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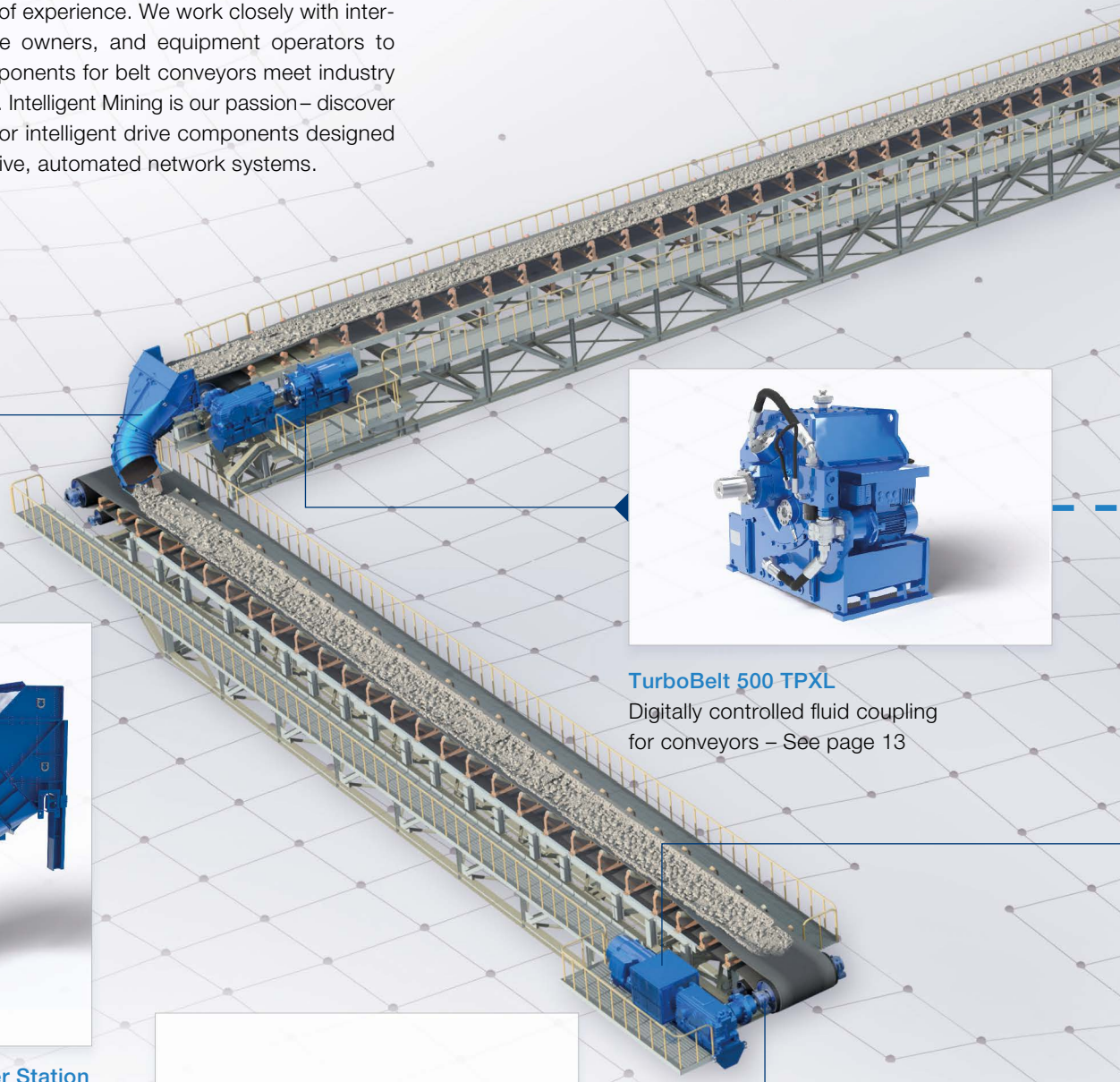
VOITH

Key components for belt conveyors in mining

TurboBelt portfolio

A wide range of systems and services for mining operations

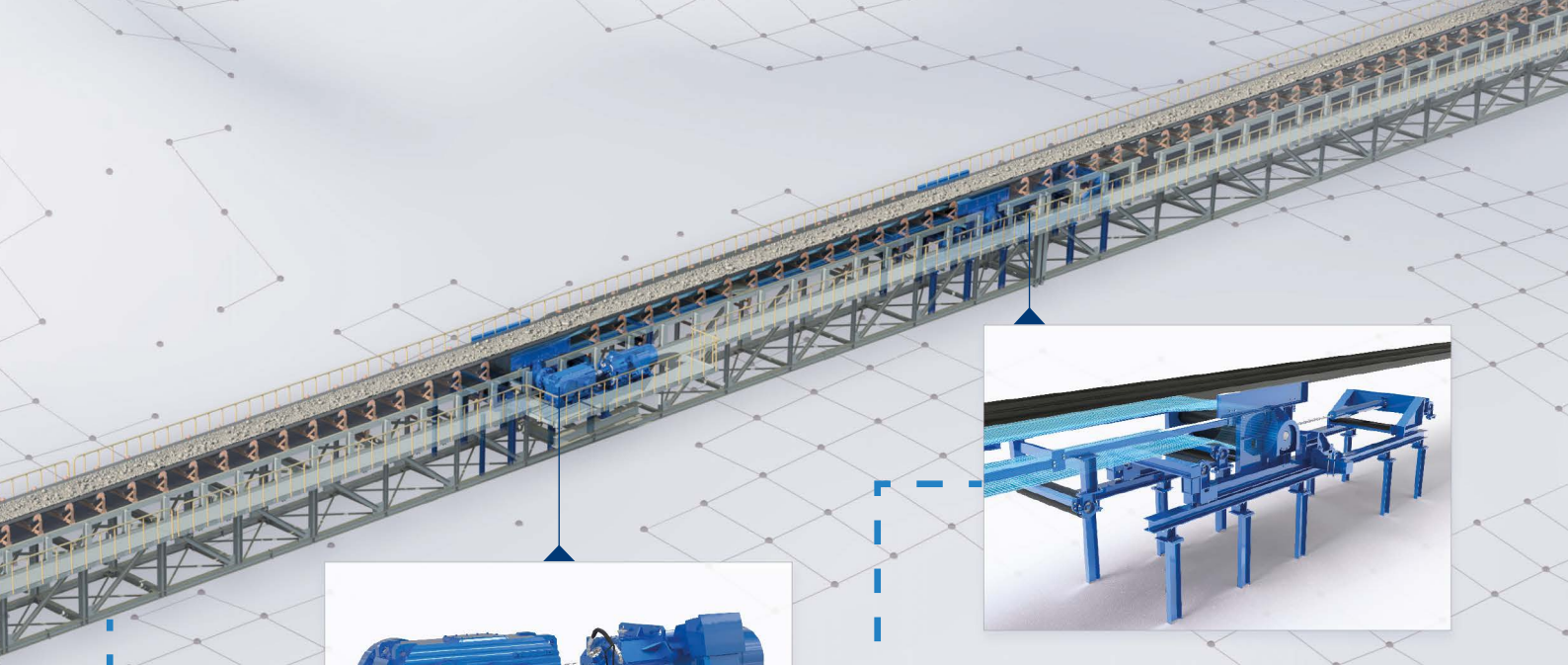
Voith has been a trusted partner of the mining industry with more than a century of experience. We work closely with international OEMs, mine owners, and equipment operators to ensure that our components for belt conveyors meet industry needs and standards. Intelligent Mining is our passion – discover our latest solutions for intelligent drive components designed to operate in innovative, automated network systems.



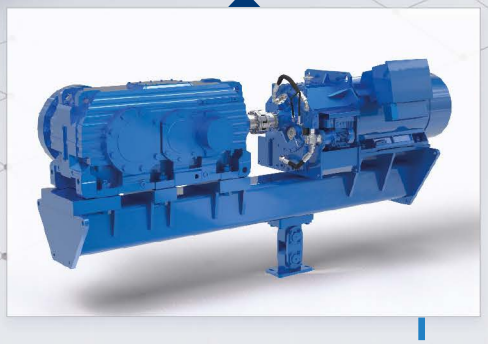
TurboBelt 500 TPXL
Digitally controlled fluid coupling for conveyors – See page 13

TurboBelt Transfer Station
Designed sliding path for a long lifetime – See page 17

TurboBelt Hese Pulley
Belt conveyor pulleys engineered for highest reliability – See page 16



TurboBelt TT Linear Booster Drive
Most efficient and cost-saving booster drive solution – See page 8



TurboBelt Drive Package
Turnkey drive package incl. controller developed by Voith – See page 10

Communication Bus

TVVS Fluid Coupling
Best-in-class torque limiting fluid coupling – See page 12

TurboBelt DriveControl
Intelligent drive control system for belt conveyors – See page 5

Intelligent mining meets proven reliability

Changing markets

Mining has seen radical changes in the recent decades. The decreasing ore quality and the sometimes extremely remote deposit locations mean serious challenges for both, the operations and the productivity of mine sites. Digitization and automation can help to increase productivity. However, this strategy will only be successful when reliability remains to be a top-level focus.

For mining applications, Voith provides intelligent drive components that are designed to operate in innovative, automated network systems. They work under the most demanding environmental conditions with little maintenance and wear – for greater productivity and less downtime.

Reliable performance even in harsh environments

Voith key components for conveyors such as chutes, pulleys, TT Linear Booster drives and fluid couplings are extremely robust and safe. Our products have an excellent track of reliability operating in harsh surroundings. Accordingly, the Mean Time Between Failure (MTBF) of our components is benchmark in the mining industry. Beyond offering a broad portfolio of fluid couplings for demanding belt conveyor drives, Voith will also work with you to provide complete drive and control solutions. Based on your specific requirements, we will help you determine the most appropriate drive system for your operation.

When we talk about intelligent mining, it is not just about technology but also about costs. We find the best solution for our customers in terms of lifetime costs.

“We have never seen such a great start-up, and control. [...] Thanks to Voith’s technical support and effort, the plant will enjoy sustainable operations providing value to its community, its owner, and the employees.”

Mr. Dukgi Lee, General Manager of the plant and maintenance team of Ssang Yong Cement, South Korea

Voith TurboBelt Drive Control – state-of-the-art control technology

The TurboBelt DriveControl System is the core of the operational data network along the belt conveyor. It controls the conveyor behavior and features integrated self-diagnostics, conditioning monitoring as well as active load-sharing.

The TurboBelt DriveControl allows a horizontal data integration covering all operational data of the compatible conveyor components. The software equally supports the vertical data integration, providing accumulated and partially processed data for the use in management information systems.

By making use of the Voith TurboBelt DriveControl and its available remote access, fast support is provided in case of emergency. This results in less downtime and lower costs for troubleshooting. In addition, it allows professional support by taking full control (if authorized).

Our engineers have detailed knowledge of the product and the system. Real-time monitoring as well as availability of all necessary data without transfer loss round off the integrated approach of the Voith TurboBelt DriveControl.

Our Voith experts are ready to support you using the remote service capability even after commissioning.

Technical capabilities to provide best solutions

Design tools and services allow the analysis of potential challenges and provide data for the engineering of a system retrofit project – long before the system is installed. With the aim of assisting our clients the best possible way from the earliest project stage on, Voith works with dependable field-proven and long-standing technical software, like Voith TurboSim and Finite Element Method (FEM) analysis tools.

Increasing economic pressure on the mining companies leads to the growing importance of lifecycle costs in a mine, for equipment, the Total Cost of Ownership (TCO). Voith has partnered with an independent mining consultant firm to identify the global market prices of belt conveyor drive components (incl. power supply) and their maintenance, repair and overhaul (MRO) costs during their lifetime.

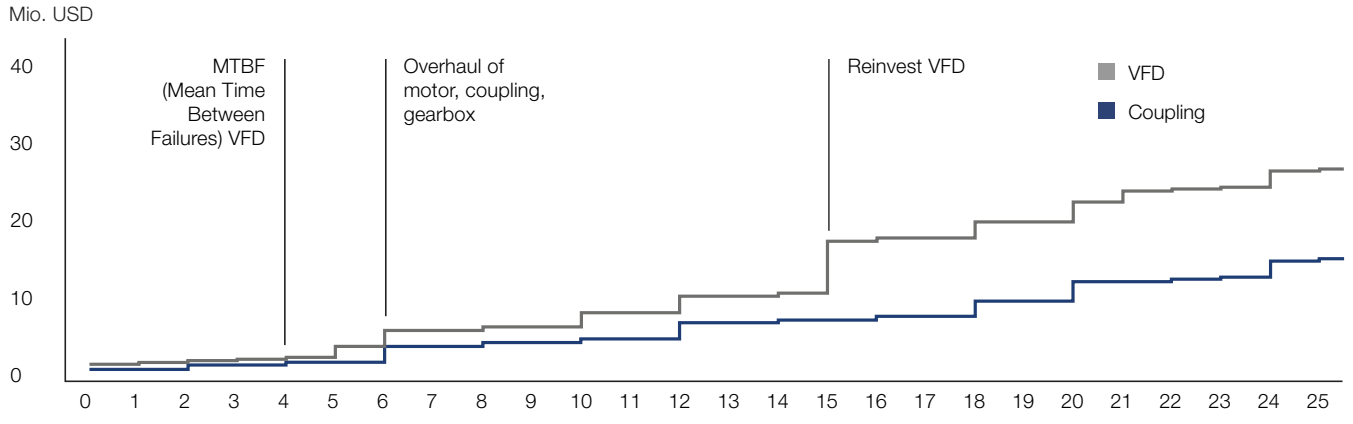
TCO Tool – finding the optimum solution

The result is the Belt Conveyor TCO Tool which enables the customer to configure a belt conveyor with different drive setups, (quantity, power, location, voltage, etc.) considering different drive technologies. This results in a detailed analysis report providing a lifecycle cost overview with all relevant CAPEX and OPEX information. This can save a considerable amount of engineering time, choosing the best drive solution with the best TCO value.

Voith TurboSim – accurate simulations for real-world results

Voith TurboSim is a calculation program for selecting Voith turbo couplings based on the technical parameters of the plant to be designed. TurboSim has been equipped with essential, coupling-specific data such as characteristic curves, values on specific heat capacities and dissipation, as well as volumes and filling levels for all coupling types. In this way, drive-specific scenarios that are essential for the safe operation of a plant can be illustrated and evaluated on the basis of a simulation.

TCO Development over lifetime of site in Mio. USD



Energy costs are not included within time line graph.

By processing real data, it is possible to incorporate the anticipated real-life operating conditions of the key component Voith Turbo Coupling into the driveline while a project is in its earliest stage. The evaluation of plant-specific conditions increase planning safety ranging from the early design phase through realization up to regular operation.

Best possible pulley design

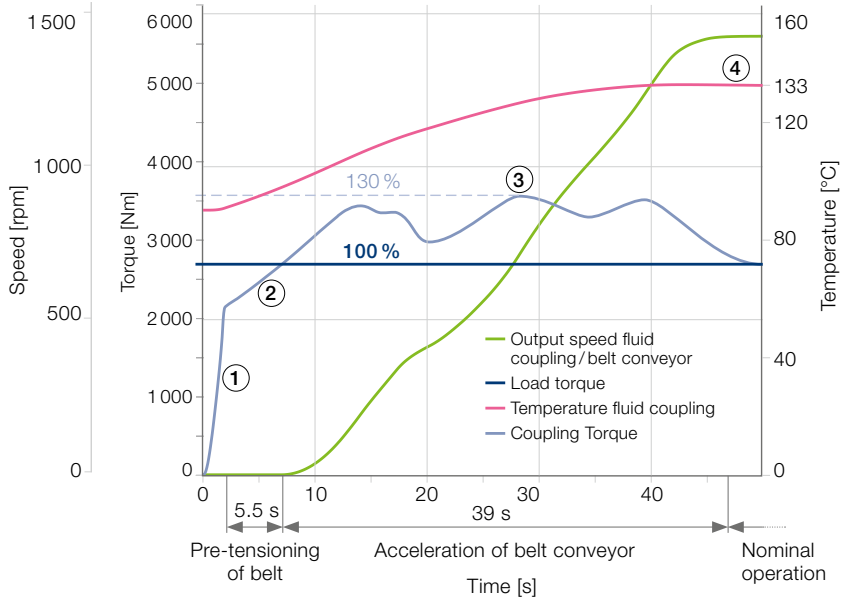
For the calculation and engineering of Voith TurboBelt Hese Pulleys, we have developed our own software. It is based on our long-term experience and various tension and deformation analyses that used FEM.

Our software ensures reliable dimensioning and design of conveyor pulleys. Our analysis provides a pulley configuration optimized for your requirements. For high-tension pulleys, we carry out an additional analysis to ensure optimum quality in operation.

"The 3rd generation of TurboSim has given us the ability to better illustrate the Voith fluid coupling capabilities to our customers. The couplings can go into operation with the calculated values, making the commissioning time very short."

Scott McElroy, VP Service Sales
Voith Turbo Inc., Canada

TurboSim – Belt conveyor start-up simulation



Motor: 500 kW @ 1 490 rpm, Fluid coupling: 750 TVVS ThyssenKrupp Fördertechnik, REK Bitola.

1 Start-up of the motor virtually load free, can be analyzed also for different power supply conditions.

2 Smooth pre-tensioning to reduce dynamics in the belt and to avoid longitudinal vibrations.

3 The fluid coupling type TVVS limits the start-up torque to a level of 140 % of the load torque. Having exact project data and using TurboSim engineering, this can be reduced down to 130 %.

4 The coupling temperature is analyzed to assure safe operation.Multi-motor drives and different load conditions can be analyzed.

Benefits driven by linear thinking and highly efficient design

In order to ensure optimum yield and efficiency from your mine under all conditions, Voith TurboBelt TT Linear Booster Drives deliver the benefits that mean the most: ease of use, flexible operation, easy maintenance, enhanced productivity and extended belt life. The system ensures improvements for all operational situations.

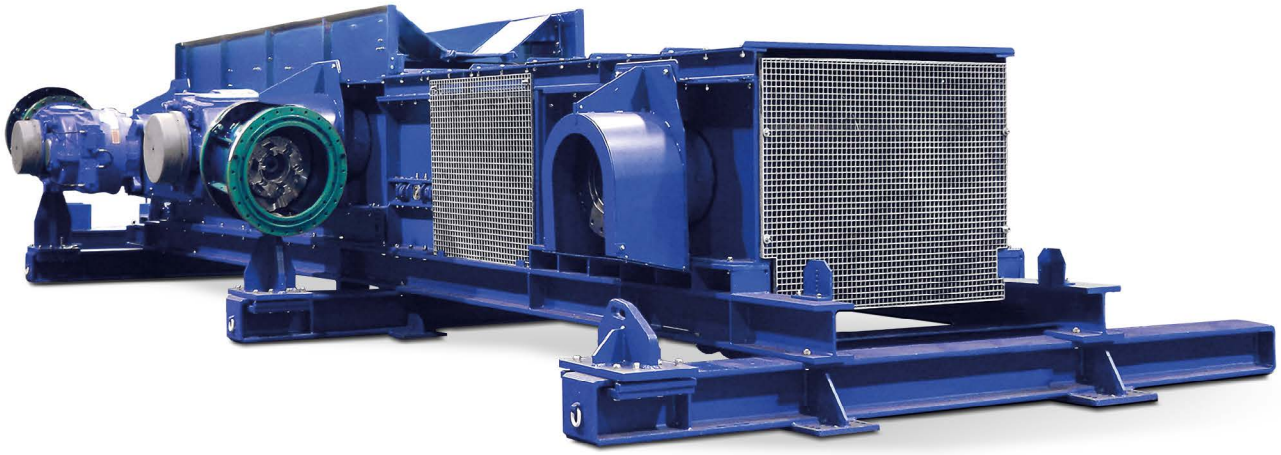
The TT Drive is a powerful and productive intermediate drive for belt conveyors. It improves conveying efficiency by extending the service life of belts, saving belt costs in new conveyors and increasing capacity in existing systems. The TT Drive is equipped with a head and tension station, which is integrated into the actual belt. The drive is assembled directly within the current conveyor system.

The top belt of the main conveyor system (carrying belt) rests upon the top belt of the introduced TT Drive (drive belt). The inserted booster drive introduces the tensile force linearly through a friction lock in the belt. Belt tensile forces are significantly lower than with standard solutions. TT Drives provide benefits when used with medium, long or inclining belt conveyors.

"Voith's solution has provided us with a dual benefit. Not only did we manage to avoid an unplanned shutdown because of the damaged belt, we are now able to use a textile belt instead of an expensive steel cord belt for the system. We would choose a solution from Voith again every time."

Ralf Dohle and Wolfgang Kosiuk project managers from RAG, Germany

Drive station of a Voith TurboBelt TT Linear Booster Drive

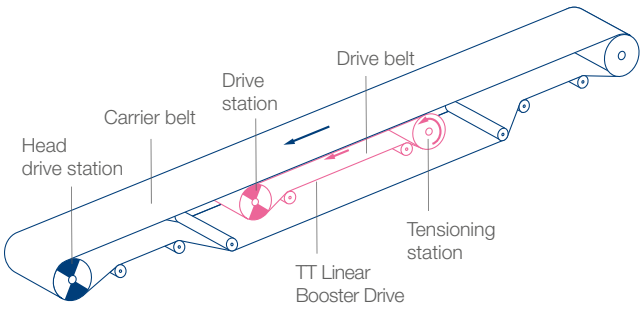


Field-proven for decades, the driving force behind this adoption is the range of clear benefits the TT Drives provide:

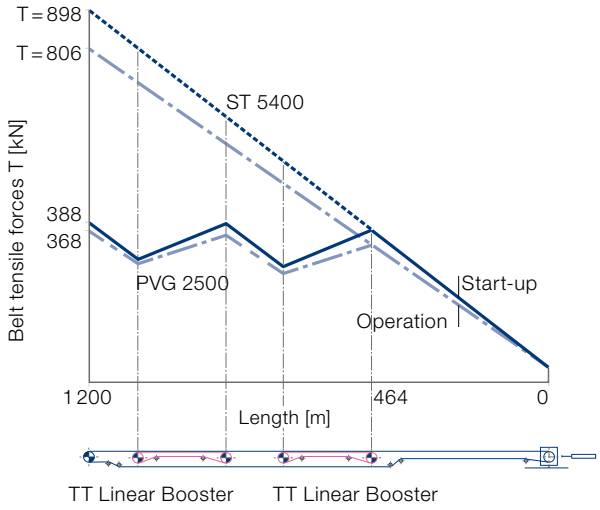
- In new as well as in existing systems, the use of TT Drives avoids transfer points, protecting the belt and resulting in a longer service life.
- In many cases and depending on reserves, TT Drives can improve the capacity of older conventional conveyors – without needing to change the existing drive or replace the belt.
- They lower belt rating requirements and, in many cases, makes it possible to use textile belts in operation where, under normal conditions, a steel cord belt would be necessary. This, in turn, eases splicing, handling and repairs, also reducing the operating cost of the overall system.
- The ability to operate with a lower-rated belt translates to lower operating cost, as well as reduced investment in the belt – which is the most expensive single component.

Voith TurboBelt TT Linear Booster Drive – significant cost savings in belt conveyor systems.

Voith TurboBelt TT Linear Booster Drive
Functioning principle



Comparison of belt tensile forces with TT drives
Actual case



A complete systems approach for optimal efficiency

Couplings and accessories matched with industry-leading know-how

Today's market places ever-greater demands on belt drives, and fluid couplings must hold up under extreme conditions. Voith constant-fill and fill-controlled couplings address multiple performance requirements with a range of start-up times and factors, torque build-up values, and drive power ratings. Among the various Voith couplings – the TV, TVV, TVVS, TPKL and TurboBelt TPXL – we will identify the right choice for your operation.

To optimize performance of your fill-controlled couplings (and thus the entire system), an advanced control unit – the Voith TurboBelt DriveControl – is available to improve the controlling and monitoring of the coupling in every operating mode. Voith customer support services, backed by extensive know-how and experience, are also ready to assist with system integration to the conveyor PLC.

For constant-fill fluid couplings, Voith also offers three temperature-monitoring systems, the MTS, BTS and BTM. These devices improve operations and allow thermal reserves to be used most efficiently to more precisely manage the process and avoid downtime.

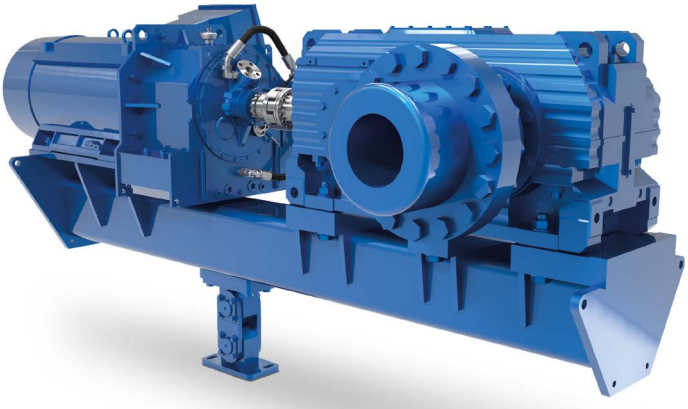
Complete drive solutions

Beyond offering a broad portfolio of fluid couplings for demanding belt conveyor drives, Voith will work with you to provide complete drive solution. Based on your specific requirements, we will help determine the most appropriate drive system for your operation. Our engineers can design and deliver drive packages, including motor, gearbox, frame, connecting couplings, etc., along with the TurboBelt DriveControl. For complete drive solutions, Voith's capabilities and expertise are unmatched in the industry.

> "Proven reliability is why we absolutely wanted to have fluid couplings in the new conveyor drives as well."

Tatra Muis, Senior Manager of Maintenance at Bukit Asam, Indonesia.

Drive package with Voith TurboBelt TPXL Fluid Coupling



Smooth torque and power transfer
The wonder of hydrodynamics

Hydrodynamic couplings are models of mechanical simplicity. They transmit drive power via a flow of fluid across a pair of bladed wheels positioned face to face. A coupling consists of two primary circumferential components – the pump and the turbine wheel. The pump wheel is connected to the motor and acts like a rotary pump, while the turbine wheel is connected to the driven machine. Operating fluid flows from the pump wheel directly into the turbine wheel and back to the pump wheel, with power transmission proportional to the fill level in the working circuit.

Thanks to a separation of the drive and driven sides, hydrodynamic couplings are able to transfer power without friction or wear while dampening torsional vibration and torque shocks in the drive chain at the same time. This results in smooth, wear-free power transmission and long operating lifetimes.

Constant-fill couplings for belt conveyor start-ups

Constant-fill couplings are self-contained, surface-cooled drive components primarily used for belt conveyor start-up and limiting torque in machines. They provide natural load sharing. The different models of constant-fill couplings are primarily identified by the type and shape of adjoining chambers where automatically controlled filling and emptying processes determine start-up behavior.

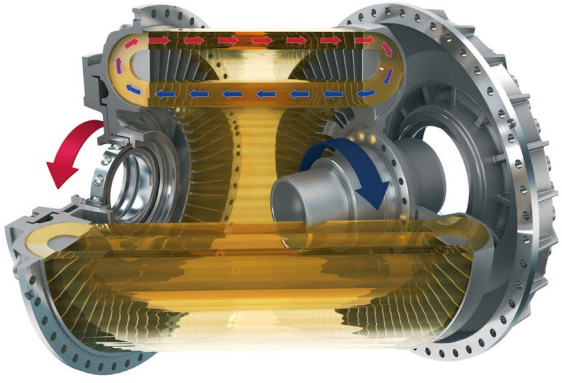
These couplings feature built-in intelligence for self-contained automation eliminating the need for external controls and ensuring smooth, trouble-free performance. The specific requirements of your drive system will determine the coupling type, torque and power needed.

Fill-controlled couplings equipped with a control device

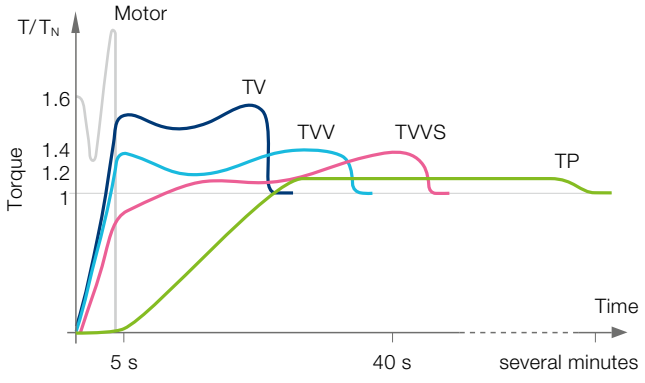
Fill-controlled couplings are advanced drive system components that provide higher power transmission with precisely controlled torque – reducing wear and tear on belt conveyors as well as the entire driveline. They incorporate a control device that continuously adjusts transmission behavior by changing the fill level to maintain precise operation and make commissioning easy and straightforward.

Fill-controlled couplings have a fluid circuit that is also used for cooling. This increases thermal capacity, allowing longer and more frequent start-up procedures with high loads and enhancing the productivity and reliability of your system. In addition, fill-controlled couplings are completely empty at start-up, enabling a load-free motor run-up that reduces strain and protects the motor and power supply circuitry.

Hydrodynamic principle



Start-up factors for Voith fluid couplings



TV, TVV, TVVS Constant fill fluid coupling
TP Fill-controlled fluid coupling

High availability & reliability
Couplings for smooth start-up

TV Coupling
The constant-fill TV coupling with delay-fill chamber is mainly used with low-powered belt drives. The delay-fill chamber facilitates precise filling of the working chamber during start- up, enabling a smooth start-up of the belt conveyor and limiting start-up torque to 160 % of nominal load.

TVV Coupling
The TVV fluid coupling is characterized by a larger delay-fill chamber that enables an even smoother startup of the belt conveyor, with start-up torque limited to 140 % of nominal load.

TVVS Coupling
With its larger delay-fill chamber and annular chamber shell, the TVVS fluid coupling delivers excellent soft-start characteristics (torque limitation of 140 % relative to nominal load). Its low start-up torque and gentle torque build-up enable the TVVS coupling to automatically adapt to the belt's load conditions, without the need for a separate control unit or external component. The coupling also provides torque limitation relative to nominal load conditions (100 %) in cases of empty or partially loaded conveyors.

"We're all very impressed with the performance of the TVVS constant-fill fluid couplings. They're very easy to maintain – only oil changes are needed – and the reliability is just great."

Kris Tjahajaning Tyas, Manager of Maintenance Planning at Bukit Asam, Indonesia.

TV / TVV Coupling

TVVS Coupling

Best-in-Class features & functions
Couplings for controlled start-up

TPKL Coupling

The fill-controlled TPKL coupling was specifically developed for the most rigorous working conditions of mining belt conveyors. It smoothly controls acceleration based on the load condition of the belt, allows active load-sharing with multimotor drives, and can have start-up times of up to several minutes. Thanks to an external cooling circuit, the TPKL can handle the most difficult start-ups multiple times in a row.

TurboBelt TPXL

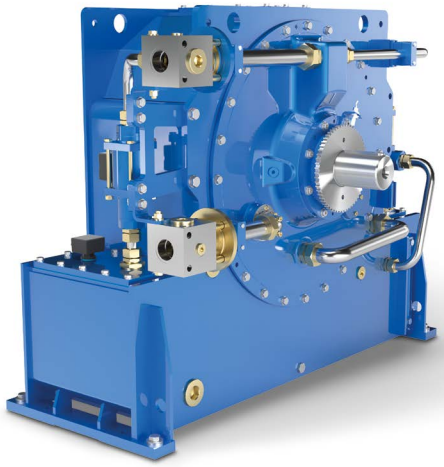
With double the power transmission capability in the same installation space, the Voith TurboBelt TPXL fill-controlled fluid couplings are specifically designed to meet the requirements of belt conveyor drives. Thanks to the proven hydrodynamics and the latest XL profile technology, the TurboBelt TPXL provides extremely smooth and wear-free power transmission.

Its compact design makes it easy to install the hydrodynamic coupling to the driveline. The integrated intelligent controller with open communication capabilities leads to optimized coupling and conveyor performance in every operating mode. By providing the ideal torque limitation, the controller protects the belt from overload. Rugged, robust and compact, TurboBelt TPXL fluid couplings are engineered to the highest standards for greater availability and reliable operation.

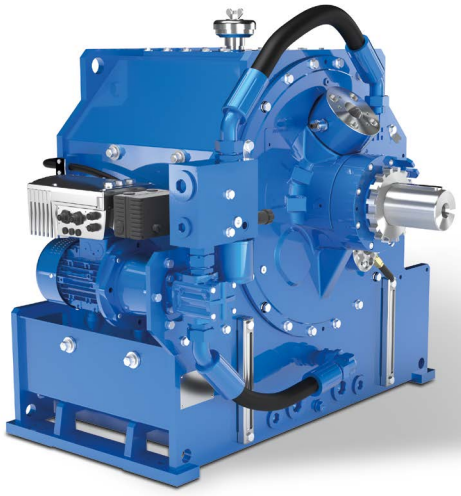
“The extraordinary soft start characteristic, very high reliability and good after-sales service of fill-controlled couplings from Voith assure the normal safe production in our mines. We’re all very happy to use these couplings in our belt conveyors.”

Mr. Lin Yong, Manager of Mechanical and Electrical Department at DaTong Coal Mining Group, China.

TPKL Coupling



TurboBelt TPXL



Hydrodynamic couplings
Technical overview

Fluid couplings for belt conveyor drives

Coupling	TV	TVV	TVVS	TPKL Coupling	TurboBelt TPXL
Power range in kW	37–400	37–630	75–1 500	150–4 000	500–1 500
Motor speed in rpm	900–1 800	900–1 800	900–1 800	1 500–1 800	900–1 800
Type	constant-fill	constant-fill	constant fill	fill-controlled	fill-controlled
Startup time	up to 25 s	up to 35 s	up to 45 s	up to several minutes	
Control	integrated process control			TurboBelt DriveControl (optional)	
Thermal capacity	surface cooling			active cooling	
Thermal monitoring	MTS, BTS, BTM (optional)			PT 100	
Housing option	spheroidal cast iron			–	
Operating medium (optional)	oil (water, biodegradable oil)			oil (biodegradable oil)	
Service	Design, planning, commissioning, technical analysis, maintenance, training				

Constant-fill fluid couplings thermal monitoring

Demanding start-up procedures or belt overloading raise coupling temperature. Voith fluid couplings continue to perform even when the heat is on. To avoid overheating, all fluid couplings are protected by fusible plugs that release oil and declutch the drive. Depending on your particular belt conveyor characteristics, you can also add temperature monitoring systems to further increase visibility and improve drive availability. These include mechanical (MTS) and non contact thermal (BTS and BTM) devices that switch off the motor or trigger an alarm to protect equipment when a specific temperature is read.

- MTS – Low cost, easy maintenance, rugged switch design
- BTS – Different temperatures available, electronic signal, incl. cable check. Ex-proof version available.
- BTM – Continuous temperature reading unit with data evaluator for up to four drives. Integration into plant PLC system with Voith-logic possible.

Equipment for the fill-controlled fluid couplings

For the fill-controlled fluid couplings including TPKL or TPXL family, the TurboBelt DriveControl System is the core of the operational data network along the belt conveyor. It deals with a continuous data stream coming from all sensors, which are supplied by Voith:

- Pt100 temperature sensor
- Pressure gauges
- Speed indicators

Voith provides turnkey solutions with complete packaging, including the integrated controls. For remote service purposes the drive units can be equipped with vibration sensors and other condition monitoring intelligence.

Additional key components for belt conveyors

Voith TurboBelt Hese Pulleys – engineered to perform

Voith TurboBelt Hese Pulleys have excellent running characteristics, even under extreme conditions such as heavy loading, heat, cold and humidity. Consequently, they substantially reduce maintenance and repair costs over the lifetime of the system compared to standard solutions. The layout and calculations are made individually in accordance with customer specifications and take into account the corresponding environmental influences in the area of application. This procedure guarantees the implementation of conveyor belt pulleys that have undergone engineering optimization. They are an indispensable element in belt conveyors for material handling and are built to last.

Technical features

Pulley diameters	up to 3 000 mm
Pulley width	up to 6 000 mm
Design standard	internal bottom as well as special high tension T-bottom design
Lagging	rubber or rubber-ceramics

Voith TurboBelt Hese Pulleys

Benefits and uses

+ **Pulleys engineered for optimum operation of the conveyor**
+ **Excellent running characteristics for high system availability**
+ **Highest quality materials and components**
+ **Highest quality manufacturing**
+ **Extremely long service life**
+ **Easy maintenance**
+ **Explosion protection according to ATEX**

Voith TurboBelt Transfer Station – making conveyor systems safer, more flexible and more cost-effective

Used in conveyor systems, the Voith TurboBelt Transfer Station provides a sliding, centered material transfer that protects the belt and generates less dust. This reduces maintenance and repair costs when handling bulk materials while also increasing the lifetime of the belt.

The Voith TurboBelt Transfer Station is considerably more cost-effective than conventional transfer systems. Thanks to its compact design and modular system, almost any operating point can be equipped with a Voith TurboBelt Transfer Station including the appropriate feeding station. If the installed system is then no longer needed, for example, after the headroom runs out, it is possible to plan, design and implement the transfer at a new operating point at low cost.

Our slide and chute systems are custom-tailored to the flow rate of the bulk material and the material-dependent delivery and receiving capacities of the systems to be connected. Through our extensive experience, we have accumulated comprehensive knowledge which we apply in matching material flow and material transfer.

Technical features

Transport capacity	100 metric tons to 6 000 metric tons per hour
Speeds	0.5 m/s to 7.5 m/s

Voith TurboBelt Transfer Station

Benefits and uses

+ **The belt conveyor has a long lifetime because the belt is not stressed**
+ **Sliding material transfer**
+ **Customized design for optimized material flow**
+ **Productivity increase due to optimized material flow**
+ **The conveyed bulk material is protected by the sliding transfer**
+ **Increased safety**
+ **Less dust generated**

Our Service – Part of Your Business
World-class service and support

Whether it is support or system operation, availability is paramount. We ensure that all components are engineered and built right – and we're always there if you need us. Belt conveyor components from Voith have been proven to perform for many years in the most demanding environments with minimal service intervention. In the rare case when service is needed, local teams are available 24/7 to ensure the efficiency, safety and reliability of your system.

Engineered for excellence, built for performance

Voith engineers have the knowledge and experience to advise you on a total solution – from couplings to complete drives. Everything is checked and rechecked before shipment, ensuring failure-free products of the highest quality. Voith service engineers assemble and inspect fluid couplings on-site and support commissioning of your entire driveline.

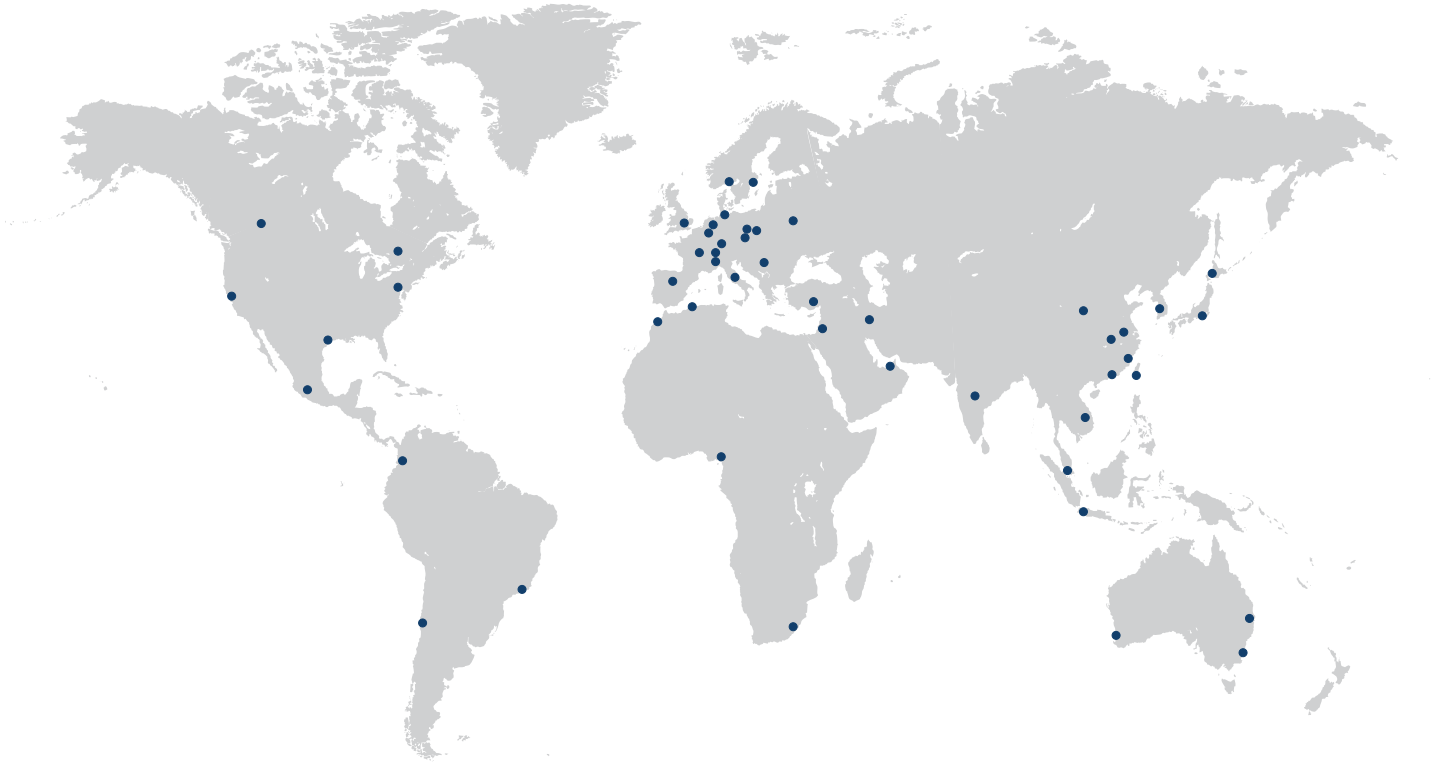
New and existing drives can benefit from a range of checks and tests to maximize performance. Beyond our standard warranty, we offer service contracts for the life of your system. If you ever need spare parts, you're guaranteed availability for the system's lifetime. All replacements meet precise Voith specifications and are engineered for your particular system.

Protecting your investment in every possible way

+ **Optimized solutions from couplings to full drive packages**
+ **Engineering new systems and optimizing existing systems**
+ **Drive system modernization and retrofits**
+ **System analysis, overhaul, and repairs**
+ **Commissioning and after-sales service**
+ **Lifetime availability of spare parts**
+ **Training and service agreements**

At your disposal
A worldwide expert network

Offices worldwide



With offices in all large mining markets of the world, Voith has an outstanding sales network. Voith has been a partner to the industry and has provided its clients with belt conveyor components for many years.

The products are used for conveying and the transport of raw materials both in underground and open-cast mining. And with our worldwide service center and parts network, whatever you need is always close at hand.

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