CUPRA LEON VZ TCR

SUSPENSION USER MANUAL V2

This document provides suspension set up guidelines of the CUPRA Leon VZ TCR

CUPRA RACING

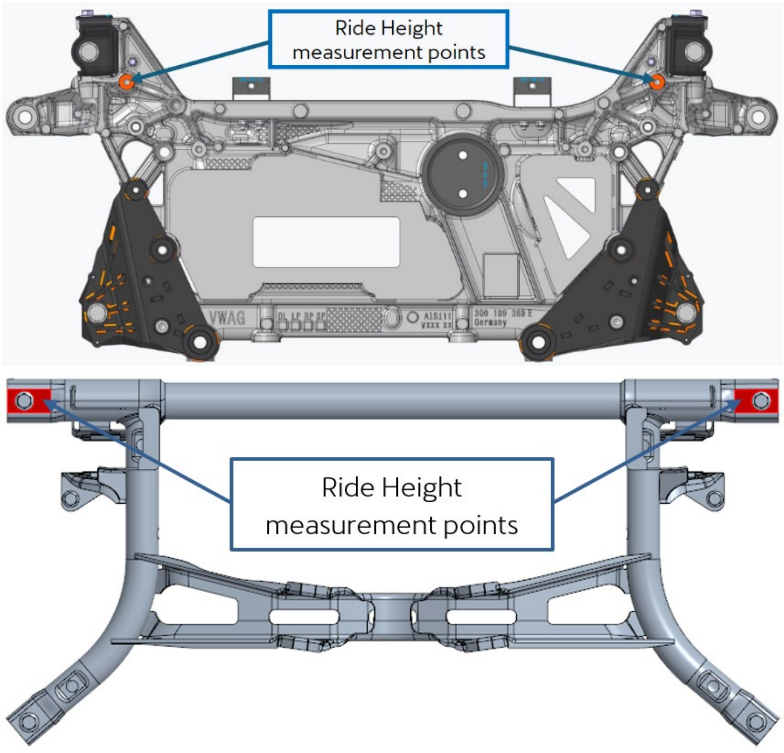
TABLE OF CONTENTS

1. SUSPENSION

1.1. MISCELLANEOUS

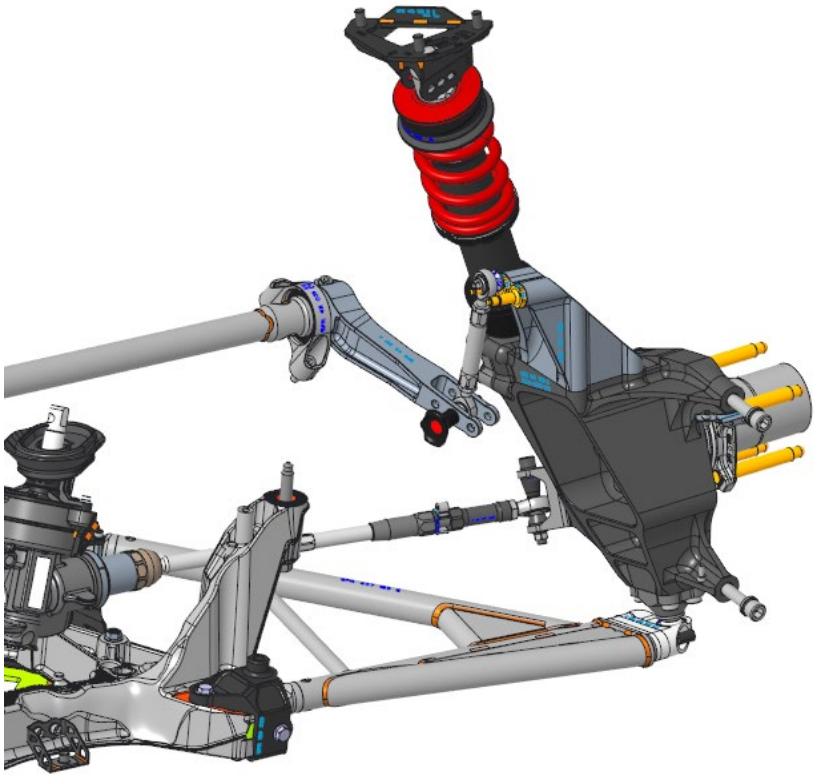
The main data of the car suspension is the following:

Parameter	Front Axle	Rear Axle	Comments
Wheelbase	2706 mm		
Track width	1770 mm	1740 mm	
Rim width x diameter	10” x 18”	10” x 18”	
Rim offset	26 mm	26 mm	E.T.
Baseline Ride height	80 mm	218 mm	Flat car
Motion Ratio	1.08	1.60	Wheel / damper
Baseline Caster	8.5º	-	
Baseline Camber angle	4.5º	4º	
Camber adjustment	3º – 6,5º	2º - 6º	Considered positive camber in the whole document
Baseline Toe	Parallel	Parallel	Toe out is positive
Steering rack ratio	4.725 º/mm	-	Steering wheel angle / rack displace
Max. rack bar travel	±44 mm	-	Limited by mechanical stop (36mm)
Max. steering angle at wheel (inner wheel)	22.4º	-	
Max. steering angle at wheel (outer wheel)	19.2º	-	
Turning radius	8.6 m	-	Wall to wall



1.2. FRONT SUSPENSION

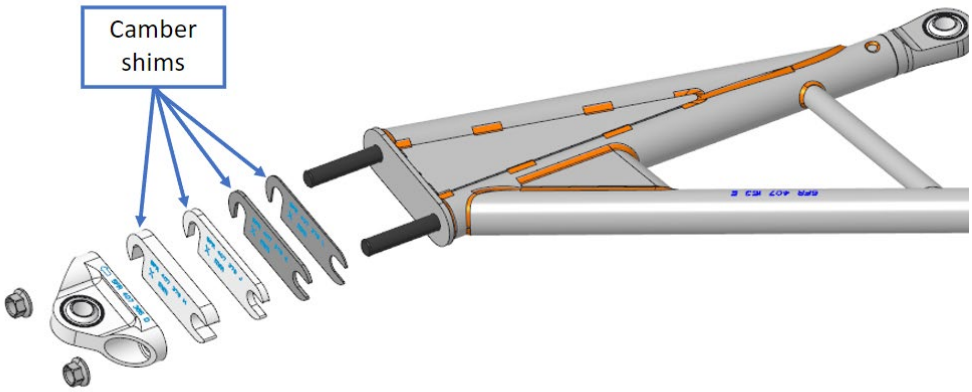
The front suspension is based on the McPherson strut and there are some possible adjustments.



1.2.1. CAMBER ADJUSTMENT

The camber setting can be made by the combination of shims with different thickness in order to get the required camber angle. The available shims are **1.2, 2.5, 5** and **10 mm** in thickness.

The maximum recommended thickness of camber shims is **37.5mm.**



The camber adjustment is causing a Ride Height and Toe change that should be corrected to keep these values on the previous setting.

∆Camber	∆Camber shims	Ride height compensation on shock absorber	Toe shims compensation
+0.1º	+1.25mm	+3/8 turns preload	+1mm
+0.4º	+5.0mm	+1.5 turns preload	+4.2mm
+1.0º	+12.5mm	+3.75 turns preload	+10.5mm

The camber gain caused by the Ride Height variation is:

∆Ride height	∆Camber
+10 mm	-0.3º

1.2.2. TOE ADJUSTMENT

The toe setting can be made by the combination of shims with different thickness in order to get the required toe at the wheel. The available shims are **0.8, 1, 1.2 mm** (fine-tuning), **2, 5** and **10 mm** in thickness.

Toe is always measured per wheel at the rim flange.

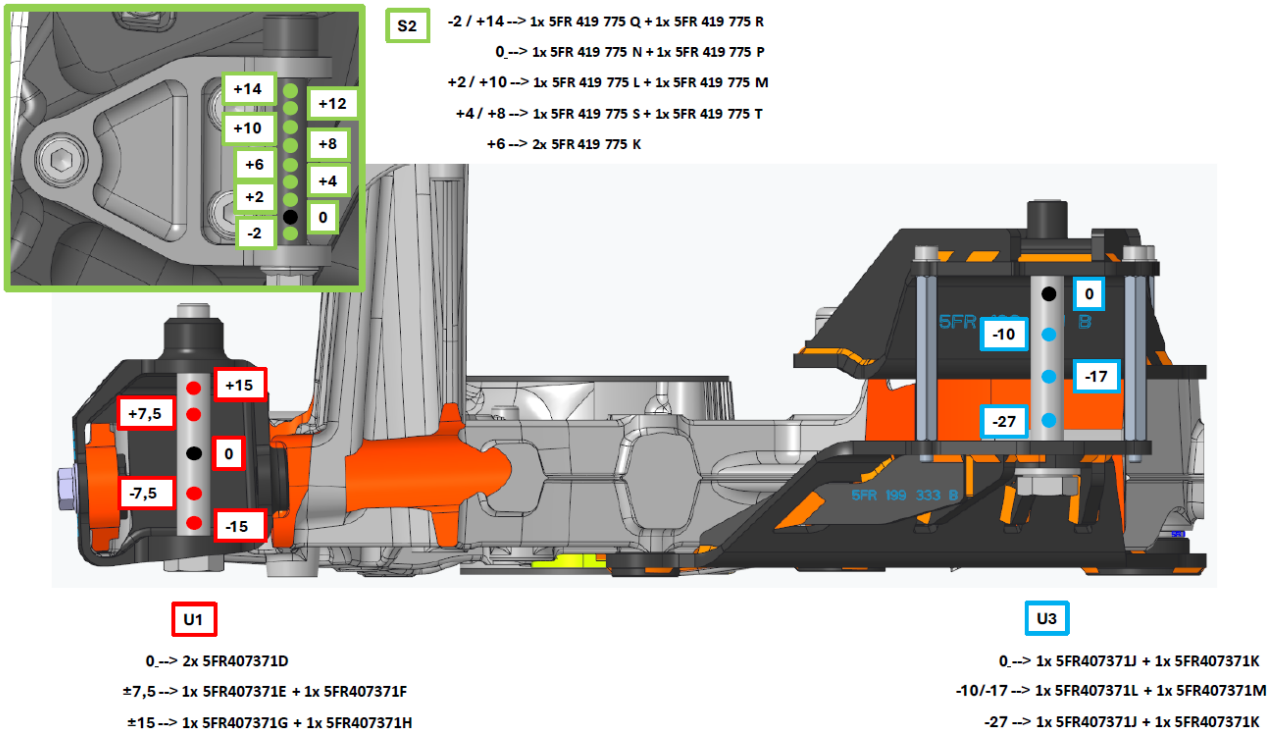
∆Toe shims	∆Toe per wheel at rim
+0.2mm	+0.7mm
+1.0mm	+3.5mm

The maximum recommended thickness of toe shims is 26mm.

Additional fine tuning can be made by turning the outer ball joint.

1.2.3. FRONT KINEMATIC OPTIONS

There are many front kinematic combinations changing the bushes on the subframe and steering arm. Most affected parameters are Roll Centre Height, Anti-dive and Anti-lift. Here below, find the recommended options:



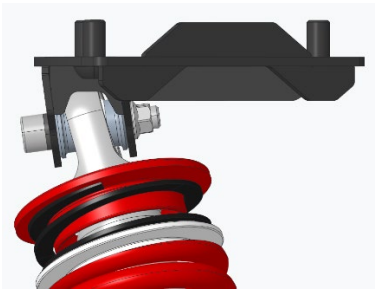
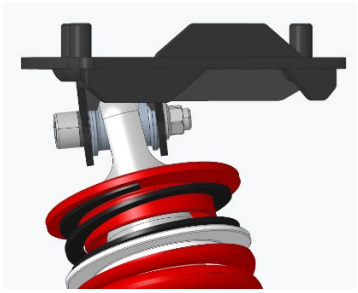
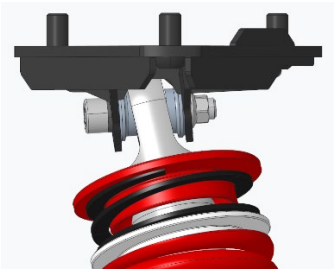
	U1 (5FR407371* index & position)	U3 (5FR407371* index & position)	S2 (5FR419775* index & position)	ΔRoll Centre Height
Baseline (Car delivery)	0 (↑ D - ↓ D)	-10mm (↑ L - ↓ M)	+2mm (↑ M - ↓ L)	STD
RC Base Low Antis	0 (↑ D - ↓ D)	-17mm (↑ M - ↓ L)	+4mm (↑ T - ↓ S)	+3mm
RC Base High Antis	0 (↑ D - ↓ D)	0 (↑ J - ↓ K)	0 (↑ N - ↓ P)	-5mm
RC Low High Antis	-7.5mm (↑ F - ↓ E)	-10mm (↑ L - ↓ M)	+8mm (↑ S - ↓ T)	-20mm
RC High Low Antis	+7.5mm (↑ E - ↓ F)	0 (↑ J - ↓ K)	-7mm *	+17mm

The baseline configuration numbers are absolute numbers considering the Baseline caster top mount is used.

* This position is not available on STD Caster and Kingpin. If you anyway want to use it, use the closer available position, in this case -2mm (↑ R - ↓ Q).

1.2.4. CASTER ADJUSTMENT

Three different top mounts have been designed to modify the caster.

		
Baseline caster	Caster +2º	Caster +4º

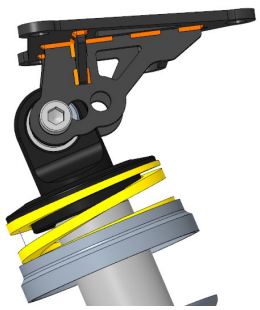
This adjustment will affect to the bumpsteer and it needs to be compensated replacing the steering arm bushings.

	Caster +2º	**Caster +4º**
Steering arm bushing height compensation (+ is upwards)*	+5mm	+10mm

*This height compensation is relative to your S2 setup.

1.2.5. KINGPIN ADJUSTMENT

The Kingpin angle and the camber angle can be quickly modified by changing the position of the front shock absorber on the top mount.

		
Inner point (high KP config.)	Central point (std config)	Outer point (low KP config.)

To cover the whole range of camber setting there are three different positions on the top mount and the standard is the central one.

Top mount position	**Δcamber and KP angle**	**Toe shims compens.**	**Bumpsteer compens.**
Outer	-1.1º	-3 mm	-3 mm
Inner	+1.1º	+3 mm	+4 mm

The maximum and minimum advisable camber angles on each position are:

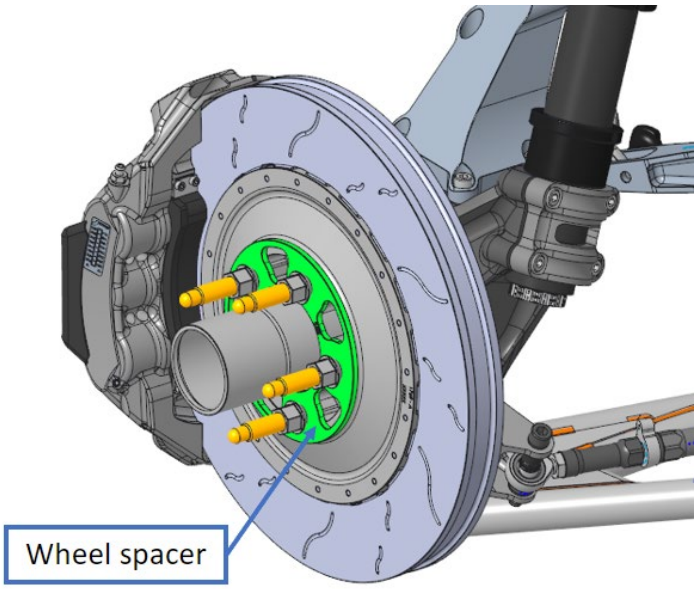
Top mount position	Minimum camber angle	Maximum camber angle
Outer	3º	4º
Std	4º	5,5º
Inner	5º	6,5º

*To keep the wheel covered by the fender (external measures certified), the overall bodywork width should be check after camber modification.

Same control must be done if wheel spacers are added.

1.2.6. TRACK WIDTH ADJUSTMENT

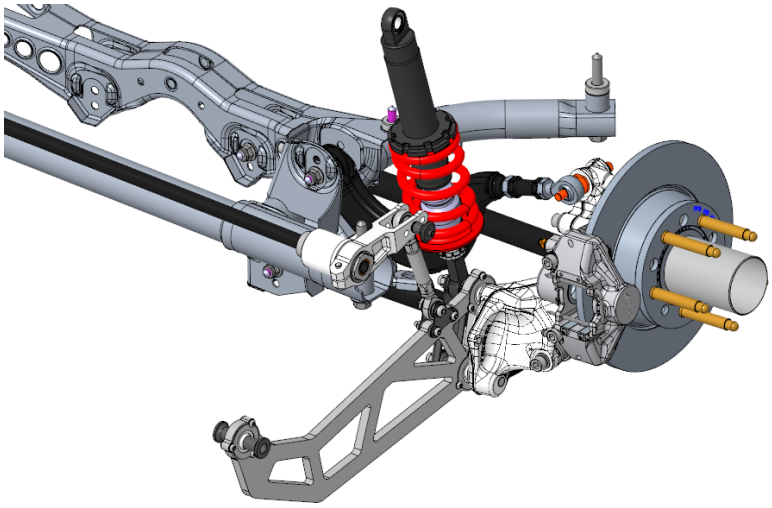
The Track width can be easily adjusted by the addition or the removal of wheel spacers. The available wheel spacers are **2, 3, 5** and **10 mm** in thickness.



The maximum recommended thickness of wheel spacers is 20 mm.

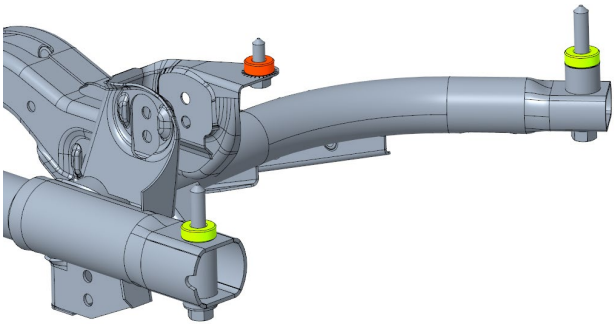
1.3. REAR SUSPENSION

The rear suspension has been designed using a multi-link concept with 4 arms.



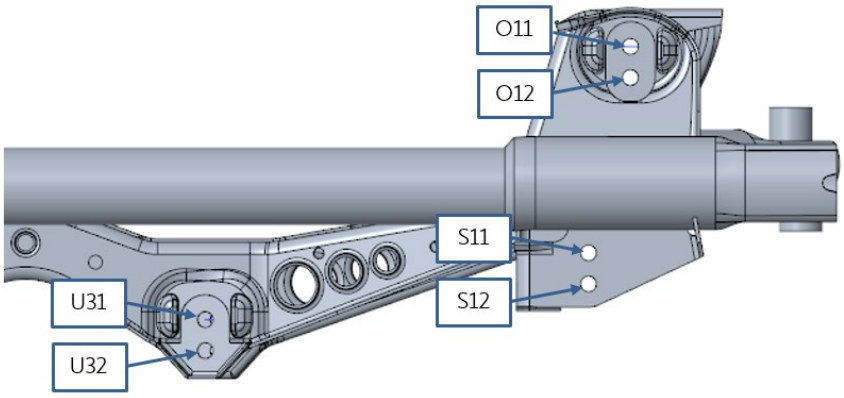
1.3.1. SUBFRAME SPACERS

There are 6 spacers at the fixing points of the subframe to the bodyshell in order to keep the same suspension geometry in case that the minimum Ride height changes. The baseline is using the 10mm thick. They have a centering function and can be placed upward or downward in case that are not useful. On the spare parts catalogue, there are available an option of 20mm thick.



1.3.2. REAR KINEMATICS OPTIONS

There are two different fixing points on the subframe for each arm, to be able to adjust the suspension geometry in different ways.



U point	O point	S point	Bumpsteer	Camber gain	ΔRoll Centre height	
U31	O12	S12	Low	Mid	Baseline	
U31	O11	S12	Low	Low	-41mm	
U32	O12	S12	Mid	Mid	-15mm	
U32	O11	S12	Mid	Low	-57mm	
U31	O12	S11	Mid	High	+53mm	
U31	O11	S11	Mid	Mid	+15mm	
U32	O12	S11	High	High	+39mm	
U32	O11	S11	High	Mid	-1mm	Car delivery

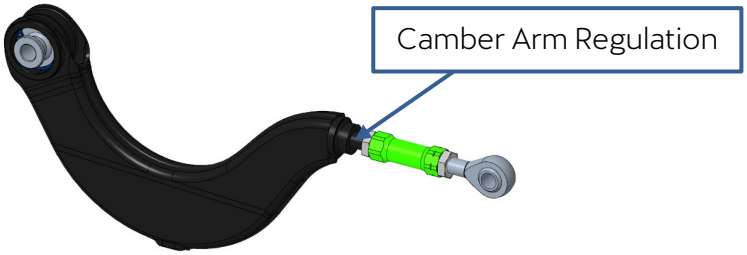
The camber and toe can be adjusted without relation with each other.

After changing any of these kinematic points the setup has to be checked.

1.3.3. CAMBER ADJUSTMENT

The camber angle can be set by adjusting the length of the camber arm through the rod.

Arm regulation	ΔArm length	ΔCamber	Ride height compensation on shock absorber
1 turn	-2.5mm	+0.86º	+1.7 turns preload
1 turn + 1notch	-2.9mm	+1.00º	+2.0 turns preload



The camber gain caused by the Ride Height variation depends on which kinematic configuration is used:

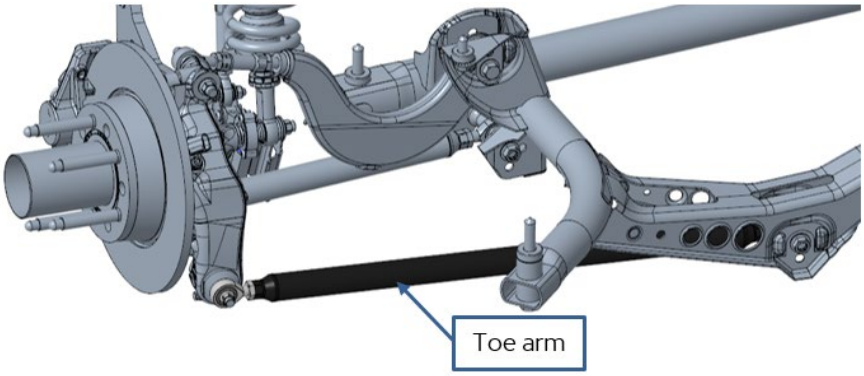
Camber gain configuration	ΔRide height	ΔCamber
Low	+10mm	-0.27º
	-10mm	+0.30º
Mid	+10mm	-0.39º
	-10mm	+0.41º
High	+10mm	-0.50º
	-10mm	+0.52º

In order to keep the wheel covered by the fender, the track width should be adjusted using wheel spacers.

1.3.4. TOE ADJUSTMENT

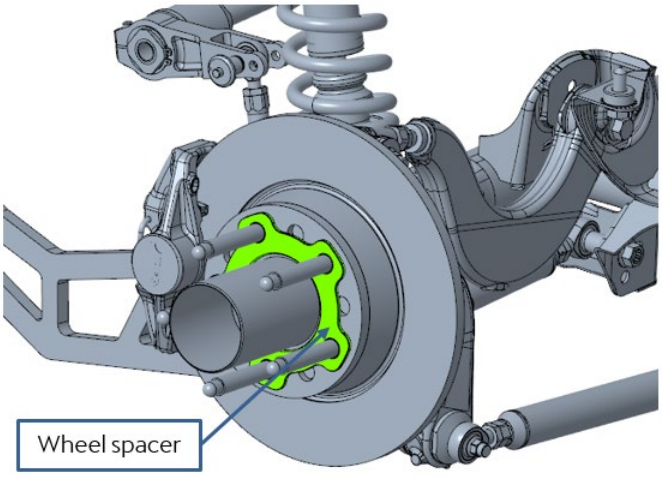
The toe setting can be made by enlarging or shortening the toe arm through the rod.

Arm regulation	ΔArm length	ΔToe per wheel at rim
1 notch	0.42mm	1mm
1 turn	2.5mm	6mm



1.3.5. TRACK WIDTH ADJUSTMENT

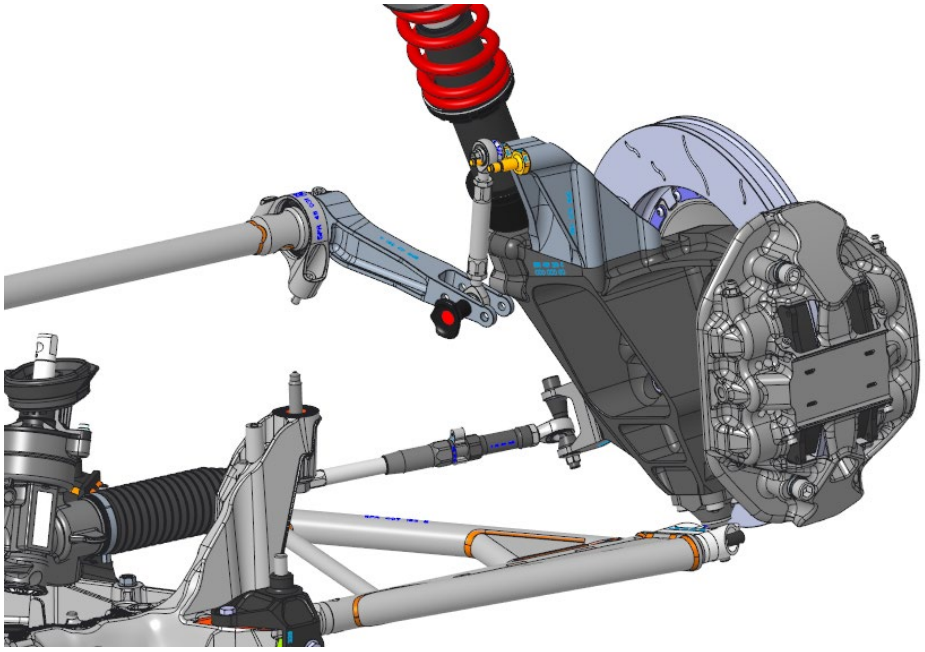
The Track width can be easily adjusted by the addition or the removal of wheel spacers. The available wheel spacers are **2, 3, 5** and **10 mm** in thickness.



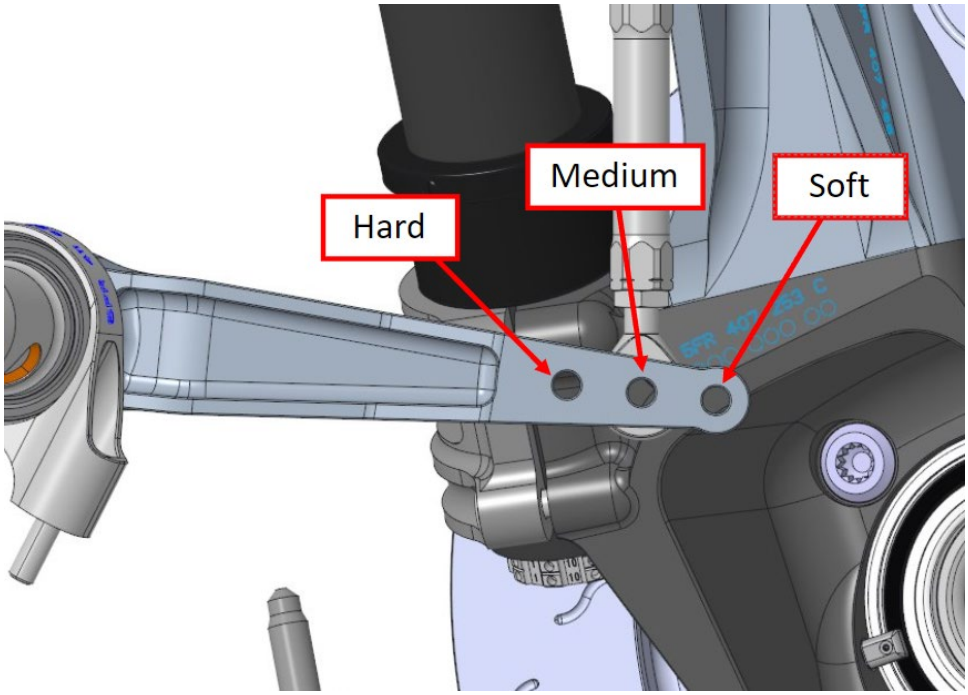
2. ANTI-ROLL BAR

2.1. FRONT ANTI-ROLL BAR

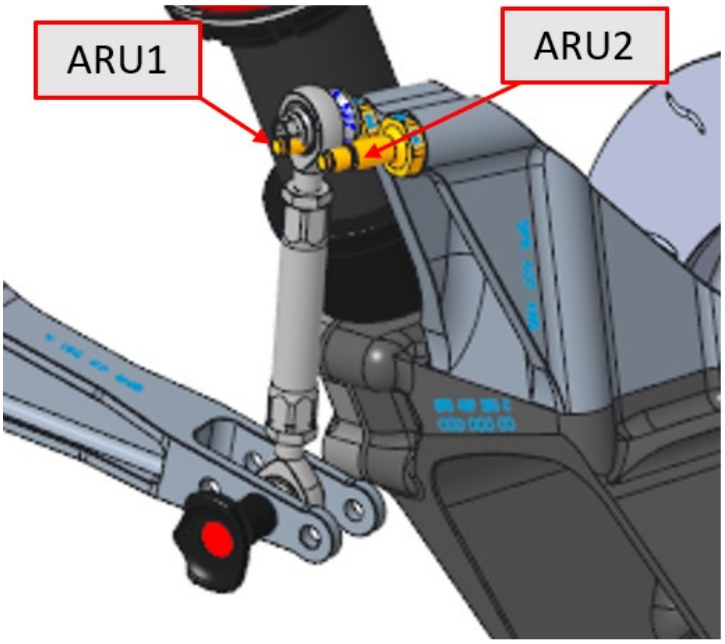
Three different bars with diameters of **Ø28, Ø30** (car delivery) and **Ø35 mm** are available to modify the stiffness that the anti-roll bar is giving to the suspension.



Each lever has been designed with three holes in order to be able to change the stiffness in smaller steps. The fixation to the drop link can be made with the quick-release pin (car delivery) for quick changes or a standard bolt can replace it.



In addition, the drop link can be fixed to the upright in two different positions (ARU) that will change the ARB lever motion ratio and consequently the ARB stiffness.



The stiffness values from the ARB on each ARU position, just taking into account the heave movement, depending on the different bar diameters and setting positions are the following ones:

ARU1

Front ARB Stiffness (%)			
External Diameter (mm)	**28**	**30**	**35**
Thickness (mm)	**2.0**	**3.0**	**3.0**
Soft-Soft	50,8	85,9	142,4
Medium-Medium	59,2	100,0	165,9
Hard-Hard	70,8	119,6	198,5

ARU2

Front ARB Stiffness (%)			
External Diameter (mm)	**28**	**30**	**35**
Thickness (mm)	**2.0**	**3.0**	**3.0**
Soft-Soft	47,8	80,9	134,2
Medium-Medium	55,9	94,5	156,7
Hard-Hard	67,0	113,3	188,0

The ARB stiffness varies also with the steering. Increasing the steering angle the ARB stiffness decreases. The following values from the ARB on each ARU position, depending on the different bar diameters and setting positions, show the unloading percentage, this means the higher the number, the lower the final stiffness at wheel coming from the ARB.

ARU1

Front ARB Stiffness (%)			
External Diameter (mm)	**28**	**30**	**35**
Thickness (mm)	**2.0**	**3.0**	**3.0**
Soft-Soft	39,7	67,2	111,4
Medium-Medium	59,2	100,0	165,9
Hard-Hard	88,5	149,6	248,2

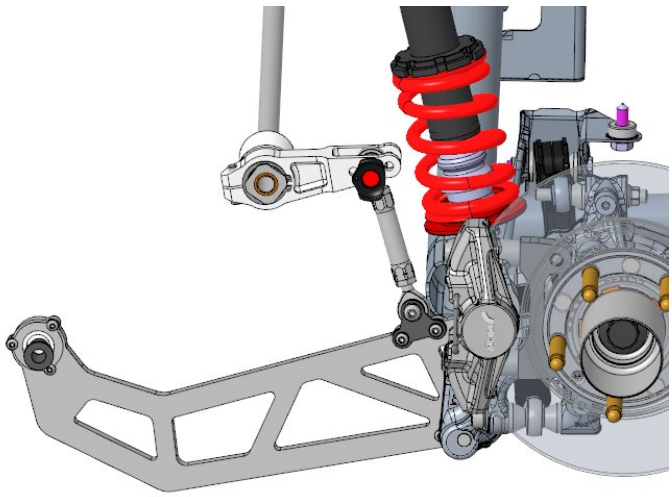
ARU2

Front ARB Stiffness (%)			
External Diameter (mm)	**28**	**30**	**35**
Thickness (mm)	**2.0**	**3.0**	**3.0**
Soft-Soft	76,8	129,8	215,3
Medium-Medium	102,0	172,5	286,2
Hard-Hard	135,9	229,8	381,2

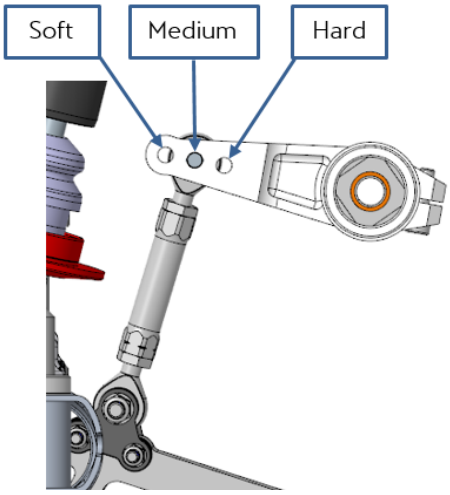
To calculate the absolute stiffness at wheel, the heave and steering tables need to be combined.

2.2. REAR ANTI-ROLL BAR

Three different bars with diameters of **Ø18**, **Ø22 and Ø25 mm** are available to modify the stiffness that the anti-roll bar is giving to the rear suspension.



In the same way as on the front axle, each lever has been designed with three holes in order to be able to change the stiffness in smaller steps. The fixation to the drop link can be made with the quick-release pin (car delivery) for quick changes or a standard bolt can replace it.



The stiffness values from the ARB, according to the different bar diameters and different positions are the following ones:

Rear ARB Stiffness (%)			
External Diameter (mm)	**18**	**22**	**25**
Thickness (mm)	**2.0**	**2.0**	**3.0**
Soft-Soft	37,8	73,5	147,9
Medium-Medium	51,5	100,0	201,4
Hard-Hard	74,1	144,0	289,9

3. DAMPERS

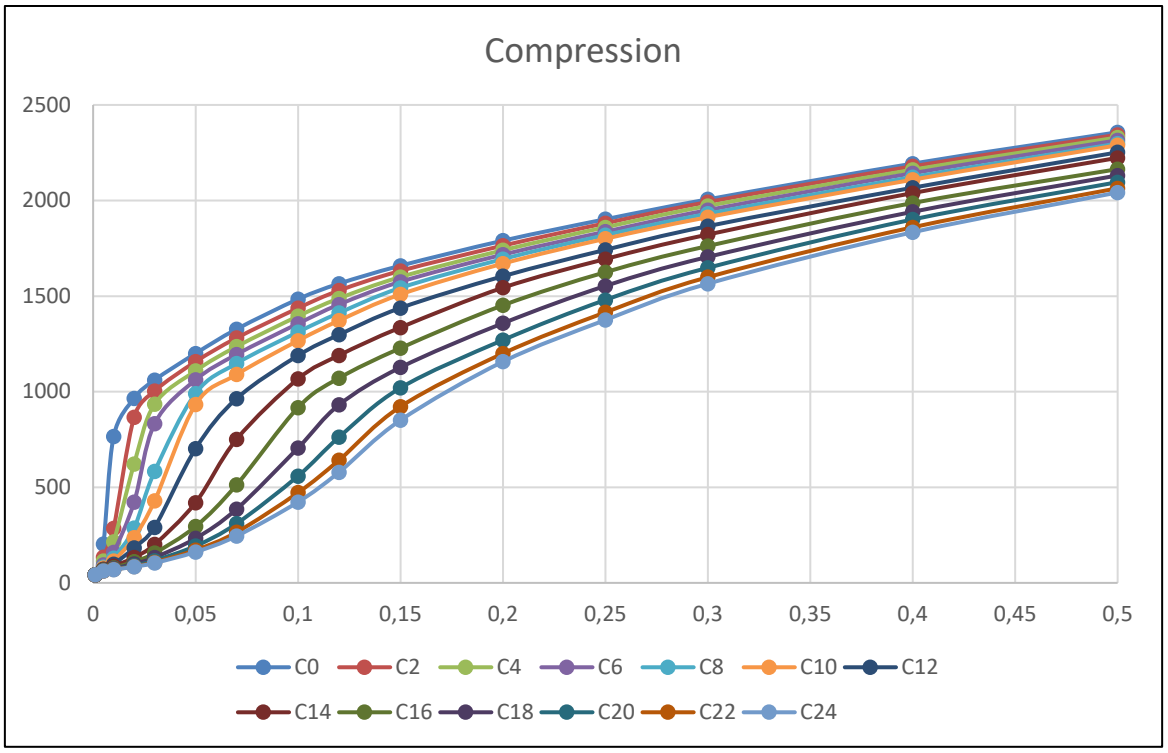
The front and rear certified dampers are Öhlins TTX specifically designed for the CUPRA Leon VZ TCR.

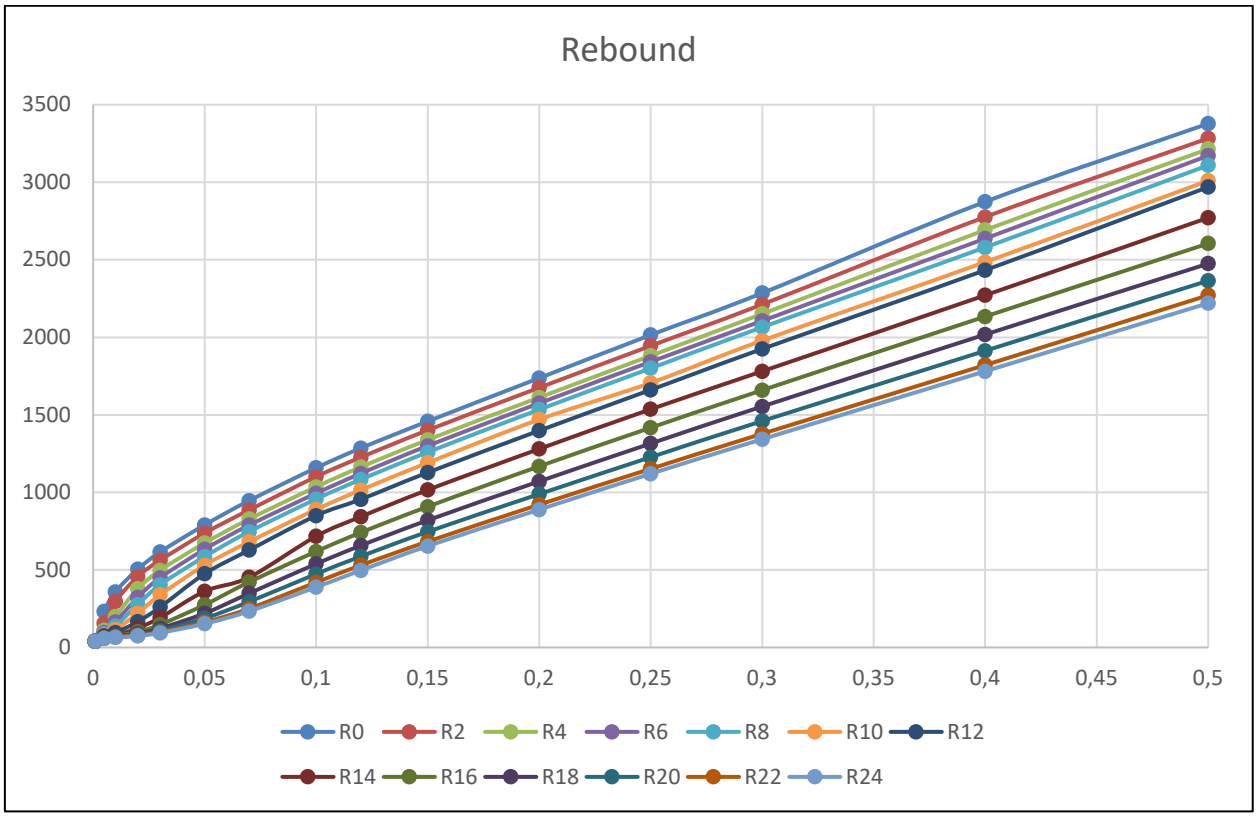
3.1. FRONT DAMPERS

TTX 46 FRONT FEATURES
> TTX-technology
> 2-way adjustable, compression and rebound
> McPherson strut
> 46 mm piston
> Through rod 30 mm
> Blow-off (shimmed)
> High-frequency piston
> Length adjustable *Please make sure to order the correct Length adjuster depending on vehicle yearmodel, please see table to the right.*

Front dampers characteristics
Aluminum outer housing and inner steel chrome tube
24 adjustment clicks for each bump and rebound phases
20 mm upright height adjustment
122mm stroke (102mm free stroke + 20mm bump-stop (5KN / 14mm))

The damper position on the upright clamp (clamping length) can be adjusted through the Upright height Adjuster in order to modify the bump and rebound percentage travels. This action will change the static ride height, so it should be adjusted.

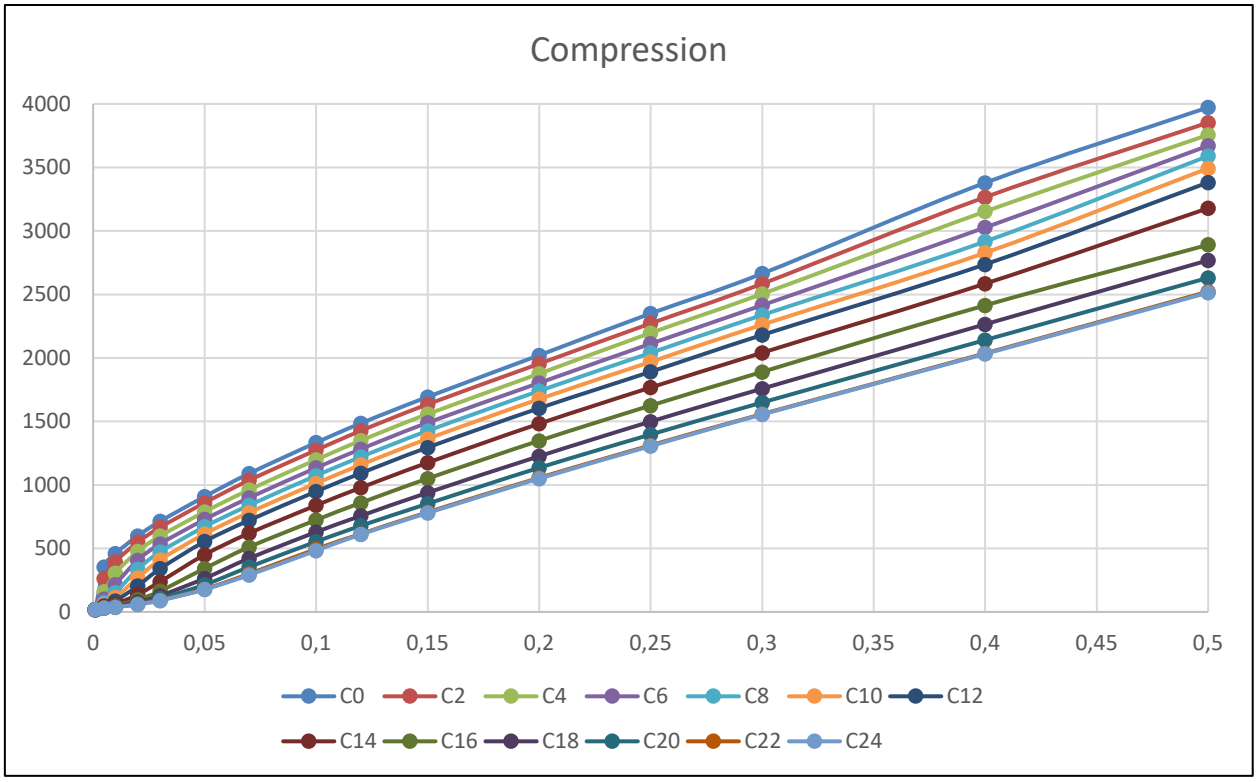


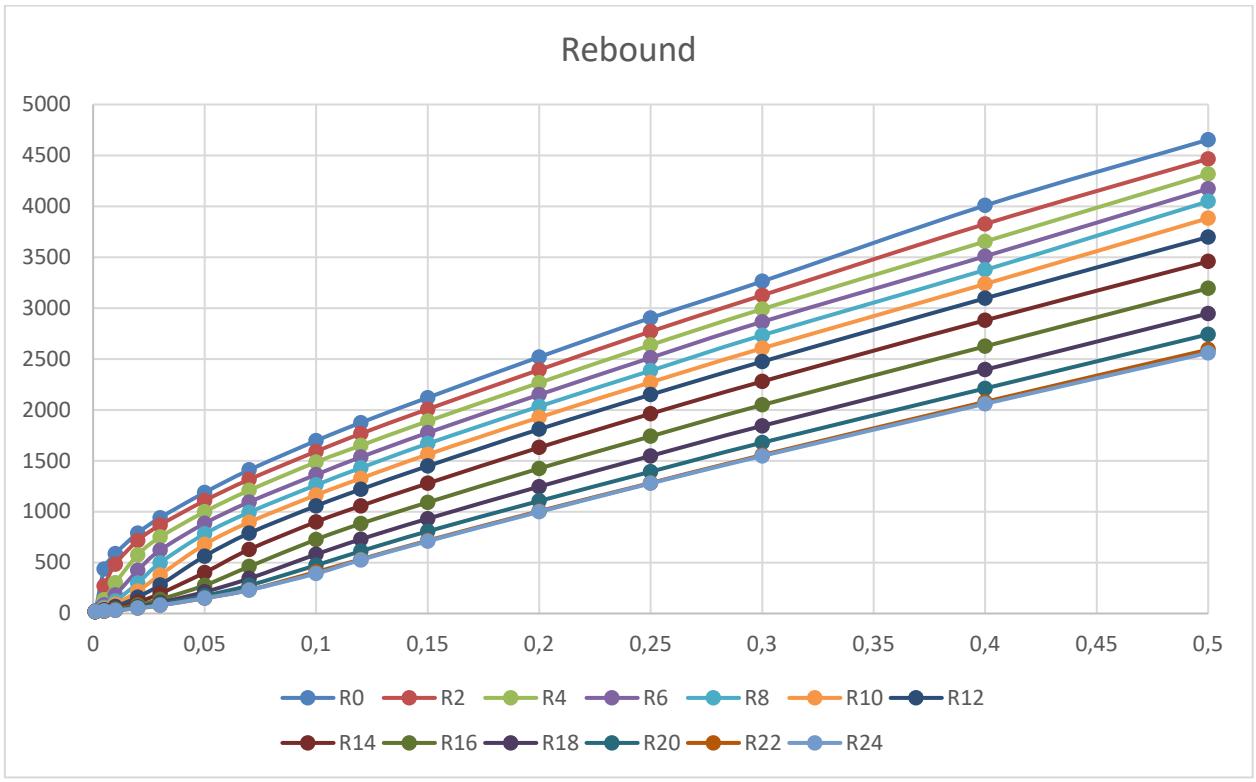


3.2. REAR DAMPERS

TTX 36 REAR FEATURES
> TTX-technology
> 2-way adjustable, compression and rebound
> 36 mm piston
> 14 mm shaft
> Length adjustable
> Possible to upgrade with blow-off (not included)
> Possible to upgrade with high-frequency piston (not included)

Rear dampers characteristics
Aluminum outer housing and steel chrome axle
24 adjustment clicks for each bump and rebound phases
76.5mm stroke (62mm free stroke + 14.5mm bump-stop (5KN / 7mm))


Compression
4000
3500
3000
2500
2000
1500
1000
500
0
0
0,05
0,1
0,15
0,2
0,25
0,3
0,35
0,4
0,45
0,5
C0
C2
C4
C6
C8
C10
C12
C14
C16
C18
C20
C22
C24


Rebound
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
0
0,05
0,1
0,15
0,2
0,25
0,3
0,35
0,4
0,45
0,5
R0
R2
R4
R6
R8
R10
R12
R14
R16
R18
R20
R22
R24

4. SPRINGS

The springs are characterized by the following format:

"Length of the spring" - "Inner diameter of the spring"- "Stiffness"

Where the length and the inner diameter are expressed in millimeters and the stiffness is expressed in N/mm.

The springs assembled at the **car delivery** are **200-60-0100 (front)** and **200-60-0200 (rear).**

To make easier the springs fitting on the damper and to prevent that the main spring becomes loose at full droop, the assembly is combined with the helper **60-60-0002**.

4.1. RISC OF COIL BINDING

Coil binding means that the coils are in contact to the next upper and lower coil when reaching the maximum designed travel (block length).

Coil binding should be avoided on the main springs as it could lead to spring failure or at least to a loss of length and/or rate. The most helper springs are designed to be used in block situation.

The parameters which can be adjusted and have an influence on the safety of the spring length are **Ride Height, Spring rate, Spring block length**, **Damper stroke** and **Damper compressed length.**

In general, the limit can be defined with the value of “Minimum Distance Spring Seats Extended“ if following values are known:

- Main Spring Block Length
- Helper Spring Block Length
- Spring Separator Height
- Damper Stroke

If the spring setup is not safe, the following should be done:

- Decrease the ride height
- Reduce bump travel by reducing the clamping length with the Upright height adjuster
- Use longer springs

5. BASIC SETUP

CUPRA LEON VZ		SET-UP		CUPRA RACING	
CAR INFORMATION		**TRACK INFORMATION**			
Chassis	MK4-	Circuit	-	DATE	05/02/2024
Engine	DNF	Length	-	FROM	-
Gearbox	CFT-	Driver	-	TO	-

CAR CONFIGURATION	FRONT	REAR
RIDE HEIGHT SUBFRAME	81/81	230/230
MIN RH SPLITTER / RAKE	80	11 mm
DAMPER SETTINGS	**FRONT**	**REAR**
MAIN SPRING	200/60/100	170/60/200
TENDER	60/60/2	60/60/2
ASSEMBLY LENGTH	-	-
CLAMPING LENGTH	43 mm	-
BUMP STOPS	STD	STD
PACKERS	STD	STD
CLICKS BUMP	Öhlins (20)	Öhlins (10)
CLICKS REBOUND	Öhlins (22)	Öhlins (10)
ARB SETTINGS	**FRONT**	**REAR**
TYPE	30x3	18x2
POSITION	M - M	M - M
WHEELS SETTINGS	**FRONT**	**REAR**
RIMS	CMS 18x10_ET26	CMS 18x10_ET26
WHEEL SPACER	5 mm	0 mm
TYRES	Hankook	Hankook
SET-UP TYRE PRESSURE	1,5	1,5
BRAKE SETTINGS	**FRONT**	**REAR**
MASTER CYLINDERS	Tilton 17,8 (7/10")	Tilton 20,6 (13/16")
BRAKE PADS	Winmax 6.5	Winmax
BRAKE DISCS	Alcon 378x33	VAG 272x10
BRAKE BALANCE	15/12	AP Racing 7 pos (P3)
AERO		
SPLITTER / WING / BLANKING	0°	0° / 0 mm

CONSTANTS	
WHEELBASE	2710 mm
MOTION RATIO (W/D)	Front 1,1 / Rear 1,6
FRONT KINEMATICS	
TOP MOUNT POSITION	Mid
CASTER	STD
ARB LINK	STD
STEERING ARM POINT	STD
STEERING ARM BUSHES	STD
U1 BUSHES	STD
U3 BUSHES	STD
REAR KINEMATICS	
SUBFRAME BUSHES	10 mm
SHORT ARM POSITION	Up
CAMBER ARM POSITION	Up
TOE ARM POSITION	Down
ENGINE & POWERTRAIN	
RPM MAX	7000 / R_efect
POWER	100% / 330
TOP SPEED	6th gear / 264 km/h
DIFFERENTIAL	
RAMPS [ACC/BRK]	45/30
PRELOAD	70 Nm
CLUTCH	
MASTER CYLINDER	Tilton Ø15,9 mm
HAND BRAKE	
MASTER CYLINDER	Tilton Ø15,9 mm

ALIGNMENT		
FRONT	**LEFT**	**RIGHT**
CAMBER (SHIMS)	4,5° (18,7 mm)	4,5° (18,7 mm)
TOE (SHIMS)	0 (7 mm)	0 (7 mm)
REAR	**LEFT**	**RIGHT**
CAMBER	4°	4°
TOE	0	0

WEIGHT (kg)					
DRIVER	75	FUEL	10	BALLAST	0
LEFT		**RIGHT**		**TOTAL**	
372		373		1215,0	
235		235			
FWD%	61,32%	CROSS	49,96%		
RWD%	38,68%	LEFT	49,96%		

NOTES

For cars with Bilstein: all clicks on 5

For cars with Sadev: Diff ramps 46/31

** This set up can suffer modifications due to fabrication needs.

6. CHANGE INDEX

Version	Date	Change / amendment	Page
_v2	09/05/2024	1.2.3 Front kinematics	8
_v2	09/05/2024	2.2 Rear ARB chart. Position stiffness in percentages	13
_v2	09/05/2024	3.1 & 3.2 Öhlins damper stroke corrected	15-16