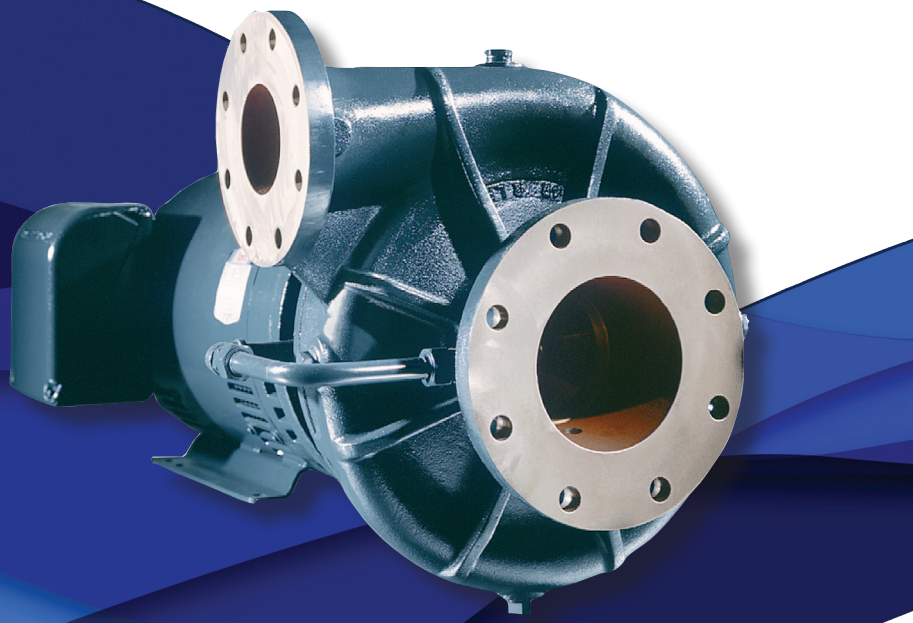
CORNELL®

EFFICIENT BY DESIGN

INSTALLATION & CARE OF

CORNELL GENERAL PURPOSE PUMPS



AGRICULTURE FOOD INDUSTRIAL MINING MUNICIPAL OIL & GAS REFRIGERATION RENTAL

ISO9001:2008 CERTIFICATION

Cornell Pump Company proudly maintains its ISO9001:2008 certification which validates that Cornell is in compliance with all necessary processes to meet customer requirements.

The elements associated with ISO 9001:2008 certification include such areas as contract review, design and development, production, purchasing, quality control and service.

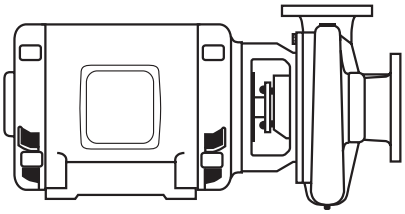
CORNELL®
EFFICIENT BY DESIGN

Printed and Bound in the U.S.A.

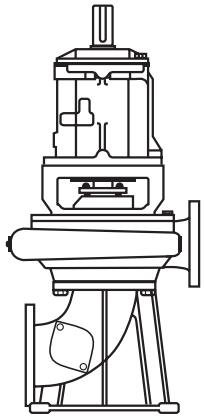
CONTENTS

This booklet is a general guide only for general purpose pumps. Applications and field conditions vary. If you have questions about a specific application, ask us or a qualified engineer. The suggestions in this booklet are not intended as engineering specifications for individual applications. Cornell Pump Company makes no performance warranty of the information contained herein with respect to any particular application.

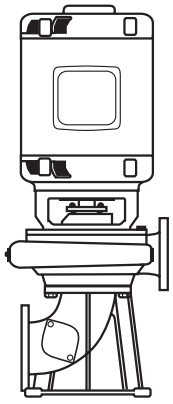
CORNELL FEATURES VARIETY



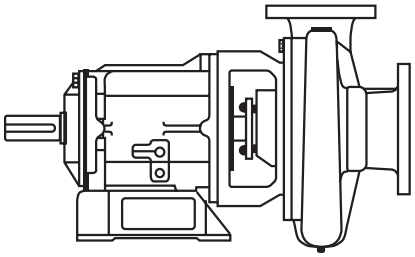
Horizontal Close-Coupled (CC).
Economical, compact and efficient.



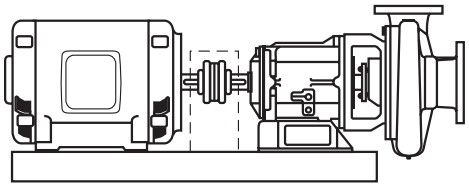
Vertical Frame (VF).
Driven by flexible shaft
from motor above pump.



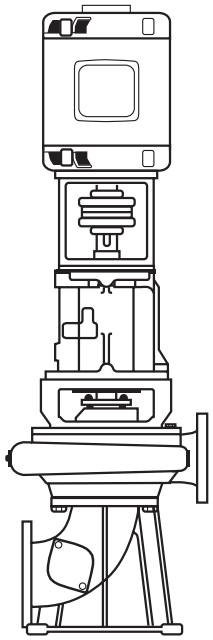
Vertical Close-Coupled (VM).
This vertical style is desirable
where space is limited.



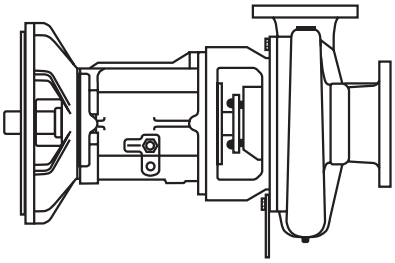
Horizontal Frame (F).
Driver flexibility.



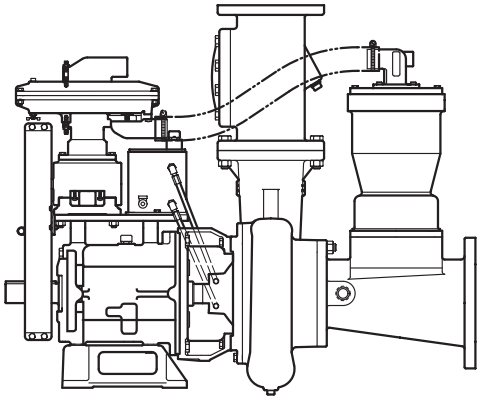
Base-Coupling-Guard Mounted
Horizontal Frame Unit.
Can be mounted with a motor or other
driver on a common base.



Vertical Coupled (VC).
Minimal floor space required.
Standard "P" base
motor used.



SAE Engine Mount (EM).
Ideal for remote locations or where
electrical power is not available.
Trailer or skid mounted.

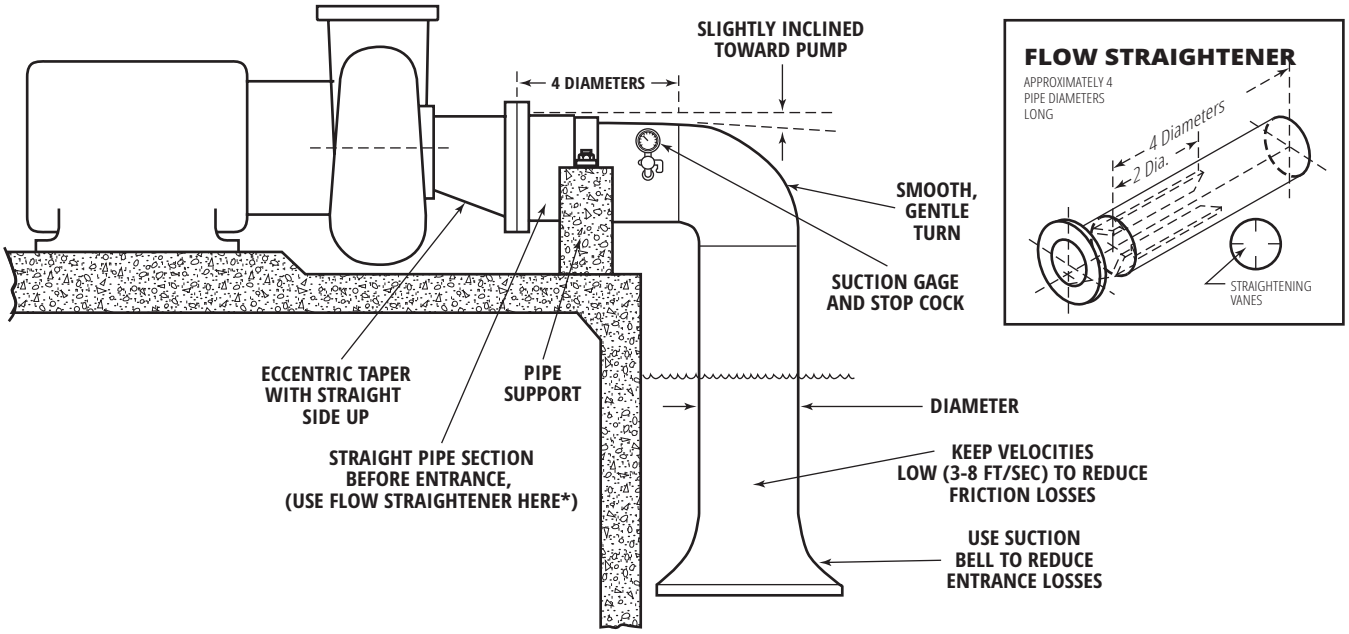


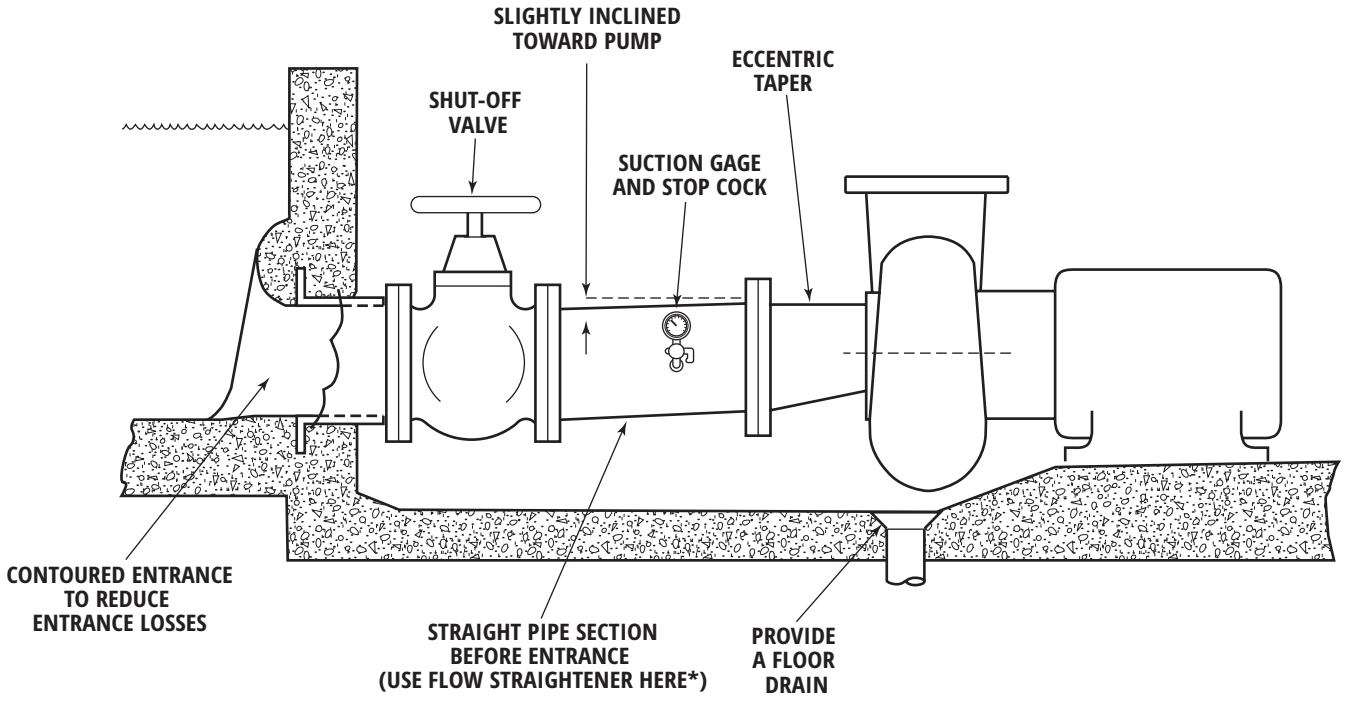
Redi-Prime® or Vacuum Prime
Run-dry, automatic dry prime and
re-priming capabilities.

SECTION I

INSTALLATION

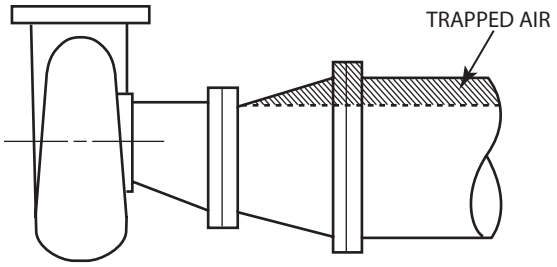
SUCTION PIPING – GOOD PRACTICES



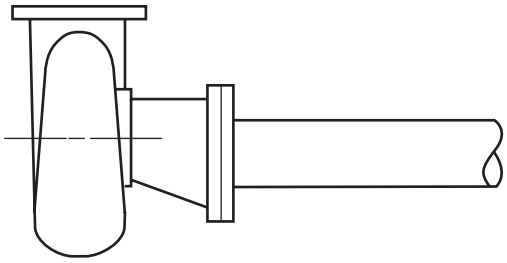


***Flow straigheners are for clear liquids applications only.**

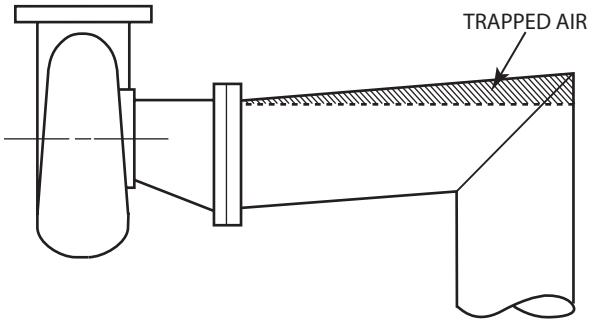
SUCTION PIPING – POOR PRACTICES



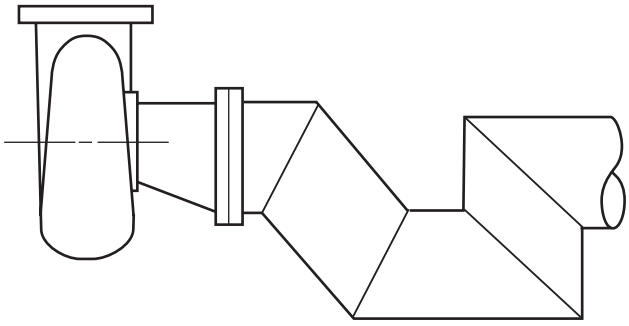
Do not use a concentric reducer. Air remains in pipe, and the pump may cavitate or lose prime.



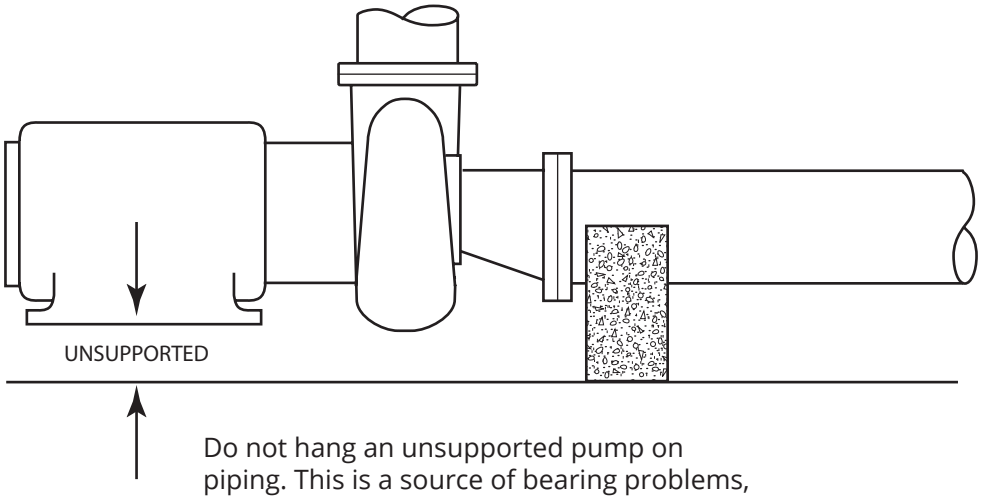
Do not restrict the flow. This may cause cavitation, reduce performance, and add friction losses.



Do not slope piping down toward the pump. Trapped air may cause the pump to cavitate or lose prime. Avoid the use of 90° miters.

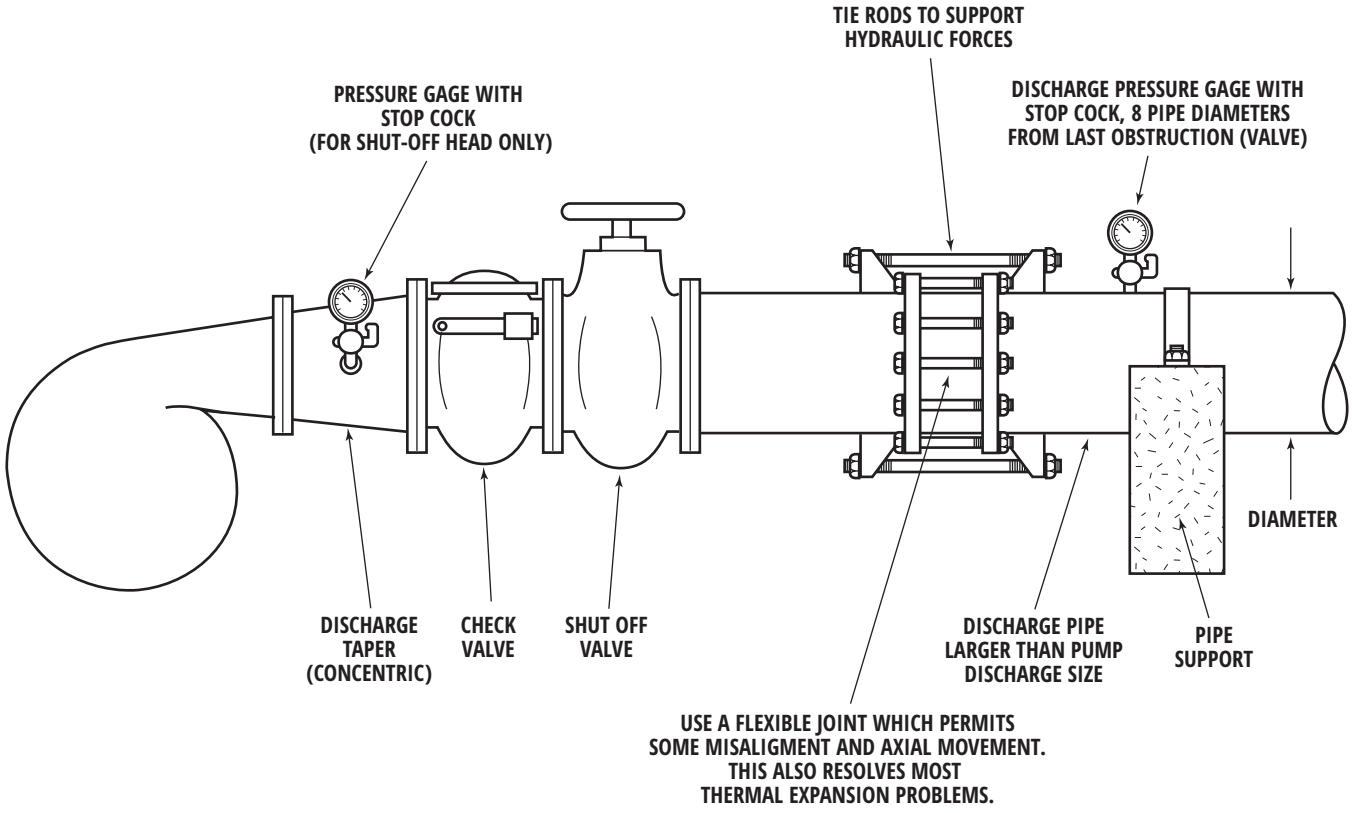


Do not use many fittings. This creates high friction losses and may cause cavitation, trapped air and reduced performance.

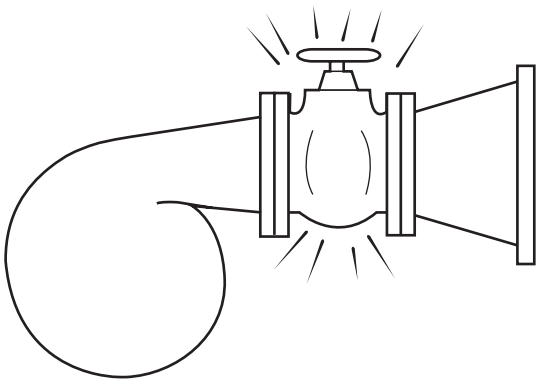


Do not hang an unsupported pump on piping. This is a source of bearing problems, accelerated wear, motor overloads, and leaks.

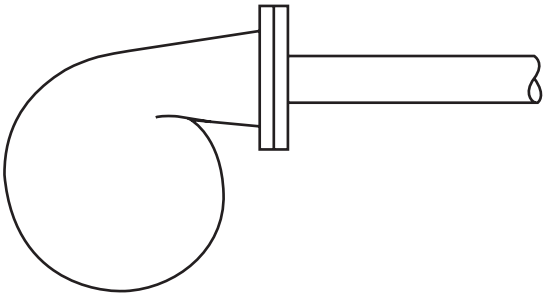
DISCHARGE PIPING – GOOD PRACTICE



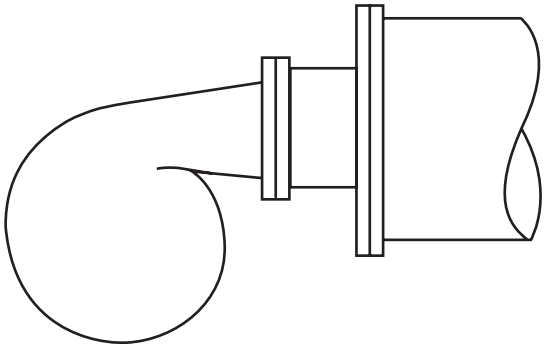
DISCHARGE PIPING – POOR PRACTICES



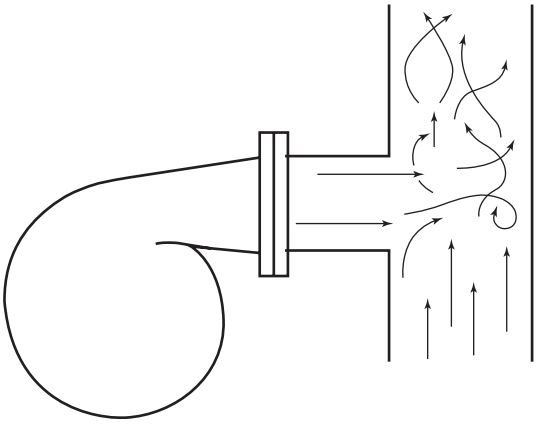
Do not design a system to operate with the discharge valve partly closed.



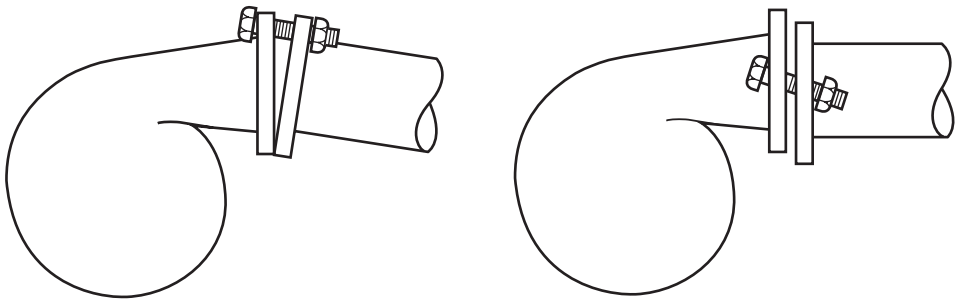
Do not use small discharge valves, piping, and fittings. This adds to friction loss.



Avoid abrupt changes in pipe diameter.

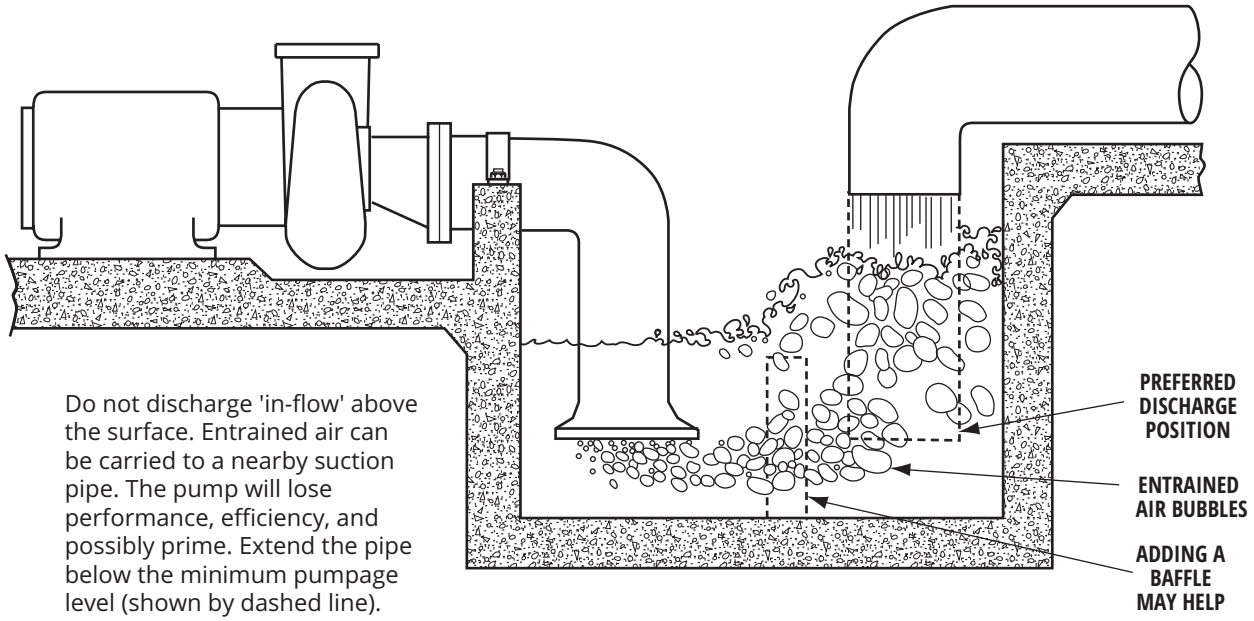


Avoid discharging at a right angle into a manifold flow. A "Y" connection in the direction of flow is preferred.

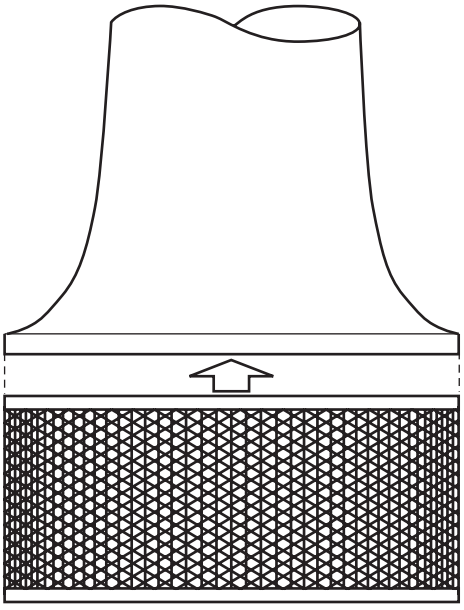


Do not tighten bolts on misaligned flanges. This can damage wear surfaces, bearings, coupling, overload motor, and create other problems.

AIR ENTRAINMENT, SUCTION BELL AND SCREEN



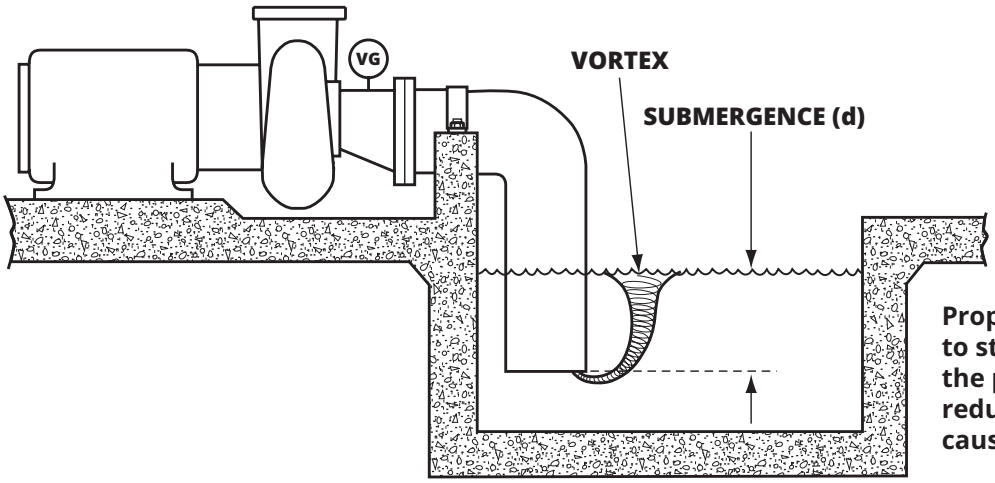
Do not discharge 'in-flow' above the surface. Entrained air can be carried to a nearby suction pipe. The pump will lose performance, efficiency, and possibly prime. Extend the pipe below the minimum pumpage level (shown by dashed line). Adding a baffle may help if the 'in-flow' already contains air bubbles. Do not let the flow cascade over the baffle.



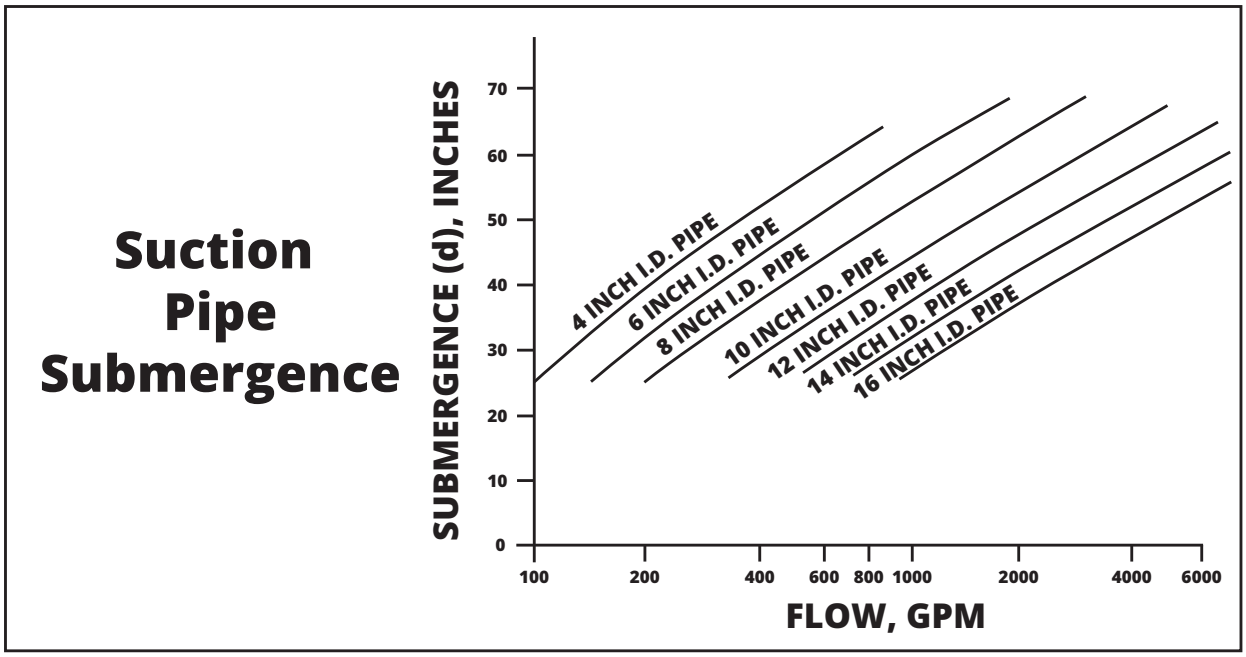
A suction bell reduces inlet losses and helps suppress vortexing.

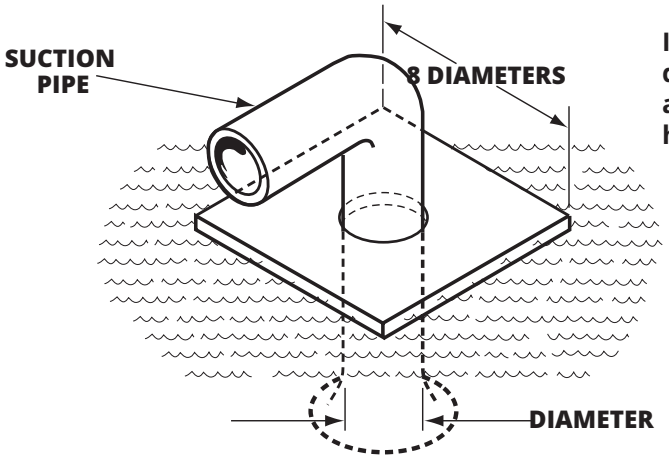
A 'basket' screen may be used. The open area should be at least four times the pipe area. Screen opening size must be less than the maximum solid passing capacity of the system. Avoid use of very fine screen. It will plug easily and possibly collapse. If very small particles must be avoided, consider the use of another type of protection. The screen is also a safety feature should someone fall or swim close to the suction inlet.

SUBMERGENCE



Proper submergence is required to stop vortexing, which can make the pump lose prime, reduce head, reduce flow, lower efficiency and cause noise.



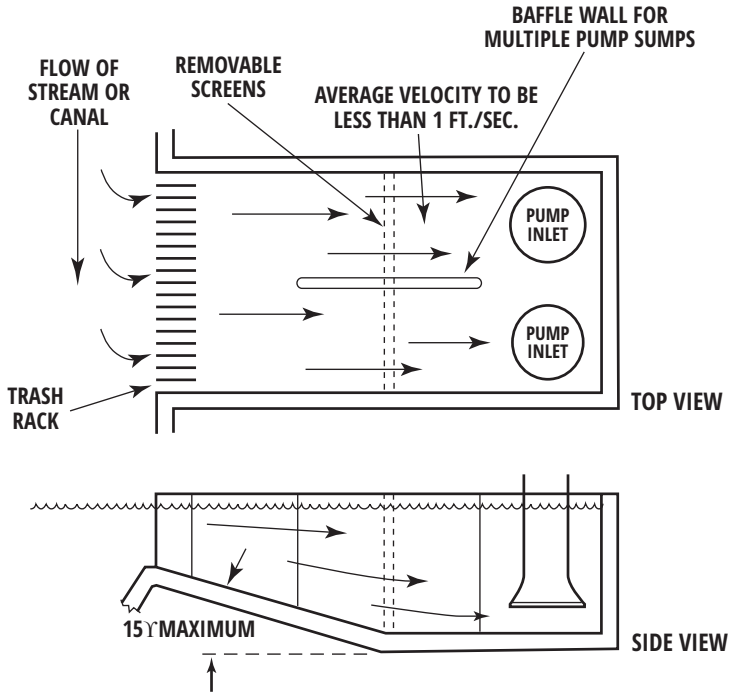


If the pumping level periodically drops below the minimum, floating a board around the suction may help control vortexing.

SUMP DESIGN

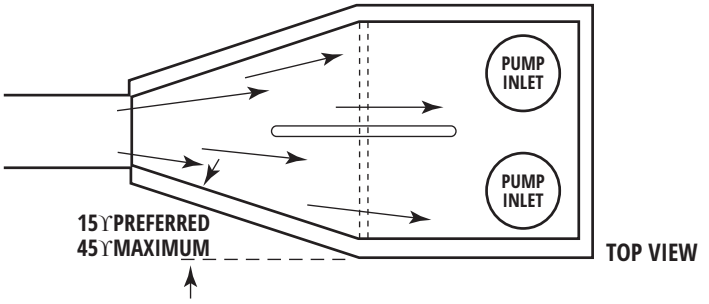
STREAM FED SUMP

Use a straight sump with low average velocity and pumps set near the rear wall. For pumps larger than 4000 GPM, more detailed design may necessary.



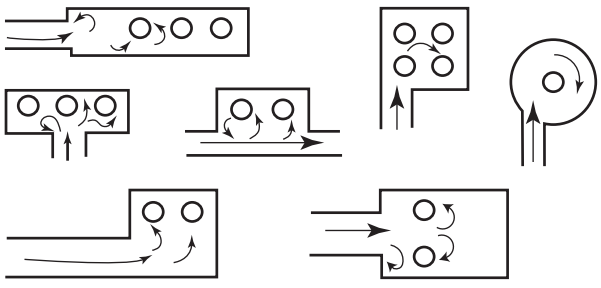
PIPE FED SUMP

The same concepts as above apply to pipe fed sumps. Slow velocity changes reduce vortexing.



THESE SUMP ARRANGEMENTS ARE NOT RECOMMENDED

Never predispose a flow to rotation. Do not place obstructions such as posts or walls in the flow path.



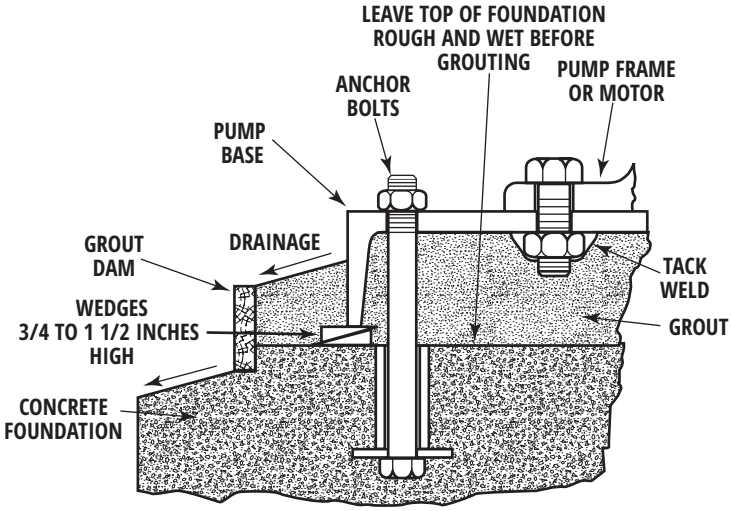
FOUNDATIONS AND PIPE SUPPORTS

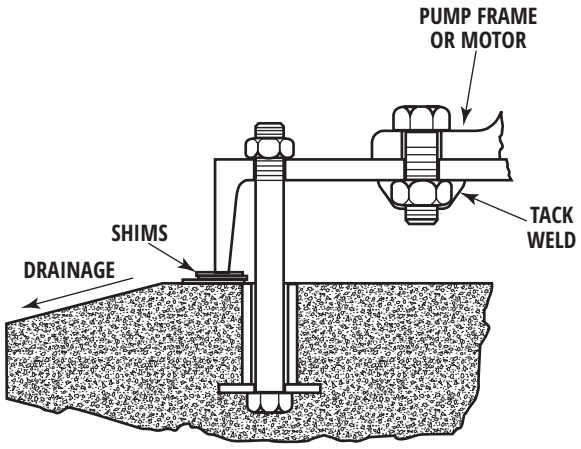
FOUNDATIONS

These are only suggestions. There are other types of secure supports in use.

Before final placement or grouting, make sure the drive coupling (if any) is within adjustable limits.

Permanent Foundation Installation



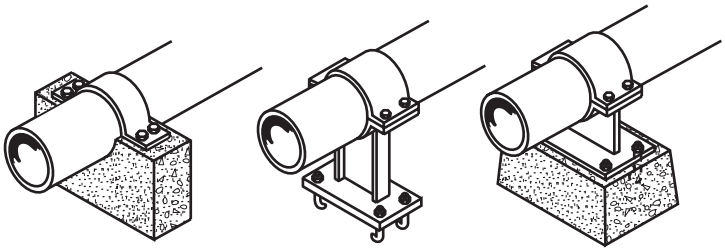


Alternate

PIPE SUPPORTS

Pipe supports must handle piping weights as filled with pumpage. If the system is subject to wide temperature ranges, make provisions for thermal expansion. (See "Discharge Piping – Good Practice" on page 4)

Permanent Pipe Supports



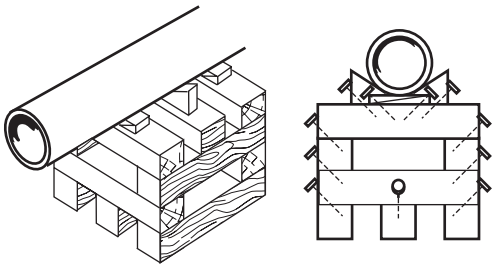
Concrete with metal strap.

"J" bolts or anchor bolts.

Use pads between piping and support.

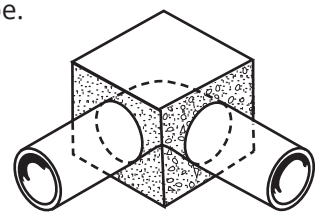
Temporary Pipe Supports

Nail all parts together.



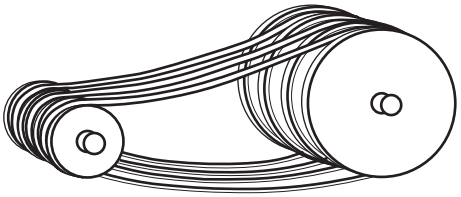
Corner Thrust Block

Use large corner thrust blocks even on buried pipe.

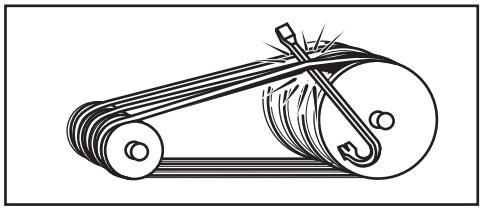


BELT DRIVES

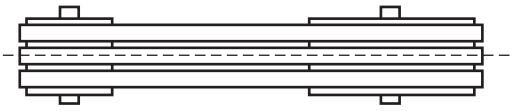
Use a matched set of v-belts.



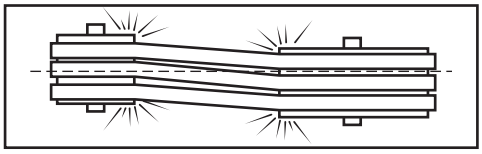
Loosen tension before removing or installing belts.

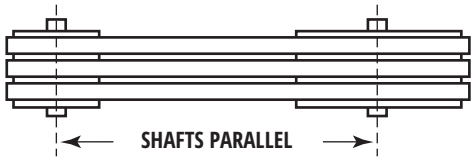


Do not force belts off sheaves.

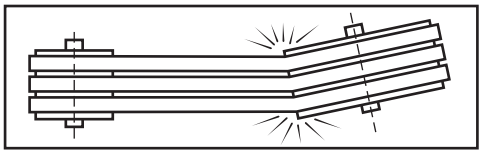


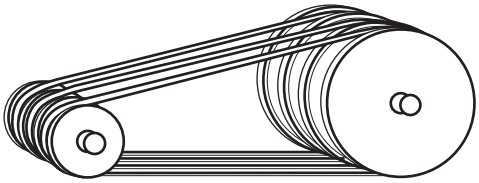
Align sheave grooves like this . . . . . Not this!





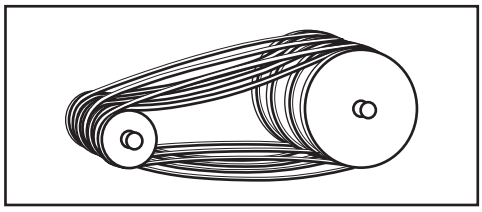
Align shafts like this. . . . . Not this!





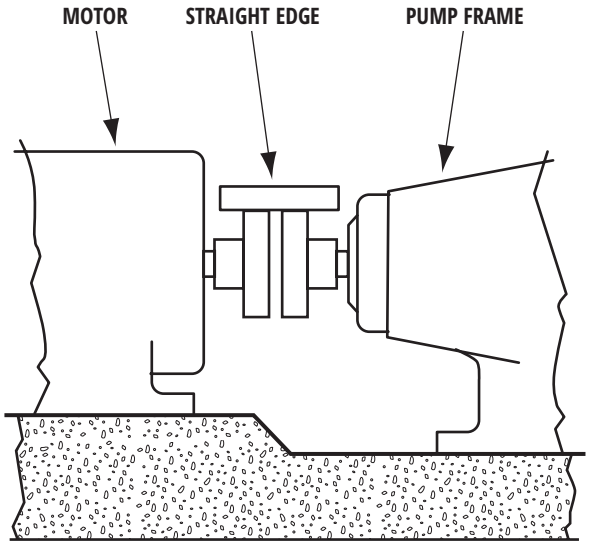
Tighten the take-up until the belts are snug. Run drive at full speed and adjust take-up until only slight bow appears in back side of belts. Vertical drives must be operated tighter than other configurations.

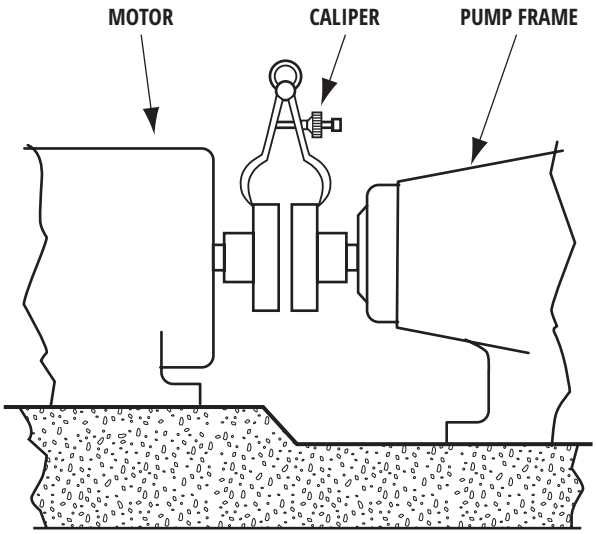
Reinstall belt guard before start-up.



If the belts slip, they are too loose or overloaded. Never use belt dressings.

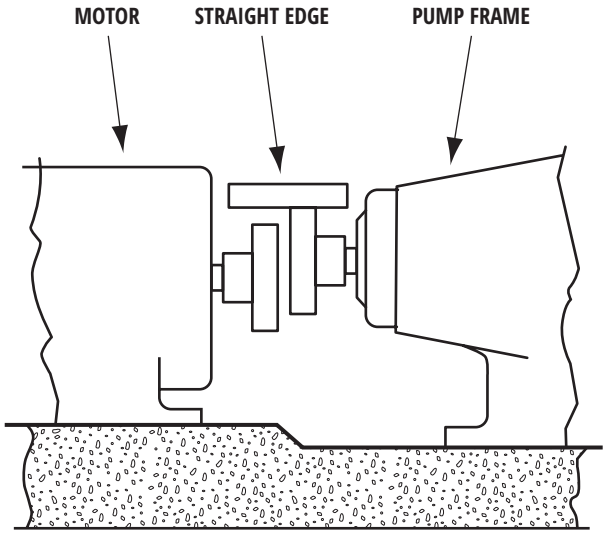
DRIVE COUPLING ALIGNMENT*

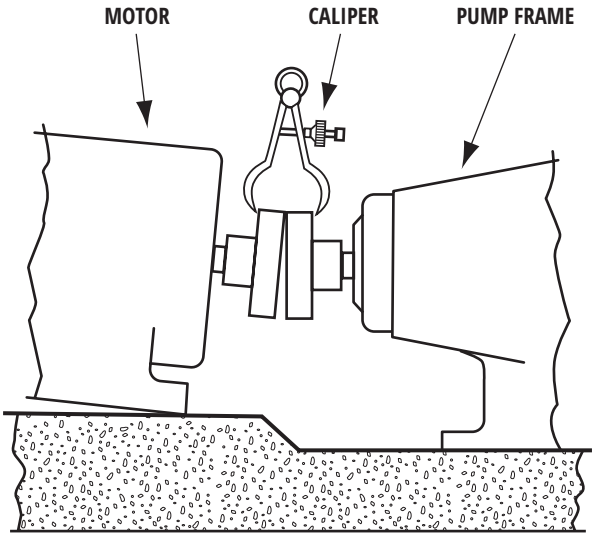




Correct Alignment

Reinstall coupling guard before start-up.





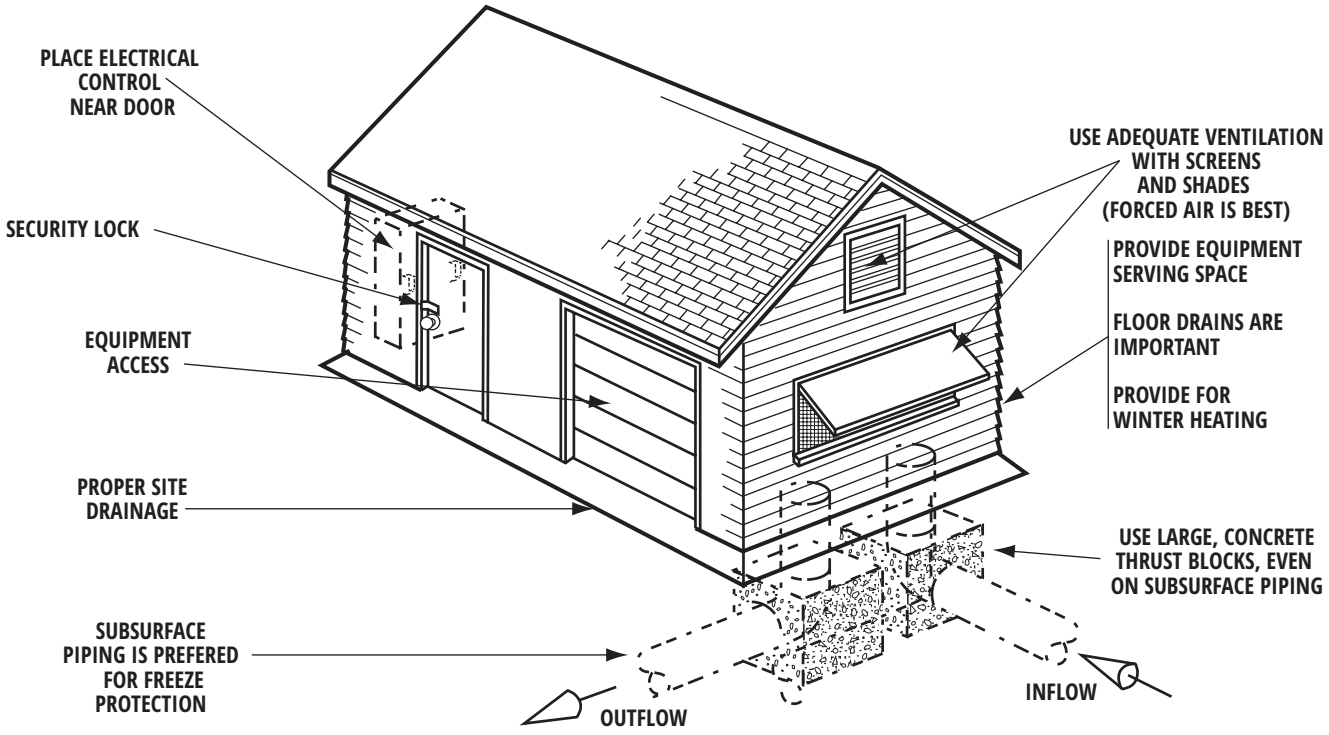
Incorrect Alignment

Reinstall coupling guard before start-up.

***Suggested method when double indicator or laser alignment is not used.**

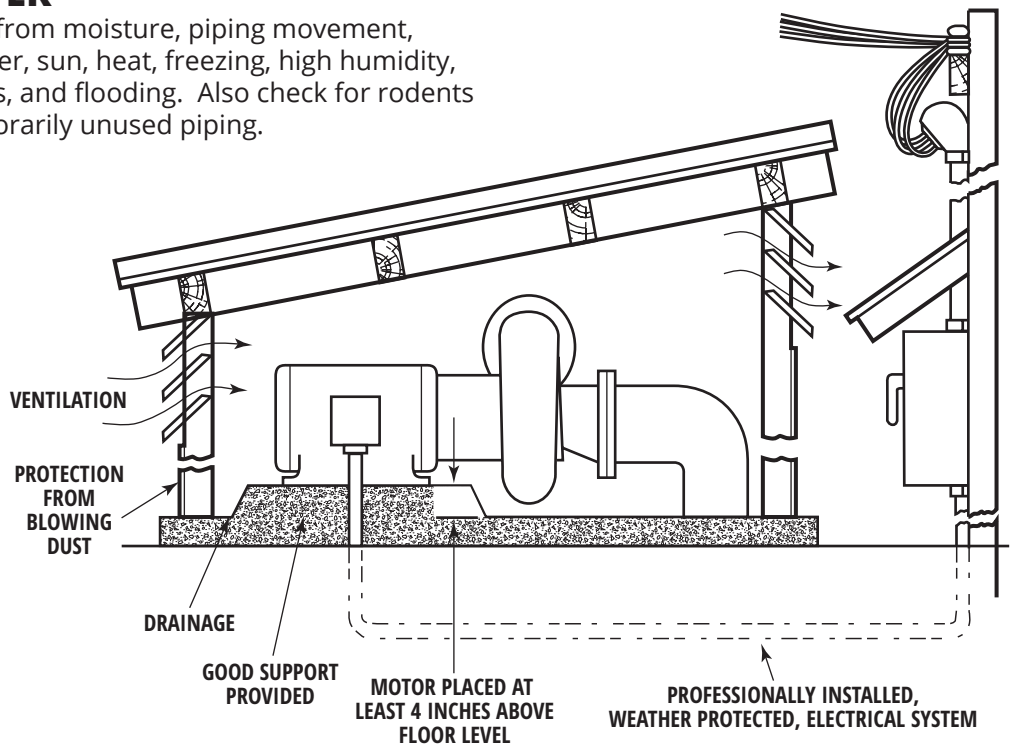
PUMP PROTECTION

PUMP HOUSE



PUMP SHELTER

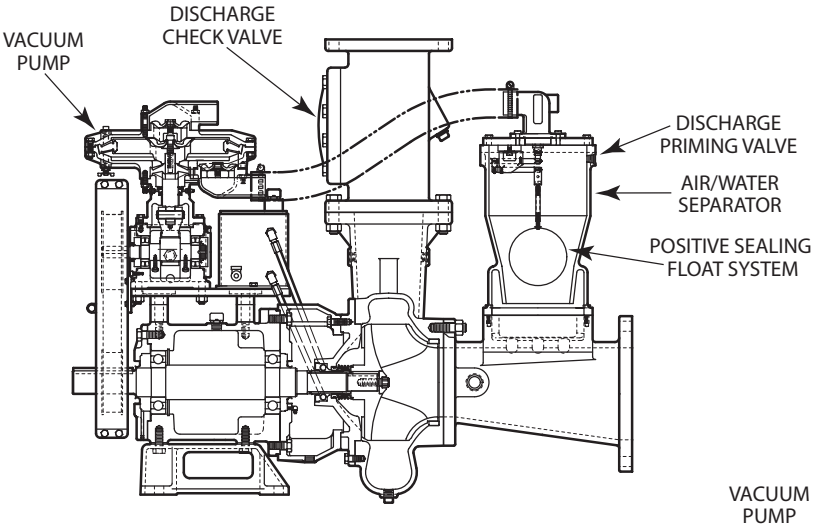
Protect the pump from moisture, piping movement, dust, standing water, sun, heat, freezing, high humidity, electrical problems, and flooding. Also check for rodents and nests in temporarily unused piping.



SECTION II

START-UP

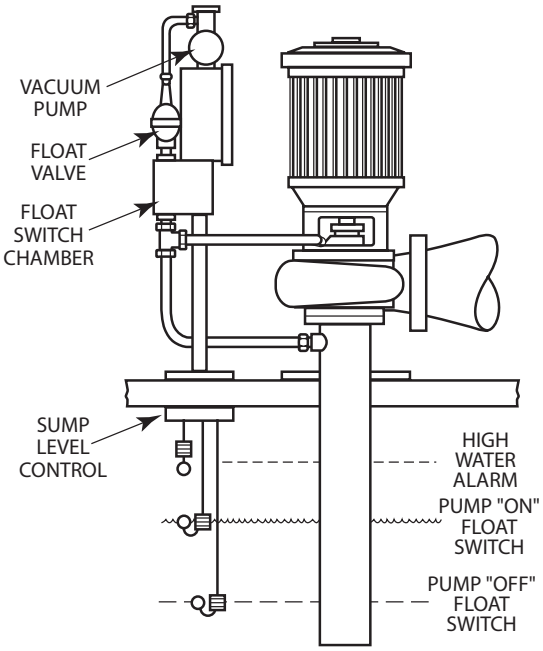
PRIMING METHODS



AUTOMATIC PUMP PRIMING

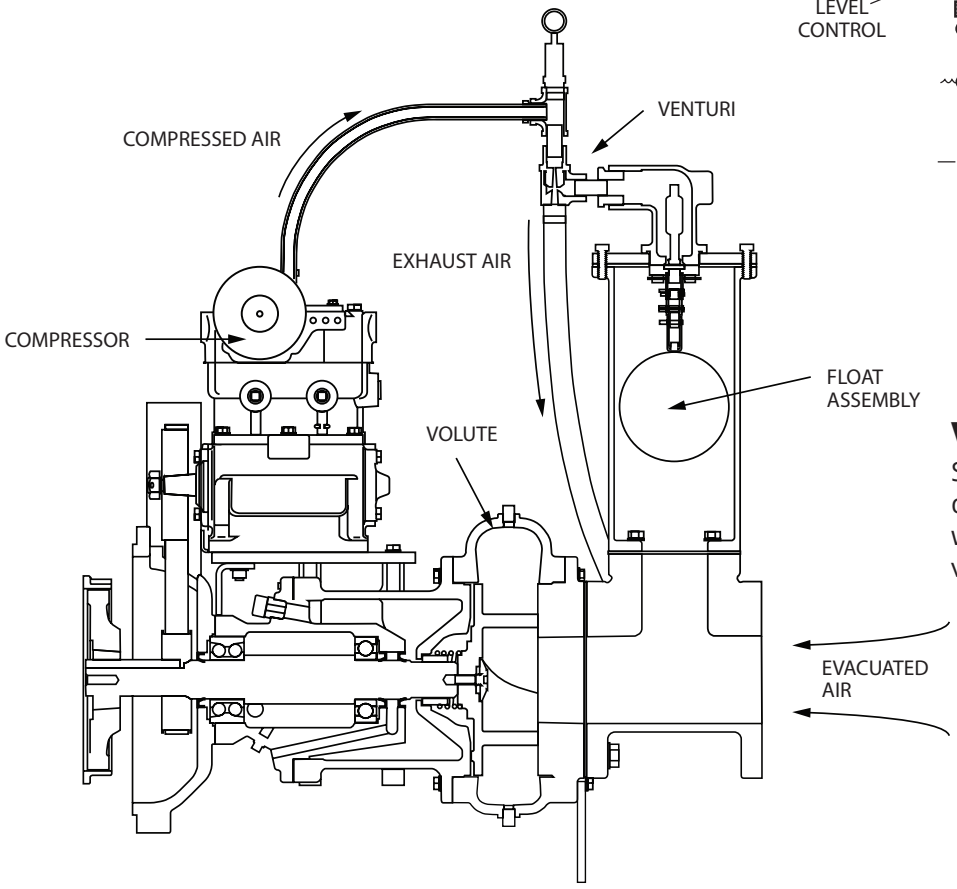
Automatic priming is used for unattended operation. Electric sensing and controls prime the unit before start-up.

Important
The pump must be filled with liquid before it is started.



CORNELL REDI-PRIME®

Cornell Redi-Prime, fully automated, self-priming pumps are ideal for unattended operation. Our postitive sealing float box and diaphram vacuum pump configurration insures that there is no water carry-over. Cornell Redi-Prime pumps handle air/water mixtures with ease.

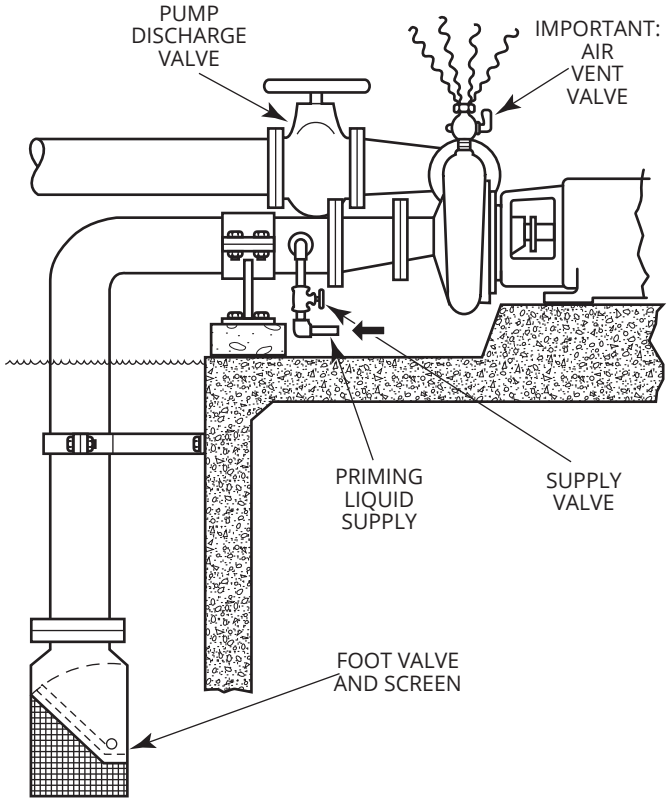


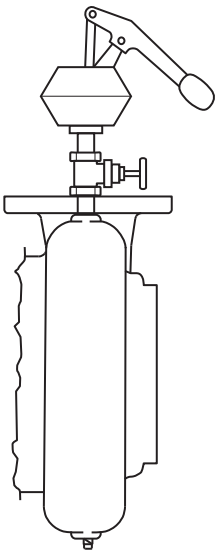
VENTURI PRIME

Specially constructed engine-driven pumps can be primed with an exhaust operated vacuum producing device.

FOOT VALVE

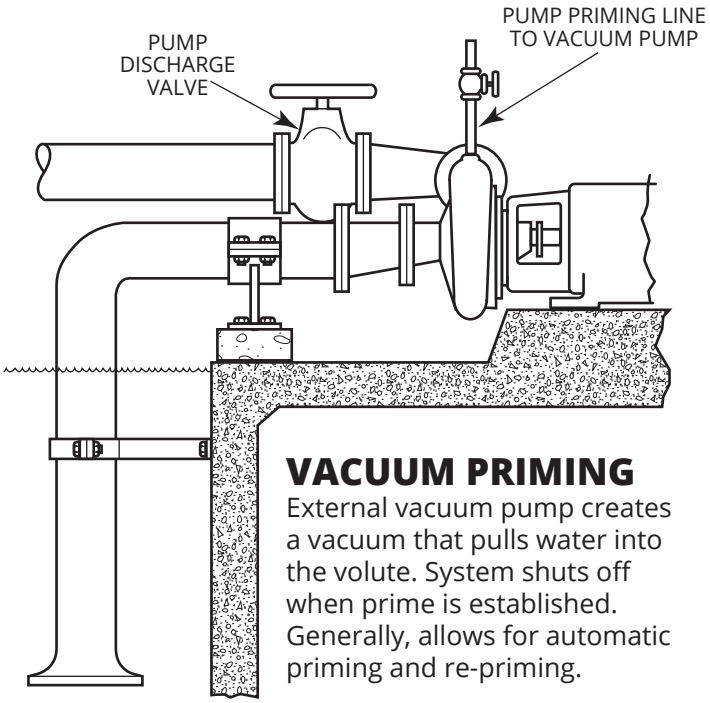
The pump is filled from a supply line; liquid flows out the volute and down the suction line until stopped by a foot valve until there is sufficient liquid to operate the pump. The separate discharge valve should be closed as well. Caution must be taken to vent of air during filling of pump & line. As little as 3% entrained air can cause centrifugal pumps to lose prime. Close vent and supply valves prior to pump operation.





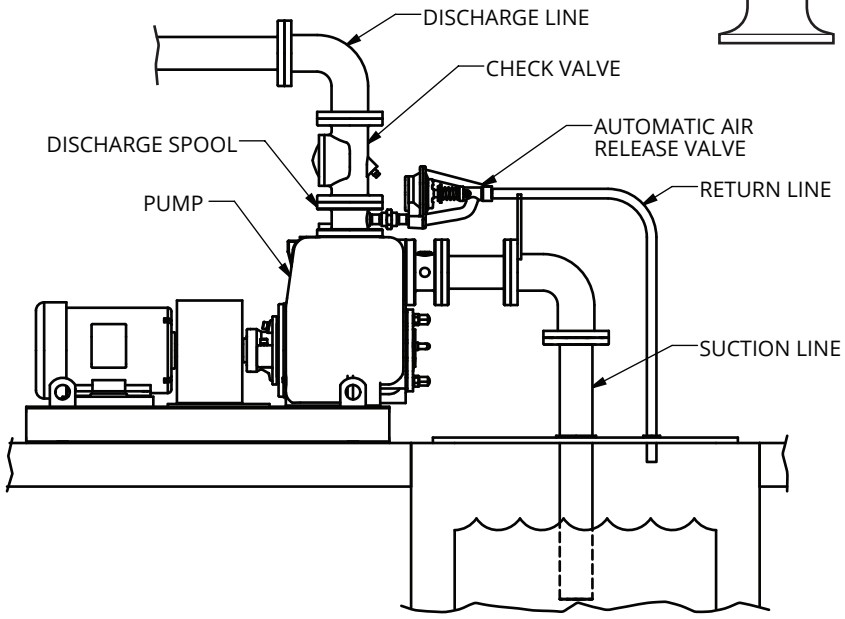
HAND PRIMER

Manual method of pulling fluid into volute, allowing pump to operate. Vacuum is created when a discharge side valve is closed and plunger in hand vacuum creates a small vacuum in the suction side of piping.



VACUUM PRIMING

External vacuum pump creates a vacuum that pulls water into the volute. System shuts off when prime is established. Generally, allows for automatic priming and re-priming.



SELF-PRIMING

During the priming cycle, air mixes with water retained inside the pump and is discharged out of the casing. The air will rise and water will fall down to the bottom of the casing. This will repeat until all air is evacuated from the suction line and is full of water. The pump is essentially creating a vacuum in the suction line which is lifting the water into the pump. Once air has been removed from the pump and suction line, flow will begin to happen.

START-UP CHECK LIST

Before the start-up of any pump, a careful check must be made to insure that all is in order.

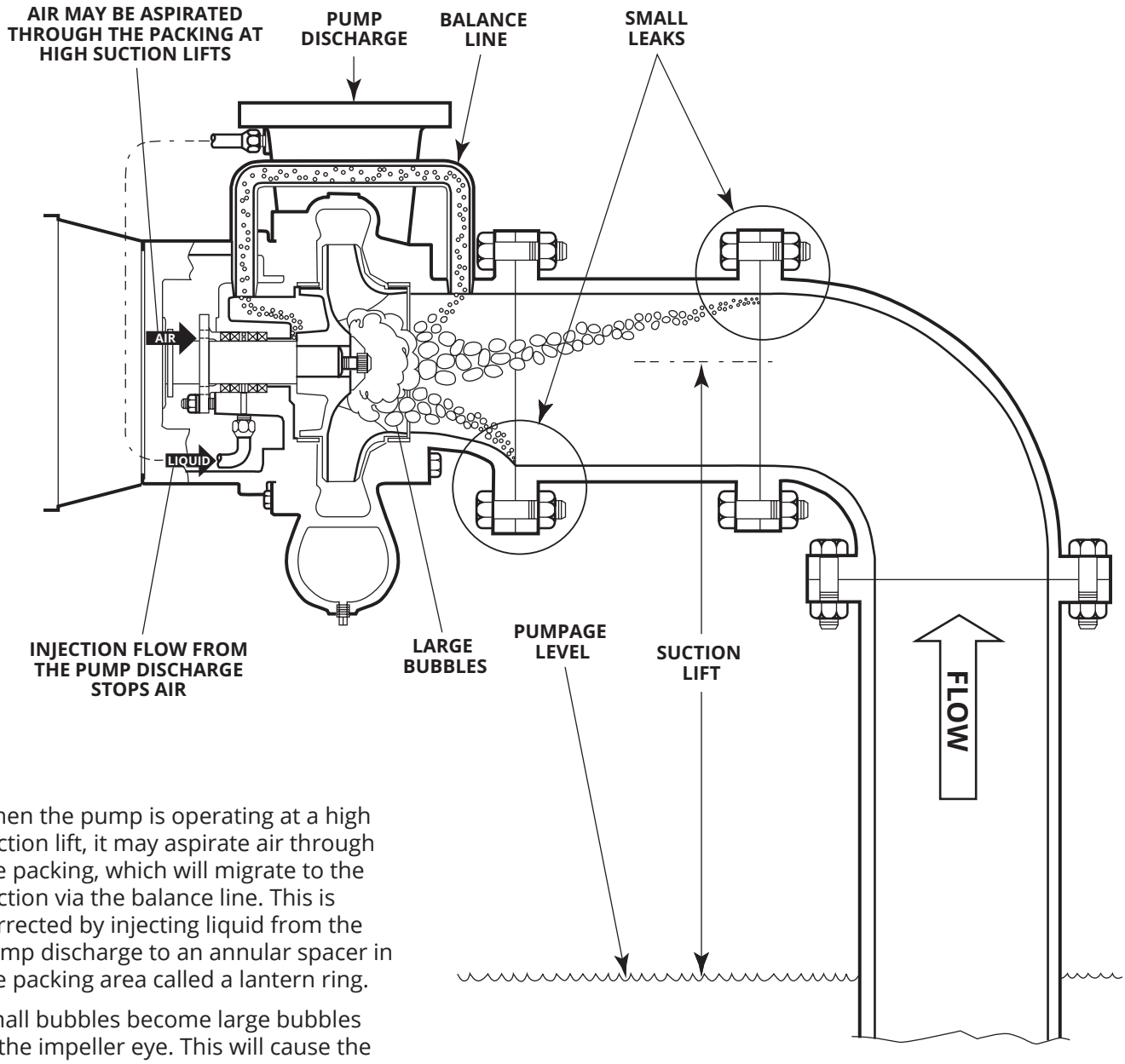
1. Re-read all instructions and check for compliance on each point.
2. Piping must be clean and free of debris and obstructions, gaskets in place and all joints secure.
3. Are all thrust blocks and supports adequate?
4. Are screens in place?
5. Check the valves and blow-offs for proper position.
6. Make sure support systems are in place and functioning, such as special lubrication, frame oil, etc.
7. Check the power supply voltage with the motor name plate.
8. Are belts and shaft couplings properly adjusted and aligned and guards in place?
9. Does the pump rotate freely?
10. Prime the pump.
11. Check pump rotational direction. (VERY SHORT on/off power pulse).
12. Comply with all seal or packing operation and start-up instructions.
13. Monitor the motor temperature.
14. Note the operating temperature of frame bearings (if any).
15. The pump may be checked for shut-off pressure with the pump performance curve.
16. Fill the system slowly.
17. Do not operate any pump without properly priming it, unless it has been specifically designed for such operation.
18. New pumps must not be started and stopped frequently. If possible, permit the unit to run until operating temperature is reached.
    NOTE: Large motors must not be started and stopped more than five times per hour.

A pump must not be started until compliance is reached on all the applicable points above and any others specified in the *Operation and Maintenance Manual* supplied with the pump. Failure to do so may cause severe damage to equipment and/or personal injury. It may also void the warranty.

SECTION III

OPERATION

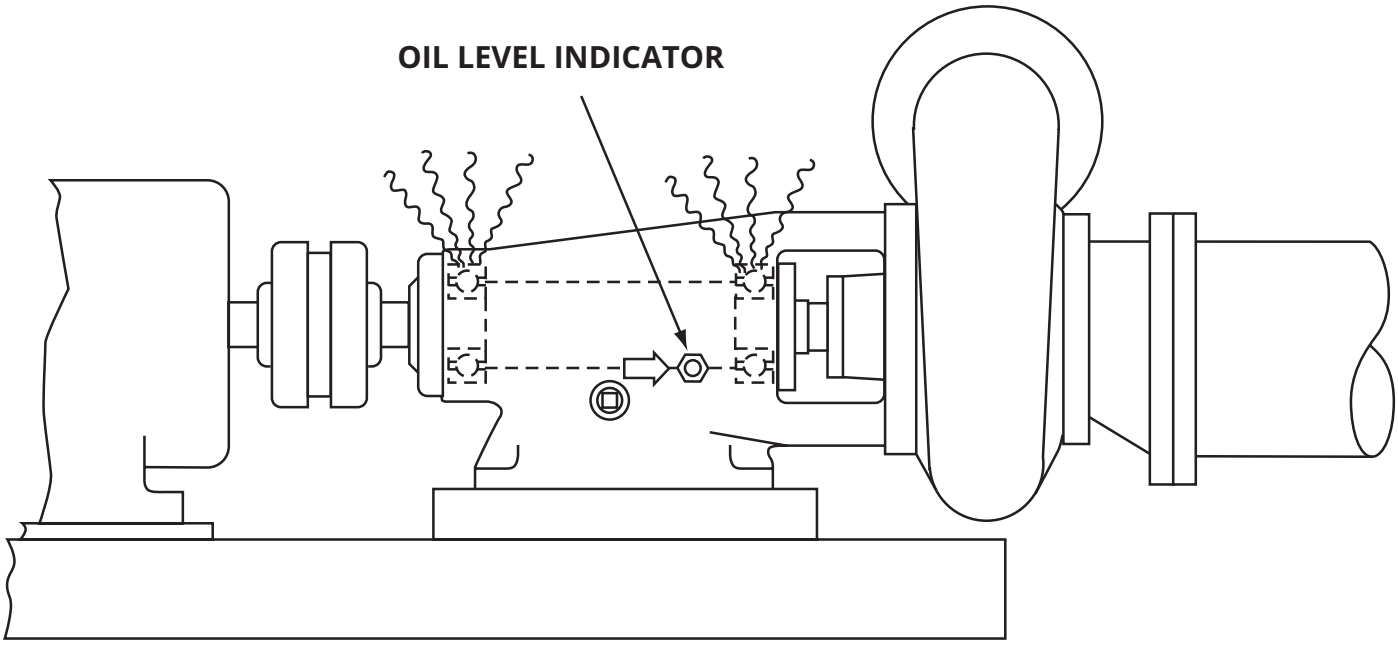
AIR LEAKS



When the pump is operating at a high suction lift, it may aspirate air through the packing, which will migrate to the suction via the balance line. This is corrected by injecting liquid from the pump discharge to an annular spacer in the packing area called a lantern ring.

Small bubbles become large bubbles in the impeller eye. This will cause the pump to lose performance, efficiency, and possibly cavitate or lose prime.

BEARING LUBRICATION AND TEMPERATURE



Bearing temperatures to 160°F (71°C) are normal. Temperatures over 200°F (93°C) are too high. The human hand can not estimate high temperatures. Use a thermometer or other device for temperature measurement.

IMPORTANT

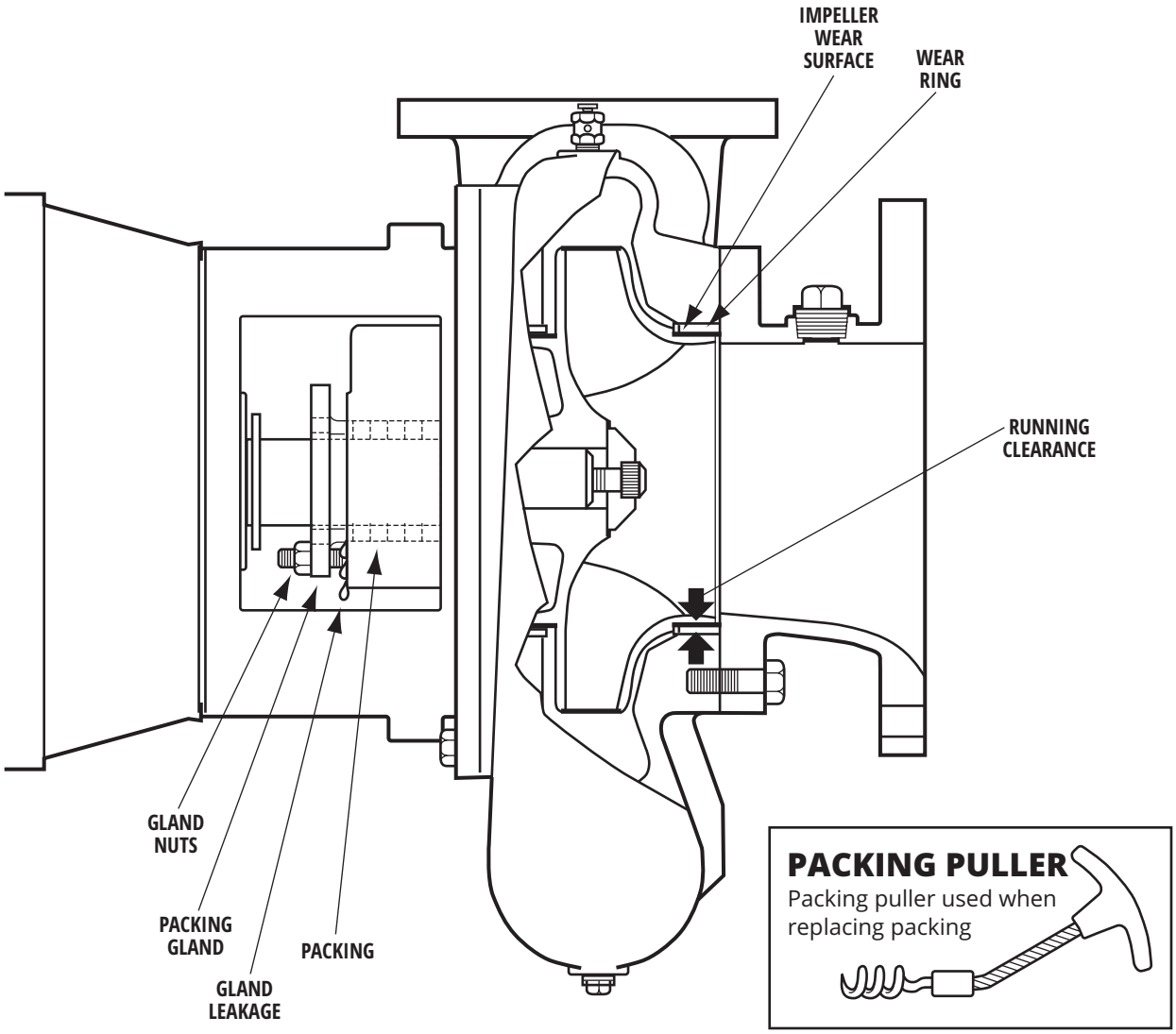
A. Oil level must be correct before unit is started.

B. Oil lubricated frames must be installed horizontally and level.

C. Grease lubricated motors and frames must be maintained per instructions accompanying the pump. Grease code EP-2 is recommended for most applications. Added grease must be the same type as recommended in the O&M manual.

D. Oil and grease should not be mixed.

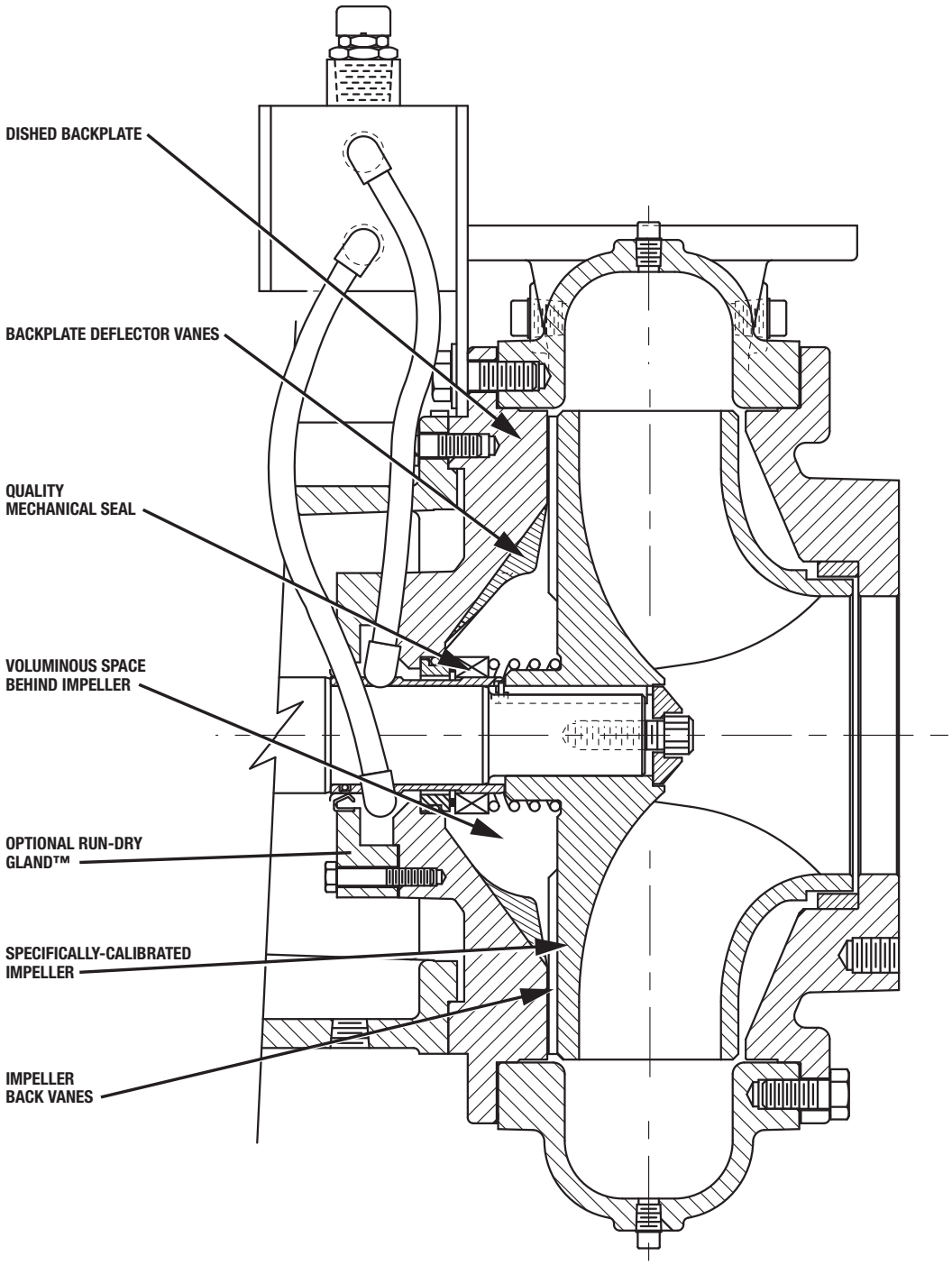
PACKING AND WEAR RINGS



Running clearance on most new general purpose water pumps is about .010 inch on a side. (check with the factory for specifications on for your model). If wear increases this to .032 inch, the wear ring should be replaced and the impeller repaired or replaced. Wear may be caused by abrasives in the pumpage, unsupported piping loads, or other causes.

Tighten the gland nuts 1/4 turn every ten minutes until a leakage of only 40–60 drops per minutes is achieved. If the packing must be replaced, a packing puller may be needed.

CYCLOSEAL® AND RUN-DRY™

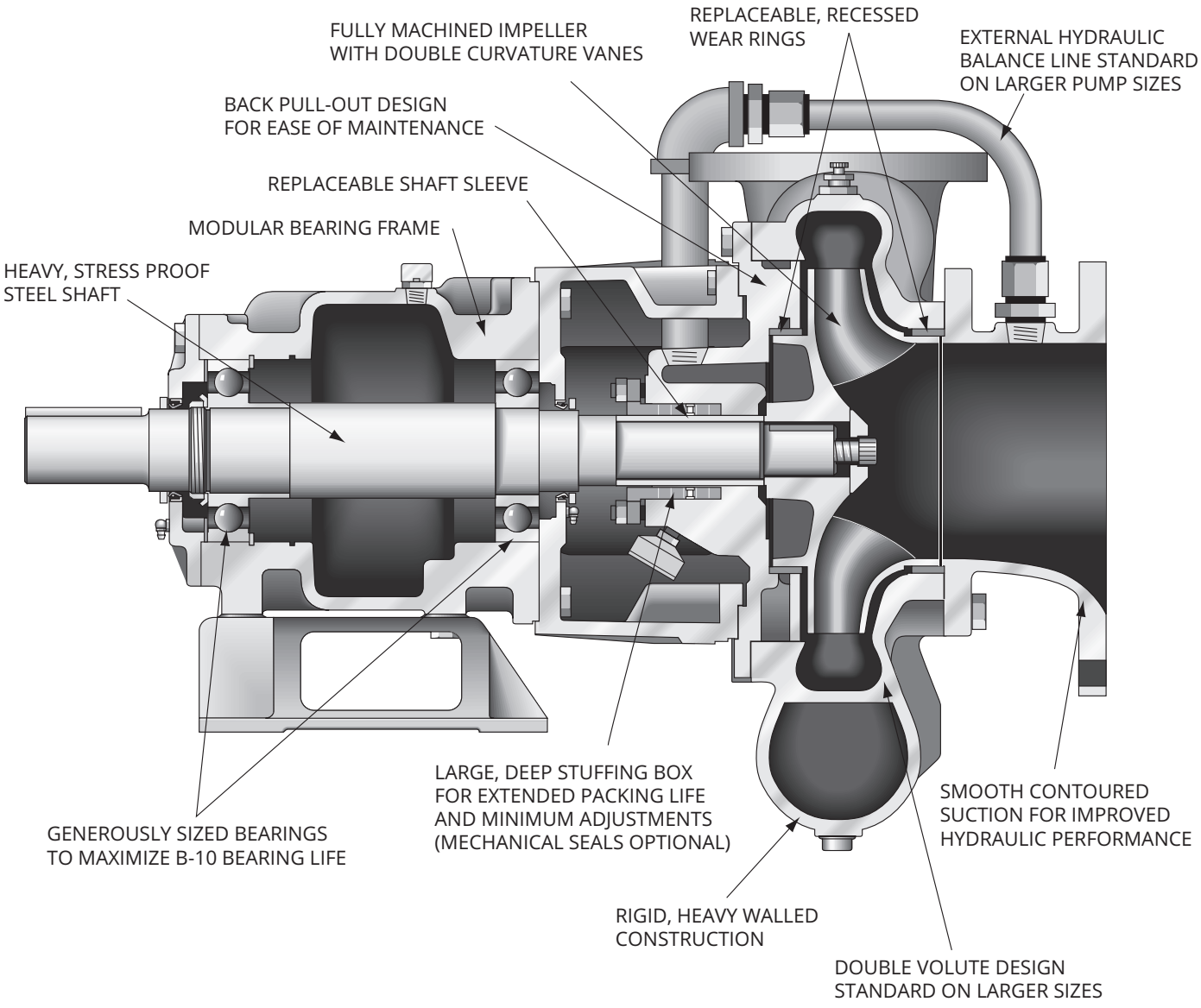


Shown is patented Cycloseal® mechanical seal configuration. Allows for longer bearing and seal life, reduces stuffing box pressure, reduces maintenance costs, and minimizes axial thrust loads.

PUMP TROUBLESHOOTING GUIDE

SYMPTOMS	CAUSES	CORRECTIONS
Failure to pump	Pump not properly primed	Prime pump correctly
	Pump running too slow or system too high	Consult Cornell factory
	Not enough head to open check valve	Consult Cornell factory
	Air leak in suction piping	Check and rework suction line
	Plugged suction pipe or impeller vanes	Unplug suction
	Suction pipe high point above impeller eye	Rework suction piping
	Suction lift too high	Consult Cornell factory
Reduced performance	Air pockets or small air leaks in suction line	Locate and correct
	Obstruction in suction line or impeller	Remove obstruction
	Insufficient submergence of suction pipe	Consult Cornell factory
	Excessively worn impeller or wear ring	Replace impeller and/or wear ring
	Suction lift too high	Consult Cornell factory
	Wrong direction of rotation	See start-up instructions
	Missing wear ring(s)	Install wear ring(s)
Driver overloaded	Speed higher than planned	Reduce speed
	Pump runs out on curve/ system incorrect	Change system head
	Liquid specific gravity too high	Consult Cornell factory
	Liquid handled of greater viscosity than water	Consult Cornell factory
	Too large an impeller diameter	Trim impeller
	Low voltage	Consult power company
	Piping stress at flanges/ pump in bind	Support piping properly
	Packing too tight	Loosen packing gland nuts
Excessive noise	Misalignment	Align all rotating parts
	Cavitation (excessive suction lift)	Consult Cornell factory
	Cavitation (improper suction design)	Correct suction piping
	Material lodged in impeller	Dislodge
	Worn bearings	Replace bearings
	Impeller screw loose or broken	Replace
	Wrong direction of rotation	See start-up instructions
Excessive vibration	Misalignment	Align correctly
	Unbalanced components	Re-balance components
	Bent shaft	Replace shaft
	Structural (rigidity/ soft foot)	Correct bolting/ shim properly
Premature bearing failure	Balance line plugged or pinched	Unplug or replace
	Worn wear rings	Replace
	Misalignment	Align all rotating parts
	Suction or discharge pipe not properly supported	Correct supports
	Bent shaft	Replace shaft
	Water or contaminants entering bearings	Protect pump from environment
	Lubrication to bearings not adequate	See lubrication instr. (O&M manual)
	Wrong type of lubrication	See lubrication instr. (O&M manual)
	Excessive belt loads	Consult Cornell factory
Electric motor failure	High or low voltage	Check voltage with voltage meter
	High electric surge	Monitor voltage and consult power co.
	Poor electric connection	Turn power off, clean and check connections
	Overloads	Check amperage; do not exceed nameplate full load amperage
	Bearing failure	Change bearings in motor
	Cooling vent plugged (rodent, leaves, dirt, etc.)	Install proper screens
	Water in motor	Protect pump from environment
Rapid wear on coupling cushion	Misalignment	Align
	Bent shaft	Replace shaft
	Wrong elastomer	Change elastomer/ Consult Cornell factory

CORNELL FEATURES QUALITY



Cornell's position of leadership has been maintained through the years by sound engineering and continuing research and development. This attention to detail provides features allowing Cornell pumps to provide the lowest cost of ownership. The quality and serviceability built into each pump permits Cornell to proudly offer a full two-year warranty against defects in material and workmanship.

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