Dual mass flywheel DMF – Multi-stage vibrational damping

ZF's DMF impresses with its modular design of the compression spring offering a solution for various torsional vibrational problems in the vehicle. Supplemented by a rpm-adaptable damper, the torsional vibration caused by the internal combustion engine is excellently decoupled.

The task

Passenger car engines with optimized fuel-consumption levels are becoming ever more powerful despite smaller displacements and fewer cylinders. To drive on less fuel, the engine's useable rpm range has been shifted toward the idling range. This has led to a marked rise in rotational irregularities in the combustion engine. To continue to provide rumble-free driving and to protect the powertrain from harmful vibrations, effective vibrational damping is needed. The highly effective DMF models from ZF provide optimum torsional damping.

The technology

The dual mass flywheel is installed between the engine and the transmission along with the clutch cover and clutch disc. The DMF and the MTD both consist of a primary and a secondary mass, which are connected by a lubricated spring set. The primary mass is bolted to the crankshaft and carries the starter ring gear. The primary and secondary masses are mounted such that they can rotate independently. The spring set has a modular design, which allows characteristic curves to be varied and optimized. It consists of compression springs as well as

Single-row DMF
For engines with low and medium torque ranges up to 400 Nm. Straight compression springs. Multi-stage characteristic curve.

Double-row DMF
For engines with medium and high torque ranges > 350 Nm. Additional inner damper for high driving comfort.

Mechanical torsional damper
For engines with low and medium torque ranges up to 350 Nm. Additional friction unit with speed-dependent effect.

DMF with rpm-adaptable damper
Swing-mounted flyweights for vibrational damping. Application for highest comfort requirements.

DMF TD with direct output
Application for CVT, dual clutch, and hybrid transmissions.

compression spring guide elements which are made of high-strength plastic.

The properties of the polyamide plastics are selected by application-specific compounding. All DMFs from ZF have multi-stage torsional characteristic curves. This is achieved by combining different quantities of compression springs with different rigidities. The soft initial stage ensures excellent engine starting and stopping behavior. Subsequent harder stages provide effective torsional vibration decoupling and sufficient overload protection at normal driving speeds.

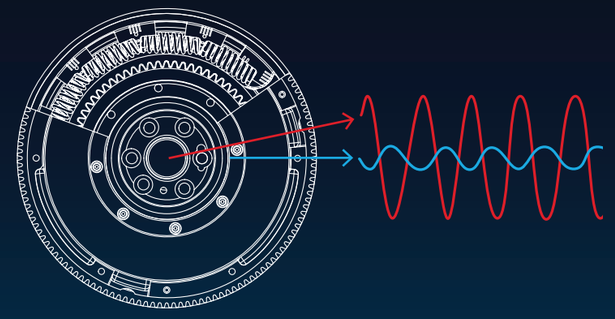
A further improvement in torsional vibration damping is achieved by a DMF with a double-row spring set. The second spring set is located radially within and downstream from the first, which substantially decreases the DMF's torsional rigidity. The inner damper's compression springs operate with low friction at both high engine rpm and torque levels. A DMF with an rpm-adaptable damper provides excellent torsional vibration decoupling. The rpm-adaptable damper operates on the DMF's secondary mass and is located within the outer spring set. The rpm-adaptable damper vibrates inversely to the rotational irregularity remaining from the DMF spring set, which nearly eliminates residual rotary vibration amplitudes. This additional vibrational damping enables vehicles to be driven at high loads without annoying noises from idling speeds on up.

Benefits

- Less noise
- Easier to shift gears
- Outstanding vibration damping throughout the entire rpm range
- Easily adjusted to vehicle designs
- Smooth start/stop performance
- Long service life
- Smaller dimensions
- Pull and push-type clutches possible
- Reduced fuel consumption because vehicles can be operated at lower rpm levels

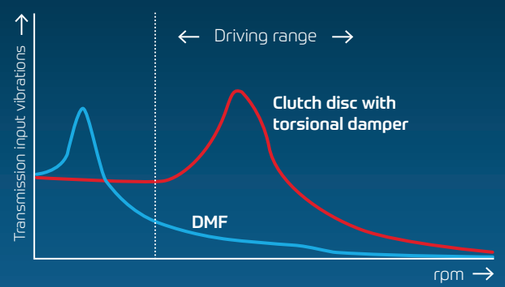
DMF at a glance

Vibrational decoupling



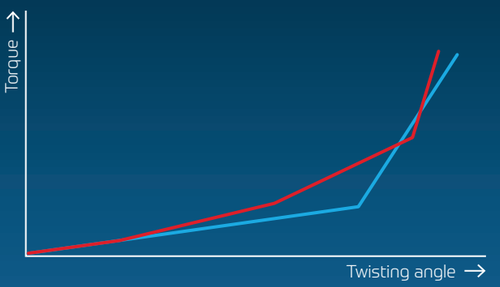
The flywheel is divided into a primary and a secondary mass. Together with the spring set, it effectively isolates torsional vibrations.

Comparison of clutch vs. DMF



For a torsional damper in the clutch disc, the resonance rpm lies in the lower engine speed range, but for a dual mass flywheel it lies well below the engine idling speed.

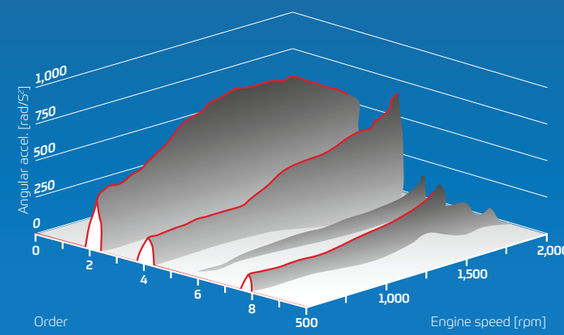
Two and three-stage DMF characteristic curves



A typical DMF characteristic curve. It starts with a soft initial stage, followed by considerably harder stages. The first stage features a minimum degree of stiff ness in order to keep the DMF natural frequency low.

Comparison of vibration damping

Clutch disc with torsional damper



Dual mass flywheel