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<div> <div>TECHNICAL SPECIFICATION FOR</div> <div>MOTOR OPERATED VALVE (BALL TYPE)</div> </div>						
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## 1. SCOPE

This specification applies to the design, manufacture, test and inspection of all electric motor actuators & valves in the natural gas supply stations.

## 2. CODES AND STANDARDS

The following codes and standards referred to in this specification shall be their latest editions before the contract. Any item inconsistent with this specification shall be approved by Owner/Purchaser before the actuators are manufactured.

### 2.1 International Electro technical Commission (IEC)

- IEC 60034 Rotating Electrical Machines
- IEC 60079 Electrical Apparatus for Explosive Atmospheres
- IEC 60529 Degrees of Protection Provided by Enclosures

### 2.2 American Petroleum Institute (API)

- RP 505 Recommended Practice for Classification of Locations for Electrical Installations at Petroleum Facilities as Class I, Zone 0, Zone 1, Zone 2
- Section 4 Classification Criteria
- Section C Recommendations for Determining Degree and Extent of Classified Locations at Petroleum Pipeline Transportation Facilities

### 2.3 Korea Gas Safety Code (KGS Code)

- GC 201 Explosion-proof Electrical Equipment of Gas Facilities

### 2.4 Technical Standards for Electrical Facilities and Standards of judgment

### 2.5 Korea Standards (KS)

- B 2823 Electric actuator for industrial valves - General requirements
- C IEC 60034-1 Rotating electrical machines - Part 1 : Rating and performance

## 3. GENERAL

### 3.1 The following units shall be used unless otherwise specified in this specification:

- Gage pressure : MPa ( $\text{kg}/\text{cm}^2$ )
- Temperature :  $^{\circ}\text{C}$
- Differential pressure : kPa or MPa( $\text{mmH}_2\text{O}$ ,  $\text{kg}/\text{cm}^2$ )
- Torque : N-m. kg-m
- Rotational speed : rpm

## 4. TECHNICAL SPECIFICATION

### 4.1 Specification

- 4.1.1 The actuator shall be appropriate to be used with the electric power of AC, 3-phase, 460V, 60Hz.
- 4.1.2 The motor shall be of a 3-phase AC induction type with high starting torque, constant speed, lubricant-injection ball bearings and insulation class value "F" or over.
- 4.1.3 The motor shall be designed so that its performance can be maintained without any trouble in the following voltage fluctuation:
  - a) Starting : AC 460V, +10%, -15%
  - b) Operation : AC 460V,  $\pm 10\%$
- 4.1.4 The contractor shall supply terminal strips marked with easily identifiable electrical elements. Power cables and control cables shall be separated from each other and separately insulated. The internal control cables shall be high-class PVC-insulated cables and each cable shall be marked with a number and its minimum rating shall be a minimum of 10A. The power cables shall be suitable for the motor capacity and their terminations shall be easy for maintenance.
- 4.1.5 The actuator shall be provided with a self-regulating power supply system not to need to impress a separate power source for control from the outside. Especially, it shall not require a power source for remote display and control.
- 4.1.6 The actuator shall be provided with electric circuits to monitor and output various actuator troubles such as motor trouble, power source trouble, local operation, excessive torque, etc. However, the external output shall be of a relay output and dry contact mode.
- 4.1.7 Electric circuits (electric contacts) shall be provided to remote-display that the actuator is in operation and the electric contacts shall be of a dry contact type.
- 4.1.8 All electric components shall be of an explosion-protected type to be used even in Zone 1 areas and manufactured in a weatherproof enclosure type. (Exd, IIB, T3 or more, IP-65)
- 4.1.9 The complete electrical system shall be designed for continuous and reliable service, safety of personnel and equipment, ease of maintenance and operation, interchangeability of equipment. The equipment installed in hazardous location

shall be approved or certified by the appropriate such as KOSHA(Korean Occupational Safety & Health Agency), KGS(Korean Gas Safety Corporation) or KTL(Korea Testing Laboratory).

#### 4.1.10 Safety Certification

The equipment installed in hazardous location shall be obtained Safety Certification from KOSHA (Korea Occupational Safety & Health Agency), KGS (Korea Gas Safety Corporation), or KTL (Korea Testing Laboratory) under article 34 of Occupational Safety and Health Act.

### 4.2 Structure

#### 4.2.1 The actuator shall consist of the following parts:

- a) Motor
- b) Reduction gear
- c) Thrust bearing
- d) Hand-wheel
- e) Local position indicator
- f) Reversible motor starter
- g) Transformer
- h) Torque switch, limit switch and operation switch
- i) Motor thermostat
- j) Space heater for moisture removal from the inside
- k) PCB for sequence and protection circuits
- l) Auxiliary circuits for remote control and display
- m) Operation switch for local operation

#### 4.2.2 The actuator shall be operable at any installation angle and the hand-wheel for local operation shall be assembled to be operated and monitored at any time regardless to the angle of the valve.

#### 4.2.3 The state of the actuator shall be indicated with an indicator or a lamp.

#### 4.2.4 The gear assembly shall be of an enclosed type and be applied with lubricant.

#### 4.2.5 Limit switches shall be installed at both ends of valve open/close directions for remote display and control. Limit switches and auxiliary limit switches shall be installed inside the actuator to local-display the valve open/close state and the valve open/close operation in addition to their remote transmission.

#### 4.2.6 In order to prevent the electric driver from tripping when the load torque rises excessively, an open/close torque switch shall be provided.

- 4.2.7 The torque switch shall be capable of changing the amount of torque according to the required torque of the valve.
- 4.2.8 When the valve is in trouble during its operation and the torque switch is tripped, the electric driver shall not be operated to protect the motor even though the same signal is continuously input. When the motor is started in a reverse direction, the torque switch shall be automatically reset.
- 4.2.9 A mechanical dial indicator shall be provided to the gearbox or to the actuator to indicate whether the valve is full open, full close or in an intermediate position.
- 4.2.10 The hand-wheel shall be provided with an automatic relaxation device to prevent its mechanical damage when the driver of the actuator is in operation.
- 4.2.11 When a hand-wheel is turned clockwise, the valve shall be closed.
- 4.2.12 The terminal blocks shall be manufactured in a design to prevent electric components from being exposed and to maintain a sealing state when they are wired in the field.  
In addition, electric parts shall be sealed with a terminal box and o-rings, and power terminals shall be separated by insulation covers.
- 4.2.13 Separate grounding lugs shall be provided inside and outside the actuator for its grounding.

#### 4.3 Performance

- 4.3.1 The actuator shall be capable of opening and closing the valve at the maximum differential pressure and temperature specified in this specification.
- 4.3.2 The opening and closing speed of an actuator shall be applied within the time period (seconds) of the NPS (Nominal Pipe Size) multiplied by 5 (example; in the case of NPS 10 valve,  $10 \times 5 = 50$  seconds), unless otherwise specified. (Refer to ATTACHMENT #2)
- 4.3.3 The actuator shall not be in trouble because of its very rare operating interval (about once a year).
- 4.3.4 The torque switch, limit switches and auxiliary limit switches shall be easily adjustable without any special tool. The repeatability of those switches shall be within 5 % of the setting value.
- 4.3.5 The hand-wheel shall be capable of sustaining hammer-blows so that the valve can

be used even when jammed.

- 4.3.6 The actuator shall be provided with a braking system and a manual operation system and its opening and closing speeds shall conform to the operation requirements.
- 4.3.7 The motor winding shall be provided with one or more winding temperature detectors to automatically disconnect the driver circuit when the motor is overheated.
- 4.3.8 The actuator shall be provided with a self-hold circuit to make itself operate or stop by the pulse input to the electric contact point even in “remote operation” in the same way as in “local operation.”  
At this time, an electric contact point with a rating of DC 24 V or under or a semiconductor switch element may be used as the external electric contact point.
- 4.3.9 All driving shall have a minimum repeatability that is 0.5 % of total trajectory and the hysteresis effect shall not exceed 1.0 % of total trajectory.

#### 4.3.10 Painting

Electro-static powder paint shall be applied after 2 or more coats of anticorrosive primer on the surface removed of rust. The color shall be green gray (Munsell No 7.5 GY 5.5/1)


## 5. TEST AND INSPECTION

### 5.1 Factory Test


Factory test shall be conducted in the presence of inspectors or in the presence of its appointed agents or as the manufacturer’ s self test according to the instruction of Purchaser.

#### 5.1.1 Appearance test

#### 5.1.2 Insulating resistance test

The insulating resistance value shall conform to the value specified in the Technical Standard for Electrical Facilities, **Article 52.** 

#### 5.1.3 Insulating strength

The electrical facilities shall pass the test prescribed in the Technical Standard for Electrical Facilities **and Standards of Judgment, Article 13.** 

#### 5.1.4 Enclosure construction test [explosion-proof and waterproof performance test (to be replaced with certificate issued by the authorized approval agency in KOREA)] ex. KOSHA, KGS, KTL

#### 5.1.5 Performance test

The contractor shall conduct the following self-tests and have them approved by Owner/Purchaser and submit the reports on those self-tests:

- a) Operating test
- b) Output test
- c) Local indicator, lamp test
- d) Operation time check
- e) Protect circuit test of phase absence, phase reverse
- f) Temperature rise test
- g) Efficiency, power factor test
- h) Locked rotor current test
- i) Remote operation test
- j) Alarm output test
- k) Position transmitter output test
- l) Switch repeatability test( $\pm 5\%$ )
- m) Operating test
  - 1) Minimum repeatability( $\pm 5\%$ )
  - 2) Hysteresis effect( $\pm 1\%$ )

## 5.2 Field Test

5.2.1 When an actuator and a ball valve are assembled together and installed in the field, the contractor shall conduct field test and test operation during the period mutually agreed on with Owner/Purchaser in accordance with the plan submitted by the contractor. The test shall include at least the followings:

- a) Performance test of each MOV (The test sheets shall be submitted by the contractor to define the test method and procedure and to record the test results.)
- b) Link test of each MOV and another facility supplied by another contractor of Purchaser (The test sheets shall be submitted by the contractor to define the test method and procedure and to record the test results.)
- c) Reliability test of each MOV

5.2.2 All instruments and tools required for the field test and test operation shall be provided by the contractor.

5.2.3 Owner/Purchaser shall notify the test date and test location to all related contractors prior to the test.

5.2.4 Owner/Purchaser may offer assistance necessary for the test and test operation.

5.2.5 The contractor shall restore equipment and parts damaged during the test due to the contractor's fault at his cost.



## 6. OTHERS

### 6.1 Spare Parts

The contractor shall recommend the details of spare parts necessary for operation up to one year after performance guarantee period and submit the spare part list.

### 6.2 Manufacture Witness and Supervision

Owner/Purchaser is entitled to supervise and witness the manufacturing process to check if the actuator is manufactured in accordance with the technical specification and to conduct quality inspection of its overall design and manufacture. The contractor shall offer facility for the purchaser in various tests and inspection and cooperate with the purchaser when tests and inspection are requested.

### 6.3 Packing and Transportation

6.3.1 The contractor shall pack the materials safe and solid not to be lost or broken and shall be held responsible when the materials are lost, broken or degraded due to improper packing.

6.3.2 Machined equipment shall be appropriately protected from rust and corrosion by applying paint in accordance with the approved technical specification.

6.3.3 The contractor shall submit the procedure for field storage and handling.

### 6.4 Submittal Documents of Contractor

6.4.1 The contractor shall submit the documents listed in ATTACHMENT #1.

6.4.2 Within 7 days the contractor shall prepare and submit again the documents submitted by the contractor for approval and corrected or commented on by Owner/Purchaser.

6.4.3 When errors or mistakes are found in the documents or drawings approved by Owner/Purchaser, those errors and mistakes shall be corrected and settled in mutual consultation.

6.4.4 When installation drawings or assembly materials have to be corrected because of incorrect interpretation of drawings, schedules or specifications, those corrections shall be made at the contractor's cost.

6.4.5 All reference data related to the drawings for approval shall be submitted together with the drawings for approval.

6.4.6 The contractor shall be responsible for various problems arising from the delay

of document submission and Owner/Purchaser is entitled to take necessary measures against them.

## 6.5 Warranty

The contractor shall warrant all equipment and materials against the following defects in addition to the performance guarantee specified in the technical specification:

6.5.1 In accordance with this specification, the contractor shall warrant all equipment and materials against the following defects from their delivery date and shall repair them at the contractor' s cost or compensate for them:

- Defects due to improper selection of raw materials
- Defects due to poor materials
- Defects due to poor manufacturing technology
- Defects due to poor design

## 6.6 Contractor' s Observance

6.6.1 The contractor shall comply with the purchaser' s instructions unless an objection is formally lodged and shall be responsible for all materials used for the functioning of the actuator and all other delivered facilities (materials supplied by the suppliers or by the manufacturers of the parts) and Owner/Purchaser may take necessary actions against them.

6.6.2 When there is any disagreement in the interpretation of this specification or its correction is required, such disagreement or correction may be adjusted in mutual consultation.

## ATTACHMENT #1. SUBMITTAL DOCUMENTS

NO	Document	For BID	After Contract		Submittal Due Date For Approval
			For Approval	For Final	
1	Vendor Document List & Schedule		5C	10C	15 days after contract agreement
2	Manufacturing Schedule		5C	10C	"
3	Progress Report(Monthly)		5C	10C	"
4	Utility Consumption List		5C	10C	"
5	Deviation List, if any	2C	5C	10C	"
6	Sub-Vendor List		5C	10C	"
7	Technical Catalog Information	2C	5C	10C	"
8	Spare Parts for Construction / Commissioning	2C	5C	10C	"
9	Spare Parts for Two(2) years operation (as an option)	2C	5C	10C	"
10	Special Tool List, if any	2C	5C	10C	"
11	Manufacturing specification	2C	5C	10C	"
12	Outline drawings showing material, dimension and weight	2C	5C	10C	"
13	Internal connection diagram and Schematic diagram, Wiring diagram		5C	10C	"
14	Terminal block diagram		5C	10C	"
15	Design calculation sheet - Output torque - Operating time - Locked Rotor current		5C 5C 5C	10C 10C 10C 10C	"
16	Data sheet	2C	5C	10C	"
17	Operating and maintenance Manual		5C	10C	"
18	QA/QC plan		5C	10C	"
19	Test and inspection Procedure		5C	10C	"
20	Test certificate - Test Certificate for The Explosion Proof Enclosure Issued By an Authorized Test Agency - Factory Test Report - Others	2C	5C  5C	10C  10C	At supply time
21	Other documents requested by purchaser		5C	10C	15 days after contract agreement

## ATTACHMENT #2. DATA SHEET

PROJECT NAME : ULSAN CLX METERING STATION				MOTOR OPERATED VALVE DATA SHEET (AC)						
CLIENT : SK ENERGY										
CONTRACTOR :										
CONTRACT NO. :										
VALVE NO.		MOV-11A		ENCLOSURE		<input checked="" type="checkbox"/> FLAME PROOF <input checked="" type="checkbox"/> WEATHER PROOF(IP-65)				
SERVICE		-		LOCATION		<input type="checkbox"/> INDOOR <input checked="" type="checkbox"/> OUTDOOR				
QUANTITY		1		E.H.A.C		Zone 1, Exd, IIB, T3 or MORE				
SPECIFICATIONS OF VALVE	TYPE OF VALVE		<input type="checkbox"/> GATE <input checked="" type="checkbox"/> BALL <input type="checkbox"/> GLOBE <input type="checkbox"/> BUTTERFLY <input type="checkbox"/> NEEDLE		SPECIFICATIONS OF ACTUATOR	TYPE				
	NOMINAL SIZE		16 (INCH)			RATIO(GEAR)				
	CONNECTION		<input type="checkbox"/> JIS FLANGE <input checked="" type="checkbox"/> ASME <input checked="" type="checkbox"/> 300# BW			OPERATING TIME 80 SEC				
	FLUID		NG			HANDWHEEL REV. CLOCKWISE CLOSE				
	MAX PRESS & TEMP.		4.6 MPa.g & 65° C			CONTROL SOURCE <input checked="" type="checkbox"/> INTERNAL <input type="checkbox"/> EXTERNAL				
	HYD. TEST PRESS.		Mpa			CLOSE TORQUE TRIP 1 POINT				
	DETAILS	MAX.		NOR./MIN.		OPEN TORQUE TRIP 1 POINT				
		INLET PRESS. 3.8 MPa.g		3.53 MPa.g		SETTING (ADJUSTABLE) OPEN SET AT % CLOSE SET AT %				
		INLET TEMP. 65° C		0 / -29 ° C		MAX. SET VALVE OPEN CLOSE				
		FLOW CAPA. 188,795 Nm <sup>3</sup> /h		72,000 / 5,664 Nm <sup>3</sup> /h		CONTACT RATING <input checked="" type="checkbox"/> AC <input type="checkbox"/> DC 250V 15A				
	KGS Stamp		Required			MAKE AT FULLY CLOSE 1 POINT		MAKE AT FULLY OPEN 1 POINT		
	MATERIAL	BODY		ASTM A350 Gr LF2		CLOSING 1 POINT		OPENNING 1 POINT		
		TRIM		ASTM A182 Gr F316		TYPE		MECHANICAL TYPE		
		BALL / SEAT		A182 Gr F316 / Reinforced PTFE		CONTACT RATING		<input checked="" type="checkbox"/> AC <input type="checkbox"/> DC 250V 15A		
	TYPE		INDUCTION			SPACE HEATER		<input checked="" type="checkbox"/> AC <input type="checkbox"/> DC		
MODEL NO.				INDICATOR		REMOTE <input checked="" type="checkbox"/> OPEN <input checked="" type="checkbox"/> CLOSE <input checked="" type="checkbox"/> INTERMEDIATE <input checked="" type="checkbox"/> MOV RUNNING <input checked="" type="checkbox"/> FAULT LOCAL <input checked="" type="checkbox"/> OPEN <input checked="" type="checkbox"/> CLOSE <input checked="" type="checkbox"/> INTERMEDIATE <input checked="" type="checkbox"/> MOV RUNNING <input checked="" type="checkbox"/> FAULT				
SERIAL NO.				POSITION TRANSMITTER		<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO				
SPECIFICATIONS OF MOTOR	RATING POWER		KW( VA) <input type="checkbox"/> 15 MIN <input type="checkbox"/> 30 MIN		LOCAL PUSH BUTTON		<input checked="" type="checkbox"/> OPEN <input checked="" type="checkbox"/> CLOSE <input checked="" type="checkbox"/> STOP			
	POLE	REV..	P	RPM	LOCAL SIGNAL LAMP		OPEN : GREEN CLOSED : RED			
	POWER SUPPLY		460V AC		METHOD OF MOTOR ↔ HAND CHANGE OVER		HAND → MOTOR (AUTO RETURN) MOTOR → HAND (LOCAL LEVER)			
	RATING VOLTAGE				CABLE ENTRY		POWER 1-1/2" NPT x 1 CONTROL 1-1/2" NPT x 2			
	FREQ.	PHASE	60 Hz	3 φ	OPTO-ISOLATOR		YES (FOR REMOTE STATION)			
	INSUL. CLASS		F CLASS		REMOTE CONTROL		<input checked="" type="checkbox"/> OPEN <input checked="" type="checkbox"/> CLOSE <input checked="" type="checkbox"/> STOP <input type="checkbox"/> ESD			
	TEMP. RISES		B CLASS		CONNECTION ACC.		SEE NOTE 1			
	STANDARD		<input type="checkbox"/> JEC <input type="checkbox"/> JIS <input checked="" type="checkbox"/> IEC 60034		PROTECTOR		<input checked="" type="checkbox"/> PHASE DISCRIMINATOR <input checked="" type="checkbox"/> THERMOSTAT <input type="checkbox"/> THERMAL RELAY			
	CURRENT		A		EARTH LUG		<input checked="" type="checkbox"/> INTERNAL <input checked="" type="checkbox"/> EXTERNAL			
	STARTING URRENT		A		OTHER		<input checked="" type="checkbox"/> LOCAL / REMOTE SELECTOR			
	STARTING TORQUE.		kg-m		COLOR					
	MAXIMUM TORQUE		kg-m							
	SLIP(RATE LOAD)		%							
	EFFICIENCY		%							
	POWER FACTOR		%(START)							
POWER FACTOR		%(RATING)								
W / T	VALVE		kg							
	ACTUATOR		kg							
	REDUCING GEAR		Kg							
MANUFACTURER & MODEL										
NOTE 1. FOLLOWING ACCESSARIES SHOULD BE SUPPLIED FOR CONDUIT CONNECTION - CONTROL ADAPTER : 1-1/2" NPT M x 28mmPF F x 1PCS, - PLUG : 1-1/2" NPT M x 1PCS - POWER ADAPTER : 1-1/2" NPT M x 28mmPF F x 1PCS 2. INTERFACE CONDITION FOR REMOTE CONTROL SHOULD BE AS FOLLOWS - OPEN, CLOSE COMMAND : NORMALLY OPEN AND VOLTAGE FREE MOMENTARY CONTACT - STOP COMMAND : NORMALLY CLOSED AND VOLTAGE FREE MOMENTARY CONTACT 3. SUPPLIER SHOULD FILL OUT ALL BLANKS. 4. A 200mm PUP PIECE SHALL BE PROVIDED FOR WELDED CONNECTION - Material : ASME A106 Gr.B(11.13mm)										

PROJECT NAME : ULSAN METERING STATION CLIENT : SK ENERGY CONTRACTOR : CONTRACT NO. :				MOTOR OPERATED VALVE DATA SHEET (AC)				
VALVE NO.		MOV-21A, MOV-21B, MOV-22A, MOV-22B		ENCLOSURE		<input checked="" type="checkbox"/> FLAME PROOF <input checked="" type="checkbox"/> WEATHER PROOF (IP-65)		
SERVICE		-		LOCATION		<input type="checkbox"/> INDOOR <input checked="" type="checkbox"/> OUTDOOR		
QUANTITY		4		E.H.A.C		Zone 1, Exd, IIB, T3 or MORE		
SPECIFICATION OF VALVE	TYPE OF VALVE		<input type="checkbox"/> GATE <input checked="" type="checkbox"/> BALL <input type="checkbox"/> GLOBE <input type="checkbox"/> BUTTERFLY <input type="checkbox"/> NEEDLE		TYPE			
	NOMINAL SIZE		12 (INCH)		RATIO(GEAR)			
	CONNECTION		<input type="checkbox"/> JIS FLANGE <input checked="" type="checkbox"/> 300# BW X RF <input checked="" type="checkbox"/> ASME		OPERATING TIME		60 SEC	
	FLUID		NG		HANDWHEEL REV.		CLOCKWISE CLOSE	
	MAX PRESS & TEMP.		4.6 MPa.g & 65° C		CONTROL SOURCE		<input checked="" type="checkbox"/> INTERNAL <input type="checkbox"/> EXTERNAL	
	HYD. TEST PRESS.		Mpa		CLOSE TORQUE TRIP		1 POINT	
	DETAILS	MAX.		NOR./MIN.		OPEN TORQUE TRIP		1 POINT
		INLET PRESS.		3.8 MPa.g 3.53 MPa.g		SETTING (ADJUSTABLE)		OPEN SET AT % CLOSE SET AT %
		INLET TEMP.		65° C 0 / -29 ° C		MAX. SET VALVE		OPEN CLOSE
		FLOW CAPA.		188,795 Nm <sup>3</sup> /h 72,000 / 5,664 Nm <sup>3</sup> /h		CONTACT RATING		<input checked="" type="checkbox"/> AC <input type="checkbox"/> DC 250V 15A
	KGS Stamp		Required		MAKE AT FULLY CLOSE		1 POINT	
	MATERIAL	BODY		ASTM A350 Gr LF2		MAKE AT FULLY OPEN		1 POINT
		TRIM		ASTM A182 Gr F316		CLOSING		1 POINT
		BALL / SEAT		A182 Gr F316 / Reinforced PTFE		OPENNING		1 POINT
	TYPE		INDUCTION		TYPE		MECHANICAL TYPE	
MODEL NO.				CONTACT RATING		<input checked="" type="checkbox"/> AC <input type="checkbox"/> DC 250V 15A		
SERIAL NO.				SPACE HEATER		<input checked="" type="checkbox"/> AC <input type="checkbox"/> DC		
SPECIFICATION OF MOTOR	RATING POWER		KW( VA) <input type="checkbox"/> 15 MIN <input type="checkbox"/> 30 MIN		INDICATOR		REMOTE <input checked="" type="checkbox"/> OPEN <input checked="" type="checkbox"/> CLOSE <input checked="" type="checkbox"/> INTERMEDIATE <input checked="" type="checkbox"/> MOV RUNNING <input checked="" type="checkbox"/> FAULT	
	POLE	REV..	P	RPM	LOCAL		<input checked="" type="checkbox"/> OPEN <input checked="" type="checkbox"/> CLOSE <input checked="" type="checkbox"/> INTERMEDIATE <input checked="" type="checkbox"/> MOV RUNNING <input checked="" type="checkbox"/> FAULT	
	POWER SUPPLY		460V AC		POSITION TRANSMITTER			<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO
	RATING VOLTAGE				LOCAL PUSH BUTTON			<input checked="" type="checkbox"/> OPEN <input checked="" type="checkbox"/> CLOSE <input checked="" type="checkbox"/> STOP
	FREQ.	PHASE	60 Hz	3 φ	LOCAL SIGNAL LAMP			OPEN : GREEN CLOSED : RED
	INSUL. CLASS		F CLASS		METHOD OF MOTOR ↔ HAND CHANGE OVER			HAND → MOTOR (AUTO RETURN) MOTOR → HAND (LOCAL LEVER)
	TEMP. RISES		B CLASS		CABLE ENTRY			POWER 1-1/2" NPT x 1 CONTROL 1-1/2" NPT x 2
	STANDARD		<input type="checkbox"/> JEC <input type="checkbox"/> JIS <input checked="" type="checkbox"/> IEC 60034		OPTO-ISOLATOR			YES (FOR REMOTE STATION)
	CURRENT		A		REMOTE CONTROL			<input checked="" type="checkbox"/> OPEN <input checked="" type="checkbox"/> CLOSE <input checked="" type="checkbox"/> STOP <input type="checkbox"/> ESD
	STARTING URRENT		A		CONNECTION ACC.			SEE NOTE 1
	STARTING TORQUE.		kg-m		PROTECTOR			<input checked="" type="checkbox"/> PHASE DISCRIMINATOR <input checked="" type="checkbox"/> THERMOSTAT <input type="checkbox"/> THERMAL RELAY
	MAXIMUM TORQUE		kg-m		EARTH LUG			<input checked="" type="checkbox"/> INTERNAL <input checked="" type="checkbox"/> EXTERNAL
	SLIP(RATE LOAD)		%		OTHER			<input checked="" type="checkbox"/> LOCAL / REMOTE SELECTOR
	EFFICIENCY		%		COLOR			
	POWER FACTOR		%(START)					
POWER FACTOR		%(RATING)						
W / T	VALVE		kg					
	ACTUATOR		kg					
	REDUCING GEAR		Kg					
MANUFACTURER & MODEL								
NOTE1 1. FOLLOWING ACCESSORIES SHOULD BE SUPPLIED FOR CONDUIT CONNECTION - CONTROL ADAPTER : 1-1/2" NPT M x 28mmPF F x 1PCS, - PLUG : 1-1/2" NPT M x 1PCS - POWER ADAPTER : 1-1/2" NPT M x 28mmPF F x 1PCS 2. INTERFACE CONDITION FOR REMOTE CONTROL SHOULD BE AS FOLLOWS - OPEN, CLOSE COMMAND : NORMALLY OPEN AND VOLTAGE FREE MOMENTARY CONTACT - STOP COMMAND : NORMALLY CLOSED AND VOLTAGE FREE MOMENTARY CONTACT 3. SUPPLIER SHOULD FILL OUT ALL BLANKS. 4. A 200mm PUP PIECE SHALL BE PROVIDED FOR WELDED CONNECTION - Material : ASME A106 Gr.B (9.52mm)								

ATTACHMENT #3. BM LIST FOR MOV

STATION	TAG NO.	VALVE SIZE (inch)	BODY MATERIAL	TRIM MATERIAL	BALL/SEAT MATERIAL	RATING	CONNECTION	REMARKS
ULSAN METERING STATION	MOV-11A	16	A350 GR LF2	A182 GR F316	316/PTFE	300	BW/BW	PUP PIECE (200mm)
	MOV-21A	12	A350 GR LF2	A182 GR F316	316/PTFE	300	BW/RF	PUP PIECE (200mm)
	MOV-21B	12	A350 GR LF2	A182 GR F316	316/PTFE	300	BW/RF	PUP PIECE (200mm)
	MOV-22A	12	A350 GR LF2	A182 GR F316	316/PTFE	300	RF/BW	PUP PIECE (200mm)
	MOV-22B	12	A350 GR LF2	A182 GR F316	316/PTFE	300	RF/BW	PUP PIECE (200mm)



## ATTACHMENT # 4. SAFETY CERTIFICATION SYSTEM

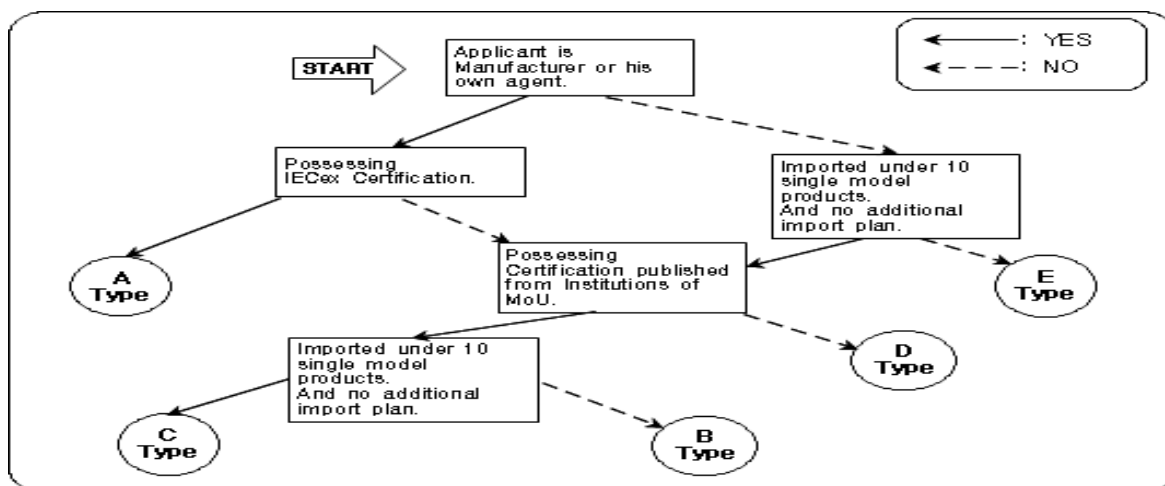
1. Existing Explosion-proof Performance Test System combined to Safety Certification System and enforced.
2. Explosion-proof electrical machines, apparatuses and parts are objects of Mandatory Safety Certification.
3. Certification Procedures.

### 1) Procedure comparison

Before Amendment (2-step)	Documentary Assessment → Test(Specimen)
After Amendment (4-step)	Documentary Assessment → Technical Capability & Production System Assessment → Product Assessment → Confirmation Assessment (Annually)

2) Procedure for Domestic product : Examine in accordance with amended 4-step procedure.

3) Procedure for Imported product : Examine in accordance with below diagram.



- **A Type**  
Able to obtain Safety Certification after relevant documents issued according to IECEx Scheme. (Exempted all certification procedures excluded Confirmation Assessment)
- **B Type**  
Examine by Certification and Test Report published from Institutions of MoU. Technical Capability & Production System Assessment needed for overseas factory.  
(Products which tested at TIIS of Japan according to JIS shall not be obtained Safety Certification.)
- **C Type**  
Examine by Certification and Test Report published from Institutions of MoU. Technical Capability & Production System Assessment are unnecessary. Able to obtain limited Safety Certification for only under 10 products.  
(Products which tested at TIIS of Japan according to JIS shall not be obtained Safety Certification.)
- **D Type**  
Unable to process Certification Procedures on account of no Test Report published from Institutions of MoU.
- **E Type**  
Unable to obtain Safety Certification on account of exceed quantities.

• Documents required for Safety Certification

Classification	Required Documents
A Type	1. Relevant documents to IECEx Certification 2. Dimensional detail drawing 3. Documents to verify his own agent by letter of attorney published from Manufacturer 4. Business License of Manufacturer(Documents to verify Manufacturer located in his own country)
B Type	1. Certification and Test Report published from Institutions of MoU 2. Dimensional detail drawing 3. Documents to verify his own agent by letter of attorney published from Manufacturer 4. Business License of Manufacturer(Documents to verify Manufacturer located in his own country)
C Type	1. Certification and Test Report published from Institutions of MoU 2. Dimensional detail drawing 3. Copy of Business License (Importer's)
Common	1. Safety Certification Application Form 2. Safety Certification Exemption Application Form 3. Copy of Service Fee Credit 4. Product Pictures(included front view, side view, and nameplate) 5. Documents to verify import 6. Product Descriptions and User's Manual

4) Institutions under MoU

Korea Gas Safety Corporation (KGS)	Korea Occupational Safety & Health Agency (KOSHA)	Korea Testing Laboratory (KTL)
1. SIMTARS (Australia) 2. LCIE (Australia) 3. BASSEFA2001 (UK) 4. NEPSI (China) 5. NANIO "CCVE" (Russia) 6. FM APPROVAL (USA)	1. Nemko (Norway) 2. PTB (Germany) 3. TIIS (Japan) 4. NEPSI (China) 5. NANIO "CCVE" (Russia) 6. TestSafe (Australia) 7. INERIS (France) 8. SIRA (UK) 9. VTT (Finland) 10. BASSEFA (UK) 11. TUV NORD (Germany)	1. KEMA (Netherlands) 2. LCIE (France) 3. TUV (Germany) 4. SIRA (UK) 5. NEPSI (China) 6. TIIS (Japan)



## ATTACHMENT # 5. 자재규격서 (BALL VALVE)

						
B	19.05.09	FOR APPROVAL	B.B.KIM	Y.H.DOKKO	K.M.KIM	
A	19.04.18	FOR APPROVAL	B.B.KIM	Y.H.DOKKO	K.M.KIM	
REV.	DATE	DESCRIPTION	DGN.	CHK.	APP.	CL. APP.
<div style="display: flex; align-items: center; justify-content: center;">  <div> <p style="font-size: 24px; font-weight: bold;">SK E&amp;S</p> </div> </div>						
<p style="font-size: 24px; font-weight: bold;">공급배관(계량설비) 설계용역</p>						
<div style="display: flex; align-items: center; justify-content: center;">  <div> <p style="font-size: 24px; font-weight: bold;">한 국 가 스 기 술 공 사</p> <p style="font-size: 18px;">KOREA GAS TECHNOLOGY CORPORATION</p> </div> </div>						
<p style="font-size: 24px; font-weight: bold;">자재규격서(BALL VALVE)</p>						
SCALE	DOCUMENT NO.					REV.
NONE	-					B

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3. FORM OF VALVE BM LIST
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5. DIMENSION TABLE AND DRAWING OF SUPPORT LEG
6. HANDLE ORIENTATION
7. BEVEL END
8. VALVE LIST

## **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.

## **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-5L                Specification for Line Pipe
- API-6D                Specification for Pipeline Valves (2008, 23<sup>rd</sup> Ver.)
- API-STD 598        Valve Inspection and Test
- API-STD 607        Fire Test for Soft Seated Quarter Turn Valves
- API-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 Specification for High Test Wrought Butt-Welding Fittings

### **2.3. American Society for Testing and Materials (ASTM)**

- A48/A48M        Standard Specification for Gray Iron Castings
- A105/A105M Standard Specification for Forgings, Carbon Steel, for Piping Components
- 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 Materials for High-Temperature Service
- A194/A194M Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High-Pressure and High-Temperature Service
- 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, Requiring Notch Toughness Testing for Piping Components
- A694/694M Specification for Forgings, Carbon and Alloy Steel, 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 Electroless Nickel Phosphorus Coating on Metal

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

- B16.5 Steel Pipe Flanges and Flanged Fittings
- B16.11 Forged Fittings, Socket-Weld and Threaded
- B16.25 Butt-welding Ends
- B16.34 Valves-Flanged, Threaded and Welding End
- B16.47 Large Diameter Steel Flange (NPS 26 through 60)
- SEC. V Nondestructive Examination
- SEC. VIII 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

### 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 <sub>4</sub>	91.332	16.043	Natural gas
C <sub>2</sub> H <sub>6</sub>	5.363	30.070	
C <sub>3</sub> H <sub>8</sub>	2.136	44.097	
iC <sub>4</sub> H <sub>10</sub>	0.459	58.123	
N <sub>4</sub> C <sub>4</sub> H <sub>10</sub>	0.476	58.123	
iC <sub>5</sub> H <sub>12</sub>	0.015	72.150	
N <sub>5</sub> C <sub>5</sub> H <sub>12</sub>	0.002	72.150	
N <sub>2</sub>	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 and the valve pressure ratings corresponding to them are as follows :

Piping Pressure Identification	Piping Pressure [MPa(kg/cm <sup>2</sup> )]		Valve Pressure Rating
	Normal Pressure	Design Pressure	
CA1	3.92 (40)	4.7(48)	Class 300

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

##### 3.1.3 Temperature

-29 ~ +93°C (temperature)

°F ~ 200

##### 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 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	CA1
Rating	Class 300
Material O.D. (nominal diameter)	ASME A106 Gr.B
406.4 (16")	12.7
355.6 (14")	9.5
323.9 (12")	8.4

273.1 (10")	7.8
219.1 (8")	7.0
168.3 (6")	7.1
114.3 (4")	6.0
60.3 (2")	5.5
48.3~21.3 (1½~½")	SCH 80

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 ¾ or ½	Socket Weld
* Drain pipe	NPS 1 (welded)	NPS ¾ or ½	Socket Weld
H o Both end threaded ball valve	NPS 1	NPS ¾ or ½	NPT
W e Screwed plug cap	NPS 1	NPT ¾ or ½	NPT

v

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 30 $\mu$ m 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 valves 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: 30  $\mu\text{m}$  and over, Hv 500 and over
- Stem
  - AISI 4140+ (30  $\mu\text{m}$  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 pressure rating 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: Pearlitic ductile cast iron with a yielding stress of 38.0 kg/mm<sup>2</sup> or over
  - Carbon steel: ASTM A53, A106 or equivalent
- d) One valve travel time shall be within 5 times the NPS number (seconds) (Example:  $10 \times 5 = 50$  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.
- 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 or SIS-SS-05-59-00.

b) External painting

The internal and external valve surfaces shall be completely cleaned of abrasives and dust. Exposed above-ground valves shall be painted with epoxy paint to the dry thickness of 150  $\mu\text{m}$  or over and then painted with urethane paint with the thickness of 50  $\mu\text{m}$  or over (color: Munsell No.7.5 GY-5.5/1 green grey).

HOLD

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	1) Ultrasonic inspection	O	*	
6	Heat treatment analysis	O	*	
7	Dimension inspection	O	△	
8	Visual inspection	O	△	
9	Hydrostatic & pneumatic test	O	△	
10	Painting inspection	O	△	
11	Operating test with motor or hydraulic actuator	O	△	
12	Plating (ENP or Cr)	O	*	
13	Sealing materials(O-ring, gasket, graphite)	O	*	
14	Antistatic Test	O	△	

△ : 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)) 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/cm<sup>2</sup>) 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 DOCUMENT**

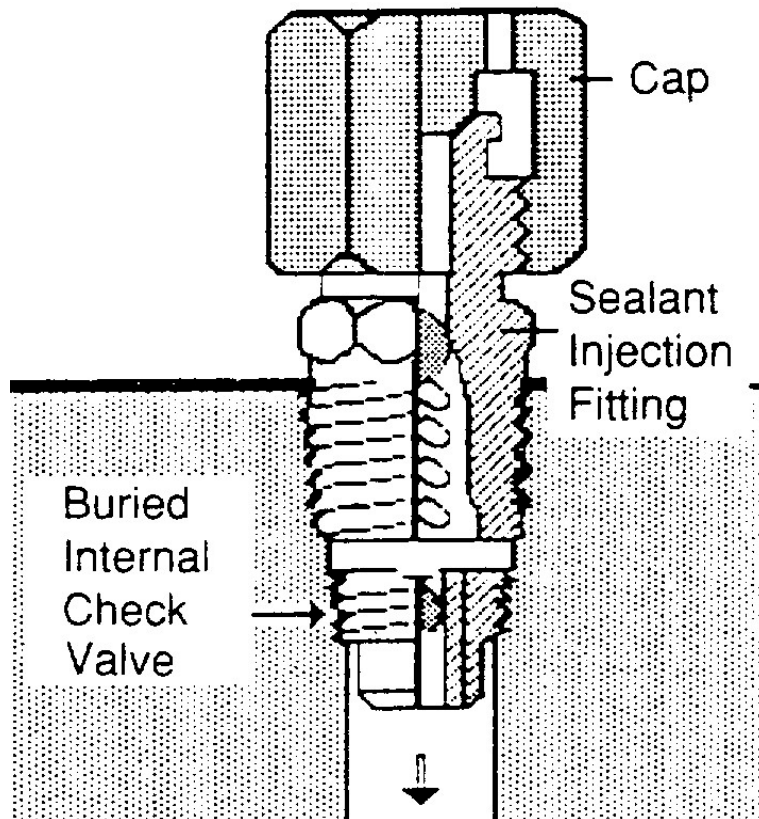
No	Submittal	For BID	After		Submittal Due Date for Approval
			For App.	For Final	
1	Supplier Certificate (Included Manufacturer Certificate)	2C	5C	10C	Within 15 Days after Contract Agreement
2	Bidding Certificate (Fire Safe Certificate, Evidence Of Job Experience)	2C	5C	10C	"
3	Manufacturer Brochure	2C	5C	10C	"
4	Manufacture & Inspection Equipment List	2C		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,		5C	10C	"
8	Each Accessories Specification and Quantity		5C	10C	"
9	Inspection Procedure	2C	5C	10C	"
10	WPS & PQR, Welding Repair Procedure	2C	5C	10C	"
11	Plating(ENP & CR) Procedure & Specification	2C	5C	10C	"
12	QC/QA Manual	2C	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	2C	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)	2C	5C	10C	at delivery time
25	Specification and Certificate of O-ring		5C	10R+	"

				9C	
26	Test Certificate (Report)		5C	1 OR + 9C	"
27	The Others Requested Drawings and Documents by		5C	10C	at Requirement
28	Deviation List	2C	5C	10C	Within 15 Days after

\* C : Copies

\* Documents in Nos 24, 25, and 26 are to be submitted to purchaser 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.

## ATTACHMENT 2. EMERGENCY SEALING FITTING (EXAMPLE)



**ATTACHMENT 3. FORM OF VALVE BM LIST**

NO	LINE NUMBER	VALVE NO.	SIZE	QT'Y	OPER.	BODY TYPE	DESIGN PRESSUREA (kg/cm <sup>2</sup> )	RATING	END TYPE	WHEEL ORIENTATION
1	92646	IV-11A	3/4"	1	LEVER	SPLIT	48	300	BW/RF	HOLD
2	92646	PV-11A	2"	1	LEVER	SPLIT	48	300	BW/RF	HOLD
3	92646	PV-11B	2"	1	LEVER	SPLIT	48	300	BW/RF	HOLD
4	92647	V-21A	12"	1	GEAR	SPLIT	48	300	BW/BW	HOLD
5	92647	V-22A	2"	1	LEVER	SPLIT	48	300	BW/BW	HOLD
6	92647	IV-21A	3/4"	1	LEVER	SPLIT	48	300	BW/BW	HOLD
7	92647	PV-21A	2"	1	LEVER	SPLIT	48	300	BW/RF	HOLD
8	92647	PV-22A	2"	1	LEVER	SPLIT	48	300	BW/RF	HOLD
9	92647	PV-23A	2"	1	LEVER	SPLIT	48	300	BW/RF	HOLD
10	92647	V-23A	12"	1	GEAR	SPLIT	48	300	BW/BW	HOLD
11	92648	V-21B	12"	1	GEAR	SPLIT	48	300	BW/BW	HOLD
12	92648	V-22B	2"	1	LEVER	SPLIT	48	300	BW/BW	HOLD
13	92648	IV-21B	3/4"	1	LEVER	SPLIT	48	300	BW/BW	HOLD
14	92648	PV-21B	2"	1	LEVER	SPLIT	48	300	BW/RF	HOLD
15	92648	PV-22B	2"	1	LEVER	SPLIT	48	300	BW/RF	HOLD
16	92648	PV-23B	2"	1	LEVER	SPLIT	48	300	BW/RF	HOLD
17	92648	V-23B	12"	1	GEAR	SPLIT	48	300	BW/BW	HOLD
18	92649	IV-32C	3/4"	1	LEVER	SPLIT	48	300	BW/RF	HOLD
19	92649	PV-21C	2"	1	LEVER	SPLIT	48	300	BW/RF	HOLD
20	92649	V-21C	16"	1	GEAR	SPLIT	48	300	BW/BW	HOLD
21	92649	PV-22C	2"	1	LEVER	SPLIT	48	300	BW/RF	HOLD

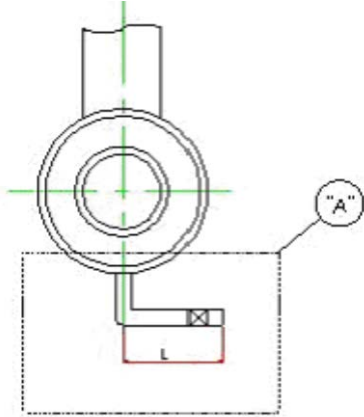
#### ATTACHMENT 4. DRAWING OF DRAIN VALVE

Item	Valve Size		Mat' l
	NPS 8 over	NPS 4,6	
① Pipe	1"	3/4" or 1/2"	A106 Gr.B
② Elbow	1"	3/4" or 1/2"	ASTMA234 Gr.WPB or EQ
③ Ball Valve	1"	3/4" or 1/2"	Class 300
④ Plug (Screw)	1"	3/4" or 1/2"	ASTMA234 Gr.WPB or EQ

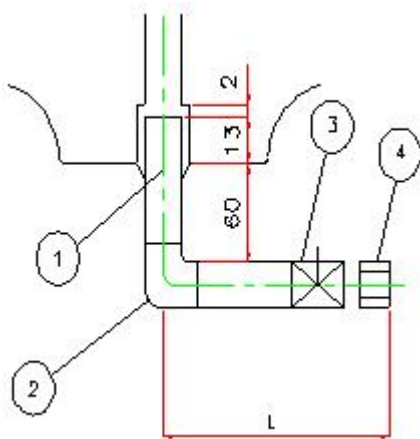
  

(단위mm)

Size (inch)	L (reference)	Remark
30	520	L = Body 외경/2 - $\Delta l$ $\Delta l$ : 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	

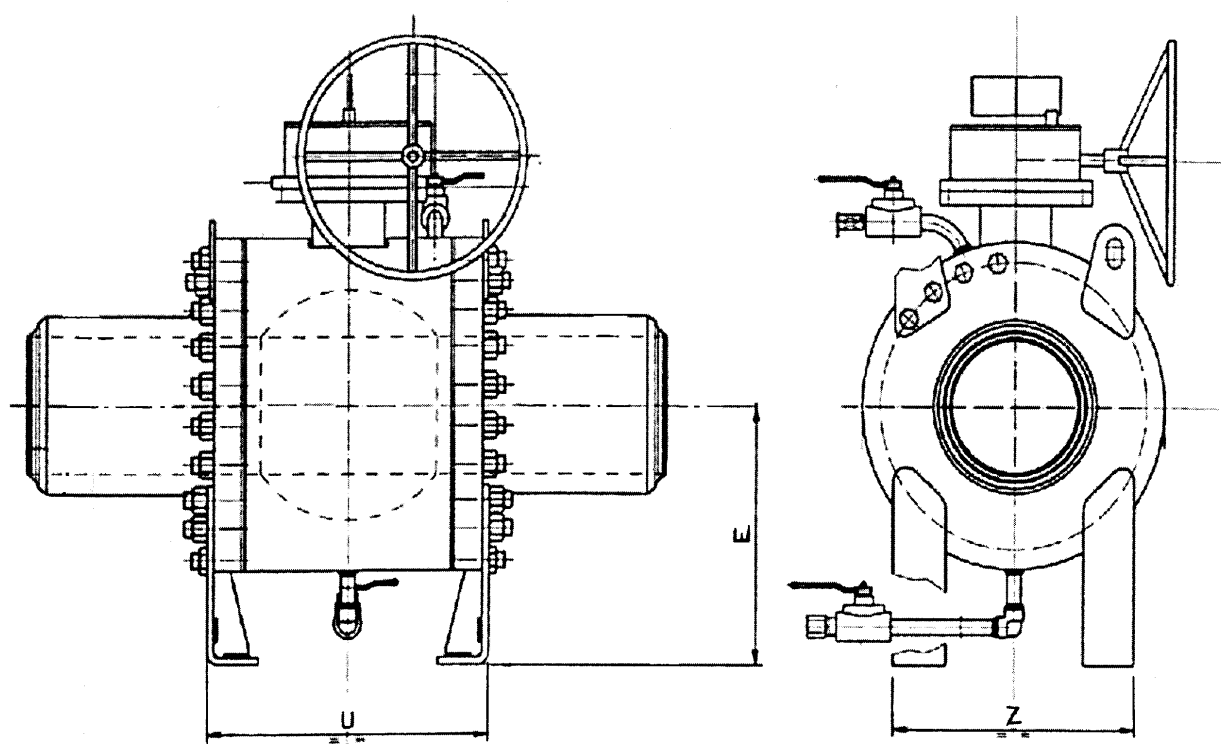


DETAIL "A" (Reference)



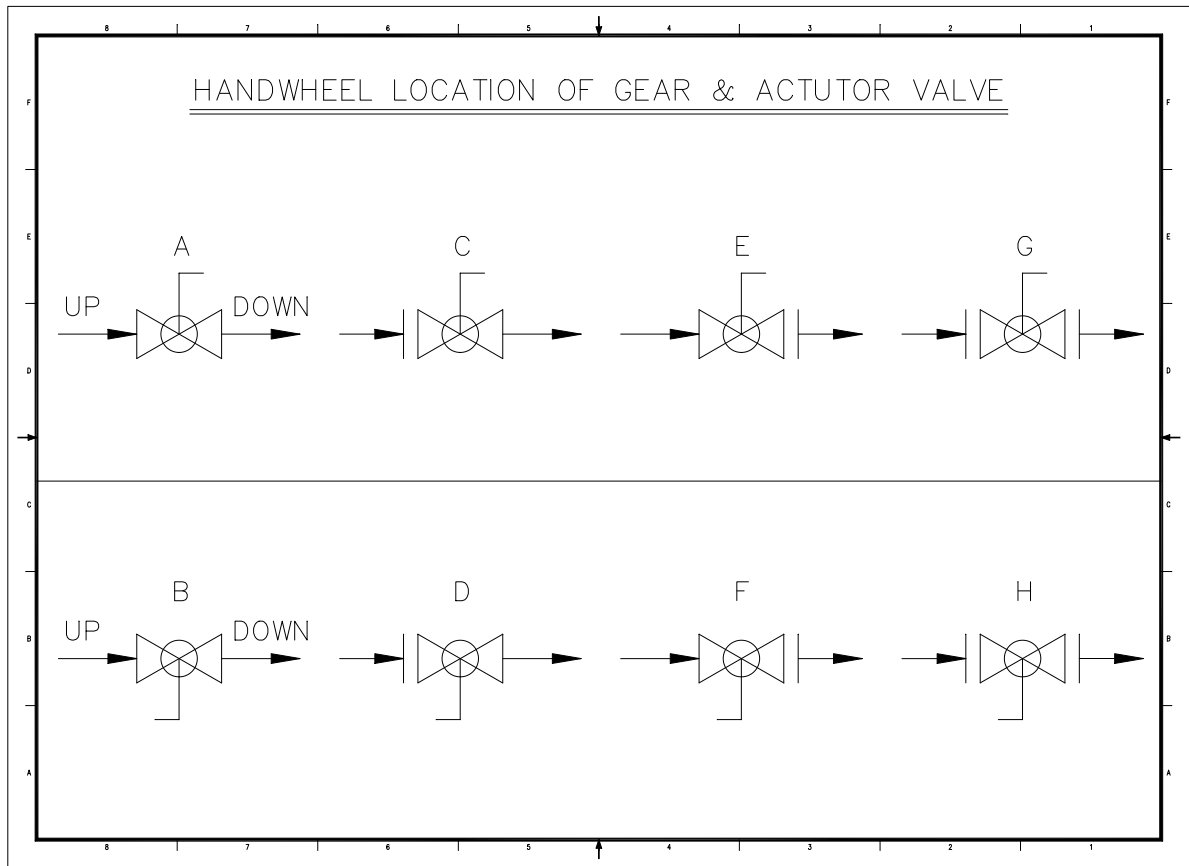


# ATTACHMENT 5. DIMENSION TABLE AND DRAWING OF SUPPORT LEG

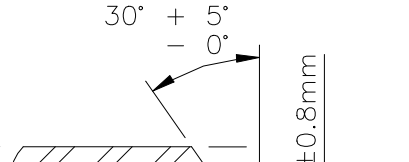
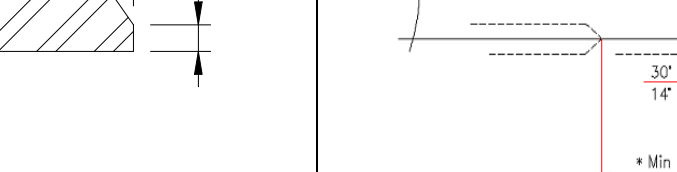


SIZE	TYPE	E(Exact)	U(MAX)	Z(MAX)	WEIGHT(MA X)	REMAR K
16"	MOV, GEAR, HYDRAULIC	530	730	590	2070	
12"	MOV, GEAR, HYDRAULIC	423	570	450	1176	

## ATTACHMENT 6. HANLDE ORIENTATION



## ATTACHMENT 7. BEVEL END

<p>When the thickness of the pipe to be welded is the same as that of the valve end</p>  <p>Tolerance for Inside Diameter : <math>\pm 0.8\text{mm}</math></p>	<p>When the thickness of the valve end is thicker than that of the pipe to be welded</p>  <p><math>t</math> : thickness of pipe to be welded          Inside diameter tolerance: <math>\pm 0.8\text{mm}</math>  <math>t_d</math> : valve edge thickness</p>
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## TECHNICAL BID EVALUATION SHEET

PROJECT : 울산공급배관(계량설비)용역

ITEM : BALL VALVE

DISCIPLINE :

REV :

DATE :

NO	DESCRIPTION	REQUIREMENT	BIDDER : <b>TO BE FILLED BY BIDDER</b>			REMARK
				BIDDER PROPOSAL	PURCHASER'S COMMNET	
ABBREVIATION - V : Acceptable(Confirmed), N/A : Not Applicable, X : Not Acceptable, ? : Not Specified, * : To be clarified						
1	SCOP OF SUPPLY					
1.1.	Ball Valve					
		SEE ATTACHMENT3. VALVE BM LIST				
2	TECHNIVAL REQUIREMENT					
2.1	Valve Body					
	- Type	Ball				
	- Body Material	ASTM A350 Gr LF2				
	- Trim Material	ASTM A182 Gr F316				
	- Ball / Seat Material	A182 Gr 316 / Reinforce PTFE				
	- Size & Connection	SEE ATTACHMENT3. VALVE BM LIST				
	- Pup Piece for all welded part of valves	2" and under: 100 mm				
		3" ~ 8" : 150 mm				
		10" and over : 200 mm				
	- Pup Piece of Material	ASME A106 Gr.B				

ATTACHMENT # 6. TECHNICAL BID EVALUATION SHEET

## TECHNICAL BID EVALUATION SHEET

**PROJECT :** 울산 공급배관 (계량설비) 용역

**ITEM :** MOTOR OPERATED VALVE

**SPEC NUMBER :** IN-SPC-002

**DISCIPLINE :** INSTRUMENT

**REV :**

**DATE :**

NO	DESCRIPTION	REQUIREMENT	BIDDER : <b>TO BE FILLED BY BIDDER</b>			REMARK
				BIDDER PROPOSAL	PURCHASER'S COMMENT	
<b>ABBREVIATION - V : Acceptable (Confirmed), N/A : Not Applicable, X : Not Acceptable, ? : Not Specified, * : To be clarified</b>						
<b>1</b>	<b>GENERAL</b>					
1.1	Quotation Number	By Bidder				
1.2	Quotation Date	By Bidder				
1.3	Explosion Proof Certificates	by KOSHA, KTL, or KGS				
1.4	KGS Stamp on valve body	Required				
<b>2</b>	<b>SCOPE OF WORK</b>					
2.1	Spare parts for operation	1 Lot				
2.3	Documents and Drawings	1 Lot (As per Attach #1 on SPEC)				
2.4	Inspection & Test	1 Lot (As per Sec #5 and Attach #5 on SPEC)				
2.5	Pakcking and Transportation	1 Lot (As per Sec #6.3 on SPEC)				
<b>3</b>	<b>SCOPE OF SUPPLY</b>					
3.1	Motor Operated Valve (Ball)					
	- MOV-11A with Pup piece	16 inch - 1 set				
	- MOV-21A/21B/22A/22B with Pup piece	12 inch - 4 sets				
<b>4</b>	<b>TECHNICAL REQUIREMENT</b>					
4.1	Valve Body					
	- Type	Ball				
	- Body Material	ASTM A350 Gr LF2				
	- Trim Material	ASTM A182 Gr F316				
	- Ball / Seat Material	A182 Gr F316 / Reinforce PTFE				
	- Size & Connection					

## TECHNICAL BID EVALUATION SHEET

**PROJECT :** 울산 공급배관 (계량설비) 용역

**ITEM :** MOTOR OPERATED VALVE

**SPEC NUMBER :** IN-SPC-002

**DISCIPLINE :** INSTRUMENT

**REV :**

**DATE :**

NO	DESCRIPTION	REQUIREMENT	BIDDER : <b>TO BE FILLED BY BIDDER</b>			REMARK
				BIDDER PROPOSAL	PURCHASER'S COMMENT	
ABBREVIATION - V : Acceptable (Confirmed), N/A : Not Applicable, X : Not Acceptable, ? : Not Specified, * : To be clarified						
	- MOV-11A	16", ASME 600# BW				
	- MOV-21A/21B/22A/22B	12", ASME 600# BW x <b>RF</b>				
	- Pup Piece for all welded part of valves	200mm				
	<b>- Pup Piece for Material</b>	<b>API 5L Gr. X42 OR API 5L Gr.B ERW OR SAW</b>				
4.2	Motor Actuator					
	- Power Supply	460V AC, 60Hz, 3Φ				
	- Electrical Connection					
	1) Power & Control : 1-1/2" NPT.F	3 EA (each MOV)				
	- Adaptor & Plug					
	1) Adaptor :1-1/2" NPT.M x 28mm PF.F	2EA (each MOV)				
	3) Plug : 1-1/2" NPT.M	1EA (each MOV)				
	- Operating Time					
	1) MOV-11A	80 sec				
	2) MOV-21A/21B/22A/22B	60 sec				
	- Electrical Hazadous Area Classification	Zone 1, Ex d IIB T3 or more				
	- Enclosure Class	IP 65				
	- Space Heater	Required				
	- Handwheel	Yes, Clockwise close				
	- Torque Switch	Open/Close				
	- Limit Switch	Open/Close				
	- Local Push Button	Yes (Open/Close/Stop)				
	- Local Signal Lamp	Yes (Open : Green, Close : Red)				
	- Local/ Remote Selector	Yes				