

eMobility

# EV Transmissions

Efficient technology for electric commercial vehicles



**EATON**

*Powering Business Worldwide*



## Purpose-built electric design

Developed to aid efficiency, Eaton's portfolio of transmissions are helping to increase range, grade capability and acceleration for commercial EVs

Leveraging decades of experience building industry-leading commercial vehicle (CV) transmissions.

Eaton's EV transmissions are based on proven, robust and efficient layshaft architecture typical of automated manual transmissions (AMTs), but they do not have a clutch and shifts are synchronized using the traction motor.

Unlike the direct-drive architecture that has long been the standard in EVs, Eaton's EV transmission portfolio offers significantly greater efficiency at high speeds and increased torque at launch and low speeds.

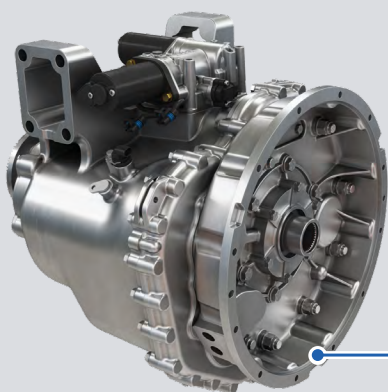
The EV transmissions feature lightweight countershaft gearbox that boast a range of torque capacities and electric gearshift actuation that allows for smaller electric motors.

The shifting strategy of the helical gears is controlled by the Transmission Control Unit, which ensures quick gear changes and maximum efficiency, extending EV battery range.

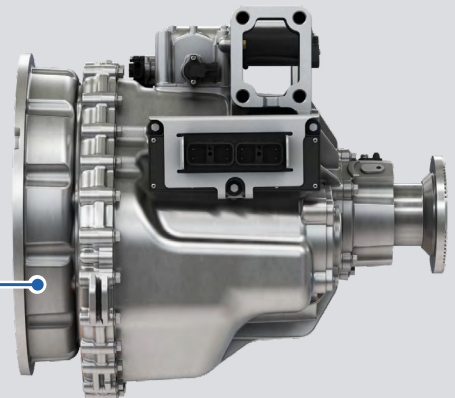
This setup enables a smooth launch on grades of up to 30%, compared with the approximately 10% grade limit of direct drives. On grades of between 5% and 7%, the transmission can maintain speeds of 80km/h (50mph), while at grades around 3% the system can hold steady at 95km/h (60mph).

Designed for light duty and heavy duty applications, the new transmissions provide a maximum input speed of 4000-5000rpm. The transmissions also improve acceleration by maintaining lower gears when possible, providing maximum motor power and efficiency at cruising speeds, and operating at higher speeds than traditional internal combustion engine transmissions. Additionally, gears are optimized for typical electric motor performance and power curves for maximum efficiency.

Road test results indicate EV transmissions provide increased efficiency under normal driving conditions compared with a direct-drive architecture.



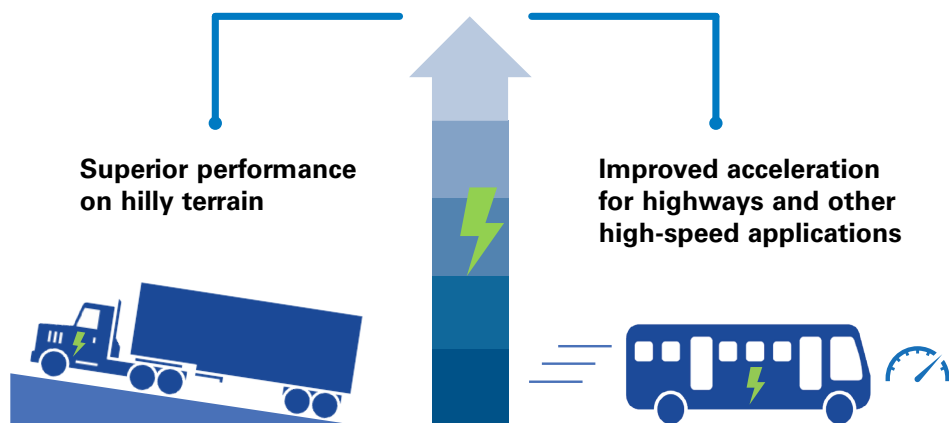
Eaton's new technology solves the primary issue related to direct-drive architecture – providing high efficiency at top speeds and increased torque at launch and low speeds





## Why do EVs need transmissions?

Using a transmission in an electric commercial vehicle enables:



*"Drivers expect the same performance as diesel, that's why we're partnering with Eaton on the HD 4-speed transmission."*

*OEM customer*

Eaton's proven EV transmissions improve performance on grades, allow motors to operate more efficiently and improve top speed in a smaller and lighter package.

# EV transmissions

## Benefit

Eaton's proven EV transmissions improve performance on grades, allow motors to operate more efficiently, and improve top speed in a smaller and lighter overall package.

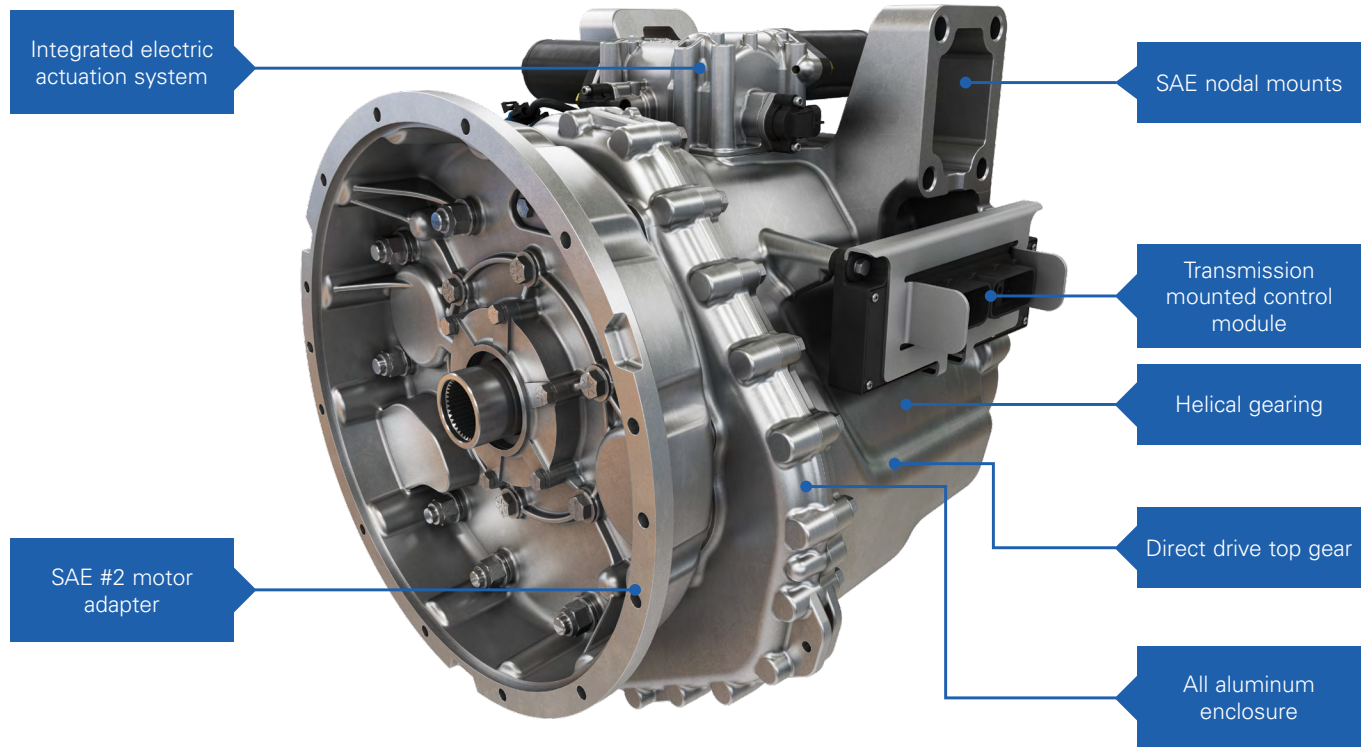


Eaton offers a variety of transmissions for electric trucks and buses. With over a century in developing safe, reliable transmissions, and a strong commercial vehicle pedigree, Eaton delivers the efficiency and performance required for these challenging applications.

- **Efficient** motor use, extended range and/or reduced battery size
- **Improved performance** on grades, improved starting ability with a smaller motor, better acceleration
- **Tailored to your application** – bus, truck, variety of motor pairings, custom shift calibrations



# EV transmissions key features



	MD EV 4	MD EV 6	HD EV 4**
<b># of forward speeds</b>	4	6	4
<b>Housing</b>	Aluminum	Cast iron	Aluminum
<b>Max. Torque (Nm)</b>	1200 Nm (Drive) & 850 Nm (Regan)	1150	2600
<b>Max. input speed (rpm)*</b>	5000	4000	5000
<b>Helical gearing</b>	✓	✓	✓
<b>Smart gear selection</b>	✓	✓	✓
<b>PTO</b>	N/A	Side PTO	Rear PTO
<b>Typical EV applications</b>	City delivery, beverage, tourist bus, shuttle bus, school bus, city bus, logistics, yard tractor	City delivery, beverage, tourist bus, shuttle bus, school bus, yard tractor, municipal, city bus, logistics	Beverage, tourist bus, yard tractor, drayage, city dump truck, municipal, logistics, linehaul, refuse

**Note:** \*Max input speed vocation dependent. \*\*Start of production Q3 2024 - final specifications may differ.

# EV transmissions specifications & capacities

## Medium duty 4-speed

Max. input speed	5000 rpm
Max. torque capacity	1200 Nm (Drive) & 850 Nm (Regen)
Dry weight	101.38 kg
Total length	450 mm (including output flange)
Oil capacity	7.5 liters
Maintenance intervals:	3 years or 300,000 km oil change

Ratio	1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>	Overall
	4.83	2.82	1.65	1	4.83



## Medium duty 6-speed

Max. input speed	4000 rpm
Shift Controls	Eaton proprietary shift control logic
Max. torque capacity	1150 Nm
Dry weight	170 kg
Total length	590 mm (including output flange)
Oil capacity	9.2 liters
PTO	Side PTO
Maintenance intervals:	3 years or 300,000 km oil change (Bus/Vocational)

Ratio	1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>	5 <sup>th</sup>	6 <sup>th</sup>	Reverse	Overall
	7.05	4.13	2.52	1.59	1	0.78	6.75	9.03



## Heavy duty 4-speed

Max. input speed	5000 rpm
Shift Controls	Eaton proprietary shift control logic
Max. torque capacity	2600 Nm
Dry weight	192 kg
Total length	650 mm (including output flange)
Oil capacity	7L
PTO	Rear PTO
Maintenance intervals:	TBD

Ratio	1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>	Overall
	5.88	3.30	1.82	1.00	5.88



**Note:** \*Start of production Q3 2024 – final specifications may differ.

Learn more about Eaton's transmissions for electric commercial vehicles by visiting [Eaton.com/eMobility](https://Eaton.com/eMobility)