

KA-SERIES

User Manual



KVA CO., LTD.

Solution Partner of Valve Automation



◆ Contents ◆

1. Before use!	3
1-1. Summary	
1-2. Special feature	
2. Deal drawing of standard AOV	4
3. Deal drawing of Large AOV	5
4. Operation order and characteristic	6
4-1. Standard AOV	
4-2. Large AOV	
5. Installment	7
5-1. AOV installing construction	
5-2. Air pipe construction	
5-3. Air purging method and check	8
5-4. Structure of air unit and signal connection	9
6. Manual operation	10
6-1. Standard AOV manual operation	
6-2. Large AOV manual operation	
7. Test working	11
7-1. Preparation of test working	
7-2. Setting of position limit switch	
7-3. Setting of torque limit switch	13
7-4. Finish of test working	
8. Auto operation	
9. Position transmitter setting	14
9-1. Preparation of setting	
9-2. Measure the resistance and setting	
9-3. 4~20mA and limit setting	15
9-4. Finish of position transmitter	
10. Regular maintenance	16
10-1. The point of maintenance	
10-2. Lubrication	
10-3. Types of lubrication	
11. Malfunction and repair	17
12. AOV size	18
13. Standard table for AOV model selection	19
14. Standard table for Position Limiter model selection	

1. Before Use!

We will explain the brief summary, name of each part and operation of machine, here.

In regards to mark of this manual

Following definition and warning mark for the 'danger' and 'caution' in this manual. Warning mark is very important for safe work. Since it contains important notes for prevention of operator's injury or damages of articles, please understand well before use.

- ▷ Danger... Contains potential danger of operator's injury in case of incorrect use.
- ▶ Warning... Contains potential damages of articles in case of incorrect use.

1-1. Summary

「AOV」is an air type valve actuator using vane type air motor for power source.

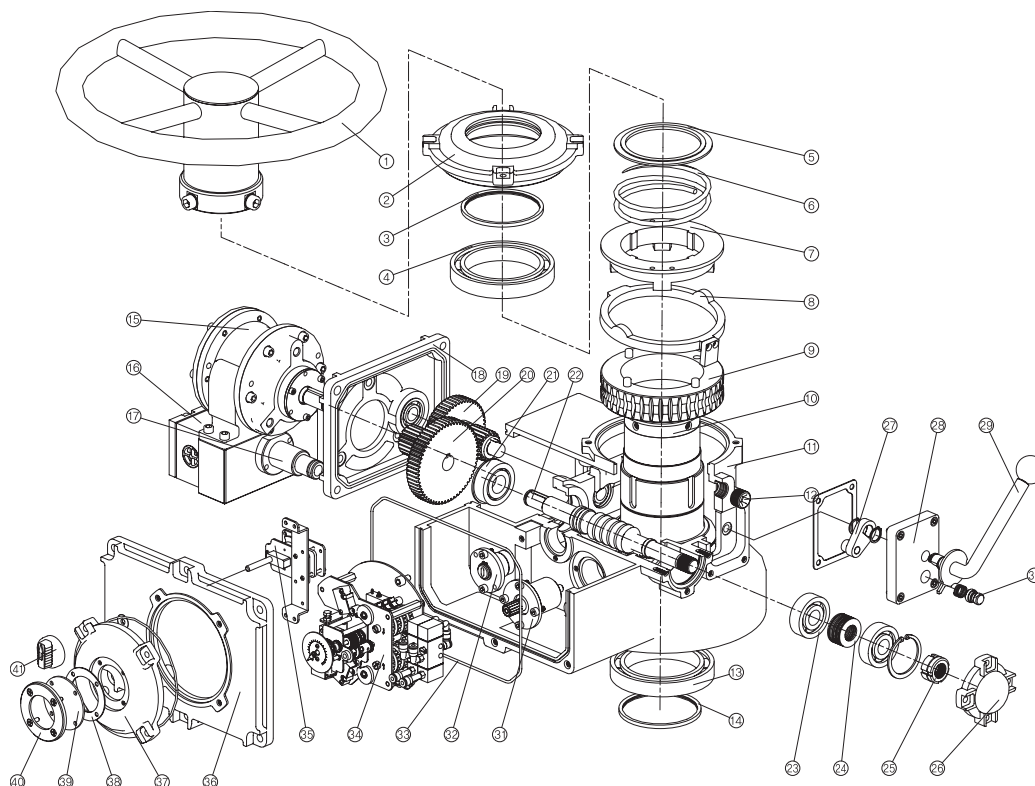
It requires lots of power for manual open and close operation and malfunction of manual valve operation can cause large scale accident or have a bad influence on local society and natural environment. Since AOV can be installed on the already installed manual valve on the pipe, it can be atomized easily and secure the plant safe operation and energy save by eradicating the malfunction of valve.

1-2. Characteristic

- ① Attachment of AOV is available by simple flange mounting type or bolt connection without detachment of valve from pipe or processing or modification of valve.
- ② Since it can get the precise and safe open and close torque by mechanical torque limit which has updated functions, it can operate valve safe without damaging the subject valve.
- ③ It can be used in the explosive dangerous places as the power source and transmission of signal is air type and the construction of system field is simple as well.
- ④ Since the air motor is highly credible vane type, it's very solid and the revolution is smooth as well.
- ⑤ It secures the exclusive manual handle and it is easy for manual operation just in case.
- ⑥ Important toothed wheel and axis are processed by carbon penetrated heat treatment and minute grinding treatment considering the frictional wear.
- ⑦ The components are unitized which makes it easy to maintain.

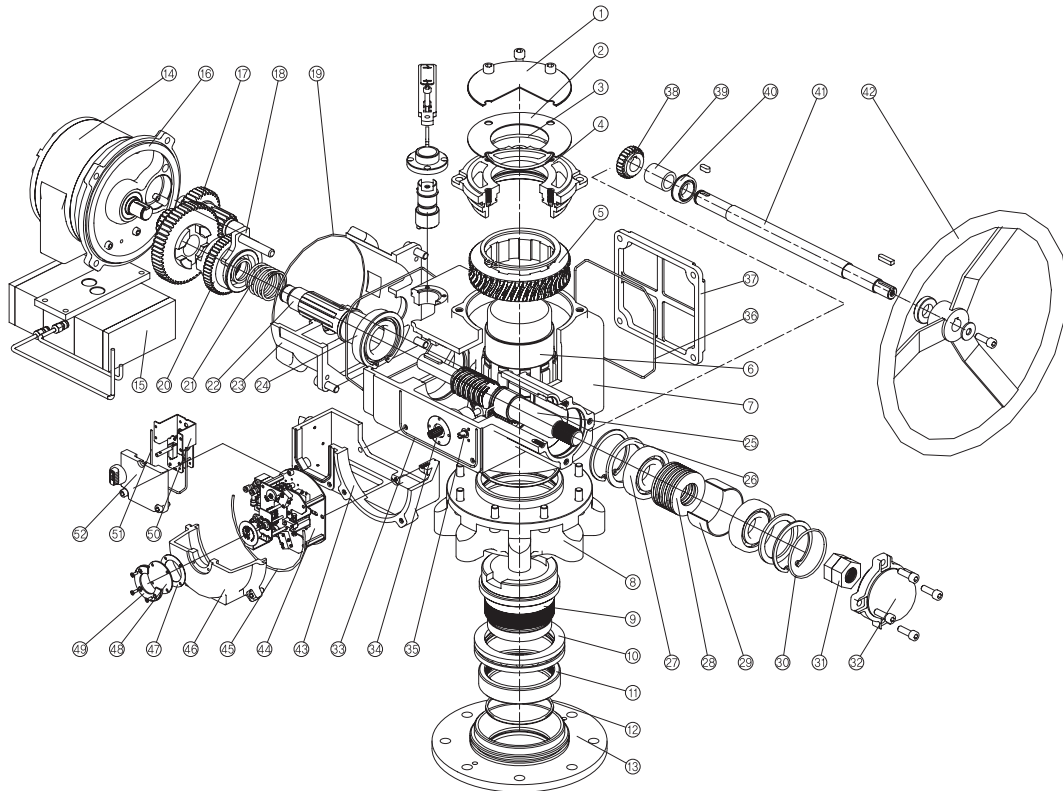


2. Deal drawing of standard AOV



No	PATR NAME	No	PART NAME
1	Handle	22	Worm Shaft
2	Handle Cover	23	Bearing
3	Thrust Ring	24	Disk Spring
4	Bearing	25	Hard Lock Nut
5	Quad Ring	26	Worm Shaft Cover
6	Clutch Spring	27	Cam
7	Clutch	28	Lever Cover
8	Clutch Yoke	29	Lever
9	Worm Wheel	30	Hold Pin
10	Drive Shaft A	31	Indicator Housing
11	Body	32	Torque Housing
12	Tapper Plug	33	O-Ring
13	Bearing	34	Indicator A' ss
14	Quad Ring	35	Selector Switch A' ss
15	Air Motor	36	Main Cover
16	Master Valve	37	Indicator Cover
17	Air Tube Direct Contact	38	Window Cover Gasket
18	Air Motor Cover	39	Window
19	Change Gear A Reduction	40	Window Cover
20	Drive Spur Gear	41	Selector Switch Knob
21	Bearing		

3. Deal drawing of Large AOV

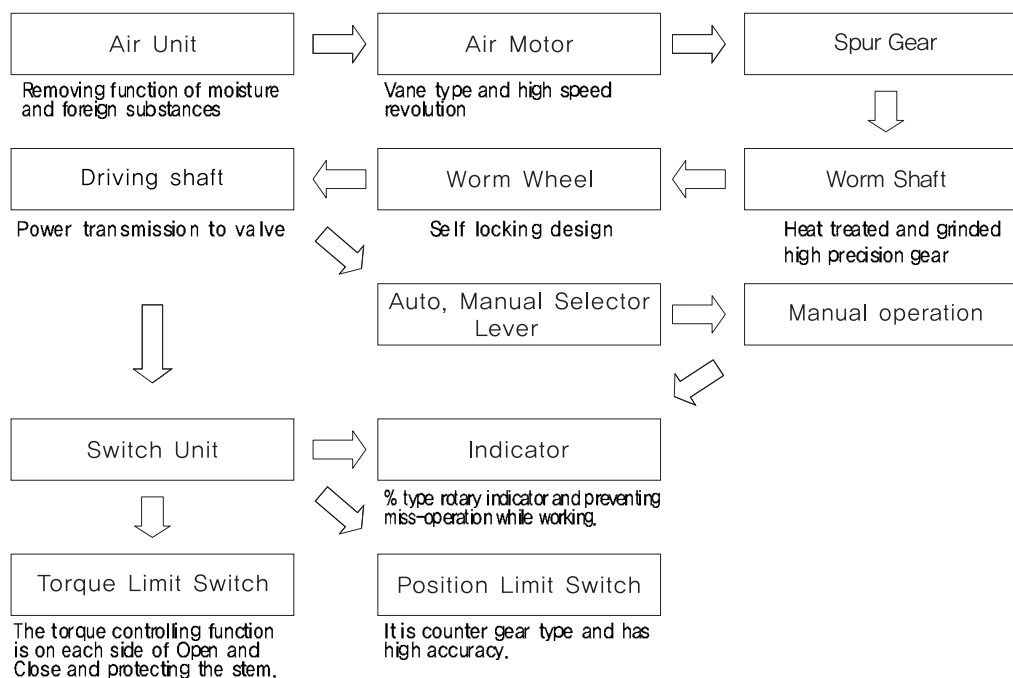


No	PART NAME	No	PART NAME
1	Stem Cover	27	Bearing
2	Stem Cover Gasket	28	Disk Spring
3	Quad Ring	29	Spring Safety Ring
4	Drive Shaft Cover	30	O-Ring
5	Worm Wheel	31	Hard Lock Nut
6	Drive Shaft A	32	Worm Shaft Cover
7	Body	33	O-Ring
8	Thrust Unit Housing	34	Indicator Housing
9	Stem Bush	35	TORQUE ROD
10	Bearing	36	O-Ring
11	Stem Bush Nut	37	Back Cover
12	Quad Ring	38	Spur Gear M
13	Thrust Unit Housing Cover	39	Manual Shaft Space Ring
14	Air Motor	40	Bearing
15	Master Valve	41	Manual Shaft
16	Air Motor Cover	42	Manual Handle
17	Spur Gear A	43	Control BOX
18	Cluch Yoke A' ss	44	Limit A' ss
19	O-Ring	45	O-Ring
20	Spur Gear D	46	Indicator Cover
21	Cluch Yoke Spring	47	Window Cover Gasket
22	Drive Shaft B	48	Window
23	Gear Housing	49	Window Cover
24	Bearing	50	Selector Switch A' ss
25	Worm Shaft	51	O-Ring
26	Thrust Ring	52	Switch Cover

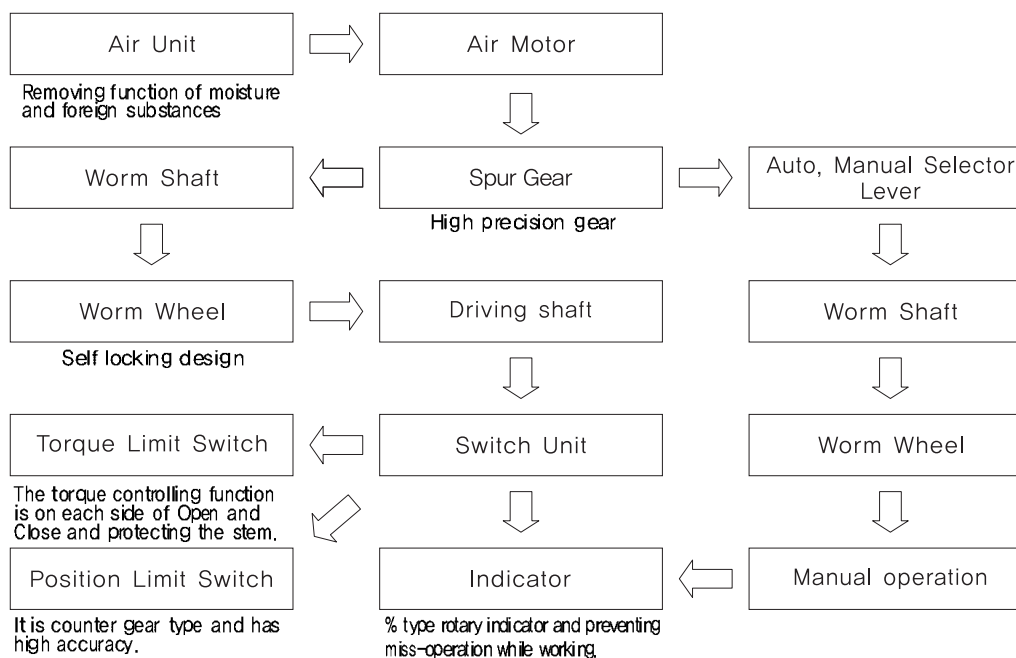


4. Operation order and special feature

4-1. Standard AOV



4-2. Large AOV



5. Installation

5-1. AOV installing construction

5-1-1. Standard AOV

- ① Disassemble the handle wheel from valve.
- ② Check if the Yoke of valve matches the Bracket and Fix bracket well.
- ③ Check if the Sleeve handle assembly and coupling of Yoke of valve assembles well.
- ④ Apply grease on stem (use high load universal grease).
- ⑤ Inject grease on Yoke sleeve.
- ⑥ Install the bracket on valve.
- ⑦ Connect wheel nut on handle assembly of Yoke sleeve after assemble the coupling.
- ⑧ Connect bolt after install AOV on valve.
- ⑨ Assemble air unit on master valve of AOV (refer to fig 5-1)

5-1-2. Large AOV

- ① Check the short diameter, depth, size of connecting bolt, stem bush of valve flange.
- ② Apply grease on stem (use high load universal grease).
- ③ Connect the bolts after install the thrust unit on valve flange.
- ④ Connect the bolt after install AOV on valve using 1 bolt.
- ⑤ Assemble air unit on master valve of AOV (refer to fig 5-1)

5-2. Air piping work

► Warning

☞ AOV is the air motor drive type and the compressed air being supplied in air motor should be

- ① Contains the oil mist,
- ② Contains no foreign substances such as dust, piping scale etc,
- ③ Contains no moisture.

※ Install air dryer for the case of moisture contained.

5-2-1. Basic piping

- 1) Connection of main and supply (branch) pipe.

Connect on the higher place than the main pipe to prevent the induction of remainders (moisture) to the supply (branch) pipe directly.

Items	Main Air Line Size	Supply Air Line Size	Remark
Standard AOV	NPT 1/2"	NPT 1/4"	
Large AOV	NPT 1"	NPT 1/4"	

[Table 5-1]



2) Installation of air unit

Assemble Air filter, Regulator, Oiler as shown on [Fig 5-1] and install on master valve of AOV (refer to table 5-1)

3) Piping between air unit and AOV main body (refer to Fig 5-1).

Follow the attentive instructions shown below in regards to piping after air filter.

- ① In order to remove the cutting scraps of pipe, sludge of zinc galvanizing and scale, don't forget to remove the scraps after cutting of pipe and screw part.
- ② In order not to project out from the pipe section, wind clockwise (when see the section) the seal tape on screw.
- ③ If disassemble the bolts assembled pipe, remove the remnant of seal tape attached on the male and female screw and wind new tape. Especially be careful with the remnant of seal tape on female screw as it can be easily overlooked.
- ④ The pipe length (for the case of air type switch box) from switch box to AOV should be less than 30m. For the case of more than 30m of length, please contact usseparately.

5-2-2. Cleaning of pipe

In order to supply the clean air to air motor, purge the dust, remnant of seal tape, scale etc inside of the pipe.

- ▶ **Warning:** Since it cause the malfunction, never connect not cleaned pipe to AOV main body.

5-3. Pipe purging method and check.

[At site operation type]

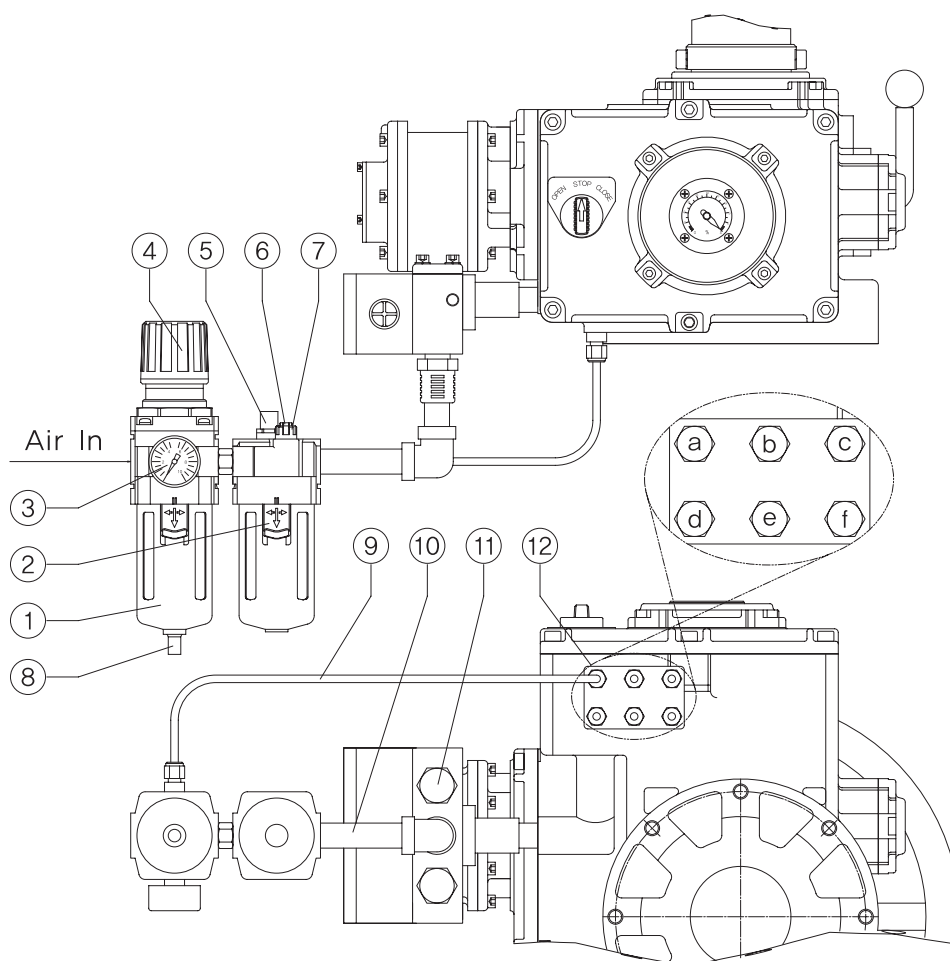
Cover the end of main and supply pipe with white cloth and repeat the ejection of compressed air intermittently. Change the signal and do the same operation repeatedly. Do it enough until there is no ejection on the cloth.

[Remote operation type]

Cover the end of main, supply and feed back pipe with white cloth and repeat the ejection of compressed air intermittently. Change the signal and do the same operation repeatedly. Observe closely at any case and do it enough until there is no ejection on the cloth.

- ▶ **Warning:** Cover enough white cloth on the pipe when purge. If it's not covered enough, dust can be entered in the eyes. In order to prevent the injury of eyes, please wear the gloves without fail.

5-4. Structure of air unit and signal connection



[Fig 5-1]

No	Part Name
1	Air Filter
2	Oiler
3	Pressure Gage
4	Air Regulator
5	Window for Drop check
6	Adjusting Screw for Oil Drop
7	Oil Filling Cap
8	Drain
9	Supply Line(1/4")
10	Main Line(1/2")
11	Muffler
12	Air Signal Connection

[Table 5-2]

No	Port Name
a	1/4" Supply
b	Open Command Signal
c	Close Command Signal
d	Supply(To Control Box)
e	Open Lamp(Air)
f	Close Lamp(Air)

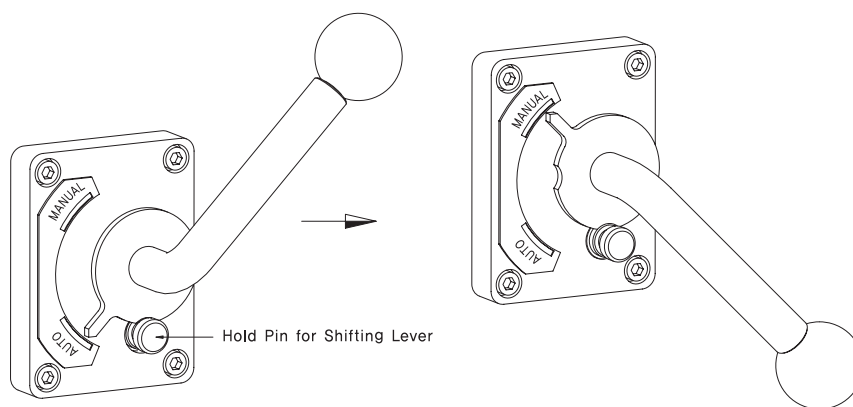
[Table 5-3] Air Signal Connection



6. Manual operation

6-1. Manual operation of standard AOV

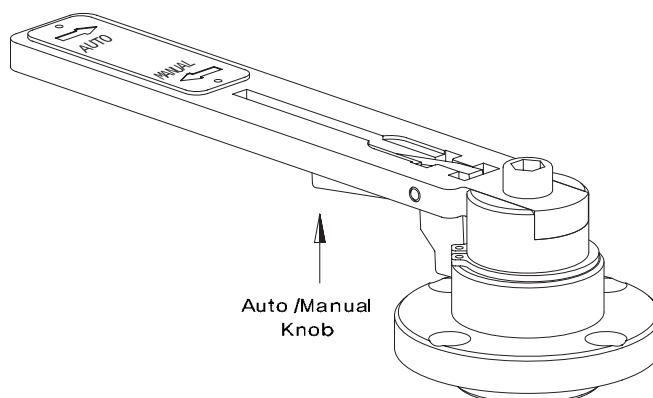
- ① Convert the lever to manual mode while pushing the auto/manual holding pin on the lever which is located on the left side of main body (refer to fig 6-1).
- ② Generally, it can be opened and closed with the manual lever as the same manner of manual valve (clockwise→ Close, counterclockwise→ Open).



[Fig 6-1] Auto/ manual converting method of standard AOV

6-2. Large AOV manual operation

- ① Convert it to the manual mode by turning the lever 90° in counterclockwise with pulling position of auto/ manual knob of auto/ manual lever on top left of main body (refer to Fig 6-2).
- ② It can be opened and closed with the manual handle on top right of main body (clockwise → Close, counterclockwise→ Open).



[Fig 6-2] Auto/ manual converting method of large AOV

► **Caution :** Put the Selector Switch on the right place.

Actuator valve can be damaged if turned by inserting the pipe wrench or stick on manual handle.

7. Test working

7-1. Preparation of test working.

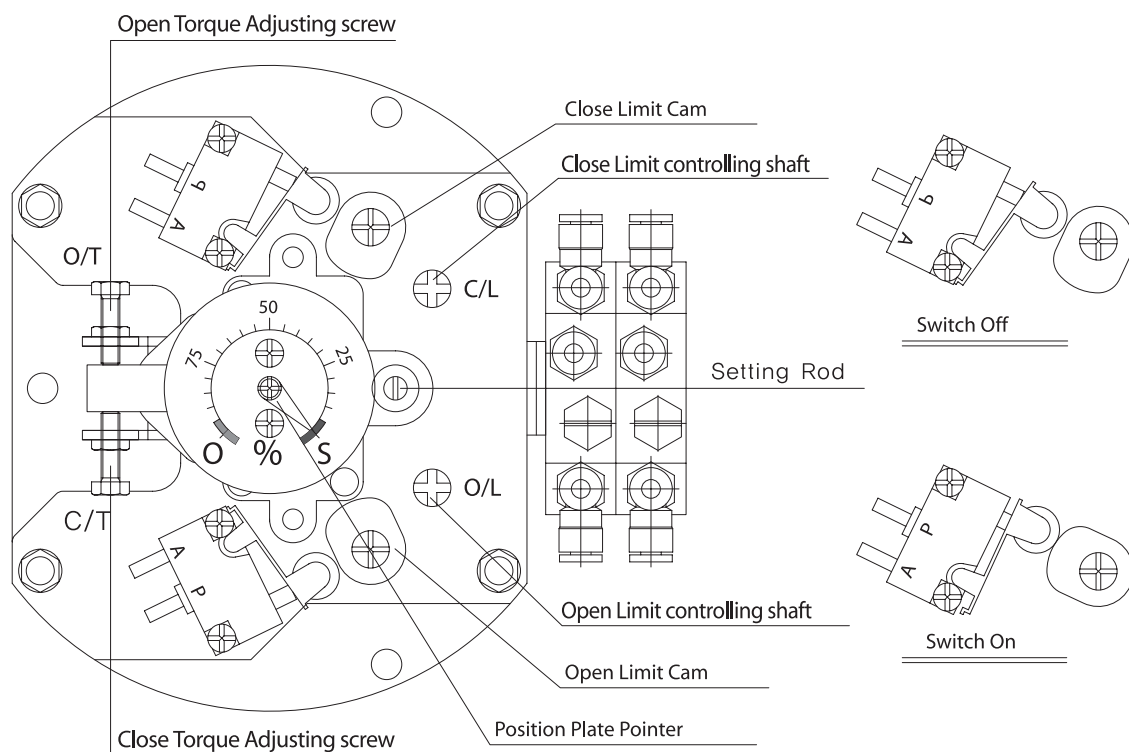
- ※ Apply the following operation after finish the AOV installation, piping work and air purge.
- ① Never forget to get the approval before the valve opening/closing operation from the valve manager.
- ② Inject the turbine oil in oiler (refer to maintenance table-1 for the type of oil).
- ③ Set the pressure of regulator as 4~7kgf/cm².
- ④ Turn the auto/ manual lever to manual mode and check the driving status of air motor and if the air discharged from the muffler of master valve by moving open/stop/close selector switch.
- ⑤ Adjust the oil dropping amount as 3~4 drops for 10 seconds when opening and closing operation by turning the adjusting screw. Dropping amount increases when turning counterclockwise.

Thus the preparation of test working finished.

► Warning:

- ☞ The open and close of valve will be executed practically in auto mode and so, it must be set on manual mode.
- ☞ Only the air motor operates in manual mode and the practical open and close of valve will not be executed.

7-2. Position Limit Switch Setting



[Fig 7-1] Name of each part of switch unit



7-2-1. Close position limit switch setting

1) Preparation before setting

- ① Close the valve tight manually.
- ② Detach the indicator cover from main body.
- ③ Know well the name and location of each part of switch unit on [Fig 7-1]
- ④ Check if the present status of close limit switch is on or off.

2) Setting procedure

- ① Turn 90° after pushing the Setting Rod using ⊖ driver.
- ② Close limit setting
 - ☞ Switch on: After turn the switch cam to switch off by turning the close limit adjusting shaft in clockwise using ⊕ driver and then turn counterclockwise and stop immediately when the switch is on.
 - ☞ Switch off: Turn the close limit adjusting shaft in counterclockwise and stop immediately when the limit cam is switched on.
- ③ Return to the original stage by turning 90° while pushing the setting lode.
- ④ If the valve is opened and closed 1/2 turn after convert to manual mode using manual handle, the limit cam on close side became switch off and then turned to switch on.
- ⑤ Verify the normal operation of valve by opening 5~10% and closing the valve after convert to the auto mode.
- ⑥ Set the indicator on 0%.
- ⑦ Finish the close position limit setting.

7-2-2. Open position limit switch setting

1) Preparation before setting.

- ① Open the valve automatically until it reaches to near full open status.
- ② Check if the present status of open limit switch is on or off.

2) Setting procedure

- ① Turn 90° after pushing the Setting Rod using ⊖ driver.
- ② Open Limit Setting
 - ☞ Switch on: After turn the switchcam to switch off by turning the open limit adjusting shaft in counterclockwise using ⊕ driver and then turn clockwise and stop immediately when the switch is on.
 - ☞ Switch off: Turn the close limit adjusting shaft in clockwise and stop immediately when the limit cam is switched on.
- ③ Return to the original stage by turning 90° while pushing the Setting Rod.
- ④ If the valve is opened and closed 1/2 turn after convert to manual mode using manual handle, the limit cam on close side became switch off and then turned to switch on.
- ⑤ Finish the open position limit setting.
- ⑥ Close the valve tightly automatically.

7-3. Torque Limit Switch Setting

- 1) Torque limit switch doesn't need to be set at site as it is set in the torque test machine with the optimized value according to the size, rating, process etc of corresponding valve when shipping from the factory.
- 2) If the setting is needed at site, setting should be performed after verify the followings.
 - ① Check if the grand flange bolt on valve is too tight.
 - ② Check if the grease is injected in valve stem and yoke sleeve.
 - ③ Check if the valve stem is not deformed and alright.
- 3) Torque limit switch setting method
 - ① Mark the present position of torque adjusting screw with marker pen etc.
 - ② Torque will be increased when turn on clockwise and decreased when turned on counterclockwise.
 - ☞ Readjust only when it is possible to open and close the valve manually.

► **Warning:**

- ☞ Execute the torque adjustment only after discuss with the supplier.

► **Danger:**

- ☞ If increase too much of torque by turning more than 1 revolution per each time, the valve or actuator can be damaged.

7-4. Finish of test working

- 1) Connect indicator cover by tightening the bolt after clean the connection part after finish the test work.
- 2) Turn the auto/ manual lever to auto mode.

8. Automatic operation

8-1. How to run automatically

- 1) When finish the trial run, AOV can be used with automatic operation.
- 2) Convert the auto/manual convert lever to auto mode.
- 3) If the selector switch turned to open or close, the practical operation of valve will be followed.

► **Warning:**

- ☞ Be careful of the revolution of handle when auto drive of standard AOV.
- ☞ If close the valve tight in auto mode and then open in manually and to close the valve in auto mode again, turn the selector switch to open and operate close then it operates normally. This is because that since it stopped the close automatically, the AOV internal circuit blocks the close side line.



9. Position Transmitter Setting

9-1. Preparation of setting

- 1) Fully close the valve with AOV selector switch.
- 2) Disassemble the transmitting housing cover with 6mm L wrench.
- 3) Disconnect the power line: Since this is the anti-explosion machine which has Exd IIC T4, IP67 level, the anti-explosion flexible coupling or the goods that has the corresponding level should be used as the input cables.

The thickness of cable should be min 1.2 sq, max 1.6 sq and soft cable should be used. The Y connection type has been used and connect the cable on terminal block referring to the circuit diagram which is attached on inside of transmitter housing cover and tightly seal the induction part of cable.

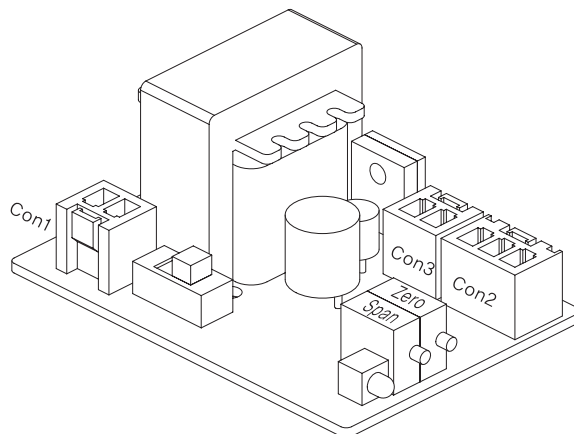
※ Adopt 3rd earth and the earth cable should be thicker than 1.6mm.

► Warning:

- ☞ Be careful of the revolution of handle when auto drive of standard AOV.
- ☞ If close the valve tight in auto mode and then open in manually and to close the valve in auto mode again, turn the selector switch to open and operate close then it operates normally. This is because that since it stopped the close automatically, the AOV internal circuit blocks the close side line.

9-2. Resistance measurement and setting

- 1) Disconnect the cable which is connected to CON2 of R/I Converter. Refer to [Fig9-1]
 - 2) Connect the black and blue on CON2 PLUG to the tester.
 - 3) Convert the tester to resistance and read the value.
 - 4) Disassemble the headless wrench bolt on bevel gear of shaft A with 2mm L wrench.
 - 5) Adjust the resistance value to be stayed in between 30~50Ω by turning the gear with hand.
 - 6) Connect the headless wrench bolt if the setting value is verified.
 - 7) Connect the terminal if the resistance value is in between 30~50Ω
- ※ It must be measured after unplug CON2. If the resistance value is measured while connected, correct value cannot be measured since the external resistance value will be read together.



[Fig 9-1] Structure of converter

9-3. 4~20mA and limit setting.

9-3-1. 4mA setting

- 1) Check if the output of 10 and 12 terminal is 3.4~4.6mA.

If it's not, perform the above 9-2 again and meet the resistance value.

- 2) If out put is 3.4~4.6mA, turn the zero on R/I converter card and match 4mA.
- 3) Open and close the valve about 10~20% and check if output is 4mA.
- 4) Repeat theabove once or twice.

※ When adjusting the zero or span, it varies + direction when turned clockwise, - when counterclockwise.

9-3-2. Close limit setting

- 1) Match the close position by turning the close limit dog with hand.
- 2) Open and close the valve about 10~20%.
- 3) Check if the close lamp is on all the time.
- 4) Repeat the above once or twice.

9-3-3. 20mA Setting

- 1) Fully open the valve with AOV selector switch.
- 2) Check if the output of 10 and 12 terminal is 19.4~20.6mA.
- 3) Match 20mA by turning the R/I converter card span.
- 4) Open and close the valve about 80~90% and check if output is 20mA.
- 5) Repeat the above once or twice.

9-3-4. Open Limit Setting

- 1) Match the open position by turning the close limit dog with hand.
- 2) Open and close the valve about 10~20%.
- 3) Check if the open lamp is on.
- 4) Repeat the above once or twice.

9-4. Finish of position transmitter setting

- After connecting the cable and setting, clean the connection area of transmitter housing cover and cover and connect securely by tightening the bolt.



10. Regular maintenance examination.

10-1. Maintenance method.

- ① Check if the air motor operates normally by idling once a week in case no operation of valve for long time (if convert the lever to manual mode, valve doesn't work and air motor idles only).
- ② Check the oil inside of oiler and supply the turbine oil for the case of shortage.
- ③ Check the looseness of connection of pipe. Shake of supporting die and looseness of other bolts regularly.
- ④ Extract the drain of filter and check clogging of elements.
- ⑤ Clean the elements of silencing equipments once a year.
- ⑥ It is recommended to check regularly every 3 years.

10-2. Lubrication

- 1) The lithium soap grease is injected enough on our product and no need to inject or replace while operated normally.
- 2) For the case of disassemble and assemble of machine for regular maintenance or repair, fill 70~80% of inner chamber with lithium soap grease (standard: 2.5kg, large: 7kg).
- 3) Same lithium soap grease can be used though the brand name is different but it is not allowed to mix the different system grease together.
- 4) Cover or inject the high load grease on stem and yoke sleeve regularly.

10-3. Types of lubrication

- 1) Turbine Oil (It is injected into the lubricator of the AIR SET.)

Company name	Commodity name
SK	SUPER TURBINE 32
GS-CALTEX	REGAL R&32
MOBIL	DTE OIL LITE32
SHELL	TURBO-T32

- 2) Grease (It is injected inside the AOV body.)

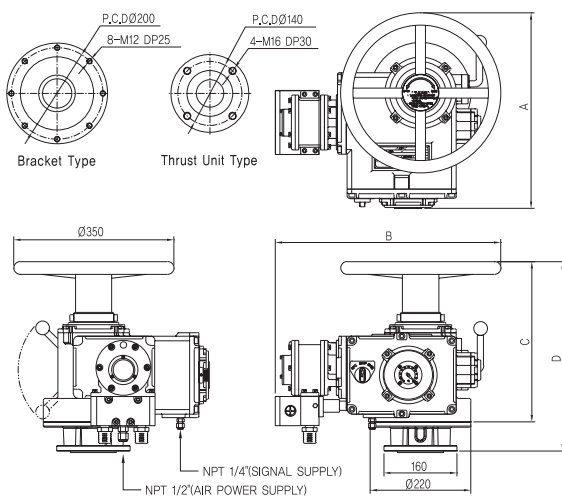
Company name	Commodity name
SK	CROWN EPO (ZERO)
GS-CALTEX	MULTI HWAK EPO
S-OIL	Asaring EP0
ISU CHEMICAL	MULTIS EP0
SHELL CO	Albamia EP0 RO

11. Malfunction, repair

Malfunction	Expected reason	Measure
Air motor doesn't revolve	• No air supply • Have not use for long time and adhered. • Supply the air with foreign substances (rust of pipe etc)	☞ Check the air supplying pipe ☞ Run the air motor after inject the oil. ☞ Clean air filter and reassemble ☞ Disassemble the motor, clean and reassemble. → Ask to supplier
Motor stops during opening and closing operation	• Torque switch initiated due to the over loading • Foreign substances on valve stem • Bad lubrication of valve stem • Too tight connection of valve grand packing • Bad lubrication of yoke sleeve.	☞ Verify the cause, recheck the torque set value and adjust. → Ask to supplier ☞ Clean the stem and recover the grease ☞ Disassemble and check the valve. ☞ Loose the connection and inject the grease again. ☞ Inject the grease on yoke sleeve.
Motor revolves but the valve does not move	• Operate after turn the lever to manual mode. • Frictional wear of coupling (standard type) • Frictional wear of stem bush (large type)	☞ Convert the manual to auto mode. ☞ Replace the coupling. ☞ Replace the stem bush
Motor doesn't stop with the limit switch	• Bad setting of limit switch. • Air doesn't supply to the limit switch • Bad limit switch	☞ Readjust ☞ Reassemble after check the air supplying line ☞ Replace the limit switch → Ask to supplier
Torque switch works but motor doesn't stop	• Bad operation of torque switch • Air doesn't supply to torque switch	☞ Replace the torque switch ☞ Reassemble after check the air supplying line
Valve doesn't move when manual → auto operation	• Operate after turn the lever to manual mode. • Air doesn't supply	☞ Set the lever to auto mode from manual. ☞ Check the air supply valve
AOV doesn't operate with selector switch	• Logic valve doesn't work due to the dust and foreign substances in air line. • Air doesn't supply to selector switch	☞ Replace the Logic valve ? perform enough Purge when first operation. ☞ Reassemble the air supplying line.
Auto/ manual doesn't convert	Malfunction of auto/ manual converting assembly.	☞ Replace the auto/ manual assembly.

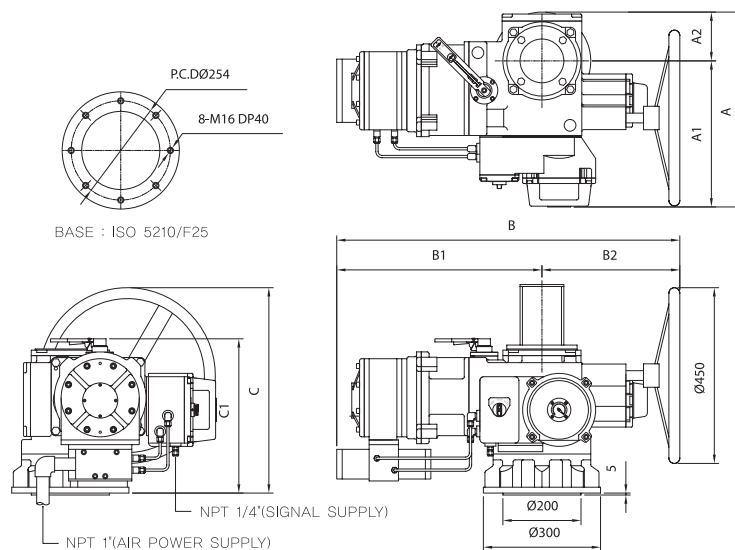
12. AOV SIZE

12-1. Standard AOV SIZE



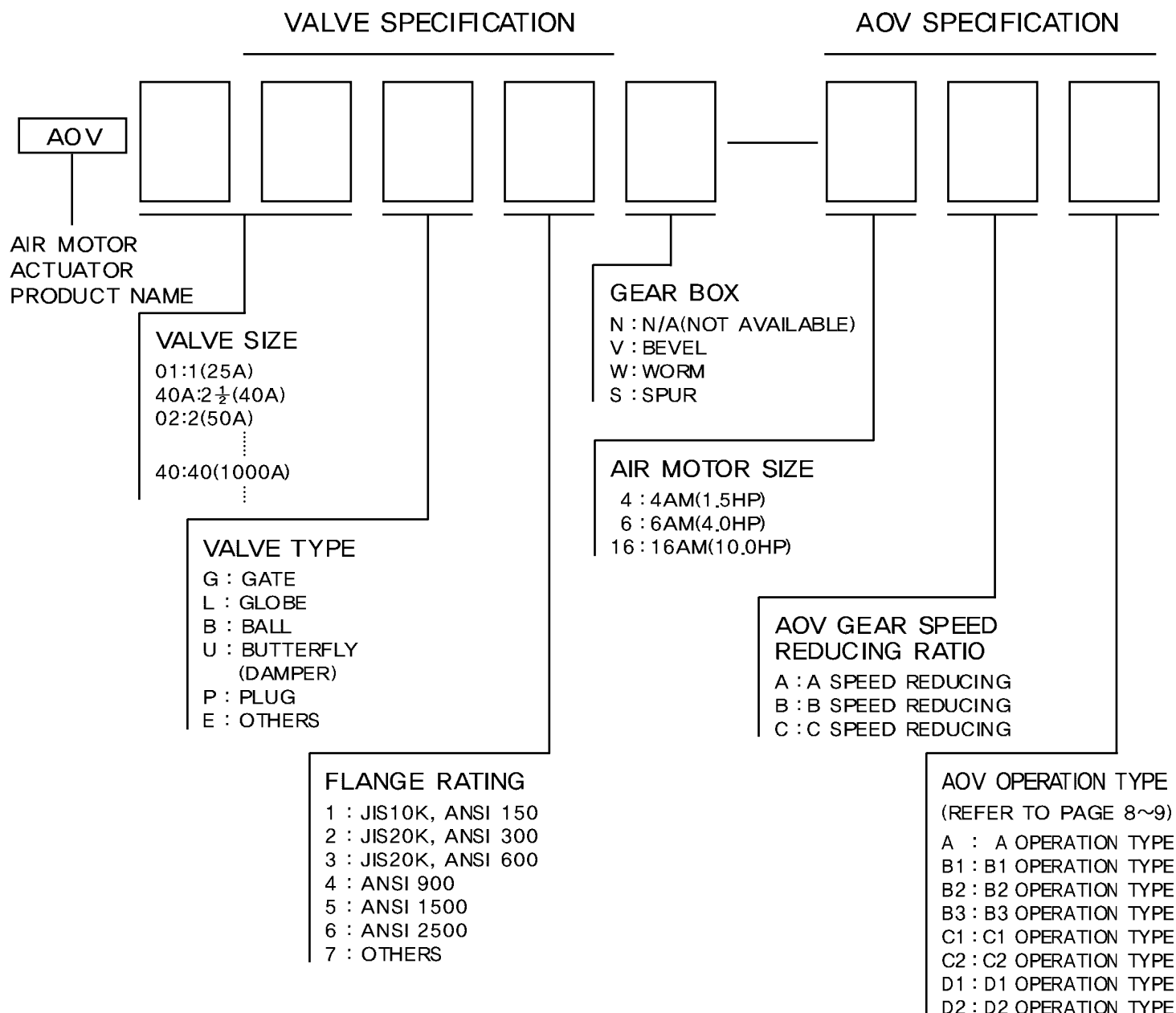
AIR MOTOR SIZE TYPE	4AM		6AM	
	A,B	C,D	A,B	C,D
A	430	530	430	530
B	460	460	492	492
C	350	400	350	400
D	415	465	415	465

12-2. Large AOV SIZE



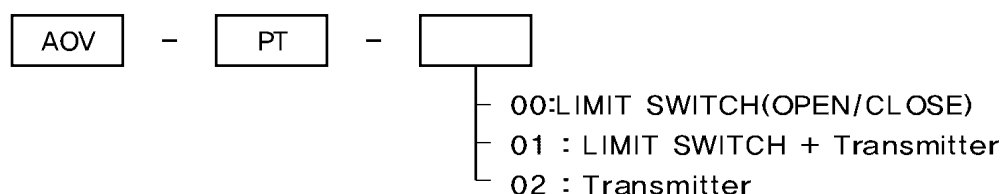
SIZE TYPE	A	A1	A2	B	B1	B2	C	C1
AB Type	500	375	125	880	527	353	526	359
C,D Type	540	415	125	880	527	353	526	359

13. Standard table for AOV model selection



(Ex.) AOV08G1N-6AA: This stands for the actuator equipped with 8 inch ANSI 150 LBS Gate Valve without gear box and 4.0 HP Air Motor, and valves should be operated in the field.

14. Standard table for Position Limiter model selection





KA-SERIES[AOV]



KE-SERIES[MOV]



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