

# Drive Systems for Agricultural Machines.

Linde Hydraulics

*Linde*



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# Competence in Agricultural Machinery. Innovative Solutions improve Efficiency.

Key factors to be considered when designing modern agricultural machinery include market-specific requirements, regulations for noise and exhaust emissions such as Tier 4, and reducing the total cost of ownership while improving performance at the same time.

We would like to master these challenges together with you. We are able to draw on 50 years of experience in this field: experience in system design and the commissioning of agricultural machinery, as well as in developing innovative components and drive systems that fulfill the diverse requirements of the global market and improve energy efficiency.

For example, electronic drive unit management and the intelligent coordination of all system components in a forage harvester allow the installed power to be optimally utilised and the ease of operation to be improved.

The operator selects the desired harvesting speed according to the application conditions. This is then reliably maintained thanks to automatic control and quickly regained after turning — as a result, efficiency increases and workload of the driver is reduced. To help protect soil, an additional hydraulic motor can be connected to the rear axle. The tractive power and speed are distributed to both axles on demand.

Hydraulic auxiliary drives also provide potential for increasing efficiency: These range from hydraulic crop intakes in place of mechanical crop intakes to the use of an MPR 50 electrically controlled medium-pressure pump instead of a gear pump.

Demand-based supply of the actuators and the integration of the MPR 50 into the electronic machine management system can achieve fuel savings of 20%.

This system-level analysis and the intelligent combination of hydraulic and electric drive components, electronics and mechanics have enabled us to design first-class overall solutions for your applications.





# Collaboration is the Key to Success.

All of the benefits offered by the individual system components can only be fully realized if the overall system is perfectly coordinated. We want our customers' machines to set the benchmark in terms of high productivity, low fuel consumption, optimum adaptability to any given task and long service life.

We are able to achieve this goal by working in partnership with our customers, already during the development stage. We provide our customers with solution-oriented advice and support them

from the product proposal stage right the way through to the technical approval of machines ready for series production.

This way of working enables us to develop drive systems that set themselves apart from standard solutions in terms of performance and operation. Our sales and application engineers are committed to providing you with professional support when it comes to optimizing your hydraulic systems. Any time, any place.



# Service. Reliability is the Key.

With subsidiaries in Europe, the USA and China, our strategic distribution partner for the USA and Asia Pacific, Eaton Hydraulics, and our representatives around the world, we guarantee that you will enjoy a reliable and competent service. Our sales organization is connected to the central spare parts warehouse in Germany via the Internet, ensuring that you receive original Linde spare parts wherever you are in the world — quickly, easily and securely.

As well as supplying spare parts and carrying out repairs, our service team also provides a remanufacturing program with “as new” warranty. We provide training to our customers' employees in the area of product and assembly technology either at our training centre or at the customer site. We also offer application-specific system training sessions.



# Product Overview.

## High-Pressure Variable Displacement Pumps for Closed Circuits

Swash plate axial piston pumps with 55 - 280 cc displacement and mechanical, hydraulic or electric control with position feedback.

### Design characteristics

- Clockwise or counter-clockwise rotation
- Precise and robust servo controls
- Integrated high-pressure relief valves with charge function
- Integrated low-pressure valves for charge and control circuit
- Charge pressure pumps with internal and external suction, optional integrated cold start valve
- Option of tandem or multiple pumps



## High-Pressure Self-Regulating Pumps for Open Circuits

Swash plate axial piston pumps with 55 - 280 cc displacement and mechanical, hydraulic or electric control.

### Design characteristics

- Clockwise or counter clockwise rotation
- Self-priming with high nominal speed
- Precise and robust load-sensing pump controller with or without swash plate position feedback
- Adaptive noise reduction SPU
- Decompression fluid discharged via pump housing to keep suction side undisturbed



## High-Pressure Hydraulic Motors for Open and Closed Circuits

Swash plate axial piston motors with fixed or variable displacement of 28 - 330 cc. Electric or hydraulic control.

### Design characteristics

- Fixed displacement motor
- Self-regulating motor with various  $V_{max}$  override options
- Variable displacement motor with position feedback and various control types and characteristics
- Plug-in motor
- PTO through-drive motor
- Double motors with common control
- Tandem motors



Bent axis axial piston motors with fixed or variable displacement of 60 - 215 cc. Electric or hydraulic control.

### Design characteristics

- Fixed displacement motor
- Variable displacement motor
- Standardized interfaces (e.g. plug-in flange)
- Wide range of options (e.g. speed sensor)



### Compact units for CVT drives

Variable displacement pump and fixed displacement motor in one common unit with integrated high pressure relief valves with charge and discharge function.

#### Design characteristics

- Inline, U- or Z- design
- Version for installation in powersplit transmissions
- Version for gearbox with PTO option or fully hydrostatic units
- Accurate control of the displacement
- Standstill control and precise crawling speed



### MPR 50 Medium-Pressure Pump for Open Circuits

Swash plate axial piston pump with 50 cc displacement and electro-hydraulic control with position-feedback.

#### Design characteristics

- Extremely compact
- Robust, heavy-duty design
- Spring for swivelling back, failsafe Vmin
- Pulsation damping
- Integrated low pressure pump with joint suction port



### Valve Technology

Designed for Linde Synchron Control (LSC) - a post-comp load sensing system. Available as sub plate mounted valves for 1-8 actuators in a modular building block system or as compact monoblocks.

#### Design characteristics

- Piloted hydraulically or electro-hydraulically
- Nominal flow up to 250 l/min (RS18), 400 l/min (RS25) or 600 l/min (RS30)
- Large cross-sections and flow-optimized supply channels
- Pressure cut-off and additional functions integrated, special functions via intermediate plates

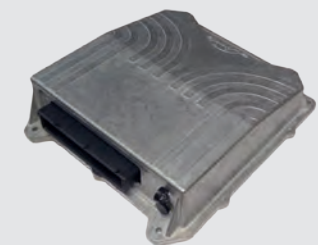


### Electronic Control Units

Linde ECUs are intended to manage the whole drivetrain and control each component to achieve maximum system efficiency and performance

#### Portfolio

- ECUs for operating voltages from 8 to 32 VDC, featuring a redundant safety concept with function and safety controller, as well as a preconfigured setup with additional freely definable switch and proportional outputs
- Communication via CAN bus



# Start-Stop-System.

## Power Range

30 – 80 kW (engine size  $\leq 3.0$  l)

## Components

- Medium pressure pump MPR 50
- Hydraulic retarder
- Hydraulic accumulator
- Valve block
- Check valve

## Advantages

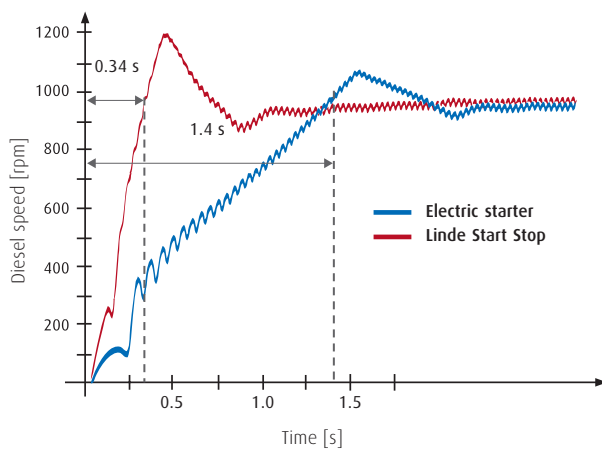
- Works without the need for a separate hydrostatic unit and with few additional components
- Almost unchanged axial installation space
- Fast starting procedure
- Maximum level of customer acceptance
- Wear-free

Thanks to the use of an MPR50 medium-pressure pump instead of a gear pump, Linde has already been able to achieve fuel savings of around 20% in relevant comparable vehicles. The hydraulic start/stop system for restarting the machine at operating temperature builds on this and opens up further saving potential.

The working hydraulics pump charges an accumulator during operation via the retarder and works as a starter motor when charged with the accumulator pressure on the suction side. The criteria for shutting off and restarting the diesel engine are stored in the electronic control unit. These criteria can be adapted to the individual demands of the specific machine and manufacturer in order to achieve the acceptance of machine operator for the system. The size of the accumulator also varies from machine to machine and is determined by the intended speed to which the diesel is started. No wear of components will endanger the availability of this feature.

Exemplary calculations (using a 50-kW machine, a fuel consumption of 1.5 l/h, 30% idling and 1000 operating hours per year) show that one active accumulator charging procedure—i.e. without using energy from the deceleration for example—already pays for itself after 2.5 seconds engine shut off time, and that the system can thus save around 450 litres of diesel per year.

The system features a modular design. If an MPR is already used as the implement pump alongside a retarder, only a check valve and two additional components are needed for the start/stop functions: a valve block and a hydraulic accumulator. These weigh very little and can also be positioned anywhere in the machine. As a result, the manufacturer can simply build the start/stop option into the production process without the need for much additional work or storage.



# Shift in Motion.

## Power Range

40 - 300 kW

### Components

- Variable displacement pump HPV-02
- Variable displacement motor HMV-02
- Actuator
- Electronic control unit iCon

### Advantages

- Automated and jerkless gear changes (<0.7 sec.) without standstill and the need of expensive synchromesh gear boxes
- Considerable reduction of fuel consumption and noise emissions
- Minimum space requirement

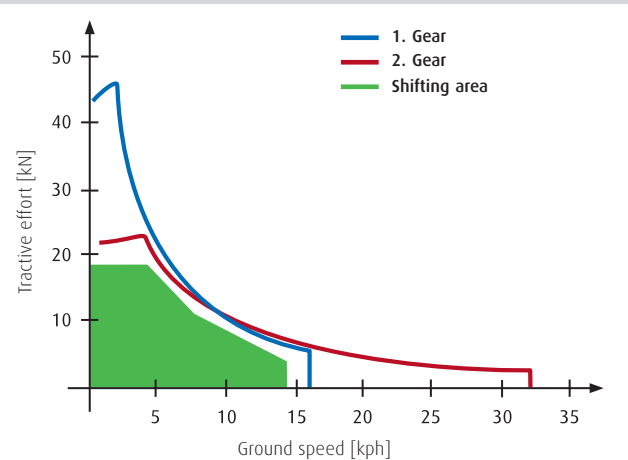
Linde combines the comfort of CVT drives with the compact dimensions of machines featuring manual transmissions that can be shifted at standstill, at prices below those of powershift transmissions. "Shift in Motion" enables shifting procedures in a moving machine, equipped with a manual transmission that is intended to be shifted at standstill by electro-hydraulically synchronising the drivetrain. "Shift in Motion" is particularly suitable for vehicles that often change between transport and operation, i.e. vehicles that require both high tractive effort and a high top speed above 25 kilometres per hour.

The shifting procedure is load-free thanks to electro-hydraulically synchronised gears and the ability to adjust the drive component's speed and torque. Thus there is no need for multi-disc clutches and mechanical synchronisation using synchronizer rings and moreover there's less pinion engagement. This makes the shifting procedures wear-free and also increases the transmission's efficiency.

"Shift in Motion" is used with a manual transmission that can be shifted at standstill and that features a selectable neutral position. Having Linde drive components and control units already installed, it may only be necessary to adjust the control software in order for "Shift in Motion" to function. Thanks to a CAN bus connection, the Linde ECU can also be used in conjunction with the customer's controllers for the rest of the overall vehicle. It then only takes care of the synchronisation and gear shifting itself.

The shifting procedure can be triggered on demand by the driver or automatically, based on the customer-specific acceptance criteria for the respective vehicle and situation. The drivetrain is brought to no load by adjusting the pump and motor, and the transmission is disengaged into the neutral position. The hydraulic transmission is then adjusted to the new ratio of the selected gear. Finally, the required gear is selected and the normal drive programme continues.

The whole process only takes about half a second. The quick and easy gear changes mean that it is worth configuring the transport gear to a higher top speed than the target speed. Doing so enables the actual maximum speed of the vehicle to be achieved using a lower speed of the hydrostats and diesel. Operating the drive components in more favourable operating points (overdrive) lowers both fuel consumption and noise emissions considerably.





# Combine Harvester.

## Linde Standard Product Portfolio

100 kW – 500 kW

### Application Example

155 kW, 18 t, tractive effort 85 kN,  
ground speed 25 kph

### Equipment

1x HPV 105-02 M1R (Propel drive)

1x HMF 105-02 (Propel drive)

### Advantages

- Sensitive and precise machine control
- Quick and reproducible machine response
- Robust and durable

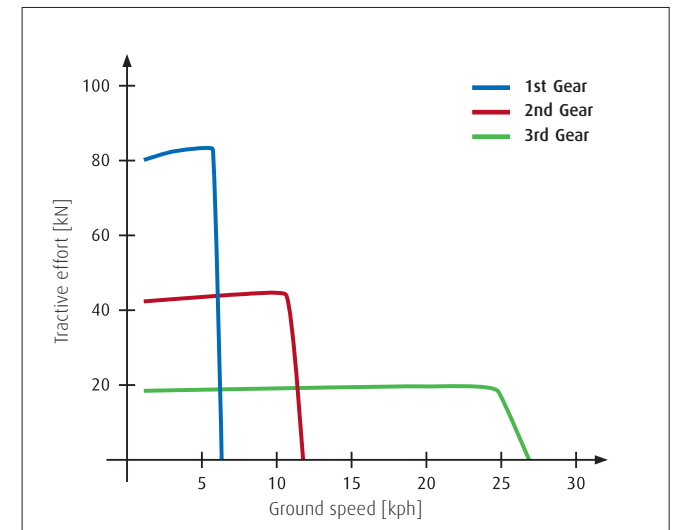
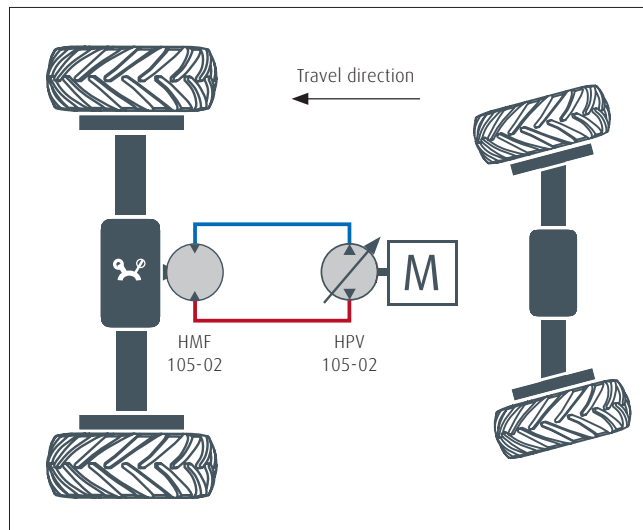
### Options

- Hydraulic or electro-proportional pump control

A harvesting machine which is reliably available throughout the entire harvesting season, which is built on robust technology and whose operation is intuitive and easy to learn, even for varying operators – in many places, this is exactly what is needed.

The design example shows such a combine harvester, driven by a 155 kW diesel engine with an HPV 105-02 pump with a mechanical hydraulic controller. It delivers oil to a fixed-displacement motor with 105 cc displacement, mounted to a 3-speed gearbox with varying gear ratios for harvesting, field travel and road travel.

A Bowden cable provides a mechanical link between the control lever in the operator's cabin and the controller of the variable displacement pump. The machine response is completely in the driver's hands. He can virtually ignore the load on the machine and the steepness of the terrain. Like all Linde controls, the M1R mechanical hydraulic control operates independently of the load. The same lever position produces the same machine response. The machine is operated intuitively.



**Equipment**

- A** 1x HPV 105-02 M1R
- B** 1x HMF 105-02



# Forage Harvester.

## Linde Standard Product Portfolio

200 kW – 900 kW

### Application Example

450 kW, 18 t, tractive effort 150 kN, ground speed 40 kph

### Equipment

- 1x HPV 135-02 E2 (Pump for propel drive)
- 2x CMV 115 plug-in E6 (Motors at front axle)
- 1x HMV 135-02 E6 (Motor at rear axle)
- 1x iCon (Electronic control unit)

### Advantages

- Intelligent propel drive management thanks to electronic control
- High harvesting power and fuel efficiency
- Safety and comfort features
- Switchable intelligent hydraulic four-wheel drive

### Options

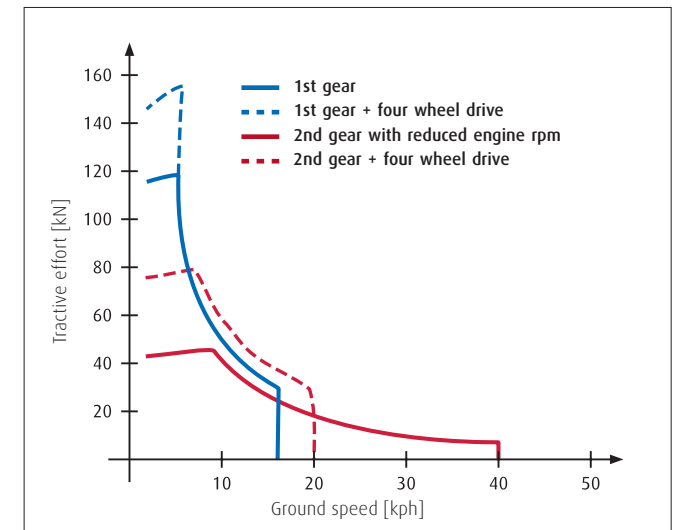
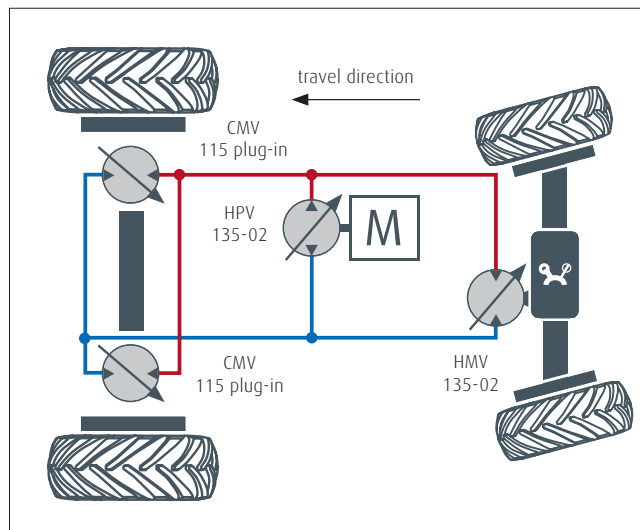
- Without or with permanent four wheel drive
- "Shift in Motion"

Harvesting performance up to 400 tonnes an hour, even when used 24 hours a day throughout the entire harvesting season. High performance and availability of a unit is independent of its type of control. Whether mechanically, hydraulically or electrically actuated, all Linde controls operate with absolute precision and reliability.

Intelligent electronic controls offer an extended range of sophisticated comfort-, application- and safety features. The controls ensure that the diesel engine, variable-displacement pump and -motor are perfectly matched to each other in every situation. Utilisation of the installed power is optimised, and the fuel is used efficiently. The electronics themselves offer an impressively high level of safety – in both concept and design. If, however, external circumstances cause the control signals to fail, the hydraulic units set their swash plate angles back to minimum volume. The machine decelerates moderately until standstill, without over-revving the diesel engine.

The powerful CMV 115 hydraulic motors enable speeds of up to 40 kph on the road. The harvesting gear covers a speed range up to 15 kph, which makes shifting gears unnecessary on the field. The optimum speed is pre-selected in each case, and is reliably maintained thanks to the automatic regulation; after turning round, it is rapidly regained.

An additional hydraulic motor can be activated at the rear axle. The two axles can be controlled independently of each other, and the axles are not mechanically coupled. The tractive effort is distributed to the front and rear axles to suit the situation so that the traction limit is reached on both axles simultaneously. The mechanical decoupling of the two axles protects the soil, even when driving in tight curves. Reducing the effective torque to zero ensures that the vehicle retains full steering properties at all times, even when decelerating sharply.





**Equipment**

- A** 1x HPV 135-02 E2
- B** 2x CMV 115 plug-in E6
- C** 1x HMV 135-02 E6
- D** 1x iCon



**Category**



# Hydraulic auxiliary drives.

## Linde Standard Product Portfolio

100 kW – 200 kW

### Application Example

160 kW (Harvester Feed System)

### Equipment

1x HPV 75-02 E1

1x HMF 105-02

### Advantages

- Boost circuit is generally available from the propel drive
- Safety
- Functionality
- Precision and dynamics
- Degree of freedom in design and configuration
- Electronic control/regulation is possible

Outstanding harvesting performance can only be achieved through interaction of all parts of the machine. Propel and auxiliary drives must be matched to each other. Hydrostatic drive systems from Linde offer many advantages for the overall system. Their compact design allows Linde hydraulic motors to be mounted exactly where the torque is required. They can therefore replace rigid shafts for power transmission. For the designer, this gives a significantly greater degree of freedom to achieve a striking design and satisfy the enhanced power requirements of modern machines.

The use of hydraulics offers additional functional and safety-related advantages: The stepless speed adjustment of a hydraulic harvesting crop intake allows stepless adjustment of the cutting length for the chopped forage – always ensuring the best possible outcome for both stock and harvesting target. Hydraulics is the best way to achieve a quick stop if stones or metal objects are detected, without overstressing the mechanical components involved.

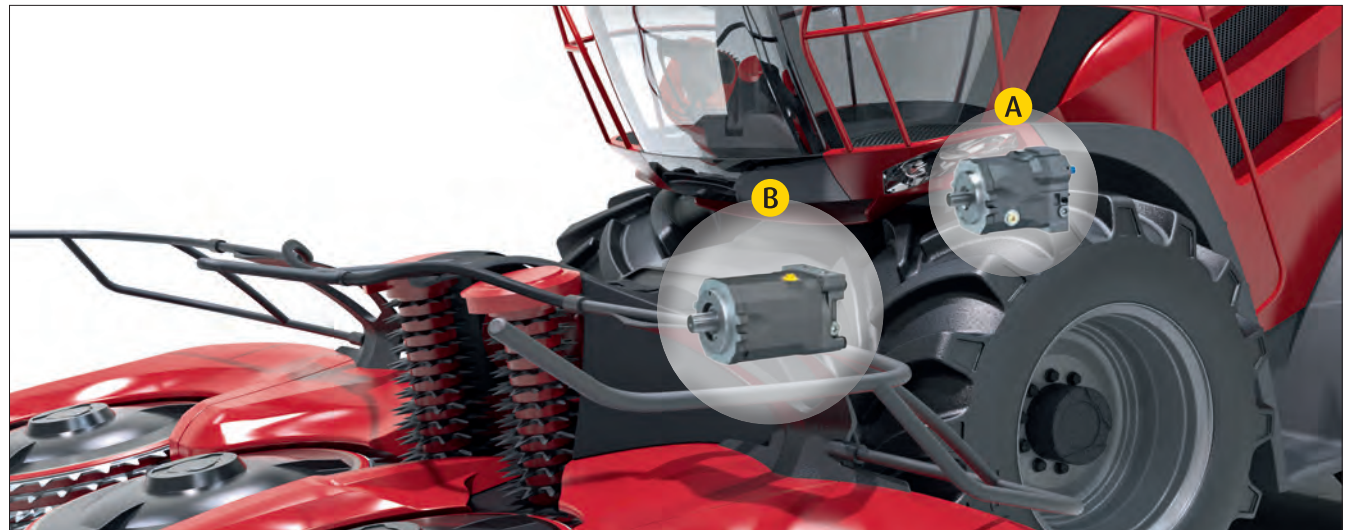
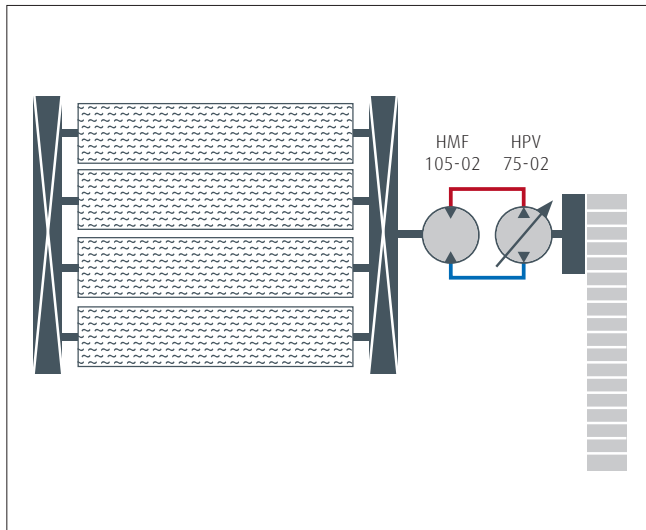
The central control of the units allows the same signal to be used for stopping both the chopping unit and the propel drive. It is also advantageous to use a hydraulic drive for the fan system in the machine. The fan speed can be intelligently and steplessly adjusted independently of the diesel engine speed.

The trend is moving towards hydraulic drives for fans, intake, choppers, transport belts, thresher drive, scraper floor, and much more. Linde Hydraulics is leading the way.

### Equipment

**A** 1x HPV 75-02 E1

**B** 1x HMF 105-02





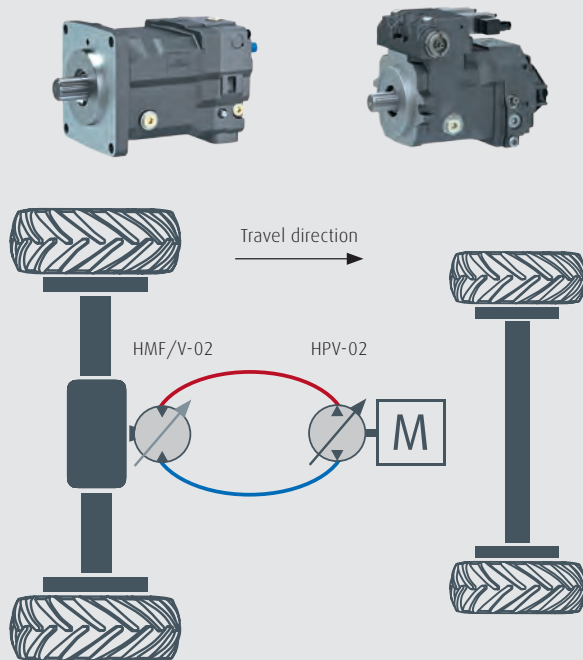
# Tractor drives.

## Classic, hydrostatic drive system

Pump fitted to the diesel engine; motor fitted to the gearbox, hose connection

### Advantages

- All the advantages of hydrostatic LinDrive® drives
- Wide conversion range of the hydraulic system
- Stepless, even in combination with a shift gearbox, for greater ranges of tractive effort and speed

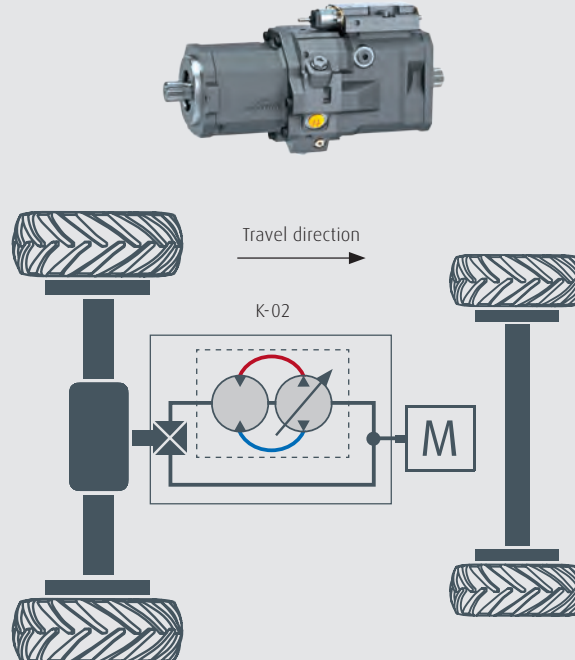


## Compact hydrostatic unit, fitted in the CVT powersplit gearbox

Variable-displacement pump and motor in a single unit, hydraulic power branch in the CVT powersplit gearbox, fitted directly in the gearbox casing

### Advantages

- All the advantages of hydrostatic LinDrive® drives
- No external hose connections necessary
- Compatible with gearbox oil

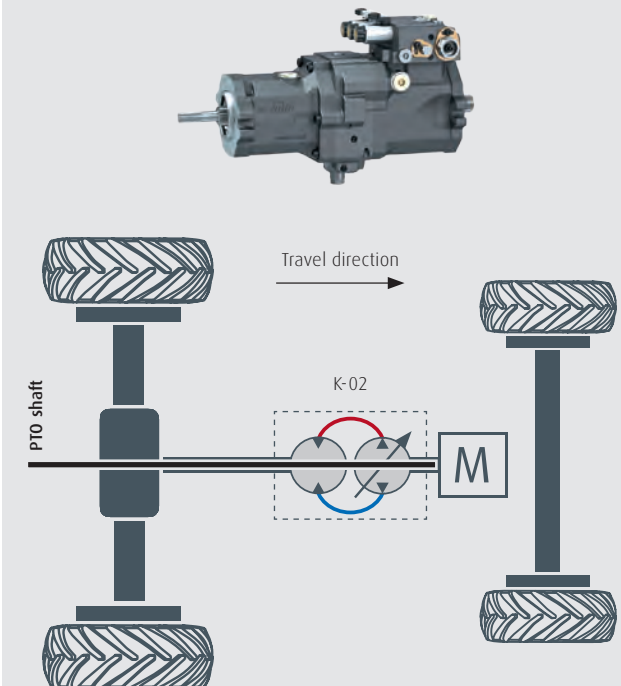


## Compact hydrostatic unit, attached to a classic gearbox

Variable-displacement pump and motor in a single unit, direct PTO shaft drive from the diesel engine via a hollow shaft

### Advantages

- All the advantages of hydrostatic LinDrive® drives
- No external hose connections necessary
- Stepless, even in combination with a shift gearbox, for greater ranges of tractive effort and speed



# Compact Tractor.

## Linde Standard Product Portfolio

40 kW – 75 kW

### Application Example

75 kW, 3 t, tractive effort 45 kN,  
ground speed 40 kph

### Equipment

1x K 75-02

(Compact drive unit in CVT gearbox)

### Advantages

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- Mechanical through-drive for PTO
- Always need-based driving function

### Options

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- Different concepts of stepless drive
- Combinable with "Shift in Motion"

The variants available for tractor drives are almost as diverse as their possible applications. In addition to the conventional hydraulic drive concepts, Linde has a special option on the market: the compact K-02 unit. The variable-displacement pump and the motor are mounted back-to-back within a common housing, thus eliminating the need for hoses.

The K-02 Series from Linde is available in two basic variants: as a fully hydrostatic drive, combined in a single unit (Page 14/15), or as the hydrostatic branch of a power-split mechanical CVT gearbox (Page 16/17).

The inline design, featuring a hollow shaft, enables direct torque transmission from the prime mover to the PTO shaft. For compact tractors, the K 75-02 therefore offers stepless drive technology for the propel drive and direct power transmission for auxiliary drives.

## Equipment

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**A** 1x K 75-02



## Category

40 kW

75 kW ▲

# Tractor.

## Linde Standard Product Portfolio

75 kW – 250 kW

### Application Example

125 kW, 6 t, tractive effort 100 kN,  
ground speed 50 kph

### Equipment

1x K 75-02

(Compact drive unit in  
CVT powersplit gearbox)

### Advantages

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- Smooth at all times
- Always at the optimum operating point

### Options

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- Two-wheel or four-wheel drive
- Variety of stepless concepts

The example on the right shows the K 75-02 as a component of a powersplit gearbox. It is fitted directly within the gearbox casing. The power of the diesel engine is split at the input. One part is linked by a direct mechanical connection to the annular gear of a planetary gearbox. The K-02 is positioned in the second path as a variable unit and drives the sun gear as required. The power is transmitted as required; the speed can be precisely controlled. The sensitive hydrostatic system keeps the tractor under control on hills, preventing inadvertent rolling away and permitting smooth and gentle starting. The high conversion capability ensures that virtually any load situation can be mastered at low diesel engine speed.

Equipment

A 1x K 75-02



Category

75 kW

125 kW

250 kW



# Sprayer.

## Linde Standard Product Portfolio

75 kW – 200 kW

### Application Example

155 kW, 12.7 t, tractive effort 44 kN, ground speed 40 kph

### Equipment

1x HPV 210-02 E2 (Propel drive)  
4x CMV 60 plug-in (Propel drive)  
1x iCon (Electronic control unit)

### Advantages

- Hydraulic drive permits even pressure on the ground and considerable ground clearance
- Adjustment of the drive power at changed load situations
- Load-independent machine response
- Uniform spraying result

### Options

- Portal axle instead of single wheel drives

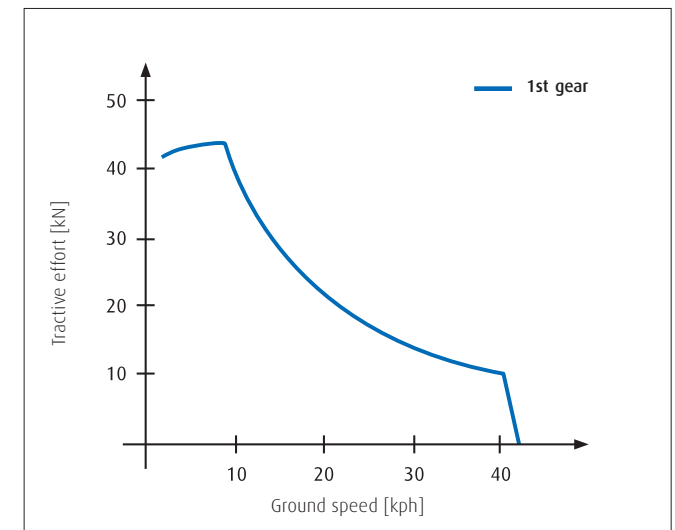
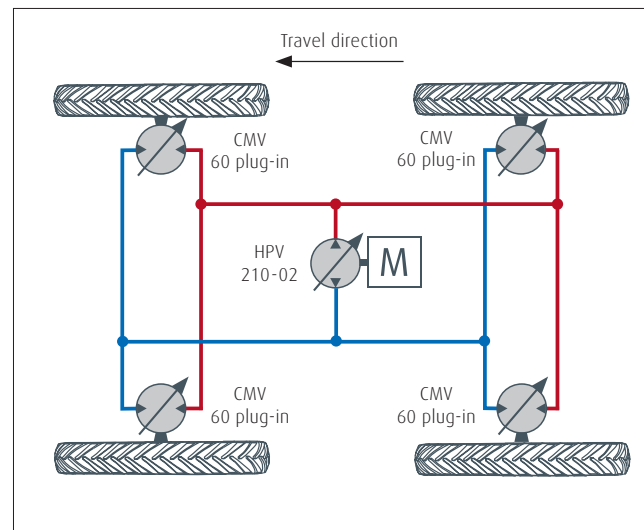
Application of fertiliser, plant protection agents or just plain water. Self-propelled sprayers are well established in agriculture. Not just in regions where several harvests are gathered during the year and sowing machines follow directly in line behind harvesting machines – in Europe too, they help to make the most of time-frames.

The use of hydraulic drives permits great freedom in configuring the machine so as to achieve uniform weight distribution across all the tyres. This helps to minimise the pressure on the ground and the compacting vibrations. Hydrostatic systems from Linde ensure that the machine always travels exactly in accordance with the position of the accelerator, irrespective of the quantity remaining in the tank and of the steepness and difficulty of the terrain. The sprayer travels completely evenly, and the spraying result is uniform across the entire field.

The example shows a machine with a contemporary design, featuring a large high-pressure pump and individual wheel

motors. This configuration allows for a more creative machine design and allows for variable ground clearance depending on the application. Moreover, this configuration does not require a manual gearbox and offers a high level of tractive effort and high top speeds for the road. Separate control of the individual motors enables the drive power of the individual wheels to be adapted to changing load and traction conditions.

Other control systems and designs, for instance layouts with portal axes or PTO motor, are also available. The wide product range from Linde Hydraulics allows machines of different sizes and power classes to be optimally equipped – all with the same familiar operating controls.



## Equipment

- A** 1x HPV 210-02 E2
- B** 4x CMV 60 plug-in
- C** 1x iCon



## Category

75 kW

155 kW

200 kW

# Sugar Cane Harvester.

## Linde Standard Product Portfolio

150 kW – 300 kW

### Application Example

260 kW, 18 t, tractive effort 200 kN,  
ground speed 10 kph

### Equipment

2x HPV 105-02 E1 (Propel drive)

2x HMV 165-02 (Propel drive)

1x iCon (Electronic control unit)

### Advantages

- Hydrostatic drive system without splitter gearbox eliminates the necessity of a shift gearbox
- Soil protection
- Precise, controlled directional stability and wear-free steering

### Options

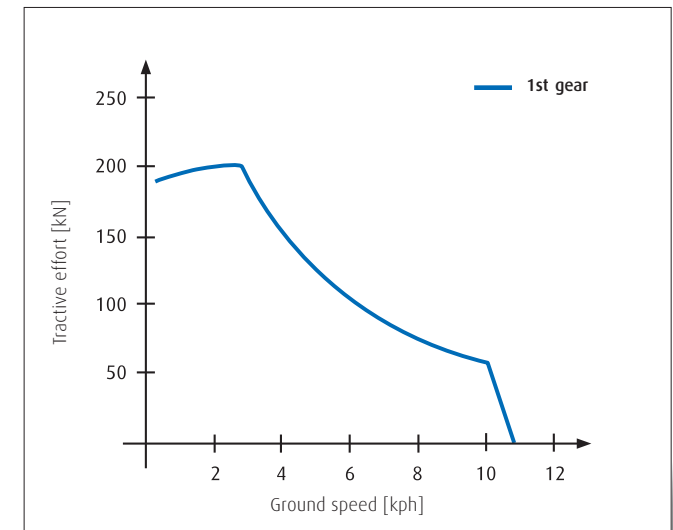
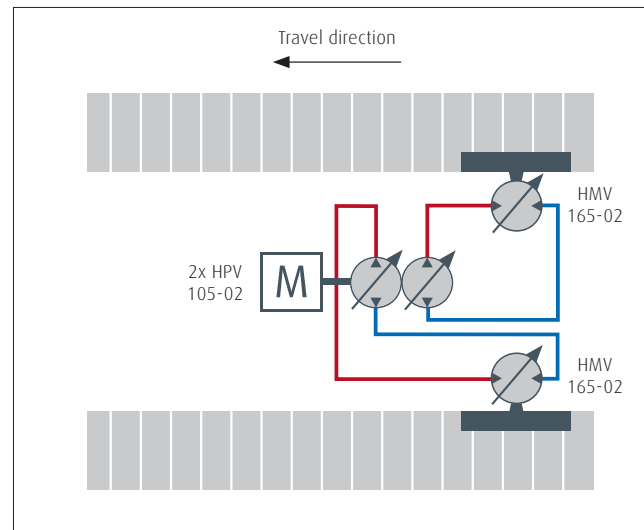
- Other tracked harvesting machines for short rotation forestry or water-intensive crops like rice
- Higher ground speeds
- Wheeled variants for fast on-road travel
- Mechanical track drive with hydraulic steering

Tracked harvesting machines offer advantages over wheeled variants in terms of stability, traction and soil protection, especially in difficult terrain comprising soft, wet soil such as on rice, soya and sugar cane plantations.

The sugar cane harvester drive depicted here is based on Linde's many years of experience in equipping construction machines. The dual circuit concept depicted sets standards for tracked machines and operates without a splitter gearbox. This special solution comprising standard components is characterised by an impressive level of durability and robustness, as well as low fuel consumption levels. It is also particularly gentle on soil — either when driving in straight lines or in curves. All this combined with outstanding ease of operation.

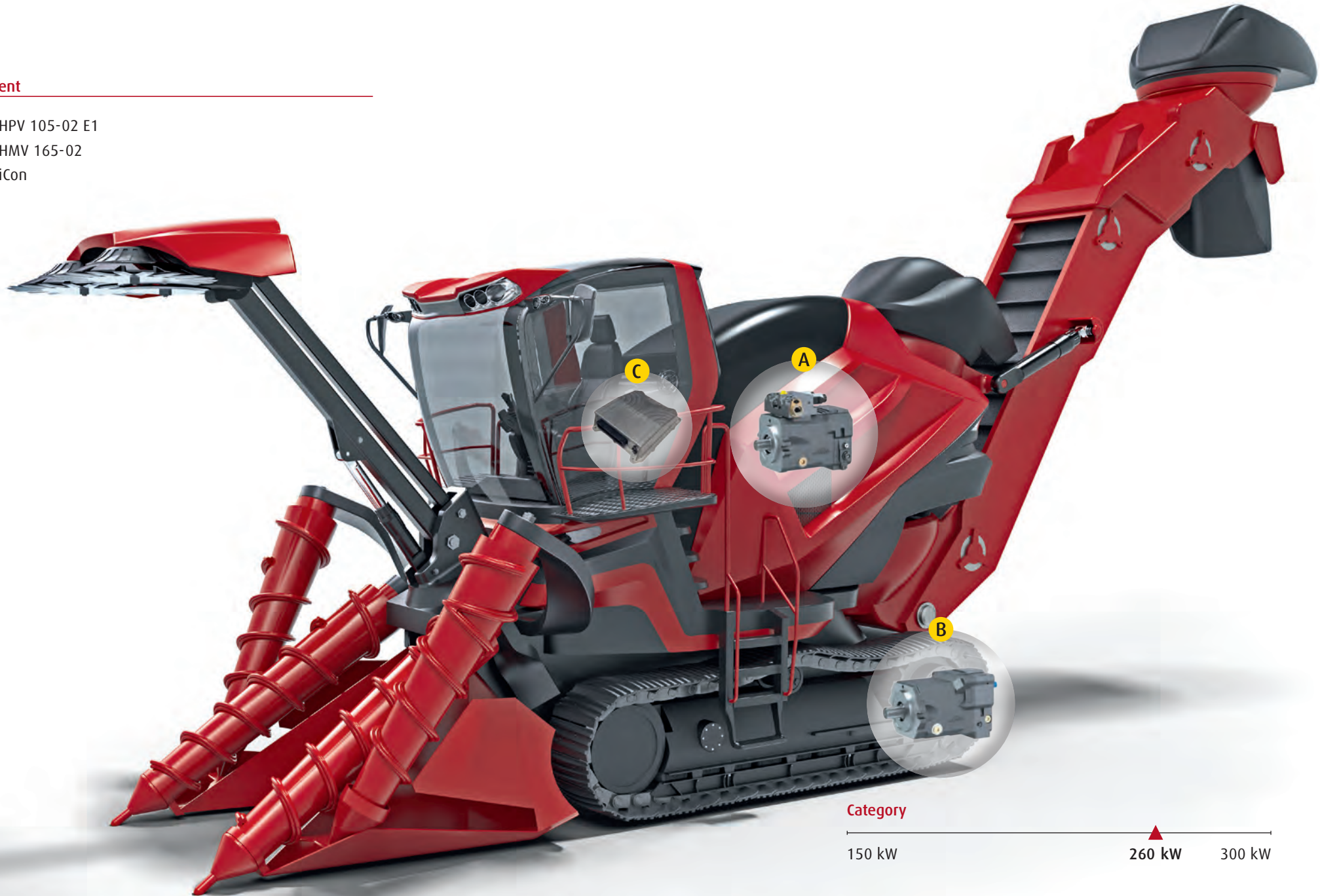
Controlled directional stability is just one example. The hydrostatic units can be easily integrated into the overall design of the machine and enable optimum interaction between driving speed, crop intake, shredding and transportation.

Furthermore, the hydrostatic system is always powerful enough to drive continuously through dense crops. They are also extremely rugged, allowing the machines to make it right through the harvesting season with a low amount of planned maintenance time. The result: many tonnes of crops harvested in line with specifications and using little fuel.



**Equipment**

- A** 2x HPV 105-02 E1
- B** 2x HVM 165-02
- C** 1x iCon



**Category**

150 kW

260 kW

300 kW



# Beet Harvester.

## Linde Standard Product Portfolio

250 kW – 500 kW

### Application Example

400 kW, 30 t, tractive effort 160 kN, ground speed 22 kph

### Equipment

- 1x HPV 280-02 E2 (Propel drive)
- 2x HMV 165-02 (Propel drive)
- 1x HMV 135-02 (Propel drive)
- 1x iCon (Electronic control unit)

### Advantages

- Low soil compaction
- Intelligent distribution of tractive effort

### Options

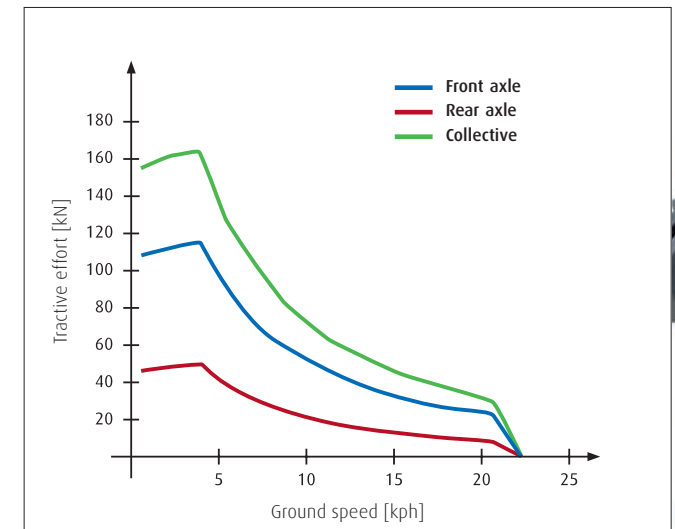
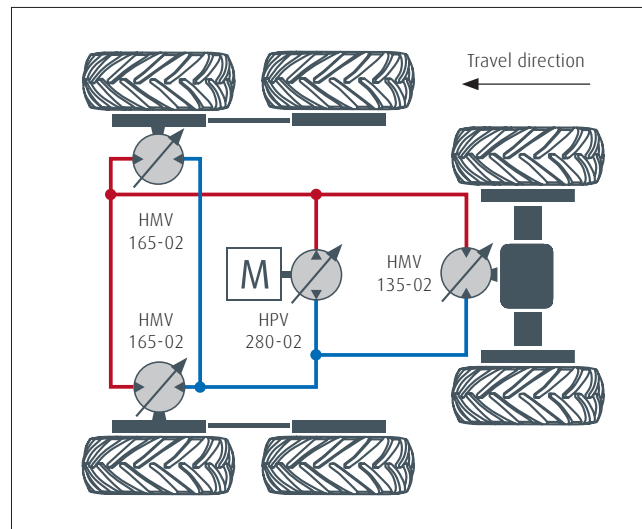
- With and without bunker
- Articulated joints, permanently offset axles, asymmetrical design
- Hydrostatic systems for auxiliary drives like choppers, transport belts, etc.

It's all about high-performance harvesting. Multi-purpose harvesting machines, with and without bunkers, quickly and efficiently perform what used to be arduous manual work. For the farmer, the number of rows, the bunker volume, the harvesting and turn-round speeds are important. It's essential at all times to ensure good harvesting quality and to avoid compacting the ground, irrespective of how quickly the machine progresses.

Machine manufacturers need hydraulic drives which enable the enormous performance of the machine and help to relieve stress on the driver. Thanks to the wide range of pumps and motors, hydrostatic systems from Linde are suitable for equipping each and every type of harvesting machine. The drive concept is optimised in each case to suit the numbers of harvesting rows, axles and wheels, and the engine power class of the machine.

The design example shows an HPV 280-02 driving three HMV-02 variable motors in parallel. Two of these, each with 165 cc maximum displacement transmit the torque via the gearbox

directly to the propulsion wheels. The third motor with 135 maximum displacement drives the twin tyres, which are offset within the travel path, via a T-axle. The motors can be controlled independently of each other. This allows tight turning circles, without any of the wheels spinning.





### Equipment

- A** 1x HPV 280-02 E2
- B** 1x HVM 135-02
- C** 2x HVM 165-02
- D** 1x iCon



### Category

250 kW

400 kW

500 kW

# Beet Loader.

## Linde Standard Product Portfolio

150 kW – 200 kW

### Application Example

180 kW, 24 t, tractive effort 1300 kN,  
ground speed 40 kph

### Equipment

1x HPV 135-02 E2 (Propel drive)  
1x HMV 165-02 D E6 (Propel drive)  
1x iCon (Electronic control unit)

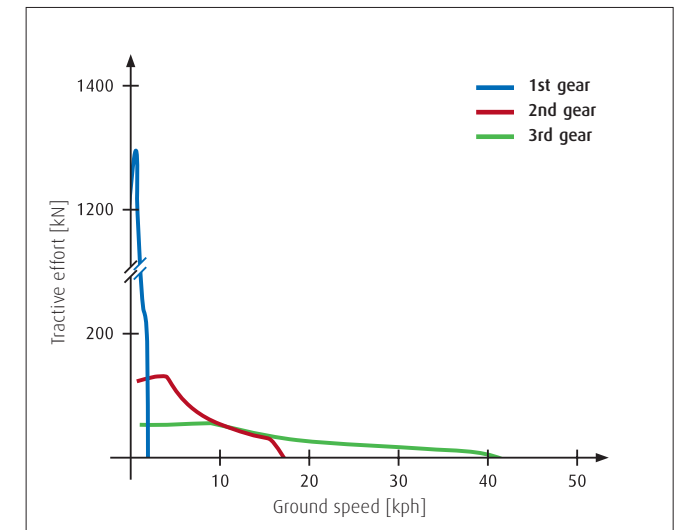
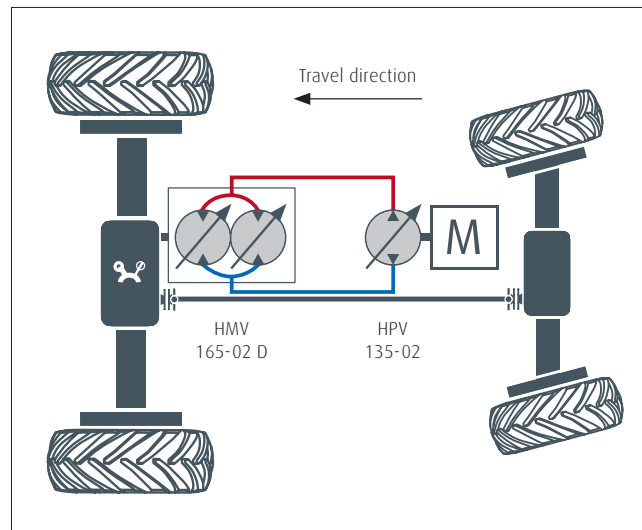
### Advantages

- Extremely high torque at creep speed
- Smooth driving, even at speeds approaching zero kph
- Large displacement with slim design of the hydraulic motor

Highly specialised self-propelled machines are firmly established in beet harvesting operations. Harvesting and transport are increasingly treated as separate operations and optimised in their own right. Self-propelled loading machines compact the ground less than towed transfer trailers, and have plenty of reserves in traction and power – especially on difficult terrain. Where towed trailers often exceed the permissible axle loads for road transport, self-propelled transfer machines allow beet to be loaded directly onto the transport vehicle from the field. The beet harvester machine can meanwhile take the ideal line across the field, with no accompanying tractor, and can then pile the beet at the end of the field.

Self-propelled transfer machines with Linde propel drives are characterised by their ability to go into the stack at high power and maintain precise movement at creep speed. The operating speeds of the cleaning and loading devices are precisely tuned at all times.

The design example shows a double motor supplied with oil by an HPV 135-02. Like all Linde motors, it is characterised by its precise low-speed behaviour. Both motor units are set synchronously and have a combined oil flow of 330 cc.





### Equipment

- A** 1x HPV 135-02 E2
- B** 1x HMV 165-02 D E6
- C** 1x iCon



### Category

150 kW

180 kW

200 kW

# Telehandler.

## Linde Standard Product Portfolio

50 kW – 150 kW

### Application Example

60 kW, 7.5 t, tractive effort 33 kN,  
ground speed 35 kph

### Equipment

- 1x HPV 55-02 E2 (Propel drive)
- 1x HMV 105-02 D E6 (Propel drive)
- 1x VW12M3 (Valve block)
- 1x iCon (Electronic control unit)

### Advantages

- Reduced components and weight reduction (approximately 33%) thanks to the omission of the transfer box and manual gearbox
- More design space and better centre of gravity thanks to direct installation in the drivetrain
- No interruption of tractive effort
- Cost reduction in the drivetrain and radiator

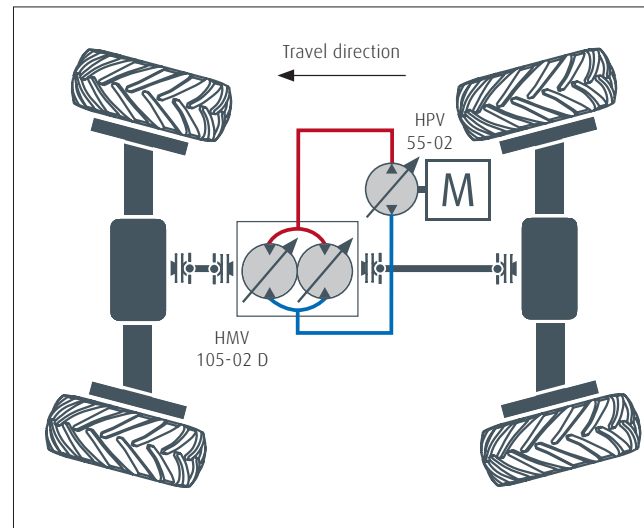
### Options

- Purely hydraulic or fully-electrified system
- Customer-specific assembly points
- Spread design with individual motors per axle

Stacking straw, filling mixer trucks, handling bales. Telehandlers are versatile and their greater lift heights make them virtually indispensable. This example design depicts a telehandler with a partly electrified Linde drive system.

The working hydraulic system has an electrically controlled directional control valve block with optimised channel design. The propel drive unit is controlled hydro-mechanically and offers high tractive effort even at low engine speeds for smooth starting and precise manoeuvring. The telehandler is smooth at all times, even when heavily loaded.

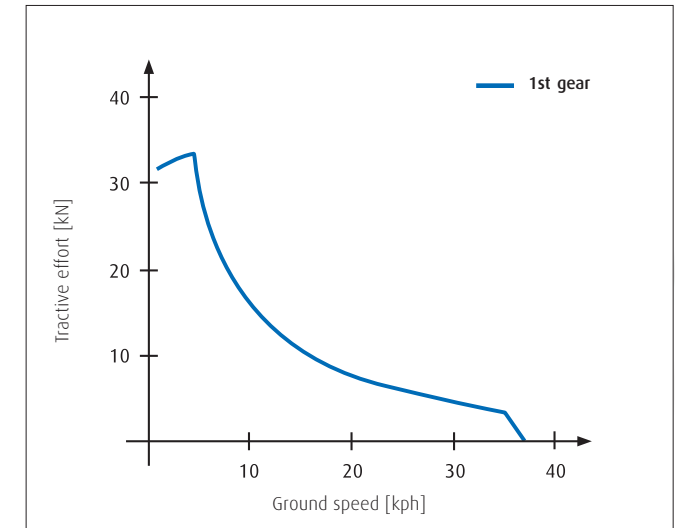
The pump controller is set to optimally utilise the available engine power in every situation. As a result, it can be operated intuitively. The diesel speed is captured hydrostatically - very robust, pressure compensated and virtually independent of the temperature. However, its star feature is the custom double motor with through drive shaft. It is fitted directly between the cardan shafts. No gearbox is required, allowing for rapid reversing.



The driver is free at all times to give his full attention to the load being moved.

This configuration with a larger hydraulic motor enables the gearbox to be omitted, eliminating gear noise, enhancing overall efficiency and allowing a smaller radiator to be used. In addition to the reduced weight, this also helps to save fuel. The configuration is still approximately one third lighter than a model with a smaller motor and manual gearbox.

For particularly high tractive effort requirements, Linde double motors are also available with 2x165 cc. They have slender radial dimensions and higher top speeds than single motors of the same volume.





## Equipment

- A** 1x HPV 55-02 E2
- B** 1x HVM 105-02 D E6
- C** 1x VW12M3
- D** 1x iCon



Category





# Feed Mixer.

## Linde Standard Product Portfolio

60 kW – 200 kW

### Application Example

120 kW, 10 t, tractive effort 33 kN,  
ground speed 32 kph

### Equipment

1x HPV 105-02 E2 (Propel drive)  
2x HMV 75-02 E6 (Propel drive)  
1x HPV 105-02 E1 (Chopping unit)  
1x HMF 55-02 (Chopping unit)

### Advantages

- Compact tandem pumps for the propel and auxiliaries circuits
- Hydraulic controls for all adjustable components
- Variable motors switchable between two stages

### Options

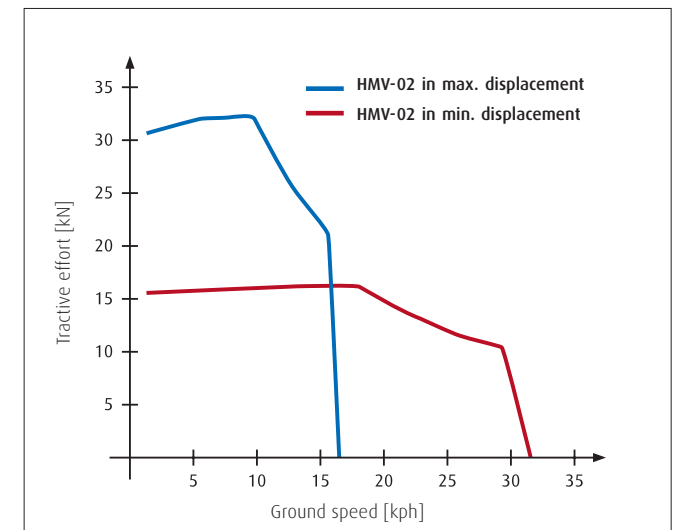
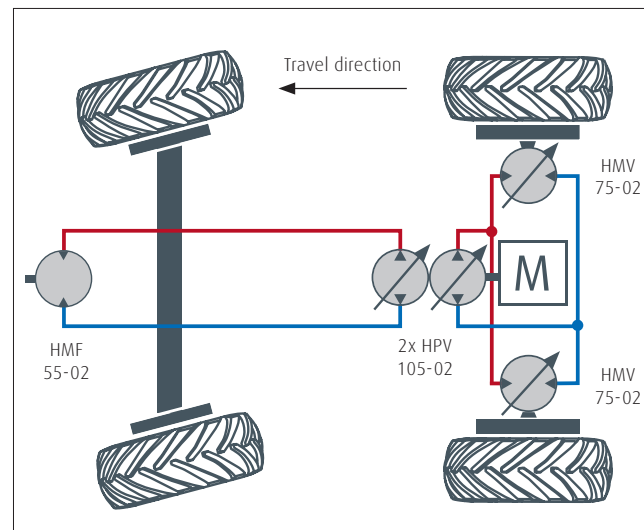
- Electro-hydraulic control of the hydrostats
- Separate, hydraulic mixer drive
- Gearbox version

The use of hydrostatic drives for auxiliary and propelling functions is illustrated by this example of a self-propelled feed-mixer. The chopping unit at the leading end of the conveying channel is driven by an HMF 55-02 fixed-displacement motor of compact dimensions. This is supplied with oil by an HPV 105-02 variable-displacement pump as required. It could also be used to drive the conveyor belt, which can be within the channel or arranged in other configurations.

The driver has a perfect overview of the chopping process and can move the machine sensitively and precisely. The reason for this is the hydraulic rear-wheel drive. This consists of two variable motors, which are connected directly to the wheels via wheel gears.

The hydraulic motors can be switched between two displacements and therefore take over the function of a mechanical shift gearbox. The machine can be moved sensitively by means of the second HPV 105-02.

The variable speed of this unit is controlled by a electric control signal, which is determined by the operator's accelerator pedal. Thanks to the PTO capability of the Series 02 units, the pumps for the drive and auxiliary circuits can be connected one directly behind the other. There is no need for a pump splitter gearbox.



**Equipment**

- A** 1x HPV 105-02 E1
- B** 1x HPV 105-02 E2
- C** 2x HVM 75-02
- D** 1x HMF 55-02



**Category**



# Feller-Buncher.

## Linde Standard Product Portfolio

150 kW – 400 kW

## Application Example

220 kW, 30 t

## Equipment

2x HPV 105-02 E1 (Propel drive)

2x HMV 165-02 (Propel drive)

1x HPR 210-02 E1L (Self-regulating pump for working hydraulics)

1x HPR 75-02 LP (Self-regulating pump for saw drive)

1x CMV 170 (Variable displacement motor for saw drive)

1x VT1 (Main control valve MCV)

1x VW12M3 (Control valve at processor)

1x iCon (Electronic control unit)

## Advantages

- Very compact units
- Precision control
- Partially automated workflows

## Options

- Wheel-driven variants
- Propel drive in open circuit
- Scalable level of electrification, LSC functions even with purely hydraulic actuation of valve sections

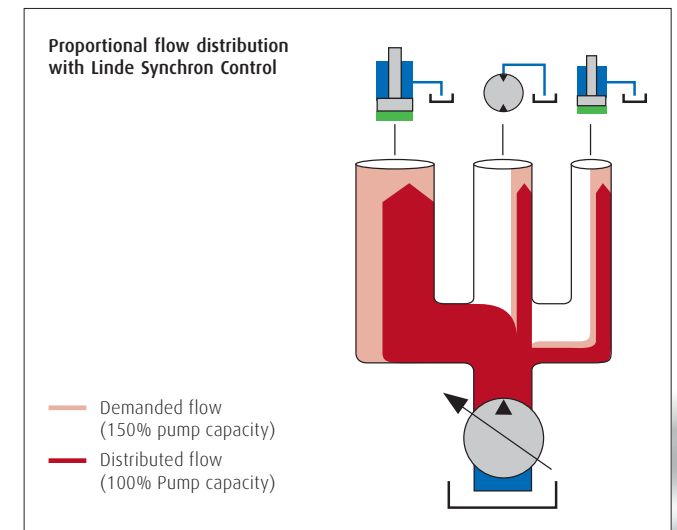
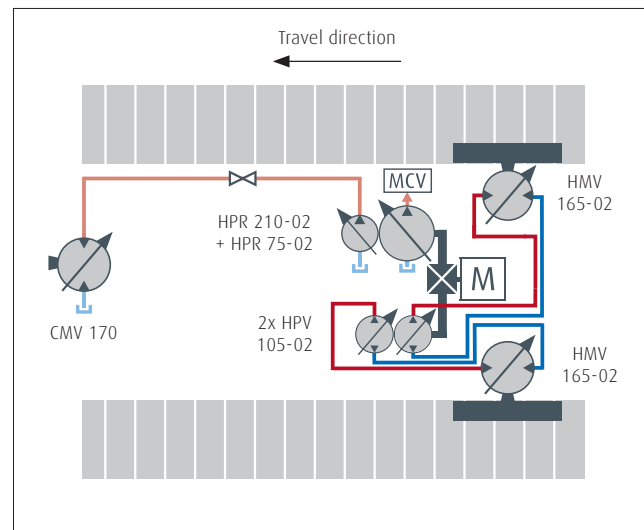
Linde components are robust, field-tested and designed for a long service life even in heavy duty applications. The example design depicts the propel drive system in a closed circuit, which provides precise, controlled directional stability and wear-free steering, especially with regard to soil protection. The saw is driven by a separate drive in an open circuit. The other machine functions are realized using a LSC valve block which distributes exactly the demanded flows.

Thanks to the parallel architecture of the LSC System and the block's modular design, based upon infrastructure modules and sub plate-mounted valves, one MCV provides a common basis for differently equipped machines. In a machine with an open circuit drive system design the other components do not change greatly: The MCV block can simply be extended with the required valve sections and pump fittings if necessary. The rest of the components remain the same, which simplifies storage and reduces the training requirements of service personnel.

Beyond that, the modular design offers the ability to customise machines even in the field.

Thanks to the LSC system, no actuator stops unexpectedly or reacts unpredictably when the system's demand exceeds the diesel motor power. Keeping the actuator responses proportionally identical makes the machine safe to control in any situation. LSC also prevents open circuit propel drive systems from unforeseen turning due to obstacles such as tree stumps. If an obstacle causes the system pressure on the drive side to increase, the oil does not flow to the other side - both drivetrains continue running at the same speed.

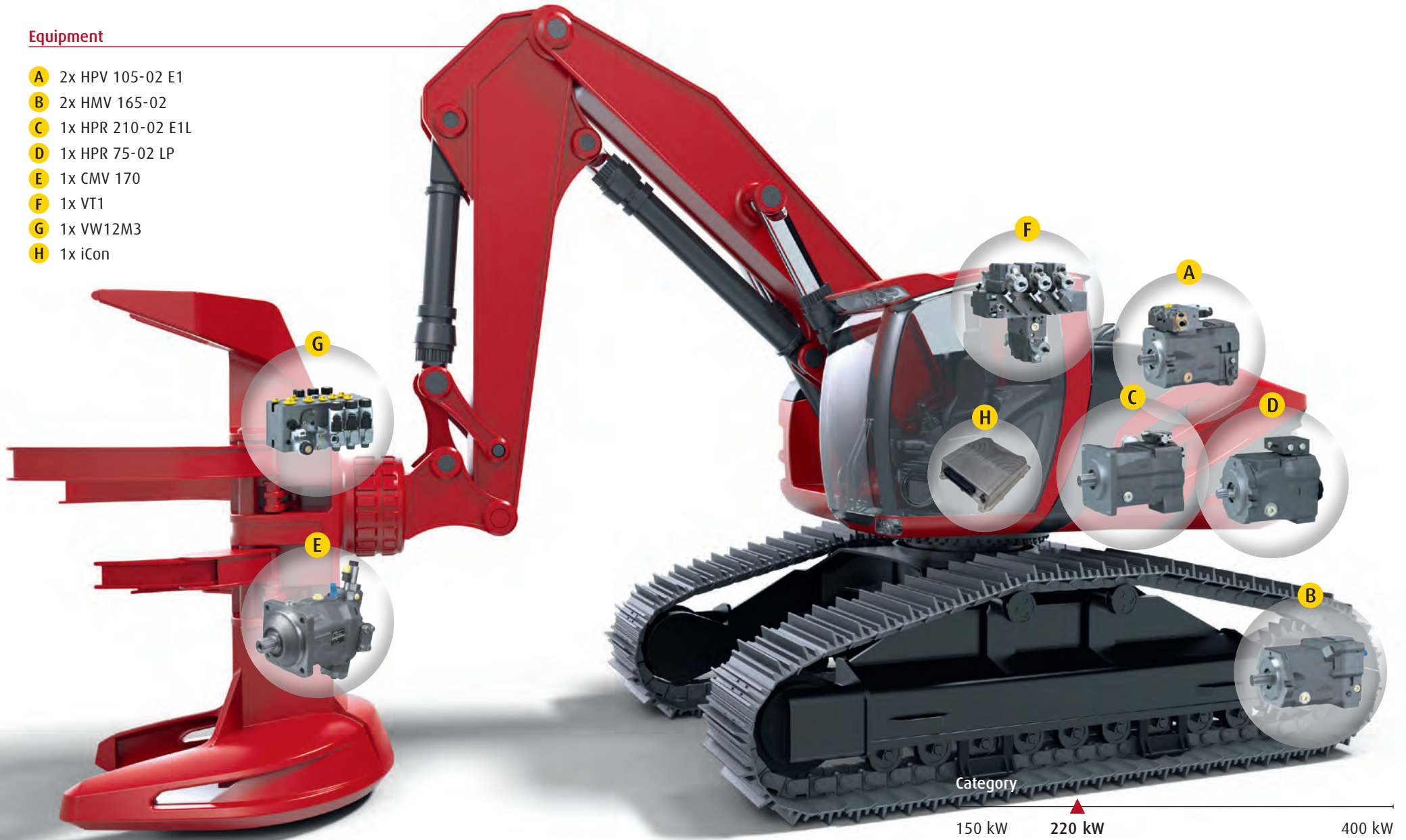
A layer-brazed valve block distributes the volume flows in the processing head. It is characterised by an extremely compact design and excellent electro-hydraulic actuation behaviour. Linde is also the perfect partner for other forestry machines, as well as wood processing and handling machines.





**Equipment**

- A** 2x HPV 105-02 E1
- B** 2x HMV 165-02
- C** 1x HPR 210-02 E1L
- D** 1x HPR 75-02 LP
- E** 1x CMV 170
- F** 1x VT1
- G** 1x VW12M3
- H** 1x iCon





# Wheeled Harvester.

## Linde Standard Product Portfolio

150 kW – 300 kW

### Application Example

200 kW, 20 t

### Equipment

1x HPV 210-02 E1 (Propel drive)

2x HMV 165-02 (Propel drive)

1x HPR 210-02 LEP (Self-regulating pump for working hydraulics)

1x VW25M3 (Main control valve MCV)

1x iCon (Electronic control unit)

### Advantages

- Maximum efficiency through the use of efficient standalone systems and components as well as the intelligent system design in closed and open circuits
- Does not require a pump distributor gear
- Only two gearbox ratios, "Shift in Motion" possible
- Low noise level thanks to SPU silencer

### Options

- Double motor instead of two single motors
- System scope and level of electrification can be scaled
- Partial automation
- LSC functions even for purely hydraulic actuation of valve sections
- Electronic actuation can be retrofitted, even for individual sections

Benefitting from Linde Hydraulics, modern, mobile wood-processing machines are both efficient and sustainable. The example design depicts a wheel-driven wood harvester with two high-performance yet compact hydraulic motors in a closed circuit. This design allows the machine to move safely and protect the soil, even on rough terrain.

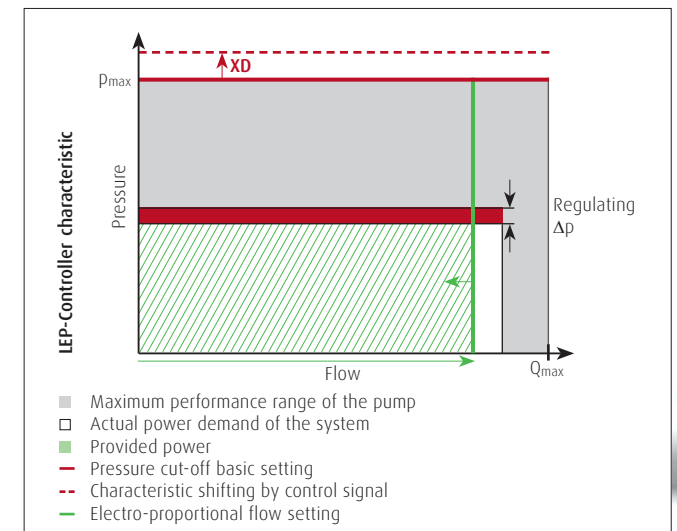
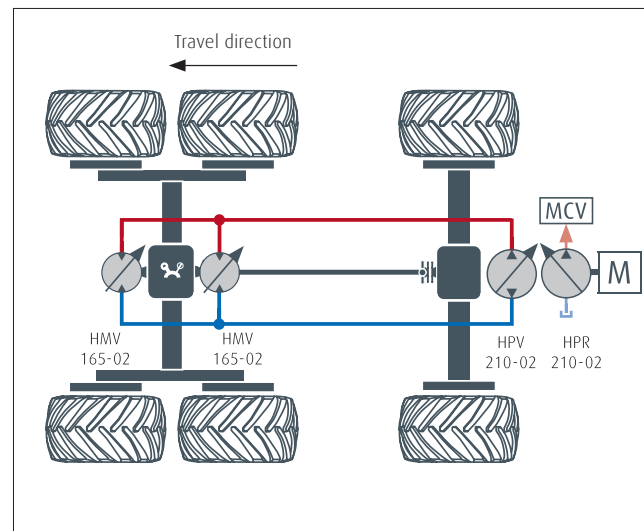
The Linde Synchron Control (LSC) system is a load sensing system with downstream pressure compensators. It enables the work functions to operate in an open circuit without mutual interference. A main control valve distributes the oil flow to the consumers. Its monoblock design combines an extremely compact build with a very low level of flow loss.

The oil is provided by a high-pressure pump of type HPR-02, which operates at the noise level of a pump in a closed circuit thanks to the SPU silencer. The LEP controller enables volume flow regulation according to actual requirements, based on the load sensing signal. Using the electrical override, the displaced volume

can also be limited or allocated according to application. Thanks to the hydraulically adjustable pressure cut-off, the hydraulic system is only operated at the defined pressure and securely protected from overloading.

The optimum coordination of individual components is always the main objective with regard to power and fuel consumption. Open and closed circuits are connected by the high-performance electronic control unit, which has already proven successful in other areas of application such as walking excavators. It actuates the pumps, motors and directional control valve sections in the machine control and can be integrated in other machine control systems, for example to fully or partially automate individual work processes.

Linde is also the perfect partner for other forestry machines such as forestry tractors, skidders and forwarders.



**Equipment**

- A** 1x HPV 210-02 E1
- B** 2x HMV 165-02
- C** 1x HPR 210-02 LEP
- D** 1x VW25M3
- E** 1x iCon



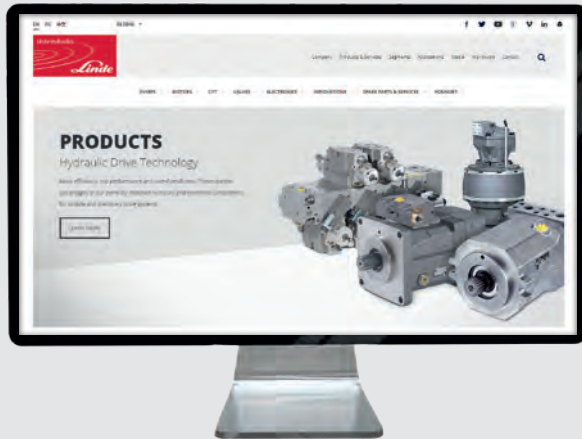
**Category**



# Well-informed. Our current Media at a Glance.

## Internet

Our home page [www.linde-hydraulics.de](http://www.linde-hydraulics.de) gives you an up to date overview of the company and its products. In addition to that you will find videos and animations. In the download area we provide selected CAD models and drawings to help you with installation studies. The following print media are available in the latest version, optimized for screen resolution.



## Product Catalogue and Brochures

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.

### Product Catalogue

- 1 Turning Power into Motion.  
Hydraulic and electric drive technology

### Brochures

- 1 Drive systems for construction machines.
- 2 Drive systems for agricultural machines.
- 3 HPV-CA. Unbeatable driving experience for applications with engine speed control
- 4 LSC Linde Synchron Control. Performance meets Flexibility
- 5 VW M3. LSC directional control valves in monoblock design

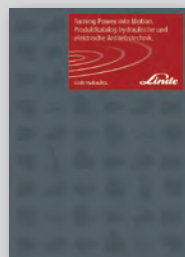
## Data Sheets

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.

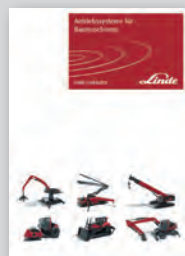
### Data Sheets

- 1 Model Code. Configuration of series 02
- 2 HMF/A/V/R-02. Hydraulic motors for closed and open circuits
- 3 HPR-02. Self-regulating pumps for open circuits
- 4 HPV-02. Variable displacement pumps for closed circuits
- 5 VT modular. LSC manifold valve plates
- 6 Mineral-oil-based hydraulic fluids

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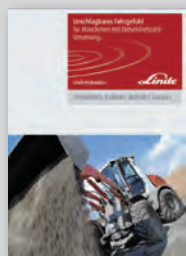
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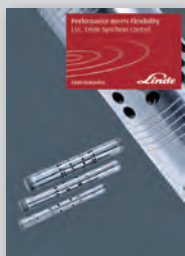
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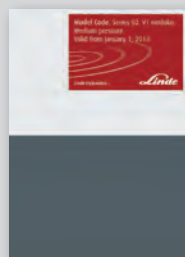
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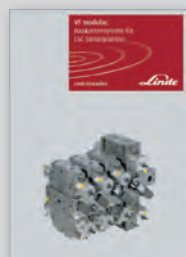
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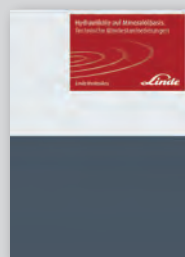
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Turning Power into Motion.

