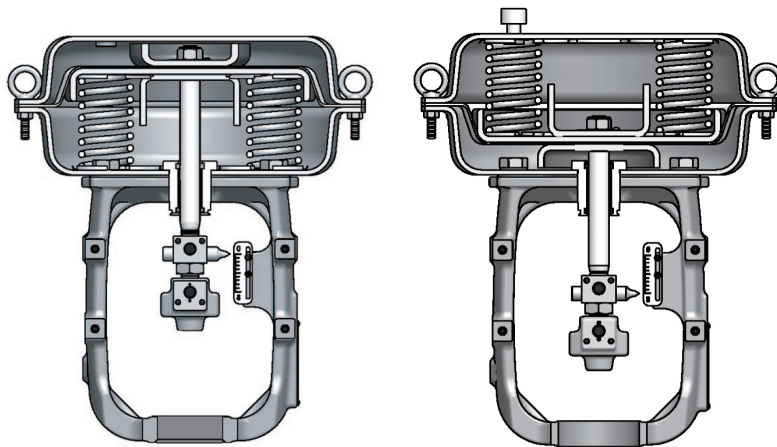


**CV3000 Series Multismotor™
Multi-Spring Type
Diaphragm Motors
Model : HA/HL
User's Manual**



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TABLE OF CONTENTS

| | <u>PAGE</u> |
|---|-------------|
| 1. GENERAL | 1 |
| 1.1 Scope | 1 |
| 1.2 Specifications | 1 |
| 1.3 Structures | 2 |
| 1.4 Nameplate | 3 |
| 2. INSTALLATION | 4 |
| 2.1 Maximum Lifting Loads of Eyebolts | 4 |
| 2.2 Items to be Checked After Installation and Before Starting Operation | 4 |
| 3. INSPECTION AND MAINTENANCE | 5 |
| 3.1 Routine Inspection | 5 |
| 3.2 Periodical Maintenance | 5 |
| 4. DISASSEMBLY AND ASSEMBLY OF ACTUATOR | 6 |
| 4.1 Disassembly and Assembly of Model HA1 Actuator | 8 |
| 4.2 Disassembly and Assembly of Model HA2, HA3, or HA4 Actuator | 16 |
| 5. DIMENSIONS, WEIGHT AND OUTPUT OF HL | 23 |
| 6. DIRECT/REVERSE ACTION TYPE CONVERSION AND SPRING RANGE CHANGE OF ACTUATOR | 25 |
| 6.1 Direct/Reverse Action Change | 25 |
| 6.2 Stroke and Range Spring Change | 27 |
| 7. INSTRUCTIONS FOR TOP HANDWHEEL OF ACTUATOR | 29 |
| 7.1 Model HA1 Actuator | 29 |
| 7.2 Model HA2, HA3, or HA4 Actuator | 34 |
| 8. INSTRUCTIONS FOR SIDE HANDWHEEL OF ACTUATOR | 41 |
| 8.1 Installation Procedure | 41 |
| 8.2 Operating Instructions | 41 |
| 8.3 Disassembly and Assembly of Side Handwheel | 41 |

1. GENERAL

1.1 Scope

This manual covers operating instructions for Model HA Multi-spring type Diaphragm Motors and Model HL Lever-type Diaphragm Motors. For Model HL Diaphragm Motors, this manual covers only the items related to the lever since other items are identical with those of Model HA Diaphragm Motors. For the positioners, refer to Operator's Manual OM2-8310-0200 (Model HTP), OM2-8313-0100 (Model HEP), OM2-8310-0410 (Model VPE).

1.2 Specifications

- Models

| Action | Model | | | |
|---------|-------|------|------|------|
| Direct | HA1D | HA2D | HA3D | HA4D |
| Reverse | HA1R | HA2R | HA3R | HA4R |

- 1) Direct-action Type: As the pneumatic signal fed to the top chamber of diaphragm case increases, the actuator stem moves downward.
- 2) Reverse-action Type: As the pneumatic signal fed to the bottom chamber of diaphragm case increases, the actuator stem moves upward.

- Major Materials

Diaphragm case: SS41

Diaphragm: Fiber-reinforced ethylene propylene rubber

Actuator stem: SUS304

Yoke: FC20

Lever: SS41

Fork: S20C

Pin: SUS304

Mounting base: SS41

} Model HL only

Spring range*: 20 – 100 kPa {0.2 – 1.0 kgf/cm²} or 80 – 240 kPa {0.8 to 2.4 kgf/cm²}

Air supply*: 140 – 400 kPa {1.4 to 4.0 kgf/cm²}

Air pipe connections: Rc1/4 or 1/4NPT internal thread

Ambient temperature: –30 to +70°C

*: The output differs depending on the spring range and air supply pressure.

Overall dimensions:

Weights:

Performance:

} See Section 5.

Hysteresis Error and Linearity

| Item | | Spring range | | (within %FS) | | | |
|------------------|--------------------|--------------|----|--|---------|--|---------|
| | | | | 20 - 100 kPa (0.2 - 1.0 kgf/cm ²) | | 80 - 240 kPa (0.8 - 2.4 kgf/cm ²) | |
| | | | | HA1 | HA2 - 4 | HA1 | HA2 - 4 |
| Hysteresis error | Without positioner | 5 | 3 | — | — | | |
| | With positioner | 1 | 1 | 1 | 1 | | |
| Linearity | Without positioner | ±5 | ±5 | — | — | | |
| | With positioner | VPE | ±3 | — | ±3 | — | |
| | | HTP | — | ±1 | — | ±1 | |
| | | HEP | ±2 | ±1 | ±2 | ±1 | |

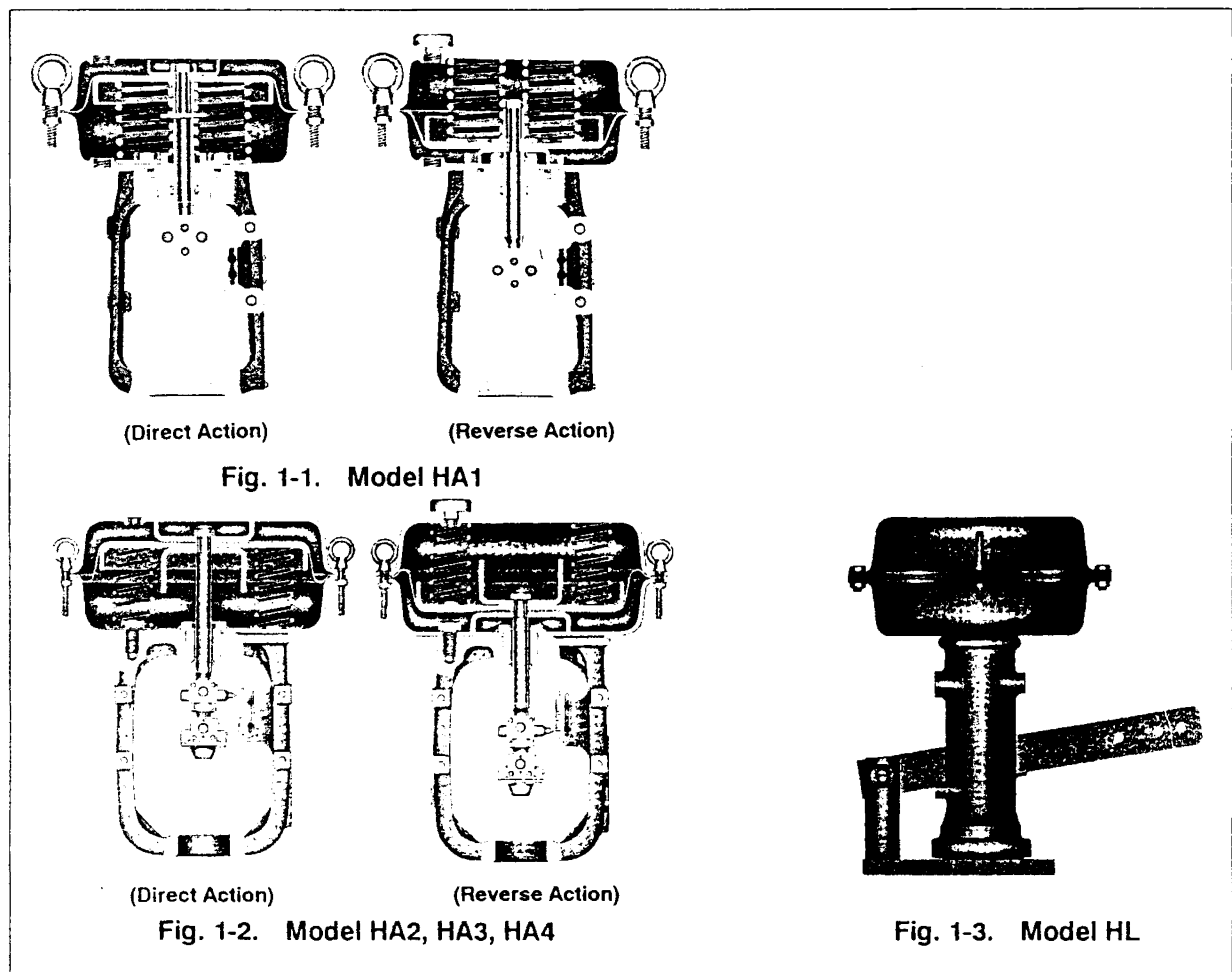
Note) When no positioner is provided, performance may differ by the type of packing used.

1.3 Structures

Model HA Multi-spring-type Diaphragm Motor has a diaphragm and springs with which to convert a pneumatic signal into a positioning signal to drive the valve stem. (See Figs. 1-1 and 1-2.)

Model HL Lever-type Diaphragm Motor has, in addition to the mechanisms identical with those of the HA diaphragm motor, a lever mechanism with which to magnify the driving stroke for the valve stem.

The Diaphragm motor can be incorporated with a manual handwheel for manual positioning of the valve stem. A handwheel is available either in a side mount type (except Model HA1) or in a top mount type.



1.4 Nameplate

A nameplate as shown in Fig. 1-4 is posted on each actuator. The nameplate indicates the model number, stroke, spring range, date of manufacture and other major specifications of the actuator. Before using the actuator, be sure that the specifications indicated on the nameplate conform with the conditions of use. The nameplate indicates also the product number (PROD No.) of the actuator. Please mention this number also when consulting your Yamatake Corporation agent for replacement of parts or other modifications of the control valve.

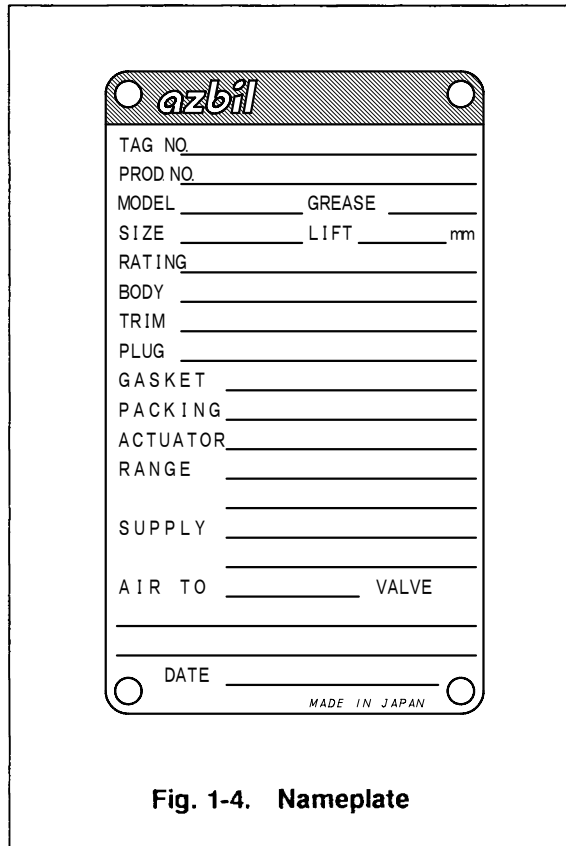


Fig. 1-4. Nameplate

2. INSTALLATION

2.1 Maximum Lifting Loads of Eyebolts

The diaphragm case has a pair of lifting eyebolts. These eyebolts primarily are for lifting the actuator alone. When using the eyebolts for other purposes (such as lifting an actuator fixed to its valve body or other components), note that the allowable maximum lifting loads of the eyebolts are as shown in the following table.

Table 2-1. Maximum Lifting Loads of Eyebolts

| Actuator Model No. | Allowable Maximum Lifting Load of Eyebolts | Weight of HA Actuator Alone | Weight of HL Actuator |
|--------------------|--|-----------------------------|-----------------------|
| HA1 | 160 kg | 8 kg | — |
| HA2, HL2 | 160 kg | 16 kg | 22 kg |
| HA3, HL3 | 160 kg | 32 kg | 45 kg |
| HA4, HL4 | 220 kg | 68 kg | 95 kg |

A pair of eyebolts are located diagonally on the diaphragm case. They also serve as two of the diaphragm case clamping-screws. Each eyebolt has at its top a ringlet to pass the cable wire to hoist the actuator.

2.2 Item to be Checked After Installation and Before Starting Operation

- (1) Before connecting the air pipes to the actuator and positioner, blow the pipes to clean them.
- (2) Check that the bolts and nuts of the diaphragm case are not loose. Standard tightening torques are as shown in Table 4-1.
- (3) Check that there is no leak from any position.
- (4) For the HL actuator, be sure that the cotter pins of the two parallel pins which acts are pivots for the lever are correctly installed.

3. INSPECTION AND MAINTENANCE

For the actuators, render routine inspection service and periodical maintenance service as described in this section.

3.1 Routine Inspection

- (1) Check that the bolts and nuts are not loose.
- (2) Check that there are no air leakage from joints and connections of air piping.
- (3) For Model HL Actuators, check that the cotter pins of the two parallel pins which act as pivots for the lever are correctly installed.

3.2 Periodical Maintenance

The parts mentioned below must be replaced once in every 5 years or thereabout, and in addition the three types of parts mentioned at the end of the below listing must be replaced whenever the actuator is disassembled. For the replacement method, see Section 4 "DISASSEMBLY AND ASSEMBLY OF ACTUATOR."

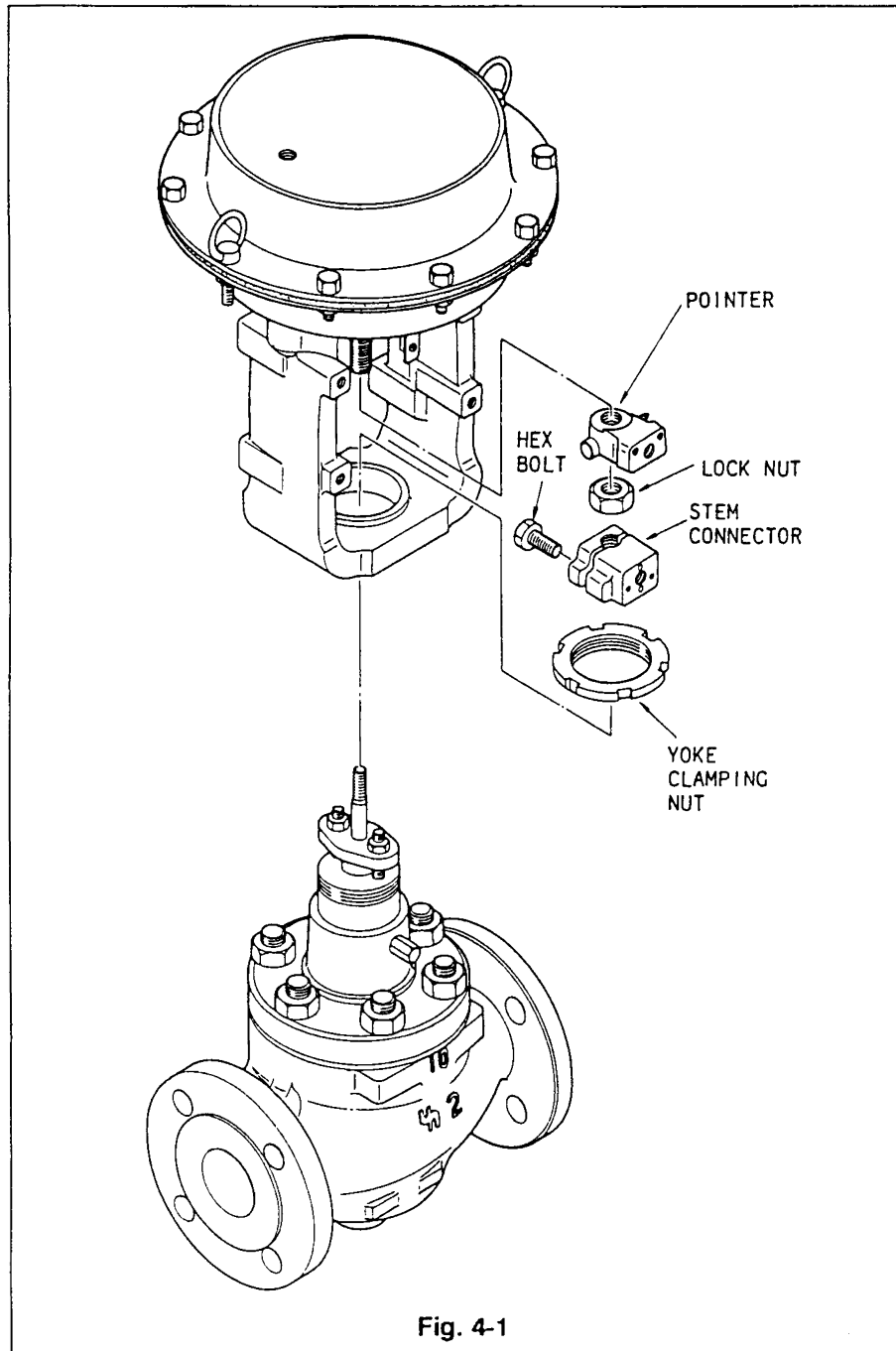
| | | |
|--------------|---------|-----------------------|
| Diaphragm | 5 years | |
| Bushing* | 5 years | |
| Cap | 5 years | |
| Seal washers | 5 years | whenever disassembled |
| Dust seal | 5 years | whenever disassembled |
| Rod packing | 5 years | whenever disassembled |

*: Model HA1 Actuator has no bushing.

4. DISASSEMBLY AND ASSEMBLY OF ACTUATOR

Normally the actuator requires no adjustment. However, it should be disassembled and assembled when installing it on a valve body, when modifying its specifications, or when replacing damaged parts. The disassembly and assembly procedure of the actuator for such purposes are covered in Sections 4-1 and 4-2.

To disassemble the actuator, refer to Fig. 4-1 to Fig. 4-16.



When disassembling or assembling the actuator, keep it in the vertical attitude.

For the tightening torques of bolts and nuts, see Tables 4-1, 4-2.

For the names of the parts, see Figs. 4-7, 8 and 4-16.

Notes for Disassembly

1. The nuts for the eyebolts are made of stainless steel. Discriminate these nuts from other nuts when assembling the diaphragm case.
2. It is recommendable to make locating marks on the top and bottom diaphragm cases before disassembly. This will help you to find easily the air piping connector location.
3. Store the removed parts in a clean place.

Caution: Never loosen or remove carelessly the bolts and nuts of the actuator. The actuator employs powerful compressed springs and if you remove the bolts and nuts carelessly, the springs may leap out causing hazards. When removing the bolts and nuts, be sure to observe the instructions given for disassembly and assembly procedures of the actuator and top handwheel.

4.1 Disassembly and Assembly of Model HA1 Actuator

Disassembly Procedure

(a) Direct Action Type (See Fig. 4-2.)

- (1) Disconnect the air piping and detach the accessories from the actuator.
- (2) Remove the stem connector.
- (3) Remove the clamping-bolts (except the pair of eyebolts) of the diaphragm case.
- (4) Loosen evenly and alternately the pair of eyebolts. (The initial setting of the springs is done by these eyebolts.)
- (5) Remove the diaphragm case. Pull out upward the actuator rod together with the diaphragm.
- (6) Take out the springs.

(b) Reverse Action Type (See Fig. 4-3.)

- (1) Disconnect the air piping and detach other external items from the actuator.
- (2) Remove the stem connector.
- (3) Remove the clamping-bolts (except the pair of eyebolts) of the diaphragm case.
- (4) Loosen evenly and alternately the pair of eyebolts. (The initial setting of the springs is done by the eyebolts.)
- (5) Remove the diaphragm case. Take out the spring.
- (6) Pull out upward the actuator rod together with the diaphragm.

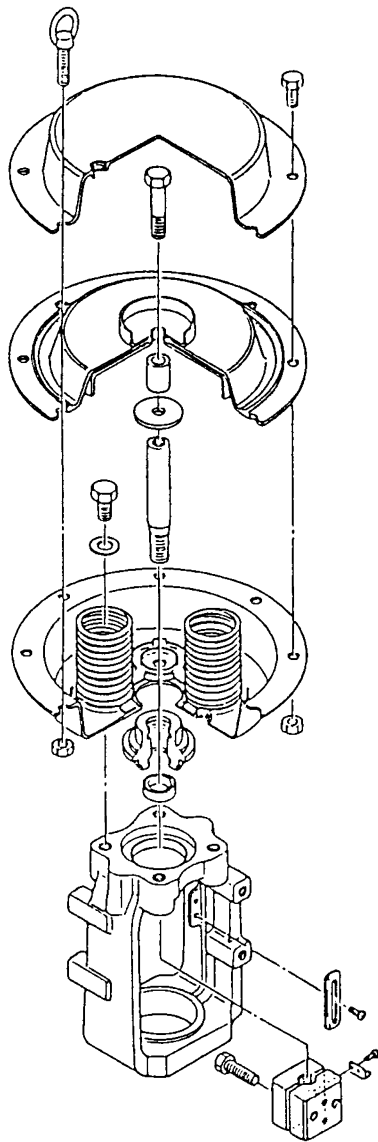


Fig. 4-2. Direct Action Type
(HA1D)

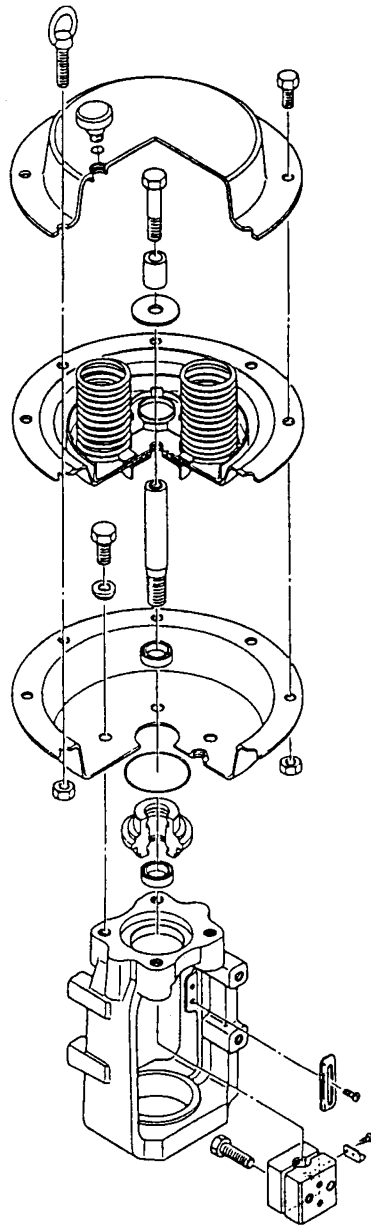


Fig. 4-3. Reverse Action Type
(HA1R)

Assembly Procedure

Before assembly, check the parts for scrapes, damage, deformation, peeling off of paint, and other abnormality. To assemble the actuator, proceed as follows:

(a) Direct Action Type

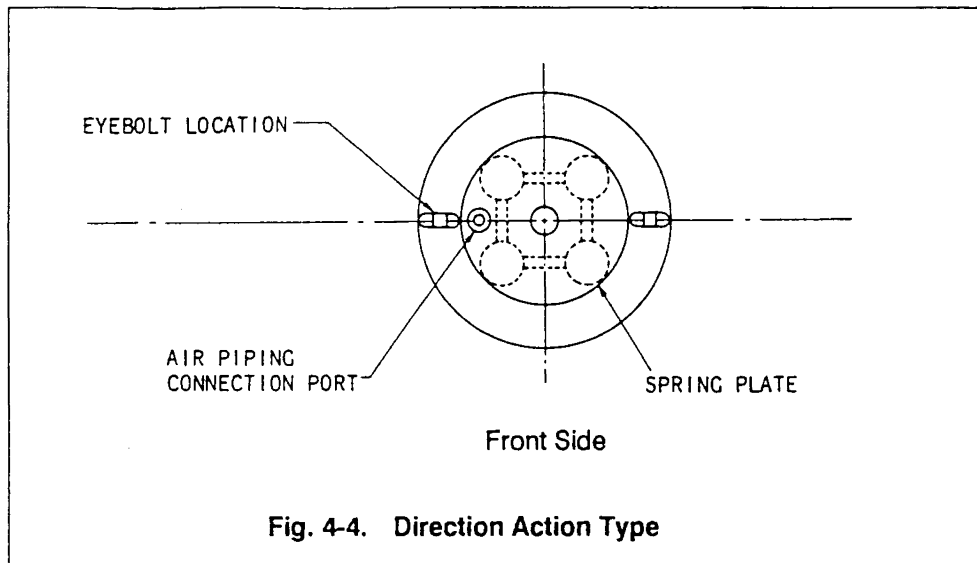
- (1) Fix the bearing (with dust seal) to the yoke. Fix the diaphragm case (bottom) with the four bolts (M10).
- (2) Fix the spring plate (see Fig. 4-4). Install the springs on the spring plate.
- (3) Insert the actuator rod (to which the diaphragm is connected) into the bearing, exercising care not to damage the bearing inside surface or dust seal with the threaded section of the rod. (For example, cover the threaded section with adhesive tape to prevent damaging the bearing.)
- (4) Place the top diaphragm case and fix it with the pair of eyebolts.

Notes:

- Set the air piping connection port in the location shown in Fig. 4-4.
- Tighten the pair of eyebolts uniformly by tightening them alternately. The initial setting of the springs is complete by tightening of these eyebolts.

- (5) Clamp the diaphragm case with other clamping-bolts than the pair of eyebolts.
- (6) Install the stem connector. (Connect the air pipe to the air piping connection port of the top diaphragm case.)
- (7) After the assembly is complete as above, check the following.
 1. Applying an air pressure of 490 kPa {5 kgf/cm²} via the air piping connection port of the top diaphragm case, check the diaphragm periphery for air leak by using soapsuds.
 2. Check that the actuator smoothly operates for its full stroke.

Note: Check this operation by operating the actuator as an independent unit.



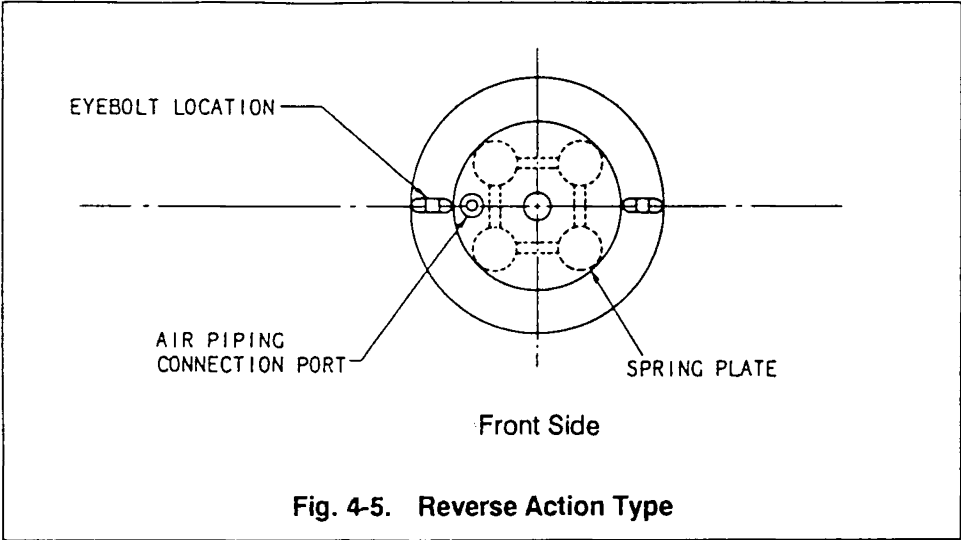
(b) Reverse Action Type

- (1) Fix the bearing (with dust seal and rod packing) and the O-ring to the yoke, and fix the bottom diaphragm case with the four bolts (M10).
- (2) Insert the actuator rod (to which the diaphragm is connected) into the bearing, exercising care not to damage the bearing inside surface or dust seal with the threaded section of the rod. (For example, cover the threaded section with adhesive tape to prevent damaging the bearing.)
- (3) Fix the spring plate and install the springs on the spring plate. (See Fig. 4-5.)
- (4) Place the top diaphragm case and fix it with the pair of eyebolts.

- Notes:
- Set the air vent hole in the location shown in Fig. 4-5.
 - Uniformly and alternately tighten the eyebolts. The initial setting of the springs is complete by tightening of these eyebolts.

- (5) Clamp the diaphragm case with other clamping-bolts than the pair of eyebolts.
- (6) Install the stem connector.
- (7) Install the rain cap on the air vent port.
- (8) Connect the air pipe to the air piping connection port of the bottom diaphragm case.
- (9) After the assembly is complete as above, check the following.
 1. Applying an air pressure of 490 kPa {5 kgf/cm²} via the air piping connection port of the bottom diaphragm case, check the diaphragm periphery for air leak by using soapsuds.
 2. Check that the actuator smoothly operates for its full stroke.

Note: Check this operation by operating the actuator as an independent unit.



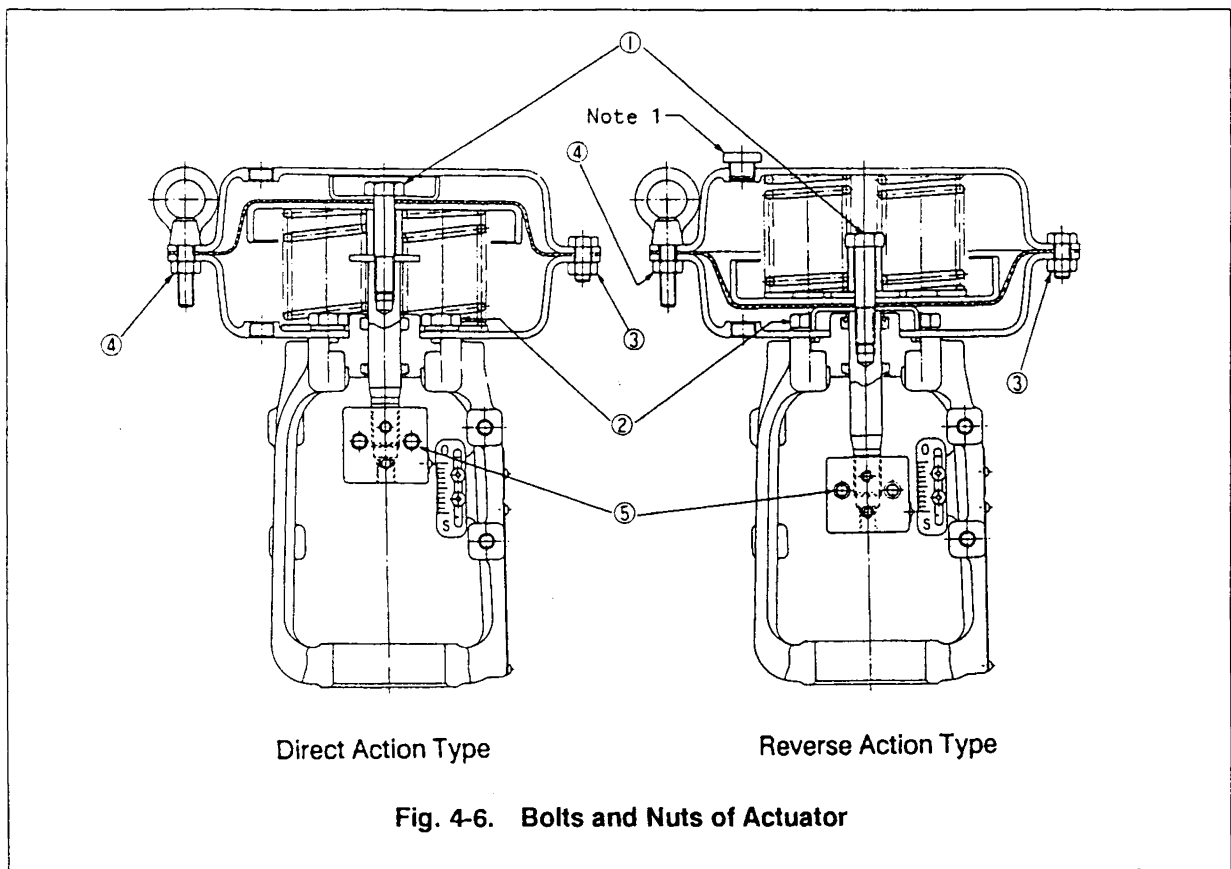
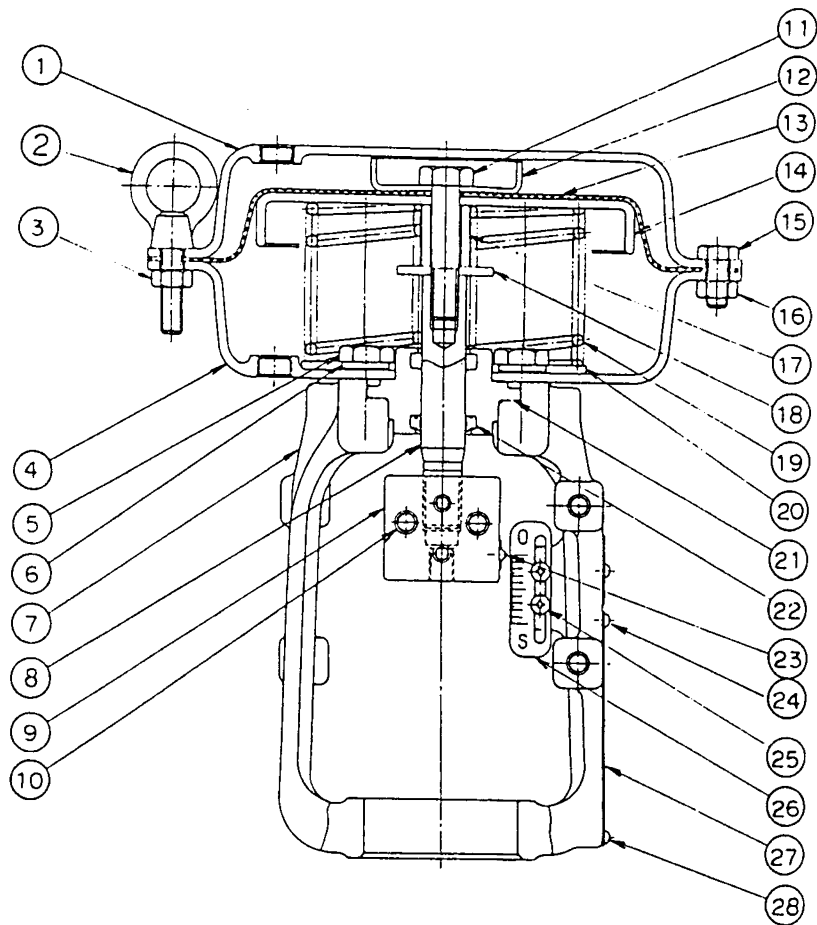


Table 4-1. Tightening Torques of Bolts and Nuts of Actuator

| No. | Material | Bolt Size | Tightening Torque (N·m {kgf·cm}) |
|-----|-----------------------|-----------|---|
| 1 | S30C | M10 | 20 to 22 {200 to 220} |
| 2 | S30C | M10 | 27 to 33 {270 to 330} |
| 3 | $\frac{S20C}{SUS304}$ | M8 | $\frac{13 \text{ to } 16 \{135 \text{ to } 165\}}{15 \text{ to } 19 \{150 \text{ to } 195\}}$ |
| 4 | SUS304 | M8 | 15 to 19 {150 to 195} |
| 5 | $\frac{S20C}{SUS304}$ | M8 | $\frac{14 \text{ to } 18 \{145 \text{ to } 180\}}{16 \text{ to } 21 \{160 \text{ to } 210\}}$ |

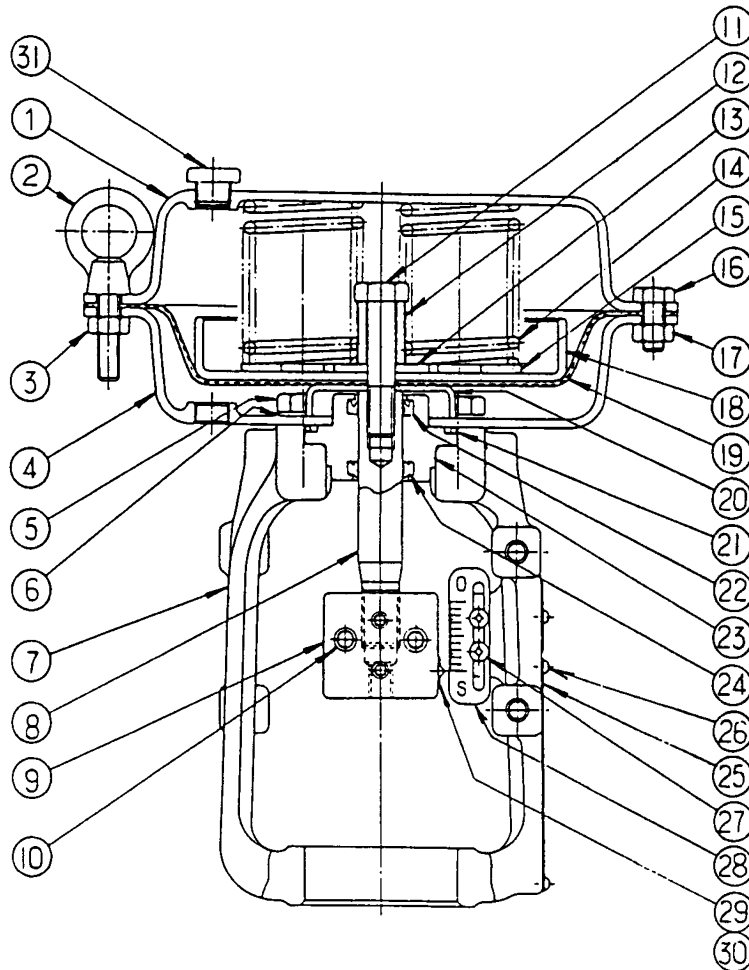
Note 1: Fix the rain cap of the reverse type of actuator as follows: Drive the cap into the diaphragm case until the shoulder (brim) of the cap is brought into contact with the diaphragm case and then drive the cap further into the diaphragm case by half of a turn.



| No. | Parts Name |
|-----|-------------------------|
| 1 | DIAPHRAGM CASE (TOP) |
| 2 | EYEBOLT |
| 3 | NUT |
| 4 | DIAPHRAGM CASE (BOTTOM) |
| 5 | BOLT |
| 6 | WASHER |
| 7 | YOKE |
| 8 | ROD |
| 9 | STEM CONNECTOR |
| 10 | STEM CONNECTOR BOLT |
| 11 | CENTER BOLT |
| 12 | DIAPHRAGM RETAINER |
| 13 | DIAPHRAGM |
| 14 | DIAPHRAGM PLATE |
| 15 | BOLT |

| No. | Parts Name |
|-----|----------------|
| 16 | NUT |
| 17 | STOPPER COLLAR |
| 18 | STOPPER RING |
| 19 | SPRING |
| 20 | SPRING PLATE |
| 21 | BEARING |
| 22 | DUST SEAL |
| 23 | POINTER |
| 24 | DRIVE SCREW |
| 25 | TRUSS SCREW |
| 26 | SCALE PLATE |
| 27 | NAMEPLATE |
| 28 | DRIVE SCREW |

Fig. 4-7. Model HA1 Actuator (Direct Action Type)



| No. | Parts Name |
|-----|-------------------------|
| 1 | DIAPHRAGM CASE (TOP) |
| 2 | EYEBOLT |
| 3 | NUT |
| 4 | DIAPHRAGM CASE (BOTTOM) |
| 5 | BOLT |
| 6 | SEAL WASHER |
| 7 | YOKE |
| 8 | ROD |
| 9 | STEM CONNECTOR |
| 10 | STEM CONNECTOR BOLT |
| 11 | CENTER BOLT |
| 12 | STOPPER COLLAR |
| 13 | STOPPER RING |
| 14 | SPRING |
| 15 | SPRING PLATE |
| 16 | BOLT |
| 17 | NUT |
| 18 | DIAPHRAGM PLATE |

| No. | Parts Name |
|-----|---------------------|
| 19 | DIAPHRAGM |
| 20 | DIAPHRAGM RETAINER |
| 21 | O-RING |
| 22 | PACKING FOR ROD |
| 23 | BEARING |
| 24 | DUST SEAL |
| 25 | NAMEPLATE |
| 26 | DRIVE SCREW |
| 27 | TRUSS SCREW |
| 28 | SCALE PLATE |
| 29 | POINTER |
| 30 | DRIVE SCREW |
| 31 | RAIN CAP AND O-RING |

Fig. 4-8. Model HA1 Actuator (Reverse Action Type)

4.2 Disassembly and Assembly of Model HA2, HA3, or HA4 Actuator

Disassembly Procedure

(a) Direct Action Type

- (1) Disconnect the air piping and detach the accessories from the actuator.
- (2) Remove the stem connector, pointer and lock nut. (See Fig. 4-1.)
- (3) Remove the clamping-bolts (except the pair of eyebolts) of the diaphragm case.
- (4) Loosen evenly and alternately the pair of eyebolts. (The initial setting of the springs is done by these eyebolts.)
- (5) Remove the diaphragm case. Pull out upward the actuator rod together with the diaphragm.
- (6) Take out the springs.

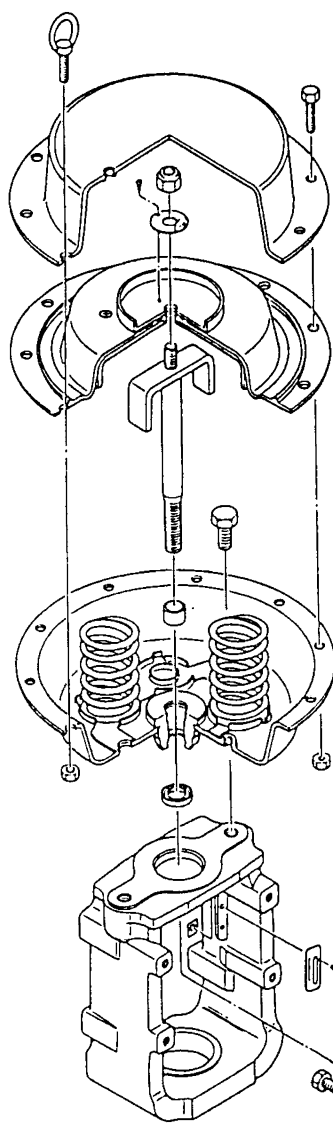


Fig. 4-9. HA2D or HA3D Actuator

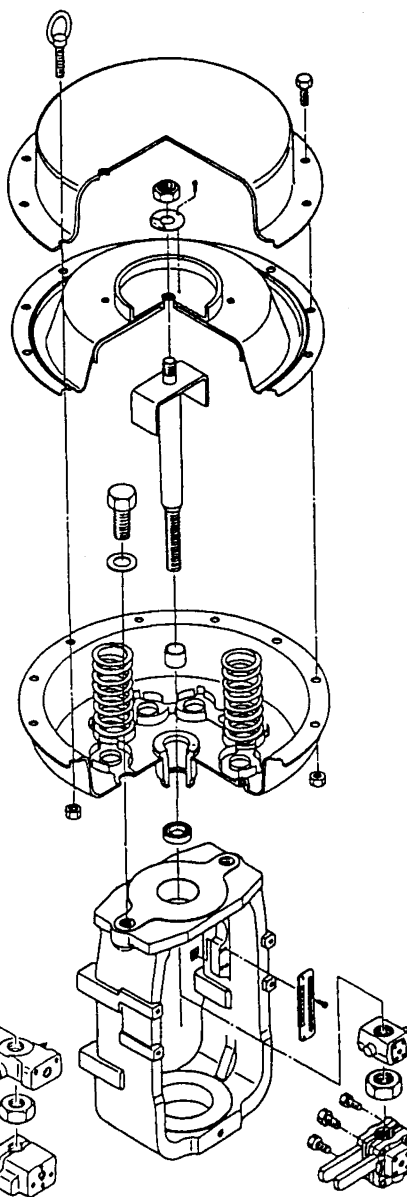


Fig. 4-10. HA4D Actuator

(b) Reverse Action Type

- (1) Disconnect the air piping and detach other external items from the actuator.
- (2) Remove the stem connector, pointer and lock nut. (See Fig. 4-1.)
- (3) Remove the clamping-bolts (except the pair of eyebolts) of the diaphragm case.
- (4) Loosen evenly and alternately the pair of eyebolts. (The initial setting of the springs is done by these eyebolts.)
- (5) Remove the diaphragm case. Take out the springs.
- (6) Pull out upward the actuator rod together with the diaphragm.

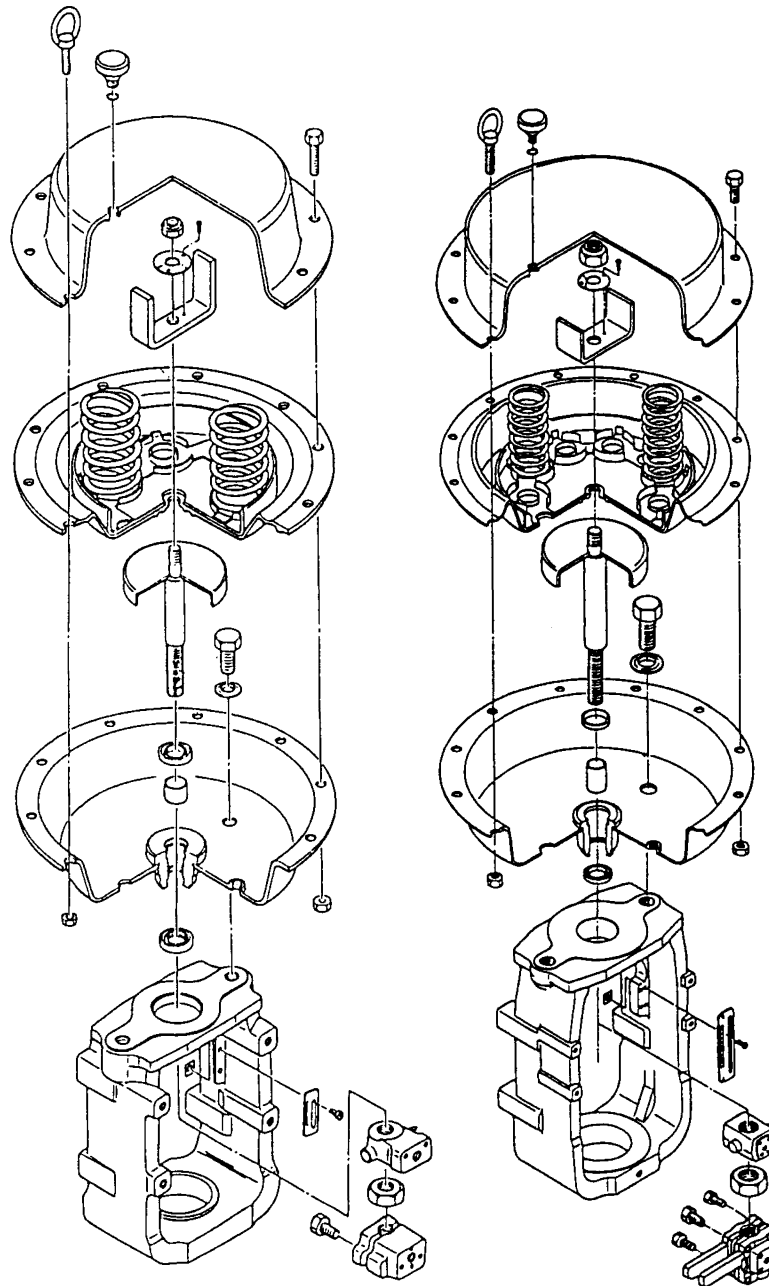


Fig. 4-11. HA2R or HA3R Actuator

Fig. 4-12. HA4R Actuator

Assembly Procedure

Before assembly, check the parts for scrapes, damage, deformation, peeling off of paint, and other abnormality. To assemble the actuator, proceed as follows:

(a) Direct Action Type

- (1) Fix the bottom diaphragm case and yoke with the bolts. (For Models HA2D and HA3D, install the diaphragm case and spring plate together.)
- (2) Install the springs on the spring plate. The quantities of springs are as follows:
HA2 4 springs
HA3, HA4 8 springs

Except particular models as follows:

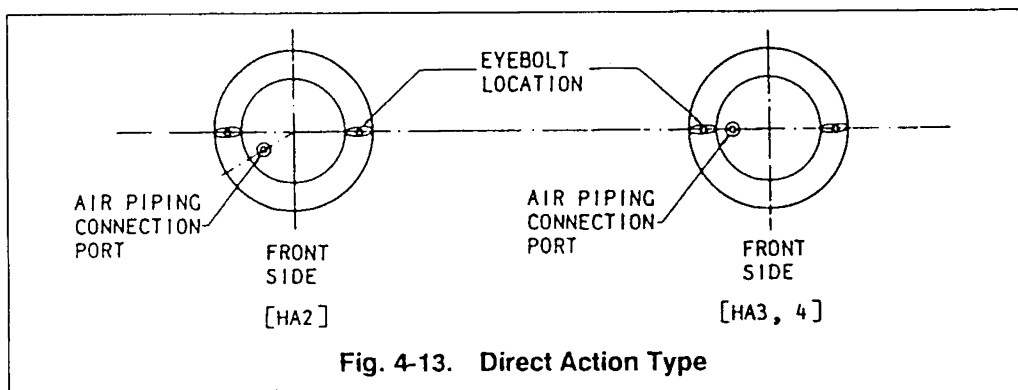
HA2, 38 mm stroke,
80 – 240 kPa {0.8 – 2.4 kgf/cm²}..... Total 8 springs (with double springs)

HA3, 50 mm stroke,
80 – 240 kPa {0.8 – 2.4 kgf/cm²}..... Total 16 springs (with double springs)

HA4, 75 mm stroke,
80 – 240 kPa {0.8 – 2.4 kgf/cm²}..... Total 16 springs (with double springs)

- (3) Insert the actuator rod (to which the diaphragm is connected) into the bushing, exercising care not to damage the bushing inside surface or dust seal with the threaded section of the rod. (For example, cover the threaded section with adhesive tape to prevent damaging the bushing.) Set the stopper in parallel with the yoke.
- (4) Place the top diaphragm case and fix it with the pair of eyebolts.

- Notes:
- Set the air piping connection port in the location shown in the illustration. (Fig. 4-13)
 - Tighten the pair of eyebolts uniformly by tightening them alternately. The initial setting of the springs is complete by tightening of these eyebolts.



- (5) Clamp the diaphragm case with other clamping-bolts than the pair of eyebolts.
- (6) Install the pointer, secure the lock nut, and install the stem connector. (Connect the air pipe to the air piping connection port of the top diaphragm case.)
- (7) After the assembly is complete as above, check the following.
 1. Applying an air pressure of 490 kPa {5 kgf/cm²} via the air piping connection port of the top diaphragm case, check the diaphragm periphery for air leak by using soapsuds.
 2. Check that the actuator smoothly operates for its full stroke.

Note: Check this operation by operating the actuator as an independent unit.

(b) Reverse Action Type

- (1) Fix the bottom diaphragm case and yoke with the bolts.
- (2) Insert the actuator rod (to which the diaphragm is connected) into the bushing, exercising care not to damage the bushing inside surface or dust seal with the thread section of the rod. (For example, cover the threaded section with adhesive tape to prevent damaging the bushing.)
- (3) Make the stopper (in the diaphragm plate) in parallel with the yoke by turning the rod.
- (4) Install the springs on the spring plate. The quantities of springs are as follows:

HA2 4 springs

HA3, HA4 8 springs

Except particular models as follows:

HA2, 38 mm stroke,
80 – 240 kPa {0.8 – 2.4 kgf/cm²}..... Total 8 springs (with double springs)

HA3, 50 mm stroke,
80 – 240 kPa {0.8 – 2.4 kgf/cm²}..... Total 16 springs (with double springs)

HA4, 75 mm stroke,
80 – 240 kPa {0.8 – 2.4 kgf/cm²}..... Total 16 springs (with double springs)

- (5) Place the top diaphragm case and fix it with the pair of eyebolts. Set the air vent hole in the location shown in the illustration (Fig. 4-14). Uniformly and alternately tighten the eyebolts. The initial setting of the springs is complete by tightening of these eyebolts.

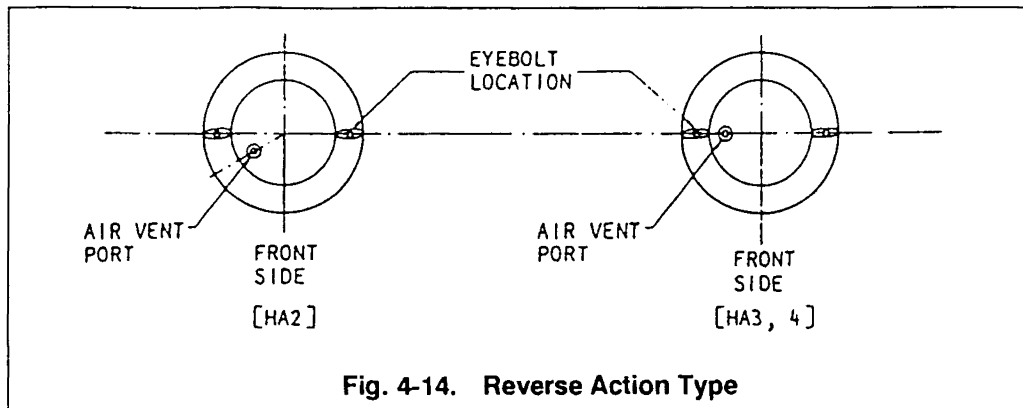


Fig. 4-14. Reverse Action Type

- (6) Clamp the diaphragm case with other clamping-bolts than the pair of eyebolts.
- (7) Install the pointer, secure the lock nut, and install the stem connector.
- (8) Install the rain cap on the air vent port.
- (9) Connect the air pipe to the air piping connection port of the bottom diaphragm case.
- (10) After the assembly is complete as above, check the following.
 1. Applying an air pressure of 490 kPa { 5 kgf/cm² } via the air piping connection port of the bottom diaphragm case, check the diaphragm periphery for air leak by using soapsuds.
 2. Check that the actuator smoothly operates for its full stroke.

Note: Check this operation by operating the actuator as an independent unit.

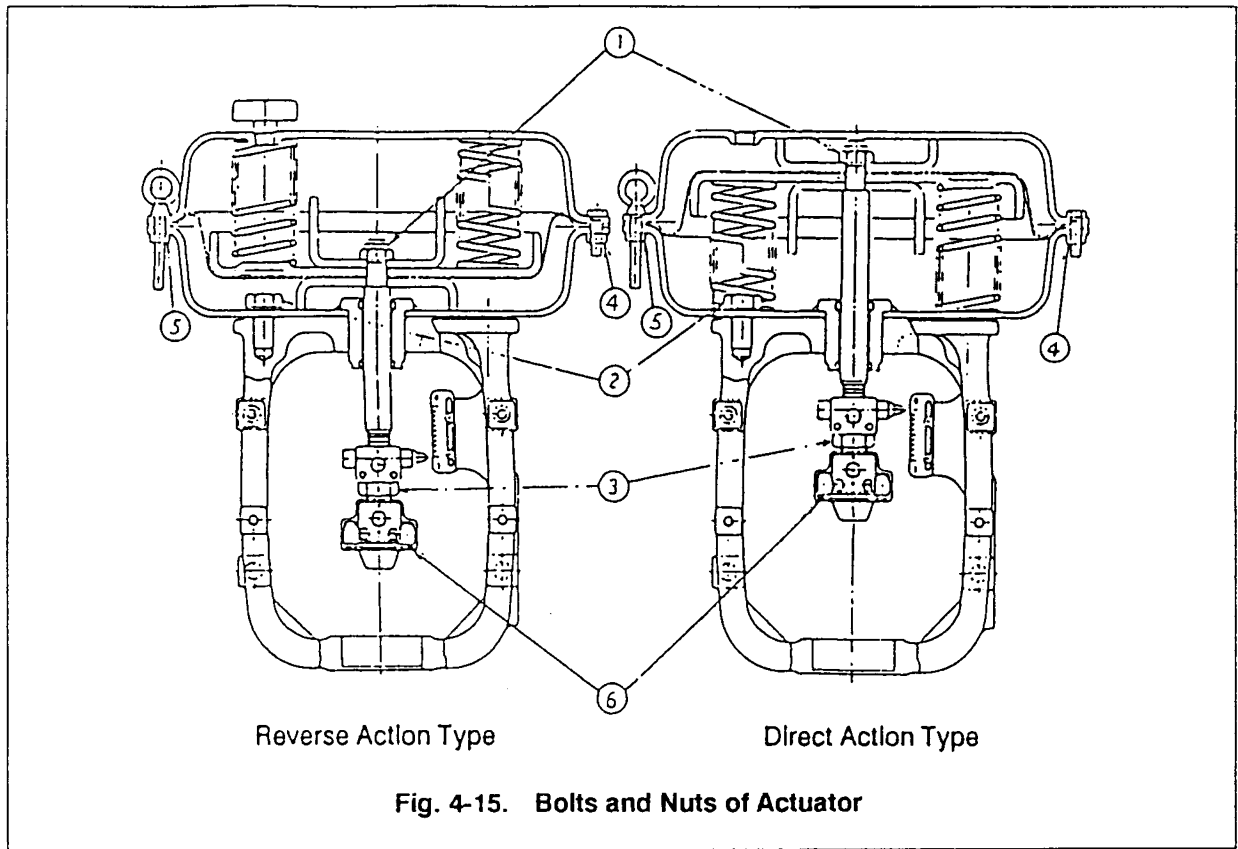
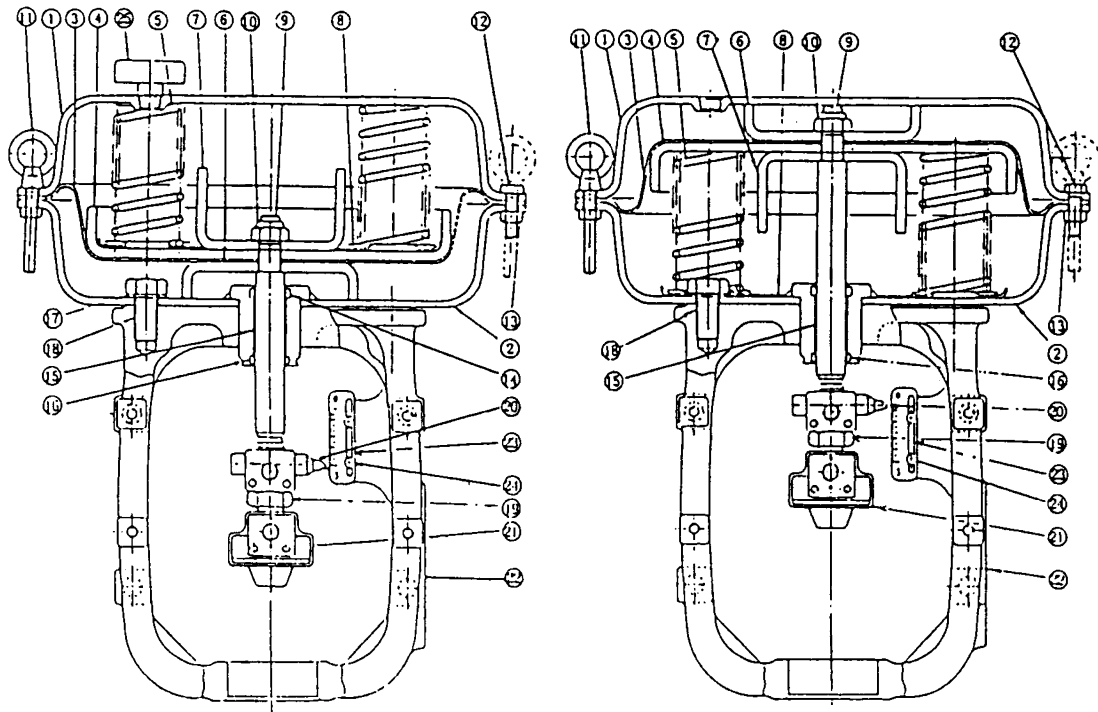


Table 4-2. Tightening Torques of Bolts and Nuts of Actuator

Unit: N·m {kgf·cm}

| No. | Materials | For HA2 | | For HA3 | | For HA4 | |
|-----|-----------|----------|----------|----------|-------------|----------|-------------|
| | | Material | Torque | Material | Torque | Material | Torque |
| 1 | SK5 S45C | M10 | 37 {370} | M14 | 100 {1,050} | M20 | 310 {3,170} |
| 2 | S30C | M12 | 42 {420} | M16 | 100 {1,050} | M24 | 360 {3,600} |
| 3 | S20C | M14 | 69 {690} | M18 | 140 {1,450} | M30 | 700 {7,160} |
| 4 | S20C | M8 | 16 {160} | M8 | 16 {160} | M12 | 42 {420} |
| 5 | SUS304 | M8 | 18 {185} | M8 | 18 {185} | M12 | 63 {630} |
| 6 | S30C | M10 | 37 {375} | M10 | 37 {375} | M12 | 42 {420} |
| | SUS304 | | 56 {560} | | 56 {560} | | 63 {630} |



Reverse Action Type
(Model HAQR)

Direct Action Type
(Model HAQD)

| Parts No. | Parts Name | Parts No. | Parts Name | Parts No. | Parts Name |
|-----------|-------------------------|-----------|--------------------|-----------|--------------------------|
| 1 | NUT | 12 | YOKE | 23 | WASHER |
| 2 | DIAPHRAGM CASE (TOP) | 13 | STEM CONNECTOR | 24 | PACKING |
| 3 | DIAPHRAGM | 14 | BOLT | 25 | ROD |
| 4 | EYE BOLT | 15 | DIAPHRAGM RETAINER | 26 | LOCK NUT |
| 5 | NUT | 16 | STOPPER | 27 | TRUS SCREW (WASHER, NUT) |
| 6 | BOLT | 17 | DIAPHRAGM PLATE | 28 | SCALE PLATE |
| 7 | DIAPHRAGM CASE (BOTTOM) | 18 | COIL SPRING | 29 | SCREW |
| 8 | BUSHING | 19 | BOLT | 30 | NAMEPLATE |
| 9 | BEARING | 20 | NUT | 31 | CAP |
| 10 | DUST SEAL | 21 | SPRING PLATE | 32 | O-RING |
| 11 | POINTER | 22 | BOLT | 33 | WASHER |
| | | | | 34 | TAPPING SCREW |

Fig. 4-16. Cut View of Actuator

5. DIMENSIONS, WEIGHT AND OUTPUT OF HL

5.1 HA Multismotors

| Model No. | Stroke (mm) | Dimensions (mm) | | | | | | | Nominal diaphragm area (cm ²) | Maximum diaphragm chamber capacity (cm ³) | Weight (kg) |
|--------------|-------------|-------------------|-----|----|----|----------|-----|-----|---|---|-------------|
| | | L | H | φd | t | K | φB | B | | | |
| HA1D HA1R | 14.3 | 119 | 260 | 56 | 22 | M9x1 | 218 | 230 | 160 | 850 | 8 |
| | 25.0 | 105 120 95 | | | | | | | | | |
| HA2D HA2R | 14.3 | 121 | 334 | 56 | 22 | M9x1 | 267 | 281 | 310 | 1100 | 15 |
| | 25.0 | 103 122 95 | | | | | | | | | |
| | 38.0 | 142 102 | | | | | | | | | |
| HA3D HA3R | 25.0 | 144 | 407 | 65 | 26 | M12x1.25 | 350 | 363 | 550 | 2800 | 31 |
| | 38.0 | 113 144 102 | | | | | | | | | |
| | 50.0 | 196 139 | | | | | | | | | |
| HA4D HA4R | 38.0 | 214 | 612 | 90 | 35 | M18x1.5 | 470 | 520 | 950 | 10000 | 68 |
| | 50.0 | 172 226 172 | | | | | | | | | |
| | 75.0 | 251 | | | | | | | | | |
| | | 172 | | | | | | | | | |

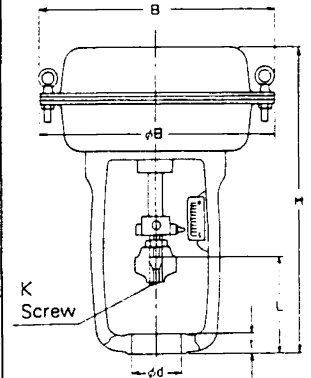


Fig. 5-1. Dimensions of HA Multismotor

Note: 1) Dimension L is as with air pressure 0 kPa (0 kg/cm²).

2) The model numbers and L dimensions are listed with those of the direct action in the top row and those of the reverse action in the bottom row.

5.2 Multismotor with Side-mounted Handwheel

| Model No. | Stroke (mm) | Dimensions (mm) | | | | | | Max. operating force required at handle (kg) | Weight (kg) |
|--------------|-------------|-----------------|-----|-----|-----|-----|-----|--|-------------|
| | | A | φB | B | C | φD | H | | |
| HA2D HA2R | 14.3 | 289 | 267 | 281 | 37 | 200 | 334 | 19 | 25 |
| | 25.0 | | | | | | | | |
| | 38.0 | | | | | | | | |
| HA3D HA3R | 25.0 | 347 | 350 | 363 | 46 | 355 | 407 | 29 | 49 |
| | 38.0 | | | | | | | | |
| | 50.0 | | | | | | | | |
| HA4D HA4R | 38.0 | 476 | 470 | 520 | 114 | 570 | 612 | 46 | 120 |
| | 50.0 | | | | | | | | |
| | 75.0 | | | | | | | | |

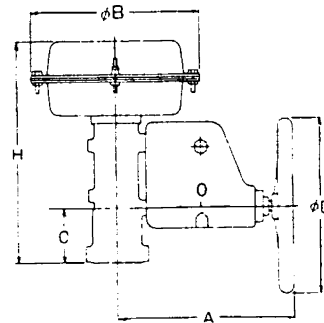


Fig. 5-2. Multismotor with Side-mounted Handwheel

Notes 1) Dimension B is as shown in Figure 1-1.

2) Model HA1 cannot be provided with the side-mounted handwheel. Only top-mounted handwheel is available.

5.3 Multismotor with Top-mounted Handwheel

| Model No. | Stroke (mm) | Dimensions (mm) | | | | Max. operating force required at handle (kg) | Weight (kg) |
|--------------|-------------|-----------------|-----|-----|------------------|--|-------------|
| | | φB | B | φD | H | | |
| HA1D HA1R | 14.3 | 218 | 230 | 140 | 410 | 16 | 11 |
| | 25.0 | | | | | | |
| HA2D HA2R | 14.3 | 267 | 281 | 200 | D: 575 R: 558 | 19 | 23 |
| | 25.0 | | | | D: 595 R: 591 | | |
| | 38.0 | | | | | | |
| HA3D HA3R | 25.0 | 350 | 363 | 355 | D: 694 R: 682 | 26 | 46 |
| | 38.0 | | | | 746 | | |
| | 50.0 | | | | | | |
| HA4D HA4R | 38.0 | 470 | 520 | 570 | 1010 | 41 | 110 |
| | 50.0 | | | | | | |
| | 75.0 | | | | | | |

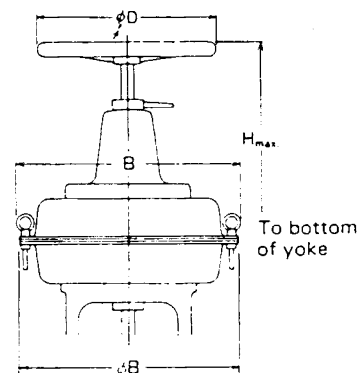


Fig. 5-3. Multismotor with Top-mounted Handwheel

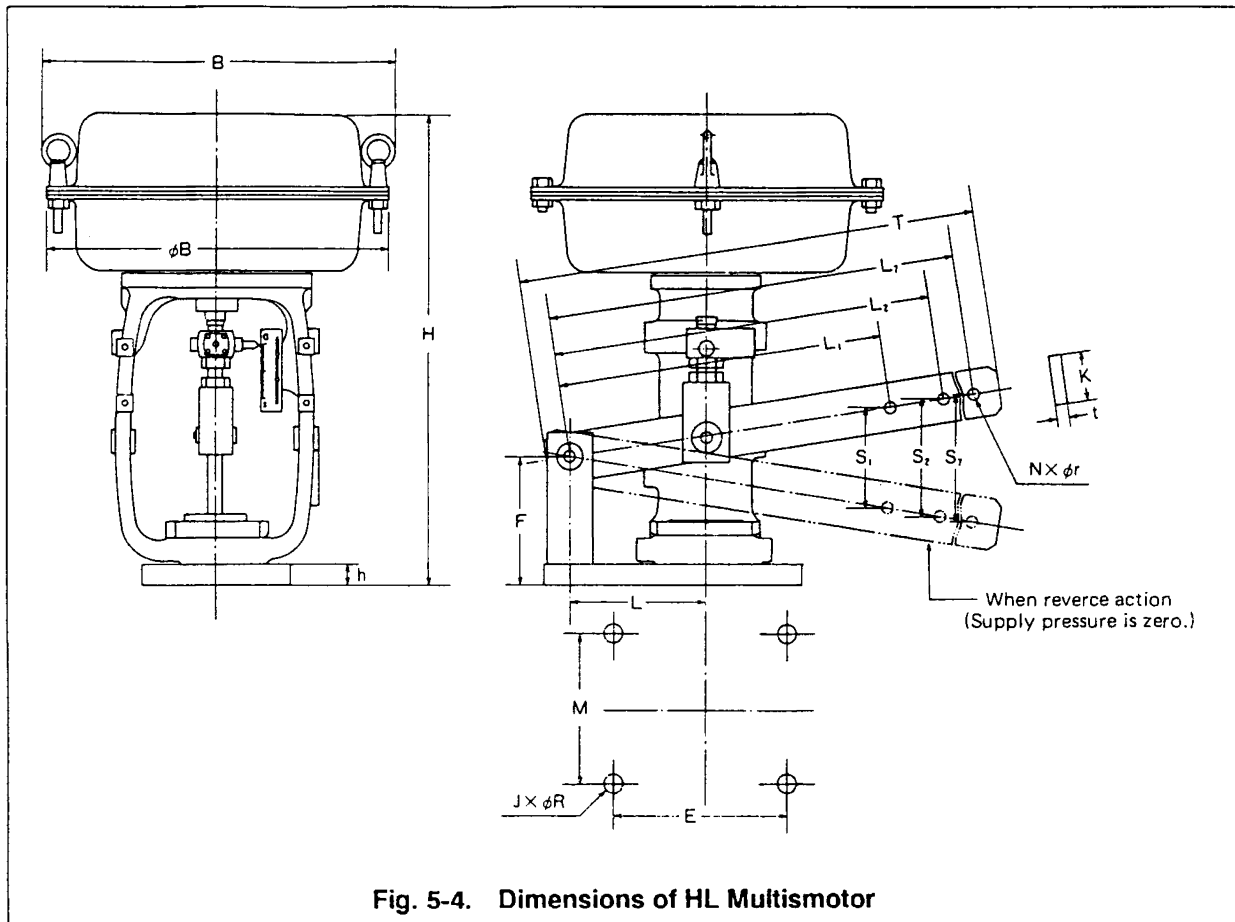


Fig. 5-4. Dimensions of HL Multismotor

5.4 Dimensions of HL Multismotors

| Model No. | Stroke (mm) | Dimensions (mm) | | | | | | | | | | | |
|-----------|-------------|-----------------|------|-----|-----|----|----|----|-----|--------|------|-----|-----|
| | | φB | B | H | F | h | K | t | T | JXφR | NXφr | E | M |
| HL2D,R | 25 | 267 | φ267 | 349 | 80 | 16 | 38 | 12 | 520 | 4X13.5 | 7X10 | 120 | 100 |
| HL3D,R | 50 | 350 | φ350 | 481 | 130 | 22 | 50 | 16 | 710 | 4X13.5 | 6X15 | 140 | 120 |
| HL4D,R | 75 | 470 | φ470 | 637 | 160 | 25 | 65 | 19 | 860 | 4X22.0 | 6X20 | 140 | 160 |

| Model No. | Dimensions (mm) | | | | | | | | | | | | | | | | | Nominal diaphragm area (cm ²) | Maximum diaphragm chamber capacity (cm ³) | Weight (kg) |
|-----------|-----------------|-----|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|-----|---|---|-------------|
| | S | L | S ₁ | L ₁ | S ₂ | L ₂ | S ₃ | L ₃ | S ₄ | L ₄ | S ₅ | L ₅ | S ₆ | L ₆ | S ₇ | L ₇ | | | | |
| HL2D,R | 25 | 100 | 60 | 240 | 70 | 280 | 80 | 320 | 90 | 360 | 100 | 400 | 110 | 440 | 120 | 480 | 310 | 1100 | 22 | |
| HL3D,R | 50 | 130 | 127 | 330 | 152 | 396 | 178 | 462 | 203 | 528 | 228 | 594 | 254 | 660 | - | - | 550 | 3400 | 45 | |
| HL4D,R | 75 | 160 | 188 | 400 | 225 | 480 | 263 | 560 | 300 | 640 | 338 | 720 | 375 | 800 | - | - | 950 | 10000 | 95 | |

5.5 Dimensions of HL Multismotors with Top-mounted Handwheel

| Model No. | Stroke (mm) | Dimensions (mm) | | | | Maximum required operating force N (kgf) | Weight (kg) |
|-----------|-------------|-----------------|-----|-----|------|--|-------------|
| | | φB | B | φD | Hmax | | |
| HL2D,R | 25 | 267 | 281 | 280 | 573 | 140 (14) | 30 |
| HL3D,R | 50 | 350 | 363 | 355 | 743 | 260 (26) | 60 |
| HL4D,R | 75 | 470 | 520 | 570 | 1008 | 410 (41) | 137 |

Drawings: Refer to 5-3.

6. DIRECT/REVERSE ACTION TYPE CONVERSION AND SPRING RANGE CHANGE OF ACTUATOR

6.1 Direct/Reverse Action Change

As a general rule it is most recommendable to prepare separately the direct type and reverse type of actuators and not to convert actuators into different types. However, when it has become unavoidable to convert actuators into other types, conversions may be done by using the parts mentioned below (Table 6-1 and Table 6-2). The parts marked "+" are the ones which are additionally needed and those marked "-" are ones which are not used.

Table 6-1. To Convert the Direct Action Type into the Reverse Action Type

| HA1D → HA1R | | |
|-------------|------|--------------|
| Parts name | Q'ty | |
| Seal washer | + 4 | 80352967-006 |
| Rod packing | + 1 | 82521067-101 |
| Rain cap | + 1 | 82664804-101 |
| Washer | - 4 | 82592130-401 |
| "O" ring | + 1 | 82592225-396 |

| HA2D → HA2R | | | |
|--------------|-------|--|------------------|
| Parts name | Q'ty | For stroke 14.3 mm, 25 mm | For stroke 38 mm |
| Seal washers | + 4 | 82521069-101 | 82521069-101 |
| Rod packing | + 1 | 82521067-101 | 82521067-101 |
| Rod unit | + 1 | 82521431-101 (14.3 mm) 82521431-102 (25 mm) | 82521431-103 |
| Rain cap | + 1 | 82592147-101 | 82592147-101 |
| Rod | (- 1) | 82521427-101 (14.3 mm) 82521427-102 (25 mm) | 82521427-103 |

| HA3D → HA3R | | | | |
|--------------|-------|--------------------|--|------------------|
| Parts name | Q'ty | For stroke 14.3 mm | For stroke 25 mm, 38 mm | For stroke 50 mm |
| Seal washers | + 2 | 82521069-102 | 82521069-102 | 82521069-102 |
| Rod packing | + 1 | 82521067-102 | 82521067-102 | 82521067-102 |
| Rod unit | + 1 | 82521431-201 | 82521063-103 (25 mm) 82521063-104 (38 mm) | 82521431-204 |
| Rain cap | + 1 | 82592147-101 | 82592147-101 | 82592147-101 |
| Rod | (- 1) | 82521428-101 | 82521428-102 (25 mm) 82521428-103 (38 mm) | 82521428-104 |

| HA4D → HA4R | | | |
|--------------|-------|------------------|--|
| Parts name | Q'ty | For stroke 25 mm | For stroke 38 mm, 50 mm, 75 mm |
| Seal washers | + 2 | 82521069-103 | 82521069-103 |
| Rod packing | + 1 | 82521067-103 | 82521067-103 |
| Rod unit | + 1 | 82521431-302 | 82521431-303 |
| Rod unit | (- 1) | 82521429-102 | 82521429-103 (38 mm) 82521429-104 (50 mm) 82521429-105 (75 mm) |
| Rain cap | + 1 | 82592147-101 | 82592147-101 |
| Flat washers | (- 2) | 82592131-201 | 82592131-201 |

Table 6-2. To Convert the Reverse Action Type into the Direct Action Type

| HA1R → HA1D | | |
|-------------|------|--------------|
| Parts name | Q'ty | |
| Seal washer | - 4 | 80352967-006 |
| Rod packing | - 1 | 82521067-101 |
| Rain cap | - 1 | 82664804-101 |
| Washer | + 4 | 82592130-401 |
| "O" ring | - 1 | 82592225-396 |

| HA2R → HA2D | | | |
|--------------|-------|--|------------------|
| Parts name | Q'ty | For stroke 14.3 mm, 25 mm | For stroke 38 mm |
| Seal washers | (- 2) | 82521069-101 | 82521069-101 |
| Rod packing | (- 1) | 82521067-101 | 82521067-101 |
| Rod unit | + 1 | 82521427-101 (14.3 mm) 82521427-102 (25 mm) | 82521427-103 |
| Rod unit | (- 1) | 82521431-101 (14.3 mm) 82521431-102 (25 mm) | 82521431-103 |
| Rain cap | (- 1) | 82592147-101 | 82592147-101 |

| HA3R → HA3D | | | | |
|--------------|-------|--------------------|--|------------------|
| Parts name | Q'ty | For stroke 14.3 mm | For stroke 25 mm, 38 mm | For stroke 50 mm |
| Seal washers | (- 2) | 82521069-102 | 82521069-102 | 82521069-102 |
| Rod packing | (- 1) | 82521067-102 | 82521067-102 | 82521067-102 |
| Rod unit | + 1 | 82521428-101 | 82521428-102 (25 mm) 82521428-103 (38 mm) | 82521428-104 |
| Rod unit | (- 1) | 82521431-201 | 82521431-202 (25 mm) 82521431-203 (38 mm) | 82521431-204 |
| Rain cap | (- 1) | 82592147-101 | 82592147-101 | 82592147-101 |

| HA4R → HA4D | | | |
|--------------|-------|------------------|--|
| Parts name | Q'ty | For stroke 25 mm | For stroke 38 mm, 50 mm, 75 mm |
| Seal washers | (- 2) | 82521069-103 | 82521069-103 |
| Flat washers | + 2 | 82592131-201 | 82592131-201 |
| Rod packing | (- 1) | 82521067-103 | 82521067-103 |
| Rod unit | (- 1) | 82521431-302 | 82521431-303 |
| Rod unit | + 1 | 82521429-102 | 82521429-103 (38 mm) 82521429-104 (50 mm) 82521429-105 (75 mm) |
| Rain cap | (- 1) | 82592147-101 | 82592147-101 |

For the conversion procedure, refer to Section 4 "DISASSEMBLY AND ASSEMBLY."

6.2 Stroke And Range Spring Change

As a general rule it is most recommendable to prepare separate actuators for different strokes and spring ranges to avoid modifications. However, modifications can be done by using the parts mentioned below.

Of Models HA2 and HA3, there are two different diameters of bonnet connecting sections. For these models, note the following:

Of Model HA2, modification for change between rated stroke of 14.3 or 25 mm and that of 38 mm cannot be done.

Of Model HA3, modification for change between rated stroke of 25 or 38 mm and that of 50 mm cannot be done.

Table 6-3. Parts Required for Respective Stroke Ranges

Note: Spring force is equivalent to air pressure (kPa (kgf/cm²))

| Actuator | | HA1D, HA1R | | |
|---------------|----------------------|------------|---------------------|---------------------|
| Parts name | | Q'ty | Stroke 25 → 14.3 mm | Stroke 14.3 → 25 mm |
| Scale plate | | 1 | 82521348-101 | 82521343-101 |
| Spring | 20 – 98 {0.2 – 0.1} | 4 | 82521340-101 | 82521340-104 |
| | 80 – 240 {0.8 – 2.4} | 4 | 82521340-102 | 82521341-103 |
| Center bolt | | 1 | 82521350-327 | 82521350-127 |
| Stopper color | | 1 | 82521338-103 | 82521338-101 |
| Rod unit | | 1 | 82521342-103 | 82521342-101 |

| Actuator | | HA2D, HA2R | | |
|-------------|----------------------|------------|---------------------|---------------------|
| Parts name | | Q'ty | Stroke 25 → 14.3 mm | Stroke 14.3 → 25 mm |
| Scale plate | | 1 | 80225032-164 | 80225037-164 |
| Spring | 20 – 98 {0.2 – 0.1} | 4 | 82521205-101 | 82521205-103 |
| | 80 – 240 {0.8 – 2.4} | 4 | 82521205-102 | 82521208-101 |
| Rod unit | R (Reverse action) | 1 | 82521431-101 | 82521431-102 |
| | D (Direct action) | 1 | 82521427-101 | 82521427-102 |

| Actuator | | HA3D, HA3R | | |
|-------------|----------------------|------------|-------------------|-------------------|
| Parts name | | Q'ty | Stroke 38 → 25 mm | Stroke 25 → 38 mm |
| Scale plate | | 1 | 80225037-164 | 80225039-164 |
| Spring | 20 – 98 {0.2 – 0.1} | 8 | 82521206-101 | 82521206-103 |
| | 80 – 240 {0.8 – 2.4} | 8 | 82521206-102 | 82521209-101 |
| Rod unit | R (Reverse action) | 1 | 82521431-202 | 82521431-203 |
| | D (Direct action) | 1 | 82521428-102 | 82521428-103 |

| Actuator | | HA4D → HA4R | | | | |
|-------------|----------------------|-------------|--------------|--------------|--------------|--------------------------------|
| Parts name | | Qty | Stroke 25 mm | Stroke 38 mm | Stroke 50 mm | Stroke 75 mm |
| Scale plate | | 1 | 80225037-164 | 80225039-164 | 80225041-164 | 80224425-164 |
| Spring | 20 – 98 {0.2 – 0.1} | 8 | 82521244-104 | 82521207-101 | 82521207-102 | 82521210-103 |
| | 80 – 240 {0.8 – 2.4} | 8 | 82521244-106 | 82521210-101 | 82521210-102 | 82521210-104* 82521210-105* |
| Rod unit | R (Reverse action) | 1 | 82521429-102 | 82521429-103 | 82521429-104 | 82521429-105 |
| | D (Direct action) | 1 | 82521431-302 | 82521431-303 | 82521431-303 | 82521431-303 |

*: The quantity of springs is 8 sets, with 2 springs for each set, or total 16 springs.

Color Codes and Dimensions of the Springs of Model HA Actuators

The color codes and dimensions of the springs of Model HA Actuators are as shown in the following table. The color codes may help you confirm springs when disassembling and assembling actuators for modification or other purposes.

Table 6-4. Color Codes and Dimensions of Springs

| Rated stroke | Model Range | (mm) | | | |
|--------------|----------------------|----------------|----------------|--------------------------|-------------------------------|
| | | HA1 | HA2 | HA3 | HA4 |
| 14.3 | 20 – 98 {0.2 – 1.0} | Red 64.6 | Red 86 | Yellow and Green 99.2 | |
| | 80 – 240 {0.8 – 2.4} | Blue 69.8 | Blue 90 | Red and Green 103.6 | |
| 25 | 20 – 98 {0.2 – 1.0} | Green 68.7 | Yellow 91.4 | Red 99.3 | Yellow and Green 148.1 |
| | 80 – 240 {0.8 – 2.4} | Purple 78.8 | Brown 99 | Blue 107 | Red and Green 155.3 |
| 38 | 20 – 98 {0.2 – 1.0} | | Green 95 | Yellow 102.9 | Red 152.8 |
| | 80 – 240 {0.8 – 2.4} | | Purple* 107 | Brown 114.9 | Blue 163.7 |
| 50 | 20 – 98 {0.2 – 1.0} | | | Green 106.5 | Yellow 156.3 |
| | 80 – 240 {0.8 – 2.4} | | | Purple 122.2 | Brown 170.6 |
| 75 | 20 – 98 {0.2 – 1.0} | | | | Green 163.4 |
| | 80 – 240 {0.8 – 2.4} | | | | Purple NOTE 1. 182, 186.7* |

- Notes:
- * set is comprised of two springs.
 - "20 – 98" {0.2 – 1.0} and "80 – 240" {0.8 – 2.4} are spring forces corresponding to air pressures in the unit of kPa {kgf/cm²}.
 - The dimensions indicated in the Table 7.4 are free lengths of springs.

7. INSTRUCTIONS FOR TOP HANDWHEEL OF ACTUATOR

7.1 Model HA1 Actuator

7.1.1 Operating Instructions

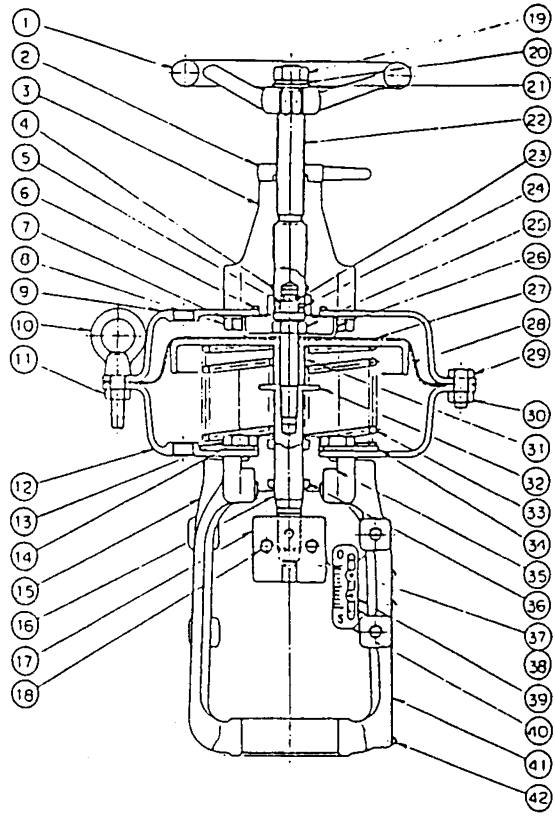
To manually operate the actuator, refer to Fig. 7-1 and Fig. 7-2 and proceed as follows:

- (1) Loosen the lock nut of the handwheel and turn the handwheel in the direction indicated by the corresponding arrowhead mark.

As you turn the handwheel clockwise, the actuator stem moves downward regardless of whether the actuator is of the direct action type or reverse action type. The handwheel bears the "SHUT" mark to indicate that the valve is closed as the handwheel is turned clockwise and the "OPEN" mark to indicate that the valve is made open as the handwheel is turned counterclockwise.

- (2) For automatic operation of the actuator, fully raise the handwheel if the actuator is of the direct action type or fully lower the handwheel if the actuator is of reverse action type, and then tighten the lock nut to secure the handwheel in such position.

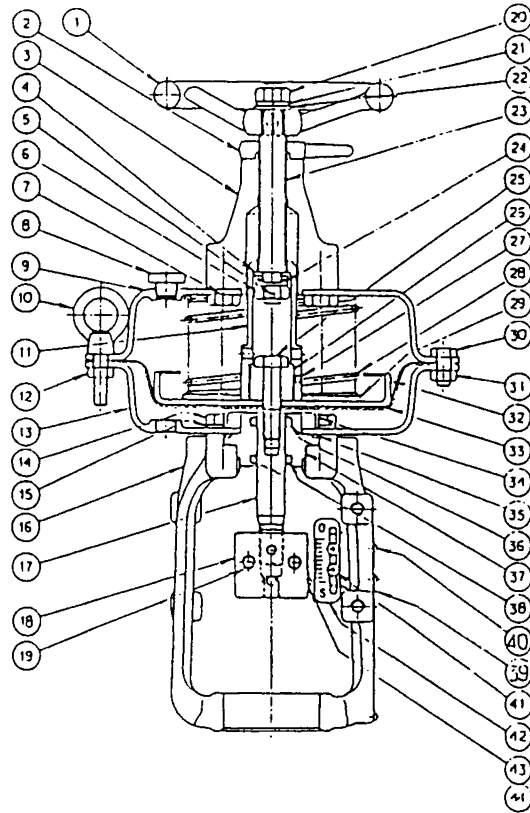
Precautions: If you forcefully turn the handwheel after it has reached the mechanical stop position, the valve stem may be damaged. Do not turn the handwheel with forces larger than 16 kgf at the outermost periphery of the handwheel.



| No.1 | Parts Name |
|------|------------------------|
| 1 | HANDWHEEL |
| 2 | LOCKNUT |
| 3 | HOUSING |
| 4 | O-RING |
| 5 | WASHER |
| 6 | O-RING |
| 7 | SEAL WASHER |
| 8 | BOLT |
| 9 | DIAPHRAGM CASE (TOP) |
| 10 | EYE-BOLT |
| 11 | NUT |
| 12 | DIAPHRAGM CAE (BOTTOM) |
| 13 | BOLT |
| 14 | WASHER |
| 15 | YOKE |
| 16 | ROD |
| 17 | STEM CONNECTOR |
| 18 | STEM CONNECTOR BOLT |
| 19 | NUT |
| 20 | SPRING WASHER |
| 21 | WASHER |
| 22 | SCREW SHAFT |
| 23 | SPRING PIN |
| 24 | BEARING |

| No.1 | Parts Name |
|------|--------------------|
| 25 | CENTER BOLT |
| 26 | DIAPHRAGM RETAINER |
| 27 | DIAPHRAGM |
| 28 | DAPHRAGM PLATE |
| 29 | BOLT |
| 30 | NUT |
| 31 | STOPPER COLOR |
| 32 | STOPPER RING |
| 33 | SPRING |
| 34 | SPRING PLATE |
| 35 | BEARING |
| 36 | DUST SEAL |
| 37 | POINTER |
| 38 | DRIVE SCREW |
| 39 | TRUSS SCREW |
| 40 | SCALE PLATE |
| 41 | NAMEPLATE |
| 42 | DRIVE SCREW |

Fig. 7-1. Model HA1 Actuator with Top Handwheel (Direct Action Type)



| No.1 | Parts Name |
|------|-------------------------|
| 1 | HANDWHEEL |
| 2 | LOCKNUT |
| 3 | HOUSING |
| 4 | WASHER |
| 5 | SPRING PIN |
| 6 | NUT |
| 7 | BOLT |
| 8 | CAP AND O-RING |
| 9 | DIAPHRAGM CASE (TOP) |
| 10 | EYE-BOLT |
| 11 | BEARING CASE |
| 12 | NUT |
| 13 | DIAPHRAGM CASE (BOTTOM) |
| 14 | BOLT |
| 15 | SEAL WASHER |
| 16 | YOKE |
| 17 | ROD |
| 18 | STEM CONNECTOR |
| 19 | STEM CONNECTOR BOLT |
| 20 | NUT |
| 21 | SPRING WASHER |
| 22 | WASHER |
| 23 | SCREW SHAFT |

| No.1 | Parts Name |
|------|--------------------|
| 24 | BEARING |
| 25 | CENTER BOLT |
| 26 | DIAPHRAGM RETAINER |
| 27 | SCREW |
| 28 | SPRING |
| 29 | SPRING PLATE |
| 30 | BOLT |
| 31 | NUT |
| 32 | DIAPHRAGM PLATE |
| 33 | DIAPHRAGM |
| 34 | DIAPHRAGM RETAINER |
| 35 | O-RING |
| 36 | ROD PACKING |
| 37 | BEARING |
| 38 | DUST SEAL |
| 39 | NAMEPLATE |
| 40 | DRIVE SCREW |
| 41 | TRUSS SCREW |
| 42 | SCALE PLATE |
| 43 | POINTER |
| 44 | DRIVE SCREW |

Fig. 7-2. Model HA1 Actuator with Top Handwheel (Reverse Action Type)

7.1.2 Disassembly and Assembly of Top Handwheel

To disassemble or assemble the top handwheel, refer to Fig. 7-1 through 7-4 and proceed as described in this section. For disassembly work, keep the actuator in the vertical attitude.

(a) Direct Action Type

- (1) Disconnect the air piping.
- (2) Set the handwheel shaft in the automatic operation position (fully raise the handwheel shaft).
- (3) Remove the top diaphragm case. When doing this, loosen the pair of eyebolts uniformly and alternately, after removing all other clamping-bolts of the diaphragm case.
- (4) Sufficiently insert the handwheel shaft by turning it and then remove the handwheel and the lock nut. Insert the shaft further and then remove the screw shaft from the housing.
- (5) Remove the O-ring.

To assemble the top handwheel, follow the disassembly procedure in the reverse order.

(b) Reverse Action Type

- (1) Disconnect the air piping.
- (2) Set the handwheel shaft in the automatic operation position (fully lower the handwheel shaft).
- (3) Remove the handwheel and the lock nut. Insert the shaft into the housing by means of the threading until the threaded sections are disengaged.
- (4) Remove the top diaphragm case. When doing this, loosen the pair of eyebolts uniformly and alternately, after removing all other clamping-bolts of the diaphragm case.
- (5) Remove the housing by loosening its clamping-screw.
- (6) Remove the setscrew and then remove the bearing case.
- (7) Remove the spring pin and then remove the castle nut.
- (8) Remove the bearing retainer and then remove the bearing.

To assemble the top handwheel, follow the disassembly procedure in the reverse order.

(c) Inspection After Assembly

- (1) Check that the handwheel turns smoothly for the full stroke.
- (2) For the direct action type of actuator, check by means of soapsuds that there is no air leak from the connecting section of the top diaphragm case.

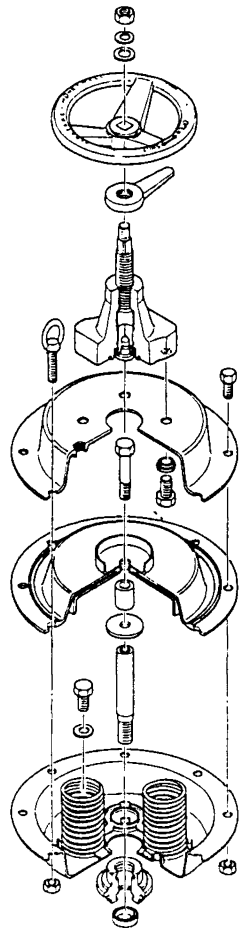


Fig. 7-3. Model HA1 Direct Action Type

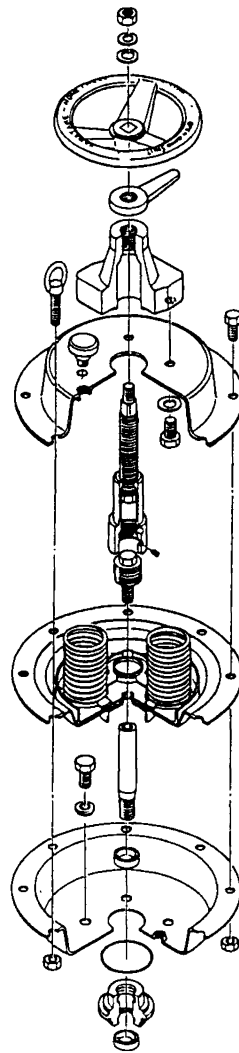


Fig. 7-4. Model HA1 Reverse Action Type

7.2 Model HA2, HA3, or HA4 Actuator

7.2.1 Operating Instructions

To manually operate the actuator, refer to Fig. 7-5 through Fig. 7-8 and proceed as follows:

- (1) First, loosen the lock nut (which has a bar-shape handle and which locks the handwheel) and turn the handwheel in the direction indicated by the corresponding arrowhead mark.

As you turn the handwheel clockwise, the actuator stem moves downward regardless of whether the actuator is of the direct action type or reverse action type. The handwheel bears the "SHUT" mark to indicate that the valve is closed as the handwheel is turned clockwise and the "OPEN" mark to indicate that the valve is made open as the handwheel is turned counterclockwise.

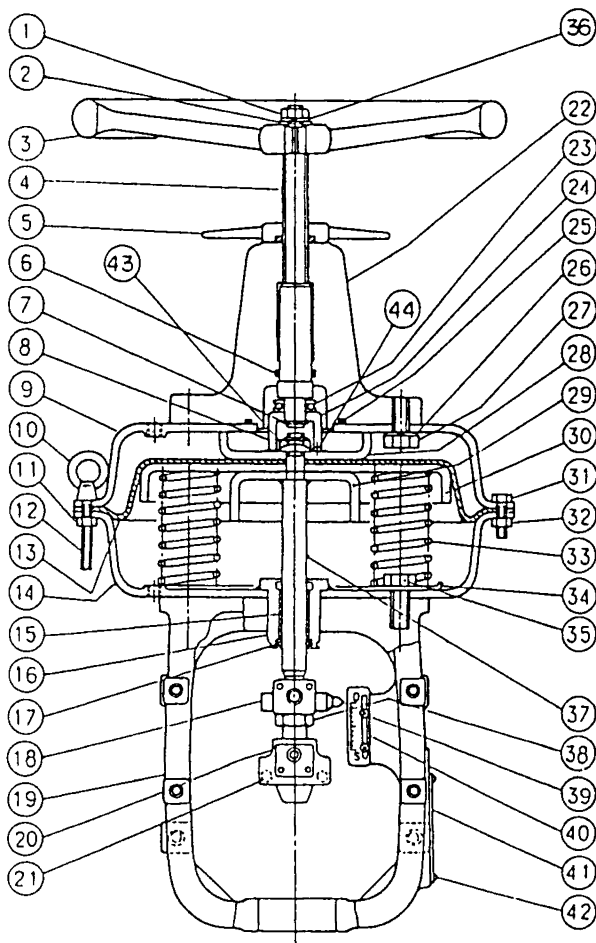
- (2) For automatic operation of the actuator, fully raise the handwheel if the actuator is of the direct action type or fully lower the handwheel if the actuator is of the reverse action type, and then tighten the lock nut to secure the handwheel in such position.

Precautions: If you forcefully turn the handwheel after it has reached the mechanical stop position, the valve stem may be damaged. Do not turn the handwheel with forces larger than the below-mentioned limits.

Model HA2: 190 N {19 kgf}

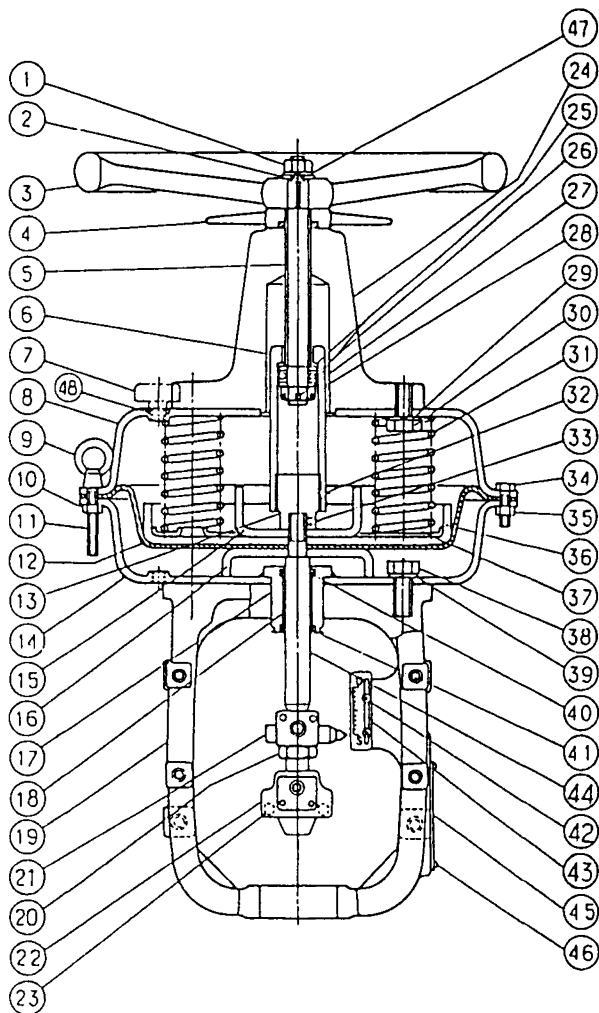
Model HA3: 260 N {26 kgf}

Model HA4: 410 N {41 kgf}
(at the outermost periphery of the handwheel)



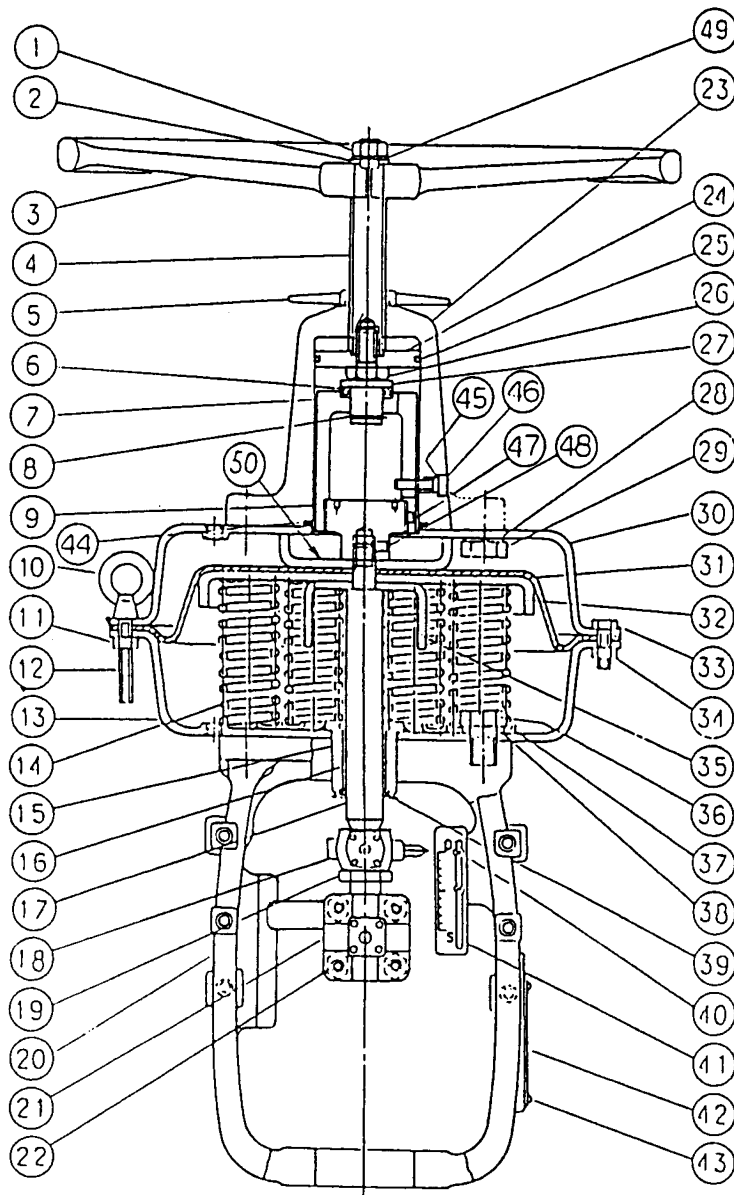
| No.1 | Parts Name |
|------|---|
| 1 | NUT |
| 2 | WASHER |
| 3 | HANDWHEEL |
| 4 | SCREW SHAFT |
| 5 | LOCK NUT |
| 6 | O-RING |
| 7 | COTTER |
| 8 | NUT |
| 9 | DIAPHRAGM CASE (TOP) |
| 10 | EYEBOLT |
| 11 | NUT |
| 12 | THROUGH BOLT |
| 13 | DIAPHRAGM |
| 14 | DIAPHRAGM CASE (BOTTOM) |
| 15 | BUSHING |
| 16 | BEARING |
| 17 | DUST SEAL |
| 18 | POINTER |
| 19 | YOKE |
| 20 | STEM CONNECTOR |
| 21 | STEM CONNECTOR BOLT |
| 22 | HOUSING |
| 23 | BEARING |
| 24 | SPRING RETAINER |
| 25 | O-RING |
| 26 | SEAL WASHER |
| 27 | BOLT |
| 28 | DIAPHRAGM RETAINER |
| 29 | STOPPER |
| 30 | DIAPHRAGM PLATE |
| 31 | BOLT |
| 32 | NUT |
| 33 | COMPRESSED COIL SPRING |
| 34 | SPRING PLATE |
| 35 | BOLT |
| 36 | SPRING WASHER |
| 37 | ROD |
| 38 | LOCK NUT |
| 39 | TRUSS SCREW, SPRING WASHER NUT, OR SPEED NUT |
| 40 | SCALE |
| 41 | NAMEPLATE |
| 42 | DRIVE SCREW |
| 43 | WASHER |
| 44 | TAPPING SCREW |

Fig. 7-5. Model HA2/3 Actuator with Top Handwheel (Direct Action Type)



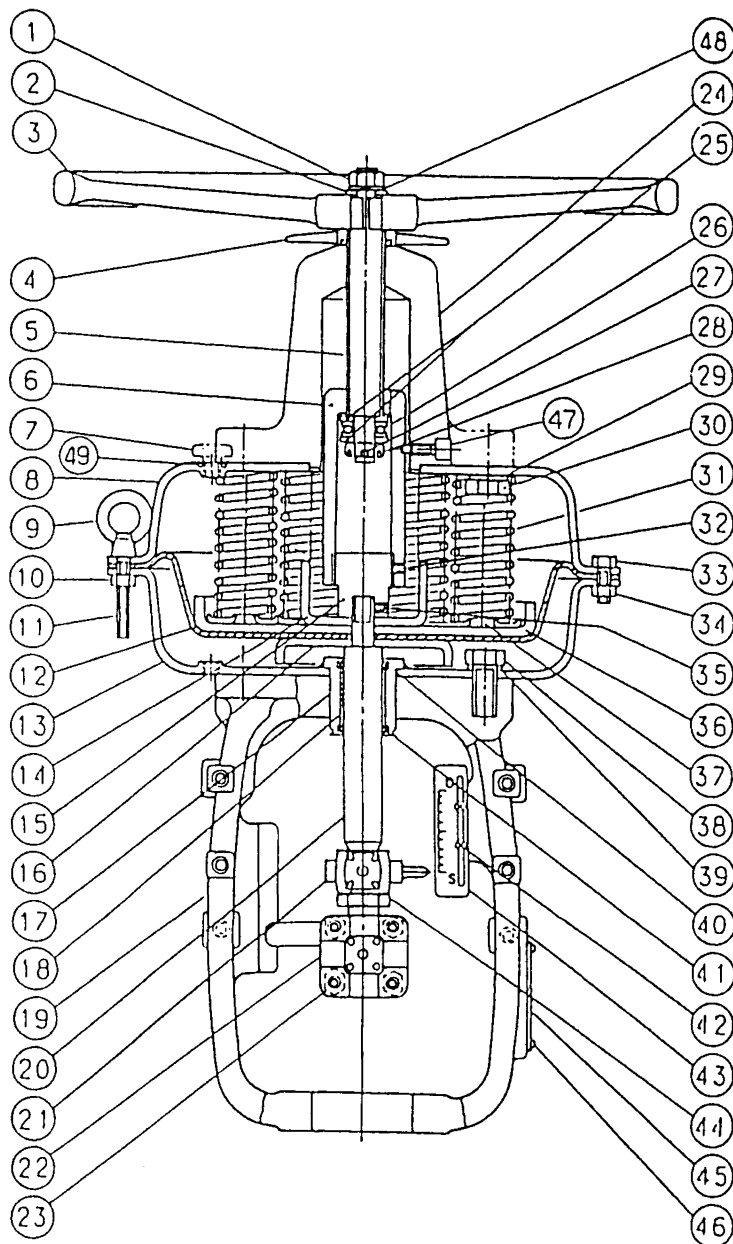
| No.1 | Parts Name |
|------|---|
| 1 | NUT |
| 2 | WASHER |
| 3 | HANDWHEEL |
| 4 | LOCK NUT |
| 5 | SCREW SHAFT |
| 6 | BEARING CASE |
| 7 | CAP |
| 8 | DIAPHRAGM CASE (TOP) |
| 9 | EYEBOLT |
| 10 | NUT |
| 11 | THROUGH BOLT |
| 12 | DIAPHRAGM |
| 13 | CONNECTOR |
| 14 | DIAPHRAGM CASE (BOTTOM) |
| 15 | STOPPER |
| 16 | DIAPHRAGM RETAINER |
| 17 | BEARING |
| 18 | BUSHING |
| 19 | YOKE |
| 20 | LOCK NUT |
| 21 | POINTER |
| 22 | STEM CONNECTOR |
| 23 | STEM CONNECTOR BOLT |
| 24 | HOUSING |
| 25 | BEARING WASHER |
| 26 | BEARING |
| 27 | COTTER PIN |
| 28 | CASTLE NUT |
| 29 | SEAL WASHER |
| 30 | BOLT |
| 31 | COMPRESSED COIL SPRING |
| 32 | SETSCREW |
| 33 | SETSCREW |
| 34 | BOLT |
| 35 | NUT |
| 36 | DIAPHRAGM PLATE |
| 37 | SPRING PLATE |
| 38 | BOLT |
| 39 | SEAL WASHER |
| 40 | PACKING FOR ROD |
| 41 | DUST SEAL |
| 42 | TRUSS SCREW, SPRING WASHER NUT, OR SPEED NUT |
| 43 | SCALE |
| 44 | ROD |
| 45 | NAMEPLATE |
| 46 | DRIVE SCREW |
| 47 | SPRING WASHER |
| 48 | O-RING |

Fig. 7-6. Model HA2/3 Actuator with Top Handwheel (Reverse Action Type)



| No.1 | Parts Name |
|------|-------------------------|
| 1 | NUT |
| 2 | WASHER |
| 3 | HANDWHEEL |
| 4 | SCREW SHAFT |
| 5 | LOCK NUT |
| 6 | BEARING |
| 7 | BEARING CASE |
| 8 | COTTER |
| 9 | CONNECTOR |
| 10 | EYEBOLT |
| 11 | NUT |
| 12 | THROUGH BOLT |
| 13 | DIAPHRAGM CASE (BOTTOM) |
| 14 | COIL SPRING |
| 15 | BEARING |
| 16 | BUSHING |
| 17 | ROD |
| 18 | POINTER |
| 19 | LOCK NUT |
| 20 | YOKE |
| 21 | STEM CONNECTOR |
| 22 | STEM CONNECTOR BOLT |
| 23 | HOUSING |
| 24 | PISTON PLATE |
| 25 | O-RING |
| 26 | BOLT |
| 27 | BEARING RETAINER |
| 28 | SEAL WASHER |
| 29 | BOLT |
| 30 | DIAPHRAGM CASE (TOP) |
| 31 | DIAPHRAGM |
| 32 | DIAPHRAGM PLATE |
| 33 | BOLT |
| 34 | NUT |
| 35 | STOPPER |
| 36 | BOLT |
| 37 | SPRING PLATE |
| 38 | WASHER |
| 39 | DUST SEAL |
| 40 | TRUSS SCREW, SPEED NUT |
| 41 | SCALE |
| 42 | NAMEPLATE |
| 43 | DRIVE SCREW |
| 44 | O-RING |
| 45 | SEAL WASHER |
| 46 | KEYBOLT |
| 47 | SETSCREW |
| 48 | SETSCREW |
| 49 | SPRING WASHER |
| 50 | DIAPHRAGM RETAINER |

Fig. 7-7. Model HA4 Actuator with Top Handwheel (Direct Action Type)



| No.1 | Parts Name |
|------|-------------------------|
| 1 | NUT |
| 2 | WASHER |
| 3 | HANDWHEEL |
| 4 | LOCK NUT |
| 5 | SCREW SHAFT |
| 6 | BEARING CASE |
| 7 | CAP |
| 8 | DIAPHRAGM CASE (TOP) |
| 9 | EYEBOLT |
| 10 | NUT |
| 11 | THROUGH BOLT |
| 12 | DIAPHRAGM |
| 13 | DIAPHRAGM CASE (BOTTOM) |
| 14 | STOPPER |
| 15 | CONNECTOR |
| 16 | DIAPHRAGM RETAINER |
| 17 | BEARING |
| 18 | BUSHING |
| 19 | YOKE |
| 20 | ROD |
| 21 | POINTER |
| 22 | STEM CONNECTOR |
| 23 | STEM CONNECTOR BOLT |
| 24 | HOUSING |
| 25 | WASHER |
| 26 | BEARING |
| 27 | COTTER PIN |
| 28 | CASTLE NUT |
| 29 | SEAL WASHER |
| 30 | BOLT |
| 31 | COIL SPRING |
| 32 | SETScrew |
| 33 | BOLT |
| 34 | NUT |
| 35 | SETScrew |
| 36 | DIAPHRAGM PLATE |
| 37 | SPRING PLATE |
| 38 | BOLT |
| 39 | SEAL WASHER |
| 40 | PACKING |
| 41 | DUST SEAL |
| 42 | TRUSS SCREW, SPEED NUT |
| 43 | SCALE |
| 44 | LOCK NUT |
| 45 | NAMEPLATE |
| 46 | DRIVE SCREW |
| 47 | KEY BOLT |
| 48 | SPRING WASHER |
| 49 | O-RING |

Fig. 7-8. Model HA4 Actuator with Top Handwheel (Reverse Action Type)

7.2.2 Disassembly and Assembly of Top Handwheel

To disassemble or assemble the top handwheel, refer to Fig. 7-5 through 7-10 and proceed as described in this section. For disassembly and assembly work, keep the actuator in the vertical attitude.

(a) Direct Action Type

- (1) Disconnect the air piping.
- (2) Set the handwheel shaft in the automatic operation position (fully raise the handwheel shaft).
- (3) Remove the top diaphragm case. When doing this, loosen the pair of eyebolts uniformly and alternately, after removing all other clamping-bolts of the diaphragm case.
- (4) Sufficiently insert the handle shaft by turning it and then remove the handwheel and the lock nut. Insert the shaft further and then remove the screw shaft from the housing.
- (5) Remove the O-ring.

To assemble the top handwheel, follow the disassembly procedure in the reverse order.

(b) Reverse Action Type

- (1) Disconnect the air piping.
- (2) Set the handwheel shaft in the automatic operation position (fully lower the handwheel shaft).
- (3) Remove the handwheel and the lock nut. Insert the shaft into the housing by means of the threading until the threading sections are disengaged.
- (4) Remove the top diaphragm case. When doing this, loosen the pair of eyebolts uniformly and alternately, after removing all other clamping-bolts of the diaphragm case.
- (5) Remove the housing by loosening its clamping-screws.
- (6) Remove the setscrew and then remove the bearing case.
- (7) Remove the pin and then remove the castle nut.
- (8) Remove the bearing retainer and then remove the bearing.

To assemble the top handwheel, follow the disassembly procedure in the reverse order.

(c) Inspection After Assembly

- (1) Check that the handwheel turns smoothly for the full stroke.
- (2) For the direct action type of actuator, check by means of soapsuds that there is no air leak from the connecting sections of the housing and top diaphragm case.

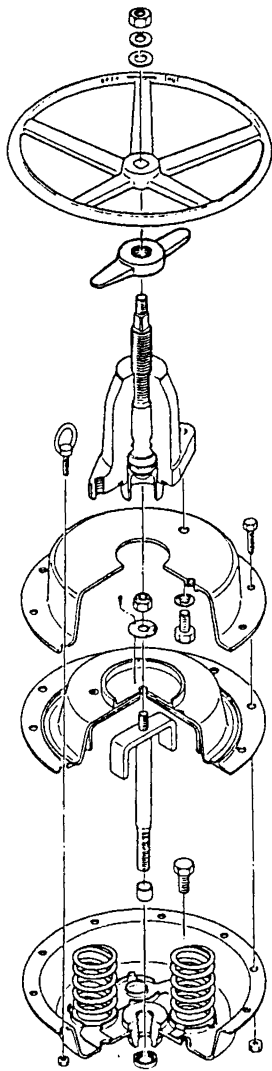


Fig. 7-9. Direct Action Type

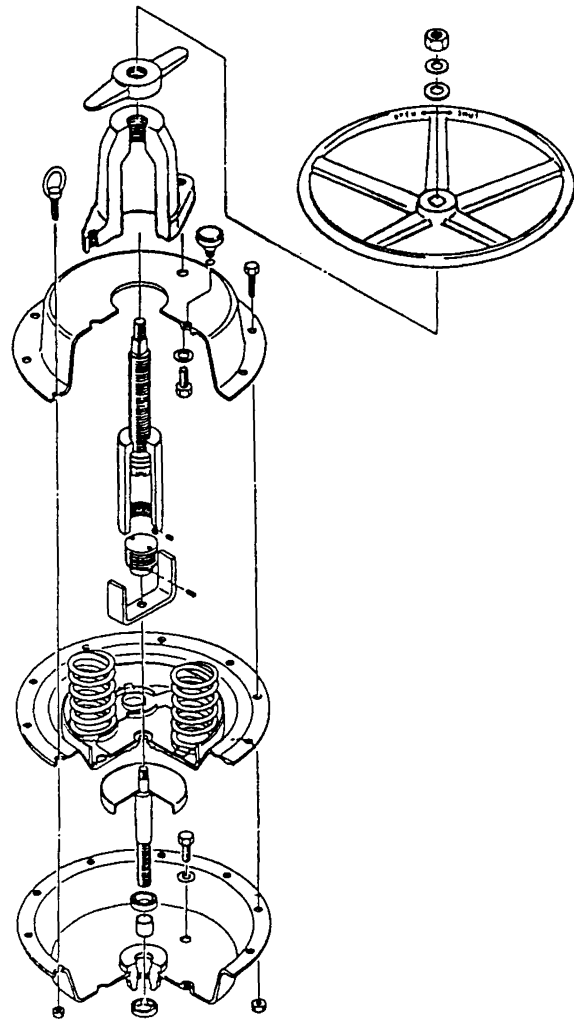


Fig. 7-10. Reverse Action Type

8. INSTRUCTIONS FOR SIDE HANDWHEEL OF ACTUATOR

As you turn the handwheel clockwise, the actuator stem moves downward regardless of whether the actuator is of the direct action type or reverse action type. The handwheel bears the "SHUT" mark to indicate that the valve is closed as the handwheel is turned clockwise and the "OPEN" mark to indicate that the valve is made open as the handwheel is turned counterclockwise.

8.1 Installation Procedure

To install the side handwheel, refer to Fig. 8-1 and proceed as follows:

- (1) Prepare a manual operation kit (a side handwheel set and its mounting accessories).
To install the handwheel, no machining or other physical processing on the actuator is necessary.
- (2) By turning the handwheel, set the pointer of the operation nut at the AUTO position.
- (3) Loosen the bolt (item number ⑥ as shown in Fig. 8-1) and widen the distance between levers.
- (4) Install the handwheel on the mounting pad at the back of the actuator, with the mounting-bolts.
- (5) Engage the holes at the end of two levers to the pointer boss and engage those of the other ends to the boss of the operation nut, and then tighten the bolt.
- (6) When the control valve is in the automatic mode of operation, set the pointer of the operation nut at the AUTO position and keep the handwheel locked.

8.2 Operating Instructions

- (1) To manually operate the actuator, remove the handwheel lock (the fork-shaped component) which locks the handwheel and turn the handwheel in the direction indicated by the corresponding arrowhead mark.
- (2) To return to the automatic operation, turn the handwheel so that the pointer of the operation nut is set at the AUTO position and then apply the handwheel lock.

Precautions: If you forcefully turn the handwheel after it has reached the mechanical stop position, the valve stem may be damaged. Do not turn the handwheel with forces larger than the below-mentioned limits.

Model HA2: 190 N {19 kgf}

Model HA3: 290 N {29 kgf}

Model HA4: 460 N {46 kgf}
(at the outermost periphery of the handwheel)

8.3 Disassembly and Assembly of Side Handwheel (Refer to Fig. 8-1)

Before starting disassembly, check that the pointer is set at the AUTO position.

- (1) Loosen the bolt ⑥ which connects the levers ② and then disengage the levers from the pointer.

- (2) Undo the mounting-bolts ① of the side handwheel unit and detach it from the actuator.
- (3) Remove the lock nut of the handwheel and then remove the handwheel.
- (4) Loosen the bolt ⑧ of the bearing holder and then remove the feed shaft ⑦.

To assemble the side handwheel, refer to Fig. 8-1 and follow the disassembly procedure in the reverse order.

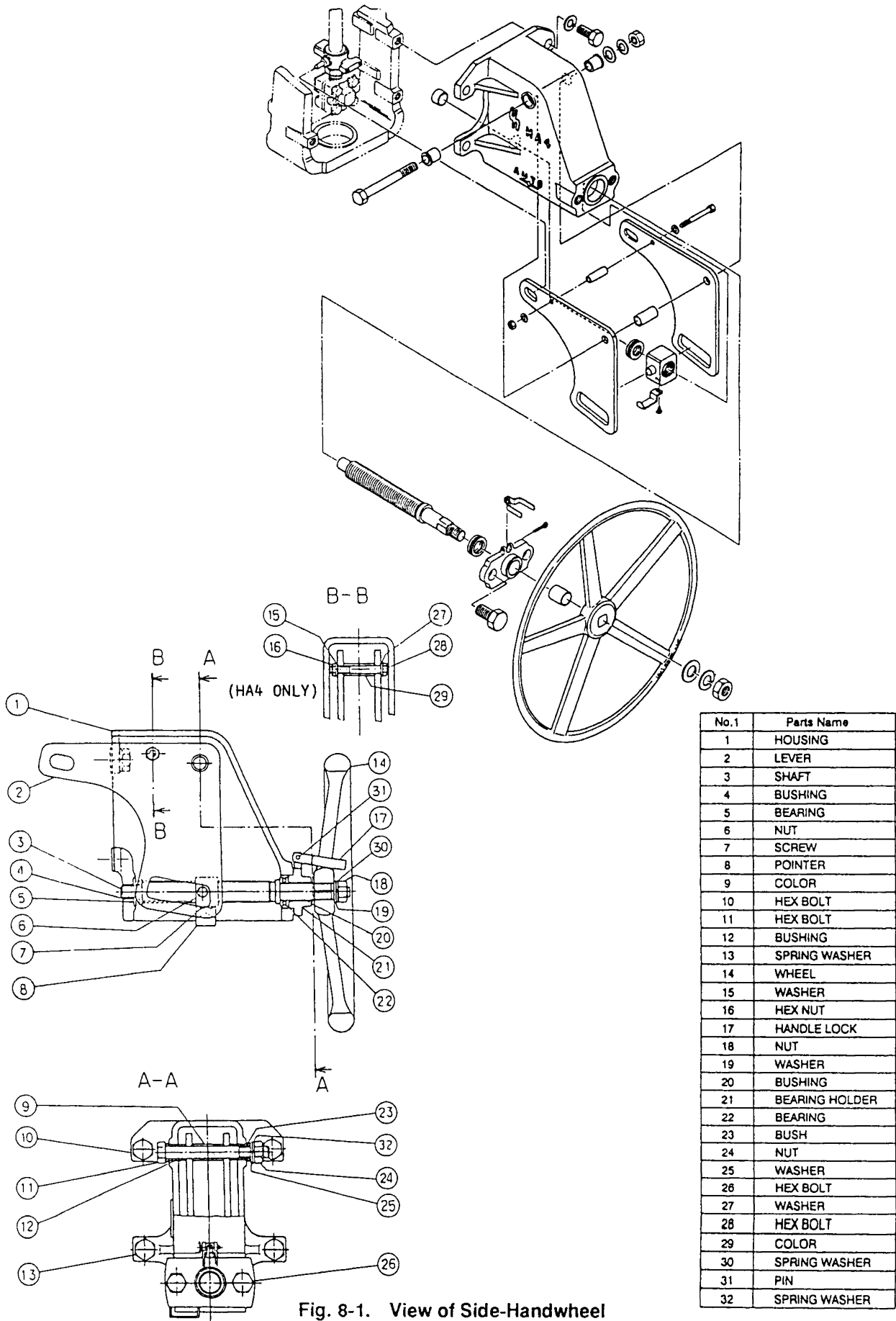


Fig. 8-1. View of Side-Handwheel

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|--------------------------|---|
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