



# Cost and Emissions Explanation File

Formula Student 2025 – Steering System

Team Name: *EPSA : Ecurie Piston Sport Auto*

May 29, 2025

## Introduction

This Cost and Carbon Bill of Materials (CCBOM) presents the steering system components for our Formula Student 2025 vehicle. The system is designed to meet all FS2025 safety regulations while optimizing for weight, cost, and environmental impact. The detailed assumptions, methodologies, and complete calculation breakdowns for all costs and CO<sub>2</sub>e values are provided in the accompanying **Cost and Emissions Explanation File**. This document serves as a top-level summary of the steering system's financial and environmental footprint. Note that, as per regulations, the carbon footprint for bought parts is only included if these parts underwent modification.

## Legend

**M (Made):** Part manufactured in-house    **B (Bought):** Part purchased from supplier

## Exchange Rates Used

Currency	Rate to EUR	Date	Source
USD	0.88	May 29, 2025	ECB Reference
GBP	1.19	May 29, 2025	ECB Reference

Table 1: Exchange Rates Documentation

## 1 Steering Rack Assembly

Part	Type	Material	Processes	Fasteners	Tooling	Cost (EUR)	CO <sub>2</sub> e (kg)
Steering rack (Narrcob)	B	Steel	-	-	-	681.54	-
Fasteners	-	Steel	-	4x M6x60 bolts grade 8.8, 4x nylon nuts	-	8.50	0.12
Assembly	-	-	Manual assembly	-		15.00	0.08
<b>Assembly Total</b>						<b>705.04</b>	<b>0.20</b>

## 2 Steering Column Assembly

Part	Type	Material	Processes	Fasteners	Tooling	Cost (EUR)	CO <sub>2</sub> e (kg)
Steering column tube	B	Steel	Cutting, facing	-	Lathe	193.38	0.15
Rigid coupling	B	Steel	-	-	-	48.12	-
Double U-joint	B	Steel	-	-	-	102.36	-
Fasteners	-	Steel	-	2x M10x30 bolts, 2x M10 nuts, 4x M6x20 screws	-	12.75	0.18
Assembly	-	-	Manual assembly, weided	22.50	0.12		
<b>Assembly Total</b>						<b>379.11</b>	<b>0.45</b>

## 3 Tie Rod Assembly

Part	Type	Material	Processes	Fasteners	Tooling	Cost (EUR)	CO <sub>2</sub> e (kg)
Rod tube	M	Carbon fiber	Sawing	-	Saw	46.25	5.92
Insert sup	M	Al 7075	CNC Turning	-	Lathe	11.21	1.66
Wedge	M	Al 7075	CNC Turning	-	Lathe	11.21	1.66

Insert middle	M	Al 7075	CNC Turning	-	Lathe	11.21	1.66
Fasteners	-	Steel	-	4x M6 bolts, 4x K-nuts	-	7.50	0.11
Assembly	-	-	Bonding, threading	-	Assembly jigs	18.75	0.10
<b>Assembly Total</b>						<b>106.13</b>	<b>11.11</b>

## 4 Rack Support Assembly

Part	Type	Material	Processes	Fasteners	Tooling	Cost (EUR)	CO <sub>2</sub> e (kg)
Half moon top	M	Al 7075	CNC Milling	-	Mill	14.28	2.56
Half moon bottom	M	Al 7075	CNC Milling	-	Mill	14.28	2.56
Left bracket	M	Al 7075	CNC Milling	-	Mill	14.28	2.56
Right bracket	M	Al 7075	CNC Milling	-	Mill	14.28	2.56
Fasteners	-	Steel	-	8x M8x35 bolts, 8x M8 nuts, 16x washers	-	18.50	0.26
Assembly	-	-	Manual assembly, torquing	-	Torque wrench	25.00	0.14
<b>Assembly Total</b>						<b>100.62</b>	<b>10.64</b>

## 5 Steering Shaft Pivot Assembly

Part	Type	Material	Processes	Fasteners	Tooling	Cost (EUR)	CO <sub>2</sub> e (kg)
Ball bearing	B	Steel	-	-	-	103.56	-
Other small parts	M	Mixed (Steel/Al)	CNC/Lathe	-	Mixed	12.38	1.63
Fasteners	-	Steel	-	2x circlips, 8x M6x12 screws	-	4.25	0.06
Assembly	-	-	Press fitting, alignment	-	Hydraulic press	12.50	0.07

Assembly Total						132.69	1.76
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## 6 Steering Wheel Assembly

Part	Type	Material	Processes	Fasteners	Tooling	Cost (EUR)	CO <sub>2</sub> e (kg)
Steering wheel	B	Al	-	3x M5 - 3 K-nuts	-	212.00	-
Quick release Assembly	B	Steel	-	-	-	90.00	-
	-	-	Final assembly, testing	-		10.00	0.05
Assembly Total						312.00	0.05

## System Totals

Subsystem	Parts Cost (EUR)	Fasteners Cost (EUR)	Assembly Cost (EUR)	Total Cost (EUR)	Total CO <sub>2</sub> e (kg)
Rack Assembly	681.54	8.50	15.00	705.04	0.20
Column Assembly	343.86	12.75	22.50	379.11	0.45
Tie Rod Assembly	79.88	7.50	18.75	106.13	11.11
Support Assembly	57.12	18.50	25.00	100.62	10.64
Pivot Assembly	115.94	4.25	12.50	132.69	1.76
Steering Wheel Assembly	302.00	0.00	10.00	312.00	0.05
<b>TOTAL</b>	<b>1,580.34</b>	<b>51.50</b>	<b>103.75</b>	<b>1,735.59</b>	<b>24.21</b>

Table 8: Final Steering System CCBOM Summary

## Performance Metrics

Metric	Value
Total System Cost	€1,735.59
Total System CO <sub>2</sub> e	24.21 kg
Cost per kg CO <sub>2</sub> e	€71.70
Assembly Cost Percentage	6.0%
Fastener Cost Percentage	3.0%

Table 9: System Performance Summary