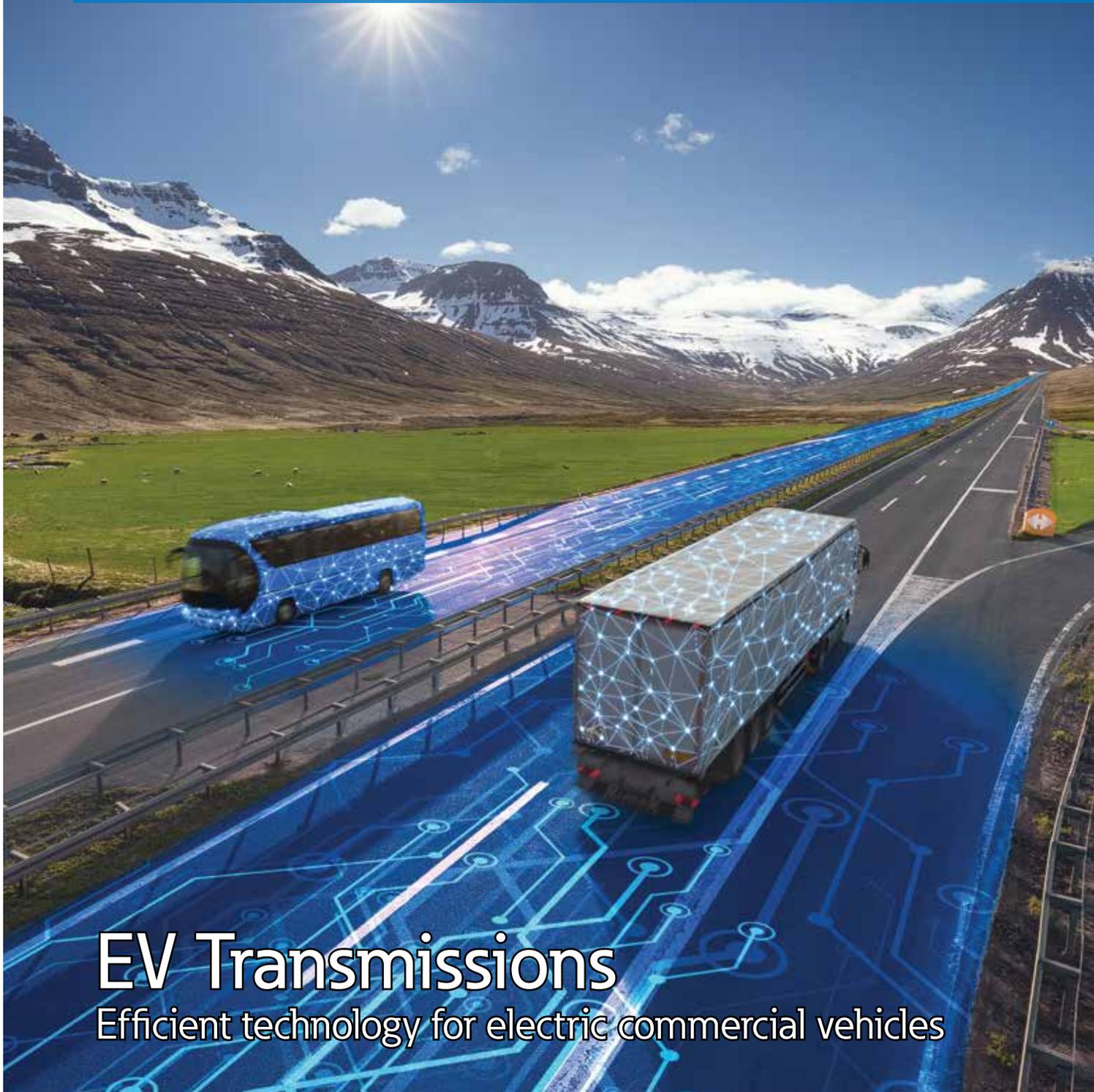


eMobility



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 transmission that has long been the standard in EVs, Eaton's 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.

A deep-ratio first gear enables smooth launches under difficult conditions that would stress the driveline in other transmissions, while the gearbox's second gear is used to launch the vehicle under normal circumstances.

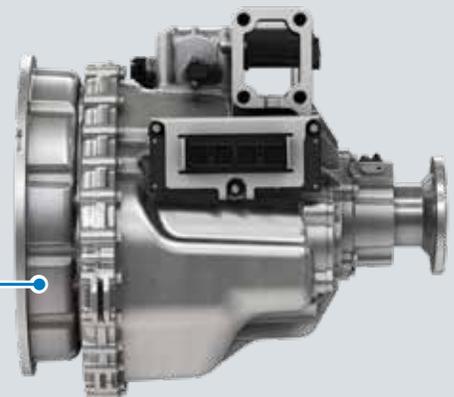
This setup enables a smooth launch on grades of up to 30%, compared with the approximately 10% grade limit of direct drives. On grades of between 5% and 7%, the transmission can maintain speeds of 80km/h (50mph), while at grades around 3% the system can hold steady at 95km/h (60mph).

Designed for 7- to 43-ton applications, the new transmissions provide a range of input speeds from 4000-6000rpm input speeds. 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 transmission.



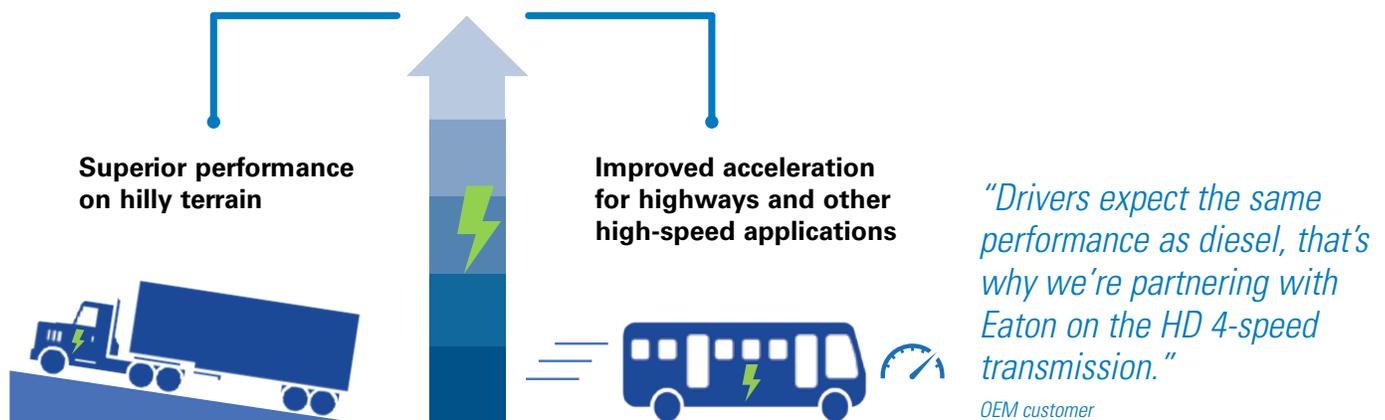
Eaton's new technology solves the primary issue related to direct-drive transmissions – providing high efficiency at top speeds and increased torque at launch and low speeds





Why do EVs need transmissions?

Using a transmission in an electric commercial vehicle enables:



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.

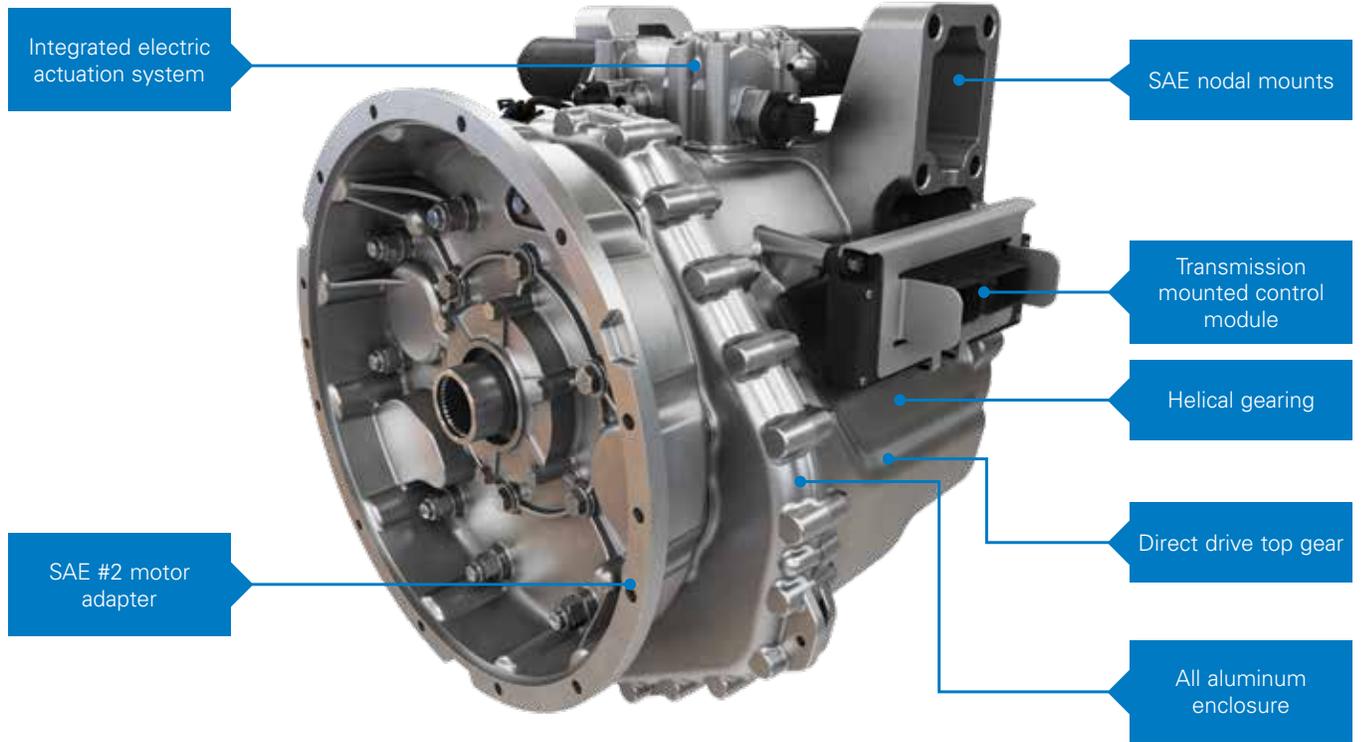


Eaton offers a variety of transmissions for electric trucks and buses. With over a century in developing safe, reliable transmissions, and a strong commercial vehicle pedigree, Eaton delivers the efficiency and performance required for these challenging applications.

- **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 2	MD EV 4	MD EV 6	HD EV 4**
# of forward speeds	2	4	6	4
Housing	Aluminum	Aluminum	Cast iron	Aluminum
Max. Torque (Nm)	700	1200	1150	2600
Max. input speed (rpm)*	6000	5000	4000	5000
Typical GCW (tons)	18T	18T	27T	43T
Helical gearing	✓	✓	✓	✓
Smart gear selection		✓	✓	✓
PTO	N/A	N/A	6-bolt PTO	Rear PTO
Typical EV applications	Shuttle bus, school bus, city bus, logistics	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 mid-2023 - final specifications may differ.

EV transmissions specifications & capacities

Medium duty 2-speed

Max. input speed	6000 rpm
Max. torque capacity	700 Nm
Dry weight	81 kg
Total length	582 mm
Oil capacity	4.6 liters
Maintenance intervals:	3 years, 300,000km (Bus/Vocational)

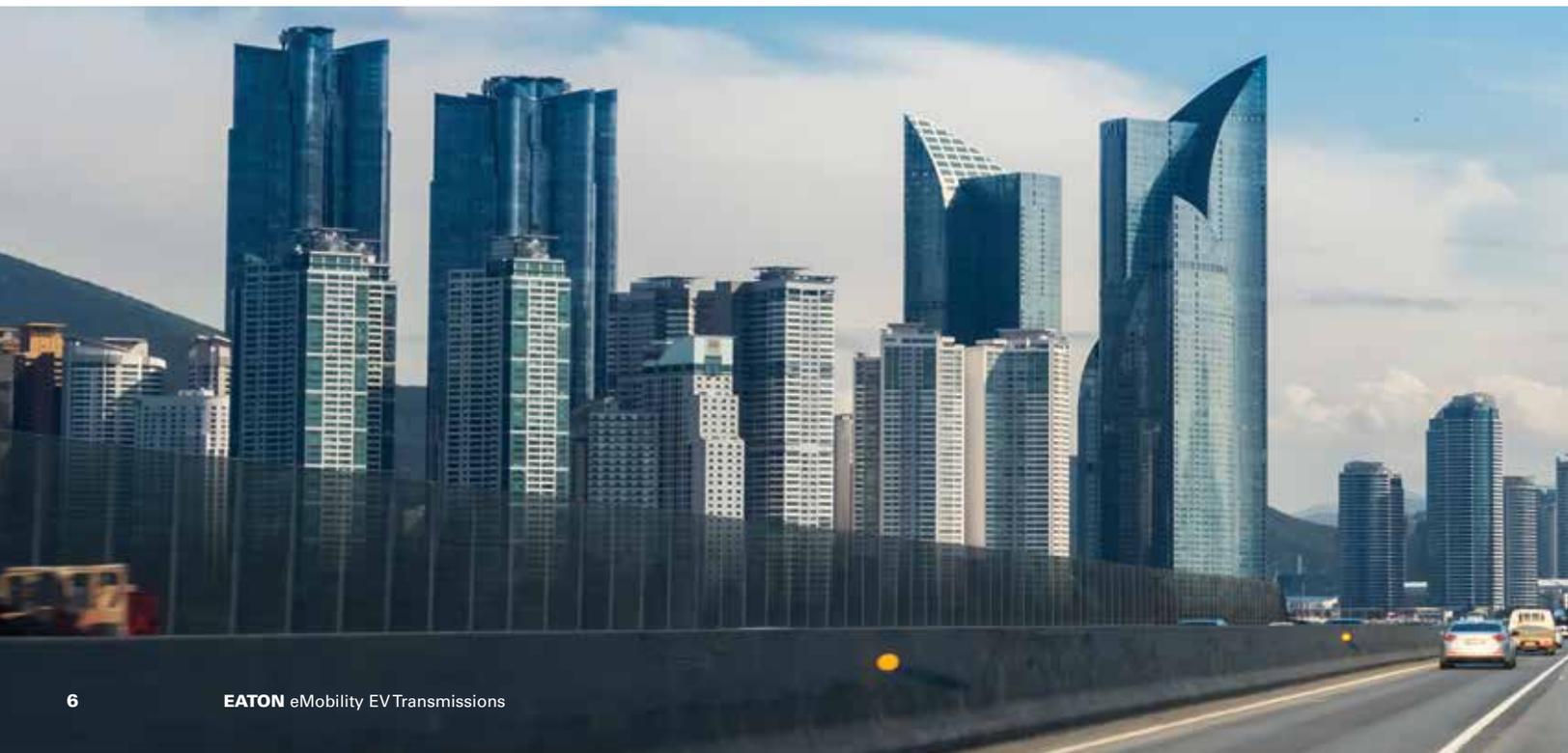
Ratio	1 st	2 nd	Overall
	3.529	1	3.529



Medium duty 4-speed

Max. input speed	5000 rpm
Max. torque capacity	1200 Nm
Dry weight	109 kg
Total length	420 mm
Oil capacity	7.3 liters
Maintenance intervals:	4 years, 300,000 km oil change

Ratio	1 st	2 nd	3 rd	4 th	Reverse	Overall
	4.83	2.82	1.65	1	4.57	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	273 kg
Total length	590 mm (with SPL90 yoke)
Oil capacity	9.2 liters
PTO	6-bolt
Maintenance intervals:	3 years, 288,000 km oil change (Bus/Vocational)

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



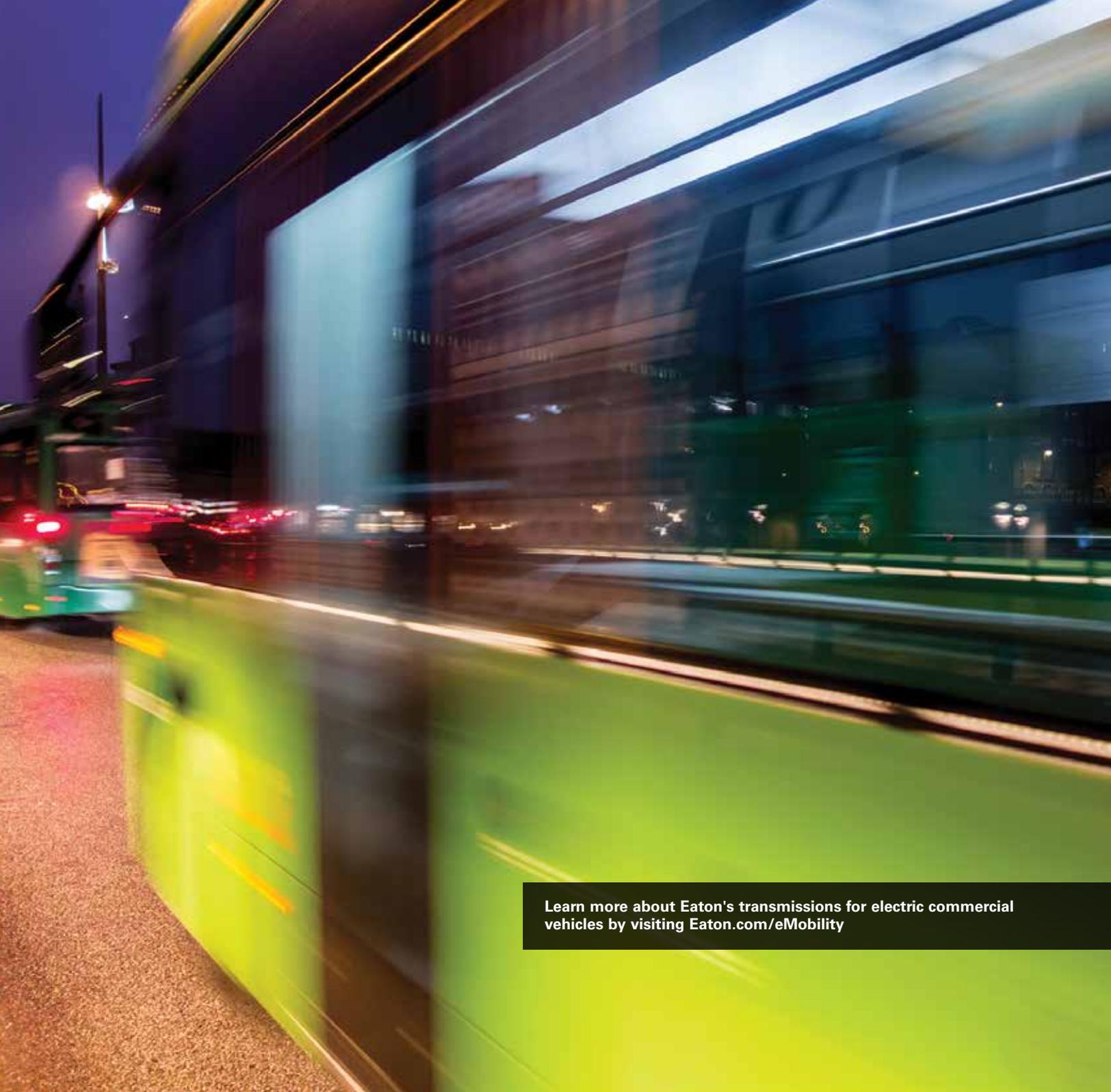
Heavy duty 4-speed

Max. input speed	5000 rpm
Shift Controls	Eaton proprietary shift control logic
Max. torque capacity	2600 Nm
Dry weight	195 kg
Total length	650 mm (with flange)
Oil capacity	8L
PTO	Rear PTO
Maintenance intervals:	TBD

Ratio	1 st	2 nd	3 rd	4 th	Overall
	5.87	3.3	1.81	1	5.87

Note: *Start of production mid-2023 – final specifications may differ.





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

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