CATERPILLAR OEM SOLUTIONS

CAT® HYDRAULIC SYSTEMS AND COMPONENTS

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HYDRAULIC SYSTEMS AND COMPONENTS

As an original equipment manufacturer (OEM), you need hydraulic solutions that optimize the functionality and performance capabilities of your products—and enable your business to productively and efficiently move with the market.

For superior hydraulic components and systems, look to the company that has provided powerful solutions to the construction, mining, waste management, agriculture, materials handling, on-highway, and forestry markets for nearly 100 years… Caterpillar!

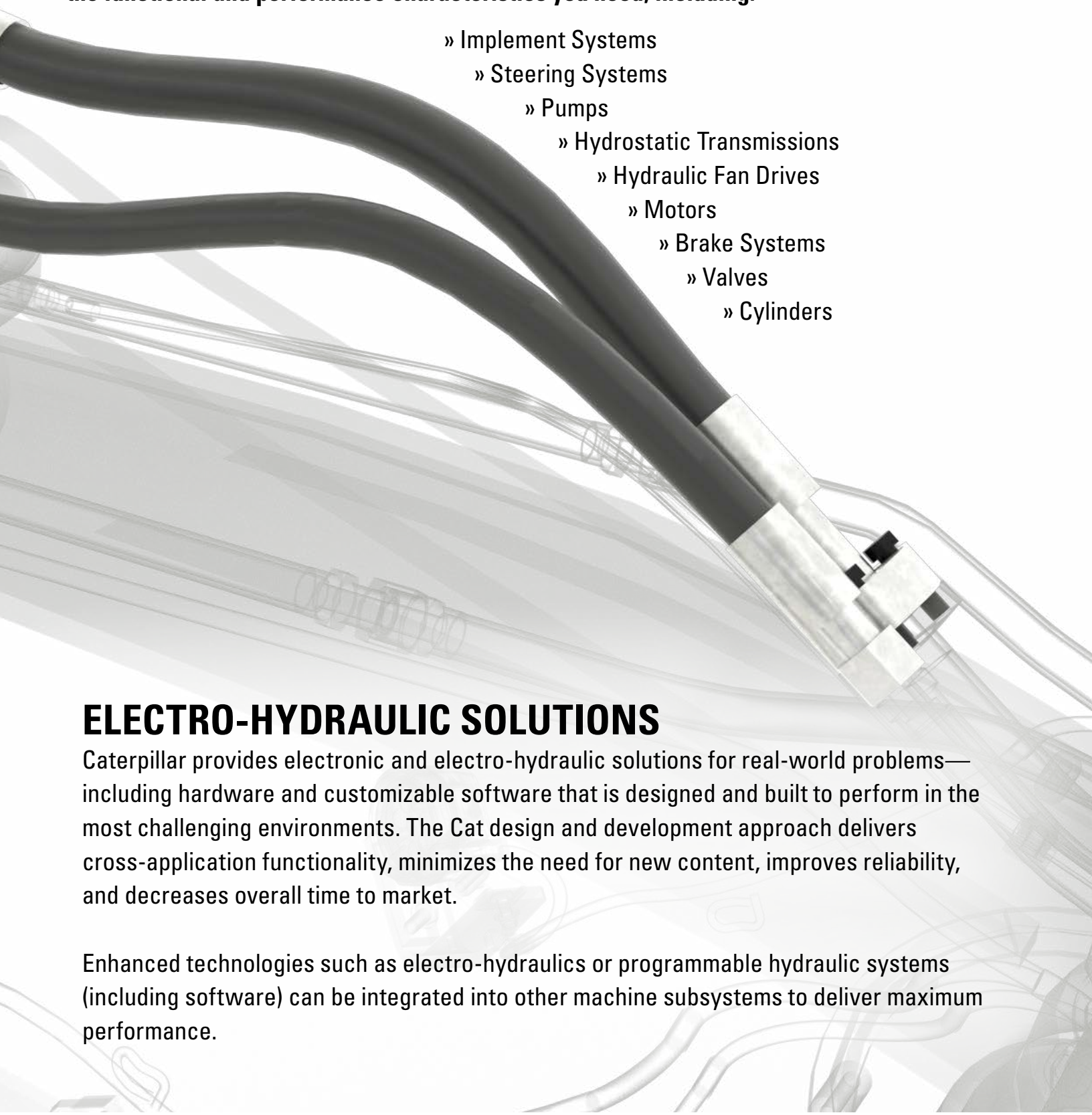
INTEGRATED SOLUTIONS FOR A COMPETITIVE EDGE

As an OEM, you can count on Caterpillar for innovative, integrated hydraulic solutions that can benefit your business in multiple ways.

- Cat® hydraulic products are designed and manufactured for superior fit, finish, and performance—delivering the precise performance and dependable operation that your customers demand.
- With Caterpillar as your hydraulics supplier, your business will benefit from greater component and system integration, as well as more competitive and cost-effective product solutions.
- Caterpillar offers unmatched capabilities and expertise—including a comprehensive product line, proven product development, worldwide sourcing, and engineering experience; sophisticated product testing in virtual, laboratory, and field environments; dedicated manufacturing facilities; world-class logistical services; and unsurpassed global service and support.

Caterpillar provides hydraulic systems and components that deliver the functional and performance characteristics you need, including:

» Implement Systems
» Steering Systems
» Pumps
» Hydrostatic Transmissions
» Hydraulic Fan Drives
» Motors
» Brake Systems
» Valves
» Cylinders



ELECTRO-HYDRAULIC SOLUTIONS

Caterpillar provides electronic and electro-hydraulic solutions for real-world problems—including hardware and customizable software that is designed and built to perform in the most challenging environments. The Cat design and development approach delivers cross-application functionality, minimizes the need for new content, improves reliability, and decreases overall time to market.

Enhanced technologies such as electro-hydraulics or programmable hydraulic systems (including software) can be integrated into other machine subsystems to deliver maximum performance.

INTEGRATED HYDRAULIC SYSTEMS

IMPLEMENT, STEERING, AND BRAKE SYSTEMS

A variety of pump and valve combinations (coupled with Cat cylinders and electronic control elements) are available to meet control, response, productivity, and efficiency requirements for these systems over a wide range of applications.

- **Implement Control Systems** can be provided with mechanical, pilot, or electronic control to meet the flexibility and feature needs for your machine.
- **Steering Control Systems** can be provided using steering wheel or joystick input.
- **Brake Control Systems** are in boosted and non-boosted configurations.

We provide all system elements from the operator's input device to the ground or tool. In addition, these three systems can be combined to provide an integrated, cost-effective hydraulic system solution for your application.

HYDROSTATIC TRANSMISSIONS

Cat hydrostatic transmissions heighten drivetrain performance and efficiency — particularly when matched with Cat engines, electronics, and mechanical drivetrain components. Stepless operation across the working range enables the best match of engine and ground speed. By integrating hydrostatic transmissions into your machines, your business will be able to:

- Integrate engine and transmission systems to satisfy emissions regulations
- Improve transmission performance compared to mechanical transmissions
- Simplify machine operation for higher productivity in the field

Whether your machine requires high torque, high speed, or both, Caterpillar can meet the specific application requirements.

IMPLEMENT SYSTEMS

Size	Compact	Small	Medium	Large
Flow Range lpm (gpm)	40 to 120 (11–32)	120 to 250 (11– 66)	250 to 450 (11–119)	>450 (119)
Available Pressure Range Bar (psi)	240 (3481)	350 (3626)	350 (3626)	350 (3626)
Typical Applications	Construction, Mining, Waste Management, Agriculture, Forestry, Material Handling			
Available Features	Pilot or Electro-Hydraulic Control, Flow Sharing, Add-On Sections for Attachments, Linkage Kickouts			

STEERING SYSTEMS

Type	Flow Range lpm (gpm)
CC EH	20 to 450 (5–119)
CC & OC HMU	4 to 227 (1–60)
CC HMU w/Flow Amplification	20 to 450 (5–119)
Piloted Flow Amplification	4 to 720 (1–190)
OC MECH	90 to 170 (24–45)
Closed Center (CC) Open Center (OC) Electro-Hydraulic (EH)	Closed Center (CC) Mechanical (MECH)

HYDROSTATIC TRANSMISSIONS

Machine Application	Engine Power kW (hp)	Max. Speed kph (mph)
Single Path Wheeled	30 to 110 (40–50)	40 (25)
Dual Path Light Tracked and Wheeled	30 to 75 (40–100)	20 (12)
Dual Path Heavy Tracked	30 to 185 (40–250)	10 (6)

INTEGRATED HYDRAULIC SYSTEMS

HYDRAULIC FAN DRIVES

Caterpillar offers a comprehensive selection of variable speed and clipped speed hydraulic fan drives. Cat hydraulic fan drives provide on-demand engine cooling for efficient, productive machine performance, on-road or off-road, in all conditions.

Because hydraulic fan drives are quieter and use less power than traditional engine-driven fans (particularly at higher speeds), they can help your company:

» Enhance fuel efficiency
» Satisfy U.S. Tier IV environmental regulations and Stage II of European Noise Directive 2000/14/EC
» Reduce owning/operating costs over the equipment lifecycle

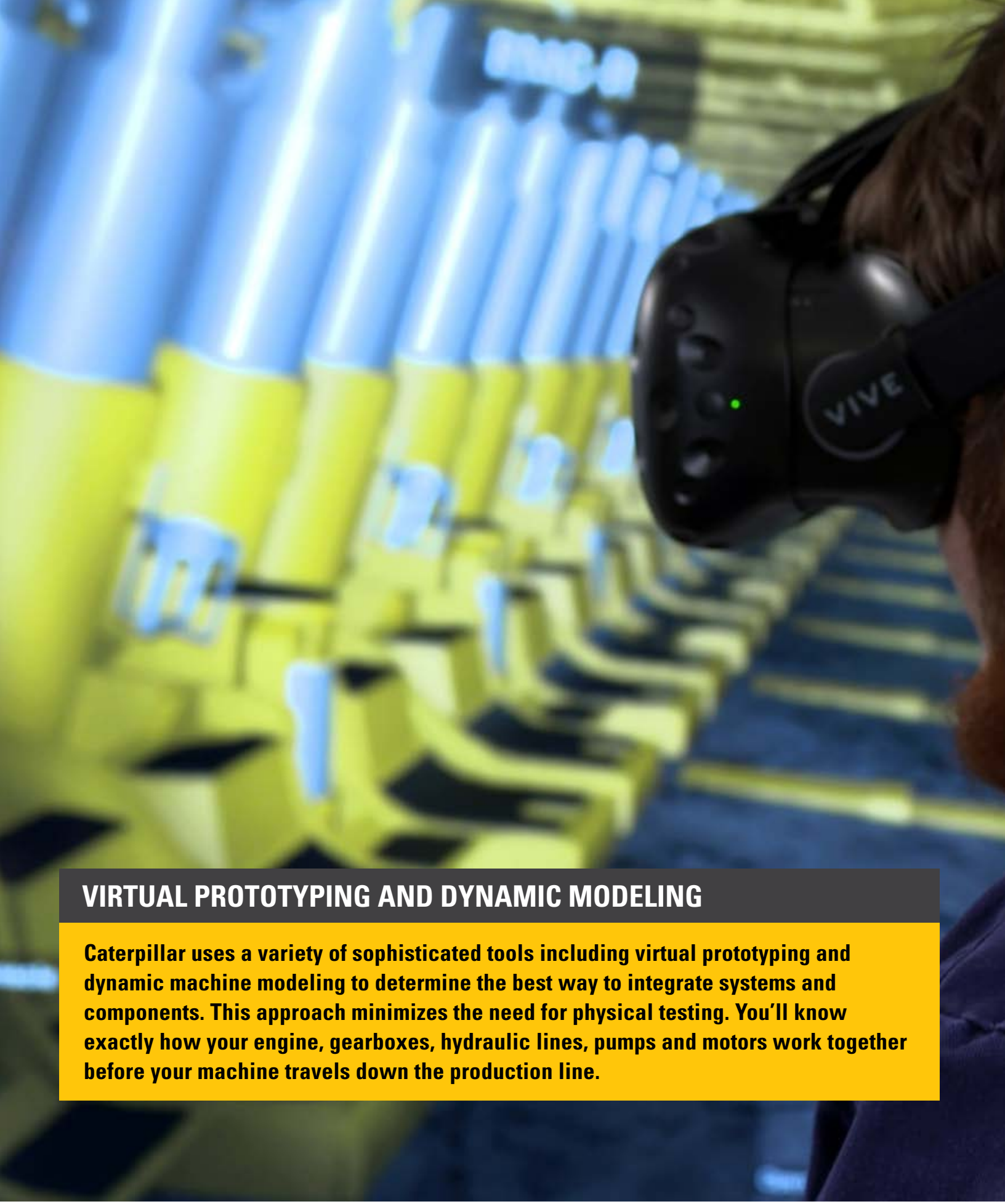
Cat hydraulic fan drives can be integrated into a new machine and/or retrofitted into an existing machine. These drives can be engineered for specific applications and engine speeds, and may be configured with reversing capability or combined with pumps and other components.

Integrating a hydraulic fan drive also allows flexibility in placement of the engine fan and radiator. This can improve engine access and reduce owning/operating costs. Hydraulic fan drives can be adjusted, enabling your customers to match performance to different seasons and working conditions.

FAN DRIVE SYSTEMS

Fan System Type	Power kW (hp)	Speed (rpm)
Variable	25 to 50 (34 – 67)	0-2500
Clipping	Up to 30 (40)	0-2500

VARIABLE SYSTEMS ARE AVAILABLE WITH:
- Open or Closed Loop pressure control
- Closed Loop speed control for noise regulations



VIRTUAL PROTOTYPING AND DYNAMIC MODELING

Caterpillar uses a variety of sophisticated tools including virtual prototyping and dynamic machine modeling to determine the best way to integrate systems and components. This approach minimizes the need for physical testing. You'll know exactly how your engine, gearboxes, hydraulic lines, pumps and motors work together before your machine travels down the production line.

HYDRAULIC COMPONENTS

VALVES

Cat valves are designed using state-of-the-art technologies such as computational fluid dynamics and hydraulic simulation aides. With nearly 60 years of experience engineering valves—with expertise in mobile equipment applications—Caterpillar offers a diverse line of proven, robust designs that feature low pressure drops and reduced heat loads, including:

» **Open-center directional valves—**
Typically used for rental, utility, and municipal specialty machines, these valves are designed to integrate with fixed pumps, providing the lowest cost solution versus variable pumps.

» **Open-center and closed-center load-sensing directional valves—**
Designed to perform in conjunction with variable pump systems, these multi-function valves deliver the most cost-efficient solution for high productivity applications and provide better machine controllability performance to different seasons and working conditions.

» **Monoblock valve configuration—**
Designed for specific applications, these low-weight, space-efficient valves are easily maintained, reducing owning/operating costs.

» **Sectional valve configuration—**
Provides the highest amount of flexibility and versatility in features and actuation methods (manual, pilot, electro-hydraulic controls). These valves also offer add-on capability for attachments and/or implements.

» **Pilot valves—**
Proportional hydraulic pressure control valves (single or multiple function), these valves offer a variety of metering characteristics and joystick control features for levers. Programming provides actuation and performance flexibility that can be matched to application requirements.

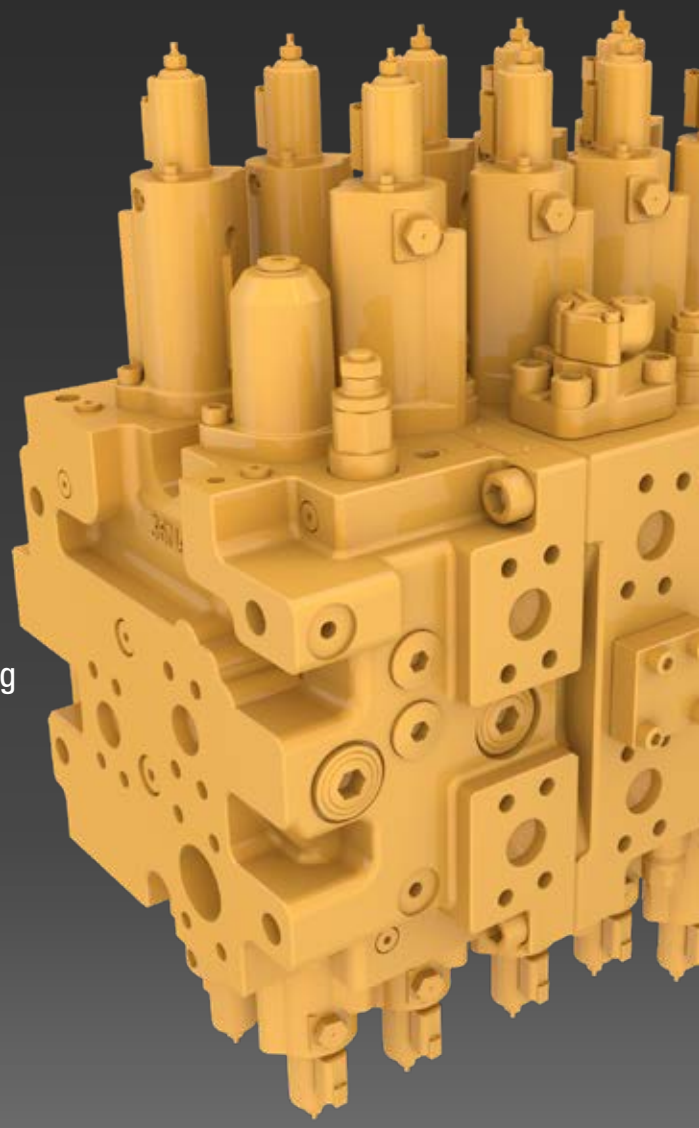
» **Electro-hydraulic control—**
Designed for multiple levels of performance, these valves provide more precise control of the hydraulic valve stem, designed actuation, programmability, and can be performance-matched to operator capability.

VALVES		
Valve Style	**Flow lpm (gpm)**	**Pressure bar (psi)**
Independent Metering	100 to 500+ (25 – 130+)	350 (5000)
Post Compensated	50 to 500+ (13 – 130+)	280 to 350 (4000-5000)
Pre Compensated	150 to 250 (40 – 65)	350 (5000)
Open Center	50 to 150 (13 – 40) and 250 to 500+ (65 – 130+)	210 to 350 (3000-5000)
Pilot		0 to 260 (0-375)

HYDRAULIC SPECIALTY VALVES

Produced to meet OEM specifications for a variety of applications including transmission, bypass, steering, and ride control valves.

- **Transmission valves**— Designed for counter-shaft and Powershift transmissions.
- **Bypass valves**— Designed for engine cooling.
- **Ride Control valves**— Designed for integration within the implement control valves, these valves offer low maintenance (fewer hose routing and fitting requirements) — reducing the owning/operating costs associated with the hydraulic system.
- **Steering valves**— Designed for hydraulic and electro-hydraulic systems, these valves can be produced with options to integrate with secondary steering systems.

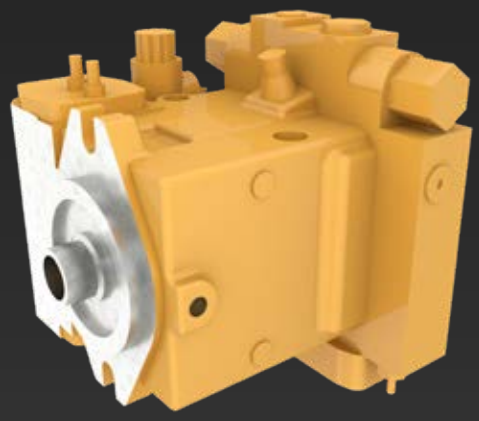


HYDRAULIC COMPONENTS

PUMPS AND MOTORS

Decades of experience designing and building tough, reliable pumps and motors for a broad variety of mobile equipment enables us to provide the components you need for your applications:

- Piston pumps for steering, implement, and fan systems
- Piston pumps and motors for hydrostatic transmission systems
- Piston and gear motors for open circuits
- Gear pumps and motors for fan drive systems
- Gear pumps for implement systems
- Gear pumps for engine lubrication (oil), transmission, and brake cooling systems



Designed with versatility in mind, Cat pumps and motors meet specific application requirements, provide excellent performance capabilities in demanding conditions—as proven by extensive testing and experience in the field—and allow easier maintenance over the life of the equipment.

PUMPS & MOTORS

	Bore Diameter mm (inches)	Rod Diameter mm (inches)
Open Circuit Piston Pump	55 to 250 (3.36 – 15.26)	up to 450 (6530)
Closed Circuit Piston Pump	55 to 250 (3.36 – 15.26	up to 450 (6530)
Fixed Piston Motor	55 to 500 (3.36 – 30.51)	up to 450 (6530)
Variable Piston Motor	55 to 500 (3.36 – 30.51)	up to 450 (6530)
2-Speed Piston Motor	80 to 250 (4.88 – 15.26)	up to 450 (6530)
Open Circuit Piston Pump	20 to 140 (1.22 – 8.54)	up to 280 (4060)
Closed Circuit Piston Pump	20 to 60 (1.22 – 3.66)	up to 280 (4060)
Fixed Piston Motor	20 to 75 (1.22 - 4.58)	up to 280 (4060)
Gear Pump	5 to 300 (.18 – 18.31)	up to 280 (4060)
Gear Motor	5 to 150 (.18 – 9.15)	up to 280 (4060)
Gear Pump	50 to 1300 (3.05 – 79.33)	up to 40 (580)

CYLINDERS

Medium-Duty Threaded Cylinders— Are available in smaller sizes and provide a cost-effective alternative for medium-duty applications with lower operating pressures.

Heavy-Duty Bolted Cylinders— Are available in longer strokes with thicker walls and accommodate large rod/bore combinations for better vehicle efficiency. These cylinders are generally designed for heavy-duty applications requiring higher operating pressures.

Position Sensing Cylinders (PSC)— Designed for electro-hydraulic and programmable hydraulic systems, PSC improve productivity by enhancing operator control. The cylinder incorporates an embedded sensor, which uses an electronic control module and proprietary software to provide position feedback to the machine operator. When integrated with Cat electronics, the PSC can enable automation of mobile equipment functions, to allow finite tracking of the cylinder stroke, reduce operator effort, and increase productivity.

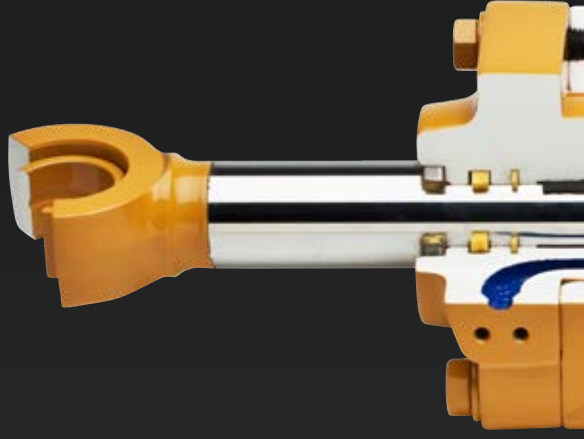
Front and Rear Struts— Used to absorb shockloads on the bodies and frames of large trucks (25 to 400 tons) —reducing stresses and enabling a smoother ride, higher travel speeds, and increased productivity. Front assemblies act as steering kingpins for good maneuverability and shorten the turning radius. Rear assemblies, which are attached to an oscillating axle, absorb shock loads as well as improve stability and ride comfort.

In addition, Caterpillar can incorporate electro-hydraulics or programmable hydraulic systems, cushioning, bypass valves and/or other custom features with hydraulic cylinders. Used in conjunction with these features— the ability to receive rod position feedback from the cylinder—operator and/or machine performance can be enhanced.

CYLINDERS

	Bore Diameter mm (inches)	Rod Diameter mm (inches)	Pressure Ratings bar (psi)	Stroke mm (inches)
Medium-Duty Threaded	50 to 160 (2 – 6.3)	30 to 115 (.8125 – 4.528)	Up to 311 (4500)	Up to 1900 (75)
Heavy-Duty Bolted	90 to 210 (3.5 – 8.3)	50 to 150 (2 – 5.9)	Up to 311 (4500)	Up to 2716 (107)
PSC	75 to 160 (3 – 6.3)	50 to 115 (2 – 4.5)	Up to 311 (4500)	Up to 2000 (79)
Struts	216 to 425 (8.5 – 16.75)	178 to 381 (7 – 15)	Up to 311 (4500)	Up to 165 (6.5)

ENGINEERING & MANUFACTURING



ENGINEERING

To ensure that components perform as expected in the most demanding applications and harshest work environments, Caterpillar uses sophisticated, innovative engineering tools and methodologies, such as our comprehensive computational fluid dynamics approach and proprietary system simulation tools.

Finite Element Analysis (FEA)

This assessment is conducted to evaluate the structural integrity of hydraulic components, and is achieved through use of sophisticated software packages such as Abaqus, Nastran, IDEAS and FE-Safe. To ensure adequate fatigue life, static and/or dynamic analysis is performed on hydraulic components including valves, cylinders, and tanks. This may include testing the non-linear effects of geometry, loading, or materials. Structural analysis of the hydraulic components is also conducted to verify soundness of design with respect to leakage, deflections, deformations, yielding, or cracking.

Symbolic/Numeric Analysis/Synthesis (SNAS)

This analytical simulation methodology extrapolates the relationships between machine specifications, performance measures, and design parameters. Since this provides accurate values, it allows us to solve equations directly using quantitative measurements of machine performance — such as system response time and linking breakout force — instead of running iterative simulations with theoretical data.

Packages have been developed in three areas of discipline: SNAS-FP for hydraulic system and control system modeling, analysis and design optimization; SNAS-LK for linkage performance analysis and design synthesis; SNAS-WA for machine working cycle analysis and energy auditing. Machine performance improvement and engineering cost reduction are some of the applications.

MANUFACTURING

Our Manufacturing and Supply Chain is Recognized as World Class

Strategically positioned providers within our lean, highly integrated supply chain bring the benefits of technology, global cost competitiveness, and volume flexibility to our business. Seamless integration of our total value-chain partners and availability of real-time information between sites enable us to serve customers faster than ever before. And with two locations in the United States, two in Europe and a joint-venture site in Japan, we are globally positioned to meet your needs.

With a focus on the elimination of operating wastes such as idle time, rework, and excess inventory, the Caterpillar Production System (CPS) was designed to allow each facility to fill customer orders in the fastest, most accurate, and safest manner possible.
At certain facilities, we have the designated clean rooms for assembly and testing in the production of hydraulic systems and components. With resources dedicated on this scale, it is no surprise that our manufacturing materials and processes meet or exceed ASTM, DIN, ISO, and SAE standards.

Computer Numerical Control (CNC)

Used to encode machining processes for components using the ProE solid modeling system, this methodology not only crafts new tool designs, it also generates the program code to facilitate the machining of those tools.

Coordinate Measuring Machine (CMM)

This quality assurance inspection tool, used in-house and by some of our top vendors, confirms geometric tolerances against programmed specifications.

GLOBAL SERVICE & SUPPORT

Caterpillar and our dealers / distributors literally reach the four corners of the Earth — offering unmatched global coverage to meet unique local needs. Caterpillar offers a distribution network unparalleled in today's business climate.

By establishing a relationship with Caterpillar, your company will gain access to comprehensive support services designed to help businesses acquire, finance, maintain, and insure their products.

WE'RE PREPARED WITH EVERYTHING YOU NEED.

By supporting your components and operations, the Cat dealer network protects your relationship with your customers.

- Market-leading warranty
- Common service tooling and parts stock coverage
- Industry-leading parts availability
- Extended Service Contracts
- Customer Value Agreements
- Cat® Financial
- Reman options and Cat® Certified Rebuild programs


MILTON USA

Add the power of fluid motion to your machines — and your business — with innovative hydraulic solutions from Caterpillar.

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For more information, contact your OEM Solutions Account Manager or email oem_solutions@cat.com