



Ecurie Piston Sport Auto

CAR #81

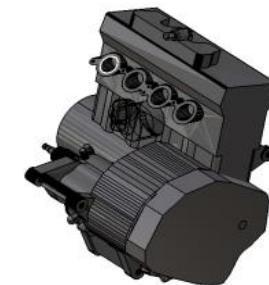


ÉCOLE
CENTRALE LYON

A close-up photograph of a Formula 1 race car's engine and drivetrain components, primarily constructed from carbon fiber. The components are highly detailed and reflective, showing intricate mechanical parts like the engine block, transmission, and drive shafts.

**ENGINE
&
DRIVETRAIN**

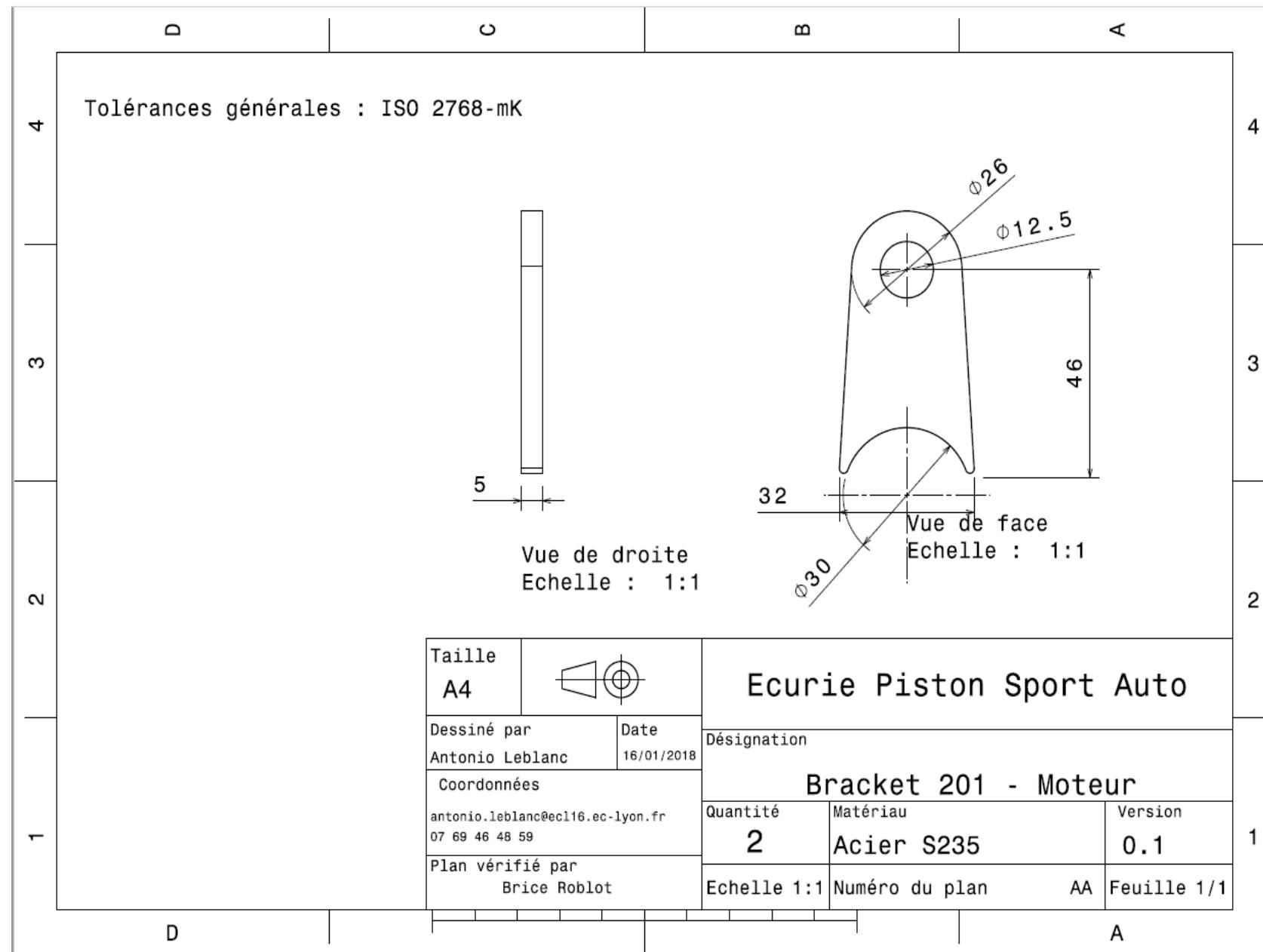
University	Ecole Centrale de Lyon	Back to BOM								Car #	81	Asm Cost	\$ 1 631,77
System	Engine & Drivetrain									Qty	1		
Assembly	Engine									FileLink1			
P/N Base	EN A0100									FileLink2			
Suffix	AA									FileLink3			
Details	Honda CBR 600 RR type PC40									Extended Cost	\$ 1 631,77		
ItemOrder	Part	Part Cost	Quantity	Sub Total									
10	Flat sump	\$ 39,37	1	\$ 39,37									
20	Rear tab	\$ 1,42	2	\$ 2,83									
30	Rear tube	\$ 1,30	2	\$ 2,59									
			Sub Total	\$ 44,80									
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	Adhesive	Sealing between oil sump and engine	\$ -	0,019	kg					0,017	0,001	1 100	1 \$ -
												Sub Total	\$ 1 500,15
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					
30	Cut (scissors, knife)	Sump seal rubber	\$ 0,06	cm	166		0	\$ -					
40	Assemble, >20 kg, Interference	Assemble engine in frame	\$ 5,63	Unit	1		1	\$ 5,63					
50	Assemble, 1kg, Line-on-Line	Positioning of the rear tube	\$ 0,13	Unit	1		1	\$ 0,13					
60	Ratchet <= 25,4mm	Tighten M12 rear bolts	\$ 0,75	Unit	2		1	\$ 1,50					
70	Ratchet <= 25,4mm	Tighten M12 front bolts	\$ 0,75	Unit	2		1	\$ 1,50					
80	Reaction tool, <=25,4mm	Tighten M12 front bolts	\$ 0,25	Unit	2		1	\$ 0,50					
90	Liquid Applicator Gun	Seal paste application	\$ 0,20	cm	70		1	\$ 14,00					
100	Assemble, 1 kg, Line-on-Line	Assemble Flat sump + rubber sealing	\$ 0,13	unit	2		1	\$ 0,25					
110	Ratchet <= 6.35 mm	Tighten flat sump blots	\$ 0,50	unit	12		1	\$ 6,00					
120	Engine first start, includes fuel		\$ 50,00	unit	1		1	\$ 50,00					
							Sub Total	\$ 80,42					
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	PFV	FractionInclud	Sub Total					
10	Welds - Welding Fixture	Rear tabs welding	\$ 500,00	point	4	3000	1	\$ 0,67					
								Sub Total	\$ 0,67				



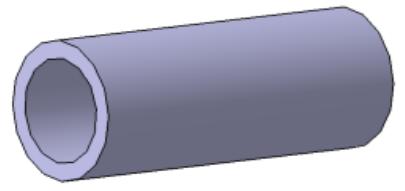
University	Ecole Centrale de Lyon	Back to BOM	Car #	81	Part Cost	\$ 39,37							
System	Engine & Drivetrain		Qty	1									
Assembly	Engine	FileLink1	FileLink1										
Part	Flat Sump	FileLink2	FileLink2										
P/N Base	EN 01001	FileLink3	FileLink3		Extended Cost	\$ 39,37							
Suffix	AA												
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	\$ 12,47
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 (DELETED)	\$ 1,30	Unit	1		0	\$ -					
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	\$ 24,74
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

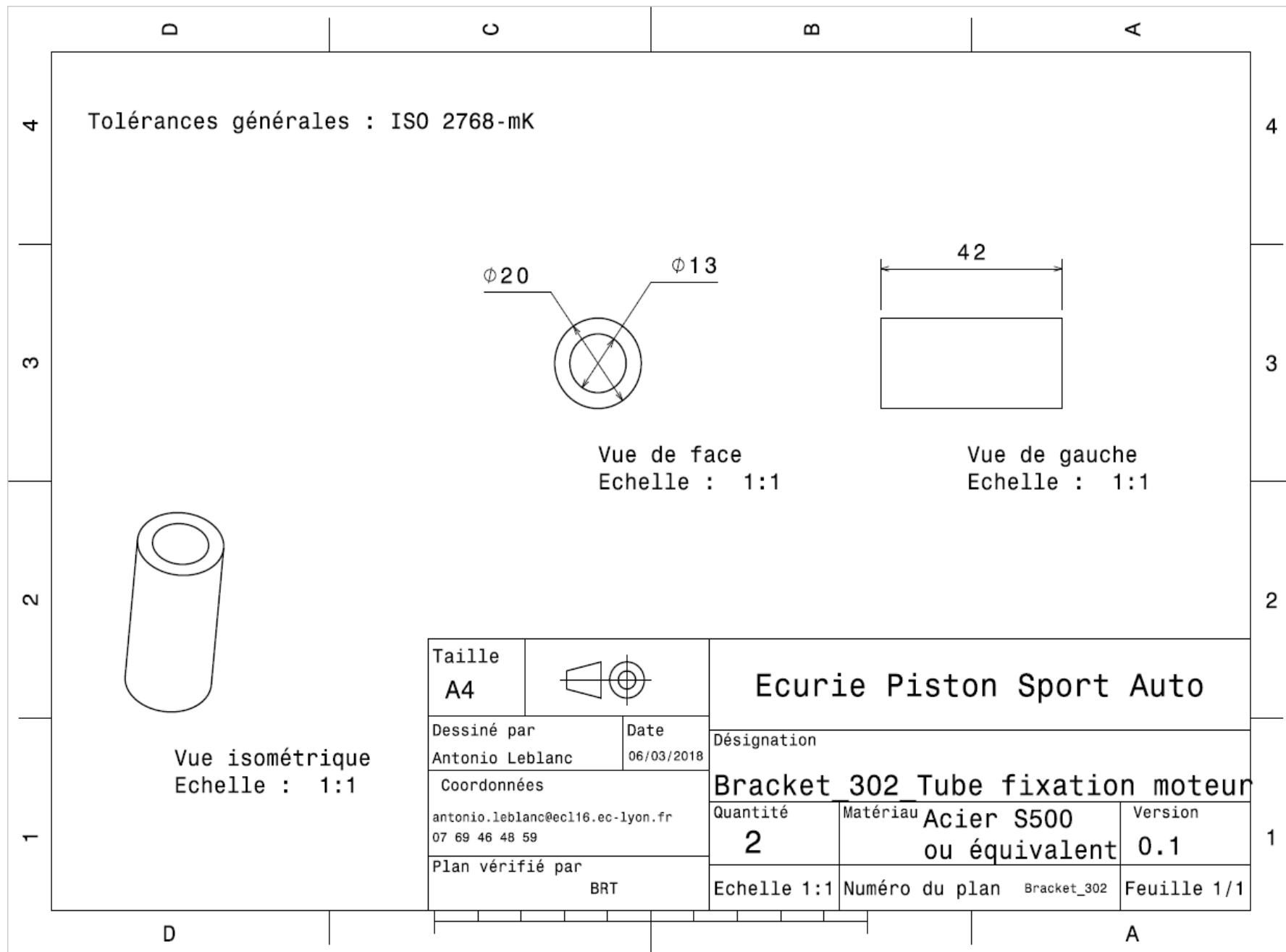


University	Ecole Centrale de Lyon	Back to BOM	Car #	81	Part Cost	\$ 1,42							
System	Engine & Drivetrain	FileLink1	Drawing	Qty	2								
Assembly	Engine	FileLink2		FileLink1									
Part	Rear tab	FileLink3		FileLink2		Extended Cost	\$ 2,83						
P/N Base	EN 01002			FileLink3									
Suffix	AA												
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 single sheet	0,5	\$ 0,65					
20	Laser cut		\$ 0,01	cm	18,8	Material - Steel	3	\$ 0,56					
							Sub Total	\$ 1,21					

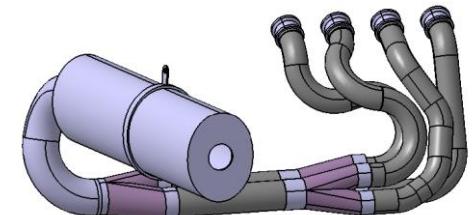


University	Ecole Centrale de Lyon	Back to BOM	Car #	81	Part Cost	\$ 1,30							
System	Engine & Drivetrain	FileLink1	Drawing	Qty	2								
Assembly	Engine	FileLink2		FileLink1									
Part	Rear tube	FileLink3		FileLink2									
P/N Base	EN 01003			FileLink3									
Suffix	AA												
Details	To 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 from	0,5	\$ 0,65					
20	Machining	To 13mm diam.	\$ 0,04	cm^3	4,2	Material - Steel	3	\$ 0,50					
							Sub Total	\$ 1,15					





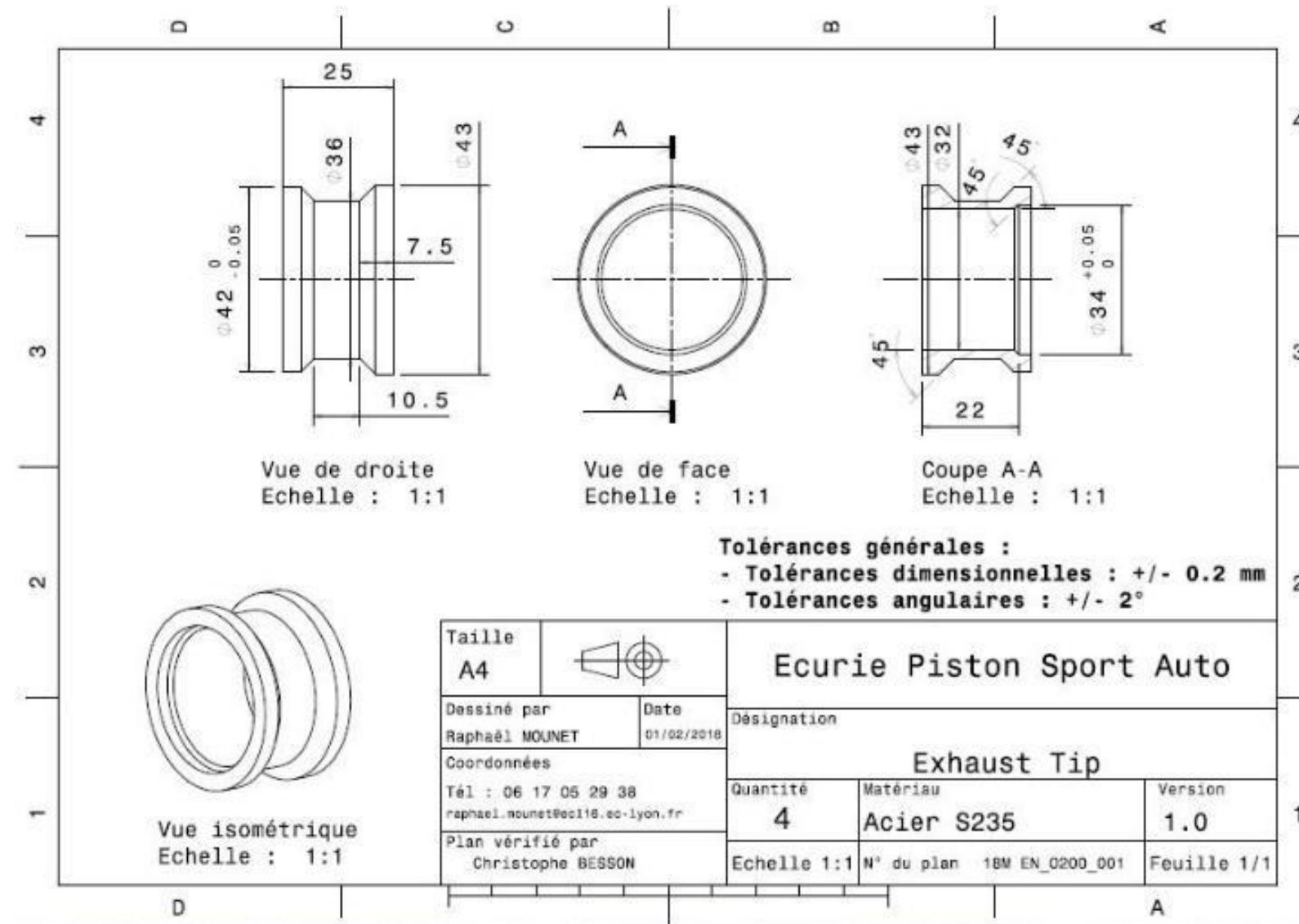
University	Ecole Centrale de Lyon	Back to BOM	Car #	81	Asm Cost	\$ 361,43								
System	Engine and Drivetrain		Qty	1										
Assembly	Exhaust System													
P/N Base	EN A0200													
Suffix	AA													
Details														
ItemOrder	Part	Part Cost	Quantity	Sub Total										
10	Exhaust 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 preparation for welding	Preparation 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 preparation for welding	Preparation 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	FractionIn	Sub Total						
10	Welds - Welding Fixture		\$ 500,00	point	6	3000	1	\$ 1,00						



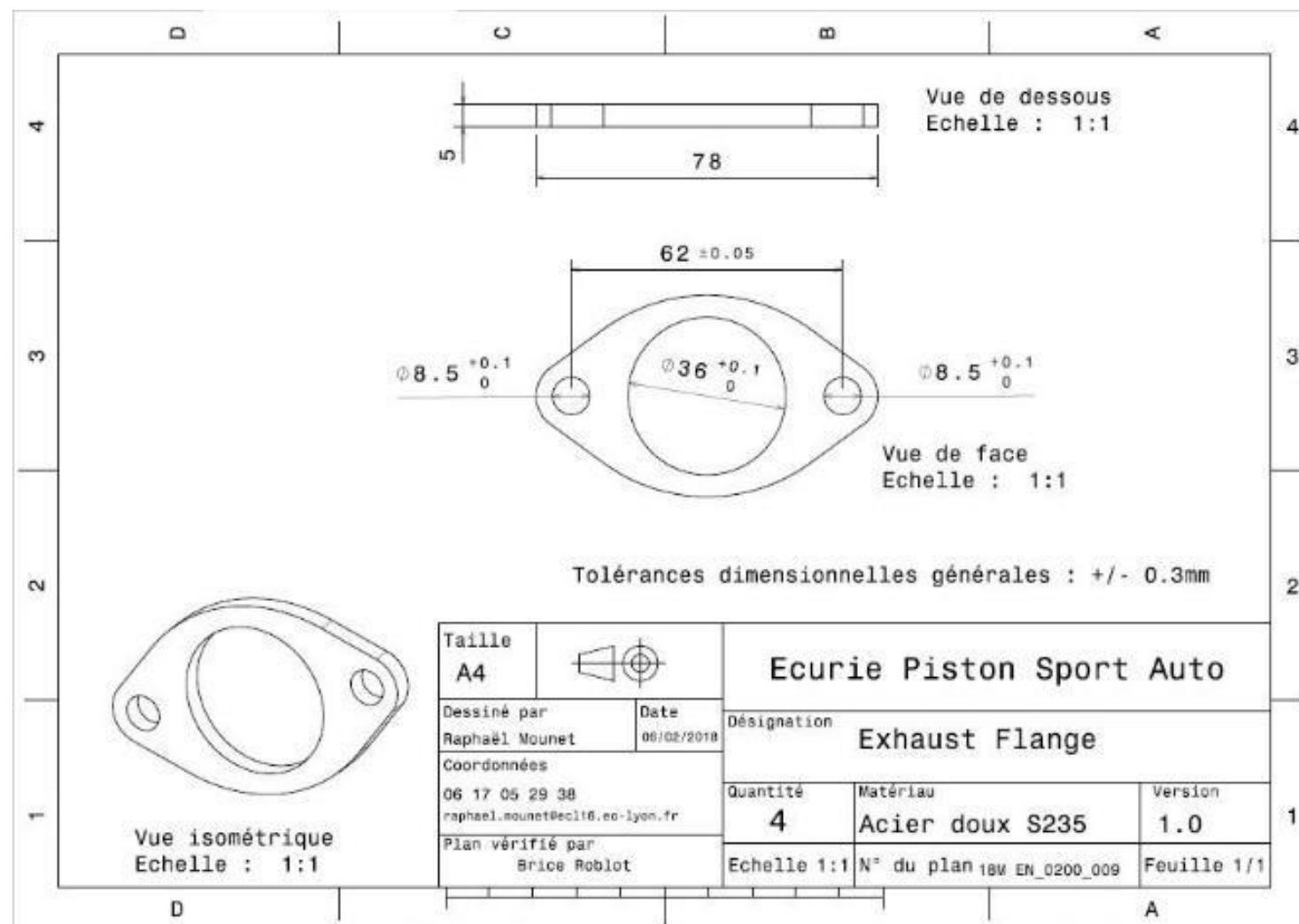
Sub Total \$ 1,00

University	Ecole Centrale de Lyon	Back to BOM	Car #	81	Part Cost	\$ 4,35							
System	Engine and Drivetrain				Qty	4							
Assembly	Exhaust System	FileLink1	Drawing		FileLink1								
Part	Exhaust Tip	FileLink2			FileLink2								
P/N Base	EN 02001	FileLink3			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)	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 remove		\$ 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						

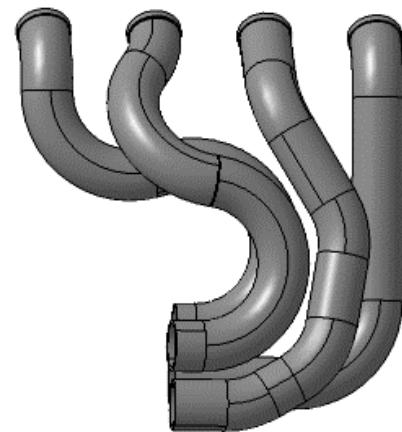




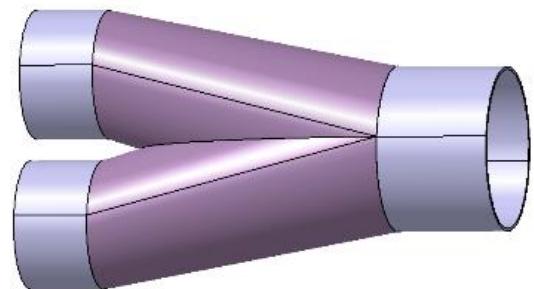
University	Ecole Centrale de Lyon	Back to BOM		Car #	81	Part Cost	\$ 1,75							
System	Engine and Drivetrain			Qty	4									
Assembly	Exhaust System			FileLink1										
Part	Exhaust Flange			FileLink2										
P/N Base	EN 02002			FileLink3										
Suffix	AA					Extended C	\$ 7,00							
Details														
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					

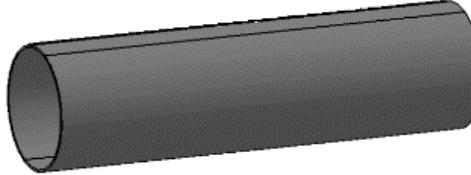


University	Ecole Centrale de Lyon	Back to BOM	Car #	81	Part Cost	\$ 109,43								
System	Engine and Drivetrain				Qty	1								
Assembly	Exhaust System		FileLink1		FileLink1									
Part	Exhaust headers		FileLink2		FileLink2									
P/N Base	EN 02003		FileLink3		FileLink3									
Suffix	AA				Extended C	\$ 109,43								
Details	4 headers in one part													
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	7850	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 preparation 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						

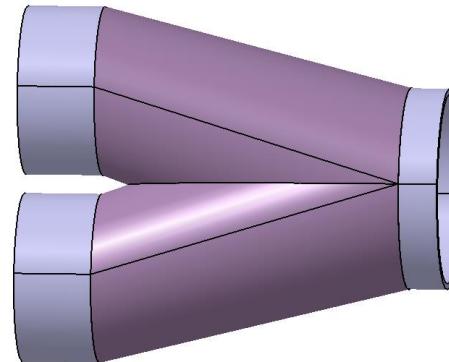


University	Ecole Centrale de Lyon	Back to BOM								Car #	81	Part Cost	\$ 20,23	
System	Engine and Drivetrain									Qty	2			
Assembly	Exhaust System									FileLink1				
Part	Primary collector									FileLink2				
P/N Base	EN 02004									FileLink3				
Suffix	AA									Extended	\$ 40,46			
Details	1 connector for each pair of headers									FileLink3				
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	7850	1	\$ 0,24	
20	Steel, Stainless	Collector material	\$ 2,25		kg			Round 42,1mm*1,5mm	1,01E-04	0,030	7850	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 preparation 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					

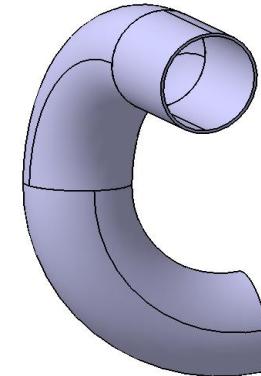


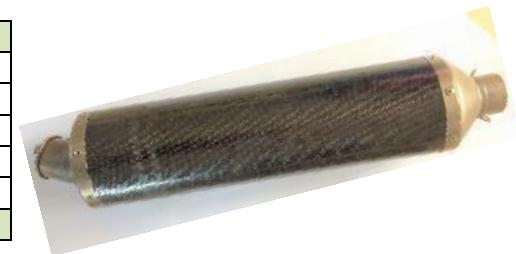
University	Ecole Centrale de Lyon	Back to BOM	Car #	81	Part Cost	\$ 1,22							
System	Engine and Drivetrain				Qty	2							
Assembly	Exhaust System												
Part	Primary collector tubing												
P/N Base	EN 02005												
Suffix	AA												
Details	2 primary collectors in 1 part												
FileLink1			FileLink1										
FileLink2			FileLink2										
FileLink3			FileLink3										
													
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	0,331	7850	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	Back to BOM								Car #	81	Part Cost	\$ 22,47
System	Engine and Drivetrain									Qty	1		
Assembly	Exhaust System									FileLink1			
Part	Secondary collector									FileLink2			
P/N Base	EN 02006									FileLink3			
Suffix	AA									Extended	\$ 22,47		
Details										FileLink3			
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	7850	1	\$ 0,37
20	Steel, Stainless	Collector material	\$ 2,25		kg			Round 49,8mm*1,2mm	9,50E-05	0,010	7850	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 preparation 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	Back to BOM								Car #	81	Part Cost	\$ 12,90
System	Engine and Drivetrain									FileLink1		Qty	1
Assembly	Exhaust System									FileLink2		Extended C	\$ 12,90
Part	Secondary collector tubing									FileLink3			
P/N Base	EN 02007									FileLink1		FileLink2	
Suffix	AA									FileLink3			
Details													
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	7850	1	\$ 0,51
												Sub Total	\$ 0,51
ItemOrder	Process	Use	UnitCost	Unit	Quantit	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 preparation 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	Quantit	PFV	FracIncl	Sub Total					
10	Welds - Welding Fixture		\$ 500,00	point	4	3000	1	\$ 0,67					
							Sub Total	\$ 0,67					



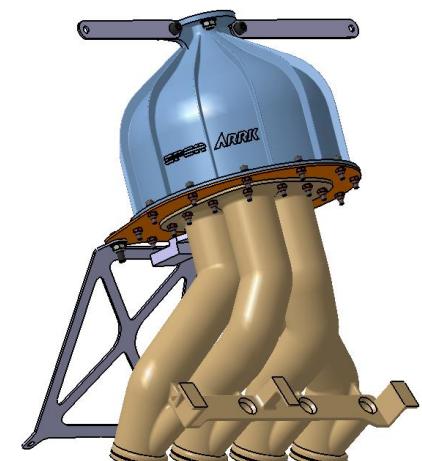
University	Ecole Centrale de Lyon	Back to BOM	Car #	81	Part Cost	\$ 40,15								
System	Engine and Drivetrain		Qty	1										
Assembly	Exhaust System		FileLink1		FileLink1									
Part	Muffler		FileLink2		FileLink2									
P/N Base	EN 02008		FileLink3		FileLink3									
Suffix	AA													
Details	Cost as made													
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	Back to BOM	Car #	81	Part Cost	\$ 6,21							
System	Engine and Drivetrain		Qty	1									
Assembly	Exhaust System		FileLink1										
Part	Muffler Collar		FileLink2										
P/N Base	EN 02009		FileLink3										
Suffix	AA				Extended C	\$ 6,21							
Details			FileLink1										
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							1580	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	Back to BOM								Car #	81	Part Cost	\$ 2,23
System	Engine and Drivetrain									Qty	1		
Assembly	Exhaust System									FileLink1			
Part	Spacer									FileLink2			
P/N Base	EN 02010									FileLink3		Extended	\$ 2,23
Suffix	AA												
Details	Spacer between the muffler collar and the mount												
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	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		\$ 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	Back to BOM	Car #	81	Asm Cost	\$ 141,75							
System	Engine and Drivetrain		Qty	1									
Assembly	Air Intake System		FileLink1										
P/N Base	EN A0300		FileLink2										
Suffix	AA		FileLink3										
Details	Air Intake Assembly		Extended	\$ 141,75									
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	\$ 1,74	1	\$ 1,74									
50	Right frame bracket	\$ 1,82	1	\$ 1,82									
60	PAIR plate	\$ 1,32	2	\$ 2,63									
70	Motor bracket	\$ 4,18	1	\$ 4,18									
80	Intake bracket	\$ 0,89	2	\$ 1,77									
		Sub Total	\$ 46,55										
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	\$ 16,20
20	Sensor, Fluid Pressure & Temperature	Measure pressure and temperature inside of the plenum	\$ 10,00									1	\$ 10,00
30	Paint	Material for painting	\$ 10,00	0,015 m^2								1	\$ 0,15
30	Seal, O-ring, Elastomer	Sealing between upper plenum and plenum plate	\$ 0,05									1	\$ 0,05
40	Seal, O-ring, Elastomer	Sealing between intake manifold and plenum plate	\$ 0,05									1	\$ 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					



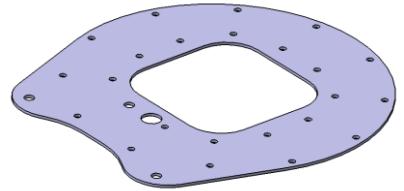
Sub Total	\$ 62,64
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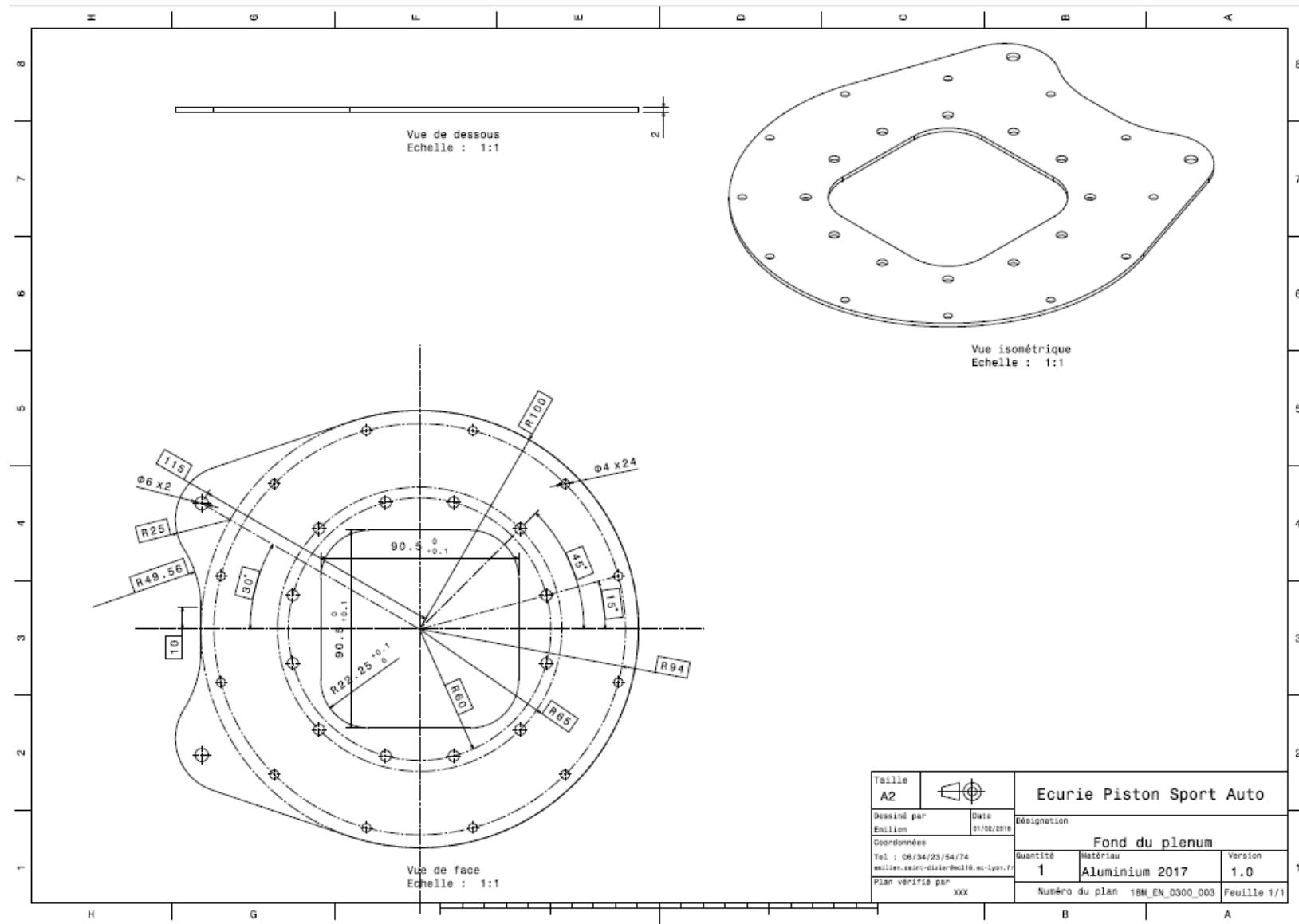
ItemOrder	Fastener	Use	UnitCost	Size1	Unit1	Size2	Unit2	Quantity	Sub Total
10	Hose Clamp, Worm Drive	Tightening the intake pipes with the intake manifold	\$ 0,69	48,5	mm			4	\$ 2,78
20	Bolt, Grade 8.8 (SAE 5)	Fastening brackets and sensor	\$ 0,05	6	mm		20	mm	\$ 0,43
30	Bolt, Grade 8.8 (SAE 5)	Fastening plenum, plenum plate and intake manifold	\$ 0,02	4	mm		16	mm	\$ 0,45
40	Washer, Grade 8,8 (SAE 5)	Fastening brackets and sensor	\$ 0,01	6	mm				\$ 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	Back to BOM	Car #	81	Part Cost	\$ 12,59							
System	Engine and Drivetrain		Qty	1									
Assembly	Air Intake System		FileLink1		FileLink1								
Part	Upper plenum		FileLink2		FileLink2								
P/N Base	EN 03001		FileLink3		FileLink3								
Suffix	AA												
Details	Made by 3D printing												
ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Plastic, Nylon	Material for part	\$ 3,30	0,350	kg							1140	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	Back to BOM								Car #	81	Part Cost	\$ 3,68
System	Engine and Drivetrain									Qty	1		
Assembly	Air Intake System									FileLink1			
Part	Plenum plate									FileLink2			
P/N Base	EN 03002									FileLink3			
Suffix	AA									Extended	\$ 3,68		
Details	Made by laser cutting									FileLink1			
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	2712	1	\$ 0,59
													Sub Total \$ 0,59
ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total					
10	Machinng 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					

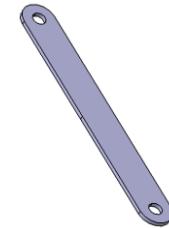




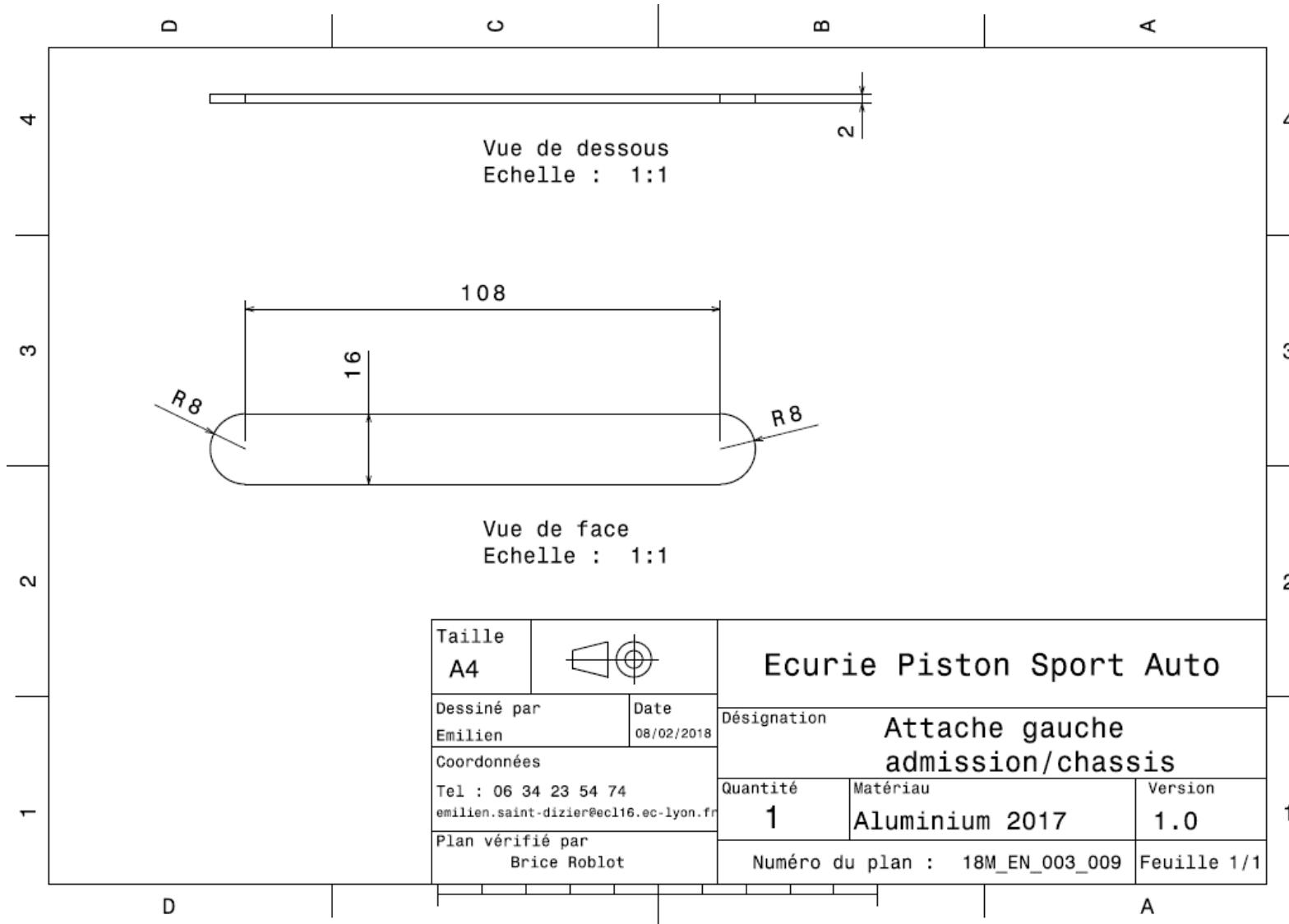
University	Ecole Centrale de Lyon	Back to BOM	Car #	81	Part Cost	\$ 18,14							
System	Engine and Drivetrain		Qty	1									
Assembly	Air Intake System		FileLink1										
Part	Intake manifold		FileLink2										
P/N Base	EN 03003		FileLink3										
Suffix	AA		FileLink1										
Details	Made by 3D printing		FileLink2										
FileLink3			FileLink3										
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							1140	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					



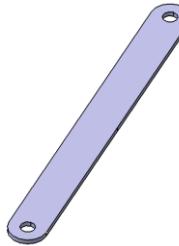
University	Ecole Centrale de Lyon	Back to BOM								Car #	81	Part Cost	\$ 1,74
System	Engine and Drivetrain									Qty	1		
Assembly	Air Intake System									FileLink1			
Part	Left frame bracket									FileLink2			
P/N Base	EN_03004									FileLink3			
Suffix	AA									Extended	\$ 1,74		
Details	Made by laser cutting									FileLink1			
FileLink1	Drawing									FileLink2			
FileLink2										FileLink3			
FileLink3													
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	2712	1	\$ 0,04
20	Paint	To protect part from rust	\$ 10,00	0,004	m^2								\$ 0,04
													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			\$ 1,30					
20	Laser Cut	Producing the left frame bracket	\$ 0,01	cm	34,7			\$ 0,35					
30	Aerosol apply	To protect part from rust	\$ 5,25	m^2	0,004			\$ 0,02					
								Sub Total \$ 1,67					

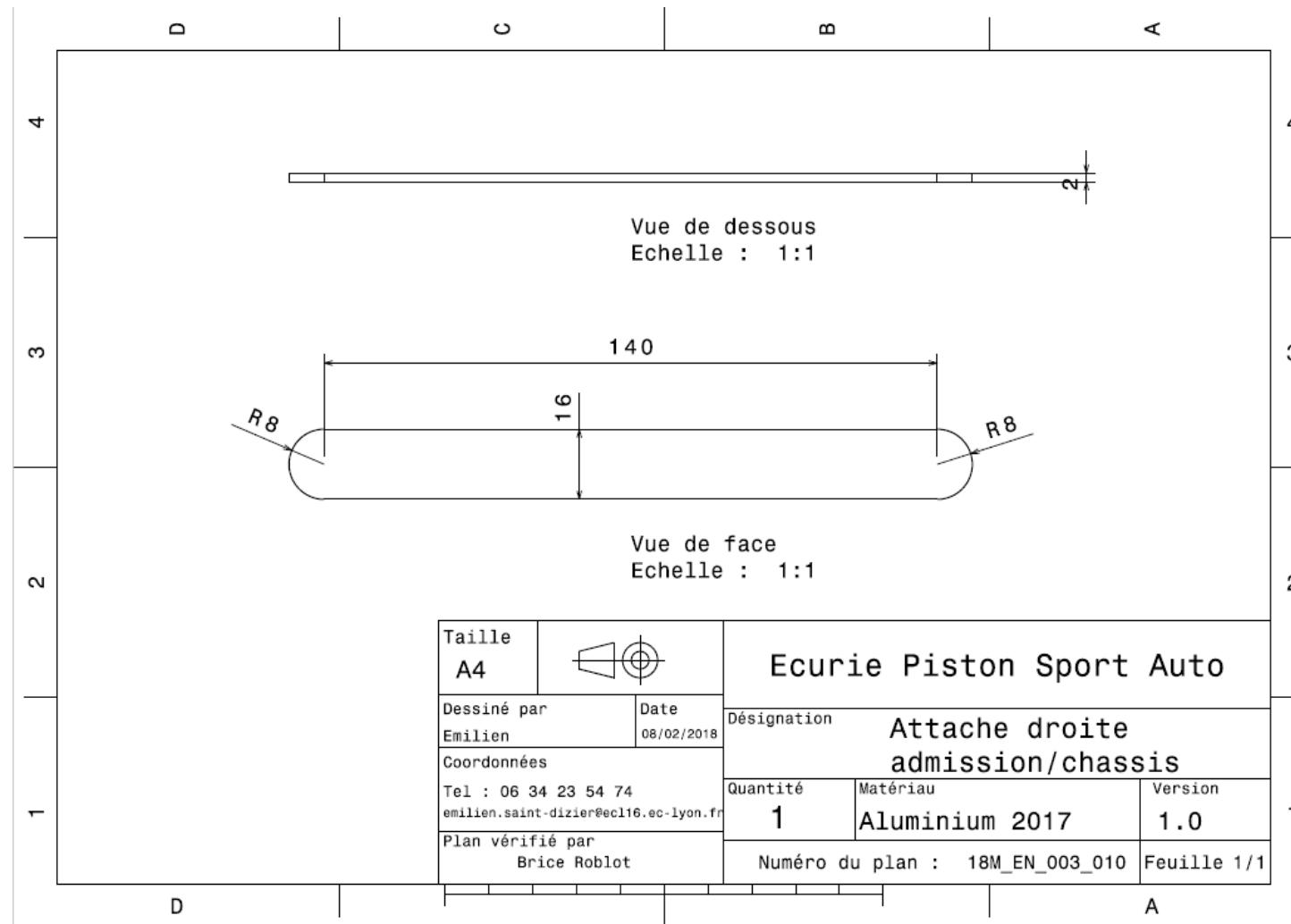


Drawing part : [Left frame bracket](#)

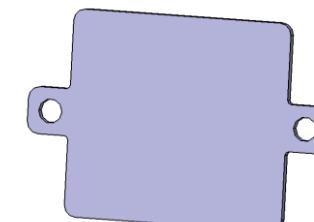


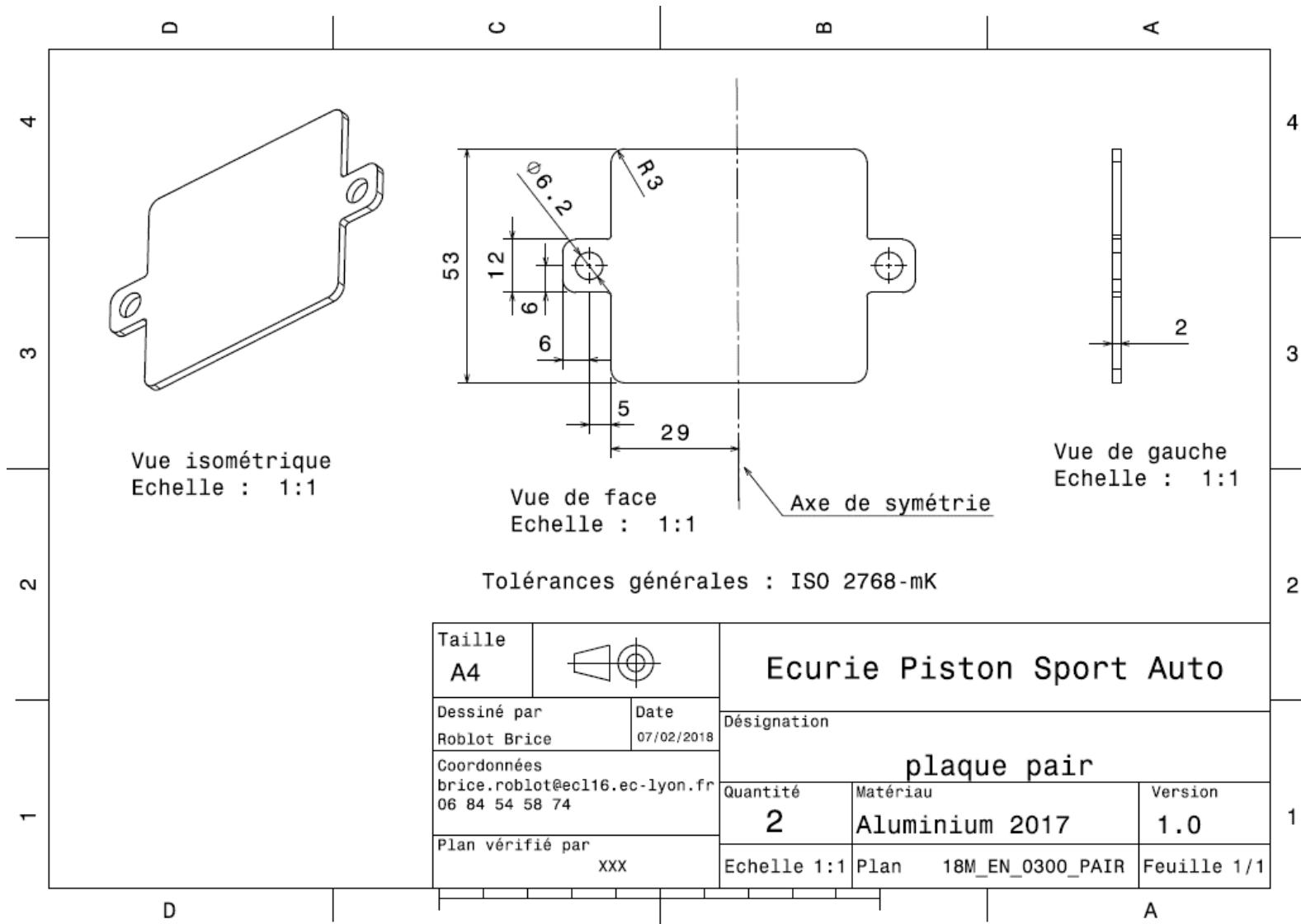
University	Ecole Centrale de Lyon	Back to BOM	Car #	81	Part Cost	\$ 1,82							
System	Engine and Drivetrain		Qty	1									
Assembly	Air Intake System		FileLink1										
Part	Right frame bracket		FileLink2										
P/N Base	EN_03005		FileLink3										
Suffix	AA												
Details	Made by laser cutting												
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	0,004	0,002	2712	1	\$ 0,05
20	Paint	To protect part from rust	\$ 10,00	0,004	m^2								\$ 0,04
												Sub Total	\$ 0,09
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					
30	Aerosol apply	To protect part from rust	\$ 5,25	m^2	0,004			\$ 0,02					
							Sub Total	\$ 1,73					



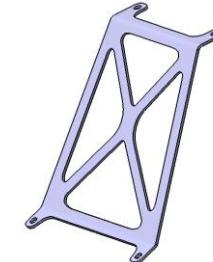


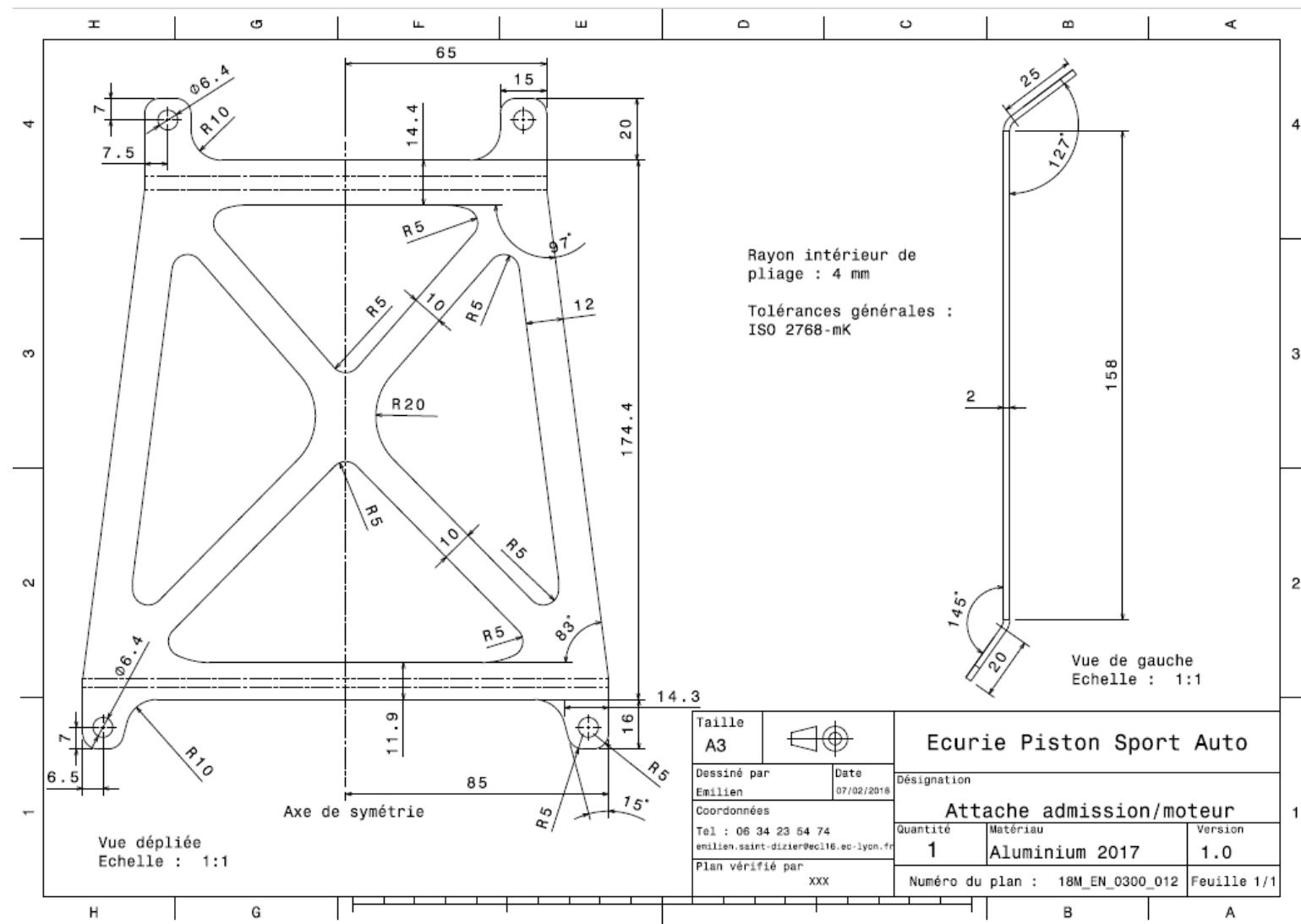
University	Ecole Centrale de Lyon	Back to BOM								Car #	81	Part Cost	\$ 1,32	
System	Engine and Drivetrain									FileLink1	Drawing	Qty	2	
Assembly	Air Intake System									FileLink1		Extended Cost	\$ 2,63	
Part	PAIR plate									FileLink2		FileLink3		
P/N Base	EN_0300_006									FileLink3				
Suffix	AA													
Details	Made by laser cutting													
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	2712	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					



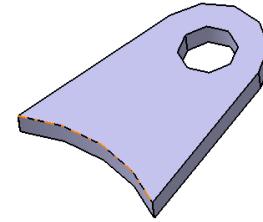


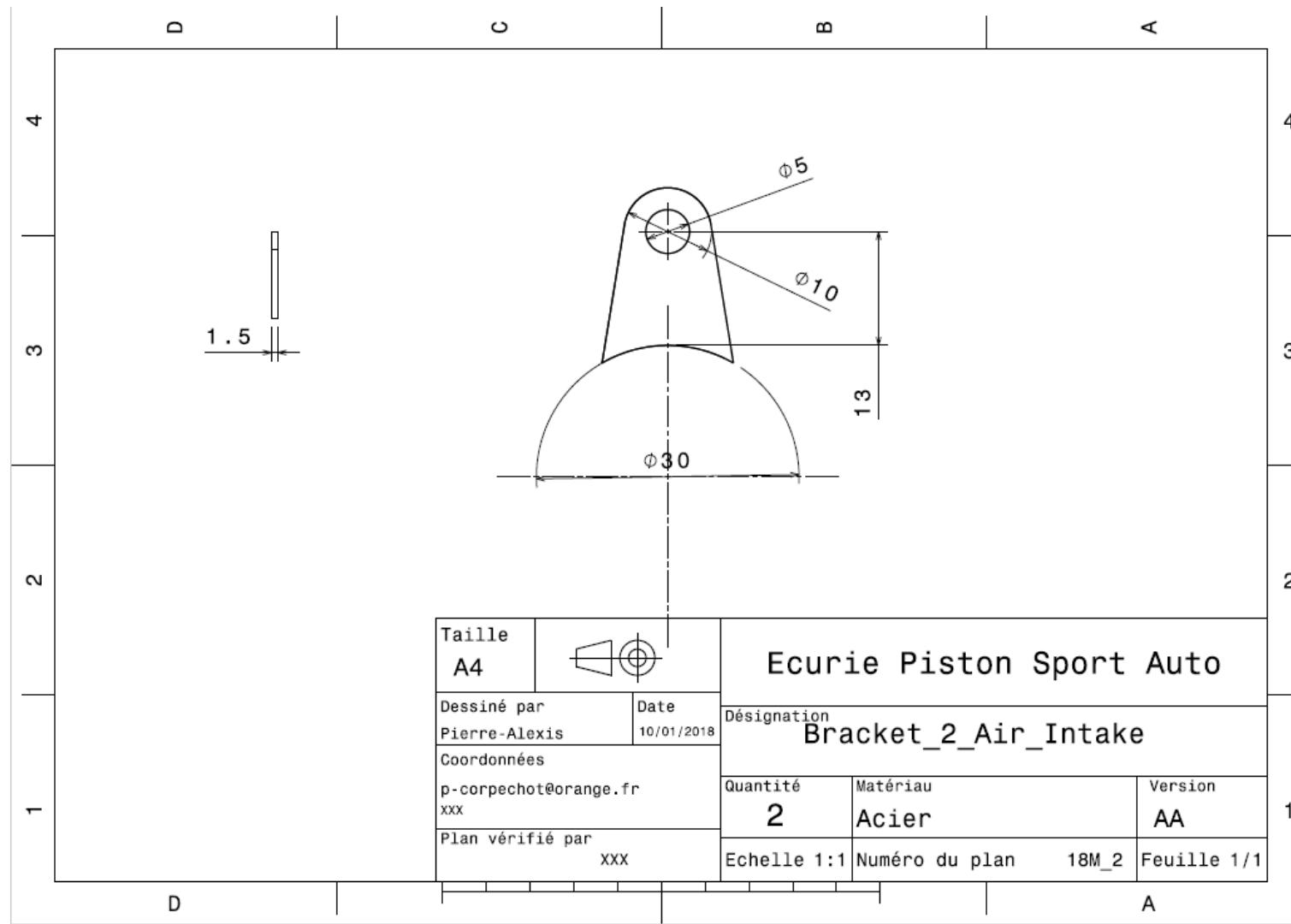
University	Ecole Centrale de Lyon	Back to BOM	Car #	81	Part Cost	\$ 4,18								
System	Engine and Drivetrain		FileLink1		Qty	1								
Assembly	Air Intake System		FileLink2											
Part	Motor bracket		FileLink3											
P/N Base	EN_03007													
Suffix	AB													
Details	Made by laser cutting													
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	2712	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				



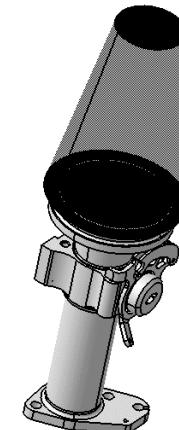


University	Ecole Centrale de Lyon	Back to BOM										Car #	81	Part Cost	\$ 0,89	
System	Engine and Drivetrain											Qty	2			
Assembly	Air Intake System											FileLink1				
Part	Intake bracket											FileLink2				
P/N Base	EN_03008											FileLink3			Extended Cost	\$ 1,77
Suffix	AA															
Details	Made by laser cutting															
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	7850	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	Material - steel		3	\$ 0,23							
								Sub Total	\$ 0,88							





University	Ecole Centrale de Lyon	Back to BOM	Car #	81	Asm Cost	\$ 170,24								
System	Engine and Drivetrain		Qty	1										
Assembly	Throttle Body													
P/N Base	EN_A0400													
Suffix	AA													
Details	Throttle Body of the air intake assembly													
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 Axe	\$ 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	\$ 63,00	
20	Spring, Tension (General)	Torsion spring	\$ 1,00									1	\$ 1,00	
30	Spring, Tension (General)	Hellicoidal spring	\$ 1,00									1	\$ 1,00	
40	Seal, O-ring Elastomer	Sealing with airfilter	\$ 0,05									1	\$ 0,05	
50	Seal, O-ring Elastomer	Sealing with plenum	\$ 0,05									1	\$ 0,05	
60	Cable, Pull	Throttle cable	\$ 15,00	2,5 m								3	\$ 37,50	
70	Cable, Adjuster		\$ 1,00									1	\$ 1,00	
80	Mount, Vibration-Damping, Sandwich	Isolation between throttle and chassis	\$ 8,10	30 mm								2	\$ 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	FileLink1								
Assembly	Throttle Body	FileLink2	FileLink2		FileLink3	Extended C \$ 5,18							
Part	Throttle Frange	FileLink3											
P/N Base	EN_04001												
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	2712	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	Drilled 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	Back to BOM								Car #	81	Part Cost	\$ 5,73
System	Engine and Drivetrain									Qty	1		
Assembly	Throttle Body									FileLink1			
Part	Restrictor									FileLink2			
P/N Base	EN_04002									FileLink3			
Suffix	AA									Extended C	\$ 5,73		
Details	Bought, cost as made									FileLink3			
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	2712	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	Back to BOM								Car #	81	Part Cost	\$ 4,27
System	Engine and Drivetrain									Qty	1		
Assembly	Throttle Body									FileLink1			
Part	Throttle Housing									FileLink2			
P/N Base	EN_04003									FileLink3			
Suffix	AA									Extended Cost	\$ 4,27		
Details	Bought, cost as made												
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	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		\$ 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	Back to BOM	Car #	81	Part Cost	\$ 2,73							
System	Engine and Drivetrain		Qty	1									
Assembly	Throttle Body		FileLink1										
Part	Throttle Axle		FileLink2										
P/N Base	EN_04004		FileLink3										
Suffix	AA				Extended Cost	\$ 2,73							
Details	Bought, cost as made				FileLink3								
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	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		\$ 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	Back to BOM								Car #	81	Part Cost	\$ 2,71
System	Engine and Drivetrain									Qty	1		
Assembly	Throttle Body									FileLink1			
Part	TPS Axle									FileLink2			
P/N Base	EN_04005									FileLink3			
Suffix	AA									Extended Cost	\$ 2,71		
Details	Bought, cost as made									FileLink1			
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	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		\$ 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	Back to BOM								Car #	81	Part Cost	\$ 3,57
System	Engine and Drivetrain									Qty	1		
Assembly	Throttle Body									FileLink1			
Part	Cable Housing									FileLink2			
P/N Base	EN_04006									FileLink3			
Suffix	AA									Extended Cost	\$ 3,57		
Details	Bought, cost as made									FileLink3			
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	Back to BOM								Car #	81	Part Cost	\$ 2,04
System	Engine and Drivetrain									Qty	1		
Assembly	Throttle Body									FileLink1			
Part	Axle Stop									FileLink2			
P/N Base	EN_04007									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	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	Back to BOM	Car #	81	Part Cost	\$ 12,51							
System	Engine and Drivetrain				Qty	1							
Assembly	Throttle Body		FileLink1		FileLink1								
Part	Ram Pipe		FileLink2		FileLink2								
P/N Base	EN_04008		FileLink3		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	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	Back to BOM	Car #	81	Part Cost	\$ 1,49							
System	Engine and Drivetrain				Qty	1							
Assembly	Throttle Body		FileLink1		FileLink1								
Part	Throttle Plate		FileLink2		FileLink2								
P/N Base	EN_04009		FileLink3		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	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

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Car #	81	Asm Cost	\$ 198,49
Qty	1	FileLink1	
FileLink2			Extended Cost
\$ 198,49			FileLink3

ItemOrder	Part	Part Cost	Quantity	Sub Total
10	Fuel Tank (with filler neck)	\$ 102,67	1	\$ 102,67
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	159,9598

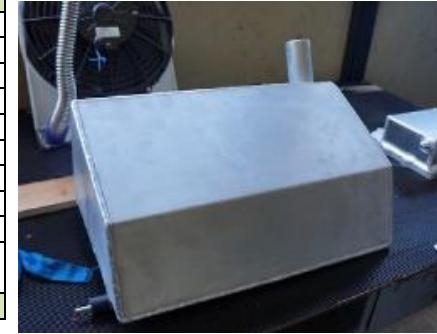
ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Mount, Vibration-Damping, Sandwich	Vibration-Damping, Sandwich for fuel tank	\$ 5,40	20	mm							4	\$ 21,60
20	Hose, Silicone	Filler hose raccording Filler tube and Filler neck	\$ 20,68	44	mm							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

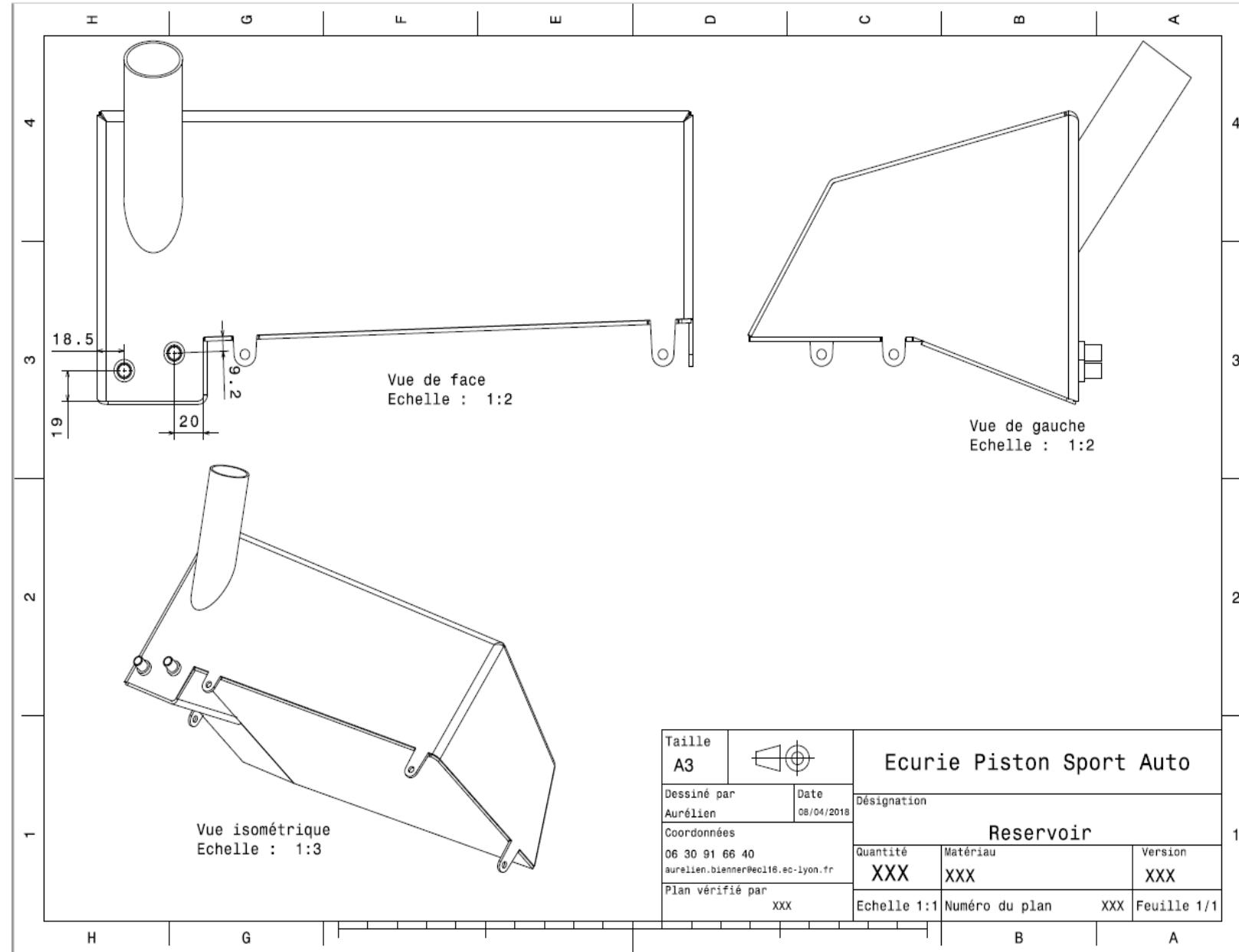
ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Weld	Tabs welding	\$ 0,15	cm	9,83		1	\$ 1,47
20	Aerosol apply	Tabs painting	\$ 5,25	m^2	0,011		1	\$ 0,06
30	Assemble, 1kg, Loose	Vibration dampings sandwich on Fuel tank	\$ 0,06	Unit	4		1	\$ 0,24
40	Ratchet <= 6.35 mm	Tighten 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	Car #	81	Part Cost	\$ 102,67							
System	Engine & Drivetrain	Qty	1									
Assembly	Fuel Tank Assembly	FileLink1										
Part	Fuel Tank (with filler neck)	FileLink2										
P/N Base	EN 05001	FileLink3										
Suffix	AA											
Details		FileLink1		Extended Cost	\$ 102,67							
FileLink2		FileLink2										
FileLink3		FileLink3										
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	\$ 0,25	Bend	1			\$ 0,25				
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 \$ 81,16				
ItemOrder	Tooling	Use	UnitCost	Unit	Quantity	PVF	FracInclId	Sub Total				
10	Welds - Welding Fixture		\$ 500,00	Point	10	3000	1	\$ 1,67				
								Sub Total \$ 1,67				





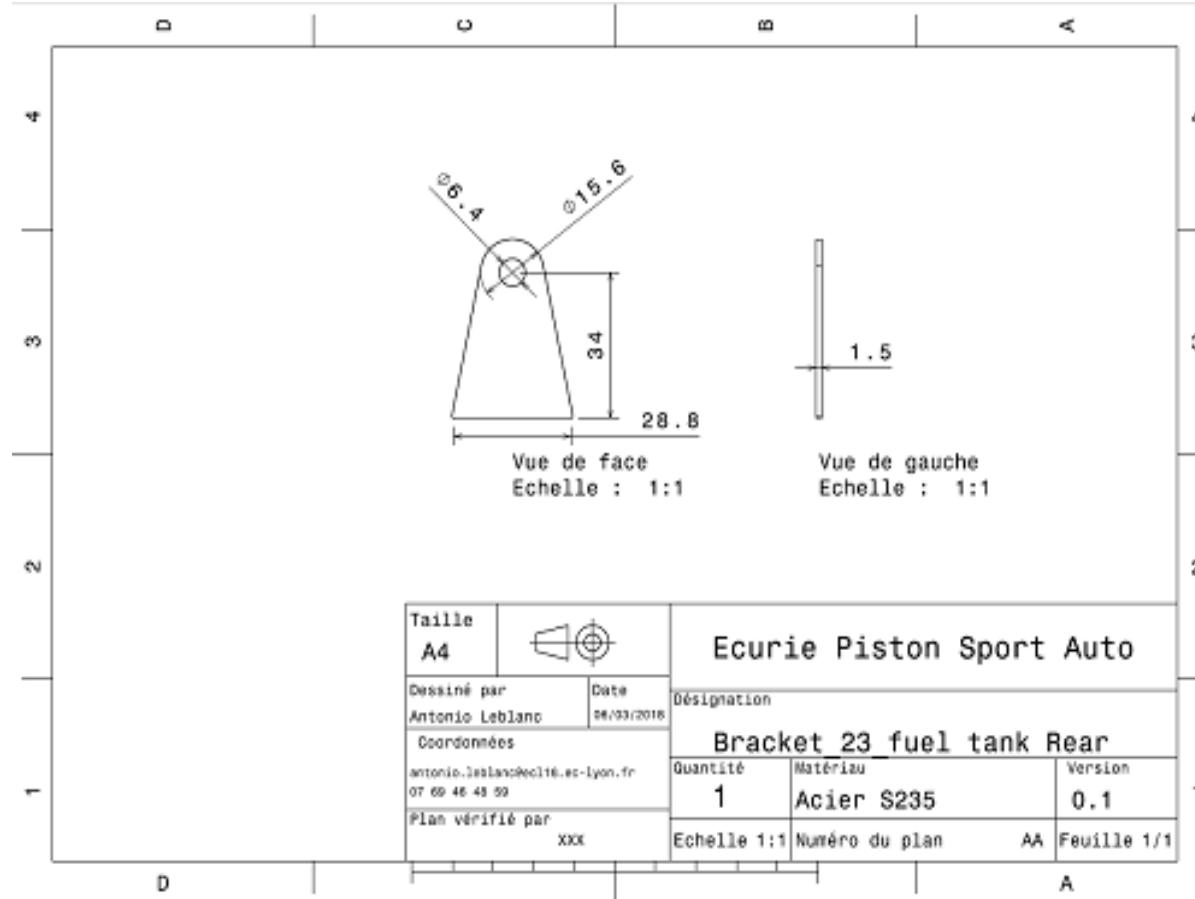
University	Ecole Centrale de Lyon	Back to BOM	Car #	81	Part Cost	\$ 31,68							
System	Engine & Drivetrain		Qty	1									
Assembly	Fuel Tank Assembly		FileLink1										
Part	Filler Cap		FileLink2										
P/N Base	EN 05002		FileLink3										
Suffix	AA				Extended Cost	\$ 31,68							
Details	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



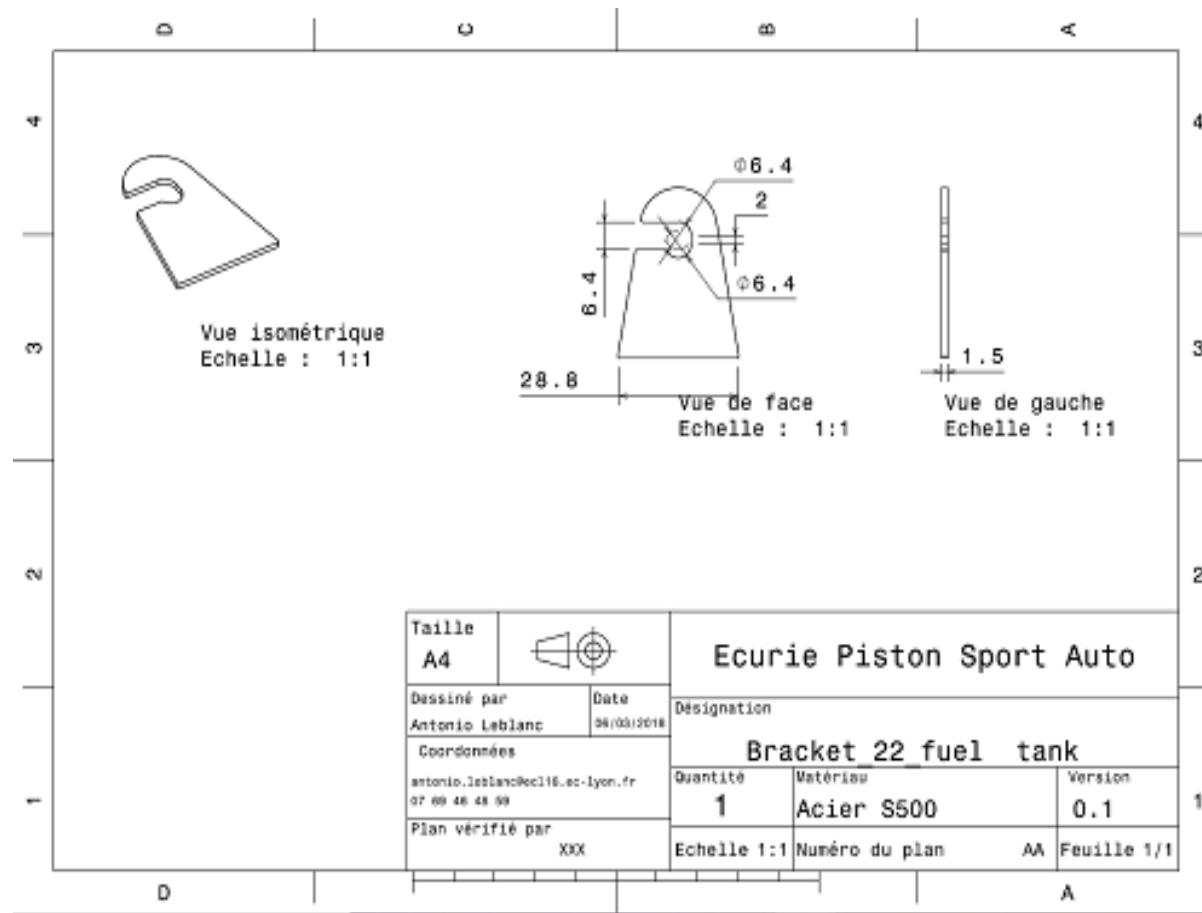
University	Ecole Centrale de Lyon	Back to BOM	Car #	81	Part Cost	\$ 18,36						
System	Engine & Drivetrain		Qty	1								
Assembly	Fuel Tank Assembly		FileLink1									
Part	Filler Tube		FileLink2									
P/N Base	EN 05003		FileLink3									
Suffix	AA											
Details			FileLink1									
ItemOrder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



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



University	Ecole Centrale de Lyon	Back to BOM	Car #	81	Asm Cost	\$ 342,71							
System	Engine & Drivetrain		Qty	1									
Assembly	Fuel System		FileLink1		Extended Cost	\$ 342,71							
P/N Base	EN A0600		FileLink2										
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	\$ 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	\$ 27,28	14,2 mm										1 \$ 27,28
80	Fitting/L.P./Elbow/90 deg./Aluminum/Anodized	\$ 26,58	14,2 mm										2 \$ 53,16
90	Fitting/L.P./Straight/Aluminum/Anodized	\$ 12,66	14,2 mm										4 \$ 50,66
100	Banjo Fitting, Aluminum	\$ 15,40	14,2 mm										1 \$ 15,40
110	Fitting/L.P./Tub Nut//Steel/	\$ 3,27	14,2 mm										1 \$ 3,27
120	Adapter/L.P./Union Tee//Aluminum/Anodized	\$ 3,86	14,2 mm		14,2 mm								1 \$ 3,86
130	Adapter/L.P./Union/FeMale Flare//Aluminum/Anodized	\$ 5,99	14,2 mm		14,2 mm								2 \$ 11,99
140	Adapter/L.P./Union Reducer//Aluminum/Anodized	\$ 2,64	14,2 mm		10 mm								4 \$ 10,56
150	Seal, O-Ring, Elastomer	\$ 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				

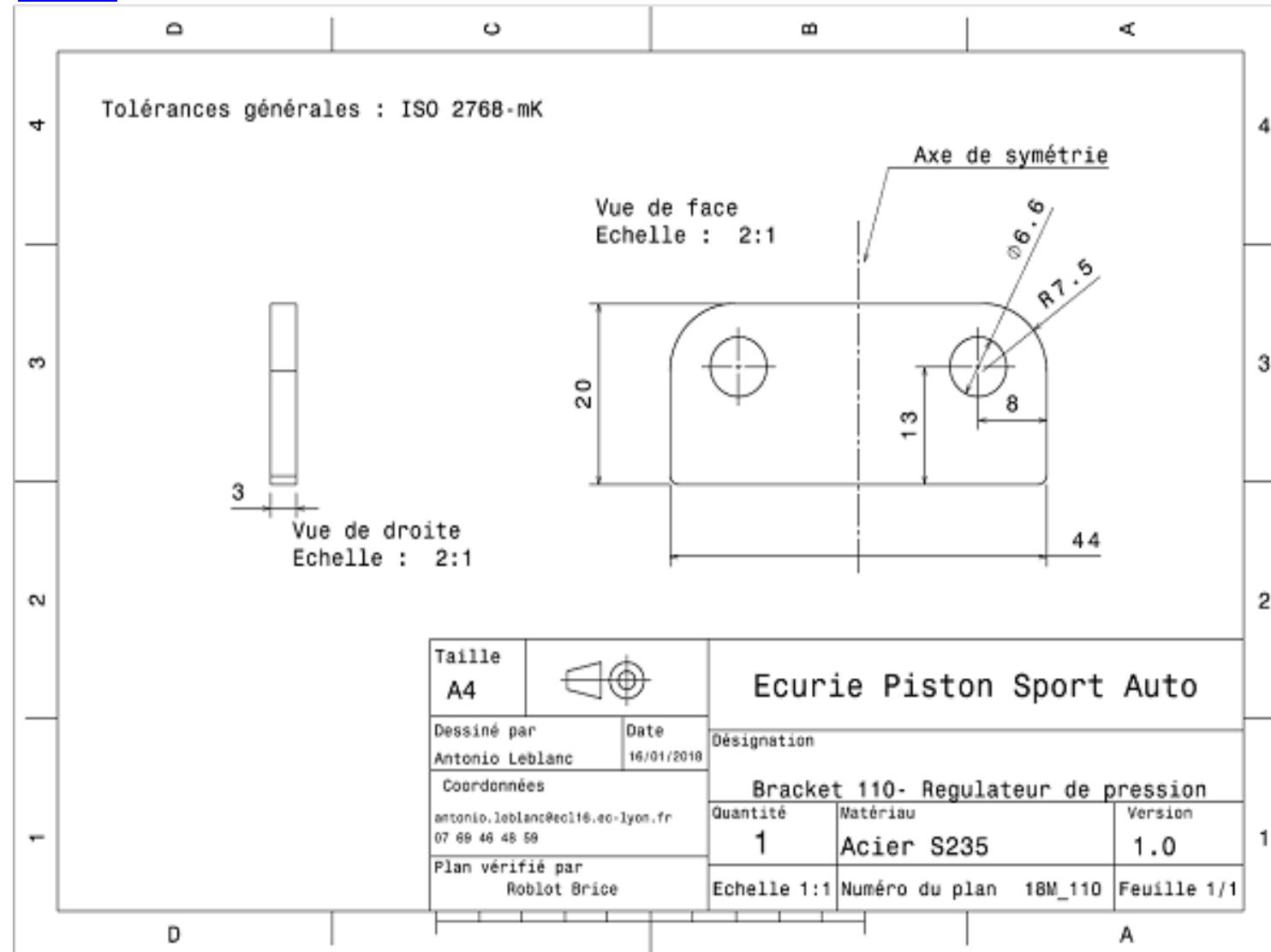
80	Nut, Grade 8.8 (SAE 5)	M6 nut for rail on admission pipe	\$ 0,03	6 mm			3	\$ 0,09
90	Washer, Grade 8.8 (SAE 5)	M6 washer for rail on admission pipe	\$ 0,01	6 mm			6	\$ 0,06
							Sub Total	\$ 0,69
ItemOrder	Tooling	Use	UnitCost	Unit	Quantity	PVF	FractionIncluded	Sub Total
10	Welds - Welding Fixture	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											
Part	Fuel Rail	FileLink3											
P/N Base	EN 06001												
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	(machining)	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	FracIncl	Sub Total					
10	Welds - Welding Fixture	Weld main tube + tabs	\$ 500,00	point	14	3000	1	\$ 2,33					
							Sub Total	\$ 2,33					

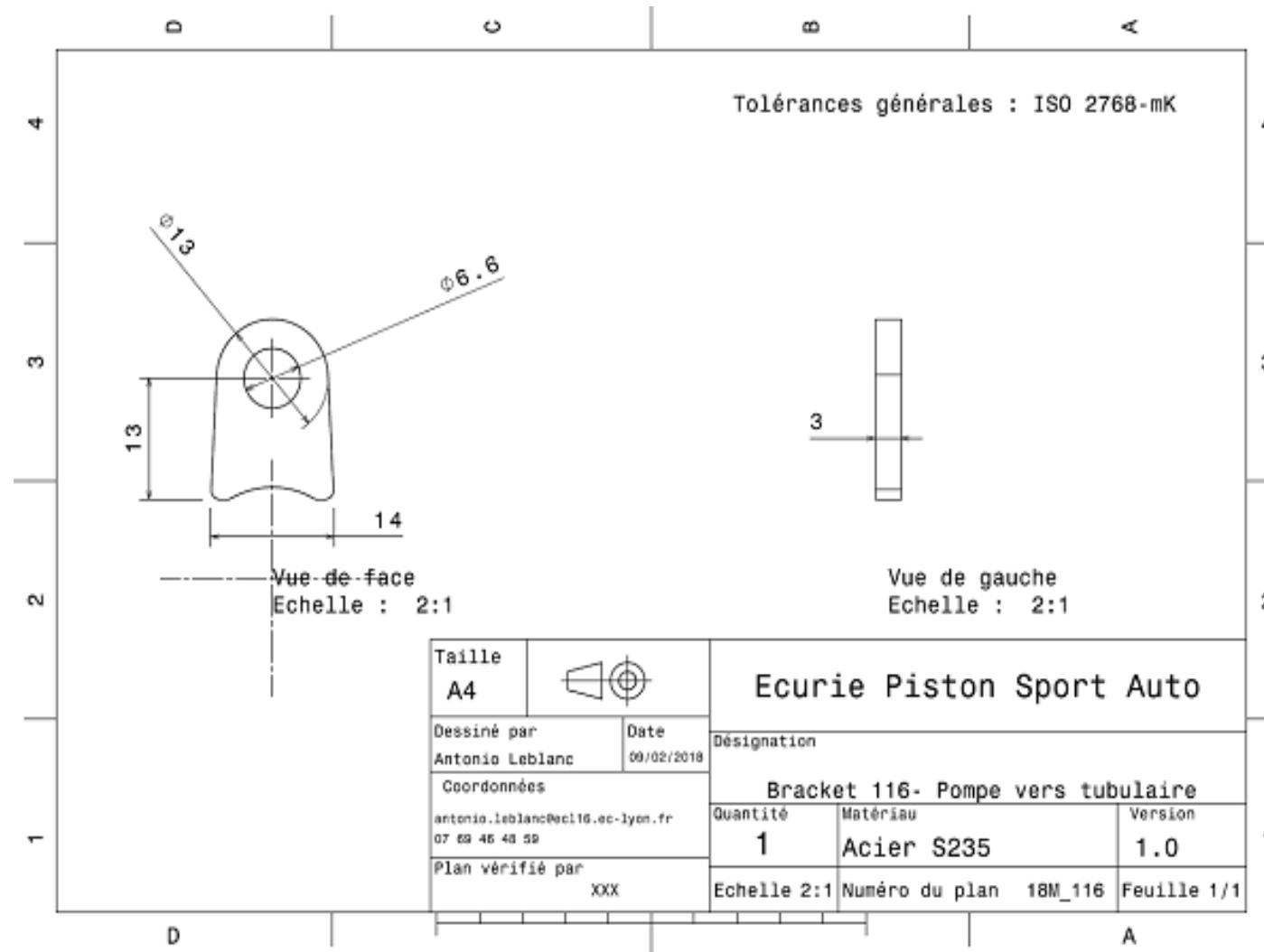


University	Ecole Centrale de Lyon	Back to BOM	Car #	81	Part Cost	\$ 3,35							
System	Engine & Drivetrain	FileLink1	Qty	1	Extended Cost	\$ 3,35							
Assembly	Fuel System	FileLink2	FileLink1										
Part	Fuel Pump Collar	FileLink3	FileLink2										
P/N Base	EN 06002		FileLink3										
Suffix	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	Car #	81	Part Cost	\$ 1,83								
System	Engine & Drivetrain	Qty	1										
Assembly	Fuel System	FileLink1											
Part	Pressure Regulator Tab	FileLink2											
P/N Base	EN 06003	FileLink3		Extended Cost	\$ 1,83								
Suffix	AA			FileLink3									
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					



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



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					

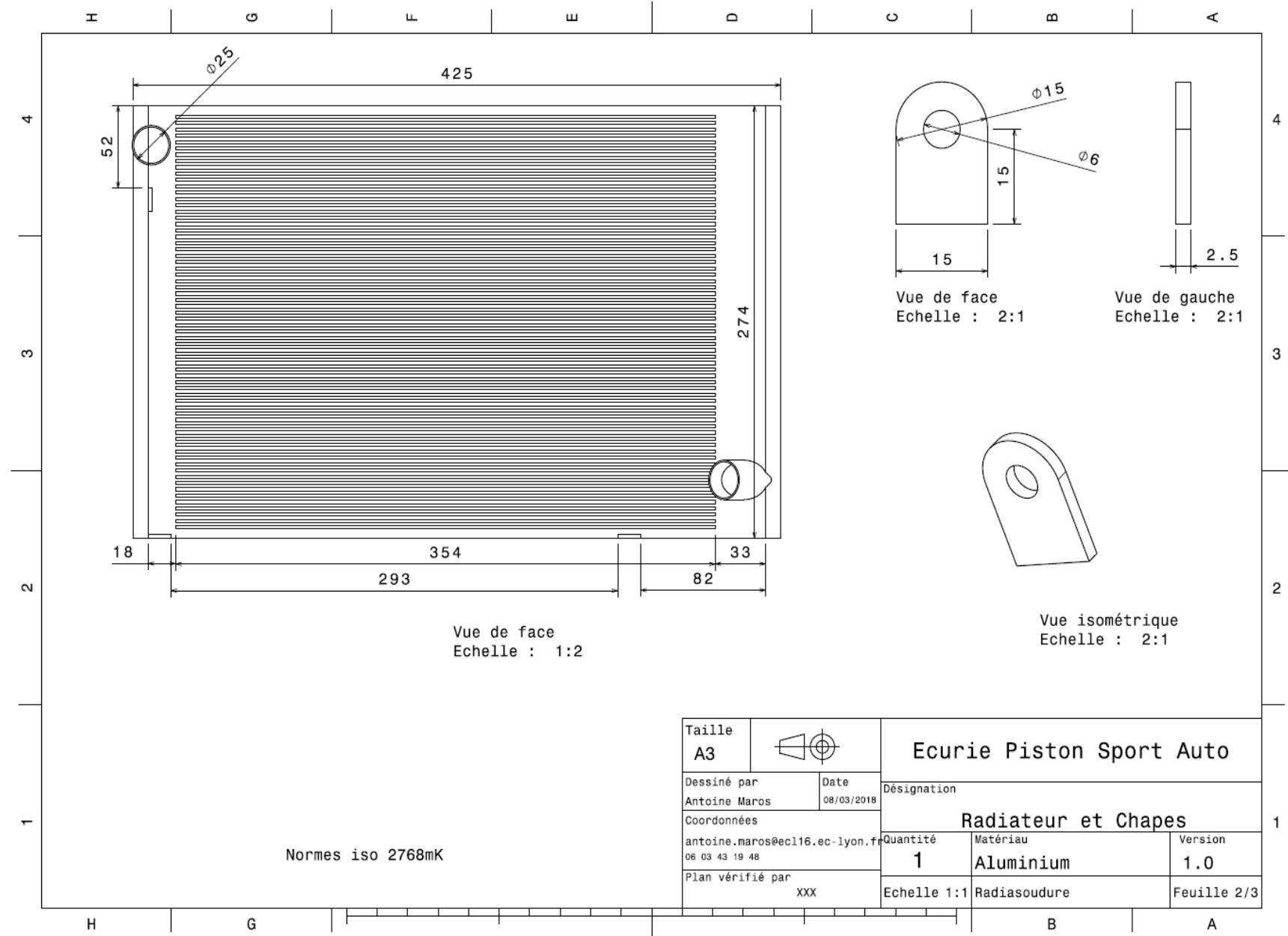
University	Ecole Centrale de Lyon	Car #	81	Asm Cost	\$ 242,13								
System	Engine & Drivetrain	Qty	1										
Assembly	Cooling System	FileLink1											
P/N Base	EN A0800	FileLink2											
Suffix	AA	FileLink3											
Details	Engine cooling system	Extended Cost	\$ 242,13										
ItemOrder	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	\$ 17,09	1	\$ 17,09									
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	\$ 7,47	1	\$ 7,47									
		Sub Total	\$ 193,09										
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

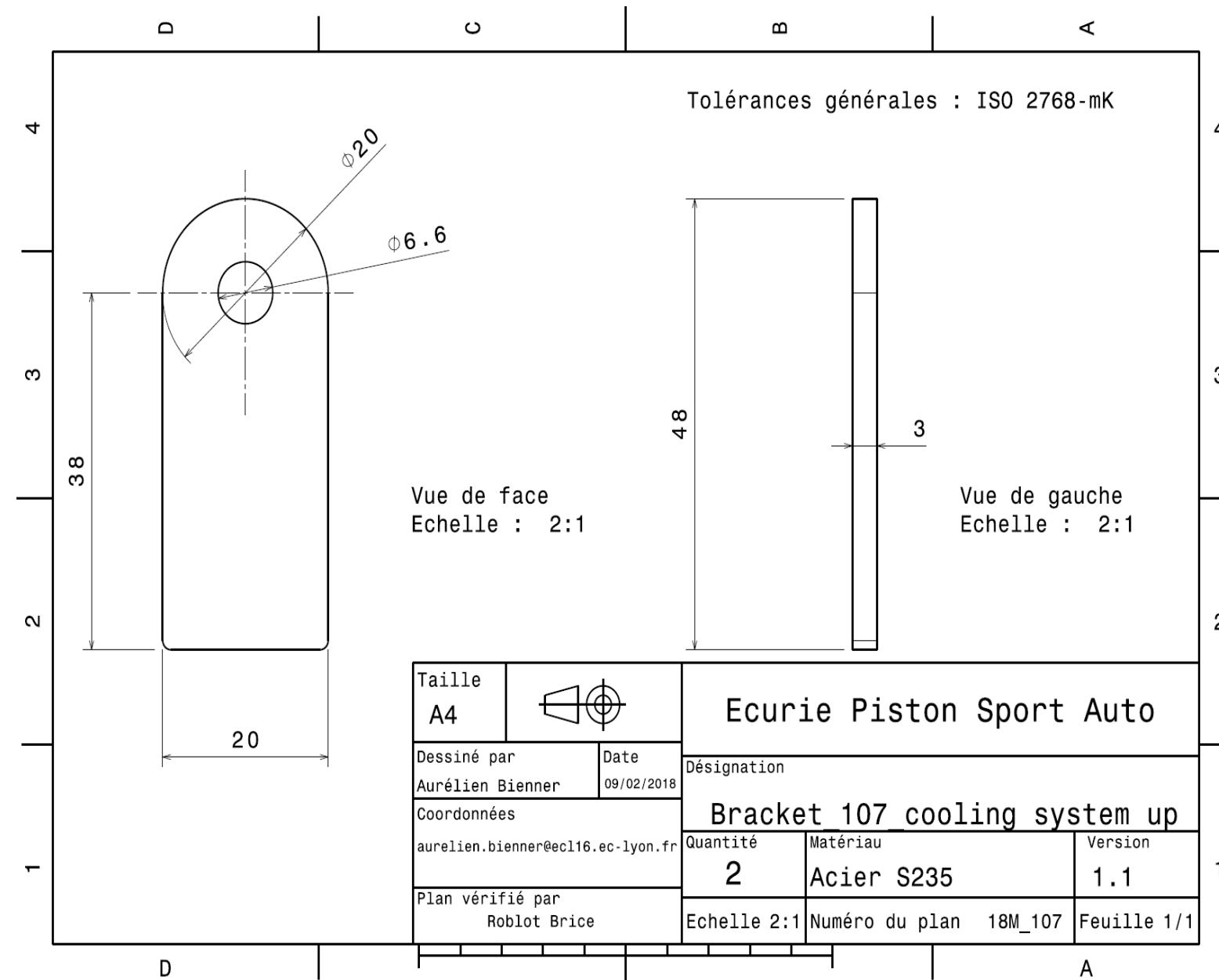
40	Hose Clamp, Miniature Bolt	Secondary Cooling Line Hose Clamp	\$ 0,55	12 mm			2	\$ 1,10
50	Hose Clamp, Miniature Bolt	Main line hose clamp	\$ 0,60	25,4 mm			9	\$ 5,41
60	Pin, Plastic Push	Set Fan to Radiator	\$ 0,10	4 unit			4	\$ 0,40
							Sub Total	\$ 8,55

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

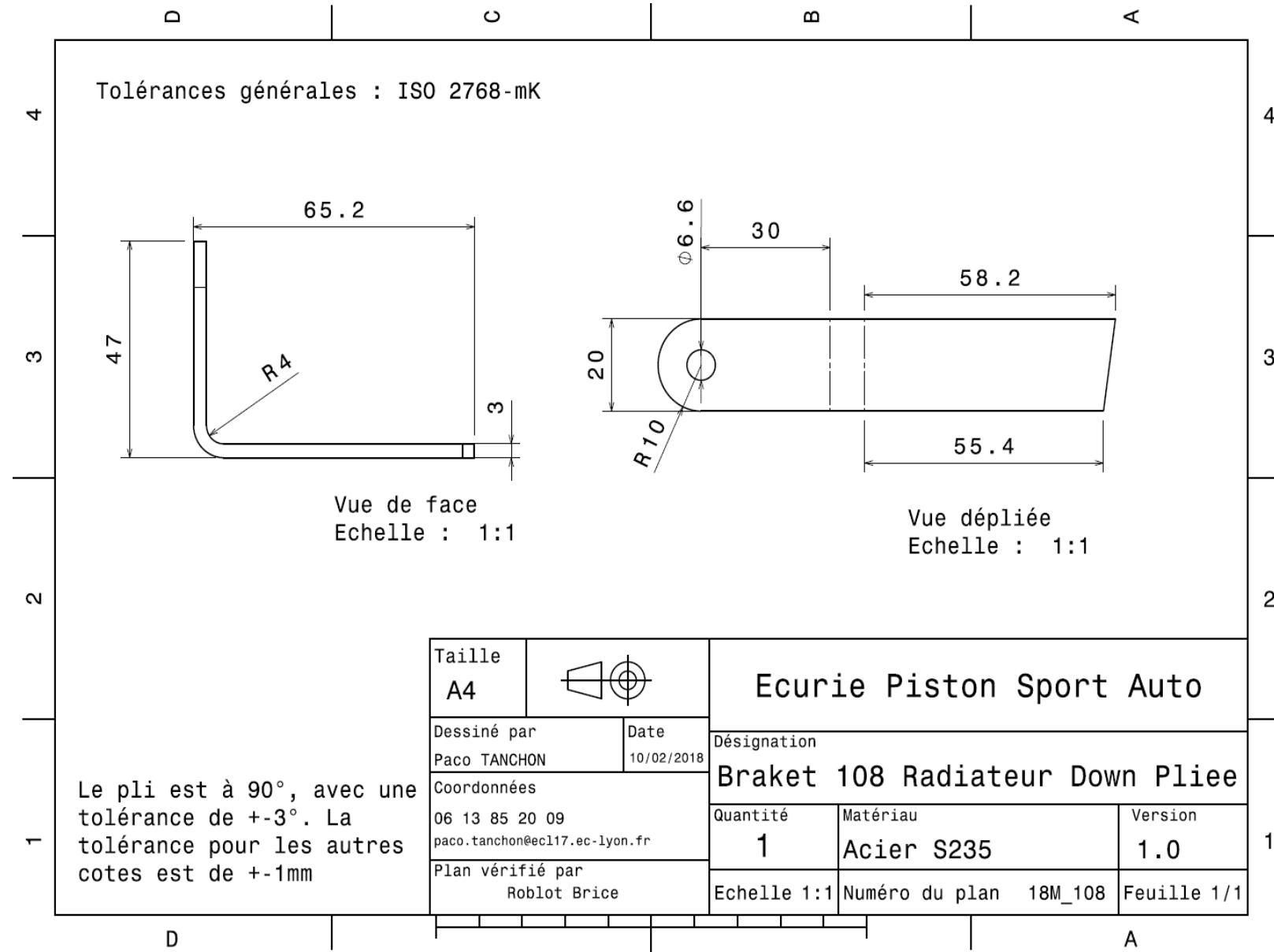
University	Ecole Centrale de Lyon	Drawing :	FileLink1	Back to BOM	Car #	81	Part Cost	\$ 102,86					
System	Engine & Drivetrain				Qty	1							
Assembly	Cooling System		FileLink2		FileLink1								
Part	Radiator		FileLink3		FileLink2								
P/N Base	EN 08001				FileLink3		Extended Cost	\$ 102,86					
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	Aluminum, 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					



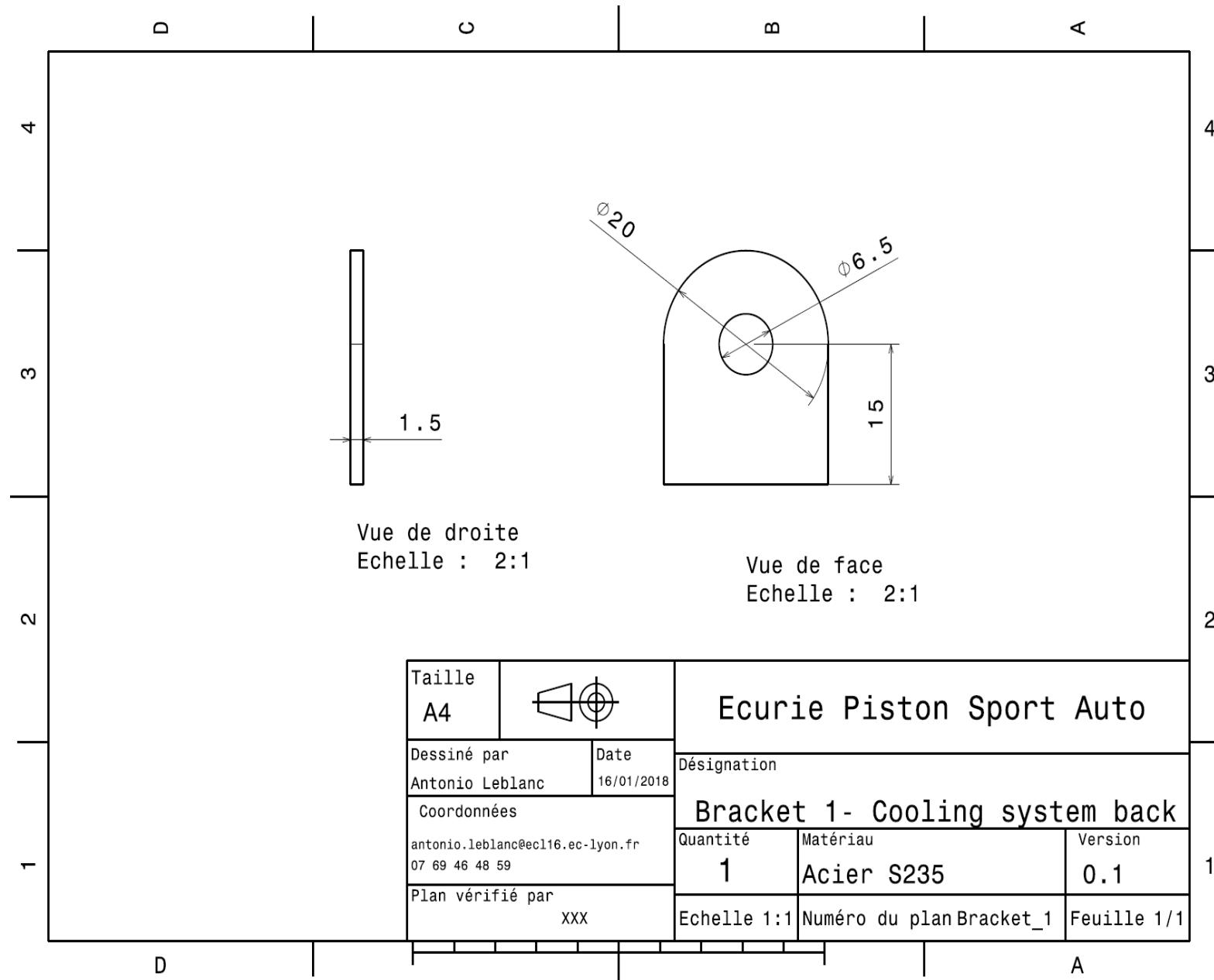
University	Ecole Centrale de Lyon	Back to BOM	Car #	81	Part Cost	\$ 1,79							
System	Engine & Drivetrain	Drawing : FileLink1	Qty	1									
Assembly	Cooling System	FileLink2	FileLink1										
Part	Radiator lateral upper tab	FileLink3	FileLink2		Extended Cost	\$ 1,79							
P/N Base	EN 08002		FileLink3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



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



University	Ecole Centrale de Lyon	Car #	81	Part Cost	\$ 1,61								
System	Engine & Drivetrain	Qty			1								
Assembly	Cooling System	FileLink1											
Part	Radiator Back tab	FileLink2											
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					



University	Ecole Centrale de Lyon	Back to BOM	Car #	81	Part Cost	\$ 17,09							
System	Engine & Drivetrain		Qty	1									
Assembly	Cooling System		FileLink1										
Part	Main Coolant Line		FileLink2										
P/N Base	EN 08005		FileLink3										
Suffix	AA												
Details			FileLink1										
FileLink2			FileLink2										
FileLink3			FileLink3										
Extended Cost	\$ 17,09												
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	\$ 0,45
												Sub Total	\$ 5,22
ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total					
10	Cut (scissors, knife)	Silicone hose cutting	\$ 0,06	cm	5,1		1	\$ 0,31					
20	Saw or tubing cuts	Steel hose cutting	\$ 0,40	cm	5,0			\$ 2,00					
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	\$ 7,07					
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				

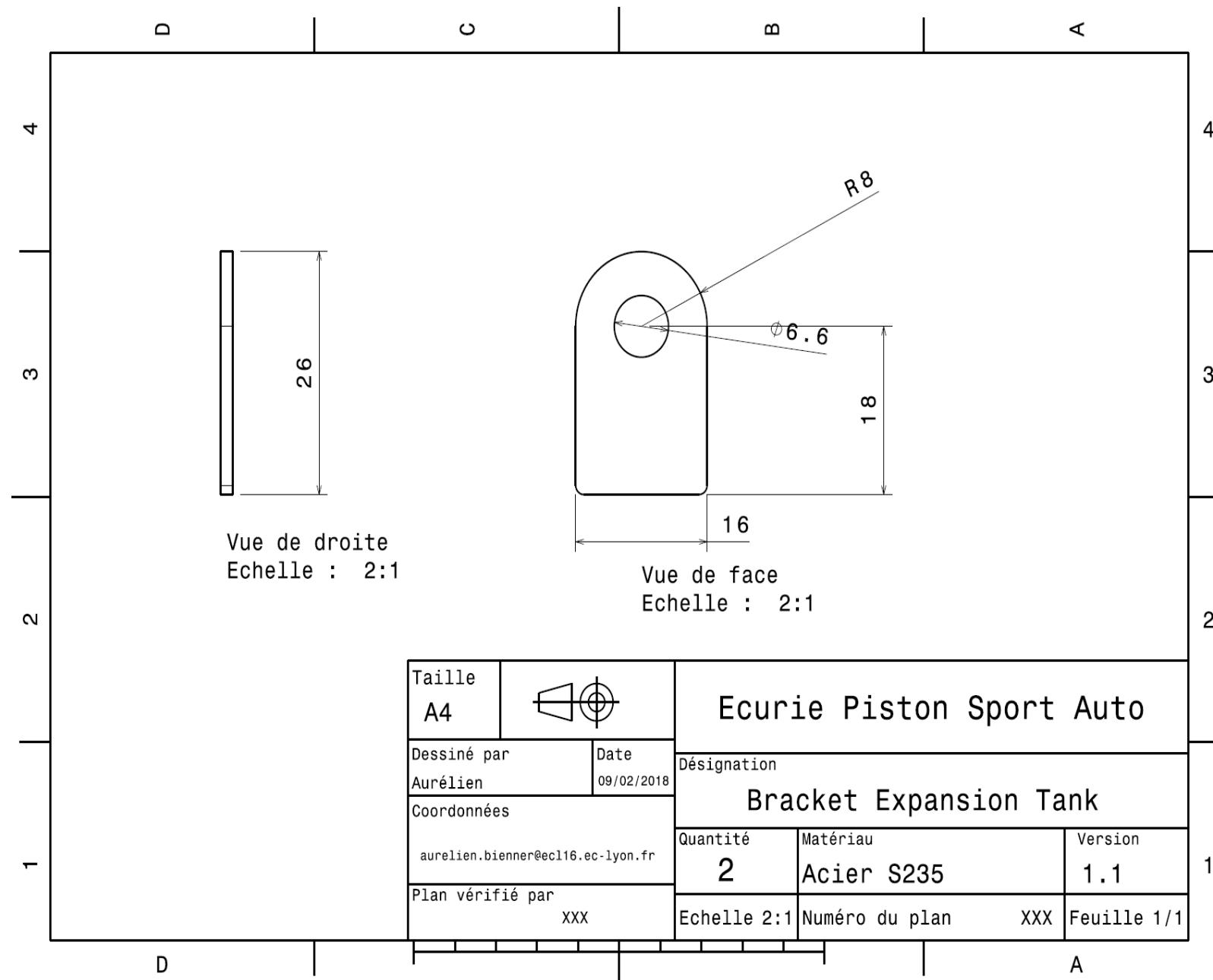
University	Ecole Centrale de Lyon	Back to BOM	Car #	81	Part Cost	\$ 30,77									
System	Engine & Drivetrain		Qty	1											
Assembly	Cooling System		FileLink1												
Part	Fan		FileLink2												
P/N Base	EN 08006		FileLink3												
Suffix	AA														
Details			FileLink1									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



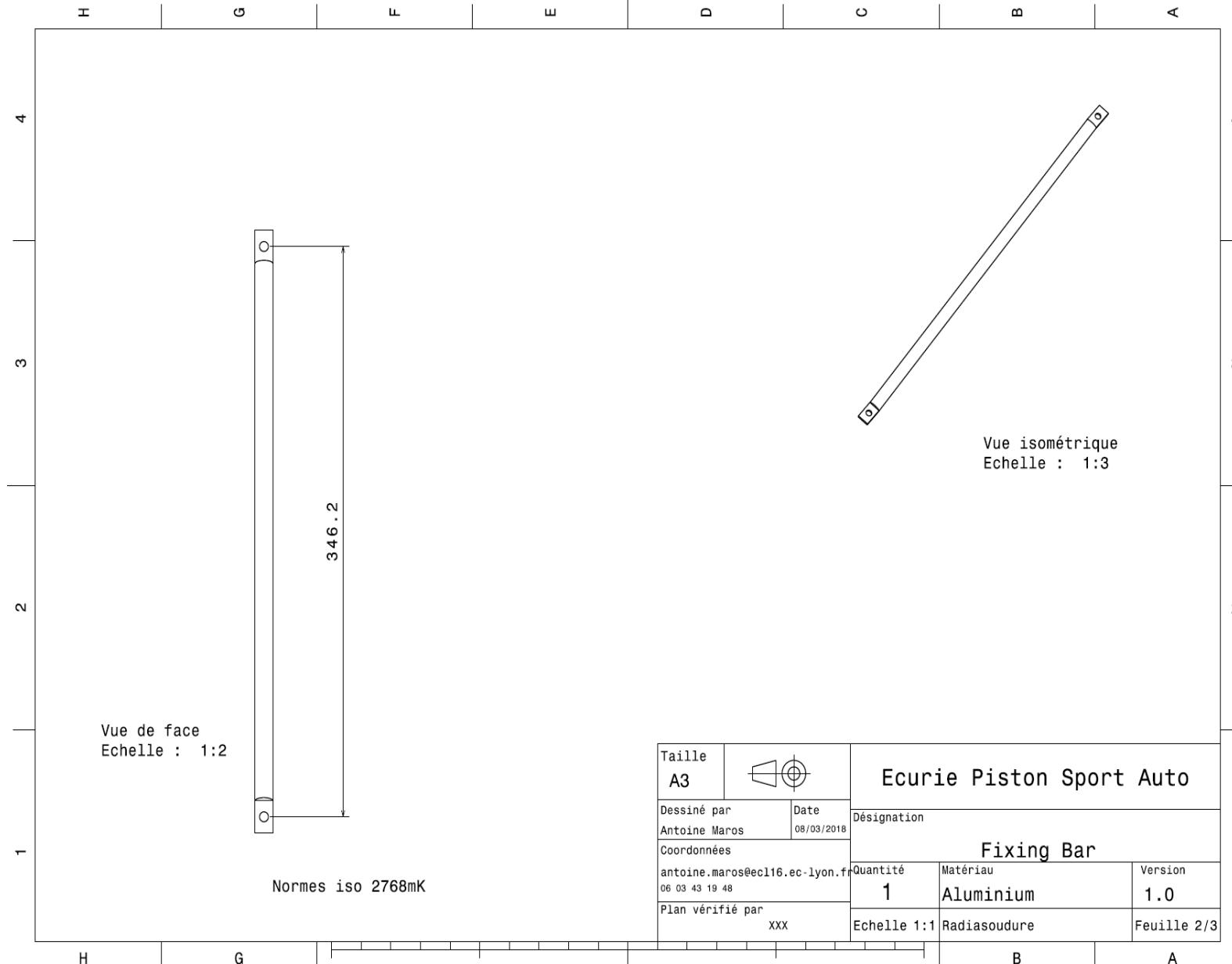
University	Ecole Centrale de Lyon	Car #	81	Part Cost	\$ 22,73								
System	Engine & Drivetrain	Qty	1										
Assembly	Cooling System	FileLink1											
Part	Expansion Tank	FileLink2											
P/N Base	EN 08007	FileLink3											
Suffix	AA												
Details													
ItemOrder	Material	Use	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 preparation 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	Car #	81	Part Cost	\$ 1,54								
System	Engine & Drivetrain	Qty	1										
Assembly	Cooling System	FileLink1											
Part	Expansion Tank tab	FileLink2											
P/N Base	EN 08008	FileLink3											
Suffix	AA												
Details		FileLink1											
Back to BOM		FileLink2											
		FileLink3											
				Extended Cost	\$ 1,54								
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					



University	Ecole Centrale de Lyon	Car #	81	Part Cost	\$ 3,15								
System	Engine & Drivetrain	Qty	1										
Assembly	Cooling System	FileLink1											
Part	Lateral Tube	FileLink2											
P/N Base	EN 08009	FileLink3											
Suffix	AA												
Details		FileLink1											
FileLink2		FileLink2											
FileLink3		FileLink3											
				Extended Cost	\$ 3,15								
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
20	Paint	To protect part from rust	\$ 10,00	0,020	m^2								\$ 0,20
												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					
30	Aerosol apply	To protect part from rust	\$ 5,25	m^2	0,020			\$ 0,11					
							Sub Total	\$ 1,35					



University	Ecole Centrale de Lyon	Back to BOM	Car #	81	Part Cost	\$ 7,47							
System	Engine & Drivetrain		Qty	1									
Assembly	Cooling System												
Part	Secondary Coolant Line												
P/N Base	EN 08010												
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				0,6	\$ 3,50
20	Steel, Stainless	Secondary lines	\$ 2,25	0,072	kg			Tube 12 x 0.5mm	9,23E-06	1,00	7850	0	\$ -
												Sub Total	\$ 3,50
ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total					
10	Cut (scissors, knife)	Silicone hose cutting	\$ 0,06	cm	2,5		1	\$ 0,15					
20	Saw or tubing cuts	Steel hose cutting	\$ 0,40	cm	2,4			\$ 0,96					
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	2			\$ 1,00					
							Sub Total	\$ 2,87					
ItemOrder	Fastener	Use	UnitCost	Size1	Unit1	Size2	Unit2	Quantity	Sub Total				
10	Hose Clamp, Miniature Bolt	Main line hose clamp	\$ 0,55	12,4	mm			2	\$ 1,10				
								Sub Total	\$ 1,10				

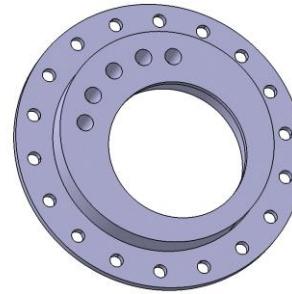
University	Ecole Centrale de Lyon	Back to BOM	Car #	81	Asm Cost	\$ 402,70							
System	Engine & Drivetrain		Qty	1									
Assembly	Differential Assembly												
P/N Base	EN A0900												
Suffix	AA												
Details	Differential housing and mounting assembly		FileLink1		Extended C	\$ 402,70							
ItemOrder	Part	Part Cost	Quantity	Sub Total	FileLink2	FileLink3							
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 differen	\$ 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
	Differential Internals, Limited Slip, Salisbury or Powerflow or Clutch Style											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				

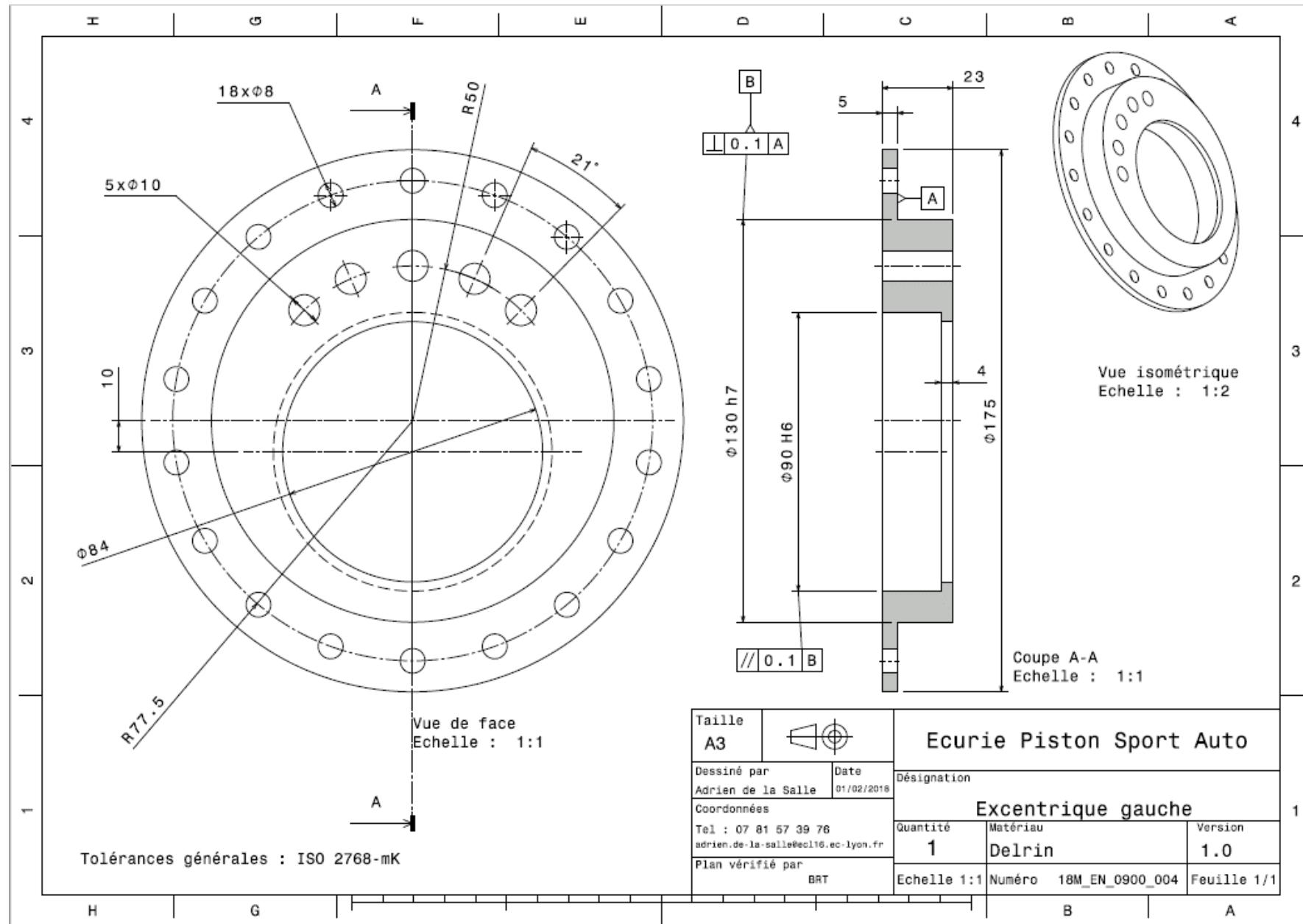
ItemOrder	Fastener	Use	UnitCost	Size1	Unit1	Size2	Unit2	Quantity	Sub Total
10	Bolt, Grade 8,8 (SAE 5)	Assemble	\$ 0,53	12	mm	50	mm	2	\$ 1,05
20	Nut, Grade 8,8 (SAE 5)	Assemble	\$ 0,10	12	mm			2	\$ 0,20
30	Bolt, Grade 8,8 (SAE 5)	Blocking le	\$ 0,12	8	mm	30	mm	2	\$ 0,24
40	Nut, Grade 8,8 (SAE 5)	Blocking le	\$ 0,04	8	mm			2	\$ 0,09
50	Washer, Grade 8,8 (SAE 5)	Blocking eq	\$ 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	FractionInd	Sub Total
10	Welds - Welding Fixture	Weld tabs	\$ 500,00	point	16	3000	1	\$ 2,67
								Sub Total \$ 2,67

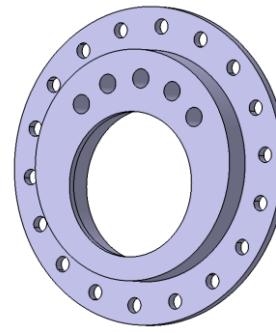
University	Ecole Centrale de Lyon	Back to BOM	Car #	81	Part Cost	\$ 125,94							
System	Engine & Drivetrain		Qty	1	FileLink1								
Assembly	Differential		FileLink2		FileLink3								
Part	Housing				Extended Cost	\$ 125,94							
P/N Base	EN 09001												
Suffix	AA												
Details	Bought, cost as made												
ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Aluminium, 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				

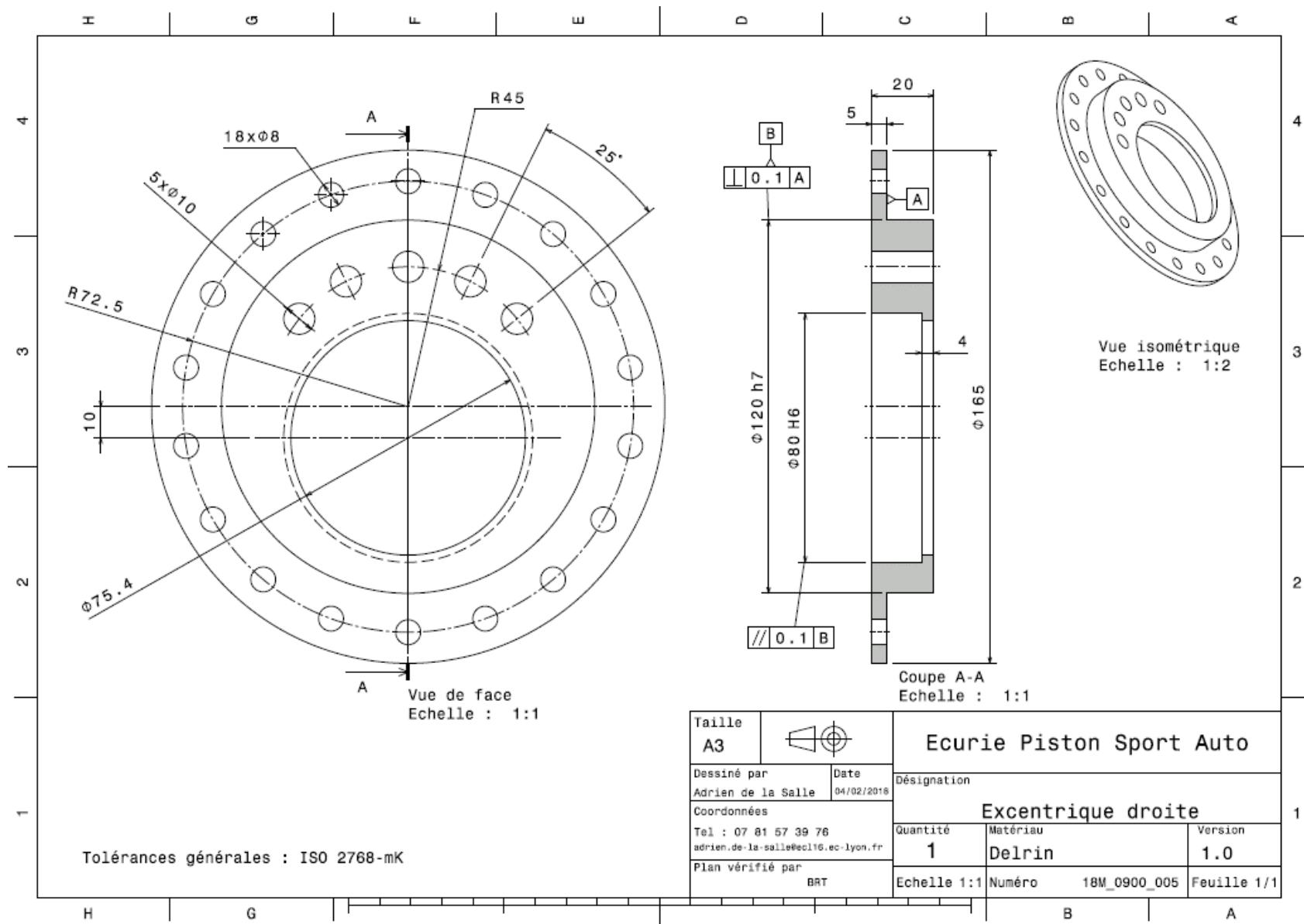
University	Ecole Centrale de Lyon	Back to BOM	Car #	81	Part Cost	\$ 10,90								
System	Engine & Drivetrain		Qty	1										
Assembly	Differential		FileLink1											
Part	Left Eccentric		FileLink2											
P/N Base	EN 09002		FileLink3											
Suffix	AA				Extended Cos	\$ 10,90								
Details														
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						





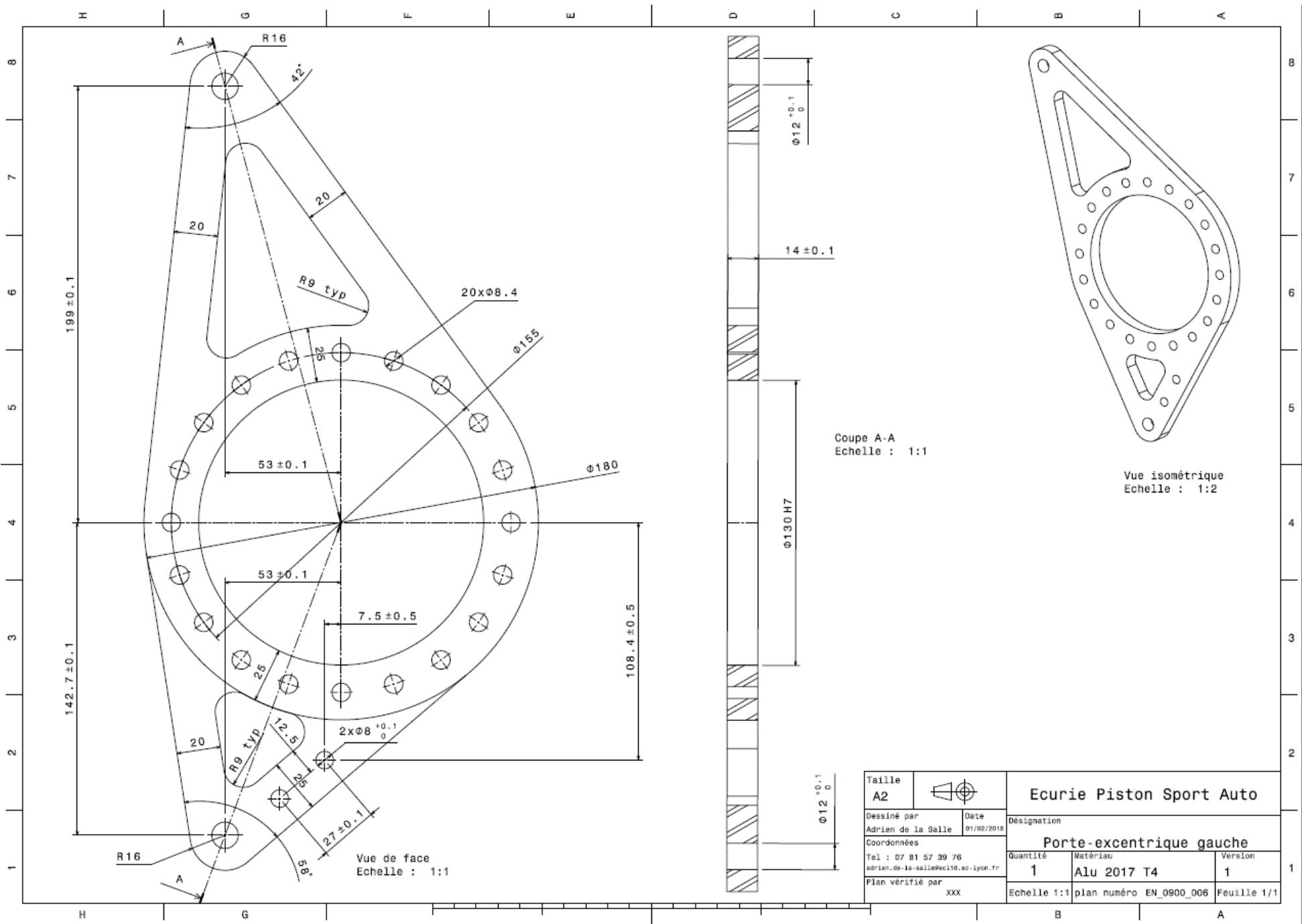
University	Ecole Centrale de Lyon	Back to BOM	Car #	81	Part Cost	\$ 8,54									
System	Engine & Drivetrain		Qty	1	FileLink1										
Assembly	Differential		FileLink1		FileLink2										
Part	Right Eccentric		FileLink2		FileLink3										
P/N Base	EN 09003		Extended Cost	\$ 8,54											
Suffix	AA														
Details															
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



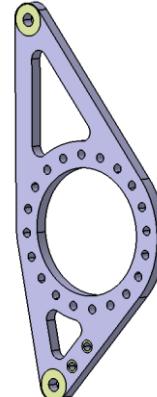


University	Ecole Centrale de Lyon	Car #	81	Part Cost	\$ 23,96								
System	Engine & Drivetrain	Qty	1										
Assembly	Differential	FileLink1	Drawing	FileLink1									
Part	Left Eccentric carrier	FileLink2		FileLink2									
P/N Base	EN 09004	FileLink3		FileLink3									
Suffix	AA												
Details													
ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Aluminium, Premium	Material for the 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					



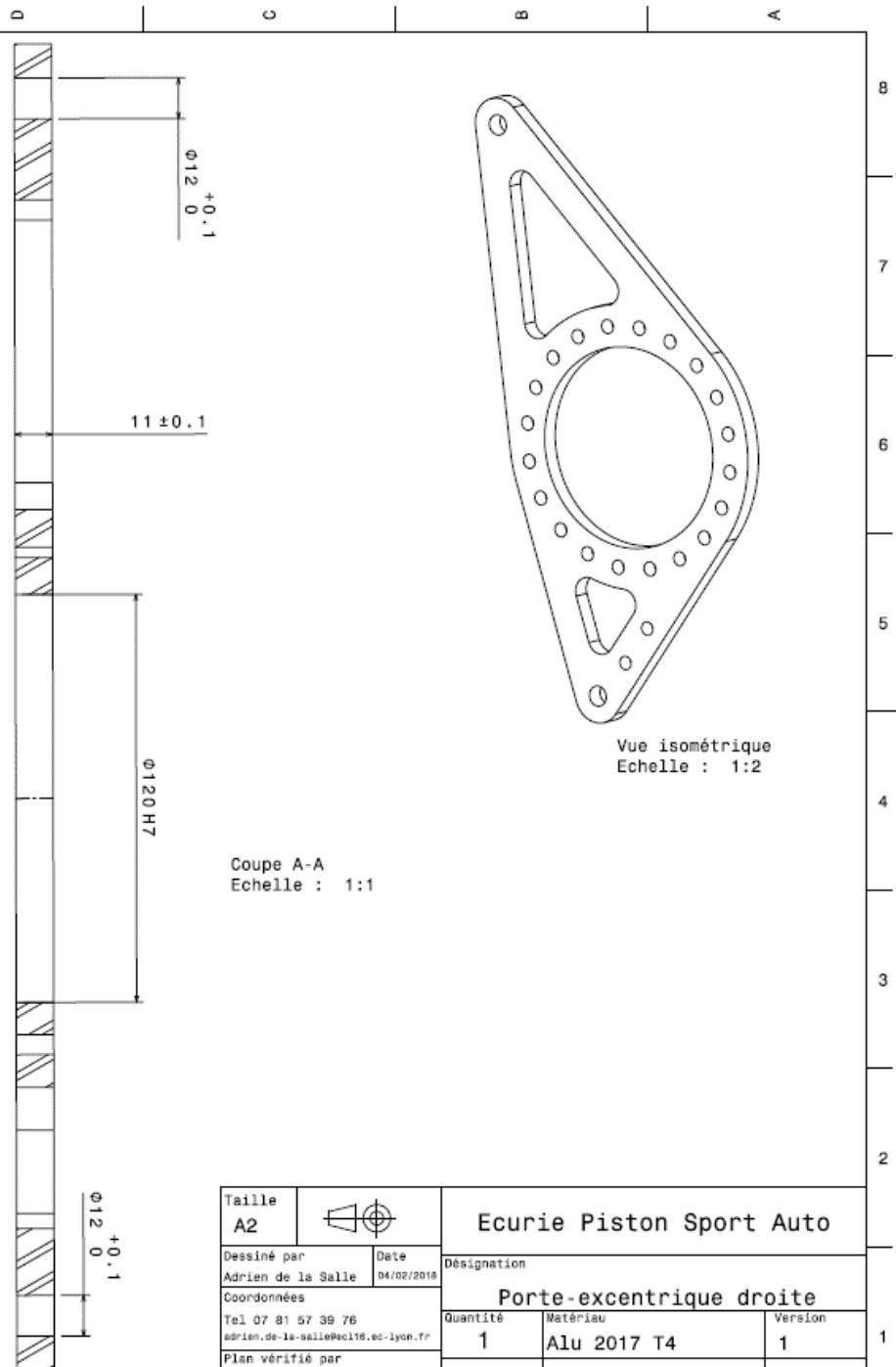
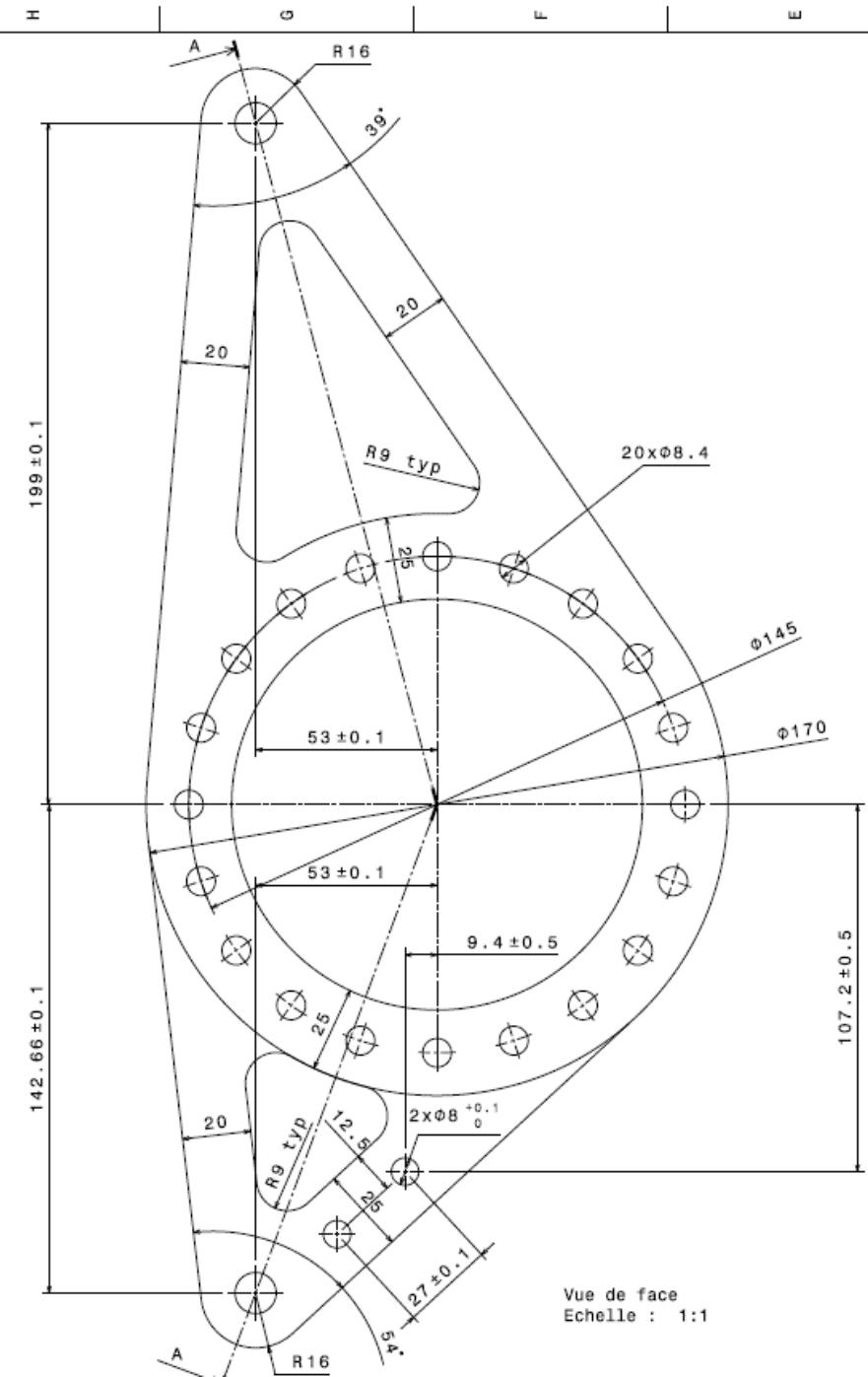


University	Ecole Centrale de Lyon	Car #	81	Part Cost	\$ 17,20								
System	Engine & Drivetrain	Qty	1										
Assembly	Differential	FileLink1	Drawing	FileLink2									
Part	Right Eccentric carrier	FileLink3		FileLink2									
P/N Base	EN 09005			FileLink3									
Suffix	AA												
Details													
ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Aluminium, Premium	Material for the 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					

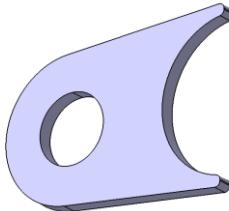


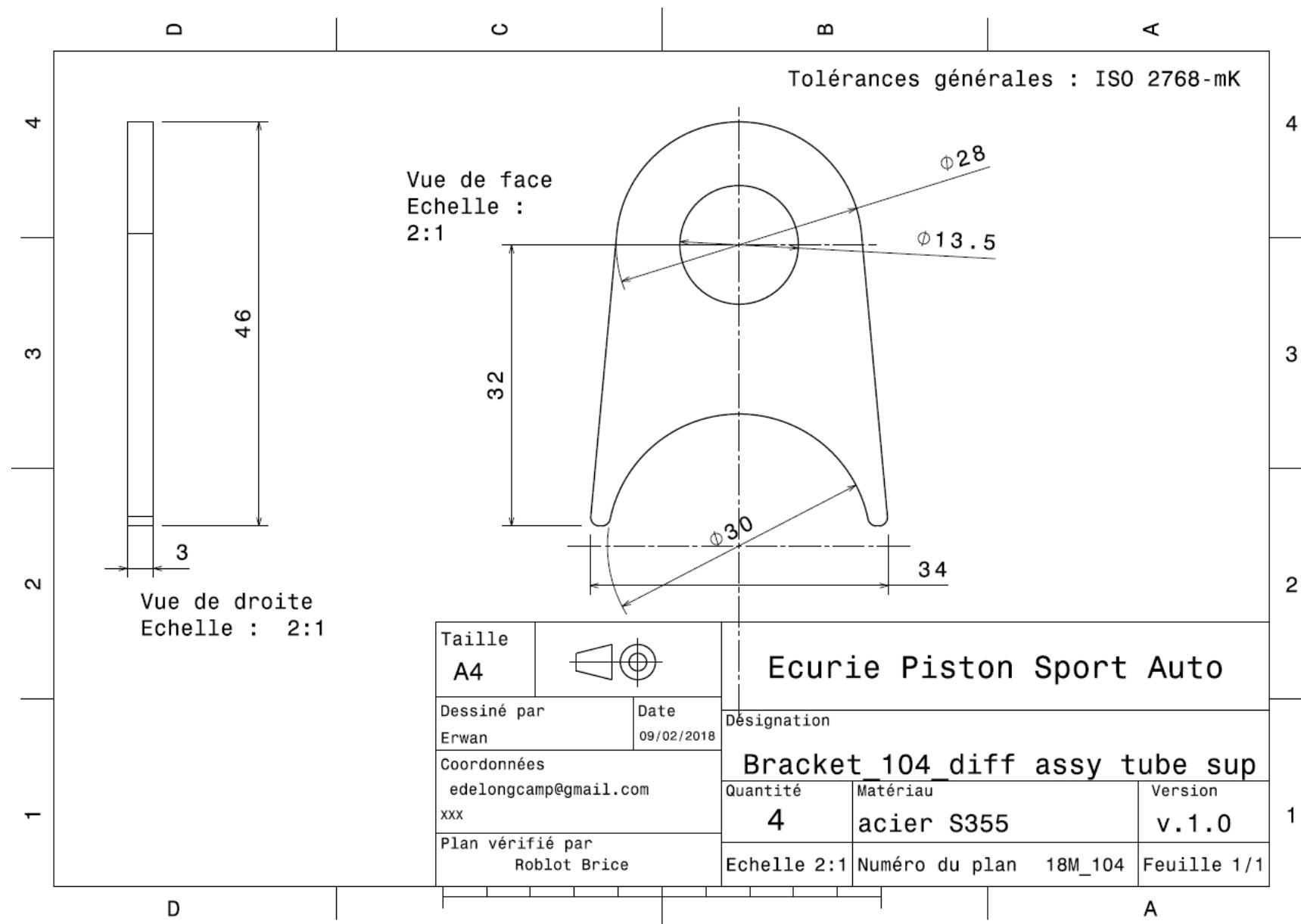
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University	Ecole Centrale de Lyon	Car #	81	Part Cost	\$ 17,20								
System	Engine & Drivetrain	Qty	1										
Assembly	Differential	FileLink1	Drawing	FileLink2									
Part	Right Eccentric carrier	FileLink3		FileLink2									
P/N Base	EN 09005			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 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					

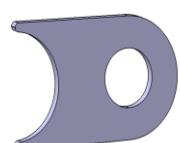


University	Ecole Centrale de Lyon	Car #	81	Part Cost	\$ 1,00									
System	Engine & Drivetrain	Qty	4											
Assembly	Differential	FileLink1		FileLink2										
Part	Upper Eccentric Carrier bracket	FileLink3		Extended Cos	\$ 3,98									
P/N Base	EN 09006	FileLink1		FileLink2										
Suffix	AA	FileLink3												
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	0,037	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						





University	Ecole Centrale de Lyon	Car #	81	Part Cost	\$ 0,97									
System	Engine & Drivetrain	Qty	4											
Assembly	Differential	FileLink1		FileLink1										
Part	Lower Eccentric Carrier bracket	FileLink2		FileLink2										
P/N Base	EN 09007	FileLink3		FileLink3	Extended Cost \$ 3,88									
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						



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Tolérances générales : ISO 2768-mK

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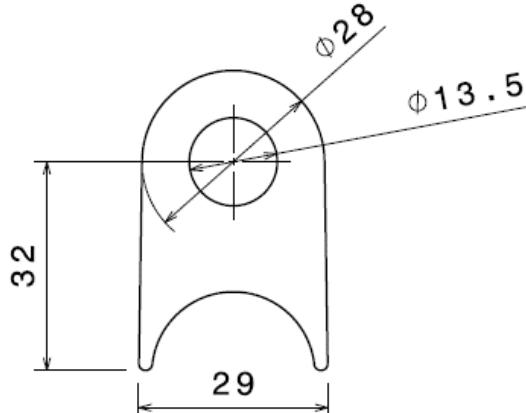
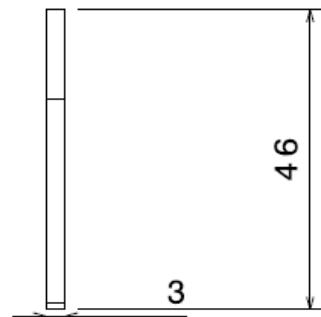
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1



Taille
A4



Dessiné par
Erwan

Date
09/02/2018

Coordonnées

edelongcamp@gmail.com
xxx

Plan vérifié par
Brice Roblot

Ecurie Piston Sport Auto

Désignation

Bracket_105_diff assy tube inf

Quantité
4

Matériau
acier S355

Version
v.1.1

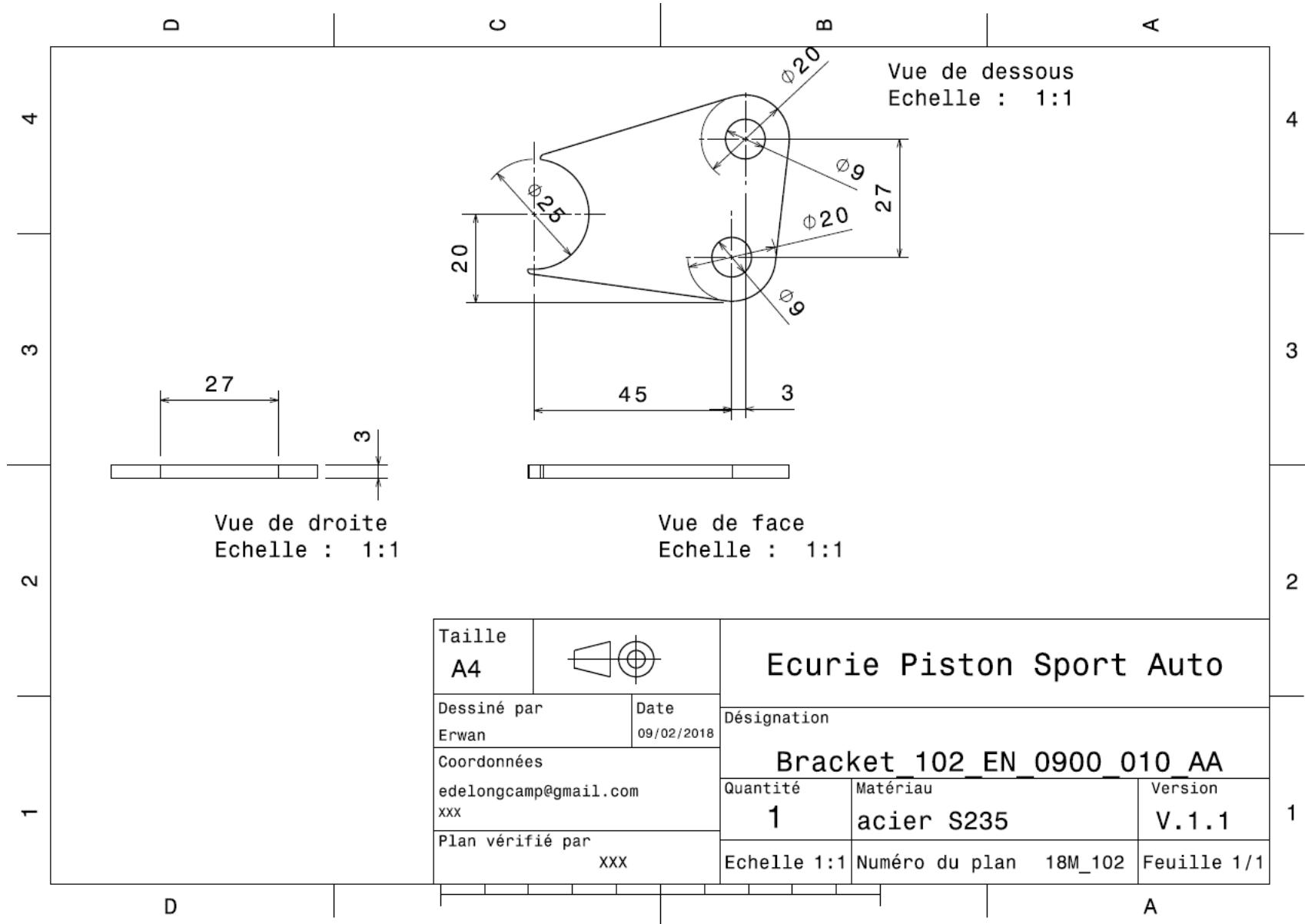
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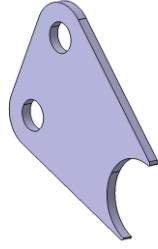
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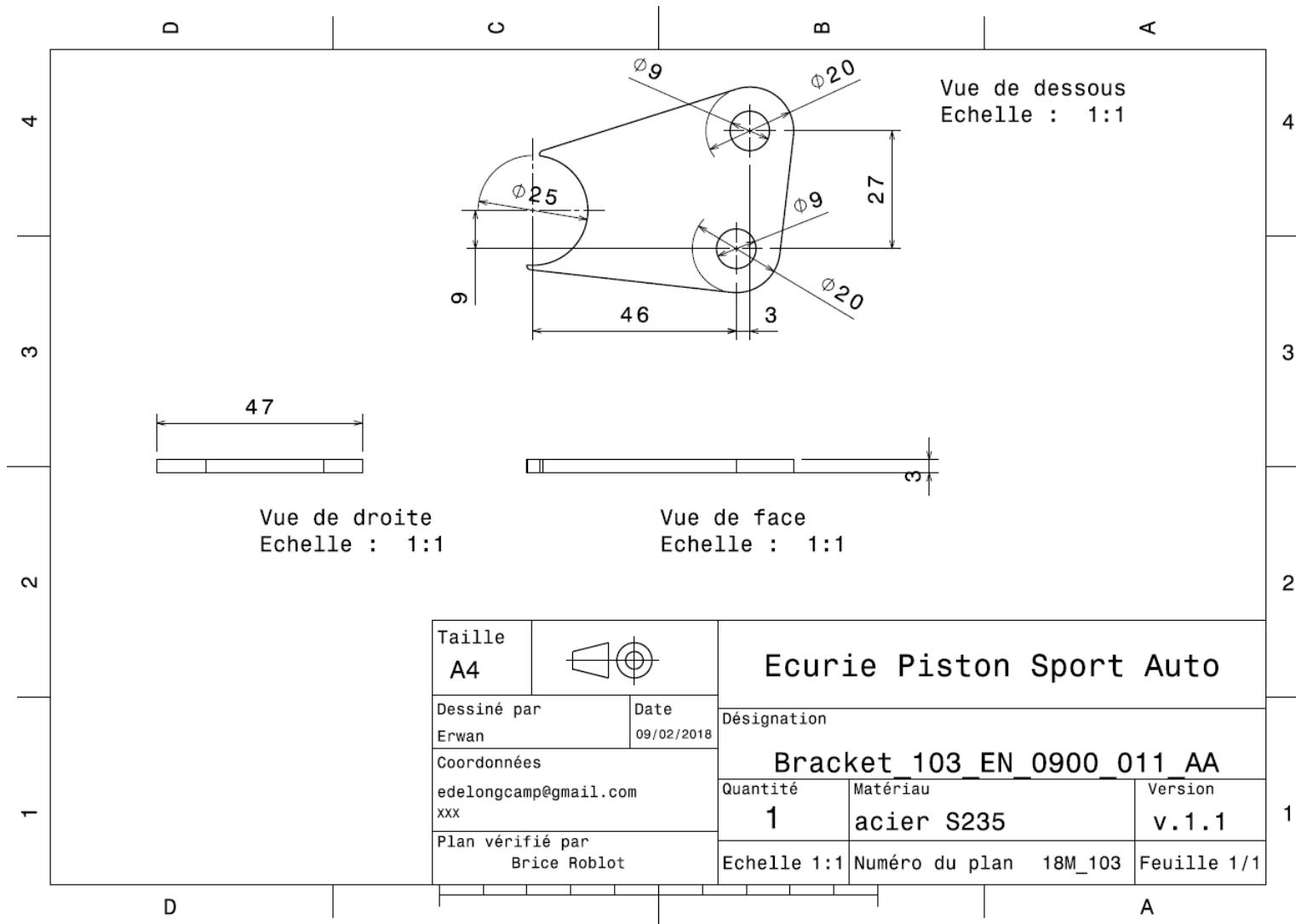
University	Ecole Centrale de Lyon	Car #	81											
System	Engine & Drivetrain	Part Cost	\$ 2,20											
Assembly	Differential	Qty	1											
Part	Left Jacking Bar bracket	FileLink1												
P/N Base	EN 09008	FileLink2												
Suffix	AA	FileLink3												
Details		Back to BOM												
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						





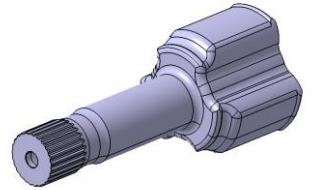
University	Ecole Centrale de Lyon	Car #	81	Part Cost	\$ 2,21									
System	Engine & Drivetrain	Qty	1											
Assembly	Differential	FileLink1	Drawing	FileLink1										
Part	Right Jacking Bar bracket	FileLink2		FileLink2										
P/N Base	EN 09009	FileLink3		FileLink3	Extended Cos \$ 2,21									
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	0,068	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						



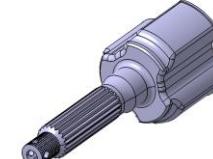


University	Ecole Centrale de Lyon	Back to BOM	Car #	81	Asm Cost	\$ 536,12								
System	Engine & Drivetrain		Qty	1										
Assembly	Driveshaft													
P/N Base	EN A1000													
Suffix	AA													
Details														
ItemOrder	Part	Part Cost	Quantity	Sub Total										
10	Inboard tripod housing	\$ 66,55	2	\$ 133,10										
20	Outboard tripod housing	\$ 73,11	2	\$ 146,22										
30	Left axle	\$ 16,43	1	\$ 16,43										
40	Right axle	\$ 17,34	1	\$ 17,34										
				Sub Total	\$ 313,09									
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 driveshaftfts	\$ 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	Back to BOM	Car #	81	Part Cost	\$ 66,55								
System	Engine & Drivetrain		Qty	2										
Assembly	Driveshaft		FileLink1											
Part	Inboard tripod housing		FileLink2											
P/N Base	EN 10001		FileLink3											
Suffix	AA				Extended Cos	\$ 133,10								
Details	Bought, cost as made				FileLink3									
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 in 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					

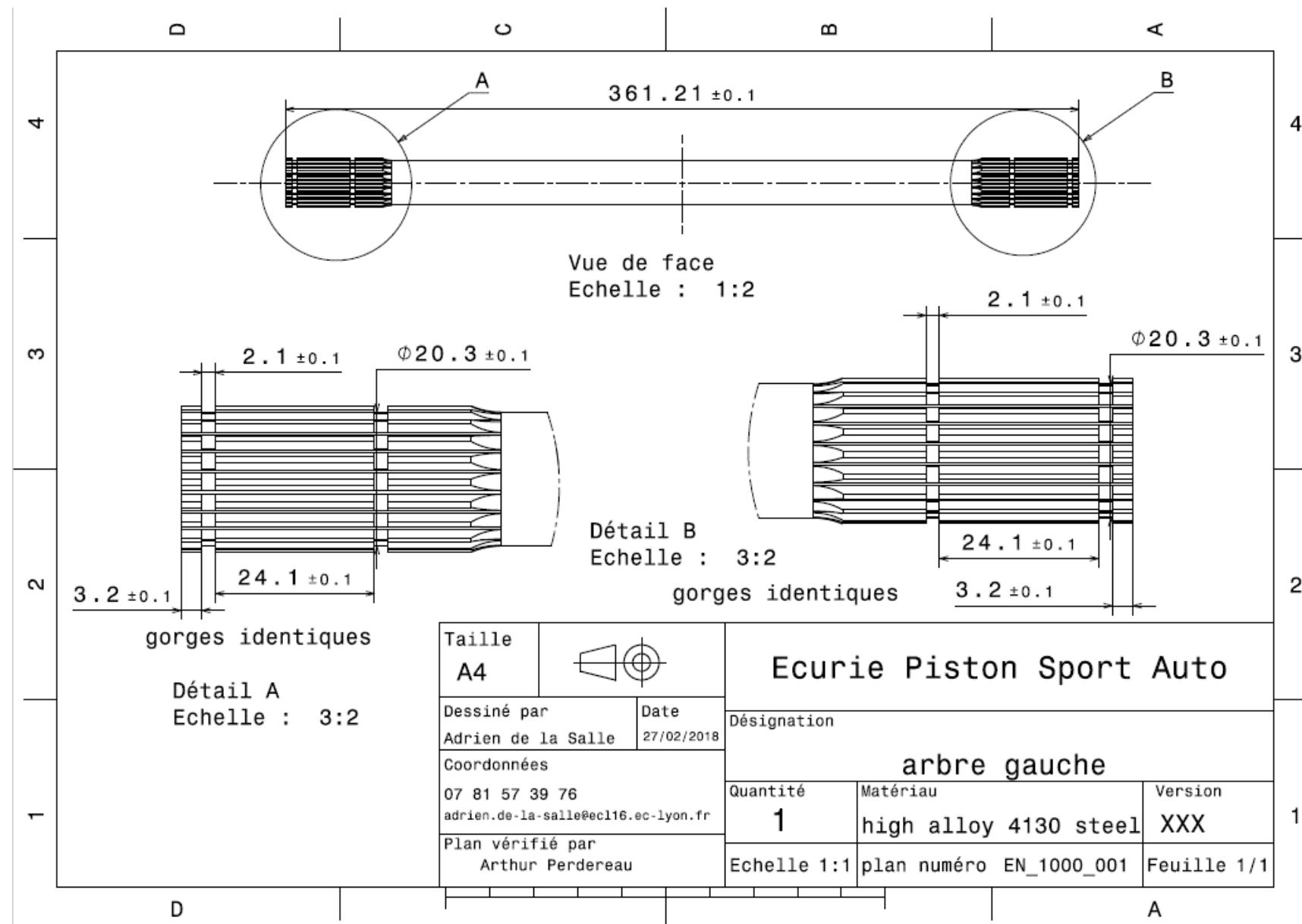


University	Ecole Centrale de Lyon	Car #	81	Part Cost	\$ 73,11									
System	Engine & Drivetrain	Qty	2											
Assembly	Driveshaft	FileLink1		FileLink1										
Part	Outboard tripod housing	FileLink2		FileLink2										
P/N Base	EN 10002	FileLink3		FileLink3	Extended Cost \$ 146,22									
Suffix	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	\$ 63,48						



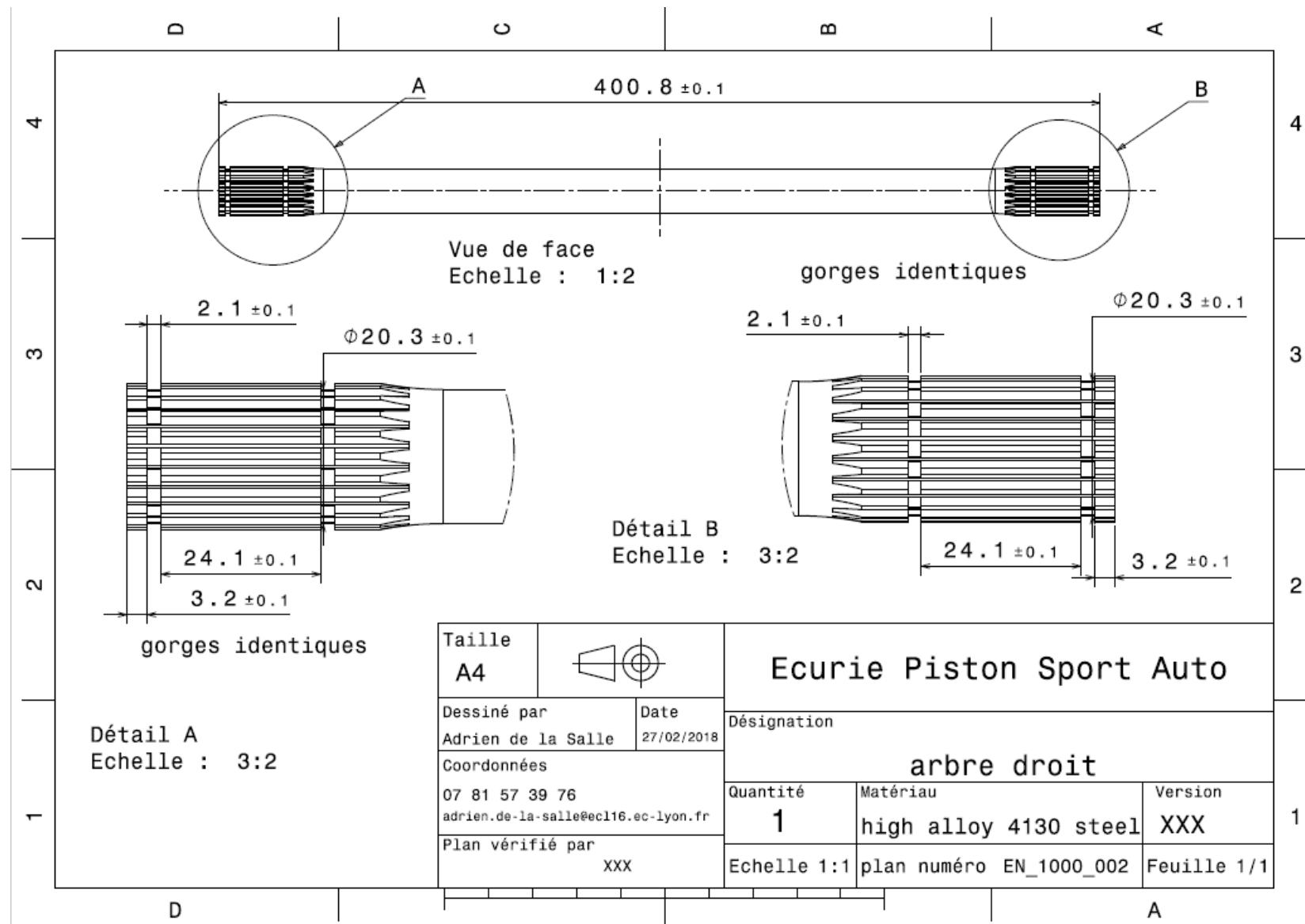
University	Ecole Centrale de Lyon	Car #	81	Part Cost	\$ 16,43									
System	Engine & Drivetrain	Qty	1											
Assembly	Driveshaft	FileLink1	Drawing of the cut	FileLink2										
Part	Left Axle	FileLink3		FileLink2										
P/N Base	EN 10003			FileLink3	Extended Cost \$ 16,43									
Suffix	AA													
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 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						





University	Ecole Centrale de Lyon	Car #	81	Part Cost	\$ 17,34								
System	Engine & Drivetrain	Qty	1										
Assembly	Driveshaft	FileLink1	Drawing of the cut	FileLink2									
Part	Right Axle	FileLink3		FileLink2									
P/N Base	EN 10004			FileLink3	Extended Cost \$ 17,34								
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 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					





University	Ecole Centrale de Lyon	Back to BOM	Car #	81	Asm Cost	\$ 133,38							
System	Engine & Drivetrain		Qty	1									
Assembly	Chain Set		FileLink1										
P/N Base	EN A1100		FileLink2										
Suffix	AA		FileLink3										
Details			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	mm	20							1	\$ 1,00
20	Paint	Chain shield and Bracket painting	\$ 10,00	m^2	0,118							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									

Item	Order	Tooling	Use	Unit Cost	Unit	Quantity	PVF	Fraction Inclu	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	Part Cost	\$ 24,75
																	FileLink1	Qty	1		
																	FileLink2			Extended Cos \$ 24,75	
																	FileLink3				
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												



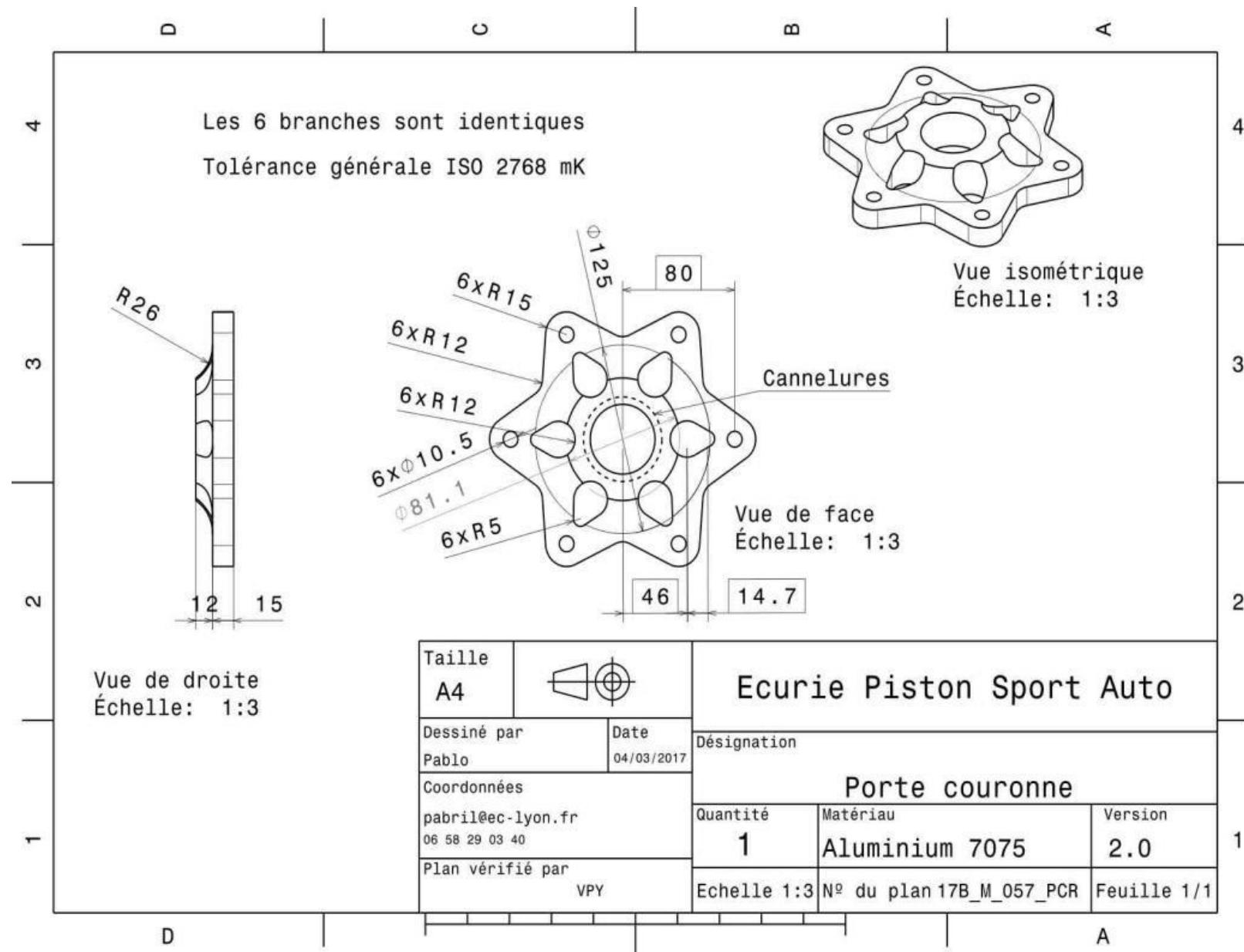
University	Ecole Centrale de Lyon	FileLink1	FileLink2	FileLink3	Back to BOM	Car #	81	Part Cost	\$ 41,80				
System	Engine & Drivetrain					Qty	1						
Assembly	Chain Set					FileLink1							
Part	Rear sprocket					FileLink2							
P/N Base	EN 11002					FileLink3							
Suffix	AA							Extended Cost	\$ 41,80				
Details	Bought, cost as made												
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			\$ 0,65					
40	Laser cut	Shaping of the sprocket	\$ 0,01	cm	126,4	Material-Steel	3	\$ 3,79					
						Sub Total	\$ 38,74						



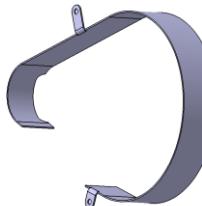


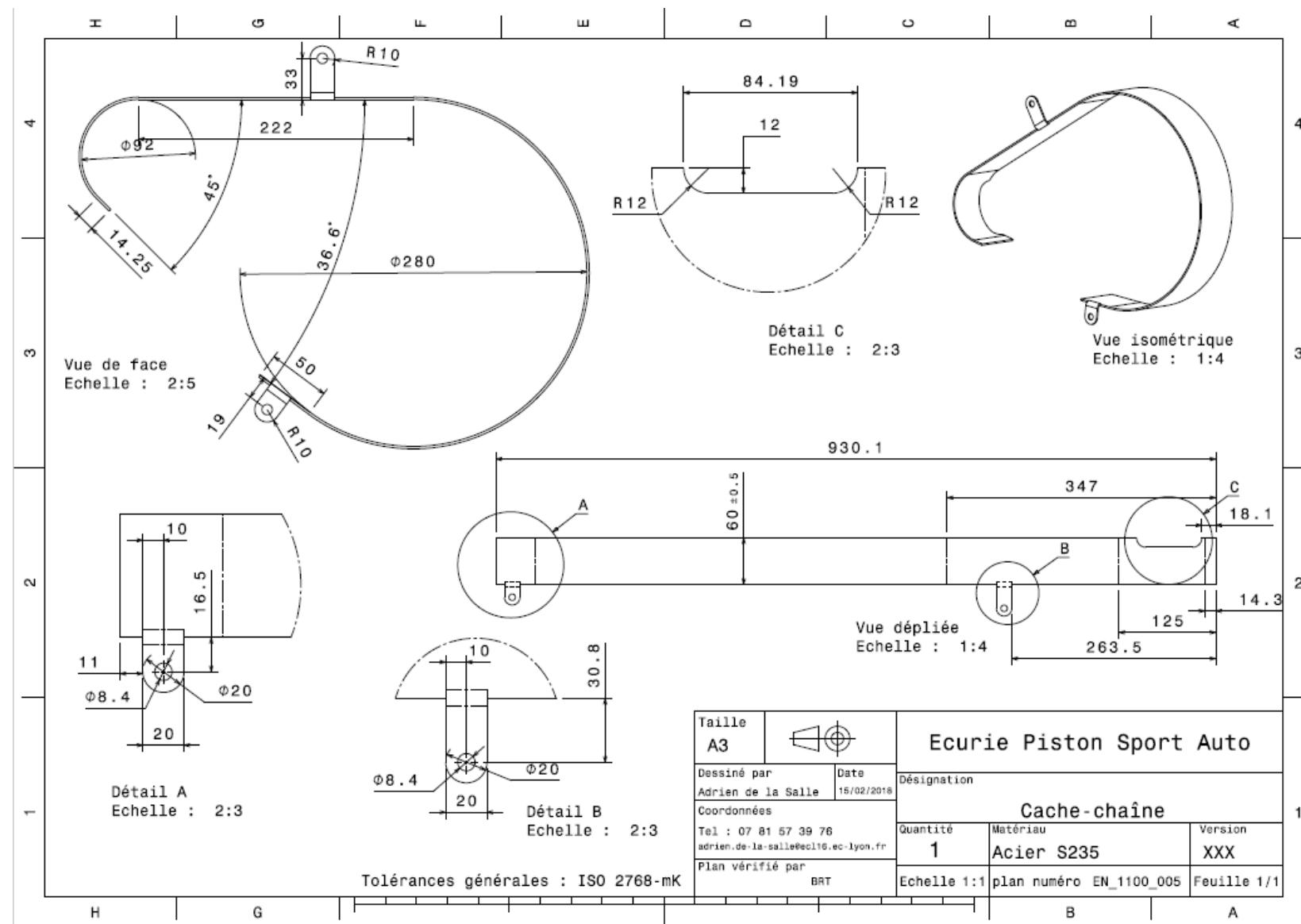
University	Ecole Centrale de Lyon	Back to BOM	Car #	81	Part Cost	\$ 29,16							
System	Engine & Drivetrain		Qty	1									
Assembly	Chain Set		FileLink1		Extended Cos	\$ 29,16							
Part	Rear sprocket adaptor		FileLink2										
P/N Base	EN 11003		FileLink3										
Suffix	AA												
Details													
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 190mn	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					





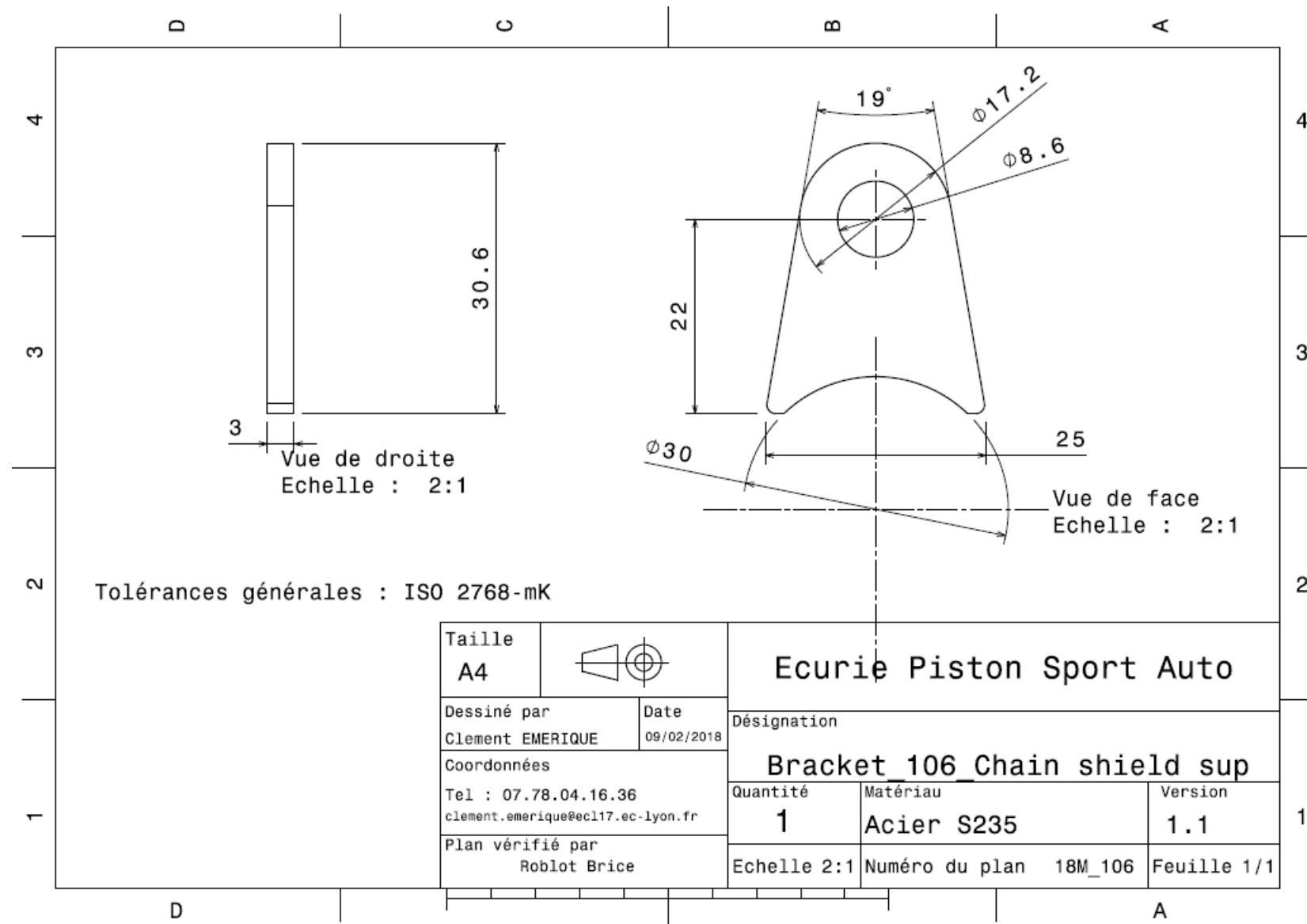
University	Ecole Centrale de Lyon	Car #	81	Part Cost	\$ 9,10								
System	Engine & Drivetrain	Qty	1										
Assembly	Chain Set	FileLink1	Drawing	FileLink1									
Part	Chain shield	FileLink2		FileLink2									
P/N Base	EN 11004	FileLink3		FileLink3									
Suffix	AA												
Details													
ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Mild	Material for the 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					





University	Ecole Centrale de Lyon	Car #	81	Part Cost	\$ 1,71									
System	Engine & Drivetrain	Qty	1											
Assembly	Chain Set	FileLink1		FileLink1										
Part	Upper chainshield bracket	FileLink2		FileLink2										
P/N Base	EN 11005	FileLink3		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	0,018	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					





University	Ecole Centrale de Lyon	Car #	81	Part Cost	\$ 1,71								
System	Engine & Drivetrain	Qty	1										
Assembly	Chain Set	FileLink1	Drawing	FileLink2									
Part	Lower chainshield bracket	FileLink3		FileLink2									
P/N Base	EN 11006			FileLink3	Extended Cos \$ 1,71								
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	0,017	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					



