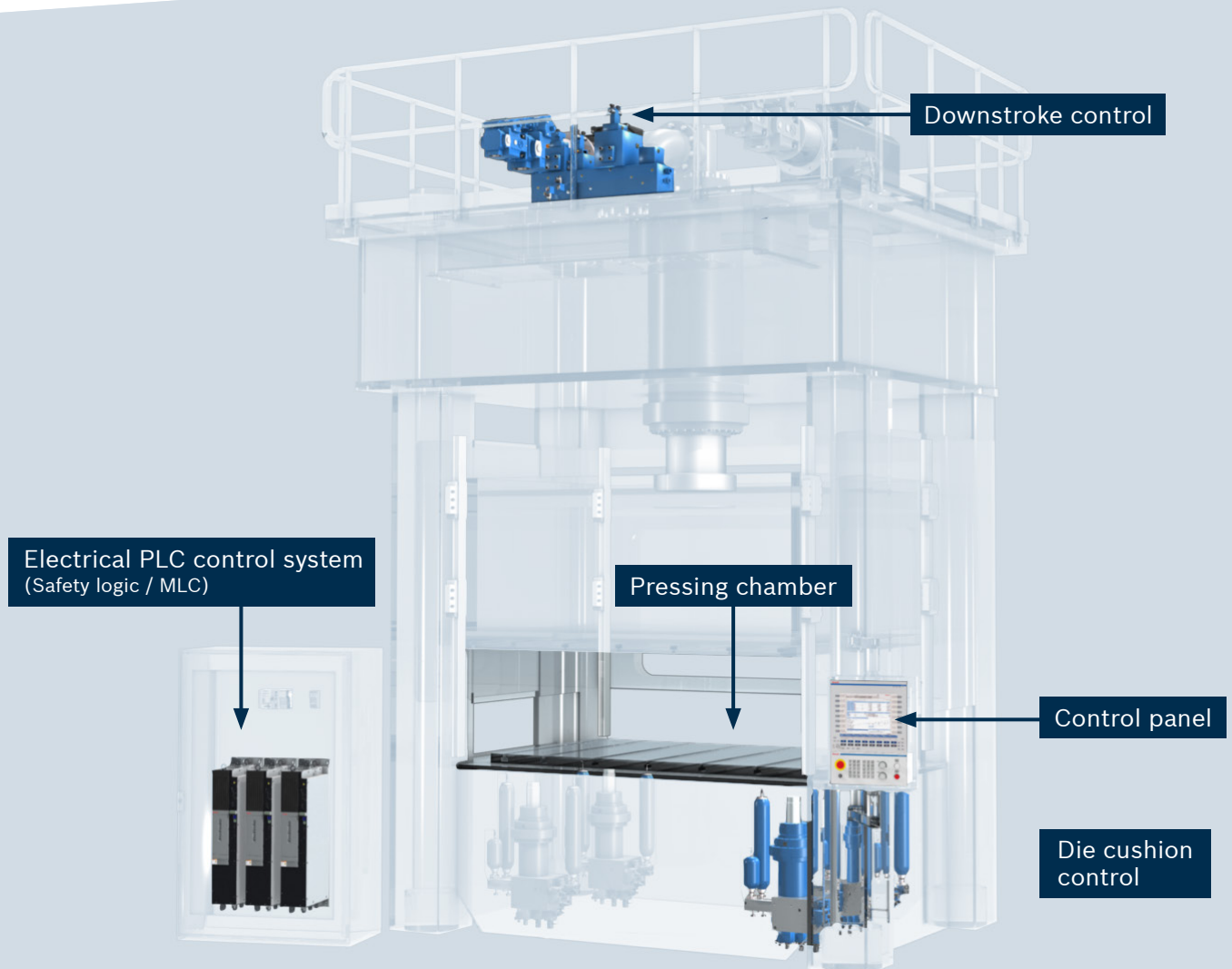


Forming the quicker, safer way:

how certified press modules increase

operational safety, improve energy

efficiency and reduce costs.



Functional safety allows no compromises. However, engineering and power consumption can always be reduced. How can press manufacturers meet the typical safety requirements specified in EN ISO 16092-3 and EN289 quickly and in a cost-effective manner while increasing energy efficiency at the same time?

Companies that manufacture hydraulic presses or rubber and plastics processing machines must ensure that these machines operate safely. The hydraulic systems must be designed to minimize the risk to the operator's health and any residual risks from the start. Constructors therefore face a challenge – they must carefully define how the protective and command systems will interact with the hydraulic safety control system.

The best way to do this is to use a general safety control system in accordance with ISO16092-3 for hydraulic presses or EN289 for plastics and rubber machines. If these standards for all design variants are met, machine safety depends neither on the size of the press module nor the way in which the press works.

And if the same switching cycle can be used all the time, the effort required to produce the safety program is reduced significantly. This is particularly true if the requirements of the 2006/42/EC directive (machinery) are already met. If the press modules are supplied as a ready-to-install system and can easily be connected to the electrical safety control, the commissioning outlay is also reduced. Detailed documentation at the end of the configuration process speeds up CE certification for the press or the machine.

NEED FOR GREATER ENERGY EFFICIENCY

In addition to functional safety, operators are increasingly focusing on energy efficiency and an improved energy balance for the overall system. In the case of hydraulic presses, these are directly linked to the cycle times and the power requirement. As a result, there are two possible approaches when it comes to improving energy efficiency:

1. with a defined drive system, the priority is to use the installed drive power as effectively as possible.
To shorten the cycle times, constructors can move the downstroke tool into the pump's power regulating system later on in the pressing process and thus reach the lower dead point more quickly.
2. If the drive concept can be changed, there is no need to buy a completely new system straight away.
Instead, it is worth finding the hydraulically relevant components and checking whether an energy-optimized press module would increase efficiency and whether downsizing is possible.

MORE POWER WITH LOWER COSTS

Energy-optimized press modules use special switching conditions to fundamentally reduce the pressure losses between the pump and the actuator. A 40 percent reduction here means 40 percent more power for the net pressing force. Compared to conventional manifolds, the press modules in Bosch Rexroth's IH04 range come close to achieving this figure. If the hydraulic systems can be downsized as a result, this offers significant cost benefits. Further cost benefits can be achieved in the engineering because combining standard building blocks in a modular fashion takes up much less time than developing and implementing individual hydraulic controls.

READY-TO-INSTALL MODULES WITH TYPE-EXAMINATION PROCEDURE

Because the modular IH04 solution from Bosch Rexroth results in ready-to-install switching systems which take into account functional safety, the engineering complexity is reduced all the more. The type-examination procedures for the downstroke and upstroke modules in accordance with EN ISO 16092 and EN289:2009 have already been carried out or requested. As a result, all safety requirements for operating modes including individual stroke, automatic, set-up with two-hand operation in accordance with PL e or reduced closing speed below 10 mm/s in accordance with PL d can be met with minimal outlay. The same applies to muting with a light barrier integrated into the press. The modular system with a standardized safety concept is made up as follows:

1. DOWNSTROKE MODULES WITH DOWNSIZING POTENTIAL

The possibility of downsizing with reduced costs is all the greater if the press modules are available in various finely graduated sizes. Constructors can choose two between types from Bosch Rexroth's current IH04 range with a standardized safety concept: Type C is available in five standard sizes (10, 16, 25, 32 and 35) and is aimed at applications with flows of up to 2,000 l/min and pressures of up to 350 bar. The IH04 Type D module in cast iron is available in two standard sizes (6 or 10) and is suitable for up to 80 l/min and up to 315 bar.

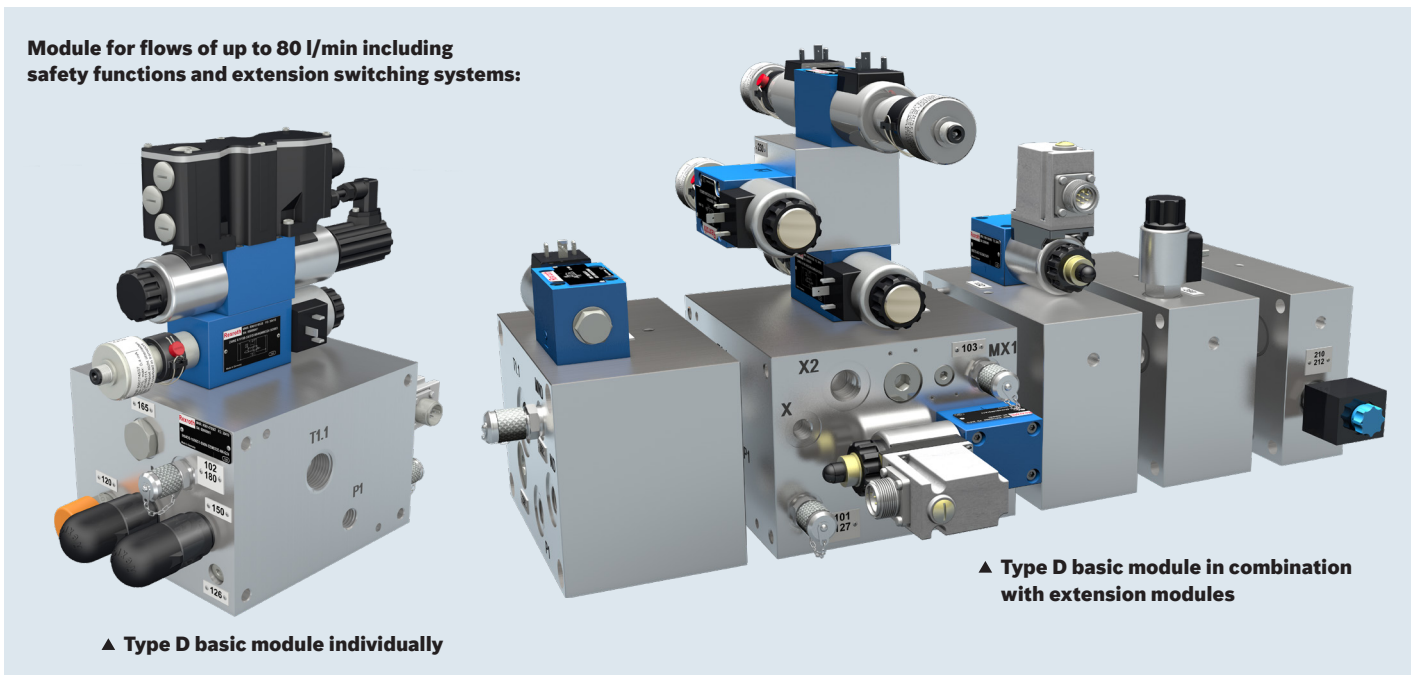
Both modular systems comprise at least one basic module, a directional valve to control the flow and function-dependent extension modules. The latter cater for all common hydraulic functions and also offer structural advantages such as lateral supply connections. This way, a range of pressure and position control functions in the open circuit including safety functions can be achieved. On the software side, a comprehensive library of safety modules for the safety PLC in accordance with PLCopen is available. These include control systems for the upper piston, the hold-down device, the ejector and the press ram.



▲ Type-examination tested module for hydraulic press control with a volume flow of up to 2,000 l/min: Type C basic modules with extension modules and directional valve

Size			10	16	25	32	35
Operating pressure	bar		350	350	350	350	350
Rated flow	Pump	l/min	140	300	600	1000	2000
	Piston chamber → Tank	l/min	250	500	700	1200	2100
	Annulus area → Tank	l/min	140	300	600	1000	2000
Recommended pumps A4VSO LR2N, HS5(E), SYHDFEn A15VSO LRDR(G) A10VSO DR(G), LA D(G/S), SYDFED	cm ³		71 100	180 210 180	250-355 280	2x 355	4x 355

▲ Performance overview and sizes – IH04 Type C press modules

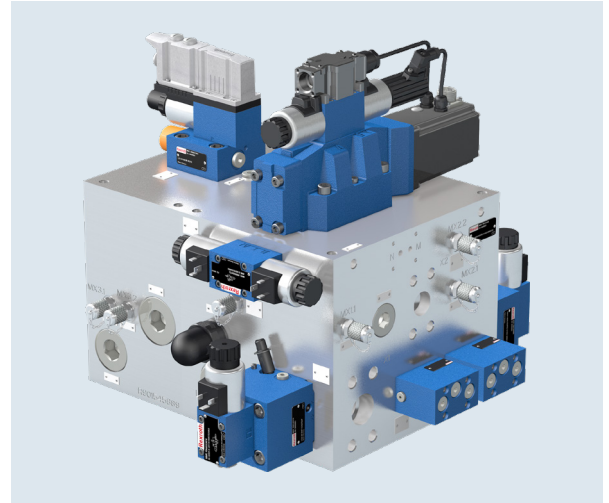


Size			06	10
Operating	bar		315	315
Rated flow	Pump	l/min	40	80
	Piston chamber → Tank	l/min	80	200
	Annulus area → Tank	l/min	40	80
Recommended A4VSO LR2N, HS5(E), SYHDFEn A10VSO DR(G), LA D(G/S), SYDFED	cm ³		28	45 (71)

▲ Performance overview and sizes – IH04 Type D press modules

2. MATCHING UPSTROKE DIE CUSHION BLOCK MODULES

In order to increase the energy efficiency, cost-effectiveness and hydraulic control options on the press beyond the upper piston, Bosch Rexroth has expanded the IH04 modular system to include suitable upstroke die cushion modules in accordance with DIN ISO 16092-3. The Type E modules for volume flows of up to 2,000 l/min have been optimized for efficiency and concept-tested. They will be launched in the sizes 10, 16, 25 and 32 in the second half of 2021. With the IH04E modules, die cushion functions with active and passive pressure control can be achieved and optimized for efficiency and costs. The available extension functions include Load Sensing (LN), Differential Circuit (DN), High-Response Valve with Zero Overlap (RN) or a combination of Differential Circuit and Load Sensing (DL).



▲ IH 04 Module für Unterkolben Ziehpressen

FUNCTIONAL SAFETY MADE EASY

To ensure safe operation in accordance with EN ISO 16092-3, Bosch Rexroth supplies a certificate for the type-examination procedure for each Type C press module. Within the control system, performance level d is achieved in set-up mode and a Cat4 performance level e for hazards when opening and closing. This prevents accidental lowering owing to the unit's own weight, an unintended start-up from the rest position or the dangerous closing movement being stopped. The IH04 press module meets all safety requirements for operating modes including individual stroke, automatic, set-up with two-hand operation in accordance with PL e or reduced closing speed below 10 mm/s in accordance with PL d. During muting, a process-controlled light barrier system ensures that operating personnel can reach into the pressing chamber to put things in it or remove things without endangering themselves.

IH04 Type	Safety measure for the hazard type	Extract from standard	Performance-Level	Safety category
Type C & Type D	Prevention of unintended lowering due to own weight	ISO 16092-3 Section 5.3.7.2	e	4
	Avoiding unintended start-up from the resting position	ISO 16092-3 Section 5.4.1.1.4a)	e	4
	Stopping the dangerous closing movement	ISO 16092-3 Section 5.4.1.1.4c)	e	4
Type C	Safe reduced speed below 10 mm/s with hold-to-run device	ISO 16092-3 Section 5.3.2	d	3

▲ Safety functions and performance level for IH04 Type C and D downstroke modules

SUMMARY OF THE COST BENEFITS

With the help of a modular system for press modules, machine manufacturers can ultimately reduce their design outlay too. A sales specialist from Bosch Rexroth configures the required module with the help of a design tool and determines the list price. The intelligence built into the software avoids design errors. Safety modules for the safety PLC minimize the programming outlay and further reduce the engineering costs. Compared to accumulator operation, the hardware and installation costs are lower if similar flows and pressure losses can be achieved with a smaller press module from the point of view of the load spectrum. An expensive “size jump” can also be avoided. Together with the Motion Control System MLC and the Safety Logic safety control system from Bosch Rexroth, users benefit from a ready-to-install state-of-the-art system which minimizes internal process costs at the same time.

CONCLUSION

Press modules which are optimized for efficiency and feature a standardized safety concept and test certification offer machine manufacturers the opportunity to gain a range of attractive competitive advantages. These range from safe operation with minimal residual risk and a better energy balance of the press to a lasting reduction in costs thanks to downsizing and considerable time savings for engineering, commissioning and assembly. The positive effects on the manufacturing costs and time to market become even greater the more comprehensively the modular approach is used, for example for downstroke and die cushion functions. Bosch Rexroth is adding new functions and press types all the time. As a result, the range of applications and the potential for optimization will continue to grow.