Ecurie Piston Sport Auto

CAR #81

ÉCOLE CENTRALE LYON

Cost report

Car #81

Formula SAE Italy

Ecole Centrale de Lyon

Table of contents

for: **Ecole Centrale de Lyon**

Car # 81

Cost Summary	3
BOM	5
Brake System	11
Engine and Drivetrain	36
Frame & Body	158
Electrical	238
Miscellaneous, Finish and Assembly	268
Steering System	299
Suspension System	339
Wheels, Wheel Bearings and Tires	488

Cost Summary Basics

for: **Ecole Centrale de Lyon**
81

Area Totals	Materials	Processes	Fasteners	Tooling	Total
Brake System	$ 1 008,59	$ 96,70	$ 5,42	$ 0,67	$ 1 111,37
Engine & Drivetrain	$ 2 652,40	$ 1 465,86	$ 54,23	$ 32,70	$ 4 205,19
Frame & Body	$ 476,00	$ 1 709,98	$ 85,03	$ 196,21	$ 2 467,22
Electrical	$ 1 603,70	$ 320,54	$ 2,73	$ 5,33	$ 1 932,30
Miscellaneous, Finish & Assembly	$ 101,75	$ 173,21	$ 6,95	$ 12,53	$ 294,44
Steering System	$ 166,39	$ 170,60	$ 2,20	$ 3,33	$ 342,53
Suspension System	$ 1 865,80	$ 924,03	$ 12,84	$ 14,67	$ 2 817,33
Wheels, Wheel Bearings & Tires	$ 1 636,97	$ 306,75	$ 23,45	$ -	$ 1 967,17
Total Vehicle	$ 9 511,59	$ 5 167,68	$ 192,84	$ 265,45	$ 15 137,55

Composition for total vehicle:

University	Ecole Centrale de Lyon
Competition Code	FSAEI
Year	2018
Car #	81

Total Vehicle Cost	15137,55

The cost of assemlies on this chart should not include the cost of the parts in the assembly but only the materials, processes, fasteners and tooling in the assembly level.

Line Num.	Area of Commodity	Asm/Prt #	Rev. Lvl.	Asm	Component	Description	Unit Cost	Quantity	Material Cost	Process Cost	Fastener Cost	Tooling Cost	Total Cost	Details Page Number
	Brake System	BR A0100	AA		Front Brake Rotor		$ 89,74	2	$ 84,71	$ 4,42	$ 0,61	$ -	$ 179,49	12
	Brake System	BR 01001	AA	Front Brake Rotor	Brake Rotor		$ 3,39	2	$ 1,47	$ 1,92	$ -	$ -	$ 6,78	13
	Brake System	BR 01002	AA	Front Brake Rotor	Brake Shrink Disc		$ 6,02	2	$ 1,89	$ 4,13	$ -	$ -	$ 12,04	14
	Brake System	BR 01003	AA	Front Brake Rotor	Brake Bobbin		$ 0,27	12	$ 0,04	$ 0,23	$ -	$ -	$ 3,22	16
	Brake System	BR 01004	AA	Front Brake Rotor	Brake Caliper Spacer		$ 0,28	4	$ 0,04	$ 0,24	$ -	$ -	$ 1,13	17
	Brake System	BR A0200	AA		Rear Brake Rotor		$ 89,74	2	$ 84,71	$ 4,42	$ 0,61	$ -	$ 179,49	19
	Brake System	BR 02001	AA	Rear Brake Rotor	Brake Rotor		$ 3,39	2	$ 1,47	$ 1,92	$ -	$ -	$ 6,78	20
	Brake System	BR 02002	AA	Rear Brake Rotor	Brake Shrink Disc		$ 6,15	2	$ 1,89	$ 4,27	$ -	$ -	$ 12,31	21
	Brake System	BR 02003	AA	Rear Brake Rotor	Brake Bobbin		$ 0,27	12	$ 0,04	$ 0,23	$ -	$ -	$ 3,22	23
	Brake System	BR 02004	AA	Rear Brake Rotor	Brake Caliper Spacer		$ 0,28	4	$ 0,04	$ 0,24	$ -	$ -	$ 1,13	24
	Brake System	BR A0300	AA		Brake Circuit Assembly		$ 699,63	1	$ 655,03	$ 40,97	$ 2,97	$ 0,67	$ 699,63	26
	Brake System	BR 03001	AA	Brake Circuit Assembly	Hydraulic Fluid Reservoir Mount		$ 1,72	1	$ 0,03	$ 1,68	$ -	$ -	$ 1,72	28
	Brake System	BR 03002	AA	Brake Circuit Assembly	Distribution Tee Mount		$ 1,66	1	$ 0,03	$ 1,63	$ -	$ -	$ 1,66	30
	Brake System	BR 03003	AA	Brake Circuit Assembly	Internal Spacer		$ 0,73	2	$ 0,02	$ 0,70	$ -	$ -	$ 1,45	32
	Brake System	BR 03004	AA	Brake Circuit Assembly	External Spacer		$ 0,67	2	$ 0,01	$ 0,66	$ -	$ -	$ 1,33	34
	Brake System				Area Total				$ 1 008,59	$ 96,70	$ 5,42	$ 0,67	$ 1 111,37	
	Engine & Drivetrain	EN A0100	AA		Engine		$1 582,99	1	1 500	76	6	1	$ 1 582,99	37
	Engine & Drivetrain	EN 01001	AA	Engine	Flat Sump		$ 38,78	1	$ 10,57	$ 26,04	$ -	$ 2,17	$ 38,78	38
	Engine & Drivetrain	EN 01002	AA	Engine	Rear tab		$ 1,42	2	$ 0,20	$ 1,21	$ -	$ -	$ 2,83	39
	Engine & Drivetrain	EN 01003	AA	Engine	Rear tube		$ 1,30	2	$ 0,14	$ 1,15	$ -	$ -	$ 2,59	41
	Engine and Drivetrain	EN A0200	AA		Exhaust System		$ 100,73	1	$ 6,00	$ 92,69	$ 1,04	$ 1,00	$ 100,73	43
	Engine and Drivetrain	EN 02001	AA	Exhaust System	Exhaust Tip		$ 4,35	4	$ 0,64	$ 3,71	$ -	$ -	$ 17,41	45
	Engine and Drivetrain	EN 02002	AA	Exhaust System	Exhaust Flange		$ 1,75	4	$ 0,35	$ 1,40	$ -	$ -	$ 7,00	47
	Engine and Drivetrain	EN 02003	AA	Exhaust System	Exhaust headers		$ 109,43	1	$ 1,65	$ 100,12	$ -	$ 7,67	$ 109,43	49
	Engine and Drivetrain	EN 02004	AA	Exhaust System	Primary collector		$ 20,23	2	$ 0,29	$ 18,44	$ -	$ 1,50	$ 40,46	50
	Engine and Drivetrain	EN 02005	AA	Exhaust System	Primary collector tubing		$ 1,22	2	$ 0,59	$ 0,63	$ -	$ -	$ 2,44	51
	Engine and Drivetrain	EN 02006	AA	Exhaust System	Secondary collector		$ 22,47	1	$ 0,39	$ 20,58	$ -	$ 1,50	$ 22,47	52
	Engine and Drivetrain	EN 02007	AA	Exhaust System	Secondary collector tubing		$ 12,90	1	$ 0,51	$ 11,72	$ -	$ 0,67	$ 12,90	53
	Engine and Drivetrain	EN 02008	AA	Exhaust System	Muffler		$ 40,15	1	$ 24,13	$ 16,02	$ -	$ -	$ 40,15	54
	Engine and Drivetrain	EN 02009	AA	Exhaust System	Muffler Collar		$ 6,21	1	$ 5,56	$ 0,62	$ -	$ 0,04	$ 6,21	55
	Engine and Drivetrain	EN 02010	AA	Exhaust System	Spacer		$ 2,23	1	$ 0,15	$ 2,08	$ -	$ -	$ 2,23	56
	Engine and Drivetrain	EN A0300	AA		Air Intake System		$ 95,20	1	$ 26,45	$ 62,64	$ 5,44	$ 0,67	$ 95,20	57
	Engine and Drivetrain	EN 03001	AA	Air Intake System	Upper plenum		$ 12,59	1	$ 1,16	$ 11,43	$ -	$ -	$ 12,59	59
	Engine and Drivetrain	EN 03002	AA	Air Intake System	Plenum plate		$ 3,68	1	$ 0,59	$ 3,09	$ -	$ -	$ 3,68	60
	Engine and Drivetrain	EN 03003	AA	Air Intake System	Intake manifold		$ 18,14	1	$ 1,65	$ 16,49	$ -	$ -	$ 18,14	62
	Engine and Drivetrain	EN 03004	AA	Air Intake System	Left frame bracket		$ 1,69	1	$ 0,04	$ 1,65	$ -	$ -	$ 1,69	63
	Engine and Drivetrain	EN 03005	AA	Air Intake System	Right frame bracket		$ 1,76	1	$ 0,05	$ 1,71	$ -	$ -	$ 1,76	65
	Engine and Drivetrain	EN 03006	AA	Air Intake System	PAIR plate		$ 1,32	2	$ 0,08	$ 1,24	$ -	$ -	$ 2,63	67
	Engine and Drivetrain	EN 03007	AA	Air Intake System	Motor bracket		$ 4,18	1	$ 0,29	$ 3,89	$ -	$ -	$ 4,18	69
	Engine and Drivetrain	EN 03008	AA	Air Intake System	Intake bracket		$ 0,73	2	$ 0,00	$ 0,73	$ -	$ -	$ 1,46	71
	Engine and Drivetrain	EN A0400	AA		Throttle Body		$ 130,01	1	$ 119,80	$ 9,19	$ 1,02	$ -	$ 130,01	73
	Engine and Drivetrain	EN 04001	AA	Throttle Body	Throttle Frange		$ 5,18	1	$ 0,73	$ 4,45	$ -	$ -	$ 5,18	75
	Engine and Drivetrain	EN 04002	AA	Throttle Body	Restrictor		$ 5,73	1	$ 1,58	$ 4,15	$ -	$ -	$ 5,73	76
	Engine and Drivetrain	EN 04003	AA	Throttle Body	Throttle Housing		$ 4,27	1	$ 0,84	$ 3,43	$ -	$ -	$ 4,27	77
	Engine and Drivetrain	EN 04004	AA	Throttle Body	Throttle Axle		$ 2,73	1	$ 0,06	$ 2,67	$ -	$ -	$ 2,73	78
	Engine and Drivetrain	EN 04005	AA	Throttle Body	TPS Axle		$ 2,71	1	$ 0,04	$ 2,67	$ -	$ -	$ 2,71	79
	Engine and Drivetrain	EN 04006	AA	Throttle Body	Cable Housing		$ 3,57	1	$ 0,17	$ 3,40	$ -	$ -	$ 3,57	80
	Engine and Drivetrain	EN 04007	AA	Throttle Body	Axle Stop		$ 2,04	1	$ 0,26	$ 1,78	$ -	$ -	$ 2,04	81
	Engine and Drivetrain	EN 04008	AA	Throttle Body	Ram Pipe		$ 12,51	1	$ 4,01	$ 8,50	$ -	$ -	$ 12,51	82
	Engine and Drivetrain	EN 04009	AA	Throttle Body	Throttle Plate		$ 1,49	1	$ 0,07	$ 1,42	$ -	$ -	$ 1,49	83
	Engine and Drivetrain	EN A0500	AA		Fuel Tank Assembly		$ 38,53	1	$ 24,86	$ 10,46	$ 1,88	$ 1,33	$ 38,53	84

	Engine and Drivetrain	EN 05001	AA	Fuel Tank Assembly	Fuel Tank (with filler neck)		$ 103,67	1	$ 19,85	$ 82,16	$ -	$ 1,67	$ 103,67	85
	Engine and Drivetrain	EN 05002	AA	Fuel Tank Assembly	Filler Cap		$ 31,68	1	$ 24,42	$ 7,26	$ -	$ -	$ 31,68	87
	Engine and Drivetrain	EN 05003	AA	Fuel Tank Assembly	Filler Tube		$ 18,36	1	$ 4,06	$ 10,78	$ 2,52	$ 1,00	$ 18,36	88
	Engine and Drivetrain	EN 05004	AA	Fuel Tank Assembly	Lateral tab		$ 1,74	2	$ 0,03	$ 1,71	$ -	$ -	$ 3,48	89
	Engine and Drivetrain	EN 05005	AA	Fuel Tank Assembly	Rear tab		$ 1,88	2	$ 0,05	$ 1,83	$ -	$ -	$ 3,77	91
	Engine and Drivetrain	EN A0600	AA		Fuel System		$ 328,33	1	$ 283,83	$ 43,14	$ 0,69	$ 0,67	$ 328,33	93
	Engine and Drivetrain	EN 06001	AA	Fuel System	Fuel Rail		$ 7,64	1	$ 0,47	$ 4,84	$ -	$ 2,33	$ 7,64	95
	Engine and Drivetrain	EN 06002	AA	Fuel System	Fuel Pump Collar		$ 3,35	1	$ 0,05	$ 3,30	$ -	$ -	$ 3,35	96
	Engine and Drivetrain	EN 06003	AA	Fuel System	Pressure Regulator Tab		$ 1,83	1	$ 0,04	$ 1,79	$ -	$ -	$ 1,83	97
	Engine and Drivetrain	EN 06004	AA	Fuel System	Fuel Pump Tab		$ 1,55	1	$ 0,01	$ 1,54	$ -	$ -	$ 1,55	99
	Engine and Drivetrain	EN A0700	AA		Overflow Bottles		$ 22,60	1	$ 11,52	$ 9,11	$ 1,98	$ -	$ 22,60	101
	Engine and Drivetrain	EN A0800	AA		Cooling System		$ 49,04	1	$ 20,04	$ 19,44	$ 8,55	$ 1,00	$ 49,04	102
	Engine and Drivetrain	EN 08001	AA	Cooling System	Radiator		$ 102,86	1	$ 17,94	$ 84,92	$ -	$ -	$ 102,86	103
	Engine and Drivetrain	EN 08002	AA	Cooling System	Radiator lateral upper tab		$ 1,79	1	$ 0,05	$ 1,74	$ -	$ -	$ 1,79	106
	Engine and Drivetrain	EN 08003	AA	Cooling System	Radiator lateral lower tab		$ 2,53	1	$ 0,26	$ 2,26	$ -	$ -	$ 2,53	108
	Engine and Drivetrain	EN 08004	AA	Cooling System	Radiator Back tab		$ 1,61	1	$ 0,01	$ 1,60	$ -	$ -	$ 1,61	110
	Engine and Drivetrain	EN 08005	AA	Cooling System	Main Coolant Line		$ 38,16	1	$ 12,26	$ 21,10	$ 4,80	$ -	$ 38,16	112
	Engine and Drivetrain	EN 08006	AA	Cooling System	Fan		$ 30,77	1	$ 30,00	$ 0,37	$ 0,40	$ -	$ 30,77	113
	Engine and Drivetrain	EN 08007	AA	Cooling System	Expansion Tank		$ 22,73	1	$ 3,02	$ 17,71	$ -	$ 2,00	$ 22,73	114
	Engine and Drivetrain	EN 08008	AA	Cooling System	Expansion Tank tab		$ 1,54	1	$ 0,02	$ 1,53	$ -	$ -	$ 1,54	115
	Engine and Drivetrain	EN 08009	AA	Cooling System	Lateral Tube		$ 3,15	1	$ 1,80	$ 1,35	$ -	$ -	$ 3,15	117
	Engine and Drivetrain	EN 08010	AA	Cooling System	Secondary Coolant Line		$ 15,48	1	$ 1,33	$ 9,36	$ 4,80	$ -	$ 15,48	119
	Engine & Drivetrain	EN A0900	AA		Differential Assembly		$ 203,89	1	$ 180,47	$ 18,49	$ 2,27	$ 2,67	$ 203,89	120
	Engine & Drivetrain	EN 09001	AA	Differential Assembly	Housing		$ 125,94	1	$ 21,41	$ 101,49	$ 3,03	$ -	$ 125,94	122
	Engine & Drivetrain	EN 09002	AA	Differential Assembly	Left Eccentric		$ 10,90	1	$ 2,59	$ 8,31	$ -	$ -	$ 10,90	123
	Engine & Drivetrain	EN 09003	AA	Differential Assembly	Right Eccentric		$ 8,54	1	$ 2,00	$ 6,54	$ -	$ -	$ 8,54	125
	Engine & Drivetrain	EN 09004	AA	Differential Assembly	Left Eccentric carrier		$ 23,96	1	$ 7,75	$ 16,20	$ -	$ -	$ 23,96	127
	Engine & Drivetrain	EN 09005	AA	Differential Assembly	Right Eccentric carrier		$ 17,20	1	$ 5,62	$ 11,58	$ -	$ -	$ 17,20	129
	Engine & Drivetrain	EN 09006	AA	Differential Assembly	Upper Eccentric Carrier bracket		$ 1,00	4	$ 0,08	$ 0,91	$ -	$ -	$ 3,98	131
	Engine & Drivetrain	EN 09007	AA	Differential Assembly	Lower Eccentric Carrier bracket		$ 0,97	4	$ 0,07	$ 0,90	$ -	$ -	$ 3,88	132
	Engine & Drivetrain	EN 09008	AA	Differential Assembly	Left Jacking Bar bracket		$ 2,20	1	$ 0,15	$ 2,05	$ -	$ -	$ 2,20	135
	Engine & Drivetrain	EN 09009	AA	Differential Assembly	Right Jacking Bar bracket		$ 2,21	1	$ 0,15	$ 2,06	$ -	$ -	$ 2,21	137
	Engine & Drivetrain	EN A1000	AA		Driveshaft		$ 223,03	1	$ 200,00	$ 15,54	$ 7,49	$ -	$ 223,03	139
	Engine & Drivetrain	EN 10001	AA	Driveshaft	Inboard tripod housing		$ 66,55	2	$ 9,22	$ 57,33	$ -	$ -	$ 133,10	140
	Engine & Drivetrain	EN 10002	AA	Driveshaft	Outboard tripod housing		$ 72,28	2	$ 9,63	$ 62,65	$ -	$ -	$ 144,55	141
	Engine & Drivetrain	EN 10003	AA	Driveshaft	Left Axle		$ 16,43	1	$ 2,58	$ 13,85	$ -	$ -	$ 16,43	142
	Engine & Drivetrain	EN 10004	AA	Driveshaft	Right Axle		$ 17,34	1	$ 2,93	$ 14,41	$ -	$ -	$ 17,34	144
	Engine & Drivetrain	EN A1100	AA		Chain Set		$ 25,14	1	$ 2,18	$ 17,71	$ 2,58	$ 2,67	$ 25,14	146
	Engine & Drivetrain	EN 11001	AA	Chain Set	Front sprocket		$ 24,75	1	$ 1,52	$ 23,23	$ -	$ -	$ 24,75	148
	Engine & Drivetrain	EN 11002	AA	Chain Set	Rear sprocket		$ 41,80	1	$ 3,06	$ 38,74	$ -	$ -	$ 41,80	149
	Engine & Drivetrain	EN 11003	AA	Chain Set	Rear sprocket adaptor		$ 29,16	1	$ 8,72	$ 20,44	$ -	$ -	$ 29,16	150
	Engine & Drivetrain	EN 11004	AA	Chain Set	Chain shield		$ 9,10	1	$ 3,31	$ 5,78	$ -	$ -	$ 9,10	152
	Engine & Drivetrain	EN 11005	AA	Chain Set	Upper chainshield bracket		$ 1,71	1	$ 0,04	$ 1,67	$ -	$ -	$ 1,71	154
	Engine & Drivetrain	EN 11006	AA	Chain Set	Lower chainshield bracket		$ 1,71	1	$ 0,04	$ 1,68	$ -	$ -	$ 1,71	156
	Engine and Drivetrain				Area Total				$ 2 652,40	$ 1 465,86	$ 54,23	$ 32,70	$ 4 205,19	
	Frame and Body	FR A0100	AA		Frame		$ 639,85	1	$ 30,70	$ 538,62	$ 3,20	$ 67,33	$ 639,85	159
	Frame and Body	FR 01001	AA	Frame	Bend Round steel tubing		$ 23,75	1	$ 12,80	$ 10,95	$ -	$ -	$ 23,75	160
	Frame and Body	FR 01002	AA	Frame	Straight round steel tubing		$ 256,01	1	$ 70,76	$ 185,25	$ -	$ -	$ 256,01	161
	Frame and Body	FR 01003	AA	Frame	Ant-intrusion plate		$ 9,13	1	$ 4,03	$ 5,10	$ -	$ -	$ 9,13	162
	Frame and Body	FR 01004	AA	Frame	Sleeved joint		$ 3,92	4	$ 0,36	$ 3,56	$ -	$ -	$ 15,68	163
	Frame and Body	FR A0200	AA		Impact Attenuator		$ 11,52	1	$ -	$ 8,06	$ 3,45	$ -	$ 11,52	165
	Frame and Body	FR 02001	AA	Impact Attenuator	Impact Attenuator		$ 35,19	1	$ 7,01	$ 28,19	$ -	$ -	$ 35,19	166
	Frame and Body	FR A0300	AA		Pedal box		$ 52,47	1	$ 18,92	$ 25,47	$ 5,08	$ 3,00	$ 52,47	167
	Frame and Body	FR 03001	AA	Pedal box	Rail		$ 3,11	2	$ 0,84	$ 2,27	$ -	$ -	$ 6,22	169
	Frame and Body	FR 03002	AA	Pedal box	Brake pedal		$ 5,69	1	$ 1,14	$ 4,55	$ -	$ -	$ 5,69	171
	Frame and Body	FR 03003	AA	Pedal box	Accelerator Pedal		$ 4,84	1	$ 1,14	$ 3,70	$ -	$ -	$ 4,84	173
	Frame and Body	FR 03004	AA	Pedal box	Foot Top Support		$ 2,10	2	$ 0,31	$ 1,79	$ -	$ -	$ 4,20	175
	Frame and Body	FR 03005	AA	Pedal box	Heel Support		$ 2,02	2	$ 0,27	$ 1,74	$ -	$ -	$ 4,03	177
	Frame and Body	FR 03006	AA	Pedal box	Brake Pedal Support		$ 3,11	2	$ 0,46	$ 2,65	$ -	$ -	$ 6,22	179
	Frame and Body	FR 03007	AA	Pedal box	Brake over-travel switch support		$ 1,97	1	$ 0,07	$ 1,90	$ -	$ -	$ 1,97	181

	Frame and Body	FR 03008	AA	Pedal box	Accelerator pedal support		$ 2,00	2	$ 0,25	$ 1,75	$ -	$ -	$ 3,99	183
	Frame and Body	FR 03009	AA	Pedal box	Cable Support		$ 4,21	1	$ 0,12	$ 4,09	$ -	$ -	$ 4,21	185
	Frame and Body	FR 03010	AA	Pedal box	Rear Rail Mount		$ 0,86	4	$ 0,05	$ 0,81	$ -	$ -	$ 3,44	187
	Frame and Body	FR 03011	AA	Pedal box	Front Rail Mount		$ 0,80	4	$ 0,07	$ 0,73	$ -	$ -	$ 3,18	189
	Frame and Body	FR 03012	AA	Pedal box	Sheath for cable mount		$ 1,86	1	$ 0,07	$ 1,79	$ -	$ -	$ 1,86	191
	Frame and Body	FR A0400	AA		Floor Pan		$ 19,19	1	$ 0,12	$ 15,12	$ 0,62	$ 3,33	$ 19,19	193
	Frame and Body	FR 04001	AA	Floor Pan	Front Floor Pan Plate		$ 8,18	1	$ 4,65	$ 3,53	$ -	$ -	$ 8,18	194
	Frame and Body	FR 04002	AA	Floor Pan	Back Floor Pan Plate		$ 20,07	1	$ 14,85	$ 5,22	$ -	$ -	$ 20,07	196
	Frame and Body	FR 04003	AA	Floor Pan	Floor Pan Bracket		$ 0,51	10	$ 0,02	$ 0,48	$ -	$ -	$ 5,06	198
	Frame and Body	FR A0500	AA		Clutch actuation system		$ 22,05	1	$ 19,00	$ 2,60	$ 0,12	$ 0,33	$ 22,05	200
	Frame and Body	FR 05001	AA	Clutch actuation system	Lever Handle		$ 4,37	1	$ 0,93	$ 3,44	$ -	$ -	$ 4,37	201
	Frame and Body	FR 05002	AA	Clutch actuation system	Handle padding		$ 7,40	1	$ 0,33	$ 0,40	$ -	$ 6,67	$ 7,40	203
	Frame and Body	FR 05003	AA	Clutch actuation system	Clutch mount		$ 2,37	1	$ 0,10	$ 2,28	$ -	$ -	$ 2,37	204
	Frame and Body	FR 05004	AA	Clutch actuation system	Lever joint		$ 11,77	1	$ 0,56	$ 4,54	$ -	$ 6,67	$ 11,77	205
	Frame and Body	FR 05005	AA	Clutch actuation system	Actuation lever		$ 10,15	1	$ 0,63	$ 2,85	$ -	$ 6,67	$ 10,15	206
	Frame and Body	FR A0600	AA		Shifter		$ 111,59	1	$ 42,48	$ 26,22	$ 0,41	$ 42,48	$ 111,59	207
	Frame and Body	FR 06001	AA	Shifter	Engine gear boxx drum gear		$ 12,69	1	$ 0,54	$ 12,15	$ -	$ -	$ 12,69	209
	Frame and Body	FR 06002	AA	Shifter	Engine gear box shifting pinion shaft		$ 15,88	1	$ 0,67	$ 15,21	$ -	$ -	$ 15,88	210
	Frame and Body	FR 06003	AA	Shifter	Engine gear box actator tab		$ 1,60	1	$ 0,02	$ 1,58	$ -	$ -	$ 1,60	211
	Frame and Body	FR 06004	AA	Shifter	Front engine gearbox actuator mount		$ 2,82	1	$ 0,03	$ 2,79	$ -	$ -	$ 2,82	212
	Frame and Body	FR 06005	AA	Shifter	Rear engine gearbox actuator mount		$ 2,56	1	$ 0,02	$ 2,54	$ -	$ -	$ 2,56	214
	Frame and Body	FR 06006	AA	Shifter	Engine gearbox actuator coupling		$ 7,49	1	$ 0,40	$ 7,05	$ 0,04	$ -	$ 7,49	216
	Frame and Body	FR A0700	AA		Bodywork		$ 111,69	1	$ 11,66	$ 25,42	$ 71,95	$ 2,67	$ 111,69	217
	Frame and Body	FR 07001	AA	Bodywork	Nose		$ 261,59	1	$ 82,80	$ 160,92	$ -	$ 17,87	$ 261,59	218
	Frame and Body	FR 07002	AA	Bodywork	Left Inlet		$ 110,33	1	$ 28,20	$ 76,13	$ -	$ 6,00	$ 110,33	220
	Frame and Body	FR 07003	AA	Bodywork	Right Inlet		$ 110,33	1	$ 28,20	$ 76,13	$ -	$ 6,00	$ 110,33	222
	Frame and Body	FR 07004	AA	Bodywork	Front Side plate		$ 86,63	2	$ 12,96	$ 69,40	$ -	$ 4,27	$ 173,25	224
	Frame and Body	FR 07005	AA	Bodywork	Back Side Plate		$ 150,71	2	$ 27,00	$ 114,38	$ -	$ 9,33	$ 301,43	226
	Frame and Body	FR 07006	AA	Bodywork	Back Inlet Bracket		$ 1,08	2	$ 0,02	$ 1,06	$ -	$ -	$ 2,15	228
	Frame and Body	FR 07007	AA	Bodywork	Front Inlet Bracket		$ 1,08	2	$ 0,02	$ 1,06	$ -	$ -	$ 2,16	230
	Frame and Body	FR 07008	AA	Bodywork	Nose Bracket		$ 0,74	4	$ 0,02	$ 0,72	$ -	$ -	$ 2,95	232
	Frame and Body	FR A0800	AA		Gearshifting paddles		$ 8,84	1	$ 4,00	$ 4,68	$ 0,16	$ -	$ 8,84	234
	Frame and Body	FR 08001	AA	Gearshifting paddles	Paddles mount main part		$ 6,50	1	$ 0,69	$ 5,81	$ -	$ -	$ 6,50	235
	Frame and Body	FR 08002	AA	Gearshifting paddles	Paddles rockers		$ 4,63	2	$ 0,11	$ 4,52	$ -	$ -	$ 9,25	236
	Frame and Body	FR 08003	AA	Gearshifting paddles	Paddles		$ 4,03	2	$ 0,84	$ 3,20	$ -	$ -	$ 8,07	237
	Frame and Body				Area Total				$ 476,00	$ 1 709,98	$ 85,03	$ 196,21	$ 2 467,22	
	Electrical	EL A0100	AA		Rear firewall instruments and wires		$1 232,15	1	$ 1 130,85	$ 97,45	$ 1,85	$ 2,00	$ 1 232,15	239
	Electrical	EL 01001	AA	Rear firewall instruments a	Fuse box bracket		$ 0,88	2	$ 0,02	$ 0,87	$ -	$ -	$ 1,77	242
	Electrical	EL 01002	AA	Rear firewall instruments a	Ground bracket		$ 0,55	2	$ 0,01	$ 0,54	$ -	$ -	$ 1,09	244
	Electrical	EL 01003	AA	Rear firewall instruments a	Break light bracket		$ 0,82	2	$ 0,01	$ 0,82	$ -	$ -	$ 1,64	246
	Electrical	EL 01004	AA	Rear firewall instruments a	Master switch panel		$ 75,94	1	$ 73,60	$ 2,34	$ -	$ -	$ 75,94	248
	Electrical	EL 01005	AA	Rear firewall instruments a	Master switch panel bracket		$ 0,83	2	$ 0,01	$ 0,82	$ -	$ -	$ 1,65	249
	Electrical	EL 01006	AA	Rear firewall instruments a	Crash sensor bracket		$ 2,09	1	$ 0,07	$ 2,02	$ -	$ -	$ 2,09	251
	Electrical	EL A0200	AA		Front vehicule electronics		$ 160,80	1	$ 112,35	$ 47,48	$ 0,30	$ 0,67	$ 160,80	253
	Electrical	EL 02001	AA	Front vehicule electronics	Dashboard		$ 114,07	1	$ 65,73	$ 46,34	$ -	$ 2,00	$ 114,07	255
	Electrical	EL 02002	AA	Front vehicule electronics	Dashboard control electronics		$ 234,70	1	$ 135,00	$ 99,30	$ 0,40	$ -	$ 234,70	256
	Electrical	EL 02003	AA	Front vehicule electronics	Dashboard Tap		$ 1,85	1	$ 0,01	$ 1,85	$ -	$ -	$ 1,85	257
	Electrical	EL 02004	AA	Front vehicule electronics	Ground bracket		$ 0,55	2	$ 0,01	$ 0,54	$ -	$ -	$ 1,09	259
	Electrical	EL A0300	AA		Battery assembly		$ 89,55	1	$ 84,52	$ 4,19	$ 0,18	$ 0,67	$ 89,55	261
	Electrical	EL 03001	AA	Battery assembly	Main battery mount		$ 4,83	1	$ 0,97	$ 3,86	$ -	$ -	$ 4,83	262
	Electrical	EL 03002	AA	Battery assembly	Side battery mount		$ 3,66	2	$ 0,26	$ 3,40	$ -	$ -	$ 7,31	264
	Electrical	EL 03003	AA	Battery assembly	Battery bracket		$ 0,59	3	$ 0,01	$ 0,58	$ -	$ -	$ 1,76	266
	Electrical				Area Total				$ 1 603,70	$ 320,54	$ 2,73	$ 5,33	$ 1 932,30	
	Miscellaneous, Finish &	MS A0100	AA		Firewall		$ 55,47	1	$ 0,29	$ 42,62	$ 3,23	$ 9,33	$ 55,47	269
	Miscellaneous, Finish &	MS 01001	AA	Firewall	Firewall Up		$ 9,27	1	$ 4,95	$ 4,31	$ -	$ -	$ 9,27	271
	Miscellaneous, Finish &	MS 01002	AA	Firewall	Firewall Middle		$ 7,54	1	$ 4,30	$ 3,25	$ -	$ -	$ 7,54	273
	Miscellaneous, Finish &	MS 01003	AA	Firewall	Firewall Bottom		$ 11,14	1	$ 6,83	$ 4,31	$ -	$ -	$ 11,14	275
	Miscellaneous, Finish &	MS 01004	AA	Firewall	Firewall Upper Side		$ 3,17	2	$ 1,24	$ 1,93	$ -	$ -	$ 6,34	277
	Miscellaneous, Finish &	MS 01005	AA	Firewall	Firewall Middle Side		$ 2,15	2	$ 0,51	$ 1,64	$ -	$ -	$ 4,30	279
	Miscellaneous, Finish &	MS 01006	AA	Firewall	Firewall Lower Side		$ 4,08	2	$ 1,99	$ 2,09	$ -	$ -	$ 8,15	281

	Miscellaneous, Finish &	MS 01007	AA	Firewall	Firewall Up Bracket		$ 0,62	4	$ 0,01	$ 0,61	$ -	$ -	$ 2,47	283
	Miscellaneous, Finish &	MS 01008	AA	Firewall	Firewall Middle, Bottom and Sides Bracket		$ 0,38	24	$ 0,01	$ 0,37	$ -	$ -	$ 9,10	285
	Miscellaneous, Finish &	MS A0200	AA		Driver's Safety		$ 0,78	1	$ -	$ 0,62	$ 0,16	$ -	$ 0,78	287
	Miscellaneous, Finish &	MS 02001	AA	Driver's Safety	Rollbar padding		$ 3,92	2	$ 1,10	$ 2,82	$ -	$ -	$ 7,84	288
	Miscellaneous, Finish &	MS A0300	AA		Head Restraint		$ 31,54	1	$ 11,22	$ 20,32	$ -	$ -	$ 31,54	289
	Miscellaneous, Finish &	MS A0400	AA		Driver's seat		$ 4,74	1	$ 0,04	$ 2,80	$ 0,56	$ 1,33	$ 4,74	290
	Miscellaneous, Finish &	MS 04001	AA	Driver's seat	Seat		$ 74,60	1	$ 18,80	$ 54,60	$ -	$ 1,20	$ 74,60	291
	Miscellaneous, Finish &	MS 04002	AA	Driver's seat	Rear seat bracket		$ 1,32	2	$ 0,01	$ 1,31	$ -	$ -	$ 2,65	292
	Miscellaneous, Finish &	MS 04003	AA	Driver's seat	Front seat bracket		$ 1,19	2	$ 0,02	$ 1,17	$ -	$ -	$ 2,37	294
	Miscellaneous, Finish &	MS A0500	AA		Harness		$ 53,65	1	$ 45,06	$ 4,92	$ 3,00	$ 0,67	$ 53,65	296
	Miscellaneous, Finish &	MS 05001	AA	Harness	Harness bracket		$ 1,25	2	$ 0,09	$ 1,16			$ 2,50	297
	Miscellaneous, Finish & Assembly				Area Total				$ 101,75	$ 173,21	$ 6,95	$ 12,53	$ 294,44	
	Steering System	ST A0100	AA		Steering Rack		$ 38,42	1	$ 19,60	$ 17,36	$ 0,80	$ 0,67	$ 38,42	300
	Steering System	ST 01001	AA	Steering Rack	Rack pinion		$ 7,97	1	$ 1,04	$ 6,93	$ -	$ -	$ 7,97	302
	Steering System	ST 01002	AA	Steering Rack	Rack		$ 6,04	1	$ 1,22	$ 4,82	$ -	$ -	$ 6,04	303
	Steering System	ST 01003	AA	Steering Rack	Upper Pinion housing		$ 2,57	1	$ 0,26	$ 2,31	$ -	$ -	$ 2,57	304
	Steering System	ST 01004	AA	Steering Rack	Lower Pinion housing		$ 6,26	1	$ 1,05	$ 5,20	$ -	$ -	$ 6,26	305
	Steering System	ST 01005	AA	Steering Rack	Rack housing support		$ 2,35	2	$ 0,42	$ 1,93	$ -	$ -	$ 4,70	306
	Steering System	ST 01006	AA	Steering Rack	Tie rod Braces		$ 2,39	2	$ 0,30	$ 2,09	$ -	$ -	$ 4,78	307
	Steering System	ST 01007	AA	Steering Rack	Rack housing		$ 65,59	1	$ 55,07	$ 10,51	$ -	$ -	$ 65,59	308
	Steering System	ST 01008	AA	Steering Rack	Steering Brackets tie		$ 1,58	4	$ 0,13	$ 1,45	$ -	$ -	$ 6,34	309
	Steering System	ST 01009	AA	Steering Rack	Steering Brackets		$ 1,60	2	$ 0,17	$ 1,43	$ -	$ -	$ 3,19	311
	Steering System	ST 01010	AA	Steering Rack	Rack protection		$ 7,62	1	$ 3,08	$ 4,54	$ -	$ -	$ 7,62	313
	Steering System	ST 01011	AA	Steering Rack	Rack protection Brackets		$ 0,38	4	$ 0,01	$ 0,37	$ -	$ -	$ 1,52	314
	Steering System	ST A0200	AA		Steering Column assy		$ 54,19	1	$ 42,22	$ 9,13	$ 0,18	$ 2,67	$ 54,19	316
	Steering System	ST 02001	AA	Steering Column Assy	Spline coupler		$ 3,63	1	$ 0,26	$ 3,37	$ -	$ -	$ 3,63	318
	Steering System	ST 02002	AA	Steering Column Assy	Steering Column tube		$ 2,11	1	$ 0,51	$ 1,60	$ -	$ -	$ 2,11	319
	Steering System	ST 02003	AA	Steering Column Assy	Steering Upper Shaft Pivot		$ 6,29	1	$ 0,81	$ 5,48	$ -	$ -	$ 6,29	320
	Steering System	ST 02004	AA	Steering Column Assy	Steering Bore		$ 9,26	1	$ 1,27	$ 7,99	$ -	$ -	$ 9,26	322
	Steering System	ST 02005	AA	Steering Column Assy	Steering Bore Support		$ 1,46	2	$ 0,35	$ 1,12	$ -	$ -	$ 2,93	323
	Steering System	ST A0300	AA		Quick Release		$ 1,74	1	$ 1,24	$ 0,32	$ 0,18	$ -	$ 1,74	325
	Steering System	ST 03001	AA	Quick Release	Quick Release Steel Sleeve		$ 12,88	1	$ 1,08	$ 11,80	$ -	$ -	$ 12,88	326
	Steering System	ST 03002	AA	Quick Release	Quick Release Fixed Part		$ 15,47	1	$ 2,48	$ 12,99	$ -	$ -	$ 15,47	327
	Steering System	ST 03003	AA	Quick Release	Quick Release Sliding Part		$ 12,94	1	$ 1,77	$ 11,17	$ -	$ -	$ 12,94	328
	Steering System	ST A0400	AA		Steering Wheel Assy		$ 2,69	1	$ -	$ 2,25	$ 0,44	$ -	$ 2,69	329
	Steering System	ST 04001	AA	Steering Wheel Assy	Steering Wheel		$ 16,34	1	$ 3,78	$ 12,56	$ -	$ -	$ 16,34	330
	Steering System	ST 04002	AA	Steering Wheel Assy	Aluminium spacer		$ 3,07	1	$ 0,62	$ 2,45	$ -	$ -	$ 3,07	331
	Steering System	ST A0500	AA		Steering rod		$ 8,55	2	$ 3,88	$ 4,37	$ 0,31	$ -	$ 17,10	333
	Steering System	ST 05001	AA	Steering rod	Steering rod tube		$ 9,79	2	$ 8,70	$ 1,09	$ -	$ -	$ 19,58	334
	Steering System	ST 05002	AA	Steering rod	Steering rod insert		$ 2,31	2	$ 0,29	$ 2,02	$ -	$ -	$ 4,63	335
	Steering System	ST 05003	AA	Steering rod	Spacer		$ 0,34	8	$ 0,03	$ 0,31	$ -	$ -	$ 2,69	337
	Steering System				Area Total				$ 166,39	$ 170,60	$ 2,20	$ 3,33	$ 342,53	
	Suspension & Shocks	SU A0100	AA		Upper Front A-arm		$ 38,58	2	$ 20,76	$ 16,03	$ 0,45	$ 1,33	$ 77,16	340
	Suspension & Shocks	SU_01001	AA	Upper Front A-arm	Upper Front Bearing Support		$ 15,09	2	$ 2,70	$ 12,39	$ -	$ -	$ 30,18	342
	Suspension & Shocks	SU_01002	AA	Upper Front A-arm	Inner Bearing Support		$ 1,87	4	$ 0,86	$ 1,01	$ -	$ -	$ 7,49	344
	Suspension & Shocks	SU_01003	AA	Upper Front A-arm	Upper Front A-arm tube (Front) Carbon Fiber Tube		$ 8,88	2	$ 7,89	$ 0,99	$ -	$ -	$ 17,75	346
	Suspension & Shocks	SU_01004	AA	Upper Front A-arm	Upper Front A-arm tube (Back) Carbon Fiber Tube		$ 7,19	2	$ 6,39	$ 0,80	$ -	$ -	$ 14,38	347
	Suspension & Shocks	SU_01005	AA	Upper Front A-arm	Spacer 1		$ 0,99	4	$ 0,04	$ 0,95	$ -	$ -	$ 3,96	348
	Suspension & Shocks	SU_01006	AA	Upper Front A-arm	Spacer 2		$ 0,32	8	$ 0,14	$ 0,18	$ -	$ -	$ 2,59	350
	Suspension & Shocks	SU_01007	AA	Upper Front A-arm	Outboard A-arm Insert		$ 0,48	4	$ 0,08	$ 0,40	$ -	$ -	$ 1,91	352
	Suspension & Shocks	SU_01008	AA	Upper Front A-arm	Front up bracket		$ 1,39	2	$ 0,15	$ 1,25	$ -	$ -	$ 2,79	355
	Suspension & Shocks	SU_01009	AA	Upper Front A-arm	Front down bracket		$ 1,36	2	$ 0,15	$ 1,21	$ -	$ -	$ 2,72	357
	Suspension & Shocks	SU_01010	AA	Upper Front A-arm	Rear up bracket		$ 1,31	2	$ 0,12	$ 1,19	$ -	$ -	$ 2,63	359
	Suspension & Shocks	SU_01011	AA	Upper Front A-arm	Rear down bracket		$ 1,33	2	$ 0,14	$ 1,19	$ -	$ -	$ 2,66	361
	Suspension & Shocks	SU A0200	AA		Lower Front A-arm		$ 38,58	2	$ 20,76	$ 16,03	$ 0,45	$ 1,33	$ 77,16	363
	Suspension & Shocks	SU 02001	AA	Lower Front A-arm	Lower Front Bearing Support		$ 9,11	2	$ 4,20	$ 4,91	$ -	$ -	$ 18,23	365
	Suspension & Shocks	SU 02002	AA	Lower Front A-arm	Inner Bearing Support		$ 1,87	4	$ 0,86	$ 1,01	$ -	$ -	$ 7,49	367
	Suspension & Shocks	SU_02003	AA	Lower Front A-arm	Lower Front A-arm tube (Front) Carbon Fiber Tube		$ 11,22	2	$ 9,97	$ 1,25	$ -	$ -	$ 22,44	369
	Suspension & Shocks	SU_02004	AA	Lower Front A-arm	Lower Front A-arm tube (Back) Carbon Fiber Tube		$ 10,00	2	$ 8,89	$ 1,11	$ -	$ -	$ 20,00	370
	Suspension & Shocks	SU_02005	AA	Lower Front A-arm	Spacer 1		$ 0,91	4	$ 0,03	$ 0,88	$ -	$ -	$ 3,63	371

	Suspension & Shocks	SU_02006	AA	Lower Front A-arm	Spacer 2		$ 0,32	8	$ 0,14	$ 0,18	$ -	$ -	$ 2,59	373
	Suspension & Shocks	SU_02007	AA	Lower Front A-arm	Outboard A-arm Insert		$ 0,48	4	$ 0,08	$ 0,40	$ -	$ -	$ 1,91	375
	Suspension & Shocks	SU_02008	AA	Lower Front A-arm	Front up bracket		$ 1,39	2	$ 0,12	$ 1,26	$ -	$ -	$ 2,77	377
	Suspension & Shocks	SU_02009	AA	Lower Front A-arm	Front down bracket		$ 1,44	2	$ 0,16	$ 1,27	$ -	$ -	$ 2,87	379
	Suspension & Shocks	SU_02010	AA	Lower Front A-arm	Rear Up bracket		$ 1,33	2	$ 0,10	$ 1,24	$ -	$ -	$ 2,66	381
	Suspension & Shocks	SU_02011	AA	Lower Front A-arm	Rear down bracket		$ 1,42	2	$ 0,15	$ 1,27	$ -	$ -	$ 2,83	383
	Suspension & Shocks	SU A0300	AA		Upper Back A-arm		$ 38,58	2	$ 20,76	$ 16,03	$ 0,45	$ 1,33	$ 77,16	385
	Suspension & Shocks	SU 03001	AA	Upper Back A-arm	Upper Back Bearing Support		$ 16,49	2	$ 2,49	$ 13,99	$ -	$ -	$ 32,97	387
	Suspension & Shocks	SU 03002	AA	Upper Back A-arm	Inner Bearing Support		$ 1,87	4	$ 0,86	$ 1,01	$ -	$ -	$ 7,49	389
	Suspension & Shocks	SU 03003	AA	Upper Back A-arm	Upper Back A-arm tube (Front) Carbon Fiber Tube		$ 10,88	2	$ 9,67	$ 1,21	$ -	$ -	$ 21,75	391
	Suspension & Shocks	SU 03004	AA	Upper Back A-arm	Upper Back A-arm tube (Back) Carbon Fiber Tube		$ 4,34	2	$ 3,86	$ 0,48	$ -	$ -	$ 8,69	392
	Suspension & Shocks	SU 03005	AA	Upper Back A-arm	Spacer 1		$ 0,72	4	$ 0,02	$ 0,70	$ -	$ -	$ 2,88	393
	Suspension & Shocks	SU 03006	AA	Upper Back A-arm	Spacer 2		$ 0,32	8	$ 0,14	$ 0,18	$ -	$ -	$ 2,59	395
	Suspension & Shocks	SU 03007	AA	Upper Back A-arm	Outboard A-arm Insert		$ 0,48	4	$ 0,08	$ 0,40	$ -	$ -	$ 1,91	397
	Suspension & Shocks	SU 03008	AA	Upper Back A-arm	Front up bracket		$ 1,50	2	$ 0,20	$ 1,30	$ -	$ -	$ 2,99	399
	Suspension & Shocks	SU 03009	AA	Upper Back A-arm	Front down bracket		$ 1,49	2	$ 0,19	$ 1,30	$ -	$ -	$ 2,98	401
	Suspension & Shocks	SU 03010	AA	Upper Back A-arm	Rear up bracket		$ 1,27	2	$ 0,07	$ 1,19	$ -	$ -	$ 2,54	403
	Suspension & Shocks	SU 03011	AA	Upper Back A-arm	Rear down bracket		$ 1,38	2	$ 0,13	$ 1,25	$ -	$ -	$ 2,76	405
	Suspension & Shocks	SU A0400	AA		Lower Back A-arm		$ 38,58	2	$ 20,76	$ 16,03	$ 0,45	$ 1,33	$ 77,16	407
	Suspension & Shocks	SU 04001	AA	Lower Back A-arm	Lower Back Bearing Support		$ 8,95	2	$ 4,20	$ 4,75	$ -	$ -	$ 17,91	409
	Suspension & Shocks	SU_04002	AA	Lower Back A-arm	Inner Bearing Support		$ 1,87	4	$ 0,86	$ 1,01	$ -	$ -	$ 7,49	411
	Suspension & Shocks	SU_04003	AA	Lower Back A-arm	Lower Back A-arm tube (Front) Carbon Fiber Tube		$ 12,03	2	$ 10,70	$ 1,34	$ -	$ -	$ 24,07	413
	Suspension & Shocks	SU_04004	AA	Lower Back A-arm	Lower Back A-arm tube (Back) Carbon Fiber Tube		$ 7,41	2	$ 6,58	$ 0,82	$ -	$ -	$ 14,82	414
	Suspension & Shocks	SU_04005	AA	Lower Back A-arm	Spacer 1		$ 1,63	4	$ 0,03	$ 1,60	$ -	$ -	$ 6,51	415
	Suspension & Shocks	SU_04006	AA	Lower Back A-arm	Spacer 2		$ 0,81	8	$ 0,14	$ 0,66	$ -	$ -	$ 6,44	417
	Suspension & Shocks	SU_04007	AA	Lower Back A-arm	Outboard A-arm Insert		$ 0,48	4	$ 0,08	$ 0,40	$ -	$ -	$ 1,91	419
	Suspension & Shocks	SU 04008	AA	Lower Back A-arm	Front up bracket		$ 1,39	2	$ 0,13	$ 1,26	$ -	$ -	$ 2,78	421
	Suspension & Shocks	SU 04009	AA	Lower Back A-arm	Front down bracket		$ 1,38	2	$ 0,13	$ 1,25	$ -	$ -	$ 2,76	423
	Suspension & Shocks	SU 04010	AA	Lower Back A-arm	Rear up bracket		$ 1,81	2	$ 0,30	$ 1,52	$ -	$ -	$ 3,63	425
	Suspension & Shocks	SU 04011	AA	Lower Back A-arm	Rear down bracket		$ 1,90	2	$ 0,36	$ 1,54	$ -	$ -	$ 3,80	427
	Suspension & Shocks	SU A0500	AA		Front suspension		$ 332,70	2	$ 330,04	$ 2,12	$ 0,20	$ 0,33	$ 665,39	429
	Suspension & Shocks	SU 05001	AA	Front suspension	Shock Front Bracket		$ 5,92	2	$ 0,39	$ 5,54	$ -	$ -	$ 11,85	430
	Suspension & Shocks	SU A0600	AA		Front Bell Crank		$ 2,27	2	$ 0,09	$ 1,59	$ 0,25	$ 0,33	$ 4,54	432
	Suspension & Shocks	SU 06001	AA	Front Bell Cranck	Rocker bushing		$ 1,37	4	$ 0,05	$ 1,33	$ -	$ -	$ 5,48	433
	Suspension & Shocks	SU 06002	AA	Front Bell Cranck	Rocker spacer		$ 1,54	2	$ 0,05	$ 1,49	$ -	$ -	$ 3,09	434
	Suspension & Shocks	SU 06003	AA	Front Bell Cranck	Sheets of metal for rocker		$ 0,88	4	$ 0,40	$ 0,48	$ -	$ -	$ 3,53	435
	Suspension & Shocks	SU 06004	AA	Front Bell Cranck	Front rocker mount		$ 2,27	4	$ 0,11	$ 2,16	$ -	$ -	$ 9,08	437
	Suspension & Shocks	SU A0700	AA		Rear suspension		$ 335,02	2	$ 330,04	$ 4,24	$ 0,41	$ 0,33	$ 670,04	439
	Suspension & Shocks	SU 07001	AA	Rear suspension	Shock rear Bracket		$ 5,92	2	$ 0,39	$ 5,54	$ -	$ -	$ 11,85	441
	Suspension & Shocks	SU A0800	AA		Rear Bell Cranck		$ 4,82	2	$ 0,20	$ 3,50	$ 0,12	$ 1,00	$ 9,64	441
	Suspension & Shocks	SU 08001	AA	Rear Bell Cranck	Rocker bushing		$ 1,37	4	$ 0,05	$ 1,33	$ -	$ -	$ 5,48	442
	Suspension & Shocks	SU 08002	AA	Rear Bell Cranck	Sheets of metal for rocker		$ 2,06	4	$ 0,34	$ 1,72	$ -	$ -	$ 8,26	443
	Suspension & Shocks	SU 08003	AA	Rear Bell Cranck	Rear rocker mount		$ 3,38	2	$ 0,82	$ 2,56	$ -	$ -	$ 6,76	444
	Suspension & Shocks	SU A0900	AA		Rear Tie rod		$ 13,66	2	$ 5,00	$ 8,10	$ 0,56	$ -	$ 27,31	446
	Suspension & Shocks	SU 09001	AA	Rear Tie rod	Tie rod tube		$ 9,07	2	$ 8,06	$ 1,01	$ -	$ -	$ 18,14	447
	Suspension & Shocks	SU 09002	AA	Rear Tie rod	Tie rod insert		$ 1,58	4	$ 0,29	$ 1,29	$ -	$ -	$ 6,33	448
	Suspension & Shocks	SU 09003	AA	Rear Tie rod	Spacer 1		$ 0,24	4	$ 0,06	$ 0,18	$ -	$ -	$ 0,96	450
	Suspension & Shocks	SU 09004	AA	Rear Tie rod	Spacer 2		$ 1,06	4	$ 0,11	$ 0,95	$ -	$ -	$ 4,25	452
	Suspension & Shocks	SU A1000	AA		Front Uprights		$ 16,48	2	$ -	$ 15,46	$ 1,02	$ -	$ 32,96	454
	Suspension & Shocks	SU 10001	AA	Front Uprights	Front Upright		$ 106,19	2	$ 28,70	$ 77,48	$ -	$ -	$ 212,37	455
	Suspension & Shocks	SU 10002	AA	Front Uprights	Upper Arm Wedge		$ 2,51	2	$ 0,22	$ 2,29	$ -	$ -	$ 5,01	457
	Suspension & Shocks	SU 10003	AA	Front Uprights	Upper Arm Bracket		$ 18,68	2	$ 2,78	$ 15,90	$ -	$ -	$ 37,36	459
	Suspension & Shocks	SU 10004	AA	Front Uprights	Speed Sensor Bracket		$ 0,84	2	$ 0,02	$ 0,81	$ -	$ -	$ 1,67	461
	Suspension & Shocks	SU 10005	AA	Front Uprights	Camber adjustment shim		$ 0,43	30	$ 0,06	$ 0,36	$ -	$ -	$ 12,81	463
	Suspension & Shocks	SU A1100	AA		Rear Uprights		$ 17,41	2	$ -	$ 16,33	$ 1,08	$ -	$ 34,82	465
	Suspension & Shocks	SU 11001	AA	Rear Uprights	Rear Upright		$ 106,52	2	$ 25,84	$ 80,68	$ -	$ -	$ 213,04	466
	Suspension & Shocks	SU 11002	AA	Rear Uprights	Upper Arm Bracket		$ 21,19	2	$ 3,31	$ 17,89	$ -	$ -	$ 42,39	469
	Suspension & Shocks	SU 11003	AA	Rear Uprights	Speed Sensor Bracket		$ 0,83	2	$ 0,02	$ 0,80	$ -	$ -	$ 1,65	471
	Suspension & Shocks	SU 11004	AA	Rear Uprights	Camber adjustment shim		$ 0,42	30	$ 0,07	$ 0,35	$ -	$ -	$ 12,74	473
	Suspension & Shocks	SU A1200	AA		Front Pullrod		$ 9,85	2	$ 5,00	$ 4,37	$ 0,49	$ -	$ 19,70	475

	Suspension & Shocks	SU 12001	AA	Front Pullrod	Pullrod tube		$ 9,07	2	$ 8,06	$ 1,01	$ -	$ -	$ 18,14	476
	Suspension & Shocks	SU 12002	AA	Front Pullrod	Pullrod insert		$ 1,58	4	$ 0,29	$ 1,29	$ -	$ -	$ 6,33	477
	Suspension & Shocks	SU 12003	AA	Front Pullrod	Spacer 1		$ 0,35	4	$ 0,02	$ 0,33	$ -	$ -	$ 1,39	479
	Suspension & Shocks	SU 12004	AA	Front Pullrod	Spacer 2		$ 0,36	4	$ 0,02	$ 0,34	$ -	$ -	$ 1,46	481
	Suspension & Shocks	SU A1300	AA		Rear Pushrod		$ 9,46	2	$ 5,00	$ 3,97	$ 0,49	$ -	$ 18,91	483
	Suspension & Shocks	SU 13001	AA	Rear Pushrod	Steel cylinder for pushrod		$ 1,45	2	$ 0,10	$ 1,35	$ -	$ -	$ 2,90	484
	Suspension & Shocks	SU 13002	AA	Rear Pushrod	Spacer		$ 0,36	8	$ 0,02	$ 0,34	$ -	$ -	$ 2,91	486
	Suspension & Shocks				Area Total				$ 1 865,80	$ 924,03	$ 12,84	$ 14,67	$ 2 817,33	
	Wheels, Wheel Bearing	WT A0100	AA		Wheel Assembly		$ 175,23	4	$ 170,00	$ 3,63	$ 1,60	$ -	$ 700,92	489
	Wheels, Wheel Bearing	WT A0200	AA		Front Hubs		$ 249,36	2	$ 243,47	$ 1,63	$ 4,26	$ -	$ 498,73	490
	Wheels, Wheel Bearing	WT 02001	AA	Front Hubs	Front Hub		$ 64,16	2	$ 13,75	$ 50,41	$ -	$ -	$ 128,32	491
	Wheels, Wheel Bearing	WT 02002	AA	Front Hubs	Wheel bearing spacer		$ 2,62	2	$ 0,24	$ 2,38	$ -	$ -	$ 5,24	493
	Wheels, Wheel Bearing	WT 02003	AA	Front Hubs	Front Wheel Spacer		$ 20,68	2	$ 3,63	$ 17,05	$ -	$ -	$ 41,35	495
	Wheels, Wheel Bearing	WT 02004	AA	Front Hubs	Speed sensor spacer		$ 0,95	2	$ 0,05	$ 0,90	$ -	$ -	$ 1,90	497
	Wheels, Wheel Bearing	WT 02005	AA	Front Hubs	Speed Sensor Disc		$ 3,97	2	$ 0,45	$ 3,52	$ -	$ -	$ 7,94	499
	Wheels, Wheel Bearing	WT A0300	AA		Rear Hubs		$ 205,24	2	$ 199,53	$ 1,44	$ 4,26	$ -	$ 410,47	501
	Wheels, Wheel Bearing	WT 03001	AA	Rear Hubs	Rear Hub		$ 52,73	2	$ 12,06	$ 40,67	$ -	$ -	$ 105,46	502
	Wheels, Wheel Bearing	WT 03002	AA	Rear Hubs	Wheel bearing spacer		$ 3,97	2	$ 0,67	$ 3,30	$ -	$ -	$ 7,94	504
	Wheels, Wheel Bearing	WT 03003	AA	Rear Hubs	Rear Wheel Spacer		$ 22,32	2	$ 3,63	$ 18,69	$ -	$ -	$ 44,63	506
	Wheels, Wheel Bearing	WT 03004	AA	Rear Hubs	Tripod housing spacer		$ 3,90	2	$ 0,66	$ 3,24	$ -	$ -	$ 7,81	508
	Wheels, Wheel Bearing	WT 03005	AA	Rear Hubs	Speed Sensor Disc		$ 3,23	2	$ 0,35	$ 2,88	$ -	$ -	$ 6,45	510
	Wheels, Wheel Bearings and Tires				Area Total				$ 1 636,97	$ 306,75	$ 23,45	$ -	$ 1 967,17	

Ecurie Piston Sport Auto

ÉCOLE CENTRALE LYON

CAR #81

BRAKE SYSTEM

University	Ecole Centrale de Lyon
System	Brake System
Assembly	Front Brake Rotor
P/N Base	BR A0100
Suffix	AA
Details	Front Brake Rotor assembly

Back to BOM

Car #	81
FileLink1	
FileLink2	
FileLink3	

Asm Cost	$ 101,33
Qty	2
Extended Cost	$ 202,65

ItemOrder	Part	Part Cost	Quantity	Sub Total
10	Brake Rotor	$ 3,39	1	$ 3,39
20	Brake Shrink Disc	$ 6,02	1	$ 6,02
30	Brake Bobbin	$ 0,27	6	$ 1,61
40	Brake Caliper Spacer	$ 0,28	2	$ 0,56
			Sub Total	$ 11,58

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Brake Caliper, Beringer 2D1	Brake Caliper (in reality Beringer 2P1A is used)	$ 83,00		unit							1	$ 83,00
20	Brake Pad, Iron or Steel Rotor	Brake Pad	$ 0,00	4 272,39	mm^3			Circular sector	1,424E-03	0,003		2	$ 1,71
												Sub Total	$ 84,71

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Assemble, 1kg, Line on Line	Line up Pad	$ 0,13	unit	2			$ 0,26
20	Assemble, 1kg, Loose	Insert Bobbins and Washer	$ 0,06	unit	6			$ 0,36
30	Assemble, 1kg, Line on Line	Assemble Brake Rotor and Shrink Disc	$ 0,13	unit	1			$ 0,13
40	Assemble, 1kg, Line on Line	Insert Retaining Ring	$ 0,13	unit	6			$ 0,78
50	Assemble, 1kg, Line on Line	Assemble Brake Rotor onto Hub	$ 0,13	unit	1			$ 0,13
60	Assemble, 1kg, Loose	Put Caliper and Spacer in place	$ 0,06	unit	1			$ 0,06
70	Ratchet <= 25.4 mm	Bolt Caliper and Spacer on Upright	$ 0,75	unit	2			$ 1,50
80	Safety Wire, Install	For Caliper Bolts locking device	$ 0,60	unit	2			$ 1,20
							Sub Total	$ 4,42

ItemOrder	Fastener	Use	UnitCost	Size1	Unit1	Size2	Unit2	Quantity	Sub Total
10	Bolt,Grade 8.8 (SAE)	Bolt Caliper on Upright	$ 0,12	8	mm	30	mm	2	$ 0,24
20	Washer, Grade 8.8 (SAE 5)	Bolt Caliper on Upright	$ 0,01	8	mm			2	$ 0,02
30	Retaining Ring, External	Secure Brake Bobbin on Brake Rotor	$ 0,04	11,5	mm			6	$ 0,24
40	Washer, Grade 8.8 (SAE 5)	Shim between Brake Bobbin and Brake Rotor	$ 0,01	12	mm			12	$ 0,12
								Sub Total	$ 0,61

University	Ecole Centrale de Lyon
System	Brake System
Assembly	Front Brake Rotor
Part	Brake Rotor
P/N Base	BR 01001
Suffix	AA
Details	Bought, cost as made

Back to BOM

FileLink1	
FileLink2	
FileLink3	

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 3,39
Qty	1
Extended Cost	$ 3,39

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Cast Iron (per kg)	Stock material for part	$ 1,00	1,467	kg			Circle area, 230mm diameter	0,042	0,005	7850	1	$ 1,47
												Sub Total	**$ 1,47**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Setup for laser cut	$ 1,30	unit	1	4 parts cut from a single machine setup	0,25	$ 0,33
20	Laser Cut	Cutout shape	$ 0,01	cm	63,95	Material - Cast Iron	2,5	$ 1,60
							Sub Total	**$ 1,92**

University	Ecole Centrale de Lyon
System	Brake System
Assembly	Front Brake Rotor
Part	Brake Shrink Disc
P/N Base	BR 01002
Suffix	AA
Details	Allows brake rotor to be mounted floating

FileLink1	Drawing
FileLink2	
FileLink3	

Back to BOM

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 6,02
Qty	1
Extended Cost	$ 6,02

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Mild (per kg)	Stock material for part	$ 2,25	0,839	kg			Circle Area, 164.95mm diameter	2,14E-02	0,005	7850	1	$ 1,89
												Sub Total	**$ 1,89**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Setup for laser cutting	$ 1,30	unit	1	4 parts cut from a single machine setup	0,25	$ 0,33
20	Laser Cut	Cutout shape	$ 0,01	cm	126,9	Material - Steel	3	$ 3,81
							Sub Total	**$ 4,13**

Drawing part : BR 01002

University	Ecole Centrale de Lyon
System	Brake System
Assembly	Front Brake Rotor
Part	Brake Bobbin
P/N Base	BR 01003
Suffix	AA
Details	Bobbins between Brake Rotor and Brake Shrink Disc

Back to BOM

FileLink1	
FileLink2	
FileLink3	

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 0,27
Qty	6
Extended Cost	$ 1,61

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Mild (per kg)	Material for Bobbin	$ 2,25	0,016	kg			Circle Area, 17mm diameter	2,270E-04	0,009	7850	1	$ 0,04
												Sub Total	$ 0,04

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Setup for machining	$ 1,30	unit	1	24 parts made from one machining setup	0,04	$ 0,05
20	Machining		$ 0,04	cm^3	1,486	Material - Steel	3	$ 0,18
							Sub Total	$ 0,23

University	Ecole Centrale de Lyon
System	Brake System
Assembly	Front Brake Rotor
Part	Brake Caliper Spacer
P/N Base	BR 01004
Suffix	AA
Details	Spacer between Caliper and Upright

Back to BOM

FileLink1	Drawing
FileLink2	
FileLink3	

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 0,28
Qty	2
Extended Cost	$ 0,56

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Mild (per kg)	Stock material for caliper spacer	$ 2,25	0,018	kg			Circular, 17mm diameter	2,27E-04	0,010	7850	1	$ 0,04
												Sub Total	**$ 0,04**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Setup for laser cut	$ 1,30	unit	1	8 parts cut from a single machine setup	0,125	$ 0,16
20	Laser Cut	Cutout shape	$ 0,01	cm	2,639	Material - Steel	3	$ 0,08
							Sub Total	**$ 0,24**

Drawing part : BR 01004

University	Ecole Centrale de Lyon
System	Brake System
Assembly	Rear Brake Rotor
P/N Base	BR A0200
Suffix	AA
Details	Rear Brake Rotor assembly

Back to BOM

Car #	81
FileLink1	
FileLink2	
FileLink3	

Asm Cost	$ 101,46
Qty	2
Extended Cost	$ 202,92

ItemOrder	Part	Part Cost	Quantity	Sub Total
10	Brake Rotor	$ 3,39	1	$ 3,39
20	Brake Shrink Disc	$ 6,15	1	$ 6,15
30	Brake Bobbin	$ 0,27	6	$ 1,61
40	Brake Caliper Spacer	$ 0,28	2	$ 0,56
			Sub Total	$ 11,72

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Brake Caliper, Beringer 2D1	Brake Caliper (in reality Beringer 2P1A is used)	$ 83,00		unit							1	$ 83,00
20	Brake Pad, Iron or Steel Rotor	Brake Pad	$ 0,00	4 272,39	mm^3			Circular sector	1,424E-03	0,003		2	$ 1,71
												Sub Total	$ 84,71

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Assemble, 1kg, Line on Line	Line up Pad	$ 0,13	unit	2			$ 0,26
>	Assemble, 1kg, Loose	Insert Bobbins and Washer	$ 0,06	unit	6			$ 0,36
30	Assemble, 1kg, Line on Line	Assemble Brake Rotor and Shrink Disc	$ 0,13	unit	1			$ 0,13
40	Assemble, 1kg, Line on Line	Insert Retaining Ring	$ 0,13	unit	6			$ 0,78
50	Assemble, 1kg, Line on Line	Assemble Brake Rotor onto Hub	$ 0,13	unit	1			$ 0,13
60	Assemble, 1kg, Loose	Put Caliper and Spacer in place	$ 0,06	unit	1			$ 0,06
70	Ratchet <= 25.4 mm	Bolt Caliper and Spacer on Upright	$ 0,75	unit	2			$ 1,50
80	Safety Wire, Install	For Caliper Bolts locking device	$ 0,60	unit	2			$ 1,20
							Sub Total	$ 4,42

ItemOrder	Fastener	Use	UnitCost	Size1	Unit1	Size2	Unit2	Quantity	Sub Total
10	Bolt,Grade 8.8 (SAE)	Bolt Caliper on Upright	$ 0,12	8	mm	30	mm	2	$ 0,24
20	Washer, Grade 8.8 (SAE 5)	Bolt Caliper on Upright	$ 0,01	8	mm			2	$ 0,02
30	Retaining Ring, External	Secure Brake Bobbin on Brake Rotor	$ 0,04	11,5	mm			6	$ 0,24
40	Washer, Grade 8.8 (SAE 5)	Shim between Brake Bobbin and Brake Rotor	$ 0,01	12	mm			12	$ 0,12
								Sub Total	$ 0,61

University	Ecole Centrale de Lyon
System	Brake System
Assembly	Rear Brake Rotor
Part	Brake Rotor
P/N Base	BR 02001
Suffix	AA
Details	Bought, cost as made

Back to BOM

FileLink1	
FileLink2	
FileLink3	

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 3,39
Qty	1
Extended Cost	$ 3,39

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Cast Iron (per kg)	Stock material for part	$ 1,00	1,467	kg			Circle area, 230mm diameter	0,042	0,005	7850	1	$ 1,47
												Sub Total	**$ 1,47**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Setup for laser cut	$ 1,30	unit	1	4 parts cut from a single machine setup	0,25	$ 0,33
20	Laser Cut	Cutout shape	$ 0,01	cm	63,95	Material - Cast Iron	2,5	$ 1,60
							Sub Total	**$ 1,92**

University	Ecole Centrale de Lyon		Back to BOM	**Car #**	81	**Part Cost**	$ 6,15
System	Brake System	**FileLink1**	Drawing			**Qty**	1
Assembly	Rear Brake Rotor	**FileLink2**		**FileLink1**			
Part	Brake Shrink Disc	**FileLink3**		**FileLink2**		**Extended Cost**	$ 6,15
P/N Base	BR 02002			**FileLink3**			
Suffix	AA						
Details	Allows brake rotor to be mounted floating						

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Mild (per kg)	Stock material for part	$ 2,25	0,839	kg			Circle Area, 164.95mm diameter	2,14E-02	0,005	7850	1	$ 1,89
												Sub Total	**$ 1,89**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Setup for laser cutting	$ 1,30	unit	1	4 parts cut from a single machine setup	0,25	$ 0,33
20	Laser Cut	Cutout shape	$ 0,01	cm	131,4	Material - Steel	3	$ 3,94
							Sub Total	**$ 4,27**

Drawing part : BR 02002

University	Ecole Centrale de Lyon		Back to BOM	Car #	81
System	Brake System	FileLink1			
Assembly	Rear Brake Rotor	FileLink2		FileLink1	
Part	Brake Bobbin	FileLink3		FileLink2	
P/N Base	BR 02003			FileLink3	
Suffix	AA				
Details	Bobbins between Brake Rotor and Brake Shrink Disc				

Part Cost	$ 0,27
Qty	6
Extended Cost	$ 1,61

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Mild (per kg)	Material for Bobbin	$ 2,25	0,016	kg			Circle Area, 17mm diameter	2,27E-04	0,009	7850	1	$ 0,04
												Sub Total	$ 0,04

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Setup for machining	$ 1,30	unit	1	24 parts made from one machining setup	0,04	$ 0,05
20	Machining		$ 0,04	cm^3	1,486	Material - Steel	3	$ 0,18
							Sub Total	$ 0,23

University	Ecole Centrale de Lyon
System	Brake System
Assembly	Rear Brake Rotor
Part	Brake Caliper Spacer
P/N Base	BR 02004
Suffix	AA
Details	Spacer between Caliper and Upright

Back to BOM

FileLink1	Drawing
FileLink2	
FileLink3	

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 0,28
Qty	2
Extended Cost	$ 0,56

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Mild (per kg)	Stock material for caliper spacer	$ 2,25	0,018	kg			Circular, 17mm diameter	2,27E-04	0,010	7850	1	$ 0,04
												Sub Total	$ 0,04

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Setup for laser cut	$ 1,30	unit	1	8 parts cut from a single machine setup	0,125	$ 0,16
20	Laser Cut	Cutout shape	$ 0,01	cm	2,639	Material - Steel	3	$ 0,08
							Sub Total	$ 0,24

Drawing part : BR 02004

University	Ecole Centrale de Lyon
System	Brake System
Assembly	Brake Circuit Assembly
P/N Base	BR A0300
Suffix	AA
Details	Brake line assembly

Back to BOM

Car #	81
FileLink1	
FileLink2	
FileLink3	

Asm Cost	$ 705,13
Qty	1
Extended Cost	$ 705,13

ItemOrder	Part	Part Cost	Quantity	Sub Total
10	Hydraulic Fluid Reservoir Mount	$ 1,72	1	$ 1,72
20	Distribution Tee Mount	$ 1,66	1	$ 1,66
30	Internal Spacer	$ 0,73	2	$ 1,45
40	External Spacer	$ 0,67	2	$ 1,33
			Sub Total	$ 6,16

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Master Cylinder, AP, CP7855	Master cylinder	$ 174,50									2	$ 349,00
20	Balance Bar, Tilton 72-250	Balance bar	$ 30,00									1	$ 30,00
30	Hydraulic Fluid Reservoir, Remote (Plastic)	Fluid reservoir	$ 5,00									2	$ 10,00
40	Brake Light Pressure Switch Banjo Bolt	Brake light switch	$ 8,00									1	$ 8,00
50	Hose, High Pressure, Stainless Steel Braided Outer	Brake line - GOODRIDGE's braking hose 6003 serie	$ 13,22	6,45	mm							4,8	$ 63,46
60	Hose, Rubber (per m)	Brake line - Hose between Master Cylinder and Fluid Reservoir	$ 2,16	12	mm							0,5	$ 1,08
70	Adapter/L.P./Union//Aluminum/Anodized	Brake line - AN7 to AN6	$ 2,42	11,11	mm	9,53	mm					2	$ 4,83
80	Adapter/L.P./Union//Aluminum/Anodized	Brake line - AN6 right to AN6 left	$ 2,32	9,53	mm	9,53	mm					2	$ 4,64
90	Fitting/L.P./Straight/Aluminum/Anodized	Brake line - GOODRIDGE's braking hose AN6 end	$ 6,49	9,53	mm							6	$ 38,96
100	Fitting/L.P./Elbow/45 deg./Aluminum/Anodized	Brake line - GOODRIDGE's braking hose AN6 end	$ 17,42	9,53	mm							2	$ 34,84
110	Adapter/L.P./Union//Aluminum/Anodized	Brake line - AN6 to 10mm	$ 2,35	9,53	mm	10	mm					6	$ 14,10
120	Adapter/L.P./Female Flare Tee//Brass	Brake line - Splitter Tee	$ 3,67	10	mm	6,45	mm					2	$ 7,33
130	Banjo Fitting, 45 Deg., Steel	Brake line	$ 16,93	6,45	mm							4	$ 67,73
140	Banjo Bolt, Steel	Brake line	$ 4,39	6,45	mm							4	$ 17,54
150	Crush Washer	Brake line	$ 0,28	6	mm							12	$ 3,38
160	Fluid, Oil	Braking fluid	$ 0,11	0,15	L							1	$ 0,11
170	Paint	Protect steel tab from rust	$ 10,00	2,40E-03	m^2							2,40E-03	$ 0,02
												Sub Total	$ 655,03

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Weld	Welding the Hydraulic Fluid Reservoir Mount	$ 0,15	cm	2,8			$ 0,42
20	Weld	Welding the Distribution Tee Mount	$ 0,15	cm	2,3			$ 0,35
30	Aerosol Apply	Painting for the Mounts	$ 5,25	m^2	2,40E-03			$ 0,01
40	Assemble, 1kg, Loose	Positioning the Balance Bar on the Brake Pedal Supports	$ 0,06	unit	1			$ 0,06
50	Hand, Loose <= 6.35mm	Fixing the Master Cylinder on the Balance Bar	$ 0,25	unit	2			$ 0,50
60	Assemble, 1kg, Loose	Positioning the M6 Bolt through the Master Cylinder bearings, the Internal Spacers, the External Spacers and the Brake Pedal	$ 0,06	unit	1			$ 0,06
70	Ratchet <= 6,35mm	Fixing the Bolt to the Master Cylinder Bearings (through the Brake Pedal)	$ 0,50	unit	1			$ 0,50
80	Reaction Tool <= 6.35mm	Fixing the Bolt to the Master Cylinder Bearings (through the Brake Pedal)	$ 0,25	unit	1			$ 0,25
90	Assemble, 1kg, Loose	Positioning the Hydraulic Fluid Reservoirs on the Hydraulic Fluid Reservoir Mount	$ 0,06	unit	1			$ 0,06
100	Ratchet <= 6.35mm	Fixing the Hydraulic Fluid Reservoir on the Hydraulic Fluid Reservoir Mount	$ 0,50	unit	2			$ 1,00
110	Reaction Tool <= 6.35mm	Fixing the Hydraulic Fluid Reservoir on the Hydraulic Fluid Reservoir Mount	$ 0,25	unit	2			$ 0,50
120	Assemble, 1kg, Loose	Positioning Distribution Tee and Washer on Distribution Tee Mount	$ 0,06	unit	1			$ 0,06

130	Ratchet <= 6.35mm	Fixing Distribution Tee and Washer on Distribution Tee Mount	$ 0,50	unit	1			$ 0,50
140	Reaction Tool <= 6.35mm	Fixing Distribution Tee and Washer on Distribution Tee Mount	$ 0,25	unit	1			$ 0,25
150	Assemble, 1kg, Line-on-Line	Positioning Adapter (AN7 to AN6) on Master Cylinders	$ 0,13	unit	2			$ 0,26
160	Ratchet <= 25.4mm	Fixing Adapter (AN7 to AN6) on Master Cylinder	$ 0,75	unit	2			$ 1,50
170	Assemble, 1kg, Line-on-Line	Positioning Adapter (AN6 right to AN6 left) on Master Cylinder	$ 0,13	unit	2			$ 0,26
180	Ratchet <= 25.4mm	Fixing Adapter (AN6 right to AN6 left) on Master Cylinder	$ 0,75	unit	2			$ 1,50
190	Cut (scissors, knife)	Cut Rubber Hose between Hydraulic Fluid Reservoir and Master Cylinder	$ 0,06	cm	1,2	Repeat - 2	2	$ 0,14
200	Saw or tubing cuts	Cut Steel Hose between Master Cylinder and Distribution Tee	$ 0,40	cm	0,645	Repeat - 2	2	$ 0,52
210	Saw or tubing cuts	Cut Steel Hose between Distribution Tee and Caliper	$ 0,40	cm	0,645	Repeat - 4	4	$ 1,03
220	Saw or tubing cuts	Cut Steel Hose between Distribution Tees	$ 0,40	cm	0,645			$ 0,26
230	Hand, Tight <= 6.35mm	Put the hose in the Banjos and in the Adapters	$ 0,50	unit	12			$ 6,00
240	Wrench <= 25.4mm	Tighten the Banjos and the Adapters	$ 1,50	unit	12			$ 18,00
250	Reaction Tool <= 25.4mm	Tighten the Banjos and the Adapters	$ 0,25	unit	12			$ 3,00
260	Hand, Loose <= 25.4mm	Put Hose between Hydraulic Fluid Reservoir and Master Cylinder	$ 0,50	unit	4			$ 2,00
270	Install Tie Wrap (Zip Tie, Cable Clamp)	Install clamps on the frame and the A-Arms	$ 0,09	unit	22			$ 1,98
							Sub Total	**$ 40,97**

ItemOrder	Fastener	Use	UnitCost	Size1	Unit1	Size2	Unit2	Quantity	Sub Total
10	Bolt, Grade 12.9	Fixing the M6 Bolt to the Master Cylinder Bearings (through the Brake Pedal)	$ 0,53	6	mm	110	mm	1	$ 0,53
20	Washer, Grade 12.9	Fixing the M6 Bolt to the Master Cylinder Bearings (through the Brake Pedal)	$ 0,02					2	$ 0,04
30	Nut, Grade 12.9	Fixing the M6 Bolt to the Master Cylinder Bearings (through the Brake Pedal)	$ 0,05	6	mm			1	$ 0,05
40	Bolt, Grade 8,8 (SAE 5)	Fixing Hydraulic Fluid Reservoir to Hydraulic Fluid Reservoir Mount	$ 0,18	6	mm	70	mm	1	$ 0,18
50	Nut, Grade 8.8 (SAE 5)	Fixing Hydraulic Fluid Reservoir to Hydraulic Fluid Reservoir Mount	$ 0,03	6	mm			3	$ 0,09
60	Bolt, Grade 8.8 (SAE 5)	Fixing Distribution Tee to Distribution Tee Mount	$ 0,04	6	mm	20	mm	1	$ 0,04
70	Washer, Grade 8.8 (SAE 5)	Fixing Distribution Tee to Distribution Tee Mount	$ 0,01					2	$ 0,02
80	Nut, Grade 8.8 (SAE 5)	Fixing Distribution Tee to Distribution Tee Mount	$ 0,03	6	mm			1	$ 0,03
90	Hose Clamp, Worm Drive	Between Hydraulic Fluid Reservoir and Rubber Hose	$ 0,55	13	mm			2	$ 1,10
100	Tie Wrap	Fix the brake line and the Distribution Tee on the frame	$ 0,04					22	$ 0,88
								Sub Total	**$ 2,97**

ItemOrder	Tooling	Use	UnitCost	Unit	Quantity	PVF	FractionIncluded	Sub Total
10	Welds - Welding Fixture	Weld the Hydraulic Fluid Reservoir Mount and the Distribution Tee Mount to the frame	500	point	4	3000	1	$ 0,67
							Sub Total	**$ 0,67**

University	Ecole Centrale de Lyon
System	Brake System
Assembly	Brake Circuit Assembly
Part	Hydraulic Fluid Reservoir Mount
P/N Base	BR 03001
Suffix	AA
Details	

FileLink1	Drawing
FileLink2	
FileLink3	

Back to BOM

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 1,72
Qty	1
Extended Cost	$ 1,72

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Mild		$ 2,25	0,014	kg			Rectangular area, 40x30mm	1,20E-03	1,50E-03	7850	1	$ 0,03
												Sub Total	**$ 0,03**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Setup for laser cut	$ 1,30	unit	1		1	$ 1,30
20	Laser Cut		$ 0,01	cm	12,795	Material - Steel	3	$ 0,38
							Sub Total	**$ 1,68**

Drawing part : [BR 03001]

University	Ecole Centrale de Lyon
System	Brake System
Assembly	Brake Circuit Assembly
Part	Distribution Tee Mount
P/N Base	BR 03002
Suffix	AA
Details	

Back to BOM

FileLink1	Drawing
FileLink2	
FileLink3	

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 1,66
Qty	1
Extended Cost	$ 1,66

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Mild		$ 2,25	0,012	kg			Rectangular area, 40x25mm	0,001	1,50E-03	7850	1,00	$ 0,03
												Sub Total	**$ 0,03**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Setup for laser cut	$ 1,30	unit	1		1	$ 1,30
20	Laser Cut		$ 0,01	cm	11,047	Material - Steel	3	$ 0,33
							Sub Total	**$ 1,63**

Drawing part : BR 03002

University	Ecole Centrale de Lyon
System	Brake System
Assembly	Brake Circuit Assembly
Part	Internal Spacer
P/N Base	BR 03003
Suffix	AA
Details	Internal Spacer next to the Master Cylinders

FileLink1	Drawing
FileLink2	
FileLink3	

Back to BOM

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 0,73
Qty	2
Extended Cost	$ 1,45

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Alloy		$ 2,25	0,010	kg				9,50E-05	0,014	7850	1	$ 0,02
												Sub Total	$ 0,02

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove		$ 1,30	unit	1	2 parts cut from a single machine setup	0,5	$ 0,65
20	Machining		$ 0,04	cm^3	0,432	Material - Steel	3	$ 0,05
							Sub Total	$ 0,70

Drawing Part : BR 03003

Vue isométrique
Echelle : 3:1

Vue de face
Echelle : 3:1

Vue de gauche
Echelle : 3:1

Norme ISO 2768-mK

Taille A4		Ecurie Piston Sport Auto	
Dessiné par Benjamin DELALANDE	Date 31/01/2018	Désignation Internal Spacer	
Coordonnées Tel : 06.02.24.03.33 benjamin.delalande@ecl16.ec-lyon.fr		Quantité 2	Matériau Acier S500	Version 1.0
Plan vérifié par XXX		Echelle 1:1	18 M_FR_0300_009_BA	Feuille 1/1

University	Ecole Centrale de Lyon
System	Brake System
Assembly	Brake Circuit Assembly
Part	External Spacer
P/N Base	BR 03004
Suffix	AA
Details	External Spacer next to the Master Cylinders

FileLink1	Drawing
FileLink2	
FileLink3	

Back to BOM

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 0,67
Qty	2
Extended Cost	$ 1,33

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Alloy		$ 2,25	2,24E-03	kg				9,50E-05	0,003	7850	1	$ 0,01
												Sub Total	$ 0,01

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove		$ 1,30	unit	1	2 parts cut from a single machine setup	0,5	$ 0,65
20	Machining		$ 0,04	cm^3	0,097	Material - Steel	3	$ 0,01
							Sub Total	$ 0,66

Drawing Part : BR 03004

Vue isométrique
Echelle : 3:1

Vue de face
Echelle : 3:1

Vue de gauche
Echelle : 3:1

Norme ISO 2768-mK

Taille A4		Ecurie Piston Sport Auto
Dessiné par Benjamin DELALANDE	Date 31/01/2018	Désignation: Entretoise extérieure pédale de frein
Coordonnées Tel : 06.02.24.03.33 benjamin.delalande@ecl16.ec-lyon.fr		Quantité 2 / Matériau External Spacer / Version 1.0
Plan vérifié par XXX		Echelle 1:1 / 18 M_FR_0300_010_BA / Feuille 1/1

Ecurie Piston Sport Auto

CAR #81

ÉCOLE CENTRALE LYON

Engine & Drivetrain

University	Ecole Centrale de Lyon	Back to BOM	Car #	81	Asm Cost $ 1 627,20
System	Engine & Drivetrain				Qty 1
Assembly	Engine		FileLink1		
P/N Base	EN A0100		FileLink2		Extended Cost $ 1 627,20
Suffix	AA		FileLink3		
Details	Honda CBR 600 RR type PC40				

ItemOrder	Part	Part Cost	Quantity	Sub Total
10	Flat sump	$ 38,78	1	$ 38,78
20	Rear tab	$ 1,42	2	$ 2,83
30	Rear tube	$ 1,30	2	$ 2,59
			Sub Total	$ 44,21

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Engine and Transmission, Ultra High Performance (>10 HP/100 cc)	Honda CBR 600 RR - type PC40	$ 2,50	599	cc							1	1 497,50
20	Fluid, oil	Engine Oil	$ 0,75	3,5	L							3,5	$ 2,63
30	Paint	Paint of the rear tabs	$ 10,00	0,003	m^2							0,003	$ 0,03
40	Rubber	Sealing between oil sump and engine	$ 3,30	0,019	kg				0,017	0,001	1 100	1	$ 0,06
												Sub Total	$ 1 500,21

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Weld	Weld rear tabs to the frame	$ 0,15	cm	5,96		1	$ 0,89
20	Aerosol apply	Paint of the rear tabs	$ 5,25	m^2	0,003		1	$ 0,01
	Cut (scissors, knife)	Sump seal rubber	$ 0,06	cm	166		1	$ 9,96
30	Assemble, >20 kg, Interference	Assemble engine in frame	$ 5,63	Unit	1		1	$ 5,63
40	Assemble, 1kg, Line-on-Line	Positioning of the rear tube	$ 0,13	Unit	1		1	$ 0,13
50	Ratchet <= 25,4mm	Tighten M12 rear bolts	$ 0,75	Unit	2		1	$ 1,50
60	Ratchet <= 25,4mm	Tighten M12 front bolts	$ 0,75	Unit	2		1	$ 1,50
70	Reaction tool, <=25,4mm	Tighten M12 front bolts	$ 0,25	Unit	2		1	$ 0,50
80	Assemble, 1 kg, Line-on-Line	Assemble Flat sump + rubber sealing	$ 0,13	unit	2		1	$ 0,25
90	Ratchet <= 6.35 mm	Tighten flat sump blots	$ 0,50	unit	12		1	$ 6,00
100	Engine first start, includes fuel		$ 50,00	unit	1		1	$ 50,00
							Sub Total	$ 76,38

ItemOrder	Fastener	Use	UnitCost	Size1	Unit1	Size2	Unit2	Quantity	Sub Total
10	Bolt, Grade 8.8 (SAE 5)	Bolt engine to the rear tab	$ 1,05	12	mm	80	mm	2	$ 2,10
20	Washer, Grade 8.8 (SAE 5)	Bolt engine to the rear tab	$ 0,01		unit			2	$ 0,02
20	Bolt, Grade 8.8 (SAE 5)	Bolt engine to the front tubes	$ 1,40	12	mm	100	mm	2	$ 2,80
30	Nut, Grade 8.8 (SAE 5)	Bolt engine to the front tubes	$ 0,10	12	mm			2	$ 0,20
40	Washer, Grade 8.8 (SAE 5)	Bolt engine to the frame	$ 0,01		unit			6	$ 0,06
50	Bolt, Grade 8.8 (SAE 5)	Bolt the flat sump	$ 0,04	6	mm	15	mm	12	$ 0,44
40	Washer, Grade 8.8 (SAE 5)	Washer for the flat sump	$ 0,01		unit			12	$ 0,12
								Sub Total	$ 5,74

ItemOrder	Tooling	Use	UnitCost	Unit	Quantity	PVF	FractionInclud	Sub Total
10	Welds - Welding Fixture	Rear tabs welding	$ 500,00	point	4	3000	1	$ 0,67
							Sub Total	$ 0,67

University	Ecole Centrale de Lyon		Back to BOM	**Car #**	81	**Part Cost**	$ 38,78
System	Engine & Drivetrain	**FileLink1**				**Qty**	1
Assembly	Engine	**FileLink2**		**FileLink1**			
Part	Flat Sump	**FileLink3**		**FileLink2**		**Extended Cost**	$ 38,78
P/N Base	EN 01001			**FileLink3**			
Suffix	AA						
Details	Flat Sump, custom made						

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Aluminum, Normal	Folded base - 5754	$ 4,20	233	mm	276	mm	Rectangular area, 233x276 mm	6,43E-02	0,0025	2712	1	$ 1,83
20	Aluminum, Normal	Upper plate - 5754	$ 4,20	250	mm	200	mm	Rectangular area, 250x200 mm	5,00E-02	0,015	2712	1	$ 8,54
30	Aluminum, Normal	Transversal wall - 5754	$ 4,20	168	mm	42	mm	Rectangular area, 168x42 mm	7,06E-03	0,0025	2712	1	$ 0,20
40	Aluminum, Normal	Upper rectangular plate - 5754	$ 4,20	50	mm	30	mm	Rectangular area, 60x30 mm	1,50E-03	0,0025	2712	1	$ 0,04
50	Fitting, Weld-in, Male, Aluminum	For Dash6 connection	$ 1,85	8	mm							1	$ 1,85
												Sub Total	**$ 10,57**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, installation and remove	Laser cut, upper plate	$ 1,30	Unit	1			$ 1,30
20	Laser cut	Upper plate	$ 0,01	cm	166			$ 1,66
30	Machining Setup, installation and remove	Laser cut folded base-wall	$ 1,30	Unit	1			$ 1,30
40	Laser cut	Laser cut folded base-wall	$ 0,01	cm	155			$ 1,55
50	Machining Setup, installation and remove	Laser cut transversal wall	$ 1,30	Unit	1			$ 1,30
60	Laser cut	Laser cut transversal wall	$ 0,01	cm	42			$ 0,42
70	Machining Setup, installation and remove	Laser cut upper rectangular plate	$ 1,30	Unit	1			$ 1,30
80	Laser cut	Laser cut upper rectangular plate	$ 0,01	cm	16			$ 0,16
90	Sheet metal bends	Fold base	$ 0,25	Unit	4			$ 1,00
100	Machining Setup, installation and remove	Install upper rectangular plate in drill	$ 1,30	Unit	1			$ 1,30
110	Drilled holes < 25.4 mm dia.	Drain valve hole - upper rectangular plate	$ 0,35	Unit	1			$ 0,35
120	Weld	Weld the 4 plates together + Dash 6 connection	$ 0,15	cm	96			$ 14,40
							Sub Total	**$ 26,04**

ItemOrder	Tooling	Use	UnitCost	Unit	Quantity	PVF	FracIncld	Sub Total
10	Welds- Welding Fixture	Mounts Welding	$ 500,00	point	13	3000	1	$ 2,17
							Sub Total	**$ 2,17**

University	Ecole Centrale de Lyon		Back to BOM	**Car #**	81	**Part Cost**	$ 1,42
System	Engine & Drivetrain	**FileLink1**	Drawing			**Qty**	2
Assembly	Engine	**FileLink2**		**FileLink1**			
Part	Rear tab	**FileLink3**		**FileLink2**		**Extended Cost**	$ 2,83
P/N Base	EN 01002			**FileLink3**			
Suffix	AA						
Details	To attach the engine to the frame						

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Mild		$ 2,25	0,090	kg			Rectangular area, 60x32 mm	1,92E-03	0,006	7850	1	$ 0,20
												Sub Total	**$ 0,20**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, installation and remove	Setup for laser cut	$ 1,30	Unit	1	2 parts made from a sing	0,5	$ 0,65
20	Laser cut		$ 0,01	cm	18,8	Material - Steel	3	$ 0,56
							Sub Total	**$ 1,21**

Drawing Part : EN 01002

Tolérances générales : ISO 2768-mK

Vue de droite
Echelle : 1:1

Vue de face
Echelle : 1:1

Taille A4		Ecurie Piston Sport Auto
Dessiné par Antonio Leblanc	Date 16/01/2018	Désignation Bracket 201 - Moteur
Coordonnées antonio.leblanc@ecl16.ec-lyon.fr 07 69 46 48 59		Quantité 2 / Matériau Acier S235 / Version 0.1
Plan vérifié par Brice Roblot		Echelle 1:1 / Numéro du plan AA / Feuille 1/1

University	Ecole Centrale de Lyon		Back to BOM	**Car #**	81	**Part Cost**	$ 1,30
System	Engine & Drivetrain	**FileLink1**	Drawing			**Qty**	2
Assembly	Engine	**FileLink2**		**FileLink1**			
Part	Rear tube	**FileLink3**		**FileLink2**		**Extended Cost**	$ 2,59
P/N Base	EN 01003			**FileLink3**			
Suffix	AA						
Details	To attach the engine to the frame						

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Alloy		$ 2,25	0,063	kg			Round area, 20mm diam.	2,01E-04	0,040	7850	1	$ 0,14
												Sub Total	**$ 0,14**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, installation and remove		$ 1,30	Unit	1	2 parts made fror	0,5	$ 0,65
20	Machining	To 13mm diam.	$ 0,04	cm^3	4,2	Material - Steel	3	$ 0,50
							Sub Total	**$ 1,15**

Drawing Part : EN 01003

Tolérances générales : ISO 2768-mK

Vue de face
Echelle : 1:1

Vue de gauche
Echelle : 1:1

Vue isométrique
Echelle : 1:1

Taille A4		Ecurie Piston Sport Auto
Dessiné par Antonio Leblanc	Date 06/03/2018	Désignation Bracket_302_Tube fixation moteur
Coordonnées antonio.leblanc@ecl16.ec-lyon.fr 07 69 46 48 59		Quantité 2 / Matériau Acier S500 ou équivalent / Version 0.1
Plan vérifié par BRT		Echelle 1:1 / Numéro du plan Bracket_302 / Feuille 1/1

University	Ecole Centrale de Lyon
System	Engine and Drivetrain
Assembly	Exhaust System
P/N Base	EN A0200
Suffix	AA
Details	

Back to BOM

Car #	81
FileLink1	
FileLink2	
FileLink3	

Asm Cost	$ 361,43
Qty	1
Extended C	$ 361,43

ItemOrder	Part	Part Cost	Quantity	Sub Total
10	Exhaust Tip	$ 4,35	4	$ 17,41
20	Exhaust Flange	$ 1,75	4	$ 7,00
30	Exhaust headers	$ 109,43	1	$ 109,43
40	Primary collector	$ 20,23	2	$ 40,46
50	Primary collector tubing	$ 1,22	2	$ 2,44
60	Secondary collector	$ 22,47	1	$ 22,47
70	Secondary collector tubing	$ 12,90	1	$ 12,90
80	Muffler	$ 40,15	1	$ 40,15
90	Muffler Collar	$ 6,21	1	$ 6,21
100	Spacer	$ 2,23	1	$ 2,23
			Sub Total	$ 260,70

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Spring, Compression (General)		$ 1,00									6	$ 6,00
												Sub Total	$ 6,00

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Assemble, 1 kg, Loose	Assemble flanges to primary collector	$ 0,06	unit	4			$ 0,24
20	Weld	Tips welding on headers	$ 0,15	cm	42,7			$ 6,41
30	Assemble, 1kg, Interference	Assemble headers to engine	$ 0,19	unit	1			$ 0,19
40	Ratchet <=25,4mm	Tighten header's nut	$ 0,75	unit	8			$ 6,00
50	Tube end preperation for welding	Preperation for primary collector welding	$ 0,75	end	4			$ 3,00
60	Weld - Round Tubing	Primary collector tubing welding on primary collector	$ 0,50	cm	8,4			$ 4,21
70	Assemble,1kg, Interference	Assemble primary collector to headers	$ 0,19	unit	2			$ 0,38
80	Tube end preperation for welding	Preperation for secondary collector welding	$ 0,75	end	2			$ 1,50
90	Weld - Round Tubing	Secondary collector tubing welding on collector	$ 0,50	cm	5,0			$ 2,49
100	Assemble, 1kg, Interference	Assemble secondary collector to primary tubing	$ 0,19	unit	1			$ 0,19
110	Assemble, 3kg, Line-on-Line	Assemble muffler to tubing	$ 0,38	unit	1			$ 0,38
120	Assemble, 1 kg, Loose	Assemble muffler mount	$ 0,06	unit	1			$ 0,06
130	Reaction Tool <= 6.35 mm	Tighten muffler mount nut	$ 0,25	unit	1			$ 0,25
140	Assemble, 1 kg, Line-on-Line	Assemble muffler collar, washers and spacer	$ 0,13	unit	3			$ 0,39
160	Ratchet <= 25.4 mm	Tighten muffler collar bolt	$ 0,75	unit	1			$ 0,75
170	Exhaust System Ceramic Coating		$ 25,00	m	2,65			$ 66,25
							Sub Total	$ 92,69

ItemOrder	Fastener	Use	UnitCost	Size1	Unit1	Size2	Unit2	Quantity	Sub Total
10	Nut, Grade 8.8 (SAE 5)	Headers nuts	$ 0,04	8	mm			8	$ 0,32
20	Washer, Grade 8.8 (SAE 5)	Engine washers	$ 0,01	40	mm			4	$ 0,04
30	Steel Loop Straps, Rubber-Cushioned	Muffler mount on the frame tube	$ 0,31	30	mm			1	$ 0,31
40	Washer, Grade 8.8 (SAE 5)	Muffler collar washers	$ 0,01	8	mm			2	$ 0,02
50	Bolt, Grade 8.8 (SAE 5)	Muffler collar bolt	$ 0,32	8	mm	70	mm	1	$ 0,32
60	Nut, Grade 8.8 (SAE 5)	Muffler mount nut	$ 0,01	2	mm			1	$ 0,01
70	Bolt, Grade 8.8 (SAE 5)	Muffler mount bolt	$ 0,01	2	mm	30	mm	1	$ 0,01

							Sub Total	$ 1,04

ItemOrder	Tooling	Use	UnitCost	Unit	Quantity	PVF	FractionInc	Sub Total
10	Welds - Welding Fixture		$ 500,00	point	6	3000	1	$ 1,00
							Sub Total	$ 1,00

University	Ecole Centrale de Lyon
System	Engine and Drivetrain
Assembly	Exhaust System
Part	Exhaust Tip
P/N Base	EN 02001
Suffix	AA
Details	

FileLink1	Drawing
FileLink2	
FileLink3	

Back to BOM

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 4,35
Qty	4
Extended C	$ 17,41

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Mild (per kg)	Raw material	$ 2,25	0,285	kg			Round 43mm diam.	1,45E-03	0,025	7850	1	$ 0,64
												Sub Total	$ 0,64

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and rem		$ 1,30	unit	0,25	4 parts made from a single machining setup		$ 0,33
20	Machining	Inner machining	$ 0,04	cm^3	20,5	Material - Steel	3	$ 2,46
30	Machining Setup, Change		$ 0,65	unit	0,25	4 parts made from a single machining change		$ 0,16
40	Machining	Outside machining	$ 0,04	cm^3	6,38	Material - Steel	3	$ 0,77
							Sub Total	$ 3,71

Drawing part : EN 02001

University	Ecole Centrale de Lyon
System	Engine and Drivetrain
Assembly	Exhaust System
Part	Exhaust Flange
P/N Base	EN 02002
Suffix	AA
Details	

Back to BOM

FileLink1	Drawing
FileLink2	
FileLink3	

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 1,75
Qty	4
Extended C	$ 7,00

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Mild (per kg)	Raw material	$ 2,25	0,157	kg			Rectangular area 80 x 50mm	4,00E-03	0,005	7850	1	$ 0,35
												Sub Total	**$ 0,35**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove		$ 1,30	unit	0,25	4 parts made from a single machining setup		$ 0,33
20	Laser Cut	Flange cut	$ 0,01	cm	35,8	Material - Steel	3	$ 1,07
							Sub Total	**$ 1,40**

Drawing part : EN 02002

University	Ecole Centrale de Lyon
System	Engine and Drivetrain
Assembly	Exhaust System
Part	Exhaust headers
P/N Base	EN 02003
Suffix	AA
Details	4 headers in one part

Back to BOM

FileLink1	
FileLink2	
FileLink3	

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 109,43
Qty	1
Extended C	$ 109,43

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Stainless	Header material	$ 2,25		kg			Round 34mm*1,2mm	6,52E-05	1,430	7 850	1	$ 1,65
												Sub Total	**$ 1,65**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Tube cut		$ 0,15	cm	92			$ 13,77
20	Tube bends		$ 0,75	bend	17			$ 12,75
30	Tube end preperation for welding		$ 0,75	end	46			$ 34,50
40	Weld - Round Tubing		$ 0,50	cm	78,2			$ 39,10
							Sub Total	**$ 100,12**

ItemOrder	Tooling	Use	UnitCost	Unit	Quantity	PVF	FracIncld	Sub Total
10	Welds - Welding Fixture		$ 500	point	46	3000	1	$ 7,67
							Sub Total	**$ 7,67**

University	Ecole Centrale de Lyon
System	Engine and Drivetrain
Assembly	Exhaust System
Part	Primary collector
P/N Base	EN 02004
Suffix	AA
Details	1 connector for each pair of headers

Back to BOM

FileLink1	
FileLink2	
FileLink3	

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 20,23
Qty	2
Extended C	$ 40,46

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Stainless	Collector material	$ 2,25		kg			Round 34mm*1,2mm	6,52E-05	0,205	7 850	1	$ 0,24
20	Steel, Stainless	Collector material	$ 2,25		kg			Round 42,1mm*1,5mm	1,01E-04	0,030	7 850	1	$ 0,05
												Sub Total	**$ 0,29**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multi	Mult. Val.	Sub Total
10	Tube cut		$ 0,15	cm	25			$ 3,69
20	Tube end preperation for welding		$ 0,75	end	9			$ 6,75
30	Weld - Round Tubing		$ 0,50	cm	16			$ 8,00
							Sub Total	**$ 18,44**

ItemOrder	Tooling	Use	UnitCost	Unit	Quantity	PVF	FracIncld	Sub Total
10	Welds - Welding Fixture		$ 500,00	point	9	3000	1	$ 1,50
							Sub Total	**$ 1,50**

University	Ecole Centrale de Lyon
System	Engine and Drivetrain
Assembly	Exhaust System
Part	Primary collector tubing
P/N Base	EN 02005
Suffix	AA
Details	2 primary collectors in 1 part

FileLink1	
FileLink2	
FileLink3	

Back to BOM

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 1,22
Qty	2
Extended C	$ 2,44

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Stainless	Tubing material	$ 2,25		kg			Round 42,1mm*1,5mm	1,01E-04	0,33	7 850	1	$ 0,59
												Sub Total	**$ 0,59**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multip	Mult. Val.	Sub Total
10	Tube cut		$ 0,15	cm	4,2			$ 0,63
							Sub Total	**$ 0,63**

University	Ecole Centrale de Lyon
System	Engine and Drivetrain
Assembly	Exhaust System
Part	Secondary collector
P/N Base	EN 02006
Suffix	AA
Details	

Back to BOM

FileLink1	
FileLink2	
FileLink3	

Car #	81

FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 22,47
Qty	1
Extended (	$ 22,47

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Stainless	Collector material	$ 2,25		kg			Round 42,1mm*1,5mm	1,01E-04	0,207	7 850	1	$ 0,37
20	Steel, Stainless	Collector material	$ 2,25		kg			Round 49,8mm*1,2mm	9,50E-05	0,010	7 850	1	$ 0,02
												Sub Total	**$ 0,39**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multip	Mult. Val.	Sub Total
10	Tube cut		$ 0,15	cm	30			$ 4,54
20	Tube end preperation for welding		$ 0,75	end	9			$ 6,75
30	Weld - Round Tubing		$ 0,50	cm	19			$ 9,29
							Sub Total	**$ 20,58**

ItemOrder	Tooling	Use	UnitCost	Unit	Quantity	PVF	FracIncld	Sub Total
10	Welds - Welding Fixture		$ 500,00	point	9	3000	1	$ 1,50
							Sub Total	**$ 1,50**

University	Ecole Centrale de Lyon
System	Engine and Drivetrain
Assembly	Exhaust System
Part	Secondary collector tubing
P/N Base	EN 02007
Suffix	AA
Details	

Back to BOM

FileLink1	
FileLink2	
FileLink3	

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 12,90
Qty	1
Extended C	$ 12,90

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Stainless	Tubing material	$ 2,25		kg			Round 49,8mm*1,2mm	9,50E-05	0,306	7 850	1	$ 0,51
												Sub Total	**$ 0,51**

ItemOrder	Process	Use	UnitCost	Unit	Quanti	Multip	Mult. Val.	Sub Total
10	Tube cut		$ 0,15	cut	15			$ 2,24
20	Tube bends		$ 0,75	bend	2			$ 1,50
30	Tube end preperation for welding		$ 0,75	end	4			$ 3,00
40	Weld - Round Tubing		$ 0,50	cm	9,96			$ 4,98
							Sub Total	**$ 11,72**

ItemOrder	Tooling	Use	UnitCost	Unit	Quanti	PVF	FracIncld	Sub Total
10	Welds - Welding Fixture		$ 500,00	point	4	3000	1	$ 0,67
							Sub Total	**$ 0,67**

University	Ecole Centrale de Lyon
System	Engine and Drivetrain
Assembly	Exhaust System
Part	Muffler
P/N Base	EN 02008
Suffix	AA
Details	Cost as made

Back to BOM

FileLink1	
FileLink2	
FileLink3	

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 40,15
Qty	1
Extended C	$ 40,15

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Titanium (per kg)	Material for muffler body	$ 22,00	0,500	kg			Rectangular area 0.5 x 0.4m	0,200		4500	1	$ 11,00
20	Steel, Mild (per kg)		$ 2,25	0,500	kg			Rectangular area 0.5 x 0.15m	0,075		7850	1	$ 1,13
30	Muffler Batting		$ 0,003	4000	cm^3							1	$ 12,00
												Sub Total	**$ 24,13**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multip	Mult. Val.	Sub Total
10	Sheet metal bends		$ 0,25	bend	2			$ 0,50
20	Sheet metal punching		$ 0,03	cm^2	300			$ 9,00
30	Sheet metal stamping		$ 0,03	cm^2	100			$ 3,00
40	Assemble, 1 kg, Line-on-Line		$ 0,13	unit	4			$ 0,52
50	Riveting		$ 0,25	unit	12			$ 3,00
							Sub Total	**$ 16,02**

University	Ecole Centrale de Lyon
System	Engine and Drivetrain
Assembly	Exhaust System
Part	Muffler Collar
P/N Base	EN 02009
Suffix	AA
Details	

FileLink1	
FileLink2	
FileLink3	

Back to BOM

Car #	81

FileLink1
FileLink2
FileLink3

Part Cost	$ 6,21
Qty	1
Extended C	$ 6,21

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Carbon Fiber, 1 Ply	Collar material	$ 200,00	0,028	kg						1 580	1	$ 5,56
												Sub Total	**$ 5,56**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multip	Mult. Val.	Sub Total
10	Lamination, Manual		$ 35,00	m^2	0,0112			$ 0,39
20	Cure, Oven		$ 20,00	m^2	0,0112			$ 0,22
							Sub Total	**$ 0,62**

ItemOrder	Tooling	Use	UnitCost	Unit	Quantity	PVF	FracIncld	Sub Total
10	Lamination - Composite Tool		$ 10 000	m^2	0,0112	3000	1	$ 0,04
							Sub Total	**$ 0,04**

University	Ecole Centrale de Lyon
System	Engine and Drivetrain
Assembly	Exhaust System
Part	Spacer
P/N Base	EN 02010
Suffix	AA
Details	Spacer between the muffler collar and the mount

FileLink1	
FileLink2	
FileLink3	

Back to BOM

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 2,23
Qty	1
Extended (	$ 2,23

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Mild	Spacer material	$ 2,25	0,066	kg			Round 16mm diameter	2,01E-04	0,042	7 850	1	$ 0,15
												Sub Total	**$ 0,15**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove		$ 1,30	unit	1			$ 1,30
20	Machining		$ 0,04	cm^3	6,47	Material - Steel	3	$ 0,78
							Sub Total	**$ 2,08**

University	Ecole Centrale de Lyon
System	Engine and Drivetrain
Assembly	Air Intake System
P/N Base	EN A0300
Suffix	AA
Details	Air Intake Assembly

Back to BOM

Car #	81
FileLink1	
FileLink2	
FileLink3	

Asm Cost	$ 141,32
Qty	1
Extended C	$ 141,32

ItemOrder	Part	Part Cost	Quantity	Sub Total
10	Upper plenum	$ 12,59	1	$ 12,59
20	Plenum plate	$ 3,68	1	$ 3,68
30	Intake manifold	$ 18,14	1	$ 18,14
40	Left frame bracket	$ 1,69	1	$ 1,69
50	Right frame bracket	$ 1,76	1	$ 1,76
60	PAIR plate	$ 1,32	2	$ 2,63
70	Motor bracket	$ 4,18	1	$ 4,18
80	Intake bracket	$ 0,73	2	$ 1,46
			Sub Total	$ 46,13

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Mount, Vibration-Damping, Sandwich	Isolation between throttle and chassis	$ 8,10	30	mm							2,00	$ 16,20
20	Sensor, Fluid Pressure & Temperature	Measure pressure and temperature inside of the plenum	$ 10,00									1,00	$ 10,00
30	Paint	Material for painting	$ 10,00	0,015	m^2							1,00	$ 0,15
30	Seal, O-ring, Elastomer	Sealing between upper plenum and plenum plate	$ 0,05									1,00	$ 0,05
40	Seal, O-ring, Elastomer	Sealing between intake manifold and plenum plate	$ 0,05									1,00	$ 0,05
												Sub Total	$ 26,45

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Weld	Welding the intake brackets on the frame	$ 0,15	cm	7,1			$ 1,07
20	Aerosol apply	Paint the intake and frame brackets	$ 5,25	m^2	0,015			$ 0,08
30	Assemble, 1 kg, Loose	Positionning the manifold seal on the manifold	$ 0,06	unit	1			$ 0,06
40	Assemble, 1 kg, Loose	Positionning the plenum plate on the manifold seal	$ 0,06	unit	1			$ 0,06
50	Wrench <= 6,35 mm	Fixing the plenum plate to the intake manifold	$ 1,00	unit	12			$ 12,00
60	Reaction Tool <= 6,35 mm	Fixing the plenum plate to the intake manifold	$ 0,25	unit	12			$ 3,00
70	Assemble, 1 kg, Loose	Inserting the pressure and temperature sensor	$ 0,01	unit	1			$ 0,01
80	Assemble, 1 kg, Loose	Positionning the plenum seal on the plenum plate	$ 0,01	unit	1			$ 0,01
90	Assemble, 1 kg, Loose	Positionning the plenum on the plenum seal	$ 0,01	unit	1			$ 0,01
100	Wrench <= 6,35 mm	Fixing the plenum to the plenum plate	$ 1,50	unit	12			$ 18,00
110	Reaction Tool <= 6,35 mm	Fixing the plenum to the plenum plate	$ 0,25	unit	12			$ 3,00
120	Assemble, 1 kg, Loose	Positionning the left and right frame bracket	$ 0,06	unit	2			$ 0,12
130	Wrench <= 25,4 mm	Fixing the left and right frame bracket on the plenum	$ 1,50	unit	2			$ 3,00
140	Reaction Tool <= 25,4 mm	Fixing the left and right frame bracket on the plenum	$ 0,25	unit	2			$ 0,50
150	Assemble, 1 kg, Loose	Positionning the motor bracket on the plenum plate	$ 0,06	unit	1			$ 0,06
160	Wrench <= 25,4 mm	Fixing the motor bracket to the plenum plate	$ 1,50	unit	2			$ 3,00
170	Reaction Tool <= 25,4 mm	Fixing the motor bracket to the plenum plate	$ 0,25	unit	2			$ 0,50
180	Assemble, 1 kg, Loose	Positionning the PAIR plates on the motor	$ 0,06	unit	2			$ 0,12
190	Assemble, 3 kg, Loose	Positionning the intake assembly on the motor	$ 0,19	unit	1			$ 0,19
200	Drilled holes < 25,4 mm dia.	Drilling holes inside the PAIR plates	$ 0,35	unit	2			$ 0,70
210	Assemble, 1 kg, Line-onLine	Positionning the PAIR plates on the motor bracket	$ 0,13	unit	2			$ 0,26
220	Wrench <= 25,4 mm	Fixing the PAIR plates to the motor bracket	$ 1,50	unit	2			$ 3,00
230	Reaction Tool <= 25,4 mm	Fixing the PAIR plates to the motor bracket	$ 0,25	unit	2			$ 0,50
240	Assemble, 3 kg, Loose	Positionning the intake assembly on the motor	$ 0,19	unit	1			$ 0,19
250	Wrench <= 25,4 mm	Fixing the PAIR plates to the motor	$ 1,50	unit	4			$ 6,00
260	Screwdriver > 1 Turn	Tightening the hose clamps on the intake manifold and the motor	$ 0,50	unit	4			$ 2,00
270	Assemble, 1 kg, Line-onLine	Positionning the frame brackets on the frame	$ 0,13	unit	2			$ 0,26
280	Sheet metal bends	Bending the frame brackets to align with the intake brackets	$ 0,25	bend	2			$ 0,50
290	Drilled holes < 25,4 mm dia.	Drilling holes inside the frame brackets	$ 0,35	unit	2			$ 0,70
300	Assemble, 1 kg, Line-onLine	Positionning Mount, Vibration-Damping, Sandwich	$ 0,13	unit	2			$ 0,26

310	Wrench <= 25,4 mm	Fixing the frame brackets on the frame	$ 1,50	unit	2			$ 3,00	
320	Reaction Tool <= 25,4 mm	Fixing the frame brackets on the frame	$ 0,25	unit	2			$ 0,50	
							Sub Total	**$ 62,64**	

ItemOrder	Fastener	Use	UnitCost	Size1	Unit1	Size2	Unit2	Quantity	Sub Total
10	Hose Clamp, Worm Drive	Tightening the intake pipes with the intake manifold	$ 0,69	48,5	mm			4	$ 2,78
20	Bolt, Grade 8.8 (SAE 5)	Fastening brackets and sensor	$ 0,05	6	mm	20	mm	9	$ 0,43
30	Bolt, Grade 8.8 (SAE 5)	Fastening plenum, plenum plate and intake manifold	$ 0,02	4	mm	16	mm	23	$ 0,45
40	Washer, Grade 8,8 (SAE 5)	Fastening brackets and sensor	$ 0,01	6	mm			9	$ 0,09
50	Washer, Grade 8,8 (SAE 5)	Fastening plenum, plenum plate and intake manifold	$ 0,01	4	mm			23	$ 0,23
60	Nut, Grade 8.8 (SAE 5)	Fastening brackets and sensor	$ 0,03	6	mm			18	$ 0,54
70	Nut, Grade 8.8 (SAE 5)	Fastening plenum, plenum plate and intake manifold	$ 0,02	4	mm			46	$ 0,92
								Sub Total	**$ 5,44**

ItemOrder	Tooling	Use	UnitCost	Unit	Quantity	PVF	FractionIn(	Sub Total
10	Welds - Welding Fixture	Intake brackets welding	$ 500,00	point	4	3000	1	$ 0,67
							Sub Total	**$ 0,67**

University	Ecole Centrale de Lyon
System	Engine and Drivetrain
Assembly	Air Intake System
Part	Upper plenum
P/N Base	EN 03001
Suffix	AA
Details	Made by 3D printing

FileLink1	
FileLink2	
FileLink3	

Back to BOM

Car #	81

FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 12,59
Qty	1
Extended Cost	$ 12,59

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Plastic, Nylon	Material for part	$ 3,30	0,35	kg						1 140	1	$ 1,16
												Sub Total	**$ 1,16**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Rapid Prototype - Plastic	Printing the upper plenum	$ 32,00	kg	0,345			$ 11,04
20	Aerosol Apply	Applying varnish inside the upper plenum	$ 5,25	m^2	0,075			$ 0,39
							Sub Total	**$ 11,43**

University	Ecole Centrale de Lyon
System	Engine and Drivetrain
Assembly	Air Intake System
Part	Plenum plate
P/N Base	EN 03002
Suffix	AA
Details	Made by laser cutting

Back to BOM

FileLink1	Drawing
FileLink2	
FileLink3	

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 3,68
Qty	1
Extended C	$ 3,68

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Aluminium, Normal	Material for part	$ 4,20	0,140	kg			Rectangular area 200x215 mm	0,043	0,002	2 712	1	$ 0,59
												Sub Total	**$ 0,59**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machinnig Setup, Install and remove	Setup for laser cutting	$ 1,30	unit	1			$ 1,30
20	Laser Cut	Producing the plenum plate	$ 0,01	cm	179,2			$ 1,79
							Sub Total	**$ 3,09**

Drawing part : [EN 03002]

University	Ecole Centrale de Lyon
System	Engine and Drivetrain
Assembly	Air Intake System
Part	Intake manifold
P/N Base	EN 03003
Suffix	AA
Details	Made by 3D printing

FileLink1	
FileLink2	
FileLink3	

Back to BOM

Car #	81

FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 18,14
Qty	1
Extended C	$ 18,14

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Plastic, Nylon	Material for part	$ 3,30	0,500	kg						1 140	1	$ 1,65
												Sub Total	**$ 1,65**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Rapid Prototype - Plastic	Printing the upper plenum	$ 32,00	kg	0,495			$ 15,84
20	Aerosol Apply	Applying varnish inside the int	$ 5,25	m^2	0,123			$ 0,65
							Sub Total	**$ 16,49**

University	Ecole Centrale de Lyon
System	Engine and Drivetrain
Assembly	Air Intake System
Part	Left frame bracket
P/N Base	EN_03004
Suffix	AA
Details	Made by laser cutting

FileLink1	Drawing
FileLink2	
FileLink3	

Back to BOM

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 1,69
Qty	1
Extended C	$ 1,69

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Aluminium, Normal	Material for part	$ 4,20	0,010	kg			Rectangular area 225x16 mm	0,004	0,002	2 712	1	$ 0,04
												Sub Total	**$ 0,04**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machinnig Setup, Install and remove	Setup for laser cutting	$ 1,30	unit	1			$ 1,30
20	Laser Cut	Producing the left frame bracket	$ 0,01	cm	34,7			$ 0,35
							Sub Total	**$ 1,65**

Drawing part : [Left frame bracket]

University	Ecole Centrale de Lyon
System	Engine and Drivetrain
Assembly	Air Intake System
Part	Right frame bracket
P/N Base	EN_03005
Suffix	AA
Details	Made by laser cutting

FileLink1	Drawing
FileLink2	
FileLink3	

Back to BOM

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 1,76
Qty	1
Extended C	$ 1,76

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Aluminium, Normal	Material for part	$ 4,20	0,012	kg			Rectangular area 256x16 mm	0,002	0,002	2 712	1	$ 0,05
												Sub Total	**$ 0,05**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machinnig Setup, Install and remove	Setup for laser cutting	$ 1,30	unit	1			$ 1,30
20	Laser Cut	Producing the right frame bracket	$ 0,01	cm	41,1			$ 0,41
							Sub Total	**$ 1,71**

Drawing part : [Right frame bracket]

University	Ecole Centrale de Lyon
System	Engine and Drivetrain
Assembly	Air Intake System
Part	PAIR plate
P/N Base	EN_0300_006
Suffix	AA
Details	Made by laser cutting

Back to BOM

FileLink1	Drawing
FileLink2	
FileLink3	

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 1,32
Qty	2
Extended Cost	$ 2,63

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Aluminium, Normal	Material for part	$ 4,20	0,018	kg			Rectangular area 80x55 mm	0,004	0,002	2 712	1	$ 0,08
												Sub Total	**$ 0,08**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machinnig Setup, Install and remove	Setup for laser cutting	$ 1,30	unit	1	2 parts made from one machine setup	0,5	$ 0,65
20	Laser Cut	Producing the PAIR plate	$ 0,01	cm	59			$ 0,59
							Sub Total	**$ 1,24**

Drawing part : [PAIR plate]

University	Ecole Centrale de Lyon
System	Engine and Drivetrain
Assembly	Air Intake System
Part	Motor bracket
P/N Base	EN_03007
Suffix	AB
Details	Made by laser cutting

FileLink1	Drawing
FileLink2	
FileLink3	

Back to BOM

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 4,18
Qty	1
Extended C	$ 4,18

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Aluminium, Normal	Material for part	$ 4,20	0,068	kg			Rectangular area 215x75 mm	0,021	0,002	2 712	1	$ 0,29
												Sub Total	**$ 0,29**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machinnig Setup, Install and remove	Setup for laser cutting	$ 1,30	unit	1			$ 1,30
20	Laser Cut	Producing the right frame bracket	$ 0,01	cm	209			$ 2,09
30	Sheet metal bends	Bending the motor bracket	$ 0,25	cut	2			$ 0,50
							Sub Total	**$ 3,89**

Drawing part : [Motor bracket]

University	Ecole Centrale de Lyon
System	Engine and Drivetrain
Assembly	Air Intake System
Part	Intake bracket
P/N Base	EN_03008
Suffix	AA
Details	Made by laser cutting

Back to BOM

FileLink1	Drawing
FileLink2	
FileLink3	

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 0,73
Qty	2
Extended Cost	$ 1,46

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Mild	Stock material for part	$ 2,25	0,002	kg				1,80E-04	1,50E-03	7 850	1	$ 0,00
												Sub Total	**$ 0,00**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machinnig Setup, Install and remove	Setup for laser cutting	$ 1,30	unit	1	2 parts made from one machine setup	0,5	$ 0,65
20	Laser Cut	Producing the PAIR plate	$ 0,01	cm	7,75			$ 0,08
							Sub Total	**$ 0,73**

Drawing part : [Intake bracket]

University	Ecole Centrale de Lyon
System	Engine and Drivetrain
Assembly	Throttle Body
P/N Base	EN_A0400
Suffix	AA
Details	Throttle Body of the air intake assembly

Back to BOM

Car #	81
FileLink1	
FileLink2	
FileLink3	

Asm Cost	$ 170,24
Qty	1
Extended Cost	$ 170,24

ItemOrder	Part	Part Cost	Quantity	Sub Total
10	Throttle Frange	$ 5,18	1	$ 5,18
20	Restrictor	$ 5,73	1	$ 5,73
30	Throttle Housing	$ 4,27	1	$ 4,27
40	Throttle Axle	$ 2,73	1	$ 2,73
50	TPS Axle	$ 2,71	1	$ 2,71
60	Cable Housing	$ 3,57	1	$ 3,57
70	Axle Stop	$ 2,04	1	$ 2,04
80	Ram Pipe	$ 12,51	1	$ 12,51
90	Throttle Plate	$ 1,49	1	$ 1,49
			Sub Total	$ 40,23

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Air filter		$ 0,15	420	cm^2							420,00	$ 63,00
20	Spring, Tension (General)	Torsion spring	$ 1,00									1,00	$ 1,00
30	Spring, Tension (General)	Hellicoidal spring	$ 1,00									1,00	$ 1,00
40	Seal, O-ring Elastomer	Sealing with airfilter	$ 0,05									1,00	$ 0,05
50	Seal, O-ring Elastomer	Sealing with plenum	$ 0,05									1,00	$ 0,05
60	Cable, Pull	Throttle cable	$ 15,00	2,5	m							2,50	$ 37,50
70	Cable, Adjuster		$ 1,00									1,00	$ 1,00
80	Mount, Vibration-Damping, Sandwich	Isolation between throttle and chassis	$ 8,10	30	mm							2,00	$ 16,20
												Sub Total	$ 119,80

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Assemble, 1kg, Interference	Assemble throttle housing on restrictor	$ 0,19	unit	1			$ 0,19
20	Assemble, 1kg, Interference	Assemble flange on restrictor	$ 0,19	unit	1			$ 0,19
30	Assemble, 1kg, Interference	Assemble ram pipe on throttle housing	$ 0,19	unit	1			$ 0,19
40	Assemble, 1kg, Interference	Assemble throttle plate in restrictor	$ 0,19	unit	1			$ 0,19
50	Assemble, 1kg, Interference	Assemble TPS axle	$ 0,19	unit	1			$ 0,19
60	Assemble, 1kg, Interference	Assemble cable housing axle	$ 0,19	unit	1			$ 0,19
70	Assemble, 1kg, Interference	Assemble negative stop	$ 0,19	unit	1			$ 0,19
80	Wrench <= 6,35mm	Tighten M5 bolt	$ 1,50	unit	1			$ 1,50
90	Reaction Tool <= 6,35 mm	Reaction tool for M5 nut	$ 0,25	unit	1			$ 0,25
100	Assemble, 1kg, Line-on-line	Assemble torsion spring	$ 0,13	unit	1			$ 0,13
110	Assemble, 1kg, Loose	Assemble axle stop	$ 0,06	unit	2			$ 0,12
120	Wrench <= 6,35mm	Tighten M5 bolt	$ 1,50	unit	1			$ 1,50
130	Assemble, 1kg, Loose	Assemble seal on throttle body	$ 0,06	unit	2			$ 0,12
140	Assemble, 1kg, Interference	Assemble throttle body on plenum	$ 0,19	unit	1			$ 0,19
150	Wrench <= 6,35mm	Tighten M6 bolt	$ 1,50	unit	2			$ 3,00
160	Reaction Tool <=6,35mm	Reaction tool for M6 nut	$ 0,25	unit	2			$ 0,50
170	Assemble, 1kg, Loose	Assemble air filter and clamp	$ 0,06	unit	1			$ 0,06
180	Screwdriver < 1 Turn	Tighten clamp	$ 0,12	unit	1			$ 0,12
190	Assemble, 1kg, Loose	Assemble cable adjuster	$ 0,06	unit	1			$ 0,06

200	Hand, Loose <=6,35mm	Tighten cable adjuster	$ 0,25	unit	1			$ 0,25
210	Assemble, 1kg, Loose	Assemble cable	$ 0,06	unit	1			$ 0,06
							Sub Total	**$ 9,19**

ItemOrder	Fastener	Use	UnitCost	Size1	Unit1	Size2	Unit2	Quantity	Sub Total
10	Bolt, Grade 8.8 (SAE 5)	Process 70	$ 0,02	5	mm	10	mm	1	$ 0,02
20	Nut, Grade 8.8 (SAE 5)	Process 70	$ 0,02	5	mm			1	$ 0,02
30	Bolt, Grade 8.8 (SAE 5)	Process 110	$ 0,02	5	mm	10	mm	1	$ 0,02
40	Bolt, Grade 8.8 (SAE 5)	Process 140	$ 0,04	6	mm	16	mm	2	$ 0,08
50	Nut, Grade 8.8 (SAE 5)	Process 140	$ 0,03	6	mm			2	$ 0,06
60	Washer, Grade 8.8 (SAE 5)	Process 140	$ 0,01	6	mm			2	$ 0,02
70	Hose Clamp, Miniature Bolt	Process 170	$ 0,80	75	mm			1	$ 0,80
								Sub Total	**$ 1,02**

University	Ecole Centrale de Lyon		Back to BOM	**Car #**	81	**Part Cost**	$ 5,18
System	Engine and Drivetrain	**FileLink1**				**Qty**	1
Assembly	Throttle Body	**FileLink2**		**FileLink1**			
Part	Throttle Frange	**FileLink3**		**FileLink2**		**Extended C**	$ 5,18
P/N Base	EN_04001			**FileLink3**			
Suffix	AA						
Details	Bought, cost as made						

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Aluminium	Material for part	$ 4,20	0,174	kg			Rectangular area, 40x20mm	8,00E-04	0,080	2 712	1	$ 0,73
												Sub Total	**$ 0,73**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining	Setup, Install and remove	$ 1,30	unit	1			$ 1,30
20	Drillet holes < 25,4mm dia,		$ 0,35	hole	5			$ 1,75
30	Machining		$ 0,04	cm^3	35	Aluminium	1	$ 1,40
							Sub Total	**$ 4,45**

University	Ecole Centrale de Lyon
System	Engine and Drivetrain
Assembly	Throttle Body
Part	Restrictor
P/N Base	EN_04002
Suffix	AA
Details	Bought, cost as made

FileLink1	
FileLink2	
FileLink3	

Back to BOM

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 5,73
Qty	1
Extended C	$ 5,73

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Aluminium, Normal	Material for part	$ 4,20	0,376	kg			Round diam 42mm	1,38E-03	0,100	2 712	1	$ 1,58
												Sub Total	**$ 1,58**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove		$ 1,30	unit	1			$ 1,30
20	Machining	Cutout shape	$ 0,04	cm^3	35	Aluminium	1	$ 1,40
30	Machining setup, change		$ 0,65	unit	1			$ 0,65
40	Machining		$ 0,04	cm^3	20	Aluminium	1	$ 0,80
							Sub Total	**$ 4,15**

University	Ecole Centrale de Lyon
System	Engine and Drivetrain
Assembly	Throttle Body
Part	Throttle Housing
P/N Base	EN_04003
Suffix	AA
Details	Bought, cost as made

Back to BOM

FileLink1	
FileLink2	
FileLink3	

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 4,27
Qty	1
Extended Cost	$ 4,27

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Aluminium, Normal	Material for part	$ 4,20	0,201	kg			Rectangular area, 45x30mm	1,35E-03	0,060	2 712	1	$ 0,84
												Sub Total	**$ 0,84**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove		$ 1,30	unit	1			$ 1,30
20	Machining		$ 0,04	cm^3	28	Aluminium	1	$ 1,12
30	Machining setup, change		$ 0,65	unit	1			$ 0,65
40	Machining		$ 0,04	cm^3	9	Aluminium	1	$ 0,36
							Sub Total	**$ 3,43**

University	Ecole Centrale de Lyon
System	Engine and Drivetrain
Assembly	Throttle Body
Part	Throttle Axle
P/N Base	EN_04004
Suffix	AA
Details	Bought, cost as made

Back to BOM

FileLink1	
FileLink2	
FileLink3	

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 2,73
Qty	1
Extended Cost	$ 2,73

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Mild	Material for part	$ 2,25	0,025	kg			Round 10 mm	7,85E-05	0,040	7 850	1	$ 0,06
												Sub Total	**$ 0,06**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove		$ 1,30	unit	1			$ 1,30
20	Machining		$ 0,04	cm^3	4	Steel	3	$ 0,48
30	Machining setup, change	Setup part for machining the back face	$ 0,65	unit	1			$ 0,65
40	Machining	Machining of the back face	$ 0,04	cm^3	2	Steel	3	$ 0,24
							Sub Total	**$ 2,67**

University	Ecole Centrale de Lyon
System	Engine and Drivetrain
Assembly	Throttle Body
Part	TPS Axle
P/N Base	EN_04005
Suffix	AA
Details	Bought, cost as made

FileLink1	
FileLink2	
FileLink3	

Back to BOM

Car #	81

FileLink1
FileLink2
FileLink3

Part Cost	$ 2,71
Qty	1
Extended Cost	$ 2,71

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Mild	Material for part	$ 2,25	0,018	kg			Round 10 mm	7,85E-05	0,040	7 850	1	$ 0,04
												Sub Total	**$ 0,04**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove		$ 1,30	unit	1			$ 1,30
20	Machining		$ 0,04	cm^3	4	Steel	3	$ 0,48
30	Machining setup, change	Setup part for machining the back face	$ 0,65	unit	1			$ 0,65
40	Machining	Machining of the back face	$ 0,04	cm^3	2	Steel	3	$ 0,24
							Sub Total	**$ 2,67**

University	Ecole Centrale de Lyon
System	Engine and Drivetrain
Assembly	Throttle Body
Part	Cable Housing
P/N Base	EN_04006
Suffix	AA
Details	Bought, cost as made

Back to BOM

FileLink1	
FileLink2	
FileLink3	

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 3,57
Qty	1
Extended Cost	$ 3,57

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Mild	Material for part	$ 2,25	0,075	kg			Rectangular area 60x2mm	1,20E-04	0,080	7 850	1	$ 0,17
												Sub Total	**$ 0,17**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove		$ 1,30	unit	1			$ 1,30
20	Laser cut		$ 0,01	cm^3	35	Steel	3	$ 1,05
30	Sheet metal bends		$ 0,25	bend	3			$ 0,75
40	Weld		$ 0,15	cm^3	2			$ 0,30
							Sub Total	**$ 3,40**

University	Ecole Centrale de Lyon
System	Engine and Drivetrain
Assembly	Throttle Body
Part	Axle Stop
P/N Base	EN_04007
Suffix	AA
Details	Bought, cost as made

Back to BOM

FileLink1	
FileLink2	
FileLink3	

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 2,04
Qty	1
Extended Cost	$ 2,04

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Mild	Material for part	$ 2,25	0,116	kg			Round 25mm diam	4,91E-04	0,030	7 850	1	$ 0,26
												Sub Total	**$ 0,26**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machinnig Setup, Install and remove		$ 1,30	unit	1			$ 1,30
20	Machining		$ 0,04	cm^3	4	Steel	3	$ 0,48
							Sub Total	**$ 1,78**

University	Ecole Centrale de Lyon
System	Engine and Drivetrain
Assembly	Throttle Body
Part	Ram Pipe
P/N Base	EN_04008
Suffix	AA
Details	Bought, cost as made

FileLink1	
FileLink2	
FileLink3	

Back to BOM

Car #	81

FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 12,51
Qty	1
Extended Cost	$ 12,51

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Aluminium, Normal	Stock material for part	$ 4,20	0,954	kg			Round 80mm diam	5,03E-03	0,070	2 712	1	$ 4,01
												Sub Total	**$ 4,01**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove		$ 1,30	unit	1			$ 1,30
20	Machining		$ 0,04	cm^3	180	Aluminium	1	$ 7,20
							Sub Total	**$ 8,50**

University	Ecole Centrale de Lyon
System	Engine and Drivetrain
Assembly	Throttle Body
Part	Throttle Plate
P/N Base	EN_04009
Suffix	AA
Details	Bought, cost as made

Back to BOM

FileLink1	
FileLink2	
FileLink3	

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 1,49
Qty	1
Extended Cost	$ 1,49

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Mild	Stock material for part	$ 2,25	0,032	kg			Round 32mm diam	8,04E-04	0,005	7 850	1	$ 0,07
												Sub Total	**$ 0,07**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove		$ 1,30	unit	1			$ 1,30
20	Machining		$ 0,04	cm^3	1	Steel	3	$ 0,12
							Sub Total	**$ 1,42**

University	Ecole Centrale de Lyon
System	Engine & Drivetrain
Assembly	Fuel Tank Assembly
P/N Base	EN A0500
Suffix	AA
Details	Fuel tank with filler neck

Back to BOM

Car #	81
FileLink1	
FileLink2	
FileLink3	

Asm Cost	$ 199,49
Qty	1
Extended Cost	$ 199,49

ItemOrder	Part	Part Cost	Quantity	Sub Total
10	Fuel Tank (with filler neck)	$ 103,67	1	$ 103,67
20	Filler Cap	$ 31,68	1	$ 31,68
30	Filler Tube	$ 18,36	1	$ 18,36
40	Lateral tab	$ 1,74	2	$ 3,48
50	Front tab	$ 1,88	2	$ 3,77
			Sub Total	160,9598

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Mount, Vibration-Damping, Sandwich	Vibration-Damping, Sandwich for fuel tank	$ 5,40	20	mm							4	$ 21,60
20	Hose, Silicone	Filler hose raccording Filler tube and Filler neck	$ 20,68	44	mm							0,150	$ 3,10
30	Seal, O-Ring, Elastomer	Between the plug and the filler tube	$ 0,05									1	$ 0,05
40	Paint	Tabs painting	$ 10,00	0,011	m^2							0,011	$ 0,11
												Sub Total	$ 24,86

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Weld	Tabs welding	$ 0,15	cm	9,83		1	$ 1,47
20	Aerosol apply	Tabs painting	$ 5,25	m^2	0,011		1	$ 0,06
30	Assemble, 1kg, Loose	Vibration dampings sandwich on Fuel tank	$ 0,06	Unit	4		1	$ 0,24
40	Ratchet <= 6.35 mm	Tighten vibration damping sandwich on Fuel Tank	$ 0,50	Unit	4		1	$ 2,00
50	Assemble, 3 kg, Line-on-Line	Fuel tank on the tabs	$ 0,38	Unit	1		1	$ 0,38
60	Ratchet <= 6.35 mm	Tighten Fuel tank on the tabs	$ 0,50	Unit	4		1	$ 2,00
70	Reaction tool, <= 6,35 mm	Tighten Fuel tank on the tabs	$ 0,25	Unit	4		1	$ 1,00
90	Assemble, 1kg, Loose	Clamp on the Filler hose	$ 0,06	Unit	1		1	$ 0,06
110	Screwdriver > 1 Turn	Hose clamps	$ 0,50	Unit	2		1	$ 1,00
120	Ratchet <= 6.35 mm	Filler tube collar on collar tab	$ 0,50	Unit	1		1	$ 0,50
130	Reaction Tool <= 6.35 mm	Tighten Filler tube collar on collar tab	$ 0,25	Unit	1		1	$ 0,25
140	Hand, Loose > 25.4 mm	Seal O-ring + Filler tube cap	$ 0,75	Unit	2		1	$ 1,50
							Sub Total	$ 10,46

ItemOrder	Fastener	Use	UnitCost	Size1	Unit1	Size2	Unit2	Quantity	Sub Total
10	Nut, Grade 8.8 (SAE 5)	M6 nut for vibration damping sandwich	$ 0,04	6	mm			4	$ 0,16
20	Washer, Grade 8.8 (SAE 5)	M6 washer for vibration damping sandwich	$ 0,01	6	mm			8	$ 0,08
30	Bolt, Grade 8.8 (SAE 5)	M6 bolt for collar on collar mount	$ 0,04	6	mm	30	mm	4	$ 0,16
40	Nut, Grade 8.8 (SAE 5)	M6 nut for collar on collar mount + for vibration damping sandwich	$ 0,03	6	mm			5	$ 0,15
50	Washer, Grade 8.8 (SAE 5)	M6 washer for collar on collar mount + for vibration damping sandwich	$ 0,01	6	mm			5	$ 0,05
60	Hose Clamp, Worm Drive	Clamp for filler neck and filler tube	$ 0,72	55	mm			1	$ 0,72
70	Hose Clamp, Worm Drive	Clamp on tube of frame to attach the filler tube	$ 0,56	15	mm			1	$ 0,56
								Sub Total	$ 1,88

ItemOrder	Tooling	Use	UnitCost	Unit	Quantity	PVF	FracIncld	Sub Total
10	Welds - Welding Fixture	Tabs welding	$ 500,00	Point	8	3000	1	$ 1,33
							Sub Total	$ 1,33

University	Ecole Centrale de Lyon	Back to BOM		**Car #**	81	**Part Cost**	$ 103,67
System	Engine & Drivetrain	Drawing :	FileLink1			**Qty**	1
Assembly	Fuel Tank Assembly		**FileLink2**	**FileLink1**			
Part	Fuel Tank (with filler neck)		**FileLink3**	**FileLink2**		**Extended Cost**	$ 103,67
P/N Base	EN 05001			**FileLink3**			
Suffix	AA						
Details							

ItemOrder	Material	Use	UnitCost	Size1		Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Aluminum, Normal (per kg)	Fuel tank plate material	$ 4,20	3,743	kg	2,5	mm	Rectangular plate 460mm x 1200mm	5,52E-01	2,50E-03	2712	1	$ 15,72
20	Aluminum, Normal (per kg)	Nek tube	$ 4,20	0,103	kg	2	mm	Circular area (tube) 45mm x 2mm	2,70E-04	0,140	2712	1	$ 0,43
30	Fitting, Weld-in, Male, Aluminum	For Dash6 connection	$ 1,85	8	mm							2	$ 3,70
												Sub Total	**$ 19,85**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and Remove	Plate material cut	$ 1,30	Unit	1	Material - Aluminum	1	$ 1,30
20	Laser cut	Upper plate	$ 0,01	cm	178	Material - Aluminum	1	$ 1,78
30	Laser cut	Lower plate	$ 0,01	cm	128	Material - Aluminum	1	$ 1,28
40	Laser cut	Side plate	$ 0,01	cm	180	Material - Aluminum	1	$ 1,80
50	Laser cut	Cavity	$ 0,01	cm	42	Material - Aluminum	1	$ 0,42
60	Sheet metal bends	Upper plate bend	$ 0,25	Bend	1			$ 0,25
70	Sheet metal bends	Side plate bend	$ 0,25	Bend	2			$ 0,50
80	Sheet metal bends	Cavity	$ 1,25	Bend	1			$ 1,25
90	Tube cut	Neck tube cut	$ 0,15	cm	4,5			$ 0,68
100	Weld	Fuel tank welding + neck tube	$ 0,15	cm	486			$ 72,90
							Sub Total	**$ 82,16**

ItemOrder	Tooling	Use	UnitCost	Unit	Quantity	PVF	FracIncld	Sub Total
10	Welds - Welding Fixture		$ 500,00	Point	10	3000	1	$ 1,67
							Sub Total	**$ 1,67**

EN 05001

18.5
9.2
19
20
Vue de face
Echelle : 1:2
Vue de gauche
Echelle : 1:2
Vue isométrique
Echelle : 1:3
Taille
A3
Ecurie Piston Sport Auto
Dessiné par
Aurélien
Date
08/04/2018
Désignation
Reservoir
Coordonnées
06 30 91 66 40
aurelien.bienner@ecl16.ec-lyon.fr
Quantité
XXX
Matériau
XXX
Version
XXX
Plan vérifié par
XXX
Echelle 1:1
Numéro du plan
XXX
Feuille 1/1

University	Ecole Centrale de Lyon		Back to BOM	**Car #**	81	**Part Cost**	$ 31,68
System	Engine & Drivetrain	**FileLink1**				**Qty**	1
Assembly	Fuel Tank Assembly	**FileLink2**		**FileLink1**			
Part	Filler Cap	**FileLink3**		**FileLink2**		**Extended Cost**	$ 31,68
P/N Base	EN 05002			**FileLink3**			
Suffix	AA						
Details							

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Aluminum - Normal (per kg)	Cap material	$ 4,20	0,080	kg			Round area diameter 50mm	1,96E-03	0,015	2712	1	$ 0,34
20	Fuel Check Valve, In-line, Aluminum Rollover		$ 15,00									1	$ 15,00
30	Hose rubber		$ 2,52	14	mm					0,59		1	$ 1,49
40	Fitting/L.P./Male Flare to Pipe//Aluminum/Anodized	Connect hose rubbber to fuel check valve	$ 7,60	14	mm	14	mm					1	$ 7,60
												Sub Total	**$ 24,42**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machning Setup, Install and Remove		$ 1,30	Unit	1			$ 1,30
20	Machining		$ 0,04	cm^3	12	Material - Aluminium	1	$ 0,48
30	Threading, Internal (machining)		$ 0,10	cm	50	Material - Aluminium	1	$ 5,00
40	Drilled holes < 25.4 mm dia.	Fuel Check Valve hole (20mm)	$ 0,35	hole	1			$ 0,35
50	Assemble, 1 kg, Line-on-Line	Fuel Check Valve assembling	$ 0,13	Unit	1			$ 0,13
							Sub Total	**$ 7,26**

University	Ecole Centrale de Lyon	Back to BOM		**Car #**	81	**Part Cost**	$ 18,36
System	Engine & Drivetrain	**FileLink1**				**Qty**	1
Assembly	Fuel Tank Assembly	**FileLink2**		**FileLink1**			
Part	Filler Tube	**FileLink3**		**FileLink2**		**Extended Cost**	$ 18,36
P/N Base	EN 05003			**FileLink3**			
Suffix	AA						
Details							

ItemOrder	Material	Use	UnitCost	Size1		Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Aluminum, Normal (per kg)	Filler neck body	$ 4,20	0,082	kg			circle area (tube) 45mm x 2mm	1,38E-04	0,220	2712	1	$ 0,35
20	Aluminum, Normal (per kg)	Adapter plug - filler neck body	$ 4,20	0,017	kg				1,54E-04	0,040	2712	1	$ 0,07
30	Aluminum, Normal (per kg)	Sight tube fitting	$ 4,20	0,001	kg			circle area (tube) 10mm x 1mm				2	$ 0,01
40	Hose, Silicone	Sight tube	$ 5,64	12	mm	0,14	m					0,14	$ 0,79
50	Hose, Silicone	Attach to fuel tank	$ 25,85	55	mm	0,11	m					0,11	$ 2,84
												Sub Total	**$ 4,06**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Tube cut	Filler neck body, and sight tube fitting	$ 0,15	cm	8			$ 1,20
20	Machining Setup, Install and Remove	Filler neck body	$ 1,30	Unit	1			$ 1,30
30	Drilled holes < 25.4 mm dia.	Filler neck body	$ 0,35	Hole	1			$ 0,35
40	Machining Setup, Install and Remove	Adapter plug - filler neck body	$ 1,30	Unit	1			$ 1,30
50	Drilled holes < 25.4 mm dia.	Adapter plug - filler neck body	$ 0,35	Hole	1			$ 0,35
60	Threading, External (machining)	Thread for plug	$ 0,10	cm	1	Material - Aluminum	1	$ 0,10
70	Machining Setup, Install and Remove	Sight tube fitting	$ 1,30	Unit	2			$ 2,60
80	Drilled holes < 25.4 mm dia.	Sight tube fitting	$ 0,35	Hole	2			$ 0,70
90	Weld	Barb fittings welding on tube	$ 0,15	cm	10			$ 1,50
100	Cut (scissors, knife)	Hose and sight tube cut	$ 0,06	cm	4			$ 0,24
110	Assemble, 1 kg, Interference	Hose, frame attach and sight tube mounting	$ 0,19	Unit	6			$ 1,14
120	Screwdriver > 1 Turn	Hose, frame attach and sight tube clamp	$ 0,50	Unit	4			
							Sub Total	**$ 10,78**

ItemOrder	Fastener	Use	UnitCost	Size1	Unit1	Size2	Unit2	Quantity	Sub Total
10	Hose Clamp, Worm Drive	Attach sight tube to filler tube	$ 0,54	10	mm			2	$ 1,08
20	Hose Clamp, Worm Drive	Attach the filler tube to frame	$ 0,72	55	mm			1	$ 0,72
30	Hose Clamp, Worm Drive	Attach filler tube to hose	$ 0,72	55	mm			1	$ 0,72
								Sub Total	**$ 2,52**

ItemOrder	Tooling	Use	UnitCost	Unit	Quantity	PVF	FracIncld	Sub Total
10	Welds - Welding Fixture		$ 500,00	Point	6	3000	1	$ 1,00
							Sub Total	**$ 1,00**

University	Ecole Centrale de Lyon		Back to BOM	**Car #**	81	**Part Cost**	$ 1,74
System	Engine & Drivetrain	Drawing :	FileLink1			**Qty**	2
Assembly	Fuel Tank Assembly	**FileLink2**		**FileLink1**			
Part	Lateral tab	**FileLink3**		**FileLink2**		**Extended Cost**	$ 3,48
P/N Base	EN 05004			**FileLink3**			
Suffix	AA						
Details							

ItemOrder	Material	Use	UnitCost	Size1		Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Mild		$ 2,25	0,015	kg			Rectangular area, 30x42 mm	1,26E-03	0,002	7850	1	$ 0,03
												Sub Total	**$ 0,03**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and Remove		$ 1,30	Unit	1		1	$ 1,30
20	Laser cut		$ 0,01	cm	13,5	Material - Steel	3	$ 0,41
							Sub Total	**$ 1,71**

EN 05004

⌀6.4
⌀15.6
34
28.8
Vue de face
Echelle : 1:1
1.5
Vue de gauche
Echelle : 1:1
Taille
A4
Ecurie Piston Sport Auto
Dessiné par
Antonio Leblanc
Date
06/03/2018
Désignation
Bracket_23_fuel tank Rear
Coordonnées
antonio.leblanc@ecl16.ec-lyon.fr
07 69 46 48 59
Quantité
1
Matériau
Acier S235
Version
0.1
Plan vérifié par
XXX
Echelle 1:1
Numéro du plan
AA
Feuille 1/1

University	Ecole Centrale de Lyon		Back to BOM	**Car #**	81	**Part Cost**	$ 1,88
System	Engine & Drivetrain	FileLink1	Drawing			**Qty**	2
Assembly	Fuel Tank Assembly	**FileLink2**		**FileLink1**			
Part	Rear tab	**FileLink3**		**FileLink2**		**Extended Cost**	$ 3,77
P/N Base	EN 05005			**FileLink3**			
Suffix	AA						
Details							

ItemOrder	Material	Use	UnitCost	Size1		Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Mild		$ 2,25	0,023	kg			Rectangular area, 30x48 mm	1,44E-03	0,002	7850	1	$ 0,05
												Sub Total	**$ 0,05**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and Remove		$ 1,30	Unit	1		1	$ 1,30
20	Laser cut		$ 0,01	cm	17,8	Material - Steel	3	$ 0,53
							Sub Total	**$ 1,83**

EN 05005

Vue isométrique
Echelle : 1:1

Vue de face
Echelle : 1:1

Vue de gauche
Echelle : 1:1

Taille A4		Ecurie Piston Sport Auto
Dessiné par Antonio Leblanc	Date 06/03/2018	Désignation Bracket_22_fuel tank
Coordonnées antonio.leblanc@ec116.ec-lyon.fr 07 69 46 48 59		Quantité 1 / Matériau Acier S500 / Version 0.1
Plan vérifié par XXX		Echelle 1:1 / Numéro du plan AA / Feuille 1/1

University	Ecole Centrale de Lyon	Back to BOM	**Car #**	81	**Asm Cost** $ 342,71
System	Engine & Drivetrain				**Qty** 1
Assembly	Fuel System		**FileLink1**		
P/N Base	EN A0600		**FileLink2**		**Extended Cost** $ 342,71
Suffix	AA		**FileLink3**		
Details					

ItemOrder	Part	Part Cost	Quantity	Sub Total
10	Fuel Rail	$ 7,64	1	$ 7,64
20	Fuel Pump Collar	$ 3,35	1	$ 3,35
30	Pressure Regulator Tab	$ 1,83	1	$ 1,83
40	Fuel Pump Tab	$ 1,55	1	$ 1,55
			Sub Total	**$ 14,38**

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Fuel filter		$ 8,00									1	$ 8,00
20	Fuel Pump, Fuel Injected, Gasoline		$ 35,00									1	$ 35,00
30	Fuel Pressure Regulator, Gasoline		$ 15,00									1	$ 15,00
40	Fuel Injector, Gasoline		$ 10,00									4	$ 40,00
50	Fitting, Fuel Pressure Gauge	On the Fuel pressure regulator	$ 3,00									1	$ 3,00
60	Hose, Low Pressure, Stainless Steel Braided Outer		$ 5,48	880	mm					0,88		1	$ 5,48
70	Fitting/L.P./Elbow/45 deg./Aluminum/Anodized	Outlet fuel tank	$ 27,28	14,2	mm							1	$ 27,28
80	Fitting/L.P./Elbow/90 deg./Aluminum/Anodized	Tee inlet, return fuel pressure regulator	$ 26,58	14,2	mm							2	$ 53,16
90	Fitting/L.P./Straight/Aluminum/Anodized	Return fuel tank, inlet pump, outlet pump, outlet tee	$ 12,66	14,2	mm							4	$ 50,66
100	Banjo Fitting, Aluminum	Fuel rail alimentation	$ 15,40	14,2	mm							1	$ 15,40
110	Fitting/L.P./Tube Nut//Steel/	Banjo fitting on rail	$ 3,27	14,2	mm							1	$ 3,27
120	Adapter/L.P./Union Tee//Aluminum/Anodized	Regulator in	$ 3,86	14,2	mm	14,2	mm					1	$ 3,86
130	Adapter/L.P./Union/FeMale Flare//Aluminum/Anodized	Tee out, pump inlet	$ 5,99	14,2	mm	14,2	mm					2	$ 11,99
140	Adapter/L.P./Union Reducer//Aluminum/Anodized	Adaptater for Pump inlet/outlet and regulator conical threading	$ 2,64	14,2	mm	10	mm					4	$ 10,56
150	Seal, O-Ring, Elastomer	Injector seals	$ 0,05									4	$ 0,20
160	Crush Washer	Copper, to ensure the sealing between ramp and banjo	$ 0,47	13	mm							2	$ 0,94
170	Paint	Tabs painting	$ 10,00	0,0022	m^2							0,0022	$ 0,02
												Sub Total	**$ 283,83**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Weld	Pump collar tab on frame (regulator tab only pointed)	$ 0,15	cm	2		1	$ 0,30
20	Aerosol apply	Tabs painting	$ 5,25	m^2	0,0022		1	$ 0,01
30	Assemble, 1 kg, Interference	Assemble fittings on hose	$ 0,19	Unit	8		1	$ 1,52
40	Wrench <= 25.4 mm	Tighten fittings male part on female part	$ 1,50	Unit	8		1	$ 12,00
50	Assemble, 1 kg, Loose	Assemble Pump on Collar	$ 0,06	Unit	1		1	$ 0,06
60	Assemble, 1 kg, Loose	Assemble Pump + Collar on Pump tab	$ 0,06	Unit	1		1	$ 0,06
70	Ratchet <= 6.35 mm	Tighten M6 bolt between Pump Collar and Tab	$ 0,50	Unit	1		1	$ 0,50
80	Reaction Tool <= 6.35 mm	Reaction tool for M6 nut	$ 0,25	Unit	1		1	$ 0,25
90	Assemble, 1 kg, Loose	Assemble Fuel pressure regulator on Tab	$ 0,06	Unit	1		1	$ 0,06
100	Ratchet <= 6.35 mm	Tighten M6 bolt between Fuel pressure regulator and Tab	$ 0,50	Unit	2		1	$ 1,00
110	Reaction Tool <= 6.35 mm	Reaction tool for M6 nut	$ 0,25	Unit	2		1	$ 0,50
120	Assemble, 1 kg, Line-on-Line	Assemble Injectors seal O Ring	$ 0,13	Unit	4		1	$ 0,52
130	Assemble, 1 kg, Line-on-Line	Assemble Injectors on Fuel rail	$ 0,13	Unit	4		1	$ 0,52
140	Assemble, 1 kg, Line-on-Line	Assemble Rail on Admission pipe	$ 0,13	Unit	1		1	$ 0,13
150	Ratchet <= 25.4 mm	Tighten M6 bolts between Rail and admission pipe	$ 0,25	Unit	3		1	$ 0,75
160	Reaction Tool <= 25.4 mm	Reaction tool for M6 nut between Rail and adm. pipe	$ 0,25	Unit	3		1	$ 0,75
170	Safety Wire, Install	Safety wire installation between fuel rail and intake pipe	$ 0,60	Unit	4		1	$ 2,40
180	Assemble, 1 kg, Loose	Assemble banjo on fuel rail	$ 0,06	Unit	1		1	$ 0,06
190	Ratchet <= 25.4 mm	Tighten Tube nut	$ 0,75	Unit	1		1	$ 0,75
200	Wrench <= 25.4 mm	Tighten fittings + adapters	$ 1,50	Unit	14		1	$ 21,00
							Sub Total	**$ 43,14**

ItemOrder	Fastener	Use	UnitCost	Size1	Unit1	Size2	Unit2	Quantity	Sub Total
10	Bolt, Grade 8.8 (SAE 5)	M6 bolt for Pump collar on Tab	$ 0,04	6	mm	20	mm	1	$ 0,04
20	Nut, Grade 8.8 (SAE 5)	M6 nut for collar on collar mount	$ 0,03	6	mm			1	$ 0,03
30	Washer, Grade 8.8 (SAE 5)	M6 washer for collar on collar mount	$ 0,01	6	mm			2	$ 0,02
40	Bolt, Grade 8.8 (SAE 5)	M6 bolt for regulator on tab	$ 0,07	6	mm	30	mm	2	$ 0,14
50	Nut, Grade 8.8 (SAE 5)	M6 nut for regulator on tab	$ 0,03	6	mm			2	$ 0,06
60	Washer, Grade 8.8 (SAE 5)	M6 washer for regulator on tab	$ 0,01	6	mm			4	$ 0,04
70	Bolt, Grade 8.8 (SAE 5)	M6 bolt for rail on admission pipe	$ 0,07	6	mm	30	mm	3	$ 0,21

80	Nut, Grade 8.8 (SAE 5)	M6 nut for rail on admission pipe	$ 0,03	6	mm			3	$ 0,09
90	Washer, Grade 8.8 (SAE 5)	M6 washer for rail on admission pipe	$ 0,01	6	mm			6	$ 0,06
								Sub Total	**$ 0,69**

ItemOrder	Tooling	Use	UnitCost	Unit	Quantity	PVF	FractionIncluded	Sub Total
10	Welds - Welding Fixture	Welding fixture from tabs (Fuel pump + Pressure regulator) on frame	$ 500,00	point	4	3000	1	$ 0,67
							Sub Total	**$ 0,67**

University	Ecole Centrale de Lyon		Back to BOM	**Car #**	81	**Part Cost**	$ 7,64
System	Engine & Drivetrain	**FileLink1**				**Qty**	1
Assembly	Fuel System	**FileLink2**		**FileLink1**			
Part	Fuel Rail	**FileLink3**		**FileLink2**		**Extended Cos**	$ 7,64
P/N Base	EN 06001			**FileLink3**			
Suffix	AA						
Details							

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Mild	Main + injectors tube material	$ 2,25	0,161	kg			Round tube 16mm x 3mm	6,83E-05	0,300	7850	1	$ 0,36
20	Steel, Mild	Fitting tabs material	$ 2,25	0,047	kg			Rectangular area 100mm x 30mm	3,00E-03	0,002	7850	1	$ 0,11
												Sub Total	**$ 0,47**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Tube cut	Main + injectors tube cut	$ 0,15	cm	5			$ 0,75
20	Machining Setup, Install and Remove	Setup and remove for tube machining	$ 1,30	Unit	1			$ 1,30
30	Threading, External	Tube end threading for Banjo nut	$ 0,10	cm	1,5	Material- Steel	3	$ 0,45
40	Laser cut		$ 0,01	cm	18	Material- Steel	3	$ 0,54
50	Weld	Weld main tube + tabs	$ 0,15	cm	12			$ 1,80
							Sub Total	**$ 4,84**

ItemOrder	Tooling	Use	UnitCost	Unit	Quantity	PVF	FracIncld	Sub Total
10	Welds - Welding Fixture	Weld main tube + tabs	$ 500,00	point	14	3000	1	$ 2,33
							Sub Total	**$ 2,33**

University	Ecole Centrale de Lyon		Back to BOM	**Car #**	81	**Part Cost** $ 3,35
System	Engine & Drivetrain	**FileLink1**				**Qty** 1
Assembly	Fuel System	**FileLink2**		**FileLink1**		
Part	Fuel Pump Collar	**FileLink3**		**FileLink2**		**Extended Cost** $ 3,35
P/N Base	EN 06002			**FileLink3**		
Suffix	AA					
Details						

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Aluminum - Normal	Collar material	$ 4,20	0,012	kg			Rectangular area 230x20 mm	4,60E-03	0,001	2712	1	$ 0,05
												Sub Total	**$ 0,05**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Setup for laser cut	$ 1,30	Unit	1			$ 1,30
20	Laser cut		$ 0,01	cm	50	Material - Aluminum	1	$ 0,50
30	Sheet metal bends	Rolling at 90°	$ 0,25	bend	6			$ 1,50
							Sub Total	**$ 3,30**

University	Ecole Centrale de Lyon		Back to BOM	**Car #**	81	**Part Cost**	$ 1,83
System	Engine & Drivetrain	Drawing :	FileLink1			**Qty**	1
Assembly	Fuel System		**FileLink2**	**FileLink1**			
Part	Pressure Regulator Tab		**FileLink3**	**FileLink2**		**Extended Cost**	$ 1,83
P/N Base	EN 06003			**FileLink3**			
Suffix	AA						
Details							

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel - Mild	Tab material	$ 2,25	0,020	kg			Rectangular area 20x42 mm	8,40E-04	0,003	7850	1	$ 0,04
												Sub Total	**$ 0,04**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Setup for machining	$ 1,30	Unit	1			$ 1,30
20	Laser cut	Tab cut	$ 0,01	cm	16,2	Material, Steel	3	$ 0,49
							Sub Total	**$ 1,79**

EN 06003

Tolérances générales : ISO 2768-mK
Axe de symétrie
Vue de face
Echelle : 2:1
⌀6.6
R7.5
20
13
8
44
3
Vue de droite
Echelle : 2:1
Taille
A4
Ecurie Piston Sport Auto
Dessiné par
Antonio Leblanc
Date
16/01/2018
Désignation
Bracket 110- Regulateur de pression
Coordonnées
antonio.leblanc@ecl16.ec-lyon.fr
07 69 46 48 59
Quantité
1
Matériau
Acier S235
Version
1.0
Plan vérifié par
Roblot Brice
Echelle 1:1
Numéro du plan 18M_110
Feuille 1/1

University	Ecole Centrale de Lyon		Back to BOM	**Car #**	81	**Part Cost**	$ 1,55
System	Engine & Drivetrain	Drawing :	FileLink1			**Qty**	1
Assembly	Fuel System		**FileLink2**	**FileLink1**			
Part	Fuel Pump Tab		**FileLink3**	**FileLink2**		**Extended Cost**	$ 1,55
P/N Base	EN 06004			**FileLink3**			
Suffix	AA						
Details							

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Mild	Tab material	$ 2,25	0,004	kg			Rectangular area 13x20 mm	2,60E-04	0,002	7850	1	$ 0,01
												Sub Total	**$ 0,01**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Setup for machining	$ 1,30	Unit	1			$ 1,30
20	Laser cut	Tab cut	$ 0,01	cm	8,16	Material, Steel	3	$ 0,24
							Sub Total	**$ 1,54**

EN 06004

Tolérances générales : ISO 2768-mK
⌀13
⌀6.6
13
14
Vue de face
Echelle : 2:1
3
Vue de gauche
Echelle : 2:1
Taille
A4
Ecurie Piston Sport Auto
Dessiné par
Antonio Leblanc
Date
09/02/2018
Désignation
Bracket 116- Pompe vers tubulaire
Coordonnées
antonio.leblanc@ecl16.ec-lyon.fr
07 69 46 48 59
Quantité
1
Matériau
Acier S235
Version
1.0
Plan vérifié par
XXX
Echelle 2:1
Numéro du plan 18M_116
Feuille 1/1

University	Ecole Centrale de Lyon	Back to BOM	**Car #**	81	**Asm Cost** $ 22,60
System	Engine & Drivetrain				**Qty** 1
Assembly	Overflow Bottles		**FileLink1**		
P/N Base	EN A0700		**FileLink2**		**Extended Cost** $ 22,60
Suffix	AA		**FileLink3**		
Details	Oil and Water catch cans, mounted on the frame				

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Overflow Bottle, Steel Oil Can	Painting cans	$ 1,00		Unit							2	$ 2,00
20	Hose, Low Pressure, Stainless Steel Braided Outer	Lines from Engine's top and Expansion tank to overflow bottles	$ 6,20	1,2	m								$ 7,44
30	Paint	Black bottle paint	$ 10,00	0,192	m^2							0,192	$ 1,92
40	Carbon Fiber, 1 Ply (kg)	For carbon clamp	$ 200,00	8,00E-04	kg				0,010	5,06E-05	1 580	1	$ 0,16
												Sub Total	**$ 11,52**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Cut (scissors, knife)	Carbon fiber strips cut	$ 0,06	cm	72			$ 4,32
20	Lamination, Manual	For carbon clamp	$ 35,00	m^2	0,01			$ 0,35
30	Cure, Oven	For carbon clamp	$ 5,00	m^2	0,01			$ 0,05
40	Drilled holes < 25.4 mm dia.	Drill the carbon fiber strips, diam 8	$ 0,35	hole	2			$ 0,70
50	Assemble, 1kg, Loose	Bend carbon fiber strips around one can	$ 0,06	Unit	1			$ 0,06
60	Ratchet <= 25.4 mm	Tighten the carbon fiber strips around one can	$ 0,75	Unit	1			$ 0,75
70	Reaction Tool <= 25.4 mm	Tighten the carbon fiber strips around one can	$ 0,25	Unit	1			$ 0,25
80	Drilled holes < 25.4 mm dia.	Bottles drilling for hoses	$ 0,35	hole	2			$ 0,70
90	Assemble, 1 kg, Loose	Fixing the Velcro to the other can	$ 0,06	Unit	2			$ 0,12
100	Assemble, 1 kg, Loose	Fixing the Velcro to the fuel tank side	$ 0,06	Unit	2			$ 0,12
110	Cut (scissors, knife)	Hoses cut	$ 0,06	Unit	4			$ 0,24
120	Screwdriver > 1 Turn	Clamps installation on the frame	$ 0,50	Unit	1			$ 0,50
130	Assemble, 1kg, Interference	Hose mounting on Bottles, Engine and Expansion tank	$ 0,19	Unit	5			$ 0,95
							Sub Total	**$ 9,11**

ItemOrder	Fastener	Use	UnitCost	Size1	Unit1	Size2	Unit2	Quantity	Sub Total
10	Hose Clamp, Single Wire	Engine and Expansion tank clamp	$ 0,08	14	mm			4	$ 0,30
20	Steel Loop Straps, Rubber-Cushioned	Attach on the bottom frame pipe	$ 0,36	35	mm			2	$ 0,72
30	Bolt, Aluminum	100 mm M6 Bolt	$ 0,38	6	mm	100	mm	2	$ 0,75
40	Nut, Grade 8.8 (SAE 5)	M6 Bolt	$ 0,03	6	mm			6	$ 0,18
50	Washer, Grade 8.8 (SAE 5)	M4 washers to tighten the collar around the frame	$ 0,01	6	mm			2	$ 0,02
60	Hook and Loop, Hook Side (Velcro)	To attach one can to the fuel tank	$ 0,003	150	cm^2			2	$ 0,90
								Sub Total	**$ 1,98**

University	Ecole Centrale de Lyon	Back to BOM	**Car #**	81	**Asm Cost** $ 271,22
System	Engine & Drivetrain				**Qty** 1
Assembly	Cooling System		**FileLink1**		
P/N Base	EN A0800		**FileLink2**		**Extended Cost** $ 271,22
Suffix	AA		**FileLink3**		
Details	Engine cooling system				

ItemOrder	Part	Part Cost	Quantity	Sub Total
10	Radiator	$ 102,86	1	$ 102,86
20	Radiator lateral upper tab	$ 1,79	1	$ 1,79
30	Radiator lateral lower tab	$ 2,53	1	$ 2,53
40	Radiator back tab	$ 1,61	1	$ 1,61
50	Main Coolant Line	$ 38,16	1	$ 38,16
60	Fan	$ 30,77	1	$ 30,77
70	Expansion Tank	$ 22,73	1	$ 22,73
80	Expansion Tank tabs	$ 1,54	2	$ 3,09
90	Lateral Tube	$ 3,15	1	$ 3,15
100	Secondary Coolant Line	$ 15,48	1	$ 15,48
			Sub Total	**$ 222,18**

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Mount, Vibration-Damping Sandwich		$ 5,40	20	mm							3	$ 16,20
20	Male flare to pipe, aluminium anodize	Hose output	$ 3,63	8	mm	9	mm					1	$ 3,63
30	Paint	Tabs and lateral tube painting	$ 10,00	0,021	m^2							0,021	$ 0,21
40	Coolant	Cooling water	$ -	2,5	L							1	$ -
												Sub Total	**$ 20,04**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Weld	Upper Lateral tab to Radiator Frame	$ 0,15	cm	2,5		1	$ 0,38
20	Weld	Lower Lateral tab to Radiator Frame	$ 0,15	cm	3		1	$ 0,45
30	Weld	Back tab to Radiator Frame	$ 0,15	cm	3		1	$ 0,45
40	Aerosol apply	Tab and lateral tube painting	$ 5,25	m^2	0,012		1	$ 0,07
50	Assemble, 1kg, Loose	Assemble Vibration-Damping Sandwich with tabs	$ 0,06	Unit	6		1	$ 0,36
60	Assemble, 1kg, Loose	Nut for vibration damping sandwiches	$ 0,06	Unit	6		1	$ 0,36
70	Ratchet <= 25.4 mm	Nut for vibration damping sandwiches	$ 0,75	Unit	6		1	$ 4,50
90	Assemble, 3kg, Line-on-line	Set Radiator to Vibration-Damping Sandwiches	$ 0,38	Unit	1		1	$ 0,38
100	Ratchet <= 25.4 mm	Nuts for vibration damping sandwiches	$ 0,75	Unit	4		1	$ 3,00
110	Reaction tool <= 25.4 mm	Nuts for vibration damping sandwiches	$ 0,50	Unit	4		1	$ 2,00
120	Assemble, 1kg, Line-on-Line	Assemble lateral bar with lateral tabs and radiator	$ 0,13	Unit	2		1	$ 0,26
130	Assemble, 1 kg, Loose	Nut for lateral bar	$ 0,06	Unit	2		1	$ 0,12
140	Ratchet <= 25.4 mm	Nut for lateral bar	$ 0,75	Unit	2		1	$ 1,50
150	Reaction tool <= 25.4 mm	Nut for lateral bar	$ 0,25	Unit	2		1	$ 0,50
160	Assemble, 1 kg, Loose	Set Expansion Tank to tabs	$ 0,06	Unit	2		1	$ 0,12
170	Assemble, 1 kg, Loose	Bolt for Expansion Tank	$ 0,06	Unit	2		1	$ 0,12
180	Assemble, 1 kg, Loose	Nut for Expansion Tank	$ 0,06	Unit	2		1	$ 0,12
190	Ratchet <= 25.4 mm	Nut for Expansion Tank	$ 0,75	Unit	2		1	$ 1,50
200	Reaction tool <= 25.4 mm	Nut for Expansion Tank	$ 0,25	Unit	2		1	$ 0,50
210	Assemble, 1 kg, Interference	Assemble main Cooling Lines with radiator	$ 0,19	Unit	2		1	$ 0,38
220	Assemble, 1 kg, Interference	Assemble secondary Cooling Lines with Expansion Tank and Fluid recuperator	$ 0,19	Unit	2		1	$ 0,38
230	Ratchet <= 6.35 mm	Bolt Hose Clamp	$ 0,50	Unit	4		1	$ 2,00
							Sub Total	**$ 19,44**

ItemOrder	Fastener	Use	UnitCost	Size1	Unit1	Size2	Unit2	Quantity	Sub Total
10	Bolt, Grade 8.8 (SAE 5)	M6 Bolt for fittings and radiator	$ 0,05	3	mm	25	mm	4	$ 0,20
20	Nut, Grade 8.8 (SAE 5)	M6 nuts for lateral bar, tabs and radiator	$ 0,03	6	mm			8	$ 0,24
30	Hose Clamp, Miniature Bolt	Main Cooling Line Hose Clamp	$ 0,60	25,4	mm			2	$ 1,20

40	Hose Clamp, Miniature Bolt	Secondary Cooling Line Hose Clamp	$ 0,55	12	mm			2	$ 1,10
50	Hose Clamp, Miniature Bolt	Main line hose clamp	$ 0,60	25,4	mm			9	$ 5,41
60	Pin, Plastic Push	Set Fan to Radiator	$ 0,10	4	unit			4	$ 0,40
								Sub Total	**$ 8,55**

ItemOrder	Tooling	Use	UnitCost	Unit	Quantity	PVF	FractionIncluded	Sub Total
10	Welds - Welding Fixture Tabs	Tabs welding	$ 500,00	Point	6	3000	1	$ 1,00
							Sub Total	**$ 1,00**

University	Ecole Centrale de Lyon		Back to BOM	**Car #**	81	**Part Cost**	$ 102,86
System	Engine & Drivetrain	Drawing :	FileLink1			**Qty**	1
Assembly	Cooling System		**FileLink2**	**FileLink1**			
Part	Radiator		**FileLink3**	**FileLink2**		**Extended Cost**	$ 102,86
P/N Base	EN 08001			**FileLink3**			
Suffix	AA						
Details	Bought, cost as made						

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Heat Exchanger, Air to Liquid	Radiator	$ 0,0035	4890	cm^3			Rectangular area				1	$ 17,12
20	Aluminium, normal (per kg)	Radiator filler necks	$ 4,20	0,099	kg			Round 25mm diam.	4,91E-04	0,074	2712	2	$ 0,83
												Sub Total	**$ 17,94**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and Remove	Setup machining and removal	$ 1,30	Unit	2			$ 2,60
20	Machining	Radiator Filler Necks	$ 0,04	cm^3	1584	Material - Aluminium	1	$ 63,36
30	Weld		$ 0,15	cm	126,4			$ 18,96
							Sub Total	**$ 84,92**

Drawing Part : EN_08001

Vue de face
Echelle : 1:2

Vue de face
Echelle : 2:1

Vue de gauche
Echelle : 2:1

Vue isométrique
Echelle : 2:1

Normes iso 2768mK

Taille A3		Ecurie Piston Sport Auto	
Dessiné par Antoine Maros	Date 08/03/2018	Désignation Radiateur et Chapes	
Coordonnées antoine.maros@ecl16.ec-lyon.fr 06 03 43 19 48		Quantité 1	Matériau Aluminium	Version 1.0
Plan vérifié par XXX		Echelle 1:1	Radiasoudure	Feuille 2/3

University	Ecole Centrale de Lyon		Back to BOM	**Car #**	81	**Part Cost**	$ 1,79
System	Engine & Drivetrain	Drawing :	FileLink1			**Qty**	1
Assembly	Cooling System	**FileLink2**		**FileLink1**			
Part	Radiator lateral upper tab	**FileLink3**		**FileLink2**		**Extended Cost**	$ 1,79
P/N Base	EN 08002			**FileLink3**			
Suffix	AA						
Details							

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Mild (per kg)	Radiator Lateral Upper Tab	$ 2,25	0,009	kg			Rectangular area	8,80E-04	0,003	7850	1	$ 0,05
												Sub Total	**$ 0,05**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and Remove	Setup for laser cut	$ 1,30	Unit	1			$ 1,30
20	Laser Cut	Laser cut	$ 0,01	cm	14,8	Material - Steel	3	$ 0,44
							Sub Total	**$ 1,74**

EN 08002

Tolérances générales : ISO 2768-mK

Vue de face
Echelle : 2:1

Vue de gauche
Echelle : 2:1

Taille A4		Ecurie Piston Sport Auto
Dessiné par Aurélien Bienner	Date 09/02/2018	Désignation Bracket_107_cooling system up
Coordonnées aurelien.bienner@ecl16.ec-lyon.fr		
Plan vérifié par Roblot Brice		

Quantité	Matériau	Version
2	Acier S235	1.1
Echelle 2:1	Numéro du plan 18M_107	Feuille 1/1

University	Ecole Centrale de Lyon		Back to BOM	**Car #**	81	**Part Cost**	$ 2,53
System	Engine & Drivetrain	Drawing :	FileLink1			**Qty**	1
Assembly	Cooling System		**FileLink2**	**FileLink1**			
Part	Radiator lateral lower tab		**FileLink3**	**FileLink2**		**Extended Cost**	$ 2,53
P/N Base	EN 08003			**FileLink3**			
Suffix	AA						
Details							

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Mild (per kg)	Radiator Lateral Lower Tab	$ 2,25	0,048	kg			Rectangular area	5,00E-03	3,00E-03	7850	1	$ 0,26
												Sub Total	**$ 0,26**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and Remove	Setup for laser cut	$ 1,30	Unit	1			$ 1,30
20	Laser Cut	Laser cut	$ 0,01	cm	23,7	Material - Steel	3	$ 0,71
30	Sheet Metal Bends	Bend Tab	$ 0,25	Unit	1			$ 0,25
							Sub Total	**$ 2,26**

EN 08003

Tolérances générales : ISO 2768-mK

Vue de face
Echelle : 1:1

Vue dépliée
Echelle : 1:1

Le pli est à 90°, avec une tolérance de +-3°. La tolérance pour les autres cotes est de +-1mm

Taille A4		Ecurie Piston Sport Auto
Dessiné par Paco TANCHON	Date 10/02/2018	Désignation Braket 108 Radiateur Down Pliee
Coordonnées 06 13 85 20 09 paco.tanchon@ecl17.ec-lyon.fr		Quantité 1 / Matériau Acier S235 / Version 1.0
Plan vérifié par Roblot Brice		Echelle 1:1 / Numéro du plan 18M_108 / Feuille 1/1

University	Ecole Centrale de Lyon		Back to BOM	**Car #**	81	**Part Cost**	$ 1,61
System	Engine & Drivetrain	Drawing :	FileLink1			**Qty**	1
Assembly	Cooling System		**FileLink2**	**FileLink1**			
Part	Radiator Back tab		**FileLink3**	**FileLink2**		**Extended Cost**	$ 1,61
P/N Base	EN 08004			**FileLink3**			
Suffix	AA						
Details							

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Mild (per kg)	Radiator Back Tab	$ 2,25	0,005	kg			Rectangular area	4,20E-04	1,50E-03	7850	1	$ 0,01
												Sub Total	**$ 0,01**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and Remove	Setup for laser cut	$ 1,30	Unit	1			$ 1,30
20	Laser Cut	Laser cut	$ 0,01	cm	10,1	Material - Steel	3	$ 0,30
							Sub Total	**$ 1,60**

EN 08004

Vue de droite
Echelle : 2:1

Vue de face
Echelle : 2:1

Taille A4		Ecurie Piston Sport Auto	
Dessiné par Antonio Leblanc	Date 16/01/2018	Désignation Bracket 1- Cooling system back	
Coordonnées antonio.leblanc@ecl16.ec-lyon.fr 07 69 46 48 59		Quantité 1	Matériau Acier S235	Version 0.1
Plan vérifié par XXX		Echelle 1:1	Numéro du plan Bracket_1	Feuille 1/1

University	Ecole Centrale de Lyon		Back to BOM	**Car #**	81	**Part Cost**	$ 38,16
System	Engine & Drivetrain	**FileLink1**				**Qty**	1
Assembly	Cooling System	**FileLink2**		**FileLink1**			
Part	Main Coolant Line	**FileLink3**		**FileLink2**		**Extended Cost**	$ 38,16
P/N Base	EN 08005			**FileLink3**			
Suffix	AA						
Details							

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Hose, Silicone	Sleeve	$ 11,94	25,4	mm			Tube 25.4 x 0.5mm				0,4	$ 4,78
20	Steel, Stainless	Main lines	$ 2,25	0,198	kg			Tube 25 x 0.5mm	1,94E-05	1,30	7850	1	$ 7,48
												Sub Total	**$ 12,26**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Cut (scissors, knife)	Silicone hose cutting	$ 0,06	cm	62,8		1	$ 3,77
20	Saw or tubing cuts	Steel hose cutting	$ 0,40	cm	31,4			$ 12,57
30	Assemble, 1 kg, Interference	Hose and sleeve assembly	$ 0,19	labor	4			$ 0,76
40	Ratchet <= 6.35 mm	Bolt Hose Clamp	$ 0,50	labor	8			$ 4,00
							Sub Total	**$ 21,10**

ItemOrder	Fastener	Use	UnitCost	Size1	Unit1	Size2	Unit2	Quantity	Sub Total
10	Hose Clamp, Miniature Bolt	Main line hose clamp	$ 0,60	25,4	mm			8	$ 4,80
								Sub Total	**$ 4,80**

University	Ecole Centrale de Lyon		Back to BOM	**Car #**	81	**Part Cost**	$ 30,77
System	Engine & Drivetrain	**FileLink1**				**Qty**	1
Assembly	Cooling System	**FileLink2**		**FileLink1**			
Part	Fan	**FileLink3**		**FileLink2**		**Extended Cost**	$ 30,77
P/N Base	EN 08006			**FileLink3**			
Suffix	AA						
Details							

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Heat Exchanger Fan		$ 30,00									1	$ 30,00
												Sub Total	**$ 30,00**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Assemble, 1kg, Line-On-Line	Set Fan to Radiator	$ 0,13	Labor	1		1	$ 0,13
20	Assemble, 1kg, Loose	Push pin	$ 0,06	Labor	4		1	$ 0,24
							Sub Total	**$ 0,37**

ItemOrder	Fastener	Use	UnitCost	Size1	Unit1	Size2	Unit2	Quantity	Sub Total
10	Pin, Plastic Push	Set Fan to Radiator	0,1					4	$ 0,40
								Sub Total	**$ 0,40**

University	Ecole Centrale de Lyon		Back to BOM	**Car #**	81	**Part Cost**	$ 22,73
System	Engine & Drivetrain	Drawing :	FileLink1			**Qty**	1
Assembly	Cooling System	**FileLink2**		**FileLink1**			
Part	Expansion Tank	**FileLink3**		**FileLink2**		**Extended Cost**	$ 22,73
P/N Base	EN 08007			**FileLink3**			
Suffix	AA						
Details							

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Aluminium, normal (per kg)	Main tube	$ 4,20	0,098	kg			Round 40mm diameter	2,39E-04	0,152	2712	1	$ 0,41
20	Aluminium, normal (per kg)	Bottom	$ 4,20	0,011	kg			Round, 40mm diameter	2,00E-03	0,002	2712	1	
30	Fitting, Weld-in, Male, Aluminum	dash4 connection, bottom	$ 2,41	14	mm							1	$ 2,41
40	Aluminium, normal (per kg)	Filler neck	$ 4,20	0,025	kg			Round 24mm diameter	4,52E-04	0,020	2712	1	$ 0,10
60	Aluminium, normal (per kg)	Expansion tank cap	$ 2,25	0,038	kg			Round 30mm diameter	7,07E-04	0,020	2712	1	$ 0,09
70	Aluminium, normal (per kg)	Expansion tank tab	$ 4,20	0,001	kg			Tab profile	1,36E-04	0,003	2712	2	$ 0,01
												Sub Total	**$ 3,02**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Setup for machining and removal	$ 1,30	Unit	1		1	$ 1,30
20	Machining	Filler neck	$ 0,04	cm^3	11,77	Material : Aluminium	1	$ 0,47
30	Drilled holes	hole for hose output in filler neck	$ 0,35	hole	1		1	$ 0,35
40	Machining Setup, Install and remove	for laser cut	$ 1,30	Unit	1		1	$ 1,30
50	Laser cut	Tabs, bottom cutting	$ 0,01	cm	35	Material : Aluminum	1	$ 0,35
60	Tube cut	Cut the main part of the expansion tank	$ 0,15	cm	4	Repeated for each end of tube	2	$ 1,20
70	Tube end preperation for welding	Preparation to weld cap and bottom to tube	$ 0,75	end	4			$ 3,00
80	Weld - Round Tubing	Welding of cap and bottom to tube	$ 0,38	end	4			$ 1,52
90	Machining Setup, Install and remove	Laser cut of tabs	$ 1,30	Unit	1	2 tabs cut from a single machine setup	0,5	$ 0,65
100	Laser cut	Tabs profile	$ 0,01	cm	6,77	Material : Aluminum - Repeat 2	2	$ 0,14
110	Weld	Tabs to expansion tank welding	$ 0,15	cm	38			$ 5,70
120	Machining Setup, Install and remove	Setup for machining and removal	$ 1,30	Unit	1		1	$ 1,30
130	Machining	Expansion tank cap	$ 0,04	cm^3	6,04	Material : Aluminum	1	$ 0,24
140	Assemble, 1 kg, Interference	Expansion tank filler neck and cap assembly	$ 0,19	Unit	1			$ 0,19
							Sub Total	**$ 17,71**

ItemOrder	Tooling	Use	UnitCost	Unit	Quantity	PVF	FracIncld	Sub Total
10	Welds - Welding Fixture Tabs	Expansion tank welding fixture	$ 500,00	point	12	3000	1	$ 2,00
							Sub Total	**$ 2,00**

University	Ecole Centrale de Lyon		Back to BOM	**Car #**	81	**Part Cost**	$ 1,54
System	Engine & Drivetrain	Drawing :	FileLink1			**Qty**	1
Assembly	Cooling System		**FileLink2**	**FileLink1**			
Part	Expansion Tank tab		**FileLink3**	**FileLink2**		**Extended Cost**	$ 1,54
P/N Base	EN 08008			**FileLink3**			
Suffix	AA						
Details							

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Mild (per kg)	Expansion Tank Tab	$ 2,25	0,007	kg			Rectangular area	3,78E-04	0,003	7850	1	$ 0,02
												Sub Total	**$ 0,02**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and Remove	Setup for laser cut	$ 1,30	Unit	1			$ 1,30
20	Laser Cut	Laser cut	$ 0,01	cm	7,6	Material - Steel	3	$ 0,23
							Sub Total	**$ 1,53**

EN 08008

Vue de droite
Echelle : 2:1

Vue de face
Echelle : 2:1

Taille A4		Ecurie Piston Sport Auto
Dessiné par Aurélien	Date 09/02/2018	Désignation Bracket Expansion Tank
Coordonnées aurelien.bienner@ecl16.ec-lyon.fr		Quantité 2 / Matériau Acier S235 / Version 1.1
Plan vérifié par XXX		Echelle 2:1 / Numéro du plan XXX / Feuille 1/1

University	Ecole Centrale de Lyon		Back to BOM	**Car #**	81	**Part Cost**	$ 3,15
System	Engine & Drivetrain	Drawing :	FileLink1			**Qty**	1
Assembly	Cooling System		**FileLink2**	**FileLink1**			
Part	Lateral Tube		**FileLink3**	**FileLink2**		**Extended Cost**	$ 3,15
P/N Base	EN 08009			**FileLink3**			
Suffix	AA						
Details							

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Aluminum, Normal (per kg)	Lateral bar	$ 4,20	0,429	kg			Circular area	4,52E-04	0,350	2712	1	$ 1,80
												Sub Total	**$ 1,80**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Sheet Metal Saw Cut	Cut of the lateral bar	$ 0,20	cm	2			$ 0,40
20	Drilled holes < 25.4 mm dia.	Holes for the lateral bar	$ 0,35	Unit	2			$ 0,70
30	Sheet metal bends	Bar twist	$ 0,25	Bend	1			$ 0,25
							Sub Total	**$ 1,35**

EN 08009

Vue isométrique
Echelle : 1:3

Vue de face
Echelle : 1:2

Normes iso 2768mK

Taille A3		Ecurie Piston Sport Auto	
Dessiné par Antoine Maros	Date 08/03/2018	Désignation Fixing Bar	
Coordonnées antoine.maros@ecl16.ec-lyon.fr 06 03 43 19 48		Quantité 1	Matériau Aluminium	Version 1.0
Plan vérifié par XXX		Echelle 1:1	Radiasoudure	Feuille 2/3

University	Ecole Centrale de Lyon		Back to BOM	Car #	81		Part Cost	$	15,48
System	Engine & Drivetrain	FileLink1					Qty		1
Assembly	Cooling System	FileLink2		FileLink1					
Part	Secondary Coolant Line	FileLink3		FileLink2			Extended Cost	$	15,48
P/N Base	EN 08010			FileLink3					
Suffix	AA								
Details									

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Hose, Silicone	Sleeve	$ 5,83	12,4	mm			Tube 12.4 x 0.5mm				0,2	$ 1,17
20	Steel, Stainless	Secondary lines	$ 2,25	0,072	kg			Tube 12 x 0.5mm	9,23E-06	1,00	7850	1	$ 0,16
												Sub Total	**$ 1,33**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Cut (scissors, knife)	Silicone hose cutting	$ 0,06	cm	9,92		1	$ 0,60
20	Saw or tubing cuts	Steel hose cutting	$ 0,40	cm	10			$ 4,00
30	Assemble, 1 kg, Interference	Hose and sleeve assembly	$ 0,19	unit	4			$ 0,76
40	Ratchet <= 6.35 mm	Bolt Hose Clamp	$ 0,50	unit	8			$ 4,00
							Sub Total	**$ 9,36**

ItemOrder	Fastener	Use	UnitCost	Size1	Unit1	Size2	Unit2	Quantity	Sub Total
10	Hose Clamp, Miniature Bolt	Main line hose clamp	$ 0,60	25,4	mm			8	$ 4,80
								Sub Total	**$ 4,80**

University	Ecole Centrale de Lyon
System	Engine & Drivetrain
Assembly	Differential Assembly
P/N Base	EN A0900
Suffix	AA
Details	Differential housing and mounting assembly

Back to BOM

Car #	81
FileLink1	
FileLink2	
FileLink3	

Asm Cost	$ 402,70
Qty	1
Extended (	$ 402,70

ItemOrder	Part	Part Cost	Quantity	Sub Total
10	Housing	$ 125,94	1	$ 125,94
20	Left Eccentric	$ 10,90	1	$ 10,90
30	Right Eccentric	$ 8,54	1	$ 8,54
40	Left Eccentric Carrier	$ 23,96	1	$ 23,96
50	Right Eccentric Carrier	$ 17,20	1	$ 17,20
60	Upper Eccentric Carrier bracket	$ 1,00	4	$ 3,98
70	Lower Eccentric Carrier bracket	$ 0,97	4	$ 3,88
80	Left Jacking Bar bracket	$ 2,20	1	$ 2,20
90	Right Jacking Bar bracket	$ 2,21	1	$ 2,21
			Sub Total	$ 198,81

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
20	Bearing, Ball, Deep groove	Left differe	$ 38,18	90	mm	18	mm					1	$ 38,18
10	Bearing, Ball, Deep groove	Right differ	$ 32,00	80	mm	16	mm					1	$ 32,00
30	Paint	Paint the b	$ 10,00	0,024	m^2							1	$ 0,24
40	Fluid, Oil	Differentia	$ 0,75	0,06	litre							1	$ 0,05
50	Differential Internals, Limited Slip, Salisbury or Powerflow or Clutch Style		$ 110,00	1	unit							1	$ 110,00
												Sub Total	$ 180,47

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Weld	Weld tabs	$ 0,15	cm	56,54		1	$ 8,48
20	Aerosol apply	Paint the ta	$ 5,25	m^2	0,024		1	$ 0,13
30	Assemble, 3 kg, Interference	Assemble t	$ 0,56	unit	2		1	$ 1,12
40	Assemble, 1 kg, Interference	Assemble t	$ 0,19	unit	1		1	$ 0,19
50	Assemble, 1 kg, Interference	Assemble t	$ 0,19	unit	1		1	$ 0,19
60	Assemble, 1 kg, Interference	Assemble t	$ 0,19	unit	2		1	$ 0,38
70	Ratchet <= 6,35mm	Bolt the be	$ 0,50	unit	4		1	$ 2,00
80	Reaction Tool <=6,35mm	Bolt the be	$ 0,25	unit	4		1	$ 1,00
90	Assemble, 3kg, Line-on-Line	Put the bea	$ 0,38	unit	2		1	$ 0,76
100	Assemble, 1kg, Loose	Put two wa	$ 0,06	unit	4		1	$ 0,24
110	Ratchet <=25,4mm	Bolt the lef	$ 0,75	unit	2		1	$ 1,50
120	Reaction Tool <=25,4mm	Bolt the lef	$ 0,25	unit	2		1	$ 0,50
130	Ratchet <=25,4mm	Bolt the rig	$ 0,75	unit	2		1	$ 1,50
140	Reaction Tool <=25,4mm	Bolt the rig	$ 0,25	unit	2		1	$ 0,50
							Sub Total	$ 18,49

ItemOrder	Fastener	Use	UnitCost	Size1	Unit1	Size2	Unit2	Quantity	Sub Total
10	Bolt, Grade 8,8 (SAE 5)	Assemble l	$ 0,53	12	mm	50	mm	2	$ 1,05
20	Nut, Grade 8,8 (SAE 5)	Assemble l	$ 0,10	12	mm			2	$ 0,20
30	Bolt, Grade 8,8 (SAE 5)	Blocking le	$ 0,12	8	mm	30	mm	2	$ 0,24
40	Nut, Grade 8,8 (SAE 5)	Blocking le	$ 0,04	8	mm			2	$ 0,09
50	Washer, Grade 8,8 (SAE 5)	Blocking ec	$ 0,01		unit			4	$ 0,04
60	Bolt, Grade 8,8 (SAE 5)	Assemble r	$ 0,12	8	mm	30	mm	2	$ 0,24
70	Nut, Grade 8,8 (SAE 5)	Assemble r	$ 0,04	8	mm			2	$ 0,09
80	Bolt, Grade 8,8 (SAE 5)	Blocking rig	$ 0,12	8	mm	30	mm	2	$ 0,24
90	Nut, Grade 8,8 (SAE 5)	Blocking rig	$ 0,04	8	mm			2	$ 0,09
								Sub Total	**$ 2,27**

ItemOrder	Tooling	Use	UnitCost	Unit	Quantity	PVF	FractionIn	Sub Total
10	Welds - Welding Fixture	Weld tabs	$ 500,00	point	16	3000	1	$ 2,67
							Sub Total	**$ 2,67**

University	Ecole Centrale de Lyon
System	Engine & Drivetrain
Assembly	Differential
Part	Housing
P/N Base	EN 09001
Suffix	AA
Details	Bought, cost as made

Back to BOM

FileLink1	Drawing
FileLink2	
FileLink3	

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 125,94
Qty	1
Extended Cost	$ 125,94

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Aluminium, Premium		$ 4,20	1,906	kg			Round 102mm diam.	8,17E-03	0,086	2712	1	$ 8,00
20	Aluminium, Premium		$ 4,20	1,396	kg			Round 102mm diam.	8,17E-03	0,063	2712	1	$ 5,86
30	Aluminium, Premium		$ 4,20	1,773	kg			Round 102mm diam.	8,17E-03	0,080	2712	1	$ 7,45
40	Seal, O-Ring, Elastomer		$ 0,05		unit							2	$ 0,10
												Sub Total	**$ 21,41**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Setup and removal	$ 1,30	unit	1		1	$ 1,30
20	Machining	Machining	$ 0,04	cm^3	623	Material-Aluminium	1	$ 24,92
30	Tapping holes	Tapping lateral holes	$ 0,35	hole	24		1	$ 8,40
40	Tapping holes	Tapping central holes	$ 0,35	hole	3		1	$ 1,05
50	Machining Setup, Install and remove	Setup and removal	$ 1,30	unit	1		1	$ 1,30
60	Machining	Machining	$ 0,04	cm^3	426	Material-Aluminium	1	$ 17,04
70	Drilled holes < 25.4 mm dia.	Hole for the diff. Housing	$ 0,35	hole	12		1	$ 4,20
80	Broach, External	Broach the housing cover	$ 0,50	cm	3,5		1	$ 1,75
90	Machining Setup, Install and remove	Setup and removal	$ 1,30	unit	1		1	$ 1,30
100	Machining	Machining	$ 0,04	cm^3	538	Material-Aluminium	1	$ 21,52
110	Drilled holes < 25.4 mm dia.	Hole for the diff. Cover	$ 0,35	hole	12		1	$ 4,20
120	Assemble, 1 kg, Line-on-Line	Assemble the three parts	$ 0,13	unit	2		1	$ 0,26
130	Ratchet <= 6.35 mm	Assemble the three parts	$ 0,50	unit	24		1	$ 12,00
140	Ratchet <= 25.4 mm	Bolt the drain	$ 0,75	unit	3		1	$ 2,25
							Sub Total	**$ 101,49**

ItemOrder	Fastener	Use	UnitCost	Size1	Unit1	Size2	Unit2	Quantity	Sub Total
10	Bolt, Grade 12.9	Assembly of the three parts	$ 0,06	6	mm	14	mm	24	$ 1,35
20	Washer, Grade 12.9		$ 0,02		unit			24	$ 0,48
30	Bolt, Grade 10.9 (SAE 8)		$ 0,07	8	mm	8	mm	3	$ 0,20
40	Washer, Crush		$ 0,34	8	mm			3	$ 1,01
								Sub Total	**$ 3,03**

University	Ecole Centrale de Lyon
System	Engine & Drivetrain
Assembly	Differential
Part	Left Eccentric
P/N Base	EN 09002
Suffix	AA
Details	

FileLink1	Drawing
FileLink2	
FileLink3	

Back to BOM

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 10,90
Qty	1
Extended Cos	$ 10,90

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Plastic, Polyoxymethylene (POM)		$ 3,30	0,786	kg			175mm diam	2,41E-02	0,023	1420	1	$ 2,59
												Sub Total	**$ 2,59**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Setup for machining	$ 1,30	Unit	1			$ 1,30
20	Machining	Holes	$ 0,04	cm^3	350,61	Material - Plastic	0,5	$ 7,01
							Sub Total	**$ 8,31**

EN 09002

18xΦ8
A
R50
21°
5xΦ10
10
Φ84
R77.5
A
Vue de face
Echelle : 1:1
B
⊥ 0.1 A
23
5
A
Φ130 h7
Φ90 H6
4
Φ175
// 0.1 B
Coupe A-A
Echelle : 1:1
Vue isométrique
Echelle : 1:2
Tolérances générales : ISO 2768-mK
Taille
A3
Dessiné par
Adrien de la Salle
Date
01/02/2016
Coordonnées
Tel : 07 81 57 39 76
adrien.de-la-salle@ecl16.ec-lyon.fr
Plan vérifié par
BRT
Ecurie Piston Sport Auto
Désignation
Excentrique gauche
Quantité
1
Matériau
Delrin
Version
1.0
Echelle 1:1
Numéro 18M_EN_0900_004
Feuille 1/1

University	Ecole Centrale de Lyon
System	Engine & Drivetrain
Assembly	Differential
Part	Right Eccentric
P/N Base	EN 09003
Suffix	AA
Details	

Back to BOM

FileLink1	Drawing
FileLink2	
FileLink3	

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 8,54
Qty	1
Extended Cos	$ 8,54

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Plastic, Polyoxymethylene (POM)		$ 3,30	0,607	kg			165mm diam	2,14E-02	0,020	1420	1	$ 2,00
												Sub Total	**$ 2,00**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Setup for mac	$ 1,30	Unit	1			$ 1,30
20	Machining	Holes	$ 0,04	cm^3	261,75	Material - Plastic	0,5	$ 5,24
							Sub Total	**$ 6,54**

EN 09003

18xΦ8
5xΦ10
R45
25°
R72.5
10
Φ75.4
A
A
Vue de face
Echelle : 1:1
20
5
B
0.1 A
A
Φ120 h7
Φ80 H6
Φ165
4
0.1 B
Coupe A-A
Echelle : 1:1
Vue isométrique
Echelle : 1:2
Tolérances générales : ISO 2768-mK
Taille
A3
Dessiné par
Adrien de la Salle
Date
04/02/2018
Coordonnées
Tel : 07 81 57 39 76
adrien.de-la-salle@ecl16.ec-lyon.fr
Plan vérifié par
BRT
Ecurie Piston Sport Auto
Désignation
Excentrique droite
Quantité
1
Matériau
Delrin
Version
1.0
Echelle 1:1
Numéro
18M_0900_005
Feuille 1/1

University	Ecole Centrale de Lyon
System	Engine & Drivetrain
Assembly	Differential
Part	Left Eccentric carrier
P/N Base	EN 09004
Suffix	AA
Details	

FileLink1	Drawing
FileLink2	
FileLink3	

Back to BOM

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 23,96
Qty	1
Extended Cos	$ 23,96

373,663

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Aluminium, Premium	Material for the left bearing carrier	$ 4,20	1,846	kg			Rectangular area 374x130 mm	4,86E-02	0,014	2712	1	$ 7,75
												Sub Total	$ 7,75

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Setup and removal of the machining of the right bearing carrier	$ 1,30	Unit	1			$ 1,30
20	Machining	Shaping of the differential bearing carrier	$ 0,04	cm^3	372,58	Material - Aluminium	1	$ 14,90
							Sub Total	$ 16,20

EN 09004

A
R16
42°
20
20
R9 typ
20xΦ8.4
Φ155
25
199 ±0.1
53 ±0.1
Φ180
53 ±0.1
7.5 ±0.5
108.4 ±0.5
142.7 ±0.1
25
20
R9 typ
12.5
2xΦ8 +0.1 0
12.5
27 ±0.1
R16
A
58°
Vue de face
Echelle : 1:1
Φ12 +0.1 0
14 ±0.1
Φ130 H7
Φ12 +0.1 0
Coupe A-A
Echelle : 1:1
Vue isométrique
Echelle : 1:2
Taille
A2
Dessiné par
Adrien de la Salle
Date
01/02/2018
Coordonnées
Tel : 07 81 57 39 76
adrien.de-la-salle@ec18.ec-lyon.fr
Plan vérifié par
XXX
Ecurie Piston Sport Auto
Désignation
Porte-excentrique gauche
Quantité
1
Matériau
Alu 2017 T4
Version
1
Echelle 1:1
plan numéro EN_0900_006
Feuille 1/1

University	Ecole Centrale de Lyon
System	Engine & Drivetrain
Assembly	Differential
Part	Right Eccentric carrier
P/N Base	EN 09005
Suffix	AA
Details	

Back to BOM

FileLink1	Drawing
FileLink2	
FileLink3	

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 17,20
Qty	1
Extended Cos	$ 17,20

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Aluminium, Premium	Material for the left bearing carrier	$ 4,20	1,339	kg			Rectangular area 374x120 mm	4,49E-02	0,011	2712	1	$ 5,62
												Sub Total	**$ 5,62**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Setup and removal of the machining of the right bearing carrier	$ 1,30	Unit	1			$ 1,30
20	Machining	Shaping of the differential bearing carrier	$ 0,04	cm^3	256,88	Material - Aluminium	1	$ 10,28
							Sub Total	**$ 11,58**

EN 09005

A
R16
39°
20
20
R9 typ
20xΦ8.4
25
Φ145
Φ170
53 ±0.1
53 ±0.1
9.4 ±0.5
25
20
R9 typ
12.5
2xΦ8 +0.1 0
25
27 ±0.1
54°
199±0.1
142.66±0.1
107.2±0.5
Vue de face
Echelle : 1:1
Φ12 +0.1 0
11 ±0.1
Φ120 H7
Φ12 +0.1 0
Coupe A-A
Echelle : 1:1
Vue isométrique
Echelle : 1:2
Taille
A2
Dessiné par
Adrien de la Salle
Date
04/02/2018
Coordonnées
Tel 07 81 57 39 76
adrien.de-la-salle@sc18.ec-lyon.fr
Ecurie Piston Sport Auto
Désignation
Porte-excentrique droite
Quantité
1
Matériau
Alu 2017 T4
Version
1

R16
Plan vérifié par
XXX
Echelle 1:1
plan numéro EN_0900_007
Feuille 1/1
H
G
B
A

University	Ecole Centrale de Lyon
System	Engine & Drivetrain
Assembly	Differential
Part	Upper Eccentric Carrier bracket
P/N Base	EN 09006
Suffix	AA
Details	

Back to BOM

FileLink1	Drawing
FileLink2	
FileLink3	

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 1,00
Qty	4
Extended Cos	$ 3,98

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Mild	Material for the bracket	$ 2,25	0,037	kg			Rectangular area 46x34 mm	1,56E-03	0,003	7850	1	$ 0,08
												Sub Total	**$ 0,08**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Setup for machining	$ 1,30	Unit	1	4 parts cut from a single machine setup	0,25	$ 0,33
20	Laser Cut	Shaping of the brackets and holes	$ 0,01	cm	19,6	Material, Steel	3	$ 0,59
							Sub Total	**$ 0,91**

EN 09006

Tolérances générales : ISO 2768-mK

Vue de droite
Echelle : 2:1

Vue de face
Echelle :
2:1

Taille A4		Ecurie Piston Sport Auto
Dessiné par Erwan	Date 09/02/2018	Désignation Bracket_104_diff assy tube sup
Coordonnées edelongcamp@gmail.com xxx		
Plan vérifié par Roblot Brice		Quantité 4 / Matériau acier S355 / Version v.1.0
		Echelle 2:1 / Numéro du plan 18M_104 / Feuille 1/1

University	Ecole Centrale de Lyon		Back to BOM	**Car #**	81	**Part Cost**	$ 0,97
System	Engine & Drivetrain	FileLink1	Drawing			**Qty**	4
Assembly	Differential	**FileLink2**		**FileLink1**			
Part	Lower Eccentric Carrier bracket	**FileLink3**		**FileLink2**		**Extended Cos**	$ 3,88
P/N Base	EN 09007			**FileLink3**			
Suffix	AA						
Details							

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Mild	Material for the bracket	$ 2,25	0,031	kg			Rectangular area 46x29 mm	1,33E-03	0,003	7850	1	$ 0,07
												Sub Total	**$ 0,07**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Setup for machining	$ 1,30	Unit	1	4 parts cut from a single machine setup	0,25	$ 0,33
20	Laser Cut	Shaping of the brackets and holes	$ 0,01	cm	19,12	Material, Steel	3	$ 0,57
							Sub Total	**$ 0,90**

EN 09007

Tolérances générales : ISO 2768-mK

Vue de droite
Echelle : 1:1

Vue de face
Echelle : 1:1

Taille A4		Ecurie Piston Sport Auto
Dessiné par Erwan	Date 09/02/2018	Désignation Bracket_105_diff assy tube inf
Coordonnées edelongcamp@gmail.com xxx		
Plan vérifié par Brice Roblot		

Quantité	Matériau	Version
4	acier S355	v.1.1
Echelle 1:1	Numéro du plan 18M_105	Feuille 1/1

University	Ecole Centrale de Lyon
System	Engine & Drivetrain
Assembly	Differential
Part	Left Jacking Bar bracket
P/N Base	EN 09008
Suffix	AA
Details	

Back to BOM

FileLink1	Drawing
FileLink2	
FileLink3	

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 2,20
Qty	1
Extended Cos	$ 2,20

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Mild	Material for the bracket	$ 2,25	0,066	kg			Rectangular area 60x47 mm	2,82E-03	0,003	7850	1	$ 0,15
												Sub Total	**$ 0,15**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Setup for machining	$ 1,30	Unit	1			$ 1,30
20	Laser Cut	Shaping of the brackets and holes	$ 0,01	cm	25,09	Material, Steel	3	$ 0,75
							Sub Total	**$ 2,05**

EN 09008

Vue de dessous
Echelle : 1:1
⌀20
⌀9
27
⌀25
⌀20
20
⌀9
45
3
27
3
Vue de droite
Echelle : 1:1
Vue de face
Echelle : 1:1
Taille
A4
Ecurie Piston Sport Auto
Dessiné par
Erwan
Date
09/02/2018
Désignation
Bracket_102_EN_0900_010_AA
Coordonnées
edelongcamp@gmail.com
xxx
Quantité
1
Matériau
acier S235
Version
V.1.1
Plan vérifié par
XXX
Echelle 1:1
Numéro du plan 18M_102
Feuille 1/1

University	Ecole Centrale de Lyon
System	Engine & Drivetrain
Assembly	Differential
Part	Right Jacking Bar bracket
P/N Base	EN 09009
Suffix	AA
Details	

FileLink1	Drawing
FileLink2	
FileLink3	

Back to BOM

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 2,21
Qty	1
Extended Cos	$ 2,21

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Mild	Material for the bracket	$ 2,25	0,068	kg			Rectangular area 61x47 mm	2,87E-03	0,003	7850	1	$ 0,15
												Sub Total	**$ 0,15**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Setup for machining	$ 1,30	Unit	1			$ 1,30
20	Laser Cut	Shaping of the brackets and holes	$ 0,01	cm	25,37	Material, Steel	3	$ 0,76
							Sub Total	**$ 2,06**

EN 09009

Vue de dessous
Echelle : 1:1

Vue de droite
Echelle : 1:1

Vue de face
Echelle : 1:1

Taille A4		Ecurie Piston Sport Auto
Dessiné par Erwan	Date 09/02/2018	Désignation Bracket_103_EN_0900_011_AA
Coordonnées edelongcamp@gmail.com xxx		
Plan vérifié par Brice Roblot		Quantité 1 / Matériau acier S235 / Version v.1.1
		Echelle 1:1 / Numéro du plan 18M_103 / Feuille 1/1

University	Ecole Centrale de Lyon
System	Engine & Drivetrain
Assembly	Driveshaft
P/N Base	EN A1000
Suffix	AA
Details	

Back to BOM

Car #	81
FileLink1	
FileLink2	
FileLink3	

Asm Cost	$ 534,45
Qty	1
Extended Cos	$ 534,45

ItemOrder	Part	Part Cost	Quantity	Sub Total
10	Inboard tripod housing	$ 66,55	2	$ 133,10
20	Outboard tripod housing	$ 72,28	2	$ 144,55
30	Left axle	$ 16,43	1	$ 16,43
40	Right axle	$ 17,34	1	$ 17,34
			Sub Total	$ 311,42

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Constant Velocity Joint, Tripod	Tripods	$ 45,00		unit							4	$ 180,00
20	Constant Velocity Joint, Boot	Boots for driveshatfts	$ 5,00		unit							4	$ 20,00
												Sub Total	$ 200,00

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Assemble, 3 kg, Interference	Assemble a tripod housing and the differential	$ 0,56	unit	2		1	$ 1,12
20	Wrench <= 25,4 mm	Fasten the differential and the tripod housing	$ 1,50	unit	2		1	$ 3,00
30	Assemble, 1 kg, Interference	Assemble a boot and an axle	$ 0,19	unit	4		1	$ 0,76
40	Assemble, 1 kg, Interference	Assemble an axle and a snap ring	$ 0,19	unit	4		1	$ 0,76
50	Assemble, 1 kg, Line-on-Line	Assemble a tripod and an axle	$ 0,13	unit	4		1	$ 0,52
60	Assemble, 1 kg, Interference	Assemble an axle and a snap ring	$ 0,19	unit	4		1	$ 0,76
70	Assemble, 3 kg, Loose	Assemble an axle and a tripod housing	$ 0,19	unit	4		1	$ 0,76
80	Assemble, 1 kg, Interference	Assemble a boot and a tripod housing	$ 0,19	unit	4		1	$ 0,76
90	Assemble, 3 kg, Interference	Assemble a tripod housing and a hub	$ 0,56	unit	2		1	$ 1,12
100	Assemble, 3 kg, Interference	Assemble a hose clamp and an axle	$ 0,56	unit	4		1	$ 2,24
110	Assemble, 3 kg, Interference	Assemble a hose clamp and a tripod housing	$ 0,56	unit	4		1	$ 2,24
120	Ratchet <= 25,4 mm	Bolt tripod housing to hub	$ 0,75	unit	2		1	$ 1,50
							Sub Total	$ 15,54

ItemOrder	Fastener	Use	UnitCost	Size1	Unit1	Size2	Unit2	Quantity	Sub Total
10	Retaining Ring, External	Snap ring for retaining the tripods	$ 0,09	20	mm			8	$ 0,74
20	Hose Clamp, Worm Drive	Fasten the boot	$ 0,79	72,466	mm			4	$ 3,16
30	Hose Clamp, Worm Drive	Fasten the boot	$ 0,61	27,788	mm			4	$ 2,44
40	Bolt, Grade 8,8 (SAE 5)	Assemble the tripod housing to the differential	$ 0,08	8	mm	20	mm	2	$ 0,16
50	Nut, Grade 8.8 (SAE 5)	Fasten the tripod housing and the hub	$ 0,49	20	mm			2	$ 0,98
								Sub Total	$ 7,49

University	Ecole Centrale de Lyon
System	Engine & Drivetrain
Assembly	Driveshaft
Part	Inboard tripod housing
P/N Base	EN 10001
Suffix	AA
Details	Bought, cost as made

Back to BOM

FileLink1	
FileLink2	
FileLink3	

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 66,55
Qty	2
Extended Cos	$ 133,10

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Alloy	Material for the housing	$ 2,25	4,100	kg			Round 65.5 mm diam.	3,37E-03	0,155	7850	1	$ 9,22
												Sub Total	**$ 9,22**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Setup and removal of the machining of the tripod housing	$ 1,30	Unit	1			$ 1,30
20	Machining	Machining the ext shape of the tripod housing (turning)	$ 0,04	cm^3	269,90	Material - Steel	3	$ 32,39
30	Machining Setup, Change	Changing of the machining of the tripod housing	$ 0,65	Unit	1			$ 0,65
40	Machining	Machining the int shape of the tripod housing (milling)	$ 0,04	cm^3	175,85	Material - Steel	3	$ 21,10
50	Machining Setup, Change	Changing of the broach of the tripod housing	$ 0,65	Unit	1			$ 0,65
60	Broach, External	Broach of the tripod housing	$ 0,50	cm	2,47			$ 1,24
							Sub Total	**$ 57,33**

University	Ecole Centrale de Lyon		Back to BOM	**Car #**	81	**Part Cost**	$ 72,28
System	Engine & Drivetrain	**FileLink1**				**Qty**	2
Assembly	Driveshaft	**FileLink2**		**FileLink1**			
Part	Outboard tripod housing	**FileLink3**		**FileLink2**		**Extended Cost**	$ 144,55
P/N Base	EN 10002			**FileLink3**			
Suffix	AA						
Details	Bought, cost as made						

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Alloy	Material for the housing	$ 2,25	4,279	kg			Round 65.5 mm diam.	3,37E-03	0,162	7850	1	$ 9,63
												Sub Total	**$ 9,63**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Setup and removal of the machining of the tripod housing	$ 1,30	Unit	1			$ 1,30
20	Machining	Machining the ext shape of the tripod housing (turning)	$ 0,04	cm^3	313,90	Material - Steel	3	$ 37,67
30	Machining Setup, Change	Changing of the machining of the tripod housing	$ 0,65	Unit	1			$ 0,65
40	Machining	Machining the int shape of the tripod housing (milling)	$ 0,04	cm^3	161,94	Material - Steel	3	$ 19,43
50	Machining Setup, Change	Changing of the broach of the tripod housing	$ 0,65	Unit	1			$ 0,65
60	Broach, External	Broach of the tripod housing	$ 0,50	cm	5,89			$ 2,95
70	Machining Setup, Change	Setup and removal of the threading of the tripod housing	$ 0,65	Unit	1			$ 0,65
80	Threading, External (machining)	Threading of the tripod housing	$ 0,10	cm	1,8453			$ 0,18
							Sub Total	**$ 62,65**

University	Ecole Centrale de Lyon
System	Engine & Drivetrain
Assembly	Driveshaft
Part	Left Axle
P/N Base	EN 10003
Suffix	AA
Details	Bought, cost as made

FileLink1	Drawing of the cut
FileLink2	
FileLink3	

Back to BOM

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 16,43
Qty	1
Extended Cos	$ 16,43

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Alloy	Material for driveshaft	$ 2,25	1,147	kg			Round 22,1 mm diam.	3,84E-04	0,381	7850	1	$ 2,58
												Sub Total	$ 2,58

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Setup and removal of the machining of the axle	$ 1,30	Unit	1			$ 1,30
20	Machining	Cut of the edge of the axle	$ 0,04	cm^3	7,6	Material-Steel	3	$ 0,91
30	Machining Setup, Change	Setup and removal of the broach of the axle	$ 0,65	Unit	1			$ 0,65
40	Machining	Shaping of the int of the axle	$ 0,04	cm^3	45,8	Material-Steel	3	$ 5,49
50	Machining Setup, Change	Setup and removal of the broach of the axle	$ 0,65	Unit	1			$ 0,65
60	Broach, External	Broach of the axle	$ 0,50	cm	9,6998			$ 4,85
							Sub Total	$ 13,85

EN 10003

A
B
361.21 ±0.1
Vue de face
Echelle : 1:2
2.1 ±0.1
Φ20.3 ±0.1
24.1 ±0.1
3.2 ±0.1
gorges identiques
Détail A
Echelle : 3:2
Détail B
Echelle : 3:2
gorges identiques
Taille
A4
Ecurie Piston Sport Auto
Dessiné par
Adrien de la Salle
Date
27/02/2018
Désignation
arbre gauche
Coordonnées
07 81 57 39 76
adrien.de-la-salle@ecl16.ec-lyon.fr
Quantité
1
Matériau
high alloy 4130 steel
Version
XXX
Plan vérifié par
Arthur Perdereau
Echelle 1:1
plan numéro EN_1000_001
Feuille 1/1

University	Ecole Centrale de Lyon
System	Engine & Drivetrain
Assembly	Driveshaft
Part	Right Axle
P/N Base	EN 10004
Suffix	AA
Details	Bought, cost as made

FileLink1	Drawing of the cut
FileLink2	
FileLink3	

Back to BOM

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 17,34
Qty	1
Extended Cos	$ 17,34

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Alloy	Material for driveshaft	$ 2,25	1,300	kg			Round 22,1 mm diam.	3,84E-04	0,432	7850	1	$ 2,93
												Sub Total	**$ 2,93**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Setup and removal of the machining of the axle	$ 1,30	Unit	1			$ 1,30
20	Machining	Cut of the edge of the axle	$ 0,04	cm^3	11,9	Material-Steel	3	$ 1,43
30	Machining Setup, Change	Setup and removal of the broach of the axle	$ 0,65	Unit	1			$ 0,65
40	Machining	Shaping of the int of the axle	$ 0,04	cm^3	50,8	Material-Steel	3	$ 6,09
50	Machining Setup, Change	Setup and removal of the broach of the axle	$ 0,65	Unit	1			$ 0,65
60	Broach, External	Broach of the axle	$ 0,50	cm	8,5837			$ 4,29
							Sub Total	**$ 14,41**

EN 10004

A
400.8 ±0.1
B
Vue de face
Echelle : 1:2
gorges identiques
2.1 ±0.1
Φ20.3 ±0.1
24.1 ±0.1
3.2 ±0.1
gorges identiques
Détail B
Echelle : 3:2
2.1 ±0.1
Φ20.3 ±0.1
24.1 ±0.1
3.2 ±0.1
Détail A
Echelle : 3:2
Taille
A4
Dessiné par
Adrien de la Salle
Date
27/02/2018
Coordonnées
07 81 57 39 76
adrien.de-la-salle@ecl16.ec-lyon.fr
Plan vérifié par
XXX
Ecurie Piston Sport Auto
Désignation
arbre droit
Quantité
1
Matériau
high alloy 4130 steel
Version
XXX
Echelle 1:1
plan numéro EN_1000_002
Feuille 1/1

University	Ecole Centrale de Lyon
System	Engine & Drivetrain
Assembly	Chain Set
P/N Base	EN A1100
Suffix	AA
Details	

Back to BOM

Car #	81
FileLink1	
FileLink2	
FileLink3	

Asm Cost	$ 133,38
Qty	1
Extended Cos	$ 133,38

ItemOrder	Part	Part Cost	Quantity	Sub Total
10	Front sprocket	$ 24,75	1	$ 24,75
20	rear sprocket	$ 41,80	1	$ 41,80
30	Rear sprocket adaptor	$ 29,16	1	$ 29,16
40	Chain shield	$ 9,10	1	$ 9,10
50	Upper chainshield bracket	$ 1,71	1	$ 1,71
60	Lower chainshield bracket	$ 1,71	1	$ 1,71
			Sub Total	$ 108,24

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Chain		$ 0,05	20	mm							1	$ 1,00
20	Paint	Chain shield and Bracket painting	$ 10,00	0,118	m^2							1	$ 1,18
												Sub Total	$ 2,18

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Weld	Weld tab to frame	$ 0,15	cm	2			$ 0,30
20	Aerosol apply	Tabs and shield painting	$ 5,25	m^2	0,118			$ 0,62
30	Assemble, 1 kg, Interference	Put the rear sprocket adapter on the differential	$ 0,19	Unit	1			$ 0,19
40	Assemble, 1 kg, Interference	Put the centering pin in the rear sprocket adaptor holes	$ 0,19	Unit	6			$ 1,14
50	Assemble, 1 kg, Line-on-Line	Put the retaining ring in the groove	$ 0,13	Unit	1			$ 0,13
60	Assemble, 1 kg, Loose	Place bolts and washers	$ 0,06	Unit	15			$ 0,90
70	Ratchet <= 25.4 mm	Bolt rear sprocket to adapter	$ 0,75	Unit	6			$ 4,50
80	Reaction Tool <= 25.4 mm	Bolt rear sprocket to adapter	$ 0,25	Unit	6			$ 1,50
90	Assemble, 1 kg, Interference	Put the front sprocket in place	$ 0,19	Unit	1			$ 0,19
100	Ratchet <= 25.4 mm	Bolt front sprocket to engine	$ 0,75	Unit	1			$ 0,75
110	Assemble, 1 kg, Line-on-Line	Put chain in place	$ 0,13	Unit	1			$ 0,13
120	Adjustment - Misc.	Chain tension	$ 5,00	Unit	1			$ 5,00
130	Assemble, 1 kg, Loose	Place bolts and washers	$ 0,06	Unit	3			$ 0,18
140	Ratchet <= 25.4 mm	Bolt upper chain shield to tab	$ 0,75	Unit	1			$ 0,75
150	Reaction Tool <= 25.4 mm	Bolt upper chain shield to tab	$ 0,25	Unit	1			$ 0,25
160	Assemble, 1 kg, Loose	Place bolts and washers	$ 0,06	Unit	3			$ 0,18
170	Ratchet <= 25.4 mm	Bolt lower chain shield to tab	$ 0,75	Unit	1			$ 0,75
180	Reaction Tool <= 25.4 mm	Bolt lower chain shield to tab	$ 0,25	Unit	1			$ 0,25
							Sub Total	$ 17,71

ItemOrder	Fastener	Use	UnitCost	Size1	Unit1	Size2	Unit2	Quantity	Sub Total
10	Bolt, Grade 8,8 (SAE 5)	Assemble the rear sprocket with the adapter	$ 0,20	10	mm	30	mm	6	$ 1,19
20	Nut, Grade 8,8 (SAE 5)	Assemble the rear sprocket with the adapter	$ 0,07	10	mm			6	$ 0,40
30	Washer, Grade 8,8 (SAE 5)	Assemble the rear sprocket with the adapter	$ 0,01		Unit			12	$ 0,12
40	Bolt, Grade 8,8 (SAE 5)	Assemble the chain shield with the tab	$ 0,08	8	mm	20	mm	1	$ 0,08
50	Nut, Grade 8,8 (SAE 5)	Assemble the chain shield with the tab	$ 0,04	8	mm			1	$ 0,04
60	Washer, Grade 8,8 (SAE 5)	Assemble the chain shield with the tab	$ 0,01		Unit			2	$ 0,02
70	Bolt, Grade 8,8 (SAE 5)	Assemble the chain shield with the tab	$ 0,08	8	mm	20	mm	1	$ 0,08
80	Nut, Grade 8,8 (SAE 5)	Assemble the chain shield with the tab	$ 0,04	8	mm			1	$ 0,04
90	Washer, Grade 8,8 (SAE 5)	Assemble the chain shield with the tab	$ 0,01		Unit			2	$ 0,02
100	Bolt, Grade 8,8 (SAE 5)	Assemble the front sprocket with the engine	$ 0,08	8	mm	20	mm	1	$ 0,08
110	Retaining ring, External	Hold the rear sprocket in place on the differential	$ 0,50	52	mm			1	$ 0,50
								Sub Total	$ 2,58

ItemOrder	Tooling	Use	UnitCost	Unit	Quantity	PVF	FractionInclu	Sub Total
10	Welds - Welding Fixture	Weld tabs to frame	$ 500,00	point	16	3000	1	$ 2,67
							Sub Total	**$ 2,67**

University	Ecole Centrale de Lyon
System	Engine & Drivetrain
Assembly	Chain Set
Part	Front sprocket
P/N Base	EN 11001
Suffix	AA
Details	Bought, cost as made

FileLink1	
FileLink2	
FileLink3	

Back to BOM

Car #	81

FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 24,75
Qty	1
Extended Cos	$ 24,75

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Mild	Material for front sprocket	$ 2,25	0,676	kg			Round 81mm diam.	5,15E-03	0,017	7850	1	$ 1,52
												Sub Total	$ 1,52

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Setup and removal of the machining of the sprocket	$ 1,30	Unit	1			$ 1,30
20	Machining	Shaping of the sprocket (turning)	$ 0,04	cm^3	49,62	Material-steel	3	$ 5,95
30	Machining Setup, Change	Setup and removal of the hobbing of the sprocket	$ 0,65	Unit	1			$ 0,65
40	Gear Shaping (hobbing)	Hobbing of the sprocket	$ 0,50	cm	9,23	Material-steel	3	$ 13,85
50	Machining Setup, Change	Setup and removal of the broach of the sprocket	$ 0,65	Unit	1			$ 0,65
60	Broach, Internal	Broach of the sprocket	$ 0,50	cm	1,67			$ 0,84
							Sub Total	$ 23,23

University	Ecole Centrale de Lyon
System	Engine & Drivetrain
Assembly	Chain Set
Part	Rear sprocket
P/N Base	EN 11002
Suffix	AA
Details	Bought, cost as made

FileLink1	
FileLink2	
FileLink3	

Back to BOM

Car #	81

FileLink1
FileLink2
FileLink3

Part Cost	$ 41,80
Qty	1
Extended Cos	$ 41,80

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Mild	Material for the rear sprocket	$ 2,25	1,359	kg			Round 210mm diam.	3,46E-02	0,005	7850	1	$ 3,06
												Sub Total	**$ 3,06**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Setup and removal of the machining of the sprocket	$ 1,30	Unit	1			$ 1,30
20	Gear Shaping (hobbing)		$ 0,50	cm	22,00	Material-steel	3	$ 33,00
30	Machining Setup, Change	Setup and removal for laser cut of the sprocket	$ 0,65	Unit	1		1	$ 0,65
40	Laser cut	Shaping of the sprocket	$ 0,01	cm	126,4	Material-Steel	3	$ 3,79
							Sub Total	**$ 38,74**

University	Ecole Centrale de Lyon			Back to BOM	**Car #**	81	**Part Cost** $ 29,16
System	Engine & Drivetrain	**FileLink1**	Drawing				**Qty** 1
Assembly	Chain Set	**FileLink2**			**FileLink1**		
Part	Rear sprocket adaptor	**FileLink3**			**FileLink2**		**Extended Cos** $ 29,16
P/N Base	EN 11003				**FileLink3**		
Suffix	AA						
Details							

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Aluminium, Premium	Material for the adapter	$ 4,20	2,076	kg			Round 190mm	2,84E-02	0,027	2712	1	$ 8,72
												Sub Total	**$ 8,72**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Setup and removal of the machining of the adapter	$ 1,30	Unit	1			$ 1,30
20	Machining	Shaping of the adapter	$ 0,04	cm^3	444,78			$ 17,79
30	Broach, Internal	Broach of the adapter	$ 0,50	cm	2,7			$ 1,35
							Sub Total	**$ 20,44**

EN 11003

Les 6 branches sont identiques
Tolérance générale ISO 2768 mK
Vue isométrique
Échelle: 1:3
R26
6xR15
6xR12
6xR12
6xΦ10.5
Φ81.1
6xR5
Φ125
80
Cannelures
Vue de face
Échelle: 1:3
46
14.7
12
15
Vue de droite
Échelle: 1:3
Taille
A4
Dessiné par
Pablo
Date
04/03/2017
Coordonnées
pabril@ec-lyon.fr
06 58 29 03 40
Plan vérifié par
VPY
Ecurie Piston Sport Auto
Désignation
Porte couronne
Quantité
1
Matériau
Aluminium 7075
Version
2.0
Echelle 1:3
Nº du plan 17B_M_057_PCR
Feuille 1/1

University	Ecole Centrale de Lyon
System	Engine & Drivetrain
Assembly	Chain Set
Part	Chain shield
P/N Base	EN 11004
Suffix	AA
Details	

FileLink1	Drawing
FileLink2	
FileLink3	

Back to BOM

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 9,10
Qty	1
Extended Cos	$ 9,10

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Mild	Material for the upper chain shield	$ 2,25	1,473	kg			Rectangular area 101 x 930 mm	9,38E-02	0,002	7850	1	$ 3,31
												Sub Total	**$ 3,31**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Setup and removal of the machining of the shield	$ 1,30	Unit	1			$ 1,30
20	Laser Cut	Shaping of the chain shield	$ 0,01	cm	116,1574	Material-Steel	3	$ 3,48
30	Sheet metal bends	Bend to shape	$ 0,25	bend	4			$ 1,00
							Sub Total	**$ 5,78**

EN 11004

R10
33
222
Φ92
45°
14.25
36.6°
Φ280
50
19
R10
Vue de face
Echelle : 2:5
84.19
12
R12
R12
Détail C
Echelle : 2:3
Vue isométrique
Echelle : 1:4
930.1
347
60 ±0.5
A
B
C
18.1
14.3
125
263.5
Vue dépliée
Echelle : 1:4
10
16.5
11
Φ8.4
Φ20
20
Détail A
Echelle : 2:3
10
30.8
Φ8.4
Φ20
20
Détail B
Echelle : 2:3
Tolérances générales : ISO 2768-mK
Taille
A3
Ecurie Piston Sport Auto
Dessiné par
Adrien de la Salle
Date
15/02/2018
Désignation
Cache-chaîne
Coordonnées
Tel : 07 81 57 39 76
adrien.de-la-salle@ecl16.ec-lyon.fr
Quantité
1
Matériau
Acier S235
Version
XXX
Plan vérifié par
BRT
Echelle 1:1
plan numéro EN_1100_005
Feuille 1/1

University	Ecole Centrale de Lyon
System	Engine & Drivetrain
Assembly	Chain Set
Part	Upper chainshield bracket
P/N Base	EN 11005
Suffix	AA
Details	

FileLink1	Drawing
FileLink2	
FileLink3	

Back to BOM

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 1,71
Qty	1
Extended Cos	$ 1,71

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Mild	Material for the bracket	$ 2,25	0,018	kg			Rectangular area 30,6x25 mm	7,65E-04	0,003	7850	1	$ 0,04
												Sub Total	**$ 0,04**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Setup for machining	$ 1,30	Unit	1			$ 1,30
20	Laser Cut	Shaping of the brackets and holes	$ 0,01	cm	12,4622	Material, Steel	3	$ 0,37
							Sub Total	**$ 1,67**

EN 11005

30.6
3
Vue de droite
Echelle : 2:1
19°
⌀17.2
⌀8.6
22
⌀30
25
Vue de face
Echelle : 2:1
Tolérances générales : ISO 2768-mK
Taille
A4
Ecurie Piston Sport Auto
Dessiné par
Clement EMERIQUE
Date
09/02/2018
Désignation
Bracket_106_Chain shield sup
Coordonnées
Tel : 07.78.04.16.36
clement.emerique@ecl17.ec-lyon.fr
Quantité
1
Matériau
Acier S235
Version
1.1
Plan vérifié par
Roblot Brice
Echelle 2:1
Numéro du plan 18M_106
Feuille 1/1

University	Ecole Centrale de Lyon
System	Engine & Drivetrain
Assembly	Chain Set
Part	Lower chainshield bracket
P/N Base	EN 11006
Suffix	AA
Details	

FileLink1	Drawing
FileLink2	
FileLink3	

Back to BOM

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 1,71
Qty	1
Extended Cos	$ 1,71

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Mild	Material for the bracket	$ 2,25	0,017	kg			Rectangular area 32,3x23 mm	7,04E-04	0,003	7850	1	$ 0,04
												Sub Total	**$ 0,04**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Setup for machining	$ 1,30	Unit	1			$ 1,30
20	Laser Cut	Shaping of the brackets and holes	$ 0,01	cm	12,5551	Material, Steel	3	$ 0,38
							Sub Total	**$ 1,68**

EN 11006

Tolérances générales : ISO 2768-mK

Vue de droite
Echelle : 2:1

Vue de face
Echelle : 2:1

Taille A4		Ecurie Piston Sport Auto	
Dessiné par Aurélien Bienner	Date 10/02/2018	Désignation Bracket_21_chain shield inf	
Coordonnées aurelien.bienner@ecl16.ec-lyon.fr		Quantité 2	Matériau Acier S235	Version 1.0
Plan vérifié par Brice Roblot		Echelle 2:1	Numéro du plan 18M_119	Feuille 1/1

Ecurie Piston Sport Auto

ÉCOLE CENTRALE LYON

CAR #81

Frame & Body

University	Ecole Centrale de Lyon
System	Frame and Body
Assembly	Frame
P/N Base	FR A0100
Suffix	AA
Details	Tubular and space frame

Back to BOM

Car #	81
FileLink1	
FileLink2	
FileLink3	

Asm Cost	$ 944,41
Qty	1
Extended Cost	$ 944,41

ItemOrder	Part	Part Cost	Quantity	Sub Total
10	Bend Round steel tubing	$ 23,75	1	$ 23,75
20	Straight round steel tubing	$ 256,01	1	$ 256,01
30	Anti-intusion plate	$ 9,13	1	$ 9,13
40	Sleeved joint	$ 3,92	4	$ 15,68
			Sub Total	**$ 304,56**

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Paint	Painting of the frame	$ 10,00	3,07	m^2							3,07	$ 30,70
												Sub Total	**$ 30,70**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Weld round tubing		$ 0,50	unit	993			$ 496,50
20	Weld round tubing	Anti-intrusion plate	$ 0,50	unit	20			$ 10,00
30	Aerosol Apply	Painting of the frame	$ 5,25	m^2	3,07			$ 16,12
40	Ratchet <= 25.4 mm		$ 0,75	unit	16			$ 12,00
50	Reaction Tool <= 25.4 mm		$ 0,25	unit	16			$ 4,00
							Sub Total	**$ 538,62**

ItemOrder	Fastener	Use	UnitCost	Size1	Unit1	Size2	Unit2	Quantity	Sub Total
10	Bolt,Grade 8.8 (SAE)	Bolt on sleeved joints	$ 0,16	8	mm	40	mm	16	$ 2,56
20	Nut, Grade 8.8 (SAE 5)	Nut on sleeved joints	$ 0,04	8	mm			16	$ 0,64
								Sub Total	**$ 3,20**

ItemOrder	Tooling	Use	UnitCost	Unit	Quantity	PVF	FractionIncluded	Sub Total
10	Welds - Welding Fixture	Frame Welding fixiture	$ 500,00	point	204	3000	1	$ 34,00
20	Welds - Welding Fixture	Anti-intrusion fixiture	$ 500,00	point	20	300	1	$ 33,33
							Sub Total	**$ 67,33**

University	Ecole Centrale de Lyon
System	Frame and Body
Assembly	Frame
Part	Bend Round steel tubing
P/N Base	FR 01001
Suffix	AA
Details	Hoops of the frame

Back to BOM

FileLink1	
FileLink2	
FileLink3	

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 23,75
Qty	1
Extended Cost	$ 23,75

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Alloy	Main Hoop	$ 2,25	3,599	kg			Round, 30 x 2 mm	1,759E-04	2,620	7850	1	$ 8,14
20	Steel, Alloy	Front Hoop	$ 2,25	2,041	kg			Round, 30 x 2 mm	1,759E-04	1,500	7850	1	$ 4,66
												Sub Total	**$ 12,80**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Tube bends	Main Hoop bends	$ 0,75	Bend	5		1	$ 3,75
20	Tube bends	Front Hoop bends	$ 0,75	Bend	4		1	$ 3,00
30	Tube cut	Cut to proper length	$ 0,15	cm	8		1	$ 1,20
40	Tube end preparation for welding		$ 0,75	end	4		1	$ 3,00
							Sub Total	**$ 10,95**

University	Ecole Centrale de Lyon
System	Frame and Body
Assembly	Frame
Part	Straight round steel tubing
P/N Base	FR 01002
Suffix	AA
Details	

FileLink1	
FileLink2	
FileLink3	

Back to BOM

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 256,01
Qty	1
Extended Cost	$ 256,01

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Alloy	Shoulder Harness Mounting Bar	$ 2,25	0,764	kg			Round, 30 x 2 mm	1,759E-04	0,553	7850	1	$ 1,72
20	Steel, Alloy	Side impact structure, Front Bulkhead, Roll Hoop Bracing, Front Bulkhead Support, Main Hoop Bracing Support	$ 2,25	12,947	kg			Round, 30 x 1,5 mm	1,343E-04	11,923	7850	1	$ 28,28
30	Steel, Alloy	Jacking point & Miscellaneous	$ 2,25	13,508	kg			Round, 25 x 1,5 mm	1,107E-04	15,034	7850	1	$ 29,41
40	Steel, Alloy	Miscellaneous	$ 2,25	3,009	kg			Round, 20 x 1,5 mm	8,718E-05	4,471	7850	1	$ 6,88
50	Steel, Alloy	Miscellaneous	$ 2,25	1,877	kg			Round, 15 x 1,5 mm	6,362E-05	3,710	7850	1	$ 4,17
60	Steel, Alloy	Miscellaneous	$ 2,25	1,877	kg			Round, 20 x 4 mm	2,011E-04	0,084	7850	1	$ 0,30
												Sub Total	**$ 70,76**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Tube cut	Cut to proper length	$ 0,15	unit	337		1	$ 50,55
20	Tube end preparation for welding		$ 0,75	end	176		1	$ 132,00
30	Machining Setup, Install and remove	Engine mounts machining	$ 1,30	unit	2		1	$ 2,60
40	Machining	Engine mounts machining	$ 0,04	cm^3	8,2E-01	Material - Steel	3	$ 0,10
							Sub Total	**$ 185,25**

University	Ecole Centrale de Lyon		Back to BOM	**Car #**	81	**Part Cost**	$ 9,13
System	Frame and Body	**FileLink1**				**Qty**	1
Assembly	Frame	**FileLink2**		**FileLink1**			
Part	Ant-intrusion plate	**FileLink3**		**FileLink2**		**Extended C**	$ 9,13
P/N Base	FR 01003			**FileLink3**			
Suffix	AA						
Details							

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Alloy	Anti-intrusion plate	$ 2,25	1,790	kg			Rectangular area	0,152	1,50E-03	7850	1	$ 4,03
												Sub Total	**$ 4,03**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Setup for metal shearing	$ 1,30	unit	1		1	$ 1,30
20	Sheet metal shearing	Cutout shape	$ 0,25	cut	4		1	$ 1,00
30	Drilled holes < 25.4 mm dia.		$ 0,35	hole	8		1	$ 2,80
							Sub Total	**$ 5,10**

University	Ecole Centrale de Lyon
System	Frame and Body
Assembly	Frame
Part	Sleeved joint
P/N Base	FR 01004
Suffix	AA
Details	

Back to BOM

FileLink1	Drawing
FileLink2	
FileLink3	

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 3,92
Qty	4
Extended C	$ 15,68

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Alloy	Sleeve joint	$ 2,25	0,158	kg			Round , 34 x 2 mm	2,011E-04	0,100	7850	1	$ 0,36
												Sub Total	**$ 0,36**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove		$ 1,30	unit	1			$ 1,30
20	Machining	Inner	$ 0,04	cm^3	21,6			$ 0,86
30	Drilled holes < 25,4 mm dia.		$ 0,35	hole	4			$ 1,40
							Sub Total	**$ 3,56**

Drawing Part : FR 01004

University	Ecole Centrale de Lyon
System	Frame and Body
Assembly	Impact Attenuator
P/N Base	FR A0200
Suffix	AA
Details	FSAE Impact Attenuator

Back to BOM

Car #	81
FileLink1	
FileLink2	
FileLink3	

Asm Cost	$ 46,71
Qty	1
Extended Cost	$ 46,71

ItemOrder	Part	Part Cost	Quantity	Sub Total
10	Impact Attenuator	$ 35,19	1	$ 35,19
			Sub Total	$ 35,19

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Assemble, 1 kg, Loose	Assemble Attenuator on IA Plate	$ 0,06	Unit	1		1	$ 0,06
20	Ratchet <= 25.4 mm	Bolt Attenuator on Plate	$ 0,75	Unit	8		1	$ 6,00
30	Reaction Tool <= 25.4 mm	Bolt Attenuator on Plate	$ 0,25	Unit	8		1	$ 2,00
							Sub Total	$ 8,06

ItemOrder	Fastener	Use	UnitCost	Size1	Unit1	Size2	Unit2	Quantity	Sub Total
10	Bolt,Grade 8.8 (SAE 5)		$ 0,39	8	mm	80	mm	6	$ 2,32
20	Bolt,Grade 8.8 (SAE 5)		$ 0,53	8	mm	100	mm	1	$ 0,53
30	Bolt,Grade 8.8 (SAE 5)		$ 0,21	8	mm	50	mm	1	$ 0,21
40	Nut, Grade 8.8 (SAE 5)		$ 0,04	8	mm			8	$ 0,36
50	Washer, Grade 8.8 (SAE 5)		$ 0,01	1	Unit			4	$ 0,04
								Sub Total	$ 3,45

University	Ecole Centrale de Lyon
System	Frame and Body
Assembly	Impact Attenuator
Part	Impact Attenuator
P/N Base	FR 02001
Suffix	AA
Details	FSAE Impact Attenuator Type 15, Bought, Cost as Made

Back to BOM

FileLink1	
FileLink2	
FileLink3	

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 35,19
Qty	1
Extended Cost	$ 35,19

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Foam, Expanding, Non-Structural	First part of foam	$ 15,00	0,229	kg			Rectangular area, 355x305 mm	1,08E-01	0,085	25	1	$ 3,44
20	Foam, Expanding, Non-Structural	Second part of foam	$ 15,00	0,153	kg			Rectangular area, 305x237 mm	7,23E-02	0,085	25	1	$ 2,30
30	Foam, Expanding, Non-Structural	Third part of foam	$ 15,00	0,085	kg			Rectangular area, 237x169 mm	4,01E-02	0,085	25	1	$ 1,27
40	Adhesive	Assemble foam parts, cost included in process	$ -										$ -
												Sub Total	$ 7,01

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Non-metallic cutting > 76.2 mm	Cut first part side	$ 1,40	cut	1	Material - Foam	0,33	$ 0,46
20	Brush apply	Apply glue on first part	$ 0,02	cm^2	723			$ 14,46
30	Non-metallic cutting > 76.2 mm	Cut second part side	$ 1,40	cut	1	Material - Foam	0,33	$ 0,46
40	Brush apply	Apply glue on second part	$ 0,02	cm^2	401			$ 8,02
50	Non-metallic cutting > 76.2 mm	Cut third part side	$ 1,40	cut	1	Material - Foam	0,33	$ 0,46
60	Assemble, 1 kg, Loose	Glue 3 parts	$ 0,06	Unit	2			$ 0,12
70	Drilled holes < 25.4 mm dia.	Drill holes for bolts	$ 0,35	Hole	8			$ 2,80
80	Drilled holes < 25.4 mm dia.	Drill larger holes at each extremities of the part	$ 0,35	Hole	4			$ 1,40
							Sub Total	$ 28,19

University	Ecole Centrale de Lyon
System	Frame and Body
Assembly	Pedal box
P/N Base	FR A0300
Suffix	AA
Details	The assembly of brake and accelerator pedals

Back to BOM

Car #	81
FileLink1	
FileLink2	
FileLink3	

Asm Cost	$ 102,32
Qty	1
Extended Cost	$ 102,32

ItemOrder	Part	Part Cost	Quantity	Sub Total
10	Rail	$ 3,11	2	$ 6,22
20	Brake pedal	$ 5,69	1	$ 5,69
30	Accelerator pedal	$ 4,84	1	$ 4,84
40	Foot top support	$ 2,10	2	$ 4,20
50	Heel support	$ 2,02	2	$ 4,03
60	Brake pedal support	$ 3,11	2	$ 6,22
70	Brake over-travel switch support	$ 1,97	1	$ 1,97
80	Accelerator pedal support	$ 2,00	2	$ 3,99
90	Cable support	$ 4,21	1	$ 4,21
100	Rear rail mount	$ 0,86	4	$ 3,44
110	Front rail mount	$ 0,80	4	$ 3,18
120	Sheath for cable mount	$ 1,86	1	$ 1,86
			Sub Total	$ 49,85

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Bearing, Needle	Pedal pivot	$ 4,28	15	mm	10	mm					4	$ 17,12
20	Paint	Painting the Mounts	$ 10,00	0,18	m^2							0,18	$ 1,80
												Sub Total	$ 18,92

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Weld	Welding the Front and Rear Rails Mounts to the frame	$ 0,15	cm	18			$ 2,70
20	Weld	Welding the Sheath for Cable Mount	$ 0,15	cm	2,1			$ 0,32
30	Aerosol Apply	Painting of the Mounts	$ 5,25	m^2	0,18			$ 0,95
40	Assemble, 1 kg, Loose	Inserting the Rails between the Front and Rear Rails Mounts	$ 0,06	unit	2			$ 0,12
50	Ratchet <= 25.4 mm	Fixing the Rails to the Front and Rear Rails Mounts	$ 0,75	unit	4			$ 3,00
60	Reaction Tool <= 25.4 mm	Fixing the Rails to the Front and Rear Rails Mounts	$ 0,25	unit	4			$ 1,00
70	Assemble, 1 kg, Loose	Positioning the Accelerator Pedal Supports on the right Pedal Rail	$ 0,06	unit	2			$ 0,12
80	Ratchet <= 25.4 mm	Fixing the Accelerator Pedal Supports on the right Pedal Rail	$ 0,75	unit	2			$ 1,50
90	Reaction Tool <= 25.4 mm	Fixing the Accelerator Pedal Supports on the right Pedal Rail	$ 0,25	unit	2			$ 0,50
100	Assemble, 1 kg, Loose	Positioning the Brake Pedal Supports on the left Pedal Rail	$ 0,06	unit	2			$ 0,12
110	Ratchet <= 25.4 mm	Fixing the Brake Pedal Supports on the left Pedal Rail	$ 0,75	unit	2			$ 1,50
120	Reaction Tool <= 25.4 mm	Fixing the Brake Pedal Supports on the left Pedal Rail	$ 0,25	unit	2			$ 0,50
130	Assemble, 1 kg, Loose	Inserting the Needle Bearings in Brake and Accelerator Pedals	$ 0,06	unit	4			$ 0,24
140	Assemble, 1 kg, Loose	Positioning the Accelerator pedal on the Accelerator Pedal Supports (with the washers)	$ 0,06	unit	1			$ 0,06
150	Ratchet <= 25.4 mm	Fixing the Accelerator Pedal on the Accelerator Pedal Supports	$ 0,75	unit	1			$ 0,75
160	Reaction Tool <= 25.4 mm	Fixing the Accelerator Pedal on the Accelerator Pedal Supports	$ 0,25	unit	1			$ 0,25
170	Assemble, 1 kg, Loose	Positioning the Brake Pedal on the Brake Pedal Supports (with the washers)	$ 0,06	unit	1			$ 0,06
180	Ratchet <= 25.4 mm	Fixing the Brake Pedal on the Brake Pedal Supports	$ 0,75	unit	1			$ 0,75
190	Reaction Tool <= 25.4 mm	Fixing the Brake Pedal on the Brake Pedal Supports	$ 0,25	unit	1			$ 0,25
200	Assemble, 1 kg, Loose	Inserting the Over-Travel Bolt between the Accelerator Supports	$ 0,06	unit	1			$ 0,06
210	Ratchet <= 6.35 mm	Fixing the Over-Travel Bolt to the Accelerator Supports	$ 0,50	unit	2			$ 1,00
220	Reaction Tool <= 6.35 mm	Fixing the Over-Travel Bolt to the Accelerator Supports	$ 0,25	unit	2			$ 0,50
230	Assemble, 1 kg, Loose	Positioning the Brake Over-Travel Switch Support on the Left Pedal Rail	$ 0,06	unit	1			$ 0,06
240	Ratchet <= 6.35 mm	Fixing the Brake Over-Travel Switch Support to the Left Pedal Rail	$ 0,75	unit	1			$ 0,75
250	Reaction Tool <= 6.35 mm	Fixing the Brake Over-Travel Switch Support to the Left Pedal Rail	$ 0,25	unit	1			$ 0,25
260	Assemble, 1 kg, Loose	Positioning the Cable Support on the Accelerator Pedal	$ 0,06	unit	1			$ 0,06
270	Ratchet <= 25.4 mm	Fixing the Cable Support to the Accelerator Pedal	$ 0,75	unit	1			$ 0,75
280	Reaction Tool <= 25.4 mm	Fixing the Cable Support to the Accelerator Pedal	$ 0,25	unit	1			$ 0,25
290	Assemble, 1 kg, Loose	Positioning the Heel Support on the Pedal Rails	$ 0,06	unit	2			$ 0,12
300	Ratchet <= 6.35 mm	Fixing the Heel Support on the Pedal Rails	$ 0,50	unit	4			$ 2,00
310	Reaction Tool <= 6.35 mm	Fixing the Heel Support on the Pedal Rails	$ 0,25	unit	4			$ 1,00
320	Assemble, 1 kg, Loose	Positioning the Foot Top Support on the Brake Pedal	$ 0,06	unit	1			$ 0,06
330	Ratchet <= 6.35 mm	Fixing the Foot Top Support on the Brake Pedal	$ 0,50	unit	2			$ 1,00
340	Reaction Tool <= 6.35 mm	Fixing the Foot Top Support on the Brake Pedal	$ 0,25	unit	2			$ 0,50
350	Assemble, 1 kg, Loose	Positioning the Foot Top Support on the Accelerator Pedal	$ 0,06	unit	1			$ 0,06
360	Ratchet <= 6.35 mm	Fixing the Foot Top Support on the Accelerator Pedal	$ 0,50	unit	2			$ 1,00
370	Reaction Tool <= 6.35 mm	Fixing the Foot Top Support on the Accelerator Pedal	$ 0,25	unit	2			$ 0,50
380	Assemble, 1 kg, Loose	Positioning the Cable in the Cable Support	$ 0,06	unit	1			$ 0,06
390	Ratchet <= 6.35 mm	Fixing the Cable to the Cable Support	$ 0,50	unit	1			$ 0,50
400	Assemble, 1 kg, Loose	Positioning the Sheath for Cable to Sheath for cable mount	$ 0,06	unit	1			$ 0,06
410	Hand, Loose <= 6.35 mm	Fixing the Sheath for Cable to Sheath for cable mount	$ 0,25	unit	1			$ 0,25
							Sub Total	$ 25,47

ItemOrder	Fastener	Use	UnitCost	Size1	Unit1	Size2	Unit2	Quantity	Sub Total
10	Bolt, Grade 8.8 (SAE 5)	Fixing the Rails to the Front and Rear Rails Mounts	$ 0,21	8	mm	50	mm	4	$ 0,84
20	Washer, Grade 8.8 (SAE 5)	Fixing the Rails to the Front and Rear Rails Mounts	$ 0,01		unit			8	$ 0,08
30	Nut, Grade 8.8 (SAE 5)	Fixing the Rails to the Front and Rear Rails Mounts	$ 0,04	8	mm			4	$ 0,18
40	Bolt, Grade 8.8 (SAE 5)	Fixing the Accelerator Pedal Supports on the right Pedal Rail	$ 0,21	8	mm	50	mm	2	$ 0,42
50	Washer, Grade 8.8 (SAE 5)	Fixing the Accelerator Pedal Supports on the right Pedal Rail	$ 0,01		unit			4	$ 0,04
60	Nut, Grade 8.8 (SAE 5)	Fixing the Accelerator Pedal Supports on the right Pedal Rail	$ 0,04	8	mm			2	$ 0,09
70	Bolt, Grade 8.8 (SAE 5)	Fixing the Brake Pedal Supports on the left Pedal Rail	$ 0,21	8	mm	50	mm	2	$ 0,42
80	Washer, Grade 8.8 (SAE 5)	Fixing the Brake Pedal Supports on the left Pedal Rail	$ 0,01		unit			4	$ 0,04
90	Nut, Grade 8.8 (SAE 5)	Fixing the Brake Pedal Supports on the left Pedal Rail	$ 0,04	8	mm			2	$ 0,09
100	Bolt, Grade 8.8 (SAE 5)	Fixing the Accelerator Pedal on the Accelerator Pedal Supports	$ 0,34	10	mm	50	mm	1	$ 0,34
110	Washer, Grade 8.8 (SAE 5)	Fixing the Accelerator Pedal on the Accelerator Pedal Supports	$ 0,01		unit			4	$ 0,04
120	Nut, Grade 8.8 (SAE 5)	Fixing the Accelerator Pedal on the Accelerator Pedal Supports	$ 0,07	10	mm			1	$ 0,07
130	Bolt, Grade 8.8 (SAE 5)	Fixing the Brake Pedal on the Brake Pedal Supports	$ 0,34	10	mm	50	mm	1	$ 0,34
140	Washer, Grade 8.8 (SAE 5)	Fixing the Brake Pedal on the Brake Pedal Supports	$ 0,01		unit			4	$ 0,04
150	Nut, Grade 8.8 (SAE 5)	Fixing the Brake Pedal on the Brake Pedal Supports	$ 0,07	10	mm			1	$ 0,07
160	Bolt, Grade 8.8 (SAE 5)	Fixing the Over-Travel Bolt to the Accelerator Supports	$ 0,05	4	mm	50	mm	1	$ 0,05
170	Thread Insert	Fixing the Over-Travel Bolt to the Accelerator Supports	$ 0,40	4	mm			2	$ 0,80
180	Nut, Grade 8.8 (SAE 5)	Fixing the Over-Travel Bolt to the Accelerator Supports	$ 0,02	4	mm			1	$ 0,02
190	Bolt, Grade 8.8 (SAE 5)	Fixing the Brake Over-Travel Switch Support to the Left Pedal Rail	$ 0,09	6	mm	40	mm	1	$ 0,09
200	Washer, Grade 8.8 (SAE 5)	Fixing the Brake Over-Travel Switch Support to the Left Pedal Rail	$ 0,01		unit			2	$ 0,02
210	Nut, Grade 8.8 (SAE 5)	Fixing the Brake Over-Travel Switch Support to the Left Pedal Rail	$ 0,03	6	mm			1	$ 0,03
220	Washer, Grade 8.8 (SAE 5)	Fixing the Cable Support to the Accelerator Pedal	$ 0,01		unit			2	$ 0,02
230	Nut, Grade 8.8 (SAE 5)	Fixing the Cable Support to the Accelerator Pedal	$ 0,04	8	mm			2	$ 0,09
240	Bolt, Grade 8.8 (SAE 5)	Fixing the Heel Support on the Pedal Rails	$ 0,07	6	mm	30	mm	4	$ 0,26
250	Washer, Grade 8.8 (SAE 5)	Fixing the Heel Support on the Pedal Rails	$ 0,01		unit			4	$ 0,04
260	Nut, Grade 8.8 (SAE 5)	Fixing the Heel Support on the Pedal Rails	$ 0,03	6	mm			4	$ 0,12
270	Bolt, Grade 8.8 (SAE 5)	Fixing the Foot Top Support on the Brake and Accelerator Pedals	$ 0,07	6	mm	30	mm	4	$ 0,26
280	Washer, Grade 8.8 (SAE 5)	Fixing the Foot Top Support on the Brake and Accelerator Pedals	$ 0,01		unit			4	$ 0,04
290	Nut, Grade 8.8 (SAE 5)	Fixing the Foot Top Support on the Brake and Accelerator Pedals	$ 0,03	6	mm			4	$ 0,12
300	Bolt, Grade 8.8 (SAE 5)	Fixing the Cable to the Cable Support	$ 0,02	3	mm	10	mm	1	$ 0,02
								Sub Total	**$ 5,08**

ItemOrder	Tooling	Use	UnitCost	Unit	Quantity	PVF	FractionIncluded	Sub Total
10	Welds - Welding Fixture	Mounts welded to the chassis	$ 500,00	point	18	3000	1	$ 3,00
							Sub Total	**$ 3,00**

University	Ecole Centrale de Lyon
System	Frame and Body
Assembly	Pedal box
Part	Rail
P/N Base	FR 03001
Suffix	AA
Details	Rail mounted on the chassis supporting the pedals

Back to BOM

FileLink1	Drawing
FileLink2	
FileLink3	

Car #	81

FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 3,11
Qty	2
Extended Cost	$ 6,22

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Aluminum, Normal (per kg)		$ 4,20	0,200	kg				1,84E-04	0,400	2712	1	$ 0,84
												Sub Total	**$ 0,84**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove		$ 1,30	unit	1			$ 1,30
20	Machining	Vertical holes	$ 0,04	cm^3	3,45	Material - Aluminum	1	$ 0,14
30	Machining Setup, Change		$ 0,65	unit	1			$ 0,65
40	Machining	Horizontal holes	$ 0,04	cm^3	4,54	Material - Aluminum	1	$ 0,18
							Sub Total	**$ 2,27**

Drawing part : FR 03001

University	Ecole Centrale de Lyon
System	Frame and Body
Assembly	Pedal box
Part	Brake pedal
P/N Base	FR 03002
Suffix	AA
Details	Branch of the Brake Pedal

Back to BOM

FileLink1	Drawing
FileLink2	
FileLink3	

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 5,69
Qty	1
Extended C	$ 5,69

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Nam	Area	Length	Density	Quantity	Sub Total
10	Aluminum, Normal (per kg)		$ 4,20	0,271	kg				0,005	0,020	2712	1	$ 1,14
												Sub Total	**$ 1,14**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove		$ 1,30	unit	1			$ 1,30
20	Machining		$ 0,04	cm^3	18,3	Material - Aluminum	1	$ 0,73
30	Machining Setup, Change		$ 0,65	unit	1			$ 0,65
40	Machining	Side	$ 0,04	cm^3	14,2	Material - Aluminum	1	$ 0,57
50	Machining Setup, Change		$ 0,65	unit	1			$ 0,65
60	Machining	Back	$ 0,04	cm^3	16,2	Material - Aluminum	1	$ 0,65
							Sub Total	**$ 4,55**

Drawing part : FR 03002

University	Ecole Centrale de Lyon			Back to BOM	**Car #**	81	**Part Cost** $ 4,84
System	Frame and Body	**FileLink1**	Drawing				**Qty** 1
Assembly	Pedal box	**FileLink2**			**FileLink1**		
Part	Accelerator Pedal	**FileLink3**			**FileLink2**		**Extended C** $ 4,84
P/N Base	FR 03003				**FileLink3**		
Suffix	AA						
Details	Branch of the Accelerator Pedal						

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Aluminum, Normal (per kg)		$ 4,20	0,271	kg				0,005	0,020	2712	1	$ 1,14
												Sub Total	**$ 1,14**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove		$ 1,30	unit	1			$ 1,30
20	Machining	Side and si	$ 0,04	cm^3	43,6	Material - Aluminum	1	$ 1,74
30	Machining Setup, Change		$ 0,65	unit	1			$ 0,65
40	Machining	front	$ 0,04	cm^3	0,2	Material - Aluminum	1	$ 0,01
							Sub Total	**$ 3,70**

Drawing Part : FR 03003

Remarque : Au contraire de la branche de pédale de frein, cette branche a bien des rainures mais que d'un seul côté (comme le montre la vue en coupe)

University	Ecole Centrale de Lyon		Back to BOM	**Car #**	81	**Part Cost**	$ 2,10
System	Frame and Body	**FileLink1**	Drawing			**Qty**	2
Assembly	Pedal box	**FileLink2**		**FileLink1**			
Part	Foot Top Support	**FileLink3**		**FileLink2**		**Extended C**	$ 4,20
P/N Base	FR 03004			**FileLink3**			
Suffix	AA						
Details	Support for the top of the foot						

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Aluminum, Normal (per kg)		$ 4,20	0,074	kg			frontal area	1,09E-02	2,50E-03	2712	1	$ 0,31
												Sub Total	**$ 0,31**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove		$ 1,30	unit	1	2 parts cut from a single machine setup	0,5	$ 0,65
20	Laser cut		$ 0,01	cm	35,9	Material - Aluminum	1	$ 0,36
30	Sheet metal bends		$ 0,25	bend	3			$ 0,75
40	Hand Finish - Material Removal	Chamfer	$ 0,20	cm^3	0,162	Material - Aluminum	1	$ 0,03
							Sub Total	**$ 1,79**

Drawing Part : FR 03004

University	Ecole Centrale de Lyon		Back to BOM	**Car #**	81	**Part Cost**	$ 2,02
System	Frame and Body	**FileLink1**	Drawing			**Qty**	2
Assembly	Pedal box	**FileLink2**		**FileLink1**			
Part	Heel Support	**FileLink3**		**FileLink2**		**Extended C**	$ 4,03
P/N Base	FR 03005			**FileLink3**			
Suffix	AA						
Details	Support for the heel						

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Aluminum, Normal (per kg)		$ 4,20	0,065	kg			frontal area	9,58E-03	2,50E-03	2712	1	$ 0,27
												Sub Total	**$ 0,27**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove		$ 1,30	unit	1	2 parts cut from a single machine setup	0,5	$ 0,65
20	Laser cut		$ 0,01	cm	31,2	Material - Aluminum	1	$ 0,31
30	Sheet metal bends		$ 0,25	bend	3			$ 0,75
40	Hand Finish - Material Removal	Chamfer	$ 0,20	cm^3	0,162	Material - Aluminum	1	$ 0,03
							Sub Total	**$ 1,74**

Drawing Part : FR 03005

University	Ecole Centrale de Lyon		Back to BOM	**Car #**	81	**Part Cost**	$ 3,11
System	Frame and Body	**FileLink1**	Drawing			**Qty**	2
Assembly	Pedal box	**FileLink2**		**FileLink1**			
Part	Brake Pedal Support	**FileLink3**		**FileLink2**		**Extended C**	$ 6,22
P/N Base	FR 03006			**FileLink3**			
Suffix	AA						
Details	Side Support for the Brake Pedal						

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Alloy		$ 2,25	0,206	kg			frontal area	8,75E-03	0,003	7850	1	$ 0,46
												Sub Total	**$ 0,46**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove		$ 1,30	unit	1	2 parts cut from a single machine setup	0,5	$ 0,65
20	Laser Cut		$ 0,01	cm	66,6	Material - Steel	3	$ 2,00
							Sub Total	**$ 2,65**

Drawing Part : FR_03006

University	Ecole Centrale de Lyon
System	Frame and Body
Assembly	Pedal box
Part	Brake over-travel switch support
P/N Base	FR 03007
Suffix	AA
Details	Support for the Brake Over-Travel Switch

Back to BOM

FileLink1	Drawing
FileLink2	
FileLink3	

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 1,97
Qty	1
Extended C	$ 1,97

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Alloy		$ 2,25	0,031	kg			frontal Area	0,002	0,002	7850	1	$ 0,07
												Sub Total	**$ 0,07**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove		$ 1,30	unit	1			$ 1,30
20	Laser Cut		$ 0,01	cm	11,7	Material - Steel	3	$ 0,35
30	Sheet metal bends		$ 0,25	bend	1			$ 0,25
							Sub Total	**$ 1,90**

Drawing Part : FR 03007

Vue isométrique
Echelle : 1:1

Vue dépliée
Echelle : 1:1

Vue auxiliaire A
Echelle : 1:1

L'angle de pli et de 85° et le rayon est de 4mm.

Norme ISO 2768-mK

Taille A4		Ecurie Piston Sport Auto	
Dessiné par Benjamin DELALANDE	Date 31/01/2018	Désignation Brake over-travel switch support	
Coordonnées Tel : 06.02.24.03.33 benjamin.delalande@ecl16.ec-lyon.fr		Quantité 1	Matériau Acier S235	Version 1.0
Plan vérifié par XXX		Echelle 1:1	18 M_FR_0300_006_BA	Feuille 1/1

University	Ecole Centrale de Lyon		Back to BOM	**Car #**	81	**Part Cost**	$ 2,00
System	Frame and Body	**FileLink1**	Drawing			**Qty**	2
Assembly	Pedal box	**FileLink2**		**FileLink1**			
Part	Accelerator pedal support	**FileLink3**		**FileLink2**		**Extended C**	$ 3,99
P/N Base	FR 03008			**FileLink3**			
Suffix	AA						
Details	Side Support for the Accelerator Pedal						

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Alloy		$ 2,25	0,110	kg			frontal area	4,68E-03	0,003	7850	1	$ 0,25
												Sub Total	**$ 0,25**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove		$ 1,30	unit	1	2 parts cut from a single machine setup	0,5	$ 0,65
20	Laser Cut		$ 0,01	cm	36,6	Material - Steel	3	$ 1,10
							Sub Total	**$ 1,75**

Drawing Part : FR 03008

Vue isométrique
Echelle : 1:1

Vue de face
Echelle : 1:1

Vue de gauche
Echelle : 1:1

Norme ISO 2768-mK

Taille A4		Ecurie Piston Sport Auto	
Dessiné par Benjamin DELALANDE	Date 31/01/2018	Désignation Accelerator pedal support	
Coordonnées Tel : 06.02.24.03.33 benjamin.delalande@ecl16.ec-lyon.fr		Quantité 2	Matériau Acier S235	Version 1.0
Plan vérifié par XXX		Echelle 1:1	18 M_FR_0300_007_BA	Feuille 1/1

University	Ecole Centrale de Lyon
System	Frame and Body
Assembly	Pedal box
Part	Cable Support
P/N Base	FR 03009
Suffix	AA
Details	Part supporting the Brake Cable

Back to BOM

FileLink1	Drawing
FileLink2	
FileLink3	

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 4,21
Qty	1
Extended C	$ 4,21

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Alloy		$ 2,25	0,051	kg				5,03E-05	0,130	7850	1	$ 0,12
												Sub Total	**$ 0,12**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove		$ 1,30	unit	1			$ 1,30
20	Threading, External (machining)		$ 0,10	cm	4,0	Material - Steel	3	$ 1,20
30	Machining Setup, Change		$ 0,65	unit	1			$ 0,65
40	Drilled holes < 25.4 mm dia.		$ 0,35	hole	1			$ 0,35
50	Threading, Internal (machining)		$ 0,10	cm	0,8	Material - Steel	3	$ 0,24
60	Drilled holes < 25.4 mm dia.		$ 0,35	hole	1			$ 0,35
							Sub Total	**$ 4,09**

Drawing Part : FR 03009

Vue isométrique
Echelle : 1:1

Vue de face
Echelle : 1:1

Vue de gauche
Echelle : 1:1

Taille A4		Ecurie Piston Sport Auto
Dessiné par Benjamin DELALANDE	Date 12/02/2018	Désignation Cable Support
Coordonnées Tel : 06.02.24.03.33 benjamin.delalande@ecl16.ec-lyon.fr	Quantité 1	Matériau Acier S235 / Version 1.0
Plan vérifié par XXX	Echelle 1:1	18 M_FR_0300_008 / Feuille 1/1

University	Ecole Centrale de Lyon
System	Frame and Body
Assembly	Pedal box
Part	Rear Rail Mount
P/N Base	FR 03010
Suffix	AA
Details	Rear Mount to fix the Rail

FileLink1	Drawing
FileLink2	
FileLink3	

Back to BOM

Car #	81

FileLink1
FileLink2
FileLink3

Part Cost	$ 0,86
Qty	4
Extended C	$ 3,44

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Alloy		$ 2,25	0,024	kg				1,02E-03	0,003	7850	1	$ 0,05
												Sub Total	**$ 0,05**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove		$ 1,30	unit	1	4 parts cut from a single machine setup	0,25	$ 0,33
20	Laser Cut		$ 0,01	cm	16,03	Material -Steel	3	$ 0,48
							Sub Total	**$ 0,81**

Drawing Part : FR 03010

Tolérances générales : ISO 2768-mK

Vue de face
Echelle : 2:1

Vue de gauche
Echelle : 2:1

Taille A4		Ecurie Piston Sport Auto
Dessiné par Aurélien	Date 09/02/2018	Désignation Bracket_112_Pedalier tube arr.
Coordonnées aurelien.bienner@ecl16.ec-lyon.fr		Quantité 5 / Matériau Acier S355 / Version 1.0
Plan vérifié par Brice Roblot		Echelle 2:1 / Numéro du plan 18M_112 / Feuille 1/1

University	Ecole Centrale de Lyon
System	Frame and Body
Assembly	Pedal box
Part	Front Rail Mount
P/N Base	FR 03011
Suffix	AA
Details	Front Mount to fix the Rail

Back to BOM

FileLink1	Drawing
FileLink2	
FileLink3	

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 0,80
Qty	4
Extended C	$ 3,18

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Alloy		$ 2,25	0,031	kg				1,32E-03	0,003	7850	1	$ 0,07
												Sub Total	$ 0,07

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove		$ 1,30	unit	1	4 parts cut from a single machine setup	0,25	$ 0,33
20	Laser Cut		$ 0,01	cm	13,34	Material - Steel	3	$ 0,40
							Sub Total	$ 0,73

Drawing Part : FR 03011

University	Ecole Centrale de Lyon
System	Frame and Body
Assembly	Pedal box
Part	Sheath for cable mount
P/N Base	FR 03012
Suffix	AA
Details	Mount which hold the Sheath for Cable

FileLink1	Drawing
FileLink2	
FileLink3	

Back to BOM

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 1,86
Qty	1
Extended C	$ 1,86

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Alloy		$ 2,25	0,030	kg				1,29E-03	0,003	7850	1	$ 0,07
												Sub Total	**$ 0,07**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove		$ 1,30	unit	1			$ 1,30
20	Laser Cut		$ 0,01	cm	16,23	Material - Steel	3	$ 0,49
							Sub Total	**$ 1,79**

Drawing Part : FR 03012

University	Ecole Centrale de Lyon
System	Frame and Body
Assembly	Floor Pan
P/N Base	FR A0400
Suffix	AA
Details	The assembly of the floor pan

Back to BOM

Car #	81
FileLink1	
FileLink2	
FileLink3	

Asm Cost	$ 52,50
Qty	1
Extended Cost	$ 52,50

ItemOrder	Part	Part Cost	Quantity	Sub Total
10	Front Floor Pan Plate	$ 8,18	1	$ 8,18
20	Back Floor Pan Plate	$ 20,07	1	$ 20,07
30	Floor Pan Bracket	$ 0,51	10	$ 5,06
			Sub Total	$ 33,31

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Paint	Painting the Brackets	$ 10,00	1,25E-02	m^2							1,25E-02	$ 0,12
												Sub Total	$ 0,12

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Weld	Welding Brackets to the frame	$ 0,15	cm	25			$ 3,75
20	Aerosol Apply	Painting the Brackets	$ 5,25	m^2	1,25E-02			$ 0,07
30	Assemble, 3 kg, Line-on-Line	Positioning the Front Floor Pan Plate on the Brackets	$ 0,38	unit	4			$ 1,52
40	Ratchet <= 6.35 mm	Fixing the Front Floor Pan Plate to the Brackets	$ 0,50	unit	4			$ 2,00
50	Reaction Tool <= 6.35 mm	Fixing the Front Floor Pan Plate to the Brackets	$ 0,25	unit	4			$ 1,00
60	Assemble, 3 kg, Line-on-Line	Positioning the Back Floor Pan Plate on the Brackets	$ 0,38	unit	6			$ 2,28
70	Ratchet <= 6.35 mm	Fixing the Back Floor Pan Plate to the Brackets	$ 0,50	unit	6			$ 3,00
80	Reaction Tool <= 25.4 mm	Fixing the Back Floor Pan Plate to the Brackets	$ 0,25	unit	6			$ 1,50
							Sub Total	$ 15,12

ItemOrder	Fastener	Use	UnitCost	Size1	Unit1	Size2	Unit2	Quantity	Sub Total
10	Bolt, Grade 8.8 (SAE 5)	Fixing the Front and Rear Plates to the Brackets	$ 0,02	4	mm	20	mm	10	$ 0,22
20	Washer, Grade 8.8 (SAE 5)	Fixing the Front and Rear Plates to the Brackets	$ 0,01					20	$ 0,20
30	Nut, Grade 8.8 (SAE 5)	Fixing the Front and Rear Plates to the Brackets	$ 0,02	4	mm			10	$ 0,20
								Sub Total	$ 0,62

ItemOrder	Tooling	Use	UnitCost	Unit	Quantity	PVF	FractionIncluded	Sub Total
10	Welds - Welding Fixture	Brackets welded to the chassis	$ 500,00	point	20	3000	1	$ 3,33
							Sub Total	$ 3,33

University	Ecole Centrale de Lyon
System	Frame and Body
Assembly	Floor Pan
Part	Front Floor Pan Plate
P/N Base	FR 04001
Suffix	AA
Details	

Back to BOM

FileLink1	Drawing
FileLink2	
FileLink3	

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 8,18
Qty	1
Extended Cost	$ 8,18

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Aluminum, Normal (per kg)		$ 4,20	1,108	kg				2,72E-01	1,50E-03	2712	1	$ 4,65
												Sub Total	**$ 4,65**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove		$ 1,30	unit	1			$ 1,30
20	Laser Cut		$ 0,01	cm	222,60	Material - Aluminum	1	$ 2,23
							Sub Total	**$ 3,53**

Drawing part : FR 04001

University	Ecole Centrale de Lyon
System	Frame and Body
Assembly	Floor Pan
Part	Back Floor Pan Plate
P/N Base	FR 04002
Suffix	AA
Details	

FileLink1	Drawing
FileLink2	
FileLink3	

Back to BOM

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 20,07
Qty	1
Extended C	$ 20,07

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Aluminum, Normal (per kg)		$ 4,20	3,535	kg				0,869	1,50E-03	2712	1	$ 14,85
												Sub Total	**$ 14,85**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove		$ 1,30	unit	1			$ 1,30
20	Laser Cut		$ 0,01	cm	392,2	Material - Aluminum	1	$ 3,92
							Sub Total	**$ 5,22**

Drawing Part : FR 04002

Vue isométrique
Echelle : 1:20

Vue de face
Echelle : 1:10

Vue de gauche
Echelle : 1:10

Norme ISO 2768-mK

Taille A4		Ecurie Piston Sport Auto
Dessiné par Benjamin DELALANDE	Date 31/01/2018	Désignation: Plaque arrière fond plat
Coordonnées: Tel : 06.02.24.03.33, benjamin.delalande@ecl16.ec-lyon.fr		Quantité: 1 / Matériau: Aluminium / Version: 1.0
Plan vérifié par XXX		Echelle 1:10 / 18 M_FR_0400_001_BA / Feuille 1/1

University	Ecole Centrale de Lyon
System	Frame and Body
Assembly	Floor Pan
Part	Floor Pan Bracket
P/N Base	FR 04003
Suffix	AA
Details	

FileLink1	Drawing
FileLink2	
FileLink3	

Back to BOM

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 0,51
Qty	10
Extended C	$ 5,06

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Nam	Area	Length	Density	Quantity	Sub Total
10	Steel, Alloy		$ 2,25	0,010	kg				8,25E-04	1,50E-03	7850	1	$ 0,02
												Sub Total	**$ 0,02**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove		$ 1,30	unit	1	10 parts cut from a single machine setup	0,1	$ 0,13
20	Laser Cut		$ 0,01	cm	11,80	Material -Steel	3	$ 0,35
							Sub Total	**$ 0,48**

Drawing Part : FR 04003

University	Ecole Centrale de Lyon
System	Frame and Body
Assembly	Clutch actuation system
P/N Base	FR A0500
Suffix	AA
Details	made in 2017

Back to BOM

Car #	81

FileLink1	
FileLink2	
FileLink3	

Asm Cost	$ 58,11
Qty	1
Extended C	$ 58,11

ItemOrder	Part	Part Cost	Quantity	Sub Total
10	Lever Handle	$ 4,37	1	$ 4,37
20	Handle padding	$ 7,40	1	$ 7,40
30	Clutch mount	$ 2,37	1	$ 2,37
40	Lever joint	$ 11,77	1	$ 11,77
50	Actuation lever	$ 10,15	1	$ 10,15
			Sub Total	$ 36,06

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Cable, Pull	Clutch actuation	$ 15,00							1,10		1	$ 16,50
20	Paint	Protect clutch from rust	$ 10,00	0,05	m^2							1	$ 0,50
30	Cable adjuster	Clutch cable	$ 1,00									2	$ 2,00
												Sub Total	$ 19,00

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Weld	Welding clutch mount on frame	$ 0,15	unit	6		1	$ 0,90
20	Aerosol Apply	Protect clutch mount from rust	$ 5,25	m^2	0,05		1	$ 0,26
30	Assemble, 1kg, Line-on-Line	Connect lever handle with clutch mount	$ 0,13	unit	1		1	$ 0,13
40	Assemble, 1kg, Loose	Put handle padding on lever handle	$ 0,06	unit	1		1	$ 0,06
50	Ratchet <= 6,35 mm	Install M6 bolt between mount and lever handle	$ 0,50	unit	1		1	$ 0,50
60	Reaction Tool <= 6,35 mm	Install M6 nut blocking	$ 0,25	unit	1		1	$ 0,25
70	Assemble, 1kg, Interference	Put lever joint on lever handle	$ 0,19	unit	1		1	$ 0,19
80	Assemble, 1kg, Line-on-Line	Put clutch cable on clutch lever	$ 0,13	unit	1		1	$ 0,13
90	Assemble, 1kg, Interference	Connect cable on engine	$ 0,19	unit	1		1	$ 0,19
							Sub Total	$ 2,60

ItemOrder	Fastener	Use	UnitCost	Size1	Unit1	Size2	Unit2	Quantity	Sub Total
10	Bolt, Grade 8.8 (SAE 5)		$ 0,07	6	mm	32	mm	1	$ 0,07
20	Nut, Grade 8,8 (SAE 5)		$ 0,03	6	mm			1	$ 0,03
30	Washer, Grade 8.8 (SAE 5)		$ 0,01					2	$ 0,02
								Sub Total	$ 0,12

ItemOrder	Tooling	Use	UnitCost	Unit	Quantity	PVF	FractionIn	Sub Total
10	Welds - Welding Fixture	Welding clutch mount on frame	$ 500,00	point	2	3000	1	$ 0,33
							Sub Total	$ 0,33

University	Ecole Centrale de Lyon
System	Frame and Body
Assembly	Clutch actuation system
Part	Lever Handle
P/N Base	FR 05001
Suffix	AA
Details	

Back to BOM

FileLink1	Drawing
FileLink2	
FileLink3	

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 4,37
Qty	1
Extended Cost	$ 4,37

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Aluminum	Stock material for part	$ 4,20	0,222	kg			Bar 381 mm Square	3,81E-04	0,215	2712	1	$ 0,93
												Sub Total	**$ 0,93**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove		$ 1,30	unit	1		1	$ 1,30
20	Machining	Main shape contouring	$ 0,04	cm	8	Material -Aluminum	1	$ 0,31
30	Machining Setup, Change		$ 0,65	unit	1		1	$ 0,65
40	Machining		$ 0,04	cm^3	1	Material -Aluminum	1	$ 0,05
50	Machining Setup, Change		$ 0,65	unit	1		1	$ 0,65
60	Machining		$ 0,04	cm^3	3,3	Material -Aluminum	1	$ 0,13
70	Drilled holes < 25,4 mm dia.	Weigth reduction	$ 0,35	hole	1	Material -Aluminum	1	$ 0,35
							Sub Total	**$ 3,44**

Drawing part : FR 05001

University	Ecole Centrale de Lyon
System	Frame and Body
Assembly	Clutch actuation system
Part	Handle padding
P/N Base	FR 05002
Suffix	AA
Details	

FileLink1	
FileLink2	
FileLink3	

Back to BOM

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 7,40
Qty	1
Extended C	$ 7,40

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Rubber	Smooth hand contact	$ 3,30	0,100	kg						1100	1	$ 0,33
												Sub Total	**$ 0,33**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Die casting	Produce handle padding	$ 4,00	kg	0,1		1	$ 0,40
							Sub Total	**$ 0,40**

ItemOrder	Tooling	Use	UnitCost	Unit	Quantity	PVF	FracInId	Sub Total
10	Die casting - Die	Produce handle padding	$10 000,00	die	2	3000	1	$ 6,67
							Sub Total	**$ 6,67**

University	Ecole Centrale de Lyon
System	Frame and Body
Assembly	Clutch actuation system
Part	Clutch mount
P/N Base	FR 05003
Suffix	AA
Details	

FileLink1	
FileLink2	
FileLink3	

Back to BOM

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 2,37
Qty	1
Extended Cost	$ 2,37

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, mild	Stock material for part	$ 2,25	0,043	kg			Bar 113mm Square	1,13E-04	0,048	7850	1	$ 0,10
												Sub Total	**$ 0,10**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove		$ 1,30	unit	1			$ 1,30
20	Machining		$ 0,04	cm^3	5			$ 0,20
30	Machining Setup, Change		$ 0,65	unit	1			$ 0,65
40	Machining	removing weight	$ 0,04	cm^3	3			$ 0,13
							Sub Total	**$ 2,28**

University	Ecole Centrale de Lyon
System	Frame and Body
Assembly	Clutch actuation system
Part	Lever joint
P/N Base	FR 05004
Suffix	AA
Details	

FileLink1	
FileLink2	
FileLink3	

Back to BOM

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 11,77
Qty	1
Extended Cost	$ 11,77

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, mild	Stock material for part	$ 2,25	0,250	kg						7850	1	$ 0,56
												Sub Total	**$ 0,56**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Die casting	Produce lever joint	$ 4,00	kg	0,25	1	1	$ 1,00
20	Machining Setup, Install and remove		$ 1,30	unit	1		1	$ 1,30
30	Machining	Main shape machining	$ 0,04	cm^3	6	Material - Steel	3	$ 0,72
40	Machining Setup, Change		$ 0,65	unit	1		1	$ 0,65
50	Machining	collar machining	$ 0,04	cm^3	0,6	Material - Steel	3	$ 0,07
60	Drilled holes < 25,4 mm dia.	holes	$ 0,35	hole	2		1	$ 0,70
70	Threading, Internal (machining)		$ 0,10	cm	1		1	$ 0,10
							Sub Total	**$ 4,54**

ItemOrder	Tooling	Use	UnitCost	Unit	Quantity	PVF	FracInId	Sub Total
10	Die casting - Die	Lever joint	$ 10 000,00	die	2	3000	1	$ 6,67
							Sub Total	**$ 6,67**

University	Ecole Centrale de Lyon
System	Frame and Body
Assembly	Clutch actuation system
Part	Actuation lever
P/N Base	FR 05005
Suffix	AA
Details	

Back to BOM

FileLink1	
FileLink2	
FileLink3	

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 10,15
Qty	1
Extended Cost	$ 10,15

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Aluminum, Normal	Stock material for part	$ 4,20	0,150	kg						2712	1	$ 0,63
												Sub Total	$ 0,63

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Die casting	Produce lever casting	$ 4,00	kg	0,15	1	1	$ 0,60
20	Machining Setup, Install and remove		$ 1,30	unit	1		1	$ 1,30
30	Machining	Main shape machining	$ 0,04	cm^3	6,3	Material - Aluminum	1	$ 0,25
40	Drilled holes < 25,4 mm dia.	holes	$ 0,35	hole	2		1	$ 0,70
							Sub Total	$ 2,85

ItemOrder	Tooling	Use	UnitCost	Unit	Quantity	PVF	FracInld	Sub Total
10	Die casting - Die	Actuation lever	$ 10 000,00	die	2	3000	1	$ 6,67
							Sub Total	$ 6,67

University	Ecole Centrale de Lyon
System	Frame and Body
Assembly	Shifter
P/N Base	FR A0600
Suffix	AA
Details	

Back to BOM

Car #	81
FileLink1	
FileLink2	
FileLink3	

Asm Cost	$ 112,48
Qty	1
Extended Cost	$ 112,48

ItemOrder	Part	Part Cost	Quantity	Sub Total
10	Engine gear boxx drum gear	$ 12,69	1	$ 12,69
20	Engine gear box shifting pinion shaft	$ 15,88	1	$ 15,88
30	Engine gear box actator tab	$ 1,60	1	$ 1,60
40	Front engine gearbox actuator mount	$ 2,82	1	$ 2,82
50	Rear engine gearbox actuator mount	$ 2,56	1	$ 2,56
60	Engine gearbox actuator coupling	$ 7,49	1	$ 7,49
			Sub Total	$ 43,04

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Paint	Protect steel tab from rust	$ 10,00	0,005	m^2							1	$ 0,05
20	Motor, 12 Volt,DC Brushless Servo	Engine gearbox actuator	$ 40,00	40	unit							1	$ 40,00
30	Mount, Viration-Damping Sandwich	Maintain motor to frame	$ 2,43	9	mm							1	$ 2,43
												Sub Total	$ 42,48

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Weld	Welding gear tab on frame	$ 0,15	cm	5		1	$ 0,75
20	Aerosol Apply	Protect gear tab from rust	$ 5,25	m^2	0,005		1	$ 0,03
30	Power Tool <= 25,4 mm	Remove engine case bolts	$ 0,25	unit	13	Disassemble	0,8	$ 2,60
40	Assemble, 3kg, Line-on-Line	Remove engine case	$ 0,38	unit	1	Disassemble	0,8	$ 0,30
50	Power Tool <= 6.35 mm	Remove clutch pressure bolts	$ 0,25	unit	5	Disassemble	0,8	$ 1,00
60	Assemble, 1 kg, Loose	Remove clutch pressure springs	$ 0,06	unit	5	Disassemble	0,8	$ 0,25
70	Assemble, 1 kg, Loose	Remove pressure disc assembly	$ 0,06	unit	1	Disassemble	0,8	$ 0,05
80	Assemble, 1 kg, Loose	Remove clutch disc assembly	$ 0,06	unit	1	Disassemble	0,8	$ 0,05
90	Power Tool <= 25.4 mm	Remove central clutch nut	$ 0,25	unit	1	Disassemble	0,8	$ 0,20
100	Assemble, 1 kg, Loose	Remove central clutch assembly	$ 0,06	unit	1	Disassemble	0,8	$ 0,05
110	Assemble, 1 kg, Loose	Remove clutch guide	$ 0,06	unit	1	Disassemble	0,8	$ 0,05
120	Assemble, 1 kg, Loose	Remove clutch roller case assembly	$ 0,06	unit	1	Disassemble	0,8	$ 0,05
130	Assemble, 1 kg, Loose	Remove clutch flywheel	$ 0,06	unit	1	Disassemble	0,8	$ 0,05
140	Power Tool <= 6.35 mm	Remove shifting shaft retaining bolt	$ 0,25	unit	5	Disassemble	0,8	$ 1,00
150	Assemble, 1 kg, Loose	Remove shifting shaft retaining plate	$ 0,06	unit	1	Disassemble	0,8	$ 0,05
160	Assemble, 3 kg, Line-on-Line	Remove shifting shaft	$ 0,38	unit	1	Disassemble	0,8	$ 0,30
170	Power Tool <= 25.4 mm	Remove shifting shaft stop	$ 0,25	unit	1	Disassemble	0,8	$ 0,20
180	Power Tool <= 6.35 mm	Remove gearshift drum stopper bolt	$ 0,25	unit	1	Disassemble	0,8	$ 0,20
190	Assemble, 1 kg, Interference	Remove shift drum stopper assembly	$ 0,19	unit	1	Disassemble	0,8	$ 0,15
200	Power Tool <= 25.4 mm	Remove shift star bolt	$ 0,25	unit	1	Disassemble	0,8	$ 0,20
210	Assemble, 1 kg, Loose	Mount gearbox drum gear	$ 0,06	unit	1		1	$ 0,06
220	Power Tool <= 25.4 mm	Tighten shift star bolt	$ 0,25	unit	1		1	$ 0,25
230	Assemble, 1 kg, Interference	Mount retaining ring on shifting pinion shaft	$ 0,19	unit	1		1	$ 0,19
240	Assemble, 1 kg, Loose	Mount washer on shifting pinion shaft	$ 0,06	unit	1		1	$ 0,06
250	Assemble, 1 kg, Line-on-Line	Mount shifting pinion shaft	$ 0,13	unit	1		1	$ 0,13
260	Assemble, 1 kg, Loose	Mount washer on shifting pinion shaft	$ 0,06	unit	1		1	$ 0,06
270	Assemble, 1 kg, Interference	Mount retaining ring on shifting pinion shaft	$ 0,19	unit	1		1	$ 0,19
280	Assemble, 1 kg, Line-on-Line	Mount gearbox actuator coupling	$ 0,13	unit	1		1	$ 0,13
290	Assemble, 3 kg, Loose	Mount clutch flywheel	$ 0,19	unit	1		1	$ 0,19
300	Assemble, 1 kg, Loose	Mount clutch roller case assembly	$ 0,06	unit	1		1	$ 0,06
310	Assemble, 1 kg, Loose	Mount clutch guide	$ 0,06	unit	1		1	$ 0,06
320	Assemble, 1 kg, Loose	Mount central clutch	$ 0,06	unit	1		1	$ 0,06
330	Assemble, 1 kg, Loose	Mount central clutch washers	$ 0,06	unit	1		1	$ 0,06
340	Power Tool <= 25.4 mm	Tighten central clutch nut	$ 0,25	unit	1		0,8	$ 0,20
350	Assemble, 1 kg, Loose	Mount clutch discs	$ 0,06	unit	1			$ 0,06
360	Assemble, 1 kg, Loose	Mount pressure disc assembly	$ 0,06	unit	1			$ 0,06
370	Assemble, 1 kg, Loose	Mount clutch pressure springs	$ 0,06	unit	1			$ 0,06
380	Power Tool <= 6.35 mm	Mount clutch pressure bolts	$ 0,25	unit	5	Fastener Engagement Length > 2D	1,25	$ 1,56
390	Assemble, 3 kg, Line-on-Line	Mount engine case	$ 0,38	unit	1		1	$ 0,38

400	Power Tool <= 25.4 mm	Mount engine case bolts	$ 0,25	unit	13	Fastener Engagement Length > 2D	1,25	$ 4,06
410	Assemble, 1 kg, Loose	Mount front actuator mount	$ 0,06	unit	1		1	$ 0,06
420	Assemble, 1 kg, Loose	Mount rear actuator mount	$ 0,06	unit	1		1	$ 0,06
430	Assemble, 1 kg, Loose	Mount washers on screws	$ 0,06	unit	2		1	$ 0,13
440	Assemble, 1 kg, Loose	Mount screws on actuator mount	$ 0,06	unit	2		1	$ 0,13
450	Assemble, 1 kg, Loose	Mount washers on screws	$ 0,06	unit	2		1	$ 0,13
460	Hand - Start Only	Mount nut on screws	$ 0,12	unit	2		1	$ 0,24
470	Assemble, 3 kg, Line-on-Line	Mount actuator assembly on coupling	$ 0,38	unit	1		1	$ 0,38
480	Assemble, 1 kg, Loose	Mount elastomere on tab	$ 0,06	unit	1		1	$ 0,06
490	Assemble, 1 kg, Loose	Align rear mount with tab	$ 0,06	unit	1		1	$ 0,06
500	Assemble, 1 kg, Loose	Mount washer on elastomere screw	$ 0,06	unit	1		1	$ 0,06
510	Wrench <= 6.35 mm	Tighten elastomer screw	$ 1,00	unit	1	Fastener Engagement Length > 4D	1,5	$ 1,50
520	Wrench <= 6.35 mm	Tighten actuator mount's bolts	$ 1,00	unit	2		1,25	$ 2,50
530	Reaction Tool <= 6.35 mm		$ 0,25	unit	2			$ 0,50
540	Wrench <= 6.35 mm	Tighten coupling bolts	$ 1,00	unit	4		1,25	$ 5,00
							Sub Total	**$ 26,22**

ItemOrder	Fastener	Use	UnitCost	Size1	Unit1	Size2	Unit2	Quantity	Sub Total
10	Bolt,Grade 8.8 (SAE 5)	Fasten star gear to the shaft	$ 0,16	8	mm	40	mm	1	$ 0,16
20	Bolt,Grade 8.8 (SAE 5)	Lock actuator between mount brackets	$ 0,02	4	mm	20	mm	3	$ 0,06
30	Washer, Grade 8.8 (SAE 5)	Lock actuator between mount brackets	$ 0,01	4	mm			5	$ 0,05
40	Nut, Grade 8.8 (SAE 5)	Lock actuator between mount brackets	$ 0,01	4	mm			2	$ 0,02
50	Washer, Grade 8.8 (SAE 5)	Make contact between rings and engine case	$ 0,01		unit			2	$ 0,02
60	Retaining Ring, External	Retain shifting pinion shaft	$ 0,05	14	mm			2	$ 0,10
								Sub Total	**$ 0,41**

ItemOrder	Tooling	Use	UnitCost	Unit	Quantity	PVF	FractionIncluded	Sub Total
10	Welds - Welding Fixture	Welding gear tab	$ 500,00	point	2	3000	1	$ 0,33
							Sub Total	**$ 0,33**

University	Ecole Centrale de Lyon
System	Frame and Body
Assembly	Shifter
Part	Engine gear box drum gear
P/N Base	FR 06001
Suffix	AA
Details	

FileLink1	
FileLink2	
FileLink3	

Back to BOM

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 12,69
Qty	1
Extended Cost	$ 12,69

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Alloy	Material for part	$ 2,25	0,241	kg						7850	1	$ 0,54
												Sub Total	**$ 0,54**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Setup for machining	$ 1,30	unit	1		1	$ 1,30
20	Machining	Shift star contact	$ 0,04	cm^3	50	Material - Steel	3	$ 6,00
30	Machining Setup, Change		$ 0,65	unit	1		1	$ 0,65
40	Machining	Screw holes	$ 0,04	cm^3	5	Material - Steel	3	$ 0,60
50	Drilled holes < 25,4 mm dia.		$ 0,35	hole	6		1	$ 2,10
60	Gear Shaping (hobbing)		$ 0,50	cm^3	1	Material - Steel	3	$ 1,50
							Sub Total	**$ 12,15**

University	Ecole Centrale de Lyon
System	Frame and Body
Assembly	Shifter
Part	Engine gear box shifting pinion shaft
P/N Base	FR 06002
Suffix	AA
Details	

FileLink1	
FileLink2	
FileLink3	

Back to BOM

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 15,88
Qty	1
Extended	$ 15,88

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Alloy	Material for part	$ 2,25	0,298	kg						7850	1	$ 0,67
												Sub Total	**$ 0,67**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Setup for machining	$ 1,30	unit	1		1	$ 1,30
20	Machining	Shift star contact	$ 0,04	cm^3	97	Material - Steel	3	$ 11,64
30	Machining Setup, Change		$ 0,65	unit	1		1	$ 0,65
40	Machining	Screw holes	$ 0,04	cm^3	1	Material - Steel	3	$ 0,12
50	Gear shaping (hobbing)		$ 0,50	cm^3	3	Material - Steel	1	$ 1,50
							Sub Total	**$ 15,21**

University	Ecole Centrale de Lyon
System	Frame and Body
Assembly	Shifter
Part	Engine gear box actuator tab
P/N Base	FR 06003
Suffix	AA
Details	

FileLink1	
FileLink2	
FileLink3	

Back to BOM

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 1,60
Qty	1
Extended C	$ 1,60

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Mild, (per kg)	Material for tube part	$ 2,25	0,010	kg						7850	1	$ 0,02
												Sub Total	**$ 0,02**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Setup for laser cut	$ 1,30	unit	1		1	$ 1,30
20	Laser Cut		$ 0,01	cm	9	Material - Steel	3	$ 0,28
							Sub Total	**$ 1,58**

University	Ecole Centrale de Lyon			Back to BOM	**Car #**	81	**Part Cost** $ 2,82
System	Frame and Body	**FileLink1**	Drawing				**Qty** 1
Assembly	Shifter	**FileLink2**			**FileLink1**		
Part	Front engine gearbox actuator mount	**FileLink3**			**FileLink2**		**Extended C** $ 2,82
P/N Base	FR 06004				**FileLink3**		
Suffix	AA						
Details							

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Aluminium Normal	Material for part	$ 4,20	0,007	kg						2712	1	$ 0,03
												Sub Total	**$ 0,03**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Setup for machining	$ 1,30	unit	1		1	$ 1,30
20	Laser Cut		$ 0,01	cm^3	24	Material - Aluminium	1	$ 0,24
30	Sheet metal bends		$ 0,25	bend	5		1	$ 1,25
							Sub Total	**$ 2,79**

Drawing part : FR 06004

University	Ecole Centrale de Lyon		Back to BOM	**Car #**	81	**Part Cost**	$ 2,56
System	Frame and Body	**FileLink1**	Drawing			**Qty**	1
Assembly	Shifter	**FileLink2**		**FileLink1**			
Part	Rear engine gearbox actuator mount	**FileLink3**		**FileLink2**		**Extended C**	$ 2,56
P/N Base	FR 06005			**FileLink3**			
Suffix	AA						
Details							

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Aluminium Normal	Material for part	$ 4,20	0,004	kg						2712	1	$ 0,02
												Sub Total	**$ 0,02**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Setup for machining	$ 1,30	unit	1		1	$ 1,30
20	Laser Cut		$ 0,01	cm^3	24	Material - Aluminium	1	$ 0,24
30	Sheet metal bends		$ 0,25	bend	4		1	$ 1,00
							Sub Total	**$ 2,54**

Drawing Part : FR 06005

University	Ecole Centrale de Lyon		Back to BOM	**Car #**	81	**Part Cost**	$ 7,49
System	Frame and Body	**FileLink1**				**Qty**	1
Assembly	Shifter	**FileLink2**		**FileLink1**			
Part	Engine gearbox actuator coupling	**FileLink3**		**FileLink2**		**Extended C**	$ 7,49
P/N Base	FR 06006			**FileLink3**			
Suffix	AA						
Details	Bought, cost as made						

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Normal	Material for part	$ 2,25	0,177	kg						7 850	1,00	$ 0,40
												Sub Total	**$ 0,40**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Setup for machining	$ 1,30	unit	1		1	$ 1,30
20	Machining		$ 0,04	cm^3	5	Material - Steel	3	$ 0,60
30	Machining Setup, Change		$ 0,65	unit	1		1	$ 0,65
40	Machining		$ 0,04	cm^3	3	Material - Steel	3	$ 0,36
50	Machining Setup, Change		$ 0,65	unit	1		1	$ 0,65
60	Machining		$ 0,04	cm^3	1	Material - Steel	3	$ 0,12
70	Machining Setup, Change		$ 0,65	unit	1		1	$ 0,65
80	Machining		$ 0,04	cm^3	1	Material - Steel	3	$ 0,12
90	Drilled holes < 25,4 mm dia.		$ 0,35	holes	4		1	$ 1,40
100	Threading, Internal (machining)		$ 0,10	cm^3	4	Material - Steel	3	$ 1,20
							Sub Total	**$ 7,05**

ItemOrder	Fastener	Use	UnitCost	Size1	Unit1	Size2	Unit2	Quantity	Sub Total
10	Bolt,Grade 8.8 (SAE 5)		$ 0,01	3	mm	10	mm	4	$ 0,04
								Sub Total	**$ 0,04**

University	Ecole Centrale de Lyon
System	Frame and Body
Assembly	Bodywork
P/N Base	FR A0700
Suffix	AA
Details	The assembly of the bodywork

Back to BOM

Car #	81
FileLink1	
FileLink2	
FileLink3	

Asm Cost	$ 1 075,88
Qty	1
Extended Cost	$ 1 075,88

ItemOrder	Part	Part Cost	Quantity	Sub Total
10	Nose	$ 261,59	1	$ 261,59
20	Left Inlet	$ 110,33	1	$ 110,33
30	Right Inlet	$ 110,33	1	$ 110,33
40	Front Side Plate	$ 86,63	2	$ 173,25
50	Back Side Plate	$ 150,71	2	$ 301,43
60	Back Inlet Bracket	$ 1,08	2	$ 2,15
70	Front Inlet Bracket	$ 1,08	2	$ 2,16
80	Nose Bracket	$ 0,74	4	$ 2,95
			Sub Total	$ 964,19

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Paint	Painting the Brackets	$ 10,00	6,05E-03	m^2							6,05E-03	$ 0,06
20	Paint	Painting the Nose, the Right Inlet and the Left Inlet	$ 10,00	1,16	m^2							1,16	$ 11,60
												Sub Total	$ 11,66

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Weld	Welding the Brackets	$ 0,15	cm	5,3			$ 0,80
20	Aerosol Apply	Painting of the body	$ 5,25	m^2	1,16			$ 6,09
30	Aerosol Apply	Painting of the brackets	$ 5,25	m^2	6,05E-03			$ 0,03
40	Assemble, 1 kg, Loose	Positioning the Pin (Quick Release) on the nose	$ 0,06	unit	4			$ 0,24
50	Hand, Loose > 25.4 mm	Fixing the Pin (Quick Release) to the nose	$ 0,75	unit	4			$ 3,00
60	Assemble, 1 kg, Loose	Positioning the bolt of the Pin (Quick Release) on the Nose Brackets	$ 0,06	unit	4			$ 0,24
70	Ratchet <= 25.4 mm	Fixing the bolt of the Pin (Quick Release) to the Nose Brackets	$ 0,75	unit	4			$ 3,00
80	Reaction Tool <= 25.4 mm	Fixing the bolt of the Pin (Quick Release) to the Nose Brackets	$ 0,25	unit	4			$ 1,00
90	Assemble, 3 kg, Loose	Positioning the nose on the chassis	$ 0,19	unit	4			$ 0,76
100	Assemble, 1 kg, Loose	Positioning the Left Inlet on the Brackets	$ 0,06	unit	5			$ 0,30
110	Ratchet <= 6.35 mm	Fixing the Left Inlet to the Brackets and the Floor Pan	$ 0,50	unit	5			$ 2,50
120	Reaction Tool <= 6.35 mm	Fixing the Left Inlet to the Brackets and the Floor Pan	$ 0,25	unit	5			$ 1,25
130	Assemble, 1 kg, Loose	Positioning the Right Inlet on the Brackets and the Floor Pan	$ 0,06	unit	5			$ 0,30
140	Ratchet <= 6.35 mm	Fixing the Right Inlet to the Brackets and the Floor Pan	$ 0,50	unit	5			$ 2,50
150	Reaction Tool <= 6.35 mm	Fixing the Right Inlet to the Brackets and the Floor Pan	$ 0,25	unit	5			$ 1,25
160	Assemble, 1 kg, Loose	Fixing the Velcro to the Frame	$ 0,06	unit	8	Both sides	2	$ 0,96
170	Assemble, 1 kg, Loose	Fixing the Velcro to the side plates	$ 0,06	unit	8	Both sides	2	$ 0,96
180	Assemble, 1 kg, Loose	Fixing the Front Side Plates to the Chassis	$ 0,06	unit	1	Both sides	2	$ 0,12
190	Assemble, 1 kg, Loose	Fixing the Back Side Plates to the Chassis	$ 0,06	unit	1	Both sides	2	$ 0,12
							Sub Total	$ 25,42

ItemOrder	Fastener	Use	UnitCost	Size1	Unit1	Size2	Unit2	Quantity	Sub Total
10	Bolt, Grade 8.8 (SAE 5)	Fixing the Inlets to the Brackets	$ 0,03	4	mm	30	mm	10	$ 0,31
20	Washer, Grade 8.8 (SAE 5)	Fixing the Inlets to the Brackets	$ 0,01		unit			20	$ 0,20
30	Nut, Grade 8.8 (SAE 5)	Fixing the Inlets to the Brackets	$ 0,02	4	mm			10	$ 0,20
40	Pin, Quick Release	Fixing the Nose to the Brackets	$ 16,56	8	mm	40	mm	4	$ 66,24
50	Hook and Loop, Hook Side (Velcro)	Fixing the Side Plates	$ 0,003	1000	cm^2			1000	$ 3,00
60	Hook and Loop, Loop Side (Velcro)	Fixing the Side Plates	$ 0,002	1000	cm^2			1000	$ 2,00
								Sub Total	$ 71,95

ItemOrder	Tooling	Use	UnitCost	Unit	Quantity	PVF	FractionIncluded	Sub Total
10	Welds - Welding Fixture	Brackets welded to the chassis	$ 500,00	point	16	3000	1	$ 2,67
							Sub Total	$ 2,67

University	Ecole Centrale de Lyon
System	Frame and Body
Assembly	Bodywork
Part	Nose
P/N Base	FR 07001
Suffix	AA
Details	Nose covering the front of the chassis

Back to BOM

FileLink1	Drawing
FileLink2	
FileLink3	

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 261,59
Qty	1
Extended Cost	$ 261,59

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Glass Fiber, 1 Ply (kg)		$ 100,00	0,414	kg				1,380	1,36E-04	2200	2	$ 82,80
												Sub Total	**$ 82,80**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Cut (scissors, knife)		$ 0,06	cm	278	For the 2 plies	2	$ 33,36
20	Lamination, Manual		$ 35,00	m^2	1,34	For the 2 plies	2	$ 93,80
30	Resin application, Manual		$ 5,00	m^2	1,34	For the 2 plies	2	$ 13,40
40	Cure, Room Temperature		$ 10,00	m^2	1,34			$ 13,40
50	Drilled holes < 25.4 mm dia.		$ 0,35	hole	4			$ 1,40
60	Waterjet Cut		$ 0,01	cm	278	Material - Composite	2	$ 5,56
							Sub Total	**$ 160,92**

ItemOrder	Tooling	Use	UnitCost	Unit	Quantity	PVF	FractionIncluded	Sub Total
10	Lamination - Mold Tool		$ 20 000,00	m^2	2,68	3000	1	$ 17,87
							Sub Total	**$ 17,87**

Drawing part : FR 07001

Vue isométrique
Echelle : 1:20

Vue de droite
Echelle : 1:20

Vue de face
Echelle : 1:20

Vue de gauche
Echelle : 1:20

Vue de dessus
Echelle : 1:20

Surface totale : 1.38 m²

Taille A4		Ecurie Piston Sport Auto
Dessiné par Benjamin DELALANDE	Date 14/03/2018	Désignation Nez
Coordonnées Tel : 06.02.24.03.33 benjamin.delalande@ecl16.ec-lyon.fr	Quantité 1	Matériau X / Version 1.0
Plan vérifié par XXX	Echelle 1:20	18_FR_0700_000_CA / Feuille 1/1

University	Ecole Centrale de Lyon
System	Frame and Body
Assembly	Bodywork
Part	Left Inlet
P/N Base	FR 07002
Suffix	AA
Details	Left Inlet covering the cooling system

Back to BOM

FileLink1	Drawing
FileLink2	
FileLink3	

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 110,33
Qty	1
Extended Cost	$ 110,33

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Glass Fiber, 1 Ply (kg)		$ 100,00	0,141	kg				0,470	1,36E-04	2200	2	$ 28,20
												Sub Total	**$ 28,20**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Cut (scissors, knife)		$ 0,06	cm	242	For the 2 plies	2	$ 29,04
20	Lamination, Manual		$ 35,00	m^2	0,45	For the 2 plies	2	$ 31,50
30	Resin application, Manual		$ 5,00	m^2	0,45	For the 2 plies	2	$ 4,50
40	Cure, Room Temperature		$ 10,00	m^2	0,45			$ 4,50
50	Drilled holes < 25.4 mm dia.		$ 0,35	hole	5			$ 1,75
60	Waterjet Cut		$ 0,01	cm	242	Material - Composite	2	$ 4,84
							Sub Total	**$ 76,13**

ItemOrder	Tooling	Use	UnitCost	Unit	Quantity	PVF	FractionIncluded	Sub Total
10	Lamination - Mold Tool		$ 20 000,00	m^2	0,9	3000	1	$ 6,00
							Sub Total	**$ 6,00**

Drawing part : FR 07002

Vue isométrique
Echelle : 1:15

Vue de dessous
Echelle : 1:15

Vue de droite
Echelle : 1:15

Vue de face
Echelle : 1:15

Vue de gauche
Echelle : 1:15

Surface totale : 0.47 m²

Taille A4		Ecurie Piston Sport Auto
Dessiné par Benjamin DELALANDE	Date 14/03/2018	Désignation Ouïe gauche
Coordonnées Tel : 06.02.24.03.33 benjamin.delalande@ecl16.ec-lyon.fr		Quantité 1 / Matériau X / Version 1.0
Plan vérifié par XXX		Echelle 1:15 / 18_FR_0700_001_CA / Feuille 1/1

University	Ecole Centrale de Lyon		Back to BOM	**Car #**	81	**Part Cost**	$ 110,33
System	Frame and Body	**FileLink1**	Drawing			**Qty**	1
Assembly	Bodywork	**FileLink2**		**FileLink1**			
Part	Right Inlet	**FileLink3**		**FileLink2**		**Extended Cost**	$ 110,33
P/N Base	FR 07003			**FileLink3**			
Suffix	AA						
Details	Right Inlet covering the exhaust system						

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Glass Fiber, 1 Ply (kg)		$ 100,00	0,141	kg				0,470	1,36E-04	2200	2	$ 28,20
												Sub Total	**$ 28,20**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Cut (scissors, knife)		$ 0,06	cm	242	For the 2 plies	2	$ 29,04
20	Lamination, Manual		$ 35,00	m^2	0,45	For the 2 plies	2	$ 31,50
30	Resin application, Manual		$ 5,00	m^2	0,45	For the 2 plies	2	$ 4,50
40	Cure, Room Temperature		$ 10,00	m^2	0,45			$ 4,50
50	Drilled holes < 25.4 mm dia.		$ 0,35	hole	5			$ 1,75
60	Waterjet Cut		$ 0,01	cm	242	Material - Composite	2	$ 4,84
							Sub Total	**$ 76,13**

ItemOrder	Tooling	Use	UnitCost	Unit	Quantity	PVF	FractionIncluded	Sub Total
10	Lamination - Mold Tool		$ 20 000,00	m^2	0,9	3000	1	$ 6,00
							Sub Total	**$ 6,00**

Drawing Part : FR 07003

Vue isométrique
Echelle : 1:15

Vue de dessous
Echelle : 1:15

Vue de droite
Echelle : 1:15

Vue de face
Echelle : 1:15

Vue de gauche
Echelle : 1:15

Surface totale : 0.47 m²

Taille A4		Ecurie Piston Sport Auto
Dessiné par Benjamin DELALANDE	Date 14/03/2018	Désignation Ouïe droite
Coordonnées Tel : 06.02.24.03.33 benjamin.delalande@ecl16.ec-lyon.fr		Quantité 1 / Matériau X / Version 1.0
Plan vérifié par XXX		Echelle 1:15 / 18_FR_0700_001_CA_sym / Feuille 1/1

University	Ecole Centrale de Lyon		Back to BOM	**Car #**	81	**Part Cost**	$ 86,63
System	Frame and Body	**FileLink1**	Drawing			**Qty**	2
Assembly	Bodywork	**FileLink2**		**FileLink1**			
Part	Front Side plate	**FileLink3**		**FileLink2**		**Extended Cost**	$ 173,25
P/N Base	FR 07004			**FileLink3**			
Suffix	AA						
Details	Front Side Plate						

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Glass Fiber, 1 Ply (kg)		$ 100,00	0,072	kg				0,360	9,09E-05	2200	1	$ 7,20
20	Carbon Fiber, 1 Ply (kg)		$ 200,00	0,029	kg				0,360	5,06E-05	1580	1	$ 5,76
												Sub Total	**$ 12,96**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Cut (scissors, knife)		$ 0,06	cm	290	For the 2 plies	2	$ 34,80
20	Lamination, Manual		$ 35,00	m^2	0,32	For the 2 plies	2	$ 22,40
30	Resin application, Manual		$ 5,00	m^2	0,32	For the 2 plies	2	$ 3,20
40	Cure, Room Temperature		$ 10,00	m^2	0,32			$ 3,20
50	Waterjet Cut		$ 0,01	cm	290	Material - Composite	2	$ 5,80
							Sub Total	**$ 69,40**

ItemOrder	Tooling	Use	UnitCost	Unit	Quantity	PVF	FractionIncluded	Sub Total
10	Lamination - Mold Tool		$ 20 000,00	m^2	0,64	3000	1	$ 4,27
							Sub Total	**$ 4,27**

Drawing Part : FR 07004

University	Ecole Centrale de Lyon
System	Frame and Body
Assembly	Bodywork
Part	Back Side Plate
P/N Base	FR 07005
Suffix	AA
Details	Back Side Plate

FileLink1	Drawing
FileLink2	
FileLink3	

Back to BOM

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 150,71
Qty	2
Extended Cost	$ 301,43

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Glass Fiber, 1 Ply (kg)		$ 100,00	0,150	kg				0,750	9,09E-05	2200	1	$ 15,00
20	Carbon Fiber, 1 Ply (kg)		$ 200,00	0,060	kg				0,750	5,06E-05	1580	1	$ 12,00
												Sub Total	**$ 27,00**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Cut (scissors, knife)		$ 0,06	cm	367	For the 2 plies	2	$ 44,04
20	Lamination, Manual		$ 35,00	m^2	0,70	For the 2 plies	2	$ 49,00
30	Resin application, Manual		$ 5,00	m^2	0,70	For the 2 plies	2	$ 7,00
40	Cure, Room Temperature		$ 10,00	m^2	0,70			$ 7,00
50	Waterjet Cut		$ 0,01	cm	367	Material - Composite	2	$ 7,34
							Sub Total	**$ 114,38**

ItemOrder	Tooling	Use	UnitCost	Unit	Quantity	PVF	FractionIncluded	Sub Total
10	Lamination - Mold Tool		$ 20 000,00	m^2	1,4	3000	1	$ 9,33
							Sub Total	**$ 9,33**

Drawing Part : FR 07005

Vue isométrique
Echelle : 1:10

Vue de face
Echelle : 1:10

Taille A4		Ecurie Piston Sport Auto	
Dessiné par Benjamin DELALANDE	Date 14/03/2018	Désignation Plaque 2	
Coordonnées Tel : 06.02.24.03.33 benjamin.delalande@ecl16.ec-lyon.fr		Quantité 2	Matériau X	Version 1.0
Plan vérifié par XXX		Echelle1:10	18_FR_0700_003_CA	Feuille 1/1

University	Ecole Centrale de Lyon
System	Frame and Body
Assembly	Bodywork
Part	Back Inlet Bracket
P/N Base	FR 07006
Suffix	AA
Details	

FileLink1	Drawing
FileLink2	
FileLink3	

Back to BOM

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 1,08
Qty	2
Extended Cost	$ 2,15

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Alloy (kg)		$ 2,25	0,007	kg			frontal area	6,09E-04	1,50E-03	7850	1	$ 0,02
												Sub Total	**$ 0,02**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove		$ 1,30	unit	1	2 parts cut from a single machine setup	0,5	$ 0,65
20	Laser Cut		$ 0,01	cm	13,7	Material - Steel	3	$ 0,41
							Sub Total	**$ 1,06**

Drawing Part : FR 07006

University	Ecole Centrale de Lyon
System	Frame and Body
Assembly	Bodywork
Part	Front Inlet Bracket
P/N Base	FR 07007
Suffix	AA
Details	

FileLink1	Drawing
FileLink2	
FileLink3	

Back to BOM

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 1,08
Qty	2
Extended Cost	$ 2,16

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Alloy (kg)		$ 2,25	0,010	kg			frontal Area	8,54E-04	1,50E-03	7850	1	$ 0,02
												Sub Total	**$ 0,02**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove		$ 1,30	unit	1,00	2 parts made from the same plate	0,5	$ 0,65
20	Laser Cut		$ 0,01	cm	13,54	Material - Steel	3	$ 0,41
							Sub Total	**$ 1,06**

Drawing Part : FR 07007

University	Ecole Centrale de Lyon
System	Frame and Body
Assembly	Bodywork
Part	Nose Bracket
P/N Base	FR 07008
Suffix	AA
Details	

FileLink1	Drawing
FileLink2	
FileLink3	

Back to BOM

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 0,74
Qty	4
Extended Cost	$ 2,95

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Alloy (kg)		$ 2,25	0,007	kg			frontal area	6,32E-04	1,50E-03	7850	1	$ 0,02
												Sub Total	**$ 0,02**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove		$ 1,30	unit	1	4 parts cut from a single machine setup	0,25	$ 0,33
20	Laser Cut		$ 0,01	cm	13,20	Material - Steel	3	$ 0,40
							Sub Total	**$ 0,72**

Drawing Part : FR 07008

Vue de droite
Echelle : 1:1

Vue de face
Echelle : 1:1

Taille A4		Ecurie Piston Sport Auto
Dessiné par Antonio Leblanc	Date 16/01/2018	Désignation Bracket 17- Nez
Coordonnées antonio.leblanc@ecl16.ec-lyon.fr 07 69 46 48 59		Quantité 4 / Matériau Acier S235 / Version 0.1
Plan vérifié par XXX		Echelle 1:1 / Numéro du plan 18M_17 / Feuille 1/1

University	Ecole Centrale de Lyon
System	Frame and Body
Assembly	Gearshifting paddles
P/N Base	FR A0800
Suffix	AA
Details	Bought from Pro Shift, cost as made

Back to BOM

Car #	81
FileLink1	
FileLink2	
FileLink3	

Asm Cost	$ 32,66
Qty	1
Extended Cost	$ 32,66

ItemOrder	Part	Part Cost	Quantity	Sub Total
10	Paddles mount main part	$ 6,50	1	$ 6,50
20	Paddles rockers	$ 4,63	2	$ 9,25
30	Paddles	$ 4,03	2	$ 8,07
			Sub Total	$ 23,82

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Spring, Compression (General)	Rockers callback springs	$ 1,00									2	$ 2,00
20	Switch, Toggle	Gearshifting signal switches	$ 1,00									2	$ 2,00
												Sub Total	$ 4,00

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Assemble, 1 kg, Line on line	Paddles rockers on main part assembling	$ 0,13		2		1	$ 0,26
20	Ratchet <= 6.35 mm	M4 Bolts assembling	$ 0,50		2	Engagement Length>4D	1,5	$ 1,50
30	Reaction tool <= 6,35 mm	M4 nuts tightening	$ 0,25		2		1	$ 0,50
40	Assemble, 1 kg, Interference	Springs installation	$ 0,02		2		1	$ 0,04
50	Assemble, 1 kg, Line on line	Switches installation	$ 0,13		2		1	$ 0,26
60	Assemble, 1 kg, Loose	Paddles on paddles rockers assembling	$ 0,06		2		1	$ 0,12
70	Ratchet <= 6.35 mm	M3 bolts assembling	$ 0,50		4		1	$ 2,00
							Sub Total	$ 4,68

ItemOrder	Fastener	Use	UnitCost	Size1	Unit1	Size2	Unit2	Quantity	Sub Total
10	Bolt, Grade 8.8 (SAE 5)	Rocker axles	0,04	4	mm	40	mm	2	$ 0,08
20	Bolt, Grade 8.8 (SAE 5)	Paddles on rockers assembling bolts	0,01	3	mm	10	mm	4	$ 0,04
30	Nut, Grade 8.8 (SAE 5)	Rocker axles nuts	0,02	4	mm			2	$ 0,04
								Sub Total	$ 0,16

University	Ecole Centrale de Lyon		Back to BOM	**Car #**	81	**Part Cost**	$ 6,50
System	Frame and Body	**FileLink1**				**Qty**	1
Assembly	Gearshifting paddles	**FileLink2**		**FileLink1**			
Part	Paddles mount main part	**FileLink3**		**FileLink2**		**Extended Cost**	$ 6,50
P/N Base	FR 08001			**FileLink3**			
Suffix	AA						
Details	Bought part, cost as made						

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Plastic, Polycarbonate		$ 3,30	0,210	kg			Rectangular 100 mm x50mm	0,0050	0,035	1200	1	$ 0,69
												Sub Total	**$ 0,69**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove		$ 1,30		1		1	$ 1,30
20	Machining	Main shape machining	$ 0,04	cm^3	120,5	Material - Plastic	0,5	$ 2,41
30	Drilled holes < 25.4 mm dia.	Steering wheel bolts holes	$ 0,35		3		1	$ 1,05
40	Drilled holes < 25.4 mm dia.	Axles holes	$ 0,35		2	Machine - Hole Length >= 4D	1,5	$ 1,05
							Sub Total	**$ 5,81**

University	Ecole Centrale de Lyon
System	Frame and Body
Assembly	Gearshifting paddles
Part	Paddles rockers
P/N Base	FR 08002
Suffix	AA
Details	Bought part, cost as made

Back to BOM

FileLink1	
FileLink2	
FileLink3	

Car #	81

FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 4,63
Qty	2
Extended Cost	$ 9,25

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Plastic, Polycarbonate		$ 3,30	0,034	kg			Rectangular 40 mm x 35 mm	1,40E-03	0,02	1200	1	$ 0,11
												Sub Total	**$ 0,11**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove		$ 1,30		1		1	$ 1,30
20	Machining		$ 0,04	cm^3	23,5	Material - Plastic	0,5	$ 0,47
30	Drilled holes < 25.4 mm dia.	Rocker axles holes	$ 0,35	unit	1		1,5	$ 0,53
40	Drilled holes < 25.4 mm dia.	Paddles mounting holes	$ 0,35		6		1	$ 2,10
50	Threading, internal	Paddles mounting threads	$ 0,10	cm	2,4	Material - Plastic	0,5	$ 0,12
							Sub Total	**$ 4,52**

University	Ecole Centrale de Lyon		Back to BOM	**Car #**	81
System	Frame and Body	**FileLink1**			
Assembly	Gearshifting paddles	**FileLink2**		**FileLink1**	
Part	Paddles	**FileLink3**		**FileLink2**	
P/N Base	FR 08003			**FileLink3**	
Suffix	AA				
Details	Bought part, cost as made				

Part Cost	$ 4,03
Qty	2
Extended Cost	$ 8,07

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Titanium		$ 22,00	0,038	kg			Rectangular 125 mm x 45 mm	0,0056	0,002	4500	1	$ 0,84
												Sub Total	**$ 0,84**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove		$ 1,30		1		1	$ 1,30
20	Laser cut	Paddle contouring	$ 0,01	cm	52	Material - Titanium	3,65	$ 1,90
							Sub Total	**$ 3,20**

Ecurie Piston Sport Auto

CAR #81

ÉCOLE CENTRALE LYON

ELECTRICAL

University	Ecole Centrale de Lyon
System	Electrical
Assembly	Rear firewall instruments and wires
P/N Base	EL A0100
Suffix	AA
Details	

Back to BOM

Car #	81
FileLink1	
FileLink2	
FileLink3	

Asm Cost	$ 1 316,34
Qty	1
Extended (	$ 1 316,34

ItemOrder	Part	Part Cost	Quantity	Sub Total
10	Fuse box bracket	$ 0,88	2	$ 1,77
20	Ground bracket	$ 0,55	2	$ 1,09
30	Break light bracket	$ 0,82	2	$ 1,64
40	Master switch panel	$ 75,94	1	$ 75,94
50	Master switch panel bracket	$ 0,83	2	$ 1,65
60	Crash sensor bracket	$ 2,09	1	$ 2,09
			Sub Total	$ 84,18

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	ECU, DTA, S80 Pro	DTA	$ 850,00		unit							1,00	$ 850,00
20	Sensor, Air Temperature	IAT sensor	$ 4,00		unit							1,00	$ 4,00
30	Sensor, Angular position	TPS	$ 4,00		unit							1,00	$ 4,00
40	Sensor, Hall effect	Rear wheels speed sensors	$ 4,00		unit							2,00	$ 8,00
50	Sensor, Hall effect	Camshaft position sensor	$ 4,00		unit							1,00	$ 4,00
60	Sensor, Hall effect	Crankshaft position sensor	$ 4,00		unit							1,00	$ 4,00
70	Sensor, Manifold Absolute Pressure (MAP)		$ 4,00		unit							1,00	$ 4,00
80	Sensor, Temperature	ECT	$ 8,00		unit							1,00	$ 8,00
90	Sensor, Two state position	Neutral switch	$ 4,00		unit							1,00	$ 4,00
100	Sensor, Two state position	Crash sensor	$ 4,00		unit							1,00	$ 4,00
110	Sensor, Fluid pressure	Oil pressure sensor	$ 4,00		unit							1,00	$ 4,00
120	Sensor, Wide band air fuel ratio		$ 35,00		unit							1,00	$ 35,00
130	Connector, Aerospace quality	gearmotor box control	$ 1,00		pin							8,00	$ 8,00
140	Connector, Aerospace quality	Firewall interface - 22 pins	$ 1,00		pin							22,00	$ 22,00
150	Connector, Computer Type	DB-9 connector for ECU control	$ 1,00		pin							9,00	$ 9,00
160	Connector, OEM Quality	TPS - 3 wires	$ 0,05		pin							3,00	$ 0,15
170	Connector, OEM Quality	Oil pressure sensor - 2 wires	$ 0,05		pin							2,00	$ 0,10
180	Connector, OEM Quality	Neutral switch - 1 wire	$ 0,05		pin							1,00	$ 0,05
190	Connector, OEM Quality	ECT - 2 wires	$ 0,05		pin							2,00	$ 0,10
200	Connector, OEM Quality	Lambda sensor - 2x3 wires	$ 0,05		pin							6,00	$ 0,30
210	Connector, OEM Quality	Camshaft position sensor - 2 wires	$ 0,05		pin							2,00	$ 0,10
220	Connector, OEM Quality	Crankshaft position sensor - 2 wires	$ 0,05		pin							2,00	$ 0,10
230	Connector, OEM Quality	ECU - 38 wires	$ 0,05		pin							38,00	$ 1,90
240	Connector, OEM Quality	Fan - 2 wires	$ 0,05		pin							2,00	$ 0,10
250	Connector, OEM Quality	Ignition coils - 2x4 wires	$ 0,05		pin							8,00	$ 0,40
260	Connector, OEM Quality	Fuel injection - 2x4 wires	$ 0,05		pin							8,00	$ 0,40
270	Connector, OEM Quality	Crash sensor - 2 wires	$ 0,05		pin							2,00	$ 0,10
280	Connector, OEM Quality	MAP & IAT - 4 wires	$ 0,05		pin							4,00	$ 0,20
290	Connector, High Power, >2Amps	Regulator input - 3 wires	$ 2,00		pin							3,00	$ 6,00
300	Connector, High Power, >2Amps	Regulator output - 2 wires	$ 2,00		pin							2,00	$ 4,00
310	Connector, High Power, >2Amps	Starter motor - 1 wire	$ 2,00		pin							1,00	$ 2,00
320	Connector, High Power, >2Amps	Gearmotor box supply - 2 wires	$ 2,00		pin							2,00	$ 4,00
330	Connector, Single wire	Fuel pump	$ 0,05		wire							2,00	$ 0,10
340	Connector, Single wire	Break light	$ 0,05		wire							6,00	$ 0,30

350	Connector, Single wire	Connection to frame's ground	$ 0,05		wire							4,00	$ 0,20
360	Fuse box	4 relays, 8 fuses -> 32 pins	$ 0,25		pin							32,00	$ 8,00
370	Relay, power	Starter motor, ECU, fuel pump, fan, gearmotor	$ 4,00		unit							5,00	$ 20,00
380	Fuse, power		$ 1,00		unit							8,00	$ 8,00
390	Fuse box	250A fuse handler	$ 0,25		unit							2,00	$ 0,50
400	Fuse, power	250A fuse	$ 1,00		unit							1,00	$ 1,00
410	Wire, signal		$ 1,00		m							35,00	$ 35,00
420	Wire sleeving, split		$ 0,50		m							1,50	$ 0,75
430	Wire, Power		$ 3,00		m							10,00	$ 30,00
440	Heat Shrink Tubing		$ 0,50		m							4,00	$ 2,00
450	Switch, Kill	Master switch	$ 3,00		unit							1,00	$ 3,00
460	Chassis Control Module, Baseline Enclosure	Gearmotor box	$ 25,00		unit							1,00	$ 25,00
470	Chassis Control Module, +Automatic Shifter	Gearmotor box	$ 5,00		unit							1,00	$ 5,00
												Sub Total	**$ 1 130,85**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Weld	Brackets welding	$ 0,15	cm	15			$ 2,25
20	Aerosol apply	Brackets painting	$ 5,25	m^2	8,38E-03			$ 0,04
30	Aerosol apply	Gearmotor box painting	$ 5,25	m^2	7,92E-05			$ 0,00
40	Assemble, 1kg, Loose	Assemble Master switch panel on brackets	$ 0,06	unit	1			$ 0,06
50	Assemble, 3kg, Loose	Assemble ECU on vehicle	$ 0,19	unit	1			$ 0,19
60	Assemble, 1kg, Loose	Lambda sensor	$ 0,06	unit	1			$ 0,06
70	Assemble, 1kg, Loose	Assemble fuse box on fuse box brackets	$ 0,06	unit	1			$ 0,06
80	Cut wire	Cut sensor to appropriate length	$ 0,08	unit	104			$ 8,32
90	Strip wire	Strip wire ends	$ 0,08	unit	208			$ 16,64
100	Cut (scissors, knife)	Cut heat shrink tubing	$ 0,06	cm	1	repeat 15	15	$ 0,90
110	Shrink tube	Install and route wiring harness	$ 0,15	cm	30			$ 4,50
120	Connector assembly, crimp		$ 0,36	contact	108			$ 38,88
130	Connector Install, Circular, Bayonet		$ 0,11	unit	5			$ 0,55
140	Taping Wire Bundle		$ 0,04	cm	300			$ 12,00
150	Wire Dressing (install and route)		$ 1,00	m	4			$ 4,00
160	Ratchet <= 6.35 mm		$ 0,50	unit	12			$ 6,00
170	Reaction Tool <= 6.35 mm		$ 0,25	unit	12			$ 3,00
							Sub Total	**$ 97,45**

ItemOrder	Fastener	Use	UnitCost	Size1	Unit1	Size2	Unit2	Quantity	Sub Total
10	Bolt,Grade 8.8 (SAE)	Regulator redressor	$ 0,04	3	mm	15	mm	3	$ 0,12
20	Washer, Grade 8.8 (SAE 5)	Regulator redressor	$ 0,01	3	mm			3	$ 0,03
30	Nut, Grade 8.8 (SAE 5)	Regulator redressor	$ 0,01	3	mm			3	$ 0,03
40	Bolt,Grade 8.8 (SAE)	Fuse box	$ 0,04	4	mm	15	mm	2	$ 0,08
50	Washer, Grade 8.8 (SAE 5)	Fuse box	$ 0,02	4	mm			2	$ 0,04
60	Nut, Grade 8.8 (SAE 5)	Fuse box	$ 0,01	4	mm			2	$ 0,02
70	Bolt,Grade 8.8 (SAE)	Master switch brackets	$ 0,04	4	mm	15	mm	2	$ 0,08
80	Washer, Grade 8.8 (SAE 5)	Master switch brackets	$ 0,02	4	mm			2	$ 0,04
90	Nut, Grade 8.8 (SAE 5)	Master switch brackets	$ 0,01	4	mm			2	$ 0,02
100	Bolt,Grade 8.8 (SAE)	Master switch	$ 0,04	4	mm	15	mm	2	$ 0,08
110	Washer, Grade 8.8 (SAE 5)	Master switch	$ 0,02	4	mm			2	$ 0,04
120	Nut, Grade 8.8 (SAE 5)	Master switch	$ 0,01	4	mm			2	$ 0,02
130	Bolt,Grade 8.8 (SAE)	M3 on ground brackets	$ 0,04	4	mm	15	mm	3	$ 0,12
140	Washer, Grade 8.8 (SAE 5)	M3 on ground brackets	$ 0,02	4	mm			3	$ 0,06
150	Nut, Grade 8.8 (SAE 5)	M3 on ground brackets	$ 0,01	4	mm			3	$ 0,03
160	Bolt,Grade 8.8 (SAE)	Crash sensor	$ 0,04	3	mm	15	mm	2	$ 0,08

170	Washer, Grade 8.8 (SAE 5)	Crash sensor	$ 0,02	3	mm			2	$ 0,04
180	Nut, Grade 8.8 (SAE 5)	Crash sensor	$ 0,01	3	mm			2	$ 0,02
190	Hook and Loop, Hook Side (Velcro)	For ECU and motogear box	$ 0,00	60	cm^2			1	$ 0,18
200	Hook and Loop, Loop Side (Velcro)	For ECU and motogear box	$ 0,00	60	cm^2			1	$ 0,12
210	Tie wrap	For harness routing	$ 0,04	1	unit			15	$ 0,60
								Sub Total	**$ 1,85**

ItemOrder	Tooling	Use	UnitCost	Unit	Quantity	PVF	FractionIn	Sub Total
10	Welds - Welding Fixture	Brackets welding	$ 500,00	point	12	3000	1	$ 2,00
							Sub Total	**$ 2,00**

University	Ecole Centrale de Lyon
System	Electrical
Assembly	Rear firewall instruments and wires
Part	Fuse box bracket
P/N Base	EL 01001
Suffix	AA
Details	

FileLink1	Drawing
FileLink2	
FileLink3	

Back to BOM

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 0,88
Qty	2
Extended Cost	$ 1,77

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, mild	Stock material for part	$ 2,25	0,007	kg			Rectangular	3,12E-04	0,003	7850	1	$ 0,02
												Sub Total	**$ 0,02**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Setup for laser cutting	$ 1,30	unit	1	2 parts cut from a single machine setup	0,5	$ 0,65
20	Laser Cut	Cutout shape	$ 0,01	cm	7	Material - Steel	3	$ 0,22
							Sub Total	**$ 0,87**

Drawing part : EL 01001

University	Ecole Centrale de Lyon
System	Electrical
Assembly	Rear firewall instruments and wires
Part	Ground bracket
P/N Base	EL 01002
Suffix	AA
Details	

Back to BOM

FileLink1	Drawing
FileLink2	
FileLink3	

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 0,55
Qty	2
Extended Cost	$ 1,09

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, mild	Stock material for part	$ 2,25	0,002	kg			Rectangular	1,95E-04	0,002	7850	1	$ 0,01
												Sub Total	**$ 0,01**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Setup for laser cutting	$ 1,30	unit	1	3 parts cut from a single machine setup	0,33	$ 0,43
20	Laser Cut	Cutout shape	$ 0,01	cm	4	Material - Steel	3	$ 0,11
							Sub Total	**$ 0,54**

Drawing part : EL 01002

University	Ecole Centrale de Lyon
System	Electrical
Assembly	Rear firewall instruments and wires
Part	Break light bracket
P/N Base	EL 01003
Suffix	AA
Details	

Back to BOM

FileLink1	Drawing
FileLink2	
FileLink3	

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 0,82
Qty	2
Extended Cost	$ 1,64

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, mild	Stock material for part	$ 2,25	0,00	kg			Rectangular	2,15E-04	0,002	7850	1	$ 0,01
												Sub Total	**$ 0,01**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Setup for laser cutting	$ 1,30	unit	1	2 parts cut from a single machine setup	0,5	$ 0,65
20	Laser Cut	Cutout shape	$ 0,01	cm	6	Material - Steel	3	$ 0,17
							Sub Total	**$ 0,82**

Drawing part : EL 01003

University	Ecole Centrale de Lyon
System	Electrical
Assembly	Rear firewall instruments and wires
Part	Master switch panel
P/N Base	EL 01004
Suffix	AA
Details	

Back to BOM

FileLink1	
FileLink2	
FileLink3	

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 75,94
Qty	1
Extended Cost	$ 75,94

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Carbon Fiber Reinf Carbon	Stock material for part	$ 0,0092	8000	mm^3							1	$ 73,60
												Sub Total	$ 73,60

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Setup for laser cutting	$ 1,30	unit	1			$ 1,30
20	Laser Cut	Cutout shape	$ 0,01	cm	52	Material - Composite	2	$ 1,04
							Sub Total	$ 2,34

University	Ecole Centrale de Lyon
System	Electrical
Assembly	Rear firewall instruments and wires
Part	Master switch panel bracket
P/N Base	EL 01005
Suffix	AA
Details	

FileLink1	Drawing
FileLink2	
FileLink3	

Back to BOM

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 0,83
Qty	2
Extended Cost	$ 1,65

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, mild	Stock material for part	$ 2,25	0,003	kg			Rectangular	2,16E-04	0,002	7850	1	$ 0,01
												Sub Total	**$ 0,01**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Setup for laser cutting	$ 1,30	unit	1	2 parts cut from a single machine setup	0,5	$ 0,65
20	Laser Cut	Cutout shape	$ 0,01	cm	6	Material - Steel	3	$ 0,17
							Sub Total	**$ 0,82**

Drawing part : EL 01005

University	Ecole Centrale de Lyon
System	Electrical
Assembly	Rear firewall instruments and wires
Part	Crash sensor bracket
P/N Base	EL 01006
Suffix	AA
Details	

Back to BOM

FileLink1	Drawing
FileLink2	
FileLink3	

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 2,09
Qty	1
Extended Cost	$ 2,09

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, mild	Stock material for part	$ 2,25	0,03	kg			Rectangular	2,54E-03	0,002	7850	1	$ 0,07
												Sub Total	**$ 0,07**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Setup for laser cutting	$ 1,30	unit	1			$ 1,30
20	Laser Cut	Cutout shape	$ 0,01	cm	24	Material - Steel	3	$ 0,72
							Sub Total	**$ 2,02**

Drawing part : EL 01006

University	Ecole Centrale de Lyon
System	Electrical
Assembly	Front vehicule electronics
P/N Base	EL A0200
Suffix	AA
Details	Dashboard assembly, dashboard control electronics and front harness

Back to BOM

Car #	81
FileLink1	
FileLink2	
FileLink3	

Asm Cost	$ 512,51
Qty	1
Extended Cost	$ 512,51

ItemOrder	Part	Part Cost	Quantity	Sub Total
10	Dashboard	$ 114,07	1	$ 114,07
20	Dashboard control electronics	$ 234,70	1	$ 234,70
30	Dashboard Tap	$ 1,85	1	$ 1,85
40	Ground bracket	$ 0,55	2	$ 1,09
			Sub Total	$ 351,71

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Lamp, LED	RPM counter	$ 0,50	1	unit							10,00	$ 5,00
20	Display, 7 Segment	Water temperature	$ 1,00	1	unit							3,00	$ 3,00
30	Display, 7 Segment	Gear	$ 1,00	1	unit							1,00	$ 1,00
40	Lamp, LED	Oil temperature alert	$ 1,00	1	unit							1,00	$ 1,00
50	Lamp, LED	Shift light	$ 1,00	1	unit							1,00	$ 1,00
60	Lamp, LED	Fan light	$ 1,00	1	unit							1,00	$ 1,00
70	Lamp, LED	Neutral light	$ 1,00	1	unit							1,00	$ 1,00
80	Lamp, LED	Contact light	$ 1,00	1	unit							1,00	$ 1,00
90	Switch, Toggle	Data logger switch	$ 1,00	1	unit							1,00	$ 1,00
100	Switch, Pushbutton	Launch control button	$ 1,00	1	unit							1,00	$ 1,00
110	Switch, Toggle	Wet/Dry switch	$ 1,00	1	unit							1,00	$ 1,00
120	Switch, Toggle	Traction control switch	$ 1,00	1	unit							1,00	$ 1,00
130	Switch, Pushbutton	Homing shifter	$ 1,00	1	unit							1,00	$ 1,00
140	Switch, Toggle	Fan switch	$ 1,00	1	unit							1,00	$ 1,00
150	Switch, Toggle	Contact switch	$ 1,00	1	unit							1,00	$ 1,00
160	Switch, Pushbutton	Start button	$ 1,00	1	unit							1,00	$ 1,00
170	Switch, Kill	Circuit breaker	$ 3,00	1	unit							1,00	$ 3,00
180	Connector, Aerospace Quality	Firewall connexion 1	$ 1,00	1	pin							16,00	$ 16,00
190	Connector, Aerospace Quality	Firewall connexion 2	$ 1,00	1	pin							5,00	$ 5,00
200	Connector, Single Wire	Ground ring	$ 0,05	1	unit							2,00	$ 0,10
210	Connector, Single Wire	Break over travel switch spades	$ 0,05	1	unit							2,00	$ 0,10
220	Wire, Signal		$ 1,00	1	m							46,00	$ 46,00
230	Wire, Power		$ 3,00	1	m							3,00	$ 9,00
240	Connector, OEM quality	Shift pads	$ 0,05	1	pin							3,00	$ 0,15
250	Switch, Kill	Break over travel switch	$ 3,00	1	unit							1,00	$ 3,00
260	Sensor, Hall effect	Front wheels speed sensors	$ 4,00	1	unit							2,00	$ 8,00
												Sub Total	$ 112,35

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Weld	Weld taps in frame	$ 0,15	cm	1,8			$ 0,27
	Cut wire		$ 0,08	unit	53			$ 4,24
	Strip wire		$ 0,08	unit	106			$ 8,48

	Connector assembly, crimp	Firewall connexion	$ 0,36	contact	21			$ 7,56
	Connector Install, Circular, Bayonet		$ 0,11	unit	3			$ 0,33
	Wire Dressing (install and route)		$ 1,00	m	4			$ 4,00
	Cut (scissors, knife)	Cut heat shrink tubing	$ 0,06	cm	1	repeat 35	35	$ 2,10
	Shrink tube		$ 0,15	cm	30			$ 4,50
	Taping wire bundle		$ 0,04	cm	400			$ 16,00
							Sub Total	**$ 47,48**

ItemOrder	Fastener	Use	UnitCost	Size1	Unit1	Size2	Unit2	Quantity	Sub Total
10	Bolt, Grade 8.8 (SAE 5)	Bolts to fix the dislays and leds	$ 0,03	3	mm			6	$ 0,18
20	Nut, Grade 8.8 (SAE 5)	Nuts to fix the dislays and leds	$ 0,02	3	mm			6	$ 0,12
								Sub Total	**$ 0,30**

ItemOrder	Tooling	Use	UnitCost	Unit	Quantity	PVF	FractionInc	Sub Total
10	Welds - Welding fixture	Material to weld the tabs	$ 500,00	point	4	3000	1	$ 0,67
							Sub Total	**$ 0,67**

University	Ecole Centrale de Lyon
System	Electrical
Assembly	Front vehicule electronics
Part	Dashboard
P/N Base	EL 02001
Suffix	AA
Details	Dashboard support

Back to BOM

FileLink1	
FileLink2	
FileLink3	

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 114,07
Qty	1
Extended C	$ 114,07

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Carbon Fiber, 1 Ply	Dashboard composite	$ 200,00	0,33	kg			rectangle	5,20E-02	0,004	1 580	1,00	$ 65,73
												Sub Total	$ 65,73

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Cut (sicssors, knife)	Carbon fiber cutting	$ 0,06	cm	218	Material - Composite	2	$ 26,16
20	Lamination, Manual	Lamination of the ply	$ 35,00	m²	0	Material - Composite	2	$ 2,87
30	Resin application, Manual	Resin application on the ply	$ 5,00	m²	0,041		2	$ 0,41
40	Vacuum form		$ 10,00	m²	0,041			$ 0,41
50	Cure, Room Temperature	Curing	$ 10,00	m²	0,041			$ 0,41
60	Machining Setup, Install and ren	Setup for dashboard cuting	$ 1,30	Unit	1			$ 1,30
70	Waterjet Cut	Cutting the outer profile and the holes	$ 0,01	cm	218			$ 2,18
80	Drilled hols <25,4mm dia.	Drilling fasteners hole	$ 0,35	hole	36			$ 12,60
							Sub Total	$ 46,34

ItemOrder	Tooling	Use	UnitCost	Unit	Quantity	PVF	FracIncld	Sub Total
10	Lamination - Flat Panel Tool	Mold for all plates	$ 1 500,00	m²	4	3000	1	$ 2,00
							Sub Total	$ 2,00

University	Ecole Centrale de Lyon
System	Electrical
Assembly	Front vehicule electronics
Part	Dashboard control electronics
P/N Base	EL 02002
Suffix	AA
Details	Embedded electronics and wire connections to dashboard control

FileLink1	
FileLink2	
FileLink3	

Back to BOM

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 234,70
Qty	1
Extended Cost	$ 234,70

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Wire, Signal	Electronic board communication	$ 1,00	1	m							32,00	$ 32,00
20	Wire, Power	Electronic board power	$ 3,00	1	m							2,00	$ 6,00
30	Chassis Control Module, +Dashboard	Student made electronic board	$ 20,00		unit							1,00	$ 20,00
40	Connector, Aerospace Quality	Signal connection with dashboard	$ 1,00		pin							32,00	$ 32,00
50	Connector, Aerospace Quality	Power connection with dashboard	$ 1,00		pin							2,00	$ 2,00
60	Connector, Aerospace Quality	Signal connection with rear vehicle electronics	$ 1,00		pin							8,00	$ 8,00
70	Connector, Aerospace Quality	Power connection with rear vehicle electronics	$ 1,00		pin							8,00	$ 8,00
80	Connector, Aerospace Quality	Connection with Break Over Travel switch	$ 1,00		pin							2,00	$ 2,00
90	Chassis Control Module, Baseline Enclosure	Electronic board box	$ 25,00		unit							1,00	$ 25,00
												Sub Total	**$ 135,00**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Cut Wire	Cut wires in correct size	$ 0,08	unit	40			$ 3,20
20	Strip Wire	Strip wire ends	$ 0,08	unit	80			$ 6,40
30	Crimp Wire	Crip wires	$ 0,17	unit	80			$ 13,60
40	Connector Assembly, Crimp	Crimp Molex and Souriau connectors	$ 0,36	unit	80			$ 28,80
50	Lay Wire - Control	Lay control wires	$ 0,02	m	40			$ 0,80
60	Connector Install, Square, Friction	Molex connector install	$ 0,14	unit	40			$ 5,60
70	Wire Dressing (Install and route)	Wires instalation	$ 1,00	m	40			$ 40,00
80	Install Tie Wrap (Zip Tie, Cable Clamp)	Tie wrap instalation	$ 0,09	unit	10			$ 0,90
							Sub Total	**$ 99,30**

ItemOrder	Fastener	Use	UnitCost	Size1	Unit1	Size2	Unit2	Quantity	Sub Total
10	Install Tie Wrap (Zip Tie, Cable Clamp)	Wires	$ 0,04					10	$ 0,40
								Sub Total	**$ 0,40**

University	Ecole Centrale de Lyon
System	Electrical
Assembly	Front vehicule electronics
Part	Dashboard Tap
P/N Base	EL 02003
Suffix	AA
Details	Attachement to frame tap

FileLink1	Drawing
FileLink2	
FileLink3	

Back to BOM

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 1,85
Qty	1
Extended C	$ 1,85

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Mild	Material for part	$ 2,25	0,004	kg			rectangle	5,20E-02	0,004	1 580	1,00	$ 0,01
												Sub Total	**$ 0,01**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Laser cut setup	$ 1,30	unit	1		1	$ 1,30
20	Laser Cut	Cutout shape	$ 0,01	cm	29,5		1	$ 0,30
20	Sheet metal bends	Part bend	$ 0,25	unit	1,0		1	$ 0,25
							Sub Total	**$ 1,85**

Drawing part : EL 02003

University	Ecole Centrale de Lyon
System	Electrical
Assembly	Front vehicule electronics
Part	Ground bracket
P/N Base	EL 02004
Suffix	AA
Details	

Back to BOM

FileLink1	Drawing
FileLink2	
FileLink3	

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 0,55
Qty	2
Extended Cost	$ 1,09

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, mild	Stock material for part	$ 2,25	0,002	kg			Rectangular	1,95E-04	0,002	7850	1	$ 0,01
												Sub Total	**$ 0,01**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Setup for laser cutting	$ 1,30	unit	1	3 parts cut from a single machine setup	0,33	$ 0,43
20	Laser Cut	Cutout shape	$ 0,01	cm	4	Material - Steel	3	$ 0,11
							Sub Total	**$ 0,54**

Drawing part : EL 02004

University	Ecole Centrale de Lyon
System	Electrical
Assembly	Battery assembly
P/N Base	EL A0300
Suffix	AA
Details	Li-Ion battery assembly

Back to BOM

Car #	81
FileLink1	
FileLink2	
FileLink3	

Asm Cost	$ 103,45
Qty	1
Extended (	$ 103,45

ItemOrder	Part	Part Cost	Quantity	Sub Total
10	Main battery mount	$ 4,83	1	$ 4,83
20	Side battery mount	$ 3,66	2	$ 7,31
30	Battery bracket	$ 0,59	3	$ 1,76
			Sub Total	$ 13,90

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Battery, Advanced chemistry (Li-Ion)	Starter bat	$ 65,00	1,3	kg							1,00	$ 84,50
20	Paint	Brackets painting	$ 10,00	5,00E-04	m^2							3,00	$ 0,02
												Sub Total	$ 84,52

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Weld	Tabs weldi	$ 0,15	cm				$ -
20	Aerosol apply	Tabs painti	$ 5,25	m^2				$ -
30	Assemble, 1kg, Loose	Side to ma	$ 0,25	unit	2			$ 0,50
40	Riveting	Side moun	$ 0,25	unit	8			$ 2,00
50	Assemble, 1kg, Line-on-line	Insert Batt	$ 0,13	unit	1			$ 0,13
60	Assemble, 1kg, Loose	Insert batt	$ 0,06	unit	1			$ 0,06
70	Ratchet <= 6.35 mm	Insert batt	$ 0,50		2			$ 1,00
80	Reaction tool <= 6.35mm	Insert batt	$ 0,25		2			$ 0,50
							Sub Total	$ 4,19

ItemOrder	Fastener	Use	UnitCost	Size1	Unit1	Size2	Unit2	Quantity	Sub Total
10	Bolt,Grade 8.8 (SAE 5)	M6 for bat	$ 0,04	6	mm	20	mm	2	$ 0,08
20	Nut, Grade 8.8 (SAE 5)	M6 for bat	$ 0,03	6	mm			2	$ 0,06
30	Washer, Grade 8.8 (SAE 5)	M6 for bat	$ 0,01	6	mm			4	$ 0,04
								Sub Total	$ 0,18

ItemOrder	Tooling	Use	UnitCost	Unit	Quantity	PVF	FractionIn	Sub Total
10	Welds - Welding Fixture	Brackets w	$ 500,00	point	4	3000	1	$ 0,67
							Sub Total	$ 0,67

University	Ecole Centrale de Lyon
System	Electrical
Assembly	Battery assembly
Part	Main battery mount
P/N Base	EL 03001
Suffix	AA
Details	To carry the battery

Back to BOM

FileLink1	Drawing
FileLink2	
FileLink3	

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 4,83
Qty	1
Extended C	$ 4,83

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Aluminium, Normal		$ 4,20	0,231	kg			Rectangular	4,27E-02	0,002	2 712	1,00	$ 0,97
												Sub Total	**$ 0,97**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Setup for laser cutting	$ 1,30	unit	1		1	$ 1,30
20	Laser Cut	Cutout shape	$ 0,01	cm	186		1	$ 1,86
30	Sheet metal bends		$ 0,35	bend	2		1	$ 0,70
							Sub Total	**$ 3,86**

Drawing part : EL 03001

University	Ecole Centrale de Lyon
System	Electrical
Assembly	Battery assembly
Part	Side battery mount
P/N Base	EL 03002
Suffix	AA
Details	To carry the battery

FileLink1	Drawing
FileLink2	
FileLink3	

Back to BOM

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 3,66
Qty	2
Extended C	$ 7,31

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Aluminium, Normal		$ 4,20	0,061	kg			Rectangula	1,12E-02	0,002	2 712	1,00	$ 0,26
												Sub Total	**$ 0,26**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove		$ 1,30	unit	1			$ 1,30
20	Laser Cut	Cutout shape	$ 0,01	cm	70			$ 0,70
30	Sheet metal design		$ 0,35	bend	4			$ 1,40
							Sub Total	**$ 3,40**

Drawing part : EL 03002

University	Ecole Centrale de Lyon
System	Electrical
Assembly	Battery assembly
Part	Battery bracket
P/N Base	EL 03003
Suffix	AA
Details	Description brève de la pièce

Back to BOM

FileLink1	Drawing
FileLink2	
FileLink3	

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 0,59
Qty	3
Extended Cos	$ 1,76

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, mild	Stock material for part	$ 2,25	12	mm	20	mm	rectangula	2,40E-04	0,002	7 850	1,00	$ 0,01
												Sub Total	**$ 0,01**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Setup for laser cutting	$ 1,30	unit	1	3 parts cut from a single machine setup	0,333333	$ 0,43
20	Laser Cut	Cutout shape	$ 0,01	cm	6	Material - Cast Iron	2,5	$ 0,15
							Sub Total	**$ 0,58**

Drawing part : EL 03003

Ecurie Piston Sport Auto

CAR #81

ÉCOLE CENTRALE LYON

Miscellaneous, Finish & Assembly

University	Ecole Centrale de Lyon
System	Miscellaneous, Finish & Assembly
Assembly	Firewall
P/N Base	MS A0100
Suffix	AA
Details	The assembly of the Firewall

Back to BOM

Car #	81
FileLink1	
FileLink2	
FileLink3	

Asm Cost	$ 113,77
Qty	1
Extended Cost	$ 113,77

ItemOrder	Part	Part Cost	Quantity	Sub Total
10	Firewall Up	$ 9,27	1	$ 9,27
20	Firewall Middle	$ 7,54	1	$ 7,54
30	Firewall Bottom	$ 11,14	1	$ 11,14
40	Firewall Upper Side	$ 3,17	2	$ 6,34
50	Firewall Middle Side	$ 2,15	2	$ 4,30
60	Firewall Lower Side	$ 4,08	2	$ 8,15
70	Firewall Up Bracket	$ 0,62	4	$ 2,47
80	Firewall Middle, Bottom and Sides Bracket	$ 0,38	24	$ 9,10
			Sub Total	$ 58,30

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Paint	Painting the Firewall Up Brackets	$ 10,00	4,09E-03	m^2							4,09E-03	$ 0,04
20	Paint	Painting the Firewall Middle, Bottom and Sides Brackets	$ 10,00	0,0245	m^2							0,0245	$ 0,25
30	Tape	Aluminum tape	$ -	5,00	m							5,00	$ -
												Sub Total	$ 0,29

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Weld	Welding the Firewall Up Brackets on the chassis	$ 0,15	cm	16			$ 2,40
20	Weld	Welding the Firewall Middle, Bottom and Sides Brackets on the chassis	$ 0,15	cm	96			$ 14,40
30	Aerosol Apply	Painting the Firewall Up Brackets	$ 5,25	m^2	4,09E-03			$ 0,02
40	Aerosol Apply	Painting the Firewall Middle, Bottom and Sides Brackets	$ 5,25	m^2	0,0245			$ 0,13
50	Assemble, 1 kg, Loose	Positioning the Firewall Middle Plate on the Brackets	$ 0,06	unit	1			$ 0,06
60	Ratchet <= 6.35 mm	Fixing the Firewall Middle Plate to the Brackets	$ 0,50	unit	4			$ 2,00
70	Reaction Tool <= 25.4 mm	Fixing the Firewall Middle Plate to the Brackets	$ 0,25	unit	4			$ 1,00
80	Assemble, 1 kg, Loose	Positioning the Firewall Upper Plate on the Brackets	$ 0,06	unit	1			$ 0,06
90	Ratchet <= 6.35 mm	Fixing the Firewall Upper Plate to the Brackets	$ 0,50	unit	4			$ 2,00
100	Reaction Tool <= 25.4 mm	Fixing the Firewall Upper Plate to the Brackets	$ 0,25	unit	4			$ 1,00
110	Assemble, 3 kg, Loose	Positioning the Firewall Bottom Plate on the Brackets	$ 0,19	unit	1			$ 0,19
120	Ratchet <= 6.35 mm	Fixing the Firewall Bottom Plate to the Brackets	$ 0,50	unit	4			$ 2,00
130	Reaction Tool <= 25.4 mm	Fixing the Firewall Bottom Plate to the Brackets	$ 0,25	unit	4			$ 1,00
140	Assemble, 1 kg, Loose	Positioning the Firewall Upper left Side Plate on the Brackets	$ 0,06	unit	1			$ 0,06
150	Ratchet <= 6.35 mm	Fixing the Firewall Upper left Side Plate to the Brackets	$ 0,50	unit	3			$ 1,50
160	Reaction Tool <= 25.4 mm	Fixing the Firewall Upper left Side Plate to the Brackets	$ 0,25	unit	3			$ 0,75
170	Assemble, 1 kg, Loose	Positioning the Firewall Middle left Side Plate on the Brackets	$ 0,06	unit	1			$ 0,06
180	Ratchet <= 6.35 mm	Fixing the Firewall Middle left Side Plate to the Brackets	$ 0,50	unit	2			$ 1,00
190	Reaction Tool <= 25.4 mm	Fixing the Firewall Middle left Side Plate to the Brackets	$ 0,25	unit	2			$ 0,50
200	Assemble, 1 kg, Loose	Positioning the Firewall Lower left Side Plate on the Brackets	$ 0,06	unit	1			$ 0,06
210	Ratchet <= 6.35 mm	Fixing the Firewall Lower left Side Plate to the Brackets	$ 0,50	unit	3			$ 1,50
220	Reaction Tool <= 25.4 mm	Fixing the Firewall Lower left Side Plate to the Brackets	$ 0,25	unit	3			$ 0,75
230	Assemble, 1 kg, Loose	Positioning the Firewall Upper right Side Plate on the Brackets	$ 0,06	unit	1			$ 0,06
240	Ratchet <= 6.35 mm	Fixing the Firewall Upper right Side Plate to the Brackets	$ 0,50	unit	3			$ 1,50
250	Reaction Tool <= 25.4 mm	Fixing the Firewall Upper right Side Plate to the Brackets	$ 0,25	unit	3			$ 0,75
260	Assemble, 1 kg, Loose	Positioning the Firewall Middle right Side Plate on the Brackets	$ 0,06	unit	1			$ 0,06
270	Ratchet <= 6.35 mm	Fixing the Firewall Middle right Side Plate to the Brackets	$ 0,50	unit	2			$ 1,00
280	Reaction Tool <= 25.4 mm	Fixing the Firewall Middle right Side Plate to the Brackets	$ 0,25	unit	2			$ 0,50
290	Assemble, 1 kg, Loose	Positioning the Firewall Lower right Side Plate on the Brackets	$ 0,06	unit	1			$ 0,06
300	Ratchet <= 6.35 mm	Fixing the Firewall Lower right Side Plate to the Brackets	$ 0,50	unit	3			$ 1,50
310	Reaction Tool <= 25.4 mm	Fixing the Firewall Lower right Side Plate to the Brackets	$ 0,25	unit	3			$ 0,75
320	Tape	Sealing with aluminium tape	$ 0,80	m	5			$ 4,00
							Sub Total	$ 42,62

ItemOrder	Fastener	Use	UnitCost	Size1	Unit1	Size2	Unit2	Quantity	Sub Total
10	Bolt, Grade 8.8 (SAE 5)	Fixing the Plates to the Brackets	$ 0,07	6	mm	30	mm	28	$ 1,83

20	Washer, Grade 8.8 (SAE 5)	Fixing the Plates to the Brackets	$ 0,01					56	$ 0,56
30	Nut, Grade 8.8 (SAE 5)	Fixing the Plates to the Brackets	$ 0,03	6	mm			28	$ 0,84
								Sub Total	**$ 3,23**

ItemOrder	Tooling	Use	UnitCost	Unit	Quantity	PVF	FractionIncluded	Sub Total
10	Welds - Welding Fixture	Mounts welded to the chassis	$ 500,00	point	56	3000	1	$ 9,33
							Sub Total	**$ 9,33**

University	Ecole Centrale de Lyon
System	Miscellaneous, Finish & Assembly
Assembly	Firewall
Part	Firewall Up
P/N Base	MS 01001
Suffix	AA
Details	Upper plate

FileLink1	Drawing
FileLink2	
FileLink3	

Back to BOM

Car #	81

FileLink1
FileLink2
FileLink3

Part Cost	$ 9,27
Qty	1
Extended Cost	$ 9,27

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Aluminum, Normal (per kg)		$ 4,20	1,179	kg			Frontal area	0,2174	0,002	2712	1	$ 4,95
												Sub Total	**$ 4,95**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove		$ 1,30	unit	1			$ 1,30
20	Laser Cut		$ 0,01	cm	201,24	Material - Aluminum	1	$ 2,01
30	Sheet metal bends		$ 0,25	bend	4			$ 1,00
							Sub Total	**$ 4,31**

Drawing part : MS 01001

Vue isométrique
Echelle : 1:10

Vue de gauche
Echelle : 1:5

Vue dépliée
Echelle : 1:10

Vue droite
Echelle : 1:10

Toutes les côtes sont tolérancées à + ou - 1mm et + ou - 1°

Tous les angles de pliage sont de 90°.
Les rayons intérieurs de pliages sont de 4mm.

Taille A4		Ecurie Piston Sport Auto
Dessiné par Benjamin DELALANDE	Date 31/01/2018	Désignation: Paroi pare-feu haut
Coordonnées Tel : 06.02.24.03.33 benjamin.delalande@ecl16.ec-lyon.fr		Quantité 1 / Matériau Aluminium 2017 / Version 1.0
Plan vérifié par XXX		Echelle1:10 / 18 M_MS_0100_001_CA / Feuille 1/1

University	Ecole Centrale de Lyon
System	Miscellaneous, Finish & Assembly
Assembly	Firewall
Part	Firewall Middle
P/N Base	MS 01002
Suffix	AA
Details	Middle plate

FileLink1	Drawing
FileLink2	
FileLink3	

Back to BOM

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 7,54
Qty	1
Extended Cost	$ 7,54

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Aluminum, Normal (per kg)		$ 4,20	1,023	kg			Frontal area	0,1885	0,002	2712	1	$ 4,30
												Sub Total	**$ 4,30**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove		$ 1,30	unit	1			$ 1,30
20	Laser Cut		$ 0,01	cm	194,74	Material - Aluminum	1	$ 1,95
							Sub Total	**$ 3,25**

Drawing part : MS 01002

Toutes les côtes sont tolérancées à + ou - 1mm

Vue isométrique
Echelle : 1:8

Vue de face
Echelle : 1:8

Vue de gauche
Echelle : 1:8

Taille A4		Ecurie Piston Sport Auto
Dessiné par Benjamin DELALANDE	Date 31/01/2018	Désignation Paroi pare-feu milieu
Coordonnées Tel : 06.02.24.03.33 benjamin.delalande@ecl16.ec-lyon.fr	Quantité 1	Matériau Aluminium 2017 / Version 1.0
Plan vérifié par XXX	Echelle 1:8	18 M_MS_0100_002_CA / Feuille 1/1

University	Ecole Centrale de Lyon
System	Miscellaneous, Finish & Assembly
Assembly	Firewall
Part	Firewall Bottom
P/N Base	MS 01003
Suffix	AA
Details	Lower plate

Back to BOM

FileLink1	Drawing
FileLink2	
FileLink3	

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 11,14
Qty	1
Extended Cost	$ 11,14

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Aluminum, Normal (per kg)		$ 4,20	1,626	kg			Frontal area	0,2997	0,002	2712	1	$ 6,83
												Sub Total	$ 6,83

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove		$ 1,30	unit	1			$ 1,30
20	Laser Cut		$ 0,01	cm	226,34	Material - Aluminum	1	$ 2,26
30	Sheet metal bends		$ 0,25	bend	3			$ 0,75
							Sub Total	$ 4,31

Drawing Part : MS 01003

University	Ecole Centrale de Lyon
System	Miscellaneous, Finish & Assembly
Assembly	Firewall
Part	Firewall Upper Side
P/N Base	MS 01004
Suffix	AA
Details	Upper side plate

FileLink1	Drawing
FileLink2	
FileLink3	

Back to BOM

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 3,17
Qty	2
Extended Cost	$ 6,34

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Aluminum, Normal (per kg)		$ 4,20	0,296	kg			Frontal area	0,0546	0,002	2712	1	$ 1,24
												Sub Total	**$ 1,24**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove		$ 1,30	unit	1	2 parts made from the same plate	0,5	$ 0,65
20	Laser Cut		$ 0,01	cm	127,57	Material - Aluminum	1	$ 1,28
							Sub Total	**$ 1,93**

Drawing Part : MS 01004

Toutes les côtes sont tolérancées à + ou - 1mm

Vue isométrique
Echelle : 1:8

Vue de face
Echelle : 1:8

Vue de gauche
Echelle : 1:8

Taille A4		Ecurie Piston Sport Auto
Dessiné par Benjamin DELALANDE	Date 31/01/2018	Désignation Paroi pare-feu latérale haut
Coordonnées Tel : 06.02.24.03.33 benjamin.delalande@ecl16.ec-lyon.fr		Quantité 2 / Matériau Aluminium 2017 / Version 1.0
Plan vérifié par XXX		Echelle 1:8 / 18 M_MS_0100_004_CA / Feuille 1/1

University	Ecole Centrale de Lyon
System	Miscellaneous, Finish & Assembly
Assembly	Firewall
Part	Firewall Middle Side
P/N Base	MS 01005
Suffix	AA
Details	Middle side plate

FileLink1	Drawing
FileLink2	
FileLink3	

Back to BOM

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 2,15
Qty	2
Extended Cost	$ 4,30

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Aluminum, Normal (per kg)		$ 4,20	0,122	kg			Frontal area	2,24E-02	0,002	2712	1	$ 0,51
												Sub Total	**$ 0,51**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove		$ 1,30	unit	1	2 parts made from the same plate	0,5	$ 0,65
20	Laser Cut		$ 0,01	cm	98,79	Material - Aluminum	1	$ 0,99
							Sub Total	**$ 1,64**

Drawing Part : MS 01005

Toutes les côtes sont tolérancées à + ou - 1mm

Vue isométrique
Echelle : 1:8

Vue de face
Echelle : 1:8

Vue de gauche
Echelle : 1:8

Taille A4		Ecurie Piston Sport Auto
Dessiné par Benjamin DELALANDE	Date 31/01/2018	Désignation Paroi pare-feu latérale milieu
Coordonnées Tel : 06.02.24.03.33 benjamin.delalande@ecl16.ec-lyon.fr	Quantité 2	Matériau Aluminium 2017 / Version 1.0
Plan vérifié par XXX	Echelle 1:8	18 M_MS_0100_005_CA / Feuille 1/1

University	Ecole Centrale de Lyon
System	Miscellaneous, Finish & Assembly
Assembly	Firewall
Part	Firewall Lower Side
P/N Base	MS 01006
Suffix	AA
Details	Lower side plate

FileLink1	Drawing
FileLink2	
FileLink3	

Back to BOM

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 4,08
Qty	2
Extended Cost	$ 8,15

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Aluminum, Normal (per kg)		$ 4,20	0,473	kg			frontal area	8,72E-02	0,002	2712	1	$ 1,99
												Sub Total	**$ 1,99**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove		$ 1,30	unit	1	2 parts made from the same plate	0,5	$ 0,65
20	Laser Cut		$ 0,01	cm	143,94	Material - Aluminum	1	$ 1,44
							Sub Total	**$ 2,09**

Drawing Part : MS 01006

Toutes les côtes sont tolérancées à + ou - 1mm et + ou - 1°

Vue isométrique
Echelle : 1:8

Vue de face
Echelle : 1:8

Vue de gauche
Echelle : 1:8

Taille A4		Ecurie Piston Sport Auto
Dessiné par Benjamin DELALANDE	Date 31/01/2018	Désignation Paroi pare-feu latérale bas
Coordonnées Tel : 06.02.24.03.33 benjamin.delalande@ecl16.ec-lyon.fr		Quantité 2 / Matériau Aluminium 2017 / Version 1.0
Plan vérifié par XXX		Echelle 1:8 / 18 M_MS_0100_006_CA / Feuille 1/1

University	Ecole Centrale de Lyon
System	Miscellaneous, Finish & Assembly
Assembly	Firewall
Part	Firewall Up Bracket
P/N Base	MS 01007
Suffix	AA
Details	Bracket for the upper plate

FileLink1	Drawing
FileLink2	
FileLink3	

Back to BOM

Car #	81

FileLink1
FileLink2
FileLink3

Part Cost	$ 0,62
Qty	4
Extended Cost	$ 2,47

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Alloy (kg)		$ 2,25	4,38E-03	kg			Frontal area	3,72E-04	0,0015	7850	1	$ 0,01
												Sub Total	**$ 0,01**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove		$ 1,30	unit	1	4 parts made from the same plate	0,25	$ 0,33
20	Laser Cut		$ 0,01	cm	9,42	Material - Steel	3	$ 0,28
							Sub Total	**$ 0,61**

Drawing Part : MS 01007

Vue de droite
Echelle : 1:1

Vue de face
Echelle : 1:1

Taille A4		Ecurie Piston Sport Auto
Dessiné par Antonio Leblanc	Date 14/01/2018	Désignation Bracket 12- Firewall appui tête
Coordonnées 07 69 46 48 59 antonio.leblanc@ecl16.ec-lyon.fr		Quantité 4 / Matériau Acier S235 / Version 0.1
Plan vérifié par XXX		Echelle 1:1 / Numéro du plan 18M_12 / Feuille 1/1

University	Ecole Centrale de Lyon
System	Miscellaneous, Finish & Assembly
Assembly	Firewall
Part	Firewall Middle, Bottom and Sides Bracket
P/N Base	MS 01008
Suffix	AA
Details	Bracket for the Middle, Bottom and Side plates

FileLink1	Drawing
FileLink2	
FileLink3	

Back to BOM

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 0,38
Qty	24
Extended C	$ 9,10

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Alloy (kg)		$ 2,25	5,43E-03	kg			Frontal area	4,61E-04	0,0015	7850	1	$ 0,01
												Sub Total	**$ 0,01**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove		$ 1,30	unit	1	24 parts made from the same plate	0,04	$ 0,05
20	Laser Cut		$ 0,01	cm	10,42	Material - Steel	3	$ 0,31
							Sub Total	**$ 0,37**

Drawing Part : MS 01008

Taille A4		Ecurie Piston Sport Auto
Dessiné par Antonio Leblanc	Date 14/01/2018	Désignation Bracket 11- Firewall
Coordonnées 07 69 46 48 59 antonio.leblanc@ecl16.ec-lyon.fr		Quantité 24 / Matériau Acier S235 / Version 0.1
Plan vérifié par XXX		Echelle 1:1 / Numéro du plan 18M_11 / Feuille 1/1

University	Ecole Centrale de Lyon
System	Miscellaneous, Finish & Assembly
Assembly	Driver's Safety
P/N Base	MS A0200
Suffix	AA
Details	2 roll bar paddings on frame

Back to BOM

Car #	81
FileLink1	
FileLink2	
FileLink3	

Asm Cost	$ 8,62
Qty	1
Extended Cost	$ 8,62

ItemOrder	Part	Part Cost	Quantity	Sub Total
10	Rollbar padding	$ 3,92	2	$ 7,84
			Sub Total	$ 7,84

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Assemble, 1kg, Line-on-Line	Placing rollbar padding on frame	$ 0,13	unit	2			$ 0,26
20	Install Tie Wrap (Zip Tie, Cable Clamp)	Maintaining rollbar padding	$ 0,09	unit	4			$ 0,36
							Sub Total	$ 0,62

ItemOrder	Fastener	Use	UnitCost	Size1	Unit1	Size2	Unit2	Quantity	Sub Total
10	Tie Wrap	Maintaining rollbar padding	$ 0,04		unit			4	$ 0,16
								Sub Total	$ 0,16

University	Ecole Centrale de Lyon
System	Miscellaneous, Finish & Assembly
Assembly	Driver's Safety
Part	Rollbar padding
P/N Base	MS 02001
Suffix	AA
Details	

FileLink1
FileLink2
FileLink3

Back to BOM

Car #	81

FileLink1
FileLink2
FileLink3

Part Cost	$ 3,92
Qty	2

Extended C	$ 7,84

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Adhesive		$ -		unit								$ -
20	Roll Hoop Padding		$ 0,05	22	cm							1	$ 1,10
												Sub Total	$ 1,10

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Brush apply	Applying glue to padding	$ 0,02	cm^2	141			$ 2,82
							Sub Total	$ 2,82

University	Ecole Centrale de Lyon
System	Miscellaneous, Finish & Assembly
Assembly	Head Restraint
P/N Base	MS A0300
Suffix	AA
Details	Placed on firewall

Back to BOM

Car #	81
FileLink1	
FileLink2	
FileLink3	

Asm Cost	$ 31,54
Qty	1
Extended Cost	$ 31,54

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Head Rest Padding		$ 0,005	2216	cm^3							1	$ 11,08
20	Adhesive	Maintain padding on firewall	$ -		unit								$ -
30	Fabric	Recover padding	$ 2,50	0,06	m^2							1	$ 0,14
												Sub Total	$ 11,22

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Cut (scissors, knife)	Cutting padding into shape	$ 0,06	cm	85,4			$ 5,12
20	Cut (scissors, knife)	Cutting fabric into shape	$ 0,06	cm	85,4			$ 5,12
30	Brush apply	Applying glue to padding	$ 0,02	cm^2	250			$ 5,00
40	Assemble, 1kg, Line-on-Line	Placing fabric on padding	$ 0,01	unit	1			$ 0,01
50	Brush apply	Applying glue to firewall	$ 0,02	cm^2	250			$ 5,00
60	Assemble, 1kg, Loose	Placing padding & fabric on firewall	$ 0,06	unit	1			$ 0,06
							Sub Total	$ 20,32

University	Ecole Centrale de Lyon
System	Miscellaneous, Finish & Assembly
Assembly	Driver's seat
P/N Base	MS A0400
Suffix	AA
Details	Driver's restraint system

Back to BOM

Car #	81
FileLink1	
FileLink2	
FileLink3	

Asm Cost	$ 84,36
Qty	1
Extended Cost	$ 84,36

ItemOrder	Part	Part Cost	Quantity	Sub Total
10	Seat	$ 74,60	1	$ 74,60
20	Rear seat bracket	$ 1,32	2	$ 2,65
30	Front seat bracket	$ 1,19	2	$ 2,37
			Sub Total	$ 79,62

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Paint	Seat brackets painting	$ 10,00	0,004	m^2							1	$ 0,04
												Sub Total	$ 0,04

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Weld	Welding brackets to frame	$ 0,15	cm	8			$ 1,20
20	Aerosol Apply	Bracket painting	$ 5,25	m^2	0,004		2	$ 0,04
30	Assemble, 1kg, Loose	Assemble seat	$ 0,06	unit	1			$ 0,06
40	Ratchet <= 6.35 mm	Fasten seat to brackets	$ 0,50	unit	2			$ 1,00
50	Reaction tool <= 6.35 mm	Fasten seat to brackets	$ 0,25	unit	2			$ 0,50
							Sub Total	$ 2,80

ItemOrder	Fastener	Use	UnitCost	Size1	Unit1	Size2	Unit2	Quantity	Sub Total
10	Bolt, Grade 8,8 (SAE 5)	Bolt seat and brackets	$ 0,10	6	mm	45	mm	4	$ 0,40
20	Nut, Grade 8,8 (SAE 5)	Bolt seat and brackets	$ 0,03	6	mm			4	$ 0,12
20	Washer, Grade 8,8 (SAE 5)	Bolt seat and brackets	$ 0,01	1	unit			4	$ 0,04
								Sub Total	$ 0,56

ItemOrder	Tooling	Use	UnitCost	Unit	Quantity	PVF	FractionIncluded	Sub Total
10	Welds - Welding Fixture	Welding bracket to frame	$ 500,00	point	8	3000	1	$ 1,33
							Sub Total	$ 1,33

University	Ecole Centrale de Lyon
System	Miscellaneous, Finish & Assembly
Assembly	Driver's seat
Part	Seat
P/N Base	MS 04001
Suffix	AA
Details	

FileLink1	
FileLink2	
FileLink3	

Back to BOM

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 74,60
Qty	1
Extended (	$ 74,60

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Glass Fiber, 1 Ply	Stock material for part	$ 100,00	0,090	kg							2	$ 18,00
20	Grommet, Elastomer	For harness holes	$ 0,05		unit							16	$ 0,80
												Sub Total	$ 18,80

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Cut (scissors, knife)	Cut ply	$ 0,06	cm	190	Repeat 2 times	2	$ 22,80
20	Lamination, Manual		$ 35,00	m^2	0,36	Repeat 2 times	2	$ 25,20
30	Resin application, Manual		$ 5,00	m^2	0,36	Repeat 2 times	2	$ 3,60
40	Non-metallic cutting > 76,2 mm	Cutout seat border	$ 1,40	cut	1			$ 1,40
50	Hand Finish - Material Removal	Clean cuts	$ 0,20	cm^3	1			$ 0,20
60	Drilled holes < 25,4 mm dia.	Cutout fixation holes	$ 0,35	hole	4			$ 1,40
70	Assemble, 1 kg, Loose	Insert gromets	$ 0,06	Unit	16			$ 0,96
							Sub Total	$ 54,60

ItemOrder	Tooling	Use	UnitCost	Unit	Quantity	PVF	FractionInc	Sub Total
10	Lamination - Composite Tool	Lamination	$ 10 000,00	m^2	0,36	3000	1	$ 1,20
							Sub Total	$ 1,20

University	Ecole Centrale de Lyon
System	Miscellaneous, Finish & Assembly
Assembly	Driver's seat
Part	Rear seat bracket
P/N Base	MS 04002
Suffix	AA
Details	

Back to BOM

FileLink1	Drawing
FileLink2	
FileLink3	

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 1,32
Qty	2
Extended Cost	$ 2,65

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Mild	Stock material for part	$ 2,25	6,10E-03	kg							1	$ 0,01
												Sub Total	**$ 0,01**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Setup for laser cutting	$ 1,30	unit	1	2 parts with one machine setup	0,5	$ 0,65
20	Laser Cut	Cutout shape	$ 0,01	cm	22	Material - Steel	3	$ 0,66
							Sub Total	**$ 1,31**

Drawing Part : MS 04002

University	Ecole Centrale de Lyon
System	Miscellaneous, Finish & Assembly
Assembly	Driver's seat
Part	Front seat bracket
P/N Base	MS 04003
Suffix	AA
Details	

Back to BOM

FileLink1	Drawing
FileLink2	
FileLink3	

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 1,19
Qty	2
Extended Cost	$ 2,37

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Mild	Stock material for part	$ 2,25	8,50E-03	kg							1	$ 0,02
												Sub Total	$ 0,02

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Setup for laser cutting	$ 1,30	unit	1	2 parts with one machine setup	0,5	$ 0,65
20	Laser Cut	Cutout shape	$ 0,01	cm	17	Material - Steel	3	$ 0,52
							Sub Total	$ 1,17

Drawing Part : MS 04003

Tolérances générales : ISO 2768-mK

Vue de face
Echelle : 2:1

Vue de gauche
Echelle : 2:1

Taille A4		Ecurie Piston Sport Auto
Dessiné par Aurélien	Date 09/02/2018	Désignation Bracket_114_Siege dessous
Coordonnées aurelien.bienner@ecl16.ec-lyon.fr		Quantité 4 / Matériau Acier S355 / Version 1.0
Plan vérifié par Brice Roblot		Echelle 2:1 / Numéro du plan 18M_114 / Feuille 1/1

University	Ecole Centrale de Lyon
System	Miscellaneous, Finish & Assembly
Assembly	Harness
P/N Base	MS A0500
Suffix	AA
Details	Driver's restraint system

Back to BOM

Car #	81
FileLink1	
FileLink2	
FileLink3	

Asm Cost	$ 56,15
Qty	1
Extended Cost	$ 56,15

ItemOrder	Part	Part Cost	Quantity	Sub Total
10	Harness bracket	$ 1,25	2	$ 2,50
			Sub Total	$ 2,50

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Harness, Driver	6-point harness	$ 45,00	1	unit							1	$ 45,00
20	Paint	Harness tab painting	$ 10,00	0,006	m^2							0,01	$ 0,06
												Sub Total	$ 45,06

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Weld	Welding tab to frame	$ 0,15	cm	7,2			$ 1,08
20	Aerosol Apply	tab painting	$ 5,25	m^2	0,006			$ 0,03
30	Assemble, 1kg, Loose	Assemble eyebolts on tabs	$ 0,06	unit	2			$ 0,13
40	Wrench <= 25,4 mm	Fastener installation	$ 1,50	unit	2			$ 3,00
50	Reaction tool <= 25,4 mm	Fastener installation	$ 0,25	unit	2			$ 0,50
60	Assemble, 3kg, Loose	Assemble harness	$ 0,19	unit	1			$ 0,19
							Sub Total	$ 4,92

ItemOrder	Fastener	Use	UnitCost	Size1	Unit1	Size2	Unit2	Quantity	Sub Total
10	Eyebolt, Threaded, Steel	Attach harness to tab	$ 1,43	10	mm			2	$ 2,86
20	Nut, Grade 8,8 (SAE 5)	Attach harness to tab	$ 0,07	10	mm			2	$ 0,14
								Sub Total	$ 3,00

ItemOrder	Tooling	Use	UnitCost	Unit	Quantity	PVF	FractionIncluded	Sub Total
10	Welds - Welding Fixture	Welding tab to frame	$ 500,00	point	4	3000	1	$ 0,67
							Sub Total	$ 0,67

University	Ecole Centrale de Lyon
System	Miscellaneous, Finish & Assembly
Assembly	Harness
Part	Harness bracket
P/N Base	MS 05001
Suffix	AA
Details	Same plan as in 2017

Back to BOM

FileLink1	Drawing
FileLink2	
FileLink3	

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 1,25
Qty	2
Extended Cost	$ 2,50

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Mild	Stock material for part	$ 2,25	0,041	kg						7 850	1,00	$ 0,09
												Sub Total	$ 0,09

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and Remove	Setup for laser cutting	$ 1,30	unit	1	2 parts with one machine setup	0,5	$ 0,65
20	Laser Cut	Cutout shape	$ 0,01	cm	17	Material - Steel	3	$ 0,51
							Sub Total	$ 1,16

Drawing part : MS 05001

Ecurie Piston Sport Auto

ÉCOLE CENTRALE LYON

CAR #81

STEERING SYSTEM

University	Ecole Centrale de Lyon	Back to BOM	**Car #**	81	**Asm Cost** $ 155,00
System	Steering System				**Qty** 1
Assembly	Steering Rack		**FileLink1**		
P/N Base	ST A0100		**FileLink2**		**Extended** $ 155,00
Suffix	AA		**FileLink3**		
Details	Bought, cost as made				

ItemOrder	Part	Part Cost	Quantity	Sub Total
10	Rack Pinion	$ 7,97	1	$ 7,97
20	Rack	$ 6,04	1	$ 6,04
30	Upper Pinion housing	$ 2,57	1	$ 2,57
40	Lower Pinion housing	$ 6,26	1	$ 6,26
50	Rack housing support	$ 2,35	2	$ 4,70
60	Tie rod Braces	$ 2,39	2	$ 4,78
70	Rack housing	$ 65,59	1	$ 65,59
80	Steering Brackets tie	$ 1,58	4	$ 6,34
90	Steering Brackets	$ 1,60	2	$ 3,19
100	Rack protection	$ 7,62	1	$ 7,62
110	Rack protection Brackets	$ 0,38	4	$ 1,52
			Sub Total	**$116,57**

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Nam	Area	Length	Density	Quantity	Sub Total
10	Bearing, Needle	To guide the rack en the rack housing	$ 5,51	17	mm	25	mm					2	$ 11,03
20	Bearing, Needle	To guide the rack pinion en the lower pinion housing	$ 4,29	17	mm	9	mm					2	$ 8,58
												Sub Total	**$ 19,60**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Weld	Welding the steering Brackets on the frame	$ 0,15	cm	20,48			$ 3,07
20	Assemble, 1 kg, Loose	Assembly of part 70 in part 40	$ 0,06	unit	1			$ 0,06
30	Assemble, 1 kg, Loose	Assembly of material 20 in part 40	$ 0,06	unit	2			$ 0,13
40	Assemble, 1 kg, Loose	Assembly of part 20 in part 40	$ 0,06	unit	1			$ 0,06
50	Assemble, 1 kg, Loose	Assembly of part 10 in part 40	$ 0,06	unit	1			$ 0,06
60	Assemble, 1 kg, Loose	Assembly of part 30 on part 40	$ 0,06	unit	1			$ 0,06
70	Screwdriver > 1 Turn	Use of fastener 10 to fix part 30 on part 40	$ 0,50	unit	4			$ 2,00
80	Ratchet <= 25.4 mm	Use of fastener 20 to fix part 20	$ 0,75	unit	1			$ 0,75
90	Liquid Apply - Spot	To glue part 70 to part 50	$ 0,10	unit	6			$ 0,60
100	Brush Apply	To glue part 70 to part 50	$ 0,02	cm^2	8			$ 0,16
110	Assemble, 1 kg, Loose	Assembly of material 10 in part 50	$ 0,06	unit	1			$ 0,06
120	Assemble, 1 kg, Loose	Assembly of part 60 on part 70	$ 0,06	unit	2			$ 0,13
130	Wrench <= 25.4 mm	Use of fastener 60 To fix part 60 on part 70	$ 1,50	unit	2			$ 3,00
140	Assemble, 1 kg, Loose	Assembly of part 80 to part 50	$ 0,06	unit	4			$ 0,25
150	Ratchet <= 6,35 mm	Use of fastener 30 To fix part 80 on part 50	$ 0,50	unit	4			$ 2,00
160	Reaction Tool <= 6.35 mm	For the process 140	$ 0,25	unit	4			$ 1,00
170	Weld	Welding of part 110 on the frame	$ 0,15	cm	6			$ 0,90
180	Assemble, 1 kg, Loose	Assembly of part 100 on part 110	$ 0,06	unit	1			$ 0,06
190	Ratchet <= 6,35 mm	Use of fastener 70 to fix part 100	$ 0,50	unit	4			$ 2,00
200	Reaction Tool <= 6.35 mm	for process 180	$ 0,25	unit	4			$ 1,00
							Sub Total	**$ 17,36**

ItemOrder	Fastener	Use	UnitCost	Size1	Unit1	Size2	Unit2	Quantity	Sub Total
10	Bolt, Grade 8.8 (SAE 5)	To close the rack housing	$ 0,02	5	mm	6,5	mm	4	$ 0,07
20	Bolt, Grade 8.8 (SAE 5)	To fix the rack	$ 0,06	8	mm	11	mm	1	$ 0,06
30	Bolt, Grade 8.8 (SAE 5)	To fix the brackets ties	$ 0,12	6	mm	50	mm	4	$ 0,47
40	Washer, Grade 8.8 (SAE 5)	To fix the brackets ties	$ 0,01		unit			8	$ 0,08
50	Nut, Grade 8.8 (SAE 5)	To fix the brackets ties	$ 0,03	6	mm			4	$ 0,12
60	Bolt, Grade 8.8 (SAE 5)	To fix the Tie rod Braces	$ 0,10	8	mm	25	mm	2	$ 0,20
70	Bolt, Grade 8.8 (SAE 5)	To fix the Rack protection	$ 0,02	4	mm	16	mm	4	$ 0,07
80	Washer, Grade 8.8 (SAE 5)	To fix the Rack protection	$ 0,01		unit			8	$ 0,08
90	Nut, Grade 8.8 (SAE 5)	To fix the Rack protection	$ 0,02	4	mm			4	$ 0,08
								Sub Total	**$ 0,80**

ItemOrder	Tooling	Use	UnitCost	Unit	Quantity	PVF	FractionIn	Sub Total
10	Welds - Welding Fixture	For the process 10, 2 point per bracket	$ 500,00	1	4	3000	1	$ 0,67
20	Welds - Welding Fixture	For the process 160, 1 point per bracket	$ 500,00	1	4	3000	1	$ 0,67
							Sub Total	**$ 0,67**

University	Ecole Centrale de Lyon	Back to BOM	**Car #**	81	**Part Cost**	$	7,97
System	Steering System				**Qty**		1
Assembly	Steering Rack		**FileLink1**				
Part	Rack pinion		**FileLink2**		**Extended Cost**	$	7,97
P/N Base	ST 01001		**FileLink3**				
Suffix	AA						
Details	Bought part, cost as made						

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Mild (per kg)	Stock for the pinion	$ 2,25	0,462	kg			Circular area diam. 31mm	7,54E-04	0,078	7850	1	$ 1,04
												Sub Total	**$ 1,04**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Installation of the item 10	$ 1,30	Unit	1			$ 1,30
20	Machining	Machining the pinion	$ 0,04	cm^3	14	Material - Steel	3	$ 1,74
30	Broach, External	For the splines	$ 0,50	cm	2			$ 1,10
40	Machining Setup, Change	To machin the other side	$ 0,65	Unit	1			$ 0,65
50	Machining	Machining of the other side	$ 0,04	cm^3	5,80	Material - Steel	3	$ 0,70
60	Machining Setup, Install and remove	Installation for the water jet cut	$ 1,30	Unit	1			$ 1,30
70	Waterjet Cut	For the pinion	$ 0,01	cm	14,45			$ 0,14
							Sub Total	**$ 6,93**

University	Ecole Centrale de Lyon	Back to BOM	**Car #**	81	**Part Cost** $ 6,04
System	Steering System				**Qty** 1
Assembly	Steering Rack		**FileLink1**		
Part	Rack		**FileLink2**		**Extended Cost** $ 6,04
P/N Base	ST 01002		**FileLink3**		
Suffix	AA				
Details	Bought part, cost as made				

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Mild (per kg)	Stock for the rack	$ 2,25	0,544	kg			Circular area diam. 31mm	1,77E-04	0,392	7850	1	$ 1,22
												Sub Total	**$ 1,22**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Installation of the item 10	$ 1,30	Unit	1			$ 1,30
20	Machining	Machining one end	$ 0,04	cm^3	1	Material - Steel	3	$ 0,11
30	Threading, External (machining)	Thread at one end	$ 0,10	cm	2			$ 0,20
40	Machining Setup, Change	To machin the other end	$ 0,65	Unit	1			$ 0,65
50	Machining	Machining the other end	$ 0,04	cm^3	1	Material - Steel	3	$ 0,11
60	Threading, External (machining)	Thread at the other end	$ 0,10	cm	2			$ 0,20
70	Machining Setup, Install and remove	Installation on a CNC machin for the gear tooth	$ 1,30	Unit	1			$ 1,30
80	Machining	Machining the gear tooth	$ 0,04	cm^3	8	Material - Steel	3	$ 0,95
							Sub Total	**$ 4,82**

University	Ecole Centrale de Lyon	Back to BOM	**Car #**	81	**Part Cost**	$	2,57
System	Steering System				**Qty**		1
Assembly	Steering Rack		**FileLink1**				
Part	Upper Pinion housing		**FileLink2**		**Extended Cost**	$	2,57
P/N Base	ST 01003		**FileLink3**				
Suffix	AA						
Details	Bought part, cost as made						

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Aluminum, Normal	Stock for the part	$ 4,20	0,055	kg			Rectangular area	2,25E-03	0,009	2712	1	$ 0,23
20	Paint		$ 10,00	2,80E-03	m^2								$ 0,03
												Sub Total	**$ 0,26**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Installation of the item 10	$ 1,30	Unit	1			$ 1,30
20	Machining	Machining of the first face	$ 0,04	cm^3	8	Material - Aluminium	1	$ 0,30
30	Machining Setup, Change	To machin the other side	$ 0,65	Unit	1			$ 0,65
40	Machining	Machining of the second face	$ 0,04	cm^3	1,5	Material - Aluminium	1	$ 0,06
50	Aerosol Apply	To apply black paint	$ 5,25	m^2	2,80E-03			$ 0,01
							Sub Total	**$ 2,31**

University	Ecole Centrale de Lyon	Back to BOM	**Car #**	81	**Part Cost**	$	6,26
System	Steering System				**Qty**		1
Assembly	Steering Rack		**FileLink1**				
Part	Lower Pinion housing		**FileLink2**		**Extended Cost**	$	6,26
P/N Base	ST 01004		**FileLink3**				
Suffix	AA						
Details	Bought part, cost as made						

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Aluminum, Normal	Stock for the part	$ 4,20	0,231	kg			Rectangular area	2,50E-03	0,034	2712	1	$ 0,97
20	Paint		$ 10,00	0,01	m^2								$ 0,08
												Sub Total	**$ 1,05**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Installation of the item 10	$ 1,30	Unit	1			$ 1,30
20	Machining	Machining of the first face	$ 0,04	cm^3	25	Material - Aluminium	1	$ 1,00
30	Threading, Internal (machining)	For the 4 holes	$ 0,10	cm	6			$ 0,60
40	Machining Setup, Change	To machin the other side	$ 0,65	Unit	1			$ 0,65
50	Machining	Machining of the second fac	$ 0,04	cm^3	21,3	Material - Aluminium	1	$ 0,85
60	Machining Setup, Change	To machin the other side	$ 0,65	Unit	1			$ 0,65
70	Machining	Machining of a beveal	$ 0,04	cm^3	3,75	Material - Aluminium	1	$ 0,15
80	Aerosol Apply	To apply black paint	$ 5,25	m^2	0,01			$ 0,04
							Sub Total	**$ 5,20**

University	Ecole Centrale de Lyon	Back to BOM	**Car #**	81	**Part Cost**	$	2,35
System	Steering System				**Qty**		2
Assembly	Steering Rack		**FileLink1**				
Part	Rack housing support		**FileLink2**		**Extended Cost**	$	4,70
P/N Base	ST 01005		**FileLink3**				
Suffix	AA						
Details	Bought part, cost as made						

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Aluminum, Normal	Stock for the part	$ 4,20	0,088	kg			Circular area 33mm diameter	8,55E-04	0,038	2712	1	$ 0,37
20	Paint		$ 10,00	4,94E-03	m^2								$ 0,05
												Sub Total	**$ 0,42**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Installation of the item 10	$ 1,30	Unit	1	2 parts made from a single setup	0,5	$ 0,65
20	Machining	First machining	$ 0,04	cm^3	21	Material - Aluminium	1	$ 0,83
30	Machining Setup, Change	To machin the other side	$ 0,65	Unit	1	2 parts made from a single setup	0,5	$ 0,33
40	Machining	for the other side	$ 0,04	cm^3	2,565	Material - Aluminium	1	$ 0,10
50	Aerosol Apply	To apply black paint	$ 5,25	m^2	4,94E-03			$ 0,03
							Sub Total	**$ 1,93**

University	Ecole Centrale de Lyon	Back to BOM	**Car #**	81	**Part Cost**	$	2,39
System	Steering System				**Qty**		2
Assembly	Steering Rack		**FileLink1**				
Part	Tie rod Braces		**FileLink2**		**Extended Cost**	$	4,78
P/N Base	ST 01006		**FileLink3**				
Suffix	AA						
Details	Bought part, cost as made						

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Aluminum, Normal	Stock for the part	$ 4,20	0,062	kg			Circular area 26mm diameter	5,31E-04	0,043	2712	1	$ 0,26
20	Paint		$ 10,00	3,66E-03	m^2								$ 0,04
												Sub Total	**$ 0,30**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Installation of the item 10	$ 1,30	Unit	1	2 parts made from a single setup	0,5	$ 0,65
20	Machining	First machining	$ 0,04	cm^3	5	Material - Aluminium	1	$ 0,19
30	Machining Setup, Change	To machin the other side	$ 0,65	Unit	0,5	2 parts made from a single setup	0,5	$ 0,16
40	Machining	Second machining	$ 0,04	cm^3	4	Material - Aluminium	1	$ 0,14
50	Machining Setup, Install and remove	Installation on a CNC machine	$ 1,30	Unit	0,5	2 parts made from a single setup	0,5	$ 0,33
60	Machining	For the planes and the center	$ 0,04	cm^3	12	Material - Aluminium	1	$ 0,46
70	Machining Setup, Change	To machin the other side	$ 0,65	Unit	0,5	2 parts made from a single setup	0,5	$ 0,16
80	Machining	For the other planes	$ 0,04	cm^3	1	Material - Aluminium	1	$ 0,04
90	Drilled holes < 25.4 mm dia.	For the two holes	$ 0,35	hole	2			$ 0,70
100	Aerosol Apply	To apply black paint	$ 5,25	m^2	3,66E-03			$ 0,02
							Sub Total	**$ 2,09**

University	Ecole Centrale de Lyon	Back to BOM	**Car #**	81	**Part Cost** $ 65,59
System	Steering System				**Qty** 1
Assembly	Steering Rack		**FileLink1**		
Part	Rack housing		**FileLink2**		**Extended Cost** $ 65,59
P/N Base	ST 01007		**FileLink3**		
Suffix	AA				
Details	Bought part, cost as made				

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Carbon Fiber, 1 Ply	Stock	$ 200,00	0,275	kg			Tube diam. 72 x 3 mm	6,50E-04	0,268	1580	1	$ 55,07
												Sub Total	**$ 55,07**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Lamination, Fillament Wirring	Tube Lamination	$ 25,00	kg	0,28			$ 6,88
20	Machining Setup, Install and remove	Installation of the item 10	$ 1,30	Unit				$ 1,30
30	Drilled holes < 25.4 mm dia.	For the two holes	$ 0,35	hole	2			$ 0,70
40	Machining Setup, Change	To machin the other side	$ 0,65	Unit	0,5			$ 0,33
50	Drilled holes < 25.4 mm dia.	For the two holes	$ 0,35	hole	2			$ 0,70
60	Machining	For the opening	$ 0,04	cm^3	4	Material - Composite	2	$ 0,28
70	Machining Setup, Change	To drill the last hole	$ 0,65	Unit	0,5			$ 0,33
80	Drilled hole < 50.8 mm dia.		$ 0,70	hole	1			$ 0,70
							Sub Total	**$ 10,51**

University	Ecole Centrale de Lyon	Back to BOM	**Car #**	81	**Part Cost**	$	1,58
System	Steering System	Drawing : FileLink1			**Qty**		4
Assembly	Steering Rack		**FileLink1**				
Part	Steering Brackets tie		**FileLink2**		**Extended Cost**	$	6,34
P/N Base	ST 01008		**FileLink3**				
Suffix	AA						
Details	To fix the steering rack						

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Aluminum, Normal	Stock for the part	$ 4,20	0,031	kg			Rectangular area	2,56E-04	0,045	2712	1	$ 0,13
												Sub Total	**$ 0,13**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Installation of the item 10	$ 1,30	Unit	1	4 parts made from a single setup	0,25	$ 0,33
20	Machining	For the half circule	$ 0,04	cm^3	7	Material - Aluminium	1	$ 0,27
30	Machining Setup, Change	To machin the two holes	$ 0,65	Unit	1	4 parts made from a single setup	0,25	$ 0,16
40	Drilled holes < 25.4 mm dia.	For the two holes	$ 0,35	hole	2			$ 0,70
							Sub Total	**$ 1,45**

ST 01008

45
16
⌀6.4x2
Vue de face
Echelle : 1:1
33
Vue de derrière
Echelle : 1:1
Vue isométrique
Echelle : 1:1
33.9
11.1
⌀23
17.5
16
Vue de dessus
Echelle : 1:1
Les pièces s'assemblent 2 à 2 pour venir serrer un tube
tolérances générales: ISO 2768-mK
Taille
A4
Ecurie Piston Sport Auto
Dessiné par
Julien
Date
11/03/2018
Désignation
Bloc serrage crémaillère
ST 0600 002
Coordonnées
06 83 55 17 96
guillaume.touze@ecl16.ec-lyon.fr
Quantité
4
Matériau
Aluminium 2017
Version
1.0
Plan vérifié par
A.Perdereau
Echelle 1:1
N° plan 18B_ST_0600_002
Feuille 1/1

University	Ecole Centrale de Lyon	Back to BOM	**Car #**	81	**Part Cost**	$	1,60
System	Steering System	Drawing : FileLink1			**Qty**		2
Assembly	Steering Rack		**FileLink1**				
Part	Steering Brackets		**FileLink2**		**Extended Cost**	$	3,19
P/N Base	ST 01009		**FileLink3**				
Suffix	AA						
Details	This part is welded to the frame						

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Mild (per kg)	Stock for the part	$ 2,25	0,059	kg			Rectangular area	5,00E-03	1,50E-03	7850	1	$ 0,13
20	Paint		$ 10,00	4,00E-03	m^2								$ 0,04
												Sub Total	**$ 0,17**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Installation of the item 10 for laser cut	$ 1,30	Unit	1	2 parts made from a single setup	0,5	$ 0,65
20	Laser Cut		$ 0,01	cm	25			$ 0,25
30	Sheet metal bends		$ 0,25	bend	2			$ 0,50
40	Aerosol Apply	To apply red paint	$ 5,25	m^2	4,00E-03			$ 0,02
							Sub Total	**$ 1,43**

ST_01009

Vue isométrique
Echelle : 1:1

Tolérance de pliage : +/-0.5mm
Tolérance dimensionnelle +/-0.2mm

Vue dépliée
Echelle : 1:1

Vue de face
Echelle : 1:1

Taille A4		Ecurie Piston Sport Auto
Dessiné par Antonio Leblanc	Date 16/01/2018	Désignation Bracket 3- Steering
Coordonnées antonio.leblanc@ecl16.ec-lyon.fr 07 69 46 48 59		Quantité 2 / Matériau Acier S235 / Version 0.1
Plan vérifié par XXX		Echelle 1:1 / Numéro du plan Bracket_3 / Feuille 1/1

University	Ecole Centrale de Lyon	Back to BOM	**Car #**	81	**Part Cost**	$	7,62
System	Steering System				**Qty**		1
Assembly	Steering Rack		**FileLink1**				
Part	Rack protection		**FileLink2**		**Extended Cos**	$	7,62
P/N Base	ST 01010		**FileLink3**				
Suffix	AA						
Details							

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Aluminum, Normal	Stock for the part	$ 4,20	0,734	kg			Rectangular area	1,80E-01	1,50E-03	2712	1	$ 3,08
												Sub Total	**$ 3,08**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Installation of the item 10 for laser cut	$ 1,30	Unit	1			$ 1,30
20	Laser Cut		$ 0,01	cm	199			$ 1,99
30	Sheet metal bends		$ 0,25	bend	5			$ 1,25
							Sub Total	**$ 4,54**

University	Ecole Centrale de Lyon	Back to BOM	**Car #**	81	**Part Cost** $ 0,38
System	Steering System	Drawing : FileLink1			**Qty** 4
Assembly	Steering Rack		**FileLink1**		
Part	Rack protection Brackets		**FileLink2**		**Extended Cost** $ 1,52
P/N Base	ST 01011		**FileLink3**		
Suffix	AA				
Details	This part is Welded on the frame				

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Mild (per kg)	Stock for the part	$ 2,25	0,002	kg			Rectangular area	1,80E-04	1,50E-03	7850	1	$ 0,00
20	Paint		$ 10,00	3,60E-04	m^2								$ 0,00
												Sub Total	**$ 0,01**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Installation of the item 10 for laser cut	$ 1,30	Unit	1	4 parts made from a single setup	0,25	$ 0,33
20	Laser Cut		$ 0,01	cm	5			$ 0,05
30	Aerosol Apply	To apply red paint	$ 5,25	m^2	1,44E-04			$ 0,00
							Sub Total	**$ 0,37**

ST 01011

Vue de face
Echelle : 3:1

Vue de gauche
Echelle : 3:1

Vue de face
Echelle : 1:1

Taille A4		Ecurie Piston Sport Auto
Dessiné par Antonio Leblanc	Date 06/03/2018	Désignation Bracket_26_Cash Cremailliere
Coordonnées antonio.leblanc@ecl16.ec-lyon.fr 07 69 46 48 59		Quantité 4 / Matériau Acier S235 / Version 0.1
Plan vérifié par XXX		Echelle 1:1 / Numéro du plan AA / Feuille 1/1

University	Ecole Centrale de Lyon
System	Steering System
Assembly	Steering Column assy
P/N Base	ST A0200
Suffix	AA
Details	

Back to BOM

Car #	81
FileLink1	
FileLink2	
FileLink3	

Asm Cost	$ 78,40
Qty	1
Extended Cos	$ 78,40

ItemOrder	Part	Part Cost	Quantity	Sub Total
10	Spline Coupler	$ 3,63	1	$ 3,63
20	Steering column	$ 2,11	1	$ 2,11
30	Steering Upper Shaft Pivot	$ 6,29	1	$ 6,29
40	Steering Bore	$ 9,26	1	$ 9,26
50	Steering Bore support	$ 1,46	2	$ 2,93
			Sub Total	$ 24,21

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steering Column Universal Joint		$ 20,00									1	$ 20,00
20	Bearing, Ball, Radial	To guide part 30 in the part 40	$ 11,11	42	mm	7	mm					2	$ 22,22
												Sub Total	$ 42,22

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Setup for tne material 10	$ 1,30	unit	1			$ 1,30
20	Machining	Machining the material 10	$ 0,04	cm^3	6	Material - Steel	3	$ 0,68
30	Weld	Welding between The part 10 and the part 20	$ 0,15	cm	6,2			$ 0,93
40	Weld	Welding between the part 20 and the material 10	$ 0,15	cm	6,2			$ 0,93
50	Weld	Welding between the part 30 and the material 10	$ 0,15	cm	10			$ 1,50
60	Weld	Welding between the two part 50 and the frame	$ 0,15	cm	6,4			$ 0,96
70	Weld	Welding between the two part 50 and the part 40	$ 0,15	cm	6,4			$ 0,96
80	Weld	Welding between the part 30 and Quick Release	$ 0,15	cm	8			$ 1,20
90	Assemble, 1 kg, Interference	Assembly of the first material 20 on the part 30	$ 0,19	unit	1			$ 0,19
100	Assemble, 1 kg, Line-on-Line	Assembly of the steering column in the part 40	$ 0,13	unit	1	Assemble - Length > 0.5m	1,25	$ 0,16
110	Assemble, 1 kg, Interference	Assembly of the second material 20 in the part 40	$ 0,19	unit	1			$ 0,19
120	Assemble, 1 kg, Line-on-Line	To install the fastener 10	$ 0,13	unit	1			$ 0,13
							Sub Total	$ 9,13

ItemOrder	Fastener	Use	UnitCost	Size1	Unit1	Size2	Unit2	Quantity	Sub Total
10	Retaining Ring, External	To retain the material 20 on the part 30	$0,18	30	mm			1	$ 0,18
								Sub Total	$ 0,18

ItemOrder	Tooling	Use	UnitCost	Unit	Quantity	PVF	FractionInclu	Sub Total
10	Welds - Welding Fixture	For the process 30, 2 point to weld	$ 500	1	2	3000	1	$ 0,33
20	Welds - Welding Fixture	For the process 40, 2 point per weld	$ 500	1	2	3000	1	$ 0,33
30	Welds - Welding Fixture	For the process 50, 2 point per weld	$ 500	1	2	3000	1	$ 0,33

40	Welds - Welding Fixture	For the process 60, 2 point per weld	$	500	1	4	3000	1	$ 0,67
50	Welds - Welding Fixture	For the process 70, 2 point per weld	$	500	1	4	3000	1	$ 0,67
60	Welds - Welding Fixture	For the process 80, 2 point per weld	$	500	1	2	3000	1	$ 0,33
								Sub Total	**$ 2,67**

University	Ecole Centrale de Lyon	Back to BOM	**Car #**	81	**Part Cost** $ 3,63
System	Steering System				**Qty** 1
Assembly	Steering Column assy		**FileLink1**		
Part	Spline coupler		**FileLink2**		**Extended Cost** $ 3,63
P/N Base	ST 02001		**FileLink3**		
Suffix	AA				
Details	Bought part, cost as made				

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, alloy (per kg)	Stock for spline coupler	$ 2,25	0,116	kg			Circular section : diameter 24	4,91E-04	0,030	7850	1	$ 0,26
												Sub Total	**$ 0,26**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Setup for tne material 20	$ 1,30	unit	1			$ 1,30
20	Drilled holes < 25.4 mm dia.	Hole before the Broach	$ 0,35	hole	1			$ 0,35
30	Machining	Machining the spline	$ 0,04	cm^3	2	Material - Steel	3	$ 0,22
40	Broach, Internal	For the splines in the spline coupler	$ 0,50	cm	1			$ 1,50
							Sub Total	**$ 3,37**

University	Ecole Centrale de Lyon	Back to BOM	**Car #**	81	**Part Cost**	$	2,11
System	Steering System				**Qty**		1
Assembly	Steering Column assy		**FileLink1**				
Part	Steering Column tube		**FileLink2**		**Extended Cost**	$	2,11
P/N Base	ST 02002		**FileLink3**				
Suffix	AA						
Details	It is a tube, 20*1.5						

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, alloy (per kg)	Stock for column tube	$ 2,25	0,225	kg			Circular area, diameter 20	3,49E-04	0,335	7850	1	$ 0,51
												Sub Total	**$ 0,51**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Setup	$ 1,30	Unit	1			$ 1,30
20	Tube cut	To cut the tube to the right lenght	$ 0,15	cm	2			$ 0,30
							Sub Total	**$ 1,60**

University	Ecole Centrale de Lyon	Back to BOM	**Car #**	81	**Part Cost**	$	6,29
System	Steering System	Drawing : FileLink1			**Qty**		1
Assembly	Steering Column assy		**FileLink1**				
Part	Steering Upper Shaft Pivot		**FileLink2**		**Extended Cost**	$	6,29
P/N Base	ST 02003		**FileLink3**				
Suffix	AA						
Details							

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, alloy (per kg)	Stock the part	$ 2,25	0,360	kg			Circular section : diameter 32mm	8,04E-04	0,057	7850	1	$ 0,81
												Sub Total	**$ 0,81**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Setup for tne material 10	$ 1,30	unit	1			$ 1,30
20	Machining	Machining of the left part	$ 0,04	cm^3	22	Material - Steel	3	$ 2,61
30	Machining Setup, Change	To machin the other side	$ 0,65	Unit	1			$ 0,65
40	Machining	Machining of the right part	$ 0,04	cm^3	8	Material - Steel	3	$ 0,91
							Sub Total	**$ 5,48**

ST 02003

46
34
5
9
7
10
B
16 g9
A
A
Φ30
Φ28.6 0 -0.21
Φ30 k5
Φ24
Φ30 k5
Vue de face
Echelle : 1:1
Φ6 TYP.
Φ20
12
42
Coupe A-A
Echelle : 1:1
ISO2768-m 3 x Chanfreins 0.5 x 45 deg
1.6
Détail B
Echelle : 2:1
Taille
A4
Ecurie Piston Sport Auto
Dessiné par
C.BESSON
Date
2018-01-30
Désignation
STEERING UPPER SHAFT
Coordonnées
christophe.besson@polymtl.ca
Quantité
1
Matériau
Acier S235
Version
AA
Plan vérifié par
XXX
Echelle 1:1
Numéro du plan ST_A07001
Feuille 1/1

University	Ecole Centrale de Lyon	Back to BOM	**Car #**	81	**Part Cost**	$	9,26
System	Steering System	Drawing : FileLink1			**Qty**		1
Assembly	Steering Column Assy		**FileLink1**				
Part	Steering Bore		**FileLink2**		**Extended Cost**	$	9,26
P/N Base	ST 02004		**FileLink3**				
Suffix	AA						
Details							

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, alloy (per kg)	Stock for the part	$ 2,25	0,540	kg			Circular section : diameter 48mm	1,81E-03	0,038	7850	1	$ 1,21
20	Paint		$ 10,00	0,006	m^2				5,70E-03				$ 0,06
												Sub Total	**$ 1,27**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Setup for tne material 10	$ 1,30	unit	1			$ 1,30
20	Machining	Machining of the left shoulder	$ 0,04	cm^3	35	Material - Steel	3	$ 4,18
30	Machining Setup, Change	To machin the other shoulder	$ 0,65	Unit	1			$ 0,65
40	Machining	Machining of the right shoulder	$ 0,04	cm^3	15	Material - Steel	3	$ 1,83
50	Aerosol Apply	To apply red paint on the exterior	$ 5,25	m^2	0,006			$ 0,03
							Sub Total	**$ 7,99**

ST 02004

Vue de face
Echelle : 1:1

Coupe A-A
Echelle : 1:1

ISO2768-m

Taille A4		Ecurie Piston Sport Auto
Dessiné par C.BESSON	Date 2018-01-30	Désignation STEERING BORE
Coordonnées christophe.besson@polymtl.ca xxx		
Plan vérifié par XXX		Quantité 1 / Matériau Acier S235 / Version AA
		Echelle 1:1 / Numéro du plan ST_07002 / Feuille 1/1

University	Ecole Centrale de Lyon	Back to BOM	**Car #**	81	**Part Cost** $ 1,46
System	Steering System				**Qty** 2
Assembly	Steering Column assy		**FileLink1**		
Part	Steering Bore Support		**FileLink2**		**Extended Cost** $ 2,93
P/N Base	ST 02005		**FileLink3**		
Suffix	AA				
Details	This part is welded to the frame and to the steering Bore				

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, alloy (per kg)	Stock for the part	$ 2,25	0,114	kg			Circular section : diameter	6,36E-05	0,228	7850	1	$ 0,26
20	Paint		$ 10,00	9,00E-03	m^2				9,00E-03				$ 0,09
												Sub Total	**$ 0,35**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Setup for tne material 10	$ 1,30	unit	1	2 parts made from a single setup	0,5	$ 0,65
20	Laser Cut	For one end	$ 0,01	cm	4,9			$ 0,05
30	Machining Setup, Change	For the other end	$ 0,65	Unit	1	2 parts made from a single setup	0,5	$ 0,33
40	Laser Cut	For the other end	$ 0,01	cm	4,7			$ 0,05
50	Aerosol Apply	To apply red paint	$ 5,25	m^2	9,00E-03			$ 0,05
							Sub Total	**$ 1,12**

University	Ecole Centrale de Lyon
System	Steering System
Assembly	Quick Release
P/N Base	ST A0300
Suffix	AA
Details	Bought, cost as made

FileLink1	
FileLink2	
FileLink3	

Back to BOM

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 43,03
Qty	1
Extended Cost	$ 43,03

ItemOrder	Part	Part Cost	Quantity	Sub Total
10	Quick Release Steel Sleeve	$ 12,88	1	$ 12,88
20	Quick Release Fixed Part	$ 15,47	1	$ 15,47
30	Quick Release Sliding Part	$ 12,94	1	$ 12,94
			Sub Total	**$ 41,29**

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Spring	Compression enabled	$ 1,00									1	$ 1,00
20	Ball Bearing	Quick Release locking	$ 0,06									4	$ 0,24
												Sub Total	**$ 1,24**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Assemble, 1 kg, Interference	Assembling of Sliding and Fixed Pard	$ 0,19	unit	1		1	$ 0,19
20	Assemble, 1 kg, Line-on-Line	Assembling of the Steel Sleeve and the Fixed part	$ 0,13	unit	1		1	$ 0,13
							Sub Total	**$ 0,32**

ItemOrder	Fastener	Use	UnitCost	Size1	Unit1	Size2	Unit2	Quantity	Sub Total
10	Retaining Ring, Internal	Locking of the quick release	$ 0,18	30	mm			1	$ 0,18
								Sub Total	**$ 0,18**

University	Ecole Centrale de Lyon		Back to BOM	**Car #**	81	**Part Cost**	$ 12,88
System	Steering System	**FileLink1**				**Qty**	1
Assembly	Quick Release	**FileLink2**		**FileLink1**			
Part	Quick Release Steel Sleeve	**FileLink3**		**FileLink2**		**Extended Cost**	$ 12,88
P/N Base	ST 03001			**FileLink3**			
Suffix	AA						
Details	Bought, cost as made						

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Mild (per kg)	Stock for the part	$ 2,25	0,482	kg			Circular area, diam. 25mm	4,91E-04	0,125	7850	1	$ 1,08
												Sub Total	**$ 1,08**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Setup for machining	$ 1,30	Unit	1			$ 1,30
20	Machining	Material removal, radius	$ 0,04	cm^3	49	Material : Steel	3	$ 5,88
30	Machining	Material removal, lenght	$ 0,04	cm^3	2,45	Material : Steel	3	$ 0,29
40	Machining Setup, Change	Prepare the machine for shoulder 1	$ 0,65	Unit	1		1	$ 0,65
50	Machining	Shoulder 1	$ 0,04	cm^3	5,53	Material : Steel	3	$ 0,66
60	Machining Setup, Change	Prepare the machine for shoulder 2	$ 0,65	Unit	1		1	$ 0,65
70	Machining	Shoulder 2	$ 0,04	cm^3	5,53	Material : Steel	3	$ 0,66
80	Machining Setup, Change	Prepare setup broaching machine	$ 0,65	Unit	1		1	$ 0,65
90	Broach, External	Broaching the splines	$ 0,50	cm	2,1			$ 1,05
100	Anodize	Hard Anodizing	$ -	cm^2				$ -
							Sub Total	**$ 11,80**

University	Ecole Centrale de Lyon		Back to BOM	**Car #**	81	**Part Cost**	$ 15,47
System	Steering System	**FileLink1**				**Qty**	1
Assembly	Quick Release	**FileLink2**		**FileLink1**			
Part	Quick Release Fixed Part	**FileLink3**		**FileLink2**		**Extended Cost**	$ 15,47
P/N Base	ST 03002			**FileLink3**			
Suffix	AA						
Details	Bought, cost as made						

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Aluminium, normal (per kg)	Stock	$ 4,20	0,590	kg			Circular area diam. 71mm	3,96E-03	0,055	2712	1	$ 2,48
												Sub Total	**$ 2,48**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Setup for machining	$ 1,30	Unit	1			$ 1,30
20	Machining	Material removal	$ 0,04	cm^3	151	Material : Aluminum	1	$ 6,04
30	Machining Setup, Install and remove	Driller setup	$ 1,30	Unit	1			$ 1,30
40	Drilled holes < 25.4 mm dia.		$ 0,35	Unit	3			$ 1,05
50	Machining Setup, Install and remove	Driller setup	$ 1,30	Unit	1			$ 1,30
60	Broach, Internal	Internal Splines	$ 0,50	cm	4			$ 2,00
70	Anodize	Hard anodizing	$ -	cm^2				$ -
							Sub Total	**$ 12,99**

University	Ecole Centrale de Lyon		Back to BOM	**Car #**	81	**Part Cost**	$ 12,94
System	Steering System	**FileLink1**				**Qty**	1
Assembly	Quick Release	**FileLink2**		**FileLink1**			
Part	Quick Release Sliding Part	**FileLink3**		**FileLink2**		**Extended Cost**	$ 12,94
P/N Base	ST 03003			**FileLink3**			
Suffix	AA						
Details	Bought, cost as made						

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Aluminium, normal (per kg)	Stock	$ 4,20	0,422	kg			Circular area diam. 60mm	2,83E-03	0,055	2712	1	$ 1,77
												Sub Total	**$ 1,77**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Setup for machining	$ 1,30	Unit	1			$ 1,30
20	Machining	Material removal	$ 0,04	cm^3	168	Material : Aluminum	1	$ 6,72
30	Drilled holes < 25.4 mm dia.	drill 9 holes	$ 0,35	Unit	9			$ 3,15
40	Anodize	Hard anodizing	$ -	cm^2				$ -
							Sub Total	**$ 11,17**

University	Ecole Centrale de Lyon
System	Steering System
Assembly	Steering Wheel Assy
P/N Base	ST A0400
Suffix	AA
Details	Bought, cost as made

FileLink1	
FileLink2	
FileLink3	

Back to BOM

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 22,10
Qty	1
Extended Cost	$ 22,10

ItemOrder	Part	Part Cost	Quantity	Sub Total
10	Steering Wheel	$ 16,34	1	$ 16,34
20	Aluminium spacer	$ 3,07	1	$ 3,07
			Sub Total	**$ 19,41**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Ratchet <= 6.35 mm	To fix the steering Wheel with the part 10, the Quick Release and the shifter	$ 0,50	unit	3			$ 1,50
20	Reaction Tool <= 6.35 mm	For process 10	$ 0,25	unit	3			$ 0,75
							Sub Total	**$ 2,25**

ItemOrder	Fastener	Use	UnitCost	Size1	Unit1	Size2	Unit2	Quantity	Sub Total
10	Bolt, Grade 8.8 (SAE 5)	To fix the Steering Wheel	$ 0,12	6	mm	50	mm	3	$ 0,35
20	Nut, Grade 8.8 (SAE 5)	To fix the brackets ties	$ 0,03	6	mm			3	$ 0,09
								Sub Total	**$ 0,44**

University	Ecole Centrale de Lyon		Back to BOM	**Car #**	81	**Part Cost**	$ 16,34
System	Steering System	**FileLink1**				**Qty**	1
Assembly	Steering Wheel Assy	**FileLink2**		**FileLink1**			
Part	Steering Wheel	**FileLink3**		**FileLink2**		**Extended Cost**	$ 16,34
P/N Base	ST 04001			**FileLink3**			
Suffix	AA						
Details	Bought part, cost as made						

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Mild (per kg)	Sheet for the structure 2 mm thickness	$ 2,25	0,903	kg			Rectangular area 250mm x 230mm	5,75E-02	0,002	7850	1	$ 2,03
20	Foam, Expanding, Non-Structural (per kg)	Foam for torus form	$ 15,00	0,100	kg								$ 1,50
30	Fabric (per m^2)	steering wheel covering	$ 2,50	0,100	m^2								$ 0,25
40	Adhesive	Steering wheel covering - Cost included in process	$ -		unit								$ -
												Sub Total	**$ 3,78**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Setup for laser cut	$ 1,30	unit	1			$ 1,30
20	Laser Cut	Outline and holes for sheet	$ 0,01	cm	100	Material - Steel	3	$ 3,00
30	Assemble, 1 kg, Line-on-Line	Assemble of foam	$ 0,13	unit	1			$ 0,13
40	Cut (scissors, knife)	Preparation of covering	$ 0,06	cm	100			$ 6,00
50	Liquid Applicator Gun	Apply of covering	$ 0,02	cm	100			$ 2,00
60	Assemble, 1 kg, Line-on-Line	Assemble of covering	$ 0,13	unit	1			$ 0,13
							Sub Total	**$ 12,56**

University	Ecole Centrale de Lyon		Back to BOM	**Car #**	81	**Part Cost**	$ 3,07
System	Steering System	Drawing :	FileLink1			**Qty**	1
Assembly	Steering Wheel Assy		**FileLink2**	**FileLink1**			
Part	Aluminium spacer		**FileLink3**	**FileLink2**		**Extended Cost**	$ 3,07
P/N Base	ST 04002			**FileLink3**			
Suffix	AA						
Details							

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Aluminum, Normal (per kg)	Sheet of aluminium for the shift plate	$ 4,20	0,148	kg			Rectangular area, 55x55 mm	3,03E-03	0,018	2712	1	$ 0,62
												Sub Total	**$ 0,62**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Set up	$ 1,30	Unit	1		1	$ 1,30
20	Machining	Machining	$ 0,04	cm^3	28,8	Material - Aluminium	1	$ 1,15
							Sub Total	**$ 2,45**

ST 04002

REF.	X	Y	Diamètre
A	-21,65	12,5	6
B	0	-25	6
C	21,65	12,5	6
D	0	0	30

Vue de droite
Echelle : 1:1

Vue de face
Echelle : 1:1

Vue isométrique
Echelle : 1:1

Tolérances générales ISO 2768 mk

Taille A4		Ecurie Piston Sport Auto
Dessiné par Axel Guittonneau	Date 05/12/2018	Désignation Entretoise volant
Coordonnées axel.guittonneau @ecl16.ec-lyon.fr 06 59 89 07 30		Quantité 1 / Matériau Alu 2017 / Version 1.0
Plan vérifié par XXX		Echelle 1:1 / No du plan 17B_L_119_ENT / Feuille 1/1

University	Ecole Centrale de Lyon
System	Steering System
Assembly	Steering rod
P/N Base	ST A0500
Suffix	AA
Details	Steering rod, right and left are symetric

FileLink1	
FileLink2	
FileLink3	

Back to BOM

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 17,60
Qty	2
Extended Cost	$ 35,21

ItemOrder	Part	Part Cost	Quantity	Sub Total
10	Steering rod tube	$ 9,07	1	$ 9,07
20	Steering rod insert	$ 1,58	2	$ 3,17
30	Spacer	$ 0,35	2	$ 0,70
			Sub Total	$ 12,93

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Nam	Area	Ler	Density	Quantity	Sub Total
10	Rod End, Industrial	Right-hand rod end for pushrod extremities	$ 1,94	6	mm			Balls Diameter				1	$ 1,94
20	Rod End, Industrial	Left-hand rod end for pushrod extremities	$ 1,94	6	mm			Balls Diameter				1	$ 1,94
												Sub Total	3,88

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Hand Finish - Surface Preperation	Solvent degreasing on carbon tube	$ 0,02	cm²	6,6		1	$ 0,13
20	Hand Finish - Surface Preperation	Solvent degreasing on insert	$ 0,02	cm²	6,6		1	$ 0,13
30	Brush apply	Glue insert to pushrod tube	$ 0,02	cm^2	6,6		1	$ 0,13
40	Hand - Start Only	Put a nut on the rod end	$ 0,12	unit	1		1	$ 0,12
50	Hand, Loose <= 25.4 mm	Screwing by hand the rod end in the pullrod insert	$ 0,50	unit	1		1	$ 0,50
60	Wrench <= 25.4 mm	Thighten the M8 nuts	$ 1,50	unit	1		1	$ 1,50
70	Reaction tool <= 25.4 mm	Thighten the M8 nuts	$ 0,25	unit	1		1	$ 0,25
80	Assemble, 1kg, Loose	Put the spacers of the rocker in place	$ 0,06	unit	1		1	$ 0,06
90	Assemble, 1kg, Loose	Put the washers of the rocker in place	$ 0,06	unit	1		1	$ 0,06
100	Hand - Start Only	Bolt pullrod into the rocker	$ 0,12	unit	1		1	$ 0,12
110	Assemble, 1kg, Loose	Put the spacers of the A-arm in place	$ 0,06	unit	1		1	$ 0,06
120	Assemble, 1kg, Loose	Put the washers of the A-arm in place	$ 0,06	unit	1		1	$ 0,06
130	Hand - Start Only	Bolt pullrod into the A-Arm	$ 0,12	unit	1		1	$ 0,12
140	Hand - Start Only	Put the nuts into the bolts	$ 0,12	unit	1		1	$ 0,12
150	Ratchet <= 25.4 mm	Thighten the M8 nuts	$ 0,75	unit	1		1	$ 0,75
160	Reaction tool <= 25.4 mm	Thighten the M8 nuts	$ 0,25	unit	1		1	$ 0,25
							Sub Total	$ 4,37

ItemOrder	Fastener	Use	UnitCost	Size1	Unit1	Size2	Unit2	Quantity	Sub Total
10	Bolt,Grade 8.8 (SAE)	Pullrod to rocker fixing bolt	$ 0,10	6	mm	45	mm	1	$ 0,10
20	Bolt,Grade 8.8 (SAE)	Pullrod to A-arm fixing bolt	$ 0,10	6	mm	45	mm	1	$ 0,10
30	Washer, Grade 8.8 (SAE 5)		$ 0,01	6	unit			4	$ 0,04
40	Nut, Grade 8.8 (SAE 5)	To tighten the rod ends	$ 0,03	6	mm			1	$ 0,03
50	Nut, Grade 8.8 (SAE 5)	To tighten the bolts	$ 0,03	6	mm			1	$ 0,03
								Sub Total	$ 0,31

University	Ecole Centrale de Lyon		Back to BOM	**Car #**	81	**Part Cost**	$ 9,79
System	Steering System	**FileLink1**				**Qty**	1
Assembly	Steering rod	**FileLink2**		**FileLink1**			
Part	Steering rod tube	**FileLink3**		**FileLink2**		**Extended Cost**	$ 9,79
P/N Base	ST 05001			**FileLink3**			
Suffix	AA						
Details							

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Carbon fiber, 1 Ply	Stock material	$200,00	0,044	kg			Round area, diameter 16x2 mm	8,80E-05	0,313	1580	1	$ 8,70
												Sub Total	**$ 8,70**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Lamination, Filament Wirring	Tube lamination	$ 25,00	kg	0,044			$ 1,09
							Sub Total	**$ 1,09**

University	Ecole Centrale de Lyon		Back to BOM	**Car #**	81	**Part Cost**	$ 2,31
System	Steering System	**FileLink1**	Drawing			**Qty**	1
Assembly	Steering rod	**FileLink2**		**FileLink1**			
Part	Steering rod insert	**FileLink3**		**FileLink2**		**Extended Cost**	$ 2,31
P/N Base	ST 05002			**FileLink3**			
Suffix	AA						
Details							

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Aluminium, Premium (per kg)	cylinder	$ 4,20	0,07	kg			diam. 18mm	2,54E-04	3,50E-02	7 850,00	1	$ 0,29
												Sub Total	**$ 0,29**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Setup for machining and removal	$ 1,30	Unit	1	2 parts from a single machine setup (tierod	0,500	$ 0,65
20	Machining	Material removal - side view profile	$ 0,04	cm^3	5,5	Material - Steel	3	$ 0,66
30	Machining setup, change	Setup for machining process	$ 0,65	Unit	1	2 parts from a single machine setup (tierod insert)	0,500	$ 0,33
40	Machining	Material removal	$ 0,04	cm^3	0,3	Material - Steel	3	$ 0,04
50	Tapping Holes	Rod End emplacement	$ 0,35	hole	1		1	$ 0,35
							Sub Total	**$ 2,02**

Drawing : ST_05002

University	Ecole Centrale de Lyon		Back to BOM	**Car #**	81	**Part Cost**	$ 0,34
System	Steering System	**FileLink1**	Drawing			**Qty**	4
Assembly	Steering rod	**FileLink2**		**FileLink1**			
Part	Spacer	**FileLink3**		**FileLink2**		**Extended Cost**	$ 1,35
P/N Base	ST 05003			**FileLink3**			
Suffix	AA						
Details							

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Mild (per kg)		$ 2,25	1,34E-02	Kg			Cylinder face	2,01E-04	9E-03	7850	1	$ 0,03
												Sub Total	**$ 0,03**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Setup for machining	$ 1,30	Unit	1	Same setup for 8	1,25E-01	$ 0,16
20	Machining	Material removal	$ 0,04	cm^3	1,2	Material - Steel	3	$ 0,14
							Sub Total	**$ 0,31**

Drawing : ST_05003

Ecurie Piston Sport Auto

ÉCOLE CENTRALE LYON

CAR #81

SUSPENSION SYSTEM

University	Ecole Centrale de Lyon
System	Suspension & Shocks
Assembly	Upper Front A-arm
P/N Base	SU A0100
Suffix	AA
Details	

Back to BOM

Car #	81
FileLink1	
FileLink2	
FileLink3	

Asm Cost	$ 80,82
Qty	2
Extended (	$ 161,65

ItemOrder	Part	Part Cost	Quantity	Sub Total
10	Upper Front Bearing Support	$ 15,09	1	$ 15,09
20	Inner Bearing Support	$ 1,87	2	$ 3,75
30	Upper Front A-arm tube (Front) Carbon Fiber Tube	$ 8,88	1	$ 8,88
40	Upper Front A-arm tube (Back) Carbon Fiber Tube	$ 7,19	1	$ 7,19
50	Spacer 1	$ 0,99	2	$ 1,98
60	Spacer 2	$ 0,32	4	$ 1,30
70	Outboard A-arm Insert	$ 0,48	2	$ 0,95
80	Front up bracket	$ 1,39	1	$ 1,39
90	Front down bracket	$ 1,36	1	$ 1,36
100	Rear up bracket	$ 1,31	1	$ 1,31
110	Rear down bracket	$ 0,38	1	$ 0,38
			Sub Total	$ 43,58

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Sperical bearing		$ 6,92	8	mm							3	$ 20,76
20	Adhesive	Glue for Ball Joint – Cost Included in Processes			95								$ -
30	Adhesive	Epoxy resin for Tube/insert assembly – Cost Included in Processes											$ -
												Sub Total	$ 20,76

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Hand Finish - Surface Preperation	Solvent degreasing on Upper Front Bearing Support	$ 0,02	cm²	8,66	Repeat 2	2	$ 0,35
20	Brush Apply	Glue applying on on Upper Front Bearing Support	$ 0,02	cm²	8,66	Repeat 2	2	$ 0,35
30	Hand Finish - Surface Preperation	Solvent degreasing on Outboard A-arm insert	$ 0,02	cm²	8,66	Repeat 2	2	$ 0,35
40	Assemble, 1kg, loose	Outboard A-arm Insert in Upper front bearing support	$ 0,06	Unit	1	Repeat 2	2	$ 0,12
50	Hand Finish - Surface Preperation	Solvent degreasing on Inner Bearing support	$ 0,02	cm²	12,43	Repeat 2	2	$ 0,50
60	Brush Apply	Glue applying on Inner Bearing support	$ 0,02	cm²	12,43	Repeat 2	2	$ 0,50
70	Hand Finish - Surface Preperation	Solvent degreasing on carbon tube	$ 0,02	cm²	12,43	Repeat 2	2	$ 0,50
80	Assemble, 1kg, loose	Inner Bearing support in Carbon Tube	$ 0,14	Unit	1	Repeat 2	2	$ 0,28
90	Hand Finish - Surface Preperation	Solvent degreasing on Outboard A-arm Insert	$ 0,02	cm²	12,43	Repeat 2	2	$ 0,50
100	Brush Apply	Glue applying on Outboard A-arm Inserts	$ 0,18	cm²	12,43	Repeat 2	2	$ 4,47
110	Hand Finish - Surface Preperation	Solvent degreasing on carbon tube	$ 0,02	cm²	12,43	Repeat 2	2	$ 0,50
120	Assemble, 1kg, loose	Outboard A-arm Insert in Carbon Tube with Inner Bearing support	$ 0,22	Unit	1	Repeat 2	2	$ 0,44
130	Hand Finish - Surface Preperation	Solvent degreasing on bearing bores	$ 0,02	cm²	4,01	Repeat 3	3	$ 0,24
140	Brush Apply	Glue applying on bearing bores	$ 0,02	cm²	4,01	Repeat 3	3	$ 0,24
150	Assemble, 1kg, loose	Bearing in Insert Bores	$ 0,30	Unit	1	Repeat 3	3	$ 0,90
160	Weld	Steel mounts welding	$ 0,15	cm²	22			$ 3,30
170	Aerosol Apply	Steel mounts painting	$ 5,25	m²	0,01			$ 0,05
180	Assemble, 1kg, loose	A-Arm Positionning	$ 0,14	Unit	1			$ 0,14
190	Assemble, 1kg, Line on line	Spacers installation	$ 0,13	Unit	4			$ 0,52
200	Assemble, 1kg, Line on line	Washers installation	$ 0,13	Unit	8			$ 1,04
210	Ratchet <= 25,4mm	M8 bolts installation	$ 0,13	Unit	2			$ 0,26
220	Reaction tool <=25,4mm	M8 nut blocking	$ 0,25	Unit	2			$ 0,50
							Sub Total	$ 16,03

ItemOrder	Fastener	Use	UnitCost	Size1	Unit1	Size2	Unit2	Quantity	Sub Total
10	Bolt, Grade 8,8 (SAE 5)	A-Arm Fixing Bolts on Frame Side	0,16	8	mm	40	mm	2	$ 0,32

20	Nut, Grade 8,8 (SAE 5)	A-Arm Fixing Nuts	0,04	8	mm			2	$ 0,09
30	Washer, Grade 8,8 (SAE 5)	A-Arm Fixing Washers	0,01	8	mm			4	$ 0,04
								Sub Total	**$ 0,45**

ItemOrder	Tooling	Use	UnitCost	Unit	Quantity	PVF	FractionInc	Sub Total
10	Welds - Welding Fixture	Welding processes	$ 500,00	point	8	3000	1	$ 1,33
							Sub Total	**$ 1,33**

University	Ecole Centrale de Lyon		Back to BOM	**Car #**	81	**Part Cost**	$ 15,09
System	Suspension & Shocks	**FileLink1**	Drawing			**Qty**	1
Assembly	Upper Front A-arm	**FileLink2**		**FileLink1**			
Part	Upper Front Bearing Support	**FileLink3**		**FileLink2**		**Extended C**	$ 15,09
P/N Base	SU_01001			**FileLink3**			
Suffix	AA						
Details							

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Aluminum, Premium	Stock material for part	$ 4,20					Upper face	5,04E-03	4,70E-02	2712	1,00	$ 2,70
												Sub Total	**$ 2,70**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove		$ 1,30	Unit	1			$ 1,30
20	Machining	Main shape contouring and top of the main hole machining	$ 0,04	cm^3	153			$ 6,12
30	Machining Setup, Change		$ 0,65	Unit	1			$ 0,65
40	Machining	First tube hole machining	$ 0,04	cm^3	2			$ 0,09
50	Machining Setup, Change		$ 0,65	Unit	1			$ 0,65
60	Machining	Second tube hole machining	$ 0,04	cm^3	2			$ 0,09
70	Machining Setup, Change		$ 0,65	Unit	1			$ 0,65
80	Machining	Angle and bottom of the main hole machining	$ 0,04	cm^3	4			$ 0,16
90	Machining Setup, Change		$ 0,65	Unit	1			$ 0,65
100	Machining	Suspension rod support machining	$ 0,04	cm^3	42			$ 1,68
110	Drilled holes < 25.4 mm	Suspension rod support drilling	$ 0,35		1			$ 0,35
							Sub Total	**$ 12,39**

Drawing part : SU_01001

University	Ecole Centrale de Lyon		Back to BOM	**Car #**	81	**Part Cost**	$ 1,87
System	Suspension & Shocks	**FileLink1**	Drawing			**Qty**	2
Assembly	Upper Front A-arm	**FileLink2**		**FileLink1**			
Part	Inner Bearing Support	**FileLink3**		**FileLink2**		**Extended Cos**	$ 3,75
P/N Base	SU_01002			**FileLink3**			
Suffix	AA						
Details							

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Aluminum, Premium	Stock material for part	$ 4,20	0,204	Kg			Cylinder face area	1,26E-03	6E-02	2712	1,00	$ 0,86
												Sub Total	**$ 0,86**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove		$ 1,30	Unit	1	16 parts from a single setup	0,0625	$ 0,08
20	Machining	Main shape machining	$ 0,04	cm^3	17	Material - Aluminium	1	$ 0,68
30	Machining Setup, Change		$ 0,65	Unit	1	16 parts from a single setup	0,0625	$ 0,04
40	Machining	Sides machining	$ 0,04	cm^3	2	Material - Aluminium	1	$ 0,08
50	Machining Setup, Change		$ 0,65	Unit	1	16 parts from a single setup	0,0625	$ 0,04
60	Machining	Hole machining	$ 0,04	cm^3	2	Material - Aluminium	1	$ 0,09
							Sub Total	**$ 1,01**

Drawing part : SU_01002

University	Ecole Centrale de Lyon
System	Suspension & Shocks
Assembly	Upper Front A-arm
Part	Upper Front A-arm tube (Front) Carbon Fiber Tube
P/N Base	SU_01003
Suffix	AA
Details	

FileLink1	Drawing
FileLink2	
FileLink3	

Back to BOM

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 8,88
Qty	1
Extended Cost	$ 8,88

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Carbon Fiber, 1 Ply	Stock	$ 7,89	0,000025	m^3			tube face	8,79E-05	0,28	1580	1	$ 7,89
												Sub Total	**$ 7,89**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Lamination, Fillament Wirring	Tube Lamination	$ 25,00	kg	0,039			$ 0,99
							Sub Total	**$ 0,99**

University	Ecole Centrale de Lyon			Back to BOM	**Car #**	81	**Part Cost** $ 7,19
System	Suspension & Shocks	**FileLink1**	Drawing				**Qty** 1
Assembly	Upper Front A-arm	**FileLink2**			**FileLink1**		
Part	Upper Front A-arm tube (Back) Carbon Fiber Tube	**FileLink3**			**FileLink2**		**Extended Cos** $ 7,19
P/N Base	SU_01004				**FileLink3**		
Suffix	AA						
Details							

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Carbon Fiber, 1 Ply	Stock	$ 200,00	3,20E-02	Kg			tube face	8,79E-05	0,23	1580	1	$ 6,39
												Sub Total	**$ 6,39**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Lamination, Fillament Wirring	Tube Lamination	$ 25,00	kg	3,20E-02			$ 0,80
							Sub Total	**$ 0,80**

University	Ecole Centrale de Lyon
System	Suspension & Shocks
Assembly	Upper Front A-arm
Part	Spacer 1
P/N Base	SU_01005
Suffix	AA
Details	

FileLink1	Drawing
FileLink2	
FileLink3	

Back to BOM

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 0,99
Qty	2
Extended Cos	$ 1,98

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Mild Steel	Stock material for part	$ 2,25	1,74E-02	Kg			Cylinder face	2,01E-04	1,10E-02	7850	1	$ 0,04
												Sub Total	**$ 0,04**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Setup for machining	$ 1,30	Unit	1	2 parts from a single setup	0,5	$ 0,65
20	Machining	Material removal	$ 0,04	cm^3	2,5	Material -Steel	3	$ 0,30
							Sub Total	**$ 0,95**

Drawing part : SU_01005

University	Ecole Centrale de Lyon
System	Suspension & Shocks
Assembly	Upper Front A-arm
Part	Spacer 2
P/N Base	SU_01006
Suffix	AA
Details	

FileLink1	Drawing
FileLink2	
FileLink3	

Back to BOM

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 0,32
Qty	4
Extended Cos	$ 1,30

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Mild (per kg)		$ 2,25	6,31E-02	Kg			Cylinder face	2,01E-04	4E-02	7850	1	$ 0,14
												Sub Total	**$ 0,14**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Setup for machining	$ 1,30	Unit	1	Same as SU_0*_006 (*=1,…,4) and SU_09_003	2,94E-02	$ 0,04
20	Machining	Material removal	$ 0,04	cm^3	1,2	Material -Steel	3	$ 0,14
							Sub Total	**$ 0,18**

Drawing part : SU_01006

University	Ecole Centrale de Lyon
System	Suspension & Shocks
Assembly	Upper Front A-arm
Part	Outboard A-arm Insert
P/N Base	SU_01007
Suffix	AA
Details	

FileLink1	Drawing
FileLink2	
FileLink3	

Back to BOM

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 0,48
Qty	2
Extended Cost	$ 0,95

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Aluminium, Premium (per kg)	cylinder	$ 4,20	12	mm			12mm	1,13E-04	0,060	2 710	1,00	$ 0,08
												Sub Total	**$ 0,08**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Saw or tubing cut		$ 0,40	cm	1			$ 0,40
							Sub Total	**$ 0,40**

Drawing part : SU_01007

Vue isométrique
Echelle : 1:1

Vue de face
Echelle : 1:1

0

University	Ecole Centrale de Lyon		Back to BOM	**Car #**	81	**Part Cost**	$ 1,39
System	Suspension & Shocks	**FileLink1**	Drawing			**Qty**	1
Assembly	Upper Front A-arm	**FileLink2**		**FileLink1**			
Part	Front up bracket	**FileLink3**		**FileLink2**		**Extended Cost**	$ 1,39
P/N Base	SU_01008			**FileLink3**			
Suffix	AA						
Details	This part is Welded on the frame						

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Mild (per kg)	Stock for the part	$ 2,25	0,054	kg			Rectangular area	1,36E-03	5,00E-03	7850	1	$ 0,12
20	Paint		$ 10,00	2,73E-03	m^2								$ 0,03
												Sub Total	**$ 0,15**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Installation of the item 10 for laser cut	$ 1,30	Unit	1	2 parts made from a single setup	0,5	$ 0,65
20	Laser Cut		$ 0,01	cm	13,6			$ 0,14
30	Machining Setup, Install and remove		$ 0,65	Unit	1	2 parts made from a single setup	0,5	$ 0,33
40	Machining	Tubing cavity	$ 0,04	cm^3	1	Material -Steel	3	$ 0,12
50	Aerosol Apply	To apply red paint	$ 5,25	m^2	2,73E-03			$ 0,01
							Sub Total	**$ 1,25**

Drawing part : SU_01008

University	Ecole Centrale de Lyon		Back to BOM	**Car #**	81	**Part Cost**	$	1,36
System	Suspension & Shocks	**FileLink1**	Drawing			**Qty**		1
Assembly	Upper Front A-arm	**FileLink2**		**FileLink1**				
Part	Front down bracket	**FileLink3**		**FileLink2**		**Extended Cos**	$	1,36
P/N Base	SU_01009			**FileLink3**				
Suffix	AA							
Details	This part is Welded on the frame							

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Mild (per kg)	Stock for the part	$ 2,25	0,053	kg			Rectangular area	1,34E-03	5,00E-03	7850	1	$ 0,12
20	Paint		$ 10,00	2,68E-03	m^2								$ 0,03
												Sub Total	**$ 0,15**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Installation of the item 10 for laser cut	$ 1,30	Unit	1	2 parts made from a single setup	0,5	$ 0,65
20	Laser Cut		$ 0,01	cm	13,8			$ 0,14
30	Machining Setup, Install and remove		$ 0,65	Unit	1	2 parts made from a single setup	0,5	$ 0,33
40	Machining	Tubing cavity	$ 0,03	cm^3	1	Material -Stee	3	$ 0,09
50	Aerosol Apply	To apply red paint	$ 5,25	m^2	2,68E-03			$ 0,01
							Sub Total	**$ 1,21**

Drawing part : SU_01009

University	Ecole Centrale de Lyon		Back to BOM	**Car #**	81	**Part Cost**	$	1,31
System	Suspension & Shocks	**FileLink1**	Drawing			**Qty**		1
Assembly	Upper Front A-arm	**FileLink2**		**FileLink1**				
Part	Rear up bracket	**FileLink3**		**FileLink2**		**Extended Cos**	$	1,31
P/N Base	SU_01010			**FileLink3**				
Suffix	AA							
Details	This part is Welded on the frame							

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Mild (per kg)	Stock for the	$ 2,25	0,045	kg			Rectangular area	1,14E-03	5,00E-03	7850	1	$ 0,10
20	Paint		$ 10,00	2,28E-03	m^2								$ 0,02
												Sub Total	**$ 0,12**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Installation of the item 10 for laser cut	$ 1,30	Unit	1	2 parts made from a single setup	0,5	$ 0,65
20	Laser Cut		$ 0,01	cm	11,7			$ 0,12
30	Machining Setup, Install and remove		$ 0,65	Unit	1	2 parts made from a single setup	0,5	$ 0,33
40	Machining	Tubing cavity	$ 0,03	cm^3	1	Material -Stee	3	$ 0,09
50	Aerosol Apply	To apply red p	$ 5,25	m^2	2,28E-03			$ 0,01
							Sub Total	**$ 1,19**

Drawing part : SU_01010

University	Ecole Centrale de Lyon			Back to BOM	**Car #**	81	**Part Cost**	$	0,38
System	Suspension & Shocks	**FileLink1**	Drawing				**Qty**		1
Assembly	Upper Front A-arm	**FileLink2**			**FileLink1**				
Part	Rear down bracket	**FileLink3**			**FileLink2**		**Extended Cos**	$	0,38
P/N Base	SU_01011				**FileLink3**				
Suffix	AA								
Details	This part is Welded on the frame								

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Mild (per kg)	Stock for the part	$ 2,25	0,050	kg			Rectangular area	1,27E-03	5,00E-03	7850	1	$ 0,11
20	Paint		$ 10,00	2,54E-03	m^2								$ 0,03
												Sub Total	**$ 0,14**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Installation of the item 10 for laser cut	$ 1,30	Unit	1	2 parts made from a single	0,5	$ 0,65
20	Laser Cut		$ 0,01	cm	11,5			$ 0,12
30	Machining Setup, Install and remove		$ 0,65	Unit	1	2 parts made from a single setup	0,5	$ 0,33
40	Machining	Tubing cavity	$ 0,03	cm^3	1	Material -Steel	3	$ 0,09
50	Aerosol Apply	To apply red paint	$ 5,25	m^2	2,54E-03			$ 0,01
							Sub Total	**$ 1,19**

Drawing part : SU_01011

University	Ecole Centrale de Lyon
System	Suspension & Shocks
Assembly	Lower Front A-arm
P/N Base	SU A0200
Suffix	
Details	

Back to BOM

Car #	81
FileLink1	
FileLink2	
FileLink3	

Asm Cost	$ 75,40
Qty	2
Extended	$ 150,79

ItemOrder	Part	Part Cost	Quantity	Sub Total
10	Lower Front Bearing Support	$ 9,11	1	$ 9,11
20	Inner Bearing Support	$ 1,87	2	$ 3,75
30	Lower Front A-arm tube (Front) Carbon Fiber Tube	$ 11,22	1	$ 11,22
40	Lower Front A-arm tube (Back) Carbon Fiber Tube	$ 10,00	1	$ 10,00
50	Spacer 1	$ 0,91	2	$ 1,82
60	Spacer 2	$ 0,32	4	$ 1,30
70	Outboard A-arm Insert	$ 0,48	2	$ 0,95
80	Front up bracket	$ 1,39	1	$ 1,39
90	Front down bracket	$ 1,44	1	$ 1,44
100	Rear Up bracket	$ 1,33	1	$ 1,33
110	Rear down bracket	$ 1,42	1	$ 1,42
			Sub Total	**$ 38,15**

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Sperical bearing		$ 6,92	8	mm							3	$ 20,76
20	Adhesive	Glue for Ball Joint – Cost Included in Processes			95								$ -
30	Adhesive	Epoxy resin for Tube/insert assembly – Cost Included in Processes											$ -
												Sub Total	**$ 20,76**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Hand Finish - Surface Preperation	Solvent degreasing on Upper Front Bearing Support	$ 0,02	cm²	8,66	Repeat 2	2	$ 0,35
20	Brush Apply	Glue applying on on Upper Front Bearing Support	$ 0,02	cm²	8,66	Repeat 2	2	$ 0,35
30	Hand Finish - Surface Preperation	Solvent degreasing on Outboard A-arm insert	$ 0,02	cm²	8,66	Repeat 2	2	$ 0,35
40	Assemble, 1kg, loose	Outboard A-arm Insert in Upper front bearing support	$ 0,06	Unit	1	Repeat 2	2	$ 0,12
50	Hand Finish - Surface Preperation	Solvent degreasing on Inner Bearing support	$ 0,02	cm²	12,43	Repeat 2	2	$ 0,50
60	Brush Apply	Glue applying on Inner Bearing support	$ 0,02	cm²	12,43	Repeat 2	2	$ 0,50
70	Hand Finish - Surface Preperation	Solvent degreasing on carbon tube	$ 0,02	cm²	12,43	Repeat 2	2	$ 0,50
80	Assemble, 1kg, loose	Inner Bearing support in Carbon Tube	$ 0,14	Unit	1	Repeat 2	2	$ 0,28
90	Hand Finish - Surface Preperation	Solvent degreasing on Outboard A-arm Insert	$ 0,02	cm²	12,43	Repeat 2	2	$ 0,50
100	Brush Apply	Glue applying on Outboard A-arm Inserts	$ 0,18	cm²	12,43	Repeat 2	2	$ 4,47
110	Hand Finish - Surface Preperation	Solvent degreasing on carbon tube	$ 0,02	cm²	12,43	Repeat 2	2	$ 0,50
120	Assemble, 1kg, loose	Outboard A-arm Insert in Carbon Tube with Inner Bearing support	$ 0,22	Unit	1	Repeat 2	2	$ 0,44
130	Hand Finish - Surface Preperation	Solvent degreasing on bearing bores	$ 0,02	cm²	4,01	Repeat 3	3	$ 0,24
140	Brush Apply	Glue applying on bearing bores	$ 0,02	cm²	4,01	Repeat 3	3	$ 0,24
150	Assemble, 1kg, loose	Bearing in Insert Bores	$ 0,30	Unit	1	Repeat 3	3	$ 0,90
160	Weld	Steel mounts welding	$ 0,15	cm²	22			$ 3,30
170	Aerosol Apply	Steel mounts painting	$ 5,25	m²	0,01			$ 0,05
180	Assemble, 1kg, loose	A-Arm Positionning	$ 0,14	Unit	1			$ 0,14
190	Assemble, 1kg, Line on line	Spacers installation	$ 0,13	Unit	4			$ 0,52
200	Assemble, 1kg, Line on line	Washers installation	$ 0,13	Unit	8			$ 1,04
210	Ratchet <= 25,4mm	M8 bolts installation	$ 0,13	Unit	2			$ 0,26
220	Reaction tool <=25,4mm	M8 nut blocking	$ 0,25	Unit	2			$ 0,50
							Sub Total	**$ 16,03**

ItemOrder	Fastener	Use	UnitCost	Size1	Unit1	Size2	Unit2	Quantity	Sub Total
10	Bolt, Grade 8,8 (SAE 5)	A-Arm Fixing Bolts on Frame Side	$ 0,16	8	mm	40	mm	2	$ 0,32
20	Nut, Grade 8,8 (SAE 5)	A-Arm Fixing Nuts	$ 0,04	8	mm			2	$ 0,09
30	Washer, Grade 8,8 (SAE 5)	A-Arm Fixing Washers	$ 0,01	8	mm			4	$ 0,04
								Sub Total	**$ 0,45**

ItemOrder	Tooling	Use	UnitCost	Unit	Quantity	PVF	FractionIn	Sub Total
10	Welds - Welding Fixture	Welding processes	$ 500,00	point	8	3000	1	$ 1,33
							Sub Total	**$ 1,33**

University	Ecole Centrale de Lyon
System	Suspension & Shocks
Assembly	Lower Front A-arm
Part	Lower Front Bearing Support
P/N Base	SU 02001
Suffix	
Details	

FileLink1	Drawing
FileLink2	
FileLink3	

Back to BOM

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 9,11
Qty	1
Extended	$ 9,11

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Aluminium, Premium (per kg)	Insert	$ 4,20					area 64x36mm	3,58E-03	1,60E-02	2712	1	$ 4,20
												Sub Total	**$ 4,20**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove		$ 1,30	Unit	1			$ 1,30
20	Machining	Main shape contouring and top side machining	$ 0,04	cm^3	30	Material - Aluminium	1	$ 1,20
30	Machining Setup, Change		$ 0,65	Unit	1			$ 0,65
40	Machining	First tube hole machining	$ 0,04	cm^3	2	Material - Aluminium	1	$ 0,09
50	Machining Setup, Change		$ 0,65	Unit	1			$ 0,65
60	Machining	Second tube hole machining	$ 0,04	cm^3	2	Material - Aluminium	1	$ 0,09
70	Machining Setup, Change		$ 0,65	Unit	1			$ 0,65
80	Machining	Bottom side and hole machining	$ 0,04	cm^3	7	Material - Aluminium	1	$ 0,28
							Sub Total	**$ 4,91**

Drawing part : SU_01001

University	Ecole Centrale de Lyon			Back to BOM	**Car #**	81	**Part Cost** $ 1,87
System	Suspension & Shocks	**FileLink1**	Drawing				**Qty** 2
Assembly	Lower Front A-arm	**FileLink2**			**FileLink1**		
Part	Inner Bearing Support	**FileLink3**			**FileLink2**		**Extended Cos** $ 3,75
P/N Base	SU 02002				**FileLink3**		
Suffix							
Details							

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Aluminum, Premium	Stock material for part	$ 4,20	0,204	Kg			Cylinder face area	1,26E-03	6E-02	2712	1,00	$ 0,86
												Sub Total	**$ 0,86**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove		$ 1,30	Unit	1	16 parts from a single setup	0,0625	$ 0,08
20	Machining	Main shape machining	$ 0,04	cm^3	17	Material - Aluminium	1	$ 0,68
30	Machining Setup, Change		$ 0,65	Unit	1	16 parts from a single setup	0,0625	$ 0,04
40	Machining	Sides machining	$ 0,04	cm^3	2	Material - Aluminium	1	$ 0,08
50	Machining Setup, Change		$ 0,65	Unit	1	16 parts from a single setup	0,0625	$ 0,04
60	Machining	Hole machining	$ 0,04	cm^3	2	Material - Aluminium	1	$ 0,09
							Sub Total	**$ 1,01**

Drawing part : SU_02002

University	Ecole Centrale de Lyon			Back to BOM	**Car #**	81	**Part Cost** $ 11,22
System	Suspension & Shocks	**FileLink1**	Drawing				**Qty** 1
Assembly	Lower Front A-arm	**FileLink2**			**FileLink1**		
Part	Lower Front A-arm tube (Front) Carbon Fiber Tube	**FileLink3**			**FileLink2**		**Extended Cos** $ 11,22
P/N Base	SU_02003				**FileLink3**		
Suffix							
Details							

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Carbon Fiber, 1 Ply	Stock	$ 9,97	0,000032	m^3			tube face	8,79E-05	3,59E-01	1580	1	$ 9,97
												Sub Total	**$ 9,97**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Lamination, Fillament Wirring	Tube Lamination	$ 25,00	kg	0,05			$ 1,25
							Sub Total	**$ 1,25**

University	Ecole Centrale de Lyon			Back to BOM	**Car #**	81	**Part Cost** $ 10,00
System	Suspension & Shocks	**FileLink1**	Drawing				**Qty** 1
Assembly	Lower Front A-arm	**FileLink2**			**FileLink1**		
Part	Lower Front A-arm tube (Back) Carbon Fiber Tube	**FileLink3**			**FileLink2**		**Extended Cos** $ 10,00
P/N Base	SU_02004				**FileLink3**		
Suffix							
Details							

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Carbon Fiber, 1 Ply	Stock	$ 8,89	0,000028	m^3			tube face	8,79E-05	3,20E-01	1580	1	$ 8,89
												Sub Total	**$ 8,89**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Lamination, Fillament Wirring	Tube Lamination	$ 25,00	kg	0,044			$ 1,11
							Sub Total	**$ 1,11**

University	Ecole Centrale de Lyon			Back to BOM	**Car #**	81	**Part Cost** $ 0,91
System	Suspension & Shocks	**FileLink1**	Drawing				**Qty** 2
Assembly	Lower Front A-arm	**FileLink2**			**FileLink1**		
Part	Spacer 1	**FileLink3**			**FileLink2**		**Extended Cos** $ 1,82
P/N Base	SU_02005				**FileLink3**		
Suffix							
Details							

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Mild Steel	Stock material for part	$ 2,25	0,0134	Kg			Cylinder face	2,01E-04	8,50E-03	7850	1	$ 0,03
												Sub Total	**$ 0,03**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Setup for machining	$ 1,30	Unit	1	a single setup	0,5	$ 0,65
20	Machining	Material removal	$ 0,04	cm^3	1,9	Material -Stee	3	$ 0,23
							Sub Total	**$ 0,88**

Drawing part : SU_02005

University	Ecole Centrale de Lyon		Back to BOM	**Car #**	81	**Part Cost**	$ 0,32
System	Suspension & Shocks	**FileLink1**	Drawing			**Qty**	4
Assembly	Lower Front A-arm	**FileLink2**		**FileLink1**			
Part	Spacer 2	**FileLink3**		**FileLink2**		**Extended Cost**	$ 1,30
P/N Base	SU_02006			**FileLink3**			
Suffix							
Details							

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Mild (per kg)		$ 2,25	6,31E-02	Kg			Cylinder face	2,01E-04	4E-02	7850	1	$ 0,14
												Sub Total	**$ 0,14**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Setup for machining	$ 1,30	Unit	1	Same as SU_0*_006 (*=1,...,4) and SU_09_003	2,94E-02	$ 0,04
20	Machining	Material removal	$ 0,04	cm^3	1,2	Material -Steel	3	$ 0,14
							Sub Total	**$ 0,18**

Drawing part : SU_02006

University	Ecole Centrale de Lyon			Back to BOM	**Car #**	81	**Part Cost** $ 0,48
System	Suspension & Shocks	**FileLink1**	Drawing				**Qty** 2
Assembly	Lower Front A-arm	**FileLink2**			**FileLink1**		
Part	Outboard A-arm Insert	**FileLink3**			**FileLink2**		**Extended Cos** $ 0,95
P/N Base	SU_02007				**FileLink3**		
Suffix							
Details							

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Aluminium, Premium (per kg)	cylinder	$ 4,20	12	mm			Round area diam. 12mm	1,13E-04	0,060	2 710	1,00	$ 0,08
												Sub Total	**$ 0,08**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Saw or tubing cut		$ 0,40	cm	1			$ 0,40
							Sub Total	**$ 0,40**

Drawing part : SU_02007

Vue isométrique
Echelle : 1:1

Vue de face
Echelle : 1:1

University	Ecole Centrale de Lyon			Back to BOM	**Car #**	81	**Part Cost**	$	1,39
System	Suspension & Shocks	**FileLink1**	Drawing				**Qty**		1
Assembly	Lower Front A-arm	**FileLink2**			**FileLink1**				
Part	Front up bracket	**FileLink3**			**FileLink2**		**Extended Cos**	$	1,39
P/N Base	SU_02008				**FileLink3**				
Suffix	AA								
Details	This part is Welded on the frame								

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Mild (per kg)	Stock for the part	$ 2,25	0,045	kg			Rectangular area 48x24 mm	1,15E-03	5,00E-03	7850	1	$ 0,10
20	Paint		$ 10,00	2,30E-03	m^2								$ 0,02
												Sub Total	**$ 0,12**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Installation of the item 10 for laser cut	$ 1,30	Unit	1	2 parts made from a single setup	0,5	$ 0,65
20	Laser Cut		$ 0,01	cm	15,5			$ 0,16
30	Machining Setup, Install and remove		$ 0,65	Unit	1	2 parts made from a single setup	0,5	$ 0,33
40	Machining	Tubing cavity	$ 0,04	cm^3	1	Material -Steel	3	$ 0,12
50	Aerosol Apply	To apply red paint	$ 5,25	m^2	2,30E-03			$ 0,01
							Sub Total	**$ 1,26**

Drawing part : SU_02008

University	Ecole Centrale de Lyon		Back to BOM	**Car #**	81	**Part Cost**	$	1,44
System	Suspension & Shocks	**FileLink1**	Drawing			**Qty**		1
Assembly	Lower Front A-arm	**FileLink2**		**FileLink1**				
Part	Front down bracket	**FileLink3**		**FileLink2**		**Extended Cos**	$	1,44
P/N Base	SU_02009			**FileLink3**				
Suffix	AA							
Details	This part is Welded on the frame							

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Mild (per kg)	Stock for the p	$ 2,25	0,059	kg			Rectangular area 68x22mm	1,50E-03	5,00E-03	7850	1	$ 0,13
20	Paint		$ 10,00	2,99E-03	m^2								$ 0,03
												Sub Total	**$ 0,16**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Installation of the item 10 for laser cut	$ 1,30	Unit	1	2 parts made from a single setup	0,5	$ 0,65
20	Laser Cut		$ 0,01	cm	16,3			$ 0,16
30	Machining Setup, Install and remove		$ 0,65	Unit	1	2 parts made from a single setup	0,5	$ 0,33
40	Machining	Tubing cavity	$ 0,04	cm^3	1	Material -Stee	3	$ 0,12
50	Aerosol Apply	To apply red p	$ 5,25	m^2	2,99E-03			$ 0,02
							Sub Total	**$ 1,27**

Drawing part : SU_02009

University	Ecole Centrale de Lyon			Back to BOM	**Car #**	81	**Part Cost**	$	1,33
System	Suspension & Shocks	**FileLink1**	Drawing				**Qty**		1
Assembly	Lower Front A-arm	**FileLink2**			**FileLink1**				
Part	Rear Up bracket	**FileLink3**			**FileLink2**		**Extended Cos**	$	1,33
P/N Base	SU_02010				**FileLink3**				
Suffix	AA								
Details	This part is Welded on the frame								

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Mild (per kg)	Stock for the	$ 2,25	0,035	kg			Rectangular area 40x22mm	8,80E-04	5,00E-03	7850	1	$ 0,08
20	Paint		$ 10,00	1,76E-03	m^2								$ 0,02
												Sub Total	**$ 0,10**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Installation item 10 for laser cut	$ 1,30	Unit	1	2 parts made from a single setup	0,5	$ 0,65
20	Laser Cut		$ 0,01	cm	13,2			$ 0,13
30	Machining Setup, Install and remove		$ 0,65	Unit	1	2 parts made from a single setup	0,5	$ 0,33
40	Machining	Tubing cavity	$ 0,04	cm^3	1	Material -Steel	3	$ 0,12
50	Aerosol Apply	To apply red paint	$ 5,25	m^2	1,76E-03			$ 0,01
							Sub Total	**$ 1,24**

Drawing : SU_02010

University	Ecole Centrale de Lyon		Back to BOM	**Car #**	81	**Part Cost**	$	1,42
System	Suspension & Shocks	**FileLink1**	Drawing			**Qty**		1
Assembly	Lower Front A-arm	**FileLink2**		**FileLink1**				
Part	Rear down bracket	**FileLink3**		**FileLink2**		**Extended Cos**	$	1,42
P/N Base	SU_02011			**FileLink3**				
Suffix	AA							
Details	This part is Welded on the frame							

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Mild (per kg)	Stock for the	$ 2,25	0,054	kg			Rectangular area	1,36E-03	5,00E-03	7850	1	$ 0,12
20	Paint		$ 10,00	2,73E-03	m^2								$ 0,03
												Sub Total	**$ 0,15**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Installation of the item 10 for laser cut	$ 1,30	Unit	1	2 parts made from a single setup	0,5	$ 0,65
20	Laser Cut		$ 0,01	cm	15,8			$ 0,16
30	Machining Setup, Install and remove		$ 0,65	Unit	1	2 parts made from a single setup	0,5	$ 0,33
40	Machining	Tubing cavity	$ 0,04	cm^3	1	Material -Steel	3	$ 0,12
50	Aerosol Apply	To apply red p	$ 5,25	m^2	2,73E-03			$ 0,01
							Sub Total	**$ 1,27**

Drawing :

10°
⌀8.6
⌀22 ±0.2
95°
42.2
5
89°
7.6
⌀30
Vue selon l'axe de perçage
Echelle : 1:1
Vue de face
Echelle : 1:1
Vue de gauche
Echelle : 1:1
Tolérance angulaire : +/- 3°
Tolérance dimensionnelle : +/- 0.1mm
Vue isométrique
Echelle : 1:1
Taille
A4
Ecurie Piston Sport Auto
Dessiné par
Antonio Leblanc
Date
16/01/2018
Désignation
(Avant Inf Arriere Inf)
Coordonnées
antonio.leblanc@ecl16.ec-lyon.fr
07 69 46 48 59
Quantité
1+1
Matériau
Acier S500
Version
0.1
Plan vérifié par
Brice Roblot
Echelle 1:1
Plan
Feuille 1/1

University	Ecole Centrale de Lyon
System	Suspension & Shocks
Assembly	Upper Back A-arm
P/N Base	SU A0300
Suffix	
Details	

Back to BOM

Car #	81
FileLink1	
FileLink2	
FileLink3	

Asm Cost	$ 76,39
Qty	2
Extended (	$ 152,78

ItemOrder	Part	Part Cost	Quantity	Sub Total
10	Upper Back Bearing Support	$ 16,49	1	$ 16,49
20	Inner Bearing Support	$ 1,87	2	$ 3,75
30	Upper Back A-arm tube (Front) Carbon Fiber Tube	$ 10,88	1	$ 10,88
40	Upper Back A-arm tube (Back) Carbon Fiber Tube	$ 4,34	1	$ 4,34
50	Spacer 1	$ 0,72	2	$ 1,44
60	Spacer 2	$ 0,32	4	$ 1,30
70	Outboard A-arm Insert	$ 0,48	2	$ 0,95
80	Front up bracket	$ 1,50	1	$ 1,50
90	Front down bracket	$ 1,49	1	$ 1,49
100	Rear up bracket	$ 1,27	1	$ 1,27
110	Rear down bracket	$ 1,38	1	$ 1,38
			Sub Total	$ 39,14

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Nam	Area	Length	Density	Quantity	Sub Total
10	Sperical bearing		$ 6,92	8	mm							3	$ 20,76
20	Adhesive	Glue for Ball Joint – Cost Included in Processes											$ -
30	Adhesive	Epoxy resin for Tube/insert assembly – Cost Included in Processes											$ -
												Sub Total	$ 20,76

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Hand Finish - Surface Preperation	Solvent degreasing on Upper Front Bearing Support	$ 0,02	cm²	8,66	Repeat 2	2	$ 0,35
20	Brush Apply	Glue applying on on Upper Front Bearing Support	$ 0,02	cm²	8,66	Repeat 2	2	$ 0,35
30	Hand Finish - Surface Preperation	Solvent degreasing on Outboard A-arm insert	$ 0,02	cm²	8,66	Repeat 2	2	$ 0,35
40	Assemble, 1kg, loose	Outboard A-arm Insert in Upper front bearing support	$ 0,06	Unit	1	Repeat 2	2	$ 0,12
50	Hand Finish - Surface Preperation	Solvent degreasing on Inner Bearing support	$ 0,02	cm²	12,43	Repeat 2	2	$ 0,50
60	Brush Apply	Glue applying on Inner Bearing support	$ 0,02	cm²	12,43	Repeat 2	2	$ 0,50
70	Hand Finish - Surface Preperation	Solvent degreasing on carbon tube	$ 0,02	cm²	12,43	Repeat 2	2	$ 0,50
80	Assemble, 1kg, loose	Inner Bearing support in Carbon Tube	$ 0,14	Unit	1	Repeat 2	2	$ 0,28
90	Hand Finish - Surface Preperation	Solvent degreasing on Outboard A-arm Insert	$ 0,02	cm²	12,43	Repeat 2	2	$ 0,50
100	Brush Apply	Glue applying on Outboard A-arm Inserts	$ 0,18	cm²	12,43	Repeat 2	2	$ 4,47
110	Hand Finish - Surface Preperation	Solvent degreasing on carbon tube	$ 0,02	cm²	12,43	Repeat 2	2	$ 0,50
120	Assemble, 1kg, loose	Outboard A-arm Insert in Carbon Tube with Inner Bearing support	$ 0,22	Unit	1	Repeat 2	2	$ 0,44
130	Hand Finish - Surface Preperation	Solvent degreasing on bearing bores	$ 0,02	cm²	4,01	Repeat 3	3	$ 0,24
140	Brush Apply	Glue applying on bearing bores	$ 0,02	cm²	4,01	Repeat 3	3	$ 0,24
150	Assemble, 1kg, loose	Bearing in Insert Bores	$ 0,30	Unit	1	Repeat 3	3	$ 0,90
160	Weld	Steel mounts welding	$ 0,15	cm²	22			$ 3,30
170	Aerosol Apply	Steel mounts painting	$ 5,25	m²	0,01			$ 0,05
180	Assemble, 1kg, loose	A-Arm Positionning	$ 0,14	Unit	1			$ 0,14
190	Assemble, 1kg, Line on line	Spacers installation	$ 0,13	Unit	4			$ 0,52
200	Assemble, 1kg, Line on line	Washers installation	$ 0,13	Unit	8			$ 1,04
210	Ratchet <= 25,4mm	M8 bolts installation	$ 0,13	Unit	2			$ 0,26
220	Reaction tool <=25,4mm	M8 nut blocking	$ 0,25	Unit	2			$ 0,50
							Sub Total	$ 16,03

ItemOrder	Fastener	Use	UnitCost	Size1	Unit1	Size2	Unit2	Quantity	Sub Total
10	Bolt, Grade 8,8 (SAE 5)	A-Arm Fixing Bolts on Frame Side	0,16	8	mm	40	mm	2	$ 0,32
20	Nut, Grade 8,8 (SAE 5)	A-Arm Fixing Nuts	0,04	8	mm			2	$ 0,09
30	Washer, Grade 8,8 (SAE 5)	A-Arm Fixing Washers	0,01	8	mm			4	$ 0,04
								Sub Total	$ 0,45

ItemOrder	Tooling	Use	UnitCost	Unit	Quantity	PVF	FractionIn	Sub Total

10	Welds - Welding Fixture	Welding processes	$ 500,00	point	8	3000	1	$ 1,33
							Sub Total	**$ 1,33**

University	Ecole Centrale de Lyon
System	Suspension & Shocks
Assembly	Upper Back A-arm
Part	Upper Back Bearing Support
P/N Base	SU 03001
Suffix	
Details	

FileLink1	Drawing
FileLink2	
FileLink3	

Back to BOM

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 16,49
Qty	1
Extended C	$ 16,49

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Aluminum, Premium	Stock material for part	$ 4,20					Upper face	3,91E-03	5,60,E-02	2712	1,00	$ 2,49
												Sub Total	**$ 2,49**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove		$ 1,30	Unit	1			$ 1,30
20	Machining	Main shape contouring and top of the main hole machining	$ 0,04	cm^3	174			$ 6,96
30	Machining Setup,		$ 0,65	Unit	1			$ 0,65
40	Machining	First tube hole machining	$ 0,04	cm^3	2			$ 0,09
50	Machining Setup, Change		$ 0,65	Unit	1			$ 0,65
60	Machining	Second tube hole machining	$ 0,04	cm^3	2			$ 0,09
70	Machining Setup,		$ 0,65	Unit	1			$ 0,65
80	Machining	Angle and bottom of the main hole machining	$ 0,04	cm^3	8			$ 0,32
90	Machining Setup, Change		$ 0,65	Unit	1			$ 0,65
100	Machining	Suspension rod support machining	$ 0,04	cm^3	57			$ 2,28
110	Drilled holes < 25.4 mm	Suspension rod support drilling	$ 0,35		1			$ 0,35
							Sub Total	**$ 13,99**

Drawing part : [SU 03001]

University	Ecole Centrale de Lyon			Back to BOM	Car #	81	Part Cost $ 1,87
System	Suspension & Shocks	FileLink1	Drawing				Qty 2
Assembly	Upper Back A-arm	FileLink2			FileLink1		
Part	Inner Bearing Support	FileLink3			FileLink2		Extended Cos $ 3,75
P/N Base	SU 03002				FileLink3		
Suffix							
Details							

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Aluminum, Premium	Stock materia	$ 4,20	0,204	Kg			Cylinder face area	1,26E-03	6E-02	2712	1,00	$ 0,86
												Sub Total	$ 0,86

0,0000

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove		$ 1,30	Unit	1	16 parts from a single setup	0,0625	$ 0,08
20	Machining	Main shape machining	$ 0,04	cm^3	17	Material - Aluminium	1	$ 0,68
30	Machining Setup, Change		$ 0,65	Unit	1	16 parts from a single setup	0,0625	$ 0,04
40	Machining	machining	$ 0,04	cm^3	2	Material - Aluminium	1	$ 0,08
50	Machining Setup, Change		$ 0,65	Unit	1	16 parts from a single setup	0,0625	$ 0,04
60	Machining	Hole	$ 0,04	cm^3	2	Material - Aluminium	1	$ 0,09
							Sub Total	$ 1,01

Drawing part : SU 03002

University	Ecole Centrale de Lyon			Back to BOM	**Car #**	81	**Part Cost** $ 10,88
System	Suspension & Shocks	**FileLink1**	Drawing				**Qty** 1
Assembly	Upper Back A-arm	**FileLink2**			**FileLink1**		
Part	Upper Back A-arm tube (Front) Carbon Fiber Tube	**FileLink3**			**FileLink2**		**Extended Cos** $ 10,88
P/N Base	SU 03003				**FileLink3**		
Suffix							
Details							

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Carbon Fiber, 1 Ply	Stock	$ 9,67	3,06E-05	m^3			tube face	8,79E-05	0,348	1580	1	$ 9,67
												Sub Total	**$ 9,67**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Lamination, Fillament Wirring	Tube Lamination	$ 25,00	kg	0,048			$ 1,21
							Sub Total	**$ 1,21**

University	Ecole Centrale de Lyon			Back to BOM	**Car #**	81	**Part Cost** $ 4,34
System	Suspension & Shocks	**FileLink1**	Drawing				**Qty** 1
Assembly	Upper Back A-arm	**FileLink2**			**FileLink1**		
Part	Upper Back A-arm tube (Back) Carbon Fiber Tube	**FileLink3**			**FileLink2**		**Extended Cos** $ 4,34
P/N Base	SU 03004				**FileLink3**		
Suffix							
Details							

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Carbon Fiber, 1 Ply	Stock	$ 3,86	1,22E-05	m^3			tube face	8,79E-05	0,139	1580	1	$ 3,86
												Sub Total	**$ 3,86**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Lamination, Fillament Wirring	Tube Lamination	$ 25,00	kg	0,019			$ 0,48
							Sub Total	**$ 0,48**

University	Ecole Centrale de Lyon
System	Suspension & Shocks
Assembly	Upper Back A-arm
Part	Spacer 1
P/N Base	SU 03005
Suffix	
Details	

FileLink1	Drawing
FileLink2	
FileLink3	

Back to BOM

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 0,72
Qty	2
Extended Cos	$ 1,44

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Mild Steel	Stock material for part	$ 2,25	0,0079	Kg			Cylinder face	200,96	5,0	7850	1	$ 0,02
												Sub Total	**$ 0,02**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Setup for machining	$ 1,30	unit	1	Same setup for 2 parts	0,5	$ 0,65
60	Machining	Material removal	$ 0,04	cm^3	1,3			$ 0,05
							Sub Total	**$ 0,70**

Drawing part : SU 03005

University	Ecole Centrale de Lyon
System	Suspension & Shocks
Assembly	Upper Back A-arm
Part	Spacer 2
P/N Base	SU 03006
Suffix	
Details	

FileLink1	Drawing
FileLink2	
FileLink3	

Back to BOM

Car #	81

FileLink1
FileLink2
FileLink3

Part Cost	$ 0,32
Qty	4
Extended Cos	$ 1,30

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Mild (per kg)		$ 2,25	6,31E-02	Kg			Cylinder face	2,01E-04	4E-02	7850	1	$ 0,14
												Sub Total	**$ 0,14**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Setup for machining	$ 1,30	Unit	1	SU_0*_006 (*=1,…,4) and SU_09_003	2,94E-02	$ 0,04
20	Machining	Material removal	$ 0,04	cm^3	1,2	Material -Stee	3	$ 0,14
							Sub Total	**$ 0,18**

Drawing part : =SU_03006

University	Ecole Centrale de Lyon			Back to BOM	**Car #**	81	**Part Cost** $ 0,48
System	Suspension & Shocks	**FileLink1**	Drawing				**Qty** 2
Assembly	Upper Back A-arm	**FileLink2**			**FileLink1**		
Part	Outboard A-arm Insert	**FileLink3**			**FileLink2**		**Extended Cos** $ 0,95
P/N Base	SU 03007				**FileLink3**		
Suffix							
Details							

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Aluminium, Premium (per kg)	cylinder	$ 4,20	12	mm			Round area diam. 12mm	1,13E-04	0,060	2 710	1,00	$ 0,08
												Sub Total	**$ 0,08**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Saw or tubing cut		$ 0,40	cm	1			$ 0,40
							Sub Total	**$ 0,40**

Drawing part : SU 03007

Vue isométrique
Echelle : 1:1

Vue de face
Echelle : 1:1

University	Ecole Centrale de Lyon		Back to BOM	**Car #**	81	**Part Cost**	$ 1,50
System	Suspension & Shocks	**FileLink1**	Drawing			**Qty**	1
Assembly	Upper Back A-arm	**FileLink2**		**FileLink1**			
Part	Front up bracket	**FileLink3**		**FileLink2**		**Extended Cos**	$ 1,50
P/N Base	SU 03008			**FileLink3**			
Suffix	AA						
Details	This part is Welded on the frame						

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Mild (per kg)	Stock for the part	$ 2,25	0,072	kg			Rectangular area 83x22 mm	1,83E-03	5,00E-03	7850	1	$ 0,16
20	Paint		$ 10,00	3,65E-03	m^2								$ 0,04
												Sub Total	**$ 0,20**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Installation of the item 10 for laser cut	$ 1,30	Unit	1	2 parts made from a single	0,5	$ 0,65
20	Laser Cut		$ 0,01	cm	18,5			$ 0,19
30	Machining Setup, Install and remove		$ 0,65	Unit	1	from a single setup	0,5	$ 0,33
40	Machining	Tubing cavity	$ 0,04	cm^3	1	Material -Stee	3	$ 0,12
50	Aerosol Apply	To apply red paint	$ 5,25	m^2	3,65E-03			$ 0,02
							Sub Total	**$ 1,30**

Drawing : SU_03008

Vue de droite
Echelle : 1:1

Vue de face
Echelle : 1:1

Vue selon l'axe de perçage
Echelle : 1:1

Vue isométrique
Echelle : 1:1

Toutes les mesures prises sur les axes de perçage sont coté sur l'intersection entre l'axe et la face supérieur

Tolérances générales :
ISO 2768-mK

Taille A4		Ecurie Piston Sport Auto
Dessiné par Victor Bessis	Date 06/02/2018	Désignation (Arrière Sup Avant Sup)
Coordonnées victor.bessis@ecl16.ec-lyon.fr 06 22 66 56 43		Quantité 1+1 / Matériau Acier S500 / Version 1.0
Plan vérifié par Brice Roblot		Echelle 1:1 / Plan / Feuille 1/1

University	Ecole Centrale de Lyon		Back to BOM	**Car #**	81	**Part Cost**	$ 1,49
System	Suspension & Shocks	**FileLink1**	Drawing			**Qty**	1
Assembly	Upper Back A-arm	**FileLink2**		**FileLink1**			
Part	Front down bracket	**FileLink3**		**FileLink2**		**Extended Cos**	$ 1,49
P/N Base	SU 03009			**FileLink3**			
Suffix	AA						
Details	This part is Welded on the frame						

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Mild (per kg)	Stock for the part	$ 2,25	0,069	kg			Rectangular area 80x22 mm	1,76E-03	5,00E-03	7850	1	$ 0,16
20	Paint		$ 10,00	3,52E-03	m^2								$ 0,04
												Sub Total	**$ 0,19**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Installation of the item 10 for laser cut	$ 1,30	Unit	1	from a single setup	0,5	$ 0,65
20	Laser Cut		$ 0,01	cm	18,8			$ 0,19
30	Machining Setup, Install and remove		$ 0,65	Unit	1	2 parts made from a single setup	0,5	$ 0,33
40	Machining	Tubing cavity	$ 0,04	cm^3	1	Material -Stee	3	$ 0,12
50	Aerosol Apply	To apply red paint	$ 5,25	m^2	3,52E-03			$ 0,02
							Sub Total	**$ 1,30**

Drawing : SU_03009

University	Ecole Centrale de Lyon		Back to BOM	**Car #**	81	**Part Cost**	$ 1,27
System	Suspension & Shocks	**FileLink1**	Drawing			**Qty**	1
Assembly	Upper Back A-arm	**FileLink2**		**FileLink1**			
Part	Rear up bracket	**FileLink3**		**FileLink2**		**Extended Cos**	$ 1,27
P/N Base	SU 03010			**FileLink3**			
Suffix	AA						
Details	This part is Welded on the frame						

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Mild (per kg)	Stock for the part	$ 2,25	0,027	kg			Rectangular area 31x22mm	6,82E-04	5,00E-03	7850	1	$ 0,06
20	Paint		$ 10,00	1,36E-03	m^2								$ 0,01
												Sub Total	**$ 0,07**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Installation item 10 for laser cut	$ 1,30	Unit	1	from a single setup	0,5	$ 0,65
20	Laser Cut		$ 0,01	cm	9,2			$ 0,09
30	Machining Setup, Install and remove		$ 0,65	Unit	1	2 parts made from a single setup	0,5	$ 0,33
40	Machining	Tubing cavity	$ 0,04	cm^3	1	Material -Stee	3	$ 0,12
50	Aerosol Apply	To apply red paint	$ 5,25	m^2	1,36E-03			$ 0,01
							Sub Total	**$ 1,19**

Drawing : SU_03010

University	Ecole Centrale de Lyon		Back to BOM	**Car #**	81	**Part Cost**	$ 1,38
System	Suspension & Shocks	**FileLink1**	Drawing			**Qty**	1
Assembly	Upper Back A-arm	**FileLink2**		**FileLink1**			
Part	Rear down bracket	**FileLink3**		**FileLink2**		**Extended Cos**	$ 1,38
P/N Base	SU 03011			**FileLink3**			
Suffix	AA						
Details	This part is Welded on the frame						

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Mild (per kg)	Stock for the part	$ 2,25	0,047	kg			Rectangular area 55x22 mm	1,21E-03	5,00E-03	7850	1	$ 0,11
20	Paint		$ 10,00	2,42E-03	m^2								$ 0,02
												Sub Total	**$ 0,13**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Installation of the item 10 for laser cut	$ 1,30	Unit	1	2 parts made from a single setup	0,5	$ 0,65
20	Laser Cut		$ 0,01	cm	14,0			$ 0,14
30	Machining Setup, Install and remove		$ 0,65	Unit	1	2 parts made from a single setup	0,5	$ 0,33
40	Machining	Tubing cavity	$ 0,04	cm^3	1	Material -Steel	3	$ 0,12
50	Aerosol Apply	To apply red paint	$ 5,25	m^2	2,42E-03			$ 0,01
							Sub Total	**$ 1,25**

Drawing : SU_03011

University	Ecole Centrale de Lyon
System	Suspension & Shocks
Assembly	Lower Back A-arm
P/N Base	SU A0400
Suffix	
Details	

Back to BOM

Car #	81
FileLink1	
FileLink2	
FileLink3	

Asm Cost	$ 83,30
Qty	2
Extended (	$ 166,61

ItemOrder	Part	Part Cost	Quantity	Sub Total
10	Lower Back Bearing Support	$ 8,95	1	$ 8,95
20	Inner Bearing Support	$ 1,87	2	$ 3,75
30	Lower Back A-arm tube (Front) Carbon Fiber Tube	$ 12,03	1	$ 12,03
40	Lower Back A-arm tube (Back) Carbon Fiber Tube	$ 7,41	1	$ 7,41
50	Spacer 1	$ 1,63	2	$ 3,26
60	Spacer 2	$ 0,81	4	$ 3,22
70	Outboard A-arm Insert	$ 0,48	2	$ 0,95
80	Front up bracket	$ 1,39	1	$ 1,39
90	Front down bracket	$ 1,38	1	$ 1,38
100	Rear up bracket	$ 1,81	1	$ 1,81
110	Rear down bracket	$ 1,90	1	$ 1,90
			Sub Total	$ 46,06

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Nam	Area	Length	Density	Quantity	Sub Total
10	Sperical bearing		$ 6,92	8	mm							3,00	$ 20,76
20	Adhesive	Glue for Ball Joint – Cost Included in Processes											$ -
30	Adhesive	Epoxy resin for Tube/insert assembly – Cost Included in Processes											$ -
												Sub Total	$ 20,76

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Hand Finish - Surface Preperation	Solvent degreasing on Upper Front Bearing Support	$ 0,02	cm²	8,66	Repeat 2	2	$ 0,35
20	Brush Apply	Glue applying on on Upper Front Bearing Support	$ 0,02	cm²	8,66	Repeat 2	2	$ 0,35
30	Hand Finish - Surface Preperation	Solvent degreasing on Outboard A-arm insert	$ 0,02	cm²	8,66	Repeat 2	2	$ 0,35
40	Assemble, 1kg, loose	Outboard A-arm Insert in Upper front bearing support	$ 0,06	Unit	1	Repeat 2	2	$ 0,12
50	Hand Finish - Surface Preperation	Solvent degreasing on Inner Bearing support	$ 0,02	cm²	12,43	Repeat 2	2	$ 0,50
60	Brush Apply	Glue applying on Inner Bearing support	$ 0,02	cm²	12,43	Repeat 2	2	$ 0,50
70	Hand Finish - Surface Preperation	Solvent degreasing on carbon tube	$ 0,02	cm²	12,43	Repeat 2	2	$ 0,50
80	Assemble, 1kg, loose	Inner Bearing support in Carbon Tube	$ 0,14	Unit	1	Repeat 2	2	$ 0,28
90	Hand Finish - Surface Preperation	Solvent degreasing on Outboard A-arm Insert	$ 0,02	cm²	12,43	Repeat 2	2	$ 0,50
100	Brush Apply	Glue applying on Outboard A-arm Inserts	$ 0,18	cm²	12,43	Repeat 2	2	$ 4,47
110	Hand Finish - Surface Preperation	Solvent degreasing on carbon tube	$ 0,02	cm²	12,43	Repeat 2	2	$ 0,50
120	Assemble, 1kg, loose	Outboard A-arm Insert in Carbon Tube with Inner Bearing support	$ 0,22	Unit	1	Repeat 2	2	$ 0,44
130	Hand Finish - Surface Preperation	Solvent degreasing on bearing bores	$ 0,02	cm²	4,01	Repeat 3	3	$ 0,24
140	Brush Apply	Glue applying on bearing bores	$ 0,02	cm²	4,01	Repeat 3	3	$ 0,24
150	Assemble, 1kg, loose	Bearing in Insert Bores	$ 0,30	Unit	1	Repeat 3	3	$ 0,90
160	Weld	Steel mounts welding	$ 0,15	cm²	22			$ 3,30
170	Aerosol Apply	Steel mounts painting	$ 5,25	m²	0,01			$ 0,05
180	Assemble, 1kg, loose	A-Arm Positionning	$ 0,14	Unit	1			$ 0,14
190	Assemble, 1kg, Line on line	Spacers installation	$ 0,13	Unit	4			$ 0,52
200	Assemble, 1kg, Line on line	Washers installation	$ 0,13	Unit	8			$ 1,04
210	Ratchet <= 25,4mm	M8 bolts installation	$ 0,13	Unit	2			$ 0,26
220	Reaction tool <=25,4mm	M8 nut blocking	$ 0,25	Unit	2			$ 0,50
							Sub Total	$ 16,03

ItemOrder	Fastener	Use	UnitCost	Size1	Unit1	Size2	Unit2	Quantity	Sub Total
10	Bolt, Grade 8,8 (SAE 5)	A-Arm Fixing Bolts on Frame Side	0,16	8	mm	40	mm	2	$ 0,32
20	Nut, Grade 8,8 (SAE 5)	A-Arm Fixing Nuts	0,04	8	mm			2	$ 0,09
30	Washer, Grade 8,8 (SAE 5)	A-Arm Fixing Washers	0,01	8	mm			4	$ 0,04
								Sub Total	$ 0,45

ItemOrder	Tooling	Use	UnitCost	Unit	Quantity	PVF	FractionIn	Sub Total

10	Welds - Welding Fixture	Welding processes	$ 500,00	point	8	3000	1	$ 1,33
							Sub Total	**$ 1,33**

University	Ecole Centrale de Lyon
System	Suspension & Shocks
Assembly	Lower Back A-arm
Part	Lower Back Bearing Support
P/N Base	SU 04001
Suffix	
Details	

Back to BOM

FileLink1	Drawing
FileLink2	
FileLink3	

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 8,95
Qty	1
Extended C	$ 8,95

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Aluminium, Premiu	Insert	$ 4,20					ar area	2,73E-03	1,60E-02	2712	1	$ 4,20
												Sub Total	$ 4,20

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove		$ 1,30	Unit	1			$ 1,30
20	Machining	Main shape contouring and top side machining	$ 0,04	cm^3	27	Material - Aluminium	1	$ 1,08
30	Change		$ 0,65	Unit	1			$ 0,65
40	Machining	First tube hole machining	$ 0,04	cm^3	2	Material - Aluminium	1	$ 0,09
50	Change		$ 0,65	Unit	1			$ 0,65
60	Machining	Second tube hole machining	$ 0,04	cm^3	2	Material - Aluminium	1	$ 0,09
70	Machining Setup, Change		$ 0,65	Unit	1			$ 0,65
80	Machining	Bottom side and hole machining	$ 0,04	cm^3	6	Material - Aluminium	1	$ 0,24
							Sub Total	$ 4,75

Drawing part : SU_04001

University	Ecole Centrale de Lyon			Back to BOM	**Car #**	81	**Part Cost** $ 1,87
System	Suspension & Shocks	**FileLink1**	Drawing				**Qty** 2
Assembly	Lower Back A-arm	**FileLink2**			**FileLink1**		
Part	Inner Bearing Support	**FileLink3**			**FileLink2**		**Extended Cos** $ 3,75
P/N Base	SU_04002				**FileLink3**		
Suffix							
Details							

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Aluminum, Premium	Stock materia	$ 4,20	0,204	Kg			Cylinder face area	1,26E-03	6E-02	2712	1,00	$ 0,86
												Sub Total	**$ 0,86**

0,0000
0,0000

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove		$ 1,30	Unit	1	16 parts from a single setup	0,0625	$ 0,08
20	Machining	Main shape machining	$ 0,04	cm^3	17	Aluminium	1	$ 0,68
30	Machining Setup, Change		$ 0,65	Unit	1	16 parts from a single setup	0,0625	$ 0,04
40	Machining	machining	$ 0,04	cm^3	2	Aluminium	1	$ 0,08
50	Machining Setup, Change		$ 0,65	Unit	1	16 parts from a single setup	0,0625	$ 0,04
60	Machining	Hole	$ 0,04	cm^3	2	Aluminium	1	$ 0,09
							Sub Total	**$ 1,01**

Drawing part : SU_04002

University	Ecole Centrale de Lyon			Back to BOM	**Car #**	81	**Part Cost** $ 12,03
System	Suspension & Shocks	**FileLink1**	Drawing				**Qty** 1
Assembly	Lower Back A-arm	**FileLink2**			**FileLink1**		
Part	Lower Back A-arm tube (Front) Carbon Fiber Tube	**FileLink3**			**FileLink2**		**Extended Cos** $ 12,03
P/N Base	SU_04003				**FileLink3**		
Suffix							
Details							

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Carbon Fiber, 1 Ply	Stock	$ 10,70	3,38E-05	m^3			tube face	8,79E-05	0,385	1580	1	$ 10,70
												Sub Total	**$ 10,70**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Lamination, Fillament Wirring	Tube Lamination	$ 25,00	kg	0,053			$ 1,34
							Sub Total	**$ 1,34**

University	Ecole Centrale de Lyon			Back to BOM	**Car #**	81	**Part Cost** $ 7,41
System	Suspension & Shocks	**FileLink1**	Drawing				**Qty** 1
Assembly	Lower Back A-arm	**FileLink2**			**FileLink1**		
Part	Lower Back A-arm tube (Back) Carbon Fiber Tube	**FileLink3**			**FileLink2**		**Extended Cos** $ 7,41
P/N Base	SU_04004				**FileLink3**		
Suffix							
Details							

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Carbon Fiber, 1 Ply	Stock	$ 6,58	2,08E-05	m^3			tube face	8,79E-05	0,237	1580	1	$ 6,58
												Sub Total	**$ 6,58**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Lamination, Fillament Wirring	Tube Lamination	$ 25,00	kg	0,033			$ 0,82
							Sub Total	**$ 0,82**

University	Ecole Centrale de Lyon			Back to BOM	**Car #**	81	**Part Cost** $ 1,63
System	Suspension & Shocks	**FileLink1**	Drawing				**Qty** 2
Assembly	Lower Back A-arm	**FileLink2**			**FileLink1**		
Part	Spacer 1	**FileLink3**			**FileLink2**		**Extended Cos** $ 3,26
P/N Base	SU_04005				**FileLink3**		
Suffix							
Details							

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Mild Steel	Stock material for part	$ 2,25	0,0123	Kg			Cylinder face	200,9600	7,800	7850	1,00	$ 0,03
												Sub Total	**$ 0,03**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Setup for machining	$ 1,30	unit	1			$ 1,30
20	Machining	Material removal	$ 0,04	cm^3	2,5	Steel	3	$ 0,30
							Sub Total	**$ 1,60**

Drawing part : SU_04005

University	Ecole Centrale de Lyon
System	Suspension & Shocks
Assembly	Lower Back A-arm
Part	Spacer 2
P/N Base	SU_04006
Suffix	
Details	

FileLink1	Drawing
FileLink2	
FileLink3	

Back to BOM

Car #	81

FileLink1
FileLink2
FileLink3

Part Cost	$ 0,81
Qty	4
Extended Cost	$ 3,22

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Mild (per kg)		$ 2,25	6,31E-02	Kg			Cylinder face	2,01E-04	4E-02	7850	1	$ 0,14
												Sub Total	**$ 0,14**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Setup for machining	$ 1,30	Unit	1	2 parts from a single setup	0,5	$ 0,65
20	Machining	Material removal	$ 0,04	cm^3	0,11	Material -Steel	3	$ 0,01
							Sub Total	**$ 0,66**

Drawing : SU_04006

University	Ecole Centrale de Lyon		Back to BOM	**Car #**	81	**Part Cost**	$ 0,48
System	Suspension & Shocks	**FileLink1**	Drawing			**Qty**	2
Assembly	Lower Back A-arm	**FileLink2**		**FileLink1**			
Part	Outboard A-arm Insert	**FileLink3**		**FileLink2**		**Extended Cos**	$ 0,95
P/N Base	SU_04007			**FileLink3**			
Suffix							
Details							

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Aluminium, Premium (per kg)	cylinder	$ 4,20	12	mm			Round area diam. 12mm	1,13E-04	0,060	2 710	1,00	$ 0,08
												Sub Total	**$ 0,08**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Saw or tubing cut		$ 0,40	cm	1			$ 0,40
							Sub Total	**$ 0,40**

Drawing part : SU_04007

Vue isométrique
Echelle : 1:1

Vue de face
Echelle : 1:1

University	Ecole Centrale de Lyon			Back to BOM	**Car #**	81	**Part Cost**	$	1,39
System	Suspension & Shocks	**FileLink1**	Drawing				**Qty**		1
Assembly	Lower Back A-arm	**FileLink2**			**FileLink1**				
Part	Front up bracket	**FileLink3**			**FileLink2**		**Extended Cos**	$	1,39
P/N Base	SU 04008				**FileLink3**				
Suffix	AA								
Details	This part is Welded on the frame								

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Mild (per kg)	Stock for the part	$ 2,25	0,047	kg			Rectangular area 50x22mm	1,20E-03	5,00E-03	7850	1	$ 0,11
20	Paint		$ 10,00	2,40E-03	m^2								$ 0,02
												Sub Total	**$ 0,13**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Installation of the item 10 for laser	$ 1,30	Unit	1	2 parts made from a single setup	0,5	$ 0,65
20	Laser Cut		$ 0,01	cm	15,3			$ 0,15
30	Machining Setup, Install and remove		$ 0,65	Unit	1	2 parts made from a single setup	0,5	$ 0,33
40	Machining	Tubing cavity	$ 0,04	cm^3	1	Material -Steel	3	$ 0,12
50	Aerosol Apply	To apply red paint	$ 5,25	m^2	2,40E-03			$ 0,01
							Sub Total	**$ 1,26**

Drawing part : SU_04008

University	Ecole Centrale de Lyon		Back to BOM	**Car #**	81	**Part Cost**	$ 1,38
System	Suspension & Shocks	**FileLink1**	Drawing			**Qty**	1
Assembly	Lower Back A-arm	**FileLink2**		**FileLink1**			
Part	Front down bracket	**FileLink3**		**FileLink2**		**Extended Cost**	$ 1,38
P/N Base	SU 04009			**FileLink3**			
Suffix	AA						
Details	This part is Welded on the frame						

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Mild (per kg)	Stock for the part	$ 2,25	0,048	kg			Rectangular area 51x22mm	1,22E-03	5,00E-03	7850	1	$ 0,11
20	Paint		$ 10,00	2,45E-03	m^2								$ 0,02
												Sub Total	**$ 0,13**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Installation of the item 10 for laser cut	$ 1,30	Unit	1	2 parts made from a single setup	0,5	$ 0,65
20	Laser Cut		$ 0,01	cm	14,1			$ 0,14
30	Machining Setup, Install and remove		$ 0,65	Unit	1	2 parts made from a single setup	0,5	$ 0,33
40	Machining	Tubing cavity	$ 0,04	cm^3	1	Material -Steel	3	$ 0,12
50	Aerosol Apply	To apply red paint	$ 5,25	m^2	2,45E-03			$ 0,01
							Sub Total	**$ 1,25**

Drawing : SU_04009

University	Ecole Centrale de Lyon		Back to BOM	**Car #**	81	**Part Cost**	$ 1,81
System	Suspension & Shocks	**FileLink1**	Drawing			**Qty**	1
Assembly	Lower Back A-arm	**FileLink2**		**FileLink1**			
Part	Rear up bracket	**FileLink3**		**FileLink2**		**Extended Cos**	$ 1,81
P/N Base	SU 04010			**FileLink3**			
Suffix	AA						
Details	This part is Welded on the frame						

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Mild (per kg)	Stock for the part	$ 2,25	0,107	kg			Rectangular area 72x38mm	2,74E-03	5,00E-03	7850	1	$ 0,24
20	Paint		$ 10,00	5,47E-03	m^2								$ 0,05
												Sub Total	**$ 0,30**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Installation of the item 10 for laser cut	$ 1,30	Unit	1	2 parts made from a single setup	0,5	$ 0,65
20	Laser Cut		$ 0,01	cm	27,3			$ 0,27
30	Machining Setup, Install and remove		$ 0,65	Unit	1	2 parts made from a single setup	0,5	$ 0,33
40	Machining	Tubing cavity	$ 0,04	cm^3	2	Material -Steel	3	$ 0,24
50	Aerosol Apply	To apply red paint	$ 5,25	m^2	5,47E-03			$ 0,03
							Sub Total	**$ 1,52**

Drawing : SU_04010

University	Ecole Centrale de Lyon		Back to BOM	**Car #**	81	**Part Cost**	$ 1,90
System	Suspension & Shocks	**FileLink1**	Drawing			**Qty**	1
Assembly	Lower Back A-arm	**FileLink2**		**FileLink1**			
Part	Rear down bracket	**FileLink3**		**FileLink2**		**Extended Cos**	$ 1,90
P/N Base	SU 04011			**FileLink3**			
Suffix	AA						
Details	This part is Welded on the frame						

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Mild (per kg)	Stock for the part	$ 2,25	0,130	kg			Rectangular area 72x46mm	3,31E-03	5,00E-03	7850	1	$ 0,29
20	Paint		$ 10,00	6,62E-03	m^2								$ 0,07
												Sub Total	**$ 0,36**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install a	Installation of the item 10 for laser cut	$ 1,30	Unit	1	2 parts made from a single setup	0,5	$ 0,65
20	Laser Cut		$ 0,01	cm	29,3			$ 0,29
30	Machining Setup, Install and remove		$ 0,65	Unit	1	2 parts made from a single setup	0,5	$ 0,33
40	Machining	Tubing cavity	$ 0,04	cm^3	2	Material -Steel	3	$ 0,24
50	Aerosol Apply	To apply red paint	$ 5,25	m^2	6,62E-03			$ 0,03
							Sub Total	**$ 1,54**

Drawing : SU_04011

University	Ecole Centrale de Lyon
System	Suspension & Shocks
Assembly	Front suspension
P/N Base	SU A0500
Suffix	AA
Details	Front suspension, right and left are symetric

Back to BOM

Car #	81
FileLink1	
FileLink2	
FileLink3	

Asm Cost	$ 338,62
Qty	2
Extended C	$ 677,24

ItemOrder	Part	Part Cost	Quantity	Sub Total
10	Shock Front Bracket	$ 5,92	1	$ 5,92
			Sub Total	$ 5,92

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Damper Öhlins TTX25 MkII		$ 305,00		unit							1	$ 305,00
20	Spring		$ 25,00		unit							1	$ 25,00
30	Bushing, Student Built		$ -		unit							2	$ -
40	Paint	Shock Front Bracket red paint	$ 10,00	0,004	m^2							1	$ 0,04
												Sub Total	$ 330,04

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Weld - Round Tubing	Weldind shock front bracket with the frame	0,38	cm	3,4			$ 1,29
20	Aerosol apply	Painting the suspension mount	$ 5,25	m^2	0,004			$ 0,02
30	Assemble, 1 kg, Loose	Insert the spring in the damper	$ 0,06	unit	1			$ 0,06
40	Wrench > 25.4 mm	Wrench the spring in the damper	$ 2,00	unit	1			$ 2,00
50	Assemble, 1kg, Loose	Insert the bushings in the damper extremity	$ 0,06	unit	1			$ 0,06
60	Assemble, 1kg, Loose	Put the damper in place	$ 0,06	unit	1			$ 0,06
70	Hand - Start Only	Bolt damper to shock front bracket	$ 0,12	unit	1			$ 0,12
80	Hand - Start Only	Put the nuts into the bolts	$ 0,12	unit	1			$ 0,12
90	Ratchet <= 25.4 mm	Thighten the M8 nuts	$ 0,75	unit	1			$ 0,75
100	Reaction tool <= 25.4 mm	Thighten the M8 nuts	$ 0,25	unit	1			$ 0,25
							Sub Total	$ 2,12

ItemOrder	Fastener	Use	UnitCost	Size1	Unit1	Size2	Unit2	Quantity	Sub Total
10	Bolt,Grade 8.8 (SAE)	Bolt Damper Öhlins TTX25 MkII on Shock Front Bracket	$ 0,14	8	mm	35	mm	1	$ 0,14
20	Washer, Grade 8.8 (SAE 5)	Bolt Damper Öhlins TTX25 MkII on Shock Front Bracket	$ 0,01	8	mm			2	$ 0,02
30	Nut, Grade 8.8 (SAE 5)	Bolt Damper Öhlins TTX25 MkII on Shock Front Bracket	$ 0,04	8	mm			1	$ 0,04
								Sub Total	$ 0,20

ItemOrder	Tooling	Use	UnitCost	Unit	Quantity	PVF	FractionIn	Sub Total
10	Welds - Welding Fixture	Welding of the mount	$ 500,00	point	2	3000	1	$ 0,33
							Sub Total	$ 0,33

University	Ecole Centrale de Lyon		Back to BOM	**Car #**	81	**Part Cost**	$ 5,92
System	Suspension & Shocks	**FileLink1**	Drawing			**Qty**	1
Assembly	Front suspension	**FileLink2**		**FileLink1**			
Part	Shock Front Bracket	**FileLink3**		**FileLink2**		**Extended C**	$ 5,92
P/N Base	SU 05001			**FileLink3**			
Suffix	AA						
Details	Suspension bracket						

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Mild	Raw material	$ 2,25	0,172	kg			circle area pi*0,0155²	0,00075	0,029	7 850	1,00	$ 0,39
												Sub Total	**$ 0,39**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Setup for machining	$ 1,30	unit	1			$ 1,30
20	Machining	Material Removal	$ 0,04	cm^3	2,6	Material-Steel	3	$ 0,32
30	Machining Setup, change		$ 0,65		1			$ 0,65
40	Machining	Material Removal	$ 0,04	cm^3	9,2	Material-Steel	3	$ 1,10
50	Machining Setup, change		$ 0,65		1			$ 0,65
60	Machining	Material Removal	$ 0,04	cm^3	6,8	Material-Steel	3	$ 0,82
70	Drilled holes < 25.4 mm dia.	Material Removal	$ 0,35	hole	2,0			$ 0,70
							Sub Total	**$ 5,54**

Drawing part : SU_05001

University	Ecole Centrale de Lyon
System	Suspension & Shocks
Assembly	Front Bell Crank
P/N Base	SU A0600
Suffix	AA
Details	Front rocker, right and left are symetric

Back to BOM

Car #	81

FileLink1
FileLink2
FileLink3

Asm Cost	$ 12,86
Qty	2
Extended C	$ 25,71

ItemOrder	Part	Part Cost	Quantity	Sub Total
10	Rocker bushing	$ 1,37	2	$ 2,74
20	Rocker spacer	$ 1,54	1	$ 1,54
30	Sheets of metal for rocker	$ 0,88	2	$ 1,76
40	Front rocker mount	$ 2,27	2	$ 4,54
			Sub Total	**$ 10,59**

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Paint	Rocker mount red paint	$ 10,00	0,003	m^2							1	$ 0,03
20	Paint	Rocker black paint	$ 10,00	0,006	m^2							1	$ 0,06
												Sub Total	**$ 0,09**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Weld	Welding the rocker mount on the chassis	$ 0,15	cm	10			$ 1,50
20	Aerosol apply	Painting the rocker mount in red	$ 5,25	m^2	0,006			$ 0,03
30	Aerosol apply	Painting the rocker in black	$ 5,25	m^2	0,012			$ 0,06
40	Assemble, 1kg, loose	Insert 2 busher into the rocker and the rocker spacer	$ 0,06	unit	1			$ 0,06
50	Assemble, 1kg, loose	Put the previous assembly in place	$ 0,06	unit	1			$ 0,06
60	Assemble, 1kg, loose	Put the washers of the rocker in place	$ 0,06	unit	1			$ 0,06
70	Hand - Start Only	Bolt rocker into rocker mount	$ 0,12	unit	1			$ 0,12
80	Hand - Start Only	Put the nuts into the bolt	$ 0,12	unit	1			$ 0,12
90	Ratchet <= 25.4 mm	Thighten the M8 nuts	$ 0,75	unit	1			$ 0,75
100	Reaction tool <= 25.4 mm	Thighten the M8 nuts	$ 0,25	unit	1			$ 0,25
							Sub Total	**$ 1,59**

ItemOrder	Fastener	Use	UnitCost	Size1	Unit1	Size2	Unit2	Quantity	Sub Total
10	Bolt,Grade 8.8 (SAE)	Bolt rocker on its mount	$ 0,19	8	mm	45	mm	1	$ 0,19
20	Washer, Grade 8.8 (SAE 5)	Bolt rocker on its mount	$ 0,01		unit			2	$ 0,02
30	Nut, Grade 8.8 (SAE 5)	Bolt rocker on its mount	$ 0,04	8	mm			1	$ 0,04
								Sub Total	**$ 0,25**

ItemOrder	Tooling	Use	UnitCost	Unit	Quantity	PVF	FractionInc	Sub Total
10	Welds - Welding Fixture	Welding process for rocker mount	$ 500,00	point	2	3000	1	$ 0,33
							Sub Total	**$ 0,33**

University	Ecole Centrale de Lyon		Back to BOM	**Car #**	81	**Part Cost**	$ 1,37
System	Suspension & Shocks	**FileLink1**				**Qty**	2
Assembly	Front Bell Crank	**FileLink2**		**FileLink1**			
Part	Rocker bushing	**FileLink3**		**FileLink2**		**Extended Cos**	$ 2,74
P/N Base	SU 06001			**FileLink3**			
Suffix	AA						
Details							

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Plastic, Flouropolymers	Stock material for bushings	$ 3,30	0,014	kg			Round area, diameter 15 mm	1,77E-04	0,009	8500	1	$ 0,05
												Sub Total	**$ 0,05**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove		$ 1,30	unit	1			$ 1,30
20	Machining (turning)	Machining removal	$ 0,04	cm^3	1,25	Material - Plastic	0,5	$ 0,03
							Sub Total	**$ 1,33**

University	Ecole Centrale de Lyon		Back to BOM	**Car #**	81	**Part Cost**	$ 1,54
System	Suspension & Shocks	**FileLink1**				**Qty**	1
Assembly	Front Bell Crank	**FileLink2**		**FileLink1**			
Part	Rocker spacer	**FileLink3**		**FileLink2**		**Extended Cost**	$ 1,54
P/N Base	SU 06002			**FileLink3**			
Suffix	AA						
Details							

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Mild	Raw material	$ 2,25	0,024	kg			Round area, diameter 14 mm	1,54E-04	0,020	7850	1	$ 0,05
												Sub Total	**$ 0,05**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove		$ 1,30	unit	1			$ 1,30
20	Machining (turning)	Machining removal	$ 0,04	cm^3	1,57	Material - Steel	3	$ 0,19
							Sub Total	**$ 1,49**

University	Ecole Centrale de Lyon		Back to BOM	**Car #**	81	**Part Cost**	$ 0,88
System	Suspension & Shocks	**FileLink1**	Drawing			**Qty**	2
Assembly	Front Bell Crank	**FileLink2**		**FileLink1**			
Part	Sheet of metal for the rocker	**FileLink3**		**FileLink2**		**Extended Cos**	$ 1,76
P/N Base	SU 06003			**FileLink3**			
Suffix	AA						
Details							

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Mild	Material for rocker	$ 2,25	0,17662500	kg			Rectangular sheet 125*65 mm^2	0,00750000	0,003	7 850	1,00	$ 0,40
												Sub Total	**$ 0,40**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining setup, install and remove	Insert and remove parts from laser	$ 1,30	unit	1	4 parts made from a single machine setup	0,25	$ 0,33
20	Laser cut	Cutting the sheets	$ 0,01	cm	5,3	Material - Steel	3	$ 0,16
							Sub Total	**$ 0,48**

Drawing part: SU_06003

University	Ecole Centrale de Lyon		Back to BOM	**Car #**	81	**Part Cost**	$ 2,27
System	Suspension & Shocks	**FileLink1**				**Qty**	2
Assembly	Front Bell Crank	**FileLink2**		**FileLink1**			
Part	Front rocker mount	**FileLink3**		**FileLink2**		**Extended Cos**	$ 4,54
P/N Base	SU 06004			**FileLink3**			
Suffix	AA						
Details							

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Mild	Raw material	$ 2,25	0,051	kg			Rectangular sheet 50*26 mm^2	1,30E-03	0,005	7850	1	$ 0,11
												Sub Total	**$ 0,11**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining setup, install and remove	Insert and remove parts from laser	$ 1,30	unit	1	4 parts made from a single machine setup	0,25	$ 0,33
20	Laser cut	Cutting the sheets	$ 0,01	cm	16	Material - Steel	3	$ 0,48
30	Machining Setup, Install and remove		$ 1,30	unit	1			$ 1,30
40	Machining	Machining removal	$ 0,04	cm^3	0,42	Material - Steel	3	$ 0,05
							Sub Total	**$ 2,16**

University	Ecole Centrale de Lyon
System	Suspension & Shocks
Assembly	Rear suspension
P/N Base	SU A0700
Suffix	AA
Details	Rear suspension, right and left are symetric

Back to BOM

Car #	81
FileLink1	
FileLink2	
FileLink3	

Asm Cost	$ 340,94
Qty	2
Extended C	$ 681,89

ItemOrder	Part	Part Cost	Quantity	Sub Total
10	Shock Rear Bracket	$ 5,92	1	$ 5,92
			Sub Total	**$ 5,92**

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Damper Öhlins TTX25 MkII		$ 305,00		unit							1	$ 305,00
20	Spring		$ 25,00		unit							1	$ 25,00
30	Bushing, Student Built		$ -		unit							2	$ -
40	Paint	Shock rear Bracket red paint	$ 10,00	0,004	m^2							1	$ 0,04
												Sub Total	**$ 330,04**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multipli	Mult. Val.	Sub Total
10	Weld - Round Tubing	Weldind shock rear bracket with the frame	0,38	cm	3,4			$ 1,29
20	Aerosol apply	Painting the suspension bracket	$ 5,25	m^2	0,004			$ 0,02
30	Assemble, 1 kg, Loose	Insert the spring in the damper	$ 0,06	unit	2			$ 0,12
40	Wrench > 25.4 mm	Wrench the spring in the damper	$ 2,00	unit	2			$ 4,00
50	Assemble, 1kg, Loose	Insert the bushings in the damper extremity	$ 0,06	unit	2			$ 0,12
60	Assemble, 1kg, Loose	Put the damper in place	$ 0,06	unit	2			$ 0,12
70	Hand - Start Only	Bolt damper to shock rear bracket	$ 0,12	unit	2			$ 0,24
80	Hand - Start Only	Put the nuts into the bolts	$ 0,12	unit	2			$ 0,24
90	Ratchet <= 25.4 mm	Thighten the M8 nuts	$ 0,75	unit	2			$ 1,50
100	Reaction tool <= 25.4 mm	Thighten the M8 nuts	$ 0,25	unit	2			$ 0,50
							Sub Total	**$ 4,24**

ItemOrder	Fastener	Use	UnitCost	Size1	Unit1	Size2	Unit2	Quantity	Sub Total
10	Bolt,Grade 8.8 (SAE)	Bolt Damper Öhlins TTX25 MkII on Shock rear Bracket	$ 0,14	8	mm	35	mm	2	$ 0,28
20	Washer, Grade 8.8 (SAE 5)	Bolt Damper Öhlins TTX25 MkII on Shock rear Bracket	$ 0,01	8	mm			4	$ 0,04
30	Nut, Grade 8.8 (SAE 5)	Bolt Damper Öhlins TTX25 MkII on Shock rear Bracket	$ 0,04	8	mm			2	$ 0,09
								Sub Total	**$ 0,41**

ItemOrder	Tooling	Use	UnitCost	Unit	Quantity	PVF	FractionInclu	Sub Total
10	Welds - Welding Fixture	Welding of the mounts	$ 500,00	point	2	3000	1	$ 0,33
							Sub Total	**$ 0,33**

University	Ecole Centrale de Lyon		Back to BOM	**Car #**	81	**Part Cost**	$ 5,92
System	Suspension & Shocks	**FileLink1**	Drawing			**Qty**	1
Assembly	Rear suspension	**FileLink2**		**FileLink1**			
Part	Shock rear Bracket	**FileLink3**		**FileLink2**		**Extended C**	$ 5,92
P/N Base	SU 07001			**FileLink3**			
Suffix	AA						
Details	Suspension bracket						

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Mild	Raw material	$ 2,25	0,172	kg			circle area pi*0,0155²	0,00075	0,029	7 850	1,00	$ 0,39
												Sub Total	**$ 0,39**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Ins	Setup for machining	$ 1,30	unit	1			$ 1,30
11	Machining	Material Removal	$ 0,04	cm^3	2,6	Material-Steel	3	$ 0,32
20	Machining Setup, change		$ 0,65		1			$ 0,65
21	Machining	Material Removal	$ 0,04	cm^3	9,2	Material-Steel	3	$ 1,10
22	Machining Setup, change		$ 0,65		1			$ 0,65
23	Machining	Material Removal	$ 0,04	cm^3	6,8	Material-Steel	3	$ 0,82
30	Drilled holes < 25.4 m	Material Removal	$ 0,35	hole	2,0			$ 0,70
							Sub Total	**$ 5,54**

Drawing part : SU_07001

University	Ecole Centrale de Lyon
System	Suspension & Shocks
Assembly	Rear Bell Crank
P/N Base	SU A0800
Suffix	AA
Details	Rear rocker, right and left are symetric

Back to BOM

Car #	81
FileLink1	
FileLink2	
FileLink3	

Asm Cost	$ 15,07
Qty	2
Extended (	$ 30,13

ItemOrder	Part	Part Cost	Quantity	Sub Total
10	Rocker bushing	$ 1,37	2	$ 2,74
20	Sheets of metal for rocker	$ 2,06	2	$ 4,13
30	Rear rocker mount	$ 3,38	1	$ 3,38
			Sub Total	$ 10,25

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Nam	Area	Length	Density	Quantity	Sub Total
10	Paint	Rocker mount red paint	$ 10,00	0,005	m^2							2	$ 0,10
20	Paint	Rocker black paint	$ 10,00	0,005	m^2							2	$ 0,10
												Sub Total	$ 0,20

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Weld	Welding the rocker mount on the chassis	$ 0,15	cm	23			$ 3,45
20	Aerosol apply	Painting the rocker mount in red	$ 5,25	m^2	0,005			$ 0,03
30	Aerosol apply	Painting the rocker in black	$ 5,25	m^2	0,005			$ 0,03
40	Assemble, 1kg, loose	Insert the busher into the rocker mount	$ 0,06	unit	2			$ 0,12
50	Assemble, 1kg, loose	Put each part of the rocker in place	$ 0,06	unit	2			$ 0,12
60	Assemble, 1kg, loose	Put the washers of the rocker in place	$ 0,06	unit	2			$ 0,12
70	Hand - Start Only	Bolt rocker into rocker mount	$ 0,12	unit	1			$ 0,12
80	Hand - Start Only	Put the nuts into the bolt	$ 0,12	unit	1			$ 0,12
90	Ratchet <= 25.4 mm	Thighten the M8 nuts	$ 0,75	unit	1			$ 0,75
100	Reaction tool <= 25.4 mm	Thighten the M8 nuts	$ 0,25	unit	1			$ 0,25
							Sub Total	$ 3,50

ItemOrder	Fastener	Use	UnitCost	Size1	Unit1	Size2	Unit2	Quantity	Sub Total
10	Bolt,Grade 8.8 (SAE)	Bolt rocker on its mount	$ 0,07	6	mm	30	mm	1	$ 0,07
20	Washer, Grade 8.8 (SAE 5)	Bolt rocker on its mount	$ 0,01		unit			2	$ 0,02
30	Nut, Grade 8.8 (SAE 5)	Bolt rocker on its mount	$ 0,03	6	mm			1	$ 0,03
								Sub Total	$ 0,12

ItemOrder	Tooling	Use	UnitCost	Unit	Quantity	PVF	FractionIn	Sub Total
10	Welds - Welding Fixture	Welding process for rocker mount	$ 500,00	point	6	3000	1	$ 1,00
							Sub Total	$ 1,00

University	Ecole Centrale de Lyon		Back to BOM	**Car #**	81	**Part Cost**	$ 1,37
System	Suspension & Shocks	**FileLink1**				**Qty**	2
Assembly	Rear Bell Crank	**FileLink2**		**FileLink1**			
Part	Rocker bushing	**FileLink3**		**FileLink2**		**Extended Cos**	$ 2,74
P/N Base	SU 08001			**FileLink3**			
Suffix	AA						
Details							

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Plastic, Flouropolymers	Stock material for bushings	$ 3,30	0,014	kg			Round area, diameter 15 mm	1,77E-04	0,009	8500	1	$ 0,05
												Sub Total	**$ 0,05**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove		$ 1,30	unit	1			$ 1,30
20	Machining (turning)	Machining removal	$ 0,04	cm^3	1,25	Material - Plastic	0,5	$ 0,03
							Sub Total	**$ 1,33**

University	Ecole Centrale de Lyon		Back to BOM	**Car #**	81	**Part Cost**	$ 2,06
System	Suspension & Shocks	**FileLink1**	Drawing			**Qty**	2
Assembly	Rear Bell Crank	**FileLink2**		**FileLink1**			
Part	Sheet of metal for the rocker	**FileLink3**		**FileLink2**		**Extended Cos**	$ 4,13
P/N Base	SU 08002			**FileLink3**			
Suffix	AA						
Details							

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Mild	Material for rocker	$ 2,25	1,53E-01	kg			Rectangular sheet 100*65 mm^2	0,00650000	0,003	7 850	1,00	$ 0,34
												Sub Total	**$ 0,34**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining setup, install and remove	Insert and remove parts from laser	$ 1,30	unit	1	4 parts made from a single machine setup	0,25	$ 0,33
20	Laser cut	Cutting the sheets	$ 0,01	cm	46,5	Material - Steel	3	$ 1,40
							Sub Total	**$ 1,72**

Drawing part: SU_08002

University	Ecole Centrale de Lyon		Back to BOM	**Car #**	81	**Part Cost**	$ 3,38
System	Suspension & Shocks	**FileLink1**				**Qty**	1
Assembly	Rear Bell Crank	**FileLink2**		**FileLink1**			
Part	Rear rocker mount	**FileLink3**		**FileLink2**		**Extended Cost**	$ 3,38
P/N Base	SU 08003			**FileLink3**			
Suffix	AA						
Details							

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Mild	Raw material	$ 2,25	0,364	kg			Rectangular sheet 58*50 mm^2	2,90E-03	0,016	7850	1	$ 0,82
												Sub Total	**$ 0,82**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining setup, install and remove	Insert and remove parts from laser	$ 1,30	unit	1	2 parts made from a single machine setup	0,5	$ 0,65
20	Laser cut	Cutting the sheets	$ 0,01	cm	20	Material - Steel	3	$ 0,60
30	Machining Setup, Install and remove		$ 1,30	unit	1			$ 1,30
40	Machining	Machining removal	$ 0,04	cm^3	0,07	Material - Steel	3	$ 0,01
							Sub Total	**$ 2,56**

University	Ecole Centrale de Lyon
System	Suspension & Shocks
Assembly	Rear Tie rod
P/N Base	SU A0900
Suffix	AA
Details	Rear tie rod, right and left are symetric

Back to BOM

Car #	81
FileLink1	
FileLink2	
FileLink3	

Asm Cost	#NOM?
Qty	2
Extended	#NOM?

ItemOrder	Part	Part Cost	Quantity	Sub Total
10	Pullrod tube	$ 9,07	1	$ 9,07
20	Pullrod insert	$ 1,58	2	$ 3,17
30	Spacer 1	$ 1,06	2	$ 2,13
40	Spacer 2	$ 0,24	2	$ 0,48
			Sub Total	$ 14,84

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Rod End, Industrial	Right-hand rod end for pushrod extremities	$ 2,50	8	mm			Balls Diameter				1	$ 2,50
20	Rod End, Industrial	Left-hand rod end for pushrod extremities	$ 2,50	8	mm			Balls Diameter				1	$ 2,50
												Sub Total	$ 5,00

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Hand Finish - Surface Preperation	Solvent degreasing on carbon tube	$ 0,02	cm²	6,6		1	$ 0,13
20	Hand Finish - Surface Preperation	Solvent degreasing on insert	$ 0,02	cm²	6,6		1	$ 0,13
30	Brush apply	Glue insert to pushrod tube	$ 0,02	cm^2	6,6		1	$ 0,13
40	Hand - Start Only	Put a nut on the rod end	$ 0,12	unit	2		1	$ 0,24
50	Hand, Loose <= 25.4 mm	Screwing by hand the rod end in the pullrod insert	$ 0,50	unit	2		1	$ 1,00
60	Wrench <= 25.4 mm	Thighten the M8 nuts	$ 1,50	unit	2		1	$ 3,00
70	Reaction tool <= 25.4 mm	Thighten the M8 nuts	$ 0,25	unit	2		1	$ 0,50
80	Assemble, 1kg, Loose	Put the spacers of the rocker in place	$ 0,06	unit	2		1	$ 0,12
90	Assemble, 1kg, Loose	Put the washers of the rocker in place	$ 0,06	unit	2		1	$ 0,12
100	Hand - Start Only	Bolt pullrod into the rocker	$ 0,12	unit	1		1	$ 0,12
110	Assemble, 1kg, Loose	Put the spacers of the A-arm in place	$ 0,06	unit	2		1	$ 0,12
120	Assemble, 1kg, Loose	Put the washers of the A-arm in place	$ 0,06	unit	2		1	$ 0,12
130	Hand - Start Only	Bolt pullrod into the A-Arm	$ 0,12	unit	1		1	$ 0,12
140	Hand - Start Only	Put the nuts into the bolts	$ 0,12	unit	2		1	$ 0,24
150	Ratchet <= 25.4 mm	Thighten the M8 nuts	$ 0,75	unit	2		1	$ 1,50
160	Reaction tool <= 25.4 mm	Thighten the M8 nuts	$ 0,25	unit	2		1	$ 0,50
							Sub Total	$ 8,10

ItemOrder	Fastener	Use	UnitCost	Size1	Unit1	Size2	Unit2	Quantity	Sub Total
10	Bolt,Grade 8.8 (SAE)	Pullrod to rocker fixing bolt	$ 0,19	8	mm	45	mm	1	$ 0,19
20	Bolt,Grade 8.8 (SAE)	Pullrod to A-arm fixing bolt	$ 0,19	8	mm	45	mm	1	$ 0,19
30	Washer, Grade 8.8 (SAE 5)		$ 0,01	8	unit			4	$ 0,04
40	Nut, Grade 8.8 (SAE 5)	To tighten the rod ends	$ 0,03	6	mm			2	$ 0,06
50	Nut, Grade 8.8 (SAE 5)	To tighten the bolts	$ 0,04	8	mm			2	$ 0,09
								Sub Total	$ 0,56

University	Ecole Centrale de Lyon		Back to BOM	**Car #**	81	**Part Cost**	$ 9,07
System	Suspension & Shocks	**FileLink1**				**Qty**	1
Assembly	Rear Tie rod	**FileLink2**		**FileLink1**			
Part	Tie rod tube	**FileLink3**		**FileLink2**		**Extended Cost**	$ 9,07
P/N Base	SU 09001			**FileLink3**			
Suffix	AA						
Details							

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Carbon fiber, 1 Ply	Stock material	$ 200,00	0,040	kg			Round area, diameter 16x2 mm	8,80E-05	0,290	1580	1	$ 8,06
												Sub Total	**$ 8,06**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Lamination, Filament Wirring	Tube lamination	$ 25,00	kg	0,040			$ 1,01
							Sub Total	**$ 1,01**

University	Ecole Centrale de Lyon		Back to BOM	**Car #**	81	**Part Cost**	$ 1,58
System	Suspension & Shocks	**FileLink1**	Drawing			**Qty**	2
Assembly	Rear Tie rod	**FileLink2**		**FileLink1**			
Part	Tie rod insert	**FileLink3**		**FileLink2**		**Extended Cos**	$ 3,17
P/N Base	SU 09002			**FileLink3**			
Suffix	AA						
Details							

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Aluminium, Premium (per kg)	cylinder	$ 4,20	0,07	kg			Round area diam. 18mm	2,54E-04	3,50E-02	7 850,00	1	$ 0,29
												Sub Total	**$ 0,29**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Setup for machining and removal	$ 1,30	Unit	1	8 parts from a single machine setup (pushrod insert)	0,125	$ 0,16
20	Machining	Material removal - side view profile	$ 0,04	cm^3	5,5	Material - Steel	3	$ 0,66
30	Machining setup, change	Setup for machining process	$ 0,65	Unit	1	8 parts from a single machine setup (pushrod insert)	0,125	$ 0,08
40	Machining	Material removal	$ 0,04	cm^3	0,3	Material - Steel	3	$ 0,04
50	Tapping Holes	Rod End emplacement	$ 0,35	hole	1		1	$ 0,35
							Sub Total	**$ 1,29**

Drawing : SU_09002

University	Ecole Centrale de Lyon
System	Suspension & Shocks
Assembly	Rear Tie rod
Part	Spacer 1
P/N Base	SU 09003
Suffix	AA
Details	

FileLink1	Drawing
FileLink2	
FileLink3	

Back to BOM

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 0,24
Qty	2
Extended Cos	$ 0,48

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Mild	Material for Part	$ 2,25	0,0253	kg			Cylindrical 16 mm diameter	8,04E-04	4,00E-03	7 850	1,00	$ 0,06
												Sub Total	**$ 0,06**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining setup, install and remove		$ 1,30	unit	1	Same as SU_0*_006 (*=1,...,4)	2,94E-02	$ 0,04
20	Machining		$ 0,04	cm^3	1,2	Material - Steel	3	$ 0,14
							Sub Total	**$ 0,18**

Drawing : SU_09003

University	Ecole Centrale de Lyon
System	Suspension & Shocks
Assembly	Rear Tie rod
Part	Spacer 2
P/N Base	SU 09004
Suffix	AA
Details	

FileLink1	Drawing
FileLink2	
FileLink3	

Back to BOM

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 1,06
Qty	2
Extended Cos	$ 2,13

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Mild	Material for Part	$ 2,25	0,0505	kg			Cylindrical 16 mm diameter	8,04E-04	8,00E-03	7 850	1,00	$ 0,11
												Sub Total	**$ 0,11**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining setup, install and remove		$ 1,30	unit	1	2 parts made from a single machine setup	0,5	$ 0,65
20	Machining		$ 0,04	cm^3	2,5	Material - Steel	3	$ 0,30
							Sub Total	**$ 0,95**

Drawing : SU_09004

University	Ecole Centrale de Lyon
System	Wheels & Tires
Assembly	Front Uprights
P/N Base	SU A1000
Suffix	AA
Details	Assembly of a part of the wheel with the uprights

Back to BOM

Car #	81
FileLink1	
FileLink2	
FileLink3	

Asm Cost	$ 151,09
Qty	2
Extended C	$ 302,18

ItemOrder	Part	Part Cost	Quantity	Sub Total
10	Front Upright	$ 106,19	1	$ 106,19
20	Upper Arm Wedge	$ 2,51	1	$ 2,51
30	Upper Arm Bracket	$ 18,68	1	$ 18,68
40	Speed Sensor Brakcet	$ 0,84	1	$ 0,84
50	Camber adjustment shim	$ 0,43	15	$ 6,40
			Sub Total	**$ 134,61**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Assemble, 3kg, Interference	Assemble upright with hub	$ 0,56	unit	1		1	$ 0,56
20	Assemble, 1 kg, Line-on-Line	Assemble Upper arm wedge with upright	$ 0,13	unit	1		1	$ 0,13
30	Assemble, 1 kg, Line-on-Line	Assemble camber adjustment shim with upright	$ 0,13	unit	1		1	$ 0,13
40	Assemble, 1 kg, Line-on-Line	Assemble Upper arm bracket with upright	$ 0,13	unit	1		1	$ 0,13
50	Ratchet <= 25.4 mm	Bolt upper arm bracket, shim and Wedge with upright	$ 0,75	unit	3		1	$ 2,25
60	Reaction Tool <= 25.4 mm	Bolt upper arm bracket, shim and Wedge with upright	$ 0,25	Unit	3		1	$ 0,75
70	Assemble, 1 kg, Line-on-Line	Assemble speed sensor bracket with upright	$ 0,13	Unit	1		1	$ 0,13
80	Assemble, 5kg, Line-on-Line	Assemble upright assembly with frame	$ 0,63	unit	1		1	$ 0,63
90	Ratchet <= 25.4 mm	Bolt upright assembly with front A-arms	$ 0,75	Unit	2		1	$ 1,50
100	Reaction Tool <= 25.4 mm	Bolt upright assembly with front A-arms	$ 0,25	Unit	2		1	$ 0,50
110	Suspension Setup-Independent Susp. (per corner)	Camber and toe adjustment	$ 8,75	Unit	1		1	$ 8,75
							Sub Total	**$ 15,46**

ItemOrder	Fastener	Use	UnitCost	Size1	Unit1	Size2	Unit2	Quantity	Sub Total
10	Bolt, Grade 8.8 (SAE 5)	Bolt Upper arm bracket, wedge, camber adjustment shim and upright	$0,09	6	mm	40	mm	3	$ 0,27
20	Nut, Grade 8.8 (SAE 5)	Bolt Upper arm bracket, wedge, camber adjustment shim and upright	$0,03	6	mm			3	$ 0,09
30	Washer, Grade 8.8 (SAE 5)	Bolt Upper arm bracket, wedge, camber adjustment shim and upright	$0,01		mm			6	$ 0,06
70	Bolt, Grade 8.8 (SAE 5)	Bolt Upper arm bracket, wedge, camber adjustment shim and upright	$0,24	8	mm	55	mm	2	$ 0,47
80	Nut, Grade 8.8 (SAE 5)	Bolt Upper arm bracket, wedge, camber adjustment shim and upright	$0,04	8	mm			2	$ 0,09
90	Washer, Grade 8.8 (SAE 5)	Bolt Upper arm bracket, wedge, camber adjustment shim and upright	$0,01		mm			4	$ 0,04
								Sub Total	**$ 1,02**

University	Ecole Centrale de Lyon
System	Wheels & Tires
Assembly	Front Uprights
Part	Front Upright
P/N Base	SU 10001
Suffix	AA
Details	Main part of the assembly

Back to BOM

FileLink1	Drawing
FileLink2	
FileLink3	

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 106,19
Qty	1
Extended C	$ 106,19

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Aluminium, Premium		$ 4,20	6,83	kg			rectangular area, 180 x 280	5,04E-02	5,00E-02	2 712	1,00	$ 28,70
												Sub Total	$ 28,70

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and Remove	Setup for milling	$ 1,30	Unit	1		1	$ 1,30
20	Machining	Milling the main part	$ 0,04	cm^3	1362	Material - Aluminium	1	$ 54,48
30	Machining Setup, Change	Change the milling setup	$ 0,65	Unit	1		1	$ 0,65
40	Machining	Milling, remove the major part of the sole	$ 0,04	cm^3	352,2	Material - Aluminium	1	$ 14,09
50	Machining Setup, Change		$ 0,65	Unit	1		1	$ 0,65
60	Machining	Milling, ending the sole, finishing the second bearing seat	$ 0,04	cm^3	72,2	Material - Aluminium	1	$ 2,89
70	Machining Setup, Change		$ 0,65	Unit	1		1	$ 0,65
80	Machining	Last holes	$ 0,04	cm^3	1,1	Material - Aluminium	1	$ 0,04
90	Machining Setup, Change		$ 0,65	Unit	1		1	$ 0,65
100	Machining	Milling upper slopes	$ 0,04	cm^3	18,2	Material - Aluminium	1	$ 0,73
110	Machining Setup, Change		$ 0,65	Unit	1		1	$ 0,65
120	Machining	Milling lower slopes	$ 0,04	cm^3	17,6	Material - Aluminium	1	$ 0,70
130	Machining Setup, Change		$ 0,65	Unit	1		1	$ 0,65
140	Machining	Milling brake side slopes	$ 0,04	cm^3	5,8	Material - Aluminium	1	$ 0,23
							Sub Total	$ 77,48

Drawing part : [SU_10001]

University	Ecole Centrale de Lyon
System	Wheels & Tires
Assembly	Front Uprights
Part	Upper Arm Wedge
P/N Base	SU 10002
Suffix	AA
Details	Part between the Upper arm bracket and the upright

Back to BOM

FileLink1	Drawing
FileLink2	
FileLink3	

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 2,51
Qty	1
Extended C	$ 2,51

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Aluminium, Normal		$ 4,20	0,05	kg			Rectangular area, 70x45mm	0,003	0,006	2 712	1,00	$ 0,22
												Sub Total	**$ 0,22**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and Remove	Setup for turning	$ 1,30	Unit	1		1	$ 1,30
20	Machining	Milling	$ 0,04	cm^3	5,3	Material - Aluminium	1	$ 0,21
30	Machining Setup, Change	Change the turning setup	$ 0,65	Unit	1		1	$ 0,65
40	Machining	Milling	$ 0,04	cm^3	3,2	Material - Aluminium	1	$ 0,13
							Sub Total	**$ 2,29**

Drawing part : SU_10002

University	Ecole Centrale de Lyon		Back to BOM	**Car #**	81	**Part Cost**	$ 18,68
System	Wheels & Tires	**FileLink1**	Drawing			**Qty**	1
Assembly	Front Uprights	**FileLink2**		**FileLink1**			
Part	Upper Arm Bracket	**FileLink3**		**FileLink2**		**Extended C**	$ 18,68
P/N Base	SU 10003			**FileLink3**			
Suffix	AA						
Details	Bracket to link the upper arm to the upright						

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Alloy		$ 2,25	1,24	kg			Rectangle /	0,004	0,045	7 850	1,00	$ 2,78
												Sub Total	**$ 2,78**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Inst	Setup for milling	$ 1,30	Unit	1		1	$ 1,30
20	Machining	Milling the main part	$ 0,04	cm^3	85,4	Material - Steel	3	$ 10,25
30	Machining Setup, Cha	Change the milling setup	$ 0,65	Unit	1		1	$ 0,65
40	Machining	Milling to remove the sole	$ 0,04	cm^3	25,2	Material - Steel	3	$ 3,02
50	Machining Setup, Cha	Change the milling setup	$ 0,65	Unit	1		1	$ 0,65
60	Machining	Milling 3 holes	$ 0,04	cm^3	0,2	Material - Steel	3	$ 0,02
70	Machining Setup, Cha	Change the milling setup	$ 0,65	Unit	1		1	$ 0,65
80	Machining	Milling, chamfer and last hole	$ 0,04	cm^3	3,56	Material - Steel	3	$ 0,43
							Sub Total	**$ 15,90**

Drawing part : SU_10003

University	Ecole Centrale de Lyon		Back to BOM	**Car #**	81	**Part Cost**	$ 0,84
System	Wheels & Tires	**FileLink1**	Drawing			**Qty**	1
Assembly	Front Uprights	**FileLink2**		**FileLink1**			
Part	Speed Sensor Bracket	**FileLink3**		**FileLink2**		**Extended C**	$ 0,84
P/N Base	SU 10004			**FileLink3**			
Suffix	AA						
Details	Bracket to maintain the speed sensor at the good position relative to the speed sensor disc						

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Mild		$ 2,25	0,01	kg			Square area 35x40mm	0,001	0,001	7 850	1,00	$ 0,02
												Sub Total	**$ 0,02**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and Remove	Setup for turning	$ 1,30	Unit	1	one setup for 2 pieces	0,5	$ 0,65
20	Laser cut		$ 0,01	cm	16,1		1	$ 0,16
30	Sheet metal bends		$ 0,25	bend	2		1	$ 0,50
							Sub Total	**$ 0,81**

Drawing part : SU_10004

University	Ecole Centrale de Lyon		Back to BOM	**Car #**	81	**Part Cost**	$ 0,43
System	Wheels & Tires	**FileLink1**	Drawing			**Qty**	15
Assembly	Front Uprights	**FileLink2**		**FileLink1**			
Part	Camber adjustment shim	**FileLink3**		**FileLink2**		**Extended C**	$ 6,40
P/N Base	SU 10005			**FileLink3**			
Suffix	AA						
Details	Part to modify the static camber of a wheel						

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Mild		$ 2,25	0,03	kg			rectangular area, 80*45mm	0,004	0,001	7 850	1,00	$ 0,06
												Sub Total	**$ 0,06**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and Remove	Setup for turning	$ 1,30	Unit	1	one setup for 2 pieces	0,033333333	$ 0,04
20	Laser cut		$ 0,01	cm	32		1	$ 0,32
							Sub Total	**$ 0,36**

Drawing part : SU_10005

University	Ecole Centrale de Lyon
System	Wheels & Tires
Assembly	Rear Uprights
P/N Base	SU A1100
Suffix	AA
Details	Assembly of a part of the wheel with the uprights

Back to BOM

Car #	81
FileLink1	
FileLink2	
FileLink3	

Asm Cost	$ 152,32
Qty	2
Extended (	$ 304,64

ItemOrder	Part	Part Cost	Quantity	Sub Total
10	Rear Upright	$ 106,52	1	$ 106,52
20	Upper Arm Bracket	$ 21,19	1	$ 21,19
30	Speed Sensor Brakcet	$ 0,83	1	$ 0,83
40	Camber adjustment shim	$ 0,42	15	$ 6,37
			Sub Total	$ 134,91

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Assemble, 3kg, Interference	Assemble upright with hub	$ 0,56	unit	1		1	$ 0,56
20	Assemble, 1 kg, Line-on-Line	Assemble camber adjustment shim with upright	$ 0,13	unit	1		1	$ 0,13
30	Assemble, 1 kg, Line-on-Line	Assemble Upper arm bracket with upright	$ 0,13	unit	1		1	$ 0,13
40	Ratchet <= 25.4 mm	Bolt upper arm bracket and shim with upright	$ 0,75	unit	3		1	$ 2,25
50	Reaction Tool <= 25.4 mm	Bolt upper arm bracket and shim with upright	$ 0,25	Unit	3		1	$ 0,75
60	Assemble, 1 kg, Line-on-Line	Assemble speed sensor bracket with upright	$ 0,13	Unit	1		1	$ 0,13
70	Ratchet <= 25.4 mm	Bolt speed sensor bracket with upright	$ 0,75	unit	1		1	$ 0,75
80	Reaction Tool <= 25.4 mm	Bolt speed sensor bracket with upright	$ 0,25	Unit	1		1	$ 0,25
90	Assemble, 5kg, Line-on-Line	Assemble upright assembly with frame	$ 0,63	unit	1		1	$ 0,63
100	Ratchet <= 25.4 mm	Bolt upright assembly with rear A-arms	$ 0,75	Unit	2		1	$ 1,50
110	Reaction Tool <= 25.4 mm	Bolt upright assembly with rear A-arms	$ 0,25	Unit	2		1	$ 0,50
120	Suspension Setup-Independent Susp. (per corner)	Camber and toe adjustment	$ 8,75	Unit	1		1	$ 8,75
							Sub Total	$ 16,33

ItemOrder	Fastener	Use	UnitCost	Size1	Unit1	Size2	Unit2	Quantity	Sub Total
10	Bolt, Grade 8.8 (SAE 5)	Bolt Upper arm bracket, wedge, camber adjustment shim and upright	$0,09	6	mm	40	mm	3	$ 0,27
20	Nut, Grade 8.8 (SAE 5)	Bolt Upper arm bracket, wedge, camber adjustment shim and upright	$0,03	6	mm			3	$ 0,09
30	Washer, Grade 8.8 (SAE 5)	Bolt Upper arm bracket, wedge, camber adjustment shim and upright	$0,01		mm			6	$ 0,06
40	Bolt, Grade 8.8 (SAE 5)	Bolt Speed sensor bracket on upright	$0,02	4	mm	16	mm	1	$ 0,02
50	Nut, Grade 8.8 (SAE 5)	Bolt Speed sensor bracket on upright	$0,02	4	mm			1	$ 0,02
60	Washer, Grade 8.8 (SAE 5)	Bolt Speed sensor bracket on upright	$0,01		mm			2	$ 0,02
70	Bolt, Grade 8.8 (SAE 5)	Bolt Upper arm bracket, wedge, camber adjustment shim and upright	$0,24	8	mm	55	mm	2	$ 0,47
80	Nut, Grade 8.8 (SAE 5)	Bolt Upper arm bracket, wedge, camber adjustment shim and upright	$0,04	8	mm			2	$ 0,09
90	Washer, Grade 8.8 (SAE 5)	Bolt Upper arm bracket, wedge, camber adjustment shim and upright	$0,01		mm			4	$ 0,04
								Sub Total	$ 1,08

University	Ecole Centrale de Lyon
System	Wheels & Tires
Assembly	Rear Uprights
Part	Rear Upright
P/N Base	SU 11001
Suffix	AA
Details	Main part of the assembly

Back to BOM

FileLink1	Drawing
FileLink2	
FileLink3	

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 106,52
Qty	1
Extended C	$ 106,52

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Aluminium, Premium		$ 4,20	6,15	kg			rectangula	0,045	0,050	2 712	1,00	$ 25,84
												Sub Total	$ 25,84

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and Remove	Setup for milling	$ 1,30	Unit	1		1	$ 1,30
20	Machining	Milling the back and the first bearing seat	$ 0,04	cm^3	350	Material - Aluminium	1	$ 14,00
30	Machining Setup, Change	Change the milling setup	$ 0,65	Unit	1		1	$ 0,65
40	Machining	Milling, the main phase	$ 0,04	cm^3	1285	Material - Aluminium	1	$ 51,40
50	Machining Setup, Change		$ 0,65	Unit	1		1	$ 0,65
60	Machining	Milling, removing the sole	$ 0,04	cm^3	227	Material - Aluminium	1	$ 9,08
70	Machining Setup, Change		$ 0,65	Unit	1		1	$ 0,65
80	Machining	Milling, 2 holes for A-Arm and toe link	$ 0,04	cm^3	1,2	Material - Aluminium	1	$ 0,05
90	Machining Setup, Change		$ 0,65	Unit	1		1	$ 0,65
100	Machining	Milling upper slopes	$ 0,04	cm^3	24	Material - Aluminium	1	$ 0,96
110	Machining Setup, Change		$ 0,65	Unit	1		1	$ 0,65
120	Machining	Milling lower slopes	$ 0,04	cm^3	16	Material - Aluminium	1	$ 0,64
130	Drilled holes < 25.4 mm dia.	Drill the hole for the speed sensor bracket	$ 0,35	Hole	1	Material - Aluminium	1	$ 0,35
							Sub Total	$ 80,68

Drawing part : [SU_11001]

University	Ecole Centrale de Lyon
System	Wheels & Tires
Assembly	Rear Uprights
Part	Upper Arm Bracket
P/N Base	SU 11002
Suffix	AA
Details	Bracket to link the upper arm to the upright

Back to BOM

FileLink1	Drawing
FileLink2	
FileLink3	

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 21,19
Qty	1
Extended C	$ 21,19

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Alloy		$ 2,25	1,47	kg			Rectangle Area, 50x70 (mm)	0,004	0,052	7 850	1,00	$ 3,31
												Sub Total	**$ 3,31**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and Remove	Setup for milling	$ 1,30	Unit	1		1	$ 1,30
20	Machining	Milling the main part	$ 0,04	cm^3	102	Material - Steel	3	$ 12,24
30	Machining Setup, Change	Change the milling setup	$ 0,65	Unit	1		1	$ 0,65
40	Machining	Milling to remove the sole	$ 0,04	cm^3	25,2	Material - Steel	3	$ 3,02
50	Machining Setup, Change	Change the milling setup	$ 0,65	Unit	1		1	$ 0,65
60	Machining	Milling 3 holes	$ 0,04	cm^3	0,2	Material - Steel	3	$ 0,02
70	Machining Setup, Change	Change the milling setup	$ 0,65	Unit	1		1	$ 0,65
80	Machining	Milling, chamfer and last hole	$ 0,04	cm^3	3,56	Material - Steel	3	$ 0,43
							Sub Total	**$ 17,89**

Drawing part : SU_11002

University	Ecole Centrale de Lyon		Back to BOM	**Car #**	81	**Part Cost**	$ 0,83
System	Wheels & Tires	**FileLink1**	Drawing			**Qty**	1
Assembly	Rear Uprights	**FileLink2**		**FileLink1**			
Part	Speed Sensor Bracket	**FileLink3**		**FileLink2**		**Extended C**	$ 0,83
P/N Base	SU 11003			**FileLink3**			
Suffix	AA						
Details	Bracket to maintain the speed sensor at the good position relative to the speed sensor disc						

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Mild		$ 2,25	0,01	kg			Square are	0,001	0,001	7 850	1,00	$ 0,02
												Sub Total	**$ 0,02**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and Remove	Setup for turning	$ 1,30	Unit	1	one setup for 2 pieces	0,5	$ 0,65
20	Laser cut		$ 0,01	cm	15,4		1	$ 0,15
30	Sheet metal bends		$ 0,25	bend	1		1	$ 0,25
							Sub Total	**$ 0,80**

Drawing part : SU_11003

University	Ecole Centrale de Lyon		Back to BOM	**Car #**	81	**Part Cost**	$ 0,42
System	Wheels & Tires	**FileLink1**	Drawing			**Qty**	15
Assembly	Rear Uprights	**FileLink2**		**FileLink1**			
Part	Camber adjustment shim	**FileLink3**		**FileLink2**		**Extended C**	$ 6,37
P/N Base	SU 11004			**FileLink3**			
Suffix	AA						
Details	Part to modify the static camber of a wheel						

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Mild		$ 2,25	0,03	kg			rectangular area, 84mm*48mm	0,004	0,001	7 850	1,00	$ 0,07
												Sub Total	**$ 0,07**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and Remove	Setup for turning	$ 1,30	Unit	1	one setup for 30 pieces	0,033333333	$ 0,04
20	Laser cut		$ 0,01	cm	31		1	$ 0,31
							Sub Total	**$ 0,35**

Drawing part : SU_11004

University	Ecole Centrale de Lyon
System	Suspension & Shocks
Assembly	Front Pullrod
P/N Base	SU A1200
Suffix	AA
Details	Front Pullrod, right and left are symetric

Back to BOM

Car #	81
FileLink1	
FileLink2	
FileLink3	

Asm Cost	$ 23,48
Qty	2
Extended C	46,96

ItemOrder	Part	Part Cost	Quantity	Sub Total
10	Pullrod tube	$ 9,07	1	$ 9,07
20	Pullrod insert	$ 1,58	2	$ 3,17
30	Spacer 1	$ 0,35	2	$ 0,70
30	Spacer 2	$ 0,35	2	$ 0,70
			Sub Total	**$ 13,63**

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Rod End, Industrial	Right-hand rod end for pushrod extremities	$ 2,50	8	mm			Balls Diameter				1	$ 2,50
20	Rod End, Industrial	Left-hand rod end for pushrod extremities	$ 2,50	8	mm			Balls Diameter				1	$ 2,50
												Sub Total	**$ 5,00**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multipl	Mult. Val.	Sub Total
10	Hand Finish - Surface Preperation	Solvent degreasing on carbon tube	$ 0,02	cm²	6,6		1	$ 0,13
20	Hand Finish - Surface Preperation	Solvent degreasing on insert	$ 0,02	cm²	6,6		1	$ 0,13
30	Brush apply	Glue insert to pushrod tube	$ 0,02	cm^2	6,6		1	$ 0,13
40	Hand - Start Only	Put a nut on the rod end	$ 0,12	unit	1		1	$ 0,12
50	Hand, Loose <= 25.4 mm	Screwing by hand the rod end in the pullrod insert	$ 0,50	unit	1		1	$ 0,50
60	Wrench <= 25.4 mm	Thighten the M8 nuts	$ 1,50	unit	1		1	$ 1,50
70	Reaction tool <= 25.4 mm	Thighten the M8 nuts	$ 0,25	unit	1		1	$ 0,25
80	Assemble, 1kg, Loose	Put the spacers of the rocker in place	$ 0,06	unit	1		1	$ 0,06
90	Assemble, 1kg, Loose	Put the washers of the rocker in place	$ 0,06	unit	1		1	$ 0,06
100	Hand - Start Only	Bolt pullrod into the rocker	$ 0,12	unit	1		1	$ 0,12
110	Assemble, 1kg, Loose	Put the spacers of the A-arm in place	$ 0,06	unit	1		1	$ 0,06
120	Assemble, 1kg, Loose	Put the washers of the A-arm in place	$ 0,06	unit	1		1	$ 0,06
130	Hand - Start Only	Bolt pullrod into the A-Arm	$ 0,12	unit	1		1	$ 0,12
140	Hand - Start Only	Put the nuts into the bolts	$ 0,12	unit	1		1	$ 0,12
150	Ratchet <= 25.4 mm	Thighten the M8 nuts	$ 0,75	unit	1		1	$ 0,75
160	Reaction tool <= 25.4 mm	Thighten the M8 nuts	$ 0,25	unit	1		1	$ 0,25
							Sub Total	**$ 4,37**

ItemOrder	Fastener	Use	UnitCost	Size1	Unit1	Size2	Unit2	Quantity	Sub Total
10	Bolt,Grade 8.8 (SAE)	Pullrod to rocker fixing bolt	$ 0,19	8	mm	45	mm	1	$ 0,19
20	Bolt,Grade 8.8 (SAE)	Pullrod to A-arm fixing bolt	$ 0,19	8	mm	45	mm	1	$ 0,19
30	Washer, Grade 8.8 (SAE 5)		$ 0,01	8	unit			4	$ 0,04
40	Nut, Grade 8.8 (SAE 5)	To tighten the rod ends	$ 0,03	6	mm			1	$ 0,03
50	Nut, Grade 8.8 (SAE 5)	To tighten the bolts	$ 0,04	8	mm			1	$ 0,04
								Sub Total	**$ 0,49**

University	Ecole Centrale de Lyon		Back to BOM	**Car #**	81	**Part Cost**	$ 9,07
System	Suspension & Shocks	**FileLink1**				**Qty**	1
Assembly	Front Pullrod	**FileLink2**		**FileLink1**			
Part	Pullrod tube	**FileLink3**		**FileLink2**		**Extended Cos**	$ 9,07
P/N Base	SU 12001			**FileLink3**			
Suffix	AA						
Details							

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Carbon fiber, 1 Ply	Stock material	$ 200,00	0,040	kg			Round area, diameter 16x2 mm	8,80E-05	0,290	1580	1	$ 8,06
												Sub Total	**$ 8,06**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Lamination, Filament Wirring	Tube lamination	$ 25,00	kg	0,040			$ 1,01
							Sub Total	**$ 1,01**

University	Ecole Centrale de Lyon		Back to BOM	**Car #**	81	**Part Cost**	$ 1,58
System	Suspension & Shocks	**FileLink1**				**Qty**	2
Assembly	Front Pullrod	**FileLink2**		**FileLink1**			
Part	Pullrod insert	**FileLink3**		**FileLink2**		**Extended Cos**	$ 3,17
P/N Base	SU 12002			**FileLink3**			
Suffix	AA						
Details							

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Aluminium, Premium (per kg)	cylinder	$ 4,20	0,07	kg			Round area diam. 18mm	2,54E-04	3,50E-02	7 850,00	1	$ 0,29
												Sub Total	**$ 0,29**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Setup for machining and removal	$ 1,30	Unit	1	8 parts from a single machine setup (tierod insert)	0,125	$ 0,16
20	Machining	Material removal - side view profile	$ 0,04	cm^3	5,5	Material - Steel	3	$ 0,66
30	Machining setup, change	Setup for machining process	$ 0,65	Unit	1	8 parts from a single machine setup (tierod insert)	0,125	$ 0,08
40	Machining	Material removal	$ 0,04	cm^3	0,3	Material - Steel	3	$ 0,04
50	Tapping Holes	Rod End emplacement	$ 0,35	hole	1		1	$ 0,35
							Sub Total	**$ 1,29**

Drawing : SU_12002

University	Ecole Centrale de Lyon
System	Suspension & Shocks
Assembly	Front Pullrod
Part	Spacer 1
P/N Base	SU 12003
Suffix	AA
Details	

FileLink1	
FileLink2	
FileLink3	

Back to BOM

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 0,35
Qty	2
Extended Cos	$ 0,70

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Mild	Material for Part	$ 2,25	0,0079	kg			Cylindrical 16 mm diameter	2,01E-04	5,00E-03	7 850	1,00	$ 0,02
												Sub Total	**$ 0,02**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining setup, install and remove		$ 1,30	unit	1	8 parts made from a single machine setup	0,125	$ 0,16
20	Machining		$ 0,04	cm^3	1,4	Material - Steel	3	$ 0,17
							Sub Total	**$ 0,33**

Drawing : SU_12003

University	Ecole Centrale de Lyon
System	Suspension & Shocks
Assembly	Front Pullrod
Part	Spacer 2
P/N Base	SU 12004
Suffix	AA
Details	

FileLink1	
FileLink2	
FileLink3	

Back to BOM

Car #	81

FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 0,35
Qty	2
Extended Cost	$ 0,70

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Mild	Material for Part	$ 2,25	0,0095	kg			Cylindrical 16 mm diameter	2,01E-04	6,00E-03	7 850	1,00	$ 0,02
												Sub Total	**$ 0,02**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining setup, install and remove		$ 1,30	unit	1	8 parts made from a single machine setup	0,125	$ 0,16
20	Machining		$ 0,04	cm^3	1,5	Material - Steel	3	$ 0,18
							Sub Total	**$ 0,34**

Drawing : SU_12004

University	Ecole Centrale de Lyon
System	Suspension & Shocks
Assembly	Rear Pushrod
P/N Base	SU A1300
Suffix	AA
Details	Rear Pushrod, right and left are symetric

Back to BOM

Car #	81
FileLink1	
FileLink2	
FileLink3	

Asm Cost	$ 12,36
Qty	2
Extended	24,72

ItemOrder	Part	Part Cost	Quantity	Sub Total
10	Steel cylinder for pushrod	$ 1,45	1	$ 1,45
20	Spacer	$ 0,36	4	$ 1,46
			Sub Total	$ 2,91

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Rod End, Industrial	Right-hand rod end for pushrod extremities	$ 2,50	8	mm			Balls Diameter				1	$ 2,50
20	Rod End, Industrial	Left-hand rod end for pushrod extremities	$ 2,50	8	mm			Balls Diameter				1	$ 2,50
												Sub Total	$ 5,00

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Hand - Start Only	Put a nut on the rod end	$ 0,12	unit	1		1	$ 0,12
20	Hand, Loose <= 25.4 mm	Screwing by hand the rod end in the steel cylinder	$ 0,50	unit	1		1	$ 0,50
30	Wrench <= 25.4 mm	Thighten the M8 nuts	$ 1,50	unit	1		1	$ 1,50
40	Reaction tool <= 25.4 mm	Thighten the M8 nuts	$ 0,25	unit	1		1	$ 0,25
50	Assemble, 1kg, Loose	Put the spacers of the rocker in place	$ 0,06	unit	1		1	$ 0,06
60	Assemble, 1kg, Loose	Put the washers of the rocker in place	$ 0,06	unit	1		1	$ 0,06
70	Hand - Start Only	Bolt pushrod into the rocker	$ 0,12	unit	1		1	$ 0,12
80	Assemble, 1kg, Loose	Put the spacers of the A-arm in place	$ 0,06	unit	1		1	$ 0,06
90	Assemble, 1kg, Loose	Put the washers of the A-arm in place	$ 0,06	unit	1		1	$ 0,06
100	Hand - Start Only	Bolt pushrod into the A-Arm	$ 0,12	unit	1		1	$ 0,12
110	Hand - Start Only	Put the nuts into the bolts	$ 0,12	unit	1		1	$ 0,12
120	Ratchet <= 25.4 mm	Thighten the M8 nuts	$ 0,75	unit	1		1	$ 0,75
130	Reaction tool <= 25.4 mm	Thighten the M8 nuts	$ 0,25	unit	1		1	$ 0,25
							Sub Total	$ 3,97

ItemOrder	Fastener	Use	UnitCost	Size1	Unit1	Size2	Unit2	Quantity	Sub Total
10	Bolt,Grade 8.8 (SAE)	Pushrod to rocker fixing bolt	$ 0,19	8	mm	45	mm	1	$ 0,19
20	Bolt,Grade 8.8 (SAE)	Pushrod to A-arm fixing bolt	$ 0,19	8	mm	45	mm	1	$ 0,19
30	Washer, Grade 8.8 (SAE 5)		$ 0,01	8	unit			4	$ 0,04
40	Nut, Grade 8.8 (SAE 5)	To tighten the rod ends	$ 0,03	6	mm			1	$ 0,03
50	Nut, Grade 8.8 (SAE 5)	To tighten the bolts	$ 0,04	8	mm			1	$ 0,04
								Sub Total	$ 0,49

University	Ecole Centrale de Lyon		Back to BOM	**Car #**	81	**Part Cost**	$ 1,45
System	Suspension & Shocks	**FileLink1**	Drawing			**Qty**	1
Assembly	Rear Pushrod	**FileLink2**		**FileLink1**			
Part	Steel cylinder for pushrod	**FileLink3**		**FileLink2**		**Extended Cos**	$ 1,45
P/N Base	SU 13001			**FileLink3**			
Suffix	AA						
Details							

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, alloy	Material for part	$ 2,25	0,045	kg			Round area, outside diameter 15 mm	1,77E-04	0,030	8500	1	$ 0,10
												Sub Total	**$ 0,10**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove		$ 1,30	unit	1	2 parts made from a single machine setup	0,5	$ 0,65
20	Machining (turning)	Machining removal	$ 0,04	cm^3	1,04	Material - Steel	3	$ 0,12
30	Tapping holes	Material removal	$ 0,35	hole	2	Drill & Tap	1	$ 0,70
40	Machining setup, change	Setup for machining process	$ 0,65	Unit	1	2 parts made from a single machine setup	0,5	$ 0,33
50	Tapping holes	Material removal	$ 0,35	hole	2	Drill & Tap	1	$ 0,70
							Sub Total	**$ 1,35**

Drawing part: SU 13001

Tolérances générales : ISO 2768-mK

M8 Pas à droite

Vue de droite
Echelle : 1:1

Vue de face
Echelle : 1:1

M8 Pas à gauche

Vue de gauche
Echelle : 1:1

Profondeur de taraudage identiques et maximales.
Par exemple 14 pour le pas gauche et 14 pour le pas droite.

Vue isométrique
Echelle : 1:1

Taille A4		Ecurie Piston Sport Auto	
Dessiné par Brice Roblot	Date 11/03/2018	Désignation SU 1500 001 Rear Pushrod	
Coordonnées brice.roblt@ecl16.ec-lyon.fr 06 84 54 58 74		Quantité 2	Matériau Acier 25CD4 ou équivalent / Version 1.0
Plan vérifié par A.Perdereau		Echelle 1:1	Plan 18B_SU_1500_001 / Feuille 1/1

University	Ecole Centrale de Lyon			Back to BOM	**Car #**	81	**Part Cost** $ 0,36
System	Suspension & Shocks	**FileLink1**	Drawing				**Qty** 4
Assembly	Rear Pushrod	**FileLink2**			**FileLink1**		
Part	Spacer	**FileLink3**			**FileLink2**		**Extended Cos** $ 1,46
P/N Base	SU 13002				**FileLink3**		
Suffix	AA						
Details							

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Mild	Material for Part	$ 2,25	0,0095	kg			Cylindrical 16 mm diameter	2,01E-04	6,00E-03	7 850	1,00	$ 0,02
												Sub Total	**$ 0,02**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining setup, install and remove		$ 1,30	unit	1	8 parts made from a single machine setup	0,125	$ 0,16
20	Machining		$ 0,04	cm^3	1,5	Material - Steel	3	$ 0,18
							Sub Total	**$ 0,34**

Drawing : SU_13002

Ecurie Piston Sport Auto

CAR #81

ÉCOLE CENTRALE LYON

Wheels, Wheel Bearings & Tires

University	Ecole Centrale de Lyon
System	Wheels & Tires
Assembly	Wheel Assembly
P/N Base	WT A0100
Suffix	AA
Details	Complete Wheel Assembly

Back to BOM

Car #	81
FileLink1	
FileLink2	
FileLink3	

Asm Cost	$ 175,23
Qty	4
Extended (	$ 700,92

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Wheel, 13", 1 Piece OZ, Aluminum	Rim	$ 80,00		unit							1	$ 80,00
20	Tire, Hoosier, R25B, 13"-20.5 x 7.0	Tire	$ 85,00		unit							1	$ 85,00
30	Valve Stem (and Tire Inflation)		$ 1,00		unit							1	$ 1,00
40	Wheel Weights (and Balancing)	Balancing and set up the wheel	$ 4,00		unit							1	$ 4,00
												Sub Total	$ 170,00

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Assemble, 5kg, Line-on-Line	Fix Wheel on Hubs	$ 0,63	unit	1		1	$ 0,63
20	Ratchet <= 25.4 mm	Tighten Lug Nuts	$ 0,75	unit	4		1	$ 3,00
							Sub Total	$ 3,63

ItemOrder	Fastener	Use	UnitCost	Size1	Unit1	Size2	Unit2	Quantity	Sub Total
10	Nut, Lug	Fix Wheel on Hubs	$ 0,40		cm			4	$ 1,60
								Sub Total	$ 1,60

University	Ecole Centrale de Lyon
System	Wheels & Tires
Assembly	Front Hubs
P/N Base	WT A0200
Suffix	AA
Details	Assembly of a part of the wheel with the hub, bearings and a part to mesure the speed of the wheel

Back to BOM

Car #	81
FileLink1	
FileLink2	
FileLink3	

Asm Cost	$ 341,74
Qty	2
Extended (	$ 683,48

ItemOrder	Part	Part Cost	Quantity	Sub Total
10	Front Hub	$ 64,16	1	$ 64,16
20	Front Bearing Spacer	$ 2,62	1	$ 2,62
30	Front Wheel Spacer	$ 20,68	1	$ 20,68
40	Speed Sensor Spacer	$ 0,95	1	$ 0,95
50	Speed Sensor Disc	$ 3,97	1	$ 3,97
			Sub Total	$ 92,38

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Nam	Area	Length	Density	Quantity	Sub Total
10	Wheel Bearing, Ball, Angular Contact		$ 118,75	72	mm	17	mm					2	$ 237,49
20	Locknut/L.P.///Steel/	Bearing Nuts	$ 5,98	35	mm							1	$ 5,98
30	Adhesive	Wheel studs and hub assemble, cost included in process	$ -										$ -
												Sub Total	$ 243,47

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Assemble, 1kg, Loose	Bearing spacer assemble on the hub	$ 0,06	unit	1		1	$ 0,06
20	Assemble, 1 kg, Interference	Bearings Assemble	$ 0,19	unit	2		1	$ 0,38
30	Assemble, 1kg, Loose	Speed sensor spacer assemble on the hub	$ 0,06	unit	1		1	$ 0,06
40	Assemble, 1kg, Loose	Speed sensor disc assemble on the hub	$ 0,06	unit	1		1	$ 0,06
50	Assemble, 1kg, Loose	Lock nut washer assemble on the hub	$ 0,06	unit	1		1	$ 0,06
80	Assemble, 1 kg, Line-on-Line	Locknut on hub	$ 0,13	Unit	1		1	$ 0,13
60	Liquid Applicator Gun	Wheel studs and hub assemble	$ 0,02	cm	15,07		1	$ 0,30
70	Assemble, 1 kg, Line-on-Line	Wheel studs and hub assemble	$ 0,13	unit	4		1	$ 0,52
80	Assemble, 1 kg, Loose	Front Wheel Spacer on hub	$ 0,06	Unit	1		1	$ 0,06
							Sub Total	$ 1,63

ItemOrder	Fastener	Use	UnitCost	Size1	Unit1	Size2	Unit2	Quantity	Sub Total
10	Stud, Grade 12.9	Wheel Studs	$ 1,07	12	mm	62	mm	4	$ 4,26
								Sub Total	$ 4,26

University	Ecole Centrale de Lyon
System	Wheels & Tires
Assembly	Front Hubs
Part	Front Hub
P/N Base	WT 02001
Suffix	AA
Details	Main part of the assembly

Back to BOM

FileLink1	Drawing
FileLink2	
FileLink3	

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 64,16
Qty	1
Extended (	$ 64,16

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Aluminium, Premium		$ 4,20	3,27	kg			round area, 130mm diameter	0,013	0,091	2 712	1,00	$ 13,75
												Sub Total	$ 13,75

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and Remove	Setup for turning	$ 1,30	Unit	1		1	$ 1,30
20	Machining	Turning	$ 0,04	cm^3	930,6	Material - Aluminium	1	$ 37,22
30	Machining Setup, Change	Change the turning setup	$ 0,65	Unit	1		1	$ 0,65
40	Machining	Turning	$ 0,04	cm^3	63,5	Material - Aluminium	1	$ 2,54
50	Machining Setup, Install and Remove		$ 1,30	Unit	1		1	$ 1,30
60	Machining	Milling	$ 0,04	cm^3	149	Material - Aluminium	1	$ 5,96
70	Machining Setup, Change		$ 0,65	Unit	1		1	$ 0,65
80	Machining	Milling	$ 0,04	cm^3	0,336	Material - Aluminium	1	$ 0,01
90	Threading, Internal (machining)	For wheel studs	$ 0,10	cm	6	Material - Aluminium	1	$ 0,60
100	Threading, External (machining)	For locknut	$ 0,10	cm	1,7	Material - Aluminium	1	$ 0,17
							Sub Total	$ 50,41

Drawing part : [WT 02001]

University	Ecole Centrale de Lyon		Back to BOM	**Car #**	81	**Part Cost**	$ 2,62
System	Wheels & Tires	**FileLink1**	Drawing			**Qty**	1
Assembly	Front Hubs	**FileLink2**		**FileLink1**			
Part	Wheel bearing spacer	**FileLink3**		**FileLink2**		**Extended C**	$ 2,62
P/N Base	WT 02002			**FileLink3**			
Suffix	AA						
Details	Part to let a space beetween the hub and the first bearing						

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Aluminium, Premium		$ 4,20	0,06	kg			round area, 55mm diameter	0,002	0,009	2 712	1,00	$ 0,24
												Sub Total	**$ 0,24**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and Remove	Setup for turning	$ 1,30	Unit	1		1	$ 1,30
20	Machining	Turning	$ 0,04	cm^3	9,2	Material - Aluminium	1	$ 0,37
30	Machining Setup, Change	Change the turning setup	$ 0,65	Unit	1		1	$ 0,65
40	Machining	Turning	$ 0,04	cm^3	1,5	Material - Aluminium	1	$ 0,06
							Sub Total	**$ 2,38**

Drawing part : WT_02002

University	Ecole Centrale de Lyon		Back to BOM	**Car #**	81	**Part Cost**	$ 20,68
System	Wheels & Tires	**FileLink1**	Drawing			**Qty**	1
Assembly	Front Hubs	**FileLink2**		**FileLink1**			
Part	Front Wheel Spacer	**FileLink3**		**FileLink2**		**Extended C**	$ 20,68
P/N Base	WT 02003			**FileLink3**			
Suffix	AA						
Details	Part to position the wheel on the good position relative to the hub and upright assembly						

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Aluminium, Premium		$ 4,20	0,86	kg			round area, 130mm diameter	0,013	0,024	2 712	1,00	$ 3,63
												Sub Total	**$ 3,63**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and Remove	Setup for turning	$ 1,30	Unit	1		1	$ 1,30
20	Machining	Turning	$ 0,04	cm^3	112	Material - Aluminium	1	$ 4,48
30	Machining Setup, Change	Change the turning setup	$ 0,65	Unit	1		1	$ 0,65
40	Machining	Turning	$ 0,04	cm^3	84	Material - Aluminium	1	$ 3,36
50	Machining Setup, Install and Remove		$ 1,30	Unit	1		1	$ 1,30
60	Machining	Milling	$ 0,04	cm^3	149	Material - Aluminium	1	$ 5,96
							Sub Total	**$ 17,05**

Drawing part : [WT_02003]

University	Ecole Centrale de Lyon		Back to BOM	**Car #**	81	**Part Cost**	$ 0,95
System	Wheels & Tires	**FileLink1**	Drawing			**Qty**	1
Assembly	Front Hubs	**FileLink2**		**FileLink1**			
Part	Speed sensor spacer	**FileLink3**		**FileLink2**		**Extended C**	$ 0,95
P/N Base	WT 02004			**FileLink3**			
Suffix	AA						
Details	Part to avoid the speed sensor disc to interfere with the Upright						

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Aluminum, Normal		$ 4,20	0,01	kg			Square area 45x45mm	0,002	0,002	2 712	1,00	$ 0,05
												Sub Total	**$ 0,05**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and Remove	Setup for turning	$ 1,30	Unit	1	one setup for 2 pieces	0,5	$ 0,65
20	Laser cut		$ 0,01	cm	25,4		1	$ 0,25
							Sub Total	**$ 0,90**

Drawing part : WT_02004

University	Ecole Centrale de Lyon
System	Wheels & Tires
Assembly	Front Hubs
Part	Speed Sensor Disc
P/N Base	WT 02005
Suffix	AA
Details	Disc use in combination with a sensor to obtain the speed of a wheel

Back to BOM

FileLink1	Drawing
FileLink2	
FileLink3	

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 3,97
Qty	1
Extended C	$ 3,97

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Mild		$ 2,25	0,20	kg			rectangular area, 160mm*160mm	0,026	0,001	7 850	1,00	$ 0,45
												Sub Total	$ 0,45

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and Remove	Setup for turning	$ 1,30	Unit	1	one setup for 2 pieces	0,5	$ 0,65
20	Laser cut		$ 0,01	cm	286,8		1	$ 2,87
							Sub Total	$ 3,52

Drawing part : WT_02005

University	Ecole Centrale de Lyon
System	Wheels & Tires
Assembly	Rear Hubs
P/N Base	WT A0300
Suffix	AA
Details	Assembly of a part of the wheel with the hub, bearings and a part to mesure the speed of the wheel

Back to BOM

Car #	81
FileLink1	
FileLink2	
FileLink3	

Asm Cost	$ 341,74
Qty	2
Extended (	$ 683,48

ItemOrder	Part	Part Cost	Quantity	Sub Total
10	Rear Hub	$ 52,73	1	$ 52,73
20	Rear Bearing Spacer	$ 3,97	1	$ 3,97
30	Rear Wheel Spacer	$ 22,32	1	$ 22,32
40	Tripod Housing Spacer	$ 3,90	1	$ 3,90
50	Speed Sensor Disc	$ 3,23	1	$ 3,23
			Sub Total	$ 86,15

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Nam	Area	Length	Density	Quantity	Sub Total
10	Wheel Bearing, Ball, Angular Contact		$ 99,77	72	mm	12	mm					2,00	$ 199,53
20	Adhesive	Wheel studs and hub assemble, cost included in process	$ -										$ -
												Sub Total	$ 199,53

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Assemble, 1kg, Loose	Bearing spacer assemble on the hub	$ 0,06	unit	1		1	$ 0,06
20	Assemble, 1 kg, Interference	Bearings Assemble	$ 0,19	unit	2		1	$ 0,38
30	Assemble, 1kg, Loose	Tripod housing spacer assemble on the hub	$ 0,06	unit	1		1	$ 0,06
40	Assemble, 1kg, Loose	Speed sensor disc assemble on the hub	$ 0,06	unit	1		1	$ 0,06
50	Liquid Applicator Gun	Wheel studs and hub assemble	$ 0,02	cm	15,07		1	$ 0,30
60	Assemble, 1 kg, Line-on-Line	Wheel studs and hub assemble	$ 0,13	unit	4		1	$ 0,52
70	Assemble, 1 kg, Loose	Front Wheel Spacer on hub	$ 0,06	Unit	1		1	$ 0,06
							Sub Total	$ 1,44

ItemOrder	Fastener	Use	UnitCost	Size1	Unit1	Size2	Unit2	Quantity	Sub Total
10	Stud, Grade 12.9	Wheel Studs	$ 1,07	12	mm	62	mm	4	$ 4,26
								Sub Total	$ 4,26

University	Ecole Centrale de Lyon
System	Wheels & Tires
Assembly	Rear Hubs
Part	Rear Hub
P/N Base	WT 03001
Suffix	AA
Details	Main part of the assembly

Back to BOM

FileLink1	Drawing
FileLink2	
FileLink3	

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 52,73
Qty	1
Extended C	$ 52,73

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Aluminium, Premium		$ 4,20	2,87	kg			round area, 130mm diameter	0,013	0,080	2 712	1,00	$ 12,06
												Sub Total	$ 12,06

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and Remove	Setup for turning	$ 1,30	Unit	1		1	$ 1,30
20	Machining	Turning	$ 0,04	cm^3	652,3	Material - Aluminium	1	$ 26,09
30	Machining Setup, Change	Change the turning setup	$ 0,65	Unit	1		1	$ 0,65
40	Machining	Turning	$ 0,04	cm^3	63,5	Material - Aluminium	1	$ 2,54
50	Machining Setup, Install and Remove		$ 1,30	Unit	1		1	$ 1,30
60	Machining	Milling	$ 0,04	cm^3	149	Material - Aluminium	1	$ 5,96
70	Machining Setup, Change		$ 0,65	Unit	1		1	$ 0,65
80	Threading, Internal (machining)	For wheel studs	$ 0,10	cm	6	Material - Aluminium	1	$ 0,60
100	EDM - Wire	For tripod housing	$ 0,20	cm	7,9	Material - Aluminium	1	$ 1,58
							Sub Total	$ 40,67

Drawing part : [WT_03001]

Comment : Drawing before the EDM process for spline at the center

University	Ecole Centrale de Lyon
System	Wheels & Tires
Assembly	Rear Hubs
Part	Wheel bearing spacer
P/N Base	WT 03002
Suffix	AA
Details	Part to let a space beetween the hub and the first bearing

Back to BOM

FileLink1	Drawing
FileLink2	
FileLink3	

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 3,97
Qty	1
Extended C	$ 3,97

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Aluminium, Premium		$ 4,20	0,16	kg			round area, 55mm diameter	0,004	0,014	2 712	1,00	$ 0,67
												Sub Total	$ 0,67

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and Remove	Setup for turning	$ 1,30	Unit	1		1	$ 1,30
20	Machining	Turning	$ 0,04	cm^3	28,3	Material - Aluminium	1	$ 1,13
30	Machining Setup, Change	Change the turning setup	$ 0,65	Unit	1		1	$ 0,65
40	Machining	Turning	$ 0,04	cm^3	5,5	Material - Aluminium	1	$ 0,22
							Sub Total	$ 3,30

Drawing part : WT_03002

Vue isométrique
Echelle : 1:1

Vue de face
Echelle : 1:1

Coupe A-A
Echelle : 1:1

Taille A4		Ecurie Piston Sport Auto
Dessiné par Arthur Perdereau	Date 06/01/2018	Désignation WT 0300 004 Rear Bearing Spacer
Coordonnées 06 83 55 17 96 arthur.perdereau@ecl16.ec-lyon.fr		Quantité 2 / Matériau 7075 T6 / Version 1.0
Plan vérifié par XXX		Echelle 1:1 / N° du plan : 18B_WT_0300_004 / Feuille 1/1

University	Ecole Centrale de Lyon
System	Wheels & Tires
Assembly	Rear Hubs
Part	Rear Wheel Spacer
P/N Base	WT 03003
Suffix	AA
Details	Part to position the wheel on the good position relative to the hub and upright assembly

Back to BOM

FileLink1	Drawing
FileLink2	
FileLink3	

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 22,32
Qty	1
Extended (	$ 22,32

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Aluminium, Premium		$ 4,20	0,86	kg			round area, 130mm diameter	0,013	0,024	2 712	1,00	$ 3,63
												Sub Total	$ 3,63

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and Remove	Setup for turning	$ 1,30	Unit	1		1	$ 1,30
20	Machining	Turning	$ 0,04	cm^3	135	Material - Aluminium	1	$ 5,40
30	Machining Setup, Change	Change the turning setup	$ 0,65	Unit	1		1	$ 0,65
40	Machining	Turning	$ 0,04	cm^3	102	Material - Aluminium	1	$ 4,08
50	Machining Setup, Install and Remove		$ 1,30	Unit	1		1	$ 1,30
60	Machining	Milling	$ 0,04	cm^3	149	Material - Aluminium	1	$ 5,96
							Sub Total	$ 18,69

Drawing part : [WT_03003]

University	Ecole Centrale de Lyon		Back to BOM	**Car #**	81	**Part Cost**	$ 3,90
System	Wheels & Tires	**FileLink1**	Drawing			**Qty**	1
Assembly	Rear Hubs	**FileLink2**		**FileLink1**			
Part	Tripod housing spacer	**FileLink3**		**FileLink2**		**Extended**	$ 3,90
P/N Base	WT 03004			**FileLink3**			
Suffix	AA						
Details	Part to allow the tripod housing to be used as locknut to prestress the bearings. Also used to separate the speedsensor disc from the upright						

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Aluminium, Premium		$ 4,20	0,16	kg			round area, 130mm diameter	0,003	0,022	2 712	1,00	$ 0,66
												Sub Total	**$ 0,66**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and Remove	Setup for turning	$ 1,30	Unit	1		1	$ 1,30
20	Machining	Turning	$ 0,04	cm^3	27,7	Material - Aluminium	1	$ 1,11
30	Machining Setup, Change	Change the turning setup	$ 0,65	Unit	1		1	$ 0,65
40	Machining	Turning	$ 0,04	cm^3	4,6	Material - Aluminium	1	$ 0,18
							Sub Total	**$ 3,24**

Drawing part : WT_03004

Vue de face
Echelle : 1:1

Coupe A-A
Echelle : 1:1

Vue isométrique
Echelle : 1:1

Détail B
Echelle : 2:1

Taille A4		Ecurie Piston Sport Auto
Dessiné par Arthur Perdereau	Date 06/01/2018	Désignation WT 0300 005 Tripod Housing Spacer
Coordonnées 06 83 55 17 96 arthur.perdereau@ecl16.ec-lyon.fr		Quantité 2 / Matériau 7075 T6 / Version 1.0
Plan vérifié par C.BESSON		Echelle 1:1 / N° du plan : 18B_WT_0300_005 / Feuille 1/1

University	Ecole Centrale de Lyon		Back to BOM	**Car #**	81	**Part Cost**	$ 3,23
System	Wheels & Tires	**FileLink1**	Drawing			**Qty**	1
Assembly	Rear Hubs	**FileLink2**		**FileLink1**			
Part	Speed Sensor Disc	**FileLink3**		**FileLink2**		**Extended C**	$ 3,23
P/N Base	WT 03005			**FileLink3**			
Suffix	AA						
Details	Disc use in combination with a sensor to obtain the speed of a wheel						

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Mild		$ 2,25	0,15	kg			rectangular area, 160mm*160mm	0,020	0,001	7 850	1,00	$ 0,35
												Sub Total	**$ 0,35**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and Remove	Setup for turning	$ 1,30	Unit	1	one setup for 2 pieces	0,5	$ 0,65
20	Laser cut		$ 0,01	cm	223		1	$ 2,23
							Sub Total	**$ 2,88**

Drawing part : [WT_03005]