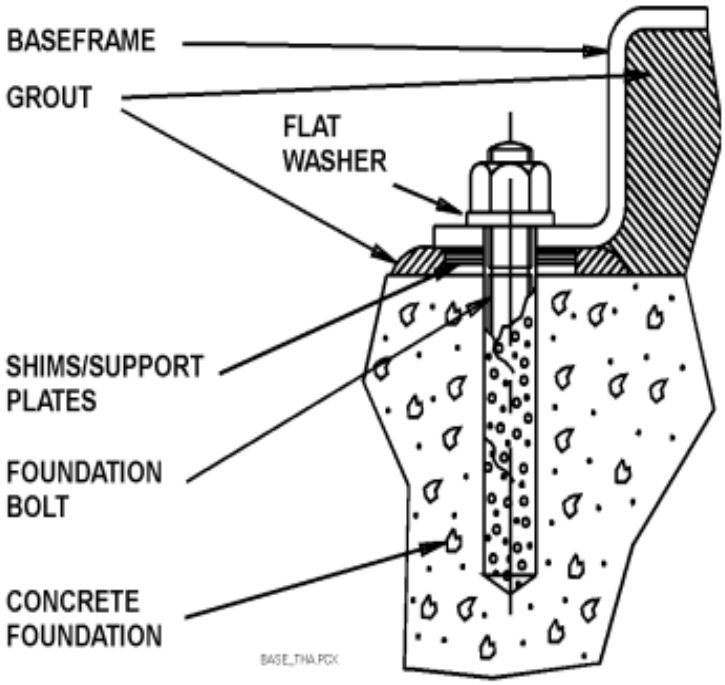
Soak top of concrete foundation thoroughly, then remove surface water. Completely fill base plate with grout.

After grout has thoroughly hardened check foundation bolts and re-tighten if necessary, then re-check alignment.

Approximately 14 days after the grout has been poured or when the grout has thoroughly dried, apply an oil based paint to the exposed faces of the grout to prevent air and moisture from coming into contact.

2.6.2 INSTALLATION FOR FOLDED METAL BASE PLATES WITH SIDE FLANGES

Move pump unit into position and drill holes using base plate foundation holes as a guide. Install anchors in line with manufacturers instructions. Use blocks and shims under the base for support, either side of foundation bolts and midway between bolts, to raise the base approximately 1 inch above the concrete foundation.



Add or remove shims under the base to level the pump-shaft. The base plate itself does not have to be level.

Torque down fixing nuts tight against the base plate and observe pump and motor shafts or coupling hubs for alignment.

Flat plain washers should be used on top of the flanges.

Grout base plate in completely using non-shrink grout and allow it to dry thoroughly before attaching piping to pump (24 hours is sufficient time with the approved grouting procedure). See procedure detailed under Channel Section base plate.
The suction and discharge piping should be installed after the pump unit, ensuring that no pipe strain is placed on either flange, and both pump and pipe flanges are square to each other.

2.6.3 INSTALLATION FOR FOLDED METAL BASE PLATE WITHOUT SIDE FLANGES

Position base plate and, using a long enough bit, drill through the holes in the base plate. It may be necessary to move the pump unit in order to complete the foundation bolt installation, which should be done in line with manufacturers instructions.

Use blocks and shims under base for support, either side of foundation bolts and midway between bolts, to position base approximately 1 inch above the concrete foundation with studs extending through holes in the base plate.

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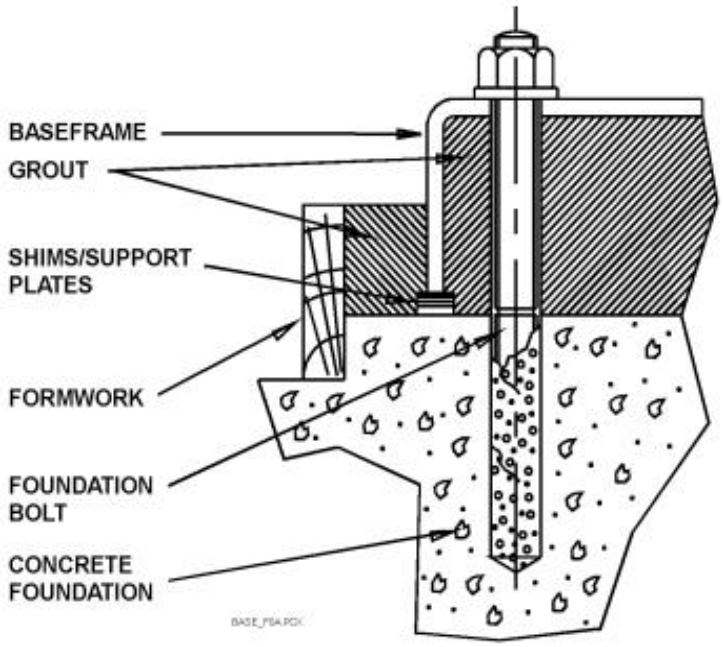


Add or remove shims under the base to level the pump-shaft. The base plate itself does not have to be level.

Grout base plate in completely and allow grout to dry thoroughly before attaching piping to pump (24 hours is sufficient time with the approved grouting procedure).

The suction and discharge piping should be installed after the pump unit, ensuring that no pipe strain is placed on either flange and that both pump and pipe flanges are square to each other.

GROUTING PROCEDURE

Grouting compensates for uneven foundations, distributes weight of unit and prevents shifting. Use an approved, non-shrinking grout as follows, after setting and leveling unit:

Build strong form work around foundation to contain grout.
Soak top of concrete foundation thoroughly, then remove surface water.

Completely fill base plate with grout.

After grout has thoroughly hardened, torque down foundation bolts, then re-check alignment. Flat plain washers should be used on top of the base plate.

Approximately 14 days after the grout has been poured or when the grout has thoroughly dried, apply an oil based paint to the exposed faces of the grout to prevent air and moisture from coming into contact.

2.6.4 INSTALLATION FOR BOX SECTION AND CAST IRON BASE PLATES.

Foundation concrete should be prepared in line with the General recommendations and allowed to cure for several days. Height should be only slightly below finished to allow for shimming.

Suction piping may be installed in advance and the pump unit positioned and shimmed to align with it, taking care that no strain is put onto the pump flange. Once positioned, holes can be drilled directly

through the base plate lugs and fixtures inserted without disturbing the position of the pump unit.

Add or remove shims under the base to level the pump-shaft of horizontally mounted pump units. The base plate itself does not have to be level.

Filling the frame with grout is not necessary, and is a purely optional detail, for aesthetic or cleanliness reasons only. The delivery piping can be connected after pump unit installation, again ensuring no strain is placed on the pump flanges.

After completion, foundation bolts should be checked for tightness, then alignment checked.

2.7 ALIGNMENT PROCEDURE (Excluding Cardan Shafting)

The pump driver, if supplied, is correctly aligned on its base plate at the factory. A certain amount of deformation of the base plate is possible during transit and it is therefore essential to check alignment, prior to final grouting and start up.

A flexible coupling will only compensate for a small amount of misalignment and should not be used to compensate for excessive misalignment of the pump and driver shafts. Inaccurate alignment results in vibration and excessive wear on the bearings, sleeve or shaft, and wear rings.

There are three forms of misalignment::

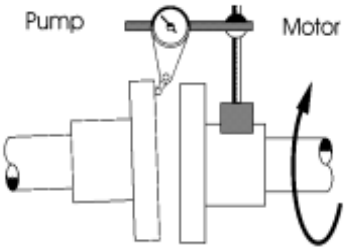
a. Angular

b. Parallel

c. Axial

2.7.1 ANGULAR - shafts with concentric axes but not parallel.

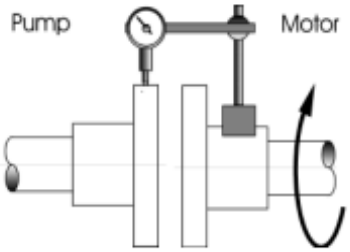
To check for angular alignment, mount a dial gauge on either flange and rotate it against the other flange close to its edge. The variation in reading should generally be within .003 inch, unless coupling details state otherwise.



2.7.2 PARALLEL - shafts with axes parallel but not concentric.

To check for parallel alignment, mount a dial gauge on either hub and rotate it against the outer diameter of the other hub. Alignment is ideally correct when there is no variation in the reading. Check coupling details for specific limits.

In both Angular and Parallel Alignment adjustments can be made by shimming under the driver mounting feet. After each adjustment, it is necessary to recheck all features of alignment.



2.7.3 AXIAL - the distance between the shaft ends should be correct.

Axial alignment should be checked last and can be achieved by moving the coupling hubs relative to the shafts. The distance between the shaft ends (DBSE) should be as stated on the General Assembly (GA) drawing, or in the coupling data.

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Alignment should be performed after the base plate has been properly set and grout has dried thoroughly according to instructions. Final alignment should be made by shimming the driver only.

2.8 SUCTION AND DISCHARGE PIPING

The following precautions should be observed during installation:

In the case of channel section and folded metal base plates without side flanges, piping should be run to the pump. Do not move pump to pipe, this could make final alignment impossible.

Both suction and discharge piping should be supported independently and close to the pump so that no strain is transmitted to the pump when the flange bolts are tightened. Use pipe hangers or other supports at intervals necessary to provide support. When expansion joints are used in the piping system, they must be installed beyond the piping supports closest to the pump.

Install piping as straight as possible, avoiding unnecessary bends. Where necessary, use 45□ or long sweep 90□ fitting to decrease friction losses.

Make sure that all piping joints are air tight. Provide pipe expansions when hot fluids are to be pumped. Where reducers are used, eccentric reducers are to be fitted in suction lines and straight taper reducers in discharge and vertical lines. Undulations in the pipe runs are also to be avoided. Failure to comply with this may cause the formation of air pockets in the piping and thus prevent the correct operation of the pump.

The suction pipe should be as short and direct as possible, and should be flushed clean before connecting to the pump. Horizontal suction lines must have a gradual rise to the pump.

The discharge pipe is usually preceded by a non-return valve or check valve and a discharge gate valve. The check valve is to protect the pump from excessive back pressure and reverse rotation of the unit and to prevent back flow into the pump in case of stoppage or failure of the driver. The discharge valve is used in priming, starting and when shutting down the pump.

FM FIREPUMP INSTALLATIONS (Loss Prevention Data 3-7N/13-4N)

Table 2-20 The diameter of the suction pipe, discharge pipe and gate valve should not be less than that shown in the Table.

Para.3-1.2 The horizontal centrifugal fire pump in horizontal or vertical position should not be used where a static suction lift is involved.

3 OPERATION

3.1 BEFORE STARTING (After Installation or Maintenance)

Before initially starting the pump, make the following inspection:

The unit base plate must be grouted (where applicable), and bolted to the foundation.

Make sure all rotating parts are found to be free when turned by hand.

Ensure motor is correctly wired to its starting device. Check that the voltage, phase and frequency on the motor nameplate are correct for the line circuit.

Confirm correct direction of motor rotation prior to coupling to pump. Check by starting motor and switching off immediately, observing rotation is the same as the arrow direction on the pump casing.

Check the alignment between pump and motor.

Check bearing lubrication is provided (see lubrication section). Also check driver lubrication.

If the pump has soft packed sealing, check that the stuffing box has been packed.

Close drain valves. Ensure that the pump is primed. Never run the unit dry. The liquid in the pump serves as a lubricant for close running fits within the pump and the pump may be damaged if operated dry. Vent and drain plugs are provided either in the casing, or in external piping.

Suction piping should have been flushed clean during installation. Failure to do this is a common reason for startup failures.

3.2 STARTING

Close valve in discharge line. Open fully all valves in the suction line.

Turn on seal water to the stuffing box where external pipe supplied.

Prime the pump and start the pump driver.

When the pump is operating at full speed, open the discharge valve slowly.
Do not operate the pump for prolonged periods with a closed discharge valve, so as to avoid overheating.

The pump should be shut down at once and the trouble corrected if the pump is running at its rated speed and found to have any of the following defects:

a. No liquid delivered.

b. Not enough liquid delivered.

c. Not enough pressure.

d. Loss of liquid after starting.

e. Excess vibration.

f. Motor runs hot.

g. Pump bearing overheating.

3.3 RUNNING

While the pump is running, a periodic inspection should be made of:

a. Bearings - Check the bearings for temperature, which should not normally exceed 158°F (70□C), after running in period.

b. Stuffing Box (if Soft Packed) - Ensure there is sufficient leakage to lubricate the packing.

c. Suction and discharge gauge readings (if included).

3.4 STOPPING

a. Slowly close delivery valve, then shut down driving unit in accordance with manufacturer's instructions.

b. Shut off external sealing liquid supply to relieve stuffing box pressure, where fitted.

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c. Successful operation of the pump depends on accurate coupling alignment. It is recommended that the alignment is re-checked after the preliminary run.

TABLE 1 FAULT FINDING CHART (for Electric Motor driven sets)

PROBABLE CAUSES	POTENTIAL FAULT OR DEFECT: No liquid delivered	Insufficient liquid delivered	Liquid delivered at low pressure	Loss of liquid after starting	Excessive vibration	Motor runs hot	Excessive noise from pump cavitation	Bearings or stuffing gland overheats	REMEDIAL ACTION (See Table 2)
Pump not primed	□								1
Speed too low	□	□	□						2
Speed too high						□	□		3
Air leak on suction	□	□	□	□	□				4
Air or gas in liquid	□	□	□	□	□				5
Discharge head too high (above rating)	□	□	□	□		□			6
Suction lift too high	□	□	□				□		7
Not enough suction head for hot liquid	□	□	□	□			□		8
Inlet pipe not sufficiently submerged	□	□		□	□		□		
Liquid viscosity greater than rating	□	□	□			□		□	9
Liquid density greater than rating						□		□	10
Insufficient net inlet head	□	□	□	□	□		□		11
Impeller plugged up	□	□	□		□		□	□	12
Wrong direction of rotation	□	□	□				□		13
Excessive wear ring clearance		□	□						14
Damaged impeller		□	□		□		□		15
Rotor binding					□	□			16
Defect in motor						□			17
Voltage/frequency lower than rating			□			□			18
Lub. oil dirty or contaminated								□	19
Foundation not rigid					□				20
Misalignment of pump/driver					□	□		□	21
Bearing worn					□	□		□	22
Rotor out of balance					□			□	23
Bent or damaged pump shaft					□	□		□	24
Impeller undersize		□	□						25
Air leak in stuffing box		□	□	□					26

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TABLE 2 FAULT RECTIFICATION CHART

FAULT	CAUSES	REMEDY
1	Pump not primed - lack of prime-incomplete priming.	Fill pump and suction pipe completely with liquid.
2	Speed too low	Check whether motor is directly across-the-line and receiving full voltage. Frequency may be too low. Motor may have an open phase.
3	Speed too high.	Check voltage on motor.
4	Air leak in suction. Loss of prime.	If pumped liquid is water or non-explosive, find leak using flame around flanges. For such liquid as gasoline, suction line can be tested by shutting off or plugging inlet and putting line under pressure. Rectify leak as appropriate. Check for leaks in suction pipe joints and fittings; vent casing to remove accumulated air.
5	Air or gas in liquid.	May be possible to over rate pump to the point where it will provide adequate pressure despite condition.
6	Discharge head too high	Check pipe friction losses. Larger piping may correct condition. Check that valves are fully open.
7	Suction lift too high.	If no obstruction at inlet, check for pipe friction losses. Static lift may be too great, measure with vacuum gauge while pump operates. If static lift is too high, liquid to be pumped must be raised or pump lowered.
8	Not enough suction head for liquid	Consult PEERLESS PUMP COMPANY.
9	Viscosity of liquid greater than rating.	Use large driver. Consult supplier for recommended size.
10	Liquid heavier than rating.	Use larger driver. Consult supplier for recommended size.
11	Insufficient net inlet head.	Increase positive suction head on pump by lowering pump.
12	Impeller plugged up or partially choked.	Dismantle pump and clean impeller.
13	Wrong direction of rotation.	Check motor rotation with directional arrow on pump casing.
14	Excessive wear ring clearance.	Dismantle, inspect and replace if necessary.
15	Damaged impeller.	Inspect impeller. Replace if damaged, or vane sections are badly eroded.
16	Rotor binding.	Check deflection of rotor. Check bearings for damage or excessive wear.
17	Defects in motor.	Check any motor defects. The motor may not be ventilated properly due to a poor site location.
18	Voltage and/or frequency lower than rating.	The voltage and frequency of the electrical current may be lower than that for which the motor was rated. Consult supplier for correct supply.
19	Lubricating oil/grease dirty, or contaminated.	Clean bearings and bearing housings as per instructions and re-lubricate.
20	Foundation not rigid.	Check if foundation bolt nuts are drawn tight against base. Check the foundations comply with the recommendations in instructions.
21	Misalignment of pump and driver.	Realign pump and driver.
22	Bearing worn.	Check bearings for damage and excessive wear. Any irregularities will cause a drag on the shaft.
23	Rotor out of balance	Check for causes. Consult supplier.
24	Shaft bent.	Check deflection of rotor. Total indicator run-out should not exceed 0.002 inch (0.05mm) on shaft and 0.004 inch (0.1mm) on impeller wear ring surface.
25	Impeller too small.	Check with supplier to see if a larger impeller can be used, otherwise cut pipe losses or increase speed or both, but be careful not to overload driver.
26	Air leak in stuffing box.	Increase seal lubricant pressure to above atmosphere.

OTHER	Obstruction of liquid passages.	Dismantle pump and inspect passages of impeller and casing. Remove obstruction.
	Defective packing.	Replace packing and sleeves if badly worn.

4. MAINTENANCE

4.1 ROUTINE MAINTENANCE

This section gives details of routine preventative maintenance. Where repair or major overhaul is required please contact PEERLESS PUMP COMPANY SERVICE.

4.1.1 GENERAL

Routine maintenance is essential to maintain the plant in a serviceable condition, and a sound insurance against enforced inopportune shutdown.

A high degree of cleanliness of equipment and surrounding areas should be maintained during all maintenance procedures.

4.1.2 FREQUENCY OF INSPECTIONS

A general guide is shown in Table 3.

Depending on operation and environmental conditions together with a comparison of previous inspections, the frequency may be altered to maintain satisfactory operation of the plant to suit established operating procedures.

4.2 LUBRICATION

GREASE LUBRICATED BEARINGS

Bearings are initially lubricated during manufacture or re-assembly. The re-greasing interval depends upon the running speed of the unit:

TABLE 3 BEARING RE-GREASING INTERVALS

PUMP RUNNING SPEED	RE-GREASING INTERVAL	AMOUNT OF GREASE
1450/1750 RPM	5000 HOURS	2 OUNCES
2950/3550 RPM	3000 HOURS	2 OUNCES

To recharge the bearings with fresh grease, use a grease gun through the two lubricating nipples provided.

DO NOT APPLY LUBRICANT WHEN PUMP IS RUNNING.

Every 10,000 hours or 2 years, remove bearings from pump, de-grease, thoroughly clean, recharge with fresh grease and refit in accordance with re-assembly instruction;

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Recommended grease:

Texaco Regal Multifak All purpose EP2 (or equivalent)

4.3 BEARINGS - GENERAL

These instructions do not supersede any information issued by the bearing manufacturers, to whom application should be made for more comprehensive literature.

Care and maintenance of bearings is a matter of ensuring that they are:

a. Correctly lubricated at intervals.

b. Removed, cleaned and refitted with care.

c. Tools used and work areas should be clean.

To remove a bearing, use correctly suited withdrawal equipment. If other means are not available, a hammer and soft metal drift may be used to tap evenly around the circumference of the inner ring.

CAUTION: Damage can be caused by exerting force against the outer ring of a ball bearing.

Ball bearings should not be dismantled.

Clean bearings thoroughly with an approved fluid.

Dry the bearings with dry compressed air. Do not spin a clean dry bearing. All the cleaning fluid must be removed from the bearing since it might damage the lubricating properties of the grease.

Inspect the bearing for wear, fractures, cracks, corrosion or other damage which may necessitate bearing replacement.

Work approximately 1 ounce of grease into both sides of bearing immediately after drying and inspecting, to prevent corrosion.

Check that the bearing, shaft and housing are clean and undamaged.

When fitting the bearing on the shaft, the use of a soft drift and hammer should be avoided if possible. The drift could shed flakes of metal into the bearing. If a lock nut is used to "push-home" the bearing then a special hook or "C" spanner must be used to turn it. A drift and hammer applied to one slot would cause damage to the nut and introduce flakes of metal into the bearing. The tab washer should not be in place during this procedure since there is a risk of shearing off the inner tab. The nut should be removed when the bearing is fully pushed home then the tab washer placed in position and the nut refitted.

In general soaking bearings in a hot oil bath prior to fitting to the shaft is recommended.

After assembly and when the bearing housings are in position, the bearing housing cavity incorporating the grease nipple should be fully charged with the recommended grease leaving the cavity on the other side of the bearing free of grease.

4.4 SOFT PACKED SEALING

Fire pumps are supplied with packed stuffing boxes with seal lubrication by copper pipe.

GLAND PACKING REPLACEMENT

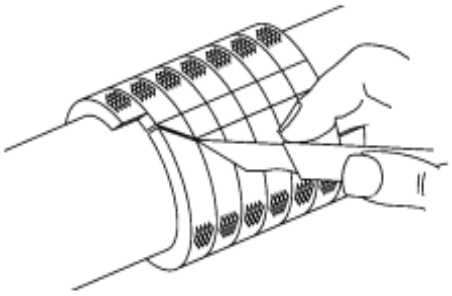
Disconnect power to the pump driver, close all valves and relieve any liquid pressure. Remove gland, gland packing, lantern ring and split bush or neck ring (where installed). A screw type packing ring extractor will aid removal but take care not to damage the stuffing box. During removal take careful note of the order and position of the parts so that the reverse procedure can be carried out for re assembly. Various different arrangements of sealing are employed with the following combinations of parts being three variations:

a. Soft packing + lantern ring

b. Split bush + lantern ring + soft packing

c. Neck ring + 2 off lantern rings + soft packing

Clean and inspect all components for wear and surface finish. If satisfactory, cut new rings diagonally at 45□ as shown in Figure 4.4.1. using a dummy shaft of the same diameter as the pump shaft.



SOFT PACKING INSERTION

4.4.1 Soft packing + lantern ring

Insert the first packing ring and tap to the bottom of the stuffing box. Each following ring should be installed in the same manner ensuring that the cut in each packing ring is rotated approximately 120° to the last.

Install the lantern ring in the appropriate position aligning with the lubrication connection. Make allowance for the lantern ring to be pushed deeper into the stuffing box during adjustment.

4.4.2 Split bush + lantern ring + soft packing

Install the split bush and push to the bottom of the stuffing box followed by the lantern ring. Check that the lantern ring aligns with the lubrication connection.

4.4.3 Neck ring + 2 lantern rings + soft packing

Install the neck ring and push to the bottom of the stuffing box followed by the lantern ring. Check that the lantern ring aligns with the lubrication connection.

Insert the first packing ring and tap it down to the lantern ring. Install the following ring in the same manner ensuring that the cut in the packing ring is rotated approximately 120° to the first.
Install the second lantern ring followed by the last packing ring.

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FINAL RE ASSEMBLY

The last packing ring should never protrude beyond the stuffing box face thus allowing the gland follower to 'start' in the stuffing box. If this is not the case, then dismantle and check that the correct number of rings have been used and that they have seated correctly.

Bring the gland follower up squarely against the last packing ring and finger tighten the securing nuts evenly.

Turn the shaft to ensure that no binding is taking place.

Pressurize the stuffing box, ensuring their is no trapped air. The gland should start to leak heavily almost immediately. If it does not stop the pump immediately and investigate.

GLAND FOLLOWER ADJUSTMENT

After the pump has been running for 10 minutes at full pressure, adjust the follower nuts by one sixth of a turn every 10 minutes until there is a small leakage only. This leakage is essential to ensure packing is lubricated.

TABLE 4 ROUTINE MAINTENANCE CHART

Every Week	Visually check for leaks. Check for vibration. Hand test bearing housing for any sign of temperature rise. Adjust gland as necessary to maintain slight leakage.
Every Month	Check bearing temperature with a thermometer.
Every 3 Months	Check running hours and consult re-lubrication interval chart. Check grease lubricated bearings for saponification - i.e. signs of any deposits, oil separation and undue hardening and softening of grease.
Every 6 Months	Check running hours and consult re-lubrication interval chart. Check soft packed gland packing, where fitted, and replace if necessary. Check shaft or shaft sleeve for scoring. Check alignment of pump and motor. Check holding down bolts for tightness. Check coupling for wear.
Every Year	Check rotating element for wear. Check wear ring clearances. Clean and re-grease bearings. Check running hours and consult re-lubrication interval chart.

Maintenance Record

Date	Summary of maintenance and repairs done - replacement parts installed etc.:
	Installed and Startup.

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