

MODEL CT-100

CONTROL VALVE

PRODUCT MANUAL

Thank you very much for choosing the Yoshitake's product. To ensure the correct and safe use of the product, please read this manual before use. This manual shall be kept with care for future references. The symbols used in this manual have the following meanings.



	Warning	This symbol indicates a potentially hazardous situation that, if not avoided, could result in death or serious injury.
	Caution	This symbol indicates a hazardous situation that, if not avoided, may result in minor or moderate injury or may result in only property damage.

Table of Contents

1. Specifications	1
2. Nominal size selection	2
3. Structure and operation	3
4. Operating example	5
5. Storage	9
6. Installation	
6.1 Installation for body part	10
6.2 Wiring and piping	12
6.3 Test run	15
7. Warning and caution for use.....	15
8. Maintenance and inspection	
8.1 Troubleshooting	16
8.2 Warning and caution for maintenance	17
8.3 Dairy inspection	17
8.4 Regular inspection.....	17
8.5 Replacing gaskets, packings and positioners.....	17
9. Selection guide	18
Warranty Information	

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⚠ Caution

- (1) Please confirm that the indications on the product correspond with the specifications of the ordered product model before use.
 * If they are different, do not use the product and contact us.
- (2) This product might be discontinued or improved without prior notice.
- (3) In order to ensure successful and safe operation of our valves the entire operation manual must have been read thoroughly and understood prior to installation and commissioning, maintenance, otherwise, serious injury or equipment malfunction could happen and control valve may be damaged. It is out of the guarantee repair or replacement are not uncompensated by us.

This is the diaphragm type control valve that controls the pressure, flow rate, liquid surface and temperature by using electrical/pneumatic positioner.

1. Specifications

Model		CT-100
Nominal size		15~50A
Application	Controlled fluid	Steam, Air, Cold and hot water, Oil, Non-dangerous fluid
	Driving fluid	Compressed air
Connection		BSEN PN16 / PN25
Temperature		-5~250°C (Freeze is not available)
Valve(Flow) characteristic		Equal percent
Range ability		50:1
Valve & valve seat		Metal seal type
Leakage rate		Cv×less than or 0.01%(ANSI Class IV)*1
Driving type		Pneumatic single acting diaphragm drive
Actuator action		DA: Direct Acting (Normally opened) *2
		RA: Reverse Acting (Normally closed) *3
Operation air pressure		0.1~0.3MPa*4
Ambient temperature		-20~60°C
Material	Body	Ductile cast iron (FCD450)
	Valve	Stainless steel
	Valve seat	Stainless steel
	Gasket	Stainless steel + Graphite coating
	Grand packing	Graphite
	Diaphragm	NBR
Accessory		E/P type DC4 ~ 20mA electrical/pneumatic positioner (2wires)
		Smart type DC4~20mA smart positioner (2wires)
		Air regulator(Pressure regulator)

*1: As for the Cv value, please check "2. Nominal size selection" which shows rated Cv value.

*2: If there is no inlet signal, valve keeps open because of spring load, and if inlet signal is increases, valve will be closed.

*3: If there is no inlet signal, valve keeps closed because of spring load, and if inlet signal is increases, valve will be open.

*4: Please apply air pressure between 0.4-0.7 MPa for air regulator.

2. Nominal size selection

The appropriate nominal size can be calculated by obtaining the Cv value for the operating conditions in question, as shown below.

【In case of steam application】

$$P_2 > \frac{P_1}{2} \quad C_v = \frac{Wk}{138\sqrt{\Delta P(P_1 + P_2)}}$$

$$P_2 \leq \frac{P_1}{2} \quad C_v = \frac{Wk}{120P_1}$$

P_1 : Inlet press.(MPa·A) W : Max. steam flow rate(kg/h)
 P_2 : Reduced press.(MPa·A) ΔP : $P_1 - P_2$ (MPa)
 k : $1 + 0.0013 \times \{\text{Super-heated temp. (}^\circ\text{C)} - \text{Saturated heat temp. (}^\circ\text{C)}\}$
 C_v : C_v value depend on each size

【In case of air application】

$$P_2 > \frac{P_1}{2} \quad C_v = \frac{Q}{2940} \sqrt{\frac{(273+t)G}{\Delta P(P_1 + P_2)}}$$

$$P_2 \leq \frac{P_1}{2} \quad C_v = \frac{Q\sqrt{(273+t)G}}{2550P_1}$$

P_1 : Inlet press.(MPa·A) Q : Max gas flow rate (m³/h nominal condition)
 P_2 : Reduced press.(MPa·A) t : Gas temperature(°C)
 ΔP : $P_1 - P_2$ (MPa) G : Specific gravity (it is against air)
 C_v : C_v value depend on each size

【In case of liquid】

$$C_v = \frac{0.365V\sqrt{G}}{\sqrt{\Delta P}}$$

V : Max. liquid flow rate (m³/h) G : Specific gravity (It is against water)
 ΔP : $P_1 - P_2$ (MPa)
 C_v : C_v value depend on each size

●Rated Cv value

Size	15A	20A	25A	32A	40A	50A
Rated Cv value	4.6	8.6	13.3	18.5	24.8 / 28.9	36.2 / 41.6

For the 40A and 50A size, two types of Cv value are prepared due to the differential pressure. For details, please refer to Section "10. Selection guide".

Caution

When selecting pipe size, please take piping condition and application into consideration and secure a safety rate of 80 %

3. Structure and operation

3.1 DA (Direct Acting)

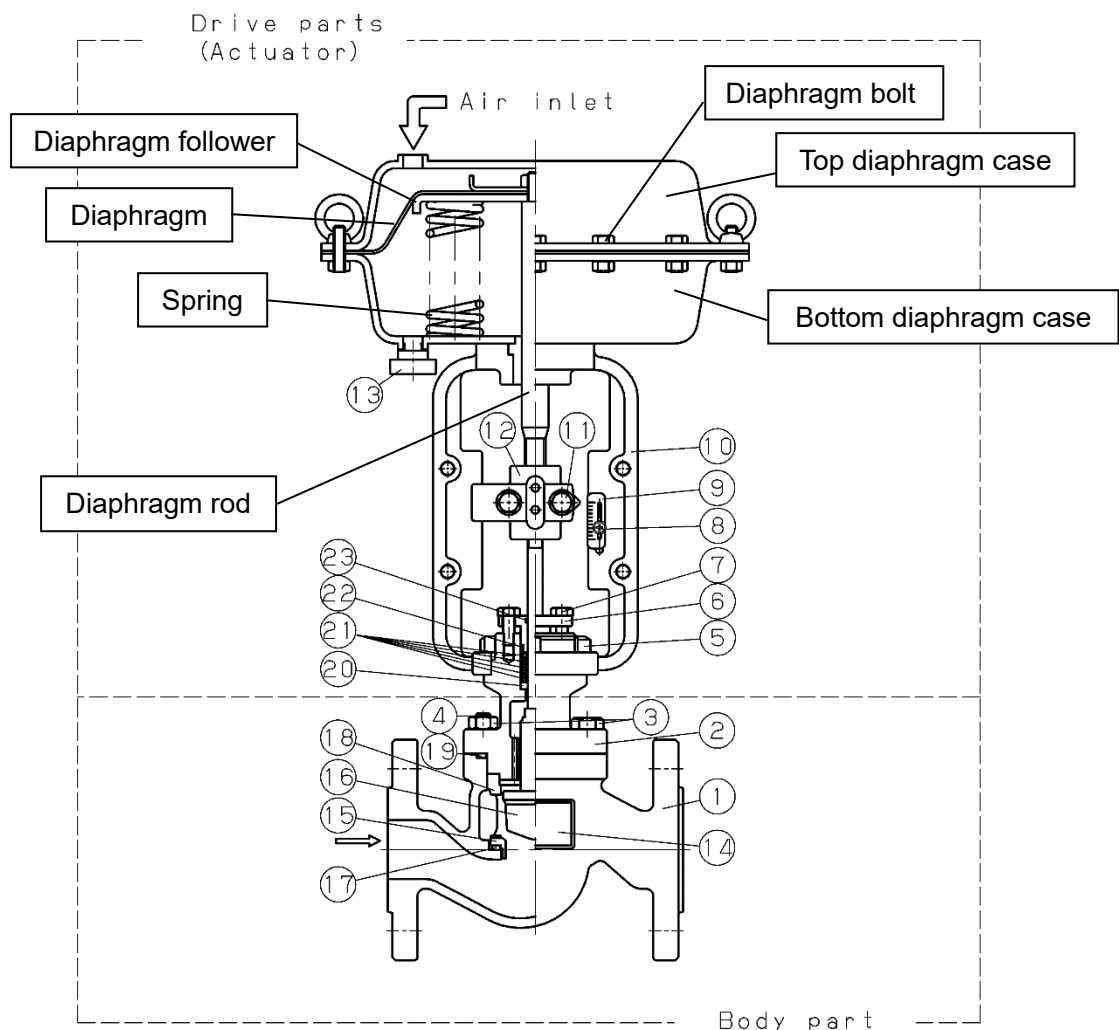


Fig.1

Parts list

No.	Name		No.	Name		No.	Name	
1	Body		8	Indicator Bolt set		16	Valve + Stem	
2	Bonnet		9	Indicator		17	Gasket (LWR)	
3	Bolt	25-50A	10	Actuator Body		18	Cage	
	Nut	15/20A	11	Connector Bolt Set		19	Gasket (UPR)	
4	Stud Bolt	15/20A	12	Connector		20	Packing Washer	
5	Bonnet Nut		13	Rubber Cap		21	Gland Packing	
6	Packing Plug		14	Name Plate		22	O-ring (Large)	
7	Gland Bolt		15	Valve Seat		23	O-ring (small)	

DA:

The valve closes by increasing air pressure in the top diaphragm case. Operated air pressure passes through the air connection port of the top diaphragm case, and by increasing air pressure on the diaphragm and the diaphragm follower, the spring is compressed by the direction of spring is compressed. And the valve is closed by displacing downward of the diaphragm rod and the connector which is assembled with the diaphragm follower, and the fluid shuts. In addition, the valve is displaced to the opening direction when the air pressure is decreased.

3.2 RA (Reverse Acting)

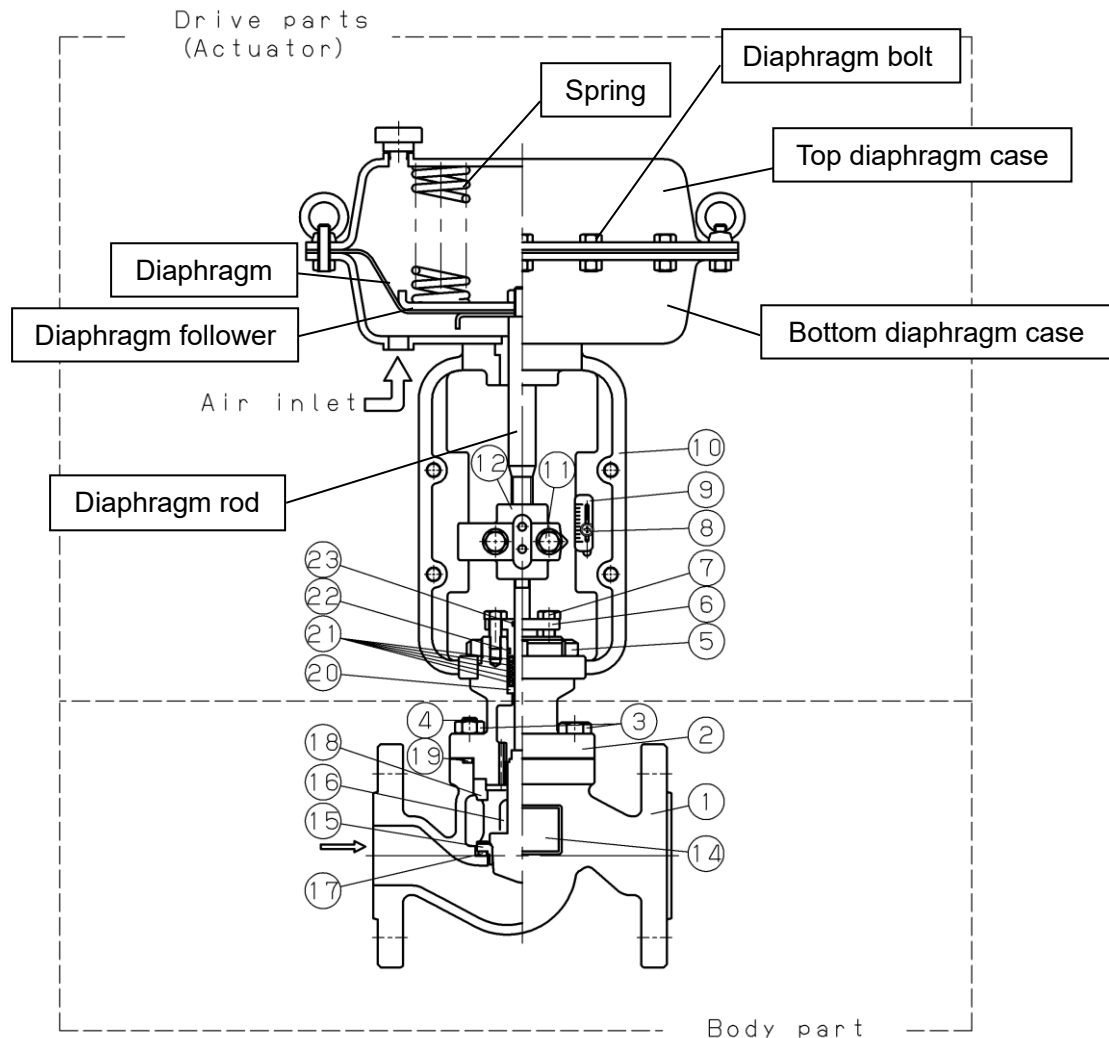


Fig.2

*The parts list of RA is as same as the list of DA.

RA:

The valve opens by increasing air pressure in the bottom diaphragm case. Operated air pressure passes through the air connection port of the bottom diaphragm case, and by increasing air pressure on the diaphragm and the diaphragm follower, the spring is compressed by the direction of spring is compressed. And the valve is opened by displacing upward of the diaphragm rod and the connector which is assembled with the diaphragm follower, and the fluid flows. In addition, the valve is displaced to the closing direction when the air pressure is decreased.

4. Operating example

*Please prepare the sensor or measure instrument by user themselves.

*These explanations in this chapter are only about RA type.

【Example of pressure control】

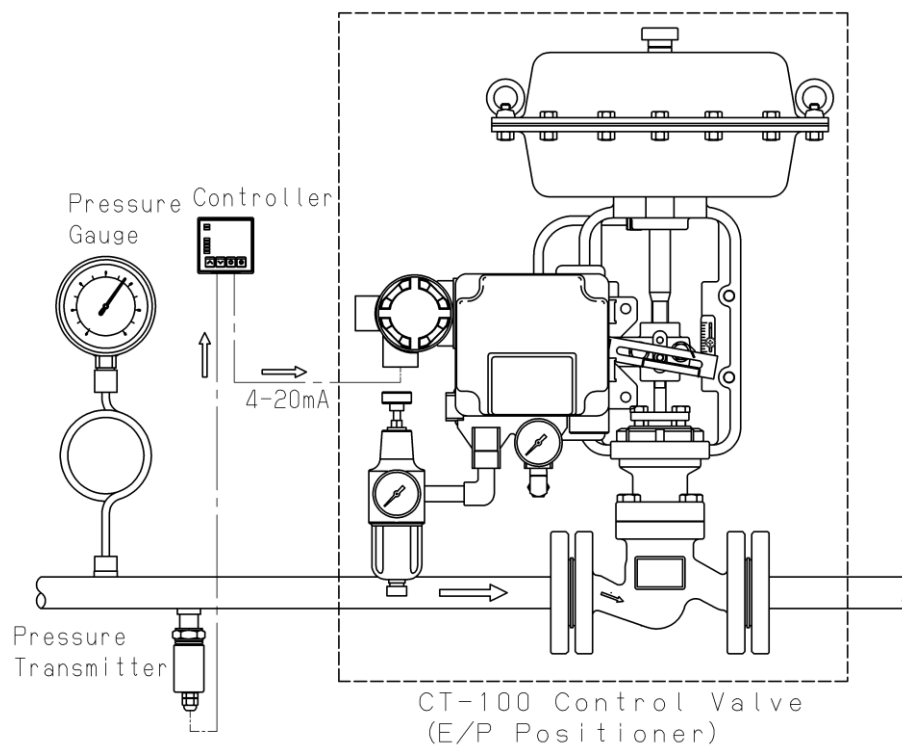


Fig.3

Signal	Valve action (Open degree of valve)	Fluid
20mA	Full opened (100%)	Press. : Min.
↑	↑	↑
Signal increase	Open	Press. : Decrease
↑	↑	↑
4mA	Full closed (0%)	Press. : Max.

[Example of flow control]

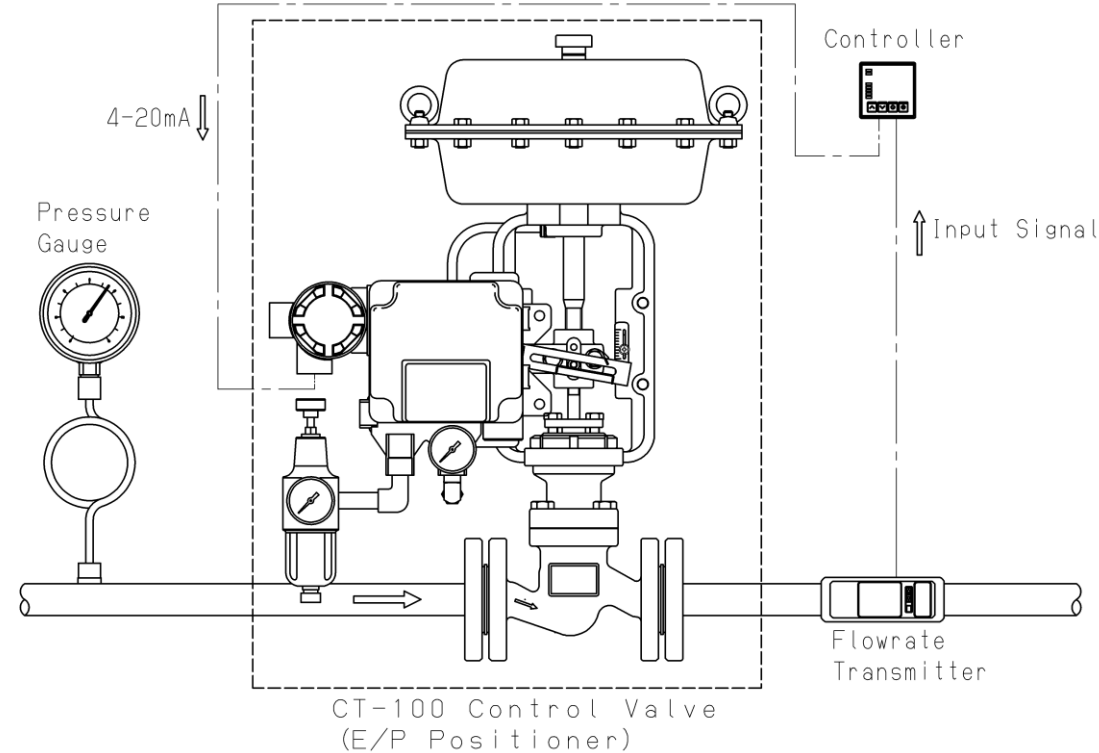


Fig.4

Signal	Valve action (Open degree of valve)	Flow rate
20mA	Full opened (100%)	Flow rate : Max.
↑	↑	↑
Signal increase	Open	Flow rate : Increase
↑	↑	↑
4mA	Full closed (0%)	Flow rate : Min.

【Example of water level control】

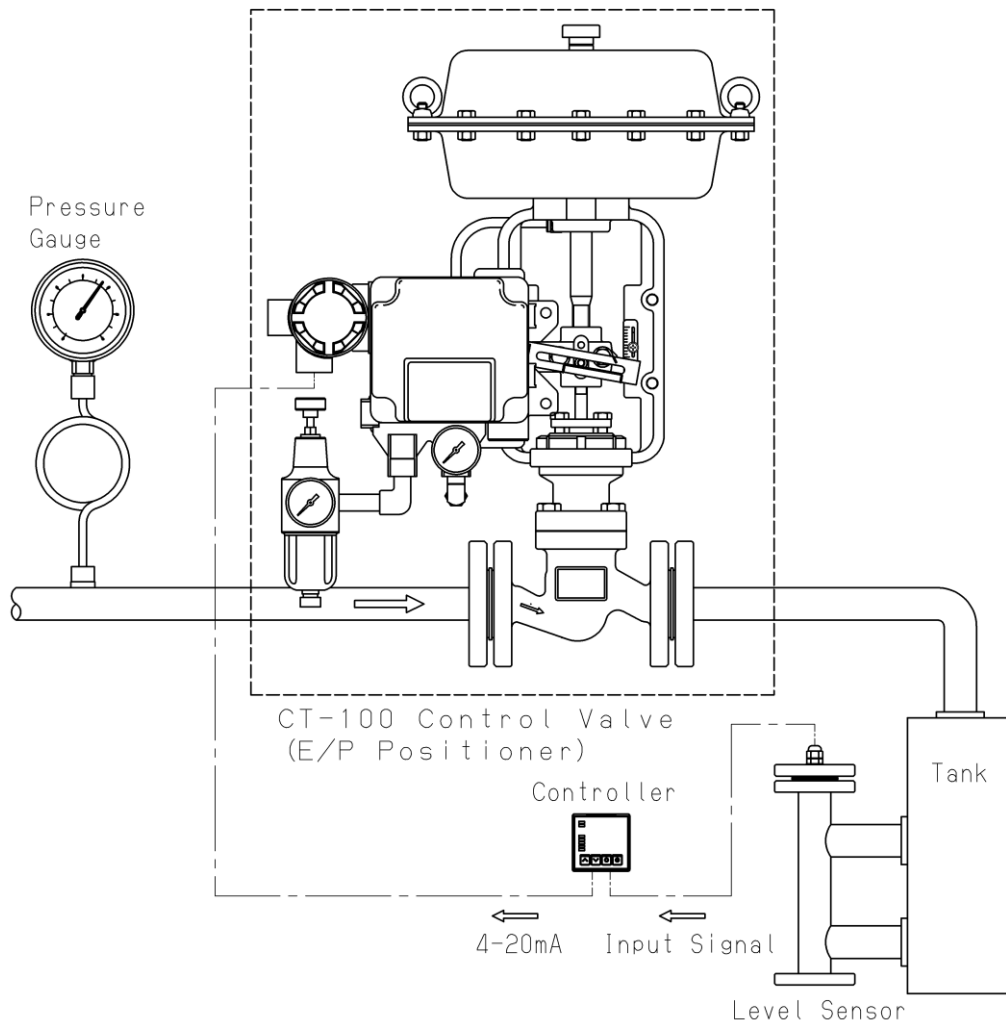


Fig.5

Signal	Valve action (Open degree of valve)	Tank
20mA	Full opened (100%)	Water level: Surge
↑	↑	↑
Signal increase	Open	Water level: Increase
↑	↑	↑
4mA	Full closed (0%)	Water level: No change

【Example of temperature control】

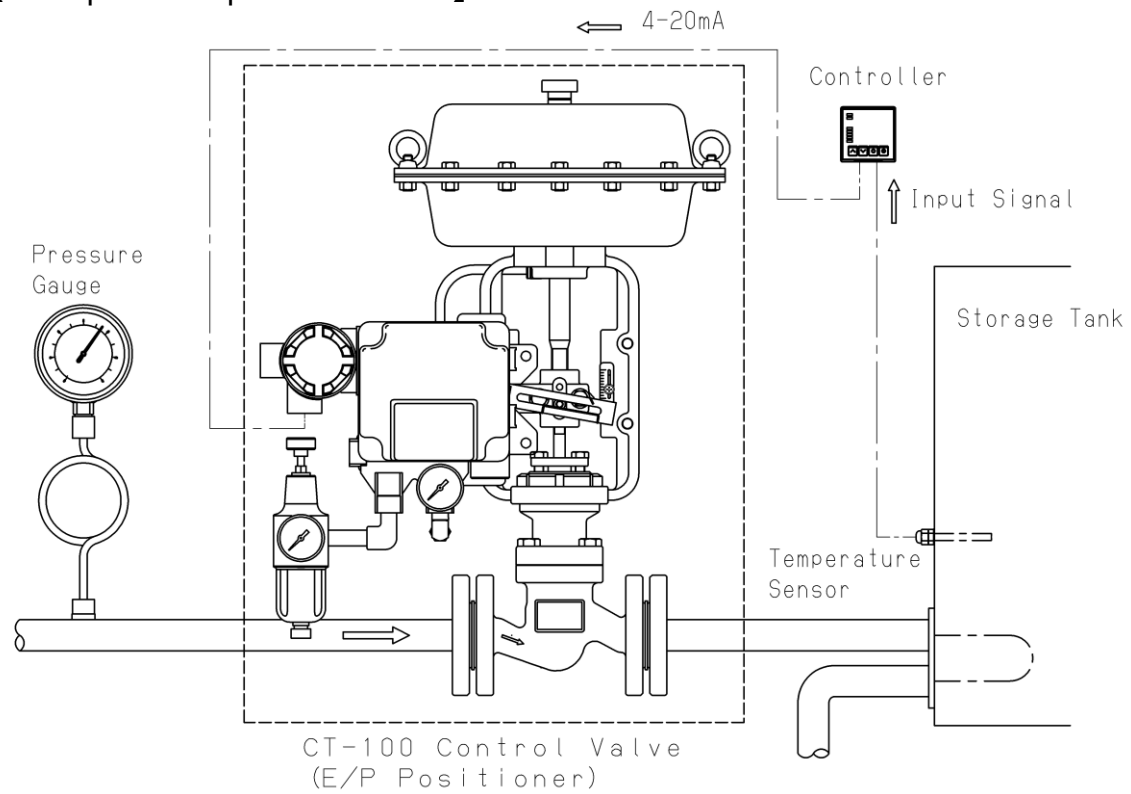


Fig.6

Signal	Valve action (Open degree of valve)	Fluid	Fluid in the tank
20mA	 Full opened (100%)	Steam flow rate: Max.	Temperature: Max.
↑ Signal increase	 Open	↑ Steam flow rate: Increase	↑ Temperature: Increase
↑	 Full closed (0%)	↑ Steam flow rate: Flow rate 0	↑ Temperature: No change
4mA			

5. Storage

Please store the product in the packaging until installation. Please observe the following points during storage.

- * After opening the package to inspect the product, please return it to its original packaging.
- * Do not store the product where it rains, where the temperature is above 60°C, and where dust or mist will damage the product.
- * Do not remove the seal and plastic cap used for pneumatic and electrical connections before installation.

6. Installation

6.1 Installation for body part

Warning

- (1) Due to heavy product, make sure to use hanging machine to hold the product. When hang this product up from package, use adequate hanging belt.
Eye bolt is installed at actuator in aim of hanging. When using eye bolt, use both eyebolt and make hanging belt same load at both side. (See Fig.7)
Besides, do not hold positioner when installation.
*Otherwise product may fall and cause injury.

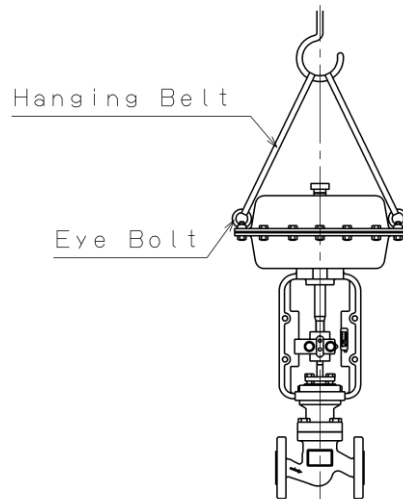


Fig.7

Caution

- (1) Do not disassemble the valve unreasonably
*Disassembling the valve at your discretion may affect the original performance
*If disassembly is required, it should be carried out by skilled worker.
*Do not disassemble the actuator as the force of the internal spring may cause injury.
- (2) Remove foreign matter and scales from the lines before connecting the valve.
- (3) Install the stop valve before and after the control valve
- (4) To ensure the connect properly without any leakage.
*If the connecting way is improper, leakage may be happened by vibration. And in case of high temperature, it may result in personal injury.
*When using the seal tape for piping, be aware not to enter it inside valve. In case of the seal tape for piping enter the valve, it may result in malfunction or device damage.
- (5) To install the product, check the direction of the product so that the fluid flowing and the arrow marked on the product are in the same direction.
(Install the valve perpendicularly to horizontal lines).
Please see the fig 8.
*Improper installation causes the malfunction.
- (6) Do not apply excessive load, torque or vibration to the valve
- (7) Do not get out the seal or polyethylene cover from the positioner or regulator until the pneumatic piping or construction of the electrical signal wiring is started.
- (8) The area to be frozen, please have the step to prevent from freezing.
*If the fluid is frozen, it may result in malfunction.

*In order to have easy maintenance, be sure to have enough space for inspection.
Please see the fig.8.

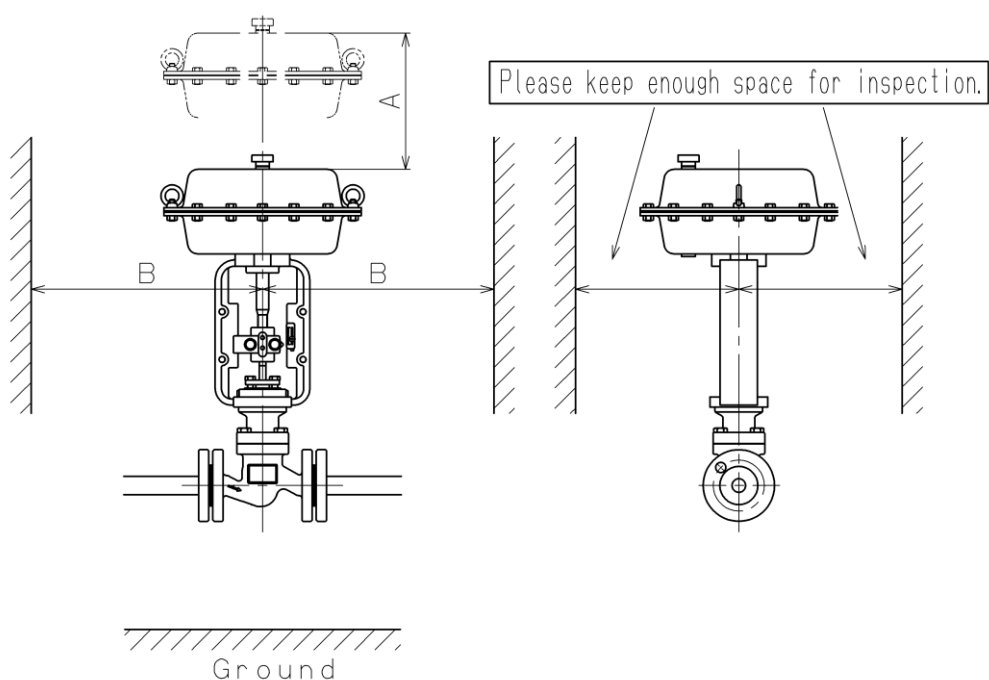


Fig.8

(mm)		
Size	A	B
15A	130	320
20A		
25A		
32A		
40A	150	340
50A		

- * The ambient temperature of the location where the valve is installed should be between $-20\sim 60^{\circ}\text{C}$ without positioner and regulator, and should also be between $-5\sim 60^{\circ}\text{C}$ with the positioner and regulator. In addition, please use the shielding plate or insulation in case the valve is affected by direct sunlight or radiant heat.

6.2 Wiring and piping

Warning

- (1) Electrical wiring must be done by expert or professional person.
- (2) This product is not available for the place (Atmosphere) where have the retention of explosive gas.
*Since it is not in the explosion-proof structure, there is a danger of fire.
- (3) When having the wiring work, please do the work in an environment where does not enter the rainwater or surrounding water. Also please make sure the rainwater or surrounding water so not enter the wiring port.
*In case of water enters there, there is the risk of electric shock
- (4) When wiring, please make sure the power supply is not provided.
- (5) Be sure to close the unused connection port with a blind plug.

Caution

- (1) Please have the proper piping diameter so as not to have pressure drop when piping to the positioner.
*The valve may not work properly.
- (2) When using the seal tape for piping, be aware not to enter it inside valve. If the seal tape for piping enter the valve, it may result in malfunction or device damage.
- (3) The compressed air the supply to the actuator, positioner and air regulator must the clean dry air which is not include the moisture, oil, and foreign matter.
*The valve may not work properly if the foreign matter comes in.
- (4) When purchasing the accessories, the air regulator and positioner are connected to the actuator when supplying, so please do not give the damage to the piping of air regulator and wiring for positioner.

【Method of connecting the air piping to the air regulator】

- When purchasing the goods with accessories, it is delivered by the structure with shown in Fig. 9-10. Please connect the air piping to the operating air connection port in Fig.9-10.

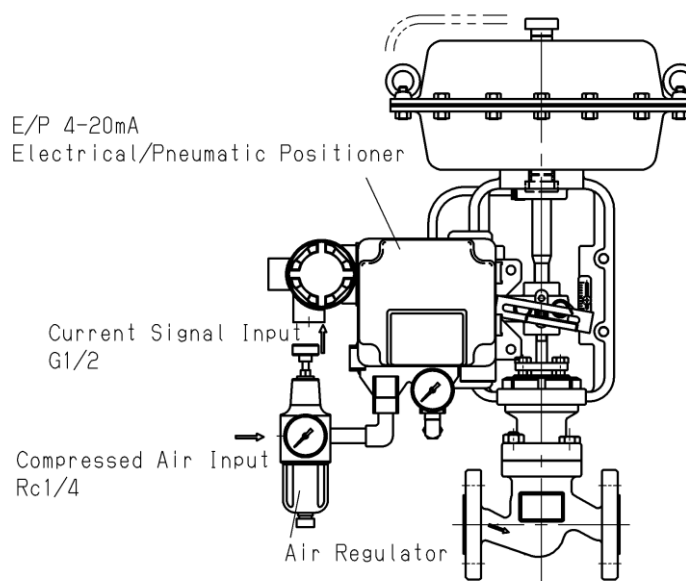


Fig.9

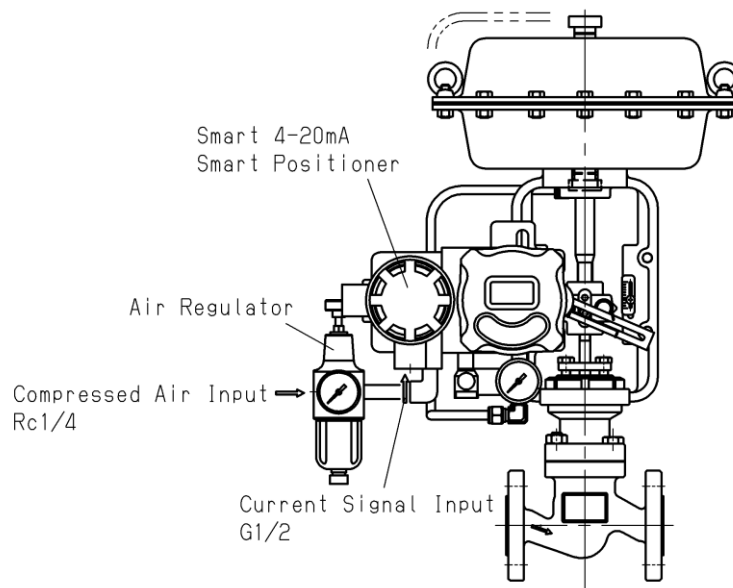


Fig.10

【How to connect the signal cable to the pneumatic positioner】(In case of E/P type)

•When purchasing the goods with accessories, it is delivered by the structure with shown in Fig.9. Please draw the signal cable from the external DC signal connection port shown in Fig.9. Connection way is 2 wire type. Please confirm and do wire the DC 4-20mA with the external signal line.

*Terminal wiring method (See Fig.11)

- ① Remove the set screw of the terminal box (Use the hex wrench) and remove the terminal box cover.
- ② Please connect the positive terminal of the terminal block located in the terminal box to the positive line of external input line. (In case of negative terminal, please connect the negative terminal of the terminal block located in the terminal box to the negative line of external input line). To protect the positioner, earth the gland earth terminal. When connecting, please tighten the terminal fastening firmly so that there is no connection failure.
- ③ After connecting the external line, tighten and fix the set screw after closing the terminal box cover. (Tightening torque: $0.25\text{N} \cdot \text{m}$)

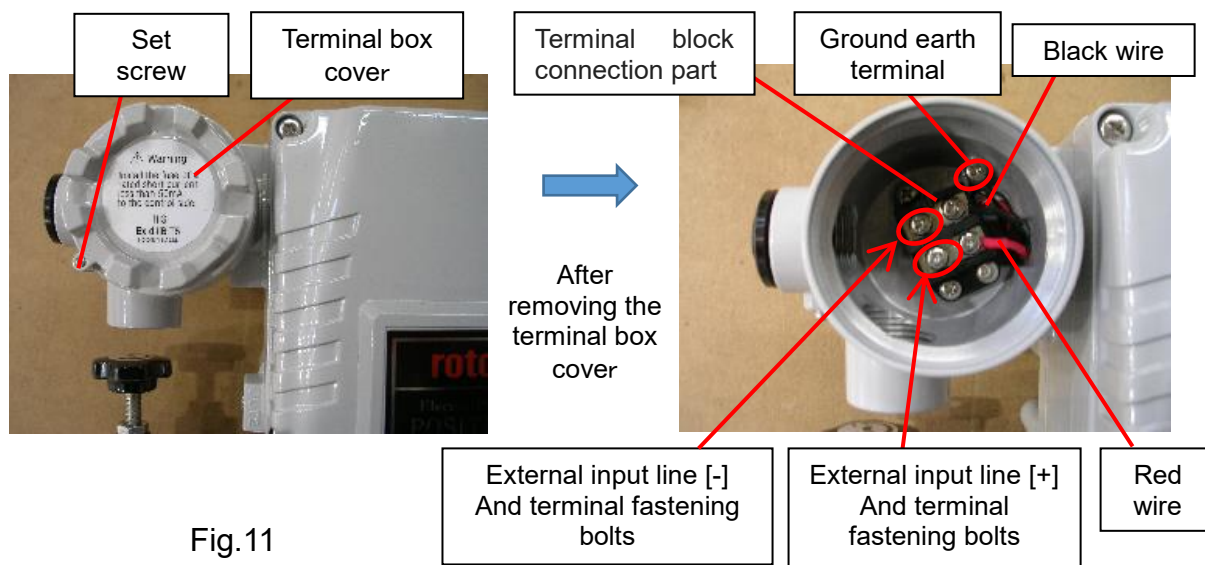


Fig.11

【How to connect the signal cable to smart positioner】(In case of Smart type)

•When purchasing the goods with accessories, it is delivered by the structure with shown in Fig.10. Please draw the signal cable from the external DC signal connection port shown in Fig.10. Connection way is 2 wire type. Please confirm and do wire the DC 4-20mA with the external signal line. The positioner normally operates with a minimum supply current of 3.8 mA DC.

*Terminal wiring method (See Fig.12)

- ① Remove the set screw of the terminal box (Use the hex wrench) and remove the terminal box cover.
- ② Please connect the positive terminal of the terminal block located in the terminal box to the positive line of external input line. (In case of negative terminal, please connect the negative terminal of the terminal block located in the terminal box to the negative line of external input line). To protect the positioner, earth the gland earth terminal. When connecting, please tighten the terminal fastening firmly so that there is no connection failure.
- ③ After connecting the external line, tighten and fix the set screw after closing the terminal box cover. (Tightening torque: $0.25\text{N} \cdot \text{m}$)

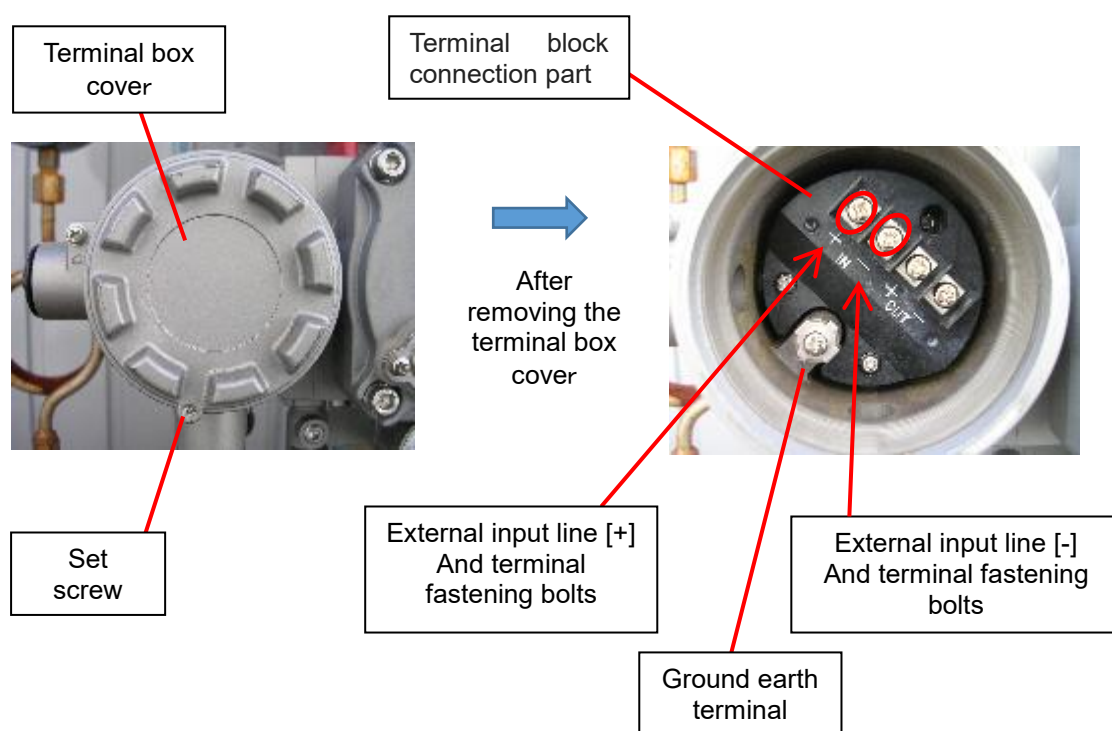


Fig.12

6.3 Test run

If the product comes with accessories, it is shipped with positioner set to zero point and the span adjusted, but it may be dropped or received impact during transportation or installation, so before operation, be sure to have a test run.

Caution

The product operates while a test run. Be sure to conduct a test run before operation. And, please have a test run in a pressure-free state with no fluid inside.

[Test run procedure]

- (1) Connect a regulator or current generator so that the positioner receives a 4-20mA DC pseudo input signal.
- (2) With the air pressure applied to the air regulator, confirm the product operates with its opening from 0 to 100% when the pseudo input signal of 4 to 20mA DC (0 to 100%) is given to the positioner and changed between 0-100%.

If the opening is incorrect, readjust the positioner according to "Product Manual (Positioner)".

7. Warning and caution for use

Warning

- (1) Before flow the steam in pipe line, make sure steam can flow without any dangerous at the end of pipe line and pipe line is connected tightly.

*Failure to follow this notice may result in burns and property damage.

- (2) Do not touch the valve directly with bare hands.

*Failure to follow this notice may result in burns.

Caution

- (1) Be sure to close the terminal box cover

*In case of remaining the cover opened, rainwater or surrounding water enter inside and it cause the leakage and malfunction

8. Maintenance and inspection

8.1 Troubleshooting (Please see section 3 "Structure and operation".)

Problem	Cause	Solution
Not working	1. Operating pneumatic pressure or external signal are not supplied.	1. Please confirm the presence or absence of the operating air (more than 0.35MPa) by the pressure gauge, etc. And confirm the external signal tester by using tester.
	2. Air piping is clogged or leaked.	2. In case of clogged, please clean it. When leaking, please replace the piping.
	3. Diaphragm bolt is loosen.	3. Retighten it.
	4. Leakage is happened between bottom diaphragm case and diaphragm rod.	4. Replace the product.
	5. Failure is occurred on accessories of positioner or regulator.	5. Inspect or replace the positioner or regulator.
	6. Failure is occurred on body part or actuator	6. Inspect or replace the product.
	7. Sensitivity of the positioner is inadequate.	7. Replace the positioner.
Working is unstable	1. Abnormal signal from the controller	1. Adjust controller again and confirm the signal system.
	2. Operating pneumatic pressure is not constant.	2. Check the air piping and exchange it to the bigger piping diameter.
Leakage from valve ^⑮	1. The valve does not move to the full closed position (Not moving downward)	1. Adjust the zero point again by using the controller.
	2. There are any scratches on the valve seat ^⑮ or valve ^⑮	2. Replace the product.
Leakage from grand packing ^⑳ or gasket ^⑲	1. The gland bolt ^⑦ or the bolt/nut ^③ is loosen.	1. Retighten the bolt/nut. After retightening, there is still leak, exchange the packing.
	2. The damage of the gland packing ^㉑ or gasket ^⑲	2. Replace them.

8.2 Warning and caution for maintenance

Warning

- (1) Do not touch the valve or piping directly with bare hands
 - *Failure to follow this notice may result in burns
- (2) Do not disassemble the valve unreasonably
 - *Disassembling the valve at your discretion may affect the original performance
 - *If disassembly is required, it should be carried out by skilled worker.
 - *Do not disassemble the actuator as the force of the internal spring may cause injury.
 - *In case of disassembling, please be sure to ask our staff

Caution

- (1) In case of no operation for a long period of time or regular inspection, discharge internal pressure from the valves, lines, and equipment completely.
 - * The scale or foreign matter inside of the pipe may cause malfunction.
- (2) After having the long term suspension, please do the inspection before re-operation.

8.3 Daily inspection

Please check the leakage from the pipe and the body portion (leak sound, etc.) following items during operation of facilities.

8.4 Regular inspection (1 time/Month)

- (1) Please make sure that there is no looseness on the installed piping of inlet and outlet side of the product.
- (2) Giving a false signal of 4-20mA DC to positioner, when it is changed by the opening signal from 0 to 100%, please make sure that the product is operated by the opening degree of 0 to 100%
 - *If the abnormality is found, please contact us.

8.5 Replacing gaskets, packings and positioners

For disassembling the product by replacing the gasket, packing, or positioner, please refer to "Product Manual (Disassembly and Assembly Procedure)" (In preparation.).

Although it varies greatly depending on the use conditions, the recommended period for replacing gaskets and packings is about two years.

9. Selection guide

Model configuration

CT-100 – □ □ □ E □ – □ □ – CV □										Annotation
Flange (Max Press.)	PN16									Flange PN16
	PN25									Flange PN25
Max working differential press.	10									Max 1.0MPa
	16									Max 1.6MPa
	25									Max 2.5MPa (Not available for PN16)
Valve size	DN015									BSEN DN 15A
	DN020									BSEN DN 20A
	DN025									BSEN DN 25A
	DN032									BSEN DN 32A
	DN040									BSEN DN 40A
	DN050									BSEN DN 50A
Valve characteristic				E						Equal percentage
Actuator type				DA						Direct Acting (Normally open)
				RA						Reverse Acting (Normally close)
Positioner					N					No positioner
					E					E/P positioner
					S					Smart positioner
EAC certification					N					None
					E					EAC certificated (Not available with positioner)
Nominal CV							CV	xxx		Refer to table below

Rated Cv value

Flange (Max press.)	Max differential pressure	Valve size					
		15A	20A	25A	32A	40A	50A
PN16	1.0MPa	4.6 (CV005)	8.6 (CV008)	13.3 (CV013)	18.5 (CV018)	28.9 (CV028)	41.6 (CV042)
	1.6MPa					24.8 (CV025)	36.2 (CV036)
PN25	1.0MPa					28.9 (CV028)	41.6 (CV042)
	1.6MPa					24.8 (CV025)	36.2 (CV036)
	2.5MPa						

*The notation in parentheses is the nominal CV described in the model configuration table.

How to order

Example: CT100 – PN16 10 DN040 E RA – E N– CV 028

(Flange PN16/ Max diff. press. 1.0MPa/ DN 40A/ Equal percentage/ RA type actuator/
/ with E/P positioner/ No EAC certification/ Nominal CV028(28.9))

Example: CT100 – PN25 16 DN050 E RA – N N– CV 036

(Flange PN25/ Max diff. press. 1.6MPa/ DN 50A/ Equal percentage/ RA type actuator/
/ No positioner option (No EAC certification)/ Nominal CV036(36.2))

Warranty Information

1. Limited warranty

This product has been manufactured using highly-advanced techniques and subjected to strict quality control. Please be sure to use the product in accordance with instructions on the manual and the label attached to it.

Yoshitake warrants the product to be free from any defects in material and workmanship under normal usage for a period of one year from the date of receipt by the original user, but no longer than 24 months from the date of shipment from Yoshitake's factory.

2. Parts supply after product discontinuation

This product may be subject to discontinuation or change for improvement without any prior notice. After the discontinuation of the product, Yoshitake supplies the repair parts for 5 years otherwise individually agreed.

3. This warranty does not cover the damage due to any of below:

- (1) Valve seat leakage or malfunction caused by foreign substances inside piping.
- (2) Improper handling or misuse.
- (3) Improper supply conditions such as abnormal water pressure/quality.
- (4) Water scale or freezing.
- (5) Trouble with power/air supply.
- (6) Any alteration made by other than Yoshitake.
- (7) Use under severe conditions deviating from the design specifications (e.g. in case of corrosion due to outdoor use).
- (8) Fire, flood, earthquake, thunder and other natural disasters.
- (9) Consumable parts such as O-ring, gasket, diaphragm and etc.

Yoshitake is not liable for any damage or loss caused by malfunction or defect of the product.