

An alternative to conventional set-up is offered by semiautomatic mold exchange with cart and clamping system, and the grouping of the fluid connectors in a few main connections

(photo: EAS Europe B.V.)

**Mold Exchange.** The large number of cooling circuits, hydraulic connections, sensors and heating connections makes conventional setting up of large molds a complex and time-consuming undertaking, with

many sources of error. Short set-up times offer hitherto untapped potential for improving efficiency, and the conditions for highly flexible production. New set-up packages make it easy to automate mold exchange.

## Tapping Hidden Reserves

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If a crisis becomes the dominating issue for wide sectors of the economy, it is not necessarily bad in every respect. On the contrary, crises often act as catalysts for the launch of new ways of thinking. Of course, cost reduction methods are top of the list. In terms of injection molding production, that means re-evaluating automation options that have been available for around 25 years, but not fully utilized. By this means, set-up work can be shortened to less than three minutes. The Austrian injection molding machine manufacturer Engel has picked up on this trend again and is extending its set-up range for mold exchanging equipment, particularly in combination with the En-

gel duo line of medium-sized and large machines.

### The Number of Long-running Jobs is Declining

Though a production plant's goal should be to use its resources efficiently, the picture is often different in reality. Production generally takes top priority and the efficiency here is being improved continually, however, much of the efficiency gained is squandered again because of the poor efficiency for set-up. With long-running jobs and large orders, this does not result in significant cost disadvantages. However, the number of long-running jobs is declining steadily. It is only in the packaging industry and parts of medical technology that long-term production without the need for set-up is still the rule. In all other industries, the trend towards individualization has resulted in smaller batches with a greater diversity. As a re-

sult, unless appropriate countermeasures are taken, set-up takes up an increasing amount of the time, and productivity falls proportionally.

At Engel, a statistical analysis of the technical delivery specifications of medium-sized and large machines showed that only 5 to 10 % of the machines in the clamping force range between 5,000 and 40,000 kN are ordered with equipment to speed up mold and material exchange ex factory. Although the necessary ancillary

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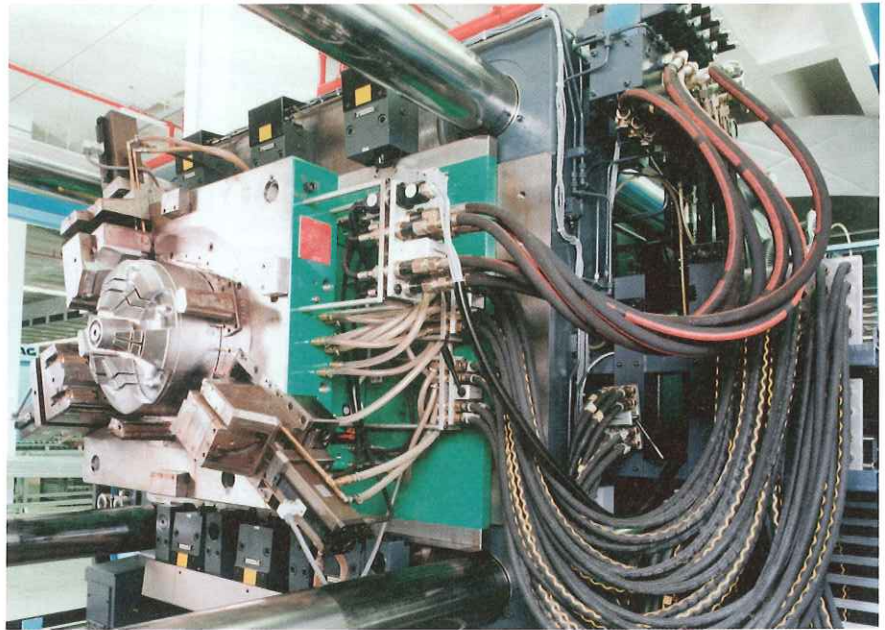
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modules, such as mold clamping systems, quick-action media couplings, preheating stations or mold transport systems have been available for around 25 years, a comparison performed over several years shows that the amount of ancillary equipment ordered to automate production changeover remains persistently at a low level.

The search for the causes revealed some surprising facts. One of the main reasons is still the fact that many plants still do not have an integrated approach to investment in modernization. They often only focus on the production capacities of machines. Systematic improvements in material flow, mold infrastructure or ancillary equipment are often neglected. This focus is the reason why equipment for streamlining the set-up process, e.g. quick-action clamping systems, are left out of the machine budget. Retrofitting the equipment or accepting the reduced efficiency are the only alternatives.

The profitability of investing in reducing set-up time is documented by empirical projects gained from implemented projects. A savings potential of 70 to 90 %



**Example of an injection molding machine adapted for rapid mold exchange: Mold clamping takes place via hydraulically operated clamping elements. The fluid connections are grouped together on coupling terminals** (photo: EAS)

over mold exchange by traditional, completely manual methods is realistic – for every machine and every mold exchange in a production shop.

### Menu-guided Mold Exchange with Enormous Savings Potential

Engel has been developing a comprehensive program of set-up modules for its entire machine range for around 25 years. In extending its Engel duo large-machine range to the medium-size range, Engel also overhauled and improved its mold changing equipment.

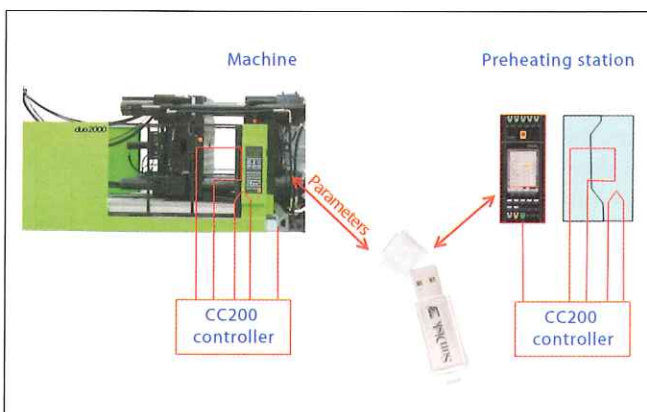
A new feature is the menu-guided mold exchange. It is a software module for interactive user guidance during semi-automatic mold exchange. The operator is guided through the sequence, and the program steps are performed automatically where possible; manual steps must be acknowledged in the control unit. The sequence itself can be planned offline on the PC on a virtual machine before the actual set-up process, and then transferred to the production machine. The menu-guided mold exchange eliminates procedure errors. Compared to the conventional personnel-dependent sequence, set-up can be reduced to about 60 %. In many cases, the time comparison was performed on an appropriately set-up machine in combination with matched injection molds with standardized interfaces for mold mounting and fluid couplings.

The “mold exchange” program module is also suitable for combination with an automatic mold changing station – either a cart with docking station or a fixed station with one or more mold po-

**Specific program modules are available for programming mold exchange. It can either be performed online on the machine or offline on the PC** (photo: Engel)



**The preheating of the injection molds to operating temperature is a key prerequisite for rapid production changeover. Machine-software program modules are available for actuating the temperature-control units and hot-runner heaters** (graphic: Engel)





The operating dialog of the preheating-station control terminal has the same operating logic as the machine control

(photo: Engel)



sitions. In this case, the program runs automatically without intermediate acknowledgement of individual program steps and synchronizes with the necessary set-up movements of the machine. A dedicated PLC is used for internal control of the mold station.

**Reducing Plant Complexity, Minimizing Downtimes**

To minimize the machine downtime between two production orders and rapidly exchange the molds, it is necessary for the new mold to be heated ready for production start. That means it must be preheated. That applies for both the hot run-

ners and the cavities themselves. Engel supplies a new control concept for the preheating station, with an appearance and control logic similar to the machine control. The mold parameters can be imported from the machine from the operating terminal via data storage media. The settings of the heating zones and error connection codes are identical to the machine. The Engel preheating station can be expanded with machine-specific options, e.g. heat flux monitoring, integration of temperature-control equipment and integration into the e-factory network.

To improve ease of operation and at the same time reduce the complexity of

a production cell with integrated mold exchange equipment, Engel will soon be integrating the movement control for the mold exchange station completely into the machine control. The advantage of integration is to integrate all the external plant modules – from mold exchange cart through preheating station for the hot-runner heaters, to the coupling station for the fluid temperature control, including the temperature-control equipment – in a control unit of the machine control, and to manage it all in one program file. The same applies to actuating stand-alone mold exchange systems for several machines, except that the plant control is performed by a single control unit.

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Another innovation is the introduction of an intelligent transponder in the machine's clamping unit for mold identification. This unit allows information such as the mold identification number, key data, operating hours and service intervals to be exchanged between the machine and mold, and stored in the mold.

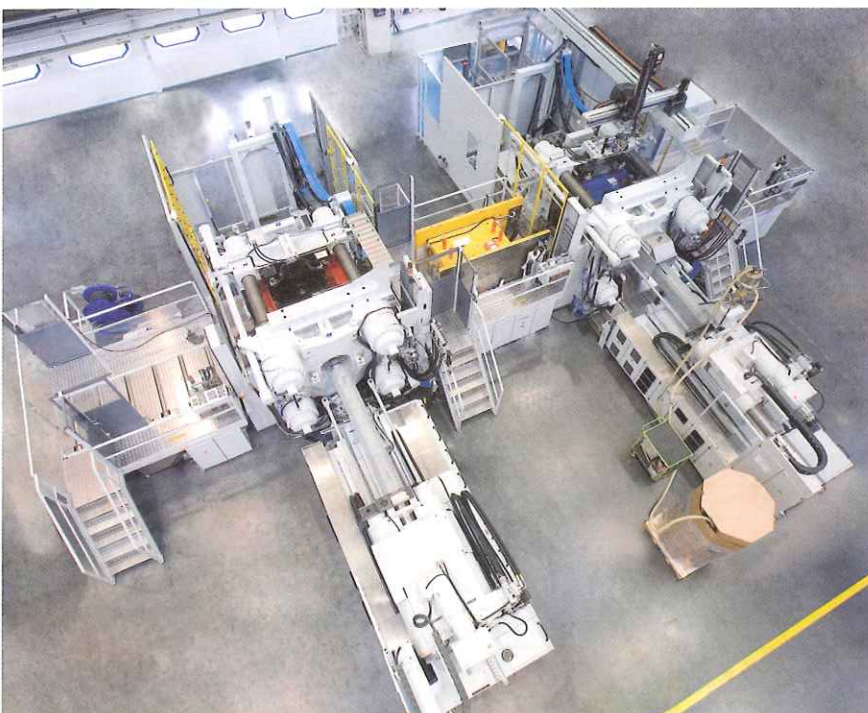
**High Value-creation Potential**

Reduction of the set-up time increases the useful potential of a system. Short set-up times make even small production batches increasingly economic and make it easier for the processor to adapt to changing market circumstances requiring maximum flexibility. The challenge now is to use the crisis as an opportunity and orient production to it. ■

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Example of a production line for alternating production of components of a subgroup in small, matched batch sizes. This presupposes frequent mold exchanges (photo: Engel)