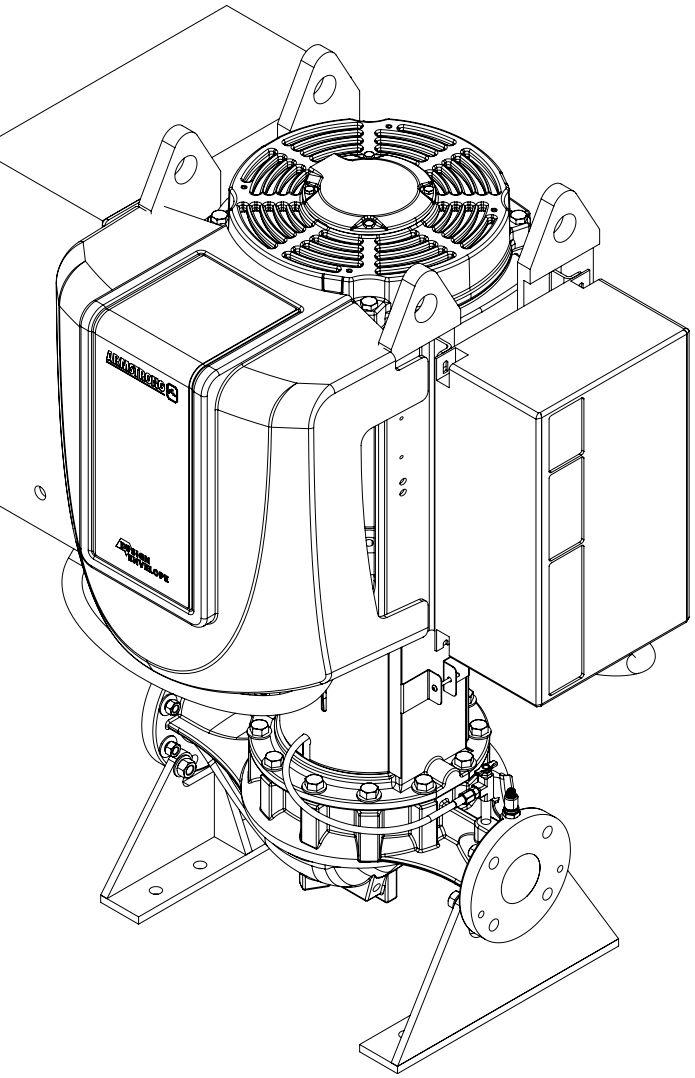
ARMSTRONG



Design Envelope Fire Pump Unit

Installation and operating instructions

File No: F100.12
Date: JANUARY 25, 2024
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CONTENTS

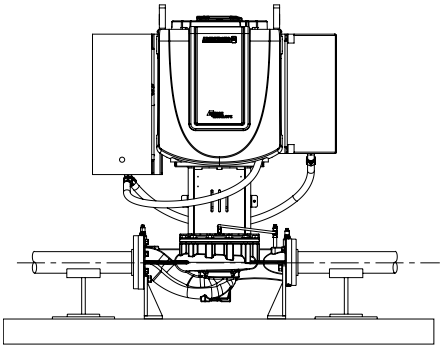
INSTALLATION AND OPERATING MANUAL DESIGN ENVELOPE FIRE PUMPS AND FIREPAKS

Design Envelope Fire Pumps 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 Design Envelope Fire Pumps 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 down upon the piping. 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 & Design Envelope Fire Pump are thoroughly tested and inspected before shipment but should be carefully examined for possible damage during transit. Contact your Armstrong Fluid Technology representative and the Transport Company immediately if there is any evidence of mishandling.

FLOOR SADDLE SUPPORT



1.0 INSTALLATION

1.1 LOCATION

- 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 DESIGN ENVELOPE FIRE PUMPS AND FIREPAKS

- 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.

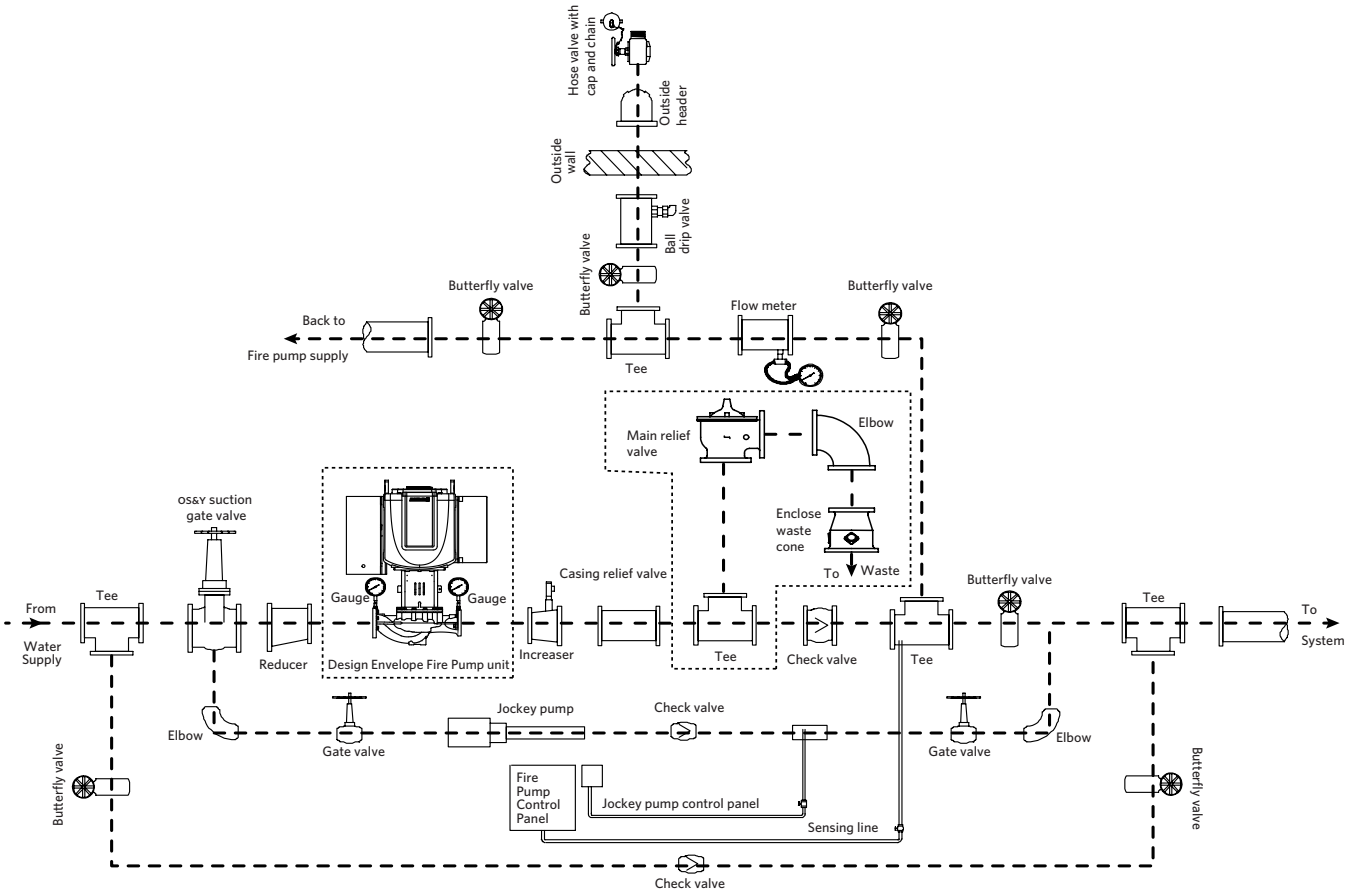
1.3 PUMP MOUNTING AND PIPING

- As per NFPA 20 the fire pump should be rigidly mounted(as shown in the dia.) before starting the operation.
- Never connect a pump to piping unless extra care is taken to measure and align the piping flanges well. Always start piping from pump.
- Do not use flexible connectors on the suction or discharge of a vertical in-line pump unless the pump is rigidly mounted to a foundation.
- Ensure piping exerts no strain on pump as this could distort the casing causing breakage or early failure due to pump misalignment.
- The piping arrangement should be adequately supported to not have any vibrations during operation.
- All connecting pipe flanges must be square to the pipework and parallel to the pump flanges.
- Suction and discharge pipes may be increased or decreased at pump nozzle to suit pump capacity and particular conditions of installation. Use eccentric reducers on suction connection with flat side uppermost.
- Layout the suction line with a continual rise towards the pump without high points, thus eliminating possibility of air pockets that may prevent the pump from operating effectively.
- No flexible connections to take up pipe misalignment are necessary since pump is not permanently connected to anything but the piping and is free to move with the expansion and contraction of the piping system.
- Never connect a Firepak to piping, always start piping from unit.
- Use as few bends as possible and preferably long radius ones.
- Make sure piping exerts no strain on pump as this would distort the casing.
- Layout the suction line with a continual rise towards the pump without high points, thus eliminating possibility of air pockets.
- Install, at pump suction, a straight pipe of a length equivalent to 10 times its diameter.

REMINDER

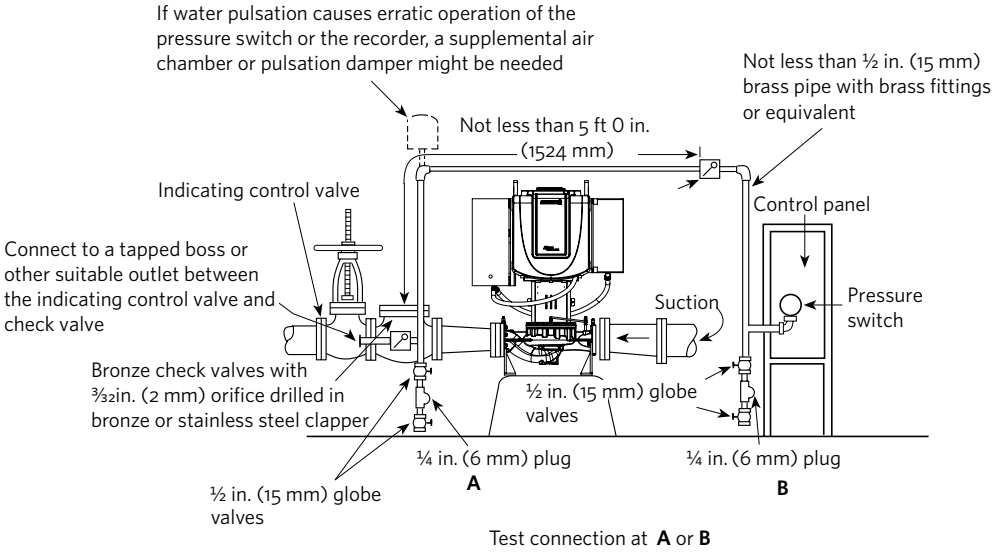
- Discharge valve only must be used to shut-off the pump.
- If Fire Pump unit is not packaged by the pump manufacturer, installation needs to be done as per NFPA 20, 2022 recommendations. (see **Typical Fire Pump & Controller Arrangement** drawing).

TYPICAL FIRE PUMP & CONTROLLER ARRANGEMENT FOR DESIGN ENVELOPE FIRE PUMP UNIT



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 DRAWING FOR DESIGN ENVELOPE FIRE PUMP UNIT



NOTES:

1. Solenoid drain valve used for engine-driven fire pumps can be at **A, B**, or inside controller enclosure.
2. If water is clean, ground-face unions with noncorrosive diaphragms drilled for 3⁄32 in. orifices can be used in place of the check valves.

1.4 MINIMUM FITTINGS

If minimum fittings recommended by NFPA 20, 2022 Edition are supplied loose, they should be installed as follows:

CASING OR CIRCULATION RELIEF VALVE

- Install Casing Relief Valve at the casing discharge.
- Set in the field at pressure to the lowest suction pressure plus the rated pressure of the unit raised to the next higher 5 lb. increment.
- The casing relief valve should be piped to drain.
- Connect drain pipe to drain pump gland (UL only).

SUCTION AND DISCHARGE GAUGES

- The following gauges are required to measure both suction and discharge pressures, and must be supplied with all fire pumps to ensure close check on pump performance:

A 3½" dial combination pressure and vacuum suction gauge.

B 3½" dial discharge pressure gauge.

C ¼" cocks with lever handle.

1.5 POWER CABLE ASSEMBLY

Power cable from the fire pump controller will be connected to the de fire pump unit through electrical bypass.

2.0 OPERATION

2.1 MODES OF OPERATION

The Design Envelope Fire pump unit comes with three different operating modes.

I The Principal operating mode or the Constant discharge mode - The onboard control will read the pressure sensors on the pump unit. From that pressure reading the speed control unit will adjust the speed of the pump unit. This will ensure the discharge pressure remains constant regardless of changes to the suction pressure or flow demand from the system.

II Ancillary Operating mode or the Constant boost mode - The onboard controls will only revert to this mode of operation if the pressure sensors on the pump unit are not reading correctly. In this mode the unit reverts to an internal mapping to ensure a constant boost pressure is provided by the pump unit. The discharge pressure will vary due to changes in the suction pressure.

III The By pass mode or the Constant speed mode - The bypass mode for the unit is **Constant Speed.** The pump unit will only revert to this mode of operation if bypass has been engaged. In this mode the unit reverts to a traditional constant speed fire pump. The discharge pressure will vary due to changes in the suction pressure and flow demand of the system.

Engagement of different Operating modes for the Design Envelope fire pumps

The Standard or default operating mode will be constant discharge mode, the pump will be running in this mode by default after installation and commissioning.

The by pass mode of operation will be engaged only if the drive has failed or if the operator has engaged the bypass manually.

The Constant boost mode of operation will be engaged when

I if both the suction and discharge transducers fail or

II if the differential value between the suction and discharge transducers does not match the factory tested and mapped values.

if a single transducer is running the pump will run at the default mode i.e. constant discharge mode.

TYPICAL PRESSURE SWITCH SETTINGS OF THE FIRE PUMP CONTROLLER

- Fire Pump Stop Point (FSP) ⇨ FSP = Fire Pump Shut Off Pressure + min. Static Suction Pressure
- Jockey Pump Stop Point (JSP) ⇨JSP = FSP
- Jockey Pump Start Point (JSTRT) ⇨ JSTRT = JSP - 10 PSI
- Fire Pump Start Point (FSTRT) ⇨ FSTRT = JSTRT - 5 PSI

2.2 PRESTART-UP

Fill out **Prestart-Up Check List.**

2.3 PRESSURE SWITCH / TRANSDUCER SETTING (FIRE PUMP CONTROLLER & JOCKEY PUMP CONTROLLER)

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.

A main relief valve must (as per NFPA 20, 2022 edition, Section 4.8) be installed at the Design Envelope pump discharge.

2.4 CASING RELIEF VALVE

The casing 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.

2.5 START-UP PROCEDURE - (PUMP SEQUENCE)

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

- Open suction gate valves.
- Check that pump is full of water and that all air contained in pump has been allowed to escape.
- Compress packing evenly with gland (gland nut should be finger tight).
- On the SRVSFPU bybass panel confirm that the selector switch is set to **VFD**. Also ensure that the mechanical bypass switch is not engaged.
- Set differential pressure switch to 15 psi between pump start (low setting) and pump stop (high setting) and adjust as required through the Fire Pump Controller.
- Lower setting of pressure switch (senses discharge pressure) to prevent pump from starting.
- Place the main disconnect switch in the **ON** position.
- Place circuitry breaker in the **ON** position and check if **POWER ON** light is illuminated.
- Check direction of driver rotation by pressing momentarily the **START** and then **STOP** push buttons on the controller (proper direction is indicated by arrow on pump casing); for in-line pump use a light on shaft to see rotation (this is clockwise looking down from top of motor). If rotation is wrong interchange motor leads in panel per instructions in panel.
- On the fire pump controller, Bring the timer setting down to one (1) minute for automatic start test purpose
- Open system butterfly valve.
- Bleed the system by opening a valve on the pressure sensing line to create a pressure drop.
- If fire pump does not start, decrease the pressure setting of pressure switch until it starts (assuming no electrical trouble).
- 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 packing adjustment to obtain slight leak of approximately one drop per second.
- After running for one minute (time set on the running period timer), stop pump with stop button. If you try stopping it before the time set on the timer, the pump will not stop.
- Bleed again until desired start-up pressure is attained.
- Allow Jockey pump to stop automatically at pressure switch setting.

START-UP PROCEDURE

(FLOW TEST PROCEDURE IF REQUIRED BY AUTHORITIES)

- Primary operating mode - Constant discharge mode.
- Ancillary operating mode - Constant boost mode.
- Bypass operating mode - Constant speed mode.
- Leave system gate valve closed. Open gate valve to hose header for flow test.
- Press start button to start pump.
- Take gauge and ammeter readings .
- When test is finished, close gate valve.

POST START-UP PROCEDURE

- 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 (1) minute for each 10hp.

2.6 AUTOMATIC OPERATION

- Turn all the isolating valves to the fully open position and place the main disconnect switch on the **ON** position.
- Switch fire pump circuit breaker to the **ON** position.
- Switch the jockey pump to **AUTO** (the **POWER ON** light must be lit).
- Bypass mode should be in **AUTO** mode.

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

- When the operating differential of pressure switches do not permit these settings, the settings should be as close as equipment will permit.
- 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

- 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.
- Maximum operating temp 104 °F.

CAUTION

- Special care must be taken with the sealing washer and seat **Do not let them drop.**
- Take particular care not to scratch the lapped faces.
- Never run seals dry.
- Follow seal manufacturer's instructions.

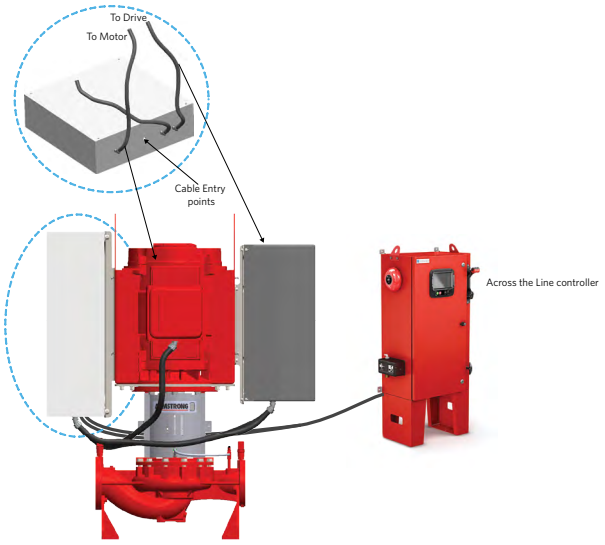
3.2 STUFFING BOX WITH PACKING (UL LISTED PUMPS ONLY)

- Adjust pressure of packing gland to obtain a slight leak of 6 to 8 drops per minute for suction pressures up to 20 psig (the increase in suction pressure causes proportional increase in leakage through the stuffing box).
- When removing old packing, make sure bottom rings are completely removed.
- Clean thoroughly the stuffing box and check condition of shaft sleeve (A badly worn or corroded shaft sleeve will never seal properly).
- 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.
- Compress packing evenly with gland and leave gland nut finger tight.

CAUTION

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

3.3 BYPASS CONNECTION



Bypass wiring details : 60 Hz

VOLATGE (V)	HORSEPOWER (HP)								WIRE SIZE	
PART NUMBER: NSYEBAD12614										
240	30	—	—	—	—	—	—	—	Cu wire - 14 AWG to 3/0 AWG	Al wire - 6 AWG to 3/0 AWG
380	30	40	50	—	—	—	—	—		
460	30	40	50	60	—	—	—	—		
575	30	40	50	60	75	—	—	—		
PART NUMBER: NSYEBAD25622										
208	30	40	50	60	—	—	—	—	Cu wire and Al wire - 6 AWG to 250kcmil AWG	
240	—	40	50	60	—	—	—	—		
380	—	—	—	60	75	100	125	150		
460	—	—	—	—	75	100	125	150		
575	—	—	—	—	—	100	125	150		

Bypass wiring details : 50 Hz

VOLATGE (V)	HORSEPOWER (HP)								WIRE SIZE	
PART NUMBER: NSYEBAD12614										
380	20	25	30	40	50	—	—	—	Cu wire - 14AWG to 3/0 AWG	Al wire - 6 AWG to 3/0 AWG
400	20	25	30	40	50	—	—	—		
415	20	25	30	40	50	60	—	—		
PART NUMBER: NSYEBAD25622										
380	60	75	100	125	150	200	250	—	Cu wire and Al wire - 6 AWG to 250kcmil AWG	
400	60	75	100	125	150	200	250	—		
415	—	75	100	125	150	200	250	—		

4.0 DE FIRE PUMP UNIT DISASSEMBLY

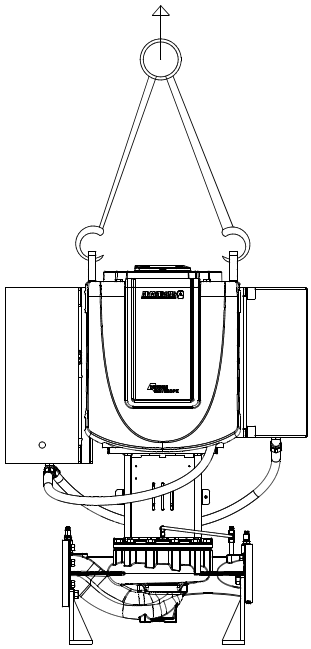
It is unnecessary to disconnect piping or casing to service Design Envelope Fire pump. All service and maintenance can be performed by removing pump assembly from casing.

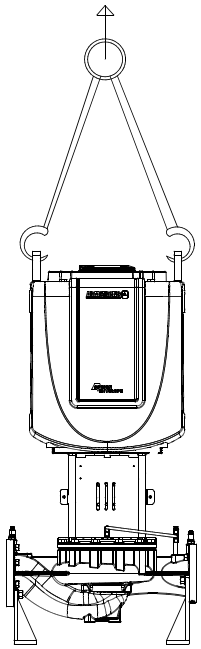
1. Disconnect wiring to the DE Fire pump unit from the fire pump controller.
2. Remove casing bolts connecting casing and spacer.
3. Entire pump assembly can be withdrawn from casing by lifting the VFD bracket.
4. Remove bolts connecting motor to adapter to lift off adapter.
5. Remove impeller bolt by turning it counter clockwise.
6. Pull off the impeller by wedging around its periphery and slip out the impeller key from its shaft groove.
7. If wear ring is to be replaced, split with cold chisel to remove from it recess.
8. Replace ring after smoothing and lightly lubricating recess and tap the new ring with a lead hammer.
9. If motor shaft sleeve is to be replaced, it is important that no pressure be placed upon the motor bearings.
10. All force must be directly against the motor shaft only as the sleeve is removed and replaced.
11. Motor removal - remove split coupling , unbolt the motor , other components at place.
12. VFD - Must be supported from above by eye bolts, not provided, that must be inserted into the eye bolt holes. Then the VFD must be removed from the backplate. Unfasten the qty 4 bolts holding the VFD in place.
13. Bypass - Must be supported independently from the pump unit. Then the bypass panel must be removed from the backplate. Unfasten the qty 4 bolts holding the bypass panel in place.

5.0 DE FIRE PUMP UNIT RE-ASSEMBLY

1. Clean seal recess of pedestal.
2. Replace impeller key in shaft groove.
3. Replace impeller cap screw and tighten by turning clockwise.
4. Remove old casing and pedestal gasket and clean off any pieces that may have broken off on the castings.
5. Put new gasket on pedestal.
6. Lower pump assembly into casing (use caution to properly align impeller into casing so that it will not be damaged.
7. Tighten up cap screws evenly and in rotation.
8. Fill pump casing with water and vent all air.
9. Re-connect motor wiring.
10. Check motor rotation to insure proper operation.

6.0 PUMP HANDLING





UL Listed Design Envelope Fire pumps shall be lifted by **METHOD #1** 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.

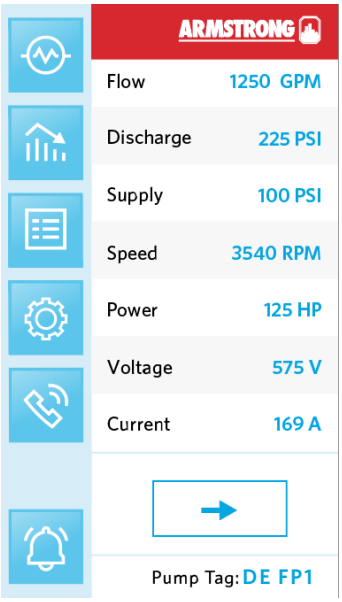
PUMP SIZE	HP	FRAME SIZE 60Hz	FRAME SIZE 50Hz
4×3×9 PF	20	254TC	256TC
	25	256TC	284TSC
	30	284TSC	286TSC
	40	286TSC	324TSC
	50	324TSC	—
	60	326TSC	—
4×3×10 PF	25	284TSC	—
	30	284TSC	286TSC
	40	286TSC	324TSC
	50	324TSC	326TSC
	60	326TSC	—
	75	364TSC	—
	100	365TSC	—
4×3×11 PF	30	284TSC	286TSC
	40	286TSC	324TSC
	50	324TSC	326TSC
	60	326TSC	364TSC
	75	364TSC	365TSC
5×4×9 PF	25	284TSC	—
	30	284TSC	286TSC
	40	286TSC	324TSC
	50	324TSC	326TSC
	60	326TSC	364TSC
	75	364TSC	—
	100	365TSC	—
5×4×10 PF	25	—	284TSC
	30	284TSC	286TSC
	40	286TSC	324TSC
	50	324TSC	326TSC
	60	326TSC	364TSC
	75	364TSC	365TSC
	100	365TSC	—
	125	404TSC	—
6×5×9 PF	30	284TSC	286TSC
	40	286TSC	324TSC
	50	324TSC	326TSC
	60	326TSC	364TSC
	75	364TSC	365TSC
	100	365TSC	404TSC
	125	404TSC	—
6×5×10 PF	40	286TSC	324TSC
	50	324TSC	326TSC
	60	326TSC	364TSC
	75	364TSC	365TSC
	100	365TSC	404TSC
	125	404TSC	—
	150	405TSC	—
	200	444TSC	—
8×6×18 PF	50	—	364TSC
	60	364TSC	365TSC
	75	364TC 365TSC	404TC
	100	404TC	405TSC
	125	405TC 405TSC	—
	150	444TSC	—

7.0 DESIGN ENVELOPE FIRE PUMP SCREENS

	Diagnostic
	Flow Trend
	Project Details
	Settings

	Help
	Next Screen
	Alarm
	Back to Home Screen
	Alarm Activated (Red)

7.1 PUMP INFORMATION



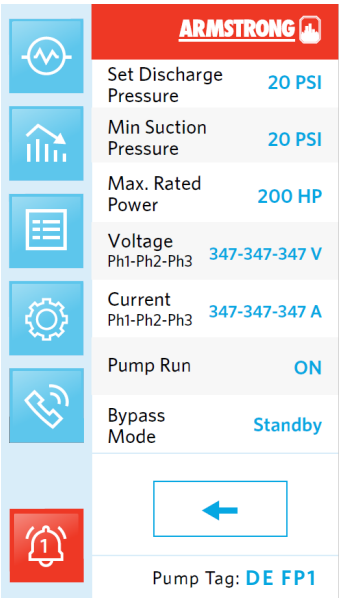
SCREEN

This is the Initial Screen which displays the following details

DESCRIPTION

Flow – System Flow
Discharge – System Discharge pressure
Supply – System Inlet Pressure
Speed – Pump Speed
Power – Motor Power
Voltage – System supply voltage
Current - System supply current

7.1.1 PUMP INFORMATION CONT.



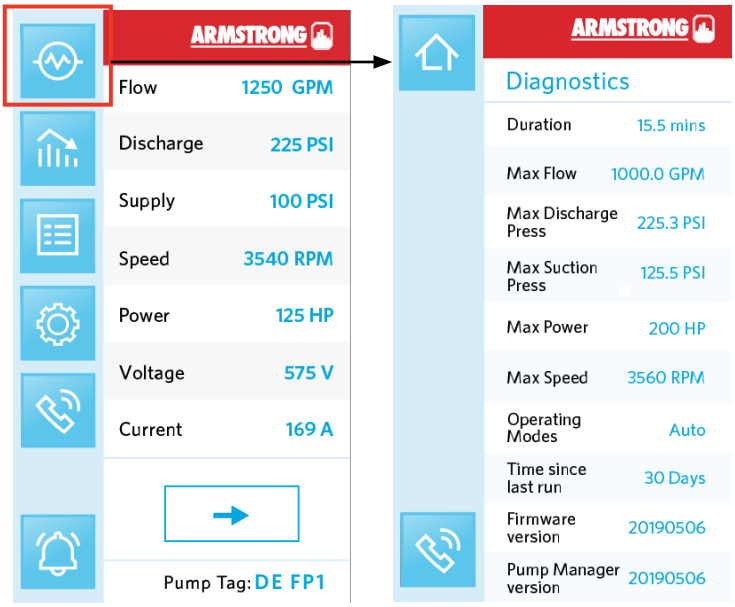
SCREEN

The second page of the home screen

DESCRIPTION

Constant Discharge pressure
Minimum Suction Pressure
Max. Rated Power
Voltage
Current
Pump Run
ByPass Mode

7.2 DIAGNOSTIC



SCREEN

This Screen displays information about the Diagnostic details of the pump.

DESCRIPTION

Duration: Duration for which pump has been running

Max. Flow: Flow of the system

Max. Discharge Pressure: (Boost Pressure * 1.14) + Maximum Suction Pressure

Max. Suction Pressure: Suction Pressure of the system

Max. Power: Motor Power

Max. Speed: Speed of the pump

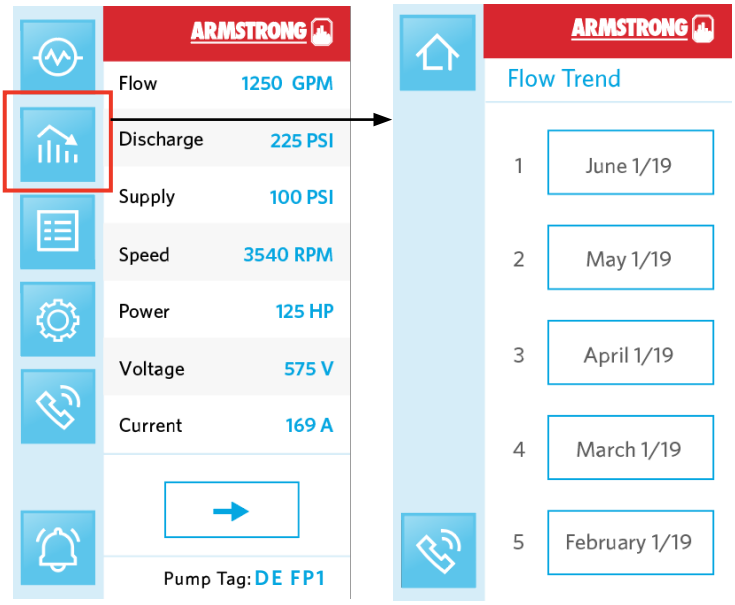
Operating Modes: Different operating modes of the pump

Time Since last run: When was the pump last run

Firmware version

Pump manager Version

7.3 FLOW TREND



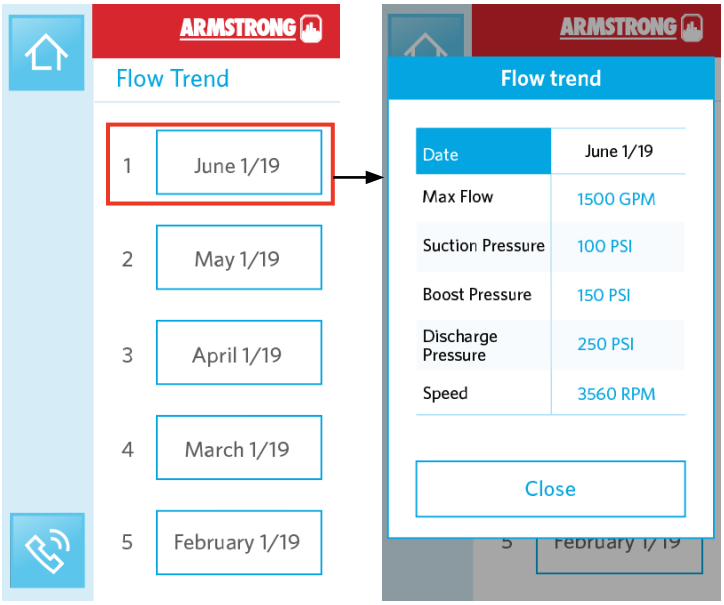
SCREEN

This screen displays Information about the pump performance on different dates.

DESCRIPTION

Information about pump performance at different measured dates.

7.3.1 FLOW TREND ON A DATE



SCREEN

This is the next screen for **Flow Trend** screen, this shows the pump performance on the selected day.

DESCRIPTION

Date: Day on which the testing done

Max Flow: System flow at testing time

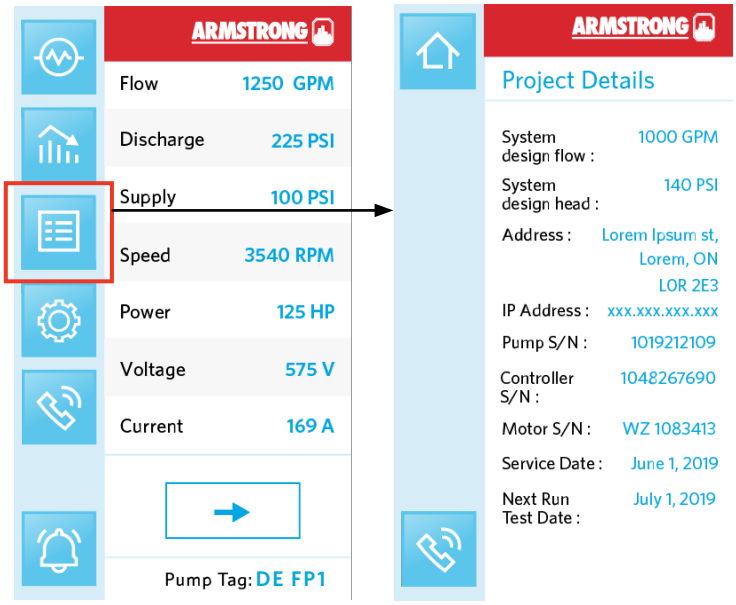
Suction Pressure: Pressure

Boost Pressure: This is the difference between **Constant discharge pressure and Minimum suction pressure**

Discharge Pressure

Speed: Speed of the pump

7.4 PROJECT DETAILS



SCREEN

This Screen shows the details of the project where the pump is installed.

DESCRIPTION

System Design Flow

System Design Head

Address: Address where the pump is installed

IP Address

Pump S/N

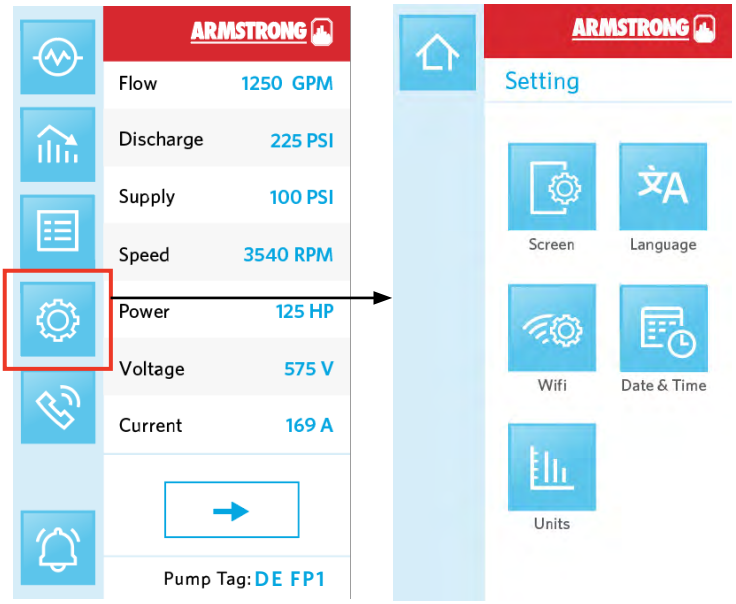
Controller S/N

Motor S/N

Service date

Next Run test Date

7.5 SETTTING



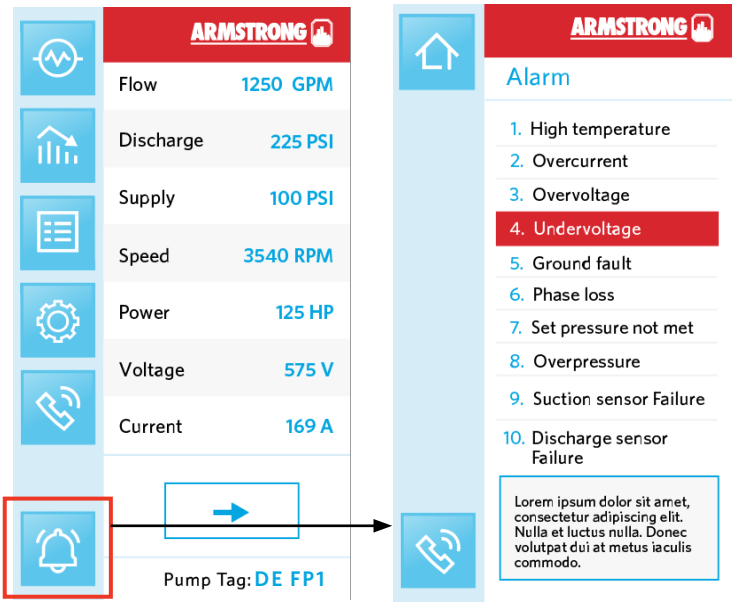
SCREEN

This screen shows the Settings of the Fire Pump manager.

DESCRIPTION

Screen
Language
Wi-Fi
Date & time
Units

7.6 ALARM



SCREEN

This section shows the different Alarms for the system.

DESCRIPTION

High Temp.
Over Current
Over voltage
Under Voltage
Ground Fault
Phase Loss
Set pressure not met
Overpressure
Suction Pressure failure
Discharge Sensor Failure

8.0 MODBUS & BACNET SETTINGS

8.1 MODBUS REGISTER MAP – FOR FIRMWARE V AND OLDER

FUNCTION CODE						MODBUS REGISTERS	DESCRIPTION	# OF REGISTERS	UNIT	NOTES
READ		WRITE								
0×01	0×03	0×05	0×06	0×0F	0×10					
x						0	Drive run status	Bool	-	-
x						1	Drive bypass status	Bool	-	-
	x					0	Max discharge pressure	Unit32	0.01	-
	x					2	Pm status	Unit16	-	0 – Not connected, 1 - Connected
	x					3	Flow unit	Uint8	-	0 - l/s, 1 - m^3/h, 2 - gpm
	x					4	Discharge pressure unit	Uint8	-	0 - bar, 1 - kPa, 2 - psi, 3 - ft, 4 - m
	x					5	Supply pressure unit	Uint8	-	0 - bar, 1 - kPa, 2 - psi, 3 - ft, 4 - m
	x					6	Actual speed	Unit16	1 rpm	-
	x					7	Motor power	Unit32	0.01 kW	-
	x					9	Motor input voltage	Unit32	0.01 V	-
	x					11	Motor input current	Unit32	0.01 A	-
	x					13	Sensorless flow	Unit32	0.01	Flow unit
	x					15	Supply pressure	Unit32	0.01	Supply pressure unit
	x					17	Discharge pressure	Unit32	0.01	Discharge pressure unit
	x					19	Alarms	Unit16	-	Refer below table 4 for alarm bits
	x					20	Max rated power	Unit32	0.01 kW	-
	x					22	Energy meter ph1 voltage	Unit16	0.01 V	-
	x					23	Energy meter ph2 voltage	Unit16	0.01 V	-
	x					24	Energy meter ph3 voltage	Unit16	0.01 V	-
	x					25	Energy meter ph1 current	Unit32	0.01 A	-
	x					27	Energy meter ph2 current	Unit32	0.01 A	-
	x					29	Energy meter ph3 current	Unit32	0.01 A	-
	x					31	Motor nominal speed	Unit16	1 rpm	-
	x					32	Operational mode	Unit16		0 - Normal mode 1 - Constant speed mode 2 - Constant head mode 3 - Bypass mode
	x					33	Set discharge pressure	Unit32	0.01	Discharge pressure unit
	x					34	Max suction pressure	Unit32	0.01	Supply pressure unit

8.2 BACNET OBJECTS – FOR FIRMWARE V AND OLDER

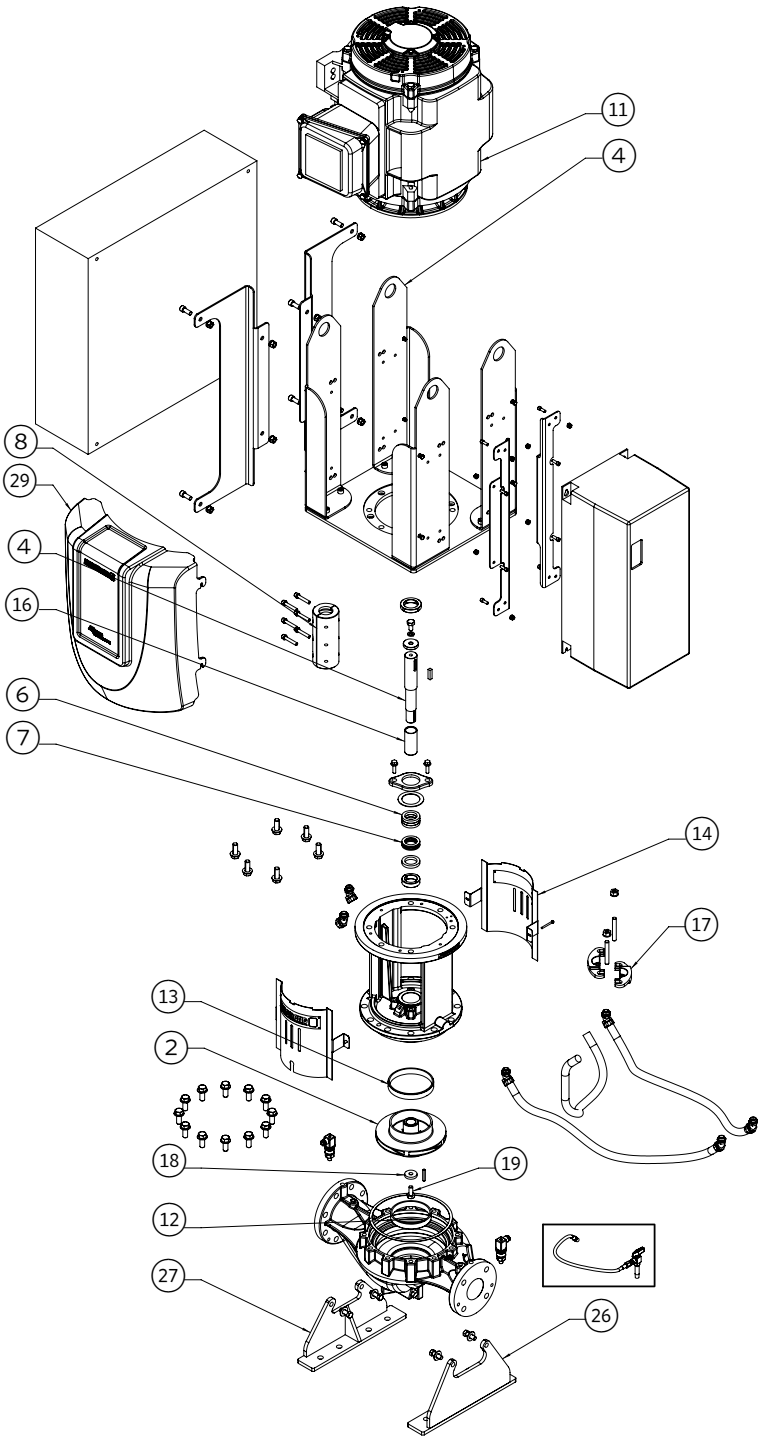
OBJECT ID	OBJECT NAME	READ/WRITE	COMMENTS
BV:0	Drive Run Status	Read	-
BV:1	Drive Bypass Status	Read	-
AV:0	Max Discharge Pressure	Read	-
AV:1	PM Status	Read	0 – Not connected, 1 - Connected
AV:2	Flow Unit	Read	0 - l/s, 1 - m^3/h, 2 - gpm
AV:3	Discharge Pressure Unit	Read	0 - bar, 1 - kPa, 2 - psi, 3 - ft, 4 - m
AV:4	Supply Pressure Unit	Read	0 - bar, 1 - kPa, 2 - psi, 3 - ft, 4 - m
AV:5	Actual Speed	Read	-
AV:6	Motor Power	Read	-
AV:7	Motor Input Voltage	Read	-
AV:8	Motor Input Current	Read	-
AV:9	Sensorless Flow	Read	-
AV:10	Supply Pressure	Read	-
AV:11	Discharge Pressure	Read	-
AV:12	Alarms	Read	Refer below table 4 for alarm bits
AV:13	Max Rated Power	Read	-
AV:14	Energy Meter Ph1 Voltage	Read	-
AV:15	Energy Meter Ph2 Voltage	Read	-
AV:16	Energy Meter Ph3 Voltage	Read	-
AV:17	Energy Meter Ph1 Current	Read	-
AV:18	Energy Meter Ph2 Current	Read	-
AV:19	Energy Meter Ph3 Current	Read	-
AV:20	Motor Nominal Speed	Read	-
AV:21	Operational Mode	Read	0 - Normal mode, 1 - Constant speed mode 2 - Constant head mode, 3 - Bypass mode
AV:22	Set Discharge Pressure	Read	-
AV:23	Max Suction Pressure	Read	-

8.3 DEFC ALARMS & WARNINGS

DEFC ALARMS	BITS
High temperature	0
Over current	1
Over voltage	2
Under voltage	3
Ground fault	4
Phase loss	5
Set pressure not met	6
Over pressure	7
Suction sensors fail	8
Discharge sensors fail	9
VFD initialization failure	10
Power Meter failure	11
Low Suction Pressure	12

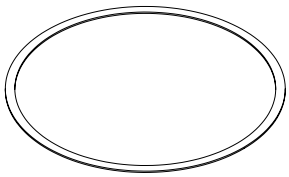
9.0 SERVICE PARTS LIST

DESIGN ENVELOPE 43PF SRVSFPU PARTS LIST

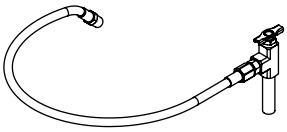


ITEM	DESCRIPTION
(12)	Casing Wear Ring
(8)	Coupling
(14)	Coupling Guards
(26)	Discharge Foot Support
(17)	Gland Split
(2)	Impeller
(19)	Impeller Capscrew
(18)	Impeller Washer
(7)	Lantern Ring
(11)	Motor
(29)	Motor Shroud
(6)	Packing Ring
(13)	Pedestal Wear Ring
(9)	Shaft Collar
(16)	Sleeve
(27)	Suction Foot Support
(4)	VFD Bracket

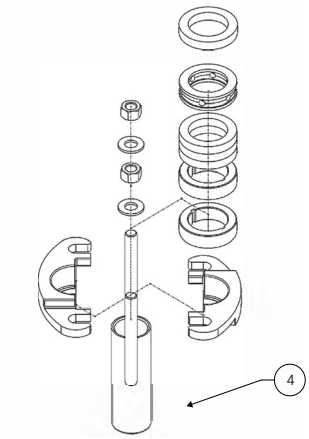
CASING GASKET KIT



FLUSH LINE KIT

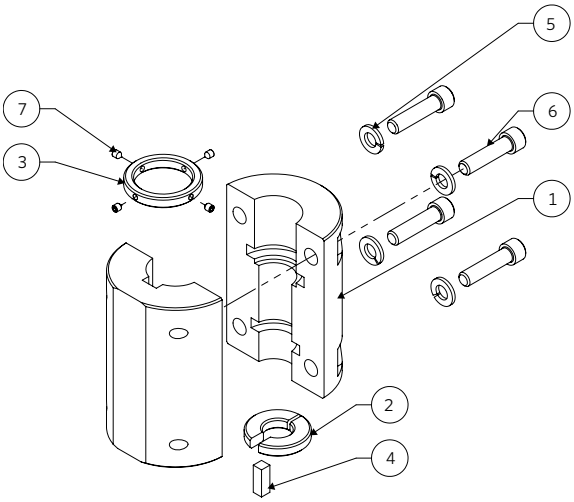


SEAL SPECIFICATION PACKING KIT



ITEM	DESCRIPTION
⑧	Carbon Bush
⑨	Lantern Ring
⑩	Packing Ring

COUPLING KIT



ITEM	DESCRIPTION
⑥	Capscrew
⑦	Collar Screw
③	Motor Collar
②	Pump Collar
④	Pump Shaft Key
①	Split Coupling
⑤	Washer

SHROUD

DEFC PARTS KIT

10.0 WARNINGS AND ALARMS

10.1 ALARM SUMMARY FOR INTERFACES

ALARM NUMBER	NAME	ALARM DESCRIPTION
1	High temperature	The temperature of a VFD or motor component is exceeding the thermal alarm limit. Turn off the power to the pump and verify that the motor, fan and VFD cooling is functioning correctly. Verify that the pump is not overloaded. Wait until hot components have cooled before returning to service and if the alarm persists after powering up contact an Armstrong Technical Service representative.
2	Over current	The VFD has detected current exceeding the safe limit. Turn the pump off. (If there is a discharge from the output phases to earth it can be verified by checking for any faults with a megohmmeter between ground and the motor leads). If a current limit has been exceeded in the VFD check that the motor can be turned. If the pump is being overloaded reduce the pump speed using hand mode control. If the alarm persists after powering up contact an Armstrong Technical Service representative.
3	Over voltage	The voltage into the VFD is out of range. Verify that the correct voltage required to operate the VFD is present by measuring each of the 3 phases. If the warning persists, contact an Armstrong Technical Service representative.
4	Under voltage	The voltage into the VFD is below to required voltage. Verify that the correct voltage required to operate the VFD is present by measuring each of the 3 phases. If the warning persists, contact an Armstrong Technical Service representative.
5	Ground fault	There is current from the output phases to ground, either in the cable between the frequency converter and the motor or in the motor itself.
6	Phase loss	A phase is missing on the supply side, or the mains voltage imbalance is too high. This message also appears for a fault in the input rectifier on the frequency converter. Options are programmed at 14-12 Function at Mains Imbalance. Check the supply voltage and supply currents to the frequency converter.
7	Set pressure not met	The current discharge pressure is at least 10% below the set discharge pressure for long period of time. Check parameter 20-21 on the drive.
8	Over pressure	The current discharge pressure is at least 10% above the set discharge pressure for long period of time. Suction pressure might be exceeding the original suction set pressure Check parameter 20-21 on the drive for discharge pressure.
9	Suction sensor fail	The suction pressure transducer is out of range. Verify the transducer sensor is firmly connected to suction pressure probe, the transducer cable is not damaged or shorted and transducer wires are terminated properly on both ends. If the alarm persists, contact an Armstrong Fluid Technology service representative.
10	Discharge sensors fail	The Discharge pressure transducer is out of range. Verify the transducer sensor is firmly connected to suction pressure probe, the transducer cable is not damaged or shorted and transducer wires are terminated properly on both ends. If the alarm persists, contact an Armstrong Fluid Technology service representative.
11	VFD initialization failure	The control card was not able to receive the initial parameters correctly. Please try to restart the pump. If the alarm persists after restart, contact an Armstrong Technical Service representative.
12	Power Meter failure	There is a communication issue between the control card and the power meter. Turn off the power to the pump and check the connections between the control card and the power meter inside the panel.

10.2 WARNING SUMMARY FOR INTERFACES

WARNING NUMBER	NAME	WARNING DESCRIPTION
1	VFD over temperature	The temperature of a VFD or motor component is near the thermal warning limit. Check that the motor, fan and VFD cooling is functioning correctly. Verify that the pump is not overloaded. If the warning persists, contact an Armstrong Technical Service representative.
2	VFD over current	The VFD has detected current exceeding the warning limit. Turn the pump off. (If there is a discharge from the output phases to earth it can be verified by checking for any faults with a megohmmeter between ground and the motor leads.) If a current limit has been exceeded in the VFD check that the motor can be turned. If the pump is being overloaded reduce the pump speed using hand mode control. If the warning persists after powering up contact an Armstrong Technical Service representative.
3	External VFD voltage	The voltage into the VFD is out of range. Verify that the correct voltage required to operate the VFD is present by measuring each of the 3 phases. If the warning persists, contact an Armstrong Technical Service representative.
4	Internal VFD voltage	An internal voltage generated by VFD is out of range. If the warning persists, contact an Armstrong Technical Service representative.
5	Internal VFD	An internal warning in the VFD has occurred. If the warning persists, contact an Armstrong Technical Service representative.
6	Reserved	
7	VFD startup	A warning occurred during the startup of the motor. Turn off the power to the pump and verify that the motor can be turned using hand mode control. If the warning persists after powering up contact an Armstrong Technical Service representative.
8	Other VFD	There has been an unknown warning condition generated by the VFD. If the alarm persists, contact an Armstrong Technical Service representative.
9	VFD communication	There is a communication issue between the control card and VFD.
10	VFD speed	The speed set by the VFD is not within tolerance. If the alarm persists, contact an Armstrong Technical Service representative.
11	VFD wiring	There is an issue in wiring to the VFD. Check the wiring to the motor from the VFD. If any I/O are used on the VFD, verify that there is continuity and no shorts for the connections.
12	System over temperature	The temperature measured by the control card is approaching the recommended operating conditions.
13	System under temperature	The temperature measured by the control card is approaching the recommended operating conditions.
14	Battery under voltage	The battery voltage is low. Replace the battery with CR2032 type cell.
15	BMS communication loss	BMS communication has been lost.
16	VFD communication loss	The communication with the VFD and the control card has stopped.
17	Invalid VFD parameter	The control card has specified an invalid VFD parameter.
18	VFD initialization failure	The initialization of the VFD through Modbus has failed. Cycle power to the pump to re-initialize.
19	VFD speed set failure	The speed could not be set by the controller. Check the connections between the VFD and control card.
20	VFD start set failure	The controller could not start the motor. Check the connections between the VFD and control card.
21	Sensorless error	The sensorless map that was entered has an error please refer to the I & O Manual for further details.
22	Hand mode timeout	The pump has been in hand mode too long. Consider setting to automatic mode to save energy.

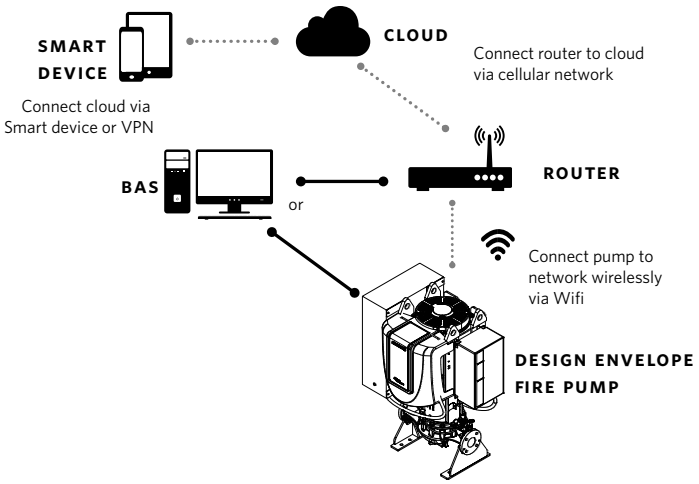
11.0 FIRE PUMP MANAGER

A key aspect of the new Design Envelope Fire Pump is the Fire Pump Manager service. Fire Pump Manager will ensure optimal performance readiness over the entire life of the pump and minimize unexpected service requirements.

The key features embedded in this service are:

- Time stamped performance test reports viewable on pumpmanager.io or in PDF format.
- Reports are created every time the Design Envelope Fire Pump operates for real or test scenarios, capturing:
  - Flow
  - Suction Pressure
  - Boost Pressure (calculated and measured)
  - Discharge Pressure
  - Speed
- Real-time diagnostics for pump readiness to help notify owners with alerts for issues including Drive over temperature, Low suction pressure etc.
- Online dashboard with tabs for:
  - Availability of historic data of all instances of operation
  - Information of all electrical parameters including voltages, currents and power drawn.
  - Quick check of Design Envelope Fire Pump operating mode.

Register your Design Envelope Fire Pump for Pump Manager by visiting
www.armstrongfluidtechnology.com/en/registration
OR
email: info@armstrongfluidtechnology.com



12.0 CONNECTIVITY KIT

An Armstrong provided Connectivity Kit (factory programmed industrial grade router) will be provided with the Design Envelope Fire pump order. This will enable data transfer from the Design Envelope Fire Pump easily to Fire Pump Manager.

Fire Pump Manger integration procedure

This process outlines the steps to connect the Connectivity Kit to a Design Envelope Fire Pump with a Design Envelope Fire Controller .

Each site will be required to have a factory programmed Connectivity kit available for Fire Pump Manager service.

Refer to **File No:** 100.8155 on Armstrong Corporate Website for full details.

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

CENTRIFUGAL PUMPS

START-UP DATE:		ORDER NO.:		SERIAL NO.:
PUMP SIZE	MIN. SUCT.PRESS.	FLOW	HEAD	VOLT_____ PHASE _____ HZ_____

CHECK THE FOLLOWING AT PRESTART-UP	OK	REMARKS / CORRECTIVE ACTIONS
1. STORAGE		
Verify equipment for improper storage or mishandling.	☐	
2. INSTALLATION		
Compare electrical supply to one indicated on motor nameplate.	☐	
Compare current rating of overload relays and fuses in controller against full load current value on motor nameplate.	☐	
3. ALIGNMENT		
Verify the alignment of driver to pump.	☐	Indicate alignment reading _____
Verify suction and discharge for pipe strain.	☐	
Do the flanges meet squarely?	☐	
4. ROTATION		
Manually turn coupling to assure free rotation of pump and motor.	☐	
5. SYSTEM		
Insure system is free of foreign matter which could damage the pump.	☐	
Responsible parties present when equipment is energized.	☐	
CHECK THE FOLLOWING AT POST START-UP	**OK**	**REMARKS / CORRECTIVE ACTIONS**
6. VIBRATION		
Upon the occurrence of excessive vibration or noise, was equipment immediately shut down?	☐	
7. FLOW		
Has flow been established?	☐	
Take gauge and amperage readings ?	☐	
Packing been adjusted to a slight leakage?	☐	
If pumps are equipped with mechanical seals, has the establishment of a clear source of water to lubricate the seals been made?	☐	
Is the lubricating seal water pressure a constant 10 to 15 psi above the discharge of the pump?	☐	
8. READINGS		
Flow, pressure and amperage readings taken immediately after correction of all problems and restart.	☐	

CUSTOMER'S REPRESENTATIVE(S) WITNESSING TESTS:

WITNESS _____

DATE: _____

ARMSTRONG PUMP DIV., REPRESENTATIVE CONDUCTING TESTS:

WITNESS: _____

DATE: _____

CHECK THE FOLLOWING AT POST START-UP

9. FIELD ACCEPTANCE TEST

ALL EQUIPMENT APPROVED ☐ YES ☐ NO

ALL REQUIRED REPRESENTATIVES PRESENT FOR TEST ☐ YES ☐ NO

AHJ AND OWNER'S REPRESENTATIVE PRESENT FOR TEST ☐ YES ☐ NO

IF NO, EXPLAIN_____

ALL ELECTRICAL WIRING COMPLETE AND PER NFPA 70 AND NFPA 20 ☐ YES ☐ NO

IF NO, EXPLAIN_____

CALIBRATE TEST EQUIPMENT USED ☐ YES ☐ NO

CALIBRATION DATE _____

FLOW TESTS

PUMP DESIGN _____GPM _____PSI

DOES THE PUMP MEET OR EXCEED THE CERTIFIES CURVE? ☐ YES ☐ NO

PUMP TYPE ☐ DESIGN ENVELOPE FIRE ☐ OTHERS

PUMP MAKE_____ MODEL#_____ SERIAL#_____

COMMENTS _____

ELECTRIC DRIVER OPERATIONAL TEST SATISFACTORY ☐ YES ☐ NO

ELEC. DRIVER_____ MODEL#_____ SERIAL#_____

VOLTAGE_____ VAC @_____ HP _____ RPM _____ FLA

CONTROLLER MAKE_____ MODEL#_____ SERIAL#_____

TESTED AT MINIMUM, RATED AND PEAK FLOW ☐ YES ☐ NO

Controller Test

SIX AUTO STARTS ☐ YES ☐ NO

SIX MANUAL STARTS ☐ YES ☐ NO

PHASE REVERSAL TEST PERFORMED (ELECTRIC ONLY) ☐ YES ☐ NO

ALTERNATE POWER SOURCE TESTED (ELECTRIC ONLY) ☐ YES ☐ NO

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