

Instruction Manual
for
Auto-Laminator MACH-610i



Hakuto **Hakuto Co., Ltd.**

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Section I

Installation Procedure

(1) Unpacking

Remove the top cover (vinyl) and other accessories.

(2) Transit

1. Carry the machine to the installation site by a fork-lift.
2. Use four (4) leveling bolts.

Note: Screw them so that their height is shorter than casters' height.

3. Lower the machine quietly, and land it at the installation site.
4. Determine an installation position while moving the machine.

Notes: 1. Do not move the machine at the places on the floor where level differences are seen. (Otherwise, the casters may be damaged.)

2. When pushing the main unit by hands, push its frame instead of the laminating block or the conveyors.

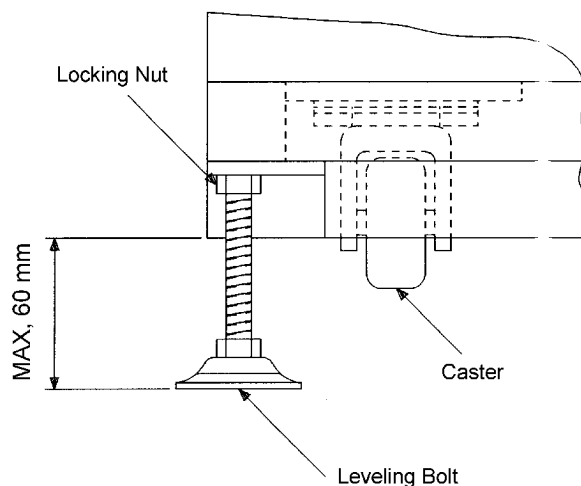
(3) Installation

1. Adjust the height of the leveling bolts using locking nuts.

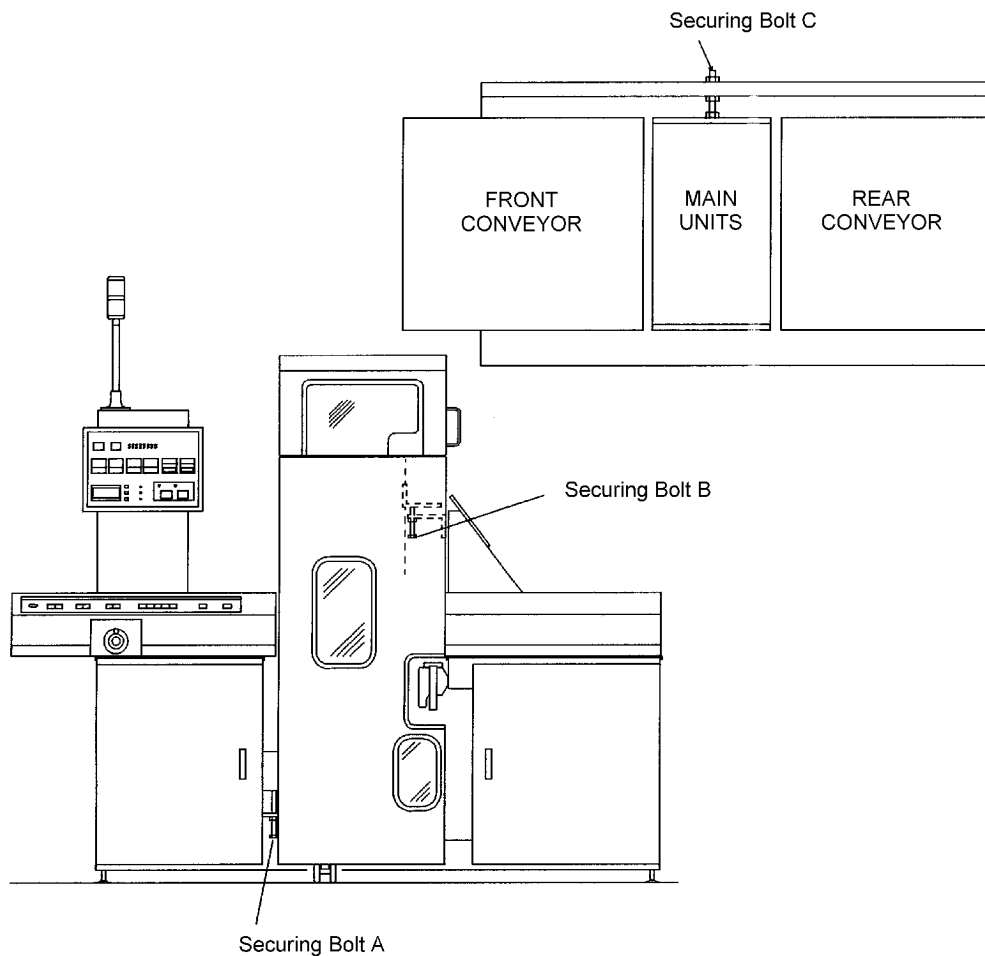
Note: Set max. 60 mm for the height of the leveling bolts. If you wish to make it higher, place four (4) spacers under each of them.

2. Adjust the level.

Put the level on the base (stainless plate) of the front or rear conveyor or the conveyor roll, and adjust it with the leveling bolts.

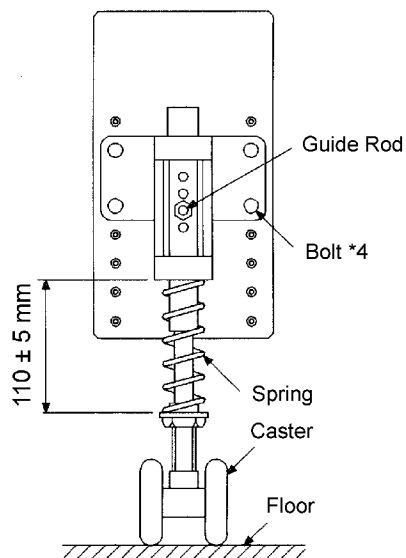


- Remove the fixing strings and the securing bolts.



Loosen the securing bolts and remove. Also, remove the strings fixing the laminating block.

- After the level adjustment, adjust the length of the spring shown below indicating the auxiliary caster to 110 ± 5 mm.



(4) Wiring and Piping

1. Power wiring

Lower terminals in the control box

- Notes:
1. Check whether power is 3, 200V, and 50/60Hz.
 2. If you rotate the vacuum pump in the direction opposite to the arrow indicated in its rear, replace the power wiring by hands.
 3. Ground the lower terminals.

2. Duct piping

Join the duct in the rear of the laminating clock ($\phi 150$ mm) to the plant's main duct with a duct.

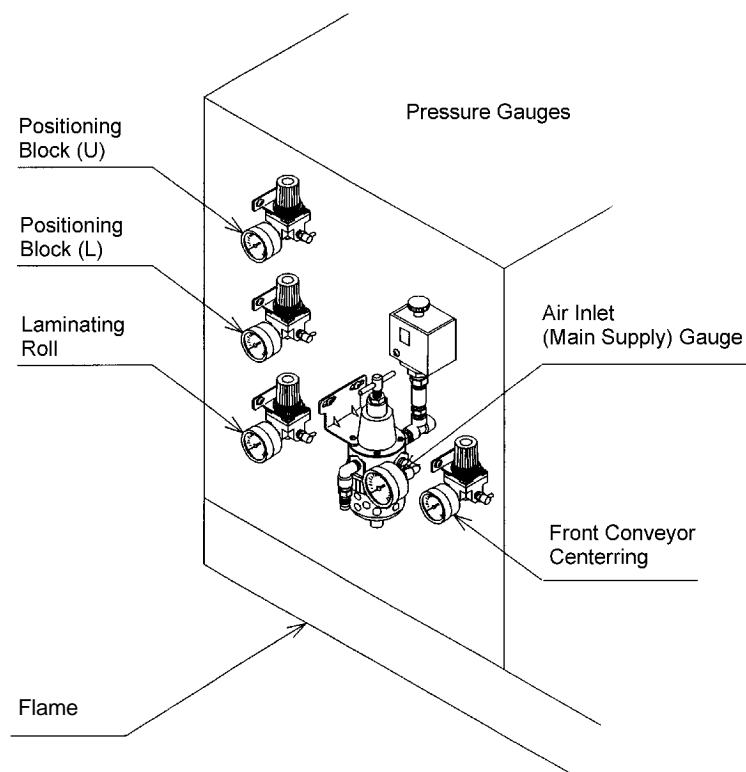
3. Air piping 5Kg/cm² (The value is checked at the main air valve using the air inlet main supply gauge shown below.) The air pressure applied to the four (4) air joints in the front conveyor and the lower door are checked.

4. Fault check

- 1) A check on whether the main unit can be smoothly pulled in and out
- 2) A check on whether the cutter edge can travel in the cutter back-up slot
- 3) A check on whether the screws are not loosened in the mechanical block and electrical block
- 4) A check on whether any damages, foreign objects, rust are found in each block

5. Trial operation

Operate each block in manual mode while referring to the instruction manual to perform fault check.



Section II

Specifications

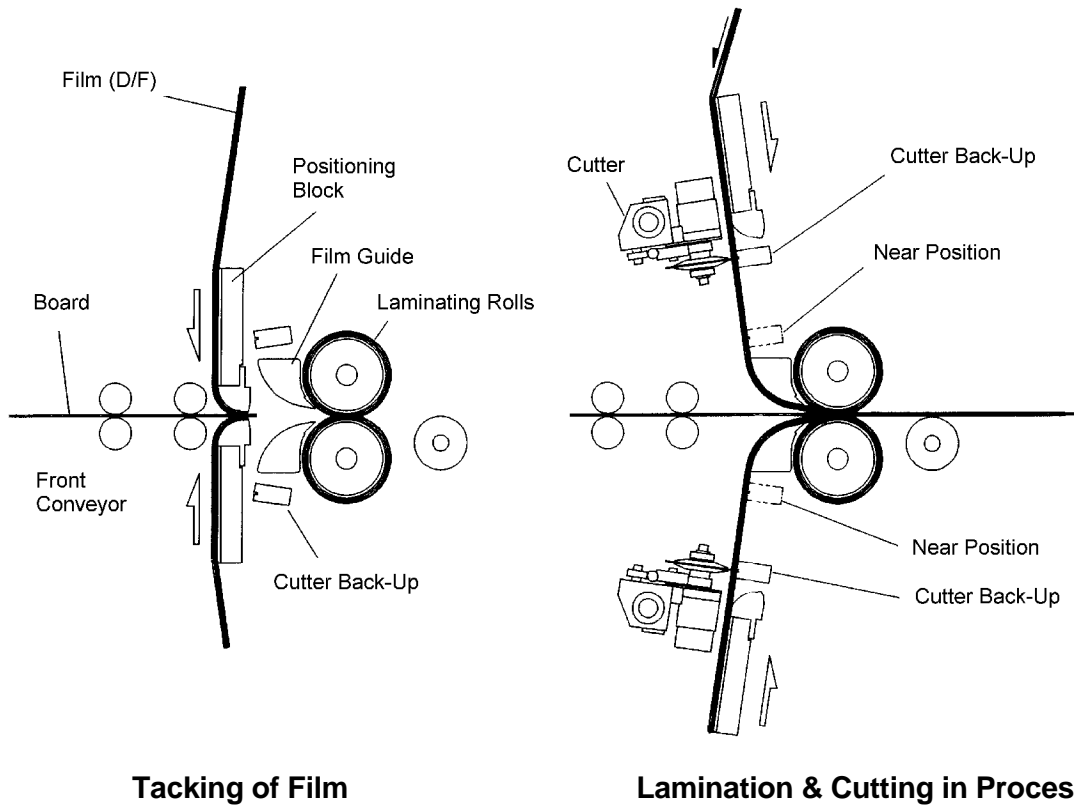
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(7) Electric Control	
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(8) Frame, Cover	

<1> Overview

(1) How MACH-610i Works

This machine is designed to automatically thermo-laminate photosensitive dryfilms to the specified part of one side or both sides of a board. It works in the following manner.



1. The board stops at the film tacking position.
2. The tacking plate and block go up to do the film tacking.
3. The film is laminated to the board with the laminating rolls.
4. The cutter goes down together with the tacking block in synchronization with the film feeding speed to cut the film to the specified length.
5. The tacking block stops at the lower position.

The machine repeats the above operation. The mechanism below the board and the mechanism above the board are symmetrical.

(2) Features of MACH-610i

1) No useless part of the film

With the existing hand laminator, a film is continuously laminated to the board and then cut, thus producing an extra amount of film in the feeding direction. With this machine, a film is cut just to the required length and then laminated, thus producing no extra amount of the film.

2) Labor saving

When laminating, the hand laminator requires two or three people.

But, this machine requires only one person when an auto-loader and a preheater are used. And, it can further reduce it to 0.5 person when an auto-unloader is additionally used.

3) Easy preparation

A newly developed film roll unit (D/F) makes the film replacement a lot easier. Also, the laminating block can be pulled out, making the preparation for the film spacing easier. They reduce the replacement time to below half of that for the hand laminator, leading to a great productivity improvement.

4) Films held by a vacuum

During film stacking and cutting, the film is held by a vacuum. And, it holds the protected side of the film to prevent the guiding rolls from touching the lamination surface, and thus no dust adheres to it. Also, four (4) vacuum widths are available for the film widths. The hand valve (optional) make it five (5).

5) Rotary film cutter

A circular rotary film cutter is used. The film cutting by it is stabilized and its life is much longer than the traditional knives.

6) Increased power of the laminating rolls

The diameters of the rolls and the cylinder are enlarged to increase the pressure distribution and laminating pressure, providing a stronger adhesion between the resist and board. This is particularly effective to the formation of fine patterns.

7) Increased spacing precision for dry films

The sequencers used only for the front and rear spacings and the feeding speed detection sensors (two (2) rotary encoders) are mounted to improve the front and rear space control precision.

- 8) Top cover as a standard for the main unit, and easy operation

The top cover improves its safety and dustproof. Control switches are located at the front of the front conveyor to make operation easier. Also, the digital display panel is used.

- 9) Smooth centering for the board on the front conveyor

The photoelectric switch of the detection sensor for the front conveyor board ensures the smooth centering for it.

- 10) Elimination of static electricity of the board

The electric conductivity resin rollers ensure the elimination of static electricity of the board before and after the film lamination.

- 11) Easy maintenance

The laminating block can be easily pulled out of the main unit for easy maintenance.

(3) Structure of MACH-610i

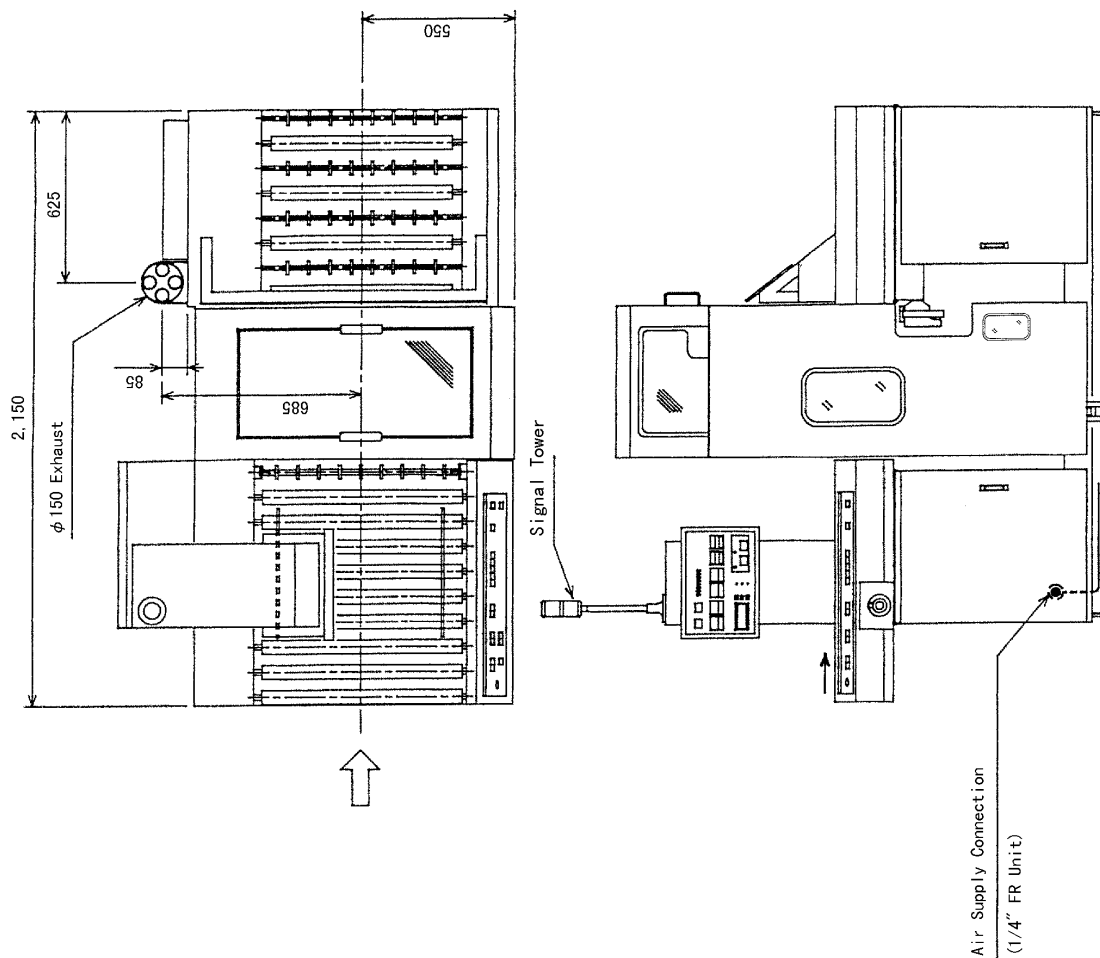
This machine consists of the following main elements:

1	Front conveyor	Board feeding, positioning, elimination of static electricity
2	Laminating block	Film feeding, cutting, tacking, thermal laminating
3	Rear conveyor	Board feeding, elimination of static electricity
4	Vacuum system	Film holding
5	Pneumatic system	Air cylinders driven in each block
6	Exhaust duct	Vacuum pump, blower, thermal lamination gas exhaust
7	Electric control	Operator panel, control board, sensors, wiring
8	Frame, cover	

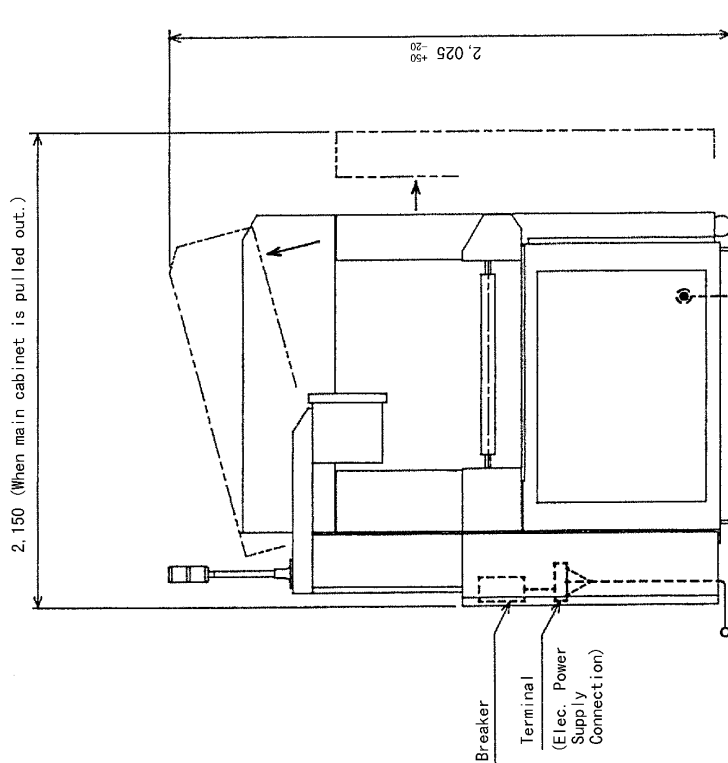
(4) Power and Weight

1	Power	220 V, 50/60 Hz, 9 Kw
2	Main air valve	5 Kg/cm ² , 15 L/min
3	Exhaust duct	9.5 m ³ /min, φ150 mm
4	Weight	1.2 t

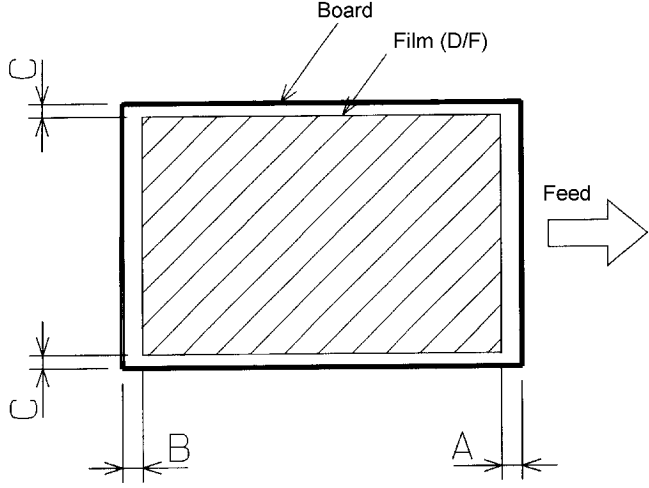
(5) MACH-610i Dimensions



Elec. Power Supply	φ3, 200 V/220 V, 9 Kw
Air Supply	5 kgf/cm ² 15 L/min.
Exhaust	φ150 mm 9.5 m ³ /min.



<2> Processing Capability

1	Board size	Max. 640 mm wide x 610 mm long Min. 330 mm wide x 250 mm long (If the hand valve is mounted, 250 mm wide (optional) is also possible.)
2	Board thickness	0.2 mm to 6.0 mm (Its both sides are copper foiled.) (0.15 mm to 2.00 mm: an option in the specifications for thin boards, Both sides of a thin board are copper foiled.)
3	Processing speed (when 1.3 sec is required for tacking)	230 boards/hr (board length: 24 inches) 287 boards/hr (board length: 18 inches) 379 boards/hr (board length: 12 inches)
4	Conveyor speed	1.0 mm to 4.0 mm/min (variable) prefer speed for lamination: 2.0 to 3.0 m/min
5	Photosensitive dry film (D/F)	Width: 330 mm to 610 mm (250 mm wide is optional.) Max. roll outside diameter: 160 mm Bobbin diameter: 76.2 mm (3") and (Inside diameter of core) 152.4 mm (6") (optional) Film thickness: Max. 50 μ Weight: Max. 20 Kg
6	Method and precision of film lamination	 <p>A : 2 mm to 60 mm ± 1.0 mm B : 0 mm to 25 mm ± 1.0 mm Board width - Film width C : _____ mm ± 1.0 mm 2</p> <p><u>Note:</u> The above value is a mechanical precision when the external dimensions error of the board, film winding error, and film properties are not considered.</p>
7	D/F tacking	Tacking temperature: Max. 65 degrees C Tacking stop duration: Approx. 3.5 sec (for 2 sec tacking)
8	Surface temperature of laminating rolls	Room temperature to 130 degrees C with in 6 degrees C

<3> Operation and Sequence

(1) Operation of the Laminating Block (See the separate illustrations.)

1. Board feeding

Operation 1: The leading edge of the board fed by the front conveyor is detected by the sensor.

Operation 2: The pulse signals of the rotary encoder mounted to the front conveyor are counted by the sensor signals of the counter.

2. Tacking

Operation 3: The front conveyor stops at a predetermined count, and the front end of the board becomes the tacking position.

Operation 4: The upper and lower tacking plates tack the film edges to the board.

Operation 5: The film tension rollers operate to loosen the film a litter.

Operation 6: The tacking plates and the tacking block leave the board to feed it again.

3. Lamination and cutting

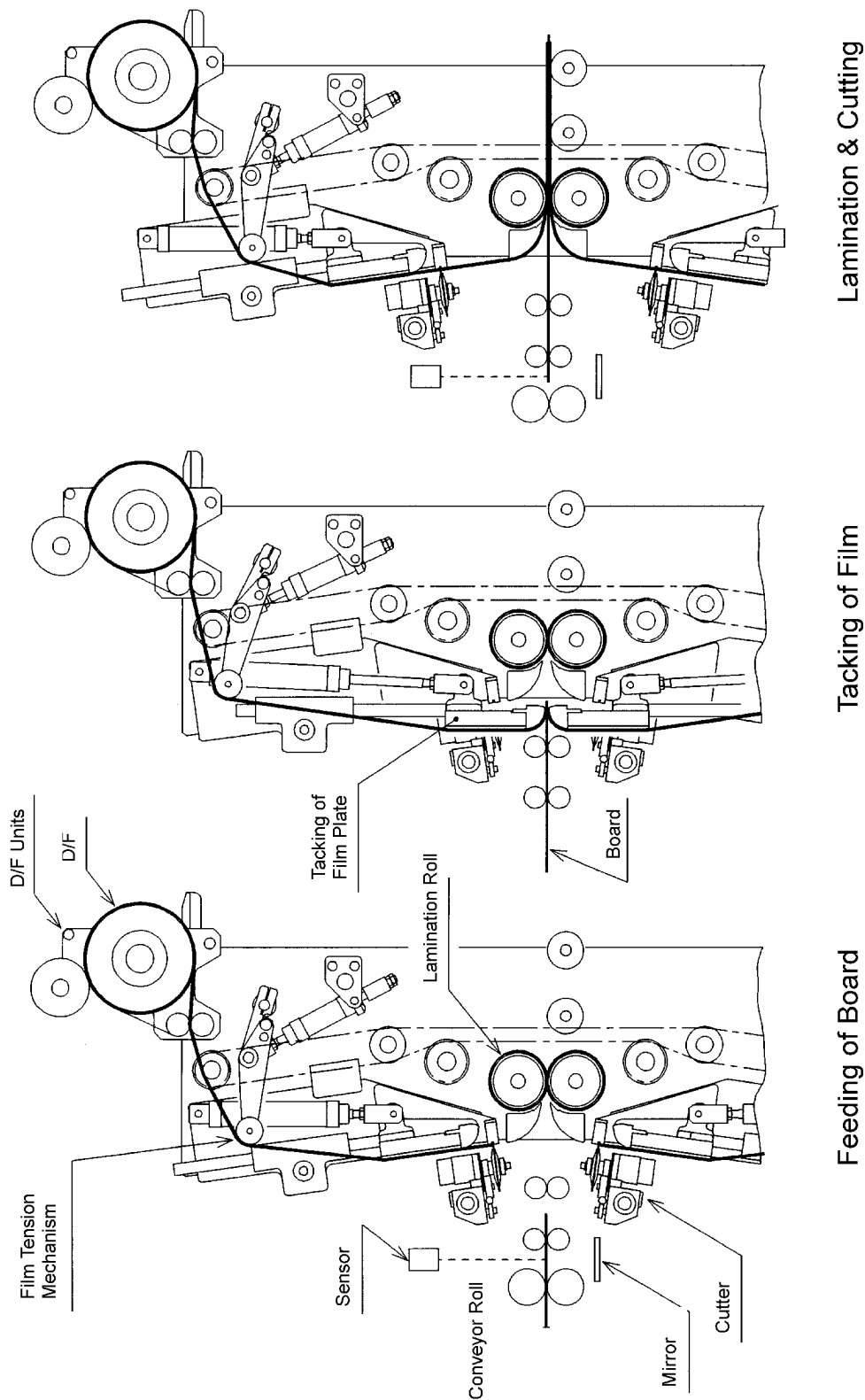
Operation 7: The laminating rolls laminate the film to the board.

Operation 8: When the sensor detects the trailing edge of the board, the counter starts counting the pulse signals of the rotary encoders mounted to another driving side of the main unit.

Operation 9: When the predetermined count has been reached, the tacking block comes near the board at a constant speed together with the film and, at the same time, the film is cut.

Operation 10: The board, the fixed part of which the film is laminated to, is fed to the next process by the rear conveyor.

Following Illustrations Give Some Brief Ideas How It Works



<4> Specifications of Each Constituting Element of MACH-610i

(1) Front Conveyor (Board centering device and thin board feeding device)

- | | | | | | | | | | | | | |
|--|--|---|--|---|---------------------------------------|---|----------------------|---|-------------------------|--------|------------------------------|--|
| 1. | Total length: | 1,015 mm
(1,065 mm when the thin board device operates) | | | | | | | | | | |
| 2. | Effective width: | 330 mm to 640 mm (If the hand valve is mounted, 250 mm wide (optional) is also possible.) | | | | | | | | | | |
| 3. | Conveyor wheels and conveyor feeding rolls: | <table border="0" style="margin-left: 20px;"> <tr> <td style="padding-right: 10px;">Axis pitch:</td> <td>90 mm (70 mm for front row)</td> </tr> <tr> <td style="padding-right: 10px;">Wheel diameter:</td> <td>φ50 mm (one (1) row)
φ30 mm for front two (2) rows</td> </tr> <tr> <td style="padding-right: 10px;">Materials of wheels:</td> <td>Urethane rubbers and electric conductivity resins</td> </tr> <tr> <td style="padding-right: 10px;">Cylinder roll diameter:</td> <td>φ50 mm</td> </tr> <tr> <td style="padding-right: 10px;">Materials of cylinder rolls:</td> <td>Five (5) urethane rubbers and four (4) electric conductivity resins.</td> </tr> </table> | Axis pitch: | 90 mm (70 mm for front row) | Wheel diameter: | φ50 mm (one (1) row)
φ30 mm for front two (2) rows | Materials of wheels: | Urethane rubbers and electric conductivity resins | Cylinder roll diameter: | φ50 mm | Materials of cylinder rolls: | Five (5) urethane rubbers and four (4) electric conductivity resins. |
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φ30 mm for front two (2) rows | | | | | | | | | | | |
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| Cylinder roll diameter: | φ50 mm | | | | | | | | | | | |
| Materials of cylinder rolls: | Five (5) urethane rubbers and four (4) electric conductivity resins. | | | | | | | | | | | |
| 4. | Driving | <table border="0" style="margin-left: 20px;"> <tr> <td>40 W 100 V Geared motor (variable speed)</td> </tr> <tr> <td>One (1) clutch for front three (3) rows</td> </tr> <tr> <td>One (1) brake for front three(3) rows</td> </tr> <tr> <td>Four (4) units of clutches and brakes combined</td> </tr> </table> | 40 W 100 V Geared motor (variable speed) | One (1) clutch for front three (3) rows | One (1) brake for front three(3) rows | Four (4) units of clutches and brakes combined | | | | | | |
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| One (1) clutch for front three (3) rows | | | | | | | | | | | | |
| One (1) brake for front three(3) rows | | | | | | | | | | | | |
| Four (4) units of clutches and brakes combined | | | | | | | | | | | | |
| 5. | Board centering stroke: | 40 mm for both ends of the board
(two (2) φ32 air cylinders for each end) | | | | | | | | | | |
| 6. | Thin board feeding stroke: | 50 mm (φ20 air cylinders) | | | | | | | | | | |
| 7. | Tacking positioning detection sensor (for front space): | <table border="0" style="margin-left: 20px;"> <tr> <td>Rotary encoder (resolution 1,000 P/R)</td> </tr> <tr> <td>24 V DC (OMRON)</td> </tr> <tr> <td>Mounting position:</td> <td>Rear frame for and entrance of the front conveyor</td> </tr> </table> | Rotary encoder (resolution 1,000 P/R) | 24 V DC (OMRON) | Mounting position: | Rear frame for and entrance of the front conveyor | | | | | | |
| Rotary encoder (resolution 1,000 P/R) | | | | | | | | | | | | |
| 24 V DC (OMRON) | | | | | | | | | | | | |
| Mounting position: | Rear frame for and entrance of the front conveyor | | | | | | | | | | | |

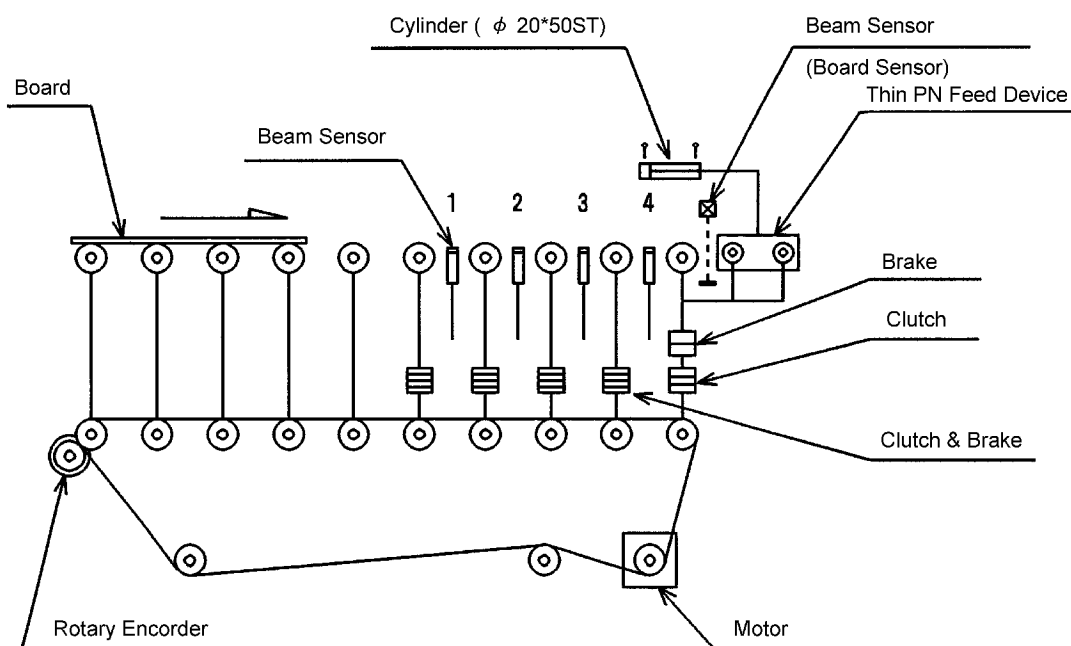
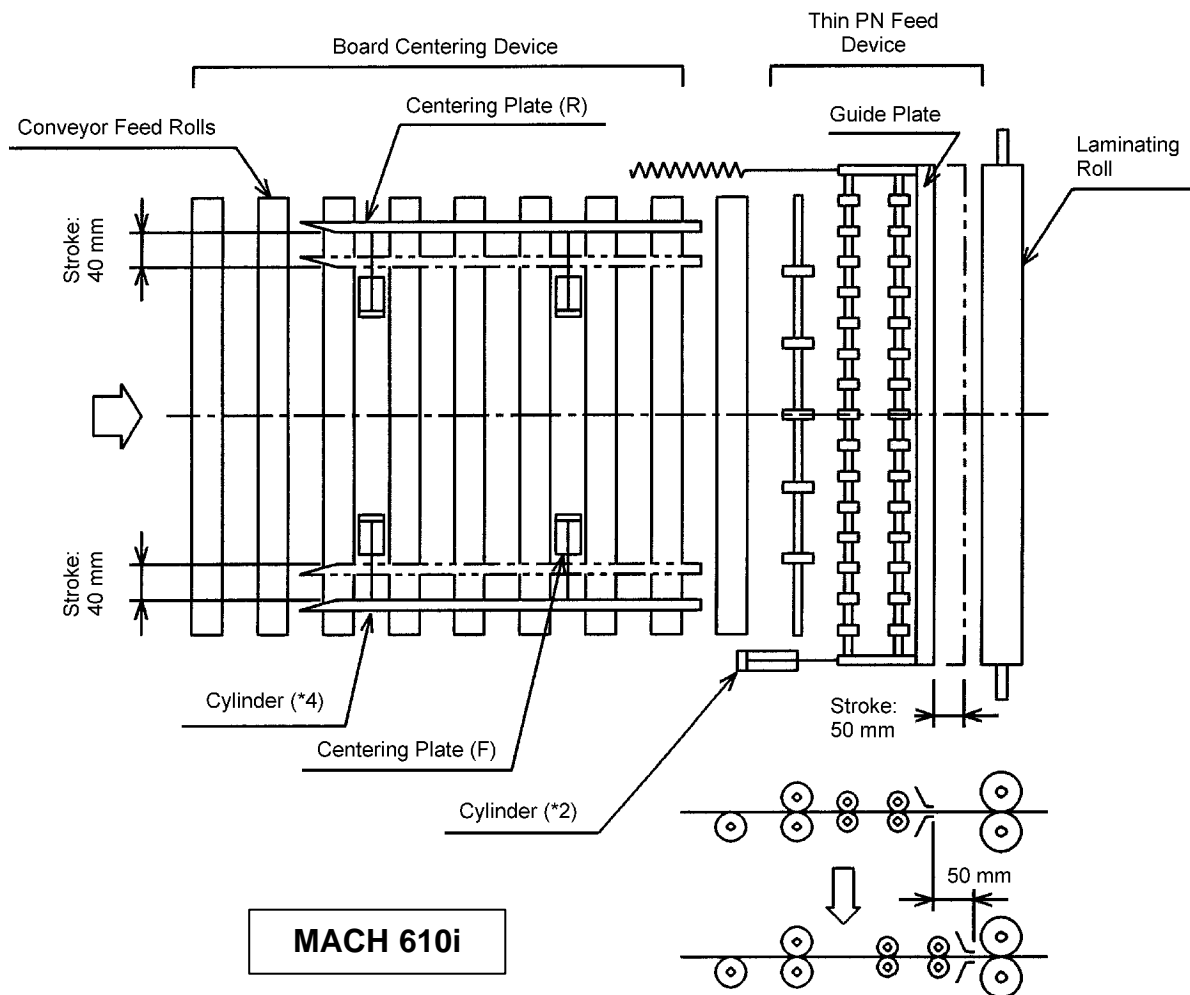
How the Front Conveyor Works (See the separate illustration.)

The front conveyor (with the board centering device) automatically does centering for the board fed by the preceding process and feeds it to the laminating block, and works in the following manner:

- 1) When sensor (2) detects the leading edge of the board, the front centering plate advances and then the rear centering plate advances a little later to do board positioning. (Spacing between the centering plates must be adjusted 0.5 mm through 1.0 mm wider than the board, since centering is done while the board is being fed.)
- 2) When the beam sensor detects the leading edge of the board after centering, the tacking counter counts the pulses of the rotary encoder. When the predetermined count is reached, the units of clutches and brakes combined work to stop and tack the board. Only the rollers which have detected the board present within the range of beam sensors (1) through (4) are stopped, and the other rollers feed the succeeding boards. Be sure to check the inter-board spacing so that the stopped board and its succeeding board do not overlap each other. (The inter-board spacing must be 20 mm or longer.)

- 3) After tacking, the conveyor restarts and the thin board feeding device is advanced by the air cylinder and, after a fixed amount of time, goes back while rotating.
- 4) When the beam sensor detects the trailing edge of the board, the tacking counter counts the pulses of the rotary encoder on the main unit driving side. When the predetermined count is reached, the tacking block comes near the board at the speed synchronized with the film feeding speed and, at the same time, the cutter cuts the film.

Board Centering & Thin PN Feed Device-OP (Front Conveyor)



(2) Laminating Block

The laminating block consists of the following elements:

1. DF unit mounting block
2. Tacking block
3. Film cutter
4. Thermal laminating rolls
5. Others: Rear conveyor, pull-out block, exhaust hood, film tension block

1	DF unit mounting block (See the separate illustration.)	<p>Specifications of D/F rolls</p> <p>Film width: Max. 610 mm</p> <p>D/F roll outside diameter: Max. 160 mm</p> <p>Core inside diameter: 76.2 mm (3")</p> <p>Number of DF units: One (1) upper DF unit, one (1) lower DF unit</p> <p>If a D/F roll has a roll outside diameter larger than the above roll outside diameter (Max. 250 mm), handle it with a dedicated unit (optional) as usual.</p>
2.1	Tacking block	<p>Tacking rubber: W4 mm × L635 mm (× 2)</p> <p>Surface temperature: Max. 65 degrees C</p> <p>Pressure: Max. 40 Kg (air pressure: 2.5 Kg/cm²)</p> <p>Heater: 100W, 27.5 V, φ 3.2 × L645 mm (effective)</p> <p>Sheathed heater (× 2)</p> <p>Pressure applied: φ 32 air cylinder (× 4)</p>
2.2	Tacking block up/down device	<p>Stroke: 70 mm (variable in the range of 60 mm through 80 mm)</p> <p>Driving: Going up: air cylinders Going down: linked with laminating rolls</p> <p>Knocking pin: for receiving reaction force of tacking (× 4) (φ 32 air cylinders)</p> <p>Up/down guide: linear bearing (× 4)</p>
3	Film cutter	<p>Round cutter: φ 64 mm × 0.8 t (× 2)</p> <p>Rotation, traveling: DC geared motor (× 2) 24 V DC, 3 W</p>
4	Thermal laminating rolls	<p>Dimension: φ 77.5 ⁺⁰/_{-0.1} ± 0.1 mm × L680 mm (× 2)</p> <p>Mandrel materials: SUS304 and SS41</p> <p>Surface temperature: Max. 130</p> <p>Pressure: Max. 218 Kg (air pressure: 5Kg/cm²)</p> <p>Heater: 1.0 Kw cartridge heater (× 2) φ 15.7 mm × L 780 mm</p> <p>Pressure applied: φ 50 mm air cylinder (× 2)</p> <p>Driving: 90 W geared motor (variable speed, with a brake) (× 1)</p>

5	Film cutting detection sensor (for rear spacing)	Rotary encoder (resolution: 1000 P/R) 24V DC Mounting position: Main unit driving motor bracket block
6	Others	Rear conveyor wheel diameter: $\phi 50 \text{ mm} \times 9 \text{ t}$ Rear conveyor wheel materials: two (2) urethane rubbers and two (2) electric conductivity MC nylons (for each row) Pull-out block: akyuraido ($\times 3$) Exhaust hood: lower part of the rear of the block (no fan) Film tension block: $\phi 25 \text{ mm}$ air cylinder ($\times 2$) (The sensors to detect the film cutting and the bad film tacking are provided.)
7	Temperature control	Temperature control: film tacking $\times 2$, laminating roll $\times 2$ Thermoregulator: digital setting, digital display, upper/lower limit alarm

(3) Rear Conveyor

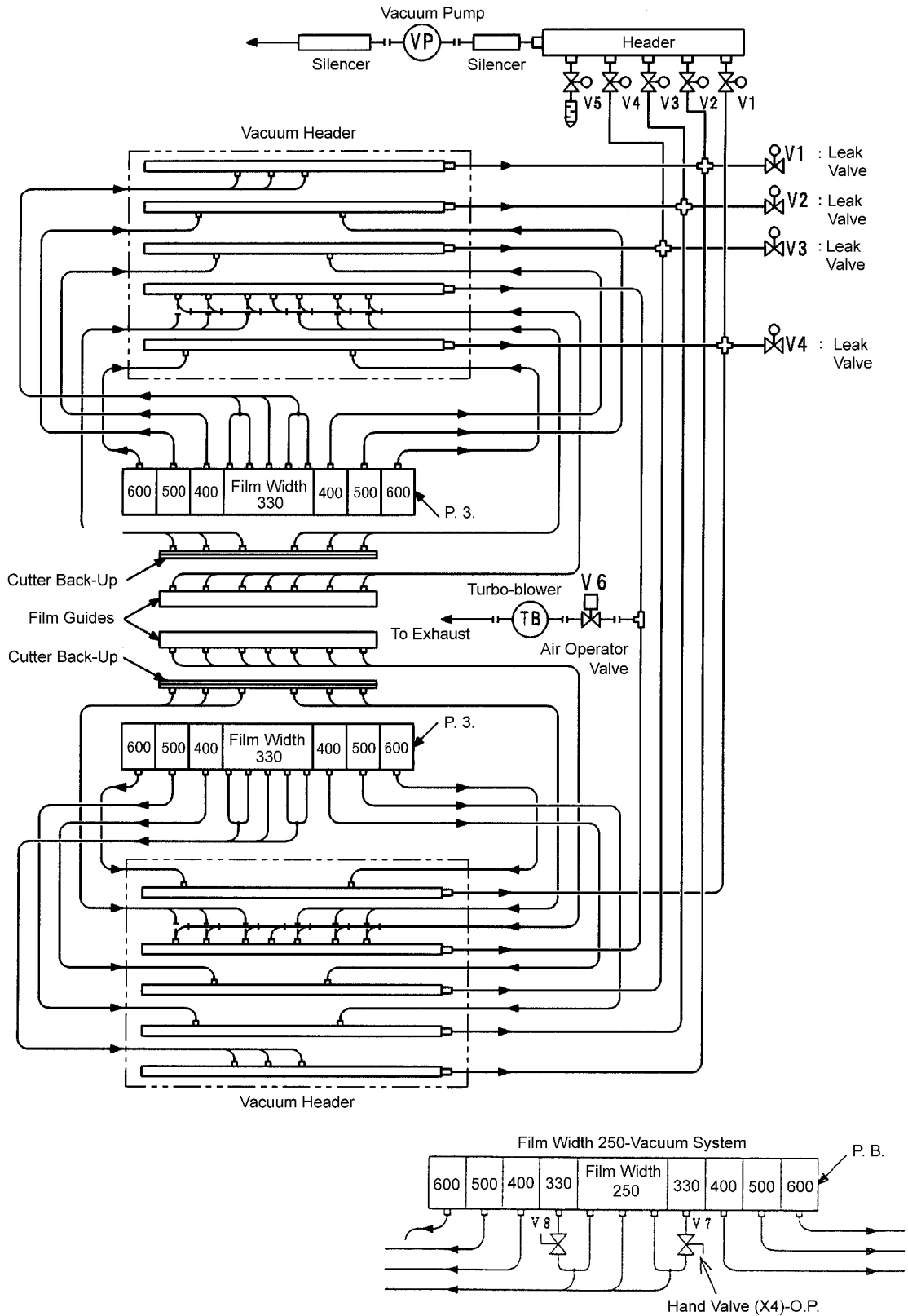
The rear conveyor is a continuously rotating roller conveyor.

1	Total length	Frame length: 770 mm
2	Effective width	700 mm
3	Conveyors and wheels	Roll axis pitch: 90 mm Roll diameter, materials: $\phi 50$ electric conductivity resin rolls (four (4) rows) Wheel diameter, materials: $\phi 50 \times 9 \text{ t}$ urethane rubbers (five (5) rows) The four (4) rolls and five (5) rubbers are arranged alternately.
4	Driving	40 W geared motor (variable speed) ($\times 1$)

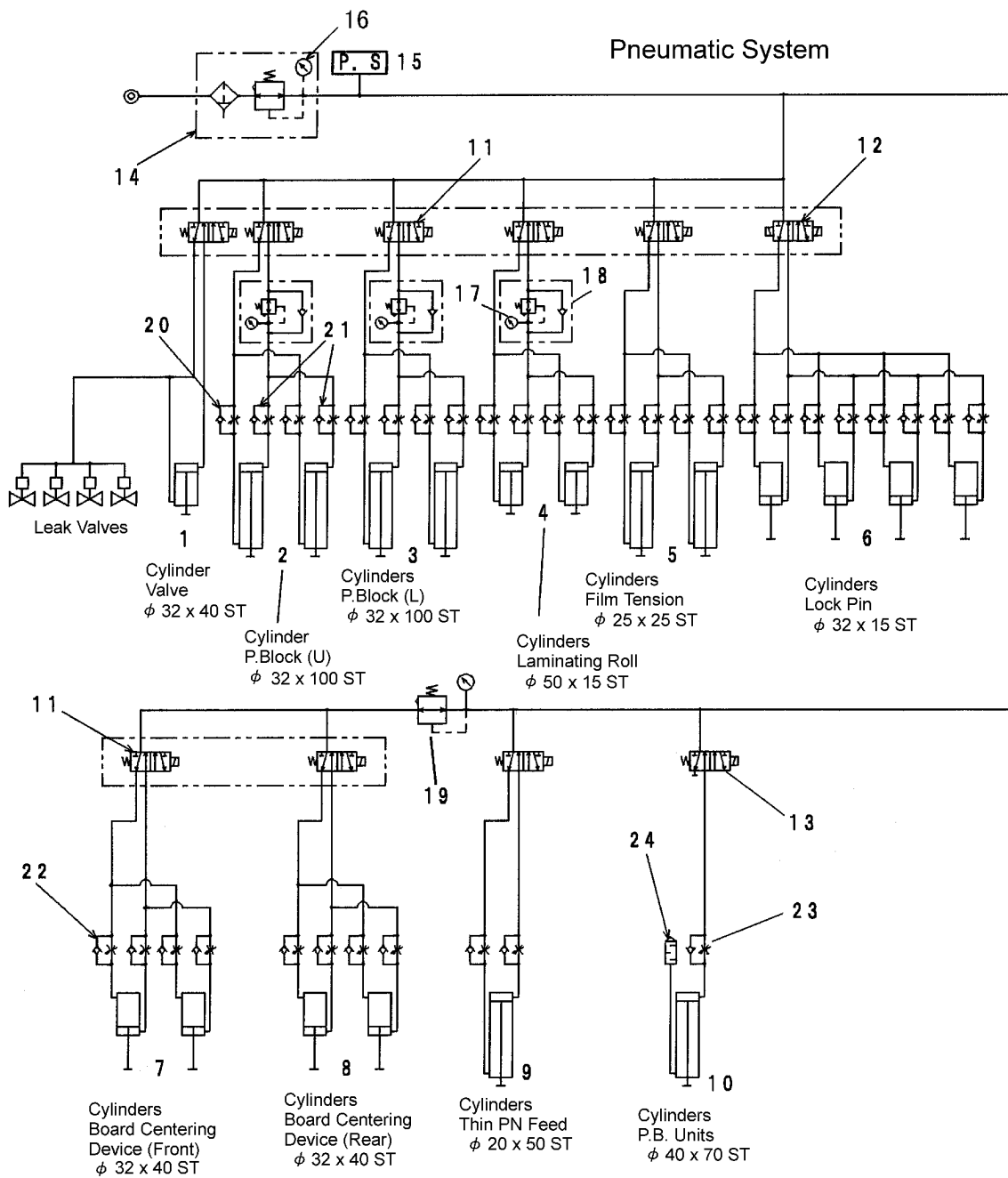
(4) Vacuum System

The vacuum system shown below is used to hold the film during the film tacking and cutting.

Vacuum System



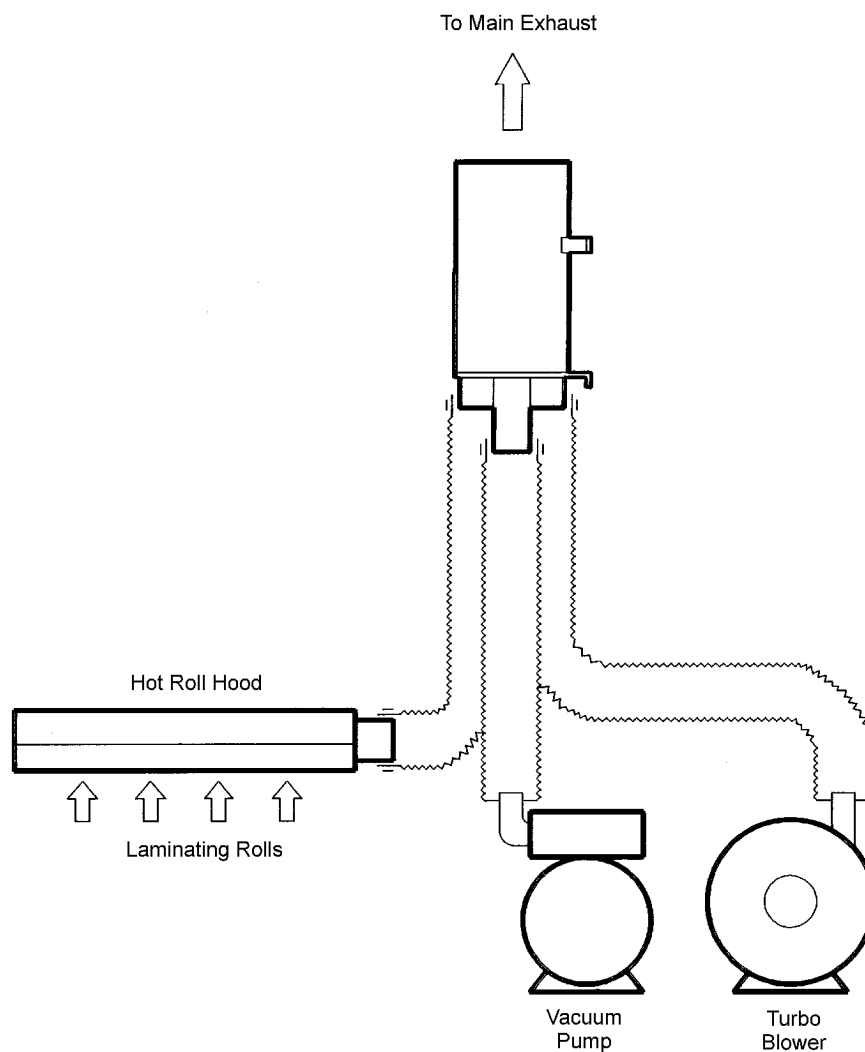
(5) Pneumatic System



- | | | | |
|----------|-----------------|---------|-------------------|
| 1-10 : | Air Cylinder | 18 : | Reverse Regulator |
| 11-13 : | Solenoid Valves | 19 : | Regulator |
| 14 : | F. R. Unit | 20-23 : | Speed controller |
| 15 : | Pressure Switch | 24 : | Silencer |
| 16, 17 : | Pressure Gauge | | |

(6) Exhaust Duct

1) Exhaust system



- | | | |
|----|-----------------------|-------------------------|
| 2) | Total exhaust amount: | 9.5 m ³ /min |
| | Vacuum pump: | 1.0 m ³ /min |
| | Turbo blower: | 3.5 m ³ /min |
| | Hood: | 5.0 m ³ /min |

- | | | |
|----|--------------------|--|
| 3) | Main exhaust duct: | Use $\phi 150$ or greater and do forced exhaust. |
|----|--------------------|--|

(7) Electric Control

1. Specifications of the Control Board and the Panels

1	Control board (See the separate illustration for its parts.)	Mounting position: Rear of the front conveyor Size: Main board: W 600 × D 265 × H 915 mm Auxiliary board: W 300 × D 205 × H 535 mm
2	Sequencer	For main control C500 For control of laminating position: C28H (Mounted into the main control board)
3	Display panel (See the separate illustration for the arrangement plan.)	Mounting position: Upper part of the front conveyor Thermoregulator: Four (4) units (× 2 for tacking, × 2 for the laminating rolls) Alarm indicating lamp (LED) (Alarms are indicated in red.) Power receiving, home position, and display lamp (× 1 each) Counter (number of boards processed) (× 1) Timer (for setting the tacking time) (× 1) Conveyor speed indicator, change-over switch, D/F front, rear spacing setting devices
4	Operator panel (See the separate illustration)	Mounting position: Front of the front conveyor Switches Power Automatic/manual change-over switch, automatic operation/stop switch, alarm buzzer stop./reset switch, D/F width set switch, vacuum/blower switch, cutter linked switch (upper and lower), emergency stop push-button switch (with a guard)
5	Main braker	Mounting position: main control board (operable from outside)
6	Interlock	Locks each unit when you pull out the laminating block (main unit) (except the cutter and laminating rolls).
7	Manual operator panel (See the separate illustration)	Portable. Mounted to the lower part of the front conveyor within the frame.

Section III

How to Operate

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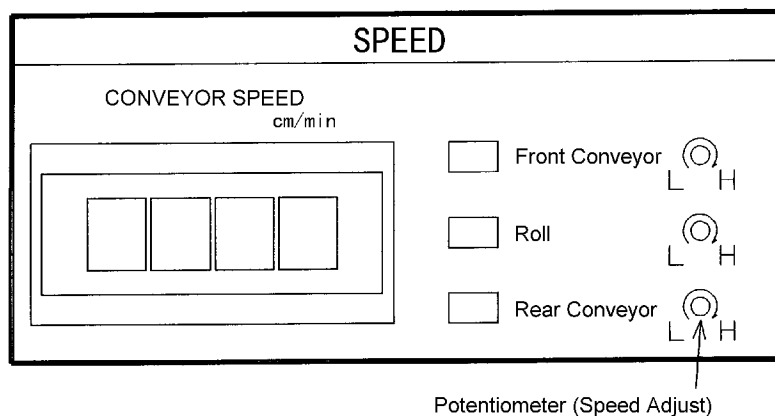
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<1> Preparation for Operation

- (1) Turn on the primary power switch. (Then, the power receiving lamp comes on.)
- (2) Open the main air valve. (Check if the secondary air pressure gauge in the door below left in MACH-610i indicates 5 Kg/cm².)
Plant facility
- (3) Check the operation of the exhaust duct.
- (4) Turn on the Power Switch.
- (5) Turn on the Manual Switch (mode change-over).
- (6) Set the thermoregulator to 130 degrees C or below.
 - 1) Upper and lower laminating rolls: degrees C (set by the user)
 - 2) Upper and lower tacking: degrees C (set by the user)

Set the values according to the film characteristics and feeding speed.
- (7) Turn on the laminating roll heater switch and the tacking heater switch.
(15 min to 30 min is required for temperature stabilization.)
- (8) Adjust the conveyor width. (Manual operation)
 - 1) Close the centering plates to switches (F, R), and adjust the conveyor width to the board width by rotating the front handle. (Make it wider than the board width by 0.5 mm through 1.0 mm.)
- (9) Check the feeding speed. (Manual operation)
 - 1) Sequentially switch to the change-over switches shown below to check if the value indicated by the speed indicator matches the set value.
 - 2) When adjusting the feeding speed, use the corresponding potentiometer on the operator panel.

Note: When doing the check, turn on each motor switch in advance.



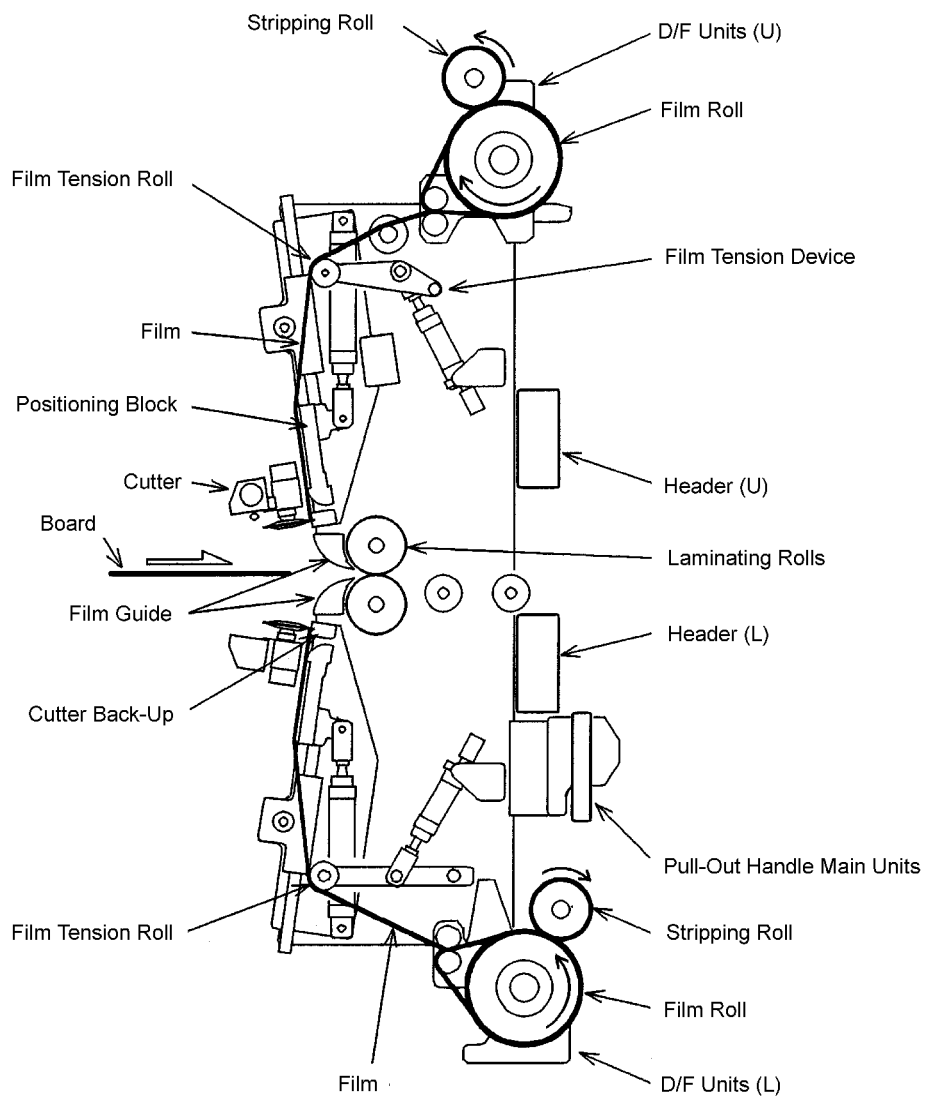
(10) Vacuum

- 1) Turn on one of these switches according to the film width: Film width 330 switch, film width 400 switch, film width 500 switch, film width 600 switch
- 2) Turn on the vacuum pump/blower switch.

Note: The film guides and the cutter back-ups are independent of the classification shown below.

Classification:	1) Film width 330:	$330 \geq \text{film width}$
	2) Film width 400:	$330 < \text{film width} \leq 400$
	3) Film width 500:	$400 < \text{film width} \leq 500$
	4) Film width 600:	$500 < \text{film width} \leq 600$

The tacking plates depend on the classification.



(11) Film Roll Setting (When the upper and lower D/F units are used)

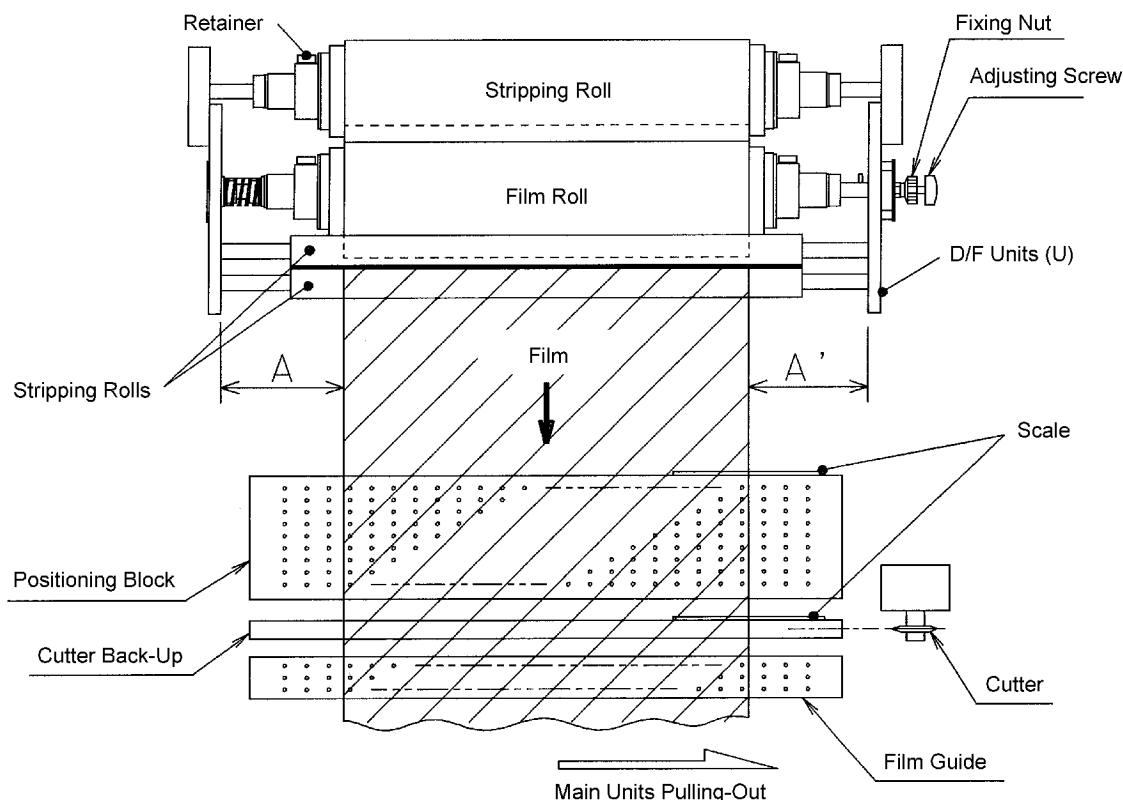
See the D/F unit instruction manual.

- 1) Hold the laminating block pull-out handle, and then pull out the main unit toward you.
- 2) Hold the tie rods of the D/F units, and then remove them from the main unit.
- 3) Mount the upper and lower D/F units in which film rolls are already set.

Note: See the appropriate instruction manual for how to set the film rolls to the D/F units.

- 4) Pull out the films until they exceed the ends of the film guides a little.
- 5) Do film centering.

- Notes:*
1. Adjust the film rolls to make A and A' equal.
 2. Do centering for the upper film according to the scales of the upper tacking plate and cutter back-up.
 3. Do centering for the lower film according to the scale of the lower cutter back-up.
 4. Do set-up by turning on the vacuum pump/blower switch and the vacuum width selection switch.
 5. Do fine adjustment for A and A' with the adjusting screw.

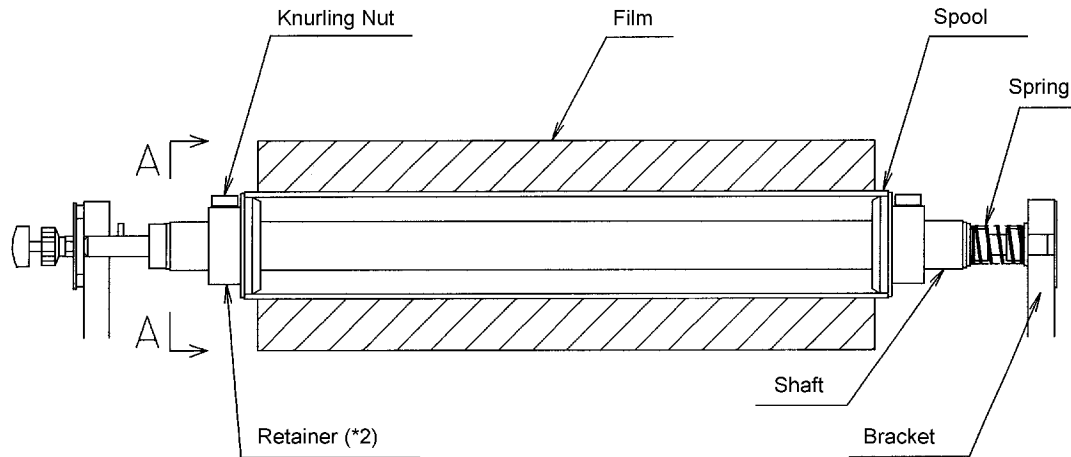


- 6) **Film cutting**
 Make the films on the film guides slightly tense, and then cut them with the cutters. (During film cutting, set the automatic/manual mode change-over switch to manual and turn on the upper and lower cutter switches.)
- 7) After setting of the upper and lower film rolls and cutting of the upper and lower films, push the

main unit back into the original position.

(12) Film Roll Setting (When the upper and lower D/F units are not used)

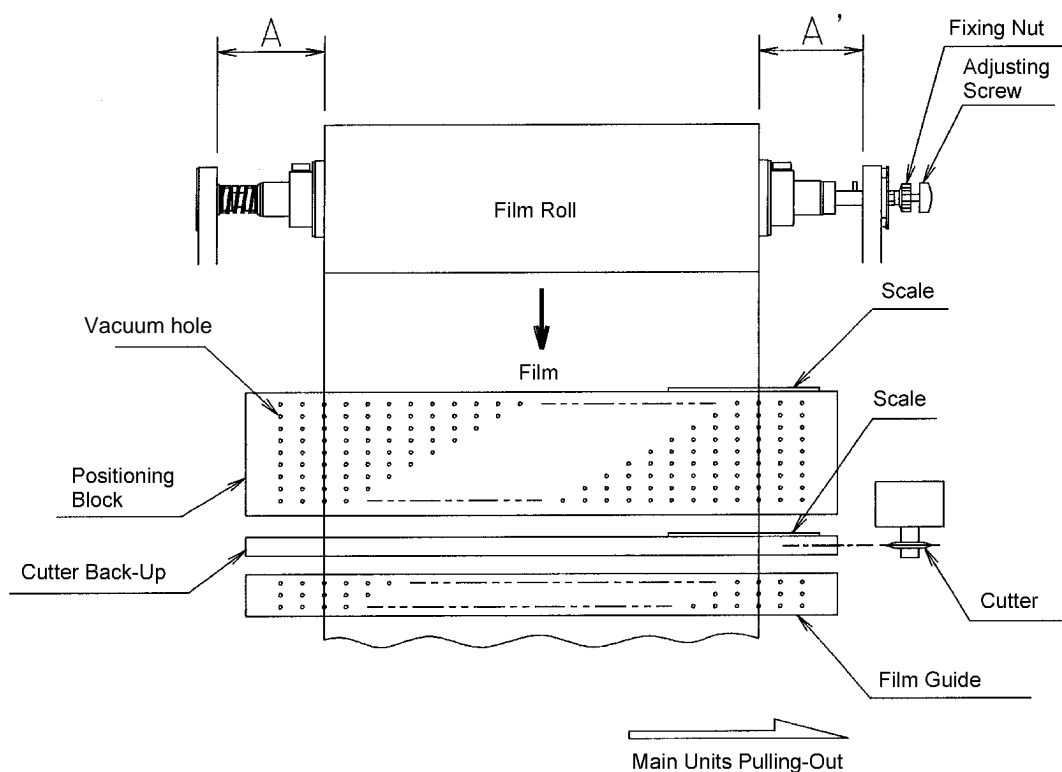
- 1) Hold the laminating block pull-out handle, and then pull out the main unit toward you.
- 2) Remove the shaft spring from the main unit while applying force in direction A shown below.



- 3) Loosen the knurling nut for a retainer, and then remove from the shaft.
- 4) Insert a new film into the shaft, and then fix it with the retainer.
- 5) Mount the empty bobbin to the protected-film winding shaft.
(Note the winding direction.)
- 6) Mount the shaft to the main unit.
(Do the mounting in a manner in which the shaft spring comes on the right side of the main unit when it is viewed from rear.)
- 7) Remove the protected film, and then fix it to the bobbin with a tape.

- 8) Pull out the films until they exceed the ends of the film guides a little.
- 9) Do film centering. (See the illustration given below.)

- Notes:
1. Adjust the film rolls to make A and A' equal.
 2. Do centering for the upper film according to the scales of the upper tacking plate and cutter back-up.
 3. Do centering for the lower film according to the scale of the lower cutter back-up.
 4. Do set-up by turning on the vacuum pump/blower switch and the vacuum width selection switch.
 5. Do fine adjustment for A and A' with the adjusting screw.



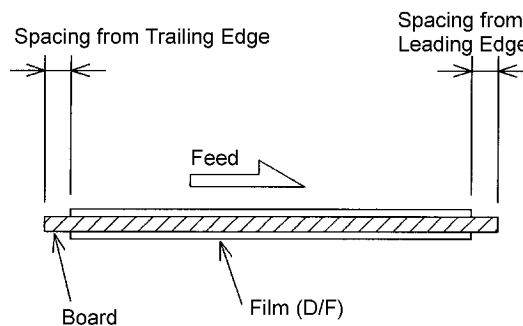
10) Film cutting

Make the films on the film guides slightly tense, and then cut them with the cutters.

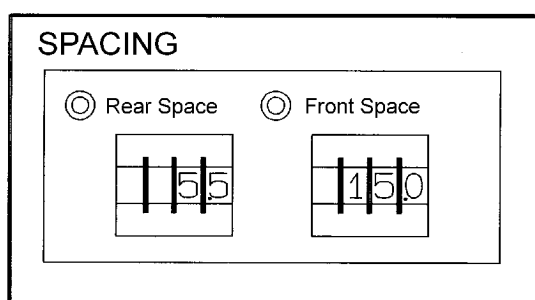
(During film cutting, set the automatic/manual switch to manual and turn on the upper and lower cutter switches.)

- 11) After setting of the upper and lower film rolls and cutting of the upper and lower films, push the main unit back into the original position.

(13) Film Spacing



Film Spacing Counter



Set the front and rear spacing according to the counter shown above.

(Setting range: 2 mm to 99 mm)

(14) Board Counter

- 1) It indicates the number of boards processed.
- 2) It can be used to alarm the remaining amount of film.

<2> Automatic Operation

- (1) Set the automatic/manual mode change-over switch to automatic.
- (2) Turn on the automatic operation switch on.

Then, automatic operation is made in effect: when a board is fed onto the front conveyor, film is automatically laminated to it and sent out from the rear conveyor.

- Notes:
1. Automatic operation can only be done when each actuator is back in the home position (the home position lamp is on).
 2. Conditions to turn on the home position lamp
 - The main unit is not pulled out.
 - The tacking block comes near the board.
 - The tacking plate leaves the board.
 - The lock pin locks the board.
 - The cutter is at an end of the board.
 - The upper laminating roll leave the board.
 - 3 The inter-board spacing for the continuous board feeding depends on the board length and feeding speed.

Inter-Board Spacing (mm)

Tacking time (sec)	Lamination speed (cm/min) (for reference)			
	150	200	250	300
1.0	88 (165)	110 (221)	132 (255)	154 (294)
2.0	133 (157)	144 (199)	174 (238)	204 (272)
3.0	138 (151)	177 (189)	215 (223)	254 (253)

Note: The numbers in () indicate the number of boards processed per hour.
(Board length in use: 18 inches)

When using the automatic board feeding machine, do not jam boards based on the above values; instead feed boards in a manner in which 20 mm or greater is maintained for the tacking board spacing.

Standard tacking time: 2 sec

<3> Alarms and Stop

	Alarm indicator (LED)	Explanation	Alarm (for stop)
A	AIR PRESSURE LOWER ('A' is indicated)	Primary pressure is below 3.5 Kgf/cm ² .	The lamp comes on and the operation stops.
K	BAD TACKING ('K' is indicated)	The films are fed to the laminating rolls without being tacked (this is detected by the tension roll sensors).	The lamp comes on, the buzzer sounds, and the operation stops.
D	P. B. OVER RUN ('D' is indicated)	The tacking block overruns the upper or lower limit sensor.	The lamp comes on, the buzzer sounds, and the operation stops.
I	CUTTER FAILURE ('I' is indicated)	The cutting of both the upper and lower films is bad (this is detected by the tension roll sensors).	The lamp comes on, the buzzer sounds, and the operation stops.
H	CUTTER OVER TIME ('H' is indicated)	The allowed cutter run time (2.5 sec) is exceed.	The lamp comes on, the buzzer sounds, and the operation stops.
G	CUTTING OVER RUN ('G' is indicated)	The cutter overruns the right or left sensor (the operation stops when the next time cycle is started).	The lamp comes on, the buzzer sounds, and the operation stops.
F	ROLL TEMP. OFF RANGE ('F' is indicated)	The surface temperature of the laminating rolls exceeds the allowed temperature range (this is detected by the temperature sensor).	The lamp comes on and the buzzer sounds, and the operation stops.
E	P. B. TEMP. OFF RANGE ('E' is indicated)	The temperature of the tacking block exceeds the allowed temperature range (this is detected by the temperature sensor).	The lamp comes on and the buzzer sounds, and the operation stops.
J	EXCESS LAM ('J' is indicated)	The allowed time (40 sec) from the sensing of the leading edge of the board by the front conveyor sensor till the completion of the actuator operation is exceed.	The lamp comes on, the buzzer sounds, and the operation stops.
B	MAIN UNIT OUT ('B' is indicated)	The main unit is not completely pulled in.	The lamp comes on, the buzzer sounds, and the operation stops.
C	PIN'S UNLOCKED ('C' is indicated)	The tacking block is not back in place, causing the lock pin not to work.	The lamp comes on, the buzzer sounds, and the operation stops.
L	OVER LOAD ('L' is indicated)	Overload of vacuum pump or blower.	The lamp comes on, the buzzer sounds, and the operation stops.
M	BOARD COUNT UP ('M' is indicated)	Count-up of the number of boards processed.	The lamp comes on and the buzzer sounds.
Stops. Return		Turn on the reset switch and buzzer stop switch, and then return it (the main unit or the tacking block) to the home position manually. (Check that "P.L" which stands for home position is indicated.)	

<4> Stable Stop

- (1) Press the automatic operation off switch.
- (2) Press the power off switch.

Note: To lengthen the life of the laminating rolls, rotate or raise them for about 15 minutes with the heater switch turned on after completion of the operation.

- (3) Turn off the circuit breaker.
- (4) Close the main air valve.

<5> Considerations

- (1) When pressing the automatic/manual mode change-over switch to automatic, the following switches are automatically turned on. (They, however, are indicated partially.)

- 1) Laminating roll heater (upper, lower)
- 2) Tacking heater (upper, lower)
- 3) Vacuum pump and turbo blower
- 4) Laminating roll motor
- 5) Laminating roll (go up)

When additionally pressing the automatic operation switch on, the following switches are all that is required for automatic operation.

(Selection must be appropriately made from the switches for vacuum film widths 330, 400, 500 and 600.)

- 1) Front conveyor
- 2) Rear conveyor
- 3) Laminating roll (go down)
- 4) Eliminator of static electricity

- (2) For manual operation, set the automatic/manual mode changeover switch to manual.
- (3) Do not make the laminating roll heater temperature and the tacking heater temperature higher than required. (Otherwise, blowholes or creases are caused, quickening the aging of the rubbers or heaters.)

Laminating roll surface temperature: Max 130 degrees C

Tacking rubber surface temperature: Max 65 degrees C

- (4) Do not put a load on the main unit pulled out.
(Otherwise, the pull-out rails may be damaged.)
- (5) Before starting work every day, clean the cutter edges, cutter back-ups, and film guides.

Section V

Maintenance Guide

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<1> Daily Check

	Item	Checking
1	Thermoregulator	The setting value and the specified value.
2	Feeding Speed	Front Conveyor, Tacking Block, Laminating Roll, Rear Conveyor.
3	Width of Film Board	Selection for each SW film width.
4	Speed of Cutter	One cutting time is within 1.5 seconds.
5	Film Spacing	Spacings from leading and trailing edges of Board (Operator Panel Set counter.)
6	Film Loading	Both upper and lower film rolls are properly centered and secured, horizontal discrepancy of the film and so on.
7	Front Conveyor feeding Width	According to width of boards to be processed.
8	Air Pressure	The Pressure Meter for within the lower door of the Front conveyor (5).
9	Others	Abnormal vibration, heating & noise
10	Rotary cutting unit	Daily cleaning for the Cutting block.

<2> Regular Check and Maintenance

(With the expected period). As to Maintaining method, refer to the separate table.

		Item	Check & Maintenance	Period
Cutter	1	Cutter	Check Cutting disc and replace if any damage is found. Regular replacement (2-3 months).	1 month
	2	Horizontal Feeding	Whether smoothly feeds all strokes. Examine moving mechanism (cutter back-up slot & disc), adjust or correct when needed.	3 months
	3	Cutter Back-up	Cleaning of the vacuum holes.	1 week
Tacking Plate & Block	1	Tacking Rubber	Whether the whole part of it is rough, defected or soiled. Whether the upper & the lower tacking rubber are parallel.	1 week
	2	Surface Temperature of Rubber	Check by Surface Thermometer.	3 months
	3	Position of the Upper & the Lower Plates	Whether there is a position discrepancy when the upper & the lower tacking rubber are touched.	3 months
	4	Air Pressure	The upper side/2.5kgf/cm ² , the lower side/4.5Kgf/cm ²	3 months
	5	Up & down Movement of Blocks	Check smoothness of up-and-down movements. (Motor Driving System & Bearings).	3 months
	6	Surface Condition	Roughness, defects & soils on the surface and cleaning of the vacuum holes.	1 week
Laminating Roll	1	Surface Condition	Ups & downs, defects & soils on the surface	1 week
	2	Surface Temperature	Check with Surface Temperature. Thermometer Positioning check with Surface Temperature Sensor.	3 months
	3	Air Pressure	2 through 4kgf/cm ² (Set pressure at the shipping time, 3Kgf/cm ²)	3 months
	4	Collecting of Electrons	Carbon, wearing of the ring.	3 months
	5	Driving Chain	Chain tension	3 months
	6	Up & Down Movement of Roll (Important)	Whether the upper roller smoothly moves up & down (Air cylinder, block.)	3 months
Vacuum	1	Blower	Vibration, noise & heat of Turbo blower	6 months
	2	Piping	Piping, deformation & leakage of each header & between vacuum parts.	6 months
	3	Vacuum Pressure	Pressure of each header.	6 months
	*4	Vacuum Pump	Tension, vibration, noise & heat of belt.	6 months

As to Vacuum Pump of Item *4, Filter Element & Vacuum Gauge should be checked once 6-months period or once a year.

		Item	Check & Maintenance	Period
Film Guide	1	Surface Condition	Cleaning of the vacuum holes	1 week
Front & Rear Conveyor	1	Driving System	Chain tension.	3 months
	2	Bearing	Wear of bearings of both ends of each conveyor roll.	6 months
	3	Conveyor Roll	Cleaning of each conveyor roll surface.	1 week
Control System	1	Sensor	Check all sensors and clean beam sensor and roll temperature sensor, and make sure that all are properly and firmly located in positions.	6 months
	2	Rotary Encoder	Gearing of the encoder moving with the front Conveyor and gearing of the encoder of the Main unit driving block.	6 months
	3	Pilot Lamps & SW	Check all warning and pilot lamps.	6 months
	4	Speed Display	Detect speed indicator and actual speed.	6 months
	5	Others	Check electric wirings of all moving components for external wear, fitting and keep them clean.	6 months
Other	1	Position of each part	Relating positional discrepancy between the Film Guide & the Cutter.	6 months
	2	Fastener	Check if fixing bolts & nuts are loosen.	6 months
	3	Sensor	Fixed positions of Sensors.	3 months
	4	Pneumatic valves & Air Cylinder	Check of operation & wearing.	6 months

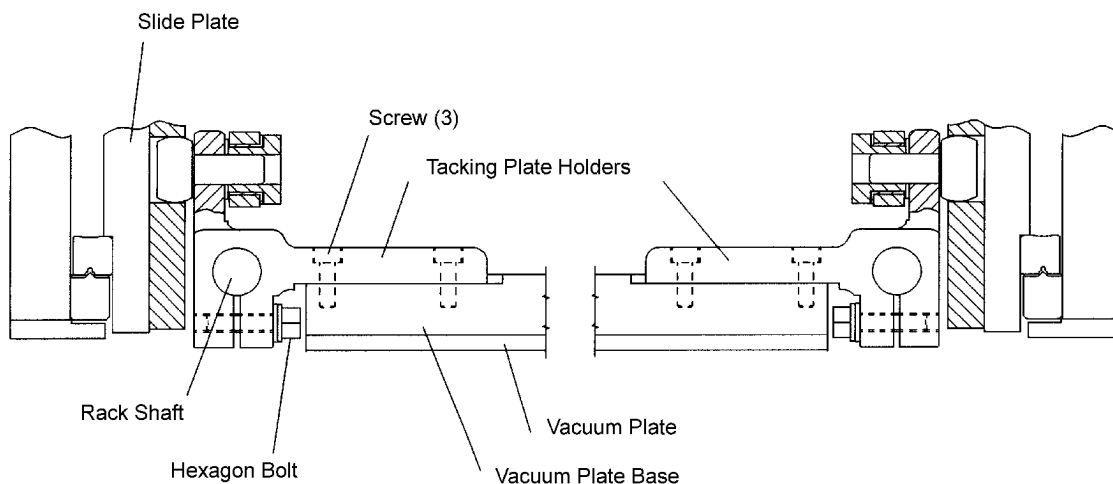
<3> Maintaining Method

(1) Replacement of Tacking Heater

- 1) Pull out the tube from the joining handle.
- 2) Remove wirings - at terminals.
- 3) Unscrew the screws of the tacking plate holders (3 for each) and then remove the tacking plate.

Note: Do not remove tacking plate holder from actuating raks to avoid future failure for up-and-down motion.

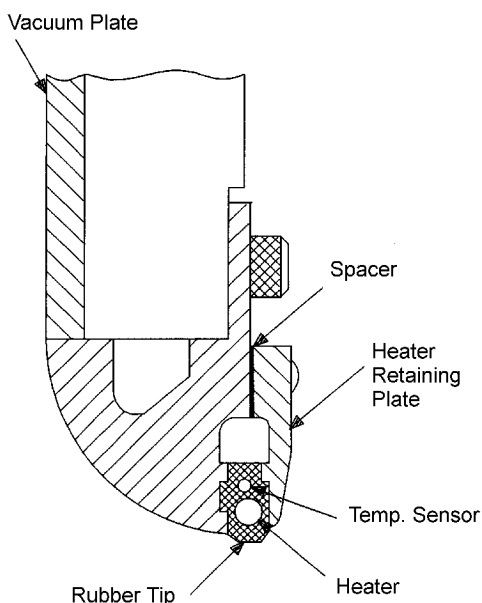
- 4) Place the removed tacking plate on work bench and unscrew heater element retaining screws.
- 5) When heater element retaining plate is released, these following elements can be taken out: the heater, the sensor, the silicon tube and the tacking rubber.



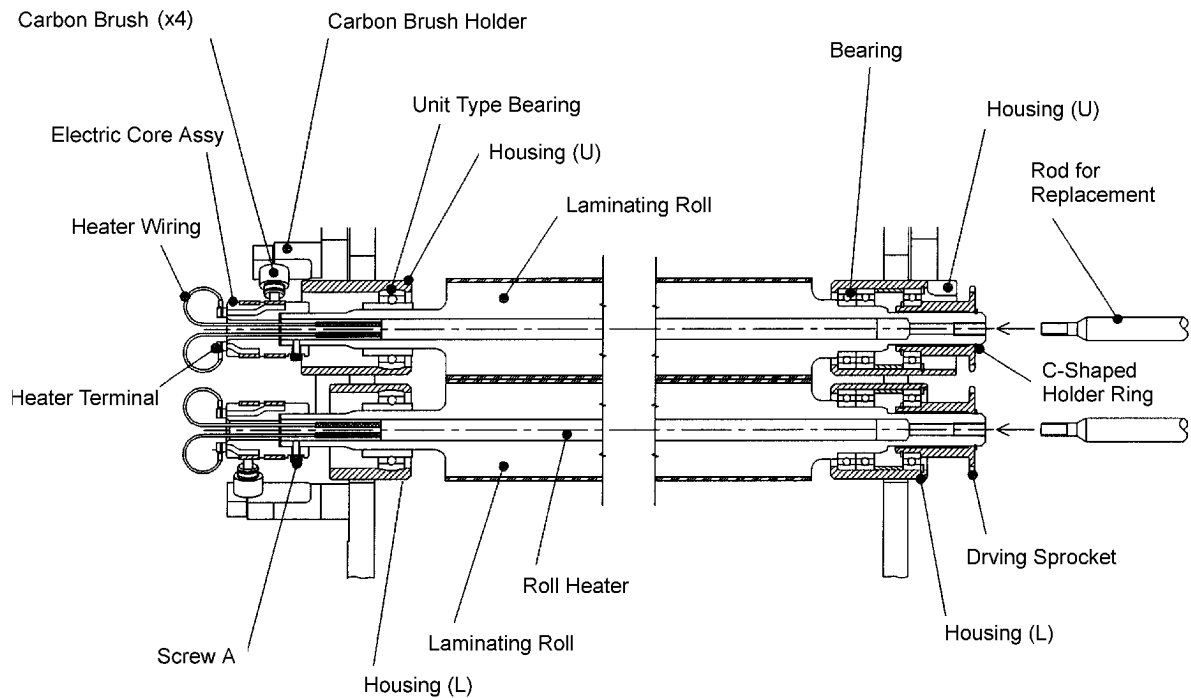
Note: After finishing replacement of the heater, be aware of the class of the tacking plates (the film width) when pushing the tube into the joining handle of the plate.

When replacing heating elements, it is absolutely important to coat a new element with the silicon grease. Use only the following grease:

MAKER: TOSHIBA Silicon Corp.
 TYPE: YG6111



(2) Replacement of Laminating Roll(s)



- 1) Remove the holder ring (on the Driving side).
- 2) Remove carbon brush with the holder.
- 3) Unscrew electrode side bearing retaining bolts from the bearing housing and screw the handling rod into the roll shaft end (pull it toward electric core)
- 4) First, remove the heater wiring from the heater terminal. And pullout the roll assy, unscrewing the screw A of the electric core and taking it out.
- 5) When heating element must be replaced, approx. $\phi 6$ through $\phi 8$ rod or stick can be used for pushing from the driving side, where the sprocket is to be installed.
- 6) When replacing heating element, it is absolutely important to coat a new element with the silicon grease. Use only the following grease:

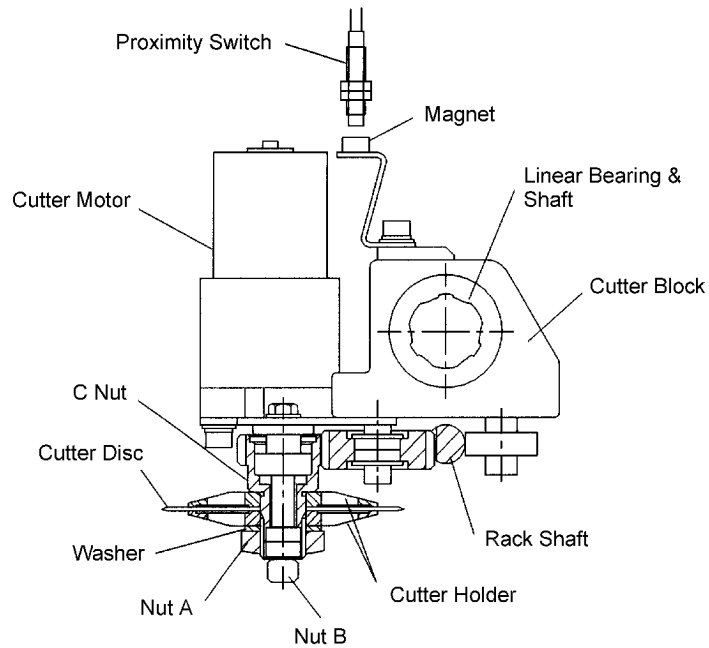
MAKER: TOSHIBA Silicon Corp.

TYPE: YG6111

(3) Replacement of Film Cutter

- 1) Remove the truss bis and take off the cover.
- 2) Apply a spanner to “C” part and unscrew ‘A’ nut.
(Do not unscrew ‘B’ nut, which is already adjusted)
- 3) Remove the washer and cutting disc can be pulled out.

Note: Be very cautious when changing the cutter blade (disc)

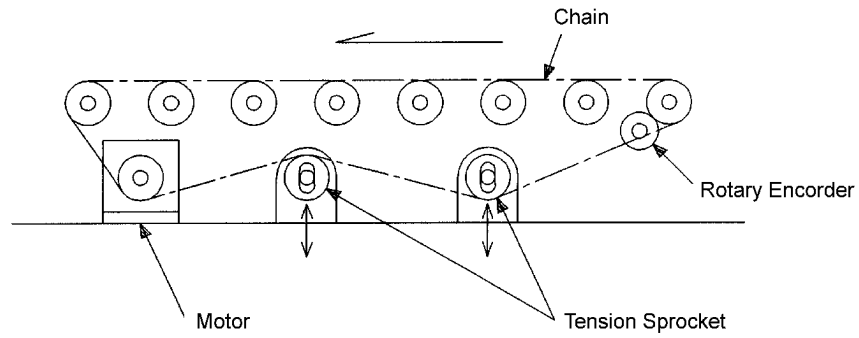


(4) Adjustment of Chain Tension

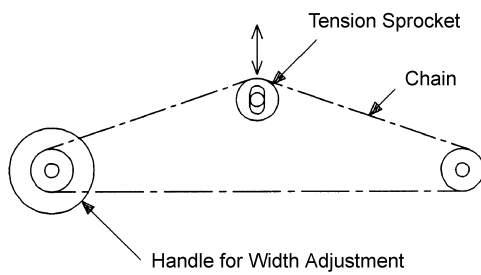
Loosen each screw of Tension sprockets to adjust.

1) Front conveyor

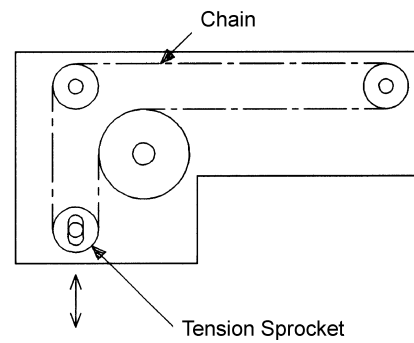
1. The Conveyor



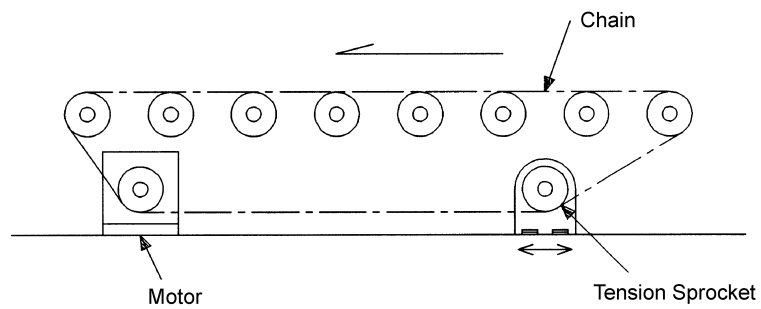
2. The Board centering adjusting part



3. The Pinch roll feeding the thin plate (O, P)

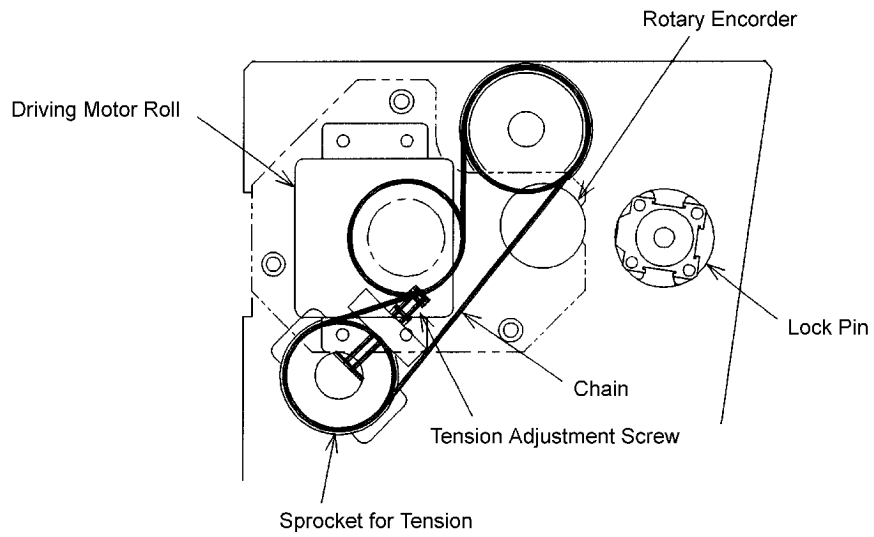


2) Rear conveyor

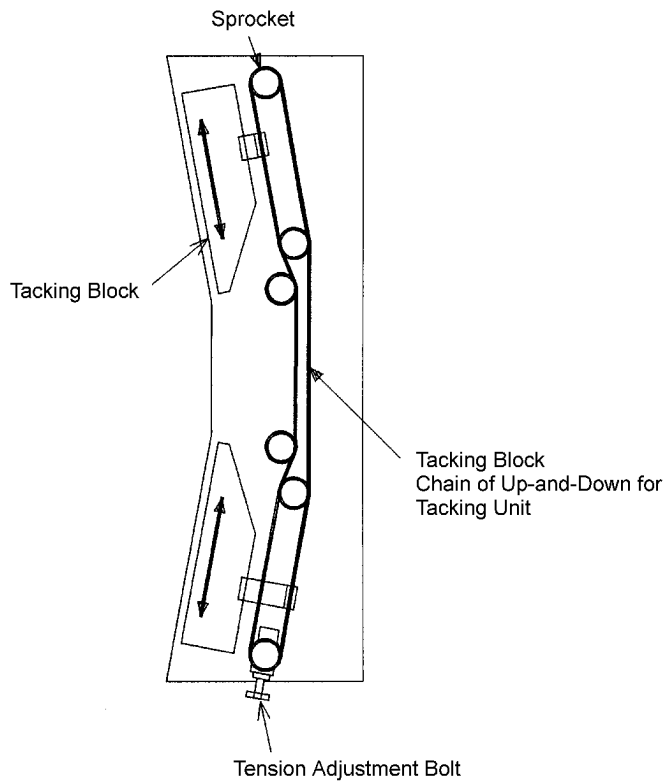


3) Tacking block & Main unit driving motor

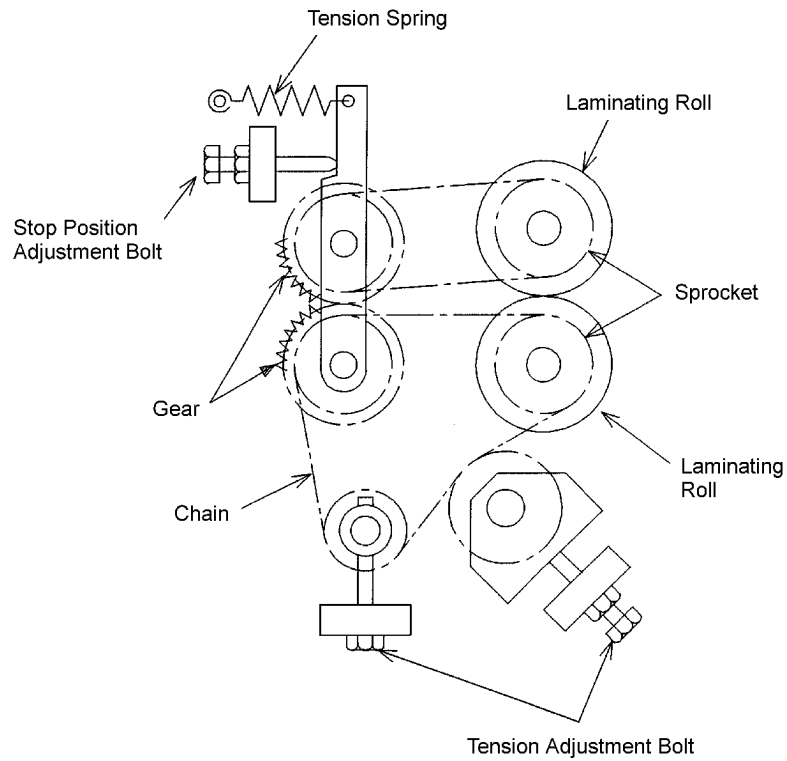
1. The driving motor block of the laminating roll



2. The tacking block



4) The laminating rolls



(5) Lock Pins

- 1) Lock pin ensures solid pressure for pressed placement of film as on the illustration.
- 2) To remove lock pin assy, unscrew 'A' - 2 pieces.

