Complete Linear Motor Propulsion Systems

Engineering that moves

INDRIVETEC
Innovative Drive Technologies AG

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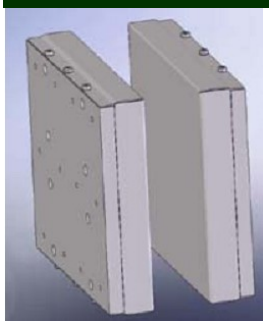
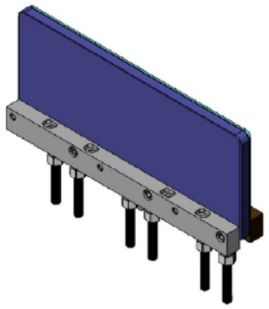
The Company

Indrivetec AG designs, develops and produces power-electronic equipment and components. This includes energy storage inverters, drive frequency converters and complete linear motor drives, in addition to special-purpose solutions.

Indrivetec linear synchronous motor drives are complete, modern systems. We develop and produce them for industrial companies, traction and roller coasters amongst other applications. The linear motor systems contain permanent-magnet synchronous motors, a sensor sytem, power distribution, drive frequency converter and energy storage system up to a power rating of 6 MW.

LSM Components

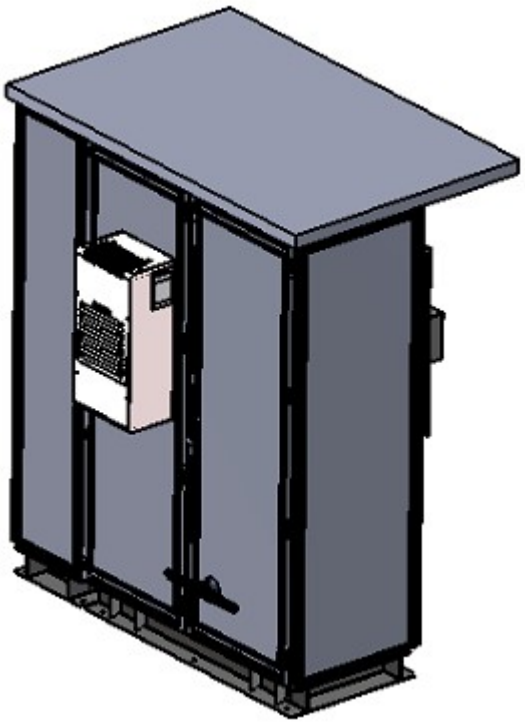


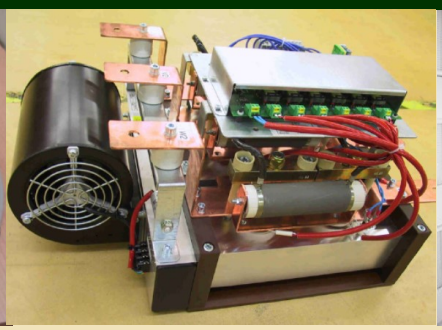


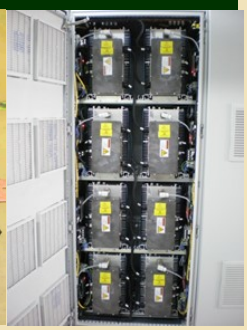
Linear motors can be used in a wide variety of technical fields. Indrivetec's team of developers develops the right solution for every drive task. We offer our customers a full service, from development through to productive use of a drive. For instance, we manufacture prototypes and personally commission installations or devices.

Powerfull and maintenance free

launch system







System Advantages

High system productivity
Servicing and maintenance are rare where linear motors are used. This means high system availability and saving of costs in the long term.

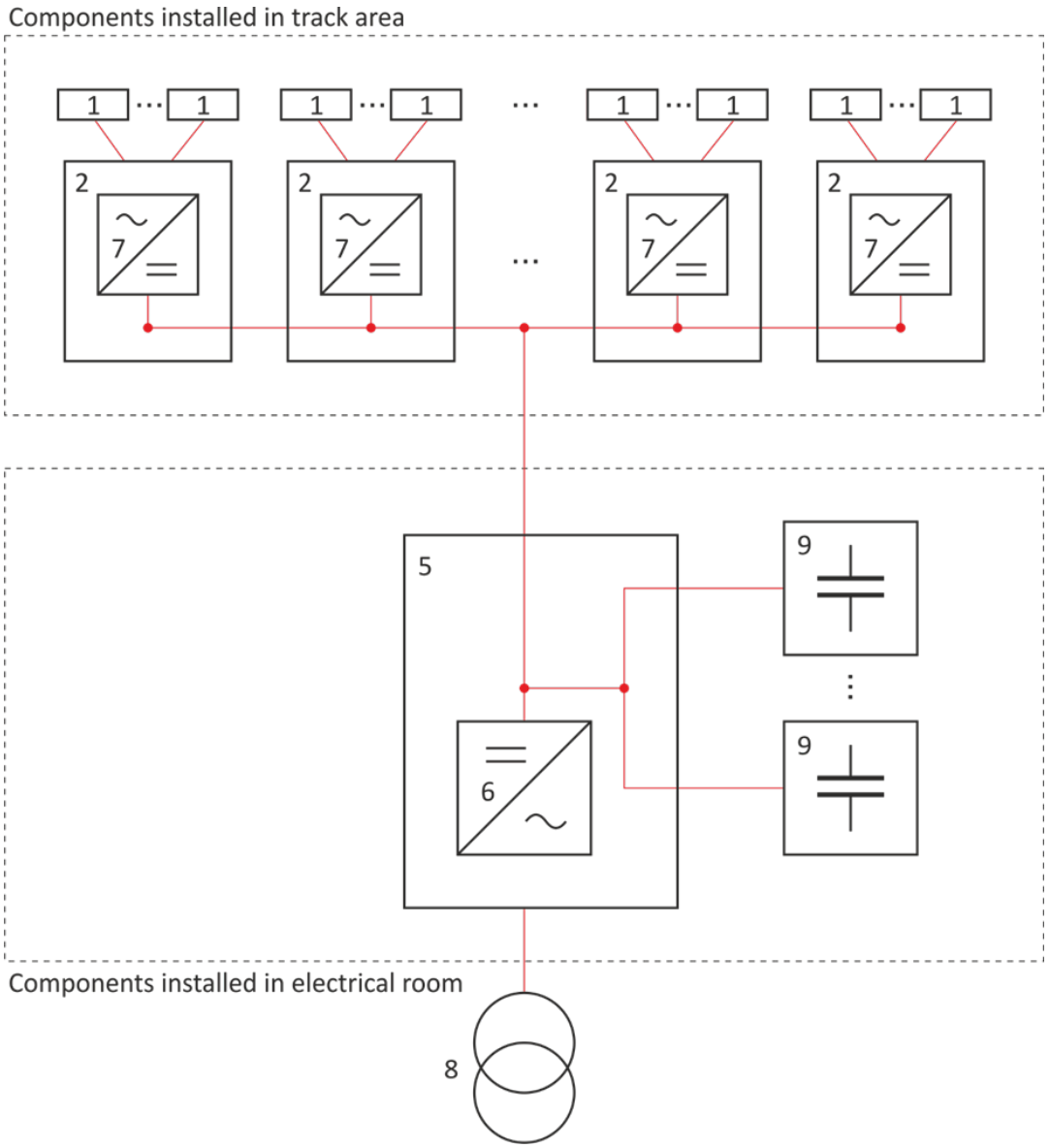
High forces
Indrivetec linear motors allows high power densities and thus a compact mechanical structure.

High dynamic response
Linear motors operate dynamically and without physical contact. This guarantees reliable execution of the required movement and only low wear phenomena which, in turn, saves costs.

The LSM System Topology

The aim of the linear drive system is to accelerate and or lift a vehicle (length of 2m … 15m, weight of 3000kg … 15000kg) along a track structure up to a defined speed and height (5m/s … 70m/s) with a high acceleration (0.5g … 2.5g).

With this topology, several power sources are used to feed the stators instead of feeding all the stators from a single power source and commutating the energy with e.g. electronic switches. Each stator group is fed by a separate inverter, installed in the power junction boxes distributed along the track area where the stators are installed. A DC bus is feeding all the inverters with DC voltage from the central rectifier unit and optional energy storage units installed in the electrical room.



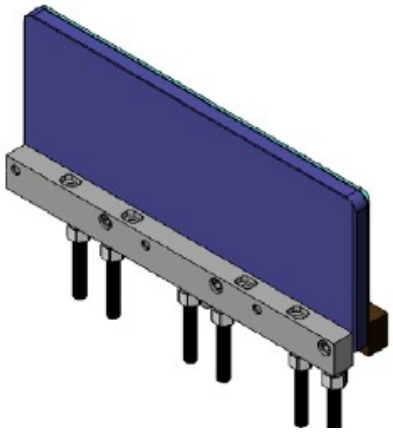
Components present in the above single line diagram:

1. Stator (linear synchronous motor)
2. Power junction box with distributed inverter unit
   (connection of power cables from the stators, optionally containing passive braking units)
5. Central power source cabinet
   (containing the rectifier unit generating the DC voltage feeding the distributed inverters, interface to the optional energy storage units)
6. Central rectifier unit
   (used to convert AC voltage in DC voltage, depending on the application may be a passive rectifier or an active front end converter)
7. Distributed inverter unit
   (used to convert DC voltage in an AC voltage source with variable amplitude and frequency in order to control the motors in an optimal way)
8. Grid connection with transformer
   (transformers needed for galvanic isolation and generation of needed voltage amplitude)
9. Optional energy storage unit
   (used for reduction of the peak power at the grid connection point during the phase of acceleration of the vehicle)

The LSM System Components

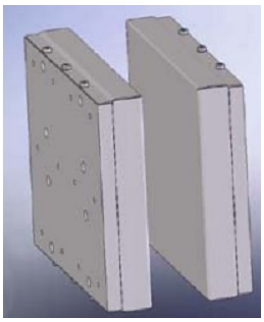
Linear motors

The linear synchronous motors (LSM) are composed of stators mounted on the track structure and runner plates mounted under the vehicle. The motors are generating the force needed to accelerate the vehicle. The force generated by the motors is controlled by the inverter unit. The stators are usually divided in groups. Each group of stators can be energized separately (via a single inverter unit).



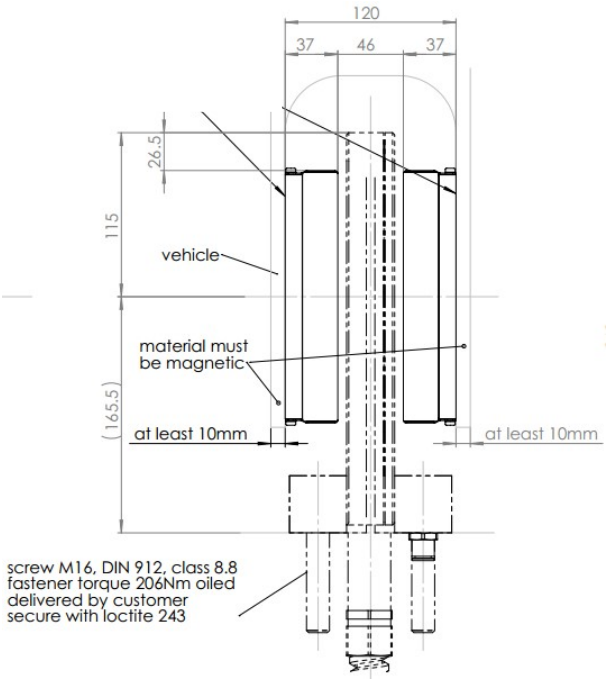
Picture 1: single 3-phase stator

Picture 2: liquid cooling unit for highly loaded stators

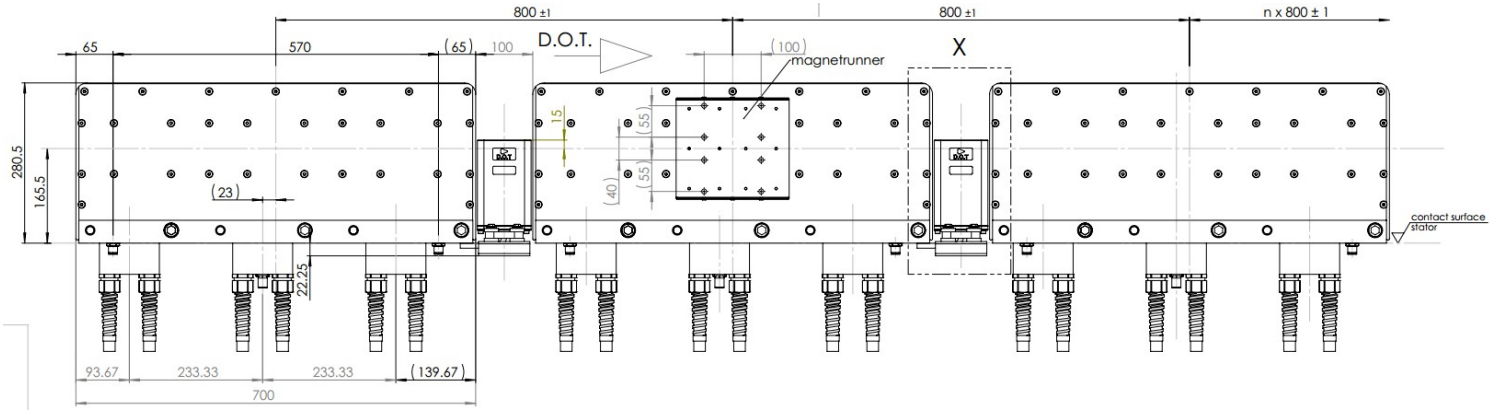


Picture 3: magnet runner plate

Picture 4: stators mounted on a track structure



Picture 5: magnet runner mounting



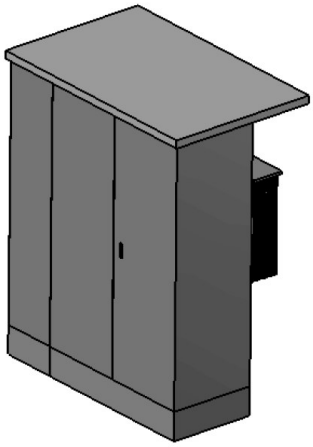
Picture 6: stator and magnet runner mounting

Frequency converters

The frequency converter is composed of a rectifier unit which is converting the AC grid voltage in a DC voltage, and of an inverter unit which is converting the DC voltage in a AC voltage applied to the stators. The frequency inverter is containing power electronic components needed to generate a voltage source with variable amplitude and frequency, driving the motors from a voltage source with constant amplitude and frequency at the grid connection point.

Depending on the application the rectifier unit may be a passive rectifier or an active front end. The inverter unit is controlling the force generated by the motors.

Picture 7: grid converter unit

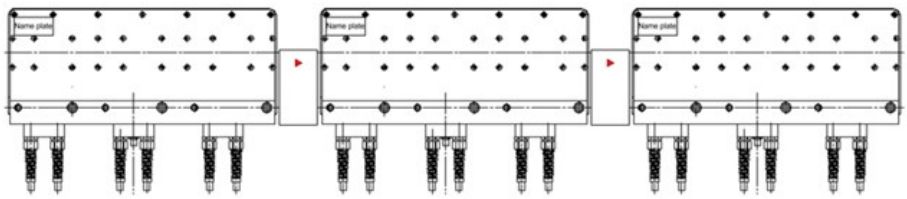


Picture 8: outdoor or indoor motor inverter unit

Sensor system

The sensor system is needed to measure the absolute position and speed of the vehicle. The position and speed feedbacks are used in the control algorithms as well as to control the frequency inverters.

Picture 9: sensor



Picture 10: stators with position/speed sensors in between

Optional energy storage units

Energy storage units are optional. They are used to reduce the peak power consumption at the grid connection point during the phase of vehicle acceleration.

Picture 11: energy storage units

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