

# **END-O-MAT System**

**Multi-die end production system**

**with straight and zig-zag sheet feeding device**

**and with innovative tooling systems.**

## **END-O-MAT – the multi-die end production system with high capacity**

### **END-O-MAT system**

The END-O-MAT is not only a single stamping press for ends, but also an integrated high-performance system for the production of ends including curling, lining, drying, wrapping and palletising.



High performance means outputs of up to 4,000 ends per minute, depending on diameter, on a single system and with uniformly high quality.

The essential prerequisites for such an endmaking system to obtain the best possible benefit are:

Processing of all materials available on the market, either single- or double-reduced, tin- or chromium-plated (ECCS), with or without lacquering.

Smallest possible web width to minimise scrap skeleton waste.

The material to be processed does not need to meet high precision requirements with regard to length, width and angularity.

To prevent soiling, clip-outs or stopping of the system, the material to be processed is already monitored for faults at the point of infeed.

High outputs due to high number of strokes and absence of idle strokes.

Short changeover times for diameter changes to minimise standstill.

Easy-to-operate manufacturing system with small need for maintenance thanks to menu-based operator interface and comprehensive fault display and diagnosis system with screen displays and an additional remote control system by telephone for fault diagnosis and elimination by our specialists.

Low staff requirements.

The END-O-MAT system fulfills all of these requirements.



## The END-O-MAT system in details (see also: [www.cantec.com](http://www.cantec.com))

The END-O-MAT system comprises the following components:

1. A driven roller or chain table where several pallets with sheets are kept in stand-by for pallet change without delay. An automatic pallet changer is available as an option.
2. A stack lift with hydraulic pallet alignment. For coil processing these components are replaced by the coil feed mechanism. The sheet infeed can even be converted to coil feeding later on without major expense.
3. A sheet feeder with electrically driven linear conveying by means of vacuum suction cups. As an option a lubricating system can be added.
4. An alignment table on which the sheets are aligned in accordance with their front scroll or, in the case of straight sheets, with a three-point system. Electronic sensors monitor the alignment process.
5. Straight feeder: Two roller-type sheet feeding systems at the infeed and the outfeed of the END-O-MAT.  
Zig-zag feeder: One or two zig-zag sheet feeding systems. The double feeding system permits production without idle strokes. The linear motors selected to drive the infeed mechanism guarantee practically wear- and maintenance-free production – even at highest traverse speed and accelerations. The x-axes carry a gripper arm with pneumatic grippers. Gripper closure is monitored by sensors. The double feeding system for production without idle strokes has an integrated lifting system so that the gripper arms can pass each other.

6. The well-known automatic END-O-MAT stamping press.
7. A double-row multi-die tooling (straight or zig-zag feeding) or a one-row multi-die tooling (zig-zag feeding only) with column die set, Agathon anti-friction guideways and pneumatic springs for blank holders, etc., which are integrated into the baseplates.
8. An end ejection system. Cam-controlled kickers eject the ends from the opened tooling. Each die is reached by a cross conveyor which takes over the end and deposits it on the outfeed belts.
9. An end conveying system for uncurled ends to connect the END-O-MAT to the curlers.
10. One (zig-zag) or two (straight) high-speed curlers (depending on capacity) with large pitch circle diameter.
11. An end conveying system for curled ends to connect the curlers and the lining machines.
12. High-speed 3, 4, 6 or 8-head lining systems.
13. End uprighting and conveying systems to connect liners and drying oven.
14. End inspection systems (optional).
15. A drying oven.
16. Conveying systems to packing stations or to the balancer.
17. End wrapping und palletising systems or a balancer.

An automatic scrap skeleton palletiser for simple disposal of scrap skeletons is also available as an option.

## **END-O-MAT stamping press**

The END-O-MAT stamping press is dened for sheet (zig-zag and straight) and coil processing (straight only). The maximum sheet dimensions are 1200 mm x 1200 mm (straight) and 1100 x 1200 mm (zig-zag); sizes which cover the entire range defined by today's printing and lacquering lines.

The number of dies depends on the diameter, the available sheet width and the feeding system and can reach between 2 dies (for diameter 153 mm and zig-zag feeding and 16 dies (for end diameter 52 mm and straight feeding).

The speed of the stamping press depends on the diameter, too, and can reach up to 250 strokes/minute for end diameter 52, without idle stroke.

For the capacity of each size and feeding system please see [www.cantec.com](http://www.cantec.com).

As already mentioned, the smallest possible web width to minimise scrap skeleton waste is an essential prerequisite to save material costs.

The web width depends on the diameter: The END-O-MAT can run with web widths of about 0.8 mm to 1,0 mm for all sizes.

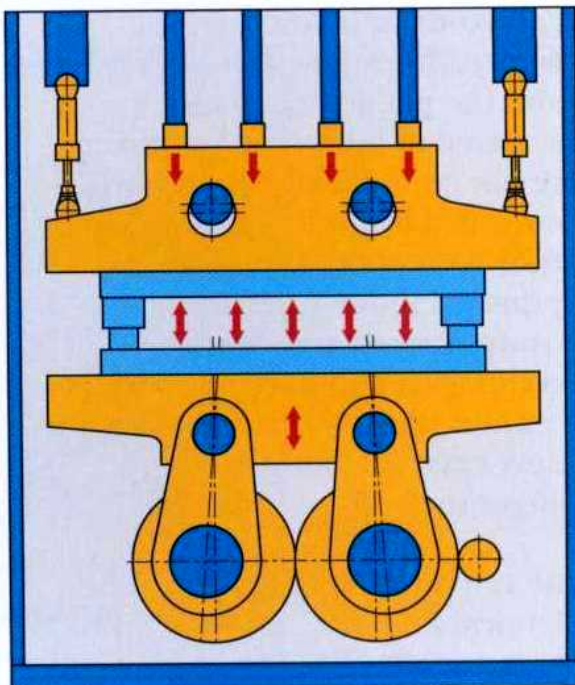
## Innovative features and advantages of the END-O-MAT stamping press

Bed and slide are of solid steel construction calculated for minimum deformation in the tooling area, thus guaranteeing uniform product geometry for the entire tooling area.

Unlike conventional stamping presses, the END-O-MAT press is powered from below, this means that the slide is positioned at the bottom and executes its strokes in an upward direction. The main advantage of this design is the absence of lubricating points for guides, gearwheels or bearings in or above the tooling area which prevents any soiling of the products by mineral oil or grease. In addition, the centre of gravity has been shifted to the bottom area of the machine which results in even smoother running of the stamping press.

Another advantage is the separation of the sheet conveying and product ejection levels. After stamping, the ends are transported downwards together with the tooling and ejected by mechanical kickers.

Another essential innovation is the fact that unlike conventional systems the END-O-MAT does not require mechanical guiding of the ram. The bottom-positioned slide is powered by a synchronous four-point drive system similar to the drives used for high-quality drawing presses in the automotive industry. The accurate parallelism of bed and slide is determined by the precision of component manufacturing and not by adjusting guides as with conventional presses.



Thanks to the absence of guides, which are liable to wear and require frequent maintenance, our machines do not require regular inspection and resetting when in operation at the customer's plant - another fact which sets them apart from conventional presses.

Our system ensures perfect parallelism of bed and slide - even under one-sided load. Despite the high stroke speed, the use of a transverse drive shaft system to power the press guarantees smooth, low-vibration running. The counter-rotating eccentric wheels of this drive system compensate the horizontal dynamic forces.

The 70 mm stroke of the press has been specially optimised for end manufacturing.

The automatic stamping press is equipped with hydraulic bed pretensioning to compensate any residual forces that may

deform the slide. Nearly identical bending curves of bed and slide result in uniform product geometry for the entire tooling area. The pretensioning force is adjustable.

The bed pretensioning device also incorporates the functions of an overload safety device to protect machine and tooling from being damaged. A variable pressure relief valve relieves the bed pretensioning in case of an overload; the controller stops the machine and displays a fault alarm.

This device also acts as a quicklift with an additional 60 mm stroke to provide optimum access to the tooling for maintenance purposes, for example for the replacement of individual dies.

Tooling access height in the stamping press is 1400 mm from plant floor. It allows the operator to carry out maintenance work on the tooling without difficulties. It takes only minutes to replace an individual die. They are precentred - no die recentring is required.

The stamping press is equipped with monitored oil circulating lubrication. Automatic monitoring of all points of lubrication results in little need for maintenance.

The END-O-MAT for double-row tooling is equipped with a roller feed mechanism at the infeed. This roller feed mechanism has been specially dened to process thin materials, with adjustable pressure and a pressure roller with optimised mass moment of inertia. High feed precision and, consequently, the smallest possible web width are achieved by means of a precisely ground feed-controlling upper roller and a highly-dynamic servo-drive. The drive is controlled by an intelligent, fully digital servo-control which allows acceleration-optimised feed profiles to be set. The relatively thin sheet can thus be accelerated, decelerated and positioned smoothly and without jerks.

This feature is of special importance for conveying of the sensitive scrap skeleton in particular. Therefore the roller feed mechanism at the discharge is of similar den, but with special emphasis on careful transport of the scrap skeleton. The feed precision of both roller feed mechanisms is better than 0.05 mm.

The END-O-MAT for single-row tooling is equipped with one zig-zag sheet feeding system at the infeed side of the stamping press. The version with double zig-zag feeding system allows the machine to run without idle stroke (optional). The linear motors selected to drive the infeed mechanism are extremely dynamic and still practically wear and maintenance-free. Together with a direct digital position detection system they guarantee extrem accurate positioning of the sheets. The drives are controlled by an intelligent, fully digital servo-control which allows acceleration-optimised feed profiles to be set. The relatively thin sheets can thus be accelerated, decelerated and positioned smoothly and without jerks.

Each of the x-axes carries a gripper arm with pneumatically actuated grippers. The grippers are dened to form a slight impression on the sheet. This mixture of interlocking and frictional clamping of the sheets ensures its smooth passage through the tooling. The clamping procedure of the grippers is monitored by sensors. The double feeding version for production without idle stroke has an integrated lifting system so that the gripper arm can pass each other.

A roller feed mechanism ejects the scrap skeleton at the outfeed side of the stamping press. The draw-out rollers rotate at constant speed and are pneumatically closed to grip and eject the scrap skeleton.

The slide itself actuates the end ejection kickers mechanically by means of cams. The kickers can thus be set easily and damage to the tooling is avoided. To ensure optimum dynamic behaviour, the material selected is ultra-light high-strength carbon fibre.

## **Flow of material through the END-O-MAT:**

Some advantages and specific features of the process are best described by describing the flow of material through the END-O-MAT:

END-O-MAT for double-row tooling: A linear feeder, which is controlled by a servomotor, lifts the uppermost sheet from the stack by self-regulating suction units and transfers it to the

point of infeed. Alignment wedges centre the sheets at the scroll. Correct alignment is monitored by proximity switches. Alignment at the scroll does not require the sheets to be of exact width and has a higher tolerance of deviation from angularity. Sensors are monitoring the alignment. In case of misalignment, the machine automatically carries out two more alignment attempts. If correct alignment of the sheet is still not possible, the machine is stopped and displays a fault alarm.

A double sheet detector and a sheet lacquering monitor system are part of the scope of supply. Detection of double sheets or any faulty lacquering on the top or bottom side of the sheets causes the controller to stop the machine to avoid scrap or damage to the tooling. The lacquering monitor system can be switched off if unlacquered sheets are to be processed.



To compensate for sheet length variations the machine is supplied with a sheet length compensation system. Sensors measure each sheet. The measured dimensions are compared with those of a reference sheet and provide the data required for correction of the clock-controlled infeed steps. The maximum permissible deviation in sheet length is 1 mm, approximately. In case of larger deviations, the controller stops the machine and displays a fault message.

As soon as the scrap skeleton reaches the roller feed mechanism at the discharge, this mechanism takes over the clock-controlled transport of the sheet through the tooling and finally ejects the scrap skeleton. Operation without idle strokes is a must for high productivity. As soon as the roller feed mechanism at the infeed has handed over the sheet to the feed mechanism at the discharge, a new sheet is aligned, taken over by the roller feed mechanism at the infeed and accelerated so that it catches up with the preceding sheet at the centre of the tooling. A stepped sheet guide plate ensures that the sheets overlap as required for production without idle stroke.

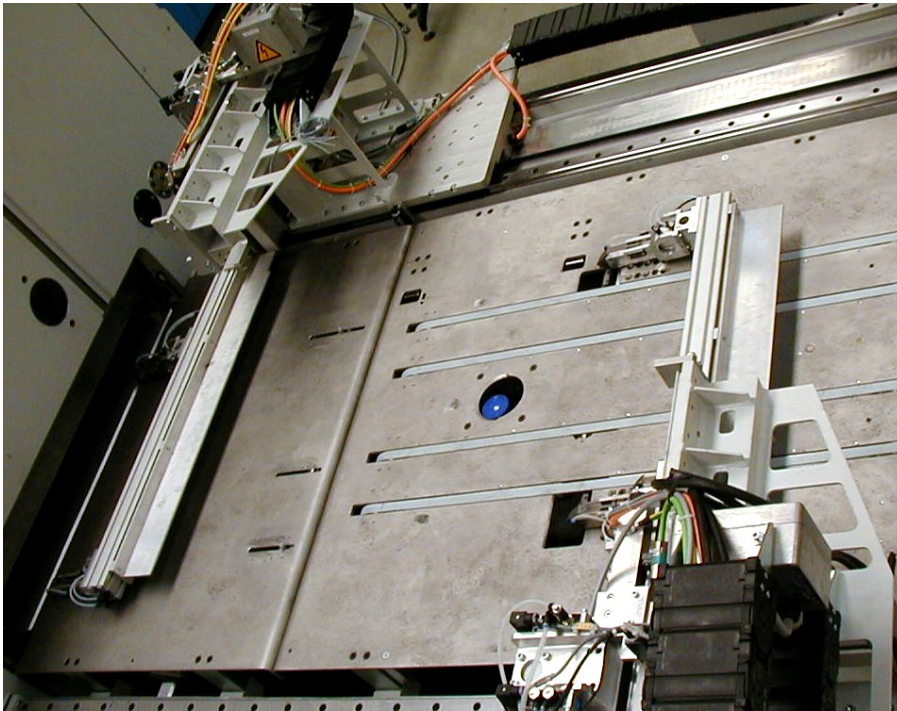
END-O-MAT with single-row tooling: A conventional sheet feeder lifts the uppermost sheet at the front end from the stack by suction units and transfers it to the transport rollers of a motor-driven roller mechanism. As an option this roller mechanism can be replaced by a lubricating system. The roller mechanism or the lubricating system transports the sheets onto an alignment table with conveying belts where they are aligned with a three point system. Sensors are monitoring the alignment. In case of misalignment, the machine automatically carries out two more alignment attempts. If correct alignment of the sheet is still not possible, the machine is stopped and displays a fault alarm.

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As soon as the sheet is aligned correctly, pneumatically actuated grippers grip the outer corners of its trailing edge. Coordinated traverse movements along the x- and y-axes of the zig-zag feeding system during the opening strokes of the stamping press then move the sheet through the tooling. A typical feature of the END-O-MAT feeding system is the fact that

the sheet is clamped only once and is not released until the whole stamping process has been completed



The second x-/y-axis infeed system of the double zig-zag feeding system has by now returned to the alignment table and has taken over the next sheet after it was aligned. To ensure that both gripper systems can pass each other without colliding the returning gripper arm is raising by a lifting system.

The ejection roller mechanism at the discharge closes after the last stamping stroke and takes over the ejection of the scrap skeleton. As soon as the tooling closes for the last stamping stroke, the clamping grippers are opened and the gripper arms return to take up a new sheet.

The ends leave the sheet conveying level when the slide performs its downward stroke and are ejected by mechanical kickers. For optimum accessibility from each side of the tool, the kickers are centrally mounted on a common shaft. Each individual kicker can be displaced lengthwise and can easily be adjusted in height and position in relation to the tool.

Having been ejected from the tooling, the ends are taken over by magnetic conveyors which reach directly into the tooling. These cross conveyors remove the ends from the tooling area and deposit them on joint magnetic conveyors, one each arranged in front of and behind the tooling area. These magnetic conveyors are positioned below sheet level. To avoid problems caused by ends which have not been ejected from the tooling, each end is monitored by a discharge monitoring system with light sensors. If an end is missing, the controller stops the machine and indicates which tool failed to eject its end.

## END-O-MAT multi-die tooling

The individual tools are mounted on the column die set and centred at the manufacturer's plant. The centring rings are then fixed and secured against dislodging. The individual tools need not be re-centred at the customer's plant - a fact which facilitates their easy replacement. Tool changes are further simplified by the fact that each toolset, this means both top and bottom tools, is fastened by one central screw.



The tooling is provided with carbide cut edges to ensure a long lifetime. The approximate service life of the tooling is about 5 million ends for each individual toolset for unwaxed, chromium-plated DR material. The dies can be reground about 20 times with about 0.2 mm each so that about 100 million ends can be produced by each individual toolset. Lacquered sheets need not be greased or waxed for this type of tooling. With waxed or tinplated lacquered material the lifetime can even be two or three times longer!

Sheet holders, blank holders and ejectors are powered by compressed air or nitrogen. There are no mechanical springs with their typical problems. The forces for the above elements can be set from outside by means of pressure regulators.

The stamping press has been designed with fast tool changeover in mind. The complete tooling can be pulled out of the machine through an opening in the narrow side of the press. Spring-loaded rollers which lift the tooling from the slide plate once the fixing screws have been loosened allow the tooling to be pulled out easily on a simple change carriage.

Then the new tooling is pushed from its carriage onto the slide of the stamping press. Index pins in the bed of the stamping press ensure correct positioning of the tooling in the press. Manual alignment is not required.

Once the kickers have been set, sheet centring has been checked and a new program has been retrieved from the controller the stamping press is ready to resume operation. Replacement does not take longer than about 30 minutes; the time required for diameter changeover is less than 1 hour, with trained staff.

Beside conventional tooling systems multi-stage tooling and thermo compensating tooling systems are available, see [www.cantec.com](http://www.cantec.com).

## End conveying

End conveying between the stamping press and the curlers is effected by accelerator belts to ensure that the ends are sufficiently spaced when entering the curlers.

## END-O-MAT downstream equipment

Only offers a complete high-speed endmaking system comprising stamping press, tooling, conveying systems, curler and liner units - all from a single source.

## Curling units

The well-proven END-O-MAT curlers have a larger pitch circle diameter. This larger diameter ensures a sufficient number of rotations even for ends with larger diameters. This system is the optimum solution for processing of DR material and thus offers a high potential for future material and cost reductions.



Passage of the ends through the curlers is monitored by sensors. A changeover of the curlers to a new diameters requires only a few minutes because only the inner tool (the curling disk) needs to be replaced.

## Lining unit

The lining unit is dened as a rotary liner with 3, 4, 6 or 8 heads, depending on end diameter. Independent of the manufacturing speed, the number of rotations of the ends during lining is adjustable between 1000 and 4500 rpm.



Each unit produces outputs of up to 2000 ends per minute, depending on the diameter, and can process ends with diameters between 52 and 153 mm. Capacities for all diameters see [www.cantec.com](http://www.cantec.com). The ends are destacked by the well-proven destacking device from our CAN-O-MAT system. For end diameters of up to 99 mm, the END-O-MAT liner can be equipped with an optional 2nd end infeed so that optimum adaptation to different line layouts is possible. A cam-controlled chuck plate takes over the ends from below, supports them at their core by positive fit and clamps them against the spring-loaded upper plate.

The spray guns can have manual or, as an alternative, electronically adjustable needle strokes. Needle stroke (optional) and spray interval can be set from outside during operation. An end marking function at head 1 allows the ends to be retraced to the corresponding lining head during compound weight control. The compound

d used is a water-based high-solid compound.

The compound volume for all spray guns is determined by the compound pressure and the adjustable needle stroke set for each spray gun. The spray interval, which can also be set separately for each individual spray gun, optimises compound distribution on the end.

Automatic cleaning of the spray nozzles with subsequent sealing as protection against drying during line standstill is available as an option. The machine is prepared for the integration of a video inspection system for product quality monitoring. After a vacuum stacking system has formed the lined ends into a row, pushing mechanisms feed this row to the drying oven.



## **Drying oven**

Usually the drying oven is an electrically heated one-row or two-row oven with forced air circulation. Gas heaters are available, too. In the oven, the ends are spaced by varying their conveying speed to ensure fast and sufficient drying. The temperature can be set between 80 and 150 °C, which covers a wide range of applications. The system can be adapted to the customer's requirements.

## **End wrapping and palletising**

The last operation after drying of the compound is wrapping or bagging of the ends and palletising of the packages. There are various semi- and fully-automatic solutions. As an alternative, the ends can even be packed on trays by a fully-automatic robot system.