CRYOGENIC BUTTERFLY VALVE

LIMANNTECH

ACE VALVE

CRYOGENIC VALVES

FOR LNG ON/OFFSHORES

ACE VALVE

LIMANNTECH

OFFICIAL AGENT FOR CYROGENIC VALVES

MULTIPLE CRYOGENIC BUTTERFLY VALVE

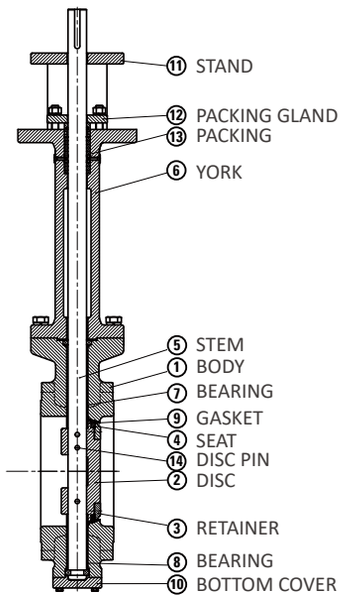
ACE VALVE

ACE cryogenic valves are widely used throughout the world, from liquefaction plants, to liquefied gas carries, receiving tank terminals as well as peak shaving plants, in a critical and hazardous service conditions down to the temperature as low as -196°.

Multiple-offset Metal Seated Cryogenic Butterfly Valve with "**Linear Lifting Stem & Disc technique**" is so Unique and the First in the world. Unique design allows disc to move linearly perpendicular to body seat against flow direction. It provides ZERO friction on overall surface of seats when both open & close of the disc during operation which leads to less torque than ever. Also, Perfect seat sealing with no seat leakage is well achieved by flexible adjusting way to push the disc against body seat when close the disc.

DESIGN COMPETITIVENESS

- Bi-directional design
- With butt-welding ends or flanged ends
- With inspection/ maintenance access (Side entry)
- Multiple offset design.
- Valve may be fitted in any orientation.
- Extended bonnet / Shaft for safe access



STANDARD COMPLIANCE

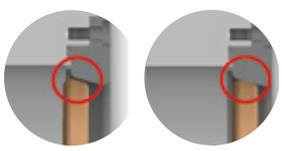
- BS 6364 Valves for Cryogenic service.
- Fire Safe approved in accordance with API 607.

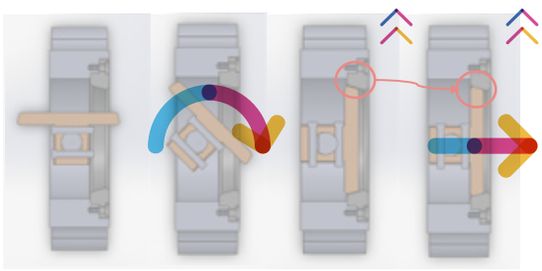
PRODUCTION RANGE

·SIZE : DN 100mm (4 inch) ~ DN 2000mm (80 inch)
·FLANGE RATING : ASME B 16.5 Class 150LB, 300LB
·WORKING PRESSURE : Up to 50bar
·WORKING TEMPERATURE : -196℃ ~ +815℃

UNIQUE FEATURE

- **Linear Lifting Stem & Disc technique**, which allows disc to move linearly perpendicular to body seat against flow direction.
- Solid Metal to Metal Seat with hard facing as a basic trim design, Metal to Soft Seat as an option
- Super Fine Seat Face roughness bystate-of-the-art machining
- Cutting Edge Seal Technology across the entire seat face
- Replaceable Metal Seat with Retainer
- Origin in South Korea exclusive





TYPE APPROVAL

DNV, LR, ABS, BV, KR

FEATURES

- **Linear Lifting Stem/Disc Design** inducing **Zero Friction** of Disc & Seat surfaces
- **Solid Metal to Metal Seat** with hard facing as a basic trim design, Metal to Soft Seat as an option
- **Super Fine Seat Face roughness** bystate-of-the-art machining
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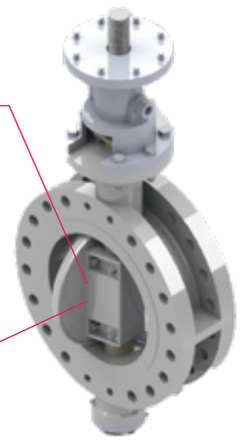
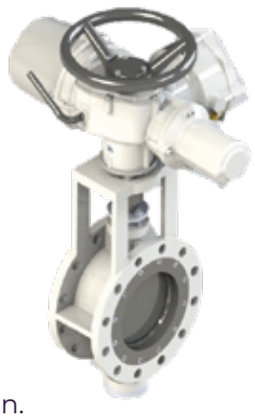


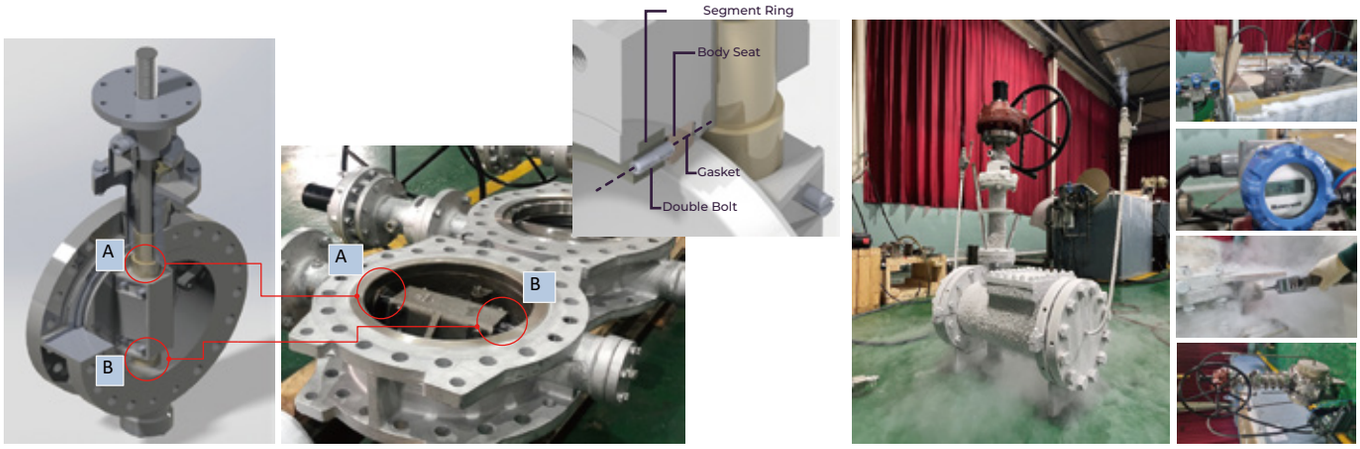
RETAINER
(SEGMENT RING TYPE)

- Centerlines of bolts and gaskets are the same center line.
- **No leakage occurs through gasket** because the sealing of gasket does not deteriorate even though any forces are exerted on the retainer ring with the disc due to internal pressure.
- Prevent loosening by double bolt design.



DISC POSITION CONTROL

- The valve disc position is controlled by the Upper and Lower Bush inserted into the Valve body.
- **No disc move by valve operation**.
- Can be maintained in initial conditions without change during valve installation.



AV-L Series Cryogenic **Gate Valve**

AV-L Series Cryogenic **Globe Valve**

AV-L Series Cryogenic **Ball Valve**

AV-L Series Cryogenic **Swing Check Valve**

PERFORMANCE RECORD

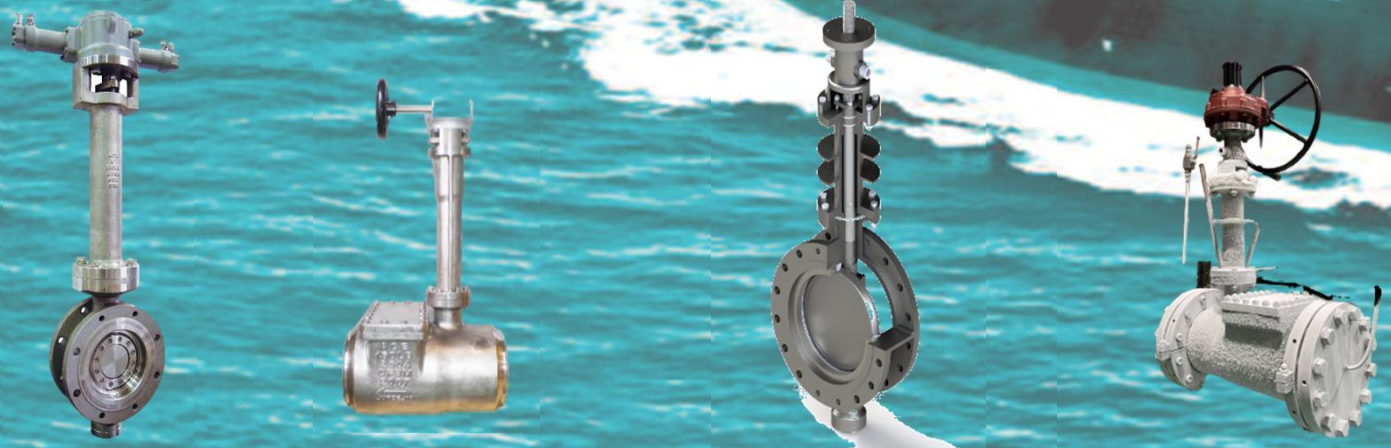
ACE VALVE

CRYOGENIC VALVES ONLY FOR PLANT/OFFSHORE

NO	COUNTRY	END-USER	CONTRACTOR	PROJECT / TYPE OF VESSEL	DESCRIPTION / SPECIFICATION				DELIVERY	
					TYPE OF VALVE	FLANGE RATING	SIZE	Q'TY	YY	MM
1	KOREA	KIMM (Korean Institute of Machinery & Materials)	JH TECH	Cryogenic Test Facility	CRYOGENIC TRIPLE ECCENTRIC BUTTERFLY VALVE (BUTT-WELD)	150LB	DN 200, 500	3EA	2021	7
2	TURKEY	PARDUS Energy LTD	HYUNDAI HEAVY INDUSTRIES CO.,LTD	294S / 170K LNG FSRU	CRYOGENIC BUTTERFLY VALVE with Hyd. Actuator / Manual CRYOGENIC GLOBE VALVE with Hyd. Motor Type Actuator / Manual CRYOGENIC GATE VALVE / Manual CRYOGENIC DUAL/SWING CHECK VALVE CRYOGENIC BALL VALVE with Hyd. Actuator / Manual	150LB 900LB	DN15 ~ DN600	164EA	2018	5
3	PANAMA	AES	POSCO ENC	PANAMA LNG COLON GAS	CRYOGENIC BUTTERFLY VALVE	150LB	DN200~DN900	17EA	2017	3
4	KOREA	LOTTE CHEMICAL	GS ENGINEERING & CONSTRUCTION	TE-3	CRYOGENIC BUTTERFLY VALVE	300LB	DN150	1EA	2016	11
5	JAPAN	MHI	OSAV CO.,LTD	MHI 2089	CRYOGENIC GLOBE VALVE (BUTT-WELD)	150LB	DN100	1EA	2016	10
6	JAPAN	MITSUBISHI HEAVY INDSTRIES, LTD.	OSAV CO.,LTD	MHI S.1412	CRYOGENIC GLOBE VALVE (BUTT-WELD)	150LB	DN80	1EA	2016	9
7	UAE	GASCO	GASOS		CRYOGENIC BALL VALVE	300LB	DN50	1EA	2015	12
8	SINGAPORE	-	LFA GLOBAL		CRYOGENIC BUTTERFLY VALVE	300LB	DN200	6EA	2015	12
9	CHINA	FENGZHEN WANJIE CITY GAS CO., LTD.	TECHNIP CHINA	FENGZHEN WANJIE CITY GAS PEAK REGULATION	CRYOGENIC LIFT CHECK VALVE	800LB	DN25	4EA	2015	11
10	CHINA	FENGZHEN WANJIE CITY GAS CO., LTD.	TECHNIP CHINA	FENGZHEN WANJIE CITY GAS PEAK REGULATION	CRYOGENIC GLOBE VALVE	150LB~800LB	DN25~DN50A	22EA	2015	11
11	CHINA	FENGZHEN WANJIE CITY GAS CO., LTD.	TECHNIP CHINA	FENGZHEN WANJIE CITY GAS PEAK REGULATION	CRYOGENIC DUAL CHECK VALVE	150LB	DN50~DN200	10EA	2015	11
12	CHINA	FENGZHEN WANJIE CITY GAS CO., LTD.	TECHNIP CHINA	FENGZHEN WANJIE CITY GAS PEAK REGULATION	CRYOGENIC BALL VALVE	150LB~800LB	DN15~DN300	82EA	2015	11
13	ANGOLA	BECHTEL	PJ VALVE	ANGOLA LNG	CRYOGENIC TRIPLE ECCENTRIC FLANGE TYPE BUTTERFLY VALVE	300LB ~900LB	DN300~DN600	4EA	2015	7
14	KSA	SABIC	OBG GLOBAL	REPLANCEMENT	CRYOGENIC TRIPLE ECCRENTRIC BUTTERTFLYS	150LB	DN600	1EA	2014	4
15	KOREA	KOREA INSTITUTE OF MACHINERY & MATERIALS	GYEONGNAM PPS	KOREA LNG CRYOGENIC INDUSTRIAL COMPLEX	CRYOGENIC BUTT-WELD TYPE GATE VALVE	150LB	DN1100	1EA	2014	3
16	KOREA	KOREA INSTITUTE OF MACHINERY & MATERIALS	GYEONGNAM PPS	KOREA LNG CRYOGENIC INDUSTRIAL COMPLEX	CRYOGENIC BUTT-WELD TYPE SWING CHECK VALVE	150LB	DN80~DN200	2EA	2014	3
17	UAE	FLOWSERVE GULF FZE	GERAB NATIONAL	GULF FZE	CRYOGENIC TRIPLE ECCENTRIC BUTTERFLY VALVE	150LB/300LB	DN80~DN400	6EA	2014	3
18	KOREA	KOREA INSTITUTE OF MACHINERY & MATERIALS	GYEONGNAM PPS	KOREA LNG CRYOGENIC INDUSTRIAL COMPLEX	CRYOGENIC BUTT-WELD TYPE BUTTERFLY VALVE	150LB/300LB	DN200~DN800	2EA	2014	2
19	JAPAN	MOL TANKSHIP MANAGEMENT	MITSUI ENGINEERING SHIPBUILDING	MES S.1230	CRYOGENIC FLANGE TYPE GLOBE VALVE	150LB	DN15	8EA	2013	12
20	CHILE	TECNICAS REUNIDAS	LOTUS CONTROL	MEJILLONES GNL NORTE GRANDE CHILE	CRYOGENIC BALL VALVE	150LB~900LB	DN40~DN150	12EA	2013	4
21	PAKISTAN	PAKISTAN PETROLEUM LIMITIED	FRENSTAR	MAKORI FIELD DEVELOPMENT	CRYOGENIC FLANGE TYPE BUTTERFLY VALVE	600LB	DN300	1EA	2013	3
22	CHILE	GNL MEJILLONES S.A	TECNICAS REUNIDAS	MEJILLONES GNL NORTE GRANDE CHILE	CRYOGENIC FLANGE TYPE BUTTERFLY VALVE	150LB	DN200~DN700	22EA	2013	3
23	KOREA	SAMSUNG TOTAL PETROCHEICALS	SAMSUNG ENGINEERING	STC EVA2	CRYOGENIC FLANGE TYPE BUTTERFLY VALVE	150LB	DN100	4EA	2013	3
24	KOREA	KOREA INSTITUTE MACHINERY & MATERIALS	KOREA INSTITUTE OF MACHINERY & MATERIALS	STUDY OF MACHINERY & MATERIALS	CRYOGENIC FLANGE TYPE BUTTERFLY VALVE	150LB	DN250	3EA	2013	1
25	CHINA	GUANDONG ZHUHAI GOLDEN BAY LNG	TECNICAS REUNIDAS	GUANDONG ZHUHAI	CRYOGENIC BUTT-WELD TYPE BUTTERFLY VALVE	150LB	DN200~DN600	39EA	2012	12
26	PHILIPPINES	JH SUMIIT PETROCHEMICAL CORP.	DAERIM INDUSTRIAL	JH SUMIIT NAPHTHA CRACKER	CRYOGENIC FLANGE TYPE BUTTERFLY VALVE	300LB	DN300~DN350	3EA	2012	12
27	CHILE	GNL MEJILLONES S.A	TECNICAS REUNIDAS	MEJILLONES GNL NORTE GRANDE CHILE	CRYOGENIC BUTTERFLY VALVE (MOTOR OPERATED VAVLE)	150LB	DN250~DN800	6EA	2012	12
28	CHILE	GNL MEJILLONES S.A	TECNICAS REUNIDAS	MEJILLONES GNL NORTE GRANDE CHILE	CRYOGENIC BUTTERFLY VALVE (PNEUMATIC OPERATED VAVLE)	150LB	DN250~DN800	4EA	2012	12
29	CHILE	GNL MEJILLONES S.A	TECNICAS REUNIDAS	MEJILLONES GNL NORTE GRANDE CHILE	CRYOGENIC BUTTERFLY VALVE (MOTOR OPERATED VAVLE)	150LB~900LB	DN40~DN150	12EA	2012	12
30	UAE	TAKREER	SAMSUNG ENGINEERING	RRE #3	CRYOGENIC FLANGE TYPE BUTTERFLY VALVE	150LB	DN1350	2EA	2012	12
31	KOREA	KUMHO PETROCHEMICAL	DAERIM INDUSTRIAL	KUMHO YEP-IV	CRYOGENIC FLANGE TYPE BUTTERFLY VALVE	300LB	DN150~DN500	6EA	2012	11
32	KOREA	KOREA INSTITUTE MACHINERY & MATERIALS	KOREA INSTITUTE OF MACHINERY & MATERIALS	STUDY OF MACHINERY & MATERIALS	CRYOGENIC FLANGE TYPE BUTTERFLY VALVE	150LB	DN250	2EA	2012	11
33	UAE	TAKREER	GS ENGINEERING & CONSTRUCTION	RUWAIS 4TH NGL	CRYOGENIC FLANGE TYPE BUTTERFLY VALVE	300LB	DN600	1EA	2012	8
34	CHINA	GUANDONG ZHUHAI GOLDEN BAY LNG	TECNICAS REUNIDAS	GUANDONG ZHUHAI	CRYOGENIC BUTT-WELD TYPE BUTTERFLY VALVE	150LB	DN200~DN600	39EA	2012	7
35	CHILE	GNL MEJILLONES S.A	TECNICAS REUNIDAS	MEJILLONES GNL NORTE GRANDE CHILE	CRYOGENIC BUTT-WELD TYPE BUTTERFLY VALVE	150LB~900LB	DN40~DN800	31EA	2012	7
36	PHILIPPINES	JH SUMIIT PETROCHEMICAL CORP.	DAERIM INDUSTRIAL	JH SUMIIT NAPHTHA CRACKER	CRYOGENIC FLANGE TYPE BUTTERFLY VALVE	300LB	DN350	1EA	2011	12
37	KSA	SAUDI KAYAN	DAERIM INDUSTRIAL	SAUDI KAYAN KLPE	CRYOGENIC FLANGE TYPE BUTTERFLY VALVE	150LB	DN150~DN600	5EA	2011	12
38	KOREA	KOREA INSTITUTE MACHINERY & MATERIALS	KOREA INSTITUTE OF MACHINERY & MATERIALS	STUDY OF MACHINERY & MATERIALS	CRYOGENIC FLANGE TYPE BUTTERFLY VALVE	150LB	DN250	2EA	2011	12
39	KOREA	KOREA INSTITUTE MACHINERY & MATERIALS	HYUNDAI ENGINEERING	KOREA LNG CRYOGENIC INDUSTRIAL COMPLEX	CRYOGENIC BUTT-WELD TYPE BUTTERFLY VALVE	150LB/300LB	DN200~DN800	19EA	2011	10
40	UAE	TAKREER	GS ENGINEERING & CONSTRUCTION	RUWAIS 4TH NGL	CRYOGENIC FLANGE TYPE BUTTERFLY VALVE	300LB	DN400/DN750	2EA	2011	6
41	KSA	SAUDI KAYAN	DAERIM INDUSTRIAL	SAUDI KAYAN KLPE	CRYOGENIC FLANGE TYPE BUTTERFLY VALVE	150LB	DN150~DN600	15EA	2011	3
42	JAPAN	ASTOMOS ENERGY JAPAN	MITSUBISHI HEAVY INDUSTRIES LTD.	MHI S.2092 GAS SCORPIO	LPG FLANGE TYPE BUTTERFLY VALVE	150LB/300LB	DN200~DN250	4EA	2010	12
43	KOREA	KOREA INSTITUTE MACHINERY & MATERIALS	HYUNDAI ENGINEERING	KOREA LNG CRYOGENIC INDUSTRIAL COMPLEX	CRYOGENIC BUTT-WELD TYPE BUTTERFLY VALVE	150LB/300LB	DN200~DN800	19EA	2010	1
44	JAPAN	ASTOMOS ENERGY JAPAN	MITSUBISHI HEAVY INDUSTRIES LTD.	MHI S.2089	CRYOGENIC GLOBE VALVE	150LB	DN100	1EA	2009	12
45	JAPAN	NYK LNG SHIP MANAGEMENT	MITSUI ENGINEERING SHIPBUILDING	MES S.1351 NORTHWEST SWALLOW	CRYOGENIC GATE VALVE	150LB	DN100~DN250	3EA	2009	4
46	JAPAN	NYK LNG SHIP MANAGEMENT	MITSUI ENGINEERING SHIPBUILDING	MES S.1351 NORTHWEST SWALLOW	CRYOGENIC SWING CHECK VALVE	150LB	DN400	1EA	2009	4
47	JAPAN	NYK LNG SHIP MANAGEMENT	MITSUI ENGINEERING SHIPBUILDING	MES S.1351 NORTHWEST SWALLOW	CRYOGENIC BUTT-WELD TYPE BUTTERFLY VALVE	150LB	DN80~DN100	2EA	2009	4
48	KSA	SAUDI ARAMCO	GABAS	SAUDI ARAMCO	CRYOGENIC FLANGE TYPE BUTTERFLY VALVE	150LB	DN1050	1EA	2008	10
49	JAPAN	SIAM LUCKY MARINE THAILAND	KAWASAKI HEAVY INDUSTRIE	KHI S.NO.1429 "NOTO GLORIA"	CRYOGENIC GLOBE VALVE	150LB	DN100~DN250	4EA	2008	8
50	JAPAN	NYK LNG SHIP MANAGEMENT	MITSUI ENGINEERING SHIPBUILDING	MHI S.2157 "LNG JAMAL"	CRYOGENIC GLOBE VALVE	150LB	DN200	6EA	2008	8
51	JAPAN	GAS SILVER CHINA	KAWASAKI HEAVY INDUSTRIE	KHI S.NO.1430 "CRYSTAL MARMAID"	CRYOGENIC WAFER TYPE BUTTERFLY VALVE	150LB	DN400	3EA	2007	1
52	JAPAN	GAS SILVER CHINA	KAWASAKI HEAVY INDUSTRIE	KHI S.NO.1421 "CRYSTAL MARMAID"	CRYOGENIC WAFER TYPE BUTTERFLY VALVE	150LB	DN400	3EA	2006	4
53	JAPAN	GAS SILVER CHINA	KAWASAKI HEAVY INDUSTRIE	KHI S.NO.1420 "CRYSTAL MARMAID"	CRYOGENIC WAFER TYPE BUTTERFLY VALVE	150LB	DN400	5EA	2005	4

MORE THAN
12,500 NEWBUILDING PROJECTS

CRYOGENIC BUTTERFLY VALVE



ACE VALVE CO.,LTD.

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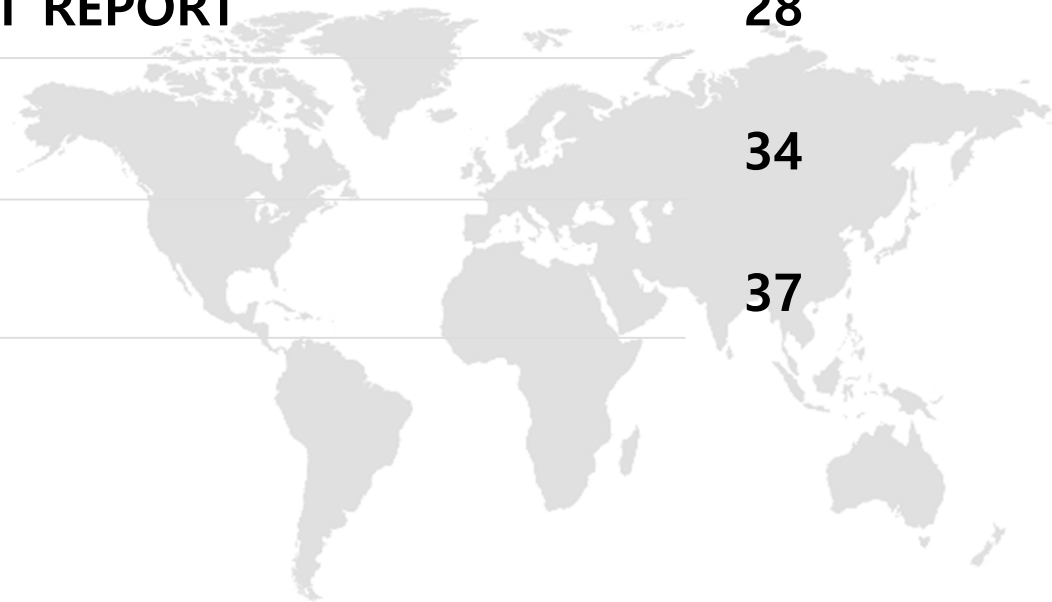


I FEATURE OF CRYOGENIC BUTTERFLY VALVE

1. FEATURES & BENEFITS

- ▶ Linear Lifting Stem/Disc Design inducing Zero Friction of Disc & Seat surfaces
- ▶ SOILD METAL TO METAL SEAT, SOFT SEAT (OPTION)
- ▶ SUPER FINE SEAT FACE (Surface roughness Ra 0.03 ~ 0.08)
- ▶ REPLACEABLE METAL SEAT WITH RETAINER

2. APPLICATION

- ▶ Gas carrier (liquefied natural gas, propane gas, butane, acetylene, ethylene etc.)
- ▶ Receiving terminal
- ▶ Liquefied Oxygen(-160℃) plants

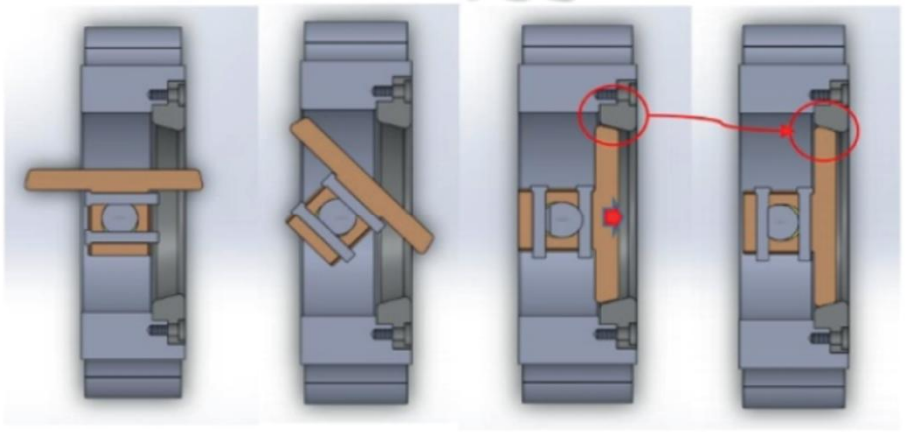
3. VALVE SPECIFICATION

- ▶ Pressure rating : ASME CLASS 150LB, 300LB
- ▶ Size Range : DN100(4”) ~ DN1200 (48”)
- ▶ Material : A351 CF8M, CF3M

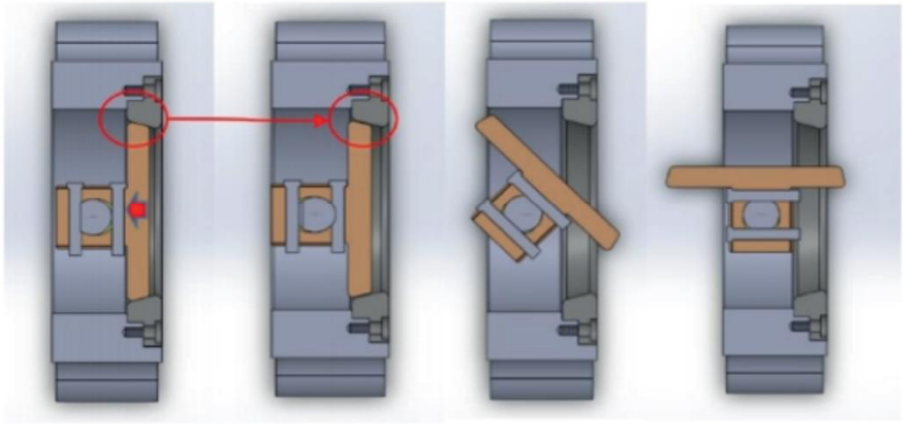
4. DESIGN PRINCIPLE

- ZERO sealing interference that occurs when rotating the DISC by combining rotational and linear movements.
- Sealing is realized by perfectly adhering to the seat through the linear movement of the DISC.
- Zero interference in all sections during OPEN & CLOSE OPERATION
- ADJUSTING of the linear movement section is possible, realizing perfect sealing.

Graphic view to exhibit innovative Linear Lifting Stem/Disc



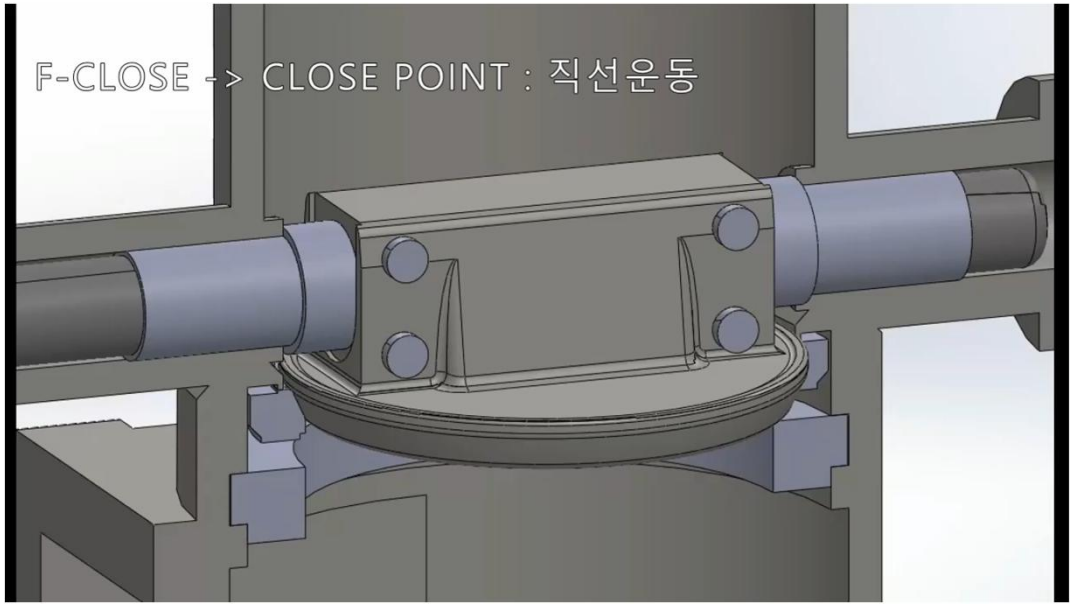
Disc Open to Close



Disc Close to Open

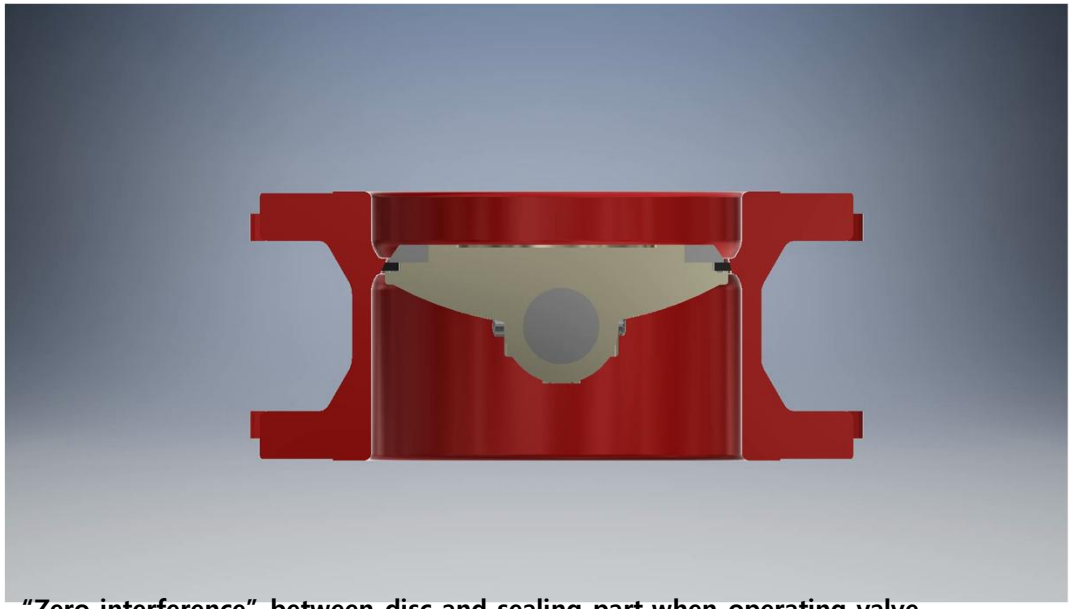
5. OPERATION MOTION

Double Offset with Linear lifting butterfly Valve



▶ Double offset with linear lifting design combines rotational and linear movements. Perfect sealing is achieved by eliminating interference in the sealing part that occurs when the disc rotates.

Triple Offset butterfly Valve



"Zero interference" between disc and sealing part when operating valve

▶ Design implementation is possible, but actual production is impossible.

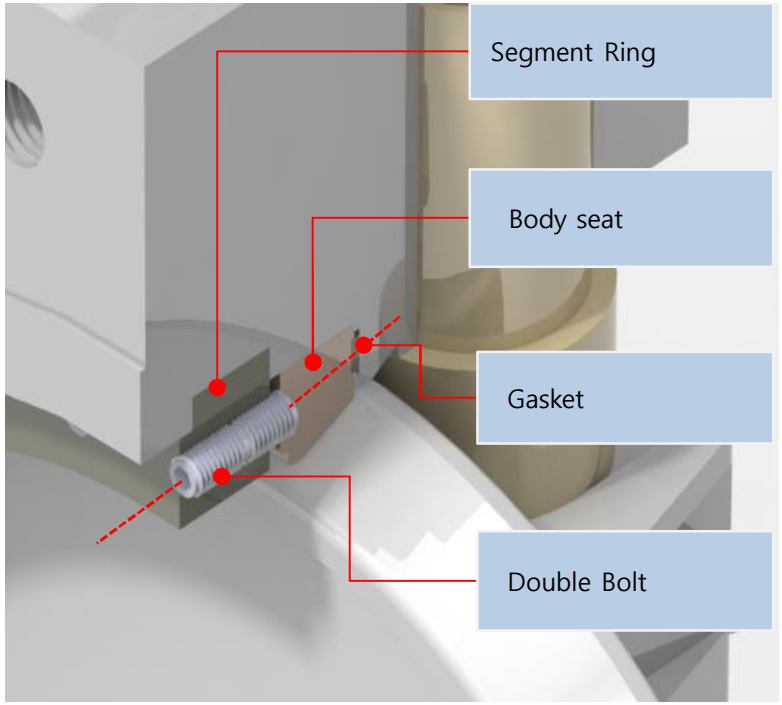
> Machining Tolerance & Assembly Tolerance

"This is because zero cumulative tolerance is impossible."

Even if zero base is implemented during design, if the sum of cumulative [processing/assembly/angle] tolerances exceeds 0.15~0.2mm, the interference between the disc and sealing part cannot be zeroed, and this cumulative tolerance (Body / Bush / Stem) during actual production Considering the axis tolerance), roundness, straightness, and angle of the seat, the cumulative production tolerance is approximately 0.4~0.6mm or more.

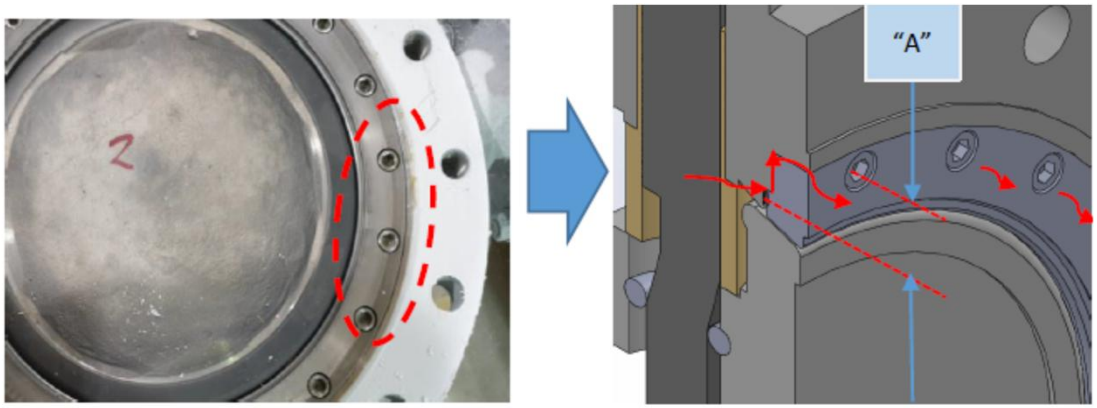
6. RETAINER RING CONSTRUCTION (SEGMENT RING TYPE)

- ▶ The center of the RETAINER BOLT and the center of the GASKET are located on the same line.
- ▶ Prevents deterioration of GASKET SEALING even when DISC applies force to RETAINER due to internal pressure.
  - ➡ Leakage prevention through GASKET
- ▶ DOUBLE BOLT TYPE prevents loosening by fluid.



RETAINER RING TYPE

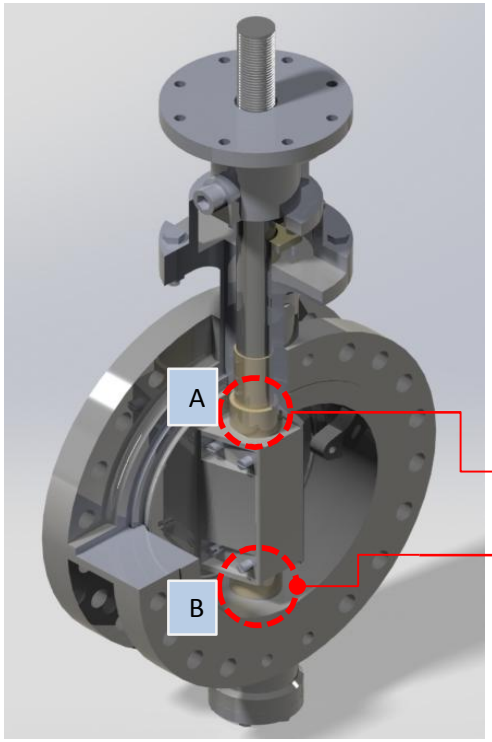
- ▶ "A" street exists between BOLT CENTER and GASKET CENTER
- ▶ When the DISC pushes the RETAINER due to internal pressure, the GASKET There is a risk of leakage due to poor sealing.

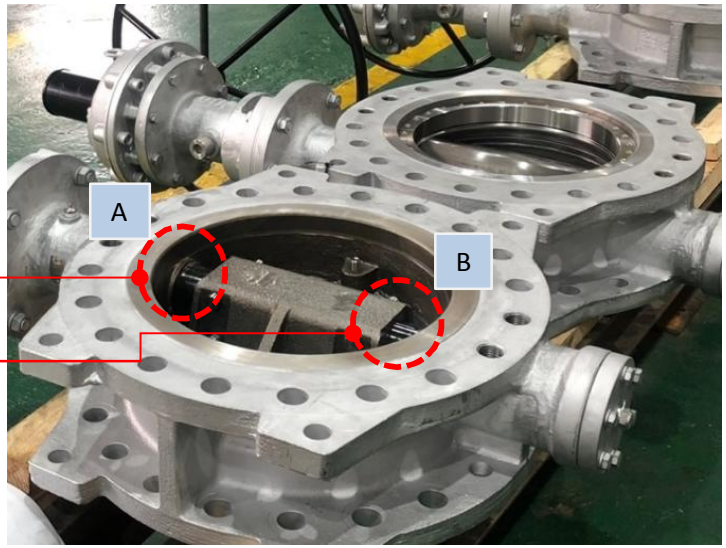


I FEATURE OF CRYOGENIC BUTTERFLY VALVE

7. DISC position control

- ▶ DISC controls position with upper and lower bushes inserted into the body.
- ▶ No sagging phenomenon due to operation of DISC
- ▶ Can be maintained at initial condition without change due to valve installation





Disc position control with upper and lower bushes

▶ When the valve operates, thrust is generated according to the direction of rotation. At this time, it is affected by the valve installation [horizontal/vertical] direction. In particular, when installed vertically, it is subject to thrust due to disk weight + rotation. As a result, the center position of the disc changes and the sealing point changes. Leakage occurs frequently. In a typical valve, disc weight + rotation generated by operation The thrust is designed to be controlled from the end cover located at the bottom of the valve. When the end cover receives all this load, the butterfly valve structure Because the space is limited, it is not easy to design it with sufficient strength. Therefore, when the valve operates after installation, the disc position changes. As a result, leakage occurs in the sealing part or sometimes the end cover There are cases where leakage occurs in the part.

▶ There are upper and lower bushes at the positions A and B indicated in the left drawing and photo. When inserted and operating the valve, the disc weight + rotational thrust generated Perfect sealing can be maintained by controlling the movement of the disc.

I FEATURE OF CRYOGENIC BUTTERFLY VALVE

8. DISC & SEAT COATING applied

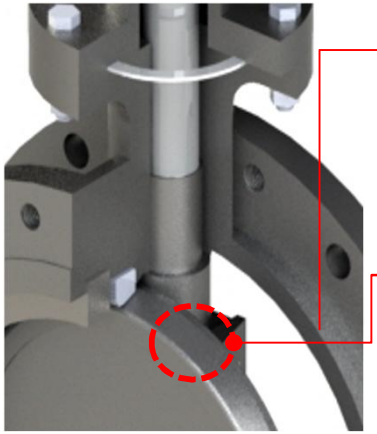
▶ DISC & SEAT surface treatment

- TCC Coating or Stellite Overlay

➡ Increased wear resistance

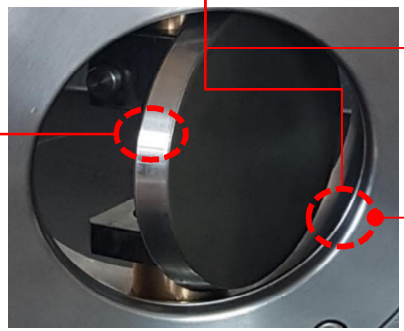
▶ Apply polishing and wrapping after COATING

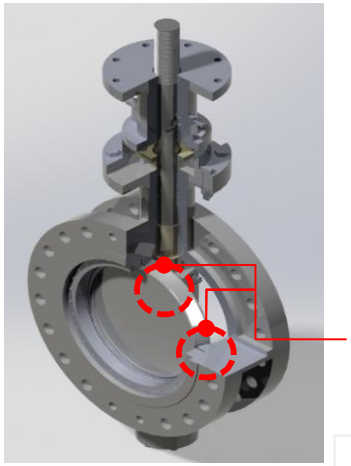
- Sealing part surface roughness Ra 0.03 ~ 0.08



▶ TCC Coating or Stellite Overlay

▶ surface roughness Ra 0.03 to 0.08.





◆ Disc & Seat surfaces zero friction

▶ Solid Metal to Metal Sealing Basically.

▶Full closed disc ▶Upper side ▶Left side ▶Lower side ▶Right side

9. DISC & SEAT ZERO FIRICTION

▶ "ZERO" interference with SEAT before DISC rotation movement

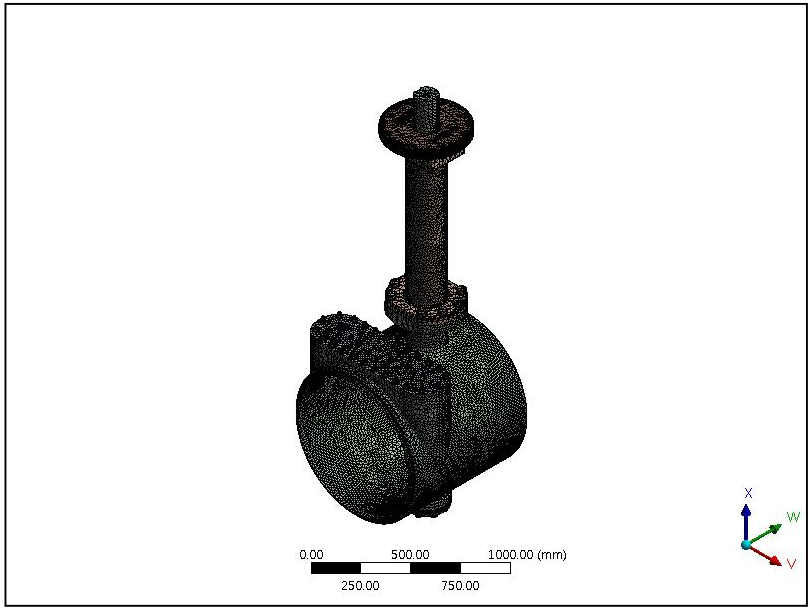
-Rotational movement after eliminating interference with the seat through the linear movement of the DISC

- Disc rotated angle 0° / offset 2~6 mm move

➡ Zero Interference.

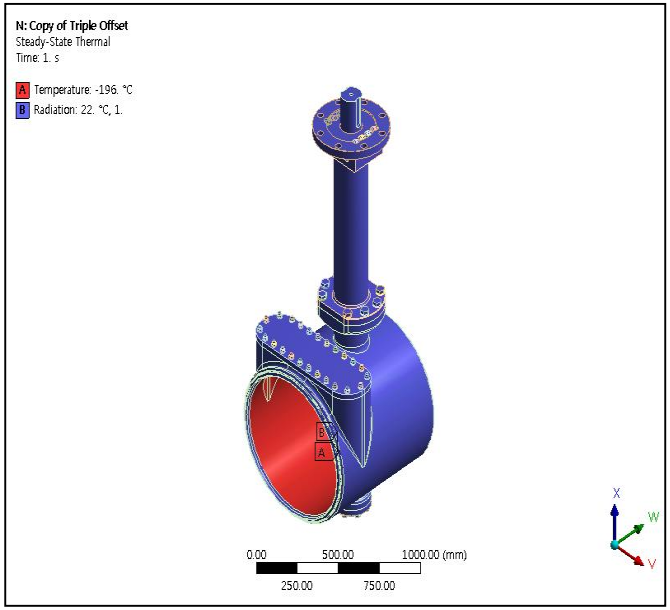
10. STEADY-STATE THERMAL & THERMAL STRESS ANALYSIS

➢ MESH STATICS



Nodes	Elements
829,947	438,294

➢ BOUNDARY CONDITION



✓ Radiation Condition all over the outer surface

✓ Environmental Temperature : 22℃

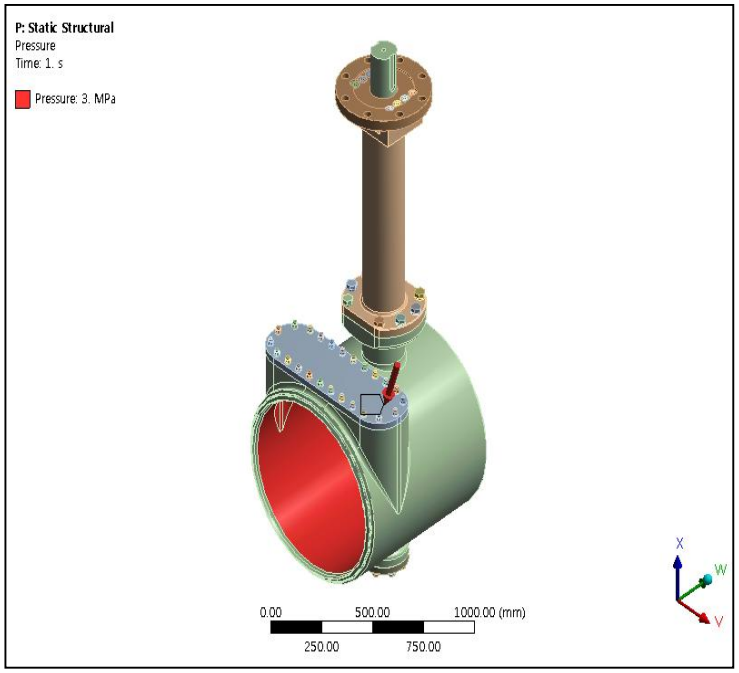
✓ Internal Temperature : -196℃

➢ RESULTS

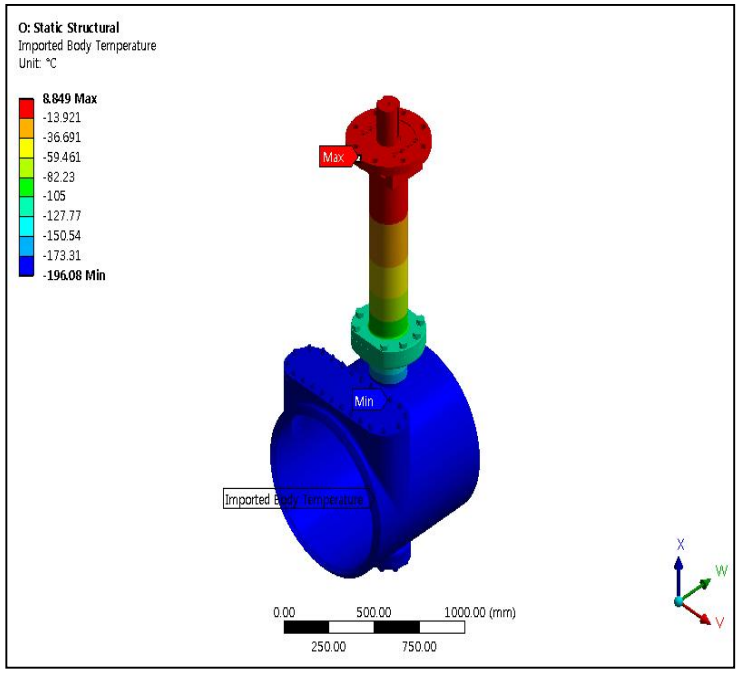
Area	Pipe Line	Operator
Temp.	-196.32˚C	8.8˚C

10. STEADY-STATE THERMAL & THERMAL STRESS ANALYSIS

➢ BOUNDARY CONDITION



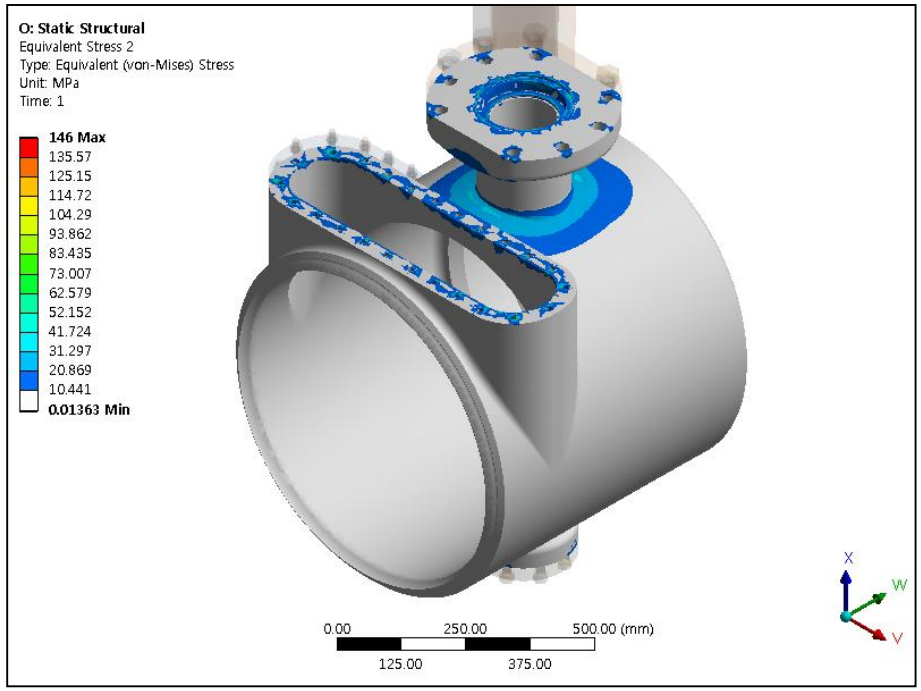
✓ Shell Design Pressure has been applied. (30Bar)



✓ Steady-State analysis result has been applied.

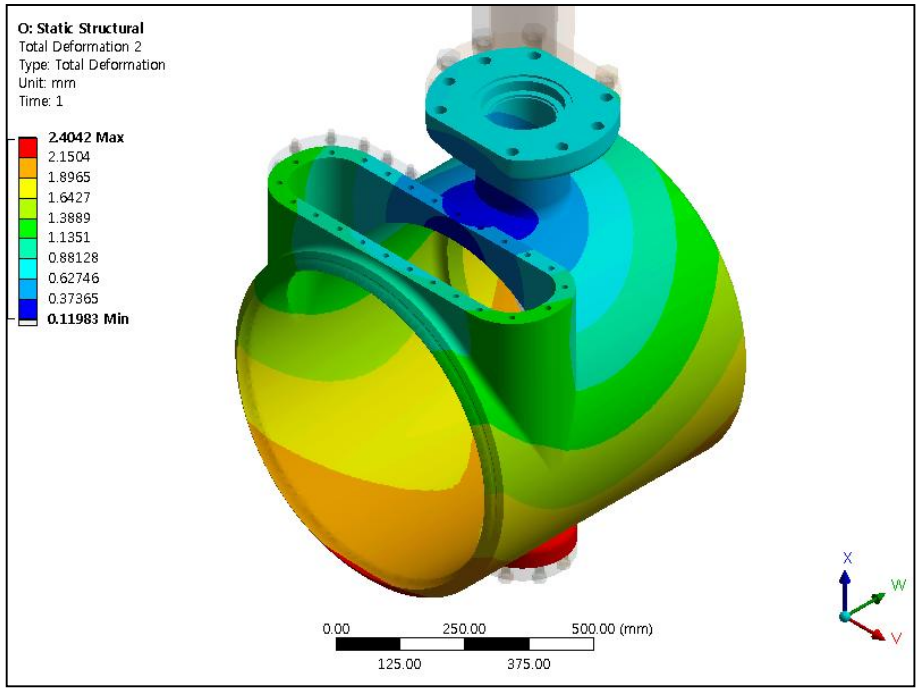
10. STEADY-STATE THERMAL & THERMAL STRESS ANALYSIS

➢ VON-MISES STRESS



✓ MAX. 146 MPa

➢ TOTAL DEFORMATION



✓ MAX. 1.57mm

11. MANUFACTURING & ASSEMBLY PROCEDURE

초저온밸브 제작 FLOW CHART (METAL SEAT TYPE)

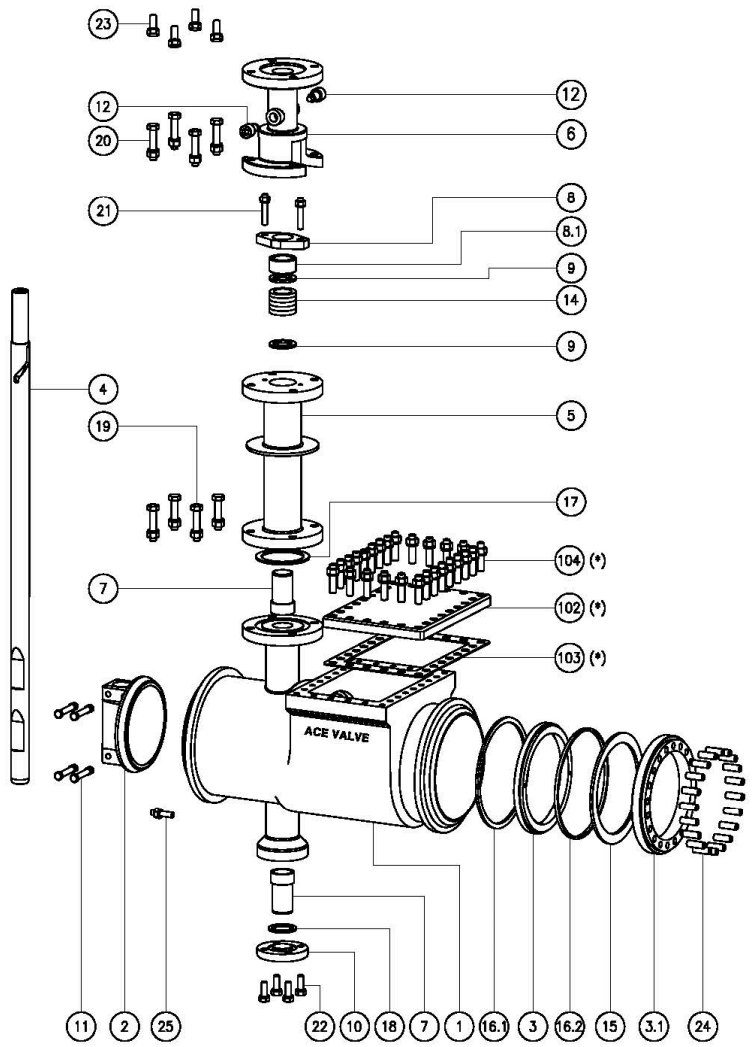
작업순서	공정기호 외주	공정기호 사내	공정명		검사항목	관리방법 기준	관리방법 검사방식	관리방법 측정기기	관리방법 기록	관련문서
1	▽		소재입고	바디 디스크 본넷	겉모양	표면이 깨끗하고 사용상 해로운 흠, 기공, 갈라짐 등이 없을 것	전수검사 (입회점)	육안	소재검사 Check Sheet	수입검사지침 (AV-WI-01)
					치수	가공 여유가 있을 것		버니어 줄자		
					화학적 성질	관련 코드에서 요구하는 값을 만족할 것	모니터링 (입회점)	분석기	성적서	
					기계적성질	관련 코드에서 요구하는 값을 만족할 것 ● 초저온 impact test (-196℃ 횡 행장 0.38mm 이상, 46J 이상)		만능재료 시험기		
					열처리	열처리 규격서에 따라서 실시할 것	모니터링 (입회점)	-	성적서	
					RT	ASME Sec. V 및 ANSI B16.34 Annex B의 합격기준을 만족할 것	모니터링 (입회점)	-	Report	
				시트, 스템 리테이너 커버, 패킹 그랜드 디스크핀 트러스트	겉모양	가공면은 해로운 흠 및 다듬질 정도가 균일할 것	샘플검사 (입회점)	육안	성적서 거래명세서	
					치수	해당 가공도면 치수의 허용 차 안에 있을 것		버니어 줄자		
2		▽	황삭	바디	치수	해당 가공도면 치수 면당 +1mm 허용 차 안에 있을 것	샘플검사 (입회점)	버니어 줄자	Check Sheet	공정검사지침 (AV-WI-02)
3			심냉	바디, 디스크 본넷, 시트 스템, 리테이너	-	-196℃(±5%)에 도달된 후 부품의 두께 25㎜당 60분 이상 유지	모니터링 (입회점)	-	-	공정검사지침 (AV-WI-02)
4		▽	정삭	바디, 디스크 본넷, 시트 스템, 리테이너 커버, 그랜드 링 패킹 그랜드 디스크핀 트러스트	치수	해당 가공도면 치수의 허용 차 안에 있을 것 해당 가공도면 조도의 허용 차 안에 있을 것 가공면의 모서리는 매끈하게 처리할 것 BODY SEAT, DISC SEAT의 가공 출발점은 가공전에 표시할 것	샘플검사 (입회점)	버니어 줄자	가공검사 Check Sheet	공정검사지침 (AV-WI-02)
5			NDE	바디	PT	ASME Sec.Ⅷ Div.1 Appendix 8 합격기준을 만족할 것	전수검사 (입회점)		Report	공정검사지침 (AV-WI-02)
6		▽	연삭	바디시트 디스크 시트	치수	해당 가공도면 치수의 허용 차 안에 있을 것 해당 가공도면 조도의 허용 차 안에 있을 것	전수검사 (입회점)	버니어 줄자	Check Sheet	공정검사지침 (AV-WI-02)
7		◇	바디 수압검사		바디 누설	변형된 곳이나 누수가 없을 것 (D.P x 1.5배, 절소 테스트)	전수검사 (필수확인점)	수압시험기 압력 게이지	수압절보 Test Report	수압검사지침 (AV-WI-03)
8		□	제품조립		겉모양	제작도에 준하여 조립되었고, 각 액세서리는 정확히 부착할 것.	샘플검사 (입회점)	육안	-	조립작업지침 (AV-WI-09)
					작동상태	개폐 조작시 이상음이 없고 디스크가 원활히 작동 될 것.		정각 토크 측정기		
					각부체결상태	견고하게 조립되어야 하며 볼트의 열 조임이 없을 것		토크렌치		

초저온밸브 제작 FLOW CHART (METAL SEAT TYPE)

작업순서	공정기호 외주	공정기호 사내	공정명		검사항목	관리방법 기준	관리방법 검사방식	관리방법 측정기기	관리방법 기록	관련문서
9		◇	시트 누설 검사	상온	시트누설	API598 허용누설량을 만족할 것 (헬륨 테스트)	전수검사 (필수확인점)	수입시험기 압력 게이지	검사 Check Sheet	수입검사지침 (AV-WI-03)
				초저온	기밀시험	-196℃에서 허용 누설량을 만족할 것 (BS 6364) * 20회 작동 후 6cc/(min/DN) 이하				
					내압시험	상용압력의1.1배 압력에서 15분간 외부누설이 없을 것 (BS 6364)				
					작동시험	BS 6364의 합격기준을 만족할 것 - 조작력 360N 이하		정각 토크 측정기		
				상온 복귀	기밀시험	API598 허용누설량을 만족할 것 (헬륨 테스트)		초저온 시험기		
					작동시험	조작력 측정 - 조작력 360N 이하		토크 측정기		
					분해검사	분해의 용이성 및 부품의 손상 및 마모 확인		육안 버니어		
10	○	○	BW가공 (필요시)	바디	치수	해당 가공도면 치수의 허용 차 안에 있을 것	전수검사 (입회점)	버니어	가공검사 Check Sheet	공정검사지침 (AV-WI-02)
11		◇	도장 (요구시)	도장상태	-	표면상태는 매끈해야 하며 핀홀, 블로우홀, 현저한 칠 얼어리 및 플러너링 등이 없을 것.	샘플검사 (입회점)	육안	도장검사 Check Sheet 성적서	도장작업지침 (AV-WI-26)
				도장 SPEC	도장회수	고객 사양에 만족할 것.		도막두께 측정기		
					도장두께					
					건조온도	페인트 사양에 만족할 것		온/습도계		
					건조시간					
12		◇	최종 검사	겉모양	외관상태	내, 외면 모두 타점, 흠, 녹, 크랙 등이 없고, 가스켓 시트면에는 흠, 기타 결함이 없을 것	전수검사 (입회점)	육안	최종검사 Check Sheet	최종검사지침 (AV-WI-04)
				도장	도막	도장의 찌짐이 없고 고객사양에 만족할 것		도막두께 측정기		
				치수	-	관련 승인도 SPEC에 일치할 것		버니어		
				재질	-			육안		
				명판	-	고객사양에 만족할 것				
13		◇	포장	포장박스	내부	외부충격에 제품이 흔들리지 않도록 견고하게 완당하고 제품에 사이에 녹 방지제 및 완충제를 삽입할 것	샘플검사 (입회점)	육안	-	포장검사지침 (AV-WI-29)
					외부	우천 및 외력에 견디기 위해 BOX에 리브 및 방수포를 설치하고 Center marking을 표시 할것				
14		▽	출하	-	-	-	-	-	-	

11. MANUFACTURING & ASSEMBLY PROCEDURE

DEVELOPMENT DRAWING



P.No.	PART NAME		ASSEMBLY PROCEDURE	REMARK
1	BODY	1	Assemble Stem bearing with Body.	
2	DISC			
3	SEAT			
3.1	RETAINER	2	Insert Stem into the body after assemble Stem Bearing with Disc.	Check the Disc Offset direction. Check the Stem direction.
4	STEM			
5	BODY EXT. HOUSING A			
6	BODY EXT. HOUSING B	3	Insert Disc Pin on the Disc.	
7	STEM BERAING			
8	PACKING GLAND			
8.1	GLAND RING	4	Assemble Extension Housing A on the Body after inert Body Gasket.	Check Packing Gland position.
9	PACKING RING			
10	BOTTOM COVER	5	Insert Packing Ring & Packing on the Ext. housing A, and then tighten the Packing Gland Bolt.	
11	DISC PIN			
12	STEM GUIDE PIN			
14	PACKING	6	Assemble Ext. Housing B.	
15	PLATE			
16.1	SEAT GASKET I	7	Assemble the Gear Box.	
16.2	SEAT GASKET II	8	Assemble the Stem Guide Pin.	Assemble in the closed position.
17	BODY TOP GASKET	9	Tighten the Extension B Bolt.	
18	BOTTOM COVER GASKET	10	Assemble the Bottom Cover with Bottom Gasket.	
19	EXTENSION A BOLT, NUT, WASHER	11	Assemble Seat Gasket → Seat → Seat Gasket II → Plate → Retainer.	
20	EXTENSION B BOLT, NUT, WASHER			
21	PACKING GLAND BOLT, NUT, WASHER			
22	BOTTOM COVER BOLT, WASHER	12	Assemble Stopper Bolt.	
23	ACTUATOR BOLT, WASHER	13	Assemble Entry Cover Gasket. Assemble Side Entry Cover. Tighten Entry Cover Bolt.	
24	RETAINER BOLT			
25	STOPPER BOLT, NUT, WASHER			
101	GEARBOX	14	Marking Full Open Position & Full Close Position on the Indicator.	
102 (*)	SIDE ENTRY COVER			
103 (*)	ENTRY COVER GASKET	15	According to the ITP, Cryogenic test shall be performed.	
104 (*)	ENTRY COVER BOLT, NUT, WASHER			

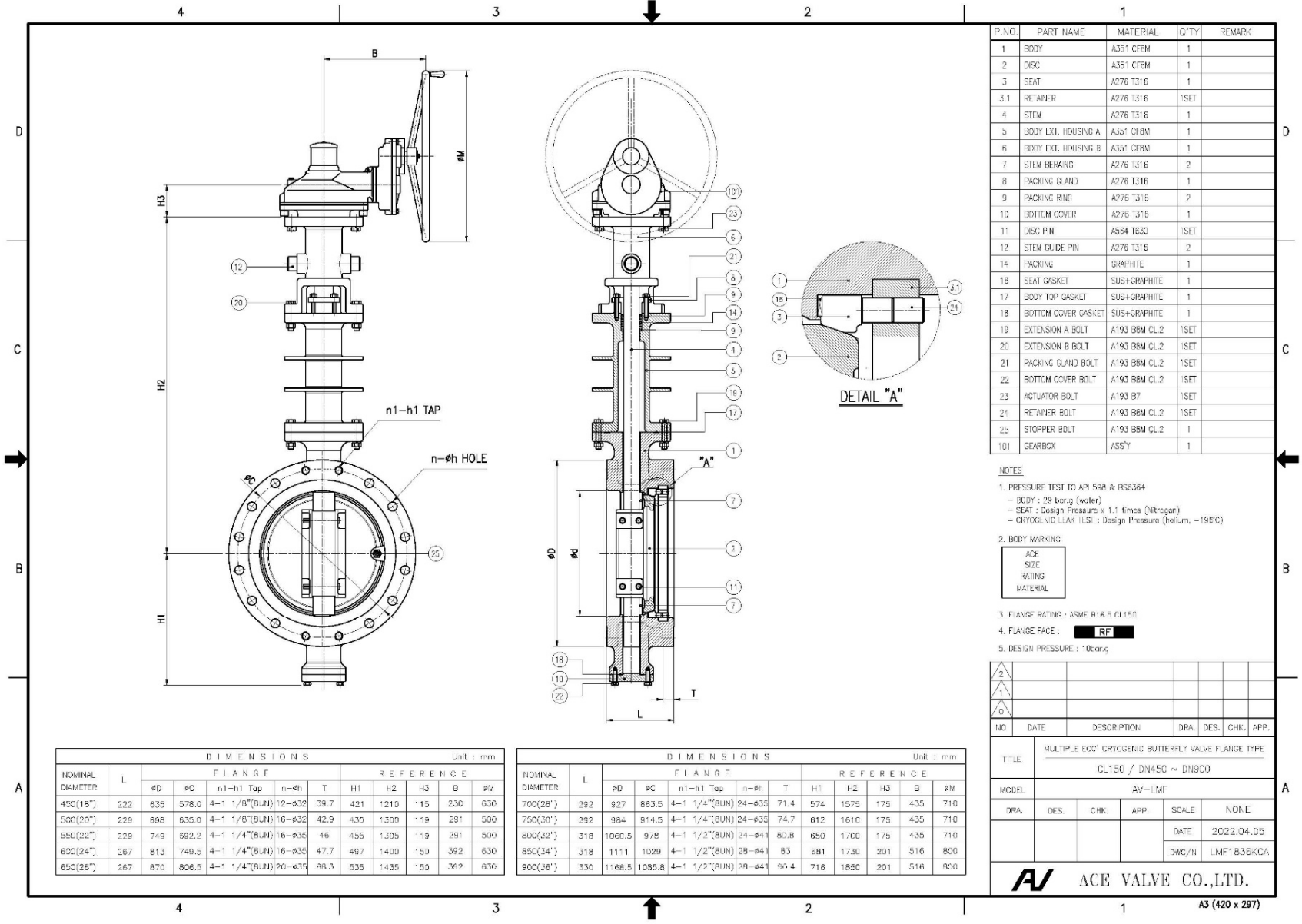
REMARK

1. P.No. 102, 103, 104 shall be applied butt-welding type only.

TITLE	DOUBLE ECC' LINEAR TYPE CRYOGENIC BUTTERFLY VALVE					
SUB.TITLE	ASSEMBLY PROCEDURE					
DRA.	DES.	CHK.	APP.	SCALE	-	
Ku.Mo.Kim		D.P.You	J.H.Choi	DATE	2023.05.02	
				DWG/N	D.E.CRYO-ASSY-PROCESS	

ACE VALVE CO.,LTD.

12. DRAWING – FLANGE TYPE



P.NO.	PART NAME	MATERIAL	Q'TY	REMARK
1	BODY	A351 CF8M	1	
2	DISC	A351 CF8M	1	
3	SEAT	A276 T316	1	
3.1	RETAINER	A276 T316	1SET	
4	STEM	A276 T316	1	
5	BODY EXT. HOUSING A	A351 CF8M	1	
6	BODY EXT. HOUSING B	A351 CF8M	1	
7	STEM BERAING	A276 T316	2	
8	PACKING GLAND	A276 T316	1	
9	PACKING RING	A276 T316	2	
10	BOTTOM COVER	A276 T316	1	
11	DISC PIN	A564 T630	1SET	
12	STEM GUIDE PIN	A276 T316	2	
14	PACKING	GRAPHITE	1	
16	SEAT GASKET	SUS+GRAPHITE	1	
17	BODY TOP GASKET	SUS+GRAPHITE	1	
18	BOTTOM COVER GASKET	SUS+GRAPHITE	1	
19	EXTENSION A BOLT	A193 B8M CL.2	1SET	
20	EXTENSION B BOLT	A193 B8M CL.2	1SET	
21	PACKING GLAND BOLT	A193 B8M CL.2	1SET	
22	BOTTOM COVER BOLT	A193 B8M CL.2	1SET	
23	ACTUATOR BOLT	A193 B7	1SET	
24	RETAINER BOLT	A193 B8M CL.2	1SET	
25	STOPPER BOLT	A193 B8M CL.2	1	
101	GEARBOX	ASS'Y	1	

NOTES

1. PRESSURE TEST TO API 598 & BS6364
   - BODY : 29 barg (water)
   - SEAT : Design Pressure x 1.1 times (Nitrogen)
   - CRYOGENIC LEAK TEST : Design Pressure (helium, -196°C)
2. BODY MARKING
   ACE
   SIZE
   RATING
   MATERIAL
3. FLANGE RATING : ASME B16.5 CL150
4. FLANGE FACE : RF
5. DESIGN PRESSURE : 10barg

DIMENSIONS Unit : mm

NOMINAL DIAMETER	L	FLANGE					REFERENCE				
		øD	øC	n1-h1 Tap	n-øh	T	H1	H2	H3	B	øM
450(18")	222	635	578.0	4-1 1/8"(8UN)	12-ø32	39.7	421	1210	115	230	630
500(20")	229	698	635.0	4-1 1/8"(8UN)	16-ø32	42.9	430	1300	119	291	500
550(22")	229	749	692.2	4-1 1/4"(8UN)	16-ø35	46	455	1305	119	291	500
600(24")	267	813	749.5	4-1 1/4"(8UN)	16-ø38	47.7	497	1400	150	392	630
650(25")	267	870	806.5	4-1 1/4"(8UN)	20-ø35	68.3	535	1435	150	392	630

DIMENSIONS Unit : mm

NOMINAL DIAMETER	L	FLANGE					REFERENCE				
		øD	øC	n1-h1 Tap	n-øh	T	H1	H2	H3	B	øM
700(28")	292	927	863.5	4-1 1/4"(8UN)	24-ø35	71.4	574	1575	175	435	710
750(30")	292	984	914.5	4-1 1/4"(8UN)	24-ø35	74.7	612	1610	175	435	710
800(32")	318	1060.5	978	4-1 1/2"(8UN)	24-ø41	80.8	650	1700	175	435	710
850(34")	318	1111	1029	4-1 1/2"(8UN)	28-ø41	83	681	1730	201	516	800
900(36")	330	1168.5	1085.8	4-1 1/2"(8UN)	28-ø41	90.4	716	1850	201	516	800

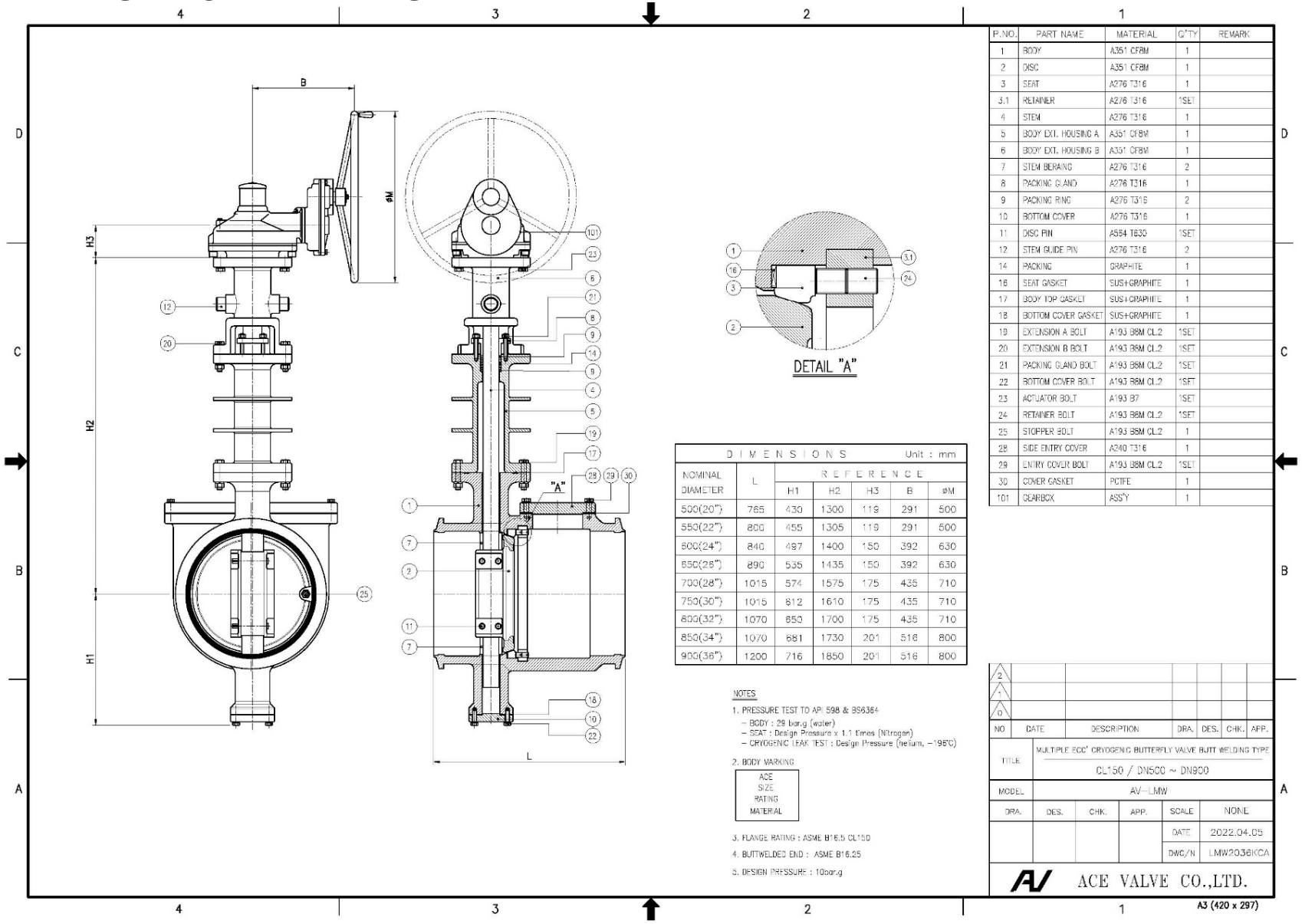
NO	DATE	DESCRIPTION	DRA.	DES.	CHK.	APP.
2						
1						
0						

TITLE	MULTIPLE ECC' CRYOGENIC BUTTERFLY VALVE FLANGE TYPE CL150 / DN450 ~ DN900
MODEL	AV-LMF
DRA. / DES. / CHK. / APP.	SCALE: NONE
	DATE: 2022.04.05
	DWG/N: LMF1836KCA

ACE VALVE CO.,LTD.

A3 (420 x 297)

12. DRAWING – BUTT WELDING TYPE



P.NO.	PART NAME	MATERIAL	Q'TY	REMARK
1	BODY	A351 CF8M	1	
2	DISC	A351 CF8M	1	
3	SEAT	A276 T316	1	
3.1	RETAINER	A276 T316	1SET	
4	STEM	A276 T316	1	
5	BODY EXT. HOUSING A	A351 CF8M	1	
6	BODY EXT. HOUSING B	A351 CF8M	1	
7	STEM BERAING	A276 T316	2	
8	PACKING GLAND	A276 T316	1	
9	PACKING RING	A276 T316	2	
10	BOTTOM COVER	A276 T316	1	
11	DISC PIN	A564 T630	1SET	
12	STEM GUIDE PIN	A276 T316	2	
14	PACKING	GRAPHITE	1	
16	SEAT GASKET	SUS+GRAPHITE	1	
17	BODY TOP GASKET	SUS+GRAPHITE	1	
18	BOTTOM COVER GASKET	SUS+GRAPHITE	1	
19	EXTENSION A BOLT	A193 B8M CL.2	1SET	
20	EXTENSION B BOLT	A193 B8M CL.2	1SET	
21	PACKING GLAND BOLT	A193 B8M CL.2	1SET	
22	BOTTOM COVER BOLT	A193 B8M CL.2	1SET	
23	ACTUATOR BOLT	A193 B7	1SET	
24	RETAINER BOLT	A193 B8M CL.2	1SET	
25	STOPPER BOLT	A193 B8M CL.2	1	
28	SIDE ENTRY COVER	A240 T316	1	
29	ENTRY COVER BOLT	A193 B8M CL.2	1SET	
30	COVER GASKET	PCTFE	1	
101	GEARBOX	ASS'Y	1	

DIMENSIONS Unit : mm

NOMINAL DIAMETER	L	REFERENCE				
		H1	H2	H3	B	øM
500(20")	765	430	1300	119	291	500
550(22")	800	455	1305	119	291	500
600(24")	840	497	1400	150	392	630
650(26")	890	535	1435	150	392	630
700(28")	1015	574	1575	175	435	710
750(30")	1015	612	1610	175	435	710
800(32")	1070	650	1700	175	435	710
850(34")	1070	681	1730	201	516	800
900(36")	1200	716	1850	201	516	800

NOTES

1. PRESSURE TEST TO API 598 & BS6364
   - BODY : 29 bar.g (water)
   - SEAT : Design Pressure x 1.1 times (Nitrogen)
   - CRYOGENIC LEAK TEST : Design Pressure (helium, -196°C)
2. BODY MARKING

ACE
SIZE
RATING
MATERIAL

3. FLANGE RATING : ASME B16.5 CL150
4. BUTTWELDED END : ASME B16.25
5. DESIGN PRESSURE : 10bar.g

NO	DATE	DESCRIPTION	DRA.	DES.	CHK.	APP.
2						
1						
0						

TITLE	MULTIPLE ECC' CRYOGENIC BUTTERFLY VALVE BUTT WELDING TYPE				
	CL150 / DN500 ~ DN900				
MODEL	AV-LMW				
DRA.	DES.	CHK.	APP.	SCALE	NONE
				DATE	2022.04.05
				DWG/N	LMW2036KCA

ACE VALVE CO.,LTD.

A3 (420 x 297)

II TEST PROCEDURE FOR BUTTERFLY VLAVE

1. MATERIAL TEST

1	INTERNATIONAL CODE	ASTM A351 Gr. CF8, CF8M, CF3, CF3M (BS 6364 Table 2)

2. SHELL STRENGTH TEST

1	TEST MEDIUM	WATER or HELIUM GAS
2	TEST DURATION (Min.)	5 MINUTES
3	TEST PRESSURE (Bar. G)	MAX. WORKING PRESSURE x 1.5 TIEMS
4	TEST CONDITION	ACCORDING TO BS 6364 & API 598, AMBIENT TEMPERATUE, DISC OPEN

III TEST PROCEDURE FOR BUTTERFLY VLAVE

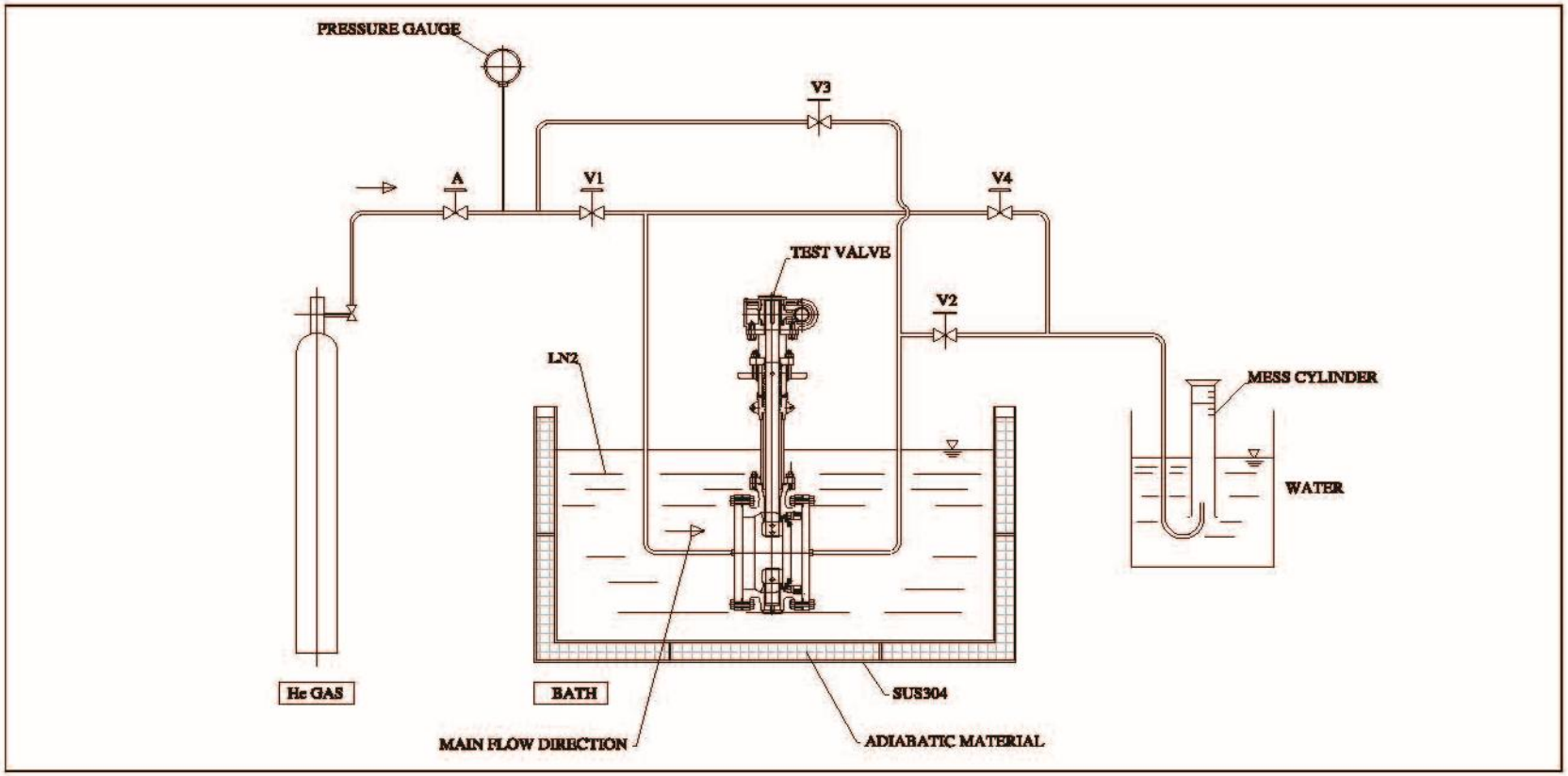
3. SHELL PRESSURE TEST

1	TEST MEDIUM	WATER or HELIUM GAS
2	TEST DURATION (Min.)	5 MINUTES
3	TEST PRESSURE (Bar. G)	MAX. WORKING PRESSURE x 1.5 TIEMS

4. SEAT LEAKAGE TEST

1	TEST MEDIUM	HELIUM GAS
2	TEST DURATION (Min.)	5 MINUTES
3	TEST PRESSURE (Bar. G)	MAX. WORKING PRESSURE x 1.1 TIEMS
4	ALLOWABLE LEAKAGE FOR METAL TO METAL SEAT	▶ BS 6364 8.3.2 (0.3mm^3/s x DN for Metal Seat) ▶ BS 6364 8.3.3 (NO VISIBLE LEAK for Soft Seat)
5	TEST CONDITION & METHOD	ACCORDING TO BS 6364 & API 598, AMBIENT TEMPERATUE, EACH SIZE

LOW TEMPERATURE LEAK TEST APPARATUS



TEST OF MAIN FLOW DIRECTION : V1 & V2 OPEN, V3 & V4 CLOSE.
TEST OF OPPOSITE DIRECTION : V3 & V4 OPEN, V1 & V2 CLOSE.

5. CRYOGENIC OPERATION TEST

1	TEST TEMPERATURE	-196℃
2	OPEATION NUMBER OF TIME (OPEN / CLOSE)	20 CYCLE

6. CRYOGENIC SHELL TEST

1	TEST TEMPERATURE	-196℃
2	TEST GAS	HELIUM GAS
3	TEST CONDITION / PRESSURE (Bar. G)	▶ DISC POSITION : OPEN ▶ TEST PRESSURE : BS 6364 A 3.1.4 d) - Max. working pressure
4	TEST METHOD AND DURATION	▶ ACCORDING TO BS6364 A 3.1.4 e) - TEST PRESSURE : MAX. WORING PRESSURE - DURATION : 15 MINUTES ▶ CHECK POINT : BODY / BONNET JOINT, VALVE GLAND
5	ALLOWABLE LEAKAGE RATE (cc/sec)	NO VISIBLE LEAK : BS 6364 1 x 10-4 cc/sec : MSS SP-134

7. CRYOGENIC SEAT LEAK TEST

1	Examination (all or sampling)	ACE : All Customer Requirement : Sampling 10%
2	Test temperature	-196℃
3	TEST CONDITION	▶ According to BS6364 Appendix A - Test temperature : -196℃ - Test pressure : Increment 3.5bar, Up to Max. working pressure - Allowable leak rate(cc/min/inch) : 100mm3/sec x DN : BS 6364 - Duration : 5minutes as per MSS SP-134

8. RETURN TO AMBIENT TEMP. AND SEAT LEAK TEST

1	TEST GAS	HELIUM GAS
2	TEST DURATION (Min.)	5 Minutes
3	TEST PRESSURE (Bar. G)	MAX. WORKING PRESSURE x 1.1 TIMES
4	ALLOWABLE LEAKAGE FOR METAL TO METAL SEAT	0.3mm3/s x DN : BS 6364 8.3.2
5	ALLOWABLE LEAKAGE FOR SOFT SEAT	NO VISIBLE LEAK : BS 6364 8.3.3
6	TEST CONDITION & METHOD	According to BS6364 & API 598 Ambient temperature, each size

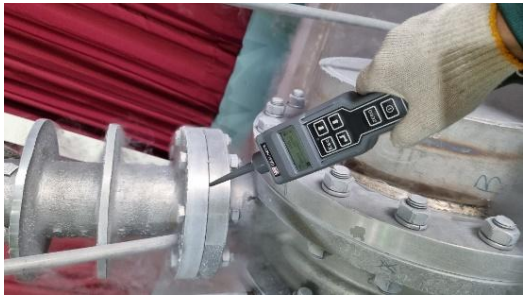
9. TEST PHOTOGRAPH

SHELL TEST

SEAT LEAK TEST
(AMBIENT Temp.)

OPERATING TORQUE TEST
(-196℃)

9. TEST PHOTOGRAPH



SEAT LEAK TEST
(-196℃)

TIGHTNESS TEST
(-196℃)

RETURN TO AMBIENT
SEAT LEAK TEST

10. CRYOGENIC TEST FACILITY

CRYOGENIC TEST ROOM

CRYOGENIC TEST CHAMBER – 6 CHAMBERS

DIGITAL TEMP., FLOW RATE & PRESSURE SENSOR

DIGITAL MONITORING ROOM

III COMPARISON TABLE

COMPARISON TABLE 1

● : EXECLLENT ○ : GOOD ▲ : NOT GOOD	Double Offset linear Lifting Stem/Disc Butterfly valve	Triple / Quadruple & Double offset Butterfly valve	Concentric Butterfly valve	Ball valve	Globe valve	Gate valve	
1. HIGH PRESSURE	●	▲	▲	●	●	●	MORE THAN 600LB
2. HIGH TEMPERATURE	●	○	▲	●	●	●	GOOD QUALITY IN 200℃~560℃ CONDITION
3. CRYOGENIC SERVICE	●	○	-	●	●	●	GOOD QUALITY IN -196℃ CONDITION
4. LARGE BORE	○	●	●	▲	▲	○	MANUFACTURE MORE THAN 2000A
5. FLOW CONTROL	○	○	▲	○	●	○	POSITIVE FUNCTION
6. EMERGENCY SHUT OFF	●	●	●	●	●		QUICK OPEN/CLOSE BY QUARTER TURN
7. SPACE	●	●	●	○	▲	▲	SPACE SAVING
8. WEIGHT	●	●	●	▲	▲	▲	LOW WEIGHT IN THE PIPE INSTALLATION
9. PRICE	●	●	●	▲	▲	▲	COMPETITIVE PRICE

III COMPARISON TABLE

COMPARISON TABLE 2

Description	Double Offset linear Lifting Stem/Disc BFV	Typical Triple Offset BFV
Offsets	Double Offset with Linear Lifting	Triple
Stem / Disc Operating	Linear lifting / Rotating	Rotating
Seating	Rotating & Linear	Rotating
Seat material	Solid metal to metal Metal to soft seat also available	Metal to laminated seat (Typical) Metal to Metal seat(Special)
Impacts(seat damage) the on seat against Flow	NO impacts	Yes, impacts on laminated seat
Friction when seating on & off	Zero friction - by linearly lifting stem /disc against body seat	None zero Friction
Seat Shut off at full pressure rate for preferred direction	No seat Leakage under metal to metal seat	Within allowable seat Leakage rate (Laminated seat) Hard to reach(metal to metal seat)
Seat Shut off at full pressure rate for non-preferred direction	No seat Leakage under metal to metal seat	Hard to reach(metal to Laminated seat) Hard to reach(metal to metal seat)
Bi-directional tight shut off	Available by way of a Unique flexible disc closing Mechanism	Hard to achieve
Seat Surface Hard facing Treatment available	Overlay welding [Body seat & Disc seat] TCC, CCC by HVOF	Overlay welding [Body seat or disc seat]

III COMPARISON TABLE

COMPARISON TABLE 2

Description	Double Offset linear Lifting Stem/Disc BFV	Typical Triple Offset BFV
Parts Repair Disc & seat replacement	Easy & Simple to replace it on site	Hard to replace the disc & Seat on site
Seating Torque [BTO]	Least Torque than ever without Rubbing on the seat	Higher Torque than Galaxy due to unavoidable seat rubbing
Actuator applicable	Pneumatic, Electric & Hydraulic with Quarter turn and Linear	Pneumatic, Electric & Hydraulic with Quarter turn only
Severe Service application (wear & Tear , erosion)	Suitable with intact metal seat face, linear disc open, seat hard facing	Difficult due to laminated seat, rubbing on the seats
Cryogenic application	Bi-directional tight shut off is achievable	Tight shut off is difficult, especially for non-preferred direction.
Severe Service application (corrosion)	Suitable with TCC, CCC on the seats	TCC, CCC is not applicable
Alternatively replaceable with Ball, Gate, Glove valve	Yes for metal seat	Few
Fire safe	Yes with metal to metal seat design	Yes but difficult with laminated seat
Fluid control Function for control valve	Yes, similar to Globe valve	Yes but not much preferred industry
Budget for the valves in the plant	Lower budget	costly

ABS

Electronically published by ABS Busan.
Reference T2427357, dated 28-JUL-2023.

ABS

CERTIFICATE NUMBER	23-2427357-PDA
EFFECTIVE DATE	28-Jul-2023
EXPIRY DATE	27-Jul-2028
ABS TECHNICAL OFFICE	Busan Engineering Services

CERTIFICATE OF

Product Design Assessment

This is to certify that a representative of this Bureau did, at the request of

ACE VALVE CO., LTD.

located at

1-12, SOMANG-GIL, JUCHON-MYEON, GIMHAE, Korea, Republic of

assess design plans and data for the below listed product. This assessment is a representation by the Bureau as to the degree of compliance the design exhibits with applicable sections of the Rules. This assessment does not waive unit certification or classification procedures required by ABS Rules for products to be installed in ABS classed vessels or facilities. This certificate, by itself, does not reflect that the product is Type Approved. The scope and limitations of this assessment are detailed on the pages attached to this certificate.

Product: Cryogenic Valve
Model: AV-LMB, AV-LMF
Endorsements:
Tier: 5 - Unit Certification Required

This Product Design Assessment (PDA) Certificate remains valid until 27/Jul/2028 or until the Rules and/or Standards used in the assessment are revised or until there is a design modification warranting design reassessment (whichever occurs first).

Acceptance of product is limited to the "Intended Service" details prescribed in the certificate and as per applicable Rules and Standards.

This Certificate is valid for installation of the listed product on ABS units which exist or are under contract for construction on or previous to the effective date of the ABS Rules and standards applied at the time of PDA issuance. Use of the Product for non-ABS units is subject to agreement between the manufacturer and intended client.

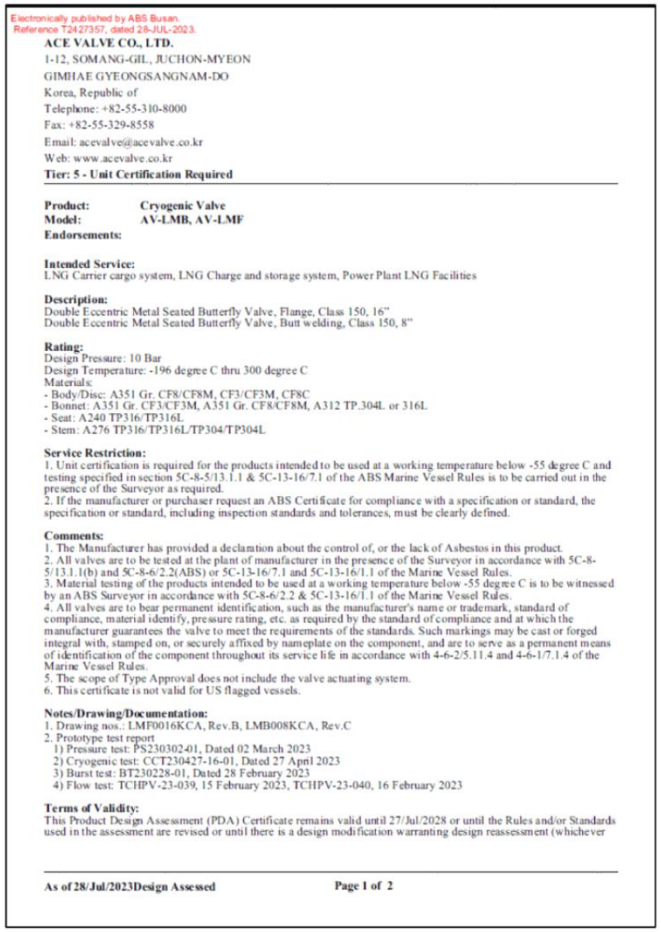
American Bureau Of Shipping

Seong-Ju Kang, Engineer/Consultant

NOTE: This certificate evidences compliance with one or more of the Rules, Guides, standards or other criteria of ABS or a statutory, industrial or manufacturer's standards. It is issued solely for the use of ABS, its committees, its clients or other authorized entities. Any significant changes to the aforementioned product without approval from ABS will result in this certificate becoming null and void. This certificate is governed by ABS Rules 1-1-A3/5.9 Terms and Conditions of the Request for Product Type Approval and Agreement (2010)

Certificate of Product Design Assessment Rev.3 Page 1 of 1

Sensitivity: Internal & Restricted



Electronically published by ABS Busan.
Reference T2427357, dated 28-JUL-2023.

ACE VALVE CO., LTD.
1-12, SOMANG-GIL, JUCHON-MYEON
GIMHAE GYEONGSANGNAM-DO
Korea, Republic of
Telephone: +82-55-310-8000
Fax: +82-55-329-8558
Email: acevalve@acevalve.co.kr
Web: www.acevalve.co.kr
Tier: 5 - Unit Certification Required

Product: Cryogenic Valve
Model: AV-LMB, AV-LMF
Endorsements:

Intended Service:
LNG Carrier cargo system, LNG Charge and storage system, Power Plant LNG Facilities

Description:
Double Eccentric Metal Seated Butterfly Valve, Flange, Class 150, 16"
Double Eccentric Metal Seated Butterfly Valve, Butt welding, Class 150, 8"

Rating:
Design Pressure: 10 Bar
Design Temperature: -196 degree C thru 300 degree C
Materials:
- Body/Disc: A351 Gr. CF8/CF8M, CF3/CF3M, CF8C
- Bonnet: A351 Gr. CF3/CF3M, A351 Gr. CF8/CF8M, A312 TP.304L or 316L
- Seat: A240 TP316/TP316L
- Stem: A276 TP316/TP316L/TP304/TP304L

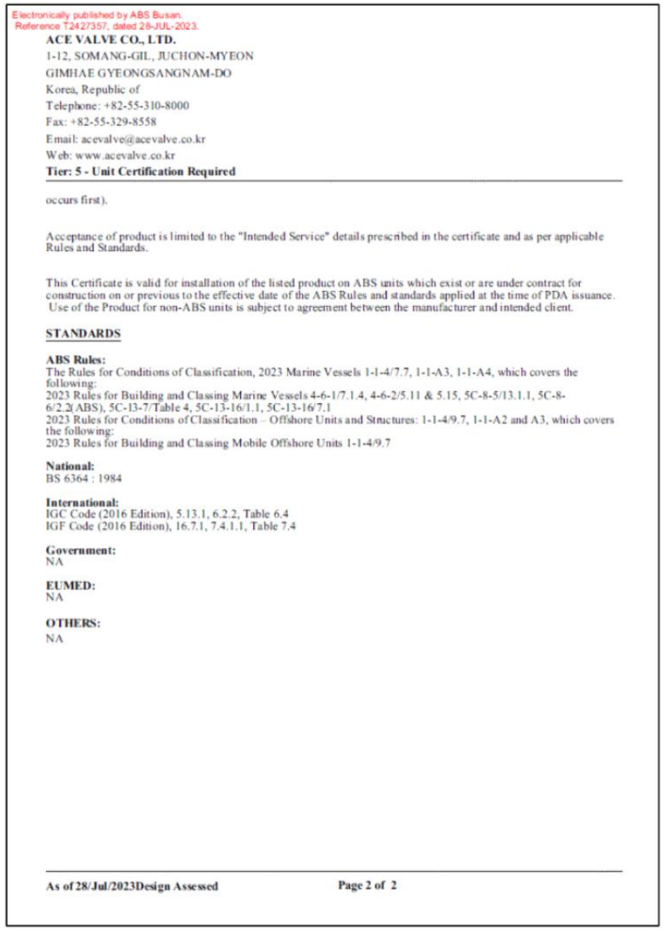
Service Restriction:
1. Unit certification is required for the products intended to be used at a working temperature below -55 degree C and testing specified in section 5C-8-5/13.1.1 & 5C-13-16/7.1 of the ABS Marine Vessel Rules is to be carried out in the presence of the Surveyor as required.
2. If the manufacturer or purchaser request an ABS Certificate for compliance with a specification or standard, the specification or standard, including inspection standards and tolerances, must be clearly defined.

Comments:
1. The Manufacturer has provided a declaration about the control of, or the lack of Asbestos in this product.
2. All valves are to be tested at the plant of manufacturer in the presence of the Surveyor in accordance with 5C-8-5/13.1.1(b) and 5C-8-6/2.2(ABS) or 5C-13-16/7.1 and 5C-13-16/1.1 of the Marine Vessel Rules.
3. Material testing of the products intended to be used at a working temperature below -55 degree C is to be witnessed by an ABS Surveyor in accordance with 5C-8-6/2.2 & 5C-13-16/1.1 of the Marine Vessel Rules.
4. All valves are to bear permanent identification, such as the manufacturer's name or trademark, standard of compliance, material identify, pressure rating, etc. as required by the standard of compliance and at which the manufacturer guarantees the valve to meet the requirements of the standards. Such markings may be cast or forged integral with, stamped on, or securely affixed by nameplate on the component, and are to serve as a permanent means of identification of the component throughout its service life in accordance with 4-6-2/5.11.4 and 4-6-1/7.1.4 of the Marine Vessel Rules.
5. The scope of Type Approval does not include the valve actuating system.
6. This certificate is not valid for US flagged vessels.

Notes/Drawing/Documentation:
1. Drawing nos.: LMF0016KCA, Rev.B, LMB008KCA, Rev.C
2. Prototype test report
   1) Pressure test: PS230302-01, Dated 02 March 2023
   2) Cryogenic test: CCT230427-16-01, Dated 27 April 2023
   3) Burst test: BT230228-01, Dated 28 February 2023
   4) Flow test: TCHPV-23-039, 15 February 2023, TCHPV-23-040, 16 February 2023

Terms of Validity:
This Product Design Assessment (PDA) Certificate remains valid until 27/Jul/2028 or until the Rules and/or Standards used in the assessment are revised or until there is a design modification warranting design reassessment (whichever

As of 28/Jul/2023Design Assessed **Page 1 of 2**



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ACE VALVE CO., LTD.
1-12, SOMANG-GIL, JUCHON-MYEON
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Telephone: +82-55-310-8000
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Email: acevalve@acevalve.co.kr
Web: www.acevalve.co.kr
Tier: 5 - Unit Certification Required

occurs first).

Acceptance of product is limited to the "Intended Service" details prescribed in the certificate and as per applicable Rules and Standards.

This Certificate is valid for installation of the listed product on ABS units which exist or are under contract for construction on or previous to the effective date of the ABS Rules and standards applied at the time of PDA issuance. Use of the Product for non-ABS units is subject to agreement between the manufacturer and intended client.

STANDARDS

ABS Rules:
The Rules for Conditions of Classification, 2023 Marine Vessels 1-1-4/7.7, 1-1-A3, 1-1-A4, which covers the following:
2023 Rules for Building and Classing Marine Vessels 4-6-1/7.1.4, 4-6-2/5.11 & 5.15, 5C-8-5/13.1.1, 5C-8-6/2.2(ABS), 5C-13-7/Table 4, 5C-13-16/1.1, 5C-13-16/7.1
2023 Rules for Conditions of Classification – Offshore Units and Structures: 1-1-4/9.7, 1-1-A2 and A3, which covers the following:
2023 Rules for Building and Classing Mobile Offshore Units 1-1-4/9.7

National:
BS 6364 : 1984

International:
IGC Code (2016 Edition), 5.13.1, 6.2.2, Table 6.4
IGF Code (2016 Edition), 16.7.1, 7.4.1.1, Table 7.4

Government:
NA

EUMED:
NA

OTHERS:
NA

As of 28/Jul/2023Design Assessed **Page 2 of 2**

IV CERTIFICATE & TEST REPORT

LR

Page 1 of 3
Certificate No: LR2334310BTA
Issue Date: 28/07/2023
Expiry Date: 27/07/2028

Type Approval Certificate

This is to certify that the undernoted product(s) has/have been tested with satisfactory results in accordance with the relevant requirements of the Lloyd's Register Type Approval System.

Manufacturer Ace Valve Co., Ltd.

Address 1-12, Somang-gil, Juchon-myeon, Gimhae-si, Gyeongnam, 50969, South Korea

Type Butterfly Valves

Description Cryogenic Butterfly Valve

Trade Name AV-LM Series

Application
- Marine use for cargo piping systems in ships for carriage of liquefied gases in bulk
- Marine use for fuel piping systems in ships using Gases as Fuel

Specified Standard
- Lloyd's Register's Rules and Regulations for Classification of Ships, Part 5, Chapter 12, Section 6 (July 2022)
- Chapter 5 of Lloyd's Register's Rules and Regulations for the Construction and Classification of Ships for the Carriage of Liquefied Gasses of Ships (July 2022)
- Part B-1, Section 16 of Lloyd's Register's Rules and Regulations for Classification of Ships using Gases or other Low-flashpoint Fuels (July 2022)

Yong-Dae Kong
Engineering Piping/Decarbon - Senior Specialist to Lloyd's Register Asia
A member of the Lloyd's Register group

71 Fenchurch Street, London, EC3M 4BS, United Kingdom

TAGS 2.0

Page 2 of 3
Certificate No: LR2334310BTA
Issue Date: 28/07/2023
Expiry Date: 27/07/2028

Type Approval Certificate

Ratings
- Nominal Size (inch) : 8, 16
- Nominal Pressure Ratings : ANSI Class 150
- Design Pressure : 10 bar g
- End Connection : RF Flange, Butt Welded End
- Minimum Operation Test Temperature (°C): -196

Additional Tests The following tests were carried out in accordance with BS 6364:1984, KS B 2101:2003 as applicable with satisfactory results:-
1) Burst test
2) Shell test
3) Cryogenic service test
4) Seat leakage test
5) Flow/Capacity test

Other Conditions

1) Where the valves are intended to be installed on a ship classed with LR, the valves are to be made, installed and tested in accordance with the Class I or II piping systems requirements of Part 5, Chapter 12 of the Rules Regulations for the Classification of ships.

2) The requirements for design temperatures below -165 °C shall be specially agreed with the Flag Administration in accordance with Chapter 6, Table 6.4 of the IGC Code & Part A-1, Table 7.4 of the IGF Code.

3) If the valves are installed as emergency shutdown valves, with materials having melting temperatures lower than 925°C, a fire test is to be performed to a standard acceptable to the Administration.

71 Fenchurch Street, London, EC3M 4BS, United Kingdom

TAGS 2.0

Page 3 of 3
Certificate No: LR2334310BTA
Issue Date: 28/07/2023
Expiry Date: 27/07/2028

Type Approval Certificate

This certificate is not valid for equipment, the design, ratings or operating parameters of which have been varied from the specimen tested. The manufacturer should notify Lloyd's Register Asia of any modification or changes to the equipment in order to obtain a valid Certificate.

The Design Appraisal Document and its supplementary Type Approval Terms and Conditions form part of this Certificate.

71 Fenchurch Street, London, EC3M 4BS, United Kingdom

TAGS 2.0

BV

Marine & Offshore

Certificate number: 74716/A0 BV
File number: .
Product code: 7334I

This certificate is not valid when presented without the full attached schedule composed of 7 sections

www.veristar.com

TYPE APPROVAL CERTIFICATE

This certificate is issued to

ACE VALVE CO., LTD.
Gimhae-si (Gyeongnam) - KOREA (REPUBLIC OF)

for the type of product

BUTTERFLY VALVES FOR LIQUEFIED GAS PIPING SYSTEMS
BUTTERFLY VALVES FOR LIQUEFIED GAS PIPING SYSTEMS

Requirements:
Bureau Veritas Rules for the Classification of Steel Ships
Bureau Veritas Rules for the Classification of Offshore Units
IGC Code as amended by IMO Res. MSC.441(99)

This certificate is issued to attest that Bureau Veritas Marine & Offshore did undertake the relevant approval procedures for the product identified above which was found to comply with the relevant requirements mentioned above.

This certificate will expire on: 11 Aug 2028

For Bureau Veritas Marine & Offshore,
At BV PUSAN, on 11 Aug 2023,
Won-jun JANG

This certificate was created electronically and is valid without signature

THE SCHEDULE OF APPROVAL

1. PRODUCT DESCRIPTION

BUTTERFLY VALVES FOR LIQUEFIED GAS PIPING SYSTEMS / Double Eccentric Metal Seated Butterfly Valve with linear lifting stem & disc

1.1 Ratings

Model	AV-LMF	AV-LMB
Size range (inch)	16"	8"
Design Standard	API 609 & BS6364	API 609 & BS6364
Class range	C1150	C1150
Design Pressure (Bar)	10	10
Design Temperature (°C)	-196/300	-196/300
End connections	Flange	Butt Welding

1.2 Materials

Part	Material
Body	A351 CF8M / CF3M
Disc	A351 CF8M / CF3M
Stem	A276 T316
Seat	A276 T316

When other choices of materials are used per manufacturer's recommendations, the BV agreement is to be obtained.

2. DOCUMENTS AND DRAWINGS

- Drawing N°LMF0016KCA Rev.B dated 09/03/2023.
- Drawing N°LMW0008KCA Rev.C dated 18/04/2023.
- Quality procedure N° AV-PR-100 Rev.0 dated 07/07/2023
- Cryogenic test procedure N° AV-WI-C234 Rev.1 dated 14/03/2023

No departure from the above documents shall be made without the prior consent of the Society. The manufacturer must inform the Society of any modification or changes to these documents and drawings.

3. TEST REPORTS

- Test report N° PS230228-01 dated 28/02/2023
- Test report N° PS230302-01 dated 02/03/2023
- Test report N° CCT230426-8-01 dated 02/05/2023
- Test report N° CCT230427-16-02 dated 02/05/2023
- Test report N° RT230502-01 dated 02/05/2023

Fire resistance test not performed.

4. APPLICATION / LIMITATION

4.1 - May be used on cargo handling systems of ships granted with the notation liquefied gas carrier

4.2 - The valves intended to be used for handling of Propylene Oxide or Ethylene Oxide/ Propylene Oxide mixtures shall be of a fire safe design.

4.3 - The valve belongs to class I pressure piping according to the relevant requirements stated in Part D, Ch 9, Sec 5 of BUREAU VERITAS Rules for Steel Ships.

4.4 - The valve intended to be installed on BUREAU VERITAS classed ship have to comply with Pt D, Ch 9, Sec 5 & IGC Code and type tests reports witnessed by BUREAU VERITAS are to be available for each type and size of valve.

4.5 - When required in Part D, Ch 9, Sec 6 of the Bureau Veritas Rules applicable to liquefied gas carriers, Charpy V-notch impact test shall be carried out for castings. Castings in steel grades 316 and 316L at any temperature will be impact tested at -196 °C. A reduction may be granted for design temperature above -60 °C after examination by the Society.

4.6 - The materials for valves housing, disc and sealing should be of a suitable type at the temperature and pressure for use with cargoes intended to be carried.

4.7 - The approval does not include any operating gear for remote control of the valves.

4.8 - The valve is to be installed according to manufacturer's instructions and Society's Rule requirements.

4.9 - The use of stainless steel and grey cast iron is to be restricted as per the BUREAU VERITAS Rules.

4.10 - When the butterfly valves are not fitted with flanges their use may be accepted as shipside valves provided that arrangements are made to allow a possible disassembling at sea of the pipes immediately inboard without any risk of flooding.

5. PRODUCTION SURVEY REQUIREMENTS

5.1 - The products are to be supplied by **ACE VALVE CO., LTD.** in compliance with the type and the requirements described in this certificate.

5.2 - This type of product is within the category IBV of BV Rule Note NR320.

5.3 - BV product certificate is required.

5.4 - BV Certificates are required for materials of valve housings of Class I (DN≥50). Materials of valve housings of Class I (DN<50) and other pressure boundary parts of Class I are to be with work's certificates.

5.5 - Materials are to comply with the approved drawings and the applicable requirements in Part D of the BV Rules for Steel Ships. Charpy impact test is to be as per the Society's Rules on materials, and where relevant, in accordance with requirements of IGC Code.

5.6 - Each valve is to be tested according BV Rules for Steel Ships Pt D, Ch 9, Sec 5 item 13.3.3.

5.7 - For information, **ACE VALVE CO., LTD.** has declared to Bureau Veritas the following production site :

ACE VALVE CO., LTD.
1-12, Somang-gil, Juchon-myeon
Gimhae-si (Gyeongnam)
KOREA (REPUBLIC OF)

6. MARKING OF PRODUCT

Each valve shall be permanently marked with at least:

- Manufacturer's name or logo
- Type designation
- Maximum working Pressure
- Society's brand as relevant

7. OTHERS

It is **ACE VALVE CO., LTD.** responsibility to inform shipbuilders or their sub-contractors of the proper methods of fitting, use and general maintenance of the approved equipment and the conditions of this approval.

*** END OF CERTIFICATE ***

KR

Certificate No : CWN15444-VV002

Type Approval Certificate

[Cryogenic Valve]

Initial Approval 2 June 2023

Manufacturer ACE Valve Co., Ltd.
1-12, Somang-gil, Juchon-myeon, Gimhae-si, Gyeongsangnam-do, Korea

Product Description Cryogenic Butterfly Valve
- Model : AV-LMF, AV-LMB
- Intended for : Liquid and Gas Service

" See Appendix 1 "

Approval Condition " See Appendix 1 "

THIS IS TO CERTIFY that the above-mentioned product has been approved in accordance with the relevant requirement of this Society's Rules and / or of the recognized standards as follows.

Pt. 7, Ch. 5, Art. 513 of the Rules for Classification of Steel Ships and IGC Code, ASME B16.34 & BS6364.

This Certificate is valid until 1 June 2028

Issued at Busan, Korea on 2 June 2023

This certificate is signed electronically in accordance with IMO FAL.5/Circ.39/Rev.2. Validation and authentication of the certificate can be confirmed from "http://e-cert.krs.co.kr" by using the tracking No(ME23027612499) and certificate No.(CWN15444-VV002).

KOREAN REGISTER

General Manager of Marine & Ocean Equipment Team

Note : 1. This certificate will be valid subject to complying with the approval conditions described on the certificate and/or on the Rules of this Society.
2. This certificate will be invalid from the expiry date aforementioned unless the extension or renewal has been granted to the applicant or the manufacturer.
3. Any significant modifications or changes in design or construction to the above product without approval from this Society will render this certificate invalid.
4. Should the specified rules, regulations or standards be amended during the validity of this certificate, the product is to be re-approved by this Society in accordance with the requirements as amended.

AC-2A (2021.01) 1/2 KOREAN REGISTER

Appendix 1

Certificate No : CWN15444-VV002

Product Description and/or Approval Condition

Date of Issue : 2 June 2023

A. Product Description

1. Product Specification

Model	Size (inch)	Pressure Rating	Design Press. (bar)	Design Temp. (℃)	End Connection	Material (Shell/Stem)
AV-LMF	16"	Class 150	10.0	-196 ~ +400	RF	A351 CF8M / A276 T316
AV-LMB	8"	Class 150	10.0	-196 ~ +400	BW	A351 CF3M / A276 T316

2. Approved Drawings and Documents
1) AV-LMF : LMF0016KCA Rev.C dated on 17 August 2022
2) AV-LMB : LMB0008KCA Rev.C dated on 17 August 2022

3. Test Reports, etc.
1) Hydro test : Report No. PS230228-01 dated on 28 February 2023
2) Seat leakage test : Report No. PS230302-01 dated on 02 March 2023
3) Cryogenic test : Report No. CCT230426-8-01 dated on 26 April 2023
Report No. CCT230427-16-01 dated on 27 April 2023
Report No. RT230428-01 dated on 28 April 2023

B. Approval Condition

1. Application & Limitation
1) The materials used for valve body & etc. as appropriately are to be certified by this Society or to be satisfactory to the Surveyor.
2) Gaskets and packings are to be suitable for the condition of use and to have a construction specified in Korean Industrial Standards or equivalent construction thereto.

2. Individual Product Cert. and Drawing Approval Requirement
1) Individual Product Certification is required.
2) The minimum average energy for Charpy V-notch impact test is to be complied with the relevant requirements of the Rules, Pt.7, Ch.5.
3) The following tests are to be applicable for each size of the valves as individual product certification.
- Hydrostatic test of the valve body at a pressure equal to 1.5 times the design pressure
- Cryogenic testing consisting of valve operation and leakage verification for a minimum of 10% of each type and size of valve for valves
- Proving testing at ambient temperature consisting of leakage test at a pressure equal to 1.1 times the design pressure

3. Marking
1) The product is to be permanently marked with manufacturer name and type designation on a suitable position.

4. Others
- N/A

< End of Certificate >

AC-2A (2021.01) 2/2 KOREAN REGISTER

DNV. GL

DNV

Certificate no.:
TAP00002TG

TYPE APPROVAL CERTIFICATE

This is to certify:

that the Butterfly Valves

with type designation(s)
AV-LMF, AV-LMB

issued to
ACE VALVE CO., LTD
Gimhae-si, Gyeongsangnam-do, Korea, Republic of

is found to comply with
DNV rules for classification – Ships Pt.5 Ch.7 Liquefied gas tankers
DNV class programme DNV-CP-0186 – Type approval – Valves

Application:

Product(s) approved by this certificate is/are accepted for installation on vessels classed by DNV.

Type:	Temperature range:	Max. working press.:	Sizes:
AV-LMF	-196° to +50°C	10 bar(g)	16"
AV-LMB	-196° to +50°C	10 bar(g)	8"

Issued at **Høvik** on **2023-10-29**

for **DNV**

This Certificate is valid until **2028-10-28**.
DNV local unit: **AK Admin Support**

Approval Engineer: **Maheshraja Venkatesan**

DNV

Job ID: **262.1-038604-1**
Certificate no.: **TAP00002TG**

Product description
Double eccentric metal seated butterfly valves with Flanged Double offset Butterfly valves with extended bonnet for cryogenic service designed according to ASME B16.34 covering following models and material of construction:

Model	Size	End connection	Material of construction			
			Body, body extension & bottom cover	Disc	Stem	Body top and seat gaskets
AV-LMF	16"	RF Flanged ends	ASTM A351 CF8/ CF8M/ CF3/ CF3M/ CF8C	ASTM A351 CF8M	ASTM A276 T316	SUS+Graphite
AV-LMB	8"	BW ends	ASTM A351 CF8/ CF8M/ CF3/ CF3M/ CF8C	ASTM A351 CF8M	ASTM A276 T316	SUS+Graphite

Valve end construction:
- Flanged ends : ASME B16.5 – Class 150
- Butt weld ends : ASME B16.25

Application/Limitation
Valves covered by this certificate may be used in general machinery service or LNG/LPG applications - Cryogenic Service.

Materials and material protection chosen for the specific system shall be suitable for the intended medium and environmental conditions. Valves of austenitic stainless steel shall not be used in direct contact with seawater.

The approval does not include actuator and/or other equipment for remote control of the valves.

The valves covered by this certificate are not to be considered fire safe and therefore shall not be installed wherever fire safe application is required; e.g. as shut off or quick closing valves.

Type Approval documentation

Document No.	Rev.	Title
(to be added)		

Tests carried out
Cryogenic seat leakage testing, flow testing

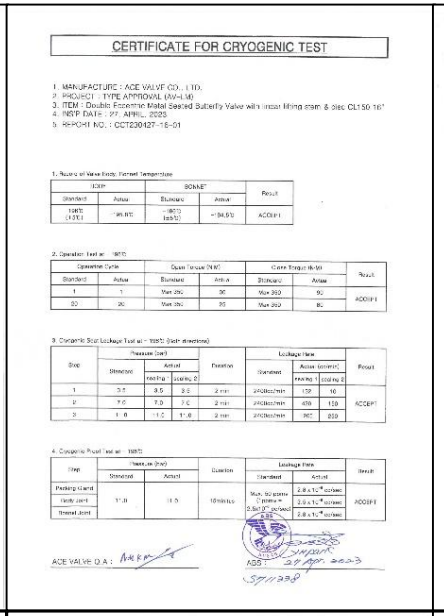
Marking of product
Production Testing and Certification for the actual intended application shall follow the latest applicable edition of the Rules (as mentioned on the front page of this certificate).

Periodical assessment
For retention of the Type Approval, a DNV Surveyor shall perform periodical assessment after two years (+/- 90 days) and after 3.5 years (+/- 90 days) to verify that the conditions for the approval are complied with. Reference is made to DNV-CP-0338.

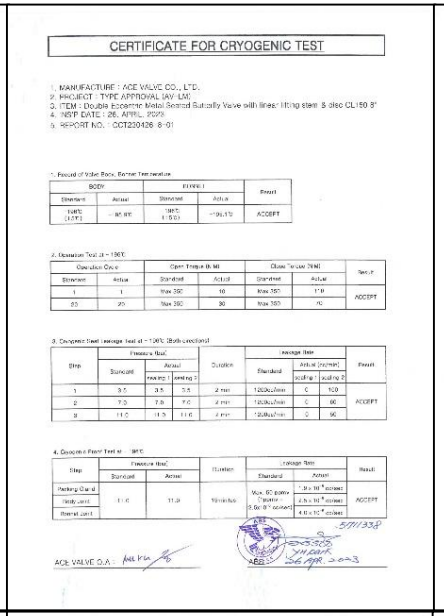
IV CERTIFICATE & TEST REPORT

TEST REPORT

Restoration Test at Ambient Temperature (Seat)

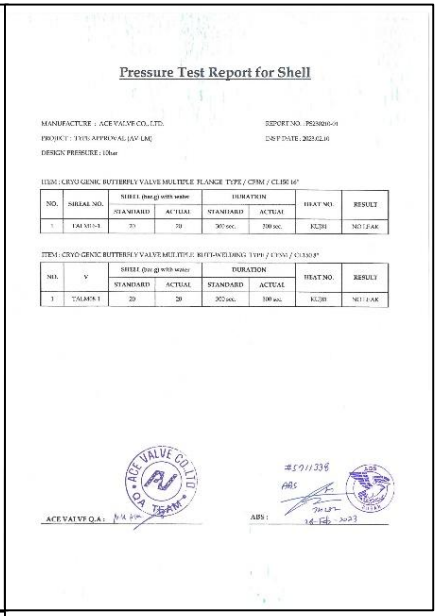


CERTIFICATE FOR CRYOGENIC TEST

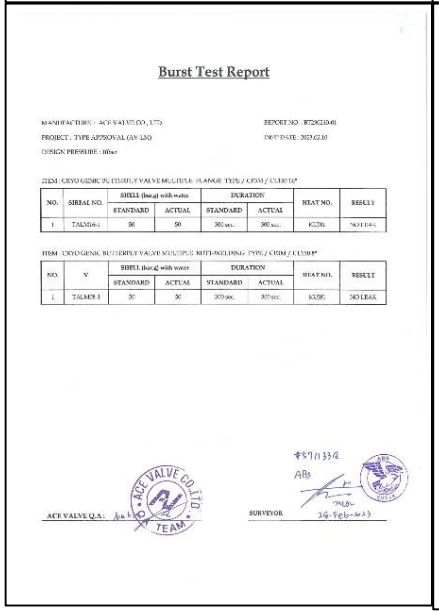


CERTIFICATE FOR CRYOGENIC TEST

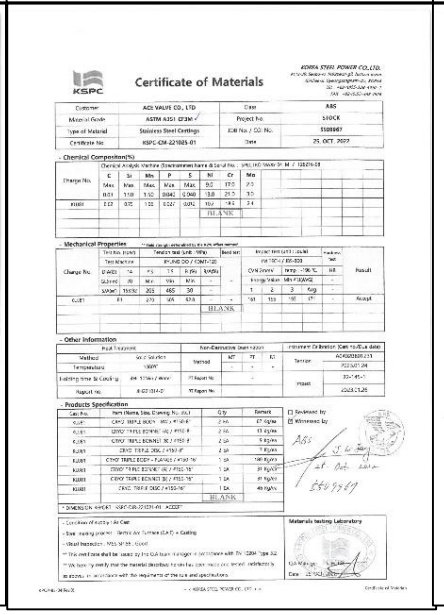
Pressure Test Report for Seat



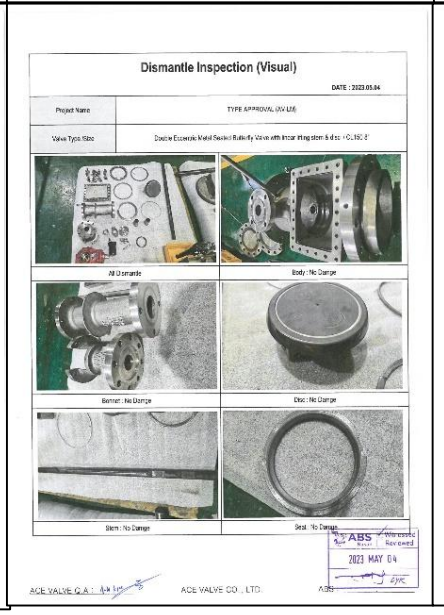
Pressure Test Report for Shell



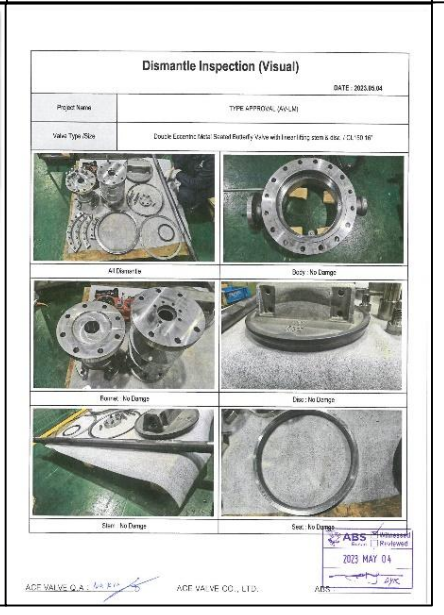
Burst Test Report



Certificate of Materials



Dismantle Inspection (Visual)



Dismantle Inspection (Visual)

- SIZE : DN 200
- RATING : ASME B16.5 150LB
- END CONNECTION : BUTT-WELDING
- OPERATOR : MANUAL GEAR

- SIZE : DN 400
- RATING : ASME B16.5 150LB
- END CONNECTION : FLANGED
- OPERATOR : MANUAL GEAR

Cryogenic Valve - Reference

- PROJECT : MEJILONES LNG STORAGE TANK
- MATERIAL : A351 CF3 STAINLESS STEEL
- DESIGN STANDARD : API 6D, API 609
- SIZE : DN40mm ~ DN800mm (1.5” ~ 32”)
- Q’TY : 42sets
- PRESSURE : 150LB
- OPERATOR : PNEUMATIC ACTUATOR
- EPC : TECNICAS REUNIDAS

Cryogenic Valve - Reference

- PROJECT : GUANGDONG ZUHAI LNG TERMINAL
- MATERIAL : A351 CF3 STAINLESS STEEL
- DESIGN STANDARD : API 609
- SIZE : DN200mm ~ DN600mm (8” ~ 24”)
- Q’TY : 39sets
- PRESSURE : 150LB
- OPERATOR : MANUAL & ELECTRIC ACTUATOR
- EPC : TECNICAS REUNIDAS

ACE VALVE CO.,LTD.

TEL : 82-55-310-80A00 FAX : 82-55-329-0657 E-MAIL : acevalve@acevalve.co.kr
HEAD OFFICE & FACTORY : (621-844) 139-12, Seobu-ro 1430beon-gil, Juchon-myun, Gimhae-si, Gyeongsangnam-do, KOREA.

REFERENCE LIST FOR CRYOGENIC VALVE

NO	COUNTRY	END-USER	CONTRACTOR	PROJECT / TYPE OF VESSEL	DESCRIPTION / SPECIFICATION				DELIVERY	
					TYPE OF VALVE	FLANGE RATING	SIZE	Q'TY	YY	MM
1	KOREA	HMM	SunBo	8,600 PCTC FGSS GSI G0036	CRYOGENIC BUTTERFLY VALVE (BUTT-WELD) CRYOGENIC BUTTERFLY VALVE (Flange)	150LB	DN 100~200	20EA	2024	8
2	KOREA	HMM	SunBo	8,600 PCTC FGSS GSI G0034,35	CRYOGENIC BUTTERFLY VALVE (BUTT-WELD) CRYOGENIC BUTTERFLY VALVE (Flange)	150LB	DN 100~200	40EA	2024	5
3	KOREA	KIMM (Korean Institute of Machinery & Materials)	JH TECH	Cryogenic Test Facility	CRYOGENIC TRIPLE ECCENTRIC BUTTERFLY VALVE (BUTT-WELD)	150LB	DN 200, 500	3EA	2021	7
4	TURKEY	PARDUS Energy LTD	HYUNDAI HEAVY INDUSTRIES CO.,LTD	2945 / 170K LNG FSRU	CRYOGENIC BUTTERFLY VALVE with Hyd. Actuator / Manual CRYOGENIC GLOBE VALVE with Hyd. Motor Type Actuator / Manual CRYOGENIC GATE VALVE / Manual CRYOGENIC DUAL/SWING CHECK VALVE CRYOGENIC BALL VALVE with Hyd. Actuator / Manual	150LB 900LB	DN15 ~ DN600	164EA	2018	5
5	PANAMA	AES	POSCO ENC	PANAMA LNG COLON GAS	CRYOGENIC BUTTERFLY VALVE	150LB	DN200~DN900	17EA	2017	3
6	KOREA	LOTTE CHEMICAL	GS ENGINEERING & CONSTRUCTION	TE-3	CRYOGENIC BUTTERFLY VALVE	300LB	DN150	1EA	2016	11
7	JAPAN	MHI	OSAV CO.,LTD	MHI 2089	CRYOGENIC GLOBE VALVE (BUTT-WELD)	150LB	DN100	1EA	2016	10
8	JAPAN	MITSUBISHI HEAVY INDSTRIES, LTD.	OSAV CO.,LTD	MHI S.1412	CRYOGENIC GLOBE VALVE (BUTT-WELD)	150LB	DN80	1EA	2016	9
9	UAE	GASCO	GASOS		CRYOGENIC BALL VALVE	300LB	DN50	1EA	2015	12
10	SINGAPORE	-	LFA GLOBAL		CRYOGENIC BUTTERFLY VALVE	300LB	DN200	6EA	2015	12
11	CHINA	FENGZHEN WANJIE CITY GAS CO., LTD.	TECHNIP CHINA	FENGZHEN WANJIE CITY GAS PEAK REGULATION	CRYOGENIC LIFT CHECK VALVE	800LB	DN25	4EA	2015	11
12	CHINA	FENGZHEN WANJIE CITY GAS CO., LTD.	TECHNIP CHINA	FENGZHEN WANJIE CITY GAS PEAK REGULATION	CRYOGENIC GLOBE VALVE	150LB~800LB	DN25~DN50A	22EA	2015	11
13	CHINA	FENGZHEN WANJIE CITY GAS CO., LTD.	TECHNIP CHINA	FENGZHEN WANJIE CITY GAS PEAK REGULATION	CRYOGENIC DUAL CHECK VALVE	150LB	DN50~DN200	10EA	2015	11
14	CHINA	FENGZHEN WANJIE CITY GAS CO., LTD.	TECHNIP CHINA	FENGZHEN WANJIE CITY GAS PEAK REGULATION	CRYOGENIC BALL VALVE	150LB~800LB	DN15~DN300	82EA	2015	11
15	ANGOLA	BECHTEL	PJ VALVE	ANGOLA LNG	CRYOGENIC TRIPLE ECCENTRIC FLANGE TYPE BUTTERFLY VALVE	300LB ~900LB	DN300~DN600	4EA	2015	7

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REFERENCE LIST FOR CRYOGENIC VALVE

NO	COUNTRY	END-USER	CONTRACTOR	PROJECT / TYPE OF VESSEL	DESCRIPTION / SPECIFICATION				DELIVERY	
					TYPE OF VALVE	FLANGE RATING	SIZE	Q'TY	YY	MM
16	KSA	SABIC	OBG GLOBAL	REPLANCEMENT	CRYOGENIC TRIPLE ECCRENTRIC BUTTERTFLYS	150LB	DN600	1EA	2014	4
17	KOREA	KOREA INSTITUTE OF MACHINERY & MATERIALS	GYEONGNAM PPS	KOREA LNG CRYOGENIC INDUSTRIAL COMPLEX	CRYOGENIC BUTT-WELD TYPE GATE VALVE	150LB	DN1100	1EA	2014	3
18	KOREA	KOREA INSTITUTE OF MACHINERY & MATERIALS	GYEONGNAM PPS	KOREA LNG CRYOGENIC INDUSTRIAL COMPLEX	CRYOGENIC BUTT-WELD TYPE SWING CHECK VALVE	150LB	DN80~DN200	2EA	2014	3
19	UAE	FLOWSERVE GULF FZE	GERAB NATIONAL	GULF FZE	CRYOGENIC TRIPLE ECCENTRIC BUTTERFLY VALVE	150LB/300LB	DN80~DN400	6EA	2014	3
20	KOREA	KOREA INSTITUTE OF MACHINERY & MATERIALS	GYEONGNAM PPS	KOREA LNG CRYOGENIC INDUSTRIAL COMPLEX	CRYOGENIC BUTT-WELD TYPE BUTTERFLY VALVE	150LB/300LB	DN200~DN800	2EA	2014	2
21	JAPAN	MOL TANKSHIP MANAGEMENT	MITSUI ENGINEERING SHIPBUILDING	MES S.1230	CRYOGENIC FLANGE TYPE GLOBE VALVE	150LB	DN15	8EA	2013	12
22	CHILE	TECNICAS REUNIDAS	LOTUS CONTROL	MEJILLONES GNL NORTE GRANDE CHILE	CRYOGENIC BALL VALVE	150LB~900LB	DN40~DN150	12EA	2013	4
23	PAKISTAN	PAKISTAN PETROLEUM LIMITIED	FRENSTAR	MAKORI FIELD DEVELOPMENT	CRYOGENIC FLANGE TYPE BUTTERFLY VALVE	600LB	DN300	1EA	2013	3
24	CHILE	GNL MEJILLONES S.A	TECNICAS REUNIDAS	MEJILLONES GNL NORTE GRANDE CHILE	CRYOGENIC FLANGE TYPE BUTTERFLY VALVE	150LB	DN200~DN700	22EA	2013	3
25	KOREA	SAMSUNG TOTAL PETROCHEICALS	SAMSUNG ENGINEERING	STC EVA2	CRYOGENIC FLANGE TYPE BUTTERFLY VALVE	150LB	DN100	4EA	2013	3
26	KOREA	KOREA INSTITUTE MACHINERY & MATERIALS	KOREA INSTITUTE OF MACHINERY & MATERIALS	STUDY OF MACHINERY & MATERIALS	CRYOGENIC FLANGE TYPE BUTTERFLY VALVE	150LB	DN250	3EA	2013	1
27	CHINA	GUANDONG ZHUHAI GOLDEN BAY LNG	TECNICAS REUNIDAS	GUANDONG ZHUHAI	CRYOGENIC BUTT-WELD TYPE BUTTERFLY VALVE	150LB	DN200~DN600	39EA	2012	12
28	PHILIPPINES	JH SUMIIT PETROCHEMICAL CORP.	DAERIM INDUSTRIAL	JH SUMIIT NAPHTHA CRACKER	CRYOGENIC FLANGE TYPE BUTTERFLY VALVE	300LB	DN300~DN350	3EA	2012	12
29	CHILE	GNL MEJILLONES S.A	TECNICAS REUNIDAS	MEJILLONES GNL NORTE GRANDE CHILE	CRYOGENIC BUTTERFLY VALVE (MOTOR OPERATED VAVLE)	150LB	DN250~DN800	6EA	2012	12
30	CHILE	GNL MEJILLONES S.A	TECNICAS REUNIDAS	MEJILLONES GNL NORTE GRANDE CHILE	CRYOGENIC BUTTERFLY VALVE (PNEUMATIC OPERATED VAVLE)	150LB	DN250~DN800	4EA	2012	12
31	CHILE	GNL MEJILLONES S.A	TECNICAS REUNIDAS	MEJILLONES GNL NORTE GRANDE CHILE	CRYOGENIC BUTTERFLY VALVE (MOTOR OPERATED VAVLE)	150LB~900LB	DN40~DN150	12EA	2012	12
32	UAE	TAKREER	SAMSUNG ENGINEERING	RRE #3	CRYOGENIC FLANGE TYPE BUTTERFLY VALVE	150LB	DN1350	2EA	2012	12

ACE VALVE CO.,LTD.
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REFERENCE LIST FOR CRYOGENIC VALVE

NO	COUNTRY	END-USER	CONTRACTOR	PROJECT / TYPE OF VESSEL	DESCRIPTION / SPECIFICATION				DELIVERY	
					TYPE OF VALVE	FLANGE RATING	SIZE	Q'TY	YY	MM
33	KOREA	KUMHO PETROCHEMICAL	DAERIM INDUSTRIAL	KUMHO YEP-IV	CRYOGENIC FLANGE TYPE BUTTERFLY VALVE	300LB	DN150~DN500	6EA	2012	11
34	KOREA	KOREA INSTITUTE MACHINERY & MATERIALS	KOREA INSTITUTE OF MACHINERY & MATERIALS	STUDY OF MACHINERY & MATERIALS	CRYOGENIC FLANGE TYPE BUTTERFLY VALVE	150LB	DN250	2EA	2012	11
35	UAE	TAKREER	GS ENGINEERING & CONSTRUCTION	RUWAIS 4TH NGL	CRYOGENIC FLANGE TYPE BUTTERFLY VALVE	300LB	DN600	1EA	2012	8
36	CHINA	GUANDONG ZHUHAI GOLDEN BAY LNG	TECNICAS REUNIDAS	GUANDONG ZHUHAI	CRYOGENIC BUTT-WELD TYPE BUTTERFLY VALVE	150LB	DN200~DN600	39EA	2012	7
37	CHILE	GNL MEJILLONES S.A	TECNICAS REUNIDAS	MEJILLONES GNL NORTE GRANDE CHILE	CRYOGENIC BUTT-WELD TYPE BUTTERFLY VALVE	150LB~900LB	DN40~DN800	31EA	2012	7
38	PHILIPPINES	JH SUMIIT PETROCHEMICAL CORP.	DAERIM INDUSTRIAL	JH SUMIIT NAPHTHA CRACKER	CRYOGENIC FLANGE TYPE BUTTERFLY VALVE	300LB	DN350	1EA	2011	12
39	KSA	SAUDI KAYAN	DAERIM INDUSTRIAL	SAUDI KAYAN KLPE	CRYOGENIC FLANGE TYPE BUTTERFLY VALVE	150LB	DN150~DN600	5EA	2011	12
40	KOREA	KOREA INSTITUTE MACHINERY & MATERIALS	KOREA INSTITUTE OF MACHINERY & MATERIALS	STUDY OF MACHINERY & MATERIALS	CRYOGENIC FLANGE TYPE BUTTERFLY VALVE	150LB	DN250	2EA	2011	12
41	KOREA	KOREA INSTITUTE MACHINERY & MATERIALS	HYUNDAI ENGINEERING	KOREA LNG CRYOGENIC INDUSTRIAL COMPLEX	CRYOGENIC BUTT-WELD TYPE BUTTERFLY VALVE	150LB/300LB	DN200~DN800	19EA	2011	10
42	UAE	TAKREER	GS ENGINEERING & CONSTRUCTION	RUWAIS 4TH NGL	CRYOGENIC FLANGE TYPE BUTTERFLY VALVE	300LB	DN400/DN750	2EA	2011	6
43	KSA	SAUDI KAYAN	DAERIM INDUSTRIAL	SAUDI KAYAN KLPE	CRYOGENIC FLANGE TYPE BUTTERFLY VALVE	150LB	DN150~DN600	15EA	2011	3
44	JAPAN	ASTOMOS ENERGY JAPAN	MITSUBISHI HEAVY INDUSTRIES LTD.	MHI S.2092 GAS SCORPIO	LPG FLANGE TYPE BUTTERFLY VALVE	150LB/300LB	DN200~DN250	4EA	2010	12
45	KOREA	KOREA INSTITUTE MACHINERY & MATERIALS	HYUNDAI ENGINEERING	KOREA LNG CRYOGENIC INDUSTRIAL COMPLEX	CRYOGENIC BUTT-WELD TYPE BUTTERFLY VALVE	150LB/300LB	DN200~DN800	19EA	2010	1
46	JAPAN	ASTOMOS ENERGY JAPAN	MITSUBISHI HEAVY INDUSTRIES LTD.	MHI S.2089	CRYOGENIC GLOBE VALVE	150LB	DN100	1EA	2009	12
47	JAPAN	NYK LNG SHIP MANAGEMENT	MITSUI ENGINEERING SHIPBUILDING	MES S.1351 NORTHWEST SWALLOW	CRYOGENIC GATE VALVE	150LB	DN100~DN250	3EA	2009	4
48	JAPAN	NYK LNG SHIP MANAGEMENT	MITSUI ENGINEERING SHIPBUILDING	MES S.1351 NORTHWEST SWALLOW	CRYOGENIC SWING CHECK VALVE	150LB	DN400	1EA	2009	4
49	JAPAN	NYK LNG SHIP MANAGEMENT	MITSUI ENGINEERING SHIPBUILDING	MES S.1351 NORTHWEST SWALLOW	CRYOGENIC BUTT-WELD TYPE BUTTERFLY VALVE	150LB	DN80~DN100	2EA	2009	4

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REFERENCE LIST FOR CRYOGENIC VALVE

NO	COUNTRY	END-USER	CONTRACTOR	PROJECT / TYPE OF VESSEL	DESCRIPTION / SPECIFICATION				DELIVERY	
					TYPE OF VALVE	FLANGE RATING	SIZE	Q'TY	YY	MM
50	KSA	SAUDI ARAMCO	GABAS	SAUDI ARAMCO	CRYOGENIC FLANGE TYPE BUTTERFLY VALVE	150LB	DN1050	1EA	2008	10
51	JAPAN	SIAM LUCKY MARINE THAILAND	KAWASAKI HEAVY INDUSTRIE	KHI S.NO.1429 "NOTO GLORIA"	CRYOGENIC GLOBE VALVE	150LB	DN100~DN250	4EA	2008	8
52	JAPAN	NYK LNG SHIP MANAGEMENT	MITSUI ENGINEERING SHIPBUILDING	MHI S.2157 "LNG JAMAL"	CRYOGENIC GLOBE VALVE	150LB	DN200	6EA	2008	8
53	JAPAN	GAS SILVER CHINA	KAWASAKI HEAVY INDUSTRIE	KHI S.NO.1430 "CRYSTAL MARMAID"	CRYOGENIC WAFER TYPE BUTTERFLY VALVE	150LB	DN400	3EA	2007	1
54	JAPAN	GAS SILVER CHINA	KAWASAKI HEAVY INDUSTRIE	KHI S.NO.1421 "CRYSTAL MARMAID"	CRYOGENIC WAFER TYPE BUTTERFLY VALVE	150LB	DN400	3EA	2006	4
55	JAPAN	GAS SILVER CHINA	KAWASAKI HEAVY INDUSTRIE	KHI S.NO.1420 "CRYSTAL MARMAID"	CRYOGENIC WAFER TYPE BUTTERFLY VALVE	150LB	DN400	5EA	2005	4

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