

APPLICATION NOTE

ABB traction motors

Light rail vehicle (LRV)



LRVs range from inner-city trams, operating in the central districts of our big cities, to trams that interconnect cities with their outer suburbs. Besides the air characteristics in the climate in which they operate, these railway applications differ in several other important respects.

LRV floors are typically low since these trains stop at low or no platforms at all. ABB's LRV motors for low-floor vehicles have a rectangular cross-section in order to maximize motor performance without compromising on floor height. Based on this common platform, each motor is tailored according to customer requirements.

LRVs are trams and other lightweight train types. They all have in common that they run on a tight schedule, mainly in urban or suburban areas. There are also big differences between LRVs, affecting the design of their traction motors.

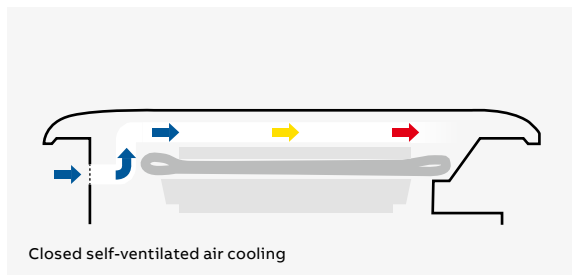
Due to their tight schedule, LRVs frequently start and stop – although there is a big variation between individual trains. The motor is heated during acceleration and deceleration and cooled in between. The thermal loading affects the motor's lifetime and maintenance intervals.

Unlike water-cooled motors, the cooling capabilities of self-ventilated motors vary with the speed of the vehicle – the higher the average speed, the more effective the cooling. Similarly, motor losses vary with the load of the motors. It is therefore necessary to make a thermal evaluation for every new LRV project.

One size doesn't fit all.

Inner-city or suburban trams?

Every LRV is unique – and so should its motors be. ABB's LRV motors are based on actual operating conditions, which means that every motor has its unique design. Here is an outline of a typical mission profile for an inner-city tram versus a suburban tram – and its consequences on the motor design.



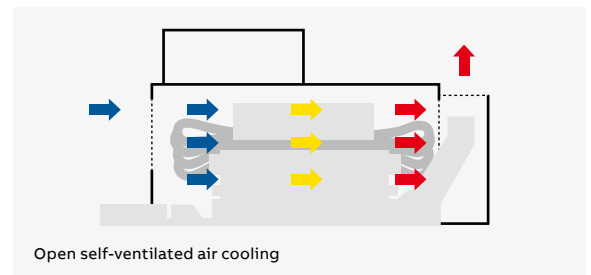
Inner-city trams

Inner-city trams have low floors, making the vehicle accessible from street level without a platform. They run on a tight schedule with frequent starts and stops in urban environments.

The low floor reduces the available space for the traction motor, which is mounted close to the ground (down to 60 mm). The motor thus operates in a polluted environment involving dust, sand, salty air or debris.

A closed cooling concept is recommended to protect the motor's sensitive components. However, its drawback is lower cooling performance, as rotor losses must be distributed to the external cooling through the stator.

ABB promotes closed cooling concepts (air/liquid) for inner-city trams. Our motors meet strict height demands. Using leading design software, we can minimize rotor losses and verify the motor's thermal behavior given the actual mission profile.



Suburban trams

Suburban trams are typically high-floor LRVs, accessible via platforms at stops. Since the distance between stops is longer, the trams can run at higher average speeds, making self-ventilated cooling concepts more favorable than with inner-city trams.

Trams operating in suburban areas often run on separate tracks – away from other traffic such as cars and buses – where there is less pollution. An open cooling concept can therefore be used, in which the rotor losses are more effectively dissipated.

The high floor solution provides a more generous space envelope for the motor and gearbox, making it possible to use less complex components.

For suburban trams operating on separate tracks, ABB offers open traction motors, which allow for a more demanding mission profile, a more compact motor – or both.

ABB offers customized traction motors based on pre-defined and proven technology platforms. We select technologies for e.g. rotors, suspension and cooling to cost-effectively tailor motors according to customer specification.



ABB LRV motors

Our LRV motor platform has a rectangular cross-section in order to optimize the given space envelope without impacting stringent height requirements. The pollution situation on site determines the selection of a closed or an open cooling concept.