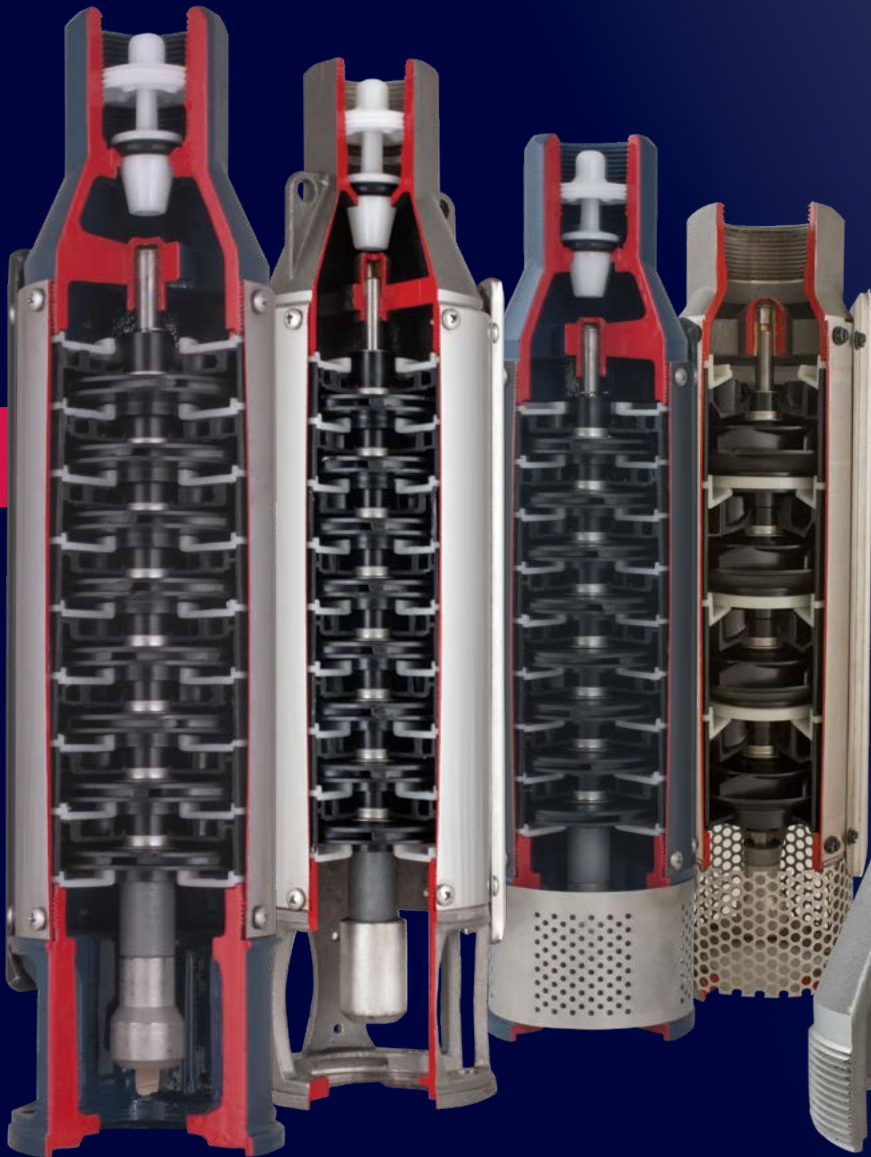


Flint & Walling Submersible Pump Ends

FW2176
0221
Supersedes
1120



TRAINING MODULE



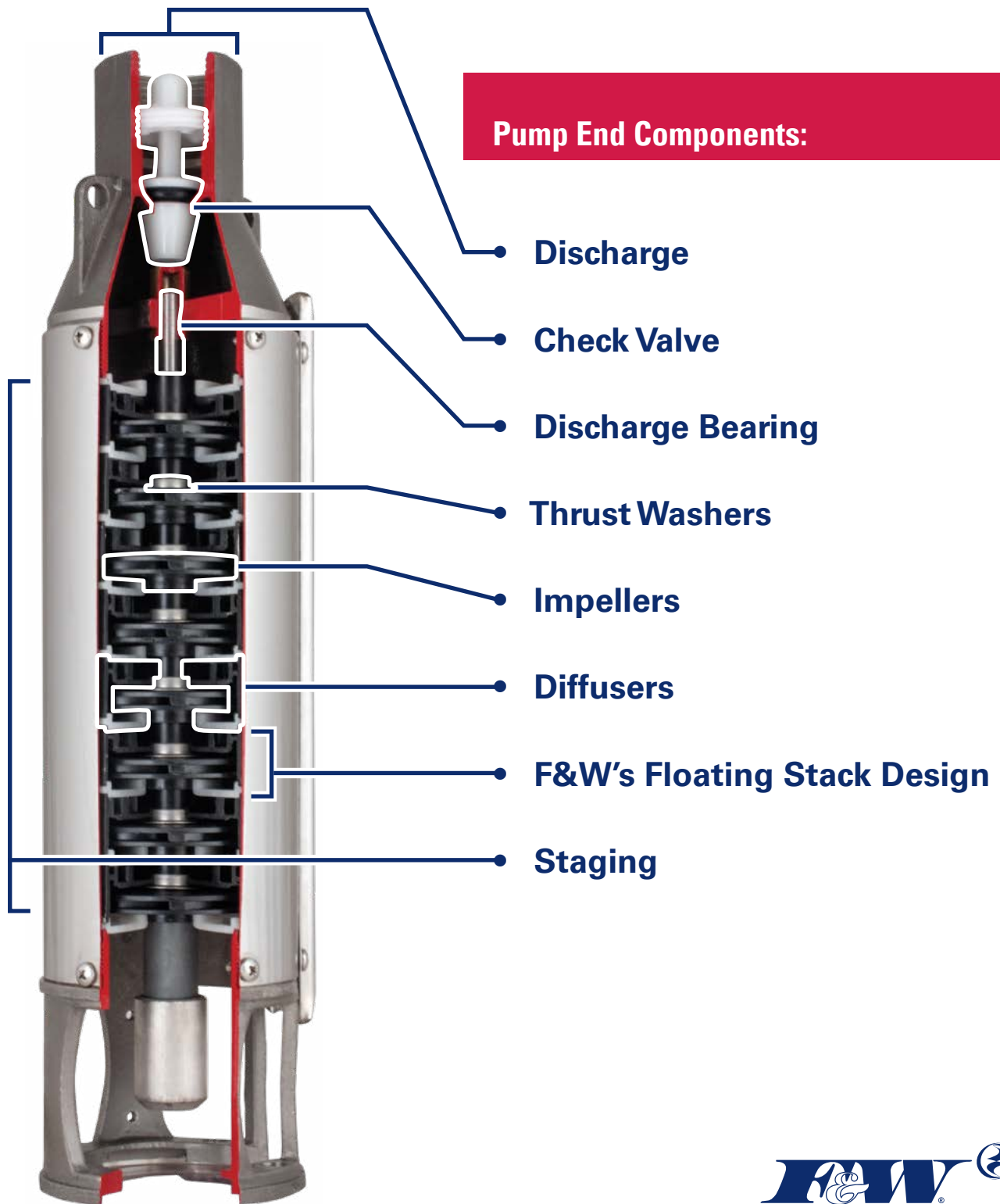
**4" Submersible
Pump Ends**



4" Submersible Components

This training module is designed to thoroughly explain the construction of an F&W submersible pump end. We'll start with the top discharge and conclude with the suction screen.

Key components, their functionality and material of construction will all be examined. Finally, we will look at the performance of these pump ends.



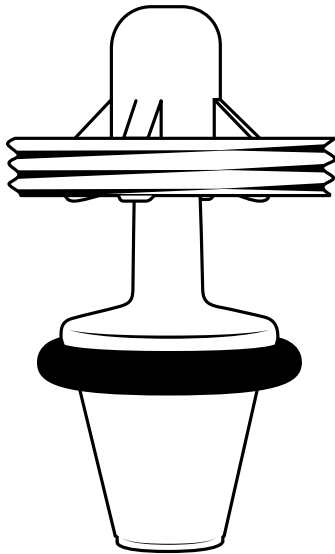
4" Submersible Components

Discharge

The pump discharge can be constructed from stainless steel, cast iron, or thermoplastic.

Discharge diameter is 1.25"

Typically two components can be found in the pump discharge, the check valve and the discharge bearing.



Check Valve

Most pump ends include a built-in check valve. F&W check valves are manufactured within our own divisions. The "poppet" style check valves are removable and have an anti-spin feature due to the rectangular poppet stem. The stem seats into a guide with a rectangular opening. The guide is closed on the top to prevent sand and debris from settling into the poppet stem area. The conical shaped poppet provides for self-centering when closing.

Note: As with all pump manufacturers, additional check valve(s) are always recommended to complete a water system.

Discharge Bearing

Essentially, discharge bearings are designed to support the desired motion and reduce friction of moving parts.

The discharge bearing is constructed of sintered lead-free bronze. Sintering is a process of compacting and forming a solid mass of material with heat and pressure, which helps it withstand sand, abrasives, and heat.

The discharge bearing has a high temperature melting point. Additionally, this bearing is "closed" at the top. This prevents sand and abrasives from passing through the bearing and shaft interface, which can happen with a sleeve type bearing.

Note: Because of their high quality construction materials, F&W pump ends have been successfully tested in a 4-hour run-dry application. No competitive pumps have endured even 1 hour of the same dry run test.



Above photo show discharge bearing after the destructive run-dry test.



4" Submersible Components

Thrust Washers

F&W self-manufactured thrust washers are constructed of stainless steel. A thrust washer is placed on every impeller hub as shown.

The purpose of the thrust washer is to compensate for "up-thrust" conditions.

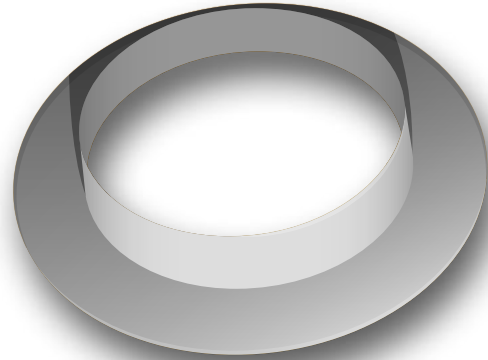
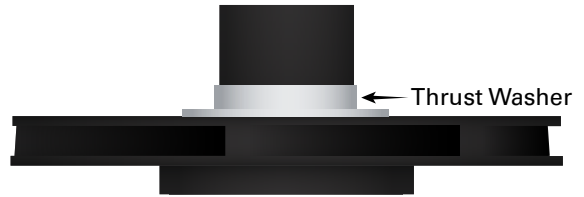
Up-thrust is defined as a "sudden" and forceful upwards movement. A 3450 RPM submersible pump motor can reach full rpm's in approximately 0.4 seconds.

Up-thrust conditions would include the following:

- The first time a pump is placed in a well and powered up
- Anytime a pump is pumping "open discharge"
- If a pump is mis-sized or not pumping from a proper depth

These conditions all have one thing in common and that is, no head pressure against the pump. When this occurs, all of the impellers and diffusers want to move toward the discharge of the pump along with the water. This is called up-thrust.

Note: Not all brands of submersible pumps utilize stainless steel thrust washers. Some manufacturers often choose to use less costly materials.



Impellers & Diffusers

F&W impellers and diffusers are manufactured within our own divisions. They are unique in design, as the top segment of the impeller is slightly smaller in diameter than the bottom segment. Yet, the impeller vanes go all the way to the outer edge to achieve efficiencies. This has been referred to as a "loose" stack by many contractors because the "tolerances" are not tight. Impellers that have tight tolerances are more subject to sand locking and can clog up more easily.

Diffuser assemblies simply convert velocity created by the impellers to pressure.

The diffuser and diffuser plate are made from dissimilar materials in order to prevent damage that could otherwise be caused by potential heat rise. Impellers and diffusers made of the same plastic material will melt and fuse into one another due to heat rise from dry-run, dead head etc.



4" Submersible Components

Floating Stack

F&W's signature "floating stack" design is just one of the many reasons for the longevity of the pump end.

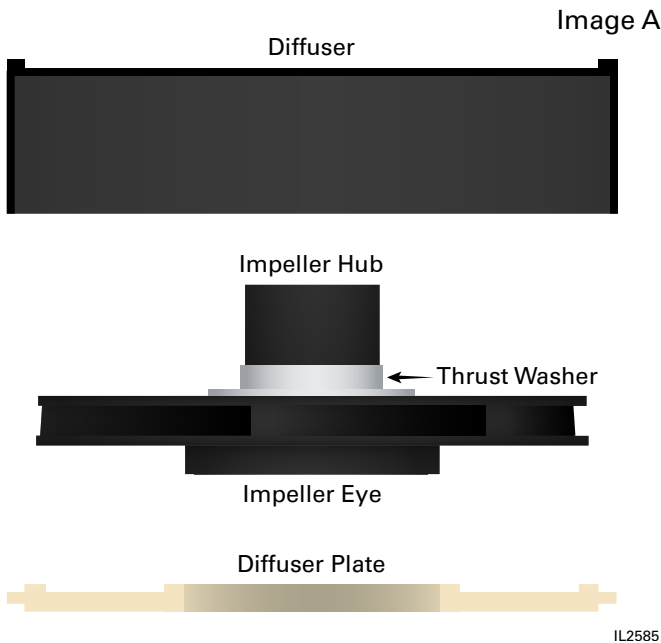
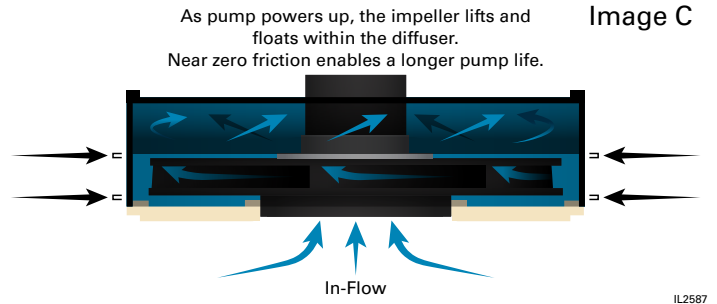
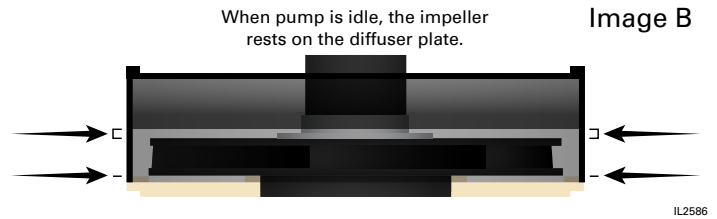
Notice the eye of the impeller has a large ridge around it. Likewise, the diffuser plate has a large ridge as well. (see image A)

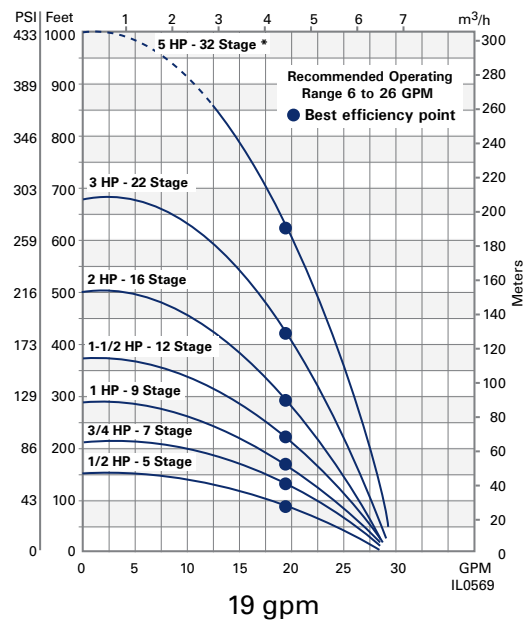
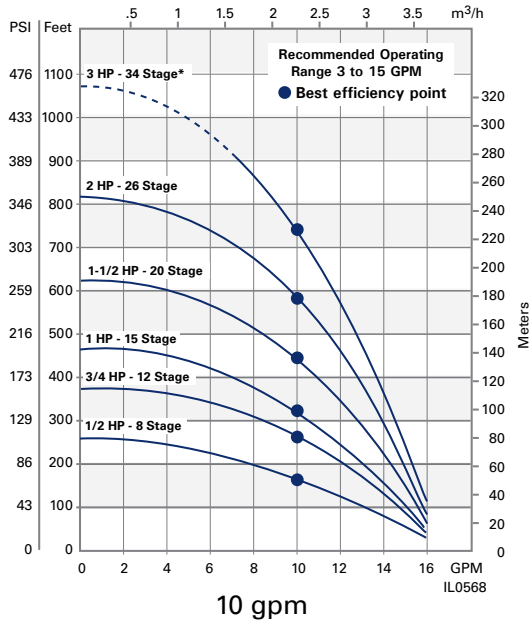
Look at images B & C. You can see how the ridge around the eye of the impeller fits inside the ridge of the diffuser plate. This engagement allows the impeller to "float" up or down without losing any of the efficiency of in-flow going directly into the eye of the impeller.

As F&W pump ends are manufactured, multiple quality checks are conducted to determine proper "shim" placement throughout the entire stack.

By design, when under a load F&W impellers will "float" within the diffuser assembly (image C) minimizing wear on the top and bottom of the impeller. F&W pump ends are shimmed at various stages to ensure a floating stack within a pump end.

Note: Some brands of pumps state they have floating stacks because their impellers are freely attached on a hex pump shaft.





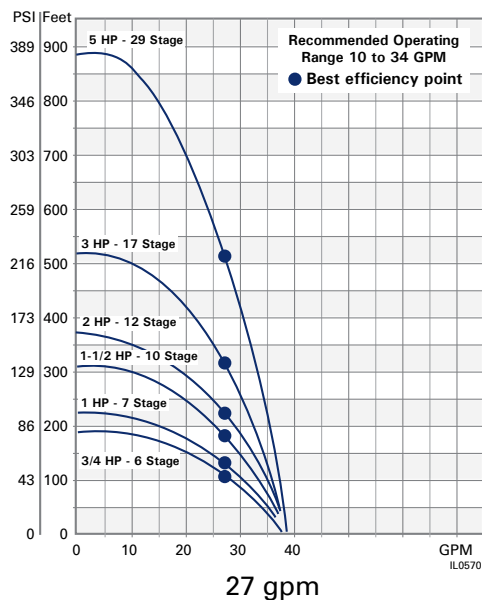
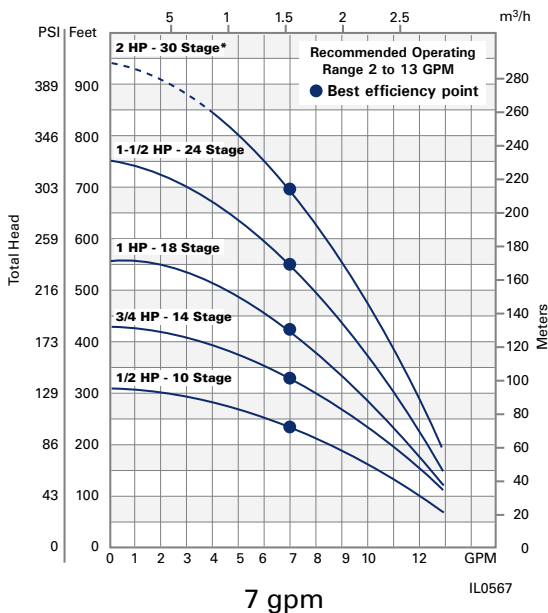
While some brands of submersible pumps ends have been de-staged over the years, F&W has never “de-staged” their submersible pump ends. The number of stages within a pump end directly correlates to increased performance through higher flows and greater feet of head.

This 7 gpm performance curve as an example illustrates the steep performance curves of an F&W pump. While many competitive pumps hit the sweet spot (black dots) on the curve, they trail off quite rapidly

anytime you may find yourself moving to the left side of the curve.

Here, you can see the difference (advantage) that having additional stages can provide. This model holds true on all F&W submersible pumps. Look at the curves below.

F&W submersible pump use premium components that have value, as this training module has shown. Each pump is quality checked and 100% wet tested.



Internal Destructive Testing

F&W conducts internal destructive testing on our brand as well as competitive brands. Audits are performed to compare results and/or wear patterns.

Protocols: Complete 4 - hours of consistent Run Dry
 Complete 3 - 30min cycles of Dead Head



Above photo shows discharge bearing after the destructive run-dry test.

Here, you can see the damage caused to various discharge bearings by heat rise and how materials of construction play a role.



Test completed after 46 mins.



Test completed after 54 mins.

Likewise, the F&W stack with out non-tight tolerances faired well with the internal sand test.

As you can see, the images on the left show excessive wear of materials, cutting grooves around the impeller.

The F&W impeller faired much better in the same test, with only a "slight rub" around the eye of the impeller.



Review Quiz

Fill in the blank - 20 pt per question (1. is worth 10 points per blank)

1. The discharge of a submersible pump contains two components.
The two components are the _____ and _____.
2. While the pump is running and under a load, each impeller is free from any contact within the diffuser and diffuser plate. This F&W signature design is called a _____.

Multiple Choice - 10 pt each (circle one)

3. What is placed on the hub of every impeller within the pump end?
 - a. spin washer
 - b. thrust washer
 - c. flat washer
 - d. lunge washer
4. What is the part that supports the pump shaft called?
 - a. cylindrical bearing
 - b. suction bearing
 - c. roller bearing
 - d. discharge bearing
5. This is always recommended in addition to the one already built into the pump.
 - a. foot valve
 - b. suction screen
 - c. check valve
 - d. none of the above
6. Up thrust conditions will occur if the following takes place.
 - a. pumping open discharge
 - b. upon an initial start-up
 - c. improperly sized pump
 - d. all the above

True or False - 5 pt each

7. A pump that has not been de-staged will provide superior performance _____ T — F
8. No pump can withstand running dry or dead heading for more than 15 mins. _____ T — F
9. Impellers and diffusers should be constructed using dissimilar materials _____ T — F
10. Impeller designs, thrust washers and discharge bearings are all features of a F&W pump end _____ T — F

Fill in the blank 0-40 points	Multiple Choice 0-40 points	True or False 0-20 points	Total 0-100 points	90-100 75-85 55-70 0-50	MASTER TRADESMAN JOURNEYMAN APPRENTICE
POINTS	POINTS	POINTS	POINTS		

