possible alternative to replacement.

Barth said he and colleagues were still trying to determine the root cause of the specific condition. Industry experience is that the softer (than the buckets) wheels usually take 80%-90% of the wear; buckets the remainder. However, data from this recent case show the opposite!

Vendor solutions

Improvements in fuel-system valves

Schuyler McElrath of Jansen's Aircraft Systems Controls Inc (JASC), Tempe, Ariz, was behind the podium at the 7EA meeting updating the industry on user experience with the company's water-cooled liquid-fuel check valve, which has gotten considerable attention of late. Cited advantage of this product is its ability to operate reliably in dual-fuel service without the coking that can cause spurious GT trips and other operational upsets. A good backgrounder on the valve is available in the 3Q/2005 issue of the COMBINED CYCLE Journal (p 27) as part of the magazine's coverage of the CTOTF (Combustion Turbine Operations Task Force) meeting (available at www.psimedia.info/ccjarchives.htm).

McElrath discussed the past, present, and future of fuel control, including a historical perspective on why liquid-fuel check valves have failed and how past deficiencies can be overcome through innovative design (Figs 19-21). He then updated the experience with the water-cooled valve (Fig 22) at the Valero Energy beta site described in the article cited above. By the end of October, the Delaware facility had accumulated more than 8000 actual operating hours on both gas and liquid fuel—6500 gas and 1500 oil. This represents more than 96,000 total hours without a failure of any kind.

McElrath

Based on the Valero experience, McElrath said designers expect the check valve to have a reliable lifetime of, perhaps, as long as 20 years. He reported that there has been a 2500% improvement in Valero's ability to transfer between gas and liquid fuels and that all of the facility's turbine starts on liquid fuel have been successful since installation of the new valve.

19. Standard installation for a liquid-fuel check valve shows close proximity of valve to high-temperature surfaces

McElrath said this performance shows that by eliminating coking, the check valves seal properly and prevent evacuation of the liquid fuel lines. The Valero retrofit proves the point conclusively, he suggested: After running on gas for as long as 22 consecutive days, Valero still was able to transfer to and start on liquid fuel without a problem.

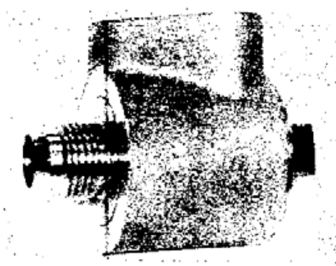
Next, he discussed the future of actively cooled fuel controls, something that had not been articulated in a public forum before the Las Vegas meeting. McElrath introduced the company's so-called actively cooled combining valve which replaces in a single housing purge-air, liquid-fuel, and fuel distribution valves (Figs 23, 24).

By eliminating coking and contamination-related failures (an integral fuel strainer removes particulates that could cause seal failures), he claimed that the new valve would require service only during regularly scheduled outages. Specifically, valve maintenance would be conducted when combustor-can end covers were replaced—regardless of the usage frequency between intervals.

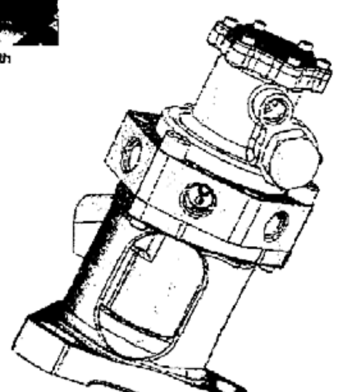
In wrapping-up, McElrath said that both valves are easily installed

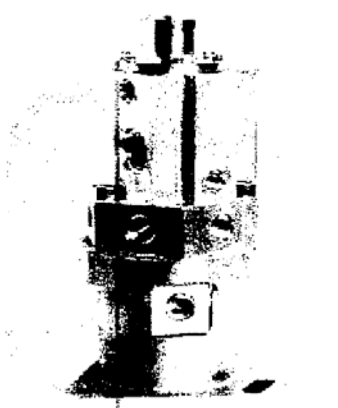
20. Example of coking in a ball-and-spring check valve that can cause operational problems

21. Coking is the primary cause of failures that occur when attempting to transfer from gas to oil



22. Production water-cooled liquid-fuel check valve exhibits robust design





23, 24. Combining valve easily bolts on to the engine on dual-fuel frame machines, regardless of make or model, where water is available at between 40 and 80 psig (typical for GTs that use cooling water systems for their atomizing air and lube-oil heat exchangers). Depending on the machine's rated output, anywhere from 5 to 18 gpm of water would be required.

Parker Hannifin Corp's solution to problems experienced with conventional OEM-supplied fuel-system valves was different from JASC's. Mike Doutt (mdoutt@parker.com), senior product engineer in the company's Instrumentation Products Div, Huntsville, Ala, followed McElrath at the podium and presented a new check-valve design for liquid fuel, purge air, and water injection.

Performance goals for Parker's new valve in liquid-fuel service (Fig 25) include the following: reliable bubble-tight shutoff, resistance to failure from coking effects, easily replaceable seal parts, easy removal of coke deposits.

The design of choice relies on a floating ball valve and a high-performance Teflon seat with a spherical sealing surface. Essentially, it combines a ball valve and a check valve, with the self-centering floating ball serving as the seal element. According to Doutt, the flexible seat adjusts the seal area to backpressure loading, thereby optimizing sealing forces. Ball cage misalignment, he said, does not adversely impact the seal.

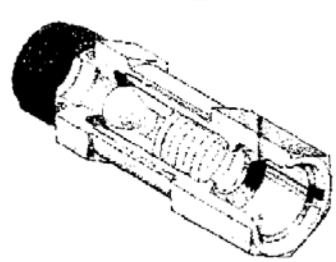

Doutt

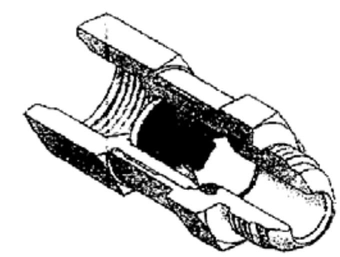
Doutt added that the application temperatures and pressures in GT fuel-system service are very compatible with Parker's new design: 300F typical maximum temperature; 300 psig (max)/150 psig (typical) purge-air pressure; 1125 psig (max)/500 psig (typical) liquid-fuel pressure.

Getting into more detail, Doutt said that the advanced carbon-graphite (for liquid fuel service) and "hard" carbon-reinforced Teflon copolymer seat materials were flexible and forgiving (the seat deforms to perfectly match the ball's spherical surface), chemically inert, capable of sustained 500F operation, and resistant to coke buildup.

Doutt demonstrated the ease of valve maintenance and repair. A "five-minute job," he said, one requiring no special tools; easy clean-out of any coke deposits that might form.

Demonstration valves have been in liquid-fuel, purge-air, and water-injection service for as long as two years, mostly on peakers—including GE 9E, 7FA, 7EA, and 7B (Fig 26) and some Siemens and Pratt & Whitney models. Doutt added that production valves now are available for a wide range of machines.


25. Reliable, bubble-tight shutoff and resistance to failure from coking effects are among the attributes of Parker's new valve for GT fuel systems


26. One of a series of valves engineered specifically for GE machines

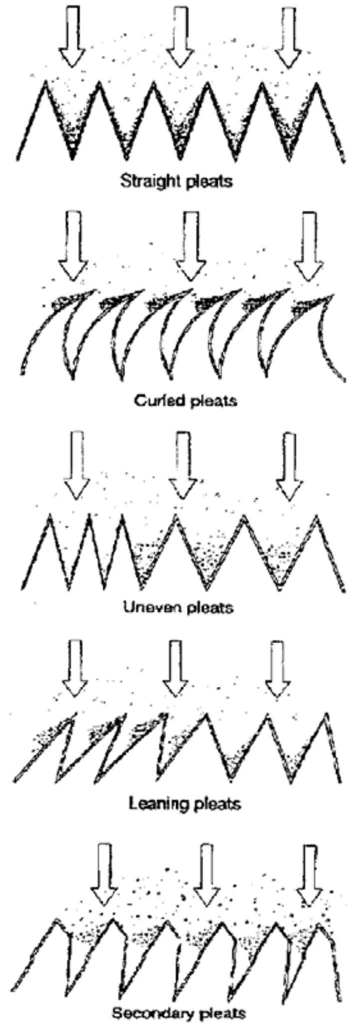
QC check for inlet air filters

Inlet air filters are up for discussion at almost every GT user-group meeting because compressor health and performance depend on their effectiveness. At the 7EA annual meeting, Ron Troxell (ron@uafilter.com), engineering manager, Greenlees Filter LLC, Forest Park, Ill, led the discussion.

Troxell reviewed filtration basics, manufacturing processes, and the need for careful evaluation of competing products before purchasing replacement filters. Most of this material had been covered previously in the COMBINED CYCLE Journal (refer to "Selecting GT inlet air systems for new, retrofit applications," Spring 2004; "Life-cycle cost analysis key to identifying optimum replacement filters," Summer 2004; "Selecting the proper inlet air filter for your GT," 4Q/2005). To access these articles, please visit the CCJ online archives at www.psimedia.info/ccjarchives.htm.


Troxell

But you learn something new almost every time you revisit a subject—no matter how familiar you are with it. A practical takeaway from Troxell's presentation was a series of sketches that can assist



27. Cut through a sample filter before making a purchasing decision to be sure the supplier is capable of making the straight pleats needed to maximize filtration effectiveness