Torque Limiting Couplings
Reliable Energy Production
The Challenges in Energy Extraction

Energy extraction from natural resources can be quite unpredictable. To be effective you need to be able to control overloads caused by grid variations, torque peaks and mechanical problems. Voith couplings ensure reliability in energy recovery.

Voith manufactures and develops world leading torque limiting couplings used in many different industries worldwide. Most of the applications in the energy recovery area includes torque converters that require high demands on transmission components. Voith Torque Limiting Couplings transmit torque in the most challenging environments.

Regardless of the application, the challenges are similar. The key to reliability and efficiency is a smooth and problem free process, with a maximum amount of uptime.

With Voith Torque Limiting Couplings it is possible to protect expensive gas turbines, compressor drivelines and other turbo machinery applications from excessive torque peaks, coming from the generator, the electric motor current supply or mechanical failures.

Voith Torque Limiting Couplings:
- Prevent damage of the machinery and equipment.
- Ensure production uptime and avoid costly downtime in case of a serious breakdown.
- Increasing profit and lengthen the machinery life span by avoiding overload cases.
- Provide a backlash free connection.
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Overview

Basic Functions

Voith 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.

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<th>Coupling and function</th>
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| SafeSet               | ![SafeSet Graph](image) | + Maximum driveline protection  
+ Accurate and constant release  
+ Adjustable release torque  
+ Quick resetting for maximum uptime  
+ Custom made to suit individual requirements |
| SmartSet              | ![SmartSet Graph](image) | + Maximum driveline protection  
+ Process improving coupling with controlled slip  
+ Ability to slip without releasing to reduce short duration and dynamic peak torques  
+ Accurate and constant release  
+ Adjustable release torque  
+ Fully disengage in case of a catastrophic failure |
| SlipSet               | ![SlipSet Graph](image) | + Maximum driveline protection  
+ Process improving coupling with controlled slip for continuous production  
+ Ability to slip without releasing to reduce short duration and dynamic peak torques  
+ Adjustable slip torque |
SafeSet
Instant Release

In an overload situation, when the set torque is exceeded, the SafeSet releases instantly, saving the driveline from catastrophic failure. SafeSet protects your driveline and maximizes production, for years to come.

Operation
The SafeSet principle is simple: transmitting torque by friction. No material fatigue, a constant torque transmission and adaptability. We develop solutions for the most demanding application requirements.

Design features:
- Torque release between 1 and 20,000 kNm
- Adjustable torque settings to suit all applications
- Immediate release at a preset torque in the event of a torque overload

The SafeSet includes a twin-walled hollow sleeve. Friction is produced upon expansion by pressurized hydraulic oil. The integrated shear tube holds pressure to ensure a constant, but easily adaptable torque transmission. In an overload situation the coupling slips and the shear tube shears off. Oil pressure drops and the frictional surfaces separate. The coupling rotates on the bearings without transmitting any torque.

Benefits
+ Maximum driveline protection
+ Accurate and constant release
+ Adjustable release torque
+ Quick resetting for maximum uptime
+ Custom made to suit individual requirements

1 SafeSet
2 SafeSets in different sizes
SmartSet
Controlled Slip and Release

The Smartset coupling is a process improving coupling with the ability to slip and cut torque peaks of short duration, without interrupting production. The coupling will fully release and disengage in case of a catastrophic failure.

Operation
The SmartSet coupling has the ability to slip up to 120° without releasing, to limit short peaks. If the torque peak is of long duration in an overload situation, the SmartSet coupling will fully release and subsequently save the drive line from serious damage.

Design features:
• Ability to slip up to 120° during a torque peak
• Torque release between 1 and 20,000 kNm
• Adjustable torque settings from 50 to 100 % of max torque setting
• Mechanical slip and release mechanism

SmartSet is based on the same technology as the SafeSet coupling, but it is equipped with a SmartSet device that gives the coupling the additional slip feature. This centrifugal device is activated by the rotational speed of the driveline. This enables the coupling to slip during high transient torques, that are an inherent part of many applications. The SmartSet device will reset itself at zero rpm and the full slip angle is regained.

Benefits
+ Maximum driveline protection
+ Process improving coupling with controlled slip
+ Ability to slip without releasing to reduce short duration and dynamic peak torques
+ Accurate and constant release
+ Adjustable release torque
+ Fully disengage in case of a catastrophic failure
SlipSet ensures continuous production and is designed to slip in the event of an overload situation. By acting as a shock absorber in drives with frequent torque peaks, the SlipSet prevents time consuming downtime due to repair work.

**Operation**
In the event of a temporary torque overload, the SlipSet coupling slips to limit the torque peaks and enable continuous production. If the blockage persists, the SlipSet coupling slips until the drive can be stopped to enable the blockage to be cleared.

**Design features:**
- Torque release between 1 and 20 000 kNm
- Adjustable torque settings from 50 to 100 % of max torque setting
- Slip at a preset torque
- Immediate slip in the event of a torque overload

SlipSet is based on the same technology as the SafeSet coupling, but with the ability to instantly slip instead of release, in the event of a torque overload. The SlipSet units are very compact and can be installed in areas with a minimum of space, to ensure the most optimal position in a drive line.

**Benefits**
- Maximum driveline protection
- Process improving coupling with controlled slip for continuous production
- Ability to slip without releasing to reduce short duration and dynamic peak torques
- Adjustable slip torque
The CMS is a new generation of Voith Coupling Monitoring System adding intelligence to the couplings. The CMS is built on a PLC based platform. This makes it possible to integrate the status signal from the coupling into an existing supervision system.

**Operation**
The monitoring is realized by calculation of the torque limiting coupling input and output rotational positions. The positions are measured by two inductive sensors which senses the pulse frequency given by the teeth wheels mounted on each part of the torque limiting coupling.

**Design Features:**
- Profinet standard
- Slip angle measurement
- Speed measurement
- Service indicator
- Web interface
- Ethernet connection

**Optional Features**
- GSM module
- HMI touch panel

The CMS makes it possible to supervise, monitor and control a torque limiting coupling over a web interface or HMI panel. The system uses Profinet communication standard for easy integration in existing industrial process monitoring systems. The slip angle is continuously calculated to measure how much the coupling has slipped. The status information can then be used to quickly identify any need for action.

**Benefits**
- Increased uptime of a complete driveline
- Integration with existing process monitoring systems enables platform independent supervision of data
- Possibility to optimize driveline performance
- Torque peaks limited without disrupting operation
- Quicker resetting to minimize downtime
- Easy to plan for proactive maintenance of a coupling
- Visual and audio warning indicators can be used for making decisions and actions

**Voith Coupling Monitoring System CMS**
Voith is a reliable partner for the entire service life of your driveline, offering a wide range of service and support, when and wherever you need it.

You can rely on us during every part of the process, from installation, to initial start-up and final commissioning. Our technicians ensure the trouble free start-up of your machine which also gives you the peace of mind that it has been correctly built in. Voith trains your personnel on how to operate the coupling, which optimizes performance and maintains constant reliability.

Regular health checks provide a high quality operation at a low expense and minimize costly production downtimes. Proactive maintenance of torque limiting couplings increases the service life, improves performance and reduces lifecycle costs, to ensure maximum return on your investment.

Voith has regional service centers worldwide. We are here to support you 24 hours a day, seven days a week. Thanks to our global network, we are always nearby.

Long Term Partnership and Support
Gas Turbine

Voith SmartSet coupling enables continuous operation of power generation plants despite power system faults, with the ability to slip and release in the case of a catastrophic failure.

If a large consumer, for example an industrial plant with several large electric motors, starts to draw power from the system, there is the risk of a critical voltage dip in the power system environment. In case of such an event, a multiple of the rated torque acts on the generators involved and deaccelerates them abruptly. This can destroy the shaft and turbine of the power producer. With its SmartSet coupling, Voith offers a solution that protects power plants during overload. As soon as the rated torque is exceeded, the SmartSet works as a friction coupling and limits the torque between generator and turbine without any need of turbine shutdown.

**SmartSet in a gas turbine:**
- Limits the torque between the generator and the turbine in the event of a fault without shutdown
- Controls the torque and absorbs shock loading
- Prevents damage caused by inertia
- Increases uptime

**Suitable torque limiting couplings:**
- SmartSet
- SafeSet
- SlipSet

Gas turbine with SmartSet
Stay on the Grid, Continue Production

**SmartSet couplings protect both plant and power systems** during a voltage dip, the generator is subjected to 7.5 to 16.5 times the rated torque. This is when the Voith SmartSet coupling acts immediately to prevent an low voltage ride through (LVRT). The moment that the set slipping torque is exceeded, the SmartSet limits the torque between the generator and turbine. The coupling then stops slipping as soon as the critical 150 to 300 ms of the voltage dip has passed. Due to its precise and immediate action, the SmartSet coupling is a lasting solution which protects energy producers and electrical power systems against damage and outages. The solution works exceptionally well for smaller plants with a power range up to 60 MW.

**Low voltage ride through (LVRT)**

1. SmartSet
2. Gear box for gas turbine with SafeSet
Wind Power

The Voith SafeSet coupling secures the driveline of wind power test rigs during testing and development.

Voith SafeSet couplings are used in the development process of new power nacelles, to protect the driveline from serious damages in the event of an overload. The realistic test conditions with a variety of displacements puts a large load on the test unit.

In order to protect the system in the event of any electrical faults or damage, a SafeSet coupling from Voith is installed between the machines and the downstream driveline in the direction of the nacelle. The SafeSet torque limiting coupling with instant release protects large capacity test rigs, from damage and costly standstill and delayed time to market.

**SafeSet in a wind power test rig:**
- Maximum drive line protection
- Adjustable release torque
- Low weight transmission component

**Suitable torque limiting couplings:**
- SafeSet
- SmartSet

Wind Power Test Rig with SafeSet
Protection of Wind Power Test Rig

The world’s largest SafeSet coupling protects the new Dynamic Nacelle Testing Laboratory (DyNaLab) against overloads. The unique test site is located at the Fraunhofer Institute for Wind Energy and Energy System Technology (IWES) in Bremerhaven, Germany. A 17 metric ton Voith SafeSet coupling protects the system against damage caused by potential torque overloads. At DyNaLab two synchronous motors in a tandem configuration provide the basis for realistic test runs of wind turbine nacelles. Each machine provides an input power of 5 MW. They introduce a rated torque of 8 600 kNm into the nacelle. The system makes it possible to test onshore and offshore nacelles of up to 8 MW in power under realistic conditions. The test phase can take place significantly faster, more reliably and therefore more cost-effectively than in a field test.

The realistic test conditions with a variety of displacements put a large load on the test unit. In order to protect the system in the event of any electrical faults or damage, the largest Voith SafeSet coupling to date is installed between the machines and the downstream driveline in the direction of the nacelle. The SafeSet SR-F 1300 weighs 16 900 kg and has a diameter of 1.9 m. It rotates at a speed of up to 25 revolutions per minute.

The maximum release torque, at 15 000 kNm, is significantly more than the torque introduced by the two synchronous machines. However, the design of the SafeSet makes it possible for the IWES to adapt the desired torque on a case-by-case basis. A precise value at which the valve system releases and prevents an overload can be selected for each test run. As a result, the SafeSet torque limiting coupling prevents, on the one hand, expensive resulting damage to the system and components while, on the other hand, it reduces the downtime of the DyNaLab following an incident to a minimum.
Maximize the output of your compressor drive
Excessive torque peaks during start-up and the resulting torsional vibration can put serious demand on the compressor drive motors. Installing SmartSet process improving coupling with controlled slip avoids these overload situations, protecting and lengthening the life span of the driveline.

SmartSet in a compressor drive:
• Protect the driveline and motors against overload and failure
• Limit the systems transient torque to a set level
• Provide an adjustable, accurate and constant set torque limit

Suitable torque limiting couplings:
• SmartSet
For 150 years, Voith’s technologies have been inspiring customers, business partners and employees around the world. Founded in 1867, Voith today has around 19,000 employees, sales of $4.7 billion and locations in more than 60 countries worldwide and is thus one of the largest family-owned companies in Europe. Being a technology leader, Voith sets standards in the markets of energy, oil & gas, paper, raw materials and transport & automotive.

Voith Turbo, a Group Division of Voith GmbH, is a specialist for intelligent drive solutions, systems and comprehensive services. Customers from highly diverse industries such as oil and gas, energy, rail and commercial vehicles, ship technology, mining and mechanical engineering rely on the advanced technologies and solutions-driven expertise of Voith Turbo.

Voith Turbo Safeset are the experts in developing and manufacturing torque limiting, process improving and connection couplings within Voith.

The company in Sweden supplies customers worldwide with the most reliable systems available. With over 30 years of experience, Voith Turbo Safeset has unique knowledge in their field. Combining engineering skills, innovative strength and a solid base, Voith Turbo Safeset is a partner to rely on for generations to come.