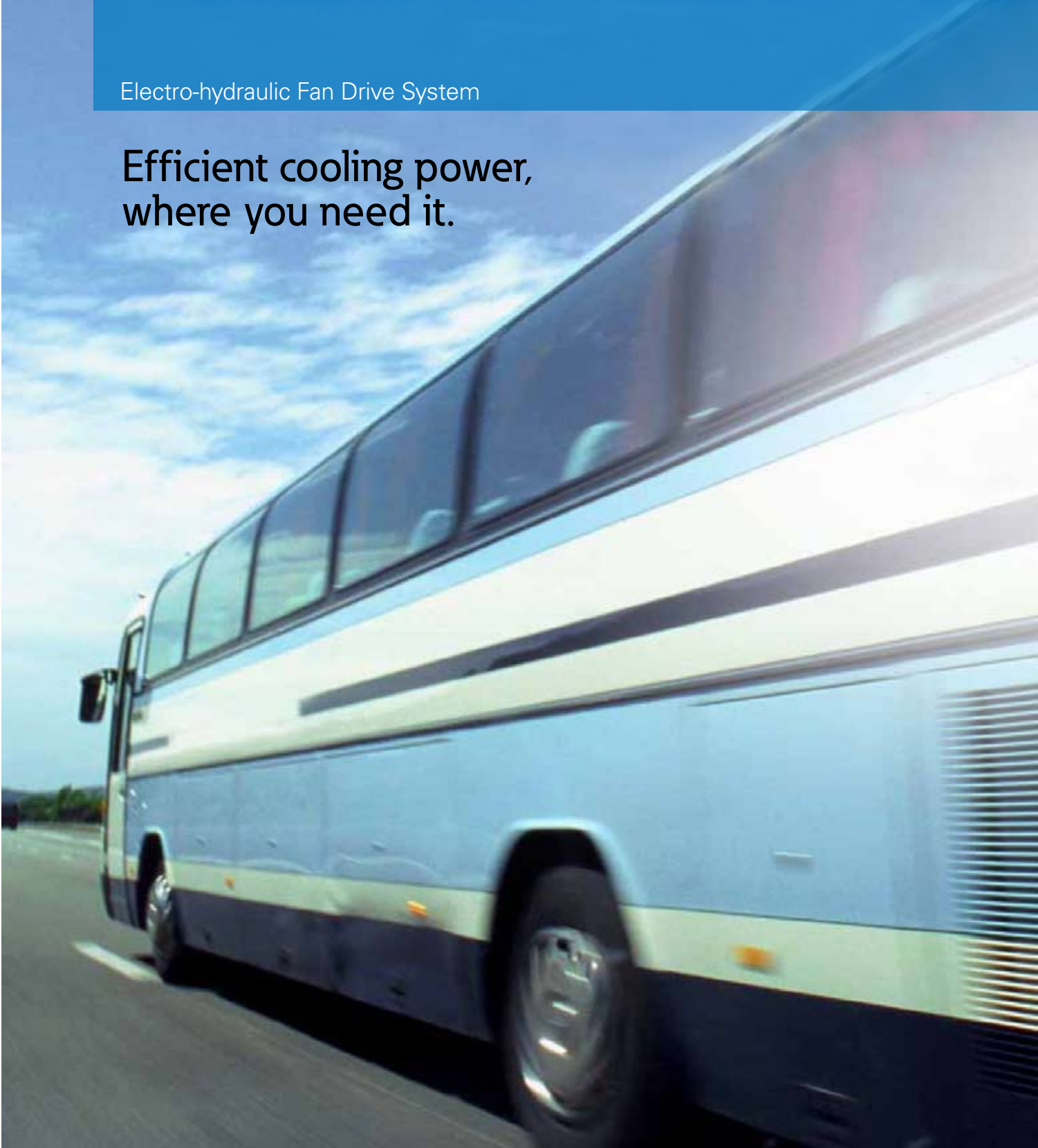


Electro-hydraulic Fan Drive System

Efficient cooling power,  
where you need it.



**EATON**

*Powering Business Worldwide*

# Complete Fan Drive Systems

The Electro-hydraulic (EH) Fan Drive System cools your engine and vehicle sub-systems by controlling a hydraulic pump and motor with a digitally programmable controller.

The EH Fan Drive System equipped with the Two Channel Amplifier offers fast, quiet and efficient cooling for engine coolant, hydraulic fluid, charge air and entire engine compartment.

## Electro-hydraulic Fan Drive benefits include:

- Flexible installation for optimum fan location
- Elimination of belt maintenance
- More accurate control of charge air temperature can help reduce engine emissions
- Improvement in fuel economy
- Increased power output
- Choice of variable- or fixed-displacement systems

## Eaton can be your single source for fan drive systems.

Eaton Fan Drive Systems can include:

- Pump (fixed- or variable-displacement)
- Motor
- Valves & manifold
- Electronic controls
- Compact patented reservoir
- Filter
- Hoses and fittings

A fully integrated electronically controlled Eaton Hydraulic Fan Drive System delivers a comprehensive cooling solution with complete controllability.

## Table of Contents

Applications and Benefits .....	3
Electronic Controller Options .....	4
Integrated Fan Drive System, Fixed-displacement Pump .....	6
Stand-Alone Fan Drive System, Variable-displacement Pump .....	7
Fan Drive System Pump and Motor Guide .....	8
Hydraulic Components .....	9
Engineered Systems .....	10



## Applications and Benefits

### Applications:

#### On-highway vehicles

- Buses
- Recreational vehicles

#### Construction machinery

- Excavators
- Loaders
- Cranes
- Forklifts

#### Agriculture machinery

- Tractors
- Forest machinery



### Benefits of Electronic Control

- Functions with Engine Control Module Input or Vehicle Sensor and Switch Inputs:
  - Allows a wide variety of configurations.
- Communications via RS 323 or CANbus link:
  - Provides versatility in communications.
- Conditions engine control module signal:
  - Filters noise, inverts signal, and re-scales signal to optimize control.
- Uses closed-loop current control, instead of voltage control:
  - Improves control accuracy of fan speed by eliminating temperature effects on proportional valve coil.

### APPLICATION SPECIFIC BENEFITS



#### Buses

- Modulates fan speed
  - Reduces operating power and noise.
- Limits fan speed on start-up
  - Reduces fan power draw on start-up.
- Increased fuel economy
  - Reduced fan power requirements lead to better fuel economy.



#### Recreational Vehicles

- Ramps between fan speed settings
  - Ensures gentle speed transitions and provides smooth operation.
- Reduces operation noise
  - Electronic control reduces the noise of the fan and pump, providing better passenger comfort.



#### Wheel Loaders

- Encapsulated construction
  - Allows installation in more exposed locations on the vehicle.
- Flexible installation
  - The electronic control of the Fan Drive System allows flexible installations for optimum fan location.
- Fan reverse feature
  - Reverse fan operation facilitates removal of debris from the vehicle radiator.

# Fan Drive Configuration

## Power Requirement

- 12 VDC or 24 VDC

## Laptop or PC Communication

- RS232 for communication with GUI

## Inputs

- Five user configurable inputs
  - Two Thermistor inputs
  - Two Digital or Switch inputs
  - Engine Control Module cooling command voltage signal

Or

- Optional CANbus signal

## Outputs

- PWM current controlled driver for proportional flow control
- On-off driver for fan off or fan reverse

## Mechanical

- Polymer enclosure
- Fully encapsulated electronics
- Flying lead harness with 10-pin MetriPak connector
- Two Mounting flanges: #8 fasteners
- Dual color LED for status and diagnosis

## Environment

- Operating temperature: -40°C to +85°C
- Meets EMC standards off-road vehicle
- Reverse battery and load dump protection
- Input/output short circuit protection
- UV resistant
- Water: temporary immersion
- Random vibration 5.8 Grms
- Shock: 50 G

# Electronic Controller Options

## TCA Electronic Controller

The TCA at the heart of the EH Fan Drive System, is a rugged, fully encapsulated digitally programmable controller specially designed for mobile environments.

It is prepared for CANbus communications on a vehicle network. Software for controlling the EH Fan Drive System is loaded in the controller memory at the factory. Control software parameters are adjusted via RS 232 hook-up to a laptop computer.

The TCA controller is available for both 12 V or 24 V vehicle power systems. With 5 configurable inputs and 2 Pulse Width Modulated (PWM) outputs, the TCA can interface with a variety of system components and drive up to two electro-hydraulic valves.



Two Channel Amplifier (TCA)

## EFX Electronic Controller

Eaton EFX electronic controllers and I/O modules provide a full range of electronic controls. With an array of controller options and I/O modules, an EFX system can address any application need. All EFX products are IP67 rated and are built for harsh mobile and industrial application environments. The EFX line is programmed and configured using Eaton CONTROL F(x)<sup>TM</sup> software.

## Applications

Excavators, forestry, telehandlers, utility vehicles, cranes, ag machinery, paving

## Specifications

Four different EFX controllers and 3 I/O expansion modules provide analog, digital, and frequency inputs as well as digital, PWM, and current-controlled outputs. Each EFX controller has both CANopen and J1939 interfaces.



EF(x) Controllers

**Two Methods of Control**



**1. Integrated Fan Drive System**

Interface the Fan Drive System to your engine control module to execute the cooling strategy exactly as directed by the engine control module.

**2. Stand-alone Fan Drive System**

Define your own cooling logic using the TCA or EFX, electronic controller.

By adding electronics to an Eaton Electro-hydraulic Fan Drive System, users can tailor the system to their needs. Fan drive control parameters are adjusted through a user-friendly graphical user interface (GUI).

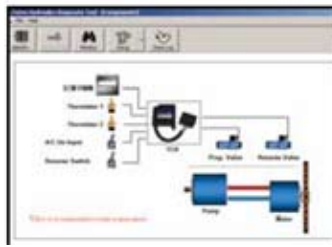
This GUI, the GUI for the TCA is shown below, walks the designer through the definition process with real-time graphical feedback to clearly indicate the system's response to each modification.

System data can also be graphically monitored and saved to verify actual results. When the cooling logic is fully defined, resulting parameters are saved and used for exact system duplication for your production application.



**Setup Screen**

The Setup Screen feature allows the user to define his own cooling logic by setting in the required parameters.



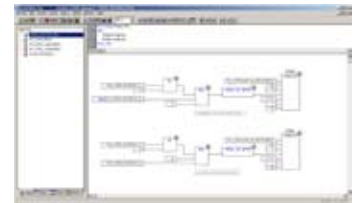
**Component Screen**

The Component Screen gives the user an overview of the system and allows the user to click on the components and enter a description.



**Monitor Screen**

The Monitor Screen allows the user to monitor the system.



**Control F(x)<sup>TM</sup> Programming Software**

Eaton CONTROL F(x) software allows you to develop programs for controlling electrohydraulic components and systems. Eaton provides control function libraries based on the IEC 61131-3 standard that reduce application development time. With the CONTROL F(x) graphical interface, you can create, debug, and monitor the control logic. This creates a reliable system that can be rapidly developed, tested, implemented, and maintained.

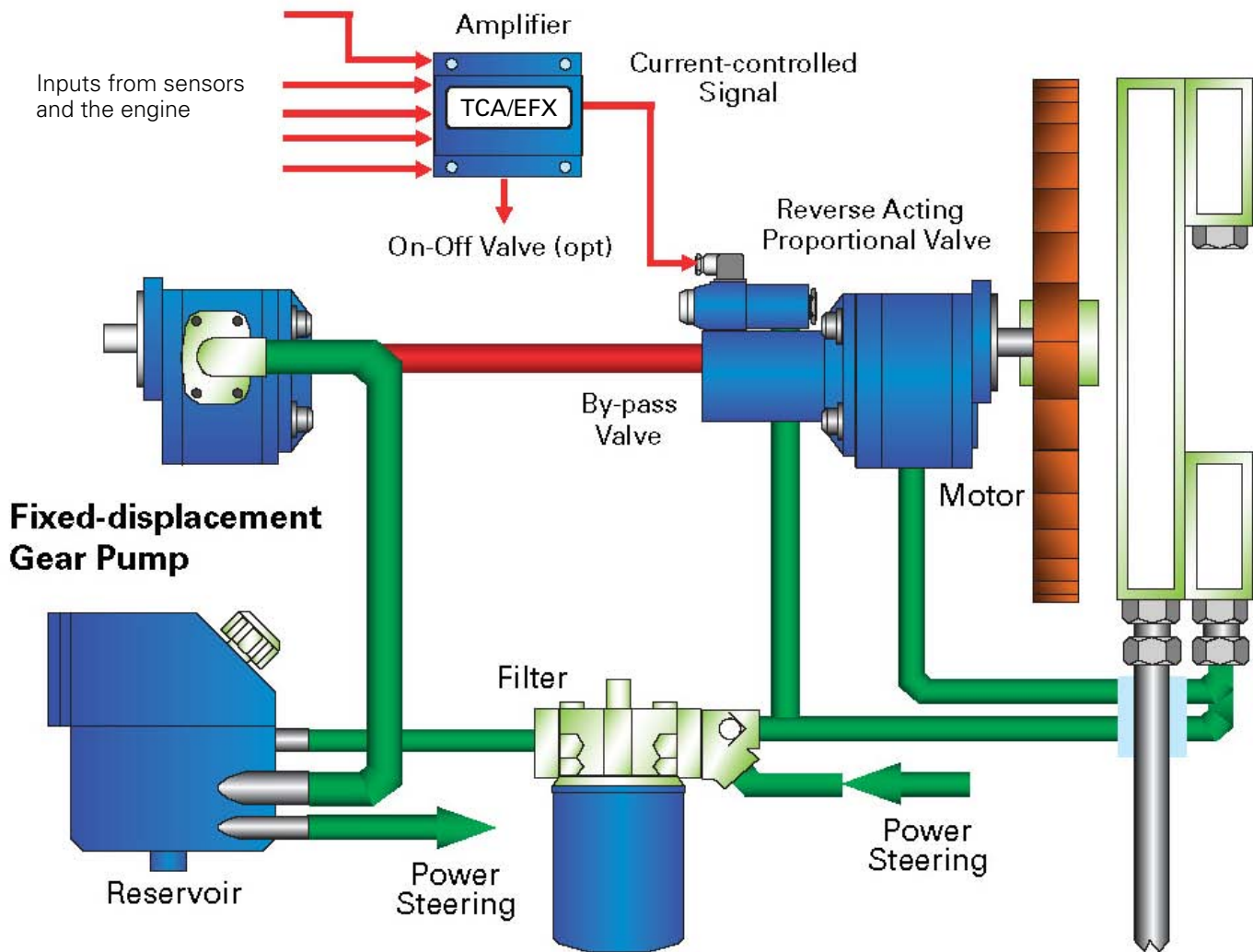
# Integrated Fan Drive System

## Fixed-displacement Pump

The system cooling strategy is based on one ECM input, two Temperature Inputs and two Digital Inputs. In some cases, the ECM signal is too noisy or too weak to control a hydraulic circuit. The TCA or EFX solution amplifies and conditions the ECM signal to be used on a hydraulic circuit.

A fixed displacement pump fan drive system is suited for a smaller and simpler cooling system. A fixed displacement pump is unable to alter its displacement to slow the fan speed with respect to the cooling demand. The excess flow generated by the pump is returned to the tank, which leads to generation of heat and energy losses.

Fixed displacement pumps are best suited for Fan Drive Systems below 10 HP.



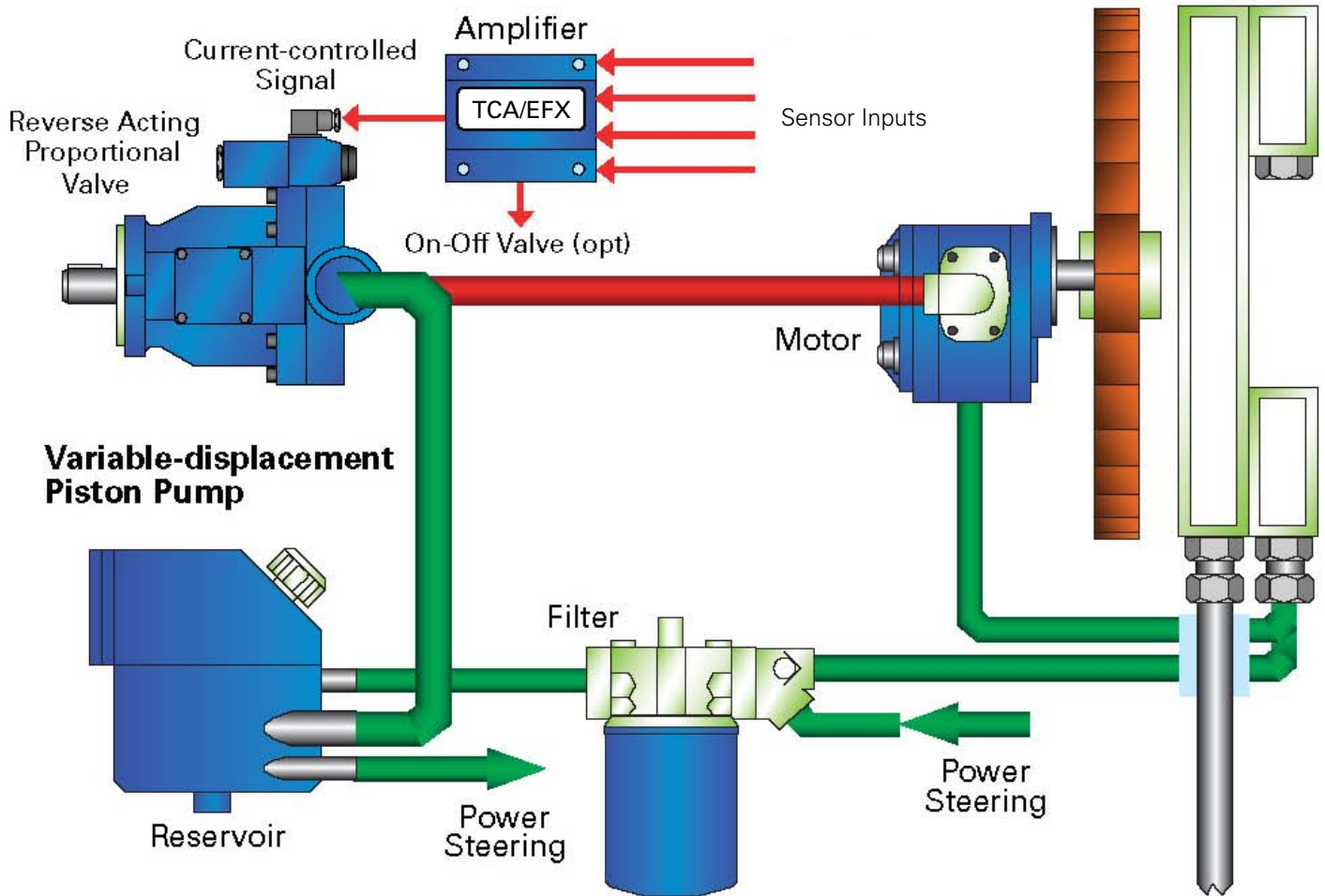
# Stand-Alone Fan Drive System

## Variable-displacement Pump

This system is similar to the Fixed Displacement Pump system. For engines not equipped with an ECM, the cooling strategy is based on a temperature sensor and digital inputs to the TCA.

A variable displacement pump fan drive system is suited for larger and more complex cooling systems. A variable displacement pump reduces the displacement to match the flow as per the cooling demand. This feature offers on-going energy savings and creates less heating of the hydraulic fluid.

Variable displacement pumps are best suited for Fan Drive Systems above 20 HP.



# Fan Drive System Pump and Motor Guide

	POWER (HP)	5	10	15	20	25	30	35	40	45	50+		
<b>PUMPS</b>	<b>Fixed Displacement Pumps</b>												
	Eaton Gear 25500										21.3 - 55.2 CC		
	Eaton Gear 26000				6.6 - 30.6 CC								
	Eaton Gear GGP Aluminum				5.3 - 33.4 CC								
	Vickers V10 Vane				3.3 - 22.8 CC								
	Vickers V20 Vane								19.5 - 42.4				
	<b>Variable Displacement Pumps</b>												
	Vickers Piston PVE								25.2 • 41.0 • 45.1 CC				
	Eaton Piston 420											41.0 • 49.2 • 62.3 • 80 CC	
	Vickers Piston PVH											57.4 • 73.7 • 98.3 • 131.1 CC	
<b>MOTORS</b>	<b>Fixed Displacement Motors</b>												
	Eaton Gear 26000				6.6 - 30.6 CC								
	Eaton Gear GGP Aluminum (unidirectional)				5.3 - 33.4 CC								
	Eaton Piston 74111				12.3 - 20.3 CC								
	Eaton Piston 74318								32.9 - 49.2 CC				
	Eaton Piston 74624											82.6 CC	
	Eaton Piston HD											54.4 - 105.5 CC	
	Vickers Vane MU2							21.6 - 25.4 CC					
	Vickers Vane 25 M											43.6 - 68.7 CC	

## PUMPS

### Gear

- High efficiency design reduces flow-pressure ripple, noise, and vibration.
- Various shaft and porting options allow design flexibility.
- Tandem and multi-section pump options minimize circuit cost.
- Compact envelope design reduces space required for installation.
- Integrated relief priority flow valve options reduce fluid leak risks, space requirements, and system costs.

### Piston

- Versatile design includes single pumps, throughdrive arrangements, and a variety of drive shaft and control options; adapts to many applications, providing cost-effective variable pump installation.
- Proven components ensure longer life at the higher performance levels of power-dense machinery.
- Compact housing and lightweight design allows better access for installation and servicing.
- Heavy-duty bearing and shafts reduce internal deflections and wear, providing longer life and operation time.
- Designed for maximum efficiency, directs more flow and input energy to the work, not to heat and waste.

### Vane

- Hydraulically balanced design increases the operating life of the bushing/ bearing by eliminating side loads.
- Consistent efficiency over life is achieved by self-compensation of vane wear.
- Quieter operation as compared to a gear pump.
- Integrated pressure compensated flow control ensures priority and constant flow regulation.
- Compact common inlet with double pump configuration allows versatility in application. One can be used for steering and the other for fan drive.
- Flexible port orientation allows easy installation and prevents hose bends.
- Vane pumps are the most commonly adopted steering pump in on-highway vehicles.

## MOTORS

### Gear

- High efficiency design reduces flow-pressure ripple, noise, and vibration.
- Various shaft and porting options allow design flexibility.
- Tandem and multi-section pump options minimize circuit cost.
- Compact envelope design reduces space required for installation.
- Integrated relief priority flow valve options reduce fluid leak risks, space requirements, and system costs.

### Piston

- Compact design reduces space required for installation.
- Lightweight durable housing minimizes system mass.
- Numerous shaft and porting options provide design versatility.
- Bi-directional rotation allows reversal of fan direction.
- Integral speed sensor available to provide optional closed-loop control of fan speed.
- Fine tolerances reduce leakage and increase system efficiency.
- Low start-up torque requires less pressure build-up for operation.

### Vane

- Lower starting torque as compared to gear and piston motors.
- Smoother operation with lesser jerks as compared to gear motors.
- Excellent capability to handle pressure shocks.
- Better efficiency at low RPM.
- No back pressure requirements as opposed to those in piston motors.
- Quieter operation with respect to gear and piston motors.



# Fan Drive System Hydraulic Components



## Vane Pump

- Fixed-displacement
- 3.3 cc to 42.5 cc
- V10 Series, V20 Series



## Vane Motor

- Fixed-displacement
- 21.6 cc to 68.7 cc
- MU2 Series, 25 M Series



## Gear Pump

- Fixed-displacement
- 7-30 cc, 21-100 cc
- 26000 Series, 25500 Series



## Gear Motor

- Fixed-displacement
- 50 cc
- 100 Series



## Piston Pump

- Variable-displacement
- 25, 40, 45 cc
- 420 Series



## Piston Pump

- Variable-displacement
- 18, 20, 45, 50 cc
- PVM Series



## Piston Motor

- Fixed-displacement
- 12, 20 cc
- 74100 Series



## Piston Motor

- Fixed-displacement
- 33, 49 cc
- 74300 Series



## Piston Motor

- Fixed-displacement
- 83 cc
- 74600 Series



## Proportional Compensator

- Bolt-on electro-hydraulic control element
- Piston pump fan drive control



## STC®

- Snap-to-connect
- Threadless connectors



## Hose & Fittings



## Filter

- Return-line filter
- 57 L/min, 95 L/min, 227 L/min
- OFRS 25



## Reservoir

- Reduced size
- 3L, 70 L/min
- AGT Cyclone tank



## EZ Torque

- Quick, easy install, ergonomically friendly
- Fewer total parts

# Engineered Systems



Other electro-hydraulic systems for steering, work circuit and fan drive applications.

## Electro-hydraulic Steer By Wire (EH-SBW)

EH-SBW is a new technology steering system for vehicles where an electronic sensor replaces the rotary steering valve of a traditional hydraulic steering system. An electrical signal, rather than mechanical or fluid connections, transfers the steering command from the operator's steering wheel to the steered wheel electrohydraulic actuator. The Eaton system includes a novel tactile feedback device at the steering wheel that simulates the feel of conventional hydrostatic steering.

### Additional Benefits:

- Hydraulic leaks and noise are reduced.
- Assembly is simplified, providing greater cab design flexibility.
- Productivity, safety, and ergonomics are all improved.
- The tailoring of steering characteristics by re-programming is simplified.

## Electro-hydraulic Work Circuits

An electronic remote control joystick replaces the hydraulic remote control, cables and levers of a traditional work circuit operator interface. An electrical signal, rather than mechanical or fluid connections, transfers the boom, bucket or implement command from the operator's joystick to an electro-hydraulic directional control valve. Other work circuit applications include control of auxiliary motors, power take-off clutches, and transmissions.

### Additional Benefits:

- The work circuit control is more accurate and stable.
- Hydraulic noise and leaks in the cab are reduced.
- Hydraulic connections are eliminated or simplified.
- Vehicle energy management is improved.

## The Electronic Transmission Automotive Control (ETAC)

ETAC system is a hydrostatic propulsion package ideally suited for small to medium sized fork lift trucks, tractors and utility vehicles. ETAC matches engine power to the vehicle propulsion and work requirement. The "Maestro" digital, programmable controller is integrated with the throttle system as well as a closed circuit hydraulic pump and motor. Maestro drives a high performance electrohydraulic interface on the pump and uses a swashplate sensor to provide precise, closed loop control.

### Additional Benefits:

- Consistent performance over a wide range of operating temperatures.
- Hydrostatic braking is adjustable through software.
- Inching function maximizes productivity by allowing the operator to regulate work circuit pump flow independently of vehicle speed.
- Anti-stall enables use of available engine power by automatically reducing pump displacement.
- Adjustment of software parameters allows new operators to operate the vehicle with the same productivity as skilled drivers.

# Tailored to Your Needs

## **World Class Product Lines and Systems**

Aeroquip®

Char-Lynn®

Eaton®

Vickers®

Weatherhead®

**Eaton is a global diversified industrial  
manufacturer. Eaton is a leader in:**

- Fluid power systems
- Electrical power quality, distribution and control
- Automotive engine air management and fuel economy
- Intelligent truck systems for fuel economy and safety

**For more information, visit [www.eaton.com](http://www.eaton.com).**

Eaton  
Hydraulics Operations USA  
14615 Lone Oak Road  
Eden Prairie, MN 55344  
USA  
Tel: 952-937-9800  
Fax: 952-294-7722  
[www.eaton.com/hydraulics](http://www.eaton.com/hydraulics)

Eaton  
Hydraulics Operations Europe  
Route de la Longeraie 7  
1110 Morges  
Switzerland  
Tel: +41 (0) 21 811 4600  
Fax: +41 (0) 21 811 4601

Eaton  
Hydraulics Operations Asia Pacific  
11th Floor Hong Kong New World Tower  
300 Huaihai Zhong Road  
Shanghai 200021  
China  
Tel: 86-21-6387-9988  
Fax: 86-21-6335-3912