

ELECTRIFICATION



With coordinated mobile hydraulics to high performance and profitability

**Efficient System Solutions for the
Electrification of Mobile Machines**

Your partner for electrification

Electrification Has Become a Trend

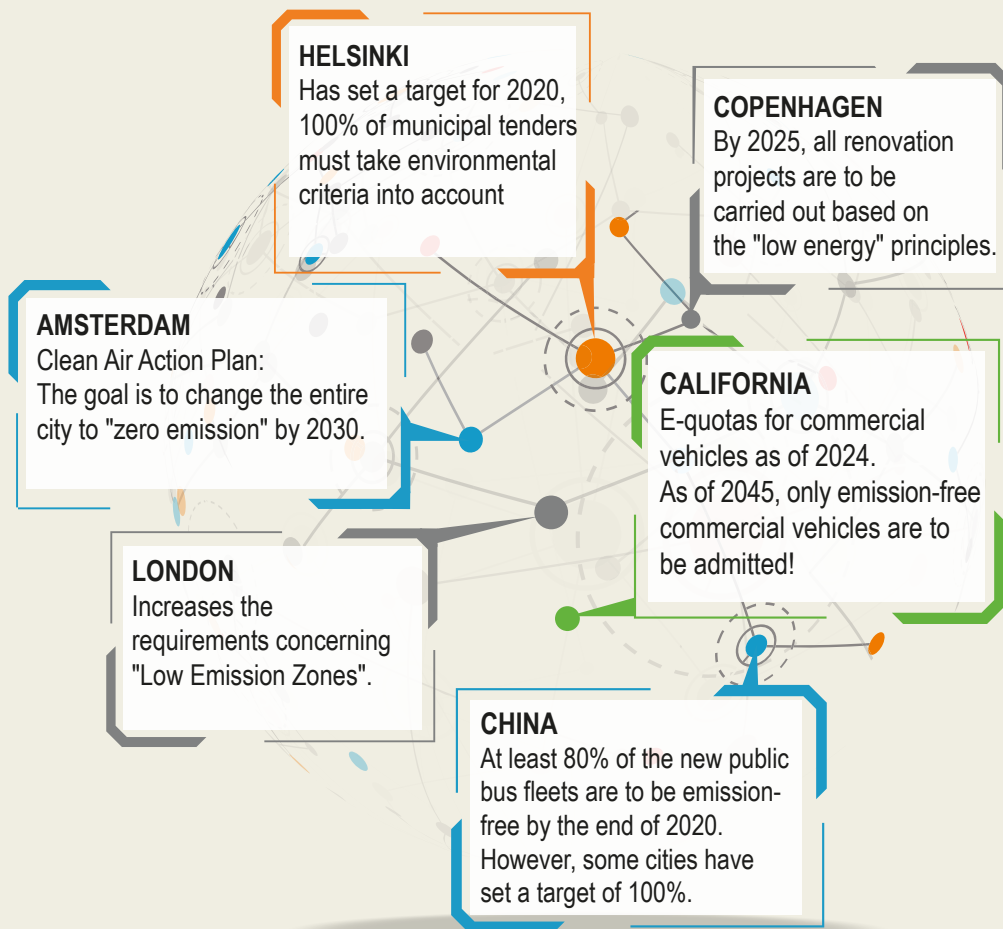
Just a passing phenomenon?

Sustainability and urbanization are two megatrends that will continue to drive the electrification and efficiency of mobile machinery. In the coming decades, this will further increase the demand for innovative solutions.

Current challenges

- Reducing CO₂ emissions in the EU by at least 60 % (by 2030) ¹⁾
- Reducing energy needs and using renewable energies, see "Energy Efficiency Strategy 2050" of the German Federal Government ²⁾
- "Zero-emission" as a goal for a positive ecological footprint

As a strong partner, Bucher Hydraulics supports its customers with innovative and efficient system solutions.



¹⁾ European Parliament (2018); Reducing CO₂ emissions; EU-climate objectives and provisions

²⁾ Climate Action Plan 2015 (2016); Climate protection political principles and objectives of the Federal Government BMU

The main topic

Smart Electrohydraulics as a Success Factor

Increased efficiency with optimal hydraulic systems

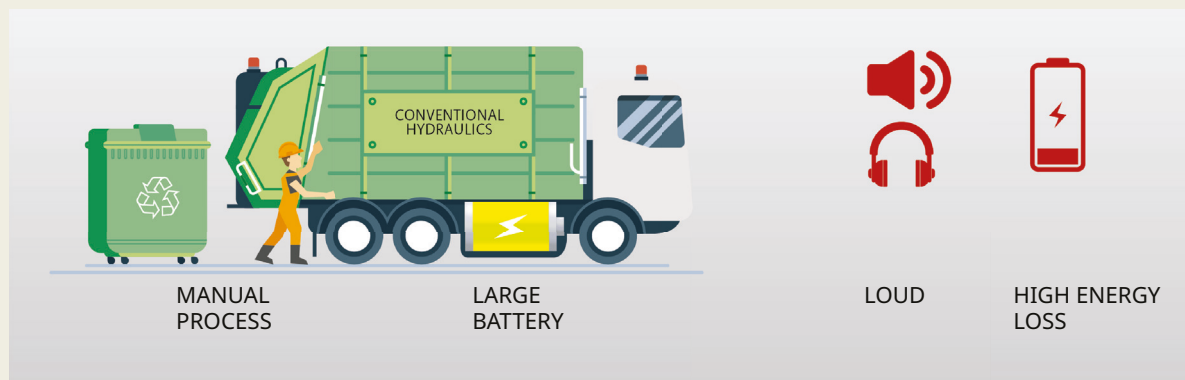
In the electrification process, many machine manufacturers focus on the traction drives, but often pay too little attention to the existing hydraulics. Classic hydraulic drive and control solutions for mobile machines are often designed to reduce initial costs rather than efficiency. This provides an opportunity to offer energy-saving potential of up to 60 %.

Benefits thanks to coordinated system components:

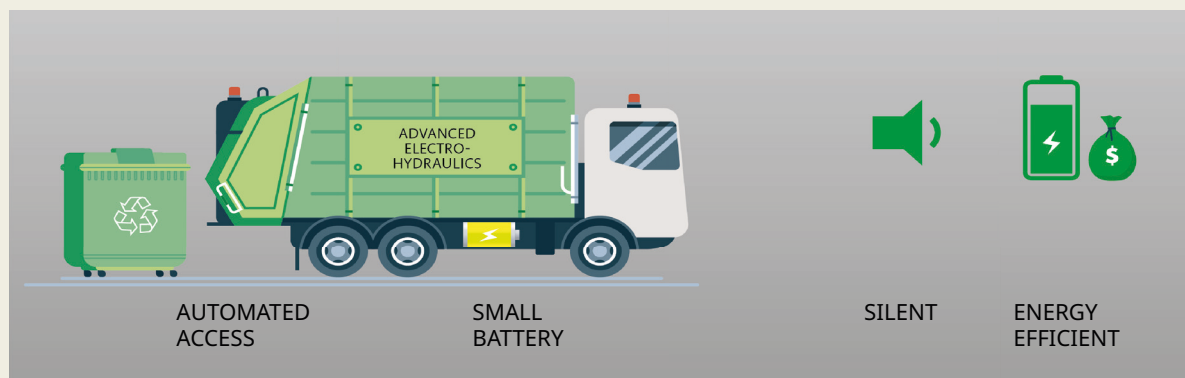
- Savings potential for battery and operating costs due to the reduced energy demand of fine-tuned hydraulic systems
- New application possibilities thanks to reduced noise emissions
- Greater range and longer operating times with the same battery size
- High energy efficiency and durability serve as a basis for successful electrification

All these advantages have a positive effect on life cycle costs.

Conventional hydraulics



Advanced electrohydraulics



System architecture

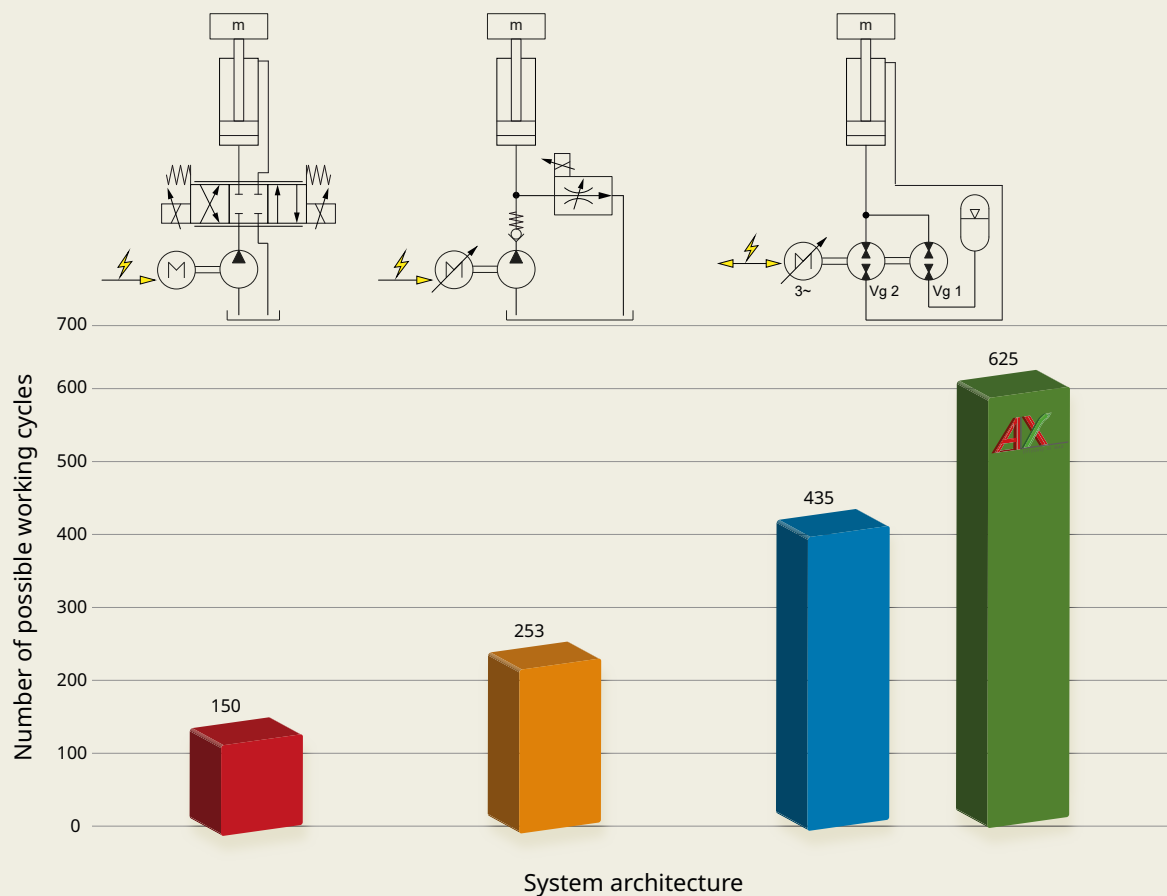
High Efficiency Thanks to Suitable System Selection

Impact of the system architecture on the energy demand

In order to achieve high cost-effectiveness, longer service life as well as reduced energy consumption, efficient, coordinated hydraulic components are of crucial importance.

We offer you innovative solutions for the electrification of mobile machines.

System comparison: number of possible cycles (lifting & lowering) with battery capacity of 20 kWh.



- Throttling control
- Displacement control **without recuperation**
- Displacement control **with recuperation**
- Displacement control **with recuperation and highly efficient AX-pump**

Approach based on HELAX

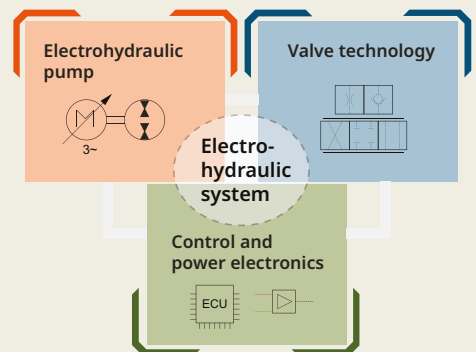
HELAX – The Solution for Decentralized Drive Concepts With High Efficiency

Massive energy savings thanks to recuperation with AX piston pump

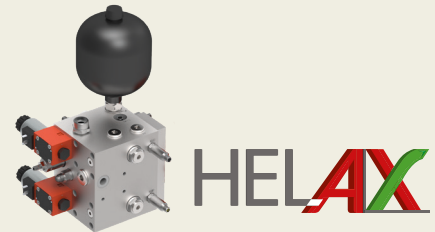
In the following application example of a reach stacker, the existing load-sensing hydraulics shows enormous savings potential compared to a new pump control system based on the AX pump.

Savings potential resulting from:

- Simple recuperation of energy while lowering due to innovative system architecture
- Highly efficient AX pump
- Reduction of the required battery energy
- Longer operational availability without battery charging



We cater to your individual requirements and needs and work with you to determine the maximum possible savings potential.



HELAX

This infographic features a reach stacker lifting a container. It includes several key elements:

- Energy reduction:** Indicated by a green lightning bolt icon with a downward arrow.
- Longer operating time:** Indicated by a clock icon with a lightning bolt.
- Cost and time savings:** Indicated by a stack of coins icon.
- Performance Metric:** A green curved arrow indicates "1 working cycle 57% energy reduction".
- Hydraulic Schematic:** A detailed diagram of the hydraulic circuit, showing a motor (M), a 3-phase pump (3~), and two valves (Vg 2 and Vg 1).
- Battery Charging:** A battery icon with a lightning bolt and a red charging cable connected to the stacker's battery pack.

Electrohydraulic overall system

Possibilities and Solutions Based on Directional Control Valves

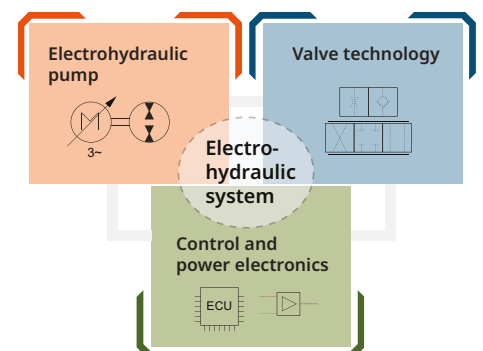
The perfect module combination

To combine electric drive technology and hydraulics, various modules are combined, resulting in an electrohydraulic system solution with demand-based volume flow control.

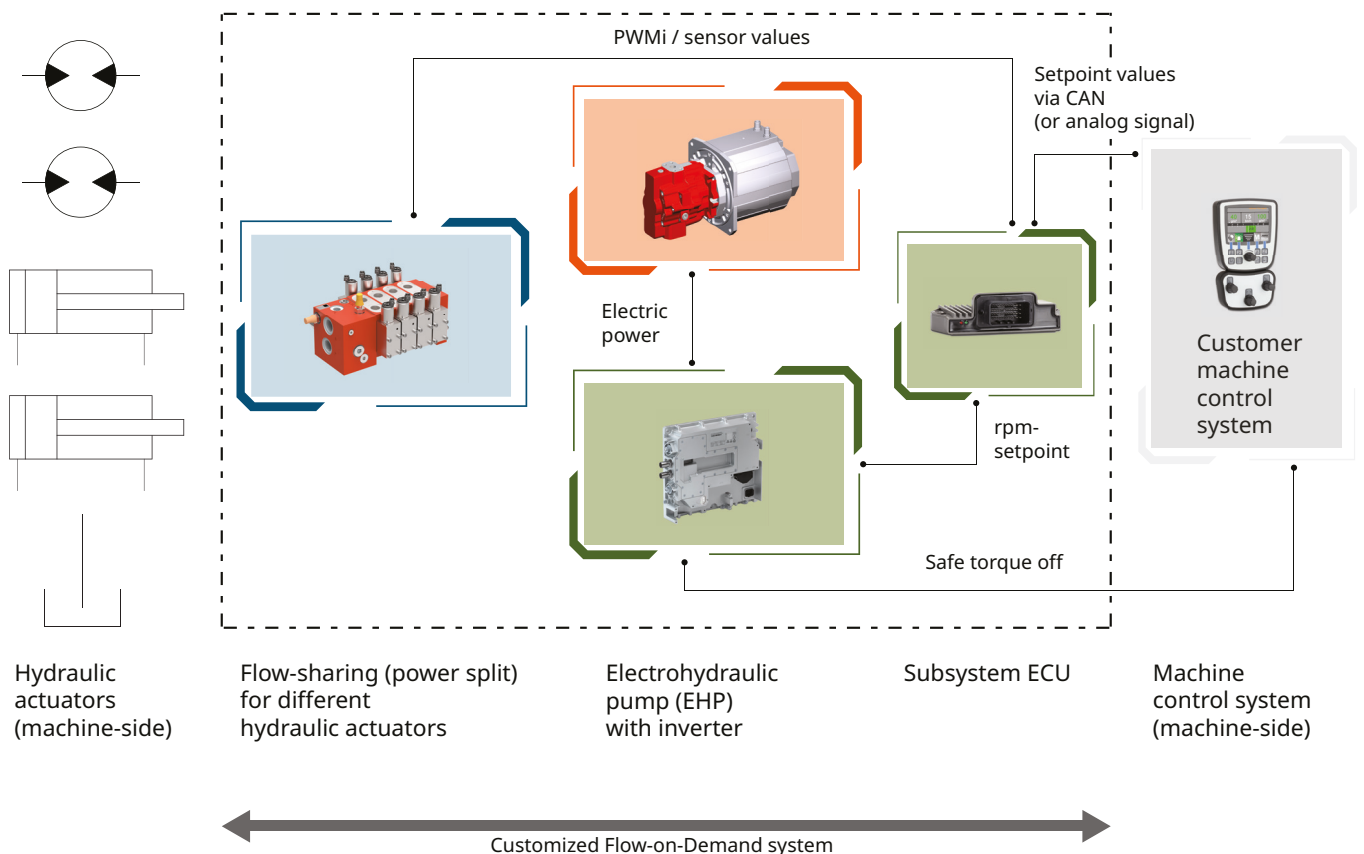
Typical module combination of a Flow-on-Demand system solution

Main components:

- Electrohydraulic pump (EHP) with suitable inverter
- Valve technology with Flow-Sharing principle
- Electronic control unit (ECU) with Flow-on-Demand software



The foundation of a unique, optimally tuned system architecture produces a decisive increase in efficiency and cost-effectiveness.



We optimize your machine

Individual System Analysis – Our Strong Point

Increased efficiency with coordinated system architecture

Bucher Hydraulics provides support with new, electrohydraulic system architectures, which are ideally matched according to technical and economic criteria.

Optimal system analysis though:

- Recording the current state incl. the economic and technical requirements
- Accurate analysis and precise evaluation thanks to specially developed design software
- Best-fit approach for your machine

Comprehensive range of services:

- The optimization potential is checked directly on your machine using a functional model
- Supervised commissioning
- Support for series start-up after prototype release
- On-time, flawless delivery of your harmonized system solution

Our customers can rely on Bucher Hydraulics' decades of proven expertise.

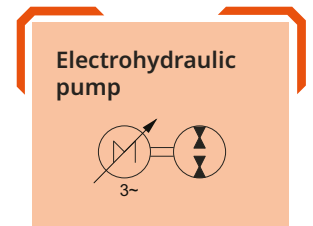


High-tech at the highest level

Key Component: AX Pump

Revolutionary technology

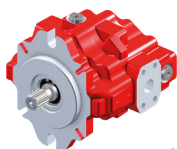
The combination of a tuned inverter, electro motor, and a Bucher Hydraulics axial pump all work together to form the foundation for a high efficiency "Power on Demand" hydraulic power supply. Previous problems such as pressure pulsations, low speeds at high pressure and high power dissipation are solved with the unique AX pump.



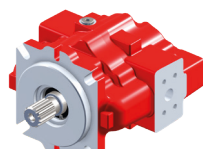
Advantages of the innovative AX pump:

- 94 % overall efficiency
- 99 % start-up efficiency
- No minimum speed limit
- Low pulsations
- Low noise level
- Compact dimensions
- Low temperature increase

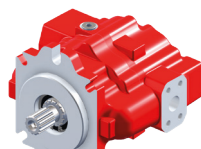
The unique AX pump opens up new possibilities for the electrification of mobile applications and is an ideal component in the modernization of your mobile equipment.



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Frame size 48



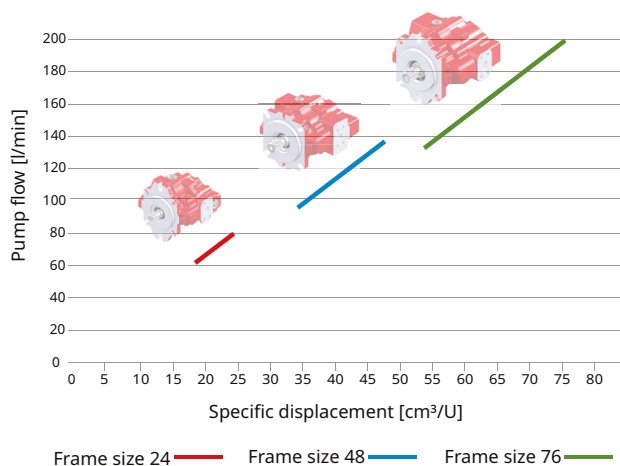
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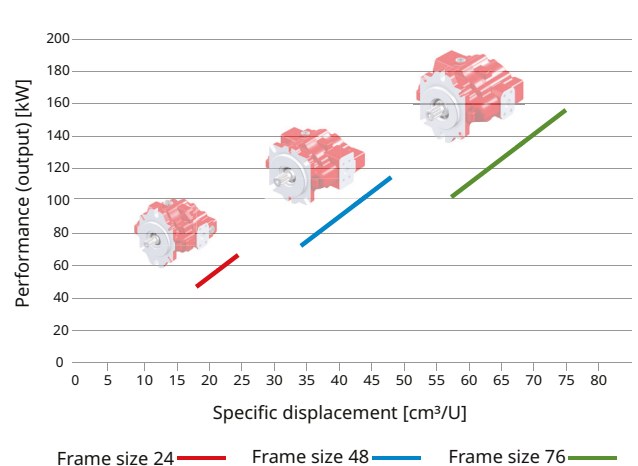
Technical data

Type	Displacement cm ³ /U	Continuous pressure max. bar	Peak pressure bar	Max. speed U/min
AXFP	18...76	450	500	<1...3600

Flow rate – ranges of AX pumps



Power – ranges of AX pumps



Adaptability and optimal control

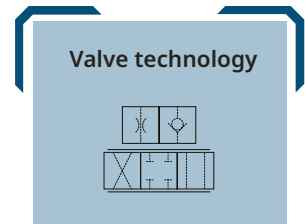
Valve Technology and Electronic Control Units

Valve technology

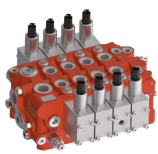
For decades, Bucher Hydraulics has been successfully positioning itself as a global player in the field of valve technology. With our directional valves, we offer an adaptable and comprehensive modular system to implement new innovative solutions.

Advantages of our directional valves in terms of electrification:

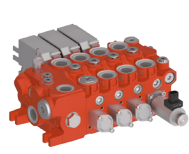
- Reduced energy consumption and precise positioning thanks to stepper motor drive
- Directional valves that can be combined together for flexible adaptation to various requirements
- Extremely precise control, even when operated simultaneously
- Considerably reduced energy consumption due to low pressure losses



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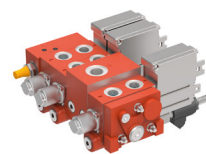
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LVS



L.8S

Technical data

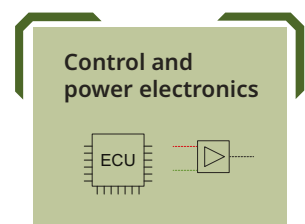
Type	Flow rate l/min	Inlet pressure bar	Actuator pressure (A + B) bar
HDSx4	70...180	280...300	320...350

Technical data

Type	Flow rate l/min	Inlet pressure bar	Actuator pressure bar
LVS	50...180	250...300	280...320
L.8S	50...150	250...315	280...315

Inverter, controller and software

Bucher Hydraulics has the necessary electronics and software expertise to successfully implement application-optimized system solutions. We use control and power electronics components from the Bucher Group as well as products from our partners. The result is an application-specific, optimized power-on-demand drive system that can be easily controlled and integrated into the machine concept.



Expansion module



Mobile DCU/PSU

Technical data

Controller

Supply voltage 8...32 VDC

Communication:
 analog voltage 0...5 V
 analog current 0...20 mA
 digital CANopen, J1939

Protection class IP65

Technical data

Inverter

Supply voltage 200...848 VDC

Power range 11...30 kW

Communication CANopen, J1939

Protection class IP65...IP6K9K

Demand-based volume flow control

Power-on-Demand System Solution

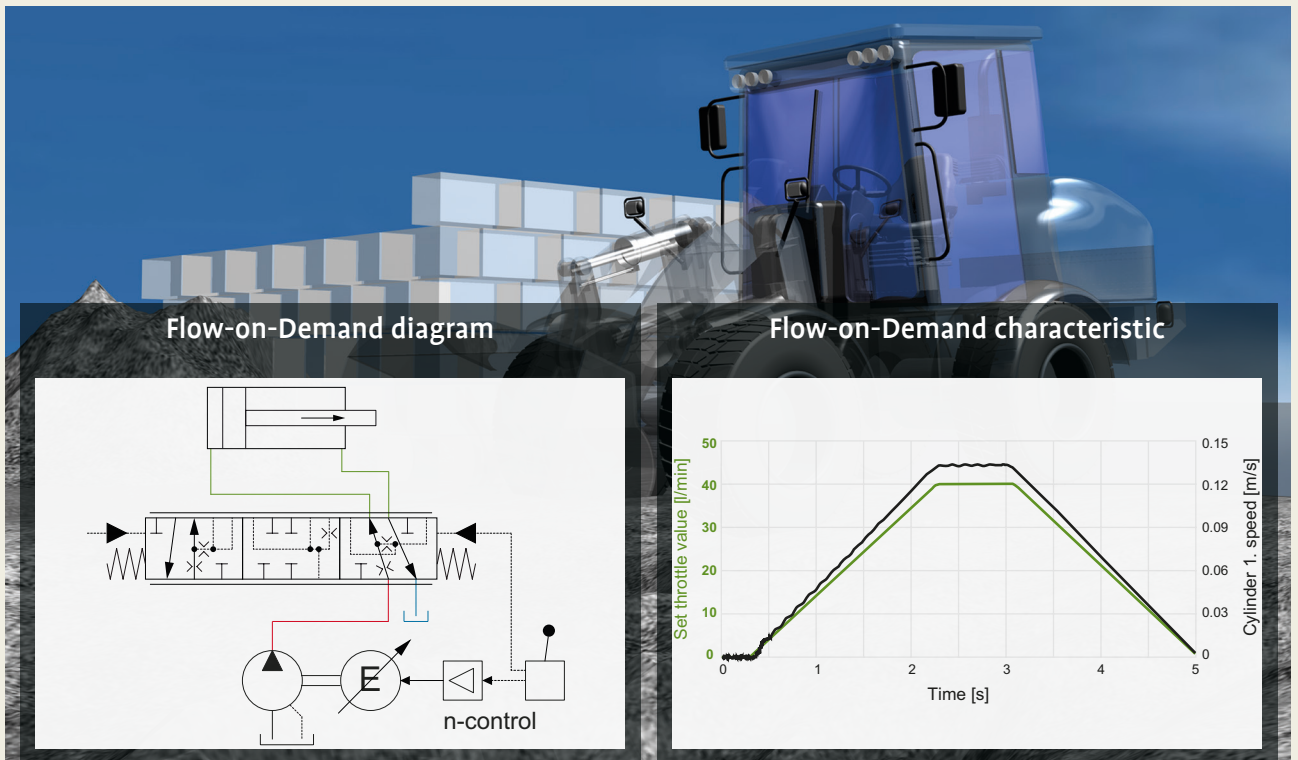
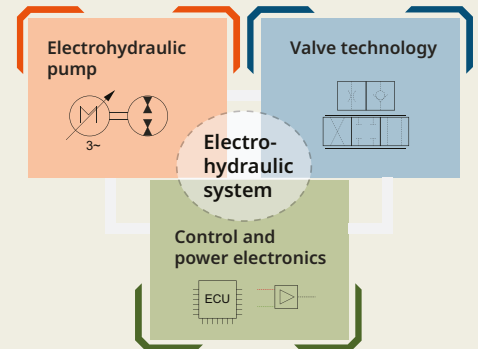
Success factors

Energy efficiency, noise emission, uprating and total operating costs depend largely on the system architecture as well as on the components used. Bucher Hydraulics has several Power-on-Demand system architectures such as Flow-on-Demand, Negative-Flow-Control or Negative-Bypass-Control.

Compared to conventional valve control, Flow-on-Demand system solutions offer many advantages:

- Simple integration into existing machine concepts
- Rapid acceleration and precise load control
- No susceptibility to oscillation of actuators
- Less heat loss and thus reduced cooling efforts
- Low noise emissions (in conjunction with AX pumps)

Together we will find a customized solution for your needs. You will be convinced by the main benefits such as increased efficiency, noise reduction and system stability. Combining your system with our AX pump can drive the electrification of your mobile machines forward.



Outlook: the future of "Electric-Hydraulic Hybrid"

The Electrified Machine

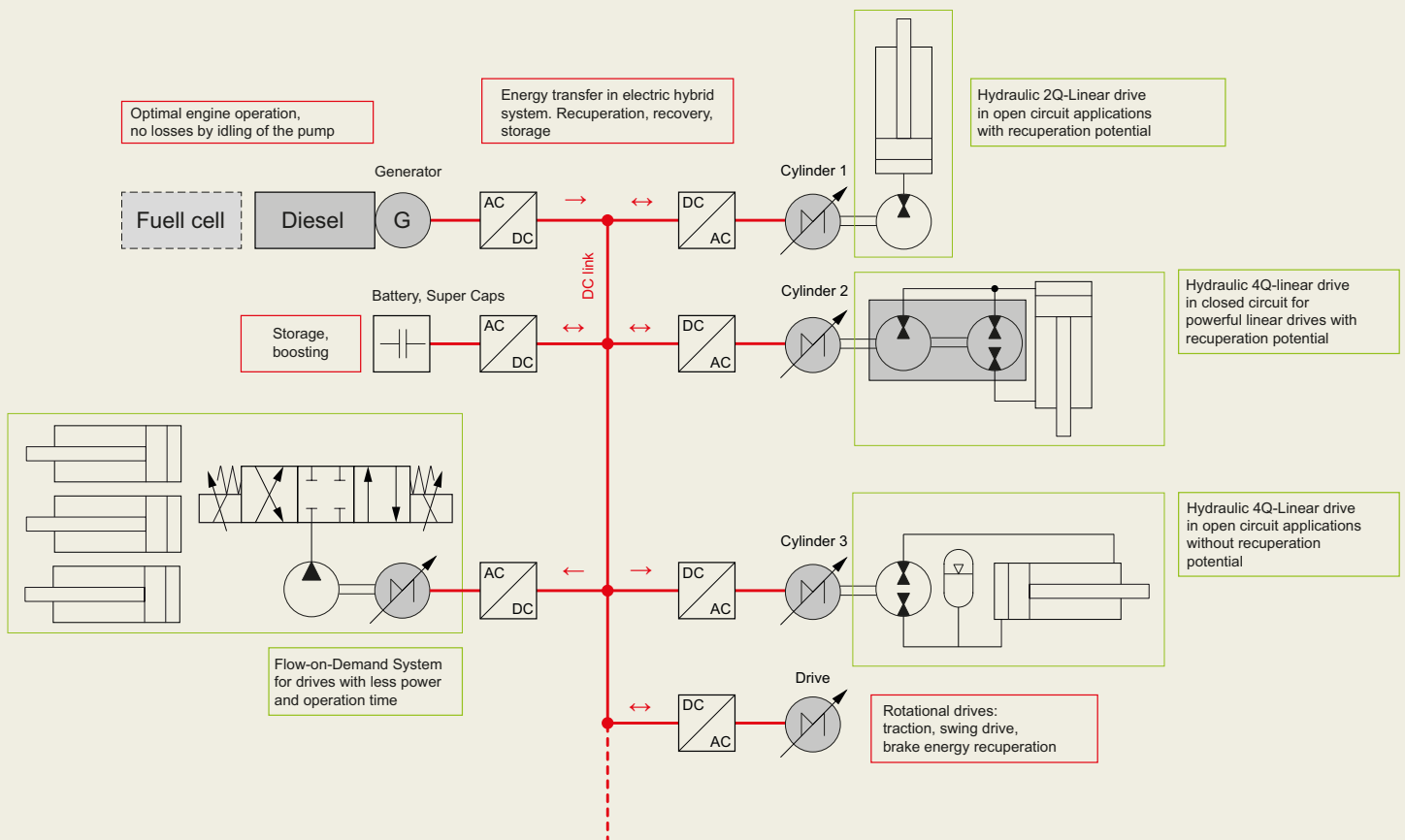
Increased energy efficiency by using the right drive

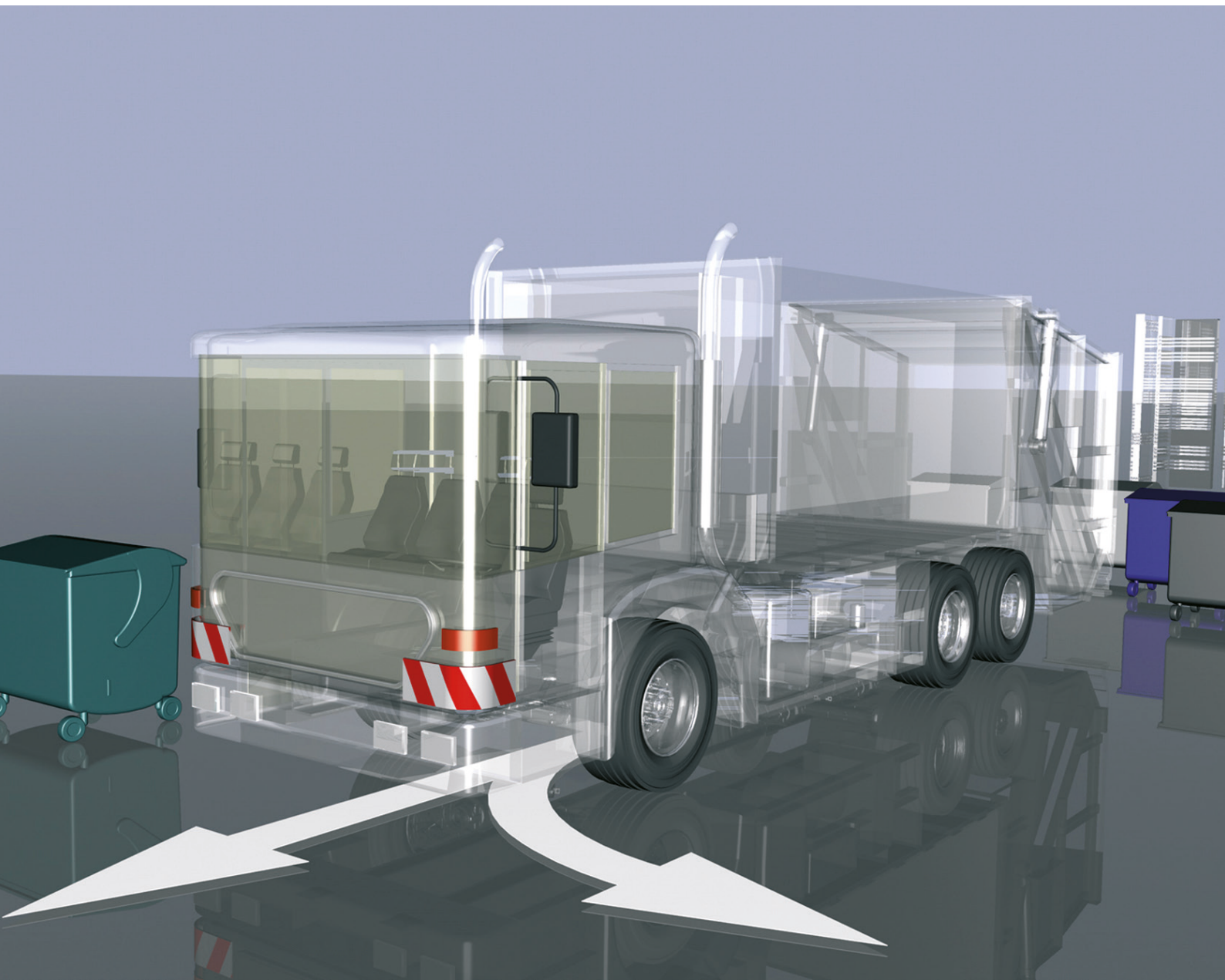
The transition from the traditional to the electrified machine must be cleverly planned and well-conceived. The right technology and our know-how will enable your mobile equipment to meet the requirements in terms of efficiency, dynamics and ruggedness.

We are prepared to offer future-oriented solutions by:

- Capturing and analyzing relevant system data
- Disclosing sources of loss
- Identifying highest possible energy saving potentials and utilizing the best system solution

We fulfil the high demands of various manufacturers. As a strong partner, Bucher Hydraulics can provide innovative and efficient electrohydraulic system solutions.





Should you have any further questions,
please do not hesitate to contact us.

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