Connect and protect
Coupler and front end systems
Systematic safety

Quality and safety – these are the attributes associated with Voith for more than a century: In 1903, Karl Scharfenberg put his first vision of an automatic train coupler into practice.

Continuous technical refinements and updated technology have made the “Schaku” one of the most prominent railway coupler systems all over the world. More than 500,000 couplers in use to date, from light rail vehicles to high speed trains, show the high degree of trust the customers have in Scharfenberg products.

Today, Voith system solutions cover the whole range of energy absorbing components for train front ends, including kinematics and control electronics. Be it light rail, monorail or metro vehicles, regional transport or high speed trains, Voith offers the best solution for every application. In close cooperation with our customers, we adapt our products to any given purpose and situation, always keeping an eye on the safety of passengers and train.
Major milestones on the Scharfenberg track record

1903 Development of the first automatic Schaku by Karl Scharfenberg; German Reichspatent
1921 Foundation of the incorporated company "Scharfenberg Aktiengesellschaft" in Berlin
1925 Introduction of the “Schaku” at the rapid transit railway “Berliner S-Bahn” and the “Hamburger Hochbahn”
1957 The “Scharfenberg GmbH” becomes part of the Salzgitter group of companies
1998 Foundation of the “Voith Turbo Scharfenberg GmbH & Co. KG”
2002 System supplier for complete train front ends, including complete front end systems; joints; system for automatically coupling AAR type couplers including electric head and air pipe connections. The type 10 Scharfenberg coupler is declared standard coupler for high speed trains
2006 Modular coupler head One4; energy absorbing joints; modular adapter coupler
2008 New data transmission concepts; start of the GFRP production on the Salzgitter site
2010 Fibre composite vehicle head Galea as new energy absorption concept; CFRP adapter coupler; new crash buffers
2012 Expansion of the Galea concept as test bed for innovative technologies
2014 GFRP energy absorber; SA3 coupler featuring automatic air pipe connections, automatic uncouple device and energy absorbing components
2018 CargoFlex freight couplers; first order for SBB going into series production

Modular concept of modern Schakus

Front end systems and energy absorption concepts
Safety comes first
Our products at a glance
Automatic front couplers

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Automatic Scharfenberg coupler

Automatic Scharfenberg couplers are mainly found at the train ends. Allowing automatic and safe coupling/uncoupling, they permit a flexible train set configuration on the track. Different coupler types are available, depending on the application and required forces.
The type 10 Scharfenberg coupler excels in strength and rigidity and possesses a particularly wide horizontal and vertical gathering range. In 2002, it was declared standard coupler for high speed applications and is now an inherent part of the TSI (Technical Specification for Interoperability).

This coupler can be found in nearly all state railways and a multitude of high speed trains world-wide, e.g. in Germany (ICE), France (TGV), Spain (AVE trains) or China (CRH series).

**Technical characteristics**

- **Strength:**
  - Compression: 1 500 kN (up to 2 000 kN)
  - Tension: 1 000 kN
- **Compliant with the UIC standard for standard gauge motor train units**
- **Two-position coupler lock**

**Type 10 automatic Scharfenberg coupler**

with top-mounted electric head, buffer, pneumatic centring device and support
Popular high-performer for metro and electric vehicles

Type 35

The type 35 coupler is mainly used for metro vehicles and it is also suitable for electric vehicles. It can be found e.g. in Shanghai, Singapore, Salt Lake City and Edmonton (Canada).

Technical characteristics

- Strength:
  - Compression: up to 1 250 kN
  - Tension: up to 850 kN
- Guiding horn for increased gathering range
- Two-position coupler lock

Type 35 automatic Scharfenberg coupler

with anti-climbing feature
Versatile for light rail and monorail vehicles

Type 330

The type 330 is mainly found in light rail and light metro vehicles. Despite its small dimensions it offers remarkable strength and the possibility to use bottom-mounted electric heads. It features a wide gathering range, even without a guiding horn. Designed as foldable or retractable coupler, it can be hidden behind closed front hatches. The extremely narrow dimensions of the tramtrain Avanto in Paris even called for a coupler that folds twice along its longitudinal axis.

Technical characteristics

- Strength:
  - Compression: 800 kN
  - Tension: 600 kN
- Particularly wide gathering range without guiding horn

Type 330 automatic Scharfenberg coupler

with bottom-mounted electric head, deformation tube, rubber cushion drawgear and centring device
Light-weight design for urban railways
Type 430 and Type 530

Their compact and lightweight design make the types 430 and 530 ideal couplers for low-floor urban railways, monorails and people movers. Designed as foldable couplers, they can be combined with front hatches. Type 430 couplers can be found in Berlin (Berliner Straßenbahn), Kuala Lumpur (KL Rapid) or the monorails of Sao Paulo and King Abdullah Financial District. The type 530 was mainly developed for the Eastern German market and is compatible to the TGL couplers that used to be very common there.

Technical characteristics
- Strength:
  Compression/tension: 300 kN
- Small dimensions, low weight
- Compact design without guiding horn

Type 430 automatic Scharfenberg coupler

with integrated electric heads and rubber cushion drawgear with support
The tough ones

Automatic shunting couplers

Couplers for industrial applications need to be extremely robust and wear resistant. Automatic shunting couplers are especially suited for this job. In shunting operations or automated marshalling of trains, even with drawhooks, these couplers make the industrial working environment considerably safer.

Type 55 automatic shunting coupler
This coupler – developed in compliance with the UIC directive for drawhooks – provides safety and rationalisation in shunting operations. The type 55 coupler allows automatic coupling and uncoupling with a drawhook, no longer requiring any shunting staff. The robust and service friendly coupler significantly reduces wear and maintenance – perfect for rough operating conditions.

Type 10 automatic shunting coupler
Together with the development of our new automatic freight coupler based on the type 10 Schaku (see also CargoFlex Type Scharfenberg, p. 34 et seq.), Voith has designed a type 10 shunting coupler. The coupler head is connected to the swivelling mechanism through muff couplings which can be easily removed. This allows connection also with other types of coupler heads.
For shunting or towing
Adapter couplers

Adapter couplers are used whenever different coupler types need to be connected or the coupling heights are not compatible. During standard train operation this should not occur, but it is common practice in shunting or towing operations.

Modular adapter coupler

Traditional adapter couplers were mostly very special in design and layout, as they had to be adapted to one particular combination of coupler heads as well as a particular difference in coupling height.

This modular approach separates the individual parts, namely the two coupler heads and the intermediate adapter piece bridging the offset in height. Should no adapter piece be required, the coupler heads can just as well be directly connected. This way, adapter couplers of any combination can be individually and flexibly assembled.

What is more, the individual components are mounted on the train one after the other, so that only a fraction of the weight needs to be carried at a time.
More safety for passenger trains
Also for couplers of other makes

More than 100 years of experience have made us experts in energy absorption and couplers, including those of other makes. Depending on customer requirements, the diverse coupler heads are adapted and combined with proven Scharfenberg energy absorbing components. This way, every application gets its optimal solution.

AAR type coupler
AAR type couplers are in common use on railcars on the American market and suited for heavy loads. The mechanical connection between the couplers is established automatically, whereas the large coupler head play usually does not allow any pneumatic or electric connection. These, however, can be integrated into an additional support system. For further information, refer to page 16.

Tomlinson type coupler
Tomlinson couplers are also mainly used on the American market. Voith has developed a coupler combining their proven energy absorption systems with the Tomlinson coupling principle, allowing mechanical, electric and pneumatic connections to be established automatically.

AAR coupler

Tomlinson coupler
**Wedgelock type coupler**

The Wedgelock principle can be mainly found on British trains and also allows automatic coupling. Here, the coupler lock members are held in place by pneumatically operated wedges.

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**GF (Fischer) type coupler**

The GF type automatic coupler is widespread in Belgium and Switzerland. During automatic coupling, the cone and funnel shaped coupler heads interlock. The couplers can be provided with air pipe connections and electric heads.

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**SCRRA Metrolink with AAR coupler, USA**
AAR Crash Energy Management

On a global scale, rail-bound traffic faces an increase in safety and crash worthiness requirements. This also applies to AAR couplers, which originally were not equipped with energy absorption features of their own. Voith has developed technologies which optimally complement the high strength of the AAR coupler head with energy absorbing components. Today, a complete CEM (Crash Energy Management) system is available, complying with the latest FRA and PRIIA 305 safety regulations.

CEM-System
A Crash Energy Management system is composed of several matched energy absorbing components which are integrated in both the coupler and the carbody. The energy absorption works in a cascading way, compensating a high amount of energy in case of a crash and preventing an overriding of the cars.

 Constituent parts of the system
- “Push back” AAR coupler including support
- Anti-climber
- Lateral energy absorbers

Crash Energy Management system (SMART Project)

Working principle: coupler
A standard AAR coupler head was fitted with state-of-the-art energy absorption features, forming a “push back” coupler. The drawgear is mounting compatible to that of standard AAR couplers. In addition to the usual reversible energy absorption element it contains an irreversible part based on deformation tube technology. Should a crash occur, the coupler is pushed back into the drawgear, absorbing a great amount of energy on its way.

Push back coupler
Anti-climber
At a certain point during the push-back process, the anti-climber brackets interlock and thus prevent any vertical movement of the cars.

A separate support structure mounted sideways of the coupler ensures that the energy absorption takes place in a controlled manner. One part of this support carries the anti-climber, another supports the coupler, the latter pivoting out of the way as soon as the push-back process starts.

Lateral energy absorbers
Two lateral energy absorbers have been integrated into the carbody structure above the coupler level. At their front ends, they are connected through the anti-climber. This way, additional energy will be absorbed as the crash proceeds.
Intermediate connections
Semi-permanent coupler with anticlimbing feature

Semi-permanent couplers establish a safe and reliable permanent connection between intermediate cars. For the first time, a semi-permanent coupler for metro vehicles assumes anti-climbing function. Contrary to conventional systems, this coupler has a stabilising effect – without additional space requirements – before any climbing occurs.

Working principle
During a train crash or heavy impact, the longitudinal forces are converted into vertical swerving movements leading to an overriding of the cars once a critical momentum has been exceeded. This may cause the wagon to disconnect from its Jacobs bogie and damage softer structures.

The anti-climbing feature has been designed to prevent this overriding right from the start. To do so, it uses a simple, yet highly effective principle: The rear end of the coupler shank features a special geometry.

As soon as the reversible stroke of the coupler has been utilised, this geometry interlocks with the bearing bracket, building a counter-momentum that holds the wagons down.

Additional energy absorbing components of the semi-permanent coupler, e.g. deformation tubes or hydrostatic dampers, convert kinetic energy and help to keep the load on a controllable level.

Operating principle of the anticlimbing feature
Joints

Whenever trains are equipped with Jacobs bogies, joints are used as intermediate connections between the cars. They transmit driving forces between the car bodies, harmonise deflection angles and cushion impacts. Joints always have a connection with the Jacobs bogie.

Basic design
Basically, joints consist of two parts which are connected: joint fork and joint eye with spherical bearing. The spherical bearing allows cardanic movements and cushions impacts. Contrary to standard semi-permanent couplers, joints also compensate vertical loads. A torsion bar suspension mounted between the cars brings additional stability.

Energy absorption
Should additional energy absorption be needed (e.g. for heavy rail applications), joints may be fitted with energy absorbing elements. Our standard energy absorbing joint can be provided with deformation tubes on both ends – a proven technology which can be exactly matched with your requirements. A combination of both energy absorbing joints and non energy absorbing joints is also possible.

Optimum safety requires a perfect interaction of all the connecting components in a trainset. In case of an impact, the automatic couplers and further energy absorbing components of the train front end work hand in hand with the semi-permanent couplers and joints connecting the wagons. Operating in a cascading way, they function as one matched energy absorption system.
Low weight, high performance
GFRP energy absorber

Energy absorbers serve to transform the crash energy generated during an impact and thus allow the best possible protection for both passengers and rolling stock. GFRP energy absorbers are characterised by a low total weight and a constant energy absorption behaviour. This results in a high energy absorption capacity and a remarkable energy to weight ratio. With approximately 90 kg, their weight is far below that of standard steel absorbers.

Design
Key element of the light-weight energy absorber is a fibre composite tube functioning as crash element. Its rear end is integrated into a bearing connecting the absorber to the vehicle.

The latter also functions as guiding element and nozzle. The front end holds an anti-climber plate which, in case of a collision, prevents the vehicles from climbing. Both bearing and anti-climber are made of aluminium.

Function
In case of a collision, the fibre composite tube is pressed through the nozzle. This induces a controlled collapse of the laminate. The laminate defibrates on its way, which makes it easy to deflect downwards. This reduces the space required behind the absorber.

The load characteristics can be adapted to customer requirements, a multiple force level layout is possible, as well as increasing force level characteristics.
Benefits

+ Low total weight
+ Constant energy absorption behaviour
+ Above average weight-specific energy absorption capacity
+ Variable design and force layout
+ Multi-level force layout possible
+ Minimum corrosion through the use of aluminium and glasfibre reinforced plastics

Deflection of laminate after an impact

Range of stroke/force layout
Modularity: everything’s possible

Apart from reliability and safety aspects, flexibility and adaptability are the main requirements a train coupler has to comply with. The modular design of the Scharfenberg couplers and different coupler types allow us to provide the optimum coupler for each and every application and condition.
P. 28 Coupler shank / energy absorption systems

P. 30 Drawgear articulation
The coupler’s centrepiece

Coupler head

An automatic coupler’s key functionalities are resumed by the coupler head. The connection of two couplers – mechanically, pneumatically and electrically – can only be established through the coupler head and its locking mechanism.

The special design
The cone and funnel shape of the coupler face establishes a rigid and slack-free connection, reducing coupler play to a minimum. Coupler head extensions and a guiding horn assure the maximum possible gathering range. This way, automatic coupling is possible even under horizontal, vertical or angular offset, as for example in curves or on hilltops.

Coupler lock: safe and wear-resistant
The coupler lock is the functional heart of every automatic Schaku. It mainly consists of a pivot-mounted hooked plate, a coupling link and tension springs. During coupling, the coupling links and hooked plates of the two couplers interlock, forming an equilibrium of forces. A very simple, but efficient mechanism that excels in wear-resistance and safety, even under extreme conditions.
Modularity at peak level

One4

The One4 coupler head concept is a logical consequence of our modular way of thinking. Coupler head and coupler body were separated, the coupler body designed as a “one size fits it all” piece to be fitted with the individual, type specific front plate. This can be easily replaced and yet remains compatible to existing couplers.

Enjoy maintenance

The One4 concept offers a number of benefits, especially for repair and maintenance. When the coupler front plate is removed, the coupler lock components are easily accessible and can be replaced without any special tools. Furthermore, a standardised electric head operating gear and heating concept considerably save repair time and effort.

One4 coupler head

Standardised electric head operating gear support (for lateral electric heads)

One4 with removed front plate

Heating elements

completely modular concept with removable front plate and standardised electric head operating gear
Performance enhancement
1 GB fast Ethernet the easy way

So far performance enhancements for signal and data transmission through the coupler meant considerable effort and high expenses, particularly for retrofit solutions. Voith has developed Fast Ethernet based systems for different applications, covering both new vehicles and upgrades of trains already in operation. With or without electric head.

Electric head
Control and data signals can be transmitted through electric heads located at the coupler head. This allows optimal centring of the contacts and safe operation. Standardised electric head casing models and interfaces ensure easy installation and a perfect interaction of all components.

Depending on the number of contacts required and on the position of the electric head in relation to the mechanical head, different casing types are available: two for lateral, and one for top or bottom mounted electric heads. The contacts are easily replaceable, the hand plugs ensure an easy-to-fit connection to the carbody.

No more wear: Transceiver
Era transceiver® is a contact free system for high speed data transmission. Before transmission, incoming electric Ethernet signals will be transformed into optical signals, to be retransformed again after transmission. Galvanic isolation at the interface allows for a contact free system without any wear on the contacts. Optical signals are free from any electro-magnetic interference, potential shift and relative movements. The system is suitable for both new vehicles and the retrofit of trains already in operation.

The three standard electric head casing models
For new Vehicles: QuatConn and OctiConn

QuatConn is a solution comprising 4-pole pin and socket connectors which need to be integrated into an electric head. Once a contact block has been prepared to hold the contacts, these are mounted just like the standard ones. This makes the QuatConn a preferred solution for new vehicles. The OctiConn connectors work along the line of the QuatConn, but with eight connectors they offer a higher data transmission rate of 1 Gbit/s.

Without electric head: GigaPlug

The contact-free GigaPlug system is particularly resistant to soiling, keeping the failure rate – and related maintenance works – to a minimum.

It allows full duplex data transfer of 1 GB. Transmission is realised using near field radio coupler pins. These may be integrated into the electric head, but can just as well be mounted anywhere on the mechanical coupler head. This makes the GigaPlug particularly interesting for retrofit applications.

Cost-effective retrofit solution: TLM

The Train Line Modem (TLM) shares the contacts and lines of an already configured electric head using a special modulation technique. This way, control and operating signals as well as train information, video or CCTV data may be transmitted without any modification on the coupler. A cost-effective solution for trains already in operation.
Energy absorption for more safety

Coupler shank

The coupler shank plays a major role in train safety. Customised to fit its individual purpose and application, it integrates the coupler’s energy absorption features. Reversible energy absorbing components like dampers smoothen train operation and compensate minor impacts. Irreversible (destructive) energy absorbing components like deformation tubes, on the other hand, can cope with major impacts. All energy absorbing features in a train set are meticulously matched in a cascading way to ensure a most efficient interaction.

Deformation tube
The deformation tube converts impact load into deformation. Its energy absorption characteristics allow the deformation tube to compensate major impacts. However, it will be destroyed while doing so.

Downstream deformation tube
This version of a deformation tube is not part of the coupler shank, but mounted on the rear end of a bearing bracket with shear-off feature, i.e. behind the coupler’s mounting plate. Any impact exceeding the absorption capacity of the coupler will result in a shearing-off, pushing the coupler rearwards through the deformation tube at a constant force level.

Characteristics

• Defined release load without peak value
• Force stroke curve can be adapted to requirements
• Max. energy absorption (when designed for rectangular response curve)

Deformation tube (coupler shank)

Rear end of coupler

featuring downstream deformation tube
Integral gas-hydraulic damper
Developed in a co-operation with Leben & Co., the integral gas-hydraulic damper converts both compressive and tensile load in a regenerative way. Its rear end is designed as a spherical bearing, while the front end can be directly connected to the coupler head through a muff coupling.

Return stroke cushioning maximises comfort and safety. The integral design minimises the number of components and with it weight, size and expenses.

**Characteristics**
- Speed-related response curve
- Pre-loaded system in both directions, tension and compression
- Usually combined with spherical bearing
- Return stroke cushioning

Hydrostatic damper
The hydrostatic damper converts compressive load in a regenerative way.

**Characteristics**
- Straight proportional response curve
- Pre-loaded system in direction of compression
- Usually combined with rubber cushion drawgear
Rubber cushion drawgear with and without shear-off feature

The rubber cushion drawgear is a bearing bracket with integrated cushioning unit. Comprising either two or three rubber elements, the rubber cushion drawgear compensates both tensile and compressive loads and can be individually adapted to its purpose.

Additionally, it can feature a shear-off solution. If the maximum load is exceeded, the screws fixing the cushioning unit shear off, and the whole coupler pushes rearwards under the carbody in a controlled way.

Coupler meets carbody

Drawgear articulation

The drawgear articulation establishes the connection to the carbody. Elastic components allow cardanic coupler moves and cushion minor impacts. Depending on its purpose and application, the drawgear articulation can be fitted with additional energy absorbing components to compensate tensile and compressive loads.
Bearing bracket
The bearing bracket represents the most straight-forward type of drawgear articulation: It is combined with a coupler shank featuring a spherical bearing to allow cardanic coupler moves. Just like the rubber cushion drawgear, the bearing bracket can feature an internal shear-off solution as overload protection.

If further energy absorption is required, the bearing bracket can be fitted with a rear-mounted (downstream) deformation tube with defined response characteristics. Any impact exceeding the absorption capacity of the coupler will result in a shearing-off, pushing the coupler rearwards through the deformation tube at a constant force level.

Rubber ring / rubber cushion articulation
The rubber ring articulation is best suited for a narrow train front offering only small mounting dimensions. Being located on both sides – in front of and behind – the coupler mounting plate, the rubber rings cushion impacts in the direction of both compression and tension. They possess a softly rising force stroke curve and thus increase travelling comfort.

Based on the rubber ring principle, the rubber cushion articulation features rectangular rubber elements. They function as anti-rotation device, while at the same time allowing a high degree of cardanic moves. These drawgear articulations can also be designed as overload protection solutions.

Benefits
+ High cushioning effect through shear stress of the rubber elements
+ Low-wear and maintenance-friendly design
+ Small dimensions
+ Different sizes for various applications

Rubber cushion drawgear under tensile load

with downstream deformation tube, centring device and support
Freight couplers
Voith CargoFlex

Freight applications are characterised by high strength requirements and rough conditions. Bulk material in particular may cause tenacious soiling. What is needed here is a simple and robust coupler, one that requires hardly any maintenance even in rough environment.

A further aspect is energy absorption. Voith’s coupler design meets the latest and upcoming crash worthiness requirements (DIN EN 15227) even for locomotives.
Voith CargoFlex represents a modular system for automatic coupling in freight applications. Different coupler head types and energy absorption systems may be combined to fit regional and customer requirements. Our developments offer maintenance-friendly design. Along with that, we provide technical support, including strength calculations and energy absorption certificates.

**CargoFlex Type Scharfenberg for SBB Cargo**
In cooperation with SBB Cargo, Voith has developed a freight coupler that is based on the type 10 automatic Scharfenberg coupler. The CargoFlex Type Scharfenberg has been optimized for freight applications.

In its basic design, the coupler offers automatic coupling including the brake pipe. Manual uncoupling from the vehicle side increases coupling safety since the coupling personnel can stay clear from the Bernese rectangle, the dangerous space between the wagons. Due to the modular coupler design, a number of additional components can be retrofitted if and as required. A standard UIC coupling interface to the vehicle allows easy mounting.

What is more, this automatic coupler is no heavier than existing systems consisting of drawhook and side buffers.

**CargoFlex Type SA3 for Siemens Vectron**
For Siemens Vectron locomotives in Finland, we have developed an advanced, modular SA3 coupler fitted with a combined energy absorption solution (reversible and irreversible). The coupler head contains a particularly strong mixed coupler device allowing coupling with both SA3 coupler heads and drawhooks.

It also allows automatic uncoupling. For this, the coupler head was fitted with a heated uncouple cylinder.

1. **CargoFlex Type Scharfenberg prototype undergoing tests on a 5L wagon of SBB Cargo**
2. **Siemens Vectron locomotive with CargoFlex Type SA3**
Modular, flexible, future-oriented
The modular design of our components allows our different coupler heads for freight applications to be combined with a suitable energy absorption solution, as appropriate for the application. For this purpose, we have refined and enhanced the connection interfaces of common SA3 and AAR coupler heads to be compatible with those of our energy absorption solutions.

Especially for European freight applications, we have developed an automatic coupler head based on the type 10 automatic Scharfenberg coupler. This offers advanced options for automation.

Advanced, modular Voith SA3 coupler head

Energy absorption
Our energy absorption solutions cover the increased requirements of the latest safety standards. Depending on the requirements, different types of energy absorption, both reversible and irreversible, are available, plus combinations of these two.

Reversible energy absorption is covered by maintenance-free polymeric springs in different load dimensions. For irreversible energy absorption, different types of deformation tubes are provided.

Draft gear with flange connection

Draft gear with yoke

with reversible and irreversible energy absorption

with reversible energy absorption
Well prepared into the future

Voith CargoFlex Type Scharfenberg

Voith CargoFlex Type Scharfenberg is a modular system for European rail freight transport. Based on the type 10 Scharfenberg coupler the system facilitates fast and easy coupling of freight trains. The coupler is suited for UIC 530 installation space and for vehicles according to TSI standard. Due to energy absorption components and a stabilizing linkage safety can be increased and wear can be reduced. Additional components allow for further automation of operation.

For locomotives
With a mixed coupler device and a swivel mechanism behind the coupler head the hybrid coupler is ideally suited to locomotives. For coupling with the UIC drawhook the coupler head is swiveled upwards. The screw coupler can then be coupled manually and used with side buffers.

Additional equipment
- Heating elements for cylinders and front plates
- Sensors for condition monitoring
- Air pipe connection to the main reservoir pipe
- Operating gear for automatic uncoupling

Perfectly prepared for future modules
- Data transmission
- Power supply

Voith CargoFlex Hybrid for locomotives

Coupler head in standard position: ready for automatic coupling
Coupler head swiveled upwards: ready for connection with drawhook
For freight wagons
This automatic center buffer coupler has been specifically designed for freight applications. The basic version of the coupler offers automatic coupling including the brake pipe. The operation without side buffers allows for lower lifecycle costs and reduced weight. A simplified car body design can be realized through central load transmission.

The low-backlash coupler with energy absorption makes for higher safety and reduces wear of trains and tracks. Furthermore the integrated stabilizing linkage reduces the risk of derailment.

The coupler allows for current and future upgrades; due to its modular design it can be equipped with additional modules.

Additional equipment
• Manual uncoupling device (from vehicle side)
• Air pipe connection for main reservoir pipe
• Operating gear for automatic uncoupling

Perfectly prepared for future modules
• Data transmission
• Power supply
• Heating elements for cylinders and front plates
• Sensors for condition monitoring
Apart from AAR couplers, SA3 couplers can be seen as the mother of all freight couplers. SA3 coupler heads are extremely robust and designed for heavy load applications, like those in coal or iron ore transportation. In a modular approach, Voith combines an advanced SA3 coupler head with automatic air pipe connections and a mixed coupler device. An automatic uncouple feature is also possible. Different types of energy absorption in the draft gear can be fitted through compatible interfaces.

**Coupler head**

The coupler head contour corresponds to that of the Russian SA3 coupler, including standard locking members. The coupler head was modified in a way that an integration of different types of mixed coupler devices is possible.

The coupler head comes in two variations, a long version with shank and a Voith standard version featuring a muff coupling collar. This way, different types of Voith energy absorption solutions in the draft gear can be fitted.

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**Voith CargoFlex Type SA3**

featuring energy absorption solution, mixed coupler device and automatic uncouple device*

**Advanced, modular Voith SA3 coupler head**

with muff coupling collar*
Voith CargoFlex Type AAR

* AAR coupler heads can also be fitted with Voith energy absorption solutions.

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Air pipe connection / automatic uncoupling
Additional guiding elements prevent vertical clearance in the coupler head, allowing for an automatic connection of air pipes and direct coupling with AK69e / Intermat coupler heads.

A pneumatic uncouple device makes automatic uncoupling possible.

Energy absorption
The coupler heads can be combined with a variation of different energy absorption solutions depending on their purpose and application. They are a key component for fulfilling the crash standard EN15227.

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SA3 coupler head for Traxx

Voith CargoFlex Type SA3

with automatic air pipe connection

featuring energy absorption solution, integrated air pipe connection and manual uncouple device*
Play it safe – even at highspeed
An ideal combination of functionality and safety: Voith front end systems offer perfectly matched components, individually designed for their operational purpose. Standardised interfaces and a modular design make the systems easy to replace in case of damage and keep the down times of the train as short as possible.
References
1 Talgo 350, 1st series
2 Citadis Kassel, Avanto Paris
3 Velaro E (AVE S-103)
4 CRH1-250, Talgo 250
5 Irish Rail Class 2200 (Ireland Intercity)
6 Velaro CN (CRH3)
7 Talgo 350 2nd series
8 Mumbai Monorail
9 CRH1-380 (Zefiro), CIT400
10 EMU800, EMU Tilting Train, HEMU400
11 Zefiro Italy
12 KTX 2
13 SMART
14 ICE4
15 EC250
Meanwhile, a whole family of CRH3 products has seen the light of day at the Salzgitter production site. They all have one thing in common: a huge delivery volume.

Both the design process of the CRH3-380 front nose and the manufacturing of the first systems took place at the Salzgitter site. The remaining front noses are manufactured locally by Chinese partners. Finally, they are mounted and adjusted at the Voith site in Shanghai.

Preceding the localisation in China, our Chinese partners underwent comprehensive training in laminating the GFRP parts, assembling the front noses and adjusting the front hatches. When production in China started, experts accompanied the process for several weeks. The result: 100% localised front noses at 100% quality and functionality.

**Our contribution**

- Front nose module including front hatches
- Front hatch kinematics (manual and automatic)
- Type 10 automatic coupler
- Semi-permanent couplers
- Modular adapter coupler type 10/AAR

**Components supplied by Voith**
With its diesel trains offering hourly service, the California commuter rail line Caltrain serves 12 million passengers every year. Starting in 2020, 16 KISS EMU trainsets manufactured by Stadler will enter service on the Caltrain line through Silicon Valley. Before they can do so, however, the Peninsula Corridor between San Francisco and San José needs to be electrified, a key component of the Caltrain Modernization program CalMod. This project was started end of 2017.

The color scheme of the KISS double-deck trains was decided in an online-survey. Four design options were available.

With a 60% localisation rate, Voith provides the Caltrain vehicles with front modules, couplers and cooling systems.

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Our contribution

- Front module
- Type 10 automatic coupler
- Semi-permanent couplers
- Modular adapter couplers type 10 / AAR
- Cooling systems

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Components supplied by Voith
ICE4

Superlatives in rapid succession: Since 2016 up to 300 ICE4 trains gradually replace the Intercity/Eurocity trains presently in operation, followed by the ICE1 and ICE2 trains. Thus the ICE4 forms the new backbone of the future DB (German Railways) main line traffic. The ICx sets new standards in flexibility and operational availability and can be perfectly adapted to different transport tasks.

An advanced aerodynamic design and optimised usable floor space result in weight and energy savings, while still providing all the comfort needed for long distance travels.

The modular design and few connection points of the front nose allow for fast mounting and easy adjustment of the components. Low-maintenance encapsulated actuators remain perfectly functional even under rough operating conditions. Apart from smooth operation, these actuators prevent any unwanted closing of the front hatches. This provides additional safety for maintenance works.

Our contribution

• GFRP driver’s cabin
• Front nose module including front hatches
• Front hatch kinematics (manual and automatic)
• Snow deflector
• Type 10 automatic coupler
• Semi-permanent couplers
• Adapter coupler type 10/UIC drawhook

Components supplied by Voith
EC250

Experiencing the Gotthard base tunnel at high speed:
The Swiss Federal Railways (SBB) has ordered 29 eleven-car trains from Stadler Rail. They will be operated as comfortable passenger trains crossing the Alps. In the first instance, railway service will be realised between Zürich and Mailand, in a later stage an extension to Frankfurt is planned.

When passing the Gotthard base tunnel in winter, spontaneous differences in temperature of up to 50 °C are possible.

The EC250, in Switzerland also known as “Giruno” (Buzzard), is an advanced development of the FLIRT concept, reaching a maximum speed of 250 km/h. Furthermore, it has been adapted to the specific safety requirements for passing tunnels.

The front hatch kinematics – patented by Voith – ensures safe and reliable operation of the front hatches, taking into account the additional energy absorption elements integrated into the train front.

Our contribution

• GFRP driver’s cabin
• Front nose module including front hatches
• Front hatch kinematics
• Coupler and front hatch control unit
• Type 10 automatic coupler
• Adapter coupler type 10/UIC drawhook

Components supplied by Voith
Our Service – part of your business
As specialists in components and systems for rail vehicles, we ensure safe operation, peak availability and maximal operational lifetime.
Competent partner
Be it rail couplers, rail drives, wheelsets, turbo transmissions, locomotives or railcars: Our highly-experienced technical service team stands ready to find a swift and cost-efficient solution to any given situation.

Anytime, anywhere
Prompt response, personalized customer support, technical expertise: Our network includes workshops, technicians, field engineers and sales support staff. They offer competent support all over the world, all around the clock.

Individual solutions
Whether overhauling a complete fleet or repairing a specific component: We provide customized services and solutions that help operators optimize maintenance costs and reduce downtime and standstills.

Customer benefits
+ Reduced maintenance time
+ Planned and calculable costs
+ Increased availability of operating trains
+ Minimized downtime in case of unexpected repairs
+ Increased profitability of operation
+ Optimized lifecycle costs

Worldwide service locations

International Service Hotline
(Technical assistance)

Phone +49 7321 37-4181
rail-service@voith.com
### Our services at a glance

<table>
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<th>Service</th>
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| **Retrofit and Modernization** | • Upgrades to the latest technology  
                              • Customized modifications  
                              • Voith engineering and know-how |
| **Inhouse MRO**           | • Maintenance, repair and overhauls  
                              • Inspection-based overhaul  
                              • Voith Warranty |
| **Contracts**             | • Individual contractual concepts  
                              • Customized service solutions |
| **Field Service MRO**     | • Field engineers and on-site service  
                              • Quick reaction times |
| **Spare Parts**           | • Voith genuine parts  
                              • Tested and certified parts  
                              • Safety, longer lifetime and higher availability of the rail vehicle |
| **Spare Units**           | • 1:1 replaceable units  
                              • Voith engineering and standards |
| **Education and Training**| • Customer focused training concepts  
                              • Customized educational content  
                              • Voith know-how and experience |
| **Non-Voith**             | • Overhauls and repairs of Non-Voith couplers  
                              • Re-engineering and manufacture of complete units  
                              • Voith Warranty |
| **Technical Support**     | • Expert advice and support for optimal maintenance  
                              • Voith know-how and experience |
| **Exchange Couplers**     | • Zero-days delivery of 1:1 spare units  
                              • Ready-to-use in exchange for ready-to-overhaul or damaged coupler  
                              • Reduced downtime and out-of-service vehicles due to accidents |

1 Individual solutions  
2 Original spare parts in Voith quality
Voith’s Coupler Exchange Program offers immediate delivery of spare units, increasing availability and reducing downtime in the maintenance and repair of all rail couplers.

**Exchange program**

Whether you’re planning an overhaul or facing unscheduled repairs, our Exchange Program provides ready-to-operate couplers in exchange for ready-to-overhaul or damaged units, effectively reducing delivery times and standstills.

The Coupler Exchange Program was designed to meet the industry’s need to keep trains in operation with minimum maintenance stops.

Operators can now sign an individual service contract where we manufacture, keep in stock and warranty immediate delivery for 1:1 spare units. The first safety-stock coupler is delivered within a maximum of 12 months after signing a binding agreement, but once in stock, the exchange couplers can be mounted within hours after request.

**Customer benefits**

+ Reduction of maintenance time
+ Minimized downtime in case of accidents or breakdowns
+ Planned downtime and calculable costs
+ Reduction of inventory of spare parts and spare couplers

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**Zero-day delivery couplers**
Real time safety
Smart Schaku

The new Smart Schaku system enables coupler monitoring in real time, giving operators the information they need to improve availability, reduce costs and optimize maintenance procedures.

Real time monitoring and problem detection
Force and coupling frequency are key parameters that give valuable insight into the coupler’s overall condition and usage. Sensors collect these data in real-time and combine it with the vehicle operation data. The result is transmitted as digital log to the Voith Cloud where it is analyzed. The information is visualized on the customer’s individualized interface and it notifies the operator of any potential trouble areas, such as a broken deformation tube or a malfunctioning damper.

Countdown to the next overhaul
Smart Schaku is the first milestone for predictive maintenance where the operator will have the ability to predict breakdowns before they occur, announcing potential damage to key coupler components.

Customer benefits
+ Immediate notification of incidents
+ Optimized maintenance frequency
+ Reduction of unexpected or planned downtimes
+ Plannable downtimes and calculable costs