

## The **LEITNER** Drive System











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Compact, flexible, reliable

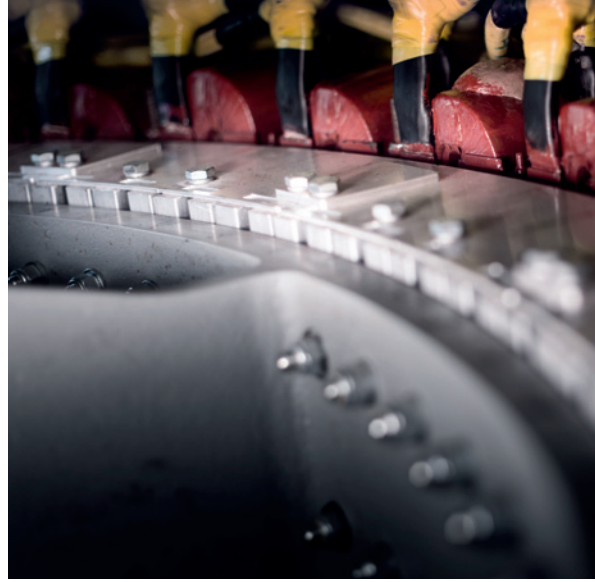
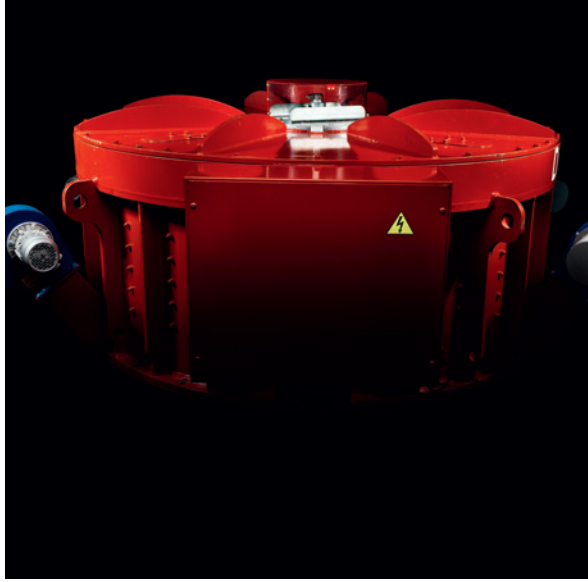
The basis for a safe ropeway ride is a reliable and powerful drive system. All LEITNER drive systems are therefore CE-certified and impress with their simple and clear design, their compact dimensions and a multitude of possible configurations.

Depending on project-specific requirements, the LEITNER drive system is set up at the bottom or top station, designed as overhead or underground drive and used as drive or drive-tension station.

The LEITNER DirectDrive is unique in the world. This gearless drive system stands out from the crowd due to its almost noiseless operation and extremely low maintenance requirements.

The braking system of the LEITNER drive systems has been designed to achieve the highest possible degree of safety. Two independent braking systems do not only work according to different physical principles (hydraulic and electric), but also act on separate braking surfaces.

For safety reasons, all LEITNER drive systems are equipped with a diesel-hydraulic emergency drive system, ensuring the availability of the installation and the safety of the passengers in case of a power failure.



## The **LEITNER DirectDrive**

The gearless drive system, an exclusive offer from LEITNER

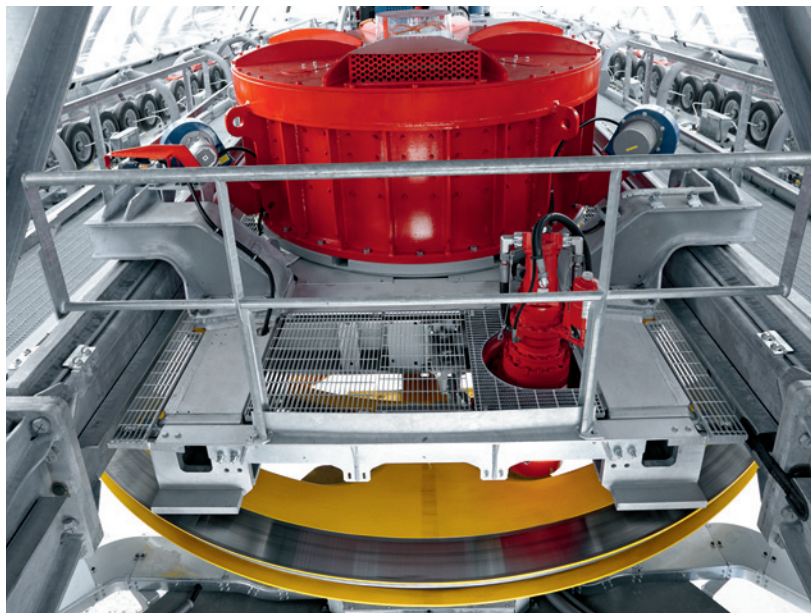
**Basis** The LEITNER DirectDrive, an in-house development, is the world's only ropeway drive system that can be operated without gearbox.

**Description** The DirectDrive has a low-rpm synchronous motor, whose output shaft is directly connected with the sheave. The drive consists of only 3 moving parts (rotor and two bearings), which rotate at the same speed as the sheave.

The electric motor is characterised by its absolute redundancy and availability. The rotor is equipped with permanent magnets, the stator has a segmented design and consists of 8 independent segments with 3 winding units each. The winding units can be replaced individually.

The braking system comprises a service and a safety brake, which both act directly on the drive sheave and are equipped with their own independent hydraulic system.

The drive sheave is connected with 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.



**Benefits** A station with DirectDrive offers the **quietest operation, minimal maintenance requirements** and extremely low operating costs (no gearbox inspection, no gearbox oil change).

In combination with a redundant set-up of the control system, the segmented design of the motor achieves the **highest possible availability** of the installation.

The drive frame of the DirectDrive is movable and can easily **compensate for possible elongations** of the **carrying-hauling rope** – quickly and with little effort.

## Technical data

|                                   |   |
|-----------------------------------|---|
| Drive motor                       | Low-rpm AC motor (external cooling)<br>8 stator segments with a total of 24 windings<br>(individual replacement possible) |
| Control system                    | Up to 4 parallel inverters, additionally inverters upon power request   |
| Service/safety brake              | Hydraulic, acting on drive sheave<br>4 callipers max.   |
| Gearbox                           | Not applicable  |
| Drive sheave Ø                    | 4.20 m (one part); 4.90 m (two parts); 5.30 m (two parts)   |
| Max. rope tension at top station  | Up to 900 kN  |
| Emergency drive system (standard) | Diesel-hydraulic, sheave driven via pinion and sprocket   |





## The **LEITNER** Underground Drive

For maximum power

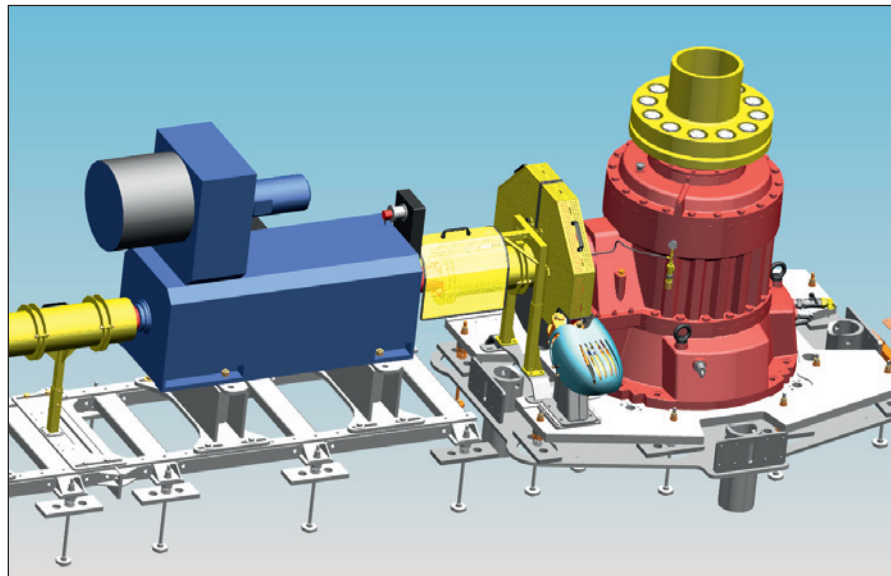
**Basis** For the LEITNER underground drive, the electric motor, gearbox and service brake are set up in a separate drive room located below the station level.

**Description** The drive system consists of an electric motor, a 4-step planetary gearbox, two braking systems and a diesel-hydraulic emergency drive system.

The electric motor can be either an AC or DC drive. At higher drive power, a double-sided input into the main gearbox is possible, allowing for drive configurations with up to 4 drive motors.

The braking system comprises a service and a safety brake. While the electromagnetic service brake acts on a flywheel fixed on the transmission input shaft, the hydraulic safety brake acts directly on the drive sheave.

The drive sheave is connected with the transmission output shaft by means of a vertical drive shaft. The shafts are connected with a bolt coupling that can be released in no time at all.



**Benefits** The underground set-up of electric motor and gearbox ensures **low noise emissions** in the station area and **maximum protection** of the drive components **at low temperatures**.

As the station structure does not have to take up the drive torque, the **maximum rope tension** required by high-power installations at the top station can be easily achieved with an underground drive.

Two independently acting braking systems with different mechanisms ensure **maximum safety** and **availability** of the installation. The 4-step planetary gearbox impresses with its low maintenance requirements and ensures **low power losses** with an **efficiency of 95 %**.

## Technical data

|                                  |  |
|----------------------------------|--|
| Drive motor                      | AC or DC   |
| Service brake                    | Electromagnetic, acting on flywheel<br>2 callipers max.  |
| Safety brake                     | Hydraulic, acting on drive sheave<br>3 callipers max.  |
| Gearbox                          | 4-step planetary gearbox, double-sided gearbox<br>input possible, max. drive torque of 660 kNm |
| Drive sheave Ø                   | 4.20m (one part); 4.90m (two parts); 5.30m (two parts)   |
| Max. rope tension at top station | Up to 1200 kN  |
| Emergency drive system           | Diesel-hydraulic, sheave driven via pinion and sprocket  |



## The **LEITNER** Overhead Drive

Compact design, clear arrangement

**Basis** For the LEITNER overhead drive, all components of the drive and braking system are set up on a movable drive frame – clearly arranged and easily accessible for maintenance.

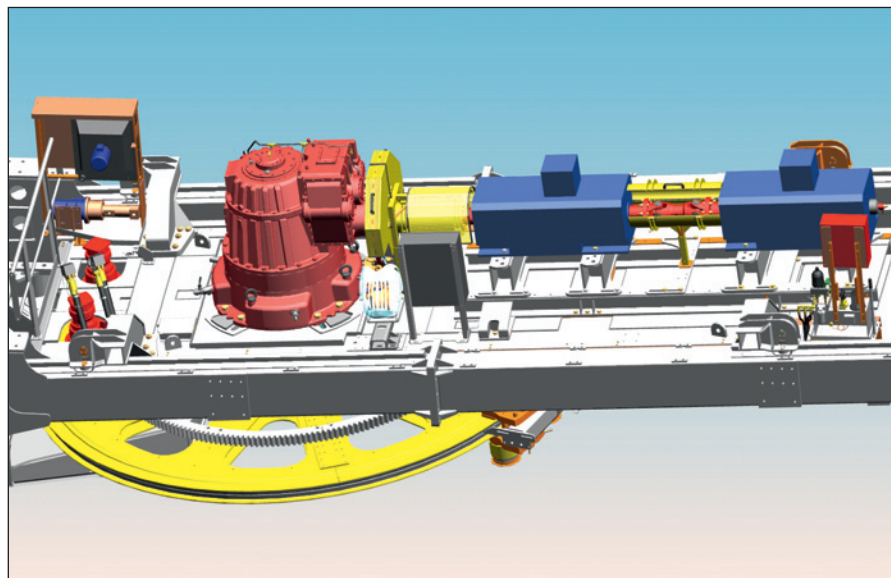
**Description** The drive system consists of an electric motor, a 4-step planetary gearbox, two braking systems and a diesel-hydraulic emergency drive system.

The electric motor can be either an AC or DC drive. At higher drive power, two motors can be connected in series. In order to increase the availability of the installation, an enhanced version allows the separate operation of two motors (one-motor operation).

The braking system comprises a service and a safety brake. While the electromagnetic service brake acts on a flywheel fixed on the transmission input shaft, the hydraulic safety brake acts directly on the drive sheave, which is the best solution in terms of safety.

The drive sheave is connected with the transmission output shaft by means of a quick-release radial tooth coupling and can be easily disconnected from the drive chain in a few easy steps.





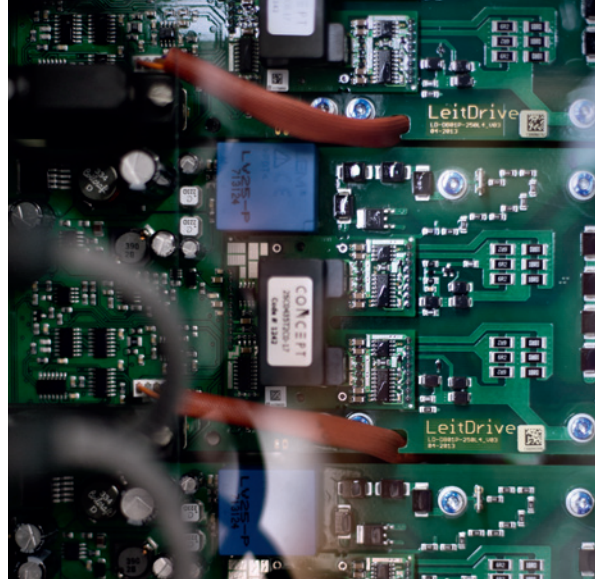
**Benefits** Two independently acting braking systems with two different mechanisms ensure **maximum safety** and **availability** of the installation.

The 4-step planetary gearbox impresses with its low maintenance requirements and ensures **low power losses** with an **efficiency of 95 %**.

The drive frame of the overhead drive is movable and can **easily compensate for possible elongations** of the **carrying-hauling rope** – quickly and with little effort.

## Technical data

|                                     |  |
|-------------------------------------|--|
| Drive motor                         | AC or DC, up to two motors in series                                 |
| Service brake                       | Electromagnetic, acting on flywheel<br>2 callipers max. per flywheel |
| Safety brake                        | Hydraulic, acting on drive sheave<br>3 callipers max.                |
| Gearbox                             | 4-step planetary gearbox, max. drive torque of<br>460 kNm            |
| Drive sheave Ø                      | 4.20m (one part); 4.90m (two parts); 5.30m (two parts)               |
| Max. rope tension<br>at top station | Up to 900 kN   |
| Emergency drive<br>system           | Diesel-hydraulic, sheave driven via pinion and<br>sprocket           |



## LeitDrive

The innovative drive solution from LEITNER

**Basis** LeitDrive is a new 4Q frequency inverter, designed and developed completely in-house by LEITNER. The fact that application-specific details were taken into account during product development ensures a perfectly adjusted interaction of the drive engine and the inverter, combined with the highest levels of reliability and economy in day-to-day operation.

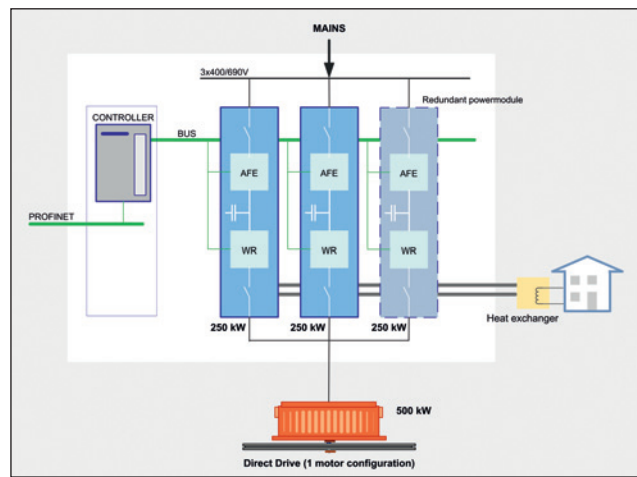
**Description** LeitDrive is based on a modular concept and, by interconnecting 250-kW basic units, can reach virtually any level of power.

A water-cooled power element allows for an extremely compact design. Only highly efficient, latest-generation IGBT modules which have been uncompromisingly adjusted to the application are used for the power element.

All interactions with the inverter are carried out in a user-friendly manner via an integrated web server, which means that no additional, unpractical software tools are required. The most common field buses are supported via expansion cards. The control algorithms are specially optimized for ropeways and on-site direct drives. This unprecedented degree of adjustment to the application ensures the highest levels of system efficiency.

LeitDrive has been specifically developed for ropeway applications and their requirements. It offers special filter design, reactive power control and sensorless operation and therefore easily meets all the needs of the network and system operators.





**Benefits** The **perfect coordination between the engine and the frequency inverter** ensures a **high overall efficiency** and a **drive engine that runs gently and efficiently** at any power level. The operation of LeitDrive is extremely **silent** and **eco-friendly**, and thus offers ropeway operators a **cost-efficient** and **redundant drive solution**.

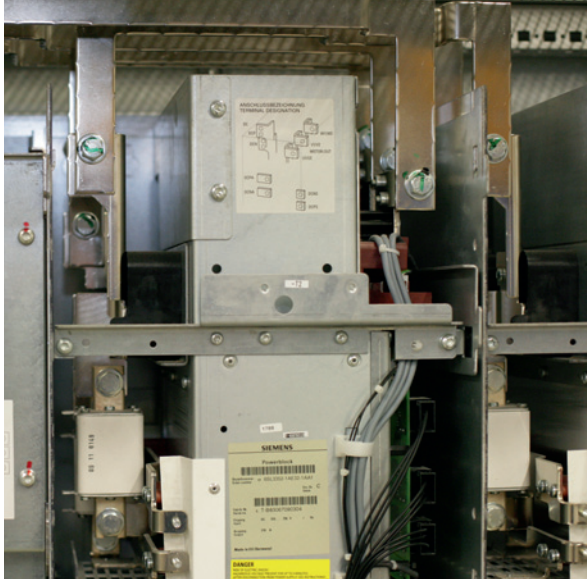
Through **modular design**, nominal capacities from **250 kW to several MW** are possible. **Easy access to components** ensures **ease of maintenance** and **service comfort**.

The **expertise** that we have acquired by **in-house development improves** our **service quality**, our **purchasing** and our entire **customer support**.

By **using waste heat from liquid cooling** for heating or hot water generation, reasonable **energy-efficient synergies** can be achieved.

## Technical data (per module)

|                         |   |
|-------------------------|---|
| Nominal power           | 250 kW (with 150 % overload for 90 s)               |
| Nominal voltage         | 3-phase 400 V                                       |
| Nominal current         | 370 A rms (mains side) – 470 A rms (generator side) |
| Dimensions (w x h x d)  | 400 x 800 x 2200 mm                                 |
| Weight                  | 260 kg  |
| Type of protection      | IP 54   |
| Application temperature | -20 to +45 °C                                       |



## LEITNER drive technologies

Intelligent solutions for highest ride comfort

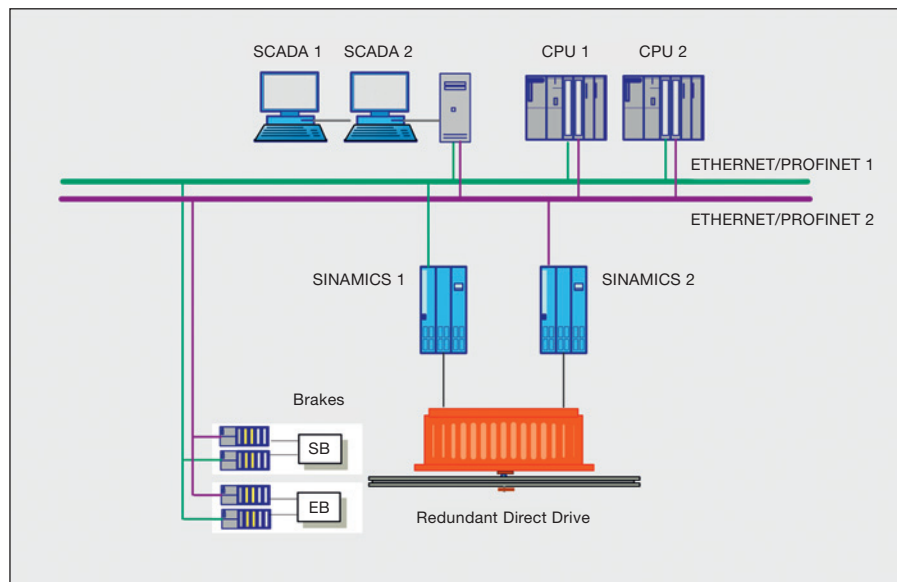
**Basics** The perfect interplay between the motor, the converter and the mechanical parts is crucial for high passenger comfort. Intelligent drive solutions are required to ensure the smooth and reliable movement of the rope under any operation and load circumstances.

**Description** Variable-speed drives from LEITNER are designed primarily in three-phase AC drive technology with modern IGBT frequency inverters. For certain projects and in certain areas of application, approved DC drives will also continue to be used.

AC converters from Siemens with active-infeed technology are important components of our drive concept. Through our control algorithms, motor powers – ranging from a few kW to large drives in the area of 2–4 MW – are adjusted precisely and powerfully to the requirements of the mechanical system.

The exclusive direct drive from LEITNER is also driven by this frequency inverter technology. This innovative concept, which is based on a permanently charged synchronous motor, requires no gearbox and represents a groundbreaking model for energy-efficient, low-maintenance drives. In markets around the world, the principle of a slowly running direct drive is also successfully applied in LEITWIND facilities for alternative power generation – with performances ranging up to 3 MW.





**Advantages** The precise control dynamics of the newest converter generation provide **optimal kinematics** of haulage rope drives and station conveyors. **Ride comfort** is increased through a **jolt-free, smooth start and stop** by intelligent LEITNER software modules.

**Frequency converters** with active-infeed technology **increase the availability** of installations. By decoupling the motor from the electrical network, the entire drive system becomes less sensitive to voltage fluctuations or power failures. In **braking operation** of ropeways with active infeed, even during short power failures, there is **no AC converter tilting**, which means that there are no service interruptions.

LEITNER drives with AC technology are particularly **energy-efficient** and **power-grid-friendly**. Harmonics on transformers and cables are very low. The **power factor** is **one (1.0)**, so factually, only the active power is taken out of the electrical network – existing **medium-voltage installations** can be **used more efficiently**.

The properties of **AC motors** are ideally suited for the constantly **changing load and climate circumstances** of ropeways. The AC drive is **particularly low-maintenance** and in this regard – taking into account all costs across the entire life cycle – it is also **economically superior** to a DC drive solution.

