



**Goldhofer**

# **E-MOBILITY AT GOLDHOFER THE FUTURE OF GROUND HANDLING**

AIRPORT TECHNOLOGY



**MADE FOR YOUR MISSION**





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INDIVIDUAL VALUE



# GOLDHOFER GET ELECTRIFIED!

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What began with a blacksmith's shop in 1705 is now a globally operating company with extensive experience and innovative power. Our robust and intelligent transportsolutions make your day-to-day work much easier, and with our »IONMASTER« technology, we have taken e-mobility in the commercial vehicles sector to a whole new level.





GET ELECTRIFIED!





# THE FUTURE IS ELECTRIC

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We at Goldhofer are convinced that true sustainability is only possible if our products are technologically sophisticated and are reliable in every respect.

With our groundbreaking »IONMASTER« technology, we are able to offer durable, economical vehicles with incredibly high operational readiness and outstanding performance.

We use power trains that have proven themselves in the commercial vehicle industry for our all-electric tractors. With minimal maintenance requirements, the vehicles promise maximum operating comfort and the shortest possible charging times.

Handling is safe and straightforward thanks to the lithium-ion battery.

# FACTS ON E-MOBILITY

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## 1. HIGH-VOLTAGE TECHNOLOGY

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- + Goldhofer's e-fleet is equipped with innovative 400 V or 700 V lithium-ion battery technology proven in the commercial vehicle sector
- + Maximum efficiency and flexibility through rapid charging
- + High power density ensures especially long range and outstanding performance

## 3. SERVICE LIFE

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- + Continuous further development means that our e-vehicles could even compete with the service life of diesel vehicles today
- + Second-life applications for battery systems possible, e.g. as stationary storage systems

## 5. EFFICIENCY

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- + Maximum availability due to extremely short charging times
- + E-vehicles with Goldhofer »IONMASTER« technology are enormously economical due to their long maintenance cycles with low maintenance outlay

## 2. STATE-OF-THE-ART TECHNOLOGY

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- + Using the latest lithium-ion battery technology, Goldhofer promises maximum capacity and efficient energy use
- + Fast intermediate charging enables reliable multi-shift operation

## 4. RESOURCE CONSERVATION

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- + In contrast to diesel vehicles with a fixed tank size, vehicles with Goldhofer »IONMASTER« technology can be precisely configured for any range of applications
- + Equipped with resource-saving and individually matched modular battery packages

## 6. ACTIVE TEMPERATURE MANAGEMENT SYSTEM

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- + Always keeps batteries in an optimal temperature range
- + Designed for minimum power consumption
- + Battery heating or cooling during the charging process
- + Cabin heating or cooling during the charging process
- + A high-voltage air-conditioning compressor and separate combined heating for battery and cabin.

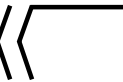
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# OUR EXPERTISE? YEARS OF EXPERIENCE!

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Our first battery electric aircraft tractor was introduced back in 1982! With our claim to be the technology leader and the goal of being able to offer the best solution at all times, we have been involved in e-mobility for almost 40 years.

Continuous research and development led to the production-ready F110e, one of the first series-produced electric aircraft tow tractors. In 2014, we introduced the Galileo concept vehicle, which was the foundation for the towbarless »PHOENIX« E, which can handle an enormous range of aircraft types.



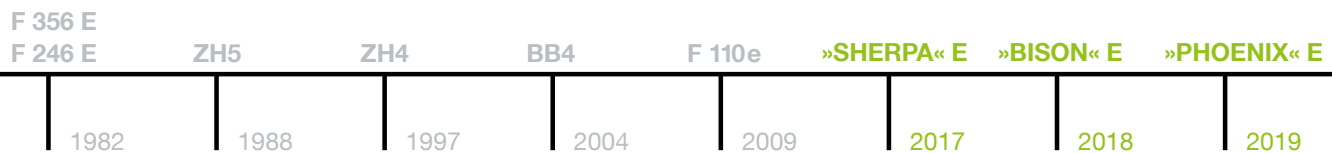


For a long time, e-vehicles led a shadowy existence as a niche product, until they attracted enormous interest for a growing number of different applications.

Goldhofer's F359e, F246e, ZH4, ZH5, BB4, and F110e tow tractors were exotic creatures, used exclusively by a few innovative airports. As climate targets grew, demand for electric vehicles – with the same performance levels as diesel vehicles – grew tremendously.

Today, Goldhofer is able to offer electric vehicles that are highly economical while also being precisely adapted to the individual application profile. We have achieved this through decades of research, development, and experience in this field.

We see ourselves as your partner who recognizes and understands your challenges and can advise you on exactly how your personal fleet needs to be equipped to meet your exact requirements.





# »IONMASTER« TECHNOLOGY

## EFFICIENT E-MOBILITY





## WHAT IS »IONMASTER« TECHNOLOGY?

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Our »IONMASTER« technology is integrated into all e-vehicles in the »BISON«, »SHERPA«, and »PHOENIX« families. The use of proven lithium-ion batteries makes ground handling challenges a breeze. Goldhofer's electric fleet is powerful, sustainable, and reliable – as you would expect from our diesel tractors.

### THE LITHIUM-ION BATTERY

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- + 400 or 700 V lithium-ion batteries proven in the commercial vehicle industry enable maximum power and endurance
- + Lithium-ion batteries guarantee more power and higher power density than lead acid batteries
- + Modularly expandable battery system, configurable for individual deployment requirements
- + Maximum performance with long battery life
- + Multi-shift operation through intermediate charging

### VEHICLE-SPECIFIC BENEFITS

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- + Electric power train, electric engine, battery, inverter and high-voltage heating system are maintenance-free
- + Integrated battery management system with intelligent thermal management system
- + Regulates battery and cabin temperature
- + In use on every continent and in all environmental conditions, from -4 °F to +122 °F
- + High-voltage components cooled by environmentally sustainable water glycol mixture:  
Consistent performance, even under extreme environmental conditions







# »IONMASTER« TECHNOLOGY CHARGING INFRASTRUCTURE





## THE CHARGING INFRASTRUCTURE

The available charging infrastructure is crucial when it comes to the efficient use of e-vehicles of all kinds. In addition to country-specific sockets, a DC charging station is the most important piece of equipment for a »BISON« E, »SHERPA« E, or »PHOENIX« E. Rapid charging is possible from 70 to 150 kW, depending on the vehicle family and the local infrastructure.



DC 70 kW



DC 150 kW



DC 80 kW

## 1. CHARGING PLUGS

With Goldhofer »IONMASTER« technology, you have the choice between all four standard connectors:

**CCS TYP 1 | USA**  
AC AC/DC



**CCS TYP 2 | EU**  
AC AC/DC



**CHAdeMO | JAPAN**  
DC



**GB/T | CHINA**  
DC



## 2. AC/DC CHARGING STATION

- + Standard solution for electrically driven vehicles
- + Enables extremely powerful charging within the shortest possible time



## 3. AC ON-BOARD CHARGER

- + No separate charging infrastructure necessary
- + Charging at up to 22 kW for all vehicles



AC 22 kW



AC 22 kW



AC 22 kW





# SERVICES FOR E-MOBILITY

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To configure the right e-vehicle for your requirements, our experts are on hand to offer advice and support.

We likewise offer support in terms of training and repairs, and even though e-vehicle fleets require minimal maintenance, we offer various services to help you run your fleet as efficiently as possible.

- + User training
- + Workshop training –upon customer requirements
- + Stocking, wear/spare parts planning
- + Goldhofer »LINK« telemetry and maintenance modules



# CONSULTATION

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SERVICE BROCHURE  
GOLDHOFER SERVICE  
AIRPORT TECHNOLOGY

**For optimal overall performance and efficiency, our vehicles can be individually configured – this involves asking four key questions:**

## 1. WHAT IS THE REQUIREMENTS PROFILE FOR THE VEHICLE?

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The first step is determining which routes and performance your new e-vehicle will need to handle. If there are major inclines or long alternative routes, this must be taken into account in the configuration.

## 2. WHAT ABOUT THE EXISTING CHARGING INFRASTRUCTURE?

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The most economical and sustainable operation of the e-vehicles is made possible by 400 or 700 V lithium-ion batteries. Rapid charging and opportunity charging enable efficient use of the e-fleet. Using the existing charging infrastructure, as well as our charging options, we develop the ideal custom charging infrastructure with you.

## 3. HOW MANY E-VEHICLES ARE NEEDED?

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The first two questions will automatically determine the size of the fleet needed. Through individual configuration and more efficient use, fewer vehicles are needed for the same application profile.

## 4. HOW IS THE ELECTRIC FLEET MANAGED?

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Once the e-vehicles are in use, they are expected to perform their tasks economically. Goldhofer can also provide support here with training and advice, as e-vehicles cannot be used in the same way as diesel vehicles. This means that driving and loading habits will have to be relearned.



# INDIVIDUAL VALUE THE »SHERPA« E



ADJUSTABLE  
BATTERY  
CAPACITY



CABIN OPTIONS  
FOR FLEXIBLE  
CONFIGURATION



MAINTENANCE  
FREE  
COMPONENTS



»SHERPA« FAMILY  
MODULAR DESIGN FOR  
CARGO TOWING  
AND PUSHBACK



## »IONMASTER« TECHNOLOGY

- + Active thermal management for cabins and all high-voltage components:  
Heating and cooling for optimal temperature conditions, even during charging, for long battery life
- + Modularly expandable battery system, configurable for individual deployment requirements
- + Commercial vehicle industry tried-and-tested 400 V lithium-ion batteries for certified, maximum safety, ultimate performance, and service life
- + Electric power train, electric engine, battery, thermo module, and inverter are maintenance-free
- + Second-life applications for battery systems possible, e.g. as stationary storage systems



## CHARGING AND INFRASTRUCTURE

- + All standard charging plugs available: CCS Typ 1, CCS Typ 2, CHAdeMO and GB/T
- + Infrastructure consulting on charging points
- + Rapid DC charging and intermediate charging at up to 70 kW
- + Optional AC charging at up to 22 kW



## VEHICLE-SPECIFIC ADVANTAGES

- + Three cabin designs: Cabless, open cab, closed cab
- + Small turning radius of 162"
- + Can be used in all climate conditions in temperatures ranging between -4 °F and +122 °F
- + 360° view for the driver
- + High-voltage components cooled by environmentally sustainable water glycol mixture: Consistent performance, even under extreme environmental conditions



»SHERPA« E  
Max towed load ≤ 132,000 lbs  
54 hp | 1x 35 kWh battery  
7,800 lbf Drawbar pull

»SHERPA« E  
Max towed load ≤ 176,000 lbs\*  
94 hp | 2x 35 kWh batteries  
10,100 lbf Drawbar pull







# INDIVIDUAL VALUE THE »BISON« E



MODULAR  
EXPANDABLE  
BATTERY SYSTEM



CABIN OPTIONS  
FOR FLEXIBLE  
CONFIGURATION



GOLDHOFER  
»IONMASTER«  
TECHNOLOGY



»BISON« FAMILY  
THE FUTURE PROOF  
PUSHBACK



## »IONMASTER« TECHNOLOGY

- + Active thermal management for cabins and all high-voltage components:  
Heating and cooling for optimal temperature conditions, even during charging, for long battery life
- + Modularly expandable battery system, configurable for individual deployment requirements
- + Commercial vehicle industry tried-and-tested lithium-ion batteries for certified, maximum safety, ultimate performance, and service life
- + Electric power train, electric engine, battery, inverter and thermo module are maintenance-free
- + Second-life applications for battery systems possible, e.g. as stationary storage systems



## CHARGING AND INFRASTRUCTURE

- + All standard charging plugs available:  
CCS Typ 1, CCS Typ 2, CHAdeMO and GB/T
- + Infrastructure consulting on charging points
- + Intermediate charging enables multi-shift operation
- + Rapid DC charging and intermediate charging at up to 80kW
- + Optional AC charging at up to 22 kW



## VEHICLE-SPECIFIC ADVANTAGES

- + Three cabin designs:  
Cabless, open cab, closed cab
- + Can be used in all climate conditions in temperatures ranging between -4 °F and +122 °F
- + 360° view for the driver
- + High-voltage components cooled by environmentally sustainable water glycol mixture:  
Consistent performance, even under extreme environmental conditions



### »BISON« E 370

101 hp | 23,600 lbf | MTOW ≤ 275,000 lbs  
70 kWh | 105 kWh | 140 kWh



### »BISON« E 620

156 hp | 46,000 lbf | MTOW ≤ 550,000 lbs  
70 kWh | 105 kWh | 140 kWh | 175 kWh



# INDIVIDUAL VALUE

## »PHOENIX« AST-2E



MODULAR  
EXPANDABLE  
BATTERY SYSTEM



AIRCRAFT RANGE  
UP TO  
776,000 lbs MTOW



GOLDHOFER  
»IONMASTER«  
TECHNOLOGY





»PHOENIX« FAMILY  
YOUR TRACTORS  
FOR THE FUTURE



## »IONMASTER« TECHNOLOGY

- + Active thermal management for cabins and all high-voltage components:  
Heating and cooling for optimal temperature conditions, even during charging, for long battery life
- + Modularly expandable battery system, configurable for individual deployment requirements
- + 700 V lithium-ion batteries, tried and tested from the commercial vehicle industry for certified, maximum safety, top performance and service life
- + Second-life applications for battery systems possible, e.g. as stationary storage systems



## CHARGING AND INFRASTRUCTURE

- + All standard charging plugs available:  
CCS Typ 1, CCS Typ 2, CHAdeMO and GB/T
- + Infrastructure consulting on charging points
- + Rapid DC charging and intermediate charging up to 150kW
- + Optional AC charging at up to 22kW



## VEHICLE-SPECIFIC ADVANTAGES

- + Retrofittable E-GPU
- + High-voltage components cooled by environmentally sustainable water glycol mixture:  
Consistent performance, even under extreme environmental conditions
- + Goldhofer »LINK« telemetry and maintenance modules



### »PHOENIX« AST-2E

66 kWh | 99 kWh | 132 kWh | 165 kWh  
20 mph | MTOW ≤ 776,000 lbs

### »PHOENIX« AST-2E WITH RANGE EXTENDER

66 kWh + range extender  
20 mph | MTOW ≤ 776,000 lbs









## CONTACT GET IN TOUCH WITH US!

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### GOLDHOFER AIRPORT TECHNOLOGY

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