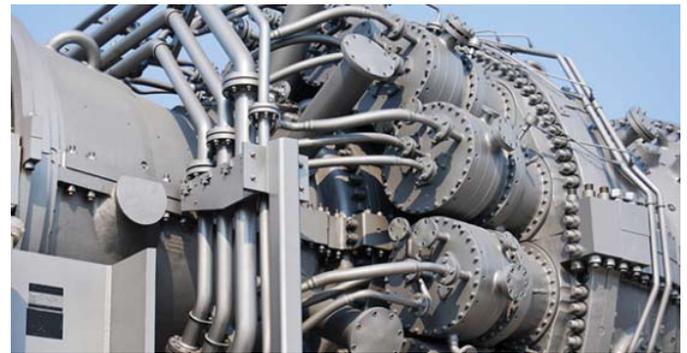




Practical, Affordable and Effective Solutions for Obtaining Dual Fuel Reliability

The Water Cooled 3-Way Purge Valve and Smart Fluid Monitor address the gas turbine industries' need for practical, cost-effective solutions to enhance the reliability of their power plants.

The ability to operate on back-up liquid fuel is achieved via the Water Cooled 3-way Purge Valve. The Smart Fluid Monitor provides monitoring and protection for the cooling water circuits with minimal purchase and installation cost.



BACKGROUND AND CHALLENGES

With the introduction of active cooling for the gas turbine back-up liquid fuel system, dual fuel gas turbine operational performance relative to startup, transfer and shutdown has never been better.

Active cooling was first installed on a turbine during the fall of 2004, followed shortly by approximately another 120 turbines being outfitted with water cooled liquid fuel check valves. These systems typically experience transfer success rates of 100%, regardless of machine type, climate or operating schedule.

Equally important is the fact that these turbine owners have the luxury of refurbishing their valves at major service intervals such as hot gas path inspections.

JASC identified and addressed two main problems with turbines that were candidates for liquid fuel system upgrades:

- Upgrading existing fuel system hardware to improve reliability is cost and time prohibitive if the new hardware isn't a bolt-in replacement.
- A system designed for decades of operation needed protection / monitoring of water cooling circuits for both the fuel controls and flame detectors

Many gas turbines purchased since 2000 have 3-way purge valves installed on the back-up liquid fuel system. Unfortunately, operational reliability for this design suffers over time for the same



reason as did standard liquid fuel check valves: high temperatures cause coke formation on the valves' internal components and degrade sealing capability. Once this occurs, refurbishment is needed in order to address the problem. The process is then repeated after every 12 to 18 months of gas fuel operation.

Previously, if a power plant which utilized the 3-way purge valve needed to improve the reliability of their backup liquid fuel system, they would have to convert to water cooled liquid fuel check valves, purge air check valves, and install cooling water piping in order to achieve this goal. This change is significant from a cost perspective because it means that the fuel and purge air piping must be modified to accept check valves. In many cases, two weeks or more of labor is required to complete this system upgrade. After having evaluated this situation, it became clear that developing a Water Cooled 3-Way Purge Valve would provide an equally effective yet less expensive alternative.

SOLUTION

JASC has developed two new products to further enhance the gas turbine owner's experience with this technology. Both the Water Cooled 3-Way Purge Valve and Smart Fluid Monitor have been created to provide inexpensive yet effective options for gas turbine owners who are looking for back-up liquid fuel system reliability.

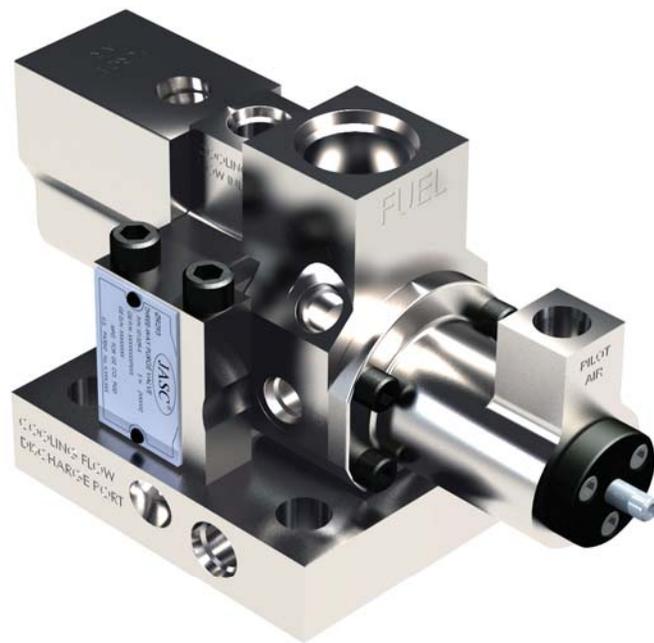
WATER COOLED 3-WAY PURGE VALVE A COST AND TIME-EFFECTIVE SOLUTION TO IMPLEMENTING A WATER-COOLED SYSTEM

Design

By changing the combustor housing and mounting flange of the standard 3-way purge valve, JASC designed a water cooled version which meets all design goals. With water cooling, the gas turbine owner seeking reliability improvement can now enjoy the same benefits as a turbine owner whose machine is equipped with standard liquid fuel check valves that have been upgraded to water

cooled liquid fuel check valves.

Conversion from a standard configured fuel system to a water cooled variation can be completed in less than two days with the Water Cooled 3-Way Purge Valve. Fuel, purge air, instrument air and valve mounting connections remain the same. The water supply and return manifolds which are fabricated from 1 inch tubing and tap into the main cooling water supply and return piping, can typically be installed in less than a day.



Upgrading

There are several options available for obtaining the Water Cooled 3-Way Purge Valve. While the most obvious option is the purchase of a new set from JASC, the second option offers the most significant opportunities for savings. Existing 3-way purge valves can be returned to JASC and upgraded to the water cooled version during refurbishment for a fraction of the cost of new valves.

Performance

Testing at JASC of Water Cooled 3-Way Purge



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Tempe, AZ 85282 USA

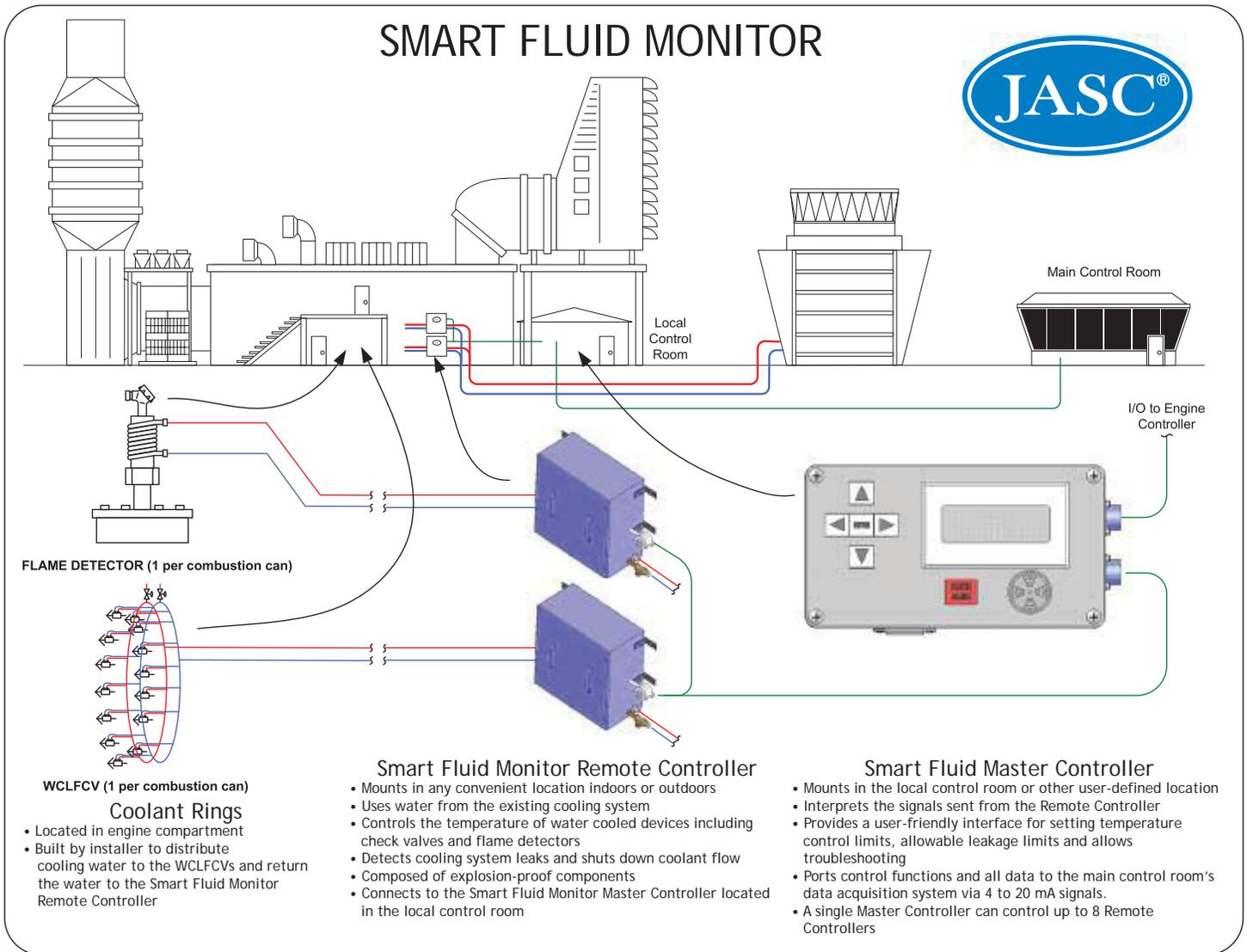
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Valves using pure air temperatures of 500°F, ambient temperatures of 450°F and cooling water temperatures of 150°F demonstrated that cooling water effectively eliminates coke formation on the valve internal components, including seals. With such promising results we are confident this design will also be able to match water cooled liquid fuel check valves and also operate from hot gas path inspection to hot gas path inspection with no maintenance or service.

SMART FLUID MONITOR

PROVIDING PROTECTION AND MONITORING OF WATER COOLED FUEL CONTROLS OR FLAME DETECTORS





The Smart Fluid Monitor automatically monitors cooling water flow, temperature and leakage. It prevents coking and waxing of water-cooled fuel components, eliminates condensation on flame detectors and prevents damage to industrial gas turbine engines from cooling system water leaks. The Smart Fluid Monitor is capable of operating several remote units on a turbine engine simultaneously. The multifunctional controller monitors water flow within user-adjustable limits and provides water system shut off with an audible alarm should a flow discrepancy of 0.1 gpm or higher occur in the cooling water circuit.

System Implementation

Due to the wide variety of turbines and auxiliary systems in use around the world, JASC understands that each site requires an individual evaluation. Contact JASC today at 602.438.4400 to find out how these designs can be used to mitigate your toughest problems.

