

TECHINFO

The LEITNER Drive System



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Behind every safe journey on a ropeway lies a reliable and powerful drive concept. That is why every LEITNER drive is CE-certified and features a simple and clear design, a compact build, and a wide range of configurations. The LEITNER drive can be positioned at the bottom or top station, designed as an overhead or underfloor system, and used as a drive system only or as a drive/tensioning station, depending on the requirements of the project. LEITNER DirectDrive is unrivalled anywhere in the world. It is designed without any gears at all, operates virtually silently, and requires less maintenance than any other system. The braking system in a LEITNER drive is designed for the greatest possible safety.

For safety reasons, all LEITNER drives come fitted with a diesel-hydraulic emergency drive system to ensure the availability of the ropeway and the safety of passengers at all times, even in the event of a power failure. Electro-hydraulic emergency drives and emergency drives with auxiliary motors and separate gear inputs can also be included, depending on the project.

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LEITNER DirectDrive

Unrivaled in the ropeway market

LEITNER DirectDrive was developed in-house at LEITNER and is the only ropeway drive system that does not need a gearbox.

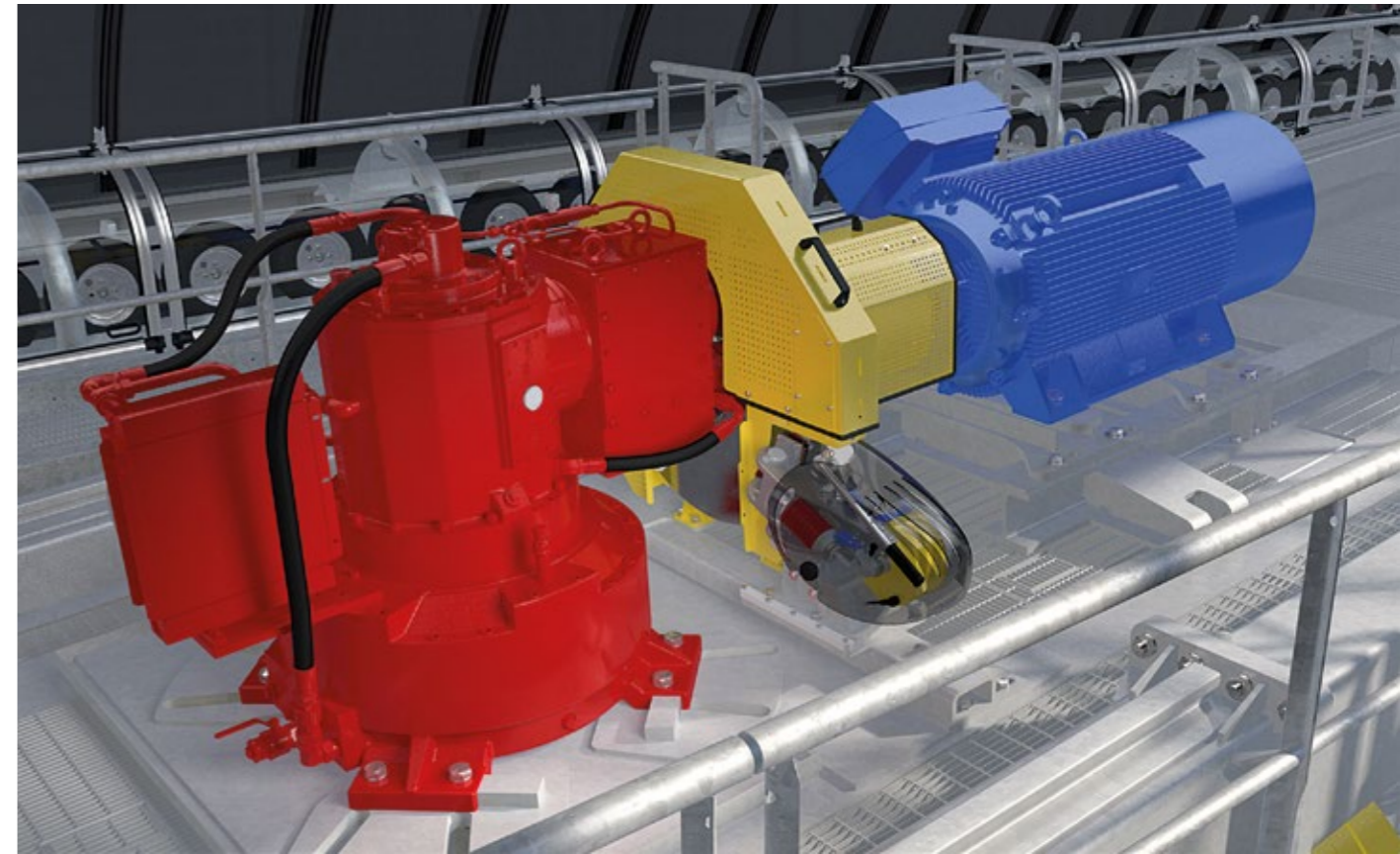
DirectDrive consists of a low-speed synchronous motor whose output shaft is connected directly to the sheave. It has just three moving parts (a rotor and two bearings) which rotate at the same slow speed as the sheave.

The electric motor offers full redundancy and availability. The rotor is fitted with permanent magnets. The stator is segmental and consists of a total of eight independent segments, each with three winding units, and each of those can be replaced separately and very quickly (two hours). The dimensions of the components are such that they can be transported to the ropeway without too much trouble and assembled without an external crane. The braking system comprises a service and a safety brake, each of which acts directly on the drive sheave and is equipped with its own independent hydraulic system. The drive sheave is connected to the output shaft by means of a quick-release radial tooth coupling and can be disconnected from the drive chain in a few easy steps. A station fitted with DirectDrive offers the quietest possible operation, minimal maintenance, and unbeatably low operating costs (no gearbox overhauls or oil changes), and it also takes up to 5% less energy to run than a conventional drive system. The motor's segmental build,

combined with the redundant design of its control system and power electronics, guarantees ultimate system availability. DirectDrive's drive frame is movable and can quickly and easily compensate for stretching of the hauling rope.

TECHNICAL SPECIFICATIONS

Drive motor	Low-rpm AC motor (externally cooled) 24 stator segments with a total of 48 windings (each segment consists of 2 windings)
Controller	Up to 2, 4 or 8 frequency inverters running in parallel, or more if more power is required
Service/safety brake	Hydraulic, acting on drive sheave, maximum four brake calipers
Gearing	Not applicable
Ø drive sheave	4.20 m to 5.30 m (five-part)
Maximum rope tension at top station	Up to 1,600 kN (sum of all ropes)
Emergency drive (standard)	Diesel-hydraulic, driven via pinion and sprocket on the drive sheave



The LEITNER Overhead Drive

Compact design, clearly placed

All of the LEITNER overhead drive's braking and drive system components are clearly arranged on a sliding drive frame, where they are easy to service.

The drive system consists of an electric motor, four-stage planetary gearing, two braking systems and a diesel-hydraulic emergency drive. The electric motor can be either AC or DC. Two motors can also be arranged in series to achieve greater power; in an enhanced version, these can be operated separately to increase system availability (single-motor operation). The braking system consists of a service and a safety brake. The electromagnetic service brake acts on a flywheel on the transmission input side, whereas the hydraulic safety brake acts directly on the drive sheave for optimum safety. The drive sheave is connected to the output shaft by means of a quick-release radial tooth coupling and can be disconnected from the drive chain in a few easy steps.

Two independently acting braking systems working on different operating principles guarantee maximum safety and system availability.

The four-stage planetary gearing requires little maintenance and, with an efficiency of 95%, causes very little power loss. The overhead drive's frame is movable and can quickly and easily compensate for stretching of the hauling rope.

TECHNICAL SPECIFICATIONS

Drive motor	AC and DC options, up to two motors in series
Service brake	Electromagnetic, acting on flywheel Max. two brake calipers per flywheel
Safety brake	Hydraulic, acting on drive sheave, max. three brake calipers
Gearing	Four-stage planetary gearing, max. torque 440 kNm
Ø drive sheave	4.20 m to 5.30 m (five-part)
Maximum rope tension at top station	Up to 1,600 kN (sum of all ropes)
Emergency drive	Diesel-hydraulic, driven via pinion and sprocket on the drive sheave



LeitDrive

The innovative frequency inverter from LEITNER

LeitDrive is a 4Q frequency inverter designed and developed in-house by LEITNER.

Because details specific to LEITNER's applications were incorporated into the product's development, interaction between the drive motor and inverter is perfectly balanced. The inverter is also extremely reliable and economical in daily operation. LeitDrive is modular by design; its 250 kW basic units can be connected together to produce whatever power level is required.

The power section is water-cooled, which enables an extremely compact design. Only the latest generation of highly efficient IGBT modules, uncompromisingly matched to the application, are used for the power section.

The operator interacts with the inverter on a user-friendly integrated web server, which eliminates the need for additional, unwieldy software tools. The most common field buses are supported via expansion cards. The control algorithms are specially optimized for ropeway systems and LEITNER's own direct drives. This unprecedented degree of adaptation to the application ensures that the system is as efficient as it possibly can be.

LeitDrive was developed specifically for ropeway systems and their requirements. It features a special filter design, reactive power control, and sensorless operation, and therefore easily meets all the requirements of grid and system operators.

Perfect coordination between motor and frequency inverter guarantees high overall efficiency and a drive motor that runs smoothly and efficiently in any load range. LeitDrive is extremely quiet and eco-friendly, and offers ropeway operators a cost-effective and redundant drive solution. Rated outputs ranging from 250 kW up to several MW can be configured on account of the modular design. Practical energy-saving synergies can be achieved using waste heat from the system's liquid cooling for heating and hot water.

Easily accessible components simplify maintenance and servicing. The expert knowledge acquired as a result of the company's development work improves service quality, the purchasing process, and overall customer care.

TECHNICAL SPECIFICATIONS (each module)	
Rated power	250 kW (with 150% overload for 90 sec)
Rated voltage	Three-phase 400 V
Rated current	370 A RMS (grid side) – 470 A RMS (generator side)
Dimensions (W x D x H)	400 x 800 x 2200 mm
Weight	260 kg

LEITNER Drive Electronics

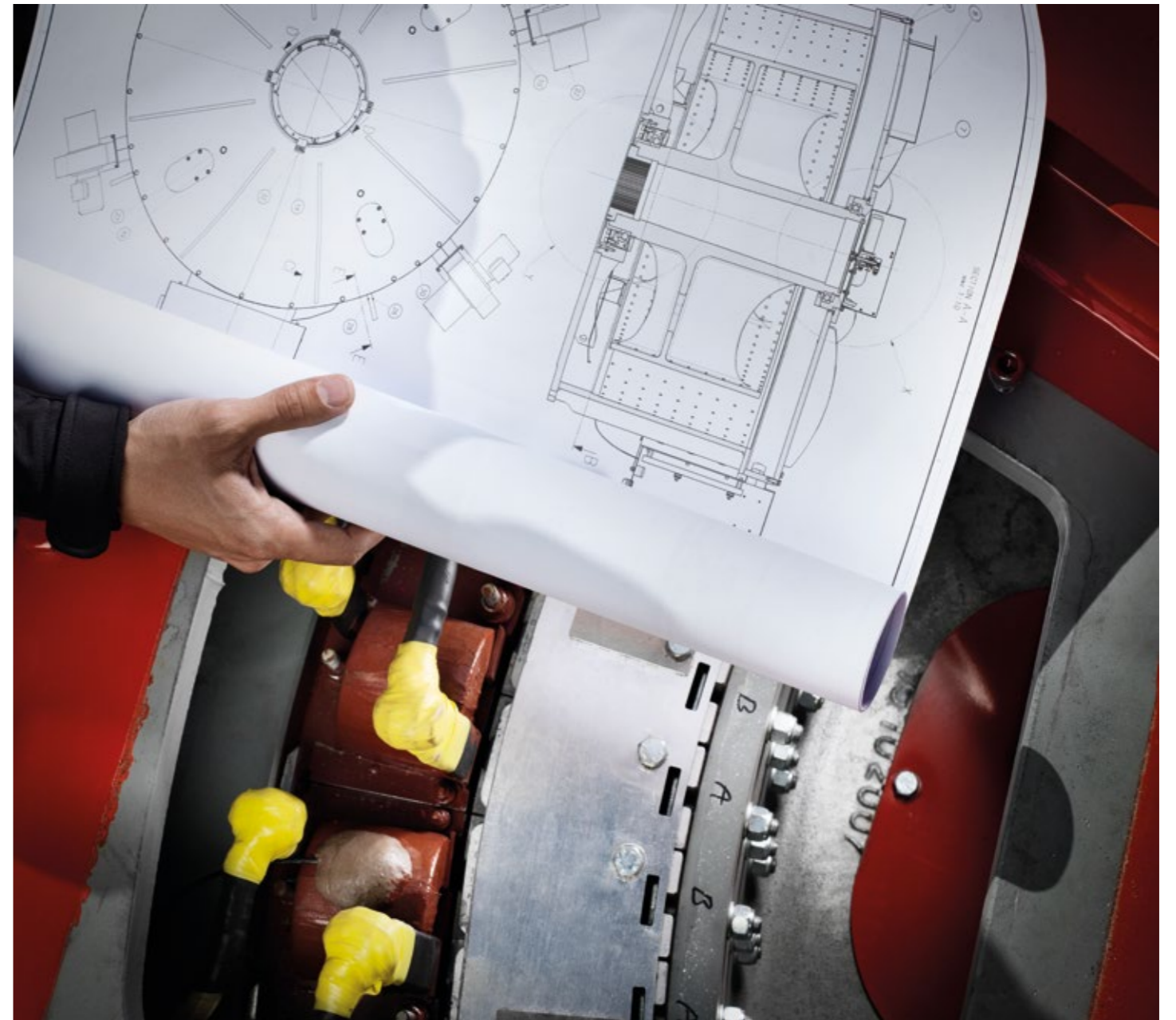
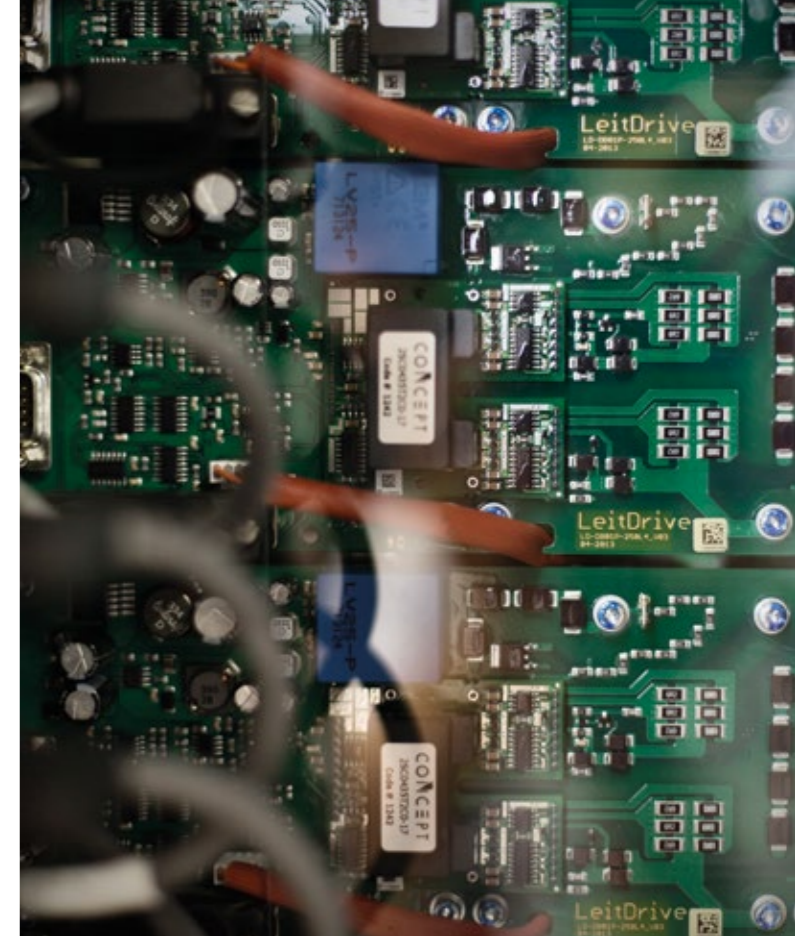
Intelligent solutions for ultimate comfort

Perfect interplay between motor, inverter, and mechanics is an essential element in passenger comfort. Intelligent drive solutions are needed to ensure that the rope moves smoothly and reliably in every operating and load scenario.

LEITNER's variable speed drives are based mainly on three-phase AC technology with modern IGBT frequency inverters. Our classic DC drive is also used for certain projects. Outputs ranging from a few kW to large drives in the 2-4 MW range are precisely and powerfully harnessed by our control algorithms to meet the requirements of the mechanical system. LEITNER's exclusive DirectDrive is also powered using this frequency inverter technology. This innovative concept, based on a permanently excited synchronous motor, requires no gearing and is a ground-breaking approach to energy-efficient, low-maintenance drives. The slow-running direct drive principle is used successfully in wind turbines (LEITWIND) for generating alternative energy on the world market at outputs of up to 3 MW.

The precise control dynamics of the latest generation of inverters optimize the kinematics of haul rope drives and station conveyors. Intelligent LEITNER software modules make the ride more comfortable by starting and stopping the system gently and without jerking. Frequency inverters featuring active infeed technology increase system availability. The motor is decoupled from the supply grid, making the entire drive system less vulnerable to voltage fluctuations and grid outages. When systems with active infeed are in braking mode, there is no conducting-through at the inverter, even if the grid supply is interrupted briefly, so there are none of the associated interruptions in operation. LEITNER drive electronics with AC technology are particularly energy-efficient and power-grid-compatible. The harmonic load on transformers and cables is very low. The grid power factor is 1.0, so only active power is taken from the grid and existing medium-voltage systems can be better utilized.

AC motors are ideally suited to the changing load conditions and climatic constraints of ropeways. An AC drive requires very little maintenance, and in this respect it is also economically superior to a DC drive solution, considering costs over the entire life cycle.



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