(株)友一아이테크
WOOIL HIGHTECH CO., LTD.

PV Module Line

Operation Manual

[M601/602. MEGALAM-2246]

For Tindo Solar

September, 2011

WOOIL HIGHTECH

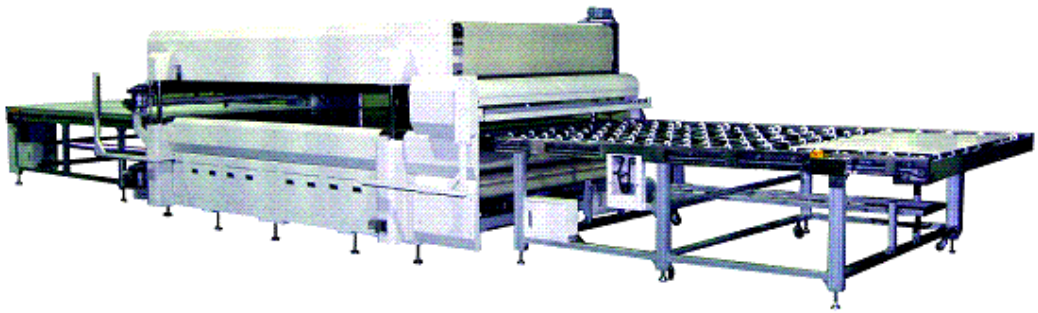
CONTENTS

1. INTRODUCTION

The installation, Operation and Maintenance manual is intended to provide the reader with a working knowledge of solar module laminator as,

'LAMINATOR MEGALAM+LOADING/UNLOADING CONVEYOR'

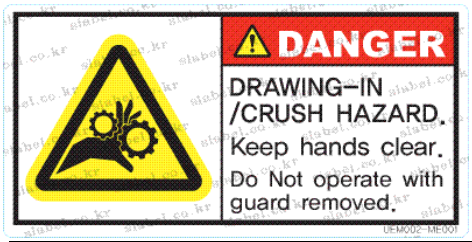
- System tour, process, and major component descriptions introduce the user to the laminator process and operation.
- The maintenance section provides introductions for maintaining and repairing the machine.
- Major system description supplies the reader with helpful information concerning assembly construction and the function of components in the process of laminator.
- This manual features a troubleshooting section to furnish the user with information to determine the root cause when problems arise.
- An illustrated parts listing is provided for repair and replacement.
- Carefully read the UNPACKING AND INSTALLATION section before performing these tasks similarly, all operators should read all sections of the manual before attempting to operate the machine.

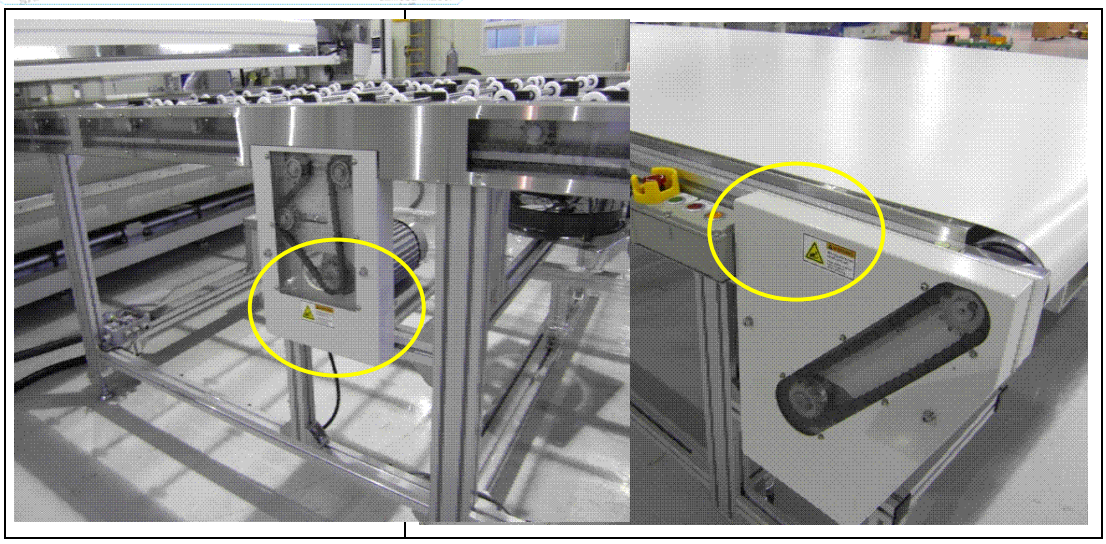


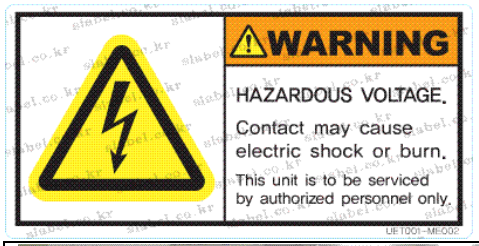
- MEGALAM_2246 with Loading and Unloading Conveyor -

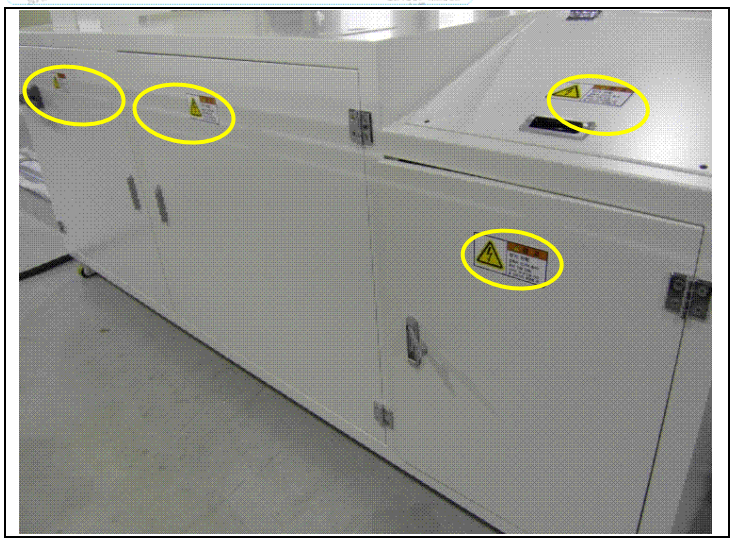
1.1 Hazard labels

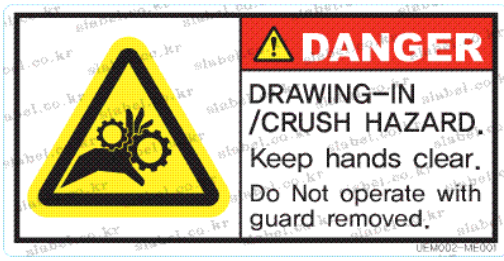
DANGER	*Statements that indicate an immediate hazardous situation that, if not avoided, will result in death of serious injury.*
WARNING	*Statements that indicate potentially hazardous situation that, if not avoided, could result in serious injury*
CAUTION	*Statements that indicate potentially hazardous situation that, if not avoided, may result in moderate injury,*
NOTICE	*Statements used for stating instruction or for the protection of personnel or property.*





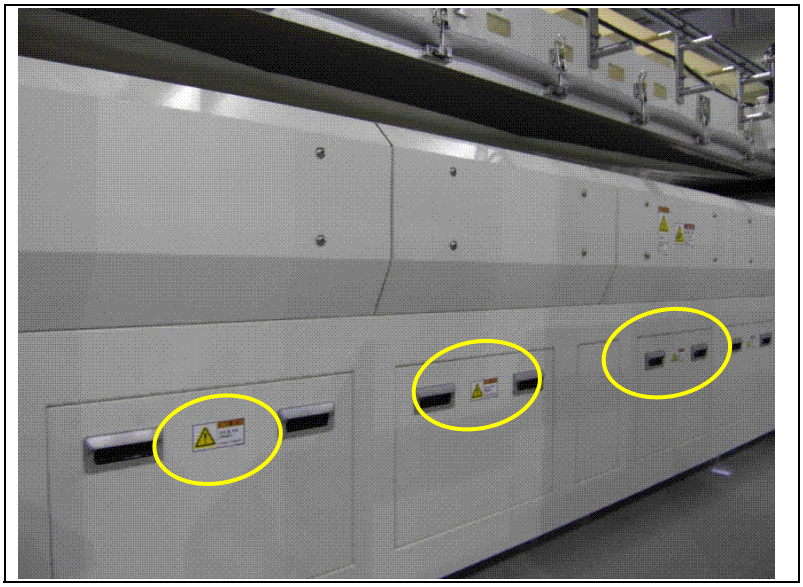

WARNING
HAZARDOUS VOLTAGE.
Contact may cause electric shock or burn.
This unit is to be serviced by authorized personnel only.

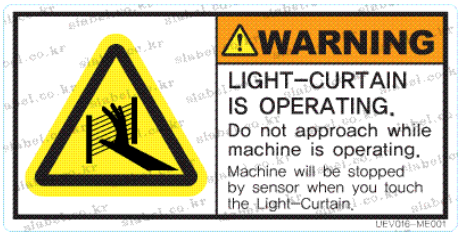



DANGER
DRAWING-IN /CRUSH HAZARD.
Keep hands clear.
Do Not operate with guard removed.


WARNING
BURN HAZARD.
Contact may cause burn.
Do Not Touch.


WARNING
Do Not open the door and cover.
Access limited only to authorized personnel.
UG/001-ME001




WARNING
LIGHT-CURTAIN IS OPERATING.
Do not approach while machine is operating.
Machine will be stopped by sensor when you touch the Light-Curtain.
UE/016-ME001

1.2 Safety Precautions

The DANGER precaution shown in below table is intended for the protection of personnel servicing or operating the machine.

Danger Notices

DANGER
● Disconnect all AC power before replacing components or servicing inside the unit. High voltage can be present in the machine that can cause personnel injury or death when the power is on.
● The platen is extremely and after lamination. Allow sufficient cooling time or wear protective clothing to remove modules or service platen.
● Never defeat any of the interlock switches.
● Never operate without protective shields or covers in place over electrical components

2. PRINCIPLE OF OPERATION

The purpose of the LAMINATOR MEGALAM is to laminate and/or encapsulate materials to form void-free composite structures. The laminator bonds multiple layers of materials together with thermoplastic or thermosetting films. The processing chamber has temperature, vacuum, and pneumatic pressure capabilities, which are independently controlled to provide optimum processing conditions for particular materials and configurations.

The laminating cycle is an empirically determined sequence of events. The usual objective is to determine the shortest sequence which produces a good lamination without adverse side effects to any of the laminate components. The most critical part of the laminating cycle is the part prior to melting of the plastic sheet encapsulated. The amount of time with the assembly under vacuum, the time with pressure applied, the temperature with pressure applied, and the duration and quantity of pressure affect the quality of the lamination.

The laminator is programmed to perform the complete lamination and cure sequence, typically in 20 to 30 minutes for standard curing ethylene vinyl acetate (EVA) based encapsulating. An alternative laminating cycle can be done at higher throughput with standard EVA. This cycle occurs at a constant temperature below the cure temperature, and automatically laminates modules in seven or eight minutes. Modules laminated in this alternative cycle are placed in a conventional oven at cure temperature for the required time.

Regarding the fast curing EVA, a complete lamination and cure cycle lasts approximately eight to twelve minutes. No curing oven is required.

When selecting a cure cycle for either standard for either standard or fast curing EVA, it is important to measure post-laminate EVA gel content and pulls strength of EVA to the other module materials such as glass and back cover file. Adequate gel content and pull strength are required to insure that structures do not delaminate in the field.

3. SPECIFICATIONS

3-1 Laminator Specifications

Item	Specifications
Effective Lamination Area	2200mm X 4600mm
Solar module	35mm
Vacuum System (option)	Vacuum pump: Leybold SV300 Rotary vane or SP630(Dry pump) Mechanical booster: Leybold WAU 501 or None Pressing speed: 5666 liters/min Pumping speed: the bottom of chamber, less than 133Pa/min.
Pressing Control	Pressing force: Adjustable between 0 and 1atm Pressing speed: Selectable 3speed by solenoid valves.
Platen Control	Temperature Uniformity: ±2 % (Upper Chamber closed, No load) Operating Temperature : Up to 180°C (Max. 185) Heating : Less than 30 minutes (from 30° to 120°C) Platen Control: 5 Independently PID controlled zones with the controlling thermocouple located approximately in the center of each zone. Spare thermocouple is built in each controlled zone. Over temperature safety system: Each of 5 platens is protected by an over temperature alarm in independent controller.
Module lift-up pins	Pin diameter: 5.5mm Pin lift-up height:5mm(hand adjustable) Pin lift-up and lift-down time required (Program can be set)
Chamber lifting System	Driven by 4 Hydraulic cylinders with hydraulic pump unit Movement stroke : 430mm/max (full open) lifting speed : Less than 30s (from closed Chamber to full open)
Diaphragm clamping system	The diaphragm is supported and sealed to the inside of the upper chamber by cramping frame and clamp lever with no bolts.
Cover for platens and Diaphragm	Top surface of the platen and under surface of diaphragm sheet covered by Teflon release sheet.
Operation system	PLC control: Mitsubishi Touch screen : 10.4” color display Operating Screens;

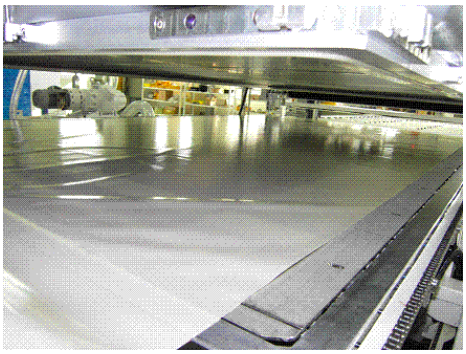
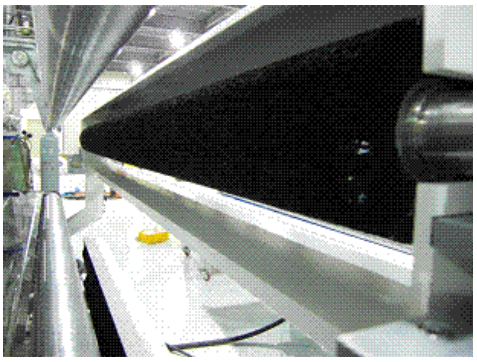
	Auto Screen: To monitor “set point” and “current value” of pressure, temperature and process time of the running recipe. Pressure and temperature monitor screen : To monitor pressure and temperature. When the lower chamber is to less than 999Pa (≒-753 mmHG), it can be monitored on Pressure of ‘Lower camber [Pa]’ on this screen. Manual screen: To control the laminator components manually. Parameter screen: To set process parameters for each recipe.
Safety system	Light curtains. Front, back, right and left sides Effective height is Appox 260mm above the top surface of the platen. Heater wire detection sensors are quipped
Painting	Snow white N 9.0(S)
Weight	NET 12,500kg(Except Loading & unloading conveyor) Required floor weight withstand capacity: 500kgf/m2
Equipment Dimensions	See attached drawing

3-2 Loading/ Unloading Specifications

Item	Specifications
Pass line	970mm(F,L)
Laminator lower belt conveyor	Transfer method : Belt transfer system Feed speed: Max. 15m/min Drive unit: Inverter controlled electric motor Max. load : 110kg
EVA removing brush unit	Drive unit: Inverter controlled electric motor EVA dust tray: Can be pulled out toward operator side.
Loading Conveyor	Feed speed: Max. 15m/min Drive unit: Inverter controlled electric motor Max. load : 110 kg Work detector: Photo-electric sensor the head of solar module. Control box: Link with ‘1 pitch’ & ‘Module set finish’ button Module feeding : Pitch transfer System(Timer setting : programmable) Operation:

	1. Place the solar module on loading conveyor by manual. 2. Feed the module by pressing 'Loading 1 pitch' button. Pressing 'Loading 1 pitch' button activates pitch-transfer movement. Feeding timer is programmable 3. Cover the modules by release sheet, and press 'Module set finish' button. The modules will be transferred into the laminator automatically when preparations for laminator are set.
Unloading Conveyor	Transfer Method : Belt conveyor system Feed speed: Max. 15m/min Drive unit: Inverter controlled electric motor Mac. Load : 110Kg Work detector : Photo-electric sensor detects the head of soar module Operation : 1. The solar module will be transferred out of the laminator automatically and stop at the end of the unloading conveyor. 2. Remove release sheet and transport the modules to next unit by hands.
System cycle time	Transfer time : within 60s Vent lower chamber > Open upper chamber > Transfer module >Close upper chamber

	
Loading Conveyor	**Unloading Conveyor**

	
Laminator Lower Belt Conveyor	**EVA Removing Brush Unit**

3-3 General specifications

Item	Specifications
Operation temperature	0 ~ 25°C
Installation temperature	0 ~ 25°C
Operation moisture	5 ~40%RH, No condensation
Installation moisture	5 ~40%RH, No condensation
Operation environment	No corrosiveness
Operation height	Less than 3000m
Overvoltage type	Category III (According to IEC60664-1)
Pollution	Degree 3(According to IEC60664-1)
Noise	Less than 68 db

3-4 Facilities

Item	Specifications
Power supply	3phase 415VAC 50Hz 121kw
Compressed air	More than 0.5 Mpa , 50 liters/min Size and Type of Connection: Φ12 one touch fitting female
Vacuum exhaust	Exhaust connection on vacuum pump : 3 inch
Test equipment	Test pieces required for inspection on installation and test-operation

4. INSTALLATION

4.1 Lifting

A forklift (wit a capacity of 15 ton or more) can be used to lift the Laminator.

See attached drawing. Separate table & roller from Laminator. (When already separated at manufacturer plant)

(1) Attach 3m long forks to the forklift. The forks need to be 3m or longer to reach the other side of machine frame.

(2) Insert forks at the marked position on the illustration. The forks need to be perpendicular to the machine frame at the listing points. Make sure that the forks reach the other side of frame.

(3) Place a cloth or padding between the jack-up point and the roller so that the machine should not be slip on the forks.

(4) Gradually raise the forks, making sure that a cloth or padding is still jack-up points and the machine will not slip sideways. –

(5) Lift the machine up from the ground by about 500 mm. Do not lift up too high.

Item	Weight
Laminator	12,500 Kg
Loading conveyor	500 Kg
Unloading conveyor	500 Kg
Vacuum pump unit(option)	200 Kg
Electric Cabinet	300 Kg
Operation Panel	60 Kg

4.2 Moving

Only a specialist vendor can move the machine sideways, which should be performed on a flat, level ground. Follow the work procedure given below. Failure to observe these precautions could result in a serious personal injury or machine failure.

<Machine Moving Procedure >

(1) Carefully and gently lower the lifted machine down onto the four rollers placed on a flat ground. Make sure that each of the jack-up points at the four corners (see the illustration) of the machine mate with each of the four rollers.

(2) As a precaution, place a cloth or padding between the jack-up point and the roller.

(3) Making sure that the machine will not slip sideways, gradually lower the machine.

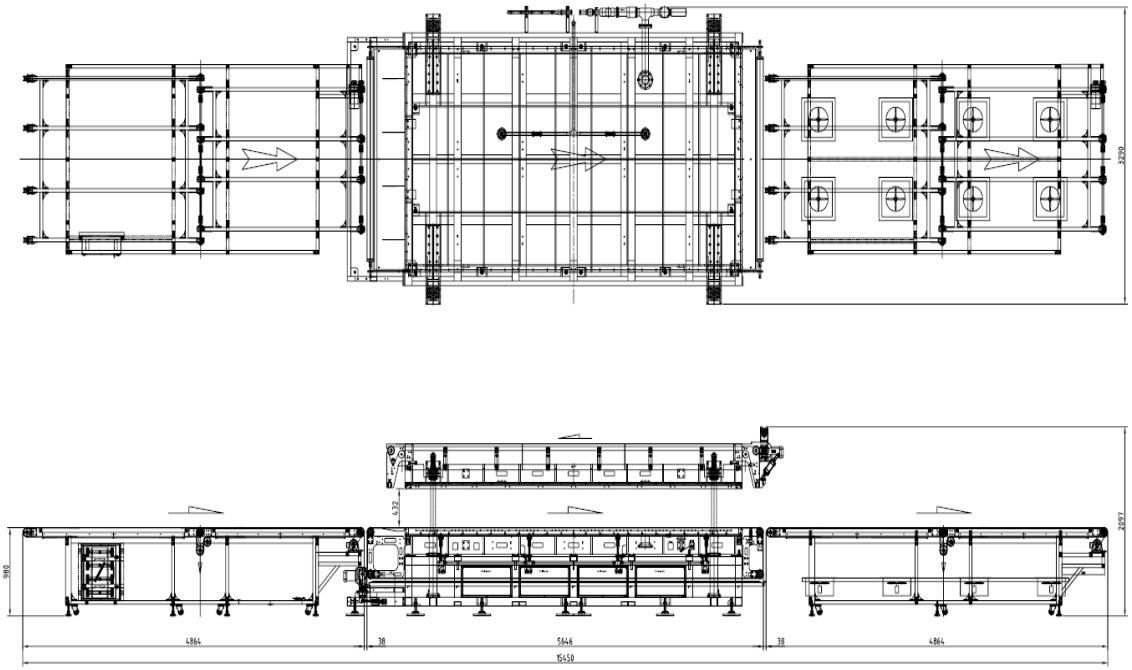
(4) When the ropes are loose enough, stop the crane and unhook the ropes from the machine.

(5) Hook a rope through a hole of the reinforcing plate at the machine leveling bolts and move the

machine to the installation position using a forklift or which secured to a solid place.

(6) When the machine has been moved to the installation position, remove the rollers one by one using a fixed-type crane (7 ton-or-more) or a hydraulic jack (2 ton-or-more) and install the machine to the foundation plate.

4.3 Installation requirements

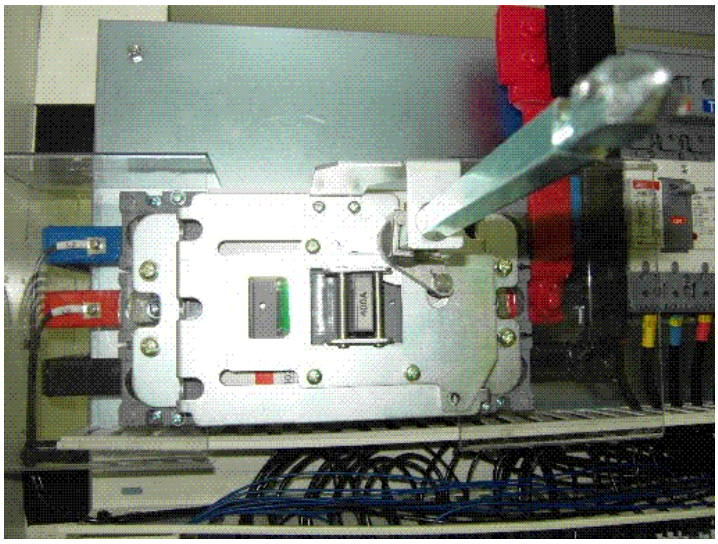


Item	Specifications
Power supply	More than 415VAC (±5 10%) 50Hz 169A Primary electrical wiring directly to the Breaker in the electric cabinet (Breaker) Cable size: 100mm² (96.3~117.2 mm²) Tightening torque: 45Nm Terminal size: M12
Compressed air	More than 0.5 MPa, 50 liters/min Inlet Connection : Φ12 female (fitting on the air panel)
Vacuum exhaust	Exhaust outlet on vacuum pump: G2” 1/2 female (optional)

4.4 Utilities

AC Power connection

Verify that main disconnect switch is in the off position. Connect 3-phase, AC 415VAC, 121kw power cable directly to main disconnect switch inside the electric cabinet. The three hot wires are connected to the top of the disconnect switch (L1, L2, L3), and the ground wire connects to the ground bus bar in the electrical cabinet. If step-down transformer is supplied for operation, refer to instructions provided with the transformer.



CAUTION

For safety during servicing, the power line must be connected to a main disconnect switch that can be locked in the off position or to a plug and receptacle that can be disconnected during servicing.

CAUTION

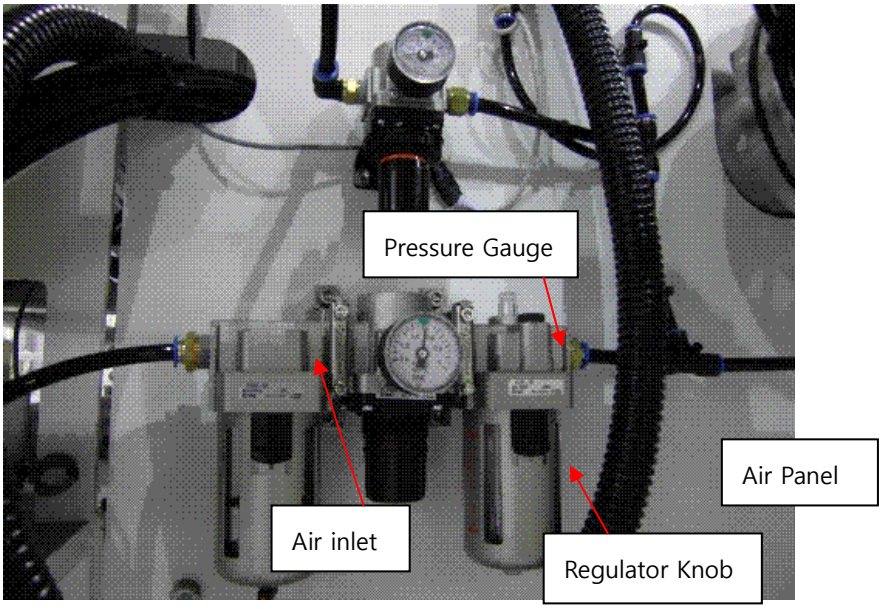
Do not provide power until preliminary installation is completed

Compressed Air connection

Clean and dry air is required.

Φ10 one touch female is located on the air panel at the backside of the laminator for connection of incoming air supply.

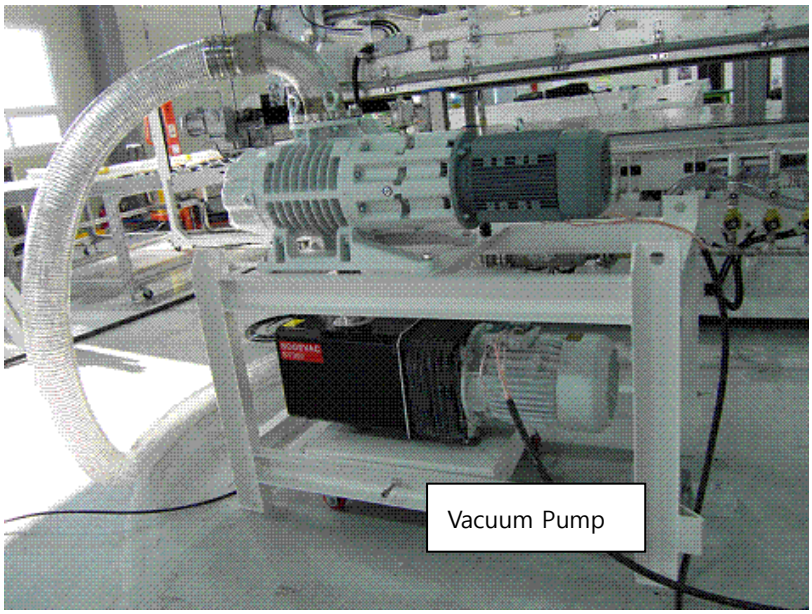
Check the air pressure gauge. Adjust the regulator following pressure to 0.55Mpa by knob.



The exhaust from Vacuum pump

The exhaust from vacuum pump should be connected to an external building exhaust line.

Connect “Exhaust” fitting (G2”1/2 male)” to the building line with hose.



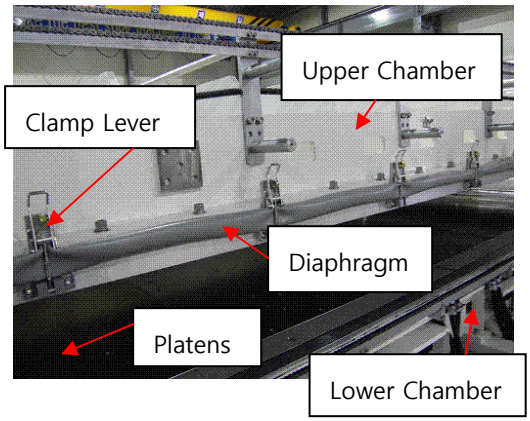
Building exhaust line should be connected through the outlet hole with the proper diameter of exhaust line so that any access should not attempt through the gap.

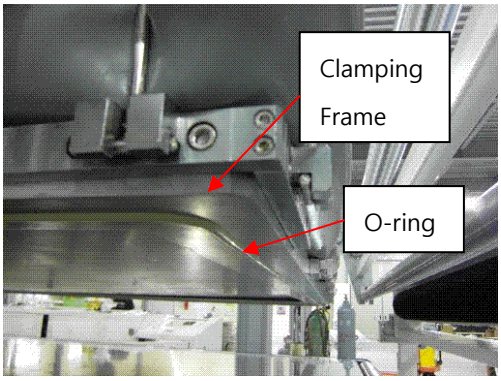
5. SYSTEM TOUR

The major components of the LAMINATOR MEGALAM are the vacuum chamber, pressure diaphragm, lamination platen, vacuum system, heating control system, chamber lifting system, PLC control system, loading/ unloading modules system. All of these systems are monitored and controlled by touch panel.

5.1 Vacuum chamber

The Vacuum chamber is two-piece clamshell design and is fabricated to withstand atmospheric pressure with minimum distortion. Chamber top is hinged to allow access for loading and unloading laminator. The two chamber halves are sealed with O-ring.

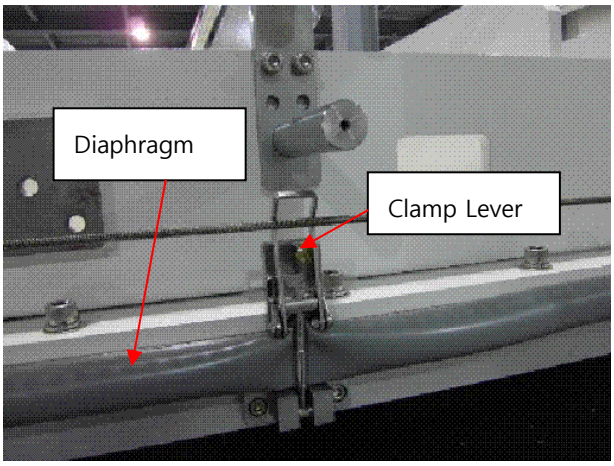




5.2 Pressure Diaphragm

A Diaphragm is used to apply lamination pressure to the module. The diaphragm is supported and sealed to the inside of the upper chamber by a clamping frame around its perimeter. The chamber volume below the diaphragm is called the lower chamber, while the volume above is called the lower chamber, while the volume above is called the upper chamber. Both chamber pressures are displayed on the touch panel.

The laminator will not operate properly if the diaphragm is punctured or its seal is broken. Replacement of the diaphragm is described in the section ‘Maintenance and Troubleshooting’



5.3 Lamination Platen

The Lamination platen is the working surface of the laminator and its function is to support and heat the modules being processed. The platen consists of 5 plates connected together, electric heaters and thermocouples. The heaters are designed for long life. The top surface of the platen is covered with a Teflon release sheet so that any molten encapsulated material that extrudes from the edges of the module will not stick to the working surface.

The temperature control of the platen is divided into 3 independent separate control systems. Each platen is independently sensed and controlled. This is done to provide temperature uniformity.

Attached to the underside of each plate are thermocouple sensors, and a ground wire. The ground wires are a safety feature to prevent high voltage on the platen and to protect the operator from electrical hazard if there is an electrical short in the heater circuit. They must not.

WARNING

Do not remove the ground wire. 200 V is charged on the heater.

The operator loading a module into the platen may get an electrical shock by 200 voltage if the heater circuit has some problem.

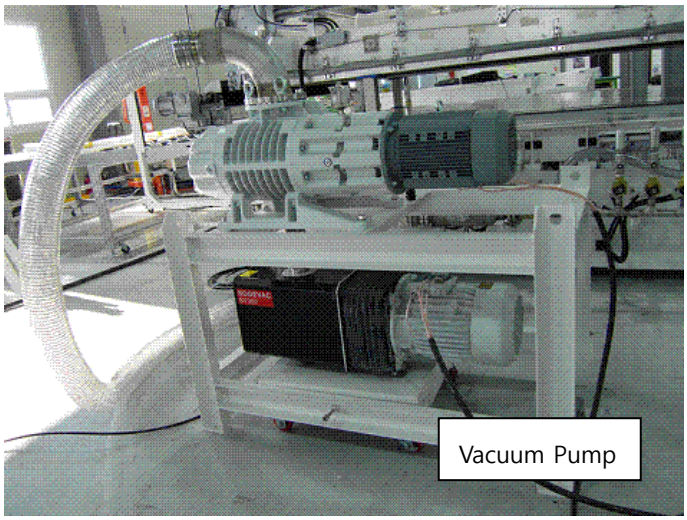
The platen contains 15 thermocouples for temperature control and uniformity. 3 thermocouples on each platen sense the platen temperature between each heater for controlling the platen temperature. These thermocouples provide platen temperature information to the temperature controllers, mounted in the electric cabinet. The other 3 thermocouples on each platen are used for monitoring unusual temperature and interlocking over heat.

The Lamination platen is supported off the Lower chamber floor by insulating bars to minimize

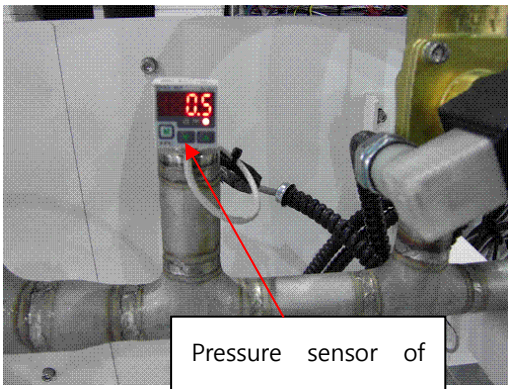
heat loss. This reduces the power consumption of the laminator and improves the temperature uniformity of the platen.

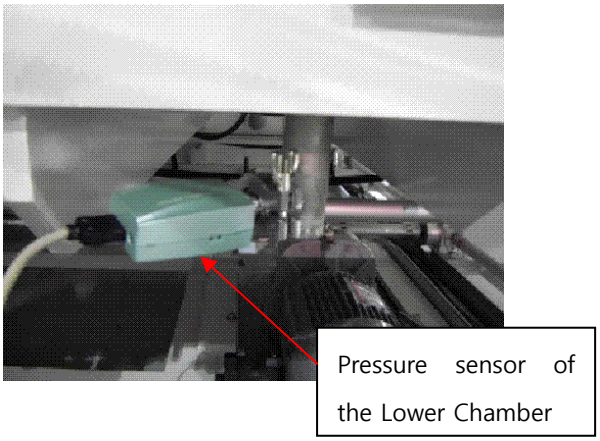
5.4 Vacuum System (Option)

The vacuum system consists of vacuum pump, boosting blower, control valves, gauge. The Vacuum pump has the excellent performance with high-throughput and is located under the unloading conveyor. Use a high-performance valve for a vacuum for a vacuum circuit; of the omission of vacuum there is it in a plumbing part with extreme caution so that there is not it.



Two pressure sensors are equipped to measure the pressure in the upper and lower chamber. The measurement of the pressure sensors are displayed on the touch panel on the console.



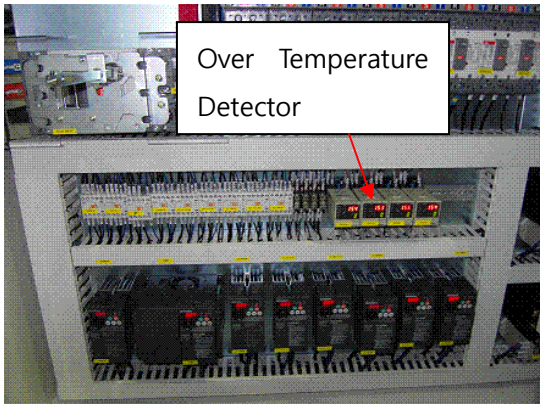


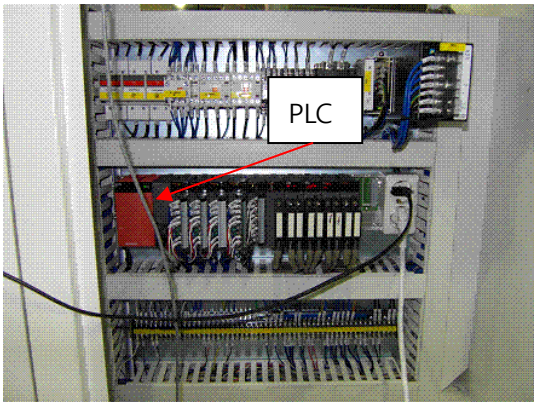
5.5. Main Heating control system

Platen Temperature is controlled by PLC. The actual temperature is sensed by thermocouples and it is continuously updated on the temperature screen.

Heaters are automatically regulated, as required, to obtain the desired temperature for any process ste. The PLC controls the temperature on 15 zones individually.

In the 'Auto' mode, the temperature is controlled to the "pump" process setpoint when idling between process cycles. In the Manual mode the temperature is also maintained at the "Pump" process setpoint when the heaters are enabled. The heaters can be turned off by pressing the "Heater OFF" button on the "MANUAL" Screen.





5.5.1 Over-temperature Safety System

Each of the 5 platen is protected by an over-temperature alarm in its controller. The alarm setpoint is factory set to approximately 185℃, and must not be changed. When the over temperature setpoint is reached, the controller trips and interlock circuit, cutting power to all of the heaters. Cooling over temperature platens can reset this interlock circuit.

WARNING

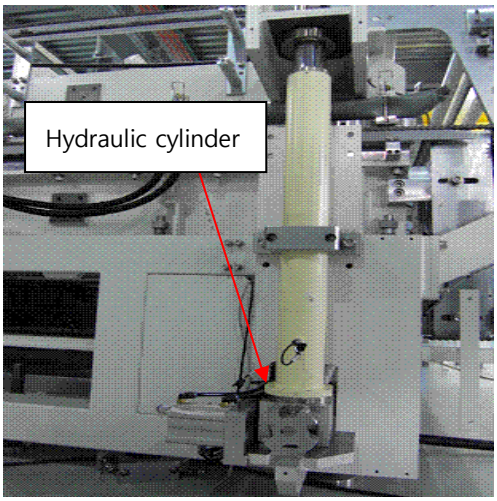
Do not change the over-temperature setting.

It may cause the serious machine trouble or the danger of fire in case of the unusual heat more than 200℃

5.6 Chamber Lifting System

Four ball screw unit driven by an inverter controlled motor are used to raise and lower the upper chamber.

The positioning is controlled through the using encoder and PLC. After the main disconnect switch is on, the indexing movement ('Home') is necessary. The upper chamber has three height of position, "CLOSE", "MIDDLE" and "OPEN" and it is possible to position at any height as well.



To prevent injury to the operator, safety barrier and mechanical lock (Lock pins). If operator's body or other objects interrupt safety barriers (light curtains) the chamber will stop and alarm message will appear on the touch panel.

Lock pin is inserted in the disk linked with ball screw unit at cycle positions of the upper chamber stopped.

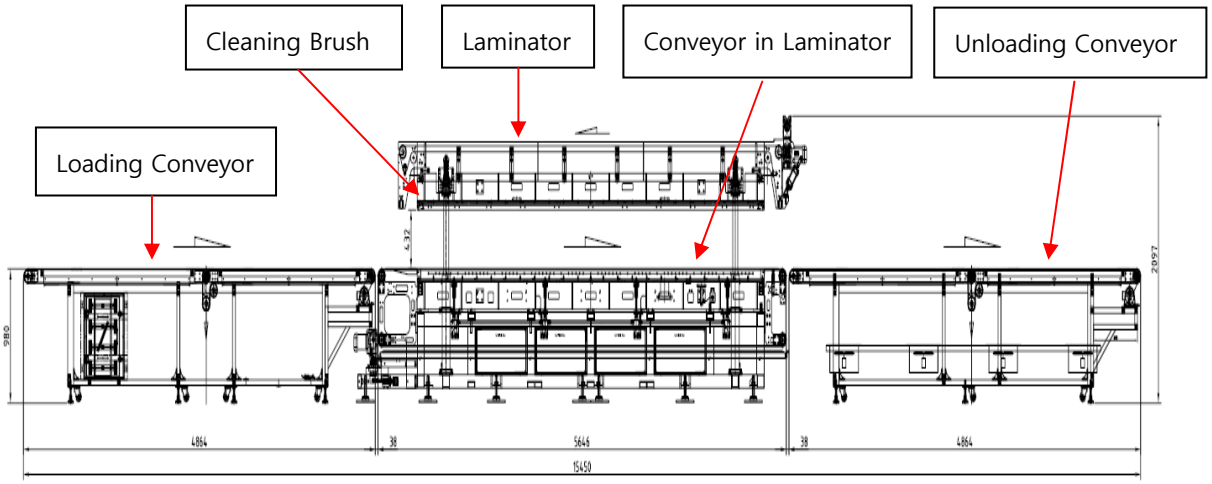
5.7 Lifting-up Pin

The Lifting-up pin the module during the pumping and separate the module from the platen to prevent the bow caused by the heat of the platen.

The lifting height is adjusted by the adjust screw on the cylinder.

5.8 Loading/ Unloading system

Automatic loading/ unloading conveyor are provided to make solar modules handling easily.



5.8.1 Loading conveyor

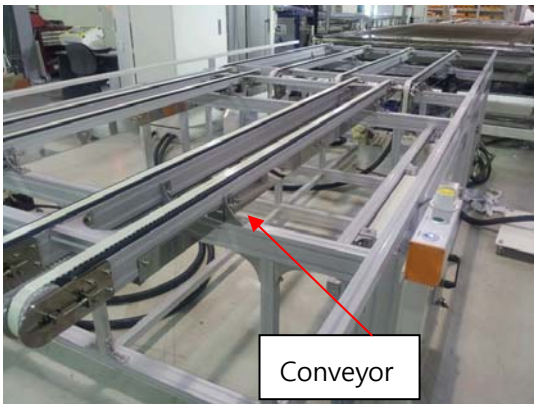
Conveyor Solar module will be set on the Loading conveyor and transferred to the laminator.

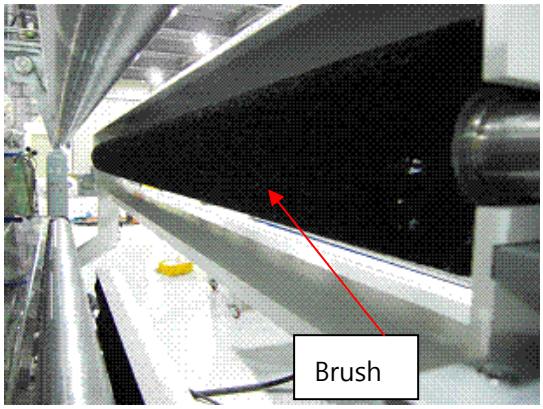
Photo-electric sensor is provided to detect misfeeding of the modules. If the sensor detects any object in the auto mode, PLC stop the upper chamber going down and the alarm message will appear on the touch panel.


Loading Conveyor

5.8.2 Conveyor in Laminator

The modules are transferred by thin Teflon sheet in the laminator. The sheet withstands over 200℃ and its thickness is so thin not to spoil the vacuum in the chamber. Teflon sheet prevents EVA sticking on it as much as possible.



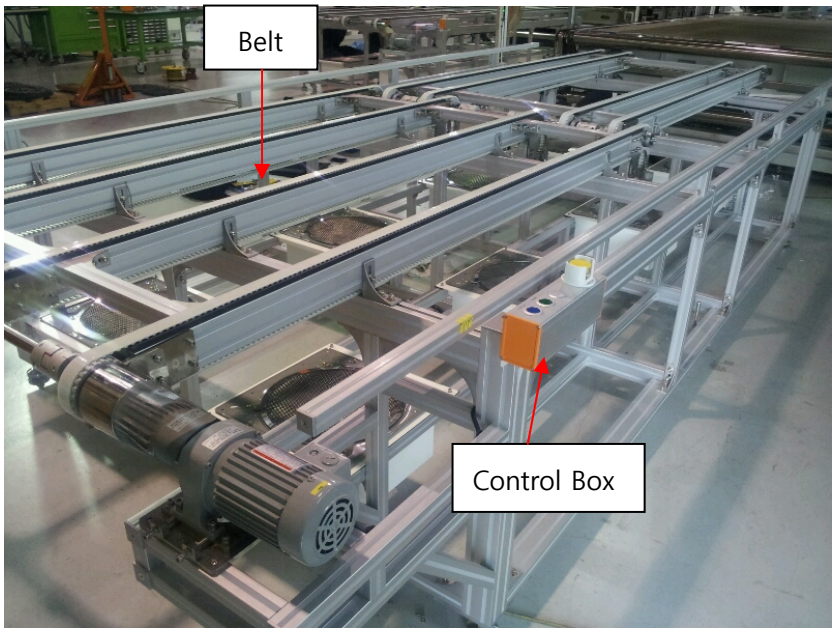


5.8.3 Unloading conveyor

Unloading conveyor consists of roller conveyor with silicon rubber rings.

The Teflon rubber rings withstand high-temperature modules and support them softly.

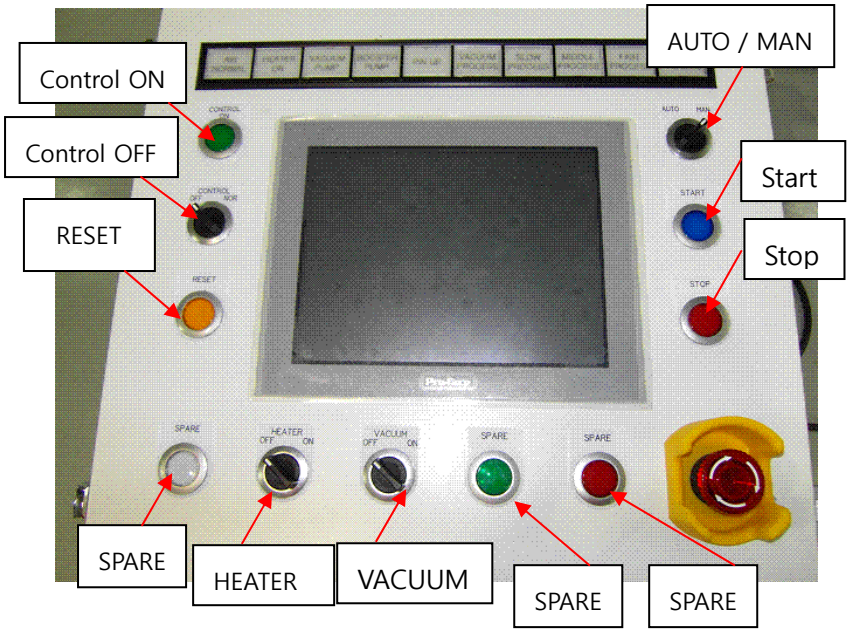
Photo-electric sensor is provided to detect misfeeding of the modules. If the sensor detects any object in the auto mode, PLC stop the upper chamber going down and the alarm message will appear on the touch panel.



Unloading Conveyor

6. CONSOLE DESCRIPTION

6.1 Console Monitor Consist



6.2 Console Button Description

1) 'Auto' button/light

This button is to set the laminator in 'Automatic' mode.

2) 'Manual' button/light

This button is to set the laminator in 'Manual' mode.

3) 'Start' button/light

This button is to set the laminator in laminating cycle.

4) 'Stop' button/light

This button is to stop the laminating cycle..

5) 'Control On': To operate 'Control system'

6) 'Control Off': To set off 'Control system'

7) 'Reset': To Reset 'Control system'

8) 'Heater': Heater ON/OFF select switch

9) 'Vacuum': Vacuum pump select switch

10) 'Spare': This button is to set when user required (Here is none)

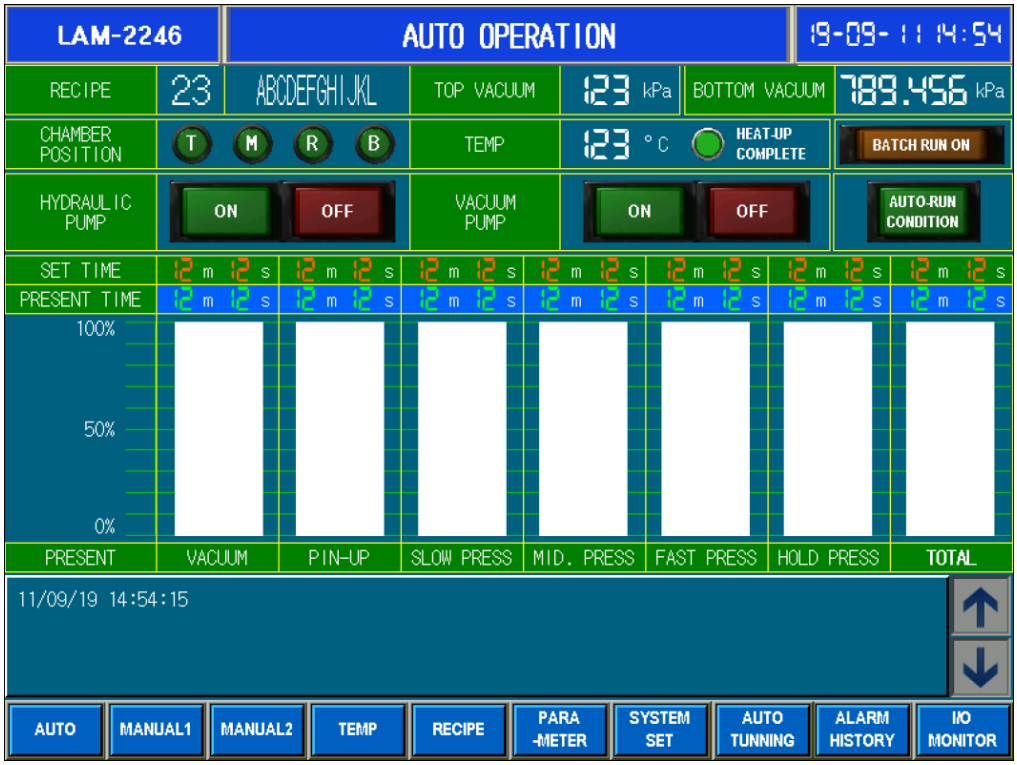
11) 'E-Stop(Emergency Stop)' button

When this button is pressed, all components in motion will stop immediately and power to the heaters and vacuum pump will be cut.

7. CONTROL PANEL OPERATING INSTRUCTION

7.1.'Auto Mode Monitor' Window

This window monitors the conditions of the laminator components, parameter setting, and process..

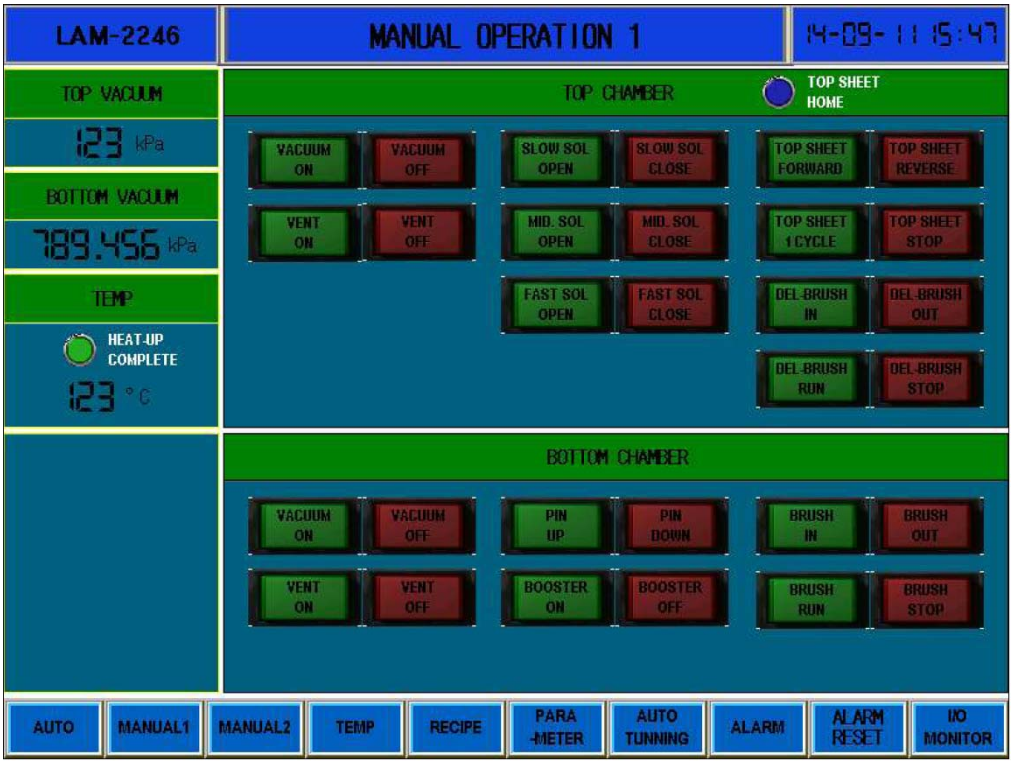


Item	Definition	Note
TEMP	Turn on when platens temperature matches the automatic cycle start temperature.	Press the 'Confirm' button to proceed to the 'Pressure/Temperature' window.
RECIPE	The current selected program name	
TOP VACUUM	The current top chamber pressure is shown.	
BOTTOM VACUUM	The current bottom chamber pressure is shown.	
VACUUM	The light Turns on while vacuuming.	
PIN-UP	The light Turns on while PIN-UP	To prevent NG out-put with pin-up process

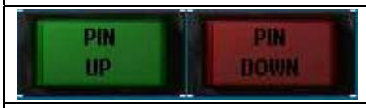
SLOW PRESS	Turn on while pressing at slow speed.	Time : Set time and current time Pressure: Set pressure and current pressure of top chamber. Leak speed: Pressure increasing speed of previous / current cycle. Temperature: Set temperature. You can select “Time” or “Pressure” on each process. The selected slot turns on.
MID. PRESS	Turn on while pressing at middle speed.	
FAST PRESS	Turn on while pressing at high speed.	
HOLD PRESS	Turn on while holding Process	Time: The current time & Set time. Pressure: The current pressure of top chamber.
TOTAL	This button is shown the accumulated time in whole process.	The real time mark.
HYDRAULIC PUMP	To show the On/Off status of hydraulic pump	
VACUUM PUMP	To show the On/Off status of vacuum pump	

'Manual Operation' Window

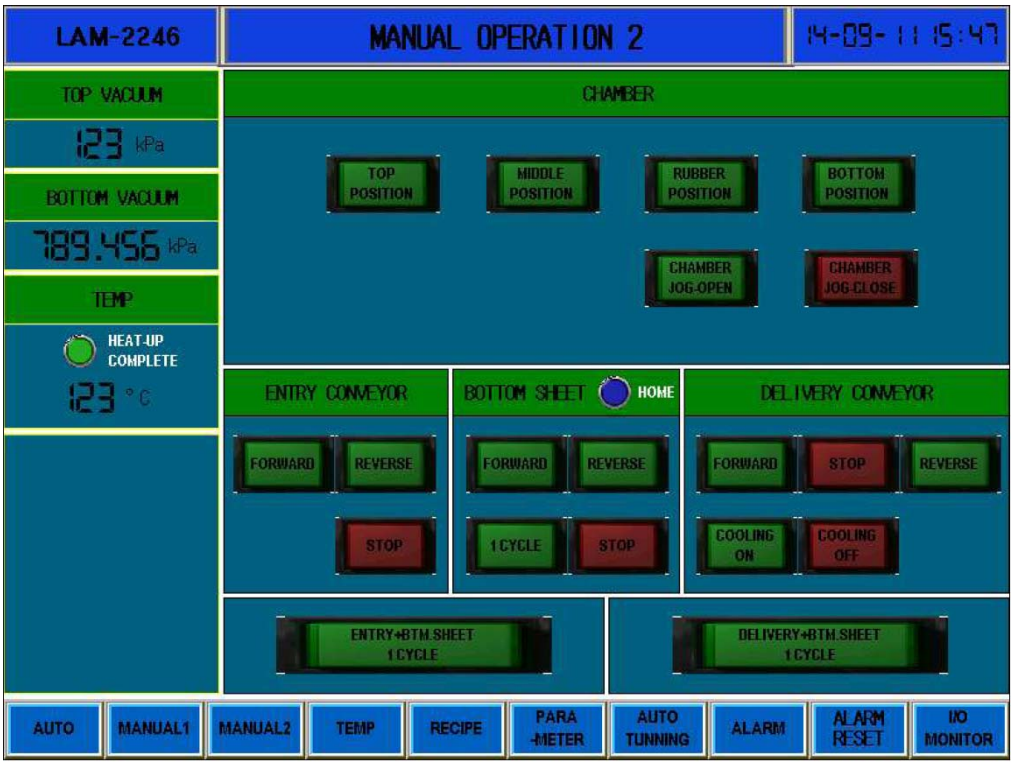
This window controls the components of laminator by Manual. Before using this window, press 'Manual' button and check whether the red light to turn on.



Item	Description	Note
TOP CHAMBER		
	In/Out Cleaning brush of Loading Conveyor.	
	Closing/Opening leaning brush of Loading Conveyor.	
	Forwarding/reversing the direction of upper conveyor.	
	Operating /stopping the upper conveyor 1 time.	
	On/ Off vacuuming system operating in top chamber	
	On/ Off Ventilation system operating in top chamber	After operating vacuum button off
	Open/Close valve in process of Slow Press	

	Open/Close valve in process of MID Press	
	Open/Close valve in process of Fast Press	
BOTTOM CHAMBER		
	Falling/Raising Pin Plate.	
	On/ Off vacuuming system operating in bottom chamber	
	On/ Off vacuuming system operating in bottom chamber	After operating vacuum button off
	On/ Off boosting for the vacuuming	To support vacuum system, if possible
	Out/In Cleaning brush.	
	Operating/Stopping Cleaning brush.	

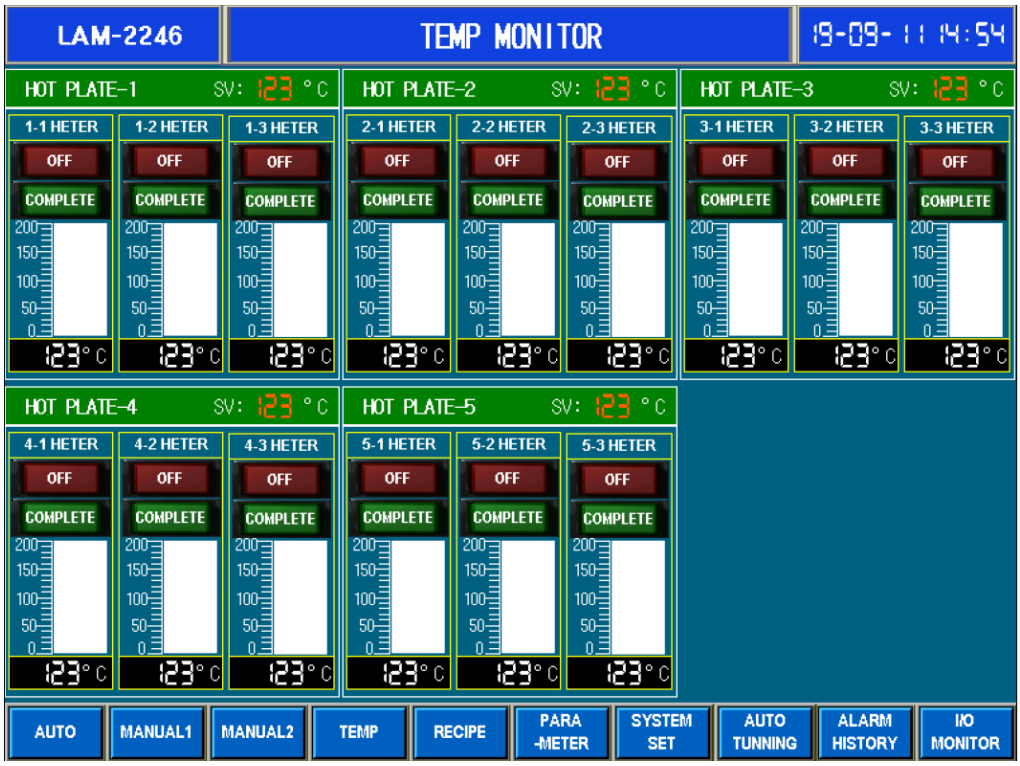
7.2. 'Module Operating 2' Window



Item	Description	Note
CHAMBER		
	To raise the upper chamber for maximum height.	
	To raise the upper chamber for middle height.	
	To raise the upper chamber for replacing Diaphragm to appropriate height.	
	The laminating position where the top chamber to have connection with the bottom chamber.	
	Closing/Opening the upper chamber by manual.	Operate while pressing.
DELIVERY CONVEYOR		
	To jog compressor conveyor for forward/backward movement.	Operate while pressing.

	On/Off the cooling fan under the Delivery conveyor	
BOTTOM SHEET		
	Move the lower conveyor backward	Operate while pressing.
	Move the lower conveyor One rounding.	One-press for one-round.
ENTRY CONVEYOR		
	Move loading conveyor to forward/backward movement.	
	Continuous Move the lower conveyor and compressed conveyor for one time	
	Continuous Move the lower conveyor compressed conveyor for one time.	

7.3. ‘Temperature Inspection ’ Window

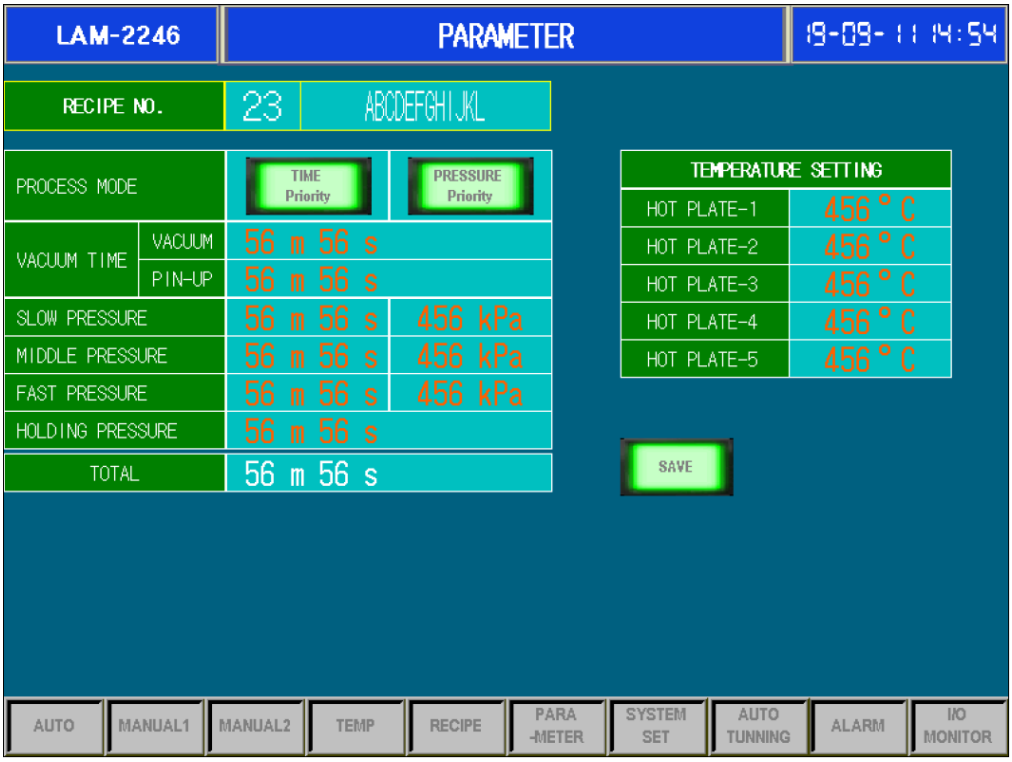


Item	Definition	Note
PLATE #1 / PLATE #2 / PLATE #3 / PLATE #4 / PLATE #5		
	To show the current temperature	
	To show the heater on/off.	
	To show the heater when to reach set temperature and range.	

7.4. ‘Reading Information’ Window

Item	Definition	Note
DESCRIPTION	To show the stored description.	
NO.	Order numbering	
SOURCE	To bring memorized recipe from No. or Description	Meaning of ‘from’
DESTINATION	To put memorized recipe to No. or Description	Meaning of ‘to’
COPY	To copy memorized recipe to No. or Description	
READ	To retrieve the needed recipe for the stored description.	

7.5. ‘PARAMETER(Details of each recipe)’ Window



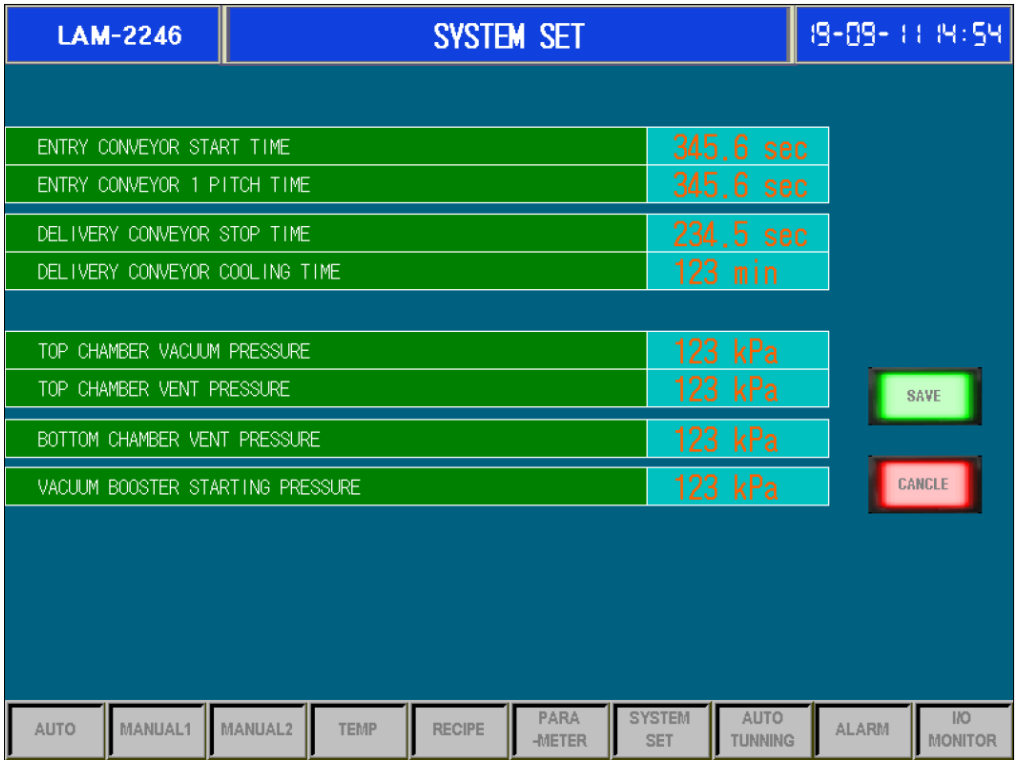
Item	Definition	Note
SLOW PRESSURE	To set the slow pressing time and pressure.	
MIDDLE PRESSURE	To set the mid pressing time and pressure.	
FAST PRESSURE	To set the fast pressing time and pressure.	
HOLDING PRESSURE	To set the elapsed time for holding.	
RECIPE NO.	Number and name of the operating recipe	
PROCESS MODE	To choose the priority process	
SAVE	Push to save the information as shown	
VACUUM TIME / VACUUM / PIN-UP	To set the vacuum and pin-up time	
TEMPERATURE SETTING	To set the temperature of each heating plate	

7.6. ‘ Auto Tuning ’ Window

This window shows to control heating plate (#1 ~ #5) of laminator and the basic parameter for alarm.

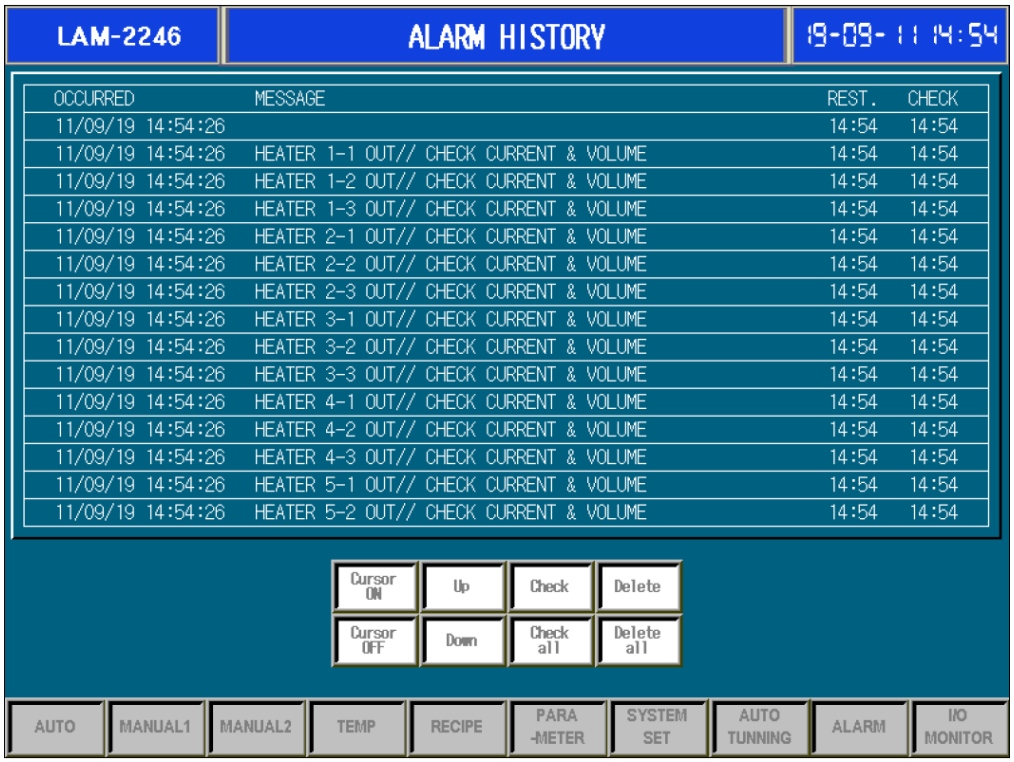
NOTICE	**This page is to initialize the control system. All parameters are set at the manufacture’s factory for optimum performance. Do not attempt to change any parameters without an advice from manufacture.**

7.7. ‘SYSTEM SET’ Window



Item	Definition	Note
ENTRY CONVEYOR START TIME	To set the loading time of entry conveyor.	
ENTRY CONVEYOR 1 PITCH TIME	To set the loading time of entry conveyor for 1 pitch.	
DELIVERY CONVEYOR STOP TIME	To set the stopping time of delivery conveyor.	
DELIVERY CONVEYOR COOLING TIME	To set the cooling time for laminated module.	
TOP CHAMBER VACUUM PRESSURE	To set the strength of vacuum pressure of top chamber	
TOP CHAMBER VENT PRESSURE	To set the strength of VENT pressure of top chamber	
BOTTOM CHAMBER VENT PRESSURE	To set the strength of VENT pressure of bottom chamber	
VACUUM BOOSTER STARTING PRESSURE	To set the starting power of vacuum booster.	

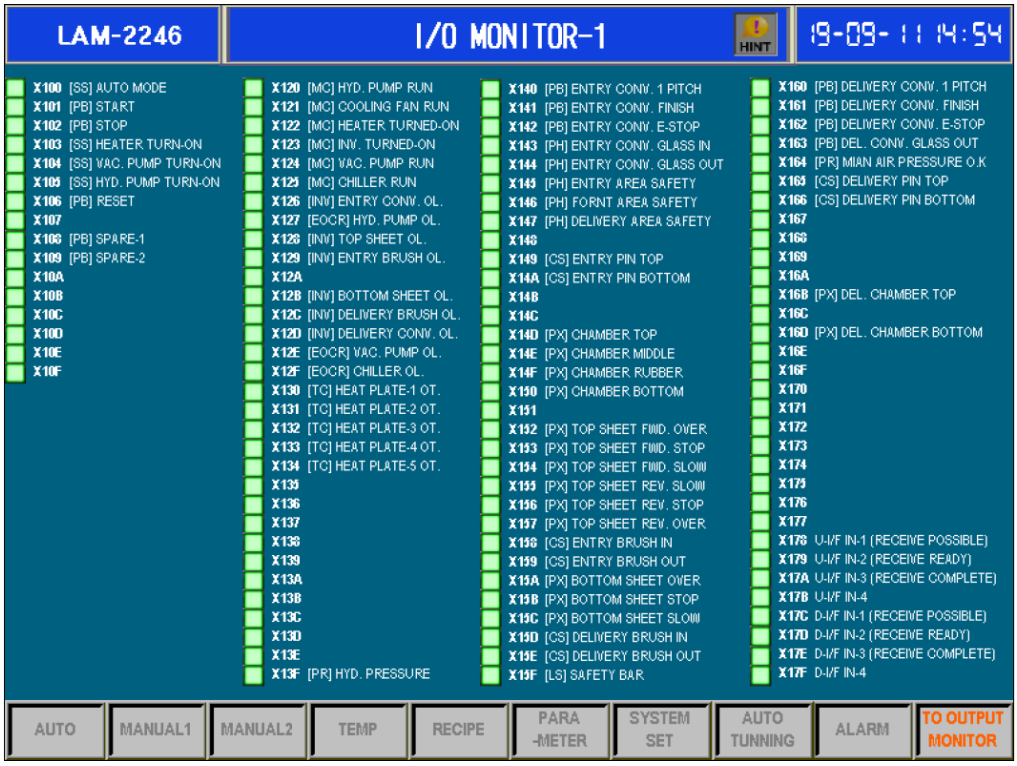
7.8. ‘ALARM’ Window



Item	Definition	Note
	To appear the cursor to check errors	
	To move the cursor up and down movement.	
	To check the recognized time by operator	
	To check the time to solve the problem	
	To delete the one or all error history	

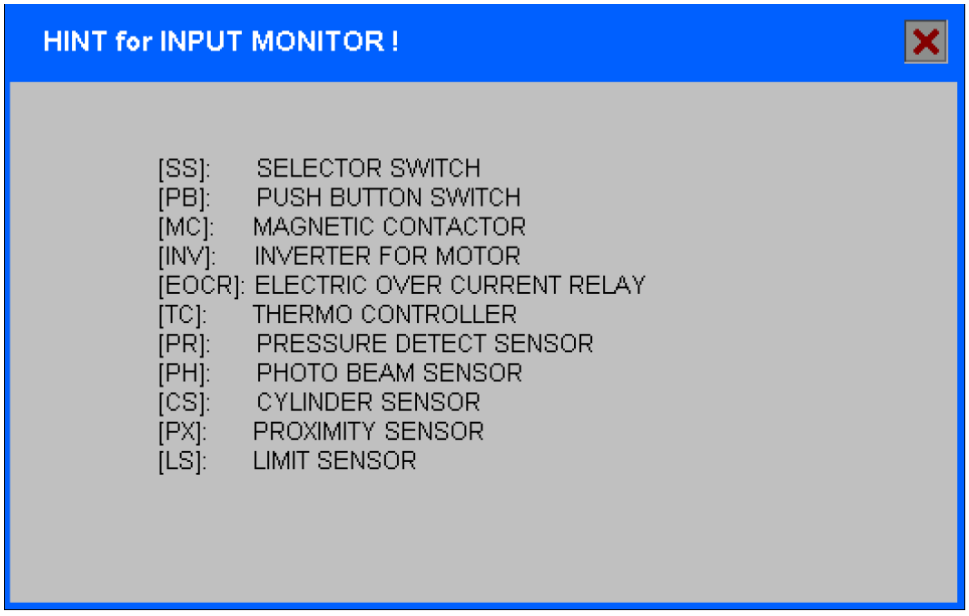
7.9. 'I/O MONITOR' Window

7.9.1 I/O MONITOR-1(input monitor)

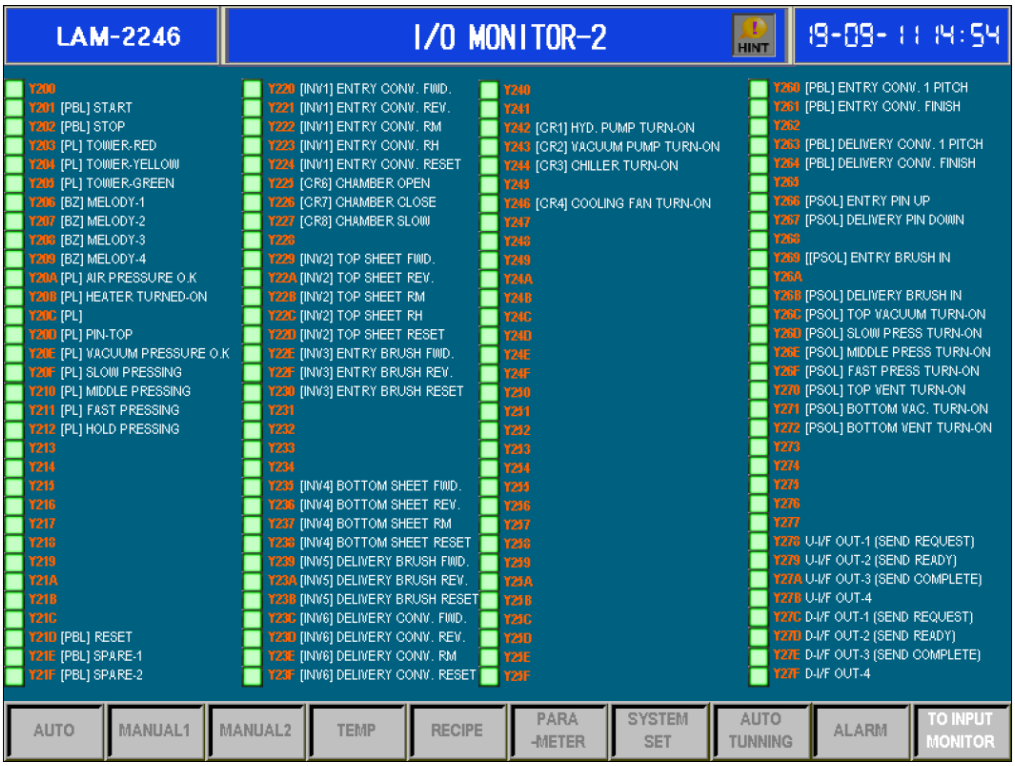


To put the switch, 

the Hint of initial should be appeared as below:

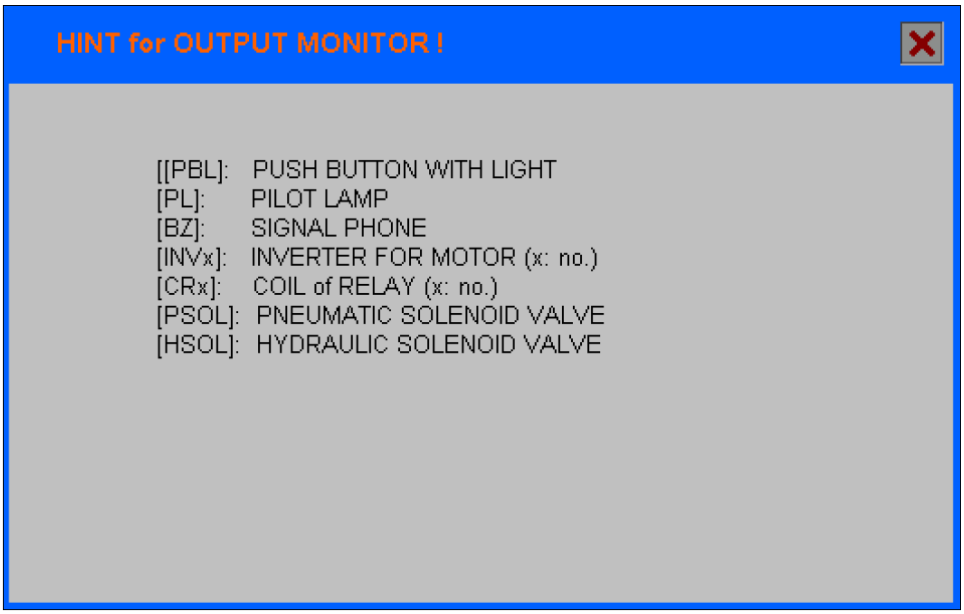


7.9.2 I/O MONITOR-2(Output monitor)



To put the switch, 

the Hint of initial should be appeared as below:



8. Operating Instruction

8.1. Start-up Operation

Prior to operate the Laminator, be sure the following checkpoints have been confirmed.

1. ***Be sure all personnel are clear of the machine.***
2. ***Verify external power source is in 'on' position.***
3. ***Be sure compressed air line is activated.***
4. ***All doors must be closed.***
5. ***Operator has the proper protective such as gloves.***

Never operate the Laminator with Electric cabinet door opened.
High voltages can be present in the box that can cause personal injury or death when the power is on.

1. Turn on the main disconnect switch on the electric cabinet and ‘POWER’ light turn on the console.

2. Press the ‘POWER ON’ button on the console stand.

The touch panel screen on the console stand will be activated.

3. Ensure that the emergency stop (E-Stop) button is in the out position.

The Laminator has and emergency stop circuit that must be reset before the Laminator will work.

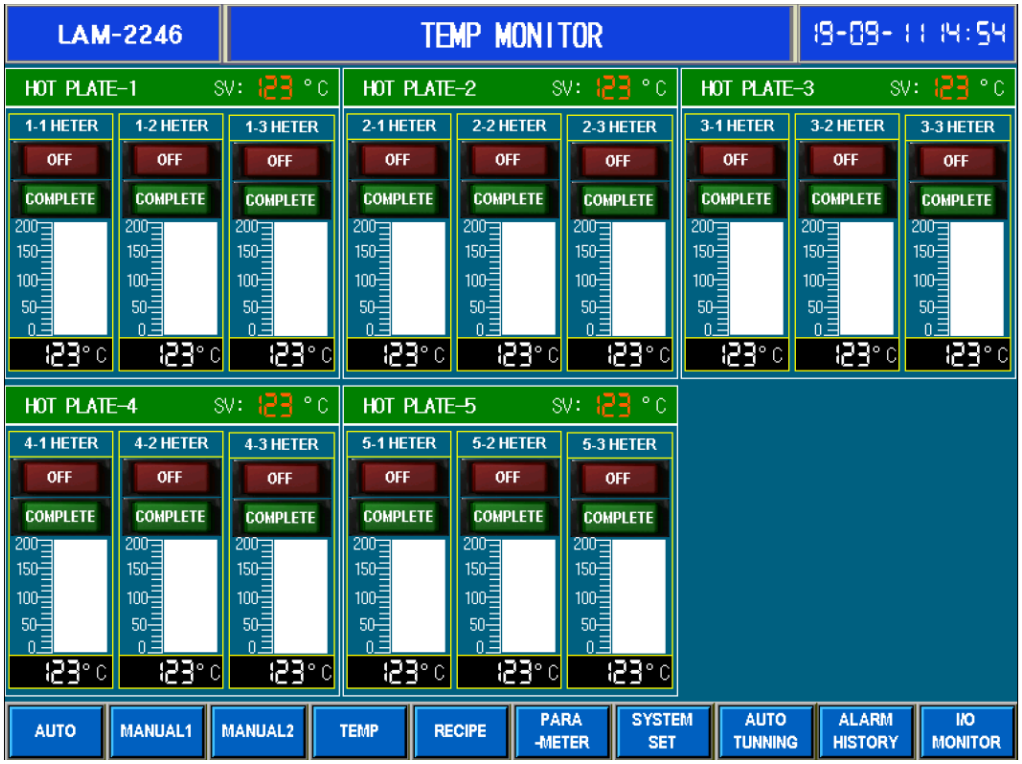
To set the E-Stop button in the out position, turn the button in the direction of the arrow.

8.2. Presetting Prior to Laminating execution

8.3. Warm up the Platens

The red light will turn on and the 2 heating control system (laminator and loading conveyor platens) will be activated.

The “Heating Complete” will turn on when the platen temperature reaches the temperature setting. All platen must be turn on the button of “Heating Completed”.

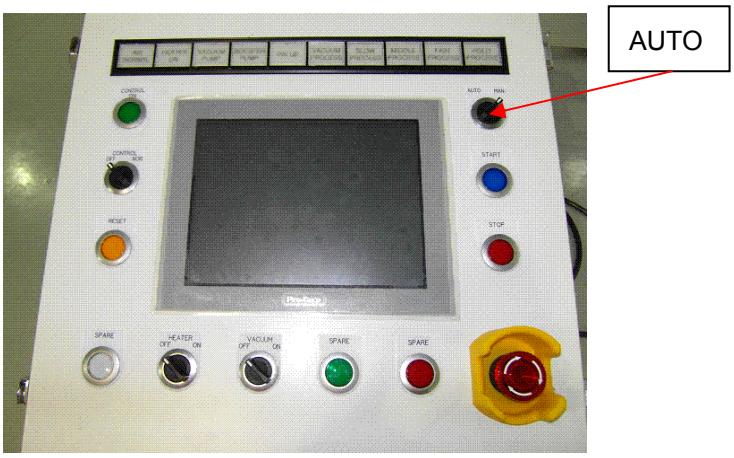


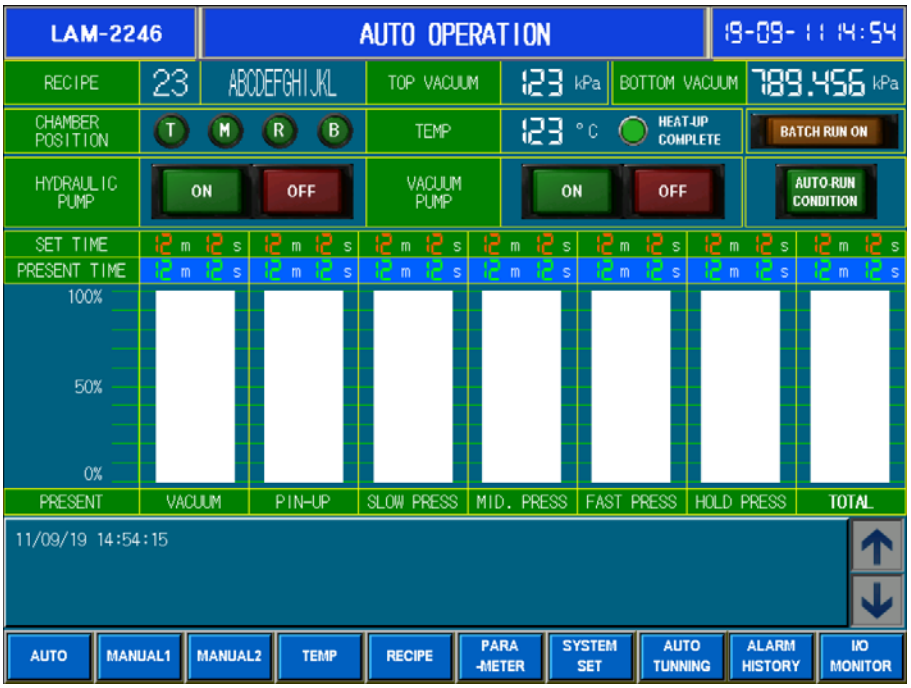
Press the key of the arrow in the right upper Loading C/V for Loading C/V temperature.

The “Heating Complete” will turn on, when the platen temperature reaches the temperature setting. All platen must be turn on the button of ‘Heating Completed’

8.4. Auto mode

1. If press the ‘AUTO’ button on the console stand. The green light should turn on.
   The heater control system starts platen temperature control..





In the ‘Auto mode monitor’’ window, the platen(Laminator) completed ‘light turns on if the platen temperature matches the target of the setpoint temperature in ‘Pump’ process.

In loading conveyor, the platen completed ‘light turns on If the platen temperature matches the target of setpoint temperature in ‘Preheating on C/V’
The ‘Home Positions’ light in the ‘Auto mode monitor’ window will turn on when laminating.

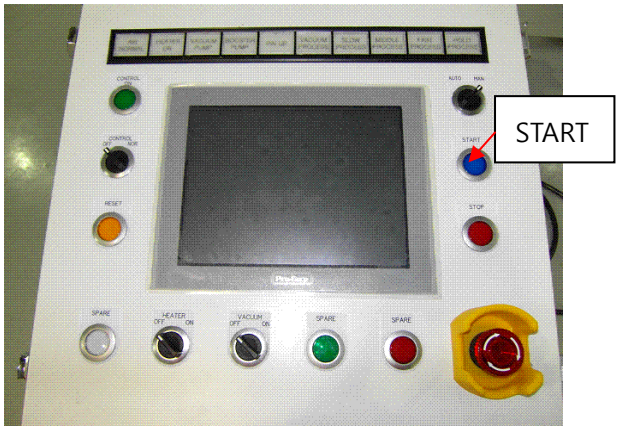
8.5. Automatic Batch Mode: 1 Cycle Automatic Mode

1. Press '1 Batch' button in the 'Auto mode monitor' window
2. Load the stack of module materials on the platen in the laminator. Be sure the stack is positioned inside the effective lamination area.

CAUTION

The laminating platen may be extremely hot.
Heavy cotton or other thermally insulation gloves must be worn to protect the hands from burns.

3. Cover the module stack with a release Teflon sheet to prevent EVA encapsulant from adhering to the diaphragm.
4. Press the 'START' button on the console stand. The green light will turn on and automatic cycle will start. The upper camber will close down automatically.



WARNING

The upper chamber is heavy and can cause personnel injury.
Be sure all personnel are clear of the machine when starts automatic.

5. Automatic Laminating

While the automatic laminating, The procedure of 'Auto monitor' can be checked in the monitor. The execution process button turns on, the process time, current temperature and vacuum pressure will be updated in the window.

6. Finishing Lamination and unloading the processed module.

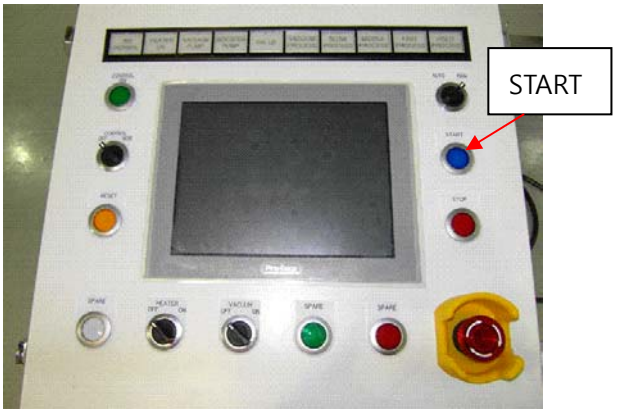
When the automatic lamination finished, the upper chamber opens automatically. The laminated module and release sheet can be removed from the laminator.

CAUTION

***The lamination platen may be extremely hot. When unloading the encapsulated module, heavy cotton or other thermally insulation gloves must be worn to protect the hands from burns*.**

8.6. Automatic Laminating (Automatic Mode)

1. Press the start button 'Auto mode monitor'.

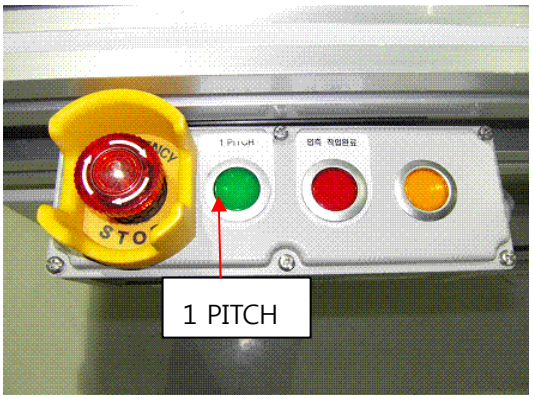


2. The green light will turn on and automatic cycle will start.
3. Load the stack of module materials on the platen in the laminator. Be sure the stack is positioned inside the effective lamination area.

CAUTION

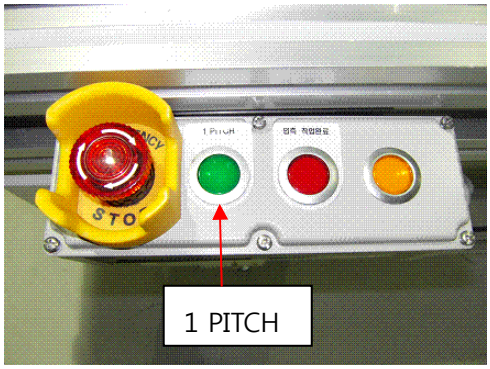
The laminating platen may be extremely hot.
Heavy cotton or other thermally insulation gloves must be worn to protect the hands from burns.

4. Cover the module stack with a release sheet Teflon sheet to prevent EVA encapsulant from adhering to the diaphragm.
5. Press the '1 pitch' button on the console stand, Be sure the stack is positioned inside the effective lamination area.



Conveyor will transfer for the time which is set in the process parameter until the module hits the loading position sensor.

8.7. Work set completed



1. “Compressor work finish” button will turn on the light when the loading position sensor detects the module.
2. Cover the release sheet and press Release sheet “Compressor work finish”.
3. When Press ‘Compressor work finish’ button and conveyor sends the module to the loading position with slow speed, The lamp will change from flashing to lighting.
4. Module is automatically loaded from conveyor into inside of laminator, when the following condition is satisfied..
   ① Temperature sensor on loading conveyor reached the set temperature for ‘starting temperature’
5. The upper chamber will close down automatically and automatic encapsulation starts.
6. When the automatic encapsulation is finished, the upper chamber opens automatically. The encapsulated modules are loaded from laminator to unloading conveyor.
7. Remove ‘release sheet’
8. Press the ‘Compressor work finish’ button. The module is loaded automatically from loading conveyor to downstream conveyor.

9. ALARM

9.1. Alarm Message

When an alarm occurs, the laminator is notified to an operator through the below devices.

1. Signal tower in AC-box
2. Music Horn
3. The alarm message in the touch panel.

9.2. Signal Tower

A Signal tower is located on the distribution box. The signal means as the below.

Red : The laminator is under warning condition.

Yellow: Being covered by Safety wall.

Blue: The laminator is in the automatic laminating.

9.3. Signal Tower

Signal horn speaker in AC-box notifies the operator to be under warning & alert.

9.3.1 How to reset the alarm

When the alarm occurs while automatic laminating.

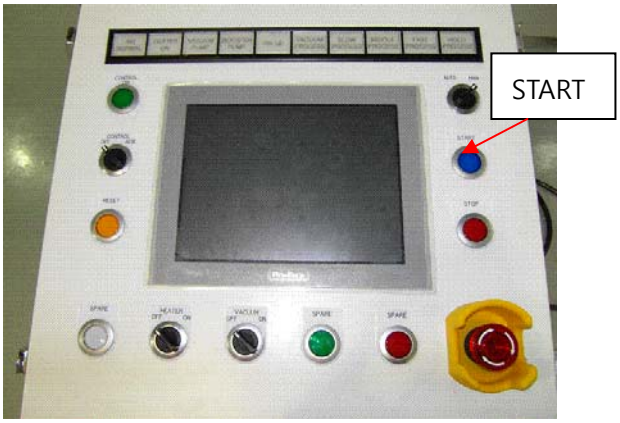
A. The red light Signal of the signal tower flashes or light.

B. The alarm history is recorded with appearing ‘Alarm’ window on the touch panel.

9.4. Resetting automatic laminating

If the ‘START’ button on the console stand is flashing, the automatic laminating can reset from interrupt process. Press the ‘START’ button.

If the ‘START’ button is not flashing, the automatic laminating cannot reset. In case, unload the stack of the module from the laminator and do ‘Home’ procedure.



10. MAINTENANCE

Preventive maintenance list

Item	Action	Frequency	Record/ Notes
Safety device			
Light curtain	Check	Everyday	Proper working
Overheat protection	Check	Everyday	Set 185°C
Lock pin For Chamber lifter	Check	Everyday	Lock pin is inserted to hold lifting arm.
Vacuum Pump(Leybold SV300B)			
Oil Height	Check & Supplement	Everyday	The middle range of gauge
Oil Condition	Check	Everyday	No dark brown and black
Oil Change	Exchange	Every 1-month	Quick Exchange depends on materials.
Oil Filter	Exchange	Every 2-month	
Inspection for pump	Close Inspection	Every 6-month	
LAMINATOR			
Chamber O Ring	Check &Clean	Everyday	
Upper release sheet	Checking &Clean	Everyday	
Conveyor sheet	Check &Cleaning check	Everyday	
Diaphragm for Punctures	Check	Every 1-month	
Leak speed Press1~3	Record	Every 1-month	Leak Time: Press1= Kpa/sec Press2= Kpa/sec Press3= Kpa/sec
Lower chamber Vacuum	Record	Every 1-month	Min. Pressure = Pa
Platen temperature uniformity	Record	Every 1-month	±2°C
Vacuum hose	Check	Every 1-month	Visual check for damage for deformation

Heating speed	Check	Every 12-month	= min(50=>130°C)
COMPRESSED AIR UNIT			
Air Pressure Regulator	Check	Everyday	Pressure> 0.5 MPa
Water Separator	Check	Every one month	Drain the liquid by pressing
Vacuum Pump (Leybold WAU501)			
Oil height	Check & Supplement	Everyday	The middle range of gauge
Oil condition	Check	Everyday	No dark brown and black
Oil exchange	Exchange	Every one month	Quick Exchange depends on materials.
Inspection	Close Inspection	Every 6-month	
Oil filter (This device not provided in this equipment)			
Pressure gauge	Check	Everyday	Check the power on. Not too low and too high
Oil height	Check	Everyday	Check the oil height on vacuum pump.
Oil condition	Check	Everyday	No dark brown and black
hose	Check	Everyday	Visual check for damage for deformation

WARNING

The main breaker needs to be turned off prior to any type of maintenance work..

WARNING

The operator is not allowed to service the machine with door key.
All the key for any doors or switches needs to be under control of supervisor only.
Do not open the door electric cabinet with power on.
There is a danger to get the electrical shock on the hot circuit with dangerous voltage in the door.
Turn off the main breaker, ELB0, prior to any type of maintenance work with the doors open.

WARNING

Never touch the following circuits. Incoming terminals on ELB0,
Circuit protector CP0 and lamp PLO0, those are hot even after the main breaker is turned off.
There is danger to get electrical shock on those.

10.1 Safety System

10.1.1 Safety Barrier System

The safety barrier system and the warning signal should be checked for proper operation. The upper chamber movement should be allowed only when the safety barriers are not interrupted. Interrupt the safety barriers by some kind of object (Not Hand) while the upper chamber is rising and/or closing, check the chamber movement is stopped and alarm message appear on the touch panel.

WARNING

Never put your hand inside the Safety barrier while the upper chamber is closing.

10.1.2 Over-temperature Control System

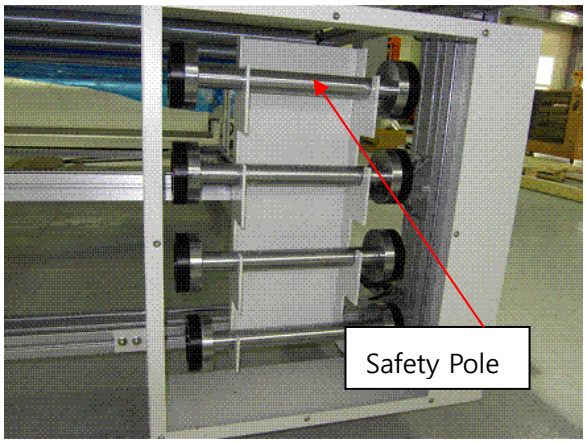
The Thermocouple meters provide protection to the laminator in the event of a failure in the main control system, which results in excess heating of the lamination platen. The meter set point should normally be set to 185℃.

WARNING

The electronic panel contains high voltage wiring and can cause serious personal injury.

10.1.3 Safety Pole

Safety pole must be set in the corners of the chamber during maintenance of platens or release sheet. Limit switches detect that the safety poles are set in the hunger. If one of the switches turned off, all control system is shut off in the same condition as emergency stop.

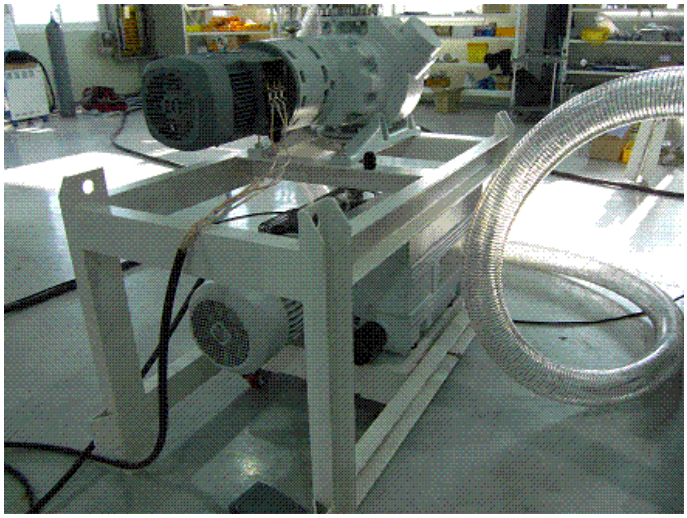


10.2.1 Vacuum Pump(Option)

WARNING

The vacuum pump gets hot over 80℃ and oil in the jump gets extremely hot.
These may cause the injury.
You should make sure to stop the pump operation and wait long enough until the pump gets cool down before you start the maintenance work.

10.2.2 Vacuum Pump SV300B(Option)



10.2.3 Check Oil Height (Option)

The pump oil height must be in the middle of oil-level glass during operating. If necessary, the pump switch turns off, supply the exact quantity of oil. Over supplying is brought oil loss, because of high suction.

The oil height must be checked every day.

10.2.4 Check Oil Condition (Option)

Typically, Oil is colorless light brown. If the color of oil is black or dark brown, it must be changed. If the dissolved gas or liquid in oil cause to decline the final pressure, Oil can be removed from pump by closing the suction port for 30-minute and opening the gas ballast valve.

For adjustment of the needed quantity, Oil can be drained out into a breaker or a small bowl under turning off and keeping the operating temperature.

10.2.5 Oil exchange (Option)

All the times, The oil must be exchanged under pump turn-off and keeping the operating temperature.

If there is the polymerized danger by the connected process, the prompt exchange must be after pump operating.

Release the Oil-drain-plug and Drain out the used oil into the proper container, when to treat with the used oil, the relevant environmental regulations must be observed.

When the speed of oil leak is slow, fasten oil-drain-plug, turn on (for max. 10-second) the pump and turn off for a while. Remove the oil-drain-plug again and then Drain out the rest of oil.

10.2.5 Oil filter replacement (Option)

Release the oil filter

Bring the new oil filer

Wet the gasket with the oil and then fasten the screw.

Insert the oil-drain plug again.

Release the oil-drain plug, the new oil must be topped up by the lower edge of the oil level glass.

Operate the pump for a while and then exchange the oil.

Make sure the proper oil.

10.2.6 Oil Filter Exchange (Option)

The oil filter is for taking off the pollutant..

The exchange time is one time oil filter in two times oil exchange.

If the oil filter is blocked, the pollutant occurs inside of the oil and the oil leakage.

A general filter automobile is available.

1. Remove the oil filter after draining out from the vacuum pump.
2. After inserting the oil filter, fasten tightly. It cause to leak, do not too much tight.

10.2.7 Pump Close Inspection (Option)

It is necessary that the vacuum pump is inspected in the case of the below. To avoid unexpected problems such as stopping. The regular inspection is recommended in every 6-month.

1. Although no breakdown diaphragm or heater hose. The vacuum does not reached to 150 Pa.
2. If the pump is covered like noise from pump, open the Noise box (The breakage may be inside of wing) Stop operating immediately, if not, It cause to the serious damage in pump.
3. After the oil exchange, Oil is quickly contaminated, which proves that the bad quality of oil is still left in circulation system, it cause to clog and overload.
4. The circuit breaker works by overloading. (The circuit breaker can be used by resetting, but the pump inspection is strongly recommended)

10.2.8 Wiring and Direction of Rotation (Option)

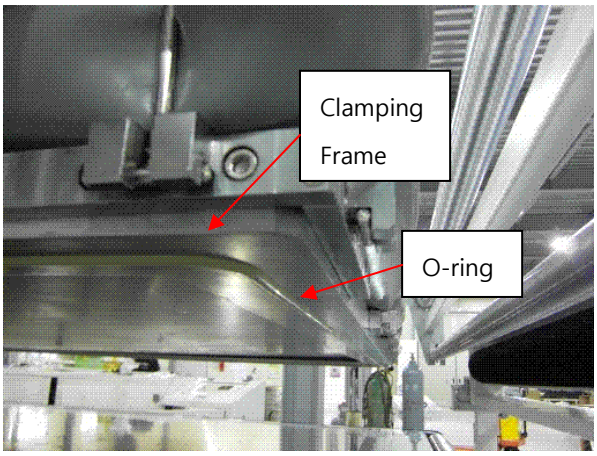
To prepare for the motor changing, The labels of ‘U1A’, ‘V1A’, W1A’ is on the terminal, even on the motor, in which must be maintained the same wiring.

1. Turn on the machine and ready.
2. Turn on the motor for 3-second, turn off and then see the rotating direction of the fan.
3. The direction of the rotation must be same the arrow direction.
4. If not, turn off both the motor and the main breaker of the machine, wire again.

10. 2.9 O-Ring Seal (Option)

The O-ring, which seals the vacuum chamber must be kept clean and greased for proper operation. Periodically, or whenever the chamber fails to attain proper vacuum, the O-ring, its groove, and the mating surface on the lower chamber should be cleaned. Use a solvent such as methyl alcohol and a soft, clean clothe, then apply a light coating of silicone vacuum grease to the O-ring before replacement.

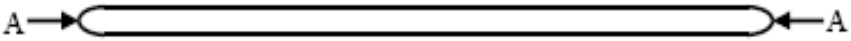
If either metal sealing surface becomes scratched, it can be polished with the very fine 600grit sandpaper. If the O-ring is damaged, it must be replaced.



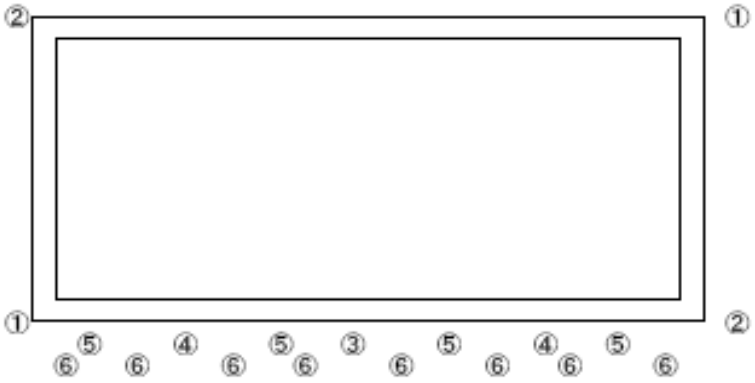
WARNING

Never put your hand or body inside the chamber without pushing emergency stop button.

1. Stop the upper chamber at the position where the operator can reach his hand to the O-ring and push the emergency stop button.
2. Straighten the O-ring and find the 'A' position shown in below figure.



3. Insert the 'A' position of O-ring in the #'1' corners of the groove of the clamping frame.
4. Insert the O-ring in the other corners (#'2'). It is important that the O-ring hang slack equally.
5. Insert the O-ring in the half point of the each part as the below drawings..(#3 >#6)
6. Insert the O-ring in the all of the groove and check that there is no protrusion.



10.3 Laminator Upper Release sheet

10.3.1 Cleaning

The laminating platen may be covered with a Teflon release sheet, adhered to the platen. The area under the O-ring tends to get dirty especially. The surface can be cleaned with methanol and soft cloths. If the surface becomes worn out, it can be replaced.

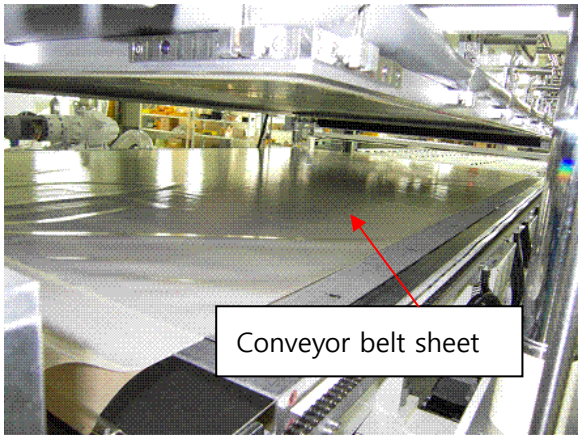
10.3.2 Replacing

It is necessary to replace the sheet when the damage is large or the stacked EVA will not come off.

The upper Teflon sheet is sandwitched by bars at both ends and fixed to the upper chamber frame.

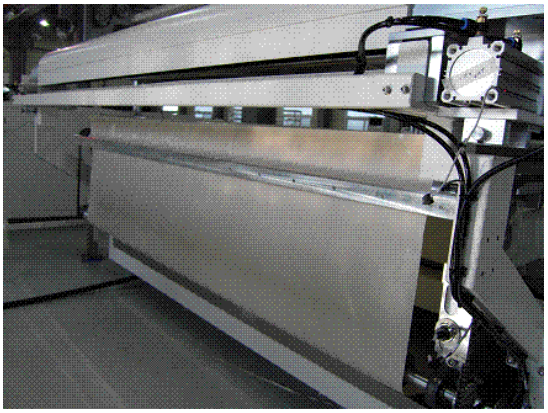
10.3.3 Cleaning

The conveyor belt sheet sliding on the platen is to transfer the module and to avoid that the platens get dirty with EVA chips. Clean the sheet surface with the lug and cleaning liquid such as alcohol when the surface is dirty. Replace it when the damage is large.

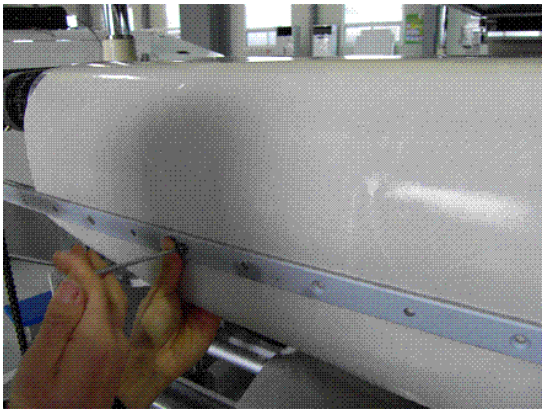


10.3.4 Replacing of Conveyor sheet

It is necessary to replace the conveyor belt sheet when the sheet is damage or the stacked Eva will not come off. Follow the next procedure.





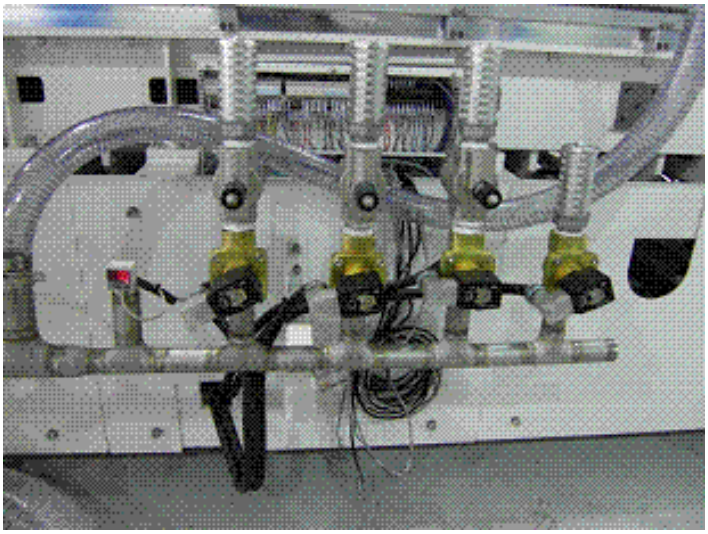
1. Entirely open the upper chamber on the“Manual operation”screen.
2. Rotate the conveyor on the “Manual operation” screen, before the edge clamping bar is

located in the platen.

3. Take off the rear plate on the rear of the edge clamping bar.
4. Rotate the conveyor on the “Manual operation” screen, before the center clamping bar is located in platen.
5. Take off the center clamping bar and the rear plate on the front.
6. Rotate the conveyor on the Rotate the conveyor on the “Manual operation” screen, Before the edge clamping bar is located in platen.
7. Take off the front platen from the front of the edge clamping bar
8. Remove the conveyor belt sheet.
9. Cut the same size as conveyor belt sheet, Make a hole the same diameter at the same position.
10. Install the new sheet at clamping bar.

10.3.5. Compressor Speed Controlling

If it needs to control the compressor speed, adjust each leakage controller.



1. To slow down the compressor speed, Turn the knob into clockwise direction..
2. To Speed up the compressor speed, Turn the knob into counterclockwise direction.
3. Operate the laminating process without module, Check the new speed with monitoring ‘leak speed’ on the ‘AUTO’ screen.

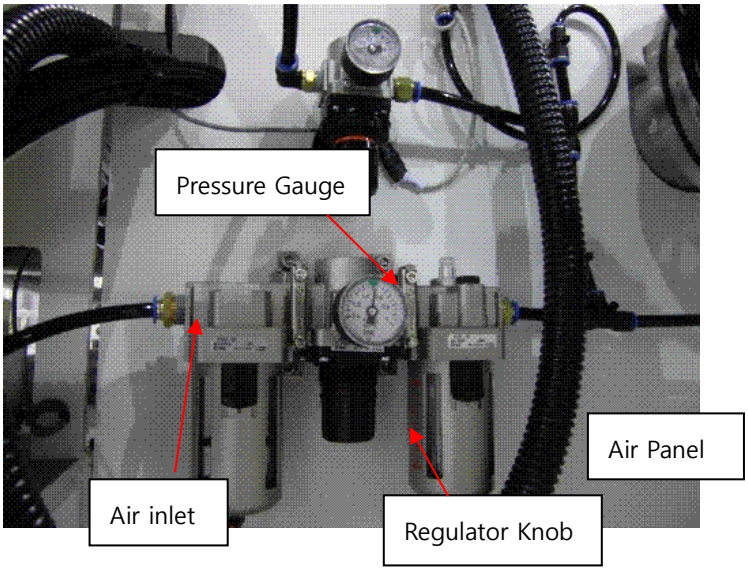
The dust in the air occurs to block the silencer, so that can be the low compressor speed. to prepare for this, The silencer must be cleaned and replaced.

10.3.6 AIR Components

10.3.7 Primary air supply

The machine requires the pressure with 0.4Mpa or more. Check the air pressure at the pressure gauge.

The water or impurities in the air supply will be separated and piled in the filter case installed at the air inlet. Drain the piled by turning the drain knob regularly.



10.4 REPLACEMENT OF PRESSURE DIAPHRAGM

WARNING

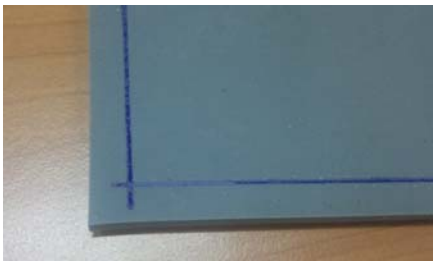
It is important that all components of the diaphragm be at the same temperature when replacing.

If the pressure diaphragm is punctured or torn, it must be replaced. To replace the diaphragm perform the following steps :

1. Draw the rectangular lines on the surface .

   The lines are decided as follows;

   Outline of the upper chamber - 2%



Diaphragm

   For example ;

   Outline of the upper chamber of Laminator 2246 is;

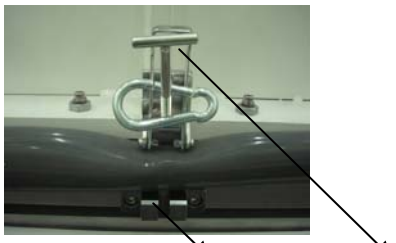
   2,500mm X 4,800mm

   Rectangular line is;:

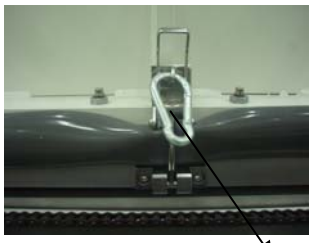
   2,314 X 4,614mm

2. Open the upper chamber on the "MANUAL" screen to take off the upper release sheet..

3. Close the upper chamber on the “MANUAL” screen.
4. Leave the heater ON with 130°C or higher
5. Take all clamping leaves off the Hook and hold the ring upward by Carabine hooks



Hook ring



Carabine hooks

6. Open the upper chamber on the “MANUAL” screen and remove the old diaphragm.

CAUTION

When removed a clamp lever, fix a department with a spring.

Fixed metal fittings are caught at the time of a rise of upper chamber suddenly, and there is Danger that I lift an installation frame..

7. Lay new diaphragm on the platen and wait until diaphragm has expanded(**20~30 min**)

WARNING

Diaphragm must be expanded by heating to reduce wrinkling.

The laminator platen is the best heating source for this task.

8. Turn off the safety curtain on the operating box.
9. Close the upper chamber to the position with some clearance between upper chamber and frame

WARNING

This procedure needs the safety curtain off.

You must pay the attention so that your fingers or the part of the body should not be pinched By the chamber.

10. Pull the diaphragm outward until the marked lines come to edge of the upper chamber. Keeping this position of the diaphragm, close the upper chamber fully to clamp it.
11. If necessary, trim the excess diaphragm from the edge of the upper chamber. The cutting Dimension is ideally about 130~150mm from the edge of the upper chamber so that handling is easy later.
12. Set all clamps on hook and hold their leaves by spring. Open the upper chamber fully Manually after setting all the clamp

13. Check the diaphragm visually. If there is large wrinkle, close the upper chamber and unclamp the wrinkled area to eliminate the wrinkle by pulling the diaphragm.
14. Install the release sheet.

10.5 TROUBLE SHOOTING

The following table lists the alarm messages that may occur during system operation.

Symptom	Analysis	Corrective Action
Vacuum is not high at all in “Pump”	O-ring out of the groove	Insert the O-ring in the groove firmly
	O-ring has damage	Replace the O-ring
	Upper chamber is not close fully	Reference position is shifted. Home the machine again. If the chamber is not close fully, contact Wooil-Hightech
Vacuum is not high as before in “Pump”	O-ring out of the groove	Insert the O-ring in the groove firmly
	O-ring has damage	Replace the O-ring
	O-ring has dirt	Clean the O-ring.
	Release sheet under the O-ting has dirt.	Replace and Clean the release sheet
	Clamping of Diaphragm is loose.	Adjust the hook shorter to increase clamping power. The four corners can be loose frequently
	Clack on the heater hose in lower chamber.	Open the cover and check the clack on the hose. Contact Wooil-hightech to replace the hose.
	Leak on the vacuum hose or connector.	Replace the hose if it has damage. Tighten up the hose band if it loose. The vacuum inlet area is frequent leaking point.
	Low vacuum on the pump.	Disassemble and clean the pump. Clean the exhaust line and then operate the pump with gas ballast on.
Vacuum get low when “Press” process begins even “Pump” process is good.	Leak on diaphragm	Replace the Diaphragm Contact Wooil-Hightech if replacing does not improve the situation.
Breaker trips due to overload on vacuum pump	The degraded oil in vacuum pump causing the overload.	Replace the vacuum oil. Overhaul the vacuum pump immediately if the noise does not disappear even after the oil change.
The vacuum pump is extremely loud.	The problem is inside of wing.	If the noise is disappeared after replacing the oil, Do prompt action for

		the close inspection.
To get slower the compressor leak speed Low/Mid/Fast.	Silencer or each valve for compressor is blocked.	The compressor speed controlling for each compressor is out of dial, Replace the silencer.
To get longer for draining time.	The silencer is blocked	Replace the silencer.
The difference for heating speed for Platen	The big space between the heater and the platen.	Take off the conveyor belt sheet and retighten up the screws. Do not tighten too hard because the aluminum thread is soft. Contact Wooil-Hightech, If there is no loose on screws.
To get slower heating speed for the Platen.		
Temperature increase more than 10°C immediately after the Upper chamber opens.		
Alarm of broken heater detector.	Wire to heater is off Heater is broken Fuse is broken	Contact Wooil-Hightech
Difference of cooling speed on Platen	Change temperature/pressure of the Note: There is a machine without the cooling function.	Adjust the valve after taking off the front cover.
To get slower heating speed for the Platen		Install some pressure stabilizer for water supply.
The “Ready” status is off.	Damaged wire cover. Start detecting the leak of voltage .	The damaged wire cover happens frequently on the wire to heater in Lower chamber.
Alarm O.T when upper chamber open/close.	The dog or switch position may have shifted on power cylinder.	Horn the machine again. Contact Wooil-Hichtech if the problem remains.

We recommend to run the following test program every month without module even there is no problem in production. Then, record the cycle time, vacuum and others. This test will show you the change of the machine status and may find potential problem.