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REV.	DATE	DESCRIPTION	PREPARED	CHECKED	REVIEWED	APPROVED
OWNER		 SPPC 신평택발전 SHIN PYEONGTAEK COMBINED CYCLE POWER PLANT				
OE		 KOREA WESTERN POWER CO., Ltd.				
CONTRACTOR		 포스코건설  (주) 서희건설				
SUPPLIER		 한국가스기술공사 KOREA GAS TECHNOLOGY CORPORATION				
TITLE		Specification for Ball Valve				
PJT. No.		OWNER'S No		CONTRACTOR No.		
10000		100009-24100-P-212-001		WD-520-EP230-0001		

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1. SCOPE

This specification is the purchasing specification for ball valves and applies to the design, manufacture, test and inspection of ball valves to be used in the natural gas piping system of PURCHASER.

2. CODES AND STANDARDS

Items not covered in this specification shall conform to the latest editions of the following laws, regulations, codes, and standards. Any inconsistency with this specification shall be approved by PURCHASER prior to manufacturing the valves.

2.1. American Petroleum Institute Specification (API)

- API SPEC 5L Specification for Line Pipe
- API SPEC 6D Specification for Pipeline and Piping Valves
- API-STD 598 Valve Inspection and Testing
- API-STD 607 Fire Test for Soft Seated Quarter-Turn Valves and Valves Equipped with Nonmetallic seats
- APISPEC STD 6FA Specification for Fire Test and for Valves

2.2. Manufacturers Standardization Society (MSS)

- MSS-SP-25 Standard Marking System for Valves, Fittings, Flanges and Unions
- MSS-SP-75 High-Strength, Wrought, Butt-Welding Fittings

2.3. American Society for Testing and Materials (ASTM)

- A48/A48M Standard Specification for Gray Iron Castings
- A53/A53M Standard Specification for Pipe, steel, Black and Hot-Dipped, Zinc-coated, Welded and Seamless
- A105/A105M Standard Specification for Carbon Steel Forgings for Piping Applications
- A106/A106M Standard Specification for Seamless Carbon Steel Pipe for High Temperature Service
- A182/A182M Standard Specification for Forged or Rolled Alloy-Steel Pipe Flanges, Forged Fitting and Valves and Parts for High-Temperature Service
- A193/A193M Standard Specification for Alloy-Steel and Stainless Steel Bolting for High-Temperature or High Pressure Service and Other Special Purpose Applications
- A194/A194M Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High-Pressure and High-Temperature Service , or Both

- A 216/A216M Standard Specification for Steel Castings, Carbon, Suitable for Fusion Welding for High-Temperature Service
- A350/A350M Standard Specification for Forging, Carbon and Low-Alloy Steel Forgings, Requiring Notch Toughness Testing for Piping Components
- A694/694M Standard Specification for Forgings, Carbon and Alloy Steel Forgings, for Pipe Flanges, Fittings, Valves, and Parts for High-Pressure Transmission Service
- B650 Standard Specification for Electrodeposited Engineering Chrome Coating on Ferrous Substrates
- B733 Standard Specification for Autocatalytic(Electroless) Nickel Phosphorus Coatings on Metal
- E45 Standard Test Methods for Determining the Inclusion Content of Steel
- E286 Standard Reference Radiographs for Heavy-Walled(2 to 4 1/2-in.(50.8 to 114-mm)) Steel Casting
- E112 Standard Test Methods for Determining Average Grain Size
- E446 Standard Reference Radiographs for Steel Casting Up to 2 in.(50.8mm) in Thickness

2.4. American Society of Mechanical Engineers(ASME), Boiler and Pressure Vessel Code(BPVC)

- ASME B16.5 Steel Pipe Flanges and Flanged Fittings NPS 1/2 through NPS 24 Metric/Inch standard
- ASME B16.11 Forged Fittings, Socket-Welding and Threaded
- ASME B16.25 Butt-welding Ends
- ASME B16.34 Valves-Flanged, Threaded and Welding End
- ASME B16.47 Large Diameter Steel Flange NPS 26 through 60 Metric / Inch standard
- SEC. II SA-788 Specification for steel Forgings, General requirements
- SEC. V Nondestructive Examination
- SEC. VIII Rules for Construction of Pressure Vessels
- SEC. IX Welding and Brazing Qualifications

2.5. American Iron and Steel Institute (AISI)

- AISI 4140 Composition Ranges and Limits for ANSI SAE Standard of Chromium-Molybdenum Steels

2.6. British Standard (BS)

- 6755 Specification for the Type-testing Requirements

2.7. Korean Gas-Related Laws

- High Pressure Gas Safety Control Act
- Urban Gas Business Act
- Safety Control and Business Regulation of Liquefied Petroleum Gas Act

2.8. Internal Organization for Standardization(ISO)

- ISO 5211 Industrial valves – Part-turn actuator attachment

2.9. Korean Standards(KS)

- KS C IEC 60529
- KS M ISO 8504-1
- KS M ISO 8504-2
- KS M ISO 8504-3

3. TECHNICAL SPECIFICATION

3.1. General

3.1.1 Fluid

The fluid flowing through the valves is natural gas vaporized from LNG, of which composition is as follows:

Composition	Mol(%)	Molecular Weight (kg/kg mol)	Remarks
CH ₄	91.332	16.043	Natural gas
C ₂ H ₆	5.363	30.070	
C ₃ H ₈	2.136	44.097	
i C ₄ H ₁₀	0.459	58.123	
N c ₄ H ₁₀	0.476	58.123	
i C ₅ H ₁₂	0.015	72.150	
N C ₅ H ₁₂	0.002	72.150	
N ₂	0.217	28.013	
Total	100		
T.H.T	max	13ppm	Odorant
T.B.M	max	6ppm	

3.1.2 Nominal pressure : The nominal pressures adopted by KOGAS and the valve pressure ratings corresponding to them are as follows :

Piping Pressure Identification	Piping Pressure [MPa(kg/cm ²)]		Valve Pressure Rating
	Normal Pressure	Design Pressure	
P0.9	$P \leq 0.88(9)$	0.97(9.9)	Class 300
P2	$0.88(9) < P \leq 1.96(20)$	2.16(22)	Class 300
P3	$1.96(20) < P \leq 2.94(30)$	3.24(33)	Class 300
P4	$2.94(30) < P \leq 3.92(40)$	4.31(44)	Class 300
P5	$3.92(40) < P \leq 4.90(50)$	7.85(80)	Class 600
P7	$4.90(50) < P \leq 6.86(70)$	7.85(80)	Class 600

* However, in the case of P0.9(normal pressure: 0.9 MPa), existing supply stations provided with Class 150 valves may be provided with the same pressure rating valves.

* Valve Classes 150, 300, 600 and 900 mean Classes 150, 300, 600 and 900 in API 6D 7.2

3.1.3 Temperature

-29°C ~ +93°C (-20°F ~ 200°F): Operating temperature (ambient and fluid temperature)

3.1.4 Installation location

In exposed pipelines in supply stations (indoors and outdoors)

3.2. Specification of valves

The types and constructions of all ball valves shall satisfy the following requirements:

3.2.1 Type and construction of body

a) The valve bodies shall be of a split type (3 pieces) in principle.

However, for valves NPS 2 and under, 2 pieces are also acceptable.

b) Unless otherwise specified, all valves shall be of a full bore type specified in API 6D and the inside diameter shall be in accordance with API 6D, Table 1.0.

c) The end-to-end length shall be in accordance with API 6D Table 4.0. However, in the case of “welded end type” connection modes, pups or transition pieces of the following sizes shall be added to both ends of the weld joint type valves or the welding ends shall be manufactured with an extended length at each end to avoid any damage to the valve seat during field welding.

○ NPS 2 and under: 100 mm

○ NPS 3 ~ 8 : 150 mm

○ NPS 10 and over : 200 mm

d) Valve end connections

○ Flanged end type

- Class 900, 600: Ring & groove type flange

- Class 300, 150: Raised face (RF) type flange

- NPS 24 and under: ANSI B16.5

- NPS 26 and over: ASME B16.47, MSS-SP44

○ Welding end type

- Butt welding type in accordance with ASME B16.25 and B31.8.

The material and thickness of pipe to be connected to the valve shall be as follows or equivalent:

<Material and thickness of pipe to be connected to the valves>

(unit : mm)

Class	P8			P7,P5			P4, P3, P2	P0.9
Rating	Class 900			Class 600			Class 300	Class 300
Material O.D. (nominal diameter)	API 5L X-70	API 5L X-65	ASTM A53-B	API 5L X-70	API 5L X-65	API 5L X-42, Gr.B	API 5L Gr.B	API 5L Gr. B, ASTM A53 or A106
914.0 (36")	30.2	36.90	-		-	-	-	-
762.0 (30")	25.4	28.58	-	15.9	17.5	-	14.3	9.5
660.0 (26")	-	-	-	14.3	15.9	-	12.7	9.5
610.0 (24")	-	-	Sch 80	12.7	14.3	-	12.7	9.5
508.0 (20")	-	-	"	11.9	11.9	-	12.7	9.5
457.0 (18")	-	-	"		11.1	-	11.1	9.5
406.4 (16")	-	-	"		9.5	-	9.5	9.5
355.6 (14")	-	-	"		9.5	-	9.5	9.5
323.9 (12")	-	-	"		-	14.3	8.4	8.4
273.1 (10")	-	-	"		-	12.7	7.8	7.8
219.1 (8")	-	-	"		-	9.5	7.0	7.0
168.3 (6")	-	-	"		-	7.1	7.1	7.1
114.3 (4")	-	-	"		-	6.0	6.0	6.0
60.3 (2")	-	-	"		-	5.5	5.5	5.5
48.3~21.3 (1½~½")	-	-	XS		-	XS	XS	XS

e) The valve body NPS 6 and over shall be provided with a body pressure relief in the top quarter of the valve body. The setting point shall be of 0.8 times the hydrostatic test pressure of the body, and the following root valves shall be provided to the valves NPS 6 and over to install or remove relief valves as required.

- NPS 1 thick-walled stub (socket weld)
- NPS 1 vent pipe (material: as specified in Table-1)
- NPS 1 both-end-threaded ball valve
- NPS 1 relief valve

- f) A drain shall be provided at the lowest point of a valve NPS 4 and over.

Item	Ball Valve Size		Remark
	Above NPS 8	NPS 4, 6	
Thick-walled stub	NPS 1	NPS 3/4 or 1/2	Socket Weld
Drain pipe	NPS 1 (welded)	NPS 3/4 or 1/2	Socket Weld
Both end threaded ball valve	NPS 1	NPS 3/4 or 1/2	NPT
Screwed plug cap	NPS 1	NPT 3/4 or 1/2	NPT

* However, only to valves installed in process line and excludes PV and IV.

- g) The material of valve bodies shall be as follows:
- ASTM A350 LF2 or equivalent
- h) The body shall be of a double-sealed construction to prevent any external leakage, and the inside shall be provided with a resilient seal and the outside with a seal of non-combustible material.

3.2.2 Types and materials of ball valves

a) Type

The ball valve shall be of a trunnion type but floating type is acceptable for NPS 4 and under. (No hollow type ball shall be applied.)

b) Material

- ASTM A350 LF2 + (with 30μm or thicker chrome or nickel plating), or equivalent
- Hardness of plating: 700 Hv and over
- Measurement method: Micro-Vickers

3.2.3 Seat units and seats

- a) The shut-off type valves shall be bidirectional and capable of double block and bleeding in “open” position.
- b) The shut-off system of fluid shall be of a double piston effect type or an all tightening type.(However, in the case of the LNG terminal, a self-relieving type is acceptable and values NPS 4 and under shall conform to the manufacturer’s specification.)
- c) The material of the seat unit shall conform to “3.2.2 Types and materials of ball valves”, “b) Material”.
- d) Maintenance of seat tightness, and material and characteristics of seat
- The tightness of the seats of valves NPS 6 and over shall be maintained primarily by metal-to-metal contact and secondarily by the mechanically protected resilient seat.

- The resilient material shall be reinforced PTFE, Viton or equivalent materials of fluoro-elastomers (FKM/FPM) which are appropriate for the operating temperature in 3.1.3 and can be replaced, which do not cause any chemical or physical reaction with the fluid (specified in 3.1.1) passing through the valve to form adhesive materials which stick to the valve interior surface and hinder smooth valve operation.
- e) Tightness of a valve seat shall be achieved by a valve seat inserted with a resilient material which is forced by a spring and the fluid pressure to make uniform contact with the ball. When the seat is damaged by an external fire, the ball and the seat shall maintain metal-to-metal contact so as to minimize internal leakage.

3.2.4 Material of gland and stem and sealing

a) Material

○ Gland

- ASTM A350 LF2 + internal plating (ENP or hard chrome)
- Thickness and hardness of plating: 30μm and over, Hv 500 and over

○ Stem

- AISI 4140+ (30 μm or thicker chrome or nickel plating) or equivalent
- Surface hardness: Micro-Vickers hardness 500 HV and over

b) Sealing

- To prevent any leakage through the stem, a stem seal such as a gland packing and/or O-rings shall be installed.
- It shall be possible to replace the packing for stem sealing during operation.
- The sealing shall be of a double sealing construction to prevent any external leakage. The inside sealing shall be a resilient sealing and the outside sealing a sealing of non-combustible material.

- c) The surface of the stem shall be finished not to permit gas leakage through the stem and not to damage the sealing material.

3.2.5 Anti-static design

Anti-static design shall be adopted to the ball and stem and to the stem and body.

3.2.6 Bolts/nuts

- a) Material: ASTM A193 Gr. B7 / ASTM A194 Gr.2H or equivalent

- b) Strength: In the case of split type valves, the strength of bolts/nuts shall be equal to that of the end connection part or equivalent.

3.2.7 Operating mechanism

- a) The operating mechanism of the valve shall be a manual operation type, unless otherwise specified. Any valve NPS 4 and over shall be provided with a gear box.
 - However, valves NPS 4 and under may be manufactured in lever types, when required.
- b) The gear ratio and handle size of valves with manual operation mechanism shall be selected and manufactured so that valve travels can be made when the force of 196 Newton maximum is applied to the operating mechanism at a differential pressure the same as PURCHASER' nominal operating pressure of the valve.
- c) The manual operation mechanism may be fabricated with welded forged steel or cast steel. The valves shall sufficiently withstand the stress to be caused during their operation at their operating differential pressures.
 - Forged steel: ASTM A105 or equivalent
 - Cast steel: ASTM A216 Gr. WCC or equivalent
 - Cast iron: Pearitic ductile cast iron with a yielding stress of 38.0 kg/mm² or over
 - Carbon steel: ASTM A53, A106 or equivalent
- d) One valve travel time shall be within 5 times the NPS number (seconds) (Example: 10 ´ 5 = 50 sec. for NPS 10). However, if a specific valve travel time is specified, that specific travel time shall be observed.
- e) The motor actuator shall be able to repeat 30 starts/stops or more in 30 minutes at the operating pressure.
- f) All valves shall be provided with a locking device (locked-open and locked-closed) on the operating mechanism and Gland Plate(ISO 5211 Table 1, 2).
- g) An open/closed indicator shall be provided on the surface of the gear box or, in the case of an integrated type actuator, on the surface of the actuator, so that the open/closed state can be readily recognized from the ground level, and an indicator shall be installed on top for the operator to check on it at a distance. The specification of this indicator shall conform to GSD-2202 Standard for Identification Plate of Supply Station Equipment, Attachment 4.
- h) The handle shall be designed to be able to be attached on the opposite side (180°), depending on the site condition, and the strength of the stem shall be the same.
- i) The gear box shall be of a waterproof type of waterproof rating IP-56 or equivalent and be able to withstand external impacts.
- j) The gear ratio shall be marked on the nameplate of the gear box.

- k) In case valves are supplied without actuators, their stems shall be designed and manufactured so that actuators supplied by PURCHASER can be easily attached to them. (PURCHASER will supply the data on the actuator to the valve manufacturer.)
- l) The contractor shall provide PURCHASER with the torque value, diameter, and dimension of the key of each bare stem valve within 10 days after the contract so that PURCHASER can select the actuator.

3.2.8 Painting

a) Surface treatment

The surfaces shall be removed of foreign materials such as oil, grease, rust, and blasted with steel shots, steel grits or other equivalent abrasives to secure necessary roughness. The treated surface condition shall conform to SA 2 1/2 or over of ISO-8504-1.

b) External painting

Stage		Surface process method	Paint	Painting method	Coating Thickness (μm)
Surface Treatment	Metal Surface of Equipment	A1+A10	-	-	-
	On-Site Welding Parts	A3+A13	-	-	-
Primer(Epoxy Zinc)		-	B2	C2 or C4	65
Secondary Coat(Epoxy)		-	B13	C4+C5	125
Third Coat(Urethane)		-	B5	C1+C2+C4	50
Total					240

※ Refer to GSD-2206 Standard for facilities painting in Governor Stations.

Stage	Type	Content	Standard applied
Surface Process method	A1	Solvent clean(per section 5.3.5 in the case of S.S. surface)	SSPC-SP1
	A3	Power tool clean	SSPC-SP3
	A10	Near white blast clean	SSPC-SP10
	A11	Vacuum blast with portable equipment to equivalent standard used on adjoining surfaces	-
	A13	Remove remaining detrimental weld flux deposits	SSPC-SP1
Paint (thickness, color)	B2	Two pack organic zinc rich polyamide cured epoxy primer	65μm, Metallic gray
	B5	Two pack aliphatic urethane	50μm, As data sheet
	B13	Two pack polyamide cured high build	125μm,

		epoxy/M10	Silver grey
Painting method	C1	Paint shall be brush applied	
	C2	Paint shall be air spray applied	
	C4	Airless or high pressure spray applied	
	C5	Spot clean and touch-up damaged areas(*)	

* Note) For C5 where spot clean and touch-up of damaged areas of galvanized surfaces and shop applied inorganic zinc silicate coating(B1) is involved, use organic zinc rich polyamide cured epoxy primer(B2) for operating temperatures up to 150°C, and limit the use of inorganic zinc silicate(B1) to surfaces having an operating temperature in excess of 150°C.

- a) Paint color : Munsell No. 7.5GY 5.5/1
- b) Color both ends of welded parts with anticorrosive paint
- c) Pin hole, crack, and peeling off should be absent when painting
- c) Internal coating

After hydrostatic test is completed, the interior surfaces shall be removed of all foreign materials and sprayed with anti-rust oil which does not have any chemical or physical reaction with the fluid in Article 3.1.1.

- d) Machined surfaces

Machined surfaces shall be applied with grease for rust prevention and flange faces shall be applied with anti-rust oil spray.

- e) The contractor shall submit detailed painting specifications for all painting works for the purchaser's approval prior to the painting.
- f) Others shall conform to the manufacturer's specification.

3.2.9 Emergency sealing fitting

- a) Valves NPS 6 and over shall be provided with 1/2"(Seat, NPT), 1/4"(Stem, NPT) sealant injection fittings in the valve stem and near the valve seat to prevent gas leakage through the valve seat and stem gland to the outside.

The threaded length of the fitting for attachment shall be 13 mm (1/2") and over. The emergency sealing fitting shall be designed and manufactured as the secondary sealant system which can stop gas leakage at the working pressure.

- b) Sealant injection fittings shall be designed and manufactured with a suitable material so that they can be safely attached to valves and shall not abrade the valve body when detached. Bottom head type sealant injection fittings shall be adopted which are fabricated in an integral type and provided with a safety vent cap and a threaded cage.

- c) A ball type 3/8"(NPT) check valve, which can be easily disassembled, shall be provided downstream of the sealant injection fitting on the valve body for easy maintenance when the sealant injection fitting leaks. (See Attachment 2.)
- d) The numbers of sealant injection fittings are 1 for the stem and 4 for the body (2 for upstream side and 2 for downstream side).

4. TEST AND INSPECTION

4.1 Classification of tests and inspection

The following tests and inspections shall be performed at the contractor's factory under his own responsibility:

No	Test and Inspection Item	Contractor	Purchaser	Remark
1	Chemical analysis for material	O	*	
2	Mechanical test	O	*	
3	Radiographic test	O	*	
4	Magnetic particle or dye penetration test	O	*	
5	Ultrasonic inspection	O	*	
6	Heat treatment analysis	O	*	
7	Macro etching	O	*	
8	Dimension inspection	O	Δ	
9	Visual inspection	O	Δ	
10	Hydrostatic & pneumatic test	O	Δ	
11	Painting inspection	O	Δ	
12	Operating test with motor or hydraulic actuator	O	Δ	
13	Plating (ENP or Cr)	O	*	
14	Sealing materials(O-ring, gasket, graphite)	O	*	
15	Antistatic Test	O	Δ	

Δ : witness (all valves: 100%)

o : submittal of documents and performance

* : check by documents

4.2 Test of materials

Mill certificates of major parts (such as body, ball and stem) specified with the results of chemical analyses and mechanical strength tests shall be submitted and the test results shall satisfy the requirements of the relevant specifications.

4.3 Nondestructive tests

a) The base metals (body, closure, stem, and ball) of all valves shall undergo

ultrasonic test (UT) (or radiographic test (RT: All valves more than 900# Rating shall be applied) and liquid penetrant test (PT) (or magnetic particle test (MT)) in accordance with ASME/ANSI B16.34 Chapter 8, and the acceptance criteria shall conform to: for RT, Mandatory appendice I, for UT, Mandatory appendice IV, for MT, Mandatory appendice II, and for PT, Mandatory appendice III.

b) Radiography test shall be performed on all welds of all valves accessible for such a test in its configuration including pipe seams in accordance with ASME SEC.V. (or ASME B 16.34 chapter 8) (Acceptance criteria shall conform to ASME SEC. VIII.)

c) Other welds and machined base metals shall undergo MT or PT.

Welds shall be tested in accordance with ASME Sec. V and the acceptance criteria shall conform to ASME Sec. VIII Div.1.

Machined base metals shall be tested in accordance with ANSI B 16.34 Chapter 8, while the acceptance criteria shall conform to : for PT, ASME B 16.34 Mandatory appendice III, and for MT, ASME B 16.34 Mandatory appendice.

d) All end parts to be welded to pipes in the field shall undergo UT in a width of 70 mm. (The acceptance criteria shall conform to ASME B 16.34 Mandatory appendice IV.

4.4 Dimensional check

Dimension check shall be performed on all manufactured valves, and the major dimensions shall be checked if they conform to the corresponding specification or the manufacturer's drawings

4.5 Appearance inspection

Machined surfaces shall be free from any harmful dent, sharp scratch and protrusion, and levers or hand-wheels shall be operated smoothly.

4.6 Inspection of heat treatment

Inspection of heat treatment shall be performed in accordance with related codes and standards. Heating temperature, heating method, heating time, holding time, cooling rate and cooling method shall be recorded in the heat treatment specification. The temperature of each point shall be recorded with a recorder and the record sheets shall be submitted to the purchaser.

4.7 Plating inspection

a) Inspection of the hardness and thickness of plated parts (ball, seat, gland and stem) shall be performed in accordance with relevant specifications and the

plating procedure (specification) submitted by the manufacturer, and its inspection and test reports shall be submitted.

- b) In the case of non-electrolytic nickel plating, the content of phosphorous (P) shall be 10 % or over (weight ratio).

4.8 Intermediate Inspection

PURCHASER (or its third-party inspector) is shall conduct the following witness test within 10 % of each manufacturing lot for major parts such as balls, seats and sealant, etc.:

- Whether the parts are designed fire-safe,
- Roundness of balls and their plated condition,
- Shape of seats and their plated condition,
- Assembly property of sealing materials and their changes in volume, etc.

4.9 Inspection of Sealing materials

O-rings, gaskets and graphite including seat sealing shall be checked to confirm they conform to their specifications submitted by the contractor, and the manufacturer's mill-certificate, along with a report from an official testing agency for each item shall be submitted.

4.10 Operation test

- 4.10.1 The operation test of completed valves shall be performed 3 times or more. The first test shall be performed without any pressure and the remaining 2 tests shall be performed in pressurized conditions.

- 4.10.2 The operating condition of a valve at the differential pressure shall be checked by applying the operating pressure on each of upstream and downstream sides and then by simultaneously applying the operating pressure on both sides. The torque values and time required for the operation shall be recorded in the test report and submitted to the purchaser.

- 4.10.3 When a manual valve is tested, the test may be performed with a spare motor actuator.

4.11 Shell hydrostatic test

All completed valves shall be hydrostatic-tested. The test shall be conducted with

the ball kept in a partially open condition and in accordance with API 6D, Table 10.3, Hydrostatic Shell Test, and the valves shall be free of any abnormal stress phenomenon and leakage.

4.12 Shell pneumatic Test

The test medium shall be either nitrogen or air. The ball shall be kept in a partially opened condition to perform the test and there shall be no leakage in any external valve surface. The test pressure shall not be less than 1.1 times the pressure specified in ASME B 16.34, Table 2-1.1 and the holding time shall conform to API 6D B.4.3.

4.13 Pneumatic test of valve seats

4.13.1 High-pressure test

High-pressure pneumatic test on valve seats shall be performed by means of nitrogen or air in full-open and full-closed conditions and shall be checked if there is any leakage. In the full-open test, both ends of the valve shall be closed and leakage shall be checked at the drain valve. In the full-closed test, each end of the valve shall be closed in turn and pressure shall be applied to check leakage at the drain valve and on the other side. After this test is performed at both ends in turn, the pressure shall be applied on both sides at the same time to check leakage at the drain valve. The test pressure and its holding time shall conform to API 6D, B.4.2 and API-STD 598 shall be referred to for others.

4.13.2 Low-Pressure Test

All valves shall be tested at a test pressure of 0.6~0.7 MPa (6~7kg/cm²) for the duration of Seat Test Duration in API 6D, Table 11

4.14 Construction Test of Double Piston Effect (DPE) Type (or All Tightening Type)

- a) Valves to be tested: All valves of DPE construction
- b) Test pressure: Operating pressures of valves
- c) Test medium: Air or nitrogen
- d) Test method: To pressurize the valve (body cavity) in full open and full closed conditions through its drain valve and to check the leakage at both ends.
- e) Test time: Seat test duration in API 6D, Table 5.4 or longer
- f) Acceptance criteria: No leakage

g) Timing of test: After completion of operation test

4.15 The results of hydrostatic tests and pneumatic tests shall be submitted in the form of the record chart recorded by an automatic pressure recorder.

4.16 Fire Safety Design and Test

The parts shall be of a fire safety design, and the test may be replaced with the certificates of API 607 and API-6FA.

4.17 Relief Valve Test

Valves 6" and over shall be provided with relief valve(s) and the test report on the set pressure shall be submitted.

4.18 Disassembly Test (in the case of leakage)

The valves which have leaked during their test(4.10 ~ 4.14) shall be disassembled and the followings shall be inspected in the presence of PURCHASER or its third party inspection agency:

4.18.1 Visual inspection

Major parts (body, ball, seat, stem, bolts/nuts, and others) of the valve shall be checked if they have any harmful scratch, sharp cut, crack, or extrusion.

4.18.2 Dimensional check

Major parts (body, ball, seat, stem, bolts/nuts, and others) of the valve shall be checked if they conform to their manufacturing drawings.

4.18.3 Pressure test and operation test

Disassembled valves shall undergo the tests in 4.7, 4.8, 4.9, 4.10, 4.11, 4.12, 4.13 and 4.14 after their reassembly.

4.19 The contractor for bare stem valves shall perform on bare stem valves all the tests that ordinary valves undergo (excluding actuator test) and have them approved by Korea Gas Safety Corporation.

4.20 Electrostatic Performance Test

The electric resistance between the ball and the stem and between the stem and the body shall not exceed 10Ω. The test method and procedure shall conform to

API-6D B.5.

5. OTHERS

- 5.1 Valves shall be packed in wooden boxes to avoid any damage to them.
- 5.2 Valve handles shall be fixed in the open position of the valves.
- 5.3 The end openings of all valves shall be covered with plastic or metal caps to prevent any damage, corrosion and ingress of foreign materials during transportation and storage.
- 5.4 All valves including bare stem valves shall be inspected and stamped by Korea Gas Safety Corporation. Imported valves shall be stamped in accordance with the following procedure :
 - Inspection reports of imported valves shall be submitted to Korea Gas Safety Corporation(KGS)
 - Test and inspection(inspection location: KGS or other places designated by KGS)
- 5.5 The approved manufacturers shall be limited to those bestowed of API monogram.
- 5.6 Documents To Be Submitted by Contractor
 - 5.6.1 The contractor shall submit the documents listed in Attachment 1 upon the purchasing department's request.
 - 5.6.2 All drawings, certificates, inspection records, and operation and maintenance manuals (in Korean or in English) to be submitted by the contractor shall be prepared in computer files and submitted in the forms of diskettes, tapes or C/D ROMs.
 - 5.6.3 Correction and submission of documents
 - a) Documents to be corrected according to PURCHASER comments shall be corrected and submitted within 15 days after receipt of such comments.
 - b) The procedure for document correction is the same as that for document approval.
 - c) If documents are in error or flawed, correction may be made in mutual consultation.
 - d) The contractor shall be responsible for problems arising from any delay in

submission of documents.

- 5.7 All ball valves of NPS 6 and over shall be provided with lugs for lifting and legs for supporting. Drawings with dimensions of lifting lugs and supporting legs shall be submitted for PURCHASER' approval.
- 5.8 The contractor shall submit the drawings specified with materials and dimensions to the purchaser prior to manufacturing valves.
- 5.9 The marking of valves shall conform to API 6D 13.

ATTACHMENT 1. LIST OF SUBMITTAL DOCUMENTS[example]

(Subject to change depending on the contract)

No	Submittal	After Contract		Submittal Due Date for Approval
		For App.	For Final	
1	Supplier Certificate (Included Manufacturer Certificate)	5C	10C	Within 15 Days after Contract Agreement
2	Bidding Certificate (Fire Safe Certificate, Evidence Of Job Experience)	5C	10C	"
3	Manufacturer Brochure	5C	10C	"
4	Manufacture & Inspection Equipment List		10C	"
5	Fabrication, Design, Inspection Schedule	5C	10C	"
6	Manufacturing Specification	5C	10C	"
7	Assembly Drawing Showing Material, Dimension, Cv(Flow Coefficient) & Weight, Spare Part List & Spec (Included Drawing for Grease Fitting Sets Part, Gland Packing, Support Legs, Lifting Lugs, End Connection Part, Stub Connection Part, Drawing FOR Stem Diameter, Gear Box, Gear Ratio)	5C	10C	"
8	Each Accessories Specification and Quantity	5C	10C	"
9	Inspection Procedure	5C	10C	"
10	WPS & PQR, Welding Repair Procedure	5C	10C	"
11	Plating(ENP & CR) Procedure & Specification	5C	10C	"
12	QC/QA Manual	5C	10C	"
13	Painting Specification	5C	10C	"
14	Test and Inspection Specification	5C	10C	"
15	Installation Manual	5C	10C	"
16	Operation and Maintenance Manual (Included Assembly, Disassembly Drawings)	5C	10C	"
17	Packing and Transportation Specification	5C	10C	"
18	Nameplate Specification	5C	10C	"
19	Strength Calculation Sheets(Body, Closure, Stem, Bolt)	5C	10C	"
20	Supply List for Applicable Codes and Standards	5C	10C	"
21	Repair Specification and Manual	5C	10C	"
22	O-ring(Included Seat Sealing), Gasket, Graphite Specification	5C	10C	"
23	Gear Box Detail DWG	5C	10C	"
24	Specification, Certificate of Heat Treatment and Plating (Body, Ball, Stem)	5C	10C	at delivery time

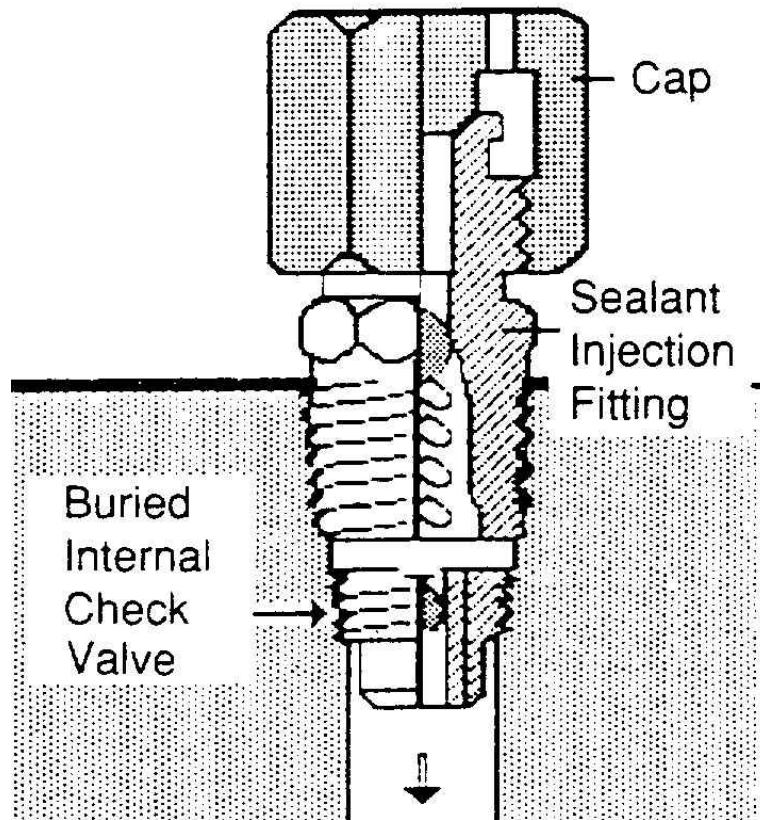
25	Specification and Certificate of O-ring	5C	1OR +9C	"
26	Test Certificate (Report)	5C	1 OR + 9C	"
27	The Others Requested Drawings and Documents by Purchaser (ex. Gear Box Drawing & Materials)	5C	10C	at Requirement

* C : Copies

* Documents in Nos 24, 25, and 26 are to be submitted to KOGAS QA/QC Department. In the case of the document in No.26, the original (for approval, 1 original) shall be submitted in principle. In an unavoidable case, a copy collated with the original may replace the original.

* Modification of Certificate not allowed.

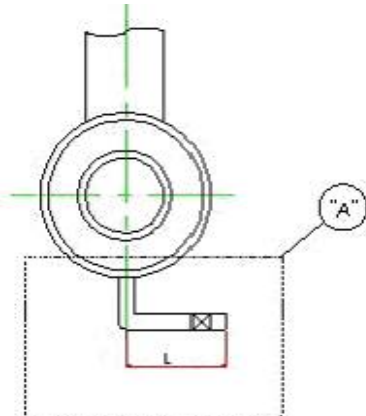
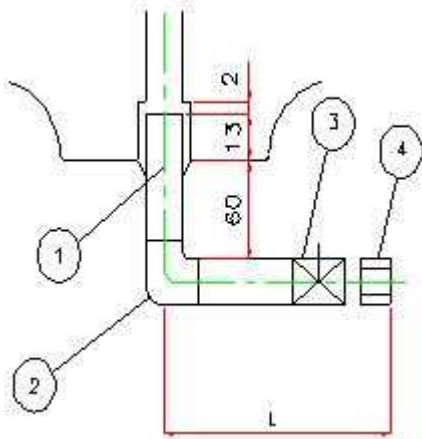
ATTACHMENT 2. EMERGENCY SEALING FITTING (EXAMPLE)



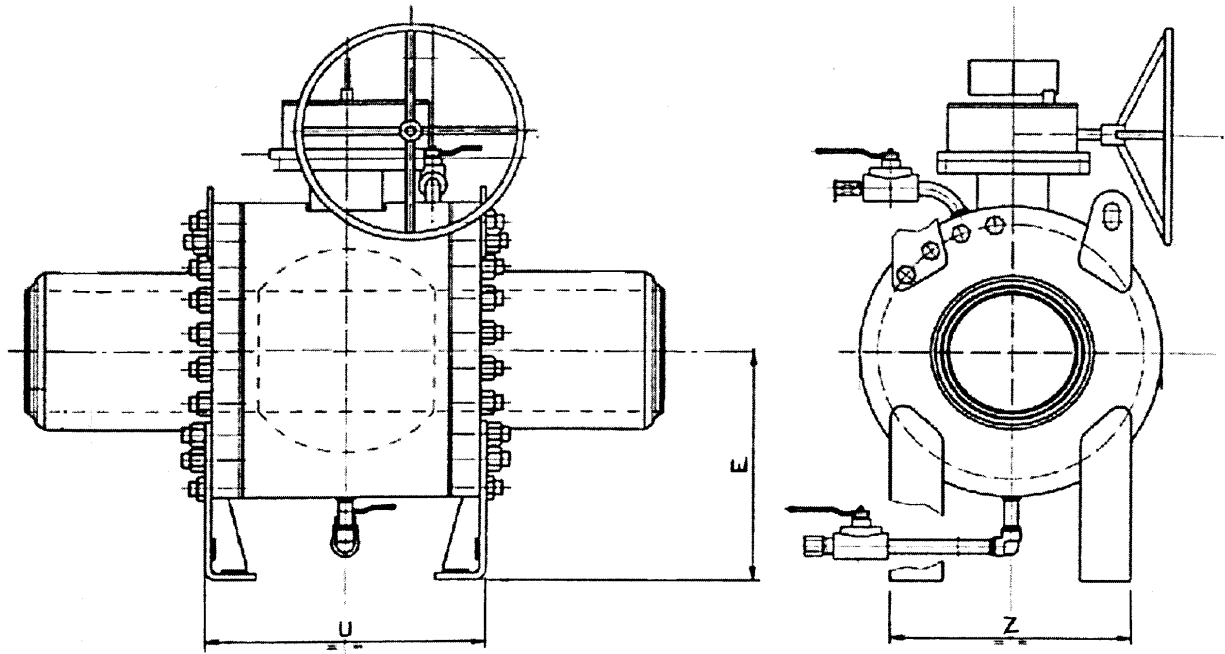
ATTACHMENT 3. FORM OF VALVE BM LIST

No	Station	Valve NO	Size	QT'Y	Oper.	Body Type	Pres.	Rating	End Type	Remark

ATTACHMENT 4. DRAWING OF DRAIN VALVE

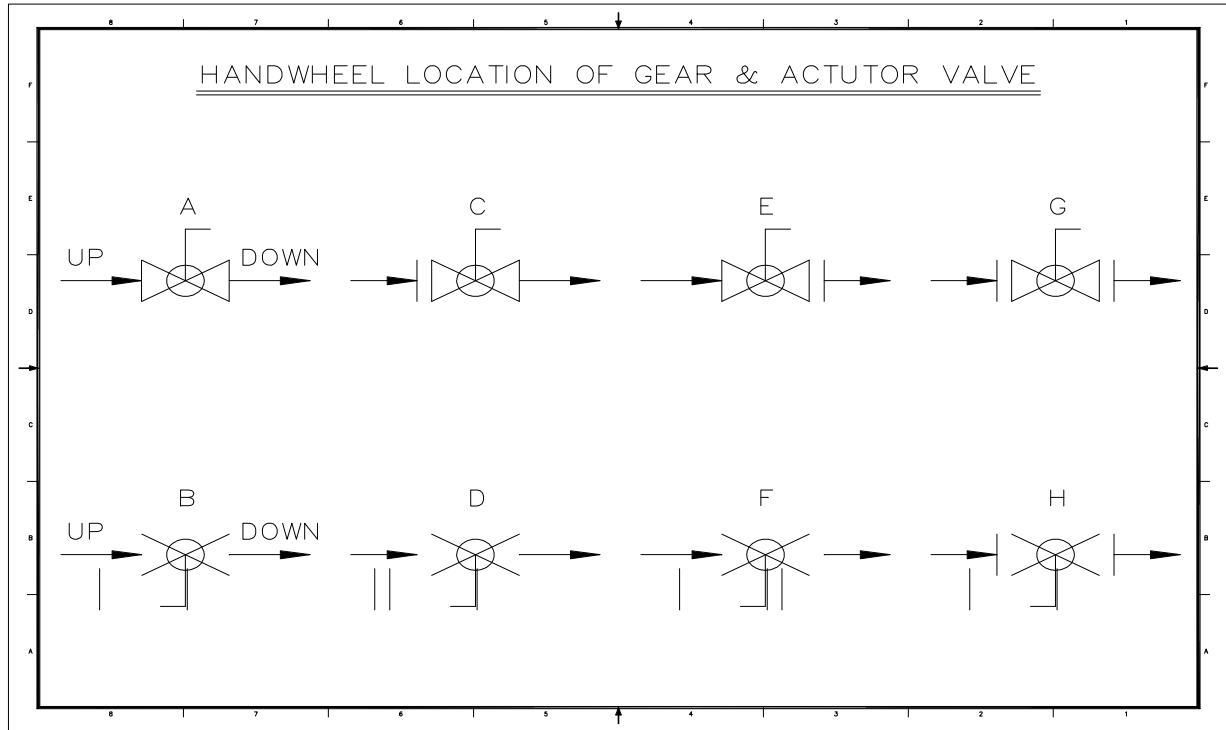
			
<p>DETAIL "A" (Reference)</p> 	Size (inch)	L (reference)	Remark
	30	520	$L = \text{Body 외경}/2$ $- \Delta \ell$ $\Delta \ell:$ o 24 ~ 30 : 100mm o 16 ~ 20 : 50mm o 8 ~ 14 : 30mm o 6 : 0 <example> 30" L= 1240/2-100 = 520 20" L= 860/2-50 = 380
	26	450	
	24	400	
	20	380	
	18	340	
	16	290	
	14	290	
	12	260	
	10	210	
	8	180	
	4	130	

ATTACHMENT 5. DIMENSION TABLE AND DRAWING OF SUPPORT LEG

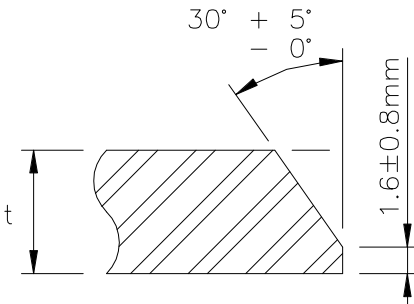
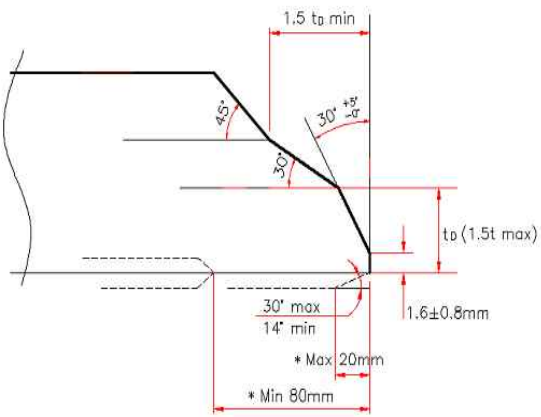


SIZE	TYPE	E(Exact)	U(MAX)	Z(MAX)	WEIGHT(MAX)	REMARK
30"	MOV, GEAR, HYDRAULIC	800	1164	1036	9700	
26"	"	750	1095	900	6250	
24"	"	683	950	905	5315	
20"	"	610	807	735	3400	
18"	"	550	760	700	2730	
16"	"	530	730	590	2070	
14"	"	455	614	540	1310	
12"	"	423	570	450	1176	
10"	"	380	546	430	881	
8"	"	320	440	394	510	

ATTACHMENT 6. HANLDE ORIENTATION



ATTACHMENT 7. BEVEL END

When the thickness of the pipe to be welded is the same as that of the valve end	When the thickness of the valve end is thicker than that of the pipe to be welded
 <p style="text-align: center;">Tolerance for Inside Diameter : $\pm 0.8\text{mm}$</p>	 <p> t : thickness of pipe to be welded Inside diameter tolerance: $\pm 0.8\text{mm}$ t_d : valve edge thickness </p>

8. VALVE LIST