

Optimized Propulsion Systems in Marine Applications. Class Approved Connection and Torque-limiting Couplings.







Photo: US Navy

- 1 Ship loading
- 2 Pilot boat
- 3 Aircraft carrier

Challenges in Marine

Conditions out at sea are often rough with strong winds, towering waves and dangerous currents. The environment in ports and docks is also challenging with obstacles and debris in the water.

Most applications in marine need to withstand extreme forces, whilst providing a steady and smooth propulsion. Any problems could lead to dangerous situations for personnel, equipment or the ship itself. Once things go wrong it means days in the dry dock, which cost a fortune.

Precision maneuverability, reliable shaft connections and torque protection are important for all applications, be it cargo vessels, ferries, tugboats, yachts, offshore supply vessels, cruise ships or naval vessels.

Connection and torque-limiting couplings from Voith offer safe performance and reliable protection in all marine areas where drive technology is of the essence.



The Mainstay for Your Operation

Let our friction based driveline technology be your first choice for easy operation and excellent accuracy. Connection and torque-limiting couplings from Voith allow for optimized drivelines and safe protection of the drive systems.

HyCon is the most compact low weight connection coupling for conventional propulsion drives. It is the optimized solution for each marine application.

SafeSet torque-limiting couplings protect propellers, water jets, thrusters and important deck machinery from overload, expensive time in dry dock and repair.

Our couplings offer a constant torque transmission and adaptability with no material fatigue. Every coupling is specifically adapted for the application intended, to ensure best possible use. HyCon and SafeSet are class approved by DNV and project bounded approvals can be achieved at all different classification societies involved.

Connection couplings and torque-limiting couplings from Voith:

- Prevent damage of machinery, which leads to financial savings
- Increase production uptime and minimize time in dry dock
- Lengthen the life span of the machinery
- Increase torque and payload capacity



HyCon and SafeSet are DNV approved



2



3



4



5

- 1 Harbor maneuvering
- 2 Offshore supply vessel
- 3 Fast ferry
- 4 Propeller
- 5 Naval vessel

Propulsion drive systems	Description	Product	Solution
Conventional	Shaft propulsion system	HyCon SafeSet	Shaft connection Driveline protection
Thruster	Propellers placed in rotatable pods which eliminate the use of rudders	SafeSet	Driveline protection
Water jet	Water drawn through an impeller to create a water jet for high speed propulsion	HyCon SafeSet	Shaft connection Driveline protection

HyCon

A Breakthrough in Connection Technology

DNV approved HyCon connection couplings ensure a reliable low weight friction connection with outstanding performance and torque capacity. HyCon is easily installed without oil leakage.

Operation

The HyCon connection coupling consists mainly of a tapered sleeve and a tapered hub. By means of a sealed piston sleeve a piston space is created, which exerts hydraulic axial forces on the hub when oil pressure is applied. Consequently, the hub is pushed up onto the tapered inner sleeve, creating a secure connection. The tapered surfaces are totally separated with hydraulic oil pressure. The surface of the taper is sealed on both sides, thus no oil leakage can occur. This ensures a minimized environmental impact, which is an important responsibility for every naval application.

Design features:

- Minimized hydrodynamic turbulence if located outboard
- Tailor made for solid or hollow shafts
- Torque capacity available from 1 to 20 000 kNm
- Shaft-shaft and shaft-flange connections
- Backlash-free connection
- Flange bolts can be tightened before drive up
- No oil leakage due to a sealed taper surface on both sides

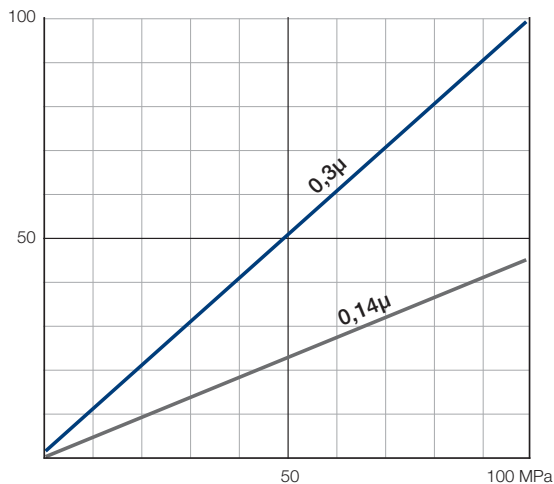
Benefits:

- Increased payload capacity, due to at least 40% reduced system weight
- Safe and fast installation, setting and releasing
- Only one pump for setting and releasing
- Easy to position axially and radially
- Shock load resistant
- Simple clamping process optimal for applications that require frequent changes
- Sealed tapered surfaces ensure protection against seawater

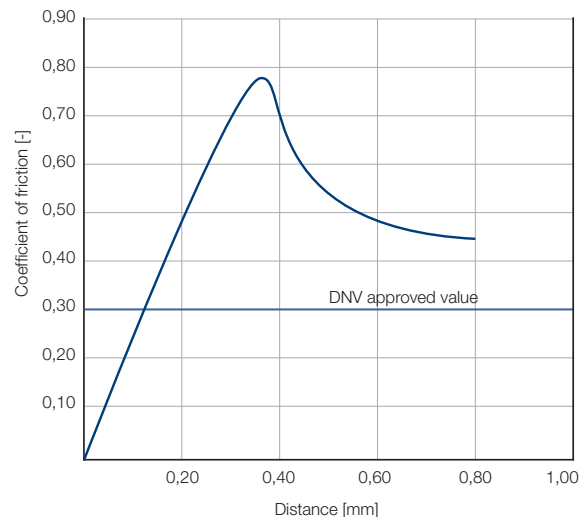
Doubled torque capacity with HFC

High Friction Coating makes HyCon the most compact and effective connection coupling available on the market. A thin fatigue and wear resistant layer of tungsten carbide is plasma sprayed onto the inner surface of the coupling. HFC strengthens the bond between the shaft and sleeve and more than doubles the torque capacity. Test results below verify that the coefficient of friction is not dependent upon the type of metal surface HFC is combined with. In the test HFC was combined with aluminum bronze, normal/stainless steel and titanium.

HFC doubles the friction coefficient



Test of friction. Static: 0,76 Sliding: 0,46



Function Principle of HyCon

HyCon S/SX

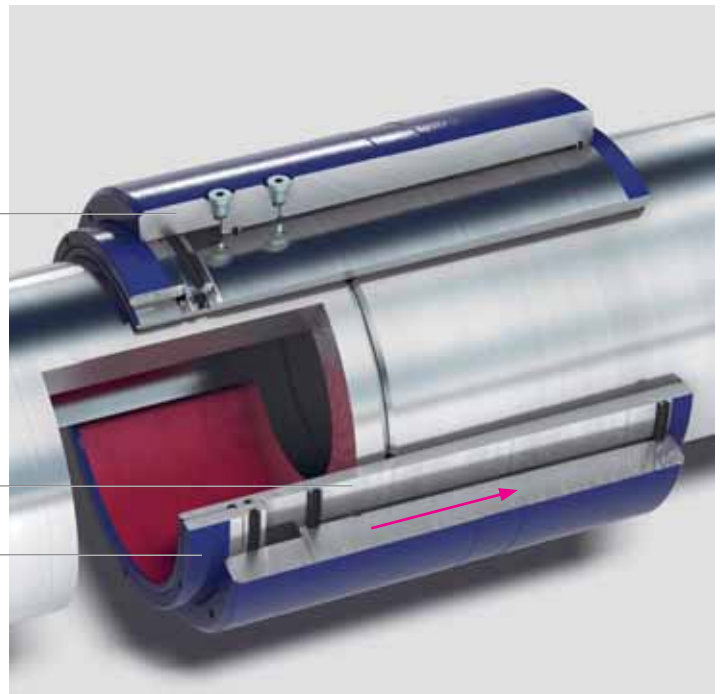
Setting:

By moving the outer sleeve up on the taper, the friction connection between coupling and shaft is created.

Outer sleeve

Inner sleeve

Piston Sleeve



HyCon F/FX

Releasing:

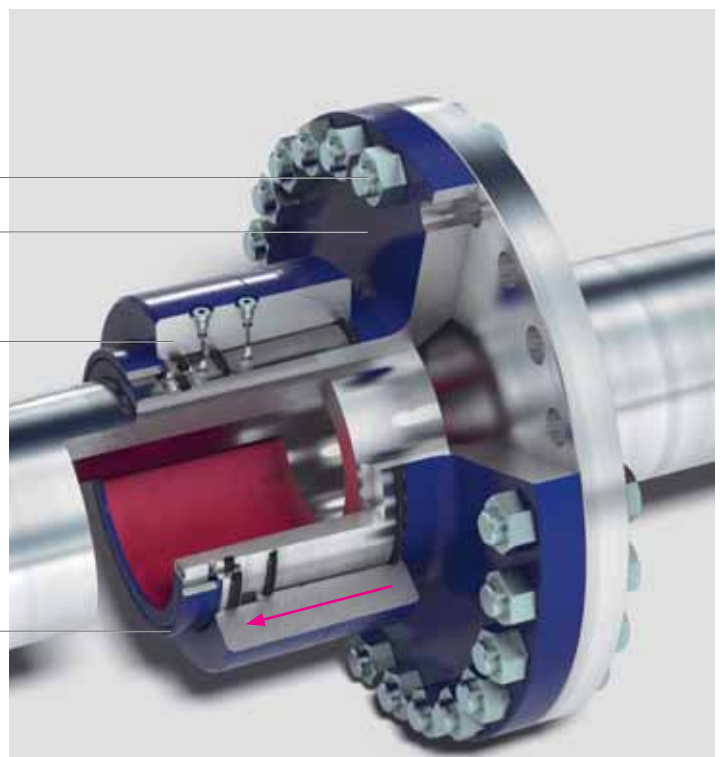
By moving the outer sleeve down on the taper, the friction connection releases between coupling and shaft.

Flange bolts

Flange sleeve

Outer sleeve

Piston Sleeve



SafeSet

The Torque-limiting Safety Coupling

SafeSet torque-limiting couplings prevent machine damage in high value rotating equipment. They work like a mechanical fuse in the driveline by protecting the system from costly breakdowns.

Operation

The main part of a SafeSet coupling consists of a twin-walled pressure sleeve. Subsequently a pressure cavity is created inside the coupling. By pressurizing oil in the pressure sleeve, it will compress around the shaft and a perfect defined friction grip is created. In an overload situation, when the set torque is exceeded, the SafeSet releases instantly and the shear tube shears off.

The immediate reaction saves the driveline from serious damage and the coupling rotates freely on the bearings until standstill. The sheared shear tube is fast replaced and the coupling is re-pressurized, so that the drive system can go into operation again.

Design features:

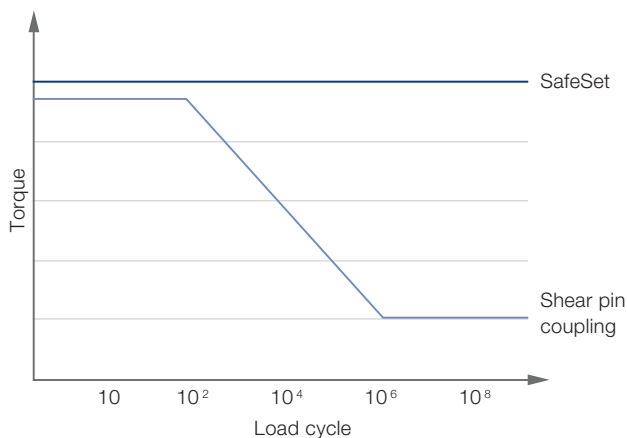
- Instant release in overload situations
- Accurate release torque
- Easy adjustable torque settings
- Torque capacity available from 1 to 20 000 kNm

Benefits

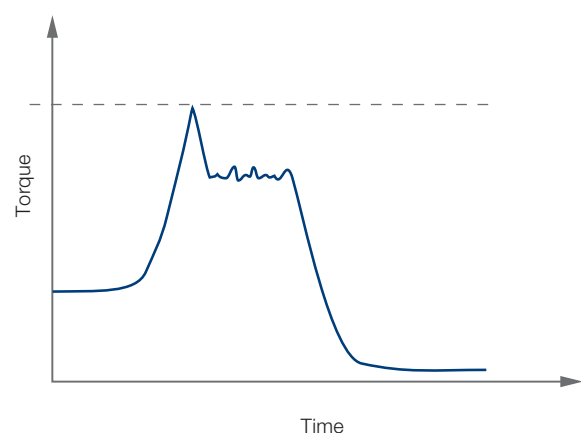
- Maximum driveline protection
- Set torque remains constant over time
- Quick resetting for maximum uptime
- Tailor made to suit individual requirements
- Minimize standstill in dry dock

The SafeSet torque-limiting coupling is DNV approved, which makes it the ideal choice for safe operation in the marine industry. SafeSet is a coupling to rely on, for years to come. The set release torque remains constant over time – regardless of the number of load cycles. SafeSet only releases when the set torque is really exceeded.

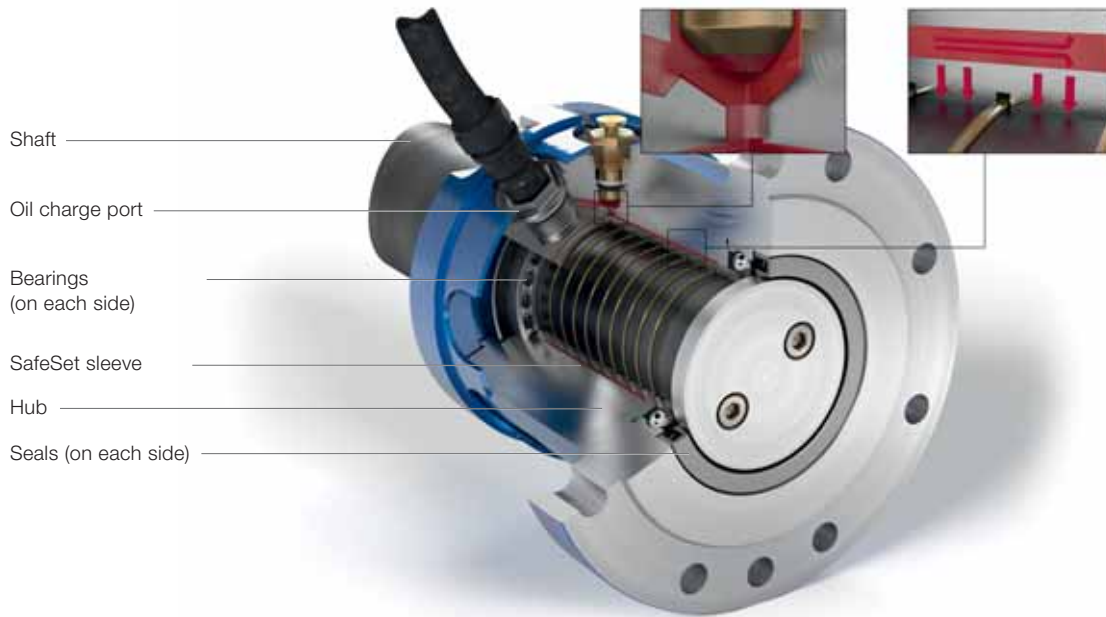
Fatigue curve (S-N curve)



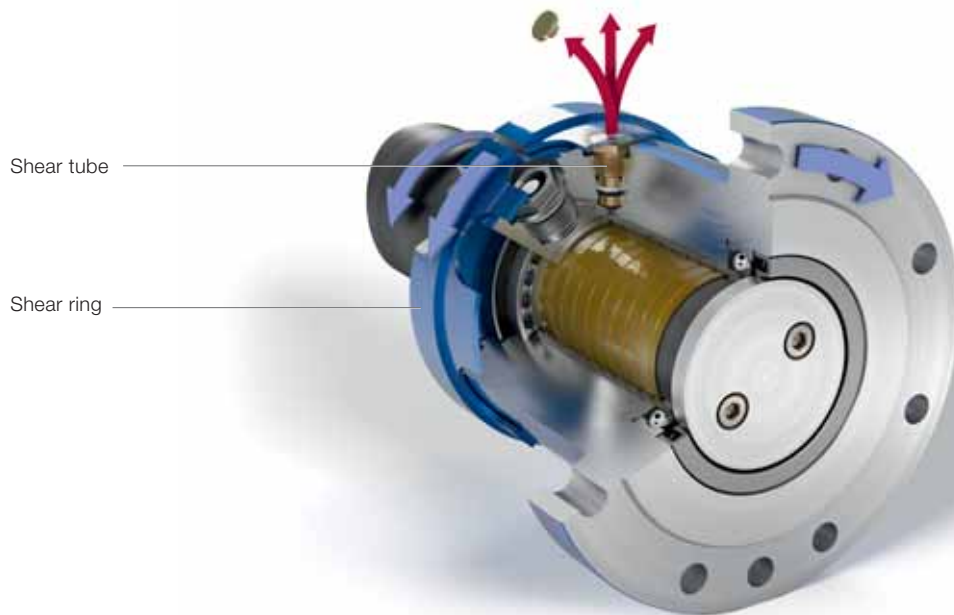
Typical release curve



SafeSet being pressurized



SafeSet following a release





Conventional Drives

A conventional shaft driven propulsion drive is the most common system for the majority of vessels, due to its high performance, efficiency and reliability.

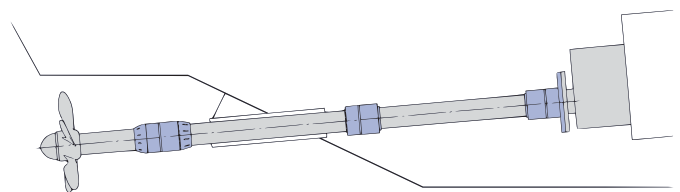
HyCon connection couplings provide a backlash free and secure friction connection for propulsion shafts and are preferred by most naval designers.

Thanks to our revolutionary High Friction Coating technique, the HyCon coupling has a high torque capacity in relation to size and weight. HyCon can be built in stainless steel to withstand corrosion, or be manufactured in other special materials, such as titanium or antimagnetic material, which is sometimes required in naval vessels.

SafeSet can protect drivelines with fixed pitch propellers from overload, when navigating in shallow water.

HyCon connection couplings and SafeSet torque-limiting couplings can be used in:

- Tankers and carriers
- Offshore supply vessels
- Cargo ships
- Naval vessels
- Container ships
- Dredgers
- Car transport ships
- Cruise ships and ferries
- Megayachts
- Pilot boats
- Fire fighting vessels



HyCon in a conventional drive



Photo by Marine Jet Power AB



- 1 Luxury cruise ship
- 2 High speed yacht
- 3 Tanker
- 4 Container ship
- 5 Naval vessel

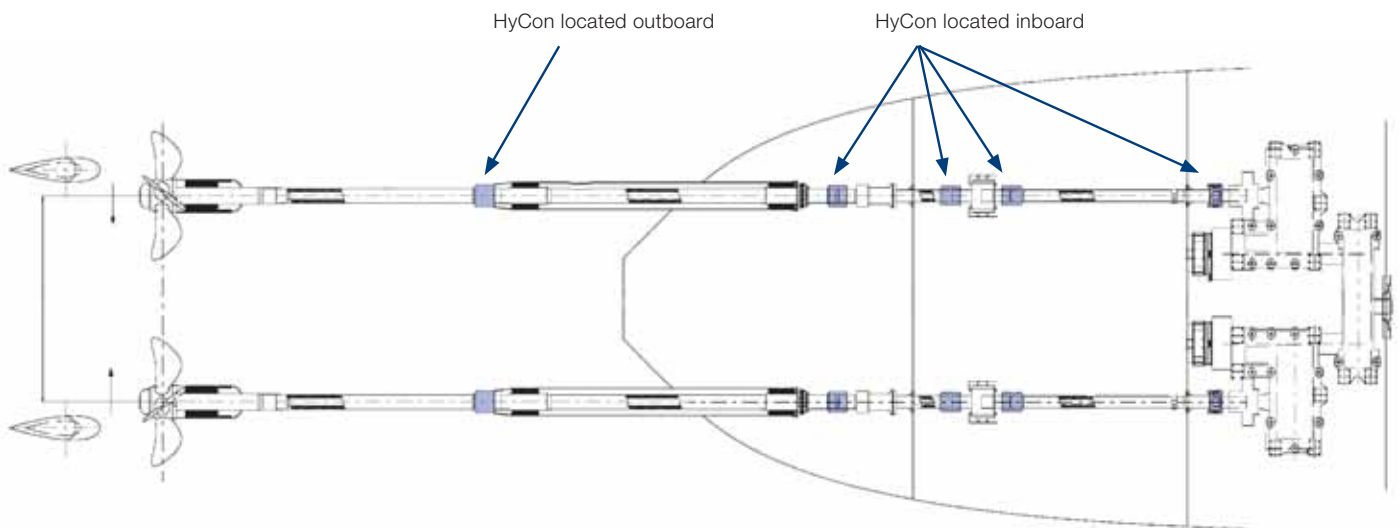




Photo by Taiwan Navigation Co Ltd

Thrusters

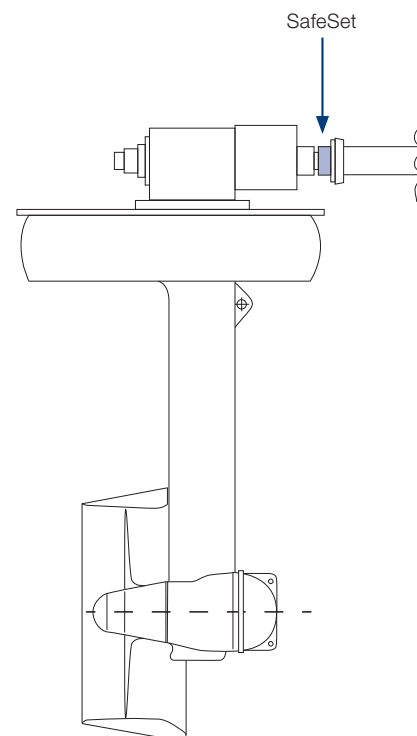
Optimum maneuverability, decreased stopping distance and greater fuel efficiency are the reason why many applications use azimuth thrusters. The pod of a thruster allows the propellers to rotate 360 degrees, eliminating the need for a rudder.

When the propellers of a thruster become blocked by external debris, the inertia and the motor torque can lead to a damaging overload.

SafeSet torque-limiting couplings are installed between the prime mover and the angular gear box, to protect all drive components from unexpected torque peaks.

SafeSet Torque-limiting Couplings can be used in:

- Tugboats
- Offshore supply vessels
- Ferries
- Naval vessels
- Cruise ships
- Dredgers



SafeSet installed onto the input shaft to the angular gearbox of the thruster



2

Photo by Marine Jet Power AB

- 1 Tugboat
- 2 Patrol boat

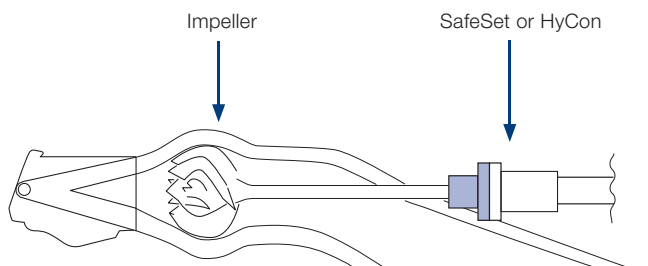
Water Jets

Water jets are used for their high speed and easy maneuverability in shallow water for speeds of 20-50 knots. A water jet generates propulsive thrust by drawing in water and then accelerating and expelling it through a nozzle at high velocity. The impeller water intake can draw in other objects from the water and become blocked by debris. When the impeller is jammed, the motor and driveline inertia continue to deliver torque, which can cause severe damage and potential time in dry dock.

HyCon connection couplings provide a secure connection between the impeller or prime mover and the water jet. SafeSet torque-limiting couplings can protect the impeller from overload in the event of a blockage.

SafeSet Torque-limiting Couplings and HyCon Connection Couplings can be used in:

- Pilot boats
- Fire fighting vessels
- Patrol boats
- Ferries
- Naval vessels
- Megayachts



SafeSet or HyCon installed to protect or connect the driveline of a waterjet



HyCon for impeller connection in a water jet



Dredger

Harbor and Deck Machinery

Optimize the driveline by providing reliable protection from overload and preventing production stoppages in harbor and deck machinery. Many ships and harbors are equipped with machinery such as cranes, loaders, dredger pumps, and excavators. Torque peaks or overloads can cause damage to the driveline and lead to periods of downtime.

SafeSet torque-limiting couplings installed between the motor and driveline equipment, protect cargo handling and deck machinery from overloads and machinery damage. The couplings also improve processes and increase production by minimizing downtime and extending the life span of the driveline.



SafeSet in a dredger pump



SafeSet in a ship loader

Image: Studio e



Service and Maintenance

The quality of our products is exceptionally high and the life-span is long. Nevertheless, all mechanical drive components need correct service and maintenance to ensure reliable performance.

Our most important task is to help our customers to prevent unplanned stoppages and production downtime. By providing correct installation, training of your maintenance personnel and frequent service we make sure your equipment meets its full design potential.

Our service personnel are present during installation, initial start-up and final commissioning. At the same time we instruct your personnel how to operate the couplings and how to optimize their settings.

Whenever our customers need support we provide it instantly. Our service personnel use the latest technology and all their knowledge and experience to provide the service needed.

We carry out scheduled servicing and repairs on our couplings in order to reduce life cycle costs, and guarantee their continuous operating performance. Furthermore, we propose possible improvements and upgrades.

Voith has regional service centers worldwide. We offer different types of service solutions tailored to your specific needs.



Torque Transmission Developed for Optimized Drivelines

World leading connection couplings from Voith transfer the most torque in relation to size. This adds high performance and allows for more effective dimensioning of the driveline.

Easy maintenance and service

Connection couplings HyCon, HyLoc and HyGrip provide a backlash-free, friction connection. They are suitable for shaft-flange, shaft-hub or shaft-shaft connections. The setting and releasing of the connections occur hydraulically, which enables fast installation, service and maintenance. Easy assembly means short stoppages for service, which increases production uptime.

Optimal design

The compact design also improves process control and thereby the service life of the driveline. All models can be customized to suit existing, as well as newly designed interfaces.



Torque Limiting Designed for Increased Performance

The outstanding accuracy of SafeSet torque limiters from Voith substantially improve productivity. This enables your equipment to work at a maximum level.

Reduced downtime

The safety coupling SafeSet is the most precise torque limiter available on the market. SafeSet couplings only release when the set torque is really exceeded. This minimizes propulsion stoppages and time in dry dock. The adjustable release torque allows an optimized driveline for maximum output.

Improved performance

SafeSet couplings eliminate rapid torque peaks, improve the production process and lengthen the life span of the driveline. The process-improving couplings SmartSet and AutoSet have a slipping function. The couplings restrict short torque peaks, without disconnecting transmission entirely. This protects the driveline and maximizes production output.



Voith – Engineered Reliability

Voith is a globally active engineering company. With its broad portfolio covering plants, products and industrial services, Voith supplies essential markets: energy, oil & gas, paper, raw materials and transport & automotive.

Founded in 1867, Voith employs more than 42 000 people, generates 5.7 billion Euros in sales, operates in about 50 countries around the world and is today one of the biggest family-owned companies in Europe. The holding company, Voith GmbH, is based in Heidenheim/Brenz, Germany.

Voith Turbo SafeSet are the experts in development and manufacture of torque-limiting and connection couplings within Voith. For over 30 years the company has supplied the market with the most reliable systems available. By combining engineering skills, innovative strength and solid base Voith Turbo SafeSet is a partner to rely on for generations to come.

Voith Turbo SafeSet AB
Rönningevägen 8
82434 Hudiksvall, Sweden
Tel. +46 650 540150
Fax +46 650 540165
info.safeset@voith.com
www.voith.com

VOITH
Engineered Reliability