

**FORCE**<sup>®</sup>

# Cryogenic Service Ball Valve

Class 150, 300, 600, 900, 1500 & 2500



[www.force-valves.com](http://www.force-valves.com)  
**Dongsan Valve Co., Ltd.**

# INTRODUCTION & APPLICATION

## INTRODUCTION

**DONGSAN** Valves for Cryogenic service have been developed to meet the most advanced and demanding technological standards of Korea, the world's leading importer of environmentally friendly, clean energy LNG(liquid natural gas). The cryogenic service ball valve expertise of **DONGSAN** has been combined to offer the cryogenic industry the most complete and technically most advanced cryogenic valves line from one source.

We offer stainless steel and cast carbon steel ball valves for processing, storage, shipment and distribution of ethylene, LPG, LNG and other low temperature or cryogenic fluids down to -196°C(-321°F).

## APPLICATION

**DONGSAN** specially-adapted extended bonnet valves offer safe and efficient service including LNG liquifaction plants and receiving terminals as well as cargo systems of LNG and aerospace ground support facilities for liquid, hydrogen and oxygen.

- LNG(Liquefied Natural Gas)
- Ethylene Plant
- Industrial Low-Temperature Gas
- Cryogenic Service



**MANUAL & MOV OPERATOR FLOATING BALL VALVES  
SIDE ENTRY-FORTED TYPE**



**TRUNNION MOUNTED BALL VALVES, 2" to 40"  
CLASS 150 to 2500,**

# CERTIFICATES

Dongsan's quality program is fully compliant with the industry's most stringent standards.

Total reliability on products comes from exhaustive inspection and thorough such analysis as mechanical and physical properties over the whole processes.

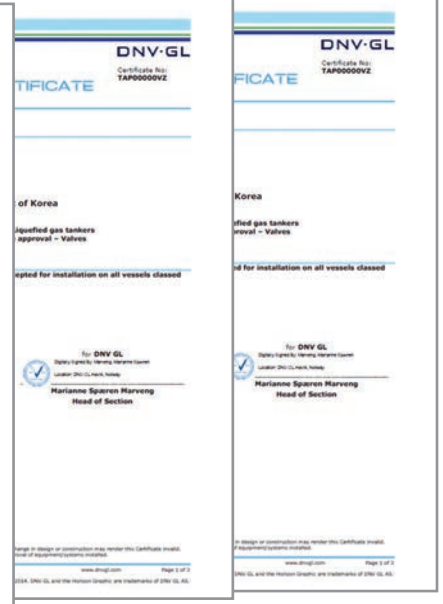
Dongsan holds all major approvals, including ISO 9001:2015, ISO 14001:2015/OHSAS 18001:2007, API 6D, CE-PED, CRN, Fire-test Cert, CERT of Registration-KOGAS and Type Approval Cert-Cryo. Ball Valves.



CERT OF REGISTRATION-KOGAS



TYPE APPROVAL CERT-CRYO. BALL VALVES



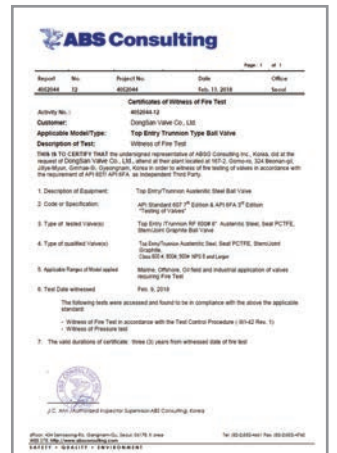
ISO 9001:2015



CE-PED Cert



CRN-ABSA



Fire-Test Cert



ISO 14001:2015



OHSAS 18001:2007



API Monogram -6D

# DONGSAN QUALITY SYSTEMS

## QUALITY ASSURANCE

Every step from procurement through production, welding, assembly, testing and packaging is in accordance with written rules contained in QA manuals. (An ASME Section III manual for code valve production and an ISO 9001 QA manual for all other production.) Orders are reviewed by Engineering and QA Departments and all special customer requirements are incorporated into QCI (Quality Control Instructions) issued for each project. The QA Department also operates calibration and gauge control systems, and trains and qualifies skilled welders and NDT inspectors.



Reliability of valve operation affects service life and ease of inspection and maintenance. In order to predict reliability, a sound valve design must be backed up by a stress analysis and functional qualification testing under critical operating conditions.

## QUALITY CONTROL

As an ISO 9001 certified manufacturer, DONGSAN is committed to the highest degree of excellence. DONGSAN cryogenic valves are produced under special conditions to ensure tight machining tolerances, high quality surface finish and meticulous material selection. The quality control department is responsible for ensuring that all the specifications throughout the process, including material acquisition, machining, welding, cleaning, assembly, pressure testing, packing and final inspection are maintained at the highest level. 3.1 certification and full material test reports are available for customer use.



**TRUNNION MOUNTED BALL VALVES  
TOP ENTRY-CASTING TYPE**



**MANUAL & MOV OPERATOR FLOATING BALL VALVES  
SIDE ENTRY-FORTED TYPE**

## CRYOGENIC SERVICE VALVE CONFIGURATIONS

DONGSAN Cryogenic service ball valves are available in Six basic body configurations ; BFC(1/2" to 6"), DFC(1/2" to 6"), SFC(1/2" to 2"), BTC(2" to 12"), DTC(2" to 40"), TWC(2" to 24"). All Six valv styles offer the same features: exclusive Polyfill seats, all stainless steel construction, pressure safe stem, extension bonnet lengths, positive ball cavity relief and low operational torques.

### STANDARD FEATURE

- DESIGNED IN ACCORDANCE WITH INDUSTRY SATANDARD  
**API 6D/ISO 14313, ASME B16.34, ISO 17292, API 608, ASME B16.5, BS 6364**
- FULL BORE  
Meets the minimum bore requirements according to **API 6D/ISO 14313**, Table 1.
- REDUCED BORE  
One size below nominal size of valve with bore according to **API 6D/ISO 14313**, Table 1.
- STANDARD MATERIALS of CONSTRUCTION  
are Casting & forged Stainless Steel.
- PRESSURE CLASS 150 TO 2,500
- FIRE SAFE IN ACCORDANCE TO **API 607/ISO 10497** AND **API 6FA**
- FACTORY TESTED  
in accordance with **ASME B16.34, API 6D/ISO 14313, ISO 5208, BS 6364**
- BALL SEAT MATERIAL  
KEL-F(PCTFE), UHMWPE Seated
- EXTENSION BONNET  
The extension bonnet provides efficient cold insulation, minimizing heat conduction and transfer from cryogenic flow, while preventing the exposure of valve packing to cryogenic media and providing a secure seal. Thermal conduction and heat tansmission from the low temperature fluid is suppressed to a minimum while a cooling effect is provided, and the packing is prevented from being exposed to the low temperature liquid and a secure seal is realized.
- Packing/Gasket  
Flexible graphite excelling in resistance to low temperatures, sealing qualities, and durability is used in the packing and gasket.
- ANTI-BLOWOUT STEM DESIGN AND ANTI-STATIC DESIGN
- CERTIFICATION AND TRACEABILITY  
Material test certificates 3.1 according to **EN 10204**. A unique code is stamped on all relevant components linking them with their material and chemical analysis certificates.

### PRODUCT RANGE, FULL & REDUCED PORT

	SIZE		ASME CLASS						
	DN	NPS	Class 150	Class 300	Class 600	Class 800	Class 900	Class 1500	
FLOATING	15	1/2	● Lever	● Lever	● Lever	● Lever	● Lever	● Lever	● Lever
	20	3/4	● Lever	● Lever	● Lever	● Lever	● Lever	● Lever	● Lever
	25	1	● Lever	● Lever	● Lever	● Lever	● Lever	● Lever	● Lever
	40	1 1/2	● Lever	● Lever	● Lever	● Lever	● Lever	● Lever	● Lever
	50	2	● Lever	● Lever	● Lever	●	●		
	75	3	● Lever	● Lever	● Gear	●	●		
	100	4	● Gear	● Gear	● Gear	●	●		
	150	6	● Gear	● Gear		●	●		

● : BUC, BFC, DFC, SFC Sereies (Casting or Forged, Side entry, Flanged End/ Welding End/ Socket Welding End)

	SIZE		ASME CLASS						
	DN	NPS	Class 150	Class 300	Class 600	Class 900	Class 1500	Class 2500	
TRUNNION MOUNTED	50	2	■ Lever	■ Lever	■ Lever	■ Lever/Gear	■ Lever/Gear	■ Gear	
	75	3	■ Lever	■ Lever	■ Lever/Gear	■ Gear	■ Gear	■ Gear	
	100	4	■ Lever/Gear	■ Lever/Gear	■ Gear	■ Gear	■ Gear	■ Gear	
	150	6	■ Lever/Gear	■ Lever/Gear	■ Gear	■ Gear	■ Gear	■ Gear	
	200	8	■ Gear	■ Gear	■ Gear	■ Gear	■ Gear		
	250	10	■ Gear	■ Gear	■ Gear	■ Gear	■ Gear		
	300	12	■ Gear	■ Gear	■ Gear	■ Gear	■ Gear		
	350	14	■ Gear	■ Gear	■ Gear	■ Gear	■ Gear		
	400	16	■ Gear	■ Gear	■ Gear	■ Gear	■ Gear		
	450	18	■ Gear	■ Gear	■ Gear	■ Gear			
	500	20	■ Gear	■ Gear	■ Gear	■ Gear			
	600	24	■ Gear	■ Gear	■ Gear	■ Gear			
	750	30	■ Gear	■ Gear	■ Gear				
	1000	40	■ Gear	■ Gear					

■ : BTC, DTC, TWC Sereies (Casting or Forged, Side entry or Top entry, Flanged End/ Welding End/ Socket Welding End)

# General Cryogenic valves

## PRESSURE BUILDUP PREVENTION

The DONGSAN cryogenic ball valve is designed with no trapped cavities. A cavity relief hole faces upstream and eliminates pressure buildup caused by thermal expansion.

## SEATS AND SEALS

For temperatures down to -200 °C / -328 °F, DONGSAN recommends the use of either TFM 1600™ or DONGSAN CR-PTFE seats - for a lower operating torque, smaller actuator and a cost effective product.

For temperatures down to -269 °C / -452 °F, DONGSAN recommends the use of PCTFE (KEL-F). A hybrid seat comprised of a stainless steel housing and a PCTFE (KEL-F) insert is DONGSAN's recommendation for high pressure cryogenic applications.

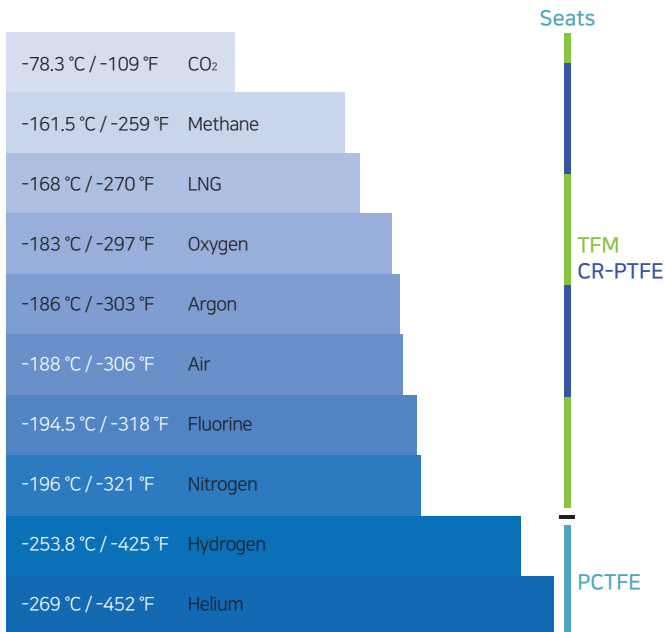
When PCTFE seats are sized for the application, a high tensile 17-4PH stem (code M) must be used to overcome the high operating torque.

Both graphite and PTFE body seals are used in the cryogenic series, with PTFE for non-fire safe applications and graphite for fire safe applications.

Both seal types are designed to accommodate the same body/end encapsulation.



## SEATS AND SEALS



## EFFICIENT HEAT TRANSFER

The DONGSAN standard bonnet length design complies with BS6364 for non-cold-box applications.

The long neck bonnet insulates the stem seal from the low temperatures of cryogenic fluids, thus enabling safe and long lasting seal service.

A thin layer of liquid cryogenic media between the bonnet ID and the stem OD, enables safe evaporation of cryogenic fluid at the ambient environment temperature.



Top Entry, Trunnion Class 150 3", 6", 8"- SEATANKERS PJT



Top Entry, Trunnion Class 900 12" - LNG Free Port



Top Entry, Trunnion Class 150 3", 6", 8"- SEATANKERS PJT



Top Entry, Trunnion Class 800/1500 2" - KOGAS, LNG Terminal

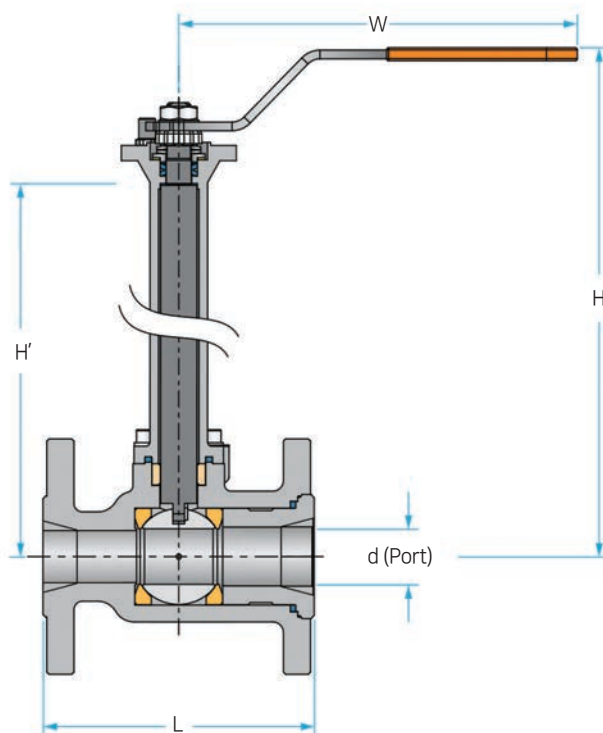


Side Entry, Floating Ball Class 800/1500 2" Below - KOGAS, LNG Terminal

# BUC / BFC

"Uni & Split Body, Free Floating Ball, Cast & Forged Valves"

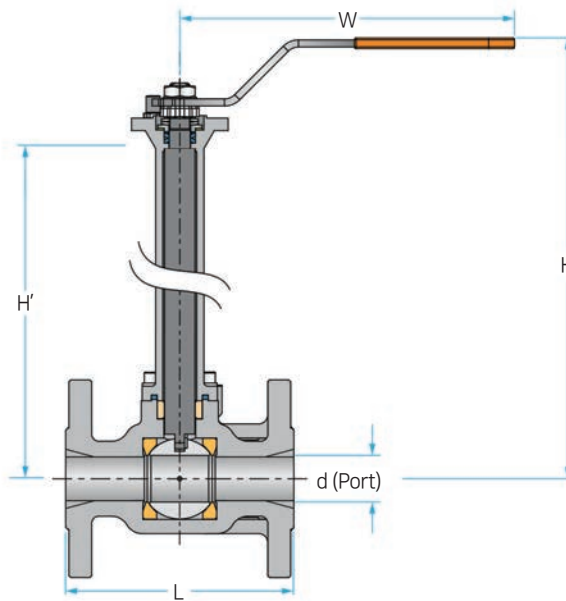
## BUC



DIMENSIONS		CLASS 150 & 300						
Valve Size		1-1/2"	2"	2-1/2"	3"	4"	6"	
Ød (port)	inch	1	1.5	2	2.32	3	4	
	mm	25	39.8	51	59	76	102	
L (RF)	150	inch	6.5	7	7.5	8	9	10.5
		mm	165	178	191	203	229	266.7
	300	inch	7.5	8.5	-	11.14	12	15.87
		mm	191	216	-	283	305	403
H'	150	inch	23.6	23.6	25.6	27.6	27.6	27.6
		mm	600	600	650	700	700	700
	300	inch	23.6	23.6	-	27.6	27.6	27.6
		mm	600	600	-	700	700	700
H	150	inch	25.7	26.7	28.6	31.0	31.9	32.6
		mm	652	677	727	788	810	829
	300	inch	25.7	26.7	-	31.0	31.9	32.6
		mm	652	677	-	788	810	829
W	inch	-	-	-	-	-	-	
	mm	160	230	230	380	380	450	
ØW1	inch	-	-	-	-	-	-	
	mm	-	-	-	-	-	-	



**BFC**



**DIMENSIONS CLASS 150 & 300**

Valve Size		1/2"	3/4"	1"	1 1/2"	2"	2 1/2"	3"	4"	6"	
Ød (port)	inch	0.5	0.7	1.0	1.5	2.0	2.5	3.0	4.0	6.0	
	mm	13	19	25	38	51	64	76	102	152	
L	150	inch	4.25	4.61	5.00	6.50	7.01	7.50	8.00	9.02	15.51
		mm	108	117	127	165	178	190.5	203.2	229	394
	300	inch	5.51	5.91	6.50	7.50	8.50	9.49	11.14	12.01	15.87
		mm	140	150	165	190.5	216	241	283	305	403
H	150	inch	21.4	21.6	21.7	26.7	27.0	29.3	31.9	33.1	37.8
		mm	544	549	552	677	685	745	810	842	960
	300	inch	21.4	21.6	21.7	26.9	27.0	29.3	32.2	33.3	37.8
		mm	544	549	552	682	685	745	817	846	960
H'	150	inch	19.7	19.7	19.7	23.6	23.6	25.6	27.6	27.6	27.6
		mm	500	500	500	600	600	650	700	700	700
	300	inch	19.7	19.7	19.7	23.6	23.6	25.6	27.6	27.6	27.6
		mm	500	500	500	600	600	650	700	700	700
W	inch	5.12	5.12	6.10	9.06	9.06	14.96	14.96	17.72	23.62	
	mm	130	130	155	230	230	380	380	450	600	
ØW1	inch	-	-	-	-	-	-	-	-	19.69	
	mm	-	-	-	-	-	-	-	-	500	

**DIMENSIONS CLASS 600**

Valve Size		1/2"	3/4"	1"	1 1/2"	2"	3"x2"	3"	4"x3"	4"
Ød (port)	inch	0.5	0.7	1.0	1.5	2.0	2.0	3.0	3.0	4.0
	mm	13	19	25	38	51	51	76	76	102
L	inch	6.50	7.50	8.50	9.50	11.50	14.02	14.00	17.01	17.01
	mm	165.1	190.5	215.9	241.3	292	356	355.6	432	432
H	inch	21.6	21.9	22.3	27.2	27.9	33.3	35.0	-	-
	mm	548	556	566	691	709	847	890	-	-
H'	inch	19.7	19.7	19.7	23.6	23.6	27.6	27.6	-	-
	mm	500	500	500	600	600	700	700	-	-
W	inch	9.65	9.65	9.65	14.57	14.57	14.57	17.72	17.72	23.62
	mm	245	245	245	370	370	370	450	450	600
ØW1	inch	-	-	-	-	-	-	-	-	-
	mm	-	-	-	-	-	-	-	-	-

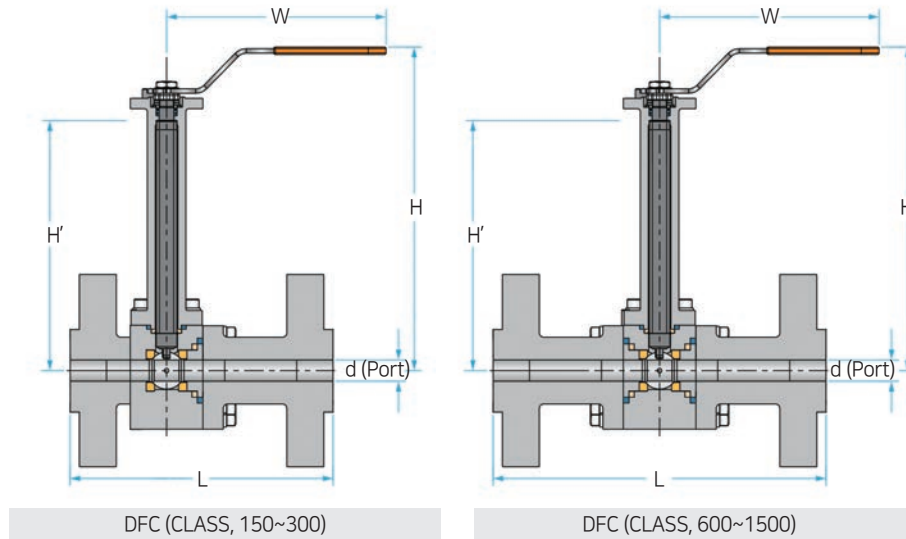
**DIMENSIONS CLASS 900 & 1500**

Valve Size		1/2"	3/4"	1"	1 1/2"
Ød (port)	inch	0.5	0.7	1.0	1.5
	mm	13	19	25	38
L	inch	8.50	9.02	10.00	12.01
	mm	216	229	254	305
H	inch	21.6	21.7	22.2	27.3
	mm	549	552	565	694
H'	inch	19.7	19.7	19.7	23.6
	mm	500	500	500	600
W	inch	9.65	9.65	9.65	14.57
	mm	245	245	245	370

# DFC / SFC

"Split Body, Free Floating Ball, Forged Valves"

## DFC



### DIMENSIONS

### CLASS 150 & 300

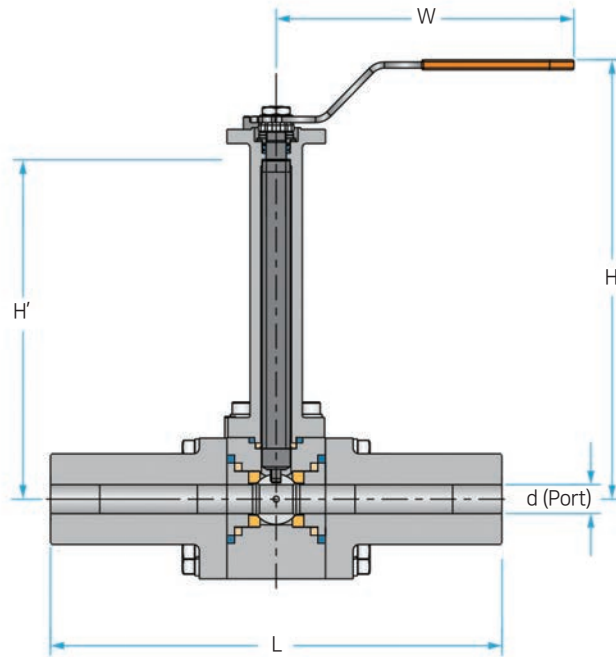
Valve Size		1/2"x3/8"	1/2"	3/4"x1/2"	3/4"	1"x3/4"	1"	1 1/2"x1"	1 1/2"	2x1 1/2"	2"	
Class 150	Ød (Ball port)	inch	0.43	0.5	0.5	0.75	0.75	1.0	1.0	1.5	1.5	1.9
		mm	11	13	13	19	19	25	25	38	38	49
	L	inch	4.25	4.25	4.61	4.61	5.00	5.00	6.50	6.50	7.01	7.01
		mm	108	108	117	117	127	127	165	165	178	178
	H	inch	-	543	-	550	-	555	-	675	-	685
		mm	-	21.4	-	21.7	-	21.9	-	26.6	-	27.0
H'	inch	-	500	-	500	-	500	-	600	-	600	
	mm	-	19.7	-	19.7	-	19.7	-	23.6	-	23.6	
W	inch	5.12	5.12	5.12	7.09	7.09	8.46	8.46	9.65	9.65	10.63	
	mm	130	130	130	180	180	215	215	245	245	270	
Class 300	Ød (Ball port)	inch	0.43	0.5	0.5	0.75	0.75	1.0	1.0	1.5	1.5	1.9
		mm	11	13	13	19	19	25	25	38	38	49
	L	inch	5.51	5.51	5.98	5.98	6.50	6.50	7.48	7.48	8.50	8.50
		mm	140	140	152	152	165	165	190	190	216	216
	H	inch	-	543	-	550	-	555	-	675	-	685
		mm	-	21.4	-	21.7	-	21.9	-	26.6	-	27.0
H'	inch	-	500	-	500	-	500	-	600	-	600	
	mm	-	19.7	-	19.7	-	19.7	-	23.6	-	23.6	
W	inch	5.12	5.12	5.12	7.09	7.09	8.46	8.46	9.65	9.65	10.63	
	mm	130	130	130	180	180	215	215	245	245	270	

### DIMENSIONS

### CLASS 600 & 900/1500

Valve Size		1/2"x3/8"	1/2"	3/4"x1/2"	3/4"	1"x3/4"	1"	1 1/2"x1"	1 1/2"	2x1 1/2"	2"	
Class 600	Ød (Ball port)	inch	0.43	0.5	0.5	0.75	0.75	1.0	1.0	1.5	1.5	1.9
		mm	11	13	13	19	19	25	25	38	38	49
	L	inch	6.50	6.50	7.48	7.48	8.50	8.50	9.49	9.49	11.50	11.50
		mm	165	165	190	190	216	216	241	241	292	292
	H	inch	-	21.5	-	21.9	-	22.0	-	26.8	-	27.2
		mm	-	545	-	555	-	560	-	680	-	690
H'	inch	-	19.7	-	19.7	-	19.7	-	23.6	-	23.6	
	mm	-	500	-	500	-	500	-	600	-	600	
W	inch	7.09	7.09	7.09	8.46	8.46	9.06	9.06	9.65	9.65	10.63	
	mm	180	180	180	215	215	230	230	245	245	270	
Class 900 / 1500	Ød (Ball port)	inch	0.43	0.5	0.5	0.75	0.75	1.0	1.0	1.5	1.5	1.9
		mm	11	13	13	19	19	25	25	38	38	49
	L	inch	8.50	8.50	9.02	9.02	10.00	10.00	12.01	12.01	14.49	14.49
		mm	216	216	229	229	254	254	305	305	368	368
	H	inch	-	21.9	-	22.2	-	22.6	-	27.4	-	28.0
		mm	-	557	-	565	-	575	-	695	-	710
H'	inch	-	19.7	-	19.7	-	19.7	-	23.6	-	23.6	
	mm	-	500	-	500	-	500	-	600	-	600	
W	inch	8.46	8.46	8.46	9.65	9.65	9.65	9.65	10.63	10.63	13.78	
	mm	215	215	215	245	245	245	245	270	270	350	

SFC



DIMENSIONS

CLASS 800 & 1500

Valve Size		1/2"x3/8"	1/2"	3/4"x1/2"	3/4"	1"x3/4"	1"	1 1/2"x1"	1 1/2"	2x1 1/2"	2"	
Class 800	Ød (Ball port)	inch	0.43	0.5	0.5	0.75	0.75	1.0	1.0	1.5	1.5	1.9
		mm	11	13	13	19	19	25	25	38	38	49
	L (without Nipple)	inch	5.71	5.71	5.91	5.91	6.10	6.10	7.09	7.09	7.87	7.87
		mm	145	145	150	150	155	155	180	180	200	200
	L (with Nipple)	inch	3.15	3.15	3.94	3.94	4.53	4.53	5.12	5.12	6.30	6.30
		mm	80	80	100	100	115	115	130	130	160	160
	H	inch	-	21.9	-	22.0	-	22.2	-	26.6	-	27.2
		mm	-	500	-	500	-	500	-	600	-	600
	H'	inch	-	19.7	-	19.7	-	19.7	-	23.6	-	23.6
		mm	-	555	-	560	-	565	-	675	-	690
	W	inch	7.09	7.09	7.09	8.46	8.46	9.06	9.06	9.65	9.65	10.63
		mm	180	180	180	215	215	230	230	245	245	270
Class 1500	Ød (Ball port)	inch	0.43	0.5	0.5	0.75	0.75	1.0	1.0	1.5	1.5	1.9
		mm	11	13	13	19	19	25	25	38	38	49
	L (without Nipple)	inch	5.71	5.71	5.91	5.91	6.10	6.10	7.09	7.09	7.87	7.87
		mm	145	145	150	150	155	155	180	180	200	200
	L (with Nipple)	inch	3.94	3.94	4.33	4.33	4.92	4.92	5.51	5.51	6.69	6.69
		mm	100	100	110	110	125	125	140	140	170	170
	H	inch	-	21.9	-	22.0	-	22.2	-	26.6	-	27.2
		mm	-	500	-	500	-	500	-	600	-	600
	H'	inch	-	19.7	-	19.7	-	19.7	-	23.6	-	23.6
		mm	-	555	-	560	-	565	-	675	-	690
	W	inch	8.46	8.46	8.46	9.65	9.65	9.65	9.65	10.63	10.63	13.78
		mm	215	215	215	245	245	245	245	270	270	350

# BTC / DTC / TWC

“Uni & Split Body, Trunnion Mounted, Cast & Forged Valves”



## FEATURESBTC

## BTC / DTC

- Basic design : API 6D, ASME B16.34 and BS 6364
- Split & Bolted Body, Side entry design
- Double Block and Bleed Design
- Piston action SR(Self-relieving) Seats
- Spring energized seats for Sealing at low Line-pressure
- Blow out proof stem construction
- Anti-static design
- Locking device
- Micro-finished ball for long service life
- Metal-backed, Self-lubricating PTFE sleeve bearing and Thrust washers reduced torque and extend service life
- Full & Reduced Port
- Size range : NPS 2(DN 50) to NPS 16(DN 400)
- Pressure Rating : ASME Class 150 to 900
- Graphite gasket and Stem packing prevent post-fire external leakage.
- Post-fire metal-to-metal seal prevents internal leakage after fire.
- Fire-safe design : API 607/ ISO 10497 or API 6FA

## TECHNICAL SUMMARY

No.	Parts	End Connection	Port	ASME Class	Size Range
BTC	Cast	ASME B16.5 (Flanged End)	Full Reduced	Class 150	NPS 2 to NPS 16
				Class 300	NPS 2 to NPS 16
				Class 600	NPS 2 to NPS 12
				Class 900	NPS 2 to NPS 6
DTC	Forged	ASME B16.5 ASME B16.47 (Flanged End)	Full Reduced	Class 150	NPS 2 to NPS 40
				Class 300	NPS 2 to NPS 40
				Class 600	NPS 2 to NPS 30
				Class 900	NPS 2 to NPS 24

## STANDARD MATERIALS

Part Name	Materials	
Body	ASTM A351-CF8, CF8M/ A182-F304, F316	ASTM A351-CF3, CF3M/ A182-F304L, F316L
Cap (& Insert)	ASTM A351-CF8, CF8M/ A182-F304, F316	STM A351-CF3, CF3M/ A182-F304L, F316L
Ball	ASTM A182-F304, F316	
Stem	ASTM A182-F304, F316	
Stem bush	SS 304/ 316	
Gland Flange	ASTM A351-CF8, CF8M	ASTM A351-CF3, CF3M
Extension Bonnet	ASTM A351-CF8, CF8M	ASTM A351-CF3, CF3M
Seat Retainer	ASTM A182-F304, F316	
Seat Ring	KEL-F (PCTFE)	
Trunnion	ASTM A182-F304, F316	
Seal	PTFE, Graphite Gasket or Lip Seal	
Gasket	PTFE, Graphite Gasket or Spiral Wound Gasket(304/316SS+Graphite)	
Bushing	PTFE or DU-BUSH (Stainless Steel +PTFE Coating)	
Thrust Washer	PTFE or DDU (Stainless Steel +PTFE Coating)	
Spring	Inconel X-750	
Lever Operator	Cast Iron or Carbon Steel with Vinyl coating or Stainless Steel	
Gear Operator	Cast Iron Case, Ductile Iron Gear, High Carbon Steel Worm Shaft	
Bolts/ Nuts (for Joint)	ASTM A320-B8(M) Class.2 / A194-8(M), 8MA	



**FEATURES**

**TWC**

- Basic design : API 6D, ASME B16.34 and BS 6364
- Uni Body, Top entry design
- Double Block and Bleed Design
- Piston action SR(Self-relieving) Seats
- Spring energized seats for Sealing at low Line-pressure
- Blow out proof stem construction
- Anti-static design
- Locking device
- Micro-finished ball for long service life
- Metal-backed, Self-lubricating PTFE sleeve bearing and Thrust washers reduced torque and extend service life
- Full & Reduced Port
- Size range : NPS 2(DN 50) to NPS 40(DN 1000)
- Pressure Rating : ASME Class 150 to 1500
- Graphite gasket and Stem packing prevent post-fire external leakage.
- Post-fire metal-to-metal seal prevents internal leakage after fire.
- Fire-safe design : API 607/ ISO 10497 or API 6FA

**TECHNICAL SUMMARY**

No.	Type	End Connection	Port	ASME Class	Size Range
TWC	Cast or Forged	ASME B16.5 ASME B16.47 (Flanged End)  ASME B16.25 (But-welding End)	Full Reduced	Class 150	NPS 2 to NPS 40
				Class 300	NPS 2 to NPS 40
				Class 600	NPS 2 to NPS 30
				Class 900	NPS 2 to NPS 24
				Class 1500	NPS 2 to NPS 16

**STANDARD MATERIALS**

Part Name	Materials
Body	ASTM A351-CF8, CF8M/ A182-F304, F316 ASTM A351-CF3, CF3M/ A182-F304L, F316L
Cap (& Insert)	ASTM A351-CF8, CF8M/ A182-F304, F316 ASTM A351-CF3, CF3M/ A182-F304L, F316L
Ball	ASTM A182-F304, F316
Stem	ASTM A182-F304, F316
Stem bush	SS 304/ 316
Gland Flange	ASTM A351-CF8, CF8M/ A182-F304, F316
Extension Bonnet	ASTM A351-CF8, CF8M/ A182-F304, F316
Seat Retainer	ASTM A182-F304, F316
Seat Ring	KEL-F (PCTFE)
Trunnion	ASTM A182-F304, F316
Seal	PTFE, Graphite Gasket or Lip Seal
Gasket	PTFE, Graphite Gasket or Spiral Wound Gasket(304/316SS+Graphite)
Bushing	PTFE or DU-BUSH (Stainless Steel +PTFE Coating)
Thrust Washer	PTFE or DDU (Stainless Steel +PTFE Coating)
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Lever Operator	Cast Iron or Carbon Steel with Vinyl coating or Stainless Steel
Gear Operator	Cast Iron Case, Ductile Iron Gear, High Carbon Steel Worm Shaft
Bolts/ Nuts (for Joint)	ASTM A320-B8(M) Class.2 / A194-8(M), 8MA

# General Terms of Sale

## ■ General

On to terms and subject to the conditions set forth, seller agrees to sell to Buyer and Buyer agrees to buy from Seller, the products or services specified in the sales contract agreement which includes Seller's offer.

## ■ Price And Payment

All sales are subject to approval of Seller's credit department. If Buyer fails to make a payment when due, Seller may withhold all subsequent deliveries until full payment is made and require such security as Seller deems appropriate to secure future payments.

Full risk of loss shall pass to the buyer upon delivery to FOB point or destination port in case of CIF however, Seller retains title, for security purposes only, to all products until paid for in full in cash. Unless other terms are specified hereof, payment is due in U.S.

dollars, thirty(30) days after invoice date to by Letter of Credit. Amounts not paid by Buyer on or before due date shall bear interest at the lesser rate of buyer, the date of readiness for delivery shall be deemed date of delivery for invoice purposes and Seller may impose a storage charge.

## ■ Shipment

Shipment dates offered are estimates and represent the date materials may be available. Shipment dates offered commence only after receipt of Buyer's Purchase Order, clarification of required technical information, resolution of engineering and/or commercial issues of customer's written approval of drawings when required. Any product offered from stock is subject to prior sale

## ■ Warranty

All FORCE Ball Valves are guaranteed against defects in workmanship for a period of twelve(12) months after being placed in service, but not exceeding eighteen(18) months after shipment, when products are properly installed and used within the service and pressure range for which they were manufactured. This guarantee is limited to replacement free of charge any parts found to be defective in material or workmanship in **FORCE** Ball Valve products voids this warranty.

## ■ Cancellation

No order may be canceled by the Buyer except upon written notice to Seller and upon payment to Seller of all costs incurred by it arising out of, or in connection with, the order. Seller shall have the right to cancel any order or to refuse to ship or to cancel shipment in the event Buyer fails to submit payments when due or perform any other obligations of Buyer. Export of goods covered hereby is subject to Korean Government control. In the event the Korean Government denies a validated Export License Buyer's order(s) will be immediately canceled and Buyer will be liable for the other value or actual costs incurred, whichever the greater.

## ■ Return of Goods

No product shall be returned to Seller without written authorization and shipping instructions having been obtained from Seller. Products authorized for return are to be shipped freight prepaid to the FOB manufacture point and are subject to restocking charge.

## ■ Limitation of Liability

The liability of Seller under this agreement or with respect to any products supplied or services, performed pursuant to this agreement, whether in contract, in tort, in strict liability or otherwise, shall not exceed the purchase price paid by Buyer with respect thereto. In no event will Seller be liable in contract, in tort, in strict liability or otherwise for any special, indirect, incidental or consequential damages, including, but not limited to, loss of anticipated profits or revenues, loss of use, non-operation or increased expense of operation of equipment, cost of capital, or claims of customers of Buyer for failure or delay in achieving anticipated profits or products.

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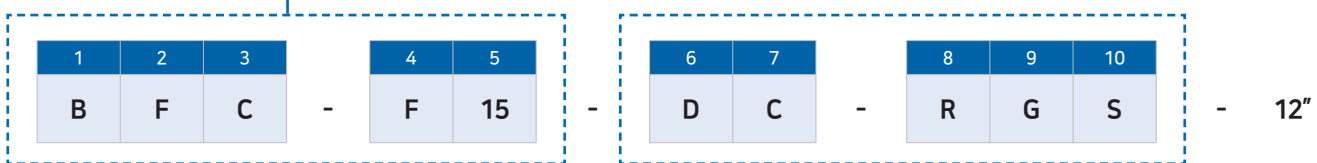
## ■ Policy for Change of Design

**FORCE** Valve reserve the right to discontinue the manufacture or, or change or modify, the design and construction of any **FORCE** Valve product **without prior notice**, in due course of our manufacturing procedure, without incurring any obligation to accept for credit, to replace or furnish or install such changes or modifications on products previously or subsequently sold.

**HOW TO ORDER**

**FIGURE NUMBER CODING SYSTEM**

1, 2, 3. Type of valve / Series						4. Type port		5. Pressure Rating	
B	Side entry, Casting Ball Valves	U	Floating Ball, Uni-body	S	Soft Seated	F	Full Port	15	ASME Class 150
D	Side entry, Forged Ball Valves	F	Floating Ball, Split-body	M	Metal Seated	R	Reduced Port	30	ASME Class 300
S	Side entry, Screwed & Socket welded Ends Ball Valves	T	Trunnion Mounted, Split-body	C	Cryogenic Service	G	Regular Port	60	ASME Class 600
T	Top entry, Casting Ball Valves	W	Trunnion Mounted, Uni-body	P	Spare Parts	L	L-Port	80	ASME Class 800
G	Top entry, Forged Ball Valves	A	Floating Uni Body-SBB	R	Repair	T	T-Port	90	ASME Class 900
3	3 Way Ball Valves	B	Floating Uni Body-DBB			Y	L-Port	51	ASME Class 1500
J	Jacket Ball Valves	C	Floating Split Body-SBB			A	9mm	52	ASME Class 2500
G	Gate Valves	D	Floating Split Body-DBB			B	13mm	10	JIS 10K
R	Globe Valves	H	Trunnion Split Body-SBB			C	19mm	20	JIS 20K
C	Check Valves	N	Natural			X	Special	40	JIS 40K
X	Other Valves	X	Other Type					63	JIS 63K
								P1	DIN PN10
								P2	DIN PN16



6. Material of Construction : Body/Cap & Trim parts		7. Material of Construction : Seat		8. End Connection		9. Operators		10. Options	
A	ASTM A216-WCB(A105)/CS+ENP TRIM	P	PTFE	B	But-Welding End	L	Manual Lever	S	FORCE Standard
B	ASTM A216-WCB(A105)/SS316 TRIM	R	R-PTFE (Reinforced Glass)	F	Flanged End ; FF	G	Enclosed Wormgear	A	with Limit Switch
C	ASTM A351-CF8(F304)/SS304 TRIM	E	CR-PTFE (Reinforced Carbon)	R	Flanged End ; RF	B	Bare Stem	L	with Mechanical Locking System
D	ASTM A351-CF8M(F316)/SS316 TRIM	N	NYLON	H	Hub End	M	Motor Actuator	E	Extended Stem
E	ASTM A351-CF3(F304L)/SS304L TRIM	V	DEVLON V	J	Flanged End ; RTJ	P	Pneumatic Actuator	B	Extended Bonnet
F	ASTM A351-CF3M(F316L)/SS316L TRIM	K	PEEK	T	Threaded End (Screwed End)	H	Hydraulic Actuator	C	cladding & Overlay
G	ASTM A351-CF8C(F321)/SS316 TRIM	D	DELIN	W	Socket Welding End (with/without Nipple)	O	Gas Oval Actuator	X	Special(According to any project spec.)
H	Duplex Stainless Steel	C	PCTFE (KEL-F)	C	Compact Flange	X	Special		
I	Nickel Alloy (Inconel)	M	Tungsten Carbide Coating	K	Large Groove				
J	ASTM A352-LCC(LF2)/LTCS+ENP TRIM	S	Stellite	S	Small Groove				
K	ASTM A352-LCC(LF2)/SS316 TRIM	X	Special	X	Special				
M	Monel								
R	Al-Bronze								
X	Special								



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