Innovative, High-Pressure, Cryogenic Control Valve: Short Face-to-Face, Reduced Cost

This design includes several improvements over prior designs.

Stennis Space Center, Mississippi

A control valve that can throttle high-pressure cryogenic fluid embodies several design features that distinguish it over conventional valves designed for similar applications. Field and design engineers worked together to create a valve that would simplify installation, trim changes, and maintenance, thus reducing overall cost. The seals and plug stem packing were designed to perform optimally in cryogenic temperature ranges. Unlike conventional high-pressure cryogenic valves, the trim size can be changed independent of the body.

The design feature that provides flexibility for changing the trim is a split body. The body is divided into an upper and a lower section with the seat ring sandwiched in between. In order to maintain the plug stem packing at an acceptable sealing temperature during cryogenic service, heat-exchanging fins were added to the upper body section (see figure).

The body is made of stainless steel. The seat ring is made of a nickel-based alloy having a coefficient of thermal expansion less than that of the body material. Consequently, when the interior of the valve is cooled cryogenically, the body surrounding the seat ring contracts more than the seat ring. This feature prevents external leakage at the body-seat joint. The seat ring has been machined to have small, raised-face sealing surfaces on both sides of the seal groove. These sealing surfaces concentrate the body bolt load over a small area, thereby preventing external leakage.

The **Split-Body Design** of this valve accommodates changes in trim. The heat-exchanger fins help keep the plug stem packing warm enough to function at cryogenic temperatures.

The design of the body bolt circle is different from that of conventional high-pressure control valves. Half of the bolts clamp the split body together from the top, and half from the bottom side. This bolt-circle design allows a short, clean flow path, which minimizes frictional flow losses. This bolt-circle design also makes it possible to shorten the face-to-face length of the valve, which is 25.5 in. (65 cm). In contrast, a conventional, high-pressure control valve face-to-face dimension may be greater than 40 in. (>1 m) long.

This work was completed by Karlin Wilkes, Ed Larsen, and Jackson McCourt of Flowserve Corporation for **Stennis Space Center**. *For further information, please contact Flowserve Corporation at (801) 489-8611 or www.flowserve.com.*

Inquiries concerning rights for the commercial use of this invention should be addressed to the Intellectual Property Manager, Stennis Space Center [see page 20]. Refer to SSC-00159.

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. REPORT DATE *(DD-MM-YYYY)*	2. REPORT TYPE	3. DATES COVERED *(From - To)*
09-05-2002		

4. TITLE AND SUBTITLE
Innovative High Pressure Cryogenic Control Valve: Short Face to Face, Reduced Const

5a. CONTRACT NUMBER

5b. GRANT NUMBER

5c. PROGRAM ELEMENT NUMBER

6. AUTHOR(S)
Technology Development and Transfer Office

5d. PROJECT NUMBER

5e. TASK NUMBER

5f. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
Technology Development and Transfer Office

8. PERFORMING ORGANIZATION REPORT NUMBER
NP-2002-05-00019-SSC

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
Program Integration Office

10. SPONSORING/MONITOR'S ACRONYM(S)

11. SPONSORING/MONITORING REPORT NUMBER

12. DISTRIBUTION/AVAILABILITY STATEMENT
Publicly Available STI per form 1676

13. SUPPLEMENTARY NOTES
Peridical Tech Brief

14. ABSTRACT

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19b. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			Technology Development and Transfer Office
U		U	UU	2	19b. TELEPHONE NUMBER *(Include area code)* (228) 688-1929