

Fire pump troubleshooting - start from the symptom

Won't prime, loses prime, short on capacity or pressure, transfer valve or pressure control trouble, won't shift into pump, overheats, leaks, cavitates: the likely causes in the order to check them.

SYMPTOM, THEN CAUSES IN THE ORDER TO CHECK

Won't prime, or primes slowly	1. An air leak on the intake side, the usual reason 2. A discharge or drain valve that doesn't seal, or a bypass line left open 3. A worn or starved primer 4. Too much lift, a blocked strainer, or a long or collapsed suction hose 5. Primer run too long, or released too soon
Primer won't run, or runs and won't stop	1. No click at the switch 2. The switch chatters but the motor doesn't run 3. The motor keeps running with the switch off 4. It runs but won't pull vacuum
Loses prime while pumping at draft	1. A high point in the suction hose, trapping air 2. The strainer isn't deep enough, so a whirlpool pulls air in 3. An air leak at the suction side while running 4. A primer valve that lets air back in 5. Taking more water than the source and lift can give
Can't make rated capacity, or the engine is turning too fast for the flow	1. The truck transmission in the wrong gear 2. A restriction on the intake side 3. A relief valve set too low 4. A two-stage pump in pressure (series), or a transfer valve not fully home 5. Not enough engine power 6. Worn wear rings or impellers
Not enough discharge pressure	1. Flowing more water than the pump is built for at that pressure 2. The water supply is used up 3. A two-stage pump in volume when it needs pressure, or a stuck flap valve 4. The pressure control system set too low, or faulty 5. Only 60 to 100 psi after a rebuild
Transfer valve won't shift (two-stage pumps)	1. Trying to shift under pressure 2. A stiff remote control or a valve that's never moved 3. It moves, but the pump doesn't change
Pressure surges, or the relief valve or governor won't hold	1. Electronic governor: a fouled transducer or bad engine data 2. Electronic governor: running in RPM mode instead of pressure mode 3. Relief valve: won't open, or won't return to its setting 4. Relief valve: hunts, or is slow to respond 5. Relief valve: pressure surging back and forth 6. A supply problem the pressure control can't fix
Won't shift into pump, or the pump lights don't come on	1. The shift sequence wasn't followed (split-shaft, automatic transmission) 2. Butt-tooth: the gear teeth meet end to end 3. Not enough air for an air-shift unit, or an air leak 4. A multiplex node that isn't firing the shift (multiplexed trucks) 5. An indicator or interlock fault rather than the pump 6. A PTO pump that won't engage on the move
Pump water overheats at low or no flow	1. No flow, and the cooling path closed 2. A thermal relief valve that doesn't open 3. The engine or pump transmission running hot during the test

Packing leaks too much, or a mechanical seal drips	1. Packing gland too loose 2. Packing too tight, or no drip at all 3. A worn or damaged mechanical seal 4. Water getting into the pump gearbox
Gravel noise, and pressure that won't follow the throttle	1. Flow higher than the supply or lift can feed 2. A restricted intake or an air leak 3. Warm water 4. Running far below capacity at high speed

PROCEDURE

- 1 Rule out the readings**
Check the gauges, pitot and tachometer before believing a bad number.
- 2 Read intake and discharge together**
Both falling points to the supply; discharge alone points to the pump, the power or the pressure control.
- 3 Vacuum test before priming work**
Prove the pump holds 22 inHg before you work on the primer.
- 4 Compare with the test label**
More than 110 percent of the label's engine speed at any test point means repair.
- 5 Fix it at the test site and write it down**
Record the results and compare them with earlier years: a slow climb in engine speed is the pump wearing.

NUMBERS

Dry vacuum test	22 inHg, lose 10 inHg or less in 5 min	NFPA 1910 22.7.7; 1 inHg less per 1000 ft above 2000 ft
Priming time	30 s up to 1250 gpm; 45 s 1500 to 2999; 90 s 3000+	22.7.6; +15 s with a 4 in. or larger auxiliary intake of 1 cu ft or more
Pressure control	rise 30 psi or less	all discharges closed in 3 to 10 s at 150 psi net (22.7.9.2.1)
Engine speed	within 50 rpm of governed; repair over 110% of label	22.7.3.2 and 22.8.4
Readings that vary	more than 5%	find and correct the cause (22.7.8.5)
Gauges and flowmeters	off by 10 psi / 10%	recalibrate, repair or replace (22.7.11.2, 22.7.12.2)
Test water temperature	35 to 90 F	22.4; warmer water restricts the intake
Maximum lift	22 ft (Hale, Waterous); 20 ft (Darley)	less at altitude
Packing drip at 150 psi	Hale 8-10; Waterous 10-120; Darley 5-60 per min	use the maker's figure for the pump
Clearance (wear) rings	Hale: new 0.005-0.007 in./side; used max 0.015-0.020 in./side	radial clearance, Hale Muscle manual; use your pump's manual

COMMON MISTAKES

- Working on the primer before running a dry vacuum test.
- Revving the engine to prime faster.
- Reading the top of a bouncing gauge needle instead of the middle.
- Adding throttle to a pump that is cavitating.
- Shifting the transfer valve at high pressure.

- Leaving the cab before both green pump lights are on.
- Tightening packing until it stops dripping, or adjusting it with the engine running.
- Oiling a primer's vanes without checking the maker's manual - Hale says never on its primers.
- Trying to tighten a leaking mechanical seal - it has to be replaced.

Overhaul Prep · overhaulprep.app/learn/fire-pump-troubleshooting · practice and prep material, not a substitute for the manufacturer's service information.