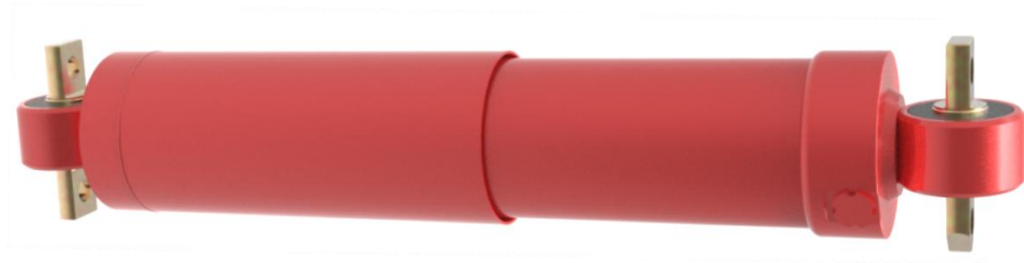




Introduction of railway vehicle damper



Zhejiang Yonggui Electric Equipment Co.,Ltd.

5-2023

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Application of damper

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Function and working principle of damper

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Typical structure of damper

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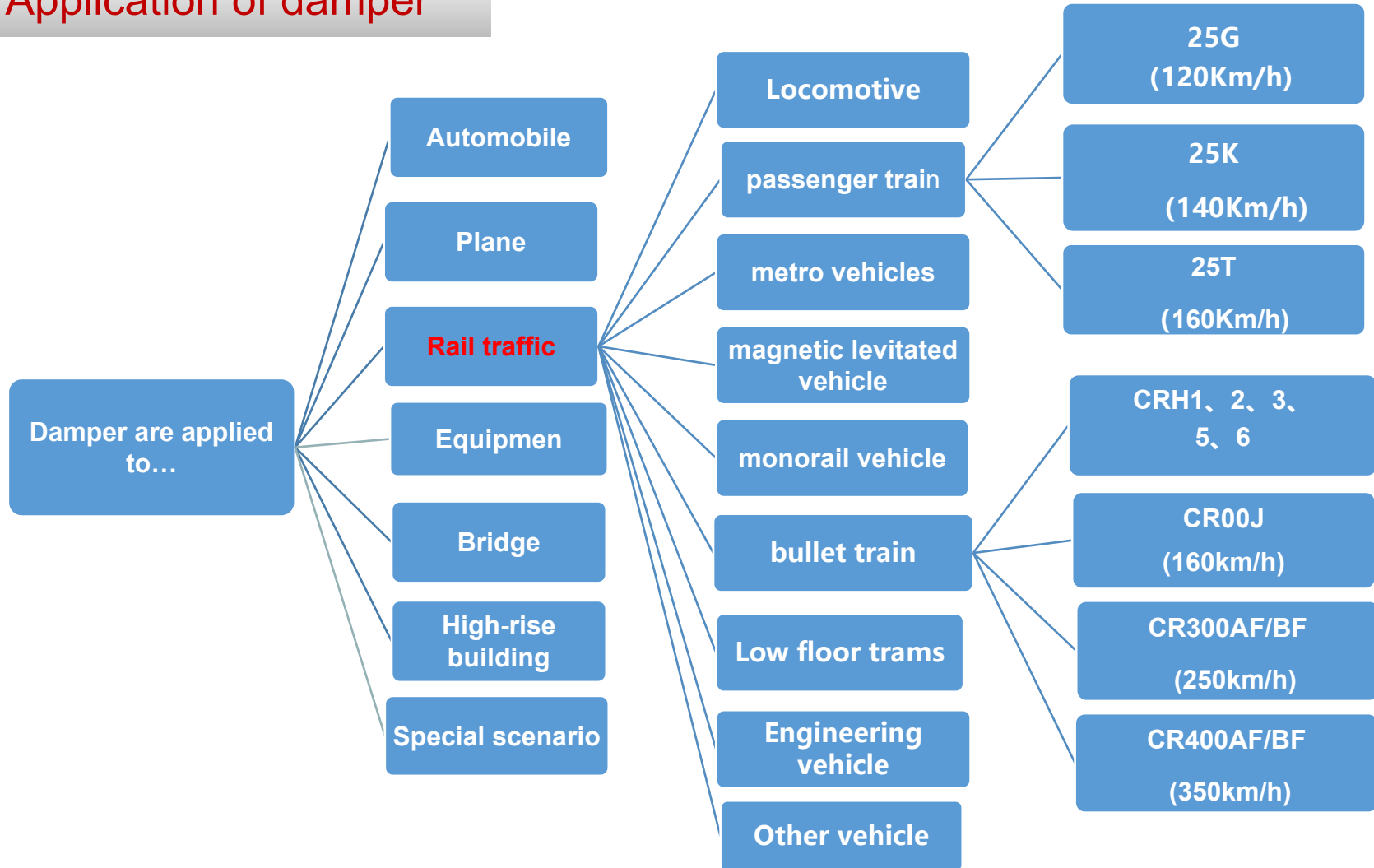
Damper failure

5

Rolling stock damper configuration



Application of damper





永贵电器



Rail vehicle



Locomotive



passenger train



Goods train



Mullet train



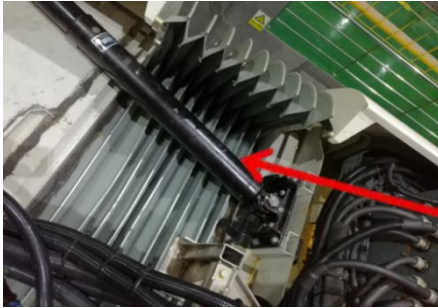
Metro vehicles



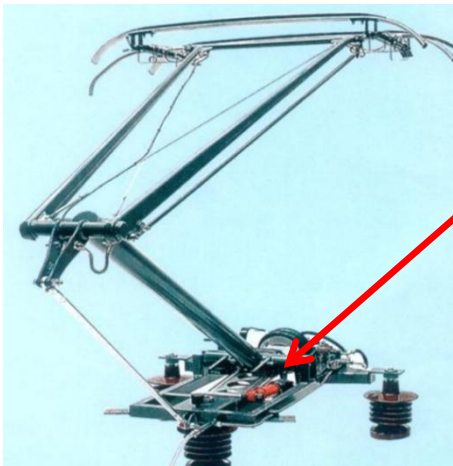
Low floor trams



Application of damper in rolling stock



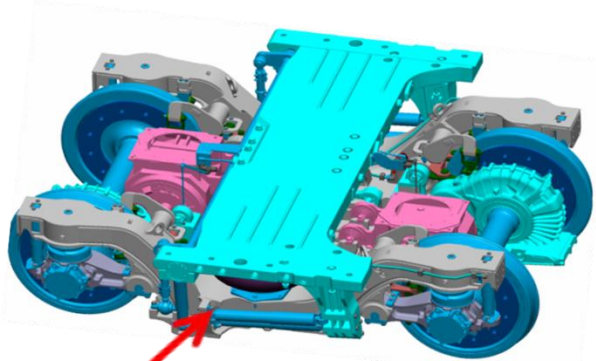
Installation part of damper



End-of-train

Bogie

Pantograph



Axle box

Secondary vertical

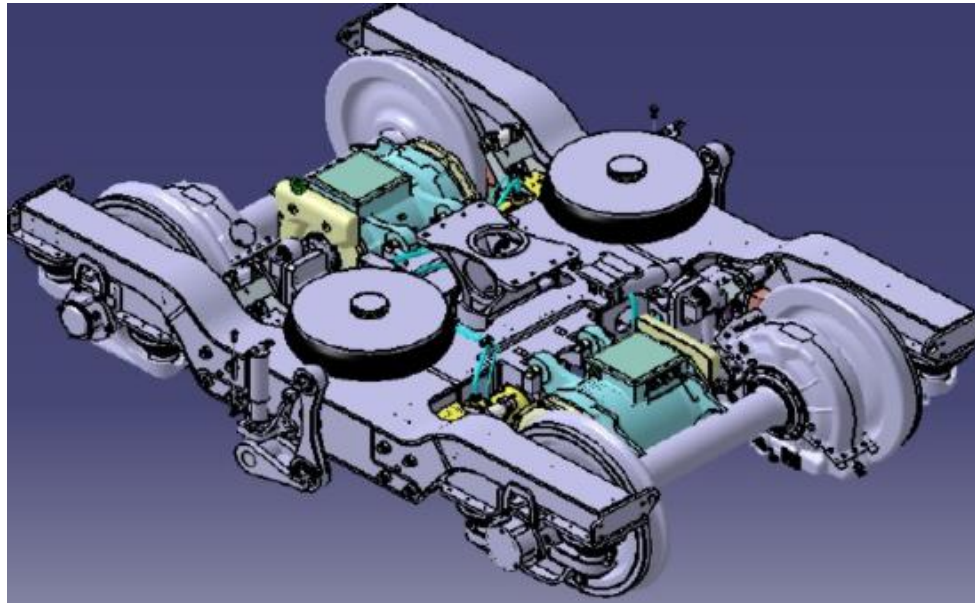
Secondary lateral

Motor

Yaw



Metro Bogie



Type A = 3 meters wide, There are 310 passengers per train.
 Type B = 2.8 meters wide, There are 240 passengers per train.

A 型车 (采用7号线为例)

容纳乘客
1800-2500人

每节车厢5对门

车门宽度: 1.4×1.9米



B 型车 (采用1号线为例)

容纳乘客
1360-2062人

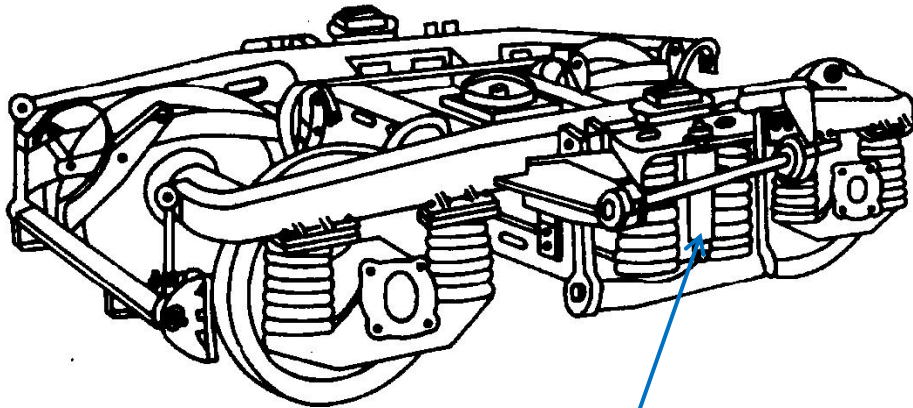
每节车厢4对门

车门宽度: 1.3×1.9米





Type 209 bogie



Secondary vertical damper

25G passenger train
120km/h



Type SW-160 bogie

Secondary lateral damper

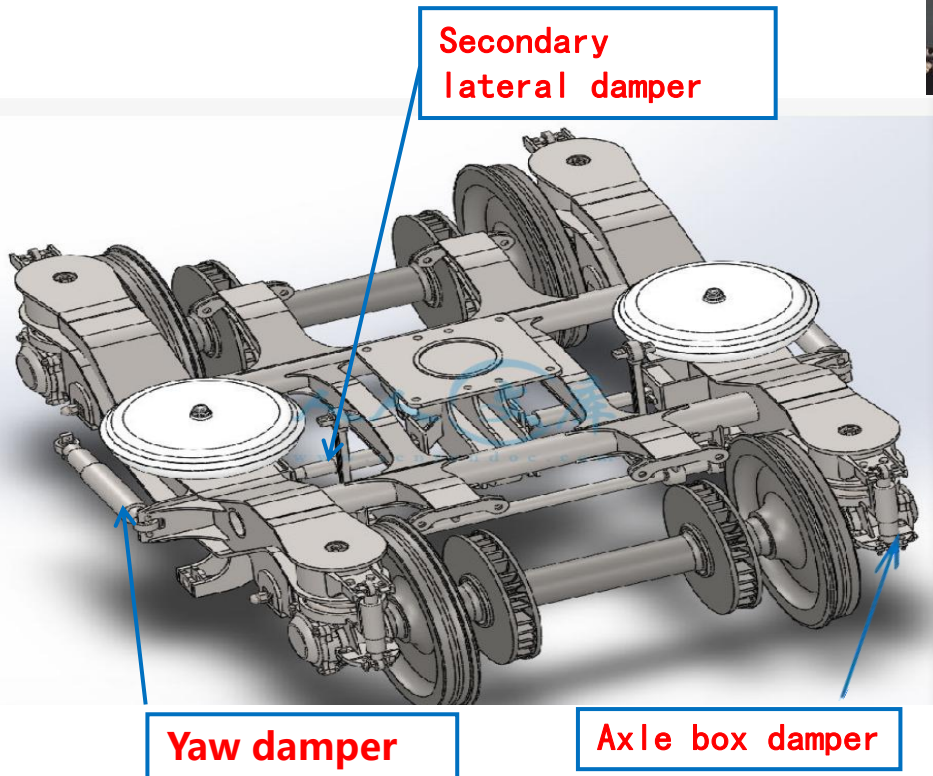


Axle box damper

25K passenger train
140km/h



Type CW-200 bogie

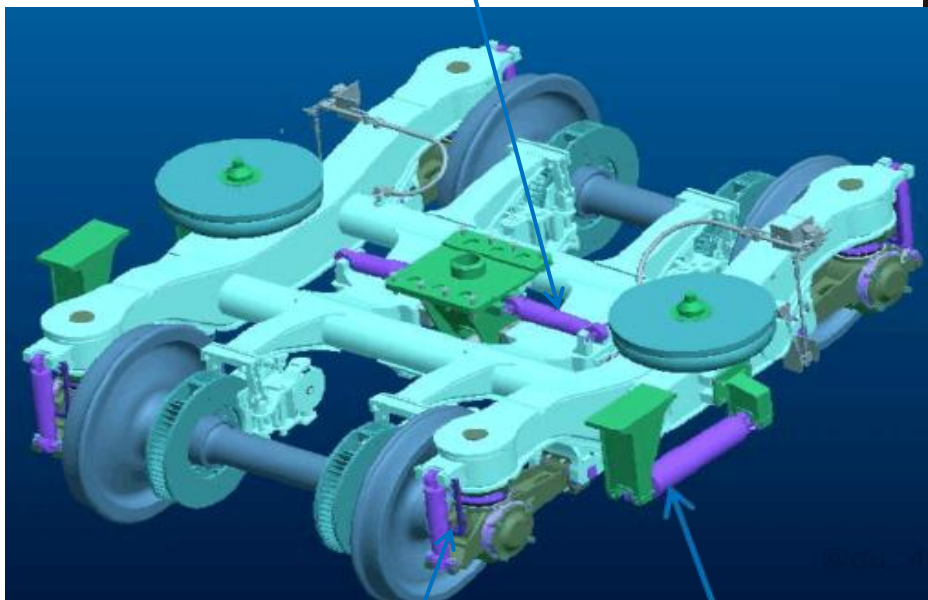


25T passenger train
160km/h



Type SW-220K bogie

Secondary lateral damper



Axle box damper

Yaw damper



25T passenger train
160km/h



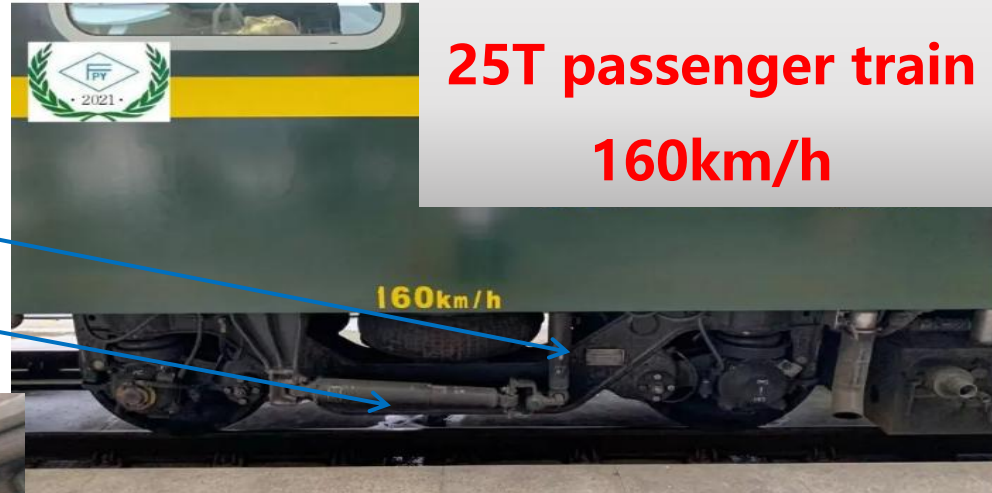
Type PW-220K bogie

Secondary vertical damper

Secondary lateral damper

Yaw damper

Axle box damper



25T passenger train
160km/h

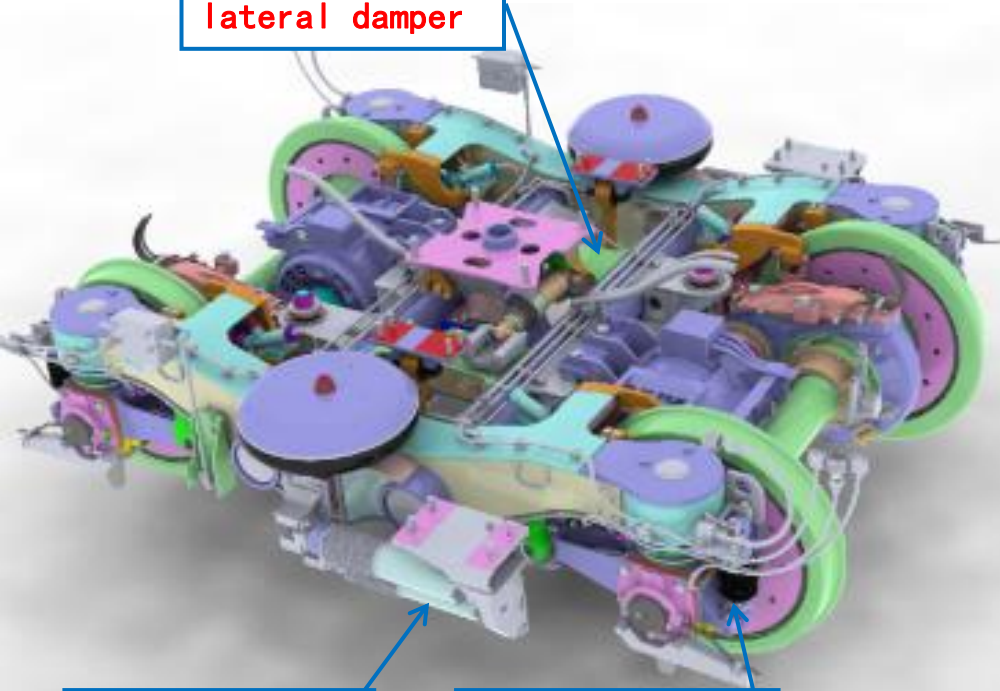


CR200J train
160km/h



Type CR400/300AF bogie

Secondary lateral damper



Yaw damper

Axle box damper



CR300AF-0001

CR300AF



一等座车 ZY 211616
First Class Coach

CR400AF-B



CR400/300AF

350/250km/h



Type CR400/300BF bogie

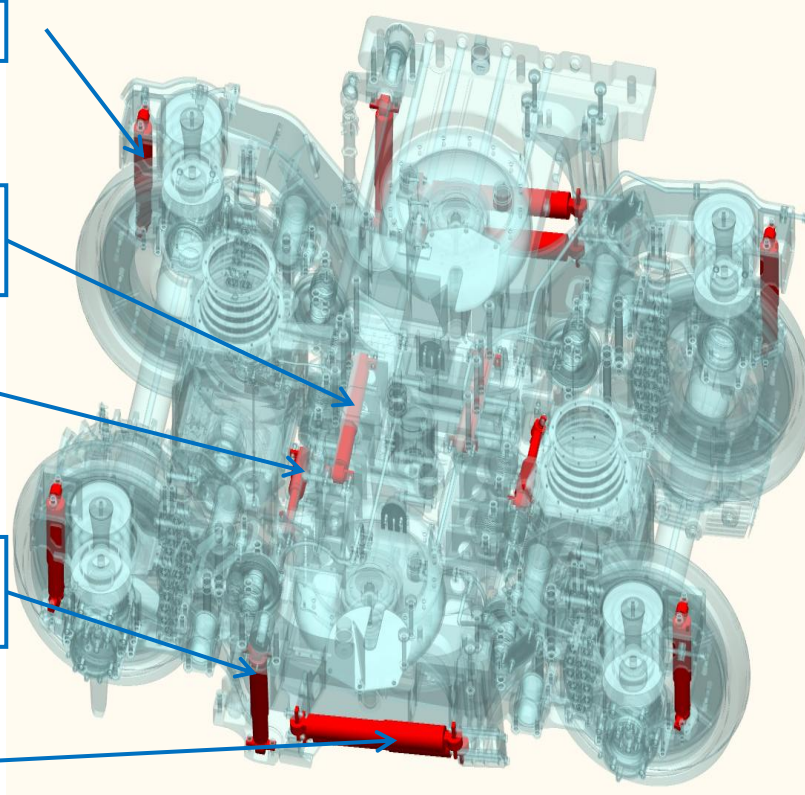
Axle box damper

Secondary lateral damper

Motor damper

Secondary vertical damper

Yaw damper



CR400/300BF

350/250km/h



Application environment and requirements

- Natural environment (wind, sand, rain, snow, light, temperature, etc.) .
- Working conditions (uneven, ramps, bends, joints, switches, acid and alkalicleaning agent, flying stone impact.
- Vibration from external excitation or itself .
- Impact caused by acceleration and deceleration .
- The running speed .
- The stationarity index .
- Load or axle load .
- Maintenance-free cycle or mileage .

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Damper failure

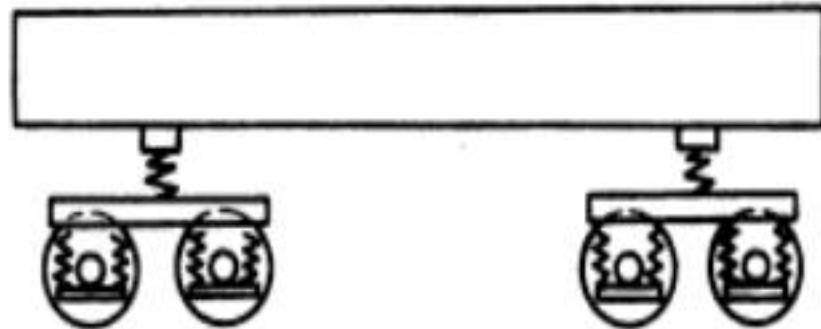
5

Rolling stock damper configuration



Generation of vibration

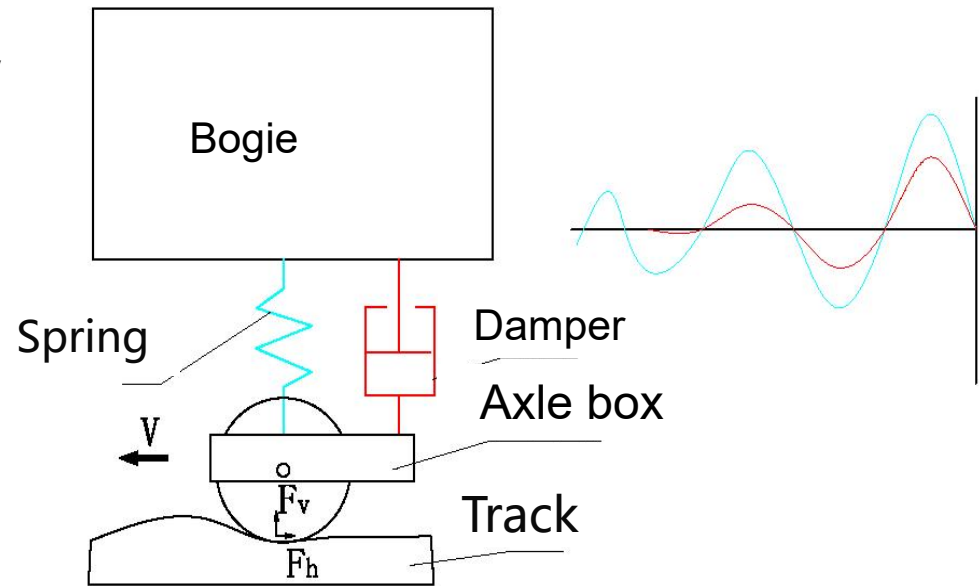
- The uneven track, bends, joints, switches, etc.;
- Wheel set is not round, centroid deviation;
- Acceleration and deceleration of vehicles;
- Vibration caused by motor operation...





The function of suspension

➤ In suspension system, the elastic element and the damper respectively undertake the task of mitigating the shock and damping the vibration. The elastic element converts the impact kinetic energy from the spring into elastic potential energy, The damper attenuates the vibration rapidly, The two are installed in parallel.





The role of damper

- It quickly attenuates the vibration transmitted from the road to the body of the vehicle, and improves improve the ride comfort.
- Make the seat is not easy to fatigue goods are not easy to damage.
- Reduce the impact on related parts, reduce wear, improve the use of economy.
- Improve wheel grounding to inhibit high-speed wheel bounce and improve driving safety.
- The vehicle in the rapid acceleration, rapid deceleration, sharp corners, improve the stability of operation.

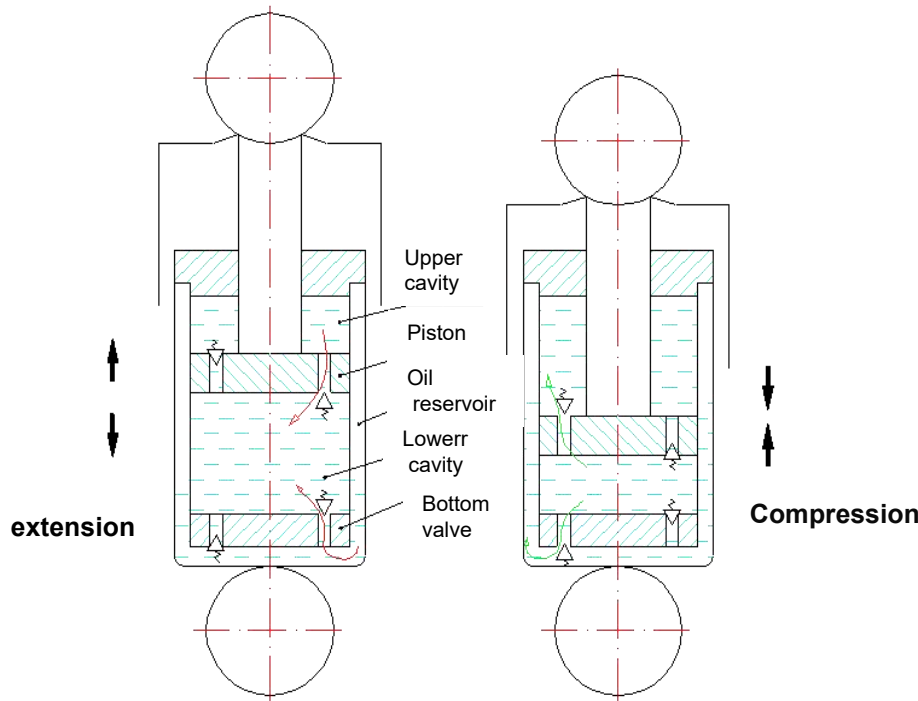


Working principle of the oil damper

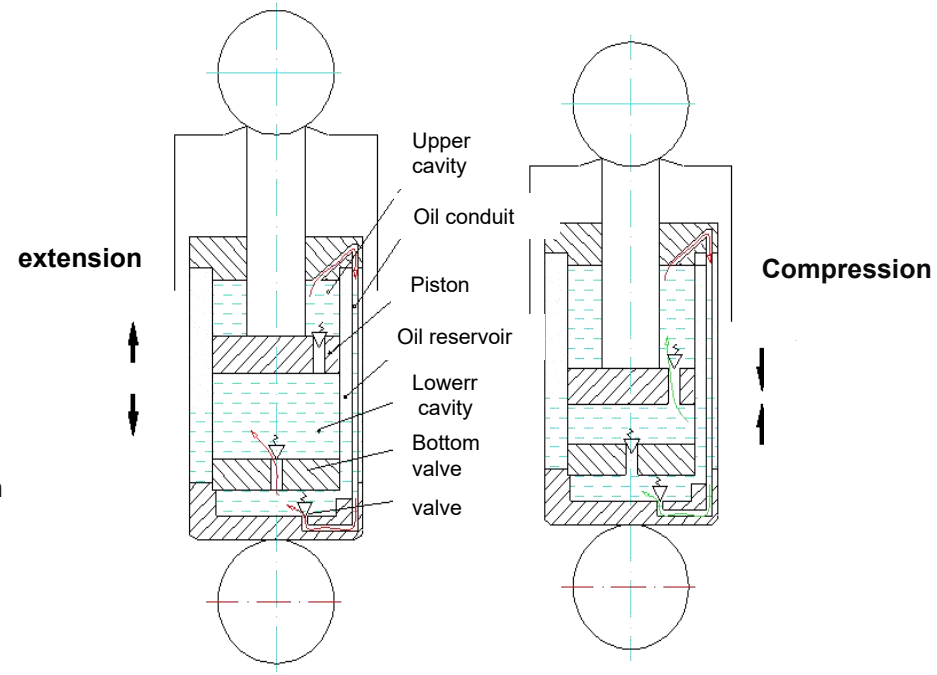
Most of the suspension systems of modern vehicles use oil dampers, The working principle is when there is relative motion between the bogie and the axle box(or the body of vehicle and the bogie) due to vibration, The piston in the damper moves up and down ,The oil in the working cylinder flows from one chamber to the other through the orifice , At this time, the friction between the valve system and the oil and the internal friction between the oil molecules produce damping force on the vibration. The vibration of the vehicle is suppressed , Vibration energy is converted into heat energy , Radiate into the atmosphere .



Working principle of the oil damper



Working principle diagram of double cycle oil damper

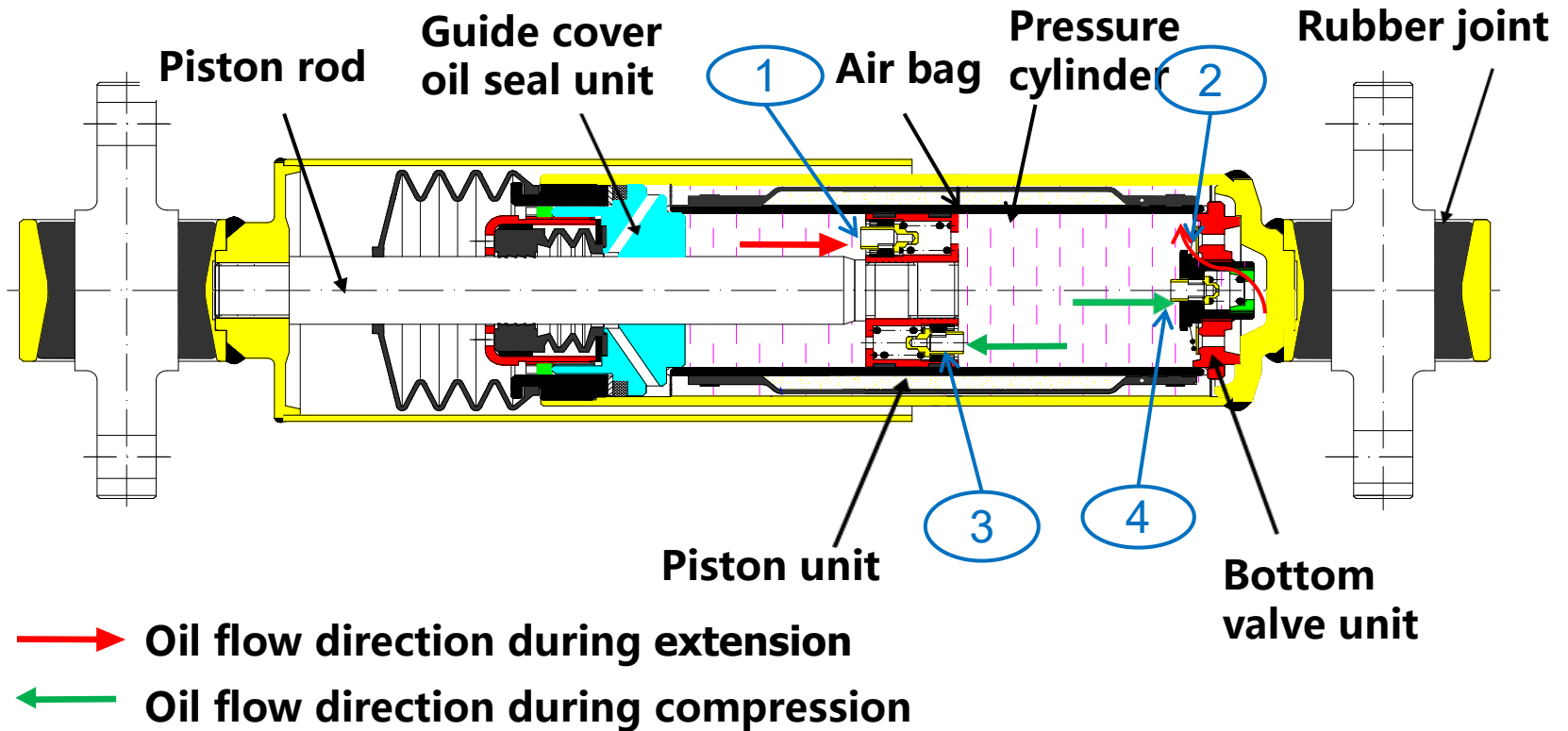


Working principle diagram of single cycle oil damper



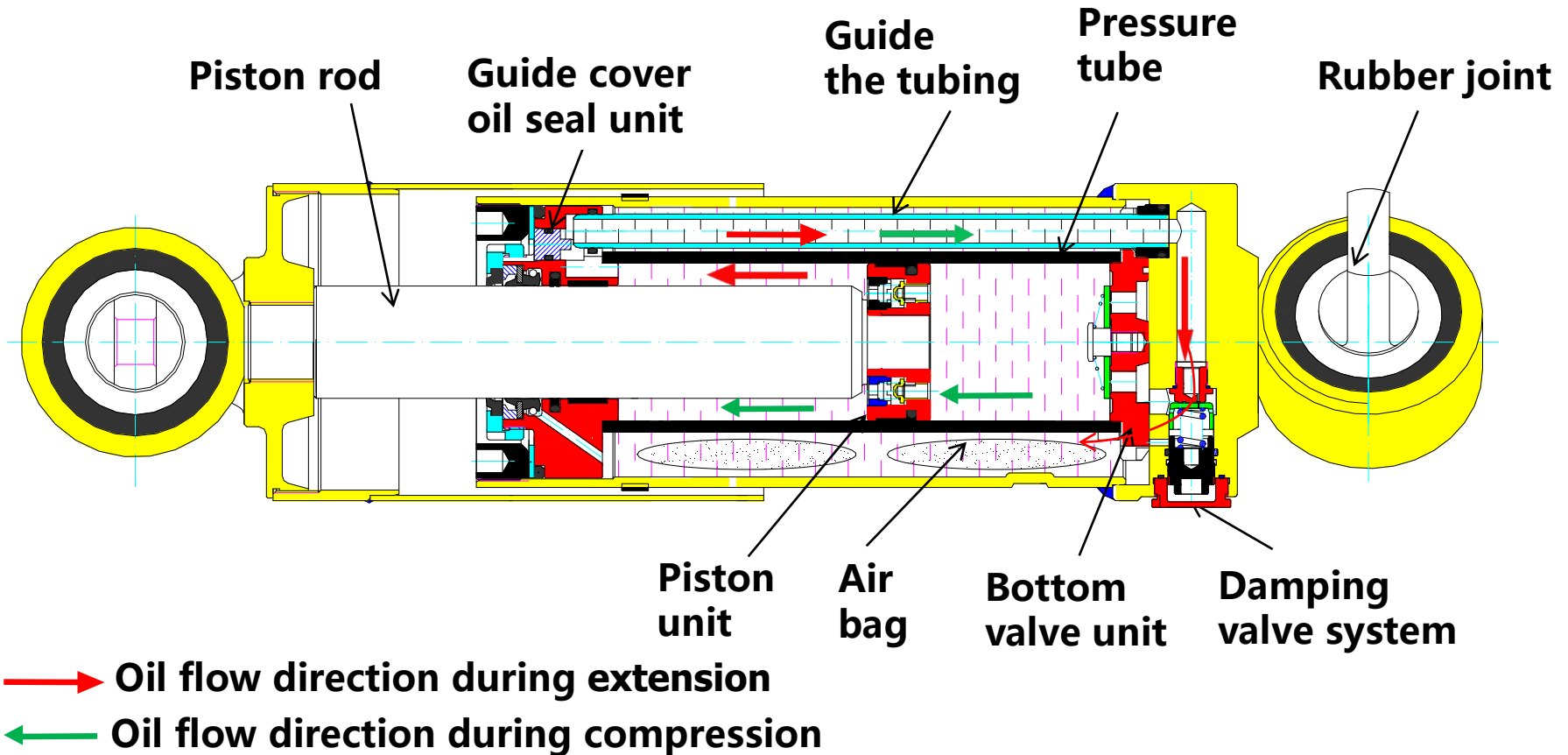
Double cycle oil damper structure and operation (air bag type)

- Process of extension , 1 and 2 valves work at the same time . Process of compression, 3 and 4 valves work at the same time .





➤ single cycle oil damper structure and operation



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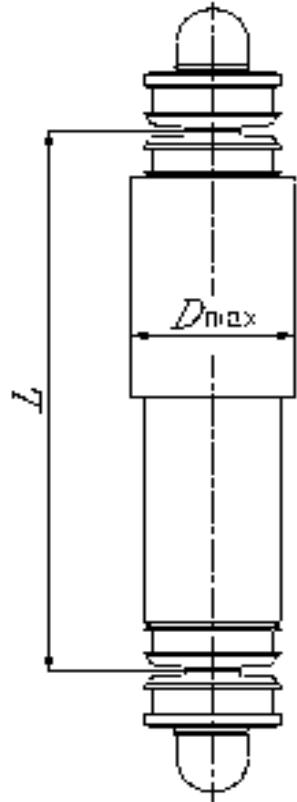
Damper failure

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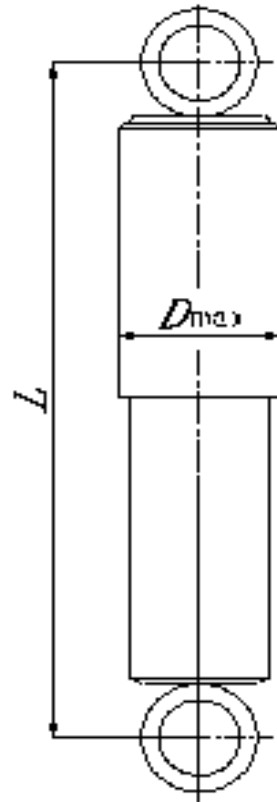
Rolling stock damper configuration



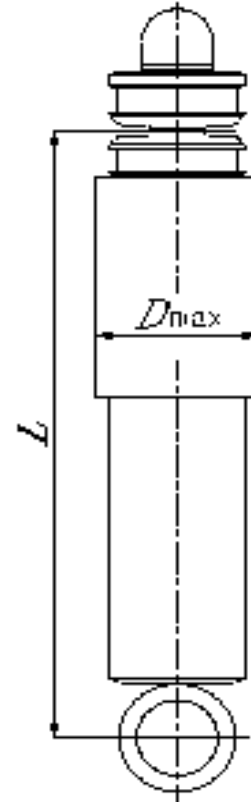
Damper's shape and connection method



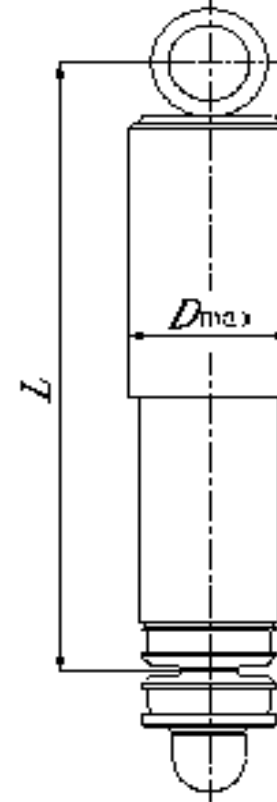
Pole/pole type



Ring/ring type



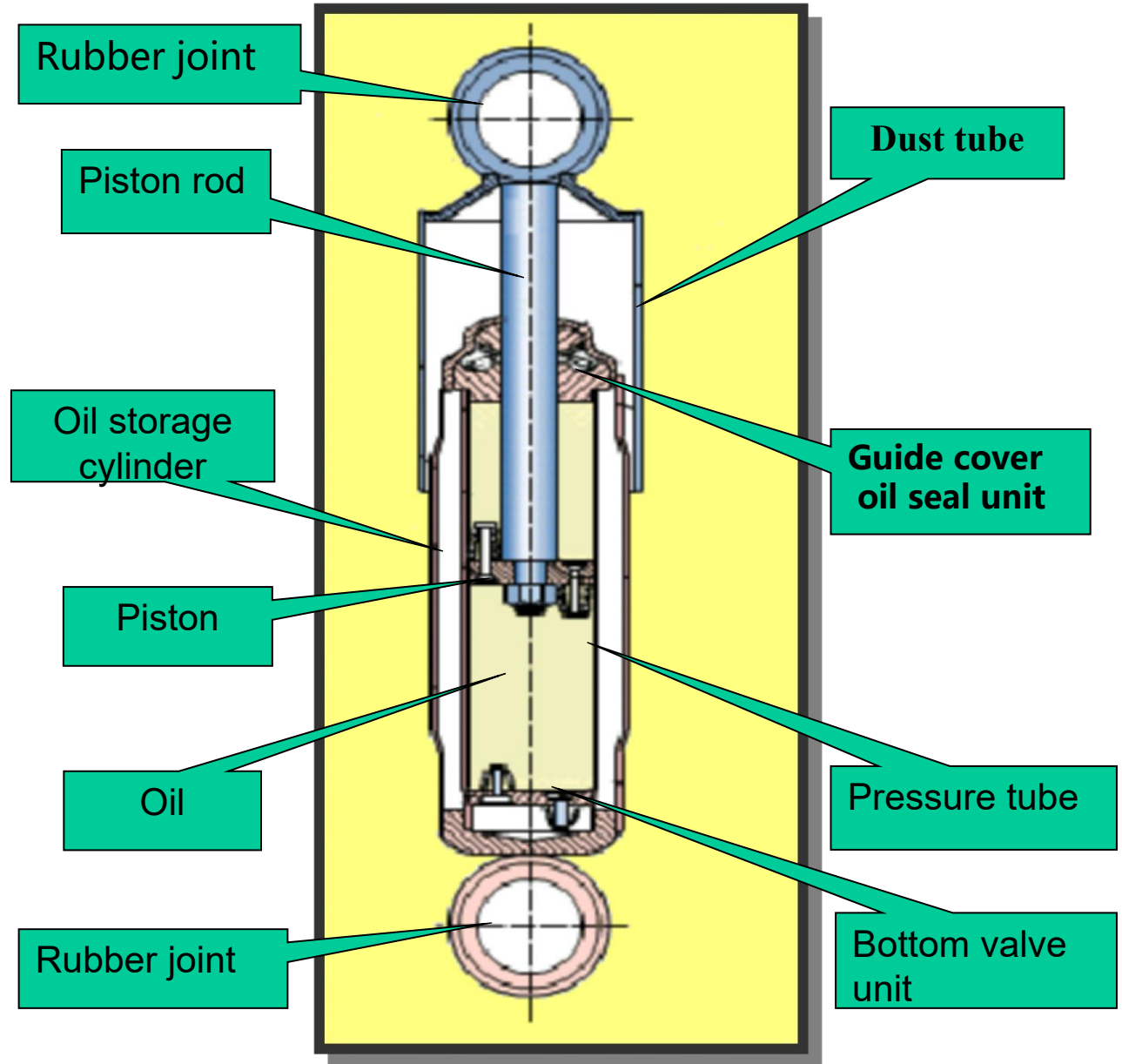
Pole/ring type



Ring/pole type



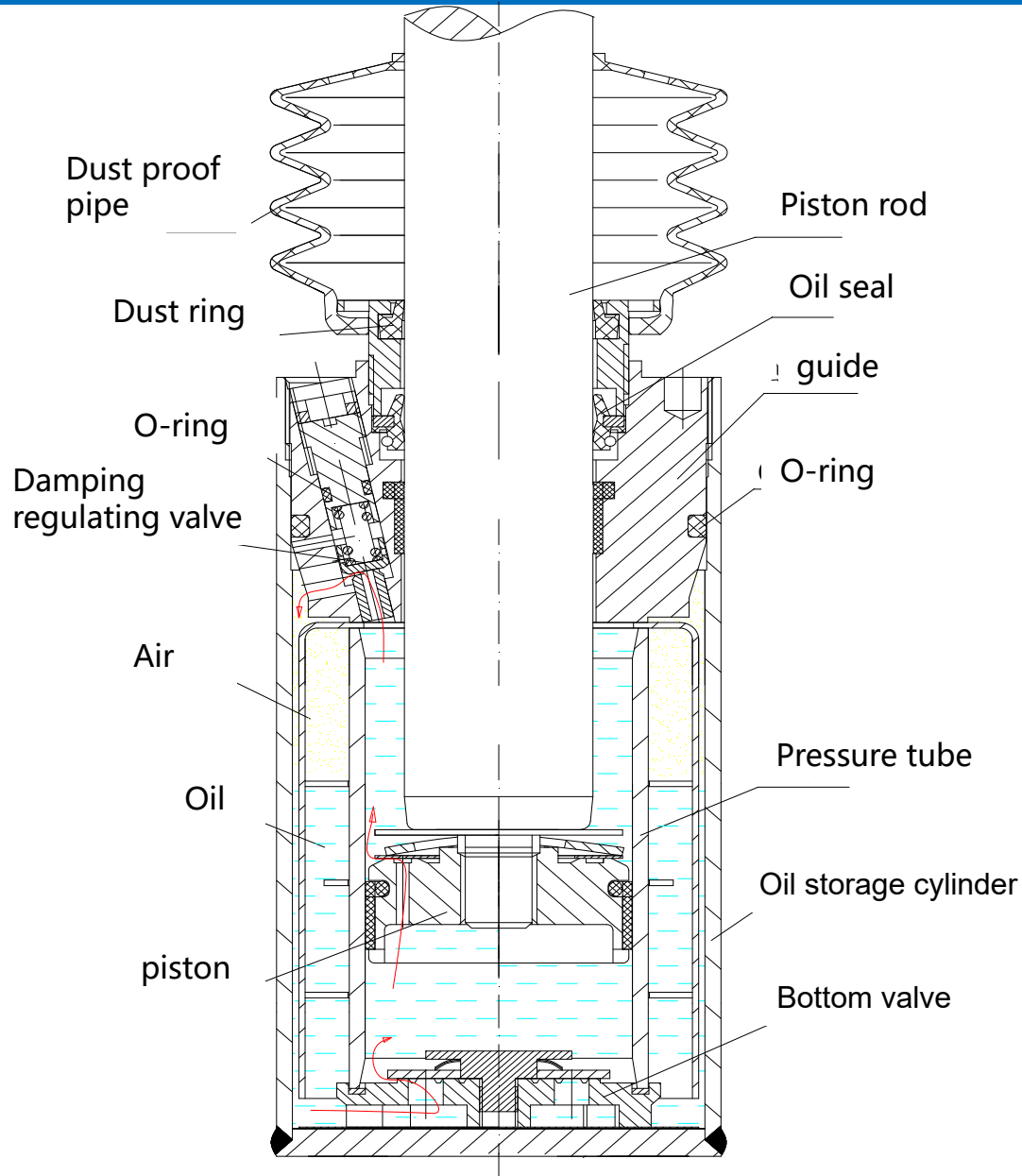
Basic structure of oil damper





Koni oil damper

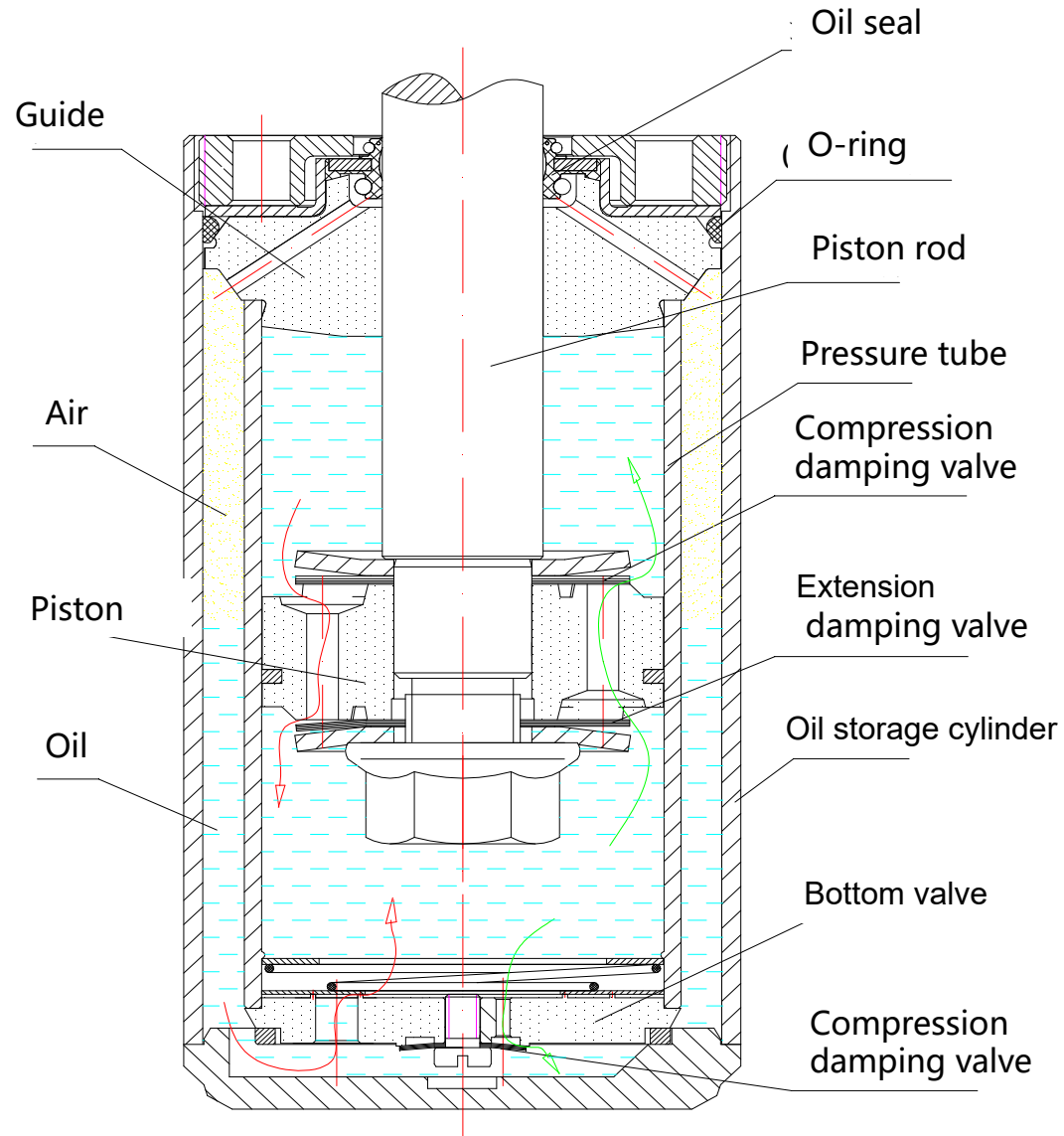
This is a single cycle oil pressure shock absorber, The bottom valve and the piston are provided with a check valve, The damping valve is on the guide seat , The valve system is spring type structure, The oil always flows in the same direction when working(The red lines in the diagram indicate the oil flow direction), Damping forces are established and adjusted by damping regulating valves .





Sachs oil damper

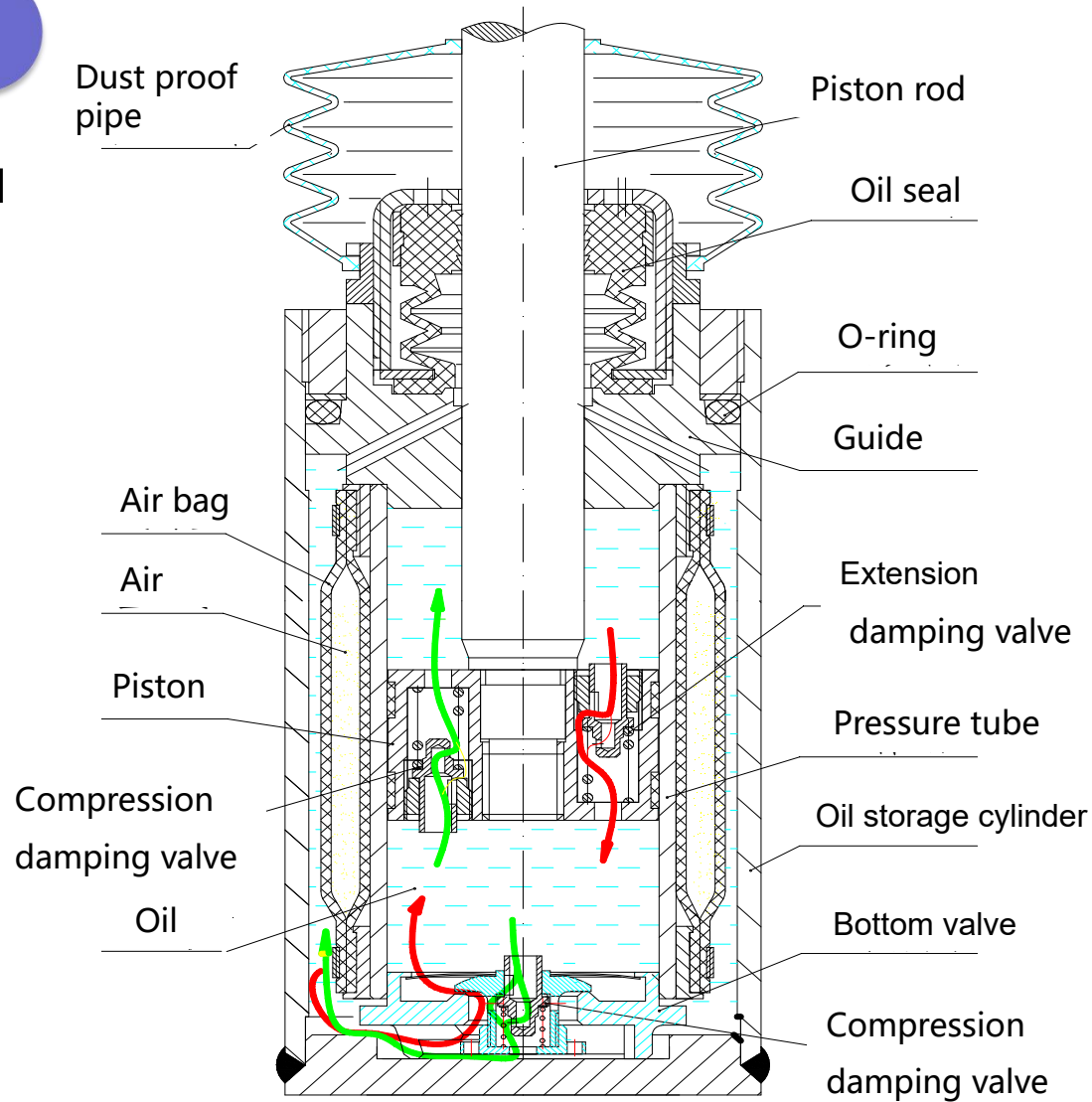
This is a double single cycle oil pressure damper, The damping valve is arranged on the piston and the bottom valve, The valve system is of pure valve disc structure, The oil flows in both directions (The red and green lines in the figure show the flow direction of the oil during the extension and compression processes respectively), Pressure is established through the valve system on the piston and bottom valve .





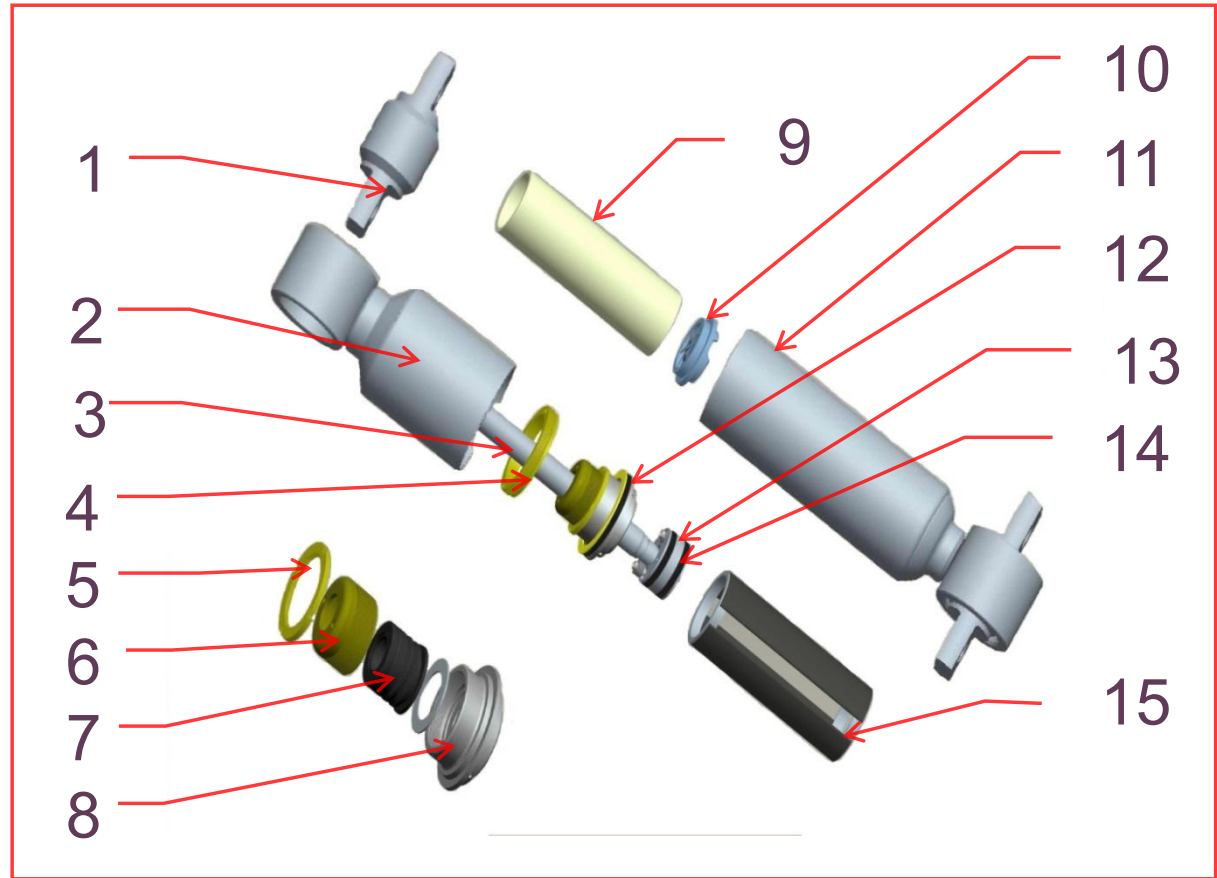
Dispen oil damper

This is a double single cycle oil pressure damper, The damping valve is arranged on the piston and the bottom valve, The valve system is spring type structure, The oil flows in both directions (The red and green lines in the figure show the flow direction of the oil during the extension and compression processes respectively), Pressure is established through the valve system on the piston and bottom valve .





- 1、 Rubber joint
- 2、 Dust cover assembly
- 3、 Piston rod
- 4、 Outer cylinder nut
- 5、 Seal cover nut
- 6、 Seal retainer
- 7、 Oil seal
- 8、 Guide
- 9、 Pressure tube
- 10、 Bottom valve unit
- 11、 Oil storage Cylinder
- 12、 O-ring
- 13、 Piston
- 14、 Piston ring
- 15、 Air bag



Structure of Dispen' s
oil damper

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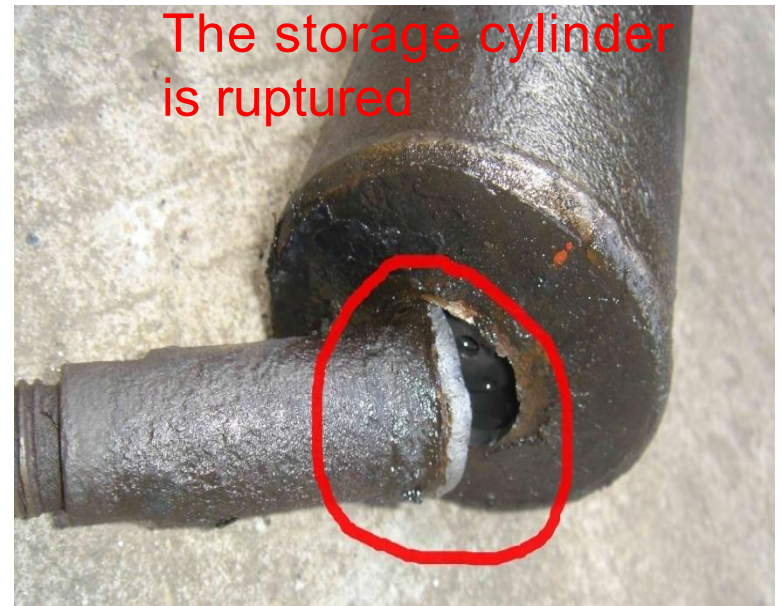
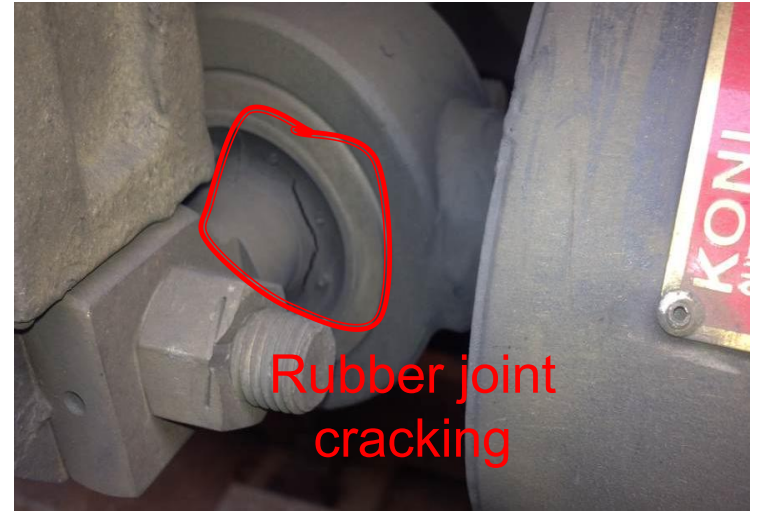
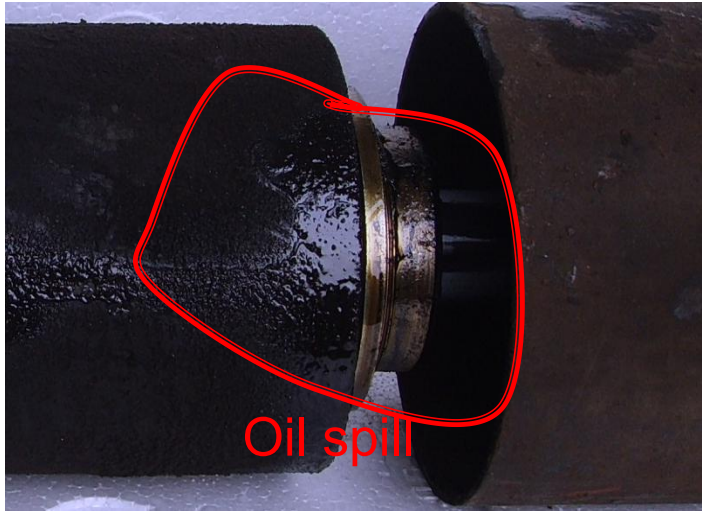
Damper failure

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Rolling stock damper configuration



Serial No.	Form of failure	Grade of failure	Definition of failure	Remark
1	Screw break off	A	Complete loss of product functionality	Rules for the implementation of qualification examination for overhaul of railway passenger oil damper (V3.0)
2	The piston rod is broken			
3	Piston rod off			
4	Upper and lower body detached			
5	The storage cylinder is ruptured			
6	Indicator diagram is unqualified●	B	Performance degrades and important quality characteristics are not met	
7	Interface ill-fitting due can't loading			
8	Rubber joint cracking aging			
9	Rubber joint out			
10	Oil spill ●	C	Other reasons that do not reach Class B or above fault level	
11	The protective cover is loose			
12	Paint chipping			
13	Nameplate off			
14	Cylinder block logo is not clear			
15	Corrosion			
16	Dust cover deformation			
17	Oil infiltration	B		
18	Service is not timely, problem solving is not complete/time			

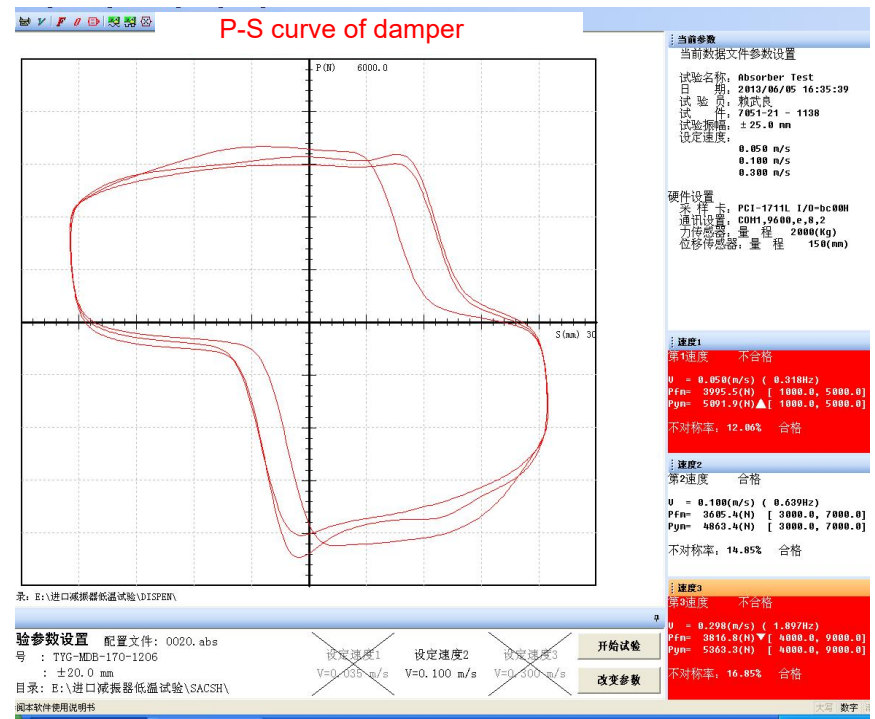
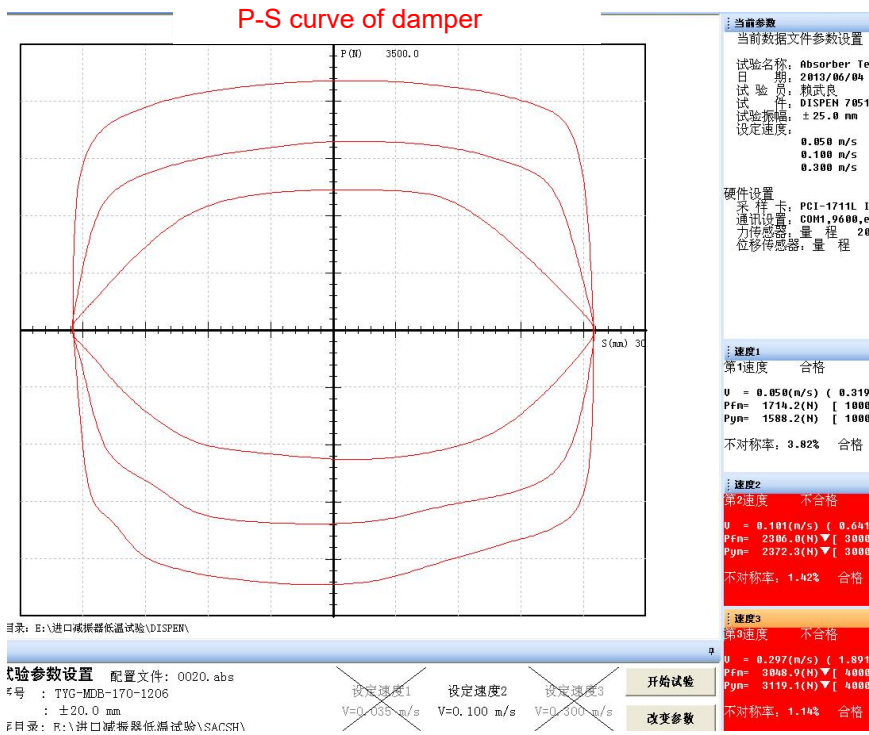




Indicator diagram is unqualified

Qualified figure

Unqualified figure



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Rolling stock damper configuration



Vehicle type	Bogie	Site of installation	Damper model			Number of vehicles
			YGA	Dispen	Koni	
25G	209P	Secondary vertical	209P2CA	209P2CA	/	4
	206P	Secondary vertical	206P2CA	206P2CA	/	4
		Secondary lateral	206P2HA	206P2HA	/	4
	206 206G	Secondary vertical	YGA-KC2-80	2140-00	02V-1672	4
		Secondary lateral	YGA-KH2-25B	2168-00	02H-1595-011	4
	206P	Secondary vertical	YGA-KC2-80	2140-00	02V-1672	4
		Secondary lateral	YGA-KH2-25A	2218-00	96H-1797	4
	209T	Secondary vertical	YGA-KC2-100B	2173-00	02V-1731	4
	209P	Secondary vertical	YGA-KC2-100A	2174-00	02V-1732	4
	202	Secondary vertical	YGA-KC2-80	2140-00	02V-1672	4



Vehicle type	Bogie	Site of installation	Damper model			Number of vehicles
			YGA	Dispen	Koni	
25K	209HS	Axle box	YGA-KC1-20A	2113-01	02A-1641-021	8
			YGA-KC1-20B	2113-03	02A-1641-021	8
		Secondary vertical	YGA-KC2-70A	2113-02	02V-1642-01	4
			YGA-KC2-80A	2113-04	02V-1642	4
		Secondary lateral	YGA-KH2-23	2114-03	/	4
			YGA-KH2-30	2115-02	96H-1719	4
	YGA-KH2-36		2114-01	96H-1719-01	4	
	206KP 206WP	Axle box	YGA-KC1-15	2167-00	02A-1597-011	8
			YGA-KC1-20	/	02A-1597	8
		Secondary vertical	YGA-KC2-60A	2168-01	02V-1596	4
		Secondary lateral	YGA-KH2-20	2168-02	02H-1595-021	2
			YGA-KH2-25B	2168-00	02H-1595-011	2
			YGA-KH2-40	/	02H-1595	2



Vehicle type	Bogie	Site of installation	Damper model			Number of vehicles	
			YGA	Dispen	Koni		
25K	206KP 206WP	Secondary lateral	YGA-KH2-40	/	02H-1595	2	
	SW-160	Axle box	YGA-KC1-10	2217-00	96A-1675-011	8	
		Secondary lateral	YGA-KH2-25C	2218-00	96H-1797-011	4	
	209PK	Secondary lateral	YGA-KH2-80	/	/	4	
	CW-1 (K) CW-2	Axle box		YGA-KC1-6	2175-05	/	8
				YGA-KC1-20C	2175-02	02A-1606-021	8
				YGA-KC1-25	ED1085-00	02A-1606	8
		Secondary vertical	YGA-KC2-60B	2176-00	02V-1621-011	4	
		Secondary lateral	YGA-KH2-35	2175-03	02H-1668	2	
			YGA-KH2-55	2175-06	02H-1607	2	
	CW-2E	Axle box	YGA-KC1-20D	2261-00	02A-1774	8	
		Secondary lateral	YGA-KH2-35	2175-03	02H-1668	2	



Vehicle type	Bogie	Site of installation	Damper model			Number of vehicles
			YGA	Dispen	Koni	
25T	CW-200	Axle box	YGA-KC1-15B	2170-00	96A-1824	8
		Secondary lateral	YGA-KH2-25D	2171-00	96H-1825	4
		Yaw	YGA-KS-250	2172-00	04R-1613	4
	SW-220K	Axle box	/	2409-20	96A-1928-011	8
		Secondary lateral	/	2298-00	96H-1930-011	4
		Yaw	/	2299-01	04R-1693-011	4
	PW-220K	Axle box	YGA-KC1-9	2077-01	96A-2341	8
		Secondary vertical	YGA-KC2-15	2097-00	96V-2343	4
		Secondary lateral	YGA-KH2-30B	2276-02	96H-2342	2
		Yaw	YGA-KS2-205	2314-01	02R-2330	4



Vehicle type		Site of installation	Damper model	Number of vehicles	Number per train
Mullet train	CRH1	Axle box	KONI 96A-2114	4	64
		Secondary vertical	KONI 96V-2121	2	32
		Secondary lateral	KONI 96H-2122	2	32
		Yaw	KONI 04R-1722	2	32
	CRH2	Axle box	KAYABA 0D42090-01	4	64
		Secondary lateral	KAYABA 0D50116	2	32
		Yaw	KAYABA 0D70230-1	4	64
	CRH380AL	Axle box	0D42090-2	4	128
		Secondary lateral	0D50126	2	64
		Yaw	0D70256-1	4	128
		End-of-train	YD90580-1	/	30



车型		Site of installation	Damper model	Number of vehicles	Number per train
Mullet train	CRH380B	Axle box	SACHS40 1300 001 704	4	64
		Secondary vertical	SACHS40 1300 001 705	2	32
		Secondary lateral	SACHS40 1300 001 706	2	32
		Motor lateral	SACHS40 1300 001 707	2	16
		Yaw	SACHS42 1300 001 708	4	64
		End-of-train		/	14
	CRH5	Axle box	DISPEN 7009-23	4	64
		Secondary vertical	DISPEN 7040-20/21M/T	2/2	20/12
		Secondary lateral	DISPEN 7051-21/20M/T	2/2	20/12
		Yaw	DISPEN 2428-00	2	32



Vehicle type		Site of installation	Damper model	Number of vehicles
Locomotive	HXD1	Axle box	42 1300 000 471	8
		Secondary vertical	42 1300 000 472	4
		Secondary lateral	42 1300 000 473	4
	XD2	Axle box	DISPEN 7041-20	8
		Secondary vertical	DISPEN 7030-22	4
		Secondary lateral	DISPEN 2305-00	4
	HXD3	Axle box	40 1300 000 246	8
		Secondary vertical	42 1300 000 281	4
		Secondary lateral	60 1300 000 247	4
	HXN5	Axle box	42 1300 001 132	8
		Secondary vertical	42 1300 000 133	4
		Secondary lateral	60 1300 000 361	4



Vehicle type		Site of installation	Damper model			Number of vehicles
			Dispen	Koni	Sachs	
Locomotive	DF11/ DF11G	Axle box	2128-00	04A-1560	42 1300 000 077	8
		Secondary vertical	2129-00	04V-1561	42 1300 020 326	8
		Secondary lateral	2130-00	04H-1562	42 1300 020 325	4
		Yaw	2131-00	04R-1271-011 (021)	60 1300 020 327	4
	DF8B	Axle box		02A-1892	42 1300 000 342	8
		Secondary lateral		02H-1891	42 1300 000 343	4
	DF4D	Axle box	N2158-01	02A-1807	42 1300 020 416	8
		Secondary vertical	N2253-00	02V-1808	42 1300 020 415	8
		Secondary lateral	N2210-00	02H-1809	42 1300 020 417	4
		Yaw	2132-00	04R-1206-013	60 1300 020 414 (A)	4



Vehicle type		Site of installation	Damper model			Number of vehicles
			Dispen	Koni	Sachs	
Locomotive	SS8	Axle box	2212-00	04A-1548-011	42 1300 020 406	8
		Secondary vertical	2213-00	04V-1547	42 1300 020 407	4
		Secondary lateral	2214-01	04H-1546-011	42 1300 020 408	4
		Yaw		04R-1237	60 1300 020 409	4
	SS9	Axle box		04A-1548(-011)	42 1300 020 746	8
		Secondary vertical		04V-1547	42 1300 000 163	8
		Secondary lateral		04H-1546-011 (021)	42 1300 020 748	4
		Yaw		04R-1237-041	60 1300 020 749	4
	SS4G	Axle box		02A-1983	42 1300 000 470	16
		Secondary lateral		02H-1984	42 1300 000 471	8