The racing machine

Demag Plastics Group

EL-EXIS S

110 – 770 tons

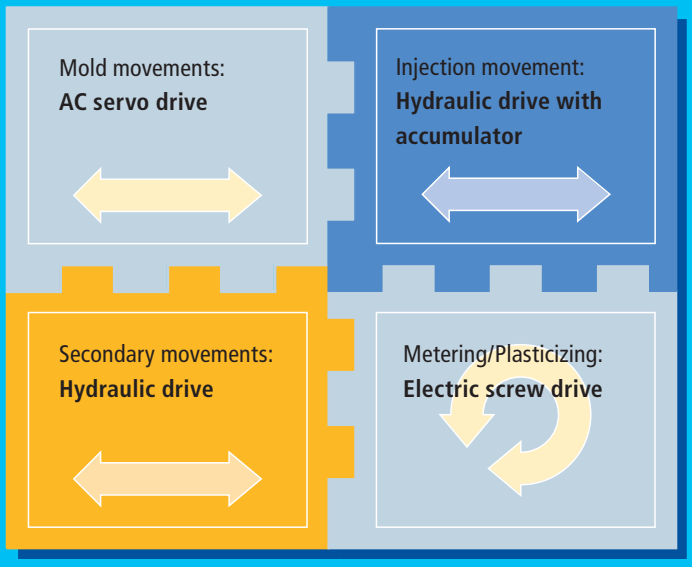
The EL-EXIS S at a glance

- **dynamic:** shortest injection times with extremely high injection rate through hydraulic accumulator
- **powerful:** higher plasticizing capacity and homogeneity of the melt through independent electric screw drive
- **fast:** faster, more sensitive opening and closing of mold via independent electric drive of clamping unit
- **safe:** active mold protection system with piezoelectric sensors
- **precise:** high-resolution stroke measuring system on the injection unit combined with rapid-response servo-valve for accurate process control
- **flexible:** modular system for all fast-cycling, thin-wall and precision applications
- **energy-saving:** up to 40 % lower energy requirements through parallel drives and practically loss-free power transmission; stand-by operation
- **low maintenance:** through wear-resistant force-transmitting components
- **quiet:** through compact, noise-dampened drive units

"A convincing concept with which we enhance your competitiveness."

Andreas Kübel, Manager Drive Technology, Demag Plastics Group

The racing machine EL-EXIS S



EL-EXIS S drive matrix

Energy review of different movements of an injection-molding machine

Movement/ Load	Energy consumption hydraulic IMM %	Ideal drive	Advantages of drive	Energy savings with EL-EXIS S
Mold movement	20 %	electrical with hydro-static transmission	rapid response, sensitivity, energy savings	60 %
Ejector and core pull	1 %	hydraulic*	high force and precision	–
Injection	11 %	hydraulic*	rapid response, high speed	–
Plasticizing	55 %	electrical	energy savings, parallel movements, cycle time reduction	30 %
Carriage movement	1 %	hydraulic*	high contact force, high speed	–
(Heater bands)	12 %	electrical	–	–
Total	100 %			20 % – 40 %

Reduced energy consumption through small pump size
(even at no load, each pump uses 15 – 20 % of its rated power)

*with accumulator

Reduced energy consumption

	Weight [g]	Cycle [s]	hydraulic fast-cycling machine [kWh/kg]	EL-EXIS S [kWh/kg]	dE [%]
Flower pot	33.5	2.97	1.17	0.67	43
Razor handle	138	6.59	0.57	0.36	37
Bowle	68.7	6.03	0.99	0.54	45
Razor	39.2	6.98	0.72	0.34	47
Drinking cup	61.2	3.47	0.68	0.43	37

New Benchmark in High-Performance Fast-Cycling

Short-lived trends in the field of packaging products set the pace in fast cycling. Whether food or technical packaging, closures or technical precision components: parts are becoming more demanding and more complex all the time as product life cycles grow ever shorter.
To meet tomorrow's requirements for precision and repeatability in terms of both quality and economics, machine builders must use new approaches.
The EL-EXIS S is a case in point. Its innovative concept combines the advantages of all-electric machines with those of hydraulic fast-cycling designs. The concept features independent drives running in parallel for each movement of the machine which has set new standards: shorter cycles, optimal dynamics, and energy savings. Additional modular options for the clamping and injection units provide accurate solutions for nearly every fast-cycling and precision part in a clamping force range from 110 to 770 tons.
The unique EL-EXIS S concept is our answer to increasing requirements in fast-cycling and precision injection molding. The growing number of EL-EXIS S users proves that we are on the right course.

HIGH TECHNOLOGY

The Power of Parallel Drives

The EL-EXIS S sets tomorrow's standards of precision and speed. Extremely fast injection rates are easily achieved without sacrificing in precision and safety. For thin-walled and packaging parts with minimum tolerances, as well as, fast-cycling and precision applications employing high injection pressures, and in each clamping force range from 110 to 770 tons. Integral to achieving this is the unique combination of electric and hydraulic drives. Independent, parallel acting control loops for the clamping unit, injection unit, and secondary movements, allow the EL-EXIS S to realize extremely fast, harmonic and consistent movement cycles.

High-speed plasticizing and injection
The speed and response required for high-precision, fast-cycling parts during plasticizing and injection are generated by the EL-EXIS S at two levels. First, the frequency-controlled electric screw drive is the energy source with a high stored energy driving the rotary movements of the screw. The AC-servomotor transmits power practically loss-free to the screw. This design minimizes maintenance requirements while ensuring quiet and energy-efficient operation. Its decisive advantage: plasticizing is possible over almost the entire machine cycle, cycle time is shortened, and output, melt homogeneity, and quality of color dispersion are higher. Secondly, high speed injection is achieved by a hydraulic accumulator and a servo-valve. The result dynamic response of the linear movement is not compromised, during acceleration, nor in applying the force by mechanical transmission elements. In effect, with injection speeds of up to 1,000 mm/s and a screw acceleration up to 12 m/s² the machine achieves absolute maximum values.

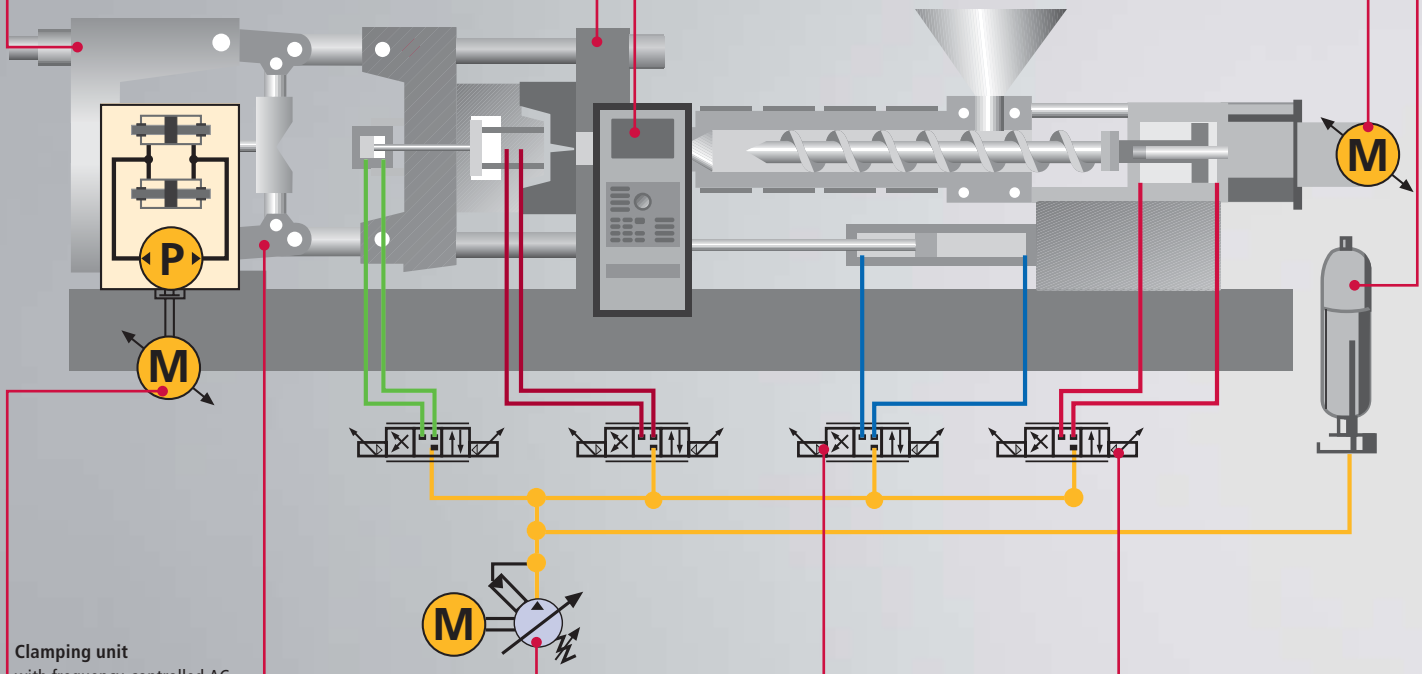
Mold protection
through high-resolution measuring system with piezoelectric sensors

Robust tie bars and platens,
reinforced centring area on fixed platen

NC4 control system
with user-friendly Ergocontrol panel for convenient setting, monitoring, and documentation

Electric screw drive
with frequency-controlled, quiet-running AC servo-motor for high plasticizing capacity for extremely short cycles

Central hydraulic accumulator
for injection speeds up to 1,000 m/s and screw accelerations up to 12 m/s²



Clamping unit
with frequency-controlled AC servo-drive and hydrostatic transmission for dynamic acceleration of 5-point double toggle

Non-contact stroke measuring system
on all axes for highest precision

Variable-delivery pump
with hydraulic accumulator

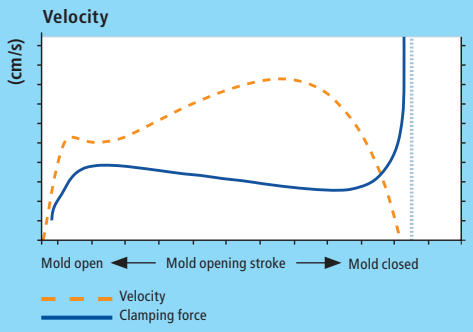
Proportional valves
for rapid response and precision of secondary movements

Servo-valve
for high dynamics of injection

Improved acceleration and deceleration

While the injection unit design is innovative, so is the independent clamping unit drive. The electric servo-motor drive equipped with a hydrostatic transmission provides nearly loss-free power transmission to the five-point double toggle – the dynamic response of the clamping movement results in a significantly shorter dry cycle time compared to straight hydraulic machines.
The high-precision Demag clamping unit with 5 point double toggle and integrated, short-length clamping cylinders, in conjunction with variable tie bar distances, provides ample space for large molds. The powerful kinematics of the double toggle ensure short locking times and high mold opening forces. Especially in the end positions, the large movement of the toggle is contrasted by a relatively small movement of the clamping platen permitting extremely sensitive closing and opening while reducing mold stresses to a minimum.
High drive dynamics, extremely fast and precise injection, as well as, accelerated mold open and parts removal – all these factors make for distinctly shorter machine cycles and energy savings of up to 40 % and more when compared to conventional fast-cycling machines.

Force and velocity profiles of the 5-point double toggle



Computer-optimized deceleration and acceleration profiles provide sensitive and mold-friendly control of the high-speed movements of the 5-point double toggle

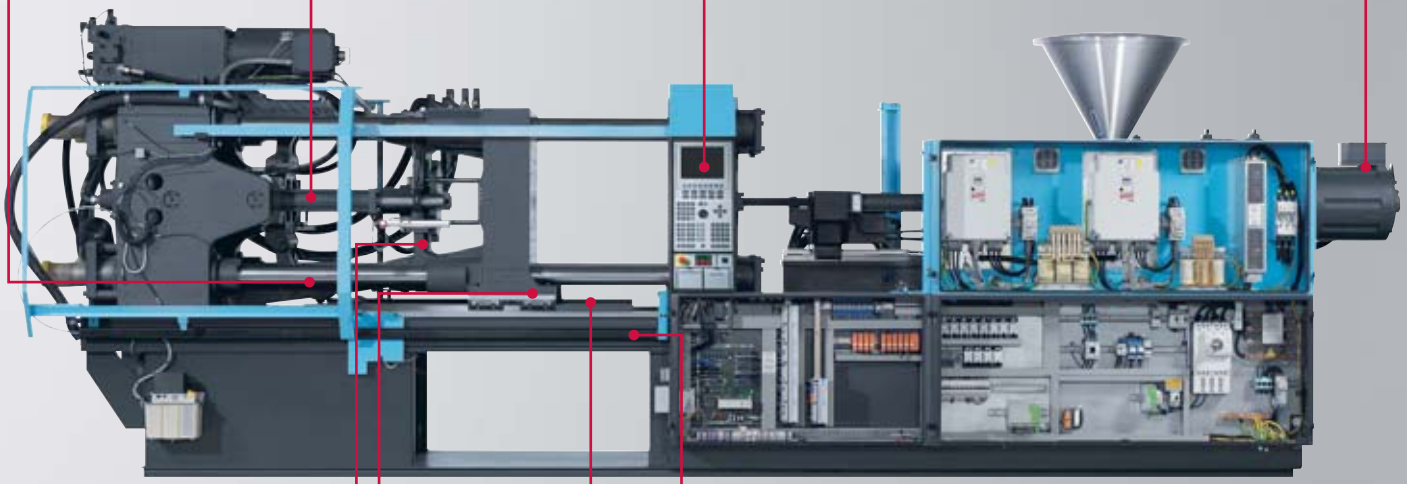
HIGH PRECISION

Mold protection through
high-resolution measuring system
with piezoelectric sensors

Non-contact ultrasonic stroke measuring system
for extremely high precision
of injection, opening, closing
and ejection

Core pullers and ejectors
are freely programmable for
complex sequences of mold and
secondary movements

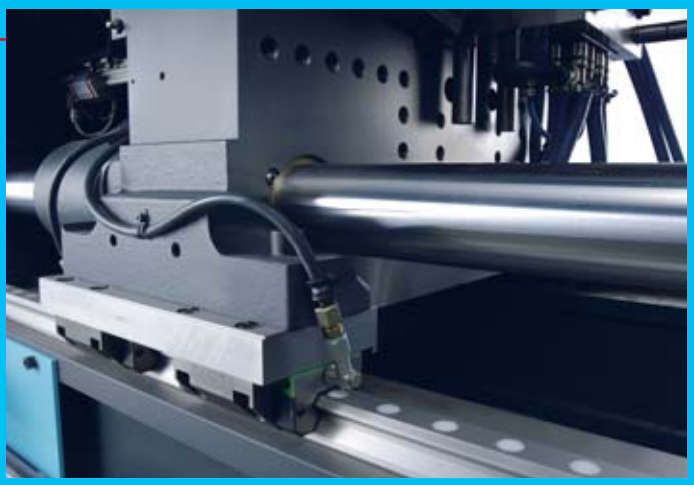
High-torque direct drive
for high metering capacity



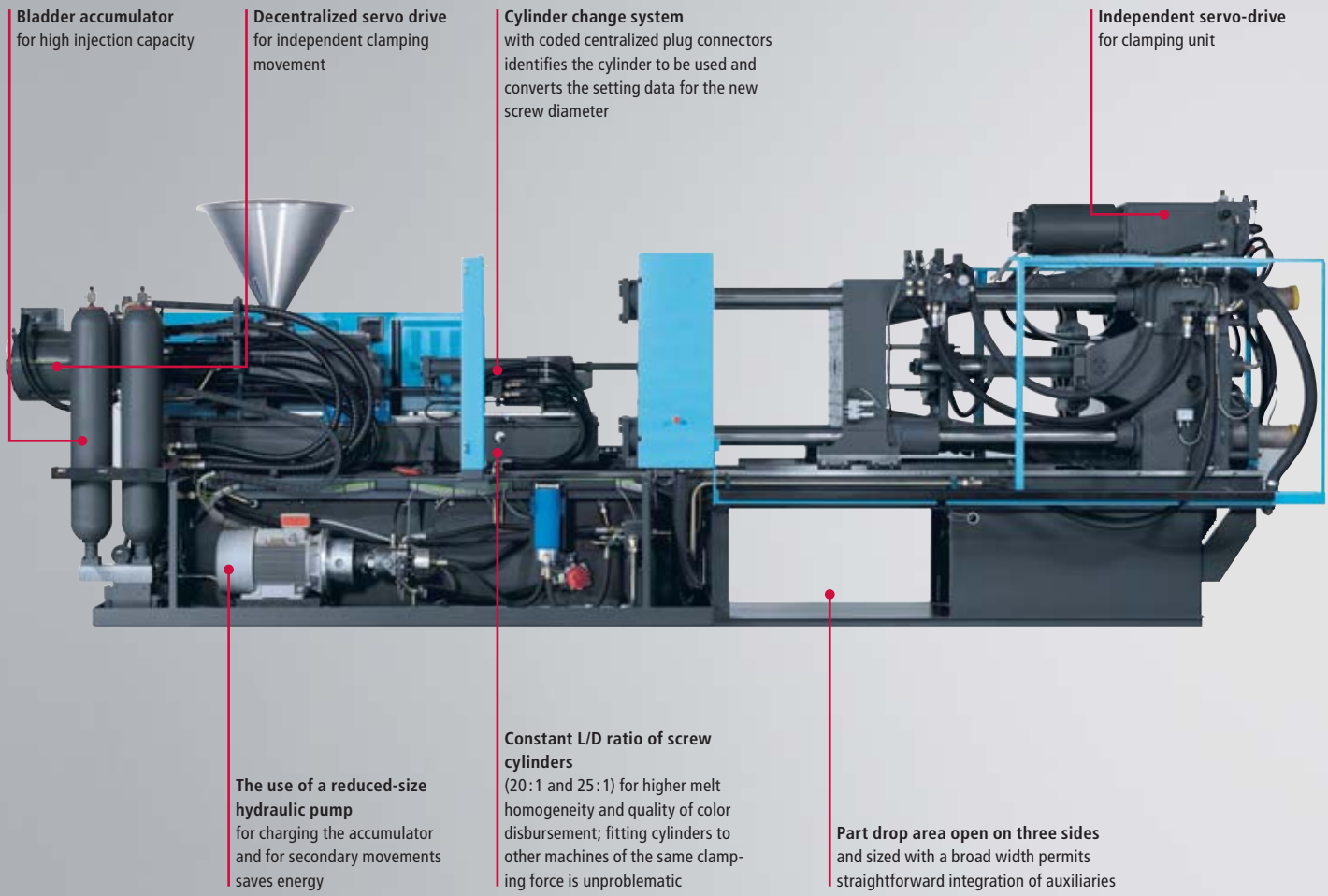
5-point double toggle
with computer-optimized
deceleration and acceleration
profiles

Moving platen supported
by linear guidance
system (recirculating
roller bearings)

Strengthened machine base



Supporting the moving platen on the machine base in a high-precision, low-friction, linear guidance system is designed to accommodate heavy loads, ensures easy movements of the mold, and reduces susceptibility to mold wear.



Accuracy in Machine Design

The combination of servo valves, the high-resolution ultra-sonic stroke measuring system, and the NC4 controller warrants extremely high process consistency – thanks to exact change-over from injection pressure to holding pressure, high consistency of the residual melt cushion, and exact duplication of metering stop position.

Extreme precision is indispensable for many fast-cycling parts. The electrical drives of the EL-EXIS S provide high positioning accuracy of the moving platen – for minimal mold wear during closing of the mold and positive pick-up of the molded parts by parts handling systems at the end point of the opening movement. Should any irregularities occur in demolding, the active mold protection system of the EL-EXIS S will intervene, stopping the machine within milliseconds and protecting expensive molds reliably from damage (see page 8 on the subject of mold protection).

Structurally, the machine is carefully designed for precise movements and high, dynamic loads. The machine base of the EL-EXIS S is dimensioned for high solidity. So too are the platens which have been optimized by means of finite element analysis. In addition, we have reinforced the stationary platen in the centring area in order to enhance stability at the mold center. High platen parallelism is ensured by stable, non-warping guidance of the moving platen on the tie bars of the clamping system.

In order to equip your EL-EXIS S quickly and economically for new jobs, there are a host of modules available from the Demag modular range – for single-component and multiple-component parts in each clamping force range from 110 to 770 tons.

In short, for thin-walled applications where extremely close tolerances are specified, and also for complex moldings involving long flow distances, the EL-EXIS S overcomes existing limits of practicability, thanks to superior injection capacity and precision.

HIGH PERFORMANCE

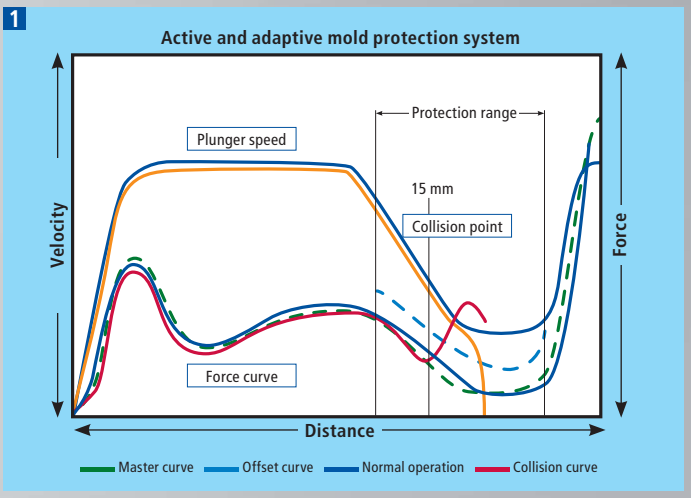
Top Performance in Every Detail

Whether it is the dynamic-response injection unit, the innovative mold protection system, or the multiple component fast-cycling machine, the high performance of the EL-EXIS S is the result of the interaction of numerous intelligent individual components. These innovations are backed by extensive experience accumulated over many decades in the progressive development of innovative toggle technology and advanced drive systems – and our proactive introduction of new technologies providing economical solutions to meet the industry's upcoming needs.

1 + 2 Molds perfectly protected

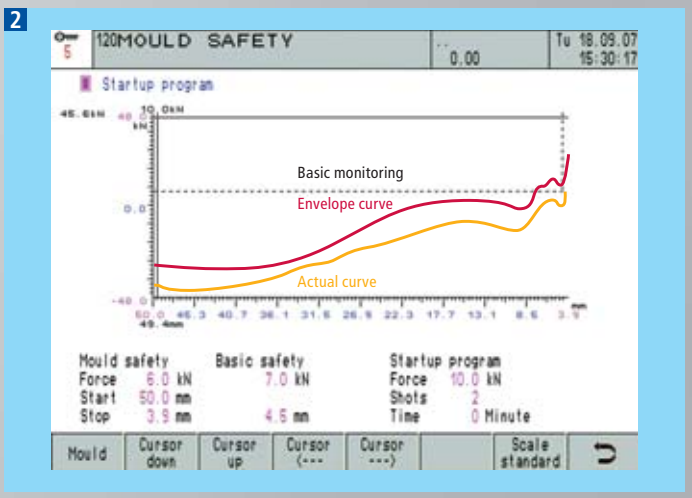
A new system for optimizing mold protection during high-speed travel of the clamping unit has been designed into the EL-EXIS S. This innovative and truly unique mold protection system incorporates a piezoelectric sensor which ascertains the force required over a normal cycle to move the clamp and stores it as a master curve in the machine controller. In every cycle, the controller compares the force variation against the master curve. If the actual values deviate, the clamp is stopped within a fraction of a second.

1



The mold protection system can be conveniently set on the Ergocontrol operator terminal. Matching it up to the mold is automatic, the graphic display facilitating operation and defect analysis.

2



The protective function is conveniently set via the Ergocontrol operator panel. It is automatically optimized for the mold in use. Visualization facilitates operation and trouble-shooting.

The advantages

- The high-resolution sensor will detect even minimal deviations from the master curve.
- The system will detect deviations over the full opening and closing strokes of the clamping unit, so the system is effective before the immediate approach range – a short distance before the mold halves touch.
- The clamping unit is actively braked – with a correspondingly shorter reaction time.
- The system does not involve an extension of the cycle time which makes it well suited for fast-cycling applications.

3 Cycle time systematically minimized

Whether mold-specific cycle optimization, programming of hot runner nozzle, simultaneous injection during locking or total cycle time analysis – the control of the EL-EXIS S incorporates a host of intelligent software features which enable machine cycles to be systematically analyzed and distinctly optimized.

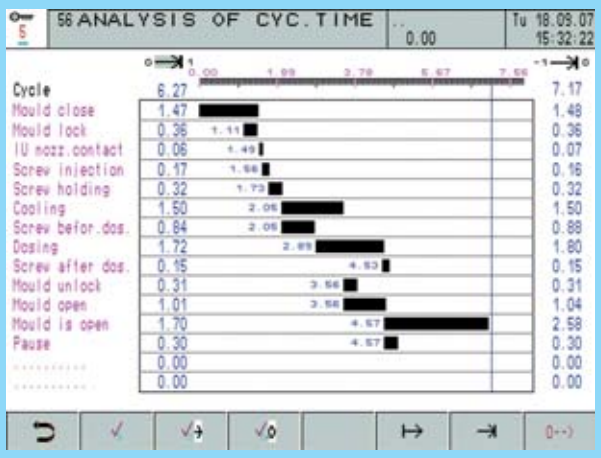
Unlimited parallel movements

The secondary movements for core pull, ejectors and nozzle contact are linear movements which have no significant impact on the machine's energy consumption. Therefore, their energy supply is from a hydraulic accumulator – separate from the main drives. This solution permits parallel machine movements without power losses – saving both cycle time and costs. Superior precision plus rapid response are ensured by the use of control servo-valve technology and ultrasonic stroke-measuring systems.

4 Faster acceleration, dynamic response of injection

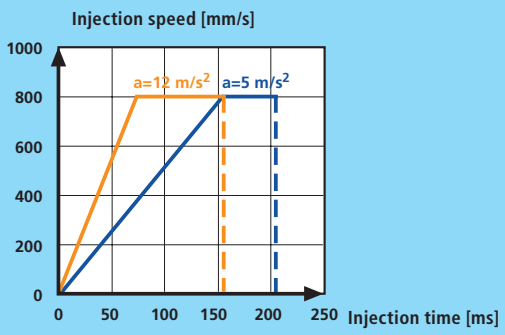
Injecting the melt for fast-cycling and thin-walled moldings requires accelerating the screw at rates of up to 1,000 mm/s. In order to achieve such high acceleration rates, it is necessary to have high capacities on call – quickly and independently of other movements. Because high-speed applications typically use small shot volumes or short screw strokes, it is important for an injection unit to respond quickly. This is the only way to obtain high injection rates and, consequently, very short cycle times. Since electric drives are limited to a fraction of the required capability, injection on the EL-EXIS S is effected through a hydraulic accumulator which has a substantially higher power density.

3



The cycle time analysis permits all process phases to be plotted, time reserves to be utilized, and sequences to be optimized.

4



Conventional injection operation (a = 5 m/s²)
injection speed setting: 800 mm/s, mean injection speed attained: 488 mm/s
injection time: 205 ms
Rapid-response injection operation (a = 12 m/s²)
injection speed setting: 800 mm/s, mean injection speed attained: 633 mm/s
injection time: 157 ms

The stored energy of the EL-EXIS S accumulator-assisted hydraulics provide extremely high injection speeds and shortest cycle times, even on short stroke applications.

EL-EXIS S Multi with second injection unit

Energy saved on drive and cooling

Another key advantage over conventional fast-cycling machines is the EL-EXIS S's low energy consumption. On average, it will save as much as 40 % compared to a hydraulic fast-cycling machine with an electric screw drive. Compared to conventional hydraulic machines, energy savings can amount to more than 50 %. And because electrical drives convert less energy into heat than hydraulic drives, cooling requirements are also less than those of an equally large conventional machine – in the case of an EL-EXIS S with 220 tons, for example, cooling power savings are 40 %.

Multiple component parts from fast-cycling EL-EXIS S Multi

Entirely new perspectives have been opened by the EL-EXIS S Multi for multi-component parts: Aside from all advantages of the single-component, fast-cycling machine, the "Multi" permits the second component to be injected by a second injection unit mounted piggyback fashion (R-position or L-position). Key benefit: The EL-EXIS S Multi comes custom-configured to meet users' specifications.

DEMANDING APPLICATIONS

Solutions for every Molded Part

From mold technology, thin-wall, in-mold labeling (IML) or multi-component machine configuration to the engineering of production cells and complete plants, we have the know-how. And we will provide you with comprehensive and seamless support from the idea to the commercial product. Our guiding principle is that "a chain is only as strong as its weakest link", meaning that we will consider each component uniquely, and will configure it to suit your specifications for top performance.

10 Points in Favor of EL-EXIS S Machines

- independent parallel movements
- high dry cycling rate
- precise travel movements reducing mold stresses
- high process consistency
- high positioning accuracy, e. g. for parts-handling systems
- highly dynamic injection
- up to 50 % less energy for drives, up to 40 % less for cooling
- active mold protection over full cycle
- smooth and quiet running
- turn-key contracts accepted for complete production cells and plants

Here are a few examples of commercial EL-EXIS S projects:

PACKAGING

CUPS AND DISHES – Thin-walled packaging articles:
Thin-walled containers, cups and lids call for a high injection speed and rapid injection response in order to positively fill the thin walls over long flow distances and to neatly pack the sealing edges at the end of the flow path. The EL-EXIS S with its accumulator-backed hydraulic system provides the force and dynamics required to meet these requirements.

PACKAGING

Thin-walled drinking cups from multi-cavity molds:
As an ubiquitous mass-produced article, drinking cups primarily call for economical high-volume production – which means fastest cycle times. As a production system, the highly dynamic EL-EXIS S attains exceptionally short cycle times – the 140 tons model being on record to reduce cycle time to less than 2 seconds. Ever new production systems are being created in combination with high-speed parts handling systems and in close cooperation with mold makers for a wide variety of drinking cups.

PACKAGING

Thin-walled yoghurt-container production with parts-handling equipment:
This system using a 2-cavity mold was incorporated in an EL-EXIS S 110. The PP-container, 14 g shot weight, has a flow-distance/wall-thickness ratio of 200 : 1. An interesting feature of this plant is the parts-handling equipment (PHE) which includes a stacking device. The PHE is mechanically inter-locked with the travel movement of the clamping unit, so there is no possibility of the gripper colliding with the mold on entry.

PACKAGING

Containers decorated with in-mold labeling (IML):
Many food packaging articles are no longer being decorated by means of adhesive labels. Modern in-mold labeling (IML) provides for prepunched labels to be automatically fed to and placed in the mold to be chemically bonded to the molded part on ejection. Its rapid response and high positioning accuracy of mold movements make the EL-EXIS S an ideal candidate where harmonic interaction is required with feed systems for the IML foil and with parts removal robots and stackers.

MEDICAL

Syringe cylinders and plungers:
Medical disposable products are another instance of high-volume production for a highly competitive market where the EL-EXIS S high-performance machine has become molders' first choice as a production system. Manufacturers of syringe cylinders and plungers rate the EL-EXIS S highly for such features as the three-platen clamping unit with five-point double toggle, its high load-carrying capacity for heavy stack molds, linear guidance for the clamping platens and center plates of multi-daylight molds.

PACKAGING

Closures – Dispensing top for vacuum beverage packaging:
Large-volume production on EL-EXIS S machines includes customized closures, such as flip tops, sport closures (push pulls), closure systems for carton packaging, as well as, PE bag closures. In addition to very high precision, reproducibility and consistency, the EL-EXIS S excels in these applications by short cycle times and a 40 % lower power consumption compared to competitors' machines.

ELECTRICAL

Technical precision parts – Connectors, mobile phone shells and mass-produced parts:
Where electrical components involve extremely long flow distances, where only a few tenths of a millimeter wall thickness exist between cores, or where thin mobile phone shells are to be molded within extremely short cycle times, processors' frequently request the EL-EXIS S. Poor-flow materials, such as PC/ABS are no problem: its plasticizing unit with high torque and parallel metering movements of the electrical screw motor provides gentle treatment and reliable production of a homogenous melt.

PACKAGING

SCREW CAPS – Premier performance for screw cap production
The EL-EXIS S is perfectly suitable for the production of standard screw closures in multi-cavity and stack molds – with short cycle times of distinctly less than 4 s (dependent on product). Electrical screw drive, hydraulic high-performance injection, independent electrical drive for the clamping unit, and ejector movement independent of the former constitute the most modern drive concept among the injection molding machines for packaging articles. And, last but not least, the EL-EXIS S offers very low energy consumption.

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The responsibility to ensure that everything runs smoothly

Many molders today operate three shifts, some 365 days a year – this calls for maximum availability of machinery, spare parts, and service support.
Backed by highly skilled service teams, advanced spare parts logistics and multiple service levels to address a customer's specific needs, we provide total support world-wide: from straightforward inspections to comprehensive maintenance, extended warranties for high capacity utilization levels, emergency hotline support, and training of your personnel.
Full documentation and a digital catalog ensure that spare parts are delivered to you in a minimum amount of time, usually within a few hours. Users of older machinery can have them upgraded by our retrofit service at fair prices, for instance, state-of-the-art control software or specialized injection-molding processes. In short, Demag service provides you with whatever support you need to complete your jobs efficiently and on schedule.

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