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VOITH

Reliability through simplicity
Voith hydrodynamic torque converters

Get the

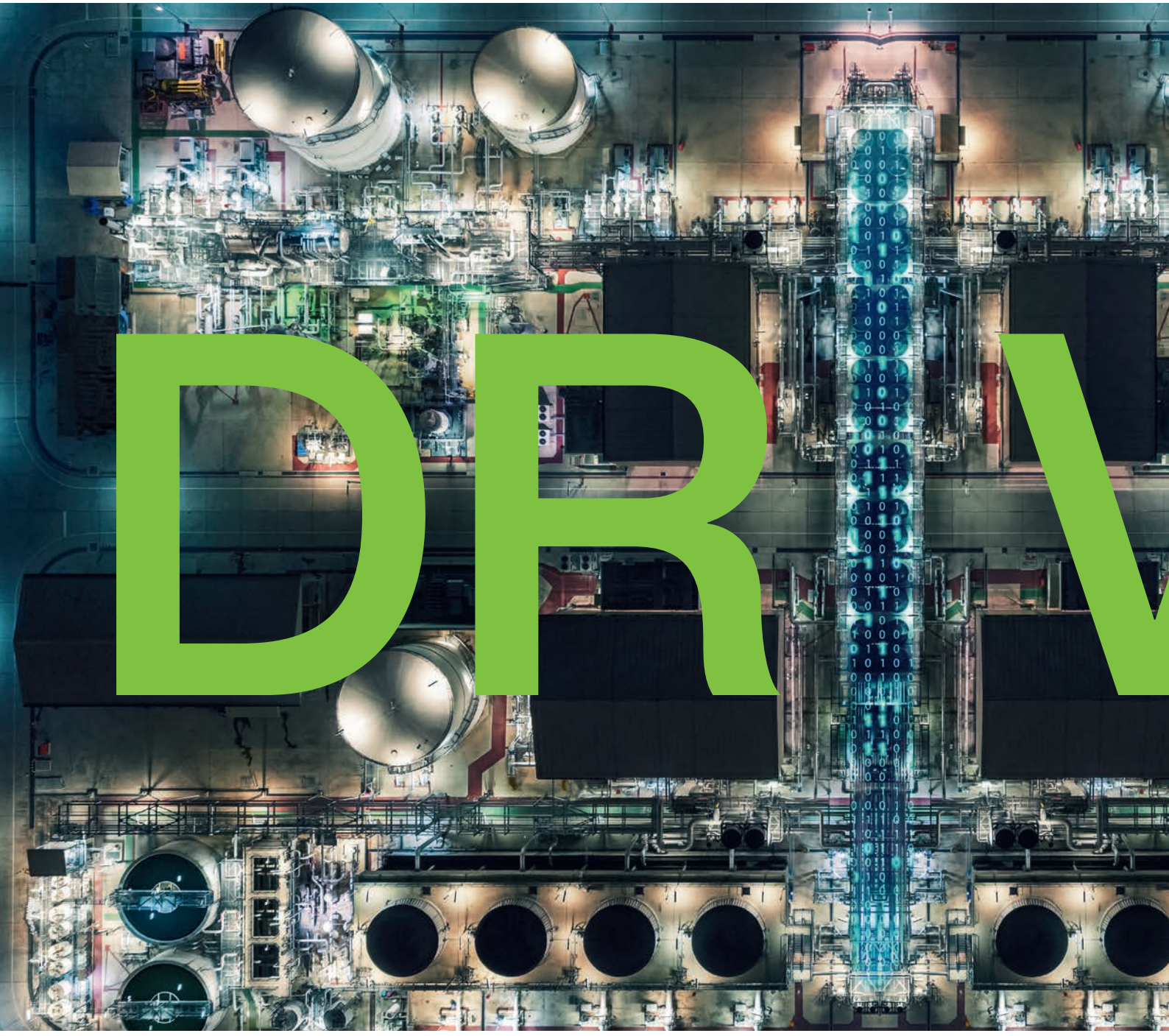


Table of contents

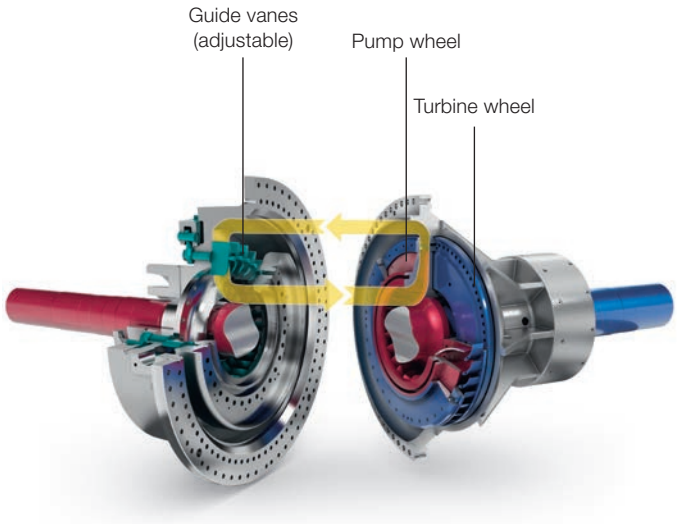
Reliable starting and operation of drivetrains can be challenging, especially when working with heavy load conditions. Increased torque is often required where drive motors or gas turbines are installed. Offering great versatility and reliability, this simple and robust system covers a power range of up to 100 MW.

In general, there are two types of torque converters, depending on the torque and speed requirements of the application. The Type E… torque converters have fixed guide vanes, whereas the Type EL… torque converters are equipped with adjustable guide vanes.

How torque converters work

Torque converters are hydrodynamic transmissions, that were invented based on the “Foettinger Principle”. Driving power is transmitted without any wear and tear, while torque and speed are adjusted steplessly.

Basic design hydrodynamic torque converter



A hydrodynamic circuit consists of a pump, turbine and guide wheel with adjustable guide vanes. The mechanical energy of the motor is converted into kinetic fluid energy through the pump wheel. In the turbine wheel, this kinetic energy is converted back into mechanical energy and transmitted to the output shaft. The adjustable guide vanes regulate the mass flow thereby providing variable output speed.

Overcoming high breakaway forces easily

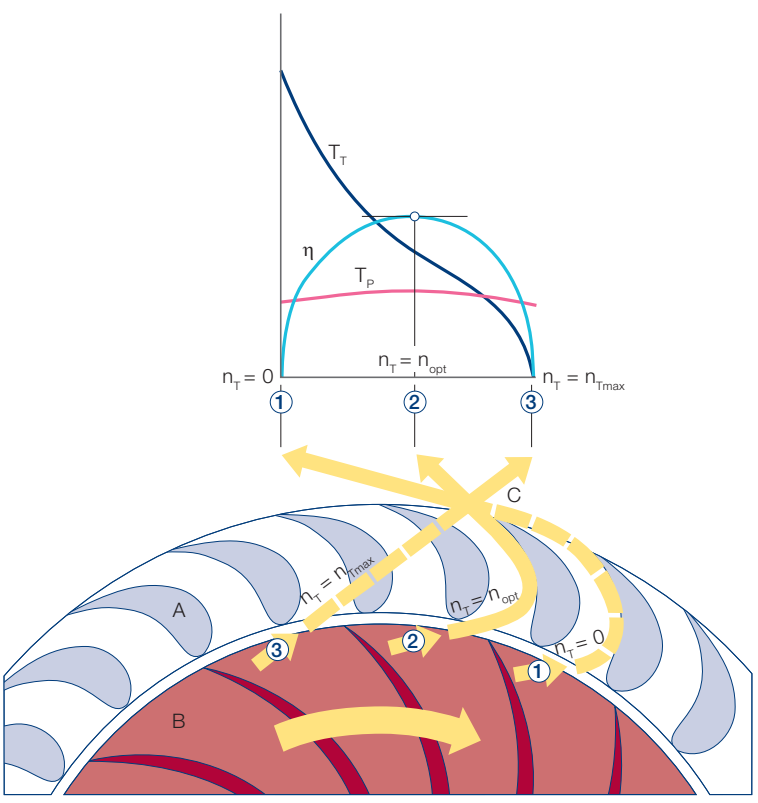
Optimal protection of the driver – no overload

The unique principle of the torque converter enables the input torque to be increased by a factor of 2 to 10.

A high breakaway force can be achieved when installing a Voith torque converter. Guide vanes ensure that the torque difference between turbine (output) and pump (input) is absorbed and transferred to the foundation.

By placing the guide vanes upstream of the pump wheel, the torque requirement of the pump (input) remains constant at a given guide vane setting, independent of the load on the turbine (output). That means an overload of the driver (motor or engine) is not possible through the hydraulic circuit. When the hydraulic fluid is removed from the torque converter circuit, the pump (input) is "uncoupled" from the turbine (output).

High torque availability for easy-start applications



T_T : Turbine torque
T_P : Pump torque
η : Efficiency
A : Turbine wheel
B : Pump wheel
C : Mass flow (oil)

Controls and guide vane adjustment for the Type EL… series

Closed guide vanes

Open guide vanes

Adjustable guide vanes can be controlled by a pneumatic, hydraulic or electric actuator, which receives an input signal of 4 to 20 mA or 0.2 to 1 bar from the customer's master control system. The feedback signal, to incorporate the torque converter in a closed control loop, can be provided by switches or as a 4 to 20 mA signal.

Benefits at a glance

Easy motor start-up

Torque converters help decouple heavy loads from the motor. Assuring an easy motor start.

Precise torque

Accelerating heavy loads smoothly and adjusting speed precisely.

Grid protection

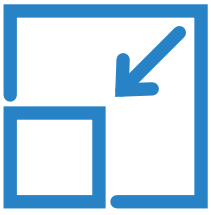
Protecting the electric grid and avoiding big voltage dips.

Vibration reduction

Torsional vibration damping during start-up.

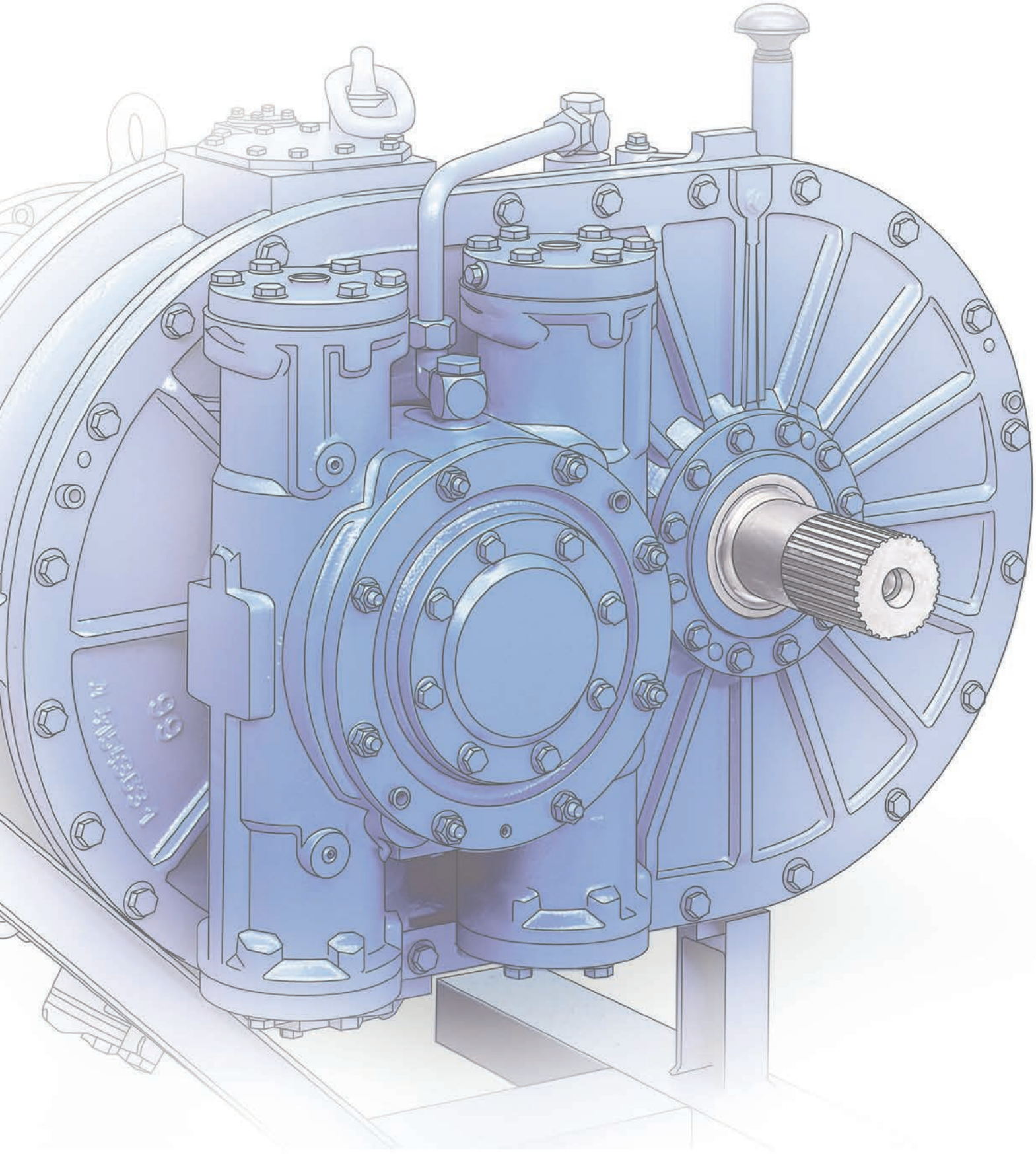
Long lifespan

Design life of 30 years thanks to a reliable and robust design with guaranteed service and spare part availability.



Small footprint

Saving space with the smallest footprint due to outstanding power density.



Compact and simple Type E...

Compact in design and built for high reliability!

The Type E... torque converter series is ideal for starting of gas turbines in a power range of up to 45 MW.

In diesel engine applications, the torque converter is ideally suited to the diesel motor characteristics. Subsequently, an unloaded engine start is facilitated.

For applications that have special speed requirements, a gear can be integrated. Furthermore, a hydraulic rotor turning device can also be integrated.

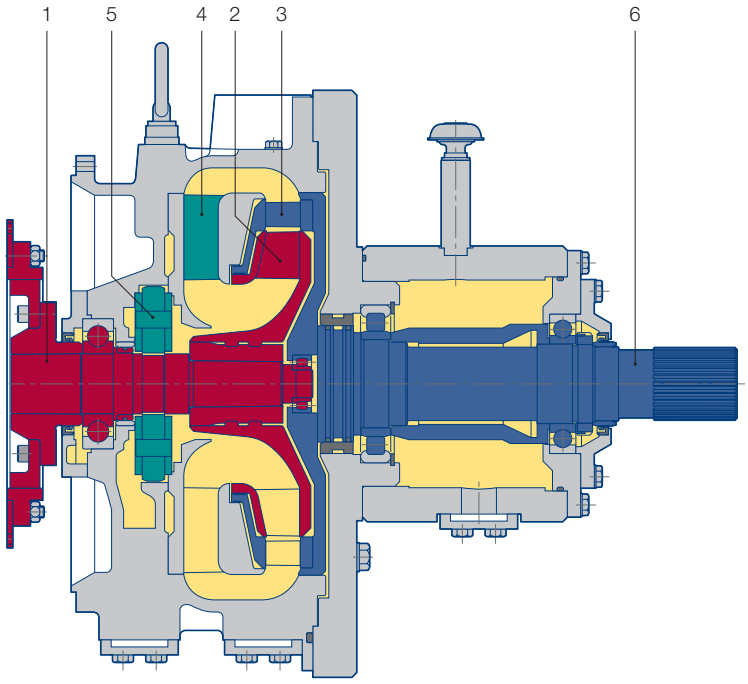
Typical application

- Starting of gas turbines up to 45 MW

Technical feature

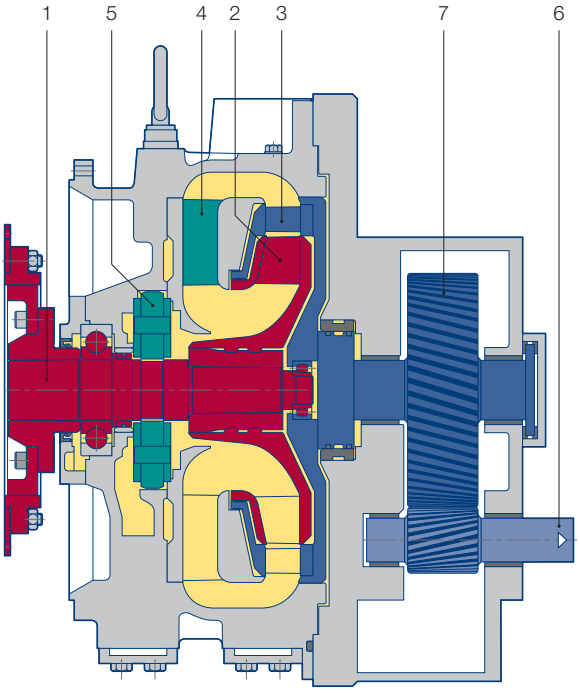
- Power range of 280 kW to 700 kW

Sectional drawing of torque converter Type E...



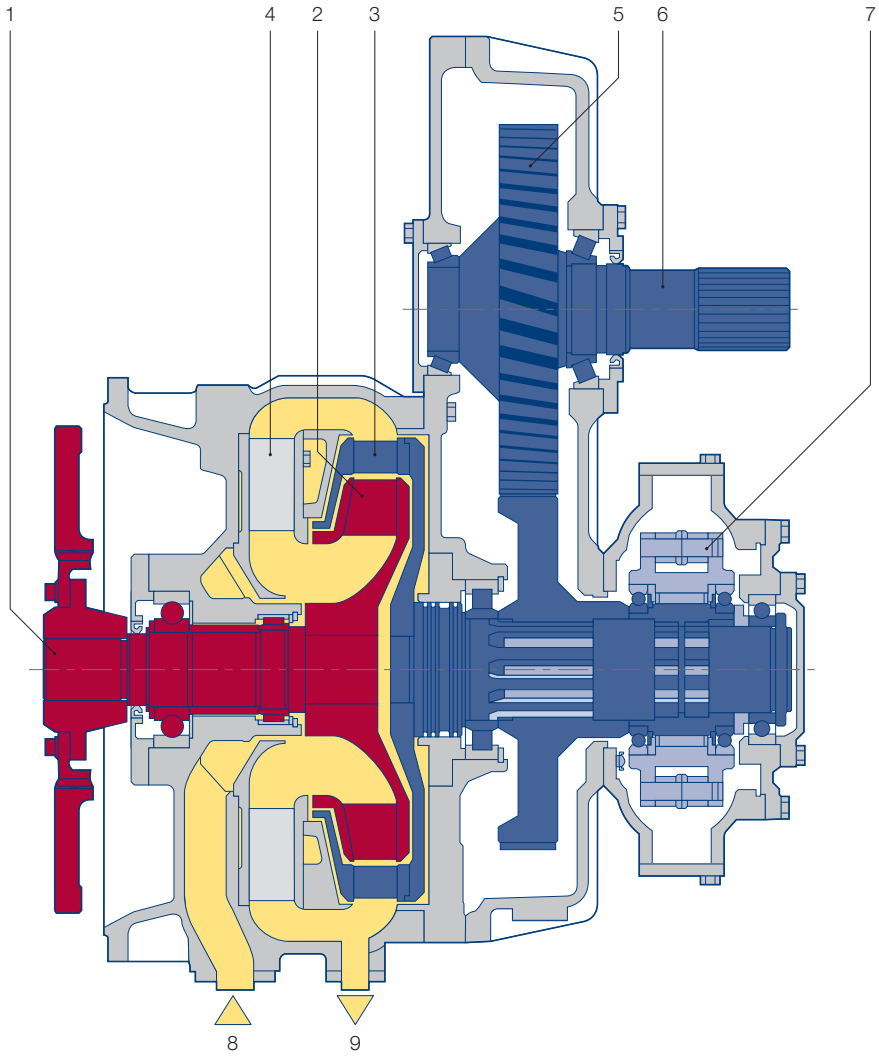
1 Input shaft
2 Pump wheel
3 Turbine wheel
4 Fixed guide vanes
5 Integrated gear pump
6 Output shaft

Sectional drawing of torque converter Type E... with an integrated gear stage



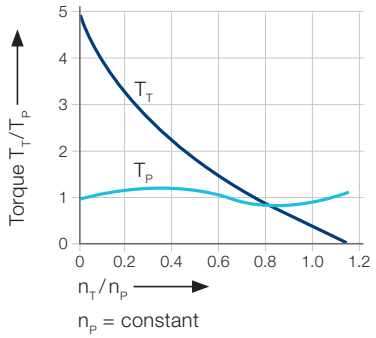
1 Input shaft
2 Pump wheel
3 Turbine wheel
4 Fixed guide vanes
5 Integrated gear pump
6 Output shaft
7 Gear stage

Sectional drawing of torque converter Type E…with an integrated gear stage and turning device



1 Input shaft with connecting coupling
2 Pump wheel
3 Turbine wheel
4 Fixed guide vanes
5 Gear stage
6 Output shaft
7 Hydrostatic turning device
8 Working oil supply
9 Working oil return

Torque/speed characteristics

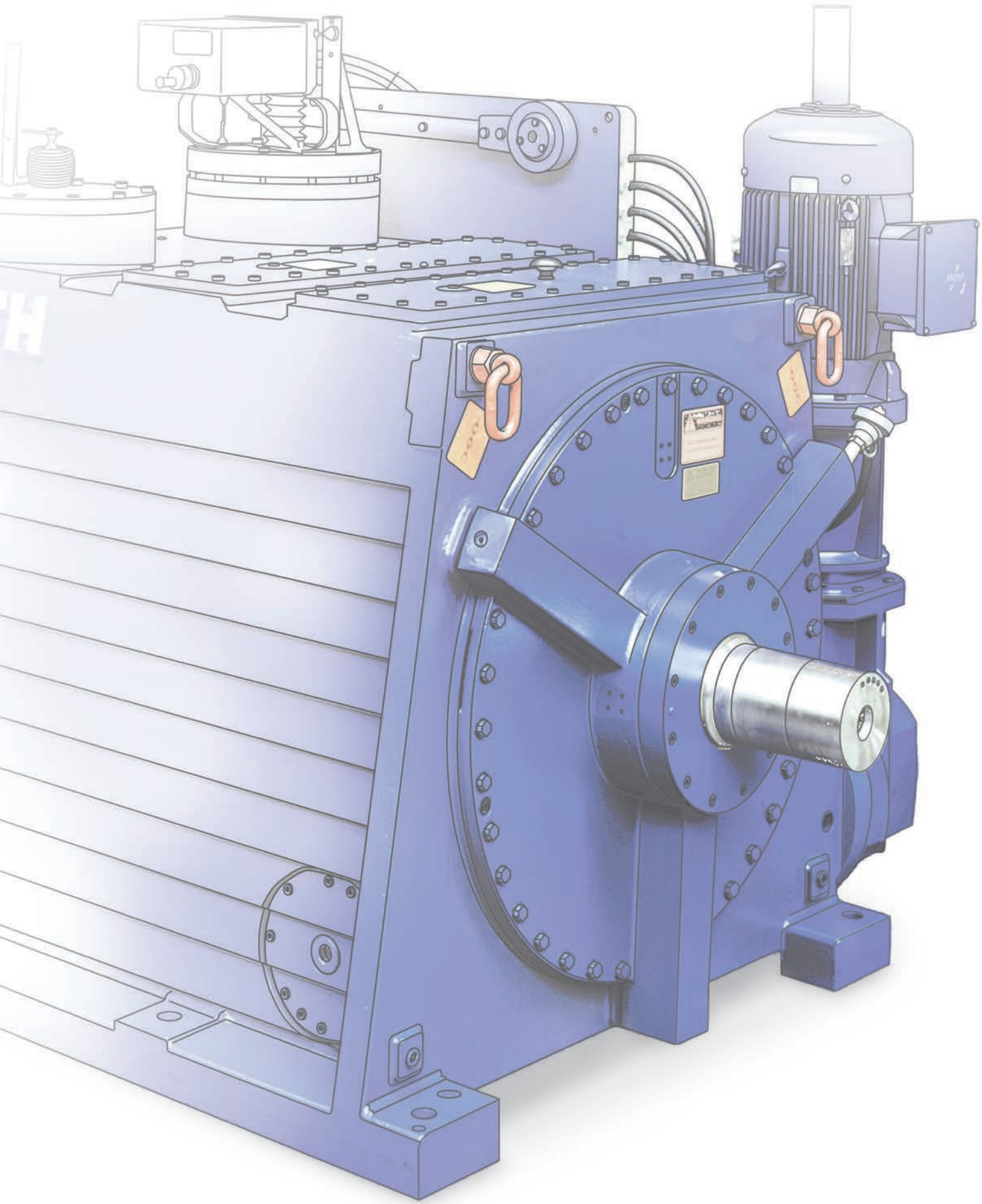


T_P: Input torque

T_T: Output torque

Examples of the torque converter Type E… series

Type	E 5 WAT	E 6 WAT	E 6 YAT	E 7 WAT	E 7 W	E 7 Y	E 8 W
Max. input power (kW)	280/300	450	450	460/460	700	700	700
Input speed (rpm)	3000/3600	3000	3600	2300/2100	3000	3600	2100
Turning	45° intermittent	45° intermittent	45° intermittent	45° intermittent	–	–	–
Breakaway torque (Nm)	11000	11000	11000	11000	–	–	–



Power meets speed
Type EL...

Fast and powerful!

The Type EL... torque converter is suited to driving machines over 50 MW, where a high breakaway torque is required.

Developed for electric motors with constant speed (induction motors/squirrel cage) or diesel engines with limited regulating range, the adjustable guide vanes control the output speed and torque within a wide operation range.

A smooth start of the driven machine is ensured, as there is no mechanical connection between the input and output shafts (referred to as an unloaded start).

Depending on the applications requirements, a torque amplification from factor 2 to 10 is provided. This starting and/or speed controling unit can therefore be used in a wide range of machines.

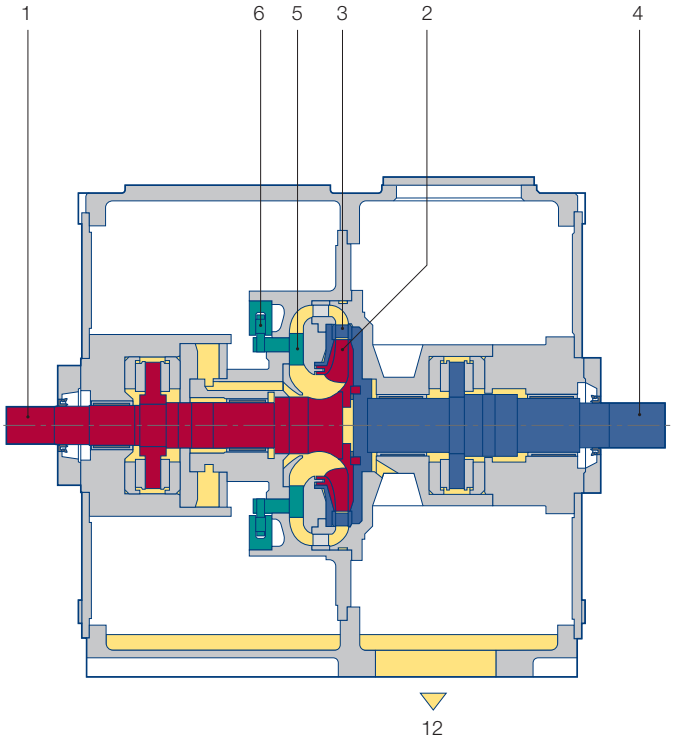
Typical applications

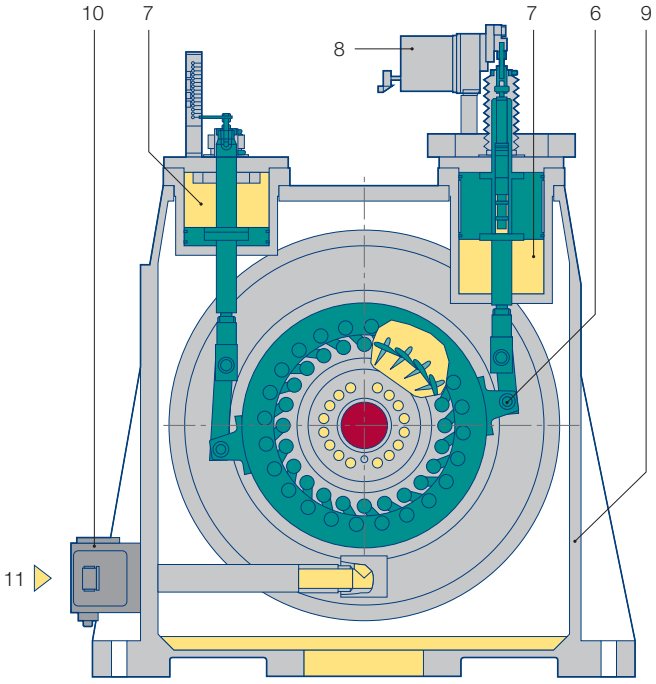
- Gas turbine starting
- Starter packages for large motors
- Test fields
- Reciprocating pumps
- Screw pumps
- Compressors
- Agitators
- Extruders
- Winches

Technical features

- Power range up to 65 MW
- Torque amplification factor of approximately 2 to 10
- Over-synchronous output speed is possible
- Hydraulic guide vane system is controlled by solenoid valves or an electric actuator
- Various operating points are easily obtained
- Type EL… can be combined with a separate or integrated rotor turning device.

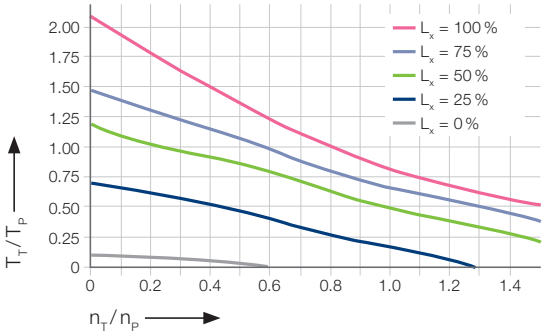
Sectional drawing of torque converter Type EL… with variable guide vanes

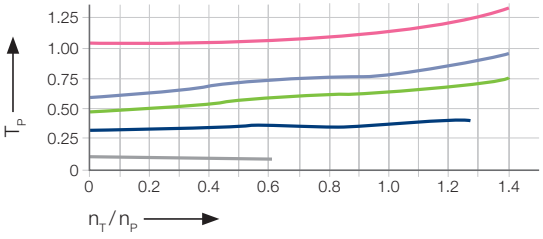




1 Input shaft
2 Pump wheel
3 Turbine wheel
4 Output shaft
5 Adjustable guide vanes
6 Adjusting mechanism
7 Hydraulic cylinder for guide vane adjusting
8 Guide vane actuator
9 Housing
10 Fill and drain valve
11 Operating oil supply
12 Operating oil return

Selected example of torque/speed characteristics

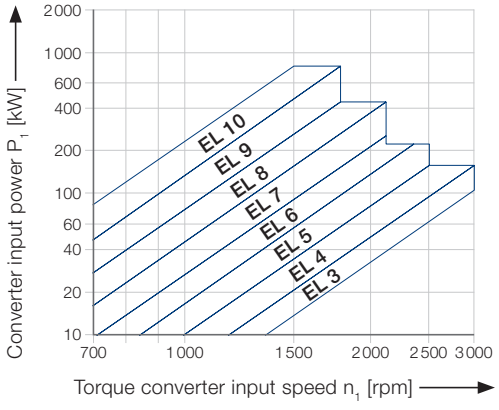


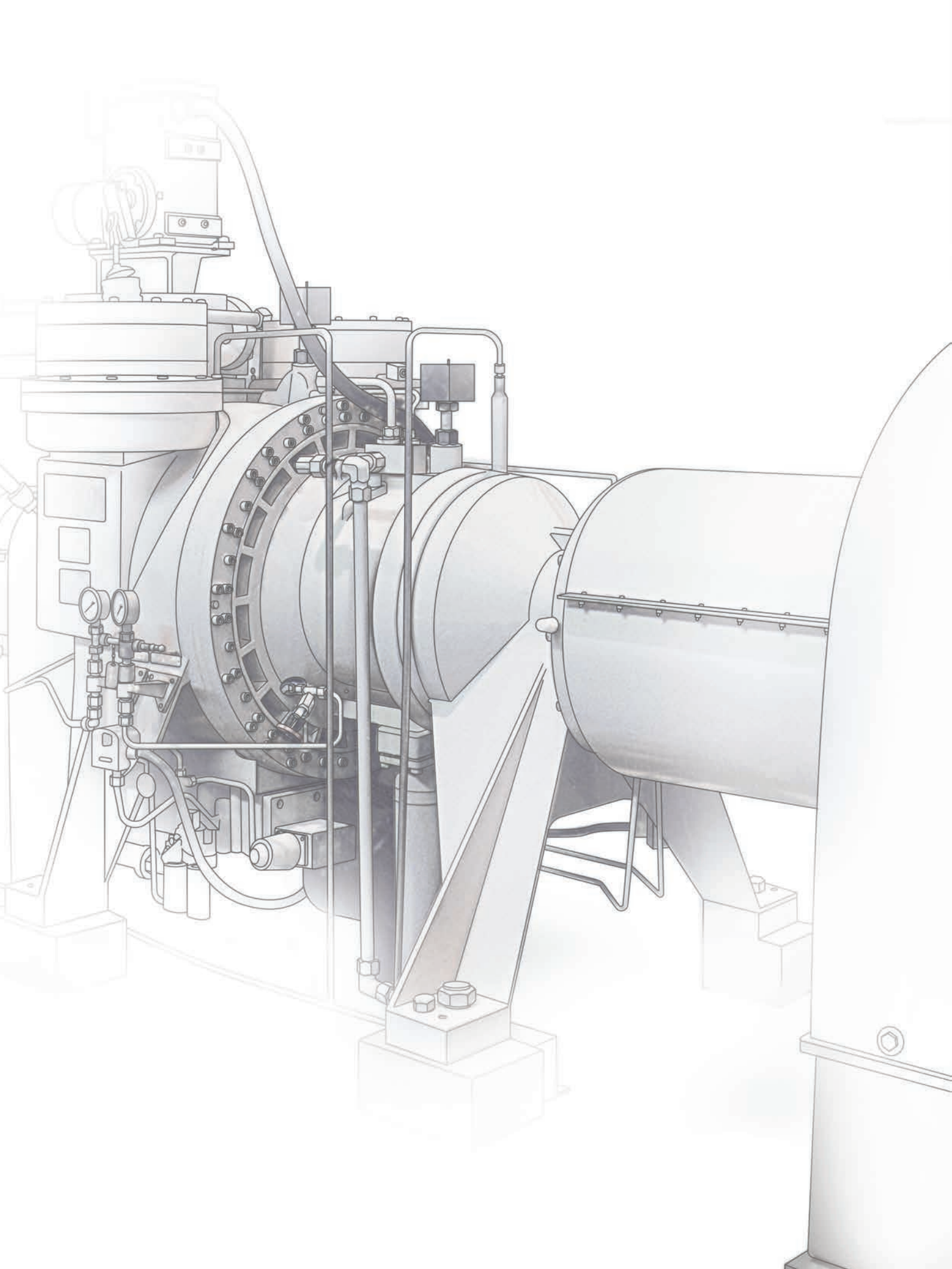


L_x: Guide vane position
T_P: Input torque
T_T: Output torque
n_P: Input speed
n_T: Output speed

Examples of the torque converter Type EL... series

Type	EL 9 G 6.0		EL 9 GTM 6.0-50	EL 10 GTM 7.5-86
Max. input power (kW)	6000	3400	6000	7500
Input speed (rpm)	3600	3000	3600	3600
Turning (rpm)	–	–	3.0	2.2
Breakaway torque (Nm)	–	–	50000	86000





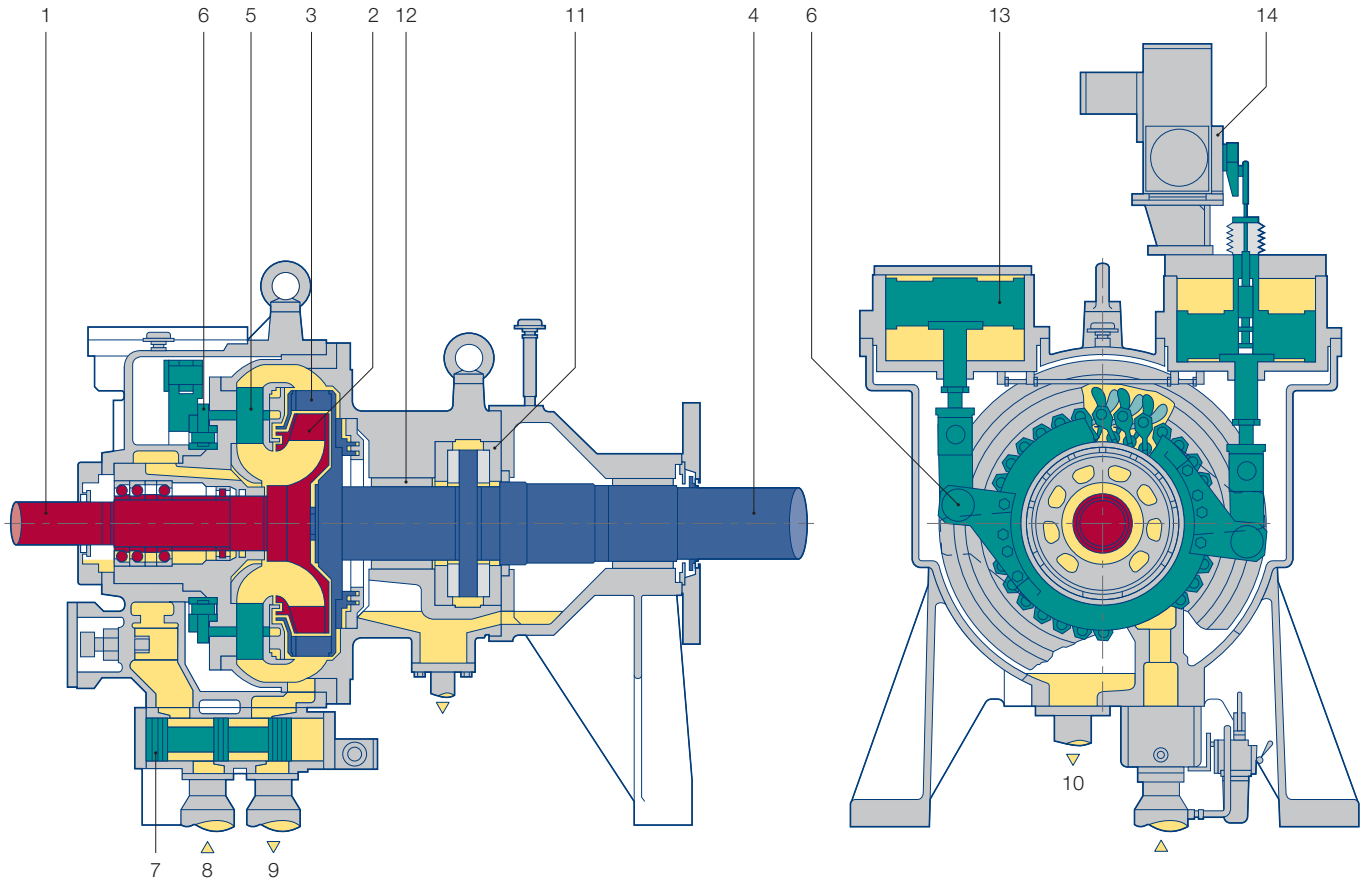
Classic design
Type EL...Y

Classic in design and features, this torque converter is recognized for its established value.

The Type EL…Y torque converter series is suited to a torque multiplication of up to 5 and is usually combined with an integral turning gear unit.

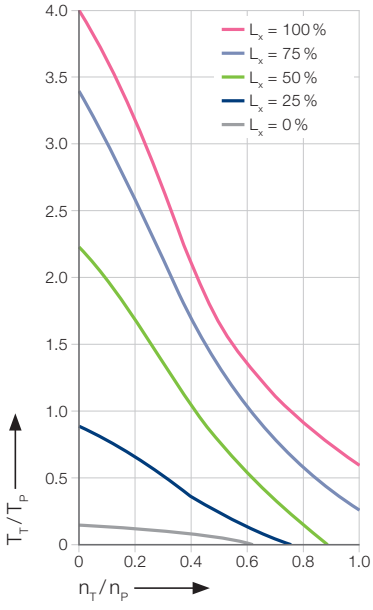
Perfectly suited to applications where the output speed is lower than the input speed. The input speed can fall within a range of up to 3600 rpm.

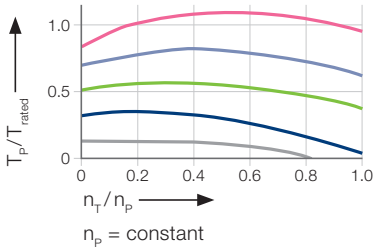
Sectional drawing of torque converter Type EL...Y



1 Input shaft
2 Pump wheel
3 Turbine wheel
4 Output shaft
5 Adjustable guide vanes
6 Adjusting mechanism
7 Filling and draining valve
8 Working oil supply
9 Working oil return
10 Lube oil return
11 Axial bearing
12 Radial bearing
13 Hydraulic cylinder
14 Guide vane actuator

Torque/speed characteristics

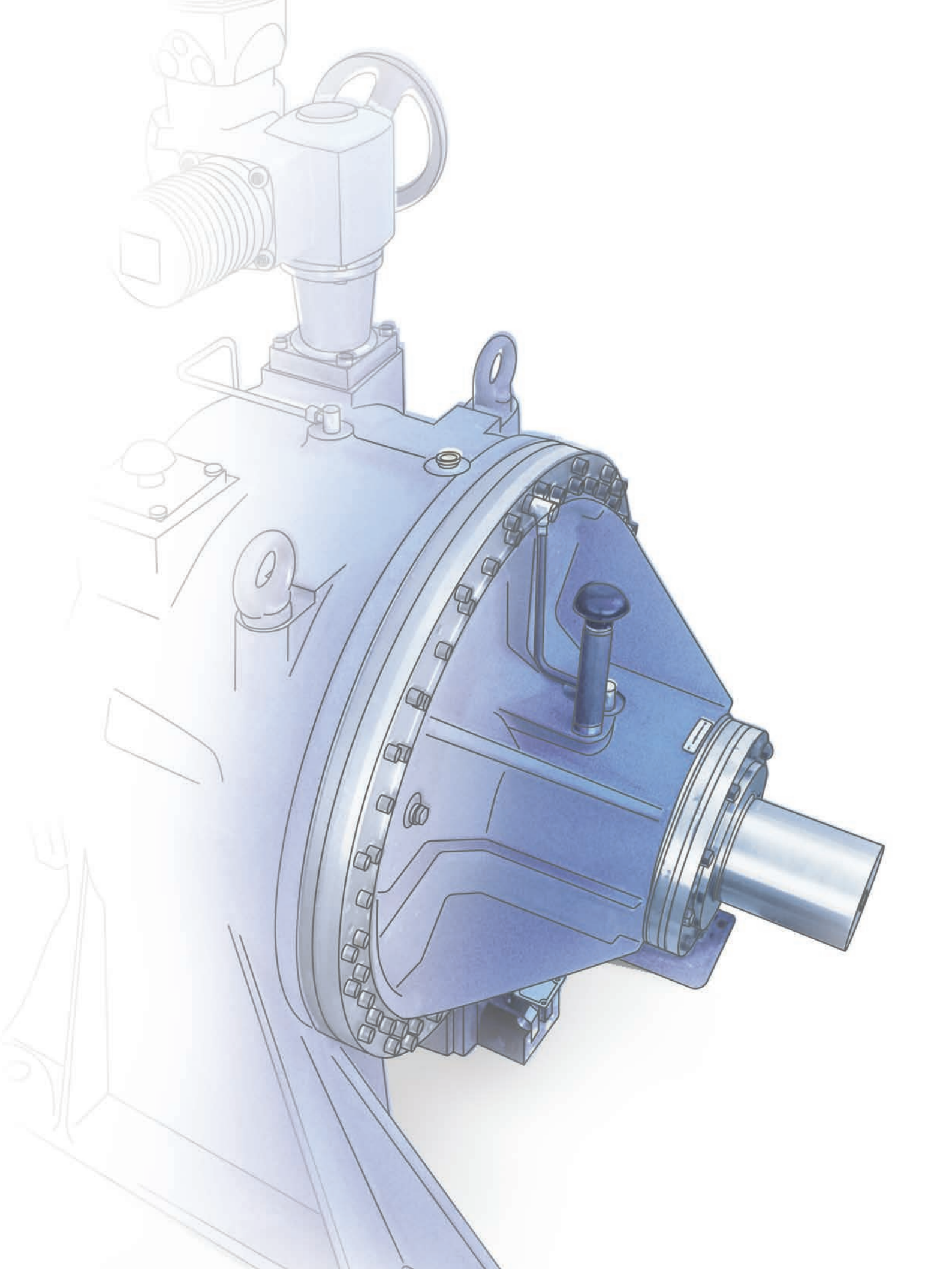




L_x: Guide vane position
T_P: Input torque
T_T: Output torque
n_P: Input speed
n_T: Output speed

Examples of the torque converter Type EL...Y series

Type	EL 7.5 YFG 2.2		EL 10 YFG 6.5		EL 10.5 YG 10	
Max. input power (kW)	2200	1270	6500	3700	10000	5800
Input speed (rpm)	3600	3000	3600	3000	3600	3000



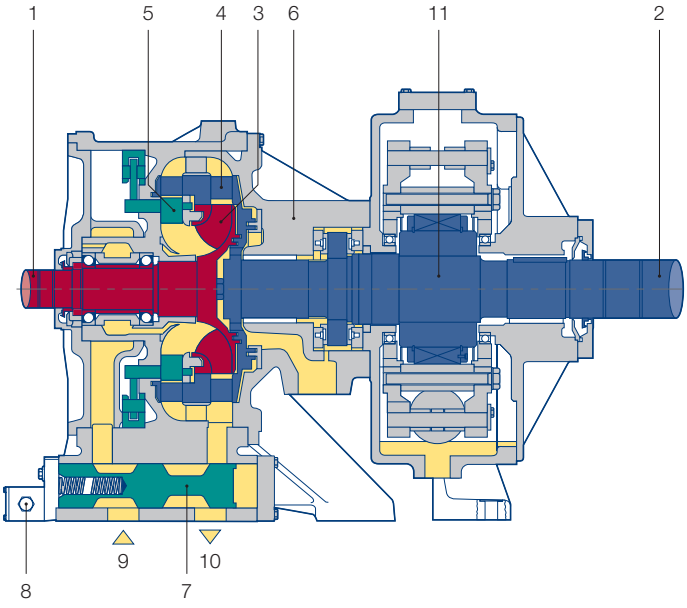
The mighty one
Type EL...Z

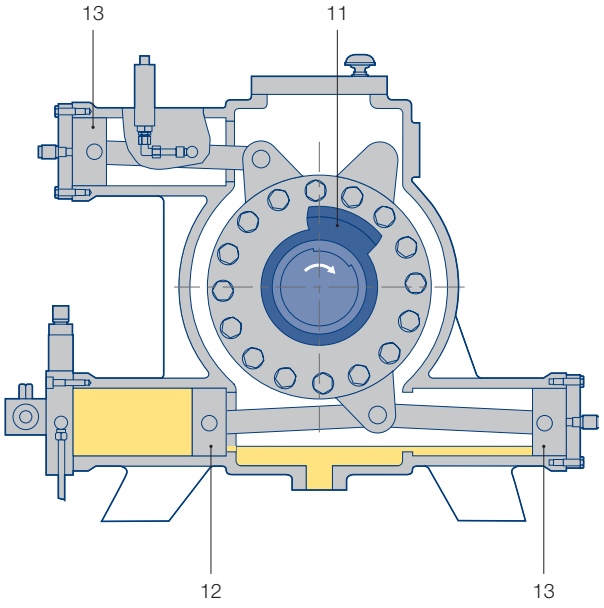
Referred to as the mighty one, this torque converter offers a torque multiplication factor of up to 10!

This powerful torque converter uses a double-stage turbine, in order to enable the 10-fold torque increase and allows a maximum input speed of 3600 rpm. The guide vane adjustment is equipped with electric actuators. The hydraulic fluid can be supplied by the driven unit's lube oil system.

Furthermore, turning can be facilitated by a seperate or integrated rotor turning device or pony motor.

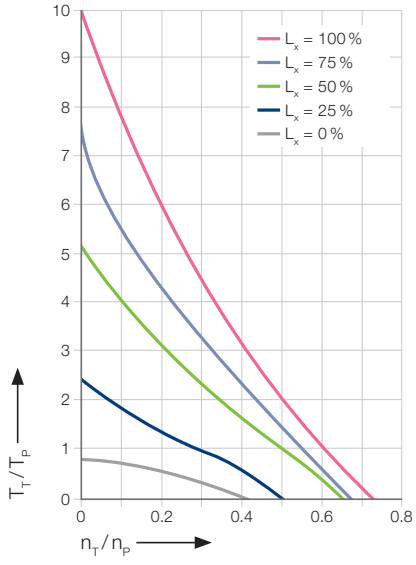
Sectional drawing of torque converter Type EL...Z

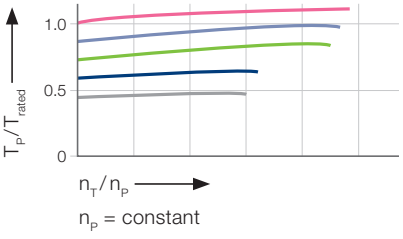




1 Input shaft
2 Output shaft
3 Pump wheel
4 Turbine wheel
5 Adjustable guide vanes
6 Housing
7 Filling and draining valve
8 Control valve for filling and draining
9 Working oil supply
10 Working oil return
11 Overrunning clutch
12 Return stroke piston/cylinder
13 Working stroke piston/cylinder

Torque/speed characteristics

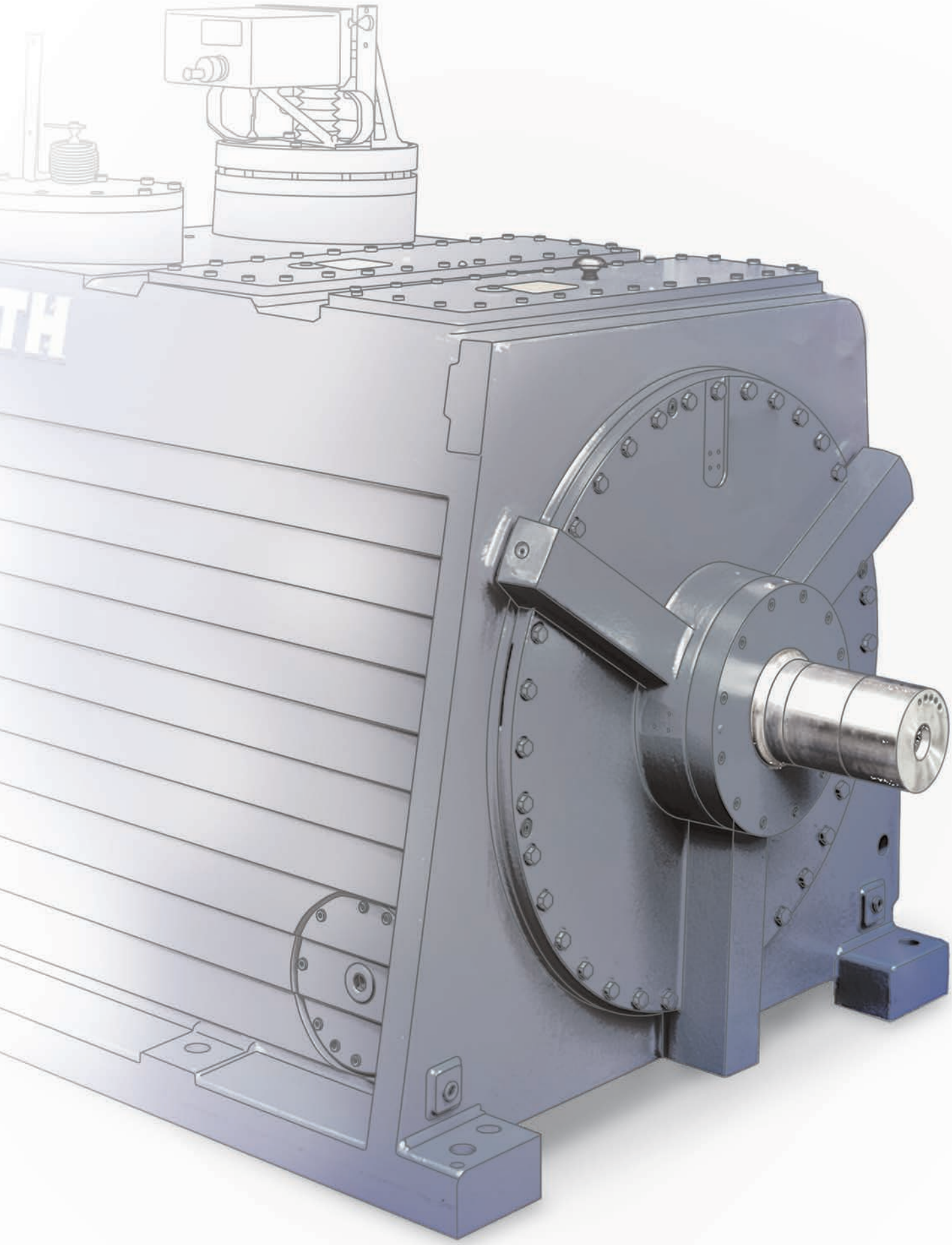




L_x: Guide vane position
T_P: Input torque
T_T: Output torque
n_P: Input speed
n_T: Output speed

Examples of the torque converter Type EL...ZGTM series

Type	EL 7.5 ZGTM	EL 10 ZGTM
Max. input power (kW)	1 000	1 800
Input speed (rpm)	3 600	3 000
Turning	45° intermittent	45° intermittent
Breakaway torque (Nm)	35 000	46 000



Withstanding tough conditions

Type EL... .1

The robust and reliable torque converter, just tougher!

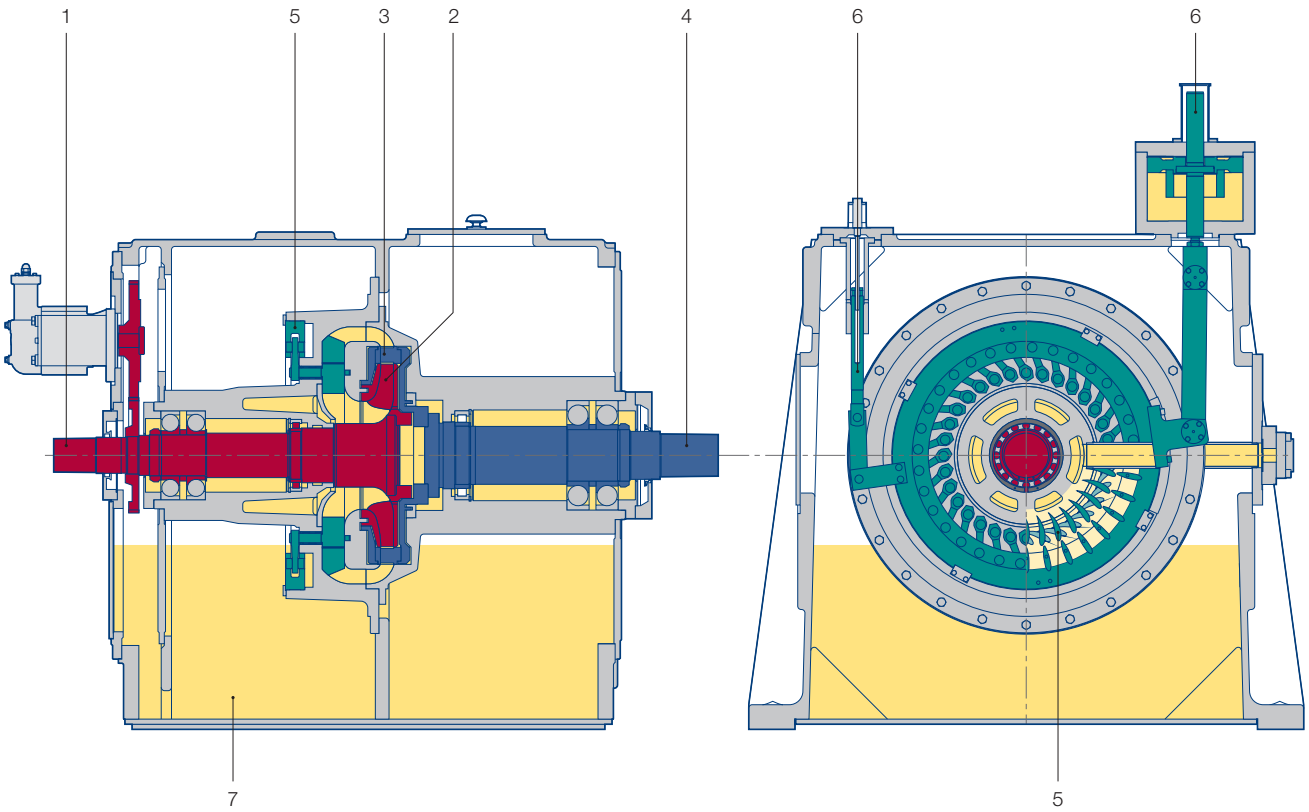
A special housing can be requested for any torque converter within the Type EL… series. Different housing sizes can accomodate the integrated oil tank and pump, which is driven by the input shaft.

The shafts are optionally supported by sleeve bearings that ensure a long lifetime and facilitate a higher speed. It is also possible to run the unit with a two-pole motor of 3 000 rpm or 3 600 rpm.

ANSI flanges are standard, and the unit can withstand a wide variety of conditions, i.e., from tropical, desert, offshore and arctic climates to hazardous environments.

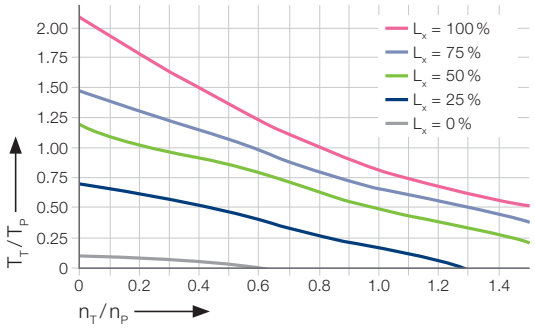
All models can be combined with an integrated or separate rotor turning device.

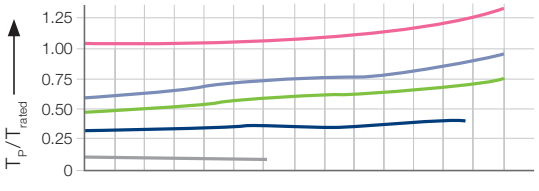
Sectional drawing of torque converter Type EL....1



1 Input shaft
2 Pump wheel
3 Turbine wheel
4 Output shaft
5 Adjustable guide vanes
6 Guide vane adjustment mechanism
7 Oil reservoir

Torque/speed characteristics

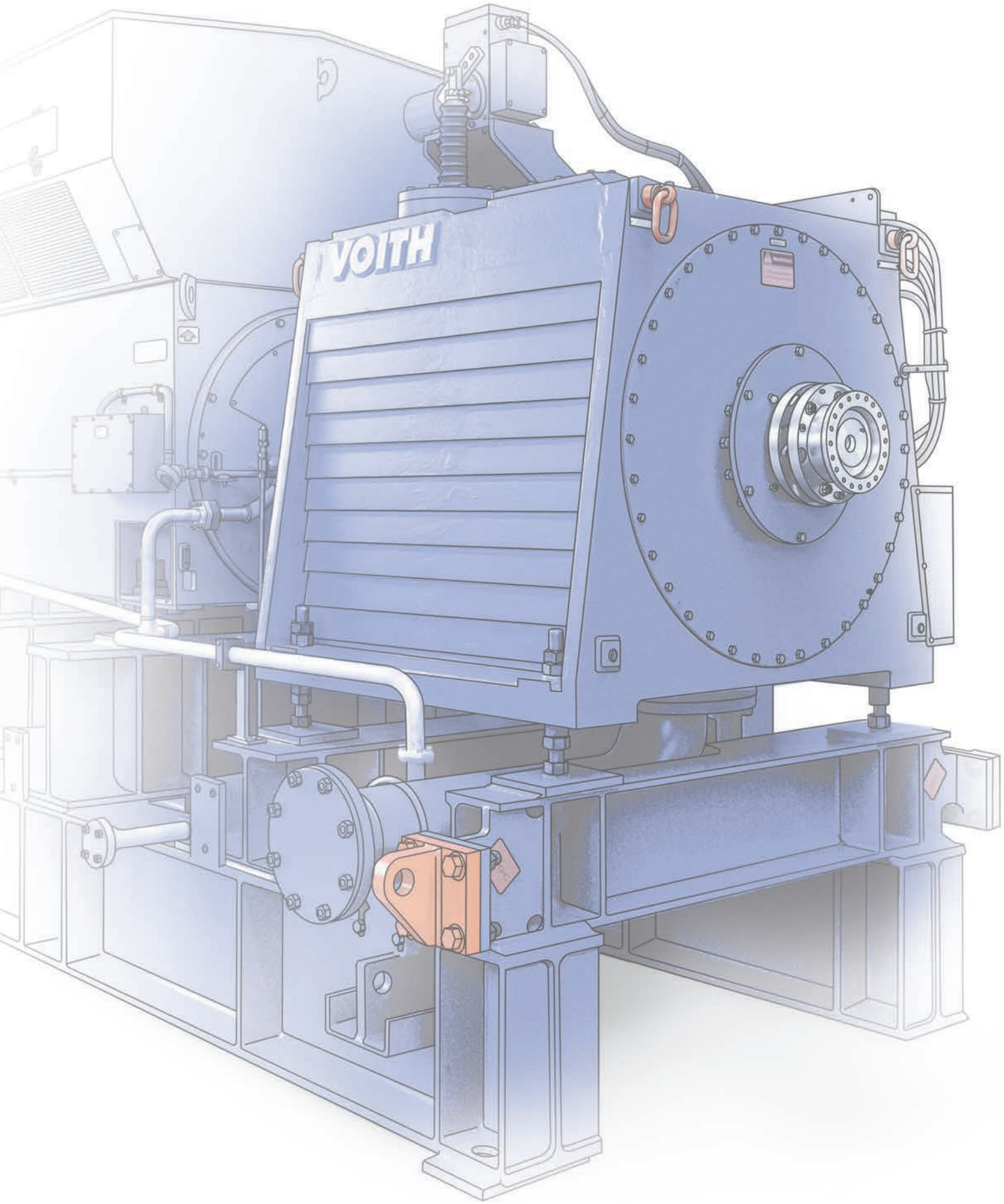




L_x: Guide vane position
T_P: Input torque
T_T: Output torque
n_P: Input speed
n_T: Output speed

Examples of the torque converter Type EL... .1 series

Starter/model	EL 9 G 6.0		EL 9 GTM 6.0-50	EL 10 GTM 7.5-86
Max. input power (kW)	6000	3400	6500	10000
Input speed (rpm)	3600	3000	3600	3600
Turning speed (rpm)	–	–	3.0	2.2
Breakaway torque (Nm)	–	–	50000	86000


VOITH

An all inclusive solution!

Packaged starters

Reduce your site assembly, alignment and commissioning time.

This all-inclusive solution assists in reducing site assembly, alignment and commissioning time, as the components of the packaged starting system are selected to complement each other, achieving an economical and space-conscious design.

The torque converter, motor and all required accessory equipment are factory mounted onto a common skid. For more demanding requirements, such as retrofitting an older gas turbine, a self-contained packaged starter design can include an integral oil tank. Additionally, an optional onboard PLC system can be fitted to control the various phases of the starting sequence.

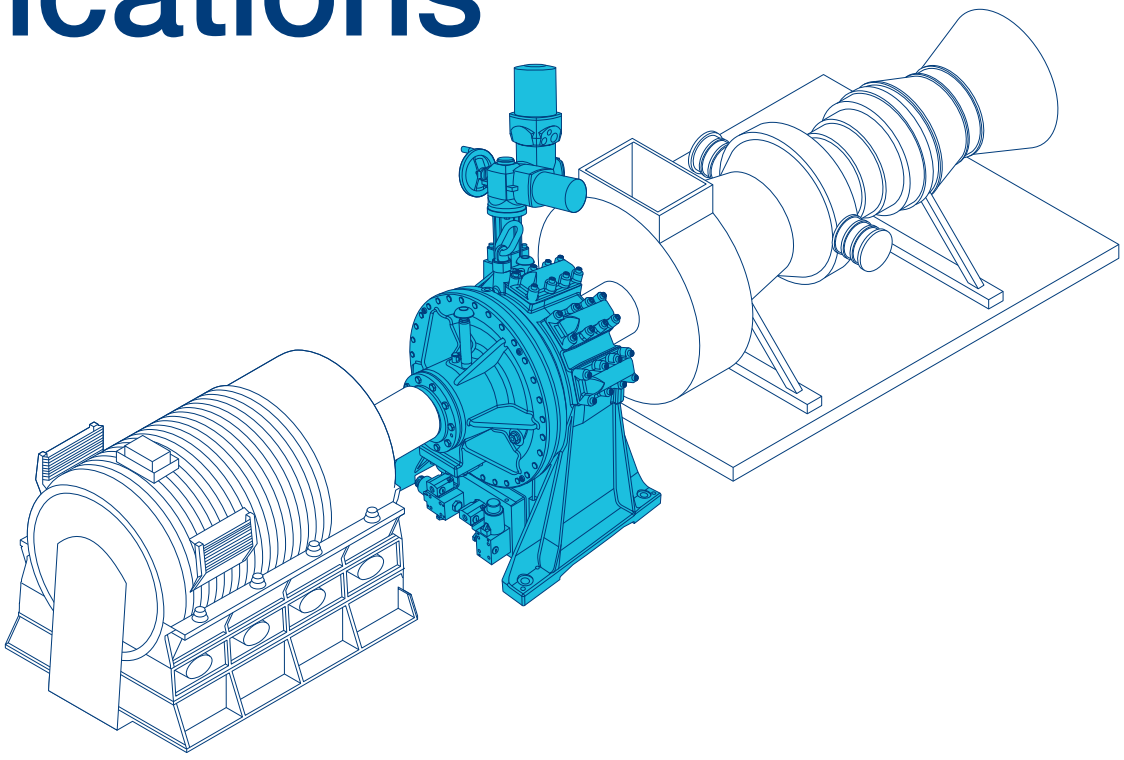
Starting of gas turbines

The torque converter decouples the starting motor from the gas turbine and allows an unloaded and easy motor start. Due to the torque amplification characteristics, a small and economic motor can be used.

Starting of large electric motors

Torque converters in starter packages facilitate the start-up of large and heavy electric motors by using small and economical pony motors. The pony motor runs up quickly while decoupling from the main motor through the torque converter. Then, the main motor is accelerated smoothly to the rated speed before synchronizing and connecting to the power line; this protects the electric grid from big voltage dips and strong inrush currents.

Applications



Fast and reliable
Gas turbine starting

Due to their performance characteristics, torque converters are ideal for accelerating the high mass of a gas turbine. Depending on the breakaway forces required, torque converters can increase the torque by two to 10-fold the input torque.

The possibility of separating the electric motor from the gas turbine during its run-up makes the torque converter technically and economically the best solution for gas turbine start-up.

Other important functions include:

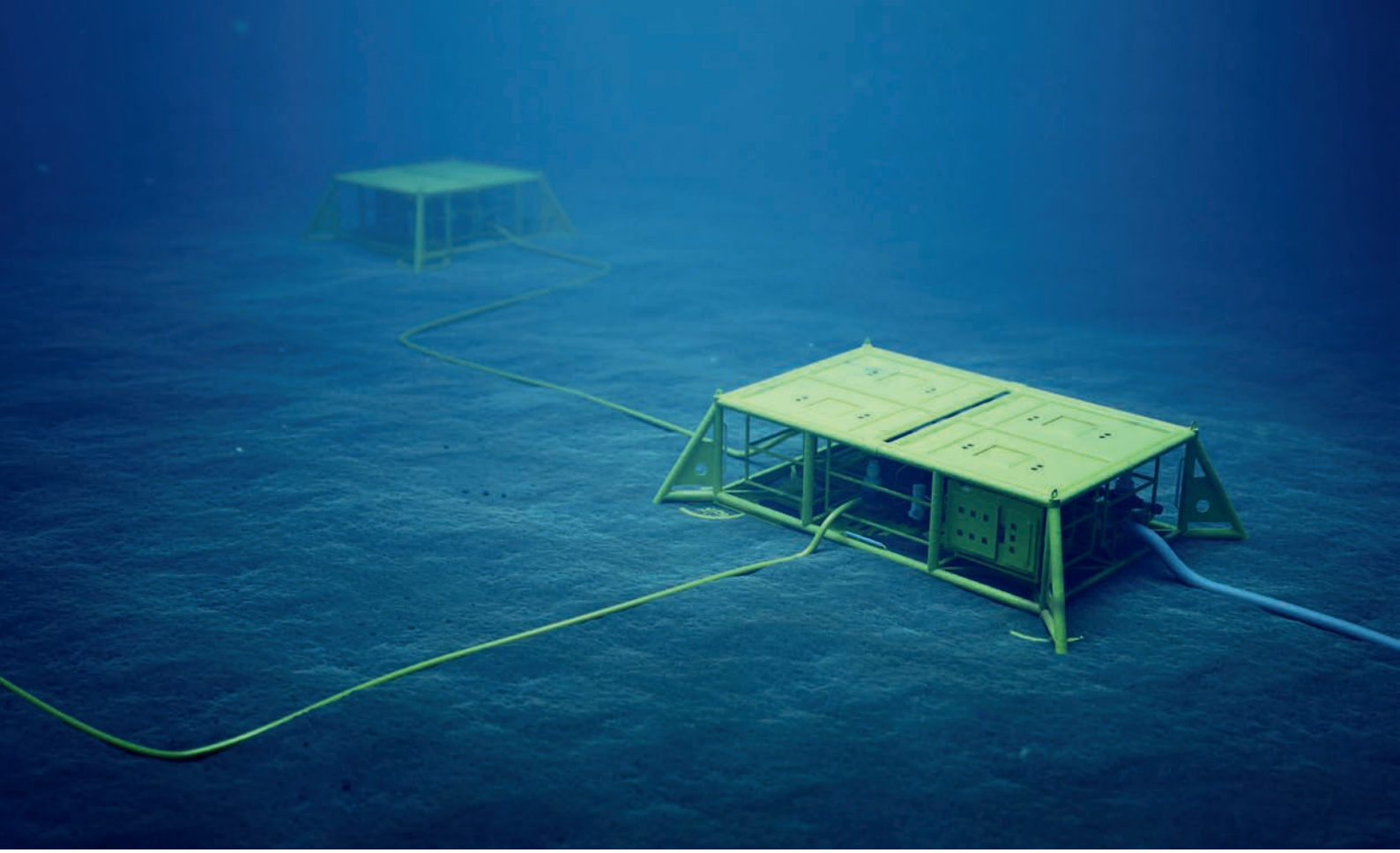
- **Turning by means of the integrated turning gear for slow-roll**
- **Indexing for inspections**
- **Fast spin-cooling for ease of maintenance**
- **Purching**
- **Extended water-wash cycles**

Test field drives
High power density units with a small footprint

This high power density, small footprint, compact torque converter, is used in power applications of up to 65 MW. Type EL... torque converters have adjustable guide vanes and are ideally suited to test field drive applications.

Torque converters in test field applications provide a huge operating map with ample output torque at turn-down speed. The torque converter also provides full torque instantaneously, even if output is blocked, and can be easily started without any big inrush current and grid impact.

Most importantly, speed and torque are controlled accurately and smoothly. Designed for a long lifespan of at least 30 years, these units have guaranteed spare part availability worldwide.



Compact, reliable and economical solution
Subsea pumps and compressors

This new technology is a game changer for the subsea market! By integrating the torque converter into the subsea module and submersing it, several hundred tons of weight and space is freed up in terms of infastructural topside costs.

Allowing for uninterrupted production, speed control on the seafloor is facilitated at a water depth of up to 3000 m. Providing precise and reliable torque, our subsea torque converter is also scalable due to the hydrodynamic principle. These torque converters have virtually limitless power capacity!

Subsea torque converter

Variable frequency/speed drive configuration

Fig. 1: VFD on topside

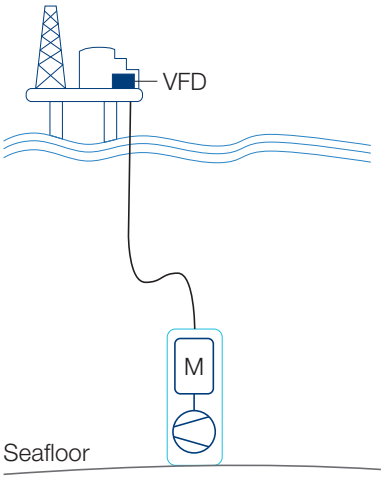


Fig. 2: VFD on seafloor

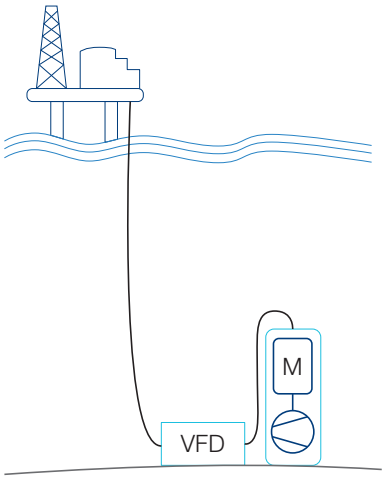
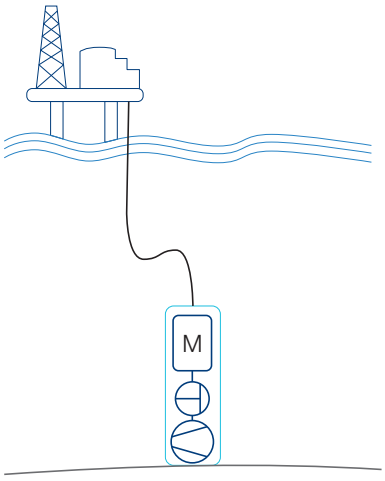


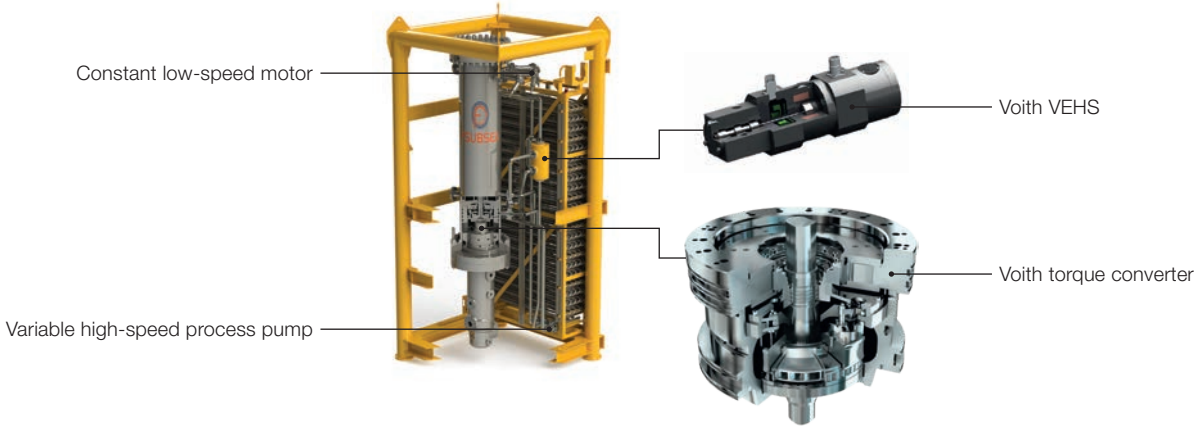
Fig. 3: Voith torque converter



While the motor runs at a fixed speed, the torque converter controls the operation of the driven equipment. Variable guide vanes in the torque converter are positioned via an integrated Voith actuator system, called a VEHS, which controls the speed.

Facilitating an increased speed ratio of up to 2.5 times greater than that of the speed value between the motor and driven equipment, the torque converters provide speed control, an unloaded motor start and motor overload protection.

Design of a subsea torque converter



Providing reliable constant torque
Positive displacement pumps

Ensuring a safe restart, even after a long break, our torque converters provide constant torque, which is particularly important in positive displacement pump applications. Furthermore, the hydrodynamic principle offers high vibration damping.

Robust in design
Agitator motors

Primarily used to increase the output torque, e.g., in PVC production in the chemical industry, these torque converters are robust and can withstand the harshest environmental conditions.

Easy start-up
Large electric motors

This becomes easy and reliable with torque converter starter packages by Voith. Thanks to their torque amplification capability, smaller pony motors may be used. They run up quickly because the torque converter decouples them from the main motor. This protects the pony motor from overload as well as the electric grid from big inrush currents.

Voith Service

Every day holds new challenges. We help you master them successfully. Anytime. Anywhere.

Ensuring maximum reliability, our high-quality torque converters are built to last. Nonetheless, regular maintenance is recommended.

For a complete overview of our torque converter service portfolio:

Hydrodynamic torque converters | Voith

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