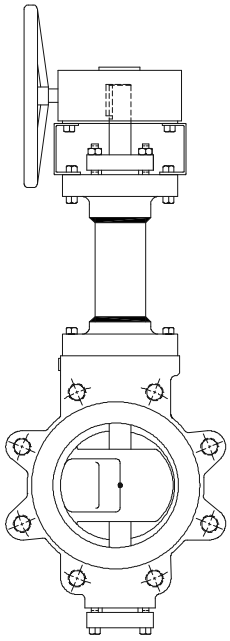
SCORE VALVES TRICENTRIC®

CRYOGENIC SERVICE



TECHNICAL BULLETIN 101

General: TRICENTRIC® high performance butterfly valves are designed for application to cryogenic services to - 425 ᴺF. The valves all metal robust construction and metal-to-metal unique sealing design provides maintained tight shut-off. Unlike other valve designs which incorporate soft seat materials. That become hard and brittle at cryogenic temperatures thereby increasing their vulnerability to damage and decreasing their life expectancy.

Valve Design: The TRICENTRIC® valve meets all required design objectives for selecting a valve for low temperature application including design to ASME B16.34.

- **MATERIALS** - All construction materials are selected to maintain their ductility to -425 ᴺF., including qualified welding as per ASME B31.3 requirements. Standard materials of construction are shown below. Special application materials such as monel are available where high pressure and/or high velocity particle impingement are issues.
- **SEAT LEAKAGE** - Extensive independent test results at cryogenic temperatures (Yarmouth Laboratories, NASA Test Facility) as well as in service applications in hundreds of cryogenic installations (primary valve supplier to Air Liquide - North America) have proven the in service tight shut-off of the TRICENTRIC® butterfly valve. Each valve is tested to ANSI/FCI 70-2, Class V and VI conditions as well as hydrostatic and pneumatic shell testing.
- **THERMAL MASS** - The TRICENTRIC® wafer style design minimizes thermal mass in comparison to other valve styles, reducing the amount of metal exposed to cryogenic fluids, thereby reducing energy costs.
- **SEATING TORQUE** - Consistent seating torque throughout the ambient to cryogenic temperature range allows for accurate actuator selection and maintained tight shut-off.
- **FLOW CAPACITY** - TRICENTRIC® valves have a high flow capacity and good flow characteristics for application to control systems.
- **EASE OF MAINTENANCE** - TRICENTRIC® valves are field repairable and easy to disassemble. No special tooling or equipment required. There are minimal blind spot cavities in the valve assembly which could trap contaminating fluids. All TRICENTRIC® cryogenic valves are cleaned and degreased for oxygen service using FDA audited procedures under an ISO 9002 registered quality system.
- **AUTOMATION** - TRICENTRIC® valves are readily automated. With vertical or near vertical extension installation, the extension is designed to take the full weight of standard pneumatic or electric actuators.
- **COST EFFECTIVE** - TRICENTRIC® butterfly valves are cost effective because the majority of components used are standard stock components resulting in minimized costs and short lead times.

Bonnet Extension : The objective of the bonnet extension is to maintain the stem seal packing at a functional temperature and prevent the formation of ice in the stuffing box. The extension also allows for the replacement of stem seal packing in an insulated line. A cryogenic bonnet extension provides the solution by extending beyond the cold box/insulation providing a vapour pocket space resulting from liquid boil-off preventing the cold liquid from contacting the steam seal packing area.

- **DESIGN MATERIAL** - A large portion of the heat influx that occurs in cryogenic systems is caused by conduction through control valve parts that extend beyond the insulated area. To minimize this heat influx TRICENTRIC® extension bonnets use thin walled pipe of austenitic (300 series) stainless steel to take advantage of the low conductivity of the material.
- **STRESSES** - TRICENTRIC® bonnet extensions are designed to be rugged enough to take the stresses associated with the valve torque, weight of the actuator, line pressure, system vibration and shock.
- **SIDE LOADING** - The side loads generated by actuator weights as well as differential pressures across the disc are carried by a self lubricating upper bearing adjacent to the stem seal packing to reduce packing loads and maintain the stem seal to full ANSI pressure rating.

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- **EXTENSION TO BODY CONNECTION** - The TRICENTRIC® standard method of attaching the bonnet extension to the valve body is by using a high strength fastener bolted joint. This proven method allows for the use of standard off-the-shelf components which are fully field serviceable and readily assembled and cleaned. Each valve assembly is given a full ANSI pressure hydrostatic test as well as an 80 PSIG pneumatic test to ensure joint integrity. Where required by specific process applications, a seal weld can be provided to absolutely ensure zero emission but field serviceability is sacrificed.

Installation Guidelines:

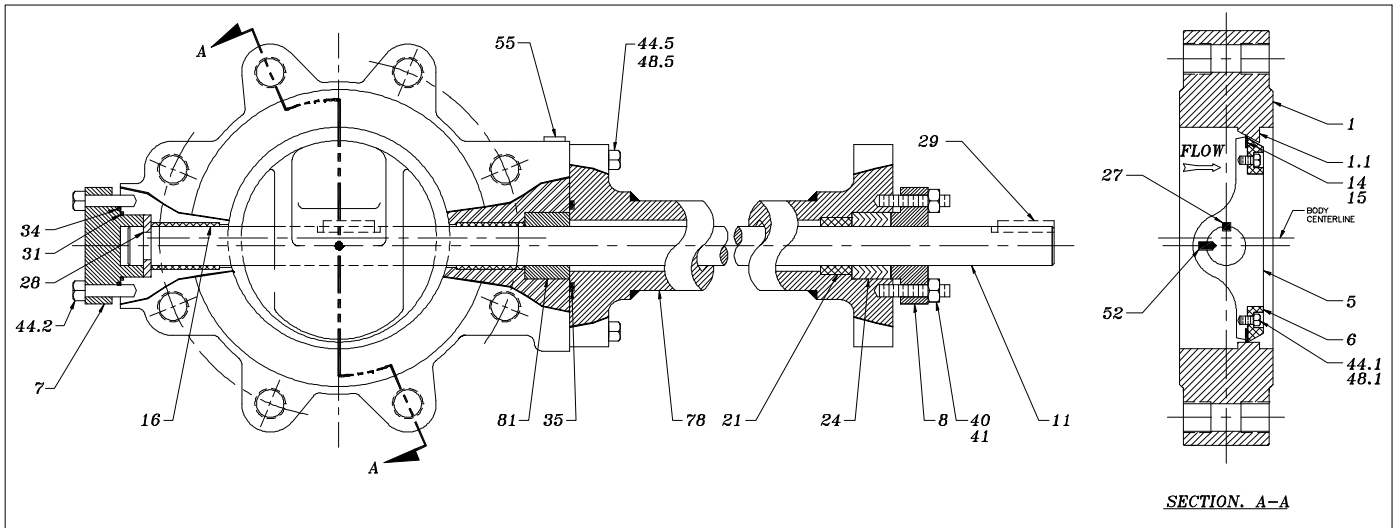
Generally a 60% frost line is used in most extended bonnets.
- Suggested orientation is with the stem vertical with no more than ± 30 degrees from the vertical.
- Extension should extend four (4) to six (6) inches beyond the cold box or insulation.
- Cold box seals shall normally be rubber boot or weld fabricated plate.

Recommended Bonnet Extension Length:

The length of each extension is application specific and must be determined by the customer. The following chart specifies minimum recommended length relative to valve size and process temperature.

Size	Process Temperature	
	- 50 °F to - 150 °F	**Below - 150 °F**
3" to 8"	8 inches	12 inches
10" to 16"	10 inches	18 inches
18" to 30"	12 inches	18 inches
36" to 48"	14 inches	24 inches

Cryogenic Valve Construction:



SECTION. A-A

AR – AS REQUIRED PER VALVE SIZE AND CLASS
■ – DENOTES RECOMMENDED SPARE PARTS

IT.#	QTY.	DESCRIPTION	MATERIAL
81	1	BORE SPACER	A 276 / A 479 T316
78	1	EXTENSION	A 351 GR. CF3M & A 312 T316L
55	1	NAME PLATE	A 240 T304
■ 52	1	SPIRAL PIN	A 240 T302
48.5	AR	LOCKWASHER	ANSI B18.21.1 T316
48.1	AR	LOCKWASHER	ANSI B18.21.1 T316
44.5	AR	H.H.CAP SCREW	A 193 GR. B8M CL. 2
44.2	AR	H.H.CAP SCREW	A 193 GR. B8M CL. 2
44.1	AR	H.H.CAP SCREW	F 593 T316

IT.#	QTY.	DESCRIPTION	MATERIAL
41	AR	HEX. NUT	F 594 T316
40	AR	STUD	A 193 GR. B8M CL. 1
■ 35	1	FLEXGASKET	316 SST w/ GRAFOIL
■ 34	1	SECONDARY SEAL	GRAFOIL w/ 316 SST INSERT
■ 31	1	METAL O-RING	B 167-UNS N06600/SILVER PL.
29	AR	ACTUATOR KEY	A 108 GR. 1045
■ 28	1	ANNULAR KEY	A 276 / A 479 T316
27	AR	DISC KEY	A 276 / A 479 T316
■ 24	1	PACKING	CHEVRON SET: PTFE
21	1	EXTEN. BEARING	'METCAR' GR. M10 OR EQL.

IT.#	QTY.	DESCRIPTION	MATERIAL
■ 16	AR	BEARING	'METCAR' GR. M10 OR EQL.
■ 15	1	BOTTOM GASKET	GRAFOIL
■ 14	1	SEAL (laminated)	A 240 T316 w/ GRAFOIL
11	1	SHAFT	A 564 T630 H1150 DBL.
8	1	PACKING GLAND	A 351 GR. CF8M
7	1	COVER GLAND	A 351 GR. CF8M
6	1	CLAMP RING	A 351 GR. CF8M
5	1	DISC	A 351 GR. CF8M
1.1	1	SEAT	INTEGRAL w/ VALVE BODY
1	1	VALVE BODY	A 351 GR. CF8M

Bulletin contents may change at any time without notice.

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