

## Little St. James Service Report:

Feb. 22<sup>th</sup>, 2015

On February 12 and 13, TSG technical staff traveled to the island to perform a service on the LSJ 90 K RO plant's high pressure positive displacement pump. The high pressure pump is somewhat similar to a car engine in that it contains 5 cylinders, 10 valves and 5 plungers (pistons in a car engine) that allow filtered sea water to enter the pump on the low pressure side at about 40 psi and leave the pump on the high pressure side at 800-900 psi to force the seawater through the membranes and achieve salt separation and desalination. It is composed of two stainless steel sides, a "power end" that transmits the motive power from the electric motor to the crankshaft and a "fluid end" that allows the water to be pressurized via valves and plungers. Unlike air, water is incompressible and a positive displacement pump will raise the water pressure to the high pressures needed for desalination. Because of the corrosive nature of seawater and the high pressures involved, regular service of this equipment is vital.

This plant was installed in February 2011 and is now 4 years old. The following tasks were to be accomplished during the service.

- 1- Drain Oil and Remove Power End backplate, Wipe Out Power End, Remove and Clean Oil Strainer, Refill With New Oil.
- 2- Remove plungers, packings, Wiper Boxes, Inspect Plungers and Replace as Necessary, Upon Reassembly, Replace Packings, Oil Seals and Reinstall Wiper Boxes
- 3- Replace Spherical Valve Assemblies
- 4- Inspect Media Filters to Ascertain Media Level/Condition
- 5- Start Unit and Inspect Operation, Adjust Oil Pressure As Necessary.

Task 1 was completed without incident.

Task 2-Upon disassembly of the fluid end to check the plungers, it was discovered that one of the plungers had broken loose from the corresponding power end cross head and was not moving at all. Its threaded portion had broken off in the crosshead and the broken plunger had

been impacting the cross head for an undetermined duration. Two more plungers were discovered to have damaged threads, due to having come loose. Of the five plungers and cross heads, three had sustained damage. It took the better part of a day to remove the broken piece of the plunger from the crosshead. It was necessary to return a second day with a tap to chase the damaged threads in the three power end casing cross heads. It should be noted that the power end crosshead-plunger interface on three of the five crossheads have been compromised and should be carefully monitored to ensure that they remain tight or future damage will occur.

The gland nuts that hold the packings into the fluid end were severely corroded and completely fused into the fluid end and were not able to be removed, nor were the packings changed out.

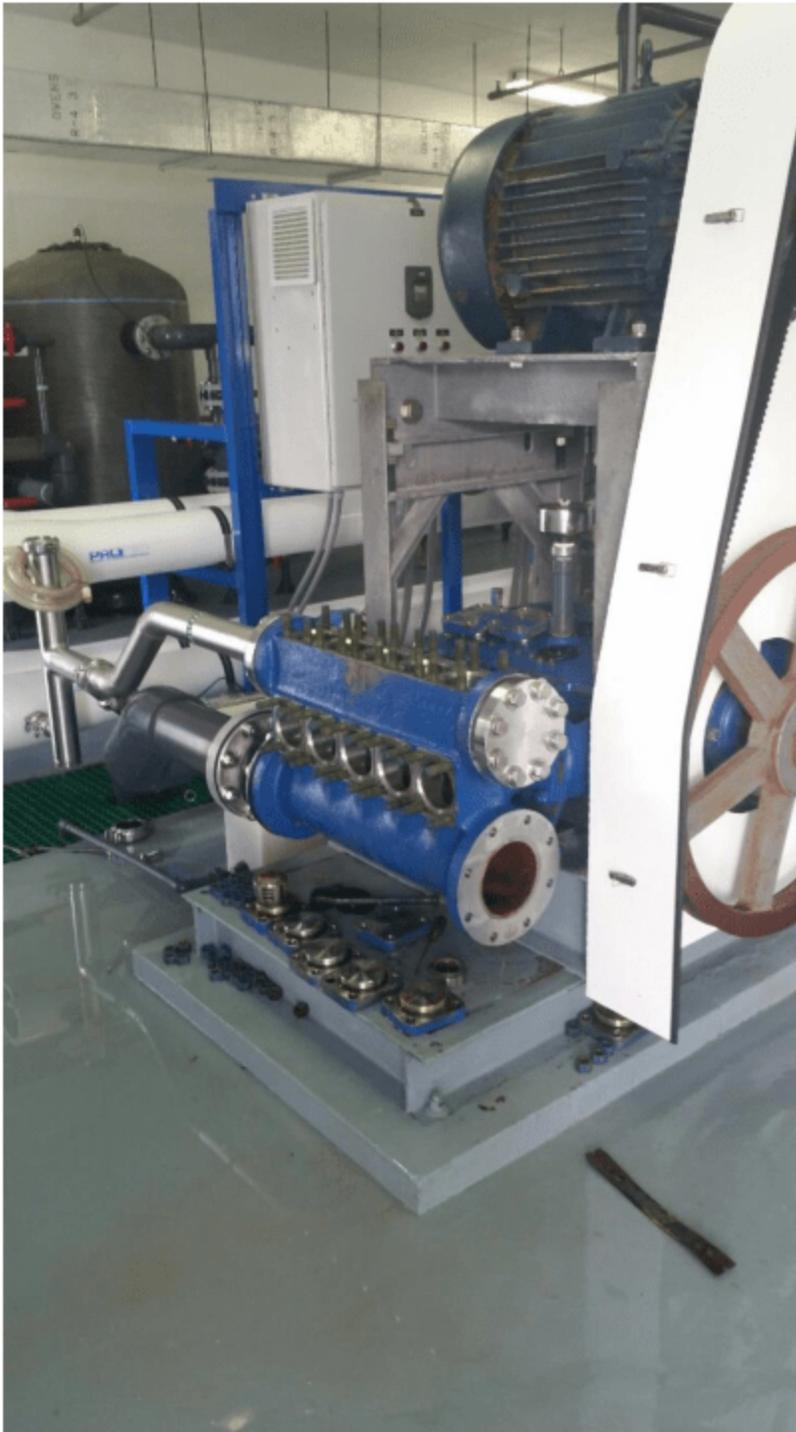
TSG recommends that funds be budgeted to replace the entire stainless steel fluid end assembly of the high pressure pump with stainless steel body, new plungers, gland nuts, packings, etc. This is a costly item with a lead time of 12-18 months. Price available upon request. Another option to consider is to replace the Wheatley pump & motor entire with an axial piston pump/motor manufactured by Danfoss. This technology direct couples the motor to the pump, uses no drive belt, no oil and needs no adjustment. The pump is lubricated by the water itself. Price available upon request.

Task 3- Advanced pitting was observed in the valve recesses of the fluid end, which has compromised the valves' ability to seat and seal during each pump revolution and accounts for the pulsation observed on the analog pressure monitoring gauge. This pulsation is caused by high pressure escaping from around the compromised and pitted valve recesses into the pressure side of the pump. All ten of the spherical valves were replaced as seven out of the ten original valves showed advanced corrosion. Five valves had to be supplied from TSG inventory to complete this task. The pulsation condition is unfavorable and prompt attention by replacement of the fluid end assembly.

Task 4- The media filters were each opened, inspected and depth to top of media measured. All showed adequate levels of media and did not need topping off.

Task 5- The plant was restarted and controls issues were observed but were not able to be addressed by the staff present and will need an I&C technician's input.

The following photos document the service trip:



*Figure 1- Disassembled Fluid end of high pressure pump, power end is directly beneath the electric motor.*



*Figure 2- Removal of Five plungers showing thread damage and broken threaded end*



*Figure 3- Close up of plunger thread damage and broken end*





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*Figure 4- Close up of Crosshead thread damage*



*Figure 5- Fused Gland nut in Fluid End*



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*Figure 6- Pitted valve recess in Fluid end*



*Figure 7- Condition of valves in Fluid end- all were replaced*



*Figure 8- Danfoss Axial Piston Pump/Motor installed by TSG at Frenchman's Cove*