
Vertical In-Line fire pumps and firepaks

Installation and operating instructions

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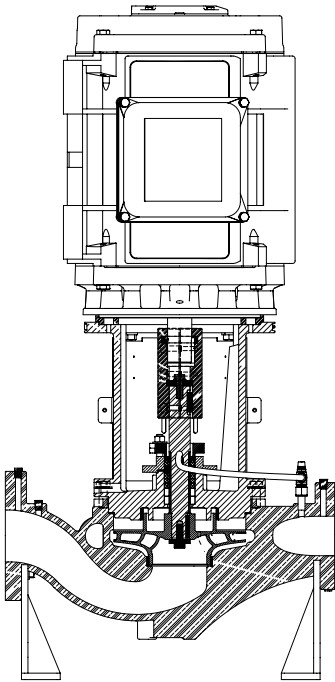
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INSTALLATION AND OPERATING MANUAL VERTICAL IN-LINE FIRE PUMPS AND FIREPAKS

FirePak fire systems are completely self-contained package pumping units, factory assembled, wired, tested and pre-adjusted before shipment to suit the specified conditions. These systems are ready to receive suction and discharge piping and to be connected to power supply. The Vertical In-Line pump is designed to be mounted vertically in the pipe line with the motor above the pump. Center line suction and discharge keep weight evenly balanced and directly mounted upon base frame. When properly installed and given reasonable care and maintenance, Vertical In-Line pumps and FirePak units will provide many years of reliable trouble-free fire protection.

FirePak and Vertical In-Line pump fire pumps are thoroughly tested and inspected before shipment but should be carefully examined for possible damage during transit. Contact your Armstrong representative and the Transport Company immediately if there is any evidence of mishandling.

1.0 INSTALLATION

1.1 LOCATION AND STORAGE

- Locate the unit in a dry place as near the city water entrance as practical with a short, direct suction pipe

REMINDER: Assure sufficient space above the pump to give clearance for lifting the pump assembly from the casing and around the pump for general accessibility and ventilation.

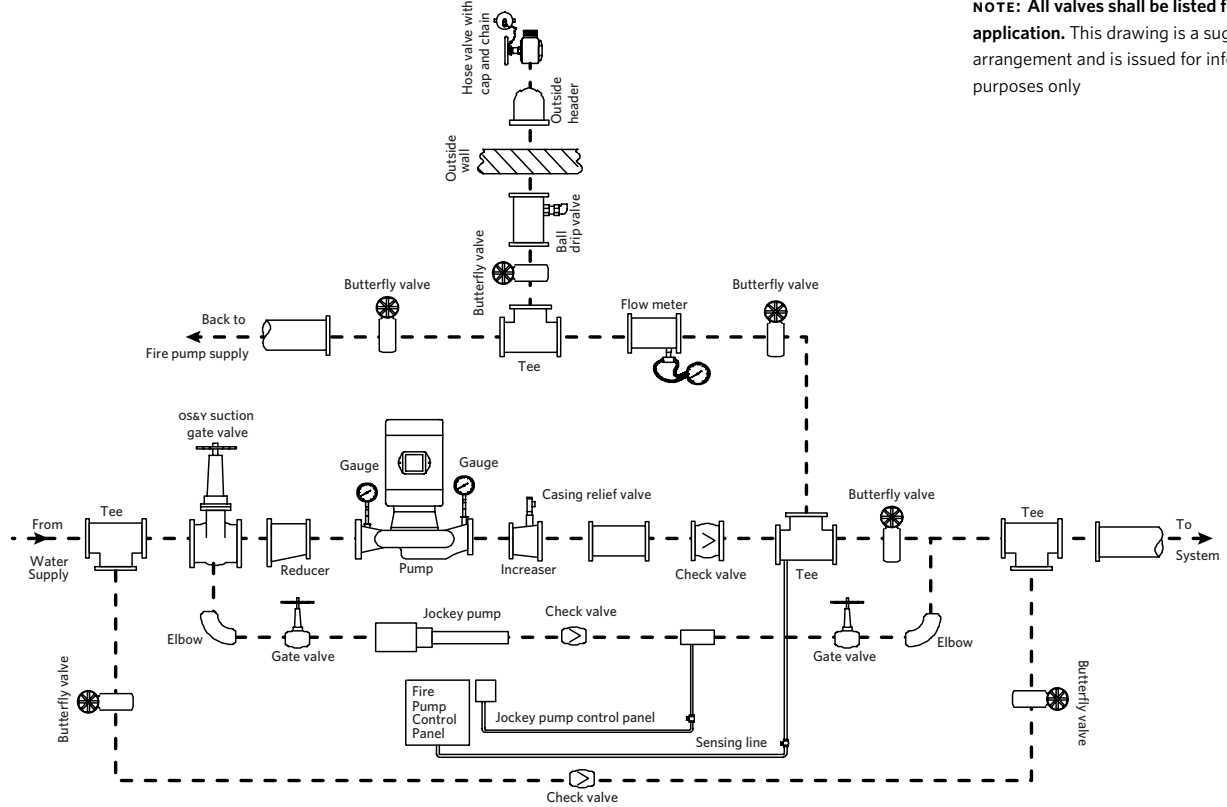
1.2 FOUNDATION FOR FIREPAK ASSEMBLY

- Foundation should be sufficiently substantial to absorb any vibration and to form a permanent, rigid support for the base plate
- Foundation bolts of suitable size should be embedded in the concrete, located by a drawing or template

1.3 PUMP MOUNTING AND PIPING

- Never connect a FirePak to piping, always start piping from unit
- Use as few bends as possible and preferably long radius ones
- Support the ad-joining piping to prevent pipe strain.
- Layout the suction line with a continual rise towards the pump without high points, thus eliminating possibility of air pockets
- Test suction line for air leaks before starting; this becomes essential with long suction line
- Install, at pump suction, a straight pipe of a length equivalent to 10 times its diameter from suction flange.

TYPICAL FIRE PUMP & CONTROLLER ARRANGEMENT



NOTE: All valves shall be listed for fire application. This drawing is a suggested arrangement and is issued for information purposes only

PRESSURE SENSING LINE CONNECTION FOR FIRE PUMP CONTROLLERS

If water pulsation causes erratic operation of the pressure switch or the recorder, a supplemental air chamber or pulsation damper may be needed

Not less than 1/2" brass pipe with brass fittings or equivalent

FIRE PUMP CONTROLLER
PRESSURE SWITCH

1/4" PLUG

BRONZE CHECK VALVE WITH 3/32" ORIFICES IN CLAPPER

NOT LESS THAN 5'-0"

INDICATING CONTROL VALVE

Connect to a tapped boss or other suitable outlet between the indicating control valve and check valve

1/2" GLOBE VALVE

1/2" GLOBE VALVE

* Recommended location of pressure gauges (either location)

If water is clean, ground face unions with noncorrosive diaphragms drilled for 3/32" orifices may be used in place of the check valves.

1.4 MINIMUM FITTINGS

If minimum fittings recommended by N.F.P.A. 20 are supplied loose, they should be installed as follows:

CASING OR CIRCULATION RELIEF VALVE

- The circulation relief valve should be set in the field at pressure to the lowest suction pressure, plus the rated pressure of the unit raised to the next higher 5 lbs increment. When the fire pump is first running at churn, ensure an adequate water discharge through the circulation relief valve.

AUTOMATIC AIR RELEASE VALVE

- Install automatic air release valve on top of pump casing to vent casing and suction piping of air and vapor before start-up.
- When a flow meter loop or bypass loop are included in the firepak and ARV installed on each.

SUCTION AND DISCHARGE GAUGES

- The following gauges are required to measure both suction and discharge pressures and installed on the firepak
 - A** 3½" dial combination pressure and vacuum suction gauge
 - B** 3½" dial discharge pressure gauge
 - C** ¼" cocks with lever handle

2.0 OPERATION-ELECTRIC DRIVEN

Set pressure to the following setting values:

Example: Rated Flow and Head = 750 USgpm and 55 psi ; Min. Suction pressure = 50 psi

Fire Pump Stop Point (FSP)	=	Fire Pump shutoff pressure + min. static suction pressure	=	Cut-out
	=	60 psi + 50 psi	=	110 psi
Jockey Pump Stop Point (JSP)	=	Fire Pump shutoff pressure + min. static suction pressure	=	Cut-out
	=	60 psi + 50 psi	=	110 psi
Jockey Pump Start Point (JSTRT)	=	JSP - 10 psi	=	Cut-in
	=		=	110 psi - 10 psi = 100 psi
Fire Pump Start Point (FSTRT)	=	JSTRT - 5 psi	=	Cut-in
	=		=	100 psi - 5 psi = 95 psi
Pressure Relief Valve	=	Minimum suction pressure + rated pressure + 5 psi	=	50 psi + 55 psi + 5 psi = 110 psi
Resume	=	Fire Pump	Cut-in	Cut-out
			95 psi	110 psi
		Jockey Pump	Cut-in	Cut-out
			100 psi	110 psi
		Pressure Relief Valve to open at 110 psi		

2.1 PRESTART-UP

Fill out PRESTART-UP CHECK LIST

2.2 FIRE PUMP PRESSURE SETTING

2.2.1 PRESSURE SWITCH SETTING

The pressure switch to start the fire pump is normally located in the lower left-hand side of fire pump controller. Similarly the pressure switch to start the Jockey pump is located in the Jockey pump controller.

2.2.2 PRESSURE TRANSDUCER SETTING

The controller shall be supplied with a solid state pressure transducer with Rated for 0-500psi working pressure (standard display at 0-300psi) and a run test solenoid valve. The wet parts shall be externally mounted and include a protective cover. The pressure sensing line connection to the transducer shall be ½" FNPT. Provisions for a redundant pressure transducer shall be provided.

Make sure pump shutoff + MAX. suction pressure does not exceed system rated pressure or its components.

2.3 CASING RELIEF VALVE

The circulation relief valve should be set in the field at pressure to the lowest suction pressure, plus the rated pressure of the unit raised to the next higher 5 lbs increment. When the fire pump is first running at churn, ensure an adequate water discharge through the circulation relief valve.

2.4 START-UP PROCEDURE



CAUTION: In case of electrical control circuit problem use the emergency disconnect lever to bypass control circuits

2.4.1 ELECTRIC DRIVEN

- Open suction gate valves.
- Check that pump is full of water and that all air contained in pump has been allowed to escape through the air release valve.
- Compress packing evenly with gland (gland nut should be finger tight).
- Standing to side of the controller, turn disconnecting means to the on position of the Fire Pump controller.
- An initial startup menu will appear. This will only appear on the first power up or if you power down prior to completion.

- Controller will automatically check for correct voltage.
- Next it will want to check rotation, it allows you to **bump** the motor and visually check rotation. Always spins towards suction.
- For controller manufacture specific startup instruction follow direction showing on screen or found in controller IOM.
- *(Fire controller) cut-in pressure to be set based on discharge pressure at churn (no flow). Initially use low pressure setting to ensure the fire pump will not start on pressure drop.
- Verify System control valve is in the closed position.
- Bleed the system by opening a valve on the pressure sensing line to create a pressure drop.
- As soon as fire pump starts check if full load current value is within the electric motor nameplate rating with service factor taken into account.
- Check and adjust packing glands. HSC will have one on either side, A good rule of thumb is a drip of water per second. There will be a drain plumbed for these, make sure it is unclogged and not tied in with any other drains.
- After running for one minute, stop pump with stop button.
- Bleed again until desired start-up pressure is attained.
- Allow Jockey pump to stop automatically and the **Start**, **Stop** and **System Pressure** shall be digitally displayed and adjustable through the user interface on Jockey pump controller.

START-UP PROCEDURE

(FLOW TEST PROCEDURE IF REQUIRED BY AUTHORITIES)

- Close system control butterfly valve.
- Open gate valve to hose outside header for flow test or flow meter discharge valve.
- Press start button to start pump.
- Adjust flow by the quantity of hose valves opened or with pump discharge valve if using flow meter.
- Perform flow test for 0% (churn), 100% (rated flow), 150% (rated flow) using approved flow testing device.
- At these 3 flows record suction pressure, discharge pressure, pump RPM, pump current and voltage.
- When test is finished, close test header and stop pump.

REMINDER



- Leave the disconnect switch **ON** and the circuit breaker **ON** (the **POWER ON** light must be lit)
- Bring timer setting back to required value, one minute for each 10 HP, maximum 10 minutes

2.5 AUTOMATIC OPERATION

- Switch the Jockey pump to **Auto** (The **Power On** light must be lit).
- Turn all the isolating valves to the fully open position and place the main disconnect switch on the **On** position
- Typically Jockey pump will be allow to run until the system is pressurized then fire pump circuit breaker turn **On**

REMINDER

- Valve on pump suction must be fully open as throttling on suction side is harmful to the pump
- Make sure pump will not run dry. Most centrifugal pumps have close clearances and cannot run dry without serious damage resulting

NOTE

- The controller not have pressure switch there is inbuilt pressure transducer and setting can be done in the controller as per the requirement.
- The settings should be established by pressures observed on test gauges
- All devices are preset at the factory and should normally require no further adjustment
- A final adjustment may be made on any control to match the exact system requirements

3.0 MAINTENANCE

VIL pumps are built to operate without periodic maintenance with the exception of lubrication of motor bearings. A systematic inspection made at regular intervals, giving special attention to the following, will ensure years of trouble-free operation.

3.1 GENERAL CARE

- Proper ventilation should be provide in the pump room.
- Keep unit clean.
- Provide the motor with adequate overload protection.
- Keep flying chips or other loose particles away from the ventilating openings of the motor.
- Avoid operating the unit in overheated surroundings.

3.2 BEARINGS

- Life lubricated bearings** are heavy duty permanently lubricated, sealed type and require no maintenance.
- Grease lubricated bearings** require very little attention. More trouble can be caused by overcharging than undercharging with grease. Approximately every month, inject a small quantity of grease (Esso Andok No. 280 or equal).

3.3 STUFFING BOX WITH PACKING

STUFFING BOX DISMANTLING

- Remove flush line connection from stuffing box extension.
- Remove gland plate from stuffing box.
- Remove stuffing box extension.

PACKING REPLACEMENT

- When removing old packing, make sure bottom rings are completely removed (Maintain sequence of lantern ring and packing ring).
- Thoroughly clean the stuffing box and check condition of shaft sleeve (a badly worn or corroded shaft sleeve will never seal properly).
- Cut packing into lengths allowing $\frac{1}{8}$ " between ends when installed.
- Place first ring around shaft and press firmly and evenly into stuffing box.
- Continue in the same manner staggering ring joints one quarter of a turn until stuffing box is filled.
- Make certain lantern ring is in correct position under pipe connection.

STUFFING BOX ASSEMBLY

- Install back stuffing box extension.
- Install flush line connection on stuffing box extension.
- Install gland plate and compress evenly leaving it finger tight.
- Compress packing evenly with gland and leave gland nut finger tight.
- With pump running adjust gland with recommended leakage rate.



CAUTION: Packing should not be pressed too tight, as this may result in burning the packing and scoring the shaft sleeve.

4.0 PUMP DISASSEMBLY

It is unnecessary to disconnect piping or casing to service VIL fire pumps. All service and maintenance can be performed by removing pump assembly from casing.

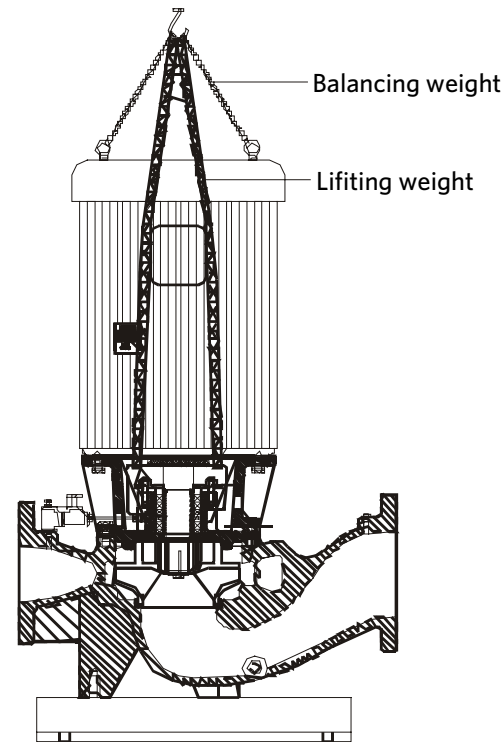
- Disconnect wiring to the motor
- Remove casing bolts connecting casing and spacer
- Entire pump assembly can be withdrawn from casing by lifting the motor
- Remove impeller bolt by turning it counter clockwise
- Pull off the impeller by wedging around its periphery and slip out the impeller key from its shaft groove

- 6 Slide spring loaded carbon rotating face off impeller shaft (ULC pumps only)
- 7 Remove bolts connecting motor to adapter to lift off adapter
- 8 If wear ring is to be replaced, split with cold chisel to remove from it recess
- 9 Replace ring after smoothing and lightly lubricating recess and tap the new ring with a lead hammer
- 10 If motor shaft sleeve is to be replaced, it is important that no pressure be placed upon the motor bearings
- 11 All force must be directly against the motor shaft only as the sleeve is removed and replaced.

5.0 PUMP REASSEMBLY

- 1 Clean seal recess of adapter
- 2 Lightly check lubricate seat ring and press stationary seal assembly and adapter (ULC only)
- 3 Bolt motor to adapter (use caution not to bump the motor shaft against the Packing Graphite) (ULC pumps only)
- 4 Replace impeller key in shaft groove
- 5 Slip on spring loaded carbon seat (ULC pumps only) and impeller on shaft
- 6 Replace impeller cap screw and tighten by turning clockwise
- 7 Remove old casing and adapter gasket and clean off any pieces that may have broken off on the castings
- 8 Put new gasket on adapter
- 9 Lower pump assembly into casing (use caution to properly align impeller into casing so that it will not be damaged)
- 10 Tighten up cap screws evenly and in rotation
- 11 Fill pump casing with water and vent all air
- 12 Re-connect motor wiring
- 13 Check motor rotation to insure proper operation

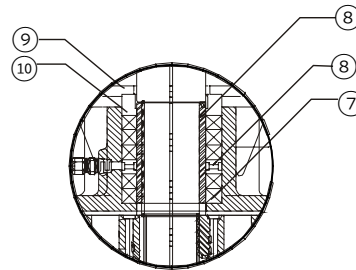
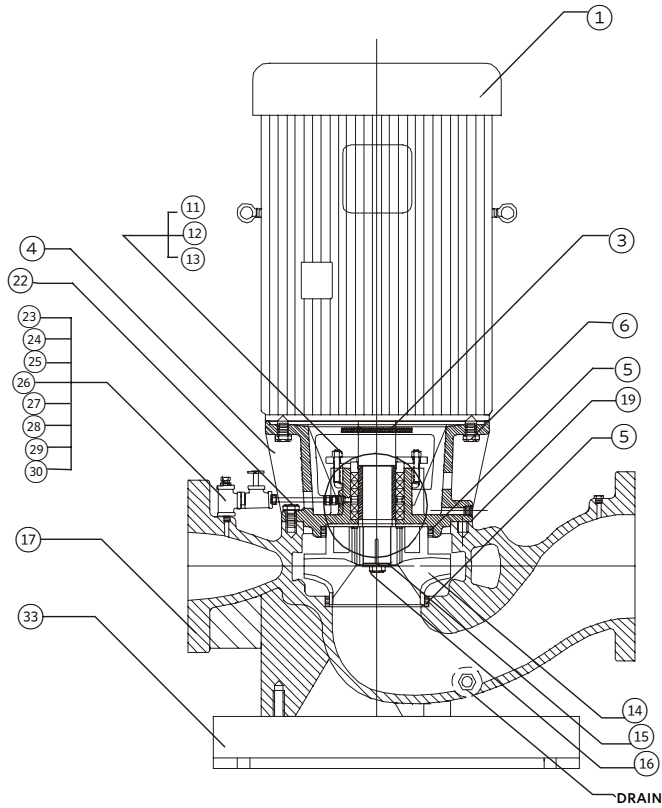
6.0 PUMP HANDLING



Vertical In-Line fire pumps shall be lifted by as shown on the above drawing. Most of the weight of the pump-motor assembly shall be lifted by the slings through the motor bracket. Slings through the motor eye bolts should only balance the pump-motor assembly.

7.0 VERTICAL IN LINE FIRE PUMP PARTS LIST

7.1 CLOSE COUPLED PUMPS



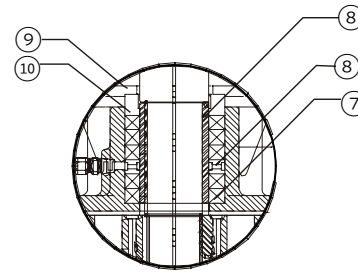
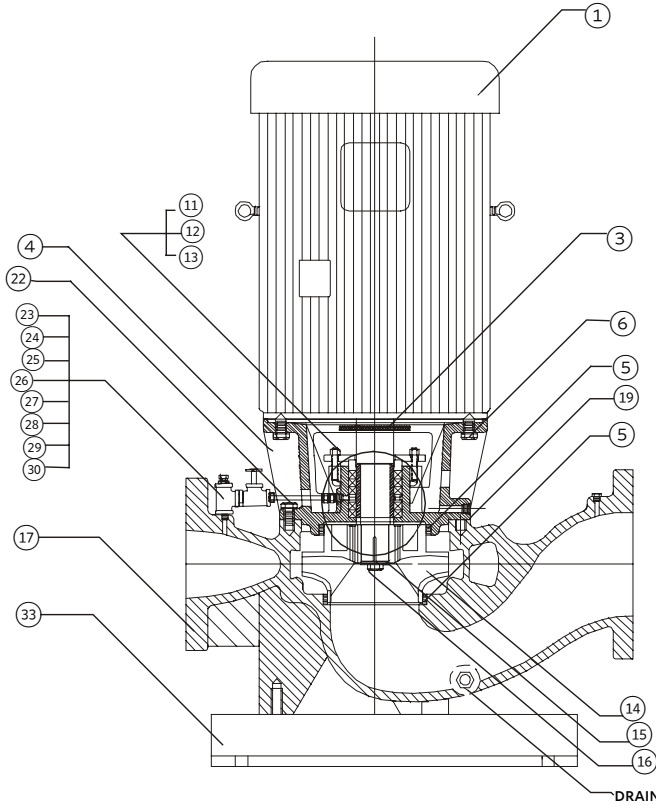
SL.NO	PUMP MODELS
1	2x1½ LA-F
2	6x5 LY- F
3	6x4 LA-F
4	6x4 LB-F

ITEM NO	DESCRIPTION	MATERIAL
1	Motor	
2	Sleeve	Stainless steel
3	Slinger	Rubber
4	Spacer - bracket	Cast iron
5	Wearing ring	Bronze
6	Capscrew	Steel
7	Packing	Graphite
8	Lantern ring	Teflon
9	Gland outer	Bronze
10	Gland inner	Bronze
11	Hook bolt	S. Bronze
12	Washer	Bronze
13	Nut	Bronze
14	Impeller	Bronze
15	Washer impeller	Stainless steel
16	Capscrew imp-selflocking	Stainless steel
17	Casing	Cast Iron

ITEM NO	DESCRIPTION	MATERIAL
18	Adapter ring	Not shown
19	Gasket	Fibre nitrile
20	Gasket adapter	Not shown
21	Drive screw	Not shown
22	Capscrew	Steel
23	Nipple	Brass
24	Tee	Bronze
25	Valve needle	Brass
26	Connector	Brass
27	Coupling	Brass
28	Bushing	Bronze
29	Air vent	Brass
30	Tubing	Soft copper
31	Bracket nameplate	Not shown
32	Nameplate capacity - SAA	Not shown
33	Base plate	Steel
34	Nameplate - FM	Not shown

7.2 SPLIT COUPLED PUMPS

7.2.1



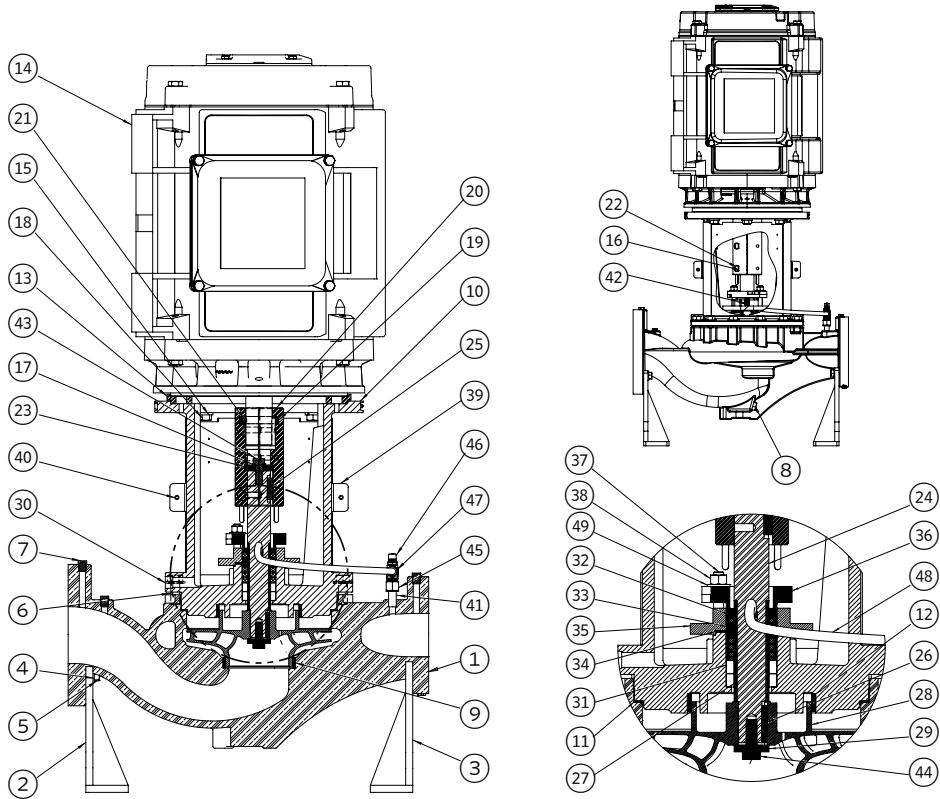
SL.NO	PUMP MODELS
1	2×2×8
2	3×3×8
3	5×5×8
4	8×8×13
5	8×8×15
6	8×8×16FM

ITEM NO	DESCRIPTION	MATERIAL
1	Motor	
2	Capscrew	Steel
3	Lockwasher	Steel
4	Nut-hex	Steel
5	Coupling-split	Aluminum
6	Key	Stainless steel
7	Shaft	Stainless steel
8	Collar	Steel
9	Collar	Steel
10	Bushing carbon	Carbon
11	Capscrew-stuffing box cover	Steel
12	Gland - split	Bronze
13	Stud	Stainless steel
14	Washer	Stainless steel
15	Nut-hex	Stainless steel
16	Pedestal-driver	Cast iron
17	Stuffing box cover	Ductile iron
18	Wearing ring-stuffing box	Bronze
19	Lockwasher	Steel
20	Capscrew	Steel
21	Nut-hex	Steel
22	Shaft sleeve	Bronze
23	Packing	Graphite
24	Lantern-ring	Teflon
25	Impeller key	Stainless steel

ITEM NO	DESCRIPTION	MATERIAL
26	Impeller	Bronze
27	Impeller washer	Stainless steel
28	Impeller capscrew self-lock	Stainless steel
29	Casing	125# flgd = cast iron 250# flgd = ductile iron
30	Wearing ring-casing	Bronze
31	Gasket casing	Fibre-nitrile
32	Lockwasher	Steel
33	Capscrew	Steel
34	Connector	Bronze
35	Valve	Brass
36	Tubing	Soft copper
37	Tee	Bronze
38	Bushing-hex	Bronze
39	Nipple	Brass
40	Vent-air	Brass
41	Guard-coupling	Steel
42	Screw-coupling	Steel
43	Nut-hex coupling	Steel
44	Nameplate - SAA (not shown)	Aluminum
45	Bracket nameplate (not shown)	Steel
46	Screw-drive (not shown)	Steel
47	Nameplate FM, UL(C) (not shown)	Aluminum
48	Pipe plug-gauge	Steel
49	Pipe plug-drain	Steel
50	Baseplate-casing support	Steel

* RECOMMENDED SPARES

7.2.2



SL.NO	PUMP MODELS
1	4×3×9PF(M)
2	4×3×9PF(S)
3	4×3×10PF

ITEM NO	DESCRIPTION	MATERIAL
1	Casing	Ductile iron
2	Support foot 4" side	Steel
3	Support foot 3" side	Steel
4	Foot washer	Steel
5	Foot capscrew	Steel
6	Pedestal capscrew	Steel
7	Pipe plug ¼"	Stainless steel
8	Pipe plug ½"	Stainless steel
9	Casing wear ring	Bronze
10	Pedestal	Cast iron
11	Casing gasket	Klingersil c4430
12	Pedestal wear ring	Bronze
13	Spacer	Red brass/bronze
14	Motor	-
15	Pedestal lock washer	Steel
16	Coupling lock washer	Steel
17	Shaft lock washer	Steel
18	Pedestal capscrew	Steel
19	Motor collar	Steel
20	Coupling split	Aluminium
21	Setscrew	Steel
22	Coupling capscrew	Steel
23	Pump collar	Stainless steel
24	Shaft	Stainless steel
25	Coupling key	Stainless steel

ITEM NO	DESCRIPTION	MATERIAL
26	Impeller key	Stainless steel
27	Shaft sleeve	Bronze
28	Impeller	Stainless steel
29	Impeller washer	Stainless steel
30	Pedestal washer	Steel
31	Carbon bush	Morganite cy9 carbon
32	Packing ring	PTFE
33	Lantern ring	Teflon
34	Extension gasket	Klingersil c4430
35	Pedestal extension	Red brass/bronze
36	Gland split	Red brass/bronze
37	Gland stud	Stainless steel
38	Gland hex. Nut	Stainless steel
39	Osha guard	Steel
40	Guard capscrew	Steel
41	Nipple	Brass
42	Hose End-A	Brass
43	Shaft capscrew	Steel
44	Impeller capscrew	Stainless steel
45	90° elbow adapter	Brass
46	Valve ball straight	Brass
47	Male connector	Brass
48	Hose braid pipe	PTFE
49	Gland washer	Stainless steel

8.0 TROUBLE SHOOTING

CAUSES	REMEDY
PUMP WILL NOT START	
Faulty electrical circuit	<ul style="list-style-type: none"> Make sure both circuit breaker and disconnect switch are in the ON position If the circuit breaker trips when the pump tries to start check horsepower and voltage specified on the schematic and wiring diagram inside the starter door with the pump motor nameplate Ensure that the pressure switch/Pressure transducer is working properly and is responding to changes in pressure.
Impeller Jammed	<ul style="list-style-type: none"> Remove obstruction
PUMP IS NOISY OR VIBRATES	
Stuffing box too tight or packing improperly installed	<ul style="list-style-type: none"> Loosen gland swing bolts and remove stuffing box gland halves; replace packing
Impeller obstructed	<ul style="list-style-type: none"> Pressures fall off rapidly when an attempt is made to draw a large amount of water, remove obstruction from impeller
Excess bearing friction due to wear and dirt	<ul style="list-style-type: none"> Remove bearings and clean, lubricate, or replace as necessary
Foundation not rigid	<ul style="list-style-type: none"> Tighten foundation bolts or replace foundation if necessary
Alignment	<ul style="list-style-type: none"> Correct the alignment
Pump cavitation	<ul style="list-style-type: none"> Ensure adequate suction pressure
NO WATER DISCHARGE	
Air pocket or air leakage in suction line	<ul style="list-style-type: none"> Uncover suction pipe and locate and re-arrange
Suction connection obstructed	<ul style="list-style-type: none"> Examine suction intake, screen, and suction pipe and remove obstruction
Impeller obstructed	<ul style="list-style-type: none"> Pressures fall off rapidly when an attempt is made to draw a large amount of water, remove obstruction from impeller
Pump not primed	<ul style="list-style-type: none"> First warning is a change in pitch of the sound of the driver; shut down the pump
DISCHARGE PRESSURE TOO LOW	
Air leakage in suction line	<ul style="list-style-type: none"> Uncover suction pipe and locate and re-arrange
Suction connection obstructed	<ul style="list-style-type: none"> Examine suction intake, screen, and suction pipe and remove obstruction
Stuffing box too tight or packing improperly installed	<ul style="list-style-type: none"> Loosen gland swing bolts and remove stuffing box gland halves; replace packing
Water seal or pipe to seal obstructed or air leak into pump through stuffing boxes	<ul style="list-style-type: none"> Loosen gland swing bolt and remove stuffing box gland halves along with the water-seal ring and packing. Clean the water passage to and in the water seal-ring. Replace water seal-ring, packing gland and packing in accordance with manufacturer's instructions
Impeller obstructed	<ul style="list-style-type: none"> Pressures fall off rapidly when an attempt is made to draw a large amount of water, remove obstruction from impeller
Speed too low	<ul style="list-style-type: none"> Check that rated motor speed corresponds to rated speed of pump, voltage is correct, and starting equipment is operating properly
Wrong direction of rotation	<ul style="list-style-type: none"> With polyphase electric motor drive two wires must be reversed; where two sources of electrical current are available, the direction of rotation produced by each should be checked
Rated motor voltage different from line voltage i.e., 220 or 440 volt motor on 208 or 416 volt line	<ul style="list-style-type: none"> Obtain motor of correct rated voltage or larger size motor
PUMP WILL NOT STOP	
* Faulty electrical circuit	<ul style="list-style-type: none"> Is the pressure switch inside the starter properly piped up to the water system? (system side) Is the stop valve in the piping to the pressure switch open? Check that pressure switch is working properly by disconnecting one of the pressure switch leads to simulate open contact position Ensure that pressure switch connection lines have been flushed to clear dirt in piping Make sure that pressure switch set point is correct according to suction and working pressure Change manual start handle to automatic
Run period timer defective	<ul style="list-style-type: none"> Remove jumper if applicable
Pressure too low	<ul style="list-style-type: none"> Verify pressure switch setting compared to system pressure
Fire pump controller emergency start handle engaged or in run position.	<ul style="list-style-type: none"> Return emergency start handle to off position

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9.0 WARRANTY

Refer standard warranty document.

10.0 PRE START-UP / POST START-UP CHECK LIST

Refer Armstrong pre-startup check list.

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