

# Section 2.1

## Single-beam Let-off Motion

2.1.1	Electronic-control Let-off Motion .....	2.1-3
	[ 1 ] Setting of Let-off Conditions on the Function Panel .....	2.1-3
2.1.2	Negative Easing Motion.....	2.1-6
	[ 1 ] Negative Easing Motion.....	2.1-6
	[ 2 ] Height Adjustment of Back Brackets .....	2.1-8
	[ 3 ] Warp Beam Change Job .....	2.1-8
2.1.3	Positive Easing Motion .....	2.1-9
	[ 1 ] Positive Easing Motion .....	2.1-9
	[ 2 ] Height Adjustment of Back Brackets .....	2.1-12
	[ 3 ] Front-to-rear Adjustment of Back Rod Brackets.....	2.1-13
2.1.4	Setting the Let-off Tension .....	2.1-17

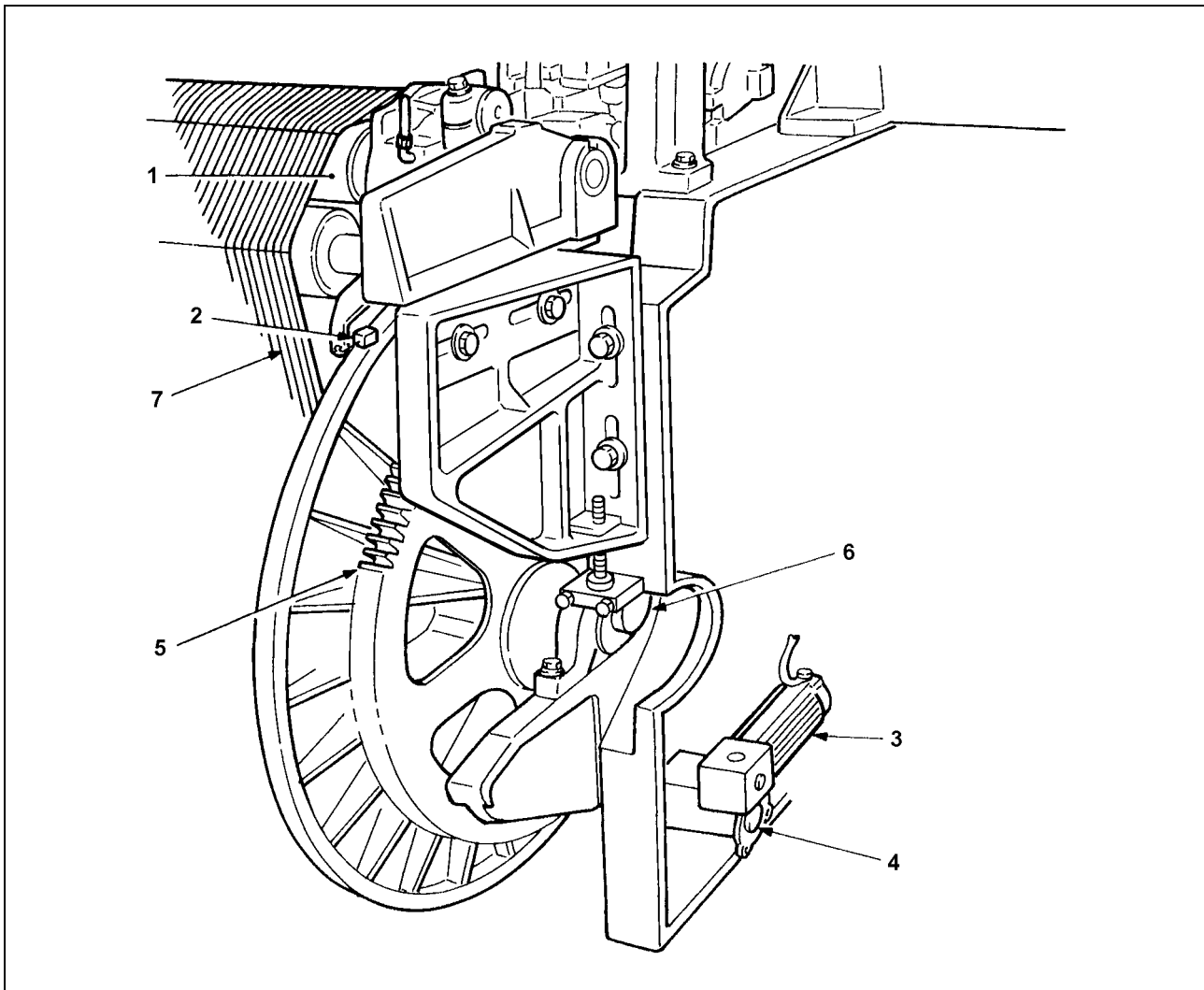
## 2. LET-OFF MOTION

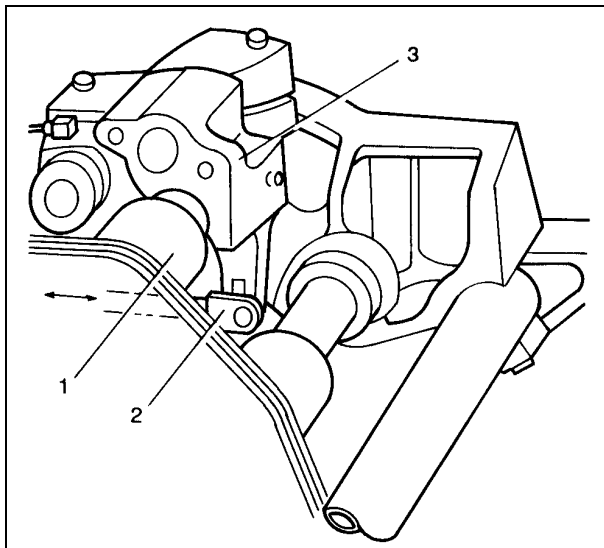
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### 2.1 Single-beam Let-off Motion

- (1) The electronic-control let-off motion detects the total warp tension applied to tension roller **1** with load cell **2** (set at the right-hand side of the machine), and then calculates the difference between the detected tension and preset tension with the computer in order to control the speed of AC servomotor **3**.
- (2) The rotation of AC servomotor **3** is transmitted via reduction gear **4** to warp beam gear **5**. Fixed to warp beam gear **5**, warp beam **6** rotates to let off warps **7**.
- (3) To alleviate variation of warp tension resulting from shed opening and closing, negative easing motion (standard) and positive easing motion (air bag) are available.

**REFERENCE:** For the instrumentation of the let-off motion, refer to Chapter 9, Subsection 9.1.3.





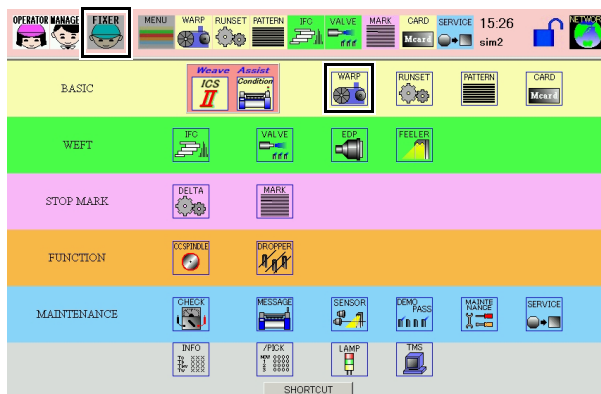
**⚠ CAUTION**

NEVER reach out towards tension roller 1, easing rods 2, and easing levers 3 while the machine is in operation.

Easing levers 3, which support tension roller 1 at both ends, swing as easing rods 2 move towards the front and rear of the machine.

**2.1.1 Electronic-control Let-off Motion**

**[ 1 ] Setting of Let-off Conditions on the Function Panel**



To enter various let-off conditions via the function panel, touch the [ WARP ] switch (shown at left) on the upper menu in the FIXER mode to call up the screen (target entry screen) shown at left bottom.

After completion of data entry, touch the [ ENTER ] switch located in the right bottom corner of the screen.

If the “Normally processed” appears, the data entry has been completed.

Unless you press the [ ENTER ] switch, the newly entered data will not be established.

**REFERENCE:** At the start of new fabric weaving, you may set each of the weaving conditions. If you use the initial condition setting [ ICS ] switch and enter the weaving conditions (yarn density and type), then the ICS function automatically transfers the optimum parameters to each motion or unit. For the [ ICS ] switch, see Chapter 5, Section 5.1 “Weft Inserting Motion”.

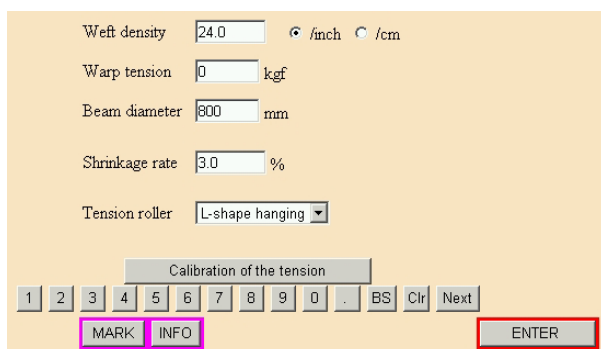
**[ 1.1 ] Setting the Weft Density**

In those machines equipped with the electronic-control take-up motion (option), you may set the weft density also on the target entry screen called up by the [ WARP ] switch.

In setting the weft density for density-switchable electronic-control take-up motion, refer to Chapter 3, Section 3.2 “Electronic-control Take-up Motion (Border Weaving Type).”

**(1) Setting procedure**

Touch the weft density  switch and then enter the desired density with the 0 through 9 switches.



## 2. LET-OFF MOTION

### (2) Weft density setting range

The table below lists the available range of weft density relative to the barrel diameter, the flange diameter, the number of teeth on beam gear, and the machine speed (rpm) of the weaving machine.

The minimum weft densities in the table below should apply to weaving with kickback operation. For weaving without kickback operation, those minimum weft densities multiplied by 0.78 may apply.

Let-off type	Standard density: From the number of picks below (min. weft density) to 240 picks per inch					Low density: From the number of picks below (min. weft density) to 100 picks per inch					
	ø800			ø914	ø1000	ø800			ø914	ø1000	
Warp beam flange dia. (mm)	ø800			ø914	ø1000	ø800			ø914	ø1000	
Barrel dia. (mm)	ø164	ø167	ø178	ø214	ø214	ø164	ø167	ø178	ø214	ø214	
No. of teeth on beam gear	120	120	120	142	142	120	120	120	142	142	
(For LW/JAT)	LW	LW	JAT	LW	LW	LW	LW	JAT	LW	LW	
Machine speed (rpm)	650	30 or over	30 or over	30 or over	30 or over	34 or over	11 or over	11 or over	9 or over	8 or over	11 or over
	700	30 or over	30 or over	30 or over	30 or over	34 or over	12 or over	12 or over	10 or over	9 or over	12 or over
	750	32 or over	31 or over	30 or over	30 or over	36 or over	13 or over	12 or over	11 or over	10 or over	13 or over
	800	34 or over	33 or over	30 or over	30 or over	38 or over	13 or over	13 or over	11 or over	10 or over	13 or over
	850	36 or over	34 or over	30 or over	30 or over	40 or over	14 or over	14 or over	12 or over	11 or over	14 or over
	900	38 or over	36 or over	32 or over	30 or over	42 or over	15 or over	15 or over	12 or over	11 or over	15 or over
	950	39 or over	38 or over	33 or over	30 or over	44 or over	16 or over	15 or over	13 or over	12 or over	15 or over
1000	41 or over	40 or over	35 or over	30 or over	46 or over	16 or over	16 or over	14 or over	12 or over	16 or over	

Weft density:   /inch  /cm  
 Warp tension:  kgf  
 Beam diameter:  mm  
 Shrinkage rate:  %  
 Tension roller:

Calibration of the tension

### (3) Inch/cm selection

You may select the indication unit of the weft density-- /inch or  /cm, by touching the preceding the desired unit .

## [ 1.2 ] Setting the Warp Tension

### (1) Setting procedure

Touch the warp tension  switch and then enter the desired value with the 0 through 9 switches.

### (2) Warp tension setting range

The table below lists the setting range of warp tension for filament yarns.

Let-off type		R/S (cm)	Tension setting range (kgf)
Negative easing	Low-density	Less than R/S230	10 to 150
	Standard-density		30 to 350
	High tension		30 to 500
Positive easing	Standard-density	Less than R/S230	30 to 350
	High tension		30 to 500
	Ultrahigh tension	Less than R/S230 R/S280	30 to 800 30 to 1000

### (3) Calculating the warp tension

The warp tension value can be calculated with the following formulas:

TE: Warp tension (kgf) = (9.8 N)

W: Total number of warp yarns

D: Yarn number count (Denier)

■ **Filament yarn** 
$$TE = \frac{W \times D \times \text{coefficient}}{10^3}$$

Warp type	Coefficient
Nylon	0.20 to 0.40
Polyester	0.20 to 0.30

The coefficient varies with the warp yarn type and treatment method.

### [ 1.3 ] Setting the Beam Diameter

Touch the beam diameter  switch and then enter the outer diameter of the selected warp beam with the 0 through 9 switches.

### [ 1.4 ] Setting the Shrinkage Rate

Not required for machines equipped with the mechanical take-up motion.

### [ 1.5 ] Setting the Weft and Warp Correction Values

Use the [ MARK ] switch for setting the weft and warp correction values.

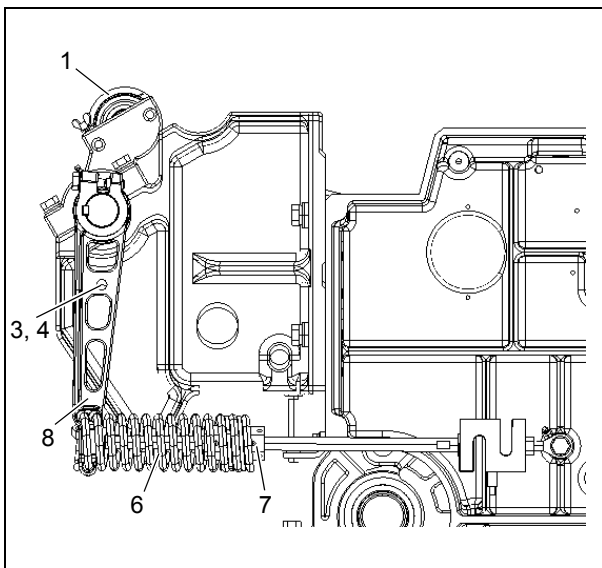
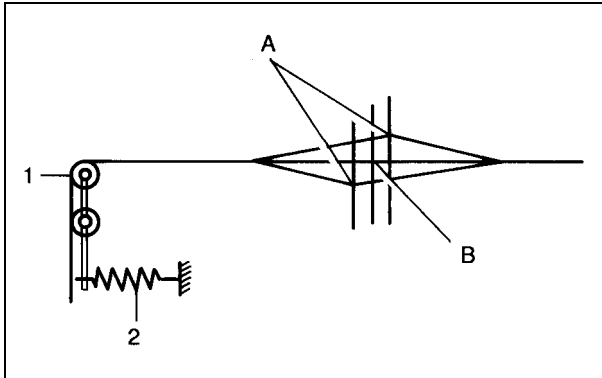
This function should be used if a stop mark is found. For the setting procedure, refer to Section 2.2 "Stop Mark Preventions".

## 2. LET-OFF MOTION

### 2.1.2 Negative Easing Motion

#### [ 1 ] Negative Easing Motion

The difference in warp tension between shed opening **A** and shed closing **B** is corrected by negatively moving tension roller **1** by means of tensioning and relaxing spring **2**.



Adjust the tension lever according to the steps below.

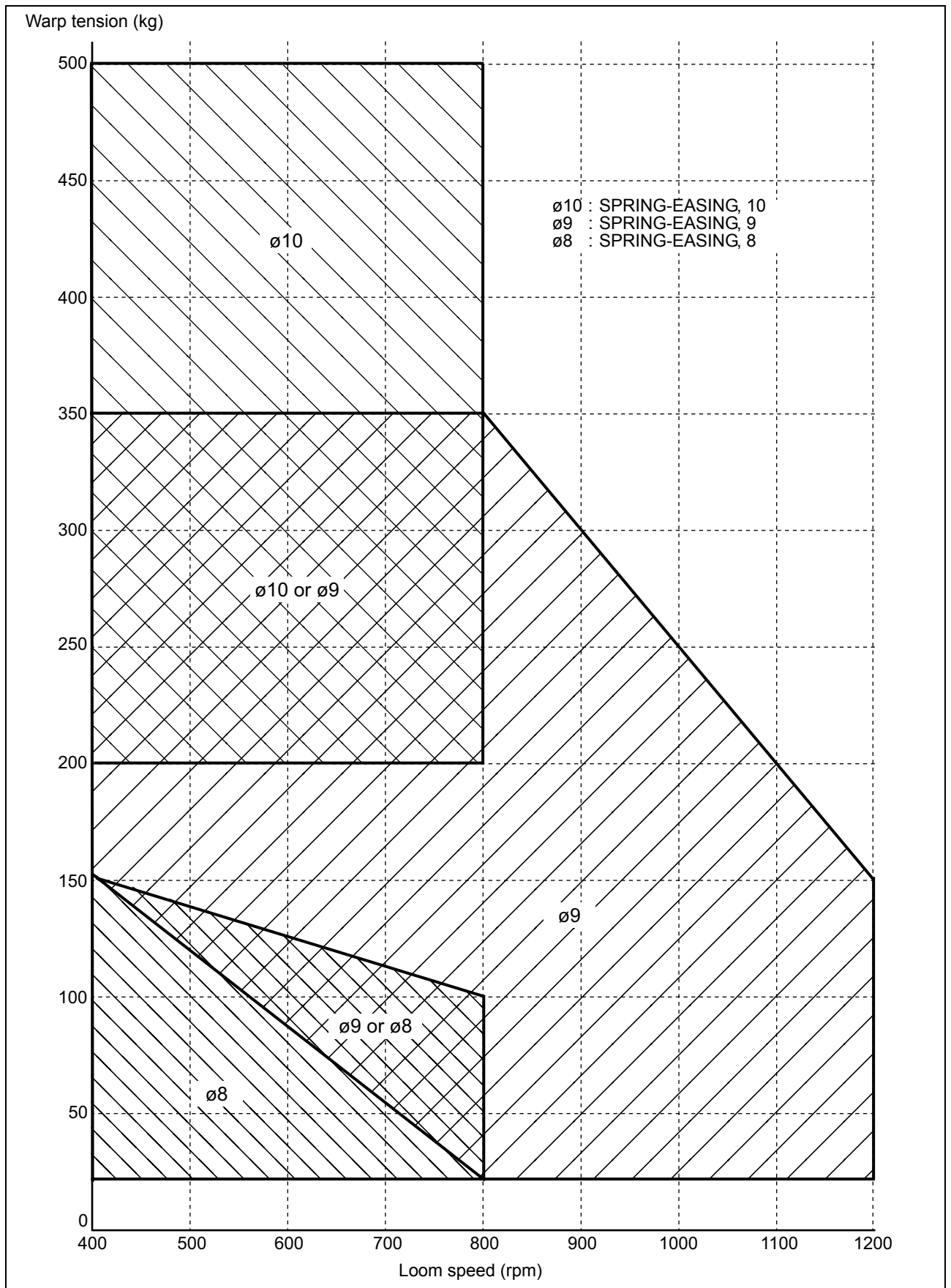
- (1) Release the load of tension roller **1**.  
Turn spring adjustment nut **7** so that hole **3** provided in tension lever **8** comes aligned with hole provided in back bracket **4**.
- (2) Apply warp tension onto the tension roller.
- (3) Run the machine and check that tension lever **8** operates when it becomes almost perpendicular.
- (4) The follower capability of tension roller **1** is determined by the effective number of turns ( $N_a$ ) on buffer spring **6** and the wire diameter. Generally, the effective number of turns on buffer spring **6** has the following tendency. While checking the weaving conditions and fabric quality, determine it.

Smallest	[Effective number of turns, $N_a$ ]	Largest
←		→
3 turns		9 turns
Small	← Shed size →	Large
High	← Warp tension →	Low
High	← Machine speed →	Low

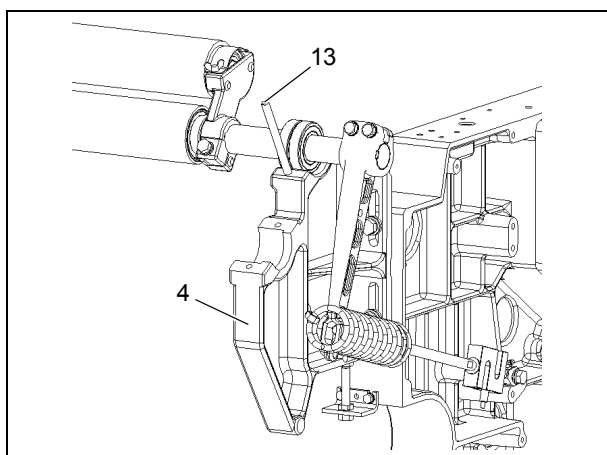
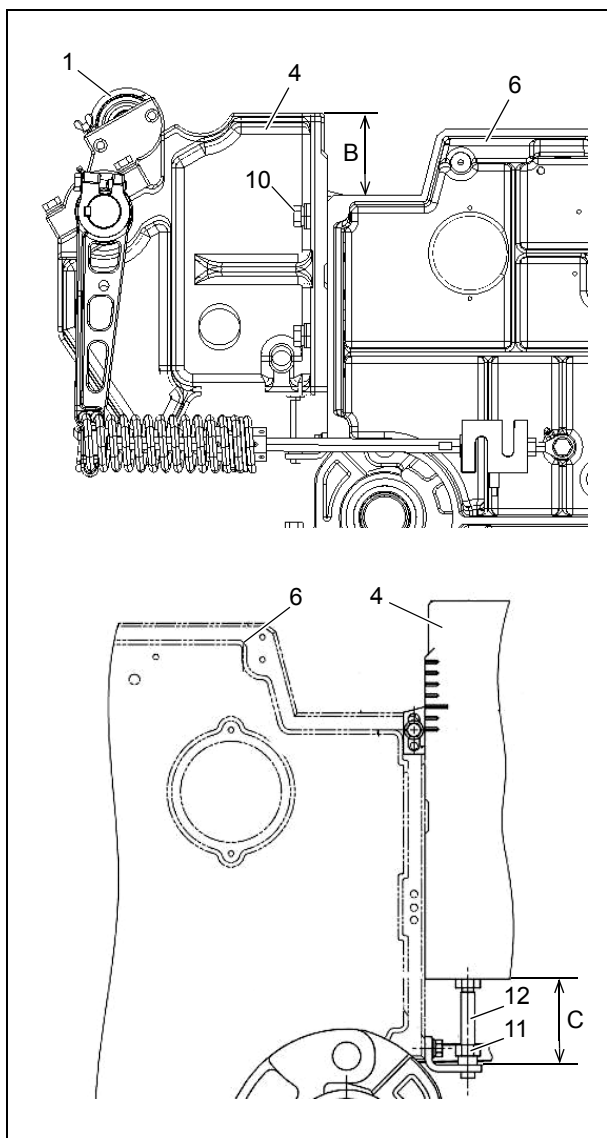
The easing spring is provided in the three following types:

- SPRING-EASING, 8....ø8 (Wire diameter)
- SPRING-EASING, 9....ø9 (Wire diameter)
- SPRING-EASING, 10...ø10 (Wire diameter)

■ Adaptable range of easing spring



## 2. LET-OFF MOTION



### [ 2 ] Height Adjustment of Back Brackets

The table below lists the standard heights of the back brackets.

Fabric texture	Graduation on the back bracket
Plain weave ( $\frac{1}{1}$ ) Twill ( $\frac{2}{2}$ )	0
Twill ( $\frac{1}{2}$ , $\frac{1}{3}$ , $\frac{1}{4}$ )	-2
Satin ( $\frac{1}{4}$ )	-4
Dobby	0

#### Reference dimensions

Tension roller diameter	Dimension B	Dimension C
ø102	93.5	70.5
ø89	100	77

Adjust the heights of the back brackets according to the steps given below.

- (1) Loosen bolts **10** which secure back brackets **4** to frame **9**.
- (2) Loosen nuts **11** for back brackets on both sides and turn adjusting bolt **12** to adjust the dial position on back bracket **4** (to be selected according to the table above). Make alternate adjustment on the left and right sides.
- (3) Put levels on the top and middle of tension roller **1** and check that the tension roller is level.  
If it is not level, go back to step (2) and adjust the height of the RH back bracket again. (The height of the LH back bracket should be a reference position.)

### [ 3 ] Warp Beam Change Job

When replacing a warp beam, put the back roller on the mount provided at the top of back bracket **4** and lock it with stopper pin **13**.



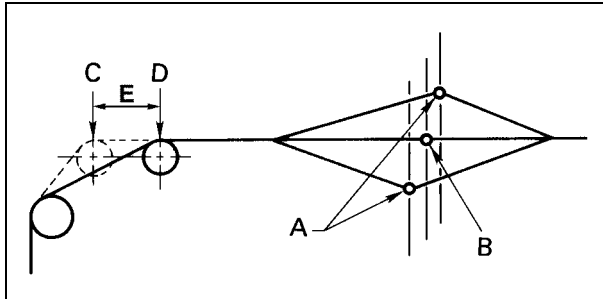
#### ⚠ CAUTION

Always lock the back roller by inserting stopper pin **13** (J8203-01010-\*\*) into a hole in the back bracket in order to prevent the back roller from falling.



### 2.1.3 Positive Easing Motion

#### [ 1 ] Positive Easing Motion



(1) The positive easing motion corrects the warp tension difference caused at shed opening **A** and closing **B**, by positively moving the tension roller.

**C**: Tension roller position at shed closing (Easing timing)

**D**: Tension roller position at shed opening

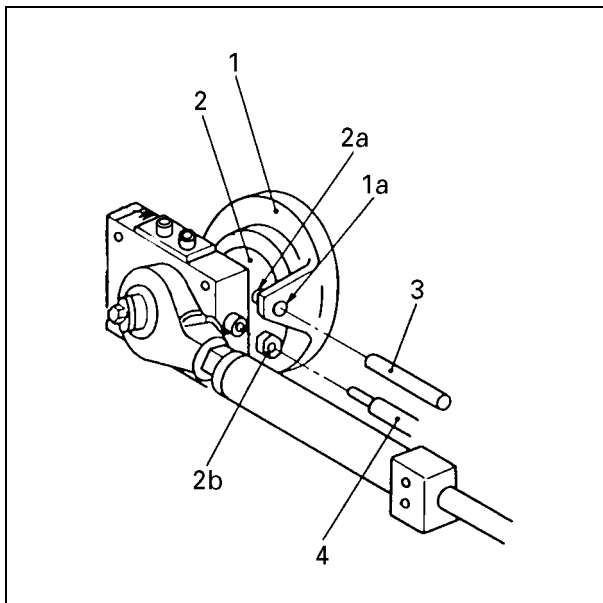
**E**: Easing amount

(2) The table below lists the standard easing timings according to the fabric texture, shed close timing, and shed size.

	Items	Cam shedding motion (cams for filament)		Crank shedding motion (for filament)	Dobby (for filament)	
Filament warp	Shed size (crank angle)	24°		Dial position 3 (24°)	24°	
	Shed close timing	Plain weave	Twill weave	350°	350°	
		350°	350°			
	Easing amount	Scale mark 3	Scale mark 1	Scale mark 3	Plain weave: Scale mark 3	Twill or satin weave: Scale mark 1
Easing timing	350°	350°	350°	350°		

**REFERENCE:** If the heald deflection is great or the easing effect is hard to be obtained, advance the standard timing and opening timing apart from the easing timing.

#### [ 1.1 ] Adjusting the Easing Timing



(1) Stop the weaving machine. Be sure to lock the machine with the emergency stop button except for jobs requiring manual rotation with the hand wheel tool.

**REFERENCE:** If the emergency stop button is locked, pressing the RELEASE BRAKE switch cannot turn off the main brake.

(2) Rotate the machine by hand and align gauge hole **1a** of cap **1** with gauge hole **2a** of bracket **2**.

(3) Insert stopper pin **3** (J8203-01010-00 which is set on the back bracket) into the holes aligned in step (2), simultaneously on each of the right and left sides.

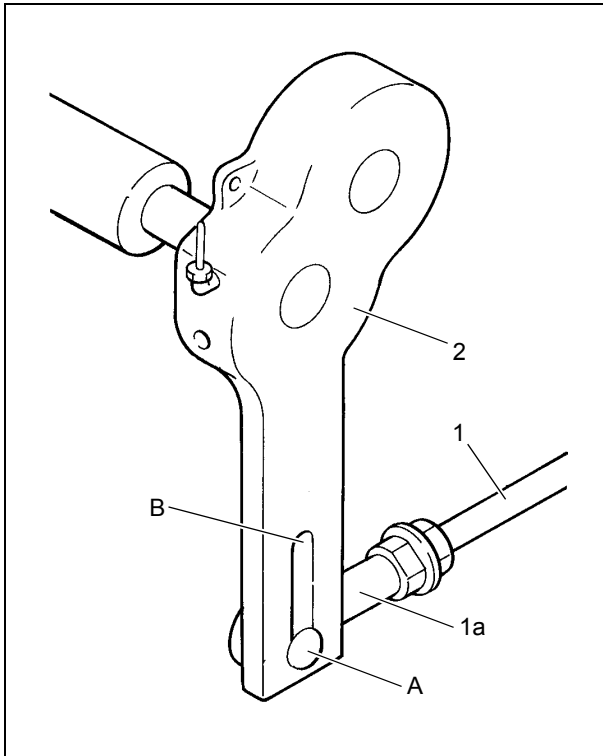
(4) Loosen fixing bolt **2b** of bracket **2** on each of the right and left sides, with tool **4** (J8203-02010-00).

(5) Rotate the machine to set the desired crank angle according to the easing timing list shown on the previous page.

(6) Tighten fixing bolt **2b** of bracket **2** on each of the right and left sides, with tool **4**.

(7) Pull out stopper pin **3** which was inserted in step (3) on each of the right and left sides, then reposition them to the back bracket.

## 2. LET-OFF MOTION



### [ 1.2 ] Adjusting the Easing Amount

The table below lists the standard easing amount and the easing rod mounting position (scale division for indicator setting shown on the next page) according to the fabric texture and shedding angle.

Shedding angle	Fabric texture		
	Plain weave		Twill or satin
	Position A	Position B	
24°	3	1	1
26°	3	1	
28°	4	2	

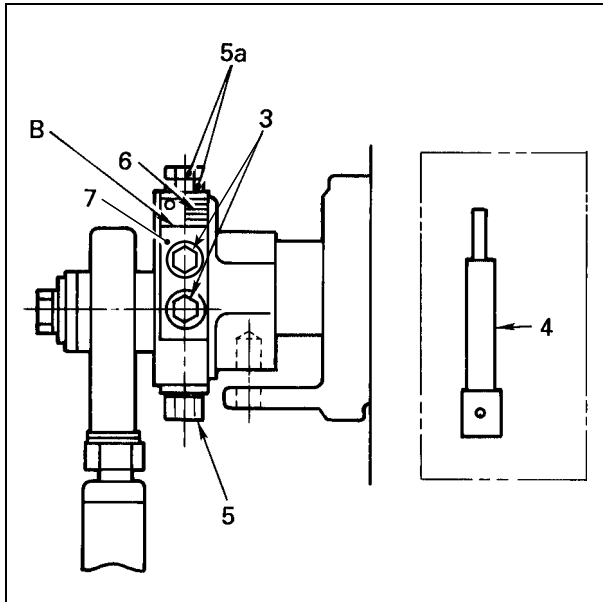
#### REFERENCE:

- If the shed opening is unclear in weaving twill or satin, increase the easing amount (taking the half of the easing amount for plain weave as a guide).
- When installing easing rod **1** into easing lever **2**, be sure to fit easing rod **1** into bottom **A** of the slot in easing lever **2**.
- For installation in the upper **B** portion of non-standard the oblong hole, see Subsection 2.1.3 “Positive Easing Motion” [ 3 ] “Front-to-rear Adjustment of Back Rod Brackets”.
- The easing amount is determined by the fabric texture and shed size. However, if the machine speed is 1000 rpm or higher, the settings listed below should be the upper limit.

Machine speed	Position A	Position B
900 to 1000 rpm	8	6
Higher than 1000 to 1100 rpm	6	4
Higher than 1100 rpm	4	2

**NOTE:** Apply grease to the joint between easing rod end **1a** and easing lever **2** as specified below.

- Lubricating intervals: Every 10 days
- Lubrication tools: Grease gun
- Lubricant: Lubricant D (Refer to Chapter M, Section M.3.)



Adjust the easing amount according to the steps given below.

**REFERENCE:** During the procedure below, never loosen double nut **5a** of adjustment bolt **5**.

- (1) Stop the weaving machine and release the warp tension.

**NOTE:** Be sure to release the warp tension; otherwise, the adjustment bolt **5** may be broken during the adjustment work below.

- (2) Except when you run the machine by hand, press the emergency stop button down until it locks itself and the machine.

- (3) Rotate the machine by hand to bring fixing bolts **3** of the easing slider to the rear of the machine.

- (4) Loosen two fixing bolts **3** on each of the right and left sides, with tool **4** (J8203-02010-00).

**NOTE:** Be sure to loosen this bolt **3** sufficiently; otherwise, the adjustment bolt **5** may be broken in step (7).

- (5) Rotate the machine by hand to bring adjustment bolt **5** to the rear of the machine.

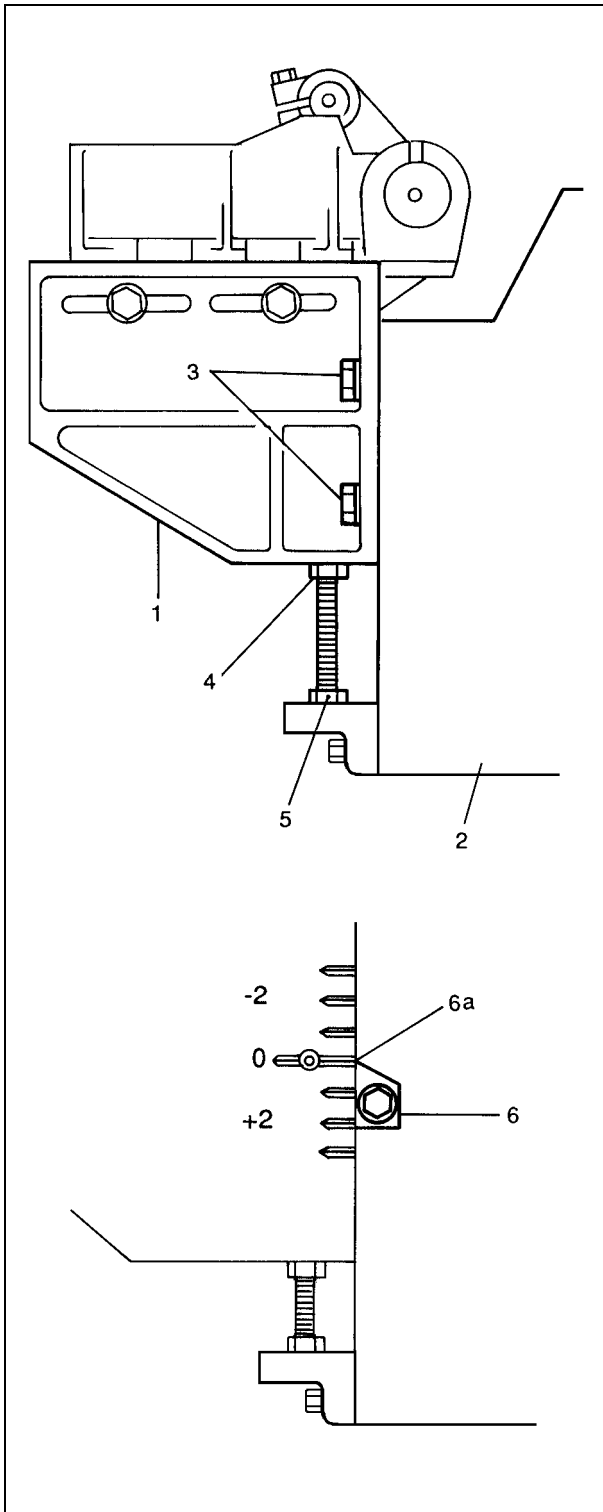
- (6) Turn adjustment bolt **5** on each of the right and left sides with tool **4** in order to set edge **B** of indicator **7** to desired scale mark **6**.

**NOTE:** Do not turn adjustment bolts **5** so much that edge **B** of indicator **7** goes out of the "scale mark 0 to 10" range. Screwed sections may freeze up.

- (7) Rotate the machine by hand to bring fixing bolts **3** to the rear of the machine.

- (8) Tighten two fixing bolts **3** on each of the right and left sides, with tool **4**.

## 2. LET-OFF MOTION



### [ 2 ] Height Adjustment of Back Brackets

The table below lists the standard heights of the back brackets.

Fabric texture	Graduation on the back bracket
Plain weave ( $\frac{1}{1}$ )	0
Twill ( $\frac{2}{2}$ )	
Twill ( $\frac{1}{2}, \frac{1}{3}$ )	-2
Satin ( $\frac{1}{4}$ )	-4
Dobby	0

Adjust the heights of the back brackets according to the steps given below.

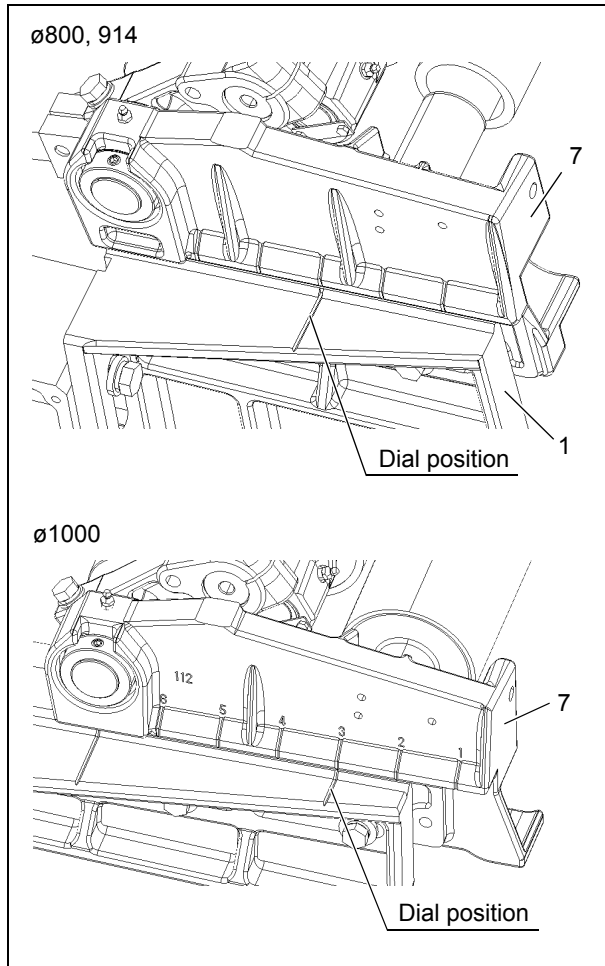
- (1) Loosen bolts **3** (which secure back bracket **1** to frame **2**) at each of the right and left sides of the machine.
- (2) Loosen nut **4** and turn adjustment bolt **5** to align the graduation on the back bracket **1** (selected according to the above table) with pointer **6a** of scale plate **6** at each of the right and left sides of the machine.
- (3) Tighten bolts **3** at each side.
- (4) Tighten nut **4** at each side.

**REFERENCE:** Make sure that the heights of the back brackets **1** are equal at the right and left sides.

**[ 3 ] Front-to-rear Adjustment of Back Rod Brackets**

The front-to-rear position of back rod brackets 7 can be adjusted at 6 stages in increments of 50 mm.

The table below lists the standard positions according to the fabric texture.



Graduation on back rod bracket					
Flange dia.	ø800 mm	ø914 mm	ø1000 mm		
R/S	Less than 230	Less than 230	Less than 230	280	
Fabric texture	Plain weave	5	5	3	4
	Twill or satin	5	5	3	4
	Dobby	5	5	3	4


**REFERENCE:** The above standard positions may change depending upon the weaving condition.

The restrictions listed in the tables below are imposed on the relationship among the front-to-rear position of back rod brackets 7, the height of back bracket 1, and the diameter of the warp beam flange. Adjust to the rear dial position for ø1000.

For the meanings of symbols , , and , see ■ “Symbols”.

Table 1. Back tension roller types: For standard and high tension

Flange dia. Scale for front-to-rear position of back rod bracket adjustment Scale for height of back bracket	ø800 mm (For LW)					ø800 mm (For JAT)					ø914 mm (For LW)					ø1000 mm (For LW)				
	2	3	4	5	6	2	3	4	5	6	2	3	4	5	6	2	3	4	5	6
+5	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
+4	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
+3	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
+2	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
+1	△	△	○	○	○	○	○	○	△	△	○	○	○	○	○	○	○	○	○	○
0	□	□	○	○	○	○	○	○	△	△	○	○	○	○	○	○	○	○	○	○
-1	△	△	○	○	○	○	○	○	△	△	○	○	○	○	○	○	○	○	○	○
-2	△	△	○	○	○	○	○	○	△	△	○	○	○	○	○	○	○	○	○	○
-3	△	△	○	○	○	○	○	○	△	△	○	○	○	○	○	○	○	○	○	○
-4	△	△	○	○	○	○	○	○	△	△	○	○	○	○	○	○	○	○	○	○
-5	△	△	○	○	○	○	○	○	△	△	○	○	○	○	○	○	○	○	○	○

 : Scale for horizontal warp.

## 2. LET-OFF MOTION

Table 2. Back tension roller type: Ultrahigh tension

Flange dia. Scale for front-to-rear position of back rod bracket adjustment Scale for height of back bracket	ø800 mm (For LW)					ø800 mm (For JAT)					ø914 mm (For LW)					ø1000 mm (For LW)				
	2	3	4	5	6	2	3	4	5	6	2	3	4	5	6	2	3	4	5	6
+5	/	○	○	○	○	/	○	○	△	△	/	○	○	○	○	/	○	○	○	/
+4	/	○	○	○	○	/	○	○	△	△	/	/	○	○	○	/	○	○	○	/
+3	/	○	○	○	○	/	△	○	△	△	/	/	/	○	○	/	/	○	○	/
+2	/	○	○	○	○	/	△	△	△	△	/	/	/	○	○	/	/	○	○	/
+1	/	○	○	○	○	/	/	△	△	/	/	/	/	○	○	/	/	○	○	/
0	/	○	○	○	○	/	○	△	○	/	/	○	○	○	○	/	○	○	○	/
-1	/	/	/	○	○	/	/	/	○	/	/	/	/	○	○	/	○	○	○	/
-2	/	/	/	/	○	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
-3	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
-4	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
-5	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/

□ : Scale for horizontal warp.

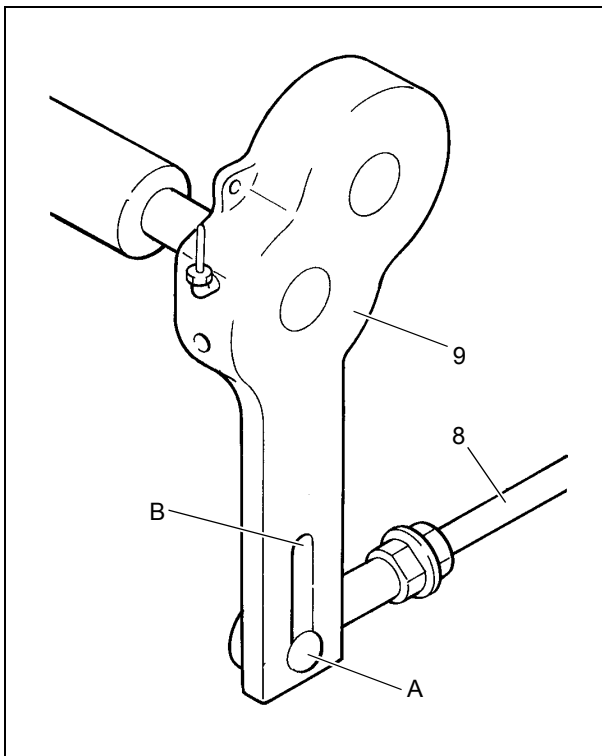
### ■ Symbols

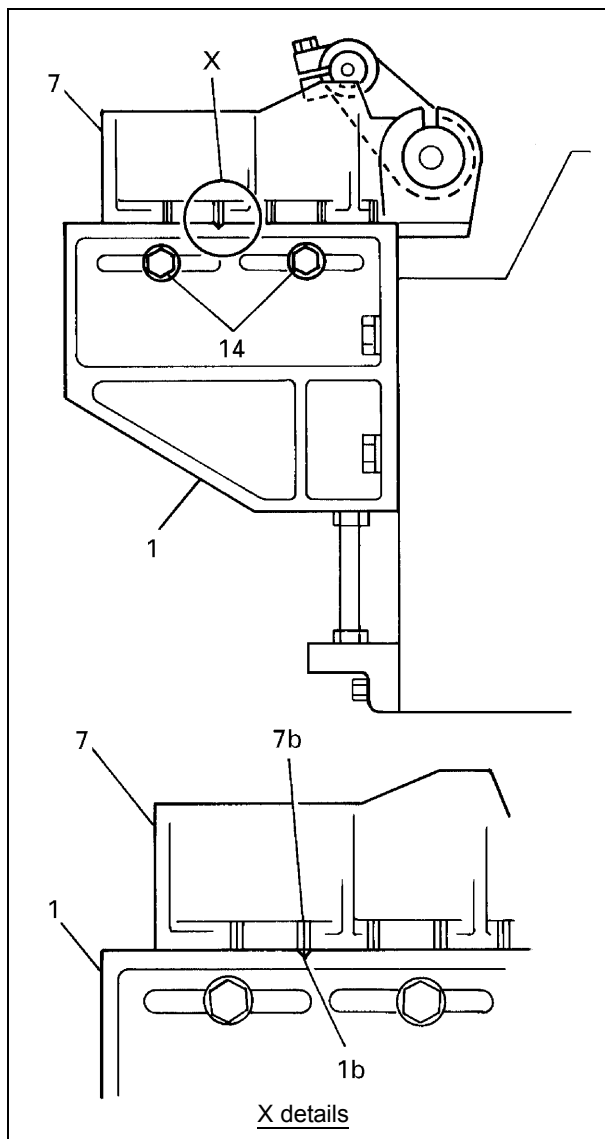
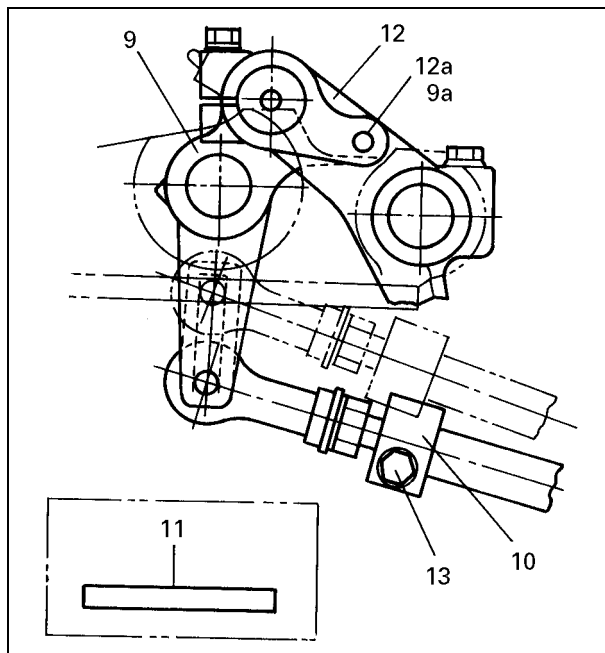
○ : Easing rod 8 should be fitted into bottom A of the slot provided in easing lever 9.

△ : Easing rod 8 should be fitted up to top B of the slot provided in easing lever 9.

**NOTE:** In this case, decrease the easing amount by 2 from the scale division numbers listed in [ 2 ].

/ : No combination allowed.



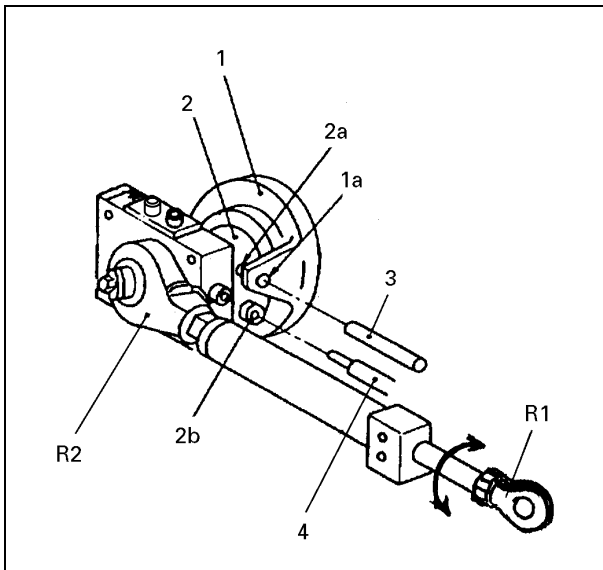


Adjust the front-to-rear position of the back rod brackets according to the steps given below.

- (1) If warps have been loaded on the machine, slack them until no warp tension is applied onto the tension roller.
- (2) Press the emergency stop button down until it locks itself and the machine, except for jobs requiring manual rotation.  
When moving the back rod brackets to the rear, slacken the tension gage cord and lubrication pipes beforehand.
- (3) Loosen tightening bolt **13** on each of the right and left easing rod cases **10**.
- (4) Move easing lever **9** to align its pin hole **9a** with pin hole **12a** provided in tension upper lever **12**, then insert stop pin **11** (J8203-01010-\*\*) into those holes at both right and left sides.
- (5) Loosen bolts **14** (which secure back rod bracket **7** to back bracket **1**) at each of the right and left sides.
- (6) Move the back rod bracket **7** to align its scale **7b** with reference mark **1b** provided on back bracket **1** at both right and left sides.  
For the mounting restrictions, refer to the table listed in [ 2 ].
- (7) Tighten bolts **14** loosened in step (5).
- (8) Rotate the machine by hand to set the crank angle to the value (Easing timing angle  $-95^\circ$ ).  
If the easing timing angle is  $350^\circ$ , for example, set  $255^\circ$  ( $350^\circ - 95^\circ$ ).
- (9) Support easing rod case **10** (loosened in step (3)) and easing rod end **R2** so that they are not at an angle relative to the mounting face, and then tighten bolt **13** on each of the right and left easing rod cases **10**.
- (10) Pull out both stop pins **11** inserted in step (5), then return them into the tool box.

## 2. LET-OFF MOTION

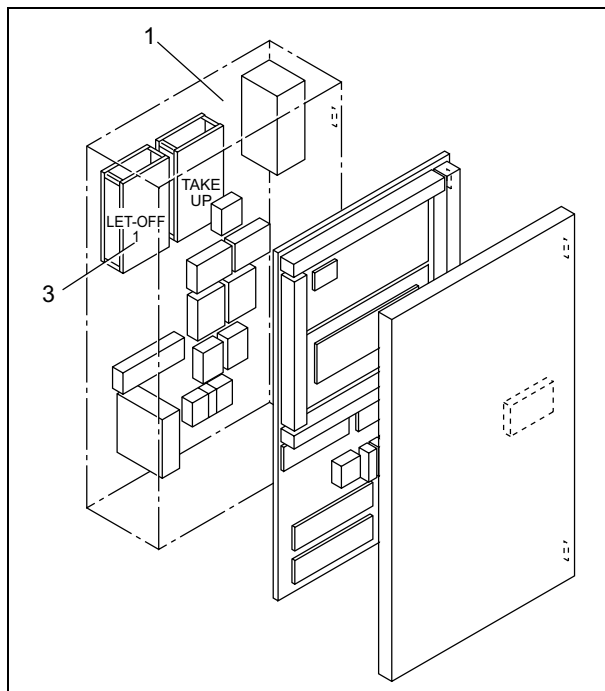
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### NOTE:

- Rod ends **R1** and **R2** (spherical bearings) provided at both ends of the easing rod should easily (but slightly) swivel in the direction of rotation even after any adjustments. If they do not swivel easily or they have frozen up, abnormal heat or wear will result soon. Check the movement of the rod ends when the machine is placed at the forward end and backward end (at the easing timing).
- When installing a new easing rod, rotate the spherical section of its rod ends 90° and apply grease (Lubricant D) to the entire surface of the spherical section beforehand.

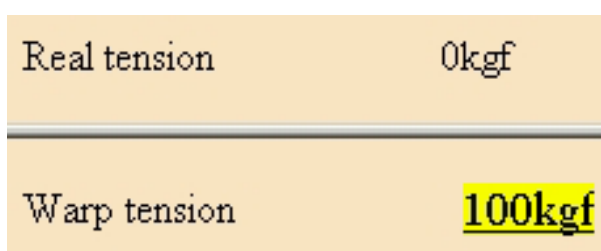
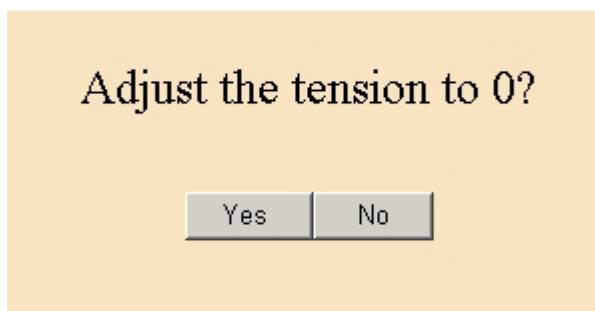
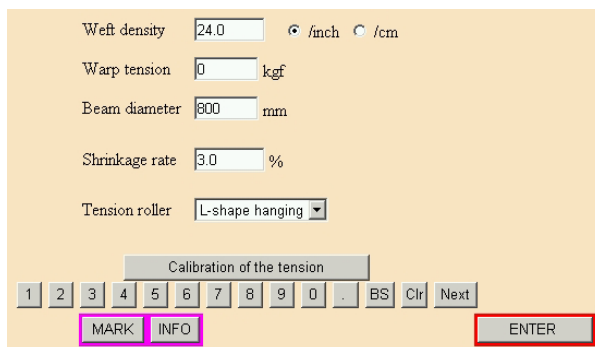




### 2.1.4 Setting the Let-off Tension

In any of the following cases, set the basic let-off tension according to the let-off tension calibration and zero adjustment procedure.

- When [ WARP TENSION CALUBRATION NECESSARY ] or [ INITIALIZE SET VALUES ] appears on the function panel.
- When the RAM is cleared.
- When a new machine is installed.
- When the let-off servo amplifier board is replaced with a new one.
- When the warp is loosened so that the actual tension becomes within the range from -2 to +2.
- When the warp beam is replaced.



#### ■ Let-off tension calibration and zero adjustment

- (1) If warps have been loaded on the machine, slack them until no warp tension is applied onto the tension roller.
- (2) Touch “Warp tension” on the [ FIXER ] – [ WARP ] screen on the function panel.
- (3) “Adjust the tension to 0?” appears. Touch [ Yes ].  
Tension adjustment and zero adjustment are completed now. The display automatically returns to the [ FIXER ] – [ WARP ] screen.
- (4) Touch [ OPERATOR ] – [ TENSION ] on the function panel to display the screen shown at left, then check that the “Real tension” shows -2 to 2 kg.  
If the “Real tension” is outside of -2 to +2 kg, repeat from step (2).

