

Car Number 281

University Ecole Centrale de Lyon

Team Name Ecurie Piston Sport Auto



System		Cost
FR	Frame and Body	14,929.52
GRAND TOTAL		14,929.52

System	Assembly	Part	M/B	P/M/F/T	Comments	Qty (per piece)	Cost	Cost Comments	ID
FRAME AND BODY					Total	14,929.52			
FR	Bodywork					1,997.02			
		Nose	m		Nose of the bodywork	1			FR-0052-002
				M	Glass Fiber	1.00	38.70	5m² x 7.74€/m²	FR-0052-002-0012
				M	Glass	1.00	24.60	2.5m² x 9.84€/m²	FR-0052-002-0013
				T	Lamination - Composite Tool	1.00		300g x 104€/kg	FR-0052-002-0015
				T	Lamination - Composite Tool	1.00	50.00	2.5kg x 20€/kg	FR-0052-002-0016
				P	Cut (scissors, knife)	1.00	95.82	3h x 31,94€/h	FR-0052-002-0017
				P	Lamination	1.00	127.75	4h x 31.94€/h	FR-0052-002-0018
				P	Resin Application	1.00	127.75	4h x 31,94€/h	FR-0052-002-0019
				P	Vacuum Form	1.00	31.94	1h x 31.94€/h	FR-0052-002-0020
				P	Casting	1.00	31.94	1h x 31,94€/h	FR-0052-002-0021
				P	Hand Finish	1.00		5h x 31,94€/h	FR-0052-002-0022
				P	Cut (scissors, knife)	1.00	8.00	15min/part x 31.94€/h	FR-0052-002-0023
				F	Push clips	4.00	39.90	Up to 90 kg of resistance	FR-0052-002-0024
				T	Master manufacturing	1.00	980.00	Manpower and equipement cost	FR-0052-002-0025
		Side and additionnal Plates	m			2			FR-0052-003
				M	Glass Fiber	1.00	9.90	1.28m² x 7.74€/m²	FR-0052-003-0026
				M	Glass	1.00	6.30	0.67m² x 9.84€/m²	FR-0052-003-0027
				T	Lamination - Composite Tool	1.00	8.00	77g x 104€/kg	FR-0052-003-0028
				T	Lamination - Composite Tool	1.00	12.80	0.64kg x 20€/kg	FR-0052-003-0029
				P	Cut (scissors, knife)	1.00	31.94	1h x 31,94€/h	FR-0052-003-0030
				P	Lamination	1.00	63.88	2h x 31.94€/h	FR-0052-003-0031
				P	Resin Application	1.00	63.88	2h x 31.94€/h	FR-0052-003-0032
				P	Vacuum Form	1.00	15.47	30min x 31.94€/h	FR-0052-003-0033
				P	Hand Finish	1.00	79.85	2h x 31,94€/h	FR-0052-003-0035
				P	Cut (scissors, knife)	1.00		2*15min/part x 31.94€/h	FR-0052-003-0036
				F	Hook and loop belts	10.00	2.89		FR-0052-003-0037
FR	Floor Pan					124.86			
		Front Plate	m		Front pan	1			FR-0055-060
				F	Bolt	4.00	0.03	0.28€ the pack of 10	FR-0055-060-0091
				F	Nut	4.00	0.04	3.49€ the pack of 100	FR-0055-060-0092

			F	Washer	M4 Nutto fix pan to fram	4.00	0.04	3.53€ the pack of 100	FR-0055-060-0093
			M	Aluminium	0.244m² x 5mm =309000mm³	1.00	42.43	Alu 2017A. 3.48E-5€/mm3	FR-0055-060-0095
			P	Laser Cut	Machining and manpower cost	1.00	0.33	2588mm x 1.29E-4 €/mm	FR-0055-060-0096
			T	Filler Oxygen	Plate + holes (4xM4)	1.00	0.09	3.34€/m x 2745mm	FR-0055-060-0097
			P	Laser Cut	For the holes	1.00	0.01	100mm x 1.29E-4 €/mm	FR-0055-060-0098
			P	Programming and measuring part	Cost of an operator + equipement	1.00	1.32	3 min of programming and measuring	FR-0055-060-0099
			P	Setup and cleaning	Cost of an operator + equipement	1.00	12.15	13 min of setup and cleaning	FR-0055-060-0100
	Cockpit Plate	m			Floor pan from front to main hoop	1			FR-0055-061
			F	Bolt	M4x20 Screw to fix pan to frame	4.00	0.03	0.28€ the pack of 10	FR-0055-061-0101
			F	Nut	M4 washer to fix pan to frame	4.00	0.04	3.49€ the pack of 100	FR-0055-061-0102
			F	Washer	M4 Nutto fix pan to fram	4.00	0.04	3.53€ the pack of 100	FR-0055-061-0103
			M	Aluminium	0.329m² x 5mm =309000mm³	1.00	53.74	Alu 2017A. 3.48E-5€/mm3	FR-0055-061-0104
			P	Laser Cut	Machining and manpower cost	1.00	0.32	2488mm x 1.29E-4 €/mm	FR-0055-061-0105
			T	Filler Oxygen	Plate + holes (4xM4 + 2x r=12.5mm)	1.00	0.09	3.34€/m x 2745mm	FR-0055-061-0106
			P	Laser Cut	For the holes	1.00	0.03	258mm x 1.29E-4 €/mm	FR-0055-061-0107
			P	Programming and measuring part	Cost of an operator + equipement	1.00	1.32	3 min of programming and measuring	FR-0055-061-0108
			P	Setup and cleaning	Cost of an operator + equipement	1.00	12.15	13 min of setup and cleaning	FR-0055-061-0109
FR	Frame / Frame Tubes						11,526.00		
	Frame Tubes	m			35CrMo4, 30x1.5/25x1.5,20x1.5,15x1.5	1			FR-0057-001
			M	Steel	35CrMo4	1.00	666.00	Evaluated with our partner help	FR-0057-001-0002
			P	Laser Cut	Tubes	1.00	1,135.00		FR-0057-001-0003
			P	Bending	main +front hoop bending	1.00	360.00	Invoice from Flash Cintrage	FR-0057-001-0004
			P	Weld	Manpower cost	1.00	6,680.00	Welder wage /h * hours of work	FR-0057-001-0005
			P	Painting	All the tubes	1.00	360.00	Invoice from PSEP	FR-0057-001-0006
			T	Welding Fixture	All the equipement for welding	1.00	369.00	Welding&chiller station,...	FR-0057-001-0008
			T	Laser Cutting Fixtures	Equipement for 3D laser cutting	1.00	1,795.00	3D Laser cut machine and specific tooling	FR-0057-001-0009
			M	Steel	Filler Metal	1.00	41.00	4.89€/m x 8.4m (lenght to weld)	FR-0057-001-0010
			M	Gas	Filler Gas, Argon	1.00	120.00	14.35€/m x 8.4m (lenght to weld)	FR-0057-001-0011
FR	Impact Attenuator						371.43		
	Impact Attenuator	b			Approved by event	1	356.40		FR-0058-005
	Anti-Intrusion Plate	m			Steel (thickness 1.5mm, perimeter 1440mm)	1			FR-0058-006
			M	Steel	35CrMo4 360x360mm	1.00	6.00	0.625m² at 46.3€/m²	FR-0058-006-0038
			P	Setup and cleaning		1.00	7.47	Fixed Cost of Setup	FR-0058-006-0039
			P	Programming and measuring part	Cost of Manpower and equipement	1.00	1.32	3mn x 0.66€/min	FR-0058-006-0040
			P	Laser Cut	2D Laser cut	1.00	0.19	Machining and manpower cost	FR-0058-006-0041
			T	Oxygen	Filler Gas	1.00	0.05	33.4€/mm x (360x4)mm	FR-0058-006-0042
FR	Pedals						910.21		

Frame Throttle	m			Laser cut and soldered	1		FR-0061-007
		F	Bolt	M8x30 (frame-stick)	1.00	2.57 25,70€ the pack of ten	FR-0061-007-0043
		F	Nut	M8x16 nut (frame-stick)	1.00	0.26 12.92€ the pack of 50	FR-0061-007-0044
		F	Washer	M8 washer (frame-stick)	1.00	0.07 6.75€ the pack of 100	FR-0061-007-0045
		F	Bolt	M4x25 (Stick - neg stop)	1.00	0.03 0.28€ the pack of ten	FR-0061-007-0046
		F	Nut	M4x9 (Stick - neg stop)	1.00	0.04 3.49€ the pack of 100	FR-0061-007-0047
		F	Washer	M4 (Stick - neg stop)	1.00	0.04 3.53€ the pack of 100	FR-0061-007-0048
		P	Laser Cut	2917mm all plates and holes included	1.00	0.38 manpower and equipment costs	FR-0061-007-0179
		T	Filler Oxygen	2917mm all plates and holes included	1.00	0.10	FR-0061-007-0180
		M	Aluminium	189030mm^3 of raw material	1.00	6.57 Alu 2017A at 3,48E-05€/mm^3	FR-0061-007-0181
		P	Machining	20min (Includes setup, cleaning....)	1.00	7.79 Manpower cost	FR-0061-007-0182
		P	Setup and cleaning		1.00	12.15	FR-0061-007-0183
		P	Weld	2.068m to weld	1.00	180.15	FR-0061-007-0184
		T	Filler gas and metal	2.068m to weld	1.00	39.80	FR-0061-007-0185
Footrest	m			Laser cut and bended	2		FR-0061-008
		F	Bolt	M4x25 (footrest - stick)	0.03	0.28€ the pack of ten	FR-0061-008-0049
		F	Nut	M4x9 (footrest - stick)	0.04	3.49€ the pack of 100	FR-0061-008-0050
		F	Washer	M4 (footrest - stick)	0.04	3.53€ the pack of 100	FR-0061-008-0051
		P	Laser Cut	410mm for the main piece	1.00	0.05 Cost of mainpower + equipment =1.3E-4/mm	FR-0061-008-0110
		P	Laser Cut	443mm for the holes	1.00	0.00 Cost of mainpower + equipment =1.3E-4/mm	FR-0061-008-0111
		P	Programming and measuring	Programmation on the machine by Operator	1.00	1.32 3min Cost of manpower + equipment	FR-0061-008-0112
		P	Setup and cleaning	By Operator	1.00	12.15 13min Cost of manpower + equipment	FR-0061-008-0113
		P	Sheet metal Process	Bending of 3 sheets by Operator	1.00	0.78 3min Cost of manpower + equipment	FR-0061-008-0114
		M	Aluminium	124x85x3mm of raw material	1.00	1.10 Alu2017A at3.48E-5€/mm^3	FR-0061-008-0115
Throttle pedal stick	m			Link frame and footrest	1		FR-0061-009
		M	Aluminium	156480mm^3 of raw material	1.00	5.44 Alu 2017A at 3.48E-05€/mm^3	FR-0061-009-0196
		P	Mill - Form Cutter	122750mm^3 of material removed	1.00	15.40 Machining and manpower cost	FR-0061-009-0197
		P	Programming and measuring part		1.00	4.06 Equipment and manpower cost	FR-0061-009-0198
		P	Setup and cleaning		1.00	22.40 25 min Equipment and manpower cost	FR-0061-009-0199
Throttle Fixing rail	m			Allow position ajustement	2		FR-0061-010
		F	Bolt	M6x30 (fix rail - wedges)	4.00	0.09 8.56€ the pack of 100	FR-0061-010-0052
		F	Nut	M6x12 (fix rail - wedges)	4.00	0.04 3.70€ the pack of 100	FR-0061-010-0053
		F	Washer	M6 (fix rail - wedges)	8.00	0.04 4.28€ the pack of 100	FR-0061-010-0054
		M	Aluminium	307x43x3mm for raw material	1.00	1.38 Alu 2017A at 3,48E-05€/mm^3	FR-0061-010-0116

Throttle R Rail Wedge	m	P	Laser Cut	1326mm for the main piece	1.00	0.17	Cost of manpower and equipment	FR-0061-010-0117
		P	Filler Oxygen	1861mm	1.00	0.06		FR-0061-010-0118
		P	Laser Cut	535mm for the holes	1.00	0.07	Cost of manpower and equipment	FR-0061-010-0119
				Laser cut	2			FR-0061-011
		M	Aluminium		1.00	0.04	Alu 2017A at 3,48E-05€/mm^3	FR-0061-011-0127
		P	Laser Cut	Part + holes = 182mm	1.00	0.02	manpower + equipment	FR-0061-011-0128
		T	Filler Oxygen	Part + holes = 182mm	1.00	0.01		FR-0061-011-0129
		P	Programing and measuring part	Part + holes = 182mm	1.00	1.32	3 min of manpower + equipment	FR-0061-011-0130
		P	Setup and cleaning	Fixed Costs	1.00	12.15	12 min of manpower + equipment	FR-0061-011-0131
				To position rails	2	2.90		FR-0061-012
Throttle Threated Rod	b							
Throttle Front Rail Wedge	m			Laser cut	2			FR-0061-013
Negative Mechanical Stop	m	M	Aluminium		1.00	0.04	Alu 2017A at 3,48E-05€/mm^3	FR-0061-013-0132
		P	Laser Cut	Part + holes = 182mm	1.00	0.02	manpower + equipment	FR-0061-013-0133
		T	Filler Oxygen	Part + holes = 182mm	1.00	0.01		FR-0061-013-0134
		P	Programming and measuring part	Part + holes = 182mm	1.00	1.32	3 min of manpower + equipment	FR-0061-013-0135
		P	Setup and cleaning	Fixed Costs	1.00	12.15	12 min of manpower + equipment	FR-0061-013-0136
				To protect potentiometer	1			FR-0061-014
		M	Aluminium	2700mm^3	1.00	0.09	Alu 2017A at 3,48E-05€/mm^3	FR-0061-014-0166
		P	Laser Cut	Part + holes = 120mm	1.00	0.02	manpower + equipment	FR-0061-014-0167
		T	Filler Oxygen	Part + holes = 120mm	1.00	0.01		FR-0061-014-0168
		P	Programming and measuring part		1.00	1.32	3 min of manpower + equipment	FR-0061-014-0170
Positive Mechanical Stop	m	P	Setup and cleaning	Fixed Costs	1.00	12.15	12 min of manpower + equipment	FR-0061-014-0171
		P	Bending	1.32	1.00	1.32	3 min of manpower + equipment	FR-0061-014-0172
				To protect potentiometers	1			FR-0061-015
		F	Bolt	M4x25 (Pos stop - frame)	1.00	0.03	0.28€ the pack of 10	FR-0061-015-0055
		F	Nut	M4x9 (Pos stop - frame)	1.00	0.04	3.49€ the pack of 100	FR-0061-015-0056
		F	Washer	M4 (Pos stop - frame)	1.00	0.04	3.53€ the pack of 100	FR-0061-015-0057
		M	Aluminium	2100mm^3	1.00		Alu 2017A at 3,48E-05€/mm^3	FR-0061-015-0173
		P	Laser Cut	Part + holes = 98mm	1.00	0.01	manpower + equipment	FR-0061-015-0174
		T	Filler Oxygen	Part + holes = 98mm	1.00	0.01		FR-0061-015-0175
		P	Programming and measuring part		1.00	1.32	3 min of manpower + equipment	FR-0061-015-0176
Throttle Pedal Bearing	b	P	Bending		1.00	1.32	3 min of manpower + equipment	FR-0061-015-0177
		P	Setup and cleaning		1.00	12.15	12 min of manpower + equipment	FR-0061-015-0178
				Allow soft rotation	2	2.02		FR-0061-016
Spring	b			Bring back the pedal	2	0.82	8.20€ the pack of ten springs	FR-0061-017

Throttle F Threated Rod	b			Position the frame of the pedal	1	2.90		FR-0061-019
		F	Nut	Nut 6x12	2.00	0.04	3.10€ the pack of 100	FR-0061-019-0059
		F	Washer	Washer M6	2.00	0.04	4.28€ the pack of 100	FR-0061-019-0060
Throttle R Threated Rod	b			Position the frame of the pedal	1	2.90		FR-0061-020
		F	Nut	Nut 6x12	2.00	0.03	3.10€ the pack of 100	FR-0061-020-0064
		F	Washer	Washer M6	2.00	0.04	4.28€ the pack of 100	FR-0061-020-0065
Axle Spacer	m			Allow a good position	1			FR-0061-021
		P	Machining	Lathe	1.00	2.64	5 min by operator	FR-0061-021-0152
Potentiom R Threated Rod	b			Fix potentiom to frame	1	3.79		FR-0061-042
		F	Nut	Nut 3	6.00	0.06	5.50€ the pack of 100	FR-0061-042-0066
		F	Washer	Washer M3	6.00	0.01	0.98€ the pack of 100	FR-0061-042-0067
Potentiom F Threated Rod	b			Fix potentiom to frame	1	3.79		FR-0061-043
		F	Nut	Nut 3	6.00	0.06	5.50€ the pack of 100	FR-0061-043-0068
		F	Washer	Washer M3	6.00	0.01	0.98€ the pack of 100	FR-0061-043-0069
Frame Brake	m			Laser cut and soldered	1			FR-0061-044
		F	Bolt	M8x30 (frame-stick)	1.00	2.57	25,70€ the pack of ten	FR-0061-044-0070
		F	Nut	M8x16 nut (frame-stick)	1.00	0.26	12.92€ the pack of 50	FR-0061-044-0071
		F	Washer	M8 washer (frame-stick)	1.00	0.07	6.75€ the pack of 100	FR-0061-044-0072
		F	Bolt	M4x25 (BOTS Support)	1.00	0.03	0.28€ the pack of ten	FR-0061-044-0073
		F	Nut	M4x9 (BOTS Support)	1.00	0.04	3.49€ the pack of 100	FR-0061-044-0074
		F	Washer	M4 (BOTS Support)	1.00	0.04	3.53€ the pack of 100	FR-0061-044-0075
		P	Laser Cut	5779mm all plates and holes included	1.00	0.75	Manpower and equipement costs	FR-0061-044-0186
		T	Filler Oxygen	5779mm all plates and holes included	1.00	0.19		FR-0061-044-0187
		M	Aluminium	224186mm^3 of raw material	1.00	7.80	Alu 2017A at 3,48E-05€/mm^3	FR-0061-044-0188
		P	Bending	5 min	1.00	1.95	Manpower	FR-0061-044-0189
		P	Weld	3.628 m to weld	1.00	316.05	Manpower and equipement cost	FR-0061-044-0190
		T	Filler gas and metal	3.628 m to weld	1.00	69.83		FR-0061-044-0191
Brake pedal stick	m			Link frame and footrest	1			FR-0061-045
		F	Bolt	M6x80 (master cyl-stick)	1.00	0.10	10,43€ the pack of 100	FR-0061-045-0076
		F	Nut	M6x12 (master cyl-stick)	1.00	0.04	3.70€ the pack of 100	FR-0061-045-0077
		F	Washer	M6 (master cyl-stick)	1.00	0.04	4.28€ the pack of 100	FR-0061-045-0078
		M	Aluminium	264000mm^3 of raw material	1.00	9.18	Alu 2017A at 3.48E-05€/mm^3	FR-0061-045-0192
		P	Mill - Form Cutter	195730mm^3 of material removed	1.00	24.60	Machining and manpower cost	FR-0061-045-0193
		P	Programming and measuring part		1.00	6.47	Equipement and manpower cost	FR-0061-045-0194
Brake Pedal Bearing	b			Allow soft rotation	2	2.02		FR-0061-050

Brake Threated Rod	b			Position the frame of the pedal	2	2.90		FR-0061-059
		F	Nut	Nut 6x12	2.00	0.04	3.10€ the pack of 100	FR-0061-059-0085
		F	Washer	Washer M6	2.00	0.04	4.28€ the pack of 100	FR-0061-059-0086
Brake Fixing rail	m			Allow position ajustement	2			FR-0061-062
		F	Bolt	M6x30 (fix rail - wedges)	4.00	0.09	8.56€ the pack of 100	FR-0061-062-0120
		F	Nut	M6x12 (fix rail - wedges)	4.00	0.04	3.70€ the pack of 100	FR-0061-062-0121
		F	Washer	M6 (fix rail - wedges)	8.00	0.04	4.28€ the pack of 100	FR-0061-062-0122
		M	Aluminium	307x43x3mm for raw material	1.00	1.38	Alu 2017A at 3,48E-05€/mm^3	FR-0061-062-0123
		P	Laser Cut	1326mm for the main piece	1.00	0.17	Cost of manpower and equipement	FR-0061-062-0124
		P	Filler Oxygen	1861mm	1.00	0.06		FR-0061-062-0125
		P	Laser Cut	535mm for the holes	1.00	0.07	Cost of manpower and equipement	FR-0061-062-0126
Brake R Rail Wedge	m			Laser cut	2			FR-0061-063
		M	Aluminium		1.00	0.04	Alu 2017A at 3,48E-05€/mm^3	FR-0061-063-0137
		P	Laser Cut	Part + holes = 182mm	1.00	0.02	manpower + equipement	FR-0061-063-0138
		T	Filler Oxygen	Part + holes = 182mm	1.00	0.01		FR-0061-063-0139
		P	Programing and measuring part		1.00	1.32	3 min of manpower + equipement	FR-0061-063-0140
		P	Setup and cleaning	Fixed Costs	1.00	12.15	12 min of manpower + equipement	FR-0061-063-0141
Brake Front Rail Wedge	m			Laser cut	2			FR-0061-064
		M	Aluminium		1.00	0.04	Alu 2017A at 3,48E-05€/mm^3	FR-0061-064-0142
		P	Laser Cut	Part + holes = 182mm	1.00	0.02	manpower + equipement	FR-0061-064-0143
		T	Filler Oxygen	Part + holes = 182mm	1.00	0.01		FR-0061-064-0144
		P	Programming and measuring part		1.00	1.32	3 min of manpower + equipement	FR-0061-064-0145
		P	Setup and cleaning	Fixed Costs	1.00	12.15	12 min of manpower + equipement	FR-0061-064-0146
BOTS Support	m			Laser cut and bended	1			FR-0061-065
		M	Aluminium	85x21x4mm	1.00	0.24	Alu 2017A at 3,48E-05€/mm^3	FR-0061-065-0147
		P	Laser Cut	Part + holes = 188mm	1.00	0.02	manpower + equipement	FR-0061-065-0148
		T	Filler Oxygen	Part + holes = 188mm	1.00	0.01		FR-0061-065-0149
		P	Programming and measuring part		1.00	1.32	3 min of manpower + equipement	FR-0061-065-0150
		P	Setup and cleaning	Fixed Costs	1.00	12.15	12 min of manpower + equipement	FR-0061-065-0151
		P	Bending		1.00	1.32	3 min of manpower + equipement	FR-0061-065-0153
Brake Pedal Hose Wedge	m			Maintain Brake Hose	1			FR-0061-066
		M	Aluminium	1.6mm^3	1.00	0.00	Alu 2017A at 3,48E-05€/mm^3	FR-0061-066-0154
		P	Laser Cut	Part + holes = 202mm	1.00	0.02	manpower + equipement	FR-0061-066-0155
		T	Filler Oxygen	Part + holes = 202mm	1.00	0.01		FR-0061-066-0156
		P	Programming and measuring part		1.00	1.32	3 min of manpower + equipement	FR-0061-066-0157
		P	Setup and cleaning	Fixed Costs	1.00	12.15	12 min of manpower + equipement	FR-0061-066-0158
		P	Bending		1.00	1.32	3 min of manpower + equipement	FR-0061-066-0159