

University	Ecole Centrale Lyon
Competition Cod	FS
Year	2017
Car #	081

Total Vehicle Cost	#REF!
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The cost of assemblies 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
	Engine and Drivetrain	EN A0001	AA		Differential		91,03	1	78,48	9,90	1,32	1,33	91,03	3
	Engine and Drivetrain	EN 01001	AA	Differential	Housing		125,31	1	21,58	100,59	3,14		125,31	13
	Engine and Drivetrain	EN 01002	AA	Differential	Bearing Carrier		10,73	2	6,21	4,52			21,46	14
	Engine and Drivetrain	EN 01003	AA	Differential	Tie rod support		1,88	4	0,21	1,67			7,53	15
	Engine and Drivetrain	EN 01004	AA	Differential	bearing carrier tab		0,92	4	0,13	0,80			3,70	16
	Engine and Drivetrain	EN A0002	AA		Turnbuckle		15,75	2	5,00	8,76	1,32	0,67	31,49	5
	Engine and Drivetrain	EN 02001	AA	Turnbuckle	Tie rod tab		0,92	8	0,13	0,80			7,40	17
	Engine and Drivetrain	EN 02002	AA	Turnbuckle	Threaded tube		2,44	4	0,17	2,27			9,74	18
	Engine and Drivetrain	EN 02003	AA	Turnbuckle	Tie rod spacer		0,24	16	0,02	0,21				19
	Engine and Drivetrain	EN A0003	AA		Driveshaft		232,30	1	200,00	15,92	16,38		232,30	6
	Engine and Drivetrain	EN 03001	AA	Driveshaft	Inboard tripod housing		67,72	2	9,53	58,19			135,44	20
	Engine and Drivetrain	EN 03002	AA	Driveshaft	Outboard tripod housing		59,57	2	8,02	51,55			119,13	21
	Engine and Drivetrain	EN 03003	AA	Driveshaft	Right axle		20,86	1	3,34	17,52			20,86	22
	Engine and Drivetrain	EN 03004	AA	Driveshaft	Left axle		20,70	1	3,30	17,40			20,70	23
	Engine and Drivetrain	EN A0004	AA		Chain set		79,44	1	55,60	19,11	4,73		79,44	7
	Engine and Drivetrain	EN 04001	AA	Chain set	Front sprocket		16,15	1	2,378718	13,77154			16,15	24
	Engine and Drivetrain	EN 04002	AA	Chain set	Rear sprocket		16,88	1	4,25919	12,61712			16,88	25
	Engine and Drivetrain	EN 04003	AA	Chain set	Rear sprocket adapter		45,13	1	9,886555	35,2389			45,13	26
	Engine and Drivetrain	EN 04004	AA	Chain set	Rear sprocket spacer		0,30	6	0,026087	0,273867			1,80	27
	Engine and Drivetrain	EN 04005	AA	Chain set	chain shield		9,69	1	2,866226	6,822			9,69	28
	Engine and Drivetrain	EN A0005	AA		Air Intake System		63,29	1	36,00	22,02	4,44	0,83	63,29	9
	Engine and Drivetrain	EN 05001	AA	Air Intake System	Bottom plenum		4,97	1	1,77	3,20			4,97	29
	Engine and Drivetrain	EN 05002	AA	Air Intake System	Upper Plenum		18,81	1	1,76	17,06			18,81	30
	Engine and Drivetrain	EN 05003	AA	Air Intake System	Pipes		16,31	1	1,52	14,78			16,31	31
	Engine and Drivetrain	EN 05004	AA	Air Intake System	Upper Pipes		0,99	1	0,09	0,90			0,99	32
	Engine and Drivetrain	EN 05005	AA	Air Intake System	Obstruction Plate		0,85	1	0,10	0,75			0,85	33
	Engine and Drivetrain	EN 05006	AA	Air Intake System	Plenum Mount		1,25	2	0,06	1,19			2,49	34
	Engine and Drivetrain	EN A0006	AA		Throttle body		130,70	1	119,82	8,98	1,24	0,67	130,70	11
	Engine and Drivetrain	EN 06001	AA	Throttle body	Throttle Frange		5,18	1	0,73	4,45			5,18	35
	Engine and Drivetrain	EN 06002	AA	Throttle body	Restrictor		5,88	1	1,73	4,15			5,88	36
	Engine and Drivetrain	EN 06003	AA	Throttle body	Throttle Housing		4,35	1	0,92	3,43			4,35	37
	Engine and Drivetrain	EN 06004	AA	Throttle body	Throttle axle		2,73	1	0,06	2,67			2,73	38
	Engine and Drivetrain	EN 06005	AA	Throttle body	IPS axle		2,71	1	0,04	2,67			2,71	39
	Engine and Drivetrain	EN 06006	AA	Throttle body	Cable housing		3,57	1	0,17	3,40			3,57	40
	Engine and Drivetrain	EN 06007	AA	Throttle body	Axle stop		2,04	1	0,26	1,78			2,04	41
	Engine and Drivetrain	EN 06008	AA	Throttle body	Ram pipe		12,51	1	4,01	8,50			12,51	42
	Engine and Drivetrain	EN 06009	AA	Throttle body	Throttle Plate		1,49	1	0,07	1,42			1,49	43
	Engine and Drivetrain	EN 06010	AA	Throttle body	Tab		0,82	2	0,01	0,81			1,64	44
	Engine and Drivetrain	EN 06011	AA	Throttle body	Mount 1		0,74	1	0,04	0,70			0,74	45
	Engine and Drivetrain	EN 06012	AA	Throttle body	Mount 2		0,75	1	0,05	0,70			0,75	46
	Engine and Drivetrain	EN 06013	AA	Plenum Mount	Throttle Body		1,75	1	0,05	1,70			1,75	47
	Engine and Drivetrain				Area Total				612,05	632,60	33,89	4,17	1361,93	
	Frame and body	FR A0006	AA		Shifter		69,44	1	42,48	26,22	0,41	0,33	69,44	48
	Frame and body	FR 06001	AA	Shifter	Engine gear box drum gear		14,58	1	2,43	12,15				50
	Frame and body	FR 06002	AA	Shifter	Engine gear box shifting, pinion shaft		17,64	1	2,43	15,21				51
	Frame and body	FR 06003	AA	Shifter	Engine gear box actuator tab		1,89	1	0,05	1,84				52
	Frame and body	FR 06004	AA	Shifter	Front engine gear box actuator mount		2,83	1	0,04	2,79				53
	Frame and body	FR 06005	AA	Shifter	Rear gear box actuator mount		2,65	1	0,11	2,54				54
	Frame and body	FR 06006	AA	Shifter	Engine gear box actuator coupling		7,54	1	1,22	6,28	0,04			55

Line Num.	Area of Commodity	Asm/Prt #	Rev. Lvl.	Asm	Component	Descripti on	Unit Cost	Quantity	Material Cost	Process Cost	Fastener Cost	Tooling Cost	Total Cost	Details Page Number
	Frame and body				Area Total				48,75	67,03	0,45	0,33	69,44	

University	Ecole Centrale de Lyon
System	Engine and Drivetrain
Assembly	Differential
P/N Base	EN A0001
Suffix	AA
Details	Différentiel

Car #	81
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FileLink1
FileLink2
FileLink3

Asm Cost	247,69
Qty	1

Extended Cost	\$ 247,69
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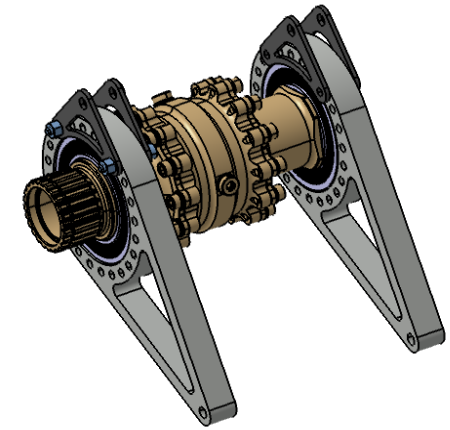
ItemOrder	Part	Part Cost	Quantity	Sub Total
10	Housing	\$ 125,31	1	\$ 125,31
20	Bearing carrier	\$ 10,73	2	\$ 21,46
30	Tie rod support	\$ 1,88	4	\$ 7,53
40	bearing carrier tab	\$ 0,92	4	\$ 3,70
Sub Total				\$ 158,00

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Bearing, Ball, Radial	Right differential bearing	\$ 40,25	90	mm	20	mm					1	\$ 40,25
20	Bearing, Ball, Radial	Left differential bearing	\$ 38,18	90	mm	18	mm					1	\$ 38,18
30	Fluid, Oil	Differential oil	\$ 0,75	0,06	liter							0,06	\$ 0,05
40	Paint		\$ 10,00	0,005	m²							1	\$ 0,08
50	Internals		\$ 110,00	1	unit							1	\$ 110,00
Sub Total													\$ 78,48

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Weld	Weld tabs to frame	\$ 0,15	cm	15,8			\$ 2,37
20	Aerosol Apply	Paint tabs	\$ 5,25	m²	0,005			\$ 0,03
30	Assemble, 3 kg, Interference	Assemble the housing and the bearings	\$ 0,56	unit	2			\$ 1,12
40	Assemble, 1 kg, Interference	Assemble the bearing carriers and the bearings	\$ 0,19	unit	2			\$ 0,38
50	Assemble, 3 kg, Line-on-Line	Put the bearing carriers and tabs in place	\$ 0,38	unit	2			\$ 0,76
60	Ratchet <=25.4 mm	Bolt the bearing carriers to tabs	\$ 0,75	unit	2			\$ 1,50
70	Reaction Tool <= 25.4 mm	Bolt the bearing carriers to tabs	\$ 0,25	unit	2			\$ 0,50
80	Assemble,1kg, Loose	Put the tie rods supports in place	\$ 0,06	unit	4			\$ 0,24
90	Ratchet <= 6.35 mm	Bolt the tie rods supports to the baring carriers	\$ 0,50	unit	4			\$ 2,00
100	Reaction Tool <= 6.35 mm	Bolt the tie rods supports to the baring carriers	\$ 0,25	unit	4			\$ 1,00
Sub Total								\$ 9,90

ItemOrder	Fastener	Use	UnitCost	Size1	Unit1	Size2	Unit2	Quantity	Sub Total
10	Bolt, Grade 8.8 (SAE 5)	Assemble bearing carriers and tabs	\$ 0,19	8	mm	45	mm	2	\$ 0,38
20	Bolt, Grade 8.8 (SAE 5)	Assemble bearing carriers and tabs	\$ 0,19	8	mm	45	mm	2	\$ 0,38
30	Nut, Grade 8.8 (SAE 5)	Assemble bearing carriers and tabs	\$ 0,04	8	mm			2	\$ 0,08
40	Bolt, Grade 8.8 (SAE 5)	Assemble bearing carrier and tie rods supports	\$ 0,08	6	mm	35	mm	4	\$ 0,32
50	Nut, Grade 8.8 (SAE 5)	Assemble bearing carrier and tie rods supports	\$ 0,03	6	mm			4	\$ 0,12
60	Washer, Grade 8.8 (SAE 5)	Assemble bearing carriers and tabs	\$ 0,01		unit			4	\$ 0,04
Sub Total									\$ 1,32

ItemOrder	Tooling	Use	UnitCost	Unit	Quantity	PVF	FractionIncluded	Sub Total
10	Welds - Welding Fixture	Tabs	\$ 500,00	point	8	3000	1	\$ 1,33
Sub Total								\$ 1,33



University	Ecole Centrale de Lyon	Car #	81	Asm Cost	\$ 20,67
System	Engine and Drivetrain	FileLink1		Qty	2
Assembly	Turnbuckle	FileLink2		Extended Cost	\$ 41,34
P/N Base	EN A0002	FileLink3			
Suffix	AA				
Details	vis-en-lanterne, biellette				

ItemOrder	Part	Part Cost	Quantity	Sub Total
10	Tie rod tab	\$ 0,92	4	\$ 3,70
20	Threaded tube	\$ 2,44	2	\$ 4,87
30	Tie rod spacer	\$ 0,24	8	\$ 1,89
	Sub Total			\$ 5,59

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Rod End, Industrial	Male left threads rod end	\$ 2,50	8	mm							1,00	\$ 2,50
20	Rod End, Industrial	Male right threads rod end	\$ 2,50	8	mm							1,00	\$ 2,50
												Sub Total	\$ 5,00

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Weld	Weld tabs to frame	\$ 0,15	cm	15,8			\$ 2,37
20	Aerosol Apply	Paint tabs	\$ 5,25	m^2	0,002			\$ 0,01
30	Assemble, 1 kg, Line-on-Line	Put nuts on rod ends	\$ 0,13	unit	2			\$ 0,26
40	Assemble, 1 kg, Line-on-Line	Put rod ends on threaded tube	\$ 0,13	unit	2			\$ 0,26
50	Wrench <= 25.4 mm	Tighten the nut to the tube	\$ 1,50	unit	2			\$ 3,00
60	Reaction Tool <= 25.4 mm	Tighten the nut to the tube	\$ 0,25	unit	2			\$ 0,50
70	Assemble, 1 kg, Loose	Put tie rod on tie rod support and spacers	\$ 0,06	unit	3			\$ 0,18
80	Ratchet <= 25.4 mm	Put the M8 bolt	\$ 0,75	unit	1			\$ 0,75
90	Reaction Tool <= 25.4 mm	Put the M8 nut	\$ 0,25	unit	1			\$ 0,25
100	Assemble, 1 kg, Loose	Put tie rod on tab with spacers	\$ 0,06	unit	3			\$ 0,18
110	Ratchet <= 25.4 mm	Put the M8 bolt	\$ 0,75	unit	1			\$ 0,75
120	Reaction Tool <= 25.4 mm	Put the M8 nut	\$ 0,25	unit	1			\$ 0,25
								Sub Total \$ 8,76

ItemOrder	Fastener	Use	UnitCost	Size1	Unit1	Size2	Unit2	Quantity	Sub Total
10	Bolt, Grade 8.8 (SAE 5)	Assemble bearing carriers and tabs	\$ 0,19	8	mm	45	mm	2	\$ 0,38
20	Bolt, Grade 8.8 (SAE 5)	Assemble bearing carriers and tabs	\$ 0,19	8	mm	45	mm	2	\$ 0,38
30	Nut, Grade 8.8 (SAE 5)	Assemble bearing carriers and tabs	\$ 0,04	8	mm			2	\$ 0,08
40	Bolt, Grade 8.8 (SAE 5)	Assemble bearing carrier and tie rods supports	\$ 0,08	6	mm	35	mm	4	\$ 0,32
50	Nut, Grade 8.8 (SAE 5)	Assemble bearing carrier and tie rods supports	\$ 0,03	6	mm			4	\$ 0,12
60	Washer, Grade 8.8 (SAE 5)	Assemble bearing carriers and tabs	\$ 0,01		unit			4	\$ 0,04
								Sub Total	\$ 1,32

ItemOrder	Tooling	Use	UnitCost	Unit	Quantity	PVF	Fraction Included	Sub Total
10	Welds - Welding Fixture	Tabs	\$ 500,00	point	4	3000	1	\$ 0,67
							Sub Total	\$ 0,67

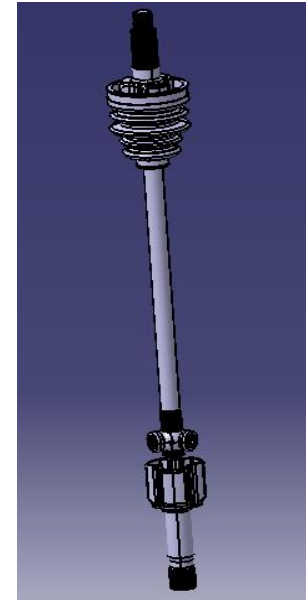
University	Ecole Centrale de Lyon	Car #	81	Asm Cost	\$ 388,45
System	Engine and Drivetrain	FileLink1		Qty	1
Assembly	Driveshaft	FileLink2		Extended Cost	\$ 388,45
P/N Base	EN A0003	FileLink3			
Suffix	AA				
Details					

ItemOrder	Part	Part Cost	Quantity	Sub Total
10	Inboard tripod housing	\$ 67,72	2	\$ 135,44
20	Outboard tripod housing	\$ 59,57	2	\$ 119,13
30	Right axle	\$ 20,86	1	\$ 20,86
40	Left axle	\$ 20,70	1	\$ 20,70
	Sub Total			\$ 156,15

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Constant Velocity Joint, Tripod	Tripod for driveshaft	\$ 45,00		unit							4,00	\$ 180,00
20	Constant Velocity Joint, Boot	Boot for driveshaft	\$ 5,00		unit							4,00	\$ 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			\$ 1,12
20	Wrench <= 25.4 mm	Fasten the differential and a tripod housing	\$ 1,50	unit	2			\$ 3,00
30	Assemble, 1 kg, Interference	Assemble a boot and an axle	\$ 0,19	unit	4			\$ 0,76
40	Assemble, 1 kg, Interference	Assemble an axle and a snap ring	\$ 0,19	unit	4			\$ 0,76
50	Assemble, 1 kg, Line-on-Line	Assemble a tripod and an axle	\$ 0,13	unit	4			\$ 0,52
60	Assemble, 1 kg, Interference	Assemble an axle and a snap ring	\$ 0,19	unit	4			\$ 0,76
70	Assemble, 3 kg, Loose	Assemble an axle and a tripod housing	\$ 0,19	unit	4			\$ 0,76
80	Assemble, 1 kg, Interference	Assemble a boot and an tripod housing	\$ 0,19	unit	4			\$ 0,76
90	Assemble, 3 kg, Interference	Assemble a tripod housing and a hub	\$ 0,56	unit	2			\$ 1,12
100	Assemble, 3 kg, Interference	Assemble a tripod housing and a hub	\$ 0,56	unit	2			\$ 1,12
110	Assemble, 3 kg, Interference	Assemble a hose clamp and an axle	\$ 0,56	unit	2			\$ 1,12
120	Assemble, 3 kg, Interference	Assemble a hose clamp and an tripod housing	\$ 0,56	unit	2			\$ 1,12
130	Wrench <= 25.4 mm	Bolt tripod housing to hub	\$ 1,50	unit	2			\$ 3,00
	Sub Total							\$ 15,92

ItemOrder	Fastener	Use	UnitCost	Size1	Unit1	Size2	Unit2	Quantity	Sub Total
10	Retaining Ring, R-ring	Snap ring for retaining tripods	\$ 0,09	20	mm			8	\$ 0,72
20	Hose Clamp, Spring Steel	fasten the boot	\$ 0,92	65,5	mm			2	\$ 1,84
30	Hose Clamp, Spring Steel	fasten the boot	\$ 0,28	20	mm			2	\$ 0,56
40	Bolt, Grade 8.8 (SAE 5)	Assemble the tripod housings and the differential	\$ 0,08	8	mm	20	mm	2	\$ 0,16
50	Nut, Grade NAS 6-Point	Fasten the tripod housing and the hub	\$ 6,55	20	mm			2	\$ 13,10
	Sub Total								\$ 16,38



University

System

Assembly

P/N Base

Suffix

Details

Ecole Centrale de Lyon

Engine and Drivetrain

Chain set

EN A0004

AA

Car #

81

FileLink1

FileLink2

FileLink3

Asm Cost

\$ 120,44

Qty

1

Extended Cost

\$ 120,44

ItemOrder	Part	Part Cost	Quantity	Sub Total
10	Front sprocket	\$ 1,00	1	\$ 1,00
20	Rear sprocket	\$ 1,00	1	\$ 1,00
30	Rear sprocket adapter	\$ 1,00	1	\$ 1,00
40	Rear sprocket spacer	\$ 6,00	6	\$ 36,00
50	chain shield	\$ 1,00	1	\$ 1,00
			Sub Total	\$ 41,00

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Chain	520 Chain	\$ 0,05	1112	mm							1112,00	\$ 55,60
												Sub Total	\$ 55,60

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Weld	Weld lower chain shield to frame	\$ 0,15	cm	15			\$ 2,25
		Put the rear sprocket adapter on the differential	\$ 0,56	unit	1			\$ 0,56
20	Assemble, 3 kg, Interference	Put the retaining ring in the groove	\$ 0,19	unit	1			\$ 0,19
30	Assemble, 1 kg, Interference	Put spacers on adapter	\$ 0,06	unit	6			\$ 0,36
40	Assemble, 1 kg, Loose	Put rear sprocket on adapter	\$ 0,06	unit	1			\$ 0,06
50	Assemble, 1 kg, Loose	Bolt rear sprocket to adapter	\$ 0,75	unit	6			\$ 4,50
60	Ratchet <= 25.4 mm	Bolt rear sprocket to adapter	\$ 0,25	unit	6			\$ 1,50
70	Reaction Tool <= 25.4 mm	Put the front sprocket in place	\$ 0,19	unit	1			\$ 0,19
80	Assemble, 1 kg, Interference	Bolt front sprocket to engine	\$ 0,75	unit	1			\$ 0,75
90	Ratchet <= 25.4 mm	Put chain in place	\$ 0,63	unit	1			\$ 0,63
100	Assemble, 5 kg, Line-on-Line	Chain tension	\$ 5,00	unit	1			\$ 5,00
110	Adjustment - Misc.	Put the upper chain shield	\$ 0,06	unit	1			\$ 0,06
120	Assemble, 1 kg, Loose	Bolt upper chain shield to lower chain shield	\$ 0,75	unit	2			\$ 1,50
130	Ratchet <= 25.4 mm	Bolt upper chain shield to lower chain shield	\$ 0,25	unit	2			\$ 0,50
140	Reaction Tool <= 25.4 mm	Put the upper chain shield on the engine	\$ 0,06	unit	1			\$ 0,06
150	Assemble, 1 kg, Loose	Bolt upper chain shield to engine	\$ 0,75	unit	1			\$ 0,75
160	Ratchet <= 25.4 mm	Bolt upper chain shield to engine	\$ 0,25	unit	1			\$ 0,25
170	Reaction Tool <= 25.4 mm							
							Sub Total	\$ 19,11

ItemOrder	Fastener	Use	UnitCost	Size1	Unit1	Size2	Unit2	Quantity	Sub Total
10	Bolt, Grade 12.9	Assemble the rear sprocket with the adapter	\$ 0,54	10	mm	50	mm	6	\$ 3,24
20	Nut, Grade 8.8 (SAE 5)	Assemble the rear sprocket with the adapter	\$ 0,07	10	mm			6	\$ 0,42
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 upper chain shield with the lower	\$ 0,08	8	mm	20	mm	2	\$ 0,16
50	Nut, Grade 8.8 (SAE 5)	Assemble the upper chain shield with the lower	\$ 0,04	8	mm			2	\$ 0,08
60	Washer, Grade 8.8 (SAE 5)	Assemble the upper chain shield with the lower	\$ 0,01		unit			4	\$ 0,04
70	Bolt, Grade 8.8 (SAE 5)	Assemble the upper chain shield with the engine	\$ 0,04	6	mm	20	mm	1	\$ 0,04
80	Nut, Grade 8.8 (SAE 5)	Assemble the upper chain shield with the engine	\$ 0,03	6	mm			1	\$ 0,03
90	Washer, Grade 8.8 (SAE 5)	Assemble the upper chain shield with the engine	\$ 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 adapter in place on the differential	\$ 0,50	52	mm			1	\$ 0,50
								Sub Total	\$ 4,73

University	Ecole Cenrale de Lyon
System	Engine and Drivetrain
Assembly	Air Intake System
P/N Base	EN A0005
Suffix	AA
Details	Air Intake assembly

Car #	81
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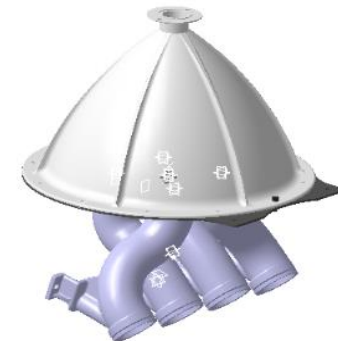
FileLink1
FileLink2
FileLink3

Asm Cost	107,71
Qty	1
Extended Cost	\$ 107,71

ItemOrder	Part	Part Cost	Quantity	Sub Total
10	Bottom plenum	\$ 4,97	1	\$ 4,97
20	Upper plenum	\$ 18,81	1	\$ 18,81
30	Pipes	\$ 16,31	1	\$ 16,31
40	Upper pipes	\$ 0,99	1	\$ 0,99
50	Obstruction plate	\$ 0,85	1,00	\$ 0,85
60	Plenum Mount	\$ 1,25	2,00	\$ 2,49
Sub Total				\$ 44,42

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Hose, Rubber	Rubber brushing	\$ 9,00	50 mm								4,00	\$ 36,00
Sub Total													\$ 36,00

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Assemble, 1kg, Line-on-line	Assemble pipes and bottom plenum	\$ 0,13		1		1	\$ 0,13
20	Ratchet <= 6,35 mm	Tighten parts together	\$ 0,50		12		1	\$ 6,00
30	Reaction tool <= 6,35 mm	Reaction for process 20	\$ 0,25		12		1	\$ 3,00
40	Assemble, 1kg, Line-on-line	Assemble upper plenum, bottom plenum and uper pipes	\$ 0,13		1		1	\$ 0,13
50	Ratchet <= 6,35 mm	Tighten parts together	\$ 0,50		8		1	\$ 4,00
60	Reaction tool <= 6,35 mm	Reaction for process 20	\$ 0,25		8		1	\$ 2,00
70	Assemble, 1kg, Interference	Assemble rubber brushing to engine	\$ 0,19		4		1	\$ 0,76
80	Assemble, 1kg, loose	Put clamp on brushing	\$ 0,06		4		1	\$ 0,24
90	Assemble, 1kg, Interference	Assemble pipes on rubber brushing	\$ 0,19		4		1	\$ 0,76
100	Screwdriver > 1Turn	Tighten hose clamp	\$ 0,50		4		1	\$ 2,00
110	Power Tool, < 6,35mm	Tighten obstruction plate with engine	\$ 0,25		4			\$ 1,00
120	Power Tool, < 6,35mm	Tighten plenum mount with obstruction plat	\$ 0,25		2			\$ 0,50
130	Ratchet <= 6,35 mm	Tighten plenum mount with pipes	\$ 0,50		2		1	\$ 1,00
140	Reaction tool <= 6,35 mm	Reaction for process 130	\$ 0,25		2		1	\$ 0,50
Sub Total								\$ 22,02



ItemOrder	Fastener	Use	UnitCost	Size1	Unit1	Size2	Unit2	Quantity	Sub Total
10	Bolt, Grade 8.8 (SAE 5)	M4 bolt for process 20	\$ 0,02	4	mm	20	mm	12	\$ 0,24
20	Nut, Grade 8.8 (SAE 5)	M4 nut for process 20	\$ 0,02	4	mm			12	\$ 0,24
30	Washer, Grade 8.8 (SAE 5)	M4 washer for process 20	\$ 0,01	4	mm			12	\$ 0,12
40	Bolt, Grade 8.8 (SAE 5)	M6 bolt for process 80	\$ 0,04	6	mm	20	mm	4	\$ 0,16
50	Bolt, Grade 8.8 (SAE 5)	M6 bolt for process 90	\$ 0,04	6	mm	20	mm	2	\$ 0,08
60	Nut, Grade 8.8 (SAE 5)	M6 nut for process 90	\$ 0,03	6	mm			2	\$ 0,06
70	Washer, Grade 8.8 (SAE 5)	M6 washer for process 90	\$ 0,01	6	mm			2	\$ 0,02
80	Hose Clamp, Miniature Bolt	Clamp for process 40	\$ 0,72	55	mm			4	\$ 2,88
90	M6 bolt for process 50	M6 bolt for process 50	\$ 0,04	6	mm	16	mm	8	\$ 0,32
100	Nut, Grade 8.8 (SAE 5)	M6 nut for process 50	\$ 0,03	6	mm			8	\$ 0,24
110	Washer, Grade 8.8 (SAE 5)	M6 washer for process 50	\$ 0,01	6	mm			8	\$ 0,08
Sub Total									\$ 4,44
ItemOrder	Tooling	Use	UnitCost	Unit	Quantity	PVF	FractionIncluded	Sub Total	
10	Welds - Welding Fixture	Exemple de Tooling	\$ 500,00	point	5	3000	1	\$ 0,83	
Sub Total								\$ 0,83	

University	Ecole Centrale de Lyon	Car #	81	Asm Cost	176,04
System	Engine and Drivetrain	FileLink1		Qty	1
Assembly	Throttle body	FileLink2		Extended Cost	\$ 176,04
P/N Base	EN A0006	FileLink3			
Suffix	AA				
Details					

ItemOrder	Part	Part Cost	Quantity	Sub Total
10	Throttle Frange	\$ 5,18	1	\$ 5,18
20	Restrictor	\$ 5,88	1	\$ 5,88
30	Throttle Housing	\$ 4,35	1	\$ 4,35
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
100	Tabs	\$ 0,82	2	\$ 1,64
110	Mount 1	\$ 0,74	1	\$ 0,74
120	Mount 2	\$ 0,75	1	\$ 0,75
130	Hose Clip	\$ 1,75	1	\$ 1,75
			Sub Total	\$ 45,34

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	Paint	Tabs painting	\$ 10,00	1,50E-03	m^2							1,50E-03	\$ 0,02
30	Spring, Tension (General)	Torsion spring	\$ 1,00									1	\$ 1,00
40	Spring, Tension (General)	Helicoidal spring	\$ 1,00									1	\$ 1,00
50	Seal, O-ring, Elastomer	Sealing with airfilter	\$ 0,05									1	\$ 0,05
60	Seal, O-ring, Elastomer	Sealing with plenum	\$ 0,05									1	\$ 0,05
70	Cable, pull	Throttle cable	\$ 15,00	2,5	m							2,5	\$ 37,50
80	Cable, adjuster		\$ 1,00									1	\$ 1,00
90	Mount, vibrating damping, Sandwich	Isolation between throttle and frame	\$ 8,10	30	mm							2	\$ 16,20
												Sub Total	\$ 119,82

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Weld	Tabs welding	\$ 0,15	cm	4		1	\$ 0,60
20	Aerosol apply	Tabs painting	\$ 5,25	m^2	0,0015		1	\$ 0,01
30	Assemble, 1kg, Interference	Assemble throttle housing on restrictor	\$ 0,19	Unit	1		1	\$ 0,19
40	Assemble, 1kg, Interference	Assemble flange on restrictor	\$ 0,19	Unit	1		1	\$ 0,19
50	Assemble, 1kg, Interference	Assemble ram pipe on restrictor	\$ 0,19	Unit	1		1	\$ 0,19
60	Assemble, 1kg, Interference	Assemble throttle plate in restrictor	\$ 0,19	Unit	1		1	\$ 0,19
70	Assemble, 1kg, Interference	Assemble TPS axle	\$ 0,19	Unit	1		1	\$ 0,19
80	Assemble, 1kg, Interference	Assemble cable housing axle	\$ 0,19	Unit	1		1	\$ 0,19
90	Assemble, 1kg, Interference	Assemble negative stop	\$ 0,19	Unit	1		1	\$ 0,19
100	Ratchet <= 6,35mm	Tighten M5 bolt	\$ 0,50	Unit	1		1	\$ 0,50
110	Reaction tool <=6,35mm	Reaction tool for M5 nut	\$ 0,25	Unit	1		1	\$ 0,25
120	Assemble, 1kg, Line-on-line	Assemble torsion spring	\$ 0,13	Unit	1		1	\$ 0,13
130	Assemble, 1kg, Loose	Assemble axle stop	\$ 0,06	Unit	2		1	\$ 0,12



140	Ratchet <= 6,35mm	Tighten M5 bolt	\$ 0,50	Unit	1		1	\$ 0,50
150	Assemble, 1kg, Loose	Assemble seal on throttle body	\$ 0,06	Unit	2		1	\$ 0,12
160	Assemble, 1kg, Interference	Assemble throttle body on plenum	\$ 0,19	Unit	1		1	\$ 0,19
170	Ratchet <= 6,35mm	Tighten M6 bolt	\$ 0,50	Unit	2		1	\$ 1,00
180	Reaction tool <=6,35mm	Reaction tool for M6 nut	\$ 0,25	Unit	2		1	\$ 0,50
190	Assemble, 1kg, Loose	Assemble air filter and clamp	\$ 0,06	Unit	1		1	\$ 0,06
200	Screwdriver <1 Turn	Tighten clamp	\$ 0,12	Unit	1		1	\$ 0,12
210	Assemble, 1kg, Loose	Assemble cable adjuster	\$ 0,06	Unit	1		1	\$ 0,06
220	Hand, Loose <=6,35mm	Tighten throttle adjuster	\$ 0,25	Unit	1		1	\$ 0,25
230	Assemble, 1kg, Loose	Assemble cable	\$ 0,06	Unit	1		1	\$ 0,06
240	Assemble, 1kg, Loose	Assemble hose clip and Mounts	\$ 0,06	Unit	1		1	\$ 0,06
250	Ratchet <= 6,35mm	Tighten M6 bolt	\$ 0,50	Unit	2		1	\$ 1,00
260	Reaction tool <=6,35mm	Reaction tool for M6 nut	\$ 0,25	Unit	2		1	\$ 0,50
270	Assemble, 1kg, Loose	Assemble Vibration-Damping, Mounts and Tabs	\$ 0,06	Unit	2		1	\$ 0,12
280	Ratchet <= 6,35mm	Tighten M6 bolt	\$ 0,50	Unit	2		1	\$ 1,00
290	Reaction tool <=6,35mm	Reaction tool for M6 nut	\$ 0,25	Unit	2		1	\$ 0,50
Sub Total								\$ 8,98

ItemOrder	Fastener	Use	UnitCost	Size1	Unit1	Size2	Unit2	Quantity	Sub Total
10	Bolt, Grade 8.8 (SAE 5)	Process 90	\$ 0,02		5 mm		10 mm	1	\$ 0,02
20	Nut, Grade 8.8 (SAE 5)	Process 90	\$ 0,02		5 mm			1	\$ 0,02
30	Bolt, Grade 8.8 (SAE 5)	Process 130	\$ 0,02		5 mm		10 mm	1	\$ 0,02
40	Bolt, Grade 8.8 (SAE 5)	Process 160	\$ 0,04		6 mm		16 mm	2	\$ 0,08
50	Nut, Grade 8.8 (SAE 5)	Process 160	\$ 0,03		6 mm			2	\$ 0,06
60	Washer, Grade 8.8 (SAE 5)	Process 160	\$ 0,01		6 mm			2	\$ 0,02
70	Hose Clamp, Miniature Bolt	Process 190	\$ 0,80		75 mm			1	\$ 0,80
80	Bolt, Grade 8.8 (SAE 5)	Process 240	\$ 0,04		6 mm		16 mm	2	\$ 0,08
90	Nut, Grade 8.8 (SAE 5)	Process 240	\$ 0,03		6 mm			2	\$ 0,06
100	Washer, Grade 8.8 (SAE 5)	Process 240	\$ 0,01		6 mm			2	\$ 0,02
110	Nut, Grade 8.8 (SAE 5)	Process 270	\$ 0,03		6 mm			2	\$ 0,06
								Sub Total	\$ 1,24

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

University	Ecole Centrale de Lyon
System	Engine and Drivetrain
Assembly	Differential
Part	Housing
P/N Base	EN 01001
Suffix	AA
Details	bought, cost as made

FileLink1
FileLink2
FileLink3

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	\$ 125,31
Qty	1
Extended Cost	\$ 125,31

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Aluminium, Premium	Material for differential housing	\$ 4,20					Round 102mm diam.	8,17E-03	0,09	2712	1	\$ 8,19
20	Aluminium, Premium	Material for differential housing cover	\$ 4,20					Round 102mm diam.	8,17E-03	0,07	2712	1	\$ 6,06
30	Aluminium, Premium	Material for differential cover	\$ 4,20					Round 102mm diam.	8,17E-03	0,08	2712	1	\$ 7,23
40	Seal, O-ring, Elastomer		\$ 0,05									2	\$ 0,10
												Sub Total	\$ 21,58

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 differential housing	\$ 1,30	unit	1			\$ 1,30
20	Machining	Machining of the diffrential housing	\$ 0,04	cm^3	623	Material - Aluminium	1	\$ 24,94
30	Tapping holes	Tapped holes for the differential housing	\$ 0,35	hole	24			\$ 8,40
40	Tapping holes	Tapped holes for the drain screw of the differential housing	\$ 0,35	hole	3			\$ 1,05
50	Machining Setup, Install and remove	Setup and removal of the machining of the differential housing cover	\$ 1,30	unit	1			\$ 1,30
60	Machining	Machining of the diffrential housing cover	\$ 0,04	cm^3	426	Material - Aluminium	1	\$ 17,06
70	Drilled holles <25,4mm dia	hole for the differential housing cover	\$ 0,35	hole	12			\$ 4,20
80	Broach, External	Broach of the housing cover	\$ 0,50	cm	3,5			\$ 1,75
90	Machining Setup, Install and remove	Setup and removal of the machining	\$ 0,35	unit	1			\$ 0,35
100	Machining	Machining of the differential cover	\$ 0,04	cm^3	538	Material - Aluminium	1	\$ 21,53
110	Drilled holles <25,4mm dia	hole for the differential cover	\$ 0,35	hole	12			\$ 4,20
120	Assemble, 1 kg, Line-on-Line	Assemble the three parts and the two seals	\$ 0,13	unit	2			\$ 0,26
130	Ratchet <= 6.35 mm	Assemble the three parts	\$ 0,50	unit	24			\$ 12,00
140	Ratchet <= 25.4 mm	Bolt the drain screws to housing	\$ 0,75	unit	3			\$ 2,25
Sub Total								\$ 100,59

ItemOrder	Fastener	Use	UnitCost	Size1	Unit1	Size2	Unit2	Quantity	Sub Total
10	Bolt, Grade 12,9	Assemble of the three parts	\$ 0,06	6	mm	14	mm	24	\$ 1,44
20	Washer, Grade 12,9		\$ 0,02		unit			24	\$ 0,48
30	Bolt, Grade 10,9	Drain screw	\$ 0,07	8	mm	8	mm	3	\$ 0,21
40	Crush Washer	Copper washer for impermeability of the differential	\$ 0,34	8	mm			3	\$ 1,01
Sub Total									\$ 3,14

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University	Ecole Centrale de Lyon													
System	Engine and drivetrain													
Assembly	Turnbuckle													
Part	Threaded tube													
P/N Base	EN 02002													
Suffix	AA													
Details														

FileLink1
FileLink2
FileLink3

Car # 81

FileLink1
FileLink2
FileLink3

Part Cost	\$ 2,44
Qty	2
Extended Cost	\$ 4,87

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Mild	Tube	\$ 2,25	0,017	m			Round diameter 17 mm	0,00023	0,04	7850	1,00	\$ 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	Machining	Shaping of the threaded tube	\$ 0,04	cm^3	5,06	Material-Steel	3	\$ 0,61
30	Threading, internal	Threading for the rod ends	\$ 0,10	cm	3,6			\$ 0,36
Sub Total								\$ 2,27

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University	Ecole Centrale de Lyon
System	Engine and drivetrain
Assembly	Driveshaft
Part	Inboard tripod housing
P/N Base	EN 03001
Suffix	AA
Details	Bought part, cost as made

FileLink1
FileLink2
FileLink3

Car # 81

Part Cost \$ 67,72

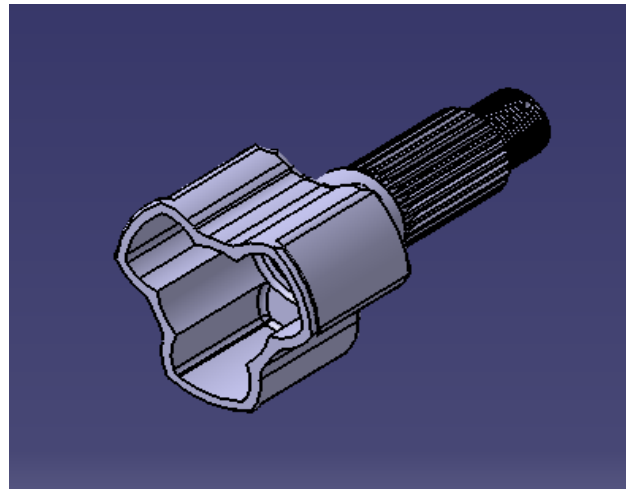
Qty 2

FileLink1
FileLink2
FileLink3

Extended Cost \$ 135,44

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Alloy	Material for the inboard tripod housing	\$ 2,25					Round 65,5mm diam.	0,00337	0,16	7850	1,00	\$ 9,53
												Sub Total	\$ 9,53

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	Shaping of the tripod housing	\$ 0,04	cm^3	453	Material-Steel	3	\$ 54,36
30	Machining Setup, Install and remove	Setup and removal of the broach of the tripod housing	\$ 1,30	unit	1			\$ 1,30
40	Broach, External	Broach of the tripod housing	\$ 0,50	cm	2,45			\$ 1,23
Sub Total								\$ 58,19



University	Ecole Centrale de Lyon
System	Engine and drivetrain
Assembly	Driveshaft
Part	Outboard tripod housing
P/N Base	EN 03002
Suffix	AA
Details	Bought part, cost as made

FileLink1
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FileLink3

Car # 81

Part Cost \$ 59,57

Qty 2

FileLink1
FileLink2
FileLink3

Extended Cost \$ 119,13

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Alloy	Material for the tripod housing	\$ 2,25					Round 65,5mm diam.	0,00337	0,13	7850	1,00	\$ 8,02
												Sub Total	\$ 8,02

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	Shaping of the tripod housing	\$ 0,04	cm^3	378	Material-Steel	3	\$ 45,31
30	Machining Setup, Install and remove	Setup and removal of the broach of the tripod housing	\$ 1,30	unit	1			\$ 1,30
40	Broach, External	Broach of the tripod housing	\$ 0,50	cm	4,2			\$ 2,10
50	Machining Setup, Install and remove	Setup and removal of the threading of the tripod housing	\$ 1,30	unit	1			\$ 1,30
60	Threading, External (machining)	Threading of the tripod housing	\$ 0,10	cm	2,4			\$ 0,24
Sub Total								\$ 51,55



University	Ecole Centrale de Lyon
System	Engine and drivetrain
Assembly	Driveshaft
Part	Right axle
P/N Base	EN 03003
Suffix	AA
Details	Bought part, cost as made

FileLink1
FileLink2
FileLink3

Car # 81

FileLink1
FileLink2
FileLink3

Part Cost \$ 20,86

Qty 1

Extended Cost \$ 20,86

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Alloy	Material for driveshaft axle	\$ 2,25					Round 24mm diam.	0,00045	0,41	7850	1,00	\$ 3,34
												Sub Total	\$ 3,34

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	Shaping of the axle	\$ 0,04	cm^3	80,1	Material-Steel	3	\$ 9,62
30	Machining Setup, Install and remove	Setup and removal of the broach of the axle	\$ 1,30	unit	1			\$ 1,30
40	Broach, External	Broach of the axle	\$ 0,50	cm	10,6			\$ 5,30
Sub Total								\$ 17,52



University	Ecole Centrale de Lyon
System	Engine and drivetrain
Assembly	Driveshaft
Part	Left axle
P/N Base	EN 03004
Suffix	AA
Details	Bought part, cost as made

FileLink1
FileLink2
FileLink3

Car # 81

Part Cost \$ 20,70

Qty 1

FileLink1
FileLink2
FileLink3

Extended Cost \$ 20,70

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Alloy	Material for driveshaft axle	\$ 2,25					Round 24mm diam.	0,00045	0,41	7850	1,00	\$ 3,30
												Sub Total	\$ 3,30

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	Shaping of the axle	\$ 0,04	cm^3	79,2	Material-Steel	3	\$ 9,50
30	Machining Setup, Install and remove	Setup and removal of the broach of the axle	\$ 1,30	unit	1			\$ 1,30
40	Broach, External	Broach of the axle	\$ 0,50	cm	10,6			\$ 5,30
Sub Total								\$ 17,40



University	Ecole Centrale de Lyon
System	Engine and drivetrain
Assembly	Chain set
Part	Front sprocket
P/N Base	EN 04001
Suffix	AA
Details	Bought part, cost as made

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FileLink3

Car # 81

FileLink1
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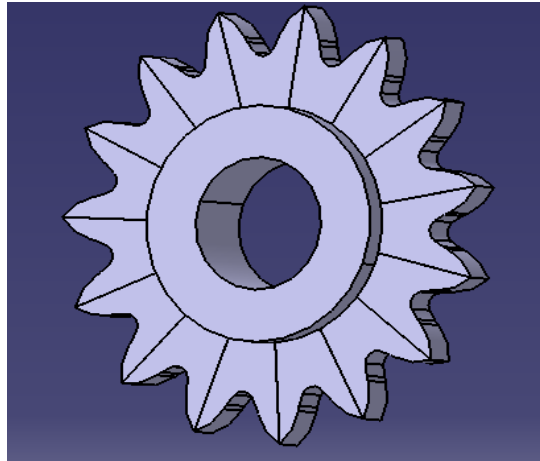
Part Cost \$ 16,15

Qty 1

Extended Cost \$ 16,15

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					Round 95mm	0,00709	0,02	7850	1,00	\$ 2,38
												Sub Total	\$ 2,38

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Setup and removal of the mach	\$ 1,30	unit	1,00			\$ 1,30
20	Machining	Shaping of the sprocket	\$ 0,04	cm^3	86,10	Material-Steel	3	\$ 10,33
30	Machinig Setup, Install and remove	Setup and removal of the broach of the sprocket	\$ 1,30	unit	1,00			\$ 1,30
40	Broach, Internal	Broach of the sprocket	\$ 0,50	cm	1,68			\$ 0,84
Sub Total								\$ 13,77



University	Ecole Centrale de Lyon
System	Engine and drivetrain
Assembly	Chain set
Part	Rear sprocket
P/N Base	EN 04002
Suffix	AA
Details	Bought part, cost as made

FileLink1
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FileLink3

Car # 81

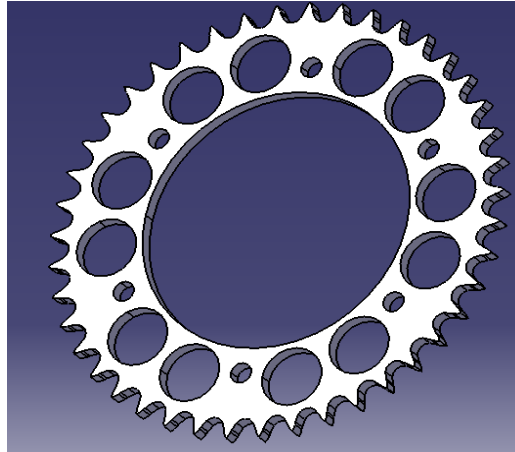
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Part Cost \$ 16,88
Qty 1

Extended Cost \$ 16,88

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Aluminium, Normal	4,2	\$ 4,20					Round 230mm	0,04155	0,01	2712	1,00	\$ 4,26
												Sub Total	\$ 4,26

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	\$ 0,04	cm^3	283	Material - Aluminium	1	\$ 11,32
Sub Total								\$ 12,62



University	Ecole Centrale de Lyon
System	Engine and drivetrain
Assembly	Chain set
Part	Rear sprocket adapter
P/N Base	EN 04003
Suffix	AA
Details	

FileLink1
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Car # 81

FileLink1
FileLink2
FileLink3

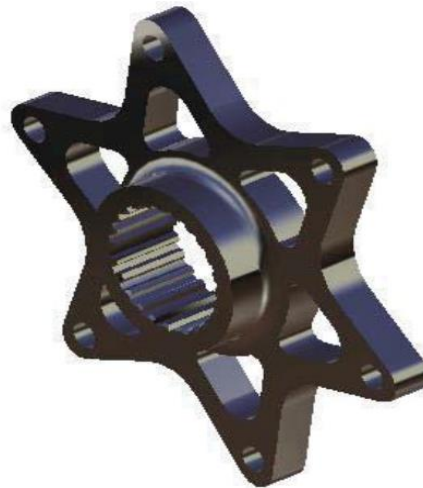
Part Cost \$ 45,13

Qty 1

Extended Cost \$ 45,13

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					Round 183mm	0,02630	0,03	2712	1,00	\$ 9,89
												Sub Total	\$ 9,89

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	701			\$ 28,04
30	Machining Setup, Change	Setup for machining the other side of the adapter	\$ 0,65	unit	1			\$ 0,65
40	Machining	Shaping of the other side of the adapter	\$ 0,04	cm^3	7,5			\$ 0,30
50	Drilled holes < 25.4 mm dia.	Hole for the rear sprocket	\$ 0,35	hole	6			\$ 2,10
60	Machinig Setup, Install and remove	Setup and removal of the broach of the adapter	\$ 1,30	unit	1			\$ 1,30
70	Broach, Internal	Broach of the adapter	\$ 0,50	cm	3,1			\$ 1,55
Sub Total								\$ 35,24



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University	Ecole Centrale de Lyon
System	Engine and Drivetrain
Assembly	Air Intake System
Part	Bottom plenum
P/N Base	EN 05001
Suffix	AA
Details	

FileLink1
FileLink2
FileLink3

Car #	81,00
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Part Cost	\$ 4,97
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Qty	1,00
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FileLink1

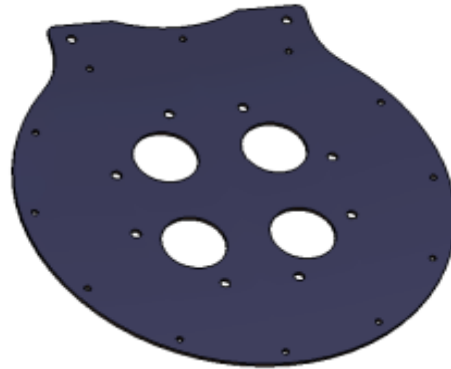
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FileLink3

Extended Cost	\$ 4,97
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ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Aluminium, Normal		\$ 4,20	0,423	kg			rectangular aera, 304x300 mm	0,062	0,0025	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 laser cutting	\$ 1,30	unit	1			\$ 1,30
20	Laser cut		\$ 0,01	cm	190,2		1	\$ 1,90
							Sub Total	\$ 3,20



University Ecole Centrale de Lyon
System Engine and Drivetrain
Assembly [Air Intake System](#)
Part Upper Plenum
P/N Base EN 05002
Suffix AA
Details The upper part of the plenum

FileLink1
FileLink2
FileLink3

Car # 81,00

Part Cost \$ 18,81

Qty 1,00

FileLink1

FileLink2

FileLink3

Extended Cost \$ 18,81

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Plastic, Nylon		\$ 3,30	0,533	kg							1	\$ 1,76
												Sub Total	\$ 1,76

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Rapid Prototype - Plastic		\$ 32,00	kg	0,533			\$ 17,06
Sub Total							\$	17,06



University	Ecole Centrale de Lyon
System	Engine and Drivetrain
Assembly	Air Intake System
Part	Pipes
P/N Base	EN 05003
Suffix	AA
Details	Description brève de la pièce

FileLink1
FileLink2
FileLink3

Car #	81,00
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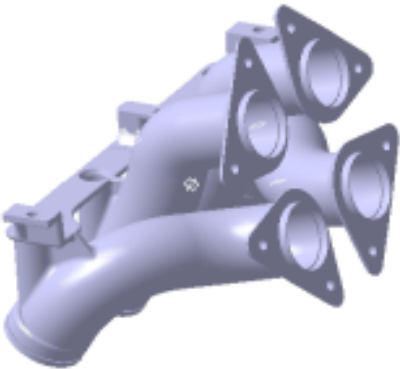
Part Cost	\$ 16,31
Qty	1,00

FileLink1
FileLink2
FileLink3

Extended Cost	\$ 16,31
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ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Plastic, Nylon		\$ 3,30	0,462	kg							1	\$ 1,52
												Sub Total	\$ 1,52

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Rapid Prototype - Plastic		\$ 32,00	kg	0,46			\$ 14,78
							Sub Total	\$ 14,78



University Ecole Centrale de Lyon
System Engine and Drivetrain
Assembly [Air Intake System](#)
Part Upper Pipes
P/N Base EN 05004
Suffix AA
Details Description brève de la pièce

FileLink1
FileLink2
FileLink3

Car # 81,00

Part Cost \$ 0,99

Qty 1,00

FileLink1

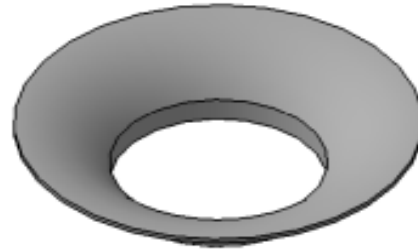
FileLink2

FileLink3

Extended Cost \$ 0,99

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Plastic, Nylon		\$ 3,30	0,007	kg							4	\$ 0,09
												Sub Total	\$ 0,09

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Rapid Prototype - Plastic		\$ 32,00	kg	0,007		4,00	\$ 0,90
							Sub Total	\$ 0,90



University	Ecole Centrale de Lyon
System	Engine and Drivetrain
Assembly	Air Intake System
Part	Obstruction Plate
P/N Base	EN 05005
Suffix	AA
Details	

FileLink1
FileLink2
FileLink3

Car #	81,00
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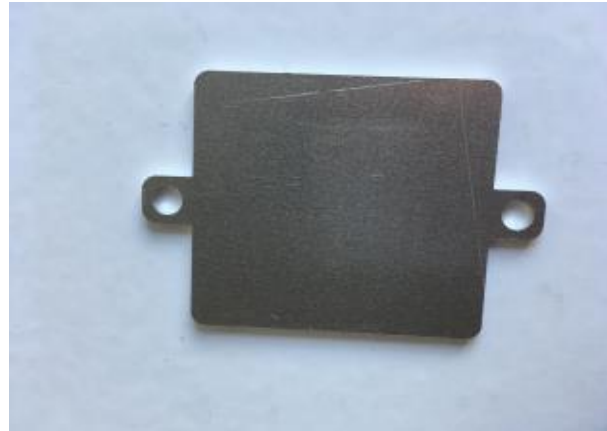
Part Cost	0,85
Qty	1,00

FileLink1
FileLink2
FileLink3

Extended Cost	0,85
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ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Aluminium, Normal (per kg)		\$ 4,20	0,023	kg			rectangular aera, 80x53 mm	4,24E-03	2,00E-03	2712	1,00	\$ 0,10
												Sub Total	\$ 0,10

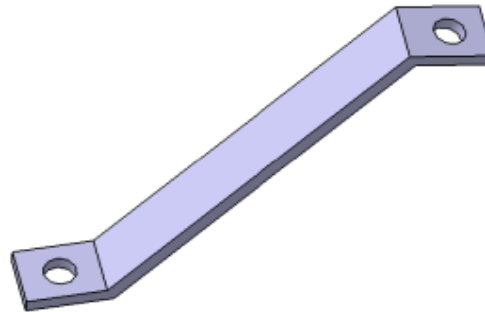
ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Setup for laser cutting	\$ 1,30	unit	1		0,5	\$ 0,65
20	Laser cut		\$ 0,01	cm	10,1		1	\$ 0,10
							Sub Total	\$ 0,75



University	Ecole Centrale de Lyon			Car #	81,00	Part Cost	1,25
System	Engine and Drivetrain	FileLink1				Qty	2,00
Assembly	Air Intake System	FileLink2		FileLink1			
Part	Plenum Mount	FileLink3		FileLink2		Extended Cost	2,49
P/N Base	EN 05006			FileLink3			
Suffix	AA						
Details							

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Mild		2,25	0,027	kg			rectangular aera, 115x10 mm	1,15E-03	3,00E-03	7850	1	\$ 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 laser cutting	\$ 1,30	unit	1	2 part cut from a single machine setup	0,50	\$ 0,65
20	Laser cut		\$ 0,01	cm	1,2	Material - Steel	3,00	\$ 0,04
30	Sheet metal bends		\$ 0,25	bend	2			\$ 0,50
Sub Total								\$ 1,19



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University	Ecole Centrale de Lyon													
System	Engine and Drivetrain													
Assembly	Throttle Body													
Part	Restrictor													
P/N Base	EN 06002													
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	Stock material for part	\$ 4,20	0,38	kg			Round diam 42 mm	1,38E-03	0,11	2712	1,00	\$ 1,73	
												Sub Total	\$ 1,73	
ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total						
10	Machining Setup, Install and remove		\$ 1,30	unit	1			\$ 1,30						
20	Machining	Cut out shape	\$ 0,04	cm^3	35	Aluminum	1	\$ 1,40						
30	Machining, setup, change		\$ 0,65	unit	1			\$ 0,65						
40	Machining		\$ 0,04	cm^3	20	Aluminum	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 06003													
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	Stock material for part	\$ 4,20	0,201	kg			Rectangular aera, 45*30mm	1,35E-03	0,06	2712	1,00	\$ 0,92	
												Sub Total	\$ 0,92	
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	Aluminum	1	\$ 1,12						
30	Machining, setup, change		\$ 0,65	unit	1			\$ 0,65						
40	Machining		\$ 0,04	cm^3	9	Aluminum	1	\$ 0,36						
							Sub Total	\$ 3,43						

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Page 40

Page 41

University	Ecole Centrale de Lyon													
System	Engine and Drivetrain													
Assembly	Throttle Body													
Part	Ram pipe													
P/N Base	EN 06008													
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	Stock material for part	\$ 4,20	0,954	kg			Round 80 mm diam	5,03E-03	0,07	2712	1,00	\$ 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						

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University	Ecole Centrale de Lyon
System	Engine and Drivetrain
Assembly	Throttle Body
Part	Mount 1
P/N Base	EN 06011
Suffix	AA
Details	

FileLink1
FileLink2
FileLink3

Car #	81,00
FileLink1	
FileLink2	
FileLink3	

Part Cost	0,74
Qty	1,00
Extended Cost	0,74

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	0,009	kg			Rectangular aera, 86x10mm	8,60E-04	0,004	2712	1	\$ 0,04
												Sub Total	\$ 0,04

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Drilled holes	holes	\$ 0,35	hole	2			\$ 0,70
Sub Total								\$ 0,70

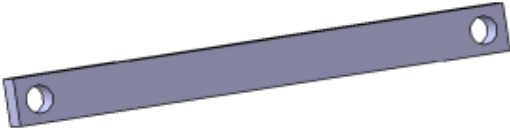


University	Ecole Centrale de Lyon													
System	Engine and Drivetrain													
Assembly	Throttle Body													
Part	Mount 2													
P/N Base	EN 06012													
Suffix	AA													
Details														

Car #	81,00	Part Cost	0,75
		Qty	1,00
FileLink1		Extended Cost	0,75
FileLink2			
FileLink3			

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	0,012	kg			Rectangular aera, 40*20mm	1,09E-03	0,004	2712	1	\$ 0,05
												Sub Total	\$ 0,05

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Drillet holes <25,4mm dia.		\$ 0,35	hole	2		1	\$ 0,70
							Sub Total	\$ 0,70



University	Ecole Centrale de Lyon
System	Engine and Drivetrain
Assembly	Throttle Body
Part	Hose clip
P/N Base	EN 06013
Suffix	AA
Details	

FileLink1
FileLink2
FileLink3

Car #	81,00
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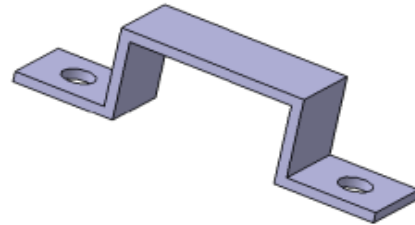
Part Cost	1,75
Qty	1,00

FileLink1
FileLink2
FileLink3

Extended Cost	1,75
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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	0,012	kg			Rectangular aera, 109*10mm	1,09E-03	0,004	2712	1	\$ 0,05
												Sub Total	\$ 0,05

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Drillet holes <25,4mm dia.		\$ 0,35	hole	2		1	\$ 0,70
20	Sheet metal bends		\$ 0,25	bend	4		1	\$ 1,00
Sub Total								\$ 1,70



University Ecole Centrale de Lyon
System Frame and Body
Assembly Shifter
P/N Base FR A0006
Suffix AA
Details Shifting system

Car # 81

Asm Cost 116,56
Qty 1

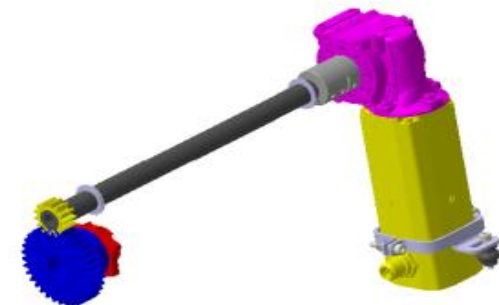
FileLink1
FileLink2
FileLink3

Extended Cost \$ 116,56

ItemOrder	Part	Part Cost	Quantity	Sub Total
10	Engine gear box drum gear	\$ 14,58	1	\$ 14,58
20	Engine gear box shifting pinion shaft	\$ 17,64	1	\$ 17,64
30	Engine gear box actuator tab	\$ 1,89	1	\$ 1,89
40	Front engine gear box actuator mount	\$ 2,83	1	\$ 2,83
50	Rear gear box actuator mount	\$ 2,65	1	\$ 2,65
60	Engine gear box actuator coupling	\$ 7,54	1	\$ 7,54
			Sub Total	\$ 47,12

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							1,00	\$ 0,05
20	Motor, 12 Volt, DC Brushless Servo	Engine gearbox actuator (motoreductor)	\$ 40,00		1 unit							1,00	\$ 40,00
30	Mount, Vibration-Damping Sandwich	Maintain motor to frame	\$ 2,43	9	mm							1,00	\$ 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 bolts	\$ 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, 1kg, Loose	Remove clutch pressure springs	\$ 0,06	unit	5	Disassemble	0,8	\$ 0,25
70	Assemble, 1kg, Loose	Remove pressure disk assembly	\$ 0,06	unit	1	Disassemble	0,8	\$ 0,05
80	Assemble, 1kg, Loose	Removes clutch disk 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, 1kg, Loose	Remove central clutch assembly	\$ 0,06	unit	1	Disassemble	0,8	\$ 0,05
110	Assemble, 1kg, Loose	Remove clutch guide	\$ 0,06	unit	1	Disassemble	0,8	\$ 0,05
120	Assemble, 1kg, Loose	Remove clutch roller case assembly	\$ 0,06	unit	1	Disassemble	0,8	\$ 0,05
130	Assemble, 1kg, Loose	Remove clutch flywheel	\$ 0,06	unit	1	Disassemble	0,8	\$ 0,05
140	Power Tool <= 25.4 mm	Remove shifting shaft retaining bolt	\$ 0,25	unit	5	Disassemble	0,8	\$ 1,00
150	Assemble, 1kg, Loose	Remove shifting shaft retaining plate	\$ 0,06	unit	1	Disassemble	0,8	\$ 0,05
160	Assemble, 3kg, 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 assembly	\$ 0,25	unit	1	Disassemble	0,8	\$ 0,20
190	Assemble, 1kg, 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, 1kg, Loose	Mount gearbox drum gear	\$ 0,06	unit	1			\$ 0,06
220	Power Tool <= 25.4 mm	Tighten shift star bolt	\$ 0,25	unit	1			\$ 0,25
230	Assemble, 1kg, Interference	Mount retaining ring on shifting pinion shaft	\$ 0,19	unit	1			\$ 0,19
240	Assemble, 1kg, Loose	Mount washer on shifting pinion shaft	\$ 0,06	unit	1			\$ 0,06
250	Assemble, 1kg, Line-on-Line	Mount shifting pinion shaft	\$ 0,13	unit	1			\$ 0,13
260	Assemble, 1kg, Loose	Mount washer on shifting pinion shaft	\$ 0,06	unit	1			\$ 0,06



270	Assemble, 1kg, Interference	Mount retaining ring on shifting pinion shaft	\$ 0,19	unit	1			\$ 0,19
280	Assemble, 1kg, Line-on-Line	Mount gearbox actuator coupling	\$ 0,13	unit	1			\$ 0,13
290	Assemble, 3kg, Loose	Mount clutch flywheel	\$ 0,19	unit	1			\$ 0,19
300	Assemble, 1kg, Loose	Mount clutch roller case assembly	\$ 0,06	unit	1			\$ 0,06
310	Assemble, 1kg, Loose	Mount clutch guide	\$ 0,06	unit	1			\$ 0,06
320	Assemble, 1kg, Loose	Mount central clutch	\$ 0,06	unit	1			\$ 0,06
330	Assemble, 1kg, Loose	Mount central clutch washers	\$ 0,06	unit	1			\$ 0,06
340	Power Tool <= 25.4 mm	Tighten central clutch nut	\$ 0,25	unit	1		0,8	\$ 0,20
350	Assemble, 1kg, Loose	Mount clutch disc	\$ 0,06	unit	1			\$ 0,06
360	Assemble, 1kg, Loose	Mount pressure disk assembly	\$ 0,06	unit	1			\$ 0,06
370	Assemble, 1kg, 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 le	1,25	\$ 1,56
390	Assemble, 3kg, Line-on-Line	Mount engine case	\$ 0,38	unit	1			\$ 0,38
400	Power Tool <= 25.4 mm	Mount engin case bolts	\$ 0,25	unit	13	Fastener Engagement le	1,25	\$ 4,06
410	Assemble, 1kg, Loose	Mount front actuator mount	\$ 0,06	unit	1			\$ 0,06
420	Assemble, 1kg, Loose	Mount rear actuator mount	\$ 0,06	unit	1			\$ 0,06
430	Assemble, 1kg, Loose	Mount washers on screws	\$ 0,06	unit	2			\$ 0,13
440	Assemble, 1kg, Loose	Mount nut on screws	\$ 0,06	unit	2			\$ 0,13
450	Assemble, 1kg, Loose	Mount washers on screws	\$ 0,06	unit	2			\$ 0,13
460	Hand - Start Only	Mount nut on screws	\$ 0,12	unit	2			\$ 0,24
470	Assemble, 3kg, Line-on-Line	Mount actuator assembly on coupling	\$ 0,38	unit	1			\$ 0,38
480	Assemble, 1kg, Loose	Mount elastomere on tab	\$ 0,06	unit	1			\$ 0,06
490	Assemble, 1kg, Loose	Align rear mount with tab	\$ 0,06	unit	1			\$ 0,06
500	Assemble, 1kg, Loose	Mount washer on elastomere screw	\$ 0,06	unit	1			\$ 0,06
510	Wrench <= 6.35 mm	Tighten elastomere screw	\$ 1,00	unit	1	Fastener Engagement le	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	12 mm				2	\$ 0,02
50	Washer, Grade 8.8 (SAE 5)	Make contact between mount brackets	\$ 0,01	14 mm		21 mm		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	FractionInc	Sub Total
10	Welds - Welding Fixture	Welding gear tab on frame	\$ 500,00	point	2	3000	1	\$ 0,33
Sub Total								\$ 0,33

FR Parts

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

Car # 81

Part Cost \$ 14,58
Qty 1

FileLink1
FileLink2
FileLink3

Extended Cost \$ 14,58

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Alloy	Axle material	\$ 2,25	0,247	kg			Round 27mm diam	5,73E-04	0,24	7850	1	\$ 2,43
												Sub Total	\$ 2,43

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 and 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 diam		\$ 0,35	hole	6		1	\$ 2,10
60	Gear Shaping (hobbing)		\$ 0,50	hole	1	Material - Steel	3	\$ 1,50
Sub Total								\$ 12,15

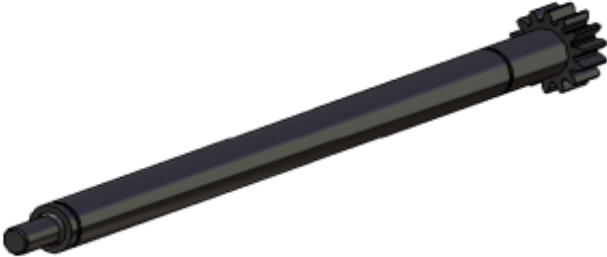


FR Parts

University	Ecole Centrale de Lyon	FileLink1		Car #	81	Part Cost	\$ 17,64
System	Frame and Body	FileLink2				Qty	1
Assembly	Shifter	FileLink3		FileLink1		Extended Cost	\$ 17,64
Part	Engine gear box shifting, pinion shaft			FileLink2			
P/N Base	FR 06002			FileLink3			
Suffix	AA						
Details							

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Alloy	Axle material	\$ 2,25	0,203	kg			Round 27mm diam	5,73E-04	0,24	7850	1	\$ 2,43
												Sub Total	\$ 2,43

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 and 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	hole	1	Material - Steel	3	\$ 1,50
							Sub Total	\$ 15,21

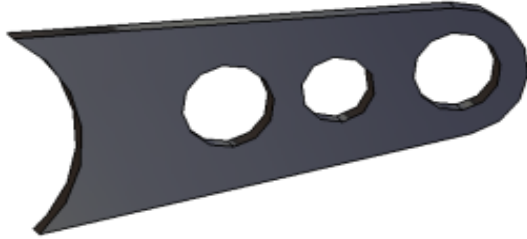


FR Parts

University	Ecole Centrale de Lyon	FileLink1	Car #	81	Part Cost	\$ 1,89
System	Frame and Body	FileLink2	Qty	1		
Assembly	Shifter	FileLink3	FileLink1			
Part	Engine gear box actuator tab		FileLink2		Extended c	\$ 1,89
P/N Base	FR 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 the tube part	\$ 2,25	0,020	kg			Rectangular aera, 23x37 mm	8,51E-04	3,00E-03	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		\$ 0,01	cm	18	Material - Steel	3	\$ 0,54
							Sub Total	\$ 1,84




FR Parts

University	Ecole Centrale de Lyon	Car #	81	Part Cost	\$ 2,83
System	Frame and Body	FileLink1		Qty	1
Assembly	Shifter	FileLink2		Extended c	\$ 2,83
Part	Front engine gear box actuator mount	FileLink3			
P/N Base	FR 06004				
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	0,009	kg			Rectangular aera, 104x11 mm	3,15E-03	3,00E-03	2712	1	3,90E-02
												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		\$	1,30
20	Laser cut		\$ 0,01	cm	24	Material - aluminium	1 \$	0,24
30	Sheet metal bend		\$ 0,25	bend	5		\$	1,25
							Sub Total	\$ 2,79

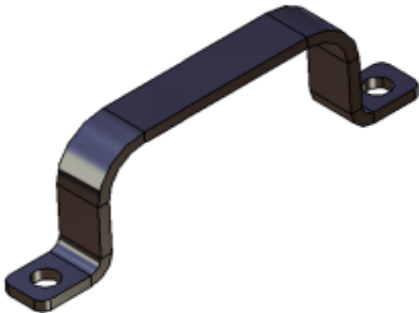


FR Parts

University	Ecole Centrale de Lyon	FileLink1	Car #	81	Part Cost	\$ 2,65
System	Frame and Body	FileLink2	Qty	1		
Assembly	Shifter	FileLink3	FileLink1		Extended c	\$ 2,65
Part	Rear gear box actuator mount		FileLink2			
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	0,026	kg			Rectangular aera, 105x30 mm	1,14E-03	3,00E-03	2712	1	0,11
												Sub Total	\$ 0,11

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	24	Material - aluminium	1	\$ 0,24	
30	Sheet metal bend		\$ 0,25	bend	4			\$ 1,00	
								Sub Total	\$ 2,54



FR Parts

University	Ecole Centrale de Lyon	FileLink1		Car #	81	Part Cost	\$ 7,54
System	Frame and Body	FileLink2				Qty	1
Assembly	Shifter	FileLink3		FileLink1		Extended Cost	\$ 7,54
Part	Engine gear box actuator coupling			FileLink2			
P/N Base	FR 06006			FileLink3			
Suffix	AA						
Details							

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, normal	Material for part	\$ 2,25	0,035	kg			Round 27mm diam	5,73E-04	0,35	2710	1	\$ 1,22
												Sub Total	\$ 1,22

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		\$ 0,04	cm^3	5	Material - Steel	3	\$ 0,60	
30	Machining Setup and change		\$ 0,65	unit	1			\$ 0,65	
40	Machining		\$ 0,04	cm^3	3	Material - Steel	3	\$ 0,36	
50	Machining Setup and change		\$ 0,65	unit	1			\$ 0,65	
60	Machining		\$ 0,04	cm^3	1	Material - Steel	3	\$ 0,12	
70	Drilled holes < 25,4 mm diam		\$ 0,35	hole	4			\$ 1,40	
80	Threading, Internal (machining)		\$ 0,10	hole	4	Material - Steel	3	\$ 1,20	
								Sub Total	\$ 6,28

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

