Suspension

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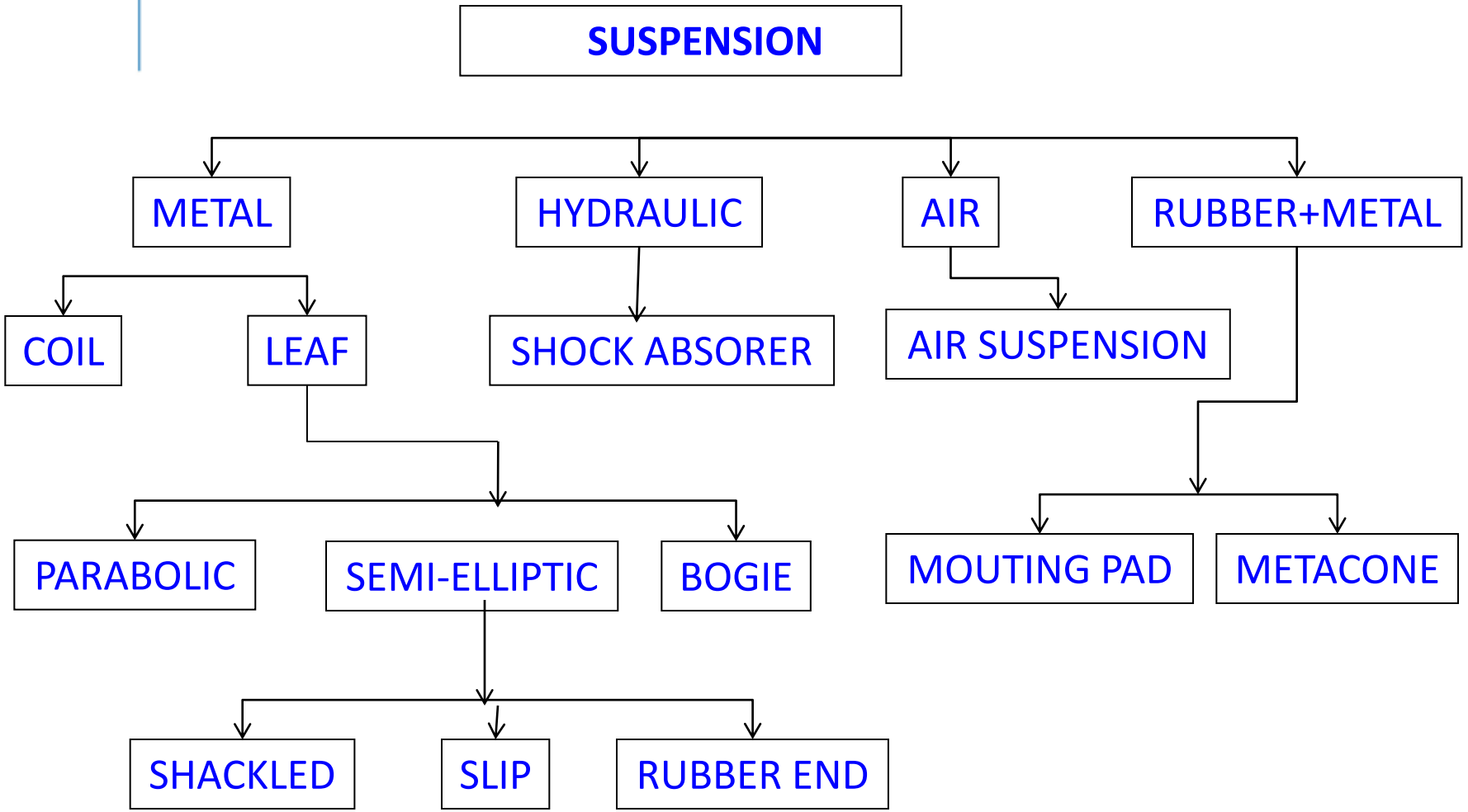
Function of Suspension

- It absorb and damp the various vibrations, oscillations and shock received by the vehicle
- It transmits the drive and braking forces, which are generated due to friction between the road surface and the wheels, to the chassis and body
- It supports the body on the axles and maintains the proper geometrical relationship between the body and wheels

Need for Suspension

- Absorb road shocks and provide ride comfort
- Improve driving stability
- Reduce Driver Fatigue
- Protect Passengers and cargo
- Enhance Frame and Coach Life

Types



Metallic Semi elliptic Leaf spring - Front

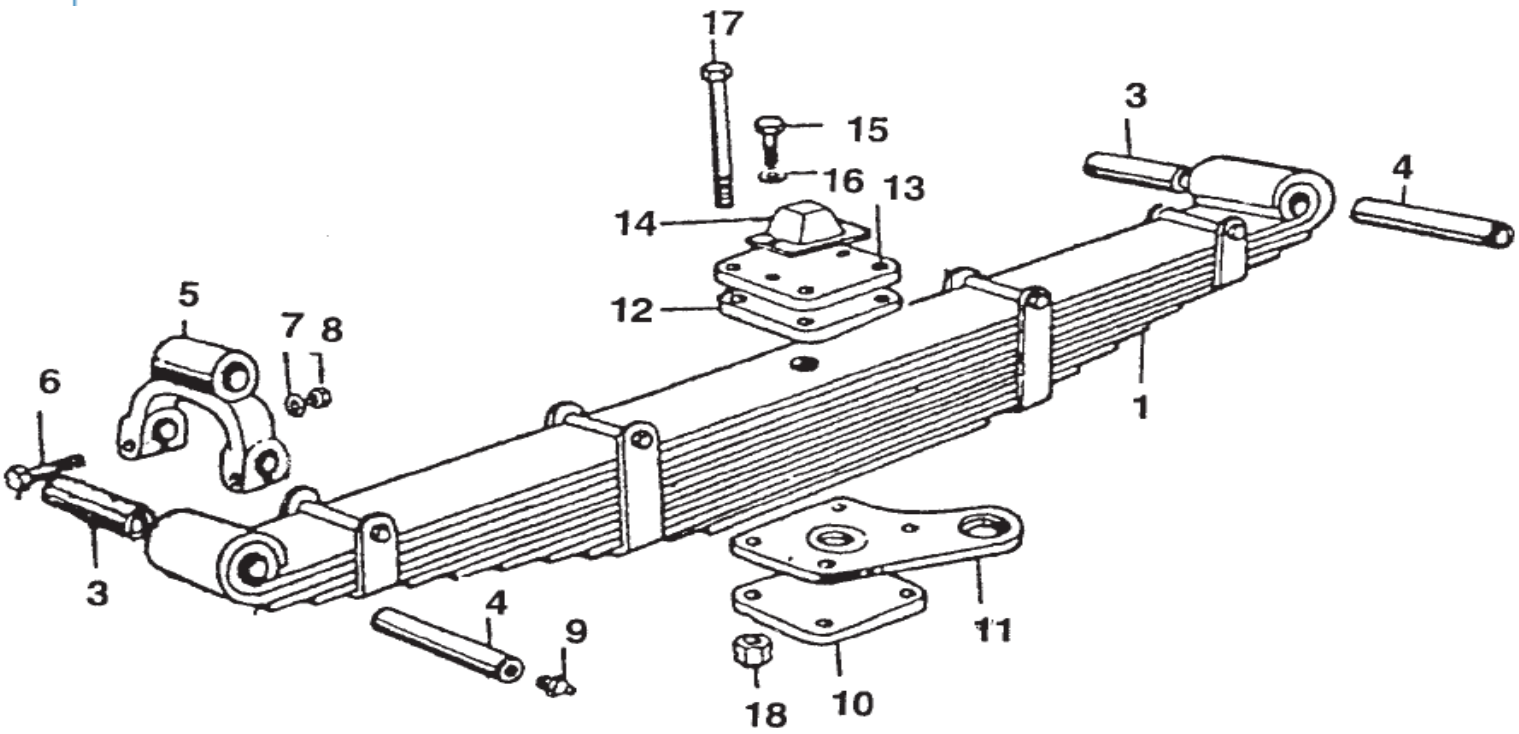
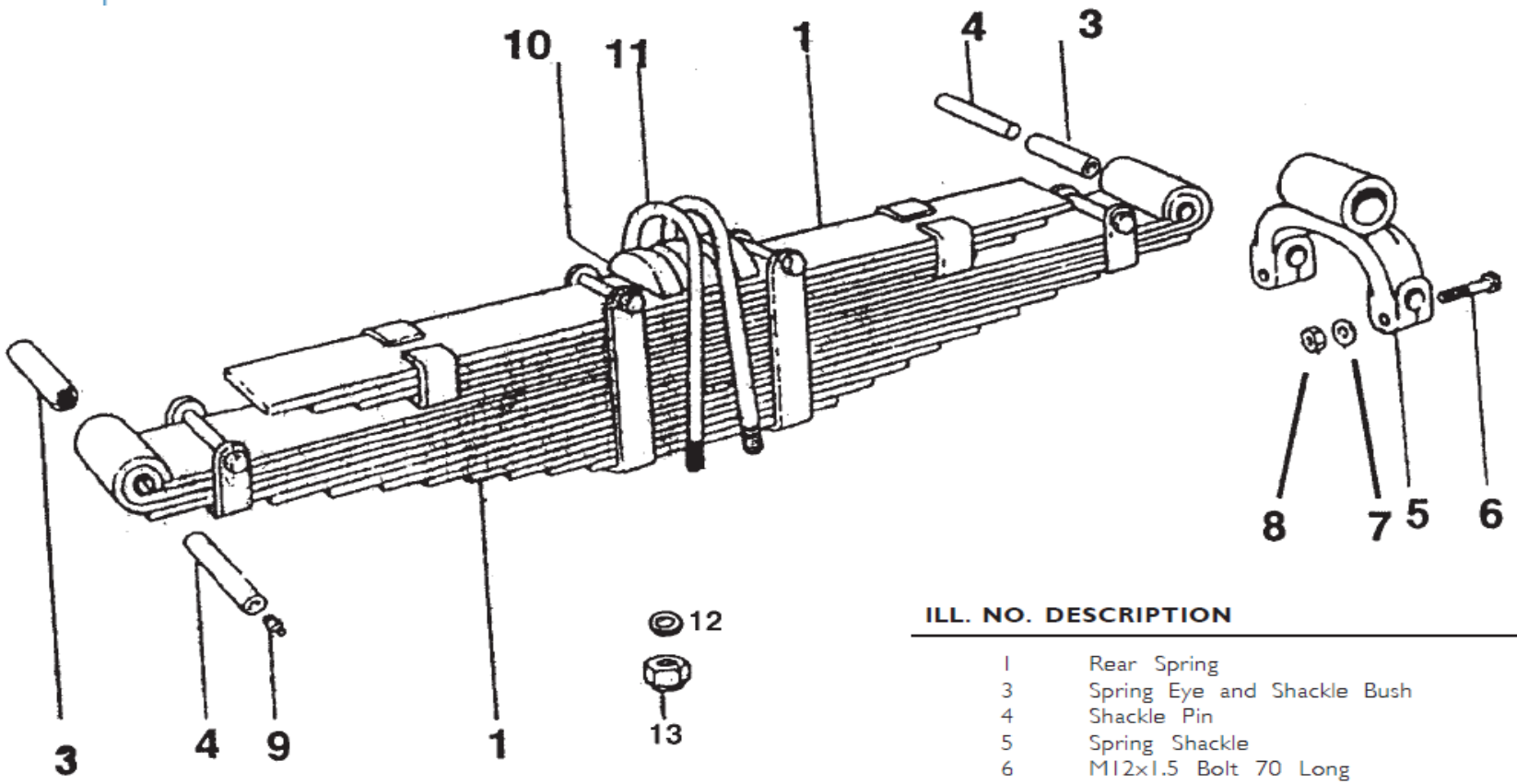


Fig. 1 Front Spring

ILL. NO.	DESCRIPTION
1	Front Spring Assy
3	Spring Eye and Shackle Bush
4	Shackle Pin
5	Spring Shackle
6	Bolt M12 x 1.5 x 70 For Shackle and Spring Bracket
7	Washer Spring M12
8	Nut M12x1.5
9	Grease Nipple M10x1
10	Packing - Below Shock Absorber Support Plate

ILL. NO.	DESCRIPTION
11	Shock Absorber Sup Plate at Bottom
12	Packing - One Above Spring Each Side
13	Buffer Mounting Plate
14	Sub Assy of Bump Stop
15	Setscrew M10x1.5 To Fix Bump Stop To Buffer Mounting Plate
16	Washer M10
17	Front Spring Bolt For Clamping Spring To Front Axle Beam
18	Nut Simmonds 3/4" BSF

Metallic Semi elliptic Leaf spring - Rear

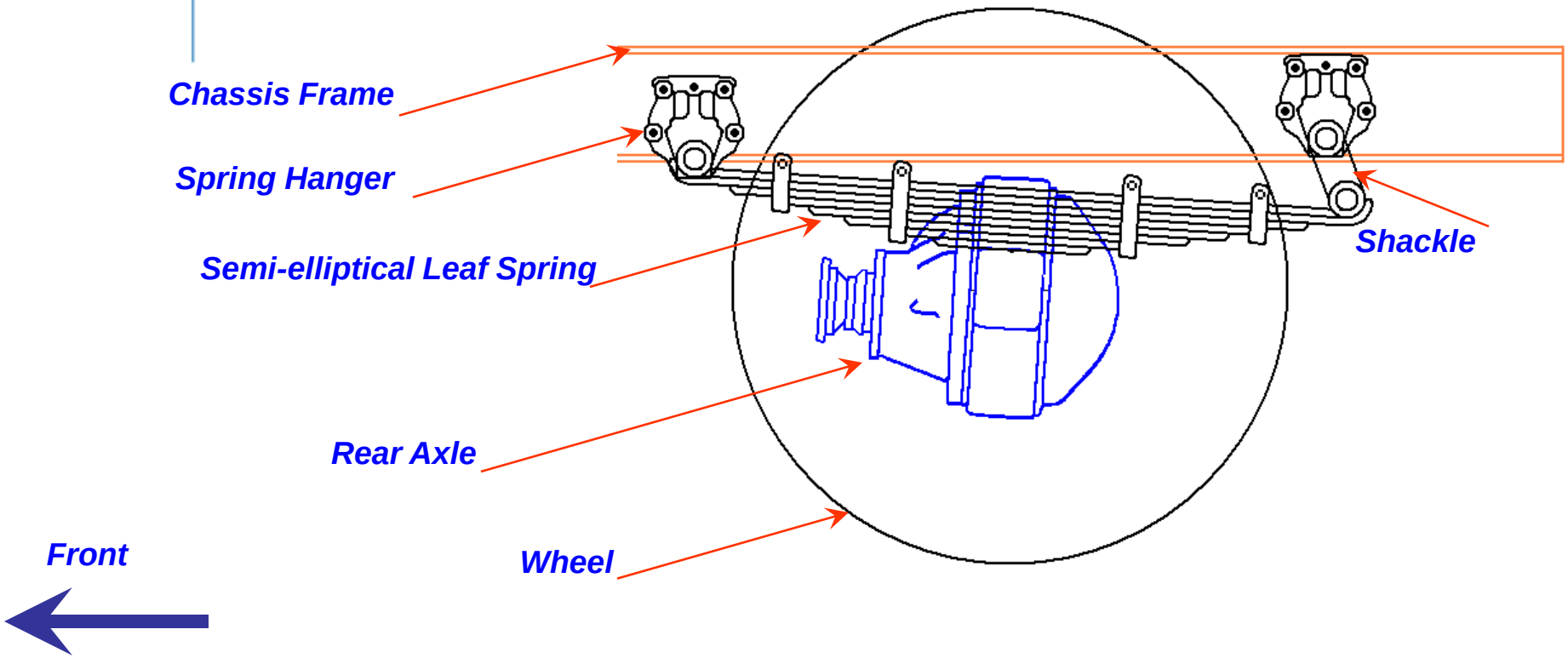


ILL. NO.	DESCRIPTION
1	Rear Spring
3	Spring Eye and Shackle Bush
4	Shackle Pin
5	Spring Shackle
6	M12x1.5 Bolt 70 Long
7	12 Dia Spring Washer
8	M12x1.5 Nut
9	Grease Nipple M10x1
10	Top Clamp
11	U Bolt - M22
12	Spherical Washer
13	Nut - Nyloc

Metallic Semi elliptic Leaf spring - Maintenance

Shackle pin - greasing	MP Grease Max NLGI 2	Servo Grease ALT	Weekly / 8000 km
Check “I” bolts / “U” bolts tightness			Weekly / 8000 km
Spring clip /Helper spring / spring shackle tightness			
Check shock absorber, rubber pads, mounting bracket bolts and nuts			Weekly
Lubricate shackle pins – regular suspension			Weekly
Lubricate shackle pins –Non reactive suspension			Weekly

Conventional Rear Suspension

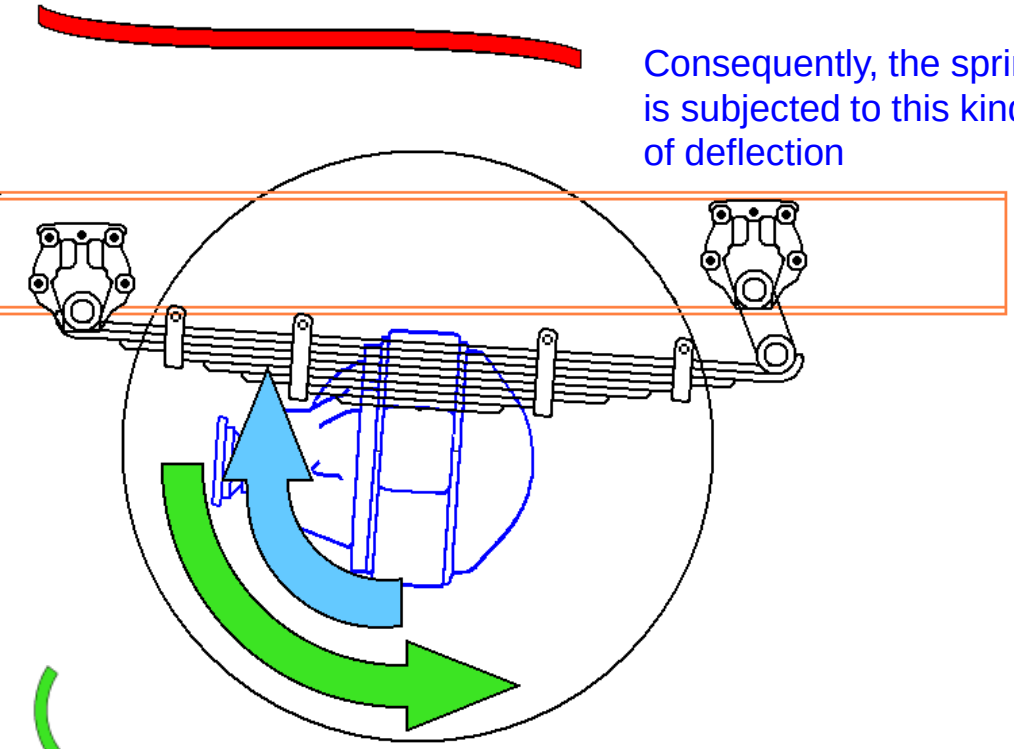


Spring - interface between the driving member and load carrying member

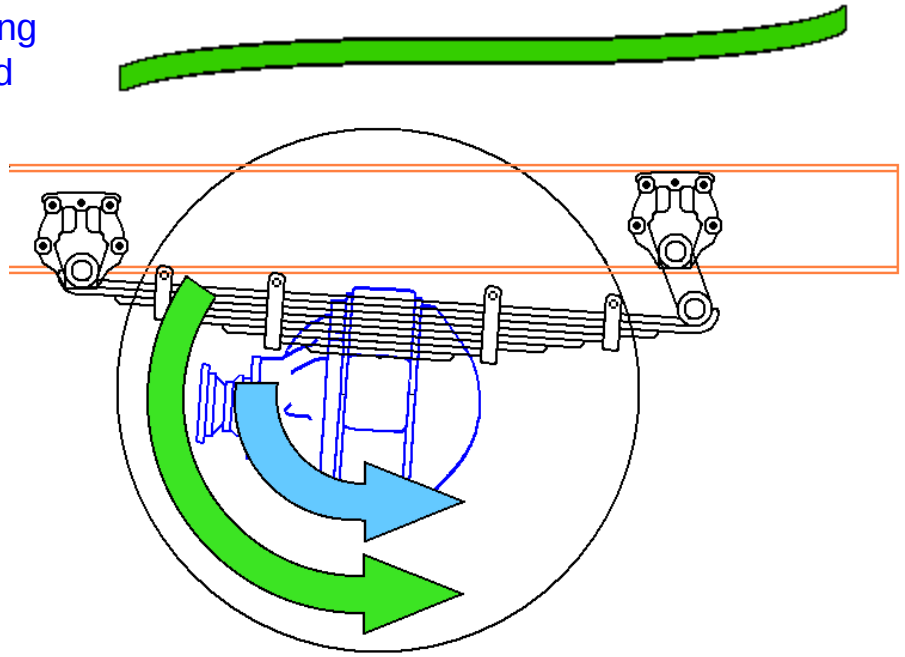
Spring - transmits the driving force and the braking force between the road wheels and chassis and ensure smooth ride

Conventional Rear Suspension

Torque Reaction ← ***Front*** ***Brake Reaction***



Consequently, the spring is subjected to this kind of deflection



Direction of rotation of wheel

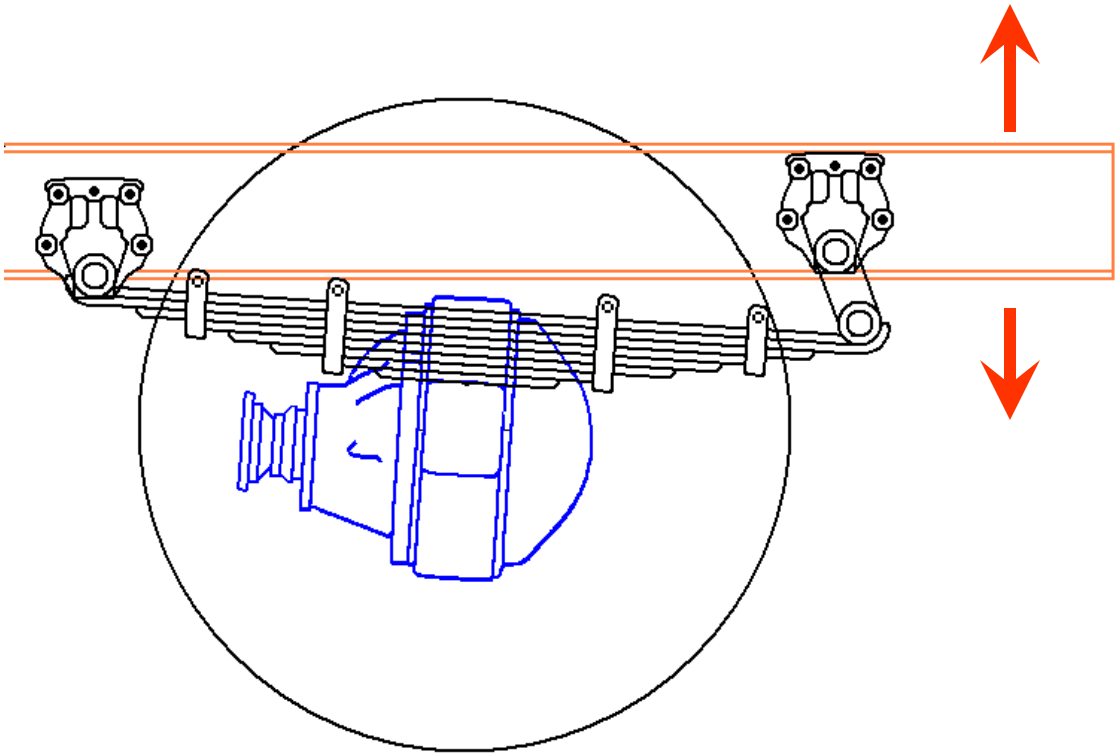
Direction of torque reaction (movement of axle casing)

Direction of rotation of wheel

Direction of Brake reaction (movement of axle casing)

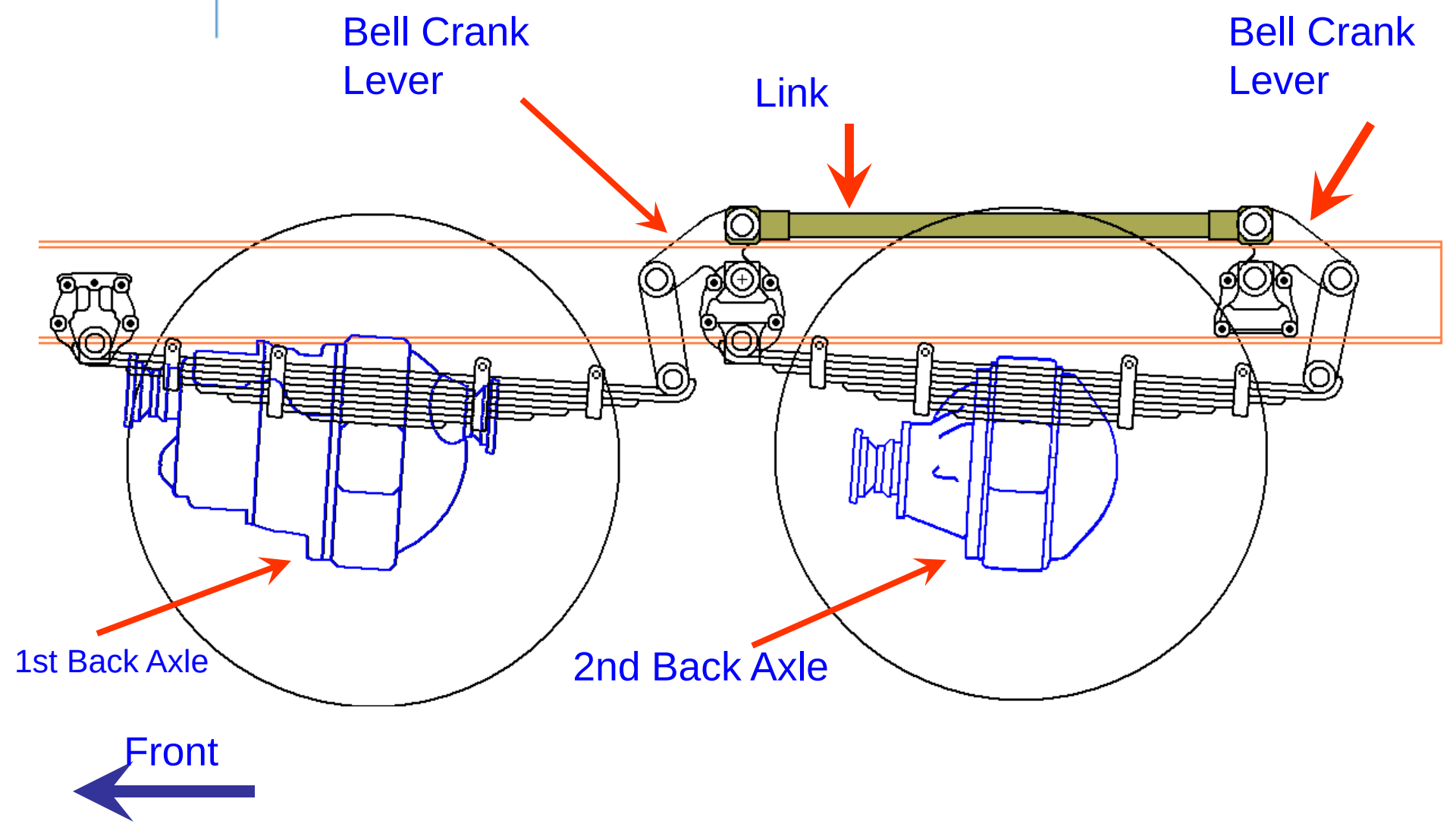
Conventional Rear Suspension

The frame is subjected to considerable up & down movements when the vehicle is in operation due to torque & brake reaction



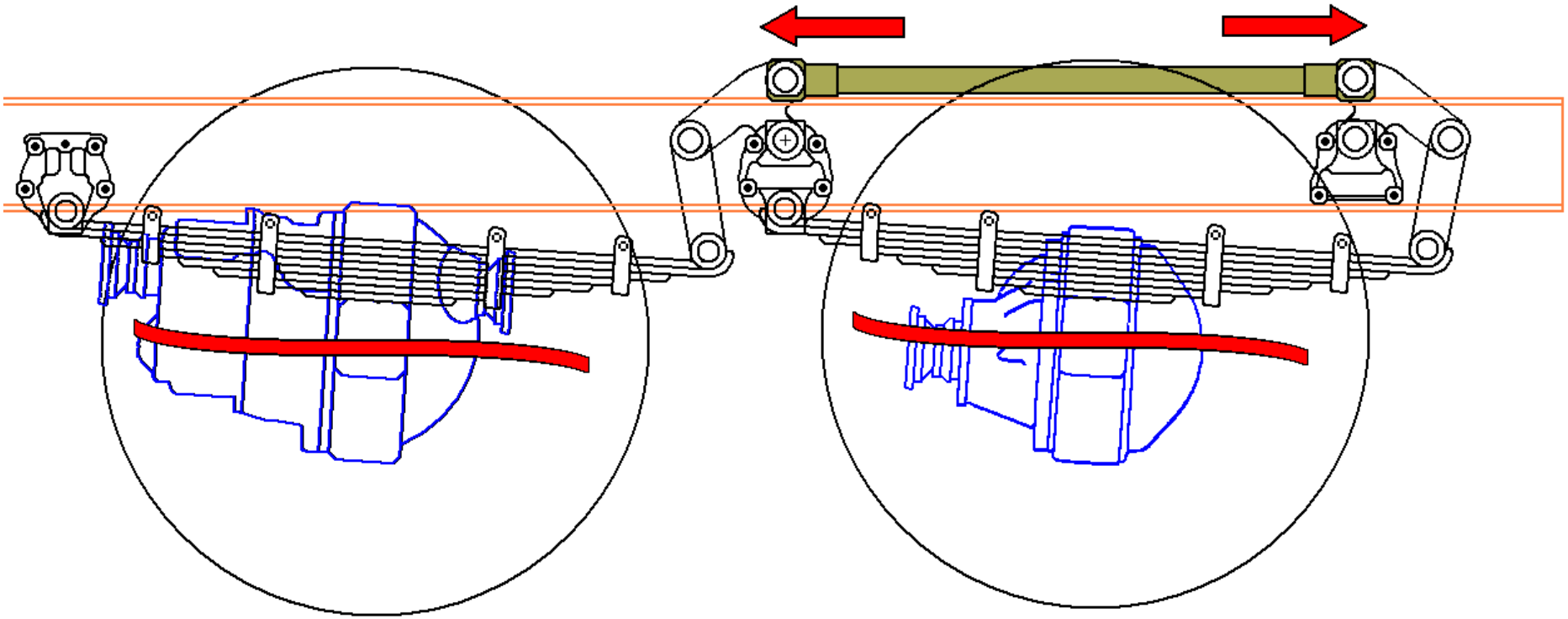
Front

Non reactive rear Suspension



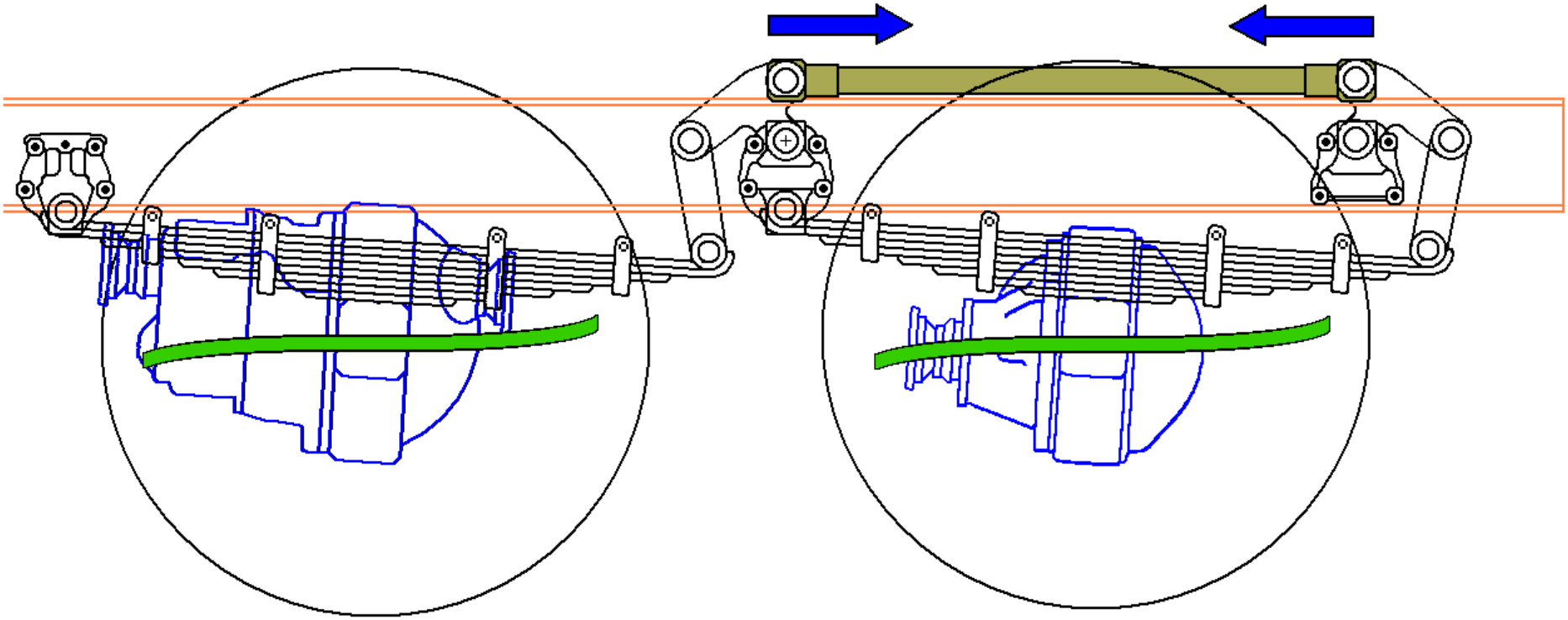
Non reactive rear Suspension

Torque reaction from both the axles elongate the link



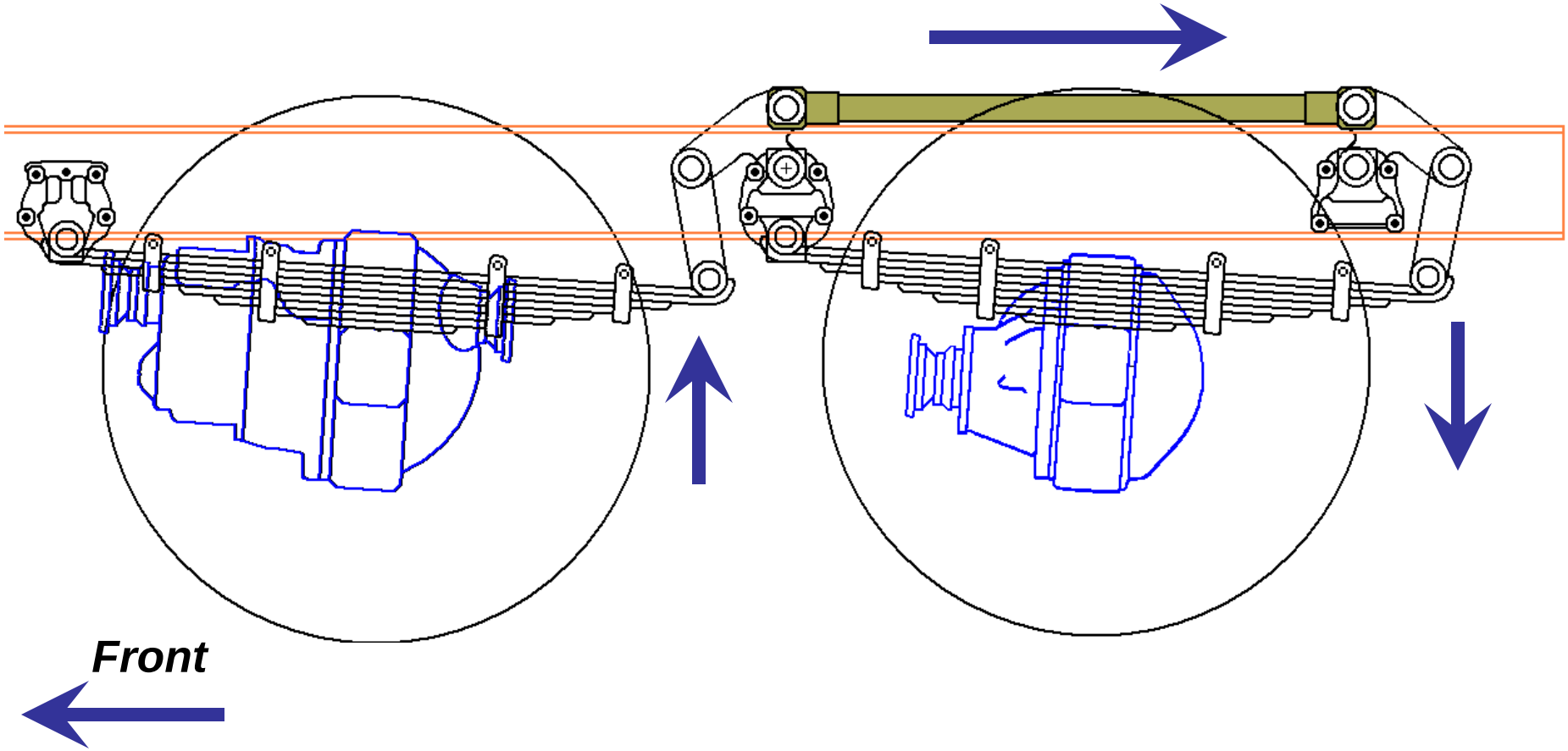
Non reactive rear Suspension

Brake reaction from both the axles compress the link



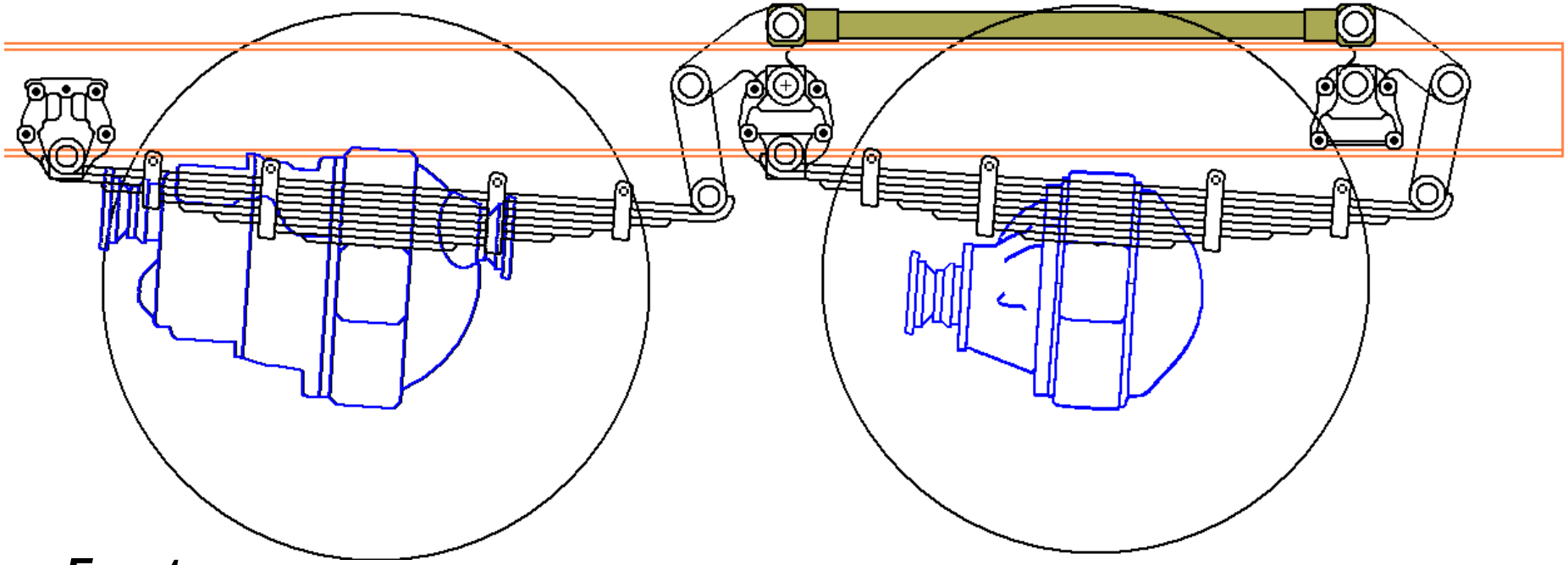
Non reactive rear Suspension

The load on the axles are balanced when the vehicle is going over undulated road



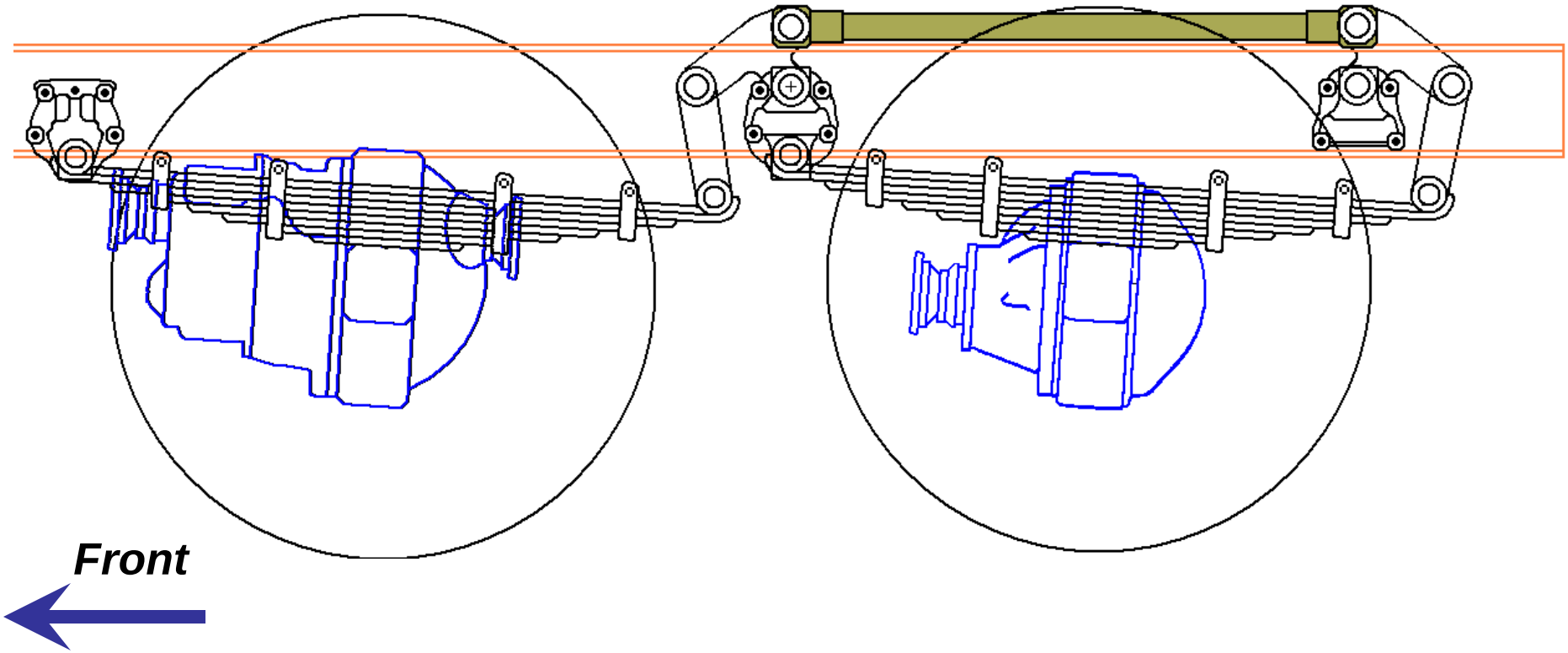
Non reactive rear Suspension

As a result, the up & down movement of the chassis frame due to torque reactions is minimized



Non reactive rear Suspension

Hence it is known to be self compensating under all operating conditions



NRS - Advantage

Load is equally shared by the two axles

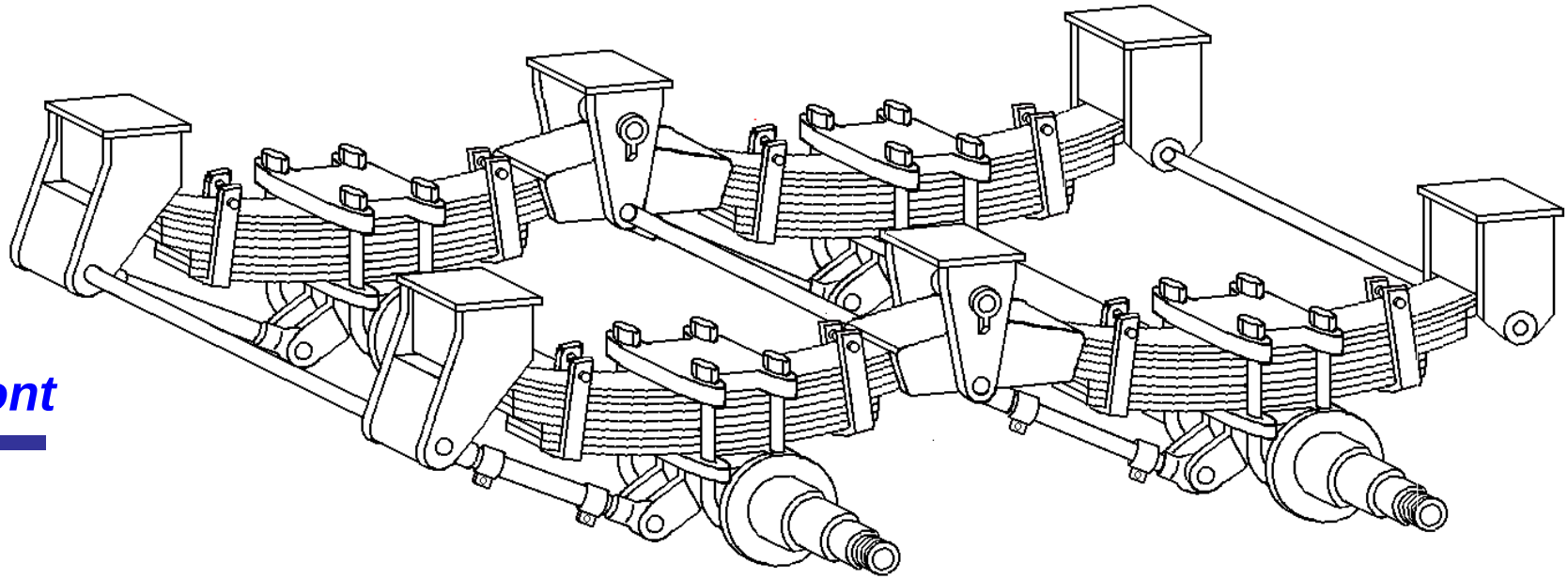
Damage to road is minimized.

There is no transfer of weight from 2nd to 1st rear axle during braking

Reduces shocks on frame, cross members & springs

Up & down movement of chassis frame is minimized

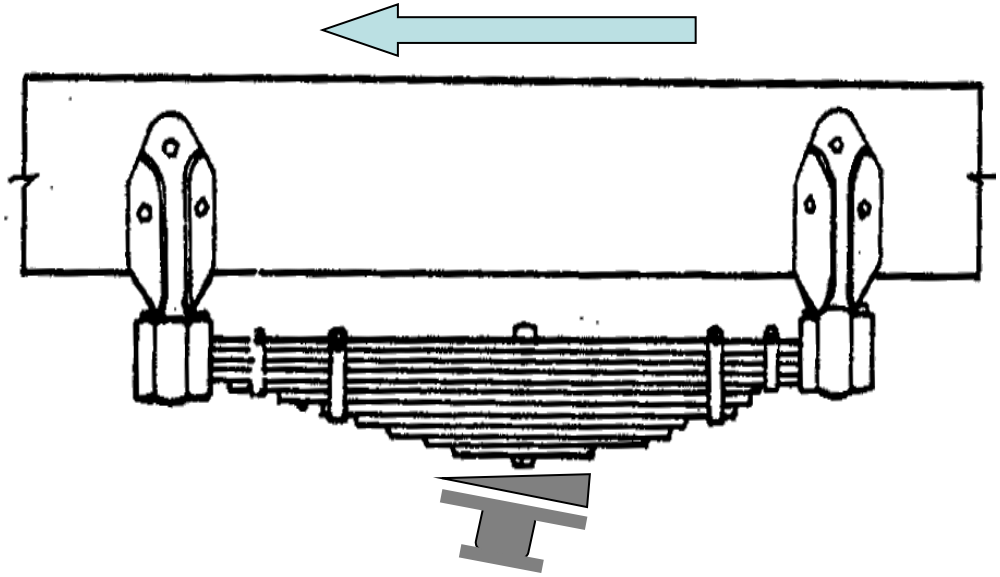
Balance beam Suspension



Front

The other tandem suspensions like balance beam or inverted springs, balance the weights on axles and also take the torque and brake reactions and transmit the same to chassis frame

Rubber Ended Springs



Front Weveller Springs

Rubber Ended Springs

Main features

Improves ride comfort

Prevents rattling

Reduces maintenance

No metal to metal contact between spring & chassis

Reduces driver fatigue

Enhances frame and coach life

Rubber Ended Springs

Ride comfort

Rubber ends act as cushions.

Rubber conforms to position of the leaf ends.

Better ride comfort as compared to conventional springs

Variable rating results in lesser deflection at higher load

Prevents rattling

Prevention of metal to metal contact is achieved by rubber as a shock absorption medium. This avoids rattling.

Reduced maintenance

Free from any daily maintenance, as all lubricating points are eliminated

Less number of components

Free-ended springs ensure axle and tyre move in pure vertical direction thereby avoiding tyre scrubbing (conventional shackle arrangement moves in an arc making axle askew)

Rubber Ended Springs

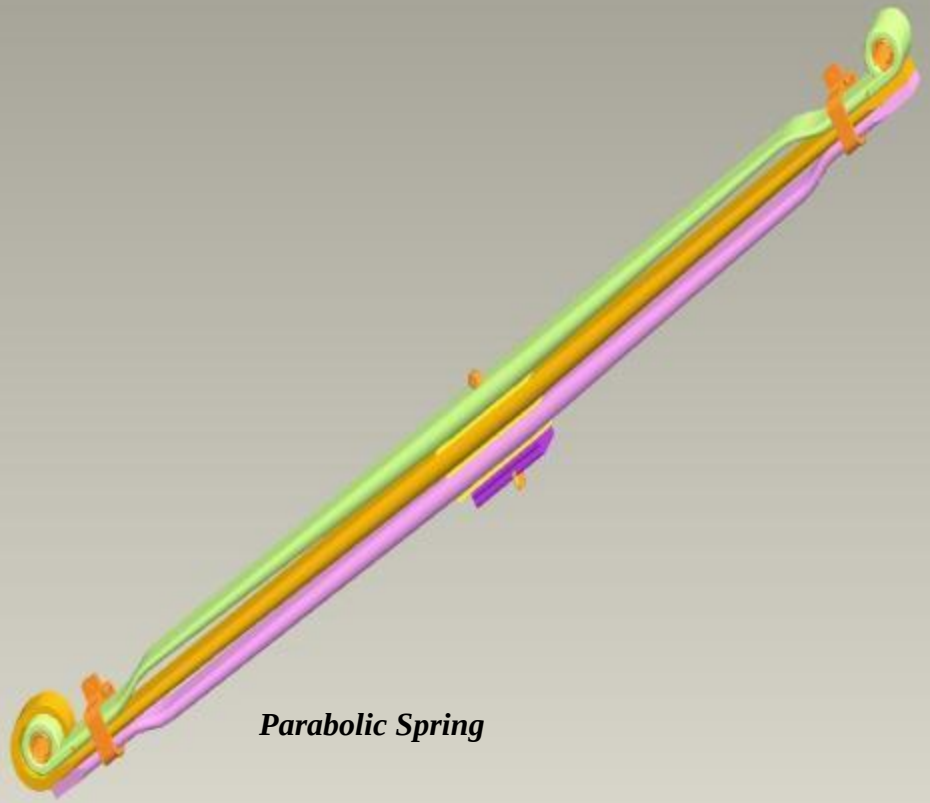
TECHNICAL SPECIFICATION / DATA

Particulars	Front Spring	Front Spring	Rear Spring
Eye	60"	60"	60“
Spring width	3"	4"	4“
Free camber	214mm	217mm	208mm
Laden camber	128mm	111mm	114.3mm
Deflection	86.2mm	106mm	93.7mm
Load	2400kg	2940kg	3540kg
Spring rate	27.8kg/mm	27.7kg/mm	37.8kg/mm
No. of leaves	10	11	10
Thickness	12.7 mm 11.1mm (for 9 leaf) 11.1 mm (for 10th leaf)	12.7mm	

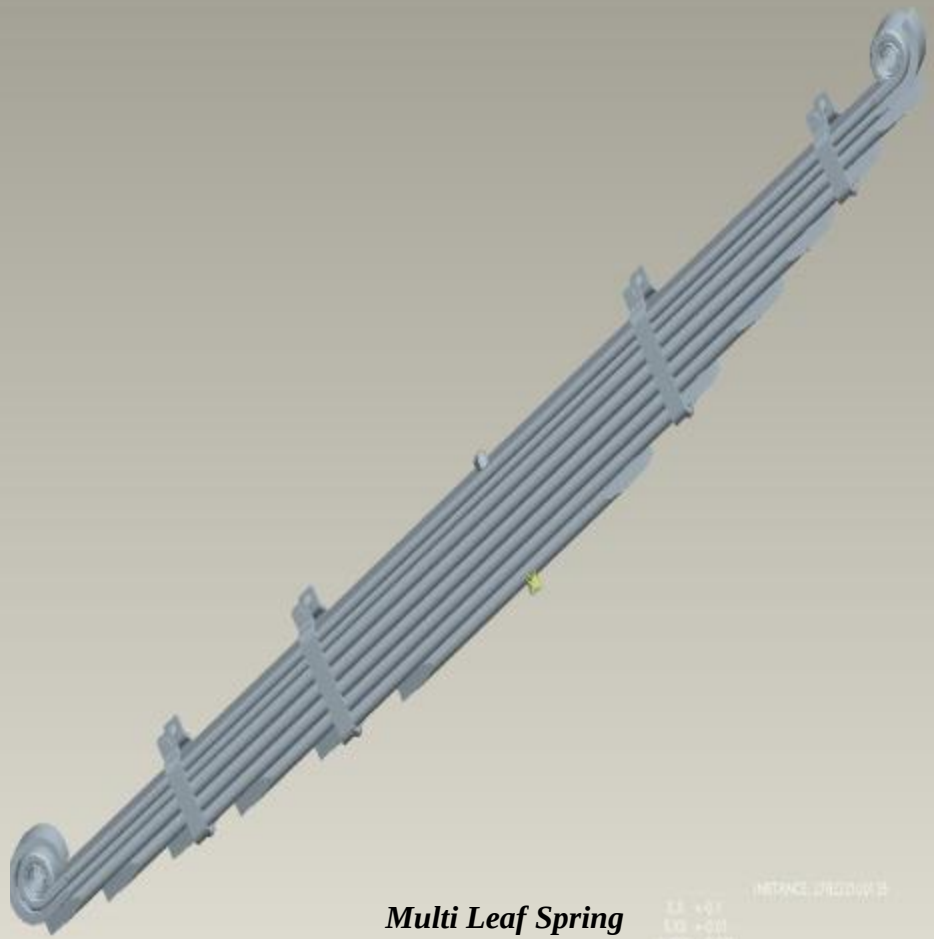
Rubber Ended Springs - Maintenance

Check “I” bolts / “U” bolts tightness	Weekly / 8000 km
Spring clip /Helper spring / spring shackle tightness	Weekly / 8000 km
Check shock absorber, rubber pads, mounting bracket bolts and nuts	Weekly

Parabolic suspension



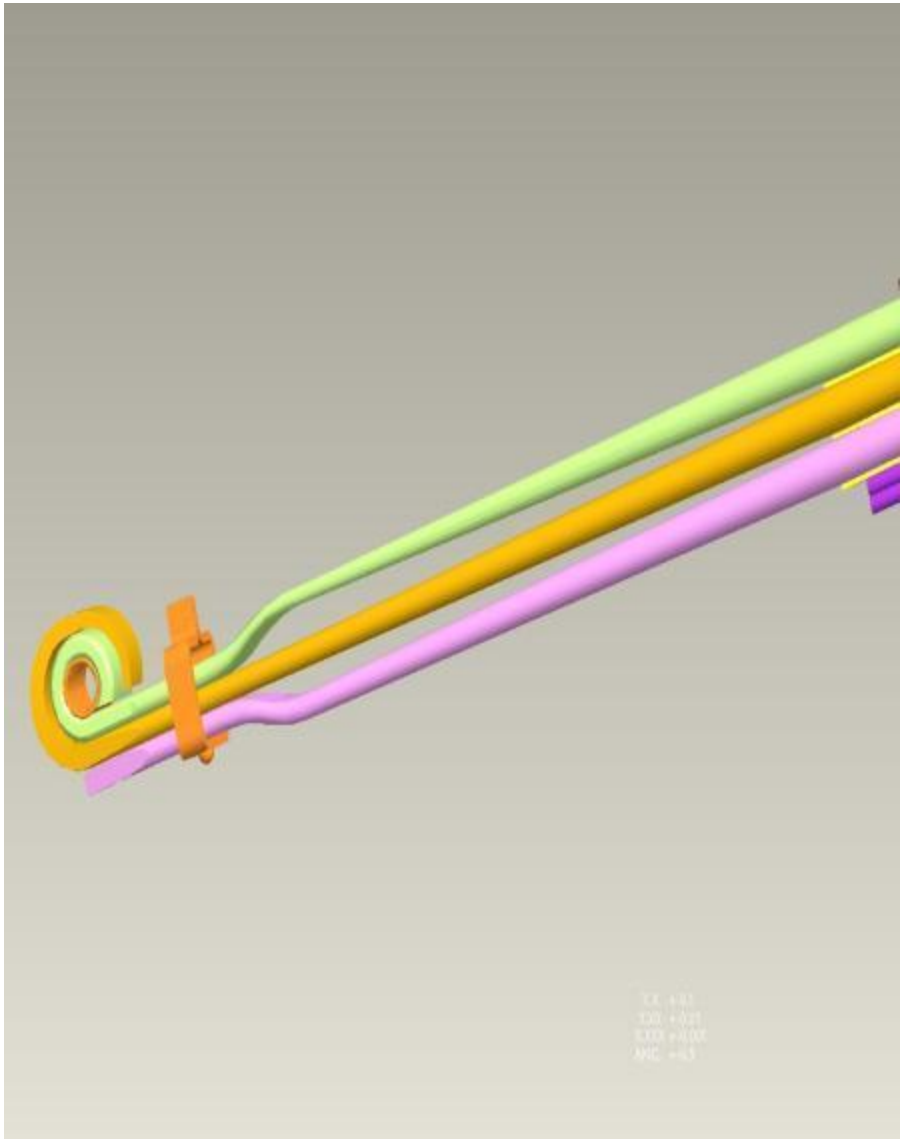
Parabolic Spring



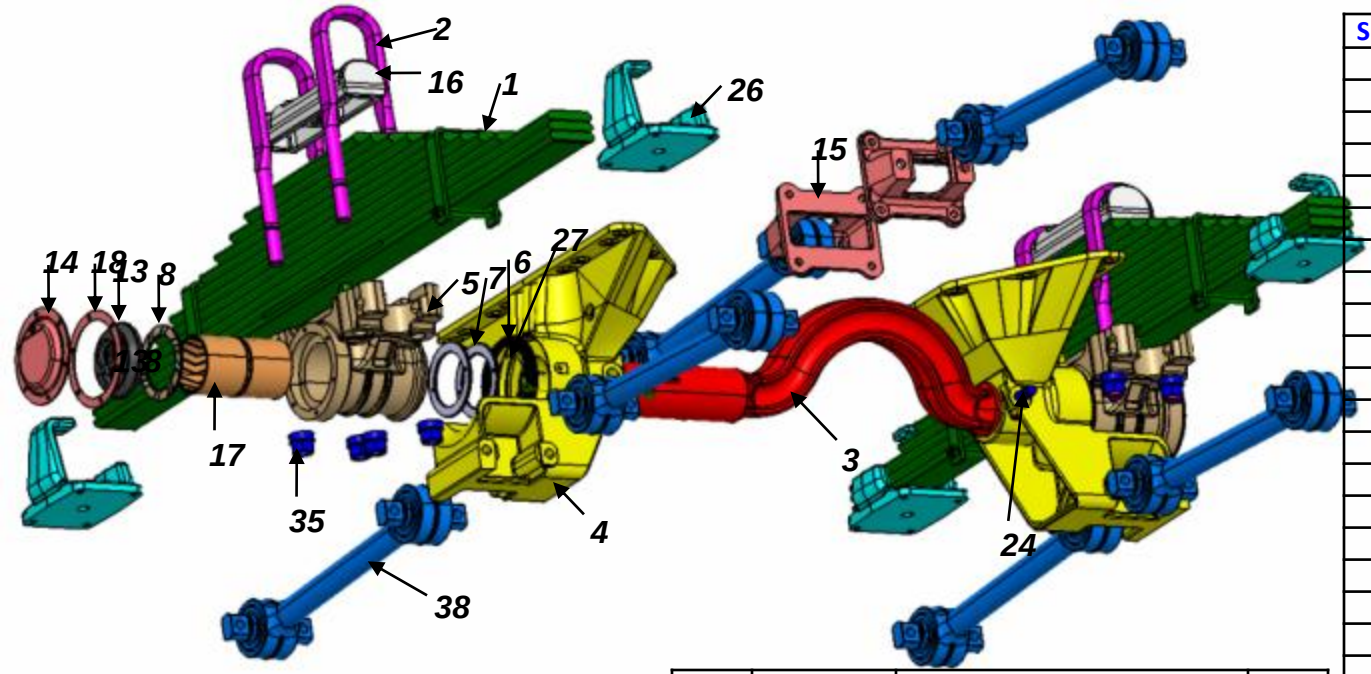
Multi Leaf Spring

Parabolic Suspension

- Contain less number of leaves
- Each leaf acts as a separate spring
- All leaves are full length leaves
- Carries the same load as Multi leaf spring.
- Gap between leaves reduce friction
- Provides better ride comfort.
- Weight is reduced by 20-30%
- The vehicle height remains same
- The leaves are stress peened.
- Better surface protection (painting) for higher salt spray life.



Bogie Suspension



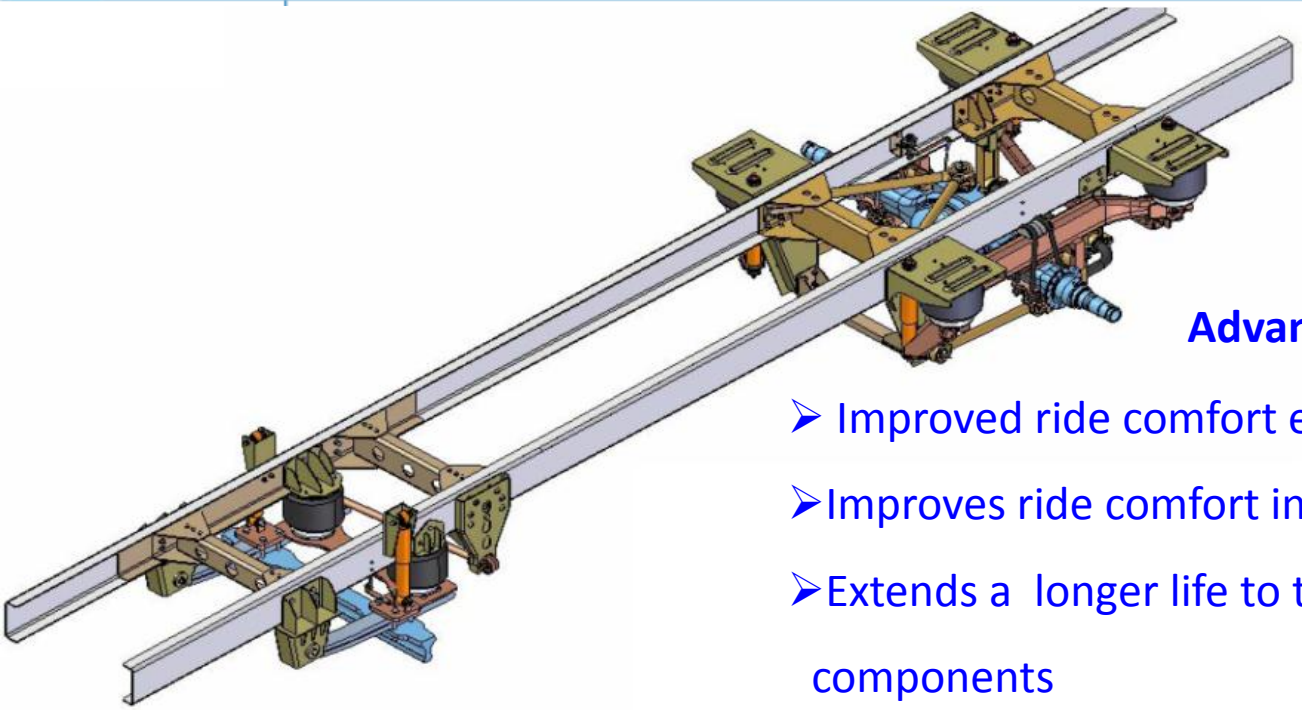
S.No	Part No	Description	QTY
1	FD300314	Rear Spring	2
2	FL100125	U-Bolt	4
3	F0X00125	Trunnion Shaft	1
4	F1A00224	Bogie Bracket	2
5	F0X00225	Spring Trunnion	2
6	FA600125	Oil Seal	2
7	FL800124	Thrust Washer	2
8	FL800125	Thrust Washer	4
9	F6C00125	Dowel Pin	12
10	F3H00222	Shim	5
11	F3H00322	Shim	5
12	F3H00422	Shim	5
13	FC100125	Locating Plate	2
14	FC100122	Cover Plate	2
15	F3H00122	Bracket-Radius Rod	2
16	F4R00122	Top Clamp	2
17	F4A00125	Spring Trunnion Bush	4
18	F7Y00123	Gasket	2
19	X3517010	Flange Bolt	4
20	F1B00421	Flange Bolt	24
21	F1B00221	Bolt	6
22	F1B00311	Bolt	12
23	F1B00511	Bolt	6
24	F1B00124	Knock Bolt	2
25	X3508615	Nut	18
26	F2Y00122	Spring Seat	4
27	FA400100	O Ring	2
28	F2932115	Grease Nipple	2
29	F3926700	Relief Valve Assy	2
30	L2010815	Screw	12

31	L4110800	SC Washer	12
32	F3522911	Flange Nut	12
33	F3523011	Flange Nut	24
34	L3032418	M24X2 (EFT and PC8)	2
35	F3598010	NUT- U Bolt-Gr.8.0	8
36	L4112400	Sc Washer	2
37	FL800115	Washer	18
38	B6Y00301	Radius Rod Assembly	6
39	L1021211	Bolt	16
40	L3621218	Nyloc Nut	16
41	X0932515	Dowel	4
42	F1B00314	Bolt	4
43	L4011200	Washer	8

Bogie Suspension - Advantages

- Grease lubrication – Ease of service & maintenance
- Higher load carrying capacity
- Better spring life
- Higher articulation – increases vehicle stability, adds advantage for tippers
- Lesser axle spread – reduction of tyre scrubbing leads to improved tyre life
- Integrated trunnion shaft with bogie bracket – Better structural strength.
- Flattened U-bolt, parallel U-bolt arrangement & longer top clamp – for better spring clamping.
- Radius rod axial compression bushes with more swing angle – allows more articulation.
- More packaging space for other components. Less component weights.

Air Suspension



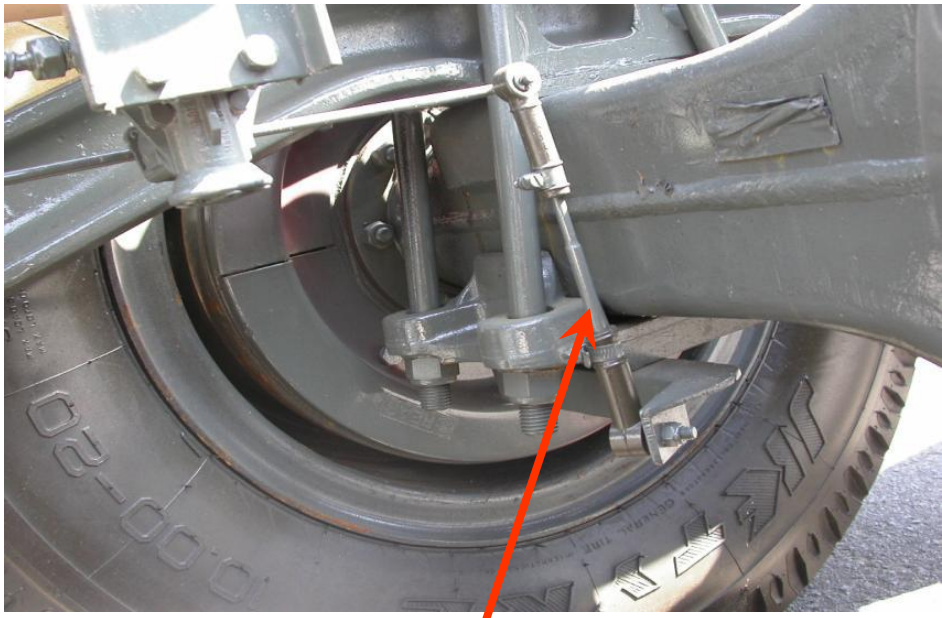
Advantages

- Improved ride comfort even at low laden condition
- Improves ride comfort in any seat in the vehicle
- Extends a longer life to the body & Chassis components
- Reduces fatigue to the driver
- Ease of service & maintenance
- Self leveling gives head lamp level control
- Roll stability
- Consistent ride height

Air Suspension

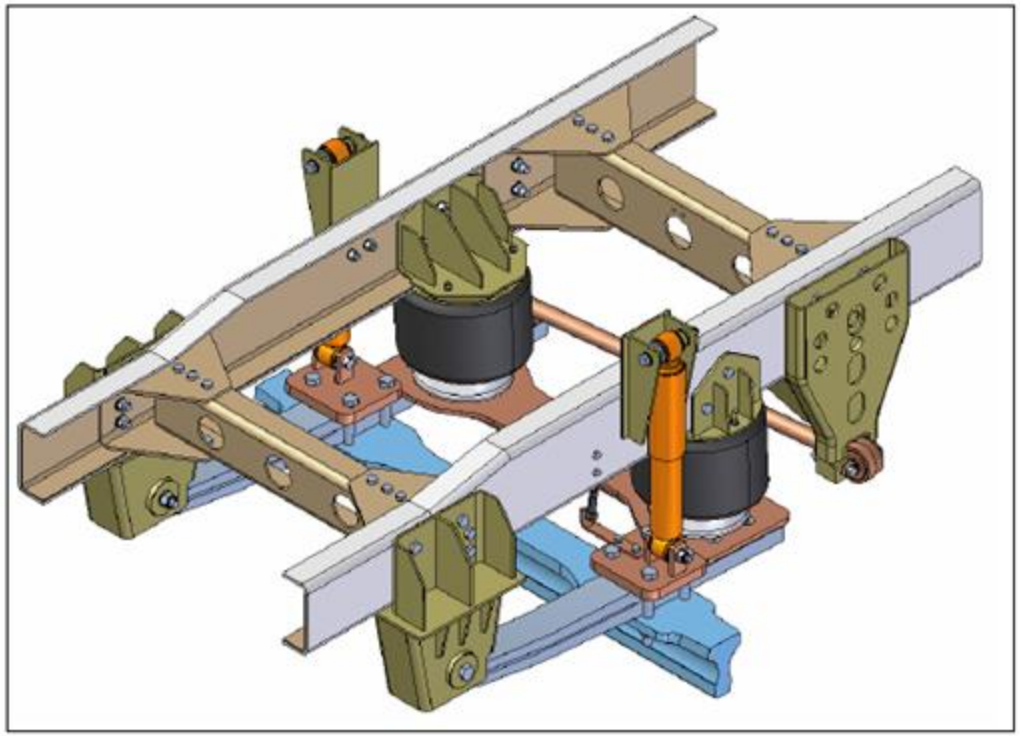
RIDE COMFORT DEPENDS ON :

- High frequency vibrations
- Body booming due to resonance
- Body pitch and roll
- Vertical springing action of springs



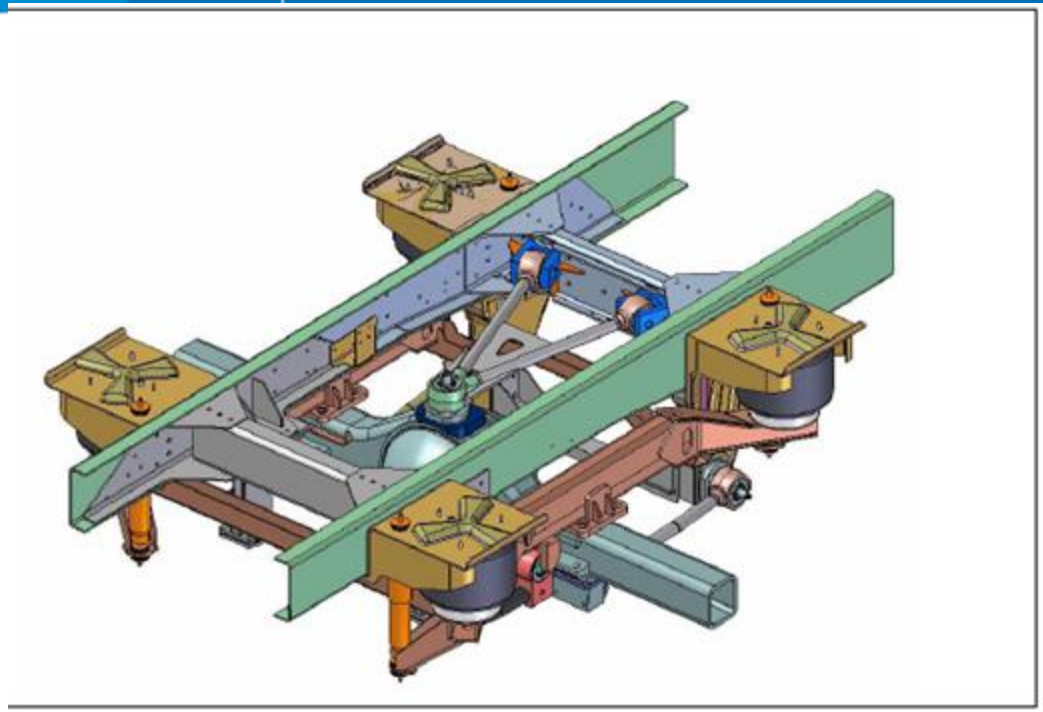
Levelling valve

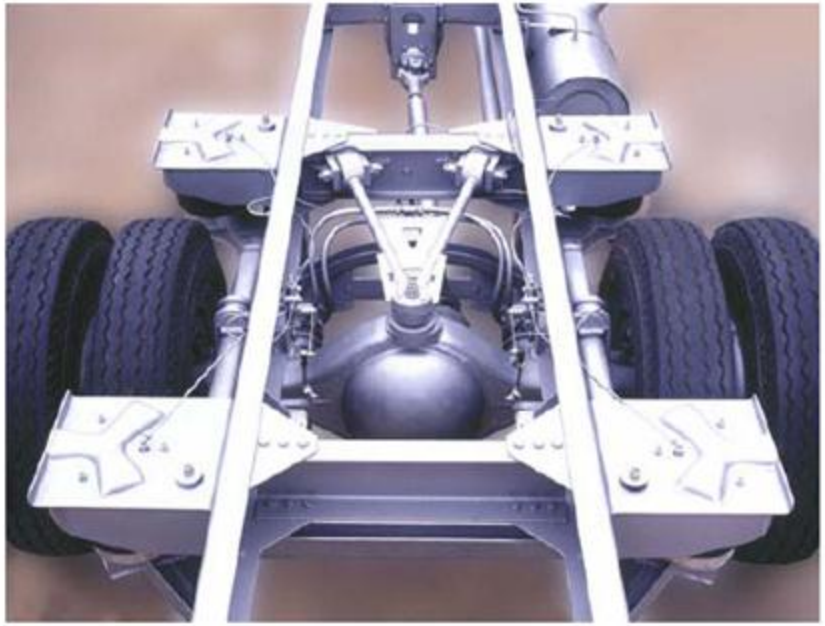
Front Air Suspension



Simple in construction
Ease of maintenance
Minimum wear part
Easy access of components for service
No anti-roll bar, as roll stiffness is taken care of by Taper leaf spring

Rear Air Suspension





Ease of maintenance
Parallelogram link design minimized driveline vibration
Anti-roll bar provides roll stability
Positioned outer the chassis frame offering greater stability during overtaking & cornering
Positioned at higher level, un-obstructed air flow, less chance of bellow hit by stones

Air Suspension - Maintenance

WEEKLY CHECK..

- Air leaks/pipe connections
- Check mountings of valves
- Wash and check condition of air bellows
- Air filters
- Leveling valve.
- Ride height
- Location links.
- Shock absorbers for leak and damage

Thank You