



# MAGNET LIFTING TECHNOLOGY

# MORE THAN HALF A CENTURY OF EXPERIENCE I

## TRUNINGER

is a family company with a tradition of more than 80 years for innovative solutions in magnet lifting technology.

Thanks to its many pioneering accomplishments, for more than 60 years TRUNINGER has been a leader in

- the development
- the manufacture
- and the sale

of electromagnetic grippers. On-going further development of existing products, customer-oriented solutions and quality-conscious employees guarantee first-class products.

## MECHANICAL DESIGN

At TRUNINGER, we place great importance on the mechanical design of the magnets and magnet spreader beams. Our goal is to provide the best possible magnet lifting system for your application. Years of experience and state-of-the-art tools help us to develop practical solutions that work in the real world.

### 1. Simulation of the load deflection

A special computer program is used to define the material bending line in order to optimise the number and positions of the magnets used. This ensures that the load will not peel off.

### 2. Construction of the magnets

With the help of the Finite Elements analysis tool, we produce a comprehensive, realistic computer model of the magnet (more on page 23). The model optimises the magnet such that the flux density/magnet performance is increased and the manufacturing process simplified without conducting elaborate tests.

### 3. Construction of the magnet spreader beams

The construction and set-up of the magnet spreader beams are defined by means of state-of-the-art CAD systems and PC-based static calculations. Proven designs, and on going development enables TRUNINGER magnet lifting systems to be adapted to customer needs.

### 4. Your benefits

- Innovative solutions using magnets ideally matched to your application
- Minimal operating costs
- Maximum reliability and safety
- Minimum dead weight
- Long service life

## CONTROL INNOVATION

TRUNINGER combines over 60 years of experience in the manufacture of magnet lifting systems with the advantages offered by state-of-the-art microelectronics. The modular structure of the TRUNINGER SmartPick™ magnet controller features extremely high safety and reliability thanks to redundant dual processor architecture. Sensors automatically monitor magnet current and temperature. Power transistors control current quickly and precisely. Microprocessors control and monitor all of the system functions. An integrated black box recorder registers every event and makes it easier to troubleshoot faults. SmartPick™ opens up a multitude of possibilities which you can use to your advantage.



# N MAGNET LIFTING TECHNOLOGY

MORE THAN 1000  
CUSTOMERS WORLD-WIDE  
PUT THEIR TRUST IN US



① Mechanical workshop showing final assembly area



③ Electrical workshop, control panel assembly

② Modern processing machine milling a coil magnet

# MATERIAL TRANSFER UNDER CONTROL

## THE RIGHT GRIP...

Workers, robots and cranes move goods from one place to another. To do so they need gripping tools to transfer the movements and power of their arms, joints, lifting gear and crabs to the material in question. Without the right approach you can not hope to get a grip on the situation!

## ...HAS TO BE LEARNT!

Anyone who watches a child eating with a fork and spoon will realise soon how much know-how and experience goes into the gripping movements we make repeatedly day after day. It takes years for a child to learn how to pick up and hold an egg, a ball or a pen quickly and securely. At the same time each item's specific characteristics have to be taken into account.

## ROBOTS

Gripping is the central function of every material handling operation. This is particularly true when we consider the use of industrial robots. No matter what has to be moved in a production process, be it bars of chocolate, hamburgers, compact discs or telephone receivers, the same type of robots are always used. Their gripping tools, on the other hand, are adapted to each specific job. While robots are more or less standard products, grippers are usually developed and built on an application-specific basis. The art is to build economical grippers with a secure and reliable grip on as wide a range of products as possible.

## CRANES AND MAGNET SYSTEMS

What is good for robots cannot be bad for cranes. Here, too, the gripper has to



suit the job. For the most efficient handling of steel, for example, the best solutions are electromagnetic grippers. Among today's lifting options, electromagnetic lifting equipment is proving more and more often to be the No. 1 choice.

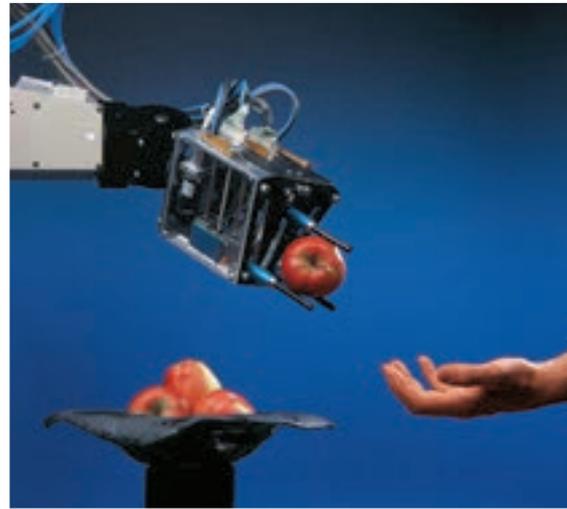
There is no such thing as a universal gripper in this case either. Billets, slabs, plates, coils, beams, pipes and scrap impose differing demands not only on the magnets themselves but also on their suspensions, positioning and associated electrical equipment. Meticulous design of the gripper and careful focus on the material's specific characteristics increase the safety, speed and efficiency of the entire material handling operation.

## THE CRANE OF YOUR CHOICE

As a magnet systems specialist we equip existing as well as new cranes of any brand. Whether you are a crane manufacturer or an end user, we are your partners for magnet lifting systems.



YOU HAVE TO GRASP  
HOW TO GRIP



① Intelligent gripper, Institute for Robotics, ETHZ



② Meticulously designed grippers increase safety and efficiency



③ Flexible grippers improve productivity

# BEAM STORAGE IN MINIMUM SPACE

Magnet systems for beam warehouses are particularly narrow to enable them to be used between tightly stacked material piles. Gaps between stacks or aisles are no longer necessary.

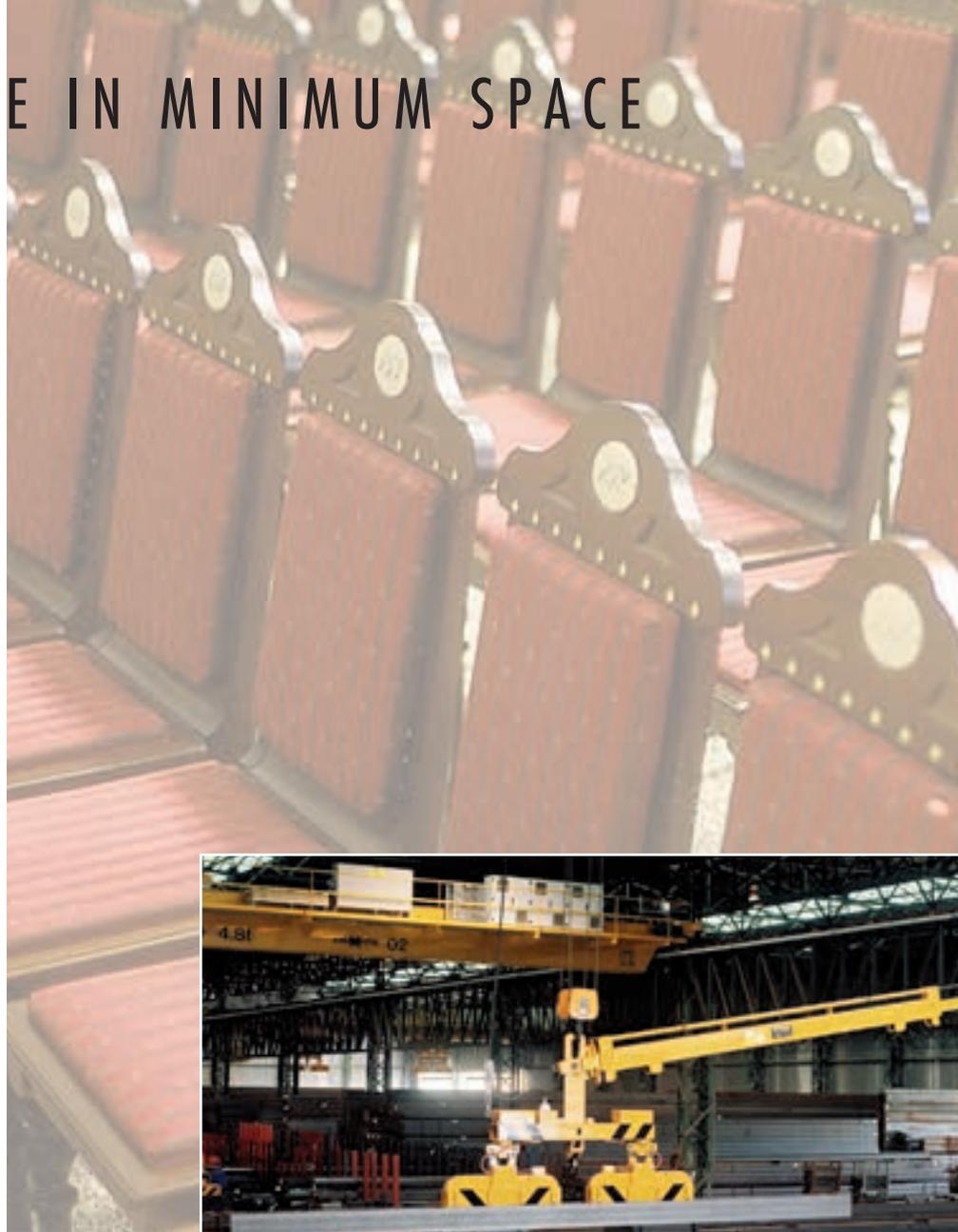
Magnet systems also make it unnecessary to separate material layers. On level, even bases, large sections can be stacked one on top of the other without uprights placed in between. It is also no longer necessary to limit stacks to a man's height when using a magnet system. All this adds up to a higher packing density for your warehouse. The relatively low investment costs for a magnet system are usually offset by the considerable savings in the amount of warehouse space required. In this way a magnet system can start paying for itself even before it begins to work.

## TWO HOOKS ARE BETTER THAN ONE

It is not possible to keep beams stable when lifted with a single crane hook. A single hook solution means that the material or the magnet has to be guided by someone at floor level, a labour-intensive, time-consuming and dangerous task. It is only when using two hooks that the magnets remain horizontally and vertically aligned with the material being lifted. Two hooks are thus a pre-requisite for safe and efficient one-man operation!

## FIXED SPREADER BEAM WITH TRAVELLING MAGNETS

For a single hoist with twin hooks of fixed distance it is possible to use a fixed spreader beam with travelling magnets. Solutions such as an active telescope (figure ①) or a fixed spreader beam with motorised travelling magnets (figure ②)



③ Magnet system with passive telescope

are frequently used. The active telescope is characterised by a short beam length.

## PASSIVE TELESCOPE

A simple and low-cost solution for cranes with two independent trolleys is to use two magnet groups that are suspended directly from the crane hooks and kept in line by a passive telescope. Single beams from 1 to 25 m long can be handled by this arrangement (figure ③).

## FOUR HOOKS ARE IDEAL

Two hoists, each equipped with twin hooks, offer a particularly lightweight and flexible solution for long beams. The distance between the two independently

controllable magnet groups can thus be adapted to different beam lengths. Short length pieces can be lifted by just one group. In this case the two groups are not connected by a spreader beam. An extremely light weight magnet gripper design with a good lifting capacity/dead weight ratio is possible thanks to two short and compact spreader beams (figure ④).

A V-rope tensioning mechanism eliminates sway (figure ⑤).



SPACE SAVINGS REDUCE  
BUILDING INVESTMENT COSTS



① Active telescope for beam bundle handling



④ Flexible and light thanks to two independent magnet groups



② Spreader beam with motorised travelling magnets



⑤ V-rope tensioning mechanism eliminates sway

# SELECTING AND MOVING SHEETS AND PLATES

Correctly designed magnets direct lifting force in a controlled manner over a broad area down into the material. Carrying sheets using magnets prevents quality degradation caused by pressure marks or damaged edges, an effect frequently observed when using chains and mechanical grippers. It also enables the material to be handled efficiently and flexibly in any volume by remote control from a safe distance.

## **FINELY CONTROLLED QUANTITIES**

With fine control of the lifting force on TRUNINGER magnet systems it is possible to separate even thin sheets quickly and precisely. In this way you can pick the exact number of sheets required or distribute a stack of sheets over several storage locations. Steel distributors, for example, can use the system in conjunction with a crane balance for direct order picking.

## **ONE AT A TIME OR IN PACKS**

Of course, the same system can be used to transport sheet packs as well as single sheets. Far larger quantities can be handled per cycle in packs than in loose stacks. Some of the sheets in thick packs are carried by the strapping.

## **ADJUSTMENT OPTIONS ON THE SPREADER BEAM**

Motor driven adjustment of the magnet spacing allows correct positioning of the magnets for the various length of plates being handled (figure ②). A load slewing device enables the pack to be aligned in the lorry or storage area as required.



## **MULTI-PURPOSE SYSTEM FOR PLATES AND BARS**

A particularly light weight and flexible solution is offered by two magnet groups, each on an independent hoist with a two-rope pulley (see page 6: "Four hooks are ideal"). A slewing crab on the crane – as opposed to a slewing device on the spreader beam – reduces weight further still.

Such a system can transport plates of 1x2m to 3x1.2m and standard thickness. It is possible to vary not only the distance between magnet groups but also the spacing between individual magnets. Slewing the magnets through 90° allows you to handle tube bundles as well as merchant bar bundles with the same system.

## **VERTICAL PLATE STORAGE**

A very interesting development from TRUNINGER is the magnet lifting equipment for vertically stored plates. For highly diversified warehouses it can be a space-saving alternative to horizontal plate storage. With the same system it is possible to pick up plates from either the horizontal or vertical position and to set them down again as required.

# WITHOUT DAMAGE

WE HANDLE YOUR MATERIAL  
WITH VELVET GLOVES



② Slewing plates during transport



③ Light weight multi-purpose system for plates, bars and tubes



① Selective picking of plates



④ Using just one magnet group for a short load

## SAFETY

Safety is not only a question of backup batteries and controls. Load deflection is particularly severe on sheets and thin plates. For this reason the magnet system has to be equipped with a sufficient number of magnets correctly distributed to prevent unacceptable degrees of deflection (see page 22: 'Load distribution" and 'Load deflection").



⑤ Vertical storage of plates greatly increases storage density

# A SEA OF COILS CAUSES A STIR

## QUALITY

Automobile manufacturers are just one of many industries which impose high standards on coil quality. They will not tolerate pressure marks, damaged edges or residual magnetism. Production requires suppliers to deliver coils in time windows of less than one hour.

TRUNINGER has produced special magnets for coils weighing from 5 up to 50 tons. With these magnets it is possible to handle a wide range of coil dimensions (diameter, width and sheet thickness).

An automotive supplier uses just one of these magnets to handle 2000 tons of steel per day. The magnet system enables the supplier to reduce his warehouse area requirement by 30%. Quality problems caused by damage from mechanical grippers (coil clamps or tongs) are eliminated. Demagnetisation programs, which run automatically when the magnets are switched off, reduce residual magnetism to practically zero.

## SPEED

When a large magnet is switched on or off it takes a certain time for the required magnetic field to build up or disappear. TRUNINGER's latest generation of fully electronic controllers: "SmartPick™", shortens considerably power-on and demagnetisation times, thanks to impulse excitation of the magnets. In this way cycle times on large coil magnets are significantly reduced.

## OPTIMISED DESIGN

For each lifting application finite element analysis is applied to the different load cases to produce models for optimised magnet design. This results in significant savings in weight and power consumption (see page 23).



① Magnet lifting a coil in line with wind



③ Considerable space saving thanks to compact storage

LIGHT WORK OF LIFTING  
HEAVY COILS



ing axis

② Plenty of steel, little space and high throughput volumes with one-man operation



④ Low overall magnet height allows total utilisation of stacking height



⑤ No pressure marks or coil edge damage when using a magnet

# TIME SAVING WHEN HANDLING BARS AND TUB

## HANDLE MORE IN LESS SPACE

With a TRUNINGER magnet system you will save not only space but also improve your productivity. Magnet grippers, when used properly, allow the load to be approached, picked, lifted and transported from the storage location, quickly and reliably. By using a TRUNINGER magnet system you can also increase your warehouse storage density, resulting in shorter travelling distances and therefore significant time savings.

## STACKING CRADLES

Cradle carriers integrated into the magnet spreader beam enable quick loading of bundles into the stacking cradles. This also allows simple mechanical rearrangement of the cradle stacks as well as precise order picking of individual bars – and all with the same system. In this way even a highly diversified warehouse can be managed very efficiently. The cradle carrier lugs, located between the two magnets of each group (figure ④), can be swivelled out electrically. Two independent crane hoists with a V-rope tensioning mechanism ensure swing-free operation and flexibility (figure ③).

## ONE OR TWO BUNDLE LIFTING

Either one or two bundles can be lifted through lateral adjustment of the magnets (figure ⑥). In the case of long and heavy bundles, only one bundle is handled at a time. Of course the same system can also be used to transport loose tubes or – with reduced lifting force – for order picking.



② Variable picking of various layer widths

## RETRACTABLE POLE ANCHOR

With a retractable pole anchor arrangement the pole surface area can adapt automatically to the load to be lifted. With the retractable anchor extended, individual bars or small quantities can be picked easily, while the large pole surfaces are available for larger material or bundles (figure ⑤).

## LOOSE PIPES

Pipes up to approximately one meter diameter can be handled using magnets. With specially designed narrow magnets it is possible to transport single pipes or complete layers with the same system. This is done by slewing the magnets through 90°.



⑤ Retractable pole anchor, adjustable for packs or single items



① Passive telescope arrangement for single pipe handling



③ Magnetic order picking from cradles



④ Mechanical stacking of the cradles



⑤ Flexible magnetic bundle transport: single or in pairs



⑦ Pipes transported as layers or singles

# REINFORCING STEEL AND SLABS HANDLED BY

Using a TRUNINGER magnet system, even storage of very long rebar bundles up to 24m length can be managed by just one person. The warehouse staff benefit from high productivity as well as a safe and pleasant workplace.

- No need to climb onto piles of rebars
- No need for people in the material handling area
- No risk of injury from handling sharp-edged materials
- Easy operation with the press of a button

## REBAR BUNDLES FROM 6-24 METERS

TRUNINGER builds special magnet systems for the handling of all standard categories of reinforcing steel. Light weight construction based on honeycomb beams reduces the dead weight of long spreaders. The magnet suspension bars incorporate a long travel path which ensures that the first magnets to make contact are held in position until all of the magnets are resting on the load. This compensates for any unevenness in the rebar bundles or in the piles.

## DOUBLE BUNDLE HANDLING

Specially shaped pole shoes enable two rebar bundles to be carried in one lift, significantly increasing the speed of handling. For even greater handling capacity the magnets are positioned crosswise to the spreader beam.

## COILS OF REINFORCING STEEL

Tightly wound and firmly strapped coils of reinforcing steel can be handled magnetically in either the horizontal or vertical axis.



## SPECIAL APPLICATIONS

Thanks to our vast application-related experience as a manufacturer of magnet systems we are also able to offer solutions for unusual jobs.

If a magnet system has to be operated above a manned working area, the load attached to the magnets can be secured mechanically using a safety gripper as shown in figure ⑥.

The magnet in figure ⑦ was specially developed for the handling and turning of slabs. The 48t, 12m long hot slabs are safely transported thanks to the special pole geometry and the pivoting magnet suspension.



⑥ Load carried magnetically and secured mechanically

# ONE MAN OPERATION

A PRESS OF A BUTTON IS ALL IT TAKES



① High stock density using a magnet system



② Transporting coils of reinforcing steel with winding axis horizontal



③ Lifting of double bundles



④ Transporting multiple bundles



⑤ Lifting a rebar coil with winding axis vertical



⑦ Special magnet turning a hot slab

# SCRAP MAGNETS: ROBUST AND EFFECTIVE

## LOW DENSITY SCRAP

The latest generation of TRUNINGER scrap magnets has been designed specifically for low density scrap.

The 'Mill Master' combines numerous advantages for rugged applications in steel mills and scrap yards.

The 'Lite Master' is aimed at rugged applications in scrap yards or on mobile excavators or trucks. For mobile applications the controller is supplied via a hydraulic pump and a generator. Thanks to the use of high-quality components, the magnet system requires little maintenance.

## IMPACT RESISTANT MAGNETS

- The magnet casing is made out of welded steel. This makes the magnet totally abrasion and impact resistant, in contrast to the usual cast-iron casing units on the market.
- The magnetic conductivity of steel is also around 30% better than that of cast-iron. This makes the magnets extremely cost-effective and efficient.
- A base plate made of manganese steel protects the coils and prevents any foreign bodies from getting into the coil cavity. The base plate is stiffened with reinforcing bars. This guarantees high rigidity even in extremely rugged conditions.
- Non-magnetic fins are welded onto the sides of the magnet casing. This provides additional protection for the casing and reduces the magnet's lateral attraction.



- The coils are cast in impact-absorbent insulating compound. This casting compound is moisture-repellent and has excellent heat dissipation properties.

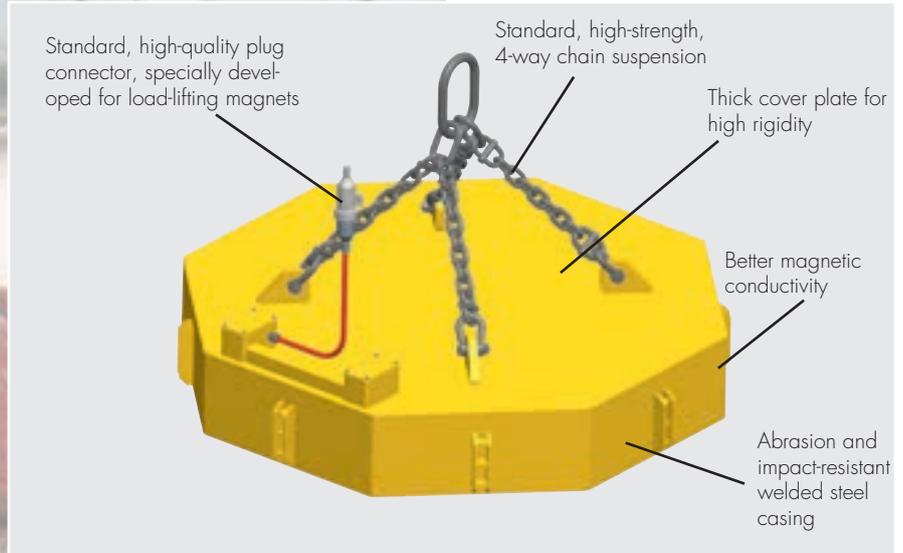
## ADVANTAGES

- Deeply penetrating magnetic field for maximum lifting power
- Easy operation of the system via cabin or remote control
- Optional back-up battery for emergency power supply
- Redundant magnet power feed possible for maximum safety using the "Mill Master" scrap magnet

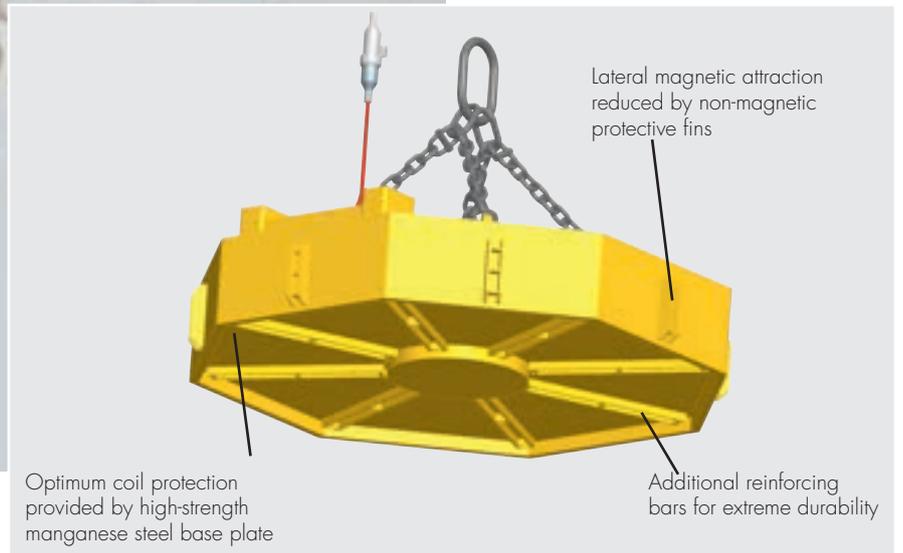
## YOUR BENEFITS

- Higher availability
- Better handling volume
- Safer and more reliable magnetic handling of scrap

## FAIL-SAFE AND RELIABLE



① TRUNINGER-scrap magnet: robust and resistant



② Sophisticated technology for maximum service life



③ Deeply penetrating magnetic field



④ Low density scrap: efficient and safely transported

# SMARTPICK™ MAGNET CONTROLLER

## MODULARITY

TRUNINGER's modular magnet controller can be used to optimum effect for all magnet applications.

- The SmartPick module is the controller's main processor. It also communicates with the crane and includes all of the monitoring and diagnostic functions.
- The SafePick module operates as a parallel processor, constantly monitoring the SmartPick functions and all magnet currents. It also charges and monitors the back-up battery. If any fault is detected, SafePick takes over control of the magnet system.
- The PowerPick module supplies the electrical power to the magnets and ensures powerful and fast magnetisation, as well as complete demagnetisation of the material.

## SAFETY

The SmartPick module's safety concept incorporates many functions that run in the background.

Magnets controlled by SmartPick always pick the load initially with reduced lifting power. As soon as the load is lifted, SmartPick switches automatically to full load, adding an extra safety factor. Every time the magnets are switched on, the back-up battery function is tested and if faulty the power-on process is aborted.

The battery backup feature provides an independent power supply, which safeguards a suspended load in the event of a power failure or a defect in the control system. Any mains failure is detected immediately, even if only one phase is affected.

For maximum safety and reliability the entire magnet system, from the magnet controller via the power supply, right through



to the magnet coils can be designed with built-in redundancy.

Magnet temperatures are monitored continuously to prevent any overheating of the magnets. Thanks to its dual processor architecture, SmartPick ensures the highest possible levels of safety.

## QUALITY

Strict manufacturing standards applied by qualified professionals, combined with the use of high-grade components, ensure optimum levels of quality. However, SmartPick also guarantees the quality of the material handled. During the power-off phase of the magnets, the "Downcycle Degauss System" almost completely eliminates any residual magnetism (<2mT). With this fea-

ture, metal chips adhering to the material are a thing of the past.

## TIME

SmartPick offers a significant reduction in material handling times. Through impulse excitation of the magnets, the time needed to build up and clear the magnetic field is considerably reduced.

Lifting force is set by selecting any of 10 partial load levels. This allows lifting of small quantities of material easily and rapidly. The CFR (Compensated Field Reduction) system enables a stack of plates to be separated efficiently and reliably, right down to the last plate, even in the case of very thin plates.

HIGHEST SAFETY AND  
RELIABILITY



① Reliability and intelligence in compact form

## EASE OF USE

A full battery capacity test can be run automatically by pressing a single button on the operator console.

The magnet controller status can be easily monitored from the factory floor level using a laptop and SmartPick's built-in Bluetooth wireless interface.

An integrated black box recorder makes it easier to troubleshoot faults and analyse statistics. Remote maintenance and fault analysis via a mobile phone guarantee an extremely high level of availability.

Thanks to its modular design the SmartPick system is ideally suited to all magnet applications.



② The fully electronic SmartPick™ control system

# INFOPICK™ DISPLAY MODULE

## INNOVATIVE DISPLAY TECHNOLOGY

TRUNINGER magnet systems now boast cutting edge display technology: in the form of the InfoPick display module. In contrast with traditional coloured lamp displays which are still widely used, InfoPick provides much more information and reacts instantly to magnet system operator commands. InfoPick informs both crane driver and staff on the ground of the magnet system's exact operational status. This makes operating the system easier, especially when using wireless remote control.

## INFOPICK™ - ADVANTAGES

InfoPick includes the following standard features:

- Robust, maintenance-free design, thanks to state-of-the-art Power LED technology
- Graphic display for easily understood visualisation of every possible operating status (including error codes)
- When combined with SafePick™ remains fully functional even if mains power is lost
- Legible from a distance of up to 30 metres

## SAFETY AND STATUS INFORMATION FOR THE OPERATOR'S BENEFIT

The graphics technology developed by TRUNINGER displays all normal operational states, thus making operation of the magnet system as easy and efficient as possible. In addition, the following fault conditions are also displayed:

- Warning alarms
- Danger alarms
- System locks
- Diagnostic information



Operators and maintenance staff thus have all the information they need without having to climb up onto the crane and read diagnostic information from the magnet controller itself.

The display module consists of six indicator elements (see figure ③):

- The red indicator on the left displays fault conditions
- The green indicator (second from left) displays the overall magnet state
- The 4 yellow indicator elements on the right, display the state of the individual magnet groups

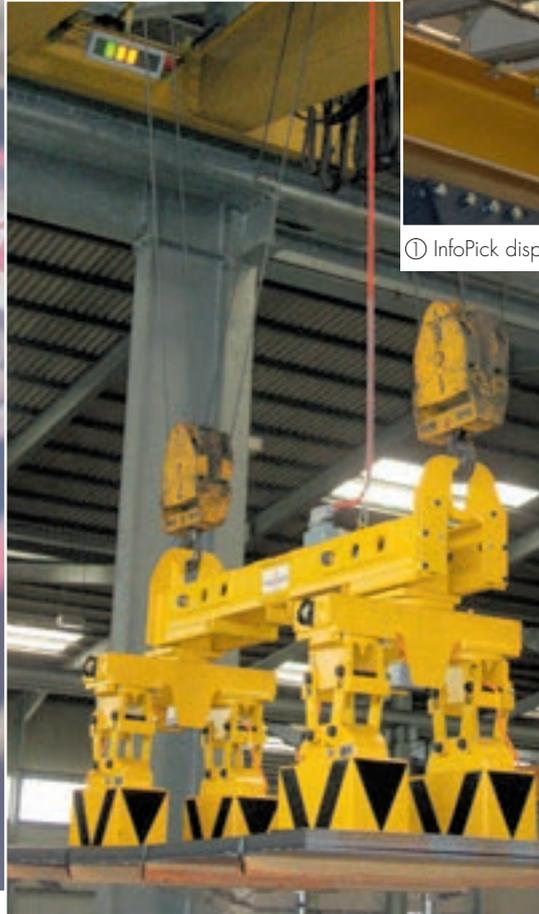
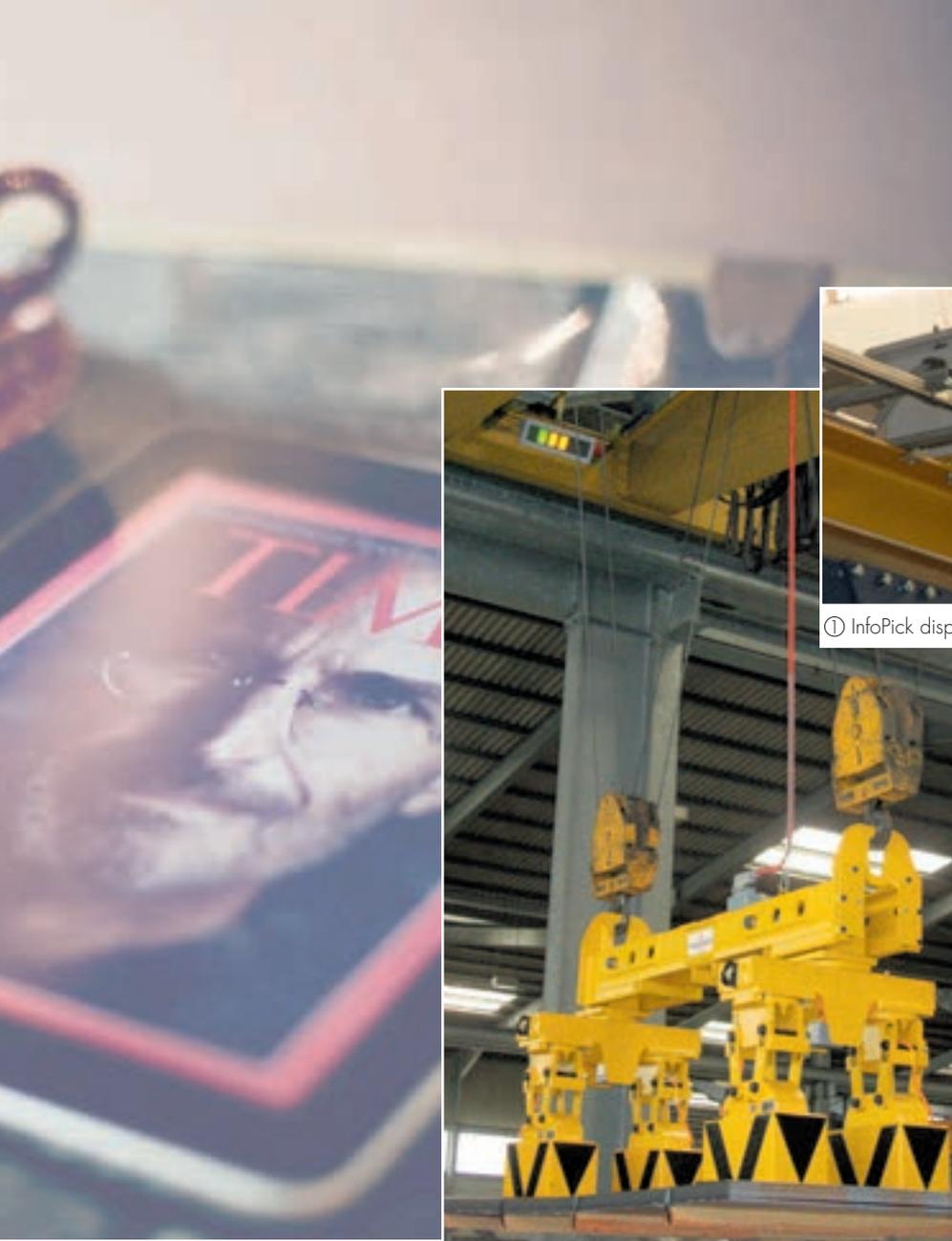
A wide range of information is provided for the operator. Here are a few selected examples:

### 1. Information

Easily understood graphics and simple status information reduce the risk of operator error, increase efficiency and improve safety (see figure ④).

### 2. Warning and danger alarms

InfoPick makes it possible to differentiate between warning and danger alarms. Warning alarms make the operator aware at an early stage of any abnormal conditions (see figure ⑤). The danger symbol together with an audible alarm indicates a safety-related fault.



① InfoPick display module mounted on a crane

② Excellent legibility at a distance of up to 30 metres



③ InfoPick with its 6 coloured indicator elements



④ Magnet groups 1 and 2 pre-selected



⑤ InfoPick indicates a warning alarm



⑥ System locked; no mains on magnet group 2



⑦ InfoPick displays an error code

### 3. System locks

When any safety-related faults exist, system locks prevent the magnets from being switched on. The system locks are indicated by a red key and explained by further symbols (see figure ⑥).

### 4. Diagnostic information

InfoPick makes it possible to access diagnostic information via wireless remote control; this is identified by a red spanner symbol. The information itself is presented as a code which can be looked up in a separate code list document (see figure ⑦).

### RADIO REMOTE CONTROL

Thanks to an intelligent interface, the magnet controller can be configured to display all InfoPick information directly on the radio remote control unit.



⑧ InfoPick display on the radio remote control

# ELECTROMAGNETS INCREASE SAFETY

TRUNINGER electromagnets have been used in thousands of applications for over 60 years. Their safety is verifiable, technically and statistically. The following aspects are important:

## POWER SUPPLY

Clearly, the supply of electrical power to the magnets has to be guaranteed at all times. This guarantee is provided by the equipment described on page 18 and 19. Redundancy of the electrical power supply is generally regarded as a high priority, but the mechanical safety of magnet systems is equally important.

## LOAD DISTRIBUTION

One of the most important safety factors is load distribution. Simply having a large number of powerful magnets is not sufficient to guarantee adequate lifting force and safe transport. Our spreader beam construction and magnet suspension mechanisms are designed in such a way that the payload is evenly spread across all of the magnets.

## LOAD DEFLECTION

A magnet system has to have a sufficient number of magnets distributed in such a way that the deflection of the load does not exceed acceptable limits.

TRUNINGER uses a special computer-based tool to calculate the material's bending line. The TRUNINGER magnet suspension concept takes into account the load deflection and allows the magnets to follow the bending of the load. The risk of the load peeling off the magnets is eliminated.



## ELECTROMAGNET OR PERMANENT MAGNET

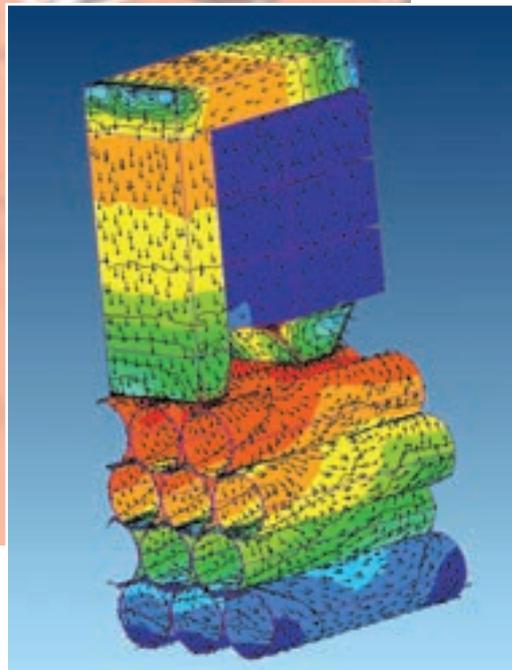
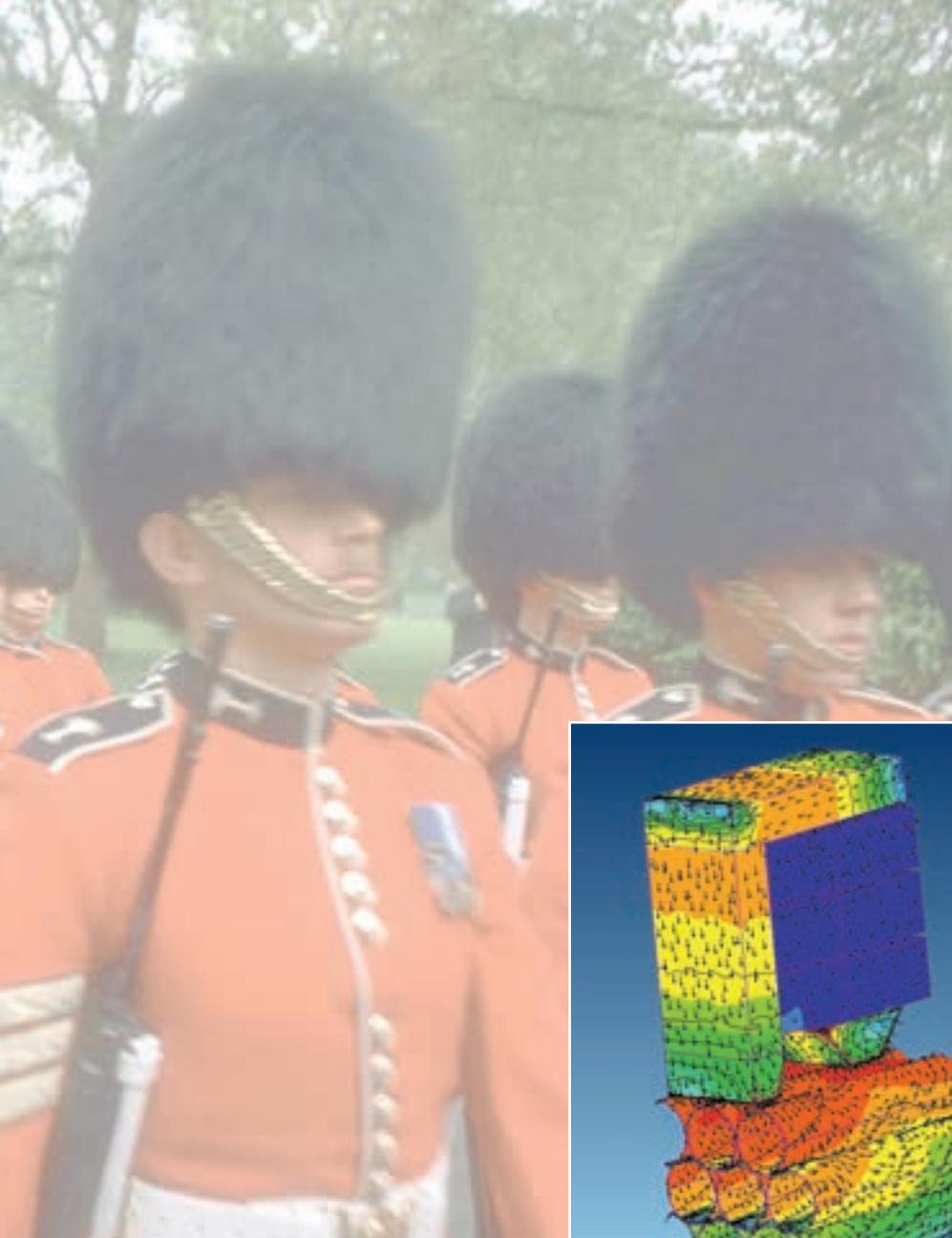
In practice, loads never lie flush against the magnet. Irregular geometries, rough surfaces, load deflection or packing material create an air gap between the magnet and the lifted load. This air gap is effectively overcome by correctly designed electro magnets. Permanent magnets, on the other hand, have a far less penetrating magnetic field. They are better suited, therefore, for loads which lie relatively flush against the magnet.

When packs or bundles are handled, only a part of the load is lifted magnetically while the rest is carried mechanically, e.g. by using straps. Here, too, a deep-penetrating magnetic field means increased safety because the greater the

depth of penetration the lower the mechanical stress and strain imposed on the straps. Figure ① shows the deep-penetrating flux of a magnetic field produced by a magnet with a corresponding load. The flux density and hence the magnet's force can be calculated with the help of the Finite Element method.

## PASSIVE SAFETY

Operators of magnet systems are generally more attentive than users of mechanical grippers. Stepping under a magnetically suspended load is always avoided. Awareness of danger has a positive effect on safety. The golden rule 'Never stand under suspended loads' is actually followed.



### **A SAFER WORKPLACE**

Proper use of magnet systems dispenses with many hazardous activities: No working between or climbing over stacks of material, no working near heavy moving loads, and no handling of sharp-edged material. Usually it is possible for one crane driver to perform the handling operations alone, without anyone else having to work in the handling area. It is also possible for crane operators to work in heated or air-conditioned cabins. All these safety aspects add up to excellent reasons for using magnet systems.

① FE analysis of flux densities makes safety more pre-definable



## CUSTOMER SERVICE

### EXPERTISE

When you buy a magnet system are you also thinking of the future? Reliable and periodic maintenance offers your magnet system the longest possible service life with the highest levels of availability and safety. Here, TRUNINGER supports you with a comprehensive range of services and a highly qualified team of service technicians. Detailed documentation of all TRUNINGER customer services is available on request.

### OUR SERVICES

At a glance:

- Installation
- Commissioning
- Training
- Maintenance
- Inspection
- Troubleshooting and repair
- Spare parts
- Retro-fitting and upgrade