

# CUPRA LEON VZ TCR

## SUSPENSION USER MANUAL v1

Draft  
16.04.24

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



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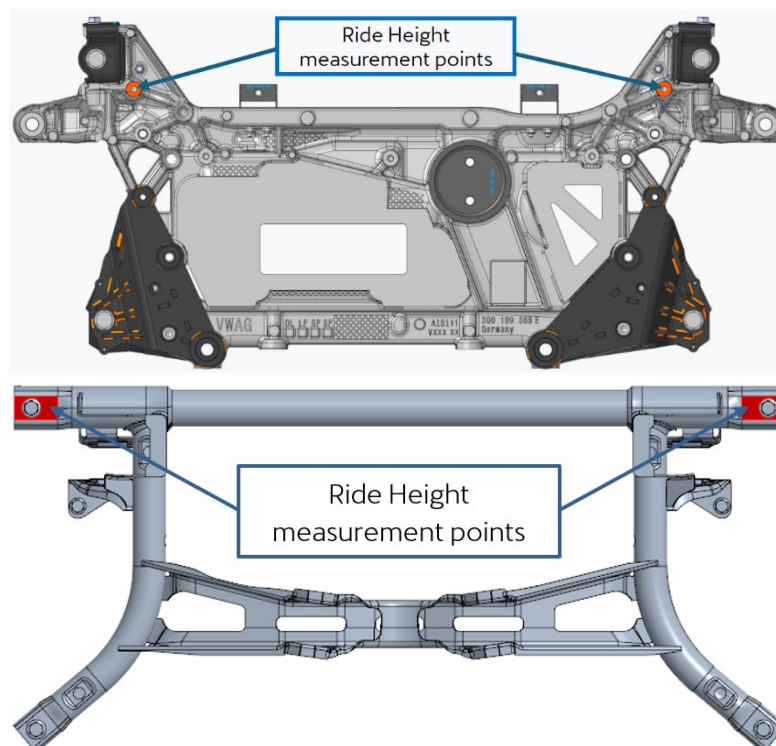


# 1. SUSPENSION

## 1.1. MISCELLANEOUS

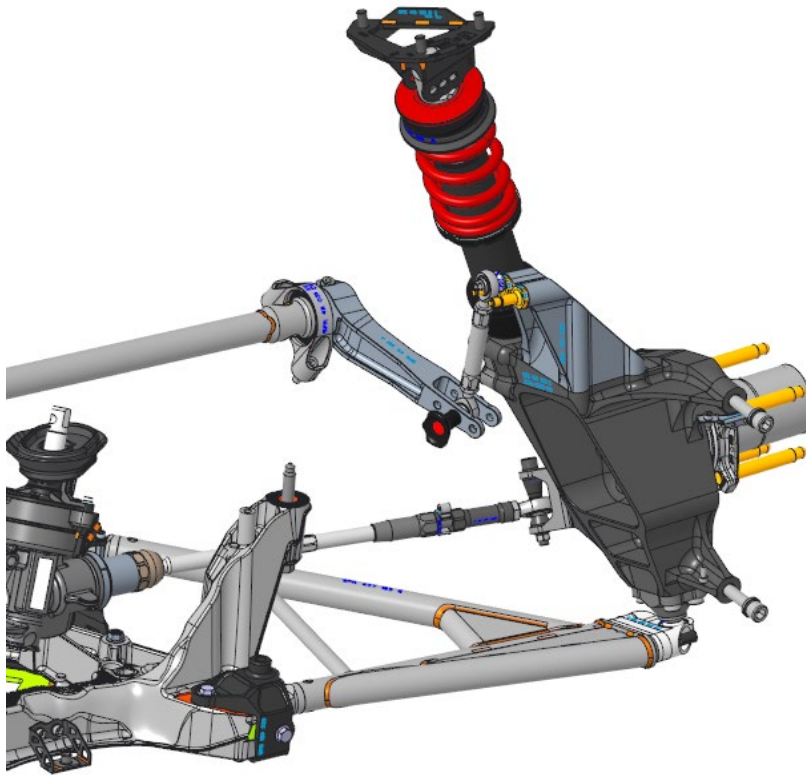
The main data of the car suspension is the following:

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	8.5°	-	
Baseline Camber angle	4.5°	4°	
Camber adjustment	3° – 6,5°	2° - 6°	Considered positive camber in the whole document
Baseline Toe	Parallel	Parallel	Toe out is positive
Steering rack ratio	4.725 °/mm	-	Steering wheel angle / rack displace
Max. rack bar travel	±44 mm	-	Limited by mechanical stop (36mm)
Max. steering angle at wheel (inner wheel)	22.4°	-	
Max. steering angle at wheel (outer wheel)	19.2°	-	
Turning radius	8.6 m	-	Wall to wall



## 1.2. FRONT SUSPENSION

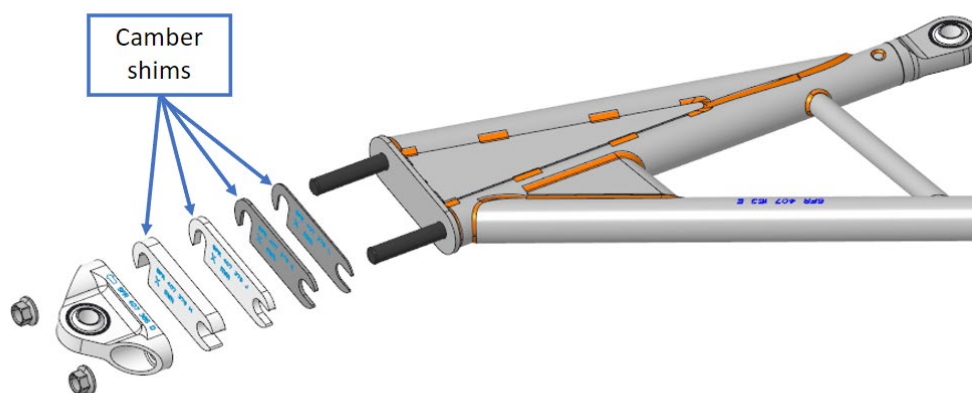
The front suspension is based on the McPherson strut and there are some possible adjustments.



### 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.

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

The camber gain caused by the Ride Height variation is:

$\Delta$ Ride height	$\Delta$ Camber
+10 mm	-0.3°

## 1 . 2 . 2 . T O E A D J U S T M E N T

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.

$\Delta$ Toe shims	$\Delta$ Toe per wheel at rim
+0.2mm	+0.7mm
+1.0mm	+3.5mm

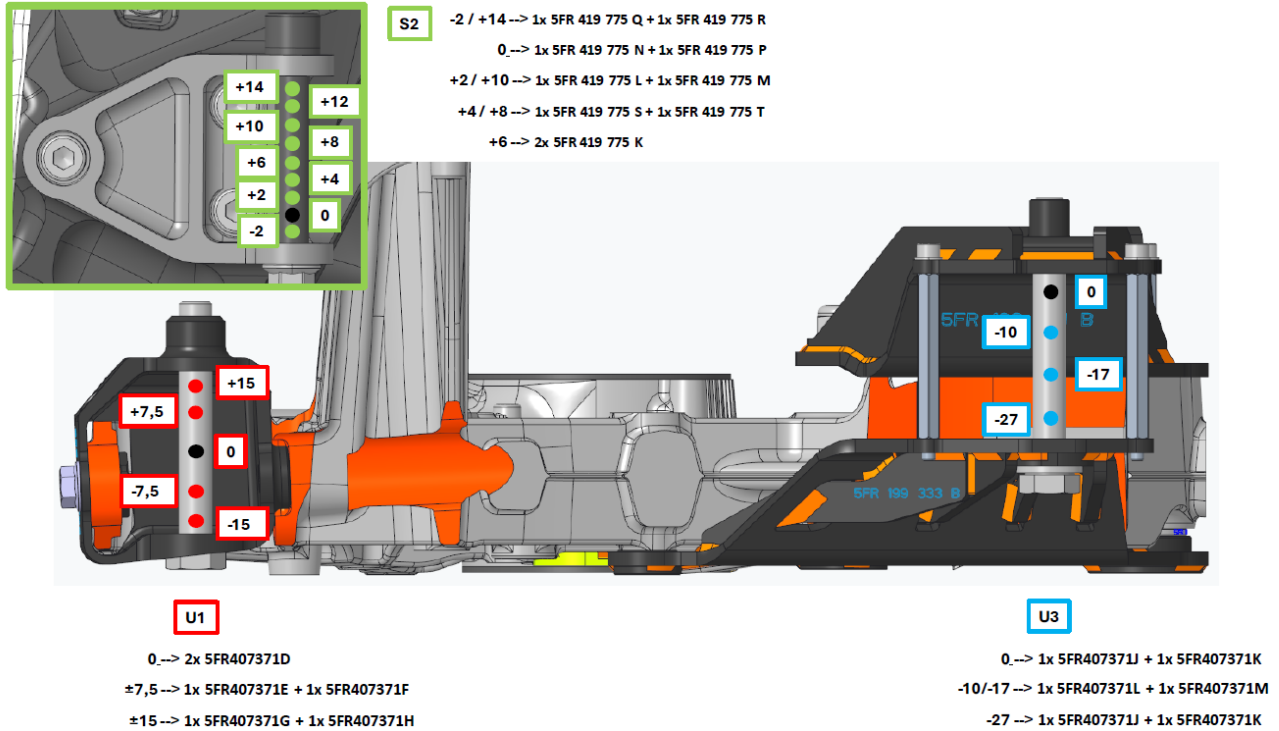
The maximum recommended thickness of toe shims is 26mm.



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:



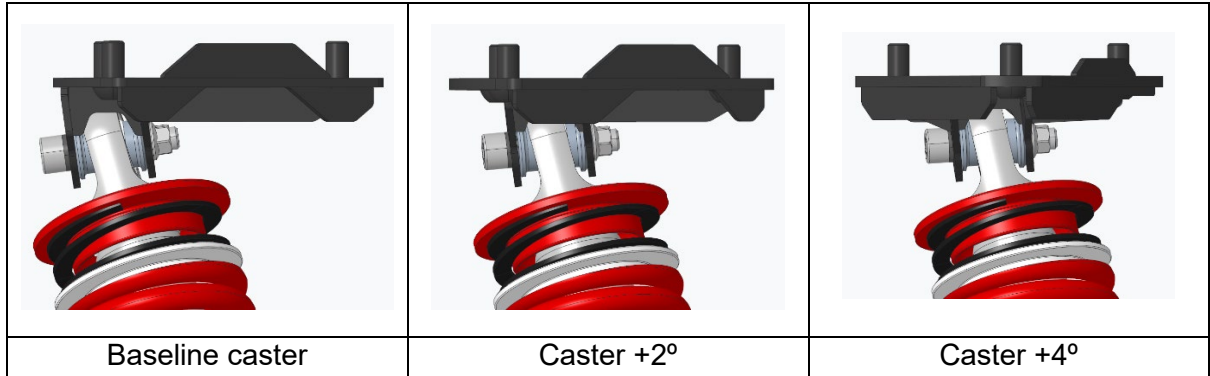
	U1 (5FR407371* index & position)	U3 (5FR407371* index & position)	S2 (5FR419775* index & position)	ΔRoll Centre Height
<b>Baseline (Car delivery)</b>	0 (↑ D - ↓ D)	-10mm (↑ L - ↓ M)	+2mm (↑ M - ↓ L)	STD
<b>RC Base Low Antis</b>	0 (↑ D - ↓ D)	-17mm (↑ M - ↓ L)	+4mm (↑ T - ↓ S)	+3mm
<b>RC Base High Antis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

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



## 1.2.4. CASTER ADJUSTMENT

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



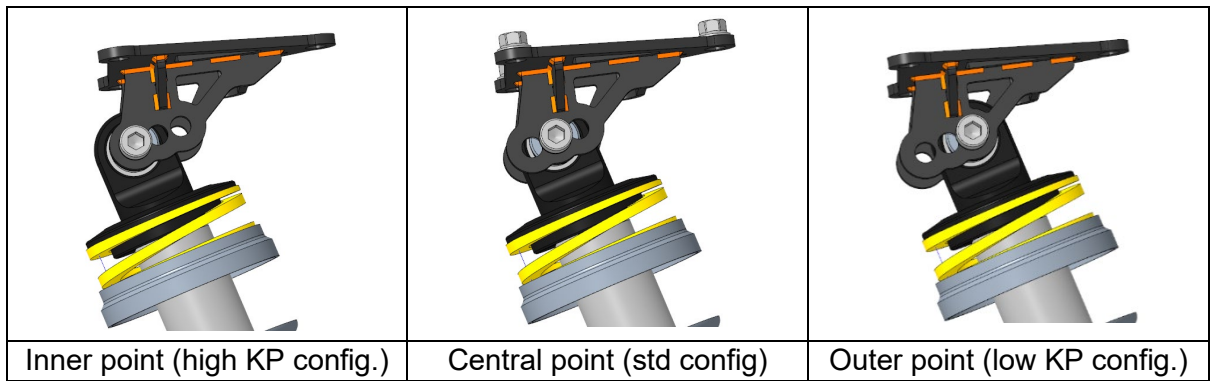
This adjustment will affect to the bump-steer and it needs to be compensated replacing the steering arm bushings.

	Caster +2°	Caster +4°
Steering arm bushing height compensation (+ is upwards)*	+4mm	+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.



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	-1.1°	-3 mm	-4 mm
Inner	+1.1°	+3 mm	+6 mm

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

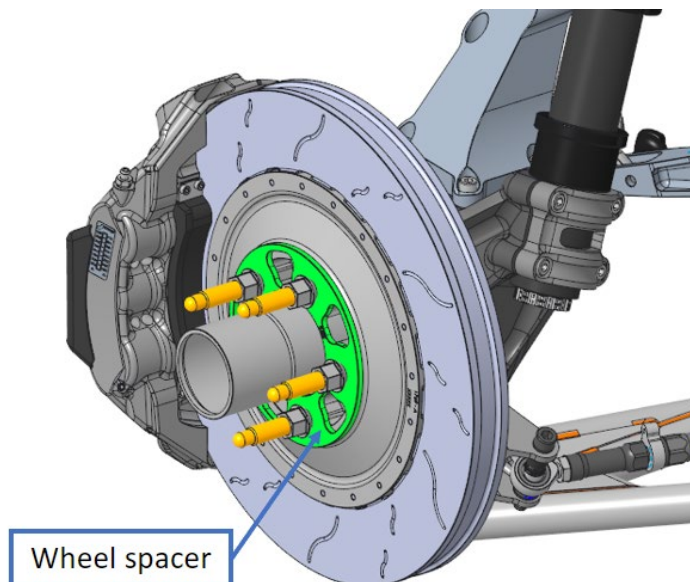
Top mount position	Minimum camber angle	Maximum camber angle
Outer	3°	4°
Std	4°	5,5°
Inner	5°	6,5°

\*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

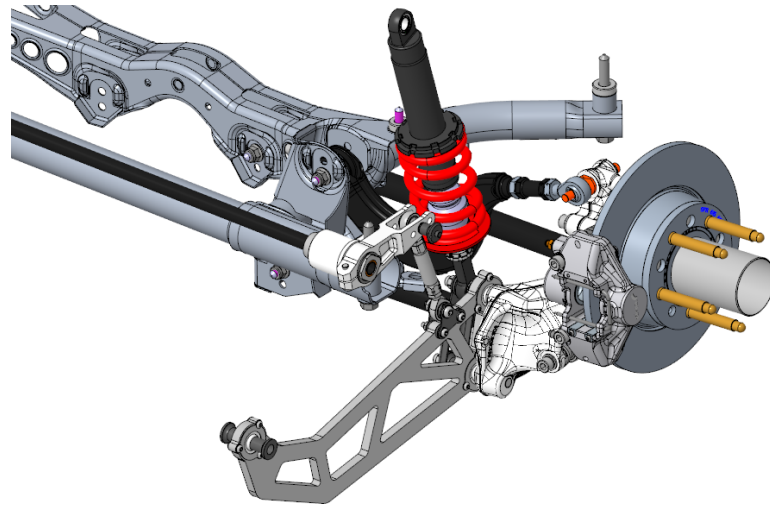
The Track width can be easily adjusted by the addition or the removal of wheel spacers. The available wheel spacers are **2, 3, 5** and **10 mm** in thickness.



The maximum recommended thickness of wheel spacers is 20 mm.

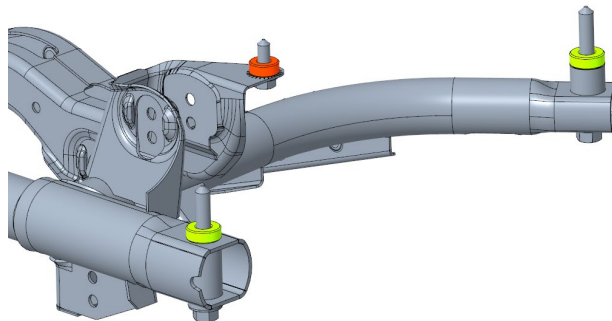
### 1.3. REAR SUSPENSION

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



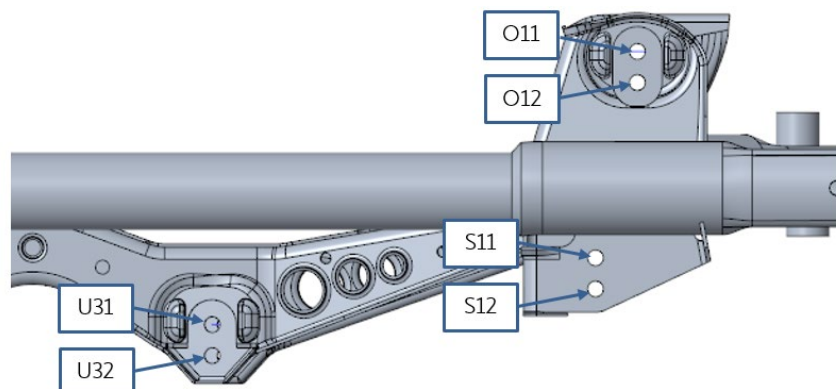
#### 1.3.1. SUBFRAME SPACERS

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

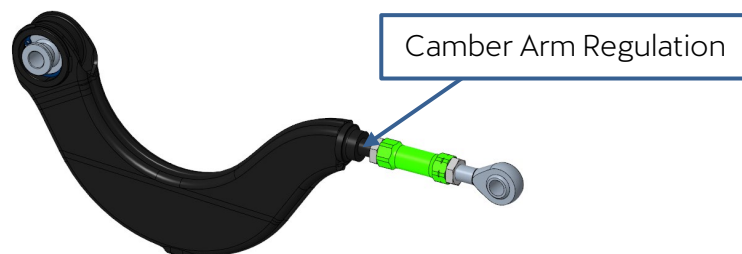
The camber and toe can be adjusted without relation with each other.

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

### 1 . 3 . 3 . C A M B E R A D J U S T M E N T

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	+0.86°	+1.7 turns preload
1 turn + 1notch	-2.9mm	+1.00°	+2.0 turns preload



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

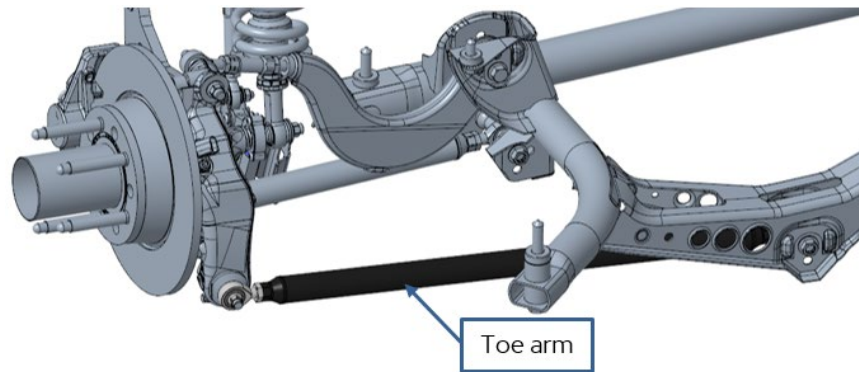
Camber gain configuration	ΔRide height	ΔCamber
Low	+10mm	-0.27°
	-10mm	+0.30°
Mid	+10mm	-0.39°
	-10mm	+0.41°
High	+10mm	-0.50°
	-10mm	+0.52°

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

### 1 . 3 . 4 . T O E A D J U S T M E N T

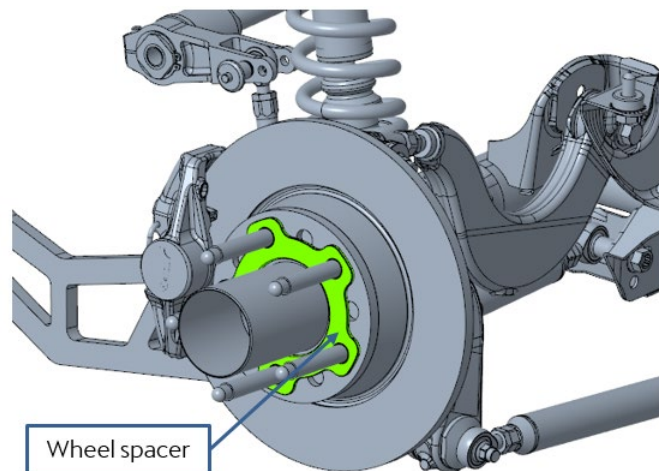
The toe setting can be made by enlarging or shortening the toe arm through the rod.

Arm regulation	$\Delta$ Arm length	$\Delta$ Toe per wheel at rim
1 notch	0.42mm	1mm
1 turn	2.5mm	6mm



#### 1 . 3 . 5 . TRACK WIDTH ADJUSTMENT

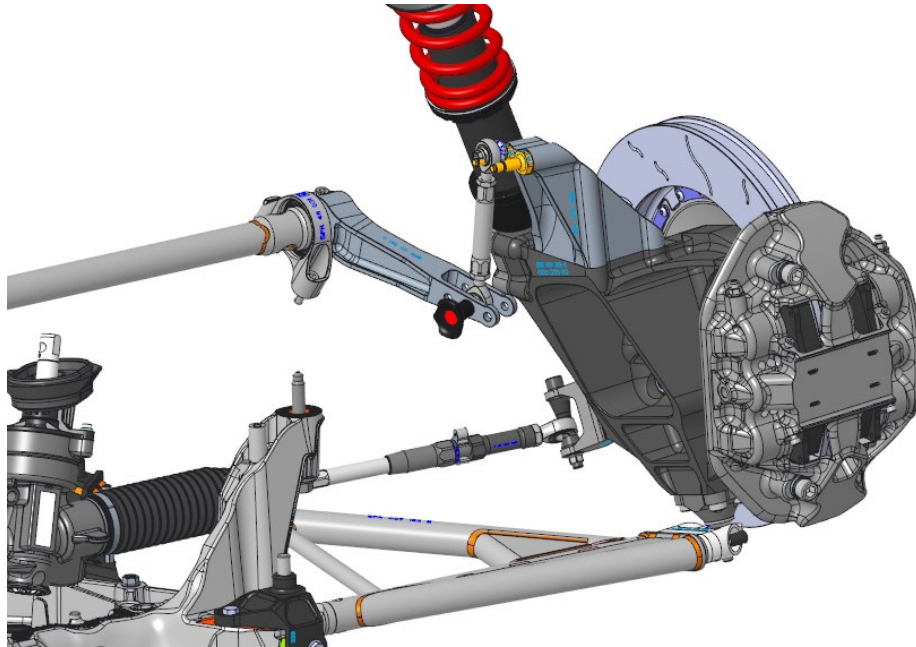
The Track width can be easily adjusted by the addition or the removal of wheel spacers. The available wheel spacers are **2, 3, 5** and **10 mm** in thickness.



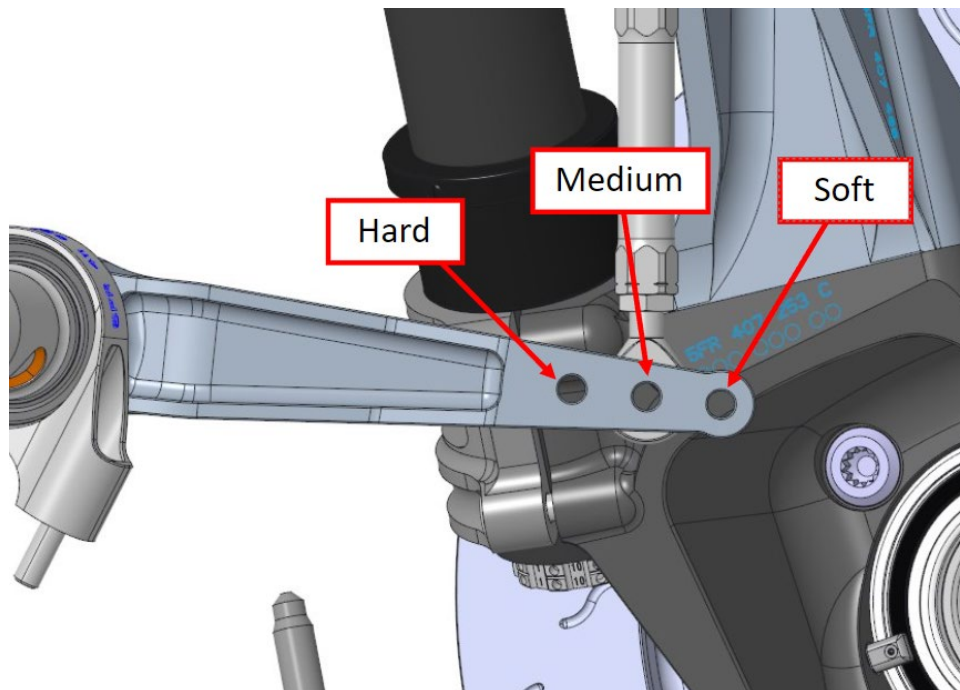
## 2. ANTI-ROLL BAR

### 2.1. FRONT ANTI-ROLL BAR

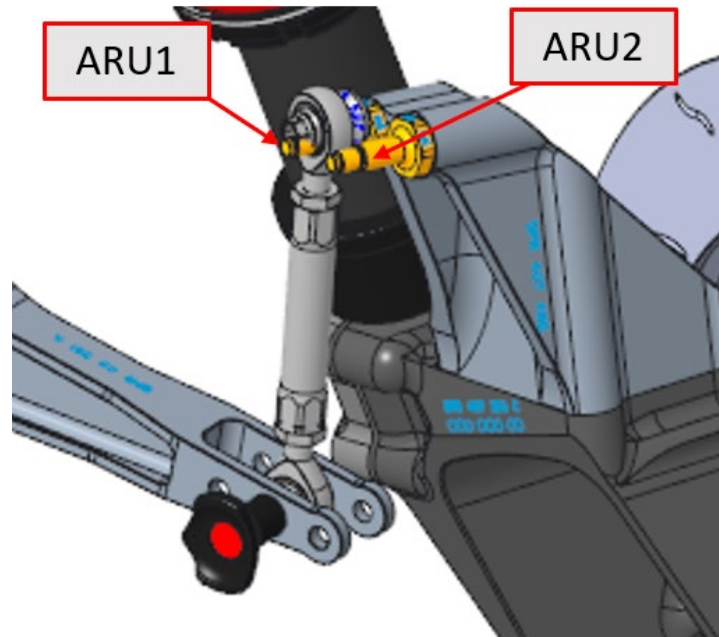
Three different bars with diameters of  $\varnothing 28$ ,  $\varnothing 30$  (car delivery) and  $\varnothing 35$  mm are available to modify the stiffness that the anti-roll bar is giving to the suspension.



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

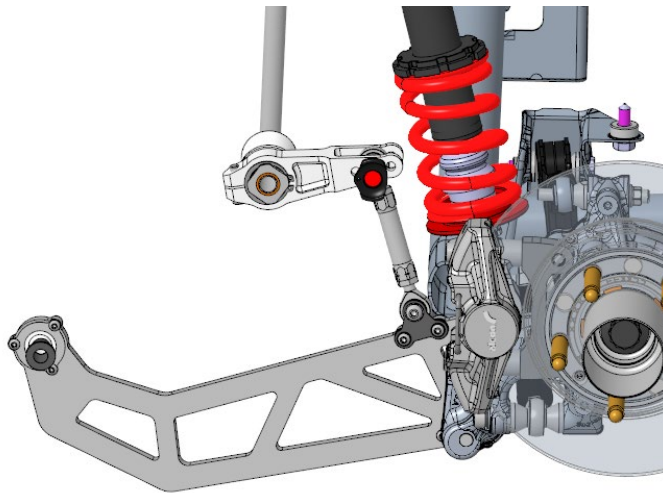
ARU2

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.

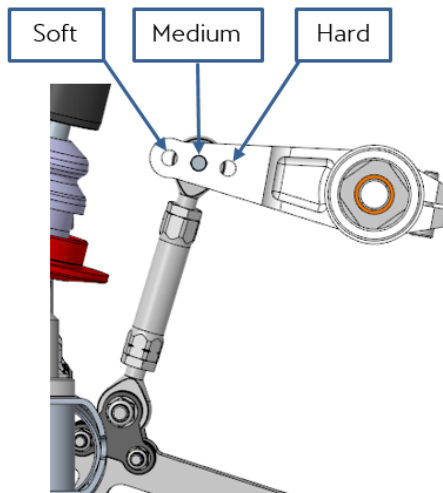
## 2.2. REAR ANTI-ROLL BAR

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:

$\Delta$ Rear ARB Stiffness (%)			
<b>External Diameter (mm)</b>	<b>18</b>	<b>22</b>	<b>25</b>
<b>Thickness (mm)</b>	<b>2.0</b>	<b>2.0</b>	<b>3.0</b>
<b>Hard</b>	37,8	73,5	147,9
<b>Medium</b>	51,5	100,0	201,4
<b>Soft</b>	74,1	144,0	289,9

### 3 . D A M P E R S

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

#### 3 . 1 . F R O N T D A M P E R S

##### 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

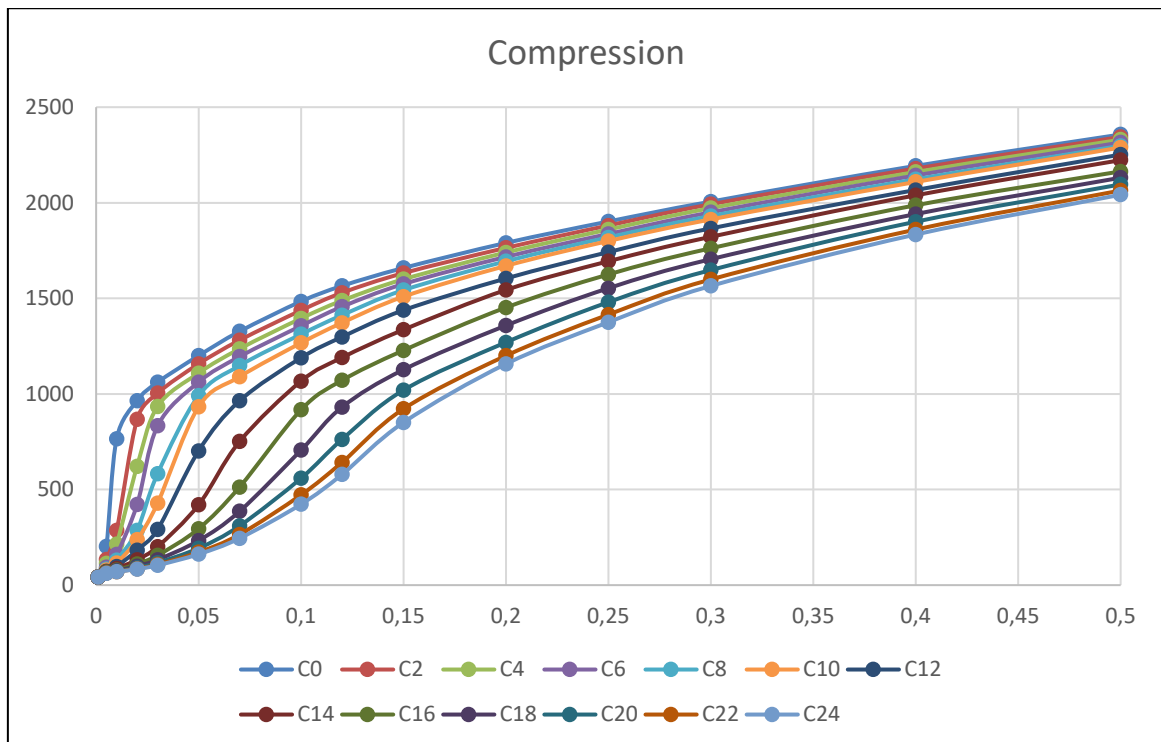
Aluminum outer housing and inner steel chrome tube

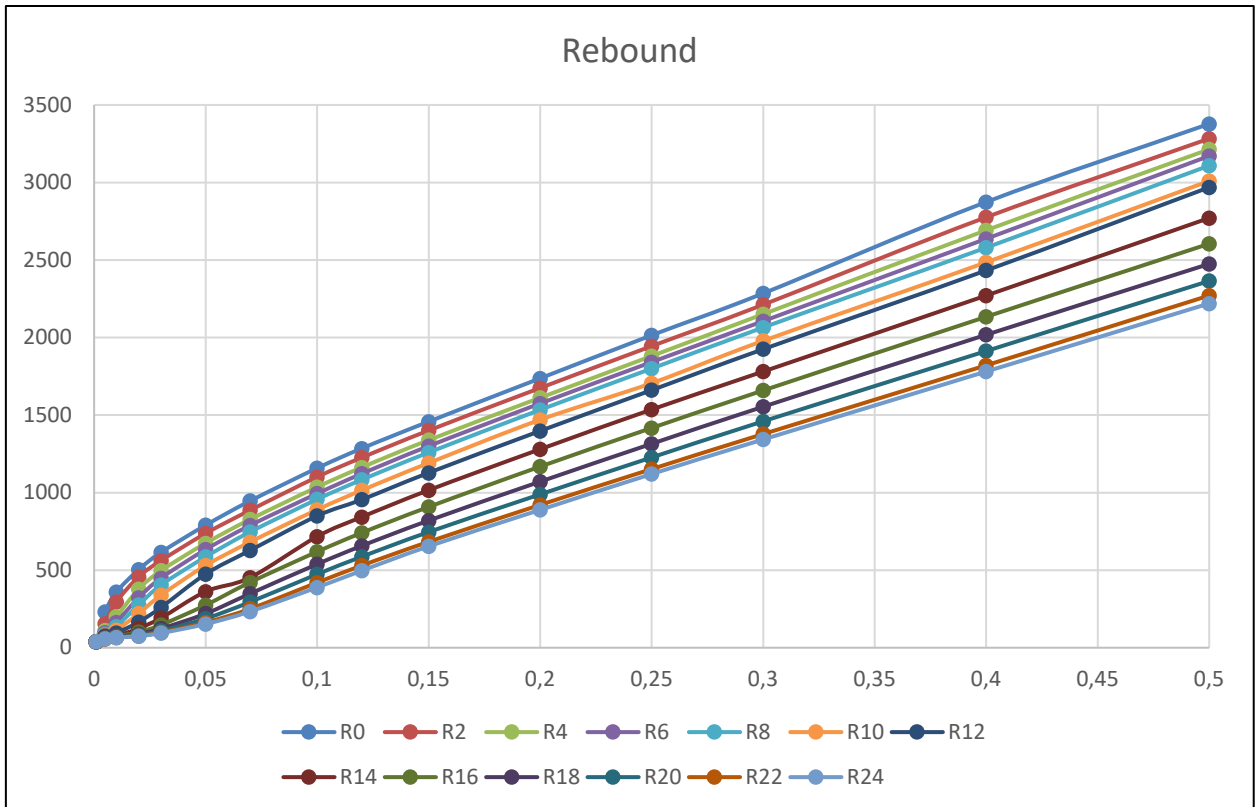
24 adjustment clicks for each bump and rebound phases

20 mm upright height adjustment

107mm stroke (75mm free stroke + 30mm bump-stop (5KN / 7mm) + 10mm packer)

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)

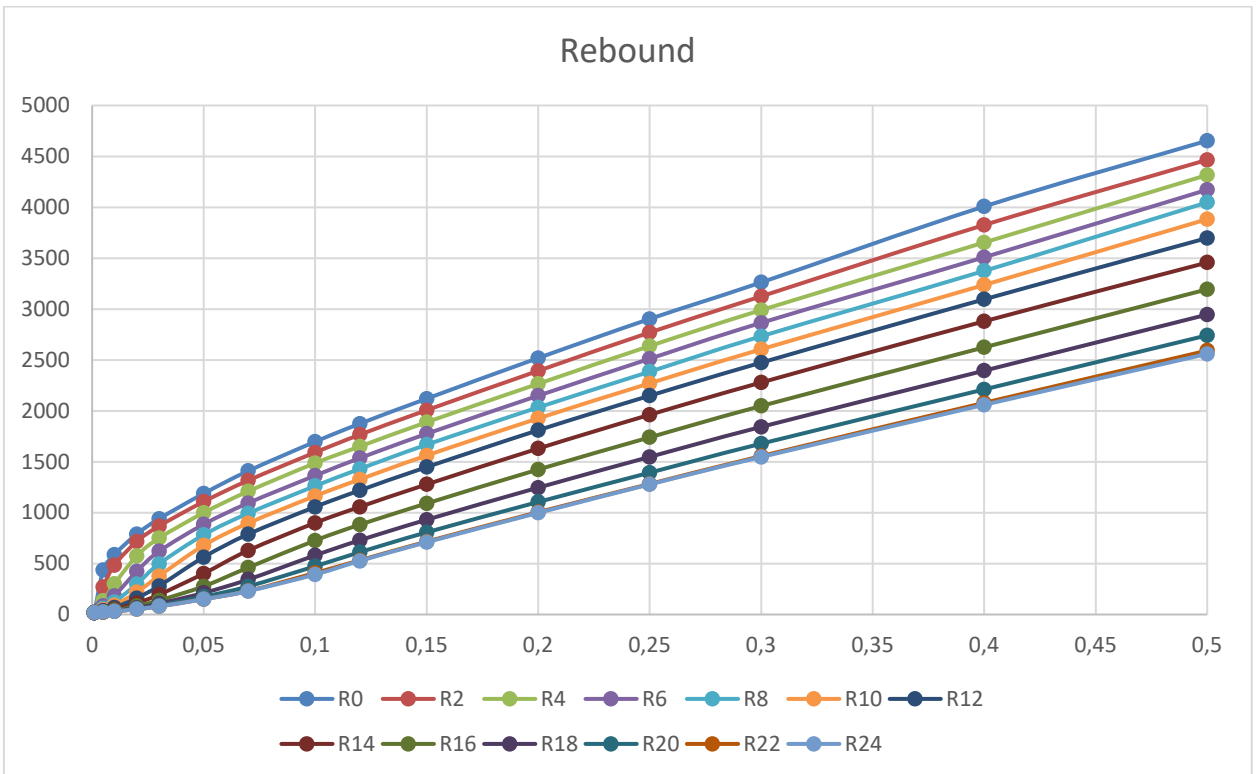
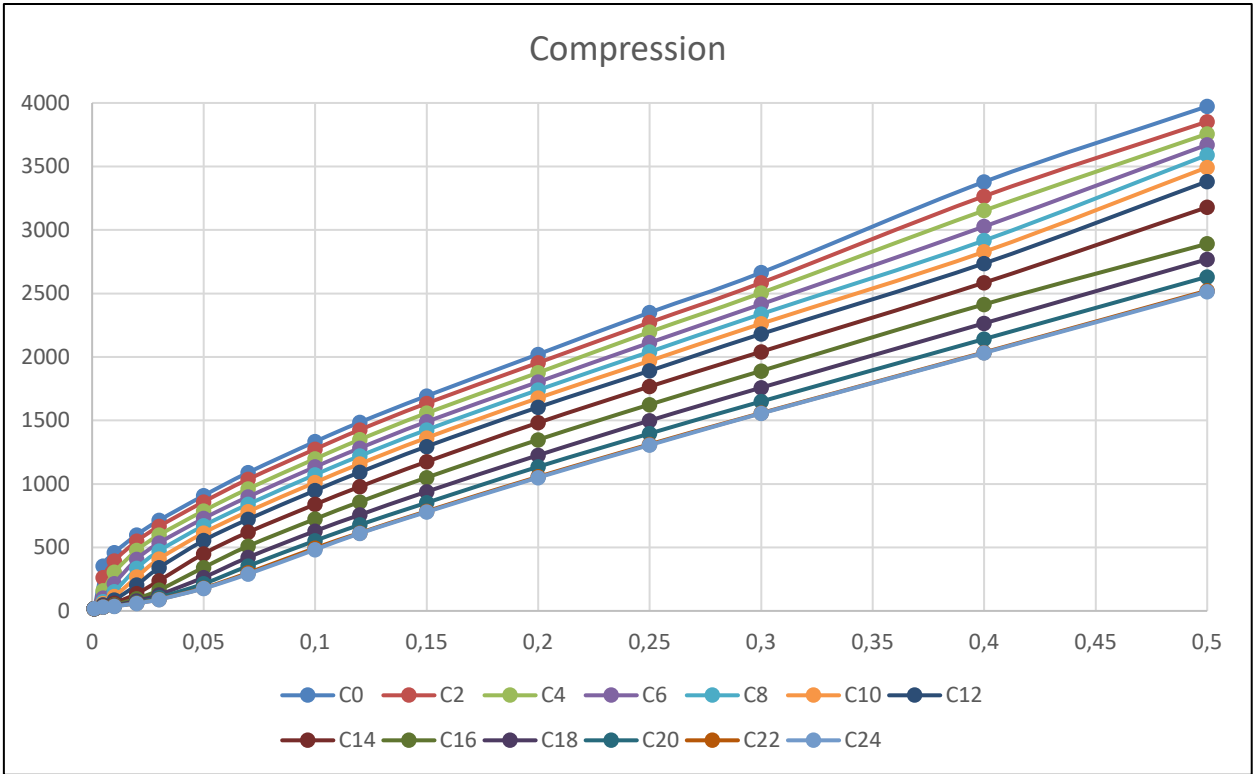


### Rear dampers characteristics

Aluminum outer housing and steel chrome axle

24 adjustment clicks for each bump and rebound phases

**77mm stroke (48mm free stroke + 35mm bump-stop (5KN / 7mm))**



## 4 . S P R I N G S

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 . R I S C O F C O I L B I N D I N G

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

<b>CUPRA LEON VZ</b>		<b>SET-UP</b>			
<b>CAR INFORMATION</b>		<b>TRACK INFORMATION</b>		DATE	05/02/2024
Chassis	MK4-	Circuit	-	FROM	-
Engine	DNF	Length	-	TO	-
Gearbox	CFT-	Driver	-		
<b>CAR CONFIGURATION</b>		<b>FRONT</b>	<b>REAR</b>	<b>CONSTANTS</b>	
RIDE HEIGHT SUBFRAME	81/81		230/230	WHEELBASE	2710 mm
MIN RH SPLITTER / RAKE	80		11 mm	MOTION RATIO (W/D)	Front 1,1 / Rear 1,6
<b>DAMPER SETTINGS</b>		<b>FRONT</b>	<b>REAR</b>	<b>FRONT KINEMATICS</b>	
MAIN SPRING	200/60/100		170/60/200	TOP MOUNT POSITION	Mid
TENDER	60/60/2		60/60/2	CASTER	STD
ASSEMBLY LENGTH	-		-	ARB LINK	STD
CLAMPING LENGTH	43 mm		-	STEERING ARM POINT	STD
BUMP STOPS	STD		STD	STEERING ARM BUSHES	STD
PACKERS	STD		STD	U1 BUSHES	STD
CLICKS BUMP	Öhlins (20)		Öhlins (10)	U3 BUSHES	STD
CLICKS REBOUND	Öhlins (22)		Öhlins (10)	<b>REAR KINEMATICS</b>	
<b>ARB SETTINGS</b>		<b>FRONT</b>	<b>REAR</b>	SUBFRAME BUSHES	10 mm
TYPE	30x3		18x2	SHORT ARM POSITION	Up
POSITION	M - M		M - M	CAMBER ARM POSITION	Up
<b>WHEELS SETTINGS</b>		<b>FRONT</b>	<b>REAR</b>	TOE ARM POSITION	Down
RIMS	CMS 18x10_ET26		CMS 18x10_ET26	<b>ENGINE &amp; POWERTRAIN</b>	
WHEEL SPACER	5 mm		0 mm	RPM MAX	7000 R <sub>effect</sub>
TYRES	Hankook		Hankook	POWER	100% 330
SET-UP TYRE PRESSURE	1,5		1,5	TOP SPEED	6th gear 264 km/h
<b>BRAKE SETTINGS</b>		<b>FRONT</b>	<b>REAR</b>	<b>DIFFERENTIAL</b>	
MASTER CYLINDERS	Tilton 17,8 (7/10*)		Tilton 20,6 (13/16*)	RAMPS [ACC/BRK]	45/30
BRAKE PADS	Winmax 6.5		Winmax	PRELOAD	70 Nm
BRAKE DISCS	Alcon 378x33		VAG 272x10	<b>CLUTCH</b>	
BRAKE BALANCE	15/12		AP Racing 7 pos (P3)	MASTER CYLINDER	Tilton Ø15,9 mm
<b>AERO</b>				<b>HAND BRAKE</b>	
SPLITTER / WING / BLANKING	0°	0°	0 mm	MASTER CYLINDER	Tilton Ø15,9 mm
<b>ALIGNMENT</b>					
<b>FRONT</b>	<b>LEFT</b>	<b>RIGHT</b>		<b>WEIGHT (kg)</b>	
CAMBER (SHIMS)	4,5° (18,7 mm)	4,5° (18,7 mm)		DRIVER	75 FUEL 10 BALLAST 0
TOE (SHIMS)	0 (7 mm)	0 (7 mm)		<b>LEFT</b>	<b>RIGHT</b>
<b>REAR</b>	<b>LEFT</b>	<b>RIGHT</b>		372	373
CAMBER	4°	4°		235	235
TOE	0	0		<b>TOTAL</b>	
				FWD%	61,32% CROSS 49,96%
				RWD%	38,68% LEFT 49,96%
<b>NOTES</b>					
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