GHH GROUP

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LATEST GENERATION OF UNDERGROUND MINING ELECTRIC LOADERS

LF-19EB

SOLID AS A ROCK

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SK GROUP

mine master
Rigs for your needs

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SAFETY SHARE

GHH drives “Going Green” initiatives through electric:

- Develop new Electric loader offering
- Expand Hybrid battery electric offering
- Drive towards Eco-friendly offering

Benefits

- No emissions
- Reduced oil leaks
- No hot surfaces in reachable areas
- Significant reduced danger of fires
- Less maintenance so less safety risk

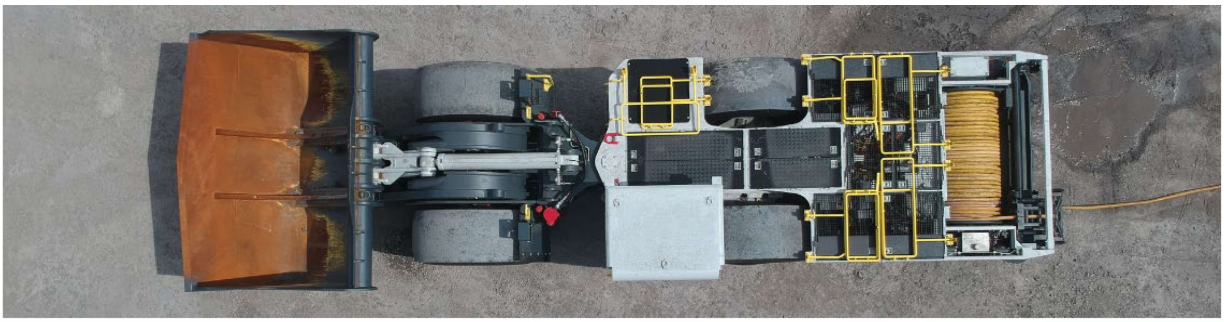
GHH - A TOTAL SOLUTION PROVIDER

You bring the needs, we will bring the solutions …

CONTENTS

LF-19EB BATTERY ELECTRIC LOADER

- Background
- Main Specifications
- Benefits over tethered or battery loaders
- Running cost benefits
- Advantages of GHH spooling cable design
- GHH inSiTE - Data Anlaytics solution
- Overview



LF-19EB

BACKGROUND

- For decades the underground mining industry has used tethered electric loaders
- GHH has a long lasting history in the design, development and operations of tethered electric LHDs going back to the 1970s
- Battery technologies as alternative energies have more recently become a focus in the mining industry as drive towards ‘going green’ increases heavily
  - First GHH electric loader was introduced in 1978 and some of them still the backbone of the customers production
- GHH were the first OEM to combine the benefits of battery and tethered electric loaders – the Hybrid LF-19EB
  - Constant power out of the mine grid
  - Independent from needing a towing vehicle or generator

LF-19EB → 19 ton Battery Electric Loader

MAIN SPECIFICATIONS

Reason for Design

- To improve utilization - no towing/generator required to move between working ends
- To Improve Productivity
- To reduce running costs

Operating specifications

- 12% Gradient average, Maximum admissible gradient: 28%
- Max. 52 °C Ambient Temperature

Main Specifications

- Payload: 19.000kg
- Tractive effort force: 380 kN
- Power Supply: Cable 3*1000VAC 250KVA Permanent Load, 315KVA Peak
- 250m trailing cable
- Max Tramming speed: 14 km/h

Operator Safety Benefits

- Ergonomic operator's compartment
- Designed for high comfort levels
- Maximum visibility
- Less heat and therefore less impact on operator
- Extremely smooth ride - Due to a direct driven gear box, axles & intelligent motor management and electric traction drive

LF-19EB → 19 ton Battery Electric Loader

BENEFITS OVER TETHERED OR BATTERY

- Perfect intermediate between tethered electric & pure battery solution
- More flexible than tethered loader
- No need for a generator or towing vehicle to move from working section to working section
- Less risky than a pure battery loader
  - When Battery technology does not meet the requirements of an eight hour shift our loader uses the tethered cable to charge the battery
  - No loss in productive time to charge the battery
- Perfect solution especially for existing mines when it comes to the power supply system
  - battery is not only designed for moving the loader without cable
  - but also to buffer peaks in power consumption and recuperation as well

LF-19EB → 19 ton Battery Electric Loader

RUNNING COST BENEFITS

- Significantly lower running costs than diesel LHD
- Lower running costs than a tethered electric LHD
- Regenerative braking reduces both brake & tyre wear thus reducing predictive operating costs
- No diesel engine therefore no refuelling and a lot less maintenance due to having electrical components.
- Smaller battery
  - less initial investment costs,
  - no infrastructure for charging stations
- Requires far less ventilation
- Significant energy savings compared to tethered electric and even more when compared to diesel LHDs, so this together with the lower operating costs results in an overall lower cost per ton.
- No need for generator or additional towing vehicle to move loader from working section to working section so therefore reduced costs

LF-19EB → 19 ton Battery Electric Loader

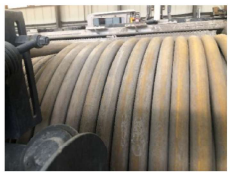
2 WAY OF SPOOLING A CABLE

Uncontrolled Spooling

- High forces due to necessary tension
- Cable slips into the gaps and twists in itself leading to premature cable failure
- Safety risk for pedestrians due to whipping cable

+ Relatively simple design

Controlled Spooling



+ Low tension forces due to controlled speed and tension

+ cable is guided into the right spot minimizing stress on the cable

- more intricate design

LF-19EB → 19 ton Battery Electric Loader

ADVANTAGES OF CONTROLLED SPOOLING

- With parallel groove system, rope wear is considerably reduced in multilayer spooling
- When the first layer has filled the drum, the second layer travels back across the drum with each wrap of the rope sitting precisely along the groove of the two wraps of the first layer.
- With parallel grooving it is possible to calculate the exact forces that the rope imposes on the drum because the spooling is controlled
- Cross winding is reduced to approximately 20% of the circumference of the drum and 80% remains parallel to the flanges in the inner layer rope groove.
- This parallel grooving evenly distributes the load between the individual layers and has been shown to increase substantially – **by more than 500%,** test have shown – the life of the wire rope.

Quote: https://en.wikipedia.org/wiki/Wire_rope_spooling_technology

- Current experience at K+S softrock application in Germany:
  - Cable is unspooled after 3000 hours, the ends are swopped and it is used again for approx. 2000 hours
  - Total life of cable approx. 5000 hours

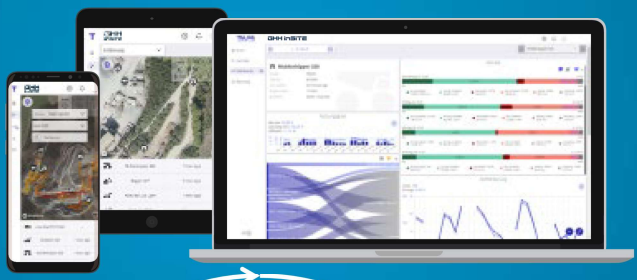
GHH inSiTE

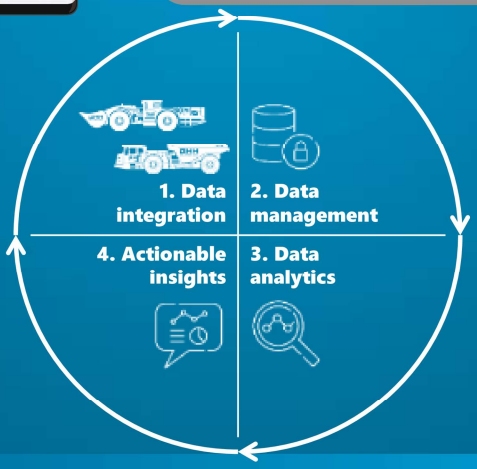
GHH

A Data Analytics Solution giving you Insights to improve you operation …

- Machine data for information & process insights
- A conclusive source with no bias or human error
- Real time data capturing (or close to real time)
- Get overview of machine activity
- Identify shortcomings in process efficiency
- Optimize allocation of mobile equipment
- Designate misuse of consumables

- GHH inSiTE can distill complicated & seemingly random information into powerful tools for analysis
- The key is to define the targeted insights and scope of analysis to maximize effective usage of data





GHH inSiTE POWERED BY TALPA SOLUTIONS

FIRST LARGE FLEET IMPLEMENTATION AT K+S

Implementation of GHH inSiTE digital analytics solution at K+S – Future global reference case

- Started first installation on LF-14 approx. 1 year ago for 3 to 4 month trial
- Data analytics, outcomes, visualization is customized together with OEM and K+S to maximize experience and potential benefits
- Quantity is 150 machines in total
- Duration of 36 months for each logger
- Implementation has started

LF-19EB

OVERVIEW

- **The LF-19EB is the largest battery electric loader in the Underground Mining market**
- **By combining the best of both worlds – pure tethered system & pure battery system, we achieve:**
  - Improve productivity & Utilization
  - Reduced running costs
  - Less maintenance
  - Less maintenance
  - Reduced danger of fires
  - No hot surface in reachable areas
- **Baseline for future offering**
- **New standard for electric loading – hybrid of battery and tethered**
- **Currently being introduced at K+S in Germany**

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