FLUID END MAINTENANCE: THE ULTIMATE GUIDE

FRAC & MUD PUMP FLUID ENDS

Reciprocating positive-displacement pumps consist of two distinct sections: a **fluid end** and a **power end**. While power ends contain the components that attach the unit to the power source, driving the pump; the hydraulic fracturing (frac) and drilling pump fluid ends contain the key components necessary to generate steady and reliable pressure required by pumping operations. Fluid ends are the part of the pump that are subjected to all types of stress, from harsh and abrasive fluids to constant high-pressure operation.

Frac fluid ends traditionally consist of a large, single forging, made from heat treated alloy steel. Initially these monoblock fluid-ends were made from carbon steel forgings, but with the ongoing quest for increased reliability and improved performance, stainless steel forgings have become the preferred material of choice.

DID YOU KNOW?
Due to their material characteristics and increased strength, stainless steel frac fluid-ends have an expected performance life of 2X compared to carbon steel.

Drilling pump (also known as mud pump) fluid ends are commonly referred to as modules. Unlike frac fluid-ends which consist of a single, mono-block forging, drilling fluid ends typically consist of 3 - 5 individual modules depending if the mud pump is a triplex, quadruplex or quintuplex design.

Considering maximum drilling pressure of 7500psi is much lower than frac operating pressures, drilling module performance life expectancy of 3 years is significantly longer in comparison to frac fluid-ends.

Gardner Denver

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COMMON ISSUES AFFECTING FRAC & DRILLING FLUID ENDS

Like any piece of equipment operating in harsh and demanding conditions, frac fluid ends and drilling pump modules are susceptible to a range of common issues that can affect performance and lead to pump failure. Thankfully, routine maintenance, as well as knowing what to look for, can help you catch a range of issues before they impact your equipment and operations on a daily basis.

Some of the more common issues that affect fluid end performance include:

CAVITATION

The most common reason for a premature frac fluid end failure is due to improperly feeding the pump with a lack of volume or pressure. This can lead to cavitation within the pump, which could in turn result in a cracked fluid end. To extend fluid end life, maintaining adequate suction pressure and volume is crucial for performance.

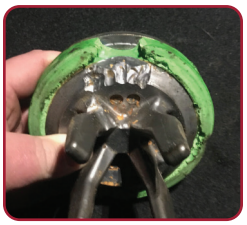
MATERIAL FATIGUE

Another common cause of failure is due to material fatigue. This occurs due to the constant impact of pressure spikes that are seen inside the fluid end; causing the material to structurally fail. Often times, this can be seen on the front face of many fluid ends when suction cover nuts are allowed to come loose, and circular cracks begin to form around the threaded area on the fluid end.

SANDING OFF

Sanding off occurs when the sand concentration, that is the ratio of fluid to sand, passing through the pump becomes too high. A high sand concentration has the potential to create a solid mass that is impossible to pump; preventing the pump from operating, and in extreme cases, causing damage to both the fluid end and the power end. However, the issue can be avoided simply by maintaining the right sand concentration at the mixer.

WASHOUT



A Washout occurs when fluid and/or sand enter the area behind, or underneath, a valve seat. Washout is usually caused by one of two issues: a worn or cracked valve seat, or improper cleaning.

Worn or cracked valve seats can allow fluid to enter the area around the valve seat, washing out the valve seat and causing it to cut into the fluid cylinder. Likewise, improper cleaning when replacing a valve seat can leave sand or debris in the valve seat area; preventing the new seat from properly forming a seal with the fluid cylinder, causing a pathway for a washout to occur.

CORROSION

Corrosion in modern frac fluid ends is almost non-existent, due to the majority of manufacturers producing stainless steel fluid ends. However, it still should be taken into account when using carbon steel fluids, especially when pumping harsh and corrosive chemicals or acids.

KNOWING WHEN TO REPLACE YOUR FRAC FLUID END CONSUMABLES

Fluid end consumables play a key role in the reliable and efficient operation of your fluid end; however their performance is only as good as their condition. There are three key parts of your fluid end that demand care and attention in order for you to obtain maximum service life. Those key components are the valves and valve seats; the plunger; and the pump packing.

VALVES & SEATS

The urethane is positioned on the suction/discharge valve, allowing for debris to be suspended in the fluid. When the urethane becomes damaged beyond the point in which it can provide a cushion to the sealing surface (the metal-to-metal face) the valve/seat is rendered no longer serviceable – preventing damage to the sealing surface. This can happen if there is a cut or wash in the seat, for example.

PLUNGER

Plungers should be replaced when they become dull or grey; or show signs of damage or wear such as nicks, lines, and scarring within the sealing surface. Any scratch that is deep enough to catch with your fingernail should be considered severe enough to warrant replacement of a plunger.

PACKING

When it comes to packing, there can be several causes of failure. Most commonly, packing failure is a direct result of physical damage to the plunger (e.g. a small scratch) that can lead to a washout. If not caught in time, washout can affect the brass that supports packing by causing deep grooves or other surface damage, requiring both new brass and packing.

Poor or incorrect lubrication is another common cause of packing failure. A lack of lubrication from the pump's oiler/greaser can cause increased heat and friction, resulting in damage, premature wear, or complete packing failure.

KNOWING WHEN TO REPLACE MUD PUMP CONSUMABLES

In addition to valves and seats, there are three additional consumables to consider when performing maintenance on a drilling pump module. Those key components are the liners, pistons, and module seals. Similar to frac fluid ends, visual inspection is the key to maximizing the service life of your pump.

LINERS

Liners should be replaced when they show signs of damage or wear such as nicks, lines, and scarring within the sealing surface. Any scratch that is deep enough to catch with your fingernail should be considered severe enough to warrant a replacement of the liner.

PISTONS

The piston should be replaced and/or inspected anytime there is an excessive leakage of drilling mud fluid from the piston and liner area. Evidence of this leakage is often visable and will quickly contaminate the rod wash system/ "duck pond" water is left unattended.

MODULE SEALS

Replacing ripped, torn or damaged seals is key to achieving maximum drilling module performance while reducing the chances of premature failure. Valve cover and wear-plate seals play a crucial role in module performance and when a seal is compromised, it must be replaced quickly to prevent a washout from occurring. Gardner Denver modules feature weep holes that will leak in the event a module seal begins to fail.

Depending on the seal type, some seals should never be reused and should always be replaced when performing module maintenance. Considering some seal materials are susceptible to chemical attack, it is very important to utilize a seal material that will not be compromised by the various chemicals present in drilling fluids. In addition, seal installation instructions should always be followed to prevent the seal from being damaged during installation.

THE BOTTOM LINE

Hydraulic fracturing and drilling pumps are designed to handle the ever growing demands of modern pressure pumping operations. Innovations and advances in technology and fluid end design are extending the service life of equipment, and allowing operators to pump for longer.

Despite this, even the most robust and reliable pieces of equipment need regular care and maintenance. From cavitation and washout, to material fatigue and corrosion, there are a number of factors that can cause lasting damage to a fluid end or drilling module. Operators, however, need to be able to spot the signs of an issue before they turn into a larger problem.

By combining knowledge with regular maintenance and equipment inspections, operators can maintain the performance of their pumps, while extending pump life and reducing the risk of pump failure.

GARDNER DENVER: YOUR FLUID END MANUFACTURER

Today's pressure pumping applications demand more from pumps and equipment than ever before. That is why, for over a decade, Gardner Denver has been offering the highest quality fluid ends for a range of Gardner Denver, SPM, and FMC pumps.

Gardner Denver's fluid ends are machined in-house from individually forged, heat treated alloy steel; and feature specially designed geometry that extends service life by reducing areas of concentrated stress. Using proprietary autofrettage techniques, Gardner Denver ensures key components, such as the fluid cylinder module, offer the highest levels of strength and durability.

Equipped with Gardner Denver's range of Redline series of high performance consumables, our fluid end's reduce the total cost of ownership by reducing downtime and extending service intervals. Backed by Gardner Denver's commitment to 24/7 service and support, our fluid ends will keep you pumping for longer.

The end result is a fluid end that is engineered to outperform and outlast the competition.

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