GIULIA SUPREMO

WHITE PAPER

CREATION	Frame-kit Combo Aero
AERODYNAMIC DESIGN	CFD Simulation CFD Analysis
PRODUCTION & TESTING	Preparing Mold ISO Test Road Test
ACHIEVEMENT	Performance Tech-info

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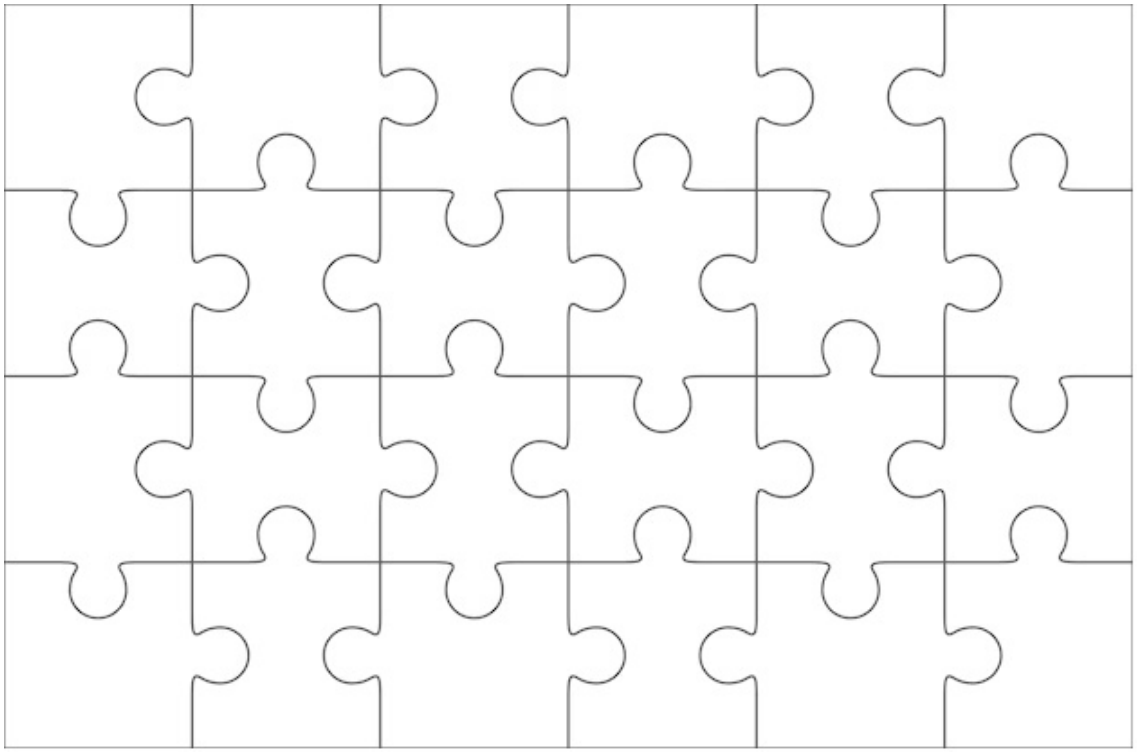
THE DREAM

After 25 years of making excellent sportive bikes, we at Intersens Bikes & Parts BV had a dream. So when the world started to puzzle during the lockdowns following the Covid-19 outbreak we decided to lay our own puzzle and put our efforts into creating the best and most exciting Sensa to date.

With the Giulia Evo Integrale we had a fast and good looking bike and with the Giulia GF we added a comfortable and lightweight racer to our line-up. We now set ourselves the goal to create a bike that would be **faster**, **lighter** and more **comfortable** than the Giulia Evo Integrale. Coming as close as possible to the comfort and weight of the Giulia GF. It had to be fast and perfect for a gran fondo or bike race.

So we started the “Giulia CFD-project”.



CHAPTER 1
CREATION

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Figure 1.1: Jelle Johannink wins the Dutch National Title 2022.

Where the Giulia Evo already proved itself in races by winning the Dutch National Title with Jelle Johannink from the Sensa - Kanjers voor Kanjers Cycling Team, we set the bar high on improving to offer our riders optimal bikes for future races.

Figure 1.2: Sensa-Kanjers voor Kanjers Cycling team.

1.1 Frame-kit

Our starting point was the Giulia Evo Integrale. With the latest CFD-technology (software to virtually do wind tunnel testing) we reviewed it to find the weak spots in the aerodynamic design of the frame. The geometry was kept basically unchanged to maintain the handling of the Giulia Evo Integrale. The tire clearance is also unchanged which allows for 30mm of rubber while maintaining at least a 5mm safety clearance around. But we added inner chainstay clearance for the trend of wider rims.

Figure 1.3: Giulia Evo Integrale.

With lessons learned from the Giulia GF project we were able to increase the comfort of the frame-kit. A different lay-up and smoother shapes found during the CFD-analysis meant we needed less material, bringing down the weight.

Figure 1.4: Giulia GF.

Also the seatpost was redesigned with a layup that allows more flex, yet being lighter. The setback is adjusted from 20mm to 15mm. Suiting a more aggressive forward position.

1.2 Combo Aero

Another big part of the project was a new cockpit. We wanted it to be compatible with our current frames and headpartsystem for internal cable routing. The goal was to improve the current Combo Integrale to make it **more aerodynamic**, **optimize ergonomics** and make it **easy to live with**. The slimmer front end with rounder edges make it faster and feels more comfortable. We added special 3D decals with grip-bumps to. The overall smoother shape fits the Giulia Supremo perfect.

Figure 1.5: Combo Aero.

The underside of the bar is now 1 big open tunnel, so its possible to change bars without detaching the hydraulic hoses from the shifters. To keep things aero there is 1 big cover which is super easy to mount.

Figure 1.6: Underside of combo aero + cover.

The bend has been reshaped. Creating a dual flare, so the bar is more narrow at the hoods than at the outers and the slight outward position of the lower part gives more room for the wrist while sprinting.

Finally the topcap can be replaced by any standard round spacer, so its possible to keep some additional length to your steerer, to finetune your position.

CHAPTER 2

AERODYNAMIC DESIGN

Contents

To make you faster, we utilize the technique of Computational Fluid Dynamics (CFD) to design the new Giulia Supremo. In addition, our CFD solver has been strictly verified and validated with standard wind tunnel models.

We chose the Giulia Evo Integrale as the basis, integrated the rear triangle geometry of Giulia GF to improve cycling comfort, and optimized the external aerodynamics for each section of the tube profile. The shape of the forkblades is optimized and the blade-angle is also further adjusted to improve the overall aero performance.

2.1 CFD Simulation

Simulation environment

- Road condition: Flat road.
- Wind direction: Windward.
- Wind velocity: 8.4 m/s = 30.24 km/h.
- Temperature: 18.3 °C.

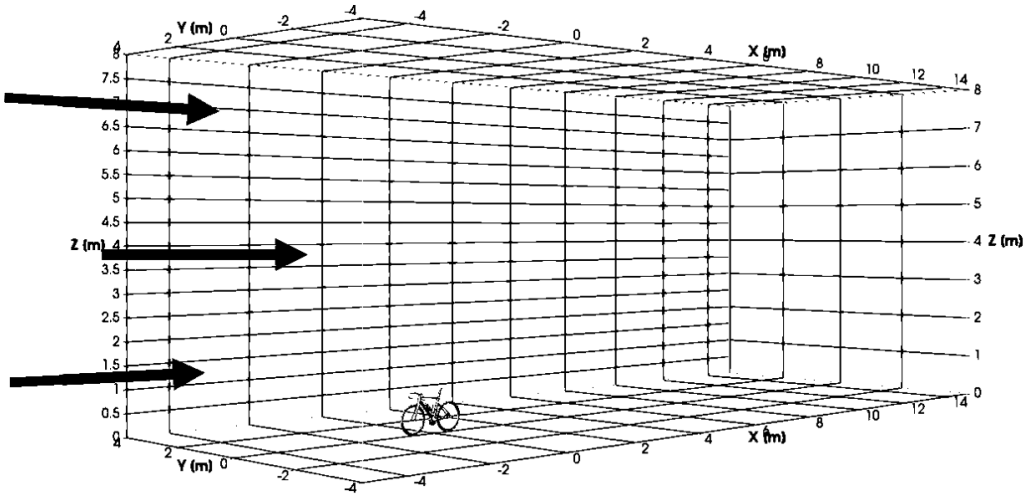
Simulation model

Figure 2.1: Giulia Evo Integrale.

Figure 2.2: Giulia Supremo.

We ignore some variable components that could be different among cyclists. This way can also ensure the stability and convergence of simulations.

Simulation domain



2.2 CFD Analysis

As we know, the frame occupies a volume ratio second only to the human body. Therefore, how the air flows past the frame of Giulia Evo Integrale is the first thing we consider.

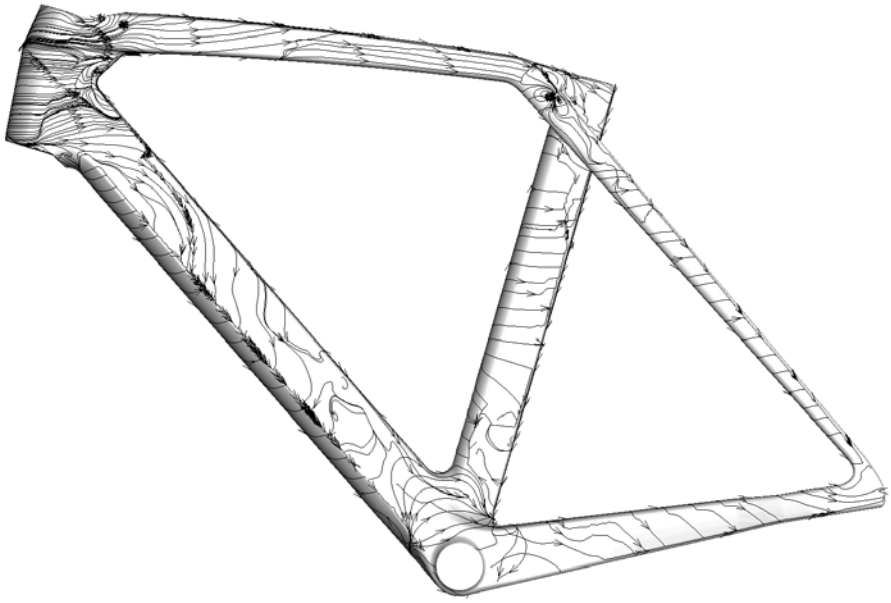
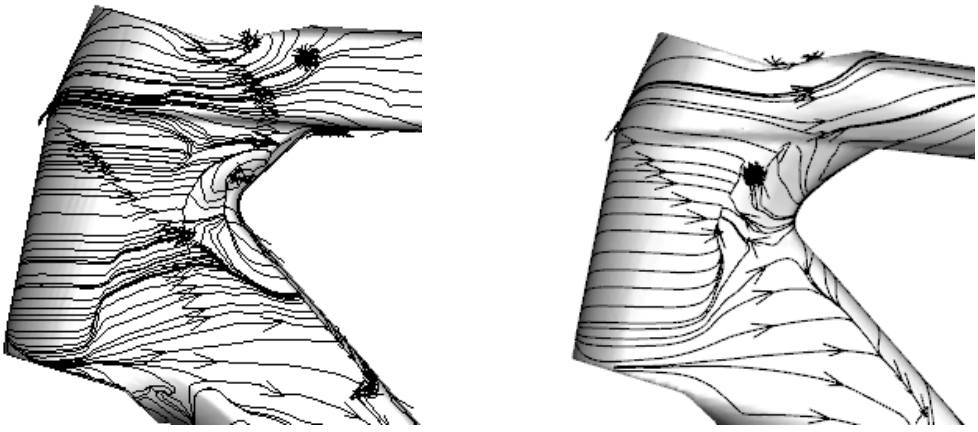


Figure 2.3: Air flow past the frame of Giulia Evo Integrale.

- Head Tube

The first section of contact with windward air. We keep the upper stripe line of the Giulia bike family and optimize the surface curvature to let the head tube become a leader of air.



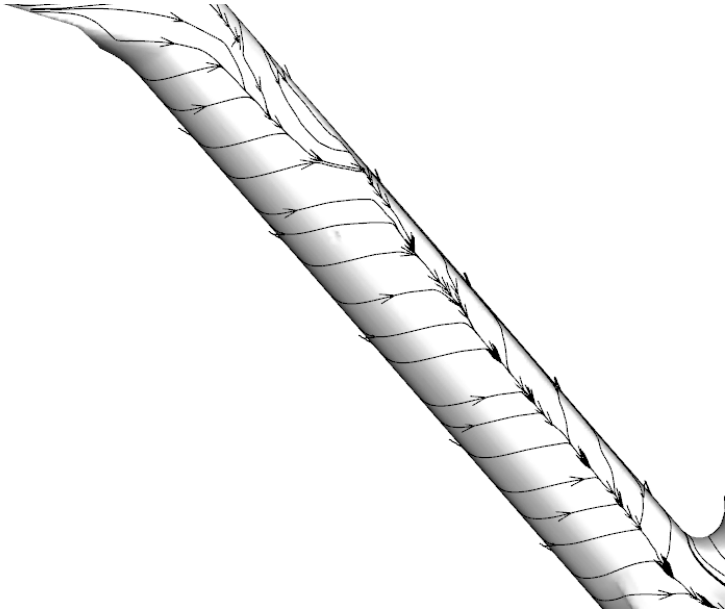
(a) Giulia Evo Integrale HT (b) Giulia Supremo HT

Figure 2.4: Air flow past the head tubes.

- Down Tube

As the significant tube, on the top edge, we indent the upper part and keep the middle-lower part to hide the water bottle behind the DT; On the bottom edge, we smooth the bottom edge to improve the air attachment. The width of the downtube is greatly reduced.

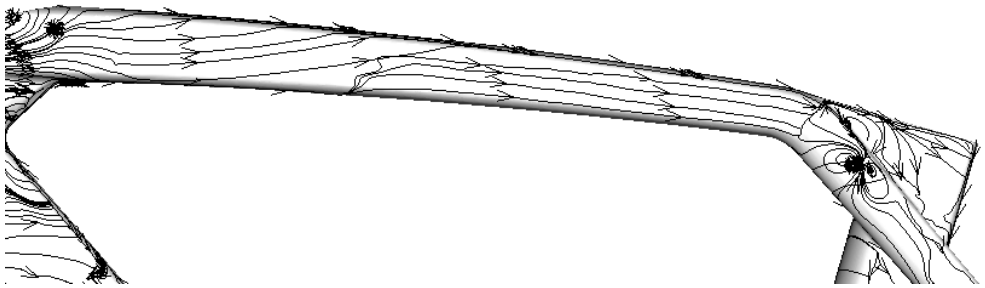
(a) Giulia Evo Integrale DT



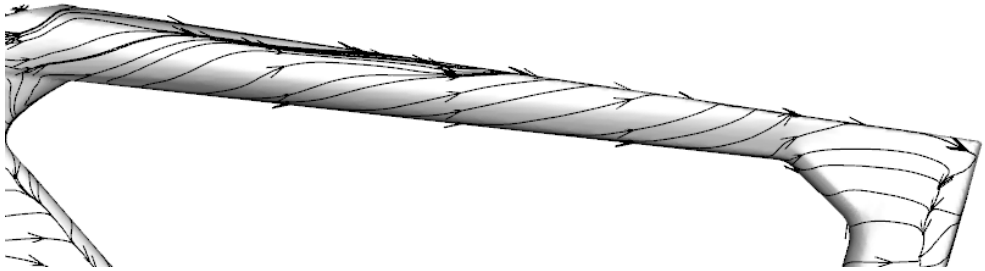
(b) Giulia Supremo DT

Figure 2.5: Air flow past the down tubes.

- Top Tube



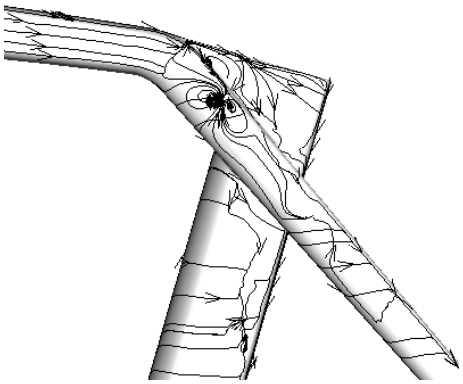
(a) Giulia Evo Integrale TT



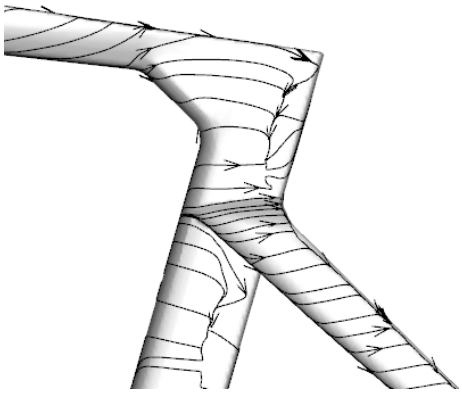
(b) Giulia Supremo TT

Figure 2.6: Air flow past the top tubes.

- Connection of SeatStay-SeatTube



(a) Giulia Evo Integrale SS-ST connection



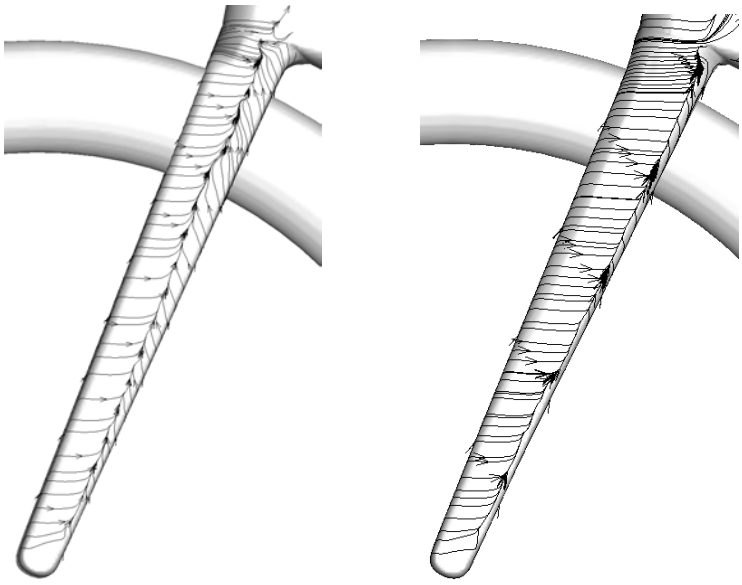
(b) Giulia Supremo SS-ST connection

Figure 2.7: Air flow past the SS-ST connections.

The all-new TT (toptube) and the SS-ST (seatstay-seattube) inspired by wings bring the Giulia Supremo a streamlined appearance and comfort. Our simulation result also shows these two sections play excellently during the wind combat.

- Fork

The redesigned blade profile and aggressive angles cut the air easier than the fork of Giulia Evo Integrale.



(a) Giulia Evo Integrale fork (b) Giulia Supremo fork

Figure 2.8: Air flow past the forks.

With the aforementioned improvements, the total frontal area of the Giulia Supremo is reduced by the equivalent of an iPhone 14 Pro screen area compared to the Giulia Evo Integrale.

Parameter	Supremo	Evo Integrale
Frontal area[m^2]	0.412566	0.423343

(a) Evo Integrale (b) Supremo (c) iPhone 14 Pro

Figure 2.9: Frontal area of the bikes.

Then, as the pressure difference is one of the major causes of air drag, we observed the frame, fork, and wheelset together. To see its interaction with the wind and the pressure changing on it.

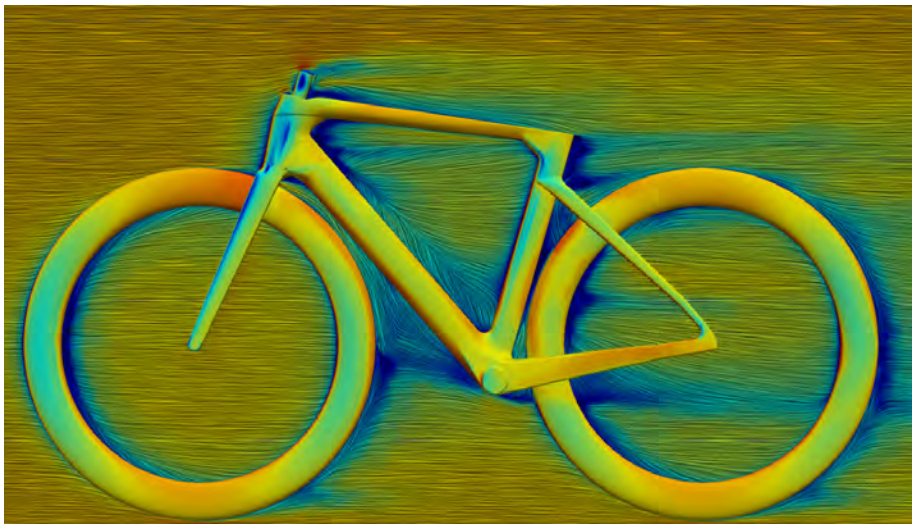
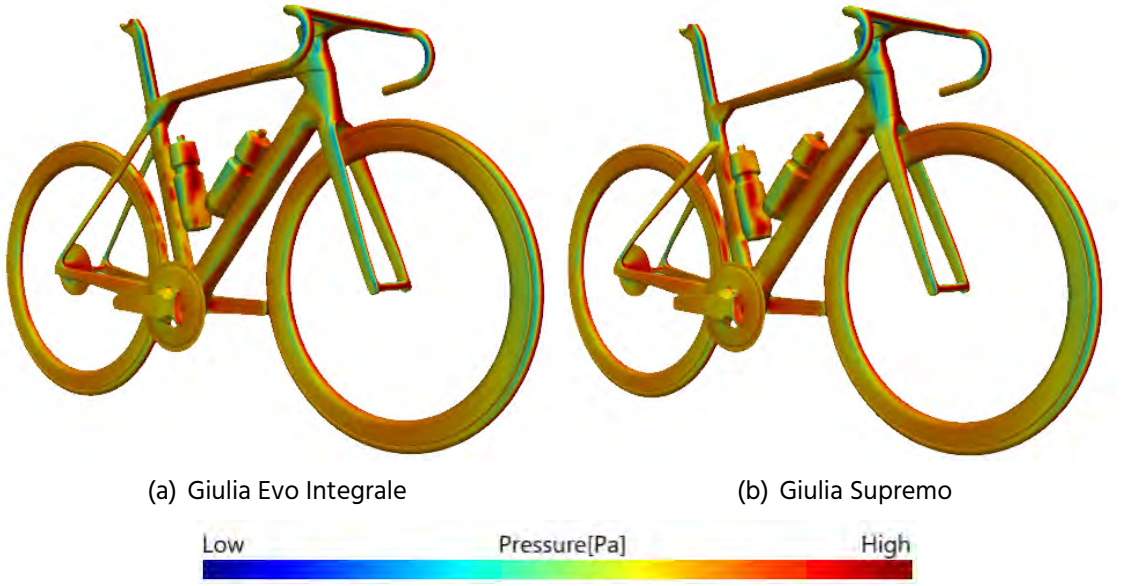


Figure 2.10: Giulia Supremo prototype against the wind.

In the same pressure scale, the Giulia Supremo has significantly lower surface pressure differences in the fork blades, downtube, and seatstay-seattube connections than the Giulia Evo integrale. Furthermore, the new downtube highly reduces the windward pressure of the water bottle on the seattube.



(a) Giulia Evo Integrale (b) Giulia Supremo

Figure 2.11: Pressure contour of the bikes.

To compare the aero performance, we normalized the results in $c_{\mathrm{d}}A$ [m^2], and get a remarkable drag reduction percentage of **9.1%*** against Giulia Evo integrale.

Being more practical to our daily cycling, we can estimate the drag reduction into watt saving. Assume that in no-wind conditions, a medium-build rider cycling on Giulia Supremo in dropped-position can gain around **1.5%*** of watt saving.

We choose the 30km/h wind parameter as this is applicable to almost all riders. The more commonly used 45km/h might have given bigger watt savings in absolute numbers, but we wanted to be as close to normal use for the majority of our riders as possible.

Bikes	$c_{\mathrm{d}}A$ [m^2]	Drag reduction [%]
Giulia Evo integrale	0.0311692	0.0%
Giulia Supremo	0.0285705	9.1%
With cyclist on bike	0.17 ~0.19	± 1.5%

*The above percentage improvements may vary depending on the cyclist's size, equipment, posture, surrounding conditions, etc.

CHAPTER 3
PRODUCTION & TESTING

Contents

3.1 Preparing Molds

Figure 3.1: Fork mold.

Figure 3.2: Frame mold.

3.2 ISO Test

ISO testing 4210 –
Standard testing for all Sensa bikes, so also the Supremo gets the treatment.

Figure 3.3: Fork ISO Test.

Figure 3.4: Seattube Fatigue Test.

Figure 3.5: Frame Impact Test.

3.3 Road Test

Initial road testing did not disappoint. The first pedal strokes confirmed the proper feeling of maximum powertransfer like we know it from the Giulia Evo Integrale. Hitting the first cobled sections also confirmed the bike did what we hoped for. It felt smooth.

Figure 3.6: Supremo Road Test.

In the mountains, the ascent feels just that bit easier when you know your bike is not holding you back. Descending at high speeds it always offers you the confidence to go for it and keep the speeds high, braking hard before the corner and picking up the pace after.

We had seen the numbers we wanted to see after mechanical and digital testing. But just as important is the ride feel. It made us smile ☺.

CHAPTER 4
ACHIEVEMENT

Contents

4.1 Performance

Giulia Supremo against the Giulia Evo Integrale

Weight* reduction

Frame: -171gr | Fork: -54gr | Seatpost: -27gr | Axles: -26gr

Total reduction: 278gr. Coming at only 45gr over the Giulia GF.

*Final frame weight including small parts like derailleur hanger 1079gr.

Aero-testing*

Drag reduction: **9.1%** improvement, resulting in ± **1.5%** watt saving.

*Measurement including new Combo Aero both frame kits fitted with identical wheels.

Stiffness

Frame Torsional Stiffness:
An even higher stiffness was not considered an advantage. So to maintain the Giulia Evo Integrale score of 97 Nm/degree was considered optimal.

Comfort Stiffness*:
Reduction from 242 Nm/mm to 169 Nm/mm, so 30% more measurable deformation measured on the seatpost.

*The Giulia GF reached a 106 Nm/mm note, so the Giulia GF remains our most comfortable racer.

4.2 Tech-info

Frame

- Generation 5 Carbon.
- EPS Moulding.
- CFD-optimized.
- Electronic groupset only.
- 12x142 Aero Thru Axles.
- Flatmount brakes.
- Pressfit 86.5.
- 1.5 upper and lower bearing.
- Internal cable-routing.

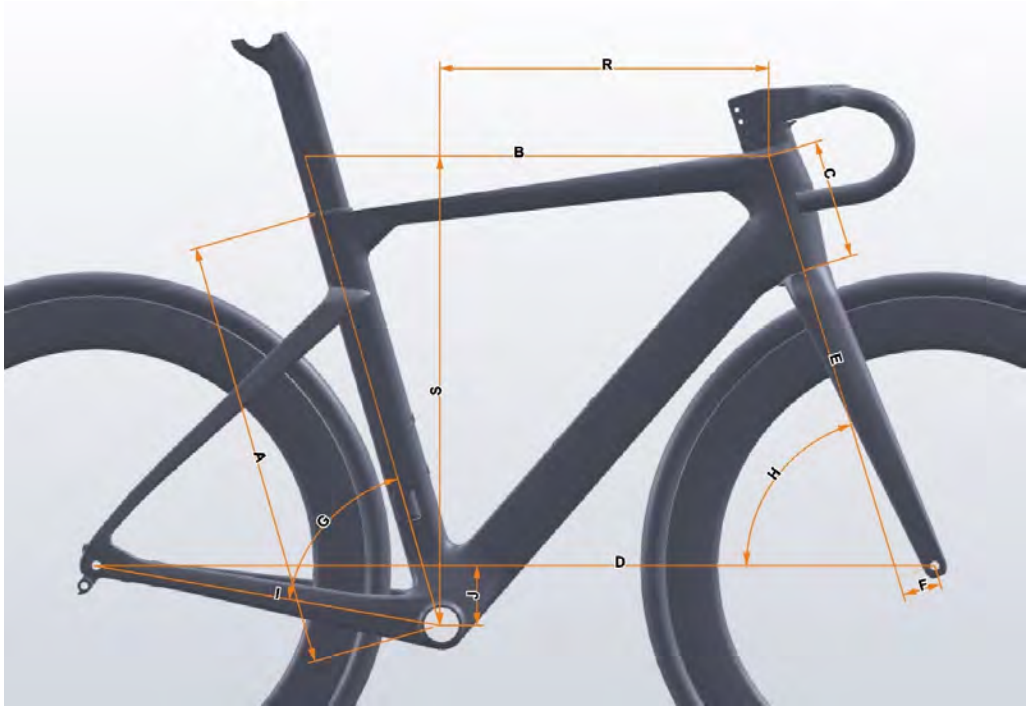
Fork

- Generation 5 Carbon.
- EPS Moulding.
- CFD-optimized.
- Supra AIR flow 2.
- 12x100 Aero Thru Axles.
- Flatmount brakes.
- Internal cable-routing.

Seatpost

- Generation 5 Carbon.
- Supra Race Line Evo.
- 15mm offset.
- 330mm (size 50-53).
- 375mm (size 55-58-61).

SENSA geometry chart



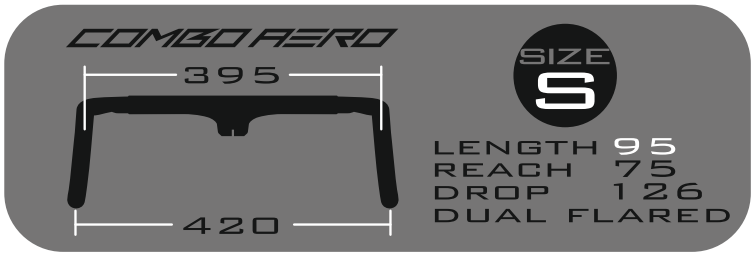
FRAME SIZE	"50" / XS	"53" / XS	"55" / XS	"58" / L	"61" / XL
ST Length(A)	467	500	522	541	564
TT Length(B)	523	542	559	575	591
HT Length(C)	112	140	161	182	201
W.B(D)	976	982	994	1005	1012
FORK Length(E)	375	375	375	375	375
Fork Offset(F)	45	45	45	45	45
ST Angle(G)	74.5°	74°	73.5°	73°	72.7°
HT Angle(H)	72°	73°	73°	73°	73.5°
RC(I)	410	410	410	410	410
BB Drop(J)	70	70	70	70	70
REACH(R)	379	384	390	395	401
STACK(S)	520	550	570	590	610
					(unit: mm)

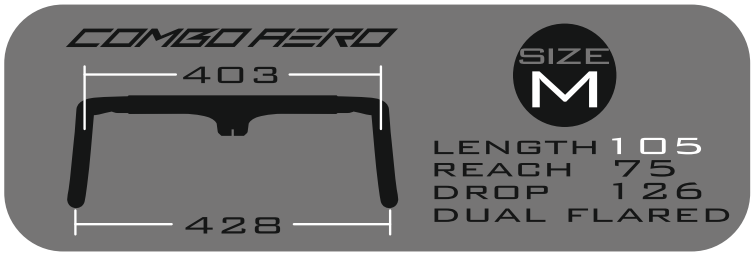
Seatpost setback (from center BB) 15mm

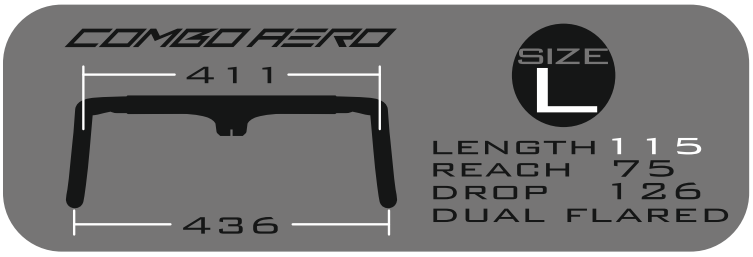
330mm post on size 50-53.

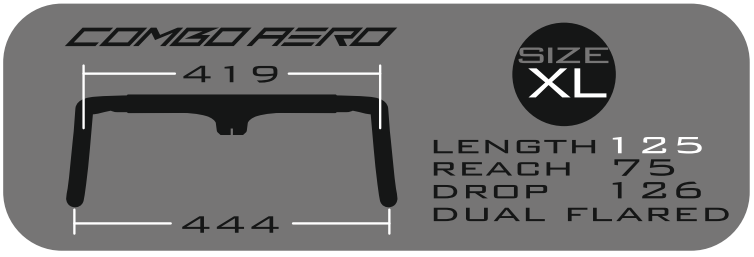
375mm post on size 55-58-61.

Combo Aero sizing









Giulia Supremo, faster lighter better.

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