



# Repair Manual

## Spring Balancer

**ELF-15**

**ELF-22**

**ELF-30**

**ELF-40**

**ELF-50**

**ELF-60**

**ELF-70**



For safe and correct operation of the product, please be sure to read this manual and fully understand its content before use.

After reading, keep the manual safe so that you can find and use it readily.

In case of resale or transfer of ownership of this product, make sure to transfer the manual to the new owner.

# Introduction



Thank you very much for purchasing the Spring Balancer. To prevent any trouble and obtain the best performance, please be sure to read this Repair Manual and the separate Users Manual, and fully understand their content.

## Notation in this manual

### Hazard levels

This product is designed with ultimate priority on the safety of operators. However, due to the nature of the system, there are risks that cannot be removed.

In this manual, the level of significance and risk is defined and indicated in three stages: "WARNING", "CAUTION", and "NOTICE". Thoroughly read and fully understand the indicated items before operating the product and performing maintenance procedures. The indications for "WARNING", "CAUTION", and "NOTICE" are in order of risk significance (WARNING > CAUTION > NOTICE). Their details are described below.

 <b>WARNING</b>	A situation that, if mishandled, may cause death or serious disability.
 <b>CAUTION</b>	A situation that, if mishandled, may cause minor or moderate injury.
<b>NOTICE</b>	A situation that, if mishandled, may cause property damage.

The extent of the problem described above (disability, injury, and property damage) is defined as follows.

**Serious disability:** Loss of eyesight, wound, burn (high-temperature or low-temperature), electric shock, bone fracture, poisoning, and other injuries that leave aftereffects and that require hospitalization or long-term outpatient treatment.

**Moderate injury:** Burn, electric shock, bone fracture, and other injuries that do not require hospitalization or long-term outpatient treatment.

**Minor injury:** Scratch, bruise, laceration, and other injuries that have a minor impact on health.

**Property damage:** Extended damage to buildings, household articles, and injury to domestic animals or pets.





Other than WARNING, CAUTION, and NOTICE described above, matters important to workers are indicated using the following format.

### REMINDER

Describes important details to be remembered for the operation.

## Symbols

This Users Manual uses the following symbols to simply provide information in addition to the indications above.

	Indicates a PROHIBITED action that must not be performed.		Indicates potential property damage or a danger that may inflict bodily injury.
	Indicates a REQUIRED action that must be performed.		Indicates that it is necessary to thoroughly read the manual and the relevant documents.

## Illustrations

This manual covers multiple models of the Spring Balancer. If their functions and details of operations are identical and can be correctly described in the same way, illustrations are provided taking a specific model as an example. Therefore, please note that the illustrations may be different from the actual equipment.

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## Scope of warranty and liabilities for the equipment

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### Warranty and liabilities for the equipment

1. We will repair or replace the product free of charge if a failure due to manufacturing defects occurs under proper usage during the warranty period. For details, contact us or your dealer.
2. The warranty will be void in the following cases:
  - 1) Change in ownership.
  - 2) Repair or modification performed by a party other than the manufacturer, agents, or dealers.
3. The warranty period is one (1) year from the date of purchase.
4. Repairs applicable to any of the following shall be charged even during the warranty period:
  - 1) Failure/damage caused by incorrect use.
  - 2) Failure/damage caused by use of non-genuine parts.
  - 3) Failure/damage caused by fire, earthquake, natural disaster, or other unexpected incident.
  - 4) Incident caused by fall, shock, negligence, or by inadequate storage.
  - 5) Failure/damage caused by use of parts or other equipment that are not included in this product.
  - 6) Replacement of consumables.
  - 7) Usage in violation of dangers or cautions stipulated in the Users Manual and this manual.
  - 8) Failure/damage caused by any reason that is not attributable to the manufacturer.
5. Warranty exclusions such as opportunity loss.

Either during or after the warranty period, opportunity loss, damage to anything other than our product(s), or other duties imposed on you/your customer as a result of the failure of our product(s) are outside the scope of the warranty.

### Copyright and liabilities

The copyright for this manual belongs to Endo Kogyo Co., Ltd.

The manual is provided for the limited purpose of supporting the safe and proper use of the product. It cannot be used for other purposes.

The customer may not use or make copies of this manual, in whole or in part, outside of this purpose without receiving prior consent from Endo Kogyo Co., Ltd.

The customer is also prohibited from translating or modifying the content of the manual, in whole or in part.

The content described in the manual is subject to change without advance notice. Please note this in advance.

## Definition of intended users for this manual

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This manual has been prepared to help all intended users involved with this product. From the standpoint of safety, we have defined intended users according to their ability and experience and provided detailed descriptions for each group.

This manual defines four user levels.

<b>Operator</b>	The operator is a user who engages in general operations. Maintenance and other operations that require special skills are excluded from the general operations. The operator is therefore not permitted to disassemble the main equipment. The operator should read the manual thoroughly and carry out their work with complete understanding of the operating procedures.
<b>Maintenance operator</b>	In addition to the work of the operator described above, the maintenance operator is permitted to perform installation, simple troubleshooting, and periodic inspections. The maintenance operator is required to develop sufficient knowledge and operating skill for this product. The maintenance operator should read the manual thoroughly and carry out their work with complete understanding of the equipment's characteristics and all work contents.
<b>Management supervisor</b>	The management supervisor is required to have sufficient knowledge of the product and advanced operating skill for this product. The management supervisor should manage not only the product itself but on-site operations that handle the product, comprehensively.
<b>Service engineer</b>	The service engineer is a worker with special knowledge and skills for installing the product, investigating the causes of a failure or damage, and performing repairs and overhauls. Service engineering (the work by the service engineer) is performed by our service technicians or other authorized service personnel.

## Emergency contact in case of malfunctions

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If any problem with the product arises, contact us or your dealer.





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# 1. Precautions for handling

Incorrect handling of this product may cause damage to the product itself as well as a fire or injury. Thoroughly read the following precautions and be sure to heed the instructions when handling the machinery.

 <b>WARNING</b>	
	<ul style="list-style-type: none"><li>● Do not use in explosive, flammable gas, or dusty atmospheres, any place where water or oil may splash, or near combustibles. This may cause fire and injury.</li><li>● Do not perform any modifications to the product.</li></ul>
	<p>The maintenance should be performed by a maintenance operator who has developed sufficient knowledge and operating skill for the balancer.</p>
	<ul style="list-style-type: none"><li>● Incorrect usage of the product may cause injury. Use the product correctly in accordance with the descriptions in this manual.</li><li>● Particularly, “WARNING”, “CAUTION”, and “NOTICE” described in this manual must be fully understood and always observed.</li><li>● Install the product correctly in accordance with the descriptions in this manual.</li></ul>

 <b>CAUTION</b>	
	<ul style="list-style-type: none"><li>● Be sure to perform daily and periodic inspections.</li><li>● Be sure to use the product within the capacity range that is described in “4-3-1 Specifications” of the Users Manual.</li></ul>

## 2. Maintenance



### WARNING



The maintenance should be performed by a maintenance operator who has developed sufficient knowledge and operating skill for the balancer.



### CAUTION



Replace any parts using genuine parts only.

Daily and periodic inspections are required for the product to be used safely and properly. If any failure is found in the inspections, the relevant parts must be replaced. For details, contact us or your dealer.

### 2-1 Daily inspections

Before starting the operation, refer to “6-1 Pre-operation inspections and checks” of the separate Users Manual and perform the inspections and checks daily.

### 2-2 Periodical inspections

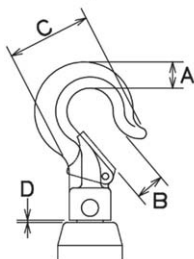
Perform an inspection at least once per month.

If the product is used in an unfavorable environment or used frequently, reduce the interval between the inspections.

#### 2-2-1 Inspection of the hook

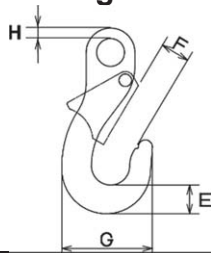
See the figure below and measure the dimensions of the hook. The hook must be replaced when any dimensions have reached the limiting dimensions. Stop using the balancer, and contact us or your dealer.

##### ■ Operating limit of the top hook



Limiting dimension (mm)			
A	B	C	D
15.3	20.0	54.5	2.0

##### ■ Operating limit of the bottom hook



Limiting dimension (mm)			
E	F	G	H
14.9	19.5	53.5	5



## 2-2-2 Inspection of the wire rope

See the figure below and measure the dimension of the wire rope. The wire rope must be replaced when the dimension has reached the limiting dimension or the limiting number of broken wires within one pitch. Stop using the balancer and change the wire rope (see “2-3 Replacement of the wire rope”), or contact us or your dealer.

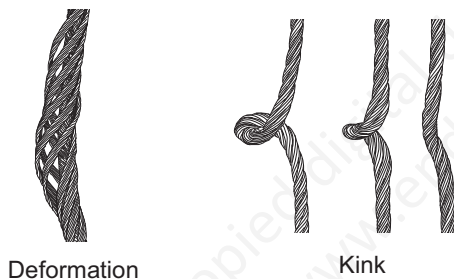
### ■ Operating limit of the wire rope



Dimension I (mm)		Limiting number of broken wires within one pitch
Reference dimension	Limiting dimension	
4.76	4.3	13

### ■ Check of the state of the wire rope

Check that there is no deformation or kink in the wire rope.



Note: Kink is the state in which the wire rope is partially deformed due to torsion or looseness.

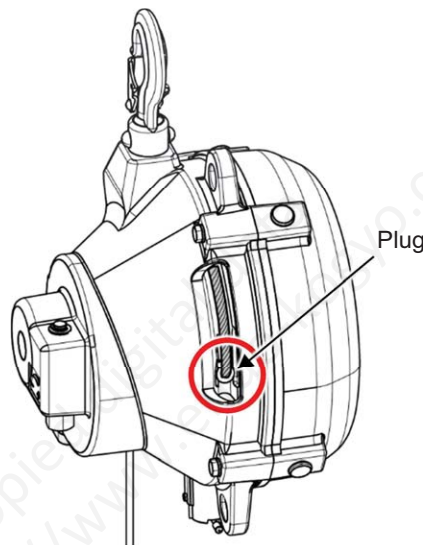
## 2-3 Replacement of the wire rope

### **WARNING**



Do not release the drum lock when the balancer is not loaded or after the tool (equipment) is replaced with one with a different mass (weight). If the drum lock is released in such situations, the wire rope may be quickly wound up as soon as the lock is released, the tool may fall, or an injury may be caused. Attach the tool and adjust the spring tension before releasing the drum lock.

- 1 Pull down the tool (equipment) and extend the wire rope completely.
- 2 Align the position of the plug attached to the drum so that the plug can be seen through the window as shown in the figure below.



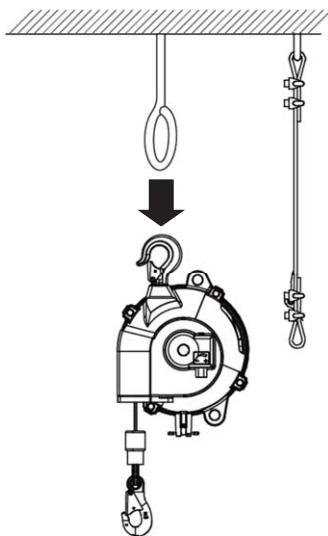
- 3 Activate the drum lock. (See “6-3 Operation method of the drum lock” in the Users Manual)
- 4 Before removing the tool, move the tool up and down to check that the drum is securely locked.

### **WARNING**

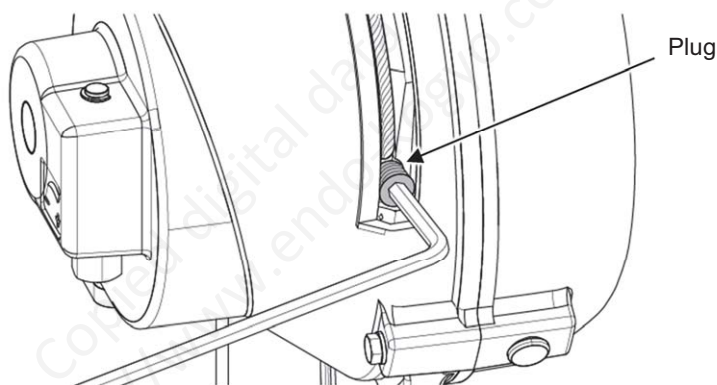


Do not remove the tool before checking that the drum is securely locked by moving the tool (equipment) up and down. If the drum is locked inadequately, the drum lock may be released during the work. Then, the wire rope may be quickly wound up, causing an injury.

- 5** Remove the balancer from the support member and place it on the ground or on a workbench.



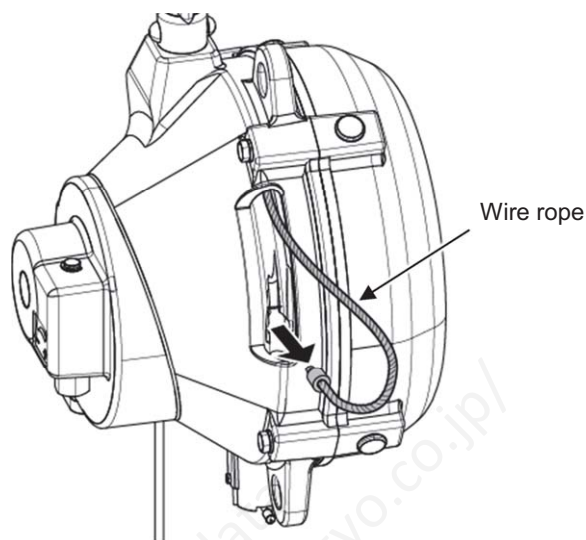
- 6** Remove the plug with a hex. key.



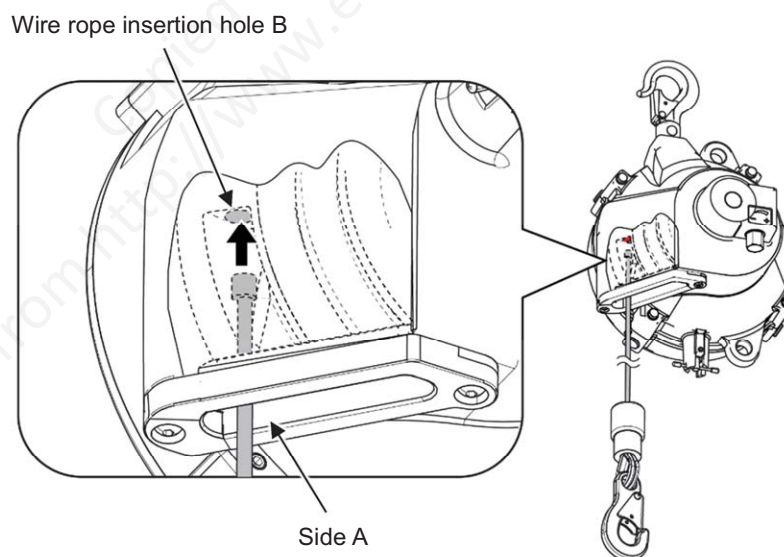
- 7 Pull the wire rope from the drum until it is totally removed.

**! REMINDER**

If the end of the wire rope becomes stuck while drawing the wire rope into the drum, push or squeeze the end of the wire rope into the drum using a tool to dislodge it.



- 8 Insert the new wire rope into the drum through wire rope insertion hole B from side A as shown in the figure below, and pass the wire rope inside the drum.



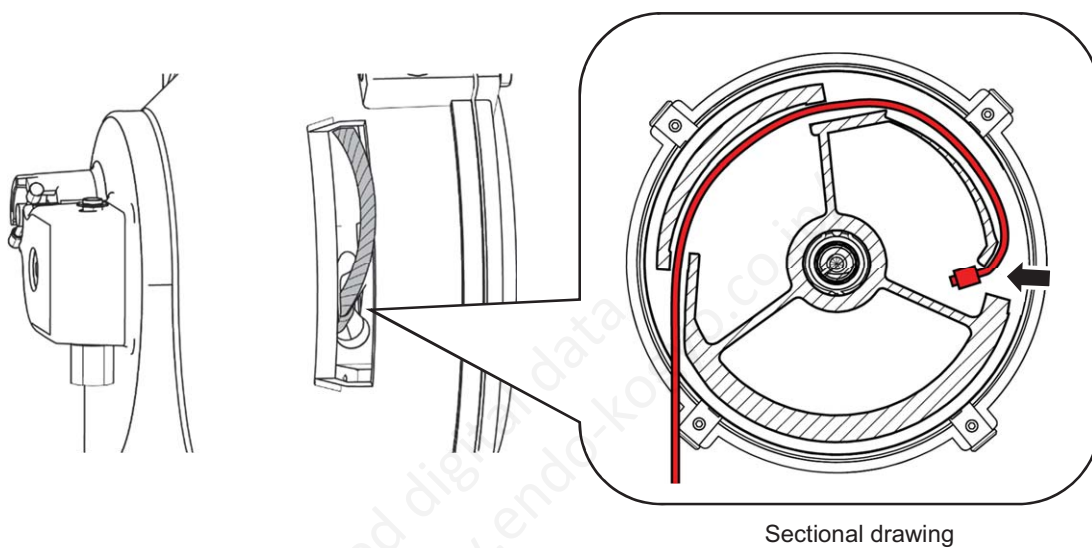
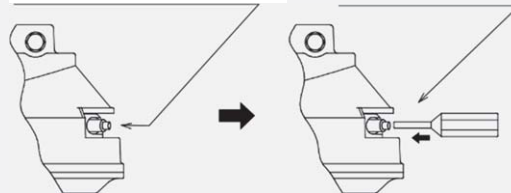
- 9** Pull out the end of the wire rope through the window and insert the end into the hole for the plug.

**! REMINDER**

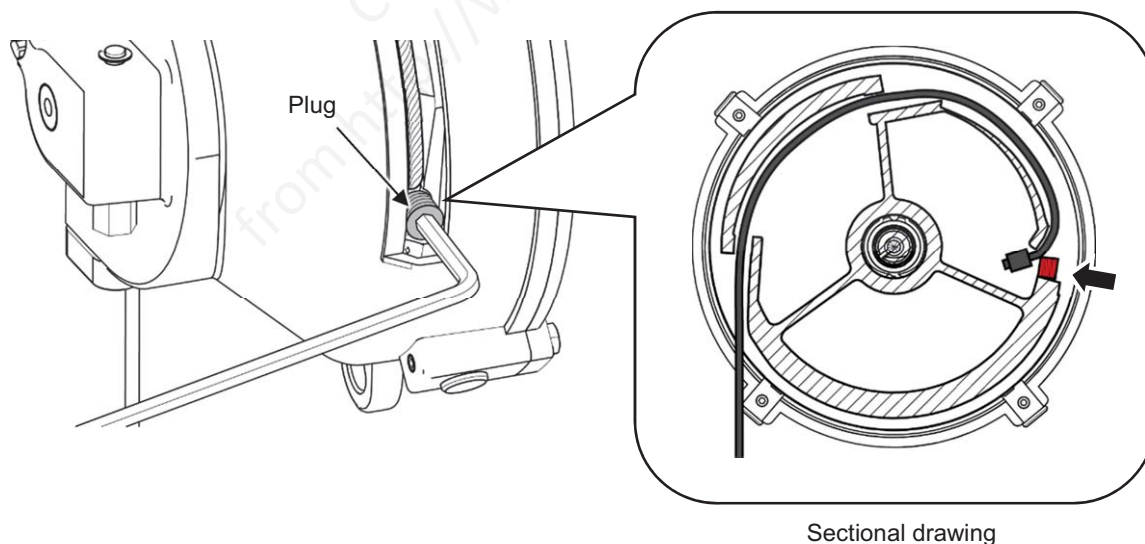
When the wire rope becomes stuck inside the drum, it can be passed through the drum easily by twisting and squeezing it.

If the end of the wire rope is caught while pulling it

Squeeze the end of the wire rope using a tool



- 10** Attach the plug and tighten it with a hex. key.



- 11** Install the balancer to the support members.

- 12** Attach the removed tool to the bottom hook again, and release the drum lock.

## 2-4 Replacement of the spring



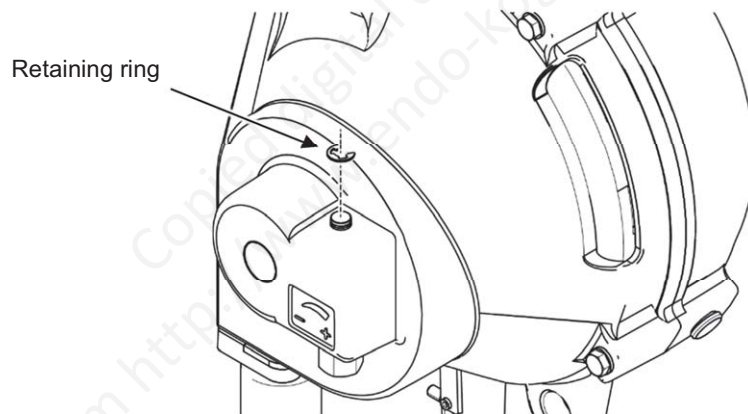
### WARNING



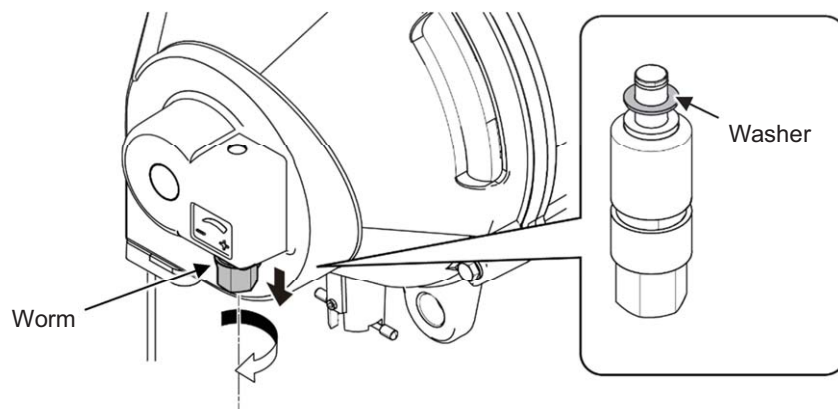
- The spring should be replaced by a maintenance operator who has developed sufficient knowledge and operating skill for the balancer.
- The spring of the product is highly dangerous if handled incorrectly. Handle the spring with great caution when replacing it.
- Do not remove the spring from the spring assembly. The spring may rapidly extend, causing an injury.
- Replace the spring as “a set of spring parts”.
- Multiple springs are used for ELF-40 and the models with a larger capacity. Therefore, even if one of the springs is ruptured, tension remains in the other springs. Perform the work with caution.

### 2-4-1 Removal of the spring

- 1 Remove the retaining ring from the end of the worm.

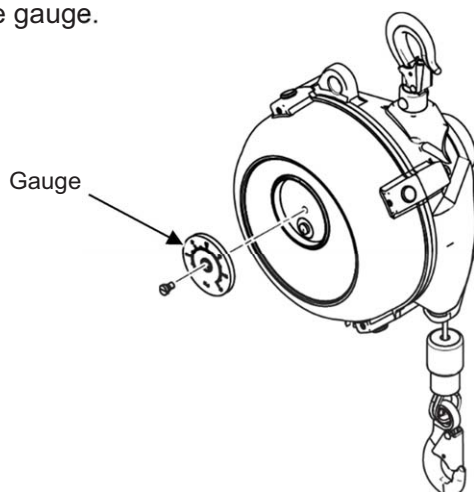


- 2 Turn the worm in the “-” direction (counterclockwise) until the worm comes off and release the spring tension. Pull the wire rope to confirm that no spring tension remains.

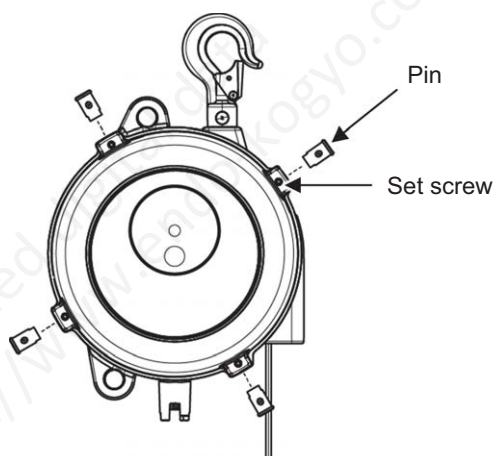


The washer comes off together with the worm. Keep the washer because it is used for reinstallation. If the washer cannot be removed, follow step 9 to remove the washer.

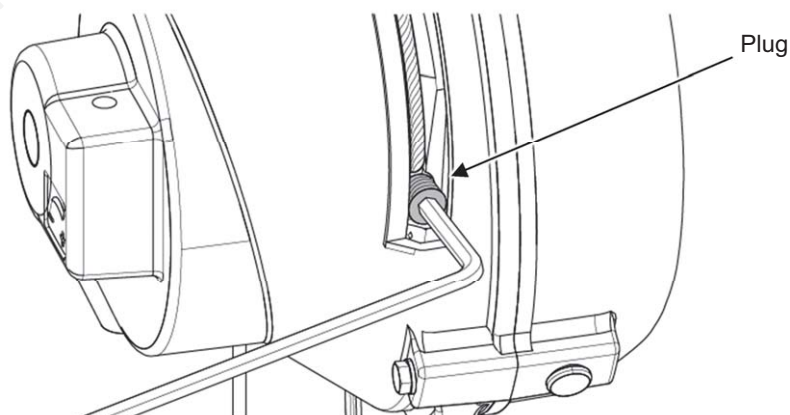
- 3 Remove the balancer from the support member and place it on the ground or on a workbench.
- 4 Remove the gauge.



- 5 Loosen the set screw and remove all pins.



- 6 Remove the plug with a hex. key.

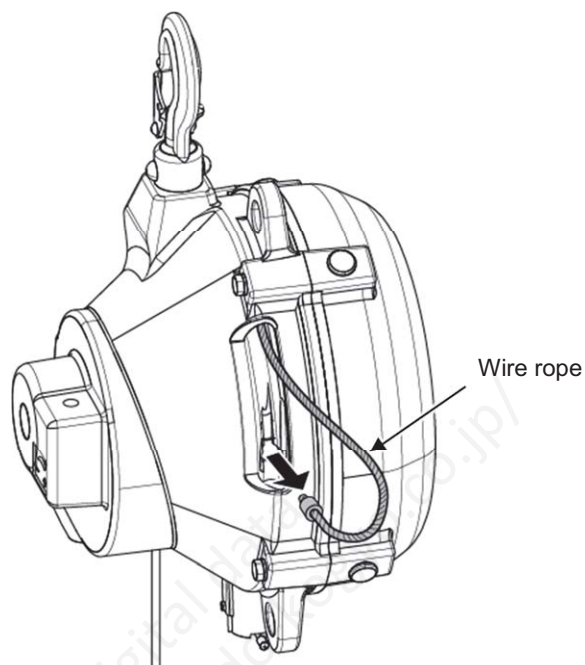




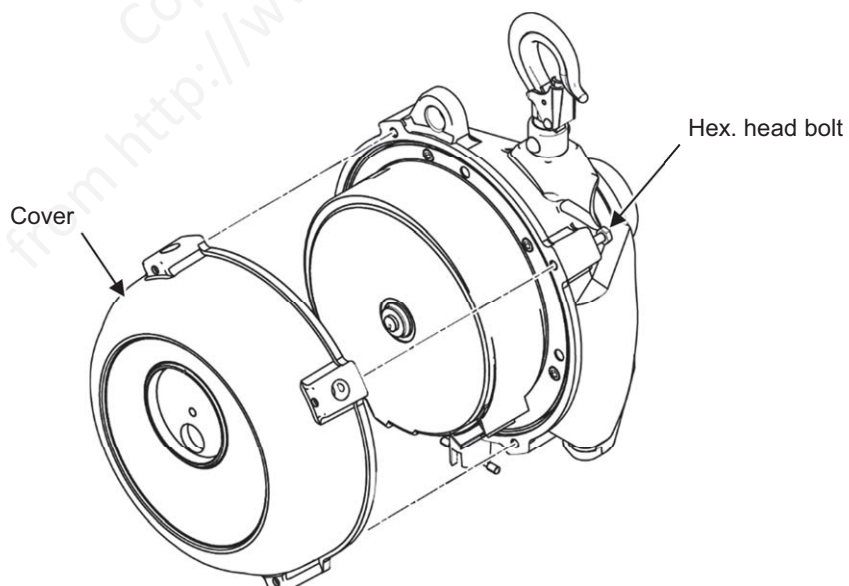
- 7 Pull the wire rope from the drum until it is totally removed.

**! REMINDER**

If the end of the wire rope becomes stuck while drawing the wire rope into the drum, push or squeeze the end of the wire rope into the drum using a tool to dislodge it.

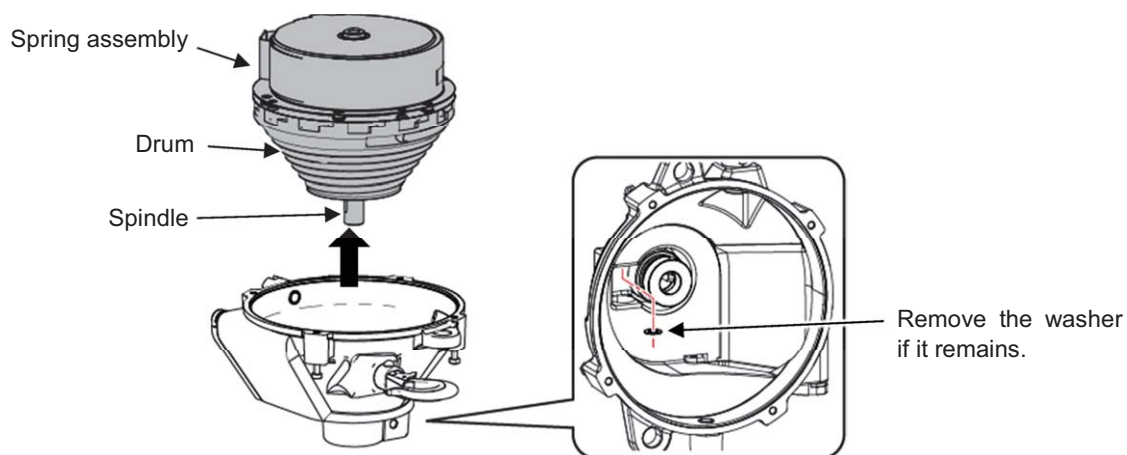


- 8 Loosen the hex. head bolts and remove the cover.



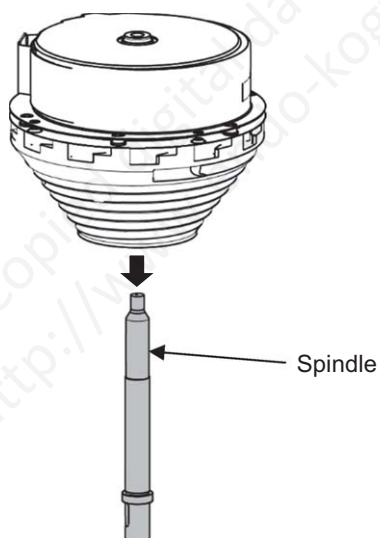


- 9** Remove the spring assembly, drum, and spindle as one unit from the casing.

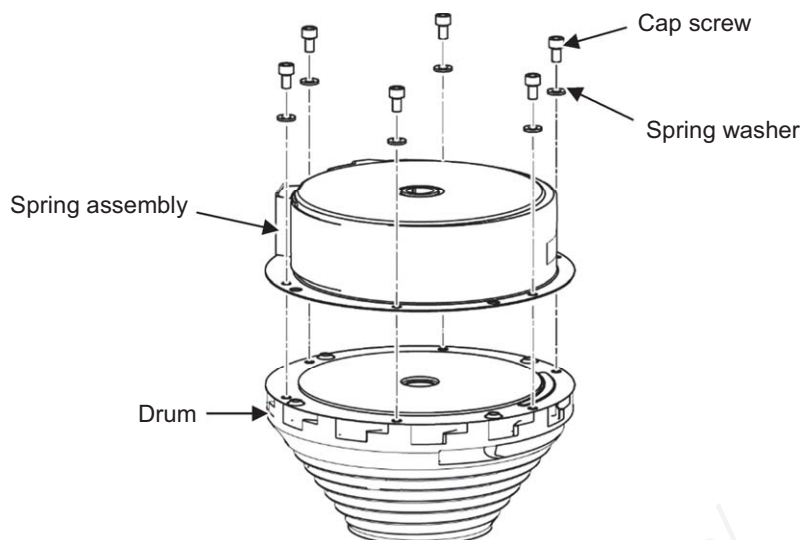


If the washer cannot be removed in step 2, remove the remaining washer from the inside of the casing. Keep the washer because it is used for reinstallation.

- 10** Remove the spindle.



- 11** Remove the Cap screw and the spring washers, and separate the spring assembly from the drum.



## WARNING



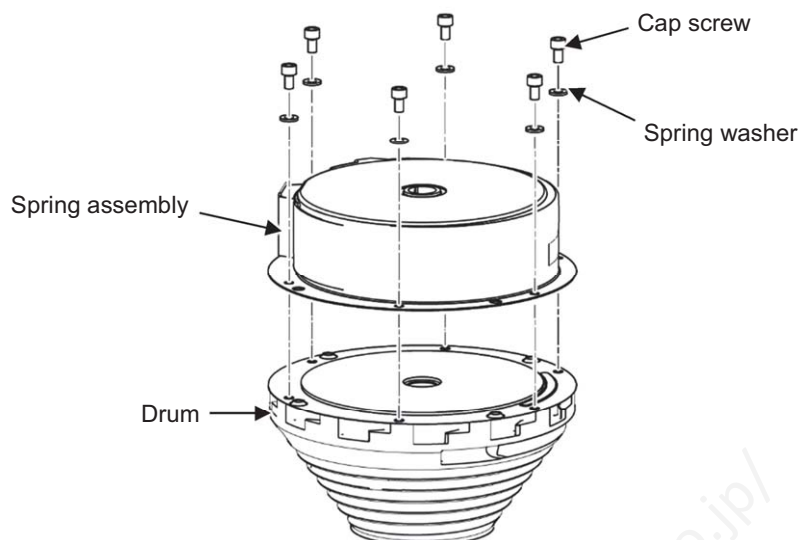
**Do not remove the cover from the spring assembly.**

**If the cover of the spring assembly is removed, the spring inside may spring out, causing an injury.**

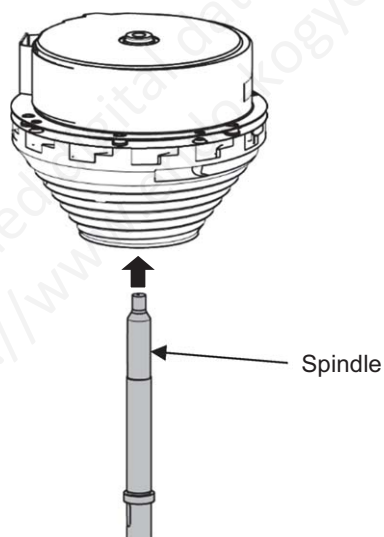


## 2-4-2 Assembling of the spring

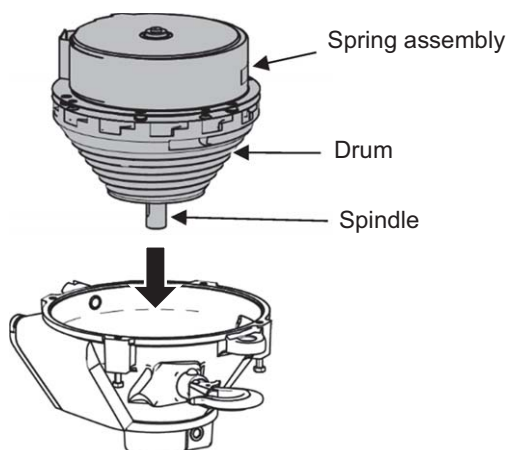
- 1 Attach the spring assembly on the drum with the Cap screw and the spring washers.



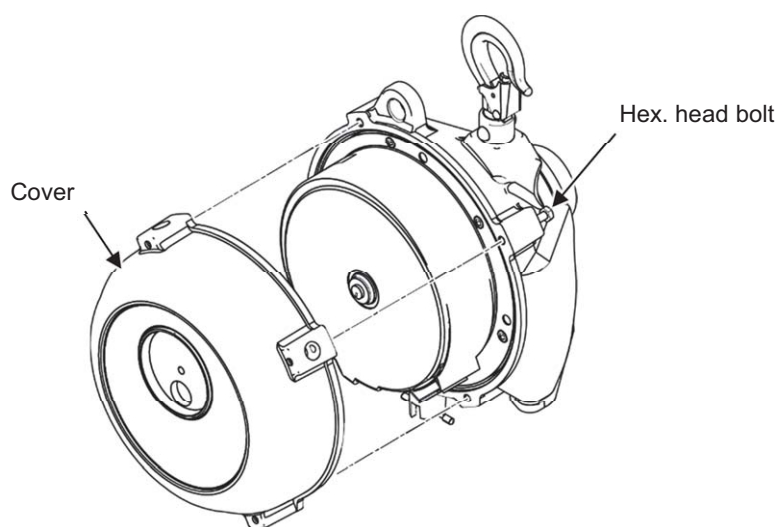
- 2 Attach the spindle.



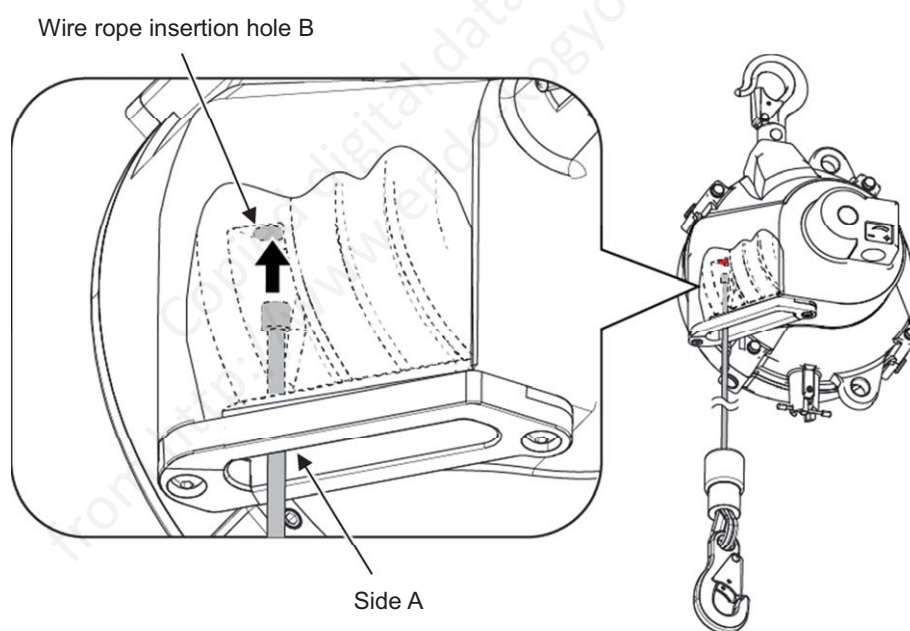
- 3 Attach the spring assembly, drum, and spindle to the casing.



- 4** Attach the cover, and attach the hex. head bolts and the spring washers.



- 5** Insert the wire rope into the drum through wire rope insertion hole B from side A as shown in the figure below, and pass the wire rope inside the drum.



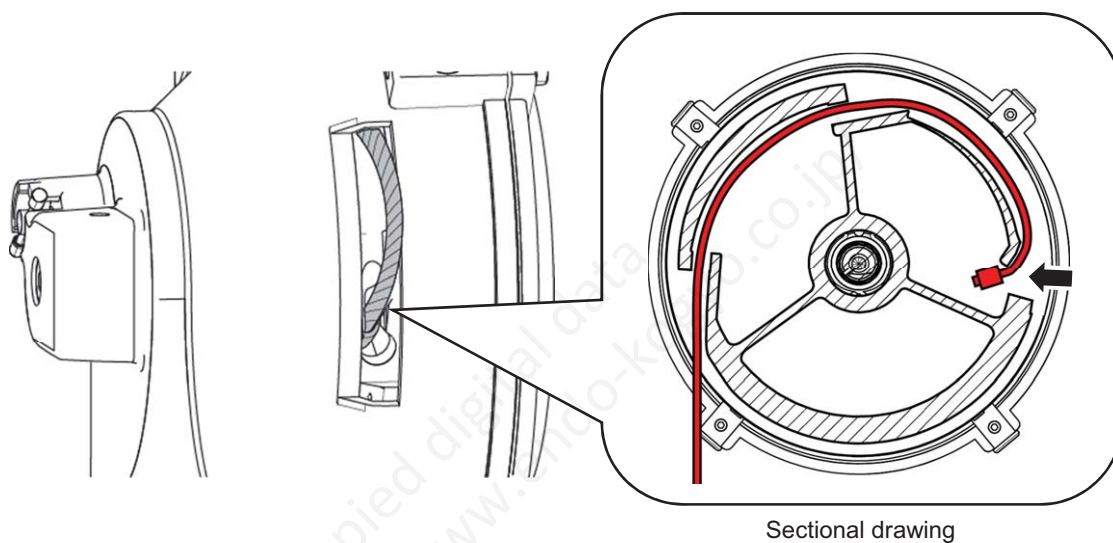
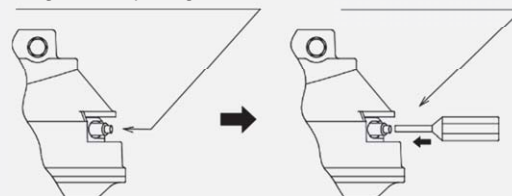
- 6 Pull out the end of the wire rope through the window and insert the end into the hole for the plug.

**! REMINDER**

When the wire rope becomes stuck inside the drum, it can be passed through the drum easily by twisting and squeezing it.

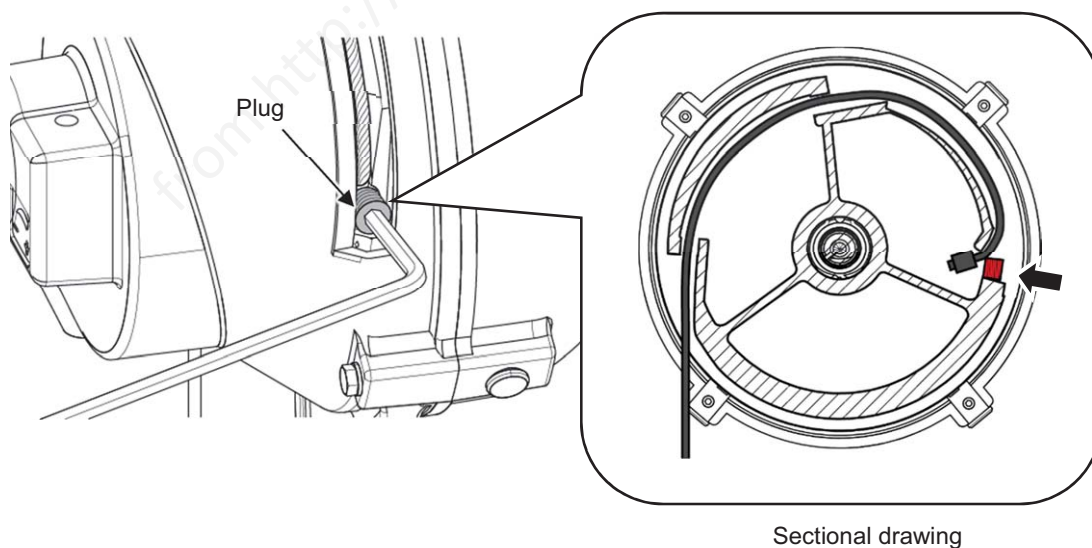
If the end of the wire rope is caught while pulling it

Squeeze the end of the wire rope using a tool



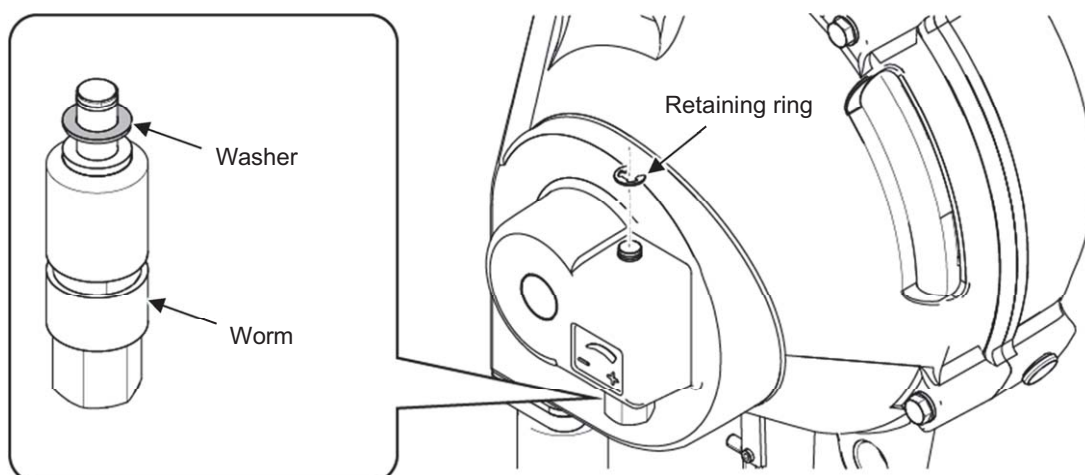
Sectional drawing

- 7 Attach the plug and tighten it with a hex. key.



Sectional drawing

- 8** Attach the worm together with the washer and attach the retaining ring.

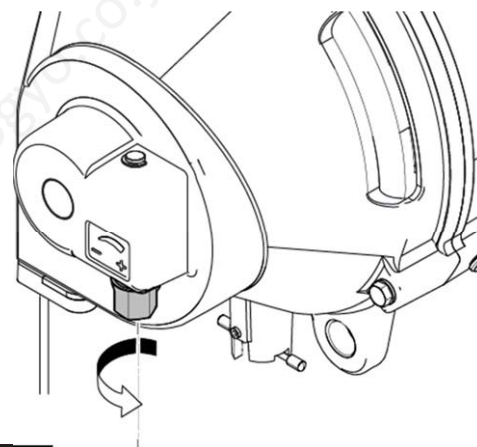


- 9** Turn the worm in the “+” direction (clockwise) and wind the spring.

**! REMINDER**

When the worm is turned, the wire rope is wound inside the drum. Prevent the wire rope from coming off the groove on the drum.

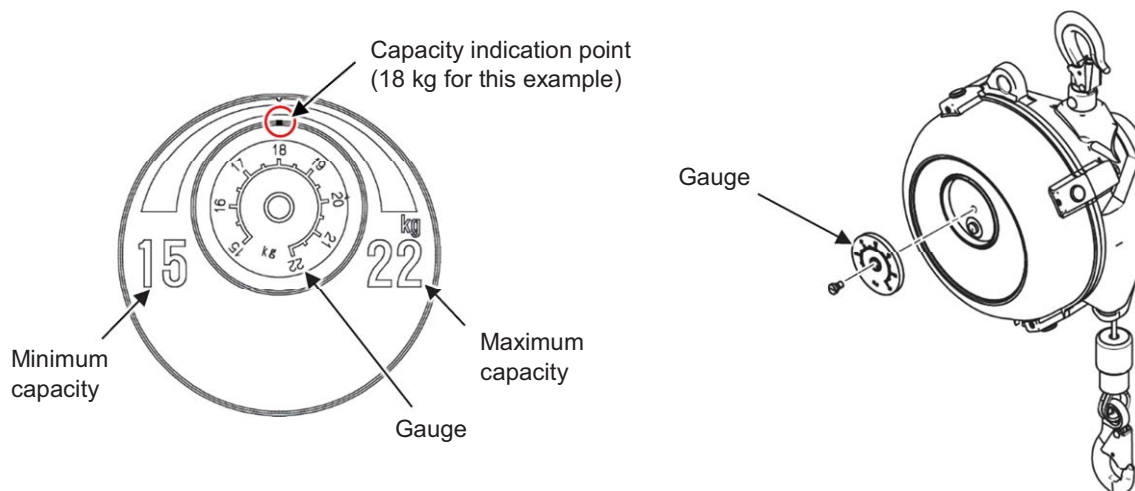
After the wire rope is completely wound inside the drum, further turn the worm by the number of times described in the table below.



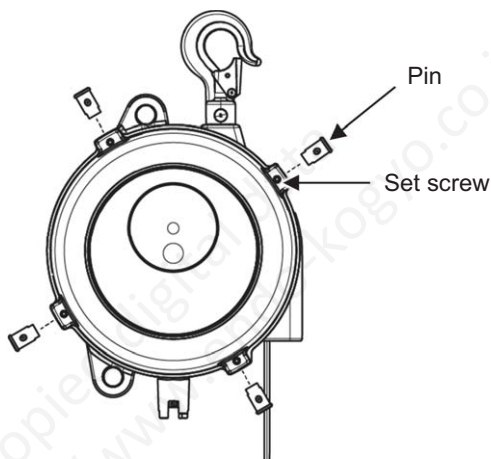
Model	Number of worm turns	Setting weight
ELF-15	Approx. 140	Approx.12kg
ELF-22	Approx. 120	Approx.18kg
ELF-30	Approx. 130	Approx.26kg
ELF-40	Approx. 120	Approx.35kg
ELF-50	Approx. 110	Approx.45kg
ELF-60	Approx. 135	Approx.55kg
ELF-70	Approx. 120	Approx.65kg

- 10** Attach a weight whose mass (weight) has been measured within the capacity range to the bottom hook, and adjust the spring tension. (See “5-2-2 Installation of tools and equipment and adjustment of the spring tension” in the Users Manual)

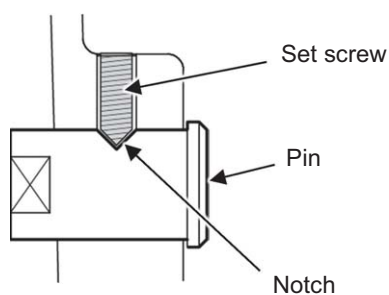
**11** Attach the gauge according to the adjusted load.



**12** Attach all pins.



**13** Align the notch on the pin with the tip of the set screw, and fix the pin with the set screw.



## **WARNING**



If the pins are not installed correctly, the fall-arrest device may not be activated when the spring is ruptured, causing an injury or property damage. Be sure to install all pins, and correctly fix them with the set screws.



## 2-5 Replacement of the wire guide

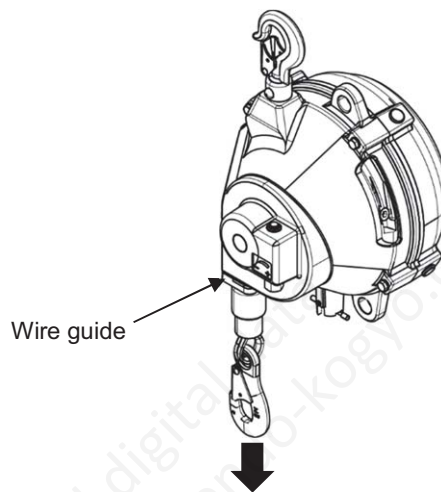


### WARNING

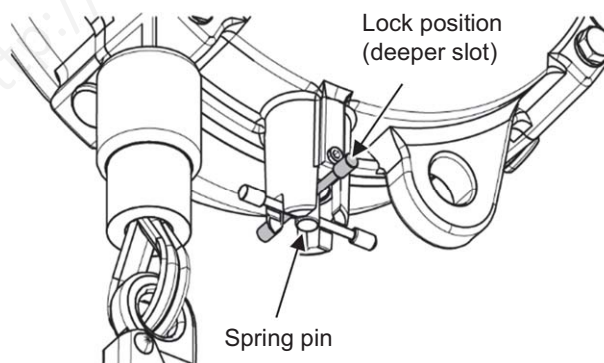


Do not remove the tool before checking that the drum is securely locked by moving the tool (equipment) up and down.  
If the drum is locked inadequately, the drum lock may be released during the work. Then, the wire rope may be quickly wound up, causing an injury.

- 1 Extend the wire rope to a position where the wire guide can be replaced.



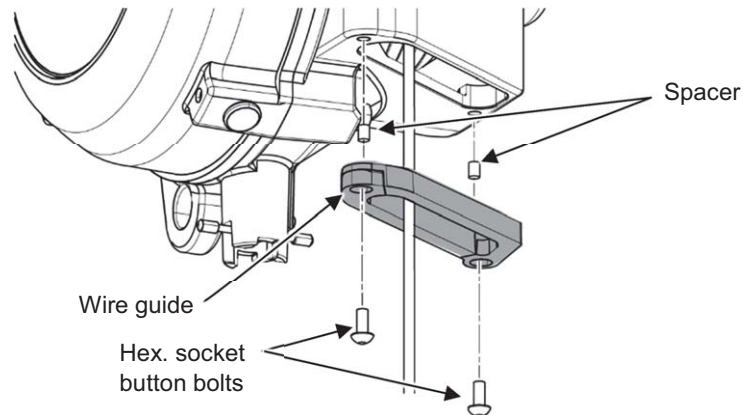
- 2 Turn the spring pin to the lock position, and lock the drum. (See “6-3 Operation method of the drum lock” in the Users Manual)



- 3 Before removing the tool (equipment), move the tool up and down to check that the drum is securely locked.
- 4 Remove the balancer from the support member and place it on the ground or on a workbench.



- 5 Remove the hex. socket button bolts (2 pieces), and remove the wire guide from the casing together with the spacers. Keep the spacers because it is used for reinstallation.



- 6 Attach the new wire guide and the spacers with the hex. socket button bolts (2 pieces). Tighten the hex. socket button bolts with a torque between 2.8 and 3.0 N·m.

**! REMINDER**

The hex. socket button bolts are processed to prevent looseness. Always replace the used screws with new ones after removing them.

- 7 Install the balancer to the support members.  
(See “5-2-1 Installation of the Spring Balancer” in the Users Manual)
- 8 Attach the removed tool to the bottom hook again, and release the drum lock.



**WARNING**



**Do not release the drum lock when the balancer is not loaded or after the tool (equipment) is replaced with one with a different mass (weight). If the drum lock is released in such situations, the wire rope may be quickly wound up as soon as the lock is released, the tool may fall, or an injury may be caused. Attach the tool and adjust the spring tension before releasing the drum lock.**

## 2-6 Countermeasures when the wire rope is caught between the drum and the casing

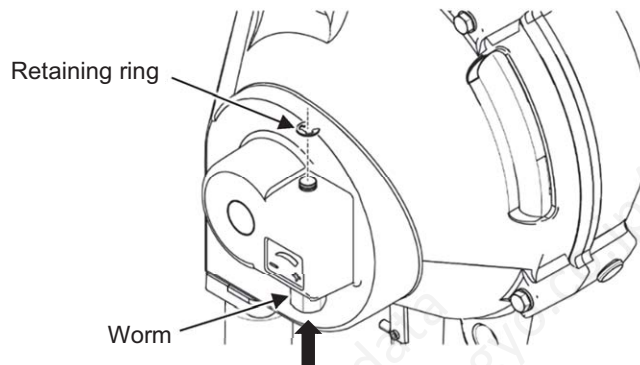
- 1 Strongly pull the wire rope with the tool (equipment) attached.



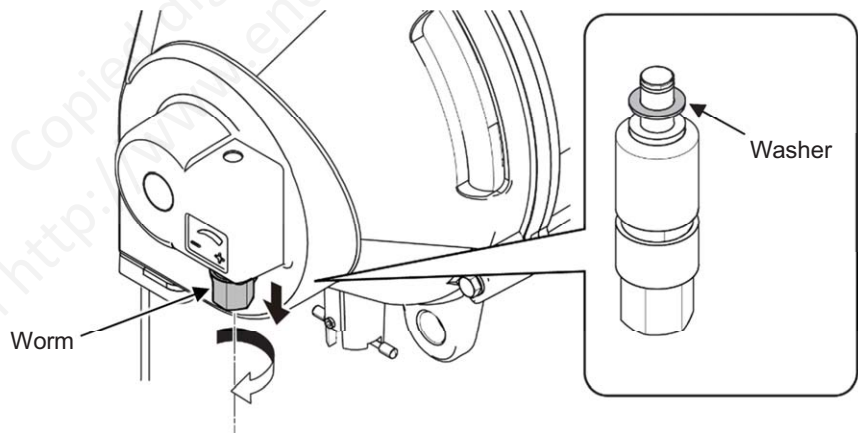
### REMINDER

Inspect the wire rope after pulling it out. Replace the wire rope if any damage is found.

- 2 If the wire rope cannot be pulled out, remove the retaining ring from the end of the worm.



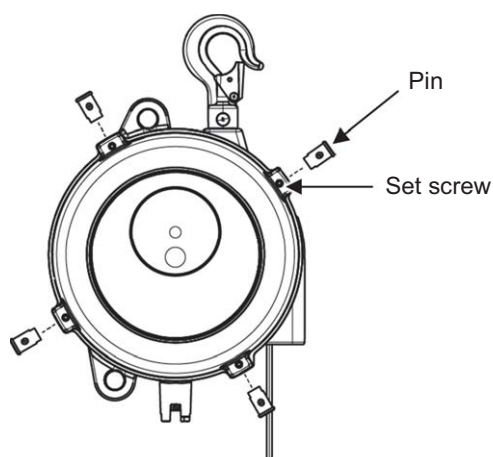
- 3 To release the spring tension, turn the worm in the “-” direction (counterclockwise) and remove the worm.



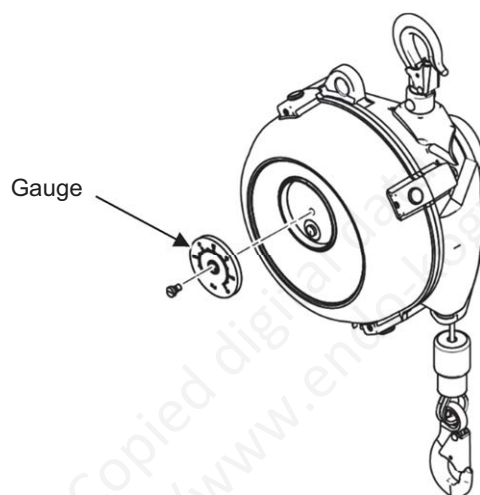
The washer comes off together with the worm. Keep the washer because it is used for reinstallation. If the washer cannot be removed, follow step 7 to remove the washer.

- 4 Remove the tool from the bottom hook, and remove the balancer from the support members.

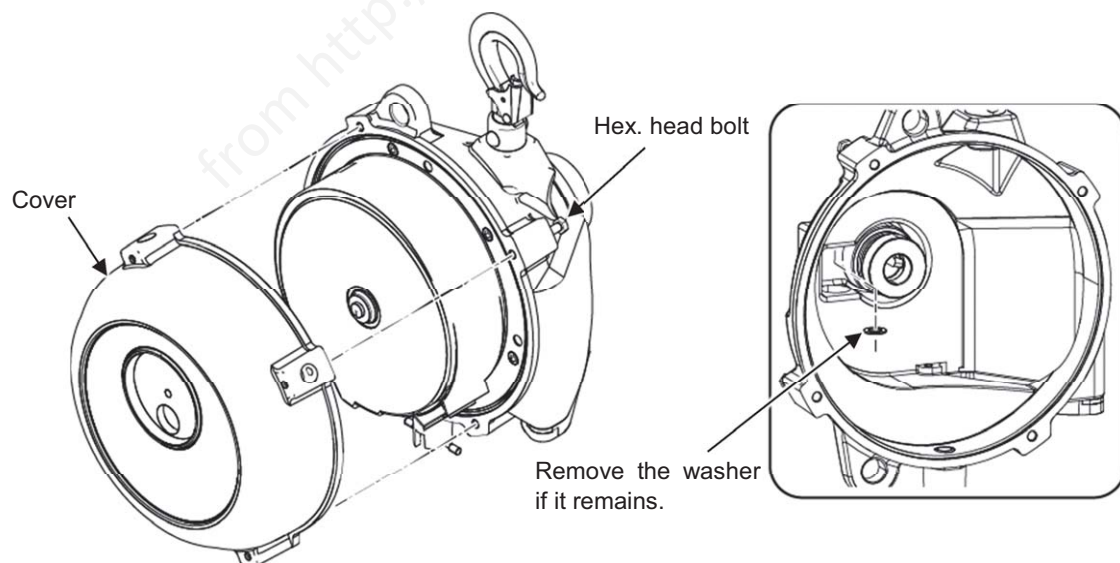
- 5** Loosen the set screw and remove all pins.



- 6** Remove the gauge.

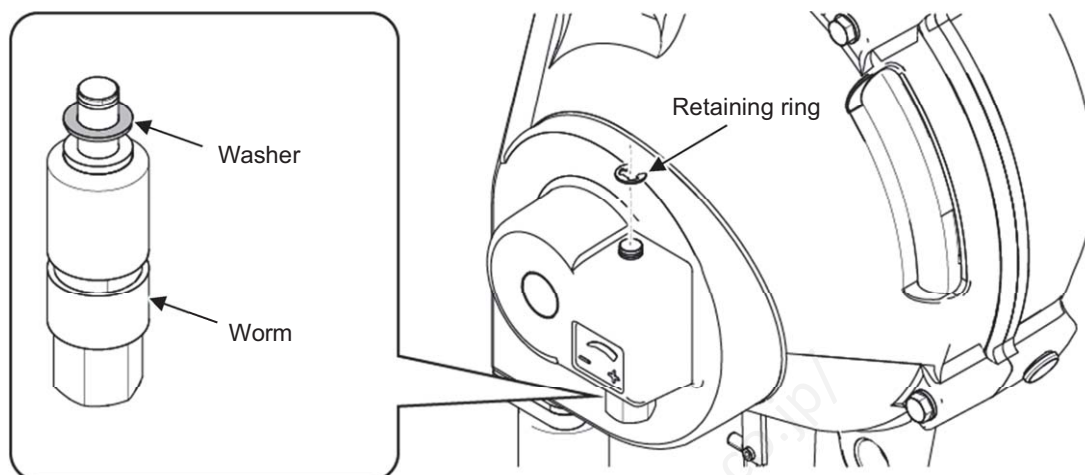


- 7** Loosen the hex. head bolts and remove the cover.



If the washer cannot be removed in step 3, remove the remaining washer from the inside of the casing. Keep the washer because it is used for reinstallation. (See Step 9 in "2-4-1 Removal of the spring" ).

- 8** Pull out the wire rope completely, and inspect the wire rope. Replace the wire rope if any damage is found.
- 9** Attach the cover, and attach the hex. head bolts and the spring washers.
- 10** Attach the worm together with the washer and attach the retaining ring.



- 11** Adjust the spring tension, and attach the gauge and the pins.  
(See steps **9** to **13** in "2-4-2 Assembling of the spring")

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