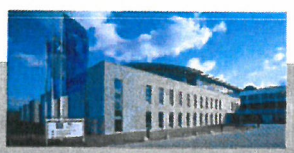
ZF SACHS

Vibration Dampers for Rolling Stock

Product Documentation BE 303
Types T50 und T70


Contents

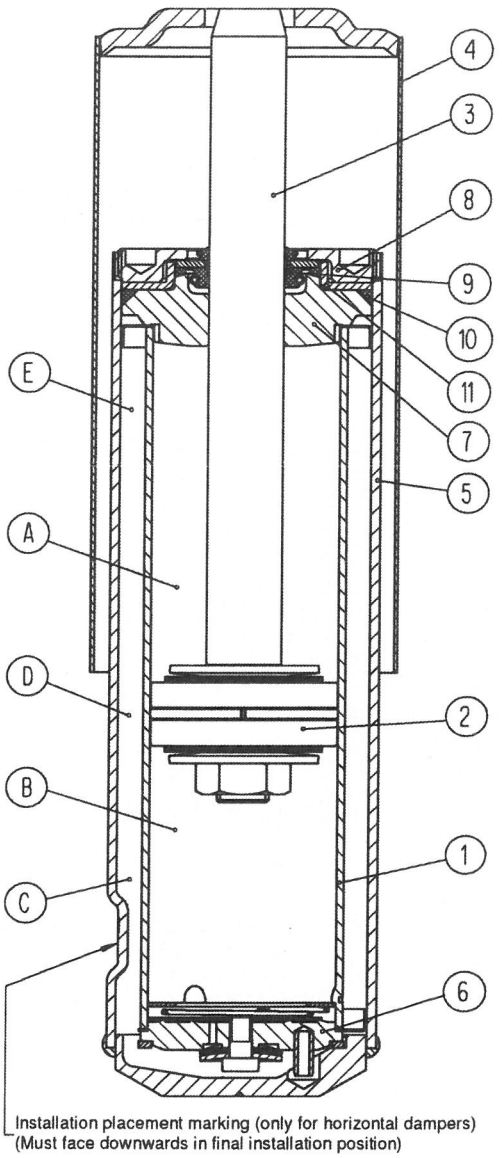
1. Describtion of Sachs Hydraulic Vibration Dampers

Valid for vibration dampers of types T50 and T70
with piston diameters of 50 mm and 70 mm
for vertical and horizontal installation

1.1 Design

Sachs vibration dampers of types T50 and T70 consist essentially of the parts described below (see diagram in section 1.2, page 4):
The pressure cylinder (1) with the reciprocating piston (2), piston rod (3), protective tube (4), reservoir tube with welded-on base (5), base valve (6), rod guide (7), locking ring (8), rod seal (9), O-ring (10), and washer (11), as well as the complete upper and lower mounting elements.
(Upper and lower mounts are not illustrated because they do not affect interior damper design or function).

1.2 Operating Principle



The piston (2) divides the pressure cylinder (1) into an upper and lower working chamber (A) and (B). In rebound, i.e. when the piston rod (3) extends, as well as in compression, damping forces are generated by the pressure differential between working chambers (A) and (B) above and below the piston. Pressure levels in the working chambers adjust automatically depending on piston velocity, and resistance to flow is controlled by the valves on the piston (2) and the base valve assembly (6).

When the piston operates, damper fluid (oil) moves in and out of the annular reservoir chamber (C), which contains air in the upper part (E) and oil in the lower part (D).

A pumping process therefore takes place when the damper operates, which is caused by the displacement effect of the piston rod volume (3) and controlled by the piston and base valves.

When the piston extends (rebound) a volume of oil corresponding to the volume of the extending piston rod is drawn from the annular reservoir chamber (C) through the inlet valve on the base valve (6). When the piston moves inwards (compression), a volume of oil corresponding to the compressing piston rod volume is displaced through the pressure valve on the base valve (6) back into the annular reservoir chamber (C).

The base valve is set in such a way that its pressure differential is always greater than that of the piston pressure valve. This ensures that the upper working chamber (A) constantly shows a higher pressure than the annular reservoir chamber (C), even during compression. This in turn prevents air from being drawn in through the gap between the piston rod (3) and the rod guide (7).

1.3 Damping Forces

The damping forces depend on the piston velocity, i.e. they increase as a function of piston velocity in accordance with the specific valve setting. When dampers are installed, the valve setting must be checked with the greatest care. The only sure way to test damping forces is to measure them. Using a special test machine, the piston is moved back and forth in the damper and the damping forces thereby generated are recorded as a function of velocity. The function chart, F = f(s), is also recorded, which shows whether the valves are operating correctly. Different velocities are achieved by changing the sinusoidal excitation frequency for the same test stroke, generally 50 mm. The damper setting is indicated on the product drawing.

1.4 Labelling

Labelling takes the form of a roll-type printing and an ID sticker, which is placed on the protective tube. The inscription includes the part number and the ZF Sachs logo, as well as the setting (rebound/ compression/velocity) in the line marked "Lei" (performance).
If required, the inscription can also include the customer number and name.

1.5 Installation Guide

When installing dampers with eye-type mountings, make sure that the mounting bush is securely tightened axially to the mounting components on the vehicle, in order for any radial movements to take place within the rubber coupling.

When installing the damper, make sure that end with the protective tube (4) is uppermost. For horizontal installations, the side of the reservoir tube (5) marked "UNTEN" must face downwards for the damper to function properly. Make sure that the protective tube end is at least 2° above the horizontal plane when the damper is in its final horizontally mounted position.
The installation instructions must also be carefully followed for dampers with pin-type mounts.

1.6 Special Advantages

1.6.1 Piston Rod

The piston rod is chrome-plated and therefore protected against corrosion.

1.6.2 Rod Seal

The seal at the piston rod outlet, made of a special oil resistant rubber compound developed in the course of a lengthy series of tests, consists of a lip-type seal with a so-called sealing lip and an additional dust ingress or wiper lip. The dust lip is designed to keep dirt particles away from the sealing lip, which ensures greater protection against wear.

The seal is not subject to hydraulic pressure generated by the working chambers, because oil ways connect the area under the seal with top of the annular reservoir chamber.
The seal is therefore relieved from pressure. It also features a high degree of thermal resistance.

1.6.3 Protective Tube

The protective tube covers the reservoir tube even at full extension of the damper, which means that the piston rod is protected against stone impact and ensures dirt is mainly prevented from entering.

1.7 Visual Inspection / Maintenance

Due to their special design, Sachs vibration dampers require absolutely no maintenance if they are correctly installed. The dampers should be visually inspected in the course of regular vehicle maintenance inspections. They should be monitored for external damage and/or significant oil presence (see section 2, "Damage and Damage Assessment").

Damper operation should be checked each time the vehicle or bogie is overhauled. Damper performance should be measured on suitable test equipment that conforms to the product description.

1.8 Storage

The dampers should be stored at minimum length or installed length. They should lie horizontally in dry, darkened (out of direct sunlight), and in well-ventilated rooms. Direct sunlight leads to premature ageing of the rubber components contained in the mounts.

They should be stored for no longer than 5 years.

When dampers are stored for lengthy periods of time, they may need to be primed. To do so, hold the damper in the vertical position (protective tube end uppermost) and cycle it through its full stroke. Depending on the setting this can be done either by hand or on a damper test machine. The damper is fully functional when resistance is felt at the reversal points.

1.9 Safety Note

Rebound or lift stops, for those dampers that have them, serve only to secure damper movement for the brief and small amount of lifting needed for derailing or re-railing. Dampers are not designed and are not to be used for other lifting purposes subject to legal regulations.
Therefore when lifting and transporting bogies or vehicles, additional safety measures must be taken in order to prevent injury to persons or property in case the bogie or wheel sets are dropped.

2. Damage and Damage Assessment

Damaged vibration dampers have to be replaced. To help decide when to replace them, some criteria are described in greater detail below.

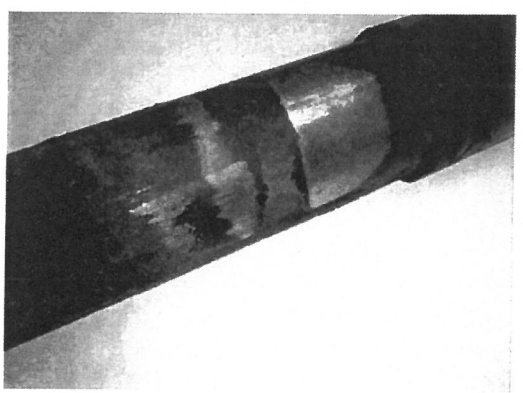
2.1 Defective Protective Tubes

Damage to the protective tubes from external influences, such as stone impact.

- Protective tube shows major denting => damper movement restricted or obstructed.
- Protective tube is loose => damper rattles.

The damper should be replaced.

2.2 Protective Tube Scrapes on Reservoir Tube



The damper should be in its installed position when inspected.

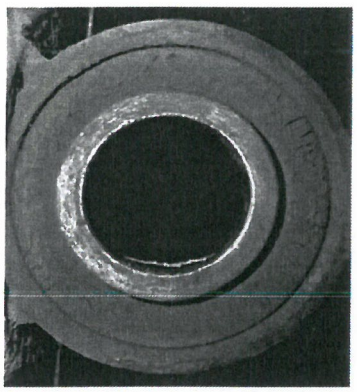
Possible causes:

- Deformation from external forces
- Faulty welded seams
- Misaligned mountings

If the reservoir tube shows a loss of paint coating, the damper should be replaced!

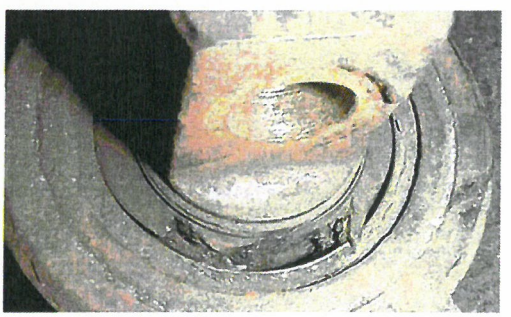
2.3 Rubber Couplings

Coupling criteria includes the following:



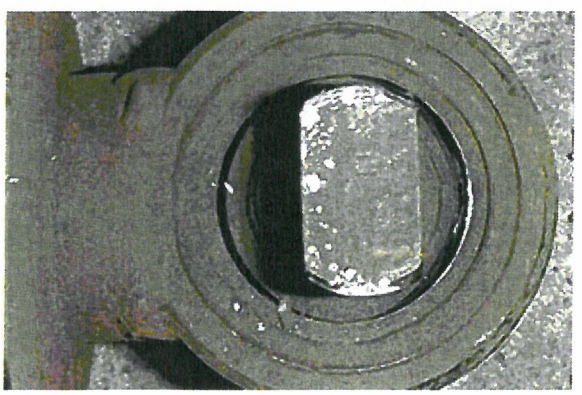
Small cracks on the surface, as well as flaking of the coating on the rubber, are not detrimental.

These surface cracks are caused by ozone, and display a pattern that radiates outwards from the centre. These cracks are usually up to approx. 1.5 mm deep.



Widening cracks and crumbling are not permissible.

Replace these components or dampers.

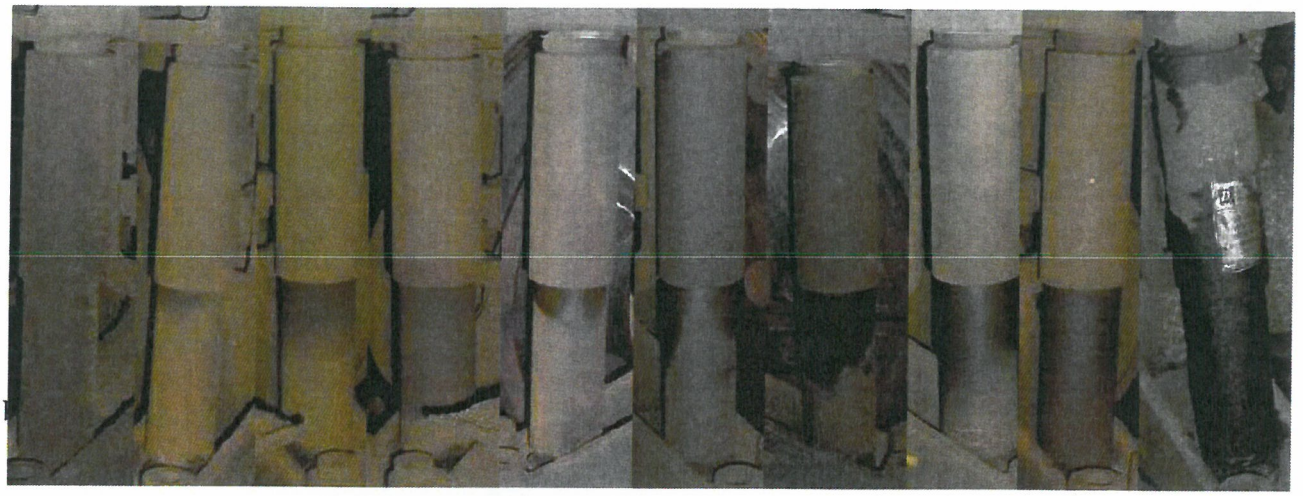


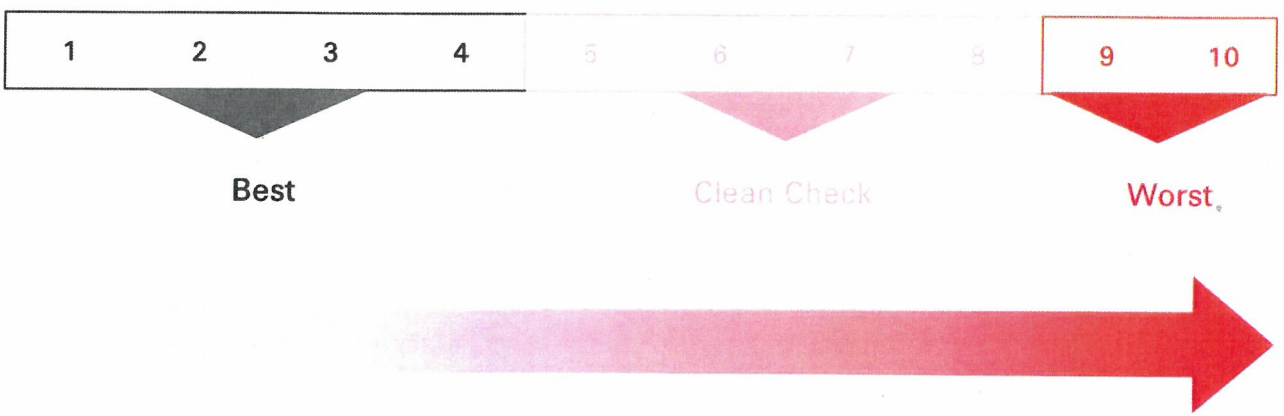
Worn-out rubber element:
Wear is evident when the rubber components separate or become de-bonded from the metal components, showing a clear gap.

Replace these components or dampers.

2.4 Oil Leakage

Scale of Leaking



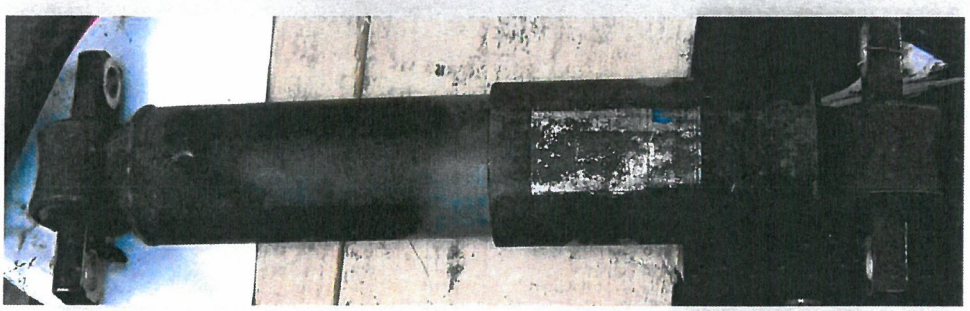


2.4.1 Inspection Guidelines

2.4.1.1 Normal Contamination

(see page 12: Scale of Leaking, pictures 1 - 4)

Normal contamination which can be found on railway dampers and will cause no problems.



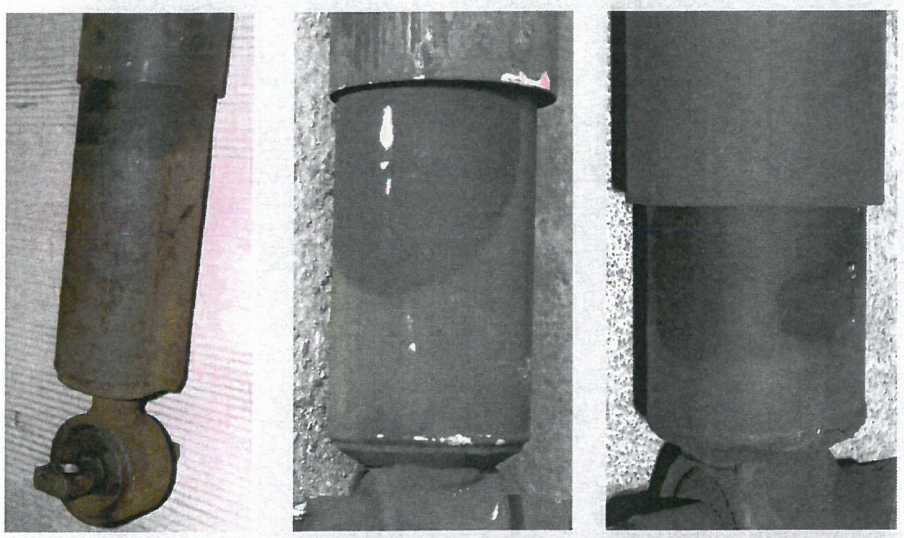
2.4.1.2 Oil Loss, Minor

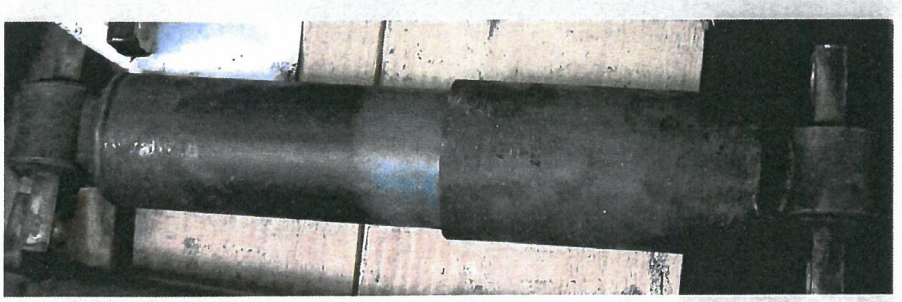
(see page 12: Scale of Leaking, pictures 5 - 8)

The damper body is only slightly moist.

Oil residues following filling procedures can take the form of a thin film on the damper surface. This shows up as discoloration on the damper surface.
A paper towel used to wipe the damper shows only the usual dry grime, but no oil traces. The damper does not have to be replaced.

Minor oil loss shows up as a thin, dry oil film. It is not a reason to change the damper.





Marking:

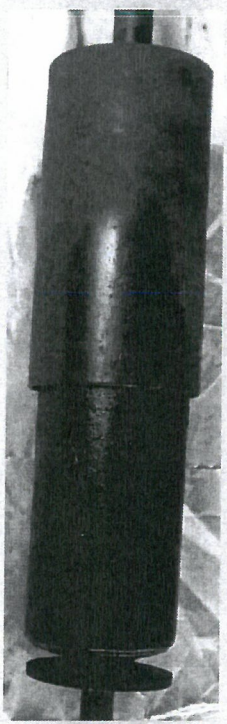
In case of doubt, the damper should be clearly marked for monitoring on the next inspection. If oil loss is evident again, the damper should be replaced.

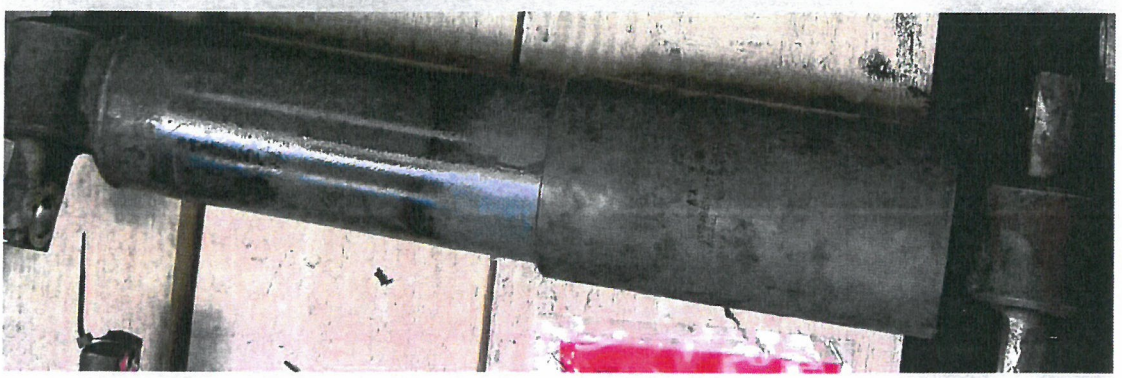
2.4.1.3 Oil Loss, Mayor

(see page 12: Scale of Leaking, pictures 9 - 10)

If large quantities of oil are lost, e.g. due to a defective seal, the damper draws in air during rebound and therefore can no longer achieve its characteristic values. In this case the damper should be replaced. A "leaking damper " can be recognized by its damp surface, on which droplets might form. A paper towel used to wipe the damper shows oil traces.

Major leakage takes the form of a wet shiny surface extending over almost the entire surface of the reservoir tube. These dampers must be replaced.





2.5 Supporting Structures

These include reservoir tubes, bridge or trunnion-type mounts, and eye-type mounts, as well as welding seams.

No damage that can impair functionality, cracks, or severe corrosion is permissible.

3. Exclusion of Liability

The above technical tips, especially those regarding installation, removal, and maintenance, consist exclusively of non-binding recommendations. Responsibility for the final formulation of technical guides resides solely with the customer. ZF Sachs AG assumes no responsibility whatsoever for the topicality, correctness, completeness, or quality of the above installation and removal guides. Liability claims against ZF Sachs AG regarding direct or indirect, and/or material or immaterial damage due to the use or non-use of the above information and/or to the use of incorrect or incomplete information, are excluded in the absence of any demonstrably intentional or grossly negligent behaviour on the part of ZF Sachs AG.

ZF Sachs AG
Dampers for Rolling Stock
Bogestrasse 50
53783 Eitorf
Germany

phone: +49 2243 12-383
fax: +49 2243 12-280
rail.technology@zf.com

Driveline and Chassis Technology