Supply this manual to the user.

INSTRUCTION MANUAL

CABLE REEL

CRL - 4000 SERIES
CRL - 5000 SERIES
CRL - 6000 SERIES
CRL - 7000 SERIES

⚠ WARNING

- Read this manual before use.
- Keep this manual available.

ENDO KOGYO CO., LTD

ENDO

RM-10547a

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SAFETY ALERT SYMBOL AND ALERT SIGNS

Please read this manual carefully and follow its instructions.

The SAFETY ALERT SYMBOL (⚠), WARNING, CAUTION, and NOTE carry special messages.

⚠ This SAFETY ALERT SYMBOL is used to call your attention to items or operations that could be dangerous to you or other persons using this equipment.

Please read these messages and follow these instructions carefully.

⚠ **WARNING** : WARNING indicates a hazardous situation which, if not avoided, could result in death or serious injury.

⚠ **CAUTION** : CAUTION indicates a hazardous situation which, if not avoided, could result in minor or moderate injury, damage or destruction of the equipment and others.

NOTE : NOTE indicates a special instruction in operation or maintenance.

Contents

1. ⚠ Safety instructions

Regarding name plates, warning labels and labels:

⚠ WARNING

- Never remove or deface any name plates, warning labels or labels which are attached to the body.
  The operator should always observe them.

Regarding installation (page 8):

⚠ WARNING

- Never use in ignitable or explosive atmospheres.
- Take sufficient care not to knock or drop the reel when handling.
  Never use the arm of the guide roller (special accessories) to lift the reel.

Regarding ground connection work (page 9):

⚠ WARNING

- Electric shock hazard.
  Do the ground connection work.
- Never connect the earth line to the following:

Gas pipes, etc.	: Danger of ignition or an explosion.
Phone lines / lightning rods	: Danger of being struck by lightning.
Along plastic water pipes	: Does not act as an earth.

Regarding cable connection (page 10):

⚠ WARNING

- Electric shock hazard.
  Turn off the power before carrying out any work.

⚠ CAUTION

- Do not install cable to drum more than 2-3 times round.
  (2-3 times means winding length & initial spring turns)
  Make free space in drum, otherwise cable could spill out from drum cover.
  If cable spilled, it causes accidents as a cable cutting.
- When used for vertical lift or horizontal stretch application, in order to prevent severing of the cable and then a fall in case of a spring breakage, protect the cable by wrapping rubber or the like around the cable portion which contacts with the oblong hole in the drum cover.
- Check the wire connections are sound and there are no wiring errors.
- Never allow the cable (leads) connected to the slip rings to protrude over 10mm from the terminal plate upper surface for slip ring capacities of 10A, 20A and 50A, or over 30mm from the top of the lead bolt for slip ring capacities of 100A and 150A.
- Leave sufficient room for connecting the cable (leads) to the brushes so as not to apply excessive force to the brushes.
- Never obliquely attach the terminal lugs to the brush holder. If obliquely attached, the insulator length will be insufficient, resulting in poor insulation.
- Securely tighten the cross recessed head screws to attach the dust proof cover and the connector nut to prevent rain penetration.
  Take sufficient care not to damage the seal ring during any work.

Regarding initial tension setting (page 14):

⚠ WARNING

- Never let go of the drum during any work.
  When released, the drum suddenly rotates, possibly causing personal injury.
- After setting the initial tension, wire connection requires more than 2 people to secure the drum and connect the cable.

Safety instructions on use (page 15):

⚠ WARNING

- Never approach the moving parts during operation.
  There is a danger of being caught up.
- Turn off the power immediately in case of any trouble to avoid the problem escalating.
- Never use the reel when damaged or abnormal sound/vibration occurs.
- Never alter the reel or its accessories.
- Never let go of or unfasten the cable from the fixed points when the cable is pulled out.
  The cable will rewind suddenly, possibly causing personal injury.

⚠ CAUTION

- Use within the rated values of the operating voltage and current.
  Refer to the name plate attached to the body.
- Never pull out the cable past the winding length. Always leave 2 - 3 dead turns on the drum. (To the sign of red tape)
  Put sign (red tape) on the 2 – 3 dead turns when installing or replacing the cable.

Regarding periodic inspections (page 17):

⚠ WARNING

- Periodically inspect the reel and replace any worn or damaged parts.
  Carefully check the cable has no damage.
- If a malfunction is found during a periodic inspection, never reuse the reel but repair immediately.
- Allow the cable to fully wind onto the drum to give the minimum winding tension before carrying out inspections.
- Electric shock hazard.
  Turn off the power before removing the dust proof cover.
- Verify safety using some kind of electrical test sensor before carrying out inspections.

⚠ CAUTION

- Always put up an instruction sign ("Equipment being inspected", "Do not turn on the power", etc.) before carrying out periodic inspections or repair.
- Take care as the slip ring assembly can still be very hot even if the power is cut.
- Always use genuine parts for replacement.
- Test the insulation after the reel has been stored for a long time.

Regarding brush and slip ring replacement (page 20):

⚠ WARNING

- Electric shock hazard.
  Turn off the power and verify safety using some kind of electrical test sensor before carrying out replacement.
- Allow the cable to fully wind onto the drum to give the minimum winding tension before carrying out replacement.

⚠ CAUTION

- Always put up an instruction sign ("Equipment being inspected", "Do not turn on the power", etc.) before carrying out replacement.
- Take care as the slip ring assembly can still be very hot even if the power is cut.
- After part replacement, test the insulation before connecting the cable.
- Check the conduction of each cable core after cable connection.

Regarding spring replacement (page 23):

⚠ WARNING

- Electric shock hazard.
  Turn off the power and verify safety using some kind of electrical test sensor before carrying out replacement.
- When disconnecting the mating equipment side wiring on the cable winding side, the drum may suddenly rotate.
  Allow the cable to fully wind onto the drum to give the minimum winding tension, then dismantle the mating equipment side wiring with more than 2 people to secure the drum and dismantle the wiring.
- Allow the dismantled cable to wind around the drum, slowly turning the drum until the winding tension in the drum is released.
  Never disassemble until the reel's winding tension is released.
  The spring will burst out and cause personal injury.
- Never disassemble using any other disassembly procedure.
  If disassembled incorrectly, the spring will burst out and cause personal injury.
- Never remove the spring from the spring case.
  If removed, the spring will expand explosively and cause personal injury.
- Treat and dispose of the spring according to the instructions.

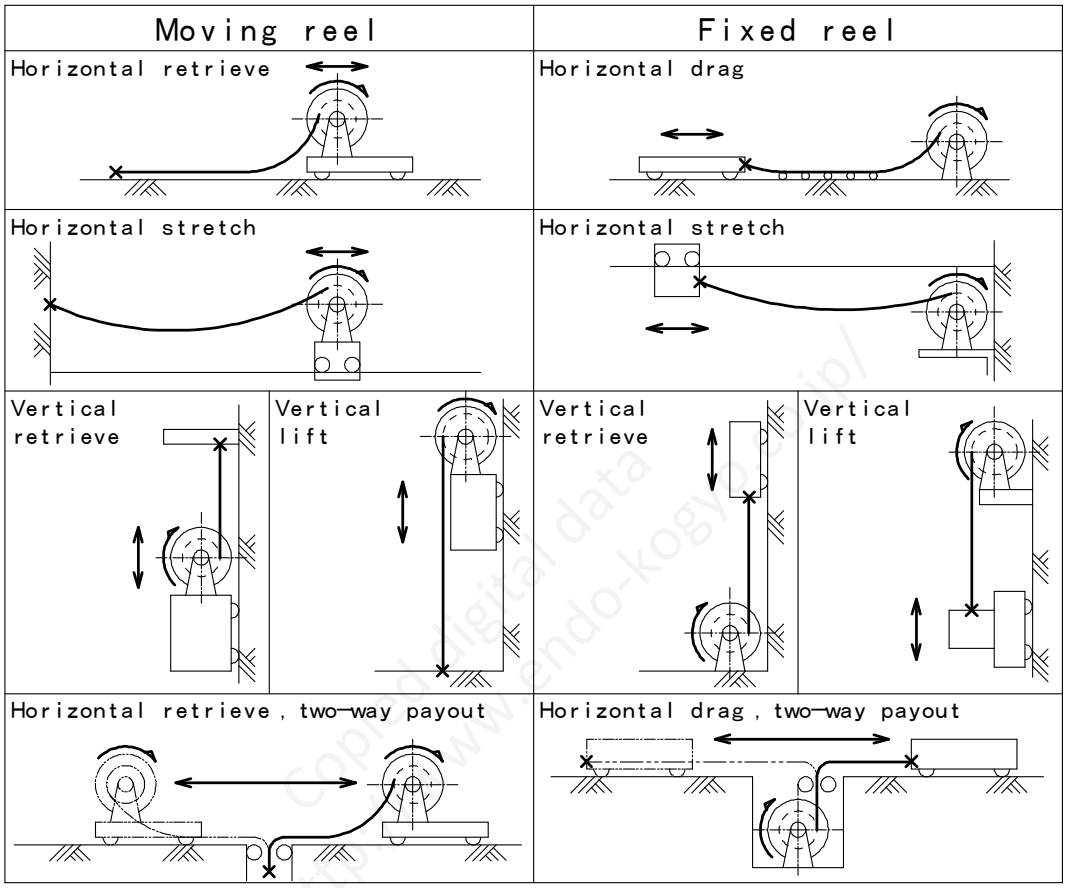
⚠ CAUTION

- Always put up an instruction sign ("Equipment being inspected", "Do not turn on the power", etc.) before carrying out periodic inspections or repair.

2. Terminology definitions

The terminology used in this manual will be explained here.
If there is any terminology which is unclear or not included in this section, please contact our company.

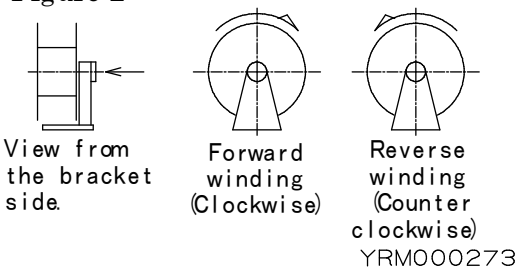
Winding methods: Figure 1



Forward winding : The winding direction when viewed from the bracket side is right (clockwise).

Reverse winding : The winding direction when viewed from the bracket side is left (counterclockwise).

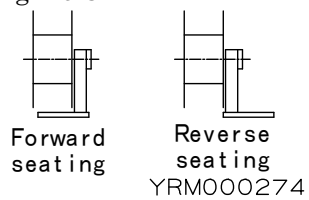
Figure 2



Forward seating : The installation plate (base plate) is located under the drum.

Reverse seating : The installation plate (base plate) is located on the opposite side of the drum.

Figure 3



C-class ground,
connection work: applied to non-charging parts of electric equipment or cable metal jackets, the ground resistance of which should be 10 ohms or less.

Dead turns : The 2-3 turns of cable wrapped around the drum other than the used winding length.

Initial spring turns : The applied initial tension to the spring. The initial tension is required for winding the cable on the drum.

3. Product Description

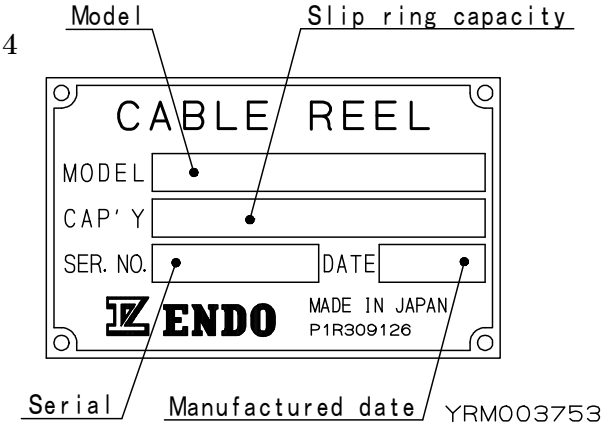
3-1. Models and specifications

(1) Models

Please observe the name plate attached to the main body.

Refer to Figure 5 (page 7) for the attached location.

Figure 4



MODEL: The product model is shown.
Please check if this manual matches with the product.
Refer to Table 1.

CAP'Y: The slip ring capacity is shown.

■ Model description

CRL	-	6M	7	112	W	-	R
Series name		Drum size and width	Drum cover size	Spring type	Spring combination		Winding direction

Drum size and width (mm)

Code	4M	4	4A	5M	5	5A	6M	6	6A	7M	7	7A
Size	280	280	280	360	360	360	440	440	440	550	550	550
Width	127	165	217	127	165	217	172	220	275	172	220	275

Drum cover size (mm)

Code	4	5	6	7	8	9
Size	440	510	630	750	870	1000

Spring type

Spring code	24	48	36	72	55	110	56	112	75	150
Number of springs	24×1	24×2	36×1	36×2	55×2	55×2	56×1	56×2	75×1	75×2
Total spring torque N・m {kgf・m}	23.5 {2.4}	47.0 {4.8}	35.3 {3.6}	70.6 {7.2}	53.9 {5.5}	107.8 {11.0}	54.9 {5.6}	109.0 {11.2}	73.5 {7.5}	147.0 {15.0}

Spring combination

Code	None	W	T	F	V
Number of sets	1	2	3	4	5

Winding direction

None	R
Forward winding	Reverse winding

(2) Specifications

Table 1

Model	Maximum spring torque N・m {kgf・m}	Calculated maximum spring tension N {kgf}	Total number of spring turns	Spring structure	Reference mass kg
CRL-4M424 CRL-4M424-R	23.5 {2.4}	166 {17.0}	13	E	28
CRL-4424W CRL-4424W-R	23.5 {2.4}	166 {17.0}	26	G	34
CRL-4424T CRL-4424T-R	23.5 {2.4}	166 {17.0}	39	G	40
CRL-4424F CRL-4424F-R	23.5 {2.4}	166 {17.0}	52	G	46
CRL-4524T CRL-4524T-R	23.5 {2.4}	166 {17.0}	39	G	42
CRL-4524F CRL-4524F-R	23.5 {2.4}	166 {17.0}	52	G	48
CRL-5M636 CRL-5M636-R	35.3 {3.6}	196 {20.0}	13	E	42
CRL-5636W CRL-5636W-R	35.3 {3.6}	196 {20.0}	26	G	52
CRL-5636T CRL-5636T-R	35.3 {3.6}	196 {20.0}	39	G	62
CRL-5636F CRL-5636F-R	35.3 {3.6}	196 {20.0}	52	G	72
CRL-5655W CRL-5655W-R	53.9 {5.5}	294 {30.0}	24	G	57
CRL-5655T CRL-5655T-R	53.9 {5.5}	294 {20.0}	36	G	70
CRL-6756F CRL-6756F-R	54.9 {5.6}	245 {25.0}	48	G	97
CRL-6756V CRL-6756V-R	54.9 {5.6}	245 {25.0}	60	G	110
CRL-6775W CRL-6775W-R	73.5 {7.5}	333 {34.0}	24	G	85
CRL-6775T CRL-6775T-R	73.5 {7.5}	333 {34.0}	36	G	100
CRL-6775F CRL-6775F-R	73.5 {7.5}	333 {34.0}	48	G	115
CRL-6M7112W CRL-6M7112W-R	109.0 {11.2}	490 {50.0}	24	G	100
CRL-7875T CRL-7875T-R	73.9 {7.5}	264 {27.0}	36	G	115
CRL-7875F CRL-7875F-R	73.9 {7.5}	264 {27.0}	48	G	130

NOTICE : The reference mass shown in the table is for a slip ring capacity of 50A×3P, and does not include accessories such as the guide rollers, turn table and ratchet mechanism.

※ The method for spring replacement is different depending on the spring structure. Refer to chapter 13. (page 23) "Spring replacement".

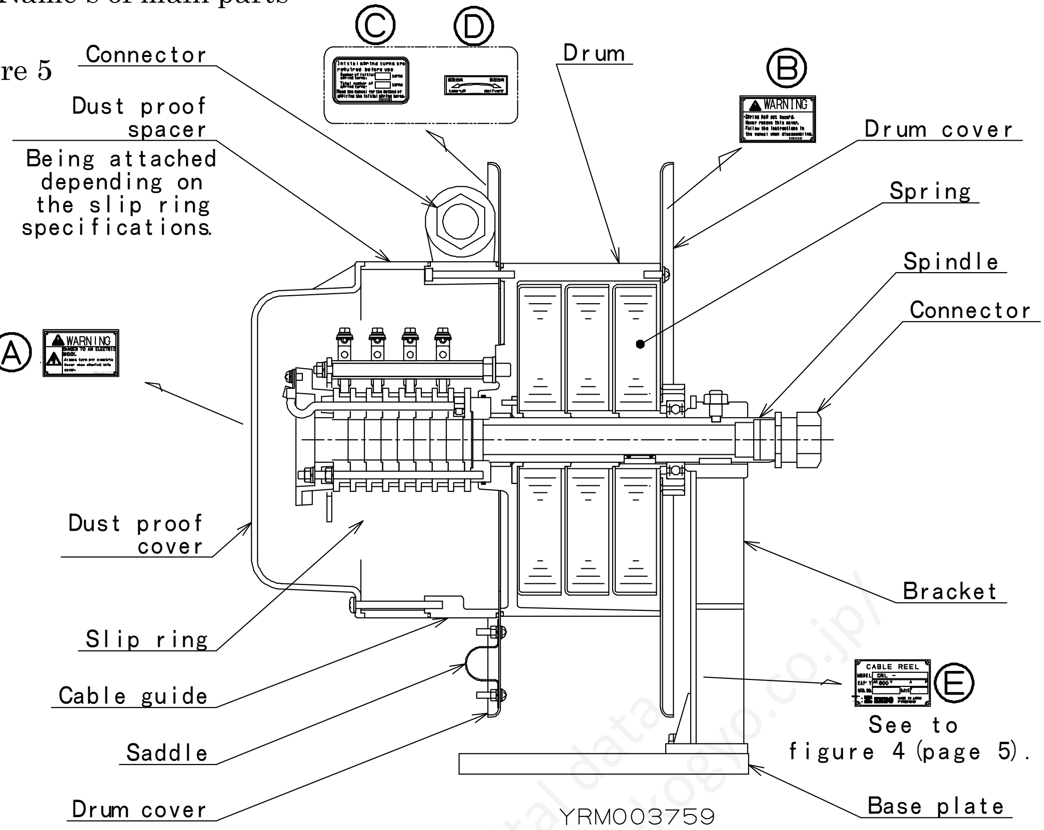
■ Working conditions

Application area : general outside conditions

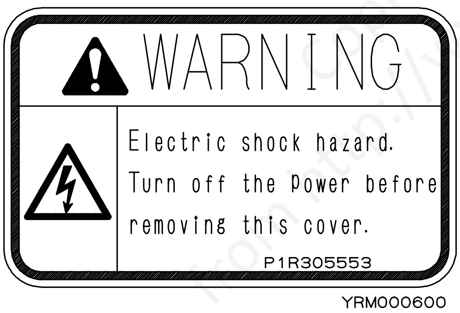
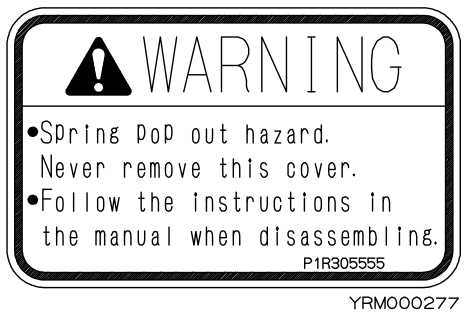
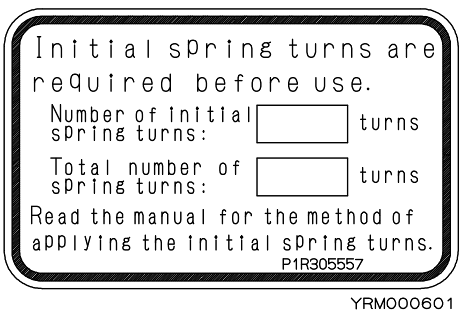
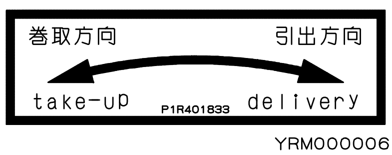
Surrounding temperature : - 10℃ to + 50℃

3-2. Name s of main parts

Figure 5



Regarding the accessories, refer to chapter 9. "Accessories" (page 16).

(A) Warning label	(B) Warning label
	
A warning is displayed regarding electric shock hazards.	A warning is displayed regarding spring ejection hazards.
(C) Label	(D) Label
	
The required number of initial spring turns is displayed.	The winding direction is displayed.

4. Installation

4-1. Checks before installation

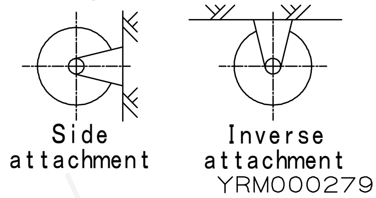
- Please check whether the items ordered were received.
  (Check the name plate.)
- Check there is no damage to the product caused during transportation.

4-2. Installation

⚠ WARNING

- **Never use in ignitable or explosive atmospheres.**
- **Take sufficient care not to knock or drop the reel when handling.**
  When lifting the reel, wrap the belt sling around the drum at least twice, and lift in stable conditions.
- **Never use the arm of the guide roller (special accessories) to lift the reel.**
- **For side attachment or inverse attachment, use bolts with a strength classification above 10.9.**

Figure 6



- Place the main body in the fixing location and anchor the bracket securely with 4 bolts.
- The bracket base plate can be changed as shown in figure 7.

  NOTE: In order to correctly wind the cable, adjust the reel position as shown in figure 7.
  Try to adjust so the center of the drum width lines up with the cables fixed point on the mating equipment.
  The surface the cable lies on should be horizontal.

Figure 7

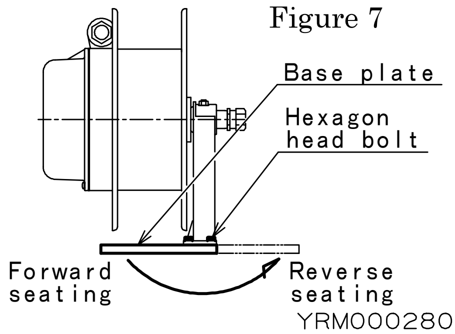
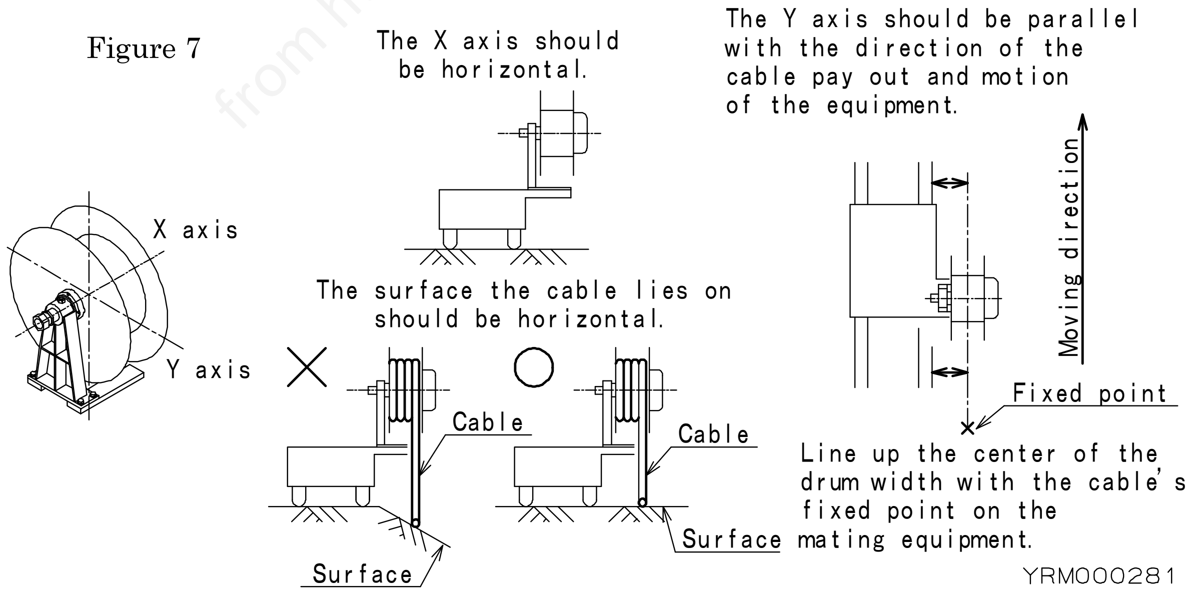


Figure 7



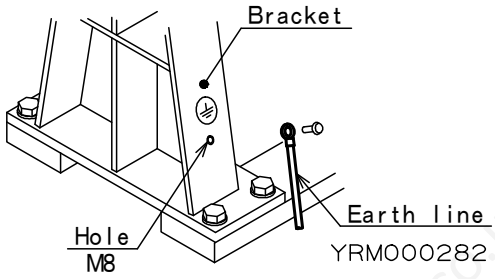
4-3. Ground connection work

⚠ WARNING

- **Electric shock hazard.**
  Do the ground connection work.
- **Never connect the earth line to the following:**
  Gas pipes, etc. : Danger of ignition or an explosion.
  Phone lines / lightning rods : Danger of being struck by lightning.
  Along plastic water pipes : Does not act as an earth.

For earth connection, connect the earth line to the hole installed in the bracket.

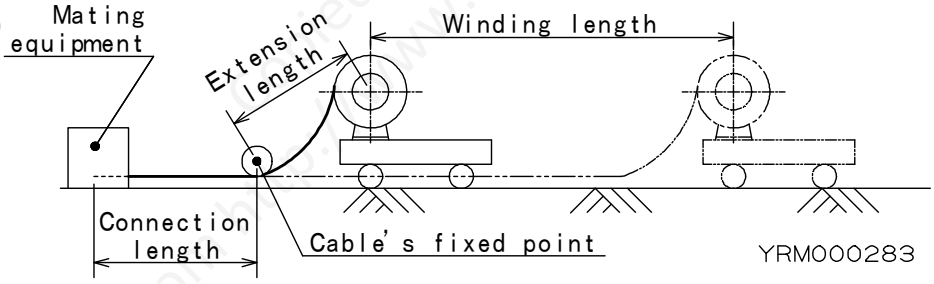
Figure 9



5. Cable connection

5-1. Calculation of required cable length on winding side

Figure 10



Cable length on winding side = Winding length + Extension length + Connection length
+ Dead turns length + Connection length inside reel.

Winding length = The length wound onto the drum.
Extension length = The length from the cable's fixed point to the end of the winding, which is not wound onto the drum.
Connection length = The length required to connect the mating equipment to the cables fixed point.
Dead turns length = The length of the 2-3 dead turns.
Connection length inside reel = Approx 1m.

$$\text{Required dead turns length} = \underbrace{(\text{Drum diameter} + \text{Cable diameter}) \times \pi}_{\text{The lengths of 1 drum turn}} \times \underbrace{2-3}_{\text{Numbers of dead turns}}$$

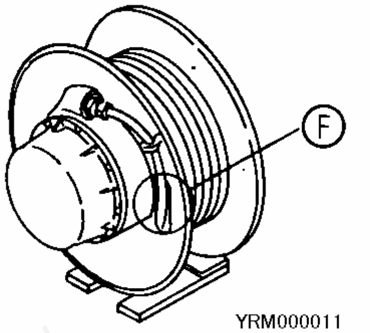
5-2. Cable connection

⚠ WARNING

- Electric shock hazard.
  Turn off the power before carrying out any work.

⚠ CAUTION

Figure 11



- Do not install cable to drum more than 2-3 times round.
  (2-3 times means winding length & initial spring turns)
  Make free space in drum, otherwise cable could spill out from drum cover.
  If cable spilled, it causes accidents as a cable cutting.
- When used for vertical lift or horizontal stretch application, in order to prevent severing of the cable and then a fall in case of a spring breakage, protect the cable by wrapping rubber or the like around the cable portion which contacts with the oblong hole (F) in the drum cover (See figure 11).
- Check the wire connections are sound and there are no wiring errors.
- Never allow the cable (leads) connected to the slip rings to protrude over 10mm from the terminal plate upper surface for slip ring capacities of 10A, 20A and 50A, or over 30mm from the top of the lead bolt for slip ring capacities of 100A and 150A
  (see figures 12 and 13).
  If protruding out too far, the fixed side cable and the dust proof cover will contact, damaging the cable insulation due to the drum rotation, causing a spark.

Figure 12

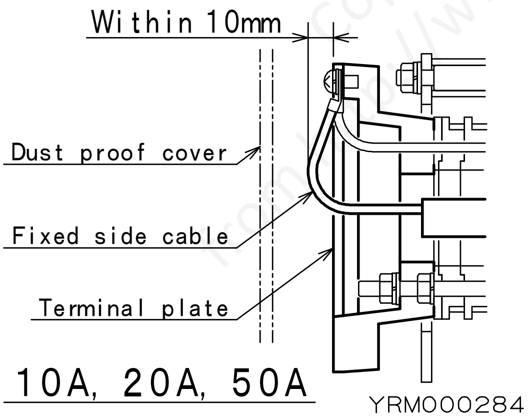
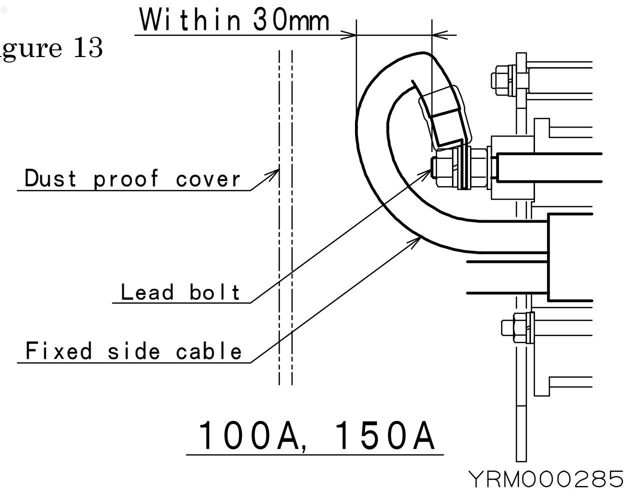


Figure 13



- Leave sufficient room for connecting the cable (leads) to the brushes so as not to apply excessive force to the brushes.
- Never obliquely attach the terminal lugs to the brush holder.
  If obliquely attached, the insulator length will be insufficient, resulting in poor insulation.
- Securely tighten the cross recessed head screws to attach the dust proof cover and the connector nut to prevent rain penetration.
  Take sufficient care not to damage the seal ring during any work._

Figure 14

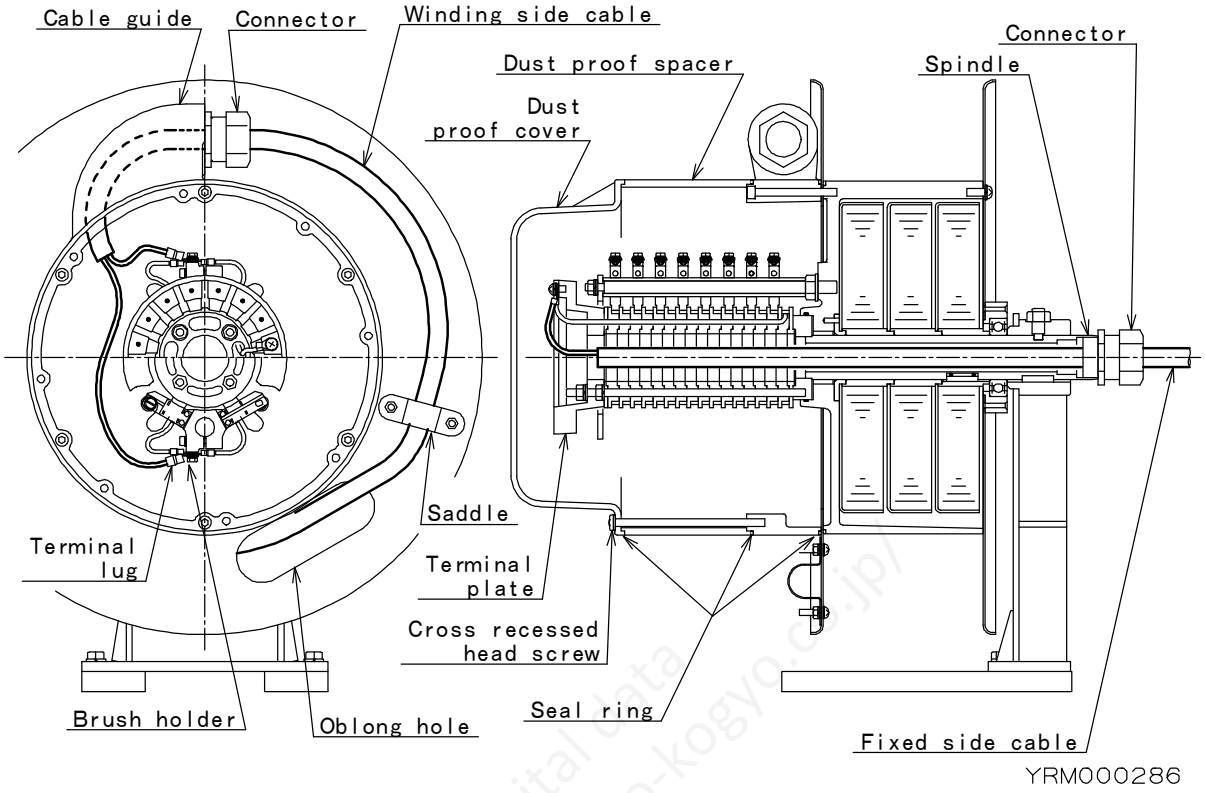
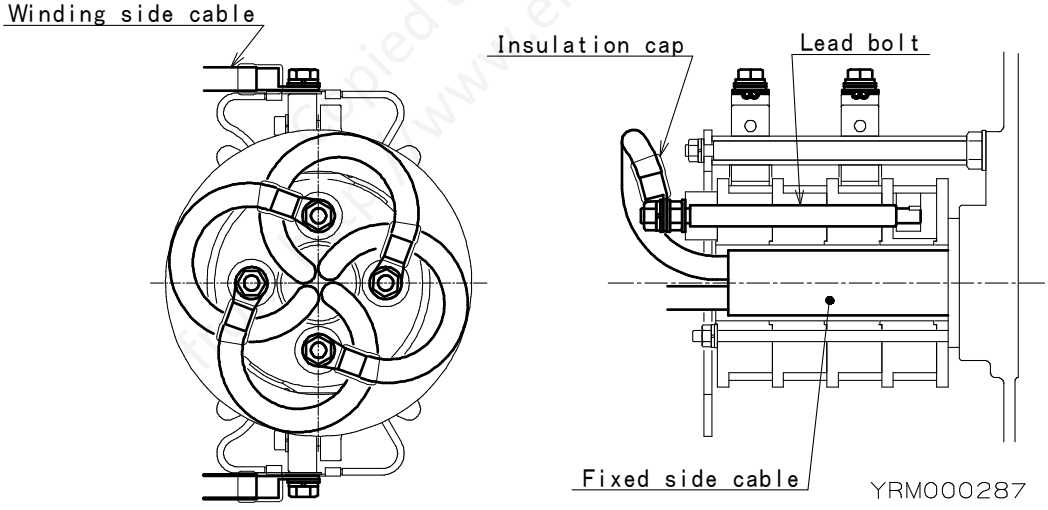


Figure 15 100A, 150A connection diagram

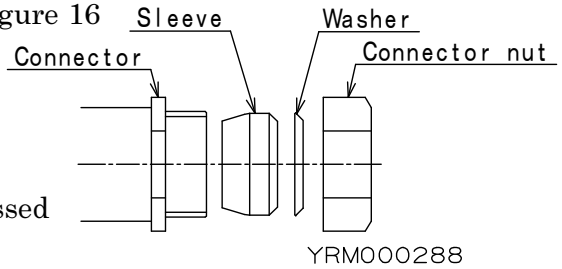


■ Winding side cable (See figure 14,15)

(1) Loosen the cross recessed head screws and remove the dust proof cover and dust proof spacer.

NOTE: The dust proof cover and dust proof spacer will fall when the cross recessed head screws are loosened.
Take care not to drop them into the slip ring assembly.

Figure 16



(2) Remove the saddle and the connector nut on the cable guide side.

(3) Pass the cable through the oblong hole in the drum cover from the drum side. Attach the removed nut, washer and sleeve to the cable (See figure 16).

(4) Peel the required length of jacket from the cable, and pass the cable through the cable guide.
Decide on the required length for peeling to allow sufficient room for connecting the cable core to the farthest brush holder from the cable guide exit.

(5) Tighten the connector nut to secure the cable while leaving sufficient room for connecting each cable core to the brush.
This is important to prevent rain penetration into the slip ring assembly.
NOTE: If the cable cannot be secured by tightening the connector nut, make the cable diameter bigger by wrapping thick tape around the cable, then secure with the connector nut (See figure 17).

Figure 17

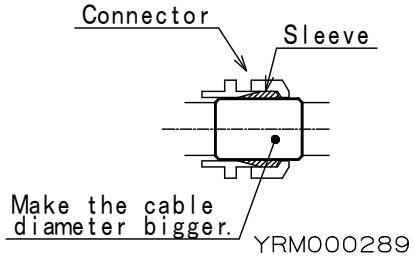
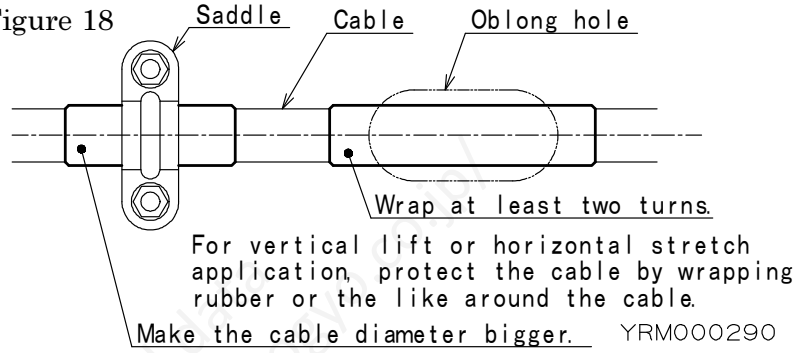


Figure 18



(6) Wrap thick tape around the cable portion which contacts with the oblong hole in the drum cover, and fix with the saddle.
If the cable cannot be secured by the saddle, make the cable diameter bigger by wrapping thick tape around the cable (See figure 18).

(7) Attach the terminal lugs to each cable core.

(8) Connect the terminal lugs to the brush holders.

■ Fixed side cable (See figure 14, 15 (page 11))

(1) Remove the connector nut on the spindle side.
Attach the connector nut, washer and sleeve to the cable.

(2) Peel the jacket from the cable, and pass the cable through the spindle.
The peeling length should be 100mm for slip ring capacities of 10A, 20A and 50A, and 300mm for slip ring capacities of 100A and 150A.

(3) Connect each cable core to the terminal plate or the lead bolts.
NOTE: Check the conduction of each cable core to ensure there are no wiring errors.

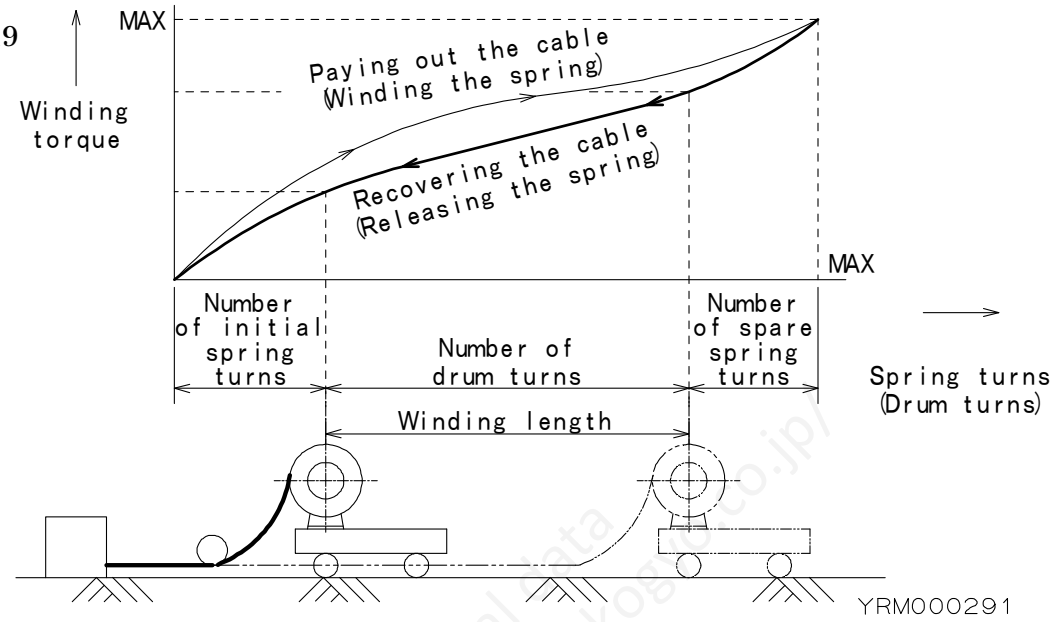
(4) Tighten the connector nut to secure the cable.
This is important to prevent rain penetration into the slip ring assembly.
NOTE: If the cable cannot be secured by tightening the connector nut, make the cable diameter bigger by wrapping thick tape around the cable, then secure with the connector nut (See figure 17).

(5) Attach the dust proof spacer and dust proof cover.

6. Spring tension adjustment

6-1. Relationship between winding torque and drum turns

Figure 19



"Number of initial spring turns" means the number of spring turns which provides the initial tension required for winding the cable onto the drum.

"Number of spare spring turns" means the number of remaining spring turns when the cable is fully paid out.
A shortage of spare spring turns shortens the spring life and causes spring breakage.

6-2. Standard value of initial spring turns and calculation for upper limit of initial spring turns

(1) Check the total number of spring turns using table 1(page 6).
(2) Rotate the drum by hand until the cable of the winding length is fully retracted, checking the number of drum turns.
(3) Check the standard value of initial spring turns and the number of spare spring turns using table 2.

Table 2

Spring combination	Number of sets	Standard value of Initial spring turns	Number of spare Spring turns
None	1	1 to 3	1.5 or more
W	2	2 to 6	3 or more
T	3	3 to 9	4.5 or more
F	4	4 to 12	6 or mor
V	5	5 to 15	7.5 or mor

Upper limit of initial spring turns = Total number of spring turns - (Number of drum turns + Number of spare spring turns)

Example) Model CRL-6M7112W, for the case of 12 drum turns
According to table 1, total number of spring turns = 24.
According to table 2, standard value of initial spring turns = 2 - 6,
Number of spare spring turns = 3 or more.
Upper limit of initial spring turns = 24 - (12 + 3) = 9.
Then the allowable number of initial spring turns = 2 - 9.

6-3. Initial tension setting

⚠ WARNING

- **Never let go of the drum during any work.**
  When released, the drum suddenly rotates, possibly causing personal injury.
- **After setting the initial tension, wire connection requires more than 2 people to secure the drum and connect the cable.**

(1) Before wire connection, wind the whole cable around the drum.
NOTE: Take care not to twist the cable during winding.

(2) With the cable still wrapped around the drum, rotate the drum by hand in the payout direction the same number of turns as the standard value of initial spring turns.
This becomes "initial spring turns".

(3) Without letting the drum rotate, unwind the cable to the extension length plus the connection length and connect the cable to the mating equipment.
Check there are no twists in the cable before connection.

(4) Pull out the cable to the winding length, then let the cable wind around the drum.
Ensure the drum can recover the cable's full winding length.

(5) If the drum stops during recovery, the initial spring tension is insufficient.
Disconnect the cable from the mating equipment and increase the number of initial spring turns in the same manner.
NOTE: Set the initial tension as small as possible and never exceed the upper limit of the initial spring turns.
Over-tensioning could cause a spring breakage.

7. Measures against uneven winding

"Uneven winding" means the cable is wound on mainly one side of the drum width.
The uneven winding will cause the cable to drop from the drum or recovery problems, resulting in damage to the cable.

7-1. Checks before adjustments

(1) Check the reel position is correct.
Refer to chapter 4, section 4-2. "Installation".
Adjust the X and Y axes of the reel.

(2) Check there are no twists in the winding side cable.
Disconnect the cable from the mating equipment and remove any twists.

※ If uneven winding still exists after the above checks, adjust according to the next section.

7-2. Adjustments

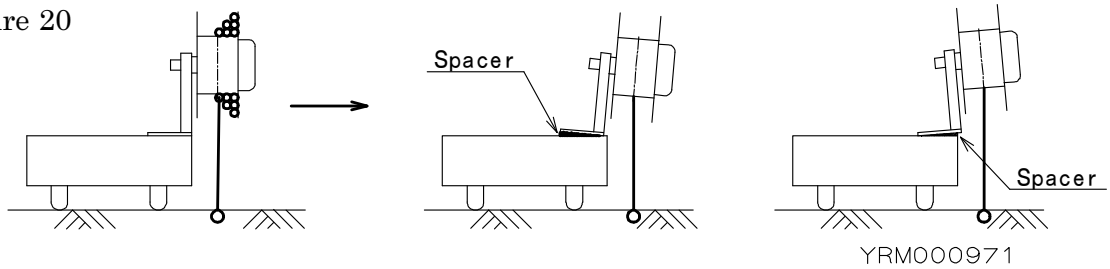
(1) Initial tension modification

Increase the number of initial spring turns one by one without exceeding the upper limit.
If there is no improvement, set the initial tension back to the first value.

(2) X axis modification

Tilt the X axis at a small angle by inserting a spacer under the bracket.

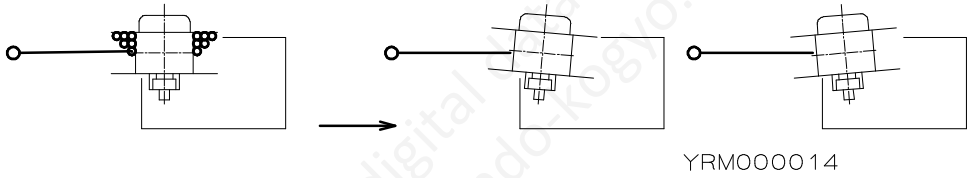
Figure 20



(3) Y axis modification

Tilt the Y axis at a small angle after adjusting the X axis.

Figure 21



8. Safety instructions on use

⚠ WARNING

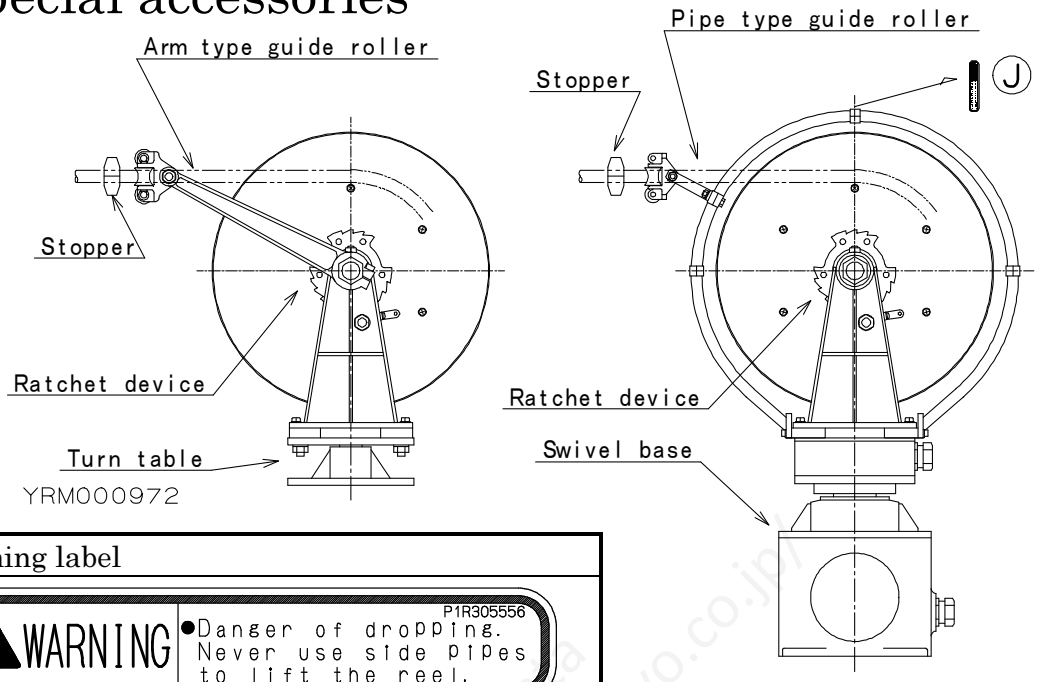
- Never approach the moving parts during operation.
  There is a danger of being caught up.
- Turn off the power immediately in case of any trouble to avoid the problem escalating.
- Never use the reel when damaged or abnormal sound/vibration occurs.
- Never alter the reel or its accessories.
- Never let go of or unfasten the cable from the fixed points when the cable is pulled out.
  The cable will rewind suddenly, possibly causing personal injury.

⚠ CAUTION

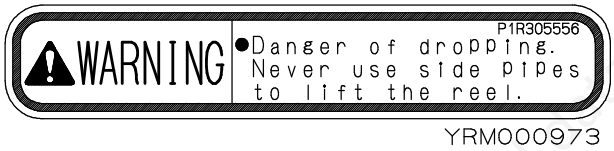
- Use within the rated values of the operating voltage and current.
  Refer to the name plate attached to the body.
- Never pull out the cable past the winding length.
  Always leave 2 - 3 dead turns on the drum. (To the sign of red tape)
  Put sign (red tape) on the 2 – 3 dead turns when installing or replacing the cable.

9. Special accessories

Figure 22



(J) Warning label



YRM000973

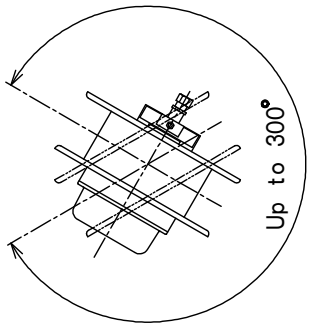
A warning not to use the guide roller to lift the reel is displayed.

⚠ WARNING

Never employ a swivel base or a standard turn table for side attachment or inverse attachment.

(1) Turn table

Figure 23



YRM000974

This can swivel the reel up to 300° .
When turned, take care the fixed side cable is not put under excessive force or contacts the reel or surrounding objects.
An arm type guide roller or pipe type guide roller is required together with the turn table.
Please contact our company in case of side attachment or inverse attachment, the specifications differ from the standard ones.

(2) Swivel base

This will freely swivel the reel.
An arm type guide roller or pipe type guide roller is required together with the swivel base.
The swivel base is not available for side attachment or inverse attachment.
For installation and so forth, refer to the swivel base instruction manual.

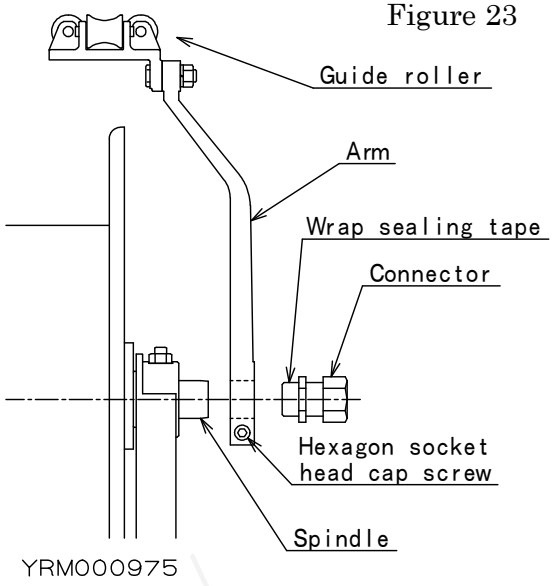
(3) Arm type guide roller

This is required when the reeling direction angle varies during operation.

For installation, remove the connector, then attach the arm to the spindle and fix with the hexagon socket head cap screw.

NOTE: After installation, wrap two turns of sealing tape around the thread of the connector and tighten the connector into the spindle.

Figure 23



(4) Pipe type guide roller

This is required when the reeling direction angle varies during operation.

For installation, attach the pipe ends to the sides of the base plate.

The pipes cannot be attached in case of reverse seating.

(5) Stopper

This will stop the cable at the attached location during a winding operation when used with the arm type guide roller.

(6) Ratchet device (Drawer dedicated manual)

This is used when the winding operation stops and the cable is still paid out.

To stop the drum, pull out the cable slightly then let it return.

If the drum does not stop, pull out the cable a different length and try again.

To release the drum, pull out the cable so as to rotate the drum by 1/2 turns.

10. Periodic inspections

⚠ WARNING

- **Periodically inspect the reel and replace any worn or damaged parts. Carefully check the cable has no damage.**
- **If a malfunction is found during a periodic inspection, never reuse the reel but repair immediately.**
- **Allow the cable to fully wind onto the drum to give the minimum winding tension before carrying out inspections.**

⚠ CAUTION

- **Always put up an instruction sign ("Equipment being inspected", "Do not turn on the power", etc.) before carrying out periodic inspections.**
- **Always use genuine parts for replacement.**

■ Inspect the reel at least every 6 months.

Make the inspection interval shorter when operating frequently or under hostile environments.

10-1. Visual inspections

- Is there any deformation or damage on the reel?
- Are any bolts or screws loose, missing or rusted?

・ Are there any twists or damage on the cable?

10-2. Slip ring inspections

⚠ WARNING

・ Electric shock hazard.
Turn off the power before removing the dust proof cover.
・ Verify safety using some kind of electrical test sensor before carrying out inspections.

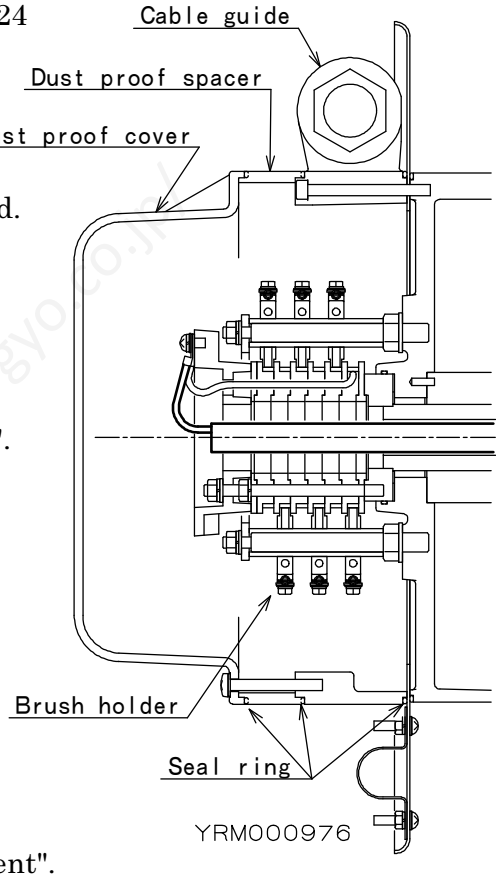
⚠ CAUTION

・ Take care as the slip ring assembly can still be very hot even if the power is cut.

(1) Dust proof cover and dust proof spacer

・ Is there any penetration of rain or dust inside the dust proof cover?
If penetration is found, the screws are not properly tightened, the seal ring are worn or damaged, or the connector is not properly tightened. Check and correct these items.
After removing any water or dust, disconnect the fixed side cable and remove the brushes from the brush holders, then test the insulation.
Refer to chapter 12, sections 12-1. "Brush replacement" and 10-2. (6) "Insulation test".
If the insulation resistance is less than 5M ohms, disassembly and repairs are necessary.
Dark brown or black color powders are carbon powders produced from the brushes due to wear. Wipe off with a cloth or the like.

Figure 24



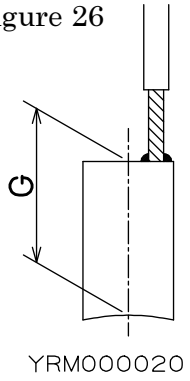
(2) Brushes

・ Are the brushes worn?
Replace the brush with a new one if dimension G reaches the limit length shown in table 3.
Refer to chapter 12, section 12-1. "Brush replacement".

Table 3 (mm)

Slip ring capacity	10A	20A	50A	100A	150A
Standard length	19.5	19.5	20.0	19.5	21.0
Limit length G	16.0	16.0	15.5	14.5	16.0

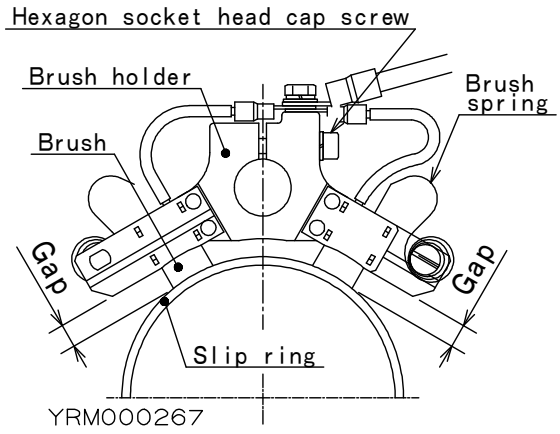
Figure 26



・ Can the brushes move smoothly in the brush holders?

(3) Brush holders

Figure 26



- Are carbon powders adhering to the brush holders?
  Wipe off with a cloth or the like if adhering.
- Are the hexagon head bolt (See figure 27) loose?
  If loose, adjust the brush holder position so that the brush is located at the center of the slip ring width and the gaps between the brush holder and the slip ring are equal, then tighten the hexagon head bolt.
- Are the brush springs broken or rusted?

(4) Slip rings

- Are carbon powders adhering to the brush holders?
  Wipe off with a cloth or the like if adhering.
- Are the slip ring surfaces rough or discolored?
  If there are any scratches or burns on the surface, polish with # 240 or finer sand paper.

(5) Bolts and screws

- Are any bolts or screws loose, missing or rusted?

(6) Insulation test

- Check each insulation resistance is 5M ohms or more using a DC 500V insulation tester.

■ When the cable is disconnected;
Measure the insulation resistance among the poles and between each pole and ground.

■ When the cable is connected;
Disconnect the fixed side cable wiring and remove the brushes from the brush holders before the test.
Measure the insulation resistance among the slip rings, among the brush holders and between each slip ring or brush holder and ground.

10-3. Slip ring inspections

⚠ CAUTION

・Test the insulation after the reel has been stored for a long time.
Refer to section 10-2. (6) "Insulation test".

Store the reel in an indoor dry location when not being used for a long time.

11. Troubleshooting

Malfunction	Main causes	Solution
Unable to set the initial tension.	Direction of initial spring turns is incorrect.	Rotate in the cable paying out direction.
	The spring is broken.	Replace with a new spring.
The reel cannot retrieve the cable.	The initial tension is insufficient.	Increase the initial spring turns.
	The spring is broken.	Replace with a new spring.
No conduction between the winding side and the fixed side cables.	Contact error between the brush and the slip ring.	Securely place the end of the brush spring into the brush recess and adjust the brush position.
	Wiring error.	Connect the wiring correctly.
Short - circuit.	The cable insulation jacket is damaged.	Replace the whole slip ring assembly. Test the insulation after replacement. See chapter 10, section 10-2. (6) "Insulation test".
	Invasion of foreign matter into the slip ring assembly.	

12. Brush and slip ring replacement

⚠ WARNING

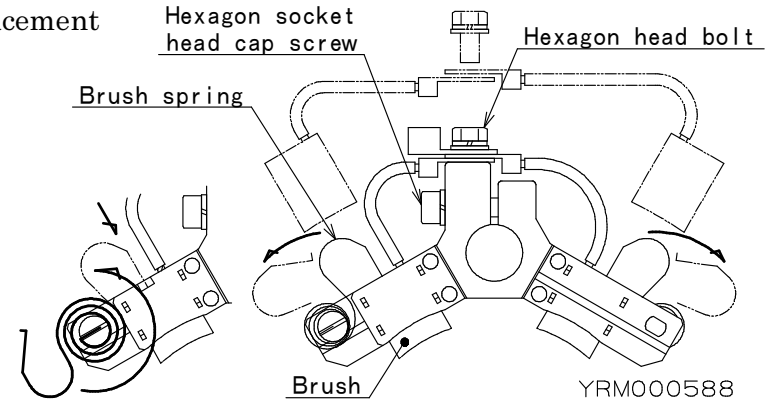
- Electric shock hazard.
  Turn off the power and verify safety using some kind of electrical test sensor before carrying out replacement.
- Allow the cable to fully wind onto the drum to give the minimum winding tension before carrying out replacement.

⚠ CAUTION

- Always put up an instruction sign ("Equipment being inspected", "Do not turn on the power", etc.) before carrying out replacement.
- Take care as the slip ring assembly can still be very hot even if the power is cut.
- After part replacement, test the insulation before connecting the cable.
  Refer to chapter 10, section 10-2. (6) "Insulation test".
- Check the conduction of each cable core after cable connection.

12-1. Brush replacement

Figure 28



(1) Loosen the hexagon head bolt and remove the terminal lugs of the cable and brush lead from the brush holder.

(2) Lift up the brush spring in the direction indicated by the arrow (See figure 28) and remove the brush from the brush holder.

NOTE: Do not lift up the brush spring more than necessary.
Otherwise, the brush spring will be permanently deformed and replacement will be required.

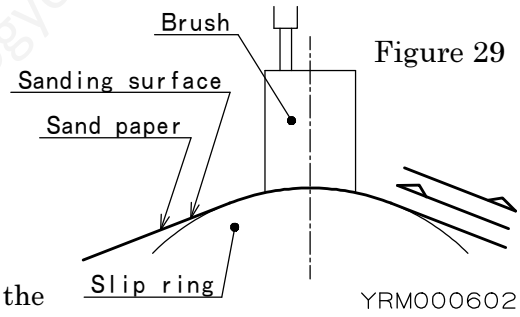
(3) Attach a new brush in the brush holder and place the end of the brush spring into the brush recess.

(4) Rotate the drum by hand and check the brush properly contacts with the slip ring.
If the contact is not sound, adjust as follows:

1) Prepare # 240 or finer sand paper having the same width as the slip ring.
2) Insert the sand paper between the brush and the slip ring so that the sanding surface contacts with the brush.
3) Move the sand paper back and forth around the slip ring surface to sand down the brush.

(5) Attach the terminal lugs of the cable and rush lead to the brush holder and fix with the hexagon head bolt.

Figure 29



⚠ CAUTION

- **Never obliquely attach the terminal lugs to the brush holder.**
  If obliquely attached, the insulator length will be insufficient, resulting in poor insulation.

12-2. Brush holder re placement (See figures 28, 30 and 31 (page 22))

Figure 30

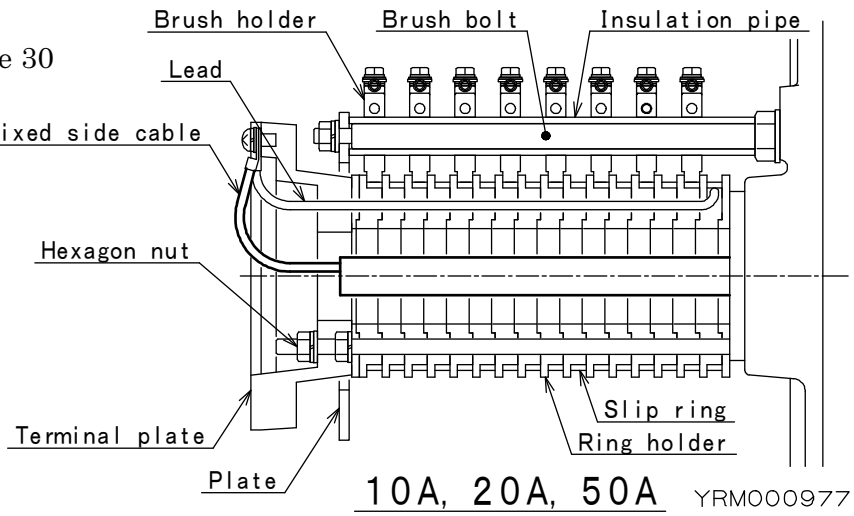
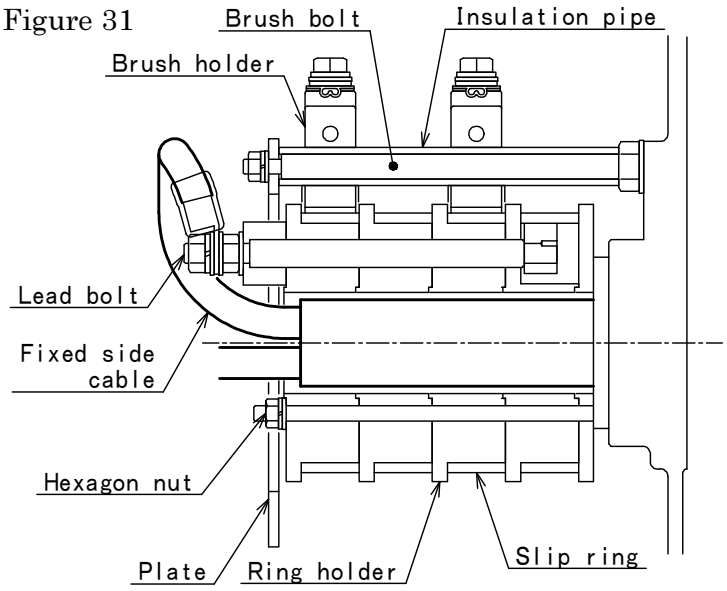
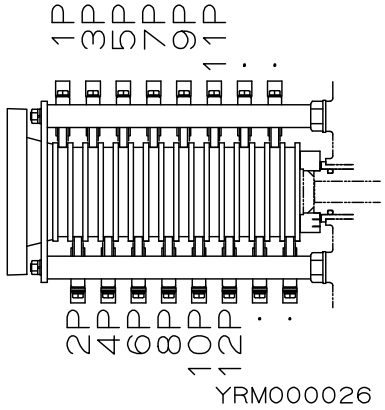


Figure 31



100A, 150A

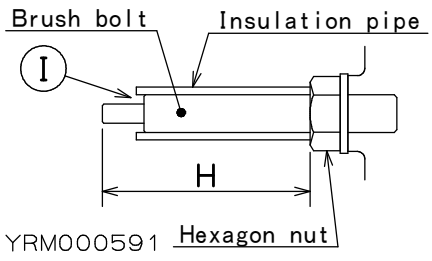
Figure 32



(1) Remove the cable and brush from the brush holder.
(2) Disconnect the fixed side cables and leads from the terminal plate (10A, 20A and 50A) or the lead bolts (100A and 150A).
(3) Remove the terminal plate (10A, 20A and 50A only) and the plate.
(4) Loosen the hexagon socket head cap screw which fixes the brush holder and remove the brush holder from the insulation pipe.
(5) Attach a new brush holder to the insulation pipe and lightly tighten the hexagon socket head cap screw.
NOTE: Attach the brush holder so that each brush holder alternates on each of the two insulation pipes as shown in figure 32.
(6) Attach the plate and the terminal plate, and connect the fixed side cables and leads.
NOTE: When assembling the terminal plate, do not over tighten the hexagon nut. Otherwise, the terminal plate could crack.
(7) Attach the brush to the brush holder, then adjust the brush holder position and fix with the hexagon socket head cap screw.
NOTE: Check the brush is located at the center of the slip ring width and the gaps between the brush holder and the slip ring are equal (See figure 27 (page 19)).

■ When disassembly of the brush bolt is required for spring replacement, etc.:

Figure 33



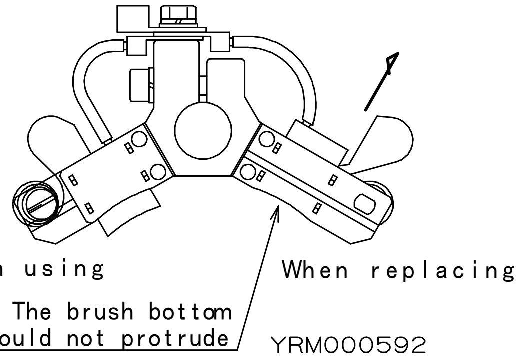
(1) Before removing the brush bolt, measure dimension H as shown in figure 33.
This dimension is important when reassembling.
(2) Loosen the hexagon nut and remove the brush bolt.
(3) For reassembly, set dimension H to the same value as before and fix the brush bolt with the hexagon nut.
NOTE: Check there is no gap between the insulation pipe and the hexagon nut, and the top of the insulation pipe protrudes from the top of the brush bolt (See location (I) in figure 33).

12-3. Slip ring replacement (See figure 30 (page 21), 31 (page 22))

(1) Remove the terminal plate (10A, 20A and 50A only), plate and brush holders in the same manner as section 12-2. " Brush holder replacement".

NOTE: When replacing the slip rings alone, the slip rings can be removed without removing the brush holders. Lift up the brush springs and pull the brushes upward, then hold the brushes by the brush springs (See figure 34).

Figure 34



(2) Loosen the hexagon head bolts which fix the ring holder, and remove the ring holder and the slip ring together.

(3) Attach a new slip ring.
Reassemble the terminal plate, plate and brush holders in the same manner as section 12-2. "Brush holder replacement".

13. Spring replacement

⚠ WARNING

- Electric shock hazard.
  Turn off the power and verify safety using some kind of electrical test sensor before carrying out replacement.
- When disconnecting the mating equipment side wiring on the cable winding side, the drum may suddenly rotate.
  Allow the cable to fully wind onto the drum to give the minimum winding tension, then dismantle the mating equipment side wiring with more than 2 people to secure the drum and dismantle the wiring.
  Allow the dismantled cable to wind around the drum, slowly turning the drum until the winding tension in the drum is released.
- Never disassemble until the reel's winding tension is released.
  The spring will burst out and cause personal injury.
  Even if the spring seems to be broken, never disassemble before ensuring no winding tension remains by rotating the drum by hand.
- Never disassemble using any other disassembly procedure.
  Treat and dispose of the spring according to the instructions.

⚠ CAUTION

- Always put up an instruction sign ("Equipment being inspected", "Do not turn on the power", etc.) before carrying out replacement.

Before disassembly, check the winding direction (forward winding or reverse winding) and the spring structure (E - K) of the reel.

Confirm the model name indicated on the name plate, then refer to chapter 3, section 3-1. "Models and specifications".

Disassembly and reassembly procedures are different depending on the winding direction and spring structure.

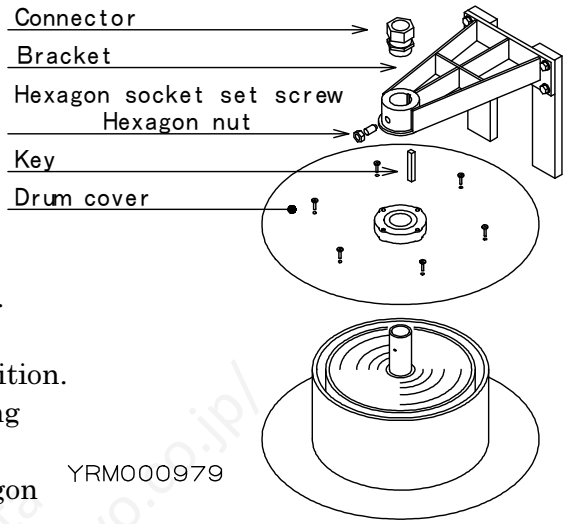
13-1. Disassembly of slip ring assembly and bracket

(Common method for all spring structures)

(1) Turn off the power and allow the cable to fully wind onto the drum to give minimum winding tension, then dismantle the mating equipment side wiring.
Allow the dismantled cable to wind around the drum, slowly turning the drum until the winding tension in the drum is released.
This work requires more than two people.

(2) Remove the slip ring assembly from the reel in the same manner as chapter 12. "Brush and slip ring replacement".
NOTE: Do not remove the cable guide, it will be necessary for later work.

Figure 35



(3) Dismantle the fixed side cable, and remove the connector which is attached to the spindle.
(4) Unwind the cable and remove from the drum, then remove the reel from the installation position.
(5) Place the reel on a work table with the slip ring side downward.
(6) Loosen the hexagon nut and remove the hexagon socket set screw.
Pull out the bracket from the spindle and remove the key from the spindle.
(7) Remove the drum cover from the drum.

⚠ WARNING

- **Move the drum cover upward about 15mm and check the internal spring does not pop out, then remove the drum cover.**

(8) Follow the disassembly and reassembly procedures depending on the spring structure.

13-2. Disassembly and reassembly according to spring structure

⚠ WARNING

- **The spring is dangerous due to its tensional energy.**
  If incorrectly handled, the spring will expand explosively and causing personal injury.
- **Never remove the spring from the spring case.**
- **Never turn the spring case upside down.**
  If turned upside down, the spring will expand explosively and cause personal injury.

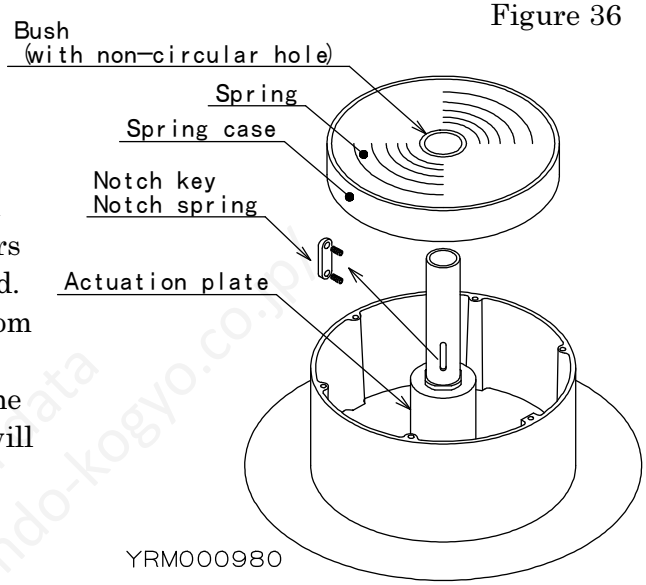
■ For spring structure E (1 spring)

⚠ WARNING

- The spring has a weight of approximately 5kg to 22kg.
  Take care when handling the spring.
  For spring types 112 (see chapter 3, section 3-1."Model and specifications"), lifting work requires more than two people.
- The spring assembly work requires more than two people to lift the spring and hold the bush (the spring center) in order to prevent the spring from bursting out.

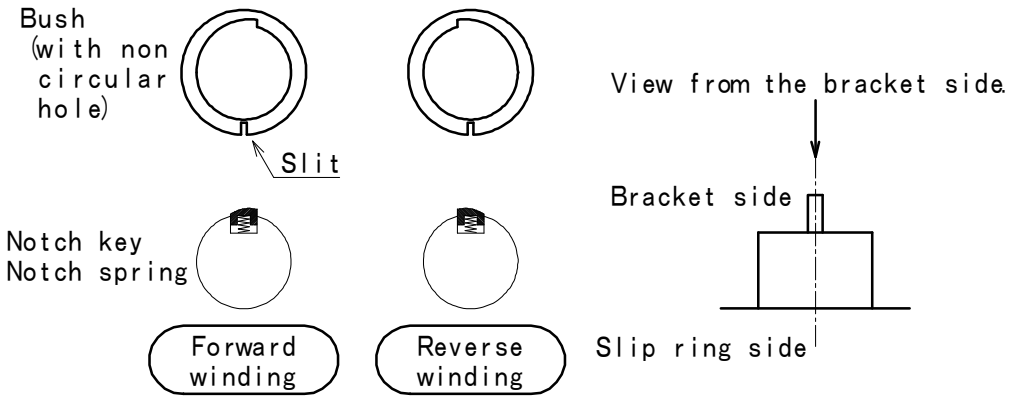
(1) Remove the spring case and spring together from the drum.
If there is space between the drum and spring case, hold the spring case with two hands and slowly remove from the drum.
If there is no space between the drum and spring case, grip the spring case with pliers and slowly pull out from the drum by hand.
Take care as the spring case is slippery from grease on the back of the spring case.
NOTE: When removing the spring case, the notch key and two notch springs will drop out from the spindle.
Take care not to lose them.

Figure 36



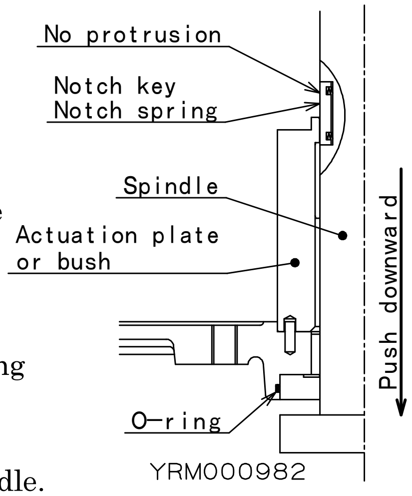
(2) Remove the bush from the spring.
(3) Before reassembly, clean and inspect all the disassembled parts.
Replace worn, cracked, damaged or deformed parts.
(4) Lightly lubricate the bush attaching portion of the spindle and the inside surface of the bush with grease (IDEMITHU, DAPHNE EPONEX GREASE EP-1 or equivalents).
(5) Attach the bush to the spring.
The machined end of the bush should face upward.
(6) Place the notch key and notch springs into the slot of the spindle.
Take care as the assembling direction of the notch key depends on the winding direction of the reel. See figure 37.

Figure 37



(7) While pressing the attached notch key in the slot with a finger, push the spindle downward so that the actuation plate keeps the notch key in the slot.
See figure 38.

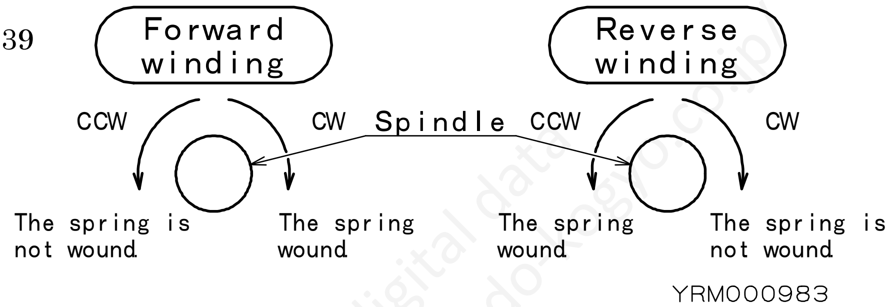
Figure 38



(8) Install the spring case into the drum.
Rotate the spring case back and forth until the spring case fits into the actuation plate.

(9) Pull the spindle upward while rotating.
After pulling upward, check the spindle winds up the spring when rotating clockwise (for forward winding) or counterclockwise (for reverse winding).
NOTE: Do not apply excessive force when pulling the spindle.
The O-ring inside the drum could be damaged.

Figure 39



(10) Lubricate the spring with grease (KYODO, ONELUBER MP No.2 or equivalents) with the specified volume shown in table 4.

Table 4

Spring type	24	36	55	56	75	112
Grease volume [cm^3 (ml)]	25	40	45	45	50	90

(11) Follow the procedure given in section 13-3. "Common reassembly method".

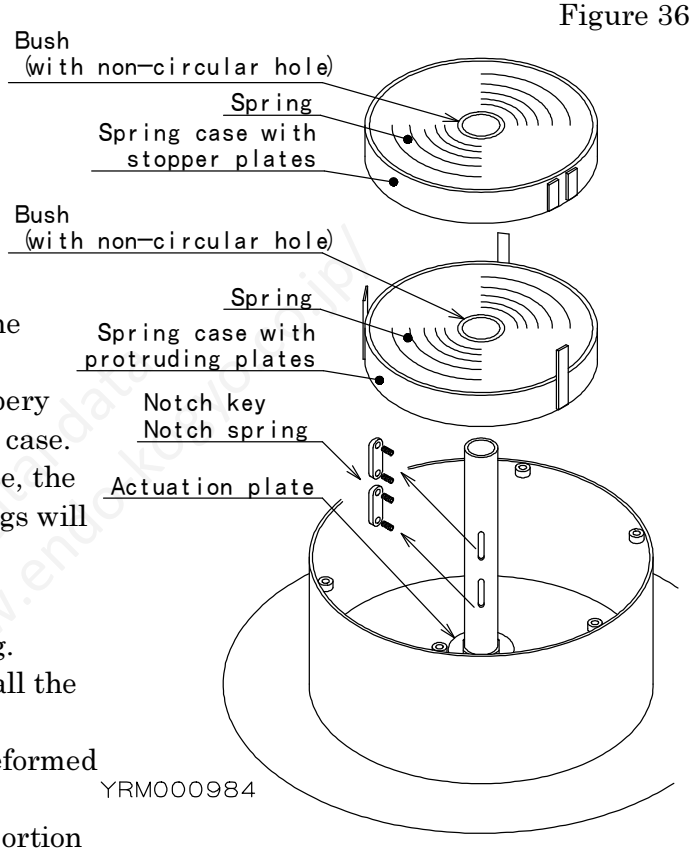
■ For spring structure F (2 springs, double-torque)

⚠ WARNING

- **The spring has a weight of approximately 5kg to 16kg.**
  Take care when handling the spring.
  For spring types 150 (see chapter 3, section 3-1."Model and specifications"), lifting work requires more than two people.
- **The spring assembly work requires more than two people to lift the spring and hold the bush (the spring center) in order to prevent the spring from bursting out.**

(1) Remove the spring case and spring together from the drum.
If there is space between the drum and spring case, hold the spring case with two hands and slowly remove from the drum.
If there is no space between the drum and spring case, grip the spring case with pliers and slowly pull out from the drum by hand.
Take care as the spring cases are slippery From grease on the back of the spring case.
NOTE: When removing the spring case, the notch key and two notch springs will drop out from the spindle.
Take care not to lose them.

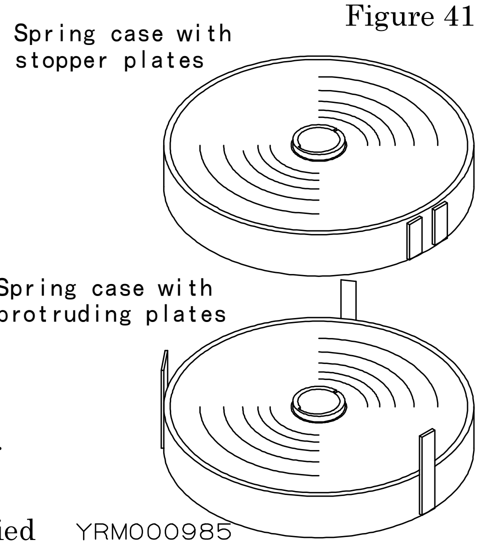
Figure 36



(2) Remove the bush from the each spring.
(3) Before reassembly, clean and inspect all the disassembled parts.
Replace worn, cracked, damaged or deformed parts.
(4) Lightly lubricate the bush attaching portion of the spindle and the inside surface of each bush with grease (IDEMITHU, DAPHNE EPONEX GREASE EP-1 or equivalents).
(5) Attach the bush to the spring.
The machined end of the bushed should face upward.
(6) Place the notch key and notch springs into the lower slot of the spindle.
Take care as the assembling direction of the notch key depends on the winding direction of the reel. See figure 37 (page 25).
(7) While pressing the attached notch key in the slot with a finger, push the spindle downward so that the actuation plate keeps the notch key in the slot.
See figure 38 (page 26).

(8) Install the spring case with the protruding plates into the drum.
Rotate the spring case back and forth until the spring case fits into the actuation plate.

Figure 41



(9) Pull the spindle upward while rotating.
After pulling upward, check the spindle winds up the spring when rotating clockwise (for forward winding) or counterclockwise (for reverse winding).
See figure 39 (page 26).
NOTE: Do not apply excessive force when pulling the spindle.
The O-ring inside the drum could be damaged.

(10) Lubricate the spring with grease (KYODO, ONELUBER MP No. 2 or equivalents) with the specified volume shown in table 5.
Spread grease all over the spring.

Table 5

Spring type	72	110	150
Grease volume [cm^3 (ml)]	40	45	50

(11) Place the notch key and notch springs into the upper slot of the spindle.
Take care as the assembling direction of the notch key depends on the winding direction of the reel. See figure 37 (page 25).
(12) While pressing the attached notch key in the slot with a finger, push the spindle downward so that the bush keeps the notch key in the slot.
See figure 38 (page 26).
(13) Install the spring case with the stopper plates into the drum.
Align the stopper plates with the protruding plates of the spring case.
(14) Pull the spindle upward while rotating.
After pulling upward, check the spindle winds up the spring when rotating clockwise (for forward winding) or counterclockwise (for reverse winding).
See figure 39 (page 26).
NOTE: Do not apply excessive force when pulling the spindle.
The O-ring inside the drum could be damaged.

(15) Lubricate the spring with grease (KYODO, ONELUBER MP No. 2 or equivalents) with the specified volume shown in table 5.
Spread grease all over the spring.
(16) Follow the procedure given in section 13-3. "Common reassembly method".

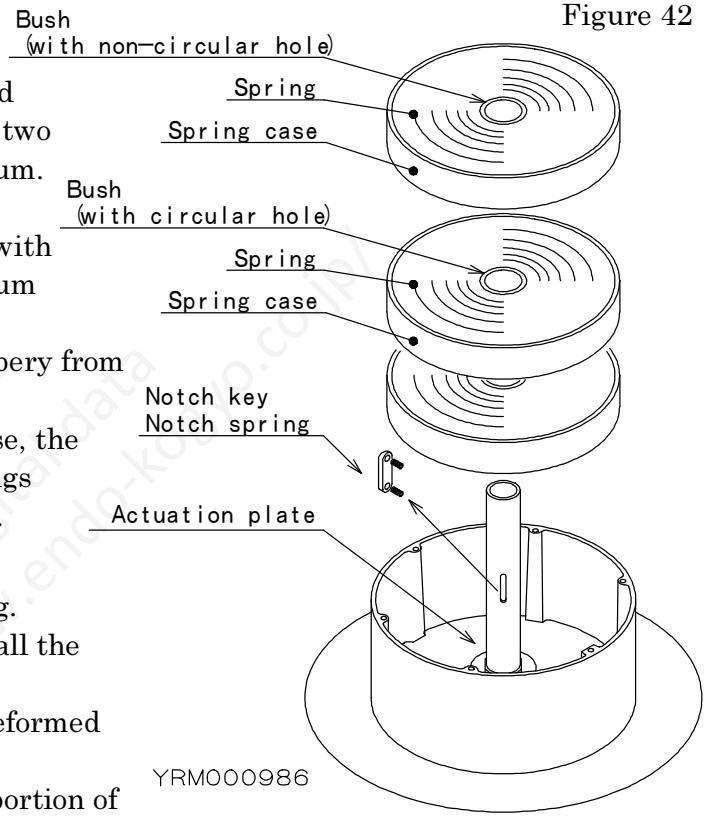
■ For spring structure G (2 or more springs, double-stroke)

⚠ WARNING

- **The spring has a weight of approximately 5kg to 22kg.**
  Take care when handling the spring.
  For spring types 112 (see chapter 3, section 3-1."Model and specifications"), lifting work requires more than two people.
- **The spring assembly work requires more than two people to lift the spring and hold the bush (the spring center) in order to prevent the spring from bursting out.**

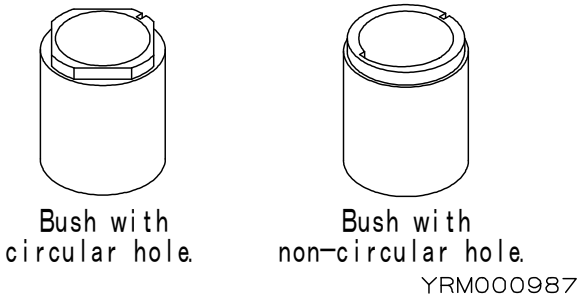
(1) Remove the spring case and spring together from the drum.
If there is space between the drum and spring case, hold the spring case with two hands and slowly remove from the drum.
If there is no space between the drum and spring case, grip the spring case with pliers and slowly pull out from the drum by hand.
Take care as the spring cases are slippery from grease on the back of the spring case.
NOTE: When removing the spring case, the notch key and two notch springs will drop out from the spindle. Take care not to lose them.

Figure 42



(2) Remove the bush from the each spring.
(3) Before reassembly, clean and inspect all the disassembled parts.
Replace worn, cracked, damaged or deformed parts.
(4) Lightly lubricate the bush attaching portion of the spindle and the inside surface of each bush with grease (IDEMITHU, DAPHNE EPONEX GREASE EP-1 or equivalents).
(5) Attach the bush to the spring.
The machined end of the bushes should face upward.
(6) Install the spring case, to which the bush with the circular hole is attached, into the drum.
Rotate the spring case back and forth until the spring case fits into the actuation plate or the bush.

Figure 43



(7) Lubricate the spring with grease (KYODO, ONELUBER MP No. 2 or equivalents) with the specified volume shown in table 4 (page 26).
Spread grease all over the spring.

(8) Install all spring cases, to which the bush with the circular hole is attached, into the drum in the same manner as (6) to (7).

(9) Place the notch key and notch springs into the slot of the spindle.
Take care as the assembling direction of the notch key depends on the winding direction of the reel. See figure 37 (page 25).

(10) While pressing the attached notch key in the slot with a finger, push the spindle downward so that the bush keeps the notch key in the slot.
See figure 38 (page 26).

(11) Install the spring case, to which the bush with the non-circular hole is attached, into the drum.
Rotate the spring case back and forth until the spring case fits into the bush.

(12) Pull the spindle upward while rotating.
After pulling upward, check the spindle winds up the spring when rotating clockwise (for forward winding) or counterclockwise (for reverse winding).
See figure 39 (page 26).
NOTE: Do not apply excessive force when pulling the spindle.
The O-ring inside the drum could be damaged.

(13) Lubricate the spring with grease (KYODO, ONELUBER MP No. 2 or equivalents) with the specified volume shown in table 4 (page 26).
Spread grease all over the spring.

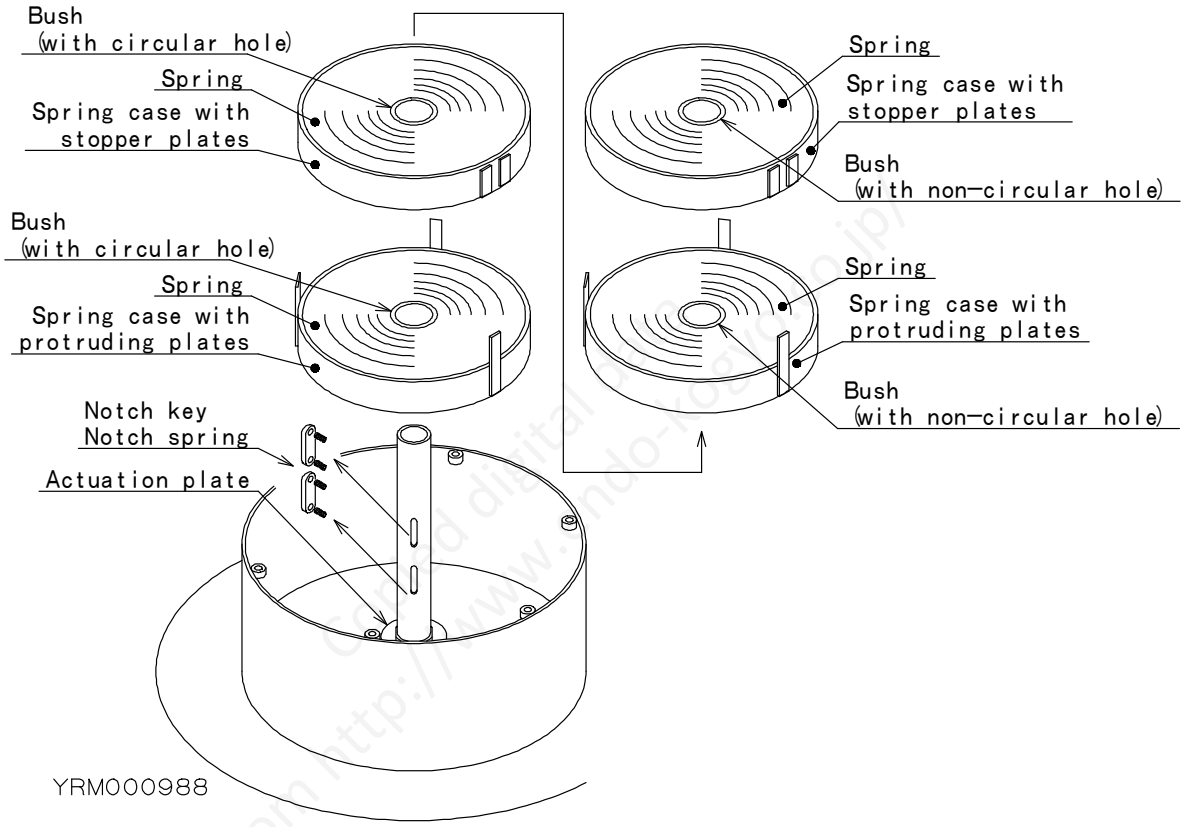
(14) Follow the procedure given in Section 13-3. "Common reassembly method".

■ For spring structure H (4 springs, double-torque and double-stroke)

⚠ WARNING

- The spring has a weight of approximately 5kg to 16kg.
  Take care when handling the spring.
  For spring types 150 (see chapter 3, section 3-1."Model and specifications"), lifting work requires more than two people.
- The spring assembly work requires more than two people to lift the spring and hold the bush (the spring center) in order to prevent the spring from bursting out.

Figure 44



(1) Remove each spring case and spring together from the drum.
If there is space between the drum and spring case, hold the spring case with two hands and slowly remove from the drum.
If there is no space between the drum and spring case, grip the spring case with pliers and slowly pull out from the drum by hand.
Take care as the spring cases are slippery from grease on the back of the spring case.
NOTE: When removing the first and second spring cases from the top, the notch key and two notch springs will drop out from the spindle.
Take care not to lose them.

(2) Remove the bush from the each spring.

(3) Before reassembly, clean and inspect all the disassembled parts.
Replace worn, cracked, damaged or deformed parts.

(4) Lightly lubricate the bush attaching portion of the spindle and the inside surface of each bush with grease (IDEMITHU, DAPHNE EPONEX GREASE EP-1 or equivalents).

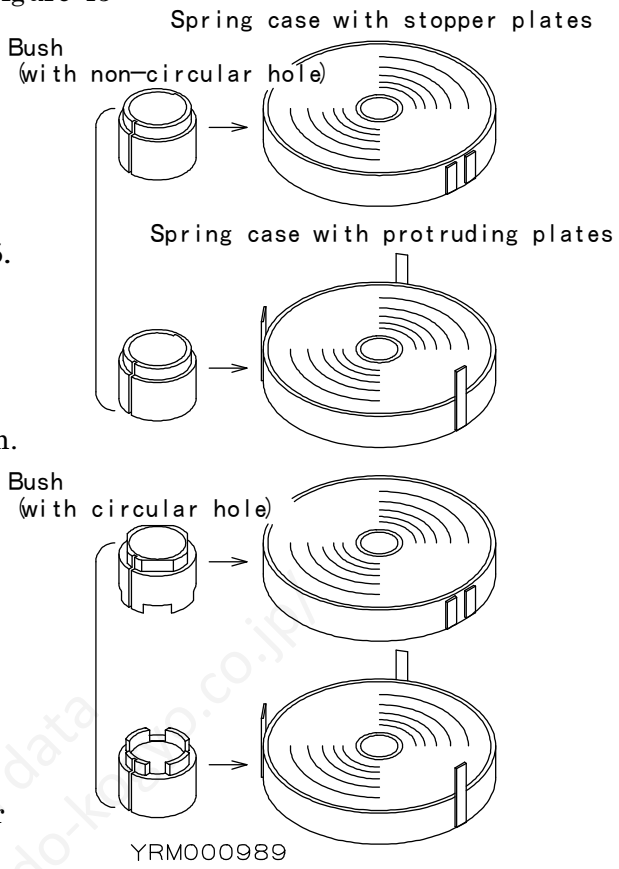
(5) Attach the bush to the spring.
Take care as the shape of each bush varies depending on the spring cases. See figure 45.
The machined end of the bushes should face upward.

(6) Install the spring case, with the protruding plates, to which the bush with the circular hole is attached, into the drum.
Rotate the spring case back and forth until the spring case fits into the actuation plate.

(7) Lubricate the spring with grease (KYODO, ONELUBER MP No. 2 or equivalents) with the specified volume shown in table 5 (page 28).
Spread grease all over the spring.

(8) Install all spring cases with the stopper plates, to which the bush with the circular hole is attached, into the drum.
Align the stopper plates with the protruding plates of the spring case.

Figure 45



(9) Lubricate the spring with grease (KYODO, ONELUBER MP No. 2 or equivalents) with the specified volume shown in table 5 (page 28).
Spread grease all over the spring.

(10) Place the notch key and notch springs into the lower slot of the spindle.
Take care as the assembling direction of the notch key depends on the winding direction of the reel. See figure 37 (page 25).

(11) While pressing the attached notch key in the slot with a finger, push the spindle downward so that the bush keeps the notch key in the slot. See figure 38 (page 25).

(12) Install the spring case with the protruding plates, to which the bush with the non-circular hole is attached, into the drum.
Rotate the spring case back and forth until the spring case fits into the bush.

(13) Pull the spindle upward while rotating.
After pulling upward, check the spindle winds up the spring when rotating clockwise (for forward winding) or counterclockwise (for reverse winding). See figure 39 (page 26).
NOTE: Do not apply excessive force when pulling the spindle.
The O-ring inside the drum could be damaged.

(14) Lubricate the spring with grease (KYODO, ONELUBER MP No. 2 or equivalents) with the specified volume shown in table 5 (page 27).
Spread grease all over the spring.

(15) Place the notch key and notch springs into the upper slot of the spindle.
Take care as the assembling direction of the notch key depends on the winding direction of the reel. See figure 37 (page 25).

(16) While pressing the attached notch key in the slot with a finger, push the spindle downward so that the bush keeps the notch key in the slot. See figure 38 (page 25).
(17) Install the spring case with the stopper plates, to which the bush with the non-circular hole is attached, into the drum.
Align the stopper plates with the protruding plates of the spring case.
(18) Pull the spindle upward while rotating.
After pulling upward, check the spindle winds up the spring when rotating clockwise (for forward winding) or counterclockwise (for reverse winding). See figure 39 (page 26).
NOTE: Do not apply excessive force when pulling the spindle.
The O-ring inside the drum could be damaged.

(19) Lubricate the spring with grease (KYODO, ONELUBER MP No. 2 or equivalents) with the specified volume shown in table 5 (page 28).
Spread grease all over the spring.

(20) Follow the procedure given in Section 13-3. "Common reassembly method".

■ For spring structure J (Type 48: 2 springs, double-stroke)

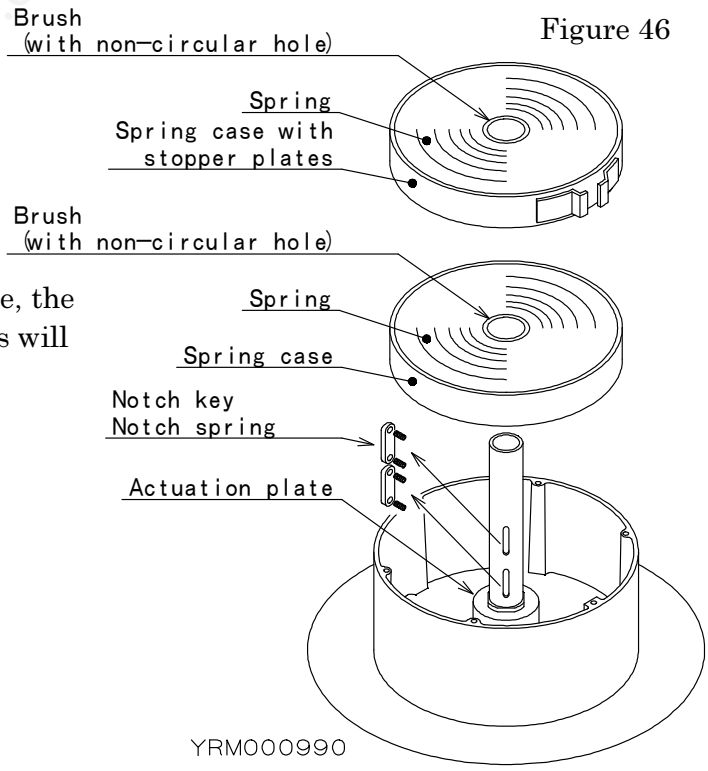
⚠ WARNING

・The spring has a weight of approximately 5kg.
Take care when handling the spring.
・The spring assembly work requires more than two people to lift the spring and hold the bush (the spring center) in order to prevent the spring from bursting out.

(1) Remove each spring case and spring together from the drum.
Grip the spring case with pliers and slowly pull out from the drum by hand.
Take care as the spring cases are slippery from grease on the back of the spring case.
NOTE: When removing each spring case, the notch key and two notch springs will drop out from the spindle.
Take care not to lose them.

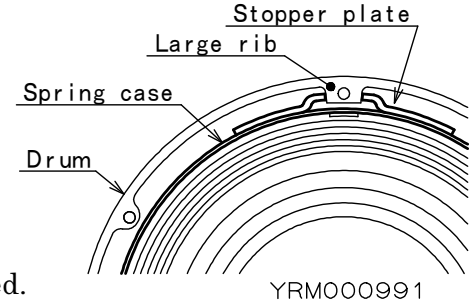
(2) Remove the bush from the each spring.

Figure 46



(3) Before reassembly, clean and inspect all the disassembled parts.
Replace worn, cracked, damaged or deformed parts.
(4) Lightly lubricate the bush attaching portion of the spindle and the inside surface of each bush with grease (IDEMITHU, DAPHNE EPONEX GREASE EP-1 or equivalents).
(5) Attach the bushes to the springs.
The machined ends of the bushes should face upward.
(6) Place the notch key and notch springs into the lower slot of the spindle.
Take care as the assembling direction of the notch key depends on the winding direction of the reel. See figure 37 (page 25).
(7) While pressing the attached notch key in the slot with a finger, push the spindle downward so that the actuation plate keeps the notch key in the slot.
See figure 38 (page 26).
(8) Install the spring case without any stopper plates into the drum.
Rotate the spring case back and forth until the spring case fits into the actuation plate.
(9) Pull the spindle upward while rotating.
After pulling upward, check the spindle winds up the spring when rotating clockwise (for forward winding) or counterclockwise (for reverse winding). See figure 39 (page 26).
NOTE: Do not apply excessive force when pulling the spindle.
The O-ring inside the drum could be damaged.
(10) Lubricate the spring with 25 cm^3 (mL) of grease (KYODO, ONELUBER MP No. 2 or equivalents).
Spread grease all over the spring.
(11) Place the notch key and notch springs into the upper slot of the spindle.
Take care as the assembling direction of the notch key depends on the winding direction of the reel. See figure 37 (page 25).
(12) While pressing the attached notch key in the slot with a finger, push the spindle downward so that the bush keeps the notch key in the slot. See figure 38 (page 26).
(13) Install the spring case with the stopper plates into the drum.
Align the stopper plates with the large rib of the drum.
(14) Pull the spindle upward while rotating.
After pulling upward, check the spindle winds up the spring when rotating clockwise (for forward winding) or counterclockwise (for reverse winding). See figure 39 (page 26).
NOTE: Do not apply excessive force when pulling the spindle.
The O-ring inside the drum could be damaged.

Figure 47



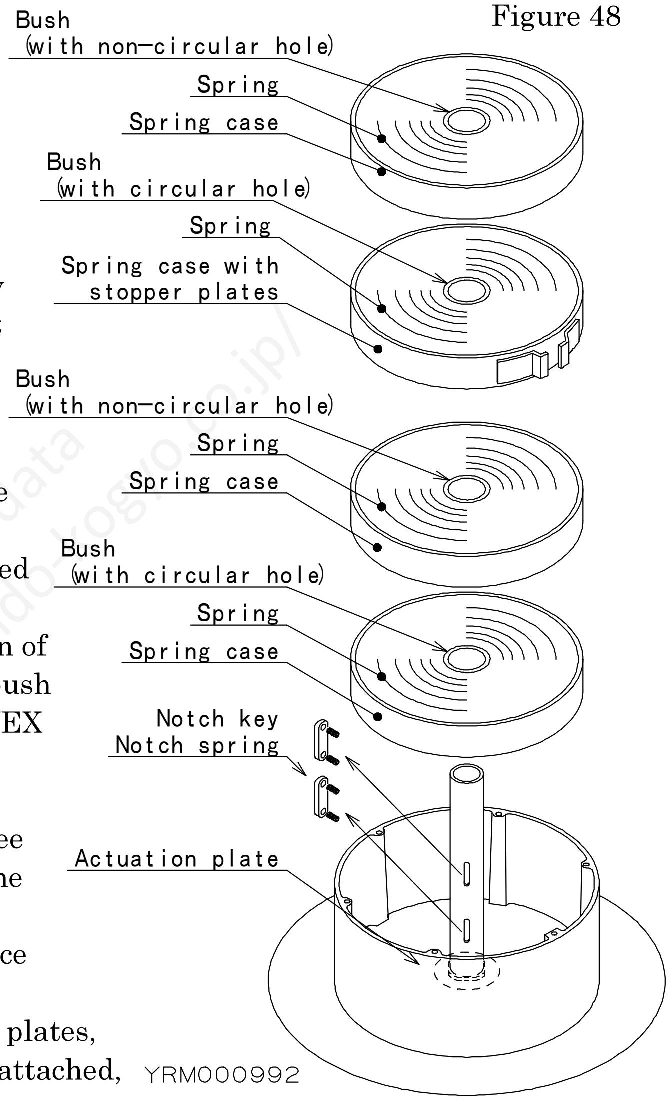
(15) Lubricate the spring with 25 cm^3 (mL) of grease (KYODO, ONELUBER MP No. 2 or equivalents).
Spread grease all over the spring.
(16) Follow the procedure given in Section 13-3. "Common reassembly method".

■ For spring structure K (Type 48W: 4 springs, double-torque and double-stroke)

⚠ WARNING

- **The spring has a weight of approximately 5kg.**
  Take care when handling the spring.
- **The spring assembly work requires more than two people to lift the spring and hold the bush (the spring center) in order to prevent the spring from bursting out.**

Figure 48



(1) Remove each spring case and spring together from the drum.
Grip the spring case with pliers and slowly pull out from the drum by hand.
Take care as the spring cases are slippery from grease on the back of the spring case.
NOTE: When removing the first and third spring case, from the top, notch key and two notch springs will drop out from the spindle.
Take care not to lose them.

(2) Remove the bush from the each spring.

(3) Before reassembly, clean and inspect all the disassembled parts.
Replace worn, cracked, damaged or deformed parts.

(4) Lightly lubricate the bush attaching portion of the spindle and the inside surface of each bush with grease (IDEMITHU, DAPHNE EPONEX GREASE EP-1 or equivalents).

(5) Attach the bushes to the springs.
One of the bushes with the circular hole (See figure43 (page 29)) should be installed in the spring case with the stopper plates.
The machined ends of the bushes should face upward.

(6) Install the spring case without any stopper plates, to which the bush with the circular hole is attached, into the drum.
Rotate the spring case back and forth until the spring case fits into the actuation plate.

(7) Lubricate the spring with 25 cm^3 (mL) of grease (KYODO, ONELUBER MP No. 2 or equivalents).
Spread grease all over the spring.

(8) Place the notch key and notch springs into the lower slot of the spindle.
Take care as the assembling direction of the notch key depends on the winding direction of the reel. See figure 37 (page 25).
(9) While pressing the attached notch key in the slot with a finger, push the spindle downward so that the bush keeps the notch key in the slot. See figure 38 (page 26).
(10) Install the spring case without any stopper plates, to which the bush with the non-circular hole is attached, into the drum.
Rotate the spring case back and forth until the spring case fits into the bush.
(11) Pull the spindle upward while rotating.
After pulling upward, check the spindle winds up the spring when rotating clockwise (for forward winding) or counterclockwise (for reverse winding). See figure 39 (page 26).
NOTE: Do not apply excessive force when pulling the spindle.
The O-ring inside the drum could be damaged.
(12) Lubricate the spring with 25 cm^3(mL) of grease (KYODO, ONELUBER MP No. 2 or equivalents).
Spread grease all over the spring.
(13) Install the spring case with the stopper plates, to which the bush with the circular hole is attached, into the drum.
Align the stopper plates with the large rib of the drum. See figure 47 (page 34).
(14) Lubricate the spring with 25 cm^3(mL) of grease (KYODO, ONELUBER MP No. 2 or equivalents).
Spread grease all over the spring.
(15) Place the notch key and notch springs into the upper slot of the spindle.
Take care as the assembling direction of the notch key depends on the winding direction of the reel. See figure 37 (page 25).
(16) Install the spring case without any stopper plates, to which the bush with the non-circular hole is attached, into the drum in the same manner as (9) to (12).
(17) Follow the procedure given in Section 13-3. "Common reassembly method".

13-3. Common reassembly method
(1) Check the top spring does not project out from the drum top, then attach the drum cover to the drum.
(2) Attach the key to the spindle.
Attach the bracket to the spindle so that the tapped hole of the bracket faces to the hole of the spindle, then tighten the hexagon socket set screw and fix with the hexagon nut.
(3) Rotate the drum in the payout direction by hand and check the drum has winding torque.
(4) Install the slip ring assembly.
Refer to chapter 12. "Brush and slip ring replacement".
(5) Install the cable.
Refer to chapter 5. "Cable connection".
(6) Adjust the spring tension.
Refer to chapter 6. "Spring tension adjustment".

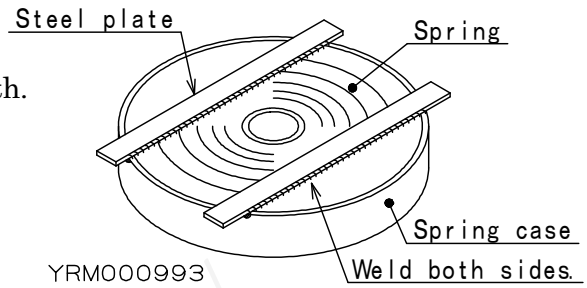
13-4. Spring disposal

⚠ WARNING

The spring is dangerous due to remaining tension even if it is broken.
Weld steel plates to the spring in order to prevent the spring from expansion before disposal.
Never use gas welding, only use arc welding.

- Weld steel plates to the spring in order to prevent the spring from expansion.
  Use steel plates with enough length to cover the spring case, and weld along the whole length.
  NOTE: Wipe off all grease from the spring surface to avoid grease combustion.
- Give a warning to disposal companies that the spring will expand explosively if the welding is broken due to rough handling.

Figure 49



14. Parts list

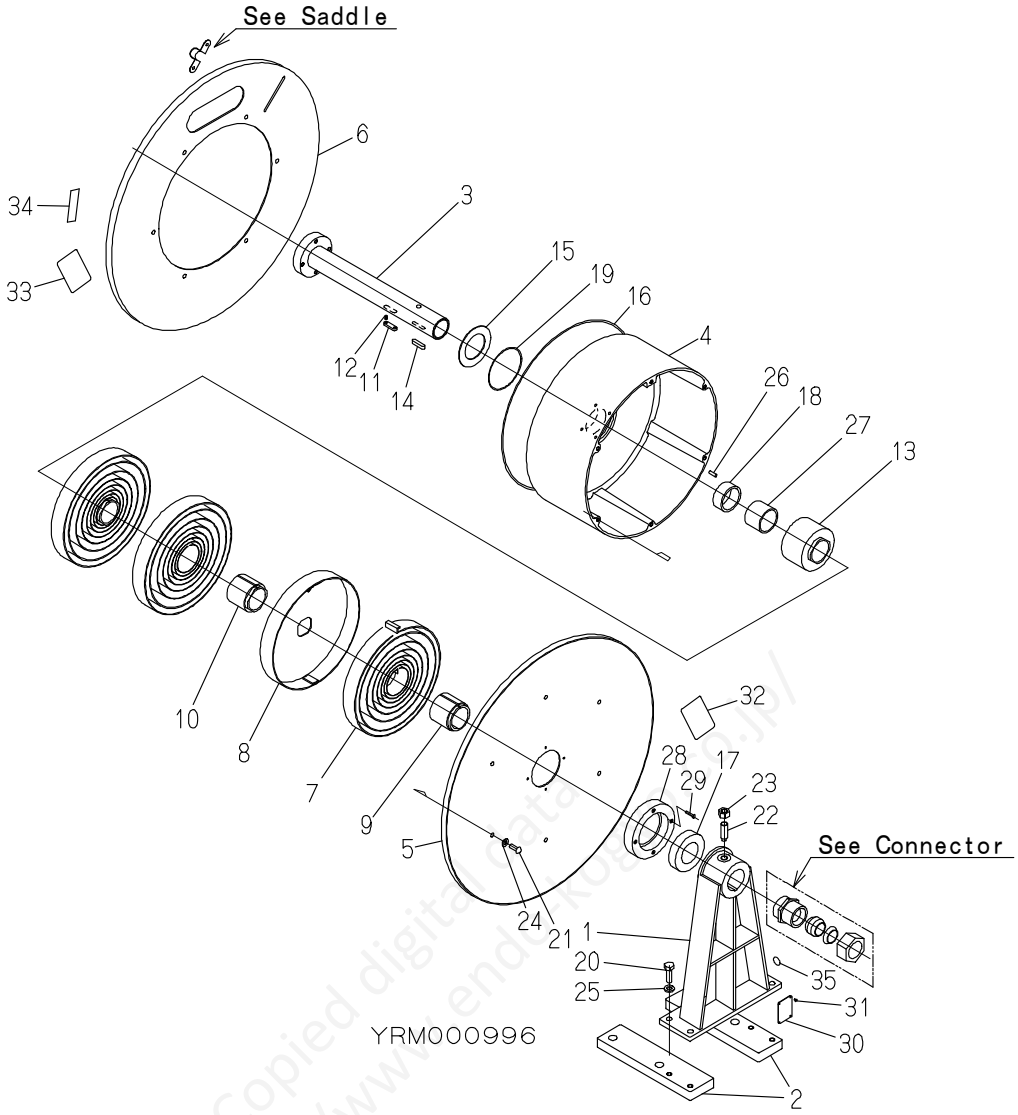
■ When ordering parts:
- State the MODEL, SER. NO. and DATE indicated on the name plate.
- State the part number and description.
- Parts without a part number cannot be supplied individually.
  Please purchase a set or complete unit.

■ How to read parts list

No.	List No. or Part No.	Description	Quantity			
			4M424	4424W	・・・	4524F
—	LRP003830	Spring assembly	1	2		4
7	—	— Spring	1	2		4
8	—	— Spring case	1	2		4

The mark indicates the range of the set or the complete unit.

■CRL−4M424～4524F MAIN BODY



No.	List No. or Part No.	Description	Quantity						
			4M424	4424W	4424T	4424F	4524W	4524T	4524F
—	LRP003839	Bracket assembly	1	—	—	—	—	—	—
—	LRP003840	Bracket assembly	—	1	1	1	—	—	—
—	LRP003841	Bracket assembly	—	—	—	—	1	1	1
1	LRP001159	- Bracket	1	1	1	1	—	—	—
1	LRP001160	- Bracket	—	—	—	—	1	1	1
2	P1R300517	- Base plate	2	—	—	—	—	—	—
2	P1R300401	- Base plate	—	2	2	2	2	2	2
20	P1R411626	- Hex. head bolt	4	4	4	4	4	4	4
25	KA31130800	- Spring washer	4	4	4	4	4	4	4
3	LRP001979	Spindle	1	—	—	—	—	—	—
3	LRP001980	Spindle	—	1	1	1	1	1	1
—	LRP003805	Drum assembly	1	—	—	—	—	—	—
—	LRP003806	Drum assembly	—	1	1	1	1	1	1
4	—	- Drum	1	—	—	—	—	—	—
4	—	- Drum	—	1	1	1	1	1	1
18	P1R400353	- Needle bearing	1	1	1	1	1	1	1
16	P1R400510	- Seal ring	1	1	1	1	1	1	1
19	KA50200670	- O-ring	1	1	1	1	1	1	1
26	KA42410412	- Spring pin	4	4	4	4	4	4	4

Parts without a part number cannot be supplied individually.

■CRL－4M424～4524F MAIN BODY

No.	List No. or Part No.	Description	Quantity						
			4M424	4424W	4424T	4424F	4524W	4524T	4524F
—	LRP003816	Drum cover assembly	1	1	1	1	—	—	—
—	LRP003817	Drum cover assembly	—	—	—	—	1	1	1
—	LRP002012	- Drum cover assembly	1	1	1	1	—	—	—
—	LRP002013	- Drum cover assembly	—	—	—	—	1	1	1
5	—	- - Drum cover	1	1	1	1	—	—	—
5	—	- - Drum cover	—	—	—	—	1	1	1
28	—	- - Bearing case	1	1	1	1	1	1	1
29	P1R400350	- - Rivet	4	4	4	4	4	4	4
17	KA60103074	- Ball bearing	1	1	1	1	1	1	1
6	P1R300365	Drum cover	1	1	1	1	—	—	—
6	P1R300368	Drum cover	—	—	—	—	1	1	1
—	LRP003830	Spring assembly	1	2	3	4	2	3	4
7	—	- Spring	1	2	3	4	2	3	4
8	—	- Spring case	1	2	3	4	2	3	4
9	P1R300465	Bush	1	1	1	1	1	1	1
10	P1R300479	Bush	—	1	2	3	1	2	3
—	LRP003836	Notch key assembly	1	1	1	1	1	1	1
11	—	- Notch key	1	1	1	1	1	1	1
12	P1R400112	- Notch spring	2	2	2	2	2	2	2
—	LRP003852	Actuation plate assembly	1	1	—	3	1	—	—
—	LRP003853	Actuation plate assembly	—	—	1	—	—	1	—
13	—	- Actuation plate	1	1	—	—	1	—	—
13	—	- Actuation plate	—	—	1	—	—	1	—
27	P1R400357	- Dry bearing	1	1	1	—	1	1	—
13	P1R300438	Actuation plate	—	—	—	1	—	—	1
14	P1R400347	Key	1	1	1	1	1	1	1
15	P1R400124	Washer	1	1	1	1	1	1	1
21	KA10130616	Machine screw	6	6	6	6	6	6	6
22	KA16331025	Set screw	1	1	1	1	1	1	1
23	KA20131000	Hex. nut	1	1	1	1	1	1	1
24	KA31130600	Spring washer	6	6	6	6	6	6	6
30	P1R309126	Name plate	1	1	1	1	1	1	1
31	KA14549803	Drive screw	4	4	4	4	4	4	4
32	P1R304994	Warning label	1	1	1	1	1	1	1
33	P1R305037	Label	1	1	1	1	1	1	1
34	P1R401833	Label	1	1	1	1	1	1	1
35	P1R406024	Label	1	1	1	1	1	1	1

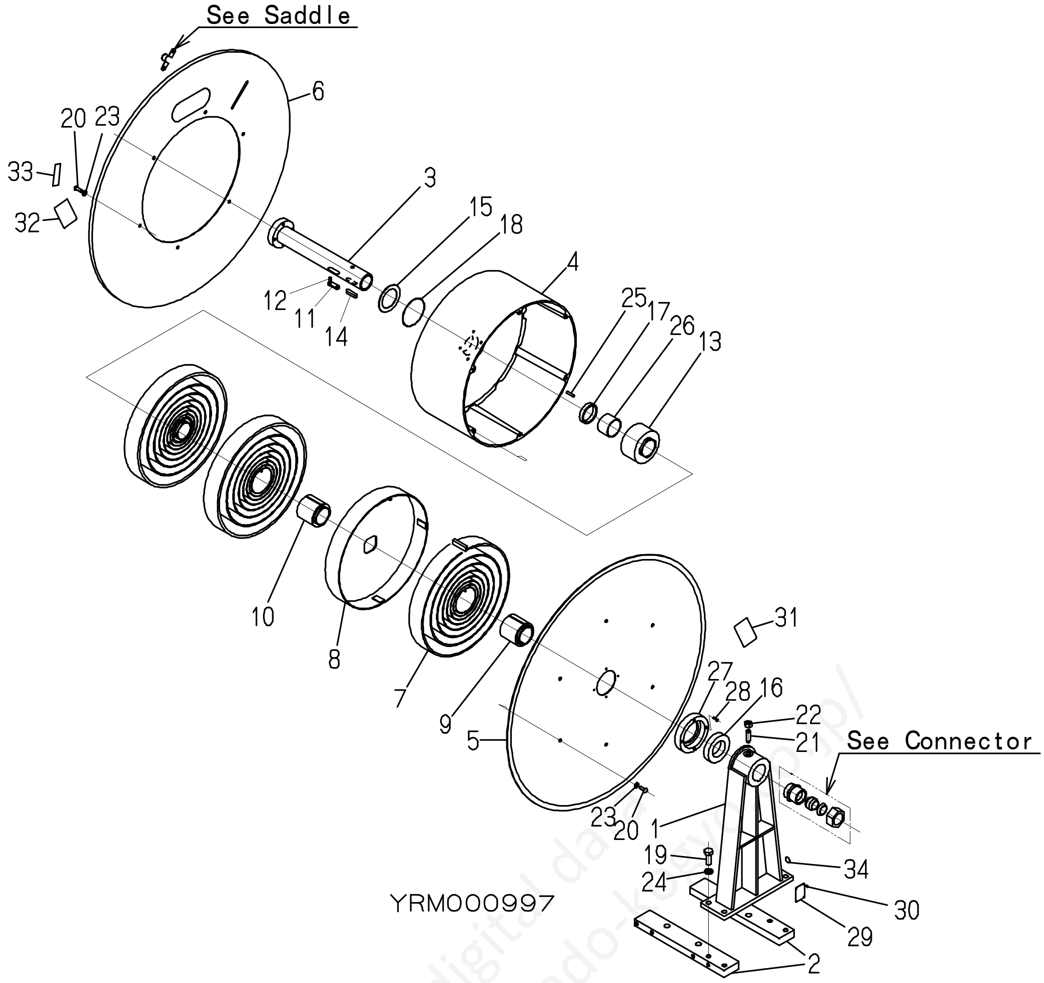
■CRL－4M424－R～4524F－R MAIN BODY

(In case of reverse winding, replace corresponding parts with these parts.)

No.	List No. or Part No.	Description	Quantity						
			4M424 －R	4424W －R	4424T －R	4424F －R	4524W －R	4524T －R	4524F －R
6	P1R300366	Drum cover	1	1	1	1	—	—	—
6	P1R300369	Drum cover	—	—	—	—	1	1	1
—	LRP003963	Spring assembly	1	2	3	4	2	3	4
7	—	- Spring	1	2	3	4	2	3	4
8	—	- Spring case	1	2	3	4	2	3	4
9	P1R300466	Bush	1	1	1	1	1	1	1
34	P1R401834	Label	1	1	1	1	1	1	1

Parts without a part number cannot be supplied individually.

■CRL－5M636～5636F MAIN BODY



No.	List No. or Part No.	Description	Quantity					
			5M636	5655W	5636W	5655T	5636T	5636F
—	LRP003842	Bracket assembly	1	—	—	—	—	—
—	LRP003843	Bracket assembly	—	1	1	1	1	1
1	LRP001166	– Bracket	1	1	1	1	1	1
2	P1R304411	– Base plate	2	—	—	—	—	—
2	P1R304551	– Base plate	—	2	2	2	2	2
19	P1R411627	– Hex. head bolt	4	4	4	4	4	4
24	KA31131000	– Spring washer	4	4	4	4	4	4
3	LRP001984	Spindle	1	—	—	—	—	—
3	LRP001985	Spindle	—	1	1	1	1	1
—	LRP003807	Drum assembly	1	—	—	—	—	—
—	LRP003808	Drum assembly	—	1	1	1	1	1
4	—	– Drum	1	—	—	—	—	—
4	—	– Drum	—	1	1	1	1	1
17	P1R400354	– Needle bearing	1	1	1	1	1	1
18	KA50200670	– O–ring	1	1	1	1	1	1
25	KA42410512	– Spring pin	4	4	4	4	4	4
—	LRP003818	Drum cover assembly	1	1	1	1	1	1
—	LRP002015	– Drum cover	1	1	1	1	1	1
5	—	– – Drum cover	1	1	1	1	1	1
27	—	– – Bearing case	1	1	1	1	1	1
28	P1R400350	– – Rivet	4	4	4	4	4	4
16	KA60103084	– Ball bearing	1	1	1	1	1	1
6	P1R200158	Drum cover	1	1	1	1	1	1

Parts without a part number cannot be supplied individually.

■CRL−5M636～5636F MAIN BODY

No.	List No. or Part No.	Description	Quantity					
			5M636	5655W	5636W	5655T	5636T	5636F
—	LRP003831	Spring assembly	1	—	2	—	3	4
—	LRP003832	Spring assembly	—	2	—	3	—	—
7	—	- Spring	1	—	2	—	3	4
7	—	- Spring	—	2	—	3	—	—
8	—	- Spring case	1	—	2	—	3	4
8	—	- Spring case	—	2	—	3	—	—
9	P1R300467	Bush	1	—	1	—	1	1
9	P1R300469	Bush	—	1	—	1	—	—
10	P1R300481	Bush	—	1	—	2	—	—
10	P1R300480	Bush	—	—	1	—	2	3
—	LRP003837	Notch key assembly	1	1	1	1	1	1
11	—	- Notch key	1	1	1	1	1	1
12	P1R400025	- Notch spring	2	2	2	2	2	2
—	LRP003854	Actuation plate assembly	1	—	1	—	—	—
—	LRP003855	Actuation plate assembly	—	1	—	—	—	—
—	LRP003856	Actuation plate assembly	—	—	—	—	1	—
13	—	- Actuation plate	1	—	1	—	—	—
13	—	- Actuation plate	—	1	—	—	—	—
13	—	- Actuation plate	—	—	—	—	1	—
26	P1R400358	- Dry bearing	1	1	1	—	1	—
13	P1R300442	Actuation plate	—	—	—	1	—	1
14	P1R400240	Key	1	1	1	1	1	1
15	P1R400121	Washer	1	1	1	1	1	1
20	KA10130616	Machine screw	12	12	12	12	12	12
21	KA16331030	Set screw	1	1	1	1	1	1
22	KA20131000	Hex. nut	1	1	1	1	1	1
23	KA31130600	Spring washer	12	12	12	12	12	12
29	P1R309126	Name plate	1	1	1	1	1	1
30	KA14549803	Drive screw	4	4	4	4	4	4
31	P1R304994	Warning label	1	1	1	1	1	1
32	P1R305037	Label	1	1	1	1	1	1
33	P1R401833	Label	1	1	1	1	1	1
34	P1R406024	Label	1	1	1	1	1	1

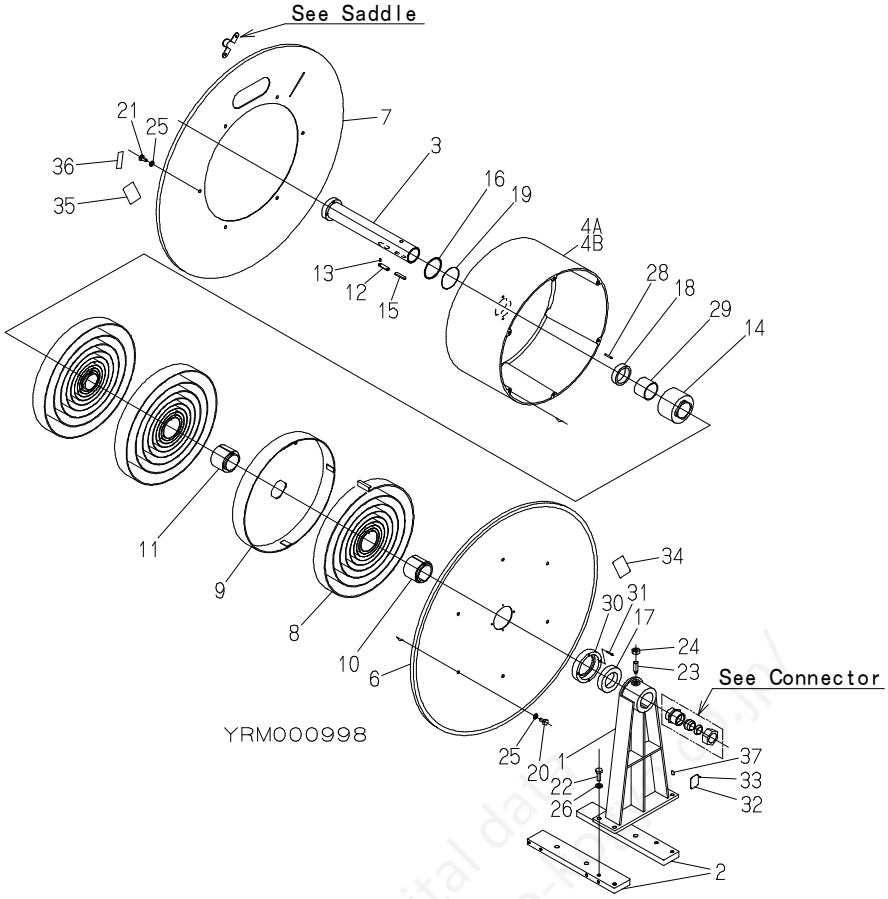
■CRL−5M636−R～5636F−R MAIN BODY

(In case of reverse winding, replace corresponding parts with these parts.)

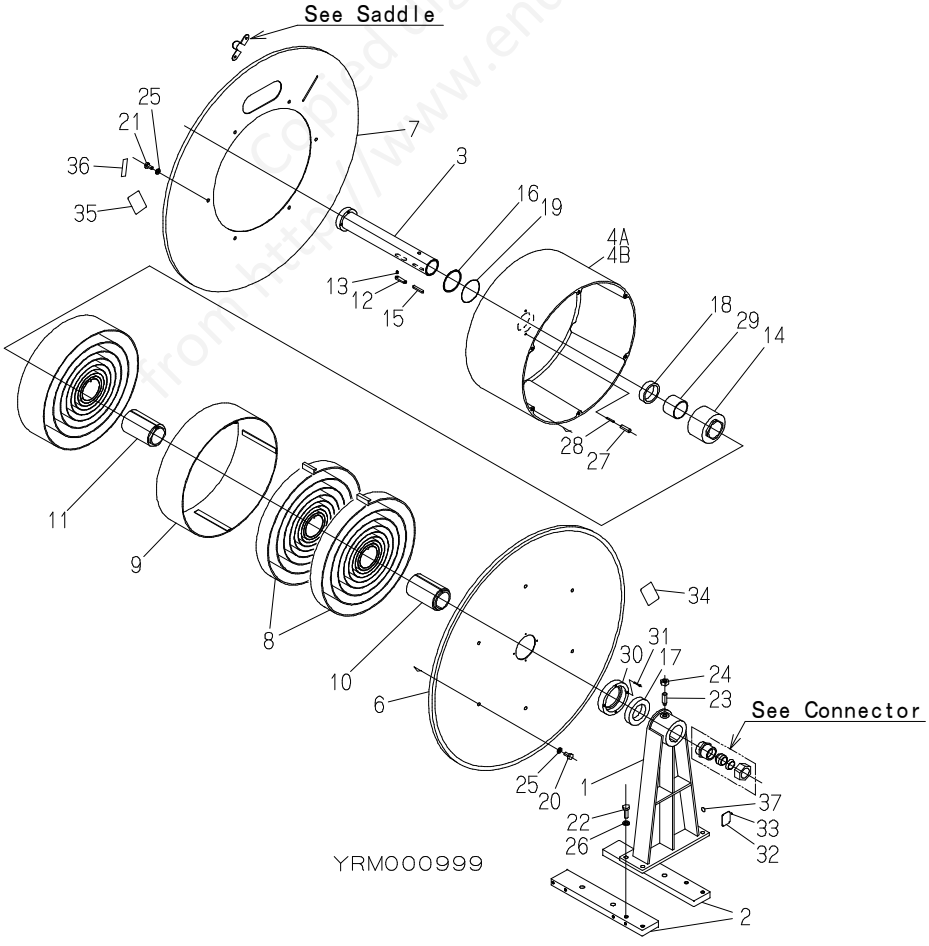
No.	List No. or Part No.	Description	Quantity					
			5M636−R	5655W−R	5636W−R	5655T−R	5636T−R	5636F−R
—	LRP003956	Drum assembly	1	—	—	—	—	—
—	LRP003957	Drum assembly	—	1	1	1	1	1
4	—	- Drum	1	—	—	—	—	—
4	—	- Drum	—	1	1	1	1	1
17	P1R400354	- Needle bearing	1	1	1	1	1	1
18	KA50200670	- O-ring	1	1	1	1	1	1
25	KA42410512	- Spring pin	4	4	4	4	4	4
6	P1R200159	Drum cover	1	1	1	1	1	1
—	LRP003964	Spring assembly	1	—	2	—	3	4
—	LRP003965	Spring assembly	—	2	—	3	—	—
7	—	- Spring	1	—	2	—	3	4
7	—	- Spring	—	2	—	3	—	—
8	—	- Spring case	1	—	2	—	3	4
8	—	- Spring case	—	2	—	3	—	—
9	P1R300468	Bush	1	—	1	—	1	1
9	P1R300470	Bush	—	1	—	1	—	—
34	P1R401834	Label	1	1	1	1	1	1

Parts without a part number cannot be supplied individually.

■CRL−677W～6756V MAIN BODY



■CRL−6M7112W MAIN BODY



■CRL－6M7112W～6756V MAIN BODY

No.	List No. or Part No.	Description	Quantity					
			6M7112W	6775W	6775T	6775F	6756F	6756V
—	LRP003844	Bracket assembly	1	—	—	—	—	—
—	LRP003845	Bracket assembly	—	1	1	1	1	1
1	LRP001177	- Bracket	1	1	1	1	1	1
2	P1R306010	- Base plate	2	—	—	—	—	—
2	P1R304543	- Base plate	—	2	2	2	2	2
22	P1R411627	- Hex. head bolt	4	4	4	4	4	4
26	KA31131000	- Spring washer	4	4	4	4	4	4
3	LRP001990	Spindle	1	—	—	—	—	—
3	LRP001992	Spindle	—	1	1	1	—	—
3	LRP001991	Spindle	—	—	—	—	1	1
4A	P1R201808	Drum (20A～100A)	1	—	—	—	—	—
4B	P1R201810	Drum (150A)	1	—	—	—	—	—
4A	P1R201615	Drum (20A～100A)	—	1	1	1	1	1
4B	P1R201616	Drum (150A)	—	1	1	1	1	1
18	P1R400355	Needle bearing	1	1	1	1	1	1
19	KA50200670	O-ring	1	1	1	1	1	1
27	KA42410312	Spring pin	6	—	—	—	—	—
28	KA42410512	Spring pin	6	6	6	6	6	6
—	LRP003819	Drum cover assembly	1	1	1	1	1	1
—	LRP002017	- Drum cover assembly	1	1	1	1	1	1
6	—	- - Drum cover	1	1	1	1	1	1
30	—	- - Bearing case	1	1	1	1	1	1
31	P1R400351	- - Rivet	4	4	4	4	4	4
17	KA60103104	- Ball bearing	1	1	1	1	1	1
7	P1R200165	Drum cover	1	1	1	1	1	1
—	LRP003833	Spring assembly	2	—	—	—	—	—
—	LRP003834	Spring assembly	—	2	3	4	—	—
—	LRP003835	Spring assembly	—	—	—	—	4	5
8	—	- Spring	4	—	—	—	4	5
8	—	- Spring	—	2	3	4	—	—
9	—	- Spring case	2	—	—	—	—	—
9	—	- Spring case	—	2	3	4	—	—
9	—	- Spring case	—	—	—	—	4	5
10	P1R300473	Bush	1	—	—	—	—	—
10	P1R300221	Bush	—	1	1	1	—	—
10	P1R300471	Bush	—	—	—	—	1	1
11	P1R300217	Bush	1	—	—	—	—	—
11	P1R300214	Bush	—	1	2	3	—	—
11	P1R300211	Bush	—	—	—	—	3	4

Parts without a part number cannot be supplied individually.

■CRL−6M7112W～6756V MAIN BODY

No.	List No. or Part No.	Description	Quantity					
			6M7112W	6775W	6775T	6775F	6756F	6756V
—	LRP003838	Notch key assembly	1	1	1	1	—	—
—	LRP003837	Notch key assembly	—	—	—	—	1	1
12	—	- Notch key	1	1	1	1	—	—
12	—	- Notch key	—	—	—	—	1	1
13	P1R400025	- Notch spring	2	2	2	2	2	2
14	P1R300455	Actuation plate	1	—	—	—	—	—
—	LRP003857	Actuation plate assembly	—	1	—	—	—	—
—	LRP003858	Actuation plate assembly	—	—	1	—	—	—
—	LRP003861	Actuation plate assembly	—	—	—	—	1	—
14	—	- Actuation plate	—	1	—	—	—	—
14	—	- Actuation plate	—	—	1	—	—	—
14	—	- Actuation plate	—	—	—	—	1	—
29	P1R400359	- Dry bearing	—	1	1	—	1	—
14	P1R300192	Actuation plate	—	—	—	1	—	—
14	P1R300451	Actuation plate	—	—	—	—	—	1
15	P1R400241	Key	1	1	1	1	1	1
16	P1R400075	Washer	1	1	1	1	1	1
20	KA00130816	Hex. head bolt	6	6	6	6	6	6
21	KA00130816	Hex. head bolt	6	6	6	6	6	6
23	KA16331230	Set screw	1	1	1	1	1	1
24	KA20131200	Hex. nut	1	1	1	1	1	1
25	KA31130800	Spring washer	12	12	12	12	12	12
32	P1R309126	Name plate	1	1	1	1	1	1
33	KA14549803	Drive screw	4	4	4	4	4	4
34	P1R304994	Warning label	1	1	1	1	1	1
35	P1R305037	Label	1	1	1	1	1	1
36	P1R401833	Label	1	1	1	1	1	1
37	P1R406024	Label	1	1	1	1	1	1

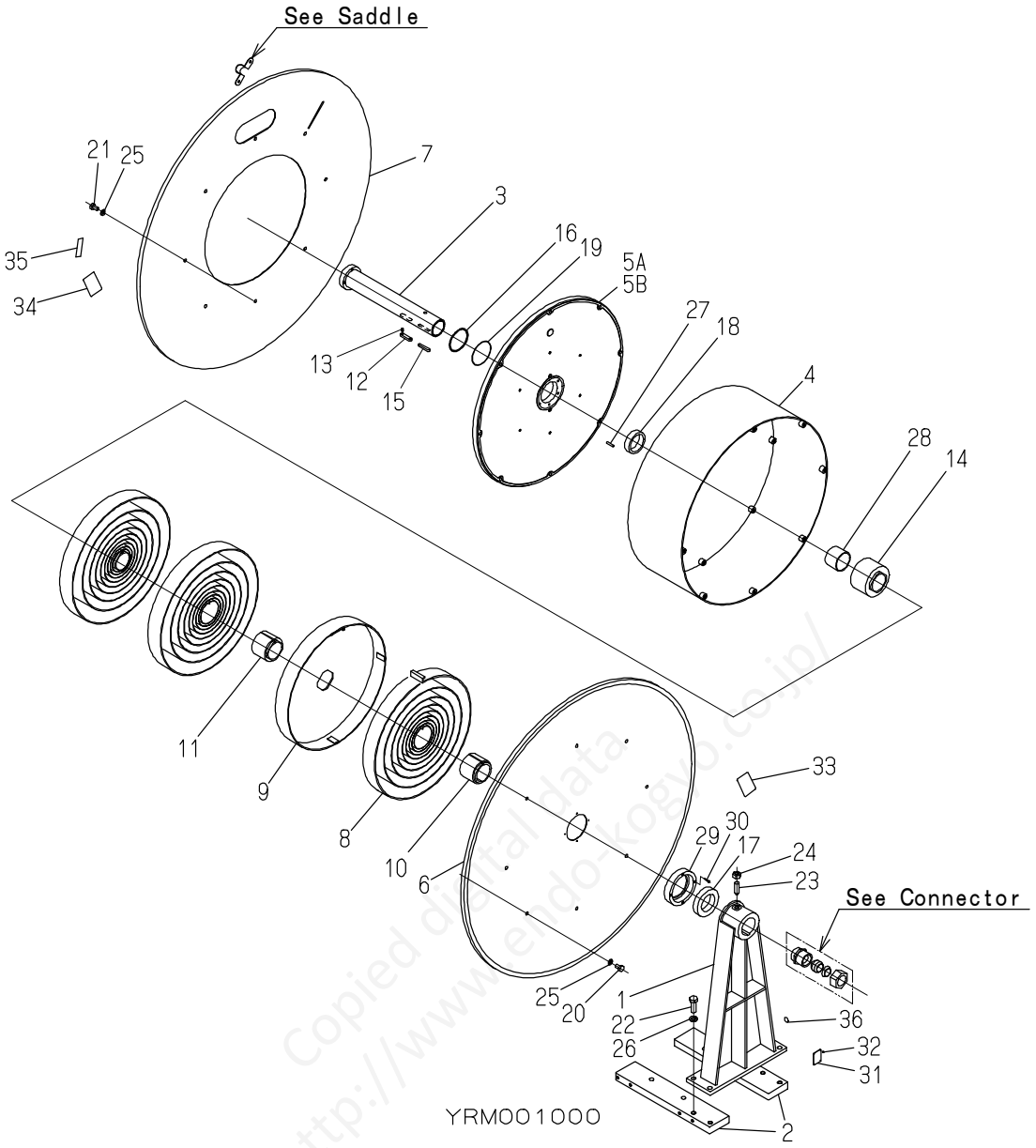
■CRL−6M7112W−R～6756V−R MAIN BODY

(In case of reverse winding, replace corresponding parts with these parts.)

No.	List No. or Part No.	Description	Quantity					
			6M7112W −R	6775W −R	6775T −R	6775F −R	6756F −R	6756V −R
7	P1R200166	Drum cover	1	1	1	1	1	1
—	LRP003966	Spring assembly	2	—	—	—	—	—
—	LRP003967	Spring assembly	—	2	3	4	—	—
—	LRP003968	Spring assembly	—	—	—	—	4	5
8	—	- Spring	4	—	—	—	4	5
8	—	- Spring	—	2	3	4	—	—
9	—	- Spring case	2	—	—	—	—	—
9	—	- Spring case	—	2	3	4	—	—
9	—	- Spring case	—	—	—	—	4	5
10	P1R300474	Bush	1	—	—	—	—	—
10	P1R300220	Bush	—	1	1	1	—	—
10	P1R300472	Bush	—	—	—	—	1	1
36	P1R401834	Label	1	1	1	1	1	1

Parts without a part number cannot be supplied individually.

■CRL−7875T～7875F MAIN BODY



No.	List No. or Part No.	Description	Quantity	
			7875T	7875F
—	LRP003846	Bracket assembly	1	1
1	LRP001179	- Bracket	1	1
2	P1R304544	- Base plate	2	2
22	P1R411628	- Hex. head bolt	4	4
26	KA31131200	- Spring washer	4	4
3	LRP001992	Spindle	1	1
4	P1R300497	Drum	1	1
—	LRP003866	Drum plate assembly (20A～100A)	1	1
—	LRP003867	Drum plate assembly (150A)	1	1
5A	—	- Drum plate (20A～100A)	1	1
5B	—	- Drum plate (150A)	1	1
18	P1R400355	- Needle bearing	1	1
19	KA50200670	- O-ring	1	1
27	KA42410512	- Spring pin	6	6

Parts without a part number cannot be supplied individually.

■CRL−7875T～7875F MAIN BODY

No.	List No. or Part No.	Description	Quantity	
			7875T	7875F
—	LRP003820	Drum cover assembly	1	1
—	LRP002019	- Drum cover assembly	1	1
6	—	- - Drum cover	1	1
29	—	- - Bearing case	1	1
30	P1R400351	- - Rivet	4	4
17	KA60103104	- Ball bearing	1	1
7	P1R200168	Drum cover	1	1
—	LRP003834	Spring assembly	3	4
8	—	- Spring	3	4
9	—	- Spring case	3	4
10	P1R300221	Bush	1	1
11	P1R300214	Bush	2	3
—	LRP003838	Notch key assembly	1	1
12	—	- Notch key	1	1
13	P1R400025	- Notch spring	2	2
—	LRP003858	Actuation plate assembly	1	—
14	—	- Actuation plate	1	—
28	P1R400359	- Dry bearing	1	—
14	P1R300192	Actuation plate	—	1
15	P1R400241	Key	1	1
16	P1R400075	Washer	1	1
20	KA00130816	Hex. head bolt	8	8
21	KA00130835	Hex. head bolt	8	8
23	KA16331230	Set screw	1	1
24	KA20131200	Hex. nut	1	1
25	KA31130800	Spring washer	16	16
31	P1R309126	Name plate	1	1
32	KA14549803	Drive screw	4	4
33	P1R304994	Warning label	1	1
34	P1R305037	Label	1	1
35	P1R401833	Label	1	1
36	P1R406024	Label	1	1

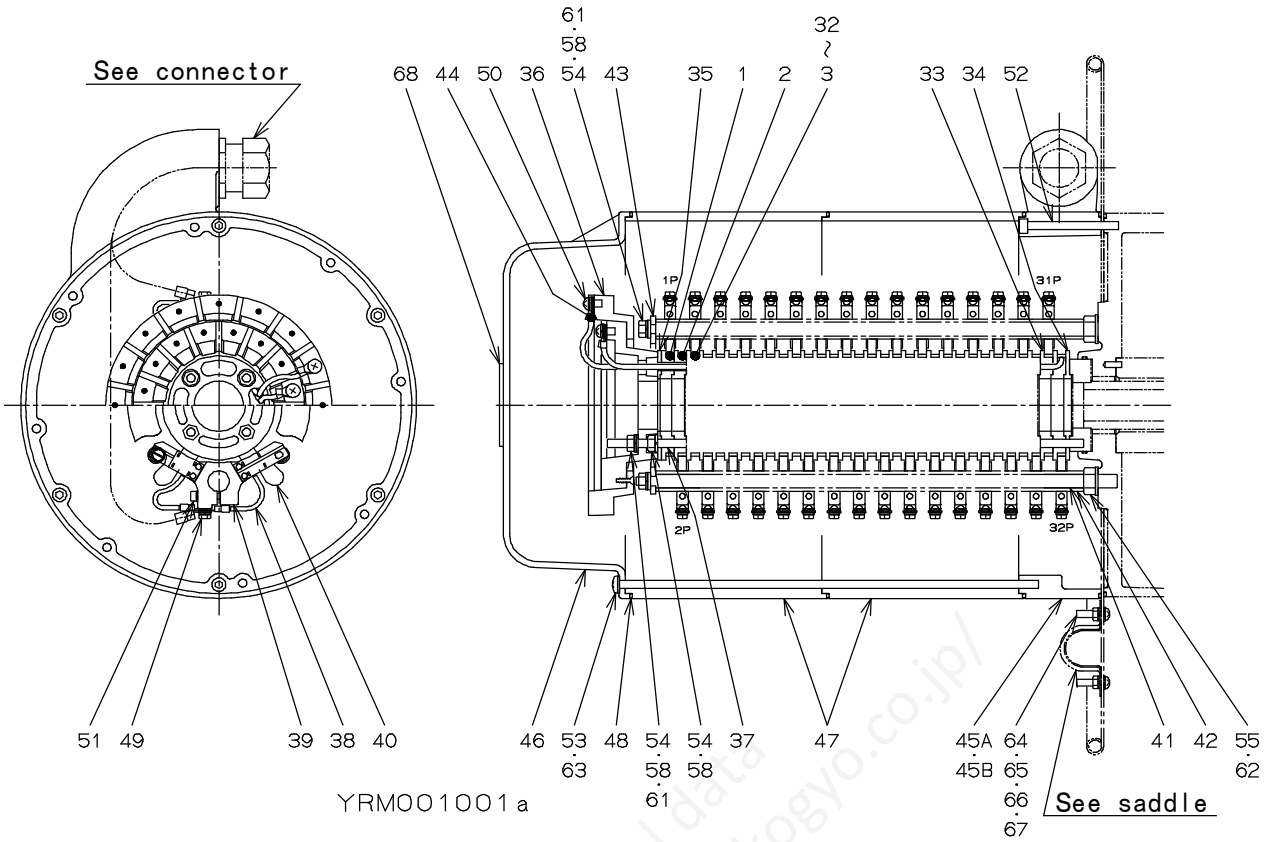
■CRL−7875T−R～7875F−R MAIN BODY

(In case of reverse winding, replace corresponding parts with these parts.)

No.	List No. or Part No.	Description	Quantity	
			7875T−R	7875F−R
7	P1R200169	Drum cover	1	1
—	LRP003967	Spring assembly	3	4
8	—	- Spring	3	4
9	—	- Spring case	3	4
10	P1R300220	Bush	1	1
35	P1R401834	Label	1	1

Parts without a part number cannot be supplied individually.

■20A Slip ring



No.	List No. or Part No.	Description	Quantity										
			3P	4P	6P	8P	10P	12P	14P	16P	20P	24P	28P	32P
—	LRP003509	Slip ring assembly	1	—	—	—	—	—	—	—	—	—	—	—
—	LRP003510	Slip ring assembly	—	1	—	—	—	—	—	—	—	—	—	—
—	LRP003511	Slip ring assembly	—	—	1	—	—	—	—	—	—	—	—	—
—	LRP003512	Slip ring assembly	—	—	—	1	—	—	—	—	—	—	—	—
—	LRP003513	Slip ring assembly	—	—	—	—	1	—	—	—	—	—	—	—
—	LRP003514	Slip ring assembly	—	—	—	—	—	1	—	—	—	—	—	—
—	LRP003515	Slip ring assembly	—	—	—	—	—	—	1	—	—	—	—	—
—	LRP003516	Slip ring assembly	—	—	—	—	—	—	—	1	—	—	—	—
—	LRP003518	Slip ring assembly	—	—	—	—	—	—	—	—	1	—	—	—
—	LRP003520	Slip ring assembly	—	—	—	—	—	—	—	—	—	1	—	—
—	LRP003522	Slip ring assembly	—	—	—	—	—	—	—	—	—	—	1	—
—	LRP003524	Slip ring assembly	—	—	—	—	—	—	—	—	—	—	—	1
1	LRP003028	- Slip ring	1	1	1	1	1	1	1	1	1	1	1	1
2	LRP003029	- Slip ring	1	1	1	1	1	1	1	1	1	1	1	1
3	LRP003030	- Slip ring	1	1	1	1	1	1	1	1	1	1	1	1
4	LRP003031	- Slip ring	—	1	1	1	1	1	1	1	1	1	1	1
5	LRP003032	- Slip ring	—	—	1	1	1	1	1	1	1	1	1	1
6	LRP003033	- Slip ring	—	—	1	1	1	1	1	1	1	1	1	1
7	LRP003034	- Slip ring	—	—	—	1	1	1	1	1	1	1	1	1

Parts without a part number cannot be supplied individually.

■20A Slip ring

No.	List No. or Part No.	Description	Quantity											
			3P	4P	6P	8P	10P	12P	14P	16P	20P	24P	28P	32P
8	LRP003035	- Slip ring	—	—	—	1	1	1	1	1	1	1	1	1
9	LRP003036	- Slip ring	—	—	—	—	1	1	1	1	1	1	1	1
10	LRP003037	- Slip ring	—	—	—	—	1	1	1	1	1	1	1	1
11	LRP003038	- Slip ring	—	—	—	—	—	1	1	1	1	1	1	1
12	LRP003039	- Slip ring	—	—	—	—	—	1	1	1	1	1	1	1
13	LRP003040	- Slip ring	—	—	—	—	—	—	1	1	1	1	1	1
14	LRP003041	- Slip ring	—	—	—	—	—	—	1	1	1	1	1	1
15	LRP003042	- Slip ring	—	—	—	—	—	—	—	1	1	1	1	1
16	LRP003043	- Slip ring	—	—	—	—	—	—	—	1	1	1	1	1
17	LRP003044	- Slip ring	—	—	—	—	—	—	—	—	1	1	1	1
18	LRP003045	- Slip ring	—	—	—	—	—	—	—	—	1	1	1	1
19	LRP003046	- Slip ring	—	—	—	—	—	—	—	—	1	1	1	1
20	LRP003047	- Slip ring	—	—	—	—	—	—	—	—	1	1	1	1
21	LRP003048	- Slip ring	—	—	—	—	—	—	—	—	—	1	1	1
22	LRP003049	- Slip ring	—	—	—	—	—	—	—	—	—	1	1	1
23	LRP003050	- Slip ring	—	—	—	—	—	—	—	—	—	1	1	1
24	LRP003051	- Slip ring	—	—	—	—	—	—	—	—	—	1	1	1
25	LRP003052	- Slip ring	—	—	—	—	—	—	—	—	—	—	1	1
26	LRP003053	- Slip ring	—	—	—	—	—	—	—	—	—	—	1	1
27	LRP003054	- Slip ring	—	—	—	—	—	—	—	—	—	—	1	1
28	LRP003055	- Slip ring	—	—	—	—	—	—	—	—	—	—	1	1
29	LRP003056	- Slip ring	—	—	—	—	—	—	—	—	—	—	—	1
30	LRP003057	- Slip ring	—	—	—	—	—	—	—	—	—	—	—	1
31	LRP003058	- Slip ring	—	—	—	—	—	—	—	—	—	—	—	1
32	LRP003059	- Slip ring	—	—	—	—	—	—	—	—	—	—	—	1
33	P1R301971	- Ring holder	3	4	6	8	10	12	14	16	20	24	28	32
34	P1R400476	- Ring cover	1	1	1	1	1	1	1	1	1	1	1	1
35	P1R400477	- Ring cover	1	1	1	1	1	1	1	1	1	1	1	1
36	LRP013540	- Terminal plate	1	1	1	—	—	—	—	—	—	—	—	—
36	LPR013541	- Terminal plate	—	—	—	1	1	1	—	—	—	—	—	—
36	LRP013542	- Terminal plate	—	—	—	—	—	—	1	1	—	—	—	—
36	LRP002541	- Terminal plate	—	—	—	—	—	—	—	—	1	1	1	1
37	LRP003327	- Ring bolt	4	—	—	—	—	—	—	—	—	—	—	—
37	LRP003328	- Ring bolt	—	4	—	—	—	—	—	—	—	—	—	—
37	LRP003331	- Ring bolt	—	—	4	—	—	—	—	—	—	—	—	—
37	LRP003335	- Ring bolt	—	—	—	4	—	—	—	—	—	—	—	—
37	LRP003338	- Ring bolt	—	—	—	—	4	—	—	—	—	—	—	—
37	LRP003341	- Ring bolt	—	—	—	—	—	4	—	—	—	—	—	—
37	LRP003344	- Ring bolt	—	—	—	—	—	—	4	—	—	—	—	—
37	LRP003347	- Ring bolt	—	—	—	—	—	—	—	4	—	—	—	—
37	LRP003352	- Ring bolt	—	—	—	—	—	—	—	—	4	—	—	—
37	LRP003358	- Ring bolt	—	—	—	—	—	—	—	—	—	4	—	—
37	LRP003362	- Ring bolt	—	—	—	—	—	—	—	—	—	—	4	—
37	LRP003364	- Ring bolt	—	—	—	—	—	—	—	—	—	—	—	4

Parts without a part number cannot be supplied individually.

■20A Slip ring

No.	List No. or Part No.	Description	Quantity											
			3P	4P	6P	8P	10P	12P	14P	16P	20P	24P	28P	32P
—	LRP003785	- Brush set	3	4	6	8	10	12	14	16	20	24	28	32
38	P1R411703	- - Brush	6	8	12	16	20	24	28	32	40	48	56	64
—	LRP003790	- - Brush holder set	3	4	6	8	10	12	14	16	20	24	28	32
39	LRP003248	- - - Brush holder	3	4	6	8	10	12	14	16	20	24	28	32
40	P1R300594	- - - Brush spring	6	8	12	16	20	24	28	32	40	48	56	64
51	P1R404881	- - - Cap screw with washer	3	4	6	8	10	12	14	16	20	24	28	32
49	P1R404740	- - Hex. head bolt with washer	3	4	6	8	10	12	14	16	20	24	28	32
41	LRP016923	- Brush bolt	2	—	—	—	—	—	—	—	—	—	—	—
41	LRP016925	- Brush bolt	—	2	—	—	—	—	—	—	—	—	—	—
41	LRP016928	- Brush bolt	—	—	2	—	—	—	—	—	—	—	—	—
41	LRP016935	- Brush bolt	—	—	—	2	—	—	—	—	—	—	—	—
41	LRP016940	- Brush bolt	—	—	—	—	2	—	—	—	—	—	—	—
41	LRP016947	- Brush bolt	—	—	—	—	—	2	—	—	—	—	—	—
41	LRP016952	- Brush bolt	—	—	—	—	—	—	2	—	—	—	—	—
41	LRP016960	- Brush bolt	—	—	—	—	—	—	—	2	—	—	—	—
41	LRP016967	- Brush bolt	—	—	—	—	—	—	—	—	2	—	—	—
41	LRP016975	- Brush bolt	—	—	—	—	—	—	—	—	—	2	—	—
41	LRP016981	- Brush bolt	—	—	—	—	—	—	—	—	—	—	2	—
41	LRP016986	- Brush bolt	—	—	—	—	—	—	—	—	—	—	—	2
42	—	- - Insulation pipe	2	2	2	2	2	2	2	2	2	2	2	2
55	KA20121000	- - Hex. nut	2	2	2	2	2	2	2	2	2	2	2	2
43	P1R411546	- Plate	1	1	1	1	1	1	1	1	1	1	1	1
44	KA91300205	- Terminal rug	3	4	6	8	10	12	14	16	20	24	28	32
50	P1R404737	- Machine screw with washer	3	4	6	8	10	12	14	16	20	24	28	32
54	KA20120600	- Hex. nut	10	10	10	10	10	10	10	10	10	10	10	10
58	KA31120600	- Spring washer	10	10	10	10	10	10	10	10	10	10	10	10
61	KA30220600	- Plain washer	6	6	6	6	6	6	6	6	6	6	6	6
62	KA30221000	- Plain washer	2	2	2	2	2	2	2	2	2	2	2	2
—	LRP003397	Cable guide assembly (CS-27)	1	1	1	1	1	1	1	1	1	1	1	1
—	LRP003398	Cable guide assembly (CS-38)	1	1	1	1	1	1	1	1	1	1	1	1
45A	—	- Cable guide (CS-27)	1	1	1	1	1	1	1	1	1	1	1	1
45B	—	- Cable guide (CS-38)	1	1	1	1	1	1	1	1	1	1	1	1
48	P1R400510	- Seal ring	2	2	2	2	2	2	2	2	2	2	2	2
46	P1R301100	Dust proof cover	1	1	1	1	1	1	1	1	1	1	1	1

Parts without a part number cannot be supplied individually.

■20A Slip ring

No.	List No. or Part No.	Description	Quantity											
			3P	4P	6P	8P	10P	12P	14P	16P	20P	24P	28P	32P
—	LRP003386	Dust proof spacer assembly	—	—	—	1	—	—	—	—	—	—	—	—
—	LRP003387	Dust proof spacer assembly	—	—	—	—	1	—	—	—	—	—	—	—
—	LRP003388	Dust proof spacer assembly	—	—	—	—	—	1	1	—	—	—	—	—
—	LRP003389	Dust proof spacer assembly	—	—	—	—	—	—	—	1	—	2	1	—
—	LRP003390	Dust proof spacer assembly	—	—	—	—	—	—	—	—	1	—	1	2
47	—	- Dust proof spacer	—	—	—	1	—	—	—	—	—	—	—	—
47	—	- Dust proof spacer	—	—	—	—	1	—	—	—	—	—	—	—
47	—	- Dust proof spacer	—	—	—	—	—	1	1	—	—	—	—	—
47	—	- Dust proof spacer	—	—	—	—	—	—	—	1	—	2	1	—
47	—	- Dust proof spacer	—	—	—	—	—	—	—	—	1	—	1	2
48	P1R400510	- Seal ring	—	—	—	1	1	1	1	1	1	2	2	2
52	P2H400112	Hex. cap screw	6	6	6	6	6	6	6	6	6	6	6	6
53	KA10530620	Cross recessed head screw	8	8	8	—	—	—	—	—	—	—	—	—
53	KA10530644	Cross recessed head screw	—	—	—	8	—	—	—	—	—	—	—	—
53	P1R411527	Cross recessed head screw	—	—	—	—	8	—	—	—	—	—	—	—
53	P1R411529	Cross recessed head screw	—	—	—	—	—	8	8	—	—	—	—	—
53	P1R411530	Cross recessed head screw	—	—	—	—	—	—	—	8	—	—	—	—
53	P1R411532	Cross recessed head screw	—	—	—	—	—	—	—	—	8	—	—	—
53	P1R411535	Cross recessed head screw	—	—	—	—	—	—	—	—	—	8	—	—
53	P1R411536	Cross recessed head screw	—	—	—	—	—	—	—	—	—	—	8	—
53	P1R411537	Cross recessed head screw	—	—	—	—	—	—	—	—	—	—	—	8
63	P1R302406	Seal washer	8	8	8	8	8	8	8	8	8	8	8	8
64	KA10130520	Machine screw	2	2	2	2	2	2	2	2	2	2	2	2
65	KA20130500	Hex. nut	2	2	2	2	2	2	2	2	2	2	2	2
66	KA31130500	Spring washer	2	2	2	2	2	2	2	2	2	2	2	2
67	KA30230500	Plate washer	2	2	2	2	2	2	2	2	2	2	2	2
68	P1R305075	Warning label	1	1	1	1	1	1	1	1	1	1	1	1

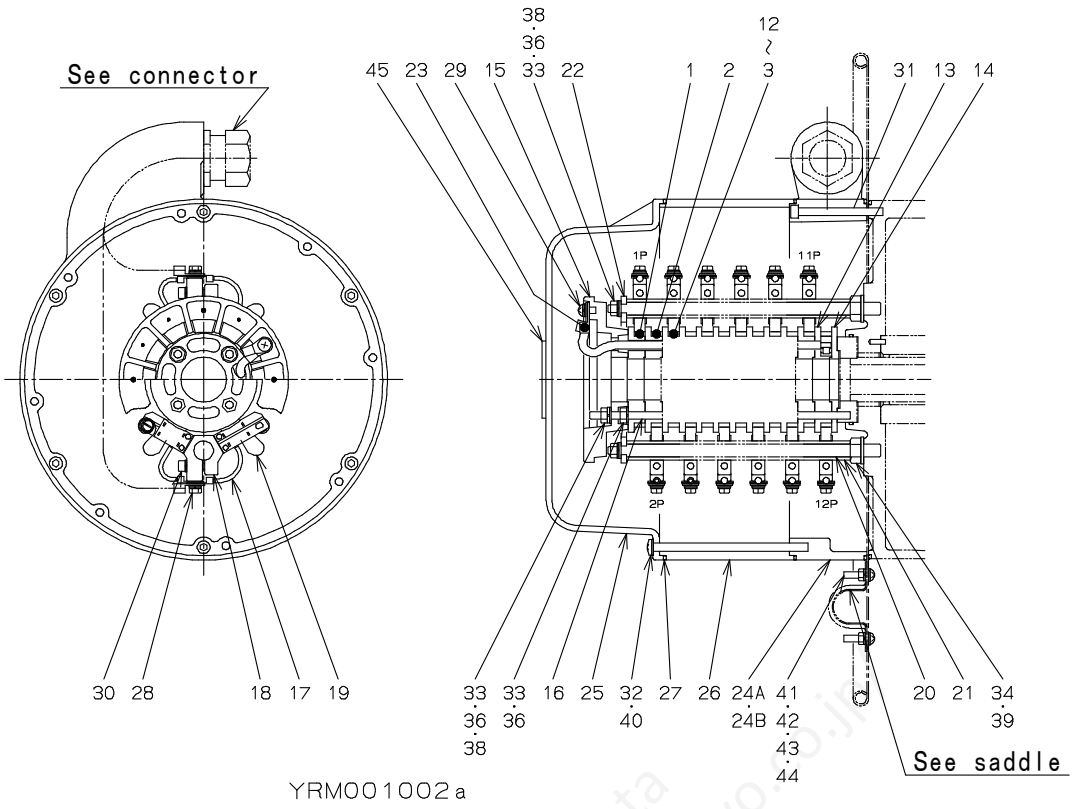
■20A Slip ring

(In case of reverse winding, replace corresponding parts with these parts.)

No.	List No. or Part No.	Description	Quantity											
			3P	4P	6P	8P	10P	12P	14P	16P	20P	24P	28P	32P
—	LRP003399	Cable guide assembly (CS-27)	1	1	1	1	1	1	1	1	1	1	1	1
—	LRP003400	Cable guide assembly (CS-38)	1	1	1	1	1	1	1	1	1	1	1	1
45A	—	- Cable guide (CS-27)	1	1	1	1	1	1	1	1	1	1	1	1
45B	—	- Cable guide (CS-38)	1	1	1	1	1	1	1	1	1	1	1	1
48	P1R400510	- Seal ring	2	2	2	2	2	2	2	2	2	2	2	2

Parts without a part number cannot be supplied individually.

■50A Slip ring



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No.	List No. or Part No.	Description	Quantity					
			3P	4P	6P	8P	10P	12P
—	LRP003525	Slip ring assembly	1	—	—	—	—	—
—	LRP003526	Slip ring assembly	—	1	—	—	—	—
—	LRP003527	Slip ring assembly	—	—	1	—	—	—
—	LRP003528	Slip ring assembly	—	—	—	1	—	—
—	LRP003529	Slip ring assembly	—	—	—	—	1	—
—	LRP003530	Slip ring assembly	—	—	—	—	—	1
1	LRP003130	- Slip ring	1	1	1	1	1	1
2	LRP003131	- Slip ring	1	1	1	1	1	1
3	LRP003132	- Slip ring	1	1	1	1	1	1
4	LRP003133	- Slip ring	—	1	1	1	1	1
5	LRP003134	- Slip ring	—	—	1	1	1	1
6	LRP003135	- Slip ring	—	—	1	1	1	1
7	LRP003136	- Slip ring	—	—	—	1	1	1
8	LRP003137	- Slip ring	—	—	—	1	1	1
9	LRP003138	- Slip ring	—	—	—	—	1	1
10	LRP003139	- Slip ring	—	—	—	—	1	1
11	LRP003140	- Slip ring	—	—	—	—	—	1
12	LRP003141	- Slip ring	—	—	—	—	—	1

Parts without a part number cannot be supplied individually.

■50A Slip ring

No.	List No. or Part No.	Description	Quantity					
			3P	4P	6P	8P	10P	12P
13	P1R301972	- Ring holder	3	4	6	8	10	12
14	P1R400478	- Ring cover	1	1	1	1	1	1
15	LRP002537	- Terminal plate	1	1	1	—	—	—
15	LRP002538	- Terminal plate	—	—	—	1	1	1
16	LRP003328	- Ring bolt	4	—	—	—	—	—
16	LRP003331	- Ring bolt	—	4	—	—	—	—
16	LRP003336	- Ring bolt	—	—	4	—	—	—
16	LRP003340	- Ring bolt	—	—	—	4	—	—
16	LRP003344	- Ring bolt	—	—	—	—	4	—
16	LRP003348	- Ring bolt	—	—	—	—	—	4
—	LRP003786	- Brush set	3	4	6	8	10	12
17	P1R411609	- - Brush	6	8	12	16	20	24
—	LRP003791	- - Brush holder set	3	4	6	8	10	12
18	LRP003249	- - - Brush holder	3	4	6	8	10	12
19	P1R300858	- - - Brush spring	6	8	12	16	20	24
30	P1R404882	- - - Cap screw with washer	3	4	6	8	10	12
28	P1R404741	- - Hex. head bolt with washer	3	4	6	8	10	12
20	LRP016925	- Brush bolt	2	—	—	—	—	—
20	LRP016927	- Brush bolt	—	2	—	—	—	—
20	LRP016936	- Brush bolt	—	—	2	—	—	—
20	LRP016945	- Brush bolt	—	—	—	2	—	—
20	LRP016953	- Brush bolt	—	—	—	—	2	—
20	LRP016963	- Brush bolt	—	—	—	—	—	2
21	—	- - Insulation pipe	2	2	2	2	2	2
34	KA20121000	- - Hex. nut	2	2	2	2	2	2
22	P1R400518	- Plate	1	1	1	1	1	1
23	KA91300805	- Terminal rug	3	4	6	8	10	12
29	P1R404737	- Machine screw with washer	3	4	6	8	10	12
33	KA20120600	- Hex. nut	10	10	10	10	10	10
36	KA31120600	- Spring washer	10	10	10	10	10	10
38	KA30220600	- Plain washer	6	6	6	6	6	6
39	KA30221000	- Plain washer	2	2	2	2	2	2
—	LRP003397	Cable guide assembly (CS-27)	1	1	1	1	1	1
—	LRP003398	Cable guide assembly (CS-38)	1	1	1	1	1	1
24A	—	- Cable guide (CS-27)	1	1	1	1	1	1
24B	—	- Cable guide (CS-38)	1	1	1	1	1	1
27	P1R400510	- Seal ring	2	2	2	2	2	2
25	P1R301100	Dust proof cover	1	1	1	1	1	1

Parts without a part number cannot be supplied individually.

■50A Slip ring

No.	List No. or Part No.	Description	Quantity					
			3P	4P	6P	8P	10P	12P
—	LRP003386	Dust proof spacer assembly	—	—	1	—	—	—
—	LRP003387	Dust proof spacer assembly	—	—	—	1	—	—
—	LRP003388	Dust proof spacer assembly	—	—	—	—	1	—
—	LRP003389	Dust proof spacer assembly	—	—	—	—	—	1
26	—	- Dust proof spacer	—	—	1	—	—	—
26	—	- Dust proof spacer	—	—	—	1	—	—
26	—	- Dust proof spacer	—	—	—	—	1	—
26	—	- Dust proof spacer	—	—	—	—	—	1
27	P1R400510	- Seal ring	—	—	1	1	1	1
31	P2H400112	Hex. cap screw	6	6	6	6	6	6
32	KA10530620	Cross recessed head screw	8	8	—	—	—	—
32	KA10530644	Cross recessed head screw	—	—	8	—	—	—
32	P1R411527	Cross recessed head screw	—	—	—	8	—	—
32	P1R411529	Cross recessed head screw	—	—	—	—	8	—
32	P1R411530	Cross recessed head screw	—	—	—	—	—	8
40	P1R302406	Seal washer	8	8	8	8	8	8
41	KA10130520	Machine screw	2	2	2	2	2	2
42	KA20130500	Hex. nut	2	2	2	2	2	2
43	KA31130500	Spring washer	2	2	2	2	2	2
44	KA30230500	Plate washer	2	2	2	2	2	2
45	P1R305075	Warning label	1	1	1	1	1	1

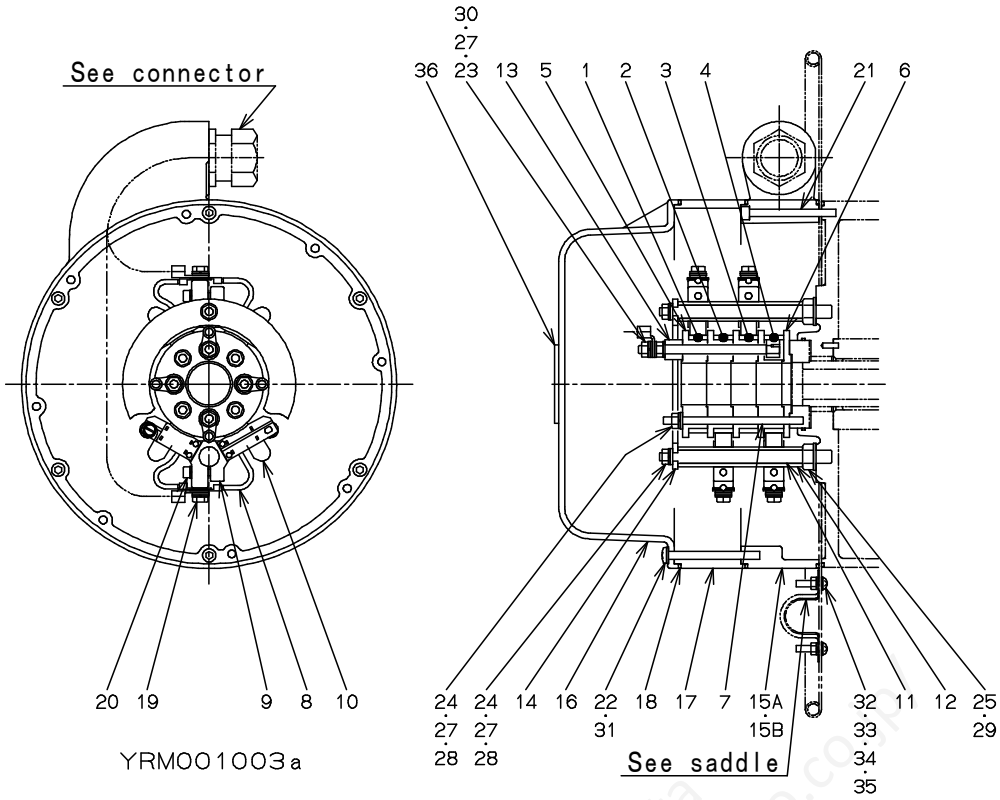
■50A Slip ring

(In case of reverse winding, replace corresponding parts with these parts.)

No.	List No. or Part No.	Description	Quantity					
			3P	4P	6P	8P	10P	12P
—	LRP003399	Cable guide assembly (CS-27)	1	1	1	1	1	1
—	LRP003400	Cable guide assembly (CS-38)	1	1	1	1	1	1
24A	—	- Cable guide (CS-27)	1	1	1	1	1	1
24B	—	- Cable guide (CS-38)	1	1	1	1	1	1
48	P1R400510	- Seal ring	2	2	2	2	2	2

Parts without a part number cannot be supplied individually.

■100A Srip ring



No.	List No. or Part No.	Description	Quantity	
			3P	4P
—	LRP006733	Slip ring assembly	1	—
—	LRP006734	Slip ring assembly	—	1
1	LRP006729	- Slip ring	1	1
2	LRP006730	- Slip ring	1	1
3	LRP006731	- Slip ring	1	1
4	LRP006732	- Slip ring	—	1
5	P1R301973	- Ring holder	3	4
6	P1R400478	- Ring cover	1	1
7	LRP003329	- Ring bolt	4	—
7	LRP003333	- Ring bolt	—	4
—	LRP003787	- Brush set	3	4
8	P1R411704	- - Brush	6	8
—	LRP003792	- - Brush holder set	3	4
9	LRP003250	- - - Brush holder	3	4
10	P1R300858	- - - Brush spring	12	16
20	P1R404882	- - - Cap screw with washer	3	4
19	P1R404742	- - Hex. head bolt with washer	3	4
11	LRP016929	- Brush bolt	2	—
11	LRP016936	- Brush bolt	—	2
12	—	- - Insulation pipe	2	2
25	KA20121000	- - Hex. nut	2	2

Parts without a part number cannot be supplied individually.

■100A Srip ring

No.	List No. or Part No.	Description	Quantity	
			3P	4P
13	P1R405260	- Insulating collar	3	4
14	P1R411546	- Plate	1	1
23	KA20140600	- Hex. nut	6	8
24	KA20120600	- Hex. nut	6	6
27	KA31120600	- Spring washer	9	10
28	KA30220600	- Plain washer	6	6
29	KA30221000	- Plain washer	2	2
30	KA30240600	- Plain washer	9	12
—	LRP003397	Cable guide assembly (CS-27)	1	1
—	LRP003398	Cable guide assembly (CS-38)	1	1
15A	—	- Cable guide (CS-27)	1	1
15B	—	- Cable guide (CS-38)	1	1
18	P1R400510	- Seal ring	2	2
16	P1R301100	Dust proof cover	1	1
—	LRP003386	Dust proof spacer assembly	1	—
—	LRP003387	Dust proof spacer assembly	—	1
17	—	- Dust proof spacer	1	—
17	—	- Dust proof spacer	—	1
18	P1R400510	- Seal ring	1	1
21	P2H400112	Hex. cap screw	6	6
22	KA10530644	Cross recessed head screw	8	—
22	P1R411527	Cross recessed head screw	—	8
31	P1R302406	Seal washer	8	8
32	KA10130520	Machine screw	2	2
33	KA20130500	Hex. nut	2	2
34	KA31130500	Spring washer	2	2
35	KA30230500	Plate washer	2	2
36	P1R305075	Warning label	1	1

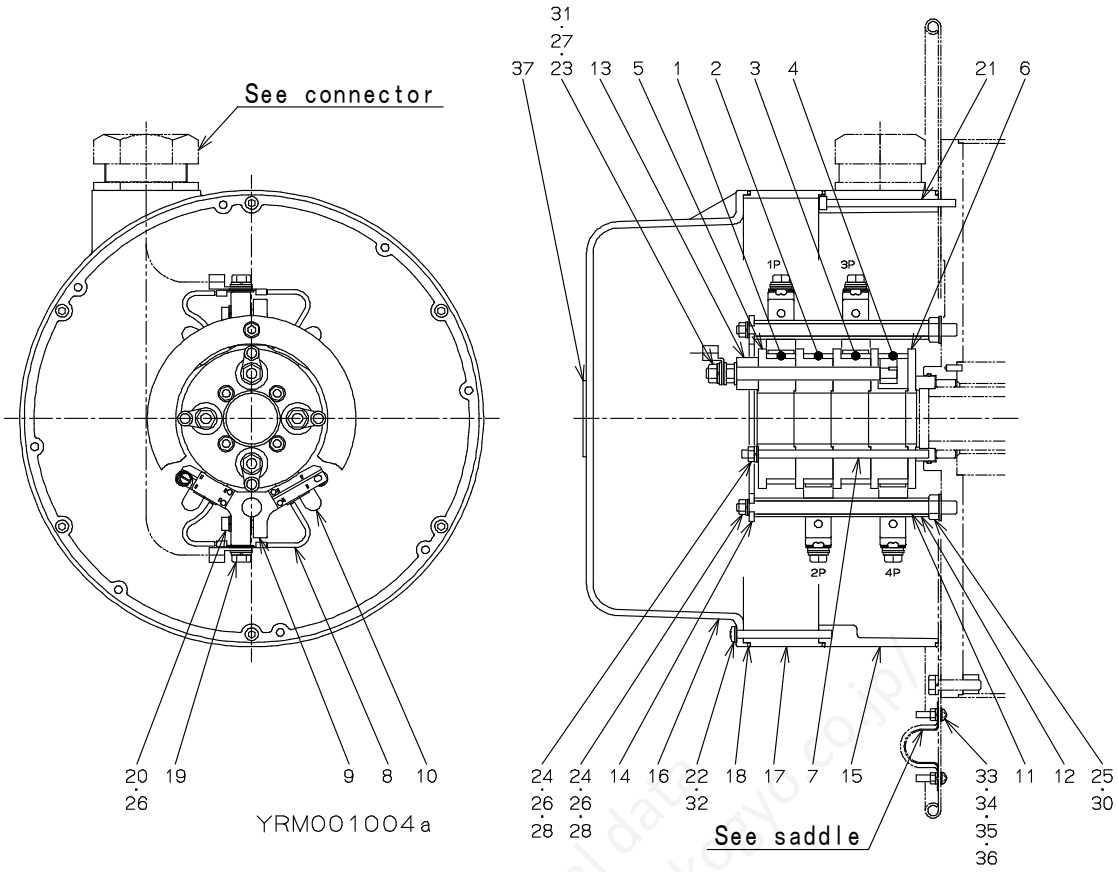
■100A Slip ring

(In case of reverse winding, replace corresponding parts with these parts.)

No.	List No. or Part No.	Description	Quantity	
			3P	4P
—	LRP003399	Cable guide assembly (CS-27)	1	1
—	LRP003400	Cable guide assembly (CS-38)	1	1
15A	—	- Cable guide (CS-27)	1	1
15B	—	- Cable guide (CS-38)	1	1
18	P1R400510	- Seal ring	2	2

Parts without a part number cannot be supplied individually.

■150A Slip ring



No.	List No. or Part No.	Description	Quantity	
			3P	4P
—	LRP003533	Slip ring assembly	1	—
—	LRP003534	Slip ring assembly	—	1
1	LRP003170	- Slip ring	1	1
2	LRP003171	- Slip ring	1	1
3	LRP003172	- Slip ring	1	1
4	LRP003173	- Slip ring	—	1
5	P1R301330	- Ring holder	3	4
6	P1R400479	- Ring cover	1	1
7	LRP003335	- Ring bolt	4	—
7	LRP003340	- Ring bolt	—	4
—	LRP003788	- Brush set	3	4
8	P1R411667	- - Brush	6	8
—	LRP003793	- - Brush holder set	3	4
9	LRP002193	- - - Brush holder	3	4
10	P1R300858	- - - Brush spring	18	24
20	KA00910630	- - - Hex. cap screw	3	4
26	KA31120600	- - - Spring washer	3	4
19	P1R407793	- - Hex. head bolt with washer	3	4

Parts without a part number cannot be supplied individually.

■150A Slip ring

No.	List No. or Part No.	Description	Quantity	
			3P	4P
11	LRP016940	- Brush bolt	2	—
11	LRP016949	- Brush bolt	—	2
12	—	- - Insulation pipe	2	2
25	KA20121000	- - Hex. nut	2	2
13	P1R401492	- Insulating collar	3	4
14	P1R411550	- Plate	1	1
23	KA20140800	- Hex. nut	6	8
24	KA20120600	- Hex. nut	6	6
26	KA31120600	- Spring washer	6	6
27	KA31120800	- Spring washer	3	4
28	KA30220600	- Plain washer	6	6
30	KA30221000	- Plain washer	2	2
31	KA30240800	- Plain washer	9	12
—	LRP003401	Cable guide assembly	1	1
15	—	- Cable guide	1	1
18	P1R400513	- Seal ring	2	2
16	P1R301323	Dust proof cover	1	1
—	LRP003391	Dust proof spacer assembly	1	—
—	LRP003392	Dust proof spacer assembly	—	1
17	—	- Dust proof spacer	1	—
17	—	- Dust proof spacer	—	1
18	P1R400513	- Seal ring	1	1
21	P2H400047	Hex. cap screw	6	6
22	KA10530642	Cross recessed head screw	8	—
22	P1R411528	Cross recessed head screw	—	8
32	P1R302406	Seal washer	8	8
33	KA10130520	Machine screw	2	2
34	KA20130500	Hex. nut	2	2
35	KA31130500	Spring washer	2	2
36	KA30230500	Plate washer	2	2
37	P1R305075	Warning label	1	1

Parts without a part number cannot be supplied individually.

■ACCESSORIES

Parts No.	Description	Size	Selection by cable diameter
LRP003421	Connector	CS－15	～φ14．5
LRP003422	Connector	CS－17	φ14．6～φ16．5
LRP003423	Connector	CS－20	φ16．6～φ19．5
LRP003424	Connector	CS－23	φ19．6～φ22．0
LRP003425	Connector	CS－27	φ22．1～φ26．0
LRP003426	Connector	CS－30	φ26．1～φ29．0
LRP003427	Connector	CS－34	φ29．1～φ33．0
LRP003428	Connector	CS－38	φ33．1～φ37．0
LRP003429	Connector	CS－43	φ37．1～φ41．5
LRP003430	Connector	CS－48	φ41．6～φ46．5

Parts No.	Description	Size	Remarks
P1R400219	Connector bush	M22×M27	
P1R402696	Connector bush	M22×M32	
P1R400220	Connector bush	M27×M32	
P1R400221	Connector bush	M27×M35	
P1R400222	Connector bush	M32×M35	
P1R400223	Connector bush	M27×M40	
P1R402697	Connector bush	M32×M40	
P1R400224	Connector bush	M35×M40	
P1R402698	Connector bush	M32×M45	
P1R400225	Connector bush	M35×M45	
P1R400226	Connector bush	M40×M45	
P1R400634	Connector bush	M22×M50	
P1R400635	Connector bush	M27×M50	
P1R400636	Connector bush	M32×M50	
P1R400227	Connector bush	M35×M50	
P1R400637	Connector bush	M40×M50	
P1R400228	Connector bush	M45×M50	
P1R401903	Connector bush	M50×M56	

Parts No.	Description	Size	Selection by cable diameter
P1R411610	Saddle	9 （SUS）	～φ10．0
P1R411611	Saddle	13 （SUS）	φ10．1～φ13．0
P1R411612	Saddle	15 （SUS）	φ13．1～φ16．0
P1R411613	Saddle	19 （SUS）	φ16．1～φ19．0
P1R411614	Saddle	16 （SUS）	φ19．1～φ22．0
P1R411615	Saddle	25 （SUS）	φ22．1～φ25．0
P1R411616	Saddle	22 （SUS）	φ25．1～φ27．0
KA90233100	Saddle	31 （SUS）	φ27．1～φ31．0
KA90232800	Saddle	28 （SUS）	φ31．1～φ34．0
KA90233900	Saddle	39 （SUS）	φ34．1～φ39．0
KA90233600	Saddle	36 （SUS）	φ39．1～φ42．0
KA90234200	Saddle	42 （SUS）	φ42．1～φ48．0
KA90235100	Saddle	51 （SUS）	φ48．1～φ51．0

ENDO KOGYO CO., LTD.

Head Office: 3-14-7, Akiba-cho, Tsubame, Niigata, Japan
Tel. 0256-62-5133 Fax. 0256-62-5772

Tokyo Office: JBSL Kanda Bldg., 2F, 12-2, Kanda Higashimatushita-cho, Chiyoda-ku, Tokyo Japan
Tel. 03-5295-3711 Fax. 03-5295-3717

Osaka Office: Daito Bldg., 3F, 3-14, Saiwai-cho 2-chome, Naniwa-ku, Osaka, Japan
Tel. 06-6568-1571 Fax. 06-6568-1573

Nagoya Office: Park IM Bldg., 3F, 1-7-14, Osu, Naka-ku, Nagoya, Aichi, Japan
Tel. 052-253-6231 Fax. 052-253-6240

Kyusyu Office: Bunki Bldg., 3F, 11-15, Hakataekihigashi 3-chome, Hakata-ku, Fukuoka, Japan
Tel. 092-412-5281 Fax. 092-412-5280

URL http://www.endo-kogyo.co.jp