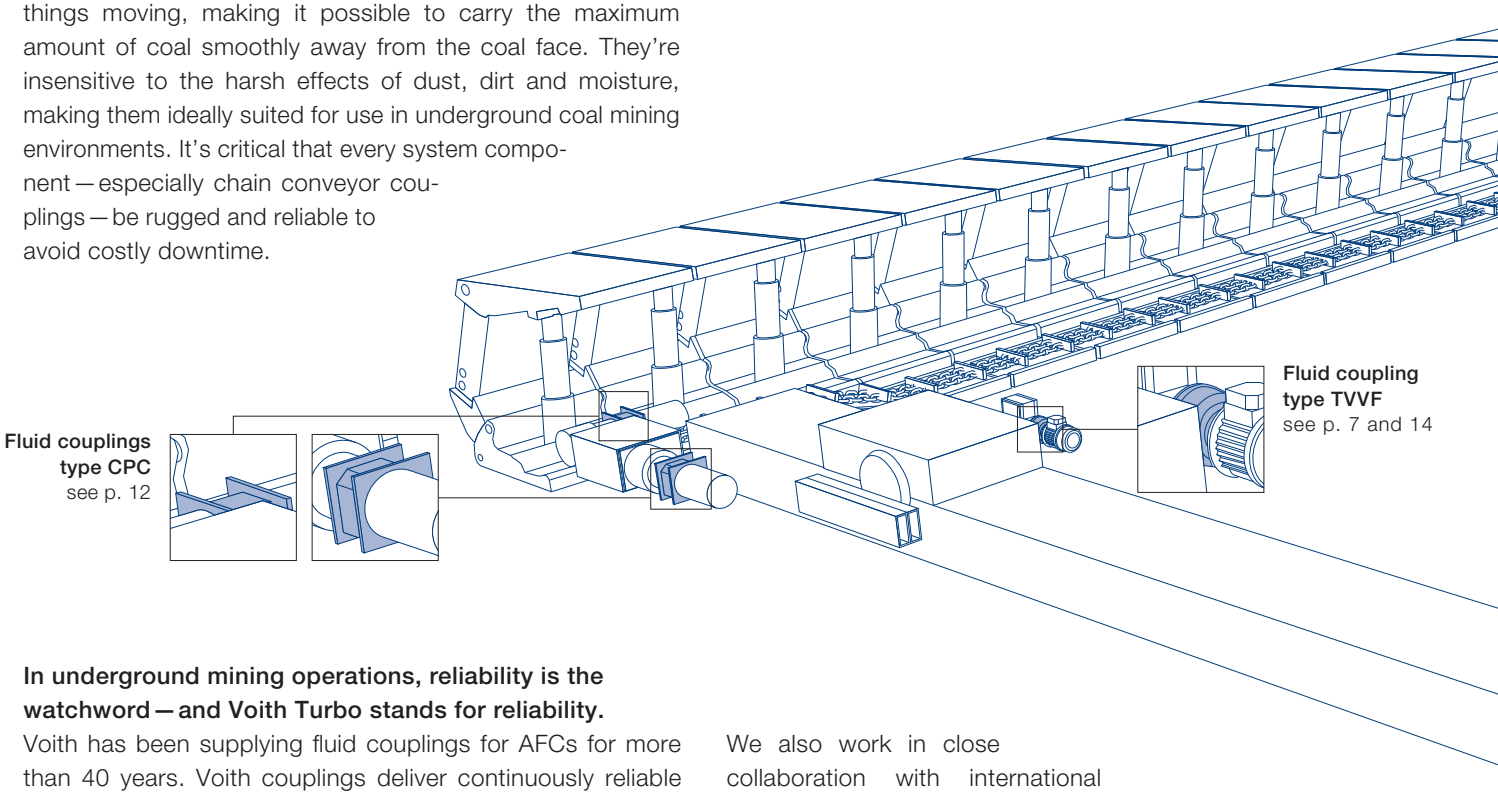
VOITH

When the Going Gets Tough.
Voith Armored Face Conveyor Couplings

Proven Performance Under the Most Demanding Conditions.

No matter how fast an underground coal mining system operates, you can only cut as long as coal is moved away from the face and through the longwall. Today's mining operations require greater production in less time, placing high demand on equipment. It's critical that every system component — especially the chain conveyor couplings — be rugged and reliable to avoid costly downtime.

Voith armored face conveyor (AFC) couplings are built to keep things moving, making it possible to carry the maximum amount of coal smoothly away from the coal face. They're insensitive to the harsh effects of dust, dirt and moisture, making them ideally suited for use in underground coal mining environments. It's critical that every system component — especially chain conveyor couplings — be rugged and reliable to avoid costly downtime.



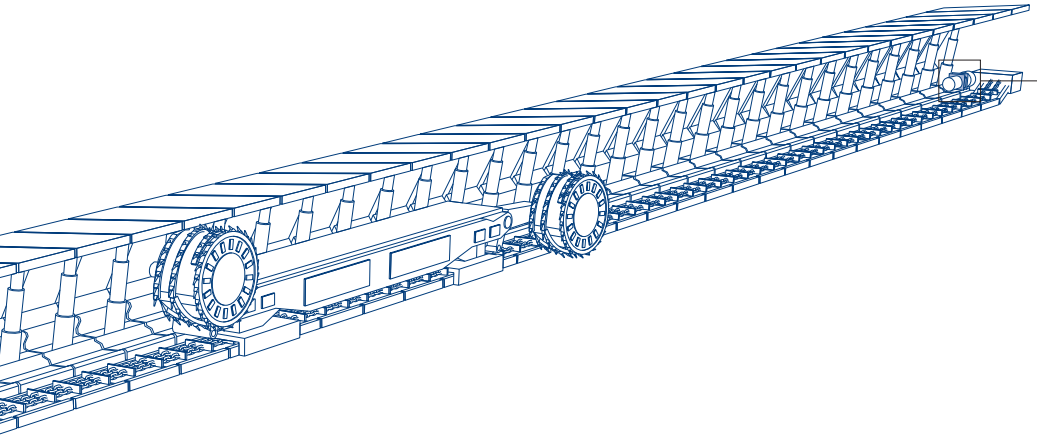
In underground mining operations, reliability is the watchword — and Voith Turbo stands for reliability.
Voith has been supplying fluid couplings for AFCs for more than 40 years. Voith couplings deliver continuously reliable operation to protect the conveyor chain and the entire drive, helping maintain optimum productivity. To meet the different needs of mine operators, we offer a broad portfolio of AFC couplings with ratings up to 1600 kW nominal power — and we continually develop new models.

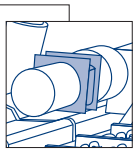
Voith fluid couplings are not only used in AFC drives, but also in drives for stage loaders and underground crushers. Just as with AFC systems, these machines also operate in demanding environments that call for smooth startups and effective torque management to protect the drive against damage.

Based on years of global experience developing mining solutions and building on our application know-how, Voith can offer the ideal coupling for every drive system, as well as customized drive solutions for your AFC, stage loader or crusher.

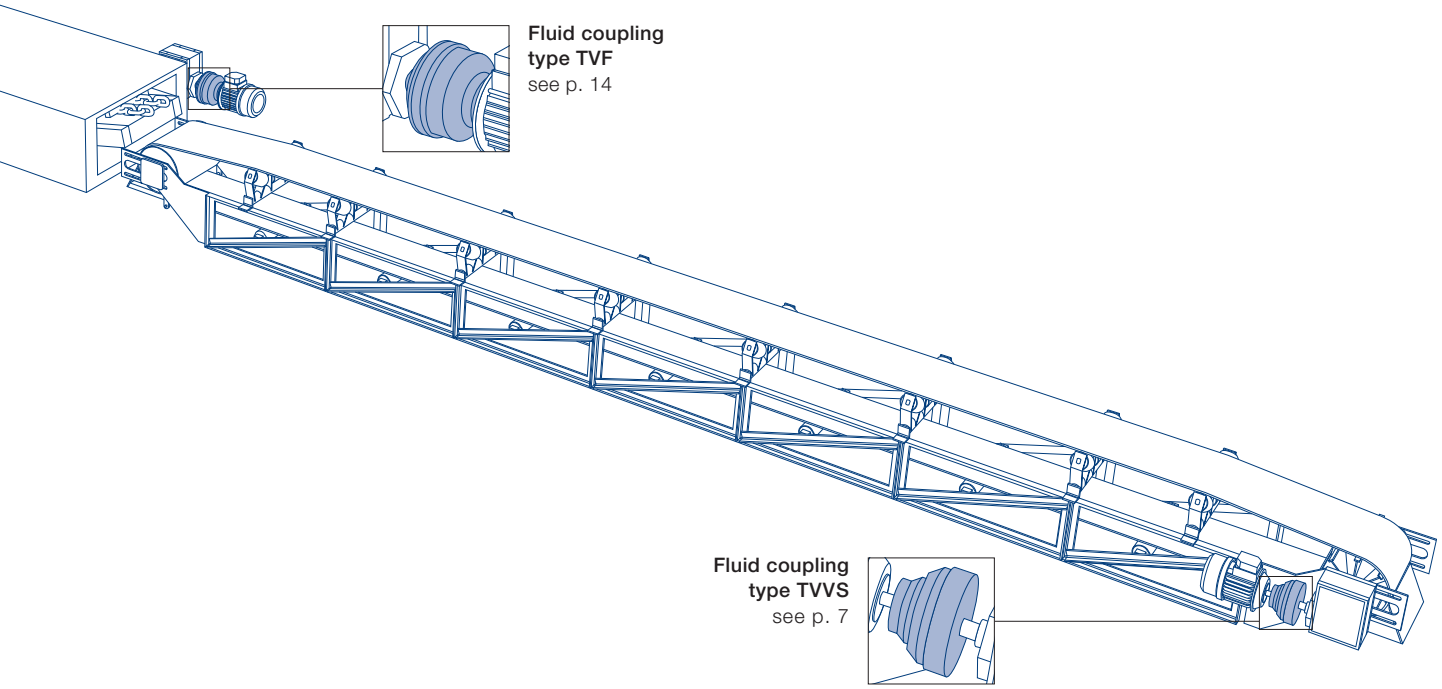
We also work in close collaboration with international OEMs, mine operators, and equipment operators to ensure that our systems meet both industry needs and standards — and keep your operation on the cutting edge of performance. Our realworld experience, combined with unequaled market and application expertise, form the foundation upon which new solutions are developed.

When it comes to couplings for armored face conveyors, you can depend on Voith.





Fluid coupling type CPC
see p. 12



Fluid coupling type TVF
see p. 14

Fluid coupling type TVVS
see p. 7

A Range of Benefits With Voith Fluid Couplings.

Maintaining high performance under all conditions. Maximizing productivity when the going gets tough. Protecting significant investment in the complete longwall system. Providing flexibility for use with more complex, multi-motor drives. These are just some of the benefits you get when you use Voith AFC couplings.

High availability and reliability

Voith fluid couplings are characterized by their longevity. Even under extremely tough working conditions, Voith fluid couplings perform like a trusted and dependable partner, ensuring availability of the entire driveline. Their wear-free power transmission reduces downtime and keeps maintenance to a minimum. To meet underground safety codes and requirements, Voith fluid couplings also use water as a benign, non-flammable operating medium.

Top productivity through performance

Voith fluid couplings deliver maximum performance in underground coal mining — even when huge chunks of falling coal might impact drive flow. Depending on geological conditions and operational needs, Voith has a suitable system available. For lower power and less-demanding conditions requiring fewer starts in a row, Voith offers a range of constant-fill couplings. For higher power requirements under tougher conditions, our fill-controlled couplings allow unlimited start-ups.

1 Voith fluid couplings provide maximum performance in underground coal mining.

2 Voith fluid couplings meet all safety codes and requirements for underground mining.

Protection of chain and drive line
Thanks to mechanical separation of the input and output sides in a hydrodynamic coupling, the motor can start up virtually load-free–no matter how much load is being carried on the chain. During start-up, the fluid couplings very gently introduce torque based on pre-set limitations, protecting the motor. The chain is pre-tensioned smoothly until the AFC starts moving, thus protecting it from excessive strain or damage.

Flexible for use in multi-motor drives
In multi-motor AFC drives, fluid couplings allow for sequential start-up of the motors, which reduces demand on the power grid. During operation they provide natural load sharing (constant-fill couplings) and active load sharing (fill-controlled couplings), avoiding overload on individual motors and extending chain life.

Process optimization and drive solutions
In addition to a broad portfolio of fluid couplings for demanding AFC drives, Voith offers in-depth system know-how and advice. We can provide help with engineering and application issues, as well designing the optimum drive concept for your operation.

Voith couplings carry all necessary mining certifications, such as MA, EAC, etc. We also provide tools for easy integration into customer control systems.

Compact and Powerful: Voith CPC 1600 Doubles Production at Chinese Coal Mine.

The Sandaogou coal mine is located in Shaanxi province, China, roughly 700 kilometers west of Beijing. Miners extract coal from two longwall faces, one of which measures seven meters high, 350 meters wide and more than three kilometers long. To mine it efficiently and with minimal downtime, its operator needed couplings that could combine maximum power transmission and small size. The existing drive system was simply not capable of transferring the necessary power to the conveyor.

To get the job done, China Coal Zhangjiakou Coal Mining Machinery Company, one of the country's largest OEMs and equipment supplier to the Sandaogou mine, engineered a drive system using Voith CPC 1600 AFC couplings. The CPC 1600 can continuously transmit up to 1 600 kW, which represents 60 percent more power than standard fluid couplings of similar size. Three CPC 1600s were installed and are currently in use in one of the faces.

Prior to the installation of Voith couplings at one of the coal faces, the mine produced 5.8 million metric tons of coal annually. Thanks to the new couplings on one of the AFCs, output has now risen by an additional 350 000 metric tons per month. This translates into an annual production increase of 4.2 million metric tons. This, in fact, has doubled production at that face.

Protecting motors and drive components

Tong Xiangyang, a team leader in the Sandaogou coal mine, is quite pleased with the power and reliability of the Voith hydrodynamic couplings. "Since there is no mechanical connection between the input and output sides of the coupling, we can bring our motors up to speed without load," says Tong. "We switch them on one after another to avoid high current demands that would strain our power system. This maximizes availability of the entire system and its productivity."

The CPC 1600 coupling also protects the motors against overload. Thanks to the principle of hydrodynamics, fill-controlled fluid couplings simply slip free, preventing overloads and protecting the AFC drive components and chain against damage.

Since the new AFC was commissioned at the Sandaogou mine in 2012, there has been no unplanned downtime and production is running at considerably higher efficiency.

The coal mine near Sandaogou in Shaanxi province, China, roughly 700 kilometers west of Beijing. Thanks to the new Voith CPC 1600 coupling, the mine produces an additional 350 000 metric tons of coal per month.

Additional Products for Underground Mining.

Underground crushers
Voith fluid couplings for crushers dampen vibrations and shocks in the driveline, providing gentle start-up of the crusher and protecting the drive against overload. The coupling safely limits torque in the driveline and reduces dynamic torque peaks. For maximum safety, these fluid couplings are available with water as operating medium. Outer parts can be made of spheroidal cast iron, for use when aluminum is prohibited.

Underground belt conveyors
Voith also offers a range of fluid couplings for smooth start-up of underground belt conveyors, e.g. fluid couplings type TVVS and TPKL. These systems do an exceptional job of protecting the belt and all drive components from damage, while meeting underground mining industry standards. Water is used as a safe, non-flammable operating medium so that couplings can be specifically deployed in explosive environments. In locations where aluminum-based components are prohibited, the outer parts of the coupling can be made from spheroidal cast iron.

Safeset torque-limiting coupling
For additional safety, the Voith Safeset torque-limiting coupling is used in AFC drives. The combination of fluid coupling with Safeset ensures high drive reliability and system availability for processes where frequent overloads may occur. Whereas a typical fluid coupling limits the transmitted torque permanently, Safeset is designed to provide additional safety–protecting the drive from sudden dynamic peak loads by reacting in a split-second.

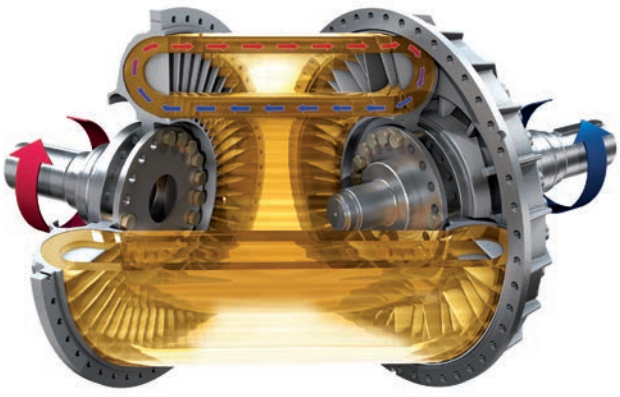
Voith TPKL fluid coupling ensures smooth start-up for belt conveyors.

Voith Safeset torque-limiting coupling provides additional safety for AFCs.

Voith TVVFS fluid coupling dampens vibrations and shocks in the crusher drive.

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.

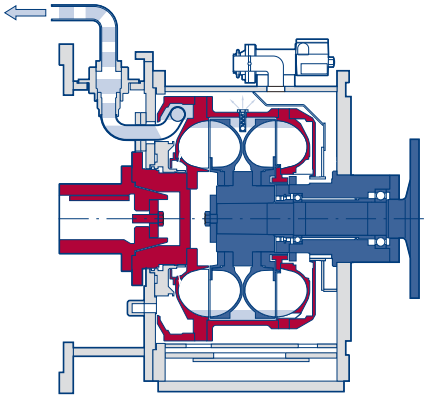


Elegant in their simplicity, fluid couplings are able to transmit huge amounts of power to machines or conveyors smoothly and efficiently.

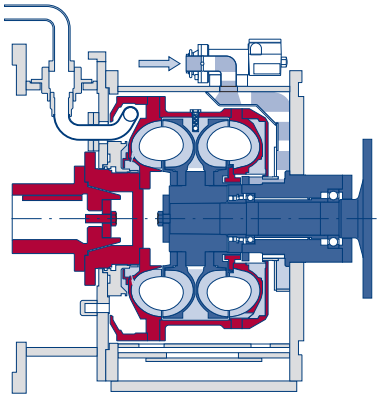
A coupling consists of two primary circumferential components — the pump and the turbine wheel. The pump wheel is connected to the motor and acts like a rotary pump, while the turbine wheel is connected to the driven machine.

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.

Operating conditions of CPC fill-controlled coupling



Motor run-up
The remaining water in the working chamber is drained.



Startup of AFC
Water is pumped into the working circuit. As the drive motor speed increases, operating fluid (water) is accelerated via the pump wheel (red). The circular flow impacts the bladed surface of the turbine wheel, which is set in motion by kinetic energy.

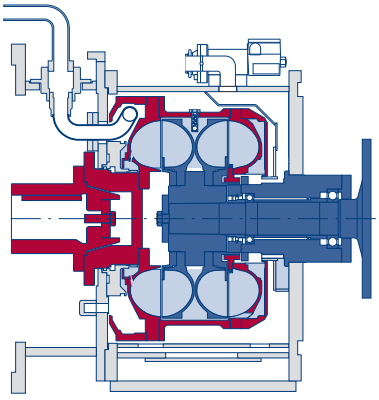
Constant-fill couplings

Constant-fill couplings are self-contained, surface-cooled drive components that provide natural load sharing. Different models are identified primarily by the type and shape of adjoining chambers, within which 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

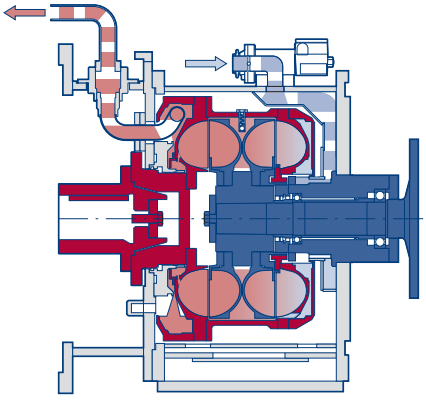
Fill-controlled couplings are advanced drive system components that provide higher power transmission with precisely controlled torque. Fill-controlled couplings have a fluid circuit that is also used for cooling. This increases thermal capacity, allowing unlimited start-up procedures with high loads 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.



Nominal operation

In nominal operation the working chamber is fully filled. For cooling, the water is exchanged when it gets too hot (water exchange).



Water exhange

Based on power consumption, water temperature and flow the control unit calculates switching cycles for water exchange.

A World-Class Portfolio of Field-Proven Fluid Couplings.

For decades, fluid couplings have proven to be the most popular and reliable method of power transmission for armored face conveyors and related equipment, thanks to their inherent simplicity and ability to start up under challenging load situations. Voith offers a wide portfolio of couplings for AFCs, crushers and stage loaders in power ranges up to 1600 kW, using constant-fill or fill-controlled designs.

Coupling	TVF	TVVF	TVVFS	CPC 700	CPC 1000	CPC 1200	CPC 1600
AFC	X	X	X	X	X	X	X
Crusher	X	X	X	-	-	-	-
Stage Loader	X	-	-	-	-	-	-
Power	up to 400 kW	up to 400 kW	up to 600 kW	up to 700kW	up to 1000 kW	up to 1200 kW	up to 1600 kW
Type	constant-fill			fill-controlled			
Blade wheel profile	standard			XL profile			
Start-ups in a row against blocked working machine	up to 3			unlimited			
Thermal capacity	middle	good	very good	unlimited			
Cooling/Cooling circuit	surface cooling			ACC	ACC or closed loop		
Operating fluid	oil or water			water			
Material outer parts	Silumin or spheroidal cast iron			steel housing			

The metal bellows coupling has a long service life

For AFC drives in the low and medium power range (up to 600 kW), we recommend the TV..F constant-fill coupling with valve control. With this device, up to three start-ups in a row can be performed. Constant-fill fluid couplings with valve control can also be used in stage loaders and underground crusher drives. The different types of constant-fill couplings (TVF, TVVF, TVVFS) are distinguished by thermal capacity and power.

The CPC 700 is a compact fill-controlled coupling for medium power and low-seam AFC drives. Unlimited sequential start-ups against a blocked AFC are possible. When greater power is needed, other fill-controlled fluid couplings are recommended, like the CPC 1000, CPC 1200 or CPC 1600.

All Voith fill-controlled fluid couplings for AFC drives provide a maximum breakaway torque of approximately 2.6x the nominal motor torque. Thanks to the Voith-designed XL blade wheel profile, couplings from the CPC family can provide high power density in a small installation footprint.

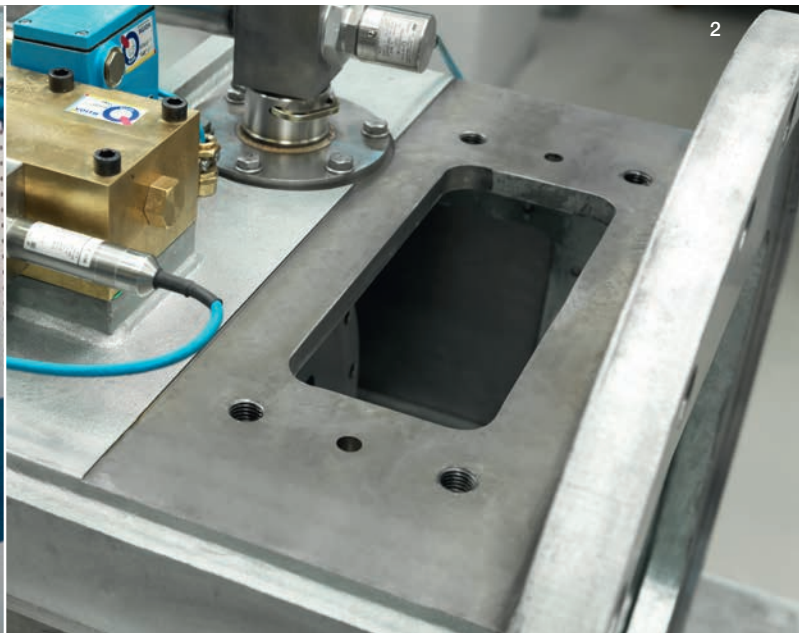
Metal bellows coupling
For the CPC 1000 Voith offers a metal bellow coupling. This connecting coupling compensates large misalignment at low restoring forces. The coupling has no wearing parts and is maintenance-free, resulting in a long service life.

Control unit
To operate the entire system in an optimum way, we also offer control units for fill-controlled couplings. These enable more efficient operation, reduced water consumption, and minimal downtime. We can also provide expert assistance with installation and programming. The control unit is MA certified.

Chain tensioner integration
The CPC 700 offers the possibility to easily integrate a chain tensioner into the system. Tensioners of different makes can be mounted onto the output-side bell housing of the CPC 700 via an adapter plate.

1 The Control units can be easily integrated into the AFC's PLC.

2 A chain tensioner can be mounted onto the output-side bell housing of the CPC 700.



The Voith CPC Family of Couplings.

The Voith Chain Protection Couplings (CPC) family of fluid couplings has been specifically developed for the tough working conditions in AFC underground mining drives. They use water as the operating medium, which has the highest thermal capacity, is environmentally benign and meets all requirements of non-flammable operating fluids. They are also extremely powerful, and require little installation space. Further, CPC sensors and actuators are intrinsically safe.

Torque limitation against overload can be individually pre-set according to customer needs to prevent damage to motor, gearbox and chain. Thanks to active cooling of the operating fluid, CPC couplings can start up as many times as necessary — and under any situation — to break a conveyor free.

The compact and innovative CPC 700

The CPC 700 is a very compact fill-controlled fluid coupling for mid-power and thin-seam AFC drives. It features the Voith-exclusive XL blade wheel profile and a double working circuit for the highest power density. The CPC 700 transmits up to 700 kW and has a low installation height, making it ideally suited for thin-seam coal mining. The CPC 700 features a highly integrated design. The coupling includes a tunnel housing for direct assembly of the gearbox and chain tensioner.

Higher power for the toughest conditions

The CPC 1000, 1200 and 1600 couplings are extremely powerful fill-controlled fluid couplings for AFC drives. They respectively transmit 1000 kW, 1200 kW and 1600 kW in nominal operation. All of them feature our XL blade wheel profile and a double working circuit for higher power transmission. The CPC 1600, for example, transmits 60% more power compared to a standard coupling of the same size.

CPC couplings operate reliably under the most demanding working conditions. Before the conveyor is set into motion they pre-tension the chain to introduce torque smoothly, thus allowing fully loaded or overloaded AFCs to start up. Output torque can be increased steadily until breaking loose, in order to start up heavy overloads.

At the same time, CPC couplings also protect the motor from overload. If falling coal chunks cause sudden load shocks, the coupling simply slips free thanks to its hydrodynamic design, effectively protecting the entire drive train — and especially the conveyor chain. In case of AFC blockage, the CPC 1600 can temporarily transmit up to 4 MW in multiple start-up attempts until the conveyor breaks free again.

1 CPC couplings have been specifically developed for the tough working conditions in AFC drives.

2 The CPC 700 has a highly integrated design.

1

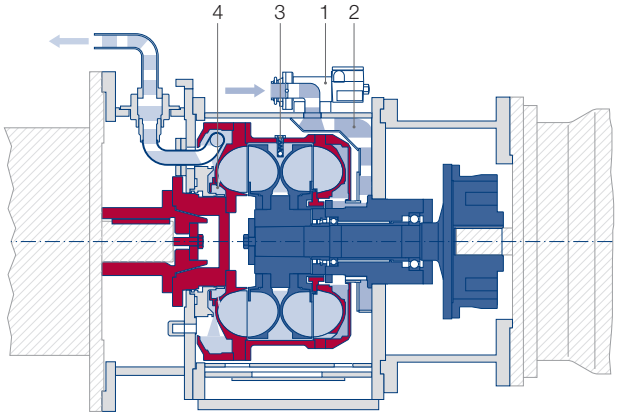
2

Features of CPC Couplings.

Automatic Cooling Circuit (ACC)
For CPC fluid couplings, several cooling circuits for different customer needs are available. When there are interruptions in the water supply, the Automatic Cooling Circuit (ACC) is the best solution. ACC ensures that your coupling always has an optimal water level, thus ensuring stable, high-power transmission. A light and sturdy valve unit significantly eases coupling control, and the valve design requires very low maintenance—increasing the productivity and cost-effectiveness of your system. ACC is suitable for new couplings as well as for existing units.

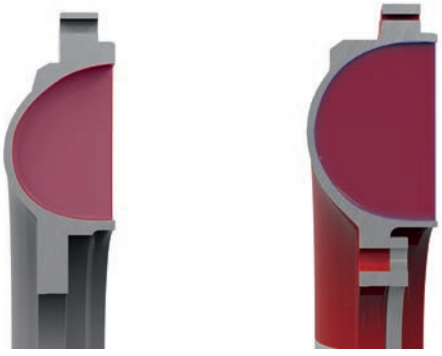
XL-Profile
CPC couplings feature an innovative Voith-designed blade wheel profile called the XL profile, which was developed using the latest Computational Fluid Dynamics (CFD) technology. Drawing on many years of experience and know-how, Voith engineers were able to increase the volume of operating medium in the working circuit of the coupling, resulting in greater power transmission within the same installation footprint.

CPC coupling with ACC



1 Filing valve
2 Pulsed water flow
3 Centrifugal force valve
4 ACC overflow

XL-Profile



Voith engineers increased the volume of operating medium in the working circuit, which leads to higher power transmission

TVF, TVVF and TVVFS Couplings.

These types of couplings are characterized by their intelligent self-control using centrifugal valves. Depending on the input speed, they control the filling and draining of the working chamber and thus the power transmission behavior of the coupling. In case of blockage or fluctuations in the power grid, the coupling reacts automatically and avoids overloading the motor.

In combination with squirrel-cage motors, Voith TV..F couplings form a robust drive that works reliably and protects all drive components. To meet underground codes and requirements, they also use water as a safe, non-flammable operating medium.

TVF fluid couplings have one delay chamber and are used in AFC, stage loader and crusher drives, transmitting up to 400kW. TVVF fluid couplings offer a higher thermal capacity, thanks to an enlarged delay chamber. They are suitable for use in AFC and crusher drives, and both couplings transmit up to 400 kW. The TVVFS coupling offers a very high thermal capacity and optimum start-up behavior for AFCs and crusher drives up to 600 kW.

Intelligent self-control with centrifugal valves

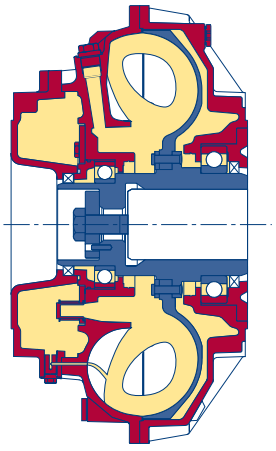
Voltage drops in supply circuits can occur frequently underground. If the drive motor becomes overloaded and speed falls to a certain switching speed, the centrifugal valves open and operating fluid flows out of the working circuit back into the delay chamber. This reduces the torque transmission rating; the motor is relieved and re-accelerates to full speed.

Once the valve switching speed is reached again, the centrifugal valves close. Operating fluid flows back into the working circuit and the transferred torque increases. This procedure is repeated until the supply circuit has re-stabilized.

When the motor is running at nominal speed, the coupling drains the fluid to the working room and torque increases to maximum startup torque.

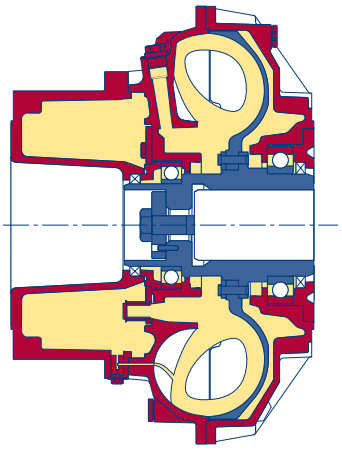
Type

TVF



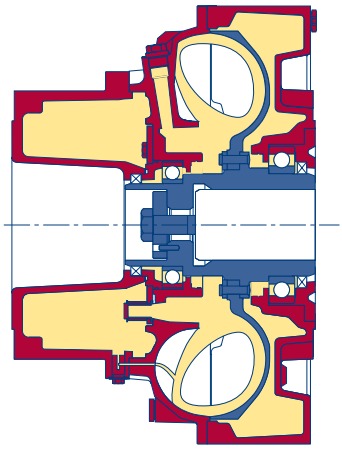
The TVF coupling is used in AFC, stage loader and crusher drives up to 400 kW.

TVVF



The TVVF is used in AFC and crusher drives up to 400 kW. The enlarged delay chamber provides good thermal capacity.

TVVFS



The TVVFS is used in AFC drives up to 600 kW. The coupling has a very good thermal capacity.

World-class Service and Support Based on Engineering Excellence.

Whether it's the operation of your system or after-sale support, availability is paramount. Voith fluid couplings for AFC systems have been proven to perform for many years in the most demanding environments with minimal service intervention.

We take great care in ensuring that all components are engineered and built right. In the rare case when service is needed, local teams are available 24/7 to ensure the efficiency, safety and reliability of your system.

Built for performance, backed by a global team

Voith engineers have the knowledge and experience to advise you on the best coupling solution for your operation. All components are checked and rechecked before shipment, ensuring failure-free systems 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 also 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.

Whether your requirement is for routine maintenance, fast-response repairs, or a complete system overhaul, Voith has the global support staff to do the job. If you 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. And with our worldwide service center and parts network, whatever you need is always close at hand.

Protecting your investment in every way possible

- Optimized coupling solutions for every AFC requirement
- Engineering new systems and optimizing existing systems
- Drive system modernization and retrofits
- System analysis, maintenance, overhaul, and repairs
- Commissioning and follow-up service
- Lifetime availability of spare parts
- Training and service agreements

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VOITH
Engineered Reliability