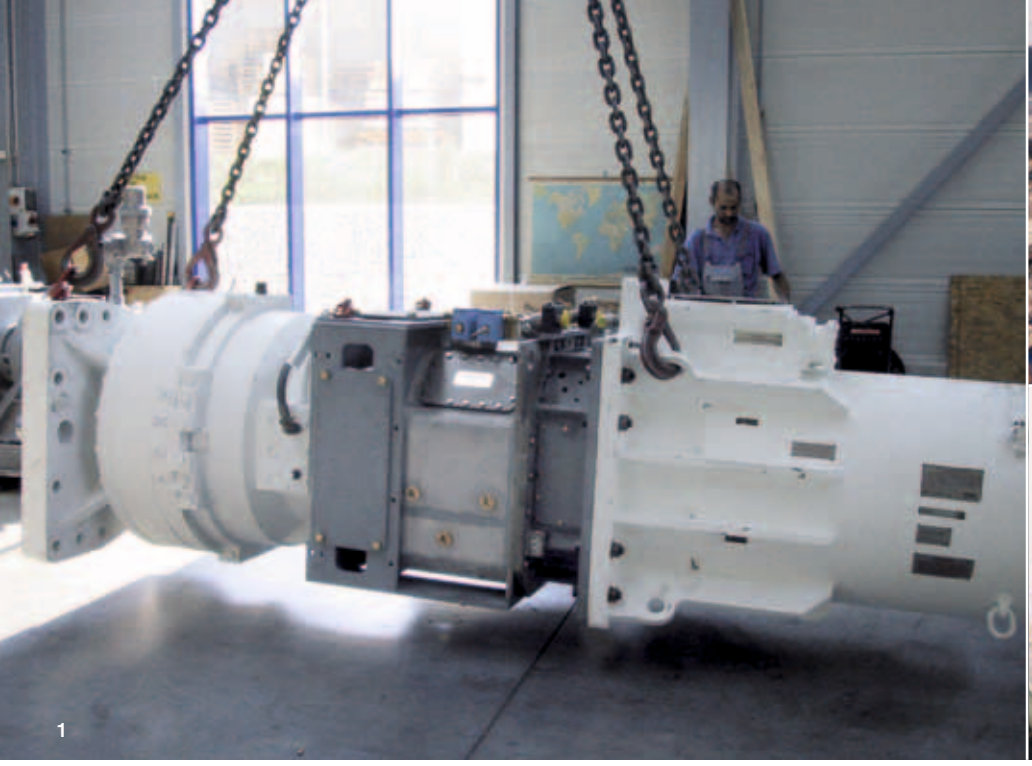
VOITH

Secure your Production.
Fill-controlled Fluid Couplings.

Start-up Components

We are the experts in constant-fill and fill-controlled fluid couplings at Voith Turbo. Voith Turbo, the specialist for hydrodynamic drive, coupling and braking systems for road, rail and industrial applications, as well as for ship propulsion systems, is a Group Division of Voith GmbH.

Voith is one of the largest family-owned companies in Europe with a workforce of around 42,000, EUR 5.7 billion in sales in the 2011 / 2012 fiscal year. The company is active in the energy, oil and gas, paper and raw materials as well as transportation and automotive markets around the world.



1 AFC drive train with 562 DTPKW-TTT

2 Belt conveyor drive train with 650 TPKL

3 Car shredder drive train with 1150 TP

Fill-controlled fluid couplings from Voith Turbo – The gentle way of getting masses going

Be it raw material extraction or process technology – wherever large masses need to be moved, high powers are required. But the higher the power, the heavier the wear. Protect your drive systems and components with fill-controlled couplings from Voith Turbo. They control and accelerate your machine gently and protect the drivetrain against damage in the event of an overload.

Machines such as shredders, crushers, armored face conveyors (AFC) or mills can suddenly block as a result of overload. Fill-controlled couplings “slip” when an overload occurs and protect the driveline effectively.

By varying their fill levels, they control the transmission of torque and consequently also the operating speed, steplessly and smoothly. In combination with an electronic start-up control system, run-up times of up to several minutes are realized. Tensile forces occurring during the start-up of belt conveyors are reduced to a minimum.

The best solution for any requirement

Single or as a “double-pack”: Voith Turbo has the right solution for your application. Depending on requirements, the hydrodynamic circuit consisting of a single set of pump and turbine wheels (TPK) can also be combined in pairs into a double coupling circuit (DTPK).

Three different designs are described on the following pages

7 10 13	Pages with product overview
7 8 9	**DTPK** – externally supported, compact unit for industrial applications
10 11 12	**TPKL** – self-supported, drive module for above and below ground belt conveyors
13 14 15	**DTPKW** – special design for mining applications, using water as the operating medium

Application features and benefits

Application	Characteristics								
	Start-up aid (load-free motor start)	Acceleration of heavy masses	Overload protection	Speed control	Vibration damping	Multi-motor drive (sequential start of motors)	Limitation of starting torque	Load compensation between drives	Break-away of driven machine
Crushers	+	++	++		++				
Shredders	+	++	+++		++		+		
Ball mills	+++				+				++
Vertical mills	++		+		+				++
Centrifuges	+	+++					+		
Belt conveyors	+	++		+		++	+++	++	+
AFC	++		+++	+		+++	++	++	+++
Mixers	+		+		+				++
Beaters	+	+	++	+	+				++
Gas turbine start	+	+++		+			+		+
Fans (retrofit)	+	++		++			+		
Pumps (retrofit)				++					

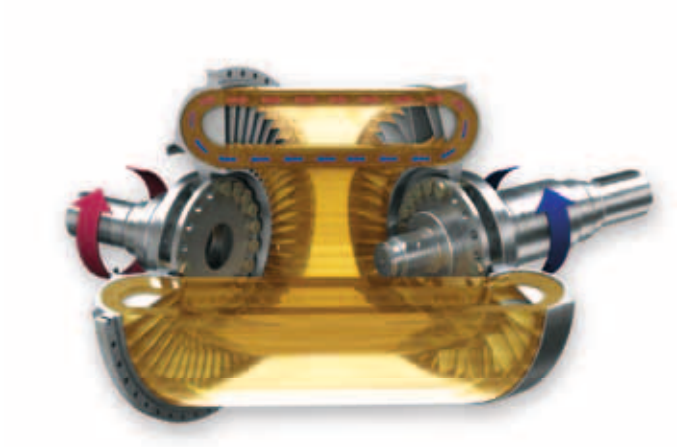
Wear-free power transmission in compact design

Voith Turbo hydrodynamic couplings combine, in the smallest of spaces, a circular pump (pump wheel) and a turbine (turbine wheel) which drives a driven machine. Torque emitted from the motor is converted into flow energy by the pump wheel. The turbine wheel transmits this energy as mechanical energy to the driven machine.

Continuously variable between “completely full” and “completely empty”

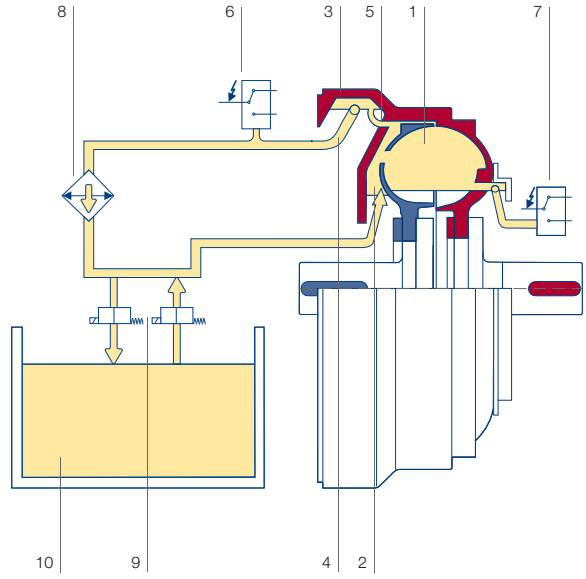
By changing the fill level in the working circuit, the transmission of torque, and consequently the operating speed of the driven machine, is adjusted smoothly and steplessly: the filling medium flows freely into the coupling‘s catching ring, and then into the working circuit by centrifugal force. The fluid between the pump and turbine wheels transmits torque via hydrodynamic action. To allow for filling control and heat dissipation, the fluid exits the working circuit via nozzles into a rotating pump shell. There, it is taken up by a dynamic pressure pump, which points into rotating fluid ring and, via the cooler, redirected back to the collecting ring. Two solenoid valves control (entirely without external moving parts) the active fluid volume in the working circuit between “completely full” and “completely empty” by adding or removing fluid from the couplings working circuit.

The basic function principle



Via an operating fluid, the pump wheel driven by the motor transmits power wear-free to the turbine wheel which, in turn, drives the driven machine.

TP coupling functional principle

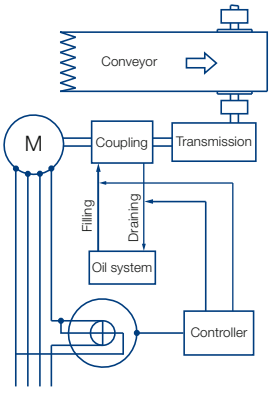


1 Working circuit
2 Collecting ring
3 Pump shell
4 Dynamic pressure pump
5 Nozzles
6 Temperature monitoring
7 100 % fill level sensor (optional)
8 Cooler
9 Solenoid valves
10 Tank

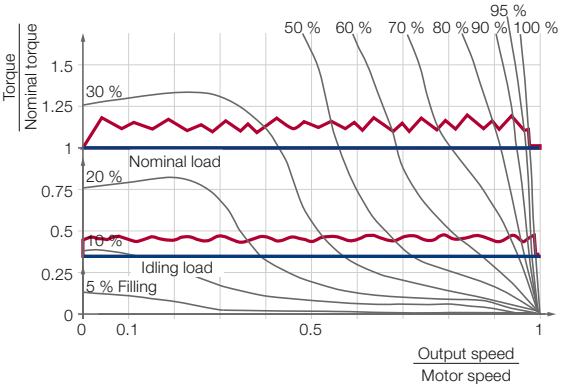
Advantages which impress

+ Wear-free transmission of power
+ Smooth build-up of break-away torque
+ Controlled acceleration of heaviest masses
+ Overload protection in the event of a blockage
+ Damping of torsional vibrations and jolts
+ Variable speed adjustment of the driven machine
+ Clutching and declutching of driven machine while motor is running
+ High efficiency at nominal operation owing to low slip
+ Load-free motor start-up; therefore possibility of frequent starts, even with motors with lower service factors
+ In the case of multi-motor drives, the electric grid is protected owing to sequential starts of individual motors
+ Available in specific designs for water as the operating medium
+ Insensitive to extreme ambient conditions such as dust, heat and cold
+ Robust design with long service life and high availability
+ Available in explosion-proof design

Smooth start-up



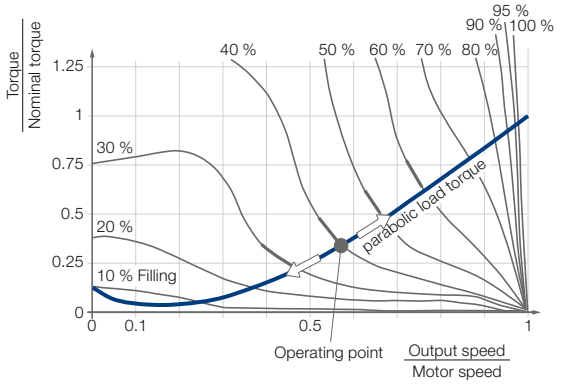
Belt conveyor start-up – Constant load torque



The smoother a machine accelerates, the more it is protected. This is especially important for the belt itself, typically the most expensive component in the system. To enable this, an electronic control processes the values of motor power and belt speed. Correspondingly, it actuates the fill and drain valve to achieve controlled acceleration of the conveyor, minimizing the tensile forces in the belt during start-up. Parameters for acceleration periods of up to several minutes can be set.

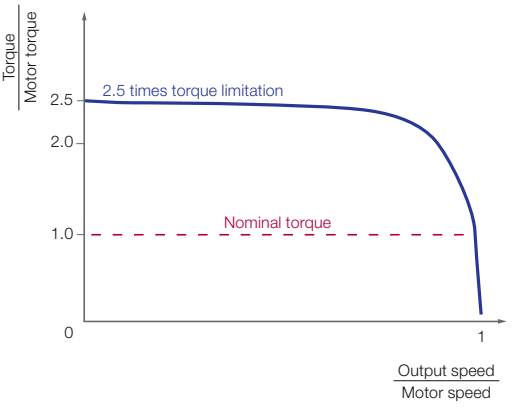
Speed control

Drive with parabolic load torque



Fill-controlled couplings, by modifying the fill level, can provide accurate speed control under full load for parabolic load machines, e.g. centrifugal pumps and fans and can also provide partial speed control for empty conveyor systems for inspection and maintenance.

Protecting the driveline



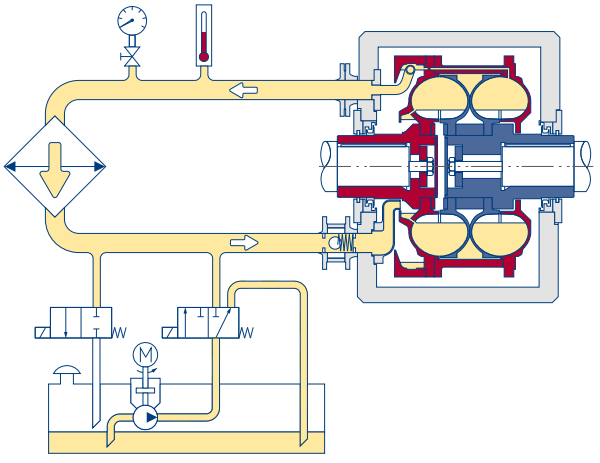
Machines such as shredders, crushers or armored face conveyors (AFC) are subject to blockage as a result of overload. Here, the coupling protects the driveline effectively: slip increases as a result of higher load until a maximum hydrodynamic torque limit is reached. This level can be factory set within the range of approximately 1.8 – 3.0 times.

DTPK – the compact coupling variation

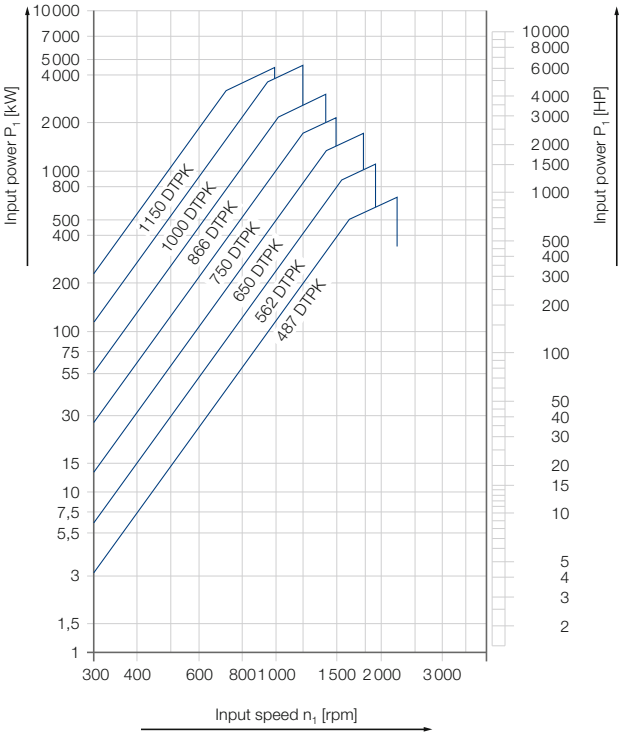
The highly compact fluid couplings of type DTPK are primarily used in drives in mills, shredders, pumps and fans. They are extremely maintenance-friendly and can operate at partial speeds.

DTPK couplings are externally supported. Their runner parts are directly installed with the hub to the shafts of the motor and driven machine, which must accommodate the axial forces created by hydrodynamics as well as the coupling's weight forces. In order to minimize these values, the runners are made from aluminum and designed as a double circuit. The shafts are sealed using contact-free labyrinths – and therefore do not contain any wearing parts. Connecting couplings are not required.

Design of DTPK coupling – Nominal operation



Perfomance diagram



The ideal coupling for retrofit projects

Compact design and a separate oil supply system make DTPK couplings the ideal choice for all retrofit projects, or where there is minimal space in the drive area. Existing plants can be rebuilt easily and quickly. Oil supply systems can be designed to provide lube oil for other drive components. The final assembly of the coupling is carried out directly on site with the preassembled components.

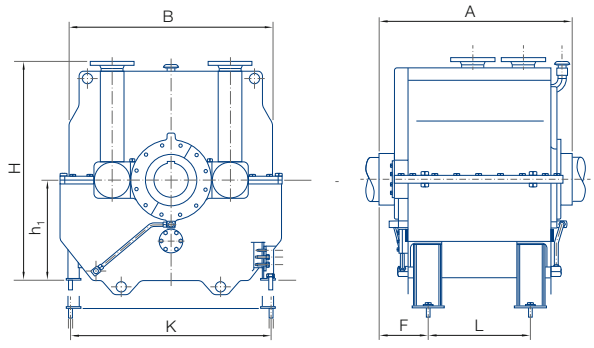
Areas of application

- Shredders
- Mills
- Retrofits in fans and pumps
- Pulpers

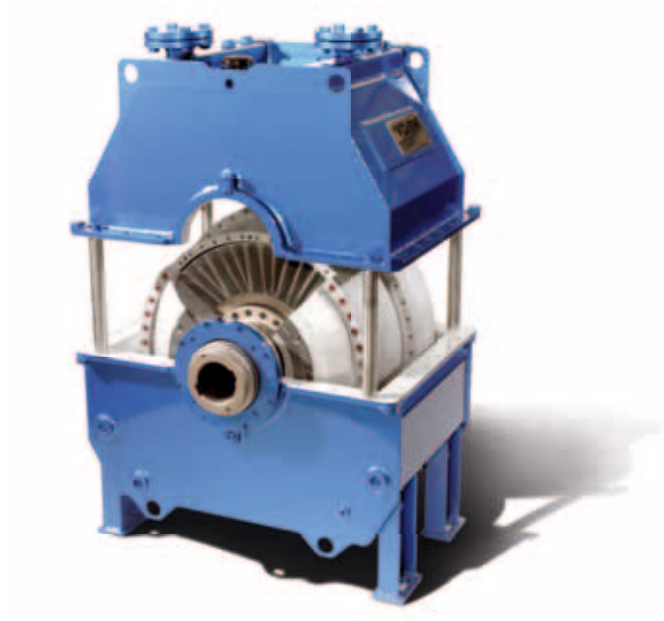
Design-specific advantages

+ Extremely maintenance-friendly, no bearings, no shaft sealing rings, no connecting couplings
+ Low installation dimensions
+ Speed control
+ Also available for water as the operating medium

DTPK



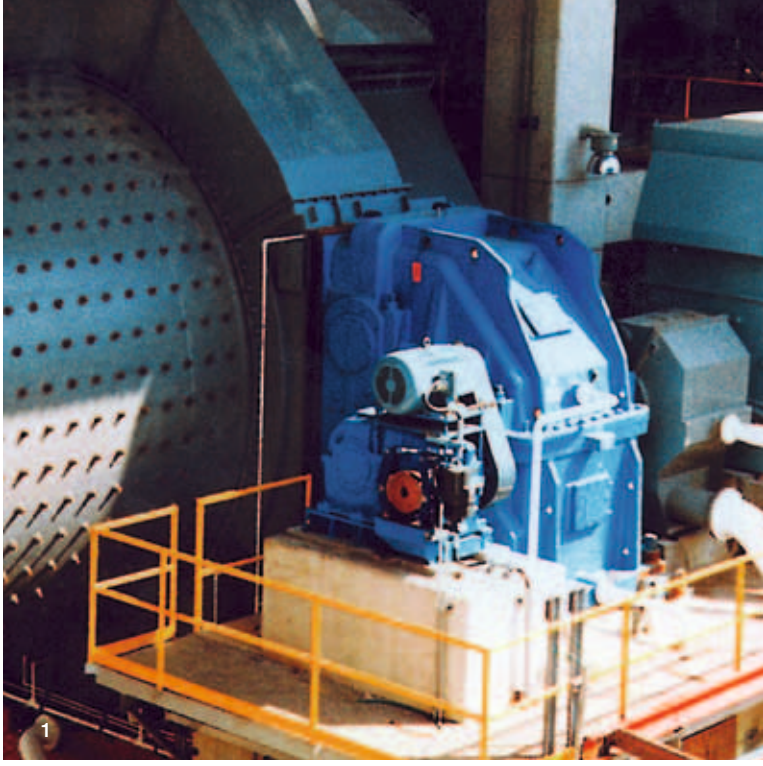
DTPK coupling



Major dimensions

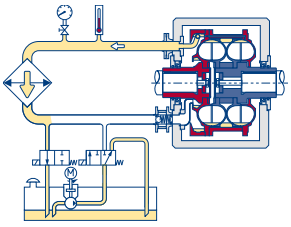
Size	Type	A	B	F	L	K	H	h_1
487	DTPK	670	816	194	290	766	923	485
562	DTPK	720	860	194	340	806	1000	525
650	DTPK	800	1030	204.5	360	980	1108	605
750	DTPK	970	1140	223.5	508	1020	1255	650
866	DTPK	1125	1300	380	465	1220	1460	765
1000	DTPK	1250	1530	354.5	500	1500	1695	920
1150	DTPK	1420	1795	425	570	1700	1903	1055

Dimensions in mm (subject to modifications)

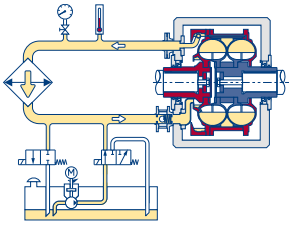


Ball mill drive: input power 5 400 kW at 1 200 rpm

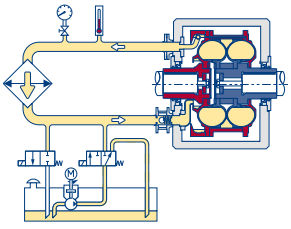
Operating conditions



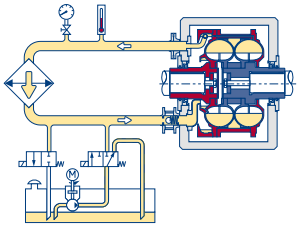
Motor start



Acceleration of driven machine

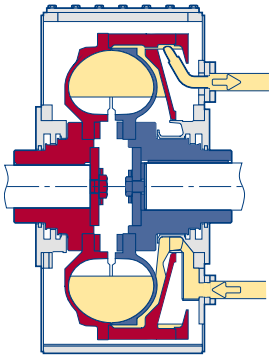


Nominal operation



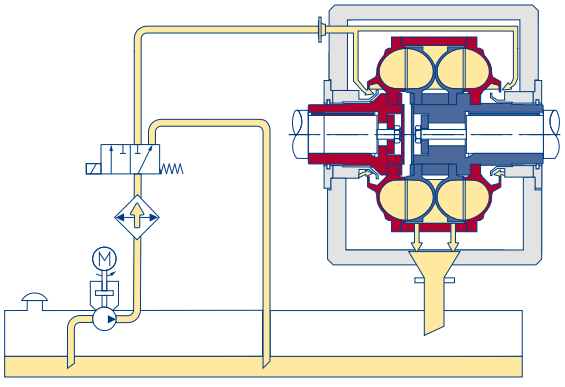
Operation at part-load speed

Type with one coupling circuit (TPK)



Type with one coupling circuit (TPK)
With this version, extremely short installation spaces can be realized. Higher axial forces are, however, to be taken into consideration. When retrofitting existing plants, shifting of individual components is reduced to a minimum.

Type with “open” operating circuit (DTP)



Type with “open” operating circuit (DTP)
The predecessor to the DTPK – with the most simple design.

TPKL / DTPKL – impressive advantages for belt conveyor start-ups

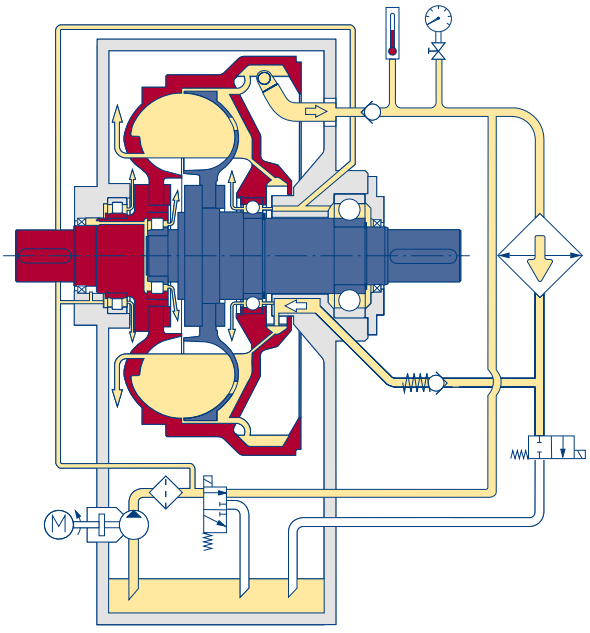
Fluid coupling types TPKL / DTPKL have been developed especially for tough belt conveyor applications at in mining environments. Adapted to the prevailing load condition, they smoothly control acceleration processes and ensure even load distribution with multi-motor drives. But their advantages also prove impressive in other applications that are typical of fill-controlled couplings.

The external cooler makes the drive extremely thermally efficient. Overloads are effortlessly overcome. Starting times of up to several minutes are mastered without problems. For inspection runs and positioning, the empty belt can be moved at approximately 20 % of its nominal speed.

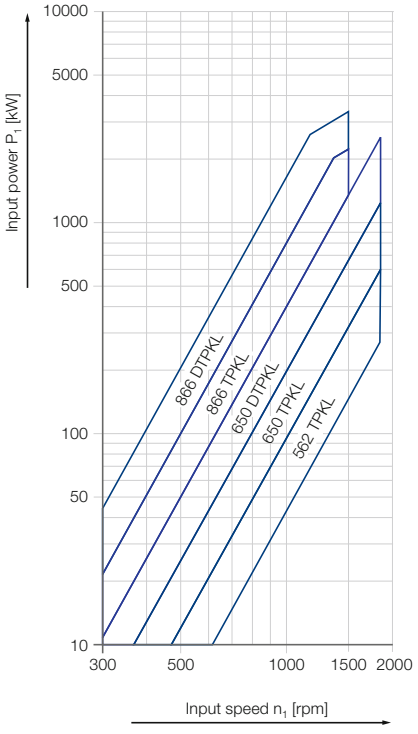
Mechanical design

- Self-supported, independent unit for mounting on foundations or swing frame
- Reinforced bearings and shafts for heavy mining applications
- Robust welded housing
- Oil tank integrated into housing
- Fully piped with the exception of the separate cooler
- Cooling provided even when plant is at a standstill
- No movable external parts

Design of TPKL coupling – Nominal operation



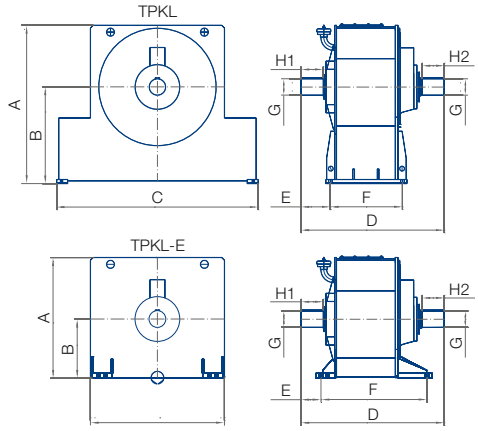
Perfomance diagram



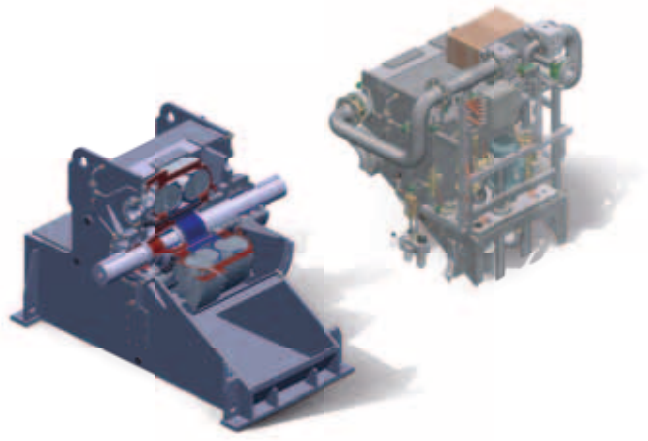
Design-specific advantages

+ Design optimized for mining applications – extremely robust and compact
+ Standardized unit – with little need for technical clarification
+ Easy maintenance of complete driveline thanks to modular construction

TPKL / TPKL-E



(D)TPKL



Major dimensions

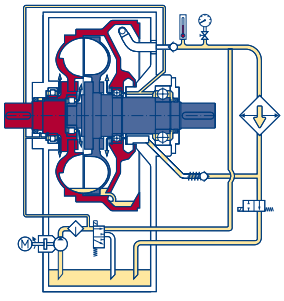
Size	Type	A	B	C	D	E	F	G m6	H1	H2
562	TPKL	1000	615	1130	849	230	310	90	135	128
562	TPKL-E	814	400	844	766	137	520	90	97	98
650	TPKL	1165	710	1480	1055	217	530	120	165	165
650	TPKL-E	888	435	985	1055	148	780	120	165	165
650	DTPKL	1165	710	1480	1200	217	675	120	165	165
650	DTPKL-E	910	455	985	1200	217	675	120	165	165
866	TPKL	1530	900	2200	1575	290	883	160	240	240
866	DTPKL	1530	900	2200	1575	290	1058	160	240	240

Dimensions in mm (subject to modifications)

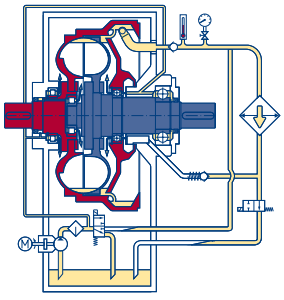
1 TPKL coupling

2 TPKL-E

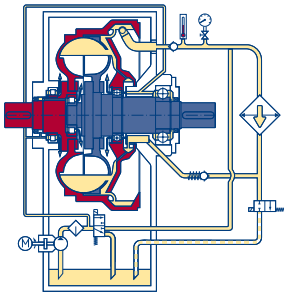
Operating conditions



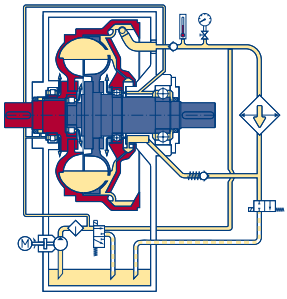
Standstill cooling



Motor start



Inspection speed



Machine start

Coupling types TPKL-R and TPKL-E

All coupling sizes of this type are available as a TPKL / DTPKL standard version with an integrated oil tank. For lower shaft centerline heights, the variant (D)TPKL-R has a flatter, but longer tank (dimensions available upon request). The most compact installation space is offered by the (D)TPKL-E as it does not have an oil tank of its own. The tank is situated externally or, for example, integrated into the swing frame.

Start-up of a belt conveyor

On belt conveyors with several drives, the motors are started sequentially in order to reduce stress on the electric power supply. Only then are the couplings filled, and the belt tension is gradually increased up to break-away. Longitudinal tension waves in the belt are therefore avoided. Controlled acceleration taking up to several minutes minimizes the start-up factor. An external cooler offers very high thermal reserves for frequent starts and inspection speed.

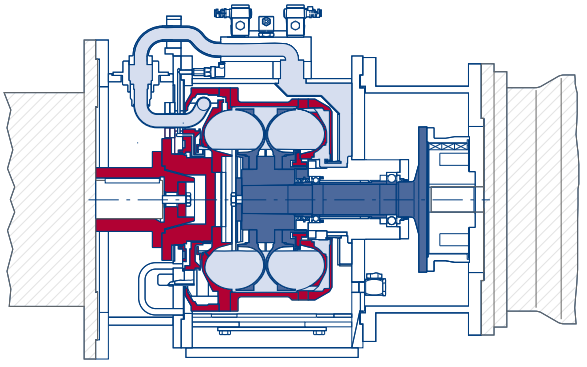
DTPKW – breaking away heaviest masses

DTPKW fluid couplings have been developed for the toughest drive applications at the coal face. They use water as the operating medium, as water offers the highest thermal capacity, is environmentally friendly and meets the safety standards for non-flammable operating media. Owing to their double circuit, DTPKW couplings are also ideal for minimum headroom.

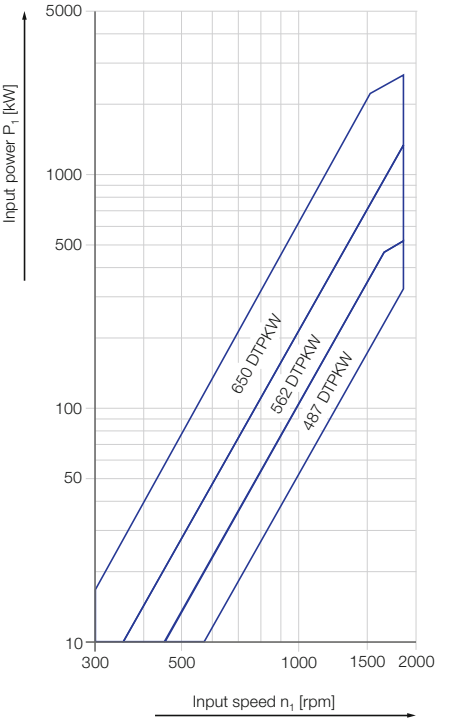
DTPKW couplings have the most robust design of the entire series, because they have been designed for the most extreme operating conditions. They are designed as a tunnel version mount style, eliminating the need for alignment of the driveline components (motor-coupling-reducer).

All control components and sensors are intrinsically safe. Valves used for controlling the water are situated in a block and directly integrated into the unit. An optional torque limit for overloads is set in the factory. This torque is 2.5 to 3 times the nominal torque and is designed to protect motor, gearbox, and chain.

Design of DTPKWL2 coupling – Nominal operation



Perfomance diagram



Areas of application

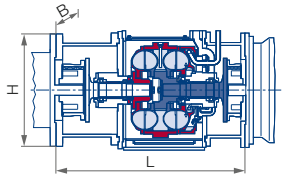
DTPKW couplings have been developed especially for armored face conveyors (AFC), but they can also be used on other applications where oil is not permitted as an operating fluid.

DTPKW couplings are available in externally or self-supported versions. An outstanding feature of externally supported models is their short installation length, while self-supported models can be mounted more quickly.

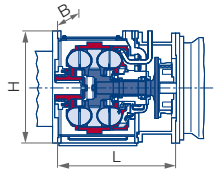
Design-specific advantages

+ Almost unlimited frequency of start-ups
+ Safe automatic torque limitation
+ Water-operated
+ (non-flammable, environmentally friendly)
+ Compact design (tunnel design)
+ No water tank if operated from water supply network
+ Easy control and monitoring

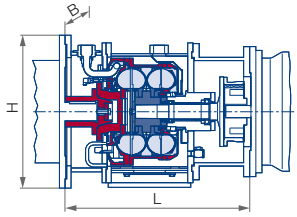
Design variants



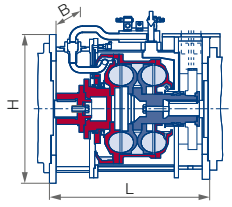
DTPKWL



DTPKWL2

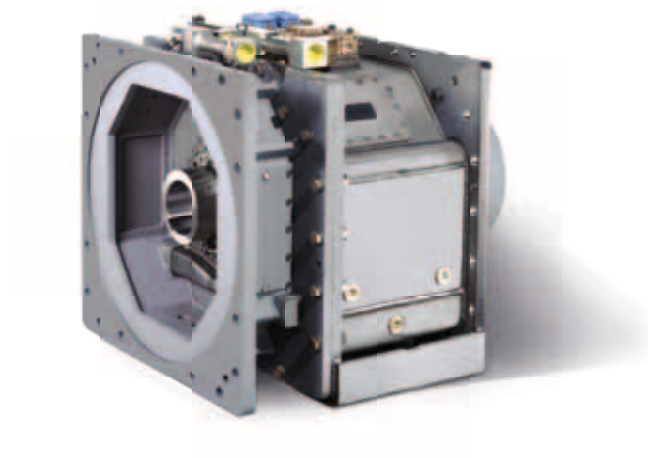


DTPKWL2-800



DTPKW-TTT

562 DTPKWL2 coupling

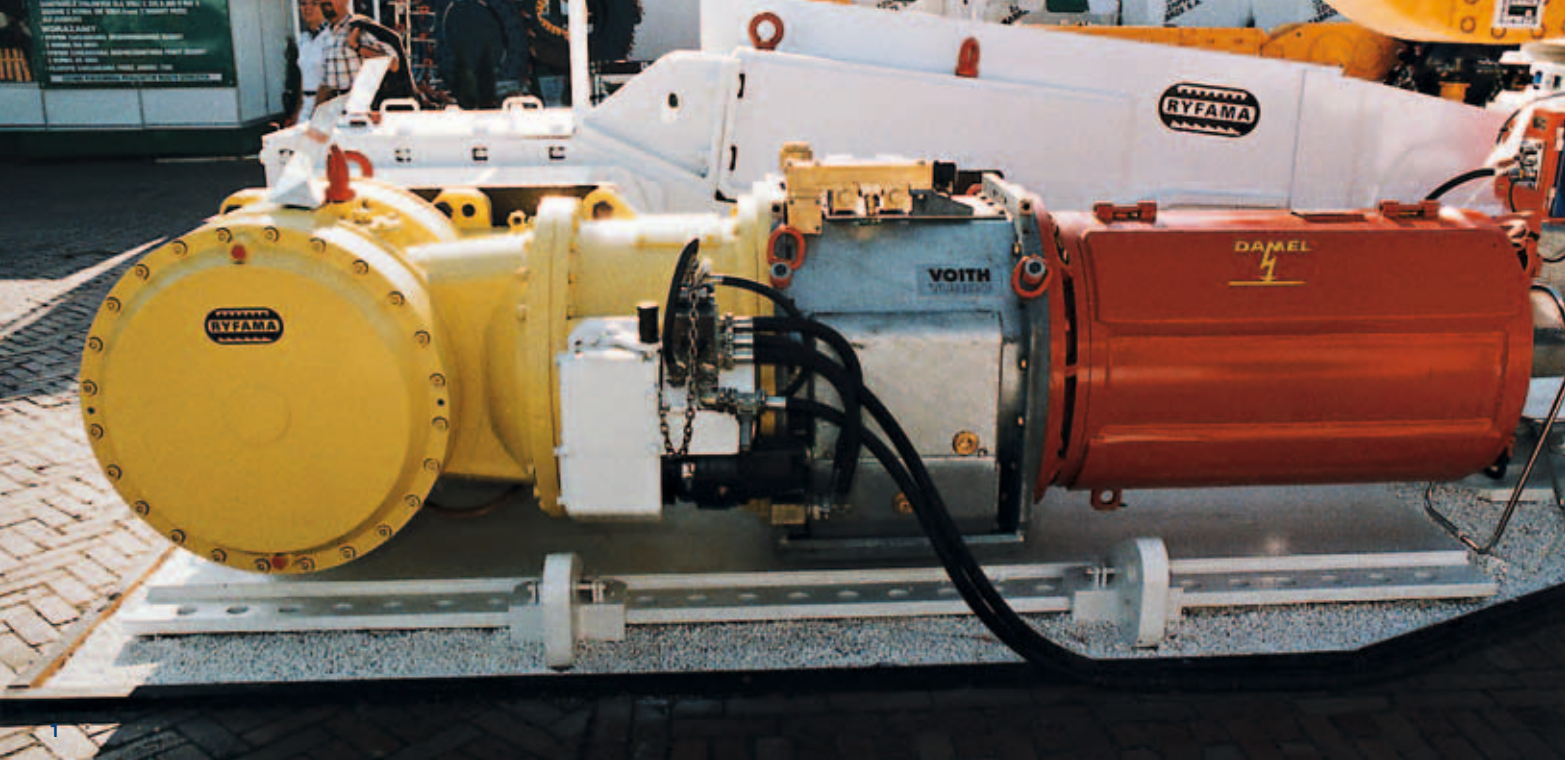


Major dimensions

Size	Type	L	H	B[1]
487	DTPKWL	1420	860	860
562	DTPKWL	1420	860	860
487	DTPKWL2	1100	860	860
562	DTPKWL2	1100	860	860
562	DTPKWL2-800	1300	950	950
562	DTPKW-TTT	970	950	950
650	DTPKW-TTT	1150	1050	1050

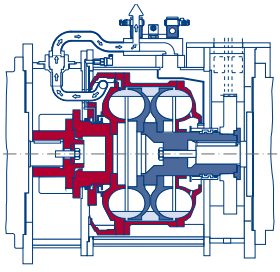
Dimensions in mm (subject to modifications)

[1]Installation width

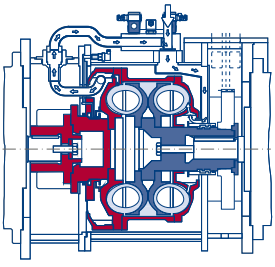


1 AFC with 562 DTPKWL2, input power 500 kW

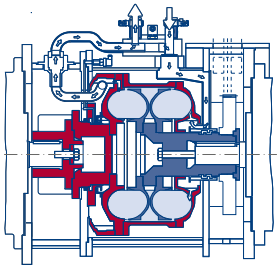
Operating conditions



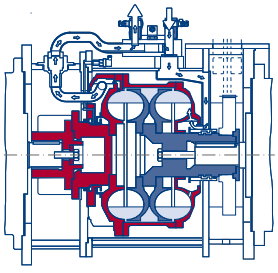
Motor run-up and disposal of excess water



Start-up of driven machine



Nominal operation with water exchange for cooling



Operation with partially filled coupling / Creep speed

Minimum water requirements during operation

At normal load conditions, the water is only slightly heated. In nominal operation, it stays in the closed coupling circuit until the thermal limit of 55 °C is reached. Only then is the water exchanged.

Apart from cooling with fresh water, a cooler can optionally be integrated into the coupling circuit, utilizing the cooling water of the motor and the gearbox. The water requirements of the coupling can therefore be even further reduced.

Maximum frequency of start-ups

During start-up attempts against the blocked conveyor, the coupling can heat up to max. 100 °C. For each further attempt, cold water from the fresh water supply system is available. The number of repeat start-ups is therefore unlimited.

cr112en, ak, 01.2015, 0. Dimensions and illustrations without obligation. Subject to modifications.

Voith Turbo GmbH & Co. KG
Startup Components
Voithstr. 1
74564 Crailsheim, Germany
Tel. +49 79 51 32-409
Fax +49 79 51 32-213
startup.components@voith.com

voith.com/fluid-couplings

VOITH
Engineered Reliability