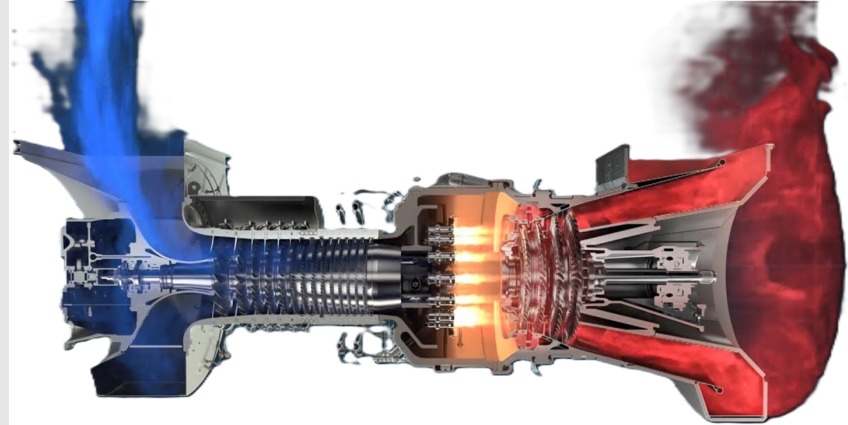




Liquid Fuel System Check Valve Options

Marla Evangelista, Luis Felix
Director of Sales / Technical Sales
2303 W. Alameda Drive
Tempe, AZ 85282
www.jasc-controls.com



JASC 3rd Generation Check Valves



JASC provides a range of specialized Liquid Fuel Check Valves engineered for reliable performance in Dual Fuel Applications.

:This presentation will talk about

- Overview of how JASC check valves integrate into Dual Fuel configurations.
- Key considerations affecting performance, reliability, and system behavior.
- How JASC's check valve technology has developed and improved over time.

JASC is available to discuss your specific application needs

A look at Liquid Fuel Components and the common problems that arise during operation....

Failure to light on Liquid Fuel

- Fuel Delivery
- Fuel Distribution
- Fuel Pressure
- Fuel Atomization
- Fuel Air Ratio
- Inadequate Initiation Energy

Temperature Splits (EGT)

- Flow Divider?
- Liquid Fuel Check Valves / Flow Dividers
- Nozzle Performance / Cooling
- Purge Air Delivery / Distribution
- Purge Air Temperature

Operational Issues

- Leakage at Seals and Connections
- Coking of components
- Failure to Transfer
- Surge / Speed Hunt
- Short maintenance intervals \$\$\$\$\$

JASC 3rd Generation Check Valves



Steps needed to Improve Reliability

1. Experience and observe an undesirable condition
2. Define the system requirements
3. Determine effect and cause of the condition
4. Research if this is a known condition that has a solution
5. Evaluate and select a potential solution
6. Evaluate the solution implementation and system impacts

**User/Vendor interaction and investment is essential
for component and system improvement!**

Time – Budget – Manpower – Software – Hardware

Operations – Safety – Compliance

Determine Effectiveness Metrics

Evaluate Performance – Corrective Feedback

Upstream System Issues: Fuel System

- **State of health of the Overall Liquid Fuel System can be seen in the condition of the JASC Valves**
- **All upstream components and operational conditions leave a signature in the JASC Fuel System Valves**
- **Fuel and Purge Air for combustion success pass through JASC components**
- **JASC will share findings related to operator's site components**

3 Generations of JASC Liquid Fuel Components

GENERATION

FEATURES

1

**INTRO TO TURBINE
FIELD SERVICE
1996**

- ANSI CLASS 6 SEATS
- DAMPING
- OPERATIONAL SURVIVABILITY
- DEDICATED DESIGN FOR
POWER GEN APPLICATION

2

**THERMAL
MANAGEMENT
2010**

- REDUCTION OF COKE
- INTRO OF WATER COOLING

3

**EXTENSIVE USE OF
STAINLESS STEEL
2018**

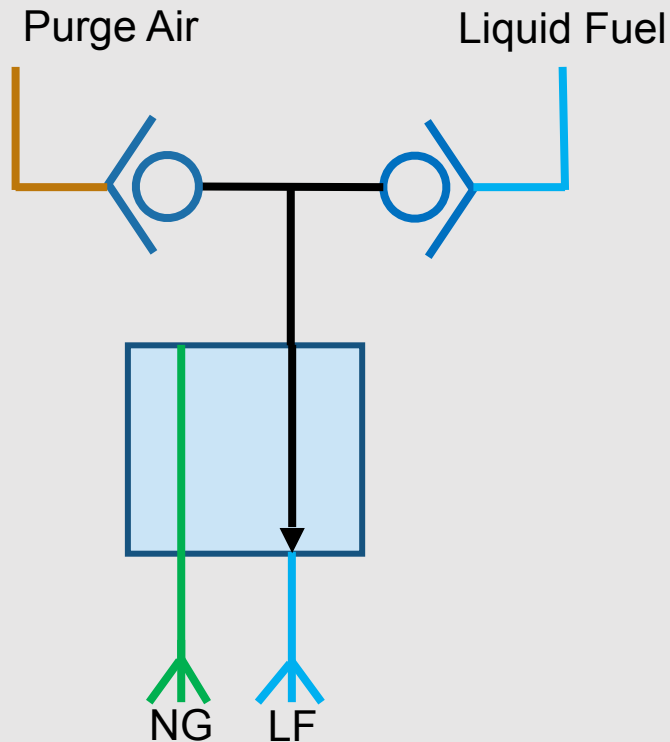
- ELIMINATION OF CORROSION
IN VALVES
- COOLING CLAMPS

JASC 3rd Generation Check Valves

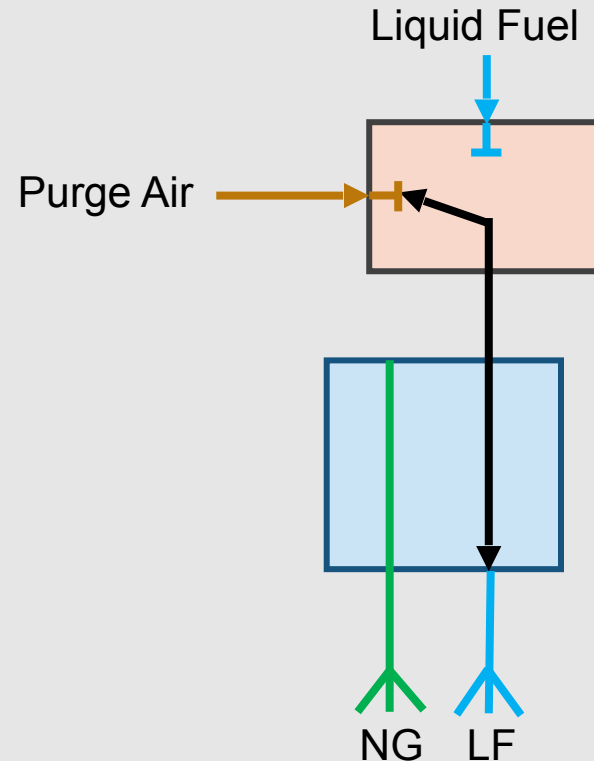


Typical Valve Installation Overview

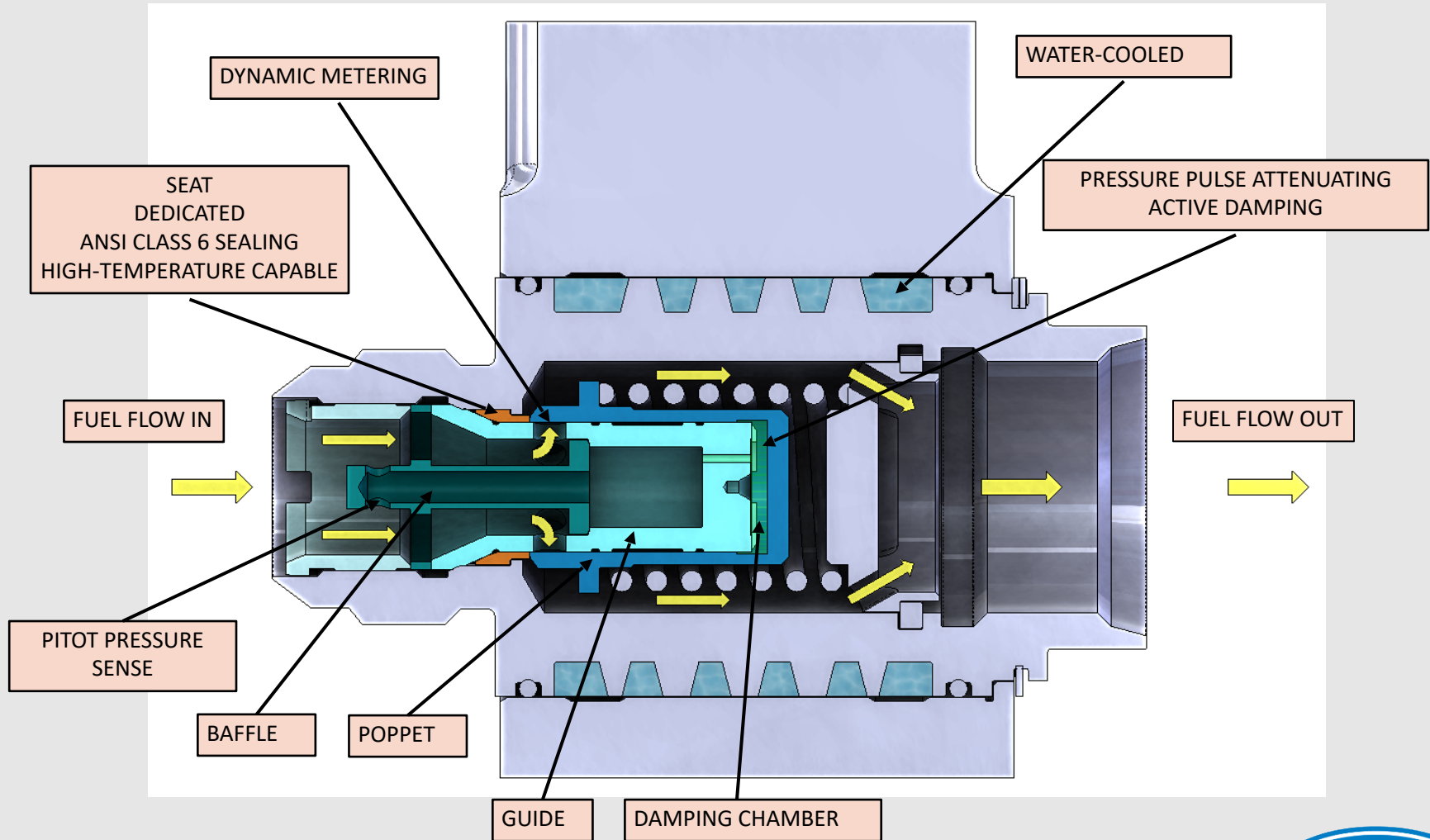
Check Valve
Combustor Arrangement:



3-Way Valve
Combustor Arrangement:



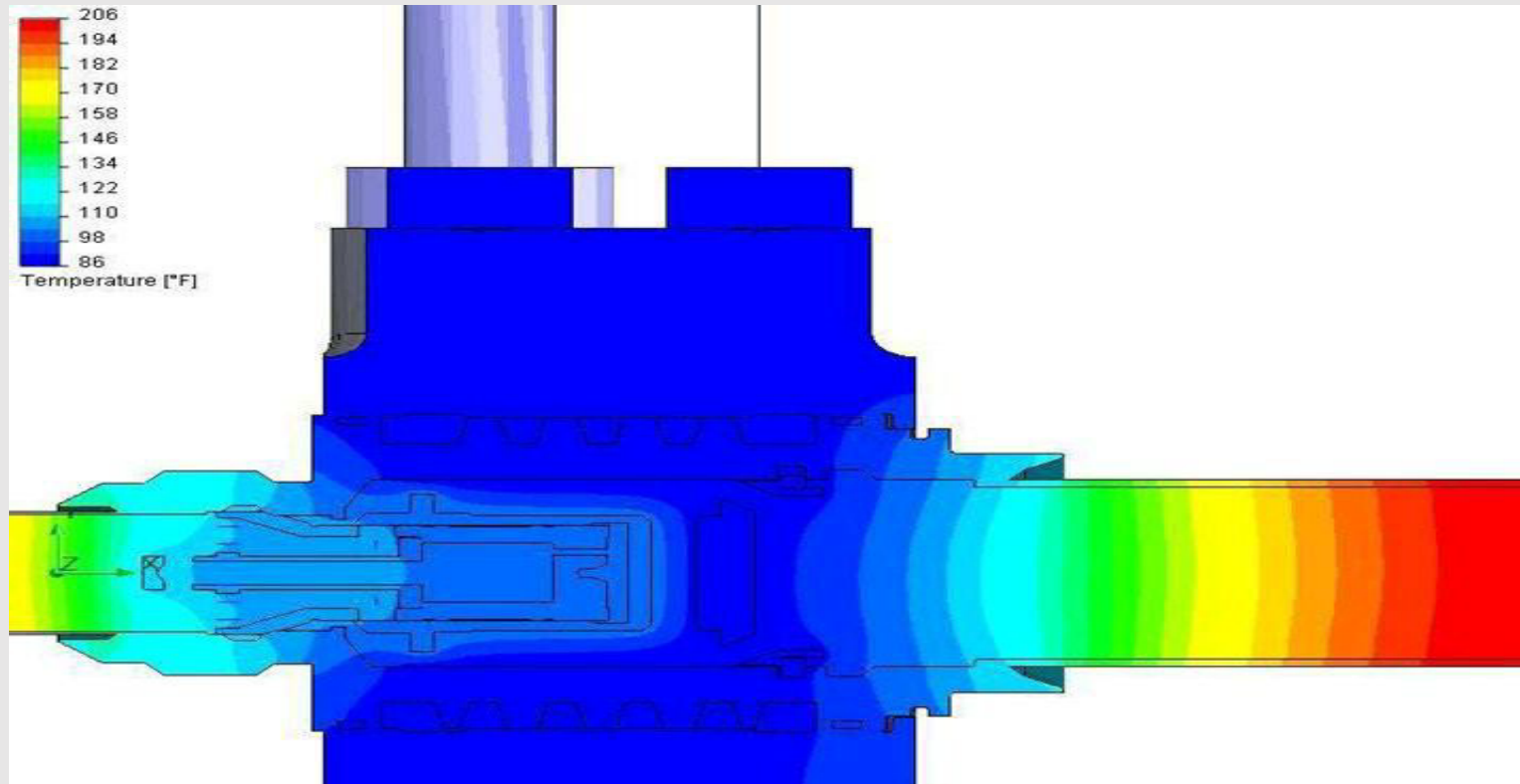
Liquid-Fuel Check Valves Designed for the Turbine Environment



JASC 3rd Generation Check Valves



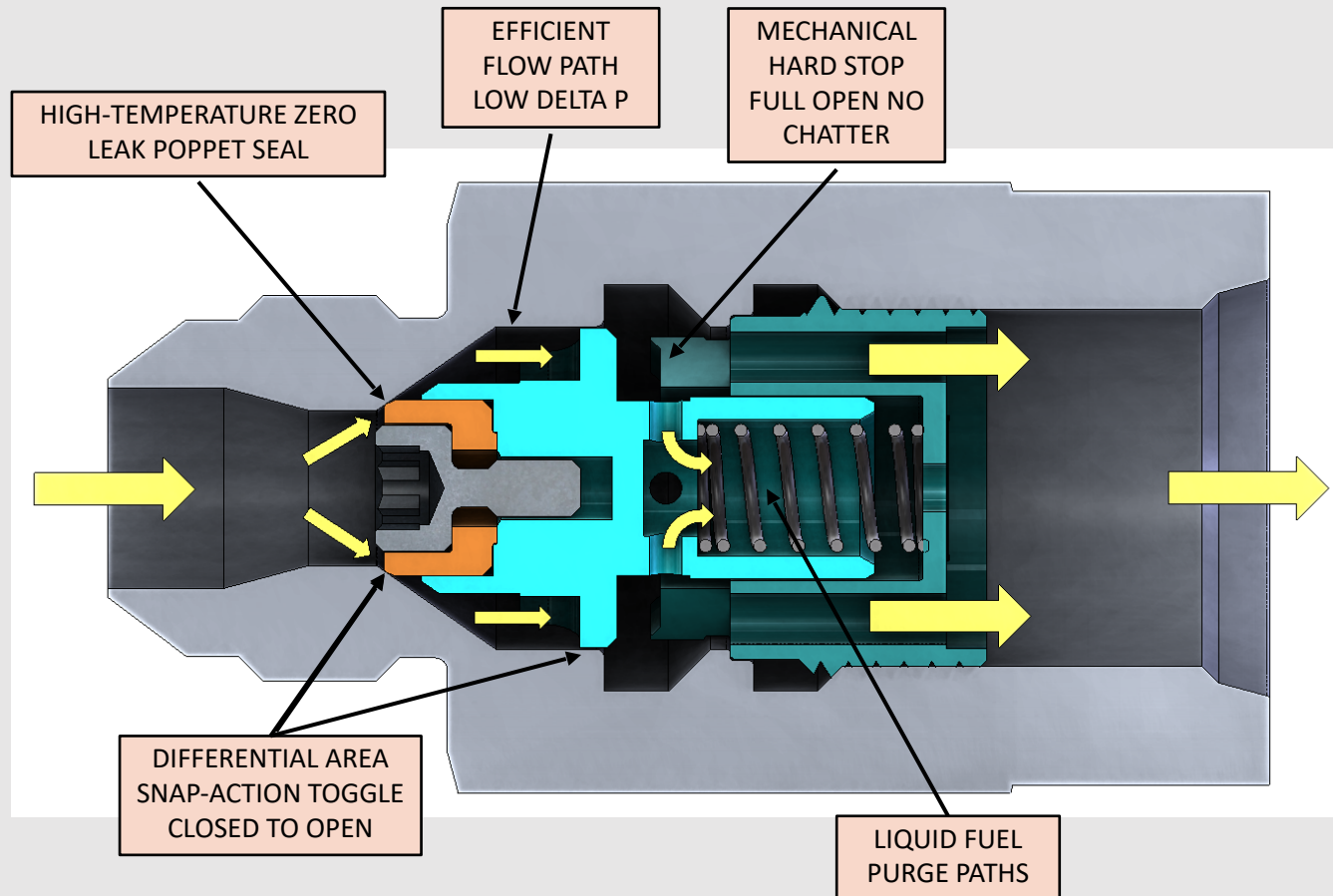
Water-Cooled Liquid-Fuel Check Valve Thermal Mapping



JASC 3rd Generation Check Valves



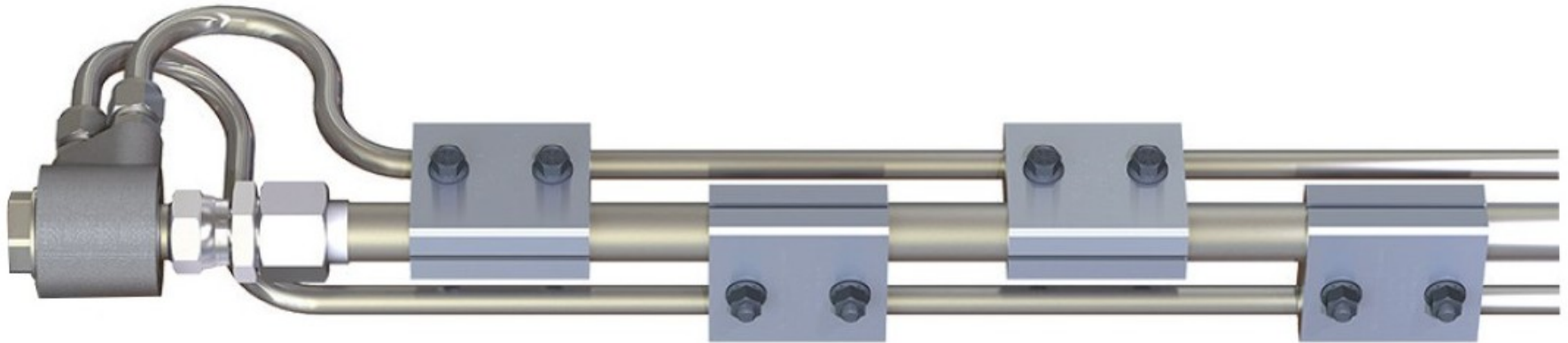
Purge-Air Check Valves Designed for the Turbine Environment



JASC 3rd Generation Check Valves



Fuel Line Thermal Management While On A Water Cooled Liquid Fuel Check Valve

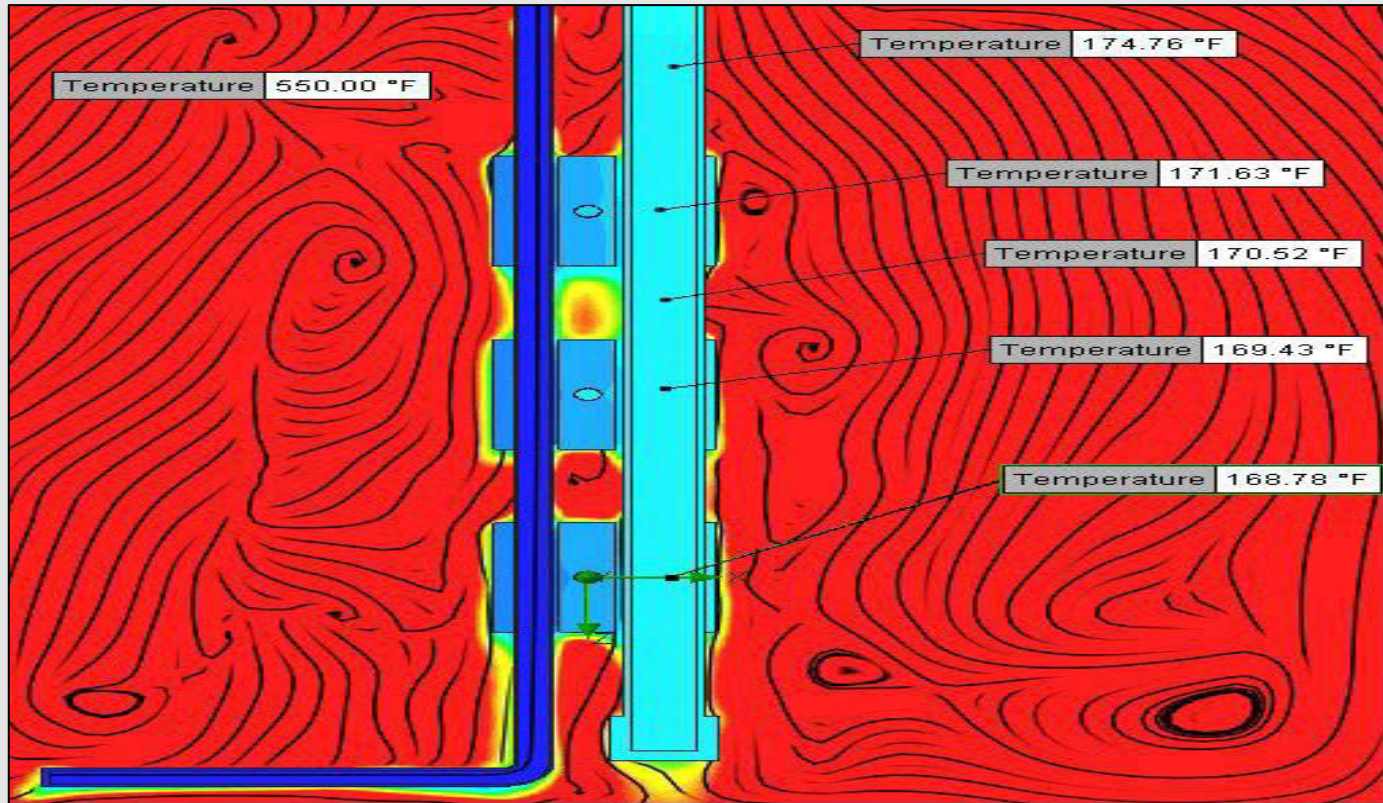


JASC 3rd Generation Check Valves



Heat-Sink Clamps

Prevents temperatures from exceeding 200°F, thus avoiding coking of both stagnant fuel or any residual fuel remaining on the piping ID

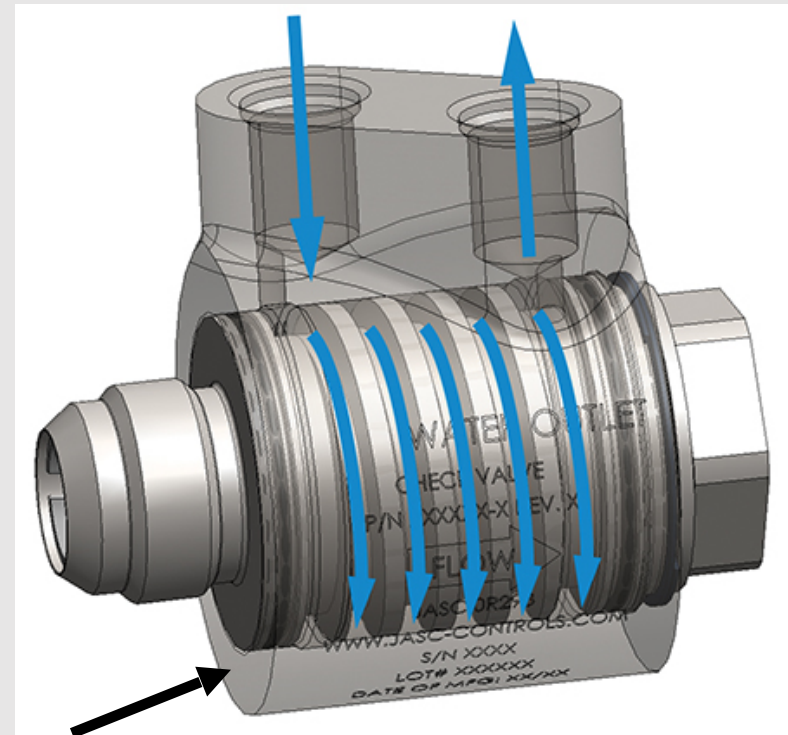


JASC 2nd Generation Improvements

Water-Cooled Liquid Fuel Check Valves

60 consecutive successful liquid fuel transfers over a 5-year period.

Site-Demonstrated Performance



Water jacket added to the standard liquid-fuel check valve design to eliminate coking on valve internals

JASC 3rd Generation Check Valves

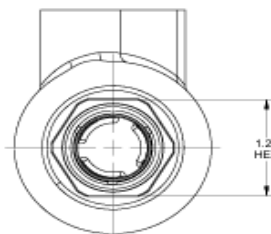
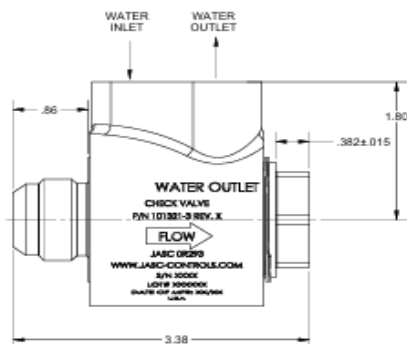
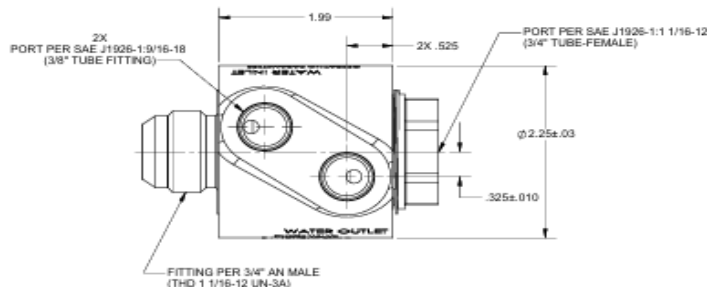


Water-Cooled Liquid-Fuel Check Valve

- The internal components of the Standard Check Valve and the Water Cooled Check valve are identical.
- The Water Cooled version installs as a direct drop-in replacement
- No re-plumbing required, existing tubing can be reused.

Water Cooled Liquid Fuel Check Valve

REVISIONS			
REV.	DATE	DESCRIPTION	BY
A	12/22/2008	See EON 3258	RPW
B	2/12/2009	See EON 3292	RPW
C	9/8/2020	See ECO 6502	RPW



4. PART NUMBERS 101321-1 AND 101321-2 ARE NO LONGER AVAILABLE FOR SALE AND HAVE BEEN REMOVED FROM THIS DRAWING
3. GENERAL
OPERATING AMBIENT TEMP: +40°F TO +400°F
NON-OPERATING AMBIENT TEMP: -20°F MIN
SOAKBACK TEMP: +700°F MAX
2. WATER PARAMETERS
INLET TEMP: +50°F TO +150°F
FLOW: 0.50 TO 0.75 GPM AT 8.0 TO 16.0 PSID
1. FUEL PARAMETERS
INLET PRESSURE: 800 PSIG NOMINAL, 1225 PSIG MAX
INLET TEMP: +60°F TO +250°F OPERATING
FLOW: 0 - 20 GPM
PRESSURE DROP: 105-120 PSID AT 20 GPM
CRACK PRESSURE: 45±3 PSID
CHECK PRESSURE: 300 PSIG
INTERNAL LEAKAGE: ANSI CLASS 6 OR BETTER (BOTH DIRECTIONS)
CONTAMINATION LEVEL: 75 MICRONS ABSOLUTE
98.6% 39 MICRONS OR LESS
4 mg/100ml

NOTES: UNLESS OTHERWISE SPECIFIED

SPARE PARTS LIST		
2	FLUOROCARBON-90 2-029	O'RING
1	RSN-150-S	RETAINING RING
1	101172-09	BAFFLE
1	101161-08	RING, SPLIT
1	101161-07	RETAINER, SPRING
1	101172-06	GUIDE
1	101172-10	SPRING
1	101161-04	POPPET
1	101161-03	SEAT
1	101161-02	RETAINER
QTY	P/N	DESCRIPTION

INTERFACE CONTROL DRAWING

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DRAWINGS APPLY AFTER PLATING
BREAK SHARP EDGES .005 - .015
MACHINED SURFACES
.005 - .020 MACHINED FILLETS

REFERENCE
PDM

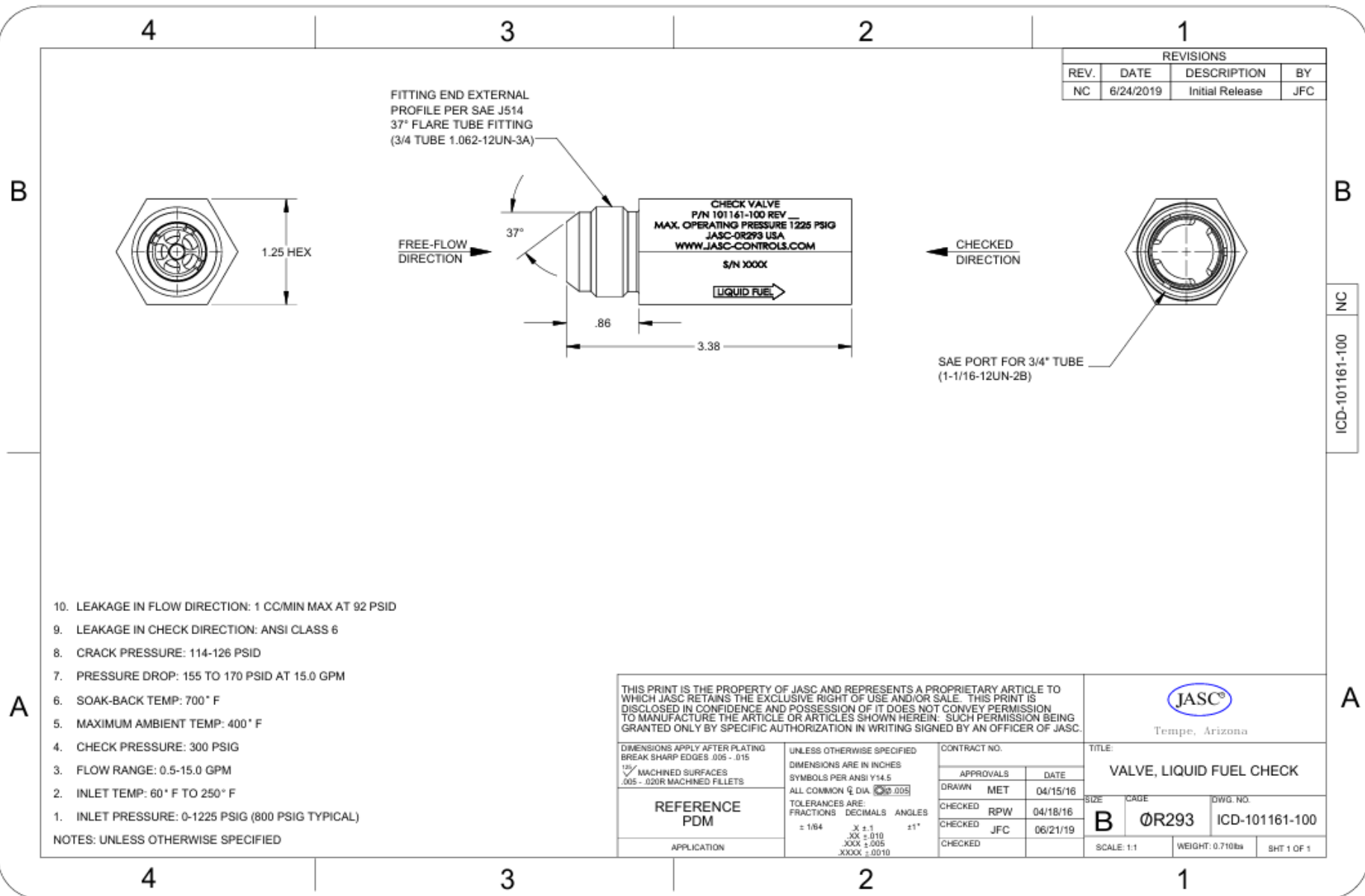
APPLICATION

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
SYMBOLS FOR AND YN-S
ALL COMMON S. DIA .005 .002
TOLERANCES ARE:
FRACTIONS DECIMALS ANGLES
X .004 X .01 X .1°
XX .010 XX .004 X .005
XXX .0010

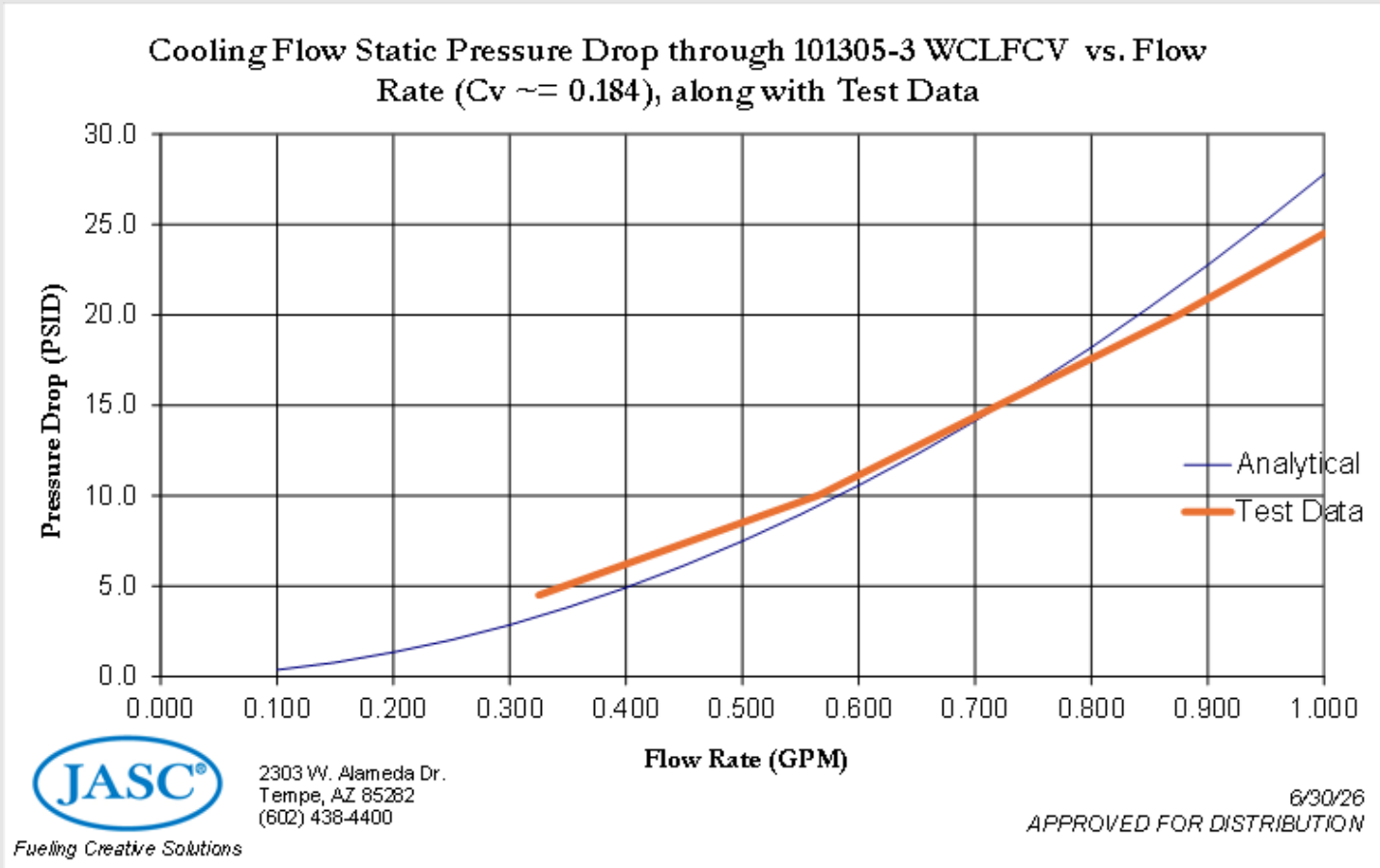
CONTRACT NO.
APPROVALS
DATE
DRAWN DKS 03/19/04
CHECKED HBL 5/5/2020
CHECKED RPW 5/4/2020
CHECKED

JASC Tempe, Arizona		TITLE WATER COOLED LIQUID FUEL CHECK VALVE	
SZS C	DATE ØR293	DWG NO. ICD-101321-3	SCALE: 1:1
WEIGHT 2.4 lbs	SHT 1 OF 1		

Standard Liquid Fuel Check Valve

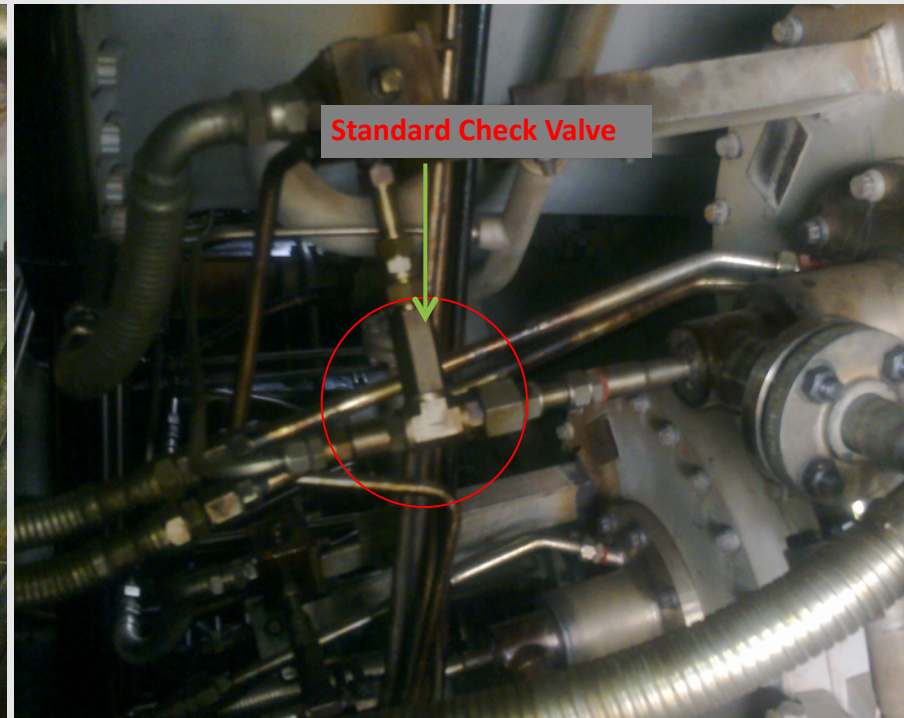
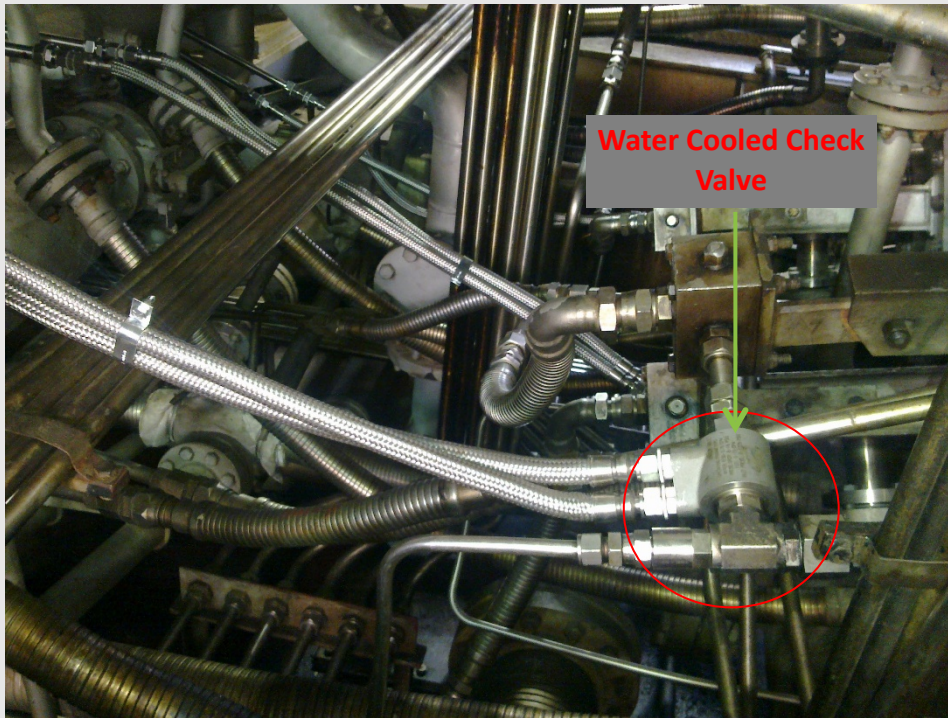


- Flowing .5 GPM of cooling water through (1) valve, is approximately 8.0 PSID
- (4) Water Cooled Check Valves in series, at .5 GPM is about 32 PSID.
- The water cooling circuit can be a combination of series and parallel loops.



Check Valve Configurations, Field Installs

- Photo on the left shows the Water-Cooled Liquid Fuel Check Valve installed in the field
- Photo on the right shows a standard Liquid Fuel Check Valve.

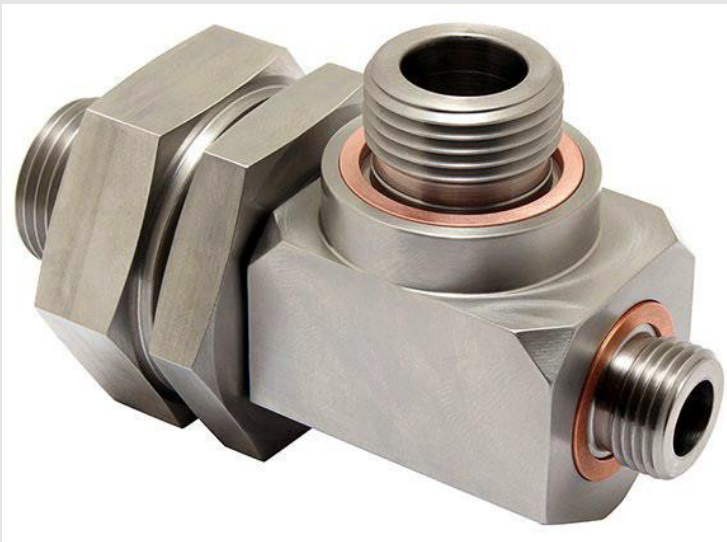


Optimizing System Reliability for Reducing Fuel and Maintenance Costs

- Water-cooled fuel components demonstrate the ability to maintain sealing that keeps the fuel system primed from the Stop Valve to the Check Valve.
- Water cooling prevents stagnant diesel fuel in the turbine compartment from experiencing fuel viscosity changes which foul fuel valves and seals.
- Heat-sink clamps provide effective use of water and thermal management of fuel:
 - Eliminate diesel fuel viscosity changes
 - Increase intervals for turbine operation on natural gas
 - Keep fuel lines primed from the stop valve to the Check Valves
 - Eliminate opportunities for coke formation inside fuel lines

JASC 3rd Generation Improvements

Positional Tee Multiple-use Metal Gasket



This design eliminates the opportunity for collecting stagnant fuel that exists within other tee configurations.



JASC 3rd Generation Check Valves



Some problems that sites were experiencing in 2016 before upgrading to Water-Cooled Valves

- Inability to reliably start on liquid fuel
- Fuel system evacuation during gas operation
- Coked fuel distributor valves
- Clogged/coked liquid fuel cartridges in nozzles
- Forced outages for fuel-nozzle repair
- Exhaust temperature spreads when operating liquid fuel
- Lost profits due to inability of seamless transition from gas to liquid fuel operation
- Annual fuel system maintenance required
- Flow divider issues
- Fuel system layup for gas operation

JASC Best Practice for System Reliability

Fuel Supply

- Eliminate stagnant fuel
- Eliminate water
- Eliminate bacterial/fungal growth
- Promote VOC cleaning action: circulate fuel
- Maintain filtration functionality
- Eliminate system FOD
- Prevent thermal degradation and coke formation

Purge Air Supply

- Maintain moisture separation for dry air
- Reduce temperature as much as possible
- Maintain purge air compressor seals / reduce lube oil seal leakage
- Maintain adequate pressure/flow

Pilot “Instrument” Air

- Maintain clean and dry

Liquid Fuel Reliability: Understand and Address Upstream System Issues

- JASC offers **proven solutions** for enhancing backup liquid fuel operation
- Both Check Valve and 3-Way Purge Valve designs have demonstrated the ability for **reliable performance** between Combustion Inspections
- JASC provides **upgraded hardware** to improve OEM-installed systems

**Innovation is our foundation.
Excellence is our goal.
Flow control is our specialty.**

Contact JASC about your most challenging fuel system issues!

Image References

7F Combustor:

<https://www.gevernova.com/gas-power/products/gas-turbines/7f>

JASC Heatsink Clamps: <https://jasc-controls.com/heatsink-clamp/>
Combined Cycle Journal, Issue #53, Second Quarter

JASC Spools (Non-water cooled vs. water cooled):
Combined Cycle Journal Issue #66, Pg. 11
<https://www.ccj-online.com/ccj-issue-66/>