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**APPLICATION NOTE**

# ABB traction motors

## Locomotive



It is important to identify as many key differentiators as possible for the actual conditions in which the locomotive will be operating. One obvious differentiator is the train's main application, i.e. whether the locomotive will be used for passenger traffic or for hauling freight.

The train's speed pattern determines many design aspects for traction motors used in locomotives. Generally, the average speed of a freight train is lower than the corresponding passenger train. Understanding the speed pattern makes it possible to optimize performance and match the lifetime of the motor with the lifetime of e.g. wheels and bearings.

When designing a new locomotive, it is difficult to specify the vehicle's usage and drive cycle – particularly if the country spans different geographic areas or climate zones. The traction motors must be designed to withstand any possible scenario.

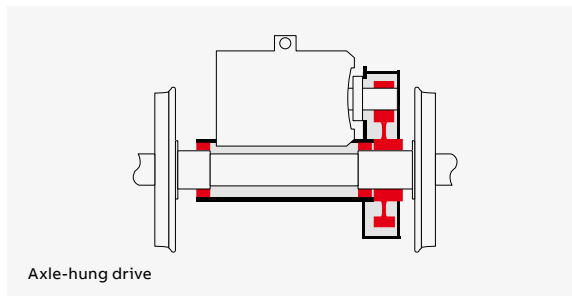
Depending on the expected speed pattern, ABB will consider the suspension type, the size and material of the bearings, whether to use grease or oil lubrication for the bearings, bogie interfaces and other aspects when customizing the traction motors.

Together with its customers, ABB has successfully designed and delivered traction motors for locomotives across the world. We can provide detailed studies to optimize the trade-off between speed, load carrying capacity and maintenance intervals.

# One size doesn't fit all.

## Passenger or freight locomotive?

Every locomotive is unique – and so should its motors be. ABB designs locomotive motors based on the train's actual operating conditions. The train's predicted speed and load pattern determine important design factors for the locomotive's propulsion system.



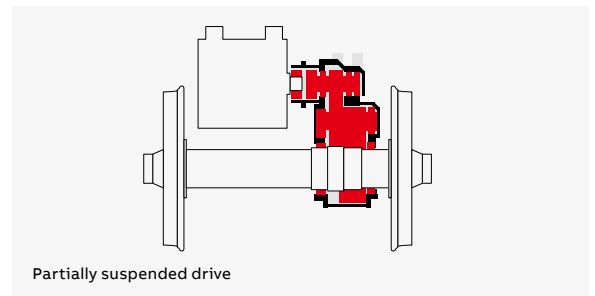
### Freight locomotive

Freight locomotives must be strong enough to start with full load at demanding inclines. Their speed is relatively low, up to 160 km/h, which allows for cost-effective axle-hung mounting of the traction motors.

To enable a high tractive effort, the motors have a high torque-space ratio. Mounting the motor directly to the gearbox and wheel shaft (axle-hung) maximizes the available space for the motor and ensures a high torque-space ratio.

Given the strong forces and heavy loads, the bearings must be big enough to provide a high load carrying capacity. However, large bearings mean high peripheral speeds, calling for oil lubrication of the drive-side bearing.

ABB's locomotive motors typically come with a welded stator frame to optimize the tight space envelope. Analyses let us optimize e.g. the trade-off between bearing and lubricant lifetime.



### Passenger and multi-purpose locomotive

These trains operate at relatively high speeds. Therefore the vehicle's unsuspended mass must be kept as low as possible to reduce wear of the rail and vehicle. A coupling between motor and gearbox makes the traction motors suspended (bogie-hung), allowing the locomotive to operate at high speeds.

The coupling makes the bogie-hung solution less torque dense than the axle-hung solution. However, the mechanical stress is lower, allowing the motor to be more lightweight than freight-locomotive motors. The bearings can be made smaller, allowing the use of grease lubrication even at high vehicle speeds.

Over the years, we have gradually refined our motors to near perfection. Today, more than 3,000 ABB traction motors are in operation in locomotives worldwide. Our motors come with a robust welded stator frame, bearings and grease adapted for high-speed operation, and proven stator and rotor technologies.

### ABB locomotive motors

Our locomotive motors with welded stator frame cover the whole range of freight, passenger and multi-purpose locomotives. We tailor every motor according to specification with regard to e.g. suspension, bearing, gearbox and lubrication solutions.

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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.



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