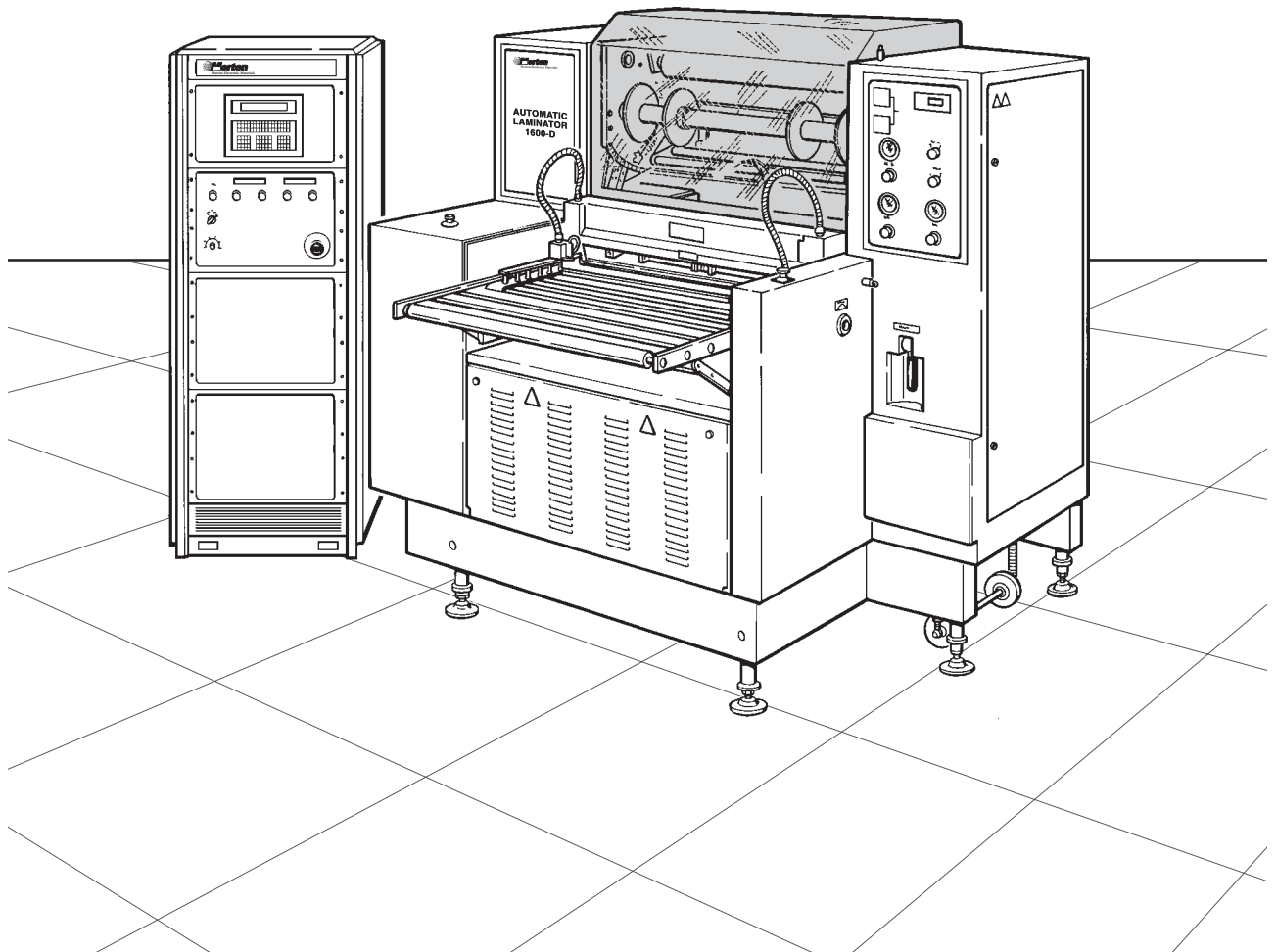


CUT-SHEET LAMINATOR 1600-D



**OPERATING
AND SERVICE MANUAL**



Morton Electronic Materials

NOTICE

PRIOR TO INSTALLING OPERATING OR PERFORMING MAINTENANCE ON THE MOD. 1600-D AUTOMATIC LAMINATOR THIS INSTRUCTION MANUAL SHOULD BE READ CAREFULLY.

“TO THE BEST OF OUR KNOWLEDGE THE INFORMATION CONTAINED HEREIN IS CORRECT, HOWEVER, MORTON DOES NOT GUARANTEE THE COMPLETENESS OR ACCURACY OF THE INFORMATION. USER IS RESPONSIBLE FOR THE SAFE INSTALLATION AND OPERATION OF THE MOD. 1600-D AUTOMATIC LAMINATOR”.

WARRANTY

The Mod. 1600-D AUTOMATIC LAMINATOR is warranted by Morton Corporation against defects in material and workmanship for a period of 90 days, from date of receipt by the customer, during which time Morton will be responsible for the replacement or repair, at its option, of any defective parts and for any labor charges connected with repair of the Mod. 1600-D AUTOMATIC LAMINATOR.

Morton, for an additional 90 days period, warrants that it will replace or repair, at its option, any part proves to be defective; however, the customer will be responsible for all labor charges during this additional 90 days period.

Morton should be notified in writing of any defect in material or workmanship of the Mod. 1600-D and if so instructed by Morton, the Mod. 1600-D or any part thereof, will be shipped, freight paid by Morton, to Morton for repair.

Neither the Mod. 1600-D nor any part thereof is to be returned to Morton without written authorization from Morton.

This warranty is effective only under the condition that the Mod. 1600-D AUTOMATIC LAMINATOR is installed in accordance with Morton specifications.

The warranty for the 1600-D AUTOMATIC LAMINATOR does not cover the laminating rolls except for original manufacturing defects reported during the warranty period.

Additionally, the warranty is null and void if the Mod. 1600-D is abused or operated contrary to the instructions or if alterations or repairs are made by other than authorized Morton representatives or by written permission from Morton.

Morton's liability for any breach of warranty is limited, as set out above, to repair or replacement of the defective part and labor charges in certain instances, and in no case shall Morton be responsible for any consequential damages, nor shall Morton's liability in any case exceed the amount of the purchase price of the Mod. 1600-D AUTOMATIC LAMINATOR.

This warranty is expressly in lieu of all other warranties, express or implied, including the warranty of merchantability of fitness for a particular purpose.

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AUTOMATIC LAMINATOR 1600-D

GENERAL DESCRIPTION

The Dynachem Laminator, model 1600-D is a completely automatic 30" laminator, based on a totally new design concept, and constructed to guarantee high quality lamination and the absolute reliability of the machine over a long period of time.

In order to achieve this objective the machine has been designed to incorporate the following innovations:

- A "soft-contact" type lateral centering unit, suitable also for inner layers.
- A frontal barrier for alignment of the boards to the lamination rolls.
- Tacking bars that turn eccentrically around the lamination rolls, thus preventing any possibility that the board is moved after the tacking and before the lamination starts (the main cause of wrinkle formation).
- Dynamic tension rolls for the film (in addition to static tension).
- Cutting on the fly by means of "SHEARS", which do not move the film sideways. This ensures a clean and reliable cut throughout innumerable operating cycles.
- Direct hot lamination by two rolls, 100 mm diameter, heated from external highly efficient short-wave infra-red lamps (very fast temperature recovery time.)
- Controlled by electronic microprocessor with mother-tongue interface through keyboard and display, including a diagnostic, alarms and operator's guide.

LAYOUT

The 1600-D laminator consists of the following component parts:

- A static front unit containing the input roller, the systems governing the centering and insertion of the board between the lamination rolls, the vacuum pump for the exhaust shoes, and an exhaust fan with pipes for the discharge of fumes arising from the lamination process.
- A static rear unit containing the output roller, on which are mounted an IR sensor which reads the temperature of the laminated board, a photocell to signal a stationary board, and the grounding bars.
- A removable central unit on which are mounted the lamination rolls, the vacuum shoes, the tacking bars, the cutting groups, rollers to feed in the rolls of dry-film, the film tensions rolls, the lateral cutting groups, the IR lamps to heat the lamination rolls, and the protective cap.
- A control panel mounted on wheels, containing all the electrical commands, the monitor and the keyboard.

DIMENSIONS AND CHARACTERISTICS

Input roller

- Length 600 mm (23,6")
- Fold down 300 mm (11.8")
- Width 900 mm (35,4")
- Height 860-1050 mm (34"-41")

Output roller

- Length 250 mm (10")
- Width 900 mm (35,4")
- Height 860-1050 mm (34"-41")

Boards for lamination

- Length Min: 200 mm (7.9")
Max: 787 mm (31")
- Width Min: 120 mm (4.7")
Max: 787 mm (31")
- Thickness Min: 0.05 mm core
(with thin layer option) (0,002")
Max: 5 mm (0.196")

Lamination rolls

- Diameter 100 mm (3.9")
- Hardness 60 Shore
- Length 814 mm (32")

Front and rear edge

Both adjustable between 0 and 50 mm (0÷1.9")
(to be compatible with the length of the board).
See detailed specifications later on.

Dimensions of the film for lamination

- Length Min: 187 mm (7.4") - Max: 762 mm (30")
- Width Min: 120 mm (4.7") - Max: 762 mm (30")
- Thicknesses: All that are available

Electrical power supply

- Standard 380V - 415V - 480V 3Phase 50/60 Hz + Ground
- Other voltages available on request, and by specific prior agreement.
- Power consumption: 8 KVA
- Building line main switch: 25A 'motor starting' type

Air supply

- Dry compressed air at 6 Atm.
- Consumption 45 NI/min.

Exhaust

- Air consumption approximately 300 m³/hr for exhaust purposes.

Conveyor speed

- 0÷5 mt./min.

Speed of lamination rolls

- 0÷5 mt/min.

Temperature of lamination rolls

- Room Temperature ÷130°C

Pressure of lamination rolls

- 320 kg max (at 6 bar).

Tacking time

- 0.1÷9.9 sec

Temperature of tacking bars

- Room temperature ÷45°C

Noise level

- 75 dB (continuous ponderated equivalent value A)

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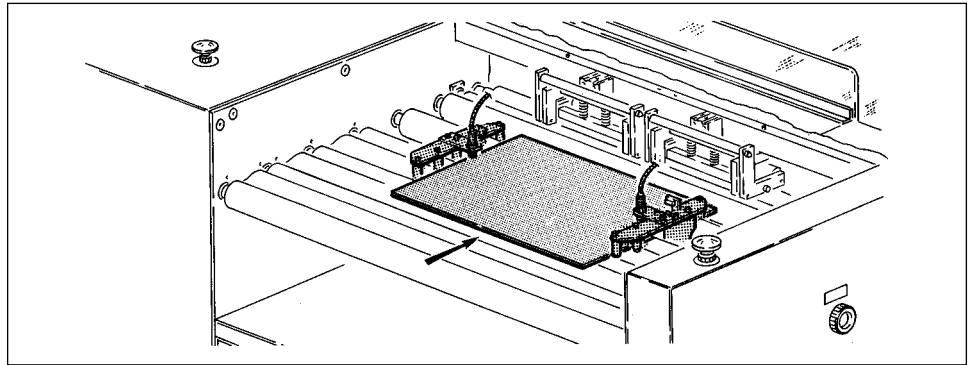
OPERATOR START-UP

- A) Turn on Main Disconnect.
- B) Machine does system Check. "EVERYTHING OK" message will display if self check runs OK.
- C) Pull out "Sliding Trolley".
- D) Start machine by pressing "Set Up" button on main control panel. Machine vacuum pump will start.
- E) To enable the machine vacuum system repositioning rotating sectors.
- F) Place film on film spool supply rollers and thread per diagram on side rail of machine. Center film by using the centering scale and lock into position. Trim leading edge of film against counter blade being careful not to damage tacking strip.
- G) Close Sliding Trolley, machine will start to heat Lamination Rollers.
- H) Verify proper temperature setting on Temperature Controllers, adjust as necessary.
- I) Verify proper lamination roll pressure, adjust as necessary.
- J) Verify lamination speed, front and rear film spacing and tacking time are set correctly. Changes can be made by pressing "Set Up" button on Main Control Panel.
- K) Start automatic lamination cycle by pressing "Cycle Start" button on Main Control Panel. Machine will not start to process panels until lamination rolls are at the selected temperature set point.
- L) Whenever an automatic cycle is started, the first panel to be processed should be a scrap panel. This will ensure that all production panels will have the correct film spacing. Also film tension and alignment will be correct.

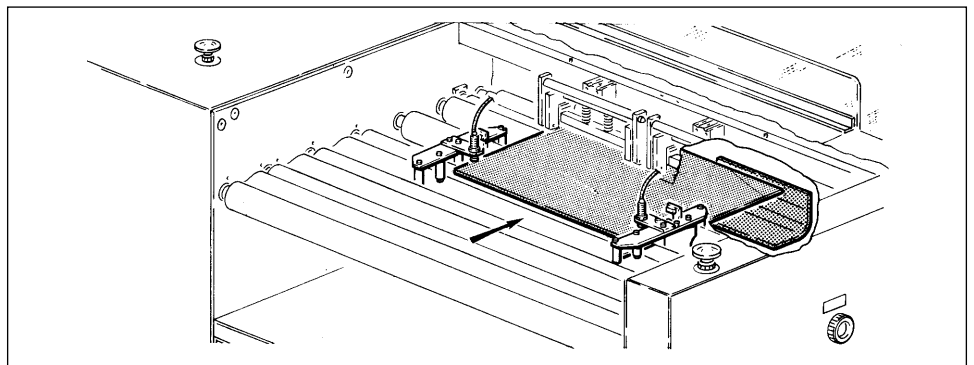
NOTE: Machine Maintenance is extremely important. Lamination Rolls should be cleaned at the start of every shift and during every change of the film rolls. Conveyor rolls should be wiped clean and the Tacking Strips should be cleaned and inspected for damage at the start of every shift.

OPERATING CYCLE

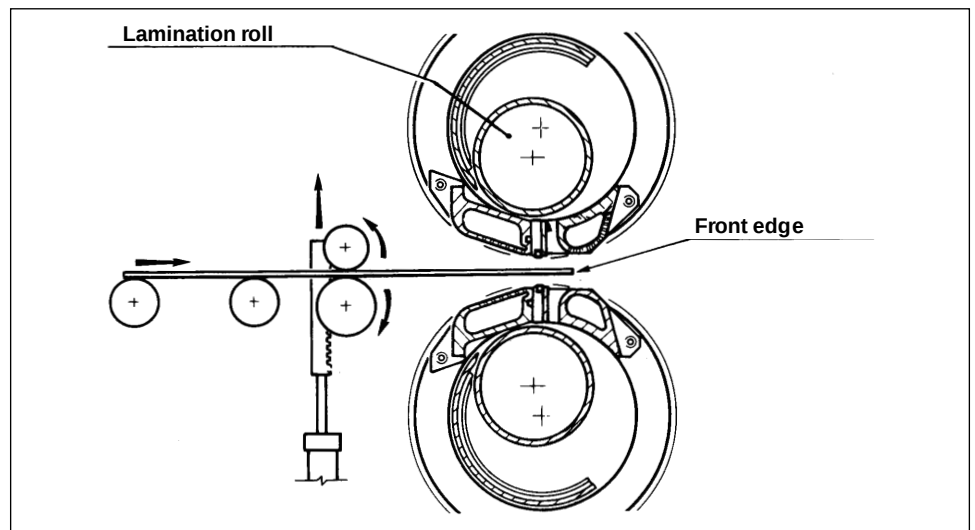
The board for lamination arrives at the input roller, where it is centered onto the center-line of the machine by the "soft-contact" centering unit.



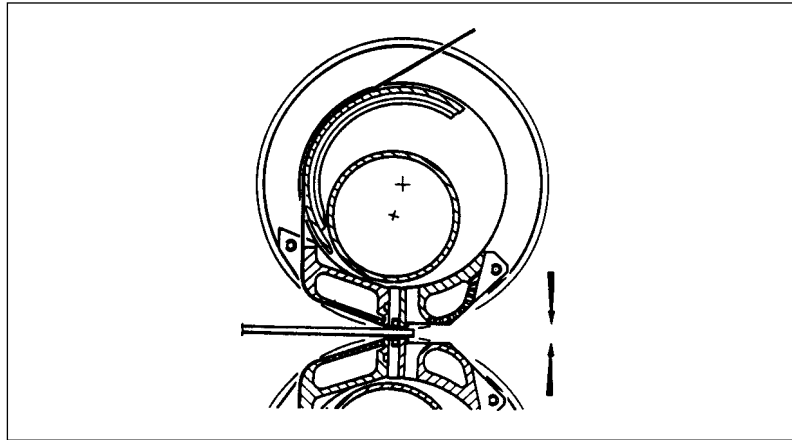
It then comes to rest against a frontal barrier which lines it up with the lamination rolls.



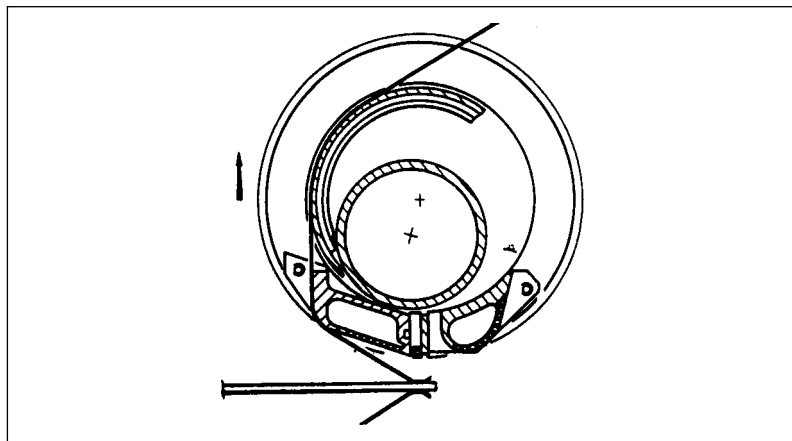
The board is then gripped between two rolls, and inserted between the exhaust units, which also include the tacking bars and the counter-blades of the cutting shears.



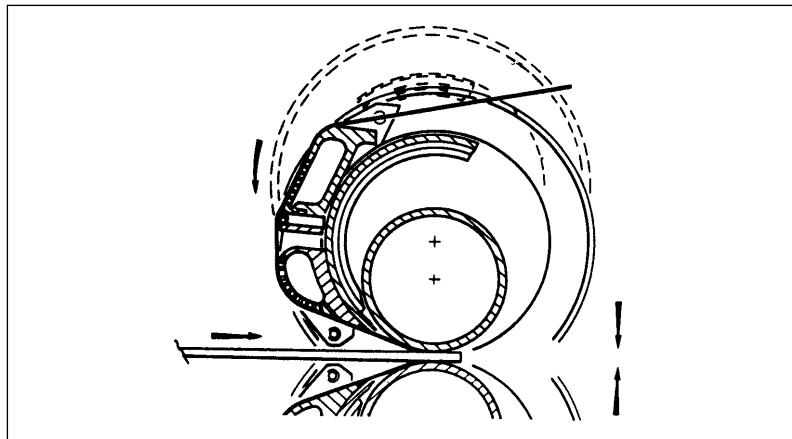
Here the film is tacked onto both edges of the board according to pre-programmed time and temperature.



Following the tacking the sectors and tacking bars separate, leaving the film attached to the board.

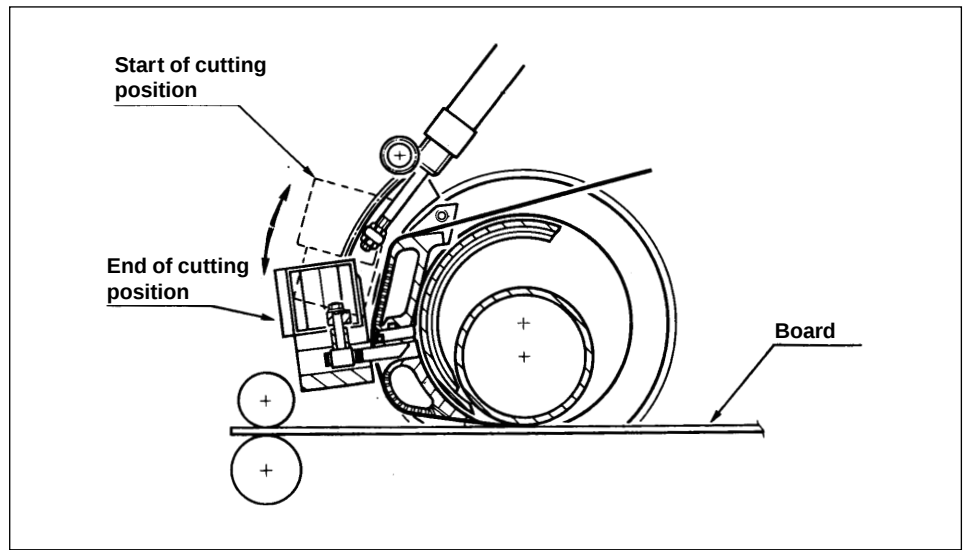


They then turn away to allow the lamination rolls to close down onto the board at the precise tacking point.

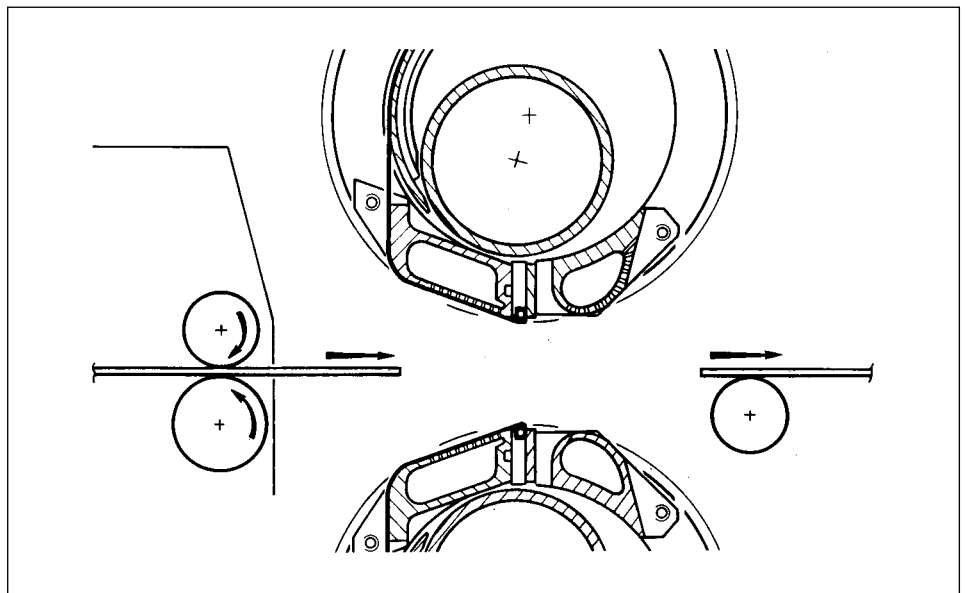


The tension rolls put the dry film in tension, and the lamination rolls move to laminate the film on the board. When the electronic controls send the signal to cut, the exhaust units and the counter-blades move forward once again together with the film.

Simultaneously the blades of the shears close down over the counter-blades and cut the film stretched between them.



Once the board has been completely laminated the rolls separate and, if there is another board ready in position for lamination, the exhaust units return to the tacking position.



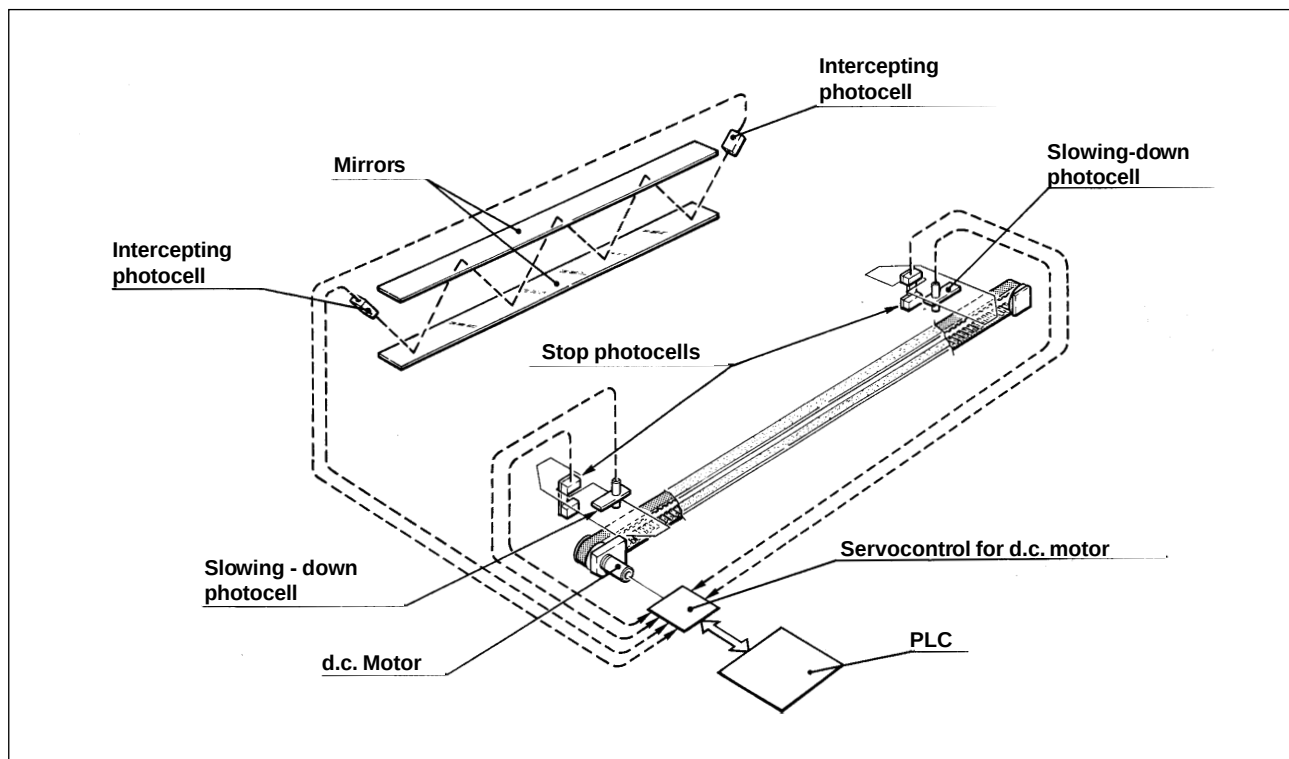
Meanwhile the laminated board has arrived at the output roller, where static electricity is drawn off, and its temperature is read by an IR sensor.

OPERATION AND CALIBRATION OF THE VARIOUS GROUPS

LATERAL CENTERING UNIT

Operating cycle

The lateral centering unit is powered by a low inertia d.c. micro-motor and a toothed belt. The motor is controlled by an electronic circuit board (Ref. S.C.C.) and by two pairs of photocells (mounted on the lateral shoulders) plus another photocell, known as the intercepting photocell.



When the board for lamination conveyed by the input roller passes between the mirrors, the intercepting photocell (FC69) signals its presence to the control panel (S.C.C.). The motor (M5) sets the two centering-guides in motion, so that they will, if necessary, move the board towards the center of the machine.

When both slowing-down photocells (FC75/76) have been activated by the board, the motor decelerates immediately, drawing the centering-guides slowly towards the board, until the two stop photocells are also activated (FC74/FC77).

The motor (M5) will stop for the interval selected on the controls (S.C.C.). Then, inverting the direction of rotation, it will reopen the centering-guides, and come to a final halt when the stop sensor (FC70) for reverse movement is activated.

Should either the forward stop sensor (FC71) or the reverse stop sensor (FC70) be out of action for any reason, the safety microswitches (FC72/FC73) will take over, immediately cut off the power supply to the motor and signal the irregularity through the video monitor.

Adjustment and calibration of the lateral centering unit

For the centering unit to function correctly, there should not be too much clearance between the centering-guides and the board when the unit is closed.

The following steps must be followed when calibrating this space: switch off the machine and disconnect only one cable from the micromotor (M5) which is situated at the top of the front left-hand crankcase.

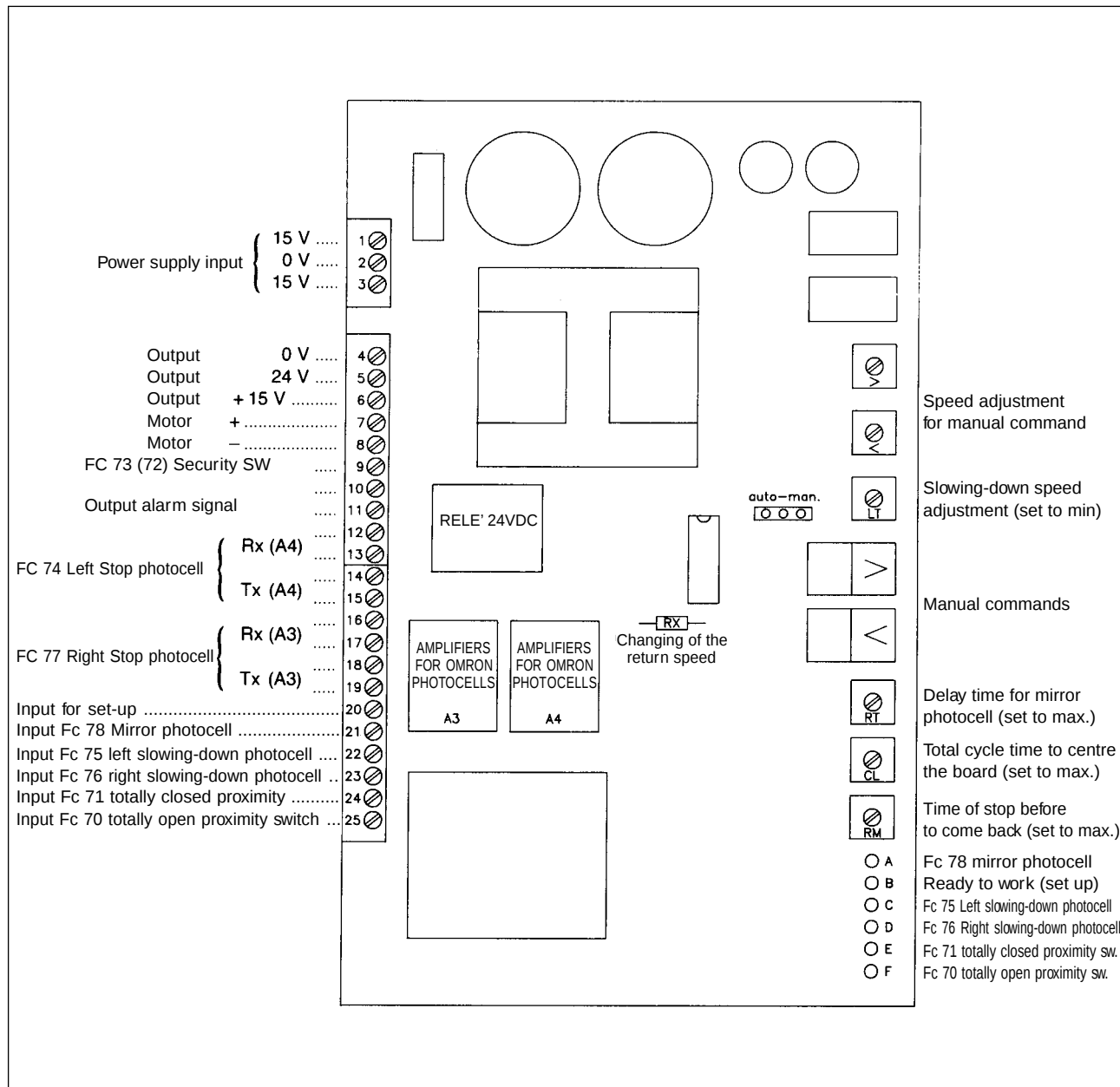
Switch the machine back on and, moving the centering-guides slowly by hand, center a well-squared up rigid board, taking care to stop immediately when the stop photocells (FC74 and FC77) (left and right) switch off. In these conditions check how much space there is between the centering-guide rollers and the board. If the space needs to be either increased or decreased, move the supports of the stop photocells. The total recommended space is approximately 1 mm.

It is equally important to check the parallelism of the two centering-guides which can be done using the same rigid board. If necessary their positions can be changed by working through their fastening screws.

The precise reading distance for the forward movement and reverse movement stop sensors (FC71 and FC70) is 1.5 mm. Their positions can be changed by working through their support units, which should be blocked firmly again after the operation.

Should the overshoot microswitches (FC72 and FC73) become activated it will be necessary to remove the cause (for example, incorrect positioning of the stop sensors, or their failure), and then to liberate the centering by hand.

The configuration of the electronic circuit which controls the operating cycle of the centering is shown on the following page.



In order to protect the transistors that power the motor from overheating, a 70° C thermal switch has been placed on their heat-dissipator.

This switch stops the motor in a state of emergency, and signals: **“Centering breakdown”**. The same signal is given when one or other of the two overshoot microswitches (FC72/FC73) is activated.

If the centering is to be absolutely precise, it is very important that the centering-guides should be slowed down decisively once both photocells (left and right) FC75 and FC76 have been activated.

For this reason it is advisable to calibrate the value of the "low" speed very carefully, using potentiometer LT.

On the other hand, with potentiometer RM one can calibrate the off-cycle time of the centering-guides once the board has been centered.

With potentiometer CL, one can determine the maximum cycle time. Once this has expired, the centering reopens, even if the board has not yet been centered. This is useful, in that it prevents overloading of the motor in the event of mechanical blockage of the centering unit, or any other failure.

The cycle time allowed should, however, always be longer than the real time needed to center the board, including off-cycle time, otherwise the centering unit would be unable to complete its run and its off-cycle pause correctly prior to reopening.

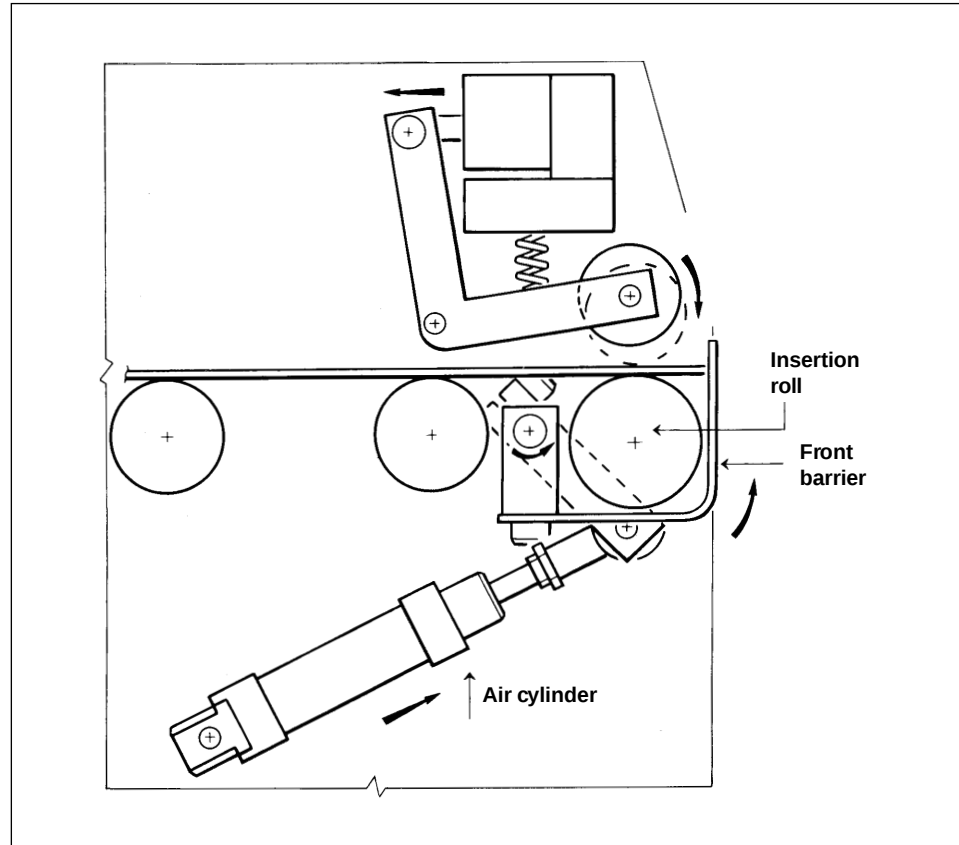
With potentiometer RT, finally, one can set the off-cycle time of the centering unit between one command to close, generated by the intercepting photocell, and the next.

The operating voltage of the lateral centering is 15V - 0V - 15V a.c., which is then transformed into d.c. by the control circuits (S.C.C.).

The alarm signal and fault diagnosis of the centering unit is "Centering breakdown".

Should it be necessary to replace the control circuit, all the potentiometers will have to be recalibrated, "copying" their positions from the previously used circuit board.

FRONTAL CENTERING UNIT



Operating cycle

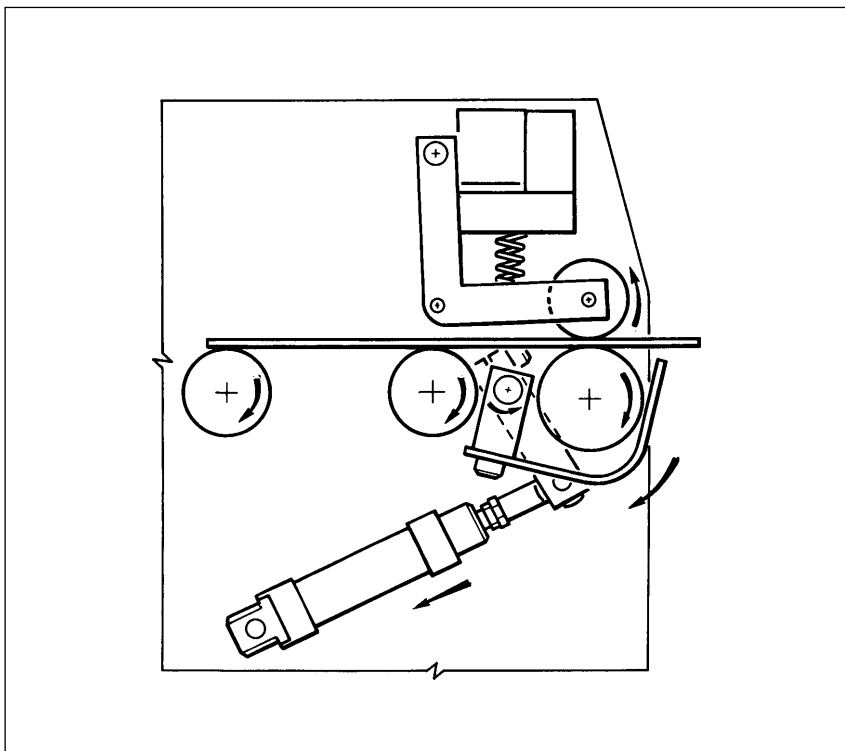
The alignment of the board with the lamination line is very important when one has to laminate with a front edge of 0 mm.

In this case the film must not be detached in any way from the board during the tacking operation.

Alignment is achieved by allowing the board, pushed forward by the input rollers, to come to rest against the frontal barrier where it automatically becomes aligned.

In order to insert the board into the machine, this barrier is lowered by its own pneumatic cylinder.

The barrier will be raised once more when the board has passed completely through the input unit.



Calibration

If the board is not in perfect alignment with the rolls this can be corrected by working on the fastening screws of the frontal barrier.

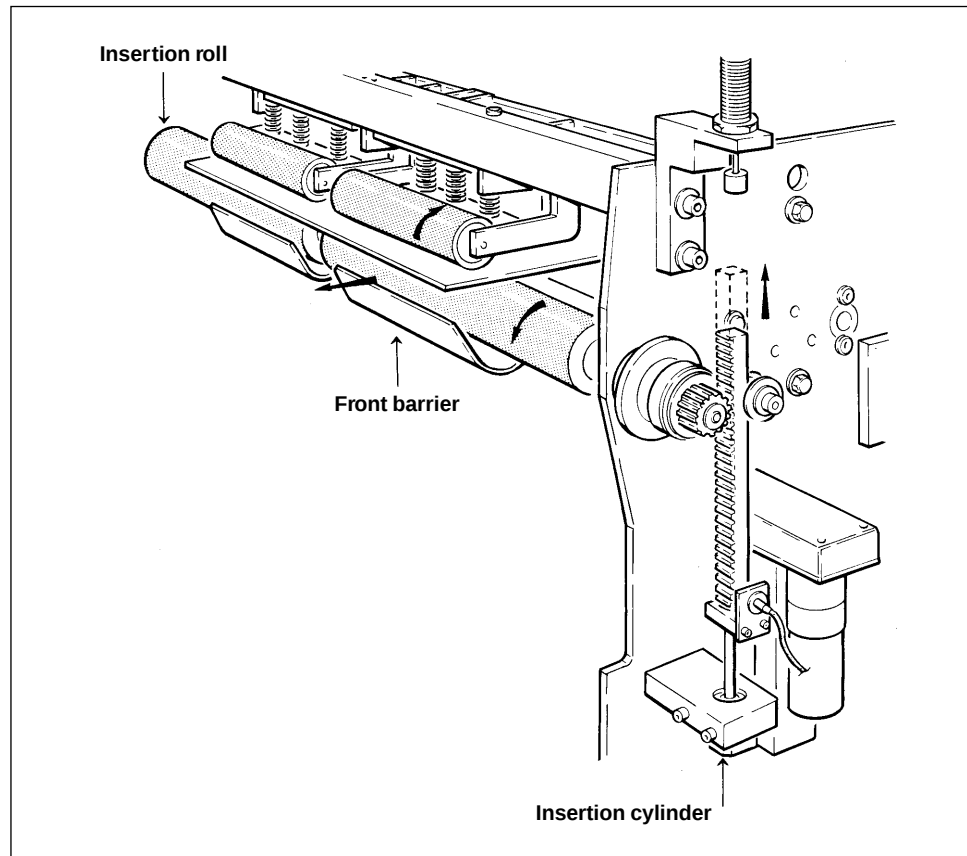
Minute successive adjustments will have to be made to carry out this operation, using a laminated board and measuring the result each time.

The cylinder which moves the barrier has two stop sensors FC18, for forward movement and FC19 for reverse.

If neither of these are activated within a time limit of 10 seconds, they give the following alarm signals:

- “Barrier up movement not completed”**
- “Barrier down movement not completed”**

INSERTION GROUP - FRONT EDGE



Operating cycle

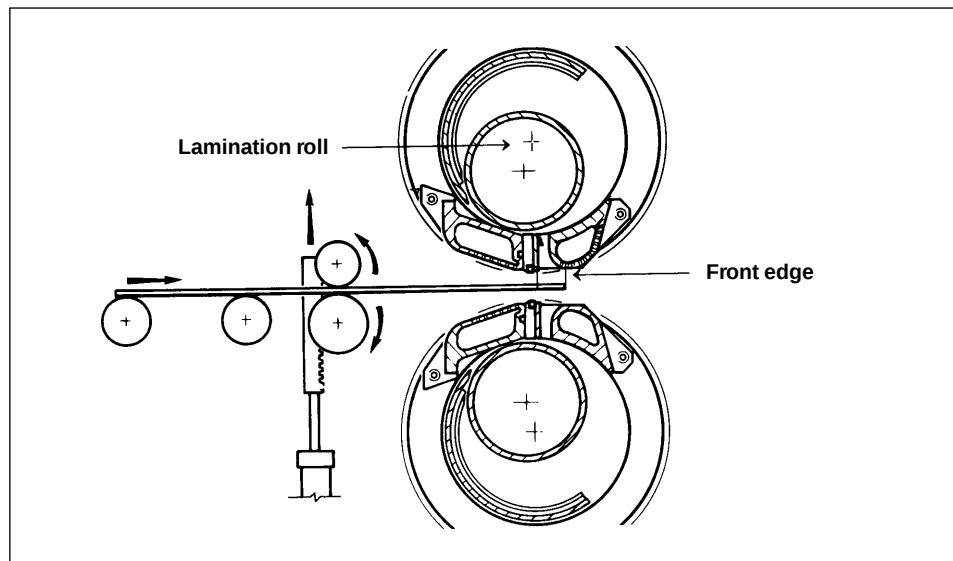
The task of the board insertion group is to insert the board between the tacking bars. Normally the lower roller turns at the same speed as the input roller. Once the board has been aligned against the frontal barrier, the lower roller stops, while the upper one is lowered onto the board firmly enough to grip it. The frontal barrier is tilted away by its driving cylinder, and the insertion cylinder is fully extended. This causes the lower roll to turn, thus pushing the board forward.

The distance covered by the board depends upon the number of revolutions and fractions of revolutions made by the lower roll. It can also depend on the stroke of the insertion cylinder or on its rack.

The motion of the lower roll is therefore generated either by the input roller, or by the rack system of the insertion group.

The switch between these two movement forces is achieved by means of two electromagnetic clutches, (FZ5-6-7) which are commutated by the PLC at the appropriate moments.

If the board is pushed to the exact edge of the tacking bars, it will have a front edge of 0 mm. On the other hand, if it is pushed 50 mm beyond this edge, it will itself have an edge of 50 mm.



In order to limit the stroke of the insertion cylinder, and thus also the distance covered by the front edge of the board, a mobile mechanical regulator has been attached to the cylinder shaft.

This regulator (Register) is powered by a d.c. micromotor (M6) controlled by an electronic circuit known as a Positioner (AZ3), which receives information on the exact position of the regulator from a conductive plastic transducer (P6).

When the PLC transmits a command to move the regulator to a certain position, the Positioner compares the present position with the one to be found, and then commands the motor to turn in one direction or the other until the transducer transmits the information that the new position has been reached.

In order to prevent the group from overshooting the limit of its mechanical stroke because of some irregularity, two overshoot microswitches have been installed (FC100 and FC110). As in the case of the centering, these switches can stop the motor (M6) immediately.

In case the two overshoot microswitches FC100 - FC110 have been activated, it needs to find the cause of the fault and after remove by hand the register from this position until the microswitch comes-back to off. For this operation turn the gear on the micro motor.

A thermal alarm, set at 70° C, has also been created for the control circuit of this group.

In any emergency either one of these two overshoot microswitches or the thermal sensor will stop the motor, and give the signal:

“Front edge device movement failed”.

Front edge: a variation of between 0 and 50 mm is possible at the front edge, but only if the board is longer than 250 mm. This is because the distance between the input rollers and the lamination lines is approximately 200 mm. Since the machine accepts boards of up to 210 mm long, the front edge should take the following relation into account:

$$\text{Maximum possible front edge} = \text{length of board} - 200 \text{ mm (not more than 50 mm)}$$

Calibration

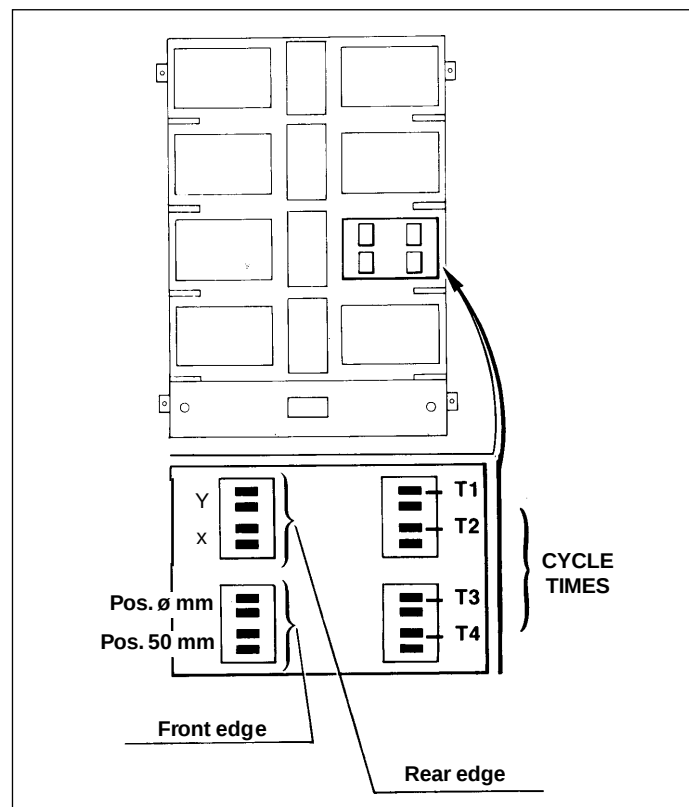
The ratio between the insertion cylinder stroke and the front edge is 1.66.

Therefore 10 mm of front edge on the board correspond to 6 mm of cylinder stroke.

The insertion group guarantees the highest level of repeatability in time for the front edges of the boards.

Nevertheless, should it become necessary to correct some differences between the preset edge and the real edge, the procedure is as follows:

Inside the PLC, which is located in the electrical control panel, there is an electronic circuit composed of 4 sets of numerical selectors, as illustrated in the diagrams.



The position of “Zero edge”, to which would correspond an equal measurement for board and film, has been preset with a code of POS 0.

Similarly, a "50 mm edge", corresponding to 50 mm of board not covered by film, is preset with the code of POS 50.

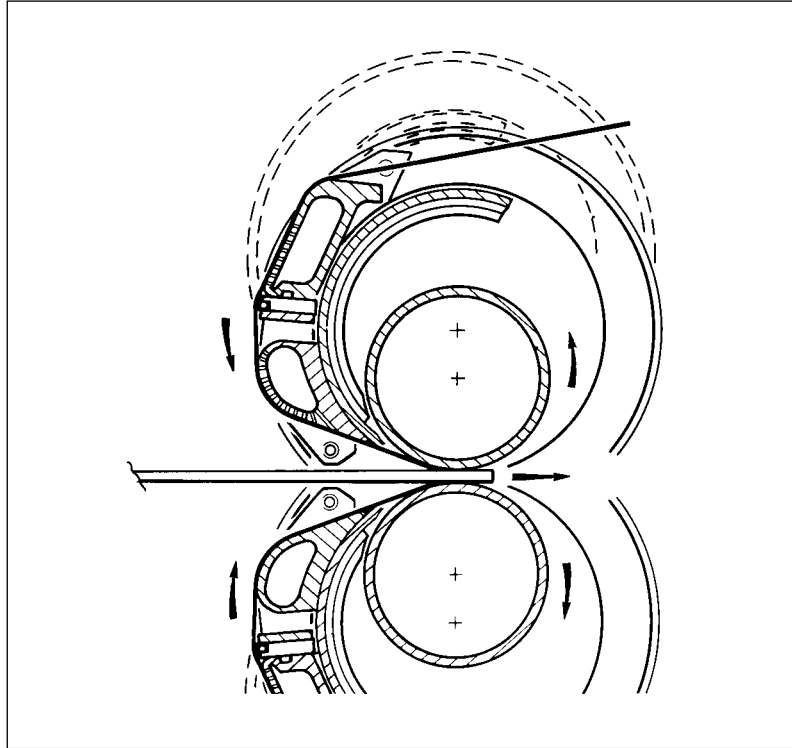
The operator must therefore first set a front edge of 0 mm on the video, and then increase this number on the "POS 0" presetters if the film is found to be longer than the laminated board. Conversely, the number must be decreased if the film is found to be shorter than the laminated board.

Once the position has been corrected for a zero edge, a front edge of 50 mm must be set, and the number of the presetters "POS 50" increased if the edge is found to be less than 50 mm. Conversely, the number must be decreased if the edge is found to be greater than 50 mm.

Caution: Once these parameters have been changed via the presetters, it will be necessary to enter into the page of parameter presetters (via SET-UP ON) and then to leave it once more without making any further modifications (via A0). **By this means the PLC will be able to read and store the new values set on "POS 0" and "POS 50 mm".**

Replacement of the control circuit board will not necessitate any readjustment of the measurements or of the electrical calibrations.

ROTATING SECTORS - VACUUM PUMP - TACKING BARS AND COUNTER-BLADES



Operation

The upper and lower rotating units grip the film and convey it from the “start cutting” position to the tacking position.

A vacuum pump, installed to the front of the machine, ensures that the film adheres to the rotating units.

Between this pump and the exhaust units there are three valves which can cut-off the vacuum. They are commanded by the PLC according to the requirements of the operating cycle.

The vacuum in the vacuum shoes is cut-off during the lamination phase, and re-stored when the groups start to turn again in order to follow the film and carry out the cutting operation.

The vacuum shoes remain under vacuum from the starting of cutting until the next tacking has taken place.

The secondary vacuum shoes are positioned beneath the main set. The film adheres to the upper unit by exhausting after it has been cut, to prevent it from falling back onto the board. The lower set does not need to be under vacuum because the film adheres to it by gravity alone.

Both the tacking bars and the counter-blades are fixed to the main vacuum shoes, and therefore turn together with them as one unit.

A rotating mercury connector (Mercotac), placed on the lefthand side of the exhaust units, is used to provide electrical power to the tacking bars.

The heating element for the tacking bars has been placed inside their rubber.

It has a value of roughly 17 Ω and an electric power of 300 W.

The heating elements are powered by a voltage of 50V, and are equipped with a device (SRT) which regulates their duty-cycle (or the ratio between time ON and time OFF).

The analog regulation has a range of between 0% and 100%. At 0% the temperature of the tacking bars remains at room temperature, and at 100% it is approximately 45°C.

It should be borne in mind that the temperature of the tacking bars is influenced by that of the lamination rolls, which means that variations from the declared values may be found.

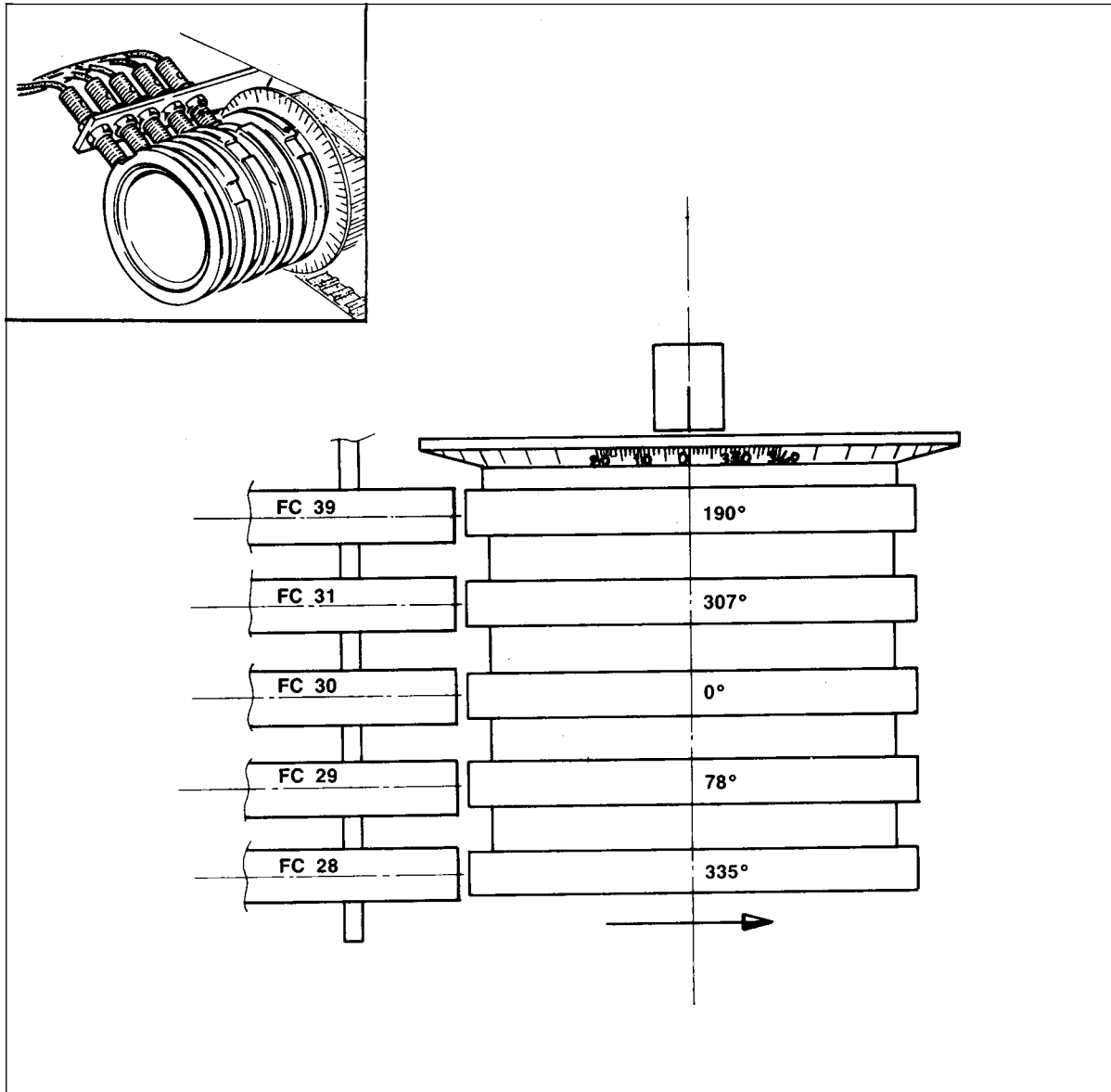
Similarly, it should be remembered that the temperature of the tacking bars is not a decisive factor for the success of the lamination process. This is due to the fact that after tacking the board does not move on until lamination starts with the intervention of the rolls.

The counter-blades of the cutting system, which operates on a shearing technique, are bolted to the tacking bars, and therefore move together with the entire rotating assembly when a cut has to be made.

Both rotating groups are powered by the main motor through an electromagnetic clutch (FZ1) situated on the left side of the machine.

Adjustment and calibration of the positions of the rotating sectors

The rotating sectors, together with the tacking bars and the counter-blades, have three different stationary positions selected by the PLC in function of the cycle.

ELECTRICAL CAMS DIAGRAM

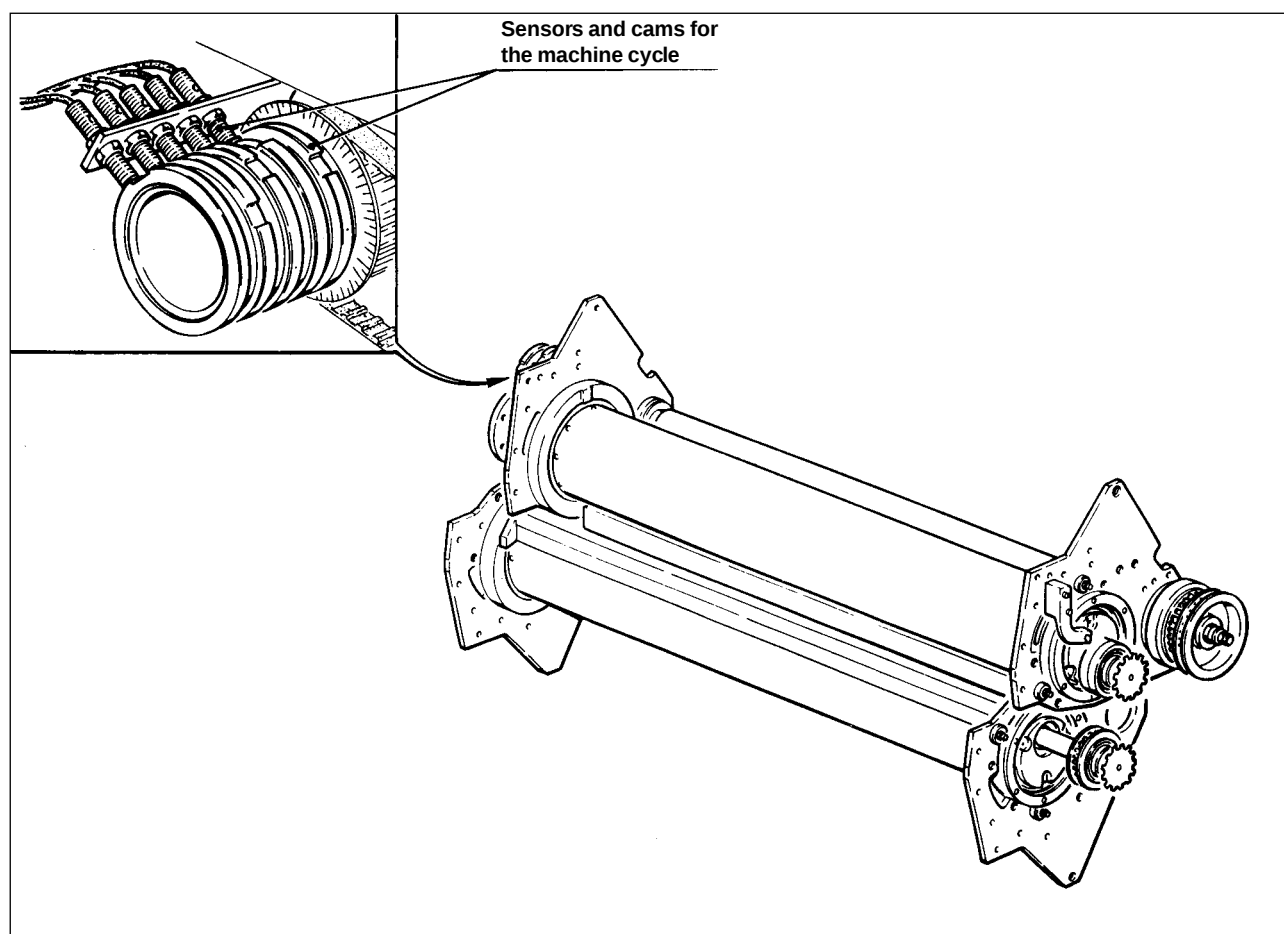
- FC 39 Cam command for lamination rolls closing
- FC 31 Cam for position of slowing down rotating sectors
- FC 30 Cam for the end of cutting position
- FC 29 Cam for the tacking position
- FC 28 Cam for the start of cutting position

ROTATING SECTORS IN TACKING POSITION

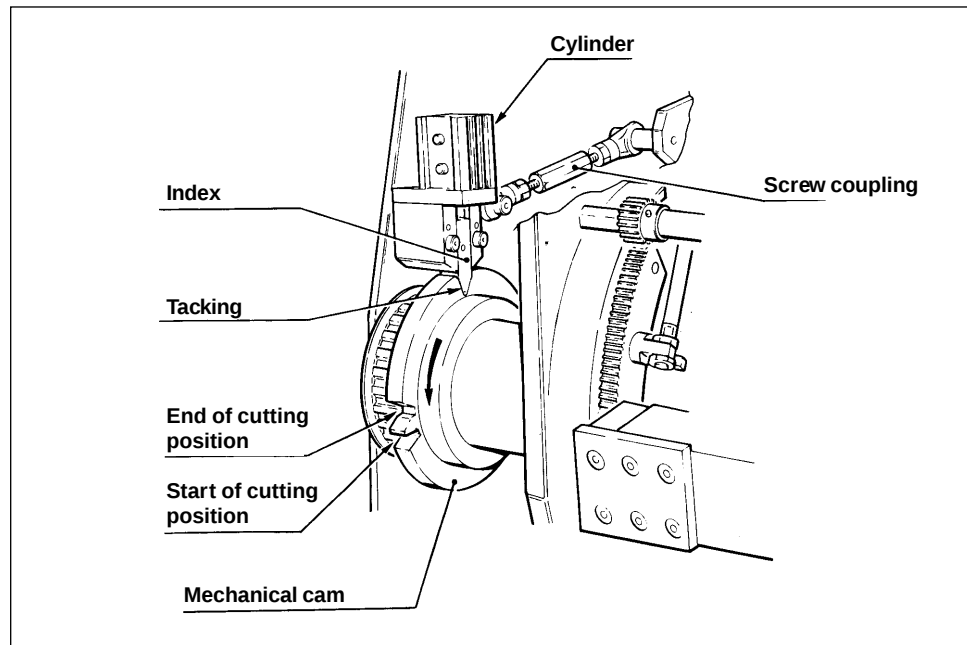
This is given by one of the three positions of the mechanical cams and by the INDEX, which is inserted into them. The phase, on the other hand, is read by an electric cam and by its sensor (FC29).

When the sensor (FC29) identifies the slot on its own electric cam, the PLC disengages the clutch for the units, and inserts the INDEX into the tacking slot of the mechanical cam.

The position and its repetitivity is thus guaranteed by the INDEX. Should it be necessary to put forward or to delay the command to activate the INDEX, it will have to be done by changing the position of the electric cam in relation to the sensor. FC29, with the cam firmly refastened using the appropriate screws once the task has been completed.

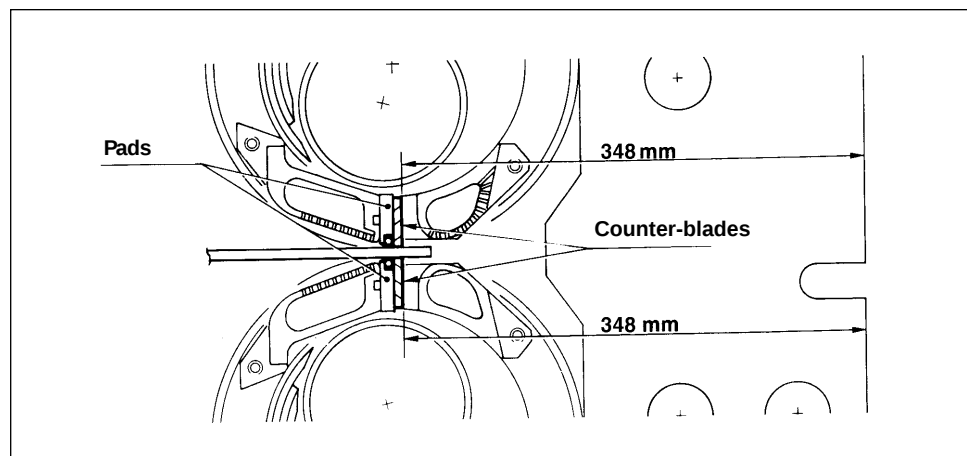


The position of the electric cam does not influence the positions of the mechanical cams. This position can be adjusted by regulating the screw coupling of the Indexes, which are situated on the left-hand side of the machine.

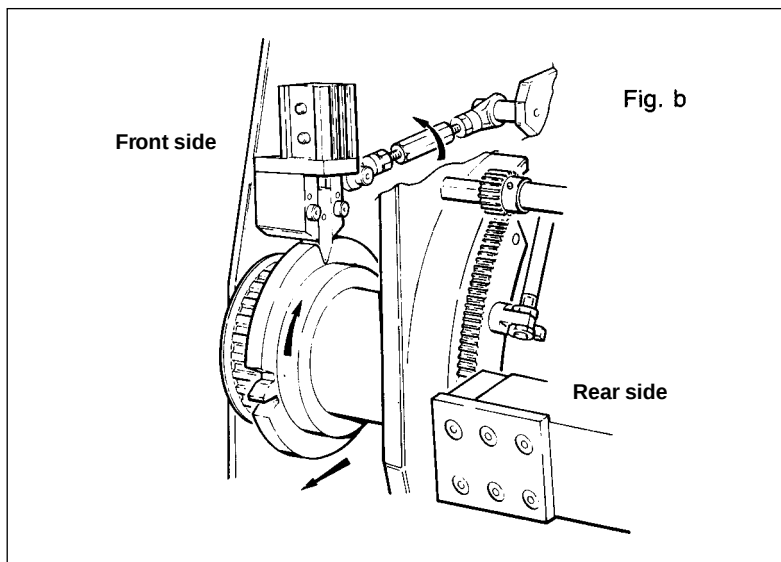
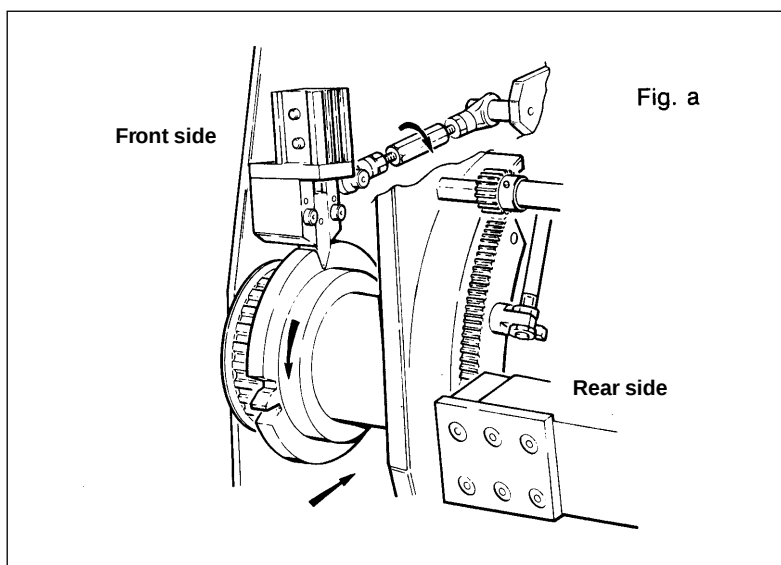


It is important that this operation should be performed with a considerable amount of skill. The procedure is as follows:

- Switch off the machine and bring the rotating sectors into the tacking position by hand.
- Block the groups in this position by inserting the Index, and activate the relative electrovalve (EV25) either manually or through the programming keyboard PCA2.P10/05.
- Insert a board between the groups, and bring them together as though for a tacking operation, by activating the relative solenoid valve (EV19).
- Go to the rear of the machine and check that the distance between the counter-blade and the rear edge of the shoulders of the machine is 347 mm.



- Should it be necessary to adjust this measurement, separate the two groups, by deactivating the electrovalve (EV19).
- When the upper and lower screws coupling are turned upwards, the tacking bars move towards the back of the machine (Fig. A). Conversely, when the screws coupling are turned downwards, the tacking bars move towards the front of the machine (Fig. B).

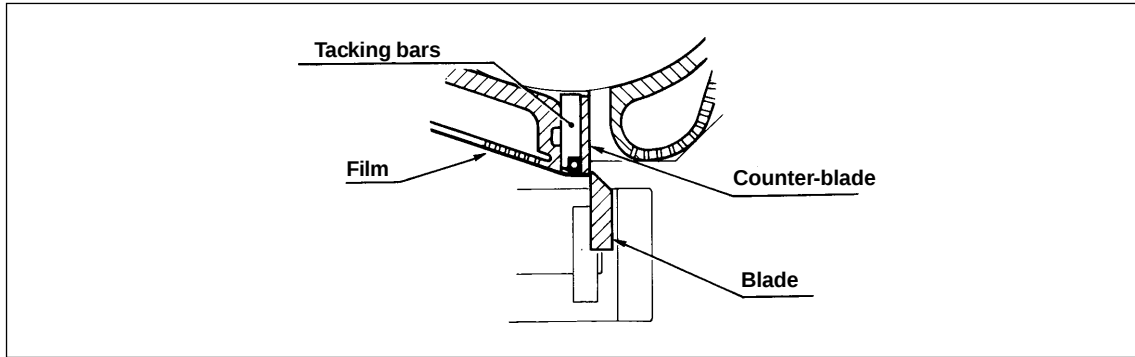


- Bring the groups together again, and read the new measurement. Repeat this operation until the desired value has been obtained.
- As a result of this manoeuvre, the lower groups will also have to be calibrated until they are perfectly aligned. Block the two screws coupling.

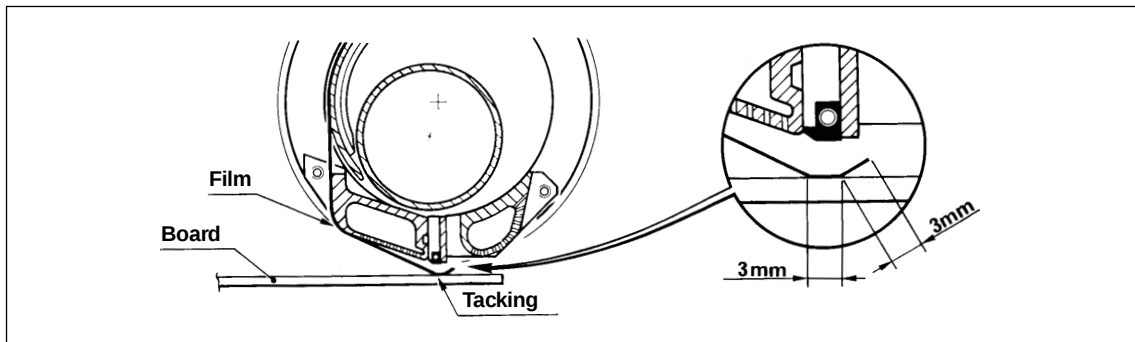
The position of the tacking bars with respect to the tangent line of the rolls is a determinant factor in preventing the formation of air bubbles in the first millimetres of lamination.

As has already been demonstrated, the operating cycle of the laminator envisages that the rolls will close down on the board at the exact point at which tacking was carried out.

Due to the width of the counter-blade the film is cut 3 mm beyond the tacking bars.

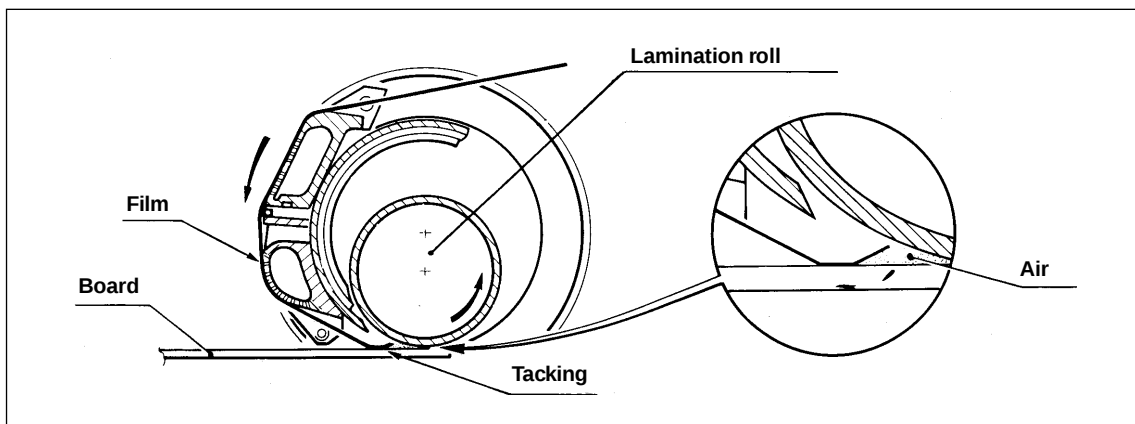


When the film is tacked onto the board, therefore, the first 3 mm of film cannot be stuck down.

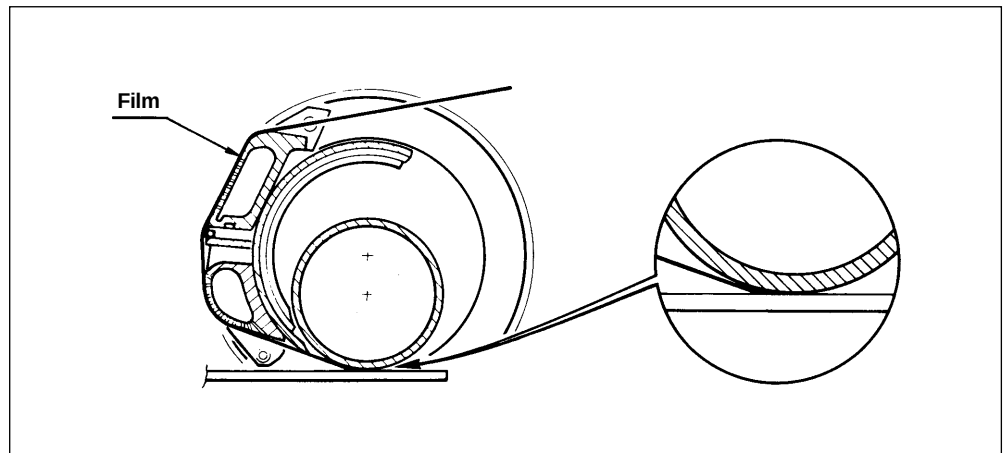
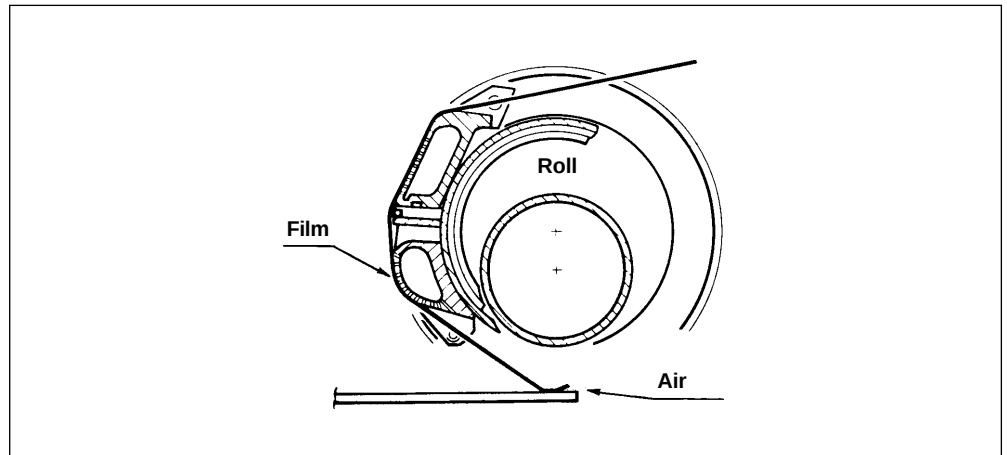


This strip of film must nevertheless be stuck down by the lamination rolls.

If the lamination rolls close down onto the board in front of the tacking area, the air underneath the 3 mm of non-stuck film will be unable to escape and, trapped between the tacking and the lamination roll, will create large bubbles.



If, on the other hand, the roll comes down precisely on the tacked line, while the rubber is being compressed these 3 mm of film will be laminated onto the board in such a way that the air will be able to escape towards the front.

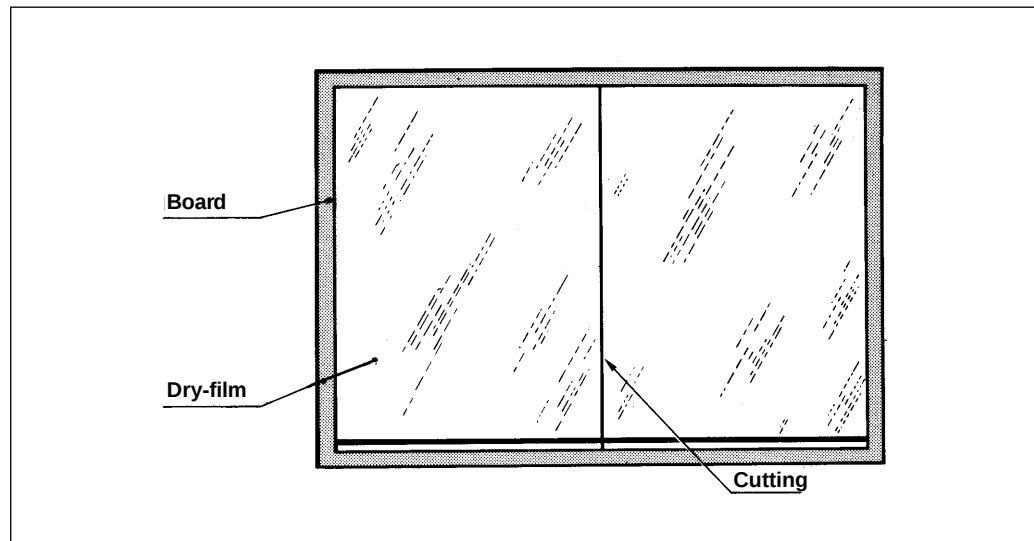


Since the contact-surface of the compressed roll is approximately 9 mm, and the tacked area only 3 mm, when the roll presses down, it will completely cover both the strip of film already stuck by the tacking and the 3 mm that have not yet adhered.

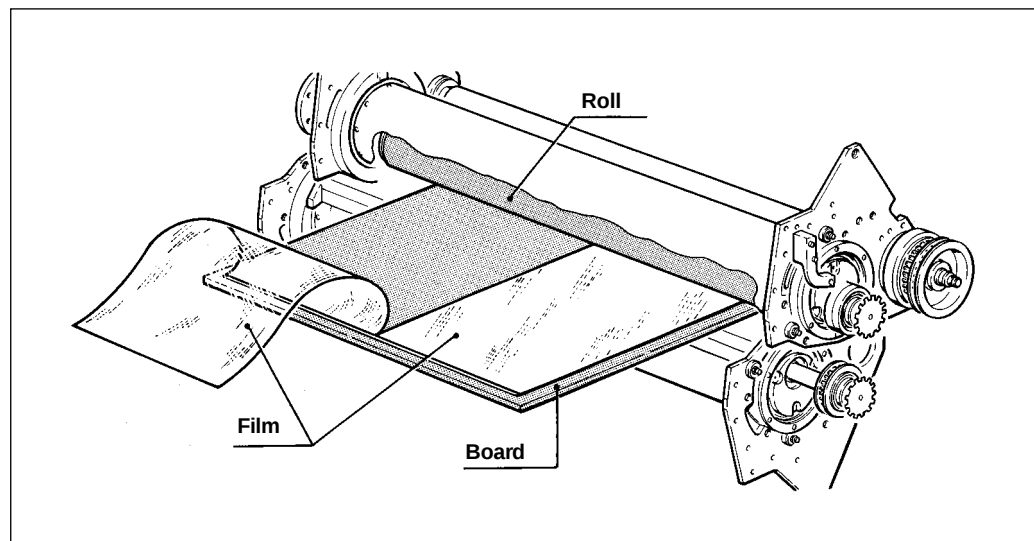
The precise position of the pads with respect to the rolls can be checked by the following procedure:

- Switch off the machine, take out the central unit, and turn the rotating sectors by hand, to bring them into the position exactly opposite to that of tacking.
- Take a rigid board and lay a piece of dry film over it, attaching it by hand to only one side of the board.

- Make a vertical cut along this film with a sharp blade, but do not detach it from the board.

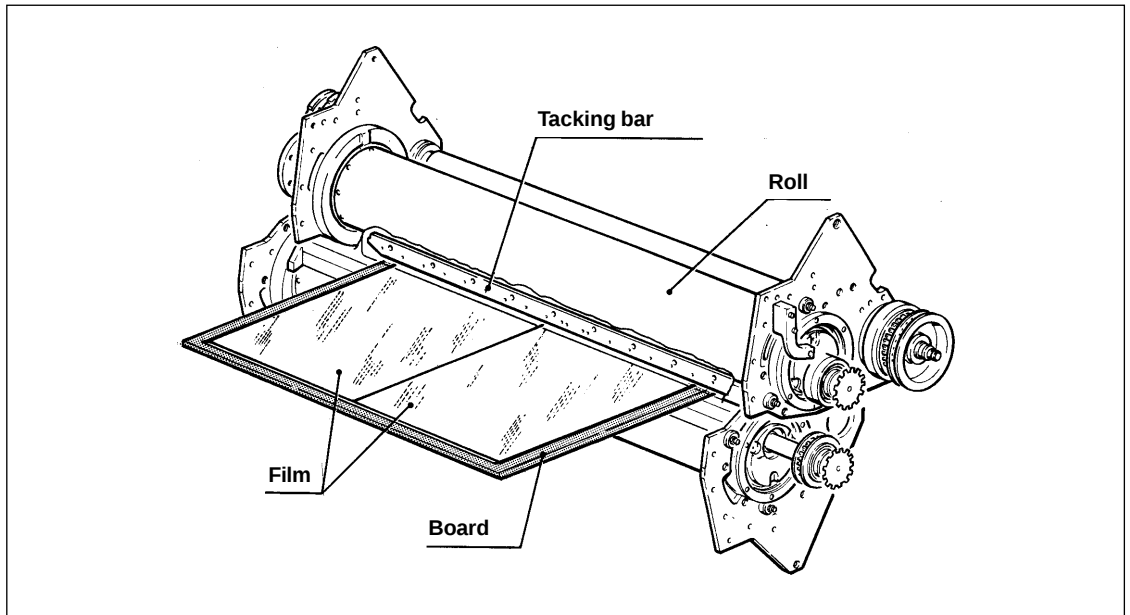


- Insert the board between the lamination rolls, keeping one of the two strips of film folded back from the board.

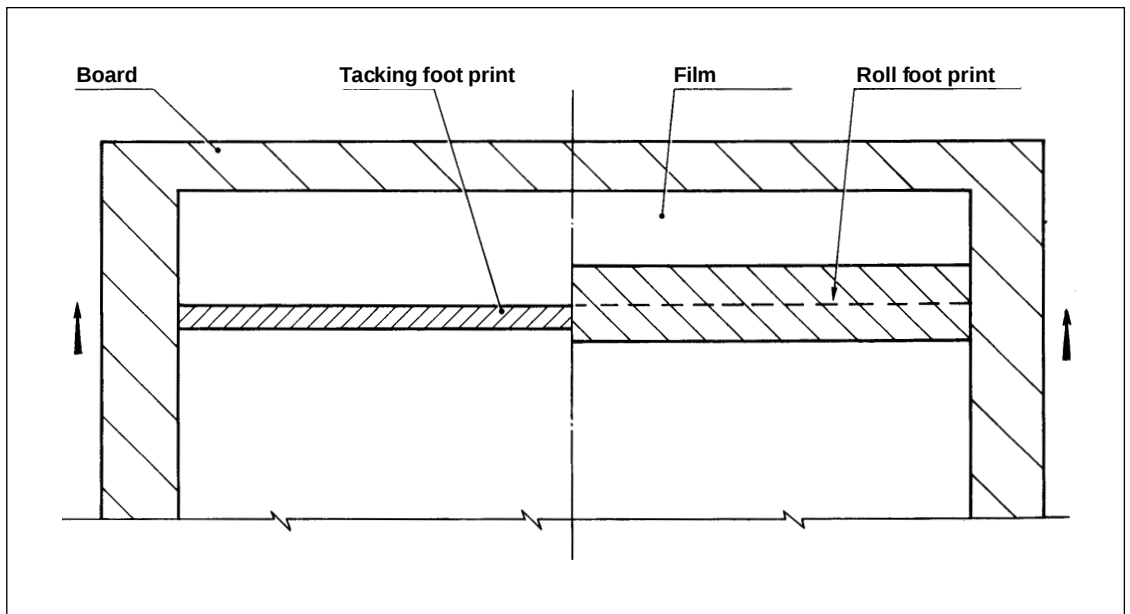


- Use either manual commands or the PLC keyboard to activate the EV19 in order to close the lamination rolls against the board; reopen them after a few seconds.
- Take care not to move the board from its position once the rolls have separated.
- (Attach it firmly to the supporting rollers with sticky tape).
- Lay the other half of the film down onto the board, and bring the rotating groups into the tacking position.

- Activate the electrovalve (EV25) insert the Index and draw the sectors (= rolls) together again for a few seconds in order to perform a tacking operation.



- Separate the groups, remove the board and check whether the two imprints – that of the rolls and that of the tacking – agree with the following sketch:



ROTATING SECTORS IN THE "ROLLS CLOSED" POSITION

Once the tacking has been carried out and the vacuum cut-off, the rotating groups lift off the board and, after the electromagnetic clutch (FZ1) has been engaged, begin to turn at a speed of 13.3 mt/min, which allows the rolls to close down onto the board as rapidly as possible.

As soon as the groups reach a position of approximately 90° with respect to the tacking position, the PLC commands closure of the rolls, by activating the electrovalve EV19.

The electric cam which tells the PLC when the groups are in the 90° position is the same one that is connected to sensor FC39 situated on the left-hand side of the machine, and it is known as the "roll-closing cam".

In order to calibrate this position exactly, it is necessary to turn the sectors by hand, and to stop them in the position opposite to that of the tacking operation.

Next draw the rolls together using the PLC keyboard or the manual command to EV19 and move the sectors backwards until they are at the minimum possible distance from each other and to the back of the machine.

Check whether or not sensor FC39 is able to identify the slot of its own cam in these conditions.

If it proves necessary to correct the positioning, unscrew the locking screws and turn the cam in the direction required. Retighten the screws once the job is finished.

ROTATING SECTORS IN “AWAITING START OF CUTTING” POSITION

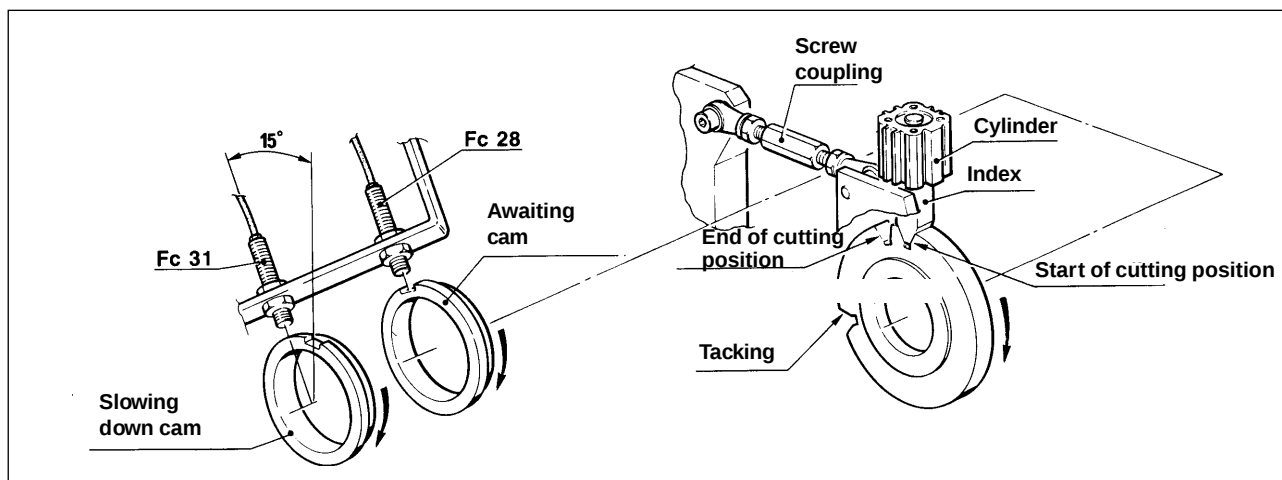
When the rolls start their closing movement, the groups are at about 90° to the tacking position, but are already turning at a speed of 13.3 mt/min, in order to reach the position of “Awaiting start of cutting”.

To allow the groups to come to a gradual stop, the PLC receives a timing command from an electric cam connected to the sensor FC31, known as the “slowing-down cam”.

This cam is positioned so as to be 15° ahead of the “Awaiting start of cutting” position.

From this point onwards the speed of the two sectors is reduced to only 3 mt/min until the electric cam connected to the sensor FC28 is activated. This cam is known as the “Start of cutting cam”.

As soon as the PLC receives this latest signal it switches-off the electromagnetic clutch (FZ1) of the rotating groups and inserts the Indexes into the slots of the mechanical cams.



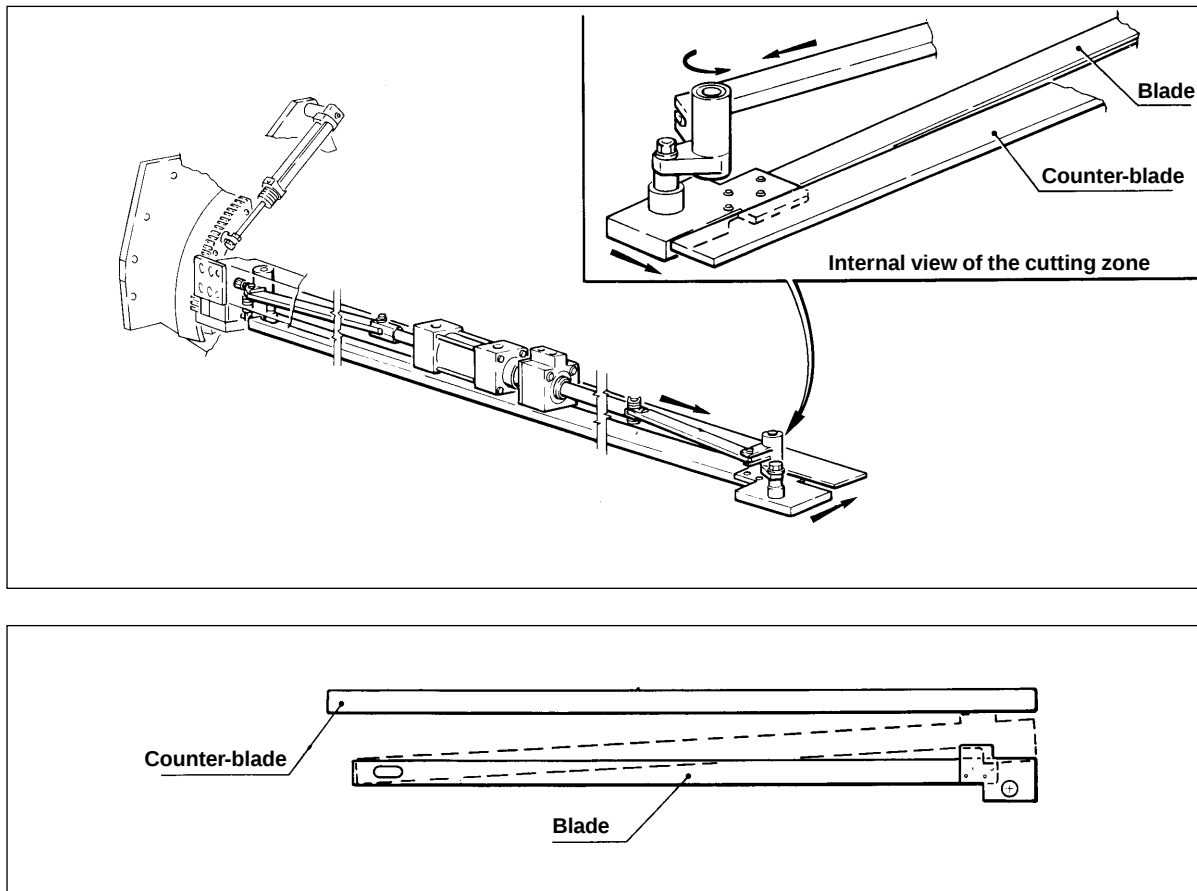
The start of cutting position and its repeatability are governed by the design of the mechanical cam.

It is, however, inadvisable to use the screws coupling to change this position because as a result the previously established positions for tacking and end of cutting would also have to be changed.

If it should prove necessary to put forward or to delay the insertion of the Index into the mechanical cam, the electrical “awaiting start of cutting” cam will also have to be put forward or delayed with respect to its own sensor FC28. Remember also to refasten the cam firmly with its appropriate screws once this adjustment has been made.

COUPLING OF THE CUTTING GROUPS (START OF CUTTING)

While the rotating sectors are stationary in the position of “Awaiting start of cutting” the upper and lower cutting groups are coupled to them by means of the moving blades.



The fact that the rotating sectors are coupled to the cutting groups means that they are now being drawn by the cutting groups and the two groups will now move in synchronisation so as to follow the film during the cutting phase.

This coupling is possible because the moving blade is set obliquely by the first of the two pistons which make up the blade movement. The coupling process is governed by EV20 both for the upper and lower cutting.

The position at which coupling (or uncoupling) takes place is recorded by two sensors FC26, for the upper cut and FC27 for the lower. If these two sensors are not activated (or deactivated) within a time-limit of 10 secs, the PLC stops the machine as for an emergency, and gives the signals:

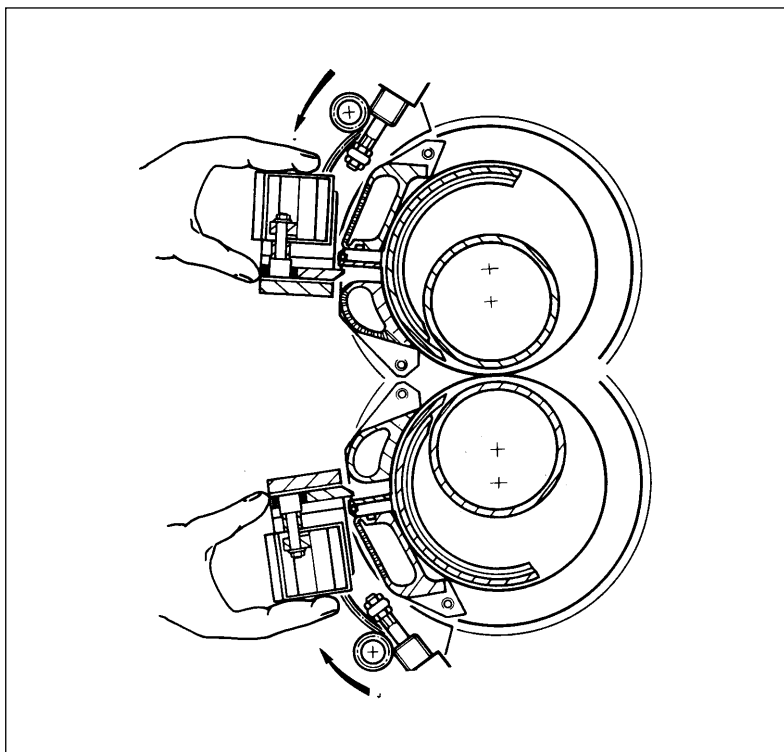
“Top and bot cut hooking movement failed”

Once the coupling has taken place, the moving blade and the counter-blade should be kept apart until the sectors start to move. There should therefore be a gap between the blades of:

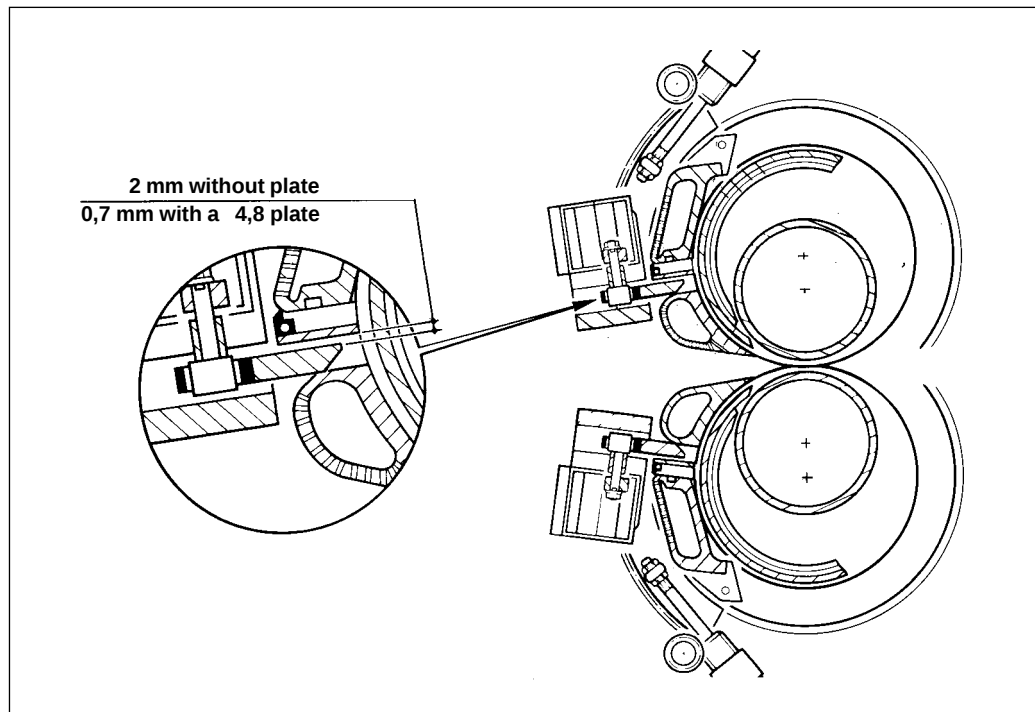
- 2 mm (upper and lower) with no board between closed rolls
- 0.7 mm (upper and lower) with 3 boards of 1.6 mm (total 4.8 mm) placed between closed rolls.

Should it be necessary to verify or calibrate this measurement the recommended procedure is as follows:

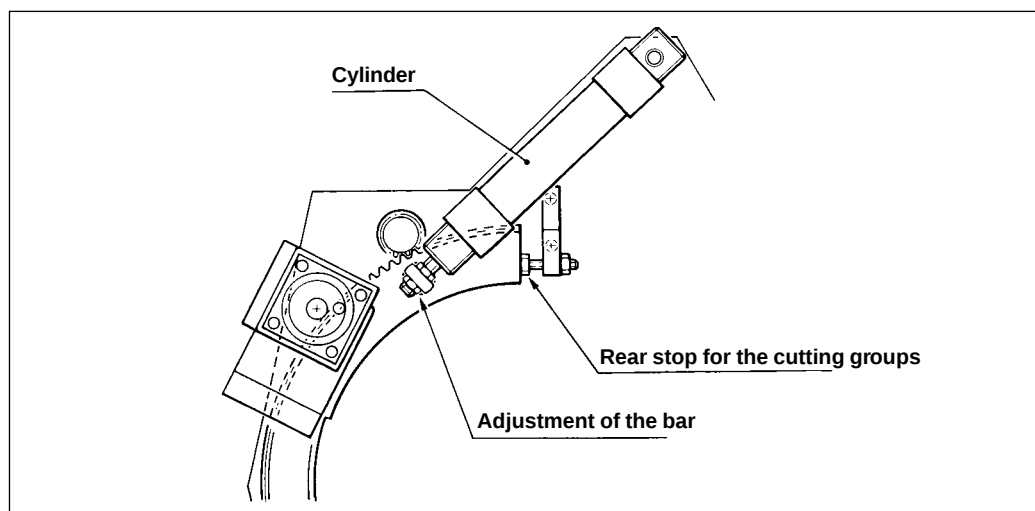
1. Switch off the machine, take out the movable central section, and place the rotating groups in a position opposite to that of tacking.
2. By hand or using the PLC keyboard, give EV19 the command to close the lamination rolls but do not insert any board between them.
3. Turn the rotating groups manually to the position "Awaiting start of cutting", and activate the electrovalve EV25 by hand (or via the PLC keyboard) to insert the index into the slot of the mechanical cam.
4. Move the two cutting groups by hand (upper and lower) into the space between the main and secondary vacuum shoes.



5. Block them firmly in this position and give the command to couple the cutting groups by activating the electrovalve EV20 (upper and lower).
6. Release the two cutting groups so that they come slowly to a complete halt.



7. Using a thickness gauge, check that the distance between the coupling tooth of the moving blade and the fixed blade is as indicated in the Table (2 mm).
8. If adjustments are necessary, work on the right and left rear stops of each cutting group, and if this is not sufficient, work on the adjustment screws of the cylinder bars.



Caution: Should it be necessary to work on the adjustment screws of the cylinder bars, it will subsequently also be necessary to check the end-of-cutting position (see chapter "Cutting Groups" and "End of Cutting" and their sequels).

9. Bring the cutting groups back towards the center of the vacuum shoes units by hand, and uncouple them by deactivating EV20 then return them to their stationary position.
10. Remove the Index, and separate the rolls.
11. Insert three 1.6 mm thick boards between the rolls and repeat all these operations starting from point 2, checking that the distance between the coupling tooth of the moving blade and the counter-blade is correct (0.7 mm) for both the upper and lower units.
12. In order to ensure a stable coupling between the moving blades and their respective counter-blades as the rotating sectors turn during the cutting phase, the upper cylinder for the "return of cutting groups" is moved in the opposite direction, thus offering resistance to the rotatory motion of the sector itself.

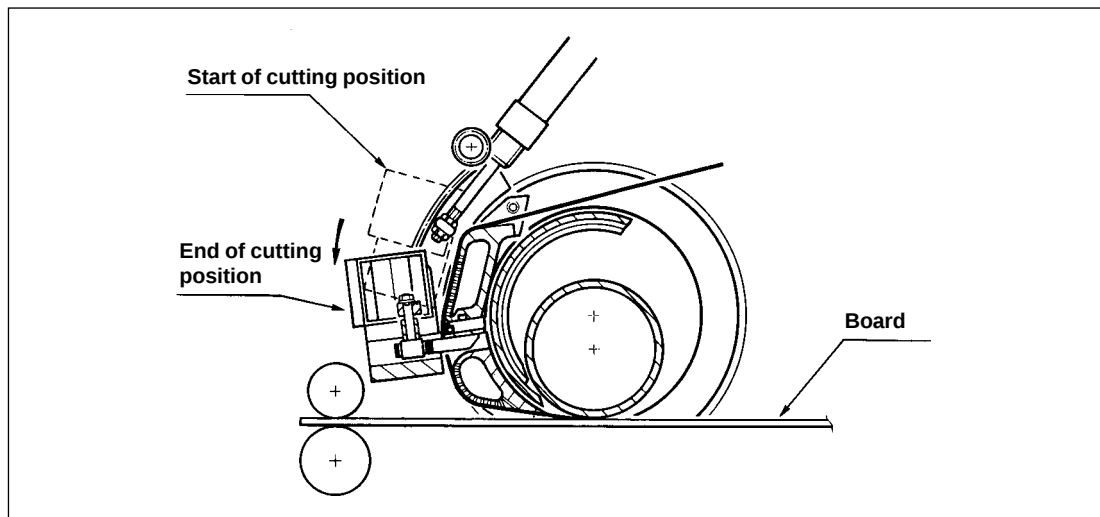
Due to the effect of gravity, the lower group does not need help from the cylinder. Its own weight is also sufficient. It is, in any case, better that this opposing force should not be excessive, because it could slow down or even stop the rotation of the rotating sectors.

The pression of the upper return cylinder is 6 atm. Its regulator is situated on the left side of the back of the machine.

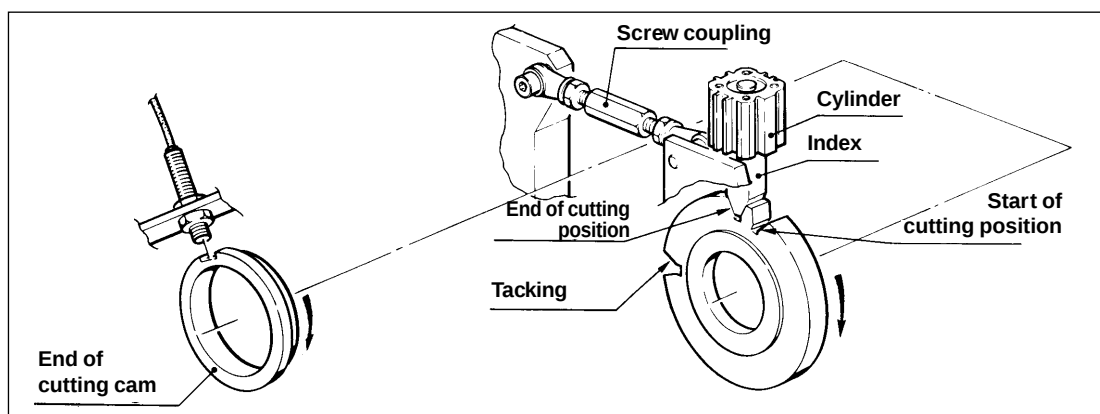
ROTATING SECTORS IN “END OF CUTTING” POSITION

The film is cut by shears between the start-of-cutting and the end-of-cutting positions.

As they move forwards the rotating groups also draw with them the two cutting groups, which extend the cylinder bars attached to them.



Once the sensor FC30 belonging to the “end-of-cutting” electric cam has identified this slot, the PLC disengages the electromagnetic clutch (FZ1), thus depriving the rotating sectors of their locomotive force, and activates electrovalve (EV25), which then inserts the Indexes into the slots of the mechanical cams.



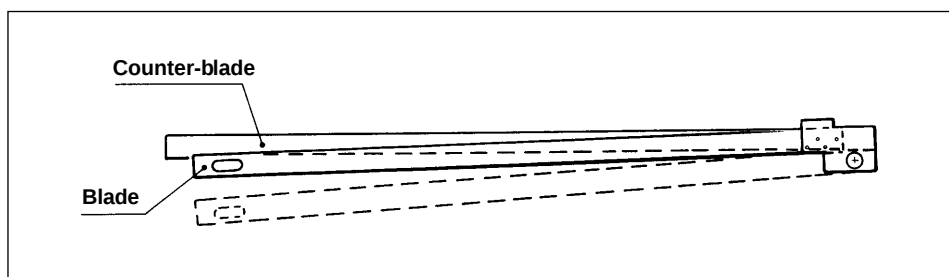
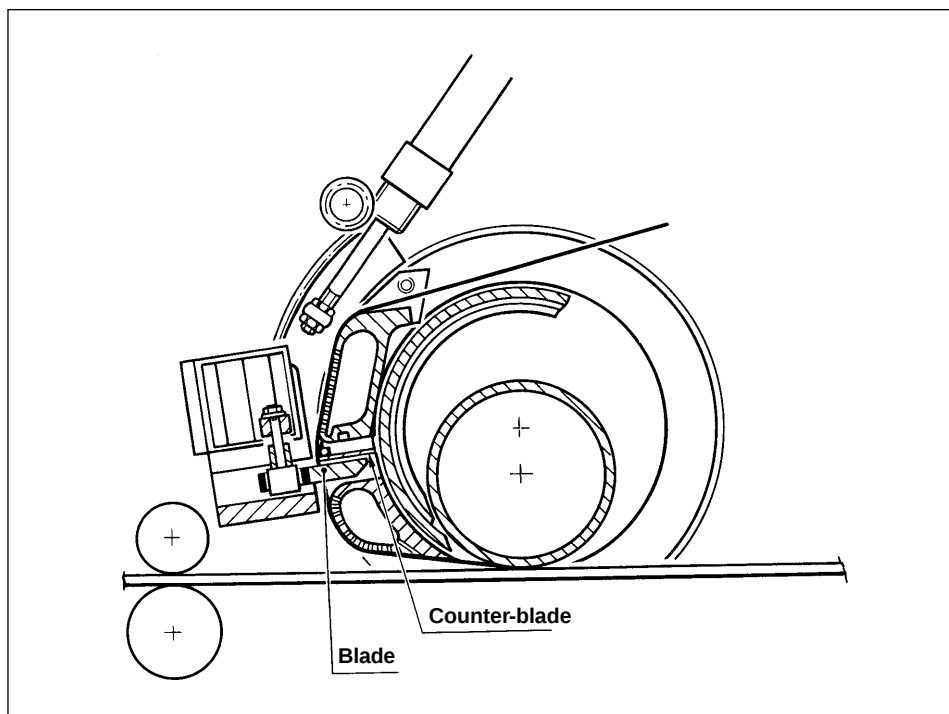
Both the “end of cutting” position and its repeatability, and the “start of cutting” position are all governed by the design of the mechanical cams.

It is therefore inadvisable to use the screws coupling to vary them in any way, otherwise the positions of tacking and “Awaiting start of cutting” will also have to be changed.

Should it become necessary to put forward or to delay the insertion of the Indexes in the mechanical cams, the “end of cutting” electrical cam will also have to be brought forward or delayed with respect to its own sensor FC30. Remember to refasten it firmly using the appropriate screws once the adjustment has been made.

CUTTING GROUPS AT THE END OF CUTTING, AND THEIR UNCOUPLING

At the end of the cutting operation, when the rotating groups are stationary in their “end of cutting” position with the Indexes inserted, the blades and counter-blades are tightly closed along their entire length.



In order to return the cutting groups to their stationary position (= “start of cutting” position), the PLC will detach the moving blades from the counter-blades by extending the return cylinders, after which it will reset the moving blades from oblique to parallel, thus uncoupling them from the rotating groups. Finally, it will command the re-entry of the two return cylinders.

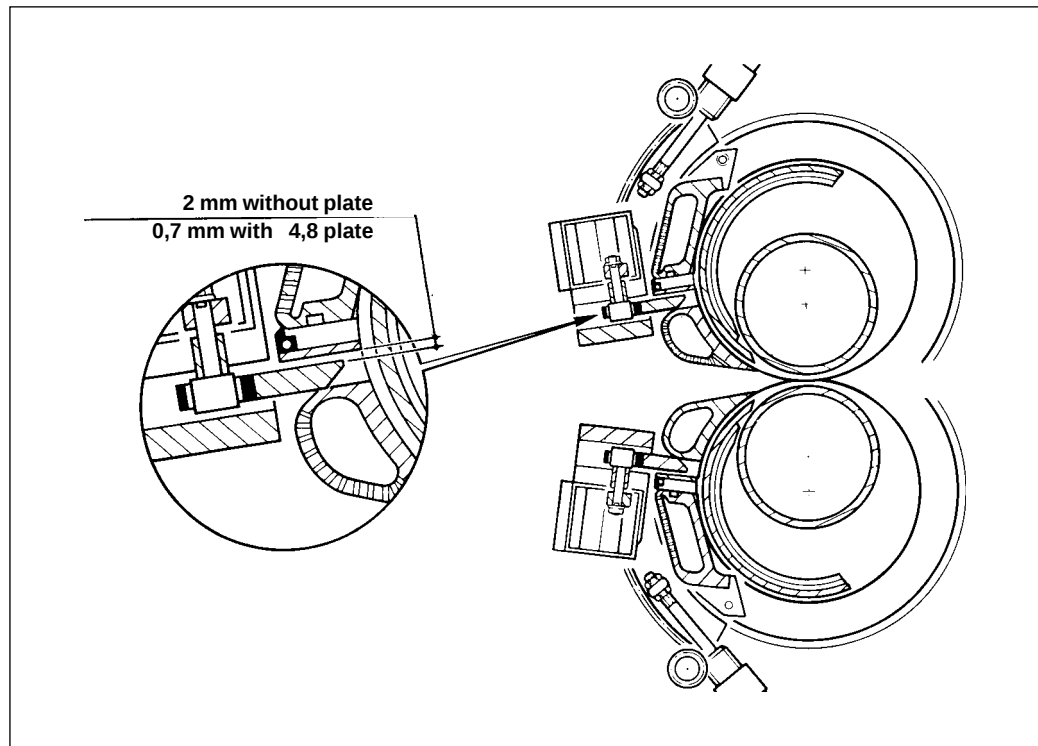
It is important that when the return cylinders of the cutting groups are fully extended, there is space enough between the moving blades and the counter-blades to prevent these implements from rubbing against each other.

This space will vary according to the thickness of the boards passing between the lamination rolls.

Ideal measurements should be:

2 mm (upper and lower) with no board between closed lamination rolls

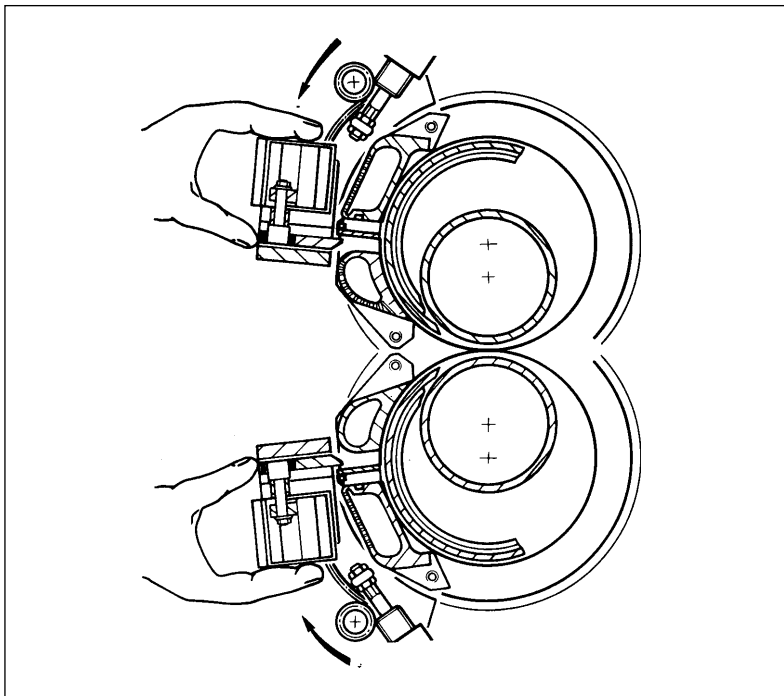
0.7 mm (above and below) with three 1.6 mm boards (=4.8 mm)
between closed lamination rolls.



If it becomes necessary to verify this measurement, proceed as follows:

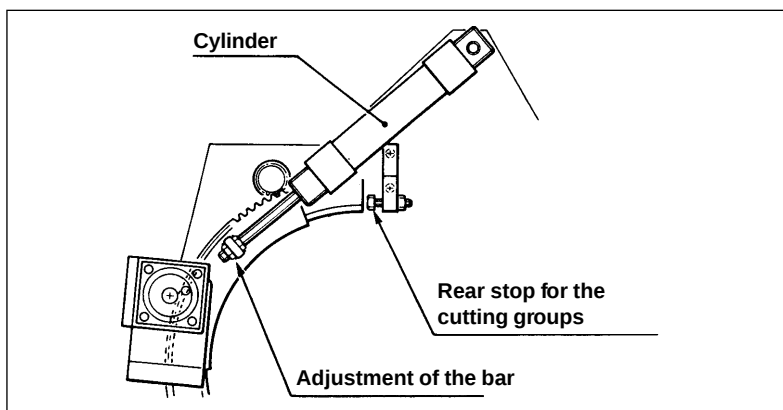
1. Switch off the machine, take out the removable central access hatch, and position the rotating groups in the position opposite to that for tacking.
2. By hand or by using the PLC keyboard, activate the electrovalve EV19 to close the lamination rolls without inserting any board between them.
3. Move the rotating groups into the "END OF CUTTING" position by hand and, using either manual commands or the PLC keyboard, activate the electrovalve EV25 in order to insert the Indexes into the slots of the mechanical cams.

4. Move the two cutting groups by hand (upper and lower) into the space between the main and secondary vacuum shoes.



5. Using either manual commands or the PLC keyboard, activate electrovalve EV21 in order to extend the return cylinders of the cutting groups.
6. Give the command to couple the cutting groups by activating electrovalve EV20 (upper and lower).
7. Using a thickness gauge, check that the distance between the coupling tooth of the moving blade and the counter-blade is as indicated in the Table (2 mm).
8. Should it prove necessary to adjust this distance, use the adjustment screws on the cylinder bars.

Caution: If the adjustment screws of the cylinder bars are used, the “coupling - start of cutting position” should then also be checked (see the chapter on “Coupling of the cutting groups”).



9. Detach the cutting groups from the rotating groups by deactivating electrovalve EV20.

Bring them back to their stationary position by deactivating EV21.

10. Remove the Indexes and separate the rolls.
11. Insert three 1.6 mm thick boards between the lamination rolls and repeat all these operations starting from point 2 checking that the distance between the coupling tooth of the moving blades and the counter-blades is correct, i.e. 0.7 mm for each unit (upper and lower).

Care should be taken to operate the return cylinders of the cutting groups at the correct pressure. Read the description given under point 13 of the chapter "Coupling of the cutting groups".

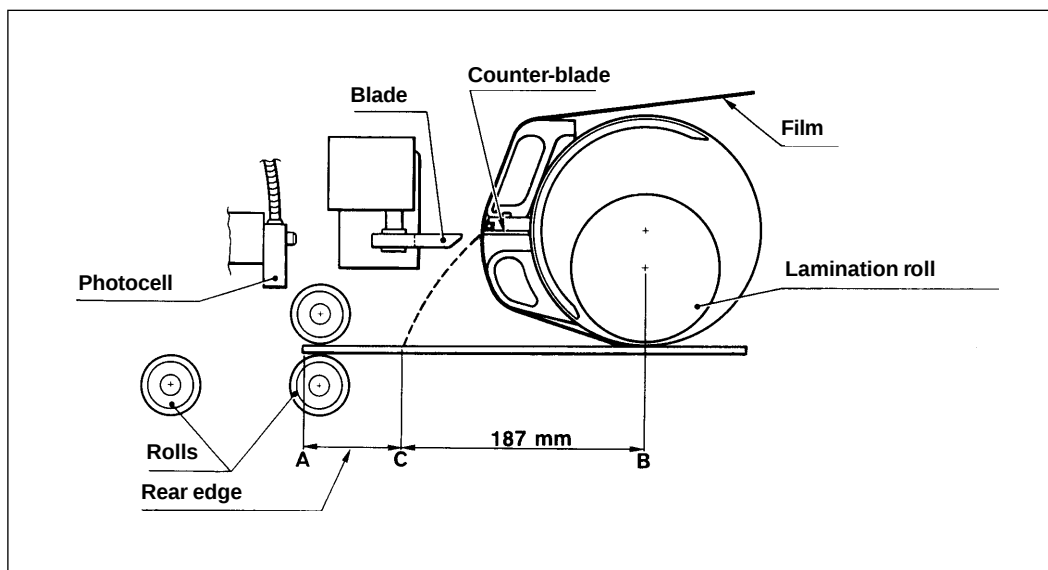
CUTTING ON THE FLY - REAR EDGE - CALIBRATION OF THE SPEED OF THE ROLLS AND THE SENSITIVITY OF THE PHOTOCELL FOR THE REAR EDGE

As already illustrated, the cutting system employed is a type of “shearing”, i.e., it consists of a moving blade and a counter-blade.

The entire assembly moves forward at the same speed as the film, so that the cuts can be made on the fly without interrupting the lamination process.

Before the film can be cut the moving blade and the counter-blade must be coupled together. The fact that the cutting groups are connected to the rotating groups makes this possible (see preceding chapter).

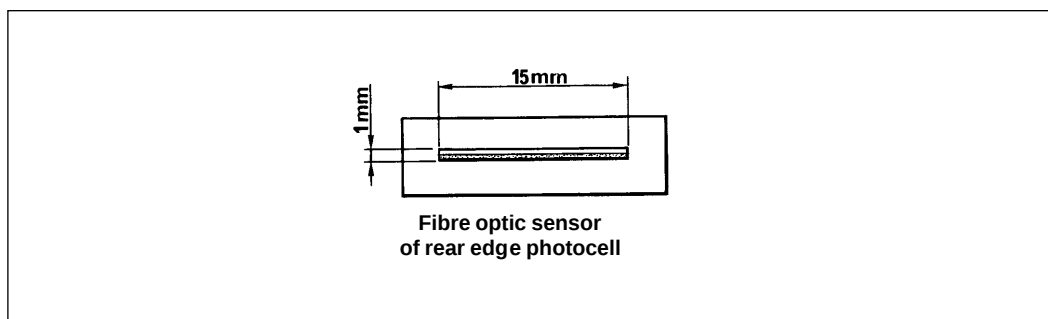
The rear edge is determined by the difference in length between measurements A-B and C-B.



Since measurement C-B is 187 mm, it follows that the minimum length of laminable film is 187 mm.

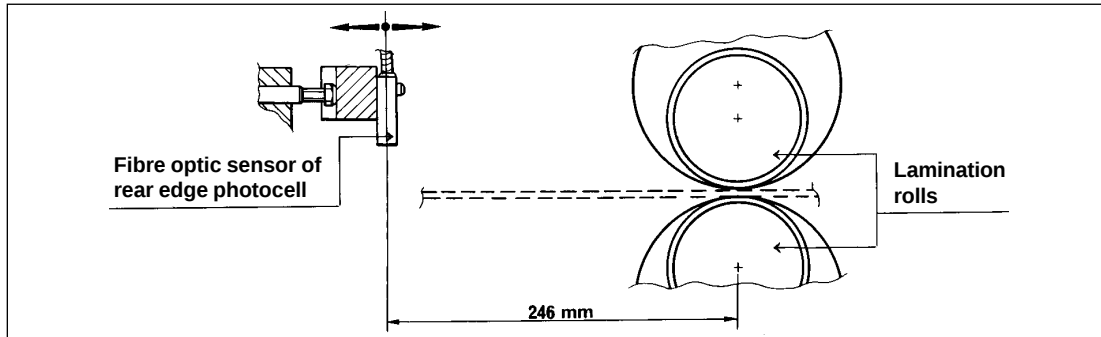
The command to execute a cut is given by the PLC after the photocell on the rear edge (FC47) no longer perceives the board.

To guard against a hole on the board being mistaken for the end of the board, this particular photocell is custom made in fibre optics, and is able to overlook holes of even 10 mm diameter, while at the same time offering a precision of 0.1 mm.



The rear edge photocell is very precisely positioned on the input roller. Its distance from the lamination line is approximately 246 mm.

Nevertheless, when calibrating the rear edge it can be moved either forwards or backwards from its theoretical position, by means of regulating system.

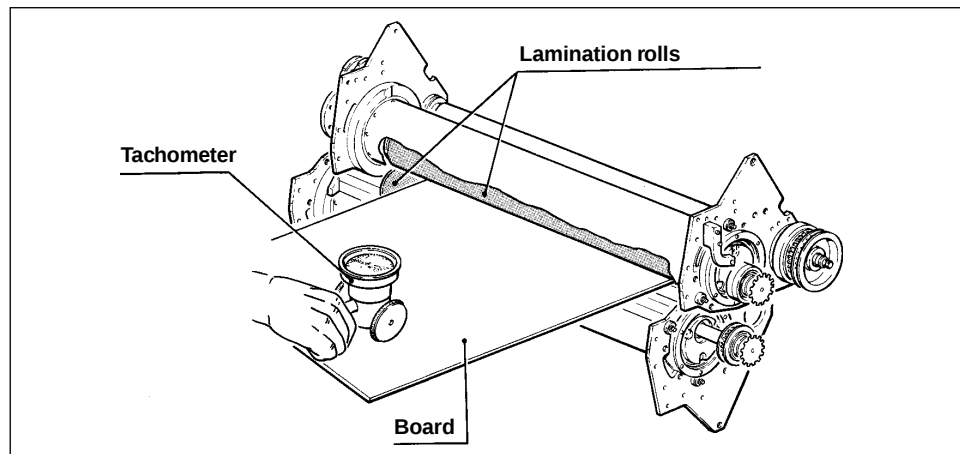


Before commencing calibration of the rear edge, it is important to carry out the following operations:

- Calibration of the conveying speed and lamination speed while the machine is performing a lamination.
- Calibration of the hysteresis sensitivity of the fibre optic photocell.
- Equalise the upper rear edge with the lower.

CALIBRATION OF THE ROLL SPEED

In order to calibrate the conveying and lamination speed the speed of 5 mt/min should be programmed into the control panel, and the true speed measured with a tachometer attached not to the rolls, but to a very long board which will actually undergo lamination between the lamination rolls.



If the speed thus measured should be found to differ from the programmed speed, adjustment will have to be made through the trimmer of the driver (ref. AZ1) installed in the control panel, until the precise programmed speed has been obtained.

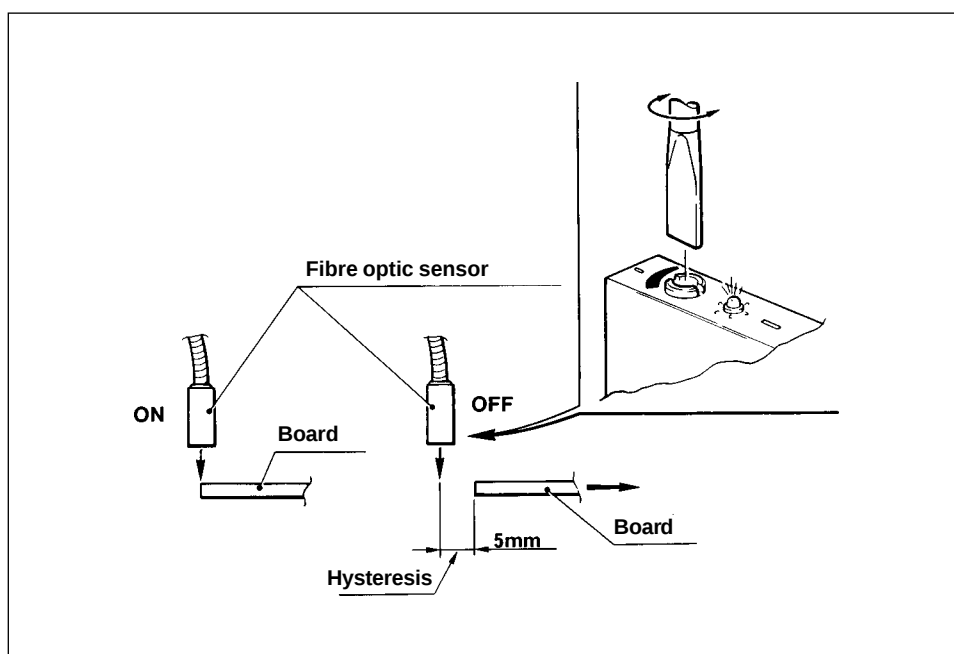
After that, it would be necessary to regulate the trimmer of the speed divider module, DVDM, since to read the 8,96 V at 5 mt/min between the E57 input and the 46 PLC wire.

This value is the one of the tachometric dynamo and represents the precise point of correspondance between speed and power read by the PLC.

CALIBRATION OF THE REAR EDGE PHOTOCELL

In order to calibrate the sensitivity and hysteresis of the fibre optic photocell (Ref. FC47), the removable front crankcase will have to be removed and, with the rolls stationary, a board inserted until it makes contact with the insertion rolls. A red signal lamp will light up on the rear edge photocell, which is mounted on the base of the mirror photocell. When the board is removed this light will switch-off.

The calibration of the sensitivity and the hysteresis of the photocell is carried out through the adjustment screws situated to the side of the red signal lamp, and this should be done in such a way that the red lamp lights up as soon as the front edge of the board is perceived by the fibre optic sensor, but that it also goes out immediately if the board is moved back 5 mm from its inspection point.

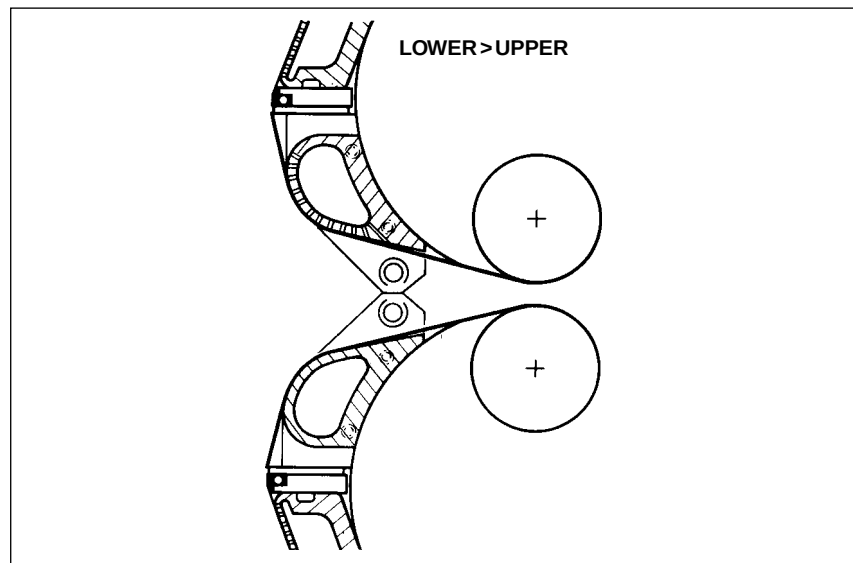


Normally this situation is achieved by increasing the sensitivity value of the photocell up towards its maximum switching on the light without any boards and coming back to the minimum up-to the light switches off again..

ALIGNMENT OF THE TWO SURFACES OF THE REAR EDGE (UPPER AND LOWER)

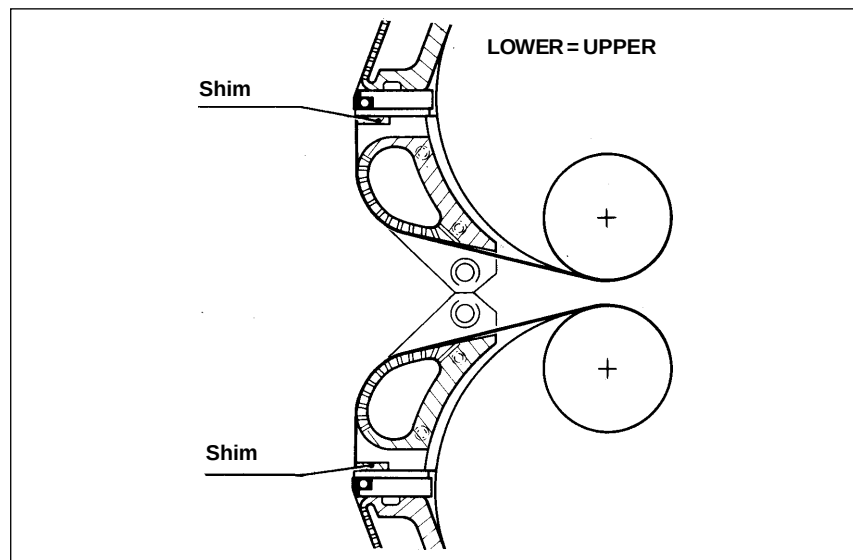
As already described, the distance between the point of "Awaiting start of cutting" and the lamination point is in theory 187 mm.

Nevertheless possible changes in the dimensions of the secondary vacuum shoes and the allowances within the assembly might give rise to differences in the length of film between one part of the machine and another, or between the upper and lower units of the same machine.



Before proceeding with the calibration of the rear edge, the upper and lower edges must therefore be evened up.

Since the actual differences will always be less than 1 mm, to make them precisely equal in measurement it will be sufficient to shim the secondary vacuum shoe corresponding to the shorter edge in such a way as to obtain a larger strip of film on that side.



CALCULATION OF THE REAR EDGE - CORRECTION OF THE PARAMETERS AND OF THE CYCLE TIMES

Between the instant when the rear edge photocell looks the end of the board and the point at which the rotating sectors are synchronised with the speed of the moving film in order to execute a cut, the PLC provides a delay interval which is calculated by taking into account the lamination speed, the rear edge required, and any delays in response by the mechanical parts in function of the lamination speed.

The formula for determining this value is as follows.

$$T = \frac{(50 - \text{Edge}) \times X + (5 - \text{Speed}) \times Y}{\text{Speed} \times 1000}$$

where:

T = Resultant delay time (sec.)

50 = Maximum rear edge (mm)

Edge = Programmed rear edge

X = Multiplication factor (≈ 60)

5 = Maximum lamination speed that can be set (mt/min)

Speed = Programmed lamination speed (read on Dynamo T.)

Y = Multiplication factor for the delay due to mechanical responses (≈ 195)

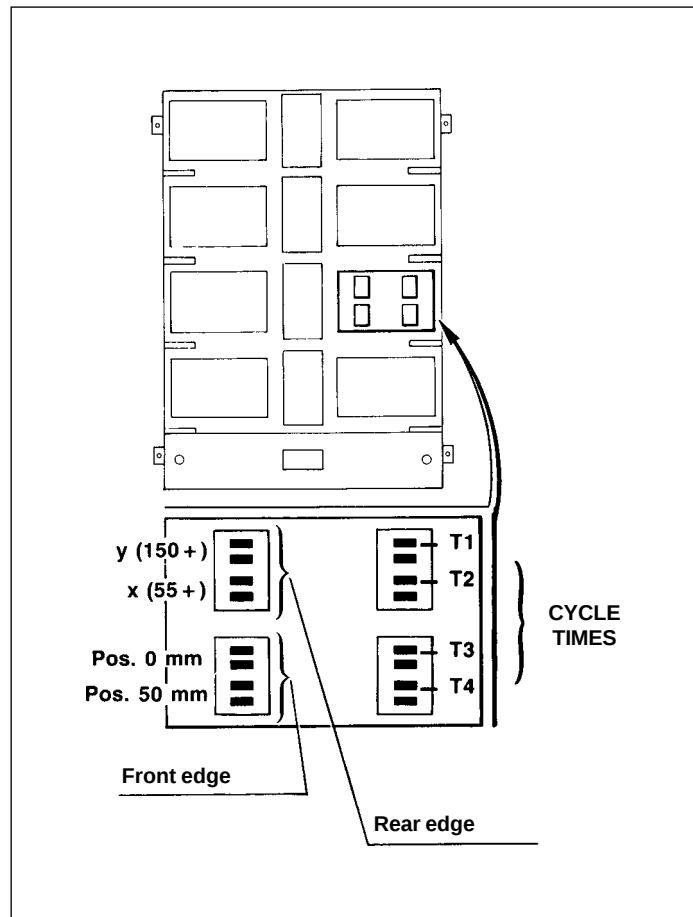
The delay interval will be 0 when lamination speed is 5 mt/min. with a rear edge of 50 mm. It will be somewhat longer, however, when laminating at a very low speed and with a rear edge of 0 mm.

The two multiplication factors, "X" and "Y" may assume slightly different values from one machine to another, or even vary with time on the same machine, due to even very slight differences in roll diameters, their operating temperatures, and the response time of the electromagnetic clutches, the moving mechanical or pneumatic parts.

Inside the PLC located within the electrical control panel, there is an electronic circuit composed of 4 sets of numerical presetters, as shown in the two diagrams.

The values of "X" and "Y" have been broken down into two parts: one is fixed, stored in the program memory, and the other is edgevariable, must be added to the fixed quantity, and must be preset via the presetters mentioned above.

The fixed value of "X" is 55.0, and to this can be added a quantity that may vary between 0.0 and 9.9.



For example: when the presetter is set to 1.3; $X = 55.0 + 1.3 = 56.3$

The fixed value of "Y" is 150, to which can be added a quantity that may vary between 00 and 99.

For example: when the presetter is set to 52; $Y = 150 + 52 = 202$

Caution: Once these parameters have been changed via the presetters, the operator must enter the page for presetting lamination parameters on the display (via SET-UP ON) and then leave it again without carrying out any further modification. **By this means the PCL will be able to read and store in memory the new values of "X" and "Y".**

During the final commissioning inspections of the laminator, these parameters are identified and stored in the memory of the PLC. However, should it prove necessary to recalibrate them, the procedure is as follows:

1. Prepare the machine for lamination with film, and key in the normal values of temperature and pressure.
2. Set a speed of 5 mt/min. and a rear edge of 50 mm.
3. Laminate a board with a length of not less than 300 mm and measure the rear edge obtained.

4. Should the measured edge be found to be greater than 50 mm, bring the fibre optic sensor of the rear edge photocell (FC47) closer to the lamination rolls by the same amount as that by which the edge exceeds 50 mm.
5. Conversely, if the edge measures less than 50 mm, increase the distance between the sensor and the rolls by the same amount as the edge falls short of 50 mm.
6. Verify the edge once more, laminating the board until the exact position of the fibre optic sensor is found.
7. Maintaining a speed of 5 mt./min., now set the rear edge to be 0 and laminate the board while measuring the actual edge obtained.
8. **If the film is shorter than the board, the value of "X" must be increased; if, on the other hand, the film is longer than the board, the value of "X" must be lowered.**
9. Repeat this operation until the optimum value of "X" has been found.
10. Now set the rear edge to be 50 mm and the lamination speed to 1 mt/min.
11. Laminate the board and measure the real edge obtained.
12. **If it is less than 50 mm, the value of "Y" will have to be lowered; if it is greater than 50 mm, the value of "Y" will have to be raised.**
13. Repeat this operation until the optimum value of "Y" has been found.

Note: Remember to fix the new X and Y values in the PLC memory following the instruction as per previous page.

Caution: The value of the rear edge, due to the specific design of this machine, may be subject to some slight shift from the set value, depending upon the thickness of the board undergoing lamination. Therefore discrepancies may be found between the set values and the real ones. We would suggest modifying the set values in function of such discrepancies, in order to obtain the precise value required.

In spite of this the laminator offers excellent repeatability in time, which is without doubt the most important characteristic of a lamination process.

CYCLE TIMES

During the lamination cycle the PLC directs several timing intervals involved in the opening and closing of the electromagnetic gears of the “enrichment rolls” (upper and lower) and the time taken for the laminated boards to emerge.

T1 = Main enrichment time. This is the time taken to activate the electromagnetic clutch (upper and lower) during the rotation of the sectors away from the position of “end of cutting” and to the “tacking” position. The value stored in the memory is 0.5 sec.

T2 = Upper supplementary enrichment time. This comes between the “end of cutting” time and the opening of the rolls. The value stored in the memory is 0.

T3 = Lower supplementary enrichment time. As above. This is equal to T2 plus the value preset for T3.

T4 = Enrichment time at the Set-Point. This is between the “start of cutting” and “end of cutting” positions, (an operation that is carried out only after having loaded the film and closed up the machine).

CAUTION:

The values preset on the selectors (T1÷T4) are read directly by the PLC, and are therefore not recorded on the parameter-variation sheets. They are all expressed in hundredths of a second.

The time taken before unloading of a laminated board from the rolls is stored in the memory, and is calculated automatically by the PLC in function of the lamination speed. Nevertheless it can be shortened by setting indicators no. 905÷909, using the PCA2-P10 heads.

909=90%; 908=80%; 907=70%; 906=60% and 905=50%.

N.B.: Every time this is done, all the other indicators, even those not directly involved, will also have to be reset:

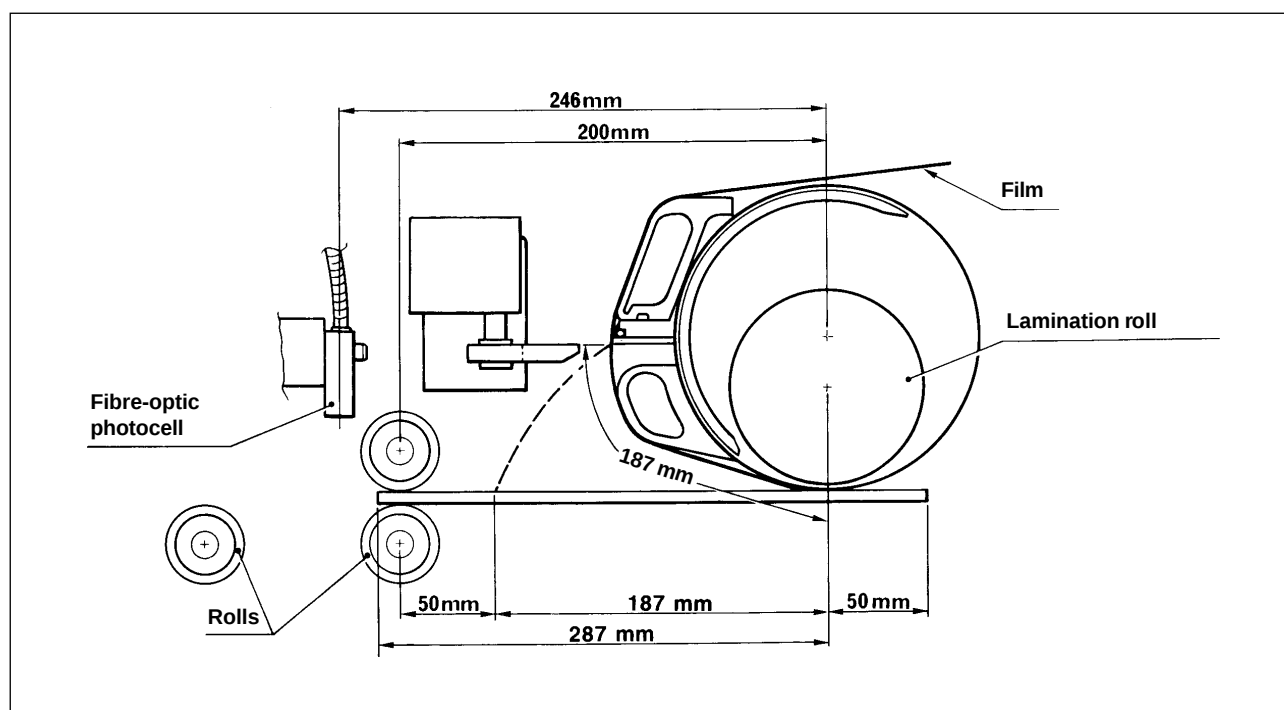
i.e., for 50%, we shall have 905 ON (1) and 906÷909 OFF (0).

EDGES ON BOARD OF MINIMUM LENGTH

As already described in the chapter on “Front edges”, the shortest board that can be laminated measures 210 mm.

Since the distance between the lamination point and the rear edge photocell is approximately 246 mm, when a board with a length of less than 246 mm is laminated, the value set for the rear edge should take into account the size of the front edge, the length of the board, and the real rear edge required.

Knowing that the minimum length of film that can be laminated is 187 mm, the board must have a minimum length of 287 mm, in order to obtain front and rear edges of 50 mm.



For boards with a length of between 287 mm and 210 mm, the value of the rear edge will be modified as follows:

If we designate “B” the maximum rear edge possible for a board with a length of less than 287 mm, we have:

$$\text{Length of board} - 187 \text{ mm} - \text{front edge} = B$$

If $B \geq$ (greater than or equal to) 50, the rear edge will correspond to the value actually programmed into the control panel.

If, on the other hand, $B <$ (less than) 50, B will in fact correspond to the programmed value of 50 mm.

For example: Board length 227 mm - Front edge 10 mm

What figure should be preset in order to have a rear edge of 10 mm?

If we apply the above relation, we have:

$$227 \text{ mm} - 187 \text{ mm} - 10 \text{ mm} = 30 \text{ mm} (= B)$$

When $B < 50$ it is found that the maximum real edge corresponding to the programmed value of 50 mm is in fact 30 mm, hence:

Preset edge	Real edge
50	30
40	20
30	10
20	0
10	+ 10 (film extending beyond board than board)

which means that in order to obtain a rear edge of 10 mm, a value of 30 mm must be entered on the keyboard.

Caution: As already explained in the chapter "Front Edge", it is not possible to set any front edge value greater than:

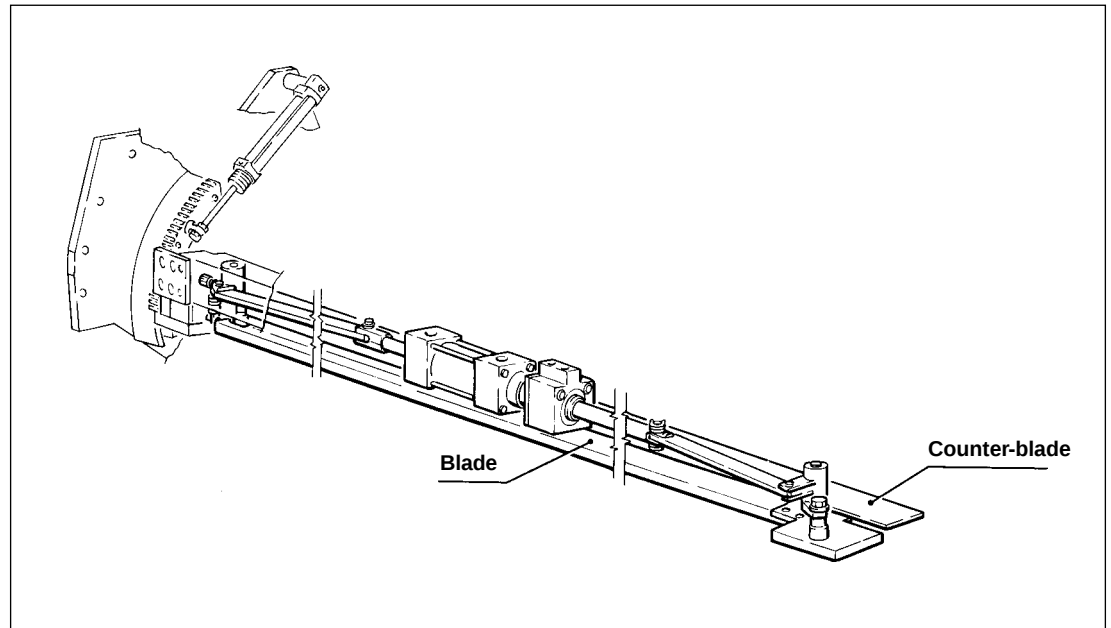
Board length – 200 mm

Read carefully the explanations given in the relative chapter.

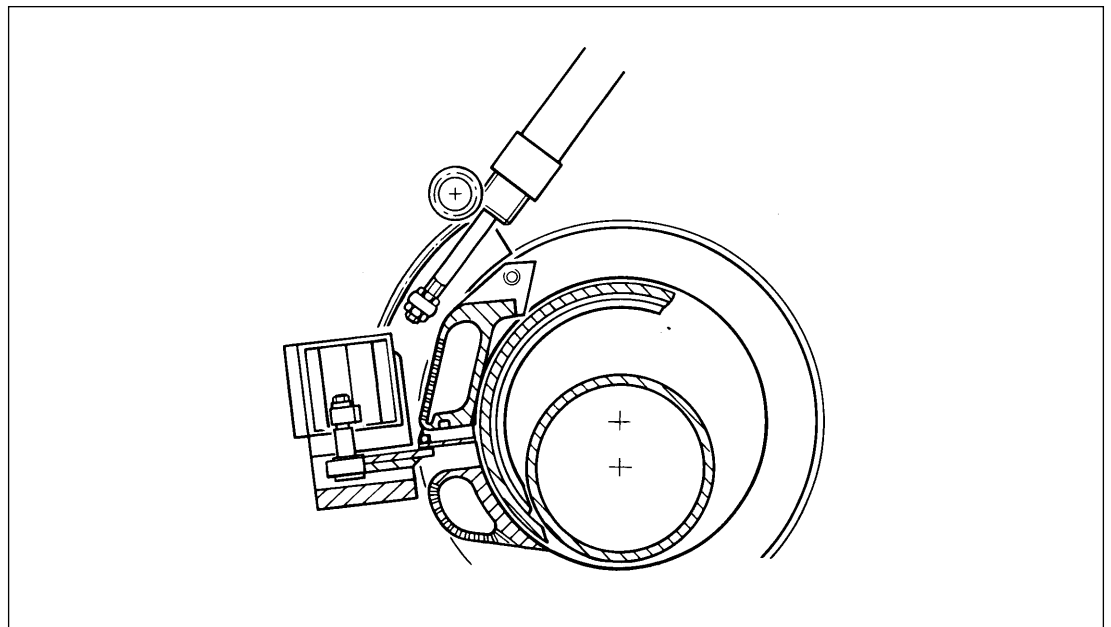
CUTTING GROUPS

The film cutting system is, as already mentioned, of the “shearing” type.

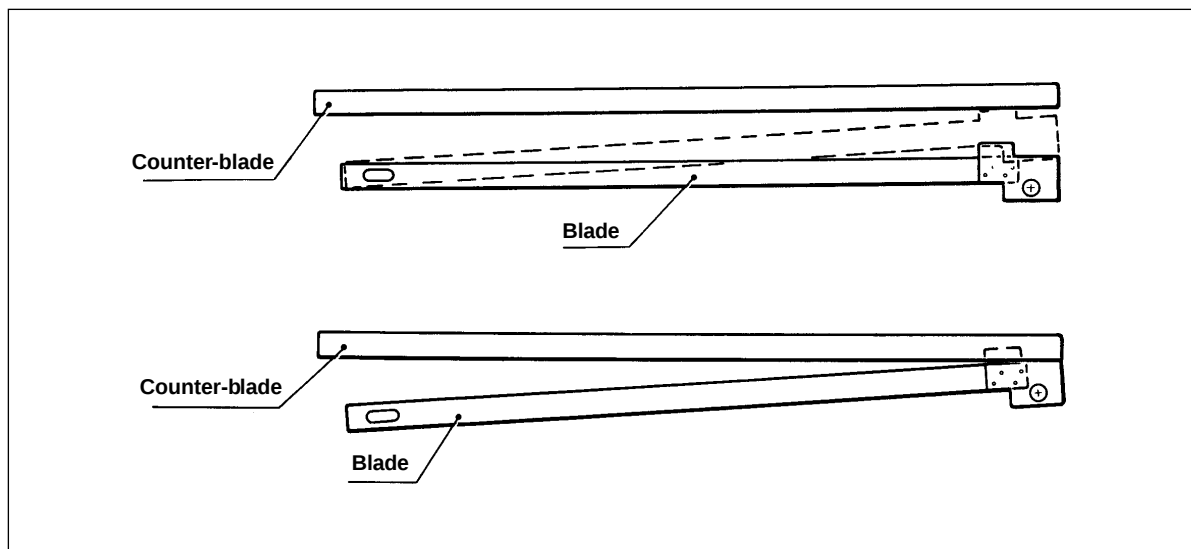
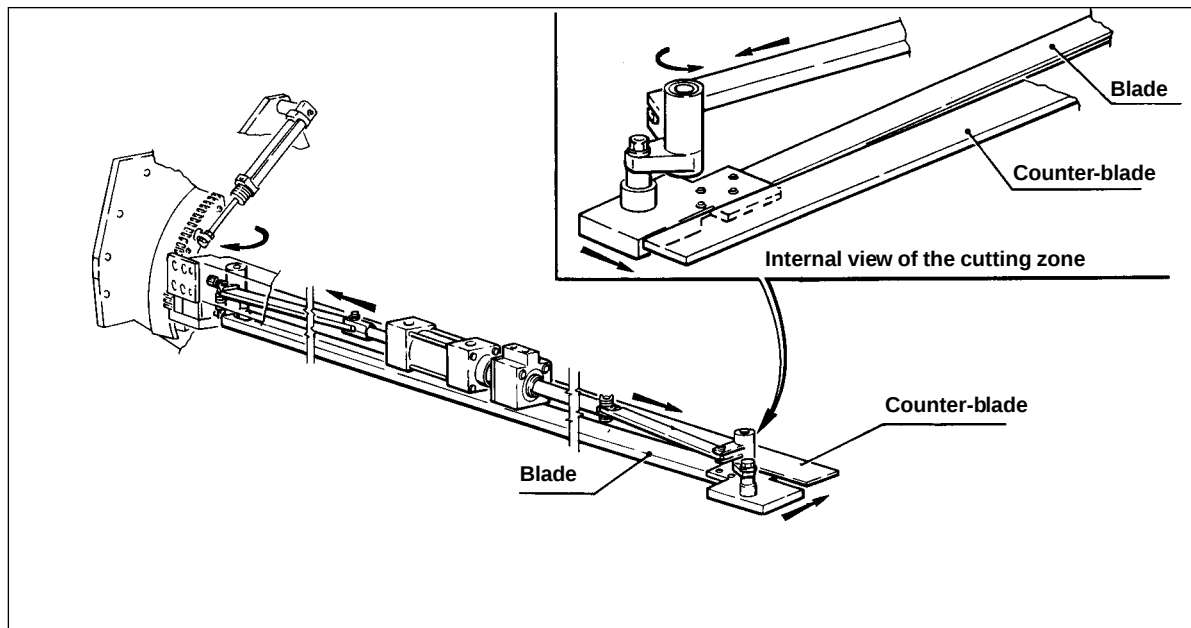
It consists of a moving blade and a fixed counter-blade. Both these implements are made from a steel with a very high hardness value.



Before coupling can be achieved between the moving blade and the counter-blade, the first must be placed in an oblique position with respect to the second, to enable the coupling tooth to engage in the appropriate cavity situated between the main and secondary vacuum shoes.



The moving blade is driven by two pneumatic cylinders connected in series. The first, which has a short stroke, positions this blade obliquely, while the second, with a double bar and a long stroke, moves the blade from both sides in order to cut the film.

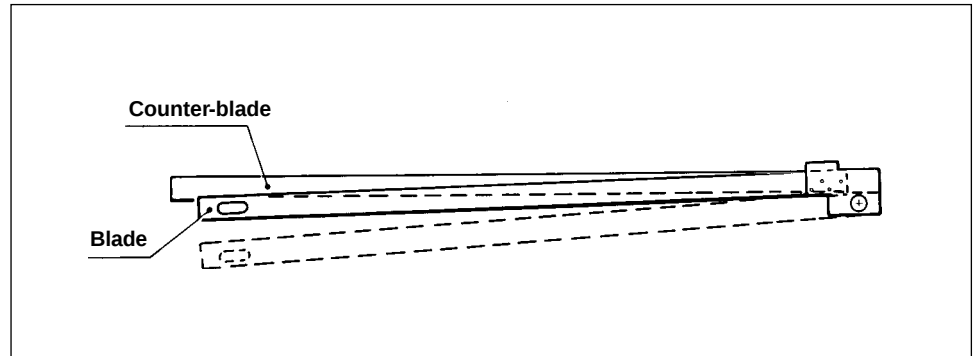


The return cylinder of the group and the spring placed at the end opposite the coupling tooth ensure that the two blades remain in contact.

Inside the group there is a stop inductive sensor, FC26/27 which perceives the positions in which coupling or uncoupling have taken place.

During the cutting operation the moving blade is moved symmetrically from both sides, due to the right and left-hand leverage of the cutting group.

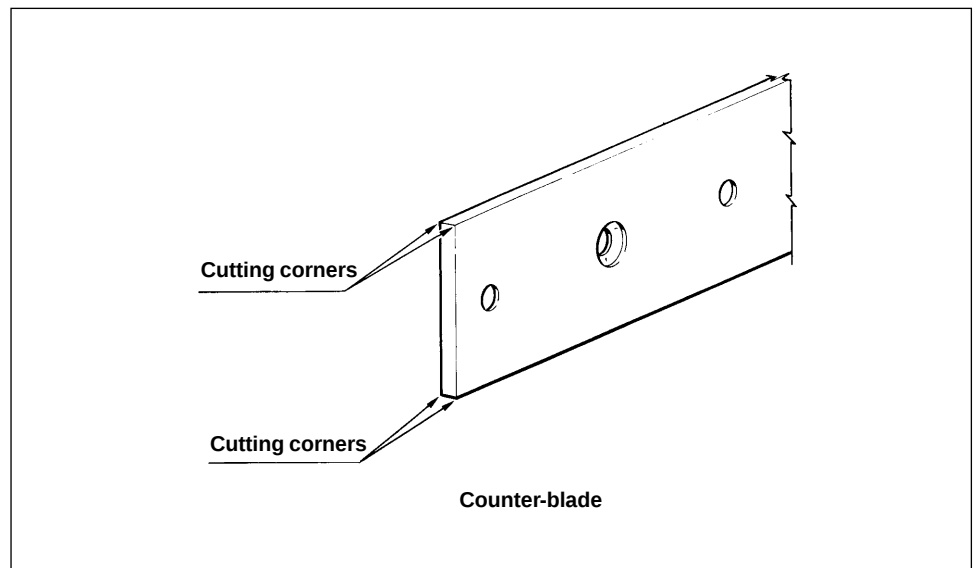
It is very important that the cutting speed should not be too slow, in order to ensure that the cut takes place on the fly, but conversely it should not be too fast, or the moving blade might bounce off the counter-blade, which would give rise to an imperfect cut.



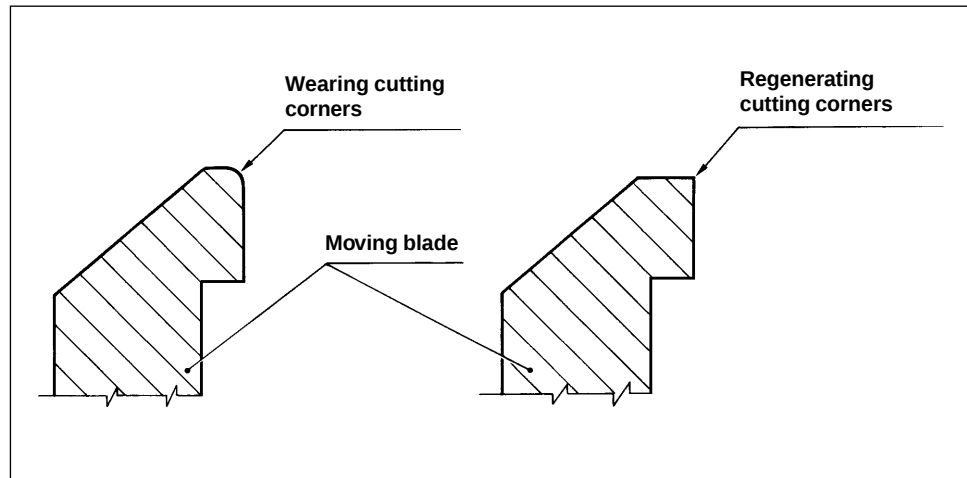
The flow regulators of the double-barred pistons make it possible to regulate the speed, which should be kept to between 0.6 and 1 sec.

The manufacturing criteria of the cutting tools are such that they should survive countless operating cycles before requiring maintenance.

However, when it does become necessary to restore optimum cutting conditions, the counter-blade will have to be turned so that one by one all four of its cutting corners can be used.



Once all four cutting corners have been worn out, the cutting corners of both the moving blade and the counter-blade will have to be restored to 90°.



The grinding process for these tools is extremely delicate, and must be carried out with the greatest precision and skill, taking care to avoid absolutely any heating of the steel of which they are made.

Caution: Do not rub any abrasive objects, such as files, glass-paper, etc. over the cutting corners of these implements.

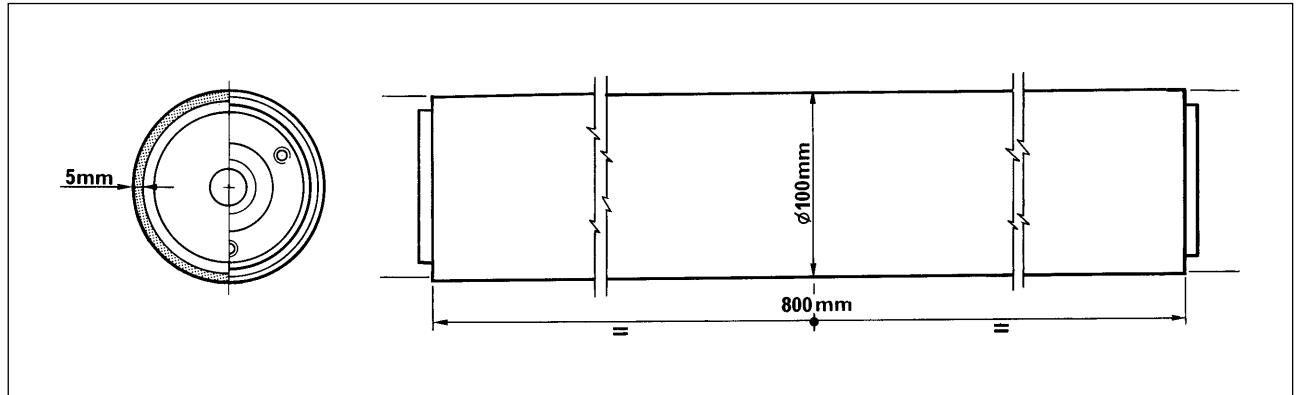
The blades will cut quite efficiently if cleaned only with a rag dipped in alcohol.

Due to the effects of gravity, the return springs of the upper and lower blades have different calibrations.

LAMINATION ROLLS, PRESSURE, HEATING AND THERMAL ALARM SIGNALS

The 1600-D laminator laminates dry film onto boards by means of a pair of hot rollers of original design, known as "lamination rolls".

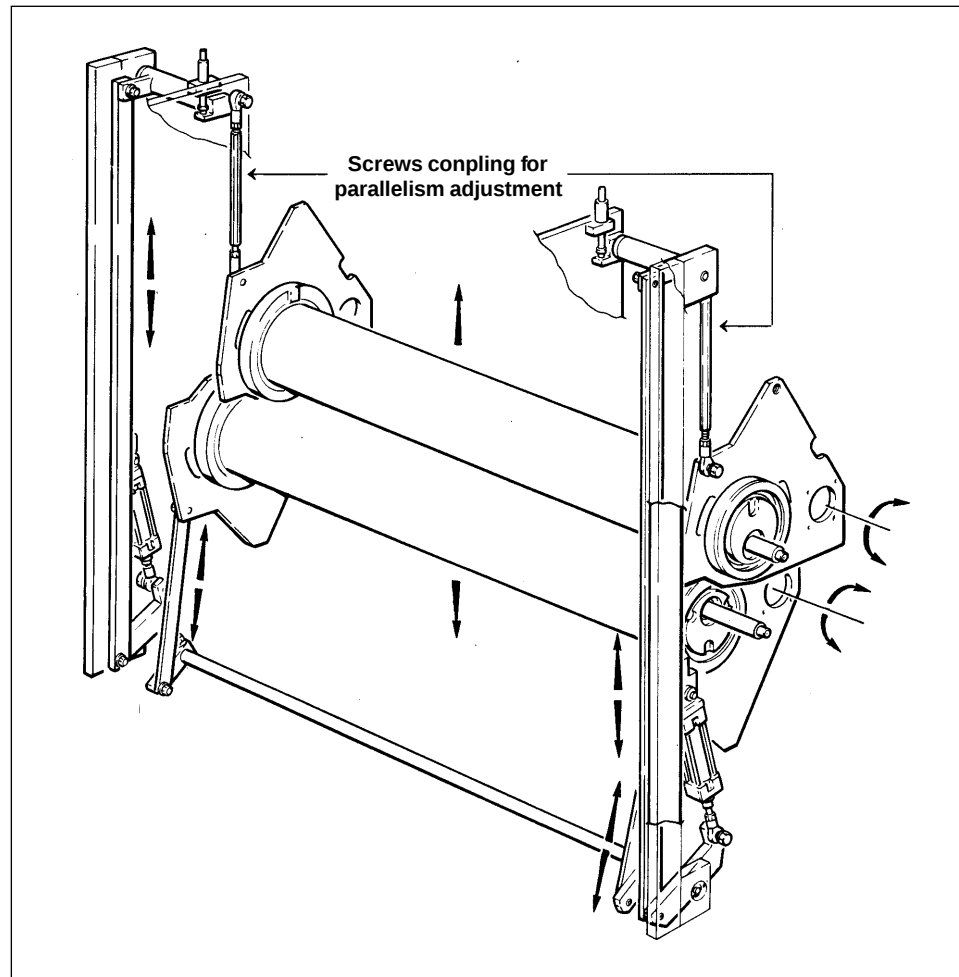
These rolls have a total diameter of 100 mm., including a 5 mm thick layer of rubber. They are 800 mm. long, coloured black, and have a rubber hardness of 60 shore.



The material of its core provides a more equal distribution of pressure over the board.

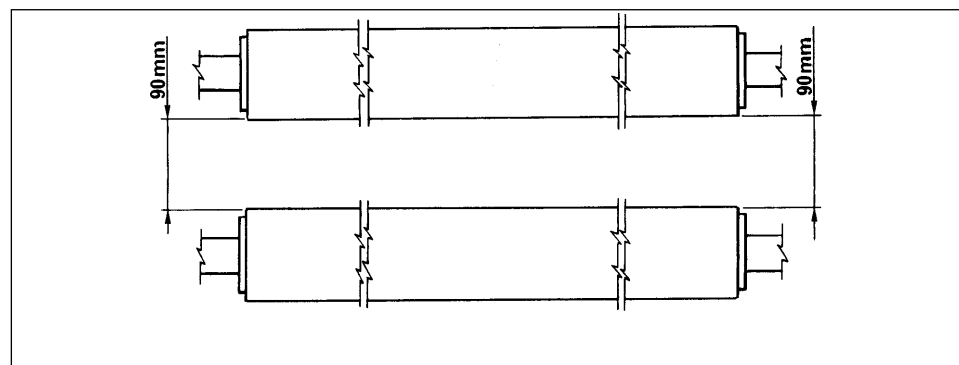
Both the upper and lower rolls, (as also in the case of the rotating sectors, etc.), move symmetrically with respect to the lamination plane.

The movement is obtained by two pneumatic cylinders, synchronised through a mechanical cam shaft and a system of levers.



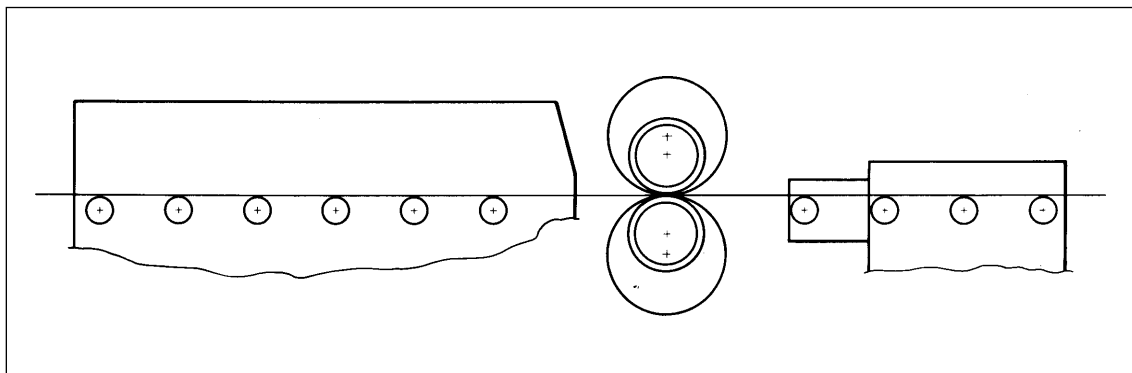
The parallelism of the rolls with respect to the theoretical lamination line can be regulated by means of the upper and lower screws coupling, left and right-hand, inserted on the control levers of the roll-bearing supports and the exhaust unit supports.

The distance between the rolls, when separated, should be 90 mm.



Should this distance require adjustment, the appropriate screw coupling should be used.

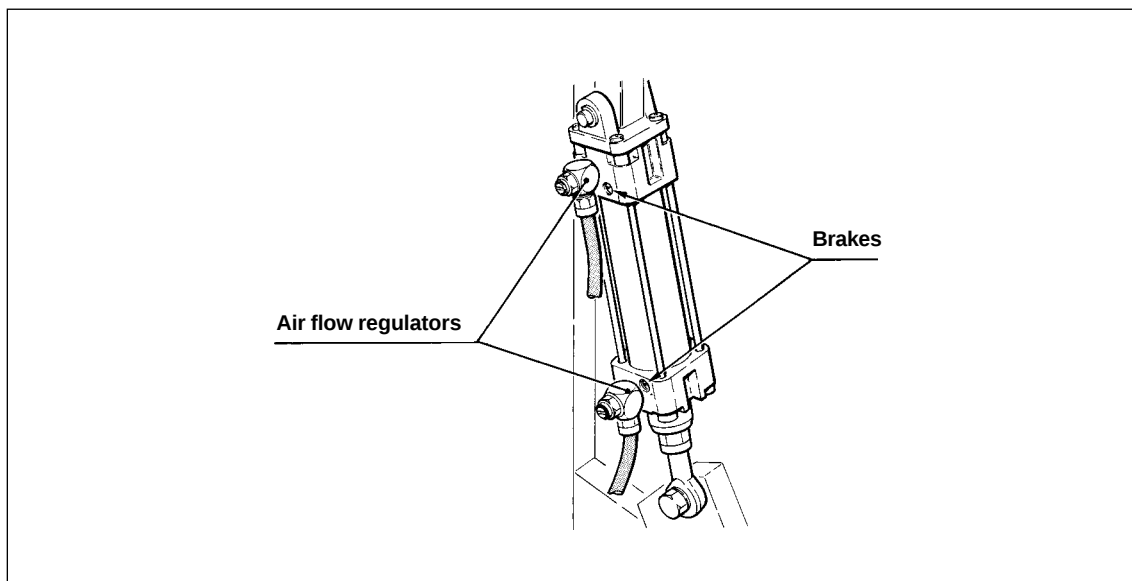
First of all, however, it is better to make sure that the closure line of the rolls coincides with that of the plane of the input and output rollers.



Next it is advisable to regulate first the height of the lower roll, and then the space between the two rolls when separated.

The opening and closing movement of the lateral little shoulders, (and therefore of the rolls) should be as rapid as possible. However, while there are no disadvantages attached to rapid opening, a too rapid closure could lead to damage to the rubber if the roll were to close down onto the sharp edge of a board.

The opening and closing speeds must be optimised by simultaneous and equal adjustment of the left and right-hand flow regulators of the actuator cylinders and their pneumatic brakes.



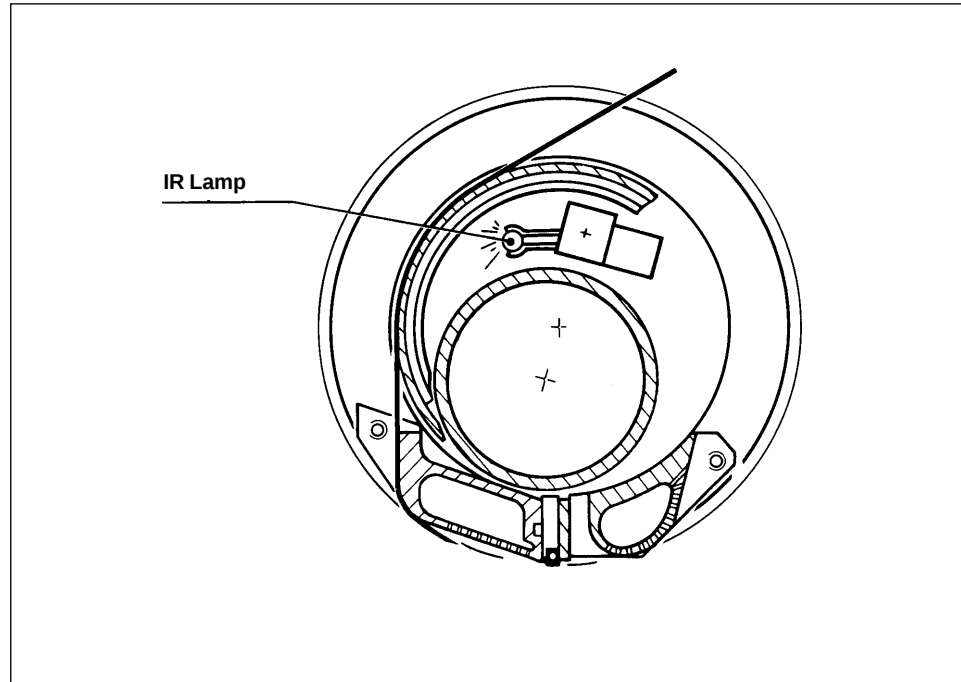
The recommended closure time is from 0.8 to 1.0 sec.

The rolls are heated by means of 2100W/220V short-wave infra-red lamps, activated by solid state relays (Ref. RL1-RL2).

The strong heating power of these elements, together with the dark colour of the rolls, leads to an extremely rapid response of the system to the command to increase the temperature of the rolls.

The average time required to pass from room temperature to 110°C is approximately 7 minutes.

The IR lamps are housed in the semi-cylindrical aluminium cover which also acts as a protective hood for the rolls.

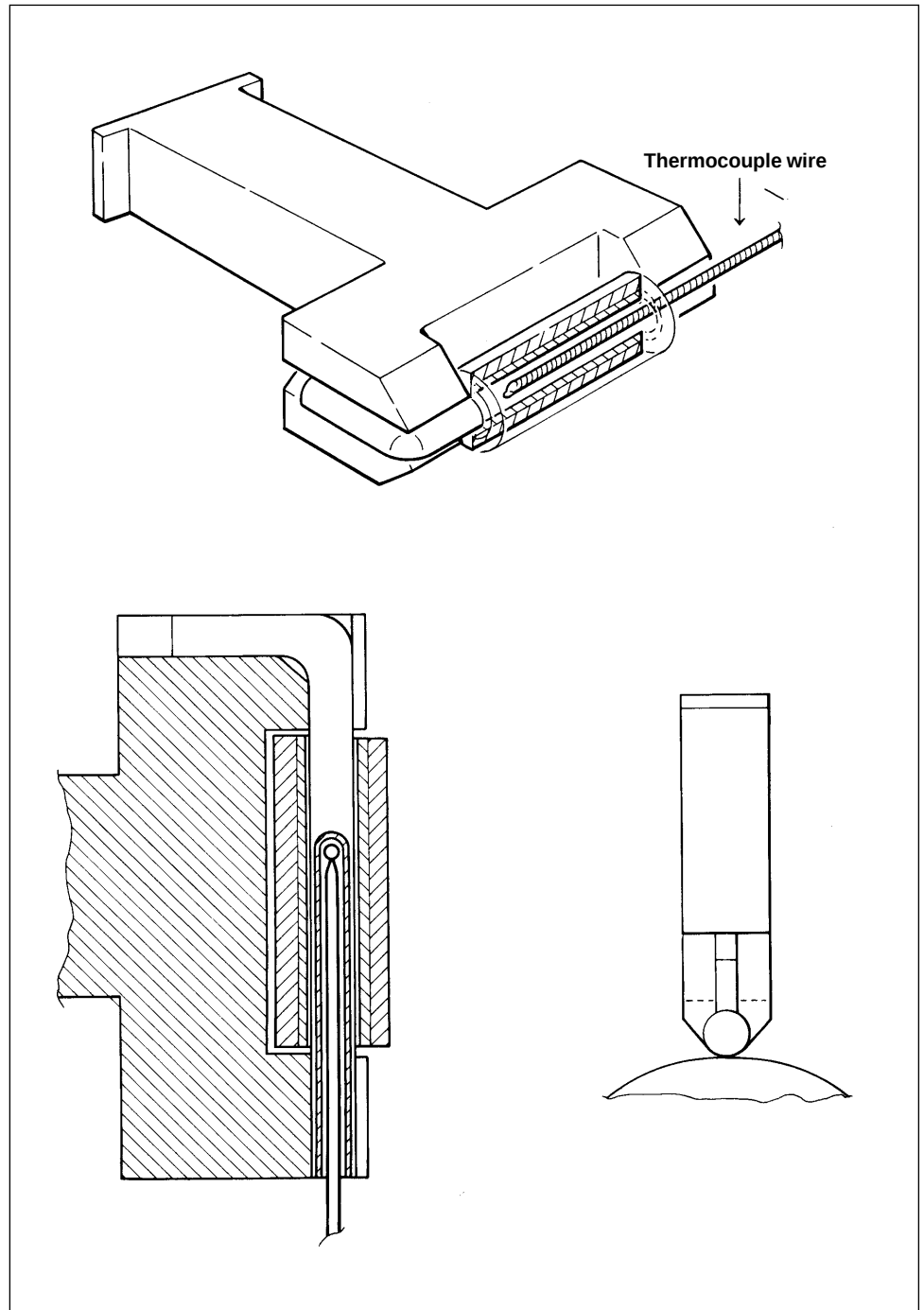


The lamps are mounted in such a way that they can slide lengthwise along one side. This displacement is caused by expansion due to the very high temperatures.

The IR lamps have a lifetime of several thousands of hours, operating at full power and continuously.

In view of the fact that they will only work intermittently, their working life can therefore be considered to be even longer.

The temperature of the rolls is measured by a “rotary-type” thermocouple sensor.



The temperature transducer is made in such a way as to avoid any friction between the probe and the roll, because its copper roller turns on the lamination roll.

The heat inertia of the transducer is very low, so any fall in roll temperature is signalled immediately to the thermoregulator.

The low heat inertias of the sensor and of the IR lamps mean that the temperature of the rolls varies very little from the set value.

This ensures that the temperature values of the laminated boards remain more constant in time.

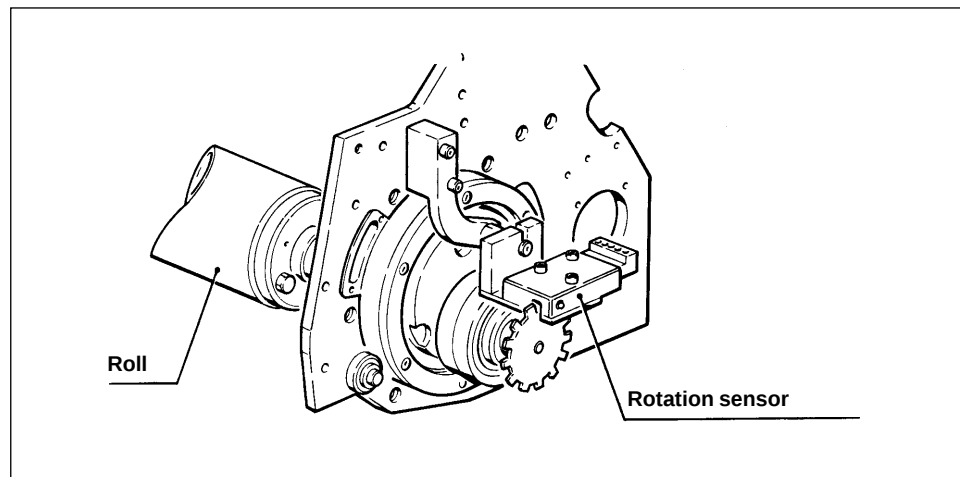
Caution: Due to the position at which it is mounted the transducer reads the temperature of the roll after it has yielded some heat to the board, so it is inevitable that the display of the thermoregulator shows a temperature slightly below the set value.

The maximum temperature permissible for the rolls is 140°C.

Since the heating element is outside the rolls, it is of the greatest importance that the rolls should continue to rotate whenever the lamps are on, to prevent the rubber burning.

A toothed disk and a sensor are attached to the righthand side of each roll (Ref. CRR1 / Ref. CRR2) to indicate that the rolls are rotating.

If a roll should stop rotating for any reason, this rotation sensor will cut off the heating to that particular roll.



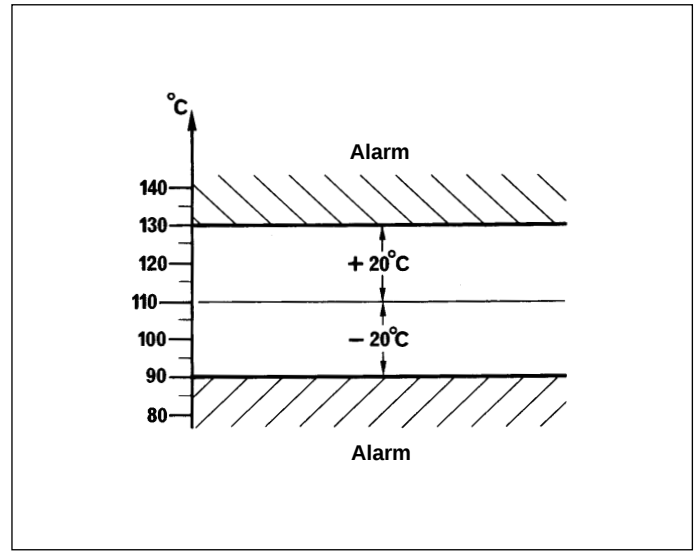
The thermoregulators controlling the roll heaters are commanded by a microprocessor housed inside them.

The thermoregulators can be programmed for different operations, and offer the possibility to set an alarm value.

The alarm is expressed in °C, and represents the value below or above which the machine will not accept boards for lamination.

For example: Set value = 110°C / alarm 20°C

The alarm will be activated between 0 and 89°C and from 131°C upwards.



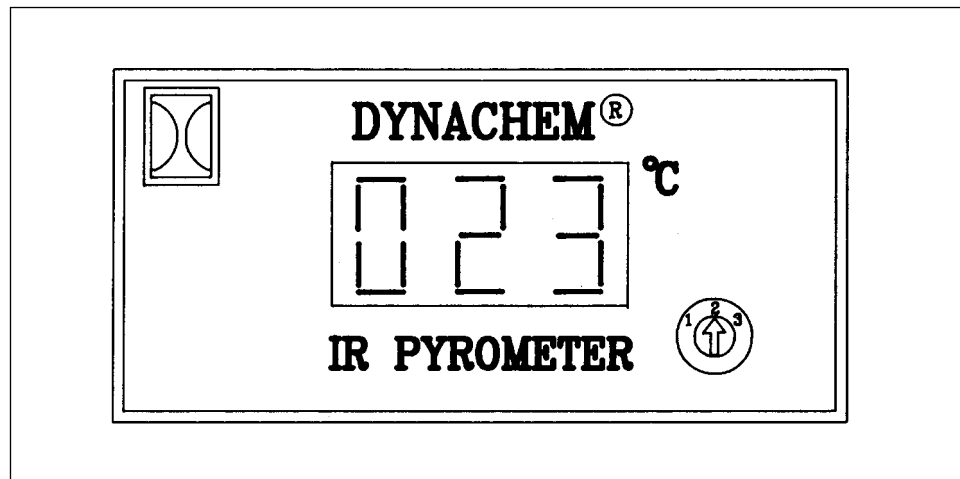
The alarm message is “**Lamination rolls temperature out of range**”.

Caution: It is important that the temperature transducer should always remain in contact with the rolls, but it should also have the possibility to draw back.

A lack of contact between the thermocouple and the roll would give rise to a dangerous rise in roll temperature, even to the extent of burning the rubber.

TEMPERATURE READER FOR THE FINISHED BOARD

On the right-hand panel of the machine there is an instrument that displays the temperature of the finished board after lamination.



This parameter is an important coordinate for discovering whether or not the lamination is proceeding within the normally correct limits.

The infra-red ray temperature sensor (not in contact) is housed in the rear section of the machine.

Since the IR sensor is influenced by colours, the display instrument contains a selector which is positioned according to the different colours of dry film (green, red.....).

However, these different values must be calibrated in function of the colour of the dry-film, using the trimmers placed on the back of the instrument itself.

Generally speaking the temperature recommended for a board laminated with a Dynachem dry film is between 45°C and 55°C.

If the instrument has been supplied with an alarm system, one could even set minimum and maximum alarms for these temperatures.

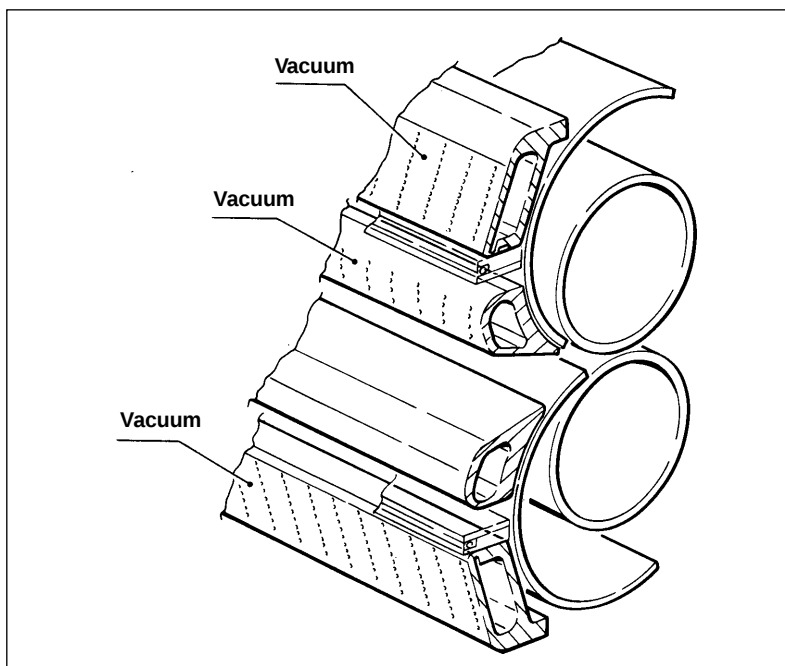
Such alarms would be entered on the instrument, and could be included or excluded by means of a switch.

In order to increase the temperature of the outgoing board, one can either increase the temperature of the rolls, lower the speed, or preheat the board before lamination.

VACUUM CUT-OFF VALVES

Between the vacuum pump and the exhaust shoes of the rotating sectors there is a vacuum distributor with three secondary air-hoses, each of which contains a gate valve, moved by a mini-pneumatic cylinder, and electrovalves (EV26, EV27 and EV35).

The three secondary air-hoses create vacuum for the main upper exhaust shoe, the secondary upper exhaust shoe, and the lower main exhaust shoe, respectively.



The lower secondary exhaust shoe does not need to be under vacuum because the cut film remains attached to it by force of gravity.

Vacuum in the upper secondary exhaust shoe acts to hold the extreme edge of the cut film away from the board until it has been laminated.

Depending upon the point reached in the cycle, the valves, by opening and closing, control communication between the exhaust shoes and the vacuum pump.

Vacuum is present in the main exhaust shoes from the “start-of-cutting” phase through to the tacking. There is no vacuum in any of the shoes during lamination.

There is vacuum in the upper secondary suction shoe from the start of cutting until the rolls separate once lamination is completed.

When all three vacuum air-hoses have been closed off by their respective gate valves, a freely circulating air discharge vent remains open to prevent overloading of the vacuum pump.

This freely circulating air discharge is noisy by its very nature, and has therefore been supplied with a silencer.

We recommend that this silencer should be cleaned out regularly once a month.

Similarly we advise cleaning the main filter of the vacuum pump once a month.

DYNAMIC TENSION ROLLS

The dynamic tensions of the film (one set above, one set below), serve to tighten up any slack that may have developed in the film during the lamination cycle.

In addition, by keeping the film tensioned, they serve to prevent the formation of diagonal wrinkles during lamination.

The tension rolls normally remain in their "extended" position. They retract when the dry film-carrying rollers are disengaged, thus allowing the polyethylene take-up rollers to move-out.

When the machine is stationary in the "Awaiting board" position, the "extended" tension rolls hold the film up above the circular sectors.

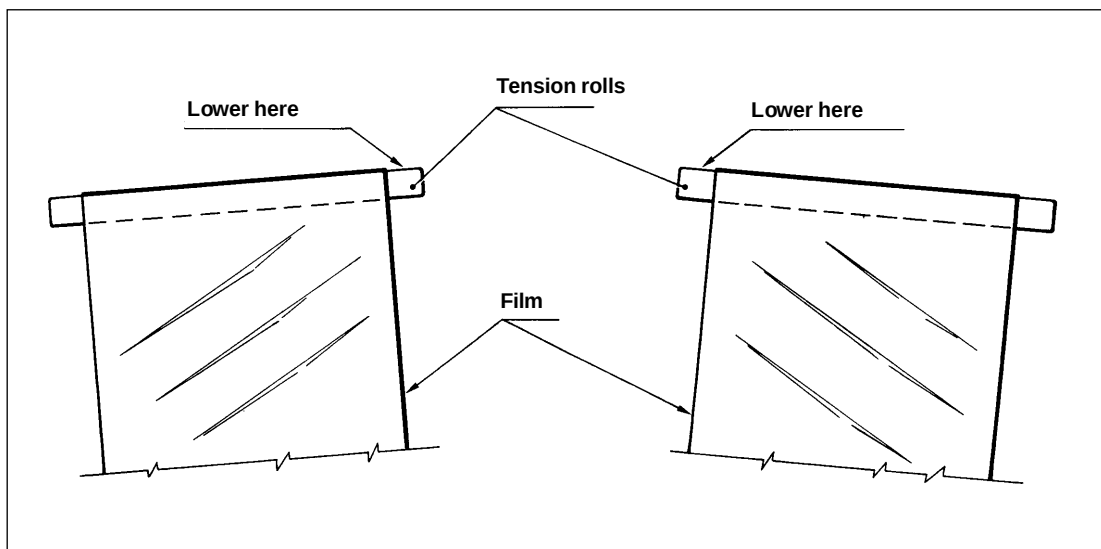
When the board for lamination has been centered by the lateral-centering unit, the tension rolls retract, and the rotating sectors move into the tacking position.

Once tacking has taken place, the sectors are rapidly returned to the "Awaiting Start of Cutting" position, the lamination rolls close down onto the board, the two tension rolls extend, and take up any slack in the dry film, thereby stretching it until it is tensioned.

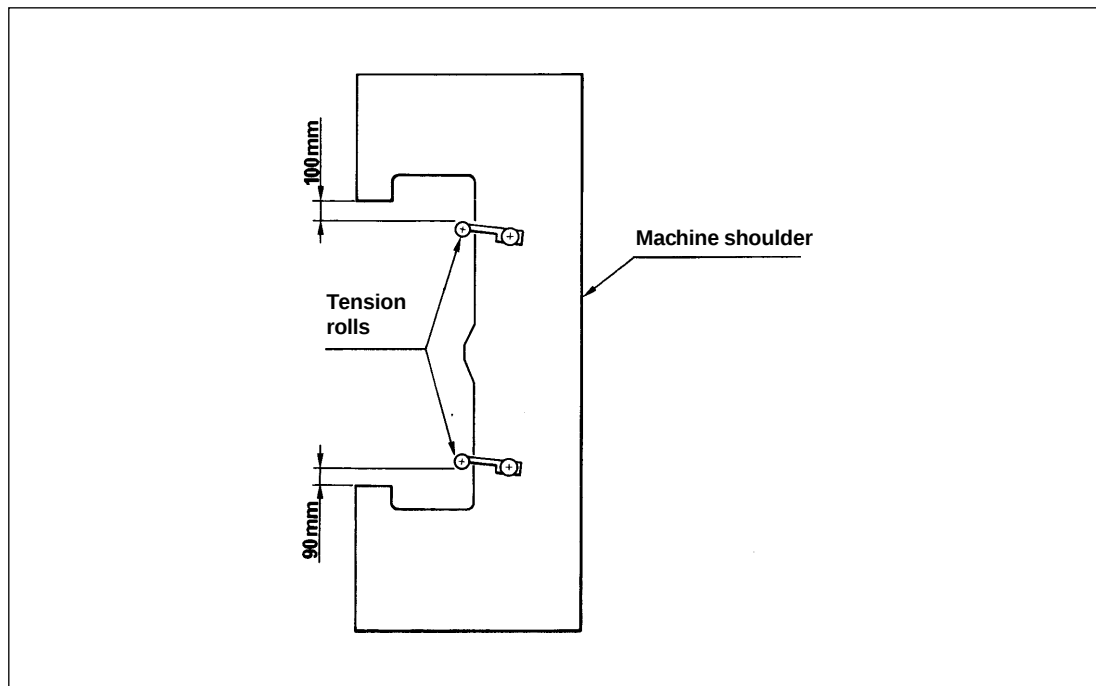
The tension rolls remain "extended" during the entire lamination phase, until an instant before the command to cut arrives. At this point they are retracted, to relieve tension on the film, so that the film will not suffer from an "elastic effect" as it is cut.

It is important, therefore, that the speed of the tension rolls in either direction should not be too much slowed, but also that it should take into account the factors shortly to be described.

It is equally important that they should be positioned in such a way as to smooth out all diagonal wrinkles in the film (see the following diagrams).



The height to which the tension rolls should be adjusted in their extended position is illustrated below:



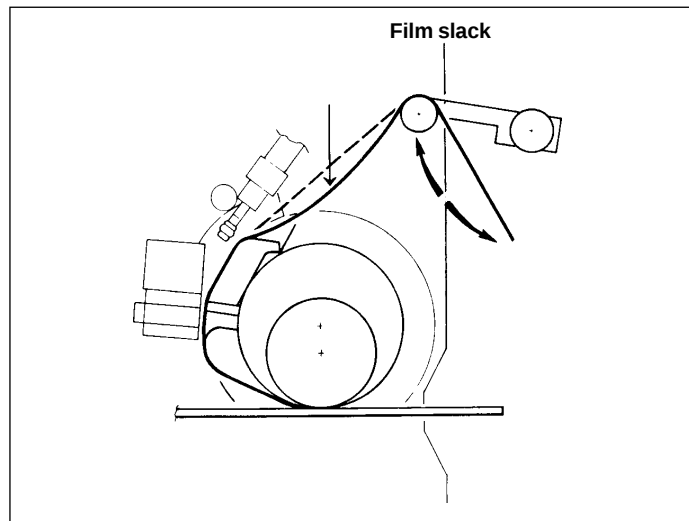
However, as can be seen from this diagram, the height can be altered on one side only for the elimination of wrinkles.

The tension rolls are driven by pneumatic cylinders, but while the speed of these cylinders can be regulated, their pressure cannot. **The recommended time for completion of the movement is approximately 1 sec.**

The tension applied by the tension rolls to the film before lamination causes the dry film spool to unwind. This movement may vary according to its diameter, its static tension, or the speed of the tension rolls.

Excessive unwinding of the film could create problems if the boards undergoing lamination are short (less than 300 mm).

In fact, the amount of slack created in the film if the dry film spool unwinds too far can never be either completely tensioned or used up by the board, because of its reduced length. Consequently, after the passage of several boards, the tension rolls will no longer be able to stretch the film sufficiently because the film will have developed a slack greater than the travel of the tension rolls themselves.



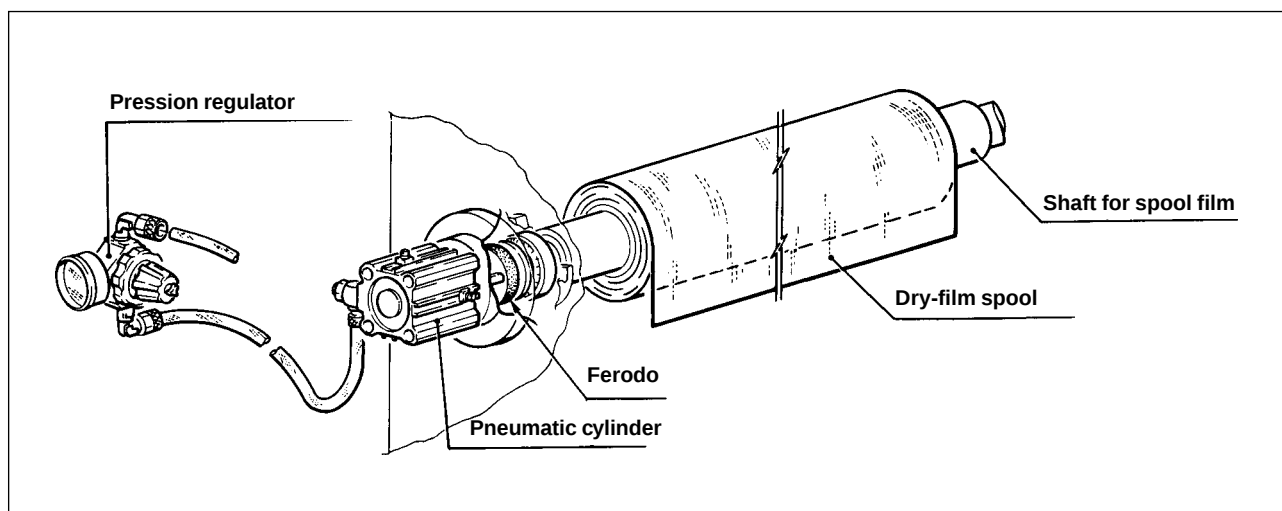
It is therefore important to control the unwinding of the spools during the tension phase, and to regulate their degree of friction so that the film always remains at the correct tension. If these measures are not sufficient, the speed of movement of the tension rolls must also be reduced.

STATIC TENSION (FRICTIONS)

The static film tensions (one above and one below) provide a braking action on the unwinding of the dry-film spools.

This braking action, applied to the shafts of the spool carrying rollers is obtained by means of a friction block pressed against a disc fixed to the ends of the shafts.

The force applied to the friction block is created by air pressure in a pneumatic cylinder.



The amount of pressure to be applied to this pneumatic cylinder will depend upon the diameter of the dry-film spool.

As is well known, the spools can be either standard size or oversize. In the latter case, the lever arm of the force needed to pull the film is greater, as is also the flywheel formed by the spool itself.

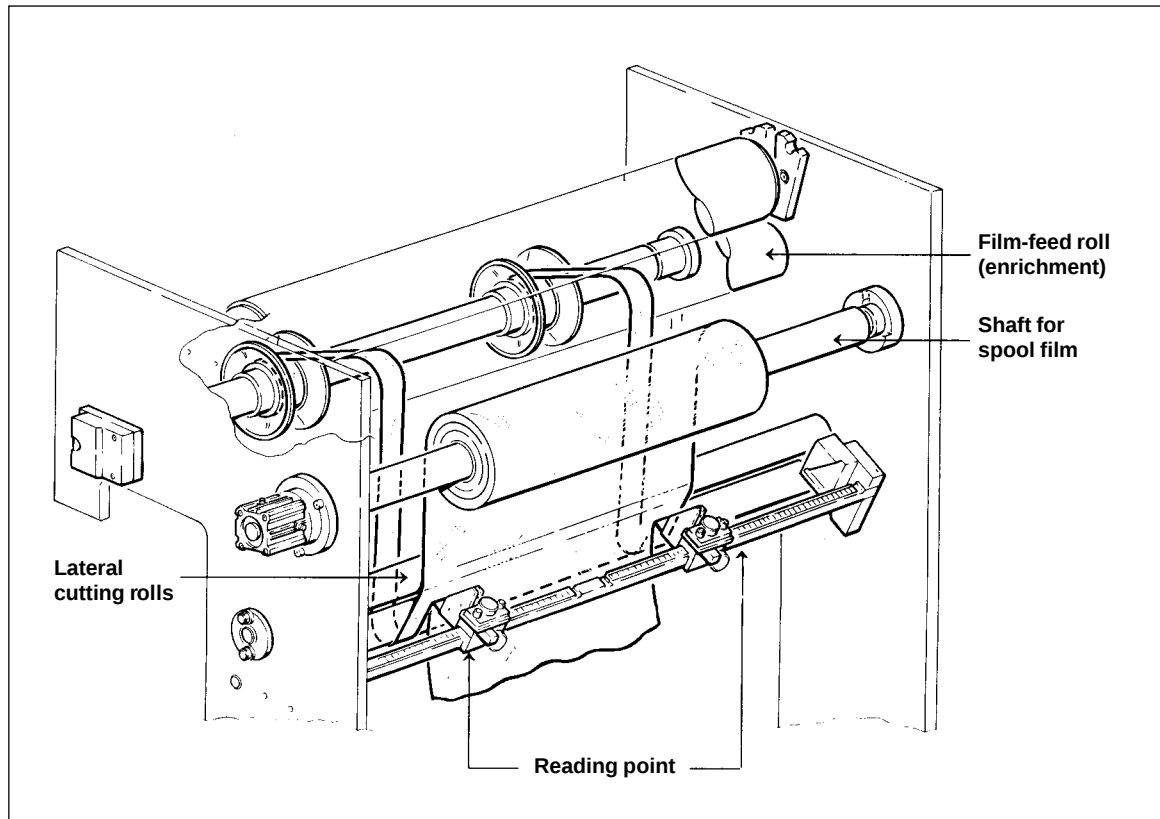
In these cases, therefore, it is advisable to increase pressure to its maximum to obtain a braking action equal to that obtained with spools of standard diameter.

As already mentioned in the chapter "**Dynamic tension**", good lamination results also depend upon the efficiency of this spool-friction device, particularly when working with shorter boards. We therefore recommend careful reading of what has been described in this chapter, and point no. 6 in the chapter entitled "**Advice on lamination**".

LATERAL-CUTTING

The 1600-D laminator is normally constructed with lateral film cutting.

This device (one for the upper and one for the lower film) reduces the width of the lamination film, depending upon individual job requirements.



A millimetric ruler permits the knives to be accurately positioned at both sides of the machine.

The edges of film to be cut (for example, 10 mm) are subtracted from the measurements carried out on the dry film spools using the built in millimetric rulers.

The position of the knives is read at the point outside the supports.

Range: 5 ÷ 200 mm for each side

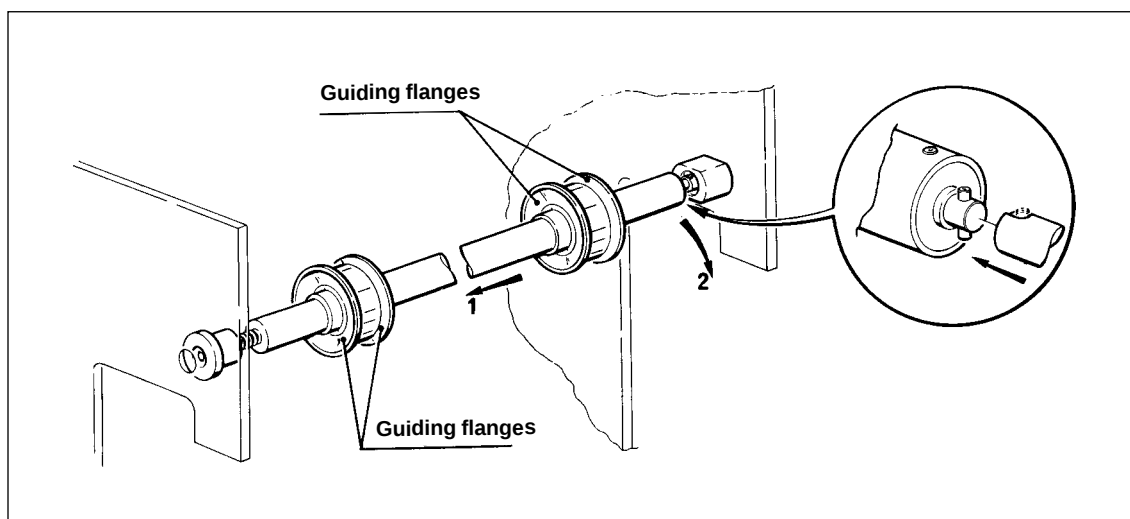
The cut strips of film are taken up and wound onto two metal rollers, each of which is driven by its own gear motor which does not suffer damage if the rotation of its shaft is suddenly blocked.

This occurs when all the loose strips have been salvaged and the dry film spool stops unwinding.

These two motors rotate in opposite directions, so care must be taken not to mix them up if they ever have to be dismantled.

In those cases where lateral-cutting is unnecessary, these motors can be shut down via a special switch mounted on the panel to the right of the machine. This switch bears the sign "**Lateral cutting ON-OFF**".

In order to make dismantling of the polyethylene take-up rollers easier, we recommend that the shafts of the winding gear motors for the strips of laterally cut film should always be removed first, following the diagram below.



It is advisable to use the "guiding flange" provided for rewinding the cut strips of film.

In order to obtain a neat cut, both blades should always be well sharpened.

Never allow the blades to touch the metal rolls. This would not only ruin the rolls, but would also compromise the entire operation.

ELECTRICAL CONTROL CABINET

The automatic laminator, model 1600-D, is controlled by a SAIA PLC, series PCA1 M46, which interacts with the operator via a numerical keyboard and a display that writes in his own mother-tongue.

This PLC has been incorporated in the control cabinet together with all other electrical components and switches.

The control cabinet is mounted on wheels and can therefore be easily moved around. It is connected to the machine by multi-wire cables and connectors.

It can be positioned either to the left or to the right of the machine, but in order to facilitate removal of the central part of the machine it is advisable, whenever possible, to stand it to the left.

The electrical power supply to the machine also supplies the control panel, and is therefore three-phase plus ground (without a neutral), 50/60 Hz.

The universal power transformer of the control panel makes it possible to use network voltages of 380V-415V-480V.

Should it ever be necessary to connect the machine to voltages other than those for which it has been designed, our technical assistance office should first be consulted for all necessary information.

The electrical control cabinet is fitted with three hand-grips containing components:

- the main one cannot be moved, and has been placed at the back;
- a secondary and movable grip is positioned on the right-hand hinge;
- another secondary and movable grip is positioned on the left-hand hinge.

INPUTS PLC

- | | | | |
|----|--|----|--|
| 0 | Set-up on push-button | 32 | Upper-lower film rolls greaped |
| 1 | Emergency line set-up
off push-button | 33 | Lamination rolls and tacking bars opened |
| 2 | Cycle start push button | 34 | Laminator rolls closed |
| 3 | Cycle stop push button | 35 | Tacking bars closed |
| 4 | Centering board detecting photocell | 36 | Upper end of film and missed cut control |
| 5 | | 37 | Lower end of film and missed cut control |
| 6 | Upper tension roll in work point | 38 | Front edge overtravel control |
| 7 | Lower tension roll in work point | 39 | Cam comand for lamination rolls closing |
| 8 | Upper / both lamination sensor | 40 | Sliding trolley locked |
| 9 | Film rolls free / greaped push button | 41 | Vacuum pump overload |
| 10 | Upper vacuum off selector | 42 | Lateral centering failure |
| 11 | Lower vacuum off selector | 43 | Missed cut & end of film for both
side On/Off select. |
| 12 | Film loading set-point push button | 44 | Remote synchronisme signal |
| 13 | Alarm output temperature regulator | 45 | Board in front barrier position |
| 14 | Air pressure detector | 46 | Output board from lamination area |
| 15 | Safety guard switches | 47 | Rear edge board detecting photocell |
| 16 | Introducing board cylinder in work point | 56 | Voltage feed back of front edge register |
| 17 | Introducing board cylinder in set-point | 57 | Voltage feed back of dynamo thaco |
| 18 | Barrier in "closed position" (working point) | 58 | |
| 19 | Barrier in "opened position" (set-point) | 59 | |
| 20 | Upper follower cylinder in set-ponit | 60 | |
| 21 | Upper follower cylinder in work point | 61 | |
| 22 | Lower follower cylinder in set-point | | |
| 23 | Lower follower cylinder in work point | | |
| 24 | Index switches in set-point | | |
| 25 | index switches in work point | | |
| 26 | Upper cutting device hooked | | |
| 27 | Lower cutting device hooked | | |
| 28 | Cam in initial cut position | | |
| 29 | Cam in tacking position | | |
| 30 | Cam in end cut position | | |
| 31 | Cam in slowing down position | | |

Numerical presetters board

- | | |
|----|----------------------------------|
| 48 | Enrichment time at the set-point |
| 49 | Lower enrichment time |
| 50 | Upper enrichment time |
| 51 | Main enrichment time |
| 52 | Front edge adjustment "50 mm" |
| 53 | Front edge adjustment "0 mm" |
| 54 | Rear edge adjustment "X value" |
| 55 | Rear edge adjustment "Y value" |

OUTPUTS PLC

- 0 Set-up on lamp + buffer relay for set-up
- 1 Cycle on start lamp
- 2 Upper / both lamination selector lamp
- 3
- 4
- 5

- 8 EV film dynamic tension rolls
- 9 Enable for control panel into machine
- 10
- 11 Relay for speed range selection
- 12 Flashing lamp alarm
- 13 Acoustic buzzer alarm

- 16 EV for gripping board rolls
- 17 EV for front barrier
- 18 EV for introduction board cylinder
- 19 EV for lamination roll & tacking bars closed-opened cylinder
- 20 EV for hooking cutting device
- 21 EV for follower cutting device

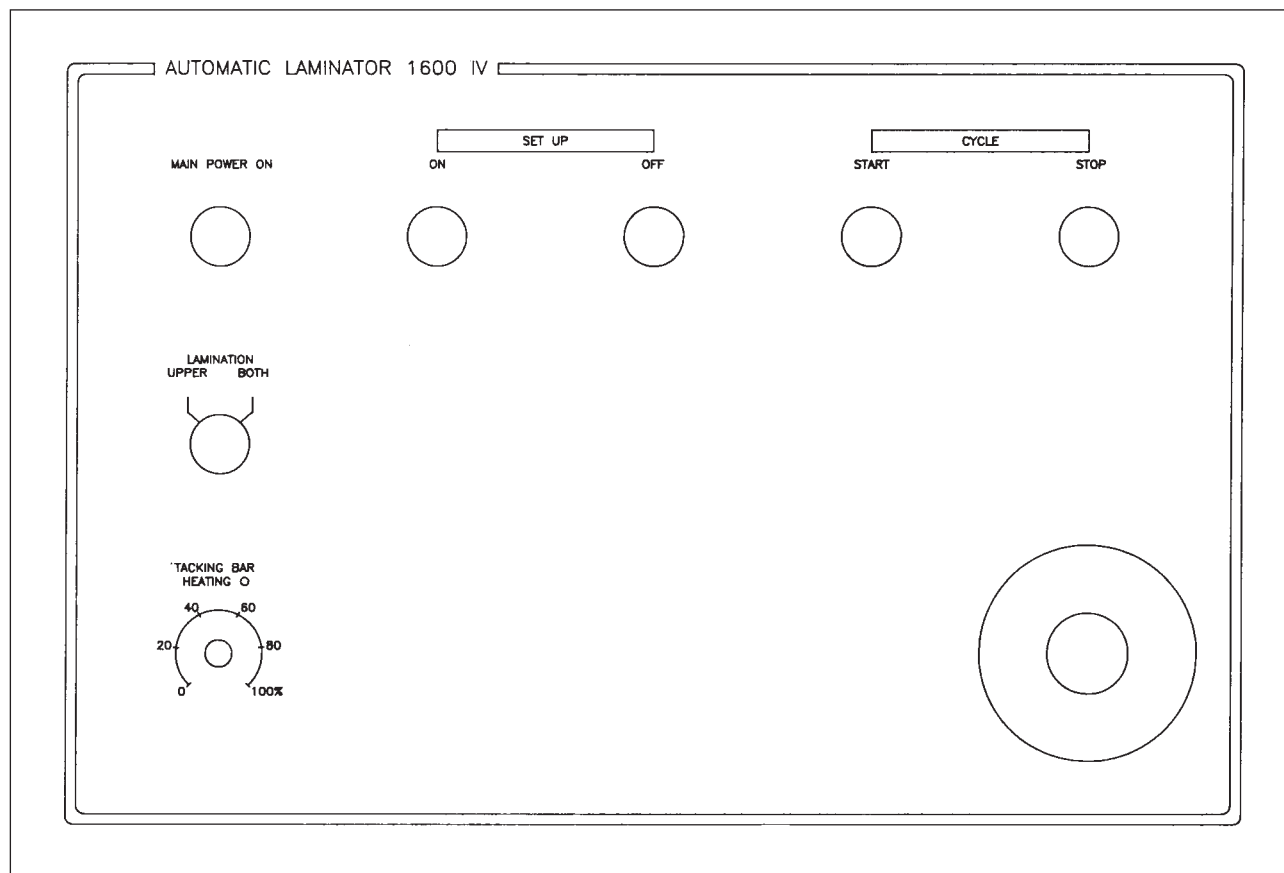
- 24 EV for grip / free dry film rolls
- 25 EV for index insert (upper and lower)
- 26 EV for vacuum in upper main shoe
- 27 EV for vacuum in lower main shoe
- 28 EV for upper cut
- 29 EV for lower cut

- 32 Enable for driver of front edge
- 33
- 34 Relay for clutch FZ7 (introduction board roll)
- 35 EV for vacuum in secondary upper shoe
- 36 Enable for centering control board
- 37 Enable for main motor

- 40 Synchronisme signal with loading machine
- 41 Relay for clutch FZ5 (input conveyor)
- 42 Relay for clutch FZ2 (lamination rolls & output conveyor)
- 43 Relay for clutch FZ1 (revolving sectors)
- 44 Relay for clutch FZ3 (upper film feed roll)
- 45 Relay for clutch FZ4 (lower film feed roll)

- 62 Main motor speed adjustment
- 63 Front edge value adjustment

CONTROL PANEL OF THE ELECTRICAL CABINET



MAIN POWER ON: This is a pilot light indicating that there is voltage present in the electrical cabinet. It lights up when the general switch at the rear of the panel is turned off.

SET UP-ON: This is a luminous button, used to enable all the other commands to the machine. It stays alight until the "Set-up" is turned off by the SET-UP OFF button, or it is overruled by one of the emergency buttons, or it goes out automatically if the machine goes into a state of "alarm". It activates the heating of the tacking bars, activates the vacuum pump, the exhaust fan, the cap ventilation and the motors for lateral cutting.

Caution: Before giving the SET-UP command be sure that there is no film between the rolls.

SET-UP OFF: This is an unlit button which deactivates the SET-UP ON switch and its functions.

CYCLE START: This is a luminous button used to start up the lamination cycle. It is dependent on the SET-UP ON and sets the input roller and lamination rolls in motion, enables the operation of the centering mechanism and the board insertion group. The "Start Cycle" is switched off via the "Cycle Stop" button, or whenever the machine stops for an emergency. This command works only when the machine has been closed and the film has been loaded.

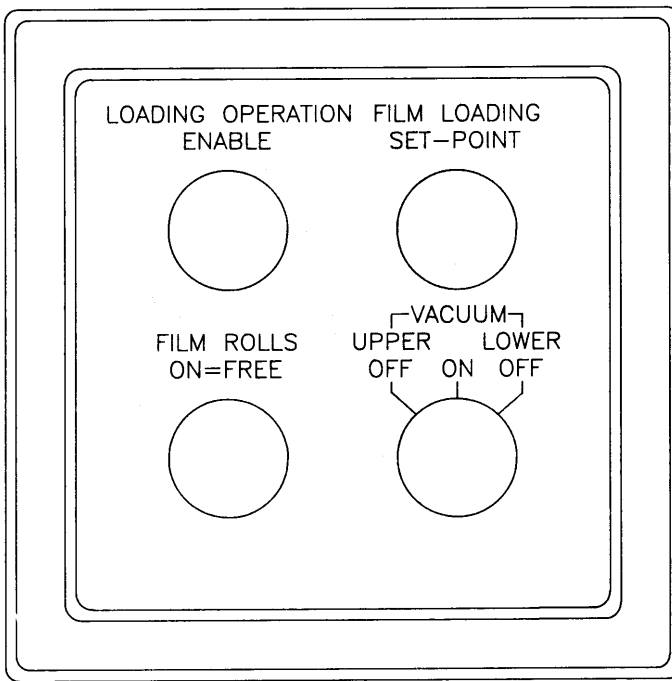
CYCLE STOP: This is an unlit button which deactivates all the functions activated by the "Cycle Start".

LAMINATION UPPER-BOTH: This is a luminous selector switch permitting lamination either on both surfaces of the board or only on the upper surface. The selection must be made when the machine is stationary.

TACKING BAR HEATING: This is a potentiometer which regulates the percentage heating of the rubber tacking bars. At 0% the temperature of the tacking bars is the same as room temperature; at 100% it is roughly 45°C. Its function is subordinated to SET-UP ON. For further details, please turn to the specific chapter.

EMERGENCY PUSH-BUTTON: This is a mushroom-shaped button which stops the machine instantly, cutting off all functions, and giving immediate warning via the video monitor.

CONTROL PANEL OF THE MACHINE ITSELF



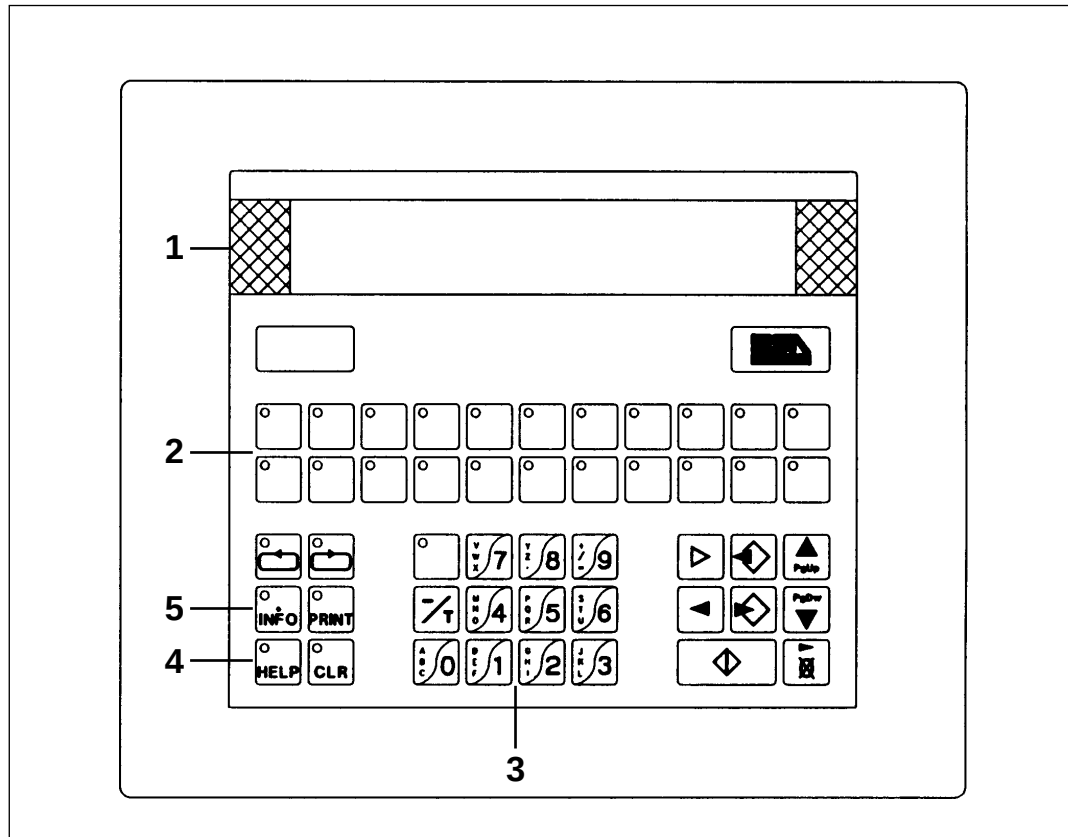
LOADING OPERATION ENABLE: This is a luminous pilot light that indicates when the procedure for loading film onto the machine has been enabled. It only lights up when the machine is open.

FILM LOADING POSITION: This is an unlit switch button which enables the procedure for loading the film spool. It is dependent upon set-up on and also upon the machine being open. First rotate by hand the rotating sectors until they reach the "Start-Cutting" position. Then push this button in order to fix the index in the mechanical cam. If an acoustic alarm is generated with this button, that means the rotating sectors are not well positioned.

FILM ROLLS ON=FREE: This is a luminous button that operates cyclically. The first impulse unblocks the two dry-film carrying spools, while the second impulse blocks them again. This latter condition is signalled by a light set into the button itself.

VACUUM UPPER OFF/ON/LOWER OFF: This is a luminous selector switch with three positions, which inhibits vacuum in the main exhaust shoes, in order to facilitate film loading.

In order to operate automatically, this selector switch should be in its central position (ON).

CSL-1600D VIDEO DISPLAY AND KEYBOARD UNIT

- 1 - LCD Display, 4 lines, 40 characters
- 2 - Function keys F1 - F22
 - F1 = front edge adjustment
 - F2 = rear edge adjustment
 - F3 = lamination speed adjustment
 - F4 = tacking time adjustment
 - F5 = panel counter (to see total counting and reset partial counting)
- 3 - Numerical keys for data input (parameters)
- 4 - HELP key for additional parameters during the adjustment
- 5 - INFO key for information to the operator during the adjustment

During every phase of the machine the display will supply you all information required for the outstanding operations, the possible choices, the settlements and modifications of lamination parameters as well as all emergency messages with the respective numerical code.

Every information is written in the language of the country for which the laminator is destined, so the relative numerical code (identical in all languages) leaves no room for doubt as to the meaning.

You can find here below the messages, the numerical code and the causes which provoked the machine stop.

COMPLETE MESSAGES AND IDENTIFICATION CODES

1	EMERGENCY-STOP ACTIVATED	1111
2	LOW PRESSURE COMPRESSED AIR	140
3	SAFETY GUARD OR DOORS OPENED	150
4	VACUUM PUMP OVERLOADED	410
5	LATERAL CENTERING FAILURE	421
6	SLIDING TROLLEY NOT LOCKED	400
7	ONE BOARD IS STOPPED INTO LAMINATOR	451
8	ONE BOARD IS STOPPED INTO LAMINATOR	4461
9	ONE BOARD IS STOPPED INTO LAMINATOR	461
10	ONE BOARD IS STOPPED INTO LAMINATOR	460
11	BOARDS STOPPING BARRIER FAILURE	181
12	BOARDS STOPPING BARRIER FAILURE	191
13	BARRIER UP MOVEMENT NOT COMPLETED	180
14	BARRIER DOWN MOVEMENT NOT COMPLETED	190
15	BREAKDOWN TO FRONT BARRIER SENSORS	1181
16	BREAKDOWN TO FRONT BARRIER SENSORS	1191
17	BOARD PUSHING MOVEMENT FAILURE	161
18	BOARD PUSHING DEVICE MOVEMENT FAILURE	171
19	BOARD PUSHING DEVICE NOT AT SET POINT	170
20	BOARD PUSHING DEVICE NOT AT WORK POINT	160
21	BREAKDOWN TO BOARD PUSHING DEVICE SENS.	1161
22	BREAKDOWN TO BOARD PUSHING DEVICE SENS.	1171
23	TACKING BARS MOVEMENT FAILURE	331
24	TACKING BARS MOVEMENT FAILURE	351
25	TACKING BARS NOT AT SET POINT	330
26	TACKING BARS NOT AT WORK POINT	350
27	BREAKDOWN TO TACKING BARS SENSORS	1331
28	BREAKDOWN TO TACKING BARS SENSORS	1351
29	LAMINATION ROLLS MOVEMENT FAILURE	2331
30	LAMINATION ROLLS MOVEMENT FAILURE	341
31	LAMINATION ROLLS NOT COMPLETELY CLOSED	340
32	LAMINATION ROLLS NOT COMPLETELY OPENED	2330
33	BREAKDOWN TO CLOSED/OPENED ROLLS SENSORS	3331
34	BREAKDOWN TO CLOSED/OPENED ROLLS SENSORS	1341
35	INDEX CAMME MOVEMENT FAILURE	241
36	INDEX CAMME MOVEMENT FAILURE	251
37	INDEX CAMME NOT IN SET POINT	240
38	INDEX CAMME NOT IN WORK POINT	250
39	REAR EDGE PHOTOCELL DAMAGED	470
40	REAR EDGE PHOTOCELL DAMAGED	471

41	FILM ROLLS NOT LOCKED	320
42	VACUUM EXCLUSION ON SELECTOR	1011
43	TOP & BOT CUT HOOKING MOVEMENT FAILURE	2670
44	TOP CUT HOOKING MOVEMENT FAILURE	260
45	BOTTON CUT HOOKING MOVEMENT FAILURE	270
46	TOP & BOT SHEARS NOT IN SET POINT	2671
47	TOP SHEARS NOT IN SET POINT	261
48	BOTTON SHEARS NOT IN SET POINT	271
49	TOP&BOT TENSION ROLLS NOT IN WORK POINT	670
50	TOP TENSION ROLL NOT IN WORK POINT	60
51	BOTTON TENSION ROLL NOT IN WORK POINT	70
52	TOP&BOT TENSION ROLLS NOT IN WORK POINT	671
53	TOP TENSION ROLL NOT IN WORK POINT	61
54	BOTTON TENSION ROLL NOT IN WORK POINT	71
55	FRONT EDGE DEVICE MOVEMENT FAILURE	381
56	FRONT EDGE DEVICE MOVEMENT FAILURE	560
57	OUTPUT BOARD TEMPERATURE OUT OF RANGE	51
58	TOP & BOT END OF FILM OR NO TACKING	3670
59	TOP END OF FILM OR NO TACKING	360
60	BOTTON END OF FILM OR NO TACKING	370
61	TOP & BOT MISSED CUT	3671
62	TOP MISSED CUT	361
63	BOTTON MISSED CUT	371
64	TOP&BOT CUTTING DEVICE NOT IN SET POINT	2022
65	TOP CUTTING DEVICE NOT IN SET POINT	200
66	BOTTON CUTTING DEVICE NOT IN SET POINT	220
67	TOP&BOT CUTTING DEVICE NOT IN WORK POINT	2123
68	TOP CUTTING DEVICE NOT IN WORK POINT	210
69	BOTTON CUTTING DEVICE NOT IN WORK POINT	230
70	INITIAL CUT POSITION NOT REACHED	281
71	TACKING POSITION NOT REACHED	291
72	END CUT POSITION NOT REACHED	301
73	SLOWING DOWN POSITION NOT REACHED	311
74	ROLLS CLOSING POSITION NOT REACHED	391
75	INITIAL CUT POSITION SENSOR DAMAGED	280
76	TACKING POSITION SENSOR DAMAGED	290
77	END CUT POSITION SENSOR DAMAGED	300
78	SLOWING DOWN POSITION SENSOR DAMAGED	310
79	ROLLS CLOSING POSITION SENSOR DAMAGED	390
80	LAMIN. ROLLS TEMPERATURE OUT OF RANGE	131

COMPLETE MESSAGES AND DESCRIPTION OF CAUSES LIST

1 EMERGENCY - STOP ACTIVATED 1111

The machine has been stopped in emergency by one of the emergency push buttons or by the set up off push button.

2 LOW PRESSURE COMPRESSED AIR 140

The machine has stopped or is unable to start, due to a low compressed air pressure.

3 SAFETY GUARD OR DOORS OPENED 150

The machine has stopped or is unable to start because one of the lateral doors or the left small one are open.

4 VACUUM PUMP OVERLOADED 410

The machine has stopped or is unable to start because the motor of the vacuum pump has gone into overload and its thermal relay has been activated.

5 LATERAL CENTERING FAILURE 421

The machine has stopped or is unable to start because during the closing or opening phase one of the 3 overstep proximity switches FC72 - FC73 - FC73A is pressed or the thermal protection for the motor placed on the board is activated.

6 SLIDING TROLLEY NOT LOCKED 400

The machine has stopped or is unable to start because the removal central unit is open or has not been firmly coupled to the fixed unit.

7 ONE BOARD IS STOPPED INTO LAMINATOR**451**

The machine has stopped because during the ascent phase of the frontal barrier the photocell FC45 is checked, if interfered it stops in emergency.

8 ONE BOARD IS STOPPED INTO LAMINATOR**4461**

During the set point phase and during the opening of the central unit the intercepting photocell for the centering unit FC69, the photocell for detecting boards in frontal barrier FC45 and the photocell for detecting output boards FC46 must be free, otherwise the message will stay without allowing the machine to continue further operations.

9 ONE BOARD IS STOPPED INTO LAMINATOR**461**

At the end of every cycle, at the reopening of the lamination rolls, the photocell FC46 checks the output of the previous board eventually stopped on the same photocell. The machine stops at the end of cycle.

10 ONE BOARD IS STOPPED INTO LAMINATOR**460**

At every cycle, the exact transport sequence of the board is checked, if this doesn't happen as established the machine will stop in emergency.

11 BOARDS STOPPING BARRIER FAILURE 181

The machine has stopped because during the opening phase of the boards stopping barrier the closing proximity switch FC18 is not released.

12 BOARDS STOPPING BARRIER FAILURE 191

The machine has stopped because during the closing phase of the boards stopping barrier the opening proximity switch FC19 is not released.

13 BARRIER UP MOVEMENT NOT COMPLETED 180

The machine has stopped because during the closing phase of the boards stopping barrier the closing proximity switch FC18 is not activated.

14 BARRIER DOWN MOVEMENT NOT COMPLETED 190

The machine has stopped or is unable to start because during the opening phase of the boards stopping barrier, the opening proximity switch FC19 is not activated.

15 BREAKDOWN TO FRONT BARRIER SENSORS 1181

The machine has stopped because during the closing phase of the front barrier the closing proximity switch FC18 is already activated.

16 BREAKDOWN TO FRONT BARRIER SENSORS 1191

The machine has stopped because during the opening phase of the front barrier the opening proximity switch FC19 is already activated.

17 BOARD PUSHING MOVEMENT FAILURE**161**

The machine has stopped because during the return phase of the board pushing device the work point proximity switch FC16 is not released.

18 BOARD PUSHING DEVICE MOVEMENT FAILURE**171**

The machine has stopped because during the insert phase of the board pushing device the set point proximity switch FC17 is not released.

19 BOARD PUSHING DEVICE NOT AT SET POINT**170**

The machine has stopped or is unable to start because during the return phase of the board pushing device the set point proximity switch FC17 is not activated.

20 BOARD PUSHING DEVICE NOT AT WORK POINT**160**

The machine has stopped because during the insert phase of the board pushing device the work point proximity switch FC16 is not activated.

21 BREAKDOWN TO BOARD PUSHING DEVICE SENS.**1161**

The machine has stopped because during the insert phase of the board pushing device the work point proximity switch FC16 is already activated.

22 BREAKDOWN TO BOARD PUSHING DEVICE SENS.**1171**

The machine has stopped because during the return phase of the board pushing device the set point proximity switch FC17 is already activated.

23 TACKING BARS MOVEMENT FAILURE**331**

The machine has stopped because during the closing phase of the tacking bars the opening proximity switch FC33 is not released.

24 TACKING BARS MOVEMENT FAILURE**351**

The machine has stopped because during the opening phase of the tacking bars the closing proximity switch FC35 is not released.

25 TACKING BARS NOT AT SET POINT**330**

The machine has stopped or is unable to start because during the opening phase of the tacking bars the opening proximity switch FC33 is not activated.

26 TACKING BARS NOT AT WORK POINT**350**

The machine has stopped because during the closing phase of the tacking bars the closing proximity switch FC35 is not activated.

27 BREAKDOWN TO TACKING BARS SENSORS**1331**

The machine has stopped because during the opening phase of the tacking bars the opening proximity switch FC33 is already activated.

28 BREAKDOWN TO TACKING BARS SENSORS**1351**

The machine has stopped because during the closing phase of the tacking bars the closing proximity switch FC35 is already activated.

29 LAMINATION ROLLS MOVEMENT FAILURE**2331**

The machine has stopped because during the closing phase of the lamination rolls the opening proximity switch FC33 is not released.

30 LAMINATION ROLLS MOVEMENT FAILURE**341**

The machine has stopped because during the opening phase of the lamination rolls the closing proximity switch FC34 is not released.

31 LAMINATION ROLLS NOT COMPLETELY CLOSED**340**

The machine has stopped because during the opening phase of the lamination rolls the opening proximity switch FC34 is not activated.

32 LAMINATION ROLLS NOT COMPLETELY OPENED**2330**

The machine has stopped or is unable to start because during the opening phase of the lamination rolls the proximity switch FC33 is not activated.

33 BREAKDOWN TO CLOSED/OPENED ROLLS SENSORS**3331**

The machine has stopped because during the opening phase of the lamination rolls the opening proximity switch FC33 is already activated.

34 BREAKDOWN TO CLOSED/OPENED ROLLS SENSORS**1341**

The machine has stopped because during the closing phase of the lamination rolls the closing proximity switch FC34 is already activated.

35 INDEX CAM MOVEMENT FAILURE**241**

The machine has stopped because during the insertion phase of the index cam the external proximity switch FC24 is not released.

36 INDEX CAM MOVEMENT FAILURE**251**

The machine has stopped because during the outlet of the index cam the proximity switch FC25 is not released.

37 INDEX CAM NOT IN SET POINT**240**

The machine has stopped or is unable to start because during the outlet of the index cam the set point proximity switch FC24 is not activated.

38 INDEX CAM NOT IN WORK POINT**250**

The machine has stopped because during the insertion phase of the index cam the work point proximity switch FC25 is not activated.

39 REAR EDGE PHOTOCELL DAMAGED**470**

At every cycle, when the photocell on the boards stopping barrier is activated, the state in ON of the rear edge photocell FC47 is checked, otherwise the machine stops in emergency. Verify the exact adjustment of the sensitivity, in case by acting on the trimmer of the photocell.

40 REAR EDGE PHOTOCELL DAMAGED**471**

At every cycle, when the photocell on the boards stopping barrier is not activated, the state in OFF of the rear edge photocell FC47 is checked, otherwise the machine stops in emergency. Verify the exact adjustment of the sensitivity, in case by acting on the trimmer of the photocell.

41 FILM ROLLS NOT LOCKED**320**

During the film loading and the repositioning of the rotating sectors the upper and lower proximity switches FC32A and FC32B for film rolls not locked are checked. An OFF condition detects if the dry film rolls are not locked, without allowing the machine to continue further operations.

42 VACUUM EXCLUSION ON SELECTOR**1011**

During the film loading and repositioning of the rotating sectors the vacuum exclusion selectors S10 and S11 are checked. An ON condition detects a wrong positioning of selectors, without allowing the machine to continue further operations.

43 TOP & BOT CUT HOOKING MOVEMENT FAILURE 2670

The machine has stopped because during the cutting groups hooking phase the top and bot proximity switches FC26 and FC27 are not activated.

44 TOP CUT HOOKING MOVEMENT FAILURE 260

The machine has stopped because during the cutting group hooking phase the top proximity switch FC26 is not activated.

45 BOTTOM CUT HOOKING MOVEMENT FAILURE 270

The machine has stopped because during the cutting group hooking phase the bot proximity switch FC27 is not activated.

46 TOP & BOT SHEARS NOT IN SET POINT 2671

The machine has stopped or is unable to start because during the cutting groups unhooking phase the top and bot proximity switches FC26 and FC27 are not released.

47 TOP SHEARS NOT IN SET POINT 261

The machine has stopped or is unable to start because during the cutting group unhooking phase the top proximity switch FC26 is not released.

48 BOTTOM SHEARS NOT IN SET POINT 271

The machine has stopped or is unable to start because during the cutting group unhooking phase the bot proximity switch FC27 is not released.

49 TOP & BOT TENSION ROLLS NOT IN WORK POINT 670

The machine stopped because during the tension rolls extension phase the top and bot sensors FC6 and FC7 are not activated.

50 TOP TENSION ROLL NOT IN WORK POINT 60

The machine stopped because during the tension roll extension phase the top sensor FC6 is not activated.

51 BOTTOM TENSION ROLL NOT IN WORK POINT 70

The machine stopped because during the tension roll extension phase the bot sensor FC7 is not activated.

52 TOP&BOT TENSION ROLLS NOT IN WORK POINT 671

The machine stopped because during the tension rolls release phase the top and bot sensors FC6 and FC7 are not released.

53 TOP TENSION ROLL NOT IN WORK POINT 61

The machine stopped because during the tension roll release phase the top sensor FC6 is not released.

54 BOTTON TENSION ROLL NOT IN WORK POINT 71

The machine stopped because during the tension roll release phase the bot sensor FC7 is not released.

55 FRONT EDGE DEVICE MOVEMENT FAILURE**381**

The machine has stopped or is unable to start because during the regulation phase of the front edge, one of the two overstep microswitches FC100 or FC110, of the movement group, is pressed or the thermal protection for the motor placed on the control board is activated.

56 FRONT EDGE DEVICE MOVEMENT FAILURE**560**

The machine has stopped because during the regulation phase of the front edge, the preselected position will not be reached in max. 20 sec.

57 OUTPUT BOARD TEMPERATURE OUT OF RANGE**51**

Alarm connected only if the instrument is equipped with an alarm thresholds. During the exit of the laminated board a reading "flash" is activated, if the readout is out of the preselected range the message will appear followed by a series of beeps, without stopping the machine.

58 TOP & BOT END OF FILM OR NO TACKING**3670**

The machine has stopped because the film in the front side is not attached to the board, because the rolls of dry film are finished or because too much dry film has been feeded by mistake. The check is managed by upper and lower sensors FC36 and FC37.

59 TOP END OF FILM OR NO TACKING**360**

The machine has stopped because the film in the front side is not attached to the board, because the top roll of dry film is finished or because too much dry film has been feeded by mistake. The check is managed by upper sensor FC36.

60 BOTTOM END OF FILM OR NO TACKING**370**

The machine has stopped because the film in the front side is not attached to the board, because the bottom roll of dry film is finished or because too much dry film has been feeded by mistake. The check is managed by lower sensor FC37.

61 TOP & BOT MISSED CUT**3671**

The machine has stopped because the film has not been, partially or completey, cut. The check is managed by upper and lower sensors FC36 and FC37.

62 TOP MISSED CUT**361**

The machine has stopped because the film has not been, partially or completey, cut. The check is managed by upper sensor FC36.

63 BOTTOM MISSED CUT**371**

The machine has stopped because the film has not been, partially or completey, cut. The check is managed by lower sensor FC37.

64 TOP & BOT CUTTING DEVICES NOT IN SET POINT 2022

The machine has stopped or is unable to start because during the return phase of the cutting group devices the upper and lower set point proximity switches FC20 and FC22 are not activated. (Set point position and retracted cylinders).

65 TOP CUTTING DEVICE NOT IN SET POINT 200

The machine has stopped or is unable to start because during the return phase of the cutting group device the upper set point proximity switch FC20 is not activated. (Set point position and retracted cylinder).

66 BOTTOM CUTTING DEVICE NOT IN SET POINT 220

The machine has stopped or is unable to start because during the return phase of the cutting group device the lower set point proximity switch FC22 is not activated. (Set point position and retracted cylinder).

67 TOP & BOT CUTTING DEVICES NOT IN WORK POINT 2123

The machine has stopped because during the unhooking phase of the cutting group devices the upper and lower work point proximity switches FC21 and FC23 are not activated. (Work point position and extended cylinders).

68 TOP CUTTING DEVICE NOT IN WORK POINT 210

The machine has stopped because during the unhooking phase of the cutting group device the upper work point proximity switch FC21 is not activated. (Work point position and extended cylinder).

69 BOTTOM CUTTING DEVICE NOT IN WORK POINT 230

The machine has stopped because during the unhooking phase of the cutting group device the lower work point proximity switch FC23 is not activated. (Work point position and extended cylinder).

70 INITIAL CUT POSITION NOT REACHED**281**

The machine has stopped because during its own positioning phase and within a maximum time referred to the speed, the sensor, initial cut position, FC28, has not reached the slot on its own cam.

71 TACKING POSITION NOT REACHED**291**

The machine has stopped because during its own positioning phase and within a maximum time referred to the speed, the sensor, tacking position, FC29, has not reached the slot on its own cam.

72 END CUT POSITION NOT REACHED**301**

The machine has stopped because during its own positioning phase and within a maximum time referred to the speed, the sensor, end cut position, FC30, has not reached the slot on its own cam.

73 SLOWING DOWN POSITION NOT REACHED**311**

The machine has stopped because during its own positioning phase and within a maximum time referred to the speed, the sensor, slowing down position, FC31, has not reached the slot on its own cam.

74 ROLLS CLOSING POSITION NOT REACHED**391**

The machine has stopped because during its own positioning phase and within a maximum time referred to the speed, the sensor, rolls closing position, FC39, has not reached the slot on its own cam.

75 INITIAL CUT POSITION SENSOR DAMAGED**280**

During the operation and before starting for its own positioning phase the actual activated state of the sensor, initial cut position, FC28 is checked, if this sensor is already in OFF condition you could detect a failure of the sensor or of the position. In this case the machine will immediately stop in emergency.

76 TACKING POSITION SENSOR DAMAGED**290**

During the operation and before starting for its own positioning phase the actual activated state of the sensor, tacking position, FC29 is checked, if this sensor is already in OFF condition you could detect a failure of the sensor or of the position. In this case the machine will immediately stop in emergency.

77 END CUT POSITION SENSOR DAMAGED**300**

During the operation and before starting for its own positioning phase the actual activated state of the sensor, end cut position, FC30 is checked, if this sensor is already in OFF condition you could detect a failure of the sensor or of the position. In this case the machine will immediately stop in emergency.

78 SLOWING DOWN POSITION SENSOR DAMAGED**310**

During the operation and before starting for its own positioning phase the actual activated state of the sensor, slowing down position, FC31 is checked, if this sensor is already in OFF condition you could detect a failure of the sensor or of the position. In this case the machine will immediately stop in emergency.

79 ROLLS CLOSING POSITION SENSOR DAMAGED**390**

During the operation and before starting for its own positioning phase the actual activated state of the sensor, rolls closing position, FC39 is checked, if this sensor is already in OFF condition you could detect a failure of the sensor or of the position. In this case the machine will immediately stop in emergency.

80 LAMIN. ROLL TEMPERATURE OUT OF RANGE**131**

During the awaiting time for the new board the programmed alarms values on the thermoregulators are checked, if the temperature is over the settled range the machine stays in a waiting condition until the temperature returns within the desired range.

ADVICE FOR LAMINATION

As is well-known, dry-film lamination of printed circuit boards involves slap-down of the mask directly onto the board at a given pressure and temperature.

Because of its particular construction and its operating cycle, the Automatic laminator 1600-D does not require critical adjustments to the regulation of its parameters in order to achieve high quality lamination.

We give below a list of recommended values for the various lamination parameters.

1. Temperature of the input board

This can even be at room temperature. However, if the lamination should be performed more rapidly the board may be preheated, but not above 35°C.

Range: 20 ÷ 35°C

Caution: The possibility of laminating at higher speed does not only depend upon the temperature of the incoming board, but on many other factors, such as the surface preparation, or the type of dry-film in use at the time.

2. Temperature of the rubber of the tacking pads

This can be regulated between room temperature and 45°C max.

We recommend establishing a temperature value in function of:

- level of adhesion of the film
- level of the surface preparation
- time set for tacking
- temperature of the input board.

Range: room temp. ÷ 45°C

Note: Certain types of dry-film need completely cold pads. With these even slightly raised temperatures create bubbles in the tacking area.

3. Tacking time

This value can be set from the control cabin, and should take into consideration:

- the level of adhesion of the film
- the level of surface preparation
- the temperature of the tacking pads
- the temperature of the input board.

Range: 0,1 ÷ 9,9 secs.

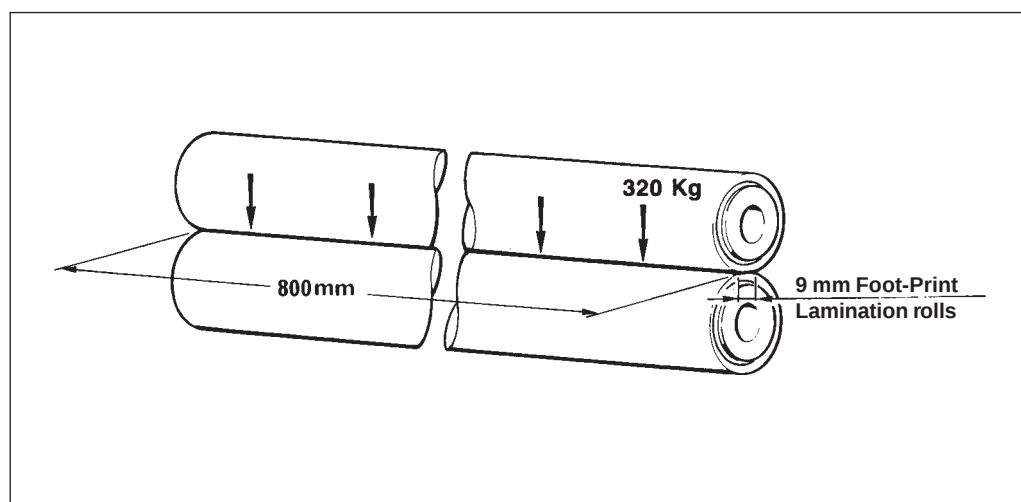
Recommended range: 1,5 ÷ 2,5 secs.

4. Lamination pressure

The lamination pressure should be set in function of:

- the type of board to be laminated
- the type of dry-film
- the pressure of the compressed air supplying the pressure roll
- the diameter of the lamination rolls
- the rubber's hardness of the lamination rolls
- the width of the board to be laminated
- the temperature of the input board
- the temperature of the lamination rolls.

The 1600-D laminator, with a pressure of 6 atm., develops a force of 320 kg. This force is distributed over the entire length of the rolls (800 mm) and over the entire width of the footprint of the rolls.



This means that the specific mean pressure exerted over each square centimetre of dry film in lamination, the pressure reading on the manometer being equal, will vary in function of the width of the board.

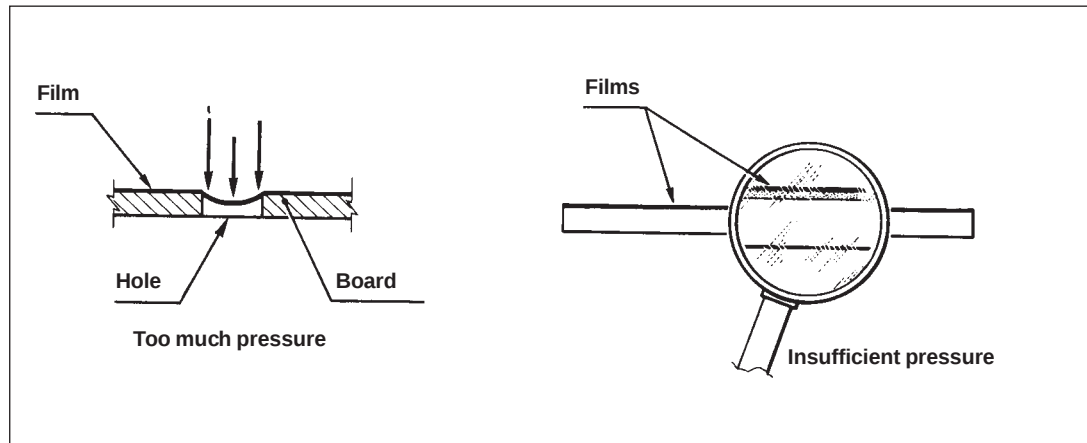
Example: a board 200 mm wide

320 kg (Roll force) : 200 mm (Width of board) × 10 mm (Foot print) (surface area) = 16 kg : cm²

Example: a board 400 mm wide

320 kg : 400 mm × 10 mm = 4 kg : cm²

Whereas insufficient lamination pressure can result in a loss of adhesion between the dry film and the board, too much pressure might lead to the formation of some wrinkles around moderate-size holes. These wrinkles will be due to too much film penetrating into the holes themselves.



Range: 0 ÷ 6 Atm.

Recommended range: 4 ÷ 6 Atm.

5. Temperature of the lamination rolls

This temperature can be preset via two thermoregulators mounted on the right shoulder of the machine.

This temperature setting of the rolls should take into consideration:

- the lamination speed
- the type of dry-film
- the type of board to be laminated
- the thickness of the board to be laminated
- the temperature of the input board
- the temperature of the output board
- the surface preparation

As is well known, any board that is thicker than another, all other parameters being equal, will leave the laminator at a lower temperature. The opposite is also true.

When using Morton dry-film, the correct temperature value for an output board is 45°C ÷ 50°C.

However, the temperature of the lamination rolls will have to be regulated in order to obtain this value.

Range: Room temp. ÷ 130°C

The most widely used values are 100° ÷ 125° (thickness of 1.6 mm at 2.8 mt/min.
Input temperature 30°C).

Caution: The temperature of the lamination rolls is not the only decisive parameter in determining the temperature of the output boards. To calculate this value, in addition to the thickness and the type of boards, the speed, the lamination pressure and the temperature of the input boards must also all be taken into account.

In any case the rolls must never exceed a temperature of 130°C because this would ruin the rubber.

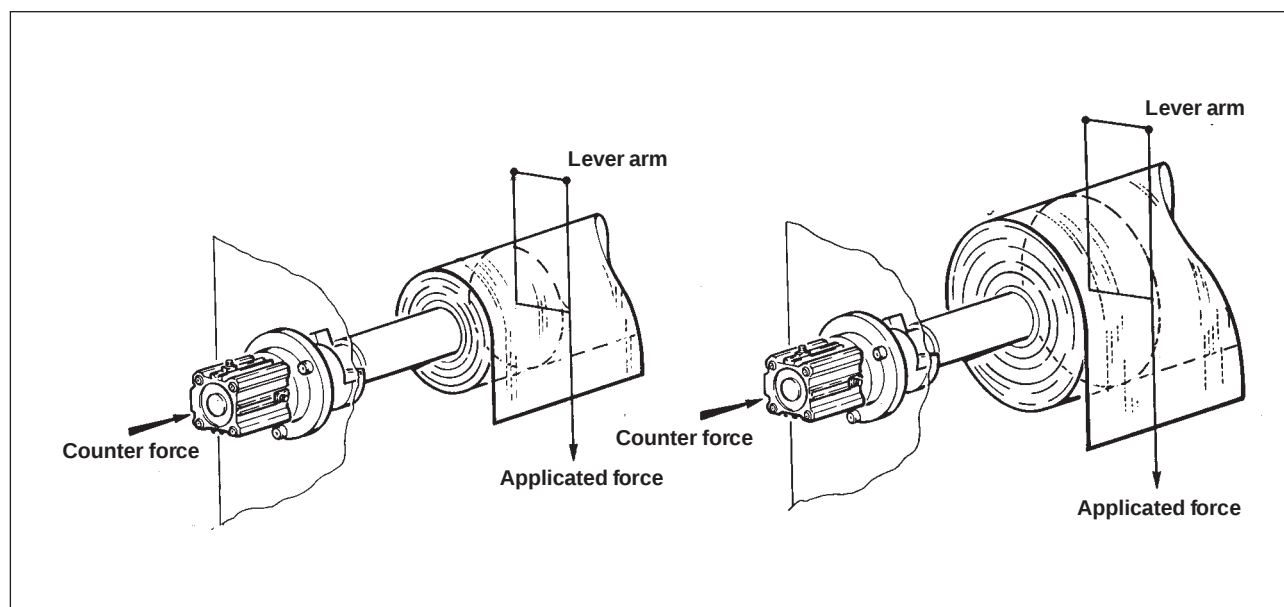
Nevertheless it is a good idea to keep both the upper and lower rolls at the same temperature value.

6. Static tension on the dry-film spools

The two spools of dry-film slide onto two metal rolls that have been fitted with a brake-lining friction-disk which serves to curb their unwinding movement.

This braking action of the dry-film rolls serves to keep the film stretched and taut, and therefore plays an important part in the final lamination result.

However, due to the design of the machine, it is better to exert this braking force directly on the dry film rolls, because their action can then be adapted to either standard or oversize spools.



It is therefore advisable to calibrate the pressures of these friction devices in function of the types of dry film spool.

Range: 0 ÷ 6 bar

Recommended value: 2 ÷ 5 bar

Caution: For boards shorter than 300 mm it is always advisable to keep the friction pressure at maximum, and to take care that the speed of the film dynamic tension rolls is not excessive.

7. Distance between input boards

This should be adjusted in function of:

- length of the board
- tacking time
- lamination speed

We recommend keeping this distance to a minimum in order to avoid loss of productivity of the machine.

The operating cycle itself gives rise to shortenings and lengthenings of the preset distance between input boards.

This does not cause any problem, however, so the machine will not require any adjustment.

We therefore recommend that in practice each user should calculate this distance according to its own specific requirements.

SETTING UP THE UNIT

The Laminator, Model 1600-D, is delivered with all accessories firmly secured to the main block.

The vacuum pump, which is mounted on shock-absorbant rubber pads, is attached to the structure during transport by a clamp which should be removed as soon as the machine has been assembled in the yellow-room.

The installation procedure is as follows:

1. After having positioned and/or levelled the machine at its permanent emplacement, remove any fastenings or bindings used in transport, and take out the mobile central unit.
2. Make the pneumatic connections. For this you will need unlubricated compressed air at 6 atm, filtered and dehumidified.
3. **Make the electrical connections. For this, you will need a three-phase system, + Ground at 25A. The voltage required is indicated on the specification tag attached to the main switch.**
4. Connect a 0 150 mm diameter tube between the main exhaust system of the shop-floor and the plug of the air-outlet of the machine.

Caution: Make sure that there are no sharp bends in this tube, or the flow will be reduced.

5. Open the general compressed air supply valve situated on the left-hand side of the machine.
6. After having made sure that all the mechanical parts are in place, supply voltage to the machine.
7. If any irregularities are found during the systems-tests put them right to the point where the machine itself transmits the message "EVERYTHING OK".
8. Once the machine has been given its check-control, apply a short pulse of "SET-UP ON" and, immediately afterwards, one of "SET-UP OFF".
9. Check whether air is being exhausted or blown through the air outlet nozzle. If there is exhaust, stop the machinery and disconnect the electricity. Then invert two of the three general power supply phases in order to invert the direction of the vacuum pump.
10. Apply voltage to the machine once more, and if the check control signals "OK", move out the trolley and proceed with the SET-UP ON.
11. Put by hand the rotating sectors in the "STAR CUTTING POSITION,, and depress the green switch called "FILM LOADING POSITION", situated on the mini-push-buttons panel on the movable unit.
12. When this button is activated the index fix the two sectors in this position.

13. The shafts for the dry-film spool can be blocked or released by pressing cycling the luminous yellow button called "FILM ROLLS ON = FREE" installed on the movable unit.
14. Load the two spools rolls of film, following the thread-up diagram provided on the shoulders of the machine.
15. Block the dry-film shafts and centre the spool of dry-film, using the metric gauges specially provided for this purpose.
16. If a lateral cut is also required, follow the same thread-up diagram.
17. Pass the film through the polythene separation rolls, following the thread-up diagram. To make it easier to insert the film through the vacuum shoes, vacuum can be suppressed in the main shoes via the yellow selector switch, "Vacuum Upper-Lower ON-OFF", situated on the movable unit.
18. Pull the film through by hand and unwind a length of about a metre, checking that the thread-up route has been followed correctly. Then lay it over the main vacuum shoe.

Pull the film in tension and, using the counterblade for support, cut the film along its cutting edge with a sharp knife.

Take care not to cut the rubber pads.

19. Repeat the operation described under point 18 for both the upper and the lower films. Insert the movable unit into the machine, and block it with the locking handle provided.

Caution: If the movable unit is moved-out, there will be an immediate emergency stoppage of the machine, with the message "MOBILE UNIT UNLOCKED".

It is possible to by-pass this safety device via a key- switch placed on the front right crankcase, in order to run the machine while it is open. This should only be done by qualified maintenance personnel, and on their own entire responsibility.

20. When the movable unit has been firmly mounted inside the machine, **block the locking handle provided**. A microswitch will record its precise position and the machine will make the Set-point.
21. Set all the lamination parameters:
 - Roll temperature
 - Tacking bars temperature
 - Tacking time
 - Length of the front edge
 - Length of the back edge
 - Lamination speed
 - Lamination pressure
 - Static tension of the film

22. Press the luminous yellow switch "CYCLE START" mounted on the control cabinet and if all the parameters necessary for lamination are correct (roll temperature, pads temperature, etc.), insert a discarded board between the rolls to check on the mechanical quality of the lamination (edges, absence of wrinkles, bubbles, etc).
23. Finally proceed to the automatic loading of the boards, leaving between each board a distance which will depend upon the board-length, the lamination speed, and the tacking time selected.

Caution: every time the machine stops for an emergency, the film must be repositioned, as described from point 18 onwards, before lamination is started up again.

AUTOMATIC CUT SHEET LAMINATOR MOD. 1600-D**Kit of recommended spare parts**

PART NUMBER	DESCRIPTION	Q.TY
062 00 004 00	PROXIMITY SWITHC D. 12mm SIEMENS 3RG 4012 OAB00	1
062 00 005 00	PHOTOCELL OMRON E3F DS10 B4 38	1
062 02 830 00	ROLLING THERMOCOUPLE ASSY	1
062 02 829 00	THERMOCOUPLE WIRE	1
062 02 818 00	INFRARED LAMP 2100W L770/840	1
062 00 017 00	PROXIMITY SWITCH D.8mm E2EG-X1R5B1+SUPPORT	1
062 01 067 00	MAGNETIC SENSOR SMC D 79	1
062 00 021 01	INDICATOR LAMP TELEMECANIQUE BA9S 30V 2W	5
062 00 070 00	FUSE 10,3 X 38 mm 16A	5
062 00 099 00	FUSE 5 X 20 mm 0,8A M	10
062 00 080 00	FUSE 5 X 20 4A	5
062 00 085 00	FUSE 5 X 20 2A	5
062 00 073 00	FUSE 5 X 20 1A	5
062 01 008 02	MAGNETIC SENSOR BOSCH N.830.100.368	1
062 02 052 00	FLAT BELT HABASIT TYPE S2 DEVELOPMENT 1015mm L.20	1
062 02 053 00	FLAT BELT HABASIT TYPE P1 DEVELOPMENT 440mm L.20	1
062 02 106 00	FLAT BELT HABASIT TYPE S2 L.25 X 715	1
062 02 200 00	SILICON LAM. ROLL D. 100 - DIS.0175.00.007	2
062 02 390 00	RUBBER BELT THERMOSOLDERING PEM Q5 D 5 303mm	2
062 02 571 00	MOVABLE BLADE ASSY	2
062 02 579 00	FIXED KNIFE DIS. 0177.00.008	2
062 02 864 00	UPPER SPRING DRW. 0177.00.0120	1
062 02 863 00	LOWER SPRING DRW. 0177.00.0119	1
062 02 616 00	BRAKE PAD 0238.00.007	2
062 02 656 00	ROLLER D. 90 0227.00.003	2
062 02 717 02	FILTER CANTRIDGE COD. C15124/1	1
062 02 418 11	CONVEYOR MOTOR BRUSHES-DRIVE SYSTEM	4
062 02 522 00	TACKING BAR	2
062 02 619 00	DRUM	2
062 02 104 00	FLAT BELT HABASIT FOL 20 X 1395	1
062 02 107 00	FLAT BELT HABASIT L 20 X 345	1
062 02 108 00	FLAT BELT HABASIT L 20 X 545	1
062 01 079 00	REGULATING VALVE BOSCH 0821.200.103	2
062 00 086 00	RELAY LY3 24 V DC OMRON	1
062 02 640 00	DISC PAD 0226.00.014	2
062 02 641 00	SPRING TYPE CO 2160	2

MAINTENANCE

REPLACEMENT OF THE LAMINATION ROLLS

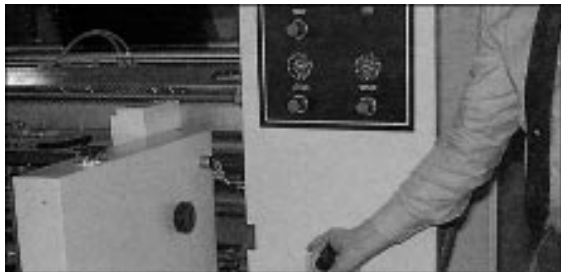
Note: When replacement has been made, check the right positioning of the thermocouples.

The lamination rolls should only be replaced by specially trained personnel using original parts which have been correctly designed and made from the right materials.



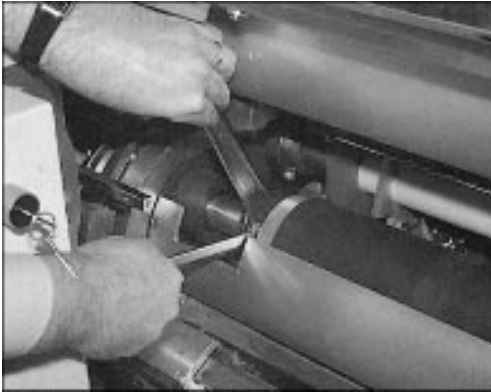
The procedure for replacement of the rolls is as follows:

1) Switch off and disconnect the laminator, then wait until the rolls have returned to room temperature.

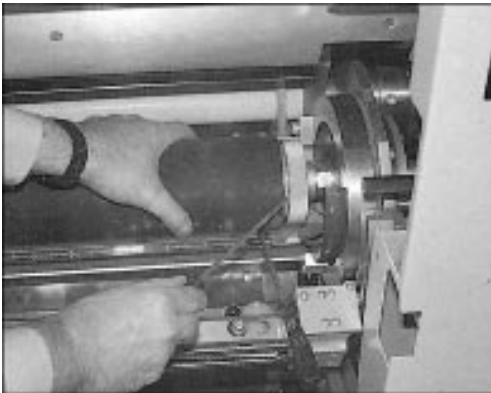


2) Take out the removable part of the machine and detach the small unit that supports the incoming board.





3) Block the shaft of the lamination roll with a 30 mm key, and proceed to unscrew the three screws of the right-hand flange. Repeat the operation for the left-hand flange.

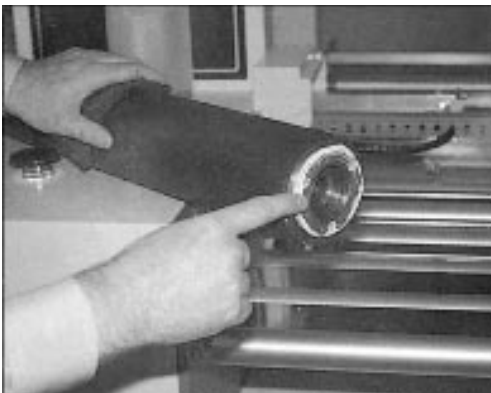


4) Hold the roll carefully so that it does not fall, remove the right-hand flange, and push the roll to the left.

5) Still holding the roll firmly, remove the left-hand flange also.



6) Detach the roll taking great care not to let it fall onto the IR lamp located inside the aluminium group.



7) Insert the new roll **applying anti-gripping silicone paste on both extremities** in order to facilitate subsequent dismantling. **Check that the thermocouple is in the correct position.**

8) Repeat the operations from point 3 onwards for the other roll.

REPLACEMENT OF THE IR LAMPS

The IR lamps should be replaced by specially trained personnel using original parts which have been correctly designed and made from the right materials.

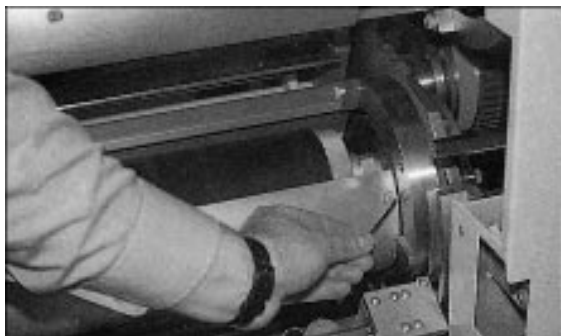
The procedure for replacement of the lamps is as follows:



1) Switch off and disconnect the laminator, then wait until the heated parts have cooled down.

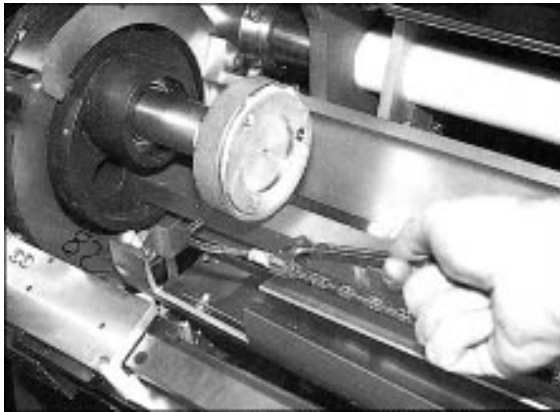


2) Take out the removable part of the machine and detach the two fixed upper and lower circular sections (not the rotating ones) by removing only the lateral screws (4 on the right and 4 on the left).

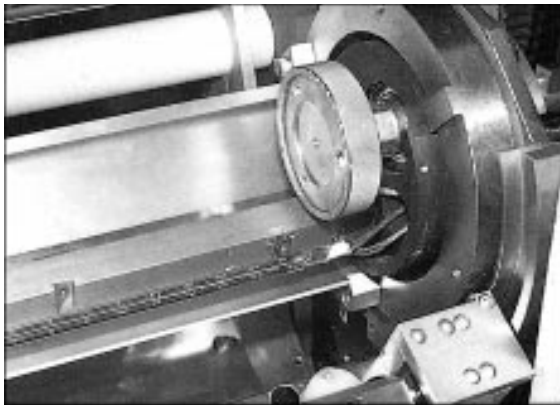


3) Disconnect the two lamps from the electric terminals positioned on the right-hand side of the machine.





4) Slacken the lamp-holding clamp and take it out.



5) Insert the new lamp, connect it to the electricity, and insert it into its holder.

Do not block the lamp on both sides, since this would hinder the natural expansion of the glass due to thermal dilatation. The radiating element should be directed towards the centre of the roll.



6) Once the assembly has been completed, wipe the lamp over with a cloth soaked in alcohol.

7) Repeat this operation for the other lamp.

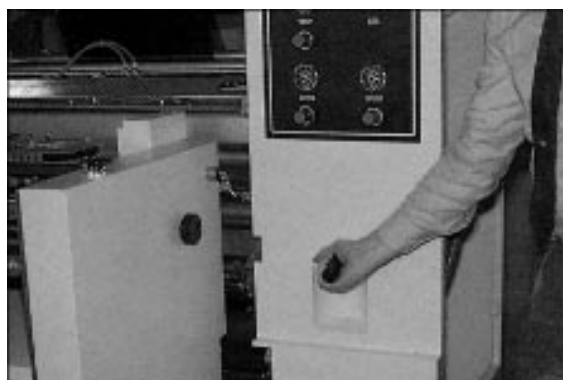
REPLACEMENT OF THE TACKING BARS

The tacking bars should only be replaced by specially trained personnel using original parts which have been correctly designed, have the correct electrical characteristics, and are made from the right materials.

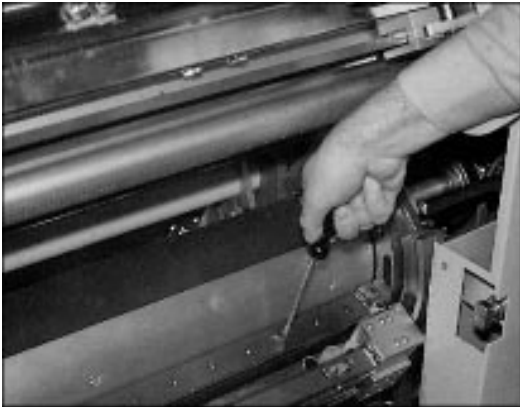
The procedure for replacement of the tacking bars is as follows:



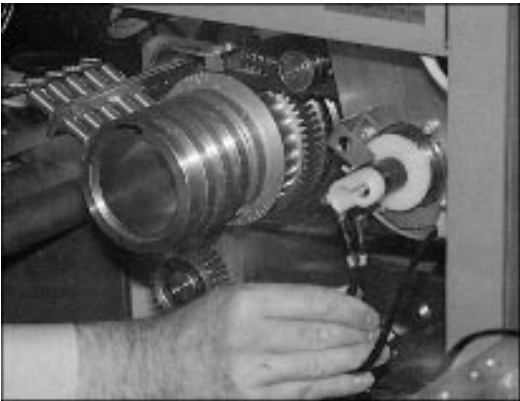
1) Switch off and disconnect the laminator, and wait for the heated parts to cool down.



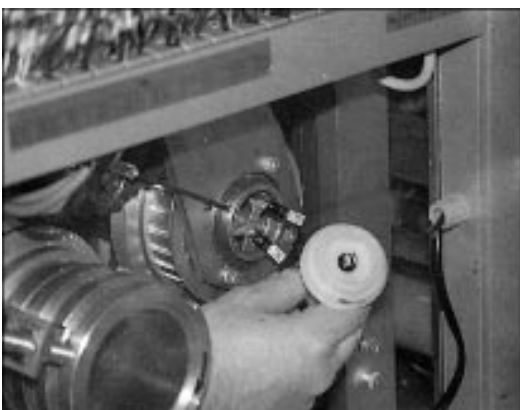
2) Take out the removable part of the machine and detach the secondary suction shoe.



3) Detach the counter-blade and place it somewhere where it will not be damaged.



4) Disconnect the cables of the tacking bar from the rotating MERCOTAC connector, which is located on the left-hand side of the machine. Connect to the existing cables a free cable which can be used to pull back the cables of the new tacking bar.





5) Unscrew and then detach the tacking bar from the main vacuum shoe.



6) Insert the new bar, passing the cables through the special holes placed on the left-hand side of the machine, and connect them to the MERCOTAC.

Take care that the pads are mounted facing in the right direction (the thicker end of the screws towards the outside).



7) Tighten up all the screws that block the bars, then position and block the counter-blades.



8) Reposition and block the secondary vacuum shoes, remembering correcting shims for the rear edge if necessary.

9) Repeat the operations described from point 3 onwards for the other tacking bar also.

REPLACEMENT OF THE COUNTER-BLADES

If the counter-blades are rotated on their own axes or tipped up, all four cutting edges of the utensil can be used.

In order to rotate, tip up, or replace the counter-blade, it is sufficient to proceed as for the "**Replacement of the tacking bars**", from point 1 to 3 and from point 7 to 8.

These parts should also only be replaced by specially trained personnel, using materials which conform, both from the point of view of design and characteristics, to the originals.

REPLACEMENT OF THE MOVING BLADES

The moving blades should only be replaced by specially trained personnel using original parts which have been correctly designed and made from the right materials.

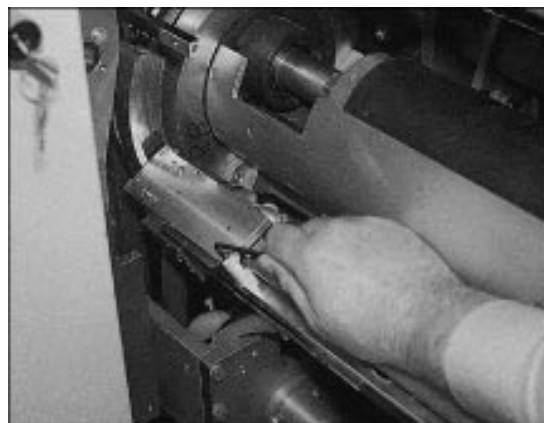
The procedure for replacement of the rolls is as follows:



1) Switch off and disconnect the laminator, then wait until the heated parts have cooled off.

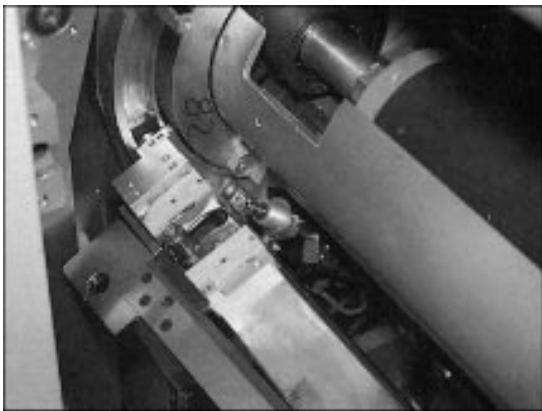


2) Take out the removable part of the machine. After loosening all the screws, detach the left-hand blade-guiding flange for the lower blade, and the right-hand flange for the upper blade.





3) Unblock the blade-tensing spring, situated at its other extremity, and detach the mobile blade completely.



4) Insert the new blade and block the spring, repositioning all the parts previously removed. **Lightly lubricate swivel joints and all parts that make mutual contact.**

Take care not to damage the edge of the blade during the entire dismantling and reassembly operation.

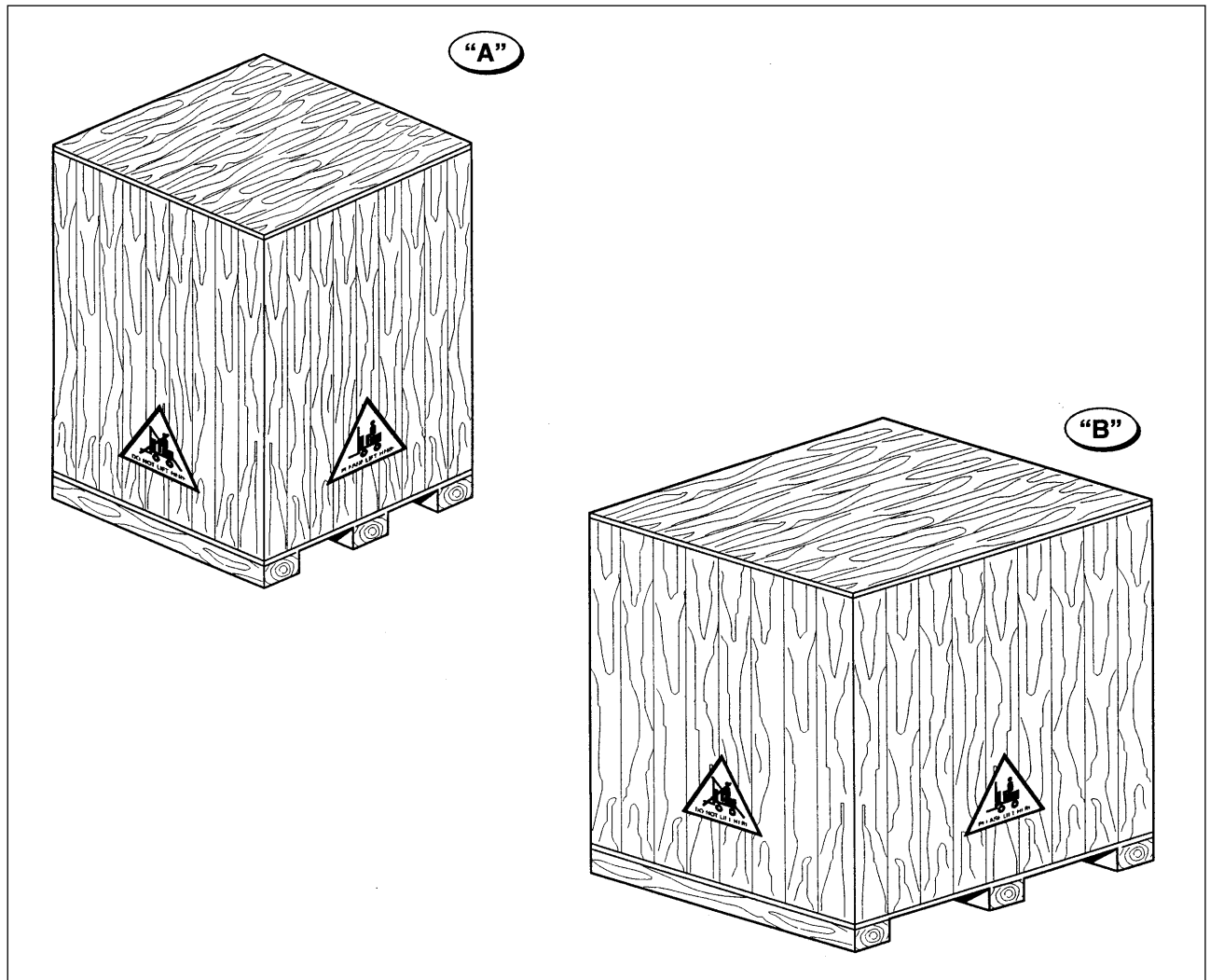
**BEFORE PROCEEDING ANY FURTHER MAINTENANCE OPERATION,
SWITCH OFF THE MACHINE AND WAIT FOR ALL PARTS IN TEMPERATURE
TO BE COMPLETELY COLD**

1600-D	Periodic maintenances recommended every:					
	Shift	Day	Week	Month	Six months	Year
Cleaning of lamination rolls with alcohol	●					
Cleaning of boards introduction rolls and input rollers with alcohol			●			
Cleaning of blades - counterblades with alcohol	●					
Cleaning of upper and lower vacuum shoes with alcohol		●				
Cleaning of tacking bars with alcohol	●					
Cleaning of upper and lower black feed rolls with alcohol		●				
Cleaning of lateral polyethylene separated rolls and tension rolls with alcohol		●				
Replacement of small lateral cut blades	●					
General cleaning: cap, safety guards, etc.				●		
Cleaning of board detecting mirrors with alcohol		●				
Cleaning the antistatic bars with alcohol and brush				●		
Cleaning of the brake pads with brush			●			
Cleaning of the vacuum pump filter			●			
Check up on and remove any condensate + cleaning of the compressed air filter				●		
Check up on the belts tension and their condition + brake pads					●	
Check up on motor (brushes, dynamo etc.)					●	
Check up on clutch gaps (all at 0,2 mm)						●
Check up on cut blades efficiency				●		
Replacement of vacuum pump filter					●	

PACKING AND SHIPPING

The machine is normally shipped in wooden crates, specially sized to suit the equipment in question.

The wooden crates are basically of two types (as illustrated in the figure below. The first type ("A") has a square base while the other ("B") is more rectangular in shape.



TYPES OF PACKING CRATE

LIFTING THE CRATE

The crate must be handled with extreme care in order to prevent damage to the machine inside.

It can be lifted by using a:

A- Transpallet:

B- Lift truck.

NOTE

In both cases, always check that the utilized lifting means and accessories (ropes, chains, lifting forks, etc.) are sized according to the overall weight of the crate as stamped on the same.

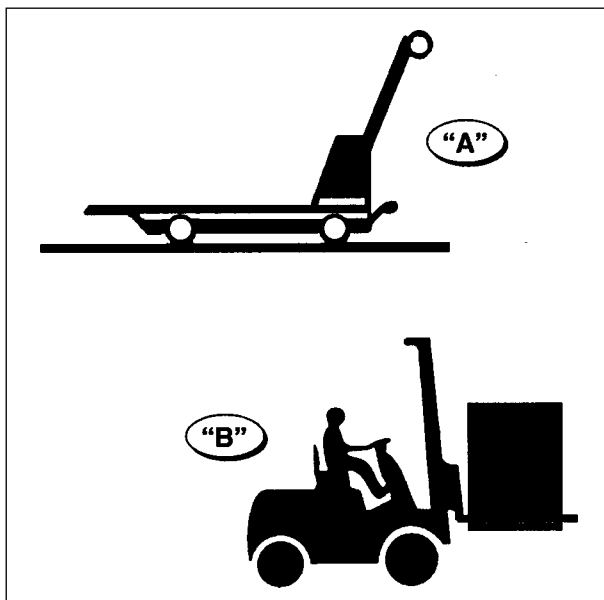
The machine weight is also indicated on the relative page of this instruction manual where all the technical characteristics are listed.

ATTENTION

The crate lifting and handing operations may only be carried out by specialized personnel authorized to use the above mentioned equipment.

Check the data plates and/or indications on the crate before it is lifted.

There are indications on the sides ("X" and "Y") marking the places where the lifting forks should be inserted.



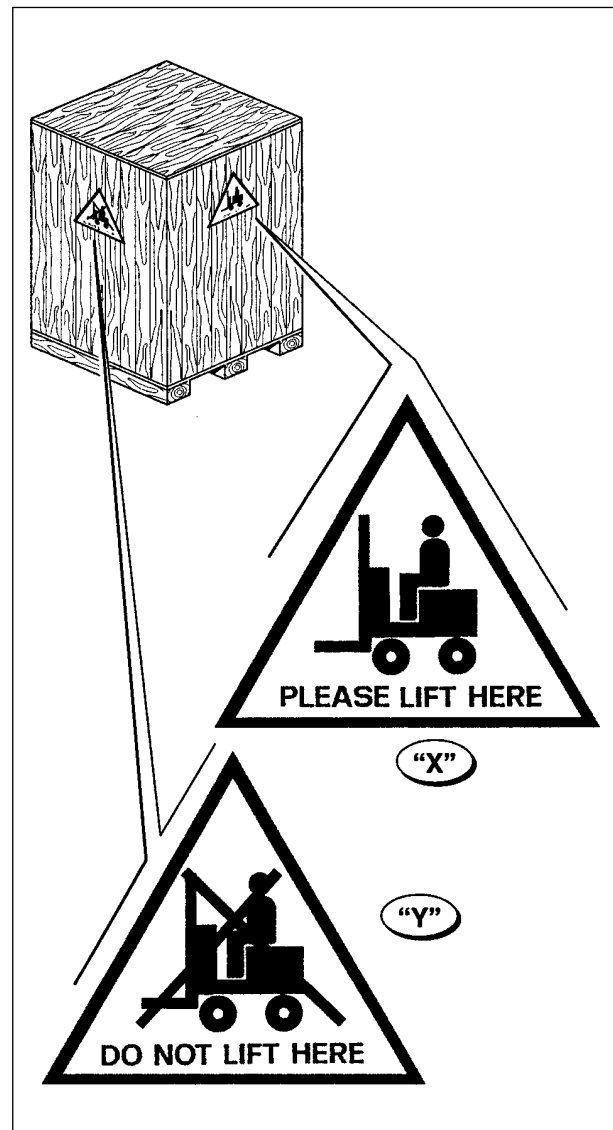
SUITABLE LIFTING MEANS

IMPORTANT

Never stand near the machine while it is being lifted.

IMPORTANT

MORTON declines all responsibility for any damage to persons or property caused by failure to comply with the instructions given in this manual and specified by the current Safety Provisions concerning lifting and handling of materials inside and outside factories.



INDICATIONS ON THE CRATE

LIFTING THE MACHINE

After having placed the crate in the position where the machine is to be installed, unpack the contents with extreme care.

IMPORTANT

Should the Customer note any defects, deformation or damage caused by transport on the crate and/or machine, he should immediately inform the haulage contractor of the matter both by phone (if the contractor is no longer present) and by Registered Letter with return receipt attached. MORTON should also be notified in merit.

The machine must only be lifted by transpallet or lift truck (after having checked that the chosen lifting means is suited to the weight of the machine itself (see the indications on the technical characteristics page of this manual).

Check that the lift forks correctly hold the bottom of the machine before it is lifted and that the machine weight is adequately balanced.

IMPORTANT

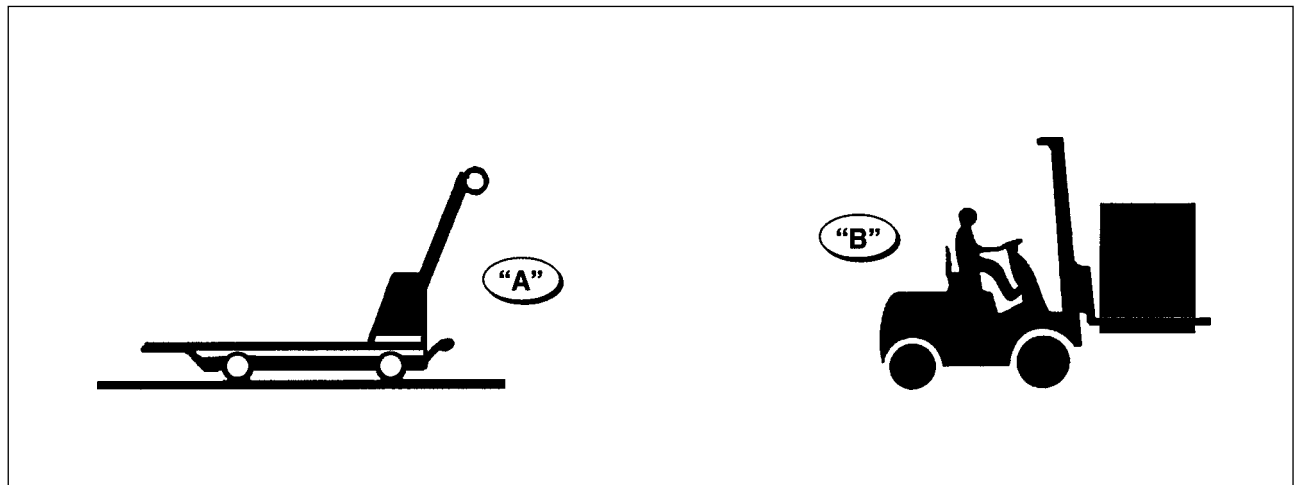
Never stand near the machine while it is being lifted.

ATTENTION

The machine lifting and handling operations may only be carried out by specialized personnel authorized to use the above mentioned equipment.

IMPORTANT

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SUITABLE MACHINE LIFTING MEANS

DEMOLISHING THE MACHINE

Proceed in the following way if the machine must be demolished for any reason (owing to age, if it can no longer be repaired, etc.):

- Disconnect the machine by carrying out the operations described in the “**operations**” and “**maintenance**” sections of this publication in reverse.
- Dismantle all possible parts of the machine (casing, lamps, guards, handles, chains, motors, etc.), dividing them according to their different nature (eg.: pipes, rubber components, lubricants, solvents, lacquering products, aluminium, ferrous material, copper, glass, etc.).

- Before the machine is scrapped, inform the authorities in charge of these matters in writing, in compliance with the provisions in force in the individual countries.
- After having received authorization from the above mentioned organizations, eliminate the components as prescribed by the current standards in merit.

ATTENTION

Any irregularity committed by the Customer before, during or after dismantling and scrapping the machine components, or in interpreting and applying the current provisions in force, shall be the exclusive responsibility of the Customer himself.