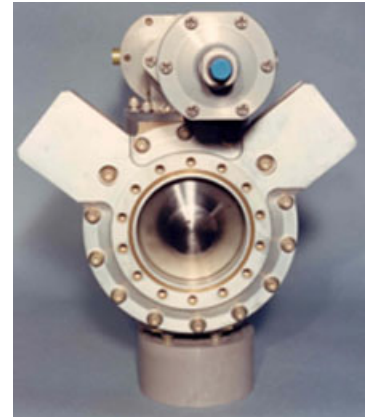


3 1/2" Cryogenic Valve

VACCO's 3 1/2" Cryogenic Dual Motion Valve—normally closed or normally open—is a human-rated, pneumatically actuated visor element used for General Dynamics, GDC/STS-Centaur. Its dual motion mechanism pivots, rather than lifts, the visor valve element off of the seat prior to rotation to eliminate sliding seal contact, maximizing seal life and improving leakage.

A bellows-encapsulated actuator rack eliminates the need for redundant dynamic shaft seals, which reduces external leakage. VACCO has developed electromechanical actuators for specific valve applications that may be adaptable as a design option.



Features

- Dual motion mechanism
 - Maximizes seal life
 - Improves leakage
- Dual pneumatic actuators
 - Open valve
 - Removable from valve housing
- Normally closed valve holds neutral position without applying pneumatic actuation pressures
- Robust, piston-driven rack and pinion mechanism rotates visor
- Rack bellows eliminates dynamic shaft seals
- Removable electrical position indicator device
- Qualified and proven limit switch design
- Relief valve to prevent excessive pressure on outlet side when valve is closed

Operating Parameters

Main Valve

Operating Pressure 0 to 85 psig
 Proof Pressure 251 psig max
 Burst Pressure 375 psig max

Actuator

Operating Pressure 350 to 495 psig
 Proof Pressure 1,169 psig max
 Burst Pressure 1,750 psig max

Response Time

Opening (normally closed) 0.2 to 0.7 sec (est)
 with actuator pressure @ 550 psig
 Closing (normally closed) 0.2 to 0.7 sec (est)
 Opening (normally open) 0.2 to 0.7 sec (est)
 Closing (normally open) 0.2 to 1.0 sec (est)
 with actuator pressure @ 550 psig

Internal Leakage

Inlet-to-Outlet (GHe) 500 SCCM max
 @ 85/20 psid (room temp & cryo)
 Outlet-to-Inlet (GHe) 4920 SCCM max
 @ 9.5 +0/-1 psid (room temp & cryo)

Actuator 100 SCCM max at 550 psig (GHe)

External Leakage 33 SCCM max
 @ 85/20 psig GHe

Relief Valve,

Cracking/Reseat Pressure 10-15/8 psid
 Relief flow 708,000 SCCM max
 @ 20 psid GHe (cryo)

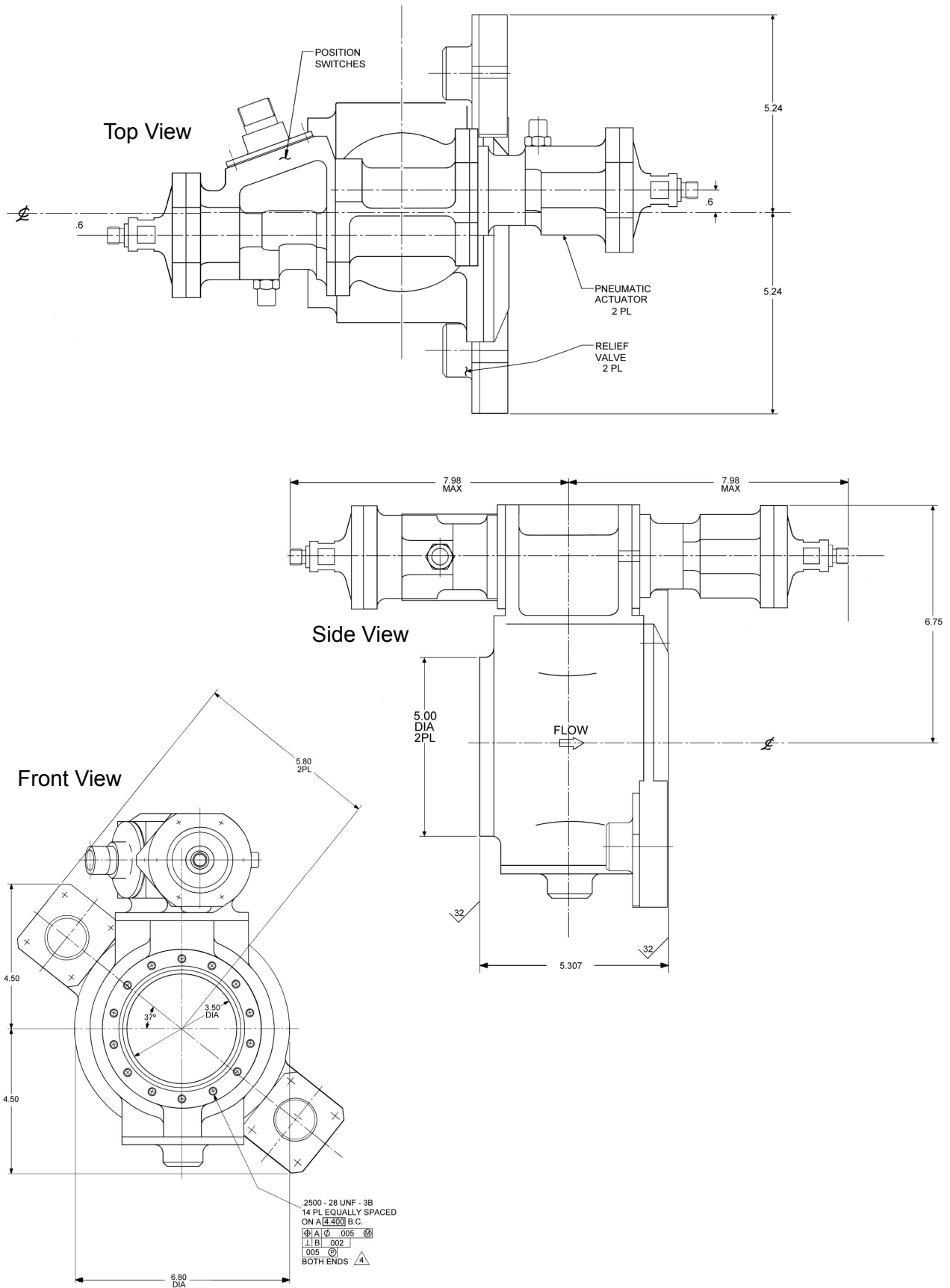
Flow Capacity

LH₂ 1,400 lb/min @ 24 psig inlet
 LO₂ 7,200 lb/min @ 43 psig inlet

Weight 25 lbs max

Operating Life 2,000 cycles

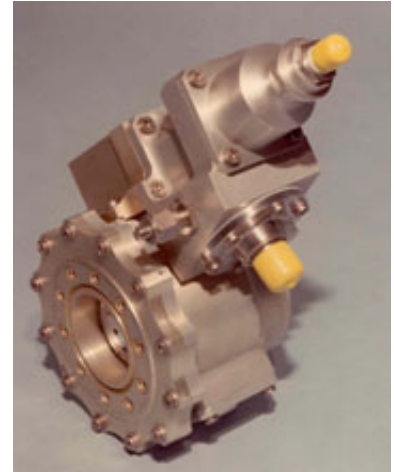
Performance characteristics are based on customer requirements. As such, they are not representative of component capabilities or limitations.



2" Cryogenic Valve

VACCO's 2" Cryogenic Shutoff Valve—normally closed or normally open—is a human-rated, pneumatically actuated visor element used for General Dynamics, GDC/STS-Centaur. Its dual motion mechanism pivots, rather than lifts, the visor valve element off of the seat prior to rotation to eliminate sliding seal contact, maximizing seal life and improving leakage.

A bellows-encapsulated actuator rack eliminates the need for redundant dynamic shaft seals, which reduces external leakage. VACCO developed electromechanical actuators for specific valve applications that may be adaptable as a design option.



Features

- Dual motion mechanism
 - Maximizes seal life
 - Improves leakage
- Single pneumatic actuator
 - Closes valve
 - Removable from valve housing
- Valve holds neutral position (normally closed or open) without applying pneumatic actuation pressures
- Robust piston-driven rack and pinion mechanism rotates visor
- Rack bellows eliminates dynamic shaft seals
- Removable electrical position indicator device
- Relief valve to prevent excessive pressure on outlet side when valve is closed
- Qualified and proven limit switch design

Operating Parameters

Main Valve

Operating Pressure	0 to 75 psig
Proof Pressure	125 psig max
Burst Pressure.....	188 psig max

Actuator

Operating Pressure	350 to 550 psig
Proof Pressure	1,000 psig max
Burst Pressure.....	1,500 psig max

Response Time

Opening (normally closed)	0.1 to 0.3 sec
Closing (normally closed)	0.2 to 0.3 sec
Opening (normally open).....	0.2 to 0.3 sec
Closing (normally open)	0.1 to 0.3 sec

Internal Leakage

Inlet-to-Outlet (GHe).....	760 SCCM max at 65/20 psid (room temp & cryo)
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Internal Leakage (cont'd)

Outlet-to-Inlet (GHe).....	7425 SCCM max at 4.5 +0/- .5 psid (room temp & cryo)
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Actuator	100 SCCM max at 550 psig (GHe)
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External Leakage	50 SCCM max at 65/20 psig GHe
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Relief Valve, Cracking Pressure	5 to 15 psid
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Relief flow	79,800 SCCM max at 20 psid GHe
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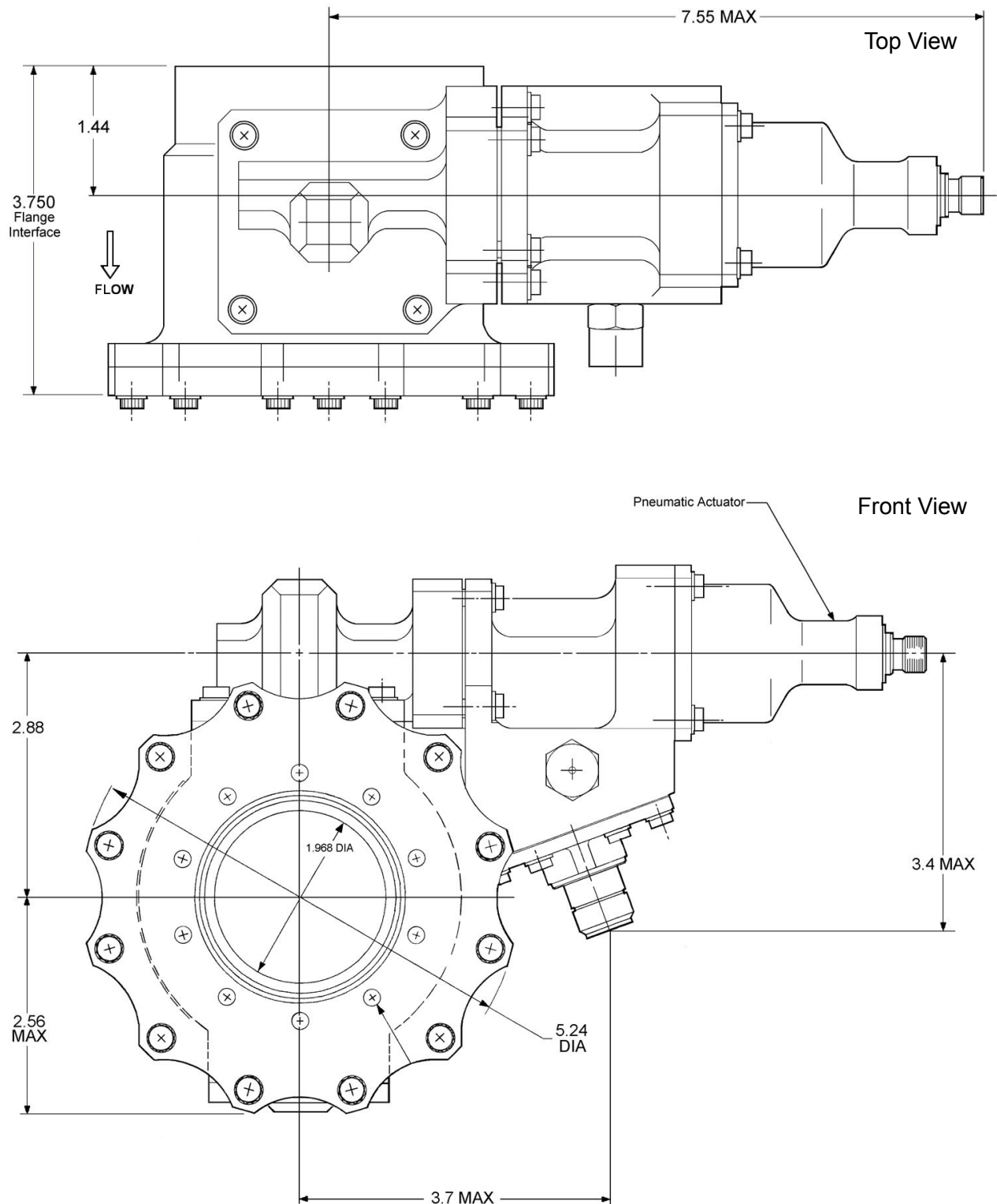
Flow Capacity

GH ₂	86 lb/min @ 46 psig inlet
GO ₂	288 lb/min @ 72 psig inlet

Weight.....	5.5 lbs max
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Operating Life	10,000 cycles
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Performance characteristics are based on customer requirements. As such, they are not representative of component capabilities or limitations.



5" Cryogenic Shut-off Valve—Normally Closed 83052001

VACCO's 5" Cryogenic Shutoff Valve—Normally Closed is a human-rated, pneumatically actuated visor element used for General Dynamics, GDC/STS-Centaur. Its dual motion mechanism utilizes a simple pivoting action rather than lifting, moving the visor valve element off of the seat prior to rotation to eliminate sliding seal contact. This maximizes seal life and improves leakage.

A bellows-encapsulated actuator rack reduces external leakage—eliminating the need for redundant dynamic shaft seals. VACCO has developed electromechanical actuators for specific valve applications that may be adaptable as a design option.



Features

- Dual motion mechanism
 - Maximizes seal life
 - Improves leakage
- Dual pneumatic actuators
 - Increase reliability
 - Open valve
 - Removable from valve housing
- Normally closed valve holds neutral position without applying pneumatic actuation pressures
- Robust piston-driven rack and pinion mechanism rotates visor
- Rack bellows eliminates dynamic shaft seals
- Removable electrical position indicator device with qualified and proven limit switch design
- Relief valve to prevent excessive pressure on outlet side when valve is closed

Operating Parameters

Main Valve

Operating Pressure 0 to 85 psig
 Proof Pressure 251 psig max
 Burst Pressure 375 psig max

Actuator

Operating Pressure 350 to 495 psig
 Proof Pressure 1,169 psig max
 Burst Pressure 1,750 psig max

Response Time

Opening 0.2 to 0.6 sec (est)
 Closing 0.2 to 0.6 sec (est)

Internal Leakage

Inlet-to-Outlet (GHe) 500 SCCM max
 @ 85/20 psid (room temp & cryo)

Internal Leakage (cont'd)

Outlet-to-Inlet (GHe) 4920 SCCM max
 @ 9.5 +0/-1 psid (room temp & cryo)
 Actuator 100 SCCM max at 500 psig (GHe)

External Leakage

..... 33 SCCM max at 85/20 psig GHe

Relief Valve, Cracking Pressure

..... 10 to 20 psid

Relief flow

..... 1,416,000 SCCM max @ 20 psid GHe

Flow Capacity

LH₂ 2,180 lb/min @ 24 psig inlet

LO₂ 10,490 lb/min @ 36 psig inlet

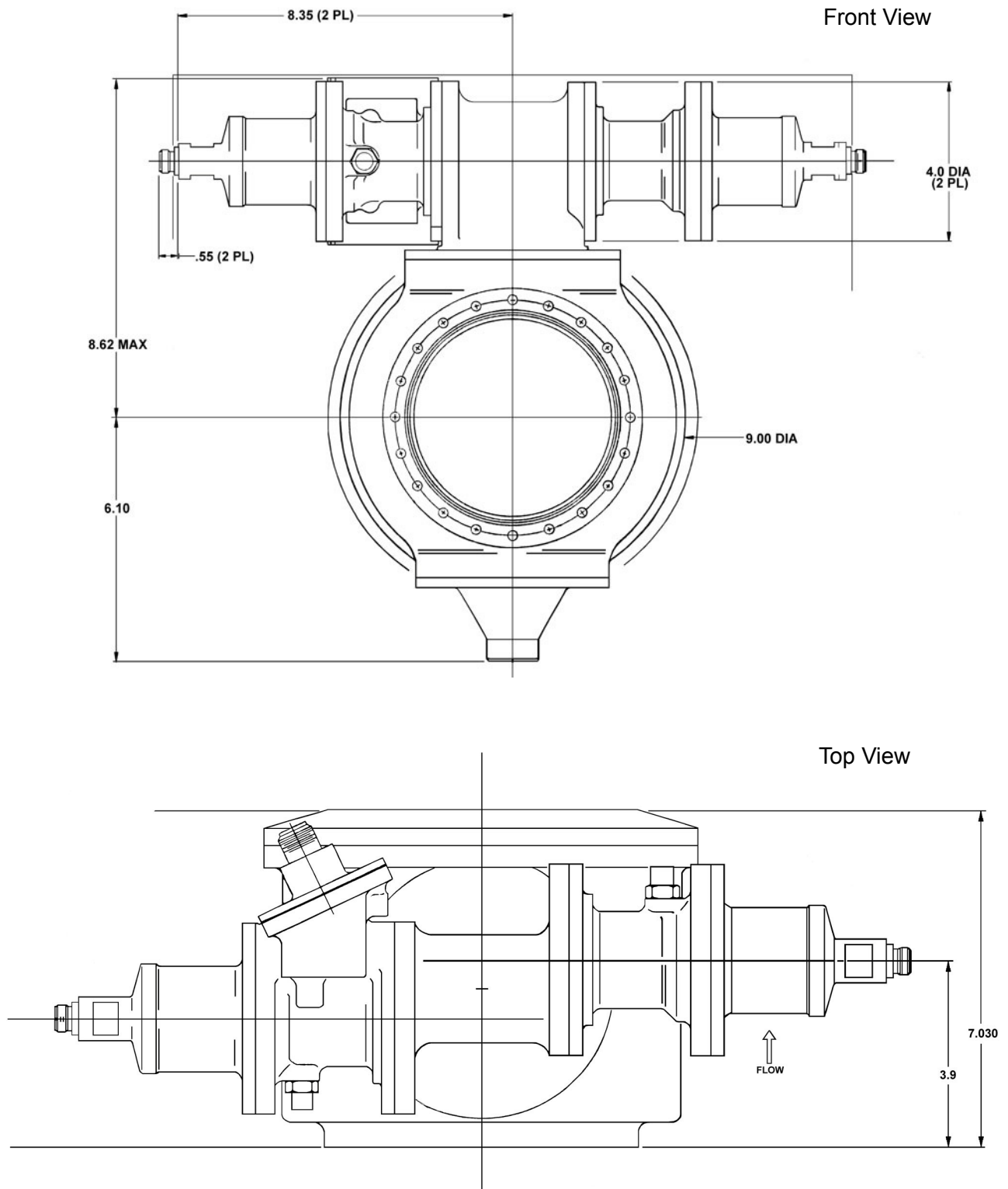
Weight

..... 32 lbs max

Operating Life

..... 5,000 cycles

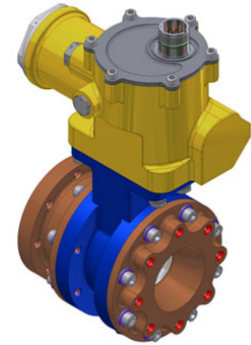
Performance characteristics are based on customer requirements. As such, they are not representative of component capabilities or limitations.



2" Cryogenic Recirculation Valve

VACCO's 2" Cryogenic Recirculation Valve is a pneumatically actuated, normally open LH₂ ball valve that supports propellant system chill down. It also facilitates propellant system drain in the event of a scrub.

This LH₂ ball valve leverages the 1 1/2" Space Shuttle qualified design with a simple, downstream double "D" check valve and a 100 micron absolute pleated mesh filter. The Shuttle heritage design was only modified to provide bidirectional sealing—incorporating an updated seal design on both sides of the ball and adding redundancy to the dynamic valve shaft seals and actuator piston seals.



Features

- Normally open valve holds open position without applying pneumatic actuation pressure
- Bidirectional sealing capability
- Man-rated
- Flow coefficient (Cv) equal to 55.0
- Simple, downstream double "D" check valve
- 100 micron absolute pleated mesh filter downstream
- Pneumatic actuator
 - Closes valve
 - Removable from valve housing
- Robust rack and pinion mechanism rotates ball valve element
- Removable electrical position indication device
- Anti-slam actuator design
- Valve redundant shaft seals and actuator redundant piston seals

Operating Parameters

Main Valve Pressures

Operating.....	internal pressure of 1 x 10E-10 Torr to 120 psig
Proof.....	180 psig max
Burst.....	300 psig max

Actuator Pressures

Closing Control.....	500 psig min
Operating.....	750 +/-50 psig norm
Actuation Control.....	880 psig max
Proof.....	1,320 psig max
Burst.....	2,200 psig max

Response Time - Command to Switch

Opening.....	3 sec max with inlet pressure @ 55 +/-3 psid and actuator pressure @ 750 +/-50 psig
Closing.....	3 sec max with inlet pressure @ 0 to 50 psid and actuator pressure @ 750 +/-50 psig

Response Time - Switch to Switch

Opening.....	0.5 sec @ 100 psig & max flow rate
Closing.....	0.5 to 2.5 sec @ 100 psig & max flow rate

Actuator Leakage..... 150 SCIM (41 SCCS) max
@ -423°F to +170°F with 750 +/-50 psig

Internal Leakage

Inlet to Outlet.....	250 SCIM (68.3 SCCS) @ 5 +/-1 psid across valve closure @ -150°F to +170°F
Inlet to Outlet.....	200 SCIM (54.6 SCCS) @ 60 +/-1 psid across valve closure @ -423°F to -150°F
Outlet to Inlet.....	250 SCIM (68.3 SCCS) @ 5 +/-1 psid across valve closure @ -423°F to +170°F
Outlet to Inlet.....	100 SCIM (27.3 SCCS) @ 50 +/-5 psid across valve closure @ -423°F to -170°

External Leakage..... 2.5 SCIM
(-423°F to +170°F) from 4 to 135 psid

Flow Rate..... 153 gal/min., LH₂ @ 50 psig
min inlet pressure

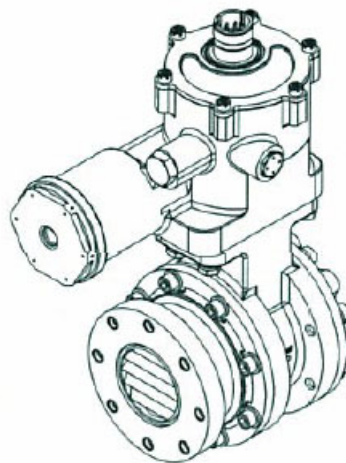
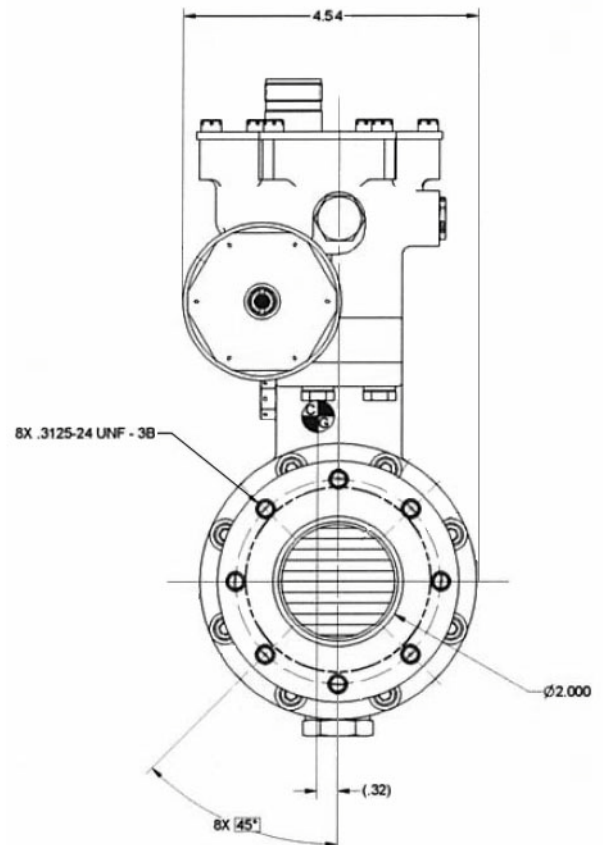
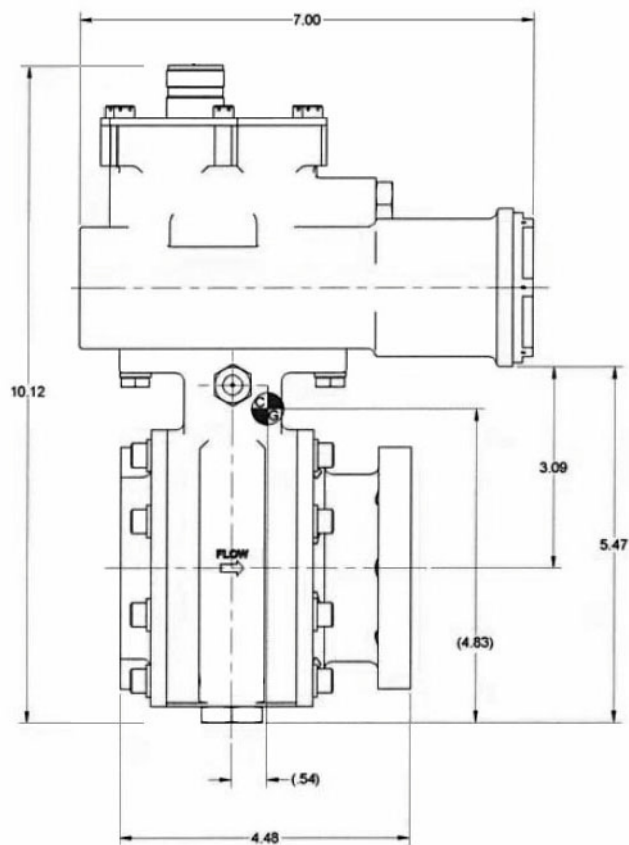
Pressure Drop..... 1.5 psid max

Weight.....8.55 lb

Life Cycles..... 1000

Check Valve,
Crack/Reseat Pressure.....0.2 psid max LH₂

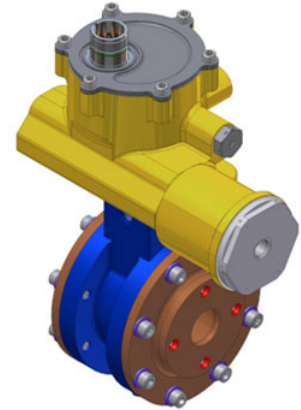
Performance characteristics are based on customer requirements. As such, they are not representative of component capabilities or limitations.



1" Cryogenic Oxygen Ball Valve

VACCO's 1" Cryogenic Oxygen Valve is a pneumatically actuated, normally closed LO2 ball valve that supports propellant system stability. It also facilitates the propellant system drain in the event of a scrub. VACCO's ball design leverages the 1 1/2" Space Shuttle qualified design.

This man-rated ball valve can be configured to be normally open or normally closed. The Shuttle heritage design was only modified to provide bidirectional sealing—incorporating an updated seal design on both sides of the ball and adding redundancy to the dynamic valve shaft seals and actuator piston seals.



Features

- Normally closed valve holds closed position without applying pneumatic actuation pressures
- Bidirectional sealing capability
- Man-rated
- Flow coefficient (Cv) equal to 35.0
- Design also allows for normally open configuration
- Pneumatic actuator
 - Closes valve
 - Removable from valve housing
- Robust rack-and-pinion mechanism rotates visor
- Anti-slam actuator design
- Removable electrical position indicator device

Operating Parameters

Main Valve

Operating Pressureinternal pressure of 1 x 10E-10 Torr to 120 psig
 Proof Pressure 180 psig max
 Burst Pressure..... 300 psig max

Actuator Pressures

Control (Opening) 500 psig min
 Normal Operating 750 +/-50 psig
 Control (Actuation) 880 psig max
 Proof 1,320 psig max
 Burst 2,200 psig max

Response Time - Command to Switch

Opening 3 sec max
 with inlet pressure @ 55 +/-5 psid and actuator pressure @ 750 +/-50 psig
 Closing 3 sec max
 with outlet pressure @ 55 +/-3 psid and actuator pressure @ 750 +/-50 psig

Actuator Leakage 150 SCIM (41 SCCS) max @ -423°F to +170°F with 750 +/-50 psig

Response Time - Switch to Switch

Opening0.5 sec @ 100 psig and max flow rate
 Closing.....0.5 to 2.5 sec @ 100 psig and max flow rate

Internal Leakage

Outlet to Inlet.....250 SCIM (68.3 SCCS) @ 5 psid across valve closure @ -320°F to +170°F
 Inlet to Outlet.....250 SCIM (68.3 SCCS) @ 5 psid across valve closure @ -150°F to +170°F
 Inlet to Outlet.....200 SCIM (54.6 SCCS) @ 60 psid LO2 across valve closure @ -320°F to -150°F

External Leakage 5.0 SCIM @ 4 to 179 psid @ -320°F to +170°F

Flow Rate 33 gal/min, LO₂ at 83 psig min

Pressure Drop 1.5 psid max

Weight 8.0 lb

Life Cycles 1000

Performance characteristics are based on customer requirements. As such, they are not representative of component capabilities or limitations.

