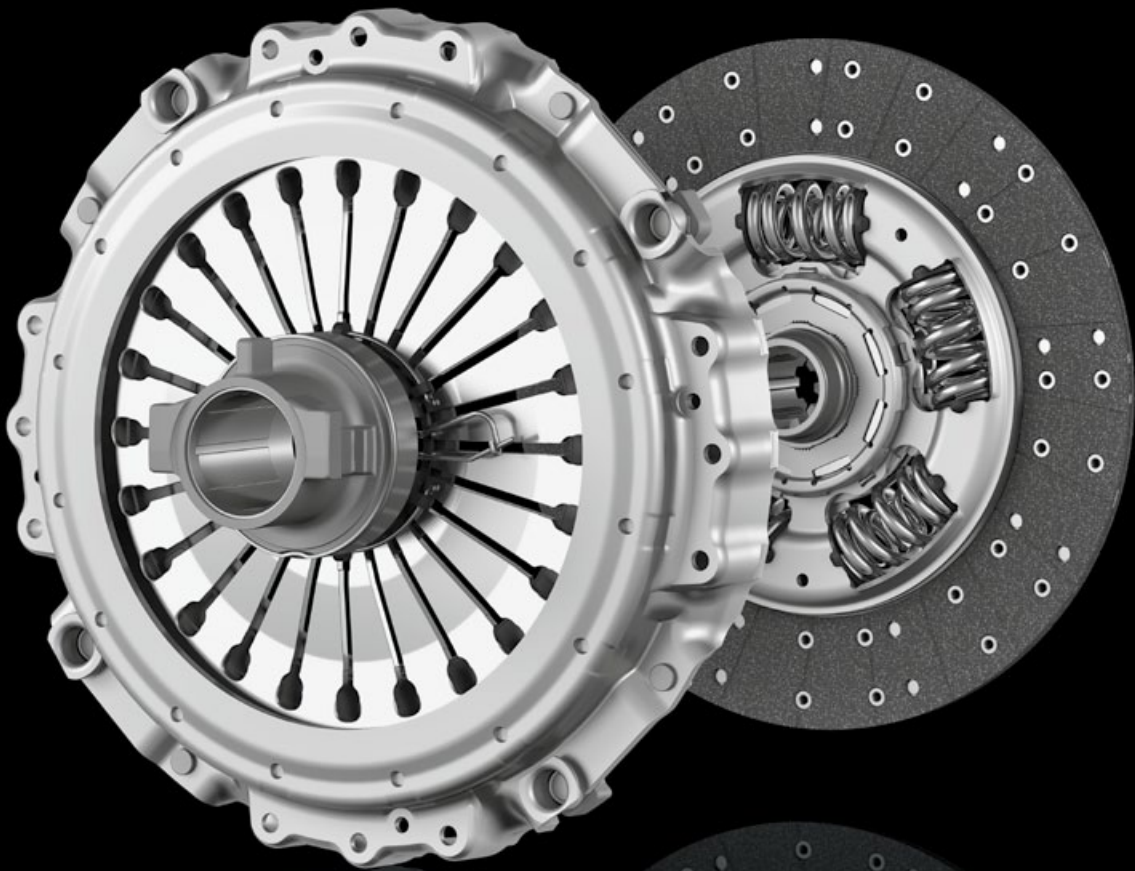


EXPERIENCING DYNAMICS – RELIABLY



COMMERCIAL VEHICLE POWERTRAIN MODULES





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THE RELIABLE PARTNER. In all regions of the world the amount of goods as well as the number of people being transported day by day is rapidly increasing. Clutch systems, transmissions and other ZF components help the vehicle owner, as well as the driver, to make their daily work easier and cost-efficient. From the smallest bus up to the biggest coach and from the lightest van up to heavy duty trucks, ZF ensures a quick, safe and cost-effective transportation with reliable and innovative products designed for the individual needs of every application and every region around the world – today and tomorrow.

POWERTRAIN INNOVATIONS BEYOND TOMORROW

Performance – comfort – environmental protection. Powertrain components and systems for commercial vehicles, developed and delivered by ZF, meet the widespread challenges of the highly complex interface between engine and transmission.



POWERTRAIN SOLUTIONS FOR ALL PURPOSES

The demands placed on suppliers are undergoing change at a fundamental level. Suppliers are increasingly expected to integrate components into complex systems – a task that can only be mastered in close developmental partnerships with the vehicle manufacturers. In the future, fuel consumption, emissions, weight, and installation space will continue to be lowered, while at the same time performance, safety, and driving comfort will rise. To achieve these objectives, innovative solutions and new products are essential.

Here ZF has taken the lead and responsibility – demonstrating expertise in generating comprehensive solutions with its integrated driveline systems. Therefore, this system approach pursued in the development and production of our new, highly innovative products and technologies, establishing tangible added value, is consistently promoted.

Quality, innovation, tailored supply and guarantee, life cycle costs, and service are our point of reference for the daily work at all locations. With help of an intelligent, globally applicable module system are the respective product requirements in a short time economically feasible.

Avoiding waste by remanufacturing as well as the use of completely recyclable materials ensures the highest possible environmental sustainability for all ZF products.



Clutch Systems

Clutch systems “Made by ZF”,
always the right partner

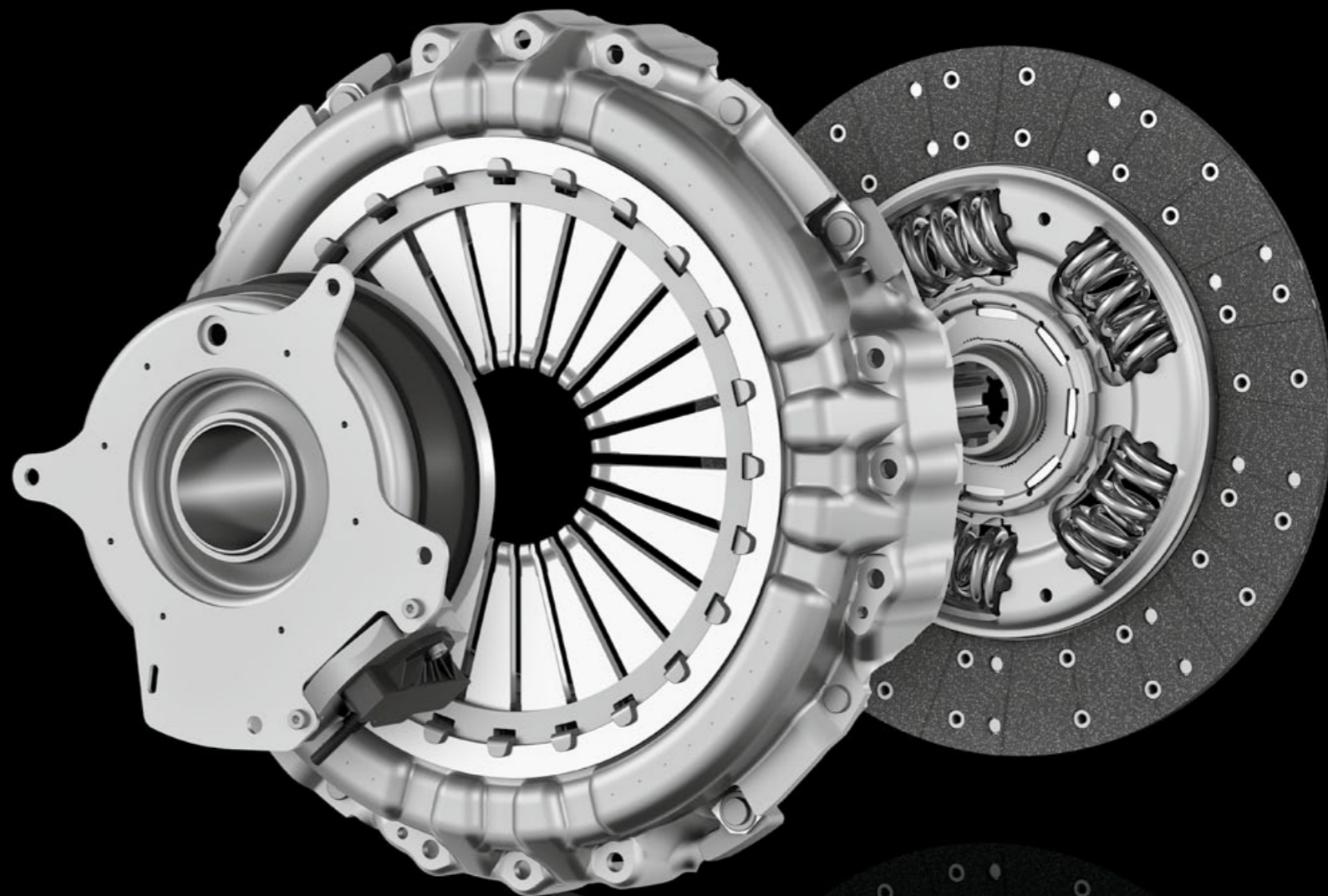
No matter which application, a ZF clutch system, sold under the traditional and renowned brand name “Sachs”, is designed to offer the perfect solution for the very different needs in the transportation industry across the globe.

The ZF commercial vehicle modular clutch system offers the perfect clutch for every vehicle from light-duty delivery trucks through buses and coaches up to heavy automated construction site dump trucks. Single- and twin-disc clutches from ZF for push- and pull-type actuation ensure a high level of cost effectiveness.

The demands placed on modern clutch systems are high: rapid and reliable disengagement and engagement of the torque flow, pleasant and ergonomic operation, maximum service life without loss of comfort, and vibrational damping using the smallest possible installation space. The clutch is exposed

to many highly dynamic influences. In particular, the system-related wear of the clutch facing leads to changes in the force and travel conditions, which must be considered in the clutch design. Last but not least, the clutch is an overload protection device intended to protect the valuable powertrain as a whole.

Crucial to the cost-effectiveness of a clutch system are the interplay of all components and control of the system interfaces in the design. Particularly in the area of commercial vehicle components, ZF has decisive advantages due to decades of experience in development partnerships with all leading manufacturers.



COMMERCIAL VEHICLE CLUTCH TECHNOLOGY FROM THE MARKET LEADER

- Complete product range from light- to heavy-duty
- Clutches available for standard as well as special applications
- All core components are developed and produced in-house
- Development partnerships with vehicle manufacturers worldwide
- Early awareness of market trends across the globe
- Global presence in development and production

MORE INFORMATION ABOUT TRUCKS/LCV
www.zf.com/trucks



MORE INFORMATION ABOUT BUSES
www.zf.com/buses



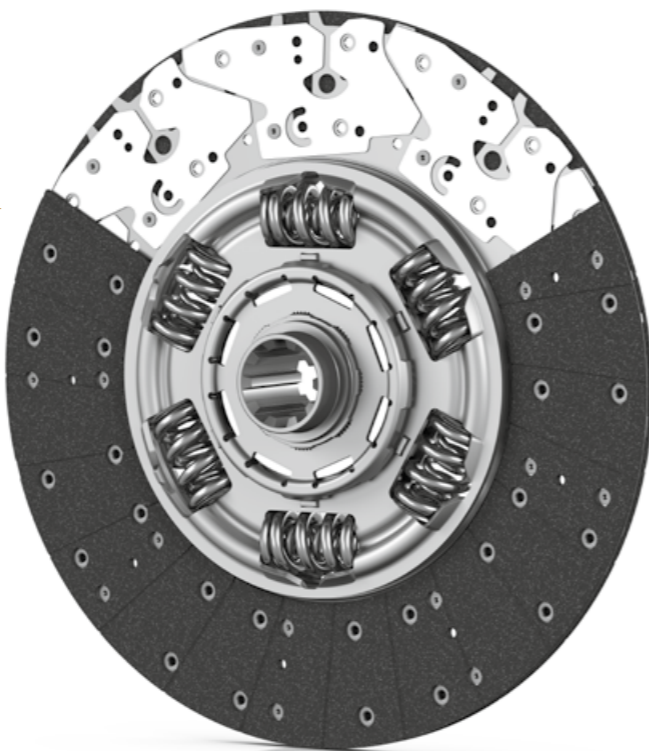
CLUTCH DISC

The clutch disc, at the interface between engine and transmission, is one of the most heavily stressed components in the powertrain and consists of the toothed sliding hub, the torsional damper, and the clutch facings with cushion springs. The cushion springs ensure a prolongation of the engagement travel and thus enable a smooth drive-off.

The level of the engine torque to be transmitted determines the disc diameter as well as the dimensioning of the torsional damper. The significance of the torsional damper is constantly rising since it is the tuning element for optimizing the torsional vibration properties of the entire powertrain. The size of the torsional damper and the dimensioning of the spring rates are defined by different criteria. Besides the already mentioned maximum engine torque, the rotational irregularities that occur play a major role. In case of noise problems during idling, the ZF clutch discs can be equipped with an additional predamper.

MODULAR DESIGN FOR ALL NEEDS

- The modular design with different torsional damper sizes permits individual tuning to every application
- Approved for engine torques above 3,500 Nm
- Special cushion-spring technology for high drive-off comfort
- Optional predamper to eliminate noise problems during idling

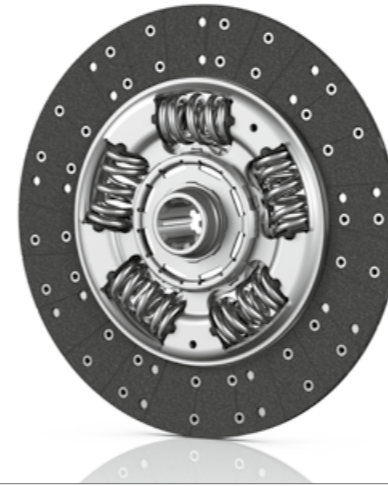


Clutch disc 430 WGTZ with 254 mm torsional damper and predamper

Modern powertrains more and more use down-speeding as a measure to increase fuel efficiency and reduce CO₂ emission. But operating a vehicle at a lower engine speed automatically increases the workload of the torsional damper in the clutch disc by shifting its working range closer to the resonance frequency of the powertrain. To compensate this trend, a significant reduction of the spring stiffness, despite of rising engine torques, had become necessary. In order to meet today's and future market demands, ZF has developed two brand new types of torsional dampers to lift the ability of noise reduction and comfort improvement to the next level.

Thanks to its sophisticated modular system, ZF is able to equip commercial vehicles with the optimal clutch for every type of requirement.

TORSIONAL DAMPER 285

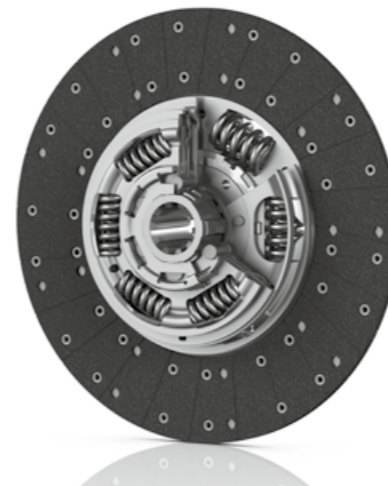


New type of torsional damper to fulfill the market demand for high performance dampers in 430 mm clutches. The 5 spring design provides an increased angular damper displacement and therefore a best-in-class comfort performance for high efficient powertrains.

YOU MIGHT CALL IT A SOFTY

- Stiffness reduction up to 40% compared to a 254 mm damper
- Suitable for engine torques up to 4,000 Nm

TORSIONAL DAMPER InLine®

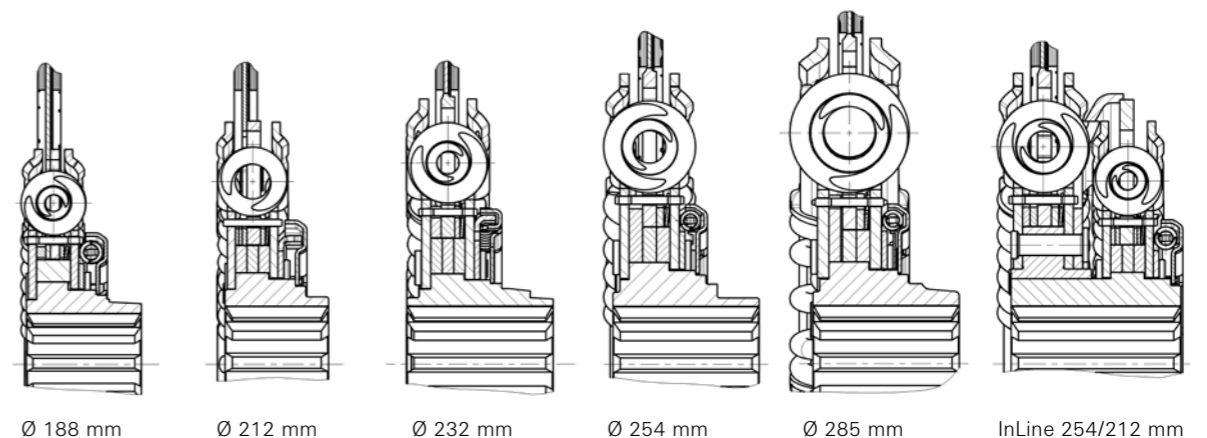


Through the innovative combination of a 254 mm and a 212 mm torsional damper, the ZF InLine® offers two independent spring stages that open a wide variety of tuning opportunities to eliminate noise and vibration problems. With each spring stage comprising its own friction device, additional potential for torsional damper tuning is given.

THE FLEXIBLE ONE

- Two independent main damper spring stages
- Friction devices in each spring stage open additional tuning options
- Suitable for engine torques up to 4,000 Nm

SIZES OF TORSIONAL DAMPERS for medium and heavy duty trucks and buses



CLUTCH COVER

The clutch cover is screwed to the flywheel and, when engaged, transmits the engine torque to the clutch disc via the housing, the tangential leaf springs and the pressure plate. For the dimensioning of the clutch cover, important factors such as the heat capacity of the pressure plate as well as the clamp load and release load of the diaphragm spring are considered.

Diaphragm springs are Belleville springs with integrated actuating levers, the diaphragm spring fingers. The housing and the pressure plate are connected by riveted leaf springs, the so-called tangential leaf springs. Due to their pretensioning, they lift the pressure plate when the clutch is released.

The diaphragm spring ensures high operating comfort with its shape, material and well-tuned characteristics. The clamp load of the diaphragm spring determines the maximum transmittable engine torque as well as the necessary release load.

The diaphragm spring characteristic is designed so that clutch-facing wear cause the clamp load to rise at first and, as wear increases, to fall again. When the facing reaches its minimum thickness, the clutch starts to slip slightly. However, the vehicle can still be driven without trouble. This ensures that the clutch can be replaced before downtimes occur.

The rapidly growing number of automated manual transmissions (AMT) implies new and different requirements on the release load characteristic of clutches. With the diaphragm spring, as a core component, being developed and produced in-house, ZF has the competence to comply with newly arising demands.

Since the facing temperature is a crucial factor in the facing wear, it is important for a cost-effective service life that the friction heat is conducted quickly through the mass of the pressure plate.



Pull-type clutch MFZ 430

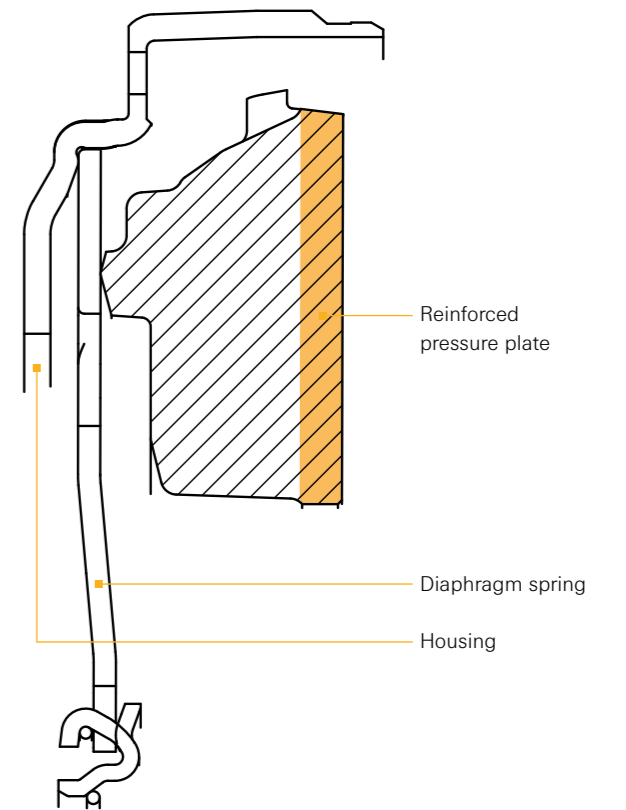


Push-type clutch MF 430

MFZ 430 HD

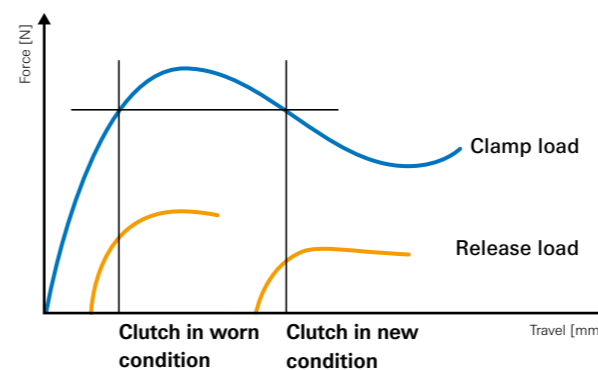


CROSS SECTION OF MFZ 430 HD



The reinforced pressure plate of the heavy-duty clutch considerably increases the heat capacity so that the temperature of the friction surface rises more slowly even during heavy usage, which substantially lengthens the service life of the facing.

CLUTCH COVER CHARACTERISTIC CURVES



The characteristic curve of the diaphragm spring is designed to ensure that after the intended facing wear is reached the clamp load has the same height as in new condition. From this point on, it falls steeply: the clutch slip tells the driver that the clutch has to be replaced.

TWIN DISC CLUTCH

Heavy vehicles, rough terrain – the clutch is subject to extreme loads here, where drive-offs on extreme gradients and frequent maneuvering can be part of the daily routine. Long slipping times of the clutch generate heat, which increases wear on the facings to a disproportionate degree.

With twice the number of friction surfaces and a greater heat absorption capacity, a twin-disc clutch can “keep cool” and protect its friction facings even under difficult conditions.

The intelligent ZF intermediate-plate control mechanism ensures reliable interruption of the power flow for both discs when disengaging the clutch. Defined control of the intermediate-plate makes sure that each disc has sufficient lift. When the clutch engages, the two clutch discs also grip uniformly and without jolting. And distributing the engine torque over two torsional dampers effectively reduces the noise level in the powertrain.

FOR THOSE WHO LIKE TO PLAY IN THE DIRT

- Long service life due to large facing volume and high thermal absorption capacity
- Excellent separating properties thanks to the intermediate-plate control mechanism and a common hub for the two discs
- Two torsional dampers offer high potential for decoupling vibrations
- Suitable for engine torque levels of up to ~ 3,800 Nm
- Pull- and push type versions for SAE-1, SAE-2 and SAE-3 bellhousings available
- Lower life-cycle costs due to longer service life and avoiding maintenance costs for clutch replacement
- Good automation capability thanks to especially smooth torque build-up



Pull-type twin-disc clutch MFZ 2/400



Pull-type twin-disc clutch GMFZ 2/380

XTend® WEAR COMPENSATION

The quality and service life of clutch facings have increased considerably, but even if treated carefully, they are by their nature subject to wear. Extending the service life is not just a matter of making the facings thicker, however, because the maximum possible stroke performed by the diaphragm spring imposes a limit on this in practice. The decrease in facing thickness has a crucial influence on the load conditions in the system. The diaphragm spring changes its position, which means that the release and clamping loads increase and therefore also the necessary pedal effort.

XTend® meets this challenge by decoupling facing wear from diaphragm spring movement: The facing reduction is registered every time the clutch is engaged.

When the clutch is released, the adjustment ring rotates and the diaphragm spring returns to its original position so that the system is again set to the optimum installation point. In contrast to the conventional clutch, the wear volume of the facings can be considerably increased. This substantially extends the service life.

AUTOMATIC WEAR COMPENSATION FOR A LONGER CLUTCH LIFE

- Economical through the avoidance of clutch changes
- All forces in the system remain constant, no rise in release load in the event of facing wear
- Axial installation space for the wear travel in the release system no longer has to be reserved
- For pull-type and push-type clutch covers
- Independent of cushion-spring or diaphragm-spring characteristics
- Completely exchangeable with conventional clutches
- Maintenance-free

XTEND®



Push type MF430 XTend®

POWER TAKE-OFF CLUTCH

Auxiliary drives allow the engine torque to be used for other jobs than just driving the vehicle. Typical use cases are drives for cement mixer drums, fire extinguisher pumps, compressors, and cable winches.

The ZF power take-off clutches are designed for continuous operation and high power transmission up to the full engine torque. The auxiliary drive is operational from the start of the engine and can be operated when the vehicle is stationary or moving. The power transmission to the auxiliary drive is independent of the vehicle clutch.

For agricultural and construction machines, special double clutches with cast housings and independent operation of the vehicle clutch and the power take-off are available.

POWER FOR EVERY MISSION

- For use with gearboxes with engine-dependent auxiliary drives, e.g. ZF NMV 221
- The auxiliary drive can be operated independently of clutch actuation, both in stationary and moving vehicles
- Power take-off via the auxiliary drive possible up to maximum engine torque
- Integrated, two-stage torsional damper in auxiliary drive reduces vibrations
- Also available as a twin-disc clutch
- Also available in other sizes



GMFZ 430 N Power take-off clutch



Clutch for agricultural applications

DRY DOUBLE CLUTCH X2C®

After the successful introduction of the Euro 6 emission regulation, the focus is changing more and more towards better fuel economy and CO₂ reduction. One measure to achieve this target is the reduction of the average engine operation speed – commonly known as downspeeding. Nevertheless, operating the engine at lower speeds immediately will increase the number of necessary gear changes, especially on uphill gradients. But every gear change results in a loss of driving speed and comfort, losing the previously gained advantages.

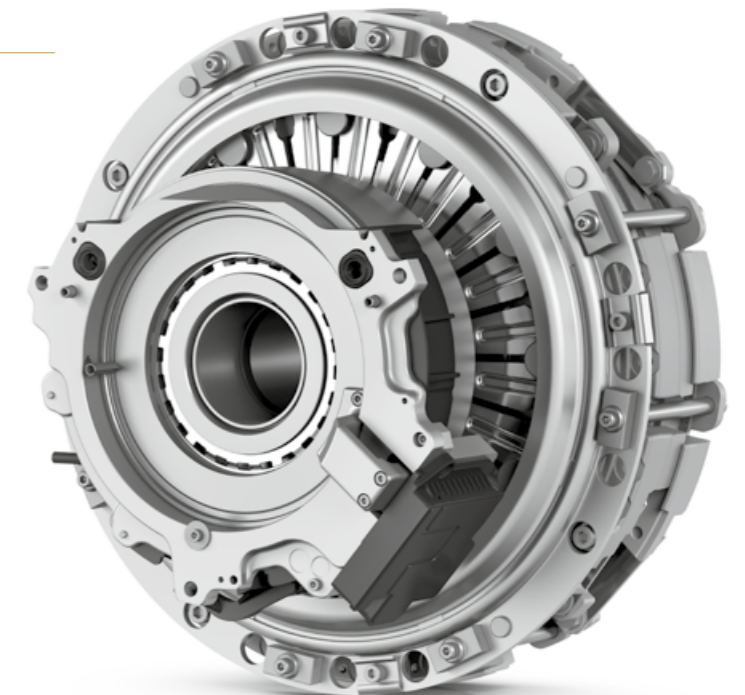
With the use of a powershift transmission, these drawbacks can be completely eliminated. Fast and comfortable shifting without torque interruption or speed loss are the essential benefits that a double clutch transmission can offer.

While driving in the actual gear, the transmission already preselects, according to the driving situation, the most likely suitable gear. The gearshift itself is then done by just opening one clutch and closing the other and thereby moving the flow of torque from one gear-wheel to another without any tangible interruption.

The ZF dry double clutch X2C® is designed for the use in heavy duty powershift transmissions, even above 3,000 Nm engine torque. The module itself consists of two friction clutches in combination with a double ConAct® release cylinder. Each clutch contains a high performance torsional damper disc, since operating at lower engine speeds will automatically multiply the need for torsional vibration reduction.

SEAMLESS POWER AND COMFORT

- Shifting without torque interruption
- No loss of vehicle speed during gear changes
- Possibility for downspeeding
- Increased fuel economy
- Reduced CO₂ emission
- Improved comfort during gear changes



Dry double clutch X2C® and double ConAct®

ConAct® PNEUMATIC CLUTCH ACTUATION

ZF has replaced the common fork type actuation with the clutch booster, the fork, and the releaser by a pneumatic release cylinder concentric with the transmission input shaft. This permits the elimination of all mechanical and hydraulic connections as well as the clutch booster, saving weight and installation length. Furthermore, the usual hydraulic systems contain a large number of components, with every interface increasing the risk of failure.

The ZF pneumatic release cylinder ConAct® is designed for push-type diaphragm spring clutches in heavy- and medium duty commercial vehicles.

ConAct® is suitable for fully automatic operation and clutch-by-wire applications. In the application with automatic transmissions, the system automatically determines the ideal release position – even for challenging driving situations such as maneuvering, starting on an incline with a heavy load, or starting on a slippery surface. Controlled by the vehicle's electronics, the solenoid valve regulates the clutch actuation by means of the pneumatic ConAct® cylinder, the danger of clutch overload caused by the driver is eliminated. And with its low number of system components and the direct clutch actuation, ConAct® remarkably improves the controllability of the clutch in AMT applications.

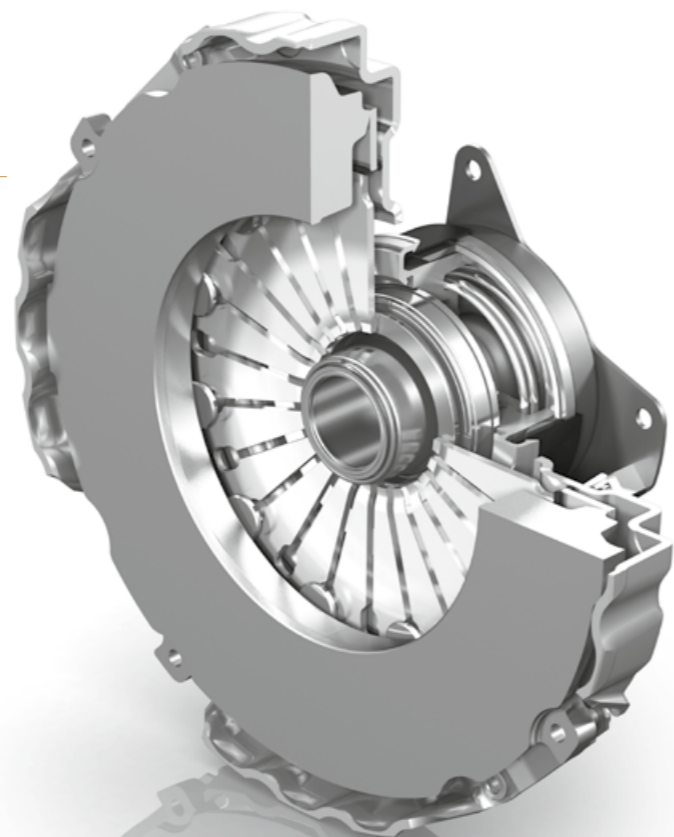
DYNAMIC CLUTCH RELEASE SYSTEM FOR AUTOMATED TRANSMISSIONS

- Reduced number of components and system weight
- Available in two different sizes
- The ability to control AMT applications is improved by the low number of friction points and the avoidance of play
- The actuation direction, parallel to the axle, reduces the load on the release bearing
- Simplified transmission assembly by means of the push-type clutch and the high degree of component integration
- Environmental friendly, no hydraulic fluid needed



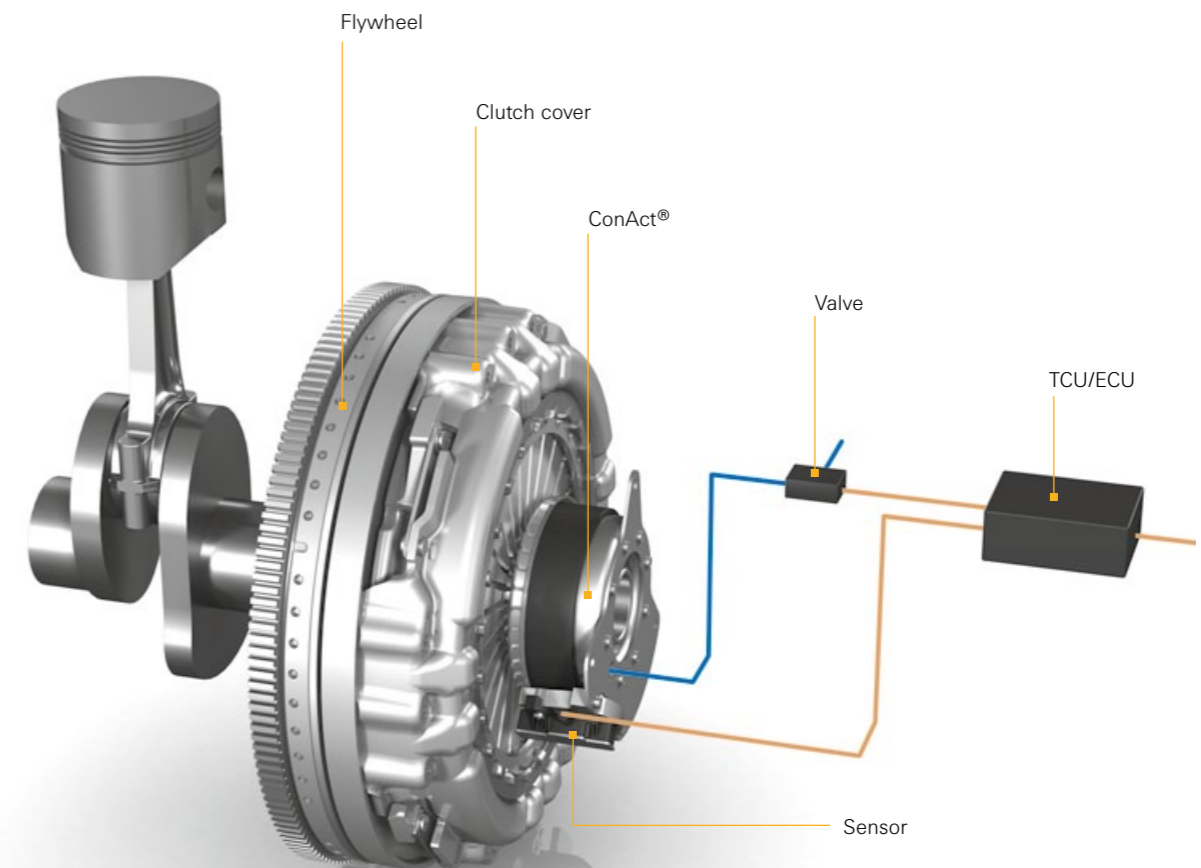
CONACT®

ConAct® pneumatic clutch actuation cylinder



ConAct® for medium duty applications

ConAct® SYSTEM DESIGN



XAct Clutch-by-wire

Conventional clutch control requires drivers to do a lot of work. They have to exert high pedal loads and concentrate on gear selection, engine speed, and clutch engagement points. Deviations from "ideal operation" lead to increased clutch wear, or in the worst case, to clutch failure. For safety reasons, therefore, conventional clutch systems have to be generously dimensioned in order to ensure vehicle mobility even in the event of incorrect operation.

Reliable clutch actuation suitable for everyday use in manual transmissions can be implemented on the basis of a clutch-by-wire system using the ConAct® cylinder.

Additionally to the AMT infrastructure, the position of the clutch pedal is communicated to the system-integrated control and the clutch is accordingly engaged or disengaged. Additional software features avoid clutch misuse or allow extended clutch functions.

For the driver, there is no noticeable difference between the XAct system and a conventional clutch. For the fleet owner, however, protection from incorrect operation means fewer clutch changes and thus more profitable vehicle operation.

RELEASER

The classic releaser transmits the force of the static release fork to the diaphragm spring, which is rotating at engine speed. The release bearing must absorb high axial forces. In push-type actuation systems, the releaser rests on the tips of the diaphragm spring, but in pull-type systems, the releaser must be locked accordingly, which makes assembly somewhat more complex. Dust and deposits are a particular hazard for the highly stressed release bearing.

Modern ZF releasers for push- and pull-type clutches are equipped with contact seals on both sides of the bearing as well as a lifetime lubrication with high performance grease. This, together with the plastic sliding sleeve, ensures a complete maintenance free operation, saving the money for a regular service.

The self-centering ability allows the bearing to adjust itself to the axis of the clutch cover, thus compensating for misalignment between the engine and transmission shafts. Wear or breakage is avoided.

MAINTENANCE FREE CLUTCH ACTUATION

- For pull- and push-type clutch actuation systems
- The bearings are equipped with contact seals as well as a lifetime lubrication and are maintenance-free
- The use of plastic sliding sleeves eliminates the need to grease the sliding seat
- The bearings are self-centering to compensate for axle offsets
- Experience in ball bearing technology since 1895



Pull-type releaser KZISZ-5



Push-type releaser KZIS-4 with plastic sliding sleeve

CLUTCH FACINGS

Friction facings are the crucial element for a stable and well definable transmission of driving power. With very few exceptions, such as in racing, agricultural tractors, and a few regional markets, organic facings are used for dry clutches. In this way, demands for a high friction coefficient, comfortable drive-off and gear-shifting, as well as a long service life – if treated correctly – can be met.

Special requirements are placed on heat resistance: If the friction surface temperature exceeds 300°C, the clutch begins to slip (fading) together with an increasing damage of the friction material.

The commercial vehicle clutch facings from ZF meet all requirements concerning wear, friction coefficient, comfort, burst resistance, and fading stability in an outstanding manner.

COMFORT FOR A LONG SERVICE LIFE

- High, constant coefficient of friction
- Smooth engagement performance
- High heat resistance against fading
- Low wear rate
- High speed stability
- No deformation tendencies
- Environmentally compatible in production and materials, solvent free
- Clutch facings for all applications available
- Approvals from all big vehicle manufacturers

Clutch facings consist of organic bonding agents such as rubber and synthetic resin as well as extrusion coated fibers made of glass and synthetic materials, also reinforced by brass, which are wound, compacted and baked in a complex process.

The facings are usually riveted or bonded onto cushion springs. These cushion springs between the facing and the clutch disc, ensure smooth and comfortable clutch engagement.

All facings used by ZF comply with the EU Directive 2000/53/EG (free of lead, cadmium, mercury and hexavalent chromium) and are produced without toluene or chlorinated organic solvents.



ZF clutch facing

DUAL MASS FLYWHEEL

Higher torques and stricter emission controls are leading to an increasing excitation of the powertrain by rotational irregularities. At the same time, the demands are increasing for noise reduction and comfort as well as the protection of the transmission and vibration-sensitive vehicle components. All this requires extremely high-performance torsional damping systems. If the torsional damper in the clutch disc is not sufficient to damp engine vibrations in critical engine speed ranges, the Dual Mass Flywheel ensures outstanding decoupling over the entire rpm range.

The Dual Mass Flywheel from ZF decouples engine vibrations in an ideal manner, making rattling and booming a thing of the past. The flywheel mass is divided into a primary and a secondary mass, with the secondary flywheel mounted to the primary flywheel by a bearing that allows it to rotate.

A highly efficient, grease-filled spring and damping system operates between the two masses. This means that the resonance speed of the Dual Mass Flywheel – in contrast to conventional clutch discs with torsional dampers – lies below the engine's idle speed.

The axial space requirements for a Dual Mass Flywheel with clutch are similar to those for a twin-disc clutch. Thus the Dual Mass Flywheel can usually be integrated into existing powertrain configurations.

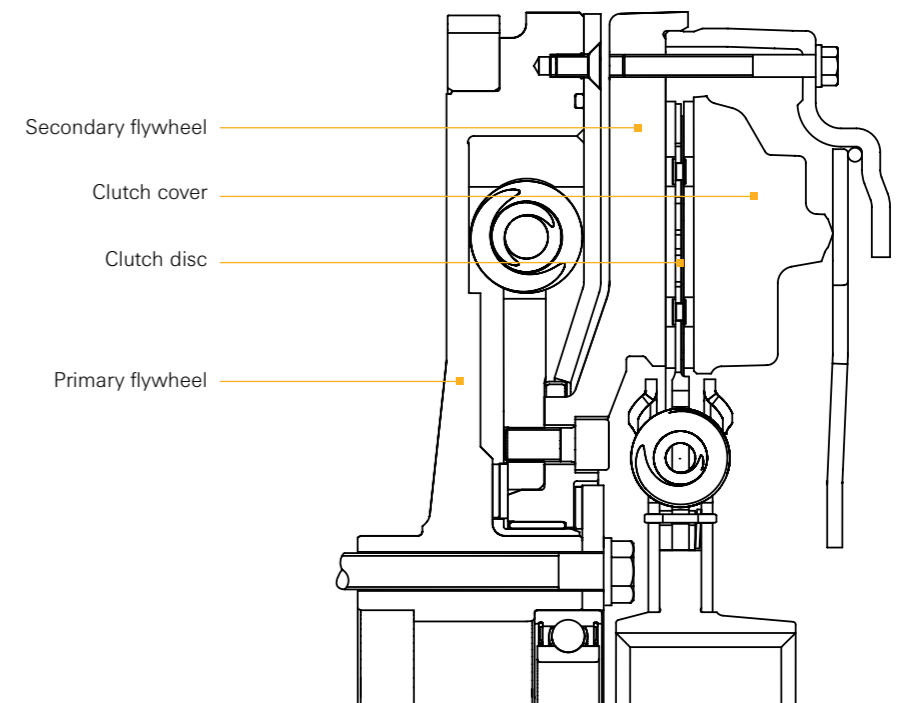
THE TOP OF THE LINE DAMPER

- Outstanding decoupling of engine irregularities
- High drive comfort
- Reduction of transmission loads
- For clutches up to Ø 430 mm
- Approved for engine torques above 3,500 Nm

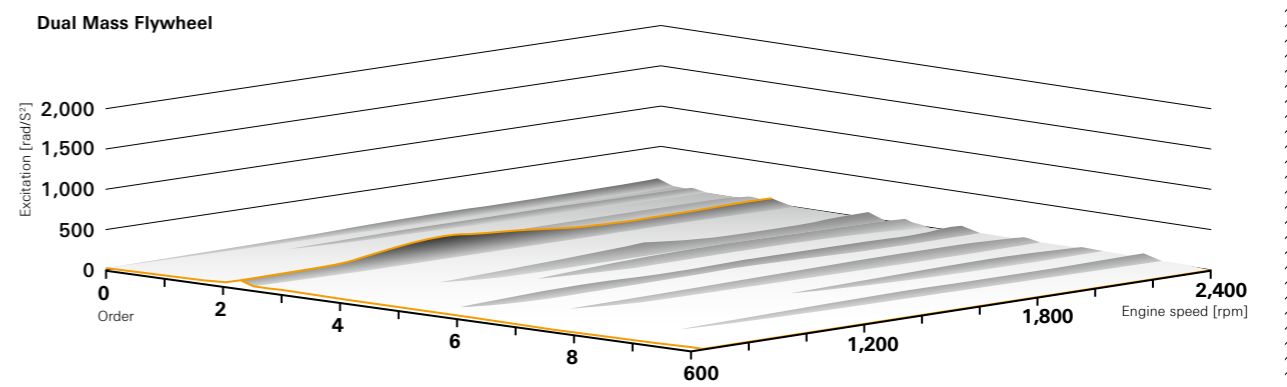
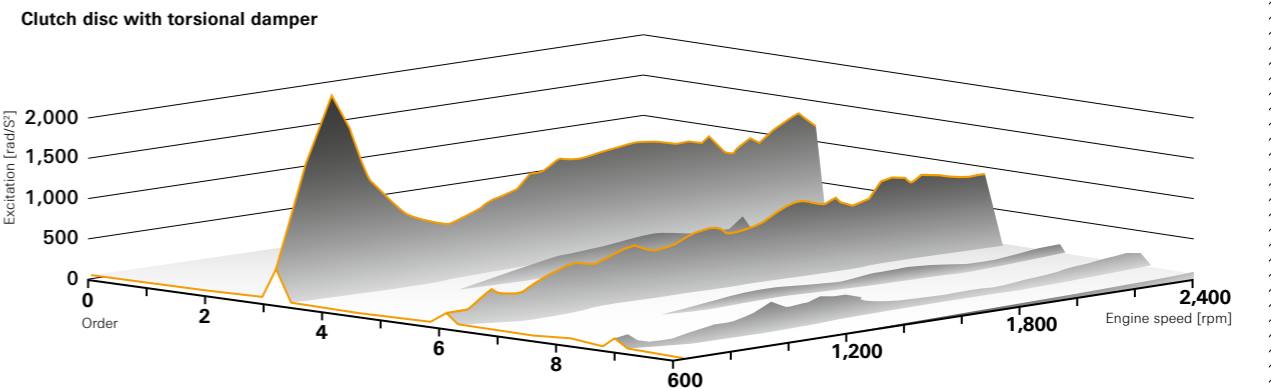


Dual Mass Flywheel 430 mm

DUAL MASS FLYWHEEL SYSTEM DESIGN



COMPARISON OF ROTATIONAL IRREGULARITIES at the transmission input shaft



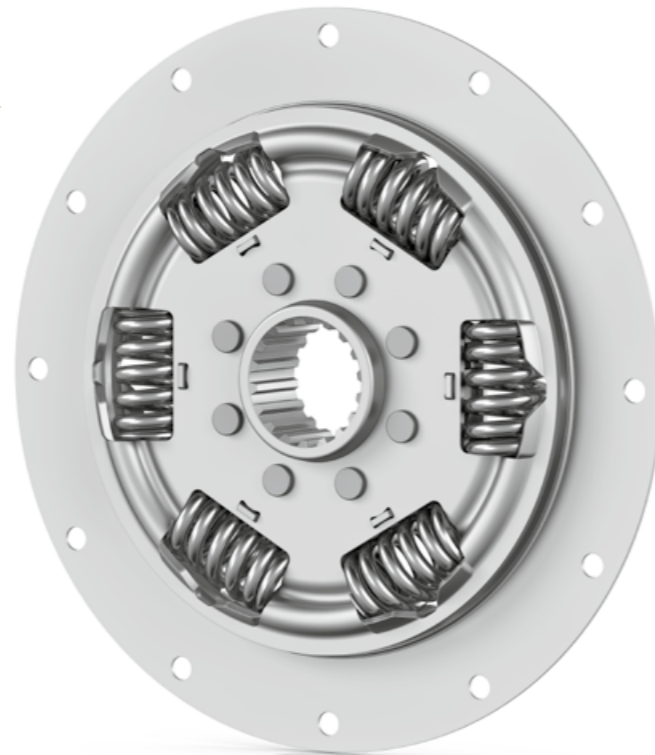
TORSIONAL DAMPER

Torsional dampers are placed behind the engine as vibrational dampers when the powertrain does not include a separating and starting clutch. The purpose of using a torsional damper is to keep engine torque peaks as well as operational irregularities away from the powertrain and connected units. Thus every commercial vehicle with a power-shift transmission or hydrostatic drive has a torsional damper that ensures "peace and quiet" in the vehicle. If the forces operating in the powertrain area were not countered, driving comfort would be noticeably reduced and the powertrain components would also show considerably higher levels of wear. A standard solution today for decoupling torsional vibrations in powertrains is to use a bolt-on torsional damper that builds on the technology in clutch discs with torsional damping.

The torsional damper consists of a set of coil springs positioned in windows that allow an amount of rotary movement between the crankshaft and the transmission input shaft and a friction device. By selecting the right torsional damper size and spring set, characteristic curves can be adjusted to meet the individual needs of specific applications. Vibrational decoupling can therefore be adapted in optimum fashion to the vehicle, and ignition-related rotational irregularities can be reduced. The torsional damper is integrated into the respective installation space by a simple adjustment of the external bolt-on area and by selecting the corresponding spline profile to match the drive shaft.

THE TORSIONAL DAMPER THAT LASTS

- Enhanced driving comfort and protection for powertrain assemblies due to reduced engine vibrations
- Low installation space requirements
- Easy to integrate in a wide range of powertrains
- Thermal stability over the entire service life via the use of heat-resistant steel springs
- Superior product quality via the use of large-scale series technology



Torsional damper 254 mm

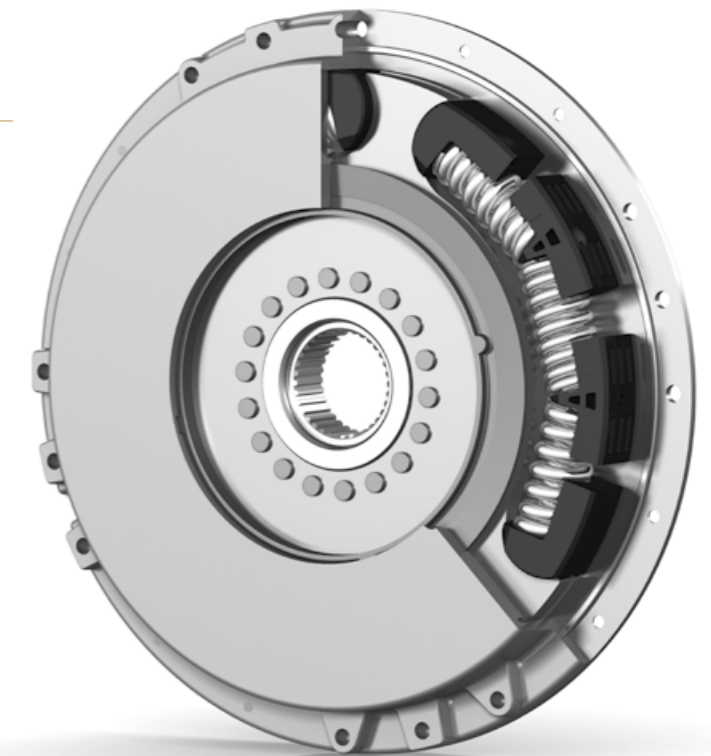
DynaDamp

For especially critical applications, torsional dampers can reach their limits when the level of rotational irregularities in the powertrain increases. This places increased strain on the powertrain and also causes disturbing noises in the vehicle. Reducing these rotational irregularities is thus a central task in order to protect the powertrain and to increase driving comfort. For these higher demands placed on decoupling torsional vibrations, ZF DynaDamp is the right solution. The DynaDamp torsional damper is available for engines with torque levels above 3,000 Nm.

The DynaDamp is integrated between the engine and the powertrain, and uses the same technology as the established Dual Mass Flywheel to decouple torsional vibrations reliably and at a high level.

VIBRATION DAMPING ON THE HIGHEST LEVEL

- Multi-stage spring characteristic curves possible
- Speed-dependent damping due to grease filling
- Enhanced driving comfort and protection of powertrain assemblies due to reduced engine vibrations
- Easy to integrate in a wide range of powertrains
- Thermal stability over the entire service life
- Superior product quality via the use of large-scale series technology



DynaDamp for SAE-1 applications

Due to the placement of the torsional damping springs with a large radius, combined with speed-dependent grease damping, the DynaDamp provides a further considerable increase in the ability to reduce rotational irregularities.

Because the spring sets are designed to consist of multiple compression springs, the combination of different springs can enable multi-stage characteristic curves and can thus be adapted in ideal form to individual requirements. This allows vibrational decoupling to be optimally adjusted to individual applications. This in turn greatly reduces ignition-related rotational irregularities.

HRTD – BELT PULLEY TORSIONAL DAMPER

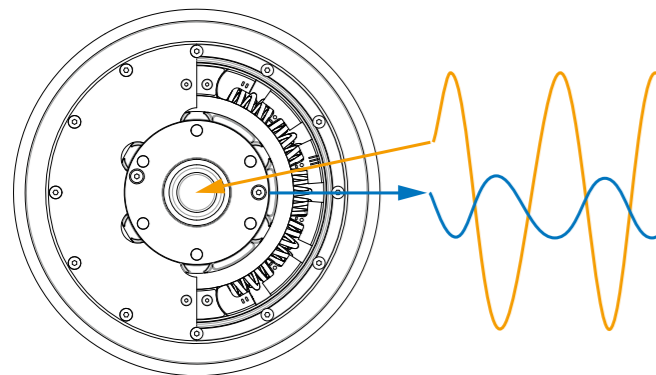
Belt damage is a common cause of interruptions to e.g. bus journeys, resulting in dissatisfied customers and the high cost of replacement vehicles. Based on the technology of the tried and tested Dual Mass Flywheel, the hydraulic belt pulley torsional damper eliminates vibrations in the belt drive, thus protecting belts and auxiliary drives.

PROTECTION FOR THE BELT

- Multi-stage spring characteristics possible
- Low stiffness for outstanding rotational vibration decoupling
- Grease filling for damping and lifetime lubrication
- Maintenance-free
- Cost efficient design via the use of large-scale series parts from Dual Mass Flywheels

VIBRATIONAL DECOUPLING

The pulley is divided into a primary and a secondary mass. In combination with a spring set, outstanding vibration insulation is achieved.



Belt pulley torsional damper

CLUTCH FOR AUXILIARY DRIVES

Conventional auxiliary assemblies in the commercial vehicle, such as compressors, are continuously in operation from the start of the vehicle and consume energy. As soon as the compressed-air reservoir tanks are filled, conventional compressors continue to run at a reduced pressure level.

With the new clutch for auxiliary assemblies, the compressor is completely separated from the engine by opening the clutch when the cut-out pressure is reached. The unit comprises a pneumatically actuated cylinder and the clutch itself, consisting of a lamella set with three discs. Since the clutch is flooded with engine oil during operation, there is practically no wear.

The multi-disc clutch ensures a reduction in fuel consumption by engaging and disengaging the compressor to meet demand, thus also reducing CO₂ emissions. The normally-closed design of the clutch ensures that, in the event of a control malfunction, for example, the compressor continues to run and maintains the supply of compressed air.

ENVIRONMENTAL FRIENDLY AND COST EFFICIENT

- Avoidance of drag losses by switching off the compressor when not needed
- Savings potential up to 0,5 l fuel per 100 km
- Normally-closed design as clutch safety concept
- Design with optimized oil cooling and lubrication
- Simple adaptation to compressor and gear train of engine possible



Air compressor clutch

EVERYTHING IN SIGHT: ZF OVERALL EXPERTISE FOR COMMERCIAL VEHICLES



ZF technology is the standard for commercial vehicles in all categories. Whether transmissions, axles, steering systems, shock absorbers, driveline or chassis components: As a systems supplier, ZF always has the entire vehicle in mind.

Efficient and safe on the road: ZF driveline and chassis technology in commercial vehicles

The driveline is the heart of the vehicle: It significantly influences how the engine power is applied to the road. ZF transmissions draw upon a long volume-production experience and are consistently developed further. They deliver their full potential in perfectly harmonized interaction with ZF components for driveline, wheel suspension, axle guidance, damping, and spring suspension as well as with ZF chassis systems.

Working better and more comfortably: ZF technology for driving dynamics and comfort

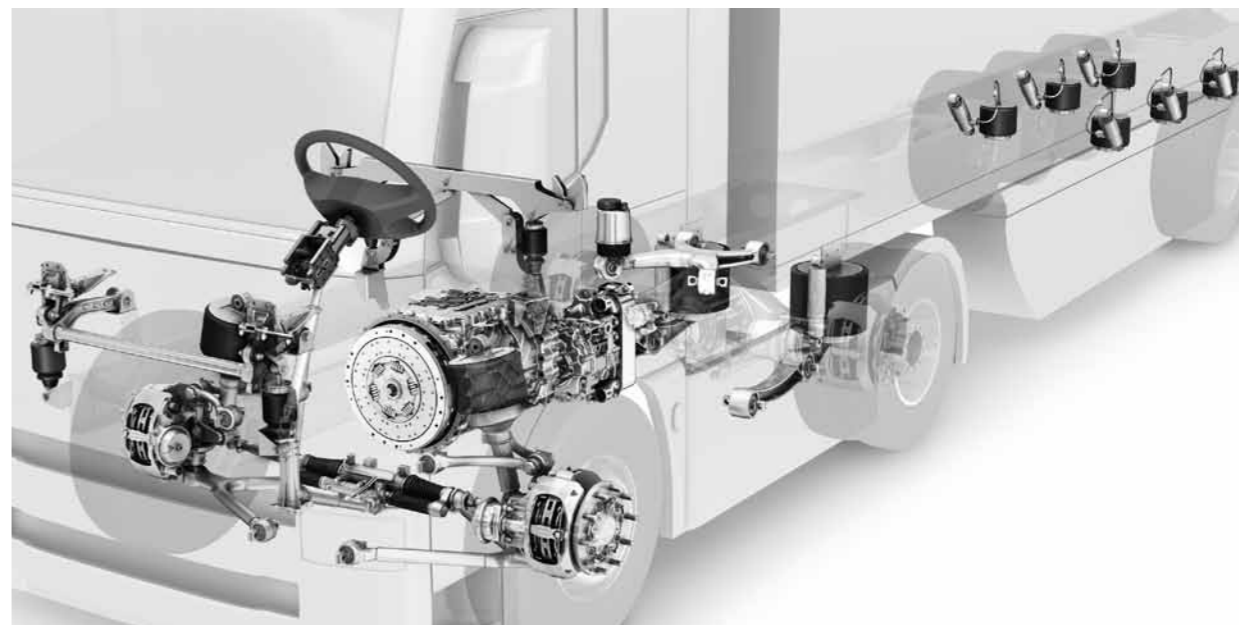
Comfort in the cabin is not a luxury, rather it is a means to an end. Driving comfort supports the concentration of drivers and improves their working conditions. At the same time, intelligent assistance systems ensure that drivers can rely on the performance of their vehicle in all driving situations. These are the prerequisites to ensure that driver, vehicle, passengers and load are always safe on the road and will arrive on time.

More economic driving: ZF driveline technology for all categories
ZF transmission systems are the first choice when it comes to driveline technology. The synchromesh transmissions have proven themselves worthwhile millions of times over. The ZF automatic transmission systems set new standards with regard to economy, safety, and comfort. Furthermore, ZF driveline components preserve the driveline and relieve the driver of stress. Obtain technical details and experience our products online at www.zf.com.

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