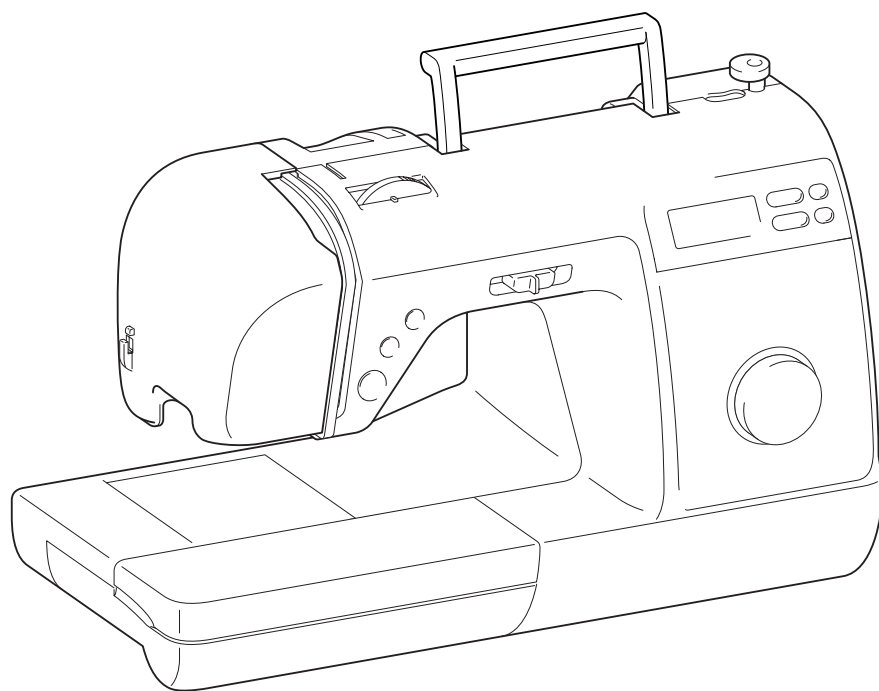


brother®

SERVICE MANUAL FOR COMPUTERIZED SEWING MACHINE



***NS-40/INV-30/ML-750
NS-30/NS-30LE
JS-70E/NS-20/INV-20LE/INV-20***

CONFIDENTIAL

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7.2007.
9.2010.

GENERAL INFORMATION

This service manual has been compiled for explaining repair procedures of this MODEL.

This was produced based on up-to-date product specifications at the time of issue, but there may have been changes of specifications for the purpose of improvements.

Contact manufacturer or local sales company for information concerning such changes.

Brother Industries, Ltd.
Nagoya, Japan

CAUTION <To do the adjustment and the repair safely and surely, follow the instructions below. >

1. Do the adjustment and the repair according to operation procedure of this service manual.
2. When you attach or remove parts, turn off a power switch and then pull out a power supply plug from outlet.
3. When you replace parts, use regular parts.
4. Do not remodel a sewing machine.
5. Always use earth band when handling printed circuit boards to exclude damage of printed circuit boards by static electricity.
6. Pack printed circuit boards in antistatic packaging and avoid subjecting them to any from of impact during storage or transportation.
7. Do not touch or damage the metal portion of a printed circuit board with a screwdriver or any other tool while making repairs or the like.
8. Insert removed connectors into the proper position according to special instructions of wiring for this service manual at the repair, the adjustment and replace printed circuit boards.
9. When you remove a connector from printed circuit boards, remove it while having a connector part.
(When you pull out a connector while having a lead wire part, there is a risk that a lead wire get broken.)
10. Do not damage lead wires, when you cut a band that bind up lead wires.

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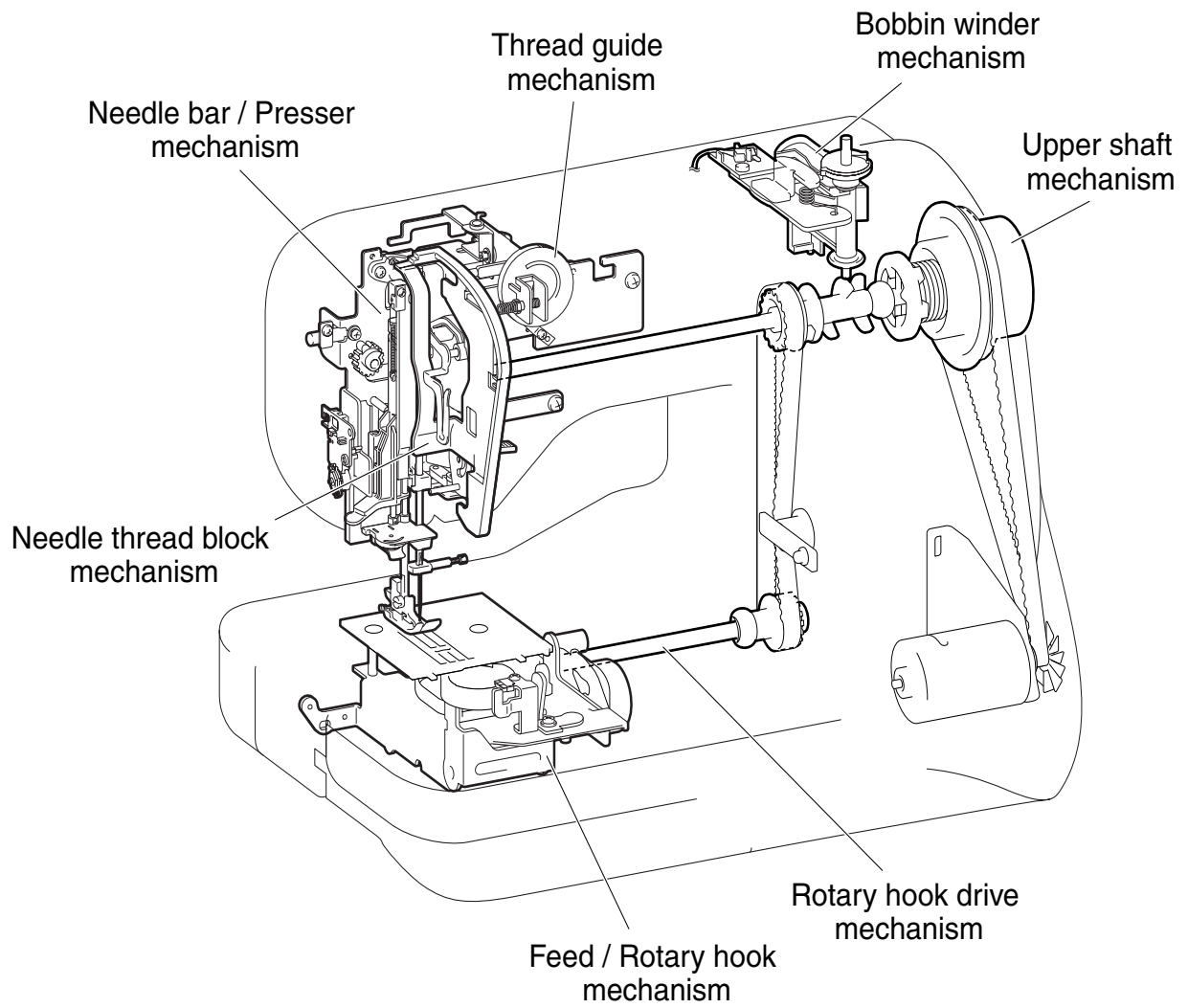
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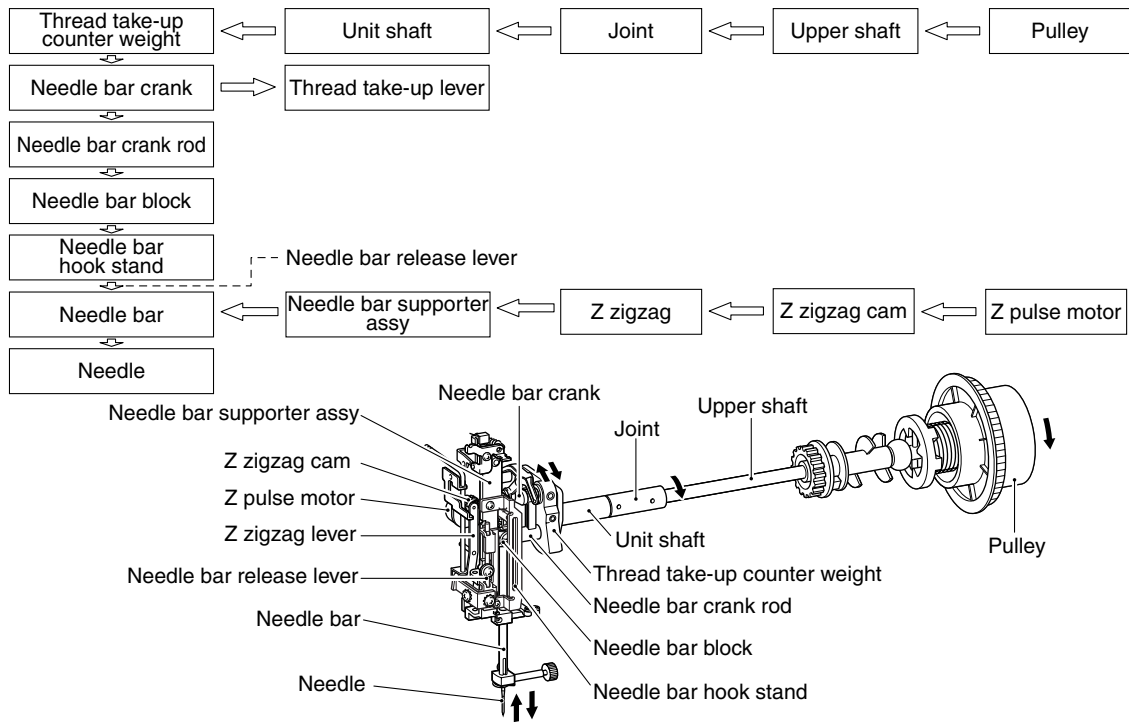
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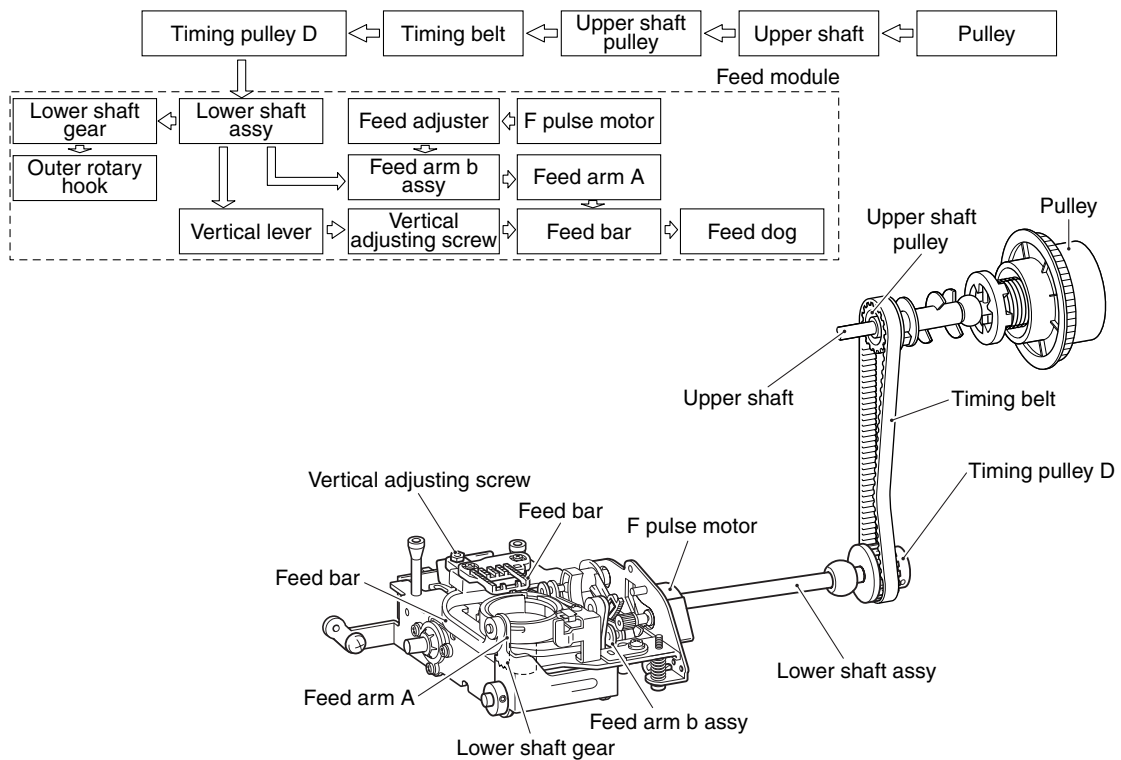
Main body



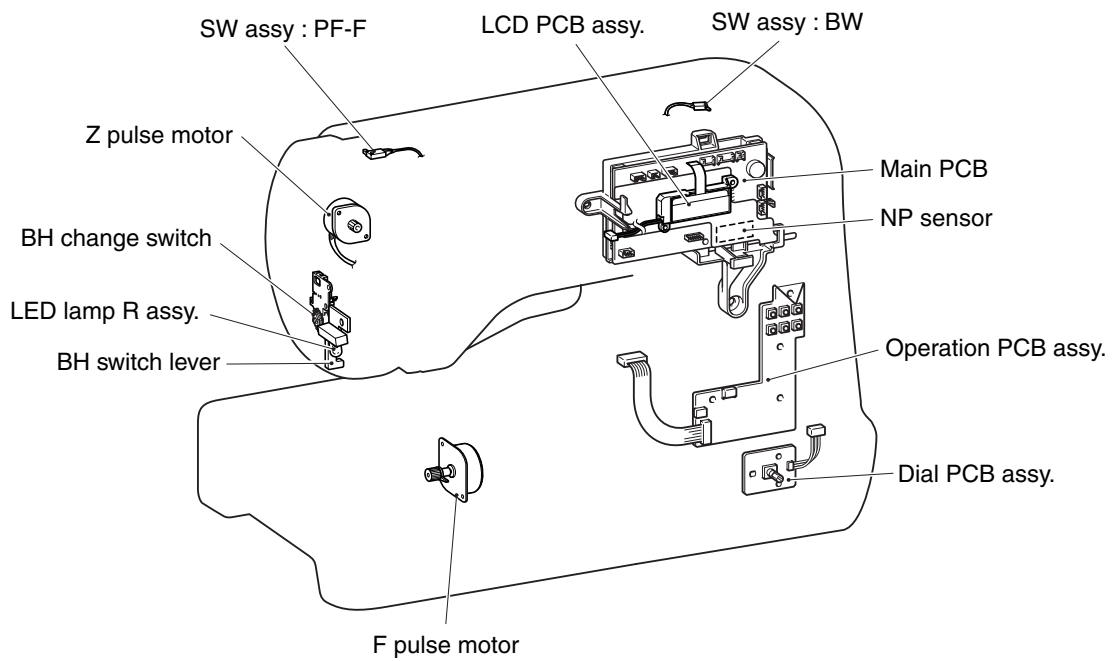
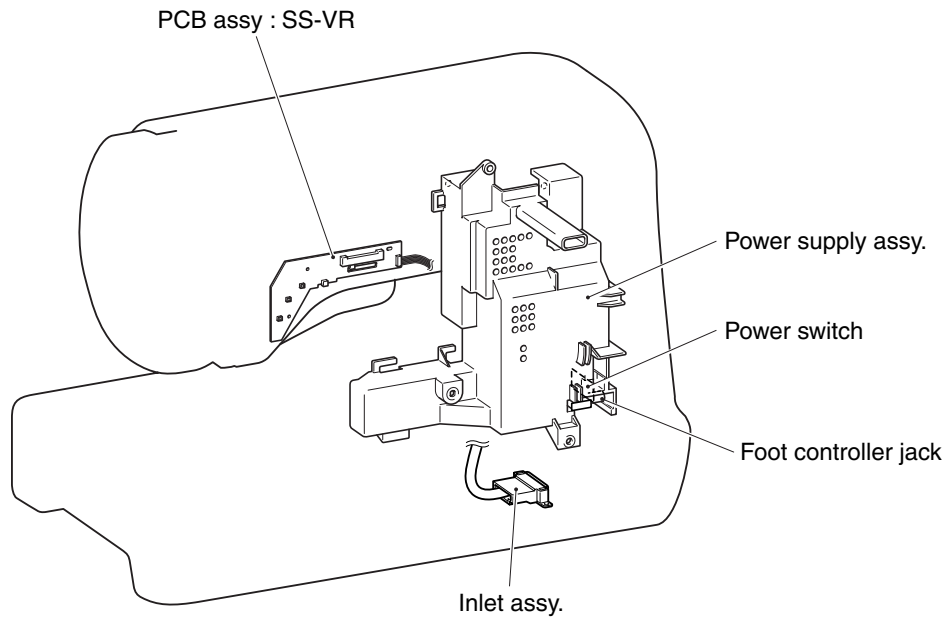
A) Up and down movement of needle bar, movement of thread take-up lever and zigzag mechanism

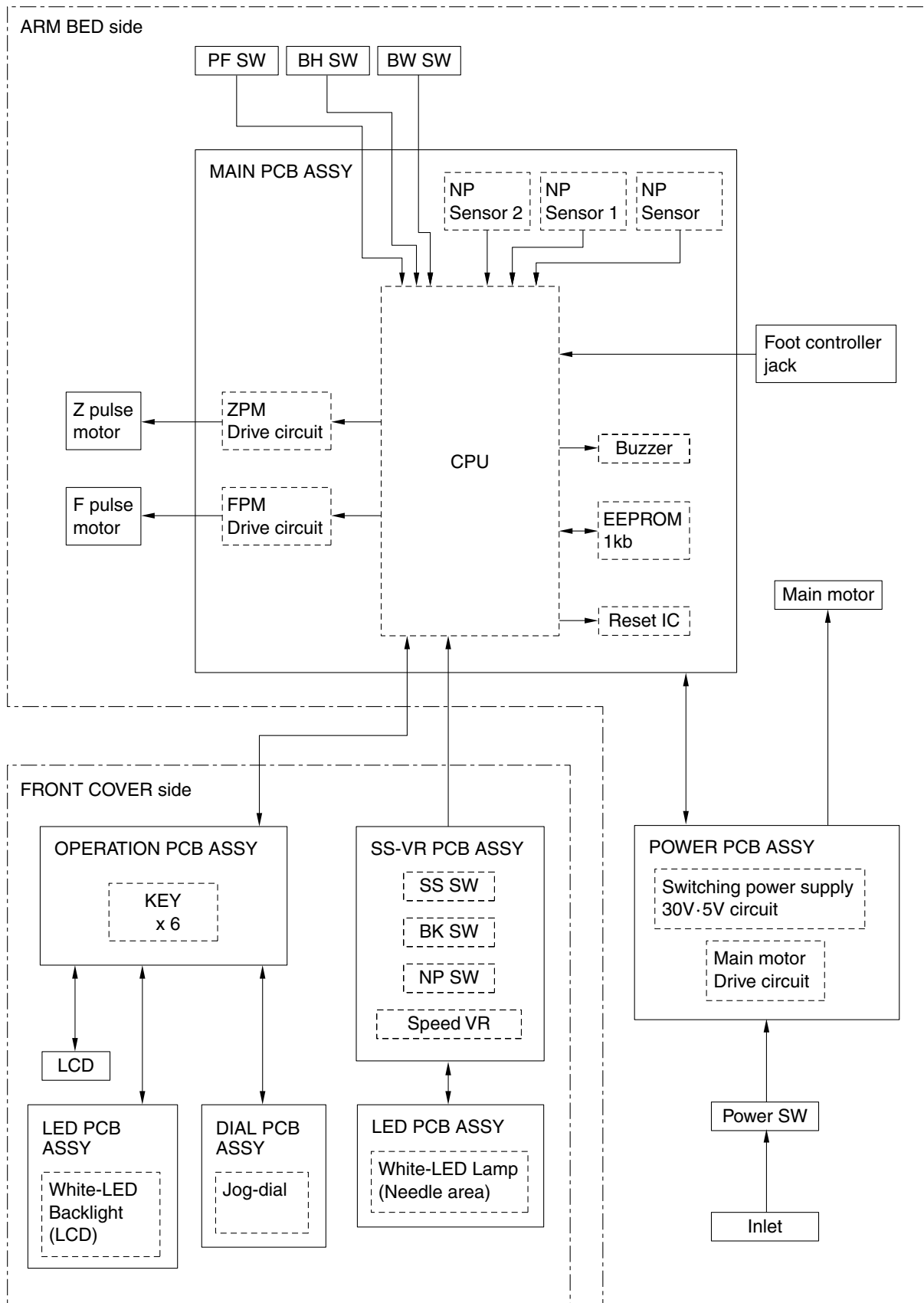


B) Movement of feed dog and bobbin



Main body





Start/Stop (SS) Switch	Switch for starting and stopping the sewing machine. The machine operates at a slow speed while the switch is being held down.
Reverse switch	This switch is for backtracking or ending a seam. If the switch is pushed, it makes three to four stitches in that place and stops automatically. If the switch is held down, it sews at a slow speed in the reverse direction as long as the switch is held.
Raise needle switch	This switch toggles the needle between the up and down positions.
Operation PCB assembly	Input for pattern selection and other conditions necessary for sewing.
BH (button hole) switch	This switch is for detecting the forward and rear ends of the button hole according to the BH presser and lever.
BH (button hole) lever switch	This switch detects whether the BH lever is up or down.
NP sensor	This sensor detects the drive timing for the pulse motor for zigzagging and feed, the vertical stop position for the needle. It detects the upper shaft angle of rotation using a shutter attached to the upper shaft and an optical sensor.
Speed sensor	This sensor detects the rotational speed of the main motor. It detects the upper shaft rotational speed using a shutter attached to the upper shaft and an optical sensor.
Presser switch	This switch detects the vertical position of the presser foot lifter.
BW (bobbin winder) switch	When the bobbin thread is wound, this switch detects whether the bobbin is set for winding or not.
Foot control jack	This is the jack for plugging in the foot controller when it is used.
LED lamp R Assy	White LED lamps for illuminating the work space.

The threader provided on this sewing machine is a device for making threading easy, but there are cases where it cannot be used because of the combination of sewing machine thread and needle type.

At present, there are various types of sewing machine thread and sewing machine needles on the market for handling a variety of sewing conditions. Not only may it be impossible to carry out the threading operation due to the combination, but also there is a danger of damaging the threader. Be sure to check the combinations for which it can be used, those for which it cannot and those for which it can but which do not give full performance in the following table to deal with customer claims.

<Cautions>

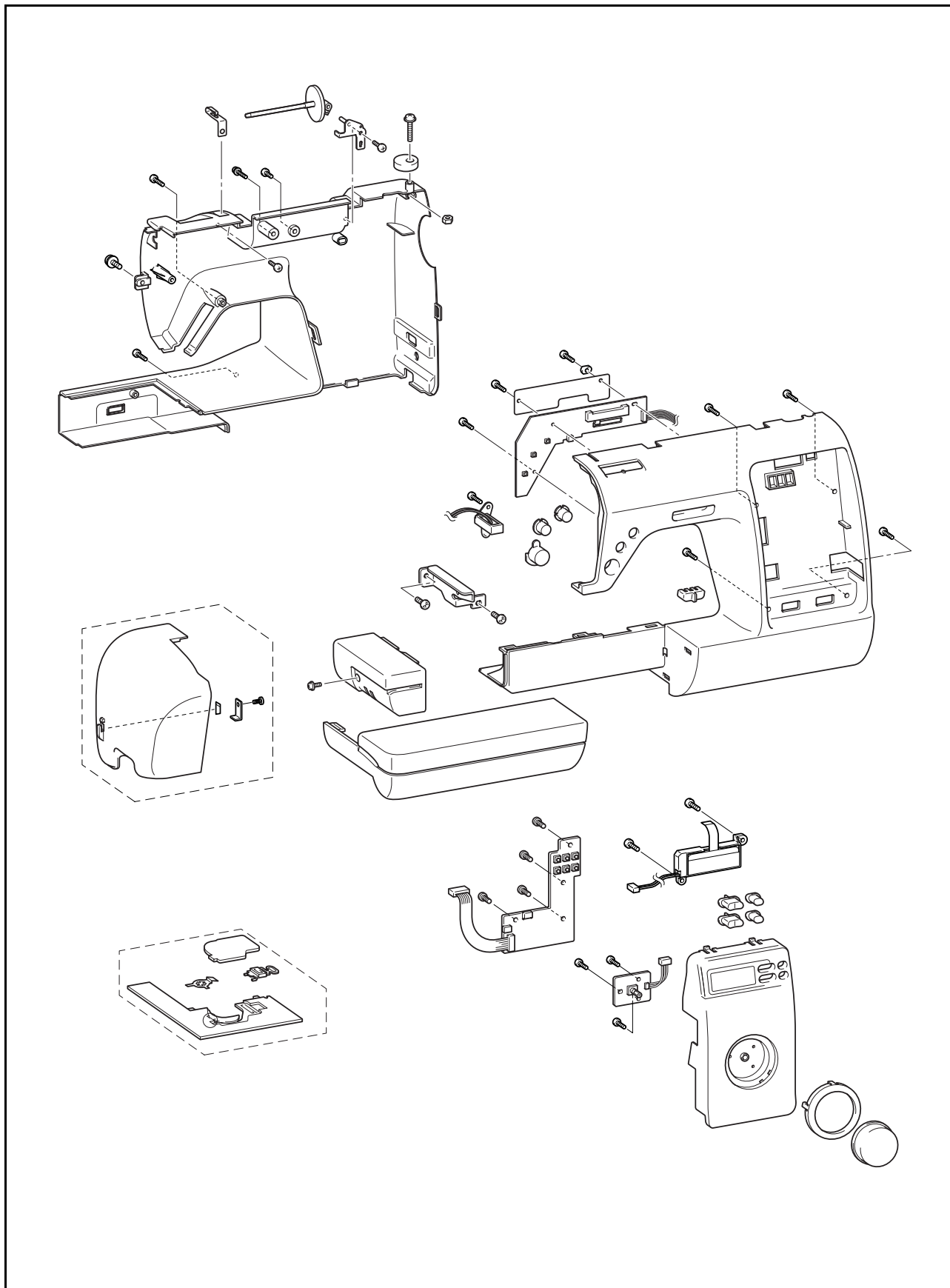
1. The threader cannot be used with sewing machine thread and needle combinations that are not in the table or those marked with an x.
2. Since combinations marked with an asterisk have a greater possibility of damaging the threader or not working properly, do your best to encourage users to avoid them.
3. When using the threader, lower the presser.
4. Do not turn the pulley while using the threader.
5. To not push the needle thread lever down when the sewing machine is in use. Not only could the threader be damaged, but this could be a cause of needle breakage and injury.
6. When a #9 sewing machine needle is used, threading may be difficult. (This is caused by variations in needle precision.)
7. If the needle tip is less than 8 mm from the upper surface of needle plate A, threading may not be possible.
8. When a side cutter is being used, the threader cannot be used. Perform the threading operation before attaching the side cutter.

Thread size Needle size	# 30	# 50	# 60	# 80	# 100	# 120
#9	×	×	×	○	○	○
#11	×	○	○	○	○	※
#14	×	○	○	○	※	※
#16	※	○	○	※	※	※
#18	※	※	※	※	※	※

2 Disassembly

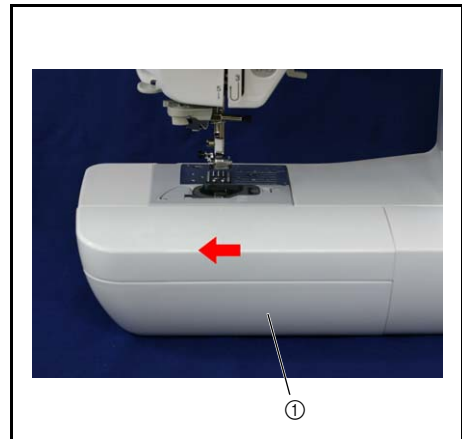
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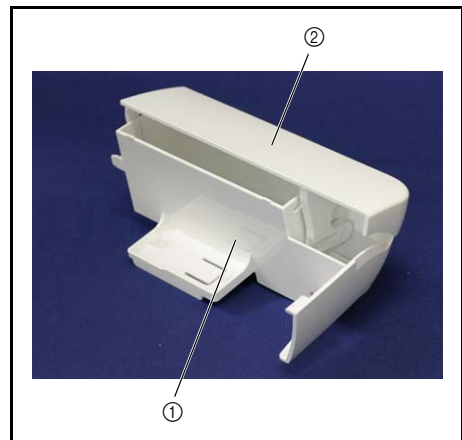


1 Removal of Accessory table

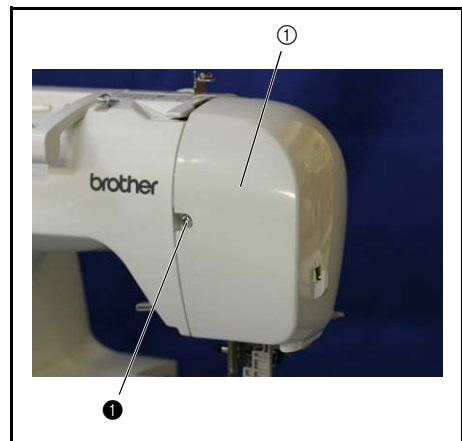
1. Remove the accessory table ①.

**1-1 Disassembly of Accessory table**

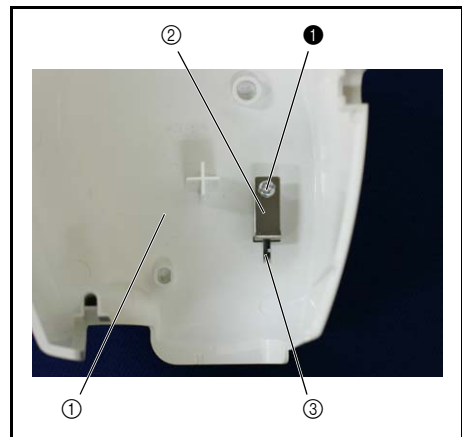
1. Remove the accessory table door ② from the accessory table ①.

**2 Removal of Face plate assy.**

1. Remove the screw ①, and then remove the face plate assy. ①.

**2-1 Disassembly of Face plate assy.**

1. Remove the screw ①, and then remove the face plate cutter holder ② from the face plate assy. ①.
2. Remove the NT lower thread cutter ③ from the face plate assy.

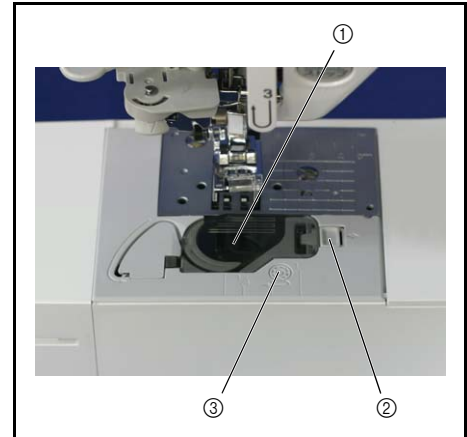


3 Removal of Needle plate B Assy.

1. Remove the needle plate cover ①.

***Key point**

- Slide the slide button ②, and then remove it.
2. Remove the needle plate B Assy. ③.

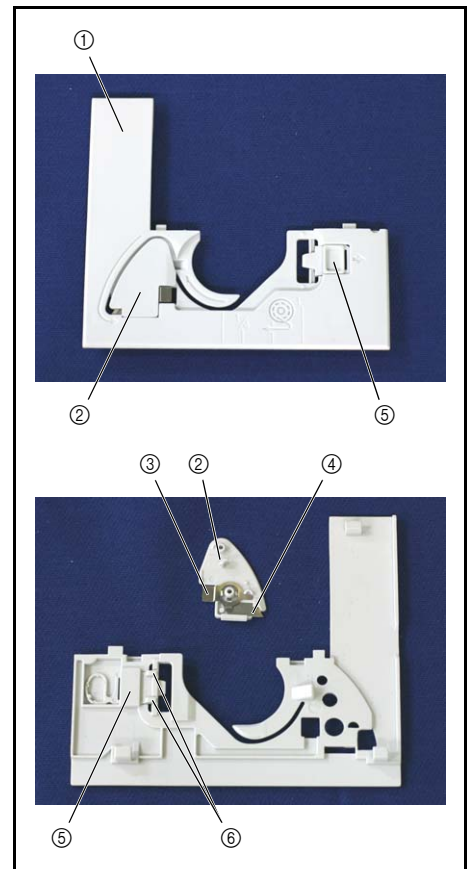


3-1 Disassembly of Needle plate B Assy.

1. Remove the cutter cover ② from the needle plate B Assy. ①.
2. Remove the spring plate ③ from the cutter cover ②, and then remove the NT lower thread cutter ④.
3. Remove the slide button ⑤ from the needle plate B Assy. ①.

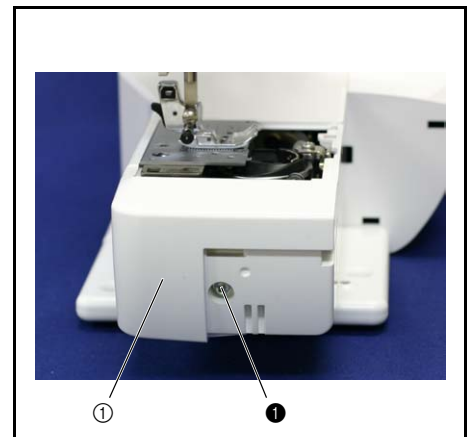
***Key point**

- Remove the hooks ⑥ (2 locations) from the backside of the needle plate B Assy. ①.



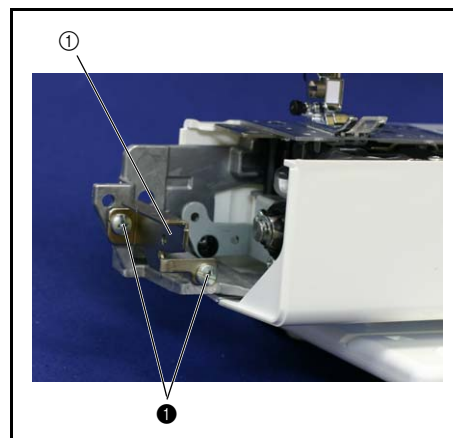
4 Removal of Free arm cover

1. Remove the screw ①, and then remove the free arm cover ① from the free arm plate.

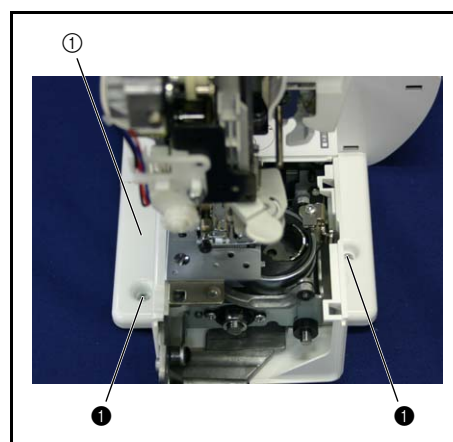


5 Removal of Free arm plate

1. Remove the 2 screws ❶, and then remove the free arm plate ❶.

**6** Removal of Base plate cover

1. Remove the 2 screws ❶, and then remove the base plate cover ❶ from the base plate.

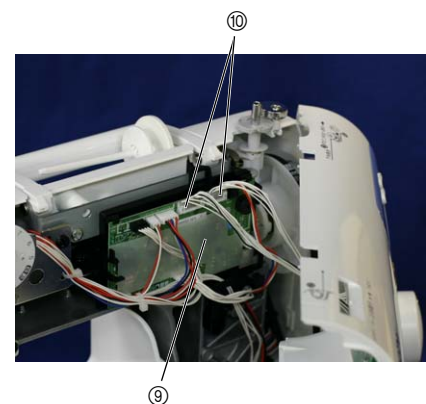
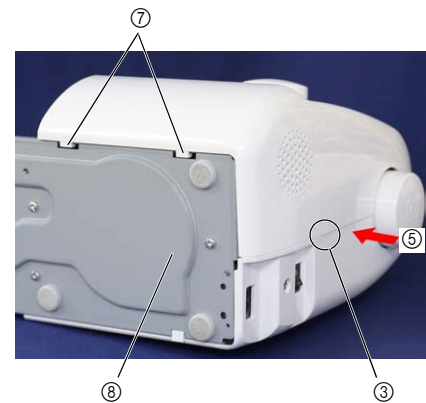
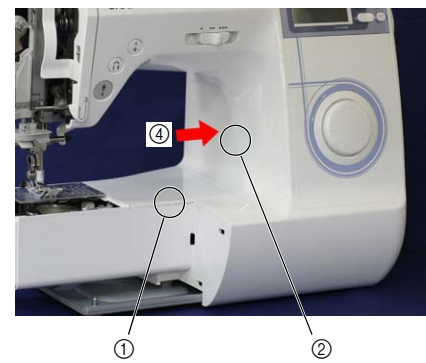
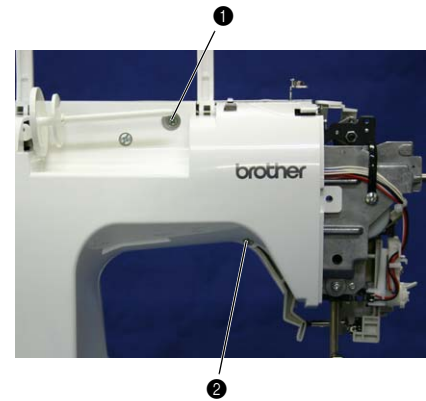


7 Removal of Front cover assy.

1. Remove the screw ① and ②.
2. Remove the hook ① of the front cover assy., and then remove the hooks ② and ③ while pushing the parts of ④ and ⑤ (Rear cover side)

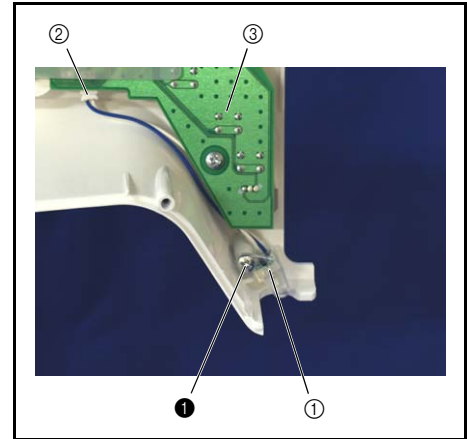
*Key point

- Be careful not to damage the hooks.
3. Remove the 2 hooks ⑦ from the base plate ⑧ while sliding the front cover assy. to the right.
 4. Remove the 2 connectors ⑩ from the main PCB assy. ⑨, and then remove the front cover assy.

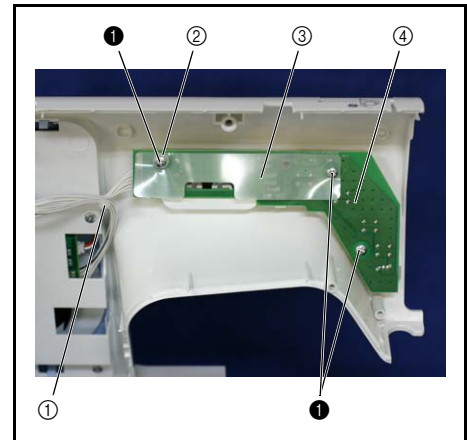


7-1 Disassembly of Front cover assy. (Removal of LED lamp-R)

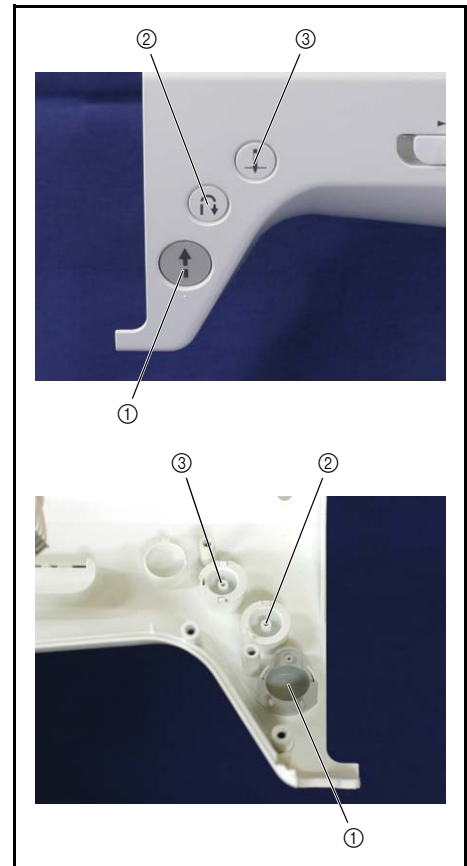
1. Remove the connector ② of the LED lamp-R ① from the SSVR PCB Assy. ③.
2. Remove the screw ①, and then remove the LED lamp-R ①.

**7-2 Disassembly of Front cover assy. (Removal of SSVR PCB assy.)**

1. Cut the band ①.
2. Remove the 3 screws ①, and then remove the board presser ②, the insulator sheet ③ and the SSVR PCB assy. ④.

**7-3 Disassembly of Front cover assy. (Removal of Buttons)**

1. Remove the SS button ①, the reverse button ②, and the NP button ③ from the front cover assy.

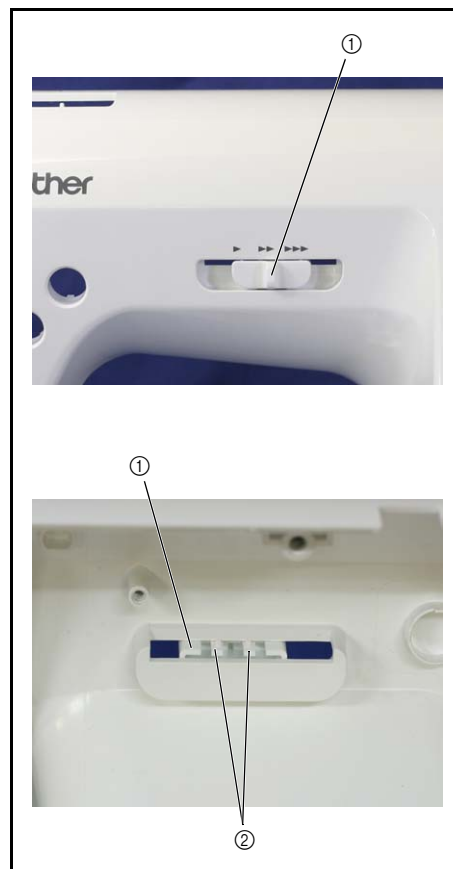


7-4 Disassembly of Front cover assy. (Removal of SV key top)

1. Remove the SV key top ① from the front cover assy.

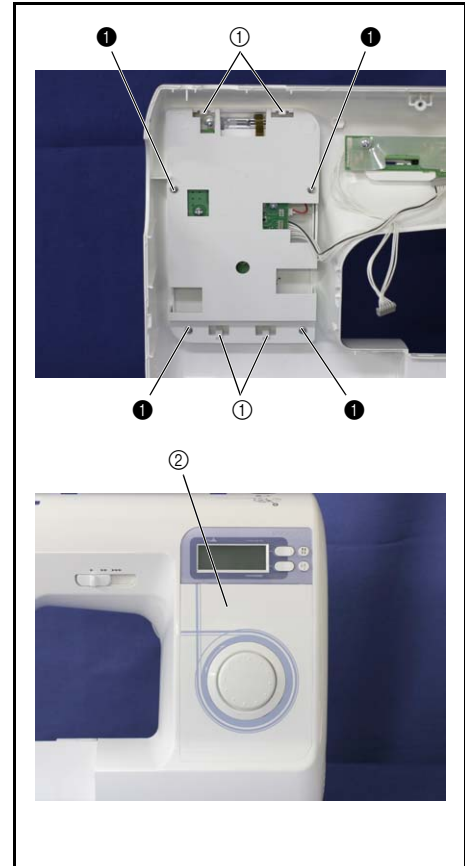
***Key point**

- Undo the hooks ② (2 locations) from the backside of the front cover assy.

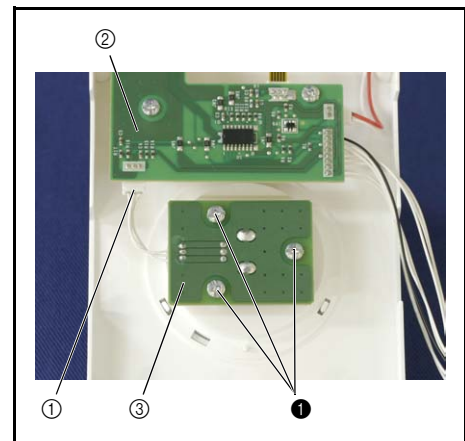


8 Removal of Selecting panel M Assy.

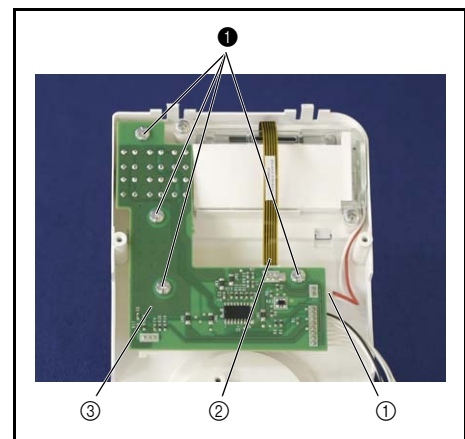
1. Remove the 4 screws ❶.
2. Push up the hooks ❶ (4 locations) from the backside of the front cover Assy., and then remove the selecting panel M Assy. ❷.

**8-1** Disassembly of Selecting panel M Assy. (Removal of Dial PCB Assy. M1YM)

1. Remove the connector ❶ from the operation PCB Assy. ❷.
2. Remove the 3 screws ❶, and then remove the dial PCB Assy. ❸ from the selecting panel M Assy.

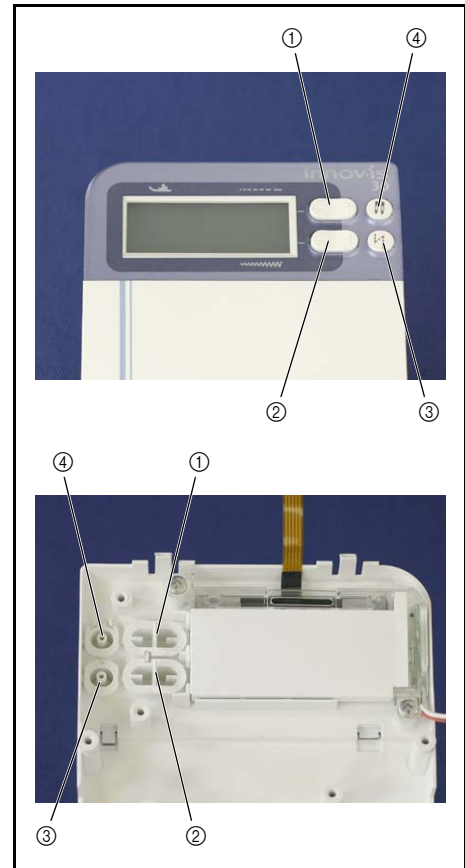
**8-2** Disassembly of Selecting panel M Assy. (Removal of Operation PCB Assy. M1YM)

1. Remove the connector ❶ and the FFC ❷ from the operation PCB Assy. M1YM ❸.
2. Remove the 4 screws ❶, and then remove the operation PCB Assy. M1YM ❸ from the selecting panel M Assy.

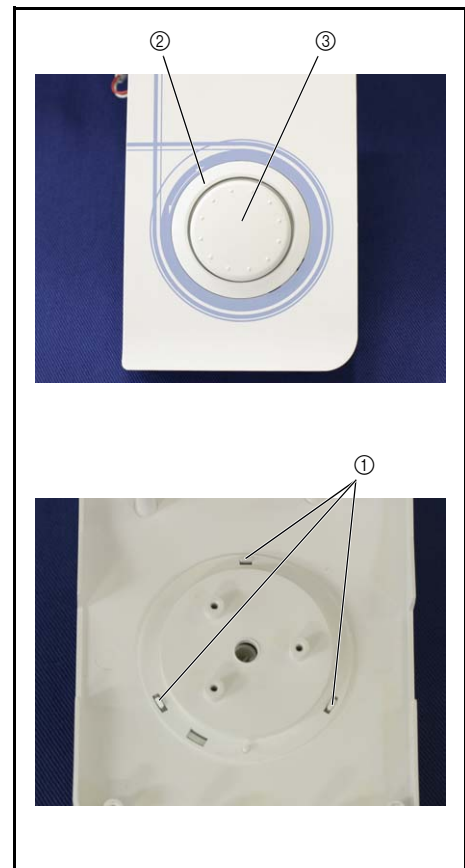


8-3 Disassembly of Selecting panel M Assy. (Removal of Buttons)

1. Remove the feed adjusting button ①, the adjusting button ②, the reinforcement stitch button ③ and the twin needle button ④ from the selecting panel M Assy.

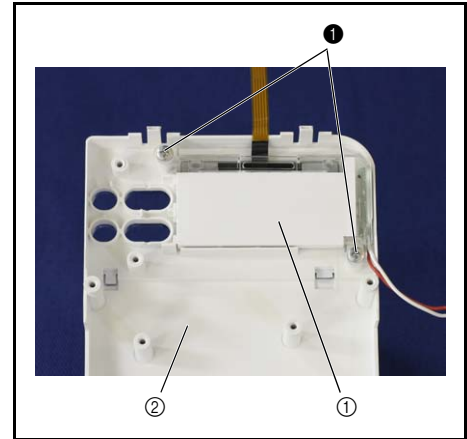
**8-4 Disassembly of Selecting panel M Assy. (Removal of Selecting dial M)**

1. Remove the hooks ① (3 locations), and then remove the dial decoration plate M ② from the selecting panel M Assy.
2. Remove the selecting dial M ③ from the selecting panel M Assy.



8-5 Disassembly of Selecting panel M Assy. (Removal of Single light guide Assy.)

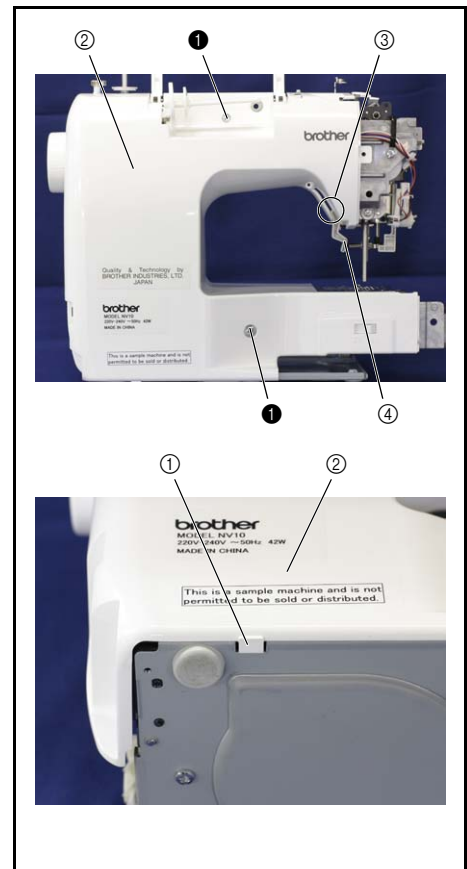
1. Remove the 2 screws ❶, and then remove the single light guide Assy. ❶ from the selecting panel M Assy. ❷.

**9** Removal of Rear cover Assy.

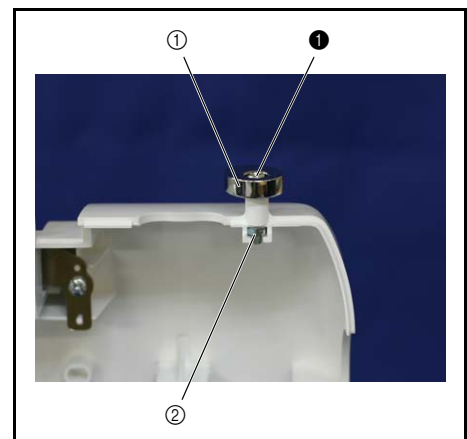
1. Remove the 2 screws ❶.
2. Remove the hook ❶, and then remove the rear cover Assy. ❷ from the arm bed.

***Key point**

- Check that the section ❸ get over the presser lever ❹.
- Be careful not to break the wing of the motor fan.

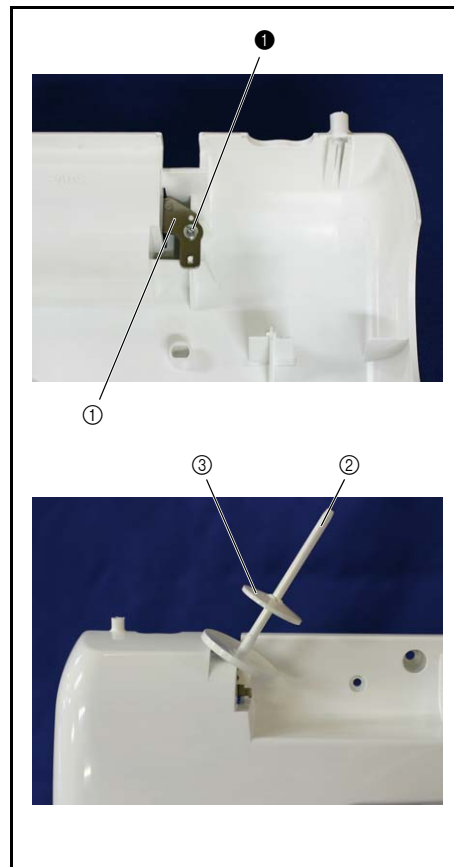
**9-1** Disassembly of Rear cover Assy. (Removal of Bobbin presser)

1. Remove the screw ❶, and then remove the bobbin presser ❶ and the nut 1 M3 ❷.

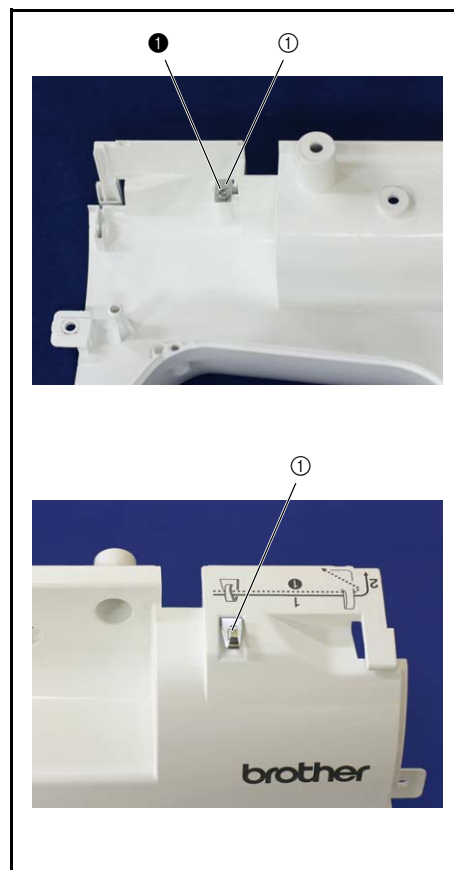


9-2 Disassembly of Rear cover assy. (Removal of Spool pin)

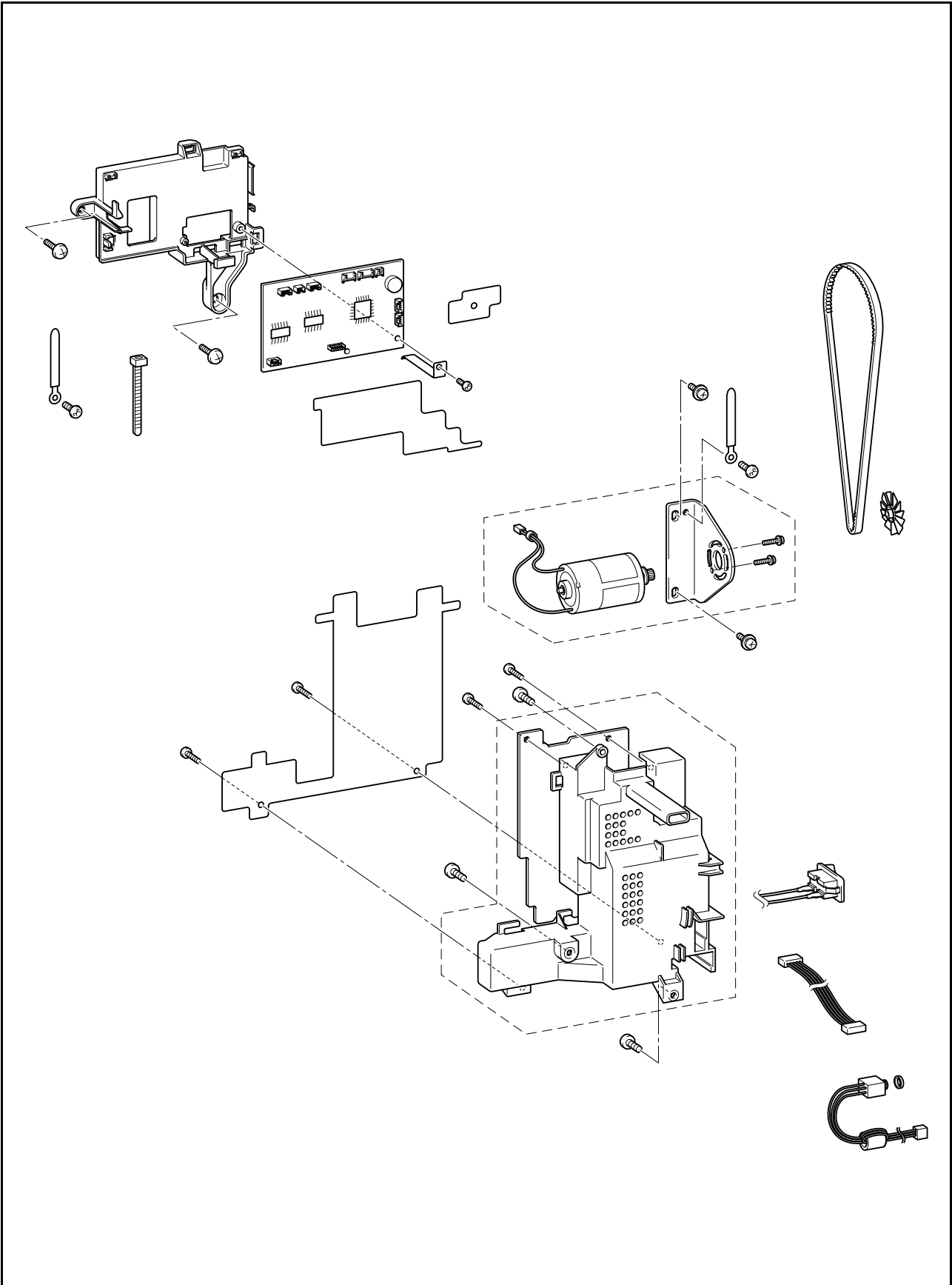
1. Remove the screw ❶, and then remove the spool pin holder assy. ❶ from the rear cover assy.
2. Remove the spool pin ❷ from the shaft of the spool pin holder assy. ❶.
3. Remove the spool presser ❸ from the spool pin ❷.

**9-3 Disassembly of Rear cover assy. (Removal of Thread guide supporting plate)**

1. Remove the screw ❶, and then remove the thread guide supporting plate ❶ from the rear cover assy.

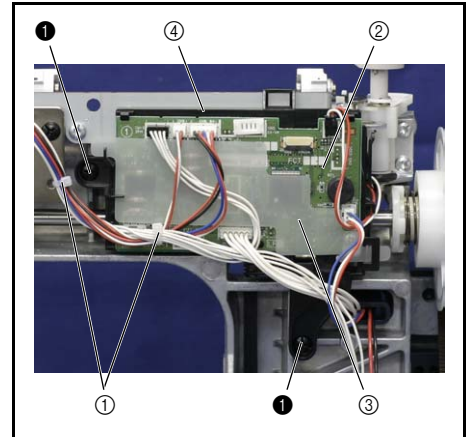


Electrical parts and motors location diagram



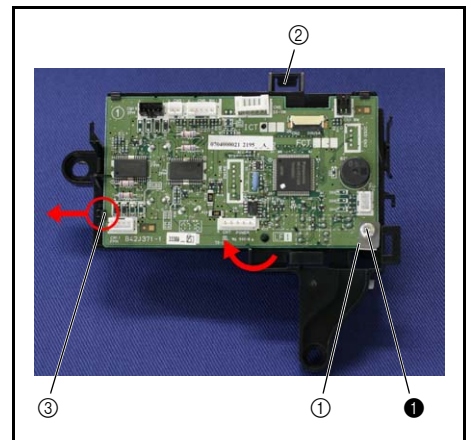
1 Removal of Shutter cover

1. Cut the 2 bands ①.
2. Unplug all of the connectors on the motor PCB assy. ②, and then remove the insulator sheet ③.
3. Remove the 2 screws ①, and then remove the shutter cover ④ from the arm bed.



1-1 Disassembly of Shutter cover (Removal of Main PCB assy.)

1. Remove the screw ①, and then remove the main PCB plate spring ① from the shutter cover ②.
2. Remove the main PCB assy. from the shutter cover while pushing the hook ③ to the left.

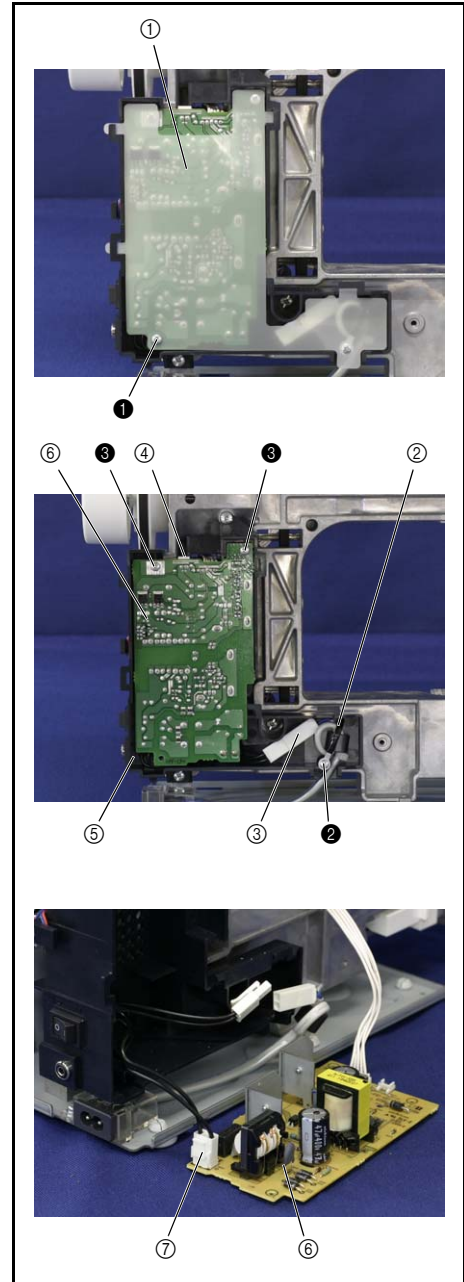


2 Removal of Power supply assy.

1. Remove the screw ①, and then remove the insulator sheet ①.
2. Remove the screw ②, and then remove the coaching clip ②.
3. Disconnect the connectors ③ and ④.
4. Remove the 2 screws ⑤, and then remove the power supply assy. ⑥ from the insulation cover ⑤.
5. Disconnect the connector ⑦ of the PWSW assy. and the connector ⑧ of the power lead wire assy. from the power supply assy. ⑥.

***Note**

- The right photographs are “NV30”.

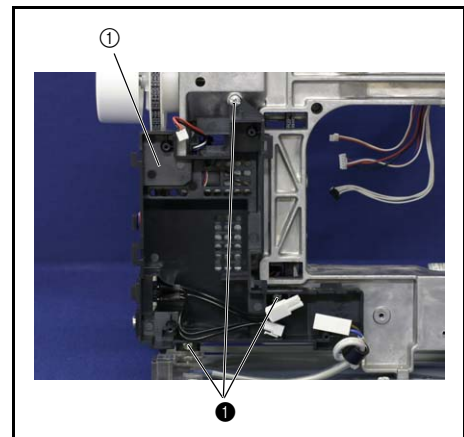


3 Removal of Insulation cover

1. Remove the 3 screws ①, and then remove the insulation cover ① from the arm bed.

***Note**

- The right photograph is “NV30”.

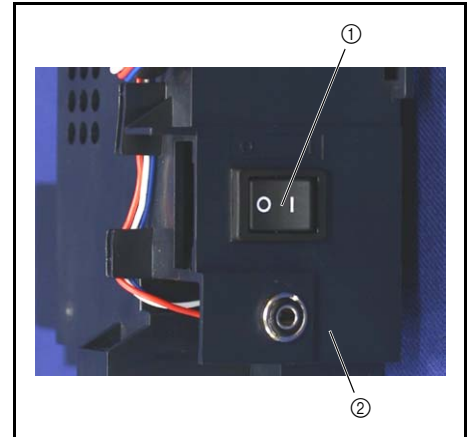


4 Removal of PWSW Assy.

1. Remove the PWSW Assy. ① from the insulation cover ②.

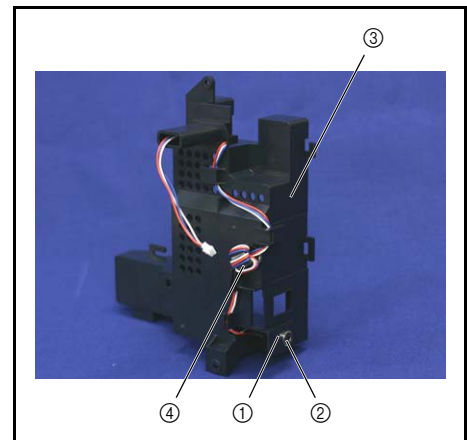
***Key point**

- Remove it from the backside of the insulation cover ② while pushing the hooks (2 locations).



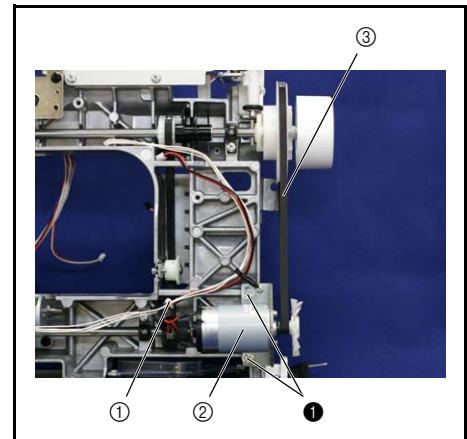
5 Removal of Pin jack Assy.

1. Remove the nut ①, and then remove the pin jack Assy. ② from the insulation cover ③.
2. Remove the ferrite core ④ from the lead wire of the pin jack Assy. ②.



6 Removal of Main motor sub Assy.

1. Cut the band ①.
2. Remove the 2 screws ①, and then remove main motor sub Assy. ② from the arm bed.
3. Remove the T belt ③.

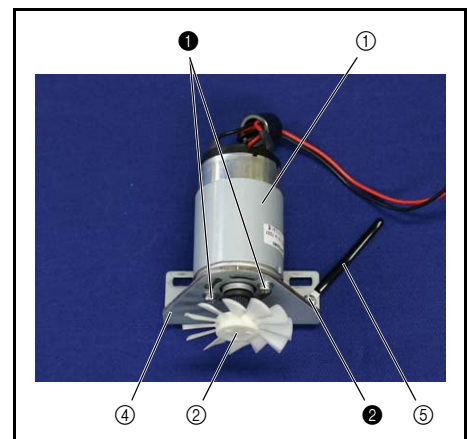


6-1 Disassembly of Main motor sub Assy.

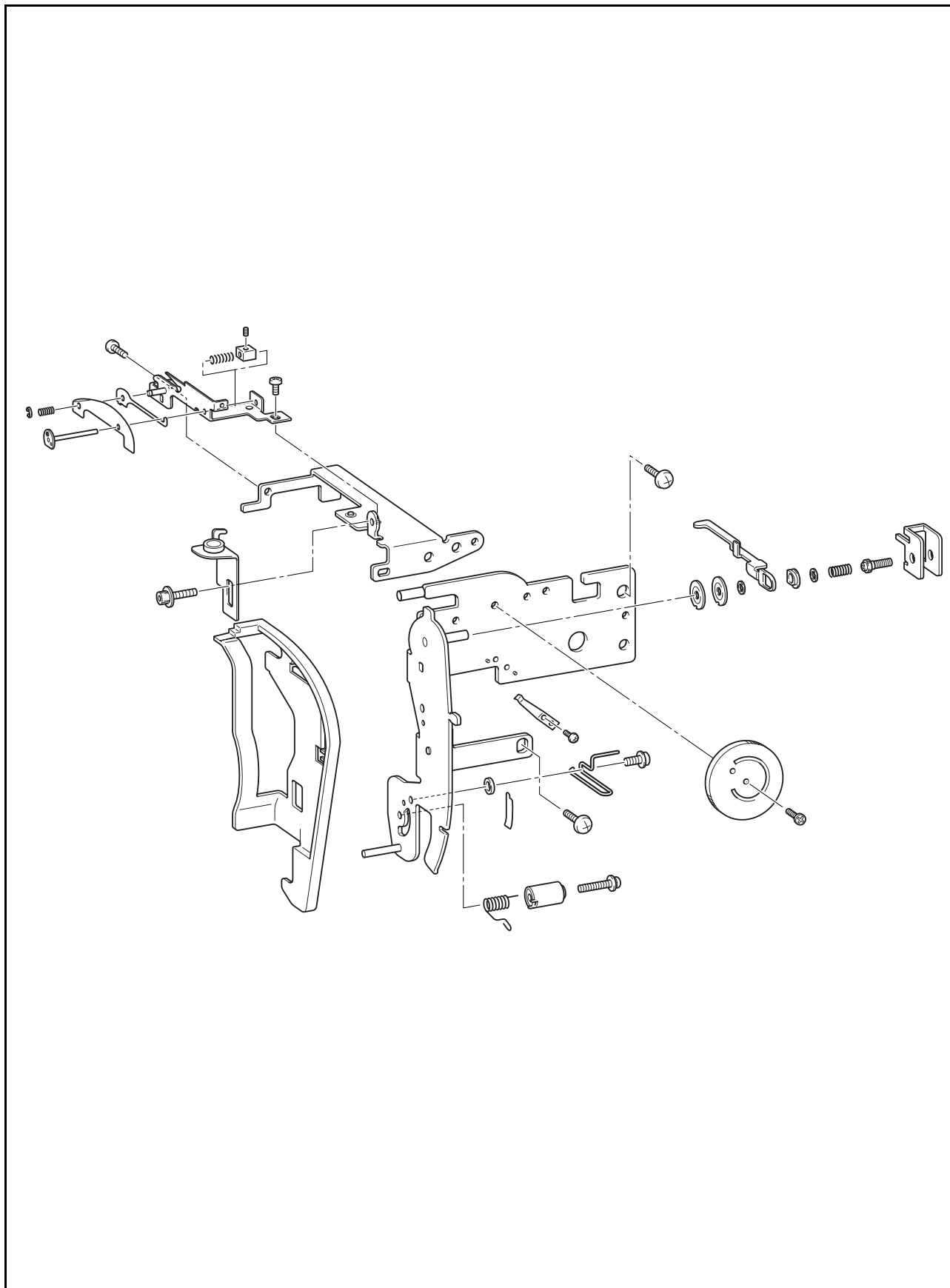
1. Remove the motor fan ② from the main motor sub Assy. ①.
2. Remove the 2 screws ①, and then remove the main motor sub Assy. ① from the motor holder ④.
3. Remove the screw ②, and then remove the coaching clip ⑤ from the motor holder ④.

***Key point**

- Be careful not to break the wing of the motor fan ②.

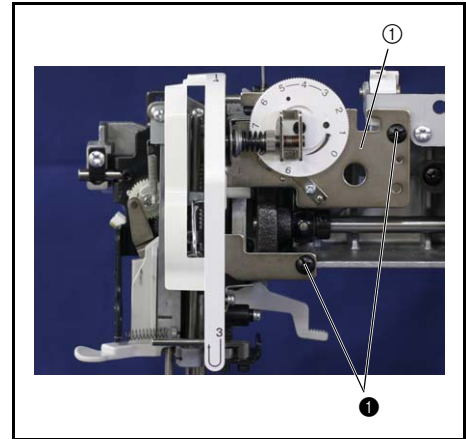


Thread tension mechanism location diagram



1 Removal of Thread unit L

1. Remove the 2 screws ❶, and then remove the thread unit L ❶ from the arm bed.

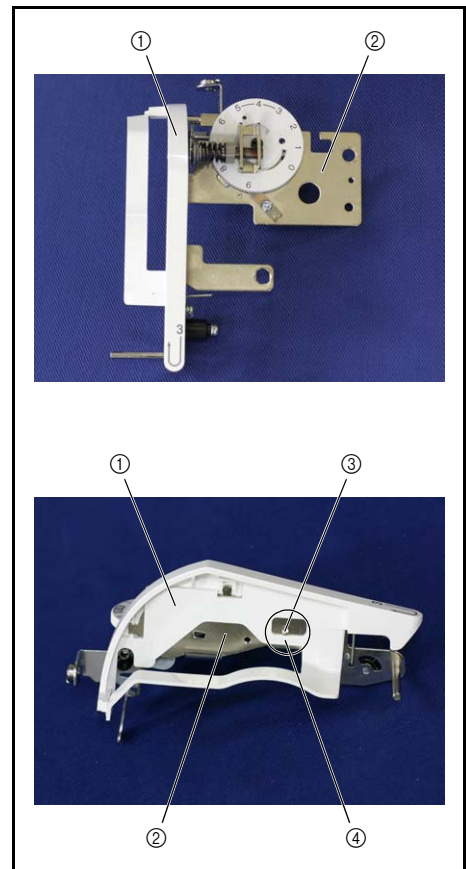


1-1 Disassembly of Thread unit L (Removal of Thread guard cover)

1. Remove the thread guard cover ❶ from the thread unit L ❷.

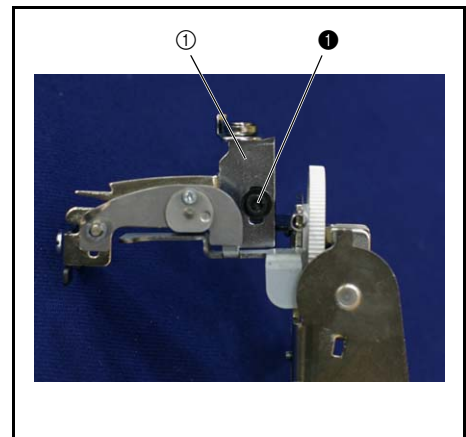
***Key point**

- Remove it while lifting the section ❹ of the thread guard cover ❶ to get over the boss ❸ of the thread unit L ❷.



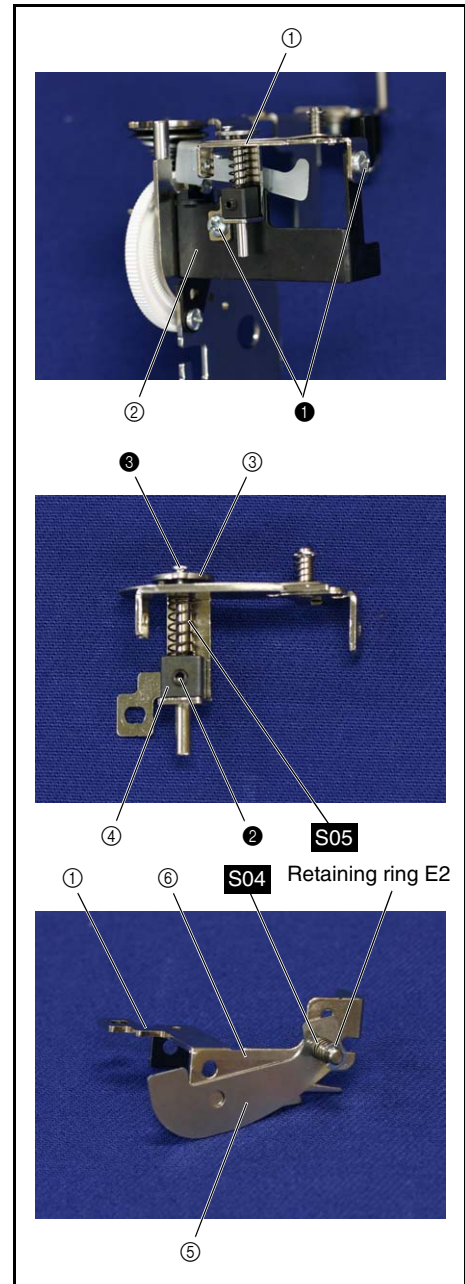
1-2 Disassembly of Thread unit H (Removal of Bobbin winder guide assy.)

1. Remove the screw ❶, and then remove the bobbin winder guide assy. ❶ from the thread unit H.



1-3 Disassembly of Thread unit H (Removal of Thread guide plate assy.)

1. Remove the 2 screws ①, and then remove the thread guide plate assy. ① from the thread unit H ②.
2. Remove the screw ②, and then pull the tension presser plate assy. ③, and then remove the spring S05 and the adjusting collar ④.
3. Remove the screw ③ from the tension presser plate assy. ③.
4. Remove the retaining ring E2, and then remove the spring S04, the tension plate ⑤ and the spacer ⑥ from the thread guide plate assy. ①.

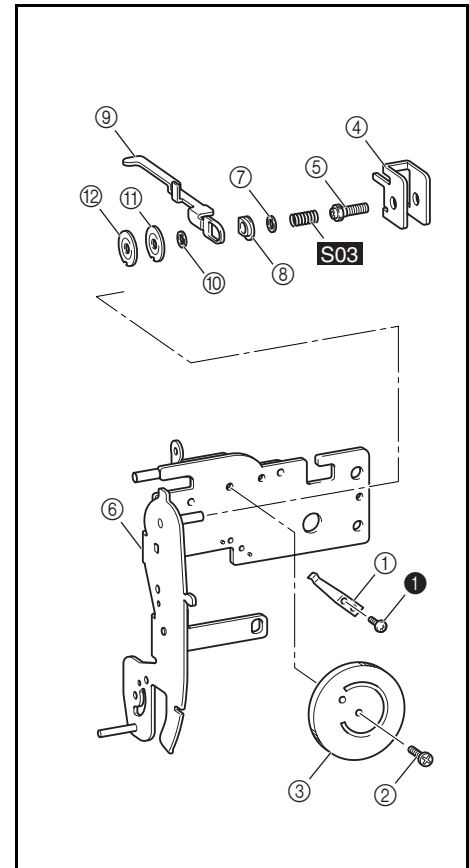


1-4 Disassembly of Thread unit H (Removal of Thread tension dial)

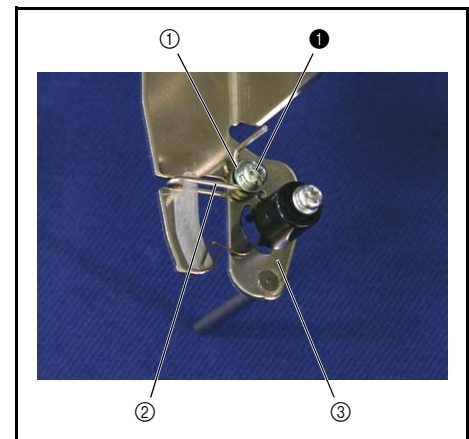
1. Remove the screw ①, and then remove the notched spring ①.
2. Remove the tension dial shaft ②, and then remove the thread tension dial ③, the thread tension plate ④ and the thread tension adjusting screw ⑤.

***Key point**

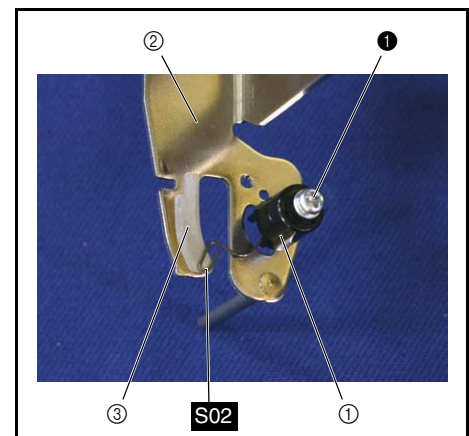
- Turn the thread tension dial ③ to the right, and slide the thread tension plate ④ to the left to see the tension dial shaft ②.
3. Remove the thread tension adjusting screw ⑤ from the thread tension plate ④.
 4. Remove the spring S03, the washer ⑦, the tension disc washer ⑧, the thread release plate ⑨, the washer ⑩, the tension disc B ⑪ and the tension disc A ⑫ from the shaft of the thread unit H ⑥.

**1-5 Disassembly of Thread unit H (Removal of Thread guide wire)**

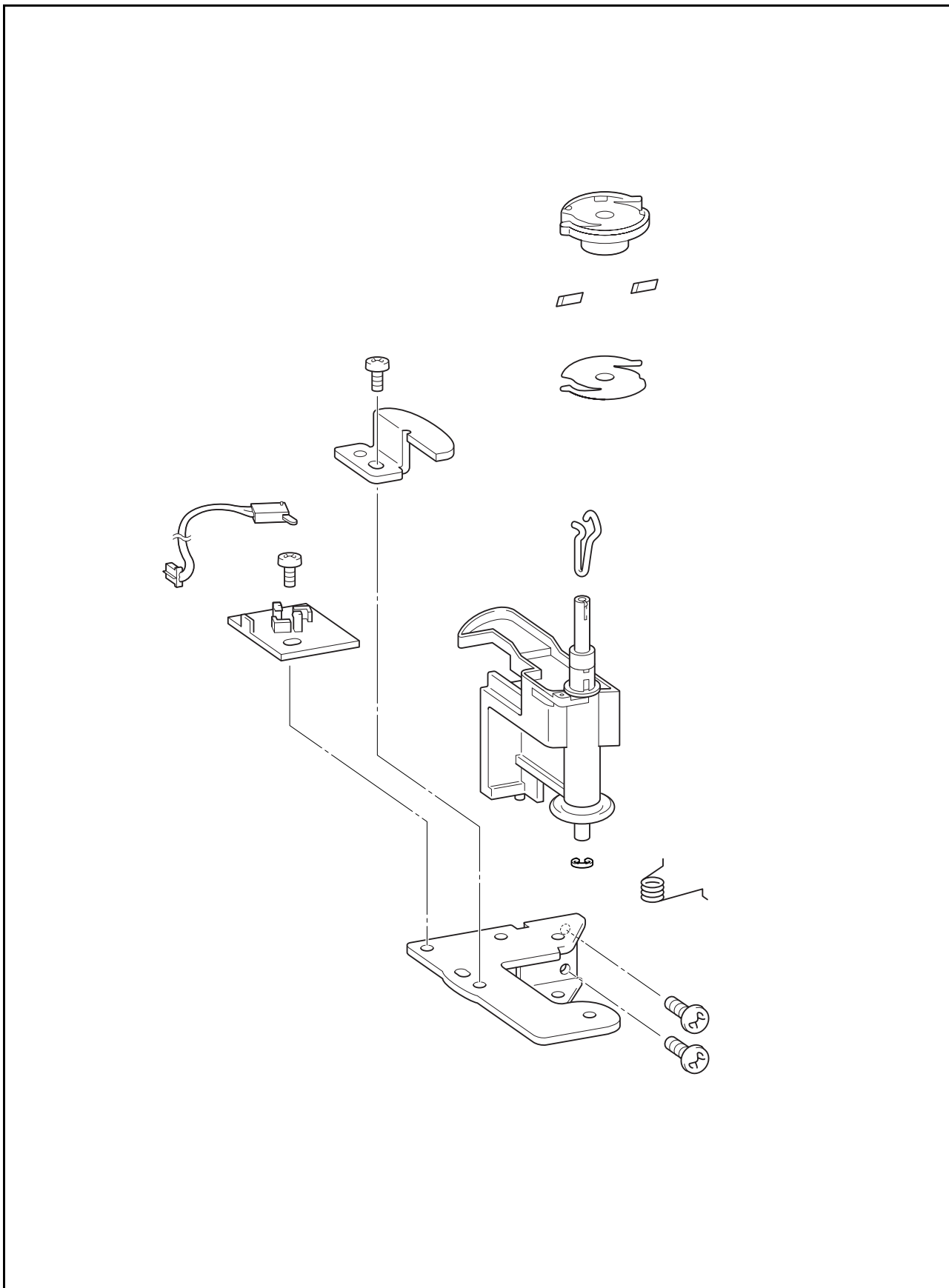
1. Remove the screw ①, and then remove the washer ① and the thread guide wire ② from the thread unit H ③.

**1-6 Disassembly of Thread unit H (Removal of Thread catching spring case)**

1. Remove the screw ①, and then remove the thread catching spring case ① from the thread unit H ②.
2. Remove the spring S02 from the thread catching spring case ①.
3. Remove the spring tape ③ from the thread unit H ②.

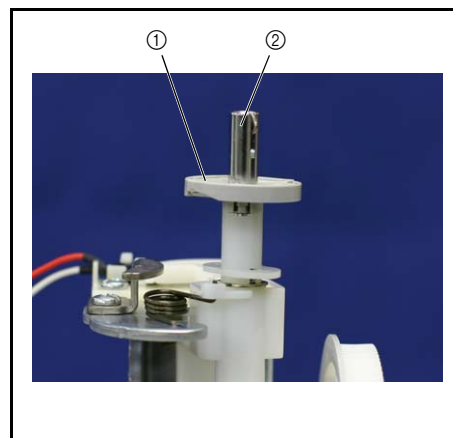


Bobbin winder mechanism location diagram



1 Removal of Bobbin base assy.

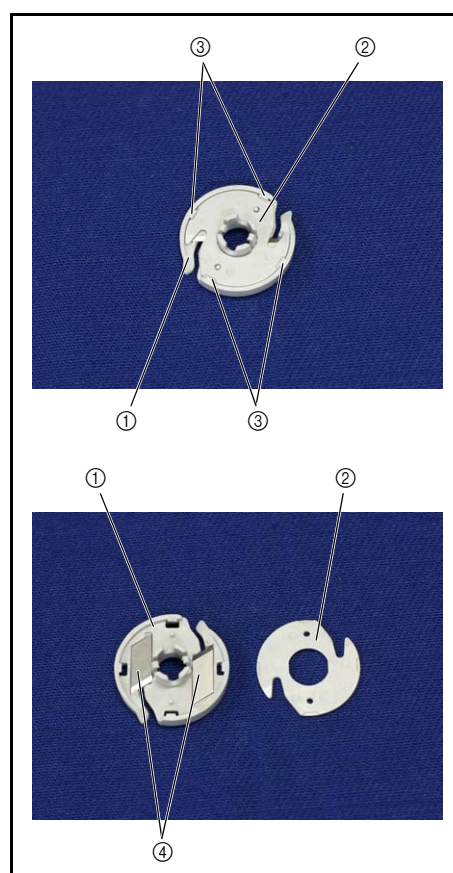
1. Remove the bobbin base assy. ① from the bobbin winder assy. ②.

**1-1** Disassembly of Bobbin base assy.

1. Remove the bobbin thread cutter holder (2) from the bobbin base assy. (1).

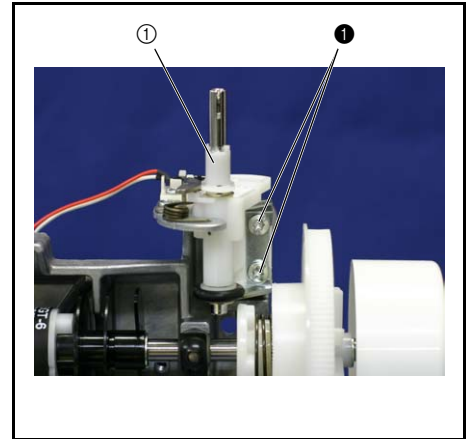
***Key point**

- Be careful not to damage the hooks (3) (4 locations).
2. Remove the NT lower thread cutter (4) from the bobbin base assy. (1).

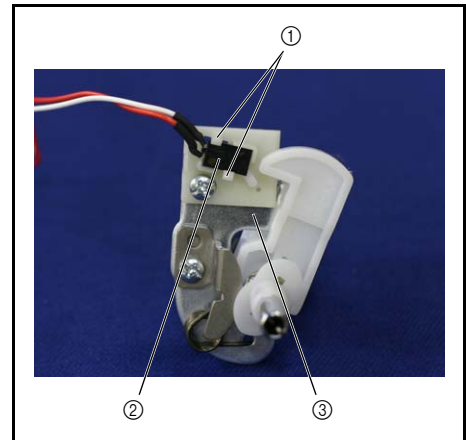


2 Removal of Bobbin winder assy.

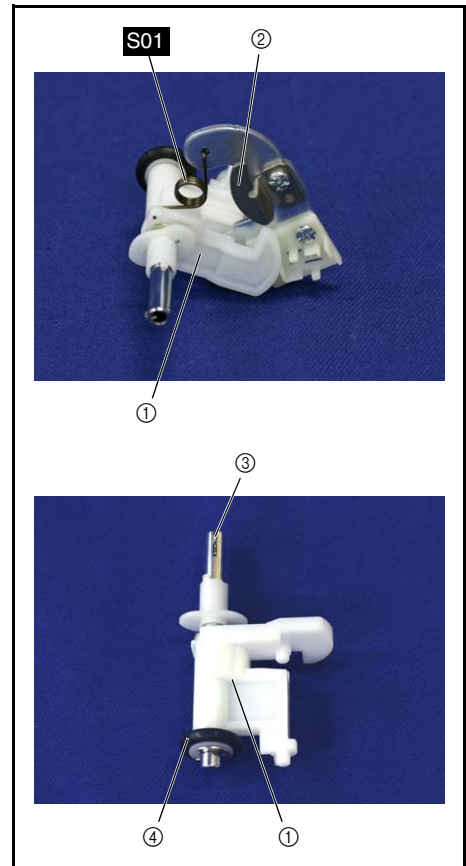
1. Remove the 2 screws ❶, and then remove the bobbin winder assy. ❶.

**2-1** Disassembly of Bobbin winder assy. (Removal of SW assy : BW-F)

1. Undo the hooks ❶ (2 locations), and then remove SW assy : BW-F ❷ from the bobbin winder assy. ❸.

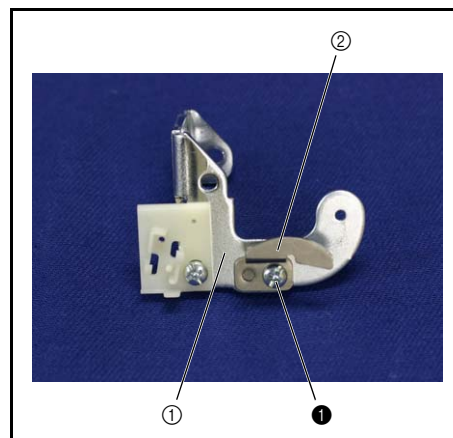
**2-2** Disassembly of Bobbin winder assy. (Removal of BW shaft holder assy.)

1. Open the bobbin winder assy.
2. Remove the spring S01.
3. Remove the BW shaft holder assy. ❶ from the bobbin winder assy. holder ❷.
4. Remove the bobbin winder shaft spring ❸ from the BW shaft holder assy. ❶.
5. Remove the rubber ring ❹ from the BW shaft holder assy. ❶.

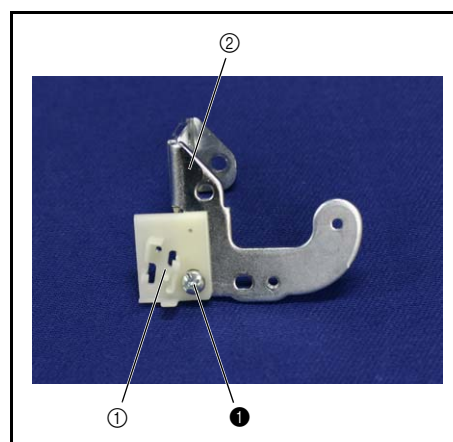


2-3 Disassembly of Bobbin winder assy. (Removal of Bobbin winder shaft stopper)

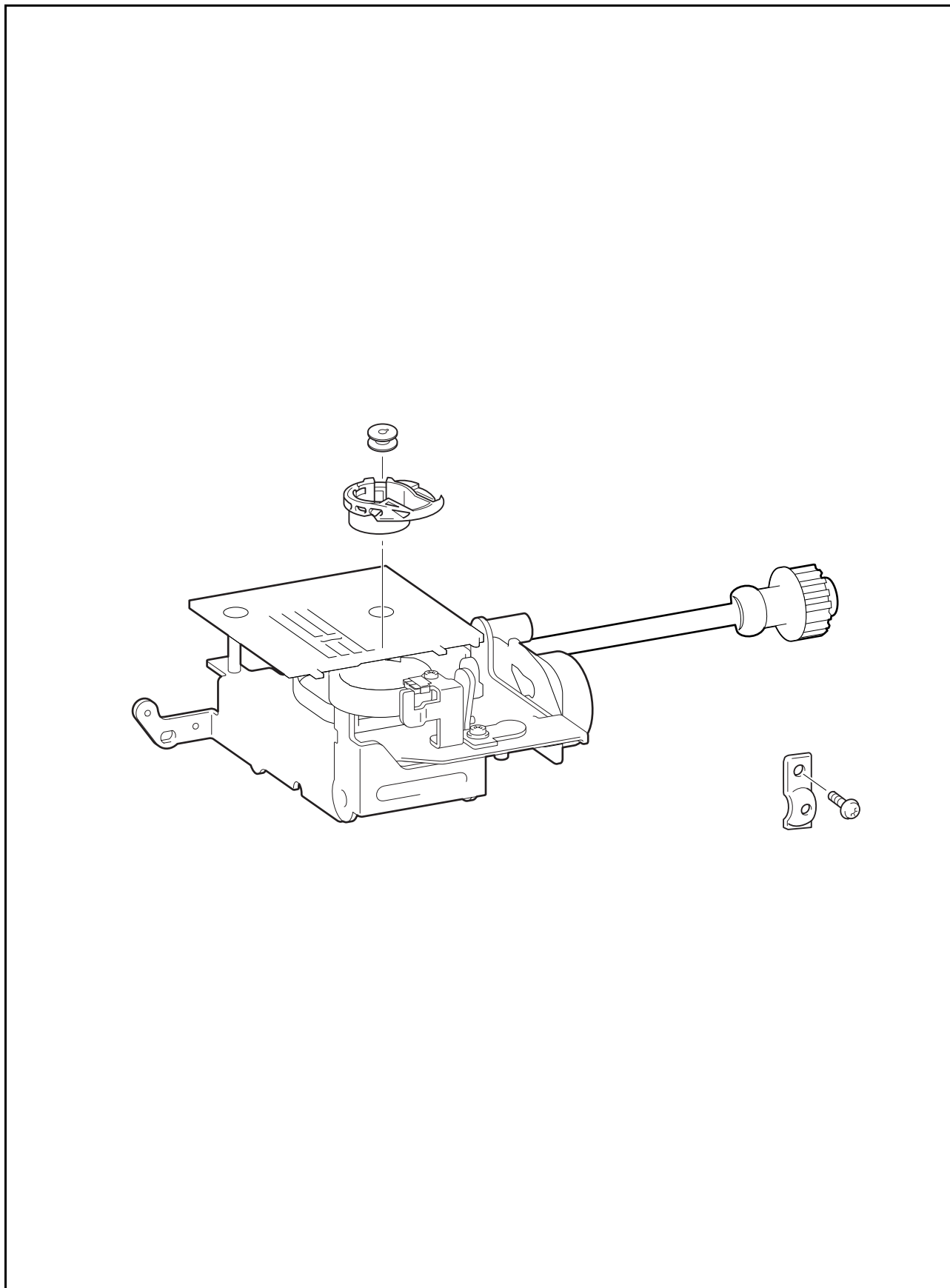
1. Remove the screw ❶, and then remove the bobbin winder shaft stopper ❷ from the bobbin winder assy. holder.

**2-4** Disassembly of Bobbin winder assy. (Removal of SW adjust plate)

1. Remove the screw ❶, and then remove the SW adjust plate removal ❷ from the bobbin winder assy. holder.

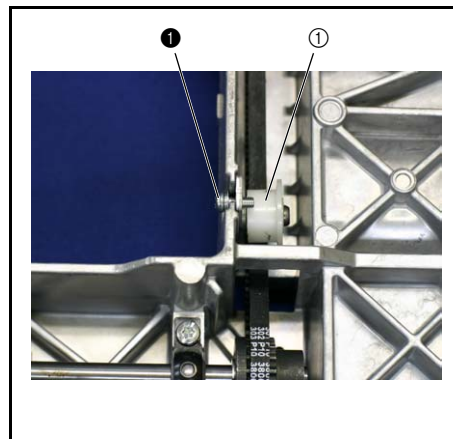


Feed mechanism location diagram

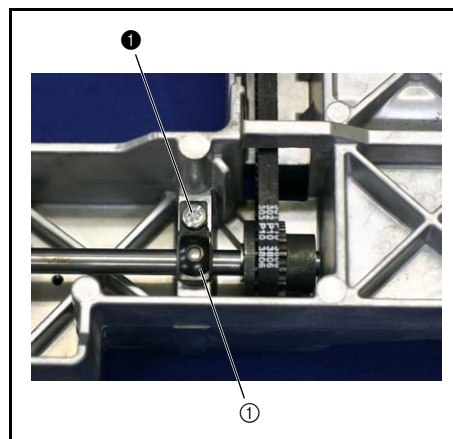


1 Removal of Tension pulley assy.

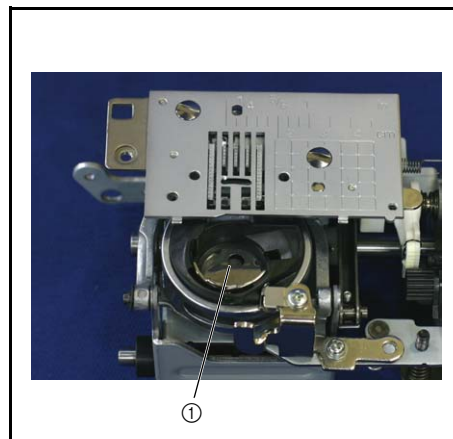
1. Remove the screw ❶, and then remove the tension pulley assy. ❶ from the arm bed.

**2** Removal of Lower shaft bushing

1. Remove the screw ❶, and then remove the lower shaft bushing ❶.

**3** Removal of Inner rotary hook assy.

1. Remove the inner rotary hook assy. ❶.

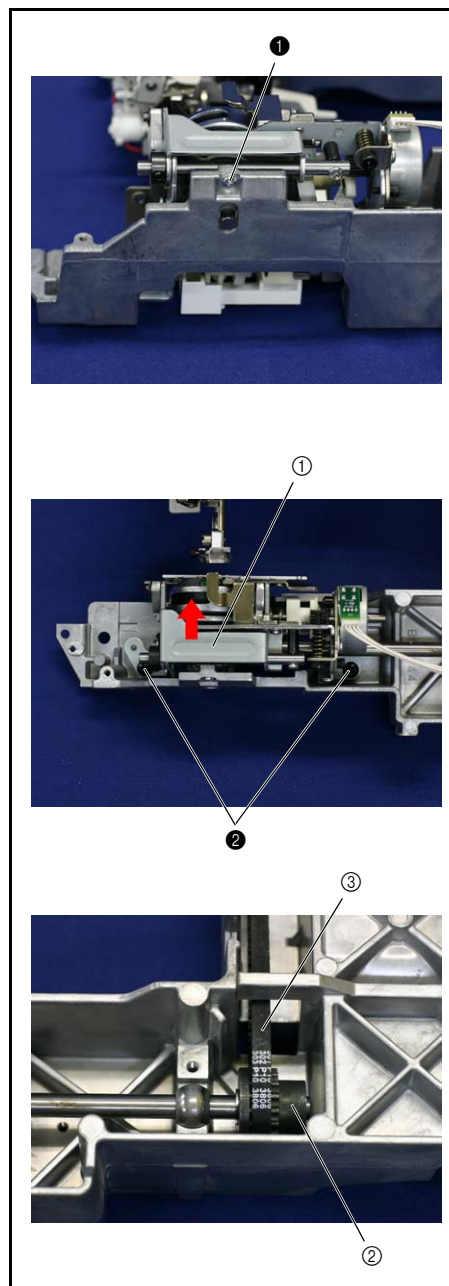


4 Removal of Feed module

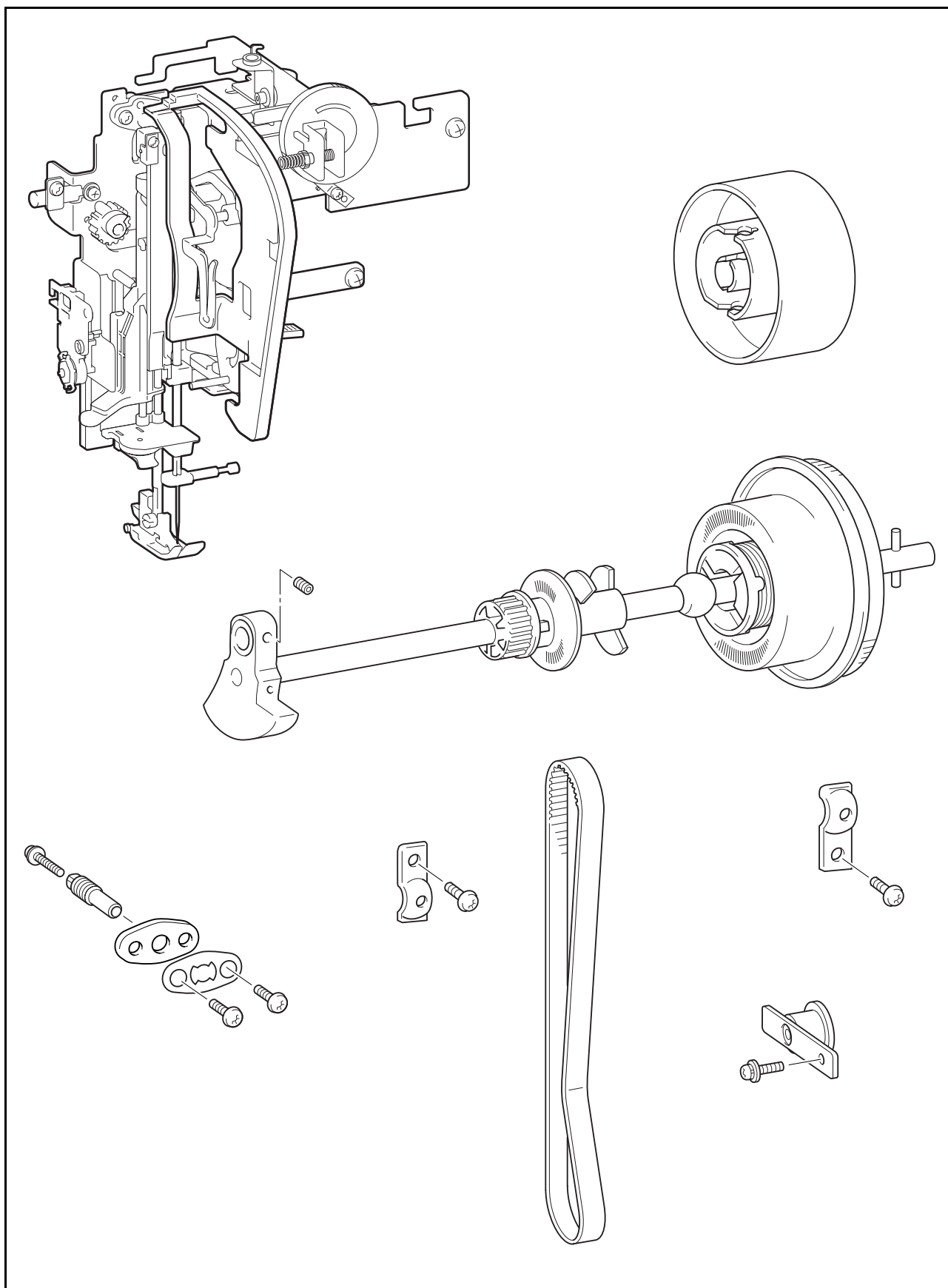
1. Remove the screw ① and the 2 screws ②, and then remove the feed module ① from the arm bed.

***Key point**

- Move up and remove the feed module ①, and then remove the timing pulley D ② from the T belt ③.

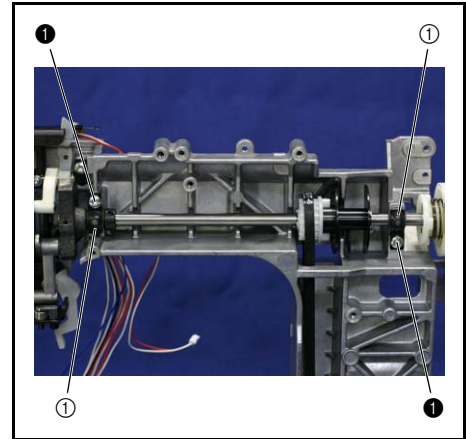


Needle bar, presser mechanism / Upper shaft mechanism location diagram



1 Removal of Bushing presser (For upper shaft)

1. Remove the 2 screws ❶, and then remove the 2 bushing pressers ❶ from the arm bed.

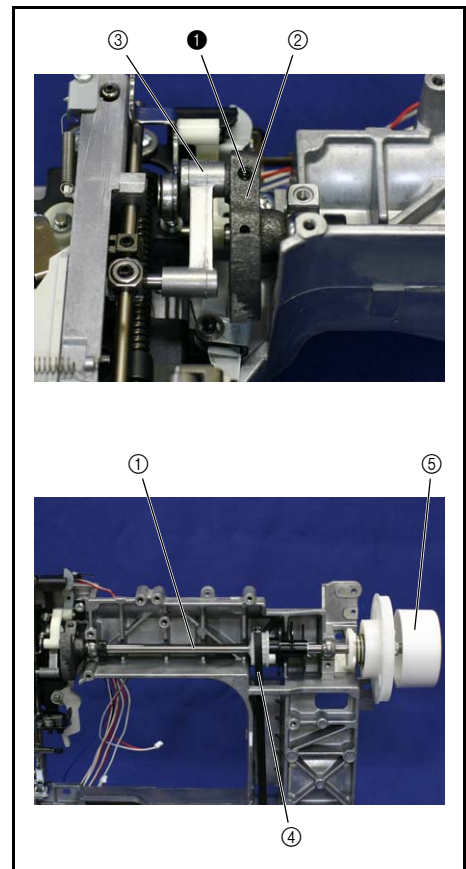


2 Removal of Upper shaft assy.

1. Remove the screw ❶.
2. Remove the upper shaft assy. ❶.

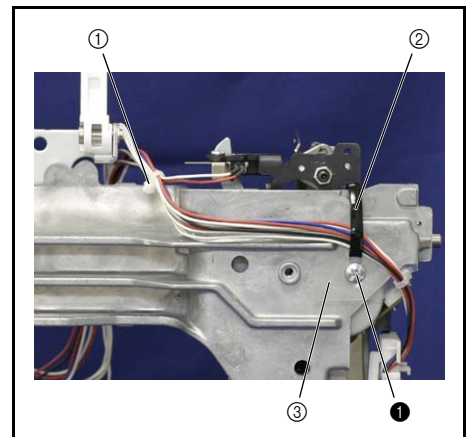
***Key point**

- Remove the thread take-up counter weight ❷ from the needle bar crank rod assy. ❸ while drawing out the upper shaft assy. ❶.
3. Remove the T belt ❷ from the upper shaft assy. ❶.
 4. Remove the pulley ❸ from the upper shaft assy. ❶.



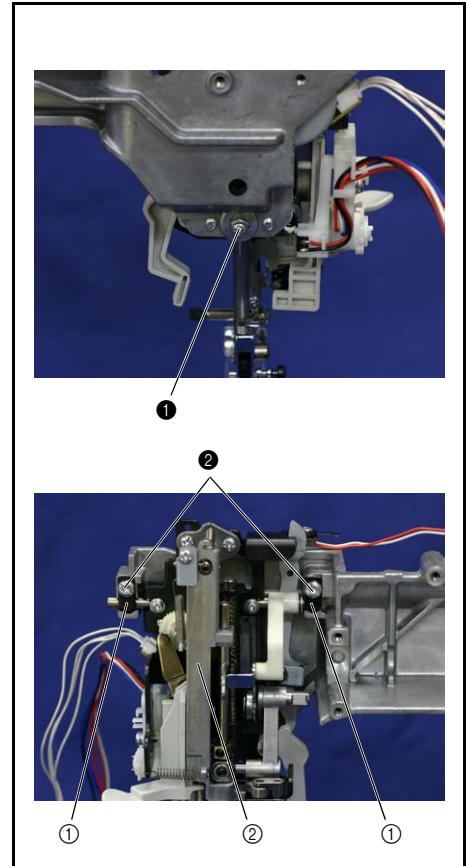
3 Removal of Coaching clip

1. Cut the band ❶.
2. Remove the screw ❶, and then remove the coaching clip ❷ and the insulator sheet ❸.



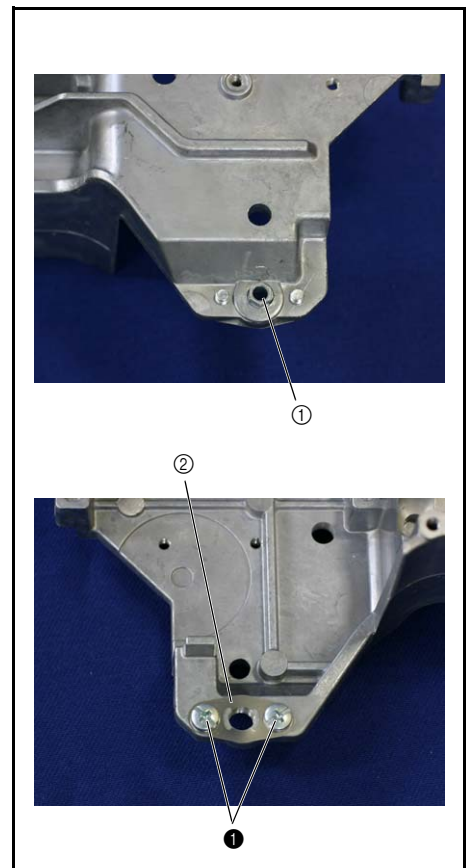
4 Removal of Needle-presser module

1. Remove the screw ①.
2. Remove the 2 screws ②, and then remove the 2 presser plates ①.
3. Remove the needle-presser module ② from the arm bed.

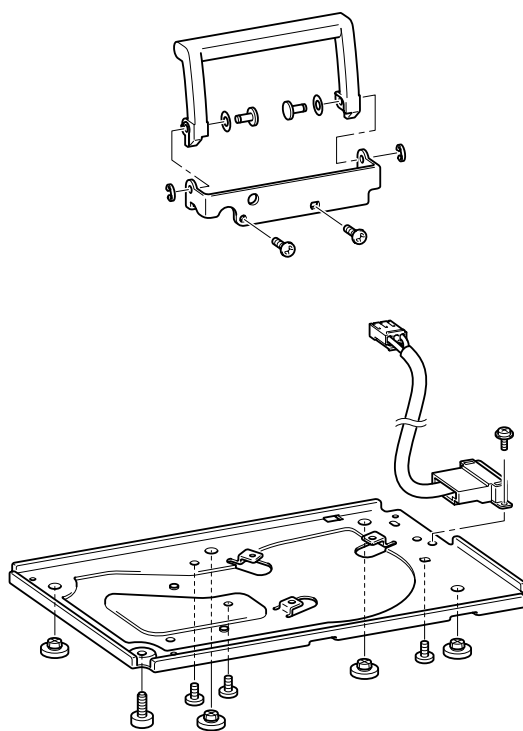


5 Removal of Plate spring

1. Remove the adjusting screw ①.
2. Remove the 2 screws ①, and then remove the plate spring ②.

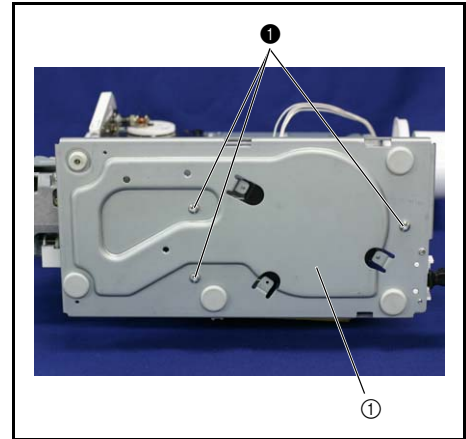


Base plate and handle location diagram

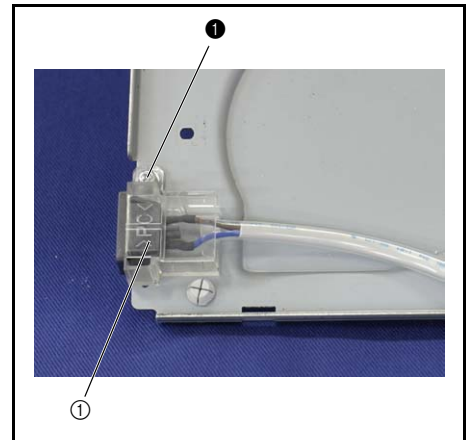


1 Removal of Base plate

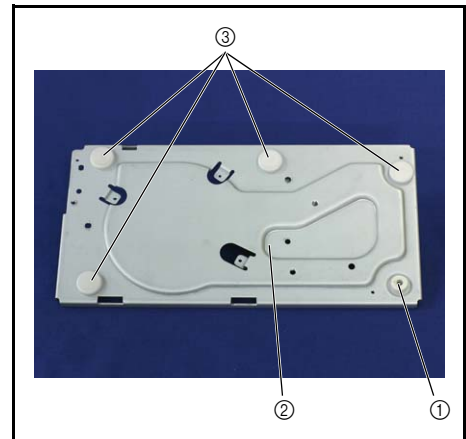
1. Remove the 3 screws ❶, and then remove the base plate ❶.

**2** Removal of Inlet assy.

1. Remove the screw ❶, and then remove the inlet assy. ❶.

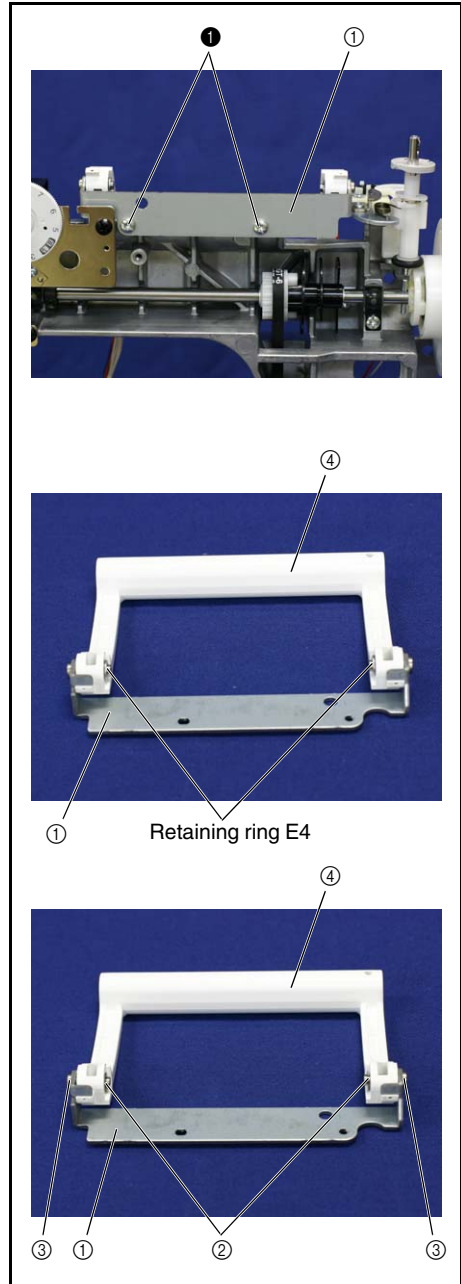
**3** Removal of Adjusting screw assy., Base rubber A

1. Remove the adjusting screw assy. ❶ from the base plate ❷.
2. Remove the 4 base rubbers A ❸ from the base plate ❷.

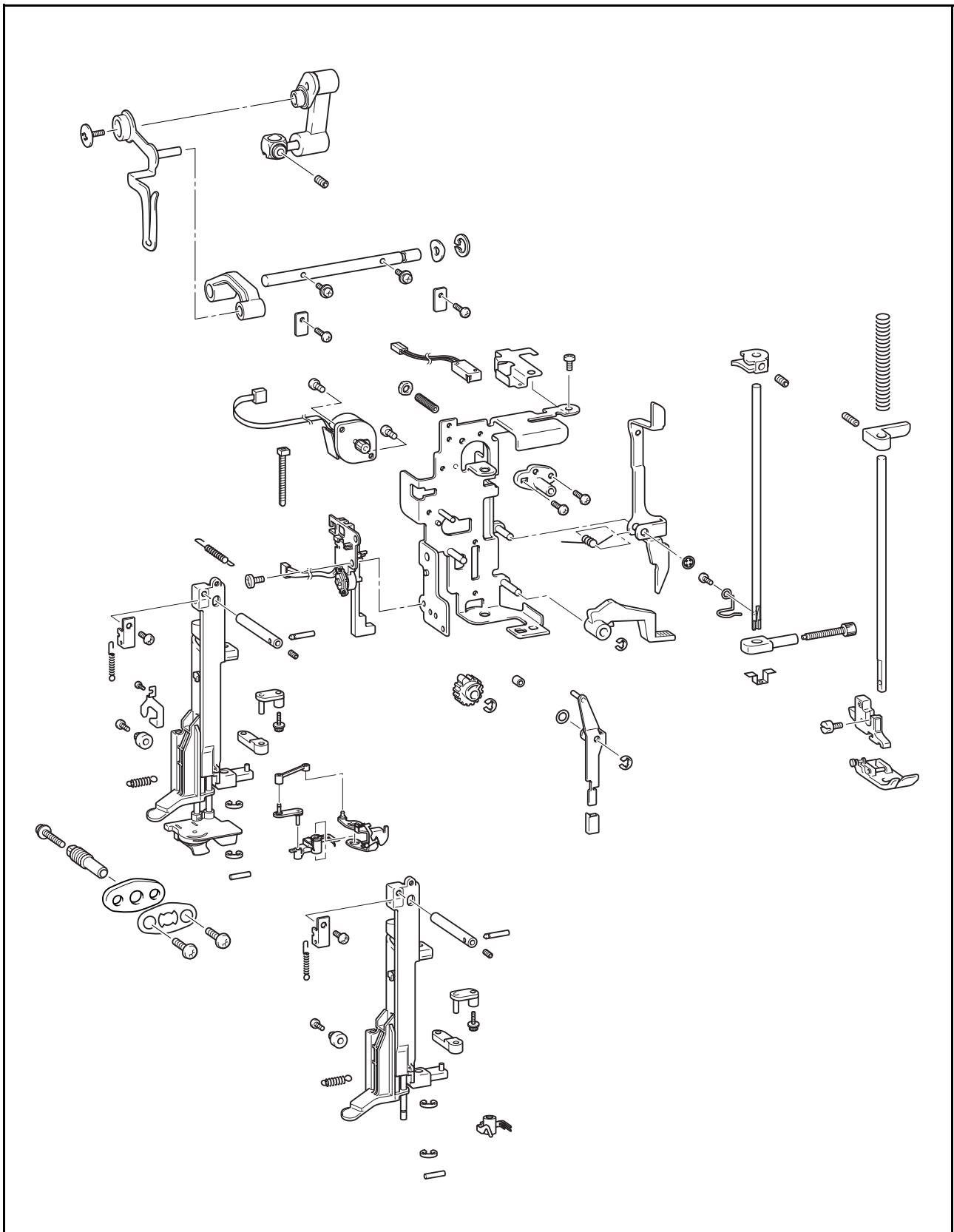


4 Removal of Handle

1. Remove the 2 screws ①, and then remove the handle holder ① from the arm bed.
2. Remove the 2 retaining rings E4, and then remove the 2 polyester sliders ②.
3. Remove the 2 handle shafts ③, and then remove the handle ④ from the handle holder ①.

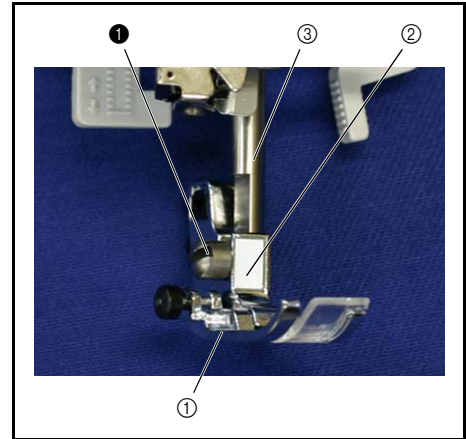


Needle-presser module breakout diagram



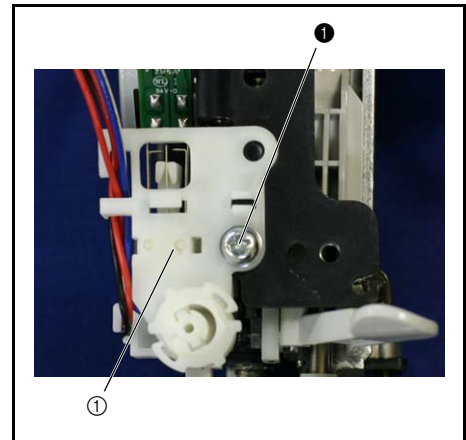
1 Removal of Presser feed holder assy.

1. Remove the Z foot ①.
1. Remove the screw ①, and then remove the presser feed holder assy. ② from the presser bar ③.



2 Removal of BH switch assy.

1. Remove the screw ①, and then remove the BH switch assy. ①.



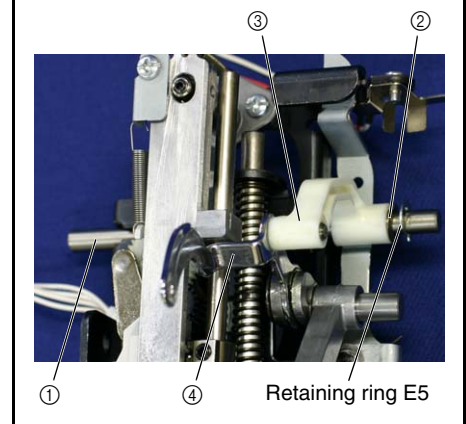
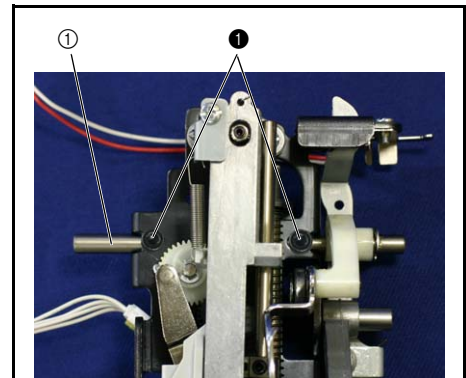
3 Removal of Thread take-up lever link

1. Remove the 2 screws ①, and then pull the take-up support shaft ①, and then remove the washer, spring ② and the thread take-up lever link ③.

***Key point**

- Pull the thread take-up lever link ③ from the shaft of the thread take-up lever ④.

2. Remove the retaining ring E5 from the take-up support shaft ①.

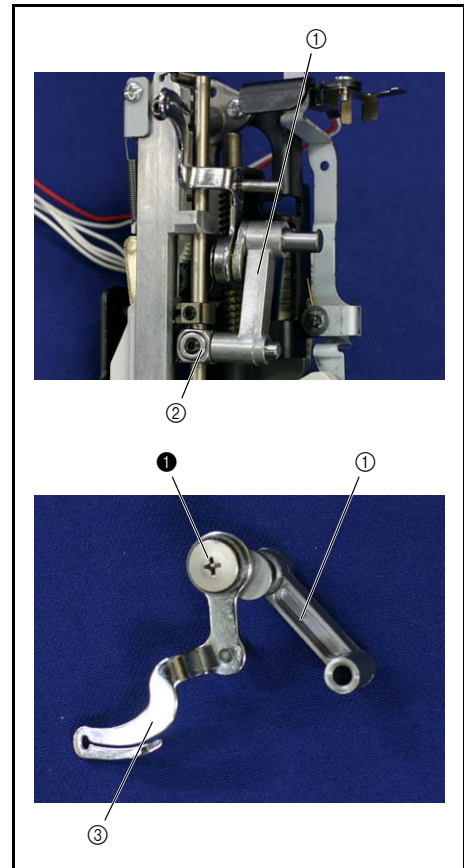


4 Removal of Needle bar crank rod assy.

1. Remove the needle bar crank rod assy. ① from the needle bar block ②.
2. Remove the screw ❶, and then remove the thread take-up lever ③ from the needle bar crank rod assy. ①.

***Key point**

- The screw is reverse threaded.

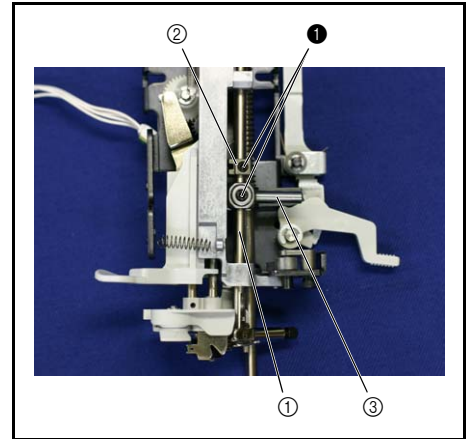


5 Removal of Needle bar assy.

1. Remove the 2 screws ①, and then pull the needle bar assy. ① from the needle bar supporter assy., and then remove the needle thread block ② and the needle bar block ③.

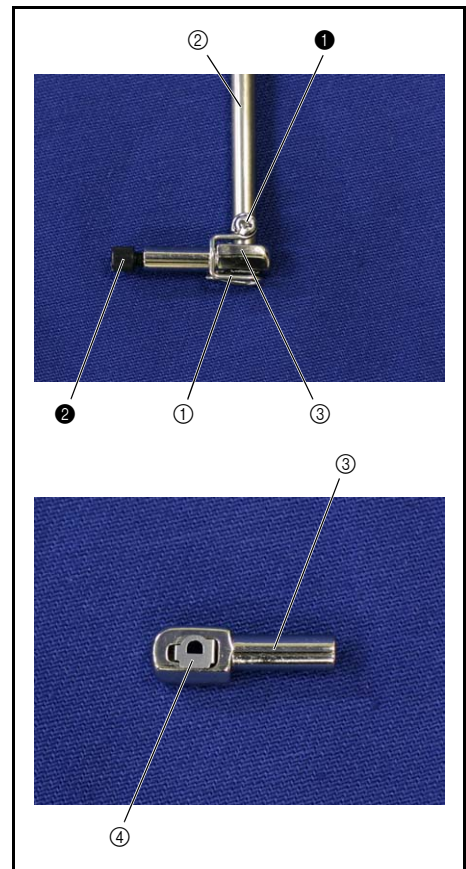
***Note**

- The right photograph is "NV30".



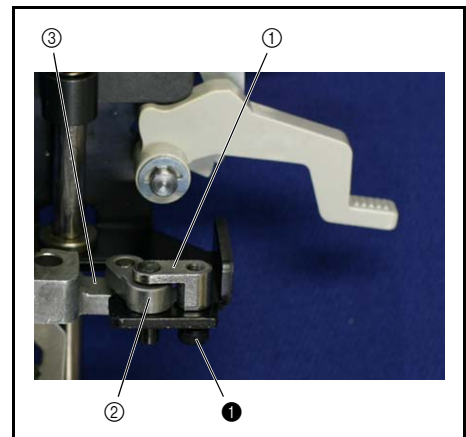
5-1 Disassembly of Needle bar assy.

1. Remove the screw ①, and then remove the needle bar thread guide ① from the needle bar ②.
2. Remove the screw ②, and then remove the needle block ③ from the needle bar ②.
3. Remove the needle thread plate ④ from the needle block ③.



6 Removal of Shaft assy.

1. Remove the screw ①, and then remove the shaft assy. ① from the base holder assy.
2. Remove the needle holder block ② from the shaft of the needle bar supporter assy. ③.

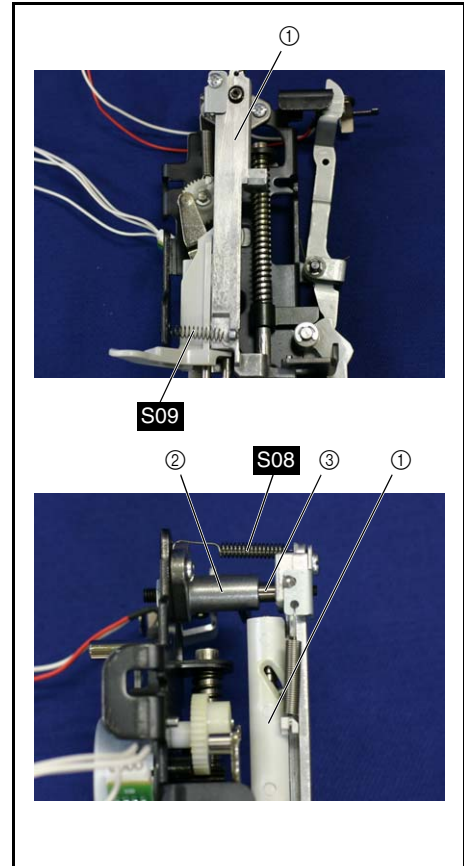


7 Removal of Needle bar supporter assy.

1. Remove the spring **S09** and the spring **S08**, and then remove the needle bar supporter assy. ① from the base holder assy.

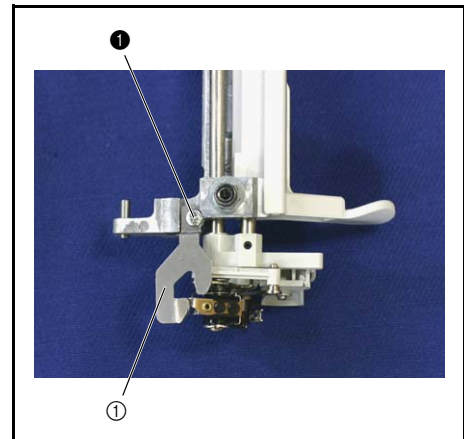
***Key point**

- Pull the shaft ② of the needle bar supporter assy. ① from the shaft bushing ③, and then remove it from the upper side.



8 Removal of Hook release plate (Only for “NV30” series)

1. Remove the screw ①, and then remove the hook release plate ① from the needle bar supporter assy.



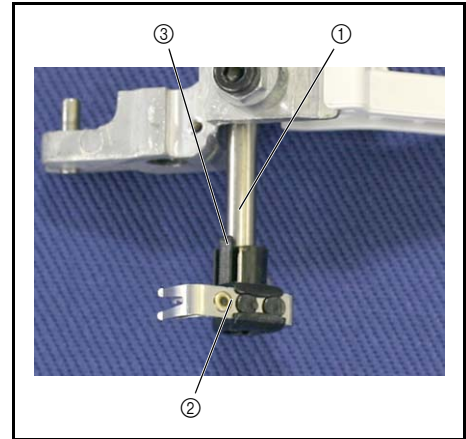
9 Removal of Threader hook assy.

9-1 For “NS40” series

1. Remove the threader hook assy. ② from the needle bar holder assy. ①.

***Key point**

- Remove the hook part ③ of the threader hook assy. ②, and then pull it to the lower side.

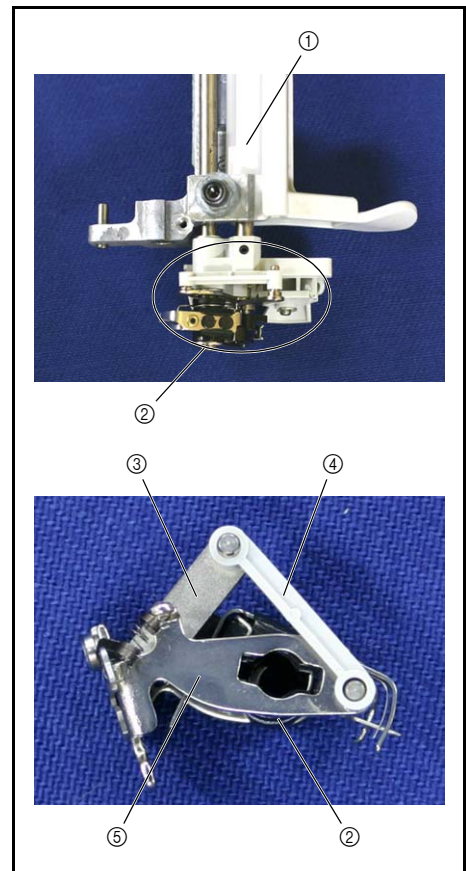


9-2 For “NV30” series

1. Remove the threader hook assy. ② from the needle bar holder assy. ①.

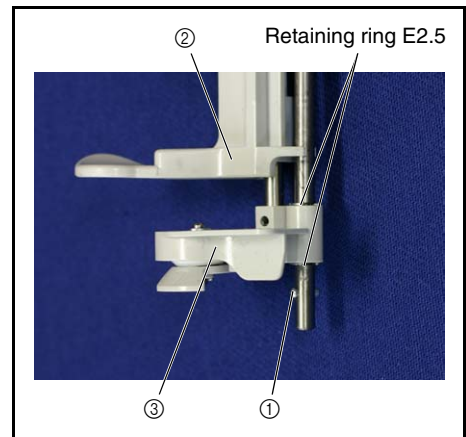
***Key point**

- Pull the threader hook assy. ② to the lower side.
2. Disassemble the threader hook assy. ②, the link A assy. ③, the link B ④ and the thread guide assy. ⑤.



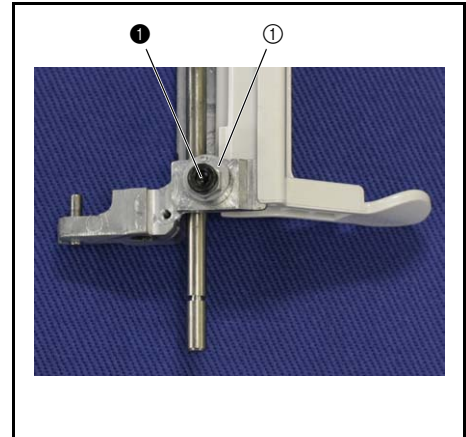
10 Removal of Thread hold guide B assy. (Only for “NV30” series)

1. Remove the pin, dowel 2 x 6 ① from the shaft of the needle bar supporter assy. ②.
2. Remove the 2 retaining rings E2.5, and then remove the thread hold guide B assy. ③.

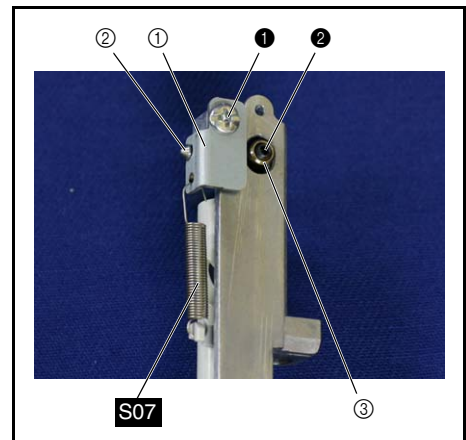


11 Removal of Zigzag adjusting nut

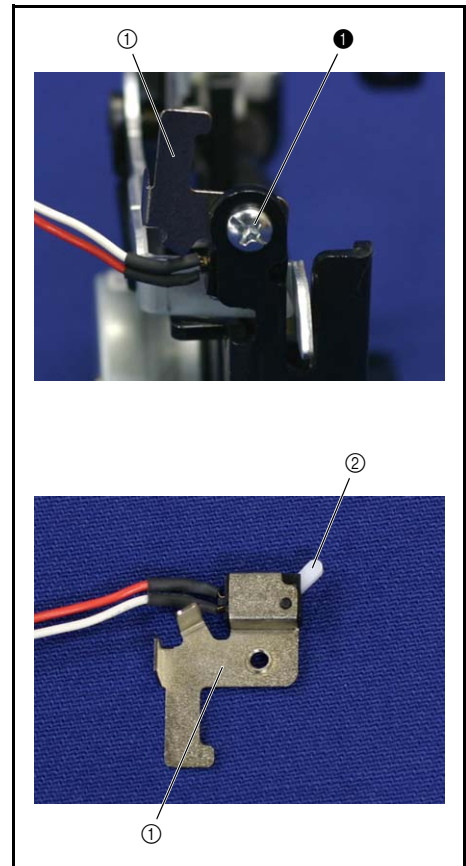
1. Remove the screw ❶, and then remove the zigzag adjusting nut ❶ from the needle bar supporter assy.

**12** Removal of Needle holder shaft A

1. Remove the spring S07.
2. Remove the screw ❶, and then remove the plate ❶ from the needle bar supporter assy.
3. Remove the screw ❷, and then pull the shaft ❷, and then remove the needle holder shaft A ❸ from the needle bar supporter assy.

**13** Removal of PF switch assy.

1. Remove the screw ❶, and then remove the presser switch holder ❶ from the base holder assy.
2. Remove the PF switch assy. ❷ from the presser switch holder ❶.



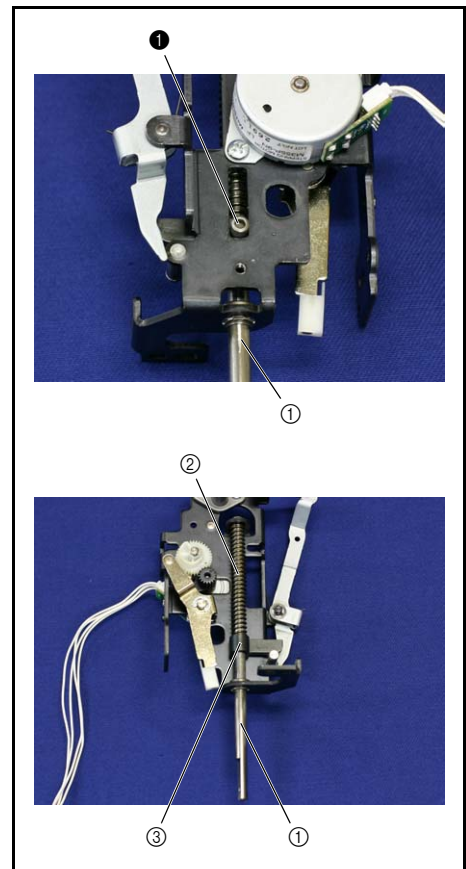
14 Removal of Presser foot lifter

1. Remove the retaining ring E4, and then remove the presser foot lifter ①.



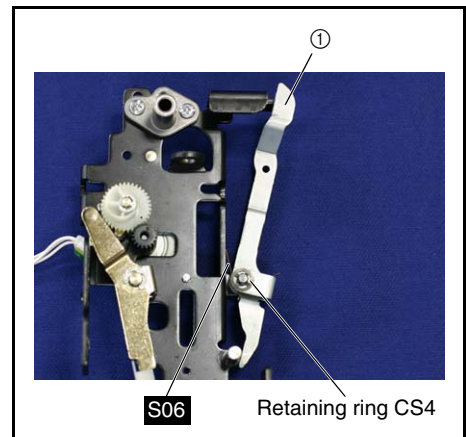
15 Removal of Presser bar

1. Remove the screw ❶, and then pull the presser bar ① from the base holder assy., and then remove the spring ② and the presser bar clamp ③.



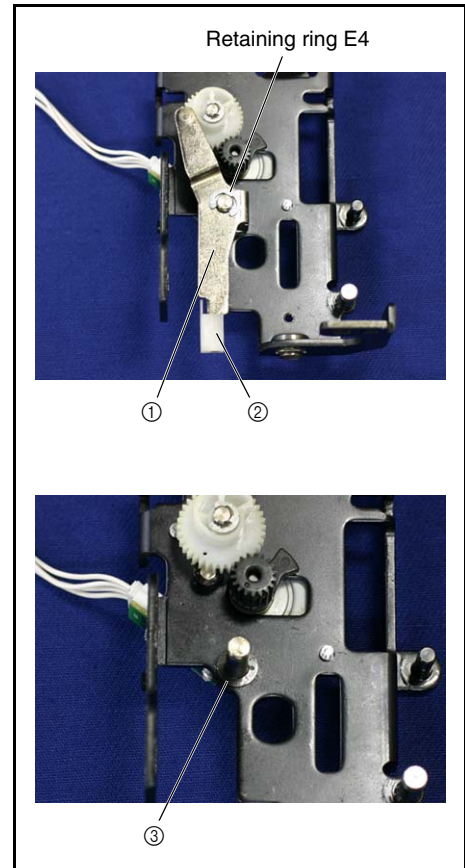
16 Removal of Thread release lever

1. Remove the retaining ring CS4, and then remove the thread release lever ① and the spring S06 from the base holder assy.

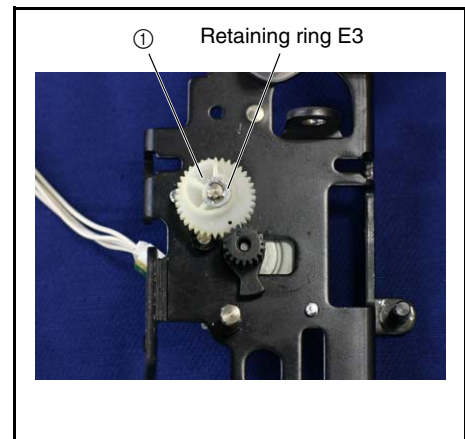


17 Removal of Z zigzag lever assy.

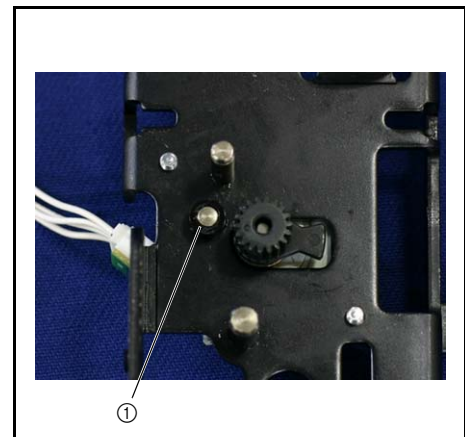
1. Remove the Z lever cap ② from the Z zigzag lever assy. ①.
2. Remove the retaining ring E4, and then remove the Z zigzag lever assy. ① and the polyester slider ③.

**18** Removal of Z zigzag cam

1. Remove the retaining ring E3, and then remove the Z zigzag cam ①.

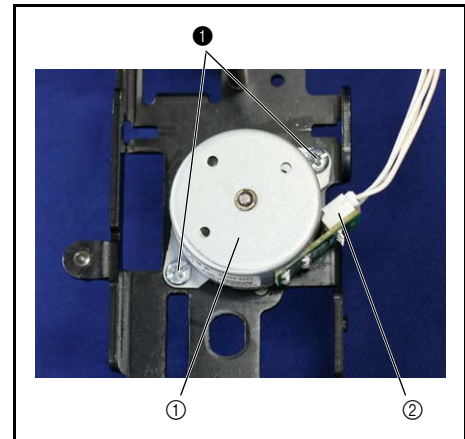
**19** Removal of Rubber

1. Remove the rubber ①.

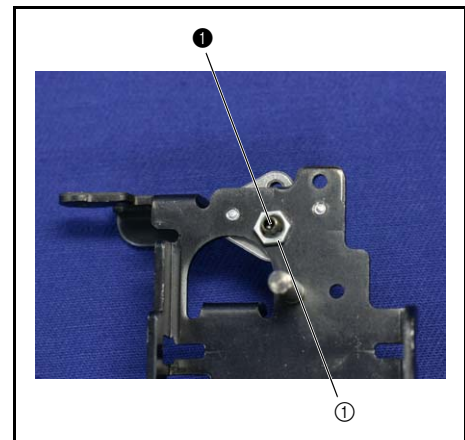


20 Removal of Z pulse motor

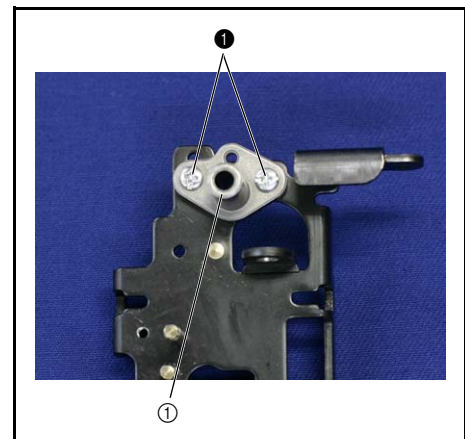
1. Remove the 2 screws ❶, and then remove the Z pulse motor ❶ from the base holder Assy.
2. Remove the lead wire sub Assy. ❷ from the Z pulse motor ❶.

**21** Removal of Lock nut

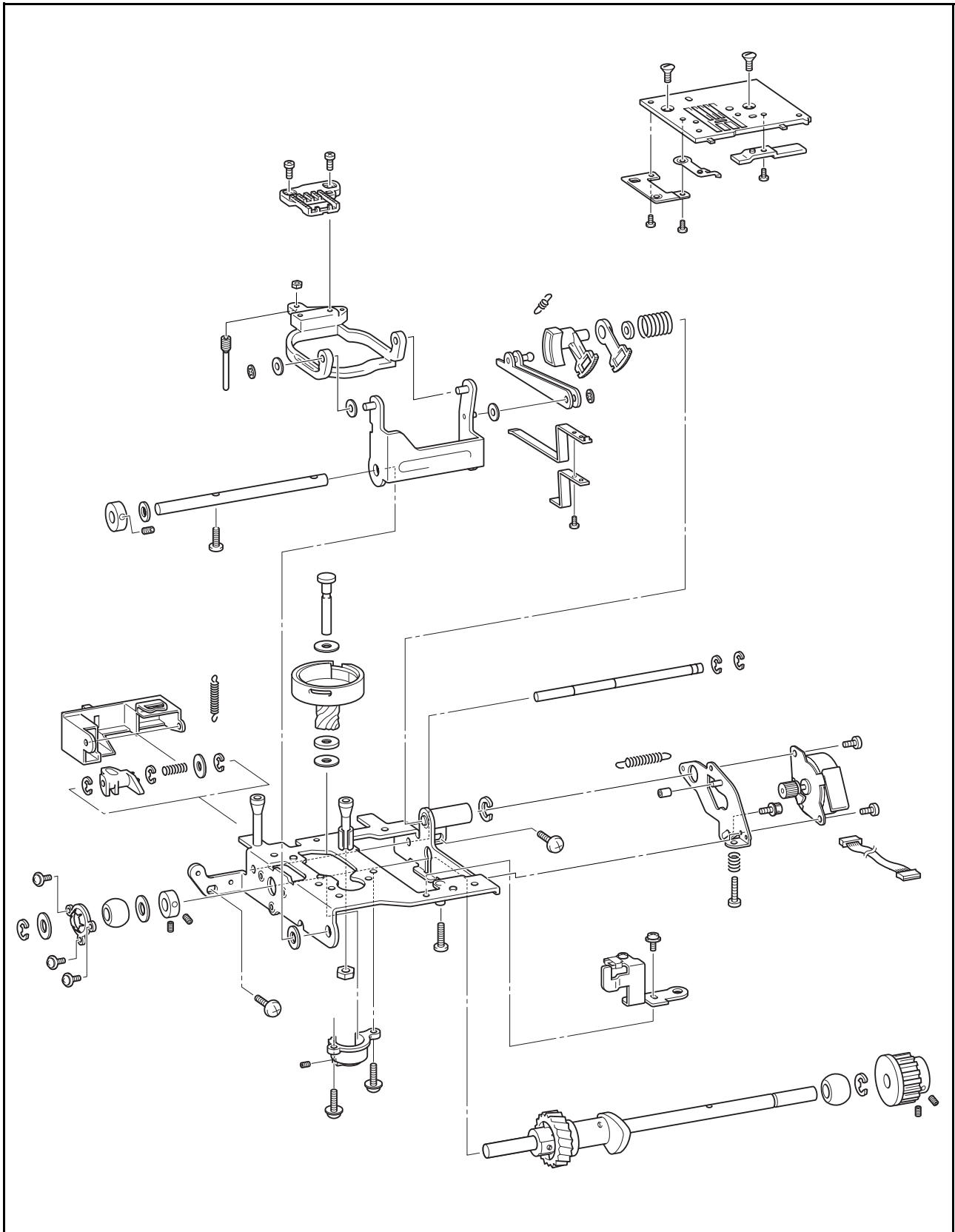
1. Remove the lock nut ❶ from the base holder Assy.
2. Remove the screw ❶.

**22** Removal of Shaft bushing

1. Remove the 2 screws ❶, and then remove the shaft bushing ❶ from the base holder Assy.

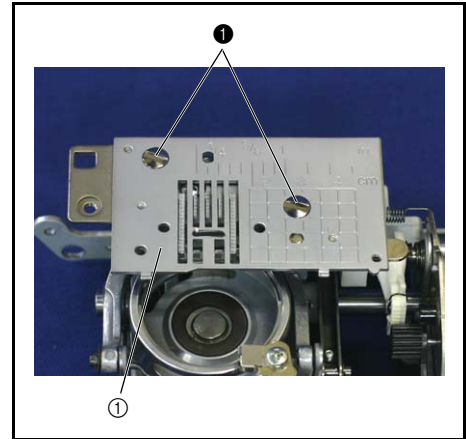


Feed and bobbin module breakout diagram



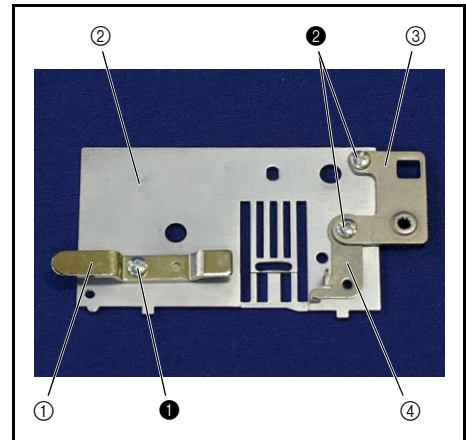
1 Removal of Needle plate A assy.

1. Remove the 2 screws ❶, and then remove the needle plate A assy. ①.



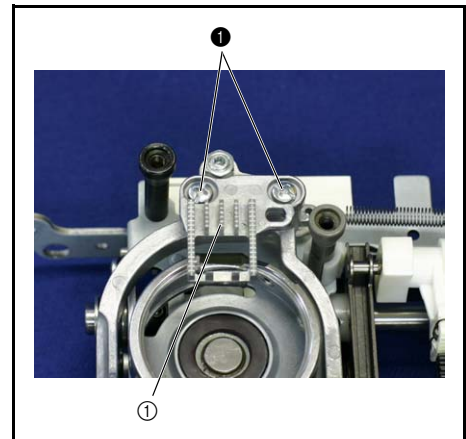
1-1 Disassembly of Needle plate A assy.

1. Remove the screw ❶, and then remove the F gear stopper plate ① from the needle plate A ②.
2. Remove the 2 screws ❷, and then remove the needle plate B support plate ③ and the stopper plate ④ from the needle plate A ②.



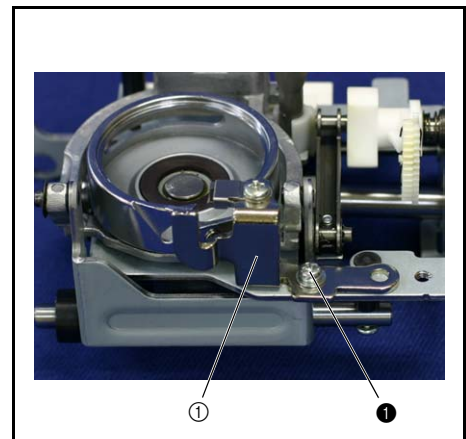
2 Removal of Feed dog

1. Remove the 2 screws ❶, and then remove the feed dog ①.



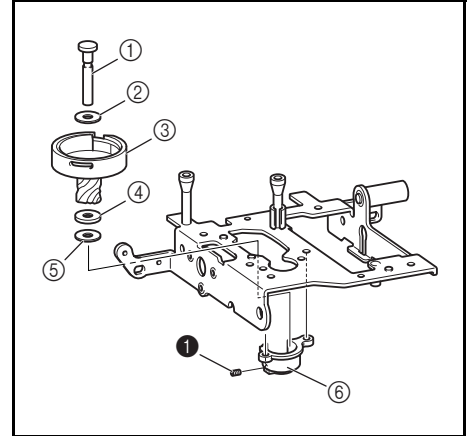
3 Removal of Inner rotary hook bracket assy.

1. Remove the screw ❶, and then remove the inner rotary hook bracket assy. ① from the base plate assy.



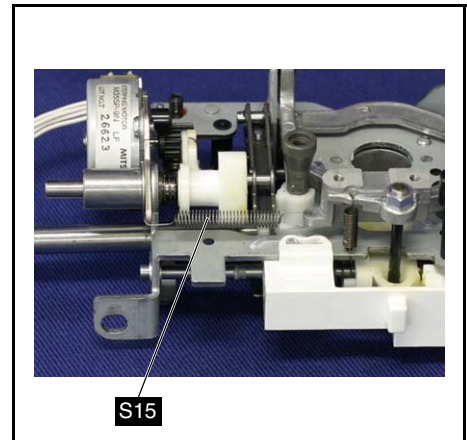
4 Removal of Outer rotary hook assy.

1. Remove the screw ❶, and then pull the outer rotary hook shaft ❶, and then remove the spacer ❷, the outer rotary hook assy. ❸, the washer ❹ and the spacer ❺ from the shaft supporter ❻.



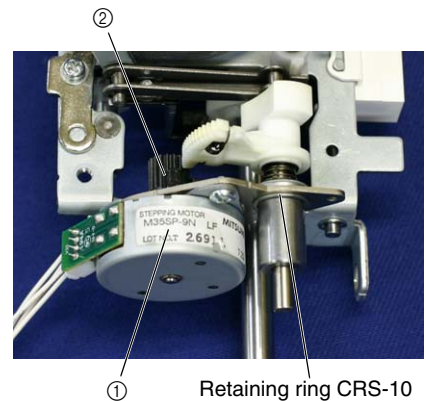
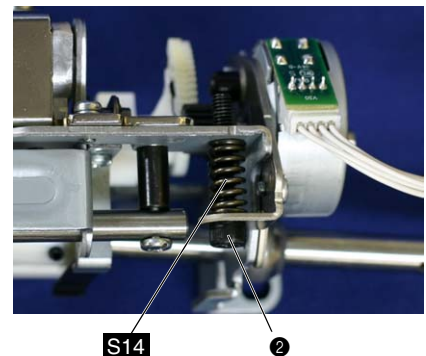
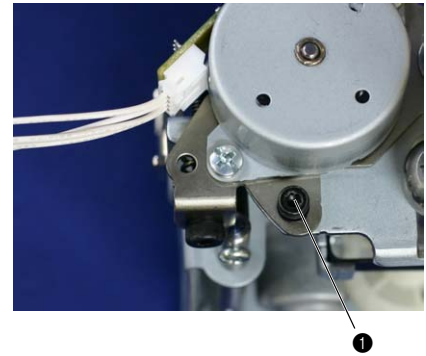
5 Removal of Spring

1. Remove the spring S15.

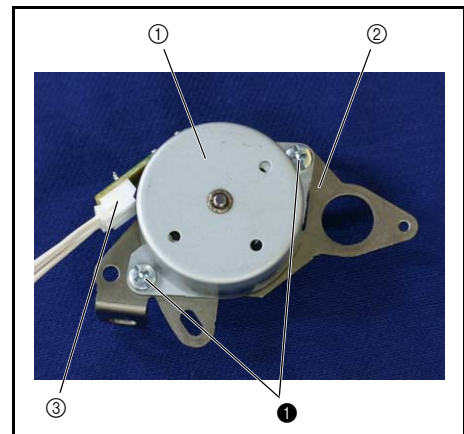


6 Removal of FPM holder sub assy.

1. Remove the screw ①.
2. Remove the screw ②, and then remove the spring S14.
3. Remove the retaining ring CRS-10, and then remove the FPM holder sub assy. ① from the base plate assy.
4. Remove the rubber ② from the FPM holder sub assy. ①.

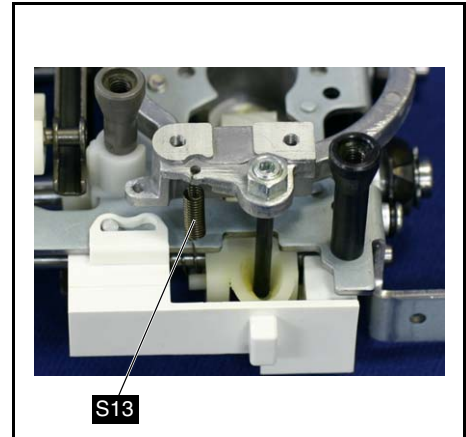
**7** Removal of F pulse motor

1. Remove the 2 screws ①, and then remove the F pulse motor ① from the FPM holder sub assy. ②.
2. Remove the lead wire assy. FPM-LE ③ from the F pulse motor ①.



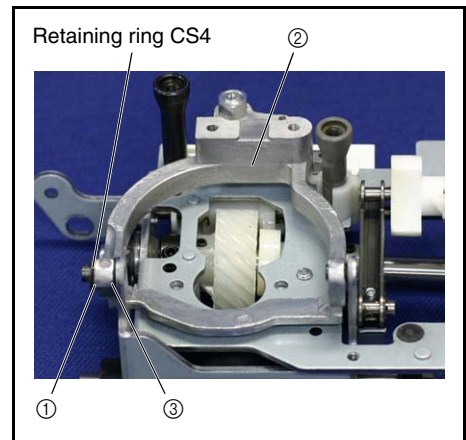
8 Removal of Spring

1. Remove the spring **S13**.



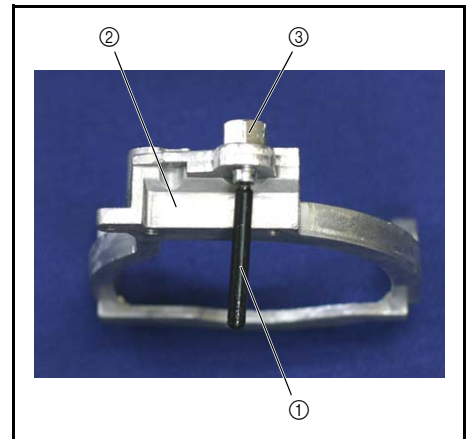
9 Removal of Feed bar

1. Remove the retaining ring CS4, and then remove the polyester slider ①, the feed bar ② and the polyester slider ③ from the feed arm A Assy.



10 Removal of Vertical adjuster screw Assy.

1. Remove the vertical adjuster screw Assy. ① from the feed bar ②.
2. Remove the M5 nut ③ from the vertical adjuster screw Assy. ①.

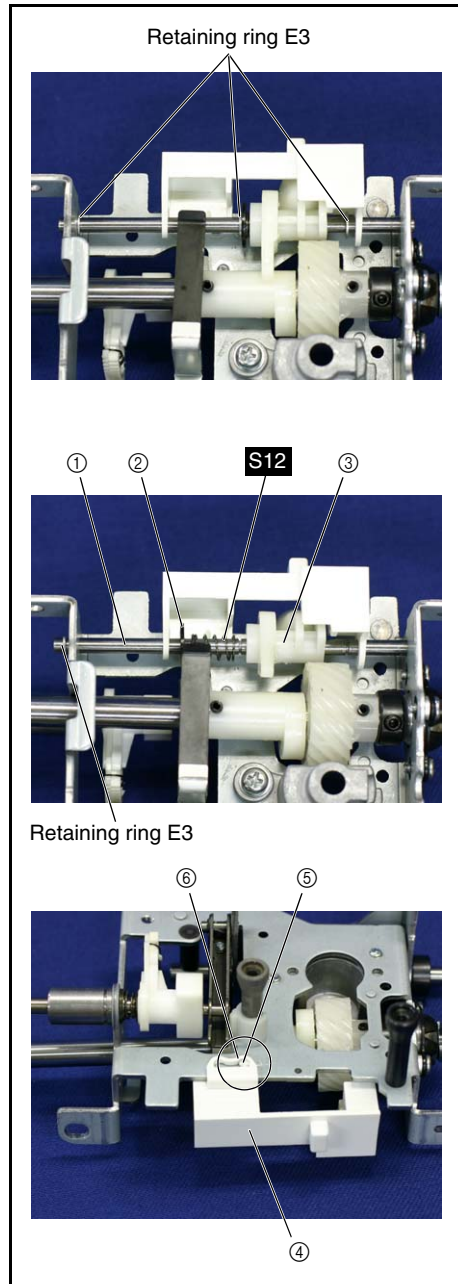


11 Removal of Drop knob

1. Remove the 3 retaining rings E3.
2. Pull the vertical feed shaft ①, and then remove the washer plain ②, the spring S12 and the vertical lever ③.
3. Remove the retaining ring E3 from the vertical feed shaft ①.
4. Remove the drop knob ④ from the base plate assy.

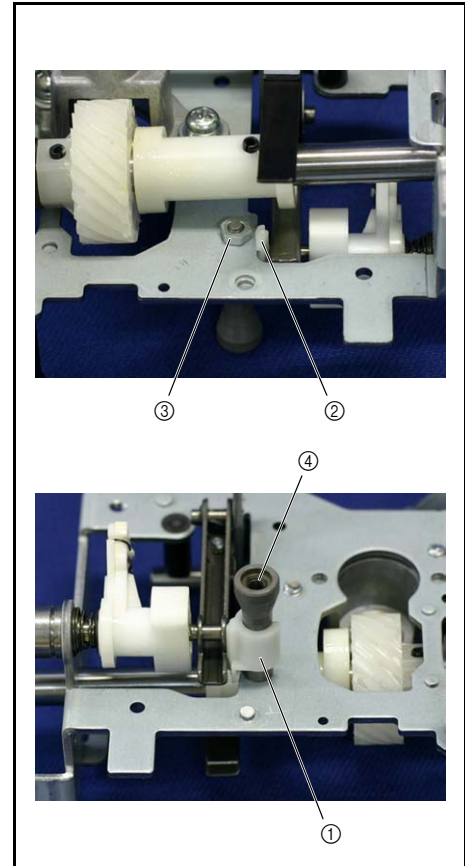
*Key point

- Remove it while lifting the section ⑥ of the drop knob ④ to get over the boss part ⑤ of the base plate assy.



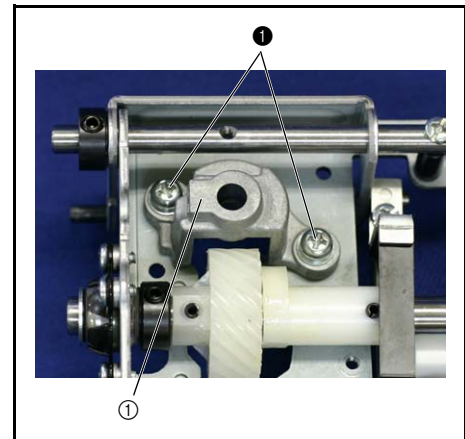
12 Removal of Needle plate supporter shaft B

1. Remove the hook ② of the feed arm supporter ①.
2. Remove the nut 1 M3 ③.
3. Remove the needle plate supporter shaft B ④ from the base plate assy.
4. Remove the feed arm supporter ① from the needle plate supporter shaft B ④.



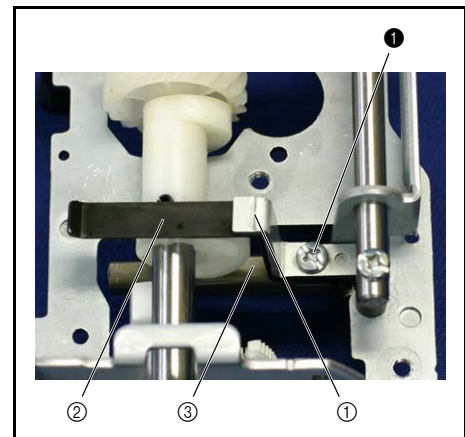
13 Removal of Shaft supporter

1. Remove the 2 screws ①, and then remove the shaft supporter ① from the base plate assy.



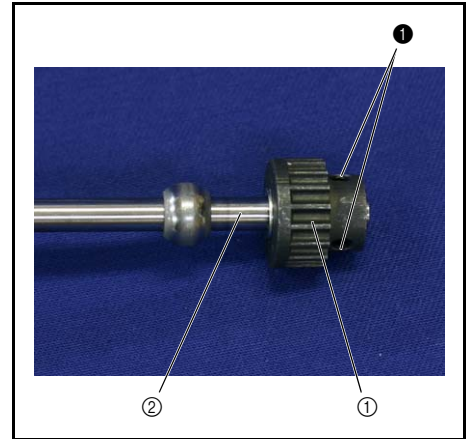
14 Removal of Feed supporting plate

1. Remove the screw ①, and then remove the feed supporting plate B ① and the feed supporting plate ② from the feed arm assy. ③.



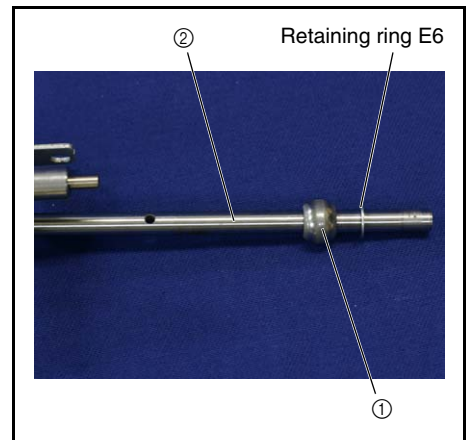
15 Removal of Timing pulley D

1. Remove the 2 screws ❶, and then remove the timing pulley D ❶ from the lower shaft assy. ❷.



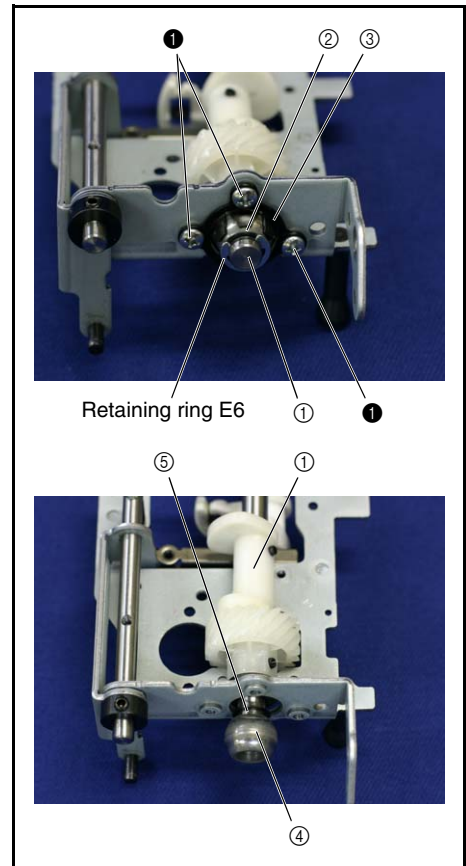
16 Removal of Lower shaft bushing

1. Remove the retaining ring E6, and then lower shaft bushing ❶ from the lower shaft assy. ❷.



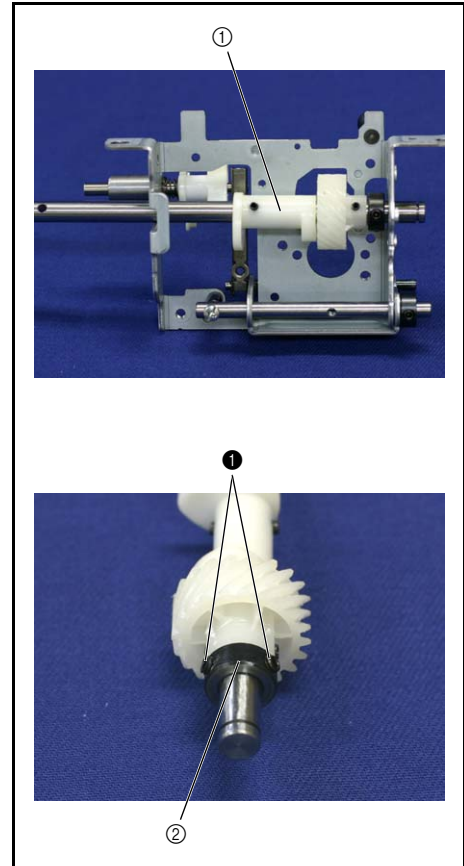
17 Removal of Bushing presser B

1. Remove the retaining ring E6, and then remove the “washer, thrust ❷” from the lower shaft assy. ❶.
2. Remove the 3 screws ❶, and then remove the bushing presser B ❸ from the base plate assy.
3. Remove the lower shaft bushing ❷ and the “washer, thrust ❸” from the lower shaft assy. ❶.



18 Removal of Lower shaft assy.

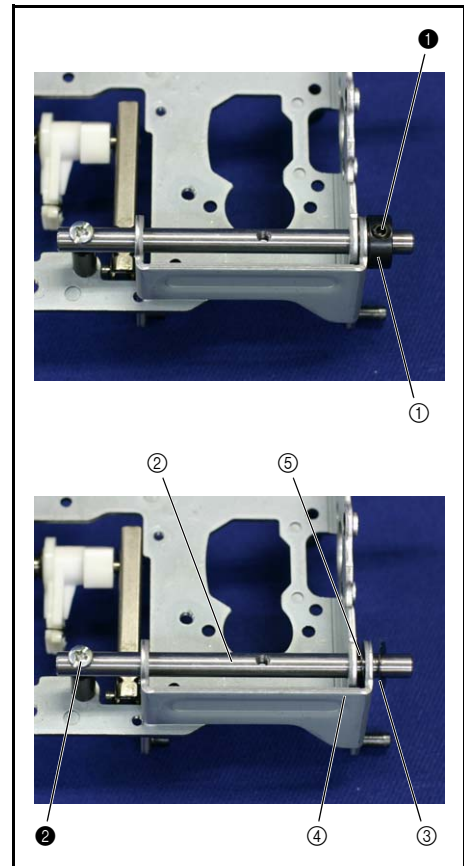
1. Remove the lower shaft assy. ① from the base plate assy.
2. Remove the 2 screws ❶, and then remove the set collar ②.

**19** Removal of Feed arm A assy.

1. Remove the screw ❶, and then remove the set collar ①.
2. Remove the screws ❷, and then pull the horizontal feed shaft ②, and then remove the “washer, thrust ③”, the feed arm A assy. ④ and the “washer, thrust ⑤”.

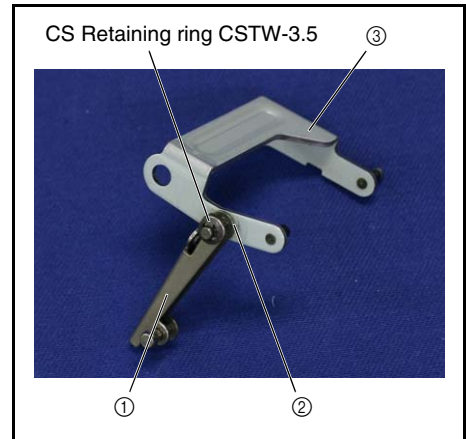
***Key point**

- Remove the feed regulator slide shaft of the feed arm B assy. from the feed adjuster.



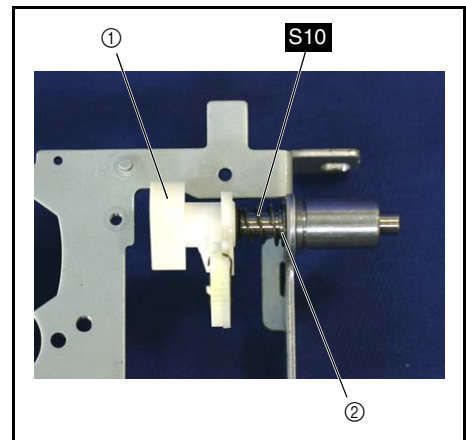
20 Removal of Feed arm B assy.

1. Remove the retaining ring CSTW-3.5, and then remove the feed arm B assy. ① and the polyester slider ② from the feed arm A assy. ③.



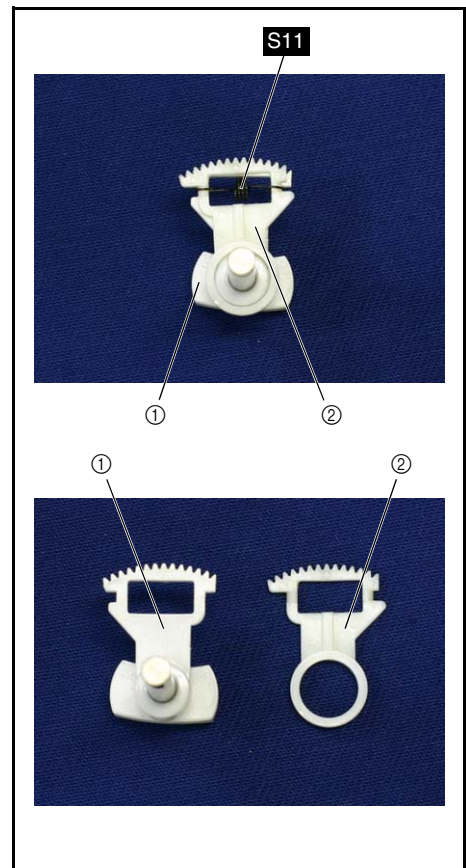
21 Removal of Feed adjuster assy.

1. Pull the feed adjuster ① from the base plate assy. and then remove the spring S10 and the polyester slider ②.



21-1 Disassembly of Feed adjuster assy.

1. Remove the spring S11, and then remove the F gear ② from the feed adjuster ①.

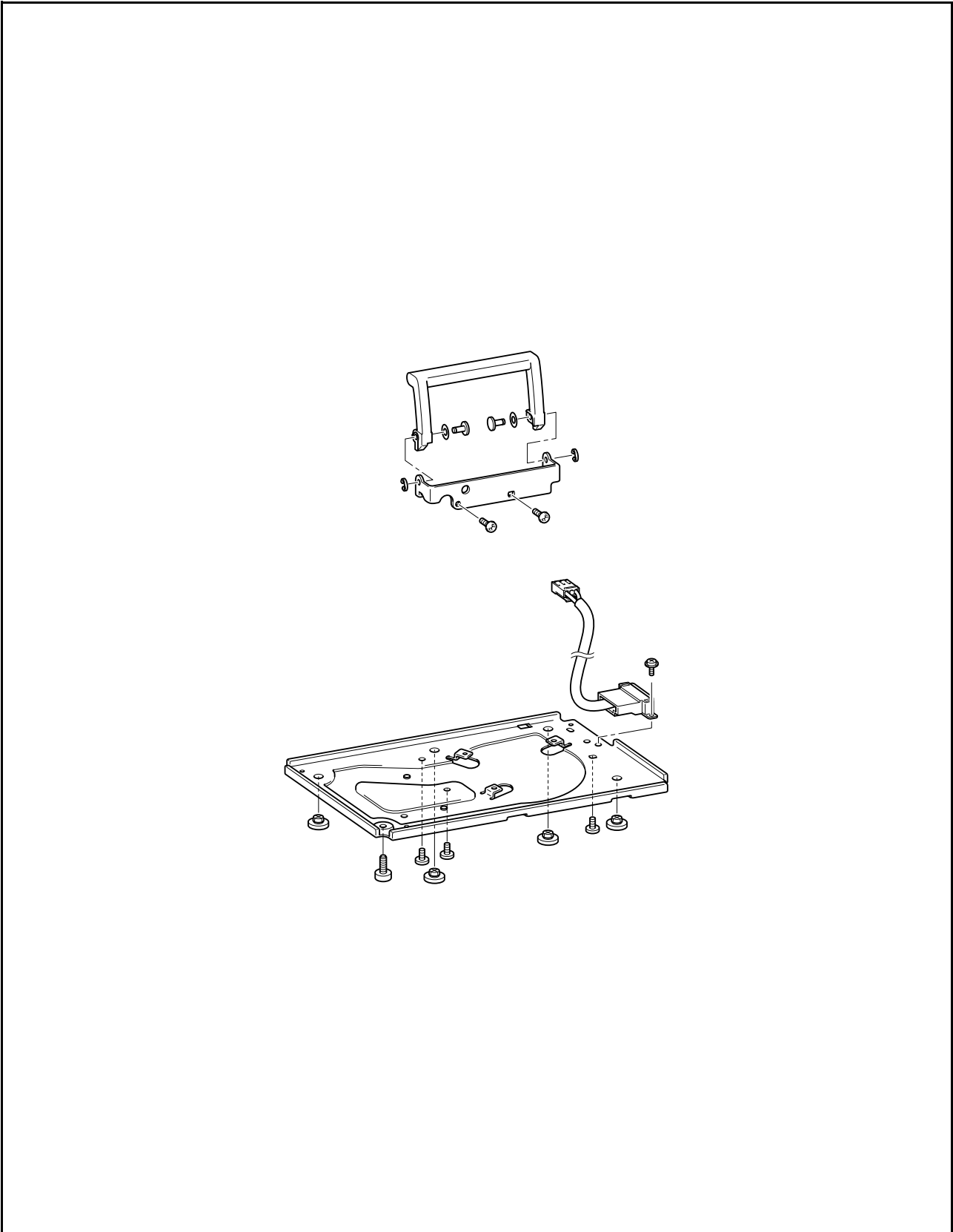


3 Assembly

When disassembly and assembly are performed, make adjustments according to "4 Adjustments."

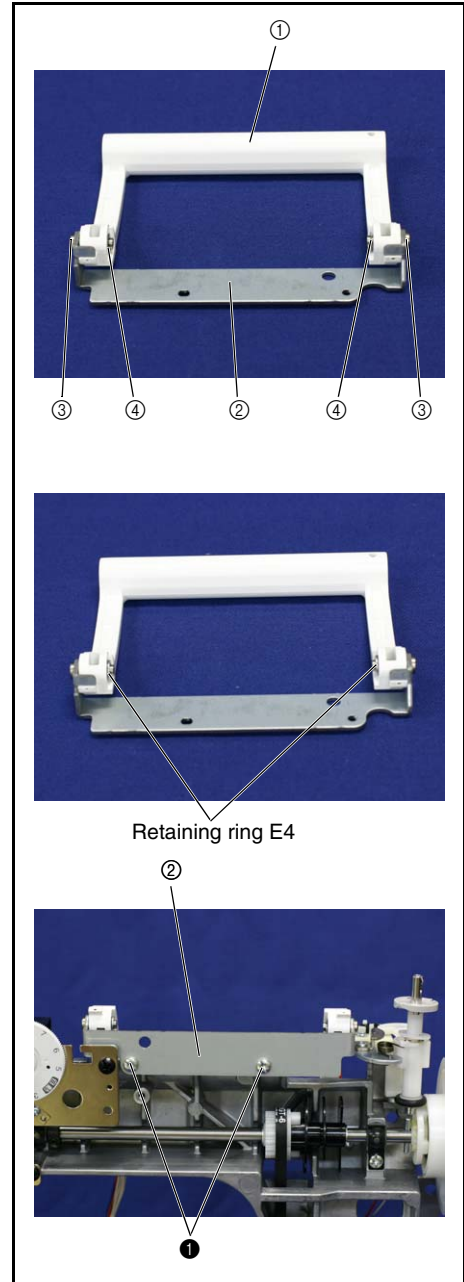
Main unit	Base plate and handle	3 - 2
	Needle bar, presser mechanism / upper shaft mechanism	3 - 5
	Feed mechanism	3 - 10
	Bobbin winder mechanism	3 - 13
	Thread tension mechanism	3 - 17
	Electrical parts and motor	3 - 23
	Main parts	3 - 28
Modules	Needle-presser module	3 - 40
	Feed and bobbin module	3 - 53



Base plate and handle location diagram



1 Attachment of Handle

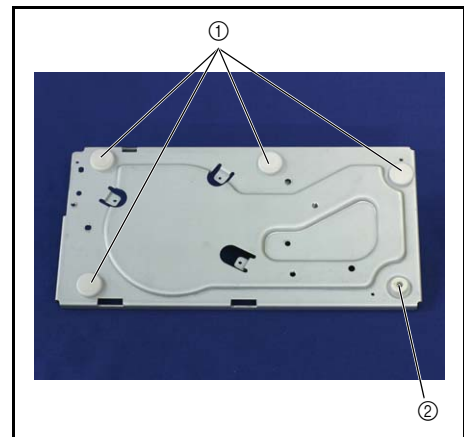
1. Set the handle ① to the handle holder ②, and then insert the 2 handle shafts ③.
2. Insert the 2 polyester sliders ④ into the handle shaft ③, and then attach the retaining ring E4.
3. Attach the handle holder ② to the arm bed with the 2 screws ①.



		Taptite, Bind S M4X10	Torque 1.47 – 1.96 N·m
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2 Attachment of Adjusting screw assy., Base rubber A

1. Attach the 4 base rubbers A ① to the base plate.
2. Attach the adjusting screw assy. ② to the base plate.




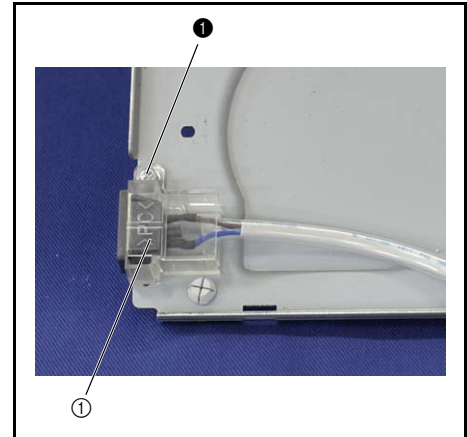
3 Attachment of Inlet assy.

1. Attach the inlet assy. ① to the base plate with the screw ①.

***Key point**


- Check that the boss part of the inlet assy. ① engaged with the positioning hole of base plate.

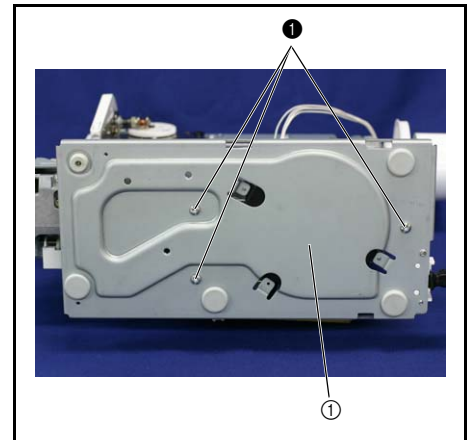
①		Screw, Pan (S/P washer) M4X8	Torque 0.78 – 1.18 N·m
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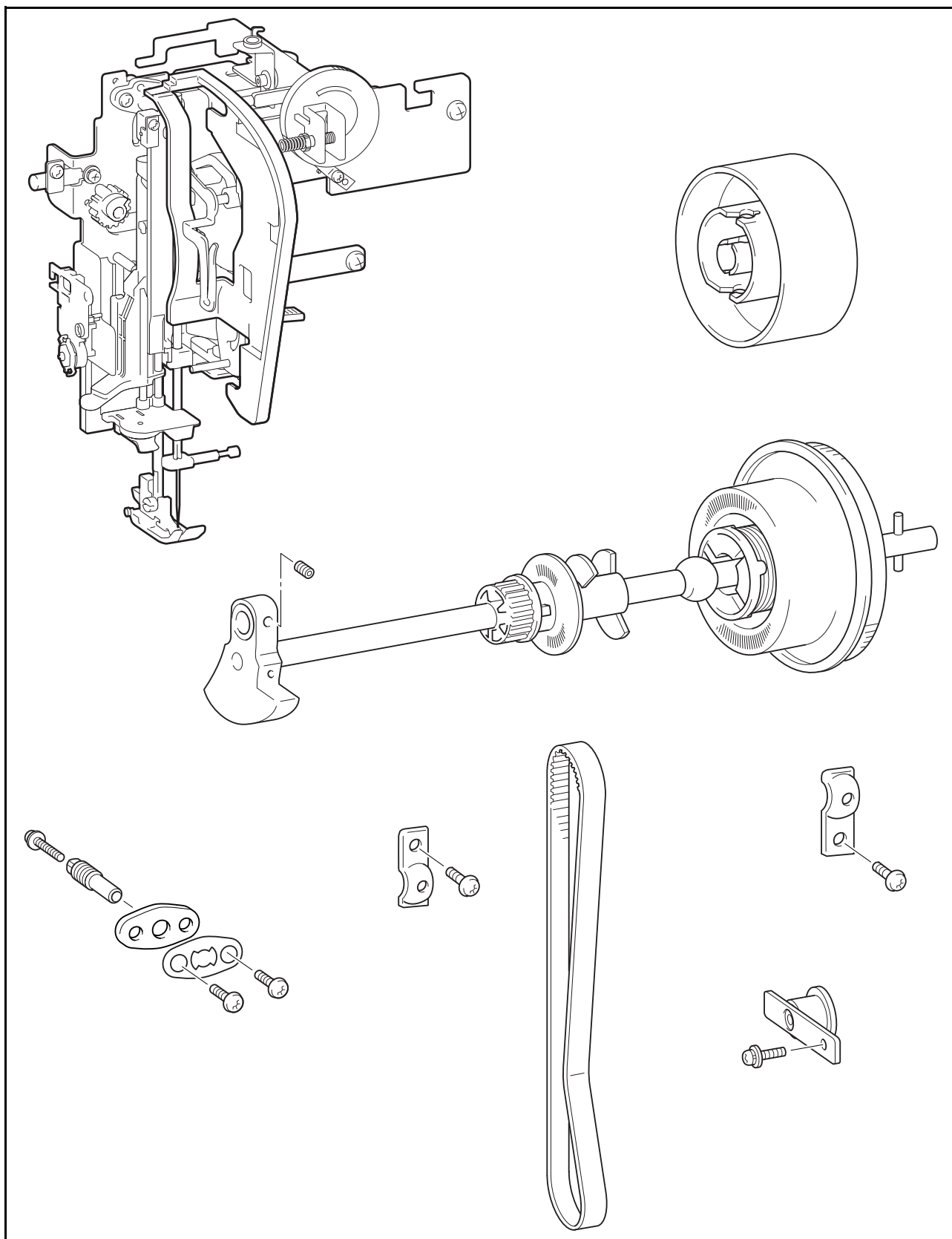
4 Attachment of Base plate

1. Attach the base plate ① to the arm bed with the 3 screws ①.

①		Tapite, Bind S M4X10	Torque 1.47 – 1.96 N·m
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Needle bar, presser mechanism / upper shaft mechanism location diagram




Assembly

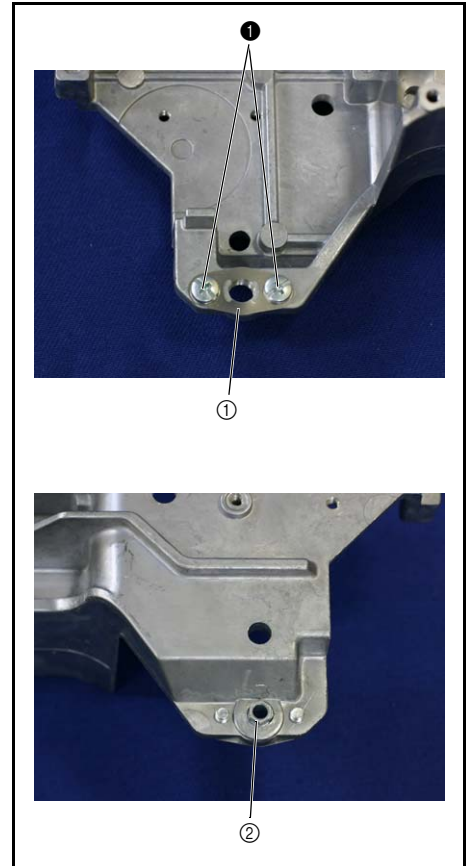
1 Attachment of Plate spring

1. Attach the plate spring ① from the front of the arm bed with the 2 screws ①.
2. Attach the adjusting screw ② from the back of the arm bed.

*Key point

- Tighten the adjusting screw ② so that the screw threads are completely hidden.

①		Screw, Blind M4X8	Torque 1.18 – 1.57 N·m
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2 Attachment of Needle-presser module

1. Attach the needle-presser module ① to the arm bed.

*Key point


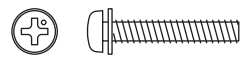
- Set in the take-up support shaft ② to the groove ③ (2 locations) of the arm bed.

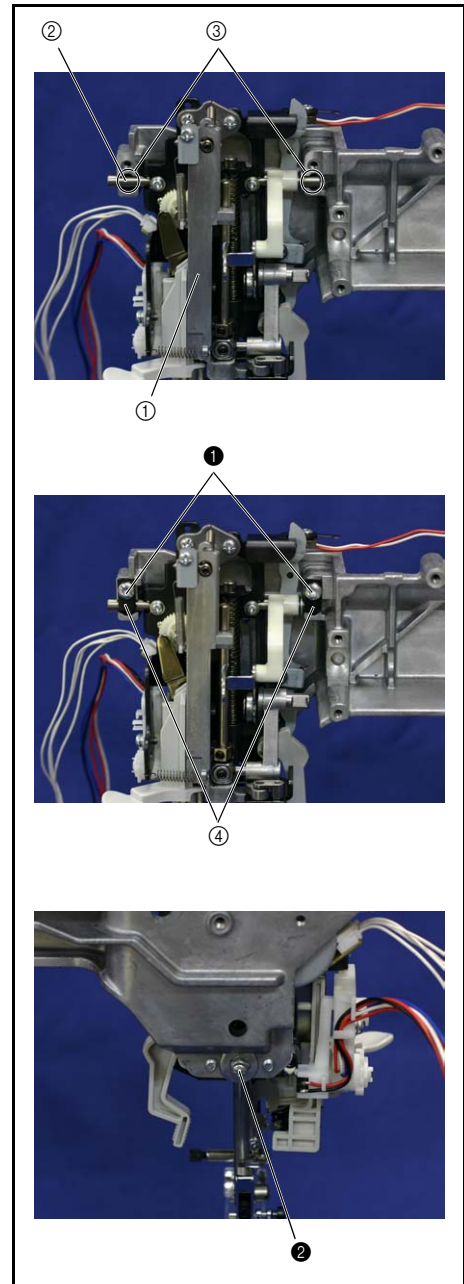
2. Attach the 2 presser plates ④ with the 2 screws ①.

3. Tighten the screw ② temporarily.

*Key point

- Fully tighten the screw after performing "4-11 Adjustment of clearance between"

①		Taptite, Bind S M4X10	Torque 1.47 – 1.96 N·m
②		Screw, Pan (S/P washer) M3X18A	Torque 0.59 – 0.78 N·m



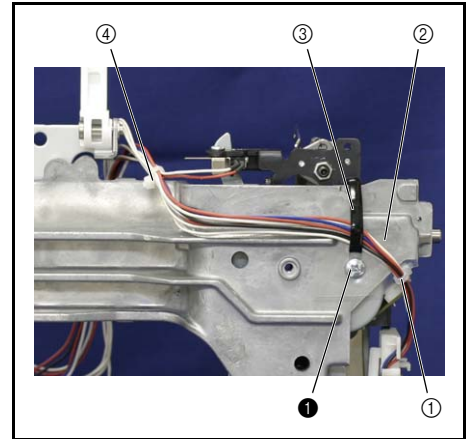
3 Attachment of Coaching clip

1. Bind up the lead wire of the BH switch Assy. and the lead wire sub Assy. with the band ①.
2. Attach the insulator sheet ② and the coaching clip ③ to the arm bed with the screw ①.
3. Bind up the lead wires with the band ④.

***Key point**

- Refer to "Special Instructions of Wiring"
- Secure the lead wire of the BH switch Assy. and the lead wire sub Assy. with the coaching clip ③.

①		Screw, Bind M4X6	Torque 1.18 – 1.57 N·m
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4 Attachment of Upper shaft assy.

1. Attach the pulley ① to the upper shaft assy. ②.
2. Hang the T belt ③ on the upper shaft pulley ④.
3. Insert the shaft of the needle bar crank ⑤ into the thread take-up counter weight ⑥, and then attach the upper shaft assy. ② to the arm bed.

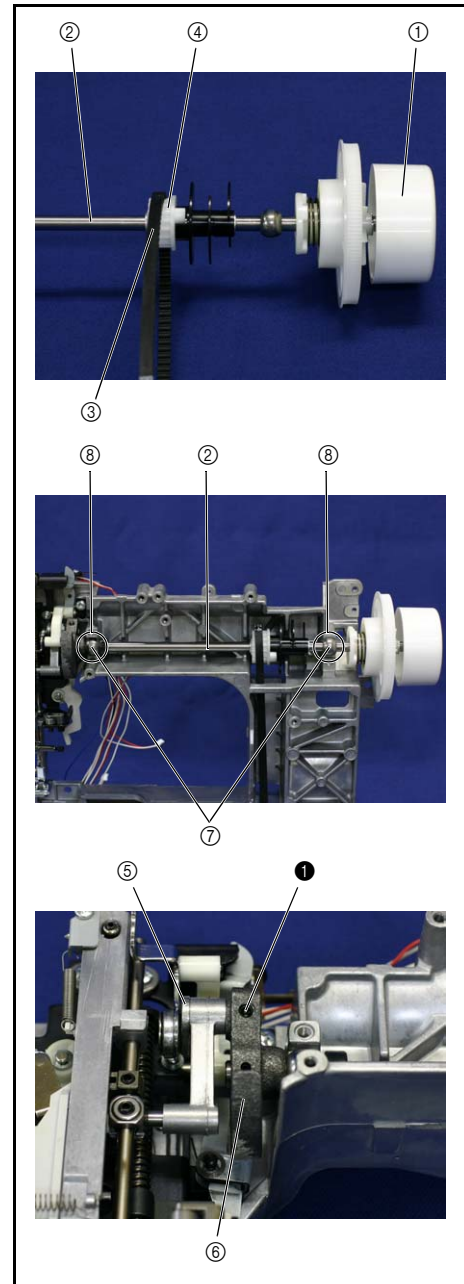
***Key point**


- Check that the 2 lower shaft bushings ⑦ engaged with the attaching part ⑧ of the arm bed.

4. Attach the screw ①.

***Key point**


- Check that the screw ① with the D cut surface of the needle bar crank rod assy. ⑤.

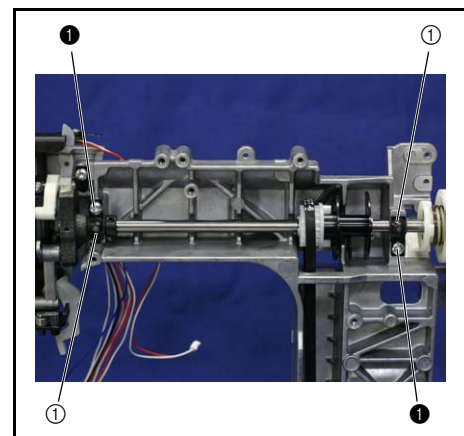


①		Set Screw, Socket (FT) M5X5	Torque 1.18 – 1.57 N·m
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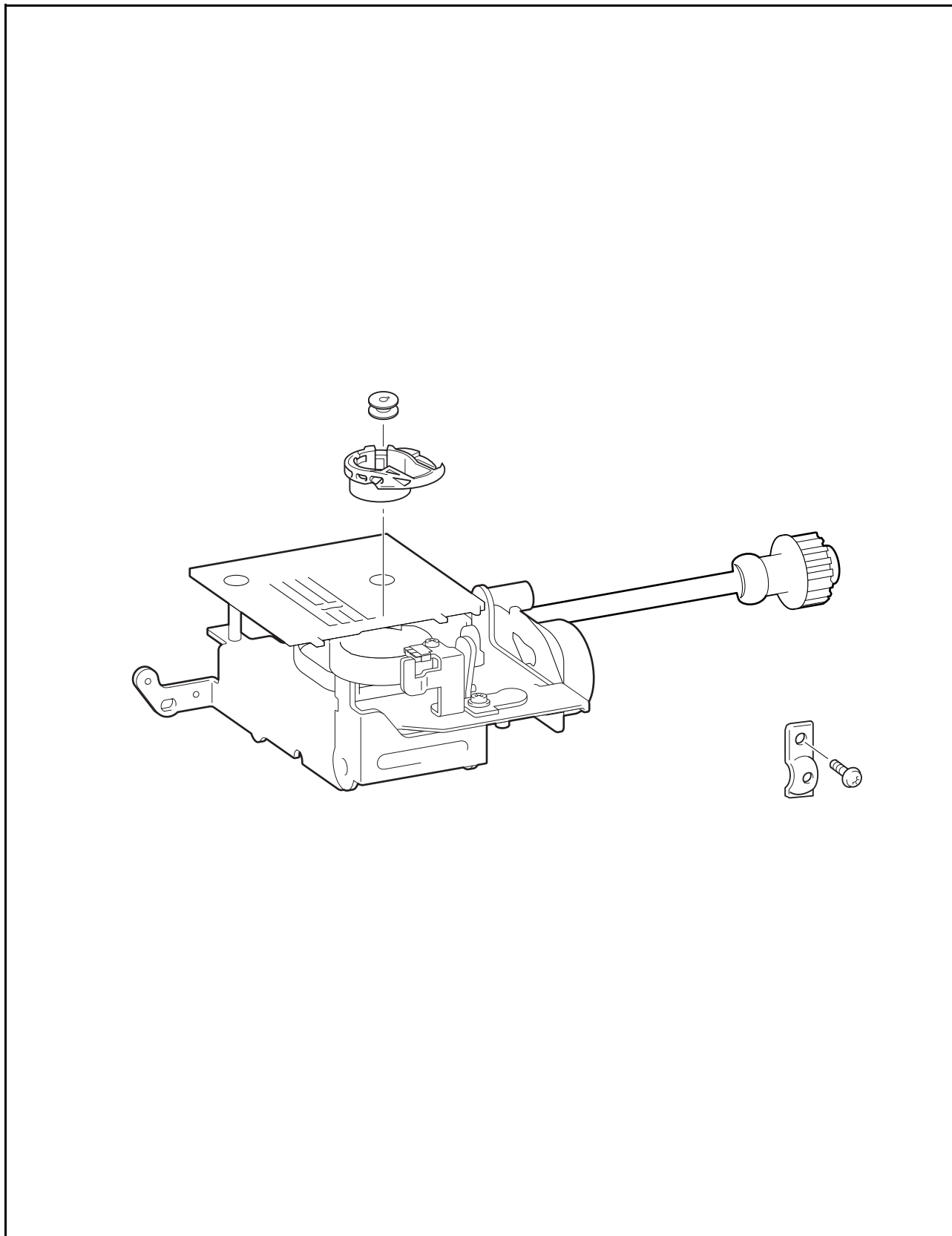
5 Attachment of Bushing presser (For upper shaft)

1. Attach the 2 bushing pressers ① to the arm bed with the 2 screws ①.

①		Taptite, Bind S M4X10	Torque 1.47 – 1.96 N·m
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Feed mechanism location diagram

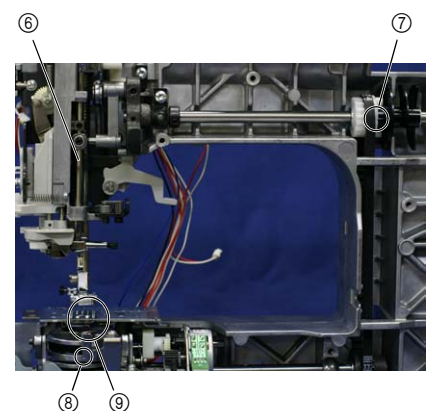
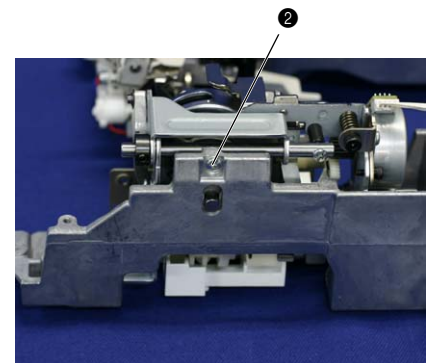
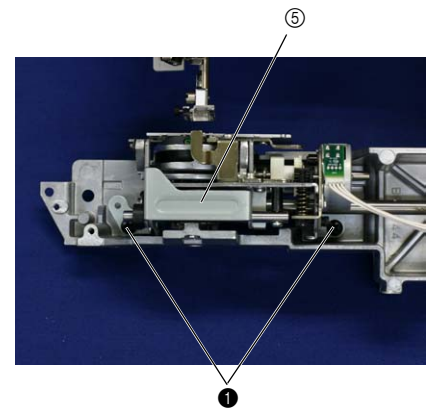
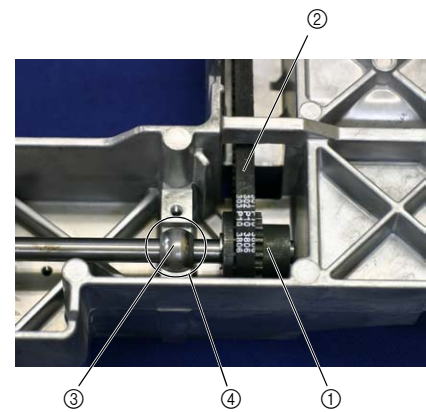


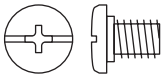
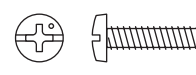
1 Attachment of Feed module

1. Hang the timing pulley D ① on the T belt ②.
2. Set in the lower shaft bushing ③ to the attaching part ④ of the arm bed.
3. Attach the feed module ⑤ to the arm bed with the 2 screws ① and ②.

*Key point

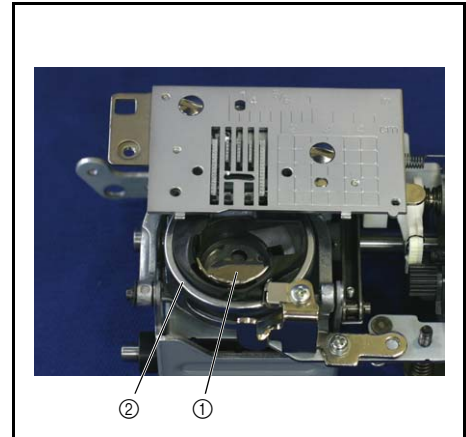
- Check that there is the gullet ⑦ of the upper shaft pulley and the reference point ⑧ of the outer rotary hook assy. in the front side, when the needle bar ⑥ and the feed dog ⑨ are the highest point.



①		Stud screw M4	Torque 1.18 – 1.57 N·m
②		Screw, Bind M3X12	Torque 0.78 – 1.18 N·m

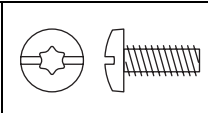
2 Attachment of Inner rotary hook assy.

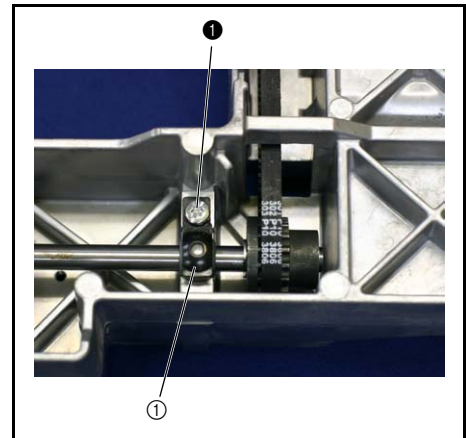
1. Attach the inner rotary hook assy. ① to the outer rotary hook assy. ②.



3 Attachment of Lower shaft bushing

1. Attach the lower shaft bushing ① to the arm bed with the screw ①.

①		Taprite, Bind S M4X10	Torque 1.47 – 1.96 N·m
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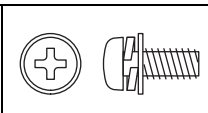


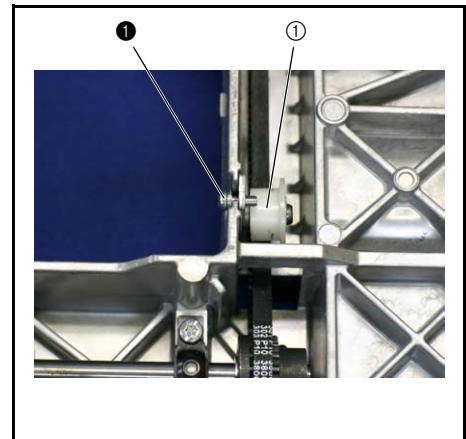
4 Attachment of Tension pulley assy.

1. Set the tension pulley assy. ① to the arm bed, and then tighten the screw ① temporarily.

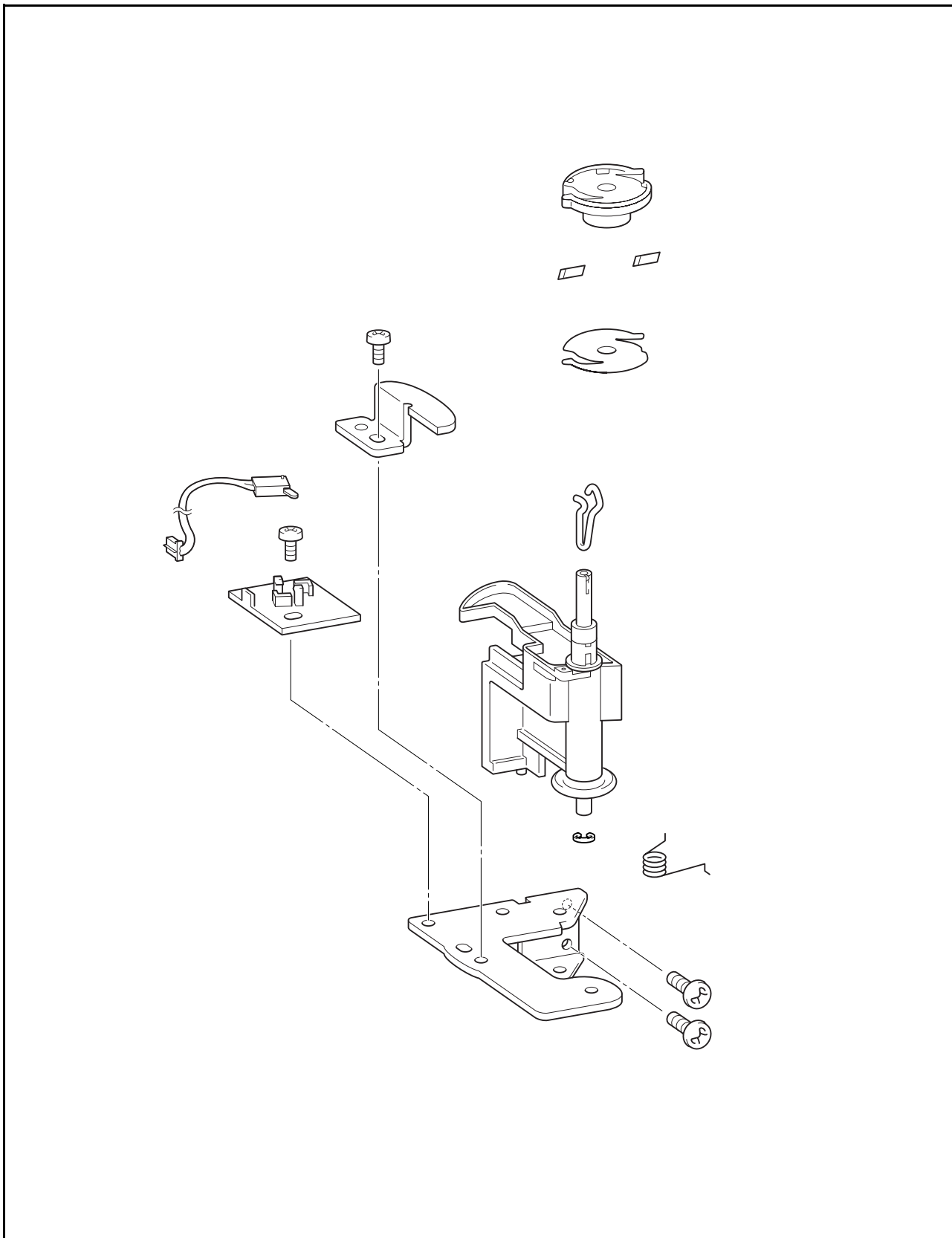
***Key point**

- Fully tighten the screw after performing "4-5 Adjustment of timing belt tension".

①		Screw, Pan (S/P washer) M4X10DA	Torque 1.18 – 1.57 N·m
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Bobbin winder mechanism location diagram

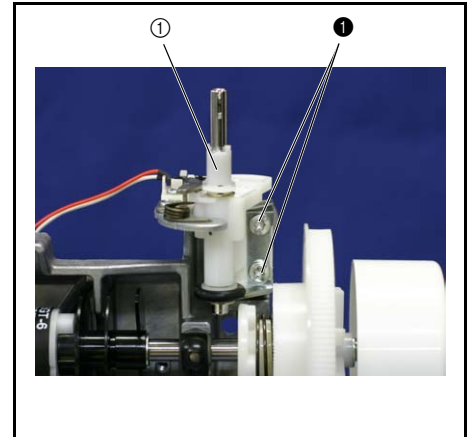


Assembly

1 Attachment of Bobbin winder assy.

1. Attach the bobbin winder assy. ① to the arm bed with the 2 screws ❶.


❶		Taptite, Bind S M4X10	Torque 1.47 – 1.96 N·m
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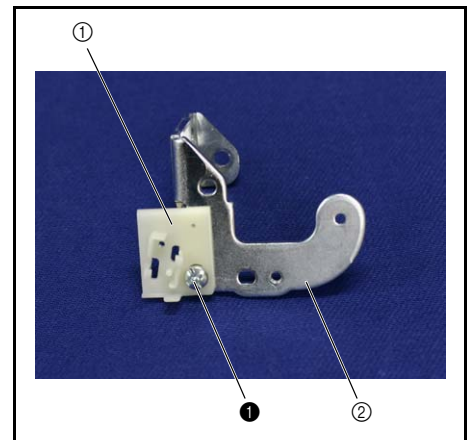
**1-1 Assembly of Bobbin winder assy. (Attachment of SW adjust plate)**

1. Align the boss part of the SW adjust plate ① with the positioning hole of the bobbin winder assy. holder ②, and then tighten the screw ❶ temporarily.


***Key point**

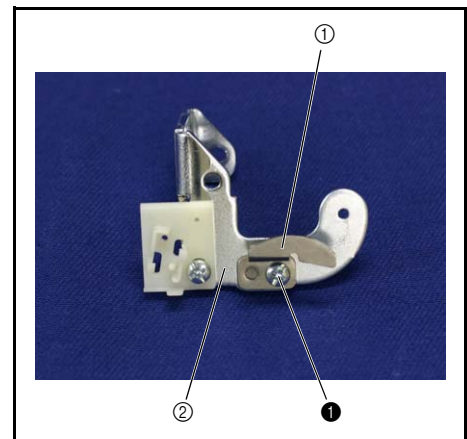
- Fully tighten the screw after performing "4-20 Adjustment of BW switch position".

❶		Screw, Bind M3X6	Torque 0.59 – 0.78 N·m
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**1-2 Assembly of Bobbin winder assy. (Attachment of Bobbin winder shaft stopper)**

1. Align the boss part of the bobbin winder shaft stopper ① with the positioning hole of the bobbin winder assy. holder ② with the screw ❶.

❶		Screw, Bind M3X6	Torque 0.78 – 1.18N·m
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1-3 Assembly of Bobbin winder assy. (Attachment of BW shaft holder assy.)

1. Attach the rubber ring ② to the BW shaft holder assy. ①.
2. Attach the bobbin winder shaft spring ③ to the top position of the BW shaft holder assy. ①.
3. Attach the BW shaft holder assy. ① to the bobbin winder assy. holder ④.

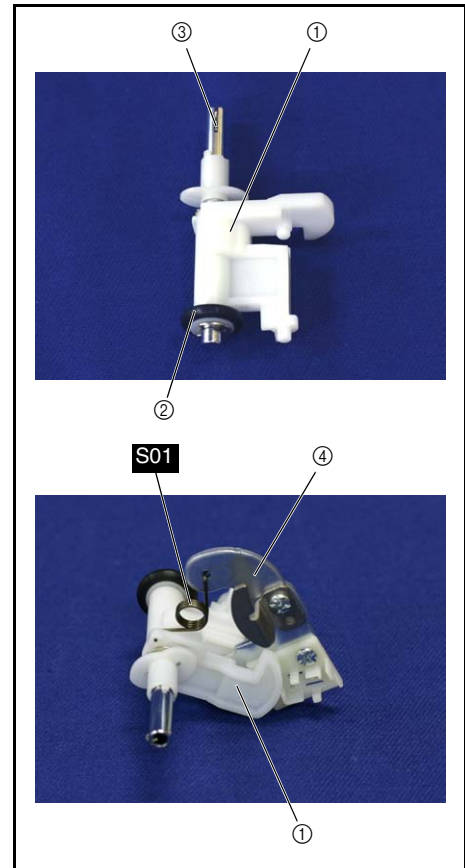
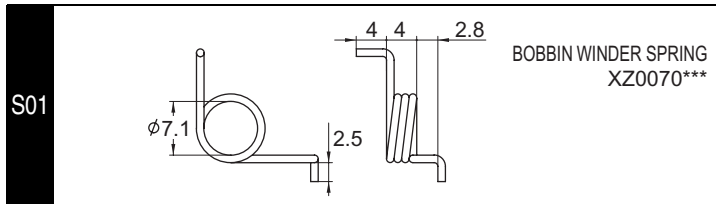
***Key point**

- Check that the 2 boss parts of the BW shaft holder assy. ① engaged with the 2 positioning holes of the bobbin winder assy. holder ④.

4. Attach the spring **S01** to the BW shaft holder assy. ① and the bobbin winder assy. holder ④.

***Key point**

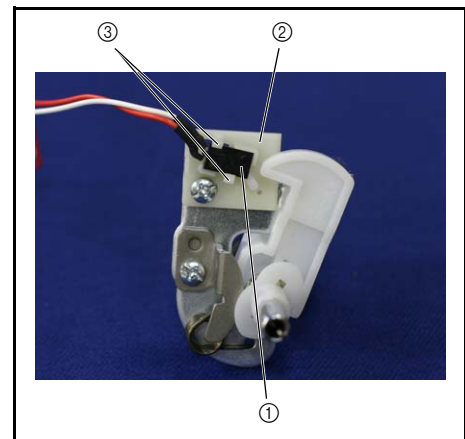
- Attach the side where the hook part of the spring is twisted in the right angle to the BW shaft holder assy. ①.

**1-4** Assembly of Bobbin winder assy. (Attachment of SW assy : BW-F)

1. Attach the SW assy : BW-F ① to the SW adjust plate ②.

***Key point**

- Check that the hooks ③ (2 locations) of the SW adjust plate ② hang on the SW assy : BW-F ①.

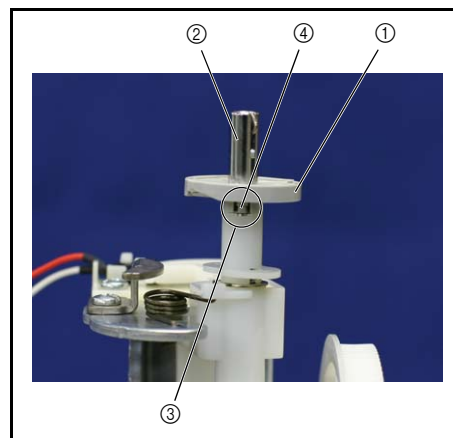


2 Attachment of Bobbin base assy.

1. Attach the bobbin base assy. ① to the bobbin winder assy. ②.

***Key point**

- Check that the 2 gullets ③ of the bobbin base assy. ① engage with the 2 protrusions ④ of the bobbin winder.

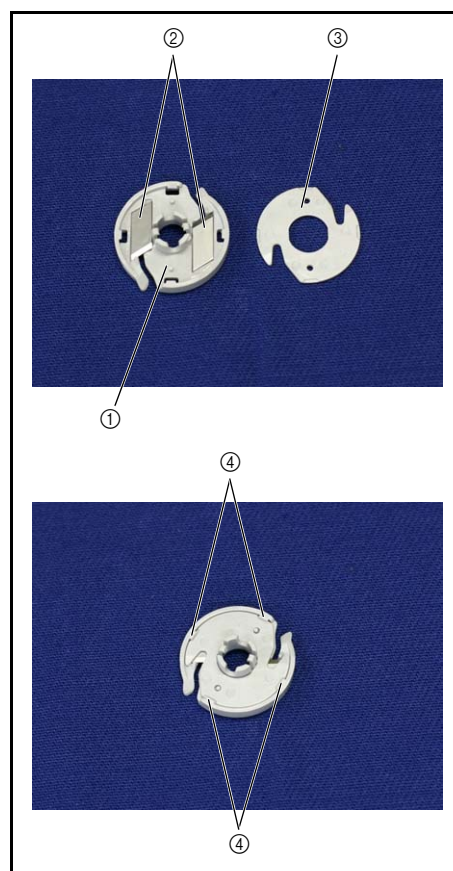


2-1 Assembly of Bobbin base assy.

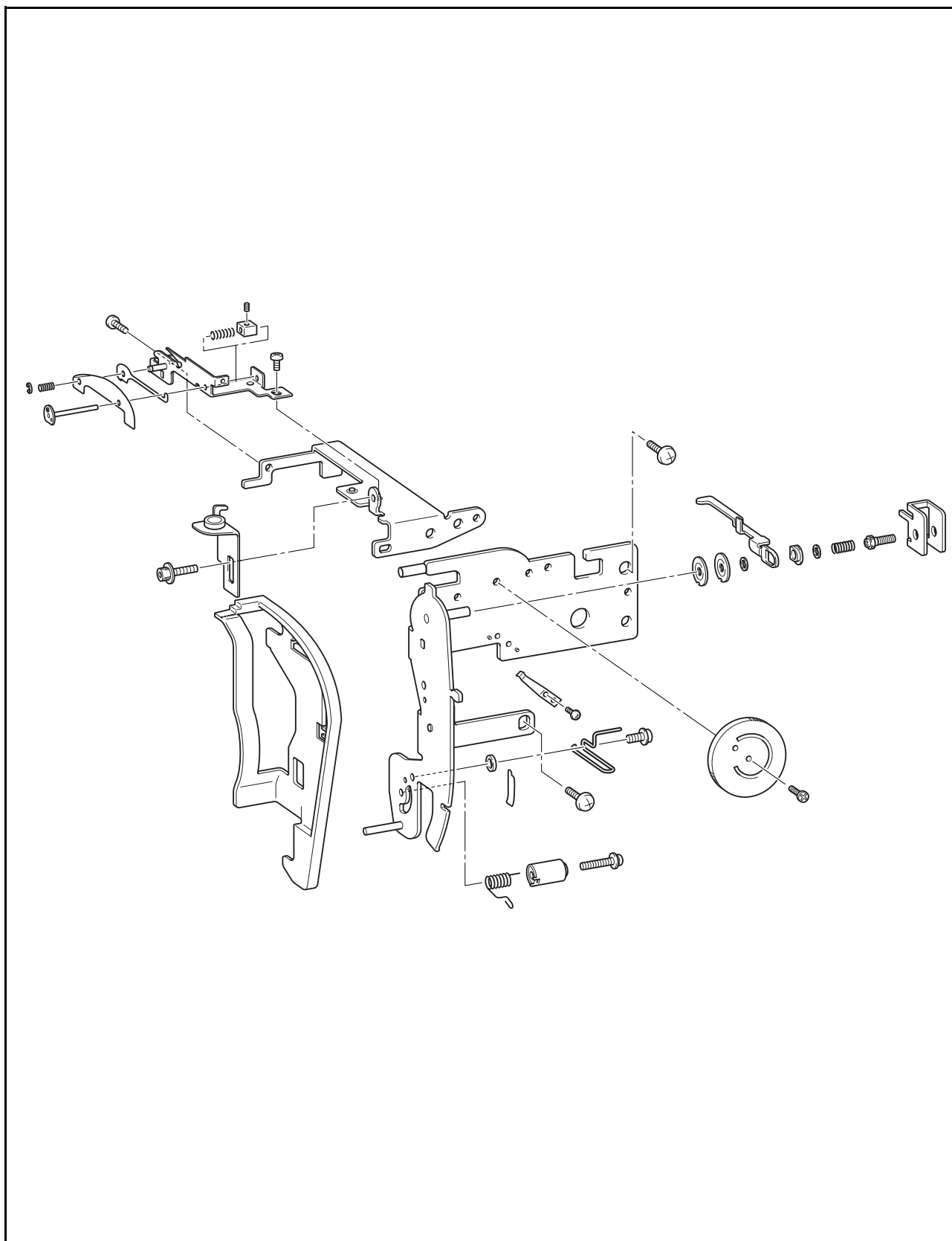
1. Attach the NT lower thread cutter (2) to the bobbin base assy. (1).
2. Attach the bobbin thread cutter holder (3) to the bobbin base assy. (1).

***Key point**

- Be careful not to damage the hooks (4) (4 locations).



Thread tension mechanism location diagram

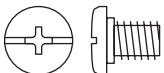


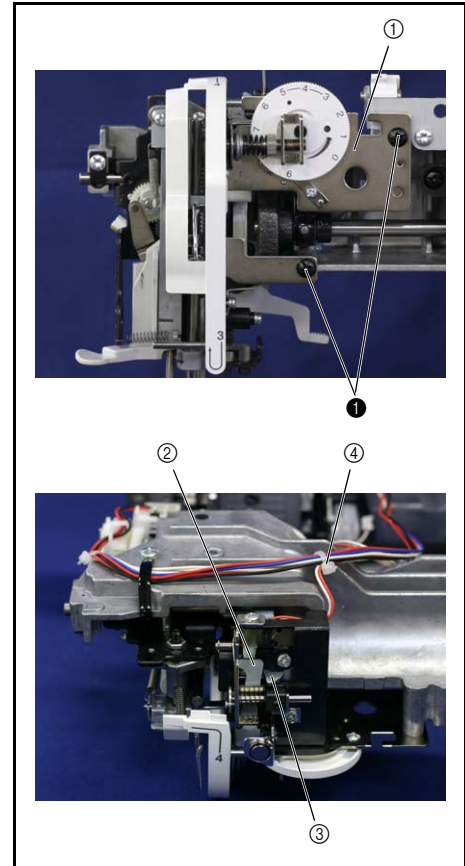
1 Attachment of Thread unit H

1. Attach the thread unit H ① to the arm bed with the 2 screws ❶.

*Key point

- Check that the thread release plate ② is on the left side of the thread release lever ③.
 - Refer to "4-8 Adjustment of upper thread tension".
2. Bind up the lead wire with the band ④.

❶		Stud screw M4	Torque 1.18 – 1.57N·m
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1-1 Assembly of Thread unit L (Attachment of Thread catching spring case)

1. Attach the spring tape ② to the Thread unit L ①.
2. Attach the spring S02 to the thread catching spring case ③.

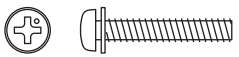

***Key point**

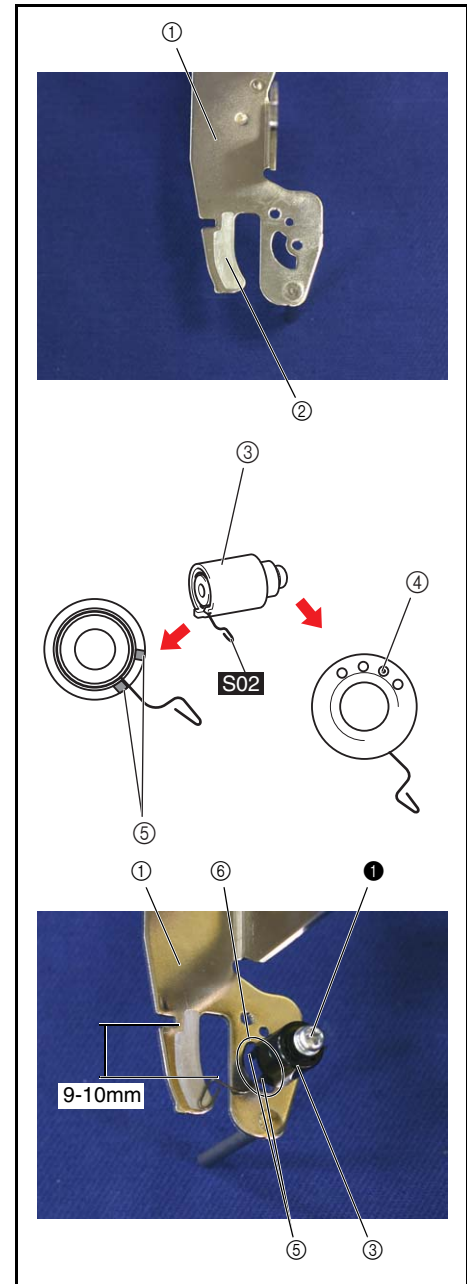
- Check that the tip of the spring insert into the hole ④ from the bottom of the thread catching spring case, when set it as shown in the right figure.
- Check that the spring is between the protrusions ⑤ (2 locations).

3. Attach the thread catching spring case ③ to the Thread unit L ① with the screw ①.

***Key point**

- Check that the protrusions ⑤ (2 locations) of the thread catching spring case ③ engaged with the positioning hole ⑥ of the Thread unit L ①.
- Check that from the lower side of the notch part of the Thread unit L ① to the bent section of the spring is 9 to 10 mm.


①		Screw, Pan (S/P washer) M3X18A	Torque 0.59 – 0.78 N·m
S02		SPRING XE2029***	

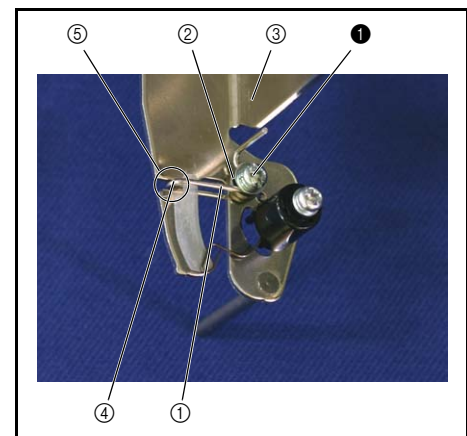
**1-2 Assembly of Thread unit L (Attachment of Thread guide wire)**

1. Attach the thread guide wire ① and the washer ② to the Thread unit L ③ with the screw ①.

***Key point**

- Check that the section ④ of the thread guide wire ① engaged with the notch part ⑤ of the Thread unit L ③.

①		Screw, Pan (S/P washer) M3X6	Torque 0.59 – 0.78 N·m
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1-3 Assembly of Thread unit H (Attachment of Thread tension dial)

1. Insert the tension disc A ②, the tension disc B ③, the washer ⑩, the thread release plate ⑤, the tension disc washer ⑥, the washer ⑦ and the spring S03 into the shaft of the thread unit H ①.

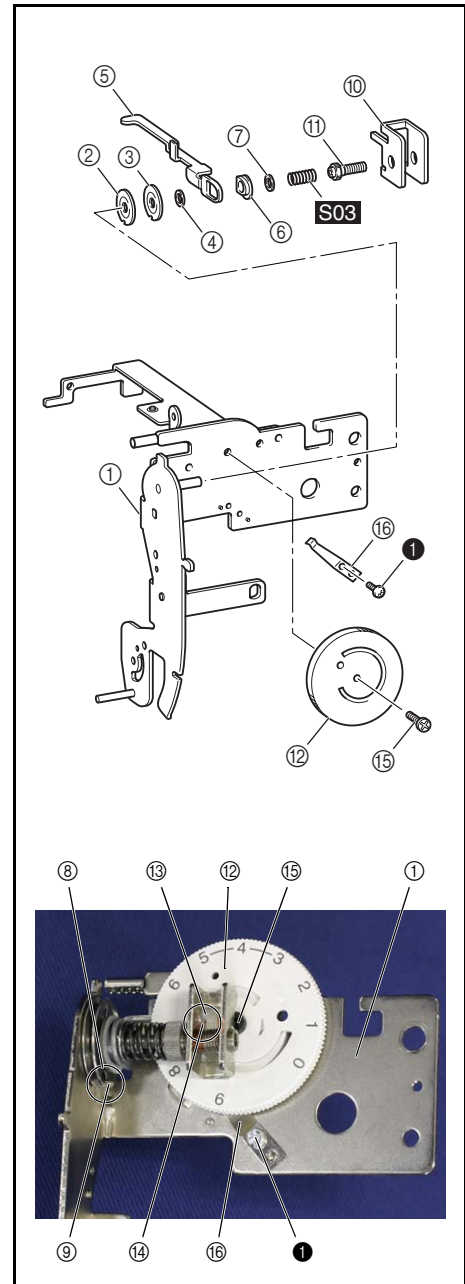
***Key point**



- Check that the notch part ⑧ of the tension disc A ② and the tension disc B ③ align the protrusion ⑨ of the thread unit H.

2. Attach the thread tension adjusting screw ⑪ to the thread tension plate ⑩, and then engage the protrusion ⑭ of the thread tension plate ⑩ in the groove ⑬ of the thread tension dial ⑫, and then insert the tension adjusting screw ⑪ into the shaft of the thread unit H ①, and then attach the thread tension dial ⑫ to the thread unit H ① with the tension dial shaft ⑮.
3. Attach the notched spring ⑯ to the thread unit H ① with the screw ⑰.

***Key point**

- Insert the tip of notched spring ⑯ into the bottom of the thread tension dial ⑫.
- Check that the boss part of the thread unit H ① engaged with the positioning hole of the notched spring ⑯.



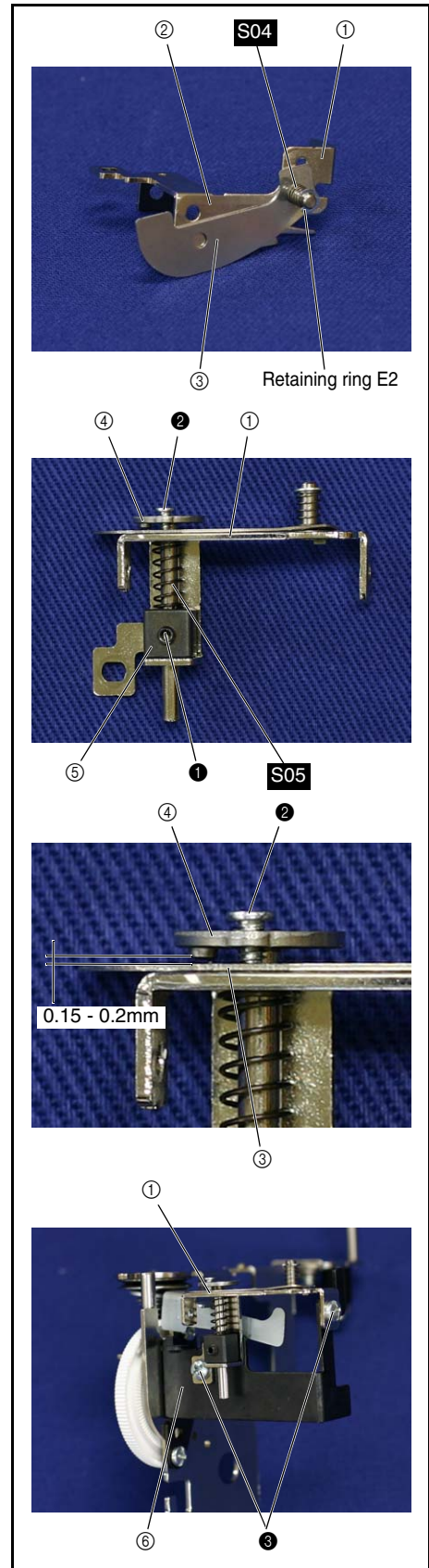
①		Screw, Pan M3X4	Torque 0.78 – 1.18 N·m
S03		THREAD TENSION SPRING XA9900***	





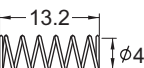
1-4 Assembly of Thread unit H (Attachment of Thread guide plate assy.)

1. Insert the spacer ②, the tension plate ③ and the spring **S04** into the shaft of the thread guide plate assy. ①, and then attach the retaining ring E2.
2. Insert the shaft of the tension presser plate assy. ④ into the tension plate ③, the thread guide plate assy. ①, the spring **S05**, the adjusting collar ⑤ and the thread guide plate assy. ①, and then attach it with the screw ①.
3. Attach the screw ② to the tension presser plate assy. ④.

***Key point**

- There should be a 0.15 mm – 0.2 mm gap between the tension plate ③ and the protrusion of the tension presser plate assy. ④.
 - Refer to "4-7 Adjustment of fine tension".
4. Attach the thread guide plate assy. ① to the thread unit H ⑥ with the 2 screws ③.



①		Set Screw, Socket (FT) M4X4	Torque 0.59 – 0.78 N·m
②		Power Lock 2X3	
③		Screw, Bind M3X4	Torque 0.78 – 1.18 N·m
S04			SPRING X57605***
S05			SPRING XA9577***

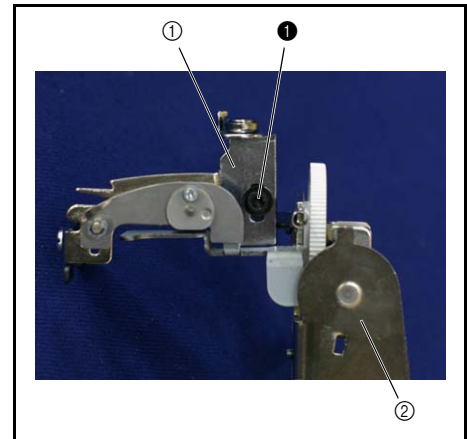
1-5 Assembly of Thread unit H (Attachment of Bobbin winder guide assy.)

1. Set the bobbin winder guide assy. ① to the thread unit H ②, and then tighten the screw ③.

***Key point**

- Fully tighten the screw after performing "4-19 Adjustment of bobbin winder".

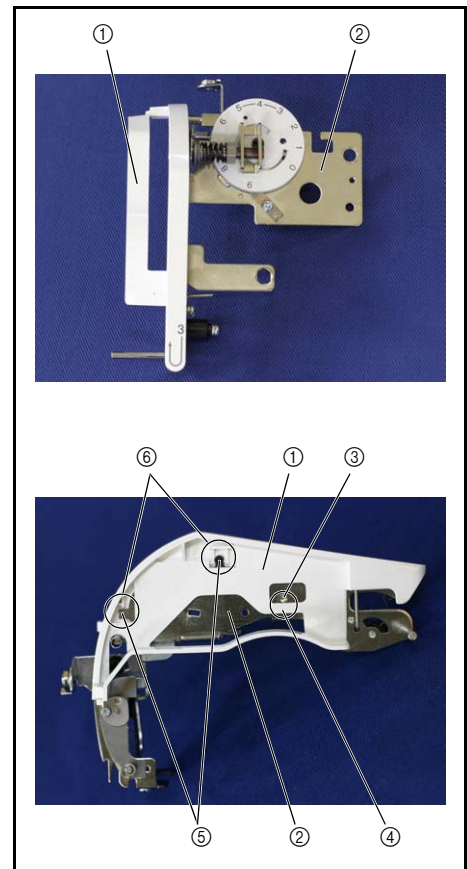
③		Screw 3X10	Torque 0.59 – 0.78 N·m
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**1-6** Assembly of Thread unit H (Attachment of Thread guard cover)

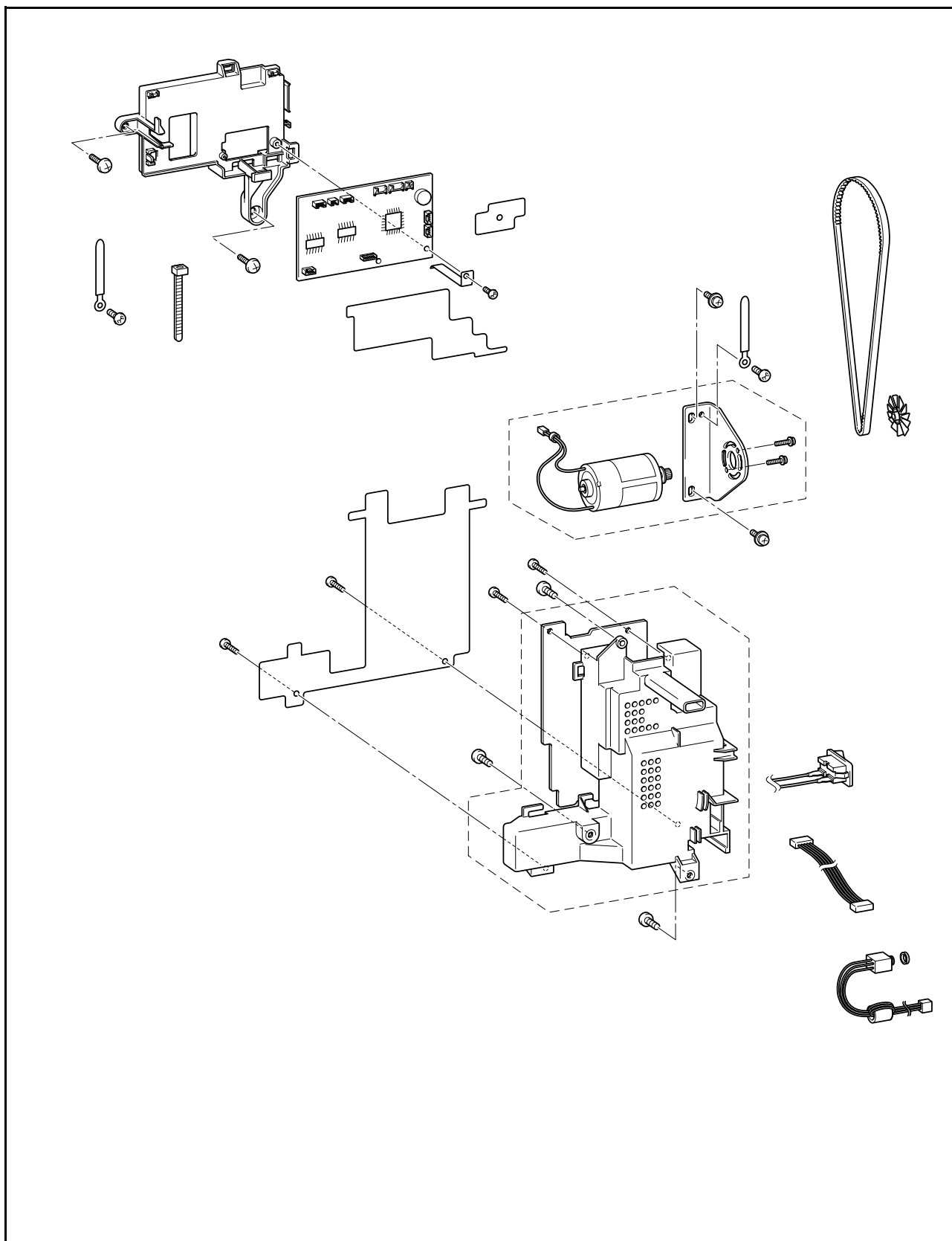
1. Attach the thread guard cover ① to the thread unit H ②.

***Key point**

- Attach it while lifting the section ④ of the thread guard cover ① to get over the boss ③ of the thread unit H ②.
- Check that the protrusions ⑤ (2 locations) of the thread unit H ② engaged with the gullets ⑥ (2 locations) of the thread guard cover ①.



Electrical parts and motor location diagram



1 Attachment of Main motor sub assy.

1. Set the main motor sub assy. ① to the arm bed, and then tighten the 2 screws ① temporarily.

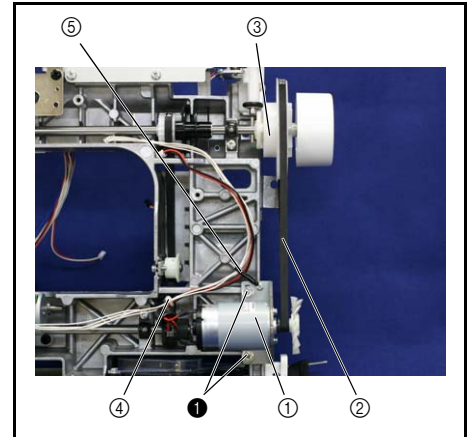
***Key point**

- Fully tighten the screw after performing "4-6 Adjustment of motor belt tension".

2. Hand the T belt ② on the T pulley ③ and the gear for the main motor sub assy. ①.
3. Bind up the lead wire with the band ④.
4. Secure the lead wire with the coaching clip ⑤.

***Key point**

- Refer tp "Special Instruction of Wiring".



①		Upset 4X12DB	Torque 1.18 – 1.57 N·m
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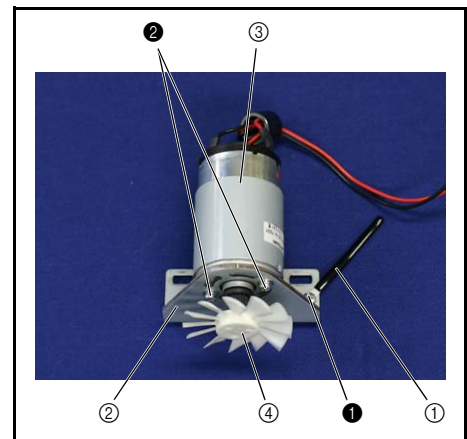
1-1 Assembly of Main motor sub assy.

1. Attach the coaching clip ① to the motor holder ② with the screw ①.
2. Attach the main motor sub assy. ③ to the motor holder ② with the 2 screws ②.
3. Attach the motor fan ④ to the gear for main motor sub assy. ③.

***Key point**

- Be careful not to break the wing of the motor fan ④.

①		Screw, Bind M3X6	Torque 0.78 – 1.18 N·m
②		Screw, Pan (S/P washer) M3X8DB	Torque 0.59 – 0.78 N·m

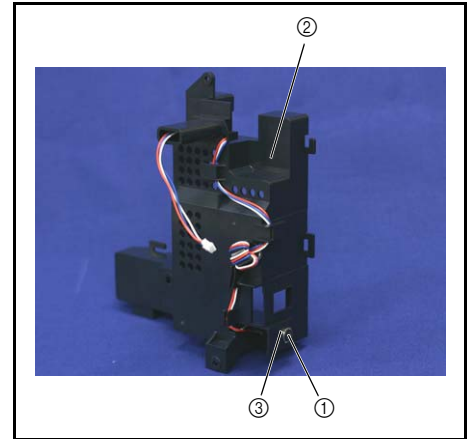


2 Attachment of Pin jack assy.

1. Insert the pin jack assy. ① into the insulation cover ②, and then attach the nut ③.

***Key point**

- See the figure to the right for positioning.
- Refer to “Special instruction of Wiring”.

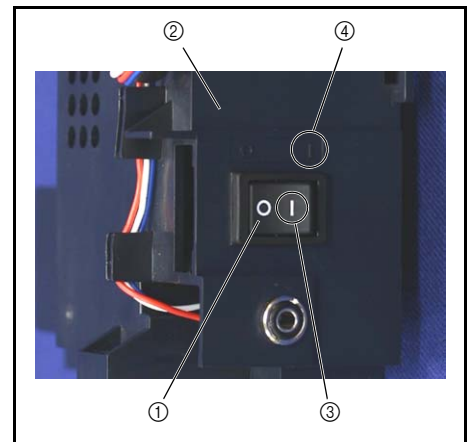


3 Attachment of PWSW assy.

1. Attach the PWSW assy. ① to the insulation cover ②.

***Key point**

- Check that the hook of the PWSW assy. ① hang on the insulation cover ②.
- Check that the match mark ③ of the PWSW assy. ① engaged with the match mark ④ of the insulation cover ②.



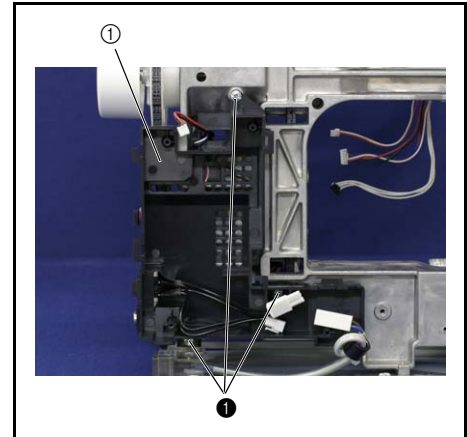
4 Attachment of Insulation cover

1. Attach the insulation cover ① to the arm bed with the 3 screws ①.

***Note**

- The right photograph is “NV30”.

①		Screw, Bind M4X8	Torque 1.18 – 1.57 N·m
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5 Attachment of Power supply assy.

1. Attach the connector ① to the power supply assy. ②.
2. Attach the power supply assy. ② to the insulation cover ③ with the 2 screws ①.
3. Attach the connector ④ and the connector ⑤ to the power supply assy. ②.
4. Attach the coaching clip ⑥ to the insulation cover ③ with the screw ②.

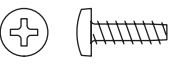
***Key point**

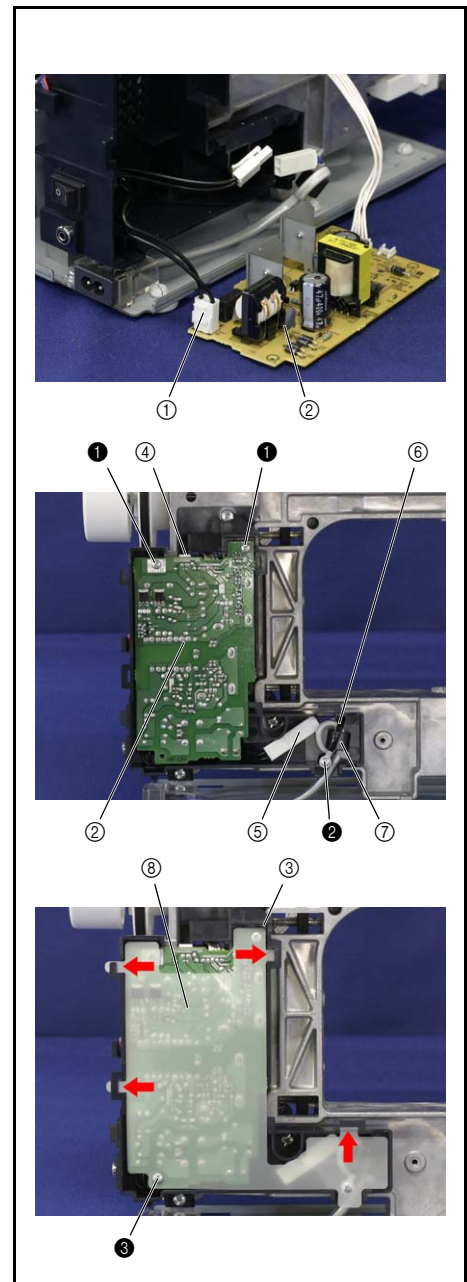
- Attach the ferrite core ⑦ with the coaching clip ⑥.

5. Attach the insulator sheet ⑧ to the insulation cover ③ with the screw ③.

***Note**

- The right photographs are “NV30”.

① ② ③		Tapite, Bind B M3X10	Torque 0.39 – 0.78 N·m
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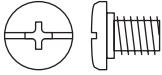


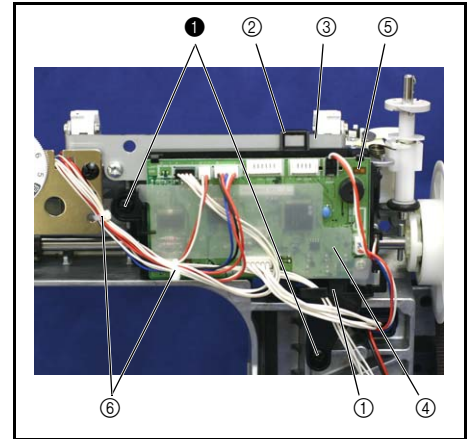
6 Attachment of Main PCB assy.

1. Attach the shutter cover ① to the arm bed with the 2 screws ①.
 - *Key point**
 - Check that the hook ② of the shutter cover ① hang on the handle holder ③.
2. Attach the insulator sheet ④ to the shutter cover ①.
3. Attach the 7 connectors to the main PCB assy. ⑤ as shown in the photo on the right, and then attach it with the band ⑥.

*Key point


- Refer to "Special Instructions of Wiring".

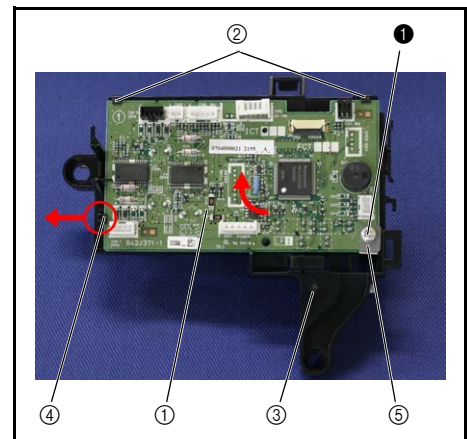
①		Stud screw M4	Torque 1.18 – 1.57 N·m
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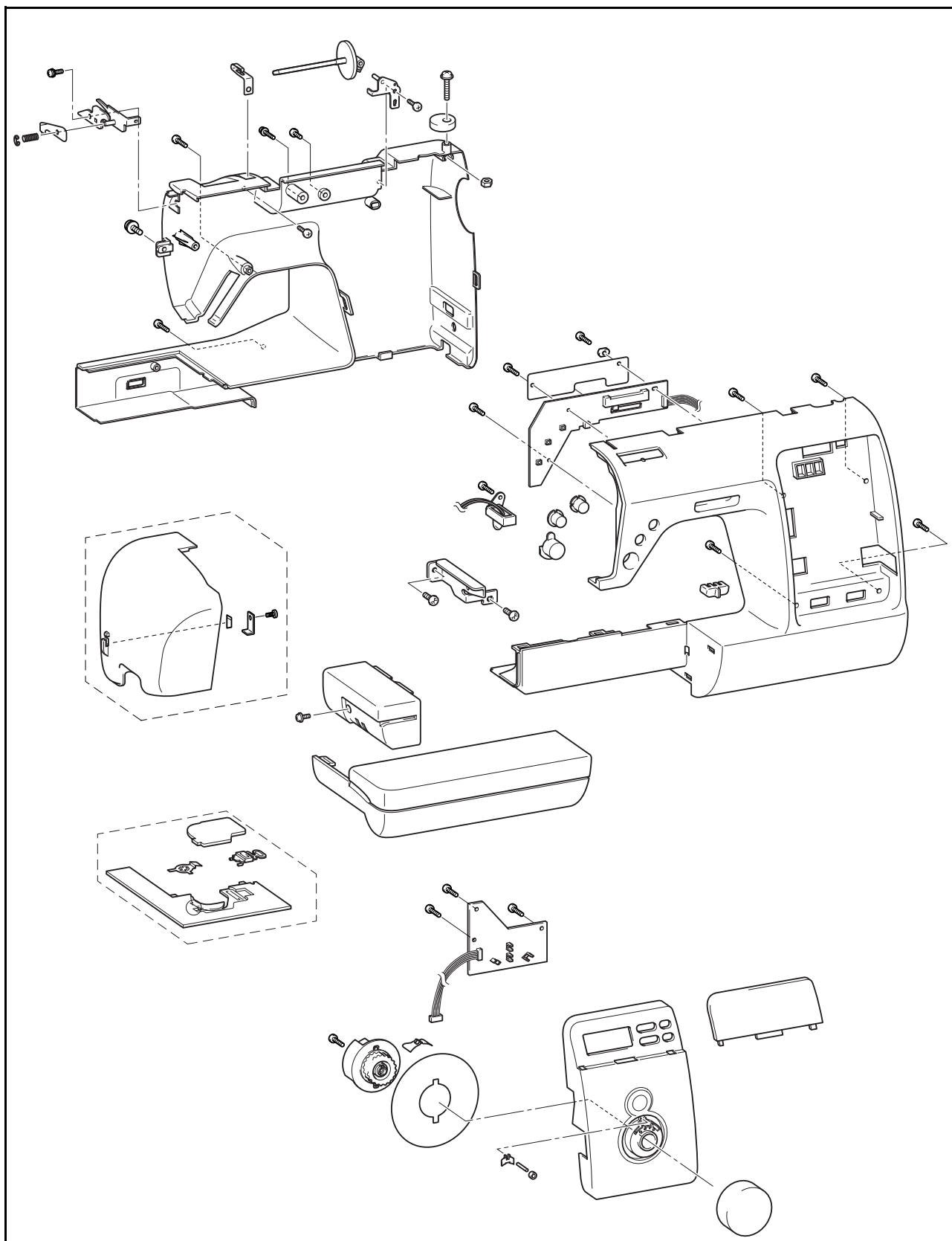
6-1 Assembly of Main PCB assy. to the shutter cover

1. Insert the main PCB assy. ① from the lower side in the hooks ② (2 locations) of the shutter cover ③.
2. Set the main PCB assy. ① in the shutter cover ③ while pushing the hook ④ to the left.
3. Attach the main PCB plate spring ⑤ to the shutter cover ③ with the screw ①.

①		Tapite, Bind B M3X10	Torque 0.39 – 0.78 N·m
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Main parts location diagram

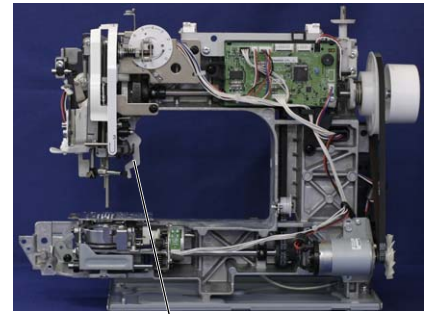


1 Attachment of Rear cover assy.

1. Lower the presser lever ①.
2. Attach the rear cover assy. ② to the arm bed and then hang the hook ③ on the base plate.

*Key point

- Check that the section ④ get over the presser lever ①.
 - Check that the 2 bosses of the rear cover assy. ② engaged with the 2 positioning holes of the arm bed.
 - Be careful not to break the wing of the motor fan.
3. Attach the rear cover assy. ② with the 2 screws ①.



①

③

②



②

①

④


①

①

①		Screw, Blind M4X8	Torque 1.18 – 1.57 N·m
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1-1 Assembly of Rear cover assy. (Attachment of Thread guide supporting plate)

1. Attach the thread guide supporting plate ① to the rear cover assy. with the screw ❶.


❶		Taptite, Bind B M3X12	Torque 0.39 – 0.78 N·m
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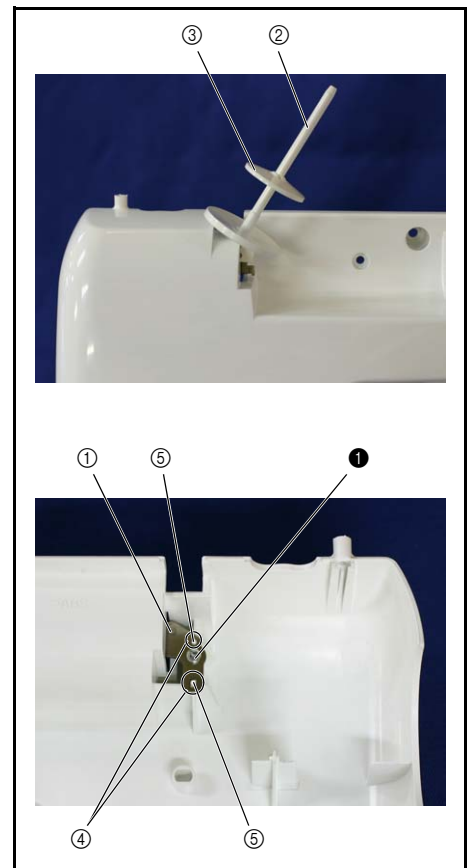
**1-2 Assembly of Rear cover assy. (Attachment of Spool pin)**

1. Attach the spool pin ② to the shaft of the spool pin holder assy. ①.
2. Attach the spool presser ③ to the spool pin ②.
3. Set the spool pin holder assy. ① to the rear cover, and then attach it with the screw ❶.

***Key point**

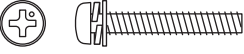
- Check that the 2 bosses ⑤ of the rear cover engaged with the 2 positioning holes ④ of the spool pin holder assy. ①.

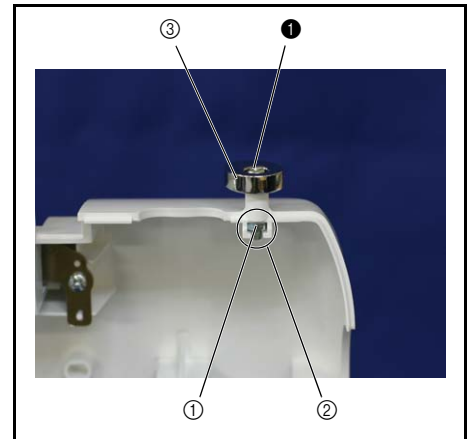
❶		Taptite, Bind B M3X10	Torque 0.39 – 0.78 N·m
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1-3 Assembly of Rear cover assy. (Attachment of Bobbin presser)

1. Set the nut 1 M3 ① to the attaching part ② of the rear cover assy.
2. Attach the bobbin presser ③ with the screw ①.


①		Screw, Pan (S/P washer) M3X20	Torque 0.59 – 0.78 N·m
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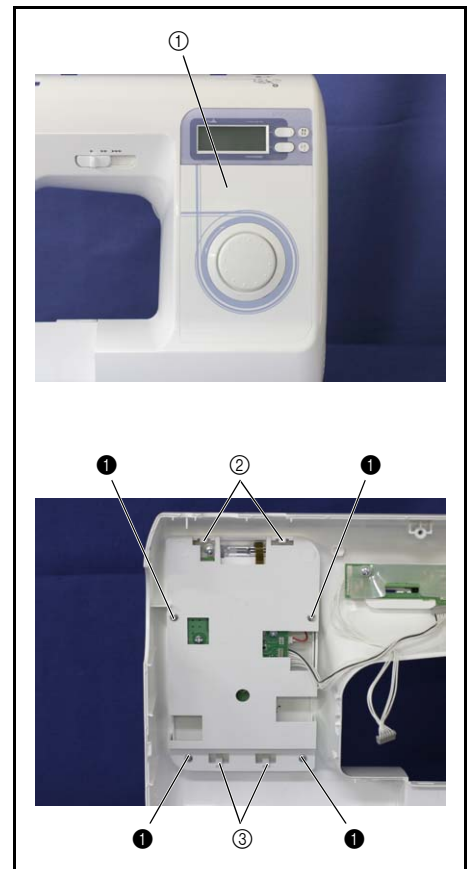
**2 Attachment of Selecting panel M assy.**

1. Attach the selecting panel M assy. ① to the front cover assy., and then attach it with the 4 screws ①.


***Key point**

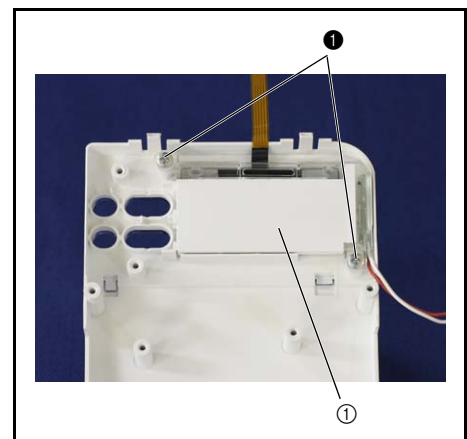
- First hang the hooks ② (2 locations) on the front cover, and then hang the hooks ③ (2 locations) on the front cover.

①		Taprite, Bind B M3X10	Torque 0.39 – 0.78 N·m
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**2-1 Assembly of Selecting panel M assy. (Attachment of Single light guide assy. M1YH)**

1. Attach the single light guide assy. M1YH ① to the selecting panel M assy. with the 2 screws ①.

①		Taprite, Bind B M3X8	Torque 0.39 – 0.78 N·m
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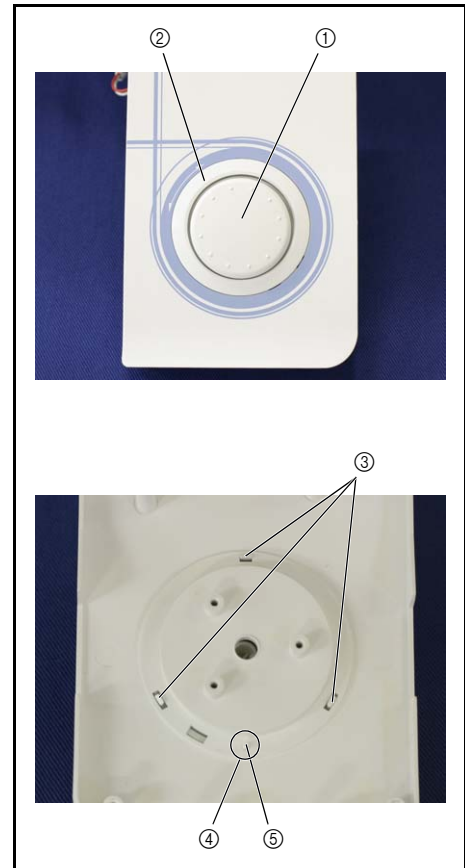


2-2 Assembly of Selecting panel M Assy. (Attachment of Selecting dial M)

1. Attach the selecting dial M ① to the selecting panel M Assy.
2. Attach the dial decoration plate M ② to the selecting panel M Assy.

***Key point**

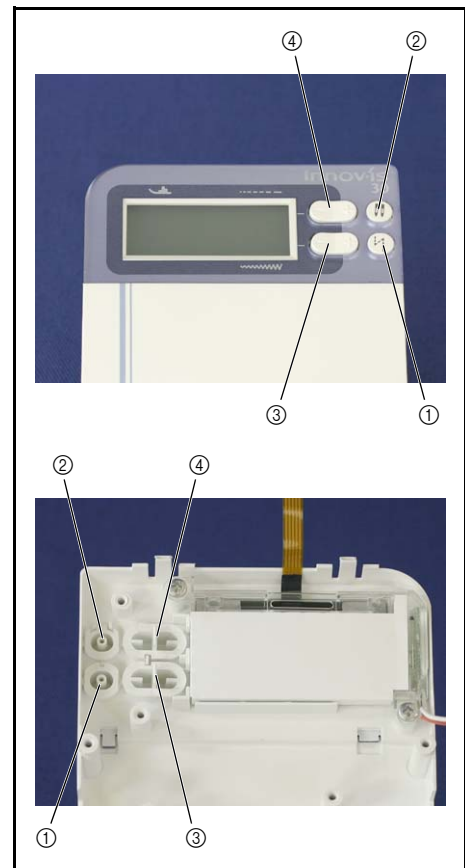
- Check the hooks ③ (3 locations) hang on the selecting panel M Assy.
- Check that the boss part ④ of the dial decoration plate M ② engaged with the positioning hole ⑤ of the selecting panel M Assy.

**2-3 Assembly of Selecting panel M Assy. (Attachment of Buttons)**

1. Attach the reinforcement stitch button ①, the twin needle button ②, feed adjusting button ③ and the adjusting button ④ to the selecting panel M Assy.


***Key point**

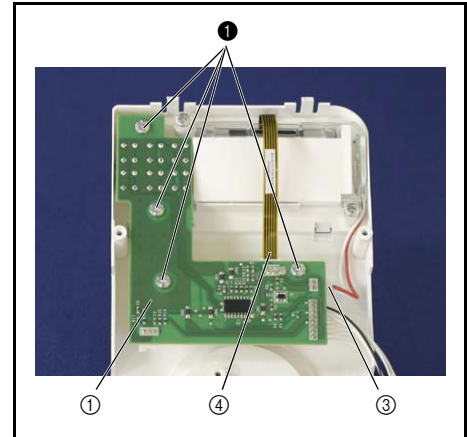
- Check that the protrusion of the selecting panel M Assy. engaged with the notch of the each button.




2-4 Assembly of Selecting panel M assy. (Attachment of Operation PCB assy. M1YH)

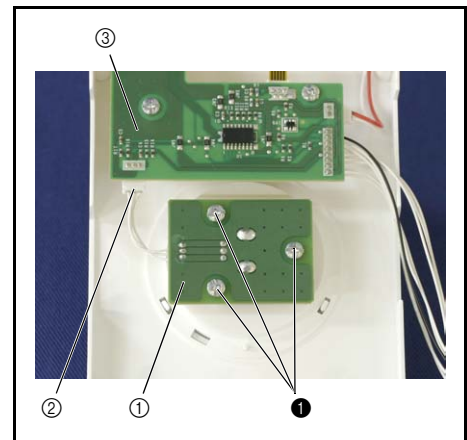
1. Attach the operation PCB assy. M1YM ① to the selecting panel M assy. with the 4 screws ①.
2. Attach the connector ③ and the FFC ④ to the operation PCB assy. M1YM ①.

①		Taptite, Bind B M3X8	Torque 0.39 – 0.78 N·m
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**2-5** Assembly of Selecting panel M assy. (Attachment of Dial PCB assy. M1YM)

1. Attach the dial PCB assy. M1YM ① to the selecting panel M assy. with the 3 screws ①.
2. Attach the connector ② to the operation PCB assy. M1YM ③.

①		Taptite, Bind B M3X8	Torque 0.39 – 0.78 N·m
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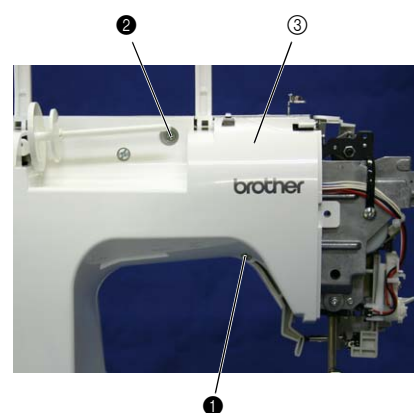
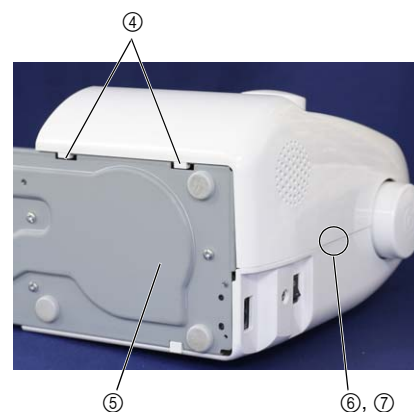
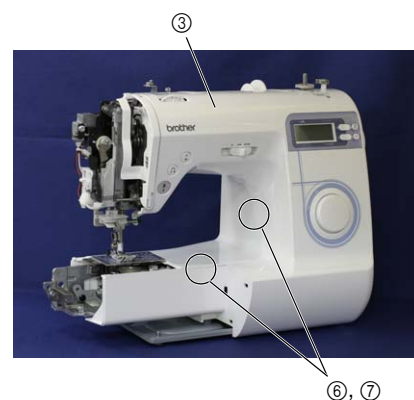
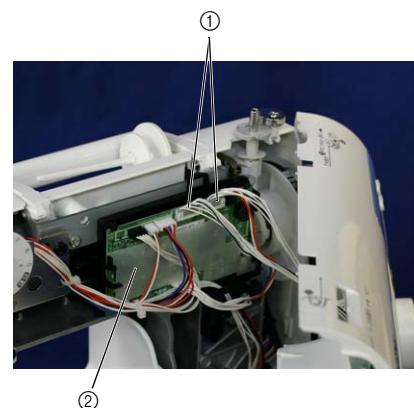


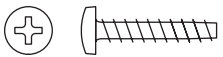
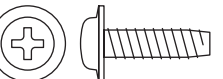
3 Attachment of Front cover assy.

1. Attach the 2 connectors ① to the main PCB assy. ②.
2. Attach the front cover assy. ③.

***Key point**

- Check that the hooks ④ (2 locations) hang on the base plate ⑤ and the hooks ⑥ (3 locations) hang on the hook attaching part ⑦.
3. Fix the front cover assy. ③ to the rear cover assy. ⑧ with the screw ① and ②.



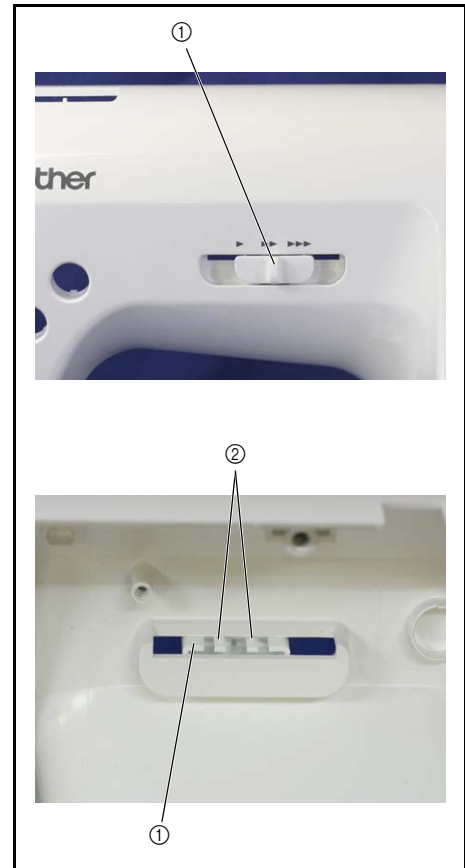
①		Tapite, Bind P M3X16	Torque 0.39 – 0.78 N·m
②		Tapite, Cup B M4X14	Torque 0.78 – 1.18 N·m

3-1 Assembly of Front cover assy. (Attachment of SV key top)

1. Attach the SV key top ① to the front cover assy.

***Key point**

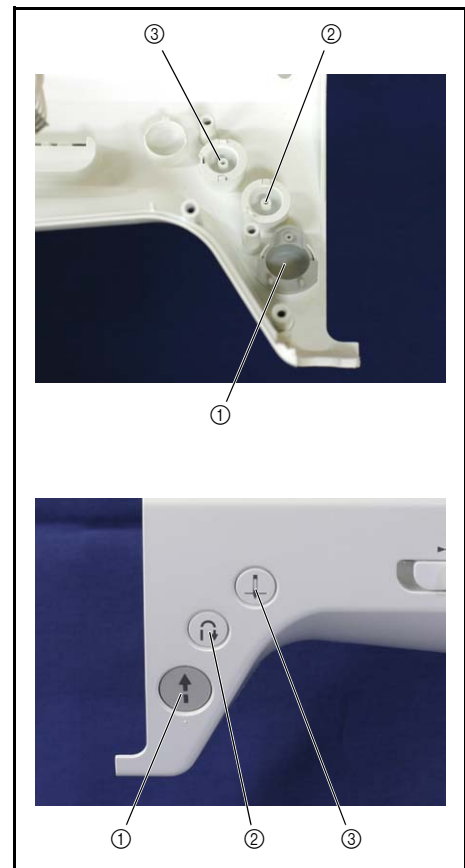
- Check that the hooks ② (2 locations) of the SV key top ① is the upper side and it hang on the front cover assy.

**3-2 Assembly of Front cover assy. (Attachment of Buttons)**

1. Attach the SS button ①, the reverse button ② and the NP button ③ to the front cover assy.

***Key point**

- Check that the protrusion of the front cover assy. engaged with the notch of the each button.





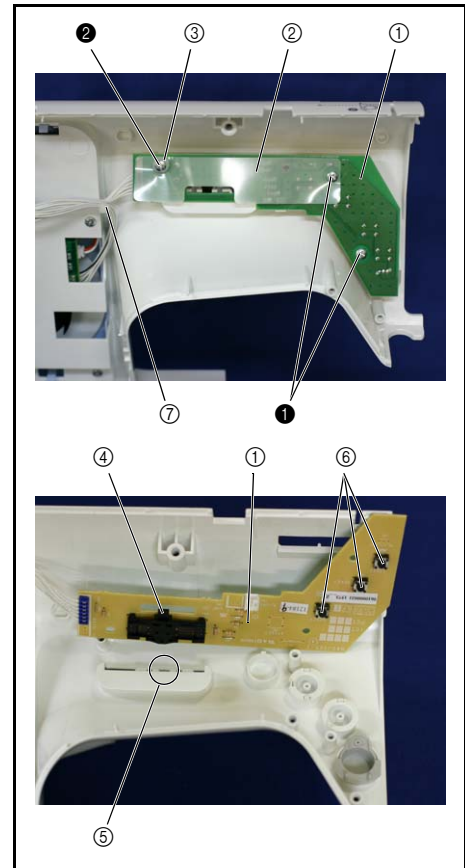
3-3 Assembly of Front cover assy. (Attachment of SSVR PCB assy.)

1. Attach the SSVR PCB assy. ① and the insulator sheet ② to the front cover assy. with the 2 screws ①.
2. Attach the board presser ③ to the front cover assy. with the screw ②.


***Key point**

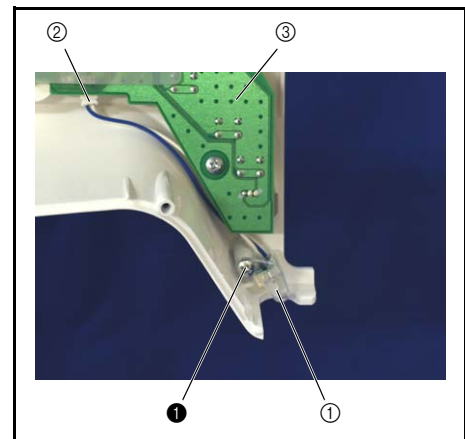
- Check that the slide volume lever ④ of the SSVR PCB assy. ① engaged with the groove ⑤ of the SV key top.
 - Check that the switch parts ⑥ (3 locations) of the SSVR PCB assy. ① contact the each buttons (3 locations).
3. Bind up the SSVR PCB assy. lead wire and the operation PCB assy. lead wire with the band ⑦.

①		Taptite, Bind B M3X10	Torque 0.39 – 0.78 N·m
②		Taptite, Bind B M3X12	Torque 0.39 – 0.78 N·m


**3-4 Assembly of Front cover assy. (Attachment of LED lamp-R)**

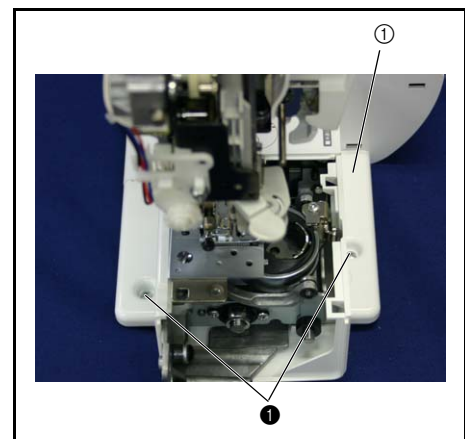
1. Attach the LED lamp-R ① to the front cover assy. with the screw ①.
2. Attach the connector ② of the LED lamp-R ① to the SSVR PCB assy. ③.

①		Taptite, Bind B M3X10	Torque 0.39 – 0.78 N·m
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**4 Attachment of Base plate cover**

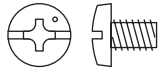
1. Attach the base plate cover ① to the base plate with the 2 screws ①.

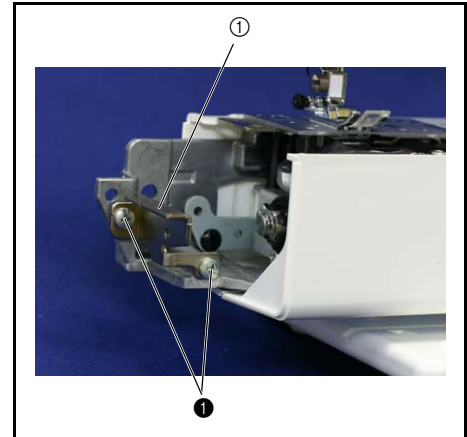
①		Screw, Pan (S/P washer) M3X6	Torque 0.39 – 0.78 N·m
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5 Attachment of Free arm plate

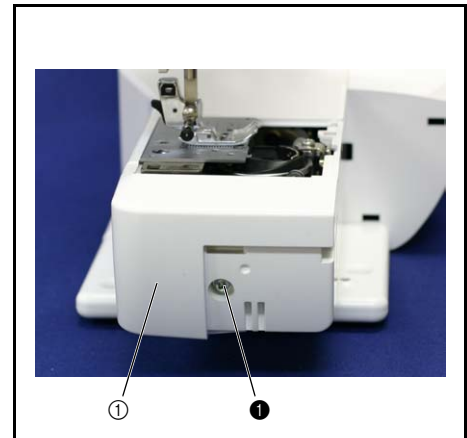
1. Attach the free arm plate ① to the arm bed with the 2 screws ①.

①		Screw, Bind M4X6	Torque 1.18 – 1.57 N·m
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**6** Attachment of Free arm cover

1. Attach the free arm cover ① to the free arm plate with the screw ①.

①		Screw, Pan (S/P washer) M4X8	Torque 0.78 – 1.18 N·m
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7 Attachment of Needle plate B Assy.

1. Attach the needle plate B Assy. ①.
2. Attach the needle plate cover ② to the needle plate B Assy. ①.



7-1 Assembly of Needle plate B Assy.

1. Attach the slide button ① to the needle plate B Assy. ②.

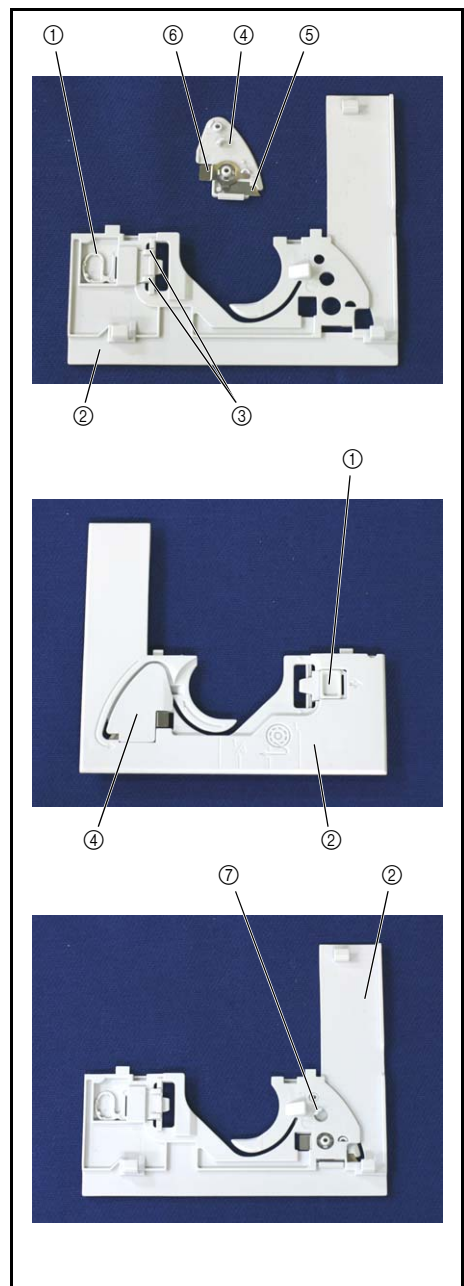
***Key point**

- Check that the hooks ③ (2 locations) hang on the needle plate B Assy. ②.

2. Attach the NT lower thread cutter ⑤ and the spring plate ⑥ to the cutter cover ④.
3. Attach the cutter cover ④ to the needle plate B Assy. ②.


***Key point**

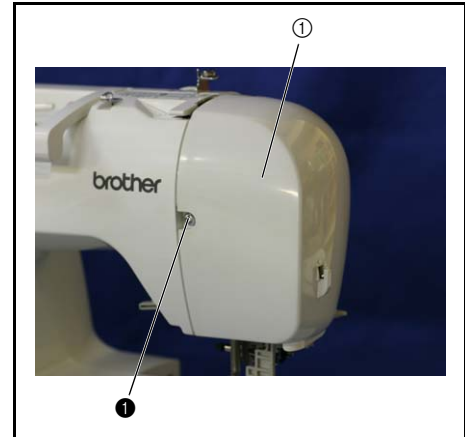
- Check that the hook ⑦ hang on the needle plate B Assy. ②.



8 Attachment of Face plate assy.

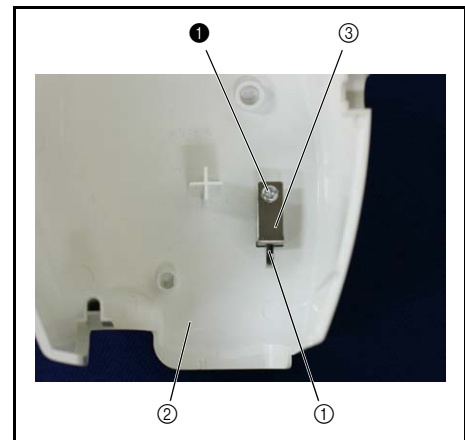
1. Attach the face plate assy. ① with the screw ❶.

❶		Screw, Pan (S/P washer) M4X14	Torque 0.78 – 1.18 N·m
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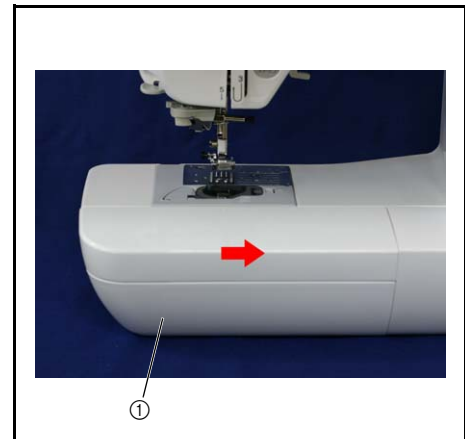
**8-1** Assembly of Face plate assy.

1. Attach the NT lower thread cutter ① to the face plate assy. ②.
2. Attach the face plate cutter holder ③ to the face plate assy. ② with the screw ❶.

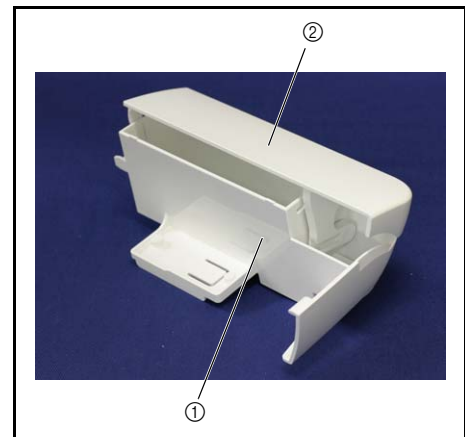
❶		Taptite, Pan B M3X6	Torque 0.39 – 0.78 N·m
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**9** Attachment of Accessory table

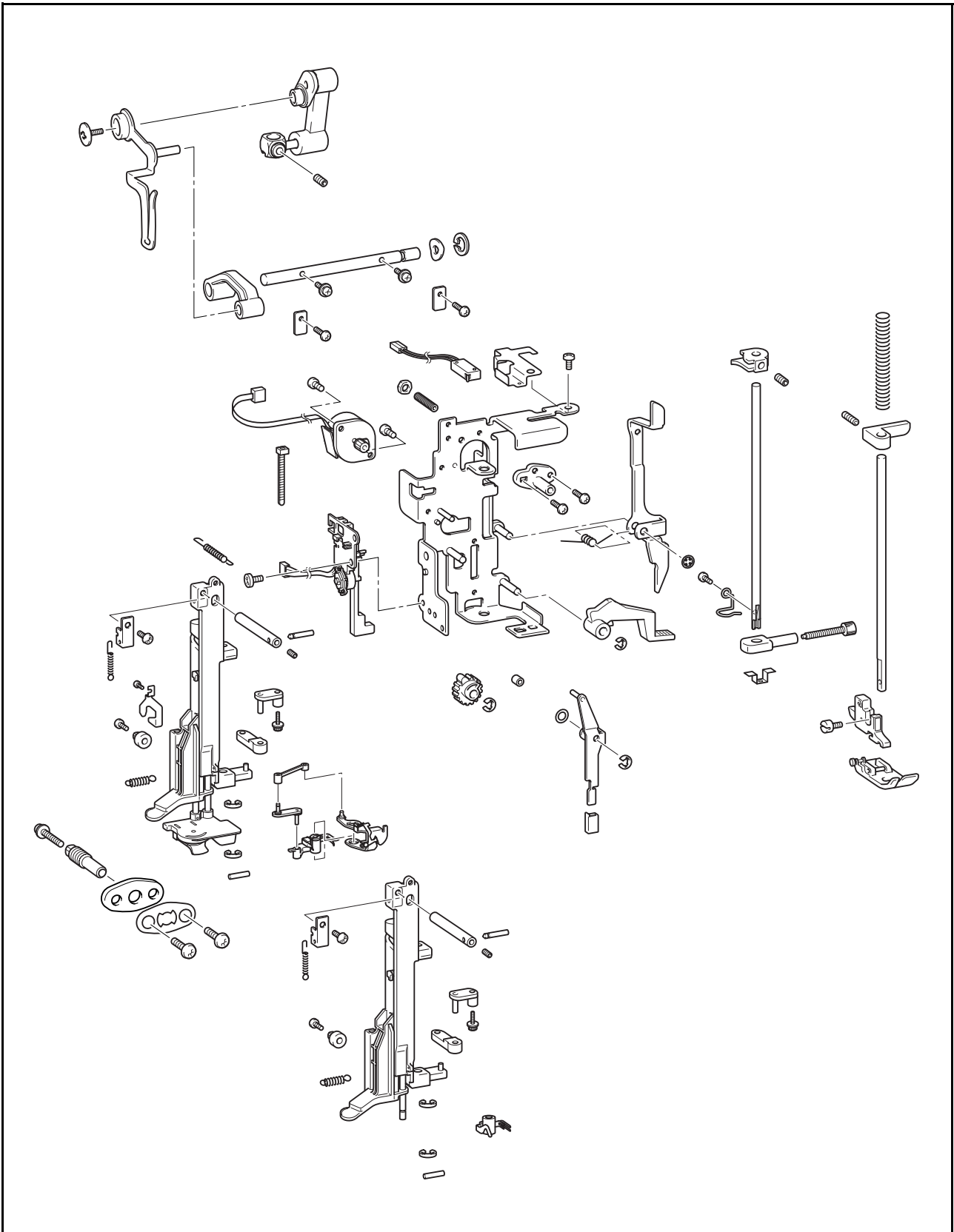
1. Attach the accessory table ①.

**9-1** Assembly of Accessory table

1. Attach the accessory table door ② to the accessory table ①.




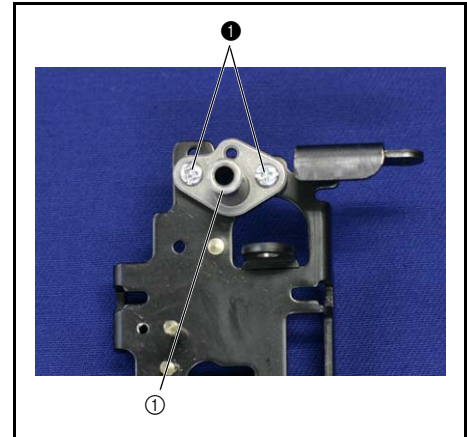
Needle-presser module breakout diagram



1 Attachment of Shaft bushing

1. Attach the shaft bushing ① to the base holder assy. with the 2 screws ❶.

❶		Screw, Bind M3X6	Torque 0.78 – 1.18 N·m
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2 Attachment of Lock nut

1. Attach the lock nut ① with the screw ❶.


***Key point**

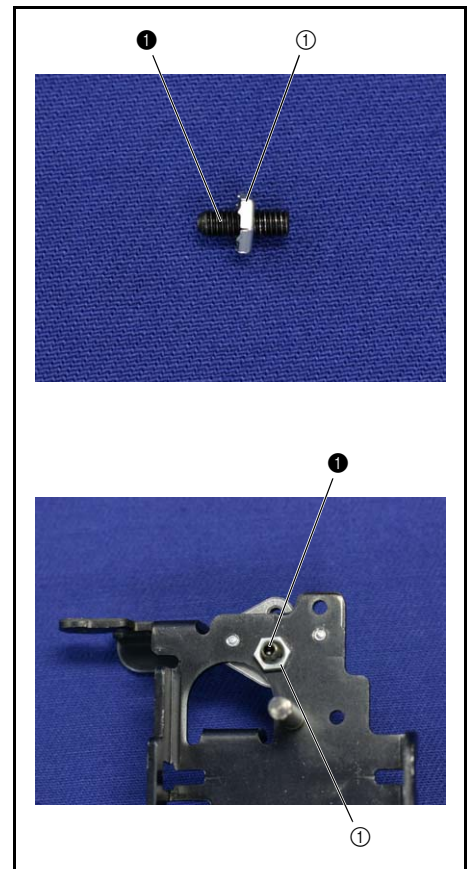
- Tighten the lock nut ① to about half of the screw ❶.

2. Attach the screw ❶ to the base holder assy.

***Key point**

- Tighten it until the lock nut ① hit the base holder assy.
- Refer to "4-10 Forward and back adjustment of needle and presser."

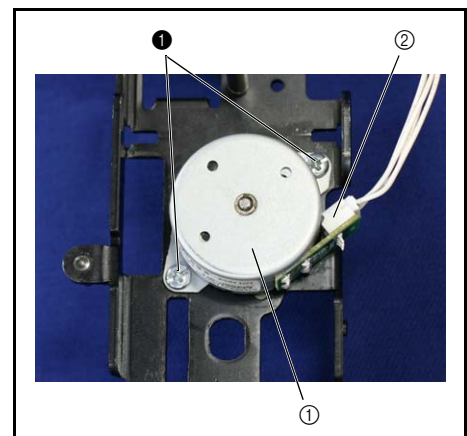
❶		Set Screw, Socket (CP) M4X12	Torque 0.78 – 1.18 N·m
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3 Attachment of Z pulse motor

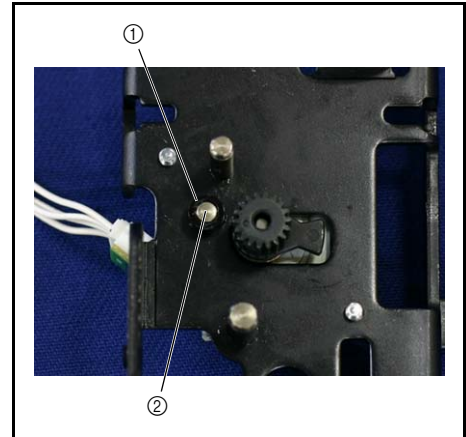
1. Attach the Z pulse motor ① to the base holder assy. with the 2 screws ❶.
2. Attach the lead wire sub assy. ② to the Z pulse motor ①.

❶		Screw, Bind M3X6	Torque 0.78 – 1.18 N·m
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4 Attachment of Rubber

1. Attach the rubber ① to the shaft ② of the base holder assy.



5 Attachment of Z zigzag cam

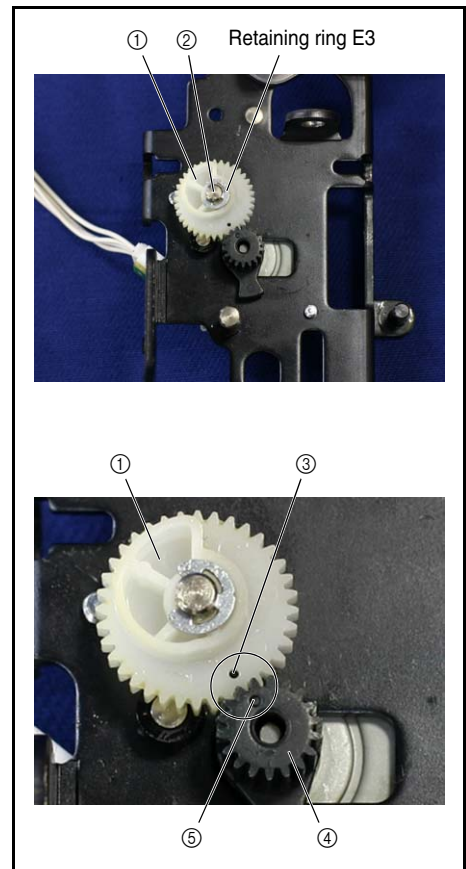
1. Attach the Z zigzag cam ① to the shaft ② of the base holder assy.

***Key point**

- Check that the match mark ③ on the Z zigzag cam ① Align the match mark ⑤ on the Z pulse motor gear ④.

2. Attach the retaining ring E3 to the shaft ② of the base holder assy.

Apply EPNOC AP (N) 0 to all of the sliding part of the Z zigzag cam pin.	Bead XC8387***
Apply EPNOC AP (N) 0 to all of the Z zigzag cam.	Bead XC8387***
Apply EPNOC AP (N) 0 to the teeth around the Z zigzag cam gear.	Bead XC8387***



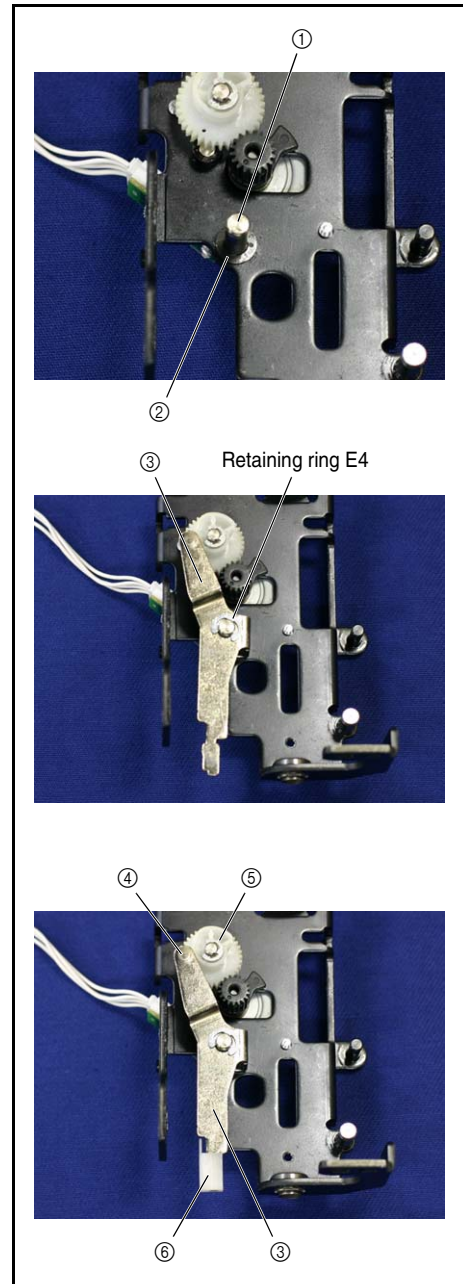
6 Attachment of Z zigzag lever assy.

1. Attach the polyester slider ② and the Z zigzag lever assy. ③ to the shaft ① of the base holder assy., and then attach the retaining ring E4.

***Key point**

- Check that the shaft ④ of the Z zigzag lever assy. ③ is at the left of the Z zigzag cam ⑤.
2. Attach the Z lever cap ⑥ to the Z zigzag lever assy. ③.

Apply EPNOC AP (N) 0 to the shaft of the base holder assy.	Bead XC8387***
Apply EPNOC AP (N) 0 to the shaft of the Z zigzag lever.	Bead XC8387***



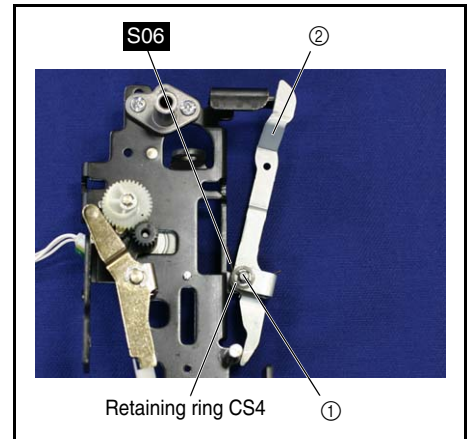
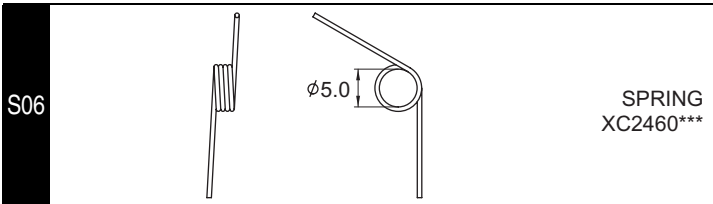
7 Attachment of Thread release lever

1. Attach the thread release lever ② and the spring S06 to the shaft ① of the base holder assy., and then attach the retaining ring CS4.

***Key point**

- Check that the hook of the spring is the upper side, when set it as shown in the right figure.

Apply EPNOC AP (N) 0 to the shaft of the base holder assy.	Small amount XC8387***
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8 Attachment of Presser bar

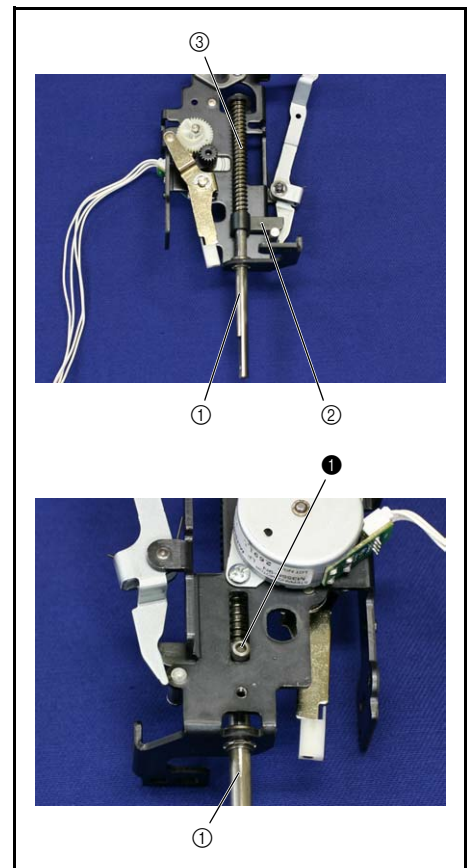
1. Insert the base holder assy., the presser bar clamp ②, the spring ③, and the base holder assy. from the bottom of the presser bar ①, and then tighten the screw ❶ temporarily.

***Key point**

- Fully tighten the screw after performing "4-16 Adjustment of presser bar height and parallel".

Apply FBK OIL RO 100 to the tip of the presser bar.	Apply liberally XC8388***
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❶		Screw stud M5	Torque 1.18 – 1.57 N·m
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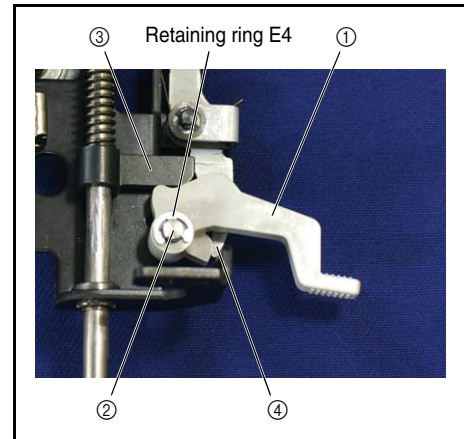
9 Attachment of Presser foot lifter

1. Attach the presser foot lifter ① to the shaft ② of the base holder assy., and then attach the retaining ring E4.

***Key point**

- Push the presser bar clamp ③ to the upper side, and then attach it while pushing the bottom side of the thread release lever ④.

Apply EPNOC AP (N) 0 to the shaft of the base holder assy.	Small amount XC8387***
Apply EPNOC AP (N) 0 to the operating surface of the presser bar lifter presser bar clamp.	Small amount XC8387***



10 Attachment of PF switch assy.

1. Attach the PF switch assy. ① to the presser switch holder ②.

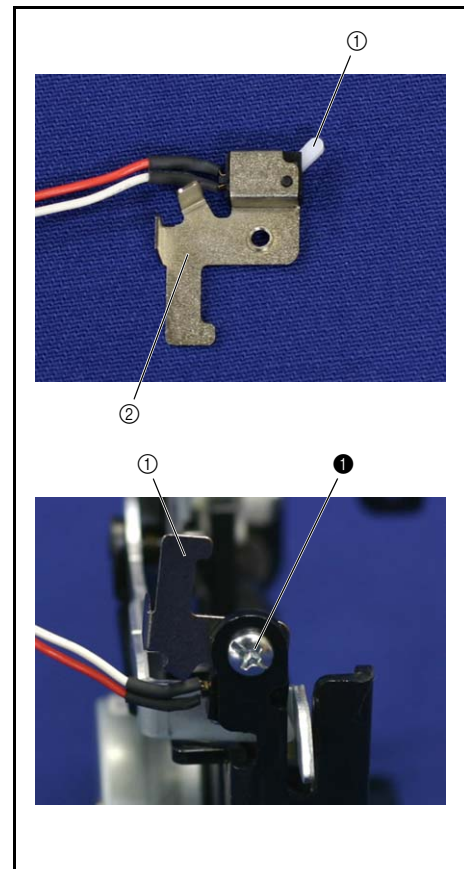
***Key point**

- Check that the boss part of the PF switch assy. ① align the positioning hole of the presser switch holder ②.

2. Attach the presser switch holder ② to the base holder assy. with the screw ①.

***Key point**

- Check that the boss part of the PF switch assy. ① align the notch part of the base holder assy.



①		Screw, Bind M3X6	Torque 0.78 – 1.18 N·m
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11 Attachment of Z zigzag adjusting nut

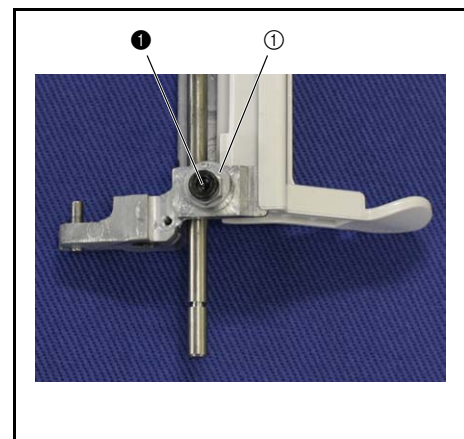
1. Set the Z zigzag adjusting nut ① to the needle bar supporter assy., and then tighten the screw ① temporarily.

***Key point**

- Check that the side of the zigzag adjusting nut ① with the greatest eccentricity toward the top (see figure at the right).
- Fully tighten the screw after performing "4-9 Adjustment of three point needle drop".

Apply EPNOC AP (N) 0 to the zigzag adjusting nut Z zigzag lever contact surface.	Bead XC8387***
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①		Bolt, Socket M3X10	Torque 0.78 – 1.18 N·m
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12 Attachment of Needle holder shaft A

1. Insert the needle holder shaft A ① to the upper side hole of the needle bar supporter assy., and then insert the shaft ② into the needle bar supporter assy., the needle holder shaft A ① and the needle bar supporter assy.

***Key point**

- Check that the groove ③ of the shaft ② is the left side, when set the needle bar supporter assy. as shown in the right figure.

2. Attach the plate ④ to the needle bar supporter assy. with the screw ①.

***Key point**

- Check that the groove ③ of the shaft ② engaged with the notch part ⑤ of the plate ④.



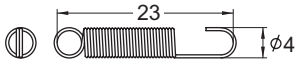
3. Attach the screw ② to the needle holder shaft A ④.

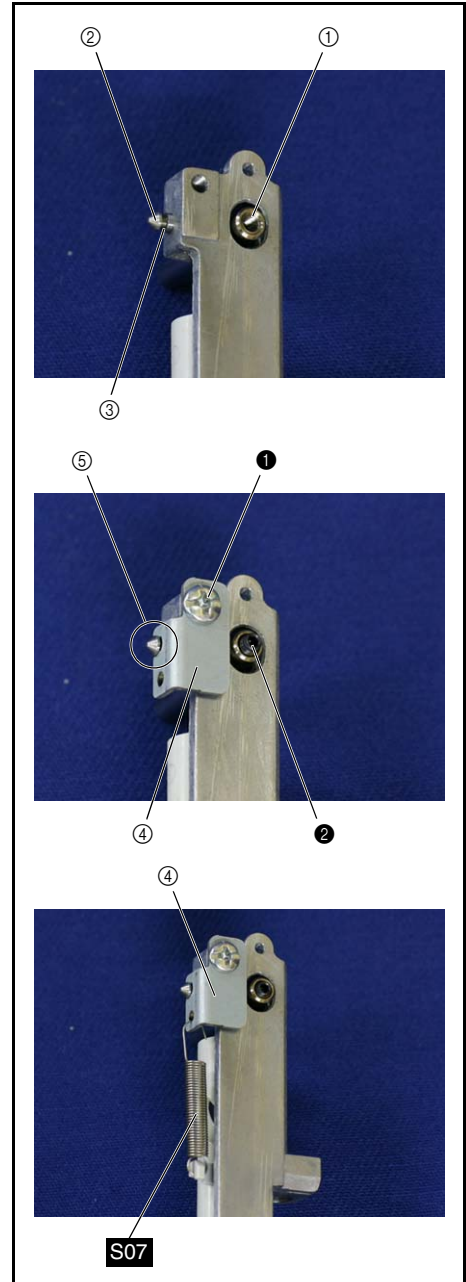
4. Attach the spring S07 to the plate ④ and the needle bar supporter assy.

***Key point**

- Attach the hook side of the spring to the plate ④.

Apply FBK OIL RO 100 to the needle holder shaft A.	1-2 drops XC8388***
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①		Screw, Bind M3X5	Torque 0.78 – 1.18 N·m
②		Set Screw, Socket (CP) M3X5	Torque 0.59 – 0.78 N·m
S07		SPRING XD1489***	



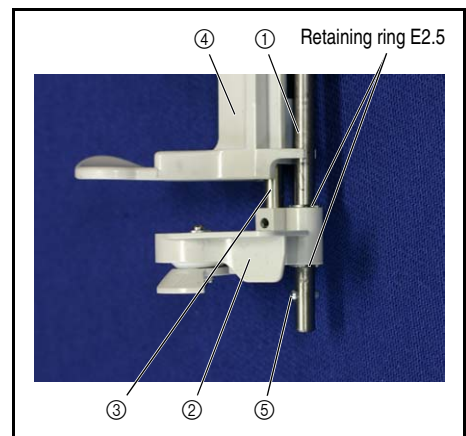
13 Attachment of Thread hold guide B assy. (Only for “NV30” series)

1. Attach the retaining ring E2.5 to the shaft ① of the needle bar supporter assy.
2. Attach the thread hold guide B assy. ② to the shaft ① of the needle bar supporter assy., and then attach the retaining ring E2.5.

***Key point**

- Insert it until the thread hold guide B assy. ② hits the upper side of the retaining ring E2.5.
- Check that the shaft ③ of the thread hold guide B assy. ② insert in to the thread guide slider ④.

3. Attach the pin, dowel 2 x 6 ⑤ to the shaft ① of the thread hold guide B assy.



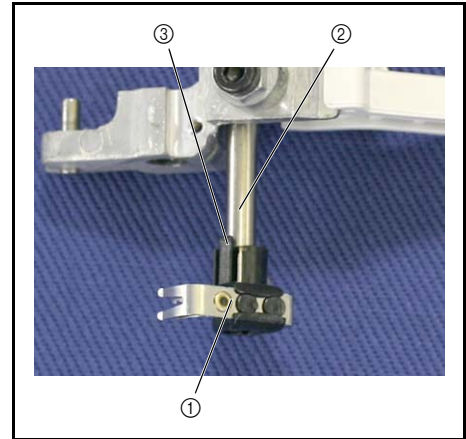
14 Attachment of Threader hook assy.

14-1 For “NS40” series

1. Attach the threader hook assy. ① to the needle bar support assy. ②.

***Key point**

- Check that the hook ③ of the threader hook assy. ① hang on the groove of the needle bar support assy. ②.

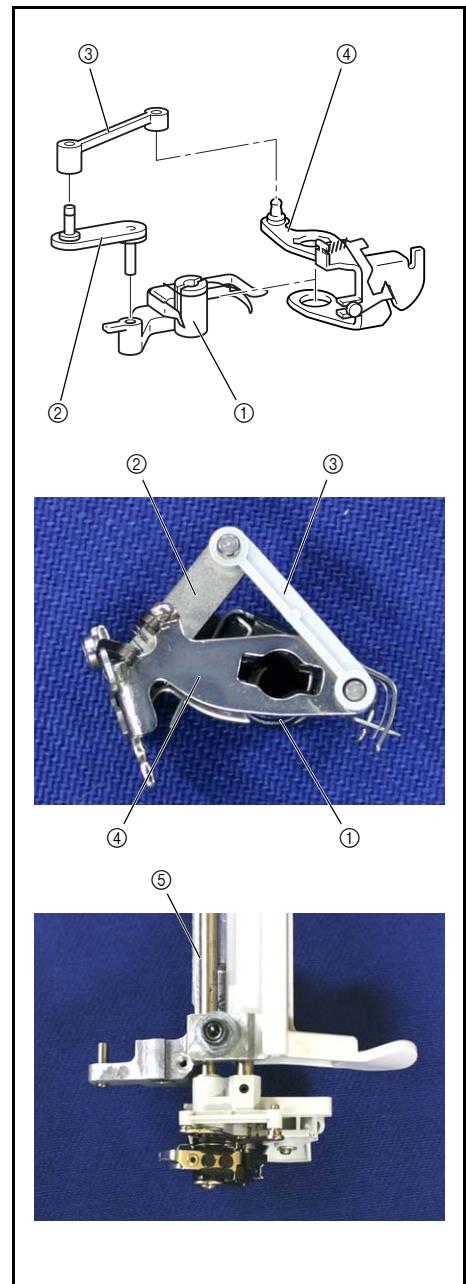


14-2 For “NV30” series

1. Assemble the threader hook assy. ①, the link A assy. ②, the link B ③ and the thread guide assy. ④.



***Key point**

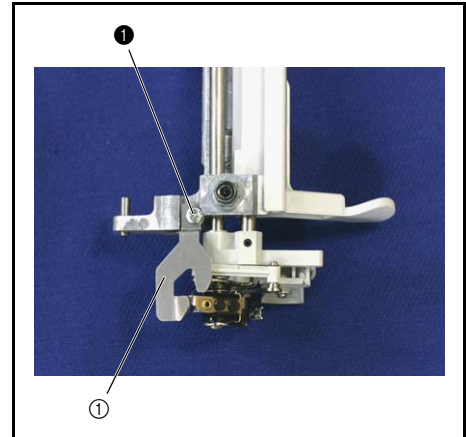
- Assemble the link A assy. ②, the link B ③ and the thread guide assy. ④ so that a triangle is formed.
2. Align the shaft hole of the thread hook assy. ① with the pin on the shaft of the needle bar supporter assy. ⑤, and then attach the threader hook assy. ① to the shaft of the needle bar supporter assy. ⑤.



15 Attachment of Hook release plate (Only for “NV30” series)

1. Attach the hook release plate ① to the needle bar supporter assy. with the screw ❶.

❶	 	Screw, Bind M2X4	Torque 0.29 – 0.49 N·m
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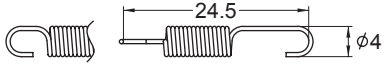
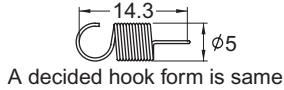


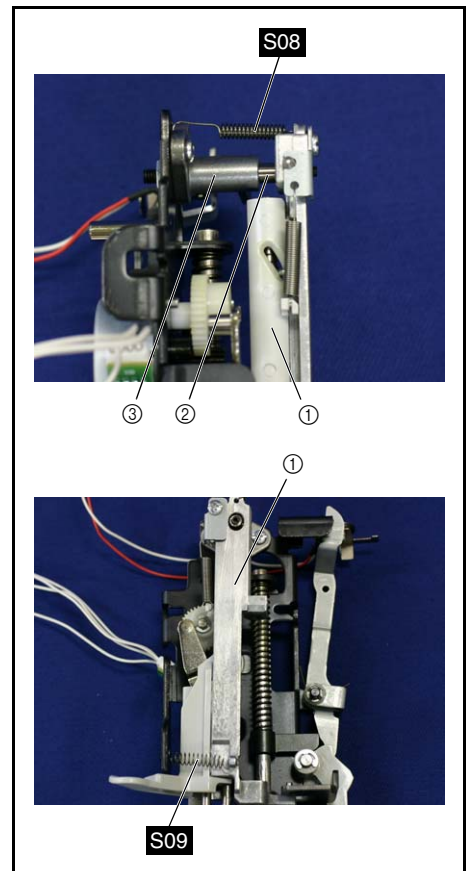
16 Attachment of Needle bar supporter assy.

1. Insert the needle holder shaft A ② of the needle bar supporter assy. ① into the shaft bushing ③ of the base holder assy., and then attach the needle bar supporter assy. ① to the base holder assy.
2. Attach the spring S08 to the needle bar supporter assy. ① and the base holder assy.

***Key point**

- Attach the long side of the hook of the spring to the shaft bushing.
3. Attach the spring S09 to the needle bar supporter assy. ① and the base holder assy.

S08		SPRING XC2429***
S09	 <p>A decided hook form is same</p>	SPRING-Z XC2748***



17 Attachment of Shaft assy.

1. Attach the needle holder block ① to the needle roller ② of the needle bar supporter assy.

***Key point**

- Flat surface of the needle holder block ① is the lower side.

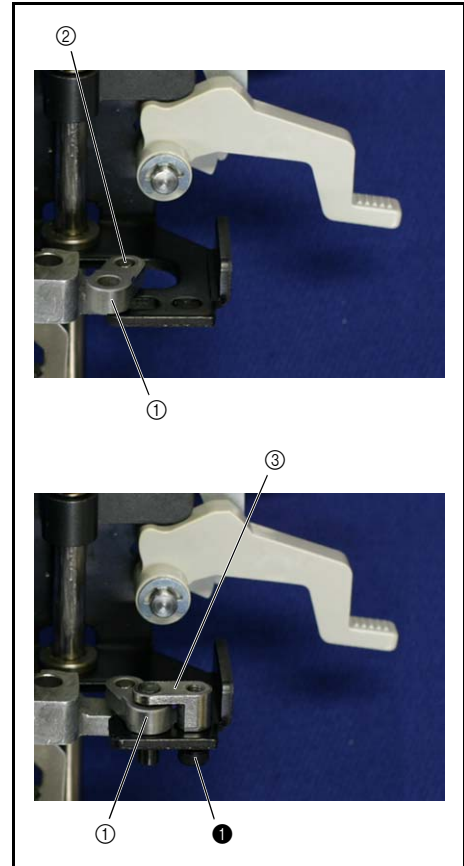
2. Attach the shaft assy. ③ to the needle holder block ① and the base holder assy., and then tighten the screw ❶ temporarily.

***Key point**

- Fully tighten the screw after performing "4-14 Adjustment of needle interference left / right".

Apply EPNOC AP (N) 0 to the needle roller.	Bead XC8387***
Apply EPNOC AP (N) 0 to the shaft of the shaft assy.	Bead XC8387***

❶		Screw M3X10	Torque 0.59 – 0.78 N·m
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Assembly

18 Attachment of Needle bar assy.

1. Insert the needle bar supporter assy., the needle bar block ②, the needle thread block ③ and the needle bar supporter assy. from the lower side of the needle bar assy. ①, and then tighten the 2 screws ❶ temporarily.


***Key point**

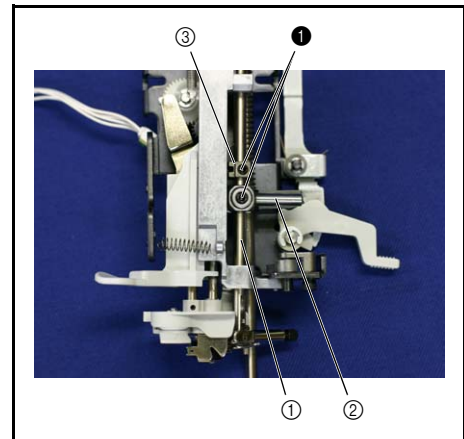
- When the needle thread block ③ is viewed from the front, it is secured in a position turned slightly counterclockwise.
- Fully tighten the screw after performing "4-13 Adjustment of needle bar height" and "4-15 Adjustment of needle thread block".

***Note**

- The right photographs are "NV30".

Lubricate the needle bar crank joint area with MOLYKOTE (OILER 90% + MOLYKOTE M DISPERSION).	1-2 drops
Apply EPNOC AP (N) 0 to the sliding pin part of the needle thread block.	Bead
Lubricate the needle bar supporter assy. needle operating area with OILER.	1-2 drops

❶		Set Screw, Socket (FT) M4X4	Torque 0.78 – 1.18 N·m
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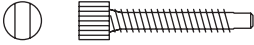



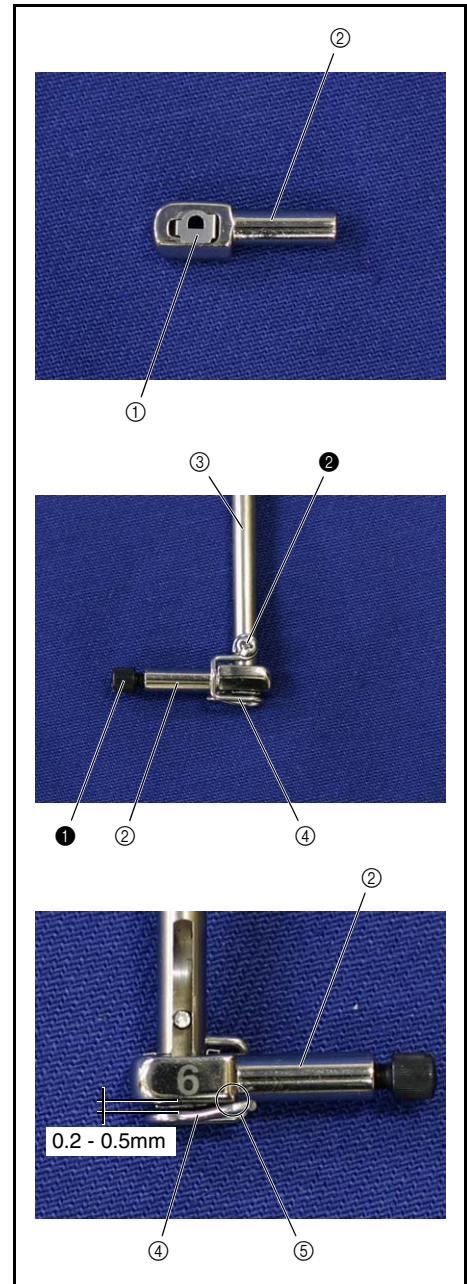
18-1 Assembly of Needle bar assy.

1. Attach the needle thread plate ① to the needle block ②.
 2. Attach the needle block ② to the needle bar ③ with the screw ①.
- *Key point**
- When the needle bar ③ groove facing forward, check that the screw ① is on the right side.
3. Attach the needle bar thread guide ④ to the needle bar ③ with the screw ②.

***Key point**

- Check that there should no gap ⑤ between the needle bar thread guide ④ and the right side of the needle bar ②.
- Check that there should be a 0.2 mm – 0.5 mm gap between the needle bar thread guide ④ and the left side of the needle bar ②.


①		Needle Clamp Screw	—
②		Screw SM2.38	Torque 0.39 – 0.78 N·m

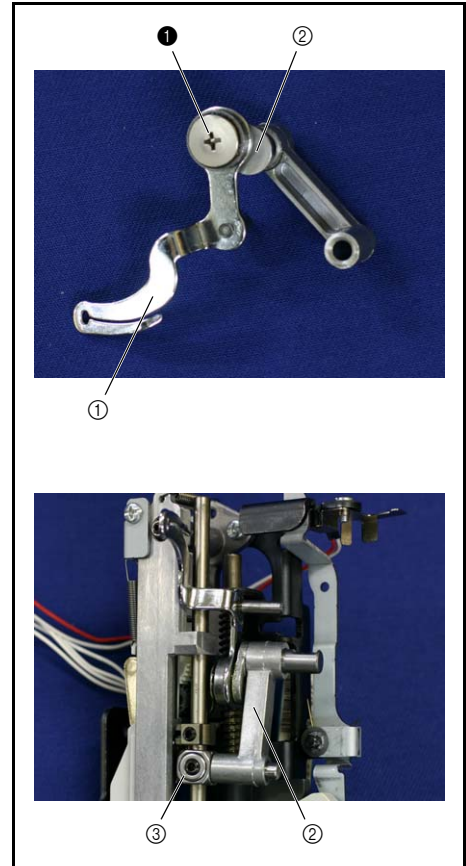


19 Attachment of Needle bar crank rod assy.

1. Attach the thread take-up lever ① to the needle bar crank rod assy. ② with the screw ①.
 - *Key point**
 - The screw is reverse threaded.
2. Attach the needle bar crank rod assy. ② to the needle bar block ③.

Apply EPNOC AP (N) 0 to the shaft of the needle bar crank.	Small amount XC8387***
Apply EPNOC AP (N) 0 to the shaft of the thread take-up lever.	Small amount XC8387***
Apply EPNOC AP (N) 0 to the thread take-up lever attachment face (left screw attachment face) of the needle bar crank.	Small amount XC8387***

① 	Screw, Flat SM3.57 - 40X7L	Torque 1.18 - 1.57 N·m
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Assembly

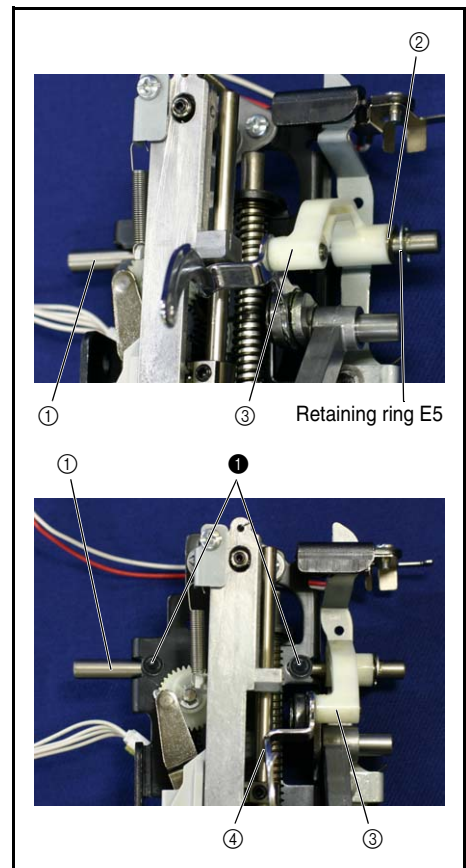
20 Attachment of Thread take-up lever link

1. Attach the retaining ring E5 to the take-up support shaft ①.
2. Set the base holder assy. as shown in the right figure, and then insert the take-up support shaft ① into the washer, spring ②, the thread take-up lever link ③ and the base holder assy. from the right side, and then attach it with the 2 screws ①.

- *Key point**
 - Insert the shaft of the thread take-up lever ④ into the thread take-up lever link ③.

Apply EPNOC AP (N) 0 to the all around the take-up support shaft hole.	Small amount XC8385***
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① 	Screw 3X8	Torque 1.18 - 1.57 N·m
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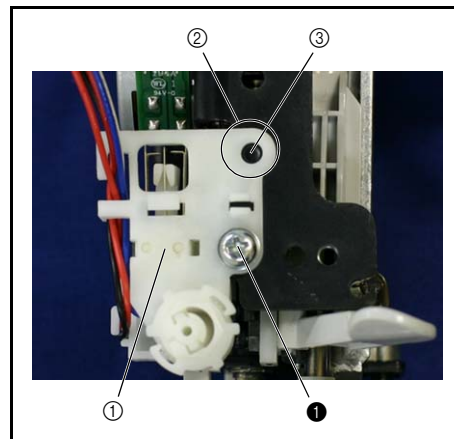
21 Attachment of BH switch assy.

1. Attach the BH switch assy. ① to the base holder assy. with the screw ❶.

***Key point**

- Check that the boss part ③ of the BH switch holder assy. engaged with the positioning hole ② of the BH switch assy. ①.
- Refer to "4-21 Adjustment of BH lever switch position".

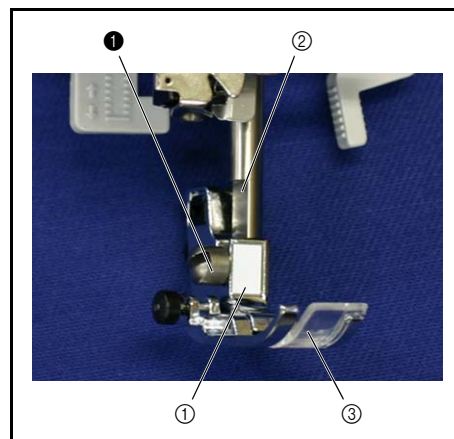
❶		Screw, Pan (S/P washer) M4X8	Torque 0.78 – 1.18 N·m
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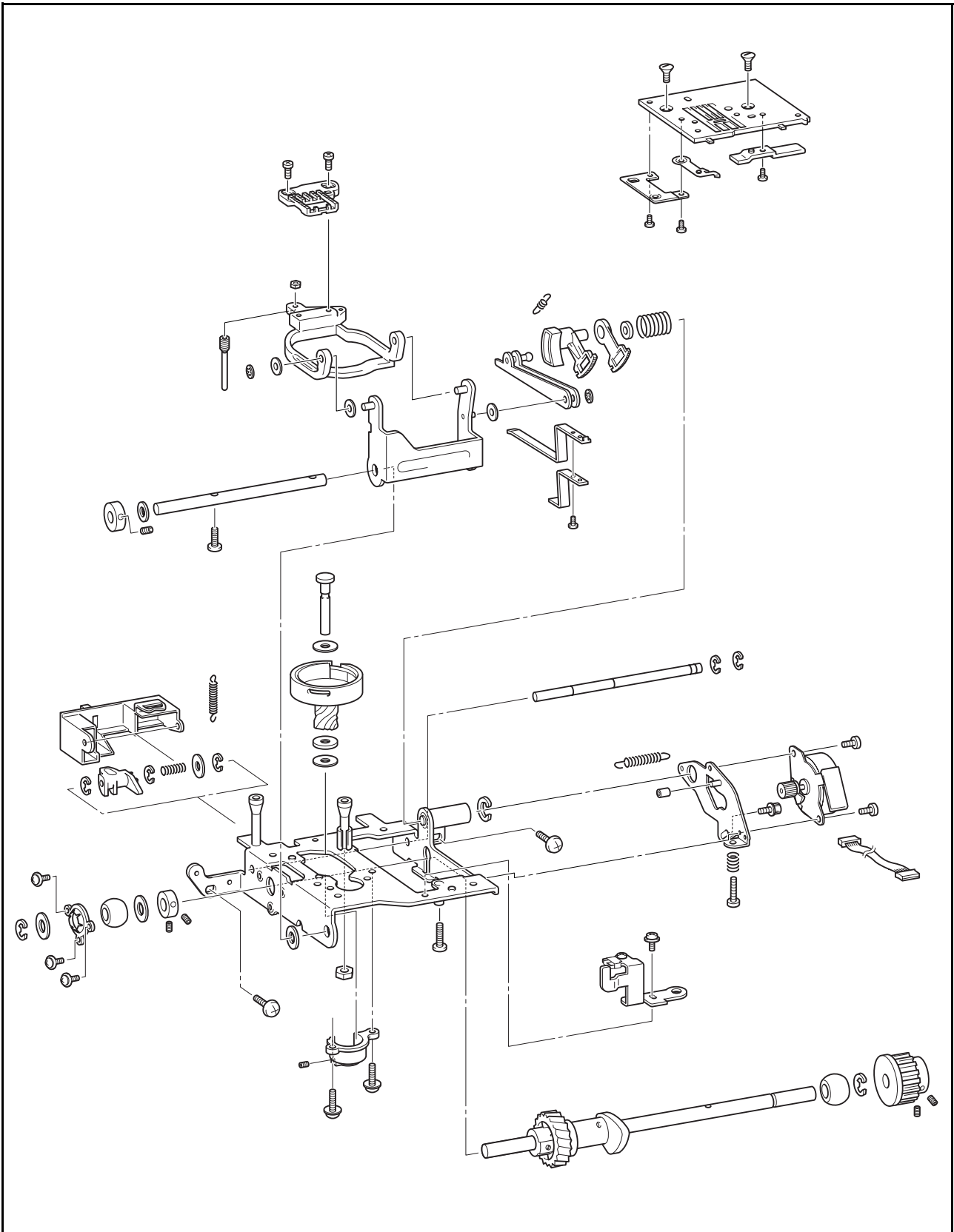
22 Attachment of Presser feed holder assy.

1. Attach the presser feed holder assy. ① to the presser bar ②.
2. Attach the Z foot ③ to the presser feed holder assy. ①.

❶		Screw 3.57	Torque 0.78 – 1.18 N·m
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Feed and bobbin module breakout diagram



1 Attachment of Feed adjuster assy.

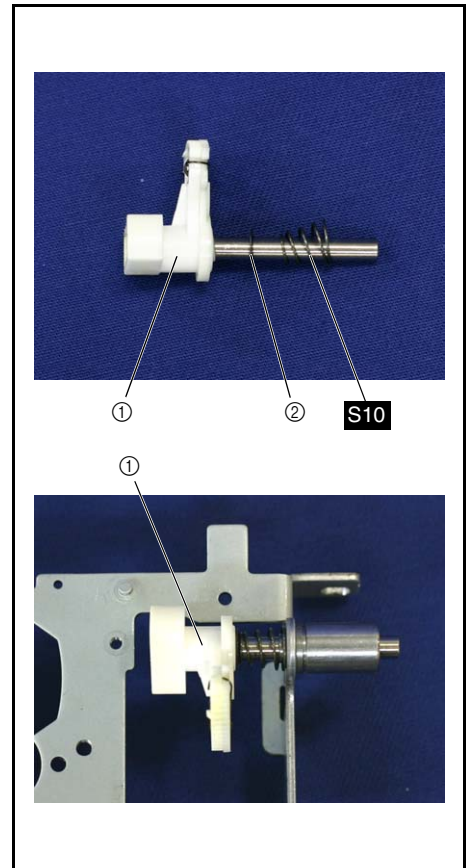
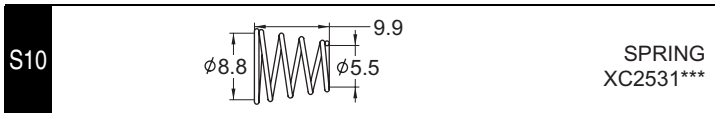
1. Insert the polyester slider ② and the spring S10 into the shaft of the feed adjuster assy. ①.

***Key point**

- Insert the spring starting with the side having the smaller spring diameter.

2. Attach the feed adjuster assy. ① to the base plate assy.

Lubricate the feed adjuster shaft with FBK OIL RO 100.	1-2 drops XC8388***
Apply EPNOC AP (N) 0 to the entire operating part of the feed adjuster feed regulator slide block.	Small amount XC8387***



1-1 Assembly of Feed adjuster assy.

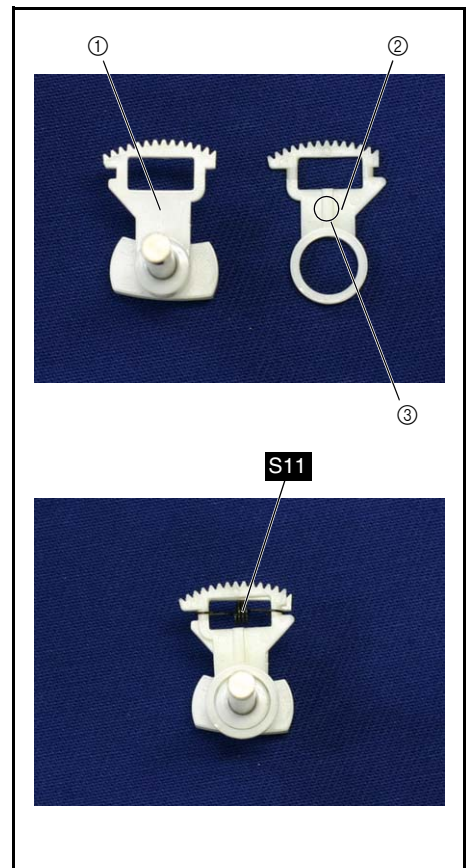
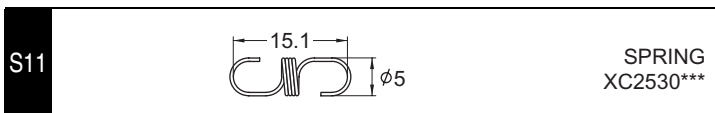
1. Attach the F gear ② to the feed adjuster ①.

***Key point**

- When set it as shown in the right figure, check that the protrusion ③ of the F gear ② is the upper side.

2. Attach the spring S11.

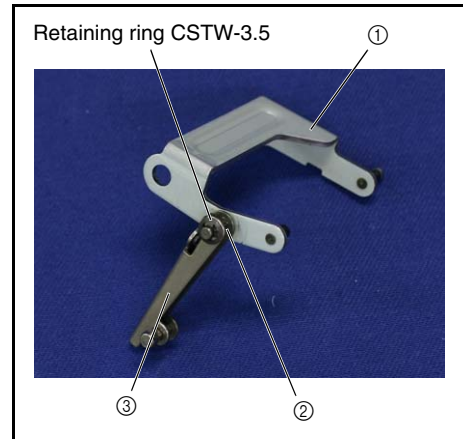
Apply EPNOC AP (N) 0 to the entire operating surface of the feed adjuster and F gear.	Small amount XC8387***
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2 Attachment of Feed arm B assy.

1. Attach the polyester slider ② and the feed arm B assy. ③ to the shaft of the feed arm A assy. ①, and then attach the retaining ring CSTW-3.5.

Lubricate the feed arm A assy. shaft with FBK OIL RO 100.	1-2 drops XC8388***
Lubricate the feed arm B assy. shaft with FBK OIL RO 100.	1-2 drops XC8388***



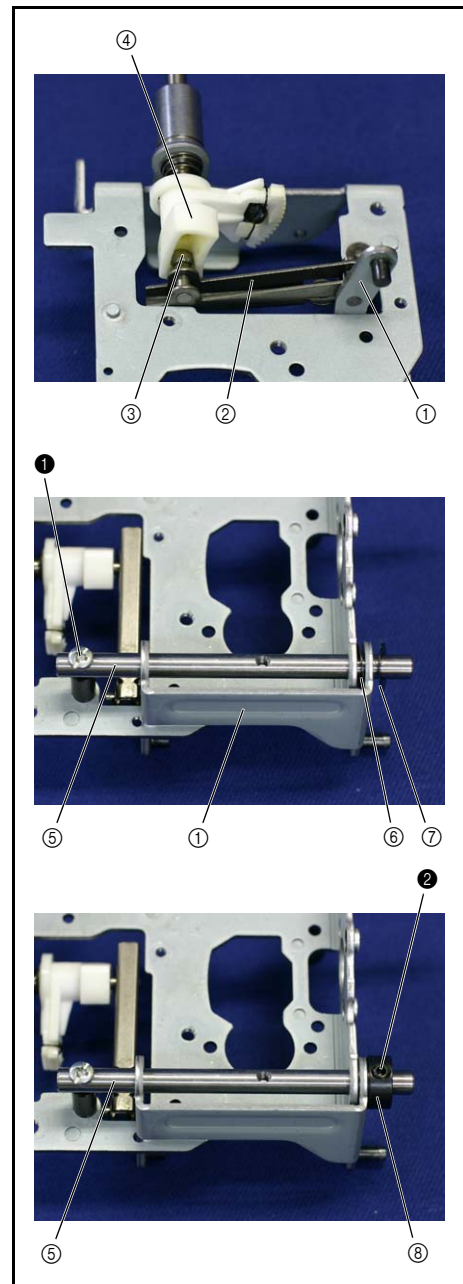
3 Attachment of Feed arm A assy.

1. Insert the feed arm A assy. ① from the back side of the base plate assy., and then attach the feed regulator slide shaft ③ of the feed arm B assy. ② to the groove of the feed adjuster ④.
2. Insert the horizontal feed shaft ⑤ into the feed arm A assy. ①, the washer, thrust ⑥ and the base plate assy. from the right side, and then align the positioning hole on the feed arm supporter shaft, and then attach it with the screw ①.
3. Insert the washer, thrust ⑦ and the set collar ⑧ into the horizontal feed shaft ⑤, and then attach it with the screw ②.

***Key point**

- Attach the feed arm A assy. ①, the washer, thrust ⑥ and the washer, thrust ⑦ so that it can sandwich with the base plate assy. and the set collar ⑧.
- Check that it is not a wobble, and it moves smoothly.

Apply OILER to the 2 sections where the horizontal feed shaft is inserted in feed arm A.	Each 1-2 drops XZ0206***
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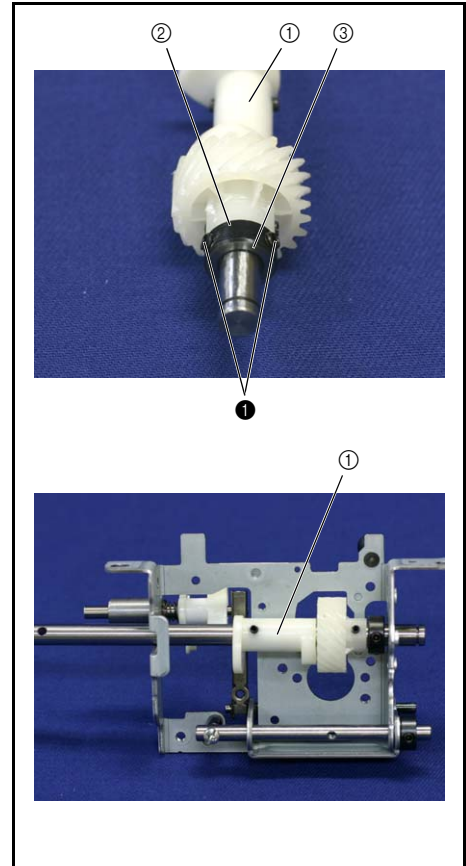
①		Screw, Bind M3X12	Torque 0.78 – 1.18 N·m
②		Set Screw, Socket (CP) M4X4	Torque 0.78 – 1.18 N·m

4 Attachment of Lower shaft assy.

1. Insert the set collar ② to the lower shaft assy. ①, and then tighten the 2 screws ① temporarily.

***Key point**

- Check that the cut surface ③ of the set collar ② is the out side.
 - Fully tighten the screw after performing "3-57 Attachment of Bushing presser B".
2. Set the lower shaft assy. ① to the base plate assy.



<p>①</p>		<p>Set Screw, Socket (CP) M4X4</p>	<p>Torque 0.78 – 1.18 N·m</p>
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5 Attachment of Bushing presser B

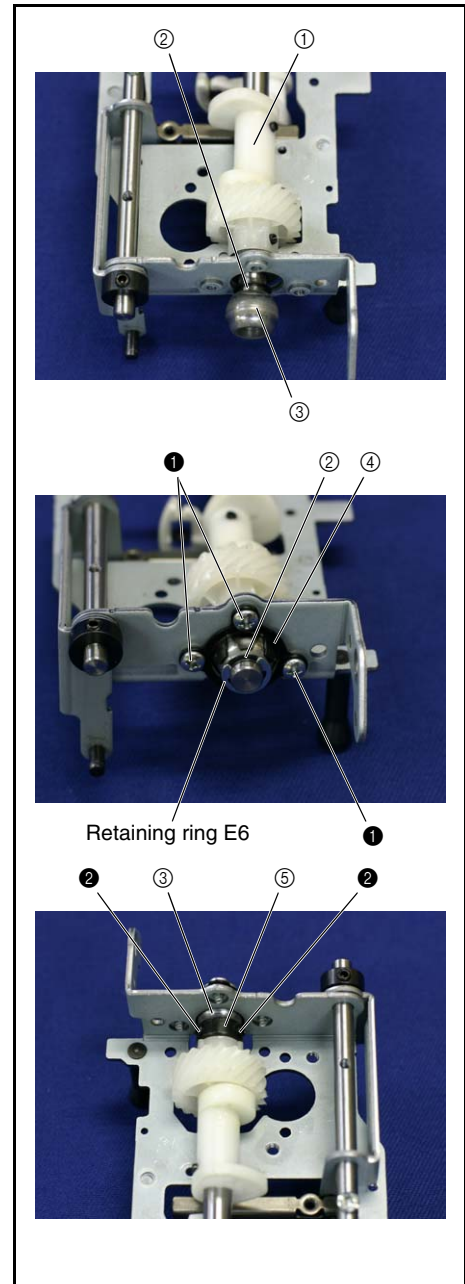
1. Insert the washer, thrust ② and the lower shaft bushing ③ into the lower shaft assy. ①.
2. Attach the bushing presser B ④ to the base plate assy. with the 3 screws ①.
3. Insert the washer, thrust ② into the lower shaft assy. ①, and then attach the retaining ring E6.
4. Sandwich the lower shaft bushing ③ with the retaining ring E6 and the set collar ⑤ and then tighten the screw ②.

***Key point**

- Check that the lower shaft assy. ① is not a wobble, and it moves smoothly.

Lubricate the lower shaft bushing round surface with FBK OIL RO 100.	1-2 drops XC8388***
Apply MOLYKOTE EM30L to all of the teeth around the lower shaft gear.	Small amount XC8385***

①		Taprite, Bind B M3X6	Torque 0.39 – 0.78 N·m
②		Set Screw, Socket (CP) M4X4	Torque 0.78 – 1.18 N·m

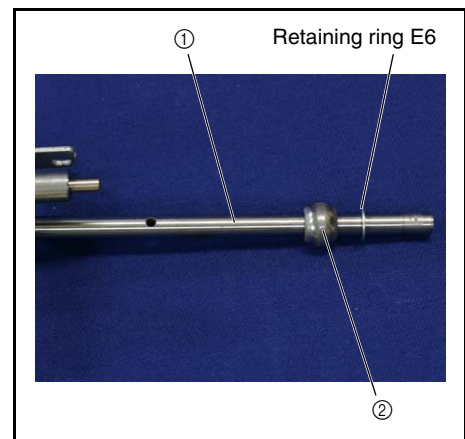


Assembly

6 Attachment of Lower shaft bushing

1. Insert the lower shaft bushing ② into the lower shaft assy. ①, and then attach the retaining ring E6.

Lubricate the lower shaft bushing with OILER.	1-2 drops XZ0206***
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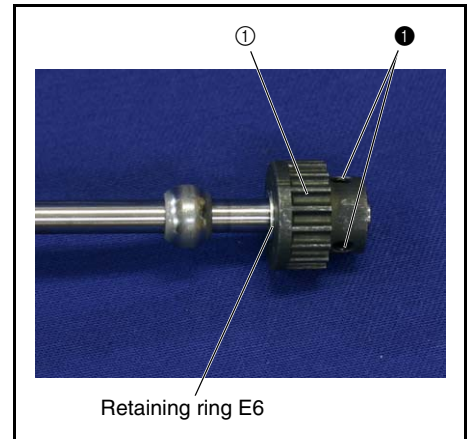
7 Attachment of Timing pulley D

1. Insert the timing pulley D ① into the lower shaft assy. and then tighten the 2 screws ① temporarily.

***Key point**

- Insert it until the timing pulley D ① hits the retaining ring E6.
- Fully tighten the screw after performing "4-12 Adjustment of needle bar rise".

①		Set Screw, Socket (CP) M5X5	Torque 1.18 – 1.57 N·m
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Retaining ring E6

8 Attachment of Feed supporting plate

1. Set the feed supporting plate ① to the feed arm B assy. ②.


***Key point**


- Check that the protrusion ③ of the feed supporting plate ① engaged with the groove ④ of the feed arm B assy. ②.

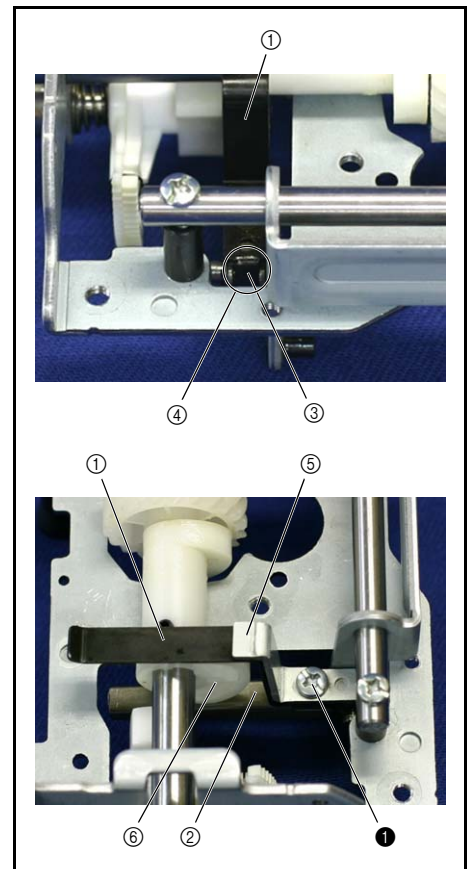
2. Set the feed supporting plate B ⑤ to the feed supporting plate ①, attach the feed arm B assy. ② with the screw ①.

***Key point**

- Check that the boss of the feed supporting plate B ⑤ engaged with the positioning hole of the feed supporting plate ①.
- Check that sandwich the feed cam ⑥ with the feed supporting plate ① and the feed arm B assy. ②.


①		Screw, Blind M3X6	Torque 0.78 – 1.18 N·m
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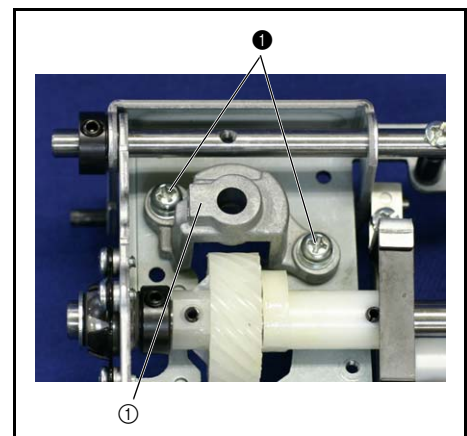
①		Screw, Pan (S/P washer) M4X10DA	Torque 1.18 – 1.57 N·m
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9 Attachment of Shaft supporter

1. Attach the shaft supporter ① to the base plate assy. with the 2 screws ①.

①		Screw, Pan (S/P washer) M4X10DA	Torque 1.18 – 1.57 N·m
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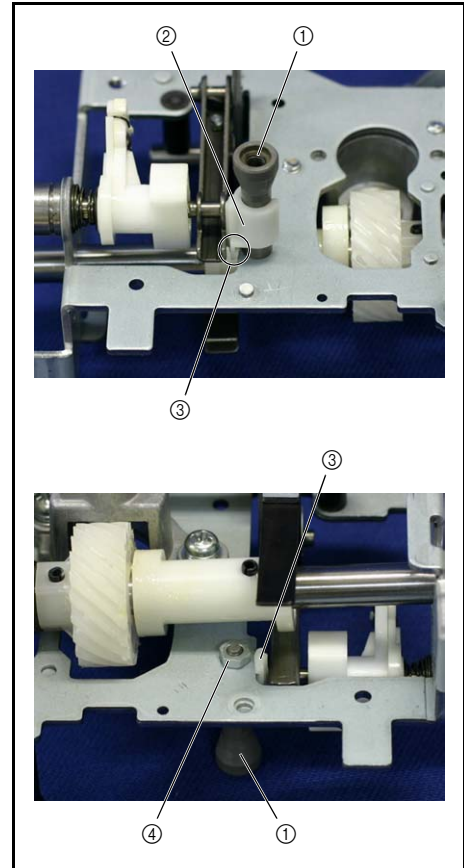


10 Attachment of Needle plate supporter shaft B

1. Attach the feed arm supporter ② to the needle plate supporter shaft B ①.

***Key point**

- Check that the hook part ③ of the feed arm supporter ② is the lower side.
2. Attach the needle plate supporter shaft B ① to the base plate assy.
 3. Attach the nut 1 M3 ④ to the needle plate supporter shaft B ①.
 4. Hang the hook part ③ of the feed arm supporter ② on the base plate assy.



11 Attachment of Drop knob

1. Attach the drop knob ① to the base plate assy.

***Key point**

- Attach it while lifting the section ③ to get over the boss part ② of the base plate assy.

2. Attach the retaining ring E3 to the vertical feed shaft ④.

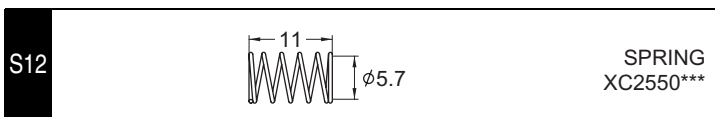
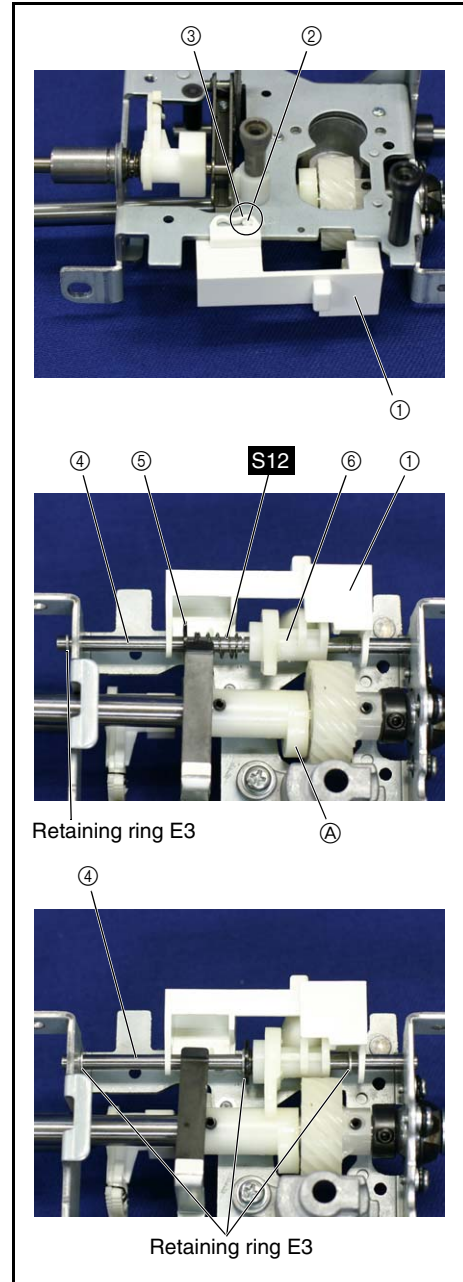
3. Set the base plate assy. as shown in the right figure, and then insert the vertical feed shaft ④ into the base plate assy., the drop knob ①, the washer plain ⑤, the spring S12, the vertical lever ⑥, the drop knob ① and the base plate from the left side.

***Key point**

- Insert it until the retaining ring hit the base plate assy.

4. Attach the 3 retaining rings E3 to the grooves (3 locations) of the vertical feed shaft ④.

Apply EPNOC AP (N) 0 to the sliding parts of the drop knob and the base plate assy.	Bead XC8387***
Lubricate the vertical feed shaft with OILER.	1-2 drops XZ0206***
Apply EPNOC AP (N) 0 to the vertical feed cam surface A.	Small amount XC8387***

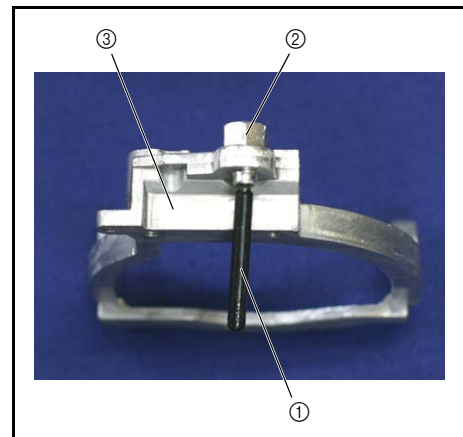


12 Attachment of Vertical adjuster screw assy.

1. Attach the M5 nut ② to the vertical adjuster screw assy. ①.
2. Attach the vertical adjuster screw assy. ① to the feed bar ③.

***Key point**

- Refer to "4-23 Adjustment of feed dog height".



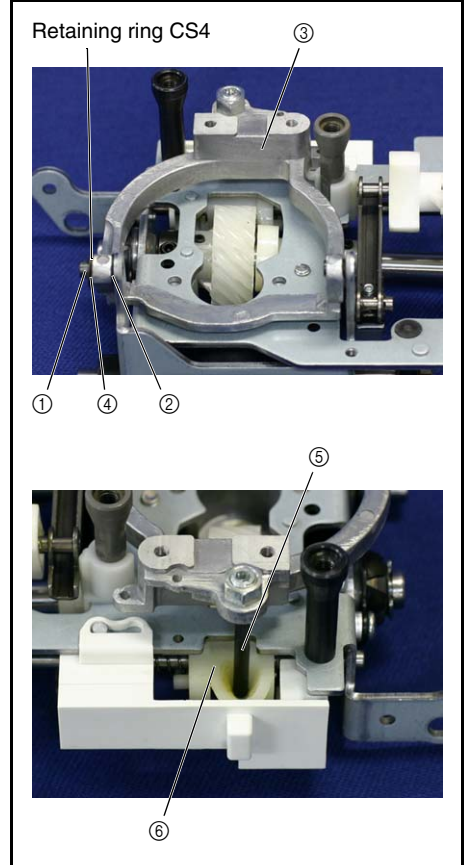
13 Attachment of Feed bar

1. Insert the polyester slider ②, the feed bar ③ and the polyester ④ into the feed arm A assy. ①, and then attach the retaining ring CS4.

***Key point**

- Check that the vertical adjusting screw ⑤ engaged with the groove of the vertical lever ⑥.
- Check that there should no gap between the retaining ring CS4 and the feed bar ③.

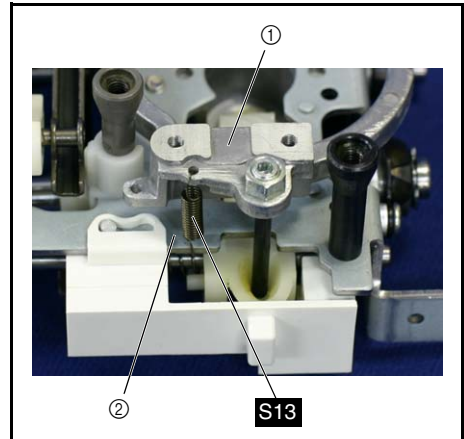
Apply EPNOC AP (N) 0 to the feed shaft hole in the feed bar.	Bead XC8387***
Apply EPNOC AP (N) 0 to the feed arm A assy.	Bead XC8387***
Apply EPNOC AP (N) 0 to the groove of the vertical lever.	Small amount XC8387***



14 Attachment of Spring

1. Attach the spring **S13** to the feed bar ① and the base plate assy. ②.

S13		SPRING XC2547***
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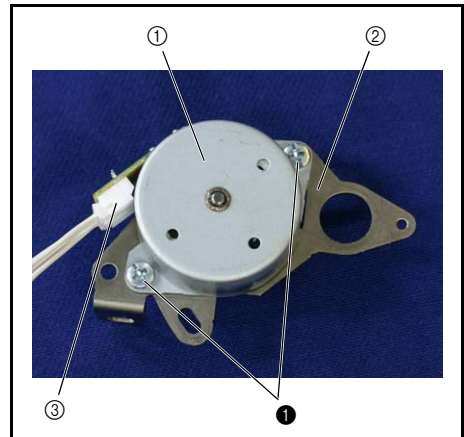


15 Attachment of F pulse motor

1. Attach the F pulse motor ① to the FPM holder sub assy. ② with the 2 screws ①.
2. Attach the lead wire assy, FPM-LE ③ to the F pulse motor ①.

Lubricate the FPM bearing with FBK OIL RO 100.	1-2 drops XC8388***
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①		Screw, Bind M3X4	Torque 0.78 – 1.18 N·m
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16 Attachment of FPM holder sub assy.

1. Attach the rubber ② to the shaft of the FPM holder sub assy. ①.
2. Attach the FPM holder sub assy. ① to the shaft ③ of the base plate assy., and then attach the retaining ring CRS-10.

***Key point**

- Check that the feed adjusting ④ is the upper side of the FPM gear ⑤.

3. Sandwich the spring S14 between the FPM holder sub assy. ① and the base plate assy., and then attach the screw ①.

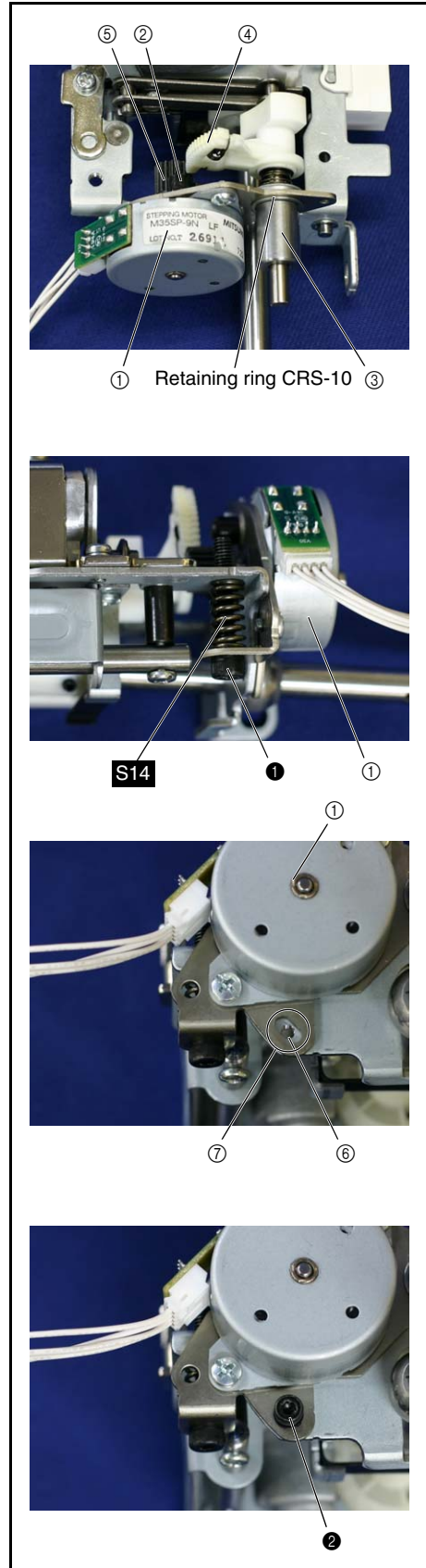
***Key point**

- Tighten the screw ① until the screw hole ⑥ in the base plate assy. comes approximately to the center of the positioning hole ⑦ in the FPM holder sub assy. ①.

4. Tighten the screw ② temporarily.

***Key point**

- Fully tighten the screw after performing "4-18 Adjustment of feed".



①		Bolt, Socket M4X25	Torque 0.78 – 1.18 N·m
②		Screw 3X8	Torque 0.59 – 0.78 N·m
S14			SPRING XC2537***

17 Attachment of F gear teeth alignment

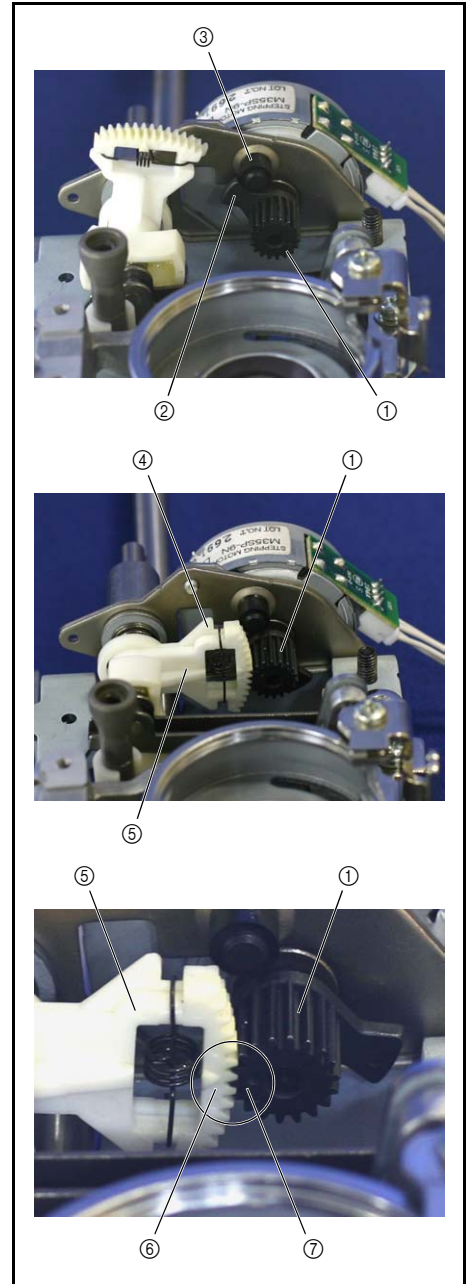
1. Turn the F pulse motor gear ① clockwise until the stopper ② of the F pulse motor gear ① on it touches the rubber ③.
2. Align the teeth of the feed adjusting assy. ④ with the teeth of the F gear ⑤, and then mesh it and the F pulse motor gear ①.

***Key point**

- Check that the match mark ⑥ of the F gear ⑤ and the match mark ⑦ of the F pulse motor gear ① are together.

Apply EPNOC AP (N) 0 to the all of the teeth on the feed adjusting assy. F gear.

Bead XC8387***

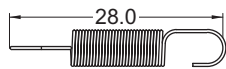


Assembly

18 Attachment of Spring

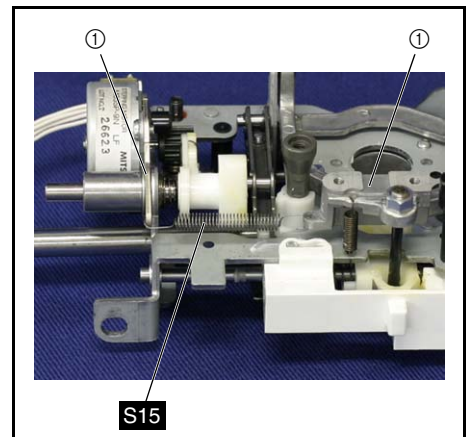
1. Attach the spring S15 to the FPM holder assy. ① and the feed bar ②.

S15



A decided hook form is same

SPRING
XE1478***



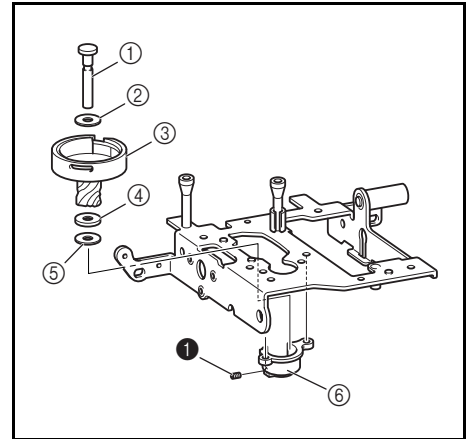
19 Attachment of Outer rotary hook assy.

1. Insert the outer rotary hook shaft ① into the spacer ②, the outer rotary hook assy. ③, the washer ④, the spacer ⑤ and the shaft supporter ⑥, and then attach it with the screw ①.

***Key point**

- Turn the lower shaft so that the large one of the feed cam is depth and the hole of the lower shaft is the upper side, and then attach so that the match mark on the rotary hook faces forward.

Apply MOLYKOTE EM30L to the shaft supporter surface.	Small amount XC8385***
Lubricate the outer rotary hook shaft with the OILER.	Apply liberally XZ0206***



①		Set Screw, Socket (CP) M4X6	Torque 0.78 – 1.18 N·m
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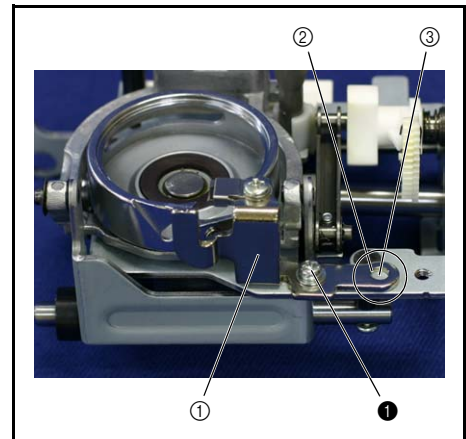
20 Attachment of Inner rotary hook bracket assy.

1. Attach the inner rotary hook bracket assy. ① to the base plate assy. with the screw ①.

***Key point**

- Check that the positioning hole ② to the inner rotary hook bracket assy. ① engaged with the boss ③ of the base plate assy.
- Refer to "4-24 Adjustment of inner rotary hook bracket position".

①		Screw, Pan (S/P washer) M3X6	Torque 0.59 – 0.78 N·m
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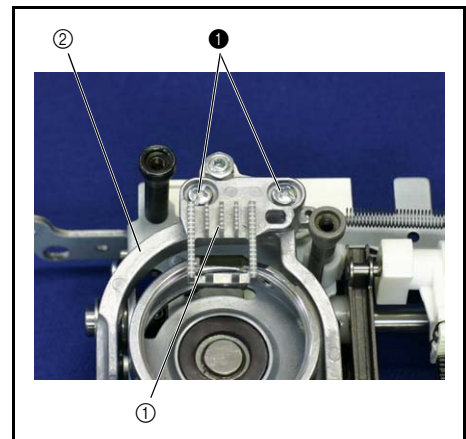
21 Attachment of Feed dog

1. Set the feed dog ① to the feed bar ②, and then tighten the 2 screws ① temporarily.

***Key point**

- Fully tighten the screw after performing "4-22 Adjustment of front/back, left/right position of feed dog".

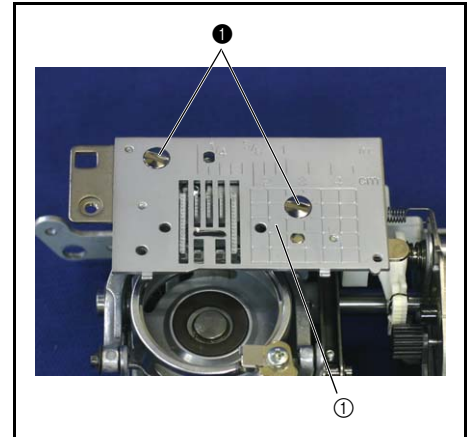
①		Screw, Bind M3X6	Torque 0.78 – 1.18 N·m
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22 Attachment of Needle plate A assy.

1. Attach the needle plate A assy. ① with the 2 screws ①.

①		Screw M4	Torque 1.18 – 1.57 N·m
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22-1 Assembly of Needle plate A assy.

1. Attach the F gear stopper plate ① to the needle plate A ② with the screw ①.

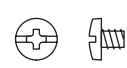
***Key point**

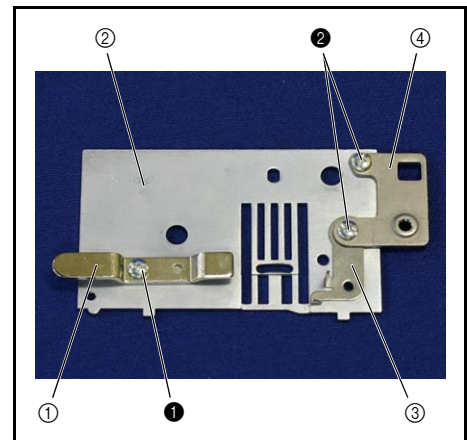
- Check that the boss part of the F gear stopper plate ① engaged with the positioning hole of the needle plate A ②.

2. Attach the stopper plate ③ and the needle plate B support plate ④ to the needle plate A assy. ② with the 2 screws ②.

***Key point**

- Check that the boss of the stopper plate ③ engaged with the positioning hole of the needle plate A ②.

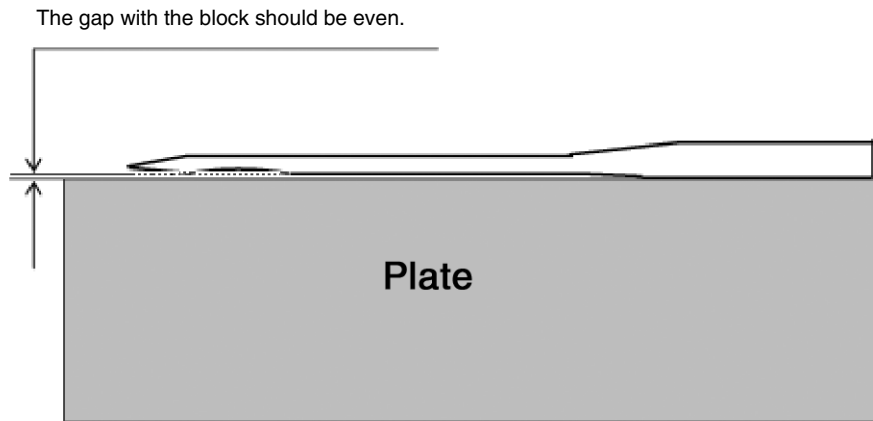
① ②		Screw, Bind M2.6X3	Torque 0.59 – 1.57 N·m
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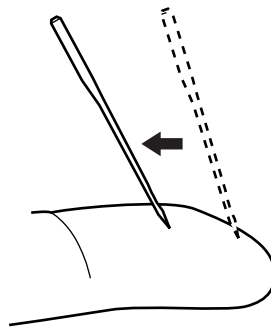
4 Adjustment

Inspection	Needle curvature / Tip damage to needle ..	4 - 2
Test Mode	Starting test mode.....	4 - 3
	Test mode list.....	4 - 4
Adjustment	Adjustment of timing belt tension	4 - 5
	Adjustment of motor belt tension	4 - 6
	Adjustment of fine tension.....	4 - 7
	Adjustment of upper thread tension	4 - 8
	Adjustment of three point needle drop	4 - 9
	Forward and back adjustment of needle and presser.	4 - 10
	Adjustment of clearance between the needle and the rotary hook point	4 - 11
	Adjustment of needle bar rise	4 - 12
	Adjustment of needle bar height	4 - 13
	Adjustment of needle interference left / right.	4 - 14
	Adjustment of needle thread block.....	4 - 15
	Adjustment of presser bar height and parallel .	4 - 16
	Adjustment of inner rotary hook (lower thread) tension ..	4 - 17
	Adjustment of feed	4 - 18
	Adjustment of bobbin winder.....	4 - 19
	Adjustment of BW switch position	4 - 20
	Adjustment of BH lever switch position.	4 - 21
Adjustment of front/back, left/right position of feed dog..	4 - 22	
Adjustment of feed dog height	4 - 23	
Adjustment of inner rotary hook bracket position .	4 - 24	
Adjustment of Pattern	4 - 25	



1. Check to be sure that there is no curvature in the needle on a level block (horizontal block).



2. Touch the tip of the needle to your finger, and check to be sure it does not catch.



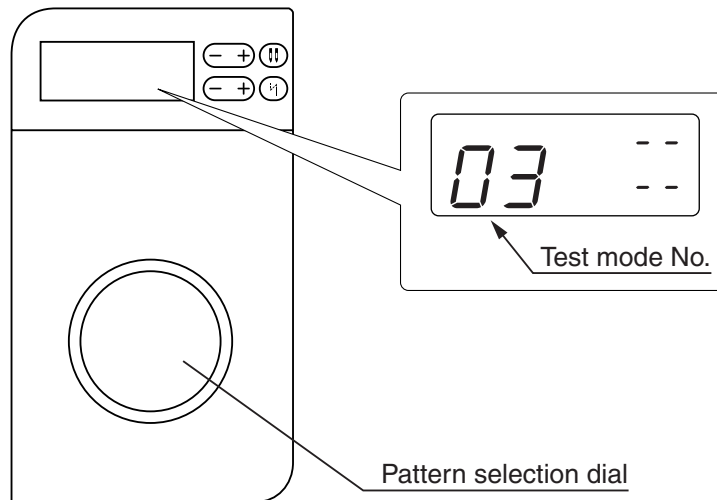
How to start test mode.

- Press the  (Start / Stop button) and the  (Reverse stitch button) while turning the power on; the buzzer will sound four times, and test mode will start.



How to get start in each test mode.

- Turn the pattern selection dial, and select the test mode number.



Test Mode

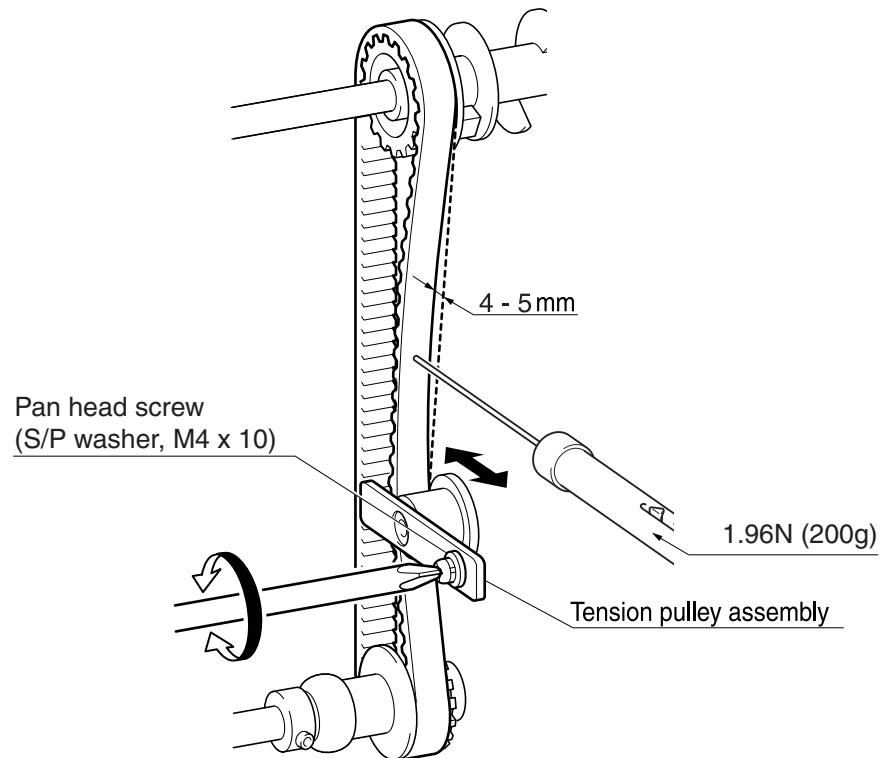
Test mode list

Mode	Test mode No.	Z (zigzag) operations	F (feed) operations	Operation speed	Adjustment used	Reference page
3 point needle drop	3	Whenever the Reverse stitch button is pushed, needle position is switched to left base line / center base line / right base line.	None	It is freely changed with the Sewing speed controller	Three point needle drop adjustment	4 - 9
					Clearance between the needle and the rotary hook point adjustment	4 - 11
					Needle bar rise adjustment	4 - 12
					Needle bar height adjustment	4 - 13
					Needle interference left/right adjustment	4 - 14
Forward and reverse feed	6	100 stitches forward on the left base line 100 stitches reverse on the right base line		It is freely changed with the Sewing speed controller	Feed adjustment	4 - 18
Feed dog position	8	-	-	-	Front/back, left/right position of feed dog adjustment	4 - 22

1. Remove the front cover.
2. Loosen the pan head screw (S/P washer, M4 x 10) on the tension pulley assembly.
3. With a force of 1.96 N (200 g) pushing on the center of the belt, adjust the tension pulley assembly position for a deflection of 4 - 5 mm.
4. Tighten the pan head screw (S/P washer, M4 x 10) on the tension pulley assembly. (torque : 1.18 - 1.57N · m)

XC2277001

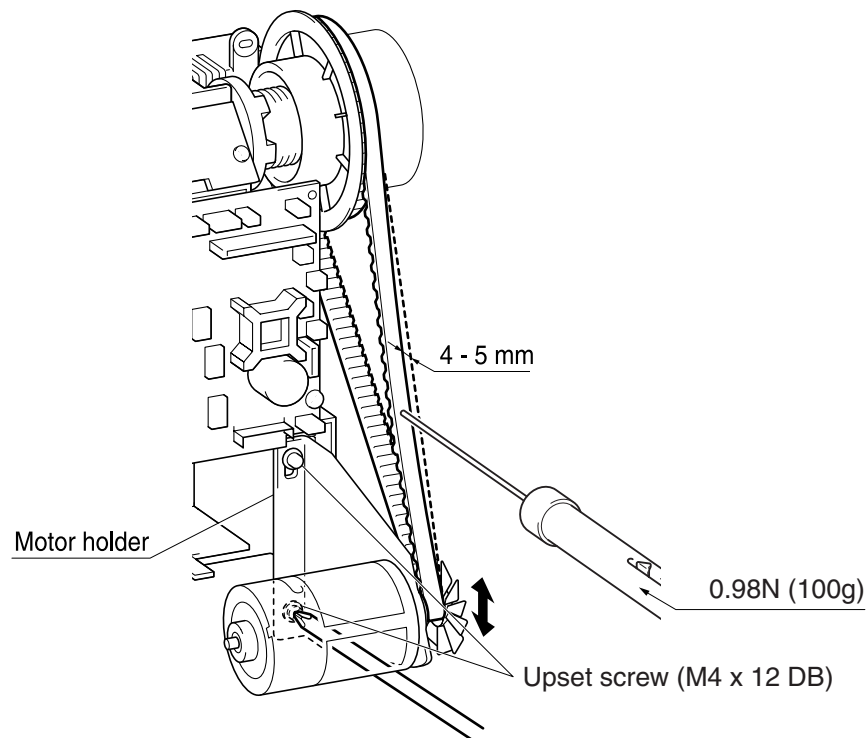
Push-pull gauge (3 N)



1. Remove the front cover.
2. Loosen the 2 upset screw (M4 x 12 DB) in the motor holder.
3. With a force of 0.98 N (100 g) pushing on the center of the belt, adjust the motor pulley position for a deflection of 4 - 5 mm.
4. Tighten the 2 upset screw (M4 x 12 DB) in the motor holder. (torque : 0.78 - 1.18N · m)

XC2277001

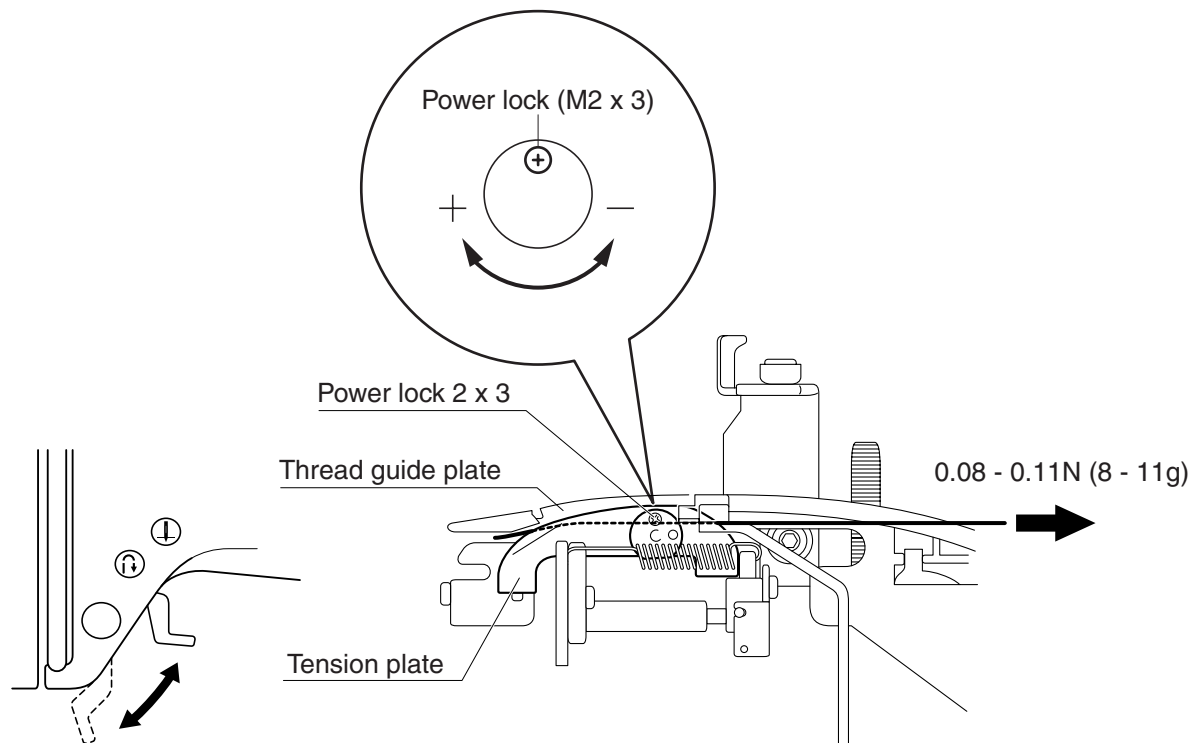
Push-pull gauge (3 N)



1. Remove the face plate.
2. Raise the presser foot lifter.
3. Pass Schappe Spun Sewing Thread #60 through the thread guide plate => tension plate.
4. Lower the presser foot lifter.
5. Pull the thread with a tension gauge, and adjust the power lock (M2 x 3) so that it is 0.08 - 0.11 N (8 - 11 g).

XA9153001

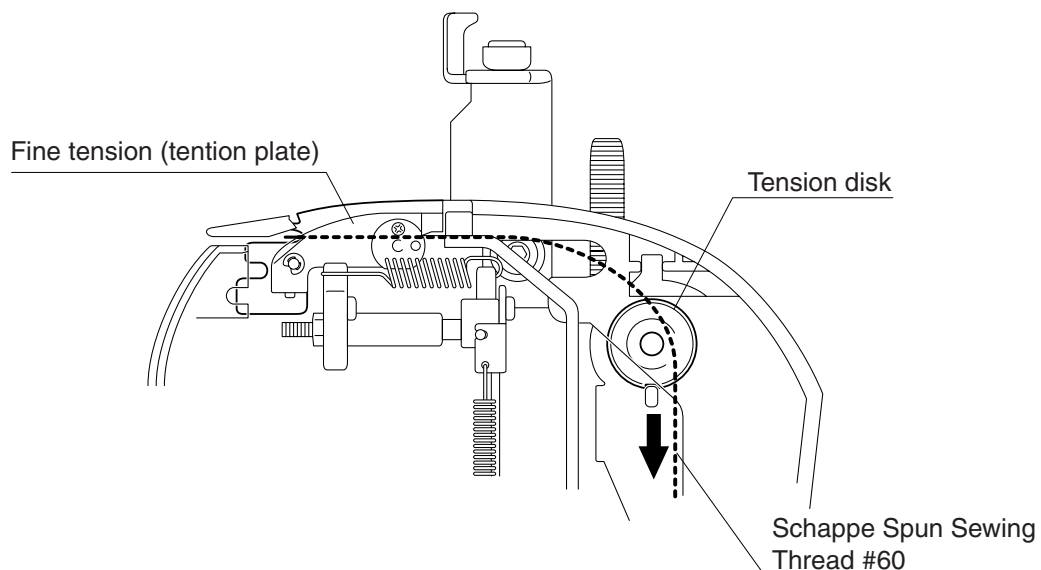
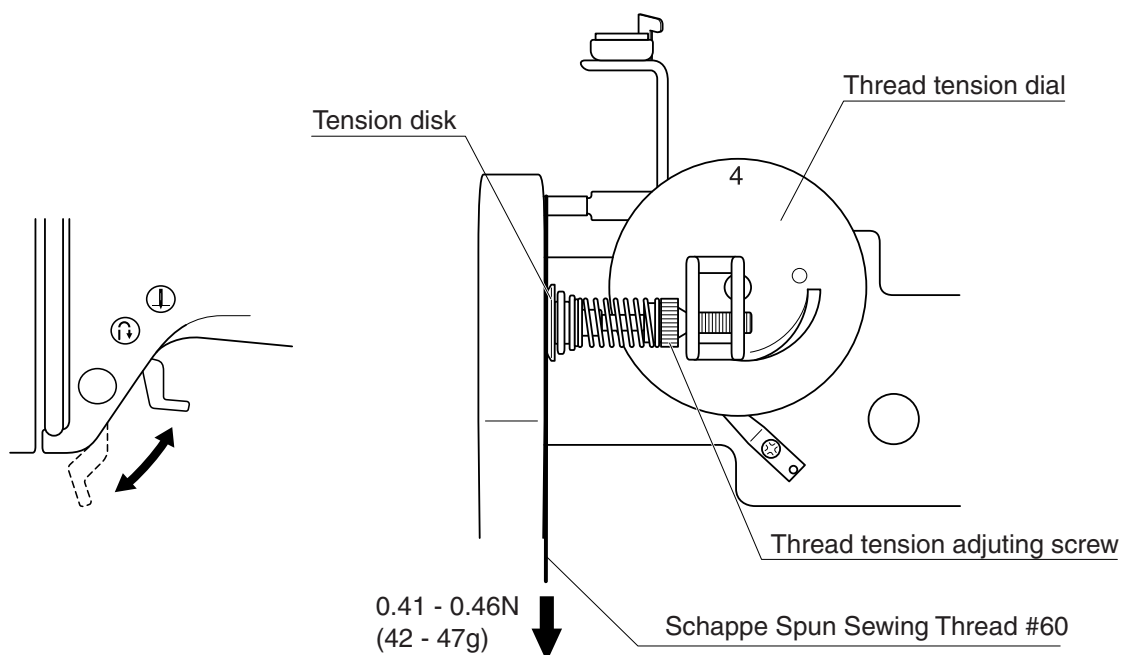
Tension gauge 30 (0.3 N)





NOTE •When use the Schappe Spun Sewing Thread #30, adjust it for 0.20 - 0.30N (20 - 30g).

1. Remove the front cover.
2. Raise the presser foot lifter.
3. Turn the thread tension dial to the “ 4 ” position.
4. Pass the Schappe Spun Sewing Thread #60 through the fine tension (tention plate) => tension disk.
5. Lower the presser foot lifter.
6. Pull the thread with a tension gauge, and adjust the thread tension adjusting screw depth for 0.41 - 0.46N(42 - 47g).
7. Apply a small amount of screw locking compound to the thread tension adjusting screw.

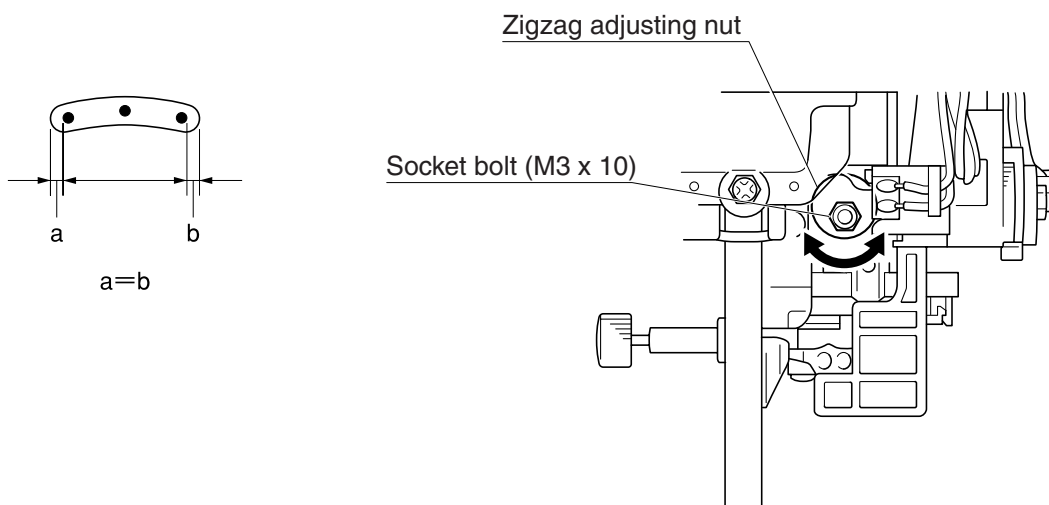
Screw locking compound for thread tension adjusting screw	Small amount
XA9154001	Tension gauge 50 (0.5 N)



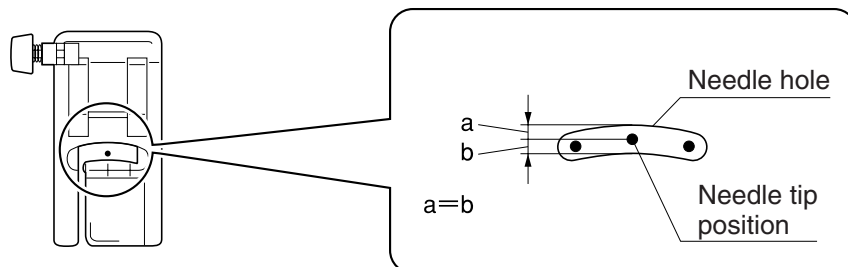
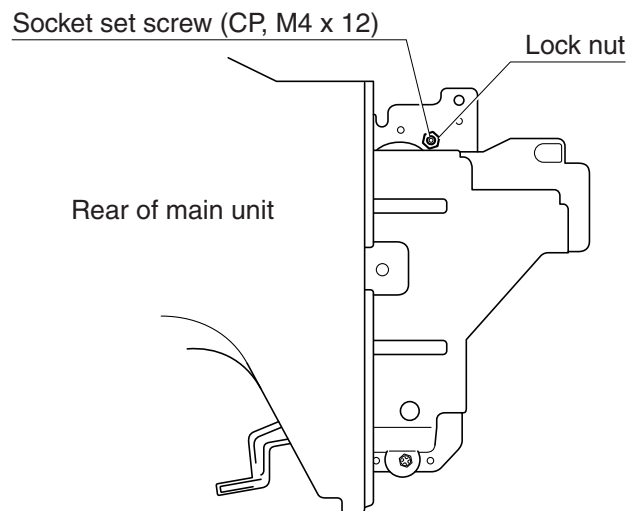
1. Attach the front cover.
2. Press  and  button on the front cover while turning the power on : the buzzer will sound four times.
3. Select the test mode number [3].
4. Turn the pulley by hand, and insert the tip of the needle into the needle hole.
5. Loosen the socket bolt (M3 x 10) of the zigzag adjusting nut.
6. Adjust the zigzag adjusting nut so that the left base line / center base line / right base line needle drop is uniform to the left and right of the needle plate A needle hole.
7. Tighten the socket bolt (M3 x 10). (torque : 0.78 - 1.18N · m)
8. Turn off the power.



XE2395001

Box screw driver 6 x 190



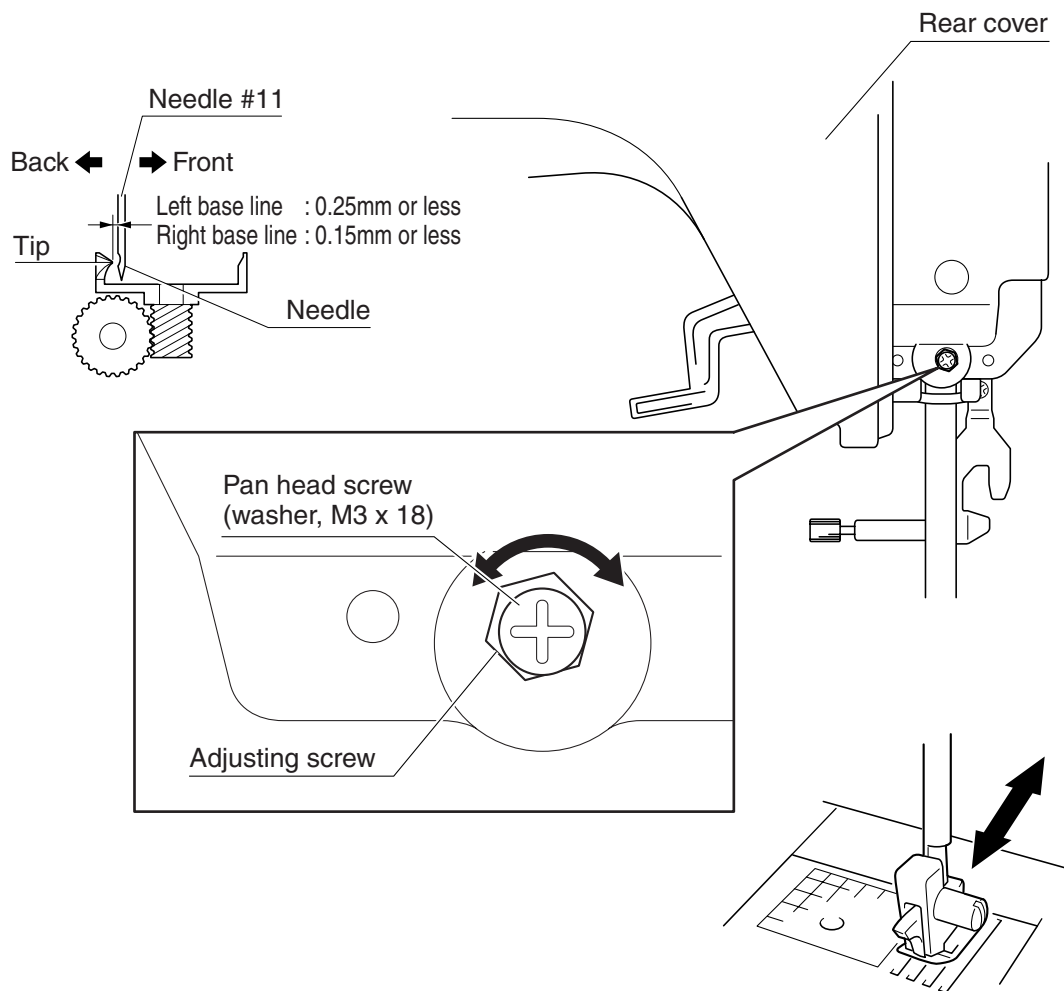
1. Remove the face plate.
2. Turn the pulley by hand, and insert the tip of the needle into the needle hole.
3. Loosen the lock nut.
4. Adjust the needle tip to the front/back center position of the needle hole using the socket set screw (CP, M4 x 12).
5. Tighten the lock nut.






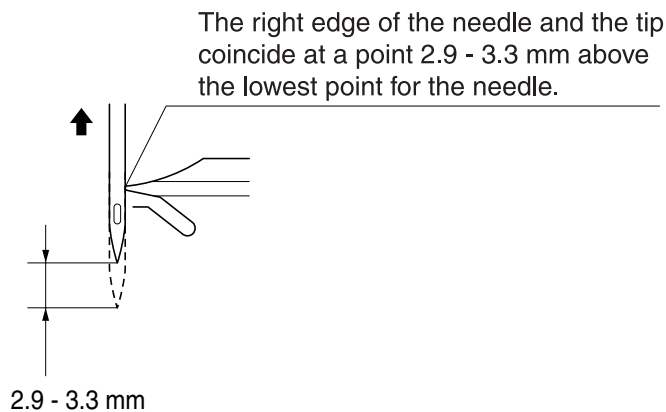
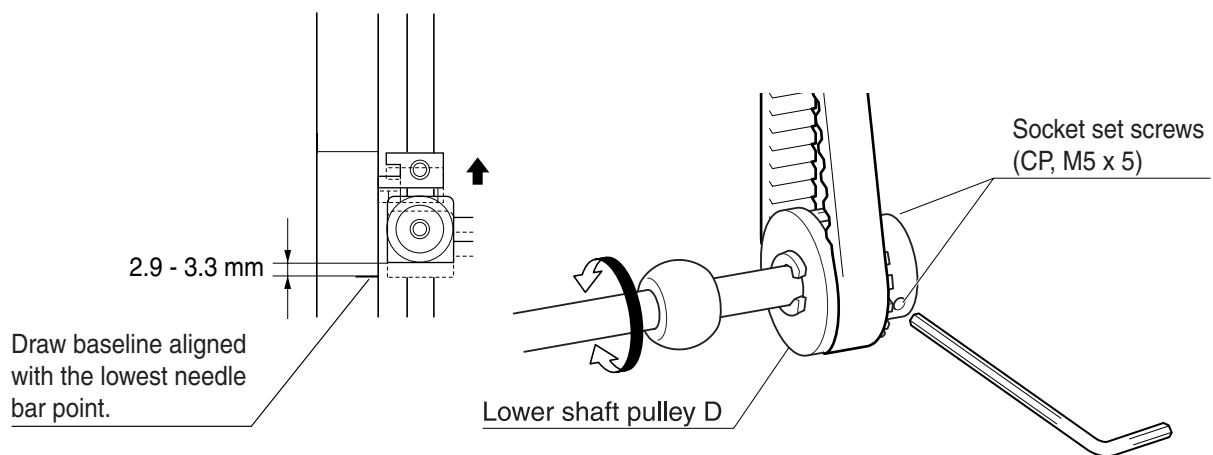
1. Remove the face plate.
2. Attach the needle #11.
3. Press  and  button on the front cover while turning the power on : the buzzer will sound four times.
4. Select the test mode number [3].
5. Remove the 2 flat screws (M4), and remove needle plate A from the feed base.
6. Loosen the pan head screw (washer, M3 x 18).
7. Turn the pulley by hand until the right edge of the needle and the outer rotary hook tip meet.
8. Adjust the gap between the needle and the outer rotary hook tip (front and back) to left base line : 0.25mm or less and right base line : 0.15mm or less using the tightening depth of the adjusting screw.
9. Tighten the pan head screw (washer, M3 x 18). (torque : 0.59 - 0.78N · m)
10. Turn off the power.




XE2395001

Box screw driver 6 x 190



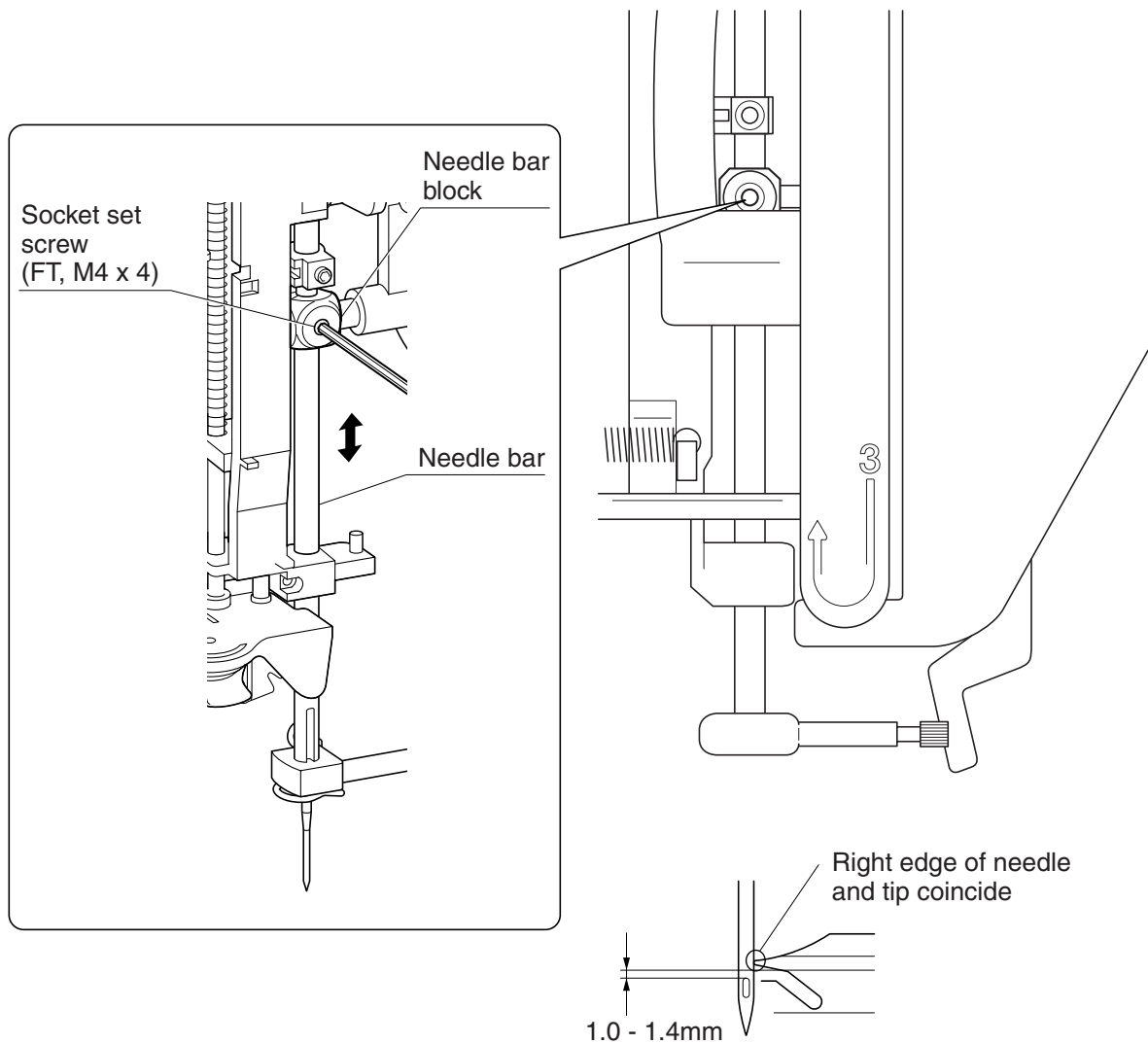
1. Attach the front cover.
2. Press  and  button on the front cover while turning the power on : the buzzer will sound four times.
3. Select the test mode number [3].
4. Press  five times to the left base line.
5. Turn off the power.
6. Turn the pulley by hand, and set the needle bar at its lowest point.
7. Loosen the 2 socket set screws (CP, M5 x 5) on lower shaft pulley D.
8. With the needle bar raised 2.9 - 3.3 mm from the needle bar low point reference line, adjust by moving the lower shaft pulley D and lower shaft assembly so that the right edge of the needle and the outer rotary hook tip come together.
9. Secure the 2 socket set screws (CP, M5 x 5) on lower shaft pulley D. (torque : 1.18 - 1.57N · m)





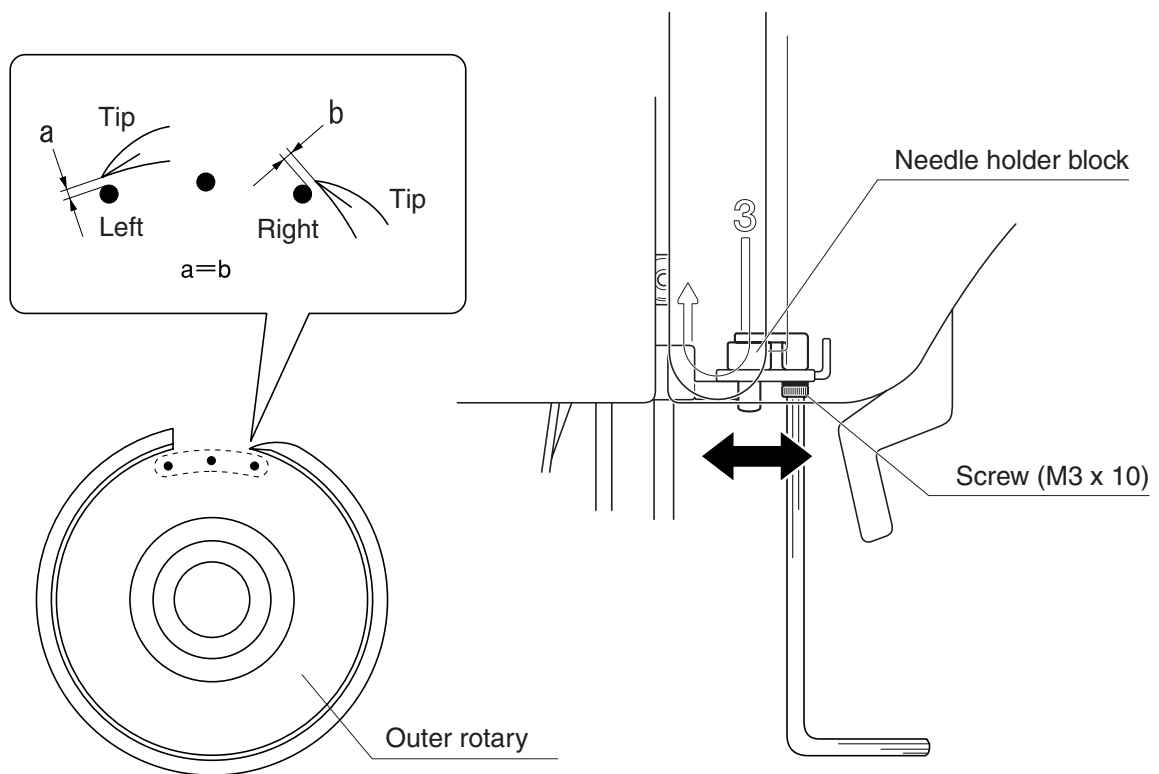
1. Remove the face plate.
2. Press  and  button on the front cover while turning power on : the buzzer will sound four times.
3. Select the test mode number [3].
4. Press  five times to the left base line.
5. Turn off the power.
6. Turn the pulley by hand until the right edge of the needle and the outer rotary hook tip meet.
7. Loosen the socket set screw (FT, M4 x 4) of the needle bar block.
8. Adjust the height of the needle bar for 1.0 - 1.4 mm between the top of the needle hole and lower edge of the outer rotary hook tip.

NOTE •Make sure the needle block is not positioned at a slant.

9. Tighten the socket set screw (FT, M4 x 4) of the needle bar block. (torque : 0.78 - 1.18N · m)
10. Perform "Adjustment of needle thread block" (4 - 15).



1. Attach the front cover.
2. Remove the 2 flat screws (M4), and remove the needle plate A.
3. Press  and  button on the front cover while turning the power on : the buzzer will sound four times.
4. Select the test mode number [3].
5. Turn the pulley by hand, and insert the tip of the needle into the needle hole.
6. Loosen the screw (M3 x 10).
7. Adjust the needle holder block to the left or right so that the left base line / right base line needle drop is uniform left and right gaps between the needle and the tip of the outer rotary to be approximately the same.
8. Tighten the screw (M3 x 10). (torque : $1.18 - 1.57\text{N} \cdot \text{m}$)
9. Turn off the power.
10. Attach the needle plate A with the 2 flat screws (M4).

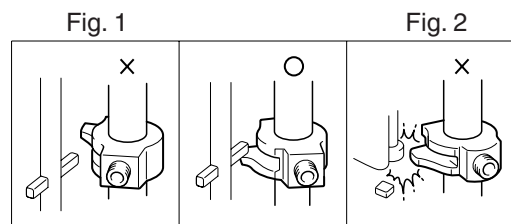
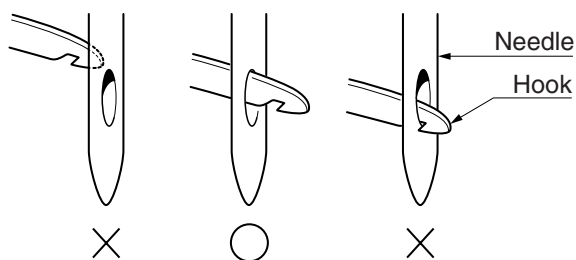
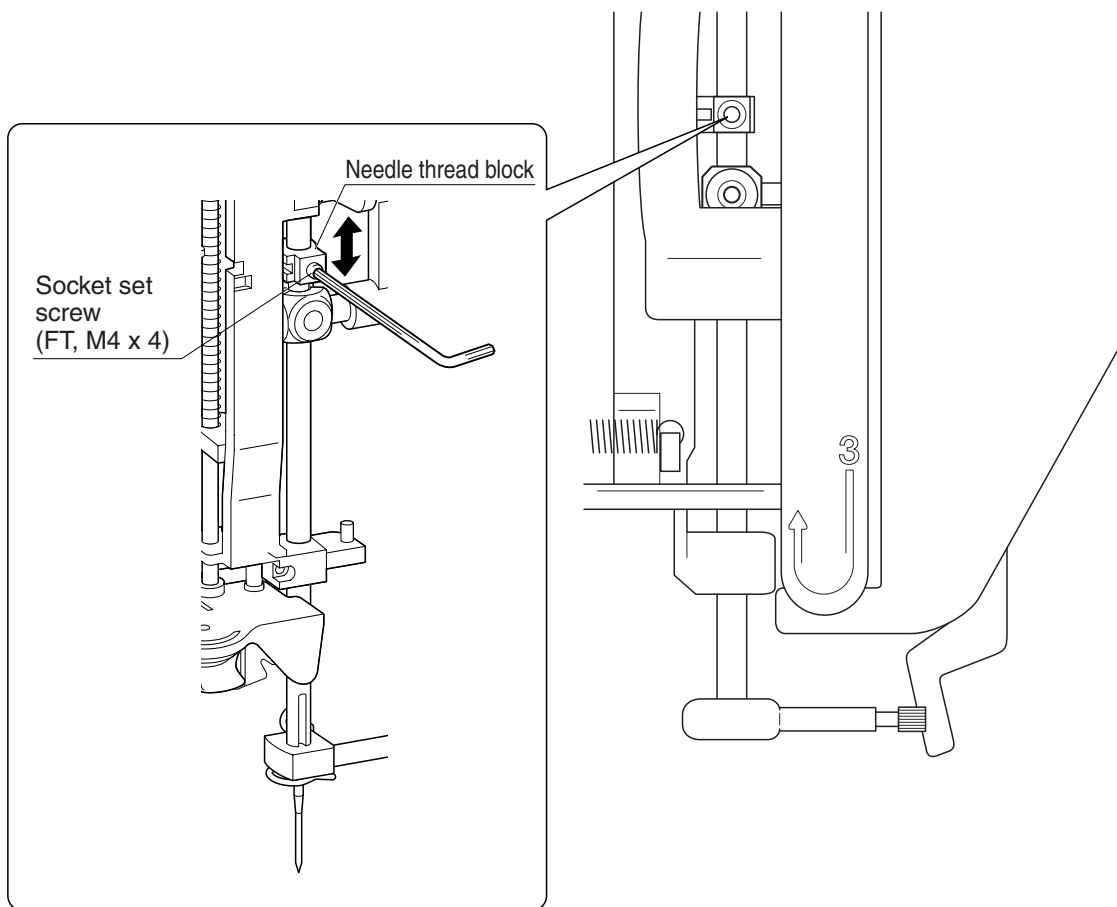


1. Attach a needle.
2. Turn the pulley by hand, and set the needle bar at its highest point.
3. Loosen the socket set screw (FT, M4 x 4).
4. Adjust the height of the needle thread block so that the threading hook passes through the needle hole, and secure with the socket set screw (FT, M4 x 4). (torque : $0.78 - 1.18\text{N} \cdot \text{m}$)

***Key point**

- Secure the socket set screw (FT, M4 x 4) so that the position of the needle thread block set screw is seen to be slight to the left when viewed from the front.
- Adjust so that the upper edge of the threading hook and the upper edge of the needle hole are at the same height.

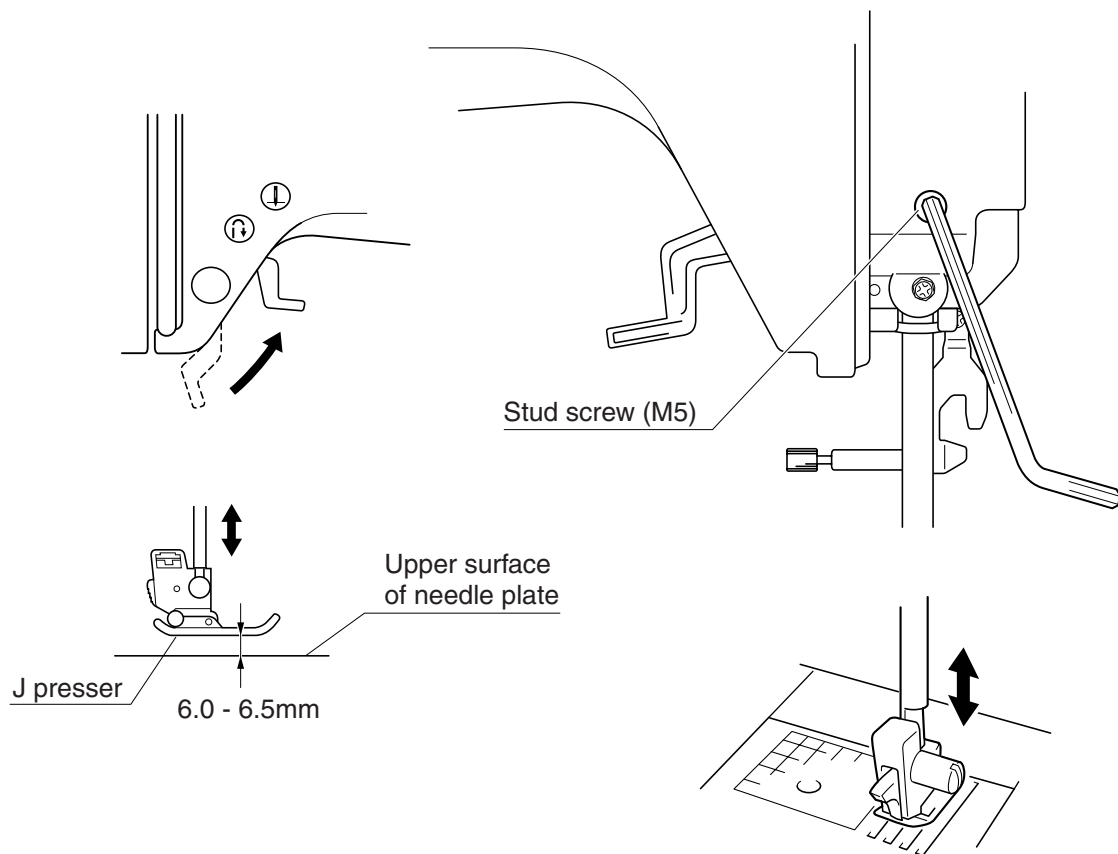
- NOTE**
- If the needle thread block set screw position is too far to the left, the hook will not operate and treading cannot be done. (Fig. 1).
 - If the needle thread block set screw position is too far to the right, the needle bar supporter assy. and the needle thread block will come into contact and be damaged (Fig. 2).



1. Remove the face plate.
2. Raise the presser foot lifter.
3. Turn the pulley so that the feed dog drops below needle plate A.
4. Loosen the stud screw (M5) in the presser bar clamp assy.
5. Adjust the height of the presser bar so that there is 6.0 - 6.5 mm between the top of needle plate A and the bottom of the presser.
6. Tighten the stud screw (M5) in the presser bar clamp assy. (torque : 1.18 - 1.57N · m)

NOTE •Use the J presser.

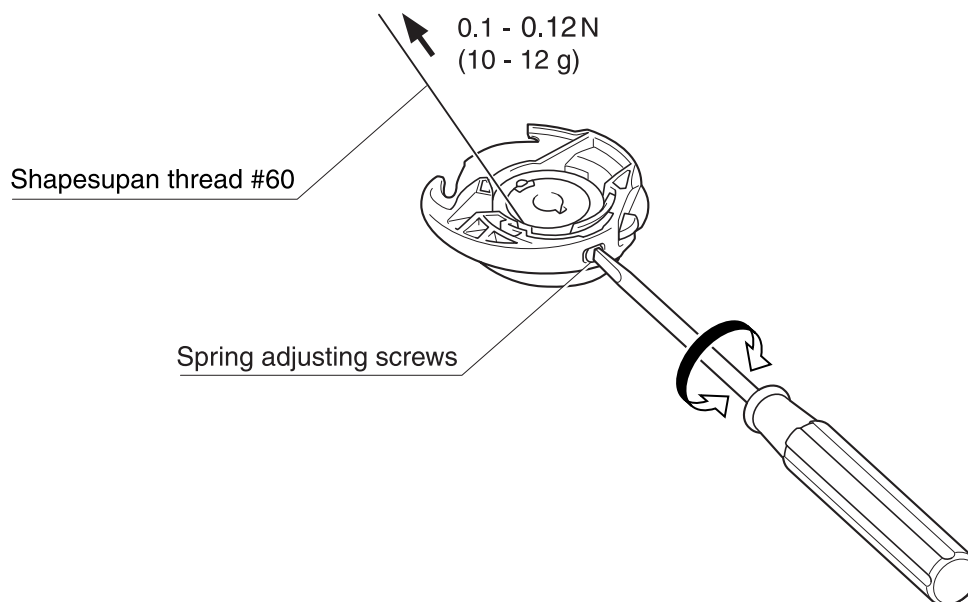
- Adjust the presser bar so that the needle plate feed dog hole and the presser are parallel (to prevent slanting during serging and damage to the needle).






1. Set a bobbin (wound with Schappe Spun Sewing Thread thread #60) in the inner rotary hook.
2. Pull the thread with a tension gauge, and adjust the spring adjusting screw so that it is 0.1- 0.12 N (10 - 12 g).
3. Apply a small amount of screw lock agent to the spring adjusting screw.

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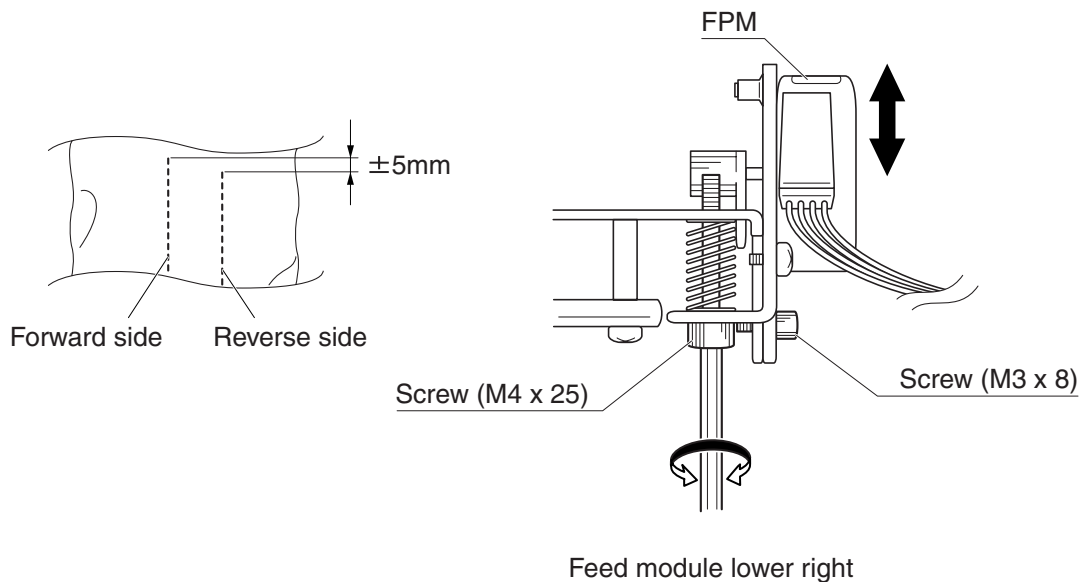
Tension gauge 30 (0.3 N)



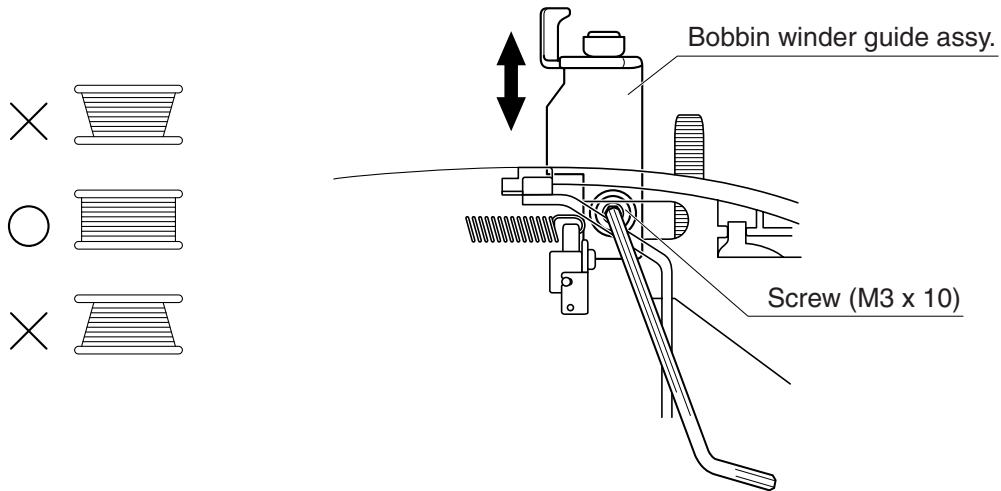
1. Attach the front cover.
2. Press  and  button on the front cover while turning the power on : the buzzer will sound four times.
3. Select the test mode number [6].
4. Press  button and run "Feed forward and reverse mode," checking the forward and reverse feed amounts.
5. Loosen the screw (M3 x 8) of the FPM holder assy.
6. Adjust the forward and reverse feed using the screw (M4 x 25)

***Key point**

- Confirm that when a material of two layers of broadcloth with paper in between is given 100 stitches forward and reverse ("Feed forward and reverse" mode), the forward side is plus or minus 5 mm longer than the reverse side.
 - Tightening the screw (M4 x 25) => shortens the reverse side.
 - Loosening the screw (M4 x 25) => lengthens the reverse side.
7. Apply a small amount of screw lock agent to the screw (M4 x 25).
 8. Tighten the screw (M3 x 8) of the FPM holder assy. (torque : $0.59 - 0.78\text{N} \cdot \text{m}$)
 9. Turn off the power.



1. Remove the face plate.
2. Loosen the screw (M3 x 10).
3. Move the bobbin winder guide assy. up and down and adjust uneven bobbin winding.
4. Tighten the screw (M3 x 10). (torque : 0.59 - 0.78N · m)

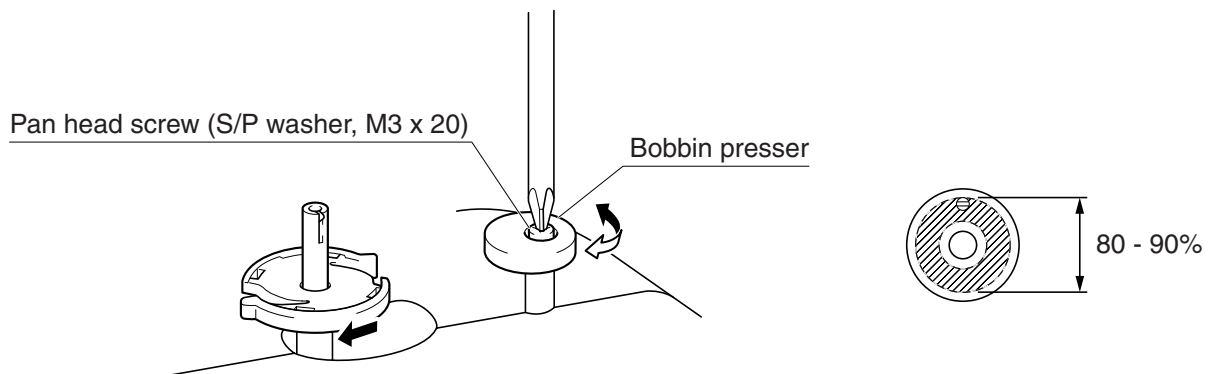


5. Loosen the pan head screw (S/P washer, M3 x 20).
6. Turn the bobbin presser left and right, and adjust the winding quantity.

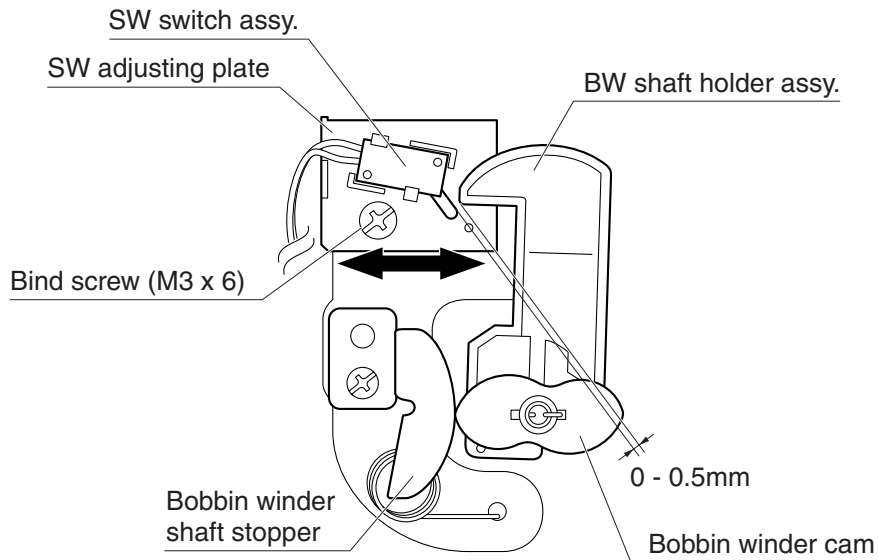
***Key point**

- The target for the bobbin winding quantity is filling 80 - 90% of the diameter.

7. Tighten the pan head screw (S/P washer, M3 x 20). (torque : 0.59 - 0.78N · m)



1. Turn the bobbin winder cam, and lay it as shown in the below figure.
2. Loosen the bind screw (M3 x 6) of the SW adjusting plate.
3. The position in the figure to the lower, and move the SW adjusting plate and adjust it so that the gap is 0 - 0.5mm between the SW switch assy. and the BW shaft holder assy.

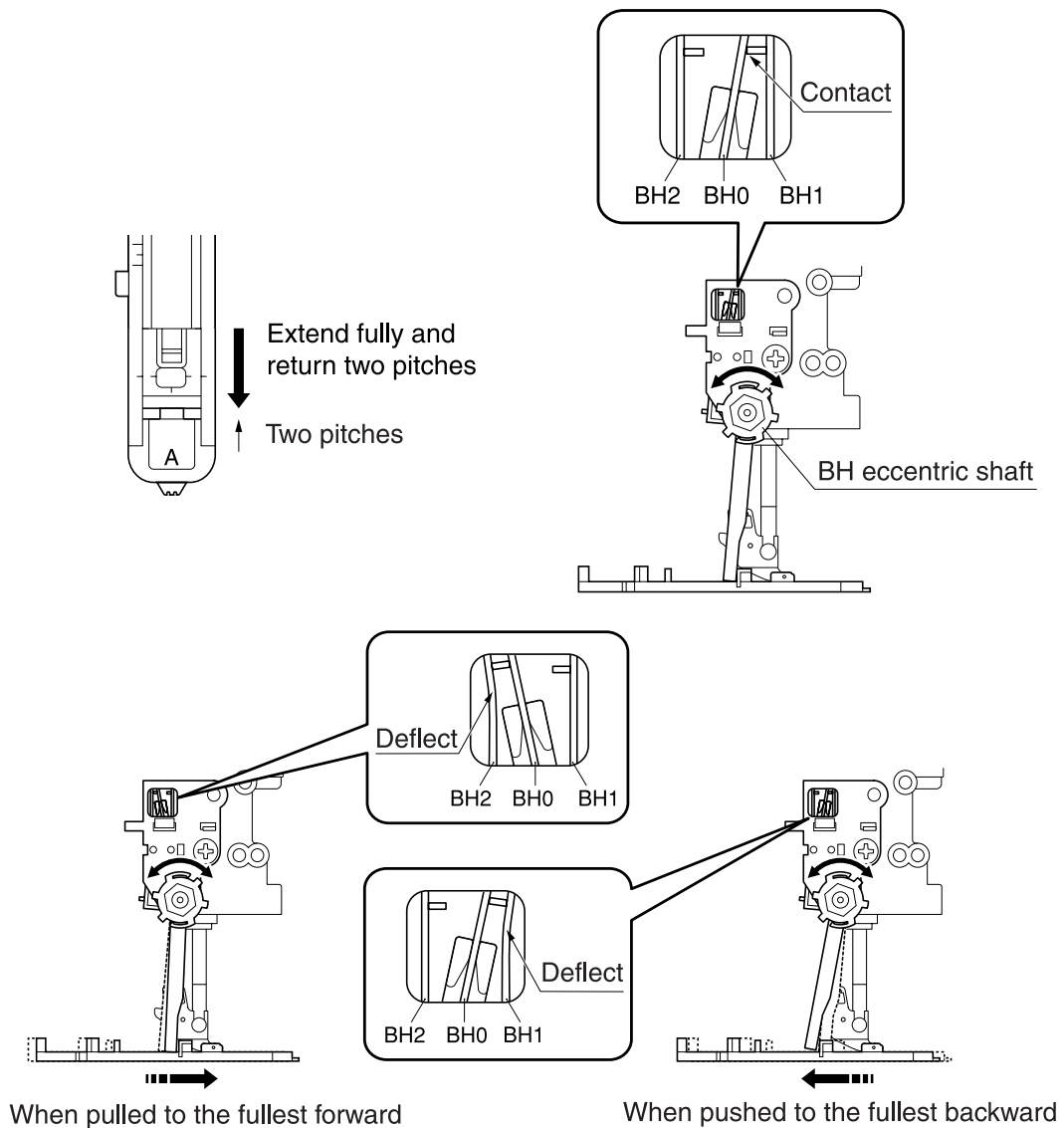




4. Tighten the bind screw (M3 x 6) of the SW adjusting plate. (torque : 0.58 - 0.78N · m)

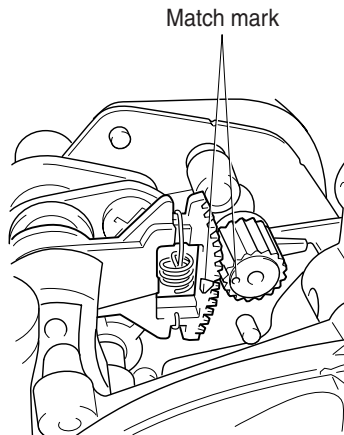
1. Raise the presser foot lifter.
2. Set the BH presser two pitches smaller than the maximum length.
3. Attach the BH presser.
4. Lower the presser foot lifter.
5. Lower the BH lever, and set to the BH presser.
6. Rotate the BH eccentric shaft so that BH0 comes into contact with BH1.

***Key point**

- With the presser foot lifter raised, pull the BH presser forward as much as possible, and check that BH0 comes into contact with BH2 and that BH2 has some deflection.
- With the presser foot lifter raised, push the BH presser back as much as possible, and check that BH0 comes into contact with BH1 and that BH1 has some deflection.



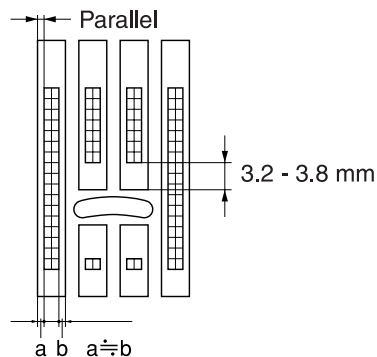
1. Press  and  button on the front cover while turning the power on : the buzzer will sound four times.
2. Select the test mode number [8].
3. Turn the pulley, and check that the feed dog is center position, and then Turn off the power.
4. Remove the 2 flat screws (M4), and remove the needle plate A from the feed base.
5. Align the feed adjuster assy. gear and F pulse motor gear match marks (feed in 0 mm position).



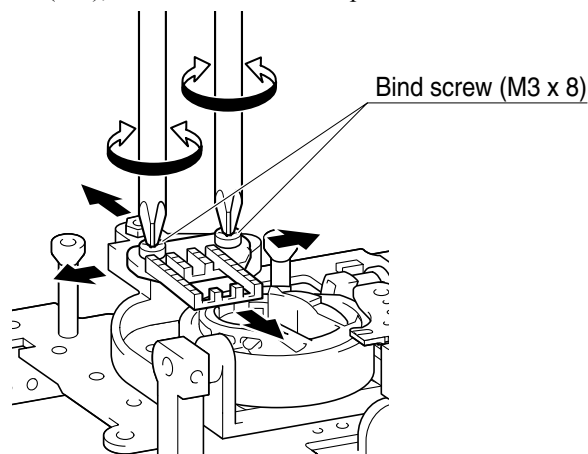
6. Loosen the 2 bind screw (M3 x 8), temporarily install needle plate A, and adjust the forward/reverse and left/right positions of the feed dog.

***Key point**

- Adjust the gap between the forward edge of the feed dog middle tooth and feed plate A front to back to 3.2 - 3.8 mm.
- Adjust the left and right gaps between the feed dog and needle plate A to be approximately the same.
- Make sure that the feed dog and needle plate A are not at an angle to each other.



7. Secure the feed dog with the 2 bind screw (M3 x 8).
8. Fully tighten the 2 flat screws (M4), and secure the needle plate A.



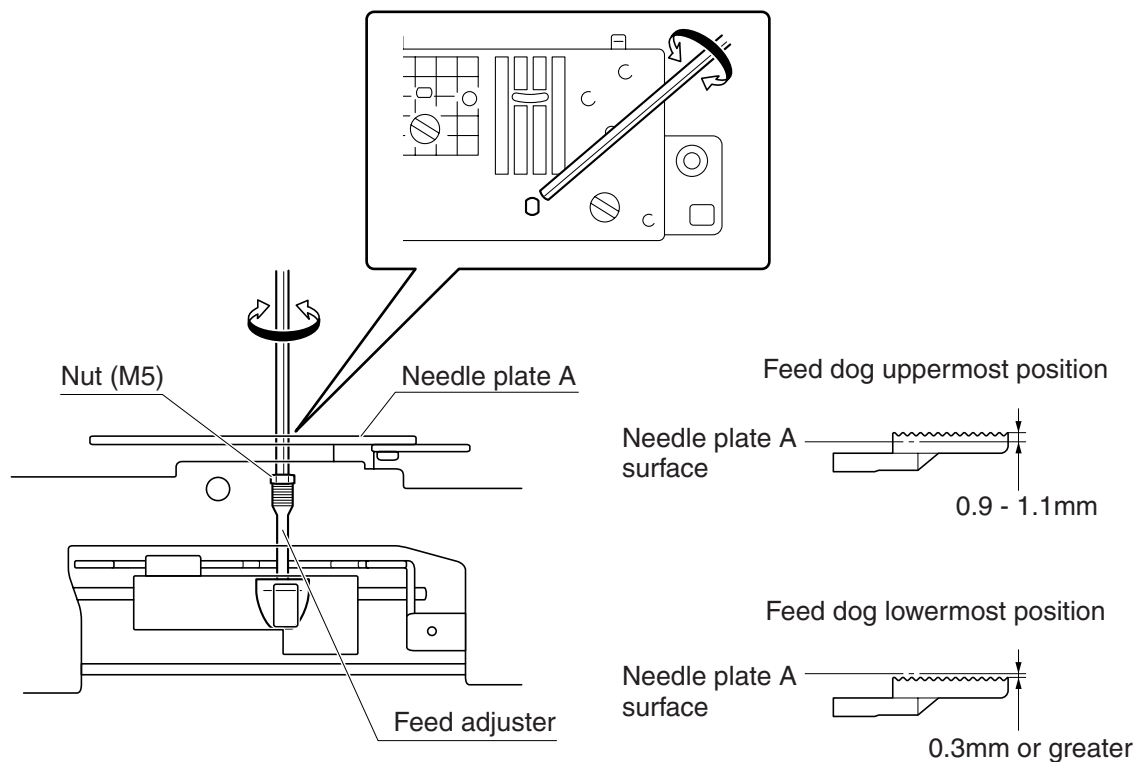
1. Turn the pulley, and bring the feed dog to its highest position.
2. Loosen the nut (M5).
3. Adjust the feed dog height so that it is 0.9 - 1.1 mm from the upper surface of the needle plate A by the amount the vertical adjuster screw assembly is screwed in.
4. Tighten the nut (M5) being careful that the vertical adjuster screw assembly does not turn.
5. With the feed dog in the lowest position, check that the feed dog is 0.3 mm or more below the upper surface of the needle plate A.

NOTE

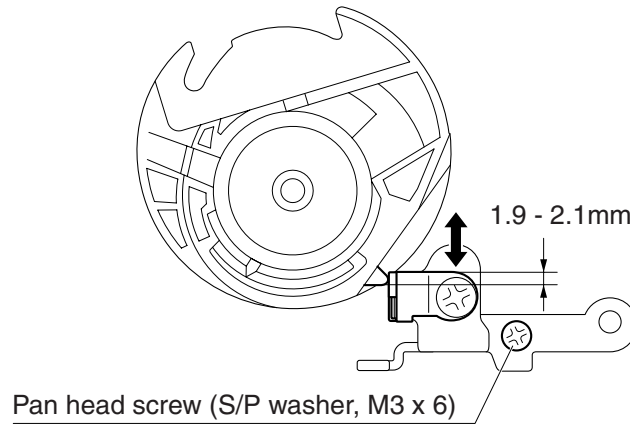
- When the feed dog is too high, problems such as abnormal noise, bad feed quantities and the cloth not being fed arise.
- When the feed dog is too low, problems such as bad feed quantities and the cloth not being fed arise.

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Feed gauge






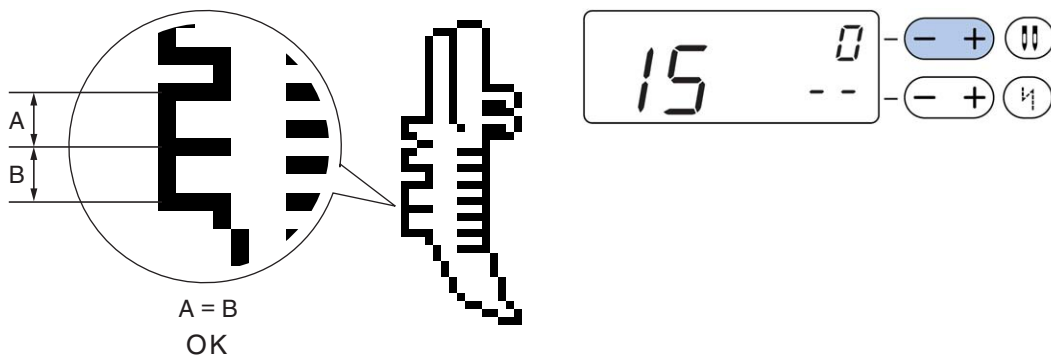
1. Set the inner rotary hook in the outer rotary hook.
2. Loosen the pan head screw (S/P washer, M3 x 6) securing the inner rotary hook bracket assy.
3. Adjust the inner rotary hook bracket assy. attachment position so that contact between the inner rotary bracket assy. and inner rotary hook is 1.9 - 2.1 mm, and secure with the pan head screw (S/P washer, M3 x 6).



1. Ready the sewing machine.

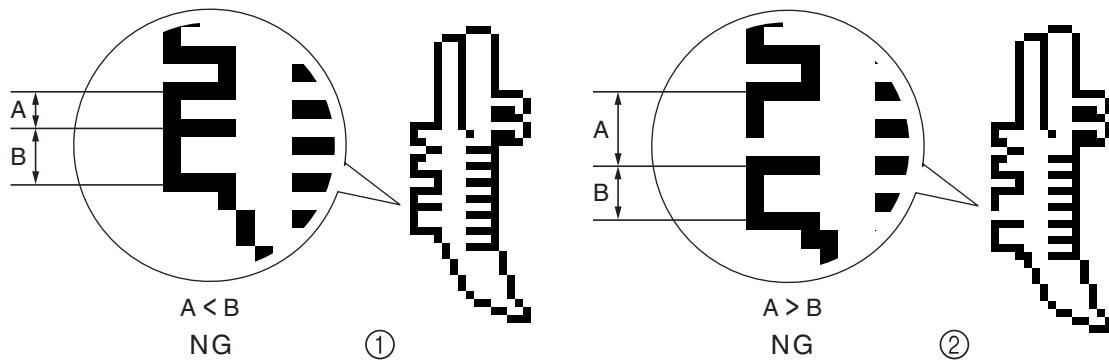
Presser foot	N presser foot
Upper thread / Lower thread	Schappe Spun thread #60
Cloth	Two-ply broadcloth
Thread tension dial position	4

2. Press  and  button on the front cover while turning the power on : the buzzer will sound four times.
3. Select the test mode number [15].
4. Lower the presser foot lever, and press the  (Start / Stop button).
5. **Change the correction value so that length of the A and B of the sewed pattern become the same.**



***Key point**

- ① Push the [+] at the time of $A < B$, and the correction value is enlarge.
- ② Push the [-] at the time of $A > B$, and the correction value is reduced.

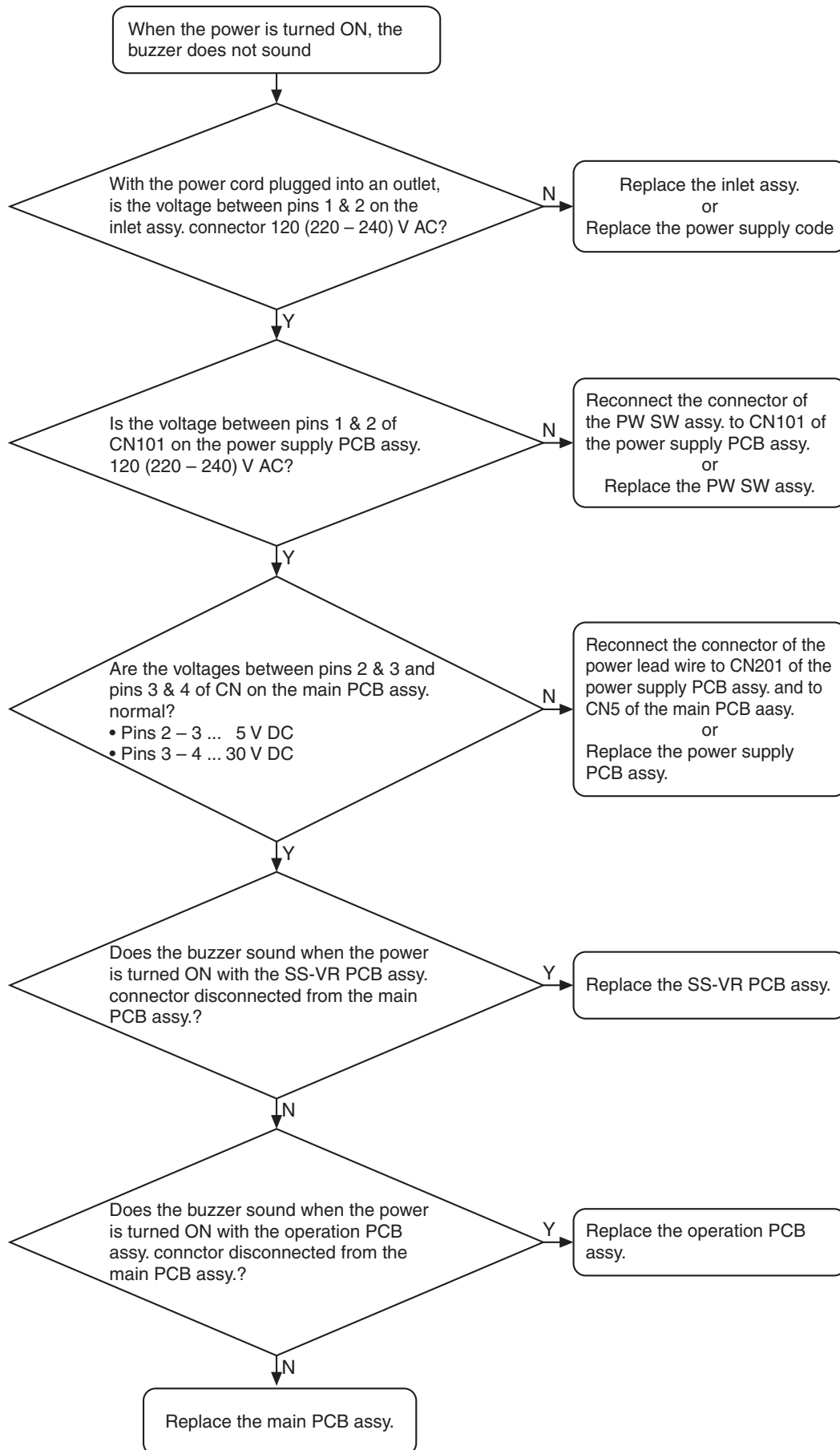


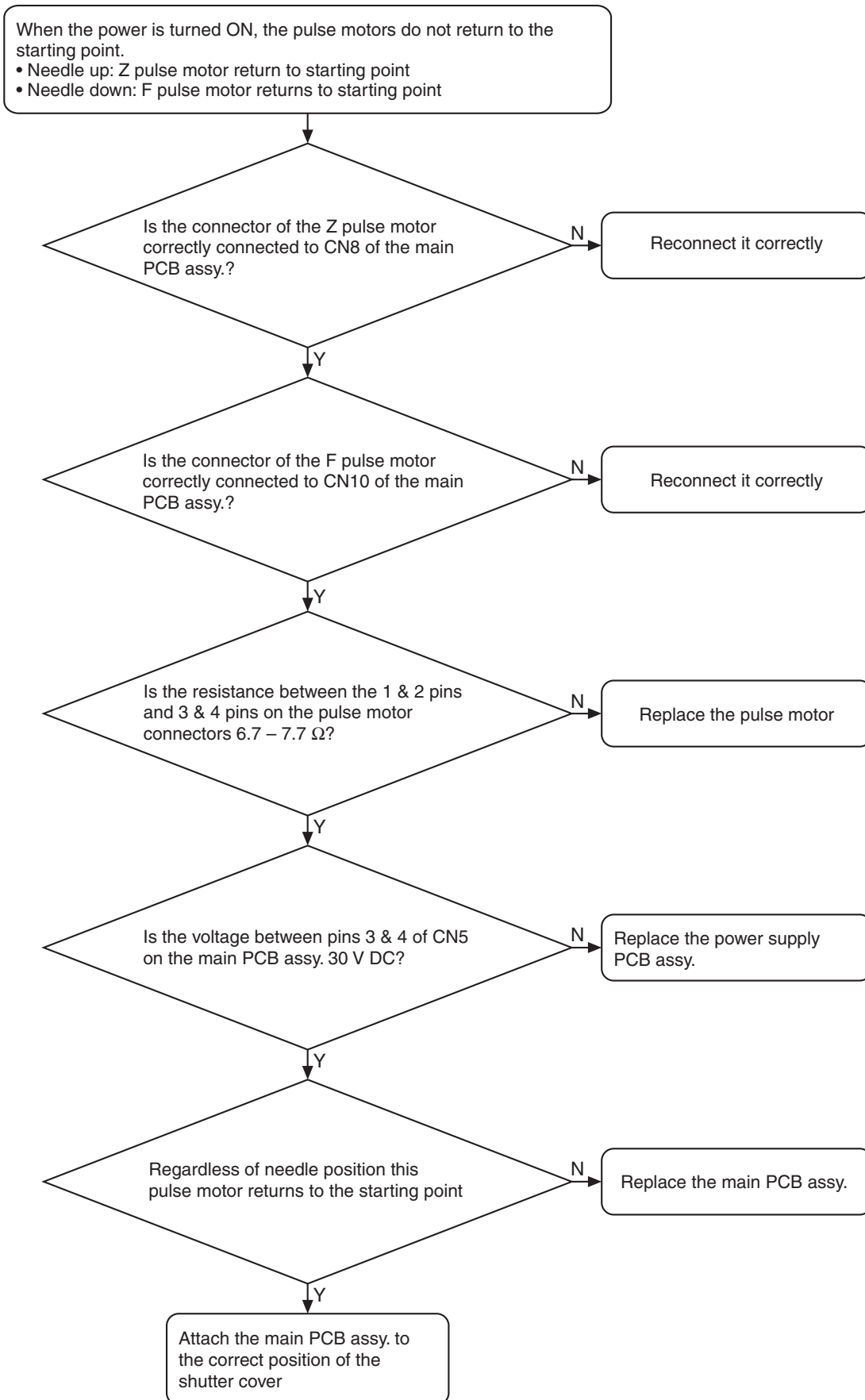
5 Failure Investigation for Electronic Parts

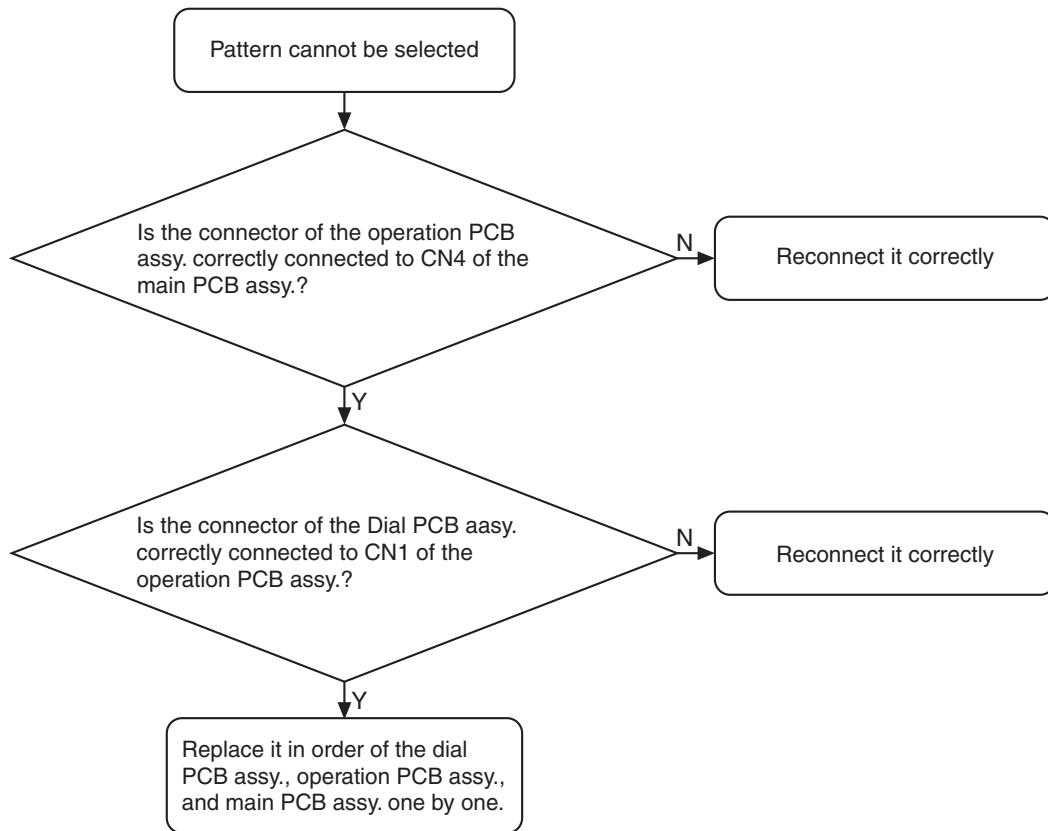
* Perform resistance measurements after turning off the power, and detaching the connectors to be measured from the PCB.

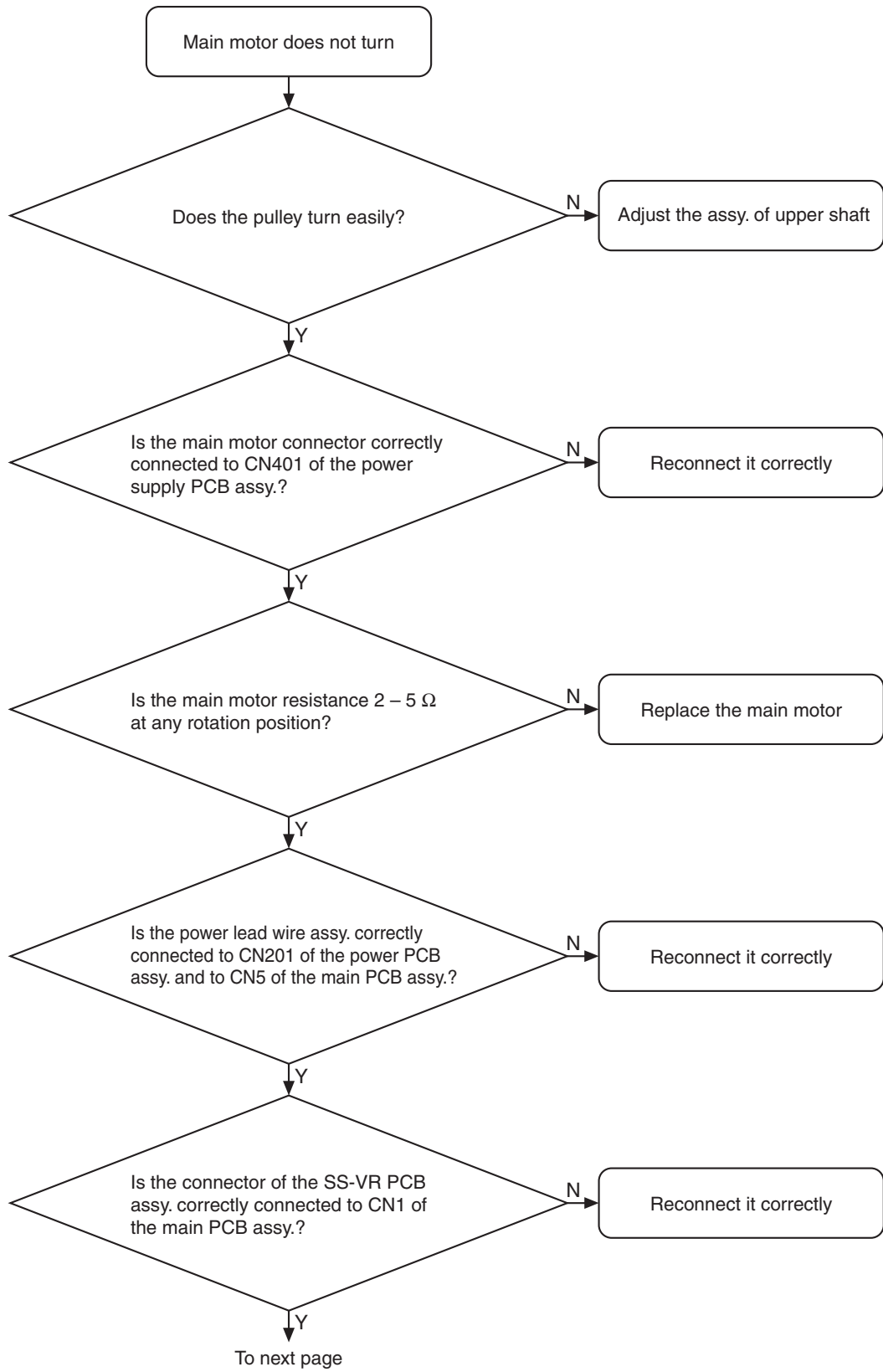
Error message list	5 - 2
Power does not come on.....	5 - 3
Pulse motors do not return to starting point	5 - 4
Pattern cannot be selected.....	5 - 5
Main motor does not turn	5 - 6
Main motor rotation abnormal	5 - 8
Cannot sew pattern well	5 - 9
Cannot sew button holes well.....	5 - 10
Stitch length and zigzag width cannot be done by manual adjustment	5 - 11
Problems with vertical needle movement and reverse stitching	5 - 12
Does not operate when the foot controller is used	5 - 13
LCD display is not normal	5 - 14
LCD light does not come on	5 - 15
Bobbin winding cannot be done	5 - 16
The lamp at hand does not have light	5 - 17
Error is displayed.....	5 - 18

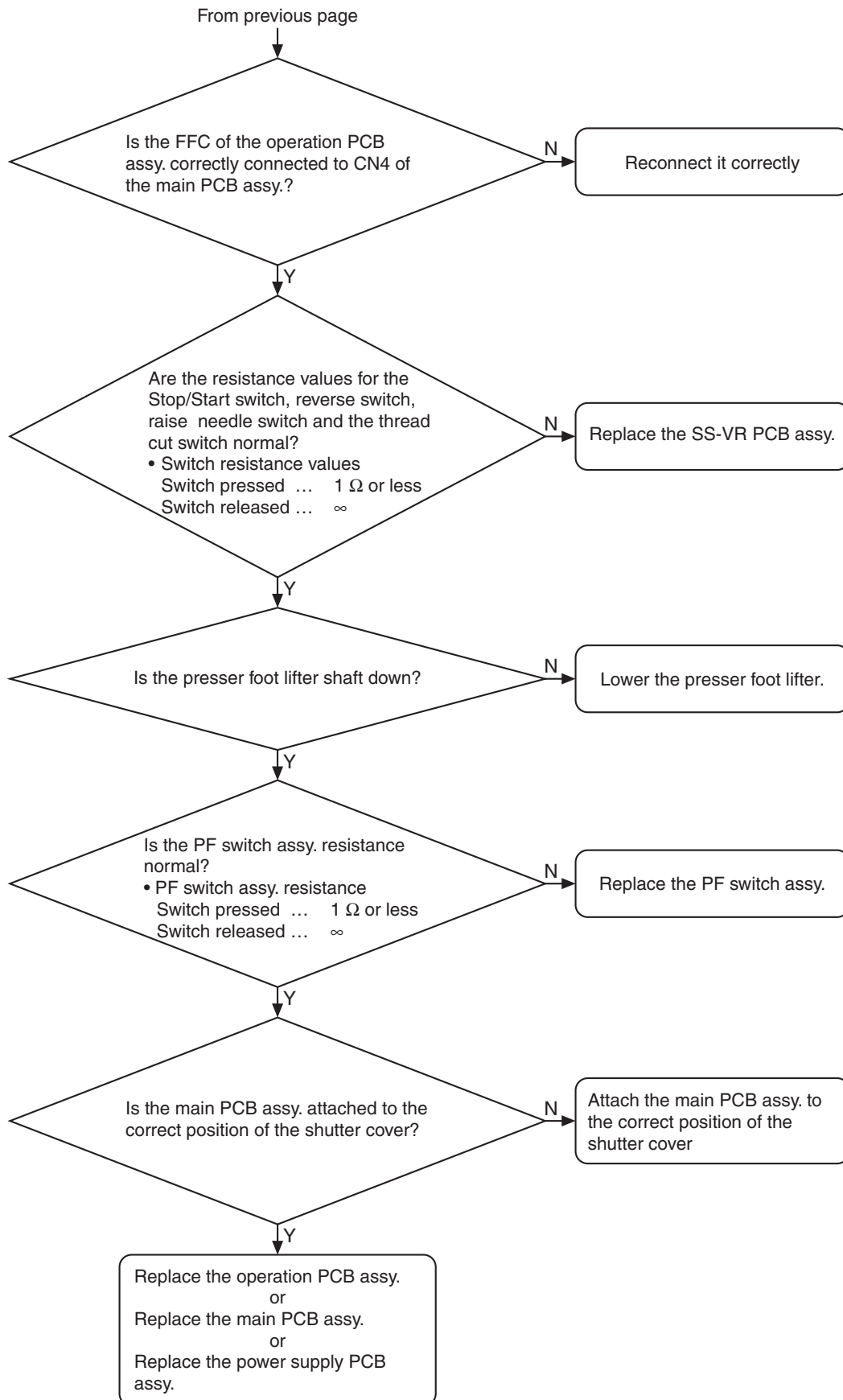
Error display	Cause
F1 (5 - 18)	Abnormal rotation in main motor.
F2 (5 - 19)	Key pressed continually with power ON (operation system SW).
F3 (5 - 20)	Key pressed continually with power ON (operation panel SW).
F4 (5 - 21)	FC disconnect
F5 (5 - 22)	Dirty speed sensor
F6 (5 - 22)	NP sensor disconnect
F7 (5 - 23)	Speed VR disconnect
F8 (5 - 24)	Electronic power supply abnormal
F9 (5 - 24)	EEPROM abnormal

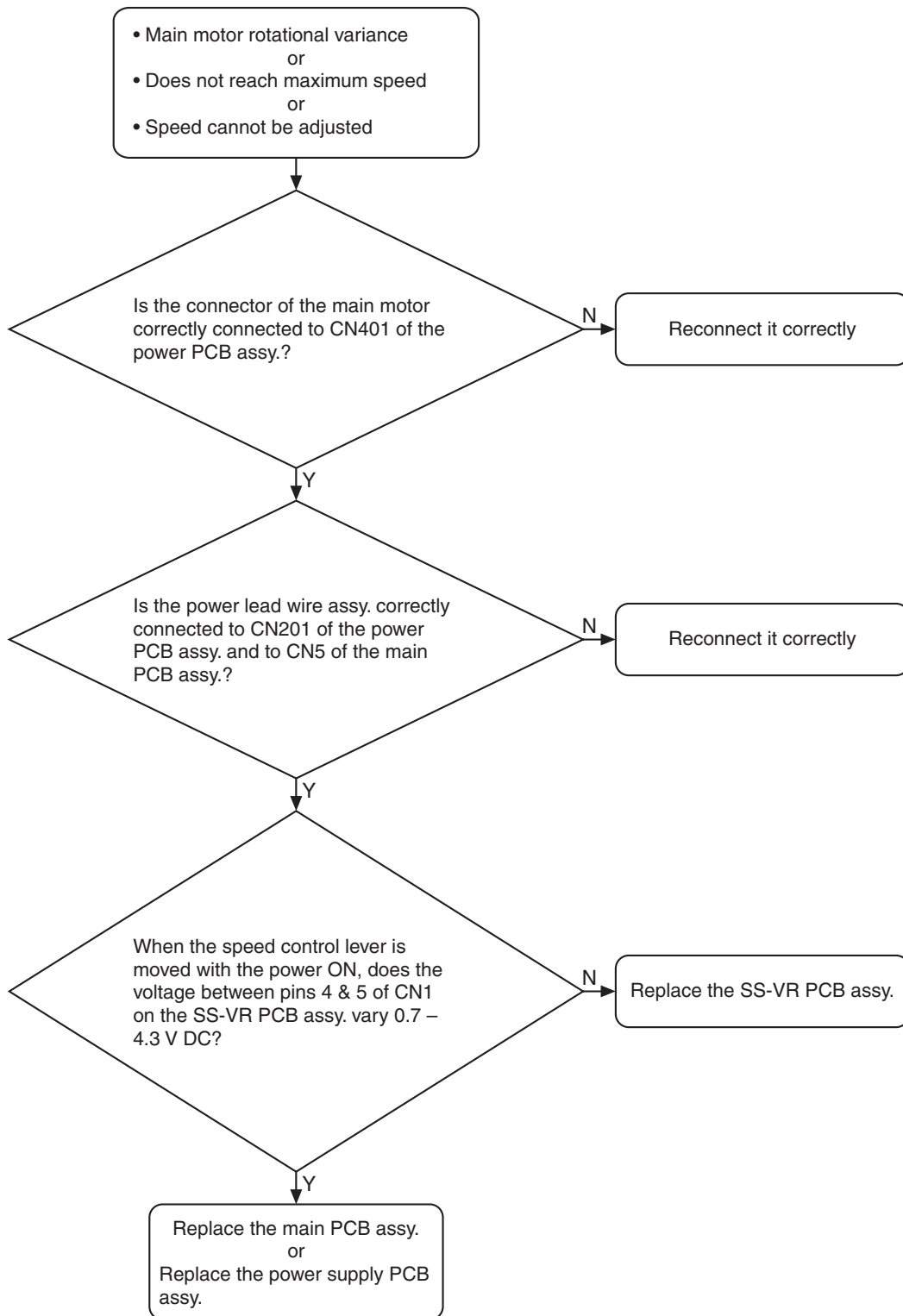


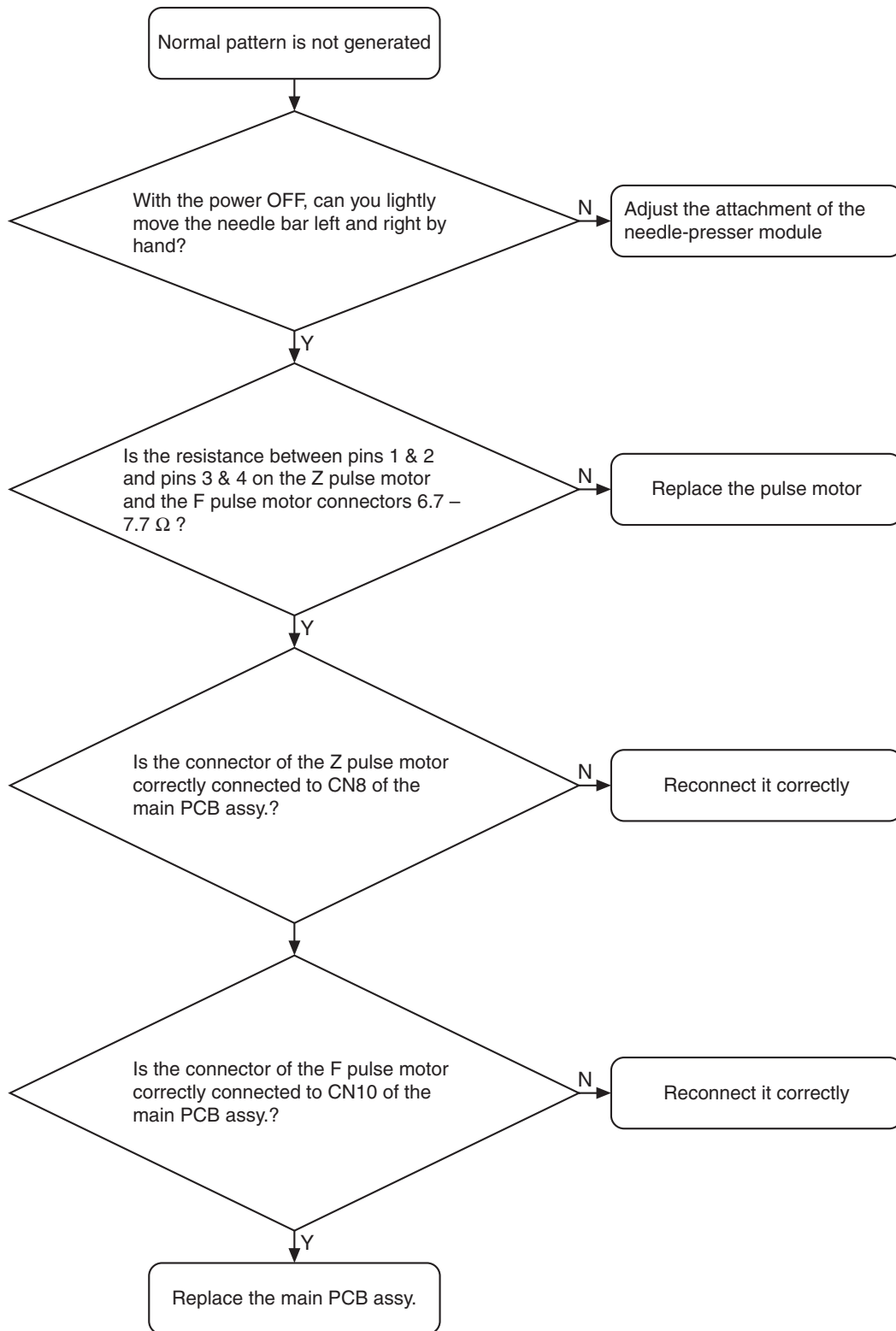


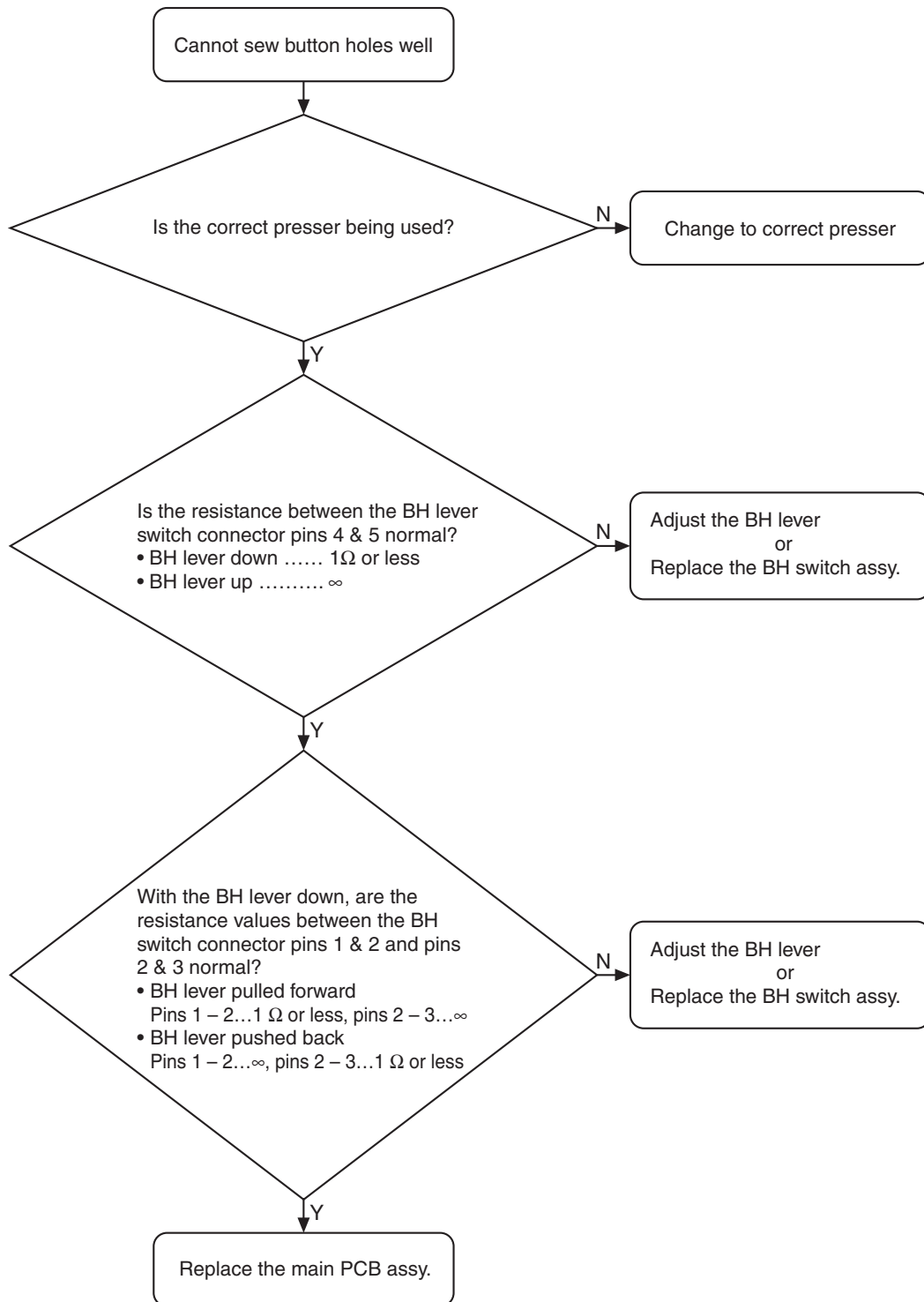


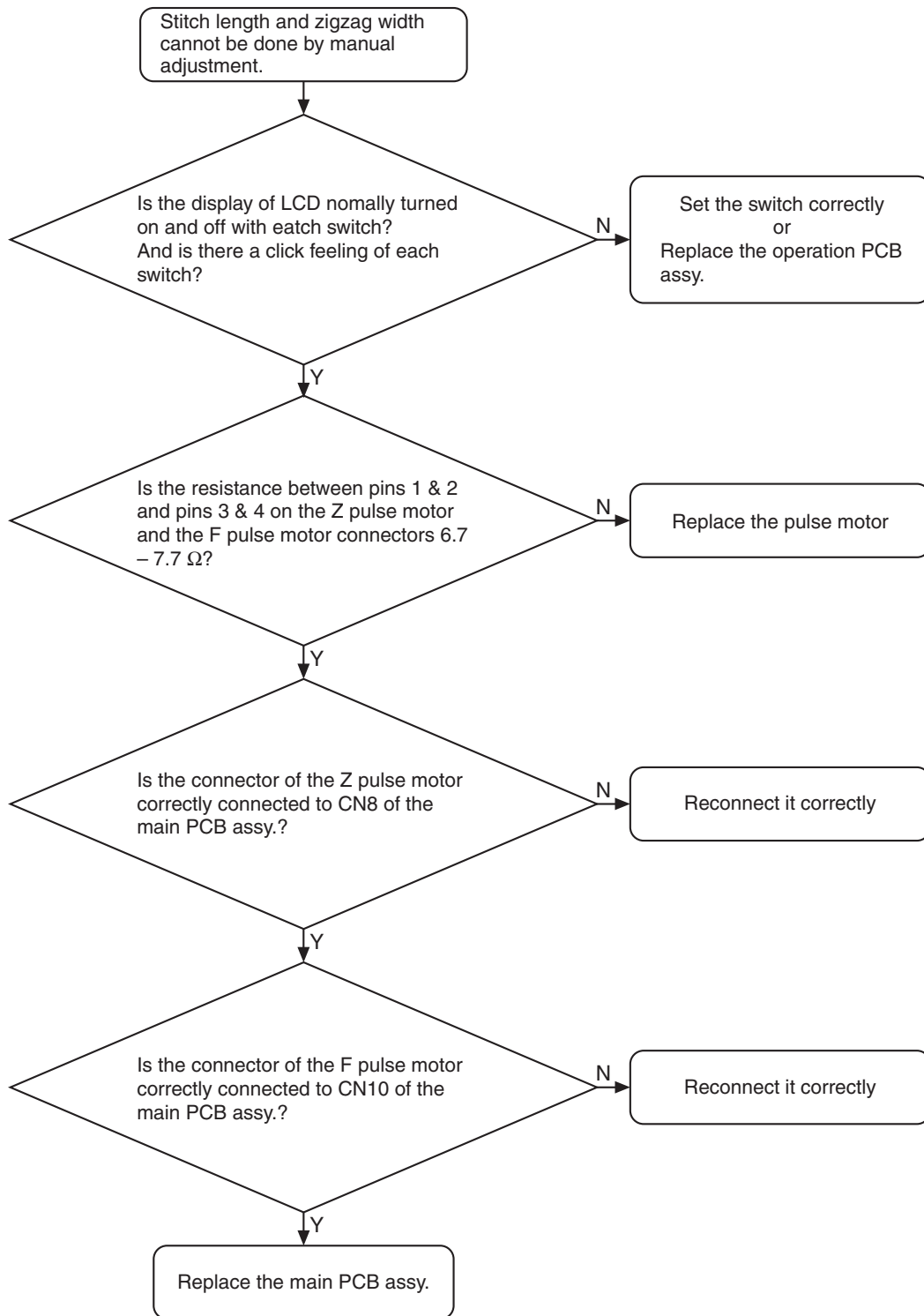


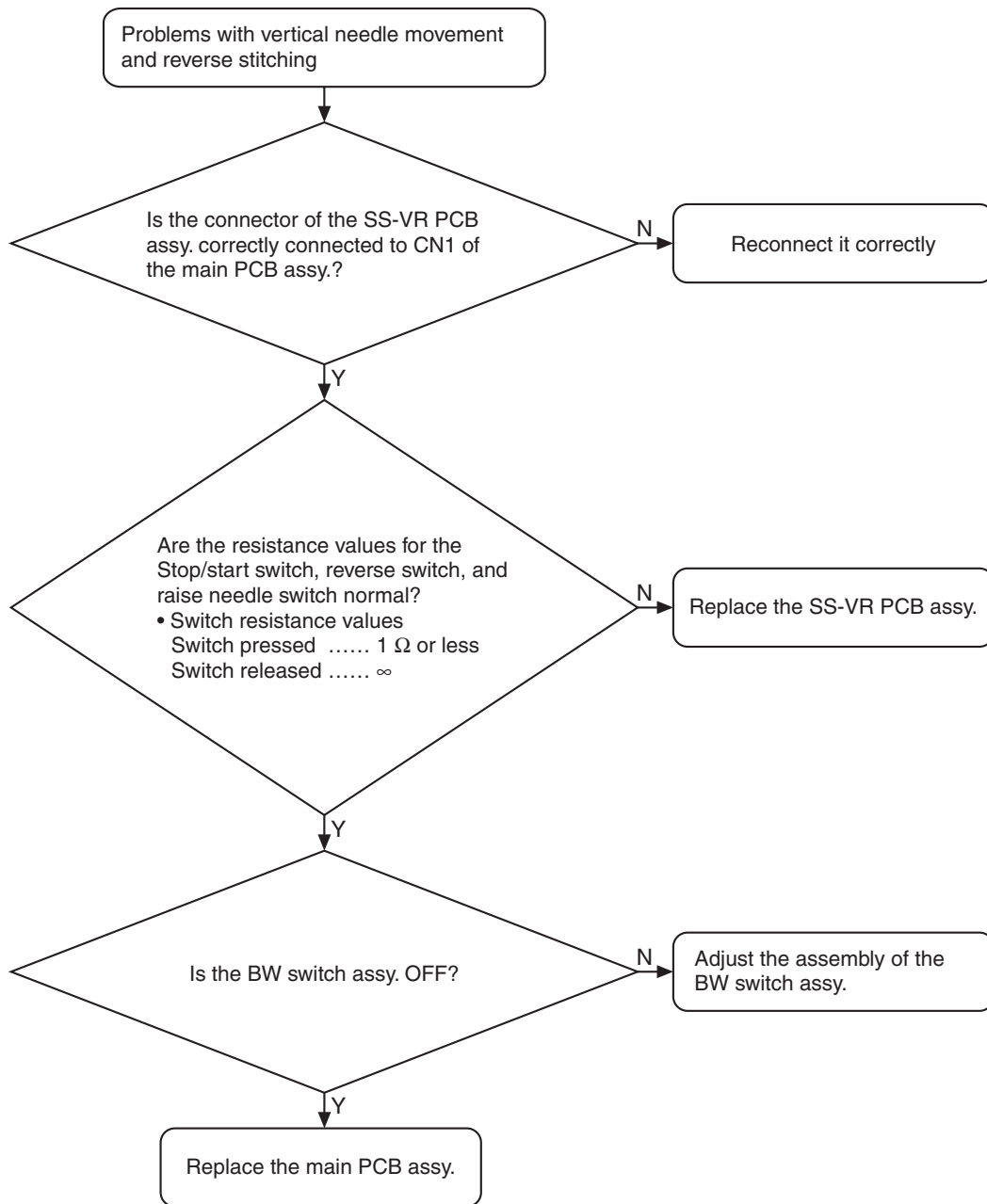


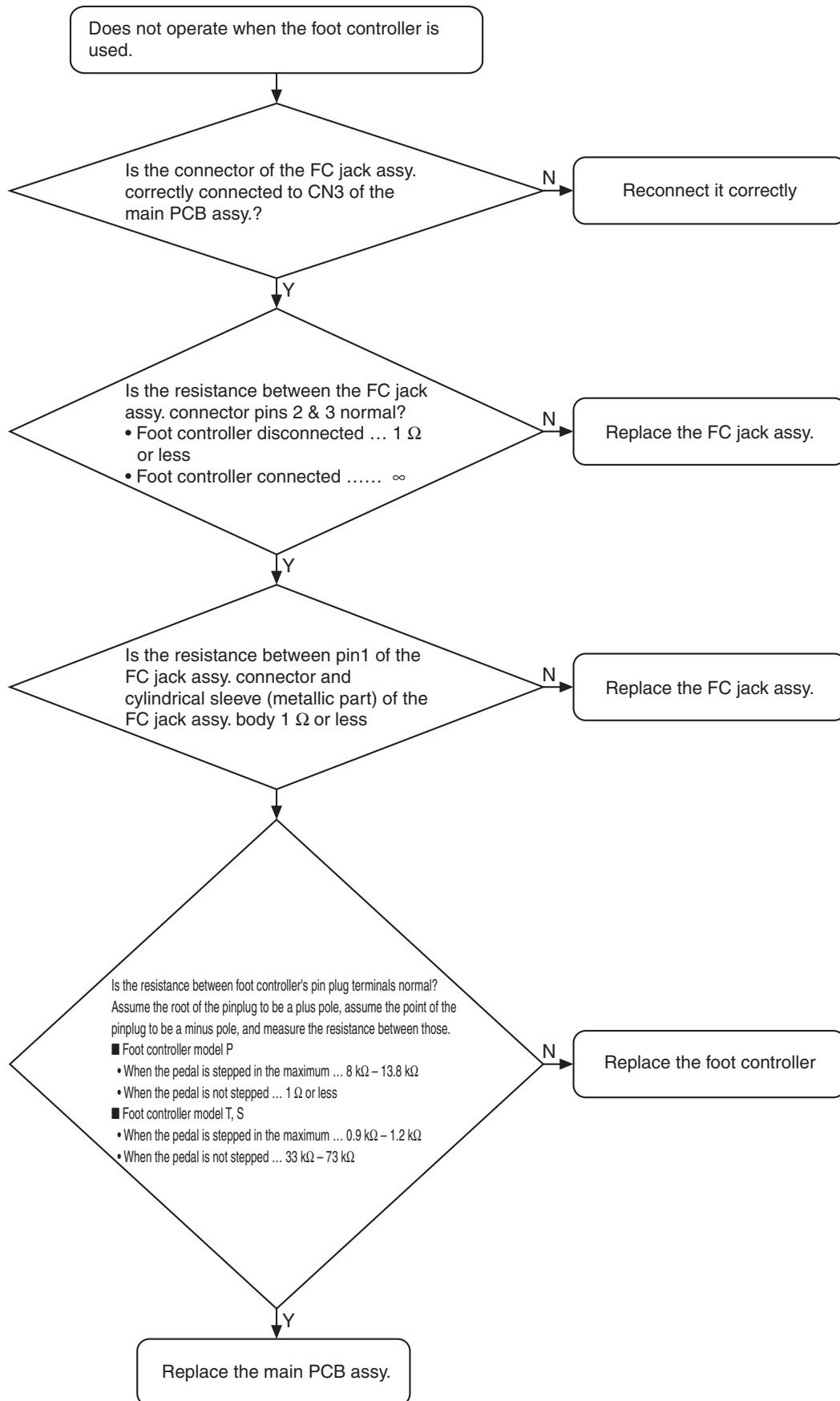


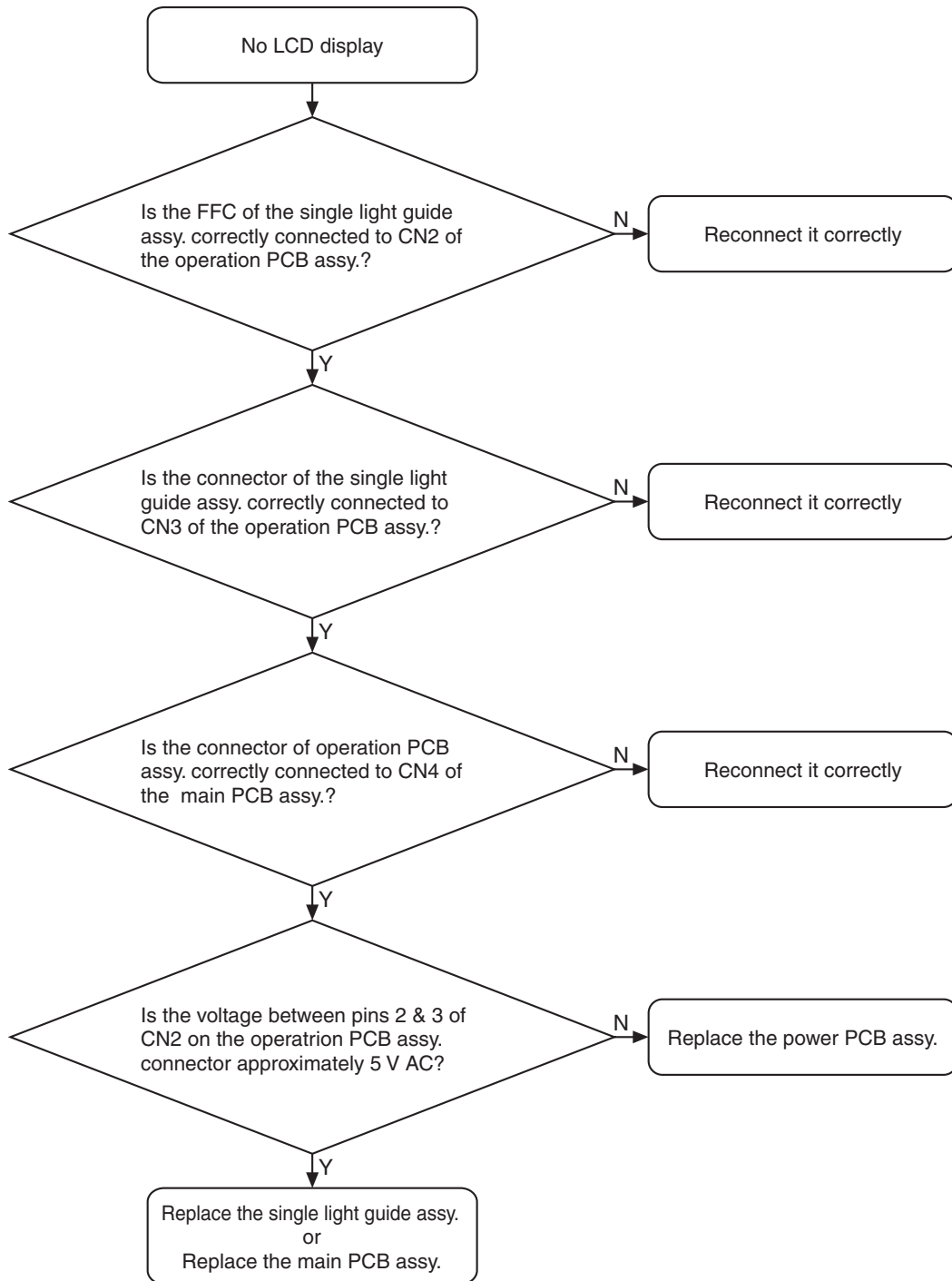


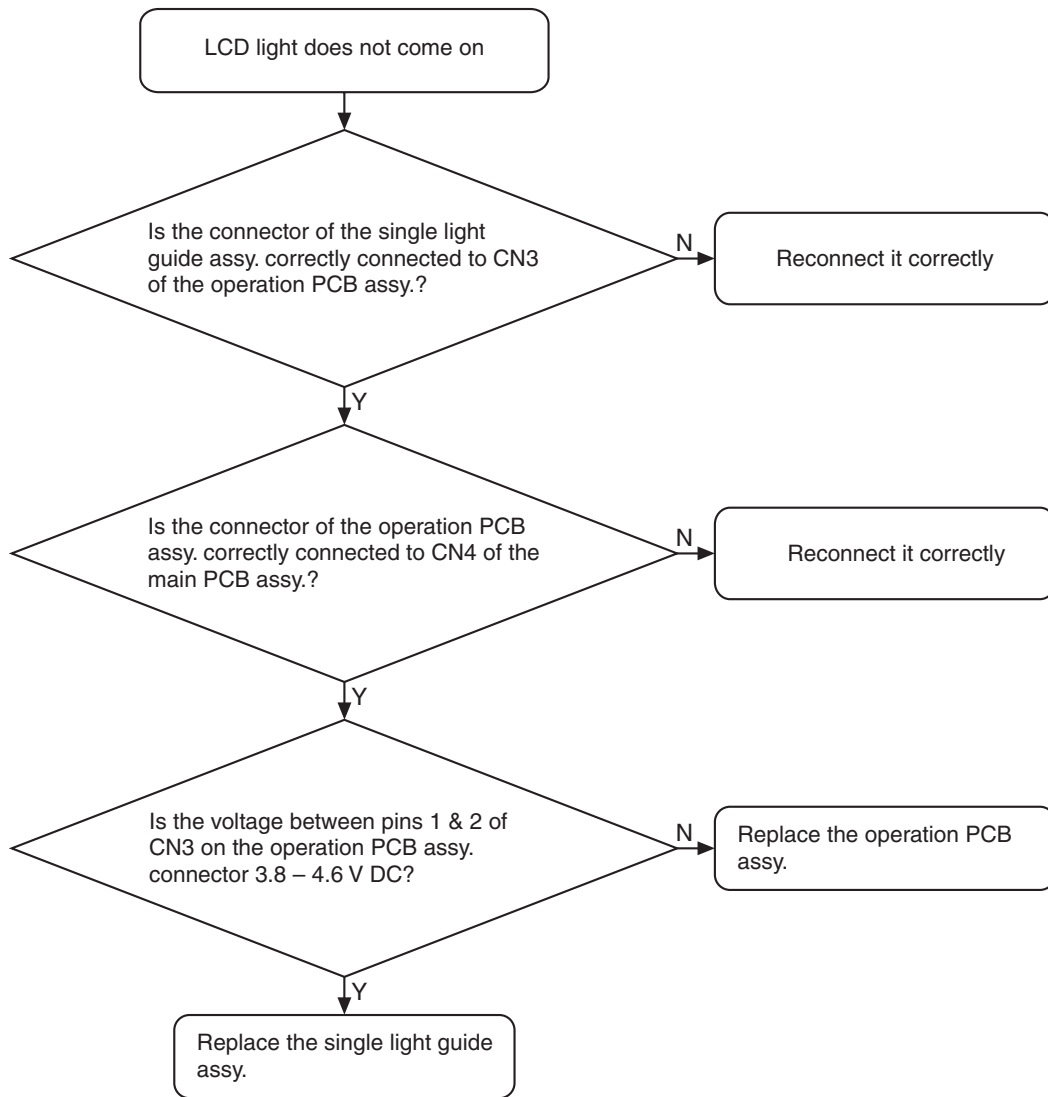


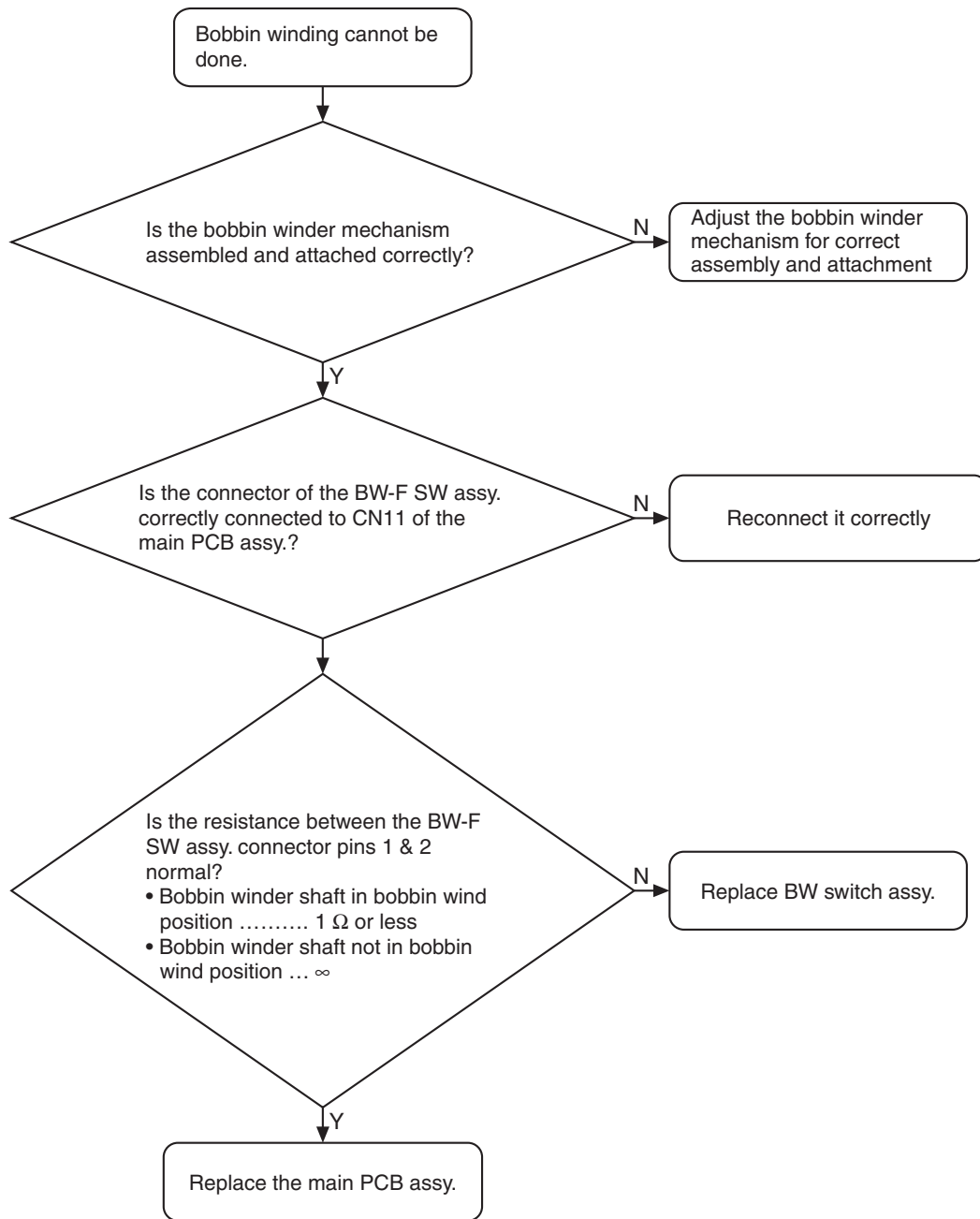


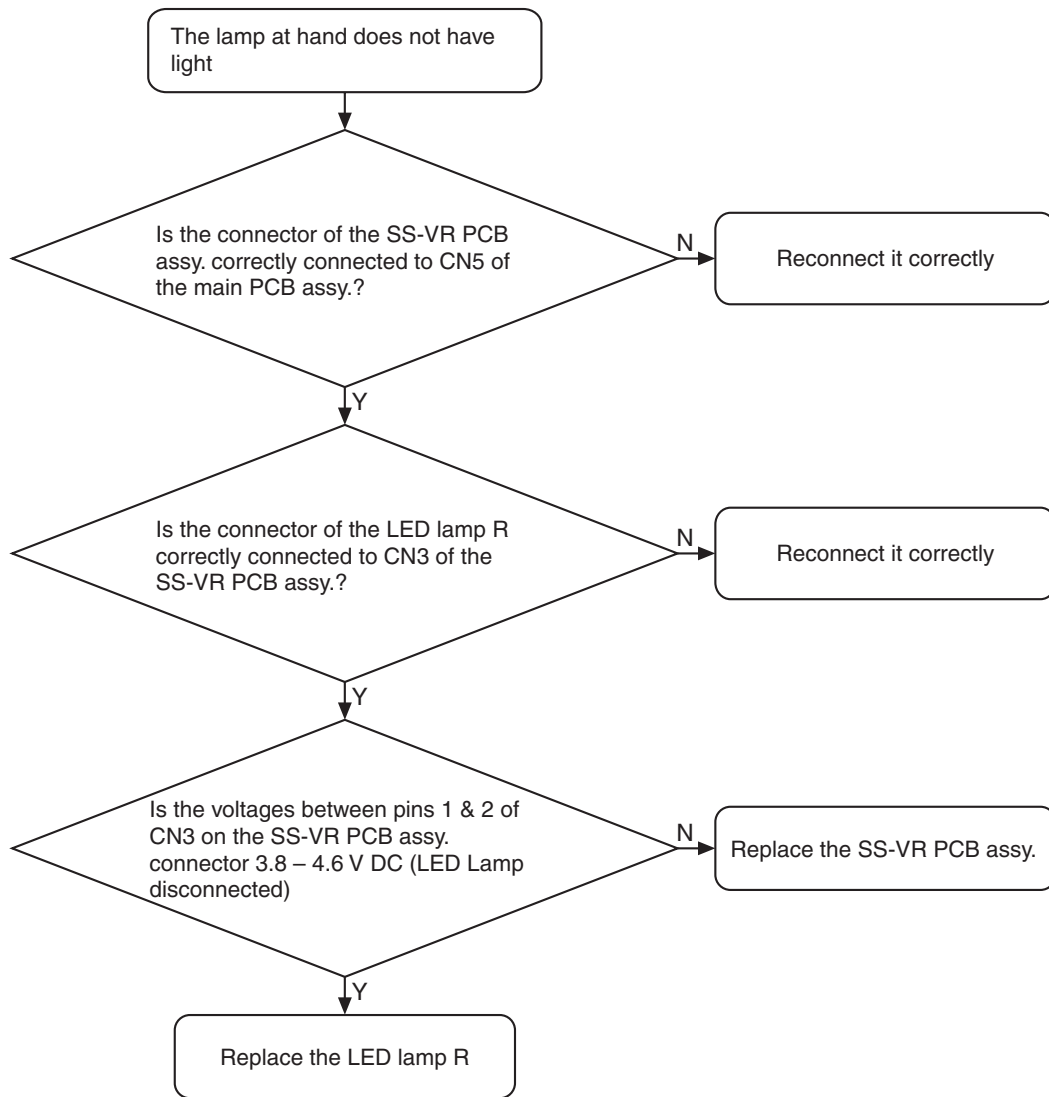


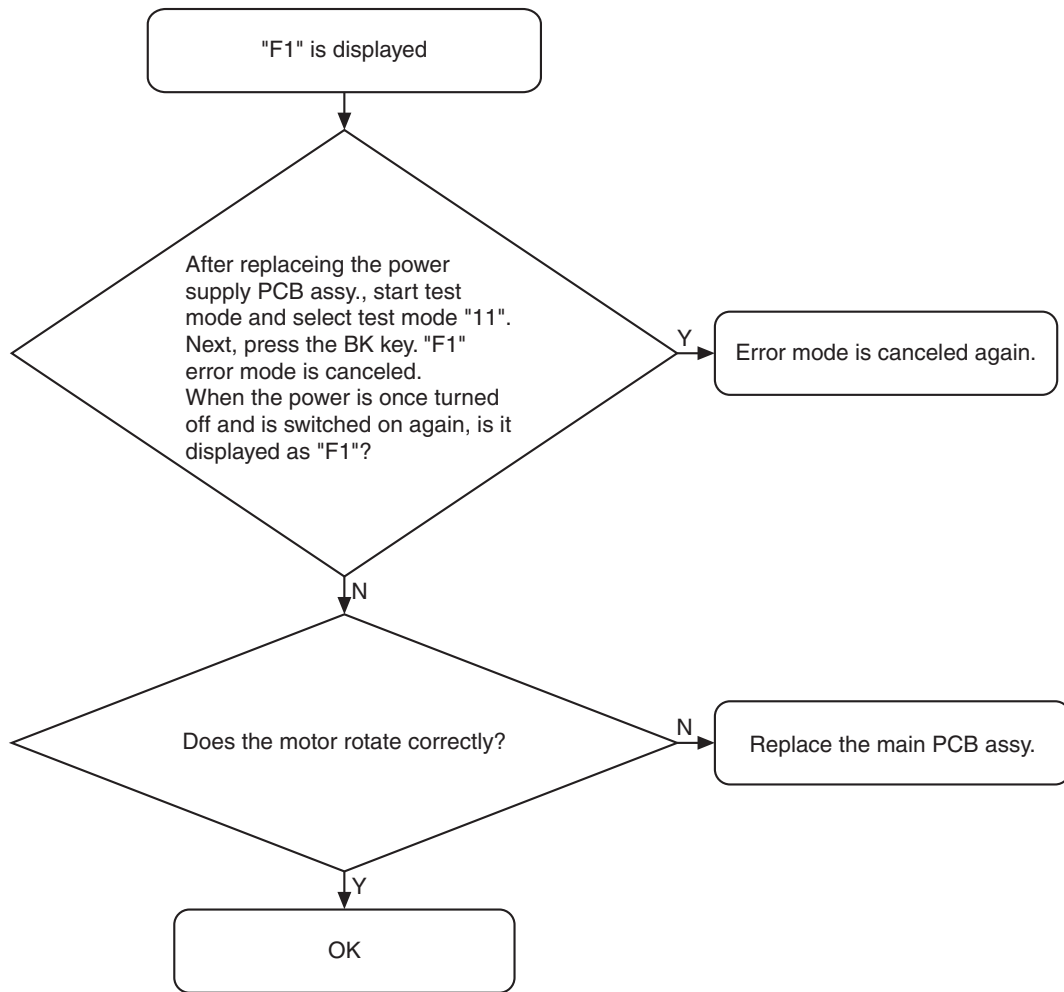


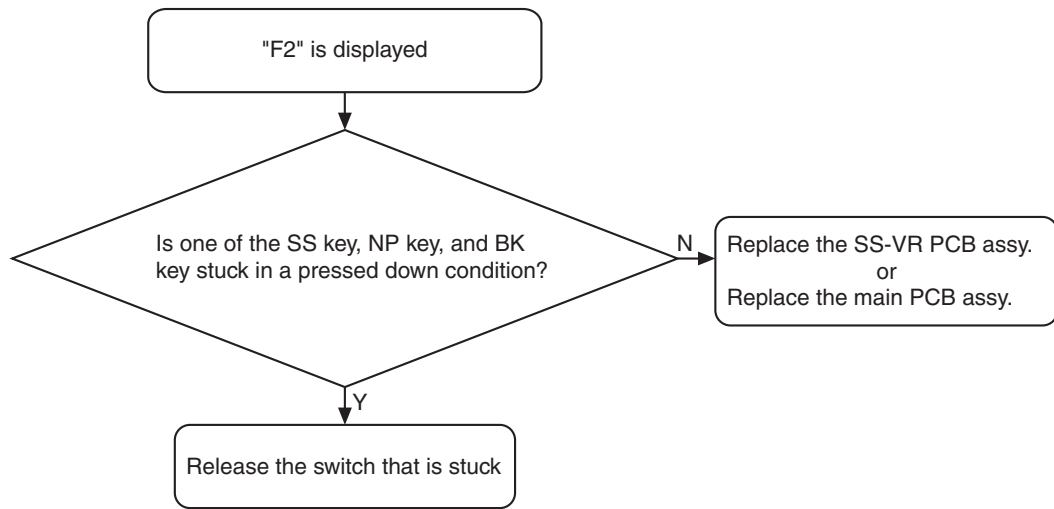


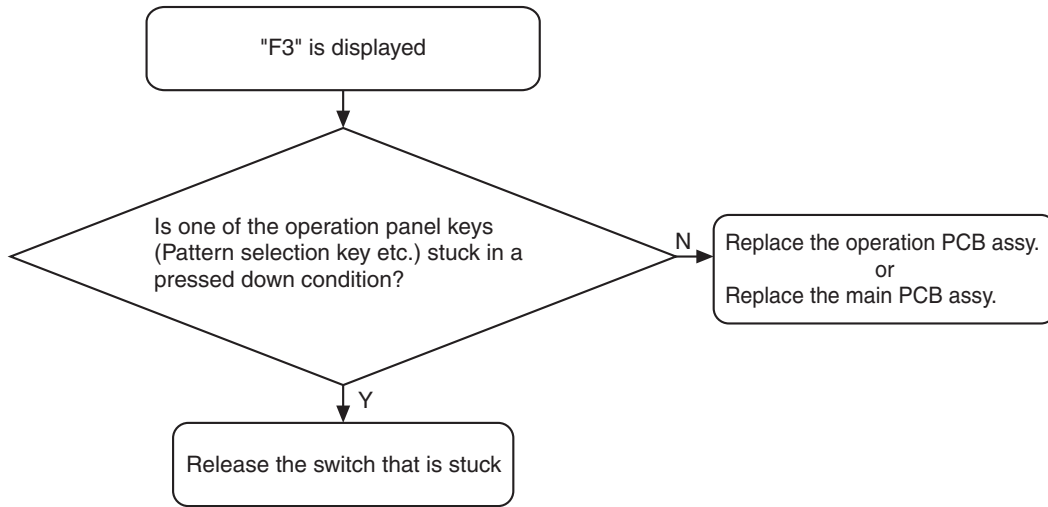


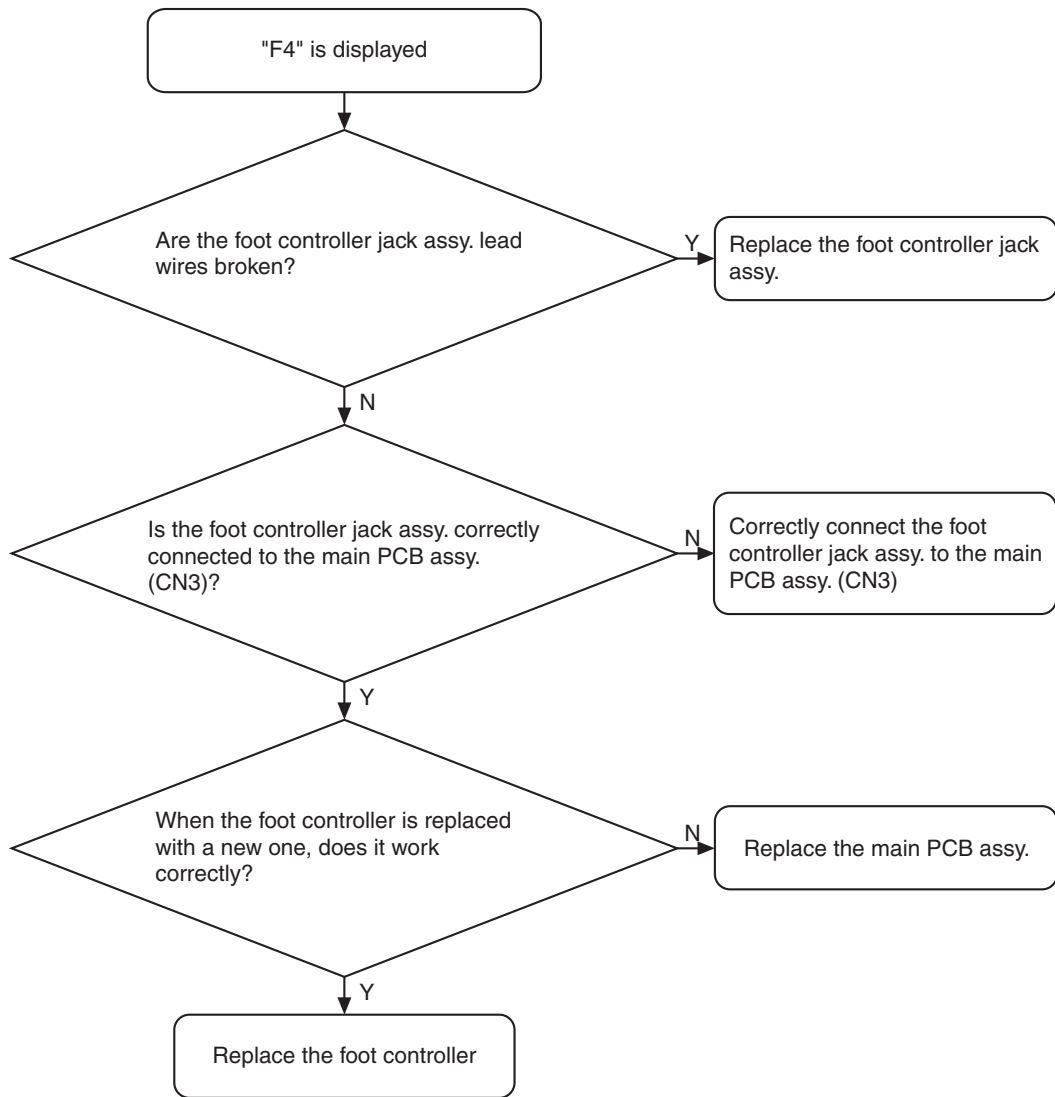


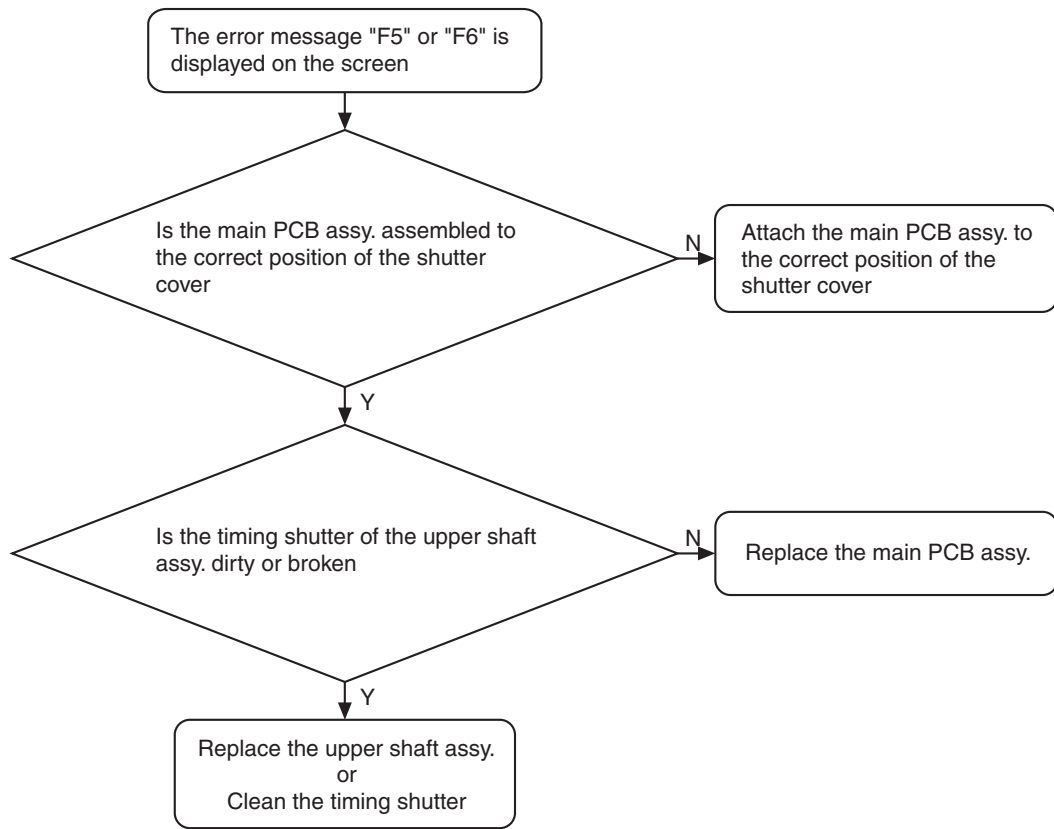


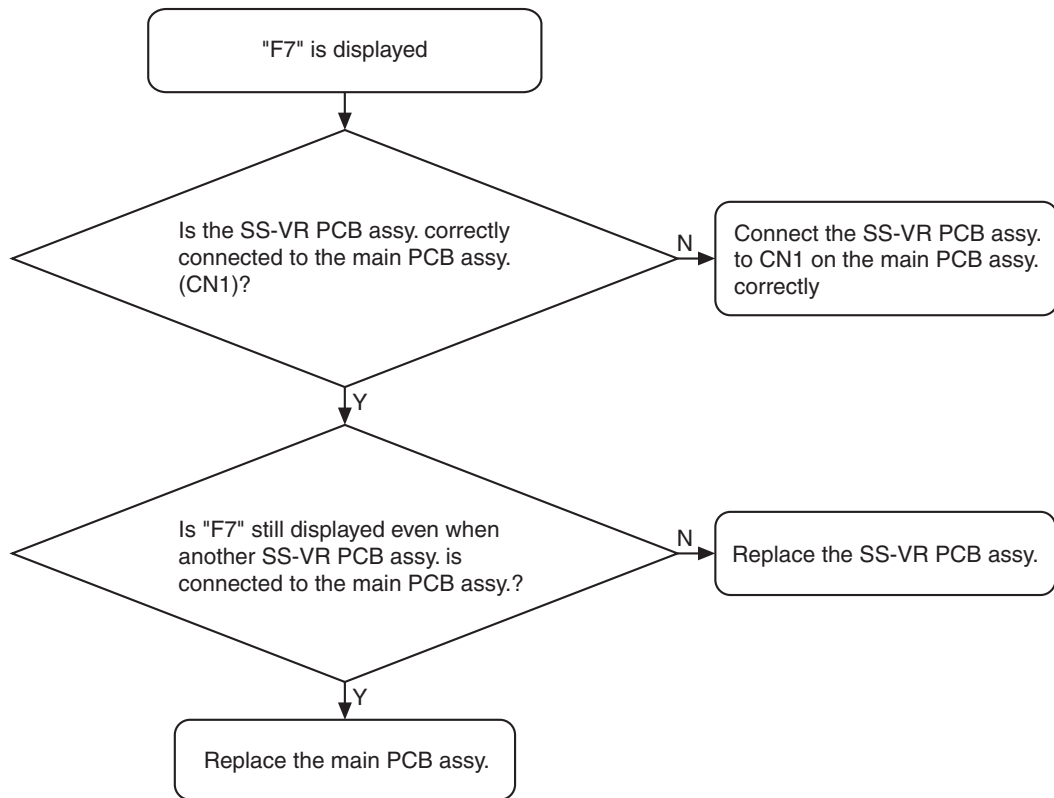


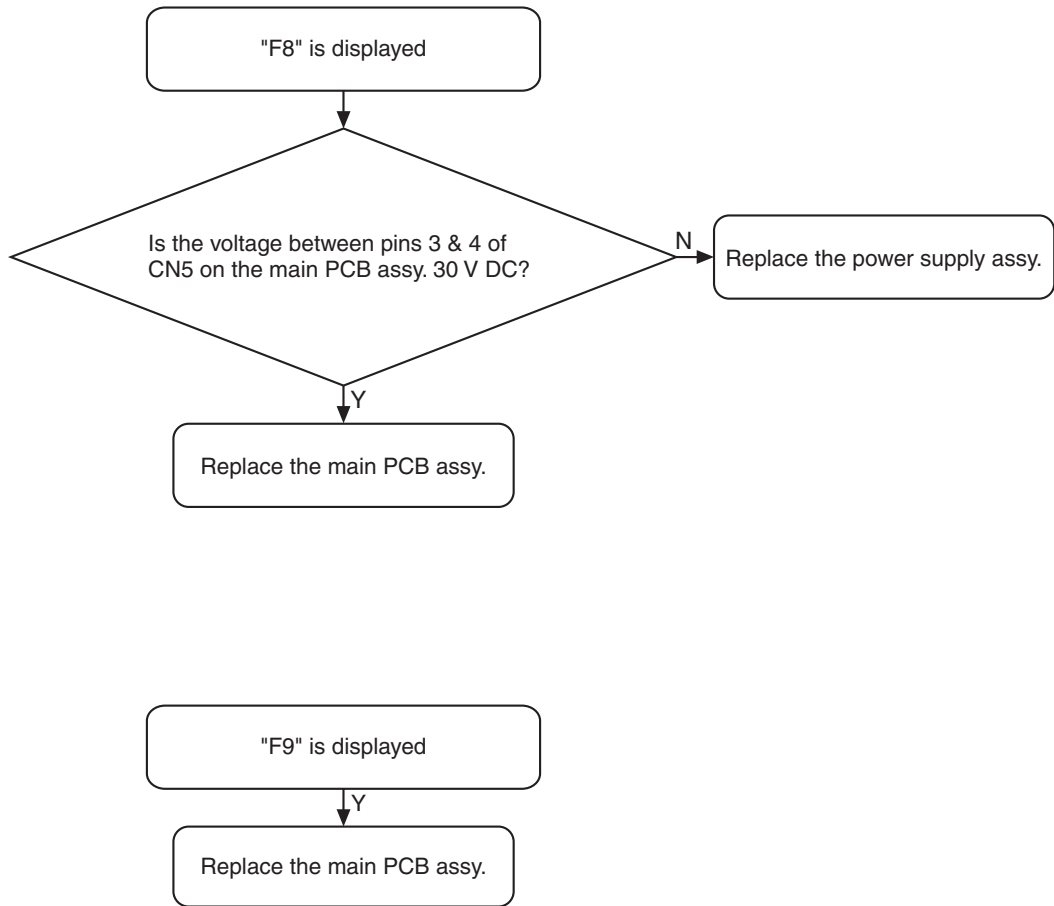












6 Repair Manual

	Problem	Primary factors and causes	Repair method	Items for Inspection	Inspection method and standards
1	Stitch skipping Thread abrasion Thread breakage Seam unevenness Needle breaks	Needle tip damaged while sewing Needle catches and bends before or after sewing	Needle replacement	Needle curvature	Remove the needle, place on level block (horizontal block) and be sure there is no curvature. (4-2)
				Tip damage to needle	Touch the needle tip with your finger, be sure that it is not damaged. (4-2)
2	Power supply does not enter	Inlet connector disconnected Bad power supply PCB Assy. Power supply PCB Assy. and main PCB Assy. connector disconnected Bad main PCB Assy. Main PCB Assy. and operation PCB Assy. connector disconnected Main PCB Assy. and SSVR PCB Assy. connector disconnected	Plug connector in Replace power supply PCB Assy. (2-15) (3-26) Plug connector in (3-27) Replace main PCB Assy. (2-14) (3-27) Plug connector in (3-34) Plug connector in (3-34)	Sewing machine runs when switched on	When power is switched ON Confirm that there is a beep, that the indication lamps and that the sewing machine lamp turns on.
	Power supply enter, but safety timer does not operate	Foot controller connector disconnected, or broken it Bad pin jack Assy. Bad main PCB Assy.	Plug connector in Replace foot controller Replace pin jack (2-16) (3-25) Replace main PCB Assy (2-14) (3-27)		
	Sewing machine lamp (LED lamp) does not light (machine operation normal)	Bad PCB unit LED lamp-R Broken lead wire of PCB unit LED lamp-R PCB unit LED lamp-R connector disconnected Bad main PCB Assy. Bad SSVR PCB Assy.	Replace PCB unit LED lamp-R (2-7) (3-36) Plug connector in (3-36) Replace main PCB Assy. (2-14) (3-27) Replace SSVR PCB Assy. (2-7) (3-36)		
3	Even when the presser is raised with a straight line pattern, the sewing machine will not turn	Bad presser switch attachment position Bad presser switch Assy.	Adjust presser switch position (2-40) (3-45) Replace presser switch Assy. (2-40) (3-45)	Presser switch function	Lower presser with straight line pattern, and check that machine operation normal
4	Straight left base line stitch unevenness (pitch)	Bad left-right needle drop adjustment Loose zigzag adjusting nut	Adjust 3 point needle drop (4-9) Adjust 3 point needle drop (4-9)	3 point needle drop (divide left and right)	Check that the needle positions are uniform to the left and right of the needle plate A needle hole. (4-9)

	Problem	Primary factors and causes	Repair method	Items for Inspection	Inspection method and standards
5	Stitch skipping, thread abrasion Thread breakage	Bad needle interference adjustment	Adjust needle interference (4-11)	Needle and tip gap	Lightly press the lower part (cover part) of the SS button while running on the right base line, and check for the faint sound of the needle and tip hitting. (4-11)
		Loose needle interference adjustment screw	Adjust needle interference (4-11)		
		Bad front-back needle drop adjustment	Adjust needle interference (4-11) Adjust left-right needle interference (4-14)	Back-front needle drop position	Turn the pulley by hand, and confirm that there is a gap with the needle before and after the needle plate A needle hole. (4-10)
		Bad needle plate A attachment position	Reattach needle plate A (2-45) (3-65)		
		Bad needle bar rise adjustment Loose timing adjustment screws	Adjust needle bar rise (4-12) Adjust needle interference (4-11)		
	Bad needle bar height adjustment Loose timing adjustment screws	Adjust needle bar height (4-13) Adjust needle bar height (4-13)	Needle bar height	When the needle and outside of the bobbin tip meet when turning the pulley on the left base line, confirm that the distance from the top of the needle hole to the bottom of the rotary hook tip is 1.0 – 1.4 mm. (4-13)	
	6	Does not turn (Electronic sounds and operating display lamps normal at startup)	Bad main motor	Replace main motor (2-16) (3-24)	Sewing machine runs when S/S button is pushed
Main motor connector disconnection			Plug connector in (3-27)		
	Does not turn (No electronic sounds / operating display lamps normal at startup)	Bad power supply PCB assy.	Replace power supply PCB assy. (2-15) (3-26)		
		Bad SSVR PCB assy.	Replace SSVR PCB assy. (2-7) (3-36)		
		SSVR PCB assy. and operation PCB assy. connector disconnected	Plug connector in (3-34)		
		Bad main PCB assy.	Replace main PCB assy. (2-14) (3-27)		
		Bad main PCB assy. attachment position	Reassemble main PCB assy. (2-14) (3-27)		
		Bad pin jack assy.	Replace pin jack assy. (2-16) (3-25)		
7	Irregular rotation (rotation slow / fast / unstable)	Grease or dust adhering to timing shutter of upper shaft assy. Grease or dust adhering to speed sensor of main PCB assy. Bad main PCB assy. Interference between timing shutter and speed sensor <ul style="list-style-type: none"> • Damage to timing shutter • Damage to speed sensor 	Remove grease or dust Remove grease or dust Replace main PCB assy. (2-14) (3-27) Eliminate cause of interference <ul style="list-style-type: none"> • Replace upper shaft assy. (2-29) (3-9) • Replace main PCB assy. (2-14) (3-27) 	Machine operation while rotating	Check that it switches to fast, middle and slow speed when the speed control lever is operated and that at high speed there is no rotational variation.

	Problem	Primary factors and causes	Repair method	Items for Inspection	Inspection method and standards
8	Even if the drop knob is returned to the left, the feed dog stays down and does not return (no material feed)	Drop knob damage Operation trouble of vertical lever Bad vertical adjuster screw assy. Vertical rod misalignment Vertical feed cam surface out of grease	Replace drop knob (2-49) (3-60) Adjust vertical lever operation (2-49) (3-60) Replace vertical adjuster screw assy. (2-48) (3-60) Adjust vertical adjuster screw assy. (2-48) (3-60) Apply grease (3-60)	Drop function	With the needle bar in the top position and the drop lever to the right, check that the feed dog is down, and moving the drop lever to the left and turning the pulley one turn by hand, that the feed dog returns to the original height.
9	Bad pattern shape Blocked by satin pattern Fine BH stitches Straight line feed too small Stitches uneven	Vertical rattle in feed dog Loose feed dog attachment screw	Adjust feed dog attachment screw (4-22)	Back/front rattle in feed dog	With the feed dog up, check that there is no rattle when the feed dog is lightly moved back and forth.
		Vertical rattle in feed bar	Reattach feed bar (2-48) (3-61)		
		Damage to horizontal feed cam	Replace lower shaft assy. (2-52) (3-56)		
		Rattle in feed adjuster assy.	Reattach feed adjuster assy. (2-53) (3-54)		
	Horizontal rattle in feed dog Loose feed dog attachment screw	Adjust feed dog attachment screw (4-22)	Left-right rattle in feed dog	With the feed dog up, check that there is no rattle when the feed dog is lightly moved left and right.	
		Horizontal rattle in feed bar			Reattach feed bar (2-48) (3-61)
	Bad feed dog height adjustment	Adjust feed dog height (4-23)	Feed dog height	With the feed dog in the highest position, check that the feed dog comes out 0.9 – 1.1 mm from the top of needle plate A at the center of the needle plate A needle hole. (4-23)	
Bad feed dog front-back position adjustment	Adjust feed dog front-back position (4-22)	Feed dog front-back position	Rotating the pulley by hand in a 0 mm feed position (test mode 8) with the feed dog aligned with needle plate A, check that the gap between the middle tooth and the needle plate is 3.2 – 3.8 mm. (4-22)		
Bad feed dog left-right position adjustment	Adjust feed dog left-right position (4-22)	Feed dog left-right position	Confirm that the feed dog has a 0.3 – 0.7 mm gap left and right parallel to the needle plate A needle hole. (4-22)		
Bad feed adjustment	Adjust feed (4-18)	Feed	Check that the difference in forward and reverse feed is within 5 mm in the feed forward/reverse adjustment. (4-18)		

	Problem	Primary factors and causes	Repair method	Items for Inspection	Inspection method and standards
10	<p>Sewing sounds Inappropriate sounds</p> <ul style="list-style-type: none"> • Thread take-up noise • Outer rotary hook vertical rattle noise • Upper shaft noise • Motor noise • Lower shaft noise • Vertical feed cam noise • Horizontal feed arm noise • Noise from contact between needle plate A and feed dog • Needle contact noise 	<p>Thread take-up lever shaft noise</p> <ul style="list-style-type: none"> • Loose screws <p>Outer rotary hook noise</p> <ul style="list-style-type: none"> • Outer rotary hook vertical rattle <p>Upper shaft bushing out of oil</p> <p>Rattle along the thread take-up counter weight shaft</p> <p>Belt too tight</p> <p>Motor brush noise</p> <p>Lower shaft axial rattle</p> <p>Vertical feed cam out of grease</p> <p>Bad horizontal feed arm</p> <p>Back/front and left/right rattle in feed dog</p> <p>Bad feed dog front-back position adjustment</p> <p>Bad feed dog left-right adjustment</p> <p>Needle plate A attachment position slippage</p> <p>Noise of contact between needle and outer rotary hook</p> <ul style="list-style-type: none"> • Bad needle interference adjustment • Loose needle interference adjustment screw 	<p>Retighten thread take-up lever shaft (2-35) (3-51)</p> <p>Reattach outer rotary hook (2-46) (3-64)</p> <p>Lubricate sliding surfaces of bushing and thread take-up counter weight</p> <p>Reattach thread take-up counter weight (2-29) (3-9)</p> <p>Adjust motor belt (4-6)</p> <p>Replace main motor assy. (2-16) (3-24)</p> <p>Reassemble lower shaft assy. (2-52) (3-56)</p> <p>Lubricate lower shaft assy. (3-57)</p> <p>Replace feed arm A (2-52) (3-55)</p> <p>Reattach feed dog (2-45) (3-64)</p> <p>Adjust feed dog front and back position (4-22)</p> <p>Adjust feed dog left and right position (4-22)</p> <p>Reattach needle plate A (2-45) (3-65)</p> <p>Adjust needle interference (4-11)</p> <p>Adjust needle interference (4-11)</p>	<p>Operating noise</p>	<p>Check that there is no abnormal noise at fast, middle and slow speed in 3 point drop (test mode 3).</p>

	Problem	Primary factors and causes	Repair method	Items for Inspection	Inspection method and standards
11	Threading not possible.	<p>Thread pushed out at the hook end.</p> <ul style="list-style-type: none"> Vertical slippage in needle thread block <p>Hook extends right of the needle hole</p> <ul style="list-style-type: none"> Wide gab between right side of needle and hook guide Needle curvature Needle slant (hole slant with slanted attachment of needle block) Threader hook assy. slippage Vertical slippage in needle thread block <p>Does not go into needle hole because of hook tip curvature.</p>	<p>Adjust needle thread block (4-15)</p> <p>Replace hook assy. (2-39) (3-47)</p> <p>Replace needle</p> <p>Replace needle bar (2-37) (3-49)</p> <p>Replace hook assy. (2-39) (3-47)</p> <p>Adjust needle thread block (4-15)</p> <p>Replace hook assy. (2-39) (3-47)</p>	Threading function	Confirm that when threading is carried out with Schappe Spun Sewing Thread #60 / #11 needle and Schappe Spun Sewing Thread #30 / #16 needle, that the threading lever moves smoothly and that threading through the needle hole is possible.
	When the threader lever returns, it stops part way through.	<p>Threader shaft tangling</p> <p>Bad thread guide shape</p> <p>Needle thread shaft and top gap too small</p>	<p>Replace needle bar supporter assy. (2-38) (3-48)</p> <p>Replace hook assy. (2-39) (3-47)</p> <p>Replace needle bar supporter assy. (2-38) (3-48)</p>		
	Needle thread lever operation catches part way through.	<p>Bad needle stop position</p> <ul style="list-style-type: none"> NP sensor damage Grease or dirt adhering to NP sensor Rotation shutter damage Bad needle thread block rotational position 	<p>Replace main PCB assy. (2-14) (3-27)</p> <p>Remove grease and dirt</p> <p>Replace upper shaft assy. (2-29) (3-9)</p> <p>Adjust needle thread block (4-15)</p>		
12	Either upper thread tension or lower thread tension	<p>Upper thread tension is high/low (check the screw lock on the tension disk tension adjustment screw).</p> <p>Lower thread tension is too strong / weak (Check inner rotary hook screw lock)</p> <p>Upper thread or lower thread unsuitable</p>	<p>Upper thread tension with Schappe Spun Sewing Thread #60 is 0.41 - 0.46 N (42 - 47 g) (4-8)</p> <p>Lower thread tension with Schappe Spun Sewing Thread #60 is 0.1 - 0.12 N (10 - 12 g) (4-17)</p> <p>Replace upper thread or lower thread</p>	<p>Upper thread tension</p> <p>Lower thread tension</p>	Check that the thread tension is good during actual sewing.

	Problem	Primary factors and causes	Repair method	Items for Inspection	Inspection method and standards
13	Actual sewing • Needle breakage	<p>Needle breaks.</p> <ul style="list-style-type: none"> • Inner rotary hook slips because the inner rotary hook and inner rotary hook bracket back/front overlap is too small • Inner rotary hook slips because the inner rotary hook and inner rotary hook bracket vertical overlap is too small • Thread catches on thread bobbin (thread falls down to the right of thread bobbin because the spool pressure is insufficient) • Thread catches on spool presser (scratches on spool presser) <p>Needle catches and bends before or after sewing.</p>	<p>Adjust inner rotary hook bracket assy. position (4-24)</p> <p>Confirm the presence of washer and spacer under outer rotary hook (2-46) (3-64)</p> <p>Rethread</p> <p>Replace spool presser</p> <p>Replace needle</p>	Actual sewing (straight line / zigzag)	Check that the needle does not break during actual sewing. Check that there are no abnormal sounds during actual sewing.
	• Thread breakage stitch skipping	<p>Thread breakage.</p> <ul style="list-style-type: none"> • Thread catches on thread bobbin (thread falls down to the right of thread bobbin because the spool pressure is insufficient) • Thread catches on spool presser (scratches on spool presser) • Scratches on outer rotary hook • Wrong thread guide path 	<p>Rethread</p> <p>Replace spool presser</p> <p>Replace outer rotary hook assy. (2-46) (3-64)</p> <p>Rethread</p>	Actual sewing (straight line / zigzag)	Check that the thread does not break during actual sewing.

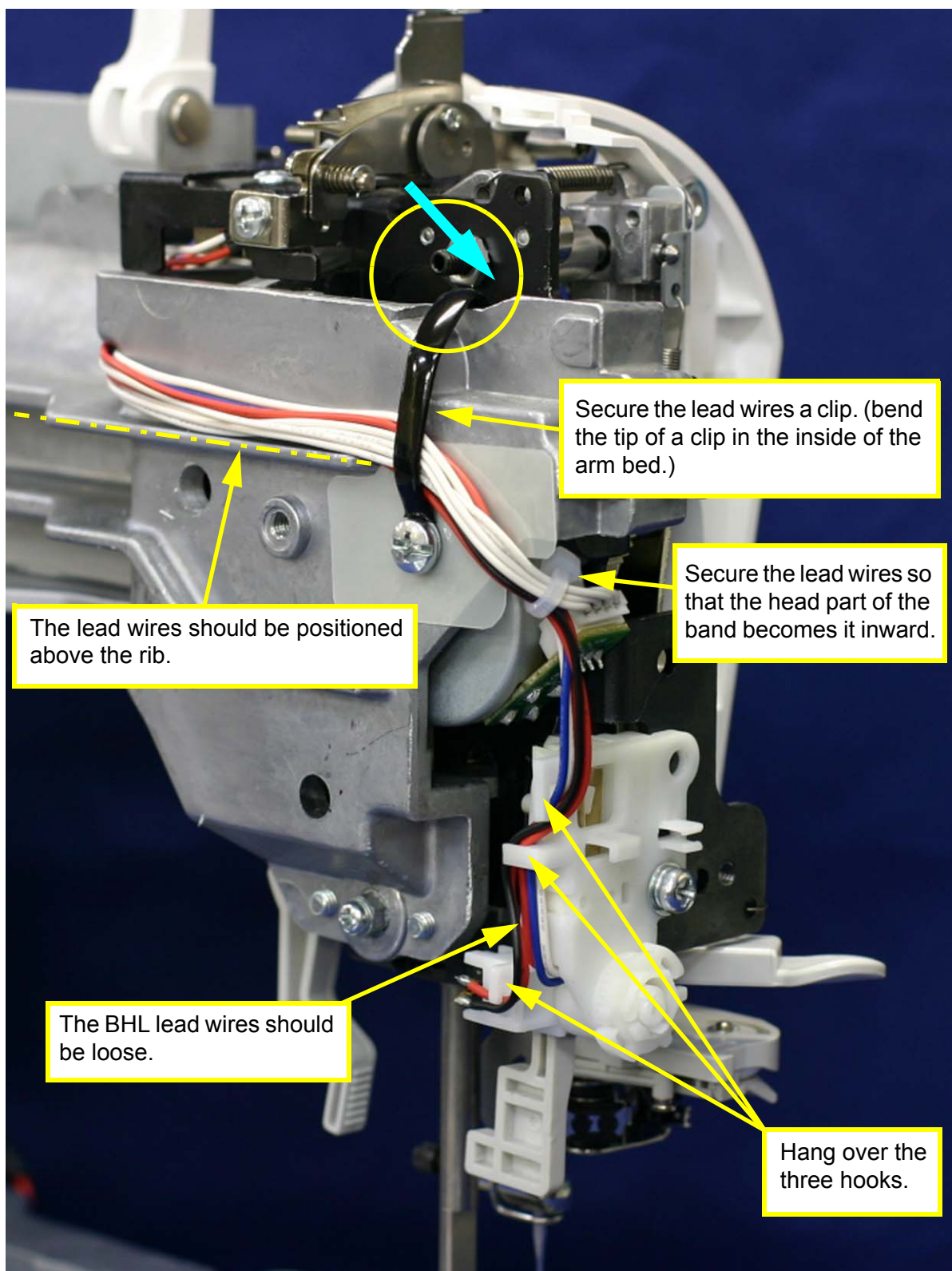
	Problem	Primary factors and causes	Repair method	Items for Inspection	Inspection method and standards
13	<ul style="list-style-type: none"> Seam unevenness 	Seam unevenness. <ul style="list-style-type: none"> Bad presser position Cloth presser is high and does not hold material completely Scratches on inner rotary hook Scratches on outer rotary hook Scratches around needle plate needle hole Scratches around presser foot needle hole Burrs and scratches in thread guide path Slippage from lower thread tension spring Tension loosened by thread scraps and dirt adhering to the thread guide plate Distortion of thread guide plate Scratches on needle plate 	Adjust presser bar height (4-16) Adjust presser bar height (4-16) Replace inner rotary hook Replace outer rotary hook (2-46) (3-64) Replace needle plate A (2-45) (3-65) Replace presser Replace parts with burrs and scratches Reset lower thread Remove thread and dust on stuck to thread guide plate Replace thread guide plate (2-18) (3-22) Replace needle plate A (2-45) (3-65)	Actual sewing (straight line / zigzag)	Check that stitches are not uneven during actual sewing.
	<ul style="list-style-type: none"> Stops during sewing 	Stops during sewing. <ul style="list-style-type: none"> No gap for bobbin winder switch No gap for BH lever switch No play in S/S button, reverse button or vertical stop button 	Adjust BW switch assy. position (4-20) Adjust BH lever switch position (4-21) Reassemble SSVR PCB assy. (2-7) (3-36)	Actual sewing (straight line / zigzag)	Check that it does not stop during actual sewing.
14	Cannot sew BH <ul style="list-style-type: none"> BH is blocked BH cannot switch BH switches part way through 	BH sewing impossible <ul style="list-style-type: none"> Bad BH connecting point BH lever detached Connector disconnected Operation drags BH presser button attachment holder is pulled out fully. 	Adjust BH switch (4-21) Replace BH switch assy. (2-35) (3-52) Plug connector in Replace BH switch assy. (2-35) (3-52) Reset range for BH presser button attachment (Move back two marks from maximum permissible range)	Bar-tack Eyelet sewing	Check that there is no stitch skipping or clogging with BH pattern sewing. With the BH presser moved the extent of its range by hand, confirm that there is slack on the BH side and the other side. (4-21)
	Becomes straight line	Bad feed forward/reverse adjustment (100 stitches forward and reverse)	Adjust feed forward/reverse (4-18)		

	Problem	Primary factors and causes	Repair method	Items for Inspection	Inspection method and standards
15	Bobbin winder shaft not turning	Bad BW switch BW switch connector disconnected BW switch attachment position unsuitable Bad main PCB Assy.	Replace BW switch (2-23) (3-14) Plug connector in Adjust BW switch position (4-20) Replace main PCB Assy. (2-14) (3-27)	Bobbin winder function	Operate the bobbin winder with Schappe Spun Sewing Thread #60, and confirm that there is no uneven bobbin winding or abnormal noises. (4-19) Check that the amount of thread wound onto the bobbin is 80 – 90% of the bobbin diameter. (4-19)
	Bobbin winding amount unsuitable	Bad bobbin presser adjustment Loose bobbin presser attachment screw	Adjust bobbin presser position (4-19) Reassemble bobbin presser (2-11) (3-31)		
	Bobbin winder winds unevenly	Bad bobbin winder guide assembly height adjustment Loose bobbin winder guide assembly screw	Adjust bobbin winder guide assembly height (4-19)		
	Abnormal sound when the bobbin winder rotates	Bobbin is coming into contact with bobbin presser Timing pulley scratches	Remove front cover, and adjust position using bobbin winder holder attachment screw (2-23) (3-14) Repair scratches or replace upper shaft Assy. (2-29) (3-9)		
16	Foot controller not effective	Bad foot controller Bad pin jack Assy. contact point Bad main PCB Assy.	Replace foot controller Replace pin jack Assy. (2-16) (3-25) Replace main PCB Assy. (2-14) (3-27)	Foot controller function	Run the sewing machine using the foot controller, and check that the sewing machine speed changes according to the amount it is pressed down.

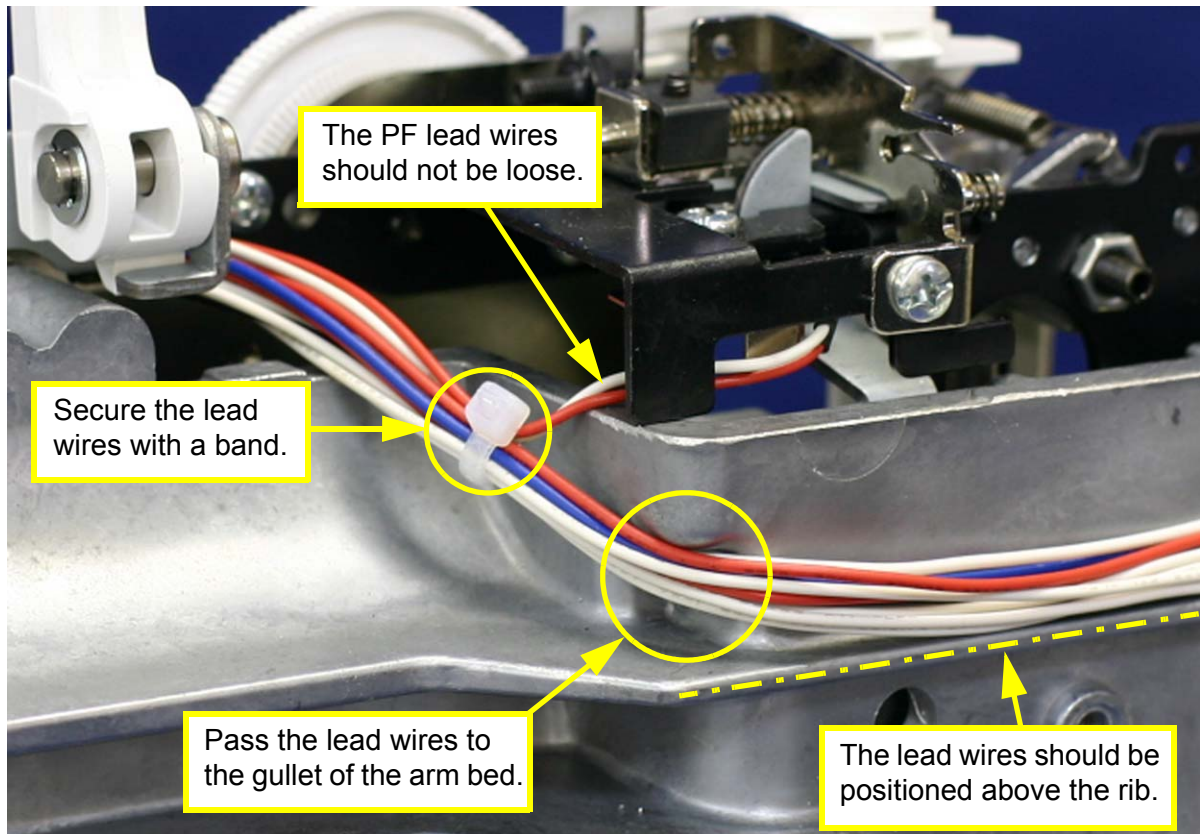
7 Special Instructions of Wiring

Wiring of needle bar module	7 - 2
Wiring of feed / rotary module	7 - 4
Wiring of power module	7 - 5
Wiring of bobbin winder assy.	7 - 11
Wiring of main PCB assy.	7 - 12
Wiring of front cover	7 - 13

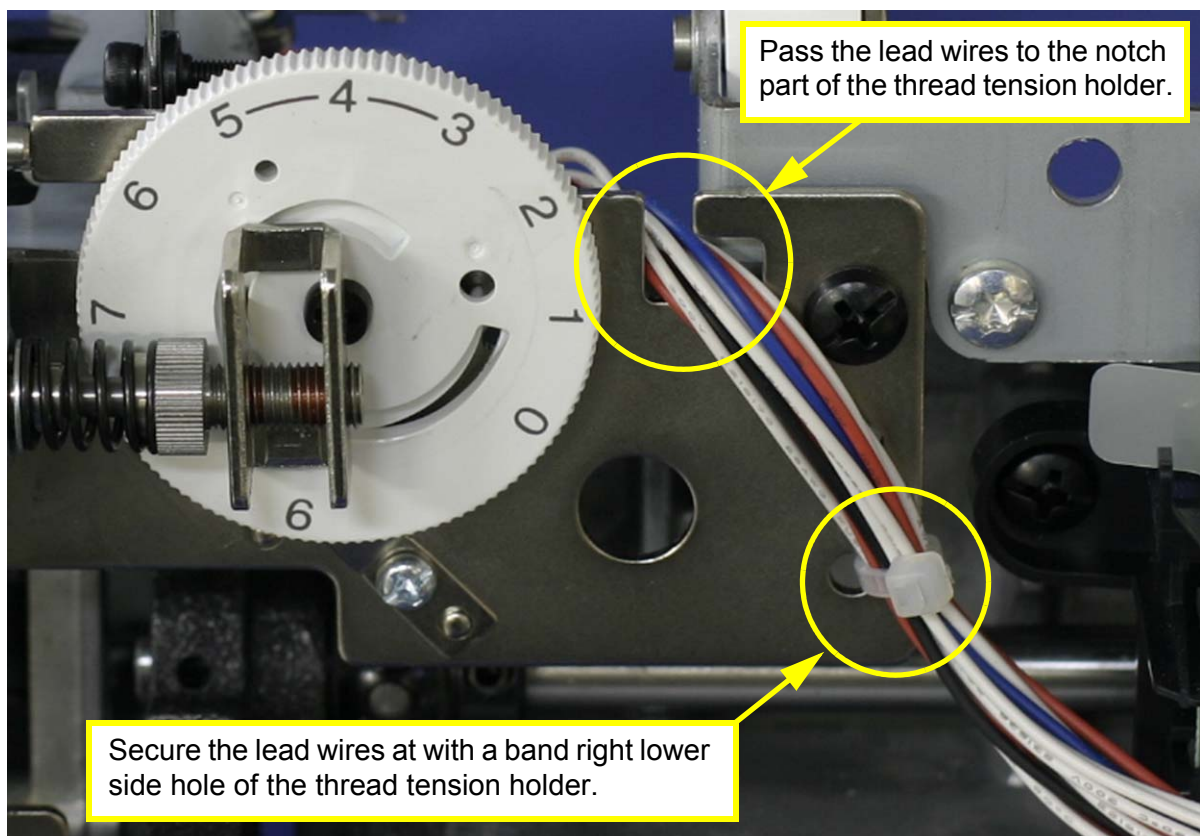
1. Wiring on left side of needle-presser module



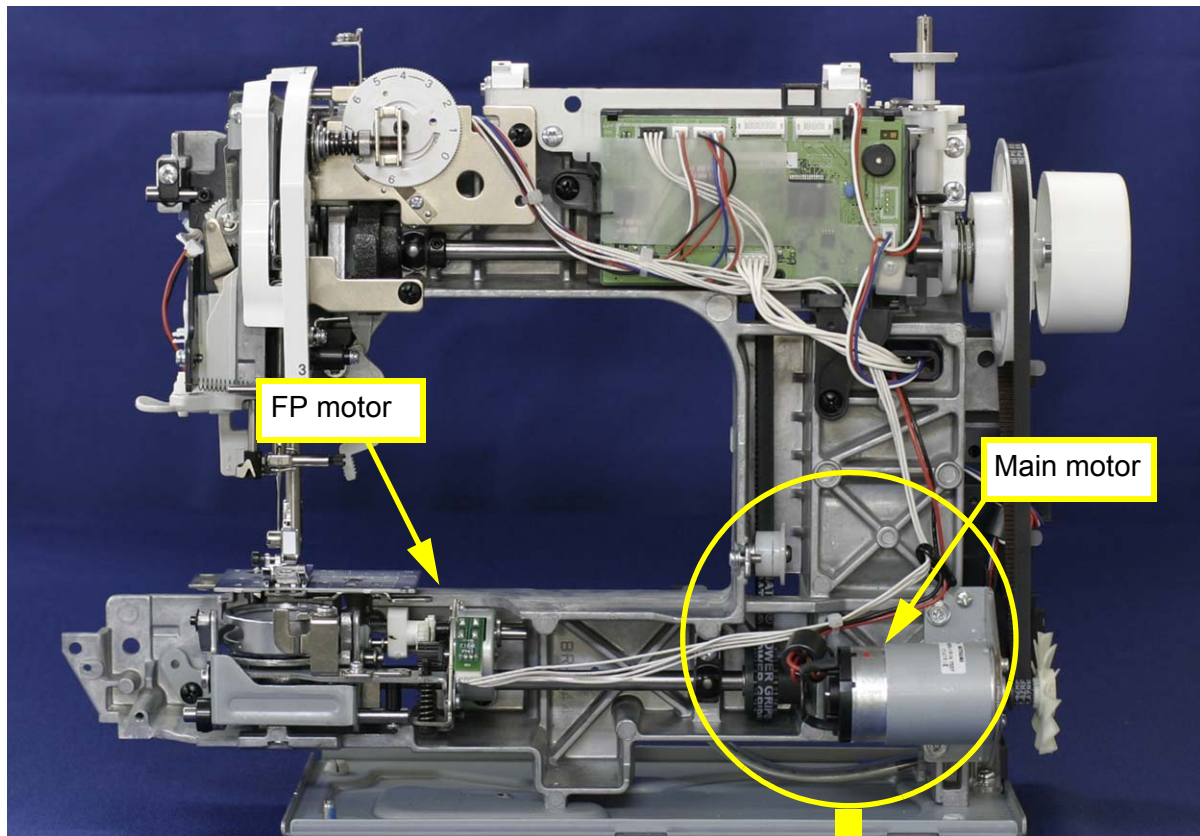
2. Wiring on right upper side of needle-presser module



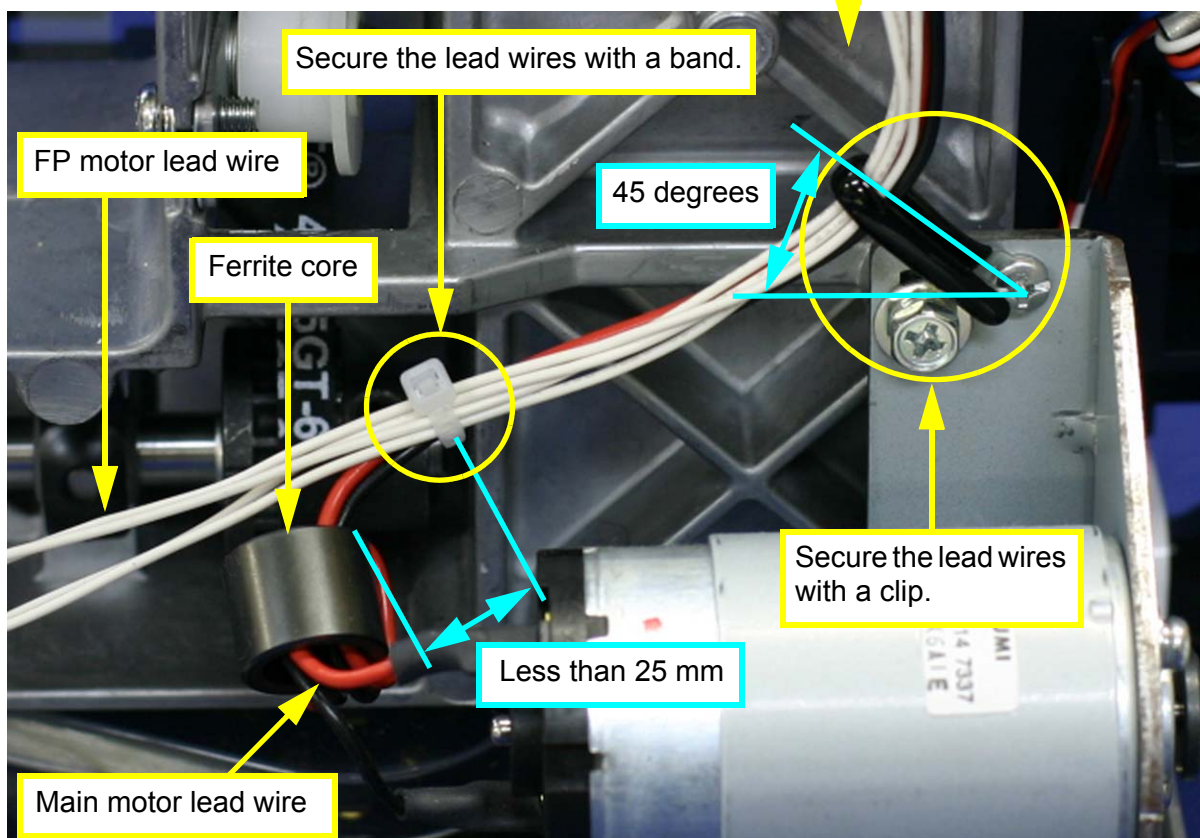
3. Wiring on right side of needle-presser module



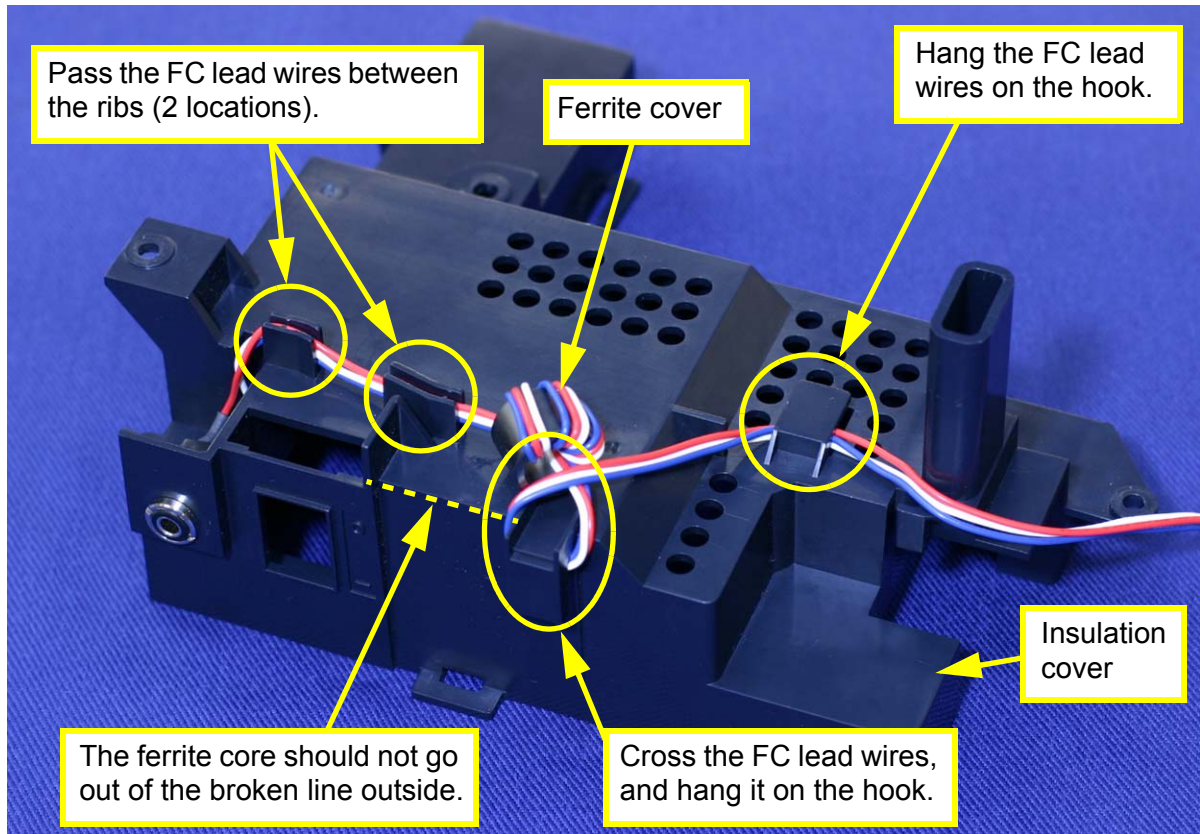
1. Wiring on front side of main body



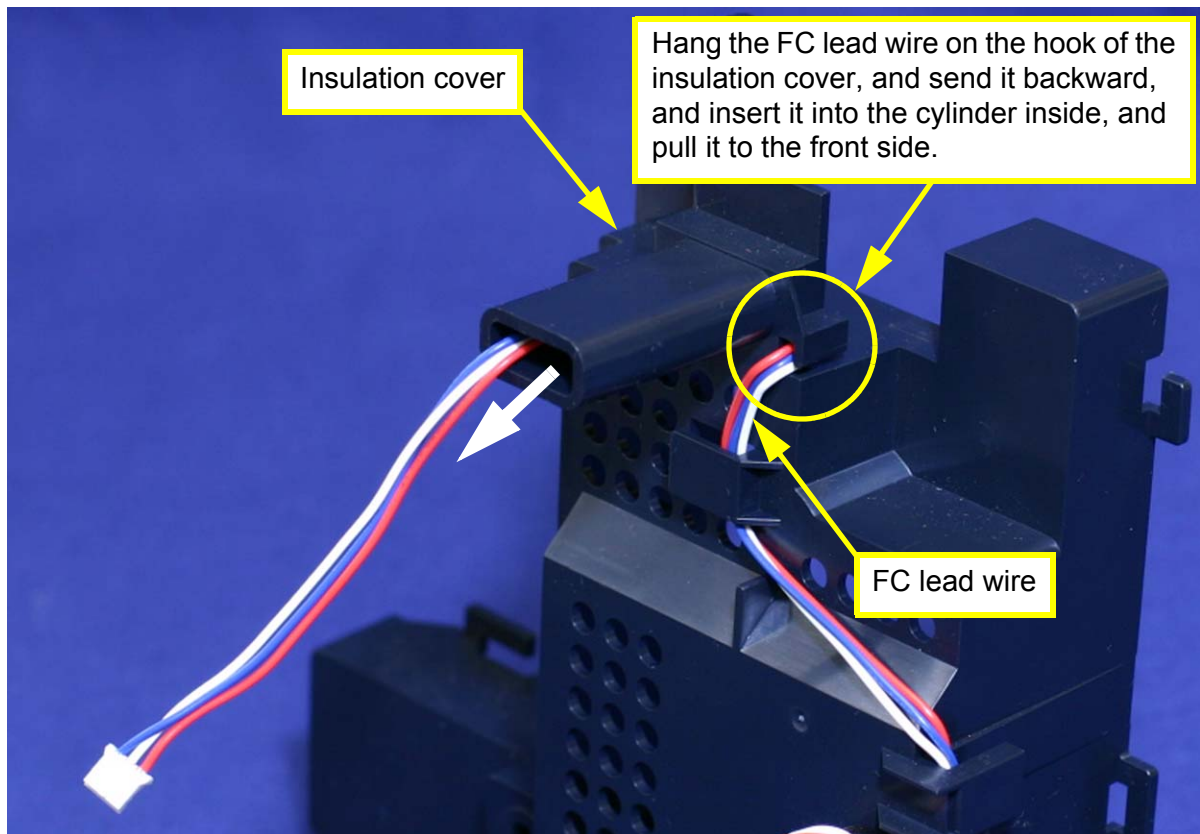
2. Wiring FP motor lead wire and main motor lead wire



1. Wiring on front side of insulation cover

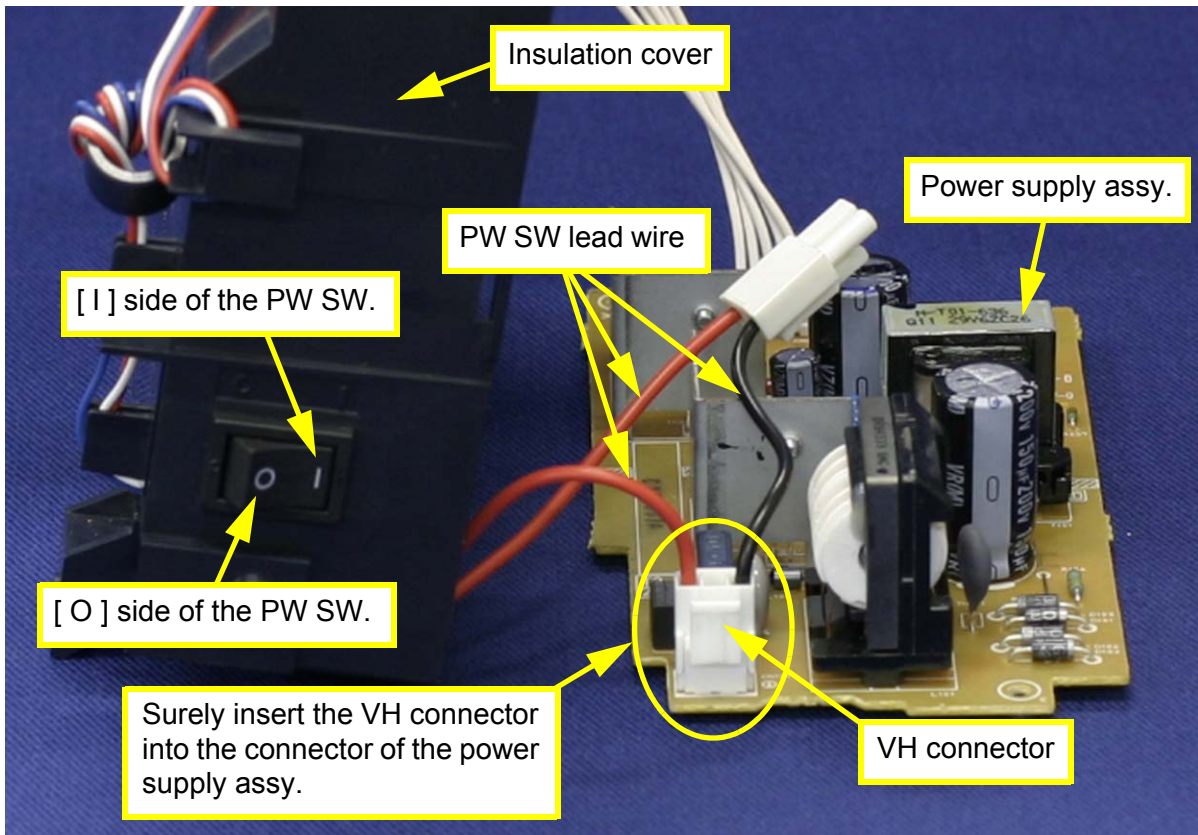


2. Wiring on front upper side of insulation cover

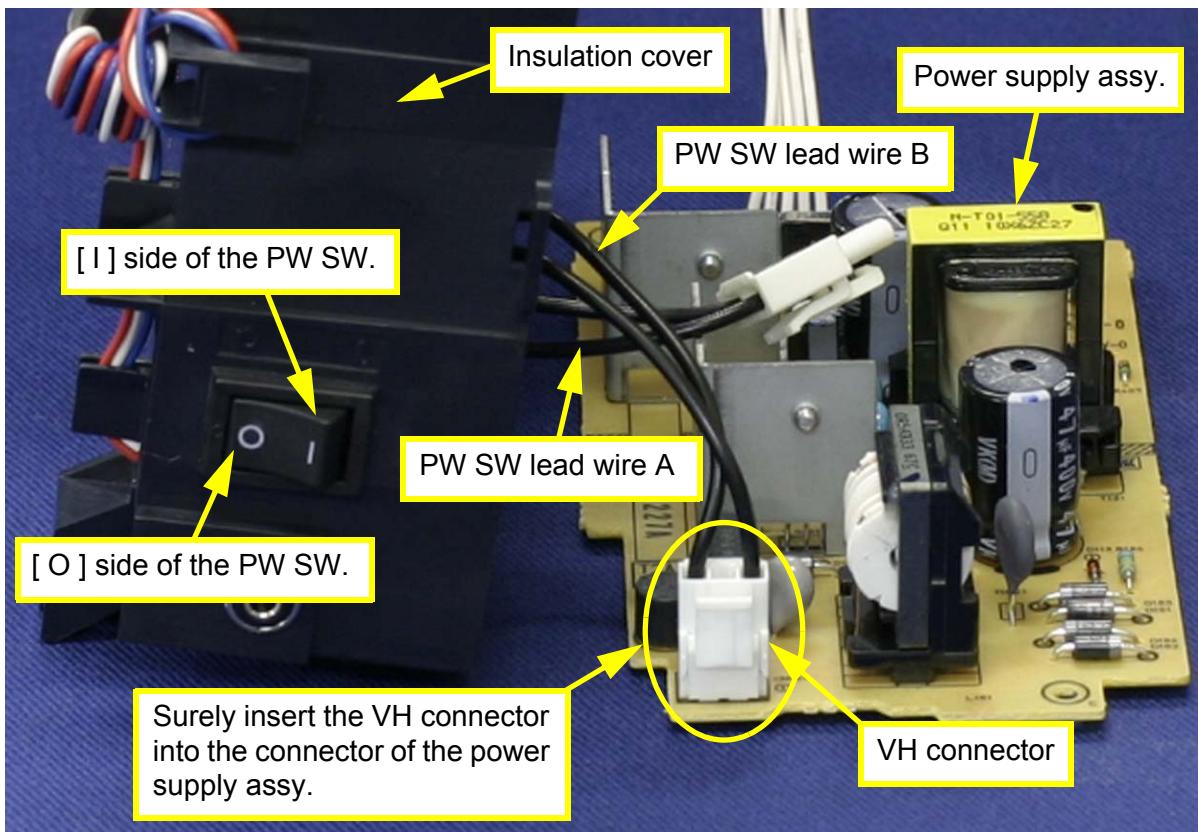


Special Instructions
of Wiring

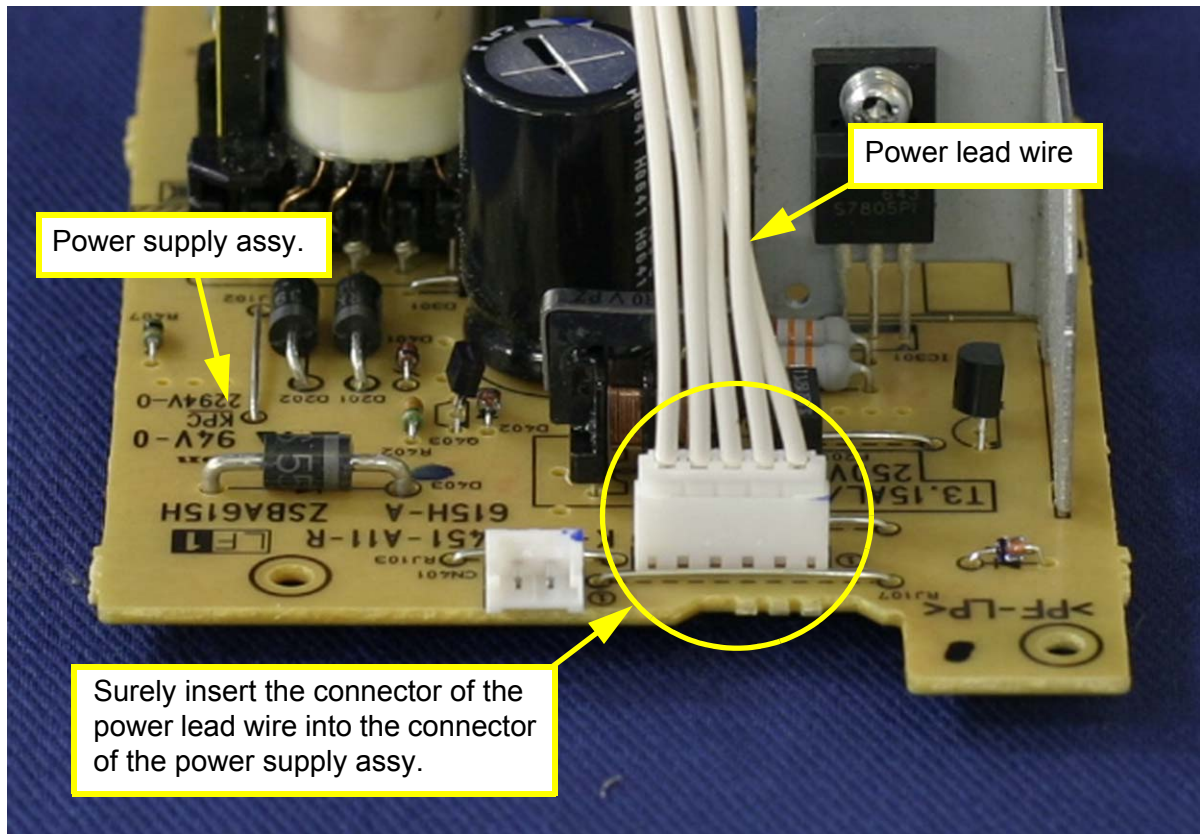
3. Wiring of PW SW Assy. and power supply Assy.
3-1. For "NS40" (120V) series



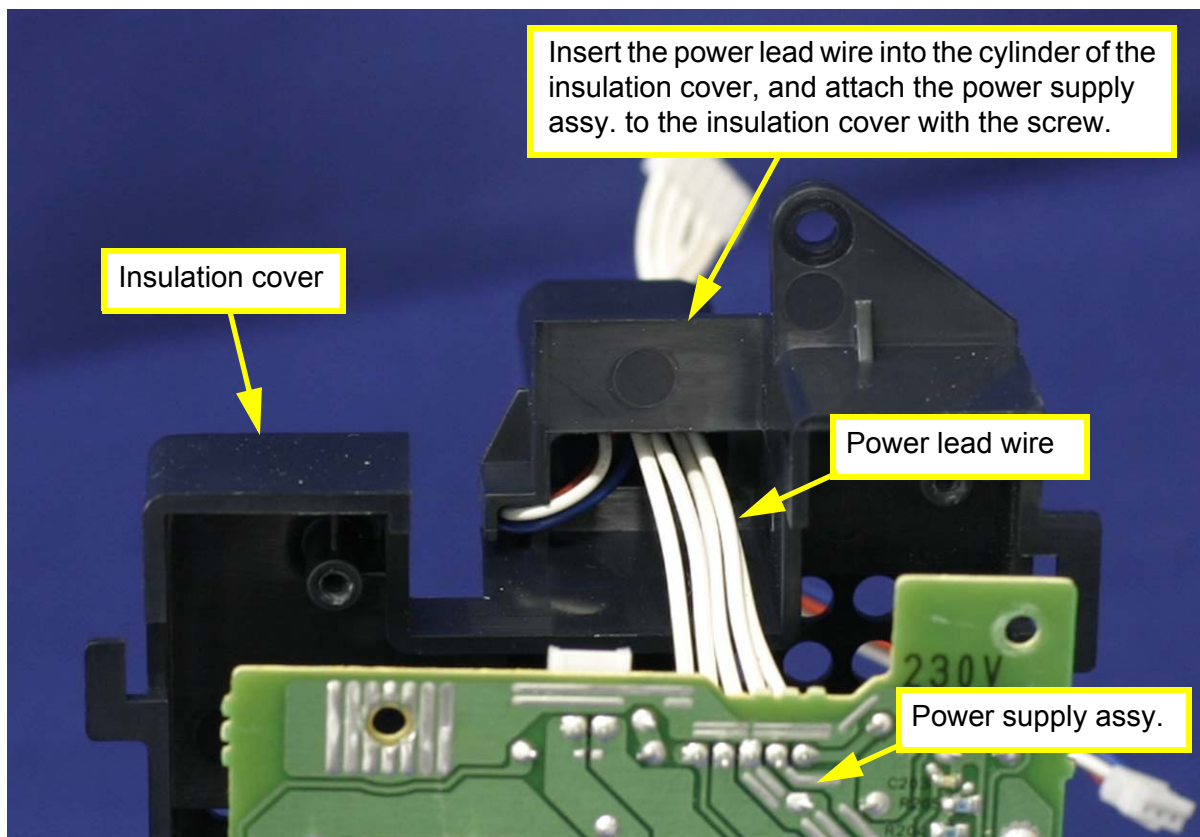
3-2. For "NV30" (230V) series



4. Wiring of power supply assy. and power lead wires assy.

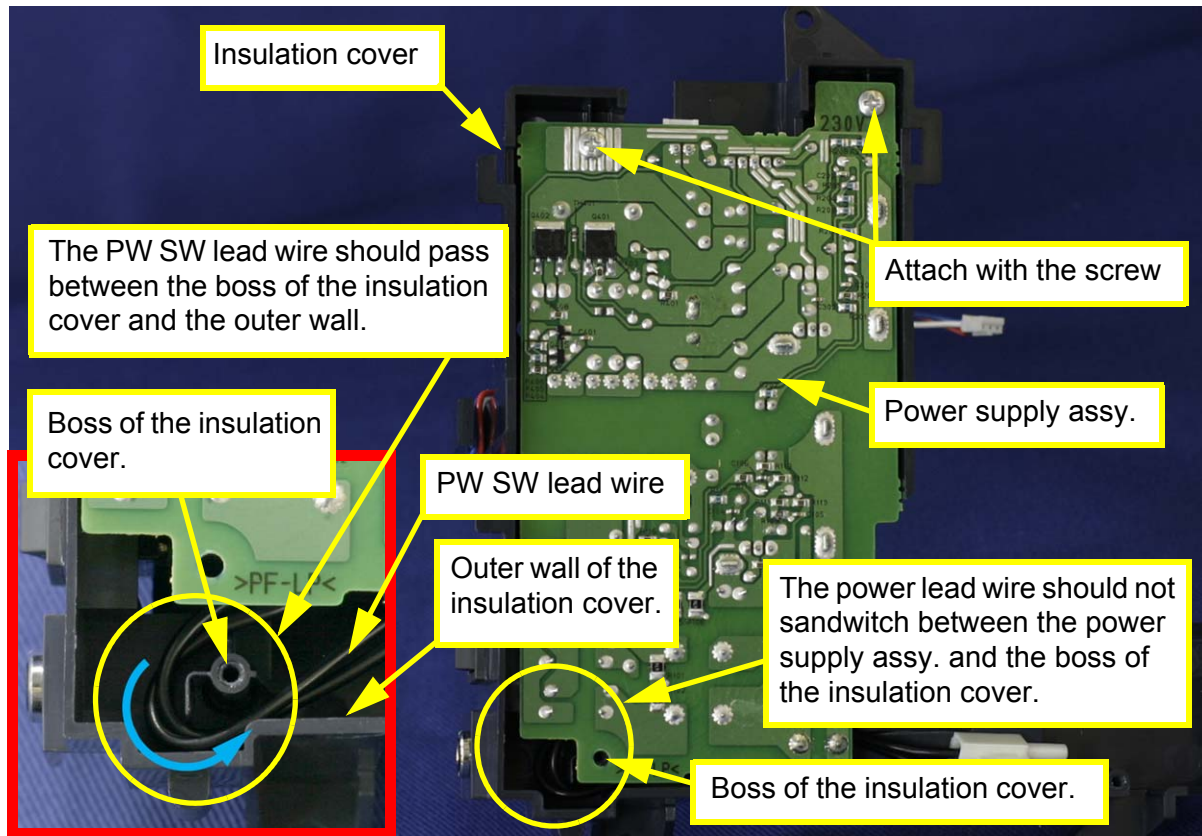


5. Wiring of power supply assy. and insulation cover



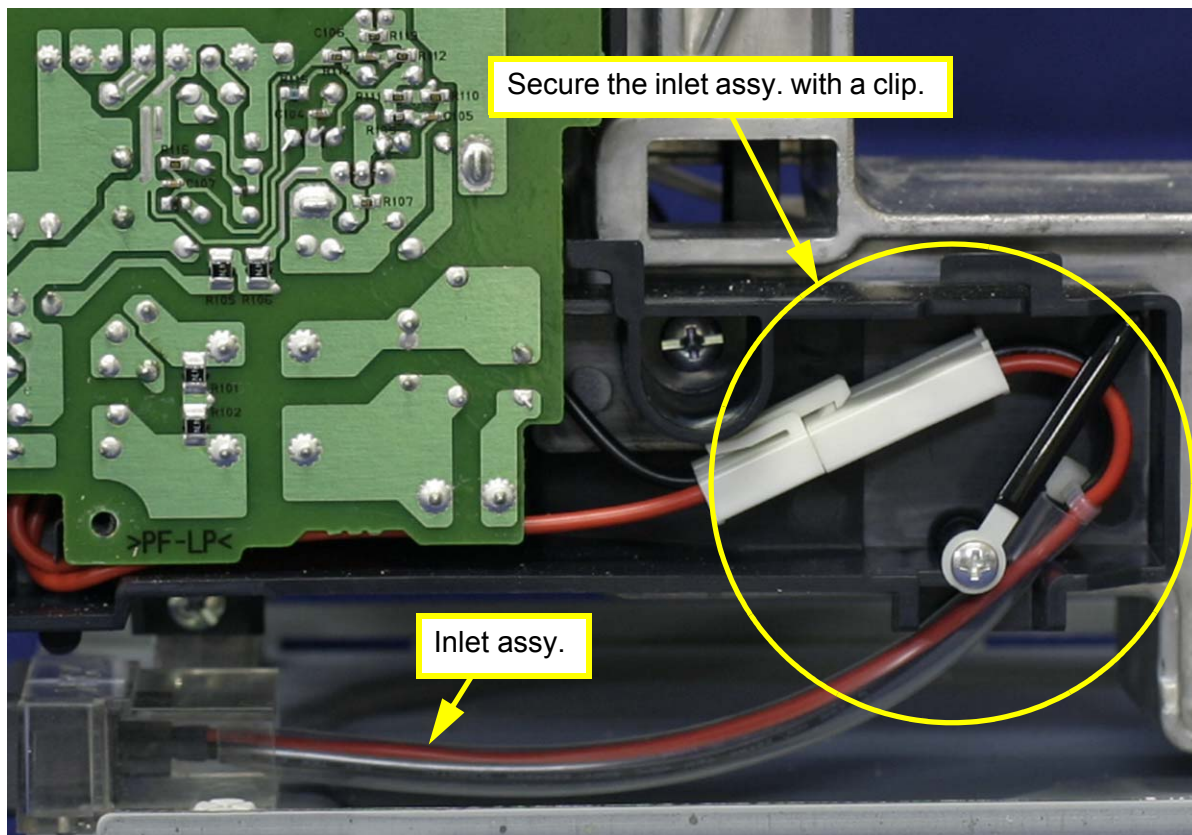
Special Instructions
Of Wiring

6. Wiring of power supply assy. and insulation cover

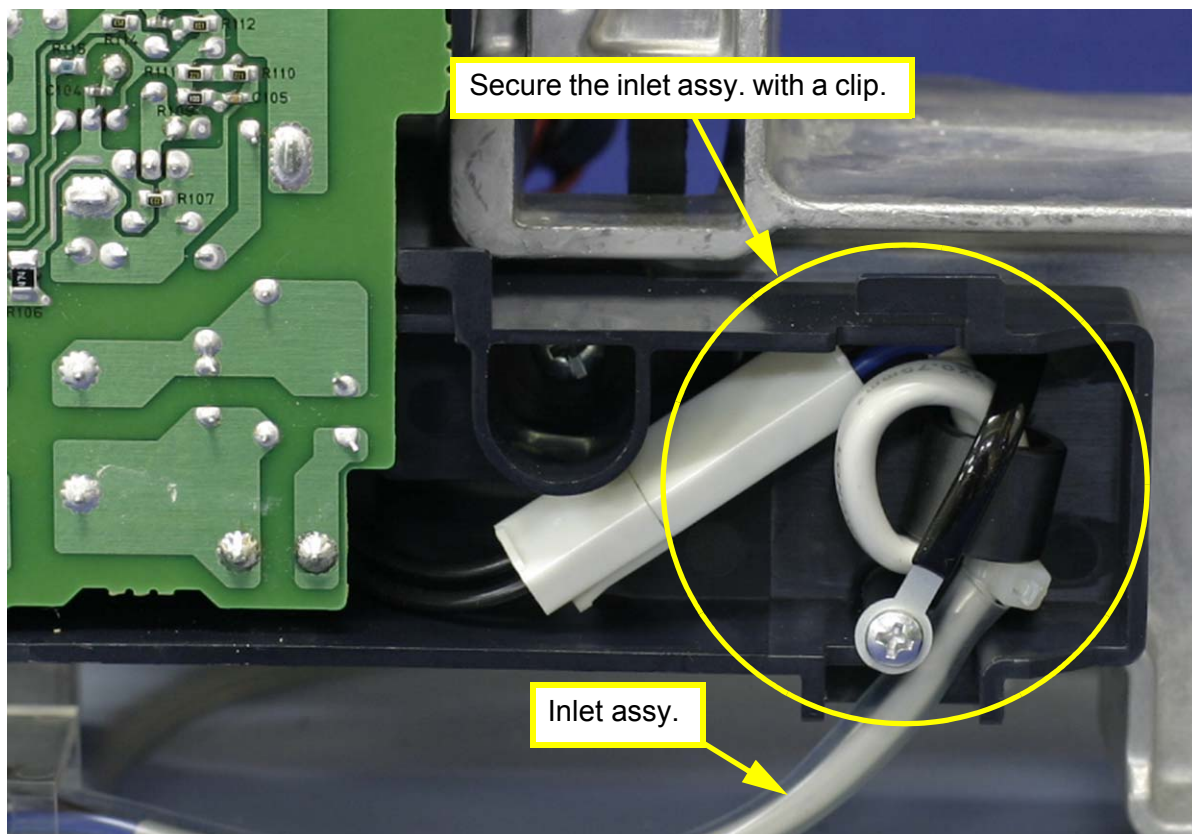


7. Wiring of inlet assy. and insulation cover

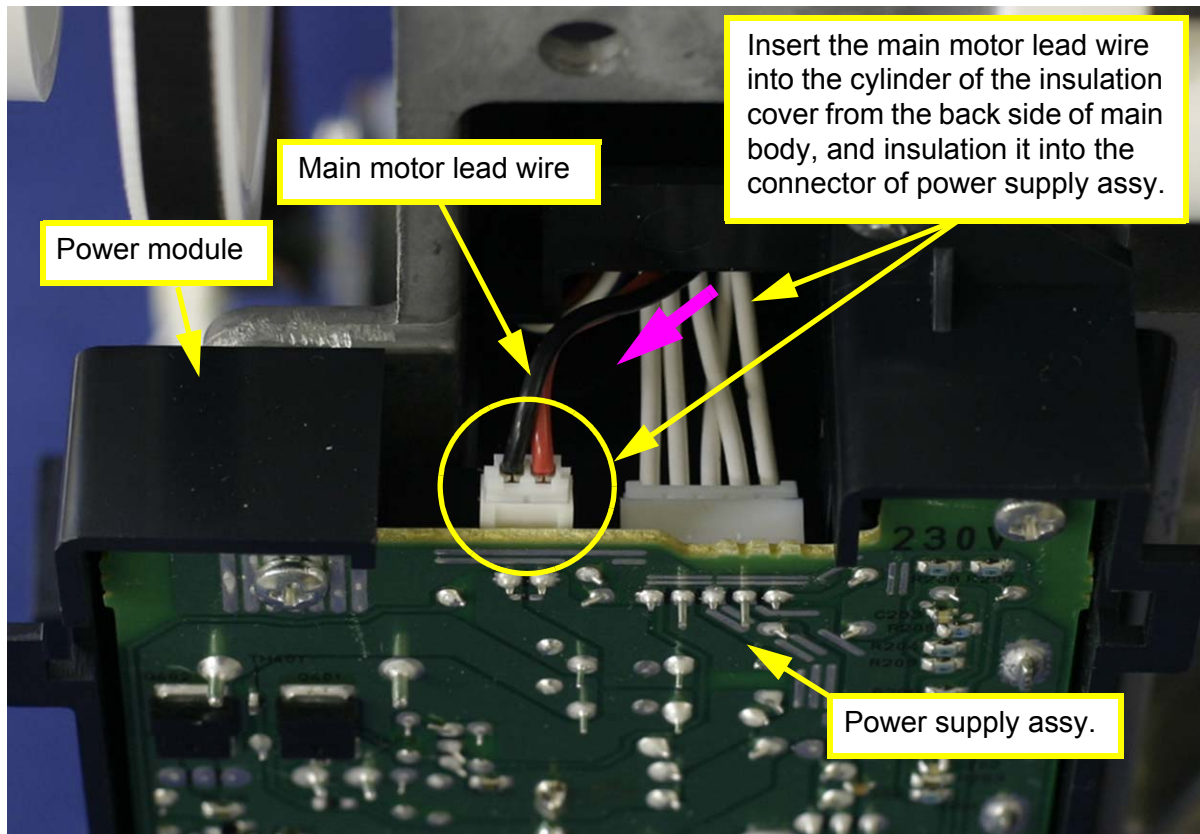
7-1. For “NS40” (120V) series



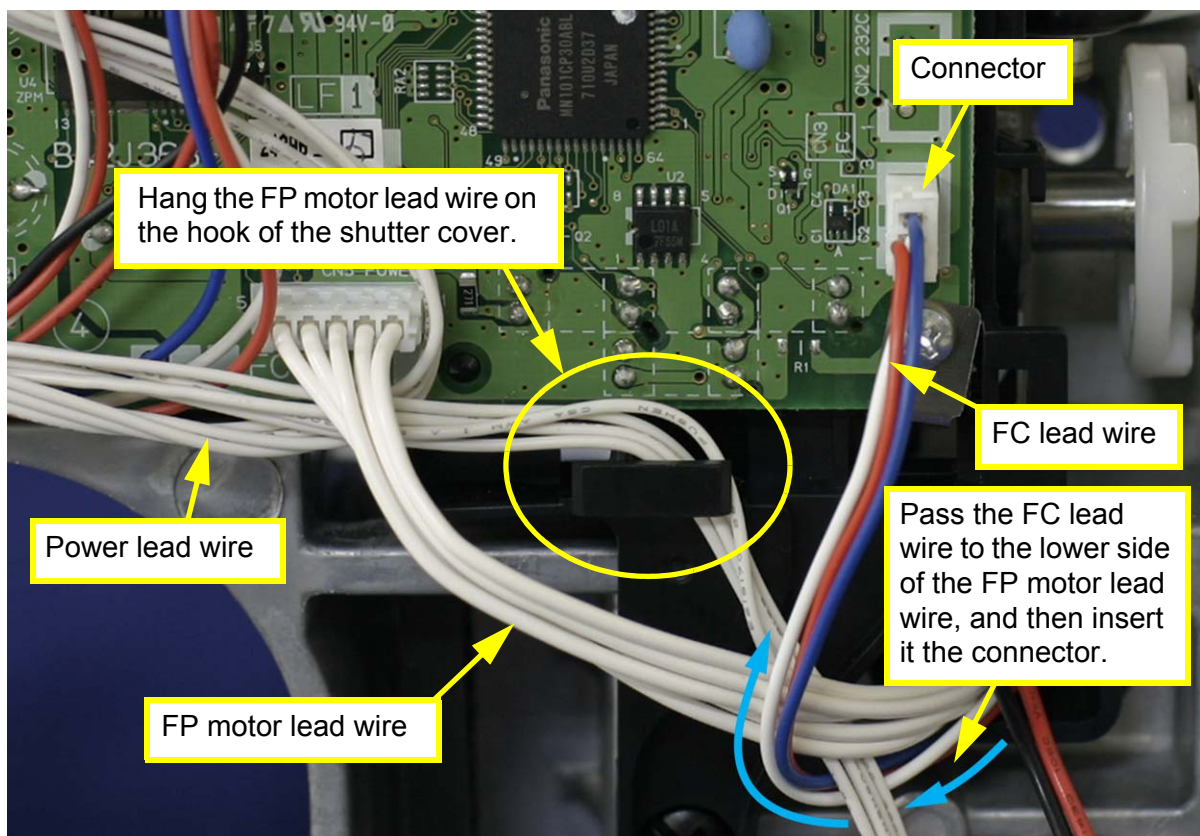
7-2. For “NV30” (230V) series



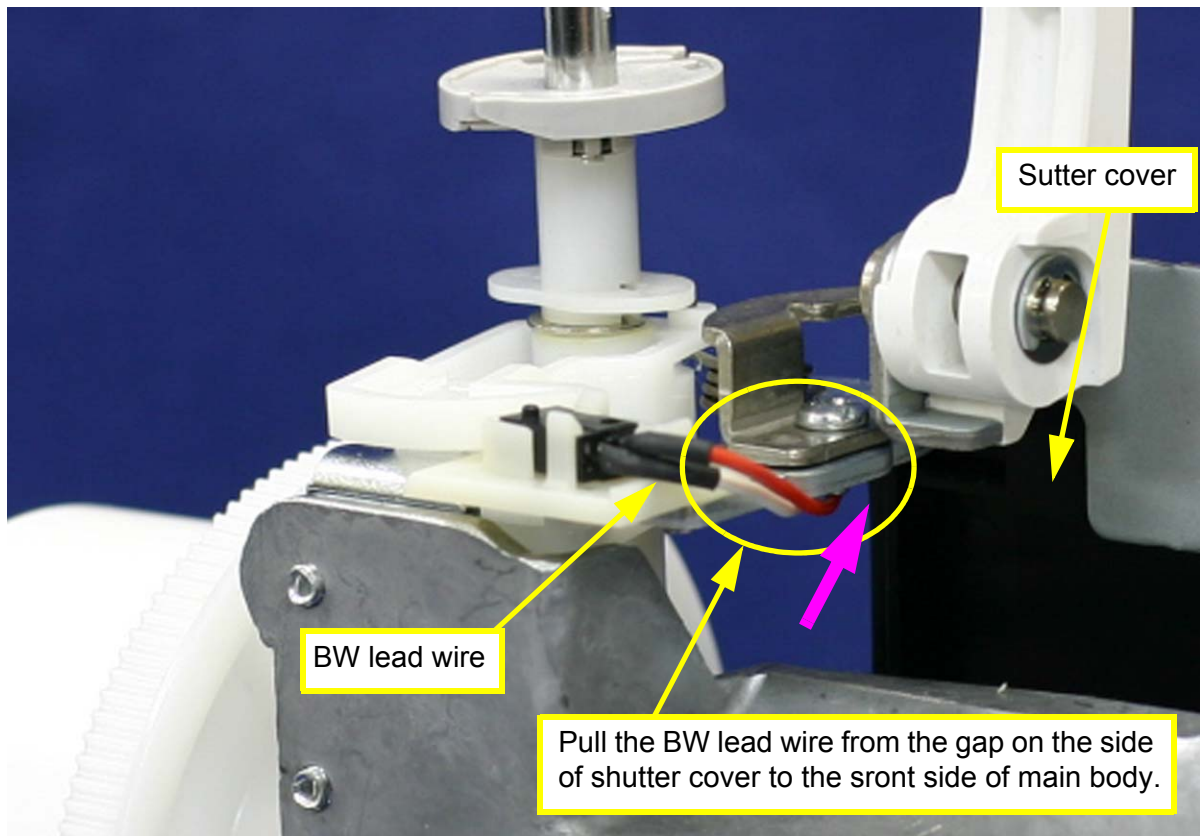
8. Wiring on back side of main body (upper side of power module)



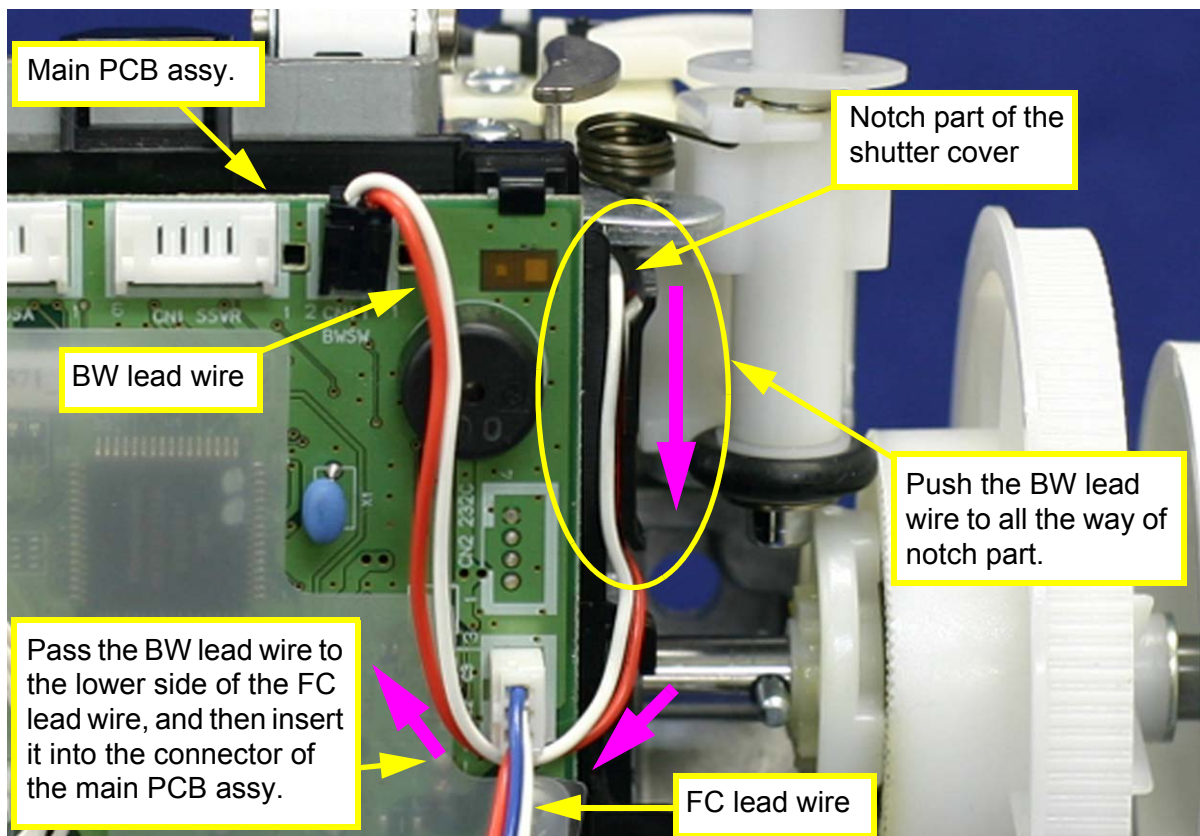
9. Wiring on front side of main body (lower side of main PCB)



1. Wiring on left side of bobbin winder sub assy.

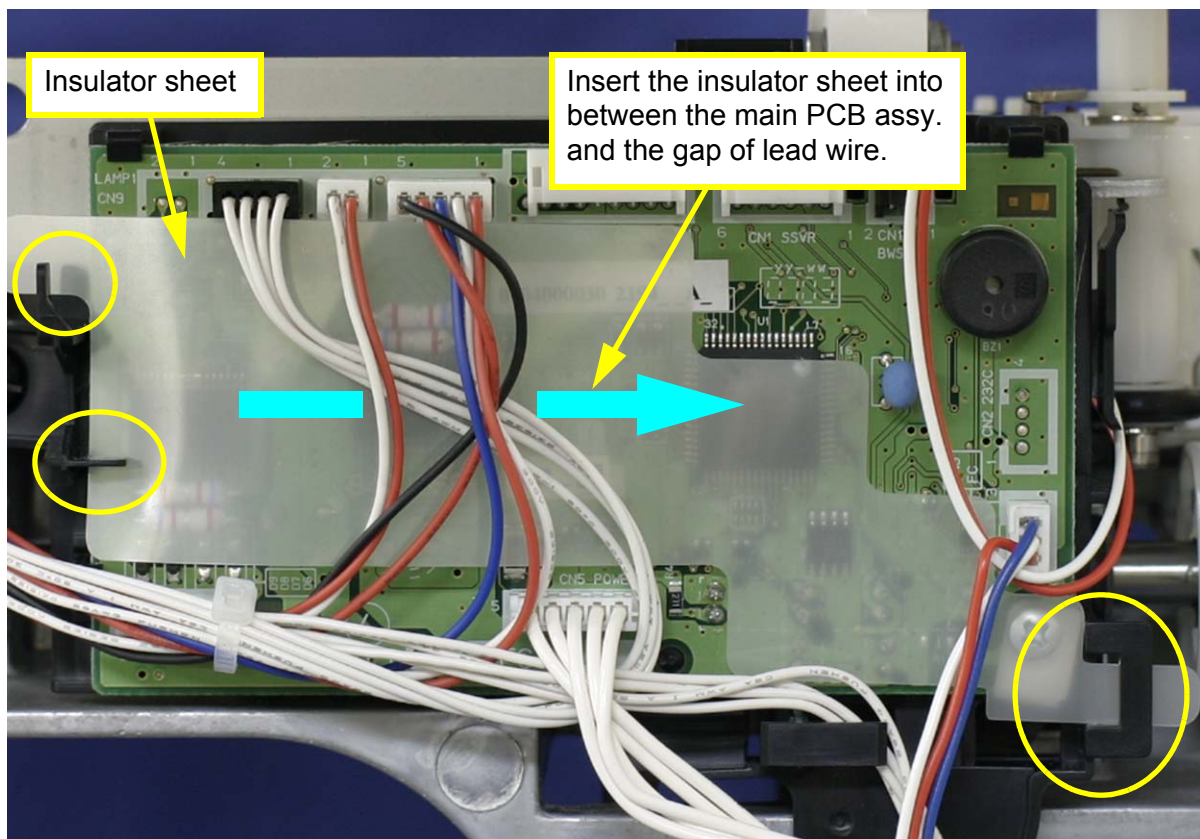
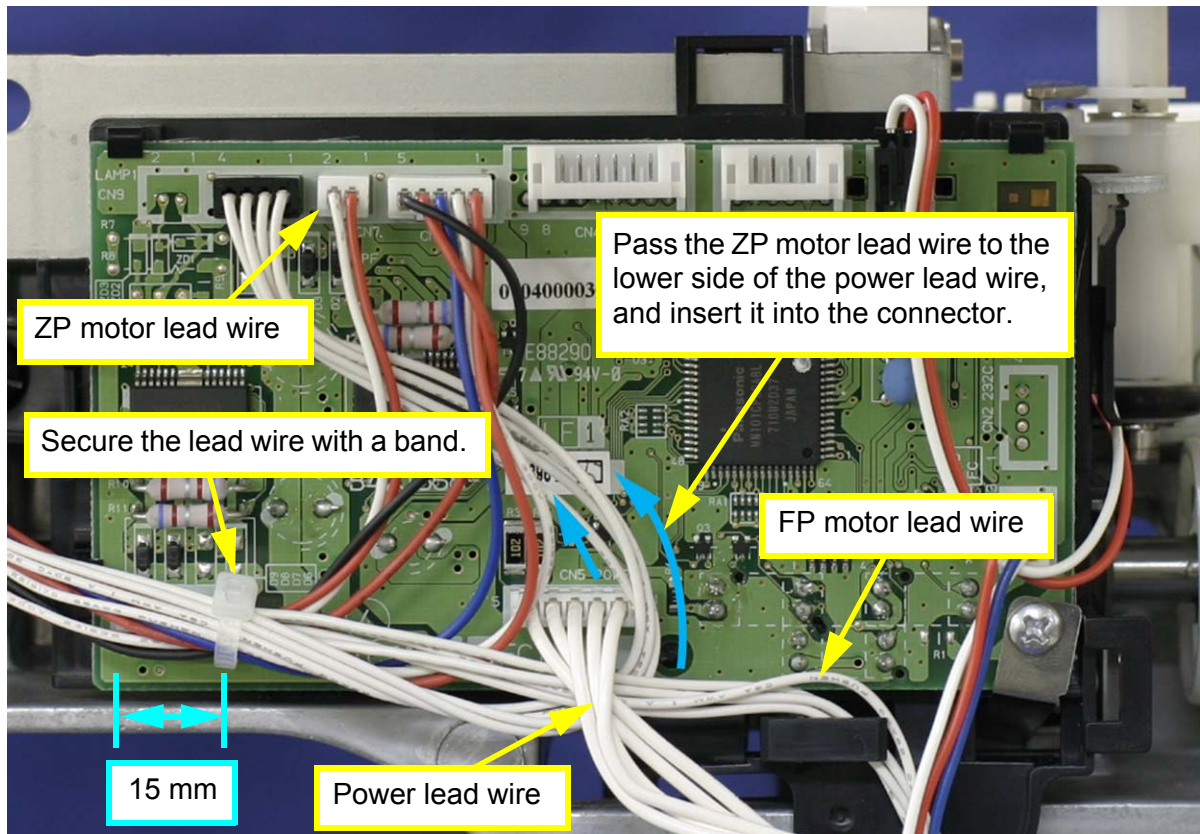


2. Wiring on front side of main body (right side of main PCB assy.)

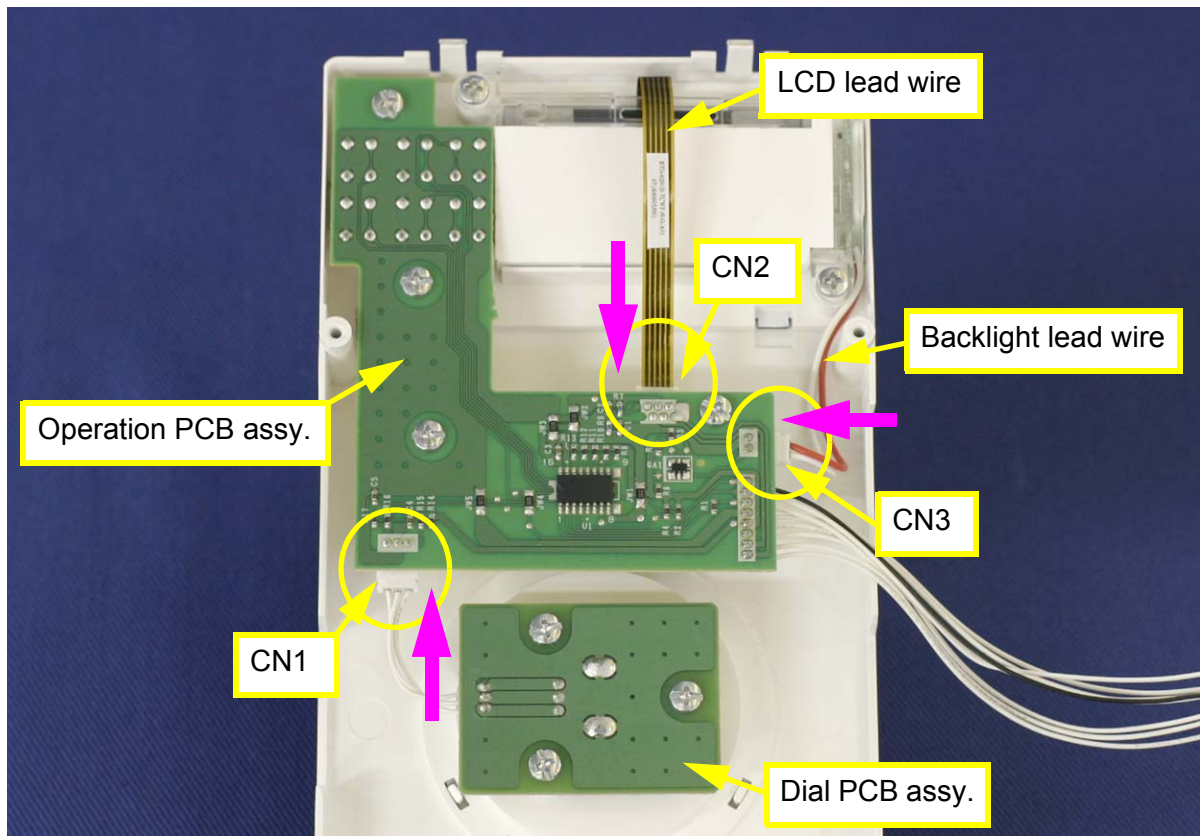
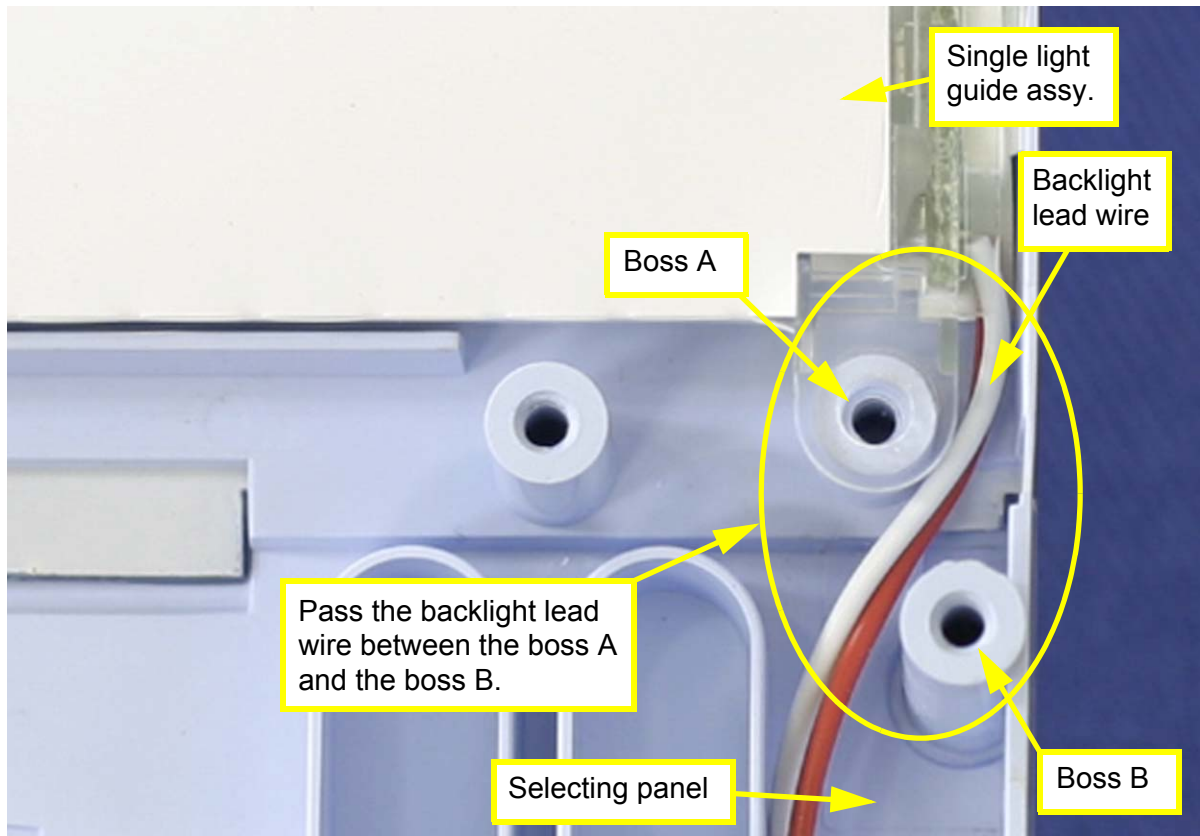


Special Instructions
Of Wiring

1. Wiring on front side of main PCB Assy.

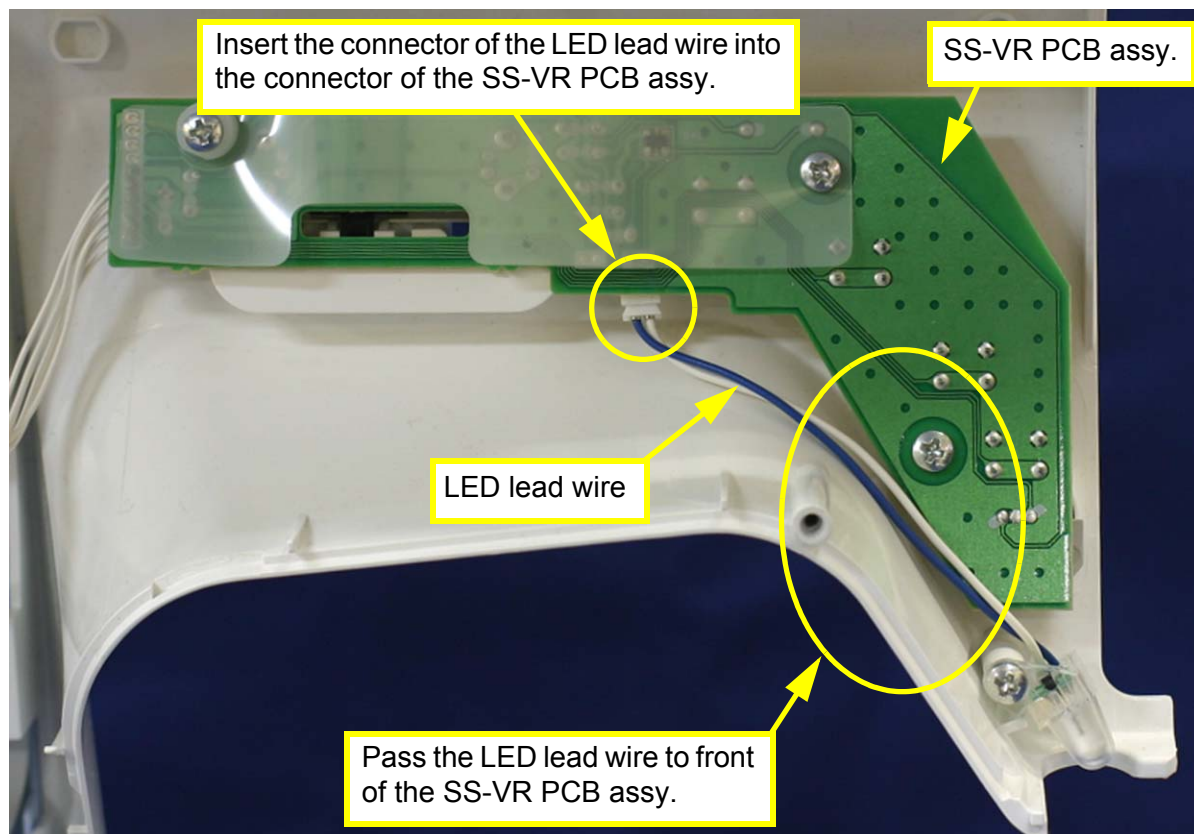


1. Wiring on back side of selecting panel assy.

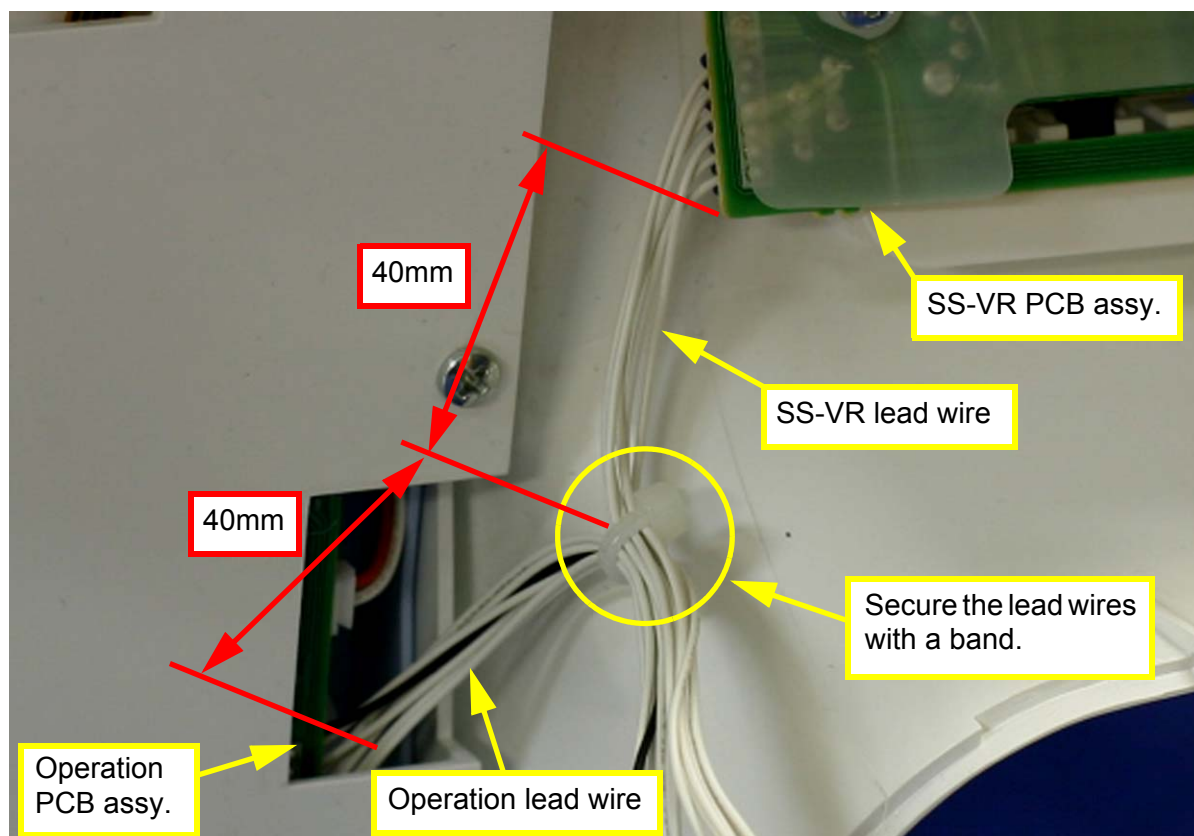


Special Instructions
Of Wiring

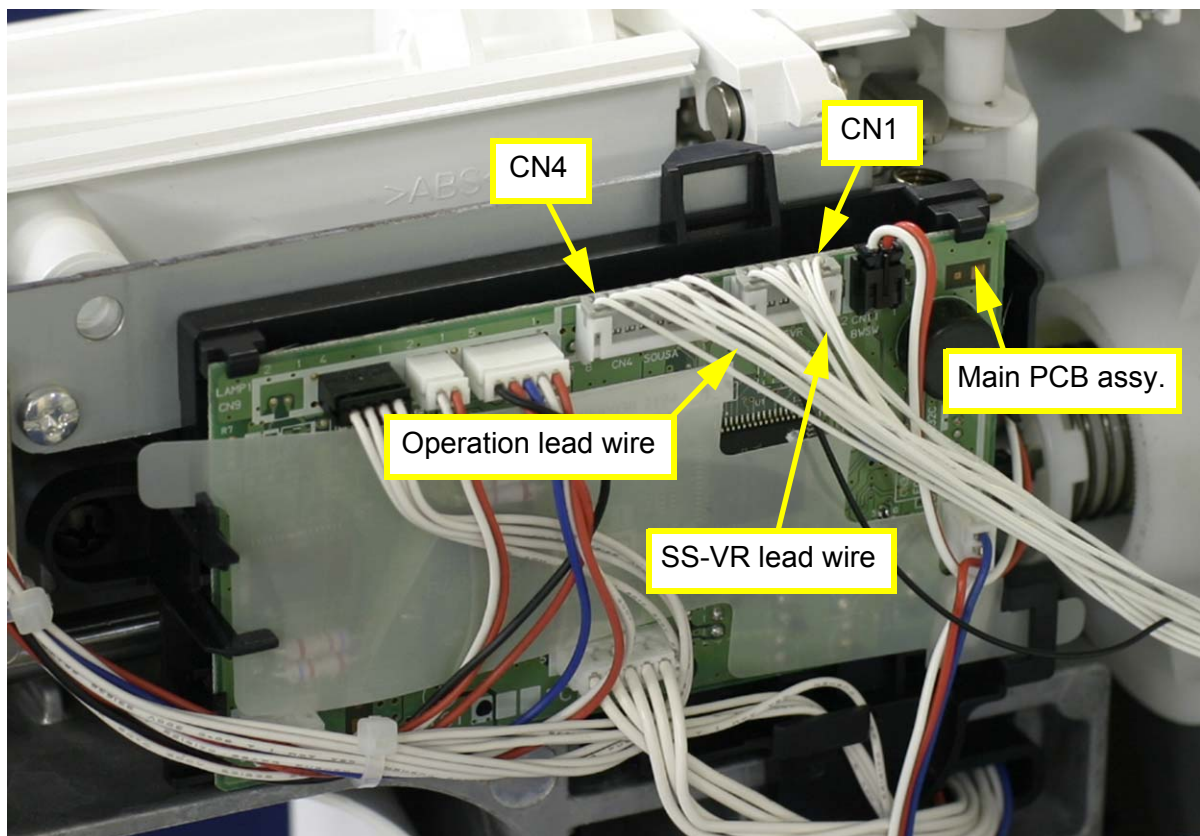
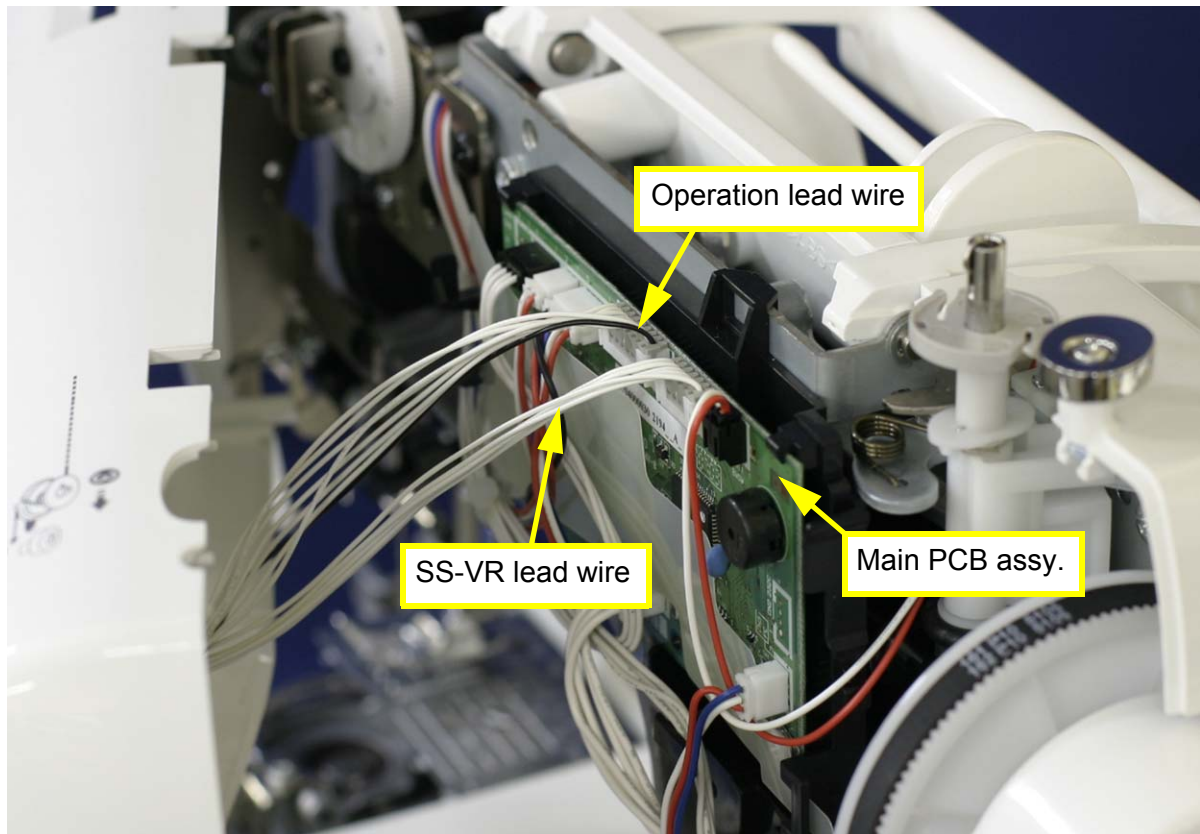
2. Wiring on inside of front cover

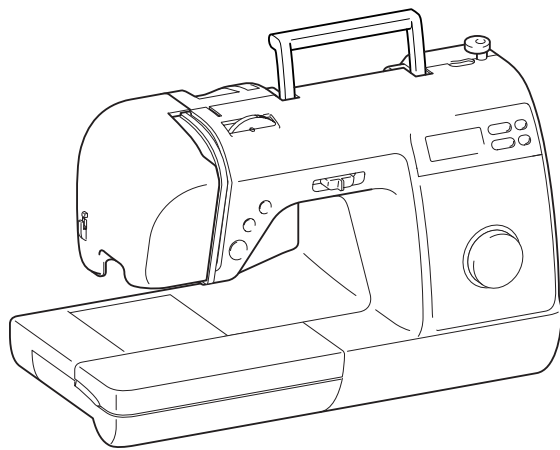


3. Wiring of SS-VR lead wire and operation lead wire



4. Assembly of front cover





NS-40/INV-30/ML-750
NS-30/NS-30LE
JS-70E/NS-20/INV-20LE/INV-20