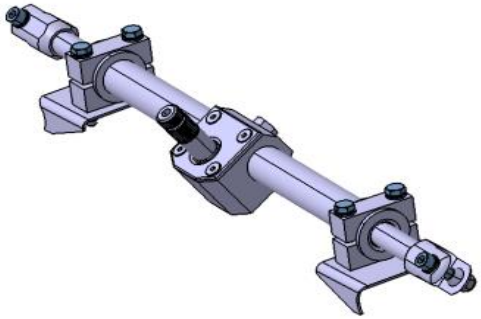
Ecurie Piston Sport Auto
CAR #81
ÉCOLE
CENTRALE LYON
STEERING SYSTEM

University	Ecole Centrale de Lyon	Back to BOM	**Car #**	81	**Asm Cost**	$ 156,18
System	Steering System				**Qty**	1
Assembly	Steering Rack		**FileLink1**			
P/N Base	ST A0100		**FileLink2**		**Extended C**	$ 156,18
Suffix	AA		**FileLink3**			
Details	Bought, cost as made					

ItemOrder	Part	Part Cost	Quantity	Sub Total
10	Rack Pinion	$ 8,82	1	$ 8,82
20	Rack	$ 6,04	1	$ 6,04
30	Upper Pinion housing	$ 2,57	1	$ 2,57
40	Lower Pinion housing	$ 6,26	1	$ 6,26
50	Rack housing support	$ 2,35	2	$ 4,70
60	Tie rod Braces	$ 2,39	2	$ 4,78
70	Rack housing	$ 65,26	1	$ 65,26
80	Steering Brackets tie	$ 1,42	4	$ 5,69
90	Steering Brackets	$ 2,04	2	$ 4,09
100	Rack protection	$ 7,62	1	$ 7,62
110	Rack protection Brackets	$ 0,47	4	$ 1,87
			Sub Total	**$ 117,70**



ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Bearing, Needle	To guide the rack en the rack housing	$ 5,51	17	mm	25	mm					2	$ 11,03
20	Bearing, Needle	To guide the rack pinion en the lower pinion housing	$ 4,29	17	mm	9	mm					2	$ 8,58
30	Paint	To paint steering brackets	$ 10,00	4,36E-03	m^2							1	$ 0,04
												Sub Total	**$ 19,65**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Weld	Welding the steering Brackets on the frame	$ 0,15	cm	20,48			$ 3,07
20	Aerosol apply	To paint steering brackets	$ 5,25	m^2	4,36E-03			$ 0,02
30	Assemble, 1 kg, Loose	Assembly of part 70 in part 40	$ 0,06	unit	1			$ 0,06
40	Assemble, 1 kg, Loose	Assembly of material 20 in part 40	$ 0,06	unit	2			$ 0,13
50	Assemble, 1 kg, Loose	Assembly of part 20 in part 40	$ 0,06	unit	1			$ 0,06
60	Assemble, 1 kg, Loose	Assembly of part 10 in part 40	$ 0,06	unit	1			$ 0,06
70	Assemble, 1 kg, Loose	Assembly of part 30 on part 40	$ 0,06	unit	1			$ 0,06
80	Screwdriver > 1 Turn	Use of fastener 10 to fix part 30 on part 40	$ 0,50	unit	4			$ 2,00
90	Ratchet <= 25.4 mm	Use of fastener 20 to fix part 20	$ 0,75	unit	1			$ 0,75
100	Liquid Apply - Spot	To glue part 70 to part 50	$ 0,10	unit	6			$ 0,60
110	Brush Apply	To glue part 70 to part 50	$ 0,02	cm^2	8			$ 0,16
120	Assemble, 1 kg, Loose	Assembly of material 10 in part 50	$ 0,06	unit	1			$ 0,06
130	Assemble, 1 kg, Loose	Assembly of part 60 on part 70	$ 0,06	unit	2			$ 0,13
140	Wrench <= 25.4 mm	Use of fastener 60 To fix part 60 on part 70	$ 1,50	unit	2			$ 3,00
150	Assemble, 1 kg, Loose	Assembly of part 80 to part 50	$ 0,06	unit	4			$ 0,25
160	Ratchet <= 6,35 mm	Use of fastener 30 To fix part 80 on part 50	$ 0,50	unit	4			$ 2,00
170	Reaction Tool <= 6.35 mm	For the process 140	$ 0,25	unit	4			$ 1,00
180	Weld	Welding of part 110 on the frame	$ 0,15	cm	6			$ 0,90
190	Assemble, 1 kg, Loose	Assembly of part 100 on part 110	$ 0,06	unit	1			$ 0,06
200	Ratchet <= 6,35 mm	Use of fastener 70 to fix part 100	$ 0,50	unit	4			$ 2,00
210	Reaction Tool <= 6.35 mm	for process 180	$ 0,25	unit	4			$ 1,00
							Sub Total	**$ 17,38**

ItemOrder	Fastener	Use	UnitCost	Size1	Unit1	Size2	Unit2	Quantity	Sub Total
10	Bolt, Grade 8.8 (SAE 5)	To close the rack housing	$ 0,02	5	mm	6,5	mm	4	$ 0,07
20	Bolt, Grade 8.8 (SAE 5)	To fix the rack	$ 0,06	8	mm	11	mm	1	$ 0,06
30	Bolt, Grade 8.8 (SAE 5)	To fix the brackets ties	$ 0,12	6	mm	50	mm	4	$ 0,47
40	Washer, Grade 8.8 (SAE 5)	To fix the brackets ties	$ 0,01		unit			8	$ 0,08
50	Nut, Grade 8.8 (SAE 5)	To fix the brackets ties	$ 0,03	6	mm			4	$ 0,12
60	Bolt, Grade 8.8 (SAE 5)	To fix the Tie rod Braces	$ 0,10	8	mm	25	mm	2	$ 0,20
70	Bolt, Grade 8.8 (SAE 5)	To fix the Rack protection	$ 0,02	4	mm	16	mm	4	$ 0,07
80	Washer, Grade 8.8 (SAE 5)	To fix the Rack protection	$ 0,01		unit			8	$ 0,08
90	Nut, Grade 8.8 (SAE 5)	To fix the Rack protection	$ 0,02	4	mm			4	$ 0,08
								Sub Total	**$ 0,80**

ItemOrder	Tooling	Use	UnitCost	Unit	Quantity	PVF	FractionIn	Sub Total
10	Welds - Welding Fixture	For the process 10, 2 point per bracket	$ 500,00	1	4	3000	1	$ 0,67
20	Welds - Welding Fixture	For the process 160, 1 point per bracket	$ 500,00	1	4	3000	1	$ 0,67
							Sub Total	**$ 0,67**

University	Ecole Centrale de Lyon	Back to BOM	**Car #**	81	**Part Cost**	$	8,82
System	Steering System				**Qty**		1
Assembly	Steering Rack		**FileLink1**				
Part	Rack pinion		**FileLink2**		**Extended Cost**	$	8,82
P/N Base	ST 01001		**FileLink3**				
Suffix	AA						
Details	Bought part, cost as made						

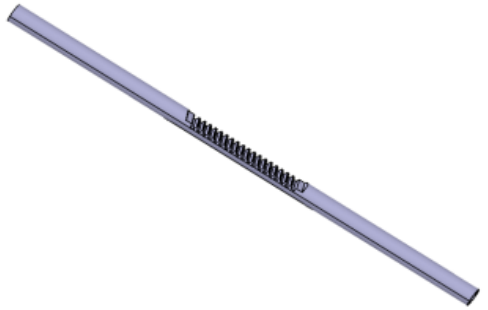
ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Mild (per kg)	Stock for the pinion	$ 2,25	0,462	kg			Circular area diam. 31mm	7,54E-04	0,078	7850	1	$ 1,04
												Sub Total	**$ 1,04**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Installation of the item 10	$ 1,30	Unit	1			$ 1,30
20	Machining	Machining the pinion	$ 0,04	cm^3	14	Material - Steel	3	$ 1,74
30	Broach, External	For the splines	$ 0,50	cm	2			$ 1,10
40	Machining Setup, Change	To machin the other side	$ 0,65	Unit	1			$ 0,65
50	Machining	Machining of the other side	$ 0,04	cm^3	5,80	Material - Steel	3	$ 0,70
60	Machining Setup, Install and remove	Installation for the water jet cut	$ 1,30	Unit	1			$ 1,30
70	Gear Shaping (hobbing)	For the pinion	$ 0,50	cm	2			$ 1,00
							Sub Total	**$ 7,79**

University	Ecole Centrale de Lyon	Back to BOM	**Car #**	81	**Part Cost**	$	6,04
System	Steering System				**Qty**		1
Assembly	Steering Rack		**FileLink1**				
Part	Rack		**FileLink2**		**Extended Cost**	$	6,04
P/N Base	ST 01002		**FileLink3**				
Suffix	AA						
Details	Bought part, cost as made						

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Mild (per kg)	Stock for the rack	$ 2,25	0,544	kg			Circular area diam. 31mm	1,77E-04	0,392	7850	1	$ 1,22
												Sub Total	**$ 1,22**

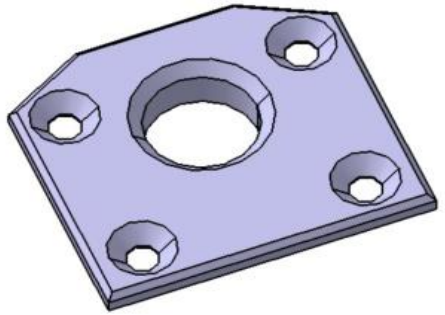
ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Installation of the item 10	$ 1,30	Unit	1			$ 1,30
20	Machining	Machining one end	$ 0,04	cm^3	1	Material - Steel	3	$ 0,11
30	Threading, External (machining)	Thread at one end	$ 0,10	cm	2			$ 0,20
40	Machining Setup, Change	To machin the other end	$ 0,65	Unit	1			$ 0,65
50	Machining	Machining the other end	$ 0,04	cm^3	1	Material - Steel	3	$ 0,11
60	Threading, External (machining)	Thread at the other end	$ 0,10	cm	2			$ 0,20
70	Machining Setup, Install and remove	Installation on a CNC machin for the gear tooth	$ 1,30	Unit	1			$ 1,30
80	Machining	Machining the gear tooth	$ 0,04	cm^3	8	Material - Steel	3	$ 0,95
							Sub Total	**$ 4,82**



University	Ecole Centrale de Lyon	Back to BOM	**Car #**	81	**Part Cost**	$	2,57
System	Steering System				**Qty**		1
Assembly	Steering Rack		**FileLink1**				
Part	Upper Pinion housing		**FileLink2**		**Extended Cost**	$	2,57
P/N Base	ST 01003		**FileLink3**				
Suffix	AA						
Details	Bought part, cost as made						

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Aluminum, Normal	Stock for the part	$ 4,20	0,055	kg			Rectangular area	2,25E-03	0,009	2712	1	$ 0,23
20	Paint		$ 10,00	2,80E-03	m^2								$ 0,03
												Sub Total	**$ 0,26**

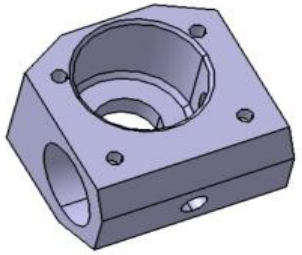
ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Installation of the item 10	$ 1,30	Unit	1			$ 1,30
20	Machining	Machining of the first face	$ 0,04	cm^3	8	Material - Aluminium	1	$ 0,30
30	Machining Setup, Change	To machin the other side	$ 0,65	Unit	1			$ 0,65
40	Machining	Machining of the second face	$ 0,04	cm^3	1,5	Material - Aluminium	1	$ 0,06
50	Aerosol Apply	To apply black paint	$ 5,25	m^2	2,80E-03			$ 0,01
							Sub Total	**$ 2,31**



University	Ecole Centrale de Lyon	Back to BOM	**Car #**	81	**Part Cost**	$	6,26
System	Steering System				**Qty**		1
Assembly	Steering Rack		**FileLink1**				
Part	Lower Pinion housing		**FileLink2**		**Extended Cost**	$	6,26
P/N Base	ST 01004		**FileLink3**				
Suffix	AA						
Details	Bought part, cost as made						

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Aluminum, Normal	Stock for the part	$ 4,20	0,231	kg			Rectangular area	2,50E-03	0,034	2712	1	$ 0,97
20	Paint		$ 10,00	0,01	m^2								$ 0,08
												Sub Total	**$ 1,05**

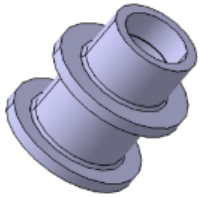
ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Installation of the item 10	$ 1,30	Unit	1			$ 1,30
20	Machining	Machining of the first face	$ 0,04	cm^3	25	Material - Aluminium	1	$ 1,00
30	Threading, Internal (machining)	For the 4 holes	$ 0,10	cm	6			$ 0,60
40	Machining Setup, Change	To machin the other side	$ 0,65	Unit	1			$ 0,65
50	Machining	Machining of the second fac	$ 0,04	cm^3	21,3	Material - Aluminium	1	$ 0,85
60	Machining Setup, Change	To machin the other side	$ 0,65	Unit	1			$ 0,65
70	Machining	Machining of a beveal	$ 0,04	cm^3	3,75	Material - Aluminium	1	$ 0,15
80	Aerosol Apply	To apply black paint	$ 5,25	m^2	0,01			$ 0,04
						Sub Total		**$ 5,20**



University	Ecole Centrale de Lyon	Back to BOM	**Car #**	81	**Part Cost**	$	2,35
System	Steering System				**Qty**		2
Assembly	Steering Rack		**FileLink1**				
Part	Rack housing support		**FileLink2**		**Extended Cost**	$	4,70
P/N Base	ST 01005		**FileLink3**				
Suffix	AA						
Details	Bought part, cost as made						

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Aluminum, Normal	Stock for the part	$ 4,20	0,088	kg			Circular area 33mm diameter	8,55E-04	0,038	2712	1	$ 0,37
20	Paint		$ 10,00	4,94E-03	m^2								$ 0,05
												Sub Total	**$ 0,42**

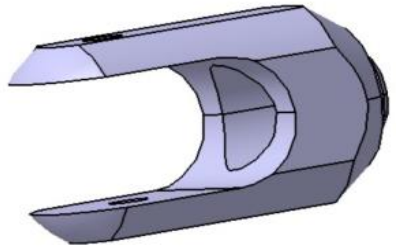
ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Installation of the item 10	$ 1,30	Unit	1	2 parts made from a single setup	0,5	$ 0,65
20	Machining	First machining	$ 0,04	cm^3	21	Material - Aluminium	1	$ 0,83
30	Machining Setup, Change	To machin the other side	$ 0,65	Unit	1	2 parts made from a single setup	0,5	$ 0,33
40	Machining	for the other side	$ 0,04	cm^3	2,565	Material - Aluminium	1	$ 0,10
50	Aerosol Apply	To apply black paint	$ 5,25	m^2	4,94E-03			$ 0,03
							Sub Total	**$ 1,93**



University	Ecole Centrale de Lyon	Back to BOM	**Car #**	81	**Part Cost** $ 2,39
System	Steering System				**Qty** 2
Assembly	Steering Rack		**FileLink1**		
Part	Tie rod Braces		**FileLink2**		**Extended Cost** $ 4,78
P/N Base	ST 01006		**FileLink3**		
Suffix	AA				
Details	Bought part, cost as made				

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Aluminum, Normal	Stock for the part	$ 4,20	0,062	kg			Circular area 26mm diameter	5,31E-04	0,043	2712	1	$ 0,26
20	Paint		$ 10,00	3,66E-03	m^2								$ 0,04
												Sub Total	**$ 0,30**

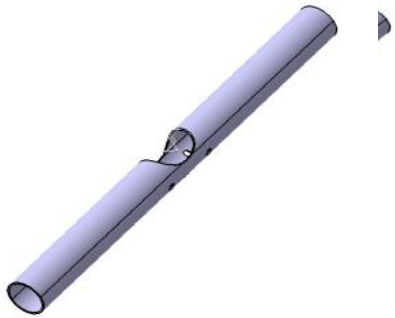
ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Installation of the item 10	$ 1,30	Unit	1	2 parts made from a single setup	0,5	$ 0,65
20	Machining	First machining	$ 0,04	cm^3	5	Material - Aluminium	1	$ 0,19
30	Machining Setup, Change	To machin the other side	$ 0,65	Unit	0,5	2 parts made from a single setup	0,5	$ 0,16
40	Machining	Second machining	$ 0,04	cm^3	4	Material - Aluminium	1	$ 0,14
50	Machining Setup, Install and remove	Installation on a CNC machine	$ 1,30	Unit	0,5	2 parts made from a single setup	0,5	$ 0,33
60	Machining	For the planes and the center	$ 0,04	cm^3	12	Material - Aluminium	1	$ 0,46
70	Machining Setup, Change	To machin the other side	$ 0,65	Unit	0,5	2 parts made from a single setup	0,5	$ 0,16
80	Machining	For the other planes	$ 0,04	cm^3	1	Material - Aluminium	1	$ 0,04
90	Drilled holes < 25.4 mm dia.	For the two holes	$ 0,35	hole	2			$ 0,70
100	Aerosol Apply	To apply black paint	$ 5,25	m^2	3,66E-03			$ 0,02
							Sub Total	**$ 2,09**



University	Ecole Centrale de Lyon	Back to BOM	**Car #**	81	**Part Cost** $ 65,26
System	Steering System				**Qty** 1
Assembly	Steering Rack		**FileLink1**		
Part	Rack housing		**FileLink2**		**Extended Cost** $ 65,26
P/N Base	ST 01007		**FileLink3**		
Suffix	AA				
Details	Bought part, cost as made				

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Carbon Fiber, 1 Ply	Stock	$ 200,00	0,275	kg			Tube diam. 72 x 3 mm	6,50E-04	0,268	1580	1	$ 55,07
												Sub Total	**$ 55,07**

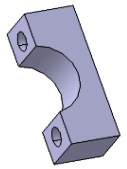
ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Lamination, Fillament Wirring	Tube Lamination	$ 25,00	kg	0,275			$ 6,88
20	Machining Setup, Install and remove	Installation of the item 10	$ 1,30	Unit				$ 1,30
30	Drilled holes < 25.4 mm dia.	For the two holes	$ 0,35	hole	2			$ 0,70
40	Machining Setup, Change	To machin the other side	$ 0,65	Unit	0,5			$ 0,33
50	Drilled holes < 25.4 mm dia.	For the two holes	$ 0,35	hole	2			$ 0,70
60	Machining	For the opening	$ 0,04	cm^3	4	Material - Composite	2	$ 0,28
70	Machining Setup, Change	To drill the last hole	$ 0,65	Unit	0,5		0	$ -
80	Drilled hole < 50.8 mm dia.		$ 0,70	hole	1			$ 0,70
							Sub Total	**$ 10,19**



University	Ecole Centrale de Lyon		Back to BOM	**Car #**	81	**Part Cost**	$ 1,42
System	Steering System	Drawing :	FileLink1			**Qty**	4
Assembly	Steering Rack			**FileLink1**			
Part	Steering Brackets tie			**FileLink2**		**Extended Cost**	$ 5,69
P/N Base	ST 01008			**FileLink3**			
Suffix	AA						
Details	To fix the steering rack						

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Aluminum, Normal	Stock for the part	$ 4,20	0,031	kg			Rectangular area	2,56E-04	0,045	2712	1	$ 0,13
												Sub Total	**$ 0,13**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Installation of the item 10	$ 1,30	Unit	1	4 parts made from a single setup	0,25	$ 0,33
20	Machining	For the half circule	$ 0,04	cm^3	7	Material - Aluminium	1	$ 0,27
30	Machining Setup, Change	To machin the two holes	$ 0,65	Unit	1	4 parts made from a single setup	0	$ -
40	Drilled holes < 25.4 mm dia.	For the two holes	$ 0,35	hole	2			$ 0,70
							Sub Total	**$ 1,29**



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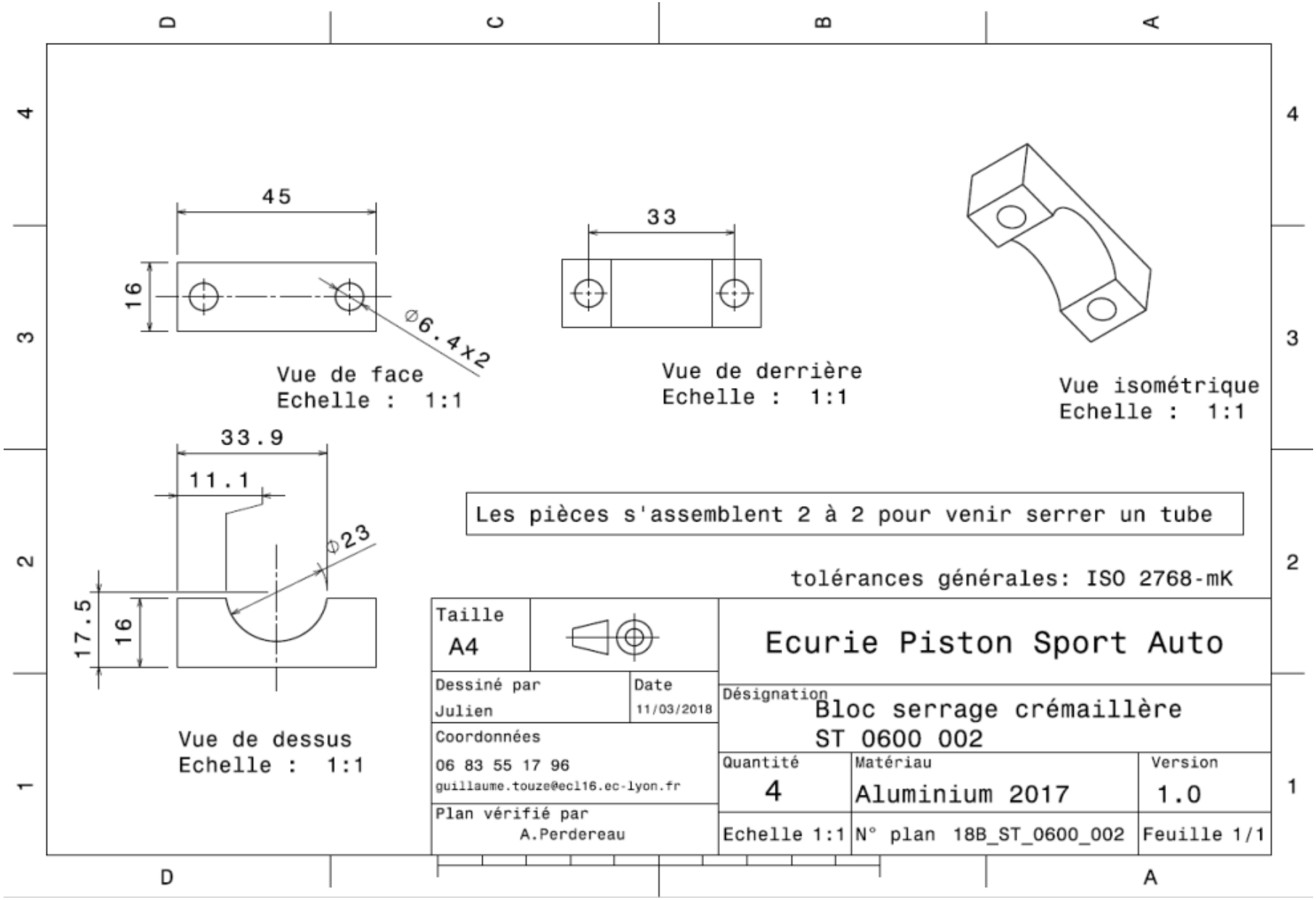
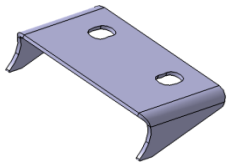

45
16
⌀6.4x2
Vue de face
Echelle : 1:1
33
Vue de derrière
Echelle : 1:1
Vue isométrique
Echelle : 1:1
33.9
11.1
⌀23
17.5
16
Vue de dessus
Echelle : 1:1
Les pièces s'assemblent 2 à 2 pour venir serrer un tube
tolérances générales: ISO 2768-mK
Taille
A4
Ecurie Piston Sport Auto
Dessiné par
Julien
Date
11/03/2018
Désignation
Bloc serrage crémaillère
ST 0600 002
Coordonnées
06 83 55 17 96
guillaume.touze@ecl16.ec-lyon.fr
Quantité
4
Matériau
Aluminium 2017
Version
1.0
Plan vérifié par
A.Perdereau
Echelle 1:1
N° plan 18B_ST_0600_002
Feuille 1/1

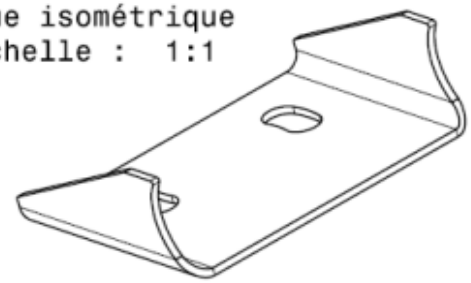
University	Ecole Centrale de Lyon		Back to BOM	**Car #**	81	**Part Cost**	$ 2,04
System	Steering System	Drawing :	FileLink1			**Qty**	2
Assembly	Steering Rack			**FileLink1**			
Part	Steering Brackets			**FileLink2**		**Extended Cost**	$ 4,09
P/N Base	ST 01009			**FileLink3**			
Suffix	AA						
Details	This part is welded to the frame						

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Mild (per kg)	Stock for the part	$ 2,25	0,059	kg			Rectangular area	5,00E-03	1,50E-03	7850	1	$ 0,13
												Sub Total	**$ 0,13**

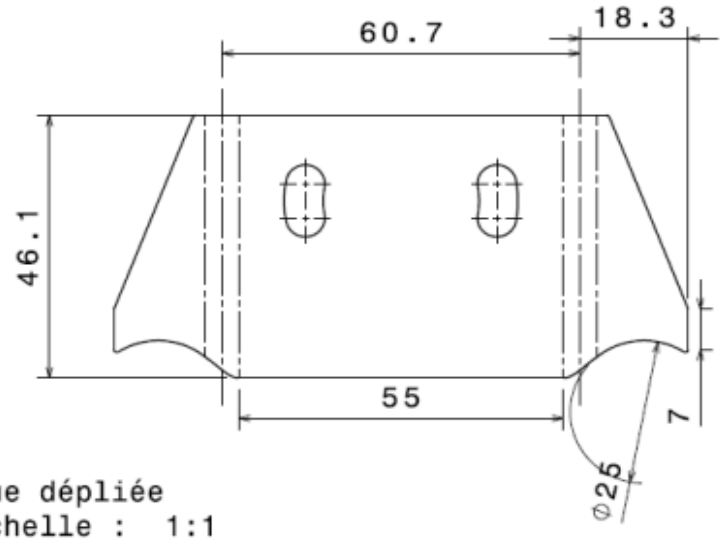
ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Installation of the item 10 for laser cut	$ 1,30	Unit	1	2 parts made from a single setup	0,5	$ 0,65
20	Laser Cut		$ 0,01	cm	25	Material - steel	3	$ 0,76
30	Sheet metal bends		$ 0,25	bend	2			$ 0,50
							Sub Total	**$ 1,91**



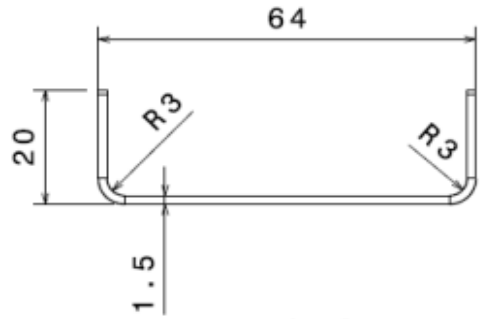
Vue isométrique
Echelle : 1:1



Tolérance de pliage : +/-0.5mm
Tolérance dimensionnelle +/-0.2mm



Vue dépliée
Echelle : 1:1



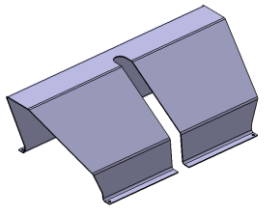
Vue de face
Echelle : 1:1

Taille A4		Ecurie Piston Sport Auto	
Dessiné par Antonio Leblanc	Date 16/01/2018	Désignation Bracket 3- Steering	
Coordonnées antonio.leblanc@ecl16.ec-lyon.fr 07 69 46 48 59			
Plan vérifié par XXX		Quantité 2	Matériau Acier S235
Version 0.1		Echelle 1:1	Numéro du plan Bracket_3
Feuille 1/1			

University	Ecole Centrale de Lyon	Back to BOM	**Car #**	81	**Part Cost**	$	7,62
System	Steering System				**Qty**		1
Assembly	Steering Rack		**FileLink1**				
Part	Rack protection		**FileLink2**		**Extended Cost**	$	7,62
P/N Base	ST 01010		**FileLink3**				
Suffix	AA						
Details							

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Aluminum, Normal	Stock for the part	$ 4,20	0,734	kg			Rectangular area	1,80E-01	1,50E-03	2712	1	$ 3,08
												Sub Total	**$ 3,08**

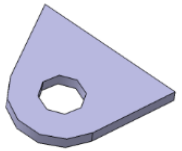
ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Installation of the item 10 for laser cut	$ 1,30	Unit	1			$ 1,30
20	Laser Cut		$ 0,01	cm	199			$ 1,99
30	Sheet metal bends		$ 0,25	bend	5			$ 1,25
							Sub Total	**$ 4,54**



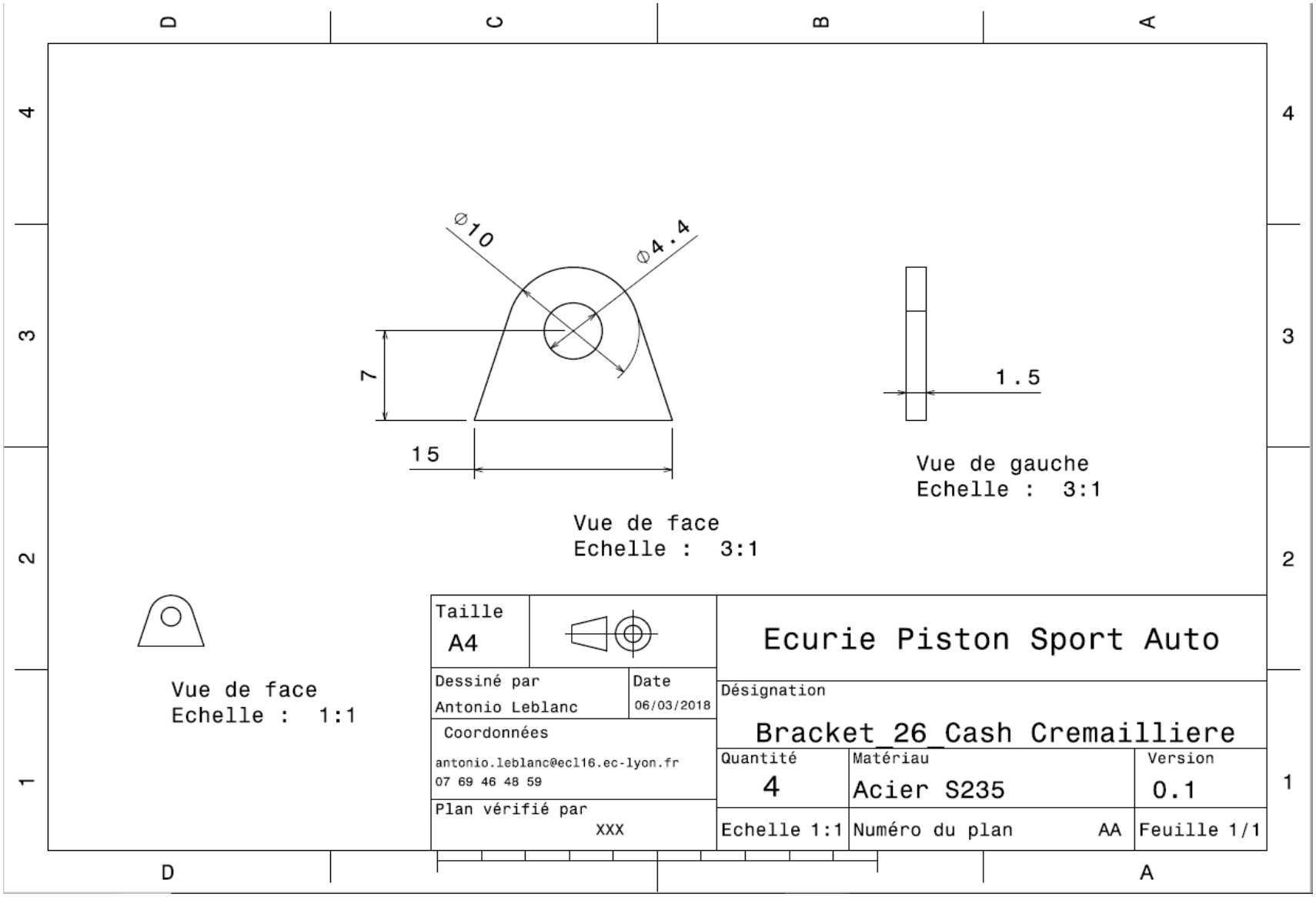
University	Ecole Centrale de Lyon		Back to BOM	**Car #**	81	**Part Cost**	$ 0,47
System	Steering System	Drawing :	FileLink1			**Qty**	4
Assembly	Steering Rack			**FileLink1**			
Part	Rack protection Brackets			**FileLink2**		**Extended Cost**	$ 1,87
P/N Base	ST 01011			**FileLink3**			
Suffix	AA						
Details	This part is Welded on the frame						

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Mild (per kg)	Stock for the part	$ 2,25	0,002	kg			Rectangular area	1,80E-04	1,50E-03	7850	1	$ 0,00
												Sub Total	**$ 0,00**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Installation of the item 10 for laser cut	$ 1,30	Unit	1	4 parts made from a single setup	0,25	$ 0,33
20	Laser Cut		$ 0,01	cm	5	Material - steel	3	$ 0,14
							Sub Total	**$ 0,46**



ST 01011


D
C
B
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4
3
2
1
⌀10
⌀4.4
7
15
1.5
Vue de face
Echelle : 3:1
Vue de gauche
Echelle : 3:1
Vue de face
Echelle : 1:1
Taille
A4
Ecurie Piston Sport Auto
Dessiné par
Antonio Leblanc
Date
06/03/2018
Désignation
Bracket_26_Cash Cremailliere
Coordonnées
antonio.leblanc@ecl16.ec-lyon.fr
07 69 46 48 59
Quantité
4
Matériau
Acier S235
Version
0.1
Plan vérifié par
XXX
Echelle 1:1
Numéro du plan
AA
Feuille 1/1

University	Ecole Centrale de Lyon
System	Steering System
Assembly	Steering Column assy
P/N Base	ST A0200
Suffix	AA
Details	

Back to BOM

Car #	81
FileLink1	
FileLink2	
FileLink3	

Asm Cost	$ 78,27
Qty	1
Extended Cost	$ 78,27

ItemOrder	Part	Part Cost	Quantity	Sub Total
10	Spline Coupler	$ 3,63	1	$ 3,63
20	Steering column	$ 2,11	1	$ 2,11
30	Steering Upper Shaft Pivot	$ 6,29	1	$ 6,29
40	Steering Bore	$ 9,17	1	$ 9,17
50	Steering Bore support	$ 1,33	2	$ 2,65
			Sub Total	**$ 23,85**

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steering Column Universal Joint		$ 20,00									1	$ 20,00
20	Bearing, Ball, Radial	To guide part 30 in the part 40	$ 11,11	42	mm	7	mm					2	$ 22,22
30	Paint	To paint parts 40 and 50	$ 10,00	0,015	m^2								$ 0,15
												Sub Total	**$ 42,37**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Setup for tne material 10	$ 1,30	unit	1			$ 1,30
20	Machining	Machining the material 10	$ 0,04	cm^3	6	Material - Steel	3	$ 0,68
30	Aerosol apply	To paint parts 40 and 50	$ 5,25	m^2	0,015			$ 0,08
40	Weld	Welding between The part 10 and the part 20	$ 0,15	cm	6,2			$ 0,93
50	Weld	Welding between the part 20 and the material 10	$ 0,15	cm	6,2			$ 0,93
60	Weld	Welding between the part 30 and the material 10	$ 0,15	cm	10			$ 1,50
70	Weld	Welding between the two part 50 and the frame	$ 0,15	cm	6,4			$ 0,96
80	Weld	Welding between the two part 50 and the part 40	$ 0,15	cm	6,4			$ 0,96
90	Weld	Welding between the part 30 and Quick Release	$ 0,15	cm	8			$ 1,20
100	Assemble, 1 kg, Interference	Assembly of the first material 20 on the part 30	$ 0,19	unit	1			$ 0,19
110	Assemble, 1 kg, Line-on-Line	Assembly of the steering column in the part 40	$ 0,13	unit	1	Assemble - Length > 0.5m	1,25	$ 0,16
120	Assemble, 1 kg, Interference	Assembly of the second material 20 in the part 40	$ 0,19	unit	1			$ 0,19
130	Assemble, 1 kg, Line-on-Line	To install the fastener 10	$ 0,13	unit	1			$ 0,13
							Sub Total	**$ 9,20**

ItemOrder	Fastener	Use	UnitCost	Size1	Unit1	Size2	Unit2	Quantity	Sub Total
10	Retaining Ring, External	To retain the material 20 on the part 30	$0,18	30	mm			1	$ 0,18
								Sub Total	**$ 0,18**

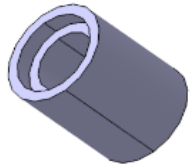
ItemOrder	Tooling	Use	UnitCost	Unit	Quantity	PVF	FractionIncluc	Sub Total
10	Welds - Welding Fixture	For the process 30, 2 point to weld	$ 500	1	2	3000	1	$ 0,33

20	Welds - Welding Fixture	For the process 40, 2 point per weld	$	500	1	2	3000	1	$ 0,33
30	Welds - Welding Fixture	For the process 50, 2 point per weld	$	500	1	2	3000	1	$ 0,33
40	Welds - Welding Fixture	For the process 60, 2 point per weld	$	500	1	4	3000	1	$ 0,67
50	Welds - Welding Fixture	For the process 70, 2 point per weld	$	500	1	4	3000	1	$ 0,67
60	Welds - Welding Fixture	For the process 80, 2 point per weld	$	500	1	2	3000	1	$ 0,33
								Sub Total	**$ 2,67**

University	Ecole Centrale de Lyon	Back to BOM	**Car #**	81	**Part Cost** $ 3,63
System	Steering System				**Qty** 1
Assembly	Steering Column assy		**FileLink1**		
Part	Spline coupler		**FileLink2**		**Extended Cost** $ 3,63
P/N Base	ST 02001		**FileLink3**		
Suffix	AA				
Details	Bought part, cost as made				

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, alloy (per kg)	Stock for spline coupler	$ 2,25	0,116	kg			Circular section : diameter 24	4,91E-04	0,030	7850	1	$ 0,26
												Sub Total	**$ 0,26**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Setup for tne material 20	$ 1,30	unit	1			$ 1,30
20	Drilled holes < 25.4 mm dia.	Hole before the Broach	$ 0,35	hole	1			$ 0,35
30	Machining	Machining the spline	$ 0,04	cm^3	2	Material - Steel	3	$ 0,22
40	Broach, Internal	For the splines in the spline coupler	$ 0,50	cm	1			$ 1,50
							Sub Total	**$ 3,37**



University	Ecole Centrale de Lyon	Back to BOM	**Car #**	81	**Part Cost** $ 2,11
System	Steering System				**Qty** 1
Assembly	Steering Column assy		**FileLink1**		
Part	Steering Column tube		**FileLink2**		**Extended Cost** $ 2,11
P/N Base	ST 02002		**FileLink3**		
Suffix	AA				
Details	It is a tube, 20*1.5				

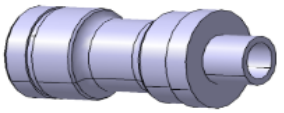
ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, alloy (per kg)	Stock for column tube	$ 2,25	0,225	kg			Circular area, diameter 20	3,49E-04	0,335	7850	1	$ 0,51
												Sub Total	**$ 0,51**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Setup	$ 1,30	Unit	1			$ 1,30
20	Tube cut	To cut the tube to the right lenght	$ 0,15	cm	2			$ 0,30
							Sub Total	**$ 1,60**

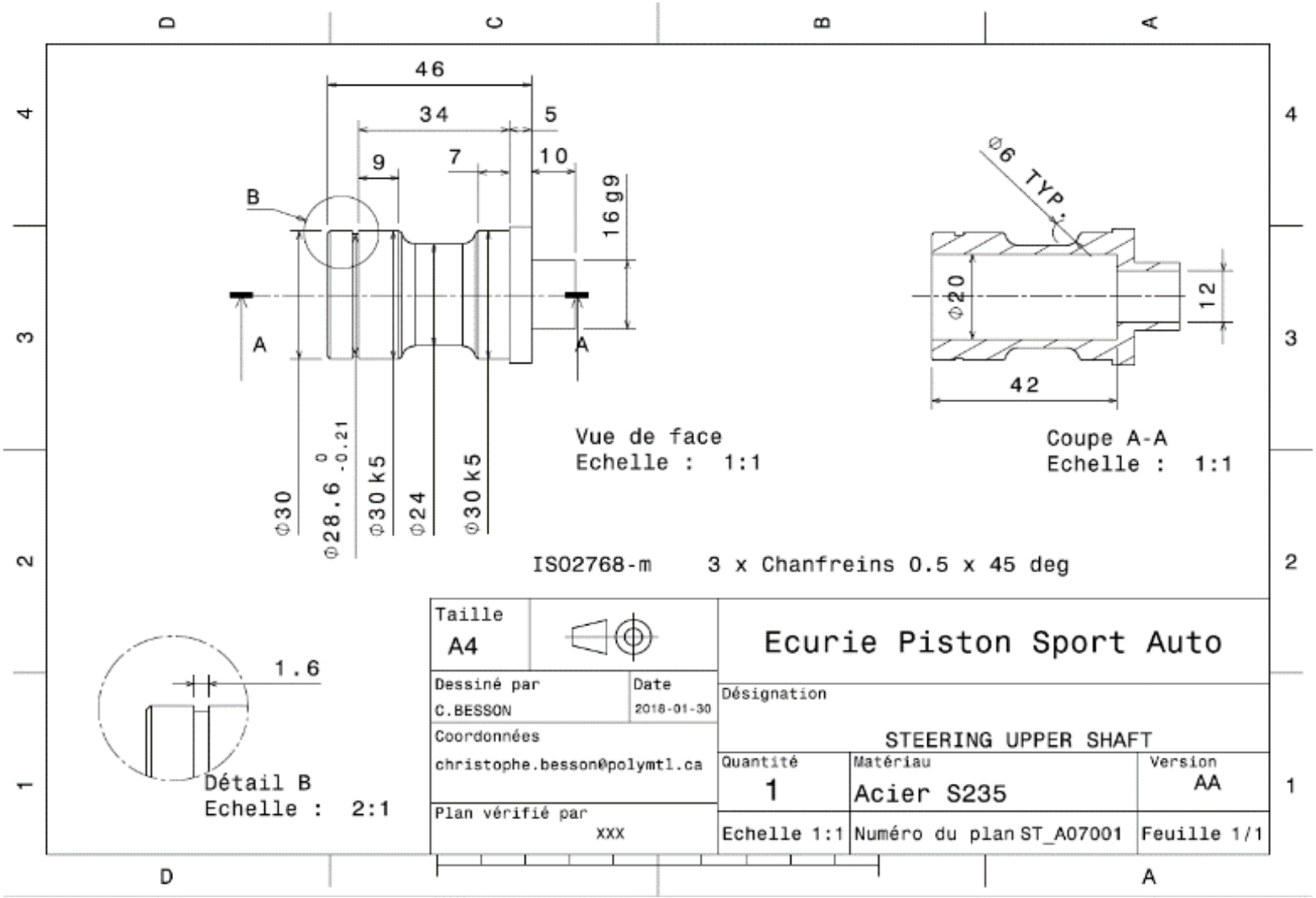
University	Ecole Centrale de Lyon		Back to BOM	**Car #**	81	**Part Cost**	$ 6,29
System	Steering System	Drawing :	FileLink1			**Qty**	1
Assembly	Steering Column assy			**FileLink1**			
Part	Steering Upper Shaft Pivot			**FileLink2**		**Extended Cost**	$ 6,29
P/N Base	ST 02003			**FileLink3**			
Suffix	AA						
Details							

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, alloy (per kg)	Stock the part	$ 2,25	0,360	kg			Circular section : diameter 32mm	8,04E-04	0,057	7850	1	$ 0,81
												Sub Total	**$ 0,81**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Setup for tne material 10	$ 1,30	unit	1			$ 1,30
20	Machining	Machining of the left part	$ 0,04	cm^3	22	Material - Steel	3	$ 2,61
30	Machining Setup, Change	To machin the other side	$ 0,65	Unit	1			$ 0,65
40	Machining	Machining of the right part	$ 0,04	cm^3	8	Material - Steel	3	$ 0,91
							Sub Total	**$ 5,48**



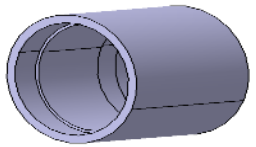
ST 02003


46
34
5
9
7
10
16 g9
B
A
A
Φ30
Φ28.6 0 -0.21
Φ30 k5
Φ24
Φ30 k5
Vue de face
Echelle : 1:1
Φ6 TYP.
Φ20
12
42
Coupe A-A
Echelle : 1:1
ISO2768-m 3 x Chanfreins 0.5 x 45 deg
1.6
Détail B
Echelle : 2:1
Taille
A4
Ecurie Piston Sport Auto
Dessiné par
C.BESSON
Date
2018-01-30
Désignation
STEERING UPPER SHAFT
Coordonnées
christophe.besson@polymtl.ca
Quantité
1
Matériau
Acier S235
Version
AA
Plan vérifié par
XXX
Echelle 1:1
Numéro du plan ST_A07001
Feuille 1/1

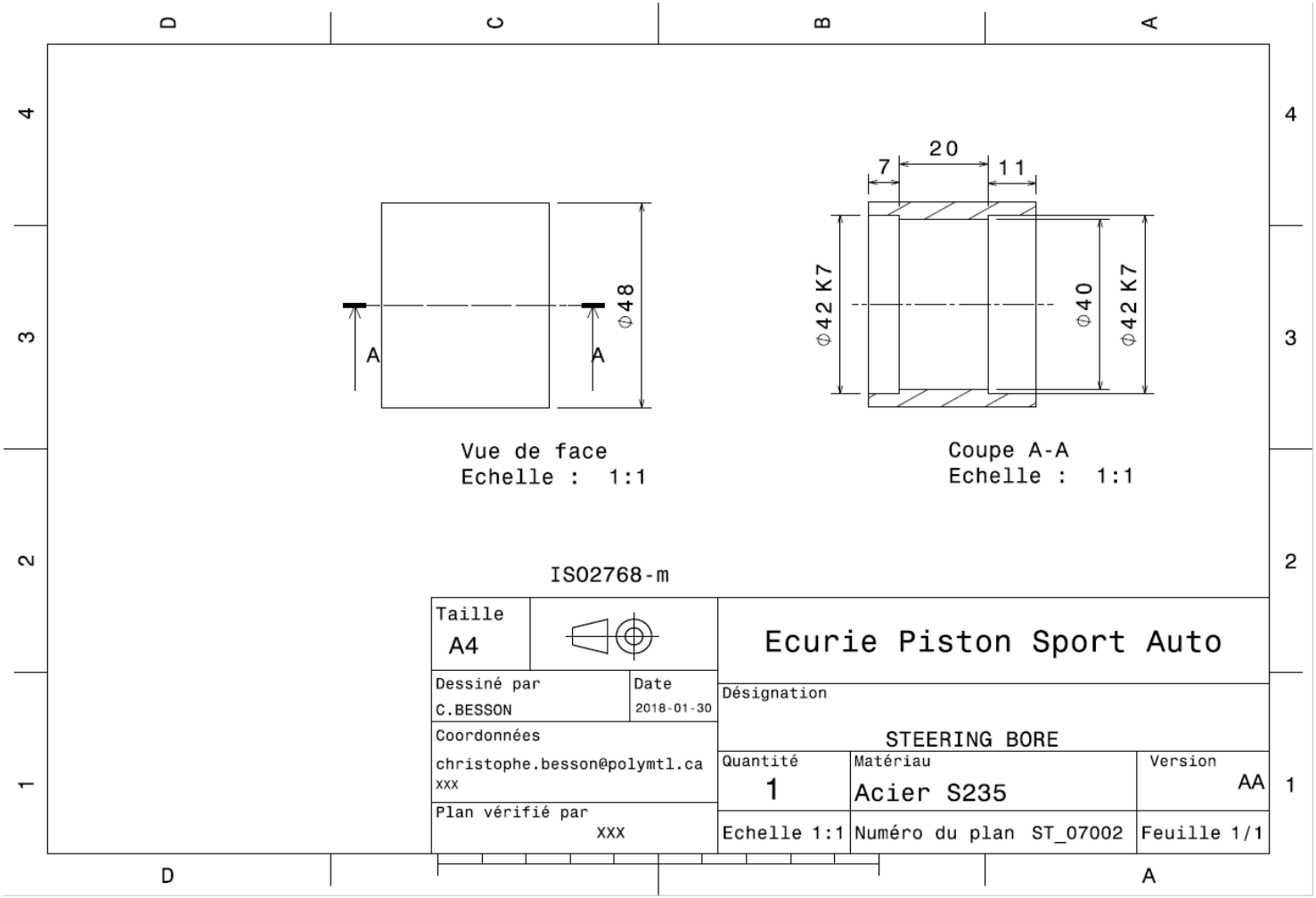
University	Ecole Centrale de Lyon		Back to BOM	**Car #**	81	**Part Cost**	$ 9,17
System	Steering System	Drawing :	FileLink1			**Qty**	1
Assembly	Steering Column Assy			**FileLink1**			
Part	Steering Bore			**FileLink2**		**Extended Cost**	$ 9,17
P/N Base	ST 02004			**FileLink3**			
Suffix	AA						
Details							

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, alloy (per kg)	Stock for the part	$ 2,25	0,540	kg			Circular section : diameter 48mm	1,81E-03	0,038	7850	1	$ 1,21
												Sub Total	**$ 1,21**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Setup for tne material 10	$ 1,30	unit	1			$ 1,30
20	Machining	Machining of the left shoulder	$ 0,04	cm^3	35	Material - Steel	3	$ 4,18
30	Machining Setup, Change	To machin the other shoulder	$ 0,65	Unit	1			$ 0,65
40	Machining	Machining of the right shoulder	$ 0,04	cm^3	15	Material - Steel	3	$ 1,83
							Sub Total	**$ 7,96**



ST 02004


D
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3
2
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20
7
11
Φ48
A
A
Φ42 K7
Φ40
Φ42 K7
Vue de face
Echelle : 1:1
Coupe A-A
Echelle : 1:1
ISO2768-m
Taille
A4
Ecurie Piston Sport Auto
Dessiné par
C.BESSON
Date
2018-01-30
Désignation
STEERING BORE
Coordonnées
christophe.besson@polymtl.ca
xxx
Quantité
1
Matériau
Acier S235
Version
AA
Plan vérifié par
xxx
Echelle 1:1
Numéro du plan ST_07002
Feuille 1/1

University	Ecole Centrale de Lyon	Back to BOM	**Car #**	81	**Part Cost**	$	1,33
System	Steering System				**Qty**		2
Assembly	Steering Column assy		**FileLink1**				
Part	Steering Bore Support		**FileLink2**		**Extended Cost**	$	2,65
P/N Base	ST 02005		**FileLink3**				
Suffix	AA						
Details	This part is welded to the frame and to the steering Bore						

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, alloy (per kg)	Stock for the part	$ 2,25	0,114	kg			Circular section : diameter	6,36E-05	0,228	7850	1	$ 0,26
												Sub Total	**$ 0,26**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Setup for tne material 10	$ 1,30	unit	1	2 parts made from a single setup	0,5	$ 0,65
20	Laser Cut	For one end	$ 0,01	cm	4,9			$ 0,05
30	Machining Setup, Change	For the other end	$ 0,65	Unit	1	2 parts made from a single setup	0,5	$ 0,33
40	Laser Cut	For the other end	$ 0,01	cm	4,7			$ 0,05
							Sub Total	**$ 1,07**

University	Ecole Centrale de Lyon
System	Steering System
Assembly	Quick Release
P/N Base	ST A0300
Suffix	AA
Details	Bought, cost as made

FileLink1	
FileLink2	
FileLink3	

Back to BOM

Car #	81
FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 43,03
Qty	1
Extended Cost	$ 43,03

ItemOrder	Part	Part Cost	Quantity	Sub Total
10	Quick Release Steel Sleeve	$ 12,88	1	$ 12,88
20	Quick Release Fixed Part	$ 15,47	1	$ 15,47
30	Quick Release Sliding Part	$ 12,94	1	$ 12,94
			Sub Total	**$ 41,29**

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Spring	Compression enabled	$ 1,00									1	$ 1,00
20	Ball Bearing	Quick Release locking	$ 0,06									4	$ 0,24
												Sub Total	**$ 1,24**

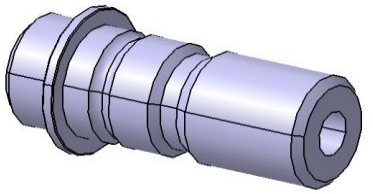
ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Assemble, 1 kg, Interference	Assembling of Sliding and Fixed Pard	$ 0,19	unit	1		1	$ 0,19
20	Assemble, 1 kg, Line-on-Line	Assembling of the Steel Sleeve and the Fixed part	$ 0,13	unit	1		1	$ 0,13
							Sub Total	**$ 0,32**

ItemOrder	Fastener	Use	UnitCost	Size1	Unit1	Size2	Unit2	Quantity	Sub Total
10	Retaining Ring, Internal	Locking of the quick release	$ 0,18	30	mm			1	$ 0,18
								Sub Total	**$ 0,18**

University	Ecole Centrale de Lyon		Back to BOM	**Car #**	81	**Part Cost**	$ 12,88
System	Steering System	**FileLink1**				**Qty**	1
Assembly	Quick Release	**FileLink2**		**FileLink1**			
Part	Quick Release Steel Sleeve	**FileLink3**		**FileLink2**		**Extended Cost**	$ 12,88
P/N Base	ST 03001			**FileLink3**			
Suffix	AA						
Details	Bought, cost as made						

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Mild (per kg)	Stock for the part	$ 2,25	0,482	kg			Circular area, diam. 25mm	4,91E-04	0,125	7850	1	$ 1,08
												Sub Total	**$ 1,08**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Setup for machining	$ 1,30	Unit	1			$ 1,30
20	Machining	Material removal, radius	$ 0,04	cm^3	49	Material : Steel	3	$ 5,88
30	Machining	Material removal, lenght	$ 0,04	cm^3	2,45	Material : Steel	3	$ 0,29
40	Machining Setup, Change	Prepare the machine for shoulder 1	$ 0,65	Unit	1		1	$ 0,65
50	Machining	Shoulder 1	$ 0,04	cm^3	5,53	Material : Steel	3	$ 0,66
60	Machining Setup, Change	Prepare the machine for shoulder 2	$ 0,65	Unit	1		1	$ 0,65
70	Machining	Shoulder 2	$ 0,04	cm^3	5,53	Material : Steel	3	$ 0,66
80	Machining Setup, Change	Prepare setup broaching machine	$ 0,65	Unit	1		1	$ 0,65
90	Broach, External	Broaching the splines	$ 0,50	cm	2,1			$ 1,05
100	Anodize	Hard Anodizing	$ -	cm^2				$ -
							Sub Total	**$ 11,80**



University	Ecole Centrale de Lyon		Back to BOM	**Car #**	81	**Part Cost**	$ 15,47
System	Steering System	**FileLink1**				**Qty**	1
Assembly	Quick Release	**FileLink2**		**FileLink1**			
Part	Quick Release Fixed Part	**FileLink3**		**FileLink2**		**Extended Cost**	$ 15,47
P/N Base	ST 03002			**FileLink3**			
Suffix	AA						
Details	Bought, cost as made						

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Aluminium, normal (per kg)	Stock	$ 4,20	0,590	kg			Circular area diam. 71mm	3,96E-03	0,055	2712	1	$ 2,48
												Sub Total	**$ 2,48**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Setup for machining	$ 1,30	Unit	1			$ 1,30
20	Machining	Material removal	$ 0,04	cm^3	151	Material : Aluminum	1	$ 6,04
30	Machining Setup, Install and remove	Driller setup	$ 1,30	Unit	1			$ 1,30
40	Drilled holes < 25.4 mm dia.		$ 0,35	Unit	3			$ 1,05
50	Machining Setup, Install and remove	Driller setup	$ 1,30	Unit	1			$ 1,30
60	Broach, Internal	Internal Splines	$ 0,50	cm	4			$ 2,00
70	Anodize	Hard anodizing	$ -	cm^2				$ -
							Sub Total	**$ 12,99**

University	Ecole Centrale de Lyon		Back to BOM	**Car #**	81	**Part Cost**	$ 12,94
System	Steering System	**FileLink1**				**Qty**	1
Assembly	Quick Release	**FileLink2**		**FileLink1**			
Part	Quick Release Sliding Part	**FileLink3**		**FileLink2**		**Extended Cost**	$ 12,94
P/N Base	ST 03003			**FileLink3**			
Suffix	AA						
Details	Bought, cost as made						

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Aluminium, normal (per kg)	Stock	$ 4,20	0,422	kg			Circular area diam. 60mm	2,83E-03	0,055	2712	1	$ 1,77
												Sub Total	**$ 1,77**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Setup for machining	$ 1,30	Unit	1			$ 1,30
20	Machining	Material removal	$ 0,04	cm^3	168	Material : Aluminum	1	$ 6,72
30	Drilled holes < 25.4 mm dia.	drill 9 holes	$ 0,35	Unit	9			$ 3,15
40	Anodize	Hard anodizing	$ -	cm^2				$ -
							Sub Total	**$ 11,17**

University	Ecole Centrale de Lyon
System	Steering System
Assembly	Steering Wheel Assy
P/N Base	ST A0400
Suffix	AA
Details	Bought, cost as made

FileLink1	
FileLink2	
FileLink3	

Back to BOM

Car #	81

FileLink1	
FileLink2	
FileLink3	

Part Cost	$ 28,84
Qty	1
Extended Cost	$ 28,84

ItemOrder	Part	Part Cost	Quantity	Sub Total
10	Steering Wheel	$ 23,08	1	$ 23,08
20	Aluminium spacer	$ 3,07	1	$ 3,07
			Sub Total	**$ 26,15**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Ratchet <= 6.35 mm	To fix the steering Wheel with the part 10, the Quick Release and the shifter	$ 0,50	unit	3			$ 1,50
20	Reaction Tool <= 6.35 mm	For process 10	$ 0,25	unit	3			$ 0,75
							Sub Total	**$ 2,25**

ItemOrder	Fastener	Use	UnitCost	Size1	Unit1	Size2	Unit2	Quantity	Sub Total
10	Bolt, Grade 8.8 (SAE 5)	To fix the Steering Wheel	$ 0,12	6	mm	50	mm	3	$ 0,35
20	Nut, Grade 8.8 (SAE 5)	To fix the brackets ties	$ 0,03	6	mm			3	$ 0,09
								Sub Total	**$ 0,44**

University	Ecole Centrale de Lyon		Back to BOM	**Car #**	81	**Part Cost**	$ 23,08
System	Steering System	**FileLink1**				**Qty**	1
Assembly	Steering Wheel Assy	**FileLink2**		**FileLink1**			
Part	Steering Wheel	**FileLink3**		**FileLink2**		**Extended Cost**	$ 23,08
P/N Base	ST 04001			**FileLink3**			
Suffix	AA						
Details	Bought part, cost as made						

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Mild (per kg)	Sheet for the structure 2 mm thickness	$ 2,25	0,903	kg			Rectangular area 250mm x 230mm	5,75E-02	0,002	7850	1	$ 2,03
20	Foam, Expanding, Non-Structural (per kg)	Foam for torus form	$ 15,00	0,100	kg								$ 1,50
30	Fabric (per m^2)	steering wheel covering	$ 2,50	0,100	m^2								$ 0,25
40	Adhesive	Steering wheel covering - Cost included in process	$ -		unit								$ -
50	Paint		$ 10,00	0,056	m^2								$ 0,56
												Sub Total	**$ 4,34**

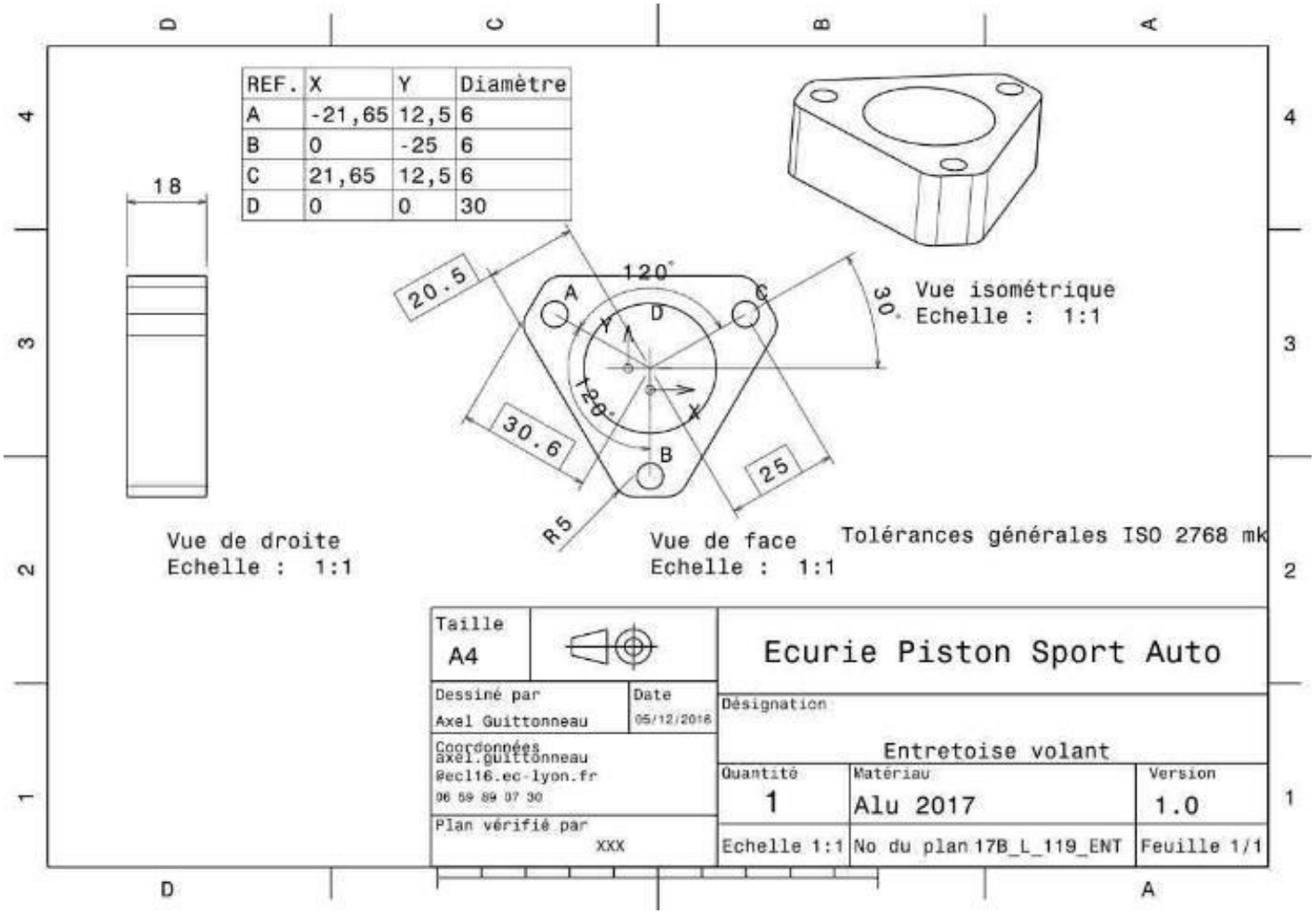
ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Setup for laser cut	$ 1,30	unit	1			$ 1,30
20	Laser Cut	Outline and holes for sheet	$ 0,01	cm	100	Material - Steel	3	$ 3,00
30	Machining Setup, Change	Rectify part	$ 0,65	unit	1			0,65
40	Machining	Rectify part	$ 0,04	cm^3	14	Material - Steel	3	$ 1,68
50	Machining Setup, Change	Rectify part	$ 0,65	unit	4			2,60
60	Machining	Rectify part	$ 0,04	cm^3	8	Material - Steel	3	$ 0,96
70	Aerosol apply		$ 5,25	m^2	0,056			$ 0,29
80	Assemble, 1 kg, Line-on-Line	Assemble of foam	$ 0,13	unit	1			$ 0,13
90	Cut (scissors, knife)	Preparation of covering	$ 0,06	cm	100			$ 6,00
100	Liquid Applicator Gun	Apply of covering	$ 0,02	cm	100			$ 2,00
110	Assemble, 1 kg, Line-on-Line	Assemble of covering	$ 0,13	unit	1			$ 0,13
							Sub Total	**$ 18,74**

University	Ecole Centrale de Lyon			Back to BOM		**Car #**	81	**Part Cost**	$ 3,07
System	Steering System	Drawing :	FileLink1					**Qty**	1
Assembly	Steering Wheel Assy		**FileLink2**			**FileLink1**			
Part	Aluminium spacer		**FileLink3**			**FileLink2**		**Extended Cost**	$ 3,07
P/N Base	ST 04002					**FileLink3**			
Suffix	AA								
Details									

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Aluminum, Normal (per kg)	Sheet of aluminium for the shift plate	$ 4,20	0,148	kg			Rectangular area, 55x55 mm	3,03E-03	0,018	2712	1	$ 0,62
												Sub Total	**$ 0,62**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Set up	$ 1,30	Unit	1		1	$ 1,30
20	Machining	Machining	$ 0,04	cm^3	28,8	Material - Aluminium	1	$ 1,15
							Sub Total	**$ 2,45**

[ST 04002]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Axel Guittonneau
Date
05/12/2016
Coordonnées
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@ec116.ec-lyon.fr
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Désignation
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Matériau
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Version
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Feuille 1/1

University	Ecole Centrale de Lyon			Back to BOM	**Car #**	81	**Part Cost**	$ 18,20
System	Steering System	**FileLink1**					**Qty**	2
Assembly	Steering rod	**FileLink2**			**FileLink1**			
P/N Base	ST A0500	**FileLink3**			**FileLink2**		**Extended Cost**	$ 36,41
Suffix	AA				**FileLink3**			
Details	Steering rod, right and left are symetric							

ItemOrder	Part	Part Cost	Quantity	Sub Total
10	Steering rod tube	$ 9,07	1	$ 9,07
20	Steering rod insert	$ 1,88	2	$ 3,77
30	Spacer	$ 0,35	2	$ 0,70
			Sub Total	**$ 13,53**

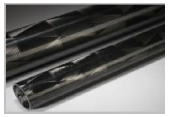
ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Ler	Density	Quantity	Sub Total
10	Rod End, Industrial	Right-hand rod end for pushrod extremities	$ 1,94	6	mm			Balls Diameter				1	$ 1,94
20	Rod End, Industrial	Left-hand rod end for pushrod extremities	$ 1,94	6	mm			Balls Diameter				1	$ 1,94
30	Adhesive	Glue insert to pushrod tube - Cost included in process	$ -		unit								$ -
												Sub Total	**3,88**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Hand Finish - Surface Preperation	Solvent degreasing on carbon tube	$ 0,02	cm²	6,6		1	$ 0,13
20	Hand Finish - Surface Preperation	Solvent degreasing on insert	$ 0,02	cm²	6,6		1	$ 0,13
30	Brush apply	Glue insert to pushrod tube	$ 0,02	cm^2	6,6		1	$ 0,13
40	Hand - Start Only	Put a nut on the rod end	$ 0,12	unit	1		1	$ 0,12
50	Hand, Loose <= 25.4 mm	Screwing by hand the rod end in the pullrod insert	$ 0,50	unit	1		1	$ 0,50
60	Wrench <= 25.4 mm	Thighten the M8 nuts	$ 1,50	unit	1		1	$ 1,50
70	Reaction tool <= 25.4 mm	Thighten the M8 nuts	$ 0,25	unit	1		1	$ 0,25
80	Assemble, 1kg, Loose	Put the spacers of the rocker in place	$ 0,06	unit	1		1	$ 0,06
90	Assemble, 1kg, Loose	Put the washers of the rocker in place	$ 0,06	unit	1		1	$ 0,06
100	Hand - Start Only	Bolt pullrod into the rocker	$ 0,12	unit	1		1	$ 0,12
110	Assemble, 1kg, Loose	Put the spacers of the A-arm in place	$ 0,06	unit	1		1	$ 0,06
120	Assemble, 1kg, Loose	Put the washers of the A-arm in place	$ 0,06	unit	1		1	$ 0,06
130	Hand - Start Only	Bolt pullrod into the A-Arm	$ 0,12	unit	1		1	$ 0,12
140	Hand - Start Only	Put the nuts into the bolts	$ 0,12	unit	1		1	$ 0,12
150	Ratchet <= 25.4 mm	Thighten the M8 nuts	$ 0,75	unit	1		1	$ 0,75
160	Reaction tool <= 25.4 mm	Thighten the M8 nuts	$ 0,25	unit	1		1	$ 0,25
							Sub Total	**$ 4,37**

ItemOrder	Fastener	Use	UnitCost	Size1	Unit1	Size2	Unit2	Quantity	Sub Total
10	Bolt,Grade 8.8 (SAE)	Pullrod to rocker fixing bolt	$ 0,10	6	mm	45	mm	1	$ 0,10
20	Bolt,Grade 8.8 (SAE)	Pullrod to A-arm fixing bolt	$ 0,10	6	mm	45	mm	1	$ 0,10
30	Washer, Grade 8.8 (SAE 5)		$ 0,01	6	unit			4	$ 0,04
40	Nut, Grade 8.8 (SAE 5)	To tighten the rod ends	$ 0,03	6	mm			1	$ 0,03
50	Nut, Grade 8.8 (SAE 5)	To tighten the bolts	$ 0,03	6	mm			1	$ 0,03
								Sub Total	**$ 0,31**

University	Ecole Centrale de Lyon		Back to BOM	**Car #**	81	**Part Cost**	$ 9,79
System	Steering System	**FileLink1**				**Qty**	1
Assembly	Steering rod	**FileLink2**		**FileLink1**			
Part	Steering rod tube	**FileLink3**		**FileLink2**		**Extended Cost**	$ 9,79
P/N Base	ST 05001			**FileLink3**			
Suffix	AA						
Details							

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Carbon fiber, 1 Ply	Stock material	$ 200,00	0,044	kg			Round area, diameter 16x2 mm	8,80E-05	0,313	1580	1	$ 8,70
												Sub Total	**$ 8,70**

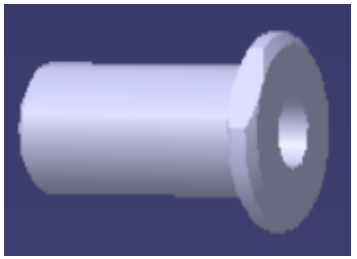


ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Tube cut		$ 0,15	cm	1,6	2 sides of the tube	2	$ 0,24
20	Lamination, Filament Wirring	Tube lamination	$ 25,00	kg	0,044			$ 1,09
							Sub Total	**$ 1,09**

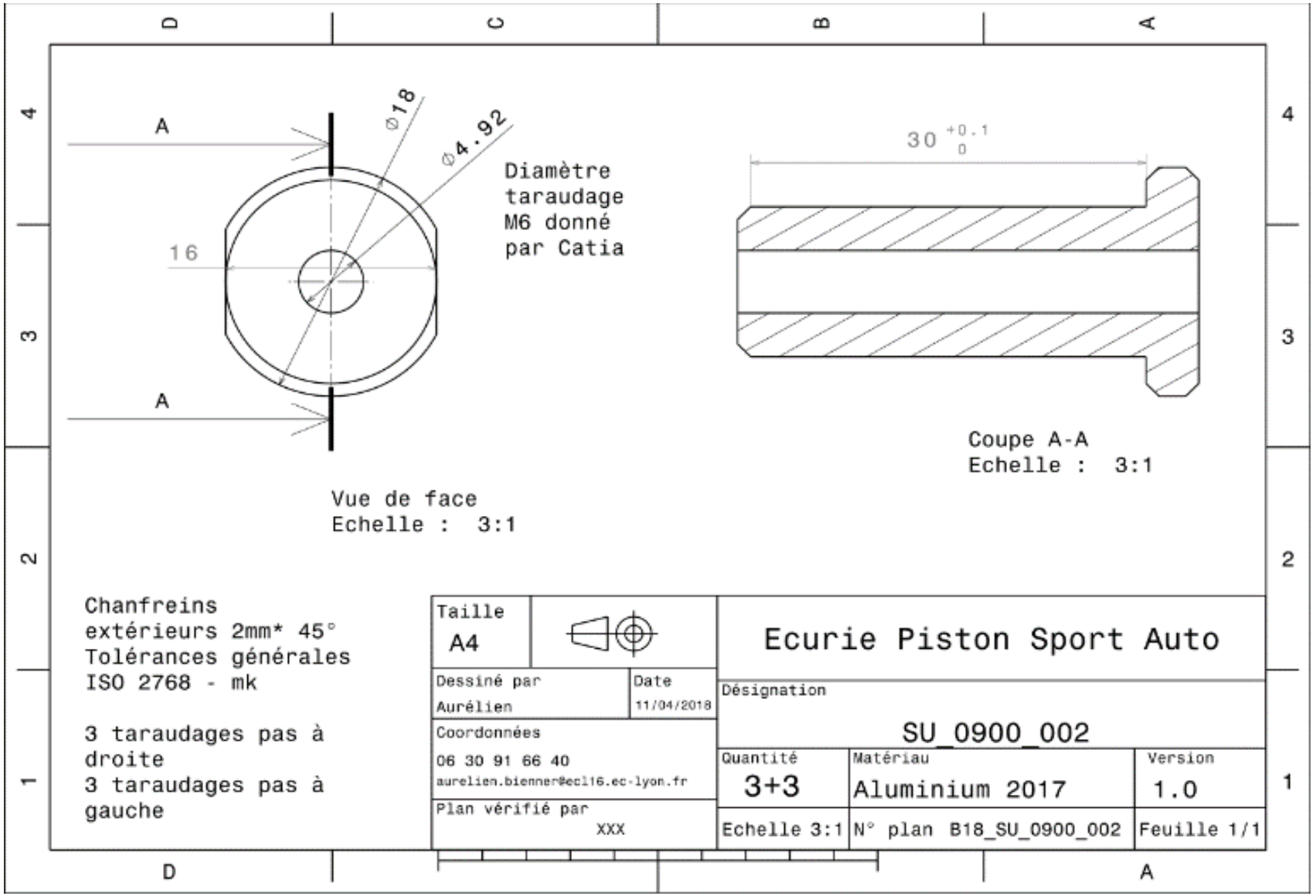
University	Ecole Centrale de Lyon			Back to BOM		**Car #**	81	**Part Cost**	$ 2,31
System	Steering System		**FileLink1**	Drawing				**Qty**	1
Assembly	Steering rod		**FileLink2**			**FileLink1**			
Part	Steering rod insert		**FileLink3**			**FileLink2**		**Extended Cost**	$ 2,31
P/N Base	ST 05002					**FileLink3**			
Suffix	AA								
Details									

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Aluminium, Premium (per kg)	cylinder	$ 4,20	0,070	kg			diam. 18mm	2,54E-04	3,50E-02	7850	1	$ 0,29
												Sub Total	**$ 0,29**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Setup for machining and removal	$ 1,30	Unit	1	2 parts from a single machine setup (tierod	0,5	$ 0,65
20	Machining	Material removal - side view profile	$ 0,04	cm^3	5,5	Material - Steel	3	$ 0,66
30	Machining setup, change	Setup for machining process	$ 0,65	Unit	1	2 parts from a single machine setup (tierod insert)	0,5	$ 0,33
40	Machining	Material removal	$ 0,04	cm^3	0,3	Material - Steel	3	$ 0,04
50	Tapping Holes	Rod End emplacement	$ 0,35	hole	1		1	$ 0,35
							Sub Total	**$ 2,02**

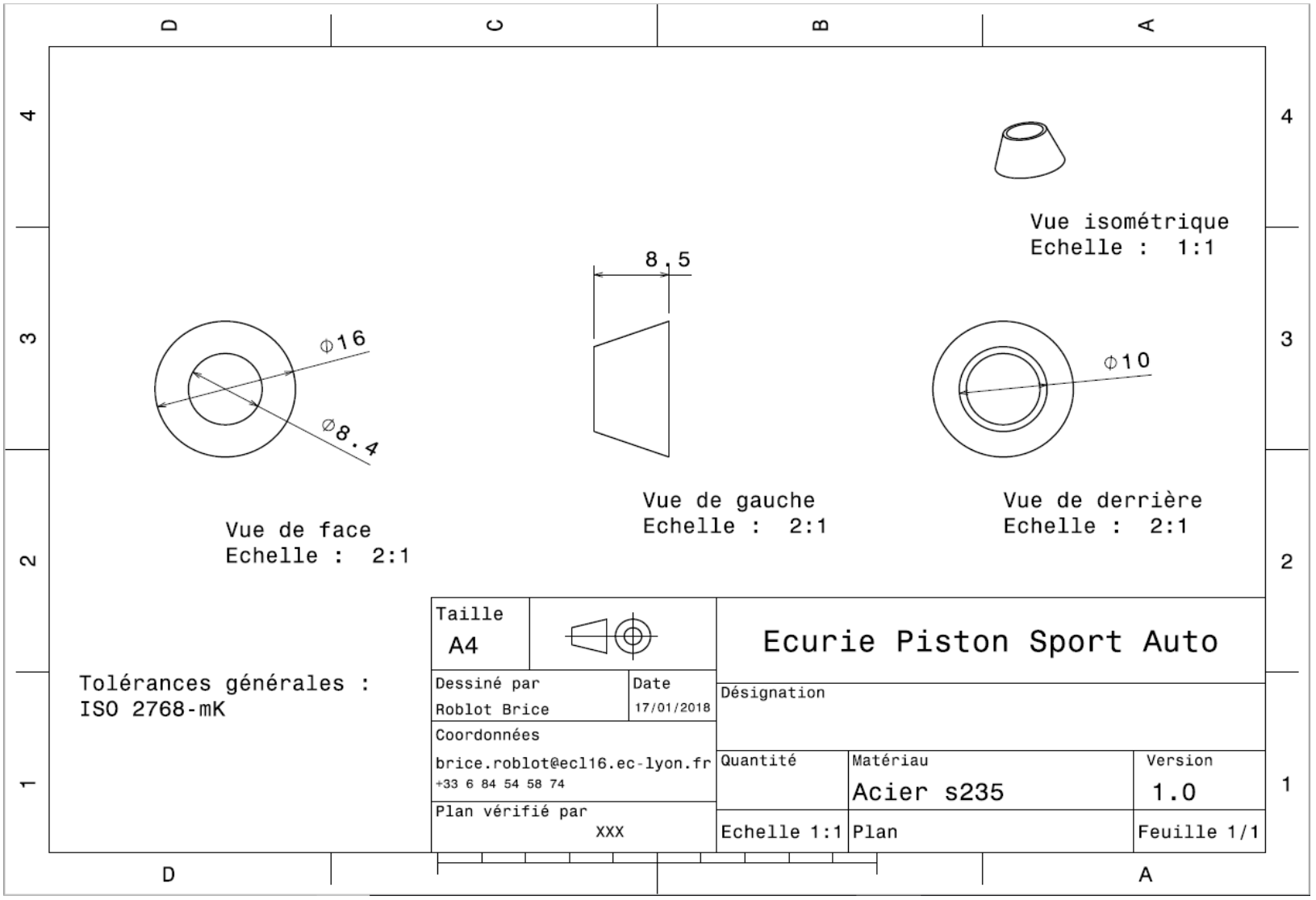


Drawing : ST_05002



University	Ecole Centrale de Lyon			Back to BOM	**Car #**	81	**Part Cost**	$	0,34
System	Steering System	**FileLink1**	Drawing				**Qty**		4
Assembly	Steering rod	**FileLink2**			**FileLink1**				
Part	Spacer	**FileLink3**			**FileLink2**		**Extended Cost**	$	1,35
P/N Base	ST 05003				**FileLink3**				
Suffix	AA								
Details									

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Mild (per kg)		$ 2,25	1,34E-02	Kg			Cylinder face	2,01E-04	9E-03	7850	1	$ 0,03
												Sub Total	**$ 0,03**

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and remove	Setup for machining	$ 1,30	Unit	1	Same setup for 8	0,125	$ 0,16
20	Machining	Material removal	$ 0,04	cm^3	1,2	Material - Steel	3	$ 0,14
							Sub Total	**$ 0,31**

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