Drive Solutions for Excavators.

Linde Hydraulics

Linde Hydraulics.
Turning Power into Motion.

At Linde Hydraulics we have always had a passion for converting power into motion. This passion is driven by customer care, a thirst for knowledge and a love of innovation. We power ideas, machines and markets, both today and in the future.

We combine components to a system and create efficient overall solutions thanks to our intelligent blend of hydraulics, electronics and mechanics. Our aspiration can be summed up by one simple concept: Adding customer value through application expertise and the pursuit of system perfection.

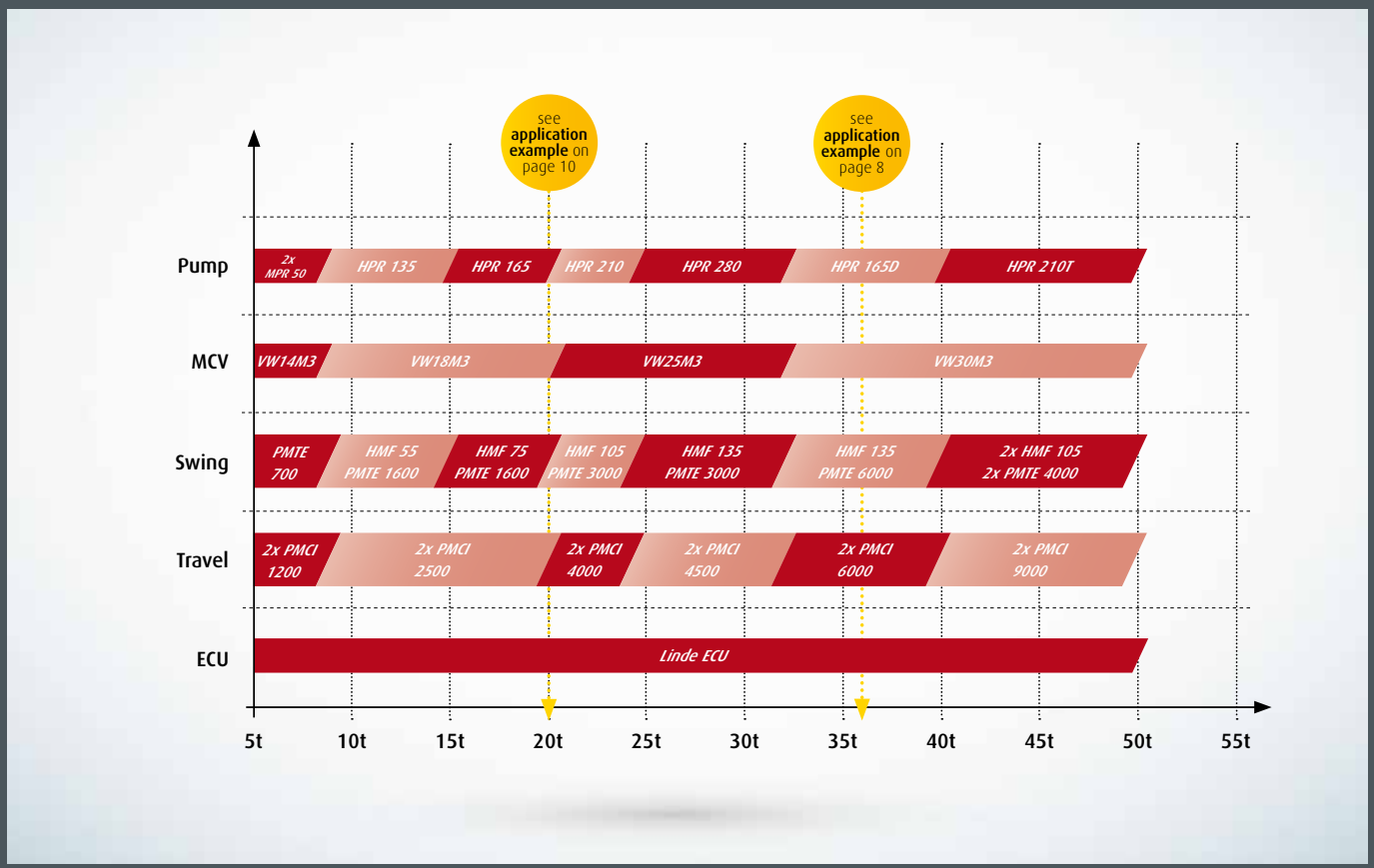
Linde Hydraulics makes all of this possible due to a combination of partnership, responsibility and the highest level of commitment.

For us, partnership is an important, indispensable part of product development and quality assurance. Therefore, we add our knowledge, experience and international market expertise to help you exceed your customers' expectation. We strive to be your best partner from initial contact to project engineering and product development, all the way through prototype commissioning, serial production and training your teams.

Our interpretation of the term customer orientation is superior service and availability: worldwide, at any place. With companies in Europe, USA and China along with a great international network distributors we guarantee you the best possible customer service.

Portfolio.

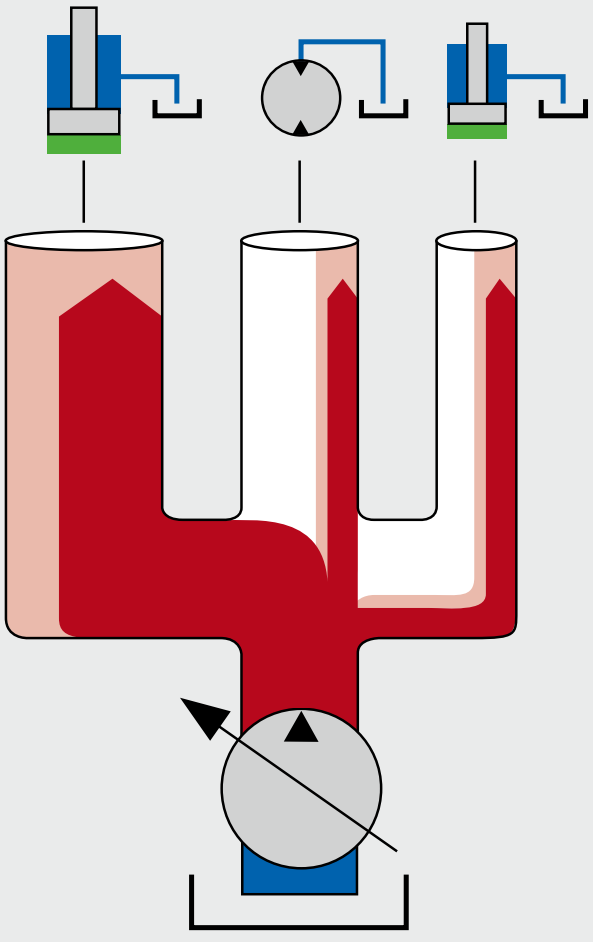
The graphic below provides a help for the selection of units with the focus on tracked excavators. But Linde Hydraulics is your partner for every kind of excavator. By the logic combination of individual products that perfectly complement each other we offer solutions for almost every class of machines. Due to these capabilities we can always offer the best possible system to our customers.



LSC - Linde Synchron Control.
The Social Flow.

Linde Synchron Control (LSC) is a valve technology system for open high-pressure hydraulic circuits. It is a load-sensing (LS) system that consistently guarantees identical machine responses in terms of sensitivity and speed when the operator's input is the same.
It does this independent of the load involved, and even when there are multiple actuators of different pressure levels. It stands out from other LS systems thanks to its pressure compensators, which are logically set downstream and enable proportional flow distribution. If the volume required by all actuators exceeds the delivery rate of the installed pump(s), no actuator will suddenly stop. Instead, all actuators will be reduced accordingly and the installed power will be utilized in an optimal way. Machines with LSC are therefore intuitive to operate while enabling reproducible workflows and guaranteeing excellent handling performance. It is also highly efficient: The demand-based pressure and volume flow regulation ensures that the prime mover only has to provide precisely as much power as the task requires. This saves energy, particularly in partial load operation.

Closed center valves only open once the pump pressure has reached the load pressure level, preventing any lowering of the load in idle mode and at the beginning of the movement.
In addition, no circulation flows are required when the machine is idle. The pump can be set to a minimum level and there is practically no loss of power. The system therefore saves a substantial amount of fuel, particularly in comparison to systems with circulation pressure compensator and open center designs. The LSC features parallel system architecture. This means that additional actuators (at additional directional control valve sections) can be easily integrated into the system without altering the existing components or resetting the machine. Multiple circuit systems are also possible. The system and its components are therefore basically the same for every sort of machine. Application-specific requirements can be implemented via individual A- and B-side characteristics, adjustable flow regulators, pressure increase and priority functions as well as pressure and speed regulation.
The result is a machine that offers consistently intuitive and sensitive operation with the ideal setup.



— Demanded Flow (150% Pump Capacity)
— Distributed Flow (100% Pump Capacity)

Design

- load-sensing system with downstream pressure compensators (post-compensated LS)
- parallel architecture (common LS signal for all actuators)
- directional control valves in closed center design

Functionality

- highly dynamic pump controller
- demand-based supply to actuators
- simultaneous movements of several actuators, independent of the load
- proportional oil distribution even at saturation
- load held in position when movement begins
- outstanding fine control, no need for readjustment
- machine movements can be reproduced exactly through precise control of actuators
- optional additional functions

Advantages

- precise and sensitive control, simple and intuitive operation
- optimal movement continuity even for combined movements
- effortless and efficient work
- perfect calibration of individual work functions for a customer-specific machine characteristic
- superior handling performance
- excellent energy efficiency and thus low fuel consumption

The LSC system.
Bottomline benefits

Flexibility in machine design

— simple, parallel interconnection of actuators with one common LS signal

High productivity

— compensation of load effects and simultaneous movement of several actuators, even in the case of saturation
— intuitive operation without readjustment
— extremely short actuating times of the regulating pump
— high machine dynamics

Excellent system efficiency

— low losses
— save fuel
— enable a smaller cooler design
— high productivity

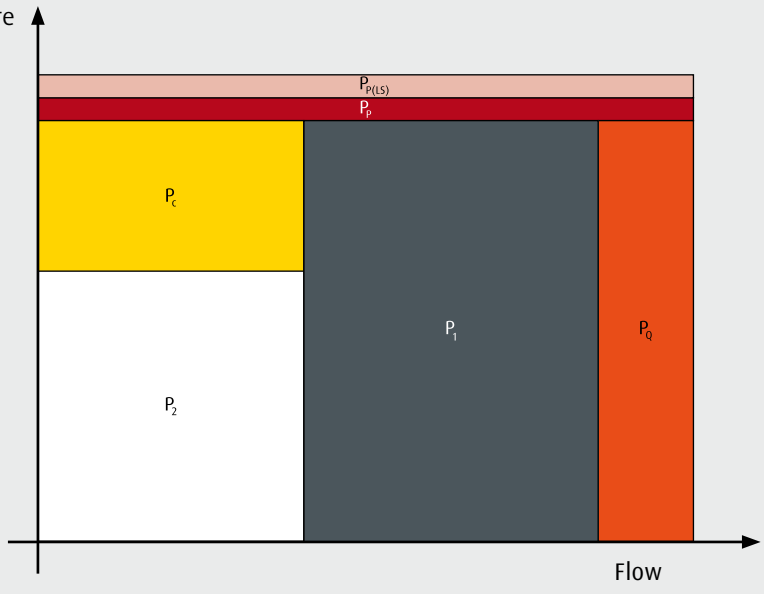
System comparison.
NFC, PFC and LSC in detail.

Around the world we find three main, but generally different concepts of open loop hydraulic systems. **Negative Flow Control** (NFC), **Positive Flow Control** (PFC) and **Load Sensing** (LS). In an unbiased comparison the Linde Synchron Control (LSC) has turned out to be clearly the most efficient system.
An example machine with a 120 kW diesel engine, a hydraulic pump with a flow rate of maximum 400 liters per minute and 2 actuators with the values described above, served as basis for this comparison.
The illustration below shows the power ranges of the two actuators and the resulting power losses.
Since both actuators are operated on different pressure levels, so-called compensation losses (P_c), occur in the system, which equalize these differences. The power of the actuators (P_1 and P_2) as well as the resulting compensation losses (P_c) are assumed to be almost identical in all systems. The comparison graphs on page 7 therefore only show the pressure related losses (P_P and $P_{P(LS)}$) and flow related losses (P_Q) of the three systems in comparison.

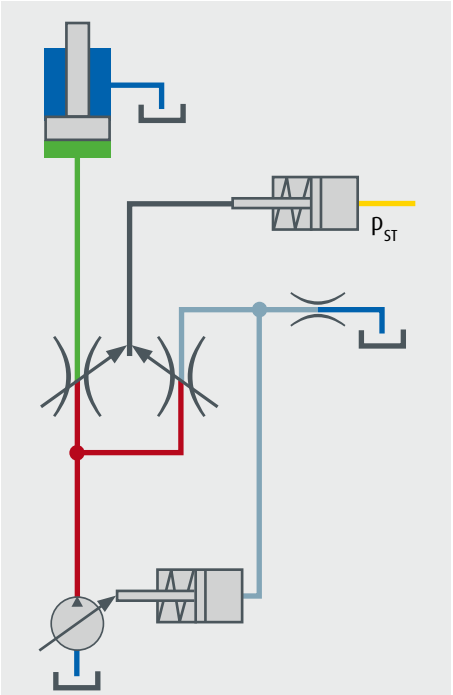
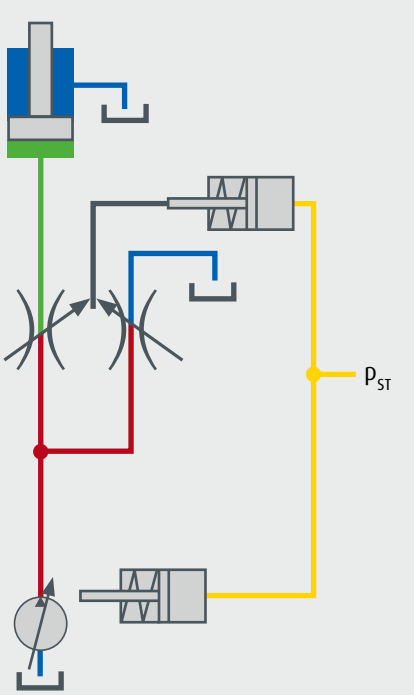
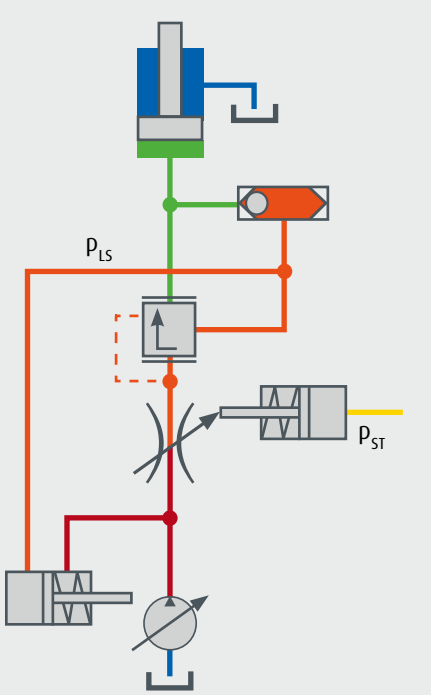
Actuator 1
— Pressure level: 300 bar
— Required flow under partial load: 50 l/min
— Required flow under full load/saturation: 300 l/min

Actuator 2
— Pressure level: 200 bar
— Required flow under partial load: 50 l/min
— Required flow under full load/saturation: 300 l/min

System
— Power of diesel engine: 120 kW
— Capacity of pump: max. 400 l/min



System comparison.
The architecture.

NFC	PFC	LSC
		
Dynamic pressure in bypass generates pilot signal	Evaluation logic generates pilot signal	Pressure demand generates pilot signal
Self-regulating pump	Variable displacement pump	Self-regulating pump
Default = Vmax	Default = Vmin	Default = Vmax
„open center“	„open center“	„closed center“
Continuous bypass flow	Continuous bypass flow	No bypass flow
No compensator	No compensator	Secondary compensator

Functionality

The **NFC system** uses a measuring orifice in the bypass oil flow to generate a pressure signal, which influences the swash angle of the regulating pump.

In **PFC systems** the control signal is used to control both valve and pump. A complex evaluation control consisting of valve cascades in combination with software determines a certain swash angle for the pump. The algorithms are exactly matched to the individual machine with a fixed configuration. Operability and efficiency are trimmed for a specific, predefined application.

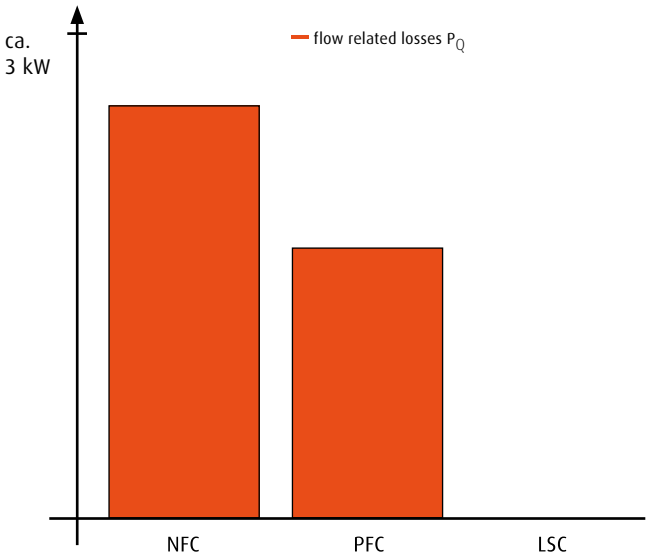
Load Sensing directional control valves are generally equipped with a compensator. The LSC system is equipped with a compensator for each actuator side. This compensator determines the pressure currently required at the actuator and feeds a pressure signal* back into the LS line. All actuators share this LS line, irrespective of their number. The LS signal is the only signal the pump requires to provide short-term and on-demand flow under high pressure. Additional actuators are connected to the LS line and can thereby be simply integrated into the system. With this it is possible to fit differently equipped machines with a generally identical LSC system.

* The graph on page 4 shows the resulting power as $P_{p(LS)}$.

System comparison.
Power losses under different load conditions.

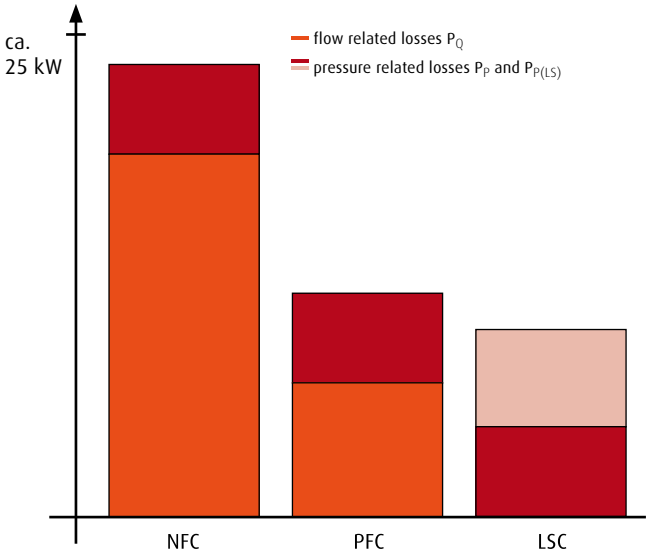
No-load

If no actuator is operated, the directional control valves are in neutral position. NFC and PFC are so-called „open center“ systems. In these systems the pump and tank paths are connected in neutral position. This way the pump permanently delivers an unused flow through the valves back to the tank, in addition to the leakage. In the NFC system up to 50 liters per minute run unused through the machine, in the PFC system up to 30 liters per minute. Due to the corresponding dynamic pressures this results in considerable power losses (P_Q). The directional control valves in the LSC system are designed as „closed center“ valves. Pump and tank paths are not connected in neutral position. Under no-load conditions the pump is regulated back towards zero. It generates a standby pressure of approx. 30 bar. However, since no oil is flowing, the power loss (product of pressure and flow) is zero.



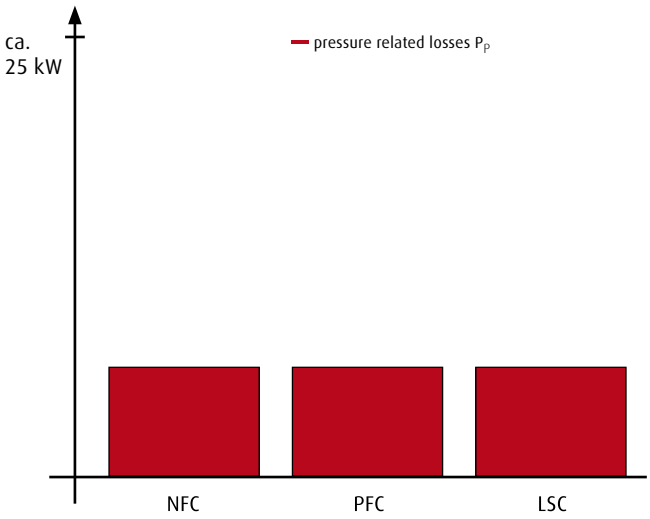
Partial load

If an actuator is to be moved, the operator triggers a control signal. This signal is fed to the spool in the directional control valve. Under partial load one or several actuators are operated. The pump delivers the requested flow and generates the highest demanded pressure. NFC and PFC directional control valves reduce the flow from pump to tank to divert it to the actuators, but still continue feeding oil back into the tank. With the LSC system the pump flow is increased just enough to meet the demands of the corresponding actuators, because the pump does not need to compensate for any bypass flow losses. Even in this situation the pump is always operated under the most favorable conditions.



Full load

If several actuators are operated at the same time and thus require more oil flow than the pump is able to deliver, the system is in saturation. In this condition the NFC and PFC systems no longer deliver any oil back to the tank. Besides the compensation losses, only pressure related losses are relevant. In the LSC system the Δp_{LS} drops because of the flow shortage. The pressure related losses of the three systems under full load are approximately identical.



System comparison.
Movement and operation behavior.

Partial load. Load independent actuator movement without readjustment by operator.
If, as in the example, several actuators need to be operated at different pressure levels, the pump needs to provide the pressure demanded by the actuator with the highest pressure requirement. With NFC and PFC systems the operator needs to take this into consideration and actuate or readjust the control elements on the machine as required for the number and pressure levels of the actuators. The LSC valve spool contains a compensator and pressure copier. The highest LS signal is always transmitted to the pump. The compensator in the directional control valve of an actuator on a lower pressure level automatically compensates for the pressure difference. The control signal does not need to be corrected. More load on the actuator generates a higher LS signal. The pump, in turn, provides a higher pressure and thereby compensates for load changes. The control signal is independent from the applied load. The operator never needs to make any readjustments. Apart from this, both compensator and pressure copier determine the load applied to the actuator, even before it is operated. The spool opens the passage between pump and actuator path only after the pressure level of the pump has reached the load pressure level. This ensures that a load will not drop before the start of operation.

Saturation. Consistent Operation thanks to Proportional Flow.
In the example both actuators together would demand 600 liters per minute from the pump which is only able to deliver 400 liters per minute. In NFC and PFC systems certain actuators, which are positioned lower in the control logic or have a pressure level which creates a higher resistance for the available oil flow, will stop while all of the flow goes to the main actuators. This is also the case in Load Sensing systems with upstream compensators.

The operator needs to reduce the flow to some actuators to supply other actuators with oil. Permanent control actions are required and make operation difficult.

In the LSC system the compensators are arranged downstream. For this reason one also refers to it as a „post compensated" Load Sensing system. This enables the so-called „Proportional Flow". The system can be operated as usual, even under saturation. The pump delivers the maximum flow. This flow is distributed to all actuators according to their proportional requirements. A fully operated actuator receives double the amount of oil as a half operated actuator with identical power. In the example both actuators receive 200 liters each. Neither function will stop.

Higher efficiency with LSC.

Duty cycle
The duty cycle of a machine consists of no-load, partial load and full load phases. Statistically the combined movements of individual actuators in the partial load range make up the majority of the cycle time. The efficiency of differently equipped machines of the same power class can be compared by measuring the time and fuel consumption when performing identical duties.
Here the LSC system excels in both aspects. In machines with complex duties and varying applications, measurements confirm a 10% advantage in efficiency over competing systems. Pressure and flow are always made available as required at the optimal point in time. The drive power is utilized efficiently, no energy is wasted. Thanks to the intuitive, load independent operation, machines with the LSC system achieve high productivity.
Owners of machines save twice: On the one hand they save on fuel, on the other hand in labor costs.

Application example.
Tracked excavator, 36 t.

Equipment

- A 1x HPR 165-02 Duo (pump)
- B 1x VW30M3/6 (valve monoblock)
- C 2x PMCI6000 (drive motor)
- D 1x PMTE6000 (swing drive motor)

Advantages

- High performance with compact dimensions thanks to double pump and directional control valves in monoblock design
- Simple expandability of the LSC system without recalibration
- Short regeneration paths in the directional control valve
- Robustness and longevity

Options

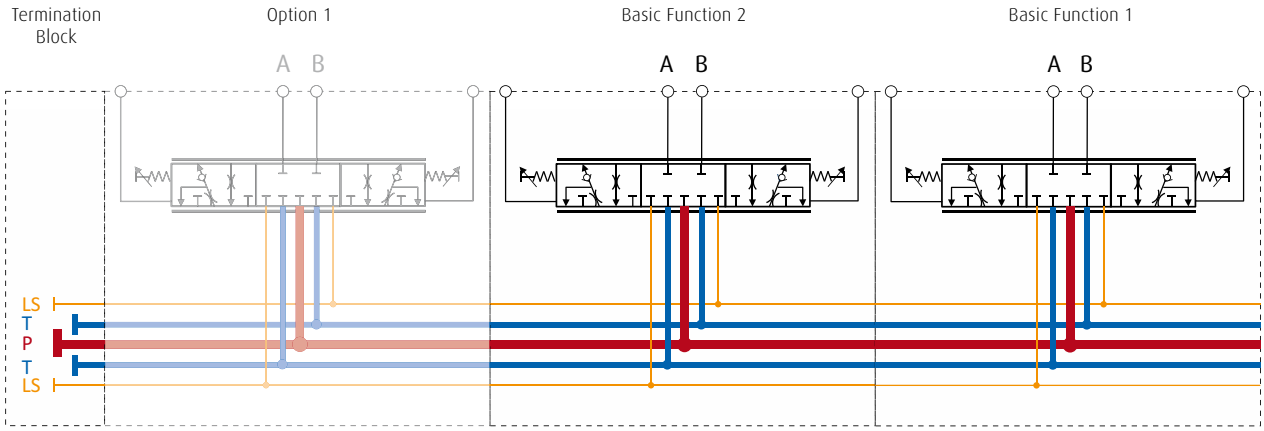
- Single-circuit or multi-circuit systems, combined dual-circuit capability
- Hydraulic or electrohydraulic actuation
- LSC+

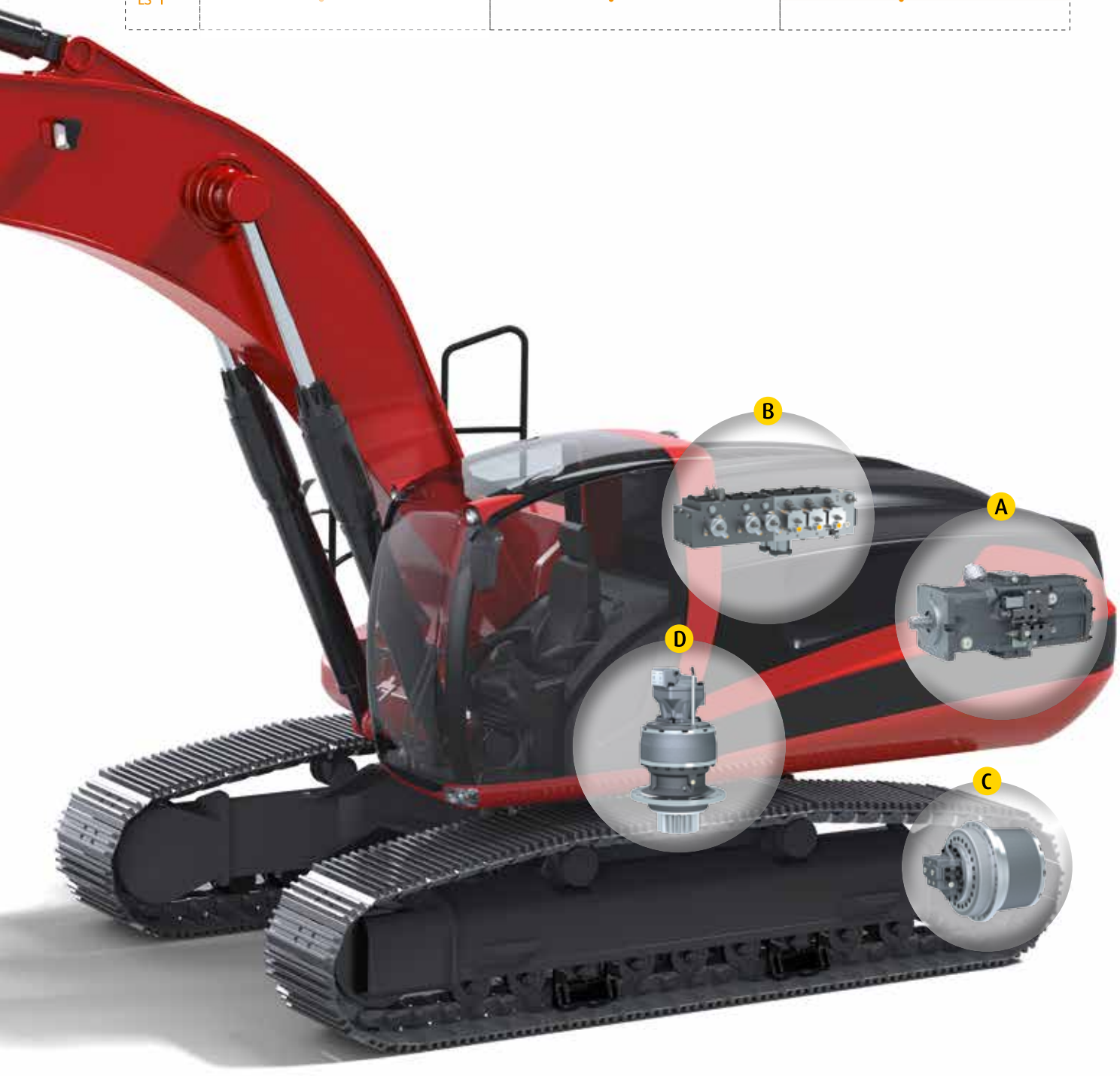
The LSC system is high-performance and adjustable. Machines with LSC are not only intuitive, easy to use, and versatile, but are also extremely powerful, as this example of a tracked excavator shows.

The control plate in the monoblock design is impressively compact. The real benefits can be seen inside: optimised supply channels with large cross-sections supply the directional control valves, which each feed up to 600 litres of oil per minute to the actuators. For extreme demands, functions can also be fed by combining multiple valves. The regeneration function of the actuator, i.e. the back-flow of the oil from the piston side to the rod side of the boom, for example, is performed in the directional control valve itself with minimum deflection.

The double pump in the design example provides the hydraulic power for the machine with 700 litres of oil per minute and can be used as a single-circuit or double-circuit pump. As such, the bucket has impressively high tear-out force and the machine demonstrates high handling performance with the low consumption and excellent operation that typifies the LSC system. Not only can it move many cubic metres of material per hour, but also per litre of fuel spent.

Basic machines for demolition work stand out thanks to another feature of LSC technology: the parallel architecture. Despite the compact design of the monoblocks, these also allow additional functions to be added later. Sandwich valves with a range of nominal sizes can be inserted between the existing sections and the cover plate and use pump and tank channels as well as the LS signal. However, the real advantage is that the system does not need to be recalibrated neither the orifices need to be exchanged.


Termination Block
Option 1
Basic Function 2
Basic Function 1
A B
A B
A B
LS
T
P
T
LS


B
A
D
C

Application example.
Wheeled excavator, 20 t.

Equipment

- **A** 1x HPR 210-02 E1L SPU (main pump)
- **B** 1x HMF 75-02 P (swing drive motor)
- **C** 1x HMR 135-02 (travel motor)
- **D** 1x VT5 (directional control valves)
- **E** 1x Electronic control unit

Advantages

- intuitively operated universal machine
- social flow distribution
- fatigue-free working
- minimal pulsation

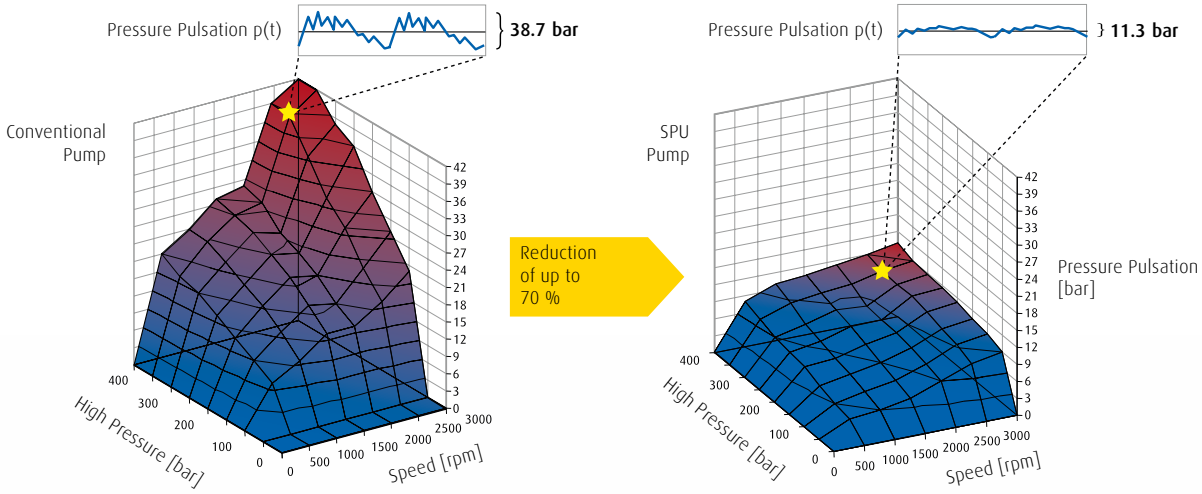
Options

- single-circuit or multi-circuit systems
- adjustable behaviour via speed controls
- adjustable start of movement, regardless of A or B side
- hydraulic or electrohydraulic actuation
- LSC$^+$

The LSC system is intuitive and efficient. All machines with LSC feature sensitive and intuitive operation. The excavator shown, which is versatile and suitable for use in different situations, greatly benefits from this technology. Thanks to the compensation of the load influences, the machine response is always the same, regardless of which functions are operated at the same time and even if the valves are not arranged on the same control plate, as shown in this example with a swing drive motor with integrated directional control valve.

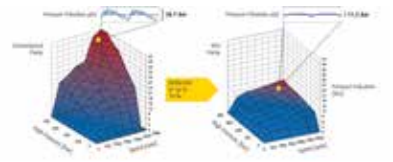
A single LS signal is enough for all actuators. As such, the driver never has to make any post-adjustments and can always concentrate fully on the task at hand. The machine is highly sensitive with continuous movements and does not experience any jerking, even at the start of movements. The directional control valves do not open the paths until the pump pressure matches the load pressure. This means the load at the start of the function does not lower. Thanks to the social flow distribution, no actuators are stopped when the system is at full capacity. As such, even challenging tasks can be completed without any post-adjusting or interruption of the movement sequence. High workloads are possible thanks to the system dynamics with fast-response pumps. This does not compromise on efficiency because the LSC system saves fuel compared with other concepts, even in the partial load range.

The operation is not the only reason that working with the machine is a pleasure; one of the best features of the pump is the SPU silencer. This reduces pressure pulsations in the hydraulic system, thereby reducing the vibrations and noise emissions of the overall machine. This means that the excavator is comparatively quiet, which benefits not only the operator, but also the environment; something that is particularly useful in residential areas.
Unlike other solutions, the SPU works across the entire typical speed range of the prime mover, reducing the pulsations of an open circuit almost to the level of a closed circuit.


Pressure Pulsation p(t)
38.7 bar
Conventional Pump
High Pressure [bar]
Speed [rpm]
Reduction of up to 70 %
Pressure Pulsation p(t)
11.3 bar
SPU Pump
Pressure Pulsation [bar]
High Pressure [bar]
Speed [rpm]


A
B
C
D
E

SPU Silencer.
Noise optimization by commutation.



Legal emission regulations force manufacturers of mobile machinery to optimize the noise emission of their products. Since secondary measures tend to be expensive and less efficient Linde prefers to fight the noise where it is generated: by optimally connecting an additional volume directly next to the commutation of the HPR-02 pump, Linde Hydraulics invented the SPU silencer. The adaptive SPU reduces flow and pressure pulsations in the regulating pump over the entire range of operation – without loss of power.
Compared to a customary variable pump, an HPR-02 with SPU reduces pulsation level by up to 70 %, independently of pressure, speed and temperature! The pulsations transmitted to system components and machine structure are significantly less, making the machine quieter.

Product advantages

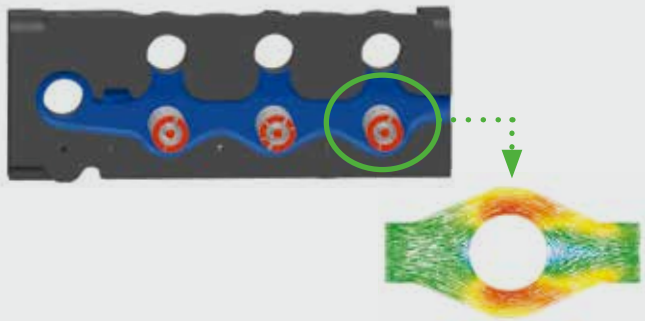
- low noise level inside the cabin and outside: obvious relief for driver and environment
- self-adapting wide scale reduction of pulsation over the whole range of operation: independent of pressure, speed and temperature
- no need of costly measures for additional noise dampening
- significantly reduced noise peaks
- no effect on function and performance
- minor increase of weight and mounting space
- simple and robust design
- immediately usable, maintenance-free

New Linde monoblock design.
Increased efficiency.

The new monoblock design from Linde features a special layout of the supply channels, i.e. of the pump pressure line and the return channels to the tank. This layout has already been proven to work in the control plates of the VT modular system, and has demonstrated that it results in lower losses. The layout also ensures that the monoblocks can be fully extended to include sandwich valves even in the same nominal size.

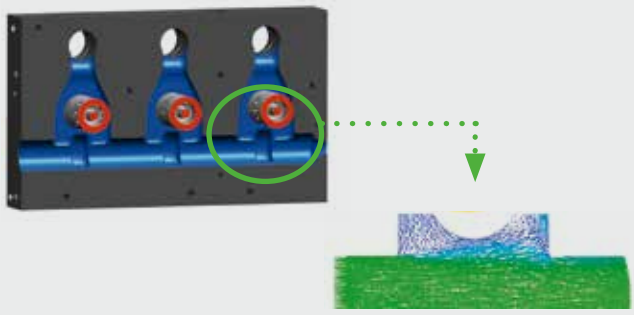
Advantages

- low-loss individual sections with only single perfusion from the pump to the actuator
- wide dimensions of main channels and their well-positioned flow layout ensure excellent efficiency throughout the entire unit
- section sizes and control types can be freely combined



Conventional monoblock design

- oil flow circulates in the supply channels around the directional control valve sections
- shock losses due to circulation
- the further away a section is from the pump connection, the greater the loss in pressure



New Linde monoblock design

- supply channels positioned below valve sections
- flow loss reduced by 85%
- pressure loss virtually identical for all sections, regardless of the distance from the pump connection (measurement: only 1.5 bar from pump inlet via six directional control valves at 600 l/min)

Technical data summary.
Find the right product for your application.

Linde products have proven to be reliable and robust. All of our products are excellent in their individual performance and outstanding when combined with each other in a complete system. Below you find the general technical data of the components shown in this brochure. Please be invited to find more detailed information about these units and their proper application in the specific datasheets and explore our overall catalogue along with other brochures for additional interesting fields of applications.

SELF-REGULATING PUMPS FOR OPEN CIRCUIT OPERATION

HPR-02		55	75	105	135	165	210	105D	280	125D	165D
Max. displacement	cc/rev	55	75.9	105	135.7	165.6	210.1	210	281.9	252	331.2
Continuous rated speed (*1)	rpm	2700	2500	2500	2350	2200	2100	2450	2000	2400	2150
Continuous rated speed (*2)	rpm	2900	2700	2700	2550	2400	2300	2650	2200	2600	2350
Max. oil flow	l/min	148.5	189.8	246.8	312,1	347.8	420.2	493.5	507.4	579.6	695.5
Nominal pressure	bar	420	420	420	420	420	420	420	420	350	420
Peak pressure (intermittent)	bar	500	500	500	500	500	500	500	500	420	500
Continuous input torque	Nm	219	302	418	540	659	836	836	1122	1003	1318
Max. input torque	Nm	368	507	702	907	1107	1404	1245	1884	1404	1964
Continuous power	kW	61.9	79.1	102.8	130.0	144.9	175.1	205.6	211.4	241.5	289.8
Max. power	kW	104	132.8	172.7	218.5	243.4	294.1	306.7	355.2	338.1	431.8
Weight	kg	39	39	50	65	89	116	96	165	113	177

(*1) w/o pressurizing, 1,0 bar abs / (*2) w/o pressurizing, 1,2 bar abs

PRODUCT ADVANTAGES

HPR-02

- optimum interaction with Linde LSC control valves
- energy saving operation by 'flow on demand'-control
- dynamic response
- excellent suction up to rated speed
- noise optimization over the whole range of operation
- compact design
- high power density
- high reliability
- long working life

SELF-REGULATING MOTORS FOR OPEN AND CLOSED CIRCUIT OPERATION

HMR-02		55	75	105	135	165	210
Max. displacement	cc/rev	54.7	75.9	105	135.6	165.6	210
Max. operating speed at V_{max}	rpm	4300	3800	3700	3200	3100	2700
Max. speed (intermittent) at V_{min}	rpm	5300	5000	4700	4000	3900	3500
Nominal pressure	bar	420	420	420	420	420	420
Peak pressure (intermittent)	bar	500	500	500	500	500	500
Continuous output torque	Nm	218	302	418	540	659	836
Max. output torque	Nm	366	507	702	907	1107	1404
Continuous power	kW	93	120	153	181	214	236
Max. power	kW	157	202	257	304	359	397
Weight	kg	28	32	42	56	76	101

PRODUCT ADVANTAGES

HMR-02

- steady low speed behaviour
- high starting torque
- large conversion range
- PTO Through-Drive Motor
- compact design
- high power density
- high reliability
- long service life
- dynamic response

FIXED DISPLACEMENT MOTORS FOR OPEN AND CLOSED CIRCUIT OPERATION

HMF-02		28	35	55	63	75	105	135
Max. displacement	cc/rev	28.6	35.6	54.7	63	75.9	105	135.6
Max. operating speed	rpm	4500	4500	4300	3900	3800	3700	3200
Max. speed (intermittent)	rpm	4800	4800	4400	4200	4100	3800	3500
Nominal pressure	bar	420	420	420	420	420	420	420
Peak pressure (intermittent)	bar	500	500	500	500	500	500	500
Continuous output torque	Nm	114	142	218	251	302	418	540
Max. output torque	Nm	191	238	366	421	507	702	906
Continuous power	kW	54	67	93	102	120	153	181
Max. power	kW	87	108	157	166	202	257	304
Weight	kg	16	16	19	23	26	33	39

PRODUCT ADVANTAGES

HMF-02

- steady low speed
- high starting torque
- compact design
- high power density
- high reliability
- long service life
- available with integrated directional control valve for direct swing drive control

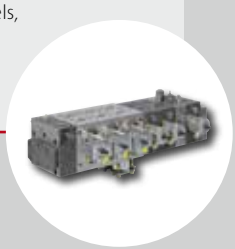
MAIN CONTROL VALVE IN MONOBLOCK DESIGN

VW30M3		VW18	VW25	VW30
Max. flow per section from pump to actuator	l/min	250	400	600
Return flow through block	l/min	450	700	1000
Rated pressure	bar	400 (420 after clarification)		
Number and size of pump ports, according to SAE ISO 6162-2		1x 1¼" (DN 32)	1x 1½" (DN 38) or 2x 1¼" (DN 32)	2x 1½" (DN 38)

PRODUCT ADVANTAGES

VW30M3

- all advantages of the LSC valve technology
- compact design
- full-size expandability
- high efficiency achieved by flow-optimized channels, even for applications with numerous actuators



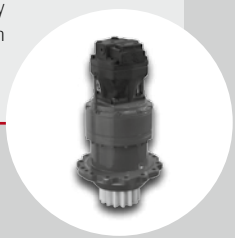
SWING DRIVES

PMT / PMTE*		650	1000	*2000	*3000	*4000	*6000	*4000
Number		1	1	1	1	1	1	2
Ratios		19-110	20-115	37-45	16-30	16-21	24-35	16-21
Max. output torque	Nm	7000	10000	8500	15000	18000	32000	18000x2
Motor displacement	cc	47-125	14-125	72	110	180	180	180x2
Max. pressure	bar	350	350	350	350	350	350	350
Typical excavator size	t	n.a.	n.a.	12-16	16-22	23-27	27-37	37-50
Weight	kg	100	135	130	200	230	310	230x2

PRODUCT ADVANTAGES

PMT / PMTE

- very high radial load capacity
- reliability and Durability
- accuracy and Quietness
- high pressure technology for increased efficiency
- of the hydraulic system



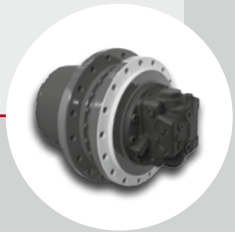
TRAVEL DRIVES WITH INTEGRATED HYDRAULIC MOTOR

PMCI		1200	2500	3000	4000	4500	6000	9000
Max. output torque	Nm	12000	20000	30000	40000	45000	62000	90000
Max. displacement	cc	55	72	72	110	110	180	180
Available ratios	i	30-53	55	56-125	63-120	55-135	60-162	65-183
Park brake torque	Nm	165	240	240	335	335	600	600
Max. pressure	bar	350	350	350	350	350	350	350
Typical excavator size	t	6-7	11-15	16-18	19-23	23-26	27-36	37-50
Weight	kg	90	175	175	245	245	370	490

PRODUCT ADVANTAGES

PMCI

- high pressure motors for increased efficiency
- high load capacity
- toughness and reliability
- smooth operation
- easy to maintain
- wide range of ratios
- suitable also for arctic applic. down to -40° C



Well-informed.
Our current media at a glance.

The product catalogue presents the company Linde Hydraulics and provides an overview of the entire portfolio. The brochures highlight single areas of the broad and interesting application spectrum of the components and systems. Datasheets offer a more detailed view of the specific product group. The emphasis is on technical data and hints for the proper configuration of the specific unit.

Product Catalogue

— **Turning Power into Motion.** Product catalogue.

Brochures

— **Drive Systems for Construction Machines.**
— **Drive Systems for Agricultural Machines.**
— **Drive Solutions for** selected applications such as **Cranes, Dozers, Excavators, Rollers** and **Wheeled Loaders.**
— **LSC.** Directional control valves.

Data Sheets

— **HPV-02.** Variable pumps for closed loop operation.
— **HPR-02.** Self-regulating pumps for open loop operation.
— **HMF/A/V/R-02.** Hydraulic motors for open and closed loop.
— **iCon.** Electronic drive controller.
— **VT modular.** Modular system for LSC manifold valve plates.

Ask your local dealer for a printed copy or visit **www.linde-hydraulics.com** to find most up-to-date information

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