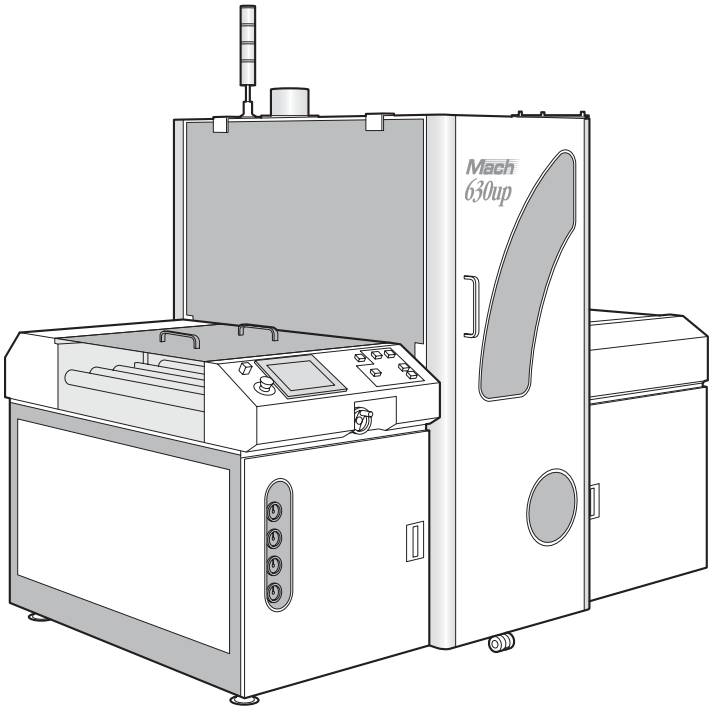
Mach 630up

DRY FILM AUTO CUTTING LAMINATOR

Operation Manual



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REVISION 1.0

Hakuto
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■ Introduction

Thank you for purchasing the Dry-Film Auto-Cutting Laminator unit manufactured by Hakuto Co., Ltd. This manual describes the methods of operation and maintenance for the unit. Read this manual before using the unit, and refer to it as necessary. Please note that this manual is based on the standard specifications, which may differ slightly from those of your unit. If you have any question regarding the specifications of your unit, please contact Hakuto Co., Ltd. or its agent.

This manual consists of Part 1, "Installation;" Part 2, "Operation;" Part 3, "Maintenance;" appendices; drawings; and optional components.

- This manual explains units that move PWBs from left to right.
  For units that move PWBs in the opposite direction, read "left" as "right",and "right" as "left".

Part 1 "Installation"
This Part provides precautions regarding the preparation and installation of the unit, and is primarily for those installing the unit. Please read this Part before installing the unit.

Part 2 "Operation"
This Part explains to users how to operate the unit.

Part 3 "Maintenance"
This Part explains the methods of daily maintenance, regular maintenance, and adjustment for those who have gained an understanding of Part 2, "Operation." This Part includes appendices, drawings, and descriptions of optional components.

Be sure to gain a full understanding of the contents of this manual to ensure the optimal performance of the unit.

- Customers who purchase an Auto-Cutting Laminator unit marketed by Hakuto Co., Ltd. are requested to gain a full understanding of the methods and processes for use of the unit, and to use it at their own risk.
- Before using the unit, customers are requested to provide a suitable environment and prepare rules and restrictions to ensure appropriate actions for the maintenance of safety and health.
- The contents of this manual are subject to change without notice.

■ Table of Contents

■ Precautions for Use

This Section explains the precautions necessary to ensure the safe and comfortable use of the unit. Please be sure to gain a full understanding of the instructions given in this Section before using the unit.

(1) General Precautions

This Section explains the general precautions regarding use of the unit.

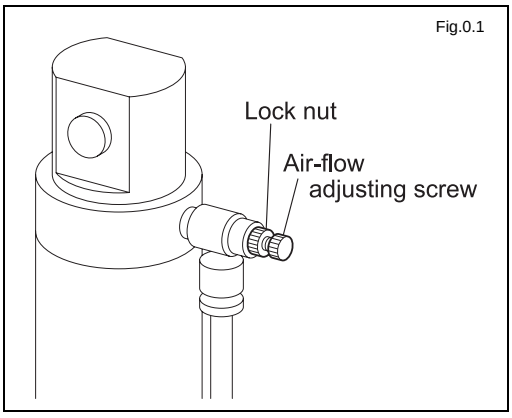
⚠ Warning

- Do not open the door when the unit is in operation.
- Before operating the unit manually for maintenance or other purposes, confirm that there is no one behind or in contact with the unit.
- Do not change the structure of the unit, particularly cables,as electric shock, fire, or failure may result.
- Do not operate or service the unit with wet hands, as electric shock may result.
- Do not use flammable or corrosive gases around the unit, as fire, leakage, or failure may result.
- If the unit emits an unusual noise, smoke, or odor, immediately open the main breaker and contact Hakuto Co., Ltd. or its agent. If the unit is used when it is damaged, fire, electric shock, or additional damage may result.

⚠ Caution

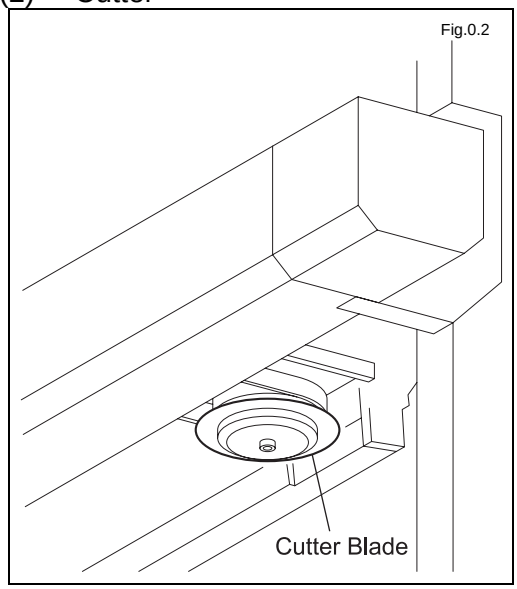
- After working inside the unit for maintenance or other purposes, clean it properly using a vacuum cleaner.
- Clean the inside of the unit with a vacuum cleaner at least once per month.
- Do not leave nuts and screws loosened. Important nuts and screws are locked with a screw-locking material. After loosening these nuts and screws for maintenance or other purposes, apply a screw-locking material and tighten them.

Fig.0.1



- The air-flow adjusting screw (speed controller) attached to the air cylinder is properly set prior to shipment. Do not change the setting. When necessary, readjust it carefully and tighten the lock nut to set it.

(2) Cutter



The unit has a rotary cutter for cutting films.
Be careful when handling it, as its circumference is razor sharp.

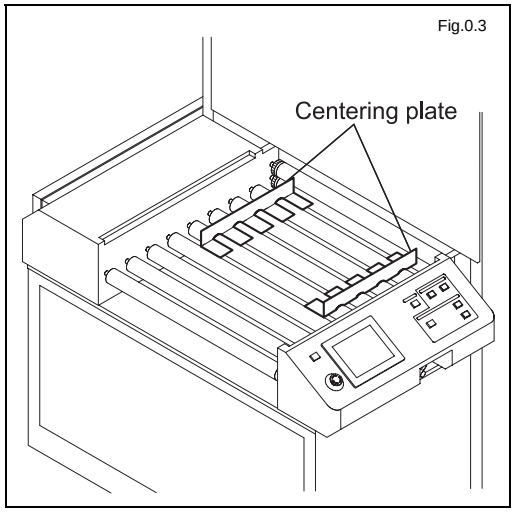
⚠ Warning

- Do not touch the circumference when holding the cutter.
- Use the specified tools to replace the cutter.
- Keep the cover closed even when the unit is not in operation.

⚠ Caution

Do not drop or apply an impact to the cutter, as it may break.

(3) Centering Mechanism



The input conveyor of the unit has a PWB centering mechanism that is driven by an air cylinder.

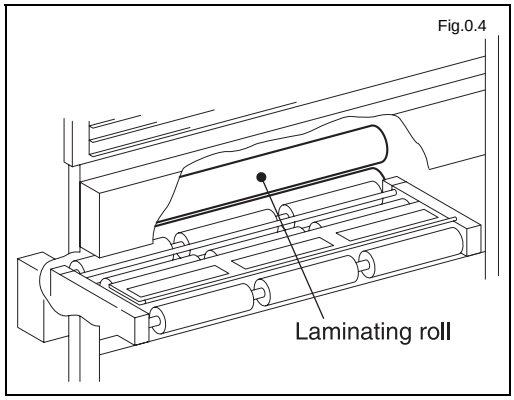
⚠ Warning

Cover the input conveyor when it is in operation in order to prevent fingers from being caught.

⚠ Caution

Do not adjust the centering mechanism so that it is smaller than the width of PWB, as the input conveyor may be damaged.

(4) Laminating Roll



The lamination module of the unit has a laminating roll that rotates at high temperatures.
Be careful, as it is hot even when the unit is not in operation.

⚠ Warning

- Do not insert your hand into the unit (even when it is not in operation), or your fingers may be caught and burnt.
- Do not touch the roll when it is hot or in operation, or your fingers may be caught and burnt.
  When it is necessary to touch it, wait until it stops and cools down.

⚠ Caution

- Do not insert foreign articles into the unit, or the laminating roll may be damaged.
- Do not use solvents other than those specified by Hakuto Co., Ltd. to clean the laminating roll, or its surface may deteriorate.
- Do not strike or apply impact to the laminating roll, or it may be damaged.
- Do not heat the laminating roll unnecessarily, or it may prematurely deteriorate.
- Do not apply excessively large loads or impacts to the lamination module when it is pulled out, or the pull-out rails may be damaged.

■ Warning Labels

This Section explains the definitions and locations of the warnings, cautions, and notes indicated by the labels that are used in this manual or affixed to the unit.

(1) Definitions of Warning, Caution, and Note

This Section explains the meanings of the label marks used in this manual or affixed to the unit.

⚠ Warning — This mark indicates that there is a danger of serious or minor injury if the user ignores the related instructions in using the unit.

⚠ Caution — This mark indicates the danger of damaging the unit or auxiliary machines (property damage) if the user ignores the related instructions in using the unit.

Note — This mark indicates instructions for using the unit safely and comfortably.

The above "serious and minor injuries," "property damage," and "user" have the meanings specified below.

【Table 0.0.1 The meanings of serious and minor injuries, property damage, and user】

Serious injury	Blindness, injury, burns (high- and low-temperature), electric shock, fractures, and toxicosis that accompany after-effects, and those that require admission or long-term hospital stays.
Minor injury	Injury, burns (high- and low-temperature), and electric shock that do not require admission or long-term hospital stays.
Property Damage	Secondary damage to the production line, peripheral devices, or other auxiliary equipment.
User	Users of the unit, including the purchaser and those who are requested to operate the unit by the purchaser.

(2) Location of Label

To ensure their visibility, warning labels are affixed at the locations indicated in the illustration below.

Fig.0.5

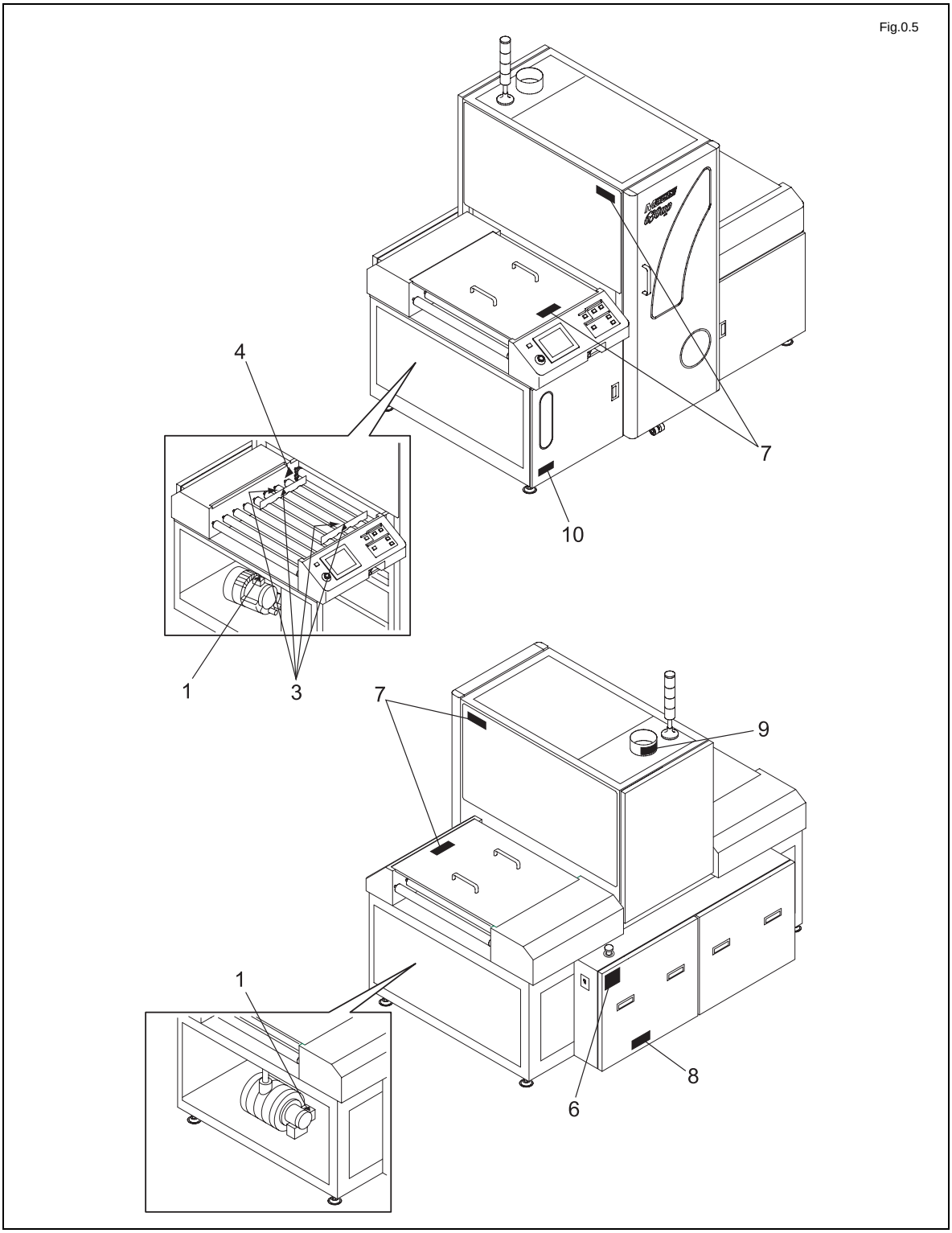
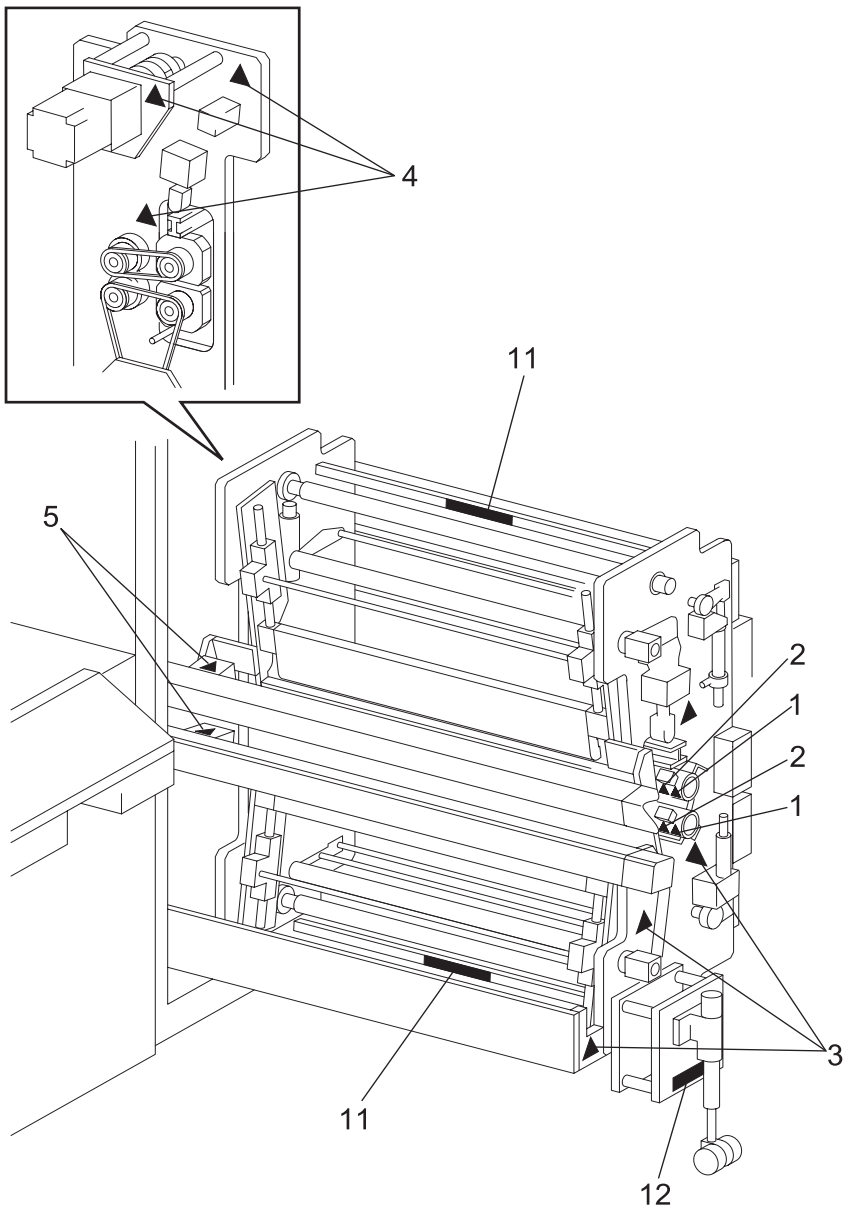
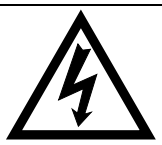
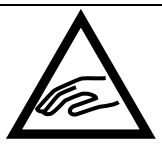
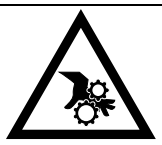


Fig.0.6



■ Warning Labels

【Table 0.0.2 Warning labels】

No.	Type of label	Description	Location
1		Caution: Electric Shock	・ Blower-fan power-supply connection ・ Lamination roll slip ring
2		Caution: High temperature	・ Laminating roll
3		Caution: Keep fingers away to prevent them from being caught.	・ Air cylinder ・ Pull-out rail ・ Centering plate
4		Caution: Keep fingers away to prevent from being caught.	・ Conveyor ・ Drive chain
5		Caution: Keep away from the cutter.	・ Cutter unit
6		Warning for the danger inside the unit	・ Control box
7		Close the cover.	・ Conveyor cover ・ Lamination module cover
8		Power-supply connection	・ Control box door
9		Exhaust-duct connection	・ Exhaust duct
10		Air connection	・ Primary air inlet
11		Caution: Be careful to prevent injury by the electrode.	・ Anti-static cover
12		Caution: Do not turn adjusting nut on pull-out caster.	・ Caster installation plate

■ Safety Devices

The unit has safety devices to prevent danger in the event that it is incorrectly operated, and to ensure preparedness for emergencies.

⚠ Caution

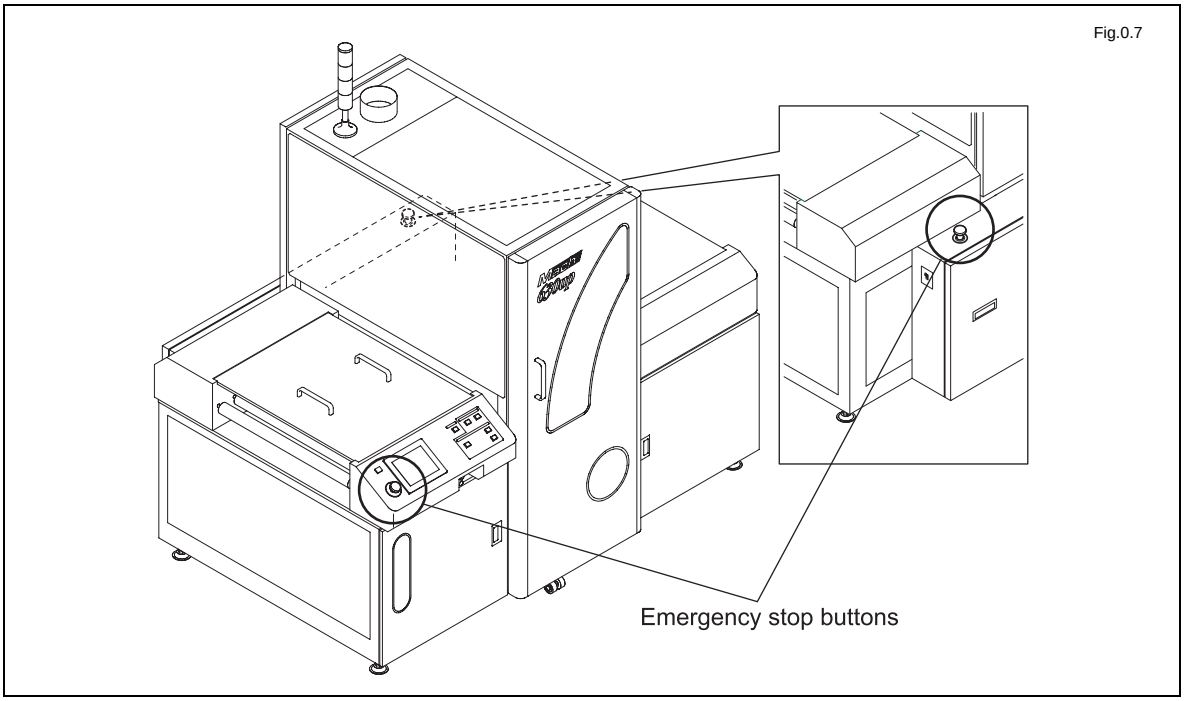
When the unit is stopped by a safety device, its operation cannot be guaranteed following resetting, unlike in cases in which it is stopped by the normal procedure. Do not use the emergency stop buttons except in an emergency (when the unit emits smoke, fire, noise, or odor, or when injury is anticipated).

(1) Emergency Stop Buttons

Emergency stop buttons are located on the operation panel and control box. In the event of a problem, press one of the emergency stop buttons. The unit will immediately stop and enter a state identical to pressing the Power OFF button on the operation panel .

The emergency stop buttons are at the locations indicated in the illustration below.

Fig.0.7



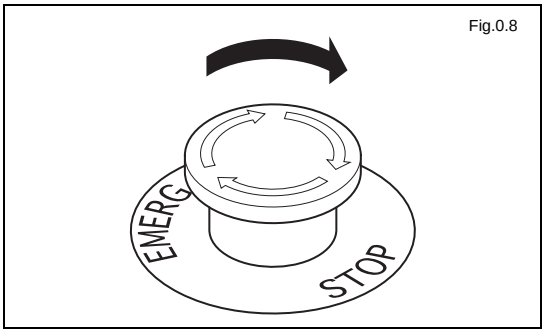


Fig.0.8

After correcting the problem, turn the button clockwise to release. Press the power ON button on the operation panel to resume normal operation.

(2) Interlock Switch

The unit has an interlock switch on the back (rear side) of the control box cover to prevent electric shock.

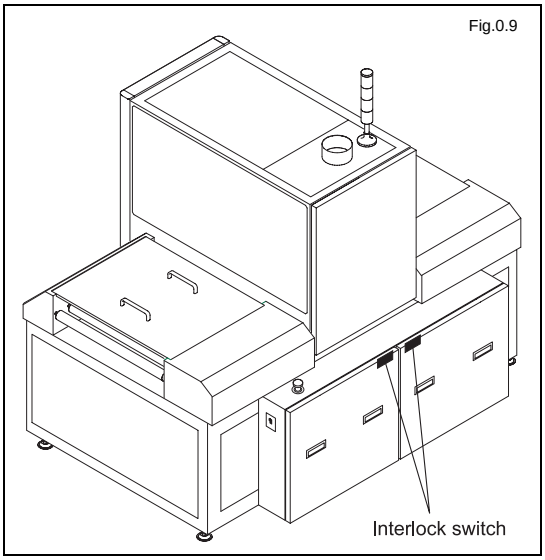


Fig.0.9

If the control box cover is opened when the unit is in operation, it will immediately stop, as when the operation-panel Power OFF button is pressed.

- To restart operation, close the control box cover and press the operation-panel Power ON button.

Part 1

Installation

Chapter 1 Preparation for Installation

This Chapter explains the precautions regarding installation of the unit, the installation conditions, and the facilities required for installation.

Contents of this Chapter

1.1 Precautions on Installation

This Section explains the precautions necessary to ensure the safe and effective installation of the unit. Carefully read the following before installing the unit.

⚠ Warning

Keep water away from the power source, power-source line, and terminal block, as the insulation of these parts may deteriorate, causing damage or electric shock. Do not allow the interior of the unit to become wet, and do not touch the unit with wet hands.

⚠ Caution

- This unit is a precision machine. Move it carefully during installation. Do not drop it or subject it to impact, or the adjustments made prior to shipment may be disturbed, resulting in damage.
- Install the unit in a level and stable location.
- Do not install the unit near volatile flammables or in an environment in which corrosive gases are generated, as fire or damage may result.

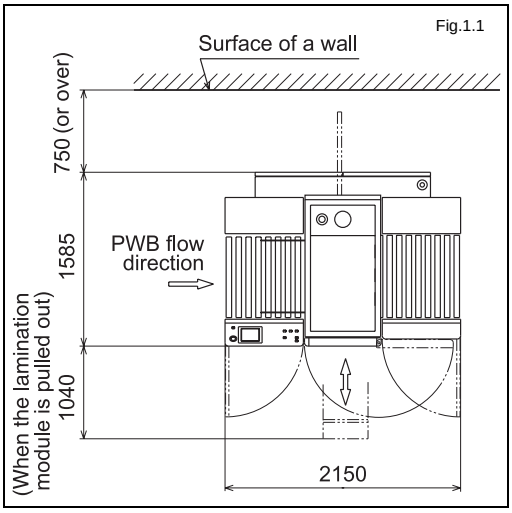
Note

Install the unit in a location in which maintenance can be performed easily.

1.2 Space and Conditions for Installation

1.2.1 Installation Space

To facilitate the operation, maintenance, and replacement of consumables, and to ensure the optimum performance and proper use of the unit, secure an installation space as shown in the illustration below.



Secure an installation space, as shown in the illustration to the left, as well as space to move the unit safely to that installation space.

1.2.2 Installation Conditions

To use the unit safely and properly, install it as follows:

- In a location free from bright light such as direct sunshine and flood lights
- In a stable and vibration-free location capable of supporting the weight of the unit (total weight of the unit: approximately 1,300 kg)
- In an environment with class 1000 or better clean room conditions

1.3 Facilities Required for Installation

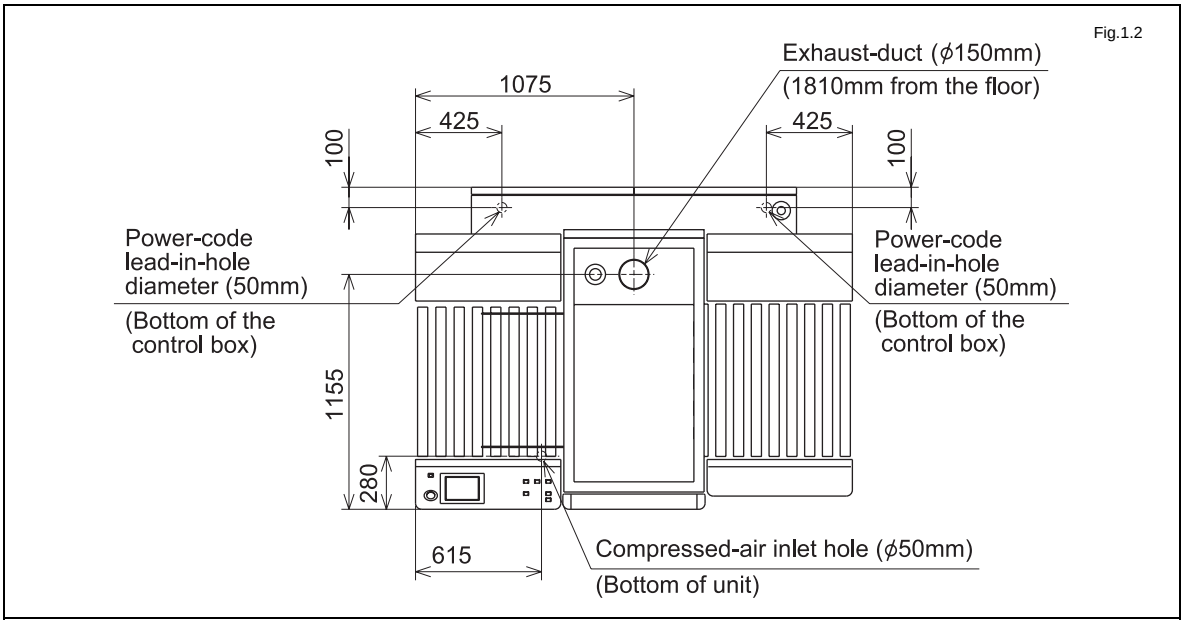
The unit requires connection to a power source, exhaust duct, and compressed-air piping (plant air piping) at the locations specified below.

⚠ Warning

The work for connecting the unit to these facilities should be performed by qualified workers.

- Power source : 200/200 V (to be switched after installation), 50/60 Hz, 10 kW
- Exhaust duct : Volume of exhaust, 9.5 m^3/min
  Connect the unit to a plant duct larger than 150 mm diameter for forced discharge.
- Compressed air : 0.5 MPa (5 kgf/cm^2); 15 L/min; connection ISO Rc: 1/4 inch
- Materials used for connection:
  - Electricity : 8.0 mm^2 power-cable terminal for M5 screws, less than 100 ohms ground
  - Air : Hose or tube for 1/4-inch fitting
  - Exhaust : 150-mm diameter aluminum flexible duct (recommended)

Fig.1.2



1.4　Main Unit and Accessories

Before installing the unit, confirm that the standard accessory parts specified below are supplied.

● List of Standard Accessory Parts

Below is a list of standard parts supplied with the unit. Accessory parts are those that cannot be installed prior to shipment and those that are prepared for maintenance. The contents of accessory parts list differ for the DF unit and DF bulk unit models.

【Table 1.1.1　List of Standard Accessory Parts (DF Unit Model)】

No.	Part	Quantity	Remarks
1	Laminating Roll replacement Rod	1	Maintenance tool
2	Tacking rubber polishing rod	1	Maintenance tool
3	Polishing sandpaper (emerypaper)	1	Maintenance tool
4	Fuse set	1	Spare part ・cylindrical fuse (10 A)　: 1-piece ・cylindrical fuse (3 A)　: 1-piece ・glass tube fuse (1 A)　: 1-piece
5	Signal tower	1	Component of the unit
6	DF unit (upper)	1	Component of the unit
7	DF unit (lower)	1	Component of the unit
8	Caster assembly	1	Component of the unit
9	Lamination module front door	1	Component of the unit
10	Input-conveyor bottom door	1	Component of the unit
11	Output-conveyor bottom door	1	Component of the unit
12	Conveyor cover	2	Component of the unit
13	Operation manual	2	This manual
14	Roll bearing grease WR-500	1	Maintenance tool
15	Roll pullout jig set	1	Maintenance tool
16	Front door hinge	1	Component of the unit

【Table 1.1.2　List of Standard Accessory Parts (DF Bulk Unit Model)】

No.	Part	Quantity	Remarks
1	Laminating Roll replacement Rod	1	Maintenance tool
2	Tacking rubber polishing rod	1	Maintenance tool
3	Polishing sandpaper (emerypaper)	1	Maintenance tool
4	Fuse set	1	Spare part ・cylindrical fuse (10 A)　: 1-piece ・cylindrical fuse (3 A)　: 1-piece ・glass tube fuse (1 A)　: 1-piece
5	Spring for film-roll shaft	2	Spare part
6	Signal tower	1	Component of the unit
7	Caster assembly	1	Component of the unit
8	Lamination module front door	1	Component of the unit
9	Input-conveyor bottom door	1	Component of the unit
10	Output-conveyor bottom door	1	Component of the unit
11	Conveyor cover	2	Component of the unit
12	Operation manual	2	This manual
13	Roll bearing grease WR-500	1	Maintenance tool
14	Roll pullout jig set	1	Maintenance tool

Chapter 2 Installation

This Chapter explains the methods for moving and installing the unit at the installation site at the plant.

Contents of this Chapter

2.1 Precautions on Moving the Unit

This Section explains the precautions for moving the unpacked unit to the installation site at the plant. Carefully read the instructions to ensure that the unit is moved safely and properly.

⚠ Warning

- This unit is heavy (approximately 1300 kg), and should be moved by more than three workers by using a well-maintained forklift, to prevent physical injury and damage.
- To balance the unit, fully insert the forks so that the unit's center of gravity is at the center of the forklift. To prevent physical injury and damage to the unit, be careful not to lose balance or drop the unit during moving.

⚠ Caution

- The unit has built-in precision components. To prevent damage lift it approximately 20 cm off the ground and move it slowly without allowing it to vibrate.
- Do not drop it or expose it to impact, as the adjustments made prior to shipping may be disturbed, resulting in damage.
- To prevent damage, movable parts are fixed with cable ties and fixing materials when the unit is shipped.
  Do not remove these fixing materials until the unit is moved to the installation site, as damage may result.
- Transport the accessories to the installation site in the original packing ,and affix them to the unit.

2.2 Flow from Installation to Power switch ON

This Section uses a flowchart to explain the procedure from installation to power switch ON.

1. Unpacking and transport (See page 1-10.)

Unpack and move the unit to the installation site at the plant using a forklift or hand lift.

↓

2. Adjustment of installation (See page 1-11.)

Level the unit and adjust the height of the conveyor-roll surface using the leveling feet.

↓

3. Removal of fixing materials for transport (See page 1-13.)

Remove the fixing materials for transport and cable ties.

↓

4. Confirmation of the connection of wiring and piping (See page 1-20.)

Ensure that the unit is connected to the power source, compressed-air line, and exhaust duct of the plant.

↓

5. Installation of accessories (See page 1-24.)

Install the signal tower and covers supplied as accessories.

↓

6. Wiring to other machines (See page 1-26.)

Connect the PWB transfer signal line of the unit to the other machines.

↓

7. Power switch ON (See page 1-30.)

Supply power to the primary side of the plant, and turn the Main breaker of the unit on (|).

2.3 Transport by Forklift

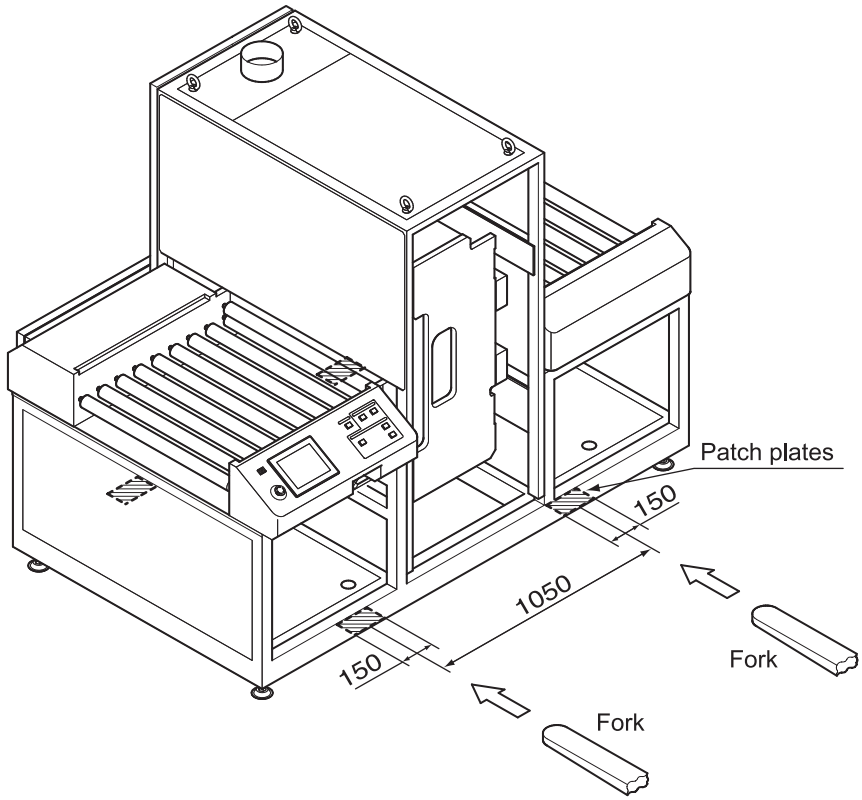
The unit is designed to be approximately symmetrical in the lateral direction, so that the center of gravity is at its center.
Insert the forks at symmetrical positions with respect to the center of the unit.

- After unloading the unit from the forklift at the installation site, use a hand lift to perform fine adjustment, when necessary.
- See the illustration below for the fork insertion direction and positions for transport.

Note

Insert the forks at the positions of the patch plates that are affixed before shipping.

Fig.1.3



2.4 Adjustment of Height

After transporting the unit to the installation site, adjust its height.

Necessary tools	・24-mm spanner ・level

⚠ Caution

If the conveyor height is not set at the same level as up-line and down-line machines, a failure will result or PWBs will not be sent normally.

1.

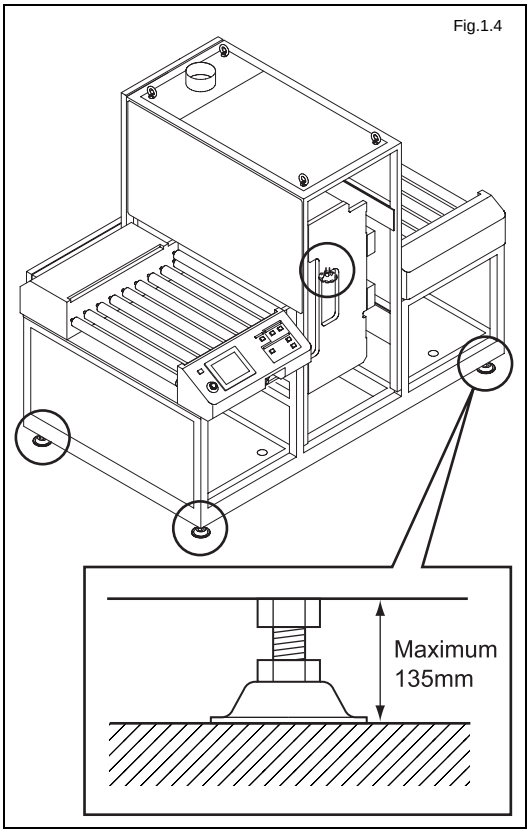


Fig.1.4

Adjust the height of the leveling feet at four corners.

⚠ Caution

The maximum height of the leveling feet is 135 mm. To set the unit higher, insert a spacer of appropriate thickness under each leveling foot.

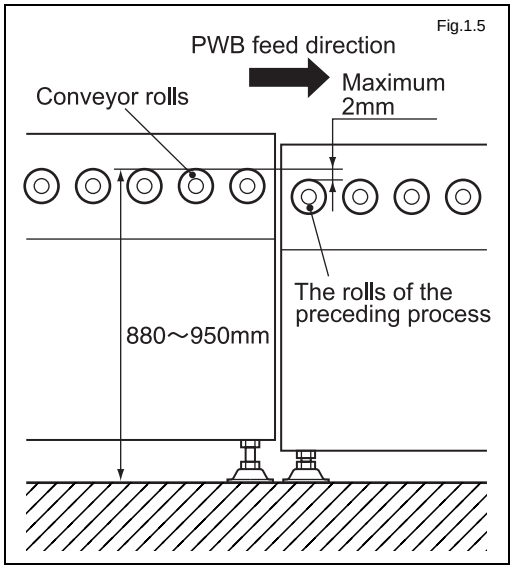
2. Adjust the level of the unit.

- Place a level on the conveyor base or conveyor rolls to level the unit using the leveling feet.

⚠ Caution

If the unit is not level, it may malfunction or degrade the quality of products.

■ Height of Conveyor Rolls



Adjust the height of conveyor rolls using the leveling feet. The height of the conveyor-roll surface from the floor must be between 880-mm and 950-mm.
When viewed from the side, the difference in height between conveyor rolls must be 2-mm or less. The height of the rolls must not increase down line. Said another way, the rolls of the preceding process must not be lower than those of the following process.

2.5 Removal of the fixing materials for transport and cable ties

To prevent damage to the unit during transport, it is shipped with movable parts fixed with cable ties (yellow) and fixing materials (yellow).

● After installing the unit , remove the cable ties and fixing materials.

⚠ Caution

After installing the unit, remove all the cable ties and fixing materials used for movable parts. If it is operated without removing the cable ties or fixing materials, it will be damaged.

2.5.1 Removal of the Fixing Materials for Transport

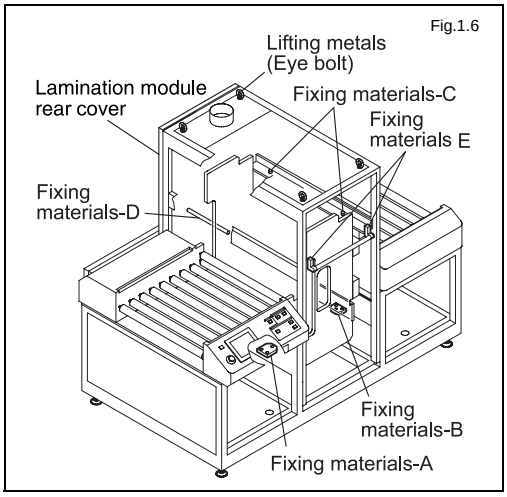
After transporting the unit and fixing it at the installation location, follow the steps specified in this section to remove the fixing materials for transport.

● Follow the steps specified below to remove these materials.

Necessary tools	・Phillips screwdriver ・5-mm Allen wrench ・8-mm Allen wrench ・10-mm spanner ・19-mm spanner ・13-mm spanner ・27-mm spanner ・claw bar or wrench

Note

Safely store the removed parts in the event that the unit is relocated in the future..



The fixing materials are used at the five locations on the unit shown in Figure 1.2.4 (left). Eye bolts for hauling are also fixed on the ceiling of the lamination module.

1

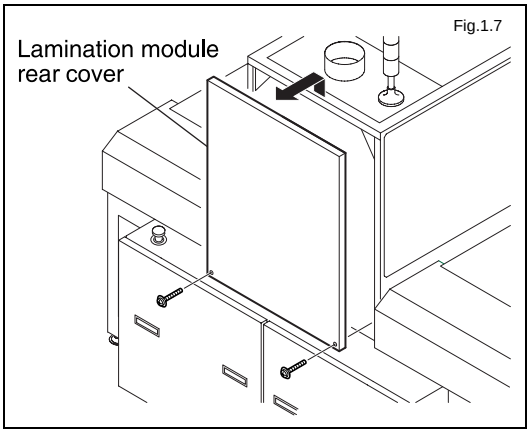


Fig.1.7

Remove the lamination module rear cover.

- To remove the cover, remove a fixing screw and then lift the cover up.

Required tool	Phillips screwdriver
Parts to be removed	M4 Phillips screw × 2

⚠ Caution

Do not touch the internal components when removing the lamination module rear cover.

2

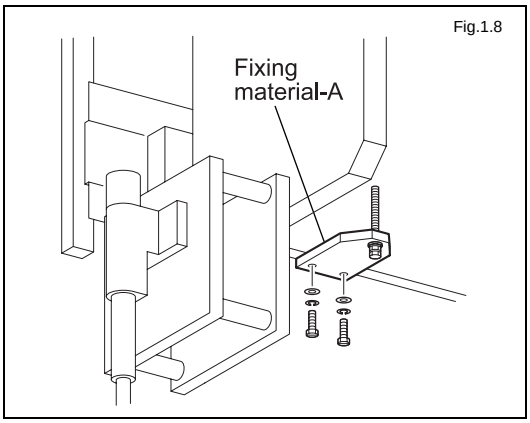


Fig.1.8

Remove fixing material A.

- Located on the input conveyor side on the bottom of the lamination module.

Required tool	13-mm spanner
Parts to be removed	M8 hex bolt, washer, spring washer × 2sets

3

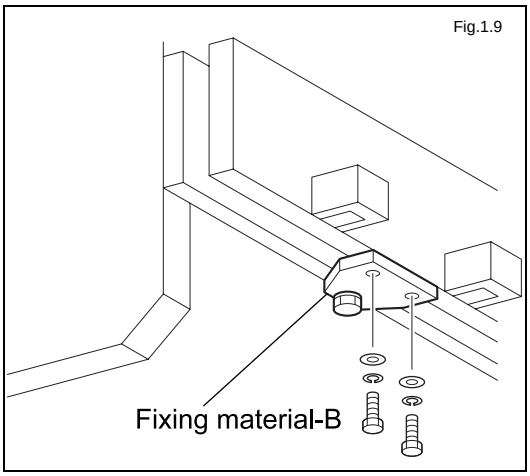


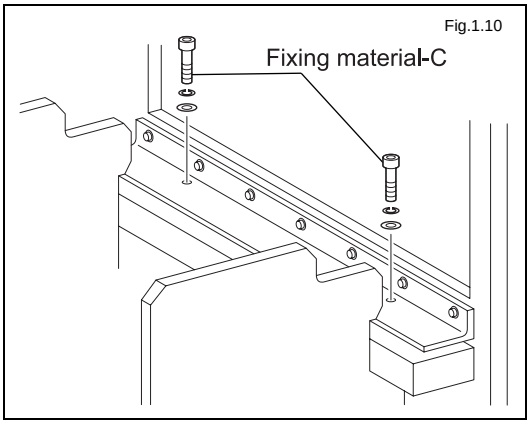
Fig.1.9

Remove fixing material B.

- Located on the output conveyor side at the bottom of the lamination module.

Required tool	13-mm spanner
Parts to be removed	M8 hex bolt, washer, spring washer × 2set

4

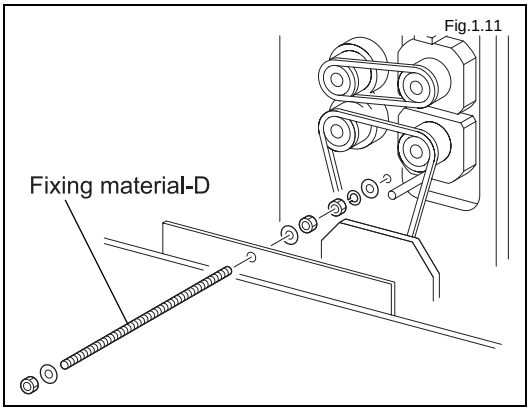


Remove fixing material C.

- Located on the output conveyor side near the top of the lamination module.

Required tool	8-mm Allen wrench
Parts to be removed	M8 cap bolt, washer, spring washer × 2sets

5

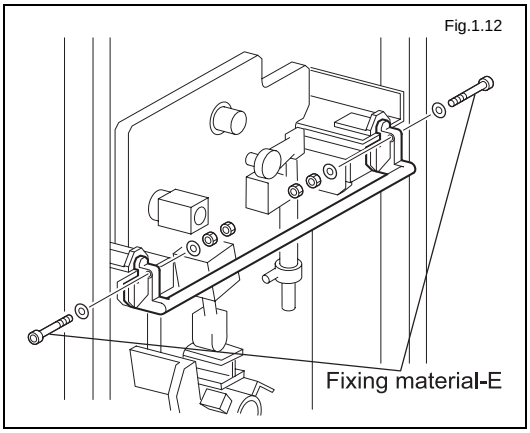


Remove fixing material D.

- Located at the center on the back of the lamination module.

Required tool	19-mm Allen wrench
Parts to be removed	M12 hex nut × 3, washer × 2, spring washer × 1, M12 stud bolt × 1

6



Remove fixing material E.

- Located on the Pull-Out handle at the center of the lamination module.

Required tool	5-mm Allen wrench, 10-mm spanner
Parts to be removed	M6 cap bolt × 2, washer × 4, M6 hex nut × 4

■ Installation and Adjustment of Pull-Out Casters

Fix the casters for pulling out the lamination module, and adjust the tension of the lamination module. Remove the fixing materials for transport to pull out the lamination module.

Required tools	・5-mm Allen wrench ・19-mm spanner

⚠ Caution

Be sure to fix the casters before pulling out the lamination module, to prevent it from overturning due to its unbalanced center of gravity.

Note

Before adjusting the tension of the pull-out casters, be sure to level the unit.

1

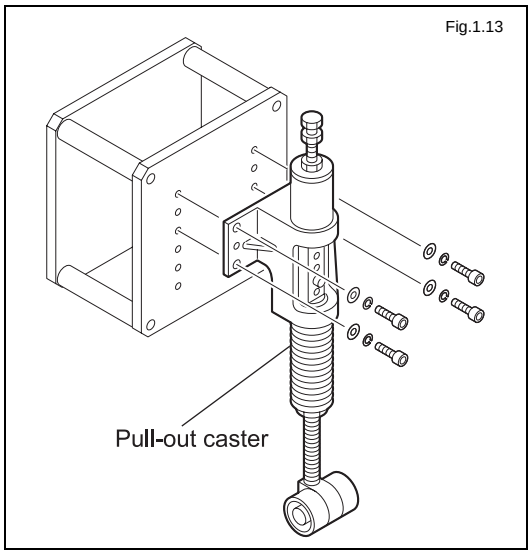


Fig.1.13

Install the pull-out casters.

● Open the lamination module front door and install the pull-out casters at the caster installation plate under the lamination module.

Required tool	5-mm Allen wrench
Parts to be install	M6 cap bolt, washer, spring washer × 4sets

2

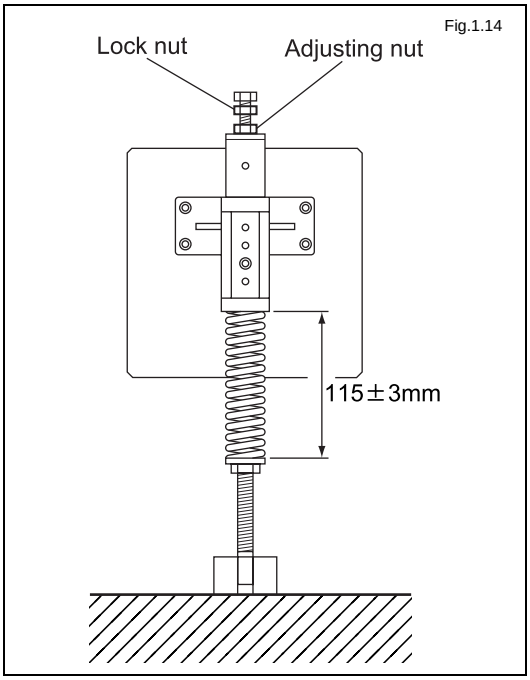


Fig.1.14

Adjust the tension of the pull-out casters.

- Use a spanner to turn the adjusting nut to adjust the casters' length, and secure them with the lock nut.

Required tool	19-mm spanner

2.5.2 Removal of Cable Ties

The cable ties (yellow) are used at various locations on the unit shown in the illustration below to fix the movable parts of the lamination module and conveyors.

- Cut them using a wire cutter.

⚠ Caution

Remove the cut cable ties from inside the unit. If the unit is operated with cut cable ties remaining inside, it will be damaged.

Fig.1.15

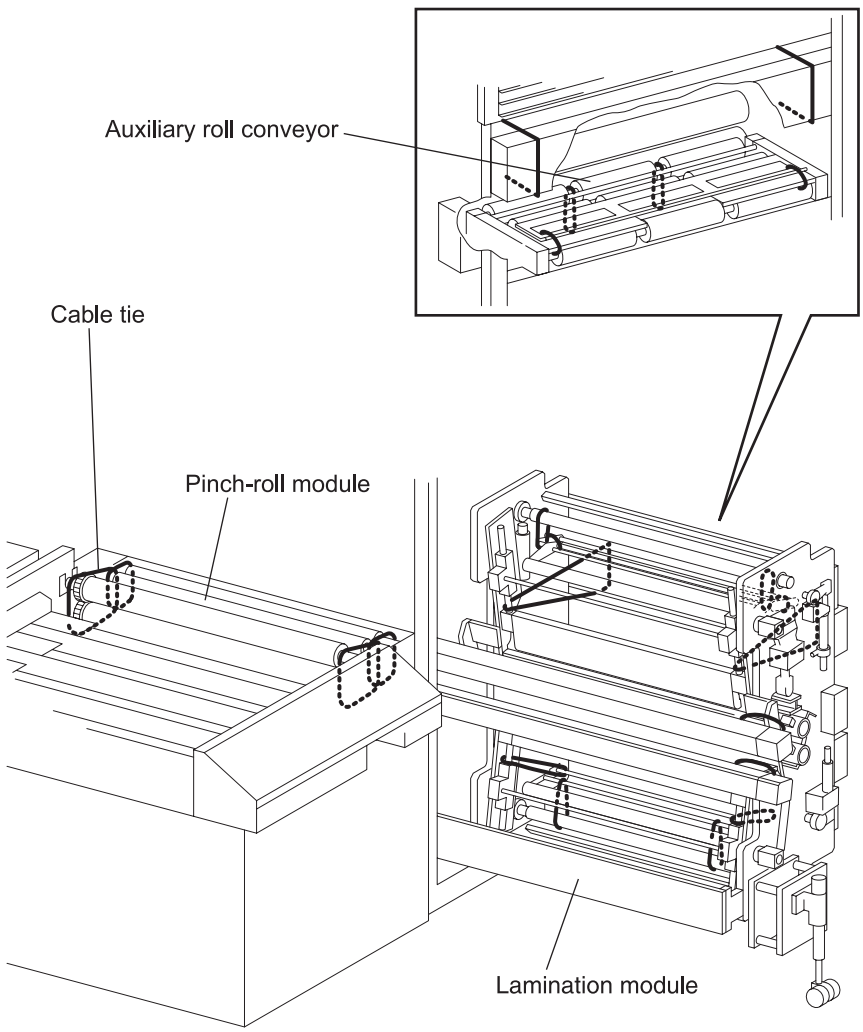
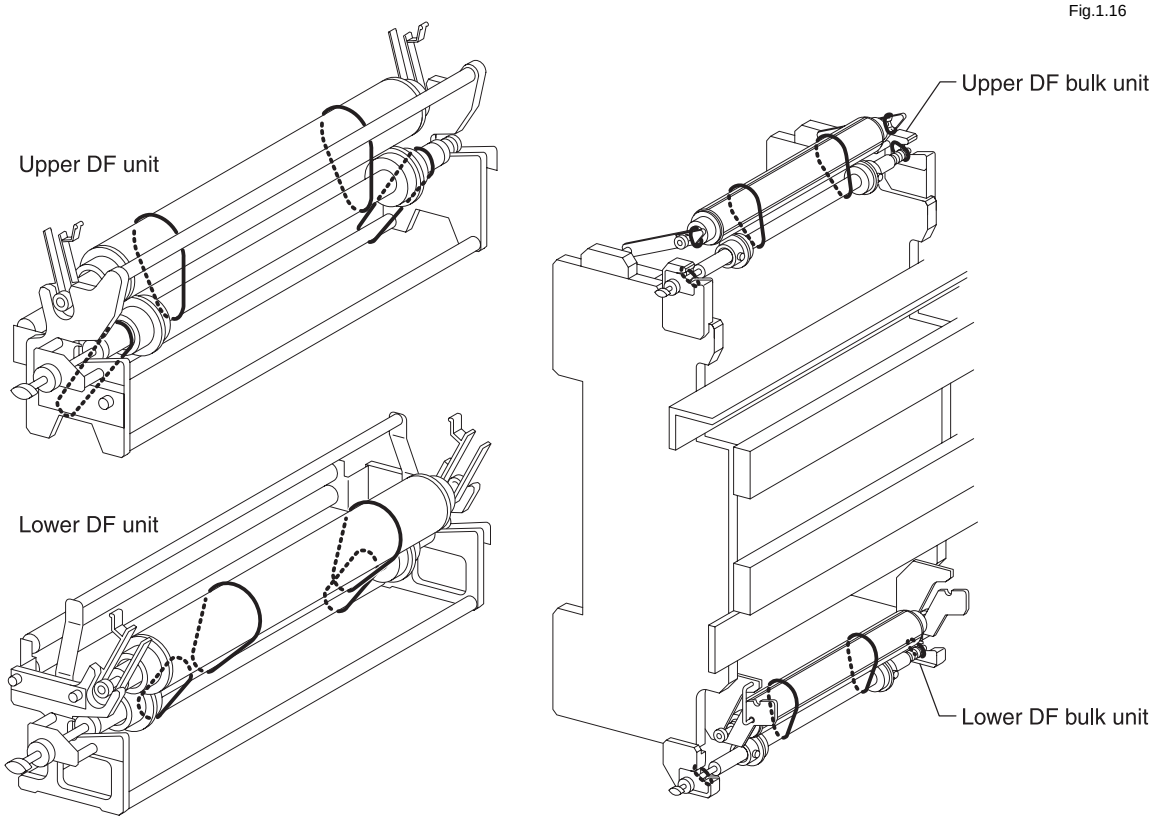


Fig.1.16

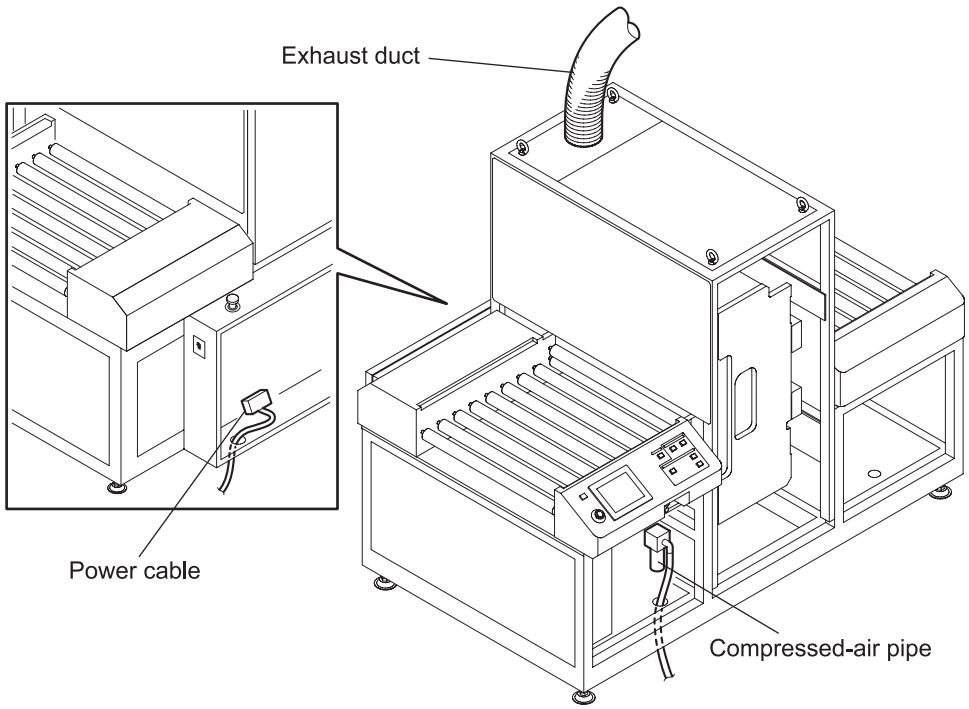

Upper DF unit
Lower DF unit
Upper DF bulk unit
Lower DF bulk unit

2.6 Confirmation of the Connection of the Power Source, Compressed Air, and Exhaust Duct

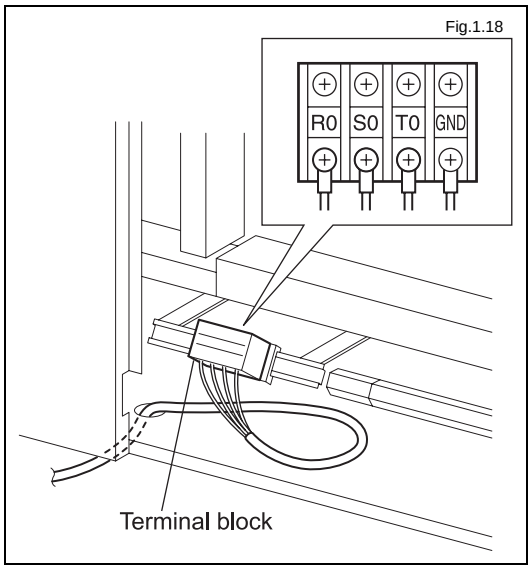
This Section explains the method for confirming the connection of the power source, compressed air, and exhaust duct after the unit is installed at the specified position.

- Confirm that the power cable, compressed-air pipe, and exhaust duct are connected to the locations shown in the illustration below.

Fig.1.17



2.6.1 Confirmation of Connection of the Power Source



Confirm that power cables are laid through the inlet at the bottom of the control box at the rear of the unit from the power source of the plant, and that they are connected to the unit.

- Confirm that power cables R, S, and T, and a grounding wire are connected to the terminal block in the control box.

⚠ Caution

To ensure normal operation, be sure to connect power cables R, S, and T correctly. If they are connected in the reverse phase, the motors will rotate in the opposite direction, resulting in malfunction.
For the method of confirming the connection of power cables R, S, and T, see 3.2, "Confirmation of the Direction of Motor Rotation" on page 31.

2.6.2 Confirmation of the Connection of Compressed Air

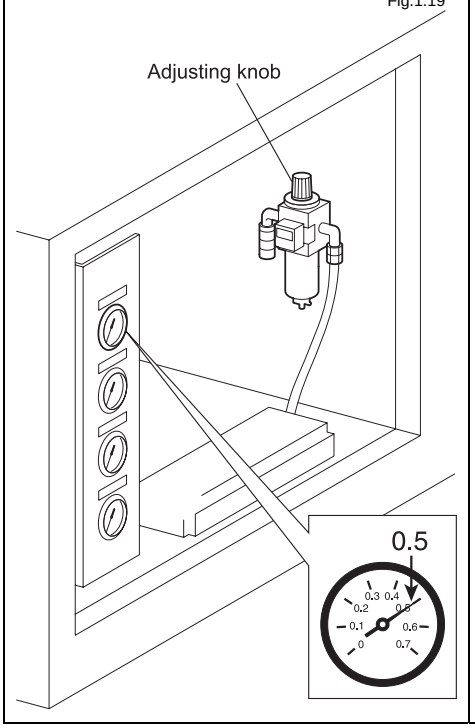
Confirm that the compressed-air pipe of the plant is laid through the compressed-air pipe inlet at the bottom of the air-blower module, and that it is connected to the unit.

⚠ Caution

- Confirm that the pressure of the compressed air is 0.5 MPa (5 kgf/cm^2) or greater.
- To operate the unit normally, supply clean compressed-air of a constant pressure.

■ Setting of Supply Pressure

Fig.1.19

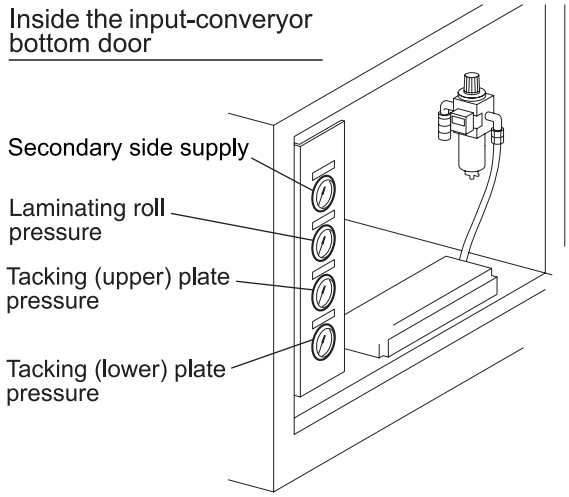


Turn the adjusting knob on the top of the filter regulator to set the supply pressure (on the secondary side) at 0.5 MPa (5 kgf/cm^2).

The supply pressure to each module is as specified below.
Set it correctly at the regulator.

- Laminating roll: 0.4 MPa (4 kgf/cm^2)
- Tacking (upper) plate: 0.25 MPa (2.5 kgf/cm^2)
- Tacking (lower) plate: 0.45 MPa (4.5 kgf/cm^2)

Fig.1.20



2.6.3 Confirmation of the Connection of the Exhaust Duct

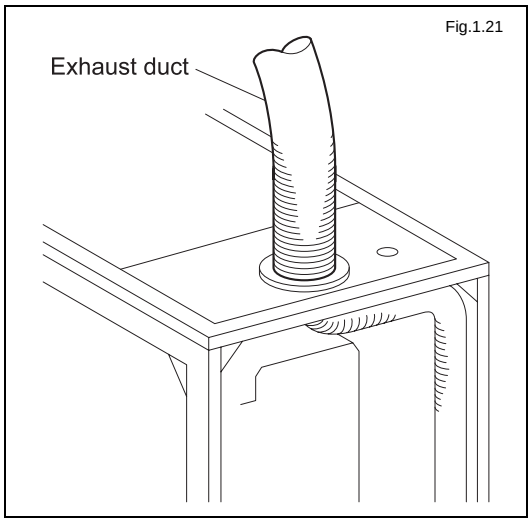


Fig.1.21

Confirm that the exhaust duct of the plant is connected to the exhaust duct on the ceiling of the lamination module.

⚠ Caution

Confirm that the exhaust from the plant is discharged outside the building.

Connect the wires, compressed-air piping, and exhaust duct.
Make sure there are no abnormalities in the unit:

- Can the lamination module be pushed and pulled smoothly?
- Are all cables and pipes connected tightly?
- Is any component loose or rattling?
- Is any component broken or rusted?
- Is there any foreign material in the components?
- Make sure the main pressure is 0.5 Mpa.

2.7 Installation of Parts

To prevent damage during transport, the unit is supplied with a signal tower, conveyor covers, and other parts that are removed and packed with air caps separately.

● After installing the unit at the installation site, fix these parts to the unit.

2.7.1 Installation of Signal Tower

1.

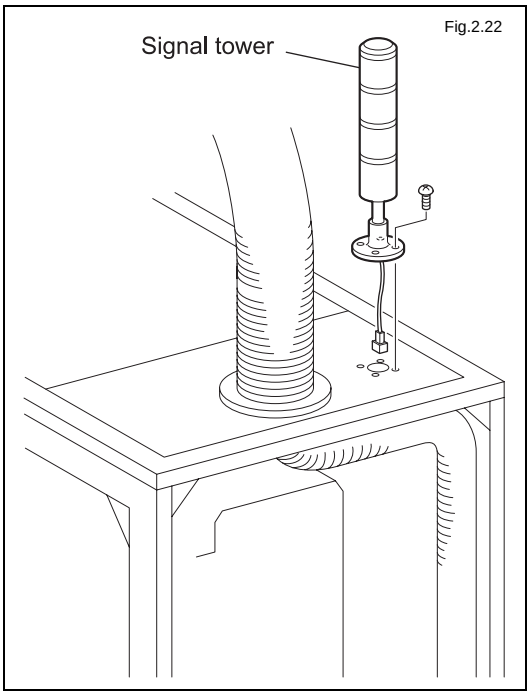


Fig.2.22

Fix the unpacked signal tower at the specified position on the ceiling of the lamination module.

Required tool	Phillips-head screwdriver
Parts to be install	M4 truss screw

2.

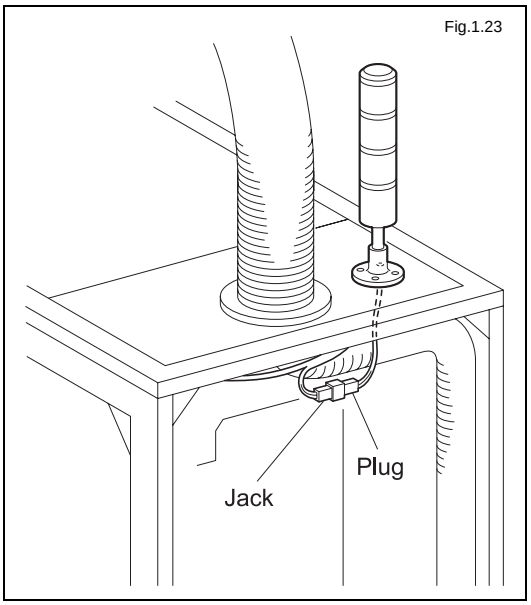
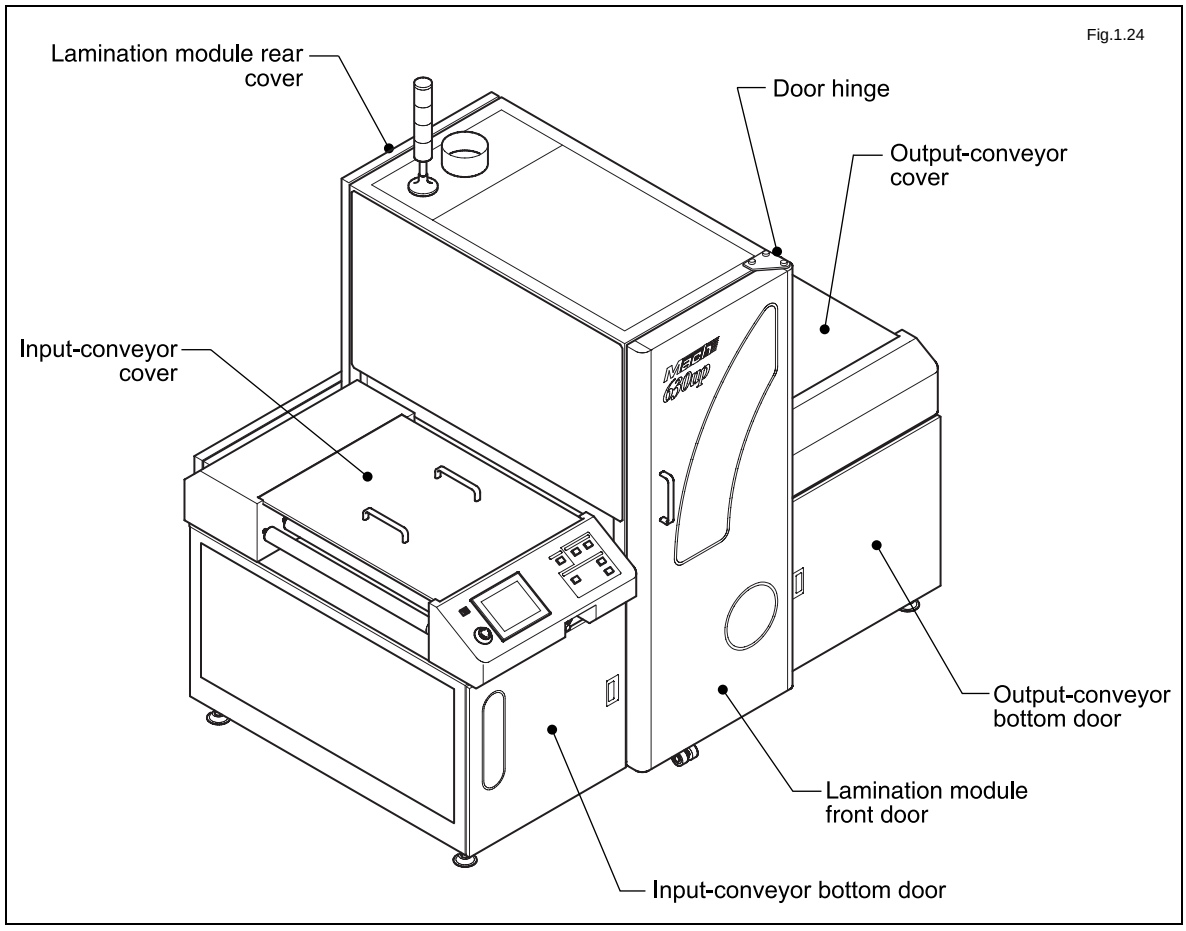


Fig.1.23

Connect the plug of the signal tower to the jack on the rear of the exhaust duct.

2.7.2 Installation of Covers

Install the unpacked doors and covers and the removed covers at the locations shown in the illustration below.



2.8 Electrical Connection with Other Machines

To ensure smooth in-line operation after the unit is installed on the process line, it is recommended that signals be transmitted to and from the upstream and downstream machines.

2.8.1 Specification of the Electrical Signal

Signal to be sent to the upstream machine (input-conveyor-side loading device) :
This signal is output from no-voltage contacts when the unit is in auto operation.

Signal to be received from the downstream machine (output-conveyor-side unloading device) :
This signal is input from no-voltage contacts into the unit when the downstream machine cannot accept PWBs.

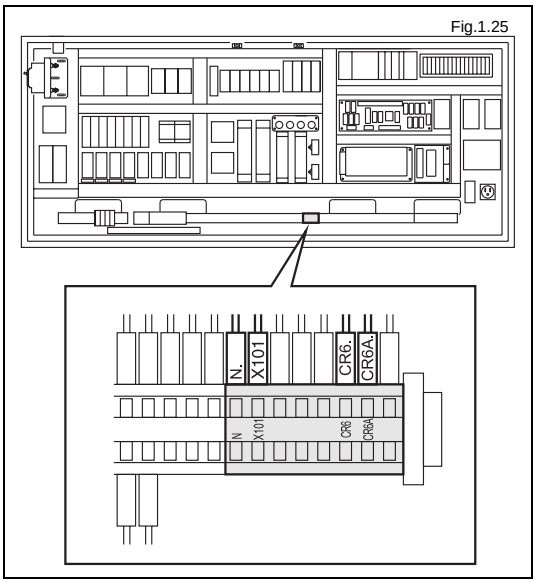
【Table 1.2.1 Electrical Signals】

	Signal to upstream machine	Signal from the downstream machine
Rating of contact	30 VDC /Maximum 2 A	24 VDC /4.5 mA or over
Configuration of contact	Normal open	
Rating of terminal	300V/10A	
Wire size	0.08 mm^2 to 1.5 mm^2 (AWG #28～#16)	

2.8.2 Connection Procedure

Lay the signal wires through the wire inlet on the left and right sides of the bottom of the control box, and through the duct to each terminal block.

Fig.1.25



Terminal block No.

Terminal for the signal to the upstream machine CR6,CR6A

Terminal for the signal from the downstream ..... machine X101,N

2.8.3 Confirmation of Connection

Lay electrical wiring from the unit to upstream and downstream machines, then issue a simulated signal from the main unit or a downstream machine to reject PWBs. After that, check upstream machine operation from the unit above.

- Issue a signal to reject PWBs from the unit (transmitter machine) to the upstream machine (receiver machine), and check the operation of the receiver machine. It should normally stop feeding PWBs to the transmitter machine. Repeat this test with the downstream machine as the transmitter machine and the unit as the receiver machine.

Note

- The signal to reject PWBs places the transmitter machine in the "BUSY" mode.
- Follow the instructions given in "3.1 Power Switch ON" (→P.1-30) to turn the power switch on. Perform an interlock operation to confirm that all components are properly connected.

Chapter 3 Power Switch ON/OFF

This Section explains the procedures for turning the power switch of the installed unit ON, operating it in manual mode, and turning the power switch OFF.

Contents of this Chapter

3.1 Power Switch ON

1.

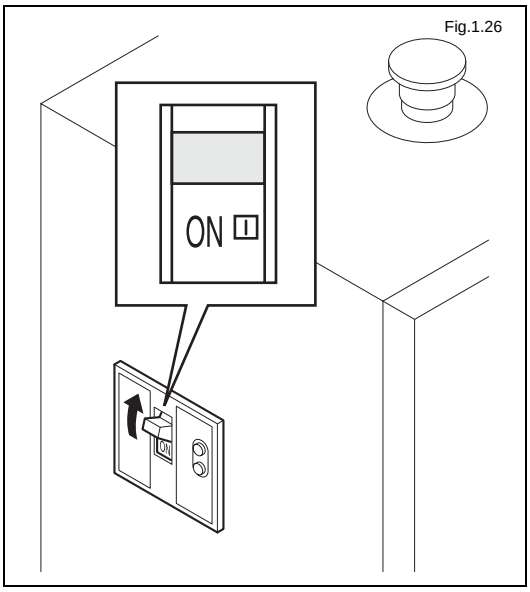


Fig.1.26

Supply power to the primary side of the plant and turn on the main breaker ON (|). The main breaker is located on the control box at the rear of the unit.

- The Source and Power OFF lamps on the operation panel will light up.

2.

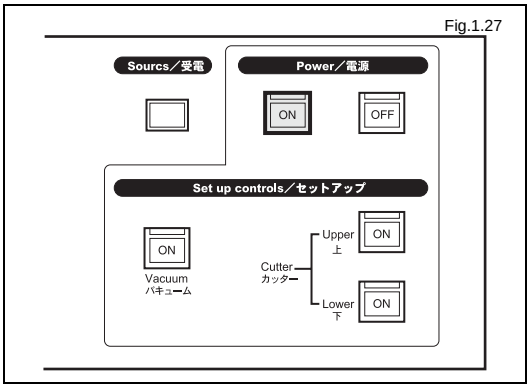


Fig.1.27

Open the cover of the Power ON button, and press the button.

- Power ON lamp will light up, and the main screen will be displayed on the touch panel.

Note

If Power ON lamp doesn't light up or the main screen is not displayed when the Power ON button has been pressed, check the emergency stop button and the interlock switch. If the emergency stop button is pressed or the control box cover is removed, power is not supplied to the unit.

⚠ Caution

After the ON button is pressed, the tacking blocks start the home position return operation.
Do not open the front door until the home position return operation is complete.

3.2 Confirmation of the Direction of Motor Rotation

The unit uses three phase (200/220 V) power. Before operating the unit, confirm that the cables (R/S/T) are connected correctly.

- To check the connection of R/S/T cables, turn the power switch on in order to drive the blower fan, and visually confirm that the motor rotates in the normal direction.

1. Open the input-conveyor bottom door.

- The blower fan is inside the input-conveyor bottom door.

⚠ Caution

The input conveyor bottom door doesn't have an interlock switch. Carefully check the rotation direction of the blower fan motor.

2.

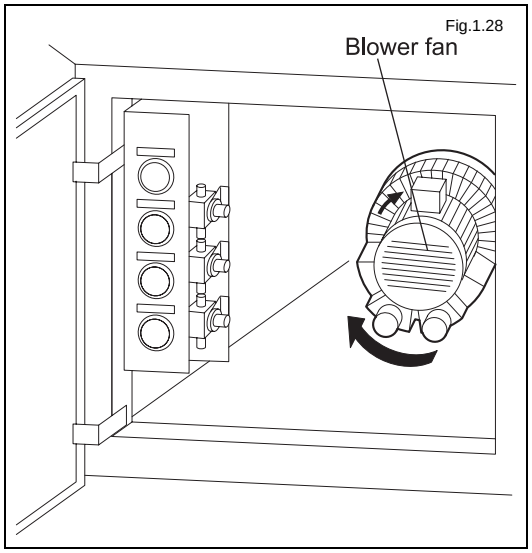


Fig.1.28

Open the cover of the Vacuum ON button, and press the switch. After approximately one second, press it again to perform inching operation*.

- The blower fan will run to rotate the motor.
- Confirm that the motor rotates in the direction indicated by the arrow on the blower fan.

* Inching operation: Operate the unit for a moment by turning the switch on and off quickly, to check whether it is operating normally.

⚠ Caution

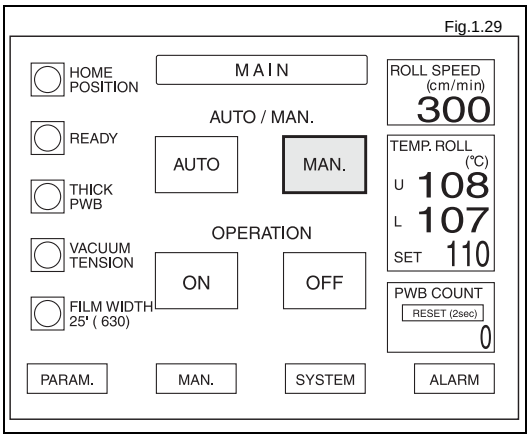
If the motor doesn't rotate in the direction indicated by the arrow, the R/S/T cables may be connected in reverse phase. See "2.6.1 Confirmation of Connection of the Power Source" on page 21 to check the connection of the power source again.

3.3 Confirmation of Functions by Manual Operation

After confirming wiring, compressed-air piping, exhaust duct, and confirming the direction of motor rotation, confirm that every module of the unit functions normally by manual operation.

1.

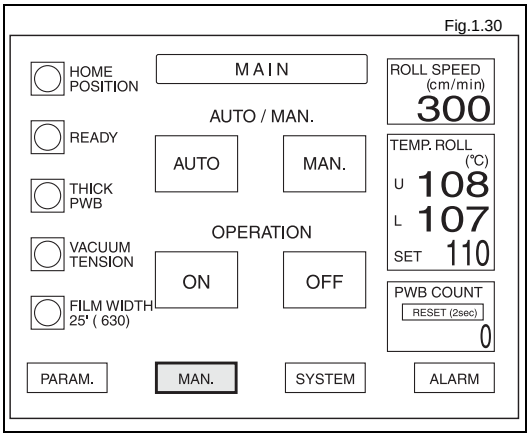
Fig.1.29



Press the yellow "MAN." button in the "AUTO/MAN." section of the main screen.

- The unit enters the "manual operation" mode, making the button for manual setup operational.

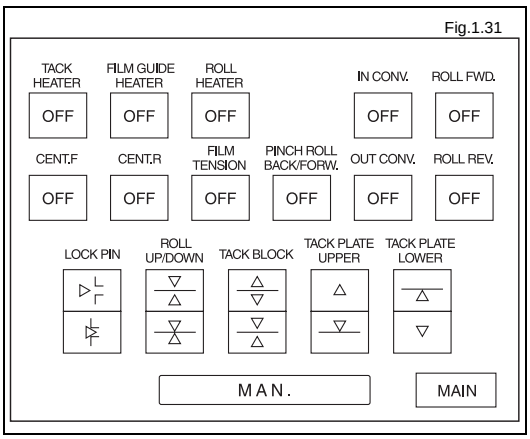
Fig.1.30



Press the white "MAN." button at the bottom of the main screen to access the manual screen.

2.

Fig.1.31



- The manual screen will be displayed.
- The unit can be operated from the manual screen.

* The explanation about film guides is indicated when you choose options.

3. Operate each module from the manual screen to confirm that it functions normally.

- See "3.4 Manual Operation" in "Chapter 3 Operation" for details on manual operation.

3.4 Power Switch OFF

⚠ Caution

Do not use the safety devices to stop the unit except in an emergency, or the unit may be adversely affected, resulting in a malfunction or degrading the quality of products when the switch is turned on to restart operation.

1.

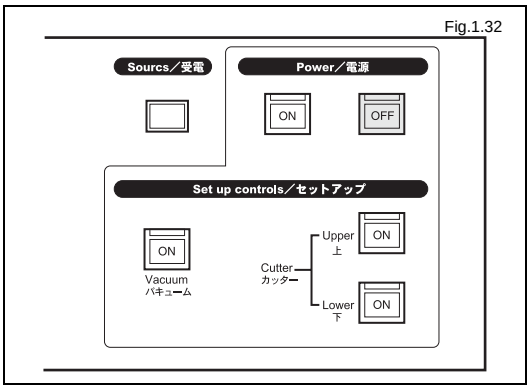


Fig.1.32

Open the cover of the Power [OFF] switch and press the button.

- The Power [OFF] lamp will light up and the display on the touch panel will disappear.

2.

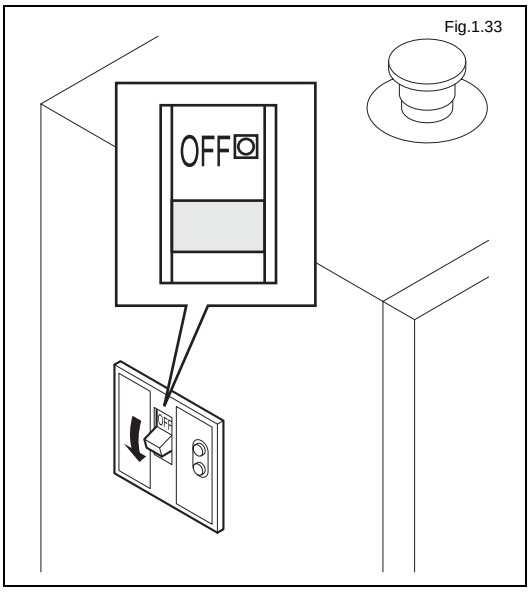


Fig.1.33

Turn off the main breaker OFF (○), which is on the control box at the rear of the unit.

- The [Source] lamp and the Power [OFF] lamp on the operation panel will go off.

Part 2

Operation

Chapter 1 Overview of the System and Process

This chapter outlines the system and its basic operation principles. Read this chapter to acquire preliminary knowledge for operation.

Contents of this Chapter

1.1 Features

① No wasted film

When a conventional hand laminator is used, the film has to be laminated continuously on the PWBs to an excessive length and then trimmed, wasting large quantities of expensive dry film. With this unit, however, it is only necessary to laminated the film after it is cut to the desired length, thereby eliminating wasted film.

② Simple operation

The newly adopted film-roll unit (DF unit) considerably simplifies film-exchange and set up, as the lamination module can be pulled out in the front. This reduces the preparation time to half or less of that required for a conventional unit, and substantially improves productivity.

③ Film holding with vacuum pressure

The film is held for tacking and cutting by the suction pressure of a vacuum. As the film is held on the protective-film side, the guide rolls do not contact the emulsion side. This keeps the film free from dirt and dust.

④ Film cutting by a rotary cutter

The disk-type rotary cutter has a longer service life than the knife-type cutter, and exhibits stable film-cutting performance.
The cutter cover ensures the safety of cutting operations.

⑤ Elimination of contaminants and increased line speed

A lower cutter rotating speed reduces the amount of contaminants generated when the film is cut. The contaminants are removed by the vacuum pressure of the cutter backup. The higher cutter shuttle speed increases the line speed and minimizes the generation of contaminants. In addition, the structure of the unit has been simplified.

⑥ Higher precision of the dry-film laminating position

The high-speed processing programmable logic controller and the feed detection sensors (two rotary encoders) have improved the precision of front and rear space control. As the motors for driving the feeding rolls and tacking block are separately controlled, a high-precision synchronization speed is attained to improve the precision of the laminating position.

⑦ Quick recovery of the laminating temperature

When a PWB is laminated the rolls' surface temperature drops as the heat is transferred to the PWB . A new type of heater and a new control method prevent such a temperature drop so that the laminating temperature is quickly recovered. Thinner roll rubber also contributes to quicker temperture recovery.

⑧ Improved pressure of laminating rolls

The sliding roll-pressure mechanism of the conventional unit has been changed to a new arm-type pinch-roll mechanism equipped with a cylinder of larger bore diameter. This ensures a greater and more uniformly distributed force is transferred to the rolls.

⑨ Film setup control

The pullout stroke is longer than that of previous models. This enables smoother film setup control (from 700 mm to 1070 mm).

⑩ Feeding speed of the input-conveyor pinch roll is synchronized with the line speed

The newly installed synchronizing mechanism eliminates the difficult adjustment of the pinch-roll feeding speed that was necessary on previous models.

⑪ Countermeasures against contaminants of mechanical parts

To prevent the generation of contaminants, stainless steel and aluminum are widely used in the components (particularly those above the path line). The tacking-block synchronizing mechanism is totally covered to prevent the generation of contaminants and to ensure improved safety, which was not possible with previous models.

⑬ Package arrangement of the controls for operation

All of the controls for operation are arranged on the front of the input conveyor to ease operation and improve visibility.

⑭ Improved cleaning feature

The pullout stroke of the lamination module has been extended, and the roll immediately after the laminate roll is detachable. As a result, it is easier to clean the upper and lower laminating rolls.

⑮ Simple design

The outside covers are made of polished stainless and oxidized aluminum plates, and are sometimes coated with anti-static resins (smoky color and clear color), making them suitable for operation in clean rooms. The touch panel simplifies operation.

⑯ Variety of optional functions

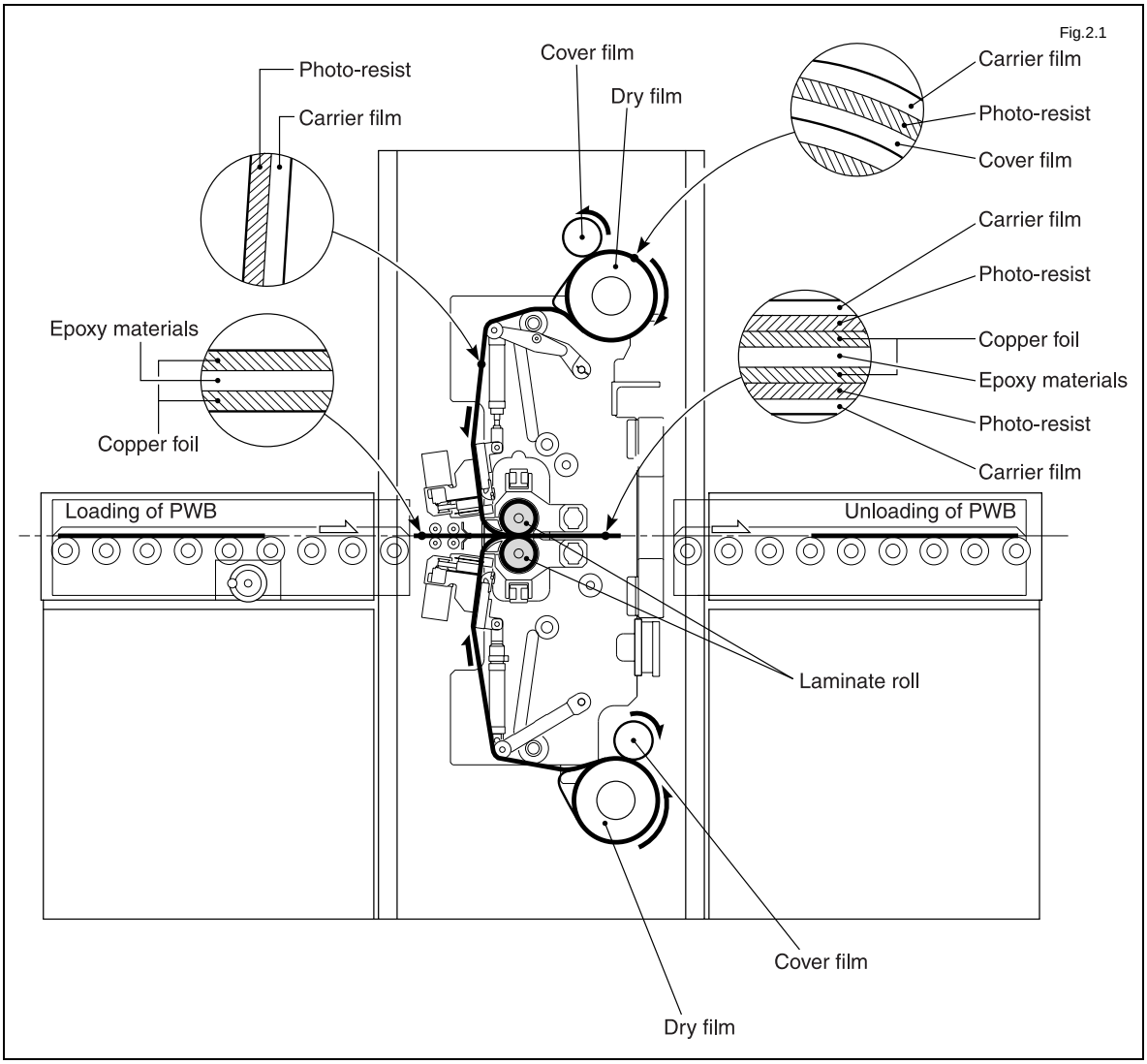
A variety of optional functions have been developed for the unit to meet the needs of users.

1.2 Basic Principles

This unit is constructed to heat-laminate dry film to the specified portions of both sides of a printed wiring board (PWB) automatically.

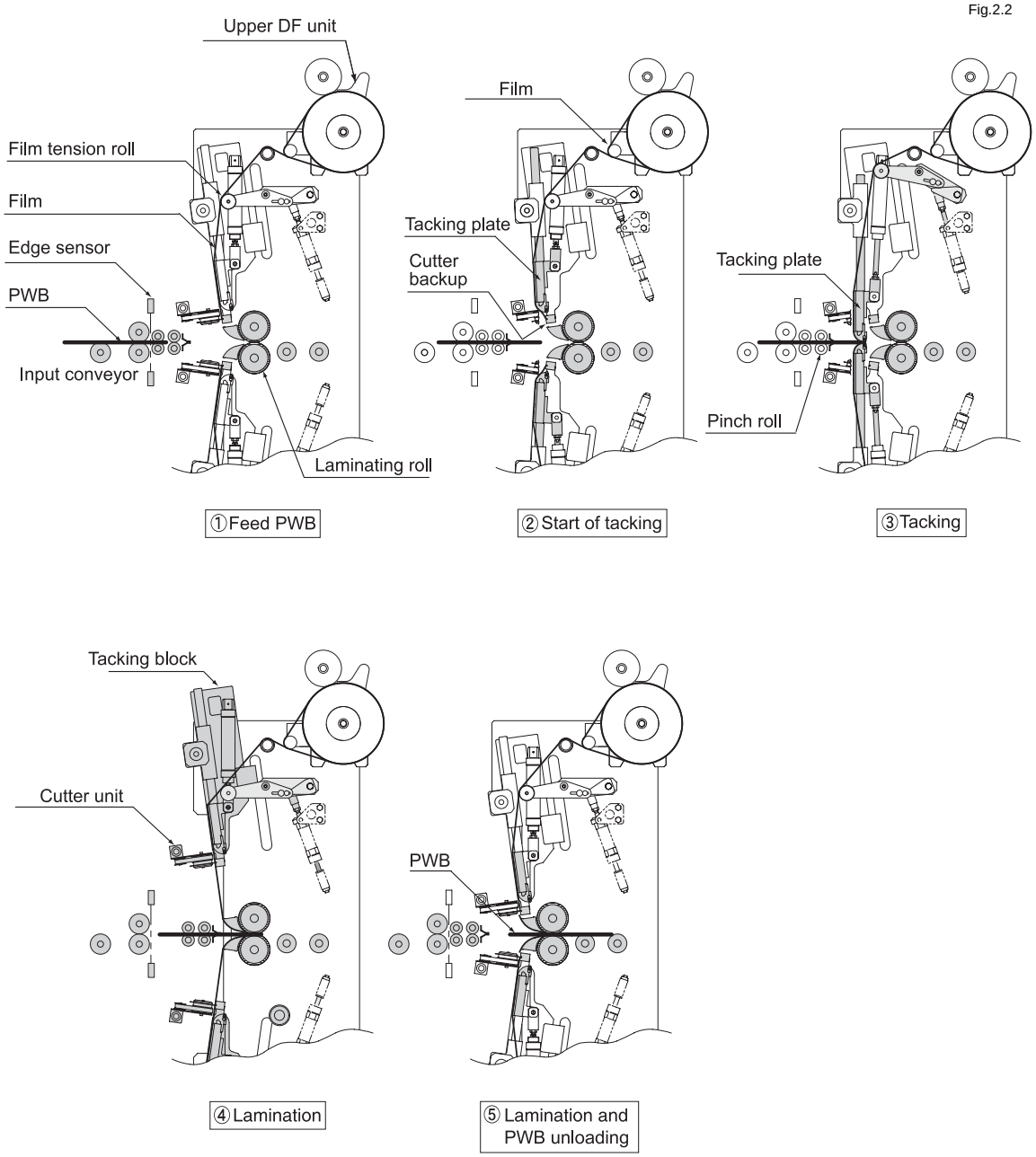
- Load a dry film roll consisting of a carrier film, a photo-resist and a cover film into the DF unit (or the DF bulk unit).
- The cover film is first separated from the dry film in DF unit. Then the dry film is passed through the film-running route to a PWB for tacking. The separated cover film is wound into the eco-roll.
- The photo-resist surface of the dry film is heat-laminated to the copper foil surface of a PWB by the rotation of the laminating rolls.
- The PWB with the heat-laminated dry film is transferred to the downstream unit (the next production process) by the output conveyer module.

Fig.2.1



1.3 Operation Sequence

Fig.2.2



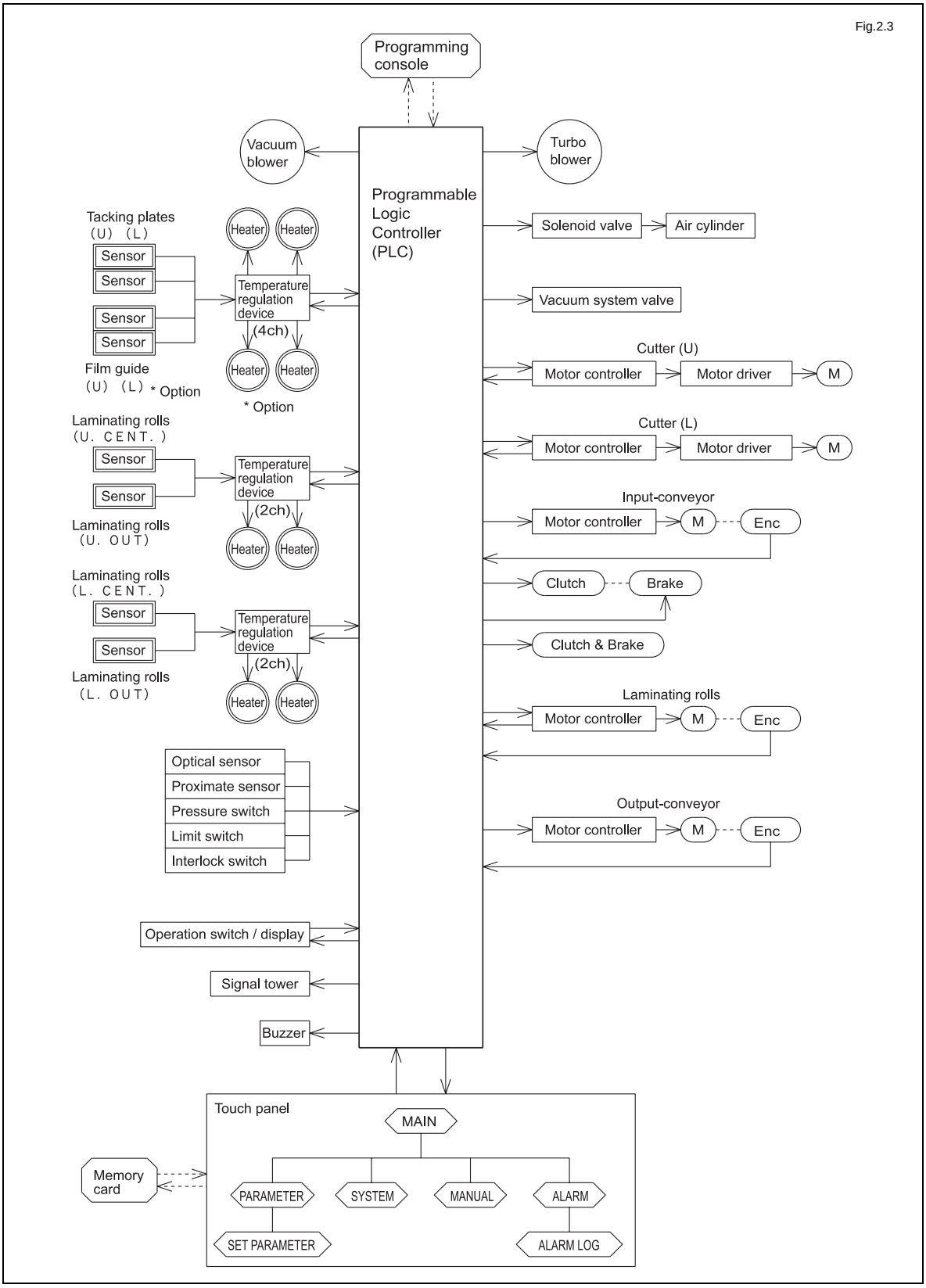
※ The above illustration shows the motion of the upper lamination module. The motion of the lower lamination module is symmetrical with that of the upper.

【Table 2.1.1 Operation Sequence】

① Feed PWB	**1.** The edge sensor detects the position of the front edge of the PWB fed by the input conveyor. **2.** The pulse signals of the rotary encoder fixed to the input conveyor are counted after the edge sensor detects the position of the PWB.
② Start of tacking	**3.** When the pulse signals generated by the rotary encoder reach the preset count, the input conveyor stops. The location of the PWB front edge when the input conveyor stops is the tacking position. **4.** The front edge of the dry film on the cutter backup moves to the tacking rubber of the tacking plate, which is close to the PWB.
③ Tacking	**5.** The tacking plate tacks the front edge of the film to the top and bottom of the PWB. **6.** The film tension roll rotates to cause the film to sag.
④ Lamination	**7.** The tacking plate and block move to the opened position. The pinch rolls feed the PWB into the laminating rolls. **8.** The laminating rolls rotate to laminate the film to the PWB. **9.** The pinch-roll module moves backward and the PWB is fed to the lamination module. **10.** When the edge sensor detects the PWB's rear edge, the counter starts counting the pulse signals of the rotary encoder installed on the lamination module drive shaft. **11.** When the pulse signals reach the preset count, the tacking block moves toward the PWB at the same speed as that of the film, while the cutter unit simultaneously shuttles to cut the film.
⑤ Lamination and PWB unloading	**12.** The cut dry film is held by the film guide until laminated on the PWB. **13.** The laminated PWB is fed to the next process unit by the output conveyor.

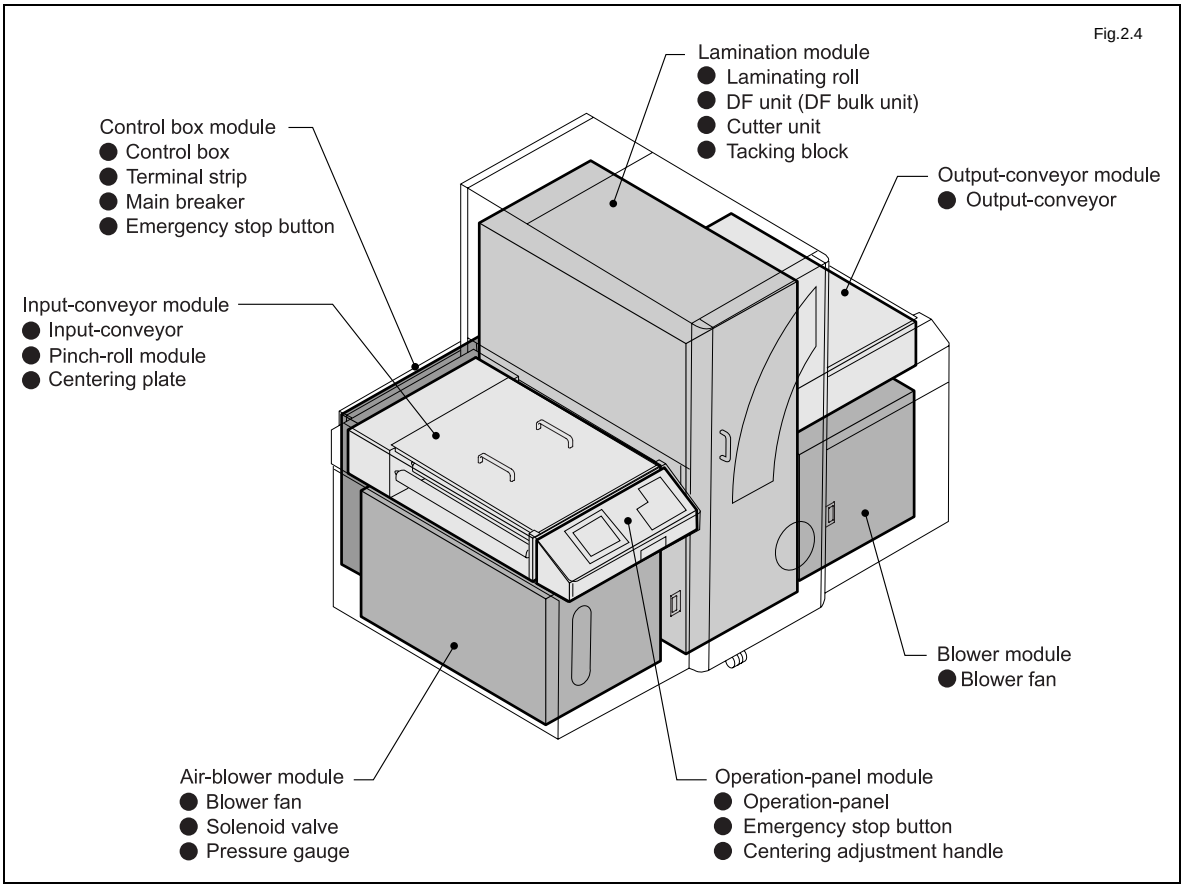
1.4 System Block Diagram

Fig.2.3



1.5 Module Locations

Fig.2.4



【Table 2.1.2 Modules】

Module	Function
Input-conveyor module	Feeds and positions PWBs (centering and detection of the PWB edge).
Lamination module	Main module of the unit for mounting the DF unit (DF bulk unit), feeding, tacking, cutting, and heat-laminating film through the use of the laminating roll.
Output-conveyor module	Transfers PWBs to the downstream machine.
Blower module	Blower fan to hold film and suck contaminants when film is cut.
Air-blower module	Has an air inlet for the unit, and houses a regulator to distribute air to other modules. Houses a blower fan to hold film.
Operation-panel module	Has the touch panel and operation buttons used to operate the unit, and a handle for adjusting the centering width.
Control box module	Houses a programmable controller, a DC power supply, and other electrical control parts.

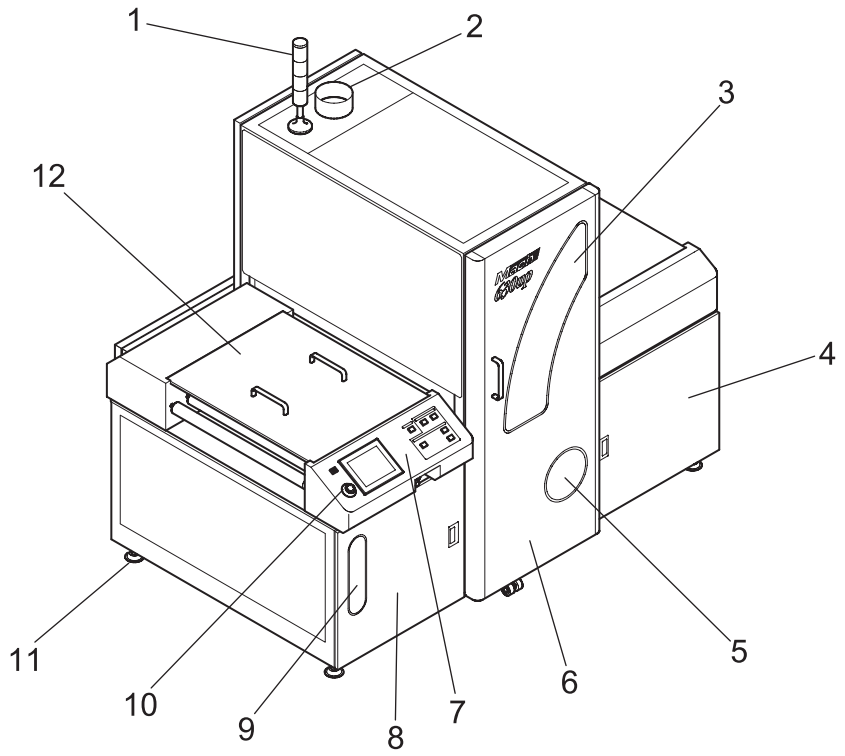
Chapter 2 Components and Functions

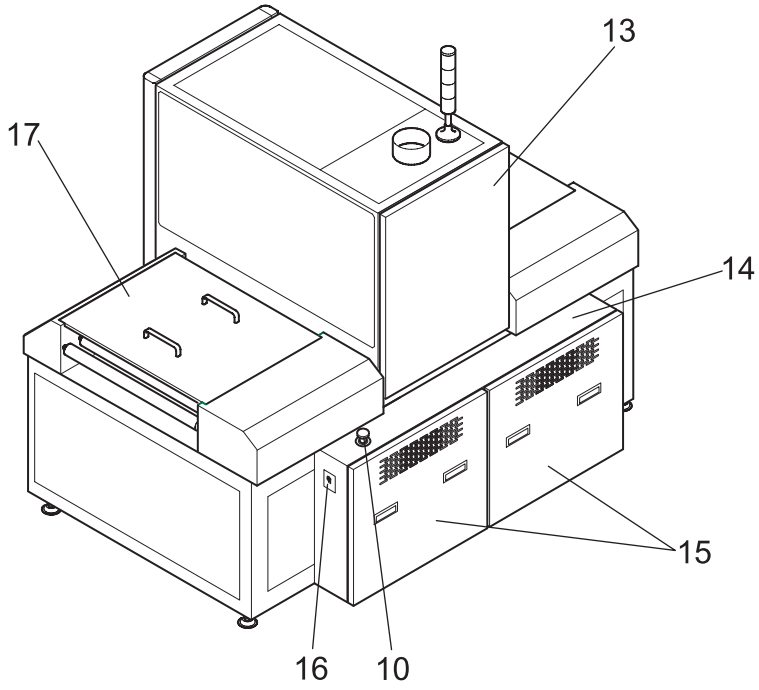
This chapter shows the components and their functions.

Contents of this Chapter

2.1 Appearance

Fig.2.5





【Table 2.2.1 Components and Functions, External Appearance】

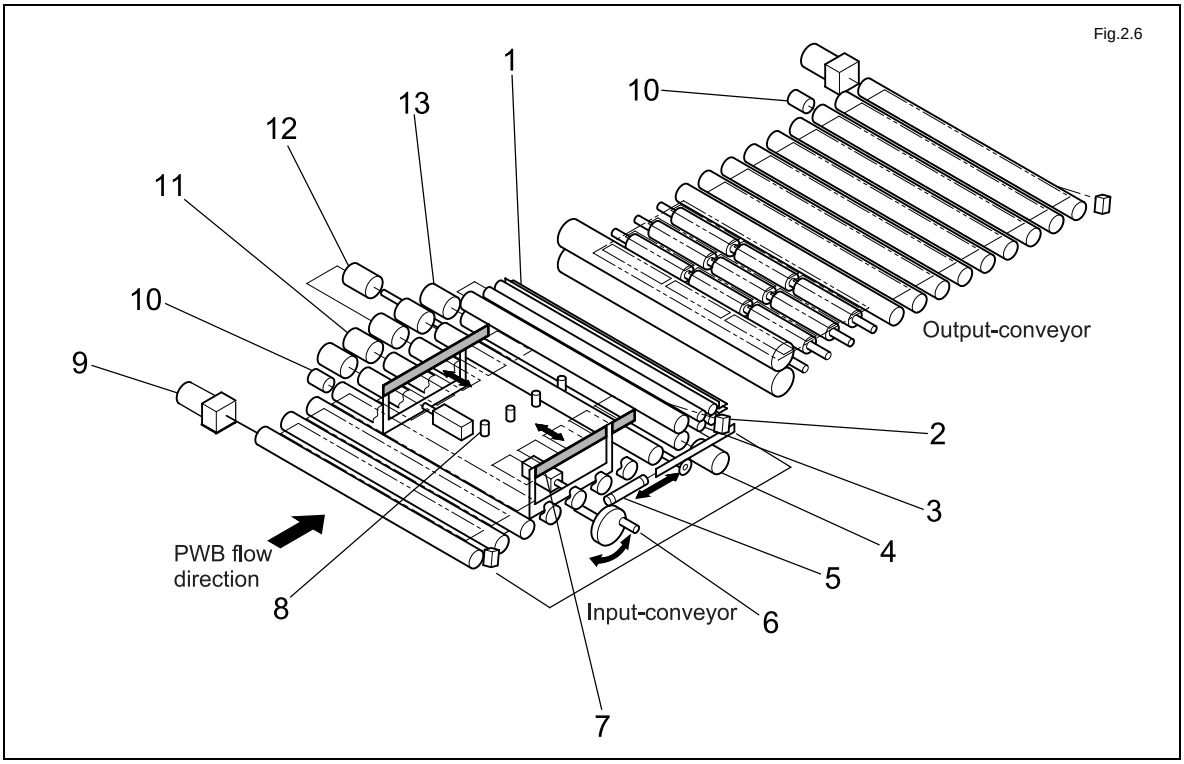
No.	Component	Function
1	Signal tower	Displays the status of the unit using three lamps (red, yellow, and green). Red lamp: Lights when an alarm has been issued in the unit. Yellow lamp: Lights when the unit is in the idle state or in the manual operation mode. Green lamp: Lights when the unit is in the automatic-operation mode.
2	Exhaust duct	Duct connected to the plant duct to discharge heat and contaminants generated within the unit.
3	Upper monitoring window	Window for monitoring the status of the lamination module operation and upper DF unit.
4	Output-conveyor bottom door	Open this door when performing maintenance on the blower fan or solenoide valves.
5	Lower monitoring window	Window for monitoring the lower DF unit.
6	Lamination module front door	Open this door when pulling out the lamination module to replace the DF unit or for maintenance purposes. Do not open it unnecessarily in the automatic-operation mode.
7	Operation panel	Used to set up PWB information and to enter, control, and display automatic operation data. The panel displays information on operational conditions and alarms, if any have been issued.
8	Input-conveyor bottom door	A blower fan is located inside the door. Open this door when connecting the plant air supply to the unit, adjusting the air pressure, replacing solenoide valves, performing maintenance service on the components or confirming the direction of rotation.
9	Pressure-gauge window	Window for checking the indications of the pressure gauges for the laminating roll, upper and lower tacking plates, and main pressure.
10	Emergency stop button	Press this button in an emergency or when a failure has occurred in the unit. The unit will immediately stop in the same manner as when the Power [OFF] button is pressed. After correcting the cause of the failure, turn it clockwise to reset.
11	Leveling feet	Feet for adjusting the height and level of the unit. There are four leveling feet, one at each corner.

【Table 2.2.1 Components and Functions, External Appearance (Continued)】

No.	Component	Function
12	Input-conveyor cover	Cover for protecting products on the input conveyor.
13	Lamination module rear cover	Remove this cover when maintenance service is performed on the lamination module. Do not remove it unnecessarily in the automatic-operation mode.
14	Control box	Houses a DC power supply, fuses, and other electrical parts.
15	Control-box cover	Remove this cover when the unit is installed or maintenance work is performed on electrical parts. This cover has an interlock switch. Do not remove it unnecessarily in the automatic-operation mode.
16	Main breaker	Supplies power to the unit. When power is supplied, the Source lamp on the operation panel lights up.
17	Output-conveyor cover	Cover for protecting the products on the output conveyor.

2.2 Conveyors

Fig.2.6



【Table 2.2.2 Conveyors】

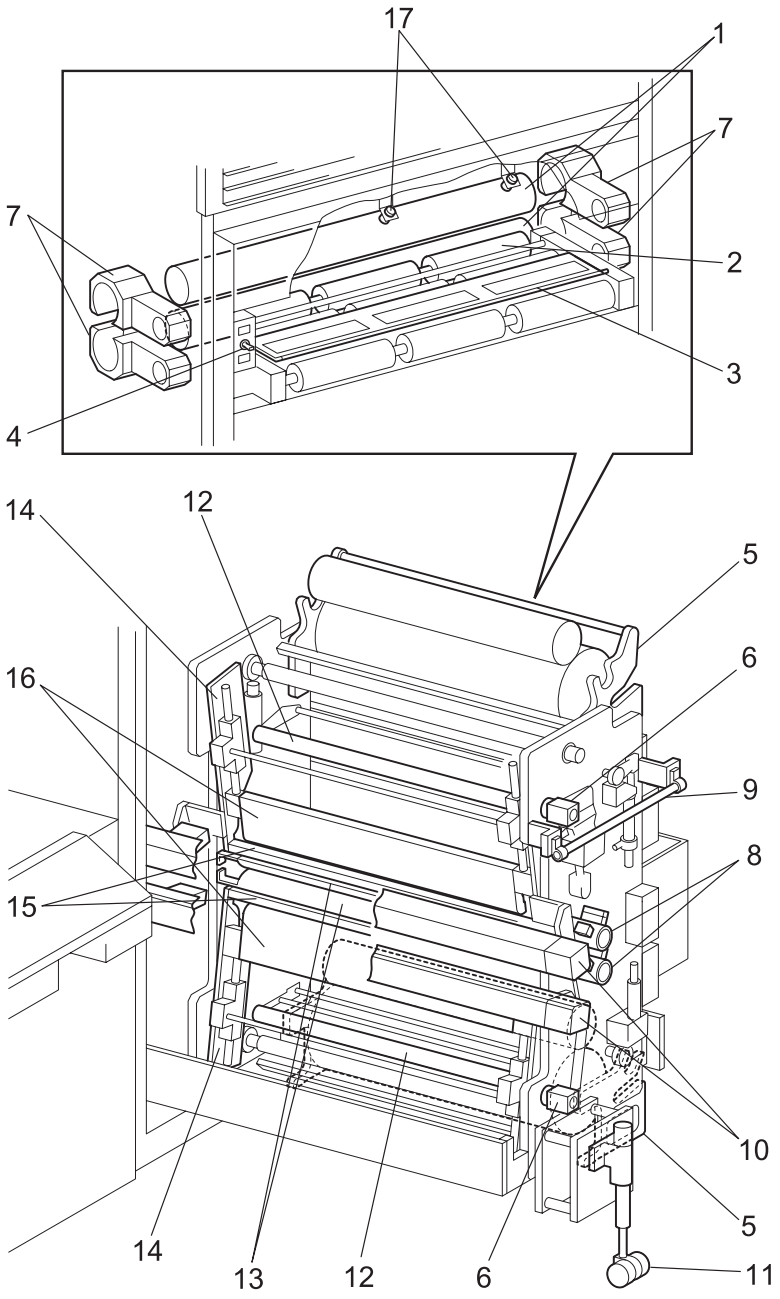
No.	Component	Function
1	Thin-PWB holding guide	Holds the front edge of a thin PWB and moves it to the laminating roll.
2	Edge sensor	Detects the PWB front and rear edges.
3	Pinch-roll module	Transfers PWBs from the input conveyor to the laminating roll.
4	Brake	Controls the roll rotation of the pinch-roll module, and stops it when necessary.
5	Air cylinder	Moves the pinch roll backward.
6	Centering adjustment handle	Adjusts the centering width of PWBs on the input conveyor.
7	Centering plate	Centers the PWB on the input conveyor.
8	PWB detection sensor	Detects the position of the PWB on the input conveyor.
9	Motor	Drives the feeding rollers on the input conveyor.
10	Rotary encoder	Pulse generator for determining the PWB travel distance based on the PWB front or rear detection signal from the edge sensor.
11	Clutch / brake 1	Controls the rotation of each feeding roll based on the PWB detection-sensor signal.

【Table 2.2.2 Conveyors (Continued)】

No.	Component	Function
12	Clutch / brake 2	Controls the forward movement of each feeding roll through the use of a motor, and stops it when necessary.
13	Clutch	Controls the rotation of the pinch roll.

2.3 Lamination Module

Fig.2.7



【Table 2.2.3 Lamination Module】

No.	Component	Function
1	Upper/lower laminating rolls	Rollers heated by a heater for heat-lamination.
2	Auxiliary roll conveyor	Conveyor for feeding the PWB products unloaded from the laminating roll to the output conveyor.

【Table 2.2.3 Lamination Module (Continued)】

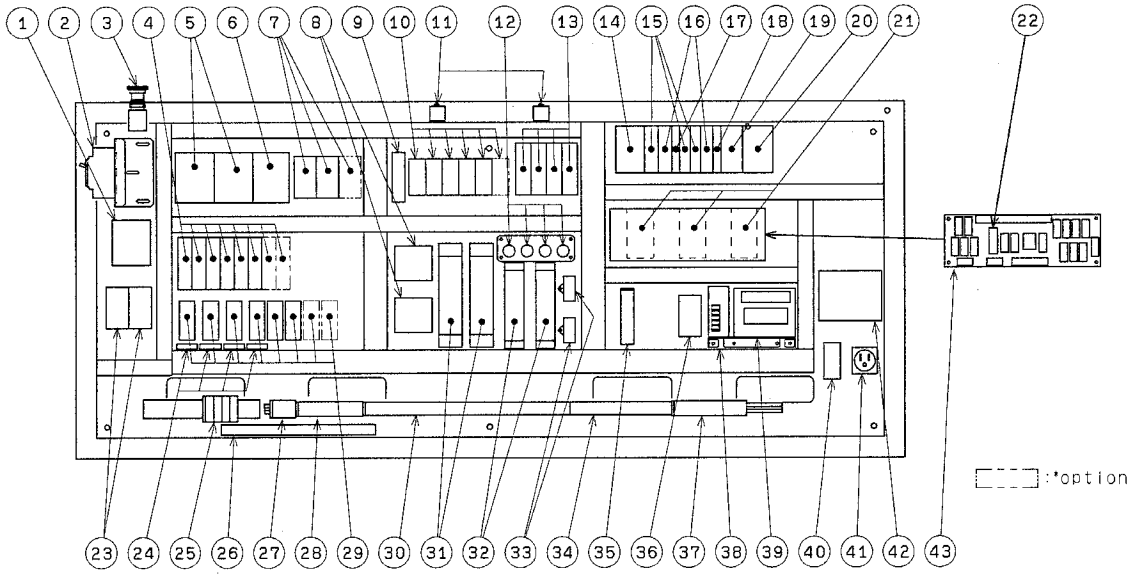
No.	Component	Function
3	Auxiliary plate *Option	Supports a thin PWB when it passes over the auxiliary roll conveyor. Open this plate when maintenance service is performed on the laminating roll.
4	Roll inching switch	Switch for rotating the laminating roll and the auxiliary roll conveyor forward and backward. Use this switch when performing maintenance service on these components.
5	Upper/lower DF units *	Units that integrate the dry-film roll and cover film rewinding roll (Eco roll) and enable easy loading/unloading to the lamination module.
6	Upper/lower lock pins	Fix and release the tacking block.
7	Housing	Supports both axles of the laminating roll.
8	Slip ring	Slip ring for supplying power to the roll heaters. As the slip-ring brush wears, inspect and replace it when necessary.
9	Pull-out handle	Use this handle to pull out the lamination module.
10	Upper/lower cutter unit	Modules installed on the tacking block used to cut dry films to a specified length.
11	Pull-out casters	Casters for supporting the weight of the lamination module when it is pulled out.
12	Upper/lower tension rolls	Reduce the tension of the dry film during tacking.
13	Upper/lower film guides	Surface upon which the dry film runs just before it contacts the PWB. ** These guides have built-in heaters for heating film to facilitate heat-lamination.
14	Upper/lower tacking blocks	Modules for tacking, laminating, and cutting films using a tacking plate and cutter unit. They approach the PWB as the cutter unit cuts the film.
15	Upper/lower cutter backup	Grooved plates that allow the cutter units to cut film without damaging the blades.The grooves have vacuum holes to collect any debris created when film is cut.
16	Upper/lower tacking plates	Plates for holding the dry film with vacuum pressure, moving film to the PWB, and tacking the film at the PWB front edge using a built-into heater and a tacking rubber.
17	Laminating roll temperature sensor	This sensor is used to control the temperate of laminating roll.

* The DF bulk unit may be installed instead of the DF unit depending on the specifications of the unit used.

** When the film-guide heaters may be chosen as an option.

2.4 Control Box

Fig.2.8



【Table 2.2.4 Components and Functions, Control Box】

No.	Component	Function
1	Magnet relay	Provides AC or DC current to the control coil, makes and breaks the mechanical contact, and drives the connected load. It is mainly used to drive the blower and heater.
2	Main breaker	Overcurrent detection circuit breaker combined with the main power switch (toggle lever). Power supply is interrupted in case of leak detection.
3	Emergency stop switch	Press this button in an emergency or in the event of a serious problem. The unit will immediately stop in the same manner as when the Power OFF button is pressed. After correcting the problem, turn it clockwise to reset.
4	Solid state relay	Semi-conductor SSR for applying DC voltage to the control circuit to drive the AC load connected to the internal bi-directional thyristor. It is used to drive the heater.
5	Motor breaker	Overcurrent detection circuit breaker used for the motor drive circuitry. It is used for the blower fan motor.
6	No fuse breaker	Recoverable overcurrent detection circuit breaker in place of fuses. It is used for the heater, power system and operation system.
7	Magnet relay	See No.1.

【Table 2.2.4 Components and Functions, Control Box (Continued)】

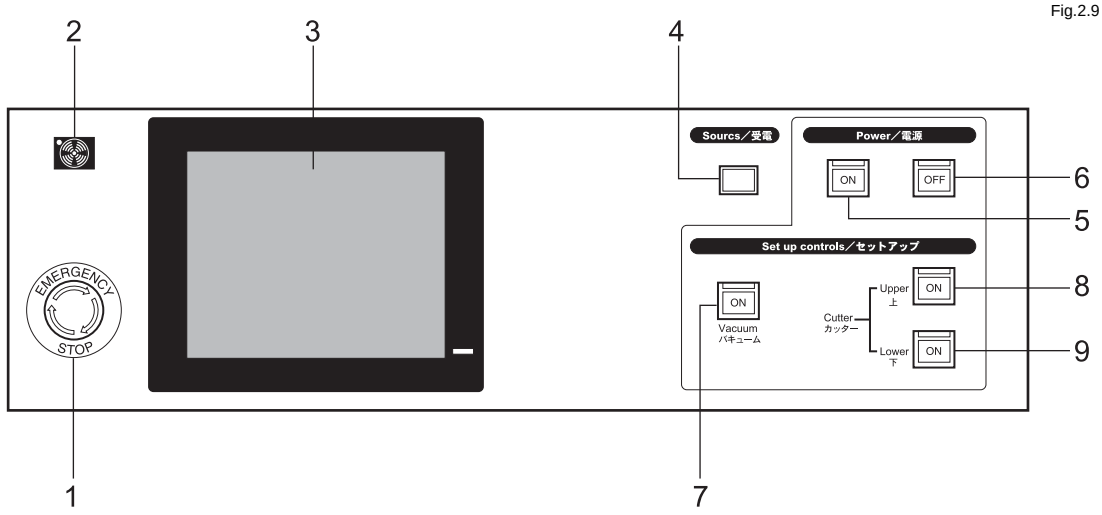
No.	Component	Function
8	Pulse motor driver	Electronic circuit for receiving signals from the pulse motor controller, amplifying power, and driving the pulse motor of the cutter unit.
9	Circuit protector	Recoverable overcurrent detection circuit breaker in place of fuses. It is used for the primary side of the transformer.
10	No fuse breaker	See No.6.
11	Inter lock switch	Switch for detecting the current state of the control box door, as it is dangerous if it is opened during operation.
12	Potentiometer	Variable resistor for adjusting motor speeds. It is used to make fine adjustments to each motor's speed in the PWB and dry film conveyor system.
13	Temperature controller	Electronic circuit for keeping the heaters at a constant temperature by detecting the difference between the current temperature and the preset temperature (measurement by use of a thermo-electric couple), and controlling the power supplied to the heater.
14	PLC	Sequence controller for system operations.
15	In-put unit	Interface circuit unit for input signals to the PLC. Digital signals from each sensor (ON, OFF) are input into this unit.
16	Out-put unit	Interface circuit unit for output signals from the PLC. Digital signals (ON, OFF) are output to the solenoid valve or others.
17	Enlargement power supply	Unit for supplying power to the enlargement.
18	Enlargement interface unit	Interface unit for installing the analog output unit.
19	Analog out-put unit	Output interface circuit unit connected to the PLC. This unit outputs analog signals to the motor controller.
20	Positioning control unit	Unit for controlling the positioning of the tacking block motor.
21	Noise filter	Reduces noise from internal and external power supplies or electrical noise, which cause trouble to the inside of the unit. It is mainly used for the DC power supply (primary side).
22	Fuse	Provides protection to the circuit.
23	Magnet relay	See No.1.

【Table 2.2.4 Components and Functions, Control Box (Continued)】

No.	Component	Function
24	Current trans	Transformer with the secondary coil wound round to the doughnut-shape core detects the AC current by running the wiring through the center of core. It is used for the roll heater open wire detection circuit.
25	Terminal (Main power)	Terminal (board) for connecting the signal and power lines.
26	Ground bus	Terminal dedicated for connecting the ground buses intensively.
27	Terminal	See No.25.
28	Terminal	See No.25.
29	Fuse	Provides protection to the heater circuit.
30	Terminal	See No.25.
31	Motor controller	Electronic circuit unit that accommodates the "clutch brake control circuit", "power control (overcurrent control included) circuit" and so on to control the rotation/immediate stop and rotation speed of the AC motor. It is used to drive the input/output conveyor, laminating roll and tacking block.
32	Motor controller	See No.32.
33	Capacitor	External capacitor necessary for activating the AC motor.
34	Terminal	See No.25.
35	Terminal	See No.25.
36	Magnet relay	See No.1.
37	Terminal	See No.25.
38	DC power supply	DC voltage generator with precisely controlled constant voltage. It is mainly used for the control circuit.
39	DC power supply	See No.38.
40	No fuse breaker	See No.6.
41	Service outlet	Outlet providing AC100 volt used at the maintenance operation.
42	Frequency converter	Adjusts the vacuum strength by controlling the rotation speed of blower fan according to the information about the dry film entered.
43	Relay	Provides AC or DC current to the control coil, makes and breaks the mechanical contact, and drives the connected load. It is generally used for the control system.

2.5 Operation Panel

Fig.2.9



【Table 2.2.5 Components and Functions, Operation Panel】

No.	Component	Function
1	Emergency stop button	Press this button in an emergency or in the event of a serious problem. The unit will immediately stop in the same manner as when the Power OFF button is pressed. After correcting the problem, turn it clockwise to reset.
2	Buzzer	Sounds when a failure has occurred in the unit to alert the operator.
3	Touch panel	Displays system controls, and is used to operate the system in both manual and automatic modes. It provides information on alarms, paramater preset values, and current production conditions such as roll temperature, line speed, etc.
4	Source lamp	Lights up when the main breaker is turned ON (|) and power is supplied to the unit.
5	Power ON button and lamp	To supply power to system components, press this button. Power "ON" will then light up. It has a protection cover to prevent it from being pressed accidentally.
6	Power OFF button and lamp	To stop the supply of power to system components, press this button. Power "OFF" will then light up. It has a protective cover to prevent it from being pressed accidentally.

【Table 2.2.5 Components and Functions, Operation Panel (Continued)】

No.	Component	Function
7	Vacuum ON button and lamp	To supply power to the blower fan, press this button. Vacuum "ON" will then light up. To stop the supply of power, press it again. The lamp will then go off. It has a protective cover to prevent it from being pressed accidentally. Use this button to set up or change dry film.
8	Upper-Cutter ON button and lamp	To run the upper cutter(i.e. to cut the upper dry film), press this button. Upper-cutter "ON" will then light up. It has a protection cover to prevent it from being pressed accidentally. Use this button to set up or change the upper dry film.
9	Lower-Cutter ON button and lamp	To run the lower cutter(i.e. to cut the lower dry film), press this button. Lower-cutter "ON" will then light up. It has a protective cover to prevent it from being pressed accidentally. Use this button to set up or change lower dry film.

2.6 Composition of the Touch Panel

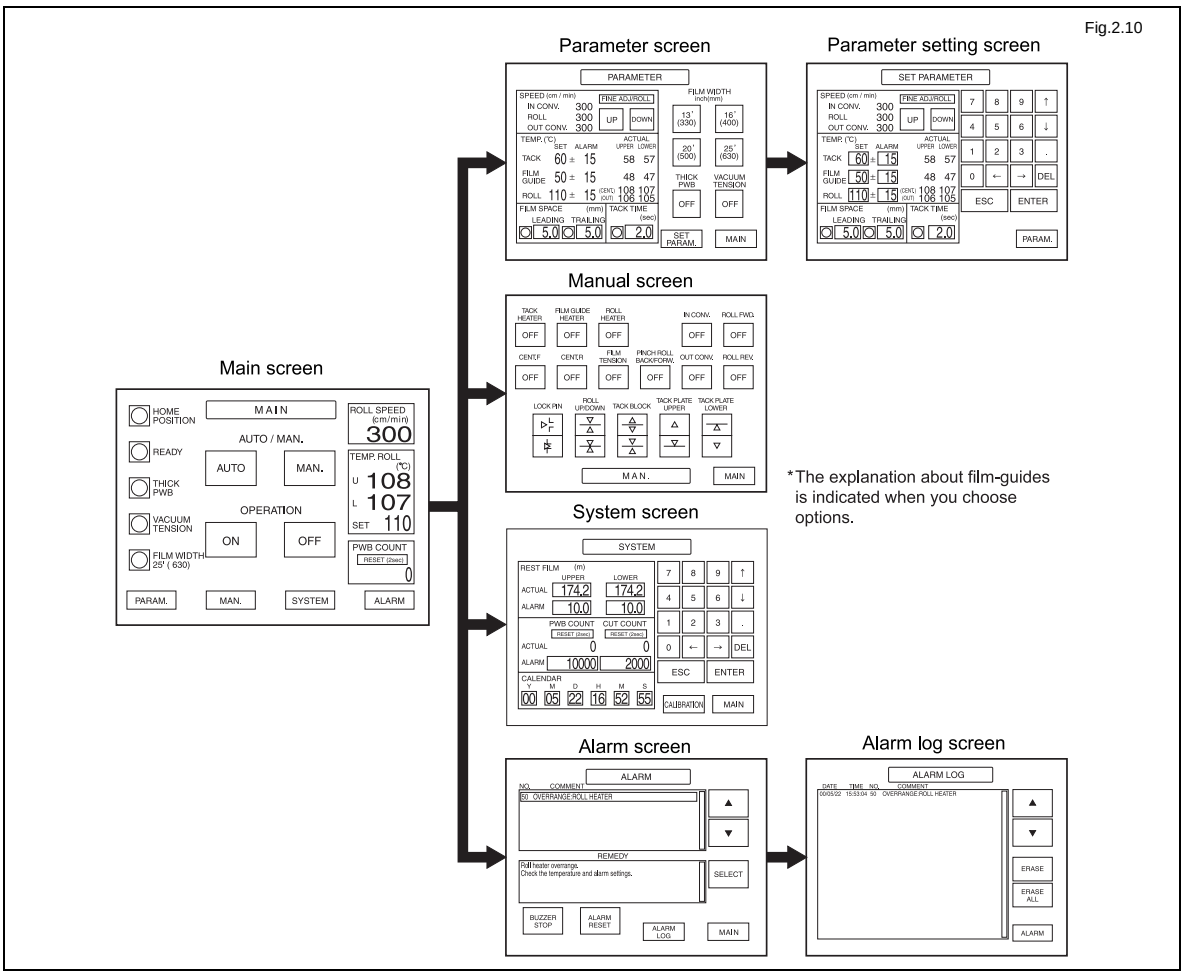
The touch panel is a hierarchy of various screens used to control the Mach 630up in both manual and automatic modes. It is used to set the PWB information, and displays alarms, parameters, and current production conditions.

- For the hierarchy of the touch panel's various screens, see the flow diagram below.

Note

- It is possible to switch between screens in the automatic- and manual-operation modes by pressing the appropriate button at the bottom of the current screen.
- The unit can be operated from the manual screen, but only when the "Manual operation" mode is set on the main screen.
- To protect the backlight, the display on the touch panel automatically disappears if the panel isn't touched for 30 minutes. To reactivate the display, touch the panel.

Fig.2.10

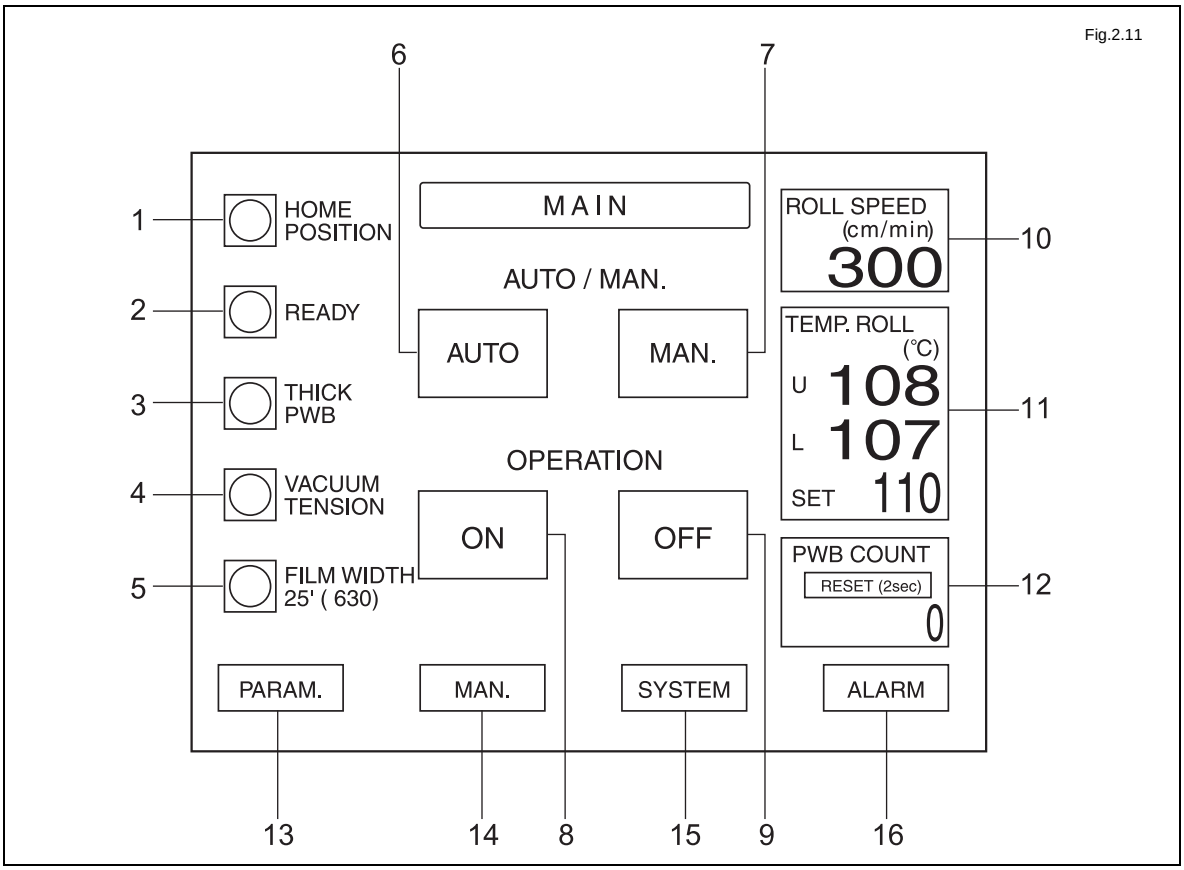


【Table 2.2.6 Touch Panel】

Screen	Function
Main screen	The screen initially displayed on the touch panel when the Power ON button is pressed. This is the screen most often used during production. It displays the buttons for selecting operation modes and other screens, the current values for roll speed, roll temp.,and the PWB count.
Parameter screen	Displays the feeding speeds of the conveyors and laminating rolls, the heater temperatures, and leading and trailing edge spacing of the film. To change the setting, select the parameter setting screen.
System screen	On this screen the remaining film indicator and PWB counter can be viewed and reset, and alarm values for both can be set and adjusted. Calendar data can also be input.
Alarm screen	Displays alarms, required actions, and an alarm log.
Manual screen	Displays the operation switches for each module. This screen is valid only when "Manual" (manual-operation mode) is selected on the main screen.

2.6.1 Main Screen

Fig.2.11



【Table 2.2.7 Components and Functions, Main Screen】

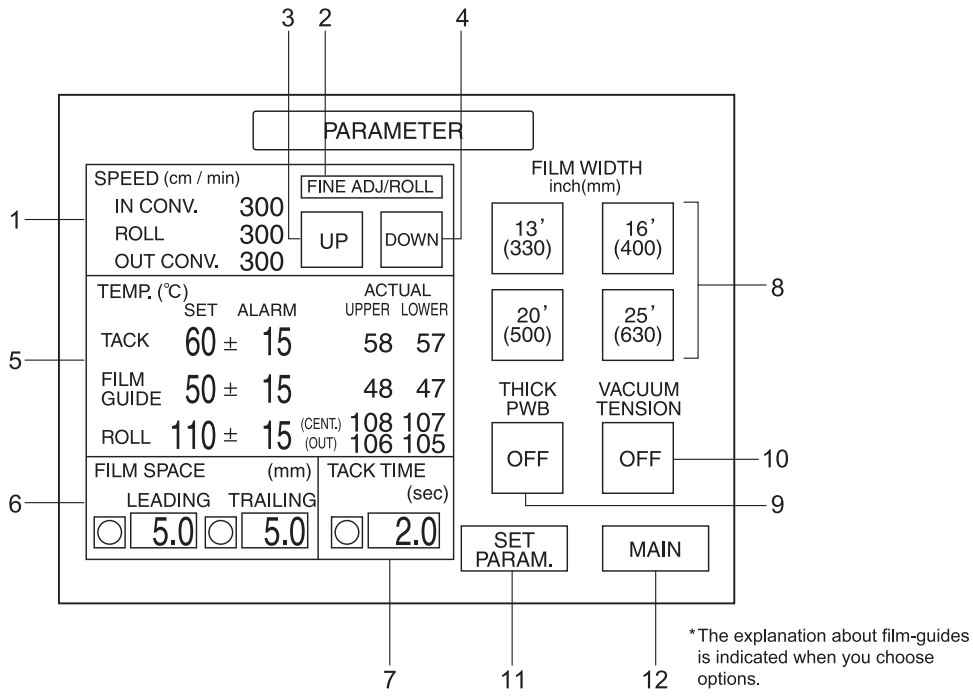
No.	Component	Function
1	"HOME POSITION" lamp	Turns green when all modules are at the home position.
2	"READY" lamp	Turns green when the unit is on standby for automatic operation or ready for operation.
3	"THICK PWB" lamp	Turns green when "THICK PWB" mode is ON on the parameter screen.
4	"VACUUM TENSION" lamp	Turns green when the "Vacuum Tension" is set to ON on the parameter screen.
5	"FILM WIDTH" display/lamp	Displays the film width selected on the parameter screen.
6	"AUTO" button	Selects "automatic operation" mode.
7	"MAN." button	Selects "manual operation" mode.
8	OPERATION "ON" button	Starts "automatic operation".

【Table 2.2.7 Components and Functions, Main Screen (Continued)】

No.	Component	Function
9	OPERATION "OFF" button	Stops "automatic operation".
10	"ROLL SPEED" display	Displays the actual laminating roll feeding speed.
11	"TEMP. ROLL" display	Displays the actual and set temperatures of the upper/lower laminating roll surfaces.
12	"PWB COUNT" display	Displays the actual PWB count. To reset it to "0," hold down the "RESET" button for more than two seconds.
13	"PARAM." button	Switches to the parameter screen.
14	"MAN." button	Switches to the manual screen.
15	"SYSTEM" button	Switches to the system screen.
16	"ALARM" button	Switches to the alarm screen.

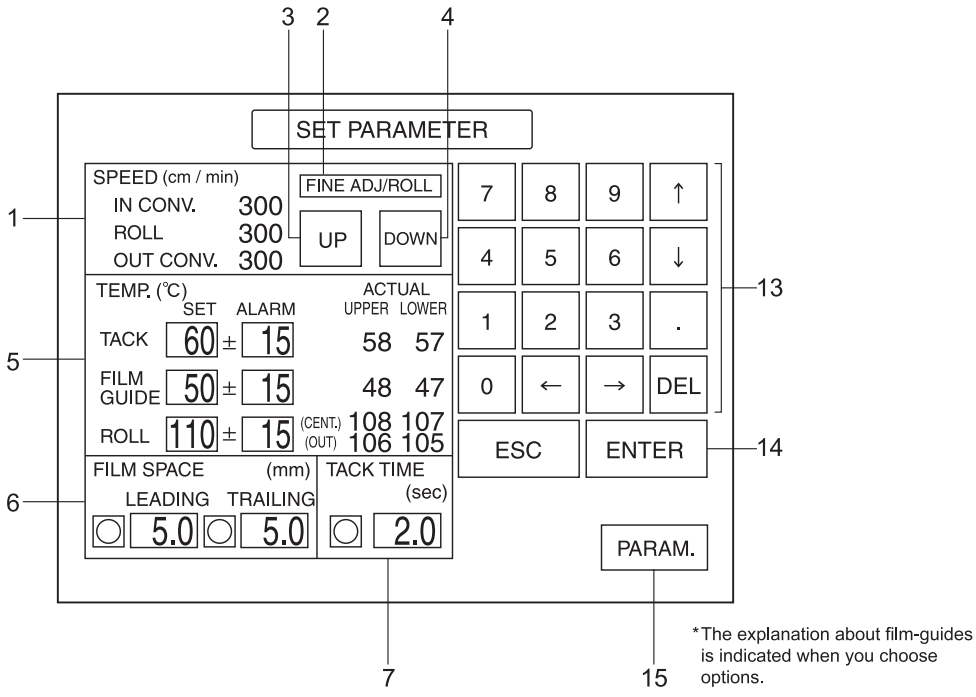
2.6.2 Parameter Screen

Fig.2.12



To switch to the parameter setting screen shown in the illustration below, press the "SET PARAM." button on the parameter screen.

Fig.2.13



To return to the parameter screen, press the "PARAM." button on the parameter setting screen.

【Table 2.2.8 Components and Functions, Parameter Screen】

No.	Item	Function
1	"SPEED" display	Displays the current feeding speeds of the laminating roll, input and output conveyor.
2	"FINE ADJ/ROLL" button	To finely adjust only the laminating roll speed, without adjusting the speeds of the input and output conveyors, press this button.*
3	"UP" button	To simultaneously increase the speeds of the input and output conveyors and laminating rolls, press this button.
4	"DOWN" button	To simultaneously decrease the speeds of the input and output conveyors and laminating rolls, press this button.
5	"TEMP." display	Displays the temperature of the tacking rubber, film guide**, and laminating roll surface. SET: Displays the set temperature of each surface ALARM: Displays the alarm temperature of each surface(+/-℃ from the SET temperature.) ACTUAL: Displays the actual temperature of the upper/lower surface.***
6	"FILM SPACE" display	"LEADING" and "TRAILING" display the distance from the dry film to the front and rear edges of the PWB. Both turn green momentarily during the corresponding parts of the laminating processes.
7	"TACK TIME" display	Displays the set time for the tacking of dry film onto the PWB by the tacking plate. A lamp lights up during the tacking process.
8	FILM WIDTH selection buttons	Selects the width of the film loaded into the DF unit. Press one of the four buttons. If the desired dry film width is not available use the next smaller available size.
9	THICK PWB "OFF" button	When thick PWBs are processed, press this button to turn THICK-PWB mode "ON." The motion of the laminating rolls will change accordingly.
10	VACUUM TENSION "OFF" button	To turn on the vacuum pressure that holds the dry film in place, press this button in order to turn vacuum tension "ON." Press it again to turn the vacuum tension "OFF" and release the dry film.
11	"SET PARAM." button	To change the settings on the parameter screen, press this button in order to switch to the parameter setting screen.

【Table 2.2.8 Components and Functions, Parameter Screen (Continued)】

No.	Item	Function
12	"MAIN" button	Returns to the main screen.
13	Ten-key pad/numeric-value input	Press the square frame of the item to be changed, and input a numeric value using the ten-key pad.
14	"ENTER" button	To enter a value inputted with the ten-key pad, press this button.
15	"PARAM." button	Press this button to return to the parameter screen. "Ten-key pad" will disappear.

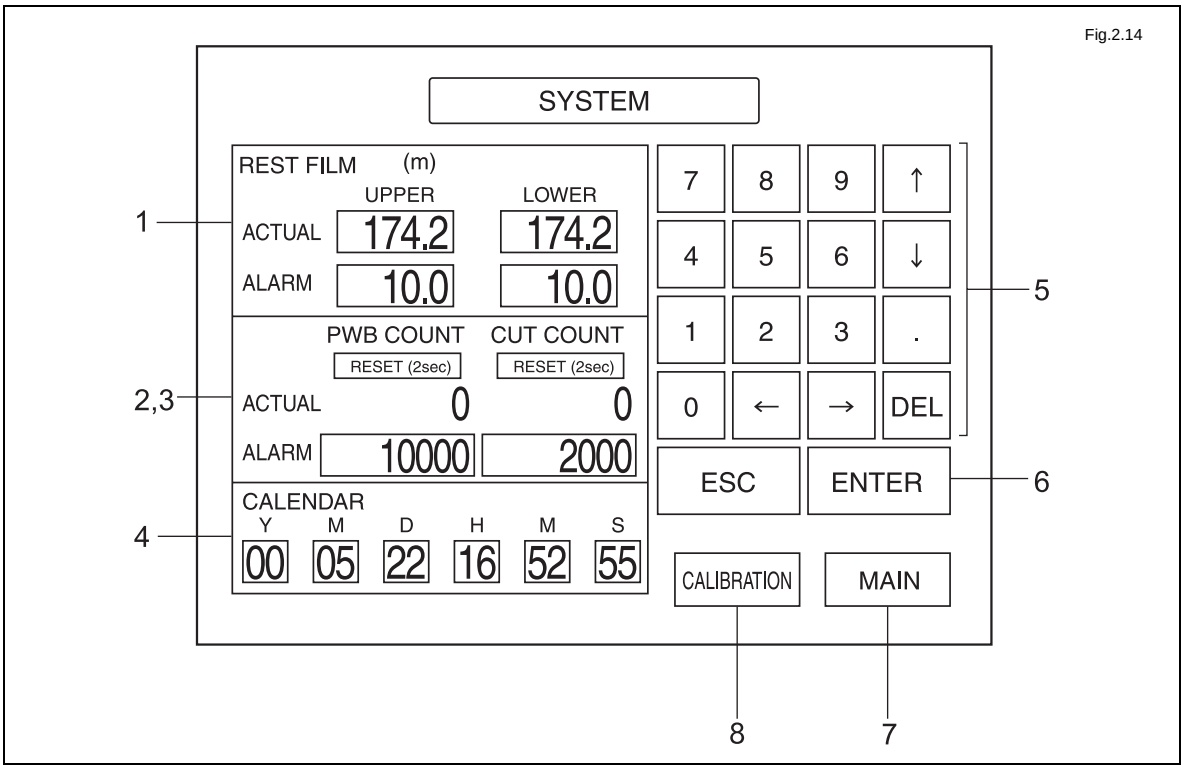
* The feeding speeds of the input conveyor, output conveyor, and laminating roll are normally synchronized. As the conveyors and laminating roll are driven by different sources, however, some time is required for the laminating roll feeding speed to synchronize with the conveyor feeding speeds after a speed-change command is issued. Therefore, to quickly synchronize these speeds manually or perform fine adjustments it may be necessary to press this button.

** When the film-guide heaters may be chosen as an option.

*** The "CENT." and "OUT" of the actual value of the laminating rolls indicate the points at which the surface temperature is measured by sensors. The temperature sensor installed at the center of the laminate roll corresponds to "CENT." while that installed at the rear of the unit corresponds to "OUT."

2.6.3 System Screen

Fig.2.14



【Table 2.2.9 Items and Functions, System Screen】

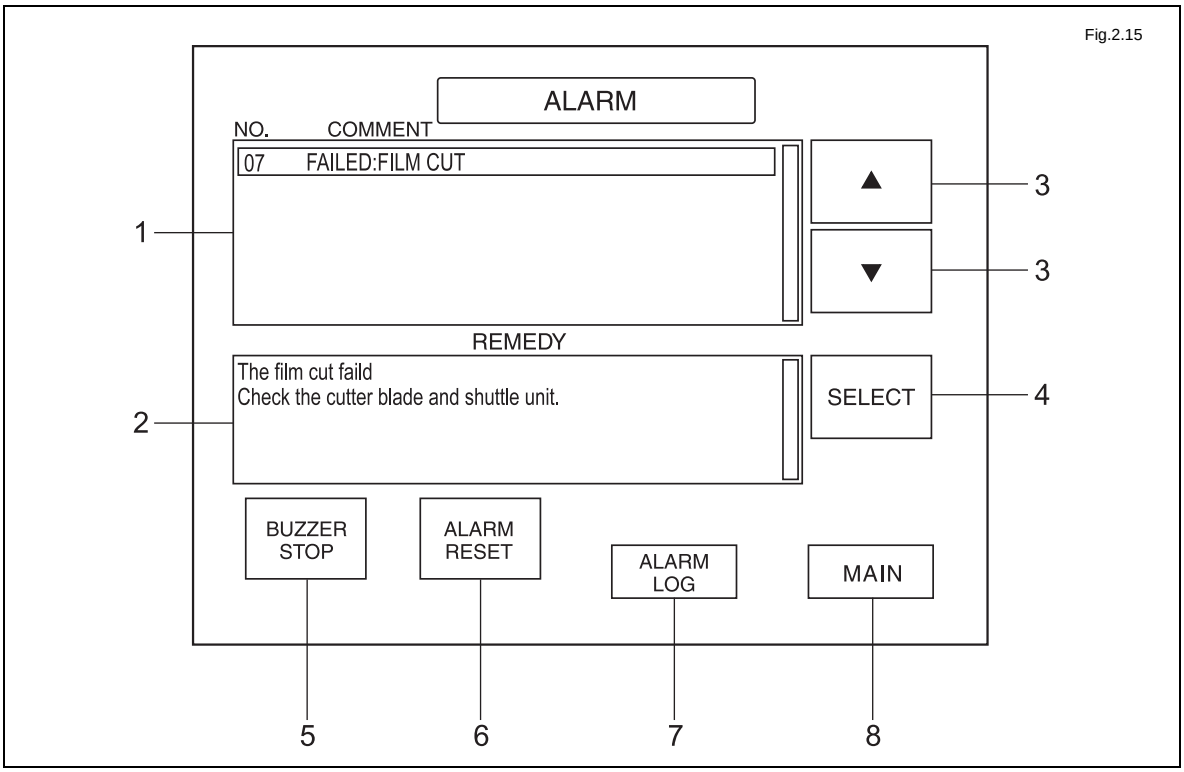
No.	Item	Function
1	"REST FILM" display	The actual (upper/lower, subtraction) and alarm (upper/lower) lengths of the remaining film can be input and displayed. When the actual value reaches the alarm value, an alarm is issued, except when "0.0" is input as the ALARM.
2	"PWB COUNT" display	The actual (addition) and alarm values of the number of processed PWBs can be input and displayed. When the actual value reaches the alarm value, an alarm is issued. To reset the current value to "0," hold down the "RESET" button for two seconds or longer.
3	"CUT COUNT" display	The actual (addition) and alarm values of the number of times the cutting blade has passed across the cutter backup can be input and displayed. When the actual value reaches the alarm value, an alarm is issued. To reset the current value to "0," hold down the "RESET" button for two seconds or longer.

【Table 2.2.9 Items and Functions, System Screen (Continued)】

No.	Item	Function
4	"CALENDAR" display	Displays the actual values for the "Y"(year), "M"(month), "D"(day), "H"(hour), "M"(minute), and "S" (second), all of which can be changed using the ten-key pad.
5	Ten-key pad	Press the square frame of the item for which the setting is to be changed, and input a numeric value using the ten-key pad.
6	"ENTER" button	To enter the input value, press this button.
7	"MAIN" button	To return to the main screen, press this button.
8	"CALIBRATION" button	To change the basic operation setting of this unit, press this button. It should be used only by maintenance personnel. Contact Hakuto or the nearest Hakuto agent for the methods of calibration.

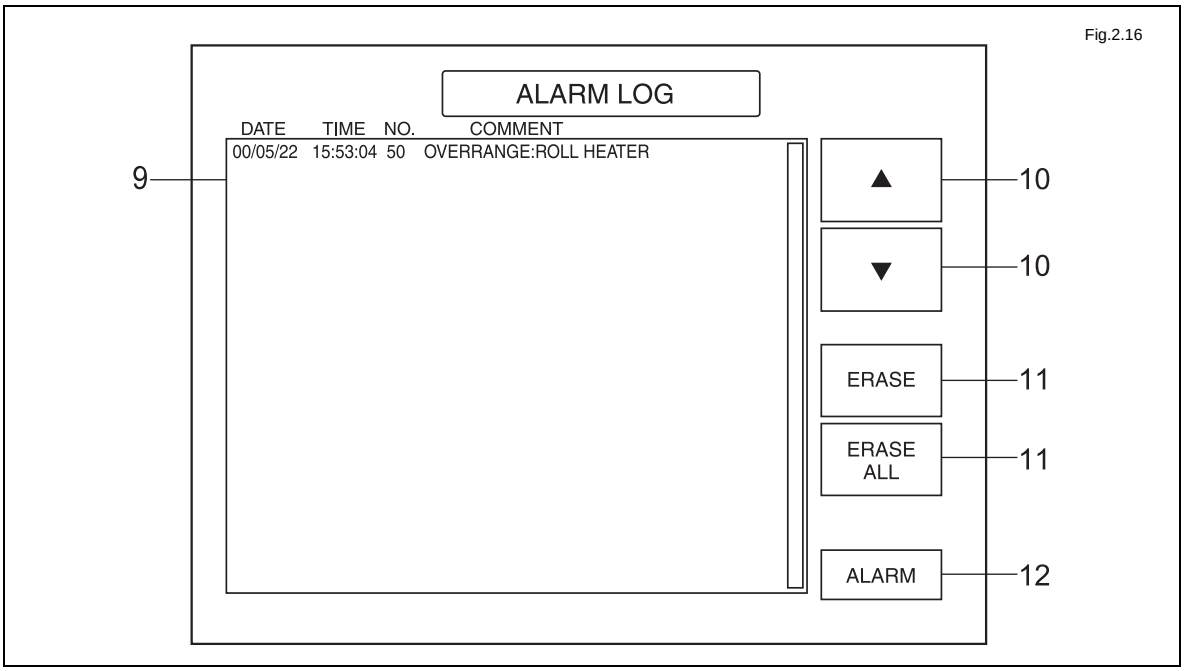
2.6.4 Alarm Screen

Fig.2.15



To switch to the alarm-log screen shown in the illustration below, press the "ALARM LOG" button on the alarm screen.

Fig.2.16



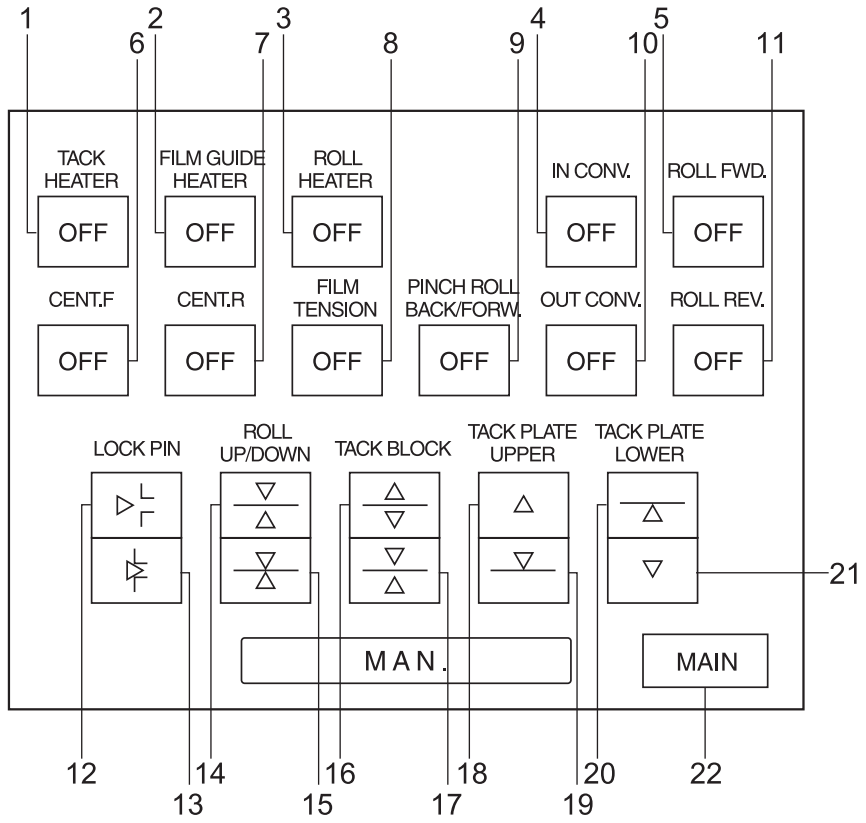
To return to the alarm screen, press the "ALARM" button on the alarm log screen.

【Table 2.2.10 Items and Functions, Alarm Screen】

No.	Item	Function
1	"ALARM" display	Displays the alarm No. and several comments.
2	"REMEDY" display	Displays the actions required to correct the problem found in the alarm display.
3	"▲" "▼" buttons	Press these buttons to scroll through and select an alarm from among those listed in the alarm display.
4	"SELECT" button	Press this button to select the alarm comment highlighted by using the "▲""▼" buttons. The "REMEDY" display will indicate the actions required for the selected alarm comment.
5	"BUZZER STOP" button	Stops the buzzer activated by an alarm signal.
6	"ALARM RESET" button	To select the displayed alarm and reset the unit, press this button.
7	"ALARM LOG" button	To display the alarm log, press this button. The alarm-log screen will be displayed.
8	"MAIN" button	Returns to the main screen.
9	"ALARM LOG" display	Lists the log of past alarms.
10	"▲" "▼" buttons	Select the alarm comment to be erased.
11	"ERASE" and "ERASE ALL" buttons	Erases one or all items in the alarm log.
12	"ALARM" button	Returns to the alarm screen.

2.6.5 Manual Screen

Fig.2.17



* The explanation about film-guides is indicated when you choose options.

【Table 2.2.11 Items and Functions, Manual Screen】

No.	Button	Function
1	TACK HEATER "OFF" button	To turn the tacking heater ON, press this button. Press it again to turn the tacking heater OFF.
2	FILM GUIDE HEATER "OFF" button *Option	To turn the film-guide heater ON, press this button. Press it again to turn the film-guide heater OFF.
3	ROLL HEATER "OFF" button	To turn the roll heater ON, press this button. Press it again to turn the roll heater OFF.
4	IN CONV. "OFF" button	To turn the input conveyor ON, press this button. Press it again to turn the input conveyor OFF.
5	ROLL FWD. "OFF" button	To rotate the laminating rolls in the forward direction (from the input side to the output side) , press this button. Press it again to stop the rolls.

【Table 2.2.11 Items and Functions, Manual Screen (Continued)】

No.	Button	Function
6	CENT. F "OFF" button	To activate the front side input-conveyor centering plate (F=Front), press this button. The plate will move towards the center of the conveyor. Press it again to move the plate back to its home position.
7	CENT. R "OFF" button	To activate the rear side input-conveyor centering plate (R=Rear), press this button. The plate will move towards the center of the conveyor. Press it again to move the plate back to its home position.
8	FILM TENSION "OFF" button	To turn the upper/lower tension rolls ON, press this button. The tension rolls will increase the tension to the dry film. Press it again to turn OFF the tension rolls.
9	PINCH ROLL BACK/FORW. "OFF" button	To move the pinch-rolls forward, press this button. Press it again to move the rolls back to their home position. Note: the rolls will not move forward unless the input conveyor is turned ON.
10	OUT CONV. "OFF" button	To turn the output conveyor ON, press this button. Press it again to stop the rolls.
11	ROLL REV. "OFF" button	To rotate the laminating rolls in the reverse direction (from the output side to the input side), press this button. Press it again to stop the rolls.
12	LOCK PIN "RELEASE" button	Unlocks the tacking block by releasing the lock pin. When the lock pin is released, the tacking block can move to the open position.
13	LOCK PIN "LOCK" button	Locks the tacking block by engaging the lock pin.
14	ROLL UP/DOWN "Raise" button	Raises the upper laminating roll.
15	ROLL UP/DOWN "Lower" button	Lowers the upper laminating roll.
16	TACK BLOCK "OPEN" button	Moves the tacking block to the opened position(i.e. away from the PWB pass line).
17	TACK BLOCK "CLOSE" button	Moves the tacking block to the closed position.

【Table 2.2.11 Items and Functions, Manual Screen (Continued)】

No.	Button	Function
18	TACK PLATE UPPER "OPEN" button	Moves the upper tacking plate to the opened position (ascending).
19	TACK PLATE UPPER "CLOSE" button	Moves the upper tacking plate to the closed position (descending).
20	TACK PLATE LOWER "CLOSE" button	Moves the lower tacking plate to the closed position (ascending).
21	TACK PLATE LOWER "OPEN" button	Moves the lower tacking plate to the opened position (descending).
22	"MAIN" button	Returns to the main screen.

Chapter 3 Operation

This Chapter explains the procedures for daily inspection, automatic operation, and manual operation.

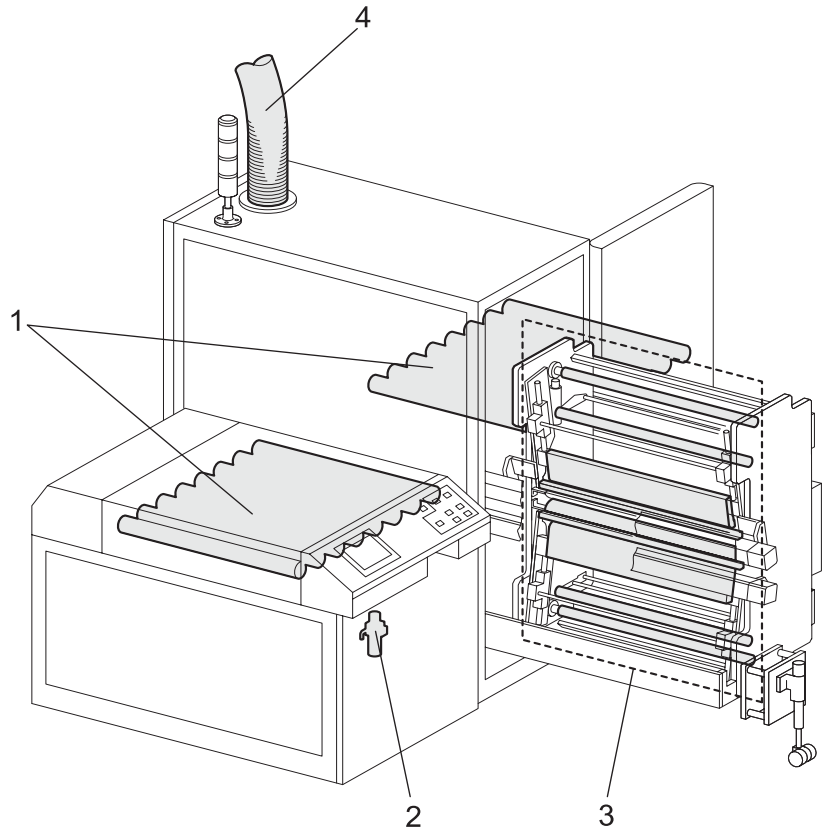
Contents of this Chapter

3.1 Daily Inspection

Before operating the unit, be sure to inspect the items specified below. Some items must be inspected "before power is switched ON", while others must be inspected "after power is switched ON." Follow the steps specified below to perform daily inspection.

■ Inspection before Power Is Switched ON

Fig.2.18

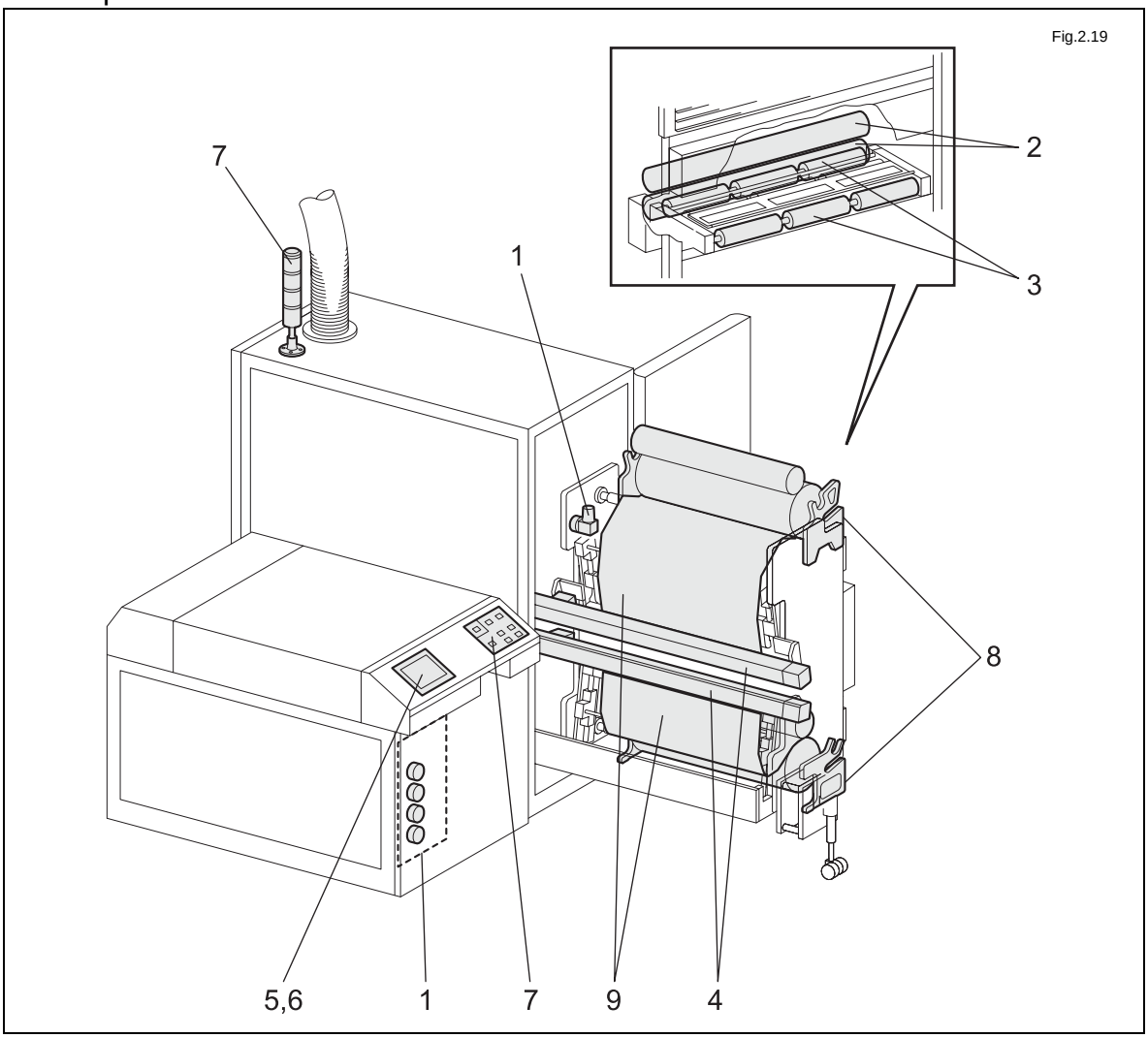


【Table 2.3.1 Inspection Items before Power Is Switched ON】

No.	Inspection item	Inspection method	Reference
1	Conveyor rolls	Cleaning	3.1.1
2	Air-filter bowl	Drainage	3.1.2
3	Film-running section	Cleaning	3.1.3
4	Exhaust duct	Check the operation of the factory exhaust system.	—

■ Inspection after Power Is Switched ON

Fig.2.19



【Table 2.3.2 Inspection Items after Power Is Switched ON】

No.	Inspection item	Inspection method	Reference
1	Air pressure	Confirmation of pressure ・Secondary supply pressure ・Laminating roll pressure ・Upper-tacking-plate pressure ・Lower-tacking-plate pressure	Part 1 "Installation" Section 2.6.2. "Confirmation of the Connection of Compressed Air".
2	Laminating roll	Cleaning and confirmation of surface conditions	3.1.4
3	Auxiliary conveyor roll	Cleaning and confirmation of surface conditions	3.1.4
4	Cutter	Confirmation of cutting performance and function	—

【Table 2.3.2 Inspection Items after Power Is Switched ON (Continued)】

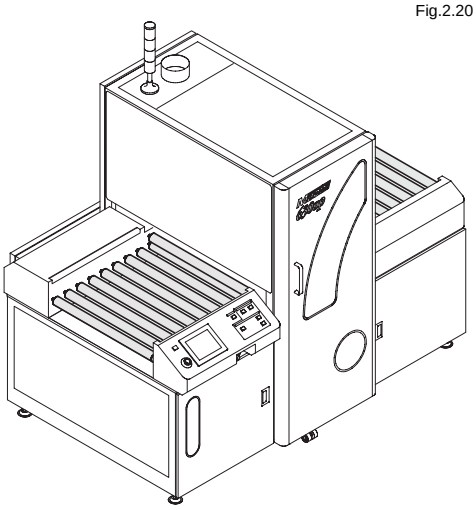
No.	Inspection item	Inspection method	Reference
5	Parameter screen	Confirmation of set values	3.2.4.1
6	System screen	Confirmation of set values	3.2.4.2
7	Indication lamps and signal tower	Confirmation of lighting	—
8	DF unit	Confirmation of loading conditions	3.2.1.3
9	Dry film	Confirmation of loading conditions and film route	3.2.1.2 3.2.1.3
10	Abnormal vibration, heat, and noise	Confirmation	—

3.1.1 Cleaning of Conveyor Rolls

Necessary tools	・Dust-free cloth ・Methyl alcohol

1. Open the input and output conveyor covers.

2. Fig.2.20



Laterally wipe any dirt off the conveyor rolls using a dust-free cloth moistened with methyl alcohol.

3. Upon completion of cleaning, close the input and output conveyor covers.

3.1.2 Draining of the Air-Filter bowl

Necessary tool	・Dust-free cloth

Note

Before draining the Air-Filter bowl, confirm that the primary-side compressed air is supplied (from the plant compressed-air supply system).

1. Open the input-conveyor bottom door.

2.

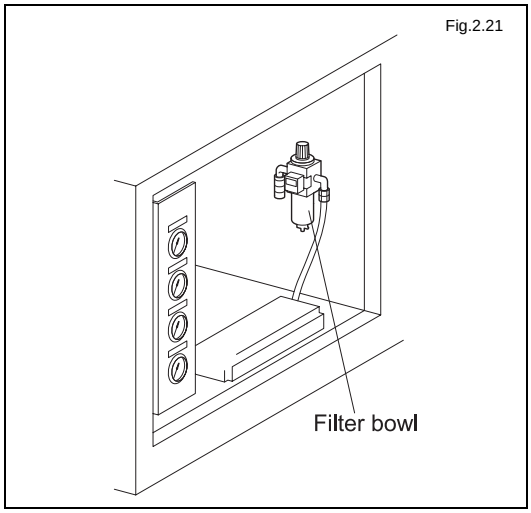


Fig.2.21

Confirm that there is no water or condensation in the filter bowl of the filter regulator unit.

3.

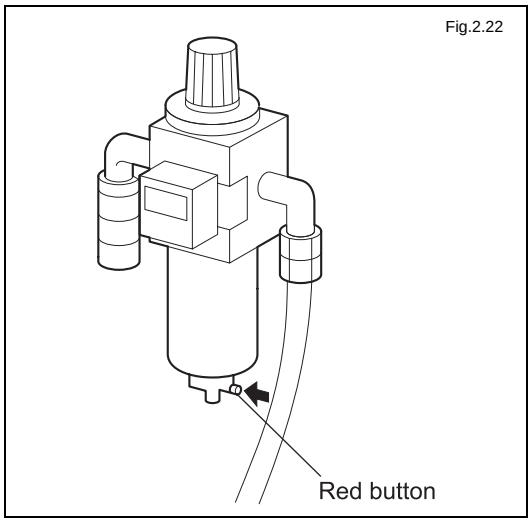


Fig.2.22

If there is any water or condensation in the filter bowl, press the red button at the bottom of filter bowl to drain it.

- Use a dust-free cloth to completely wipe away any water remaining in the unit.

Note

Droplets in the filter bowl indicate that the compressed air supplied from the plant contains water.
If the unit is operated with air containing water, the solenoid valves and other parts will fail. Inspect and make any necessary repairs to the plant compressed-air supply system.

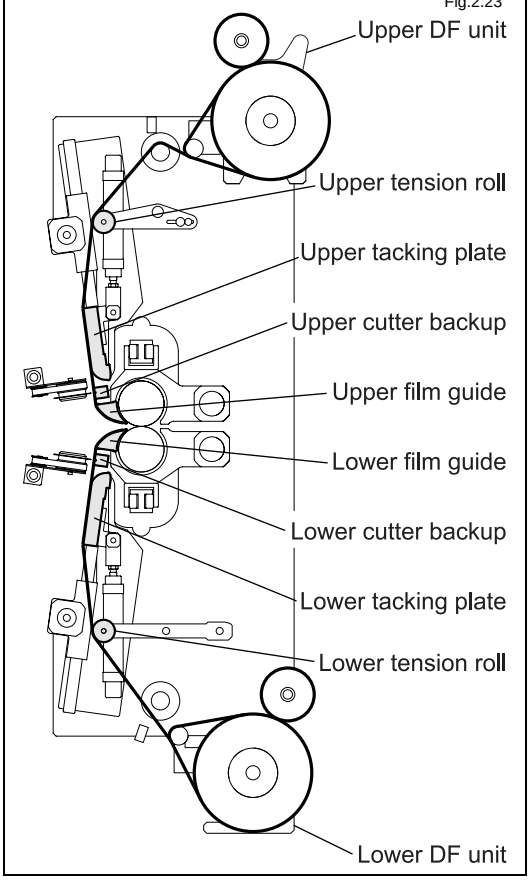
3.1.3 Cleaning of the Film-Running Surface

Necessary tools	・Dust-free cloth ・Methyl alcohol

1. Open the front door and pull out the lamination module.

2.

Fig.2.23



Wipe the film-running surface with a dust-free cloth moistened with methyl alcohol.

- The film-running surface includes all sections touched by the dry film, from after it leaves the DF unit until it reaches the film guide. Clean the tension roll, tacking plate, cutter backup plate, and film guide shown in the illustration on the left.
- The illustration (left) shows the DF unit module. The DF bulk unit may be installed depending on the specifications of the unit used.

Tools to be used	・Dust-free cloth ・Methyl alcohol

3.1.4 Cleaning of the Laminating Roll and Confirmation of Surface Conditions

Necessary tools	・Dust-free cloth ・Methyl alcohol

⚠ Warning

Clean the laminating roll while supplying power and compressed air. To prevent inadvertent operation by unauthorized workers, affix a tag indicating "Under inspection" in a conspicuous location.

⚠ Caution

- When cleaning the laminating roll, be careful to prevent your finger from being caught by or wound in the roll.
- Do not scratch the laminating roll surface, or the quality of the PWB will be degraded.

1. Open the front door and pull out the lamination module.

2.

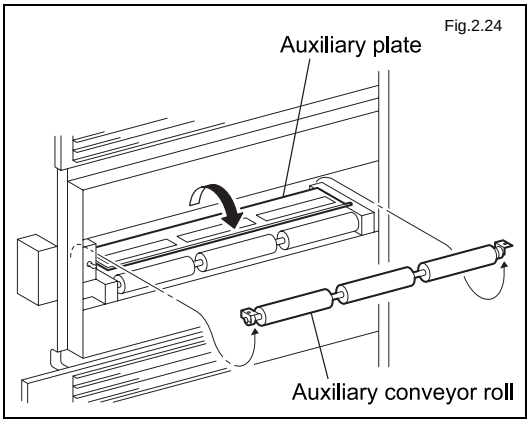


Fig.2.24

Open the auxiliary plate *Option and remove the auxiliary conveyor roll.
Lift the auxiliary conveyor roll to remove it.
Clean the conveyor roll and check its surface condition.

3.

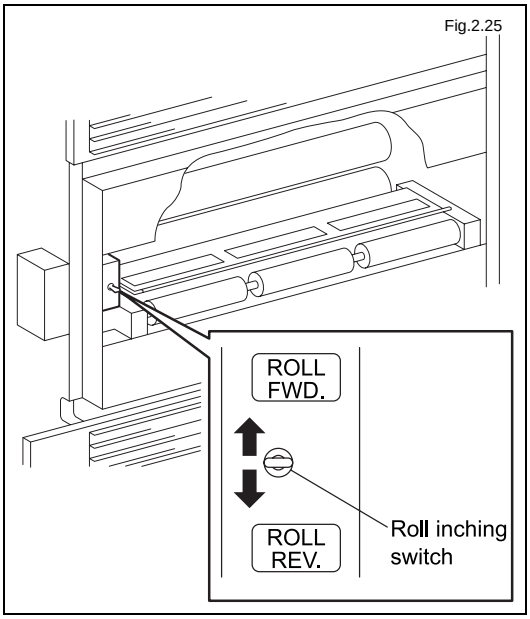


Fig.2.25

Turn the roll inching switch to "ROLL FWD." "ROLL REV." and laterally wipe away any dirt from the laminating roll surface and auxiliary conveyor roll using a dust-free cloth moistened with methyl alcohol.

- Check the surface conditions of the laminating roll. If it has faults or has deteriorated, see Part 3 "Maintenance," Section 2.2.4 "Replacing the laminating roll and roll heater," and follow the replacement procedures.

Necessary tools	・Dust-free cloth ・Methyl alcohol

⚠ Caution

Do not wipe the laminating roll while rotating it using the roll switch, or your finger may be caught by or wound in the roll. Repeatedly rotate the roll, then stop to wipe.

4.

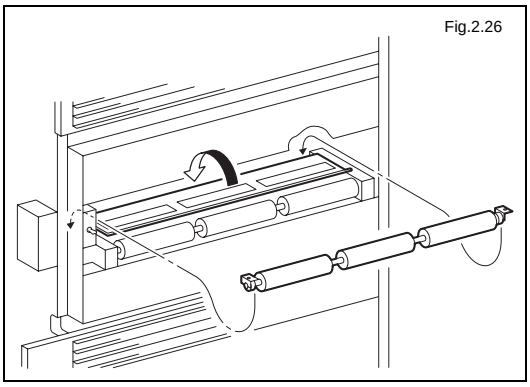


Fig.2.26

Upon completion of cleaning, fix the auxiliary conveyor roll and close the auxiliary plate *Option.

⚠ Caution

The auxiliary plate *Option is monitored by a sensor. Be sure to close it, as an error will result if it is left open. *Option

3.2 Preparation for Operation

Before starting automatic operation, follow the steps specified below to install dry film and set the PWB information.

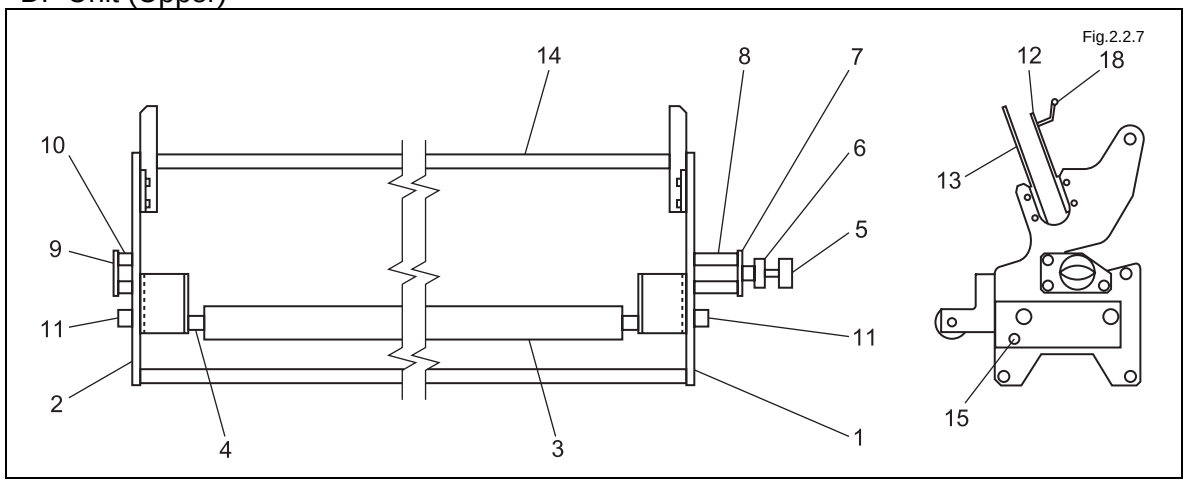
- Two methods are available for loading dry film depending on the specifications of the unit; using the DF unit or the DF bulk unit.
  See each section below according to the specifications of the unit used.

3.2.1 Loading of Dry Film (DF Unit)

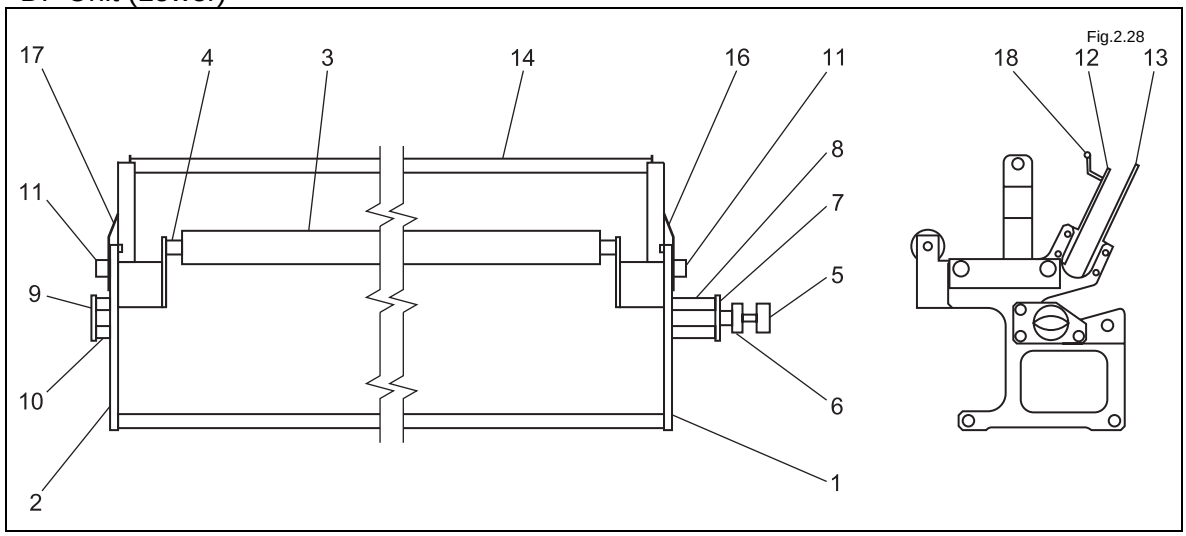
The DF unit can be used to supply dry film to the unit. This section explains the methods of loading dry film into the DF unit and of loading the DF unit into the lamination module, as well as the precautions for handling the DF unit.

3.2.1.1 Components of the DF Unit

DF Unit (Upper)



DF Unit (Lower)



【Table 2.3.3 Components, DF unit】

No.	Component	No.	Component
1	Side plate (right)	10	Spacer B
2	Side plate (left)	11	Cam follower
3	Cover-film separation roll	12	Guide A
4	Roll shaft	13	Guide B
5	Axial-direction adjustment handle	14	Tie rod
6	Locknut	15	Protective plate *Only DF unit (Upper)
7	Handle-fixing plate	16	Bracket (right) *Only DF unit (Lower)
8	Spacer A	17	Bracket (left) *Only DF unit (Lower)
9	Film roll-shaft receiving plate	18	Winding-roll holding bracket

3.2.1.2 Loading Dry Film into the DF Unit

The methods for loading dry film differ for the upper and lower DF units, as explained below.

- This section explains the methods of loading dry film into the each of the upper and lower DF units.

■ Loading Dry Film into the Upper DF Unit

1. Place the upper DF unit on a level and stable work bench.

Note

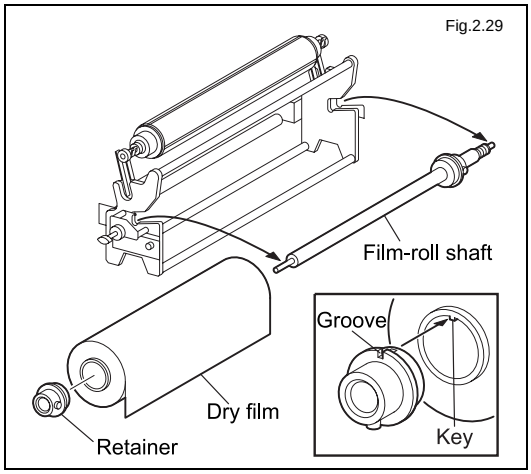
The weight of the DF unit is approximately 10 kg when loaded with dry film. Load the dry film on the floor or a stable work bench capable of supporting the weight. Secure a sufficiently large work space.

2. Remove the dry film from the crating and packing bag.

Note

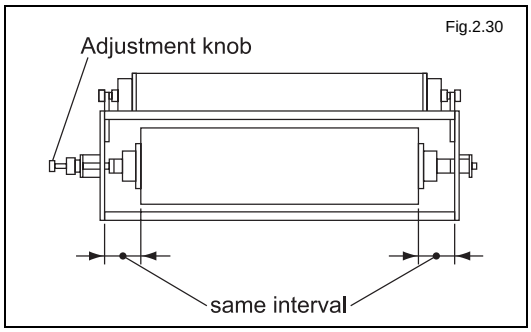
If it is exposed to light for an extended period, the dry film will be sensitized. It is therefore packed in a light-shielded bag for storage. To avoid exposing it to strong light, remove it from the packing bag and load it into the DF unit in a room with yellow light.

3.



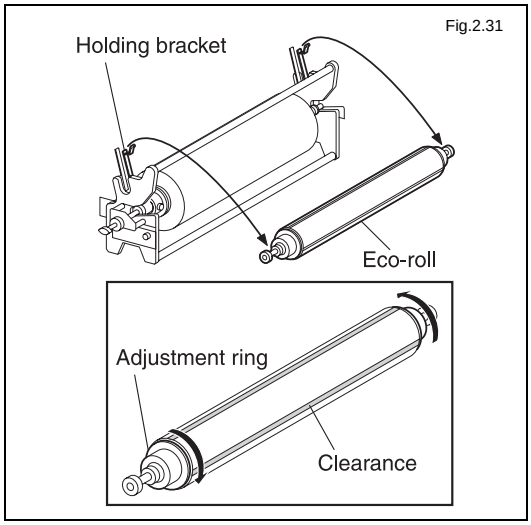
Remove the film-roll shaft from the DF unit and position the dry film at approximately the center of the shaft.
When positioning the dry film, align the key of its core with the groove of he retainer.

4.



Place the film-roll shaft loaded with the dry film into the DF unit.
Use the axial-adjustment knob to position the dry film so that it is laterally symmetrical when measured from the side plates at the edges of the unit.

5.



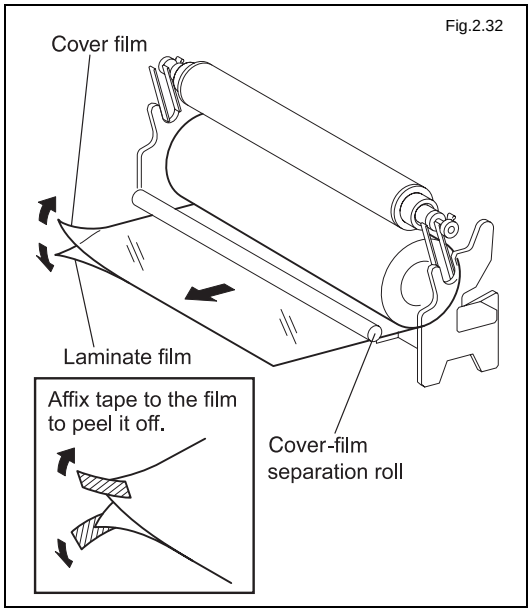
Remove the eco-roll from the DF unit and turn the adjustment ring to make a clearance on the external circumference.
Making a clearance with the adjustment ring expands the diameter of the eco-roll slightly.

Note

- After a roll of dry film is used up, reducing the diameter of the eco-roll by turning the adjustment ring makes the removal of the cover film easier.
- The cover film must be removed every time a roll of dry film is used up. Otherwise, the additional cover film will increase the diameter of the cover film on the eco-roll to a point where it interferes with other compornents, potentially causing a malfunction.

6. After the eco-roll has been prepared (step 5), place it in the eco-roll holding bracket of the DF unit.

7.

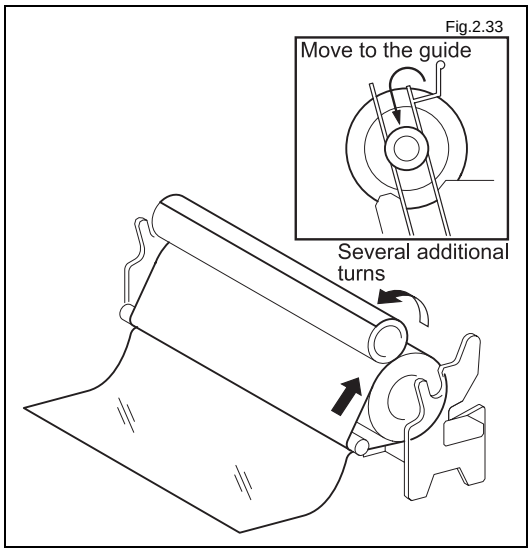


Pull out the dry film, and run it under the cover-film separation roll to separate the laminate film from the cover film.

Note

- The dry film consists of a cover film and a laminate film. And the laminate film consists of a carrier film and a photo-resist.
- Affix a piece of tape to the top and another to the bottom of the film. Pull upward and downward to separate the cover and laminate films.

8.

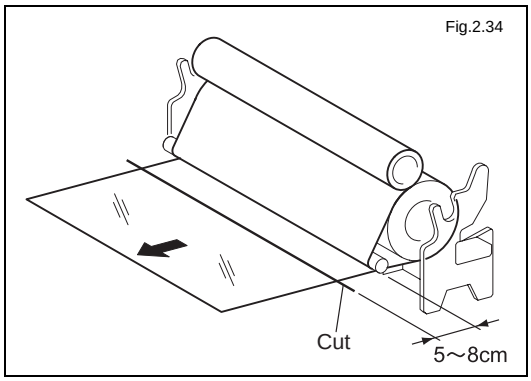


Fix the cover film to the eco-roll, and transfer the eco-roll from the holding bracket to the guide section. While separating it from the laminate film, wind the cover film several additional turns.

Note

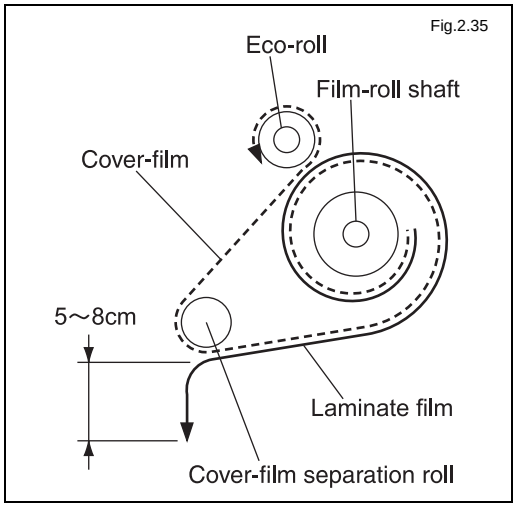
Avoid using adhesive tape or inserting cover film into the clearance of the eco-roll when fixing the cover film to the eco-roll, as it is harder to remove the cover film.

9.



Cut the laminate film leaving a section 5 cm to 8 cm in length extending from the cover-film separation roll.

10.



The dry film has now been loaded into the upper DF unit, along the route shown in the illustration to the left.

■ Loading Dry Film into the Lower DF Unit

1. Place the lower DF unit on a level and stable work bench.

⚠ Caution

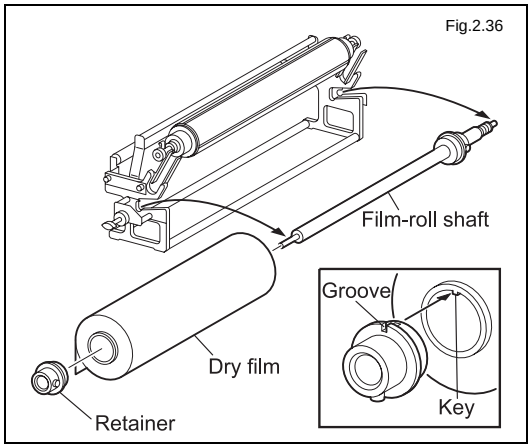
The DF unit weighs approximately 10 kg when loaded with dry film. Load the dry film on the floor or on a stable work bench capable of supporting the weight. Secure a sufficiently large work space.

2. Remove the dry film from the crating and packing bag.

⚠ Caution

If it is exposed to light for an extended period, the dry film will be sensitized. It is therefore packed in a light-shielded bag for storage. To avoid exposing it to strong light, remove it from the packing bag and load it into the DF unit in a room with yellow light.

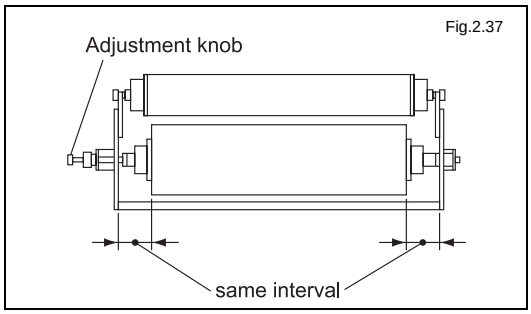
3.



Remove the film-roll shaft from the DF unit and position the dry film at approximately the center of the shaft.

- When positioning the dry film, align the key of its core with the groove of the retainer.

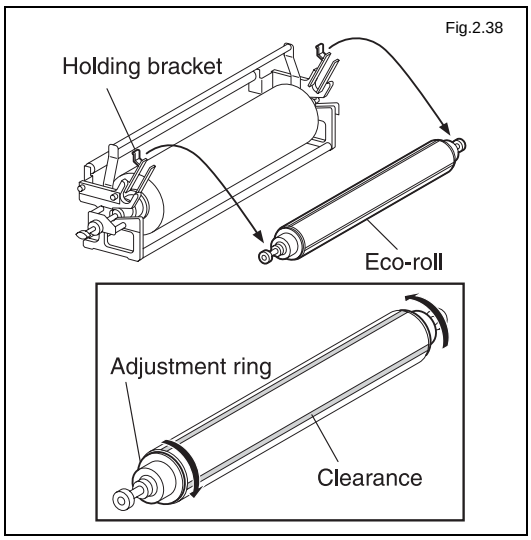
4.



Place the film-roll shaft loaded with the dry film into the DF unit.

- Use the axial-adjustment knob to position the dry film so that it is laterally symmetrical when measured from the side plates at the edges of the unit.

5.



Remove the eco-roll from the DF unit and turn the adjustment ring to make a clearance on the external circumference.

- Making a clearance with the adjustment ring expands the diameter of the eco-roll slightly.

Note

- After a roll of dry film is used up, reducing the diameter of the eco-roll by turning the adjustment ring makes the removal of the cover film easier.
- The cover film must be removed every time a roll of dry film is used up. Otherwise, the additional cover film will increase the diameter of the cover film on the eco-roll to a point where it interferes with other compornents, potentially causing a malfunction.

6. After the eco-roll has been prepared (step 5), place the eco-roll in the eco-roll holding bracket of the DF unit.

7.

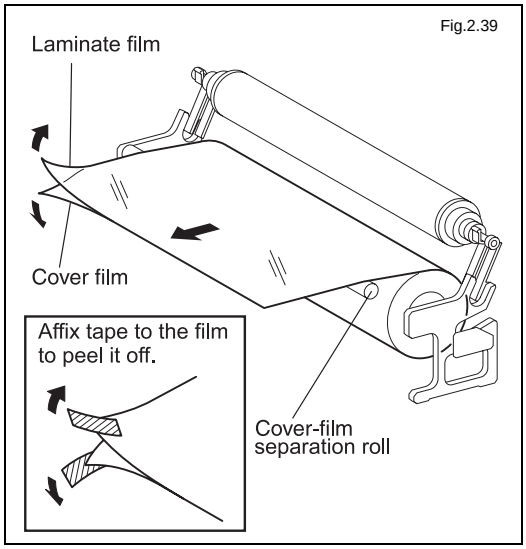


Fig.2.39

Pull out the dry film, and run it over the cover-film separation roll to separate the laminate film from the cover film.

Note

- The dry film consists of a cover film and a laminate film. And the laminate film consists of a carrier film and a photo-resist.
- Affix a piece of tape to the top and another to the bottom of the film. Pull upward and downward to separate the cover and laminate films.

8.

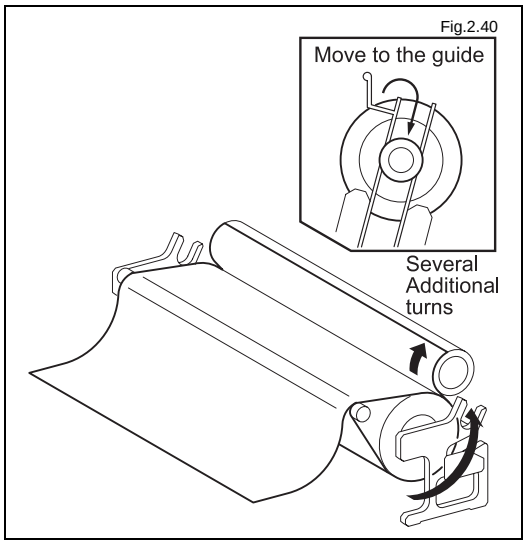


Fig.2.40

Fix the cover film to the eco-roll by running it under the dry film, and transfer the eco-roll from the holding bracket to the guide section.
While separating it from the laminate film, wind the cover film several additional turns.

Note

Avoid using adhesive tape or inserting cover film into the clearance of the eco-roll when fixing the cover film to the eco-roll, as it is harder to remove the cover film.

9.

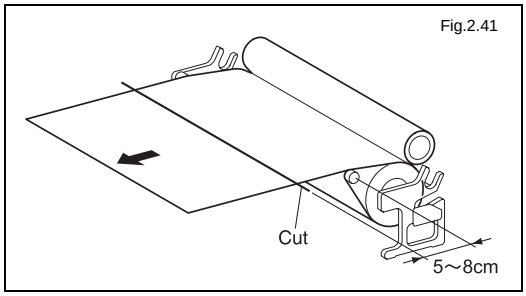


Fig.2.41

Cut the laminate film leaving a section 5 cm to 8 cm in length extending from the cover-film separation roll.

10.

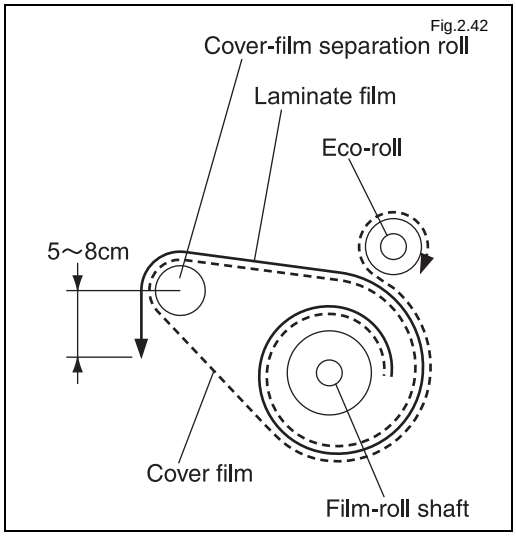


Fig.2.42

The dry film has now been loaded into the lower DF unit, along the route shown in the illustration to the left.

3.2.1.3 Loading of DF Unit

This Section explains the method for loading a DF unit containing dry film into the lamination module. To unload the DF unit, perform the loading procedure in reverse.

⚠ Caution

The weight of the DF unit is approximately 10 kg when it is loaded with dry film. Use caution when loading and unloading it to and from the lamination module.

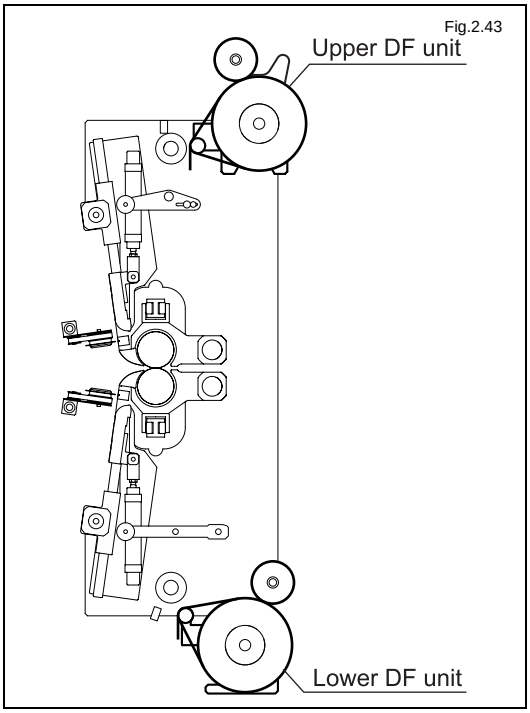


Fig.2.43

Place the upper and lower DF units at the positions of the lamination module shown in the illustration left, then run the laminate film to the lamination module.

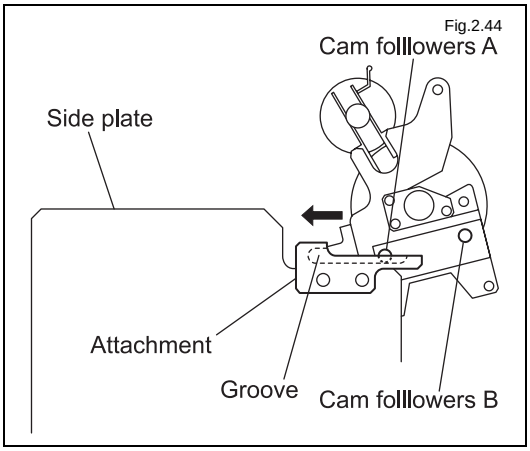
■ Loading of the Upper DF Unit

1. Open the front door and pull out the lamination module.

⚠ Caution

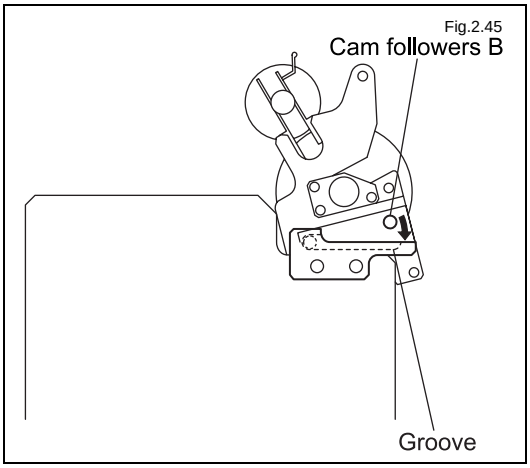
Load the upper DF unit with the power switch turned ON. The lamination module contains high-temperature and high-voltage parts, so be careful to prevent burns and electric shock.

2.



Place the front and rear cam followers A of the upper DF unit in the grooves of the attachment. Lift cam followers B and insert the DF unit in the direction indicated by the arrow.

3.



Slide cam followers A to the end of the groove, and lower cam follower B to fix the upper DF unit in the groove of the attachment.

4.

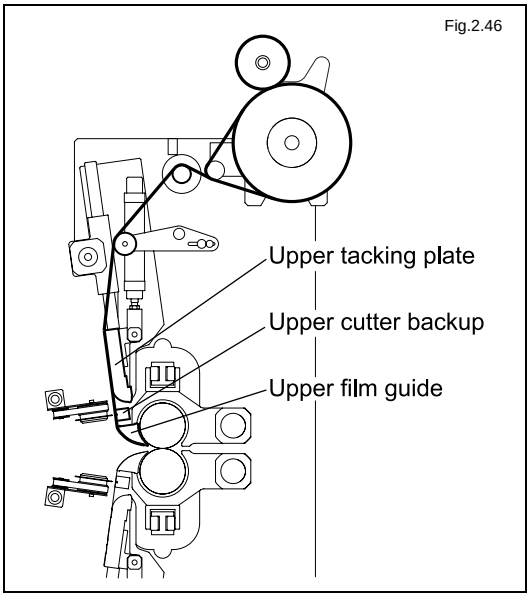


Fig.2.46

Run the laminate film along the film-running surface as shown in the illustration to the left.

⚠ Caution

Be careful, as the lamination module contains high-temperature parts.

5.

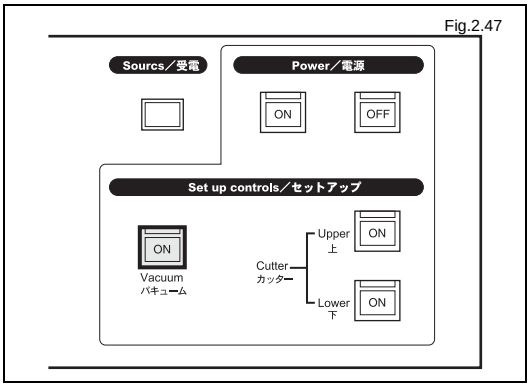


Fig.2.47

Run the laminate film down to the film guide and press the Vacuum [ON] button on the operation panel.

- The blower fan will start, activating the tacking plate, cutter backup, and guide for vacuum-pressure operation.

6.

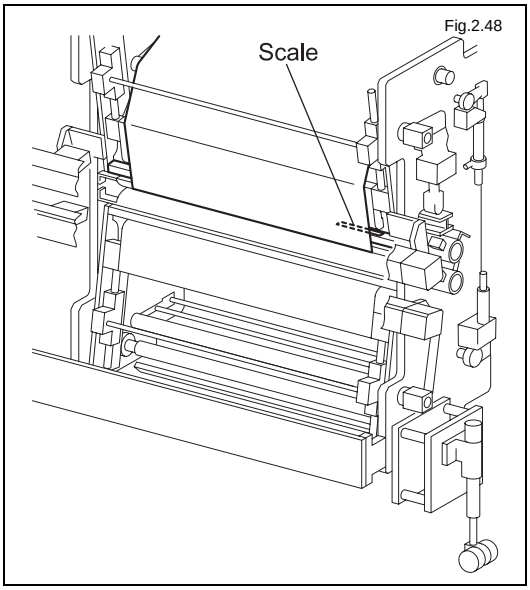


Fig.2.48

Extend the film along the film-running surface while maintaining its tautness.

- While doing so, center it by referring to the scale on the cutter backup.

7.

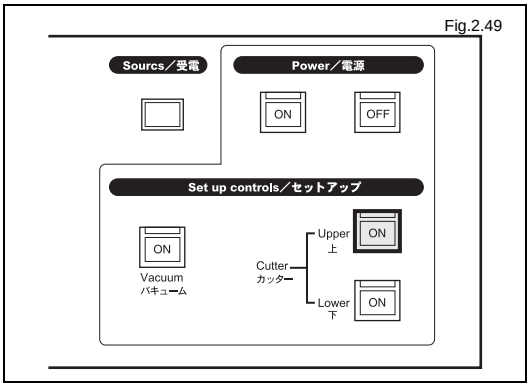


Fig.2.49

Press the Upper Cutter [ON] button on the operation panel.

- The cutter assembly will run to cut the excess-film section.

⚠ Caution

- Be careful when running the cutter to cut the film with the lamination module pulled out.
- Keep the cutter cover closed even when the cutter is not in operation.

8.

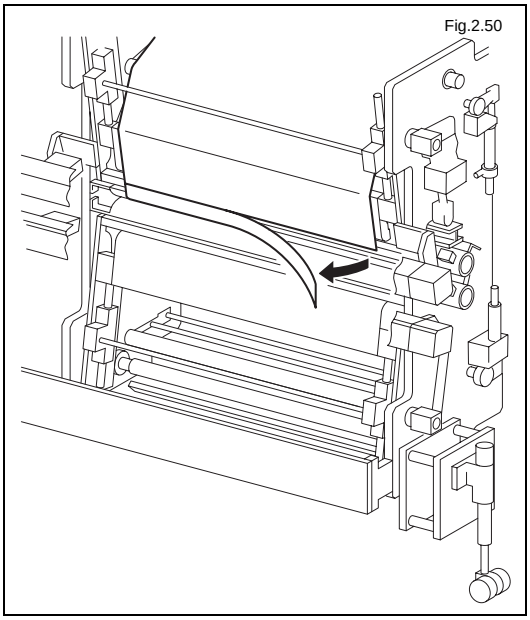


Fig.2.50

Remove the excess film that has been cut off.

- Loading of the upper DF unit is now complete.
- Push in the lamination module and close the front door, except when also loading the lower DF unit.

■ Loading of the Lower DF Unit

1. Open the front door and pull out the lamination module.

- This step is not required if the lower DF unit is loaded immediately after the upper DF unit, as the lamination module would already have been pulled out.

2.

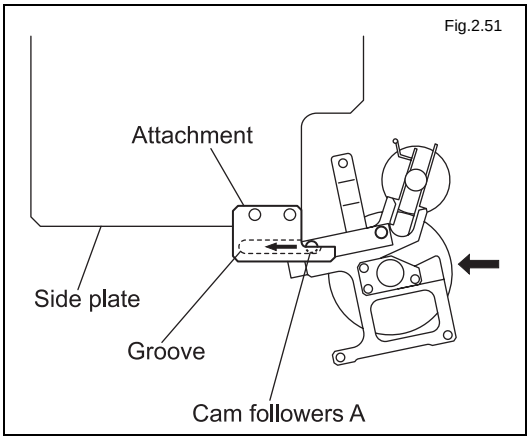


Fig.2.51

Place the front and rear cam followers A of the lower DF unit in the groove of the attachment. Lift cam followers B and insert the DF unit in the direction indicated by the arrow.

3.

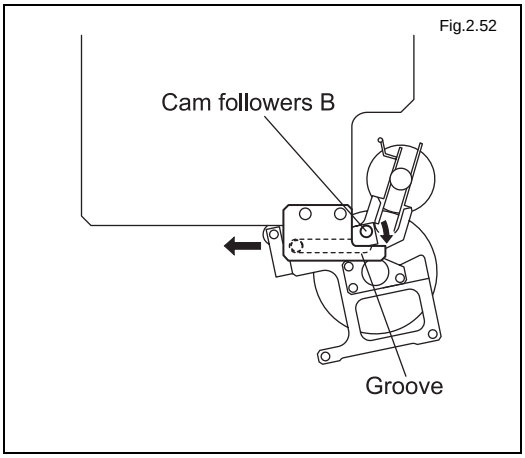


Fig.2.52

Slide cam followers A to the end of the groove, and lower cam followers B to the groove in order to fix the lower DF unit to the attachment.

Note

Confirm that cam followers A and B are in the left and right grooves.

4.

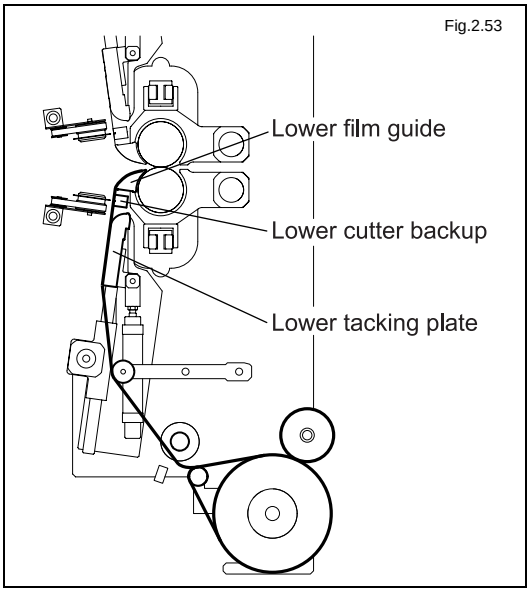


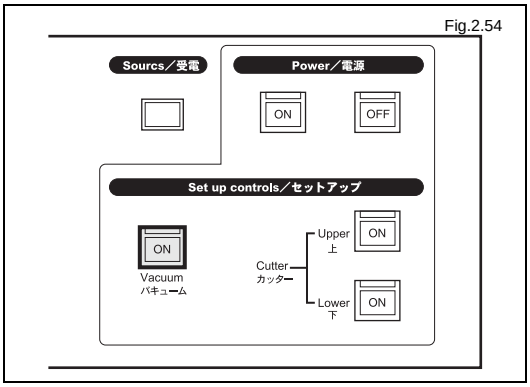
Fig.2.53

Run the laminate film along the film-running surface as shown in the illustration to the left.

⚠ Caution

Be careful, as the lamination module contains high-temperature parts.

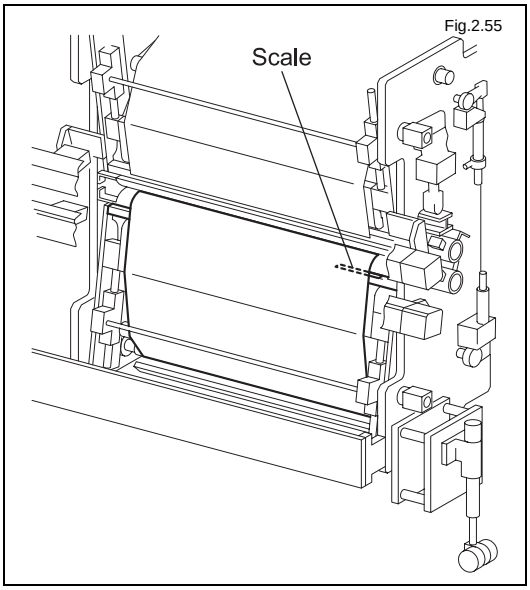
5.



Run the laminate film up to the film guide, and press the Vacuum [ON] button on the operation panel.

- The blower fan will start, activating the tacking plate, cutter backup, and film guide for vacuum-pressure operation.

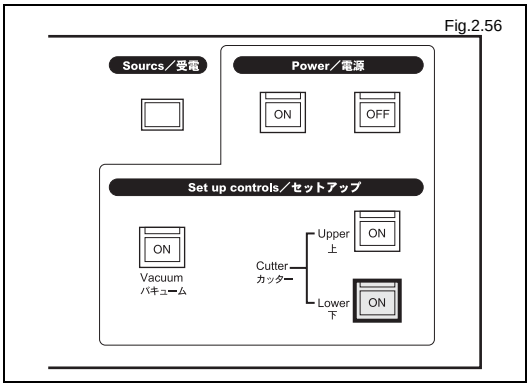
6.



Extend the film along the film-running surface while maintaining its tautness.

- While doing so, center it by referring to the scale on the cutter backup.

7.



Press the Lower Cutter [ON] button on the operation panel.

- The cutter assembly will run to cut the excess-film section.

⚠ Caution

- Be careful when using the cutter to cut film with the lamination module pulled out.
- Keep the cutter cover closed even when the cutter is not in operation.

8.

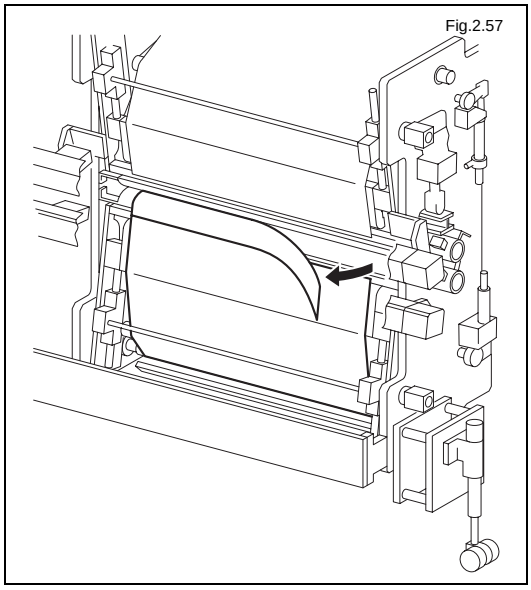


Fig.2.57

Remove the excess film that has been cut.

- The lower DF unit is now loaded.
- Push in the lamination module and close the front door.

3.2.2 Loading of Dry Film (DF Bulk Unit)

The methods for loading dry film differ for the upper and lower DF bulk unit.

- This section explains the methods of loading dry film into the each of the upper and lower DF bulk units.

■ Loading Dry Film into the Upper DF Bulk Unit

1. Open the front door and pull out the lamination module.

⚠ Caution

Load dry film into the upper DF bulk unit with the power switch turned on. The lamination module contains high-temperature and high-voltage parts, so be careful to prevent burns and electric shock.

2. Remove the dry film from the crating and packing bag.

Note

If it is exposed to light for and extended period, the dry film with be sensitized. It is therefore packed in a light-shielded bag for storage. To avoid exposing it to strong light, remove it from the packing bag and load it into the DF unit in a room with yellow light.

3.

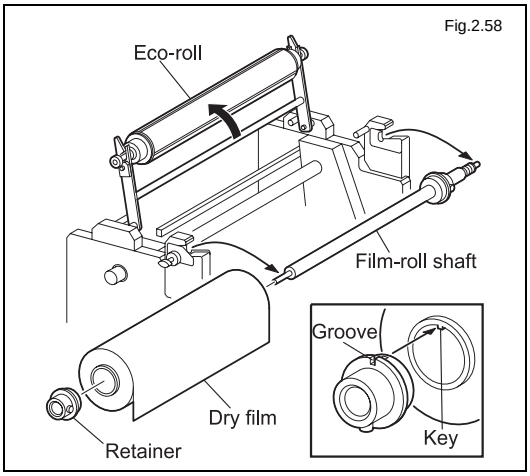


Fig.2.58

Lift the eco-roll of the upper DF bulk unit, remove the film-roll shaft and position the dry film at approximately the center of the shaft.

- When positioning the dry film, align the key of its core with the groove of the retainer.

4.

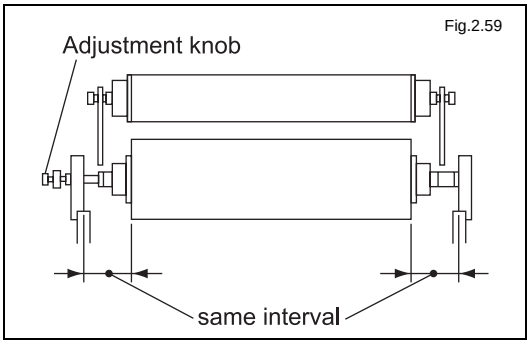


Fig.2.59

Place the film-roll shaft loaded with the dry film into the upper DF bulk unit.

- Use the axial-adjustment knob to position the dry film so that it is laterally symmetrical when measured from the side plates at the edges of the unit.

5.

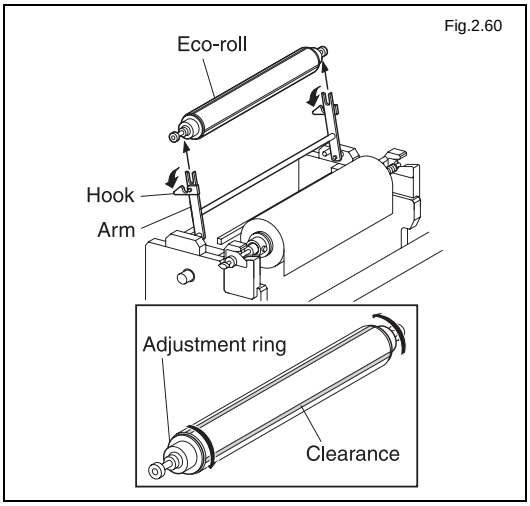


Fig.2.60

Open the hook to remove the eco-roll from the arm of the upper DF bulk unit, and turn the adjustment ring to make a clearance on the external circumference.

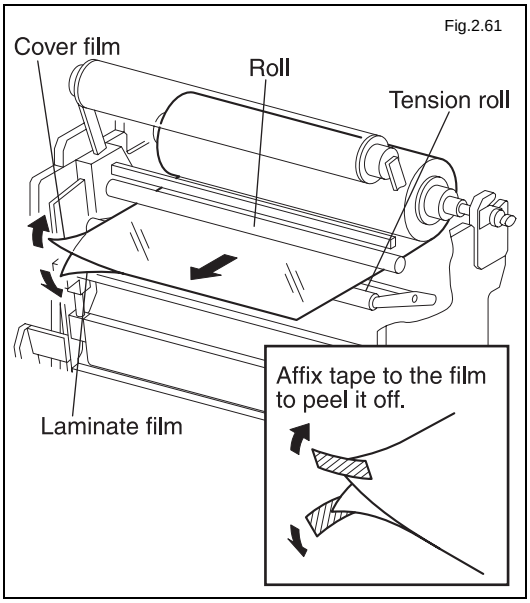
- Making a clearance with the adjustment ring expands the diameter of the eco-roll slightly.

Note

- After a roll of dry film is used up, reducing the diameter of the eco-roll by turning the adjustment ring makes the removal of the cover film easier.
- The cover film must be removed every time a roll of dry film is used up. Otherwise, the additional cover film will increase the diameter of the cover film on the eco-roll to a point where it interferes with other compornents, potentially causing a malfunction.

6. After the eco-roll has been prepared (step 5), replace the eco-roll in the arm, and secure it with the hook.

7.

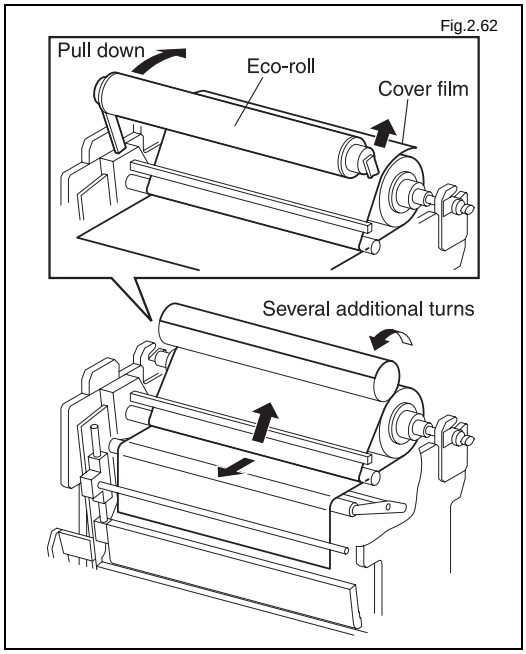


Pull out the dry film, run it between the roll and the tension roll to separate the laminate film from the cover film.

Note

- The dry film consists of a cover film and a laminate film. And the laminate film consists of a carrier film and a photo-resist.
- Affix a piece of tape to the top and another to the bottom of the film. Pull upward and downward to separate the cover and laminate films.

8.



Fix the cover film to the eco-roll, and pull down the eco-roll so it rests on the dry film. While separating the laminate film from the cover film, wind the cover film several additional turns.

Note

Avoid using adhesive tape or inserting cover film into the clearance of the eco-roll when fixing the cover film to the eco-roll, as it is harder to remove the cover film.

9.

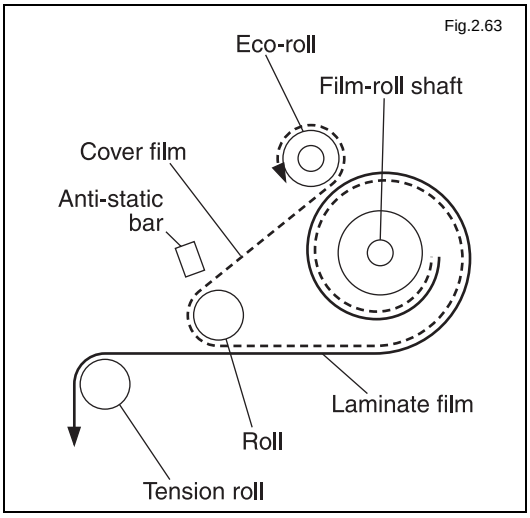


Fig.2.63

The dry film has now been loaded into the upper DF bulk unit, along the route shown in the illustration to the left.

10.

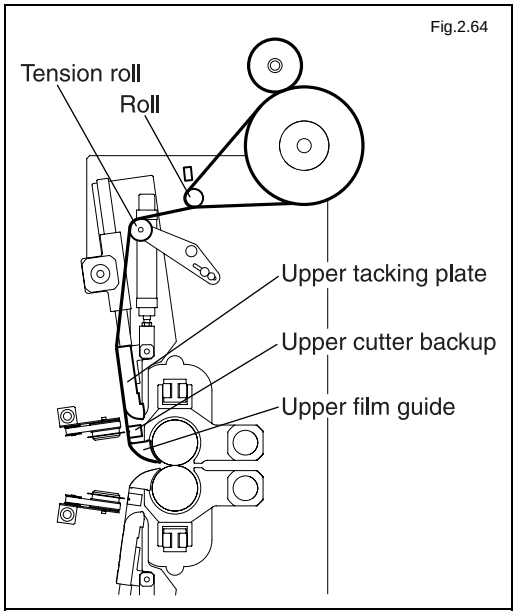


Fig.2.64

Run the laminate film along the film-running surface as shown in the illustration to the left.

⚠ Caution

Be careful, as the lamination module contains high-temperature parts.

11.

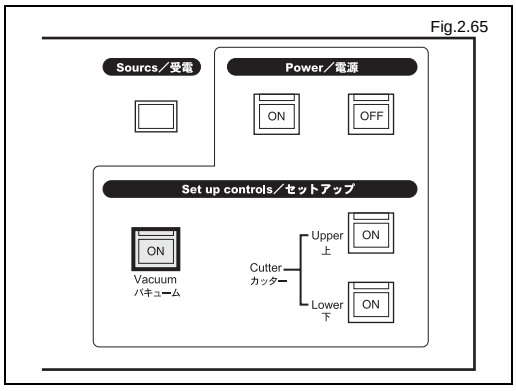


Fig.2.65

Run the laminate film down to the film guide and press the Vacuum [ON] button on the operation panel.

- The blower fan will start, activating the tacking plate, cutter backup, and guide for vacuum-pressure operation.

12.

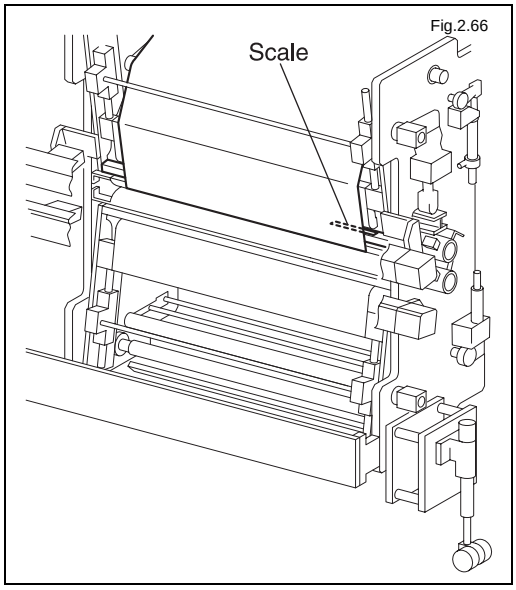


Fig.2.66

Extend the film along the film-running surface while maintaining its tautness.

- While doing so, center it by referring to the scale on the cutter backup.

13.

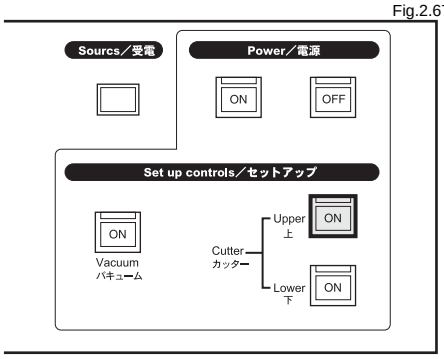


Fig.2.67

Press the Upper Cutter button on the operation panel.

- The cutter assembly will run to cut the excess-film section.

⚠ Caution

- Be careful when running the cutter to cut the film with the lamination module pulled out.
- Keep the cutter cover closed even when the cutter is not in operation.

14.

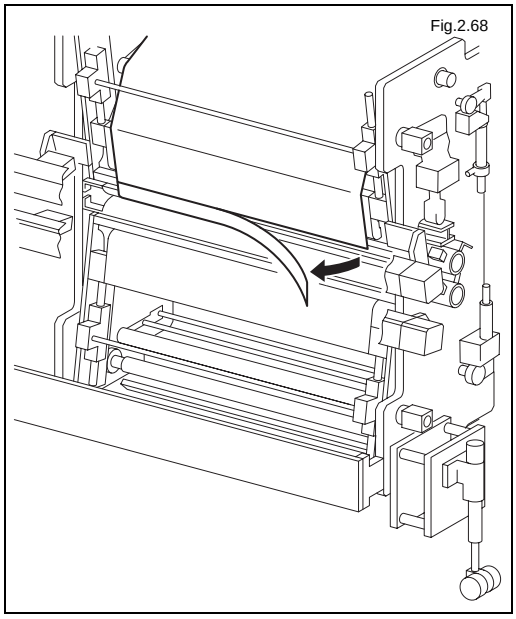


Fig.2.68

Remove the excess film that has been cut off.

- Push in the lamination module and close the front door, except when also loading the dry film into the lower DF bulk unit.

■ Loading Dry Film into the Lower DF Bulk Unit

1. Open the front door and pull out the lamination module.

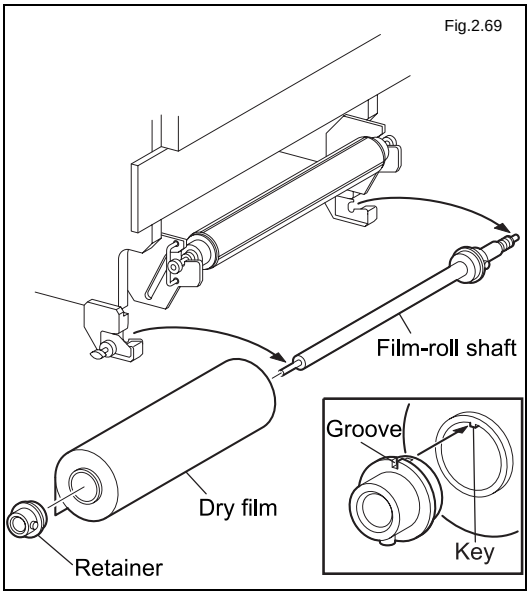
- This step is not required if the dry film is loaded into the lower DF bulk unit immediately after the upper DF bulk unit, as the lamination module would already have been pulled out.

2. Remove the dry film from the crating and packing bag.

Note

If it is exposed to light for and extended period, the dry film with be sensitized. It is therefore packed in a light-shielded bag for storage. To avoid exposing it to strong light, remove it from the packing bag and load it into the DF unit in a room with yellow light.

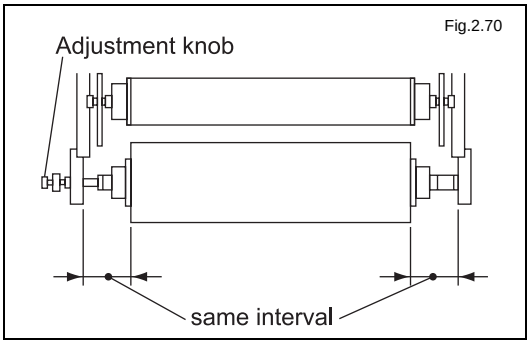
3.



Remove the film-roll shaft from the lower DF bulk unit and position the dry film at approximately the center of the shaft.

- When positioning the dry film, align the key of its core with the groove of the retainer.

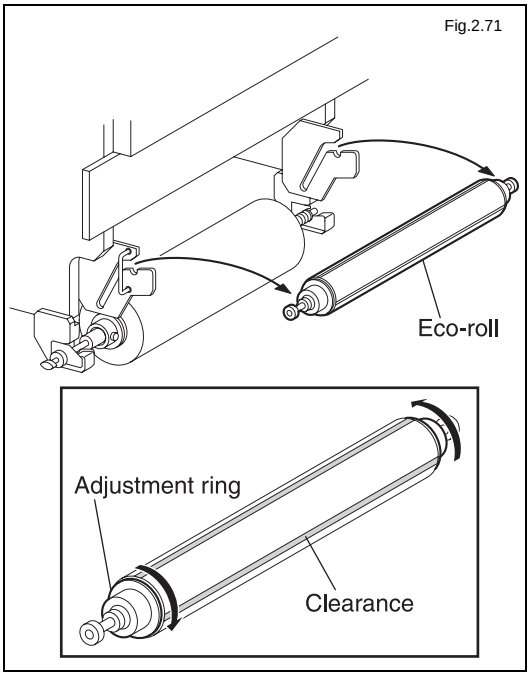
4.



Place the film-roll shaft loaded with the dry film into the lower DF bulk unit.

- Use the axial-adjustment knob to position the dry film so that it is laterally symmetrical when measured from the side plates at the edges of the unit.

5.



Remove the eco-roll from the lower DF bulk unit and turn the adjustment ring to make a clearance on the external circumference.

- Making a clearance with the adjustment ring expands the diameter of the eco-roll slightly.

Note

- After a roll of dry film is used up, reducing the diameter of the eco-roll by turning the adjustment ring makes the removal of the cover film easier.
- The cover film must be removed every time a roll of dry film is used up. Otherwise, the additional cover film will increase the diameter of the cover film on the eco-roll to a point where it interferes with other compornents, potentially causing a malfunction.

6. After the eco-roll has been prepared (step 5), replace the eco-roll in the lower DF bulk unit.

7.

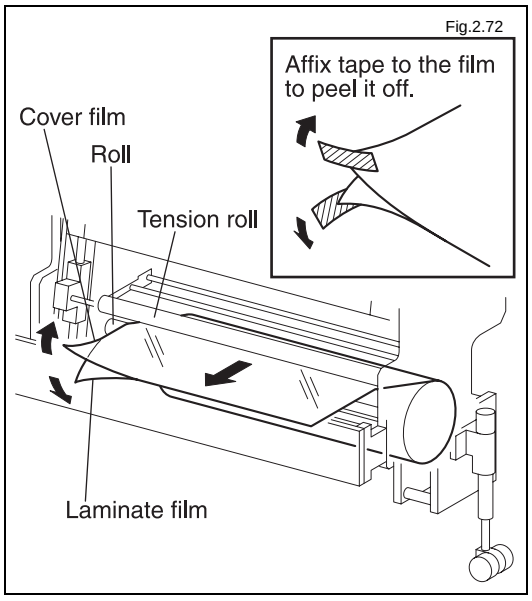


Fig.2.72

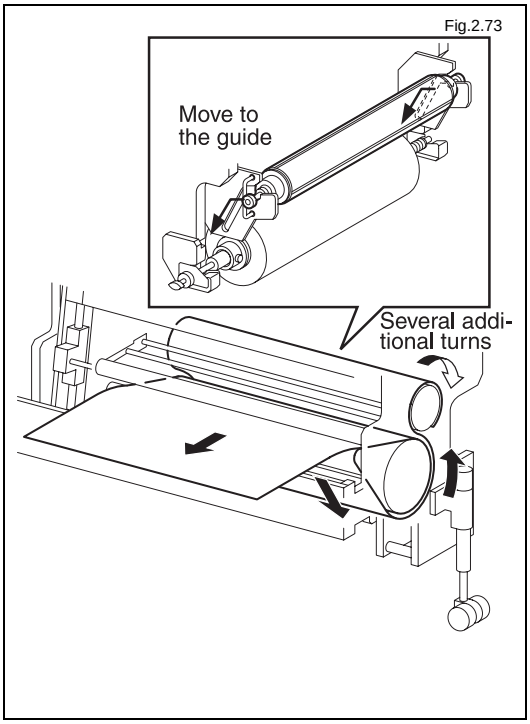
Pull out the dry film, run it between the tension roll and the roll to separate the laminate film from the cover film.

Note

- The dry film consists of a cover film and a laminate film. And the laminate film consists of a carrier film and a photo-resist.
- Affix a piece of tape to the top and another to the bottom of the film. Pull upward and downward to separate the cover and laminate films.

8.

Fig.2.73



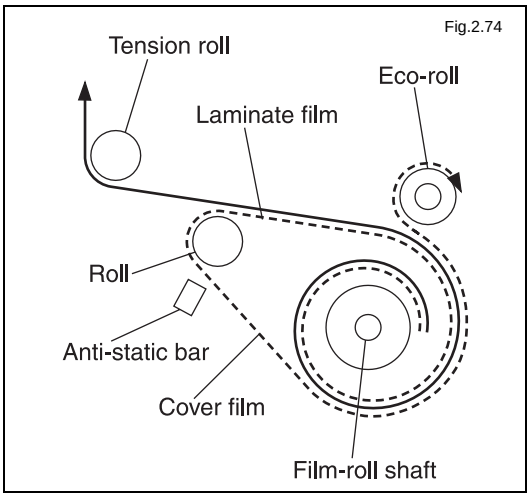
Fix the cover film to the eco-roll by running it under the dry film, and transfer the eco-roll from the holding groove to the guide section so it rests on the dry film.
While separating the laminate film from the cover film, wind the cover film several additional turns.

Note

Avoid using adhesive tape or inserting cover film into the clearance of the eco-roll when fixing the cover film to the eco-roll, as it is harder to remove the cover film.

9.

Fig.2.74



The dry film has now been loaded into the lower DF bulk unit, along the route shown in the illustration to the left.

10.

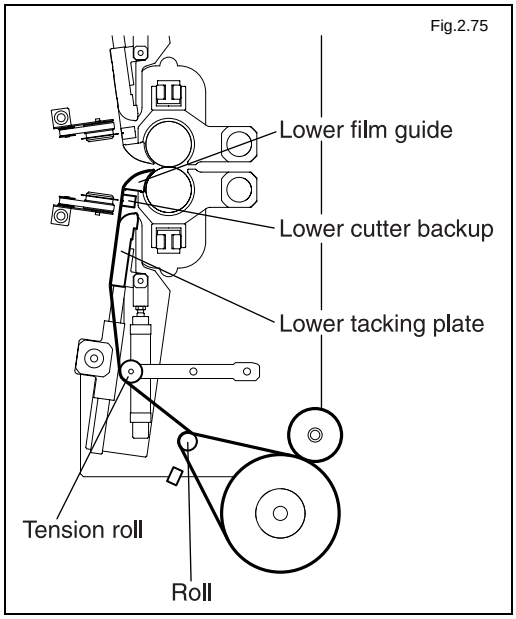


Fig.2.75

Run the laminate film along the film-running surface as shown in the illustration to the left.

⚠ Caution

Be careful, as the lamination module contains high-temperature parts.

11.

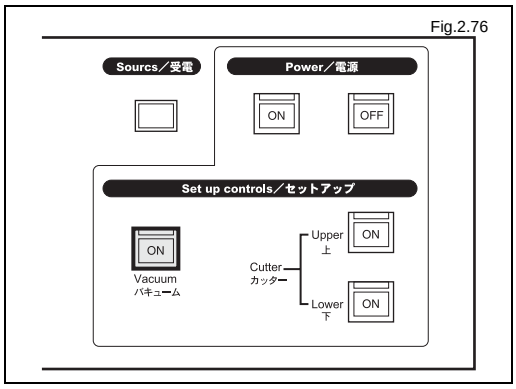


Fig.2.76

Run the laminate film down to the film guide and press the Vacuum ON button on the operation panel.

- The blower fan will start, activating the tacking plate, cutter backup, and guide for vacuum-pressure operation.

12.

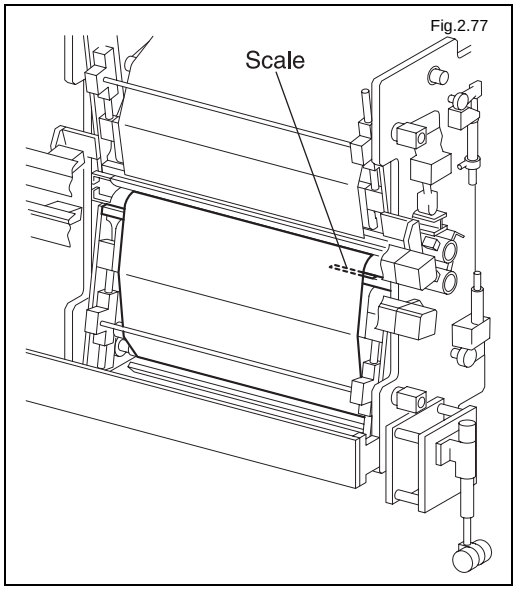


Fig.2.77

Extend the film along the film-running surface while maintaining its tautness.

- While doing so, center it by referring to the scale on the cutter backup.

13.

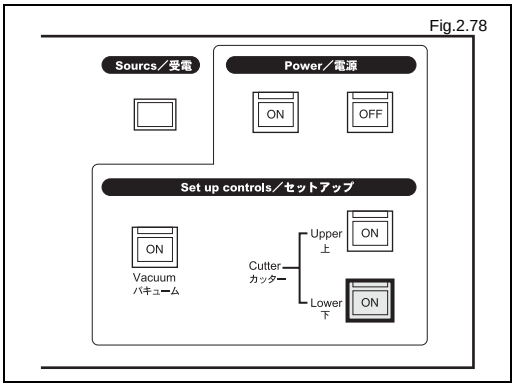


Fig.2.78

Press the Upper Cutter [ON] button on the operation panel.

- The cutter assembly will run to cut the excess-film section.

14.

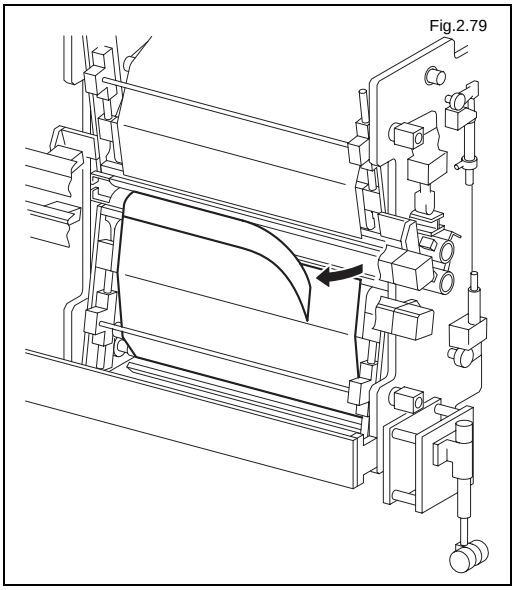


Fig.2.79

Remove the excess film that has been cut off.

- Push in the lamination module and close the front door.

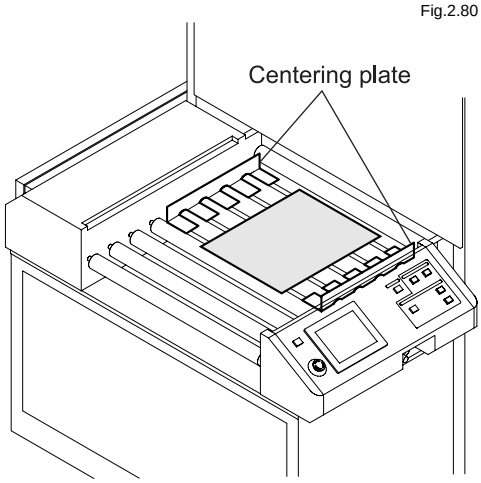
3.2.3 Adjustment of the Centering Width

To align the PWB at the center of the input conveyor, use the front and rear centering plates.

- Use the centering adjustment handle to adjust the width of the centering plates to match the width of the PWB.

1.

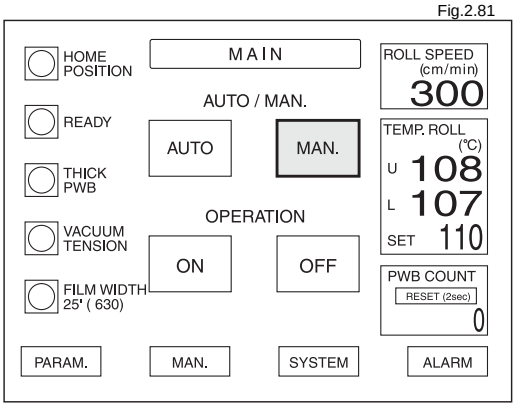
Fig.2.80



Place a PWB between the centering plates on the input conveyor.

2.

Fig.2.81

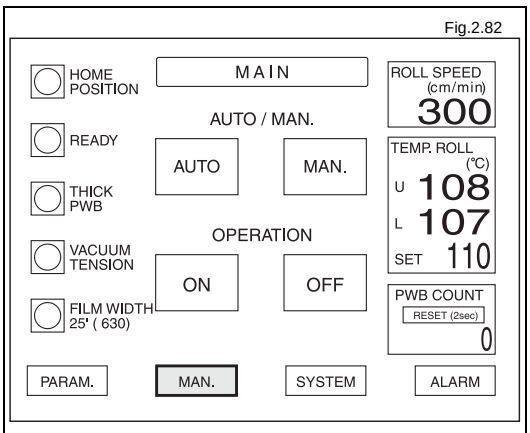


Press the yellow "MAN." button on the main screen's "AUTO / MAN." area.

- The unit will enter the "Manual operation" mode to allow operation on the manual screen.

3.

Fig.2.82

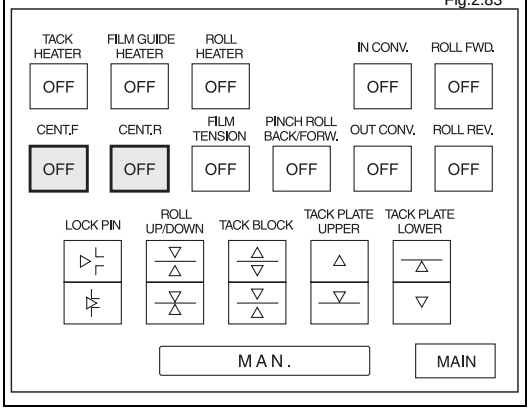


Press the white "MAN." button at the bottom of the main screen.

- The manual screen will be displayed.

4.

Fig.2.83



Press the CENT. F "OFF" and CENT. R "OFF" buttons to activate centering plates (F) and (R). Adjust the centering width to the width of PWB.

- When pressed, the CENT. F "OFF" and CENT. R "OFF" buttons turn "ON", indicating that the centering plates (F) and (R) have been activated.

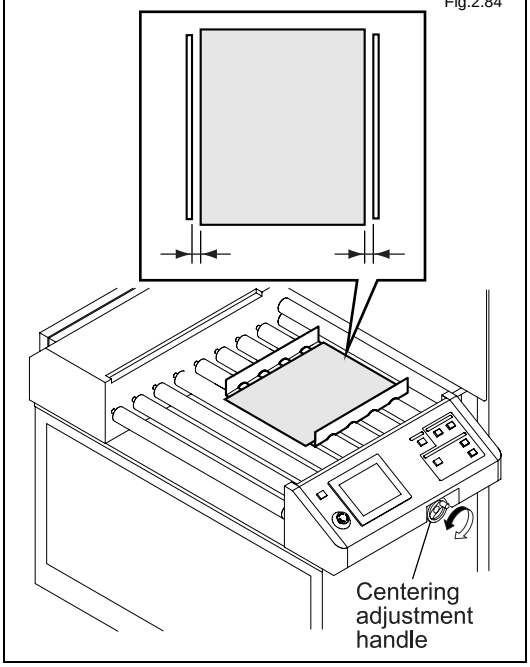
* The explanation about film-guides is indicated when you choose options.

⚠ Warning

Be sure to close the cover of the input conveyor when it is in operation. If the input conveyor is operated with its cover open, workers' hands may be caught and injury may result.

5.

Fig.2.84



Turn the centering adjustment handle to set the distance between the centering plates to a value slightly greater than the width of PWB.

⚠ Caution

There are subtle differences in width between different PWB products. If the centering width is not set a little bit wider than the PWB width, the centering plates will catch those of large widths and damage the PWBs and the centering mechanism.

6. To stop the centering motion of the centering plates (F) and (R), press the CENT. F "ON" and CENT. R "ON" buttons.

- When pressed, the CENT. F "ON" and CENT. R "ON" buttons will turn "OFF", returning the centering plates (F) and (R) to the home position.

3.2.4 Settings on the Operation Panel

Follow the steps specified below to set the PWB information and lamination conditions in accordance with the specification of the PWB.

3.2.4.1 Setting of Parameters

Set the speeds of the conveyors and laminating rolls, the temperature and alarm values of the laminating rolls, tacking blocks, and film guides, leading and trailing spaces for film, tacking time, and film width on the parameter screen.

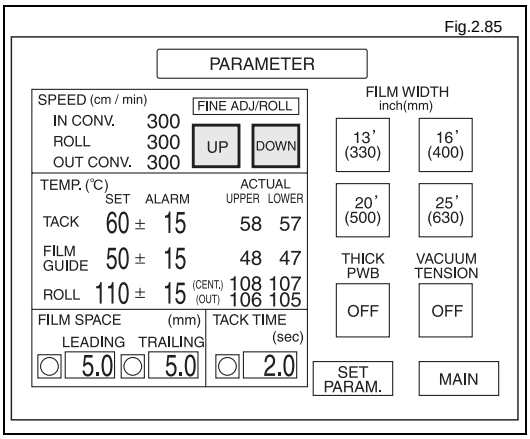
● Press the "PARAM." button on the main screen to switch to the parameter screen.

■ Setting Speed

Set the speeds (cm/min) of the input conveyor, output conveyor, and laminating rolls.

1.

Fig.2.85

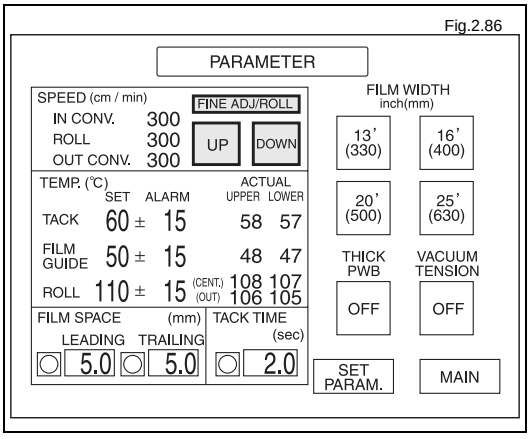


To increase or decrease the speeds of the input conveyor, output conveyor, and laminate roll, press the "UP" or "DOWN" button

- The speeds increase or decrease simultaneously.
- To finely adjust only the laminate-roll speed, follow the steps specified below.

2.

Fig.2.86



To finely adjust only the "ROLL" (laminating roll) speed, press the "UP" or "DOWN" button while holding down the "FINE ADJ/ROLL" button.

- The "UP" and "DOWN" buttons are valid only for the laminating roll speed while the "FINE ADJ/ROLL" button is being pressed.
- To return to the normal speed-adjusting mode, release the "FINE ADJ/ROLL" button.

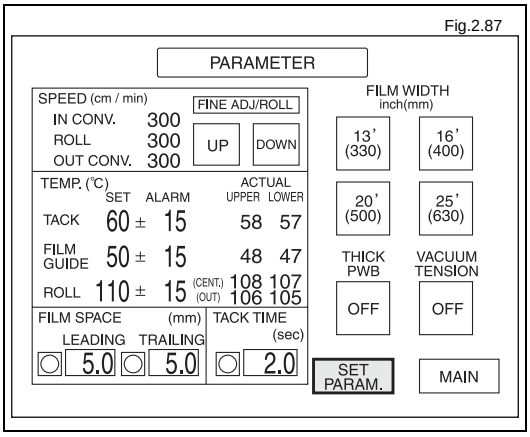
* The explanation about film-guides is indicated when you choose options.

■ Temperature Setting

Follow the steps specified below to set the alarm values and the temperature (℃) of the tacking rubber, film-guide**, and laminating rolls.

1.

Fig.2.87

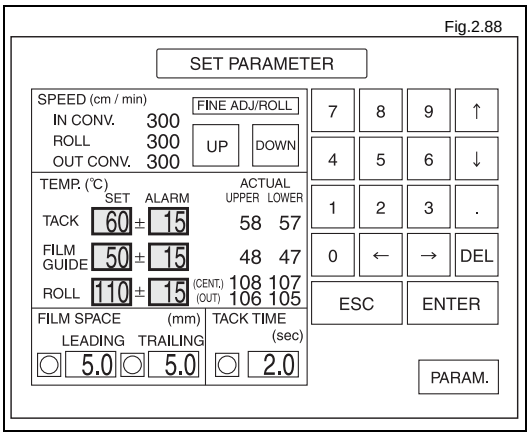


Press the "SET PARAM." button on the parameter screen to switch to the parameter-setting screen.

- A ten-key pad will be displayed. The set temperature and alarm values can now be changed.

2.

Fig.2.88

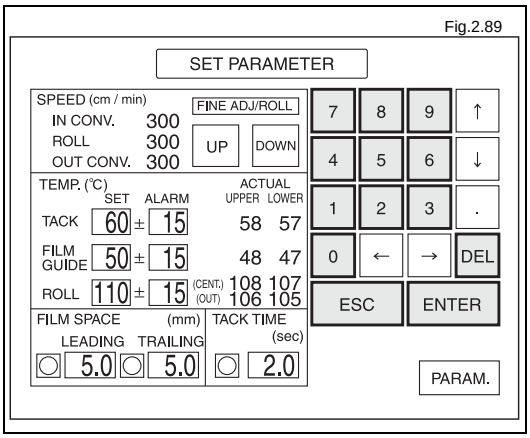


Press the square frame of the "SET" or "ALARM" temperature to be changed.

- The selected square frame will change to a thick-lined square. The set value can now be changed.

3.

Fig.2.89



Use the ten-key pad to input a value to be set.

- To erase the value shown in the frame, press the "DEL" button.
- To cancel the value input from the ten-key pad and revert the original value, press the "ESC" button.
- To enter the input value, press the "ENTER" button.

  The allowable maximum temperature to be set is:

  Tacking plate..... 70℃

  Film guide *Option ..... 60℃

  Laminating roll..... 150℃

* The explanation about film-guides is indicated when you choose options.

** When the film-guide heaters may be chosen as an option.

■ Setting of the Leading and Trailing Film Spaces

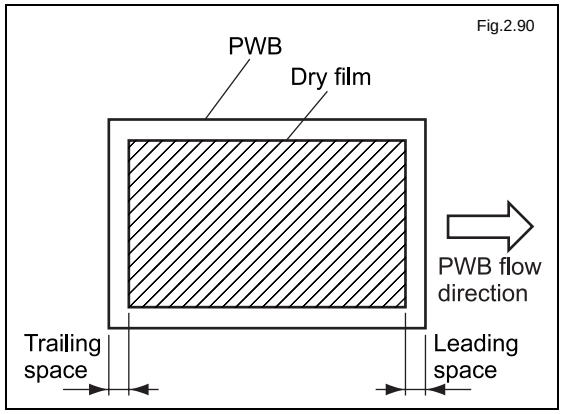


Fig.2.90

Follow the steps specified below to set the spaces on the leading and trailing edge of the board where the film will not be laminated onto the PWB (length in mm.)

1.

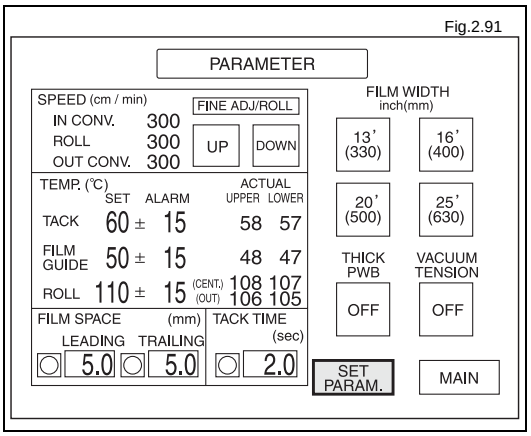


Fig.2.91

Press the "SET PARAM." button on the Parameter screen to switch to the parameter-setting screen.

- A ten-key pad will be displayed. The setting of film spaces can now be changed.

2.

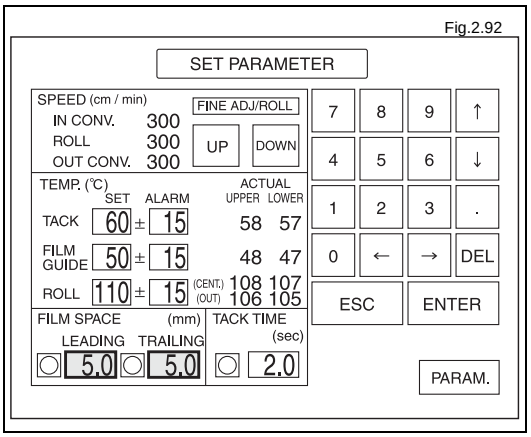


Fig.2.92

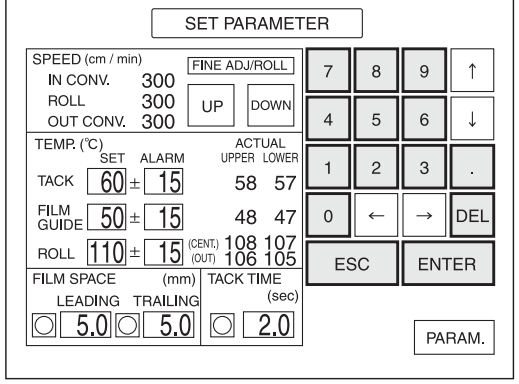
Press the square frame of FILM SPACE "LEADING" or "TRAILING" to be changed.

- The selected frame will change to a thick-lined frame. The set value can now be changed.

* The explanation about film-guides is indicated when you choose options.

3.

Fig.2.93



Use the ten-key pad to input a value to be set.

- To erase the value shown in the frame, press the "DEL".
- To cancel the value input from the ten-key pad and revert to the original value, press the "ESC" button.
- To enter the input value, press the "ENTER" button.
- The leading film space can be set between 2 and 60 mm, and trailing film space between 0 and 25 mm.

Note

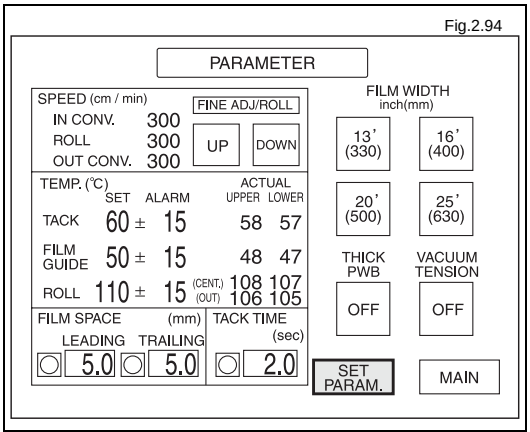
Since film placement is +/-1.0 mm, caution should be used when operating with a film space value of 1.0 mm or less.

■ Setting of Tacking Time

Follow the steps specified below to set the time (in sec) for tacking the dry film at the PWB front edge the tacking plate.

1.

Fig.2.94

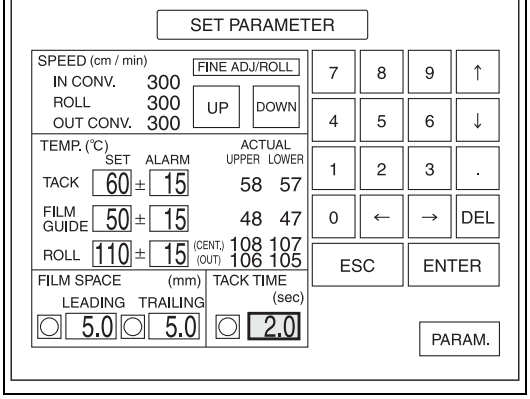


Press the "SET PARAM." button on the parameter screen to switch to the parameter-setting screen.

- A ten-key pad will be displayed. The set tacking time can now be changed.

2.

Fig.2.95



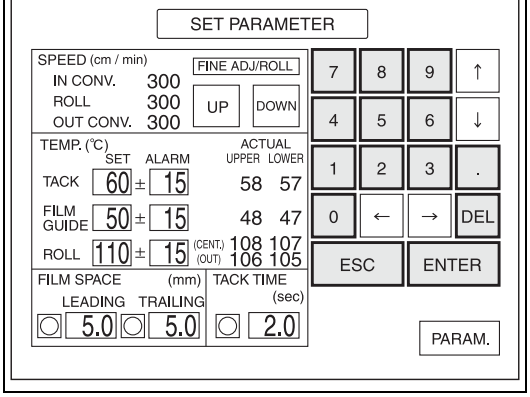
Press the tacking-time square frame.

- The tacking-time square frame will change to a thick-lined frame. The set tacking time can now be changed.

* The explanation about film-guides is indicated when you choose options.

3.

Fig.2.96



Use the ten-key pad to input the value to be set.

- To erase the value shown in the frame, press the "DEL" button.
- To cancel the value input from the ten-key pad and revert to the original value, press the "ESC" button.
- To enter the input value, press the "ENTER" button.
- The maximum allowable tacking time that can be set is 99.9 sec, while the minimum is 0.0 sec.

Note

Since a short tracking time will lead to a tacking failure, an ideal value of 2.0 sec is recommended. Different types of PWB and dry film may require a longer or shorter tacking time, but most require a value between 1.0 sec and 2.5 sec.

■ Setting of Film Width

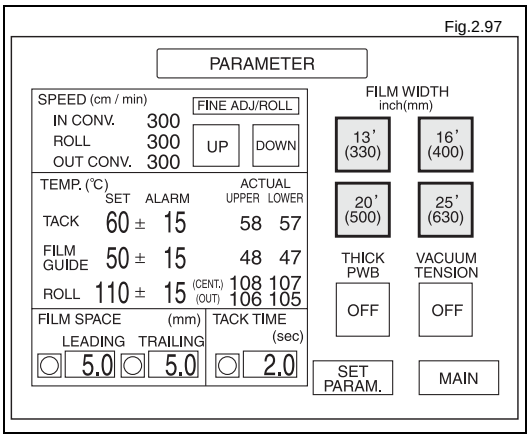
Follow the steps specified below to set the width (inches (mm)) of the dry film loaded into the lamination module.

Note

When the film width is set, the vacuum-effective width of the tacking plate is automatically adjusted. If an incorrect film width is set, proper vacuum pressure will not be obtained. Therefore, be sure to correctly set the width of the dry film to be used. If the correct value is not available,choose the next smaller film width.

1.

Fig.2.97



Select one of the four film widths that corresponds to the width of the loaded film.

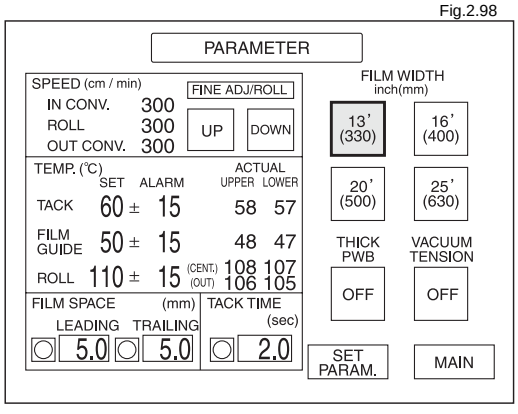
- Select one of the following film widths: 13' (330 mm), 16' (400 mm), 20' (500 mm), or 25' (630 mm).

* The explanation about film-guides is indicated when you choose options.

● To load a film of a width smaller than 13' (330 mm):
If it is necessary to laminate a film of a width smaller than 13' (330 mm), such as that with a width of 250 mm, follow the steps specified below to adjust the vacuum-effective width of the tacking plate.

1.

Fig.2.98

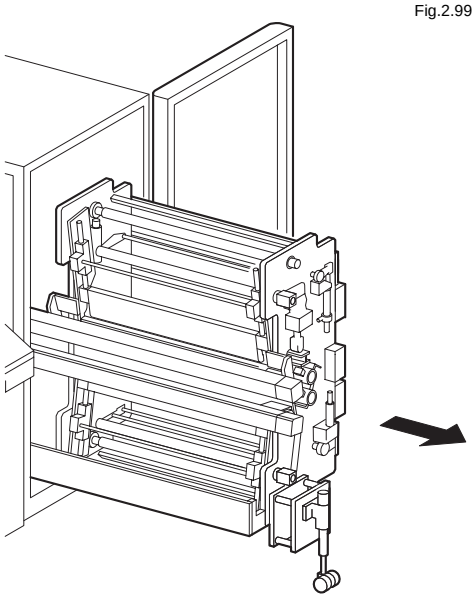


Select "13' (330)" on the parameter screen.

● The vacuum-effective width of the tacking plate will be set at 13' (330 mm).

2.

Fig.2.99



Open the front door and pull out the lamination module.

* The explanation about film-guides is indicated when you choose options.

3.

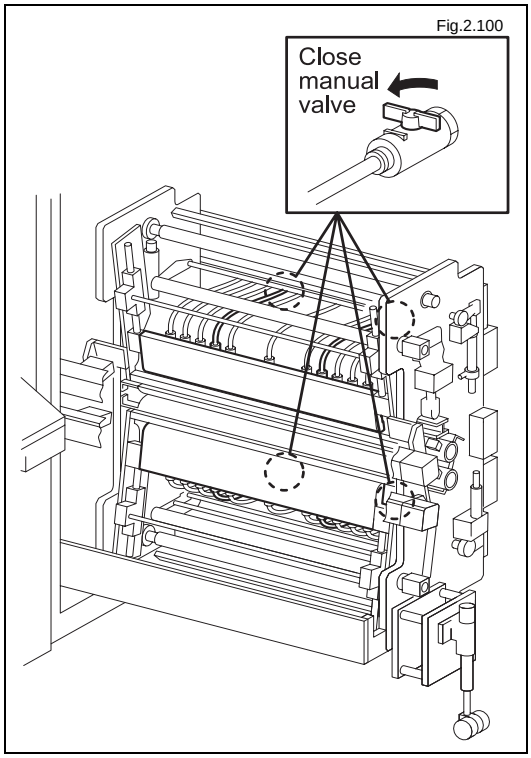


Fig.2.100

Close the four manual valves on the air tubes connected to the tacking plates (two on the top and two on the bottom). Moving away from the center air tube to the left and right, close the valve on the SECOND tube in each direction. Leave the valve for the firsts tube open (the tube adjacent to the center tube).

■ Setting of Thick-PWB Mode

When thick PWB products are used, turn the THICK PWB mode "ON."

Note

When the thick PWB mode is set, the laminating motion of the lamination module will change. If the thick PWB mode is "ON" when laminating thin PWBs, the appropriate lamination pressure will not be obtained or the unit may be adversely affected. Be sure to set the thick PWB mode only for thick PWBs.

1.

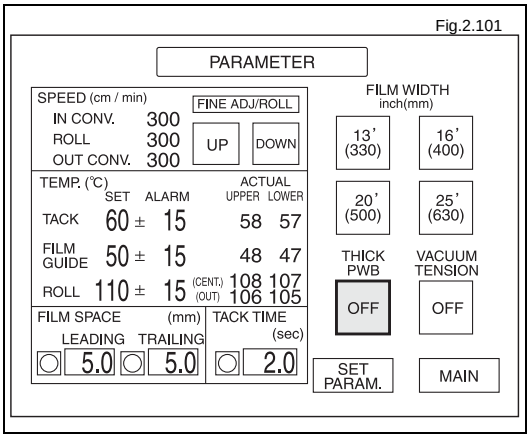


Fig.2.101

Press the THICK PWB button to turn it "ON."

- Each time the THICK PWB button is pressed, it alternates between "ON" and "OFF."
- The default setting at shipment is "OFF".

* The explanation about film-guides is indicated when you choose options.

■ Setting of Vacuum Tension

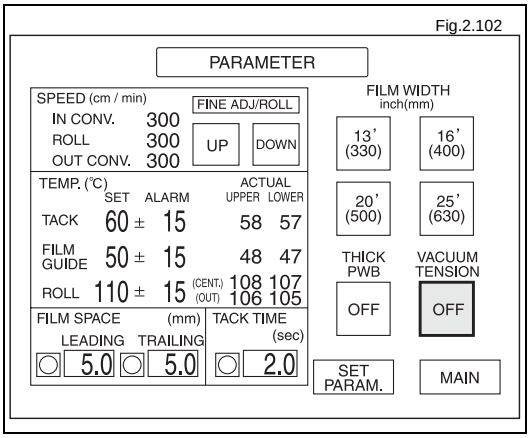
To increase the film tension through the use of vacuum pressure when the dry film is laminated, turn the VACUUM TENSION "ON."

Note

If the VACUUM TENSION button is turned "ON," the film tension will be increased during lamination by increasing the vacuum pressure of the tacking plate, cutter backup, and film guide. Select the film tension in accordance with the specifications of your products and dry film.

1.

Fig.2.102



Press the VACUUM TENSION button to turn it "ON."

- Each time the VACUUM TENSION button is pressed, it alternates between "ON" and "OFF."
- The default setting at shipment is "OFF."

* The explanation about film-guides is indicated when you choose options.

3.2.4.2 Setting of System Data

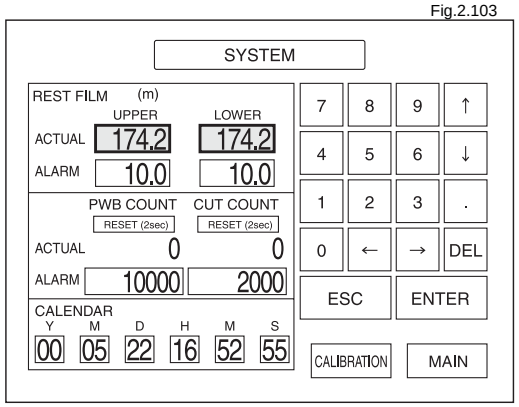
The remaining film counter, PWB count, cut count, and calendar data are set on the system screen. To set these values, follow the steps specified below. Press the "SYSTEM" button on the main screen to enter the system screen.

■ Setting of the REST FILM (Remaining Film) Counter

Input the actual value of remaining film and the desired alarm value when dry film is loaded.

1.

Fig.2.103

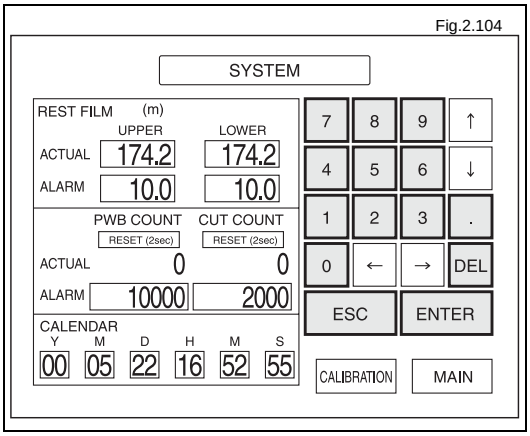


Press the square frame of the "ACTUAL" value of the REST FILM counter (m).

- The square frame of the "ACTUAL" value will change to a thick-lined frame. The set value can now be changed.

2.

Fig.2.104

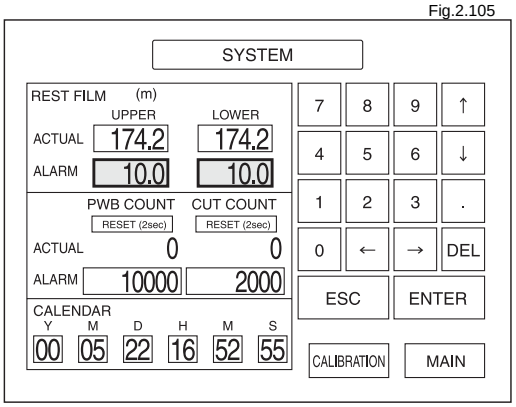


Use the ten-key pad to input the value to be set.

- To erase the value shown in the frame, press the "DEL" button.
- To cancel the value input from the ten-key pad and revert to the original value, press the "ESC" button.
- To enter the input value, press the "ENTER" button.
- The maximum allowable remaining film actual value is 9999.9 m, for both the upper and lower counters.
- Set the actual value on both the upper and lower counters.

3.

Fig.2.105



Press the square frame of the "ALARM" value.

- The frame of the "ALARM" value will change to a thick-lined frame.
  The set value can now be changed.

4. Use the ten-key pad to input the value to be set.

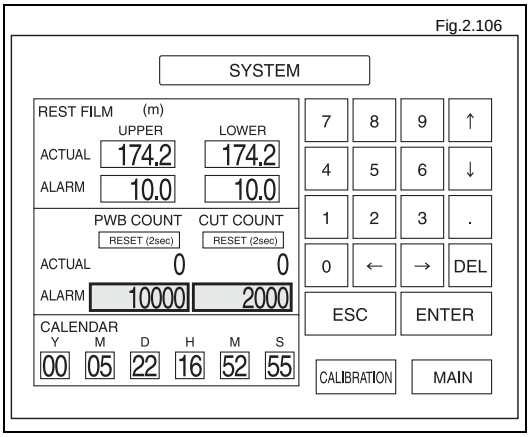
- The length of the used film will be subtracted from the "ACTUAL" value.
  When the actual value reaches the "ALARM" value, an alarm is issued.
- If the "ALARM" value is set at "0.0," alarms are not issued.
- Set the alarm value on both the upper and lower counters.

■ Setting of the PWB Count

Follow the steps specified below to display/reset the "ACTUAL" values of PWB count and cut count (number of films cut by the cutter), and input the "ALARM" value.

1.

Fig.2.106

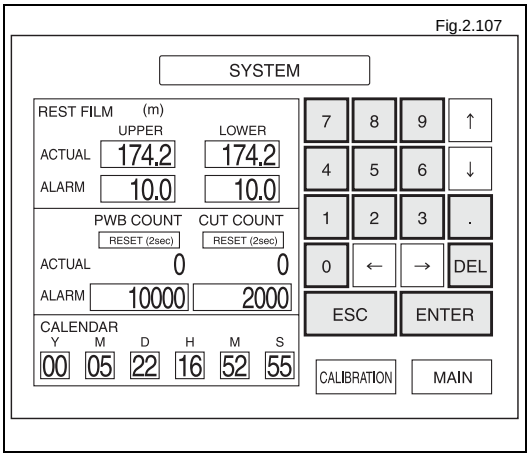


Press the square frame of the "ALARM" values of the PWB COUNT and CUT COUNT.

- The frame of the "ALARM" value will change to a thick-lined frame.
  The set value can now be changed.

2.

Fig.2.107

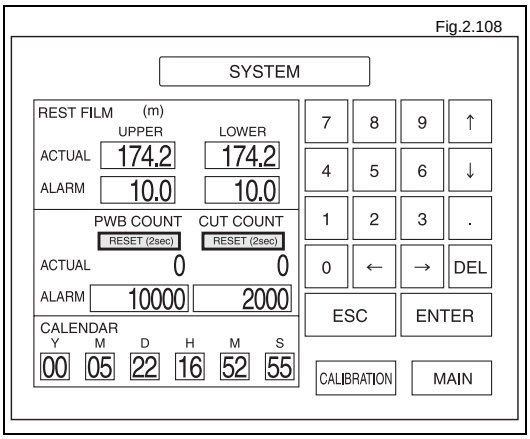


Use the ten-key pad to input the value to be set.

- To erase the value shown in the frame, press the "DEL" button.
- To cancel the value input from the ten-key pad and revert to the original value, press the "ESC" button.
- To enter the input value, press the "ENTER" button.

3.

Fig.2.108



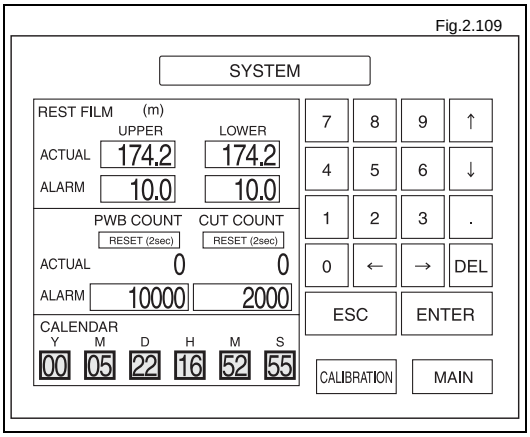
Hold down the "RESET" button for two seconds or longer.
The "ACTUAL" value will be reset to "0."

■ Setting of Calendar Data

To input the Year, Month, Day, Hour, Minute, or Second, follow the steps specified below.

1.

Fig.2.109

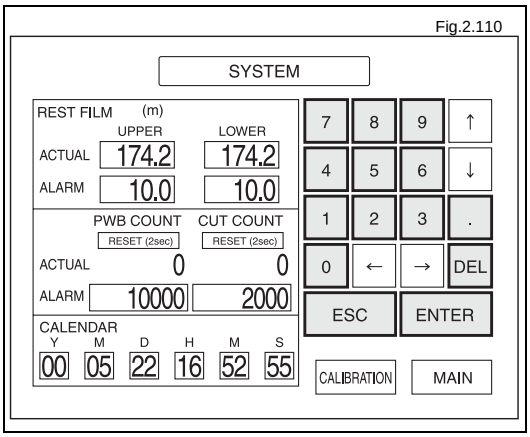


Press the square frame for the "Y", "M", "D", "H", "M", or "S".

- The selected square frame will change to a thick-lined frame.
  The set value can now be changed.

2.

Fig.2.110



Use the ten-key pad to input the value to be set.

- To erase the value shown in the frame, press the "DEL" button.
- To cancel the value input from the ten-key pad and revert to the original value, press the "ESC" button.
- To enter the input value, press the "ENTER" button.

3.2.5 Home position

Before starting automatic-operation, confirm that each section of the unit has been returned to its home position.
Use the manual screen to return each section to its home position if necessary.

Note

It is not possible to start the automatic-operation unless each section is in its home position (or if the "Home Position" lamp on the main screen is off).

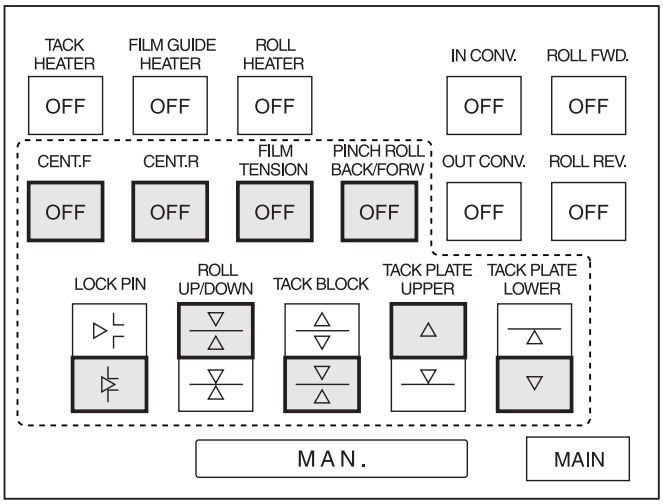
■ Description of Home Position

The diagram below shows each section in its home position. The "Home Position" lamp on the main screen lights on when all sections are set to this configuration.
The home position is one of conditions required to start the automatic-operation.

1. Confirm that the manual operation screen is configured as shown in the following diagram.

- If it is not lit, operate each button to return its associated section to the appropriate state.
- Sections within the dotted line are related to the home position. Those outside the dotted line (conveyor roll, etc.) are not related to the home position.

Fig.2.111



* The explanation about film-guides is indicated when you choose options.

2. Confirm that no PWB is on the conveyor.

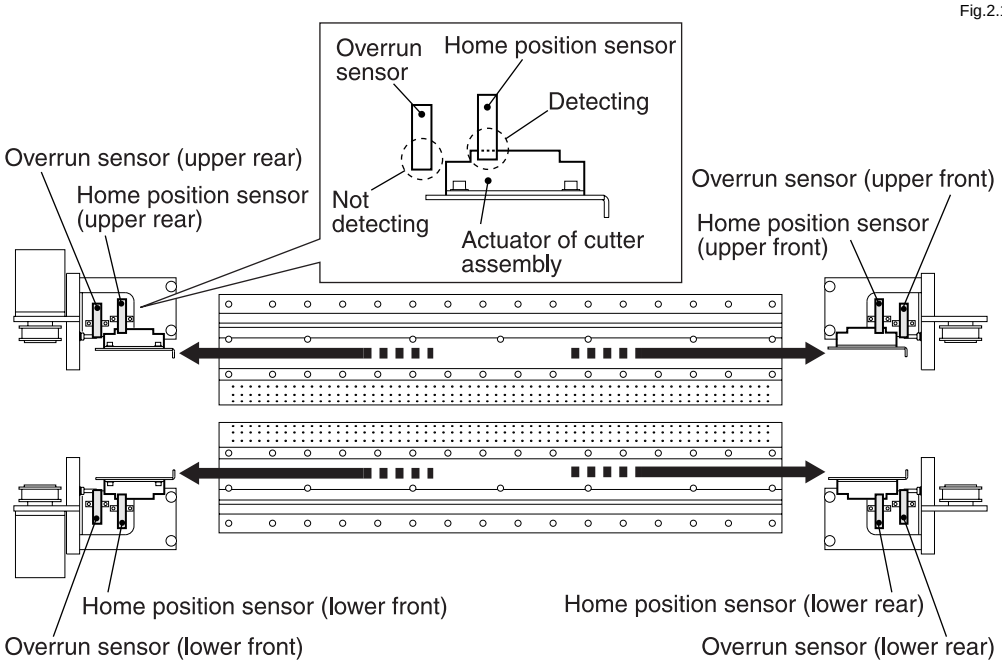
- If a PWB is on the conveyer, and the sensor is detecting it, the "Home Position" lamp on the main screen does not light.

3. Confirm that the upper and lower cutter assemblies are at their home position.

Note

- If the upper and lower cutter assemblies do not detect the home position sensor with the power ON (or if they are not at their home position), the "Home Position" lamp on the main screen does not light. In this case, turn the power off first, and then return them to the detection position of the home position sensor by hand.
- If the upper and lower cutter assemblies detect the overrun sensor with the power ON, the alarm is indicated. In this case, turn the power off first, and then return them to the detection position of the home position sensor by hand.

Fig.2.112



Caution

Turn the power OFF before the upper and lower cutter assemblies are moved by hand.

3.3 Automatic Operation

After the system data and parameters have been set, the unit can be used for film lamination in automatic operation. This Section explains the procedure for starting and stopping automatic operation, and the remedies in the event of the issuance of alarms.

3.3.1 Procedure for Starting Automatic Operation

Before starting automatic operation, confirm that daily inspection and preparation for operation have been completed.

● To start automatic operation, follow the steps specified below.

1. Daily inspection (See page 2-38.)
Confirm that the unit is connected properly to a power source, a compressed-air supply system, and the exhaust duct, and that all modules are normal.

↓

2. Power ON
Press the Power ON switch on the operation panel to start the unit. The main screen will be displayed on the touch panel. Complete the "Inspection after the Power Is Switched ON." (See page 2-39)

↓

3. Parameter setting (See page 2-71.)
Set parameters on the parameter screen.

↓

4. System-data setting (See page 2-80.)
Set system data on the system screen.

↓

5. Yellow "MAN." button
Press the yellow "MAN." button on the main screen to enter the manual-operation mode. The unit can now be operated from the manual screen.

↓

6. White "MAN." button

Press the white "MAN." button.

The manual screen will be displayed.

↓

7. Heaters and rolls "ON"

Turn the TACK HEATER, FILM GUIDE HEATER**, ROLL HEATER, and ROLL FWD buttons "ON." The heaters will start to warm-up.

Note

The ROLL FWD. button should be turned "ON" to quickly complete warm-up and ensure that the laminating roll temperature is evenly distributed.

⚠ Caution

Be careful, as the heaters become extremely hot after they are turned "ON."

** When the film-guide heaters may be chosen as an option.

↓

8. Adjustment of the centering width (See page 2-69.)

Use the centering adjustment handle to adjust the centering width.

↓

9. Positioning of dry film and the DF unit* (See pages 2-45 and 2-52.)

Place the DF unit loaded with dry film onto the lamination module.

Run the laminate film along the film-running surface, and use the cutter to cut off the excess.

- The DF bulk unit may be installed depending on the specifications of the unit used.

↓

10. Home-position check (See page 2-83.)

Confirm that the "HOME POSITION" lamp on the main screen lights up. If it is not lit, return to the manual screen and move each unit to its home position.

↓

11. "READY" lamp lights

When the heaters have warmed up and the unit is ready for automatic operation, the "READY" lamp will light up.

↓

12. "AUTO" button

The unit enters the automatic-operation mode.

↓

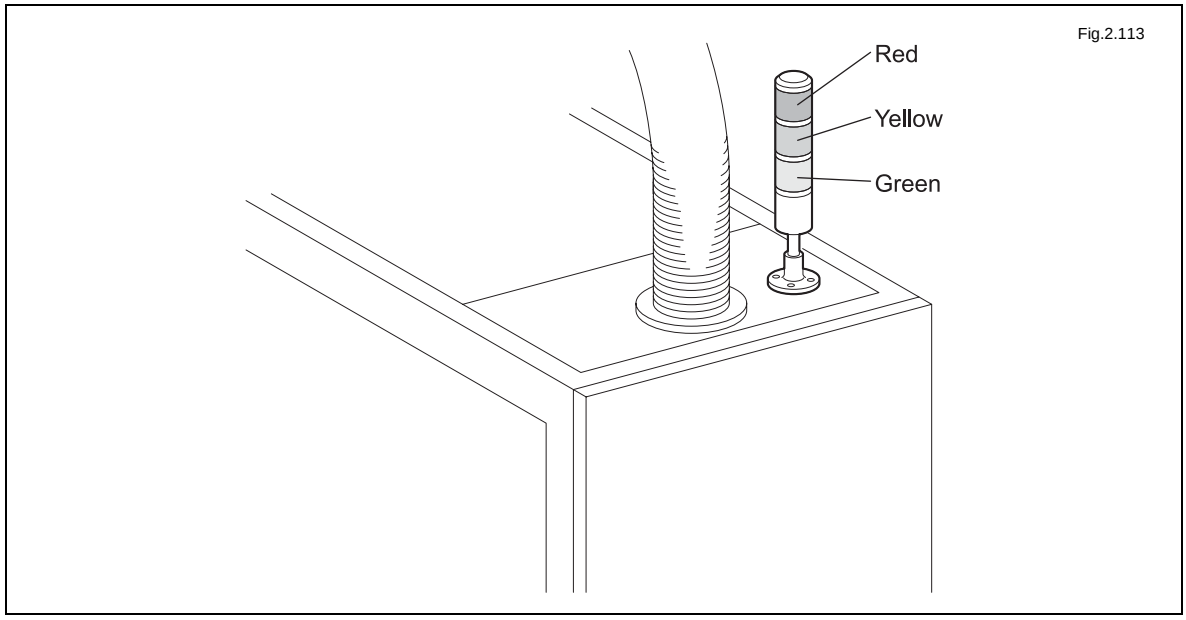
13. OPERATION "ON" button

The unit starts automatic operation and laminates the film automatically when a PWB enters the front conveyor.

3.3.2 Alarms and Remedies

When a failure has occurred in the unit, a buzzer sounds, the alarm screen is displayed, and the signal tower lights up RED to alert the operator.

■ Signal-Tower Status and Lighting Conditions



【Table 2.3.4 The Signal Tower】

Color	Status	Meaning
Red	light	A failure has occurred in the unit. Take necessary actions immediately in accordance with the display on the alarm screen.
Yellow	light	The unit is in the idle mode (e.g. manual-operation mode).
Green	light	The unit is in the automatic-operation mode.
	blinking	The unit is preparing for automatic operation.

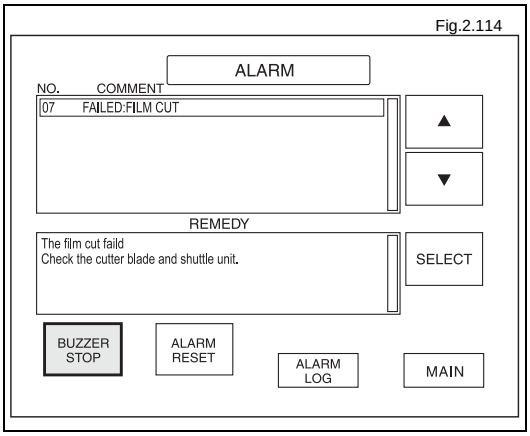
■ Operation on the Alarm Screen

When a failure occurs in the unit, the alarm screen will be displayed on the touch panel.

● Follow the steps specified below to take the required actions.

1.

Fig.2.114

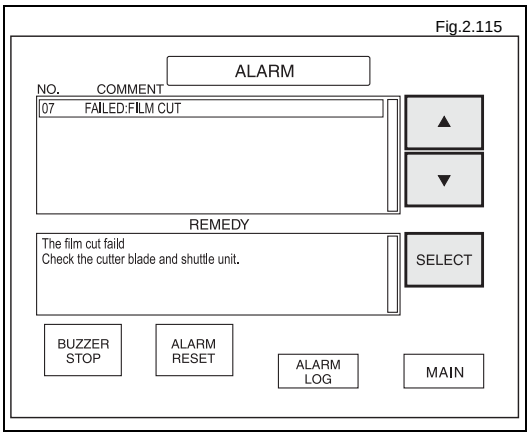


Press the "BUZZER STOP" button on the alarm screen to stop the buzzer.

● The illustration to the left shows an example of display.

2.

Fig.2.115



Press the "SELECT" button.

● The remedies required in response to the displayed alarm will be displayed.

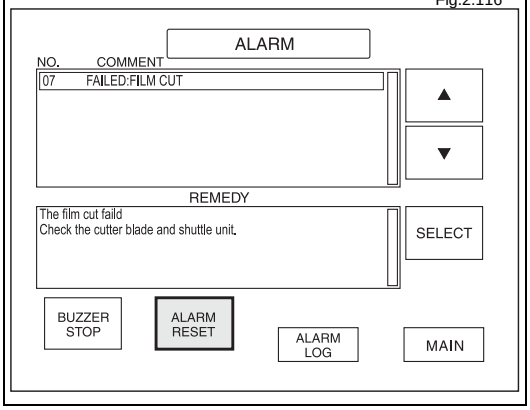
● If two or more alarms are issued simultaneously, use the "▲" and "▼" buttons to select the one for which remedies are required, and press the "SELECT" button.

3. Take the required actions specified in the displayed instructions.

● For more information, see 3.1 "Troubleshooting," Part3 "Maintenance" on Page3-70.

4.

Fig.2.116

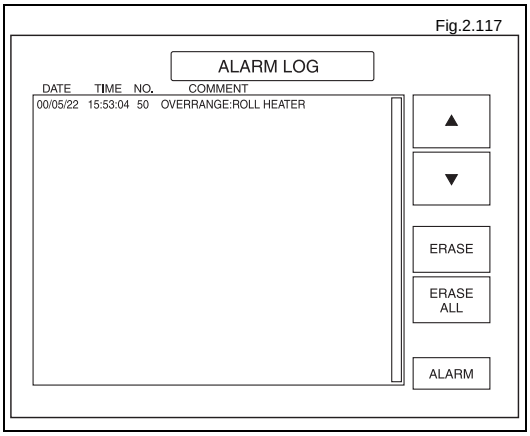


Press the "ALARM RESET" button to erase the alarm.

- Comments on the alarm screen will disappear.
- Before erasing the alarm, be sure to take the necessary actions.

5.

Fig.2.117

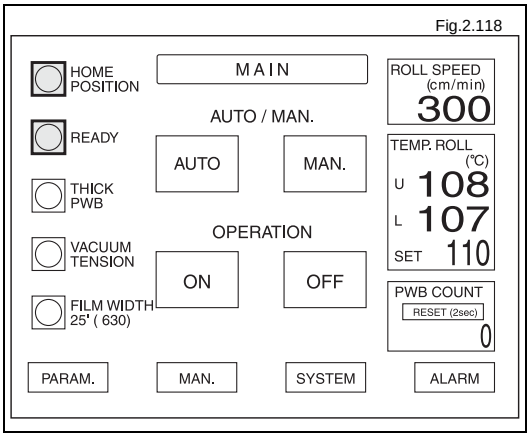


To display the log of past alarms, press the "ALARM LOG" button.

- The alarm log screen will be displayed.

6.

Fig.2.118



Return to the main screen and confirm that the "HOME POSITION" lamp and "READY" lamp are light. Press the OPERATION "ON" button to start automatic operation.

- For more information on starting automatic operation, see 3.3.1 "Procedure for Starting Automatic Operation."

3.3.3 Procedures for Stopping Automatic Operation

To stop automatic operation, follow the steps specified below.

1. Confirm the completion of all PWB lamination
Confirm that no PWB products remain in the unit.

↓

2. OPERATION "OFF" button
Press the OPERATION "OFF" button on the main screen to stop automatic operation.

↓

3. Yellow "MAN." button
Press the yellow "MAN." button to enter the manual-operation mode.

↓

4. Lamination module pullout
Open the front door and pull out the lamination module.

↓

5. Vacuum [ON] button
Press the vacuum [ON] button (the lamp for which is lit) on the operation panel to stop vacuum-pressure.
● The Vacuum [ON] lamp will go off.

↓

6. Rewinding dry film
Manually turn the film rolls of the upper and lower DF units* to rewind the dry film resting on the film-running surface.
* The DF bulk unit may be installed depending on the specifications of the unit used.

↓

7. Removal of the DF unit (See 3.2.1.3 "Loading of DF Unit" on page 2-52 for the reverse steps.)
Remove the upper and lower DF units and store them in an appropriate location.
● This step is not required for the DF bulk unit model.

↓

8. White "MAN." button

Press the white "MAN." button on the main screen to display the manual screen.

↓

9. "ROLL UP/DOWN" buttons and "ROLL FWD." button

Press the ROLL UP/DOWN "RISE" button on the manual screen to raise the upper laminating roll. Press the ROLL FWD. "OFF" button to turn "ON" the laminating roll and rotate it forward. Rotate it for 15 to 20 minutes.

Note

This operation is performed to cool down the laminating roll. To maintain its quality, it is recommended that the laminating roll be rotated in the above manner, though it is not mandatory.

↓

10. Push-in the lamination module

Push in the lamination module and close the front door.

↓

11. Power OFF

Press the Power OFF button on the operation panel to cut off the power supply.

The Power OFF lamp will light up and the display on the touch panel will disappear.

↓

12. Main breaker OFF (○)

Turn "OFF (○)" the main breaker on the control box at the rear of the unit.

↓

13. Primary-side compressed-air supply valve "Close"

Close the plant-side compressed-air supply valve to stop air supply to the unit.

↓

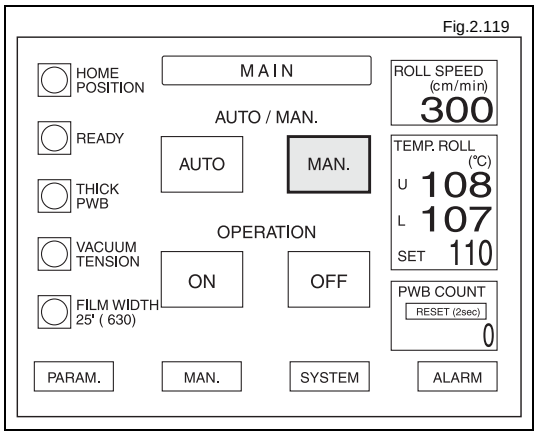
This completes the procedures for stopping automatic operation.

3.4 Manual Operation

If automatic operation has been stopped to load dry film, inspect the unit, or for other reasons, follow the steps specified below to return each part to its home position using manual operation.

3.4.1 Procedures for Manual Operation

If the unit is to be operated manually, it must be set in the "Manual operation" mode.



To set to in the manual-operation mode, press the yellow "MAN." button on the main screen.

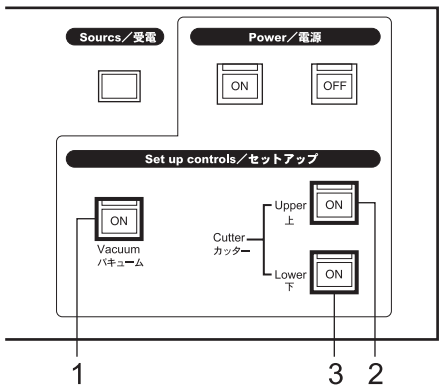
Note

The hardware buttons for setup control or operation on the manual screen are invalid unless the yellow "MAN." button has been pressed to set the unit to the manual mode.

■ Setup Control

Located on the operation panel are setup control buttons that are valid only for vacuum and cutter operations. These buttons are used to load film onto the lamination module and for some other purposes. When these buttons are used, the protective cover must be open.

Fig.2.120

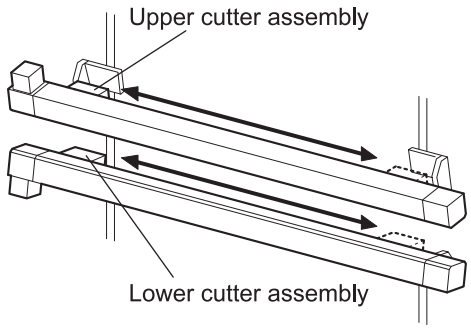


1. Vacuum ON button
Starts the blower fan and vacuum operation of each part of the lamination module.

2. Upper Cutter ON button
Runs the upper cutter assembly to cut the film.

3. Lower Cutter ON button
Runs the lower cutter assembly to cut the film.

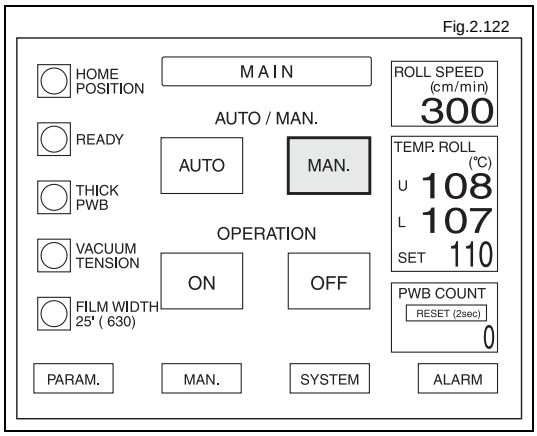
Fig.2.121



⚠ Caution

- Be careful when running the cutter to cut the film with the lamination module pulled out.
- Keep the cutter cover closed (even when the cutter is not in operation).

■ Manual Screen



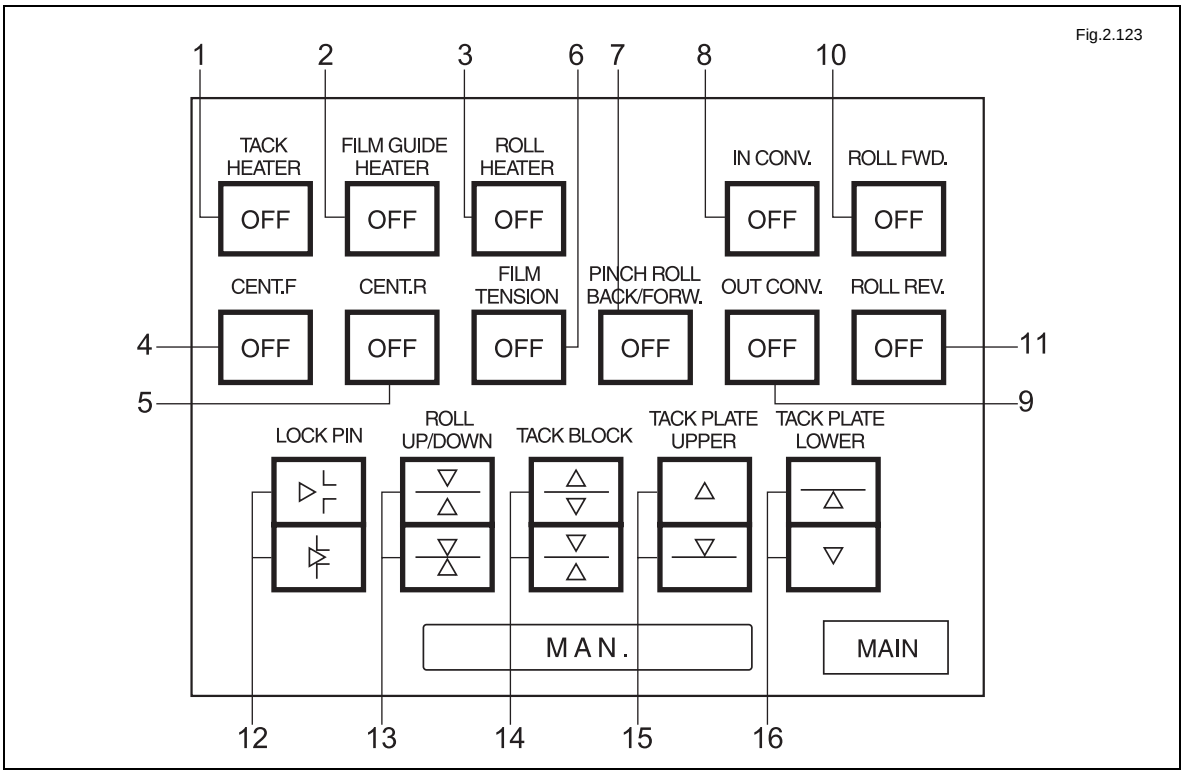
Press the white "MAN." button on the main screen.

● The manual screen will be displayed.

For the operation and function of each button on the manual screen, see 3.4.2 "Control by Manual Operation."

3.4.2 Control by Manual Operation

Fig.2.123



* The explanation about film-guides is indicated when you choose options.

1. TACK HEATER

Turns "ON"/"OFF" the tacking heater built into the tacking rubber at the tip of the upper and lower tacking plates.

2. FILM GUIDE HEATER *Option

Turns "ON"/"OFF" the film-guide heater built into the upper and lower film guides.

3. ROLL HEATER

Turns "ON"/"OFF" the roll heater built into the upper and lower laminating rolls.

⚠ Warning

- Do not touch the heaters or rollers even when they are not in operation or your fingers may be caught and / or burned.
- If you need to touch them, confirm that they have completely stopped and cooled down, or your fingers may be caught and burned.

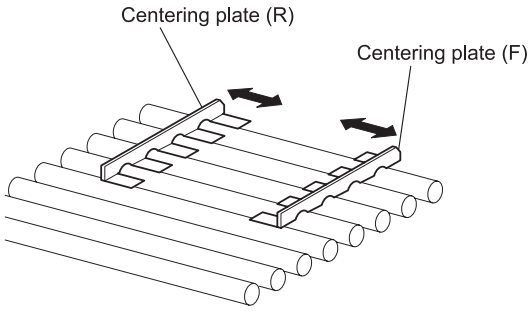
4. CENT.F

Activates the input-conveyor centering plate (F) to perform centering. "OFF" indicates an open position,"ON" indicates a closed position.

5. CENT.R

Activates the input-conveyor centering plate (R) to perform centering. "OFF" indicates an open position ,"ON" indicates a closed position.

Fig.2.124



⚠ Warning

Do not open the cover of the input conveyor when it is in operation, or your fingers may get caught.

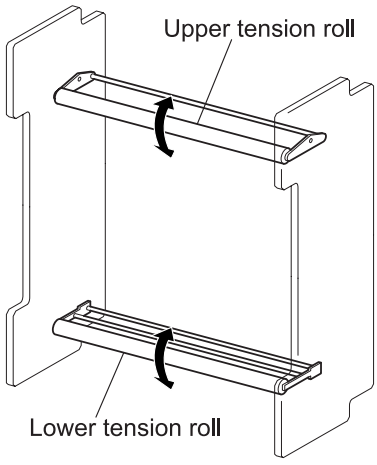
⚠ Caution

Do not set the centering width smaller than the width of PWB, or the input conveyor will be damaged.

6. FILM TENSION

Activates the upper and lower tension rolls.

Fig.2.125



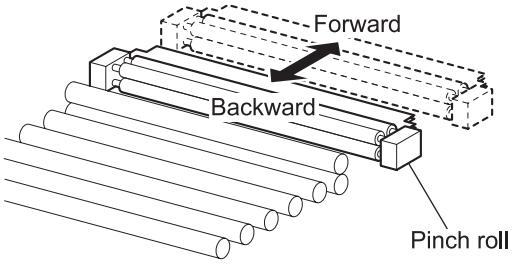
Note

The tension rolls are "ON" only while the film tension "OFF" button is pressed and held.

7. PINCH ROLL BACK/FORW.

Moves the pinch roll forward when turned "ON" and backward when turned "OFF."

Fig.2.126



Note

As the pinch roll is driven by the driving force of the input conveyor, it will not move forward unless the input conveyor is turned "ON." It will move backward, however, even when the input conveyor is not turned "ON," as it is driven in the backward direction by an air cylinder.

8. IN CONV.

Runs the input conveyor.

9. OUT CONV.

Runs the output conveyor.

10. ROLL FWD.

Runs the upper and lower laminating rolls and the roll auxiliary conveyor in the forward direction (from the input side to the output side.)

⚠ Warning

Do not touch the rolls even when they are not in operation, or your fingers may be caught and / or burned.

⚠ Caution

Do not insert foreign articles or the laminating rolls will break or become damaged.

11. ROLL REV.

Runs the upper and lower laminating rolls and the roll auxiliary conveyor in the reverse direction (from the output side to the input side.)

⚠ Warning

Do not touch the rolls even when they are not in operation. Be careful, particularly when cleaning the laminating rolls, as your fingers may be caught and / or burned.

⚠ Caution

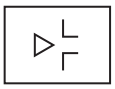
Do not insert foreign articles or the laminating rolls will break or become damaged.

Note

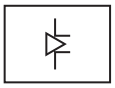
As the backward operation of rolls is abnormal, the roll backward drive button turns "ON" to rotate rolls only while the roll backward "OFF" button is pressed and held.

12. LOCK PIN

Locks or releases the tacking block. The tacking block will not move to the open position if it is locked.

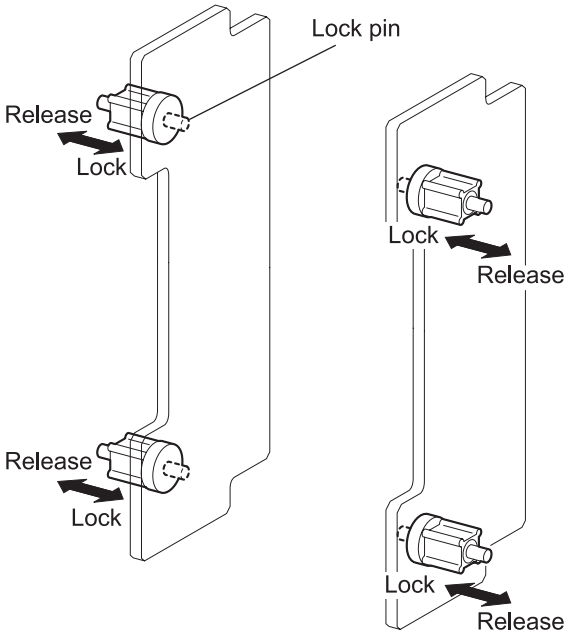


LOCK PIN "RELEASE" button:
Releases the lock pin to activate the tacking block



LOCK PIN "LOCK" button:
Fixes the lock pin to immobilize the tacking block

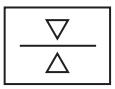
Fig.2.127



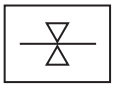
13. ROLL UP/DOWN

Raises and lowers the upper laminating roll in the vertical direction

- During lamination, the upper laminating roll moves and the lower laminating roll remains fixed.

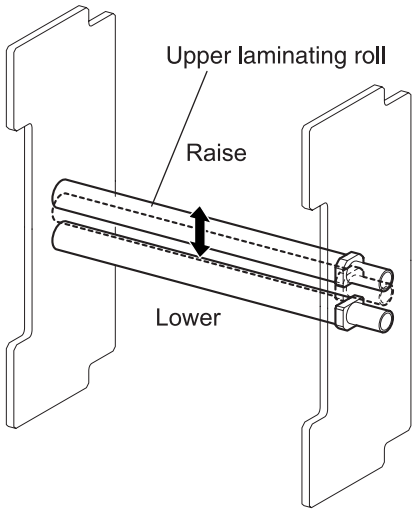


ROLL UP/DOWN "RAISE" button:
Raises the upper laminating roll



ROLL UP/DOWN "LOWER" button:
Lowers the upper laminating roll

Fig.2.128



⚠ Warning

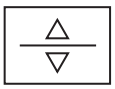
Do not touch the rolls even when they are not in operation, or your fingers may be caught and / or burned.

⚠ Caution

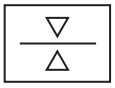
Do not put foreign objects onto the laminating rolls or the laminating rolls may be damaged.

14. TACK BLOCK

Moves the tacking blocks to the closed and opened positions

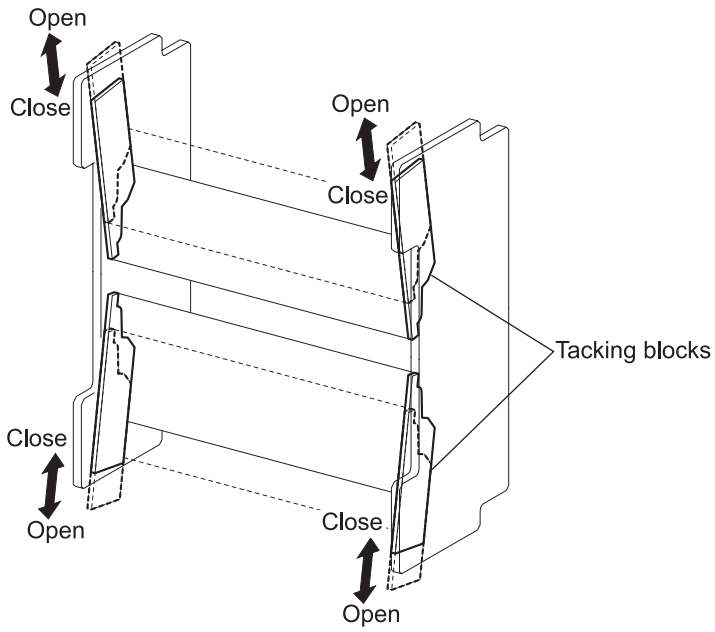


TACK BLOCK "OPEN" button:
Moves the tacking blocks to the opened position



TACK BLOCK "CLOSE" button:
Moves the tacking blocks to the closed position

Fig.2.129



Note

- Before moving the tacking block to the opened position, be sure to press the "RELEASE" button to release the lock pin. The tacking plate will not move if the lock pin is not released.

15. TACK PLATE UPPER

Moves the upper tacking plate to the closed and opened positions

△ TACK PLATE UPPER "OPEN" button:
Moves the upper tacking plate to the opened position

▽ TACK PLATE UPPER "CLOSE" button:
Moves the upper tacking plate to the closed position

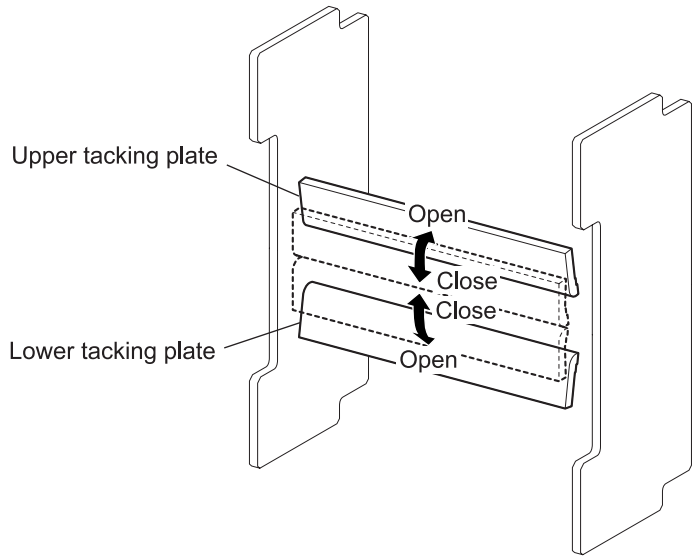
16. TACK PLATE LOWER

Moves the lower tacking plate to the closed and opened positions

△ TACK PLATE LOWER "CLOSE" button:
Moves the lower tacking plate to the closed position

▽ TACK PLATE LOWER "OPEN" button:
Moves the lower tacking plate to the opened position

Fig.2.130



⚠ Warning

Do not touch the tacking plates, even when they are not in operation, or your fingers may be caught and / or burned.

⚠ Caution

Do not put foreign objects onto tacking plate, or the tacking plates may be damaged.

Part 3

Maintenance

Chapter 1 Regular Maintenance

This Chapter explains the daily, monthly, and semi-annual maintenance for the unit. To ensure its safe and proper use, be sure to perform regular maintenance work as instructed.

Contents of this Chapter

1.1 Purpose of Regular Maintenance

The unit has adjustable parts that need to be adjusted periodically during continuous operation, and consumable parts that are subject to wear and tear. Do not use the unit without adjusting the adjustable parts or replacing worn consumable parts. Otherwise, the unit may fail and the product quality may be degraded.

Clean and inspect the unit in accordance with the daily, monthly, quarterly, and semi-annual inspection methods explained below, and immediately replace parts that have become worn or do not meet machine specifications. Only use genuine Hakuto parts, as others may damage the machine, cause it to fail, or degrade its performance.

1.2 Regular Maintenance Schedule

1.2.1 Daily Inspection

【Table 3.1.1 Daily-Inspection】

Inspection item	Inspection method	Section for reference
Inspection before switching ON ・ Cutter	Cleaning	See 1.3.3 "Cleaning/Replacement of the Cutter," Part 3 "Maintenance."
Inspection after switching ON ・ Alarm buzzer and alarm display	Check of function	

1.2.2 Weekly Inspection

【Table 3.1.2 Weekly-Inspection (Continued)】

Inspection item	Inspection method	Section for reference
Cutter backup	Cleaning	See 3.1.3 "Cleaning of the Film-Running Surface," Part 2 "Operation."
Tacking rubber	Cleaning, check of surface conditions, replacement	See 1.3.2 "Cleaning the Tacking Rubber," Part 3 "Maintenance."
Tacking plate	Cleaning, check of surface conditions	See 3.1.3 "Cleaning of the Film-Running Surface," Part 2 "Operation."
Film guide	Cleaning	See 3.1.3 "Cleaning of the Film-Running Surface," Part 2 "Operation."

1.2.3 Monthly Inspection

【Table 3.1.3 Monthly-Inspection】

Inspection item	Inspection method	Section for reference
Cutter blade	Check of wear, replacement	See 1.3.3, Part 3 "Maintenance."
Interior of the unit	Cleaning	See 1.3.1, Part 3 "Maintenance."

1.2.4 Quarterly Inspection

【Table 3.1.4 Quarterly-Inspection】

Inspection item	Inspection method	Section for reference (all in Part 3)
Laminating roll	Check surface and pressure conditions, replacement	2.2.4
Roll heater	Measurement of temperature distribution, replacement	2.2.3 2.2.4
Slip ring, slip-ring brush	Check for wear, replacement	2.2.1 2.2.2
Tacking heater	Measurement of temperature distribution, replacement	2.2.5 2.2.6
Tacking plate	Check the deviation of upper and lower tacking plates, check the deviation of film running line, check operation	
Film-guide heater *Option	Check temperature, replacement	2.2.7
Cutter	Check cutter position, check operation	
Cutter backup	Disassemble/assemble,cleaning, replacement	1.3.5
Sensors	Operation, check position, cleaning	1.3.6 1.4.1

1.2.5 Semi-annual Inspection (twice a year)

【Table 3.1.5 Semi-annual Inspection】

Inspection item	Inspection method	Section for reference (all in Part 3)
Drive belt *Option	Check, adjustment, replacement	1.4.2
Drive chain	Check, adjustment, replacement	1.4.3
Roll bearing	Check, replacement	1.3.7
Turbo blower	Check of operation	
High-pressure blower	Check of operation	
Exhaust duct	Check, replacement	
Leak line filter	Cleaning, replacement	1.3.4
Vacuum piping	Check, replacement	

【Table 3.1.5 Semi-annual Inspection (Continued)】

Inspection item	Inspection method	Section for reference (all in Part 3)
Air cylinder	Check operation, check for wear, replacement	
Air piping	Check, replacement	
Solenoid valve	Check operation, check for wear, replacement	
Position of major units	Check, adjustment	
Loosening of screw	Check	
Contactor, relay	Check for wear, replacement	
Wire	Check for wear, replacement	
Alarm label	Check	

1.2.6 List of Lubrication Points

【Table 3.1.6 Table of Lubrication Points】

No.	Lubrication point	Lubrication method	Periodicity	Lubricant
1	Drive chain	Brush on the lubricant grease.	Semi-annually	Grease A
2	Input-conveyor sliding module	Brush on the lubricant grease.	Semi-annually	Grease A
3	Centering-adjustment turnbuckle	Brush on the lubricant grease.	Semi-annually	Grease A
4	Rotary-encoder module gear	Brush on the lubricant grease.	Semi-annually	Grease A
5	Lamination module gear	Brush on the lubricant grease.	Semi-annually	Grease A
6	Tacking-block rack	Brush on the lubricant grease.	Semi-annually	Grease A
7	Tacking-plate-module cam groove	Brush on the lubricant grease.	Semi-annually	Grease A
8	Air-cylinder fixing pin	Inject the lubricant using an oiler.	Quarterly	Machine oil
9	Air-cylinder knuckle pin	Inject the lubricant using an oiler.	Quarterly	Machine oil

【Table 3.1.6 Table of Lubrication Points (Continued)】

No.	Lubrication point	Lubrication method	Periodicity	Lubricant
10	Cutter-shuttle-module spline shaft	Wipe using a lint-free cloth moistened with the lubricant.	Weekly	Machine oil
11	Tacking block rail	Brush on the lubricant grease.	Semi-annually	Grease B

Note

- After applying the lubricant, be sure to use a lint-free cloth to wipe away any excess oil from the film running line, PWB pass line, and other parts.
- Use the following grease and machine oil specified by Hakuto.
  Grease A: Grease WR-500 055017
  Grease B: JG80/CG2
  Machine oil: Terrace Oil Shell 32 manufactured by Showa Shell

1.2.7 List of Cleaning Points

【Table 3.1.7 Cleaning Point】

No.	Cleaning point	Cleaning method	Periodicity	Lubricant
1	Conveyor roll	Wipe it with dust-free cloth moistened with detergent.	Daily	Methyl alcohol
2	Laminating roll	Wipe it with dust-free cloth moistened with detergent.	Daily	Methyl alcohol
3	Cutter	Wipe it with dust-free cloth moistened with detergent.	Daily	Methyl alcohol
4	Film-running section	Wipe it with dust-free cloth moistened with detergent.	Daily	Methyl alcohol
5	Tacking rubber	Wipe it with dust-free cloth moistened with detergent.	Weekly	Methyl alcohol
6	Sensors	Wipe it with dust-free cloth moistened with detergent. Clean it using a clean-room cleaner.	Monthly	Neutral detergent Clean-room cleaner

【Table 3.1.7 Cleaning Point (Continued)】

No.	Cleaning point	Cleaning method	Periodicity	Lubricant
7	Sensors	Wipe it with dust-free cloth moistened with detergent.	Quarterly	Neutral detergent
8	Leak line filter	Remove any dust using an air gun.	Semi-annually	Air

1.2.8 List of Heat Conduction Greasing Points

【Table 3.1.8 Heat Conduction Greasing Point】

No.	Greasing point	Greasing method	Periodicity	Conduction material
1	Laminating Roll Heater	Wear gloves and affix it by hand.	At coupling and decoupling	Silicon putty
2	Tacking heater	Wear gloves and affix it by hand.	At coupling and decoupling	Silicon putty

Note

- Uniformly apply a sufficient volume of heat-conductive material so as not to adversely affect the temperature distribution.
- Insert the heater into the laminating roll and tacking rubber. Remove any excess heat-conductive material using dust-free cloth.
- Silicon putty :GE Toshiba silicon putty YG6111 055002

1.3 Regular Maintenance Procedure

This section explains the procedures for cleaning and inspecting the parts that require regular maintenance work. Also explained below are procedures on how to replace various parts. Please note that many parts involve complicated procedures and adjustment, and such parts should only be adjusted or replaced by a qualified Hakuto service representative. For those that require special work, see 2.2 "Procedures for Replacing Consumable Parts," Part 3.

1.3.1 Cleaning the Interior of the Unit

Necessary tools	・Lint-free cloth ・Neutral detergent ・Clean-room cleaner ・Phillips screwdriver ・3-mm Allen wrench

⚠ Warning

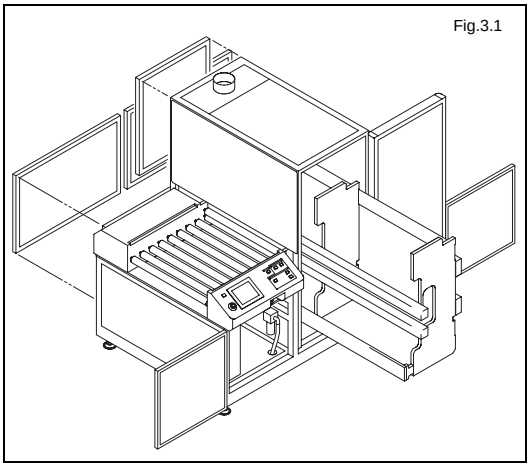
Before cleaning the interior of the unit, be sure to turn the main breaker OFF (○). As some parts may be at extremely high temperatures, wait more than 20 minutes after turning the main breaker OFF (○), and confirm that the interior of the unit has cooled down before starting cleaning.

1. Turn the main breaker OFF (○).

⚠ Warning

Affix a tag indicating "Do not turn ON" to the main breaker, to ensure that it is not inadvertently turned on by other workers.

2. Open the front door and pull out the lamination module.

3. 
Fig.3.1

Open the doors and fixed covers of the unit, and wipe away the dirt and dust from the inner and outer surfaces using a clean-room cleaner and a lint-free cloth~ moistened with a neutral detergent.

⚠ Caution

Do not use alcohol to clean painted surfaces or plastic parts. Otherwise, the paint will peel off or the material will be damaged. Be sure to use a neutral detergent to clean the inner and outer surfaces.

Note

- Carefully clean the parts around the conveyor rolls where contaminants tend to build up.
- Carefully clean the vacuum suction holes of the tacking plate, cutter backup, and film guide using a clean-room cleaner.

4. Upon completion of cleaning, close the doors and the covers of the unit.

1.3.2 Cleaning the Tacking Rubber

Necessary tools	・Lint-free cloth ・Methyl alcohol

⚠ Warning

- Clean the tacking rubber with power and compressed air supplied. Affix a tag indicating "Under Inspection" in a conspicuous location, to ensure that other workers do not operate the equipment.
- The tacking rubber is hot. After turning the tacking heater OFF, wait more than 20 minutes to confirm that the tacking rubber has cooled before starting cleaning.

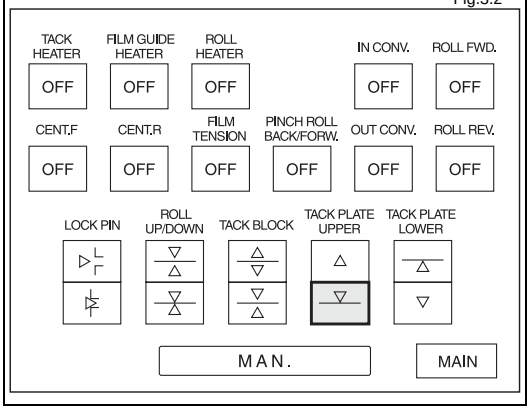
Note

Below, the procedure for cleaning the tacking rubber of the upper tacking plate is explained. This procedure also applies to the cleaning of the tacking rubber of the lower tacking plate.

1. Open the front door and pull out the lamination module.

2.

Fig.3.2



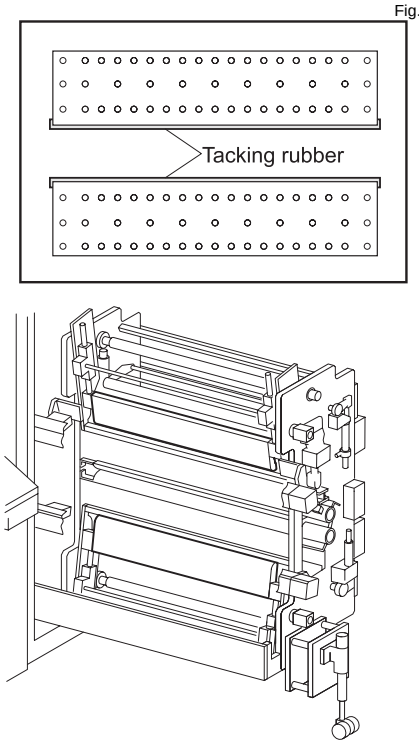
On the manual screen of the operation panel, press the TACK PLATE UPPER "CLOSE" button to move the upper tacking plate to the closed position.

- The manual screen does not accept input unless the yellow "MAN." button on the main screen has been pressed to place the unit in the manual-operation mode.
- This operation is performed to ease cleaning of the tacking rubber.

* The explanation about film-guides is indicated when you choose options.

3.

Fig.3.3



Wipe the tacking rubber in the lateral direction using a lint-free cloth moistened with methyl alcohol.

- If the tacking rubber is faulty or deteriorated, see 2.2.6 "Replacement of the Tacking-Rubber and Tacking Heater" in Part 3 "Maintenance." for the replacement procedure for the tacking rubber.

⚠ Caution

The tacking rubber is hot while in operation. After turning the tacking heater OFF, wait more than 20 minutes to confirm that the tacking rubber has cooled before starting cleaning.

4. On the manual screen of the operation panel, press the TACK PLATE UPPER "OPEN" button to move the upper tacking plate to the open position.
- This operation is performed to return the upper tacking plate to the home position.
- The manual screen does not accept input unless the yellow "MAN." button on the main screen has been pressed to place the unit in the manual-operation mode.

5. Open the cover of the Power OFF button, and press the button. Then, turn the main breaker of the control box at the rear of the unit "OFF" (○) to complete the cleaning of the tacking rubber.

1.3.3 Cleaning/Replacement of the Cutter

Necessary tools	・Lint-free cloth ・Methyl alcohol ・2.5-mm Allen wrench × 2

⚠ Warning

Exercise caution when handling the cutter. Do not hold it by the outer edge, as it is razor sharp.

Note

Below, the procedure for cleaning/replacing the upper cutter assembly is explained. It also applies to the cleaning/replacement of the lower cutter assembly.

1. Open the front door and pull out the lamination module.

2.

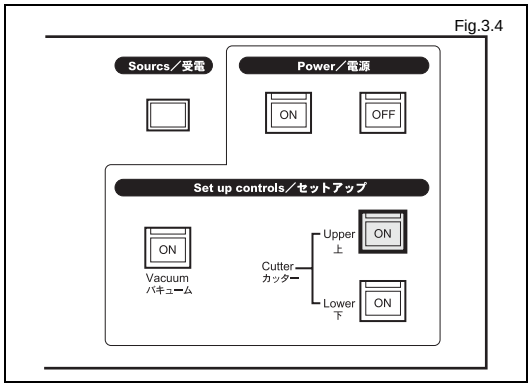


Fig.3.4

Press the Upper-Cutter ON button on the operation panel to move the upper cutter assembly to the front side of the unit (if necessary).
- The button cannot be operated unless the yellow "MAN." button on the main screen has been pressed to place the unit in the manual-operation mode.
- This operation is performed to ease disassembly and cleaning of the cutter.

Note

Exercise caution when operating the cutter with the lamination module pulled out.

3. On the manual screen of the operation panel, press the LOCK PIN "RELEASE" button and the TACK BLOCK "OPEN" button to move the tacking block to the open position.

- The tacking block will not move to the open position unless the LOCK PIN "RELEASE" button has been pressed to release the lock pin.
- This operation is performed to ease the disassembly and cleaning of the cutter.
- The above steps must be followed with the power switch in the "ON" position.

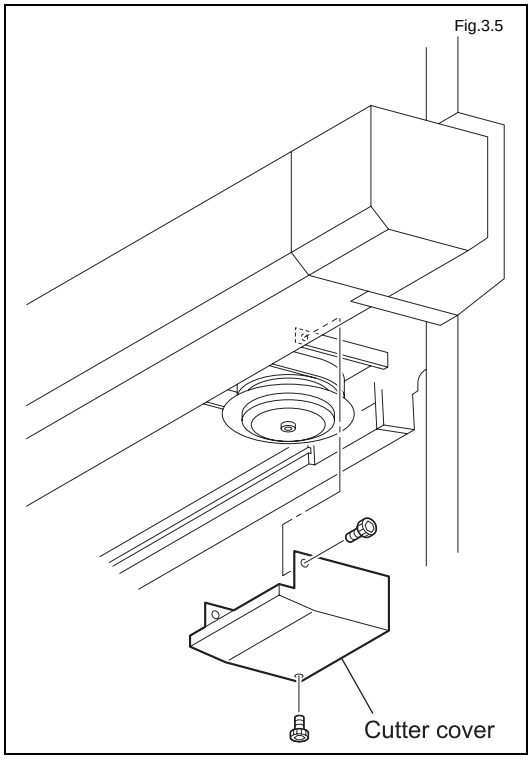
4. Open the cover of the Power OFF button, and press the button. Then, turn the main breaker of the control box at the rear of the unit "OFF"(○).

Warning

Affix a tag indicating "Do not turn ON" to the main breaker, to ensure that it is not inadvertently turned on by other workers.

5.

Fig.3.5

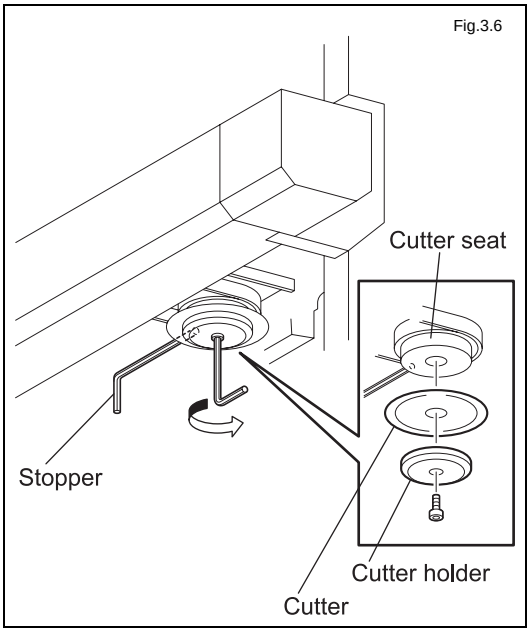


Remove the cutter cover.

- Manually move the cutter assembly to a position at which the tool can be used easily.

Tool to be used	2.5 mm hexagonal wrench
Screws to be removed	M3 SEMS CB × 2

6.



Remove the cutter and cutter holder.

- Insert an Allen wrench into the hole on the side of the cutter seat to fix the cutter and cutter holder so that they do not rotate. Turn the cap bolt at the center of the cutter holder to remove the cutter.

Tools to be used	2.5-mm Allen wrench × 2
Part to be removed	M3 cap bolt × 1

Note

The cutter cannot be removed if its circular part is in the groove of the cutter backup. To remove the cutter, confirm that it is not at a position at which it interferes with the cutter backup.

⚠ Caution

It is extremely dangerous for the cutter to drop from the cutter holder. Carefully remove the cutter holder with the cutter attached to it.

7. Wipe the cutter using a lint-free cloth moistened with methyl alcohol.

- If the cutter is worn, rusted, or nicked, replace it.

⚠ Warning

Exercise caution in handling the cutter. When wiping it, do not hold it by the outer edge, as it is razor sharp.

8. To assemble the cutter assembly, follow the steps for disassembly in reverse.

⚠ Caution

- Tightly fix the cap bolt to install the cutter holder, in order to prevent loosening.
- Do not strike the cutter with the cutter cover or other articles, as it may damage the blade.

9.

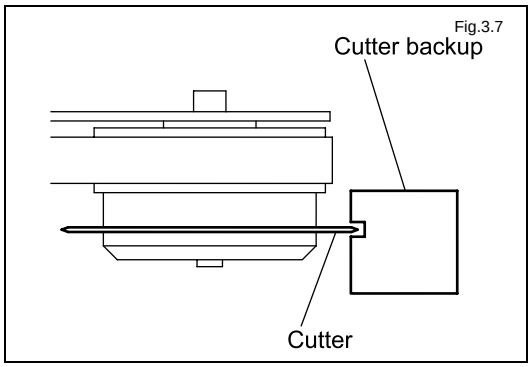


Fig.3.7

Manually move the cutter assembly back and forth slowly in the cutter backup to confirm that there is no interference between the two.

- If the cutter interferes with the cutter backup due to inclination or other reasons, disassemble and then re-assemble the cutter assembly.

⚠ Caution

Turn the power switch OFF and carefully move the cutter assembly by hand at low speed. If the cutter is not properly installed, it will come in contact with the cutter backup and break, so use extreme care when checking the cutter.

10. Move the cutter assembly to the detection position of the home position sensor by hand (see the next page).

11. Turn the main breaker of the control box at the rear of the unit "ON" (|). Then, open the cover of the Power ON button, and press the button to supply power to the unit.

12. Open the cover of the UPPER CUTTER ON button on the operation panel, and press the button to return cutter assembly to the home position.

Note

- If the upper and lower cutter assemblies do not detect the home position sensor with the power ON (or if they are not at their home position), the "Home Position" lamp on the main screen does not light on. In this case, turn the power off first, and then return them to the detection position of the home position sensor by hand.

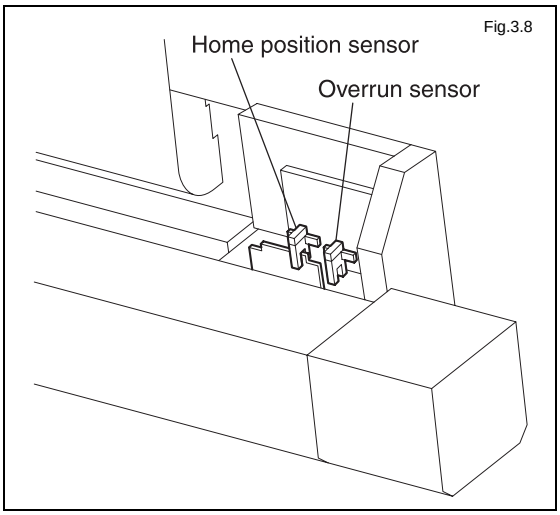


Fig.3.8

- If the upper and lower cutter assemblies detect the overrun sensor with the power ON, the alarm is indicated. In this case, turn the power off first, and then return them to the detection position of the home position sensor by hand.

13. On the manual screen of the operation panel, press the TACK BLOCK "CLOSE" button to move the tacking block to the closed position. Press the LOCK PIN "LOCK" button to lock the lock pin.

14. Open the cover of the Power OFF button and press the button. Then, turn the main breaker of the control box at the rear of the unit "OFF" (○) to complete cleaning of the cutter.

1.3.4 Cleaning/Replacement of the Leak Line Filter

Necessary tool	Air gun

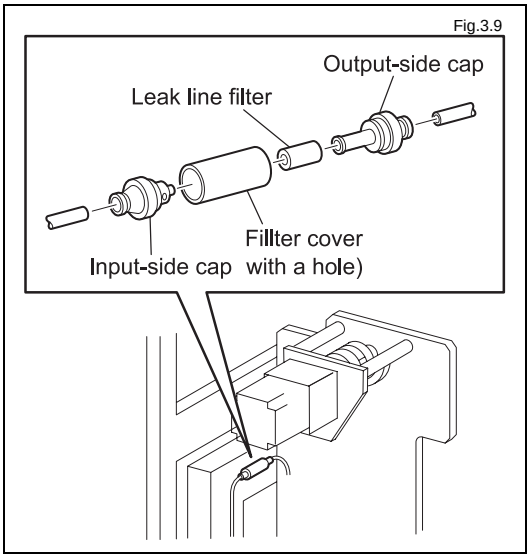
1. Turn the main breaker OFF (○) to cut off the power supply.

⚠ Warning

Affix a tag indicating "Do not turn ON" to the main breaker, to ensure that it is not inadvertently turned on by other workers.

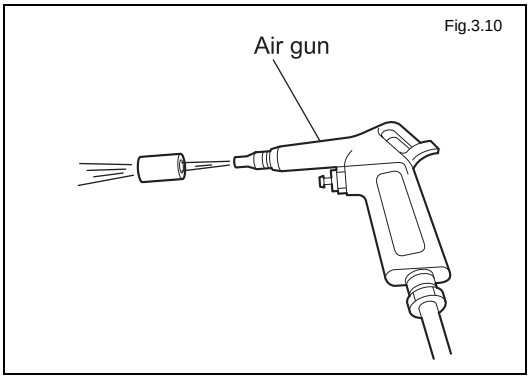
2. Open the rear cover of the lamination module.

3. Fig.3.9



Remove the tube fittings on the output and input sides of the leak-filter assembly, and disassemble the assembly.

4. Fig.3.10



Use an air gun to blow air inside the leak line filter in order to remove dust from the filter.

- If the dust cannot be removed by blowing air, replace the filter with a new one.

5. To install the leak line filter upon completion of cleaning or replacement, follow the steps for removal in reverse.

Note

When installing the filter, do not reverse the input and output sides.

1.3.5 Disassembly/Cleaning of the Cutter Backup

Necessary tools	・7-mm wrench ・Pointed article (Scriber) ・Methyl alcohol ・Dustless cloth ・150-mm scale ・Clean-room cleaner

Note

Below, the procedure for disassembling and cleaning the upper-cutter backup is explained. It also applies to the disassembly and cleaning of the lower-cutter backup. Note that the lower-cutter backup is symmetrical with the upper-cutter backup in the vertical direction.

1. Open the front door and pull out the lamination module.

2.

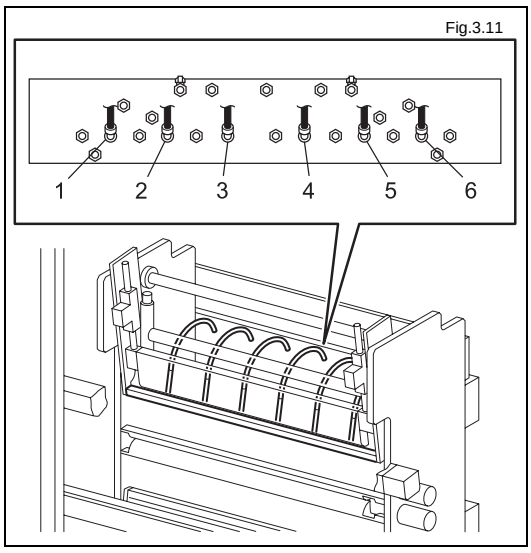


Fig.3.11

From the tube fitting at the innermost end of the lamination module, remove the six vacuum tubes extending from the cutter backup.

Note

Be sure to fix each of the six vacuum tubes to its original position when reconnecting cutter backup.

3. On the manual screen of the operation panel, press the LOCK PIN "RELEASE" button and the TACK BLOCK "OPEN" button to move the tacking block to the open position.

- The manual screen does not accept input unless the yellow "MAN." button on the main screen has been pressed to place the unit in the manual-operation mode.
- The tacking block does not move to the open position unless the LOCK PIN "RELEASE" button has been pressed to release the lock pin.
- The above steps must be performed with the power switch "ON."

4. Open the cover of the Power OFF button, and press the button.
Turn the main breaker on the control box at the rear of the unit OFF(○).

⚠ Warning

Affix a tag indicating "Do not turn ON" to the main breaker, to ensure that it is not inadvertently turned on by other workers.

5.

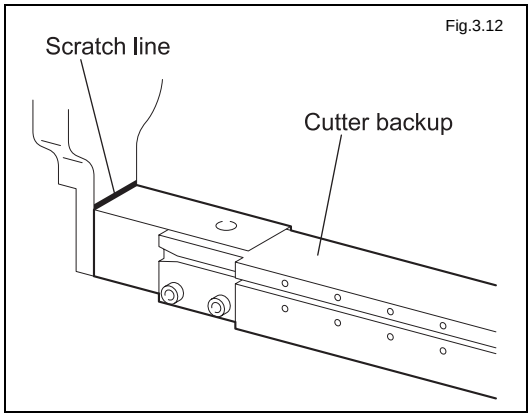


Fig.3.12

Before removing the cutter backup, scratch a line on the chassis to indicate the re-assembly position.

6.

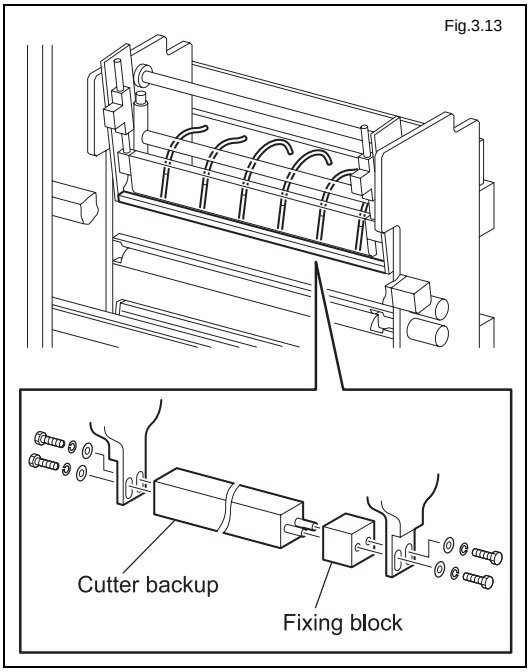


Fig.3.13

Remove the cutter backup by the method described below.

- Remove the cutter-backup fixing screws. The cutter backup will be separated from the fixing block.

Necessary tool	7-mm wrench
Parts to be removed	M4 hexagon bolt, washer, spring washers × 4

7. Remove the dust from the vacuum holes of the cutter backup using a pointed article and a clean-room cleaner. Wipe the surface and groove using a lint-free cloth moistened with methyl alcohol.

Tools to be used	・Pointed article(such as a wire or pin) ・Methyl alcohol ・Lint-free cloth ・Clean-room cleaner

8. Replace the cutter backup, aligning it to the scratched line on the chassis.

- Fix the cutter backup to the chassis with the fixing block aligned with the two projections.

9.

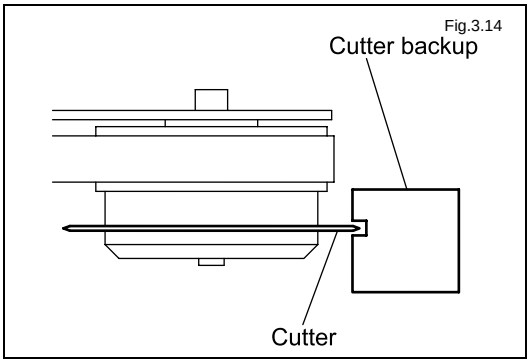


Fig.3.14

Carefully move the cutter assembly by hand back and forth in the cutter backup at low speed, to confirm that there is no interference between the two.

- If the cutter backup is not installed at an appropriate position, it will interfere with the cutter. Fix the cutter backup at the proper position.

⚠ Caution

Be sure the power switch is OFF and carefully move the cutter assembly by hand at low speed. If the cutter backup is not installed at the proper position, it will come in contact with the cutter and break it.

10.

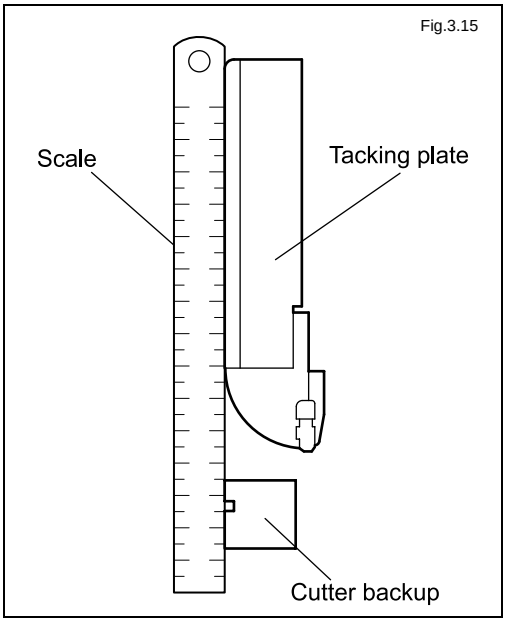


Fig.3.15

Use a scale to confirm that the tacking plate and cutter backup are flush with each other.

- If the cutter backup is not installed at an appropriate position, it will not be flush with the tacking plate. Fix the cutter backup at the proper position so that it is flush with the tacking plate.

Tool to be used	150-mm scale

⚠ Caution

In the above step, do not scratch the film running surface of the tacking plate or cutter backup with the scale.

11. Turn the main breaker ON (|). Open the cover of the Power ON button on the operation panel, and press the button to supply power to the unit.

12. From the manual screen of the operation panel, move the tacking block to the home position.

- The manual screen does not accept input unless the yellow "MAN." button on the main screen has been pressed to place the unit in the manual-operation mode.
- The ROLL FWD button must be turned "ON" in order to more the tacking blocks to the closed position.

13. Connect the six vacuum tubes extended from the cutter backup to the tube fitting at the innermost end of the lamination module.

Note

Properly fix each of the six vacuum tubes to its original position.

14. Open the cover of the Power OFF button, and press the button. Then, turn the main breaker of the control box at the rear of the unit "OFF" (○) to complete disassembly and cleaning of the cutter backup.

1.3.6 Check/Adjustment of the Edge Sensor

The edge sensor is positioned at the end of the input conveyor (downstream side) to detect the front and rear edges of PWBs.
At least every three months, adjust the sensitivity of the fiber amplifier that controls the edge sensor.

Necessary tool	Test PWB

⚠ Warning

- Adjust the edge sensor with power and compressed air supplied. Affix a tag indicating "Under Inspection" in a conspicuous location, to ensure that other workers do not operate the equipment.
- Operate the conveyor with the conveyor cover open. Exercise caution to prevent fingers from being caught or wound in the conveyor.

⚠ Caution

Do not loosen the screw fixing the edge sensor, or the optical axes of the light-emitting and receiving parts will be misaligned.

1.

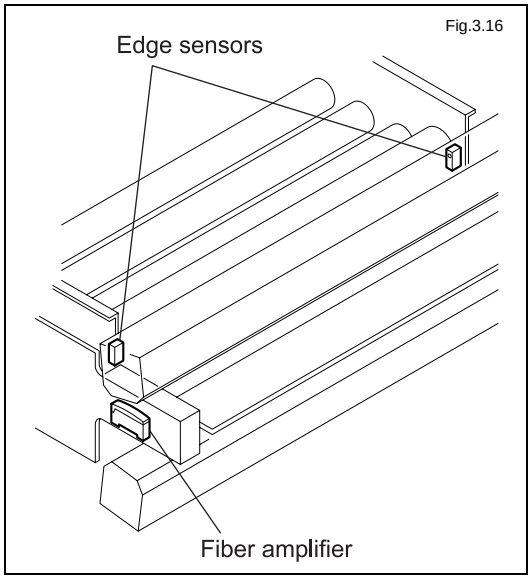


Fig.3.16

Open the front door of the lamination module and the input conveyor covers.

- The fiber amplifier is located between the upper and lower cutter shuttle units at the end of the input conveyor.
- The edge sensor is located at the end of the input conveyor (downstream side), and has two parts: a light source and a receiver.

2.

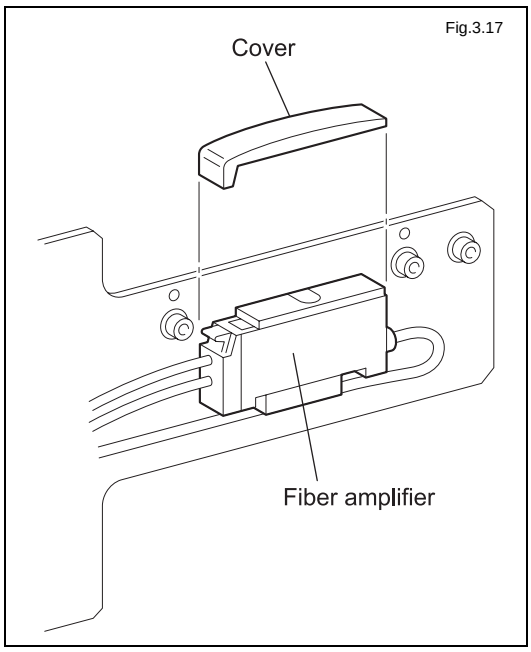


Fig.3.17

Remove the cover of the fiber amplifier.

3. Use the test PWB to adjust the centering width.

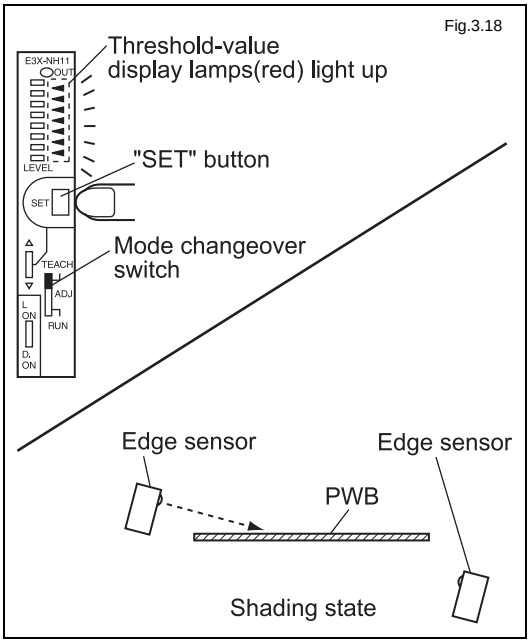
- For details, see 3.2.3 "Adjustment of the Centering Width," Part 2.

4. On the manual screen of the operation panel, turn the IN CONV, OUT CONV, and ROLL FWD switches "ON."

- The manual screen does not accept input unless the yellow "MAN." button on the main screen has been pressed to place the unit in the manual-operation mode.

5.

Fig.3.18

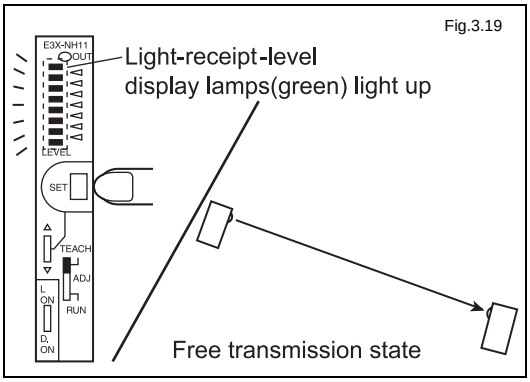


Place the mode changeover switch of the fiber amplifier in the "TEACH" position. Move the test PWB to the desired position in which it will block the light emitted by the edge sensor (shading state), and keep the "SET" button pressed for 0.5 to 2.5 seconds.

- All threshold-value display lamps (red) light up.
- The buzzer sounds.

6.

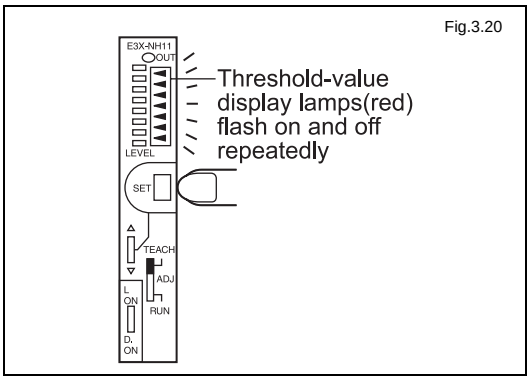
Fig.3.19



Change the position of the test PWB so that it does not block the light emitted by the edge sensor (free transmission state), and press the "SET" button again for 0.5 to 2.5 seconds.

- When TEACHING is ON:
  All light-receipt-level display lamps (green) light up.
- The buzzer sounds.

Fig.3.20



- When TEACHING does not work:
  All threshold-value display lamps (red) flash.
  → Change the PWB position and the setting distance, and perform the above procedure again starting from step 5.
- The buzzer sounds.

7.

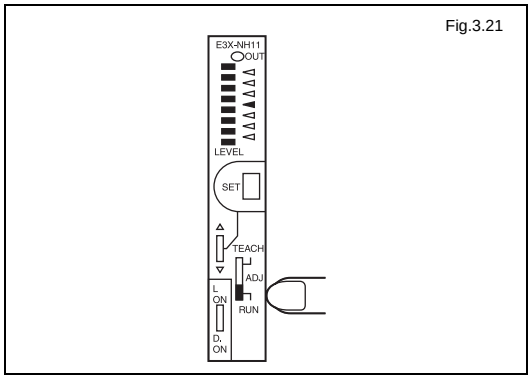


Fig.3.21

Place the mode changeover switch in the "RUN" position.

- The middle light of the threshold-value display lamps will light up.

8. Fix the cover of the fiber amplifier.

1.3.7 Replacement of the Roll Bearing (Chain driving type)

Roll bearings are contained in the housing that supports the ends of the upper and lower laminating rolls.
Inspect the roll bearing at least every six months. Replace those that emit noise or have deteriorated.

Necessary tools	・4-mm Allen wrench ・5-mm Allen wrench ・10-mm wrench ・13-mm wrench ・Snap-ring pliers

⚠ Warning

Before replacing a roll bearing, be sure to turn the main breaker OFF (○) to cut off the power supply. The parts near the laminating rolls are hot. After turning the main breaker OFF, wait at least 20 minutes to allow them to cool before starting to replace the roll bearing.

1. Turn the main breaker OFF (○) to cut off the power supply.

⚠ Warning

Affix a tag indicating "Do not turn ON" to the main breaker, to ensure that it is not inadvertently turned on by other workers.

2. For the procedure for removing the front housing, see 2.2.4 "Replacement of the Laminating Roll and the Roll Heater," Part 3.

Note

Before removing the housing, the laminating rolls must be removed. To ease the process, remove the upper laminating roll first, followed by the lower laminating roll. When the rolls are installed, the lower laminating roll should be installed first.

3.

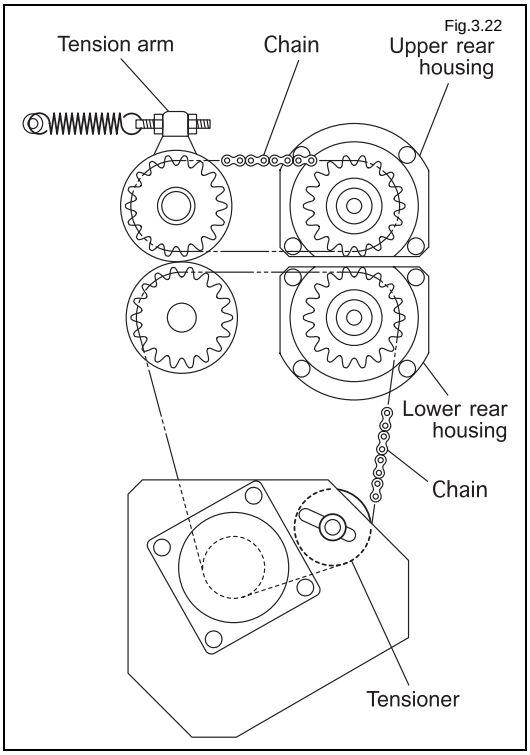


Fig.3.22

Before removing the rear housing, loosen and remove the roll-drive sprocket chain.

- The tension of the upper rear roll drive sprockets is adjusted by the spring automatically. To decrease the chain tension, move the tension arm in the direction of the arrow by hands.
- Use the tensioner to adjust the tension of the lower rear roll drive sprockets. To change the chain tension, loosen the tensioner screw.

Tool to be used	13-mm wrench

4.

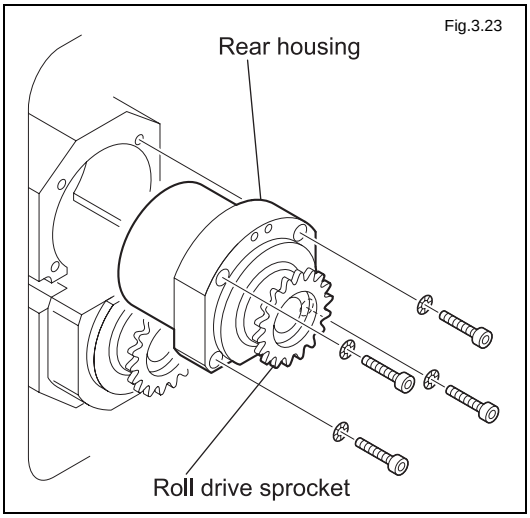
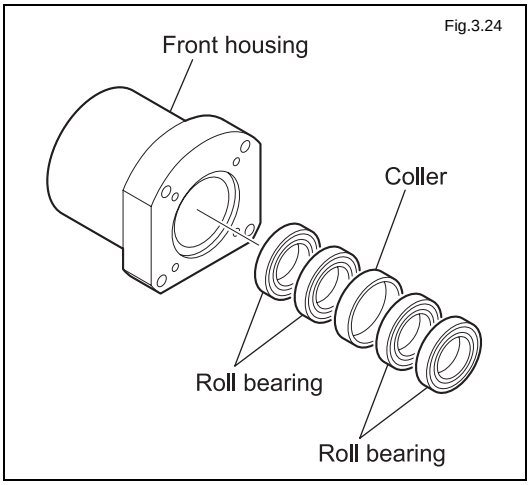


Fig.3.23

Remove the rear housing together with the roll drive sprocket.

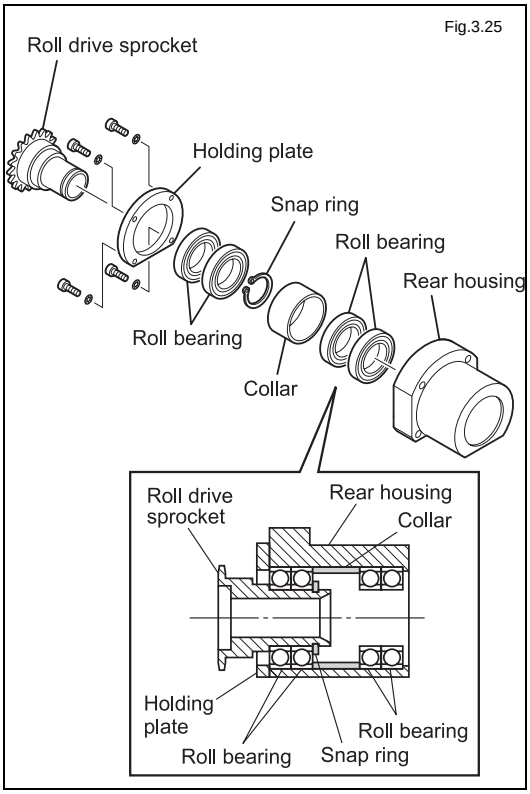
Tool to be used	5-mm Allen wrench
Parts to be removed	M6 cap bolt, conical washer × 4

5.



Remove the roll bearing of the front housing.

6.



Remove the roll bearing of the rear housing.

- Remove the holding plate. The roll drive sprocket, collar, and roll bearing can now be pulled out.
- Remove the snap ring. The roll bearing of the roll drive sprocket can now be pulled out.

Tools to be used	4-mm Allen wrench Snap-ring pliers
Parts to be removed	Snap ring, M5 cap bolt, conical washer × 4

7. After replacing the roll bearings of the front and rear housings, fix each unit by following the removal procedure in reverse.

1.3.8 Replacement of the Roll Bearing (Belt driving type) *Option

Roll bearings are contained in the housing that supports the ends of the upper and lower laminating rolls.
Inspect the roll bearing at least every six months. Replace those that emit noise or have deteriorated.

Necessary tools	・4-mm Allen wrench ・5-mm Allen wrench ・10-mm wrench ・13-mm wrench ・Snap-ring pliers

⚠ Warning

Before replacing a roll bearing, be sure to turn the main breaker OFF (○) to cut off the power supply. The parts near the laminating rolls are hot. After turning the main breaker OFF, wait at least 20 minutes to allow them to cool before starting to replace the roll bearing.

1. Turn the main breaker OFF (○) to cut off the power supply.

⚠ Warning

Affix a tag indicating "Do not turn ON" to the main breaker, to ensure that it is not inadvertently turned on by other workers.

2. For the procedure for removing the front housing, see 2.2.4 "Replacement of the Laminating Roll and the Roll Heater," Part 3.

Note

Before removing the housing, the laminating rolls must be removed. To ease the process, remove the upper laminating roll first, followed by the lower laminating roll. When the rolls are installed, the lower laminating roll should be installed first.

3.

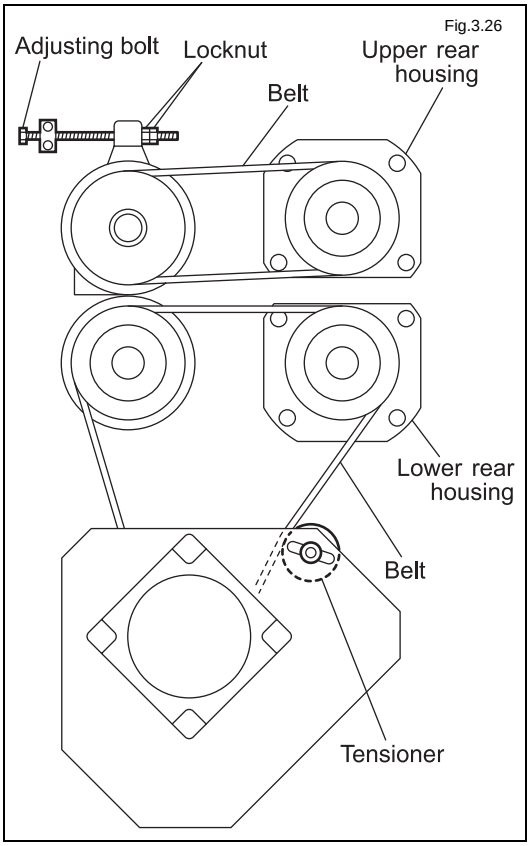


Fig.3.26

Before removing the rear housing, loosen and remove the roll-drive pulley belt.

- Use the adjusting bolt to adjust the tension of the upper rear roll drive pulleys. To decrease the belt tension, loosen the locknut and adjusting bolt.

Tool to be used	10-mm wrench

- Use the tensioner to adjust the tension of the lower rear roll drive pulleys. To change the belt tension, loosen the tensioner screw.

Tool to be used	13-mm wrench

4.

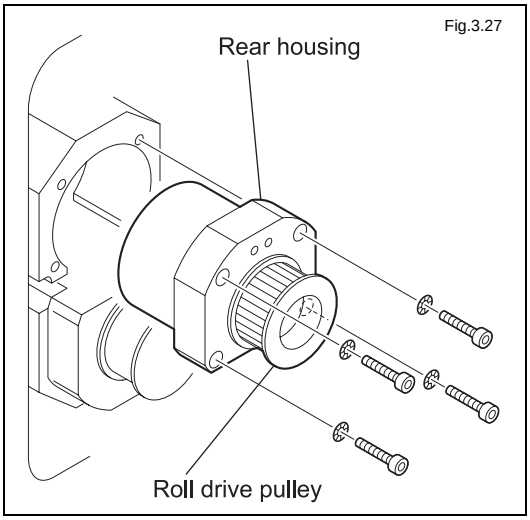
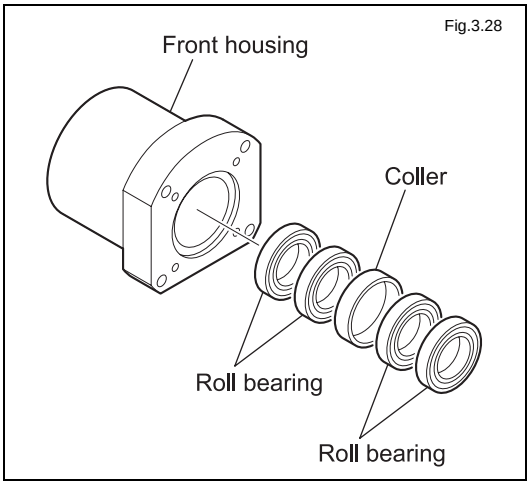


Fig.3.27

Remove the rear housing together with the roll drive pulley.

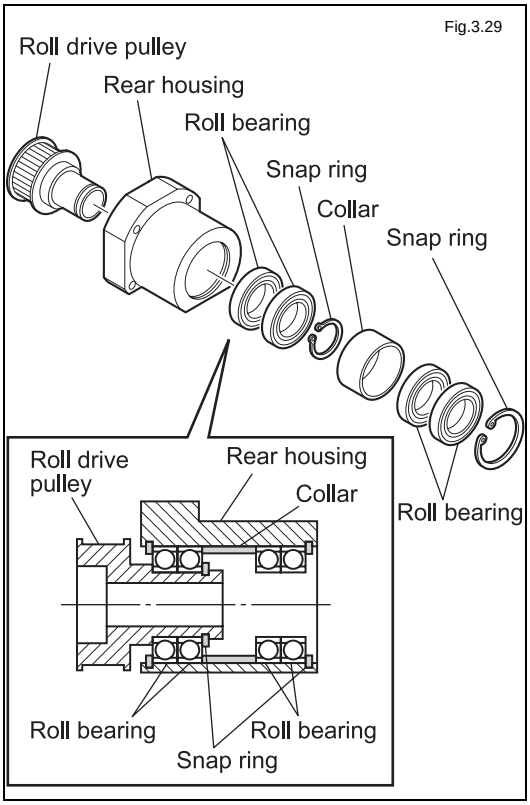
Tool to be used	5-mm Allen wrench
Parts to be removed	M6 cap bolt, conical washer × 4

5.



Remove the roll bearing of the front housing.

6.



Remove the roll bearing of the rear housing. Remove the two snap rings. The roll bearing, collar, and roll drive pulley can now be pulled out.

Tools to be used	Snap-ring pliers
Parts to be removed	Snap ring × 2

7. After replacing the roll bearings of the front and rear housings, fix each unit by following the removal procedure in reverse.

1.4 Inspection/Adjustment of Driving Parts

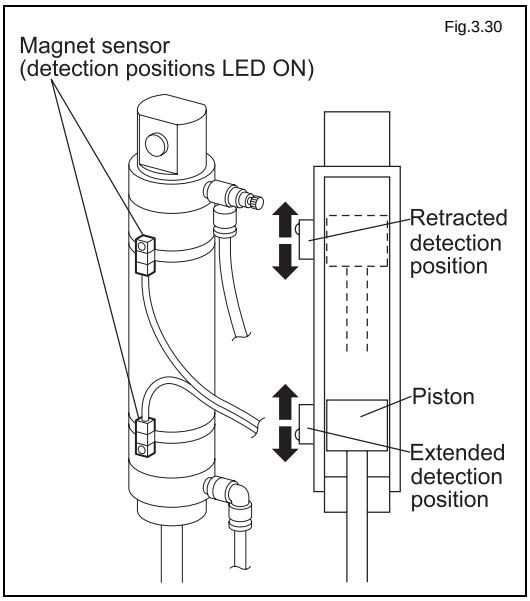
This unit uses air-cylinders to drive components, and driving belts* and chains to transmit driving power.
This section explains the procedures for adjusting the air-cylinder sensor and the tension of the driving belts* and chains.
* When the driving belts are chosen as an option.

1.4.1 Adjustment of the Air-Cylinder Sensor

The air cylinder uses two magnet sensors to detect the extended and retracted stroke positions. To adjust the detection positions, the position of the magnet sensor must be changed.

Necessary tool	Screwdriver

1. Fig.3.30



Loosen the screw of the band securing the magnet sensor, and align it with the piston by finding the ideal detection position (LED ON) when the piston is located at each end of the cylinder.

1.4.2 Check/Adjustment of Drive-Belt Tension *Option

This unit uses drive belts to transmit the driving force from the driving source. Measure the deflection of drive belts at least every six months, and adjust the tension when necessary.

Necessary tools	・10-mm wrench ・13-mm wrench ・17-mm wrench ・8-mm Allen wrench

⚠ Warning

Before adjusting the tension of the drive belts, be sure to turn the main breaker OFF (○). Affix a tag indicating "Do not turn ON" to the main breaker, to ensure that it is not inadvertently turned on by other workers.

1.

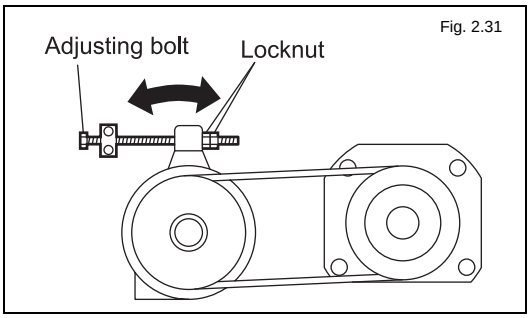


Fig. 2.31

Adjustment of the Laminating Roll Drive-Pulley Belt

- To change the tension of the roll drive-pulley belts of the upper rear housings, adjust the adjusting bolt after loosen the lock nut.

Tool to be used	10-mm wrench

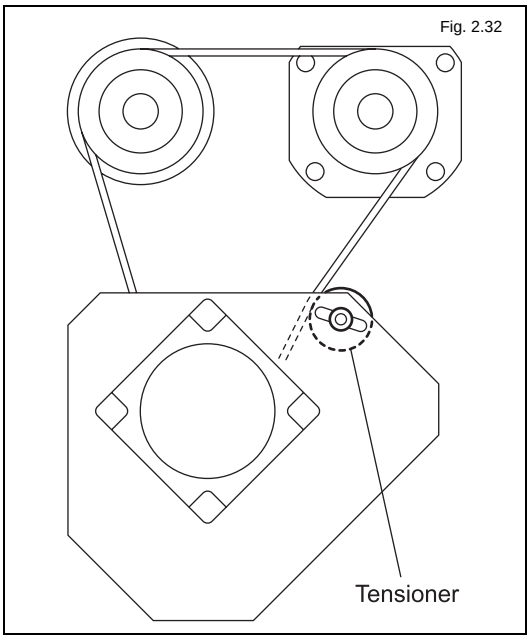


Fig. 2.32

- To change the tension of the lower rear housing-roll drive pulleys, adjust the tensioner after loosening the tensioner screw.

Tool to be used	13-mm wrench

2.

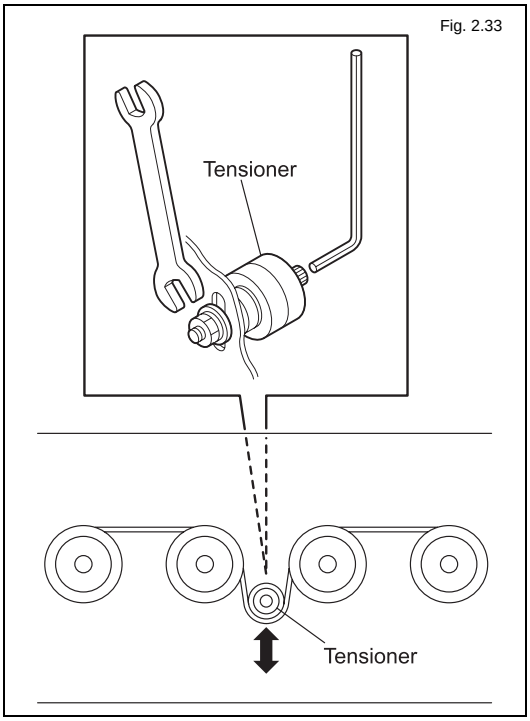


Fig. 2.33

Adjustment of the Conveyor Drive Belt

● Remove the cover fixed with screws at the rear of the conveyor. Use a wrench to hold the nut on the tensioner screw. Loosen the screw using an Allen wrench. Move the tensioner up and down to adjust the belt tension.

Tools to be used	・17-mm wrench ・8-mm Allen wrench

■ Deflection of the Drive Belt

"Deflection" is the displacement of the drive belt when a specified load is exerted at the center of the belt span.

● The appropriate value of deflection is approximately 1.6% of the span length.

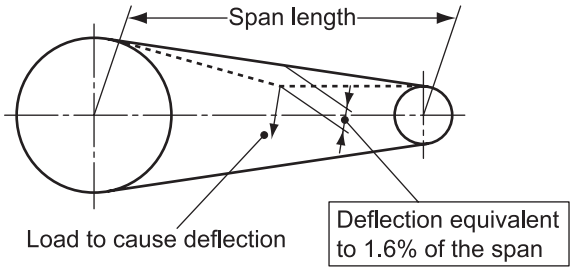


Fig.3.34

List of Appropriate Deflections

【Table 3.1.9 List of Appropriate Deflections】

No.	Location of use	Quantity pcs	Span length mm	Deflection mm	Load kgf
1	Input-conveyor roll rotation*	1	580	11.0	0.30～0.40
2	Pinch-roll forward rotation*	1	133	2.0	0.35～0.45
3	Upper-laminating roll rotation*	1	194	3.0	1.2～1.7
4	Lower-laminating roll rotation*	1	120	2.0	1.2～1.7

【Table 3.1.9　List of Appropriate Deflections (Continued)】

No.	Location of use	Quantity pcs	Span length mm	Deflection mm	Load kgf
5	Cutter assembly operation	2	1050	17.0	0.2～0.3
6	Cutter rotation	2	1000	16.0	0.2～0.3

* Option

1.4.3　Check/Adjustment of Drive-Chain Tension

This unit uses drive chains to transmit the driving force from the driving source. Measure the deflection of drive chains at least every six months, and adjust the tension when necessary.

Tools to be used	・13-mm wrench ・8-mm Allen wrench ・6-mm Allen wrench

⚠ Warning

Before adjusting the tension of drive chains, be sure to turn the main breaker OFF (○). Affix a tag indicating "Do not turn ON" to the main breaker, to ensure that it is not inadvertently turned on by other workers.

1.

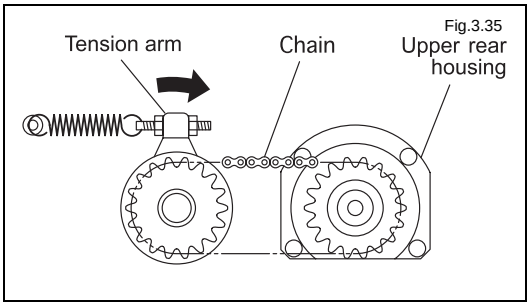
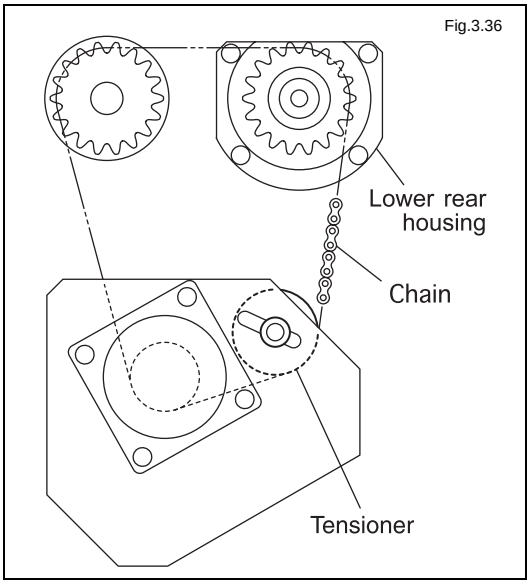


Fig.3.35

Adjustment of the Laminating Roll Drive-Sprocket Chain

- The tension of the roll drive sprocket chain of the upper rear housings is adjusted automatically to the direction of the arrow, so you need not adjust it.

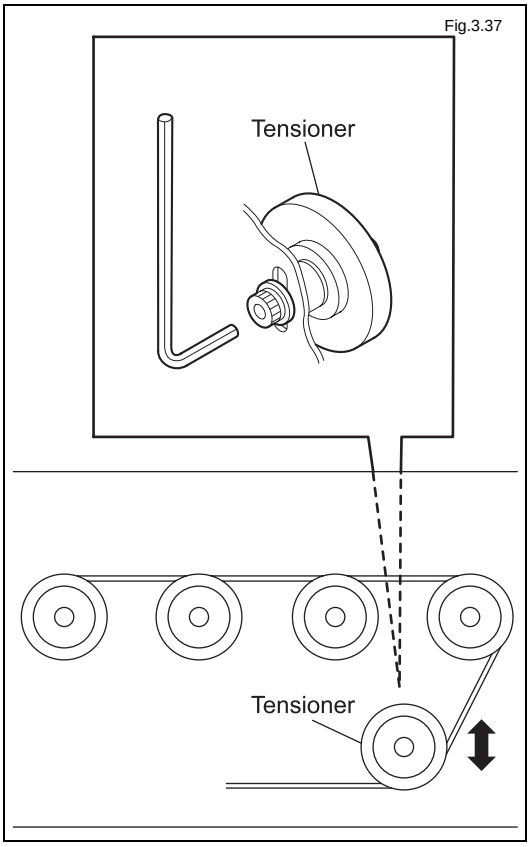
2.



To change the tension of the lower rear housing-roll drive sprockets, adjust the tensioner after loosening the tensioner screw.

Tool to be used	13-mm wrench

3.



Adjustment of the Input/Output Conveyor Drive Chain

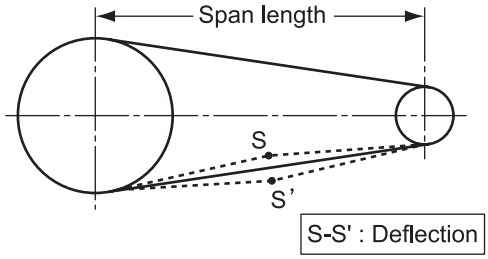
- Remove the cover fixed with screws at the rear of the conveyor. Loosen the screw using an Allen wrench. Move the tensioner up and down to adjust the chain tension.

Tools to be used	・17-mm wrench ・8-mm Allen wrench

■ Deflection of the Drive Chain

"Deflection" is the displacement of the drive chain when it is manually pressed in the perpendicular direction at the center of the chain span.
The appropriate value of deflection is either 2% or 4% of the span length, depending on the chain in question (see Table 3.1.10 for details).

Fig.3.38



List of Deflections

【Table 3.1.10 List of Appropriate Deflections】

No.	Location of use	Quantity pcs	Span length mm	Deflection mm	Ratio of deflection
1	Input-conveyor roll rotation	1	545	22.0	4%
2	Upper laminating roll rotation	1	124	5.0	4%
3	Lower laminating roll rotation	1	194	4.0	2%
4	Pinch-roll rotation (Front)	1	83	1.7	2%
5	Pinch-roll rotation (Rear)	1	40	1.6	4%
6	Auxiliary conveyor roll	1	180	7.0	4%
7	Output-conveyor roll rotation	1	625	25.0	4%

Chapter 2 Inspection, Adjustment, and Replacement of Consumable Parts

This Chapter explains the procedures for regularly replacing, inspecting, and adjusting consumable parts. To ensure safety and machine performance, follow the procedures specified in this chapter.

Contents of this Chapter

2.1　List of Consumable Parts

The table below shows the consumable parts to be replaced or checked regularly. Consumable parts will wear within one year (in some cases in much less time) if the unit is operated eight hours a day or 48 hours a week.

【Table 3.2.1　List of Consumable Parts】

No.	Part	Part No.	Section for reference (All in Part 3)
1	Laminating roll	11603162	2.2.4
2	Roll heater	142021	2.2.3、2.2.4
3	Slip ring	11502812	2.2.2
4	Slip-ring brush	11502813	2.2.1
5	Tacking rubber	11503535	2.2.6
6	Tacking heater	142024	2.2.5、2.2.6
7	Film-guide heater *Option	042008	2.2.7
8	Cutter	044022	1.3.3
9	Leak line filter	028540	1.3.4

2.2 Procedures for Replacing Consumable Parts

This section explains the procedure for inspecting and replacing consumable parts. To ensure safety and machine performance, follow the instructions specified in this section.

2.2.1 Replacement of the Slip-Ring Brush

As the slip-ring brush is always in contact with the rotating slip ring of the laminating roll, it must be replaced regularly due to wear. Check it for wear at least every three months, and replace it if it is worn.

Necessary tools	・Phillips screwdriver ・3-mm Allen wrench ・7-mm wrench

⚠ Warning

Before replacing the slip-ring brush, be sure to turn the main breaker OFF (○) to cut off the power supply. The parts near the slip-ring brush are hot. After turning the main breaker OFF, wait at least 20 minutes to allow them to cool before starting replacement of the slip-ring brush.

Note

Below, the procedure for replacing the slip-ring brush of the upper laminating roll is explained. It also applies to the replacement of the slip-ring brush of the lower laminating roll.

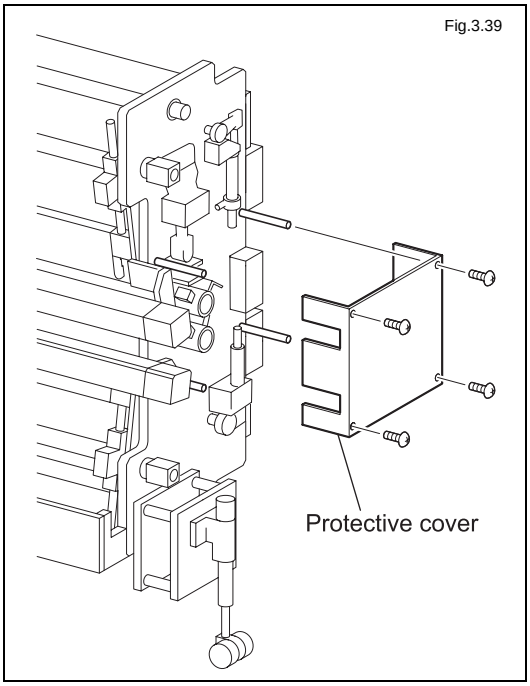
1. Turn the main breaker OFF (○) to cut off the power supply.

⚠ Warning

Affix a tag indicating "Do not turn ON" to the main breaker, to ensure that it is not inadvertently turned on by other workers.

2. Open the front door and pull out the lamination module.

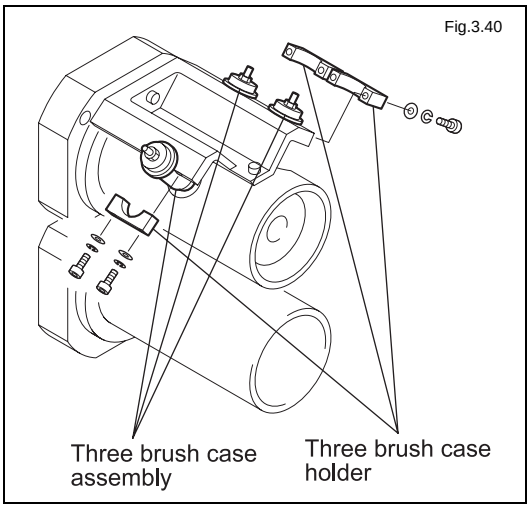
3.



Remove the protective cover.

Tool to be used	Phillips screwdriver
Parts to be removed	M4 Phillips screw × 4

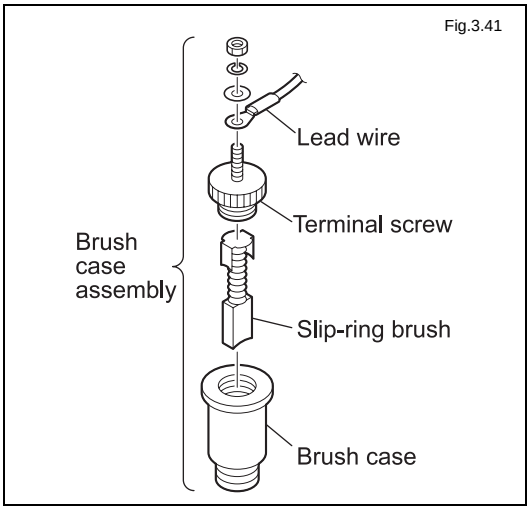
4.



Remove the three brush case holders.

Tool to be used	3-mm Allen wrench
Parts to be removed	M4 cap bolt, washer, spring washer × 2 × 3

5.



Remove the lead wires. Turn the terminal screws to remove the wires together with the brushs.

Tool to be used	7-mm wrench
Parts to be removed	M4 nut, washer, spring washer × 3

6.

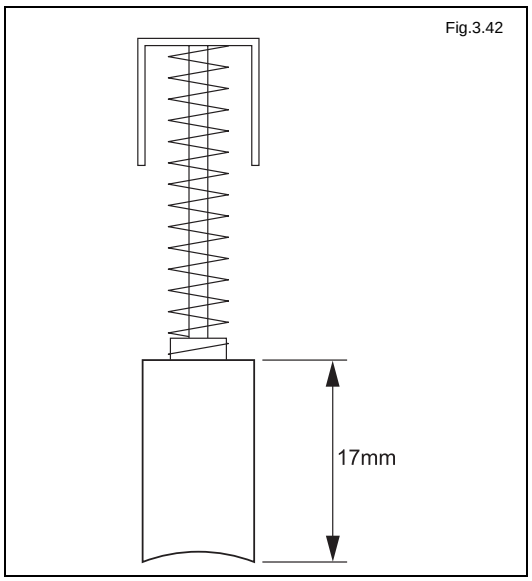


Fig.3.42

Check the wear of the slip-ring brush.

- Measure the length of the slip-ring brush. It should be 20 mm in length. If it is 17 mm or shorter, replace it.

7. To assemble the lead wires, brush case holders and protective cover, follow the procedures for removal in reverse.

8.

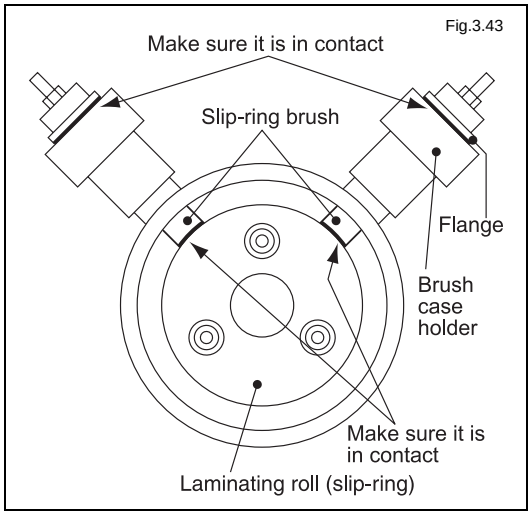


Fig.3.43

Fix the slip-ring brush and visually inspect the contact condition.

- Examine the slip-ring brush from the direction of the laminating roll shaft to confirm that it appropriately contacts the curve of the laminating roll slip ring.
- Make sure the brush case holder and flange of the brush case are in complete contact, with no gaps.

Note

If the flanges of the slip ring and brush case are not properly in contact, dismount the brush-case assembly and reinstall it. When installing the brush-case assembly, be careful not to rotate it or the slip ring brush will not sit correctly.

⚠ Caution

If the flanges of the slip ring and brush case are not properly in contact, the brush will wear unevenly or current leakage will occur.
Make sure they are completely in contact.

2.2.2 Replacement of the Slip Ring

As the slip ring is always in contact with the brush, it must be replaced regularly due to wear. Check it for wear at least every three months, and replace when it is worn.

Necessary tools	・Phillips screwdriver ・3-mm Allen wrench ・4-mm Allen wrench ・7-mm wrench

⚠ Warning

Before replacing the slip ring, be sure to turn the main breaker OFF (○) to cut off the power supply. The parts near the slip ring are hot. After turning the main breaker OFF, wait at least 20 minutes to allow them to cool before starting to replace the slip ring.

Note

Below, the procedure for replacing the slip ring of the upper laminating roll is explained. It also applies to the replacement of the slip ring of the lower laminating roll.

1. Turn the main breaker OFF (○) to cut off the power supply.

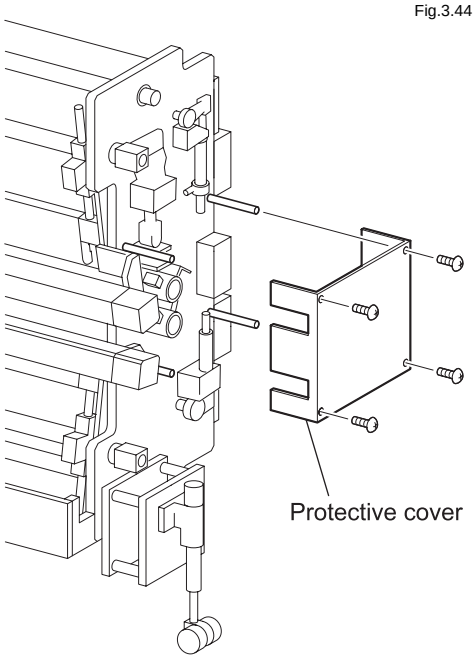
⚠ Warning

Affix a tag indicating "Do not turn ON" to the main breaker, to ensure that it is not inadvertently turned on by other workers.

2. Open the front door and pull out the lamination module.

3.

Fig.3.44

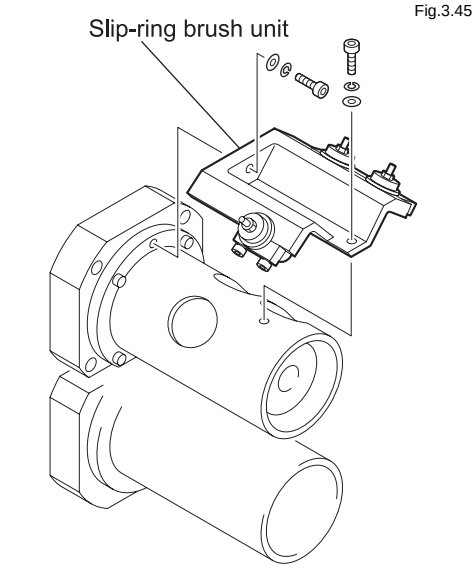


Remove the protective cover.

Tool to be used	Phillips screwdriver
Parts to be removed	M4 Phillips screw × 4

4.

Fig.3.45



Remove the slip-ring brush unit.

Tool to be used	3-mm Allen wrench
Parts to be removed	M4 cap bolt, washer, spring washer × 2

5.

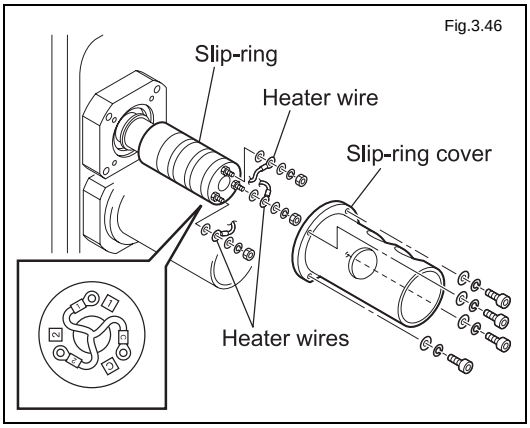


Fig.3.46

Remove the slip-ring cover and heater cord.

- The heater wire has polarity. When the wire is connected to the heater, check the label on the slip ring and the symbol on the wire for the polarity.

Tool to be used	Slip-ring cover: 4-mm Allen wrench Heater wire: 7-mm wrench
Parts to be removed	Slip-ring cover: M5 cap bolt, washer, spring washer × 4 Heater wire: M4 nut, washer (2), spring washer × 3

6.

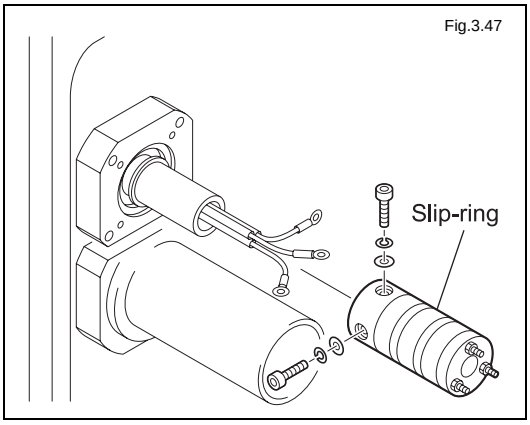
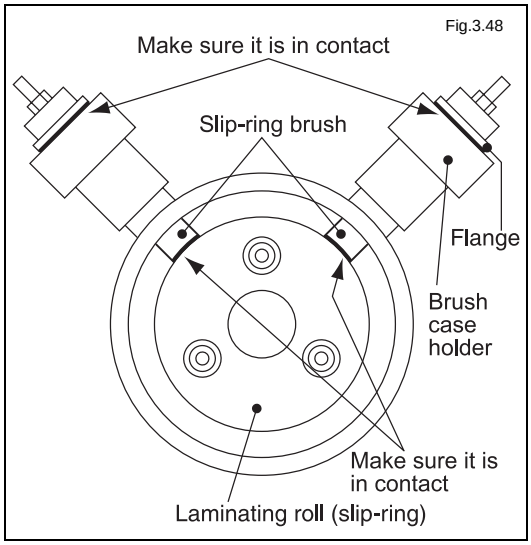


Fig.3.47

Replace the slip ring.

Tool to be used	4-mm Allen wrench
Parts to be removed	M5 cap bolt, washer, spring washer × 2

7.



Fix the slip-ring cover and slip-ring-brush unit, and visually check the contact condition.

- Examine the slip-ring brush from the direction of the laminating roll shaft to confirm that it appropriately contacts the curve of the laminating roll slip ring.
- Make sure the brush case holder and flange of the brush case are in complete contact, with no gaps.

Note

If the flanges of the slip ring and brush case are not properly in contact, dismount the brush-case assembly and reinstall it. When installing the brush-case assembly, be careful not to rotate it or the slip ring brush will not sit correctly.

⚠ Caution

If the flanges of the slip ring and brush case are not properly in contact, the brush will wear unevenly or current leakage will occur.
Make sure they are completely in contact.

8. To fix the protective cover, follow the removal procedure in reverse.

2.2.3 Measurement of the Laminating Roll Temperature Distribution

Measure the laminating roll temperature at least every three months to ensure that the temperature distribution is uniform.
If the temperature distribution is not uniform, see 2.2.4 "Replacement of the Laminating Roll and the Roll Heater," for the procedure to replace these components.

Necessary components	・Surface-temperature measuring instrument: RKC DP-500 ・Thermocouple: RKC ST-23L K-type

⚠ Warning

- Measure the temperature distribution of the laminating roll with power and compressed air supplied. Affix a tag indicating "Under Inspection" in a conspicuous location, to ensure that other workers do not operate the equipment.
- The laminating roll surface is hot (maximum temperature: approx. 150℃). Therefore, exercise caution when measuring the surface temperature.

1.

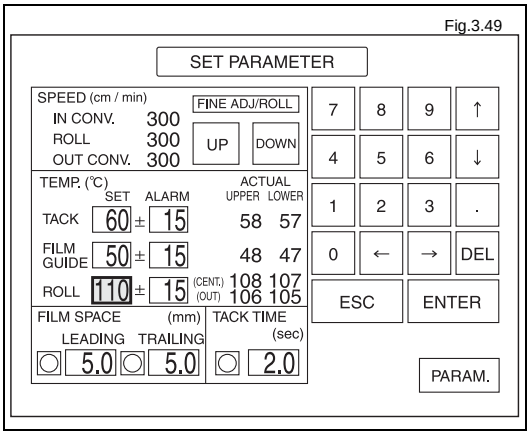
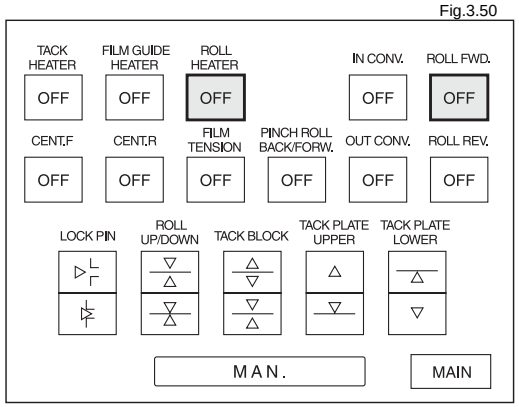


Fig.3.49

On the parameter setting screen of the operation panel, set the roll temperature at 110℃.
To display the parameter setting screen, select "PARAMETER" on the main screen, followed by " SET PARAM" on the parameter screen.

2.

Fig.3.50



On the manual screen of the operation panel, press the ROLL HEATER "OFF" button and the ROLL FWD "OFF" button to turn them "ON" and rotate the laminating roll forward.

- The manual screen does not accept input unless the yellow "MAN." button on the main screen has been pressed to place the unit in the manual-operation mode.
- This operation is performed to quickly warm the laminating roll and make the temperature distribution uniform.
- Maintain this state for approximately 20 minutes to allow the rolls to warm up.

* The explanation about film guides is indicated when you choose options.

Note

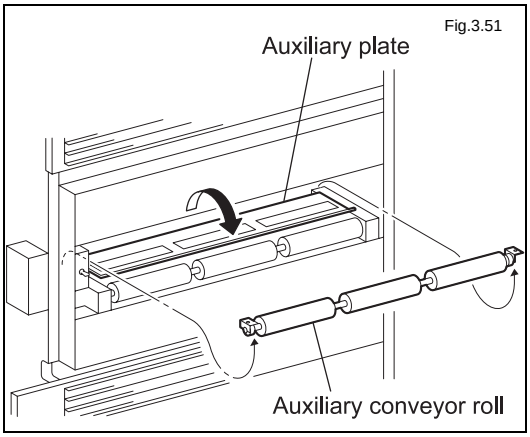
If the laminating roll is not warmed sufficiently, measurement will not be accurate.

3. Open the front door and pull out the lamination module.

4. On the manual screen of the operation panel, press the ROLL FWD "ON" button to turn it "OFF" and stop the rotation of the laminating roll.

5.

Fig.3.51



Open the auxiliary plate *Option to remove the auxiliary conveyor roll.

- Lift the auxiliary conveyor roll to remove it.

6.

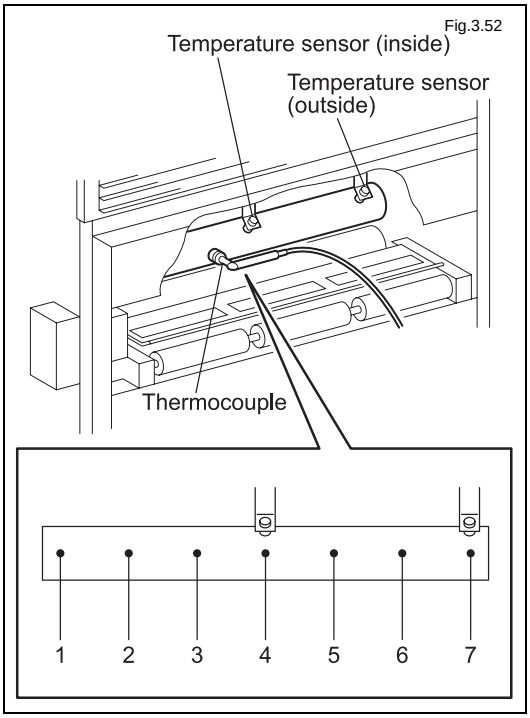


Fig.3.52

Press a thermocouple gently against the laminating roll to measure the surface temperature at the seven points specified below.

- Measure the surface temperature at seven points within the effective width of the laminating roll (630 mm).
- It is a good idea to select the points of the seven vacuum tubes for the film guide.
- Repeat the above measurements for the upper and lower laminating rolls.

Components to be used	Surface-temperature measuring instrument: RKC DP-500 Thermocouple: RKC ST-23L K-TYPE

7. The dispersion and differences in the measured surface temperatures should meet the criteria given in the table below.

Dispersion over the seven points	Within 6℃
Difference between the "ACTUAL" roll temperatures found on the parameter screen and the average of the seven temperatures measured by the thermocouple.	Within 5℃

8.

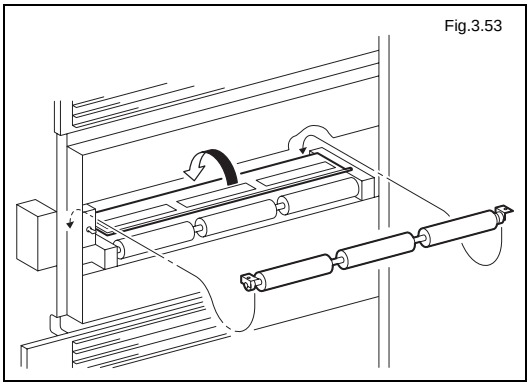


Fig.3.53

After measuring the temperature distribution, fix the auxiliary conveyor roll and close the auxilary plate *Option.

⚠ Caution

Do not leave the auxiliary plate *Option open, as it is monitored by a sensor. Otherwise, an error will occur.

2.2.4 Replacement of the Laminating Roll and the Roll Heater

Scratches on or deterioration of the laminating roll surface will lower the quality of PWBs. Check the surface and pressing conditions of the laminating roll at least every three months, and replace it if it is faulty.
Measure the temperature distributions of the roll heater and laminating roll at least every three months in accordance with "2.2.3. Measurement of the Laminating Roll Temperature Distribution," and replace these components if the temperature distribution's lack of uniformity is due to deterioration of the roll heater and laminating roll.

Necessary tools Necessary materials	・Screwdrivers (6 mm to 8 mm; length: approx. 300 mm) ・3-mm Allen wrench ・4-mm Allen wrench ・5-mm Allen wrench ・7-mm wrench ・14-mm wrench ・Wire cutter ・Snap-ring pliers ・Gloves ・Scale (150 mm) ・GE Toshiba silicon YG6111 (silicon putty) ・Lint-free cloth ・Roll replacement rod (Maintenance tool)

⚠ Warning

Before replacing a laminating roll or roll heater, be sure to turn the main breaker OFF (○) to cut off the power supply. The parts near the laminating rolls and the rolls themselves are hot. After turning the main breaker OFF, wait at least 20 minutes to allow them to cool down to less than 50 degrees centigrade before starting replacement.

⚠ Caution

- Be sure to replace a laminating roll using a roll replacement rod. Instead of using the roll replacement rod, using another method such as hitting the shaft of the laminating roll with a hammer may cause damage to the laminating roll or its bearings.
- A laminating roll weighs approximately 30 kg. Two or more workers are required to remove it from the unit. Assume a safe working posture when handling it.

Note

- Below, the procedure for replacing the upper laminating roll is explained. The same procedure applies to the replacement of the lower laminating roll.
- To ease the removal / replacement process, remove the upper laminating roll first, followed by the lower laminating roll. When the rolls are replaced, install the lower laminating roll first.
- To perform this work, prepare a clean and stable work bench capable of supporting the weight of the laminating roll (approximately 30 kg).

1. Turn the main breaker OFF (○) to cut off the power supply.

⚠ Warning

Affix a tag indicating "Do not turn ON" to the main breaker, to ensure that it is not inadvertently turned on by other workers.

2. Open the front door of the lamination module.

3. Remove the protective cover.

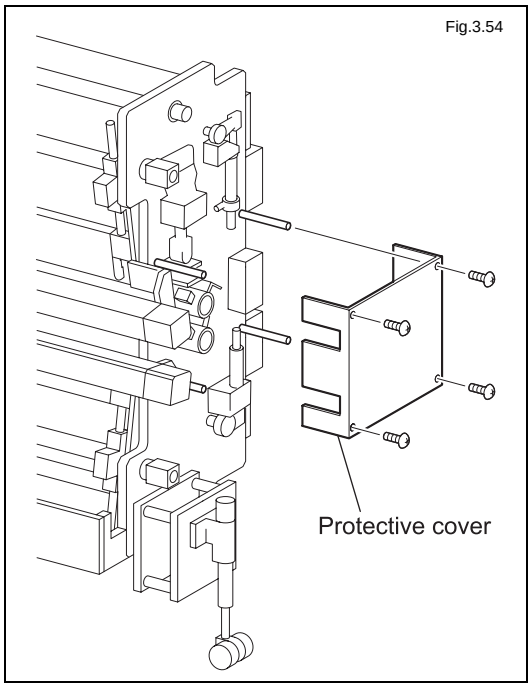


Fig.3.54

Tool to be used	Phillips screwdriver
Parts to be removed	M4 Phillips screw × 4

4.

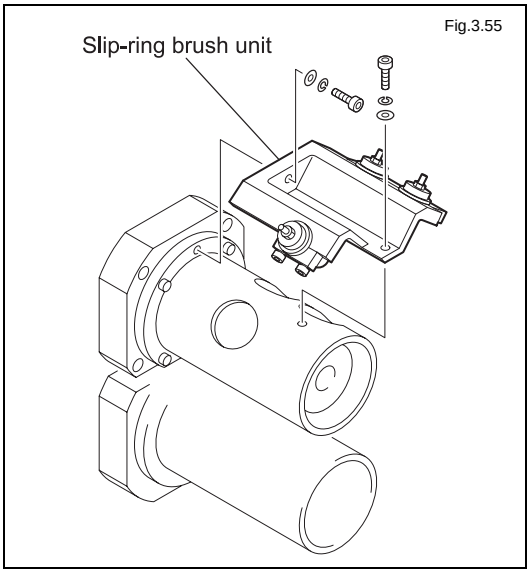


Fig.3.55

Remove the slip-ring brush unit.

Tool to be used	3-mm Allen wrench
Parts to be removed	M4 cap bolt, washer, spring washer × 2

5.

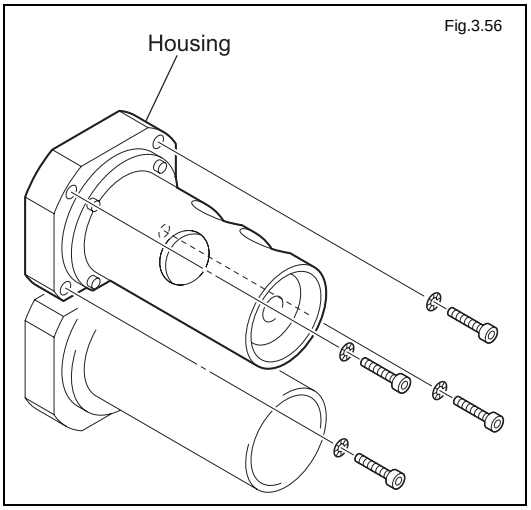


Fig.3.56

Remove the cap bolts that hold the housing in place.

- To Remove the cover, romove a fixing screw and then lift the cover up.

Tool to be used	5-mm Allen wrench
Parts to be removed	M6 cap bolt, conical spring washer × 4

⚠ Caution

Do not touch the internal components when removing the lamination module rear cover.

6.

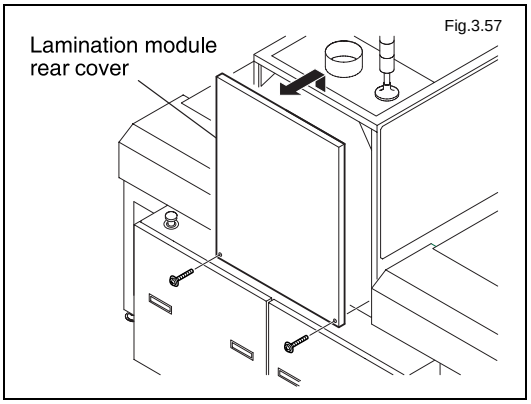


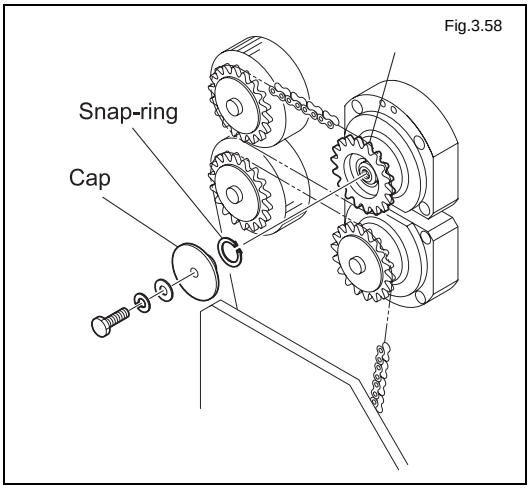
Fig.3.57

Remove the cover at the rear of the lamination module.

Tool to be used	Phillips screwdriver
Parts to be removed	M5 Phillips screw × 2

7. Pull the lamination module out slightly to ease work.

8.

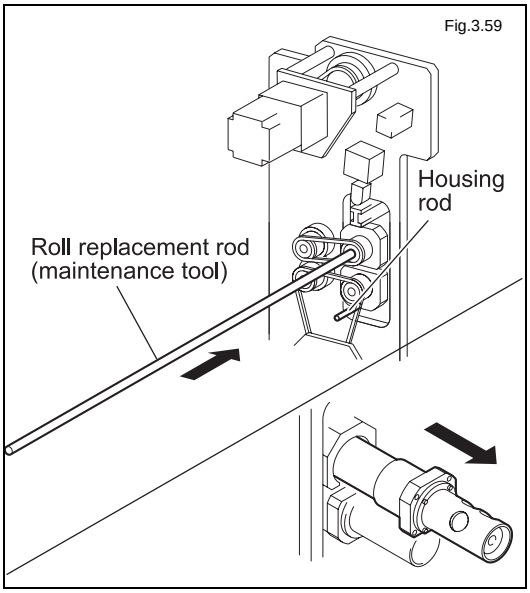


Remove the roll drive-pulley* cap or the roll drive sprocket cap, and then remove the snap ring that attached to the roll shaft.

Tools to be used	17-mm wrench, snap-ring pliers
Parts to be removed	M10 bolt, washer, spring washer, snap ring

* When the drive belt is chosen as an option.

9.



Screw the roll replacement rod (maintenance tool) into the laminating roll shaft, and push it toward the front of the unit.

- Two workers are required to perform this work: one to push the laminating roll with the replacement rod, and the other to support the laminating roll on the front side of the unit.
- Lift up the replacement rod slightly to push out the upper laminating roll.
- For the lower laminating roll, lift up the housing rod, not the roll replacement rod, slightly to push it out.

⚠ Caution

- Be sure to replace a laminating roll using a roll replacement rod. Instead of using the roll replacement rod, using another method such as hitting the shaft of the laminating roll with a hammer may cause damage to the laminating roll or its bearings.
- Do not break the spring for the tension of chain when screwing the roll replacement rod (maintenance tool) of the roll driving sprocket.
- A laminating roll weighs approximately 30 kg. Two or more workers are required to remove it from the unit. Assume a safe working posture when handling it.

10. Place the removed laminating roll on a stable and level work bench.

⚠ Caution

A laminating roll weighs approximately 30 kg. Replacement work should be performed on a stable work bench capable of supporting its weight.

11.

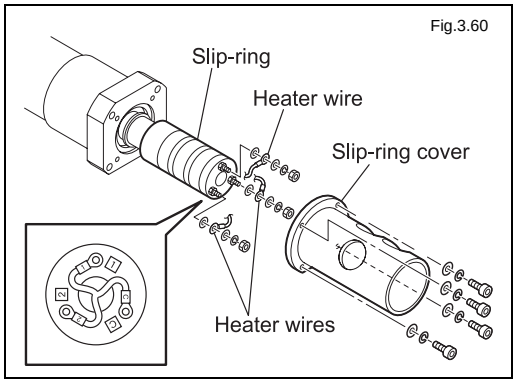


Fig.3.60

Remove the slip-ring cover and heater wires.

- The heater wires have polarity.
  To connect the wires to the heater, check the label on the slip ring and the symbol on each wire for the polarity.

Tools to be used	Slip-ring cover: 4-mm Allen wrench Heater wire: 7-mm wrench
Parts to be removed	Slip-ring cover: M5 cap bolt, washer, spring washer × 4 Heater wire: M4 nut, washer (2), spring washer × 3

12.

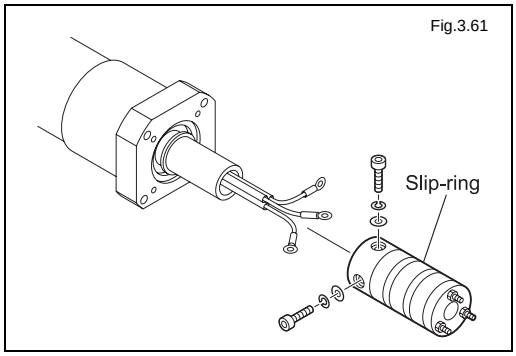


Fig.3.61

Remove the slip ring.

- Replace the slip ring if it is worn or deteriorated.

Tool to be used	4-mm Allen wrench
Parts to be removed	M5 cap bolt, washer, spring washer × 2

13.

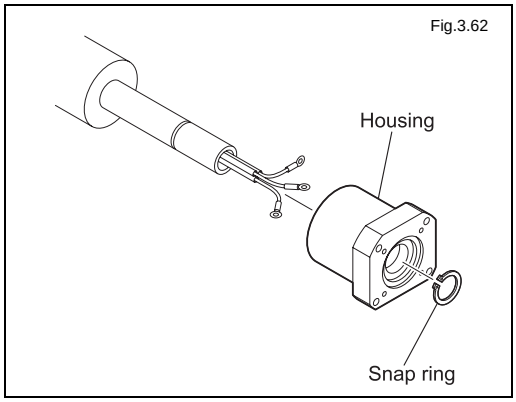


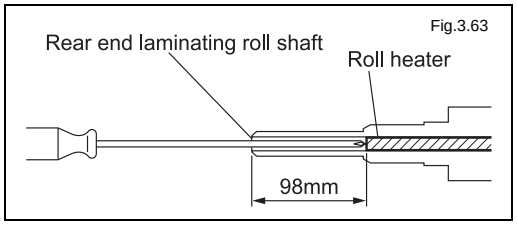
Fig.3.62

Remove the front housing.

- To replace the roll bearing in the housing, see 1.3.7 "Replacement of the Roll Bearing (Chain driving type)," Part 3.

Tool to be used	Snap-ring pliers
Parts to be removed	Snap ring

14.

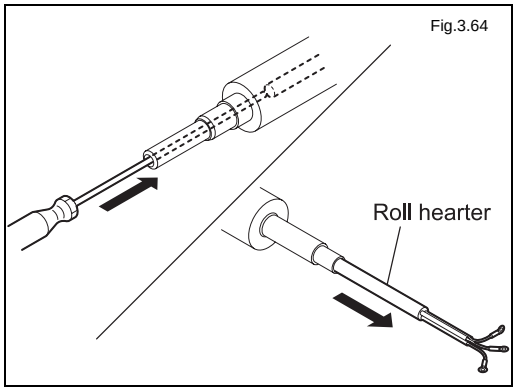


Insert a screwdriver into the rear end of the laminating roll shaft, and measure the current position of the roll heater.

- This work is performed to re-insert the roll heater at its original position in the laminating roll.
- The unit is shipped with the roll heater inserted 98 mm from the rear end of the laminating roll shaft.

Tool to be used	Screwdrivers (ϕ 6 mm to 8 mm; length: approx. 300 mm), scale (150 mm)

15.



While wearing gloves, insert a screwdriver into the rear end of the laminating roll shaft. Push the roll heater with the screwdriver, and pull it out from the front end.

Tool to be used	Screwdrivers, gloves

Note

- Wear gloves to ensure that your hands are not soiled with the silicon putty applied to the roll heater.
- Hold the heater body when pulling it out. Do not hold it by its wires, as the wires will break.

16. Before installing the roll heater, apply silicon putty to increase its thermal conductivity.

- Apply silicon putty uniformly to the heater surface. Wipe off any excess silicon putty using a lint-free cloth.

Tools to be used Materials to be used	・GE Toshiba silicon YG6111 055002 ・Lint-free cloth

17. Apply grease A (WR-500) to the laminating roll shaft.

Note

Unless greased, the roll shaft may be damaged.

18. To install the components that have been removed, follow the removal procedure in reverse.

Note

To ease the disassembly/assembly process, disassemble the upper laminating roll first, followed by the lower laminating roll. When assembling the rolls, assemble the lower laminating roll first.

2.2.5 Measurement of the Tacking-Rubber Temperature Distribution

Measure the surface temperature of the tacking rubber in the tacking-plate tip at least every three months, to ensure that the temperature distribution is uniform. If it is not, see 2.2.6 "Replacement of the Tacking-Rubber and Tacking Heater" to replace these components.

Necessary tools	・Surface-temperature measuring instrument: RKC DP-500 ・Thermocouple: RKC ST-23L-K TYPE

⚠ Warning

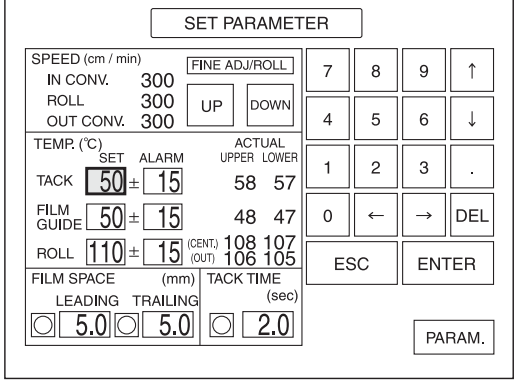
- Measure the temperature distribution of the tacking-rubber with power and compressed air supplied. Affix a tag indicating "Under Inspection" in a conspicuous location, to ensure that other workers do not operate the equipment.
- The tacking-rubber surface is hot (maximum temperature: approx. 70℃). Therefore, exercise caution when measuring the surface temperature.

Note

Below, the procedure for measuring the temperature distribution of the upper tacking rubber is explained. The same procedure applies to the measurement of the temperature distribution of the lower tacking rubber.

1.

Fig.3.65



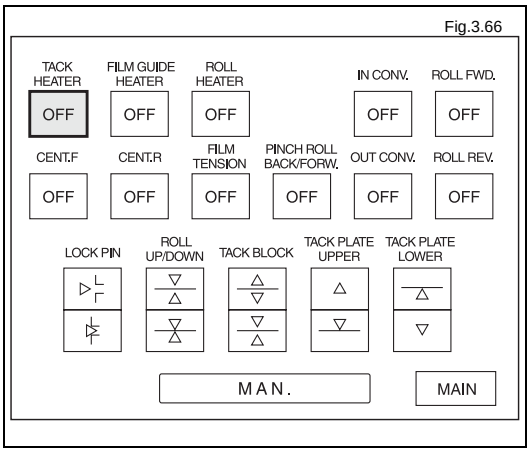
On the parameter setting screen of the operation panel, set the tacking rubber temperature at 50℃.

- To enter the parameter setting screen, select "PARAMETER" on the main screen, followed by " SET PARAM" on the parameter screen.

* The explanation about film-guides is indicated when you choose options.

2.

Fig.3.66



On the manual screen of the operation panel, press the TACK HEATER "OFF" button to turn it "ON."
The manual screen does not accept input unless the yellow "MAN." button on the main screen has been pressed to place the unit in the manual-operation mode.
Maintain this state for approximately 20 minutes for warmup.

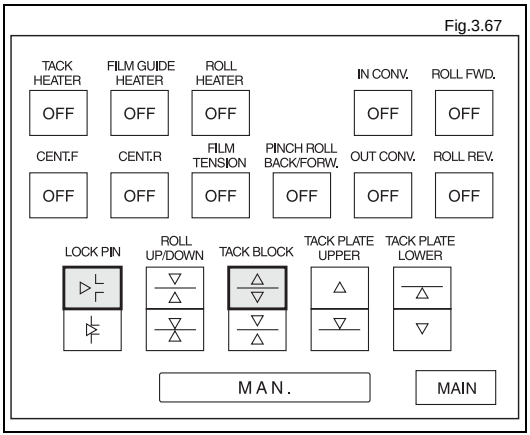
Note

If the tacking heater is not warmed sufficiently, measurement will not be accurate.

3. Open the front door and pull out the lamination module.

4.

Fig.3.67

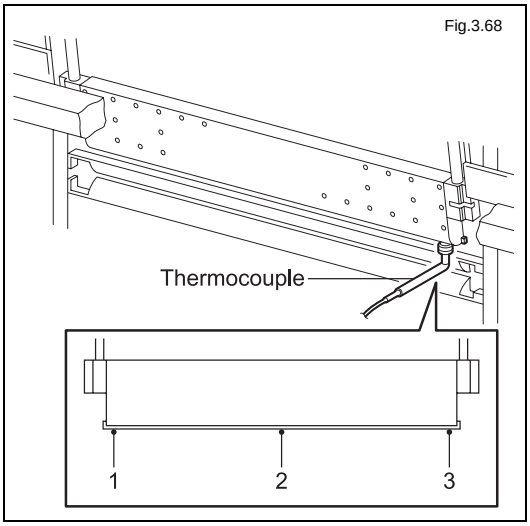


On the manual screen of the operation panel, press the LOCK PIN "RELEASE" button and TACK BLOCK "OPEN" button to move the tacking block to the open position.

5. On the manual screen of the operation panel, press the TACK PLATE UPPER "CLOSE" button to move the tacking plate to the closed position.

* The explanation about film-guides is indicated when you choose options.

6.



Press a thermocouple against the rubber at the tip of the tacking plate, and measure the surface temperature at the three points specified below.

- Measure the surface temperature at the front side, rear side, and center of the tacking rubber, within the effective width of the tacking plate (630 mm).
- Follow the steps specified above for the upper and lower tacking plates.

Components to be used	Surface-temperature measuring instrument: RKC DP-500 Thermocouple: RKC ST-23L K-TYPE

7. The dispersion of and differences in the measured surface temperatures should meet the criteria given in the table below.

Dispersion over the three points	Within 10℃
Difference between the average of the three temperatures measured by the thermocouple and the "ACTUAL" tacking temperatures found on the parameter screen	Within 5℃

2.2.6 Replacement of the Tacking-Rubber and Tacking Heater

Scratches on or deterioration of the tacking-rubber surface will lower the quality of PWBs. Check the surface condition of the tacking rubber at least once per week, and replace it if it is faulty.
Measure the temperature distribution of the tacking heater and tacking rubber at least every three months in accordance with "2.2.5. Measurement of the Tacking-Rubber Temperature Distribution," and replace these components if the temperature distribution's lack of uniformity is due to deterioration.

Necessary tools Necessary materials	・Phillips screwdriver ・4-mm Allen wrench ・Wire cutter ・GE Toshiba silicon YG6111 ・Lint-free cloth ・Gloves

⚠ Warning

Before replacing the tacking rubber or tacking heater, be sure to turn the main breaker OFF (○) to cut off the power supply. The parts near the tacking heater are hot. After turning the main breaker OFF, wait at least 20 minutes to allow them to cool before starting replacement.

Note

- Below, the procedure for replacing the upper tacking rubber and tacking heater is explained. The same procedure applies to the replacement of the lower tacking rubber and tacking heater. Note that the upper and lower tacking plates are symmetrical in the vertical direction.
- Prepare a level, stable, and clean work bench for performing this work.

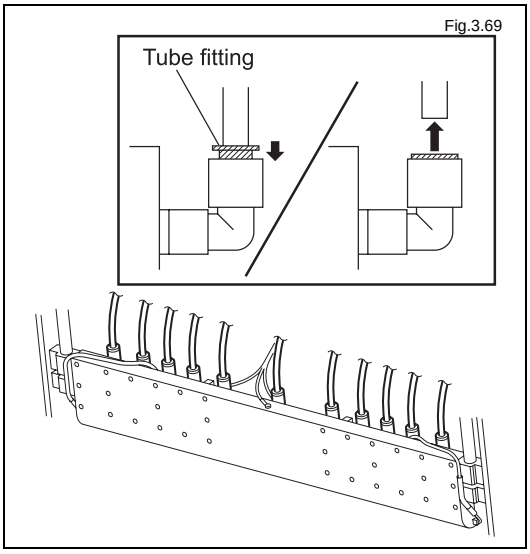
1. Turn the main breaker OFF (○) to cut off the power supply.

⚠ Warning

Affix a tag indicating "Do not turn ON" to the main breaker, to ensure that it is not inadvertently turned on by other workers.

2. Open the front door and pull out the lamination module.

3.

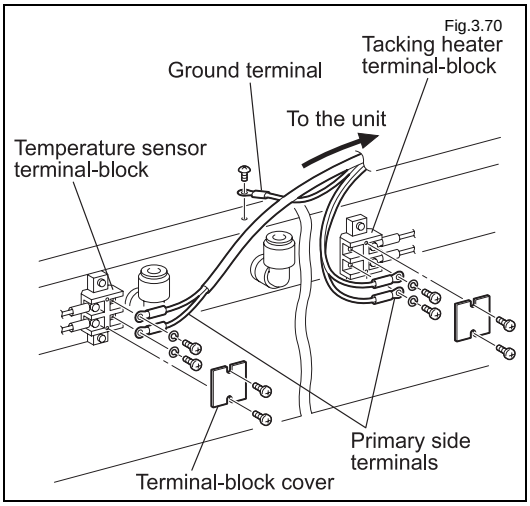


Remove the 11 air tubes attached to the tacking plate at the tube fitting.
Push and hold the blue section of the tube fitting down, and pull the air tube up to remove it.

Note

When re-attaching the tubes, be sure to attach each at its proper position.

4.



Remove the terminal-block covers and the primary-side terminals of the tacking heater and tacking temperature sensor. In addition, remove the GND terminal.

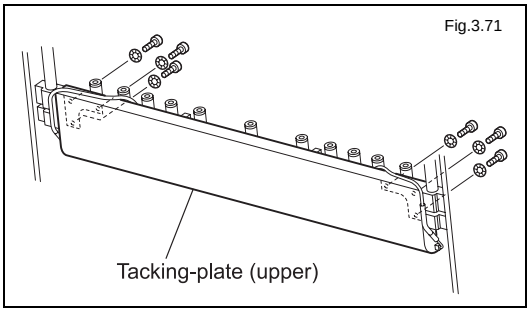
- When attaching the terminals to the tacking heater and tacking temperature sensor, do not reverse their polarity.

Tool to be used	Phillips screwdriver
Parts to be removed	Terminal-block cover: M3 Phillips screw × 2 × 2 Terminal: M3 Phillips screw, spring washer × 2 × 2 GND terminal: M4 Phillips screw

Note

Do not drop screws or washers. If one drops be sure to pick it up, as small items like these can get caught in mechanical parts and damage the unit.

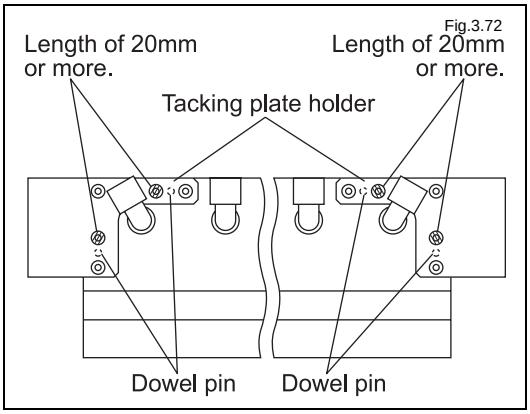
5.



Remove the tacking-plate fixing screws.

Tool to be used	4-mm Allen wrench
Parts to be removed	M5 cap bolt, conical spring washer × 3 × 2

6.



Remove the tacking plate.

- The tacking plate is fixed with two dowel pins on the left side, and two on the right side. Insert an M5 cap bolt with a length of at least 20 mm into the rear side of the four pushing taps, two each on the left and right sides, to remove the tacking plate.

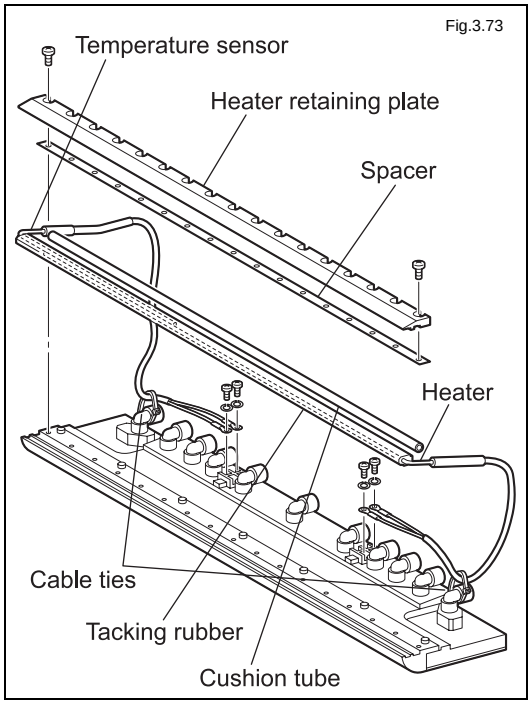
Tool to be used	4-mm Allen wrench
Bolt to be used	M5 cap bolt (length of 20 mm or more)

7. Place the removed tacking plate on a stable and level work bench.

Note

Do not scratch the film contact surface of the tacking plate.

8.



Remove the heater retaining plate, tacking heater terminal, tacking temperature-sensor terminal, tacking rubber, tacking heater, tacking sensor, and spacer.

- Pull out the tacking heater and tacking temperature sensor from the tacking rubber to replace them.
- Discard the cut cable ties. Use new ties at the same positions for installation.

Tool to be used	Phillips screwdriver, Wire cutter
Parts to be removed	Terminal: M3 Phillips screw, spring washer × 2 × 2 Heater presser: M4 Phillips screw × 17

Note

Do not break or lose the spacer.

9. Before the tacking heater and tacking temperature sensor are inserted into the tacking rubber, apply silicon putty to increase their thermal conductivity.

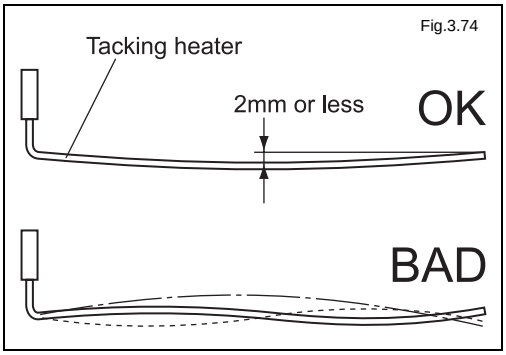
- Apply silicon putty uniformly on the surfaces of the tacking heater and tacking temperature sensor, and wipe off any excess puuty using a lint-free cloth.

Tools to be used Materials to be used	・GE Toshiba silicon YG6111 055002 ・Gloves ・Lint-free cloth

Note

If gloves are not worn, your hands will be soiled with the silicon putty applied to the tacking heater and tacking temperature sensor.

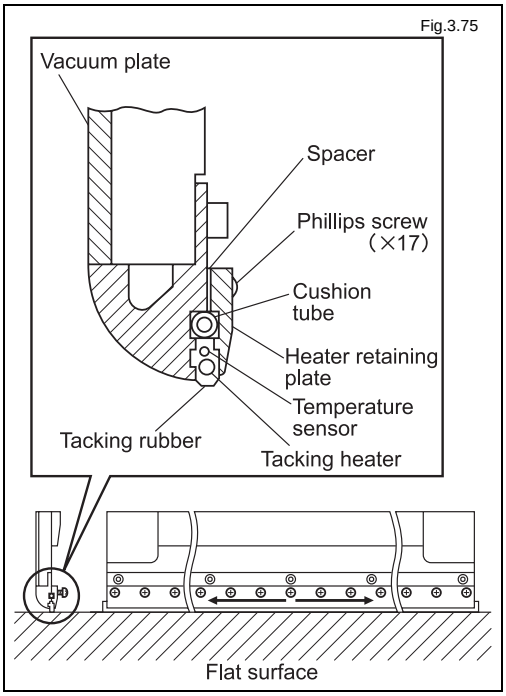
10.



Do not bend the tacking heater or tacking temperature sensor.

- The tacking heater and tacking temperature sensor must not bend by more than 2 mm. Insert these components directly into the tacking rubber.

11.



To assemble the tacking plate, temporarily assemble the components and place the assembled components upright on a clean, flat surface. Individually tighten the Phillips screws of the heater retaining plate, from the center toward the outside. See the illustration (left) for more information.

- So as not to deflect the tacking rubber, be sure to follow the above step when tightening the screws. Fix the tacking rubber so that its tacking plane uniformly contacts the flat surface.

12. To install the tacking plate, follow the removal procedure in reverse.

- Connect the wire terminals and air tubes properly.

2.2.7 Replacement of the Film-Guide Heater *Option

Use a temperature measuring device to check the difference between the actual temperature of the film guides and the FILM GUIDE TEMP on the parameter screen at least every three months, and replace the film-guide heater if the difference is too large.

Necessary tools Necessary materials	・Wire cutter ・Phillips screwdriver ・Flathead screwdriver ・Scraper ・Marker ・Scotch tape ・Adhesive: ・Sakaguchi Dennetsu Betattsu（adhesive for Samicon Super 340） ・Heat-resistant tape : ・Nippon Baruka Kogyo : Valflon glass-cross adhesion tape

⚠ Warning

The parts near the film-guide heater and the heater itself is hot. After turning the main breaker OFF, wait at least 20 minutes to confirm that they have cooled sufficiently before starting replacement.

Note

- This section explains the procedure for replacing the upper-film-guide heater. It also applies to the replacement of the lower-film-guide heater. Note that the lower film guide is symmetrical with the upper film guide in the vertical direction.
- Use adhesive to fix the film-guide heater. Approximately 12 hours are required for the film guide to become completely bonded. Therefore, do not operate the unit immediately after replacing the film-guide heater.

1. Open the front door and pull out the lamination module.

2. On the manual screen of the operation panel, press the LOCK PIN "RELEASE" button and TACK BLOCK "OPEN" button to move the tacking block to the opened position.
- The manual screen does not accept input unless the yellow "MAN." button on the main screen has been pressed to place the unit in the manual-operation mode.
- The tacking block does not move to the opened position unless the LOCK PIN "RELEASE" button has been pressed to release the lock pin.
- The above steps must be followed with the main breaker turned ON.

3. Open the cover of the Power OFF button, and press the power switch. Then, turn the main breaker on the control box at the rear of the unit OFF (○).

⚠ Warning

Affix a tag indicating "Do not turn ON" to the main breaker, to ensure it is not inadvertently turned on by other workers.

4.

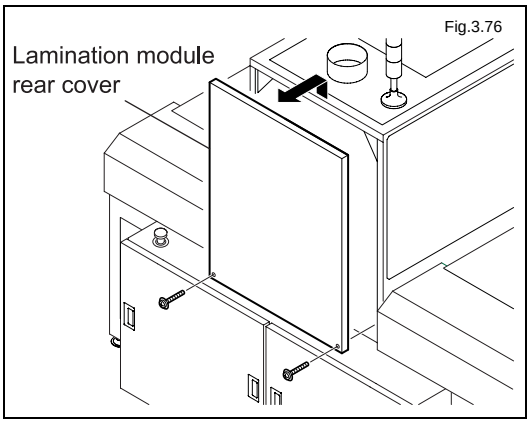


Fig.3.76

Remove the lamination module rear cover to provide access to the interior of the unit.

- To remove the cover, remove a fixing screw and then lift the cover up.

Tool to be used	Phillips screwdriver
Screws to be removed	M4 Phillips screw × 2

⚠ Caution

Do not touch the internal components when removing the lamination module rear cover.

5.

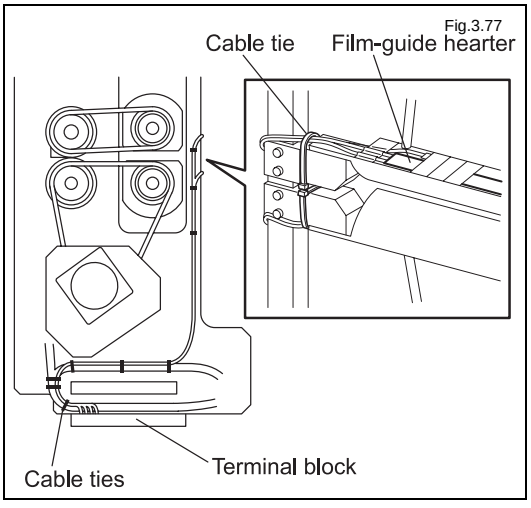


Fig.3.77

Cut the cable ties that fix the wires of the film-guide heater between the heater and the terminal block at the bottom of the lamination module.

- Manually move the cutter assembly to a position at which allows easy access to the cable ties and wires.

Tool to be used	Wire cutter
Bands to be removed	Cable ties at multiple locations

6.

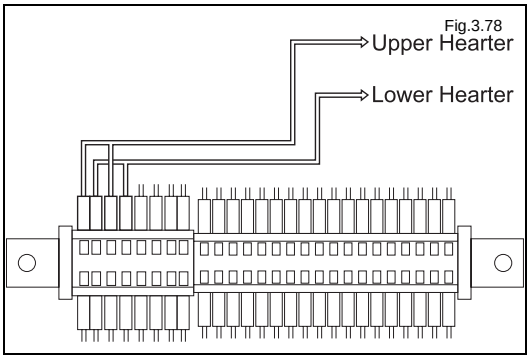


Fig.3.78

Remove the wires of the film-guide heater from the terminal block.

- Insert a flathead screwdriver into the square hole of the terminal block to remove the wire.

Tool to be used	Flathead screwdriver

Note

When replacing the wires, be sure to check the wire numbers carefully to ensure the proper wires are connected.

7.

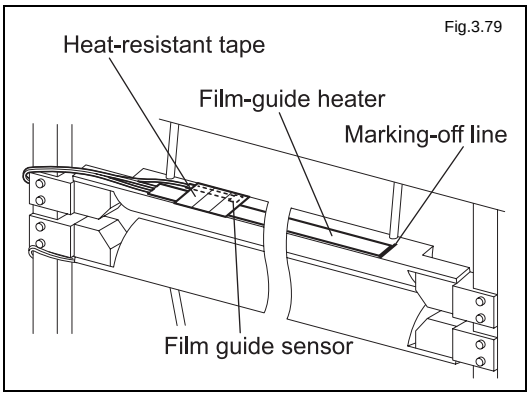


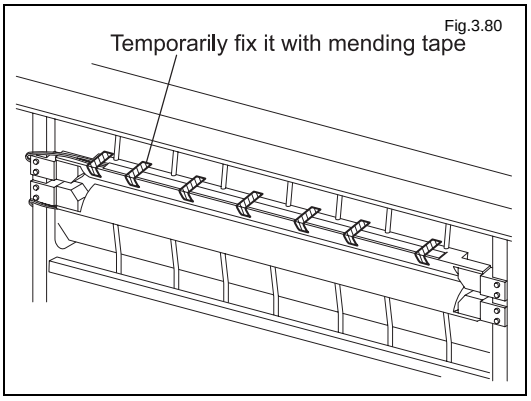
Fig.3.79

Stand in front of the lamination module. Peel off the heat-resistant tape and remove the film-guide heater.

- Before removing the film-guide heater, use a marker to draw a marking-off line at the end of the heater seat, to indicate the installation position later in the assembly process.
- Peel off the heat-resistant tape. This will remove the film-guide sensor as well.
- After removing the film-guide heater, use a scraper to remove any adhesive remaining on the film guide.

Tools to be used	・Scraper ・Marker

8.



Apply adhesive uniformly to a new film-guide heater, and affix the heater to the film guide at the marking-off line. Temporarily fix the heater using scotch tape at several locations. Wait until it becomes completely bonded before removing tape.

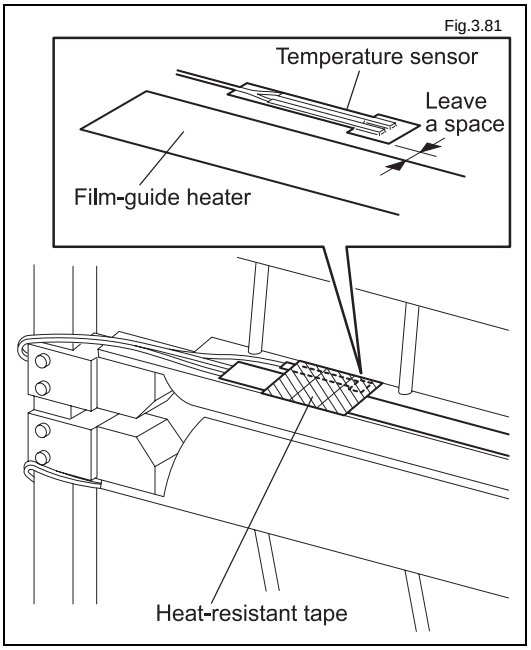
- Approximately 12 hours are required for the film-guide heater to become completely bonded.

Materials to be used	・ Adhesive: Sakaguchi Dennetsu "Betattsu" (adhesive for Samicon Super 340) ・ Scotch tape

Note

Do not lay wiring for the film-guide heater or operate the unit until the film-guide heater is completely bonded.

9.



After the film-guide heater is completely bonded, remove the scotch tape temporarily holding the heater in place, and affix the temperature sensor using heat-resistant tape.

Materials to be used	・ Nippon Baruka Kogyo : Valflon glass-cross adhesion tape

Note

When the film-guide heater and the sensor are in place, there should be a space between them.
If the film-guide heater is in contact with the sensor, the temperature of the film guide will not be accurately measured.

11.

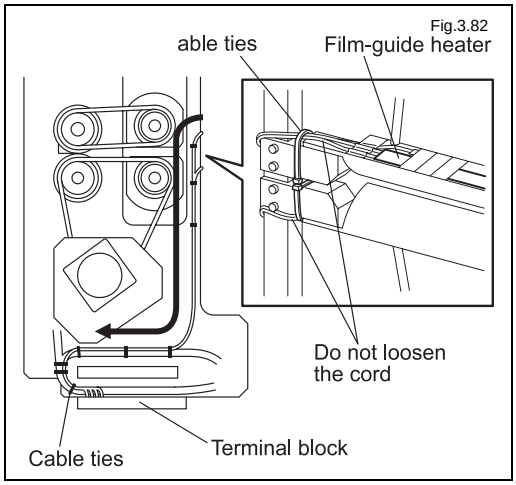


Fig.3.82

Use cable ties to fix the film-guide heater and sensor wires at the positions at which the removed cable ties were used, and connect the wires to the terminal block.

- Fix the wires using cable ties, ensuring that the wires remain taut and flush against the terminal block.

Caution

If a wire is loose, it will interfere with other parts and may be cut accidentally.

11. Turn the main breaker ON (|). Open the cover of the POWER "ON" button, and press it to supply power to the unit.

12. From the manual screen of the operation panel, move the tacking plate to the home position.

- The manual screen does not accept input unless the yellow "MAN." button on the main screen has been pressed to place the unit in the manual-operation mode.
- Select the LOCK PIN "LOCK" on the manual screen to fix the tacking block.

13. Open the cover of the Power button and press the button. Then, turn the main breaker on the control box at the rear of the unit OFF (○), to complete replacement of the film-guide heater.

Chapter 3 Troubleshooting

This chapter explains typical problems that occur during nomal operation and the actions to be taken in response to them. Follow the instructions given in this chapter to return the unit to normal operation.

Contents of this Chapter

3.1 Troubleshooting

When the unit has failed, it stops and informs the operator of the problem by sounding a buzzer, turning the signal tower RED, and by displaying an error message on the screen. This ensures safety by warning operators and also provides an explanation of the problem.
To correct problems, follow the REMEDY section of the alarm screen or the instructions given in this Chapter.

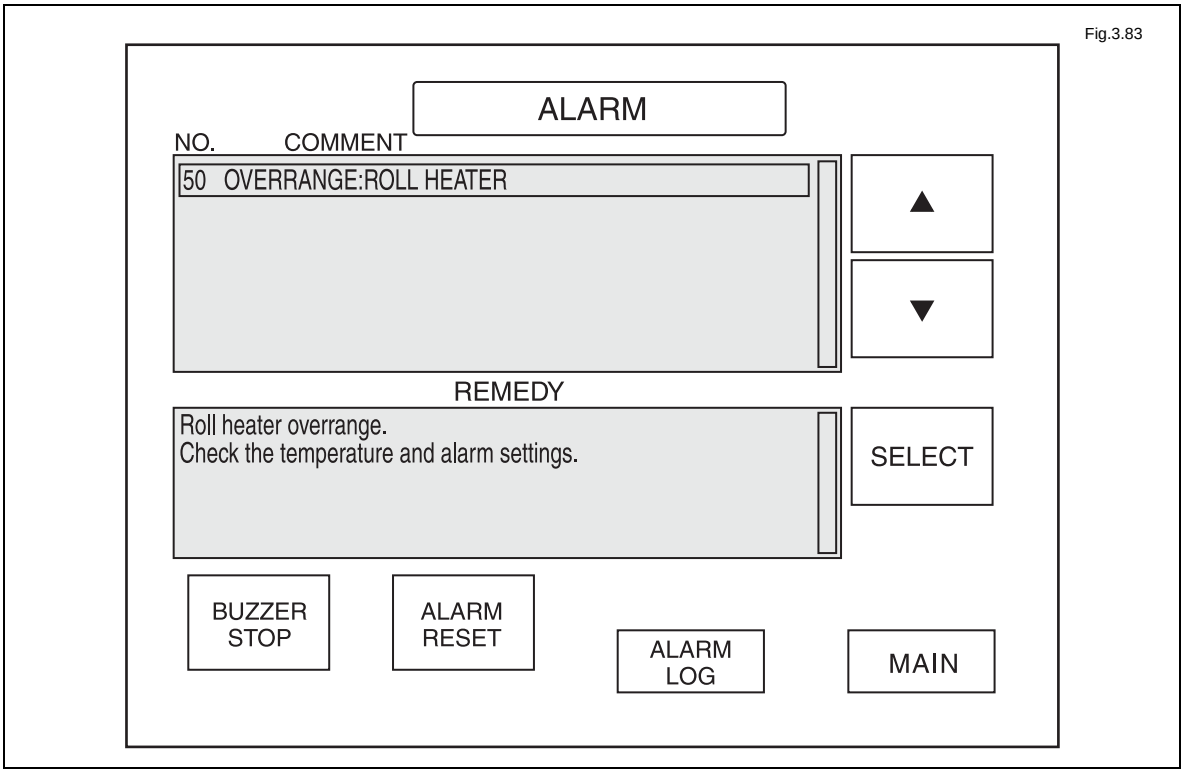
⚠ Warning

If the unit emits odor, smoke, or fire, DO NOT TOUCH THE UNIT! Immediately turn the main breaker OFF (○) and contact Hakuto or its official agent.

3.2 Alarm Comments and Actions

When the unit has failed, the alarm screen appears on the touch panel displaying the type of alarm(in the COMMENT section) and actions required(in the REMEDY section). To correct the problem, follow the instructions given on the screen.

Fig.3.83



【Table 3.3.1 Alarms and Possible Remedies】

No.	Alarm	System Reaction	Possible Remedy
01	PUSHED:EMERGENCY STOP SWITCH	A	The emergency switch has been pushed. Turn clockwise to release.
02	OPENED:CONTROL BOX DOOR	B	The control box door is open. Close the door.
03	LOW:AIR PRESSURE	B	The air pressure has dropped. Check the air hoses, regulator and factory compressed air.
04	OPENED:AUXILIARY PLATE *Option	B	The auxiliary plate behind the laminating rolls is not closed. Close correctly.
05	PULLED:LAMINATION UNIT	B	The lamination unit has been pulled out. Push until it locks in place.
06	FAILED:TACKING 1	B	Tacking failed. Check the tacking temperature and time.
07	FAILED:FILM CUT	B	The film cut failed. Check the cutter blade and shuttle unit.

【Table 3.3.1 Alarms and Possible Remedies (Continued)】

No.	Alarm	System Reaction	Possible Remedy
08	OVERLOAD	B	Blower overload. Check the pneumatic for clogging.
09	FAILURE:ROLL MOTOR	B	Roll motor drive alarm. Check the roll motor for overloading or overheating. Check the wiring for breaks or defects.
11	OVERRUN:UPPER CUTTER	B	The upper cutter overrun sensor is ON. Check for defects or problems in the setting , wiring of the motor driver , pulse generator and in the sensor wiring.
12	OVERTIME:UPPER CUTTER	B	Upper cutter run overtime. Check the cutter for smooth functioning. Check the in-position sensors at both ends for defects or problems.
13	OVERRUN:LOWER CUTTER	B	The lower cutter overrun sensor is ON. Check for defects or problems in the setting , wiring of the motor driver , pulse generator and in the sensor wiring.
14	OVERTIME:LOWER CUTTER	B	Lower cutter run overtime. Check the cutter for smooth functioning. Check the in-position sensors at both ends for defects or problems.
15	FAILURE:FRONT CENTERING BAR	B	Front centering bar cylinder failure. Check the tubing, solenoid valves, and sensors for defects or problems.
16	FAILURE:REAR CENTERING BAR	B	Rear centering bar cylinder failure. Check the tubing, solenoid valves, and sensors for defects or problems.
17	FAILURE:PINCH ROLL	B	Pinch roll forward/back mechanism failure. Check the clutch and brake for problems. Check the tubing, solenoid valves, and sensors for defects or problems.
18	FAILURE:ROLL UP/DOWN	B	Laminating roll up/down mechanism failure. Check the tubing, solenoid valves, and sensors for defects or problems.
19	FAILURE:UPPER TACKING PLATE	B	Upper tacking plate close/open mechanism failure. Check the tubing, solenoid valves, and sensors for defects or problems.
20	FAILURE:LOWER TACKING PLATE	B	Lower tacking plate close/open mechanism failure. Check the tubing, solenoid valves, and sensors for defects or problems.
21	FAILURE:LOCK PIN	B	Tacking block lock pin mechanism failure. Check the tacking block open/close end sensor position on the 85 mm stroke cylinder. Check the tubing, solenoid valves, and sensors for defects or problems.
24	OVERTIME:LAMINATION	B	Lamination overtime. Check the edge sensor for normal functioning. Check the input conveyor and roll encoders for defects or problems. Change the setting if the PWB is too long or the processing speed is too slow.
25	FAILURE:ROLL HEATER	C	Check the roll heater temperature controller or temperature sensor wiring for defects or problems. Confirm that the protection fuse has not blown out.
26	FAILURE:FILM GUIDE HEATER *Option	C	Check the film guide heater temperature controller or temperature sensor wiring for defects or problems. Confirm that the protection fuse has not blown out.

【Table 3.3.1 Alarms and Possible Remedies (Continued)】

No.	Alarm	System Reaction	Possible Remedy
27	FAILURE:TACKING HEATER	C	Check the tacking heater temperature controller or temperature sensor wiring for defects or problems. Confirm that the protection fuse has not blown out.
28	FAILURE:TEMP. SIGNAL TRANSMISSION	C	Transmission to temperature controller failure. Check the cable for transmission to the sequencer(PLC) and temperature controller.
29	FAILURE:INPUT CONVEYOR ENCODER	C	Encoder pulse is not generated. Check the input conveyor motor for function and the encoder for rotation.
30	FAILURE:ROLL ENCODER	C	Encoder pulse is not generated. Check the laminating roll motor for function and the encoder for rotation.
31	FAILURE:OUTPUT CONVEYOR ENCODER	C	Encoder pulse is not generated. Check the output conveyor motor for function and the encoder for rotation.
32	FAILED:TACKING2	B	Tacking failed. Check the tacking temperature and time.
33	OVERTIME:TACK BLOCK	B	TACK BLOCK run overtime. Check the motor for overloading or overheating. Check the wiring for breaks or defects.
34	FAILURE:SLIDE MOTOR	B	Slide motor drive alarm. Check the motor for overloading or overheating. Check the wiring for breaks or defects. After checking, open the cover of the power OFF switch. After turning off the power, wait at least 10 seconds before turning the power back on.
50	OVERRANGE:ROLL HEATER	D	Roll heater overrange. Check the temperature and alarm settings.
51	OVERRANGE:FILM GUIDE HEATER *Option	D	Film guide heater overrange. Check the temperature and alarm settings.
52	OVERRANGE:TACKING HEATER	D	Tacking heater overrange. Check the temperature and alarm settings.
53	UNLOCKED:LOCK PIN	D	The lock pin is not locked. In Manual mode move the tacking block to the closed position and lock the lock pin. Then switch to Auto mode.
54	LOW:UPPER REST FILM	D	The remaining film on the upper DF roll has reached the alarm setting. Replace the film and input the new roll's film length.
55	LOW:LOWER REST FILM	D	The remaining film on the lower DF roll has reached the alarm setting. Replace the film and input the new roll's film length.
56	REACHED:CUT COUNTS	D	The cut counts have reached the alarm setting. Replace the cutter blade and reset the current count value.
57	REACHED:PWB COUNTS	D	The PWB counter has reached the alarm setting. Reset the current count value.

【Table 3.3.1 Alarms and Possible Remedies (Continued)】

No.	Alarm	System Reaction	Possible Remedy
58	FAILURE:PWB FEED	D	When at least one sensor has detected a PWB and the edge sensor fails to detect it. The edge sensor may have failed. The alarm is also given when a PWB is removed after centering on the input conveyor. Confirm the cause of failure.
59	LOW:PLC BACKUP BATTERY VOLTAGE	D	The sequencer memory backup battery voltage has dropped. Replace with a new battery immediately.
60	FAILED:UPPER CUTTER HOMING	D	Upper cutter motor has not returned to its home position. Check the position of the cutter unit and determine whether either the front or rear in-position sensor is ON. Check whether the upper tacking plate is in the open position.
61	FAILED:LOWER CUTTER HOMING	D	Lower cutter motor homing is not completed. Check the position of the cutter unit and determine whether either the front or rear in-position sensor is ON. Check whether the lower tacking plate is in the open position.
62	OVERTIME:CENTERING	D	Input conveyor centering overtime. Check the PWBs for clogging or jamming.
65	OVERTIME:STOP CYCLE	D	Stop cycle overtime. Cut off the staled leading part of film, Film quality has deteriorated. Pull out the new leading part of film and load it again.

System Reaction

A:Power .....OFF Turn the power switch (main breaker) off.
The unit will enter the same state as when the power OFF button or the emergency stop button on the operation panel is pressed.

B:Operation stop.....Automatic operation will stop even when a PWB is being processed.

C:Operation-cycle stop .....The automatic-operation cycle will stop upon completion of the current PWB processing, in the same manner as when the automatic-operation "OFF" button is prossed.

D:Operation continuation.....Automatic operation will continue, and the operator will be informed of the failure by the system.

3.2 Actions in the Event of Problems

This section explains typical problems and the actions required to correct them.

Problem 1 Dry film wrinkles.

Possible cause	Action
The temperature of the laminating rolls is too high.	If the temperature of the laminate rolls is too high, the film will wrinkle. ・ Change the set temperature. →See 3.2.4.1 "Setting of Parameters," Part 2 "Operation."
	If the detection positions of the temperature sensors or the distance between their positions is improper, the displayed and actual temperatures will disagree. ・ Measure the temperature of the laminating rolls and place the temperature sensor at the proper position. →See 2.2.3 "Measurement of the Laminating Roll Temperature Distribution," Part 3 "Maintenance."
The temperature of the PWB immediately before laminating is too high.	If the temperature of the PWB immediately before laminating is too high, films will wrinkle. ・ Measure the temperature of the PWB. To make the surface temperature of the PWB appropriate, adjust the PWB preheating temperature in the upstream process.
Laminating rolls are	If the laminate rolls are not installed properly, the pressure of

Possible cause	Action
improperly installed.	the rolls will be unstable, causing films to wrinkle. → See 2.2.4 "Replacement of the Laminating Roll and the Roll Heater," Part 3 "Maintenance."
The laminating pressure is too high.	If the laminating pressure is too high, excessive force may be applied to the roll, causing films to wrinkle. ・ Set the roll pressure at the recommended value.
The roll bearing is broken.	If the bearing is broken, the laminating rolls will not rotate smoothly, causing films to wrinkle. ・ If the bearing emits noise, replace it. →See 1.3.7 "Replacement of the Roll Bearing (Chain driving type)," Part 3 "Maintenance."
The film guide is positioned obliquely.	If the film guide is installed obliquely, films will wrinkle, as they do not enter the laminating rolls evenly. ・ Ensure that the film guide is installed parallel to the rolls.
The tension roll is installed obliquely.	If the tension roll is installed obliquely, films will wrinkle, as they do not enter the laminating rolls evenly. ・ Make sure the tension roll is installed parallel to the rolls.
Cut films drop on the PWBs.	If air leaks from the air hose connected to the film guide or the air operation valve is defective, films will not be held by the film guide. ・ Check the connection to the air hose and the function of the air operation valve.

Problem 2 Bubbles emerge in dry film.

Possible cause	Action
The tacking temperature is too high.	If the tacking temperature is too high, bubbles will emerge. ・ Set an appropriate tacking temperature. → See 3.2.4.1 "Setting of Parameters," Part 2 "Operation."
The tacking time is too long.	If the tacking time is too long, bubbles will emerge. ・ Set an appropriate tacking time. ・ Note that the appropriate tacking time depends on the PWB thickness. → See 3.2.4.1 "Setting of Parameters," Part 2 "Operation."

Possible cause	Action
The temperature of the laminating rolls is too high.	If the temperature of the laminating rolls is too high, bubbles will emerge. ・ Change the set temperature. → See 3.2.4.1 "Setting of Parameters," Part 2 "Operation."
	If the detection positions of the temperature sensors or the distance between the rolls and the sensors are improper, the displayed and actual temperatures will differ. ・ Measure the temperature of the laminating rolls and place the temperature sensor in a proper position. →See 2.2.3 "Measurement of the Laminating Roll Temperature Distribution," Part 3 "Maintenance."
The temperature of the PWB immediately before laminating is too high.	If the temperature of the PWB immediately before laminating is too high, bubbles will emerge. ・ Measure the temperature of the PWB. To make the surface temperature of the PWB appropriate, adjust the PWB preheating temperature in the upstream process.
The tension roll swings excessively.	If the tension roll swings excessively, films will become slack and bubbles will be generated. ・ Adjust the tension roll so that films do not become slack.
The tacking rubber is worn.	If the tacking rubber is worn, the tacking pressure will become uneven and bubbles will be generated. ・ Replace the tacking rubber. →See 2.2.6 "Replacement of the Tacking-Rubber and Tacking Heater," Part 3 "Maintenance."
Cut films drop on PWBs.	If air leaks from the air hose connected to the film guide or the air operation valve is defective, films will not be held by the film guide. ・ Check the connection to the air hose and the function of the air operation valve.

Problem 3 The tacking block does not close.

Possible cause	Action
The lock pin is not unlocked.	The lock pin must be unlocked while the tacking block is open. ・ Make sure the four upper/lower and front/rear lock pins are unlocked.

Possible cause	Action
A screw or other foreign object is caught between the tacking block and unit side plate.	A slide guide is positioned between the tacking block and lamination module side plate. If a screw or foreign object becomes caught between the two, the tacking block will stick and will not close. ・ Make sure there are no foreign objects between the tacking block and lamination module side plate.

Problem 4 The lock pin does not enter the pin hole smoothly.

Possible cause	Action
The close-end sensor of the tacking block is improperly positioned.	The tacking block stops when it detects the close-end sensor. If the positions of the block and lock pin are not aligned when the tacking block stops, the pin will not enter the pin hole smoothly. ・ Adjust the position of the sensor.

Problem 5 The tacking block does not open.

Possible cause	Action
The lock pin is not retracted.	The tacking block will not open if the lock pin is not released or if the lock-pin sensor is not ON (even when the lock pin is released). ・ Check the four lock-pin cylinders (upper front, upper rear, lower front, and lower rear) to confirm that the lock pins are released. ・ Each of these cylinders has a sensor. The LED of the sensor is ON when the lock pin is released.
The solenoid valve does not operate.	When the tacking block has opened, measure the voltage of the solenoid valve for opening/closing the tacking block. ・ If the tacking block does not open when power is supplied, the solenoid valve is defective and must be replaced.
The tacking-plate suction hose is too short.	When the hose is not sufficiently long after being cut or replaced, it will pull the block when the tacking block is opened and will not allow it to open sufficiently. ・ Make sure the hose is sufficiently long.
A screw or other foreign object is caught between the tacking block and unit side plate.	A slide guide is positioned between the tacking block and lamination module side plate. If a screw or foreign object becomes caught between the two, the block will stick and will not move. ・ Make sure there are no foreign objects between the tacking block and the lamination module side plate).

Possible cause	Action
The edge sensor does not detect the PWB edge.	If the edge sensor does not detect the PWB edge, the tacking block will not move. ・ Check the sensitivity adjustment of the sensor and check the sensor wiring for breakage. →See 1.3.6 "Check/Adjustment of the Edge Sensor," Part 3 "Maintenance." ・ If there is a large hole or slit in the front edge of the PWB, the edge sensor will malfunction.

Problem 6 The tacking temperature does not increase.

Possible cause	Action
The tacking heater is turned OFF on the manual screen.	The tacking heater automatically turns ON in the automatic-operation mode. In the manual mode, however, the tacking temperature will not increase if the tacking heater is not turned ON on the manual screen. ・ Turn the tacking heater ON on the manual screen.
A tacking-heater alarm is issued.	When a tacking-heater alarm is issued, the heater turns OFF to ensure safety. ・ Make sure an alarm has not been issued. ・ Check the alarm screen on the touch panel display for additional information.
Power is not supplied to the tacking-heater connection terminal.	The heater is supplied with voltage controlled by a relay contact and solid-state relay. ・ Use a multimeter or voltmeter to check the voltage. ・ Check the ON/OFF operation of the relay. If it is not functioning properly, replace it.
The heater wire is broken.	The temperature will not increase if the heater wire is broken. ・ Remove the tacking heater to replace it. →See 2.2.6 "Replacement of the Tacking-Rubber and Tacking Heater," Part 3 "Maintenance."

Problem 7 The film guide temperature does not increase.

Possible cause	Action
The film guide heater is turned OFF on the manual screen.	The film guide heater automatically turns ON in the automatic-operation mode. In the manual mode, however, the film guide temperature will not increase if the film guide heater is not turned ON on the manual screen. ・ Turn the film guide heater ON on the manual screen.

Possible cause	Action
A film guide heater alarm is issued.	When a film guide heater alarm is issued, the heater turns OFF to ensure safety. ・ Make sure an alarm has not been issued. ・ Check the alarm screen on the touch panel display for additional information.
Power is not supplied to the film guide heater connection terminal.	The heater is supplied with voltage controlled by a relay contact and solid-state relay. ・ Use a multimeter or voltmeter to check the voltage.
The heater wire is broken.	The temperature will not increase if the heater wire is broken. ・ Remove the film guide heater to replace it. ・ Check the ON/OFF operation of the relay. If it is not working properly, replace it. →See 2.2.7 "Replacement of the Film-Guide Heater *Option," Part 3 "Maintenance."

Problem 8 The leading edge film placement is not stable.1

Possible cause	Action
The input-conveyor drive belt* or chain is loose.	When the belt* or chain for driving the conveyor rolls is loose, the position at which PWBs stop for tacking will not be stable. As a result, the tacking dimensions will be unstable as well. ・ Check the drive belt* or chain. →See 1.4.2 "Check/Adjustment of Drive-Belt Tension *Option," or 1.4.3 "Check/Adjustment of Drive-Chain Tension," Part 3 "Maintenance."
The set screw of an input-conveyor drive pulley* or sprocket is loose.	When the set screw of the gear, pulley*, or sprocket is loose, the position at which the PWB is stopped for tacking will not be stable. As a result, the tacking dimensions will be unstable as well. ・ Check all input-conveyor pulleys* or sprockets to confirm that their set screws are not loose.
The force of the input-conveyor clutch is weak.	When the force of the clutch is weak, the position at which PWBs stop for tacking will not be stable. As a result, the tacking dimensions will be unstable as well. ・ Replace the clutch if its force is weak.
PWBs do not pass the pinch roll smoothly.	If the pinch roll does not slide smoothly forward or back, it will stick to PWBs. ・ Check the forward-and-back sliding motion of the pinch roll.

Problem 9 The trailing edge film placement is not stable.

Possible cause	Action
The belts* or chain for driving the laminating roll or tacking block are loose.	If the set screw of a gear or pulley* or sprockets is loose, the roll speed and tacking-block closing speed will change when a film is cut. As a result, the lamination end dimensions will be unstable. ・ Make sure the set screws are not loose.

Problem 10 The film placement on the left and right sides differ.

Possible cause	Action
The dry film is not centered.	If the dry film is not centered on the PWB when it is tacked, the lamination dimensions on the left and right sides will differ. ・ Center the dry film roll on the DF Unit or DF Bulk Unit. →See 3.2.1.3 "Loading of DF Unit," Part 2 "Operation."
The setting of the PWB width on the input conveyor is not correct.	If the setting of the PWB width on the input conveyor is not correct, the lamination dimensions on the left and right sides will differ. ・ Make sure the centering-plate width is appropriately set for the PWB width, and that the centering plates are parallel with the conveyor flow direction. →See 3.2.3 "Adjustment of the Centering Width," Part 2 "Operation."
PWBs skew before entering the pinch-roll module.	If PWBs rotate slightly, and obliquely enter the pinch rolls followed by the laminating rolls, the lamination dimensions on the left and right sides will differ. ・ Make sure PWBs are straight when they enter the pinch roll.
The film guide is installed obliquely in relation to the laminating rolls.	The tip of the film guide must be parallel with the laminating roll shaft. ・ Adjust the film guide so that it is parallel with the laminating roll shaft.
The cutter backup is installed obliquely in relation to the laminating rolls.	The cutter backup and laminating roll shaft must be parallel. ・ Adjust the cutter backup so that it is parallel with the laminating roll shaft.

Problem 11 Films are not tacked properly.

Possible cause	Action
The PWB temperature immediately before tacking is low.	If the temperature of the PWB immediately before tacking is low, films may not be properly tacked, depending on the PWB width and thickness. ・ If the temperature of the PWB is low, increase the preheating temperature.
The tacking temperature is low.	If the tacking temperature is low, films will not be tacked. ・ Set an appropriate tacking temperature. → See 3.2.4.1 "Setting of Parameters," Part 2 "Operation."
The tacking-timer set time is short.	If the tacking time is too short, films will not be tacked. ・ Increase the tacking time. → See 3.2.4.1 "Setting of Parameters," Part 2 "Operation."
The dry-film length is too short to reach the tacking rubber.	If the suction force of the tacking-plate is weak, the film will not advance when the tacking block closes and will not reach the tacking rubber. ・ Check the suction of the blower fan and the connection of the air hose.
The tacking-plate vacuum is not turned OFF after tacking.	If the vacuum is not turned OFF after tacking is complete, films will be pulled up when the tacking plate opens. ・ Replace the solenoid valve.

Problem 12 The conveyor does not rotate.

Possible cause	Action
The motor is defective.	If the motor is worn, it will not drive the conveyor due to insufficient torque. ・ Disconnect the motor from the conveyor and run it by itself. If it rotates, the torque has decreased and the motor must be replaced. ・ If it does not rotate, the motor controller may have failed. Replace the motor controller.
The downstream machine is not in the receiving condition.	If a downstream machine is not in the automatic-operation mode or the receiving condition,and is connected to the unit by signal wires, the laminated PWBs will not be sent to the downstream machine. In such a case, automation operation will stop. ・ If the downstream machine is not in the receiving condition, the laminator's the automatic-operation switch will not turn ON. ・ Check the operation mode of the downstream machine.

Possible cause	Action
The set screw of the conveyor drive pulley* or sprocket is loose.	When the set screw of a gear, pulley* or sprocket is loose, the motor driving force will not be effectively transmitted to the conveyor. ・ Make sure the set screws of all conveyor pulleys* and sprockets are tight.
The force of the conveyor clutch and brake is weak.	When the force of the solenoid clutch is weak, the motor driving force will not be transmitted to the conveyor. ・ Replace the clutch and/or brake.

* When the drive belt is chosen as an option.

Problem 13 PWBs do not move to the conveyor.

Possible cause	Action
The downstream machine is not in the receiving condition.	If a downstream machine is not in the automatic-operation mode or the receiving condition, and is connected with the unit by signal wires, the laminated PWBs will not be sent to the downstream machine. In such a case, the automation operation will stop. ・ If the downstream machine is not in the receiving condition, the laminator's automatic-operation switch will not turn ON. ・ Check the operation mode of the downstream machine.

Problem 14 Films cannot be cut.

Possible cause	Action
The cutter is nicked.	If the cutter is nicked, films will not be cut. ・ Replace the cutter. →See 1.3.3 "Cleaning/Replacement of the Cutter."
Resist is adhering to the cutter.	If resist is adhering to the cutter, its cutting performance will deteriorate and debris will be generated. ・ Clean the cutter. →See 1.3.3 "Cleaning/Replacement of the Cutter."
The cutter is too far from the cutter backup.	If the cutter is too far from the cutter backup, it will not contact or cut films. ・ Adjust the position of the cutter running rail so that the cutter appropriately contacts the film.
Vacuum pressure is not supplied.	When a film is cut, vacuum pressure should be supplied to the tacking plate, cutter backup, and film guide. ・ Check the solenoid valve and the connecting air tubes.

Problem 15 Films are cut obliquely.

Possible cause	Action
The cutter running rail is installed obliquely.	When the cutter running rail is installed obliquely, the cutter operates askew and cuts films obliquely. ・ Make sure the running rail is installed straight.

Problem 16 The roll temperature does not increase.

Possible cause	Action
The roll heater is turned OFF on the manual screen.	The roll heater automatically turns ON in the automatic-operation mode. In the manual mode, however, the roll temperature will not increase if the roll heater is not turned ON on the manual screen. ・ Turn the roll heater ON on the manual screen.
A roll-heater alarm is issued.	When a roll-heater alarm is issued, the heater turns OFF to ensure safety. ・ Confirm that an alarm has not been issued.
Power is not supplied to the laminating roll-heater slip-ring brush.	The laminating roll heater is supplied with voltage controlled by a relay contact and solid-state relay. ・ Use a multimeter or voltmeter to check the voltage. ・ Check the ON/OFF operation of the relay. If the relay is not funtioning properly, replace it.
The heater wire is broken.	The temperature will not increase if the heater wire is broken. ・ Replace the roll heater. → See 2.2.4 "Replacement of the Laminating Roll and the Roll Heater."
The temperature sensor is soiled.	If the temperature sensor is soiled, the sensor will malfunction. ・ Clean the sensor.

Problem 17 Laminating rolls are scratched or damaged.

Possible cause	Action
PWBs have not been cleaned sufficiently.	If PWBs are not sufficiently washed in the chemical cleaning process, chemical substances (primarily acid) will remain on the PWBs, which will in turn contact the laminating rolls and damage them through chemical reaction. ・ Make sure PWBs are sufficiently washed.
Burrs and breakage frequently occur in the upstream process.	If there are burrs or breakage on the PWBs, they will scratch or dent the laminating rolls.

Appendix

Contents of this Chapter

■ Guarantee Clauses

Application of Warranty

(1) The warranties listed below are applicable to the system delivered by Hakuto or its official agent to the end user. It is non-transferable.
(2) Any part of the warranty may be exempted or modified when such changes are agreed upon in writing by both Hakuto and the end user to whom the system is delivered.

Warranties

(1) Term and period
12 months after delivery.
(2) Warranties
If a fault occurs within the warranty period and the user sends a written claim to Hakuto, Hakuto will repair the system or provide an alternate system. Replacement of the system will solely be at Hakuto's discretion.
(3) Scope
The warranties are applicable to Hakuto systems only. Hakuto is not responsible for any personal injury or any damage to production caused by other equipment or by interrupted processes.
All costs for delivery and installation of the system, and for returning the system are the sole responsibility of the end user. The warranty should not exceed the repair or replacement cost of the system.

Hakuto is not responsible for providing warranty support:

(a) When no claim is requested within the warranty period.
(b) When the system or part in question is consumable.
(c) When the fault is caused by any party who handles the system during installation other than Hakuto or its official agent.
(d) When the system is repaired or modified by any agent not approved by Hakuto.
(e) When the fault is caused by natural disaster or any other unavoidable accident.
(f) When the fault or damage is caused by improper handling by a third party other than Hakuto during transport and movement.

Hakuto is responsible for said warranties only.

■ After-Sale Service

Before requesting repairs, please read this Instruction Manual again and inspect the system according to the procedures outlined herein. If the error is persists contact Hakuto or your local Hakuto representative. When you request repairs please provide the following items:

- Model number
- Product number and serial number stamped on the nameplate
- Operation time (number of hours the machine has been in use)
- Operation condition and environment
- A detailed description of the problem

If the damage is extensive, the user may be requested to send a part or all of the system to Hakuto, in which case it may take a long time to complete repairs.

Re-coating of the Laminating Roll Rubber

Hakuto re-coats laminating rolls with new rubber. Simply fill out a laminating roll re-coating label and send it to us.

1. Address: In Japan Isehara Logistic Center,
   Hakuto Co., Ltd., 42 Suzukawa,
   Kanagawa prefecture
   TEL: 0463 (93) 8910

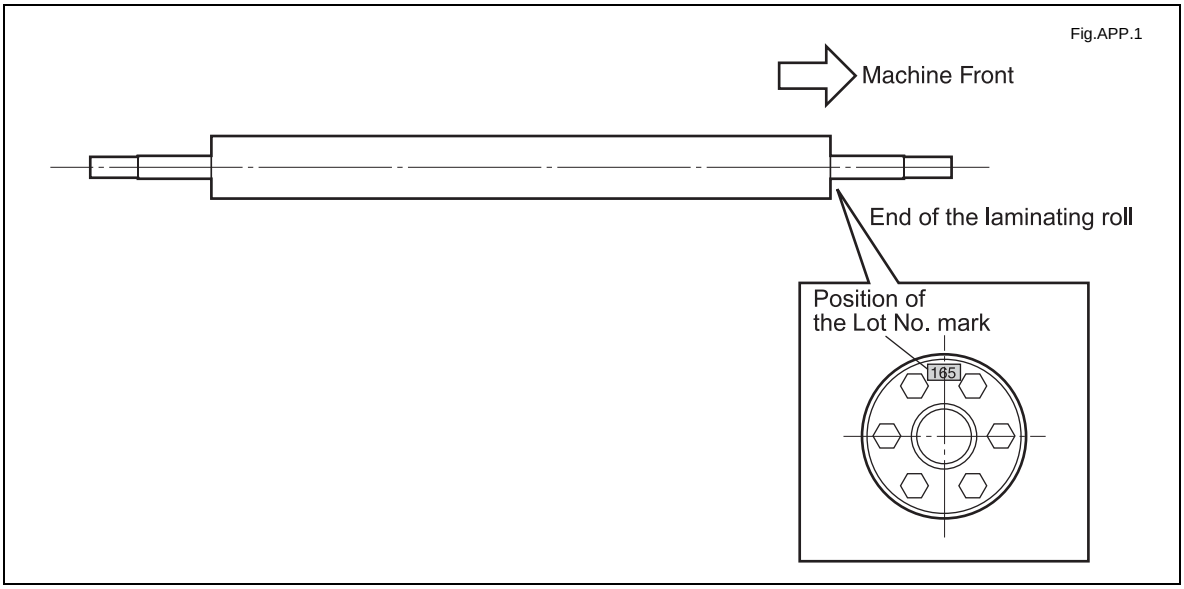
   In other countries Contact the nearest Hakuto agent.

2. Packing Material: Use special packing material (corrugated fiberboard) for the laminating rolls.
   Laminating rolls are heavy. Therefore, if other packing materials are used, a sufficient amount of cushioning material will be necessary.

3. Laminating Roll Re-coating Label:
   Fill out the label and affix it to the outside of the packing material.
   If you require laminating roll re-coating labels, contact Hakuto or the nearest Hakuto agent.

Laminating roll re-coating label Hakuto Co., Ltd.		
Company		Shipping date: Month, day, year
Division/person in charge		
Telephone No.		
Machine type	MACH 610V/ 630UP	
Lot No.		
Remarks		

4. Position of the lot No. mark



■ Basic Specifications

(1) Specifications of the Unit

Item		Specification
Lamination	Laminating roll	ϕ77.5 × 680 mm (L) (× 2pcs)
	Roll heater	ϕ20 × 750 mm (L), 3 element 200 V, 1.5-kw sheath heater, (× 2 pcs)
	Pressurizing method	Arm-type pinch-roll mechanism ϕ63 mm air cylinder, (× 2 pcs)
	Pressure	Recommended pressure: 272 kgf (air pressure: 4.0 kgf/cm^2) MAX. 334 kgf (air pressure: 5.0 kgf/cm^2)
	Roll surface	Recommended surface temperature: 120℃, MAX. 150℃ Accuracy; range within 6℃ (at set value: 110℃) measurement width: 630 mm; no loads) Roll surface material: silicon rubber; hardness: 70℃
	Temperature control	Individual ON/OFF control for center and edge heating area on each Laminating roll Infrared thermocouple, (× 4 pcs)
	Thick-PWB mode (roll automatic up/down system)	The unit adjusts the timing of the upper laminating roll's up-and-down movement to compensate for thicker PWBs.
Film preheat *Option	Film-guide heater	25.4 mm (W) × 635 mm (L), 200 V, 250 W sheet heater, (× 2 pcs)
	Film-guide temperature	Temperature MAX. 60℃
	Temperature control	ON/OFF control, seat-type thermocouple, (× 2 pcs)
Film loading	DF units	Upper-and-lower-cartridge-unit type
	DF bulk units	Upper and lower film rolls and eco-roll loaded in the unit individually.

Item		Specification
Film tacking	Tacking heater	ϕ3.2 mm × 645 mm (L), 27.5 V, 100 W sheath heater, (× 2 pcs)
	Tacking-plate drive	ϕ32 mm × 90 mm stroke air cylinder, (× 4 pcs)
	Pressure	Pressure MAX. 40 kgf (air pressure: 2.5 kg/cm^2)
	Tacking rubber	4 mm (W) × 642 mm (L) thermal conductive special silicon, (× 2 pcs) Surface temperature MAX. 70℃
	Temperature control	PID control ϕ1.6 mm × 250 mm (L) sheath-type thermocouple, (× 2 pcs)
Film cut	Cutter	ϕ64 mm × 0.8 mm (t) disk cutter, (× 2 pcs)
	Cutting method	Low rotation speed cutter, high running speed shuttle Belt/stepping-motor drive for the upper and lower units, (1 piece each)
Film holding	Tacking plate	Upper and lower porous-plate suction-holding units (1 piece each) 5 vacuum zones on each plate (including one zone for hand-valve operation) Negative pressure source, 200 V, 1.5 kw, high-pressure blower (1 piece)
	Film guide, cutter backup	Upper and lower porous-plate suction-holding units (1 piece each) Negative pressure source, 200 V, 0.9 kw turbo blower (1 piece)

Item		Specification
PWB feeding	Conveyor	Roll conveyor; effective width: 640 mm × 2150 mm (L) Roll material: nitryl rubber, stainless steel
	Conveyor speed	1.0 m/min to 5.5 m/min, variable
	Positioning	Width direction ... Automatic centering by separately operated guide plates, ϕ32 mm × 50 mm stroke air cylinder, (× 2 pcs) Flow direction ... A photo-sensor detects the PWB edge and an encoder counter stops the unit at the appropriate position (tacking position).
	Thin-PWB feeding mechanism	Pinch-roll module Forward ... Moves forward in synchronization with the conveyor speed; stroke: 95 mm(L); clutch and brake control Backward ... ϕ20 mm × 100 mm stroke air-cylinder drive, 1 piece (stroke: 95 mm when in use) Auxiliary guide ... Aluminum, Teflon surface treatment
Film tension	Roller swing tension	ϕ38 mm × 636 mm (L) tension roll, (× 2 pcs) ϕ25 mm × 25 mm stroke air-cylinder drive, (× 2 pcs)
	Vacuum tension	Tension created by the tacking-plate vacuum (when "vacuum tension" is selected)
Contamination	Anti-static	Eliminates the electrostatic charges of the upper and lower films through the use of static bars, (× 2 pcs)
	Cover	Main unit ... Upper and input/output sections, (× 3 pcs) Input conveyor ... Upper section, (× 1 pcs) Output conveyor... Upper section, (× 1 pcs) Anti-static resin covers, smoke color
Electrical control	Sequencer (PLC)	Relay symbol, stepladder type
	Touch-panel display	STN color LCD, 7.7 inches
	Display	Touch panel, indicator
	Control box	1600 mm (W) × 250 mm (D) × 685 mm (H): The power-source breaker switch is operated from outside.
	Manual operation	Touch panel (without a hand-held operation unit)
	Safety measures	Emergency stop, interlock, door switch, alarm, buzzer, signal tower
Others	Frame	Base frame ... Welded square pipe structure,

Item		Specification
		black baked finish Main-unit frame ... Welded square pipe structure, stainless
	Cover	Lower part, front of the main unit, rear side ... Aluminum, alumite finish, anti-static resin, clear color. Ceiling of the main unit, Input/output sections ... Anti-static resin, smoke color. Input and Output conveyor sides ... Stainless, luster finish, anti-static resin, smoke color. Upper Input and Output conveyor ... anti-static resin, smoke color.

Note): For options, see the separate "Optional Specifications."

(2) Capacity

Item		Capacity
PWB size	Size	MIN. 250 mm (W) × 250 mm (L) MAX. 640 mm (W) × 640 mm (L)
	Thickness	0.1 mm to 6.0 mm 0.06 mm to 1.0 mm(*Thin Panel Option) Note 1) Double-sided copper lamination, Glass epoxy core Note 2) Tests are required for PWBs other than those with a glass epoxy core when the Thin-Panel Option is used.
Processing speed	610L (24 inches) PWB	318 pieces/hour
	475L (18 inches) PWB	375 pieces/hour
	305L (12 inches) PWB	455 pieces/hour Note 1) Conveyor speed: 5.5 m/min Tacking time: 1.3 s; distance to the next PWB after tacking: 20 mm Note 2) The quantity of treated PWBs is a theoretical value.

Item		Capacity
Dry film	Width	250 mm to 630 mm
	Outer DF diameter	MAX. ϕ200 mm (when the DF unit is used) MAX. ϕ250 mm (when DF bulk unit is used)
	Core inner diameter	ϕ75.6mm *Option: ϕ76.0, 76.2, 76.9 mm *Option: ϕ132.0, 132.4 mm
Film lamination	Range and accuracy of the lamination position	A:2 to 60mm ±1.0mm B:0 to 25mm ±1.0mm PWB width - film width C: mm ±1.0mm 2 Note 1) The above figure represents the mechanical accuracy, excluding errors in the PWB outer configuration, film winding, and film characteristics.

(3)Utilities and Installation

Item		Specification
Utilities	Power source	ϕ3 220/200V 50/60Hz 10kw
	Air source	5kgf/cm^2 15L/min ISO Rc1/4 inches
	Exhaust	9.5m3/min ϕ150mm duct
Unit size	Volume	2150 mm (W) × 1585 mm (D) × 2150 mm (H)
	Weight	1.3ton（approx. 380kgf/m^2）
Pass line	Height	900mm
	Flow direction	When viewed from the front (operation-panel side) ・Left → right ・Right → left Note 1) Determine at order placement.

■ List of Recommended Parts

The table below shows the parts, including consumable parts, that must be replaced and inspected regularly). To ensure effective use of the unit, it is recommended that these parts be kept in stock.

● Parts of rank A wear faster than those of rank B.

■ Table of Recommended Parts

No.	Part	Part No.	Rank	Quantity used in the unit	Used module
1	Roll temperature sensor	006034	B	4	Lamination
2	Tacking temperature sensor	106008	B	2	Lamination
3	Film-guide temperature sensor *Option	006031	B	2	Lamination
4	Clutch	018021	A	1	Input conveyor
5	Brake	018022	A	1	Input conveyor
6	Clutch and Brake	018020	A	4	Input conveyor
7	Clutch and Brake	018031	A	1	Input conveyor
8	Bearing	045051	A	8	Lamination
9	Bearing	045050	A	8	Lamination
10	Roller follower	045052	A	8	Lamination
11	Air cylinder	021032	A	2	Lamination
12	Air cylinder	021033	A	2	Lamination
13	Solenoid valve	022025	A	5	Air blower
14	Solenoid valve	022022	A	8	Air blower
15	Solenoid valve	022023	A	1	Air blower
16	Solenoid valve	022024	A	2	Air blower
17	Solenoid valve	022028	A	1	Air blower
18	Speed controller	020508	A	Multiple	-
19	Polyurethane tube	024006	A	Multiple	-
20	Photo-sensor	003014	B	4	Input conveyor
21	Photo-sensor amplifier unit	006048	B	1	Input conveyor
22	Phot-sensor fiber unit	003013	B	1	Input conveyor
23	Rotary encoder	006023	A	2	Input/Output conveyor

No.	Part	Part No.	Rank	Quantity used in the unit	Used module
24	Rotary encoder	006038			Lamination
25	Solid-state relay	001023	B	8	Control box
26	Relay	001017	A	1	Control box
27	Relay	001042	A	2	Control box
28	Relay	001043	A	20	Control box
29	Relay	001541	A	1	Control box
30	Solid-state relay	001040	B	4	Control box
31	Solid-state relay	001041	B	5	Control box
32	LED lamp（G）	000571	B	1	Operation panel
33	LED lamp（R）	000573	B	1	Operation panel
34	LED lamp（Y）	000572	B	3	Operation panel
35	LED lamp（W）	000574	B	1	Operation panel
36	Cylindrical fuse	000438	A	6	Control box
37	Cylindrical fuse	000446	A	2	Control box
38	Glass-pipe fuse	000447	A	1	Control box
39	Front housing	00A06004	A	2	Lamination
40	Rear housing	00A06005	A	2	Lamination
41	Bush	00A01343	A	4	Lamination
42	Sprocket	044750	A	2	Lamination
43	Sprocket	00A02313	A	1	Lamination
44	Sprocket	044751	A	1	Lamination
45	Chain	044752	A	1	Lamination
46	Sprocket	00A02211	A	4	Input conveyor
47	Sprocket	044746	A	2	Input conveyor
48	Sprocket	00A02224	A	1	Input conveyor
49	Sprocket	044747	A	1	Input conveyor
50	Chain	044745	A	1	Input conveyor
51	Chain	044744	A	1	Input conveyor
52	Sprocket	044775	A	1	Lamination
53	Chain	044776	A	1	Lamination
54	Sprocket	00A11141	A	2	Lamination
55	Sprocket	00A11142	A	1	Lamination
56	Chain	044777	A	1	Lamination

No.	Part	Part No.	Rank	Quantity used in the unit	Used module
57	Sprocket	00A11143	A	1	Lamination
58	Sprocket	00A11154	A	1	Lamination
59	Sprocket	044757	A	1	Lamination
60	Chain	044778	A	1	Lamination
61	Sprocket	00A12150	A	1	Input conveyor
62	Sprocket	044779	A	3	Input conveyor
63	Sprocket	044780	A	5	Input conveyor
64	Sprocket	044754	A	1	Input conveyor
65	Sprocket	044757	A	3	Input conveyor
66	Chain	044782	A	1	Input conveyor
67	Sprocket	044773	A	1	Input conveyor
68	Sprocket	044781	A	1	Input conveyor
69	Sprocket	044757	A	1	Input conveyor
70	Chain	044777	A	1	Input conveyor
71	Sprocket	044753	A	7	Output conveyor
72	Sprocket	00A02409	A	1	Output conveyor
73	Sprocket	044754	A	1	Output conveyor
74	Sprocket	044757	A	1	Output conveyor
75	Chain	044749	A	1	Output conveyor
76	Timing belt *Option	018050	A	1	Input conveyor
77	Timing belt *Option	018051	A	1	Input conveyor
78	Timing belt *Option	018053	A	1	Lamination
79	Timing belt *Option	018049	A	1	Lamination
80	Timing belt *Option	018040	A	1	Lamination
81	Timing belt	018052	A	2	Lamination
82	Flat belt	018045	A	2	Lamination

■ List of Consumable Parts

The table below shows the consumable parts that must be replaced and inspected regularly. The consumable parts will wear within one year if the unit is used eight hours per day or 48 hours per week, and are not covered by warranty.

■ Table of Consumable Parts

No.	Part	Part No.	Remarks
1	Laminating roll	11603162	2
2	Roll heater	142021	2
3	Slip ring	11502812	2
4	Slip-ring brush	11502813	6
5	Tacking rubber	11503535	2
6	Tacking heater	142024	2
7	Film-guide heater *Option	042008	2
8	Cutter	044022	2
9	Leakline filter	028540	1

For the methods for replacing the above parts, see Part 3 "Maintenance."

■ Glossary

This appendix explains terms used in this manual. Understanding these terms is necessary for proper use of this unit.

Term	Description
Air-operated valve	A valve for compressed air and vacuum air circuits. The valve is operated by air pressure controlled by a small external solenoid valve (no electricity is used).
Centering mechanism	A mechanism in which two plates move toward each other to center a PWB on the input conveyor.
Contaminant	A particle contaminating the PWB lamination process.
Cutter backup	A bar with a groove in which the cutter blade moves. It also uses suction to hold dry film in place.
Default setting	The setting predetermined by the software program that becomes active if no valve for a given parameter is entered into the system.
DF unit	This unit unifies the dry film roll and the cover film winding roll (eco-roll) so that they can be removed from or loaded into the lamination module with a single motion.
Downstream unit	A unit that is installed in the manufacturing line that performs a function AFTER dry film lamination.
Dry film	A film that consists of a laminate film to be heat-laminated to a PWB (carrier film and photo resist) and a cover film that protects an adhesive face. Load the dry film into the DF unit, and then load the unit into the lamination module (or load it into the DF bulk unit of the lamination module).
Lint-free cloth	A cloth used in the clean room that doesn't produce any lint.
Electrode brush	A contact part that is installed at the electrode used to provide the power to the roll heater (the a heat source of the laminating roll). It is necessary to check and replace this brush periodically as it wears down over time.
Factory air (primary air)	Air supplied from the factory and connected to the unit. Required for operation.
Factory-side primary power supply	The power supply provided from the factory and connected to the unit. Required for operation.

Term	Description
Home position	Indicates that each section of the unit has returned to the predetermined initial operating position.
Inching operation	An operation to turn the power ON momentarily, and then turn the power OFF for the purpose of checking operation. For example, this operation is used to check the direction of the rotation of the blower fan.
Interlock switch	A safety switch to stop operation promptly when a door is opened during production. It has the same effect as when the emergency stop switch is pressed. This switch is located within the control box door on the back of the unit.
Laminate film	A film containing a photo-resist that will be heat-laminated to a PWB and a carrier film.
Laminating roll	A hot cylindrical roller used to apply photo-resist to a PWB.
Leak line filter	It is a filter to prevent a back-draft when the vacuum on the film guide or vacuum plater a momentarily turned off during lamination.
Normal open (NO)	A state in which the contact for an electromagnetic relay is open, preventing the flow of electricity. On the other hand, the state where the contact is closed is referred to as "normal close (NC)."
Particle	Dust or other material floating in the air.
PID control	A control method to minimize large temperature changes in the tacking heater. Stands for "proportional, integral, and differential control.
Reference sensor	Located at the edge of the input conveyor (on the downstream side), and detects the leading and trailing edges of a PWB.
Rotary encoder	A pulse oscillator that generates a pulse by the rotation of the input shaft. The location of a PWB on the conveyor can be determined by the signal detected by the reference sensor and the pulse of rotary encoder.
Setup	For preparation before operation, load the DF unit into the main unit (this loading step is not required for the DF bulk unit model), and place the laminate film along the film running surface. This step is done using the setup button on the operation panel.

Term	Description
Tacking	An action to heat-laminate the edge section of a laminate film to the leading edge of a PWB with the tacking plate. The PWB tacked with the laminate film is then transferred to the laminating roll by the pinch roll.
Tacking time	The time required to tack a laminate film to a PWB with the tacking plate.
Thermo-couple	A sensor used to measure surface temperature. Connect to a measuring device and hold it to the point to be measured when it is necessary to measure the surface temperature for maintenance.
Thick-PWB mode	This mode is selected to laminate a thicker PWB. The laminating roll motion is changed.
Upstream unit	A unit that is installed in the manufacturing line that performs a function BEFORE dry film lamination.

■ Index

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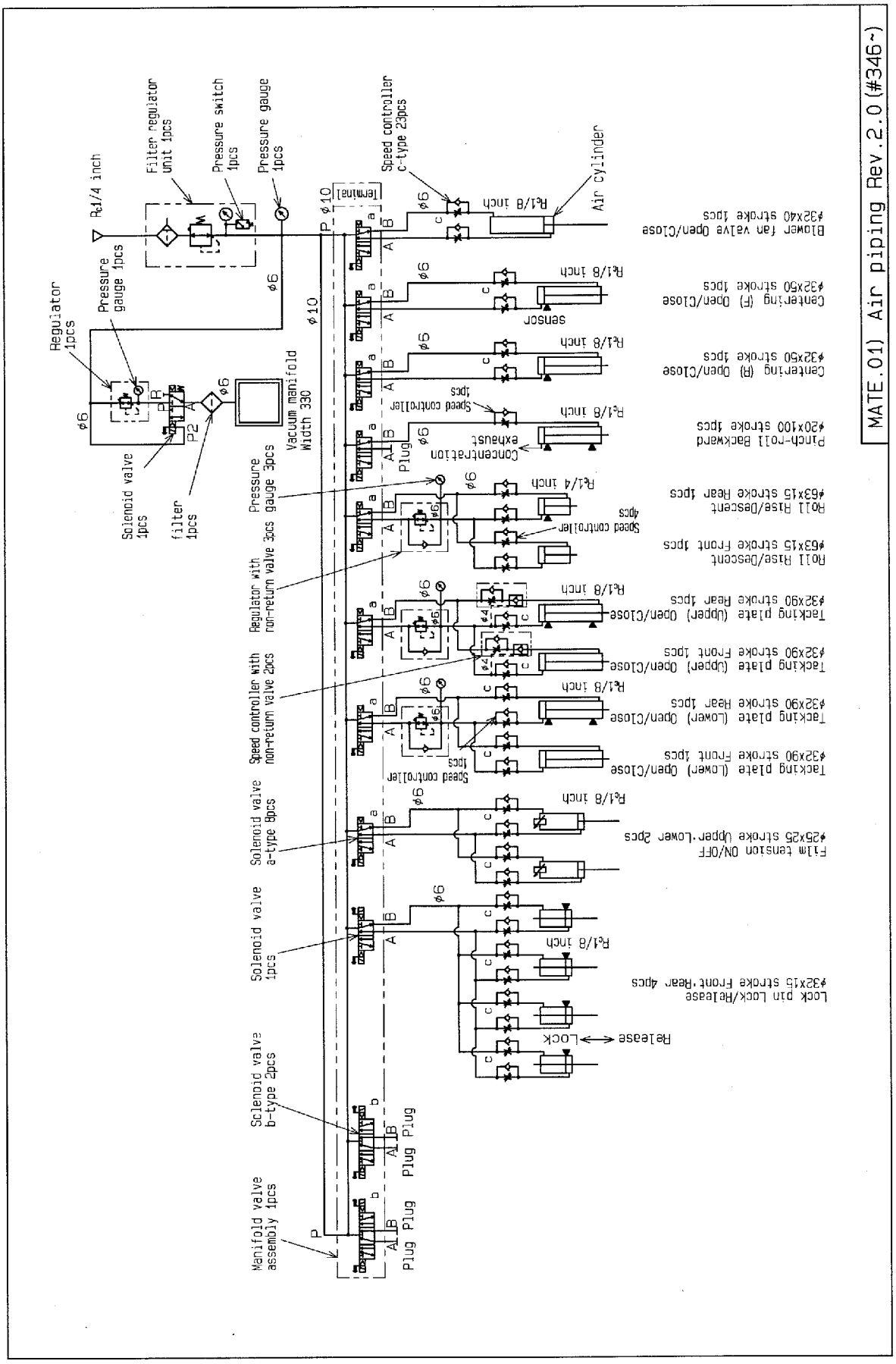
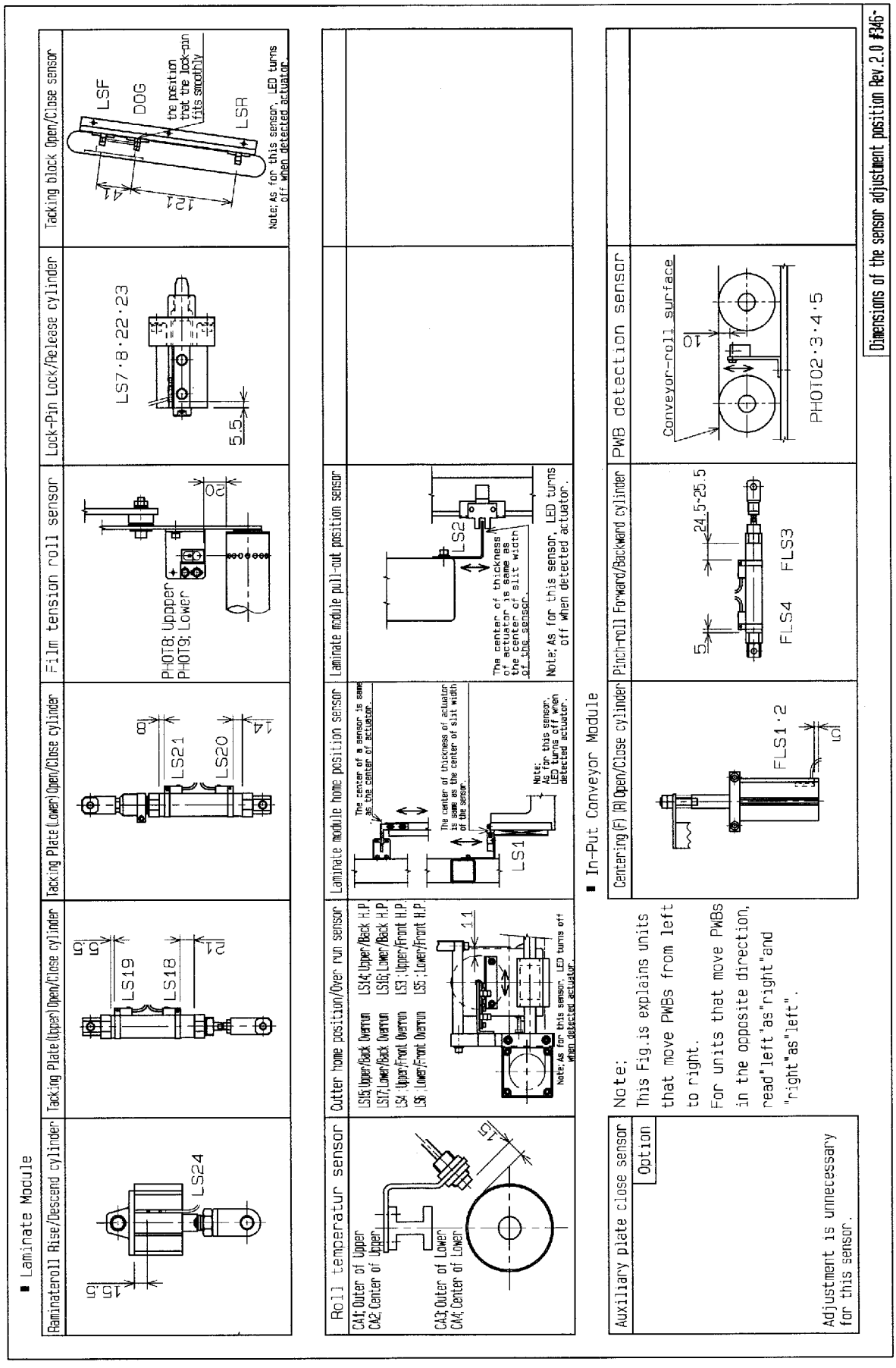
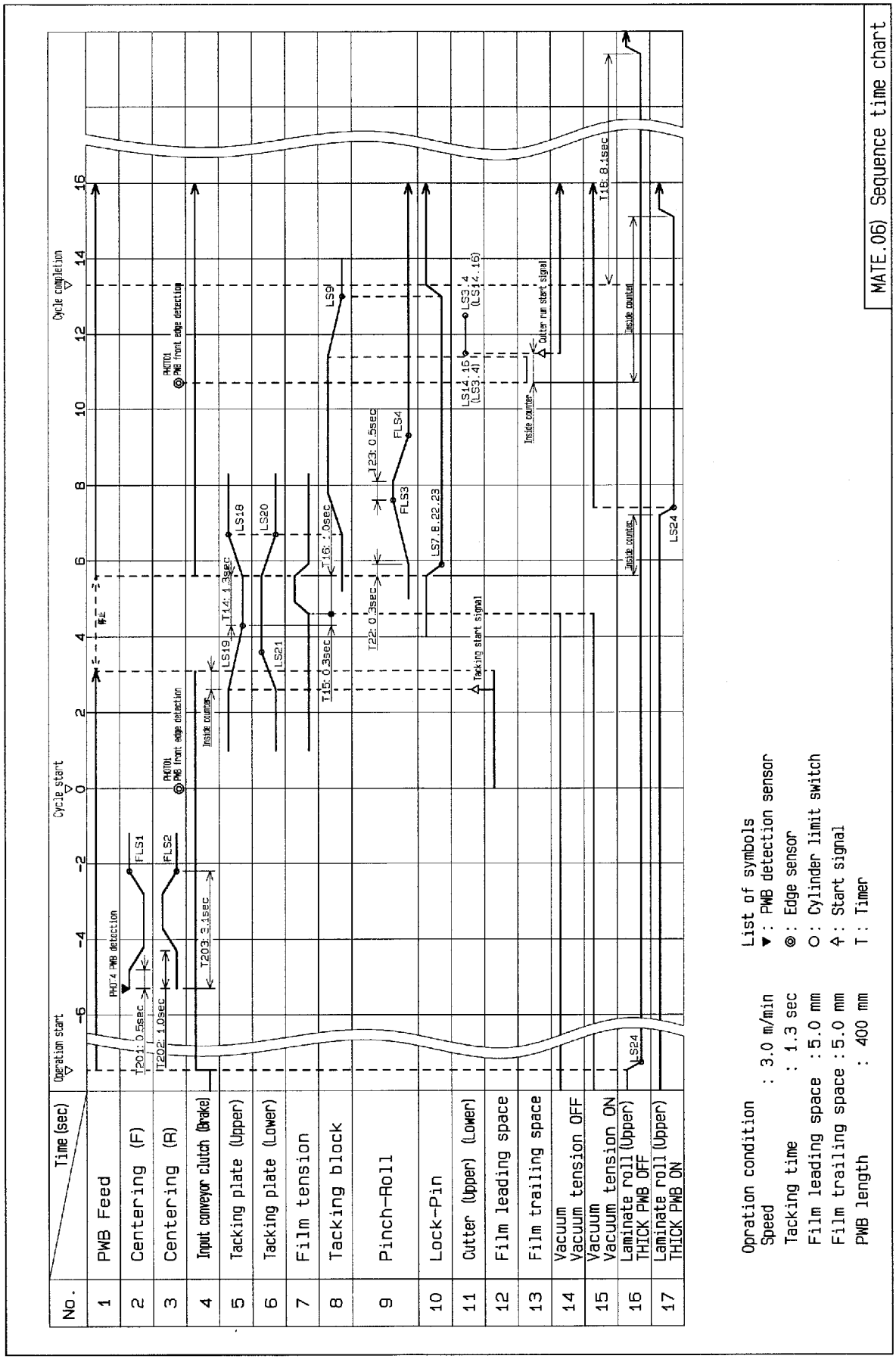
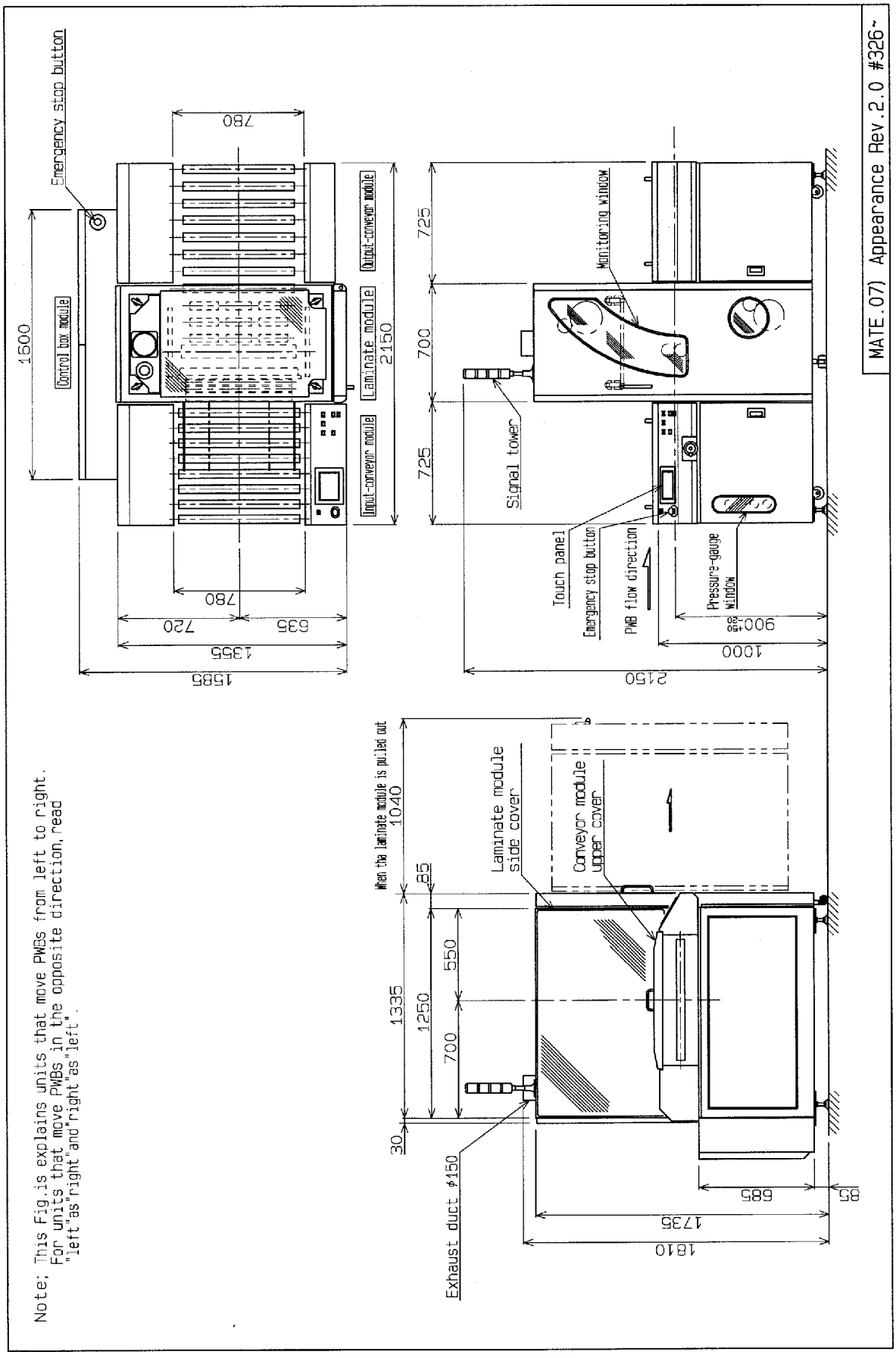
■ Air piping



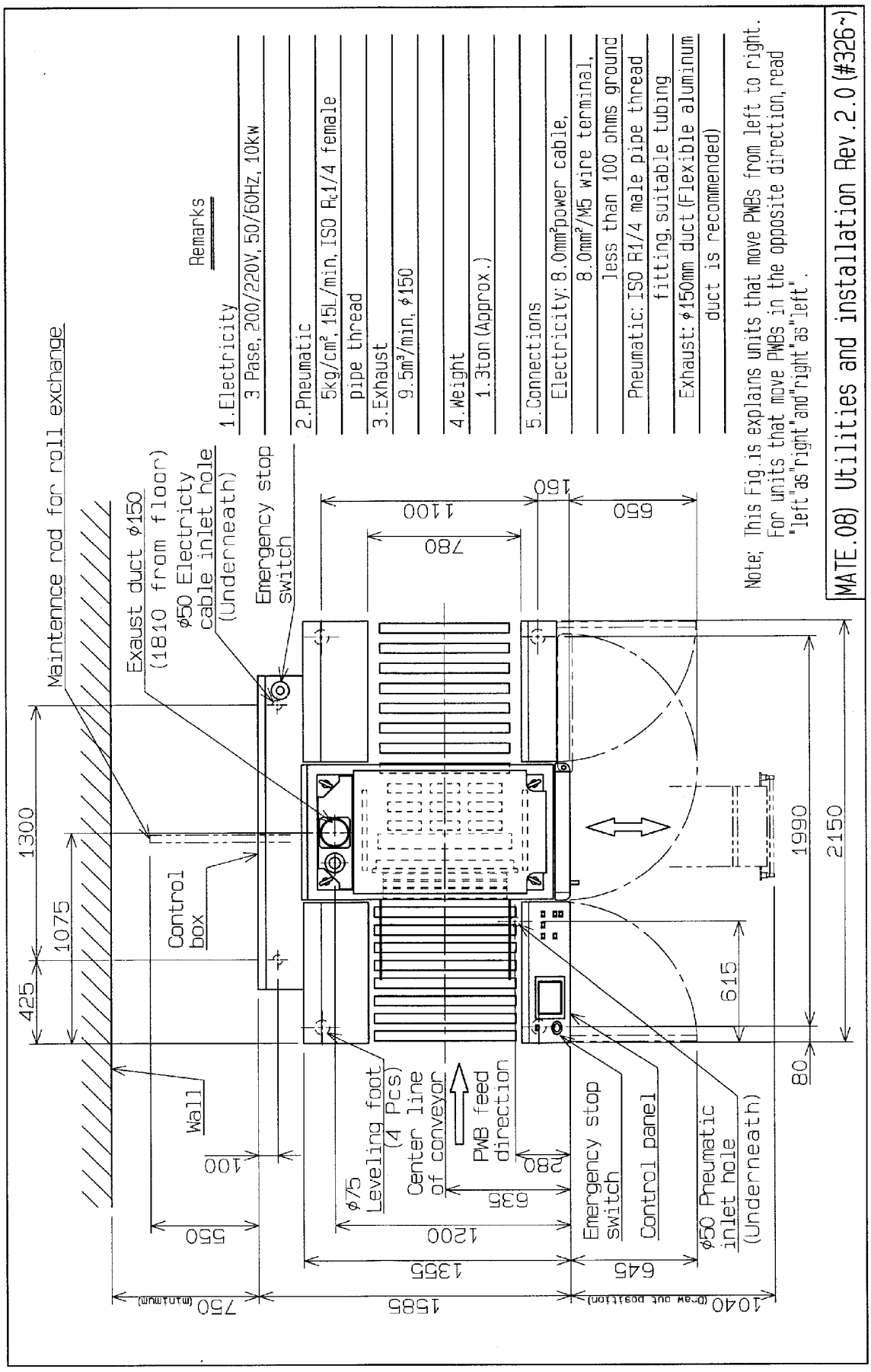

■ Laminate Module
Raminateroll Rise/Descend cylinder
Tacking Plate(Upper) Open/Close cylinder
Tacking Plate(Lower) Open/Close cylinder
Film tension roll sensor
Lock-Pin Lock/Release cylinder
Tacking block Open/Close sensor
LS24
LS19
LS18
LS21
LS20
PHOTO8; Upper
PHOTO9; Lower
LS7·8·22·23
5.5
LSF
DOG
LSR
the position that the lock-pin fits smoothly
Note; As for this sensor, LED turns off when detected actuator.
Roll temperatur sensor
CA1; Outer of Upper
CA2; Center of Upper
CA3; Outer of Lower
CA4; Center of Lower
Cutter home position/Over run sensor
LS16; Upper/Back Overrun
LS17; Lower/Back Overrun
LS4 ; Upper/Front Overrun
LS6 ; Lower/Front Overrun
LS13; Upper/Back H.P.
LS15; Lower/Back H.P.
LS3 ; Upper/Front H.P.
LS5 ; Lower/Front H.P.
Note; As for this sensor, LED turns off when detected actuator.
Laminate module home position sensor
The center of a sensor is same as the center of actuator.
The center of thickness of actuator is same as the center of slit width of the sensor.
LS1
Note; As for this sensor, LED turns off when detected actuator.
Laminate module pull-out position sensor
LS2
The center of thickness of actuator is same as the center of slit width of the sensor.
Note; As for this sensor, LED turns off when detected actuator.
■ In-Put Conveyor Module
Auxiliary plate close sensor
Option
Adjustment is unnecessary for this sensor.
Note;
This Fig.is explains units that move PWBs from left to right.
For units that move PWBs in the opposite direction, read"left"as"right"and "right"as"left".
Centering(F)·(R) Open/Close cylinder
FLS1·2
Pinch-roll Forward/Backward cylinder
24.5~25.5
FLS4
FLS3
PWB detection sensor
Conveyor-roll surface
PHOTO2·3·4·5
Dimensions of the sensor adjustment position Rev.2.0 #346-

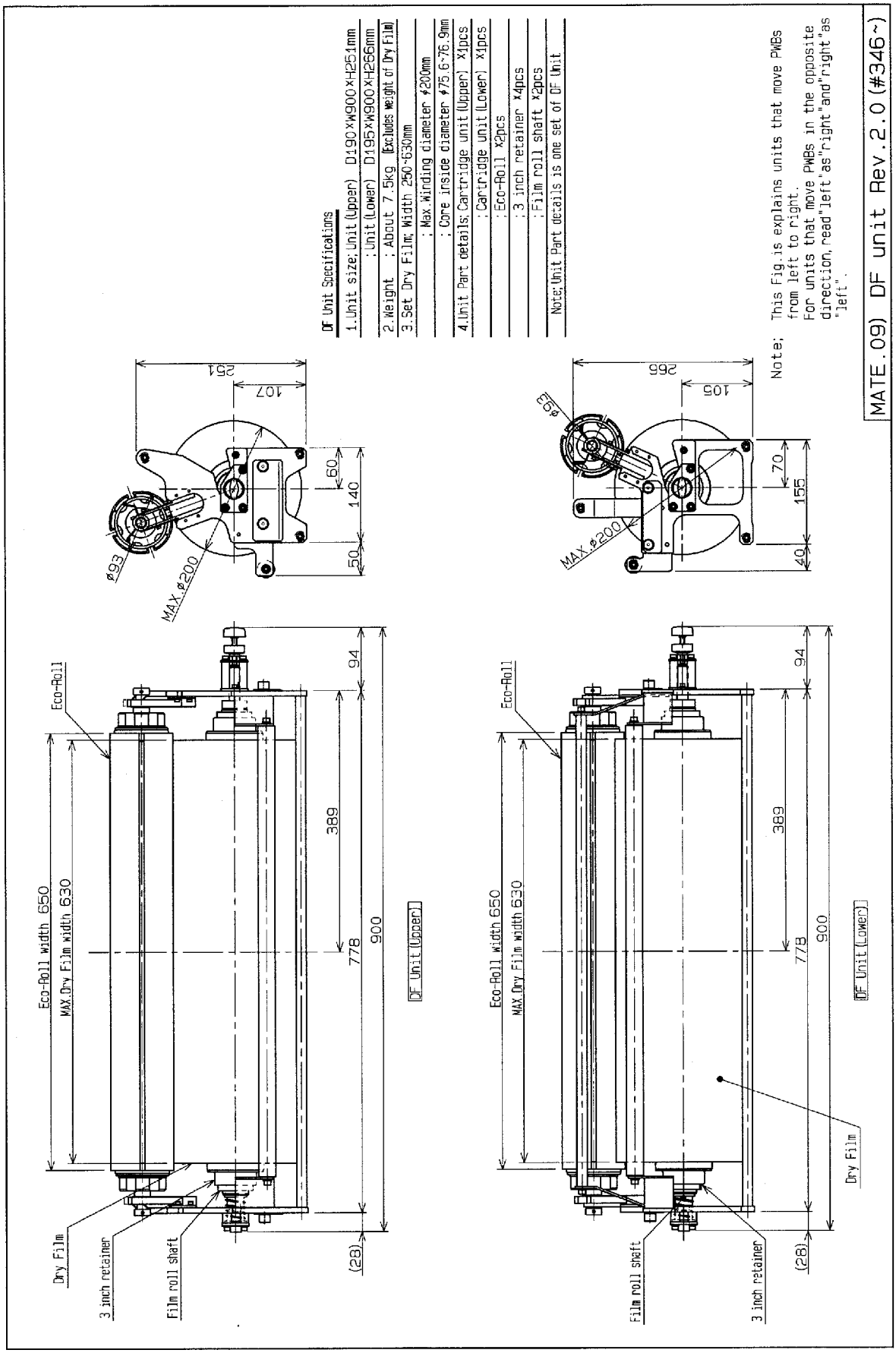
■ Sequence time chart



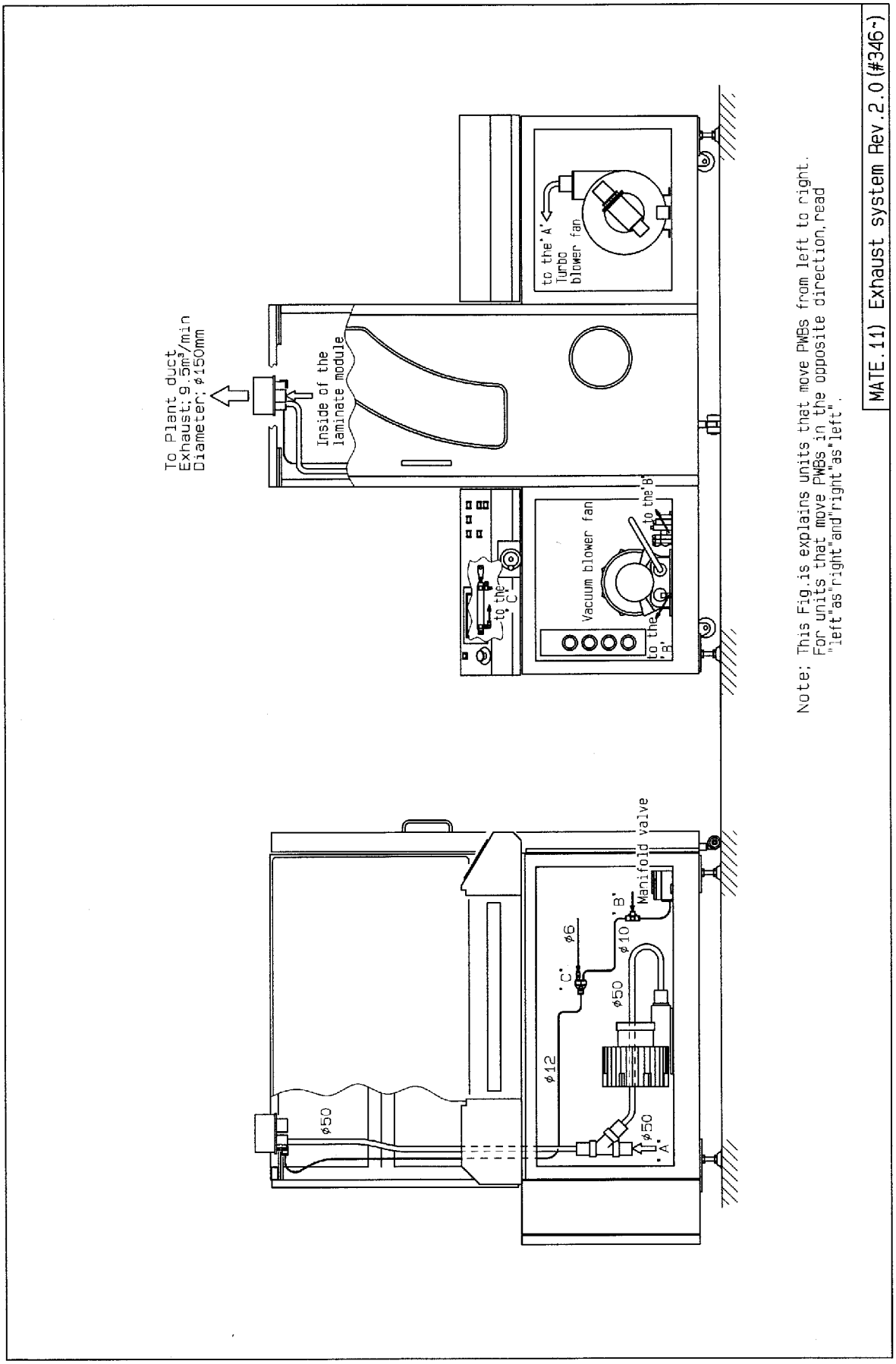


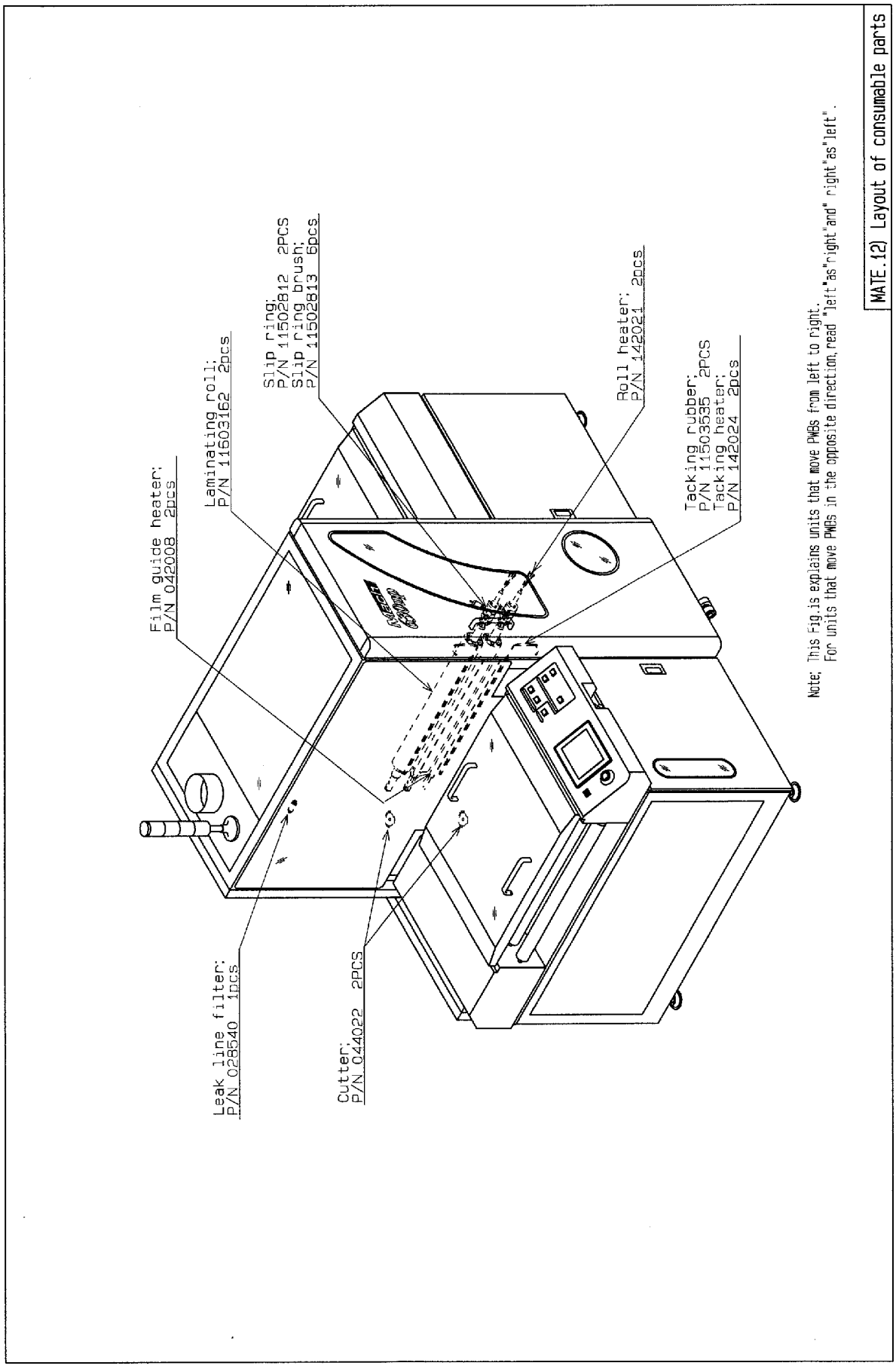
Hakuto — Click the Future —




MATE.09) DF unit Rev.2.0 (#346~)
DF Unit Specifications
1.Unit size; Unit (Upper) D190*W900*H251mm
; Unit (Lower) D195*W900*H266mm
2.Weight ; About 7.5kg (Excludes weight of Dry Film)
3.Set Dry Film; Width 250~630mm
; Max.Winding diameter φ200mm
; Core inside diameter φ75.6~76.9mm
4.Unit Part details; Cartridge unit (Upper) x1pcs
; Cartridge unit (Lower) x1pcs
; Eco-Roll x2pcs
; 3 inch retainer x4pcs
; Film roll shaft x2pcs
Note; Unit Part details is one set of DF Unit
Note; This Fig.is explains units that move PWBs from left to right.
For units that move PWBs in the opposite direction, read "left"as"right"and"right"as "left".
DF Unit (Upper)
Eco-Roll
Eco-Roll width 650
MAX.Dry Film width 630
Dry Film
3 inch retainer
Film roll shaft
389
778
900
94
(28)
MAX.φ200
ø93
251
107
60
140
50
DF Unit (Lower)
Eco-Roll
Eco-Roll width 650
MAX.Dry Film width 630
Dry Film
Film roll shaft
3 inch retainer
389
778
900
94
(28)
MAX.φ200
ø60
265
105
70
155
40

■ Exhaust system




MATE.12) Layout of consumable parts
Film guide heater;
P/N 042008 2pcs
Laminating roll;
P/N 11603162 2pcs
Slip ring;
P/N 11502812 2PCS
Slip ring brush;
P/N 11502813 6pcs
Roll heater;
P/N 142021 2pcs
Tacking rubber;
P/N 11503535 2PCS
Tacking heater;
P/N 142024 2pcs
Leak line filter;
P/N 028540 1pcs
Cutter;
P/N 044022 2PCS
Note; This Fig.is explains units that move PWBs from left to right.
For units that move PWBs in the opposite direction, read "left"as"right"and" right"as"left".

Option

Contents of this Chapter

■ Option Operation

■ Optional Specifications

■ Optional parts and other items