INSTRUCTION MANUAL

Endurance Line type 02

Medha Train 18

Installation and Operation

Document Number: 0100 78 01 86, rev -

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1 Safety precautions

1.1 General

KONI's hydraulic railway dampers are designed, developed and manufactured with state-of-the-art technologies in modern facilities. Our dampers are produced with great care and commitment to continuous quality control, utilising sophisticated quality techniques.

These instructions are intended to facilitate familiarization with the product and its use. Operating the product in compliance with these instructions is important to help ensure reliability in service and avoid risks. The instructions may not take into account local regulations; ensure such regulations are observed by all, including those installing the product. Always follow your company's safety requirements and applicable safety and health laws/regulations.

These instructions must be read prior to installing, operating and maintaining the dampers in any region worldwide. The dampers must not be put into service until all the conditions relating to safety, noted in the instructions, have been met. Failure to follow and apply the relevant user instructions is considered to be misuse. Personal injury, product damage, delay or failures caused by misuse are not covered by the KONI warranty.

1.2 Copyright

1.3 Safety

1.3.1 Marking

These user instructions contain a specific safety marking where non-observance of an instruction may cause danger. The specific safety marking is:

This symbol indicates safety instructions where non-compliance will involve risk to safe operation and personal safety and could damage the damper or train.

1.3.2 Personnel qualification and training

All personnel involved in the installation, inspection and maintenance of the damper must be qualified to carry out the work involved. If the personnel in question do not already possess the necessary knowledge and skills, appropriate training and instructions must be provided. If required the customer may commission KONI to provide applicable training.

1.3.3 Safety action

This is a summary of conditions and actions to prevent injury to personnel and damage to the environment and to equipment.

Although the damper has a strong construction, it must be treated with care. The damper must never be dropped. When working with the dampers proper protective clothing must be worn, such as steel-capped shoes, working gloves and safety glasses. During cleaning, degreasing and blow-cleaning the damper or components, the inhalation of dust or degreasing fumes must be prevented.

The dampers contain oil. Please use caution and do not spill oil on the workshop floor as this may lead to dangerous situations. During the maintenance work you should always comply with your local health, safety and environmental regulations.

1.4 Workshop

The major issue affecting damper performance and longevity is dirt inside the damper. It is therefore very important to prevent dirt entering the damper during re-assembly of the damper. For this reason it is advised that the workshop consists of two separate sections:

- A section where the damper is disassembled and its components are cleaned
- A clean section where only the assembly takes place

2 Storage Instruction

2.1 General

When the dampers are received, they should be inspected for damage or other signs of rough handling. Any damage found should be reported to the carrier immediately.

Any shortage and / or damage must be reported immediately to KONI.

Each damper has a unique serial number which can be found on the type plate. Check that this number corresponds with the sticker on the packing.

Do not drop dampers or damage dampers during handling.

2.2 Storage Conditions

Dampers should be stored in a horizontal position under normal industrial conditions. This means a dry (maximum humidity of 60%) and ventilated room with an ambient temperature between 0 ºC ~ 40ºC.

Furthermore the room should be ozone-free and protected from direct sunlight.

The shelf life of hydraulic dampers is 5 years.

If the shelf life is exceeded the dampers should be functionally checked at a KONI recognised service centre before use.

2.3 Recycling and end of product life

At the end of the service life of the damper, the relevant materials and parts should be recycled or disposed of by using an environmentally acceptable method and in accordance with local regulations.

KONI dampers contain components made of various types of steel, copper, rubber, plastic and contain a certain volume of mineral oil. The paint used on the dampers is generally water based without solvents, unless otherwise specified by the customer. The damper does not contain any dangerous substances.

Damper disposal can be realised as follows:

- Sending the dampers back to KONI
- Sending the dampers to a recognised and accredited disposal company
- Disassembling the damper at your own premises and sending parts to an accredited recycling or disposal company

2.3.1 Sending the dampers back to KONI

The KONI address and the addresses of KONI recognised service centres can be found at the KONI website www.KONI.com

2.3.2 Sending the dampers to a recognized disposal company

Disposal companies often are registered at the national government.

For local company names and addresses, please refer to the associated websites.

2.3.3 Disassembling the damper at your own premises

After disassembling, the parts and the oil must be disposed of according to the local regulations which comply with the separation and recycling processes available.

3 Damper description

3.1 General description on application

3.1.1 Primary vertical (axle box) dampers

These dampers control the vertical movements between axle box and bogie frame, in particular the motion of bogie bouncing on the axle boxes and more important, pitching of the bogie frame in relation to the axles. The latter is induced by irregularities in the track, rail joints and crossing. This causes the one end of the bogie frame to move down while the other moves upwards. Unless this motion is controlled, it can result in a serious wheel unloading with danger of derailment.

The primary vertical damper can be provided with a mechanical lift stop which provides the possibility to lift the bogie by means of the damper. The mechanical lift stop consists of a metal ring, mounted on the piston rod above the piston in order to safeguard the piston function. The maximum allowable static load is mentioned on the outline drawing and on the nameplate of the damper.

3.1.2 Secondary vertical dampers

The secondary vertical dampers control the vertical movements between car body and bogie frame, such as pitching. Correct damping is essential in relation to body mass and spring stiffness. Secondary vertical dampers, if widely spaced, will assist secondary springs to control rolling oscillations of the car body.

3.1.3 Secondary horizontal (lateral) dampers

The lateral dampers are used to control lateral movements of the car body (both ends of the body moving in the same direction relative to the bogie) as well as body nosing oscillations (one end of the body moving opposite to the other). It is essential to ensure correct lateral damping as both an under and over damped secondary lateral suspension can induce excessive sway to the car body.

It is very important to carefully select the lateral damper rates in relation to the vertical and lateral suspension stiffness.

3.1.4 Yaw dampers

Yaw dampers are special dampers designed to control small amplitude sinusoidal rotation movements. Without this damping the rotation of the bogie around the centre pivot of the bogie may become excessive. These hunting movements result in discomfort for the passengers and in case of high-speed trains in risk of derailment.

Yaw dampers are usually positioned longitudinally to control rotation of the bogie without influencing lateral damping. The damping rate must be carefully chosen. Excessive damping would result in too much resistance to bogie rotation with consequential risk of derailment, excessive wheel wear and noise.

3.2 General working principles

The KONI railway damper is a hydraulic system: the resistance of the liquid flowing through valves and restrictions generates the damping force. The damper has a two-way function: damping force is generated through both inward and outward movement. In nearly all cases, the compression and extension forces are basically equal; in other words, its characteristic is symmetrical.

3.2.1 Endurance Line type 02 dampers

3.2.1.1 General Technical Data

Maximum damping force	15,000 N
Nominal velocity	0.1 m/s
Maximum velocity	1.0 m/s
Maximum damping rate	170 kNs/m
Maximum allowable ambient temperature in service	-40°…+80°C (-50°C with special Arctic Pack)
Reservoir diameter	89 mm
Dust cover diameter	102 mm
Piston rod diameter	35 mm
Piston diameter	50 mm

3.2.1.2 Construction

The damper is constructed from a number of main components. Please refer to the general cross sectional drawing in Figure 3-1.

1. *Dust cover*; Protects the piston rod and bellow against flying particles from outside.
2. *Dust bellow*; Gives extra protection to the piston rod and the rod seals from penetrating dirt.
3. *Wiper ring*; Removes dirt film from the rod surface during the piston rod movements.
4. *Piston rod oil seal*; long-life piston rod oil seal, providing excellent fluid sealing while reducing the friction on the piston rod, even after long use.
5. *Piston rod guide*; Made from special perlitic cast-iron for minimal wear. The precision-ground working surfaces ensure maximum life. The oil pressure relief ports in the guide to the reservoir ensure that the rod oil seals are never overloaded by pressure.
6. *Adjustable damping valve*; By turning the adjusting screw the compression and extension forces can be altered. The pressure on the spring-loaded valve is changed to offer a higher or lower resistance to the oil as it flows out of the cylinder, through the damping valves, into the reservoir.
7. *Synthetic (non-metallic) ring in the guide*; With this synthetic bearing ring there is no metal-to-metal contact between piston rod and guide, thus further reducing wear.
8. *Cylinder*; Made from precision steel. Special attention is paid to the roundness and the superfinish of the bore.
9. *Piston*; Made from special perlitic cast-iron. Around the piston a synthetic (non-metallic) ring is fitted, ensuring there is no metal-to-metal contact between piston rod and cylinder, thus further reducing wear.
10. *Non-return valve*; Special flat valves are used in both bottom valve and piston, ensuring a perfect seal.
11. *Oil Reservoir*; Ample capacity for adequate oil reserve, ensuring the proper functioning of the damper and lubrication of the oil seals.

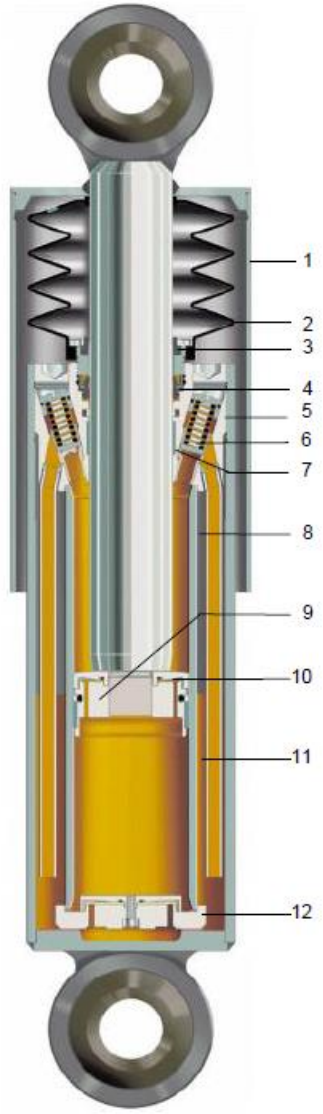

Figure 3-1 Cross sectional drawing

12. *Bottom valve assembly*; Machined from solid steel, the body is provided with large oil-flow ports, to ensure efficient damper functioning at the high damping velocities required in today's railroad environment.

Not shown in the picture; when the damper is equipped with the so-called "Arctic Pack" or "Desert-Pack", whereby a special rubber bellow is fitted around the dust cover, protecting the damper against ingress of snow/ice/sand. This can be removed easily by loosening the hose clamp.

3.2.1.3 Principle of damping

This damper type has a circulating oil principle (Figure 3-2). On the extension stroke the non-return valve in the piston is closed and the oil above the piston is forced through the damping valves into the reservoir. At the same time, because of the increased volume below the piston, oil is forced through the non-return bottom valve.

During the compression stroke the non-return bottom valve is closed and because the piston is forced down in the cylinder, oil flows through the now open non-return valve in the piston. The oil displaced by the piston rod is forced through the damping valves. Therefore during the compression stroke the oil pressures above and below the piston are equal.

It is noteworthy that the oil flows, during both strokes, constantly in one direction. Any air bubbles in the cylinder, formed during transport, are therefore dispersed in a very short time.

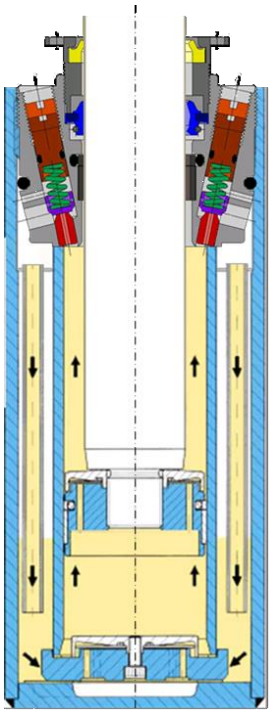

Figure 3-2 Circulating oil principle

3.2.1.4 Cooling

The circulating oil principle of the KONI dampers provides an excellent heat transfer between damper and the surrounding air, allowing a high maximum environmental temperature. This unique construction makes the KONI dampers especially suitable for warm climates (Figure 3-3).

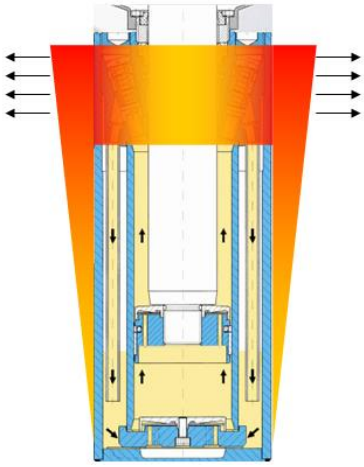

Figure 3-3; Heat transfer

3.3 Nameplate information

Every damper has a nameplate that provides information about the damper. The nameplate is located on the dust cover. In addition, the damper type number and serial number are also rolled in the reservoir tube.

When ordering spare parts, please always communicate the following damper information:

- Damper type
- Serial number
- Item numbers of the required parts

See Parts List for item numbers.

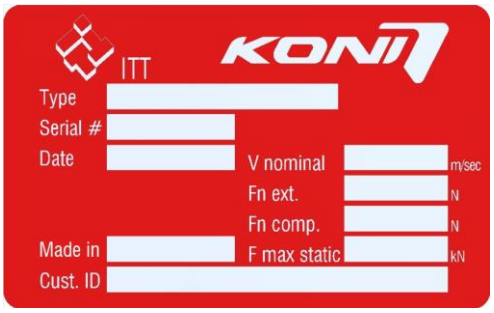

Figure 3-4; Nameplate

Table 3-1; Explanation of the nameplate

Nameplate field	Explanation	Example
Type	Damper type	02R 1201
Serial #	Serial number of the damper	70025
Date	Production date	2016 - 07
V nominal	Nominal test speed	0.1
Fn ext	Nominal damping force in extension at V nominal	7550
Fn comp	Nominal damping force in compression at V nominal	7550
F max static	Maximum static extension load (Lift Stop)	15
Made in	Indicates production location:	NL – OB: Netherlands – Oud-Beijerland CZ – OS: Czech Republic – Ostrava CN – WX: China – Wuxi Or blank, with “Assembled in USA” above it for Hebron
Cust. ID	Customer damper identification	12552

4 Installation

4.1 Mounting and priming instruction

Before mounting a damper or a damper batch, take a sample and verify that the shelf-life is not exceeded and the damper is in good visual condition.

Visual check points:

- Check the rubber of the attachments for cracks
- Check the damper for oil leakage and dents or other damages
- Check if the piston rod can rotate freely

Although the damper is self-priming in service; KONI advises to prime the dampers before mounting, this is especially advised for lateral dampers. Priming can be done by hand (when the damper has a “light” setting), or by using a damper test machine.

Priming instruction (using machine):

1. In vertical position, press the piston rod to the minimum length
2. For horizontal dampers: In horizontal position, pull the piston rod to the maximum length
3. For vertical dampers: In vertical position, pull the piston rod to the maximum length
4. Press the piston rod to the mounting length

Depending on the setting of the damper (force levels), it may be possible to prime by hand.
Priming instruction (by hand):

1. Position the damper in vertical position with the dust cover side up
2. Hold damper by placing two feet over the silentbloc end and pull with two hands on upper silentbloc until damper reaches maximum length
3. Compress damper by pushing by hand to minimum length
4. Repeat this action another 4 times
5. Press the piston rod to the mounting length

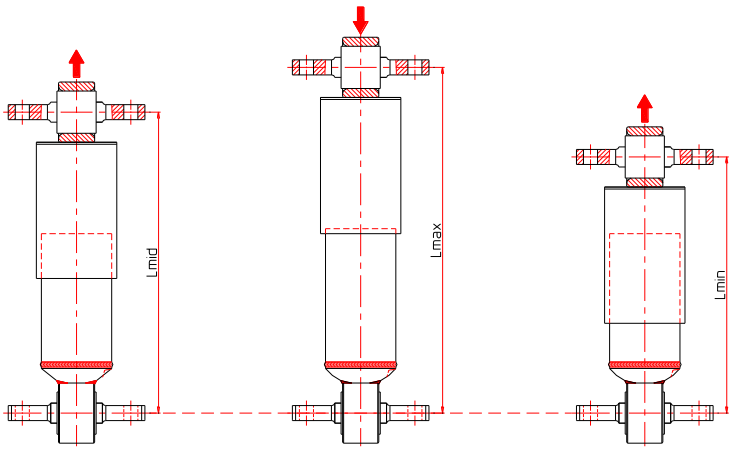

Figure 4-1 Priming positions

After these priming actions keep the dampers in vertical position until they are mounted on the bogie.

4.1.1 Primary vertical

For the primary vertical dampers no special priming actions are required.

Mounting
The primary vertical dampers are mounted vertically between the mounting brackets with the dust cover facing up.
The maximum allowable angle from the vertical is 45°.

Pin Attachment
The pin attachment must be tightened to the right mounting torque. The correct mounting torque is specified on the damper drawing (OFF drawing).

Silentbloc
The silentblocs must be bolted to the bracket and tightened at the right mounting torque. They must be mounted without any angular pre-tension as this could have a negative influence on the service life of these blocks.

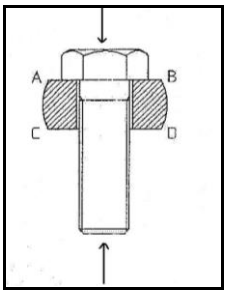

Figure 4-2; Mounting Advice

In order to avoid shearing forces in the mounting bolt, KONI advises to mount the bolt in longitudinal direction of the damper forces (Figure 4-2).

4.1.2 Secondary horizontal (lateral) and yaw dampers

The lateral and yaw dampers are mounted horizontally between the mounting brackets.

The dampers have a provision which prevents air from entering the cylinder. For this reason it is imperative that the dampers are mounted in the right position. The dampers are marked in the underside of the reservoir with the text “BELOW”, and clearly marked with a decal. In addition, the dampers also have a hard marking pressed into the reservoir. The location and shape can differ between individual damper types (see Figure 4-3), so always refer to the applicable damper drawing to see the details of the marking.

In some cases an extra air chamber (dome) is built on top of the damper. In this case the damper must be mounted with the dome facing up (Figure 4-4).

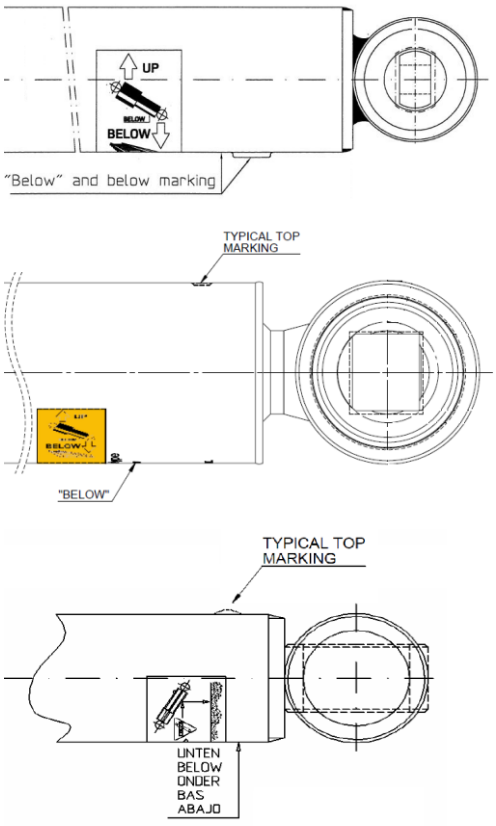

Figure 4-3; Different orientation markings

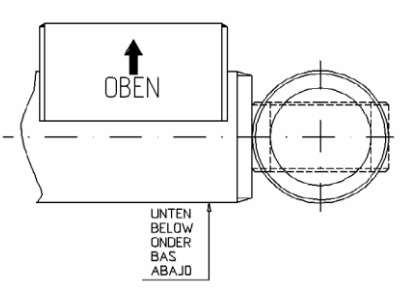

Figure 4-4; With dome

Furthermore the dampers must be mounted under a positive angle of 1° with the dust cover at the highest position (Figure 4-5).

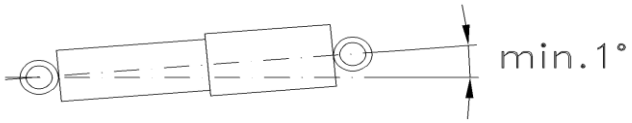

Figure 4-5; Mounting position

Pin Attachment

The pin attachment must be tightened to the right mounting torque. The correct mounting torque is specified on the damper drawing (OFF drawing).

Lateral dampers with a pin attachment are quite often provided with extra pins on the centring seat (chassis) to prevent the possibility of rotating of the damper

Silentbloc

The silentblocs must be bolted to the bracket and tightened with the right mounting torque. They must be mounted without any angular pre-tension as this could have a negative influence on the service life of these blocks.

In order to avoid shearing forces in the mounting bolt, KONI advises to mount the bolt in longitudinal direction of the damper forces (Figure 4-6).

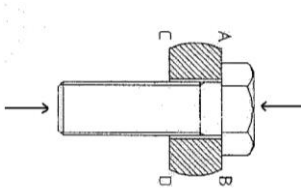

Figure 4-6; Mounting Advice

5 Operation

5.1 Planned inspection and overhaul/replacement schedule

KONI advises the periodical inspection and replacement of the dampers in accordance with Figure 5-1. These values are however indications and can vary by application and contractual agreement.

Frequency	Maintenance action	Chapter
6 months	Visual inspection of the dampers	5.2
1.400.000 km Or 6 years in service	Overhaul or replacement of the dampers	4

Figure 5-1; Maintenance schedule

5.2 Visual inspection

5.2.1 General

The dampers are exposed to dirt and oil from outside sources due to the operating environment. Road dirt accumulation covering the entire outer surface of the damper is normal and will have no adverse effects on the damper's performance.

5.2.2 Inspection for oil leakage

Inspection on new dampers

Sometimes new KONI railway dampers can appear to show a little oil loss during the first service period and as a result are suspected of leakage. In almost all cases this is assembly lube which has nothing to do with oil leakage.

Assembly lubricants (greases) are yellow or black in colour, and can easily be distinguished from the red hydraulic damping fluid. When the damper is new, the assembly lube may cause a slightly moist piston rod or damper body. If this occurs, simply wipe off the excess oil and return the damper to service. If a new damper has red oil droplets, the damper should not be installed but returned under warranty.

Figure 5-2; KONI damper oil Fluid-A

For a long service life, it is necessary for the rod oil seal to remain lubricated. The continuous inward and outward movement of the piston rod may cause oil "sweat" from the rod oil seal. This loss of oil can be recognized by the outside of the damper being slightly moist and dirty. However, there should not be any droplets of oil clinging to the damper. A slight oil sweating will not affect the damping force and such a damper may remain in service.

Even in the case of a real leakage, the damping forces will not be reduced abruptly, but very slowly, pending on the amount of oil that is left in the damper. However, when red droplets of oil are clearly formed on the damper body, it is advised to remove the damper from the train and replace it.

5.2.3 Roadmap for oil leakage

The following steps can be helpful to identify a real leakage problem of a suspicious damper.

1 *Exclude an external source of oil (or another fluid)*
The external source could be wheel lubrication systems, gear boxes, hydraulic brakes during servicing or when being maintained, detergents, etc.

a) Check the upper damper tube (also "dust cover")
If the upper part of the damper (with larger diameter) is polluted on its outside with fluid, it could not come from the damper itself.

b) Compare with corresponding dampers of other bogies / wheelsets

It is also an indication for external sources, when there are significant differences between comparable dampers of bogies or wheelsets (e.g. no wheel lubrication at the second axle).

When no external source can be seen, please follow the next steps.

2 Clean the damper housing

The surface of the damper has to be freed completely from all dirt/moisture. For this action the damper should be dismounted from the bogie, pulled to its max. length and then cleaned. After cleaning, the damper should be mounted to the bogie again.

As an alternative action the oiled area can be marked at its lower edge on the lower damper tube, for instance with a felt pen. When the damper is then installed again and inspected after a certain period, it will be possible to see if the oiled area has been extended.

3 Operate the train with cleaned damper

4 *Check the cleaned damper*
Please check the damper after a period, which can last from a week up to the next maintenance period in the workshop. If the surface of the lower damper tube is now oiled and really wet over a wide range, or when even oil drops are visible (or the marked area is considerably extended) it is an indication for a leakage problem of the damper and the damper should be returned.

In addition to the above, the following criteria can also be used during the visual inspection of the dampers:

Visual appearance	Action	Picture
Dirt Normal contamination caused by the operating environment of the dampers is harmless. If a damper has a damp film over the whole body (including the dust cover), it is very probable that this is the result of an outside source of oil or dirt. In this case the damper can remain in service.	None	 *Figure 5-3; Dirt*

Visual appearance	Action	Picture
Sweating For a long service life, it is necessary for the rod oil seal to remain lubricated. The continuous inward and outward movement of the piston rod may cause oil "sweat" from the rod oil seal. This loss of oil can be recognized by the outside of the damper being slightly moist and dirty. However, there should not be any droplets of oil clinging to the damper. A slight oil sweating will not affect the damping force and this damper may remain in service.	None	 *Figure 5-4; Sweating*

Visual appearance	Action	Picture
Oil drops An oil leakage becomes apparent by a damp surface, which usually covers a large part of the reservoir tube. Isolated oil drop formation is possible. When wiping the damper with a paper cloth, clear oil stains are visible.	Replacement / Overhaul	 *Figure 5-5; Leakage*

5.2.4 Attachments

It is important to visually check the condition of all rubber attachments. Worn or deteriorated rubber parts may adversely affect the damper's performance and cause internal damage to the damper.

While inspecting the bushings, it is advised to examine the welds between the eye and the damper body. The welds should show no evidence of cracking or deterioration.

5.2.4.1 Pin attachments

The pin attachments do not have to be removed in the following cases

Small damages to the surface of the rubber are not affecting the service life.

The pin attachment should be removed in the following cases

Pin rubbers should be replaced when the rubber develops a cut or a split. Furthermore the centring seats should be free of any damage.

5.2.4.2 Rubber bushings

The rubber bushings do not have to be removed in the following cases

Small damages to the surface of the rubber are not affecting the service life.

The rubber bushing should be removed in the following cases

Rubber bushings should be replaced when the rubber develops a cut or a split. Special attention should be paid to the position of the bushings. They should never be further from the centre of the eye than a maximum of 5 mm (Figure 5-1).

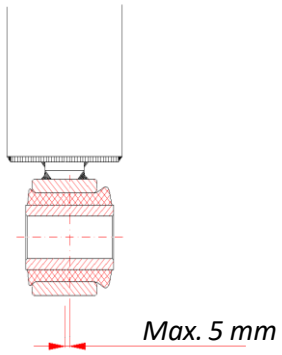

Figure 5-1; Bushing position

5.2.4.3 Silentblocs

The silentblocs do not have to be removed in the following cases

During service of the damper the rubber attachments are subject to wear. The wear is normal and if the rubber part has only developed small cracks on the surface, no action is required. The function of the silentbloc is secured mainly by the internal bonding of the rubber to the metal part. Small damages to the surface of the rubber are not affecting the service life. Please refer to below pictures.

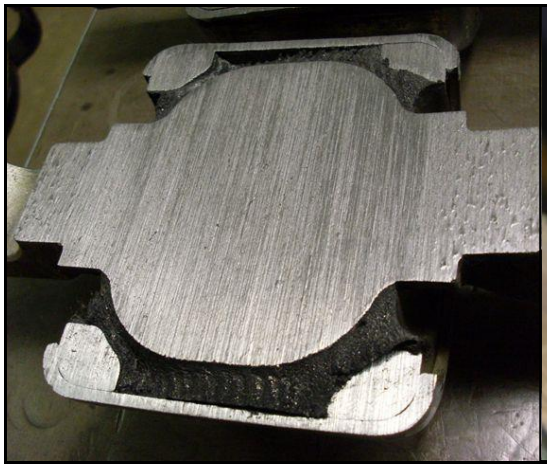

Figure 5-2; Bonding of the internal rubber

Figure 5-3; Acceptable surface cracks

The silentbloc should be removed in the following cases

Silentblocs should be replaced when the rubber develops a cut or a split. If the silent bloc has only developed small cracks on the surface of the rubber, no action is necessary.

If the rubber is deteriorated or the pin is loose in the rubber, the damper must be removed and the silentbloc replaced.

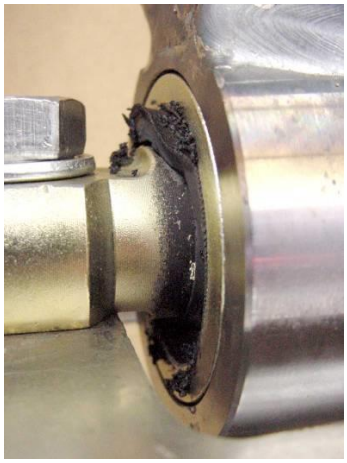

Figure 5-4; Examples of worn bushings

Guideline for replacement of silentblocs

Phenomenon	***Criteria***		***Action***
Cracks in rubber	Depth of crack	Max. 8mm	Replace attachment
	Surface cracks	Only a visual issue	No action required
De-bonding of metal and rubber	De-bonding	Max 10% of the total rubber	Replace attachment
Rubber deterioration	Pulverized rubber	Max. 10% of the total rubber	Replace attachment
Creeping of rubber	Loose collar	Only a cosmetic issue	No action required