



*CAR #81*



ÉCOLE  
CENTRALE LYON

# WHEELS, WHEEL BEARINGS & TIRES

University	Ecole Centrale de Lyon
System	Wheels & Tires
Assembly	Wheel Assembly
P/N Base	WT A0100
Suffix	AA
Details	Complete Wheel Assembly

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Car #	81
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Asm Cost	\$ 175,23
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Qty	4
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FileLink1  
FileLink2  
FileLink3

Extended Cost	\$ 700,92
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ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Wheel, 13", 1 Piece OZ, Aluminum	Rim	\$ 80,00		unit							1	\$ 80,00
20	Tire, Hoosier, R25B, 13"-20.5 x 7.0	Tire	\$ 85,00		unit							1	\$ 85,00
30	Valve Stem (and Tire Inflation)		\$ 1,00		unit							1	\$ 1,00
40	Wheel Weights (and Balancing)	Balancing and set up the wheel	\$ 4,00		unit							1	\$ 4,00
												Sub Total	\$ 170,00

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Assemble, 5kg, Line-on-Line	Fix Wheel on Hubs	\$ 0,63	unit	1		1	\$ 0,63
20	Ratchet <= 25.4 mm	Tighten Lug Nuts	\$ 0,75	unit	4		1	\$ 3,00
							Sub Total	\$ 3,63

ItemOrder	Fastener	Use	UnitCost	Size1	Unit1	Size2	Unit2	Quantity	Sub Total
10	Nut, Lug	Fix Wheel on Hubs	\$ 0,40		unit			4	\$ 1,60
								Sub Total	\$ 1,60



<b>University</b>	Ecole Centrale de Lyon	<a href="#">Back to BOM</a>
<b>System</b>	Wheels & Tires	
<b>Assembly</b>	Front Hubs	
<b>P/N Base</b>	WT A0200	
<b>Suffix</b>	AA	
<b>Details</b>	Assembly of a part of the wheel with the hub, bearings and a part to mesure the speed of the wheel	

Car # 81

Asm Cost \$ 346,18

Qty 2

FileLink1

FileLink2

FileLink3

Extended Cost \$ 692,35

ItemOrder	Part	Part Cost	Quantity	Sub Total
10	<a href="#">Front Hub</a>	\$ 63,51	1	\$ 63,51
20	<a href="#">Front Bearing Spacer</a>	\$ 2,62	1	\$ 2,62
30	<a href="#">Front Wheel Spacer</a>	\$ 20,03	1	\$ 20,03
40	<a href="#">Speed Sensor Spacer</a>	\$ 0,95	1	\$ 0,95
50	<a href="#">Speed Sensor Disc</a>	\$ 9,71	1	\$ 9,71
			<b>Sub Total</b>	<b>\$ 96,81</b>

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Wheel Bearing, Ball, Angular Contact		\$ 118,75	72	mm	17	mm					2	\$ 237,49
20	Locknut/L.P.///Steel/	Bearing Nuts	\$ 5,98	35	mm							1	\$ 5,98
30	Adhesive	Wheel studs and hub assemble, cost included in process	\$ -										\$ -
												<b>Sub Total</b>	<b>\$ 243,47</b>

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Assemble, 1kg, Loose	Bearing spacer assemble on the hub	\$ 0,06	unit	1		1	\$ 0,06
20	Assemble, 1 kg, Interference	Bearings Assemble	\$ 0,19	unit	2		1	\$ 0,38
30	Assemble, 1kg, Loose	Speed sensor spacer assemble on the hub	\$ 0,06	unit	1		1	\$ 0,06
40	Assemble, 1kg, Loose	Speed sensor disc assemble on the hub	\$ 0,06	unit	1		1	\$ 0,06
50	Assemble, 1kg, Loose	Lock nut washer assemble on the hub	\$ 0,06	unit	1		1	\$ 0,06
80	Assemble, 1 kg, Line-on-Line	Locknut on hub	\$ 0,13	Unit	1		1	\$ 0,13
60	Liquid Applicator Gun	Wheel studs and hub assemble	\$ 0,02	cm	15,07		1	\$ 0,30
70	Assemble, 1 kg, Line-on-Line	Wheel studs and hub assemble	\$ 0,13	unit	4		1	\$ 0,52
80	Assemble, 1 kg, Loose	Front Wheel Spacer on hub	\$ 0,06	Unit	1		1	\$ 0,06
Sub Total								\$ 1,63

ItemOrder	Fastener	Use	UnitCost	Size1	Unit1	Size2	Unit2	Quantity	Sub Total
10	Stud, Grade 12.9	Wheel Studs	\$ 1,07	12	mm	62	mm	4	\$ 4,26
								<b>Sub Total</b>	<b>\$ 4,26</b>

**University** Ecole Centrale de Lyon  
**System** Wheels & Tires  
**Assembly** [Front Hubs](#)  
**Part** Front Hub  
**P/N Base** WT 02001  
**Suffix** AA  
**Details** Main part of the assembly

**FileLink1** [Drawing](#)  
**FileLink2**  
**FileLink3**

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**Car #** 81

**Part Cost** \$ 63,51  
**Qty** 1

**FileLink1**  
**FileLink2**  
**FileLink3**

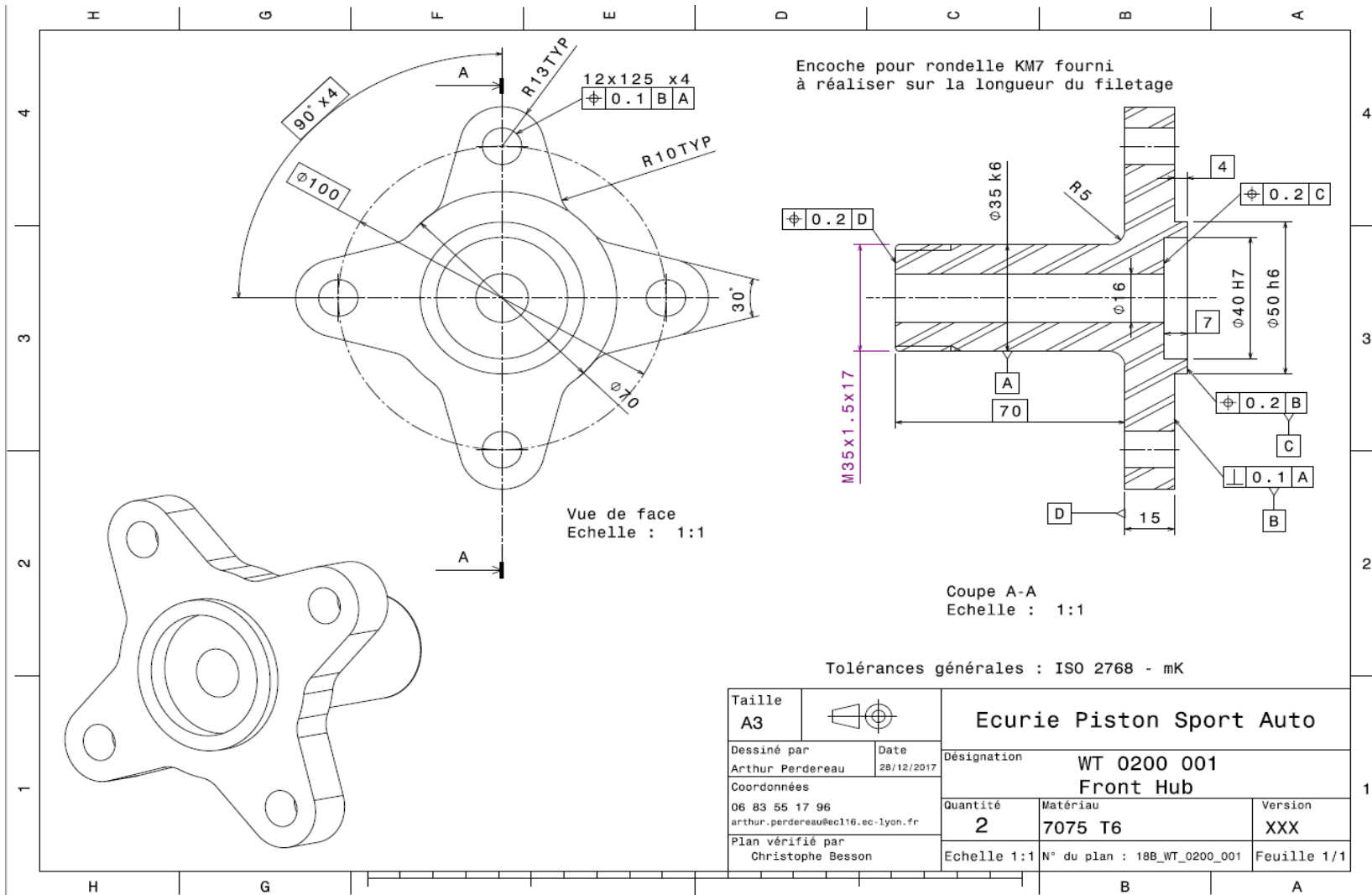
**Extended** \$ 63,51

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Aluminium, Premium		\$ 4,20	3,27	kg			round area, 130mm diameter	0,013	0,091	2712	1	\$ 13,75
												<b>Sub Total</b>	<b>\$ 13,75</b>

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and Remove	Setup for turning	\$ 1,30	Unit	1		1	\$ 1,30
20	Machining	Turning	\$ 0,04	cm^3	930,6	Material - Aluminium	1	\$ 37,22
30	Machining Setup, Change	Change the turning setup	\$ 0,65	Unit	1		1	\$ 0,65
40	Machining	Turning	\$ 0,04	cm^3	63,5	Material - Aluminium	1	\$ 2,54
50	Machining Setup, Change		\$ 0,65	Unit	1		1	\$ 0,65
60	Machining	Milling	\$ 0,04	cm^3	149	Material - Aluminium	1	\$ 5,96
70	Machining Setup, Change		\$ 0,65	Unit	1		1	\$ 0,65
80	Machining	Milling	\$ 0,04	cm^3	0,336	Material - Aluminium	1	\$ 0,01
90	Threading, Internal (machining)	For wheel studs	\$ 0,10	cm	6	Material - Aluminium	1	\$ 0,60
100	Threading, External (machining)	For locknut	\$ 0,10	cm	1,7	Material - Aluminium	1	\$ 0,17
								<b>Sub Total</b> \$ 49,76







University

Ecole Centrale de Lyon

System

Wheels & Tires

Assembly

Front Hubs

Part

Wheel bearing spacer

P/N Base

WT 02002

Suffix

AA

Details

Part to let a space beetween the hub and the first bearing

FileLink1

Drawing

FileLink2

FileLink3

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Car #

81

Part Cost

\$

2,62

Qty

1

FileLink1

FileLink2

FileLink3

Extended Cost

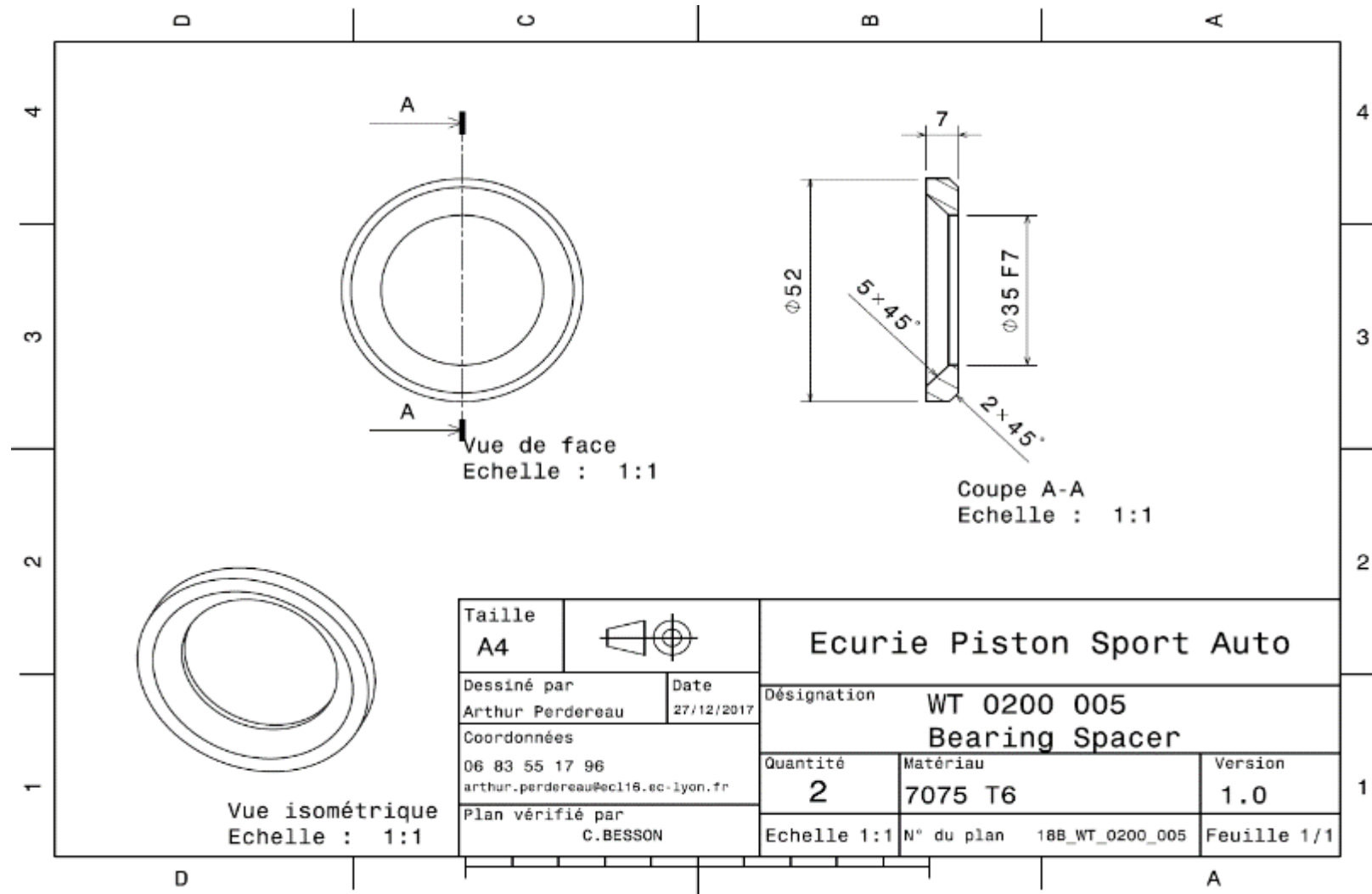
\$

2,62

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Aluminium, Premium		\$ 4,20	0,06	kg			round area, 55mm diameter	0,002	0,009	2712	1	\$ 0,24
												Sub Total	\$ 0,24

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and Remove	Setup for turning	\$ 1,30	Unit	1		1	\$ 1,30
20	Machining	Turning	\$ 0,04	cm^3	9,2	Material - Aluminium	1	\$ 0,37
30	Machining Setup, Change	Change the turning setup	\$ 0,65	Unit	1		1	\$ 0,65
40	Machining	Turning	\$ 0,04	cm^3	1,5	Material - Aluminium	1	\$ 0,06
							Sub Total	\$ 2,38

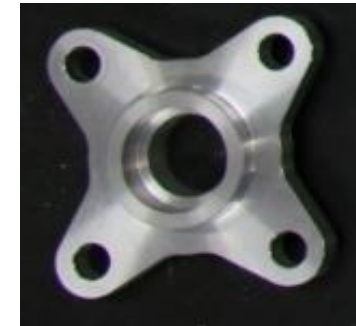




<b>University</b>	Ecole Centrale de Lyon	<a href="#">Back to BOM</a>	<b>Car #</b>	81	<b>Part Cost</b>	\$ 20,03
<b>System</b>	Wheels & Tires	<b>FileLink1</b>	<a href="#">Drawing</a>		<b>Qty</b>	1
<b>Assembly</b>	<a href="#">Front Hubs</a>	<b>FileLink2</b>				
<b>Part</b>	Front Wheel Spacer	<b>FileLink3</b>			<b>Extended Cost</b>	\$ 20,03
<b>P/N Base</b>	WT 02003					
<b>Suffix</b>	AA					
<b>Details</b>	Part to position the wheel on the good position relative to the hub and upright assembly					

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Aluminium, Premium		\$ 4,20	0,86	kg			round area, 130mm diameter	0,013	0,024	2712	1	\$ 3,63
												<b>Sub Total</b>	<b>\$ 3,63</b>

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and Remove	Setup for turning	\$ 1,30	Unit	1		1	\$ 1,30
20	Machining	Turning	\$ 0,04	cm^3	112	Material - Aluminium	1	\$ 4,48
30	Machining Setup, Change	Change the turning setup	\$ 0,65	Unit	1		1	\$ 0,65
40	Machining	Turning	\$ 0,04	cm^3	84	Material - Aluminium	1	\$ 3,36
50	Machining Setup, Change		\$ 0,65	Unit	1		1	\$ 0,65
60	Machining	Milling	\$ 0,04	cm^3	149	Material - Aluminium	1	\$ 5,96
							<b>Sub Total</b>	<b>\$ 16,40</b>







University

Ecole Centrale de Lyon

System

Wheels & Tires

Assembly

Front Hubs

Part

Speed sensor spacer

P/N Base

WT 02004

Suffix

AA

Details

Part to avoid the speed sensor disc to interfere with the Upright

FileLink1

Drawing

FileLink2

FileLink3

Car #

81

Part Cost

\$ 0,95

Qty

1

FileLink1

FileLink2

FileLink3

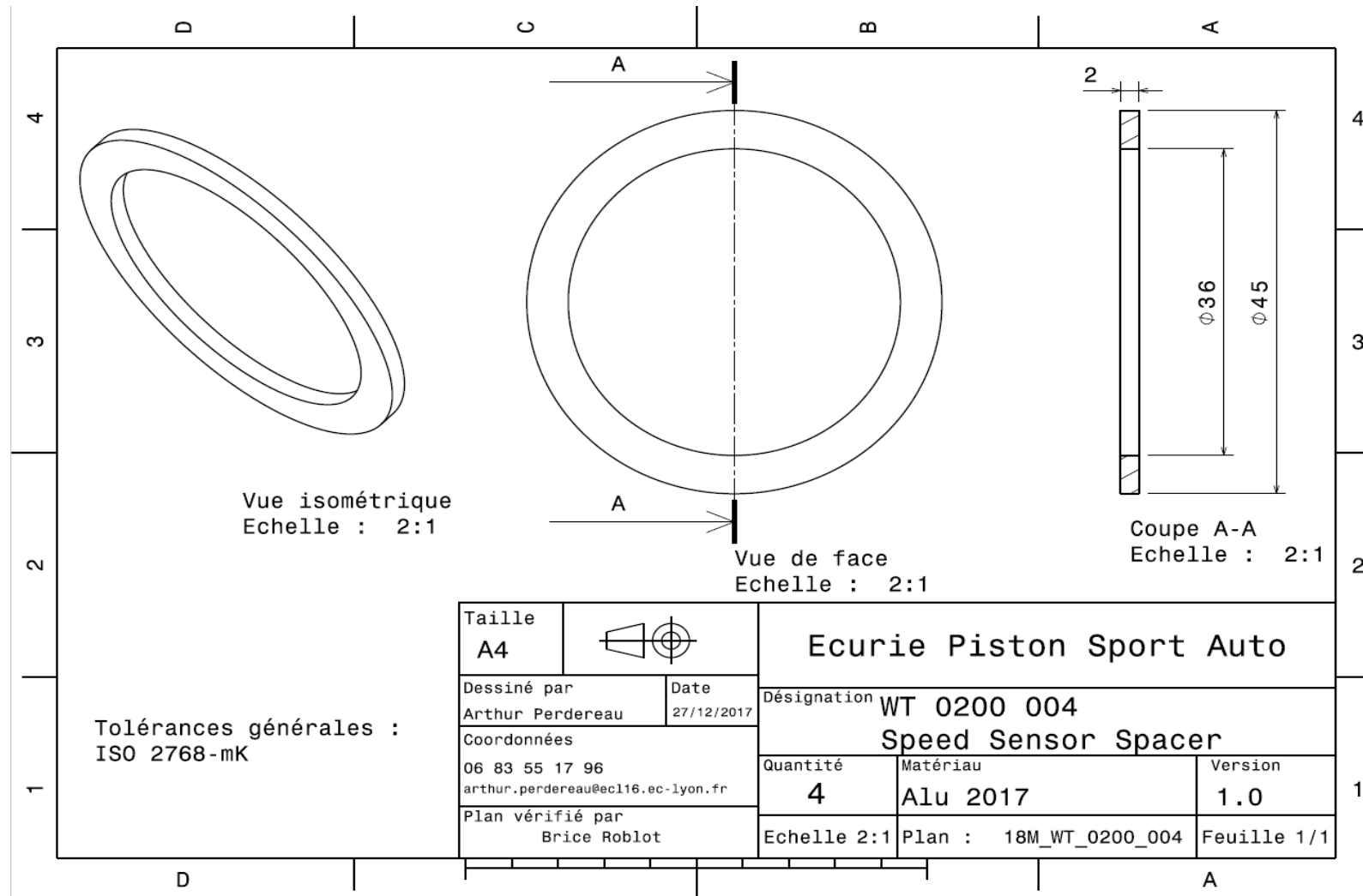
Extended Cost

\$ 0,95

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Aluminum, Normal		\$ 4,20	0,011	kg			Square area 45x45mm	0,002	0,002	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 turning	\$ 1,30	Unit	1	one setup for 2 pieces	0,5	\$ 0,65
20	Laser cut		\$ 0,01	cm	25,4		1	\$ 0,25
							Sub Total	\$ 0,90





University

Ecole Centrale de Lyon

System

Wheels & Tires

Assembly

Front Hubs

Part

Speed Sensor Disc

P/N Base

WT 02005

Suffix

AA

Details

Disc use in combination with a sensor to obtain the speed of a wheel

FileLink1

Drawing

FileLink2

FileLink3

Car #

81

Part Cost

\$ 9,71

Qty

1

FileLink1

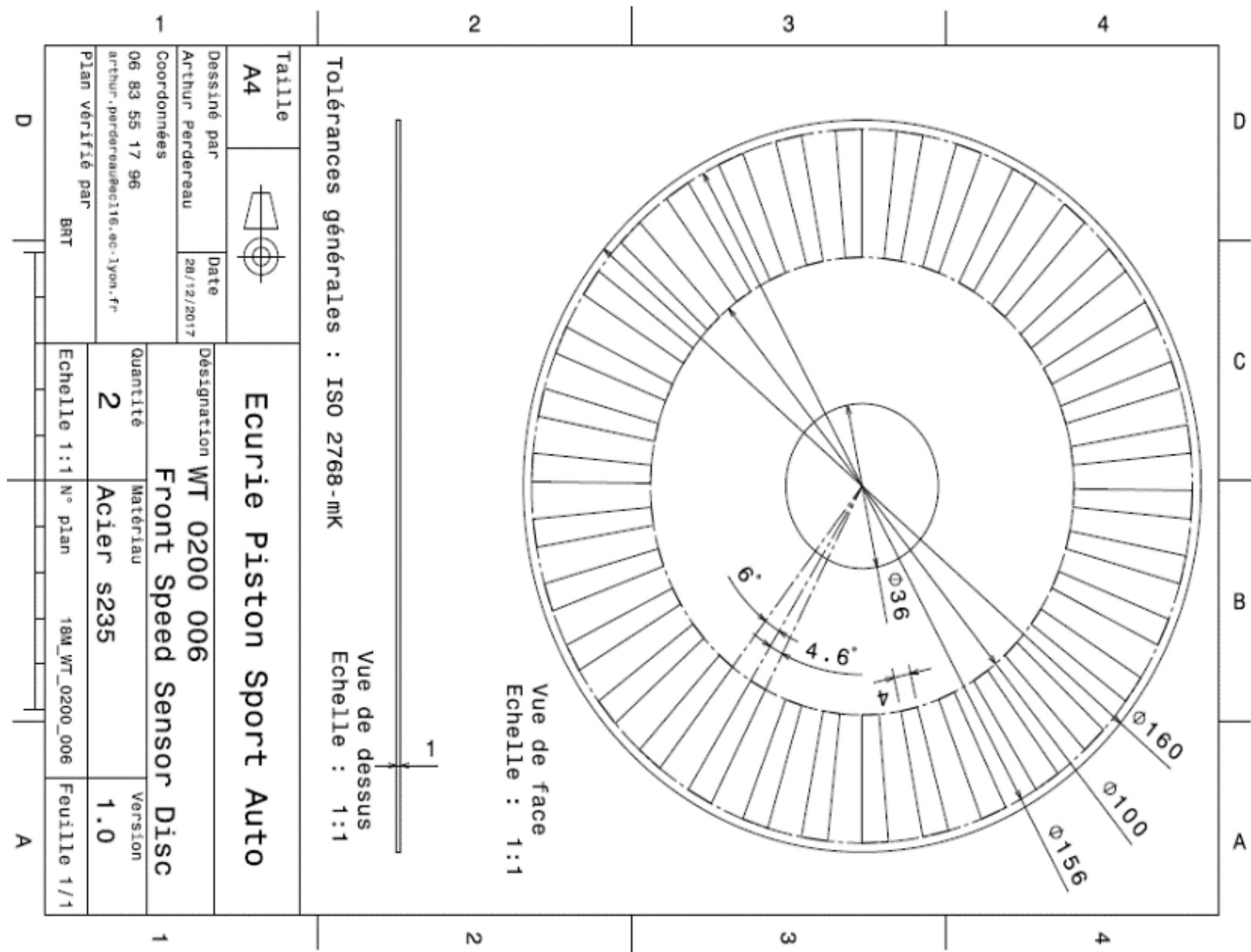
FileLink2

FileLink3

Extended Cost

\$ 9,71





<b>University</b>	Ecole Centrale de Lyon	<a href="#">Back to BOM</a>	<b>Car #</b>	81	<b>Asm Cost</b>	\$ 346,18
<b>System</b>	Wheels & Tires				<b>Qty</b>	2
<b>Assembly</b>	Rear Hubs		<b>FileLink1</b>		<b>Extended Cost</b>	\$ 692,35
<b>P/N Base</b>	WT A0300		<b>FileLink2</b>			
<b>Suffix</b>	AA		<b>FileLink3</b>			
<b>Details</b>	Assembly of a part of the wheel with the hub, bearings and a part to mesure the speed of the wheel					

ItemOrder	Part	Part Cost	Quantity	Sub Total
10	<a href="#">Rear Hub</a>	\$ 52,08	1	\$ 52,08
20	<a href="#">Rear Bearing Spacer</a>	\$ 3,97	1	\$ 3,97
30	<a href="#">Rear Wheel Spacer</a>	\$ 21,67	1	\$ 21,67
40	<a href="#">Tripod Housing Spacer</a>	\$ 3,90	1	\$ 3,90
50	<a href="#">Speed Sensor Disc</a>	\$ 7,69	1	\$ 7,69
<b>Sub Total</b>				<b>\$ 89,31</b>

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Wheel Bearing, Ball, Angular Contact		\$ 99,77	72	mm	12	mm					2,00	\$ 199,53
20	Adhesive	Wheel studs and hub assemble, cost included in process	\$ -										\$ -
<b>Sub Total</b>													<b>\$ 199,53</b>

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Assemble, 1kg, Loose	Bearing spacer assemble on the hub	\$ 0,06	unit	1		1	\$ 0,06
20	Assemble, 1 kg, Interference	Bearings Assemble	\$ 0,19	unit	2		1	\$ 0,38
30	Assemble, 1kg, Loose	Tripod housing spacer assemble on the hub	\$ 0,06	unit	1		1	\$ 0,06
40	Assemble, 1kg, Loose	Speed sensor disc assemble on the hub	\$ 0,06	unit	1		1	\$ 0,06
50	Liquid Applicator Gun	Wheel studs and hub assemble	\$ 0,02	cm	15,07		1	\$ 0,30
60	Assemble, 1 kg, Line-on-Line	Wheel studs and hub assemble	\$ 0,13	unit	4		1	\$ 0,52
70	Assemble, 1 kg, Loose	Front Wheel Spacer on hub	\$ 0,06	Unit	1		1	\$ 0,06
<b>Sub Total</b>								<b>\$ 1,44</b>

ItemOrder	Fastener	Use	UnitCost	Size1	Unit1	Size2	Unit2	Quantity	Sub Total
10	Stud, Grade 12.9	Wheel Studs	\$ 1,07	12	mm	62	mm	4	\$ 4,26
<b>Sub Total</b>									<b>\$ 4,26</b>



University	Ecole Centrale de Lyon
System	Wheels & Tires
Assembly	<a href="#">Rear Hubs</a>
Part	Rear Hub
P/N Base	WT 03001
Suffix	AA
Details	Main part of the assembly

FileLink1	<a href="#">Drawing</a>
FileLink2	
FileLink3	

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Car #	81
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FileLink1
FileLink2
FileLink3

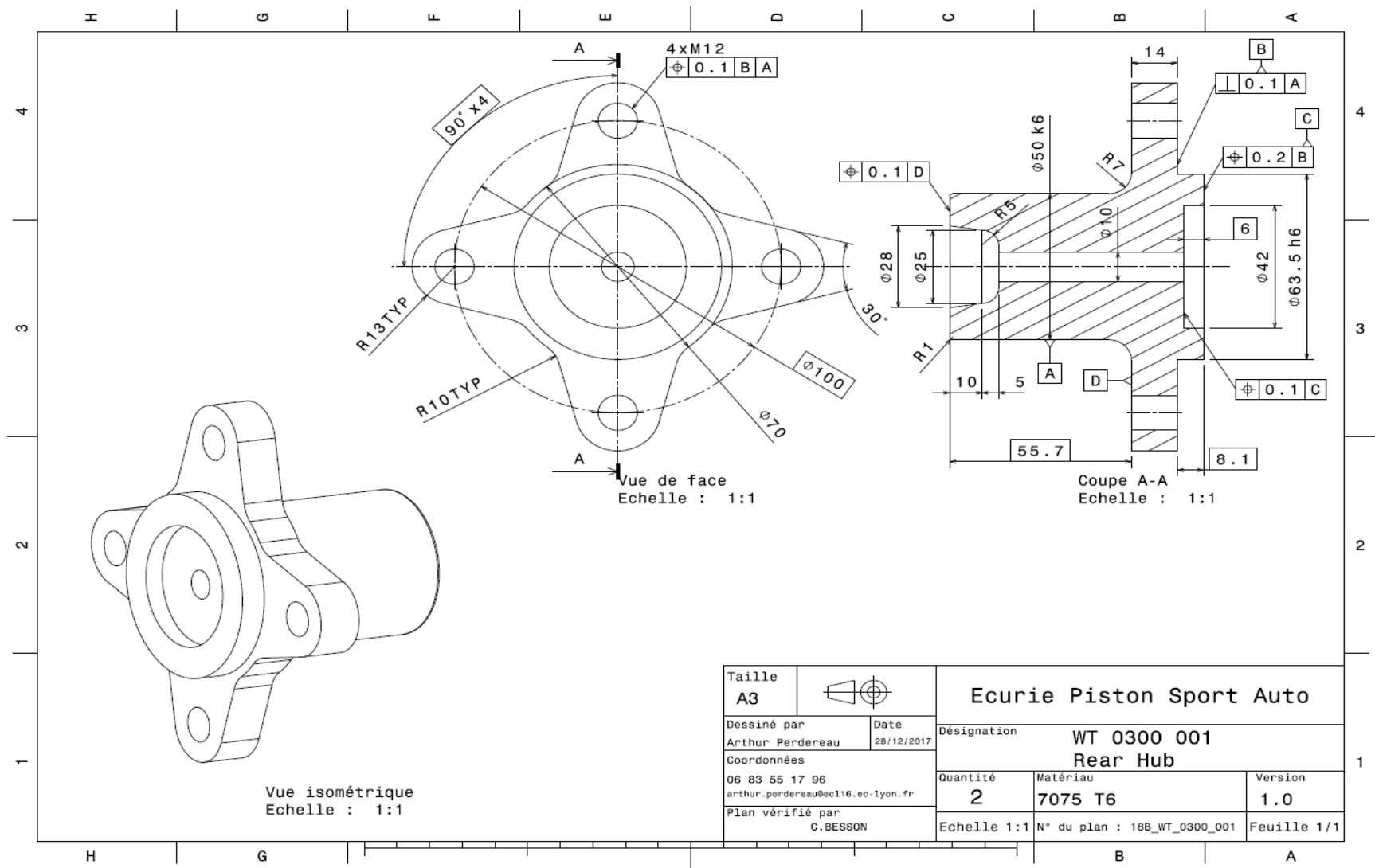
Part Cost	\$	52,08
Qty		1

Extended Cost	\$	52,08
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ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Aluminium, Premium		\$ 4,20	2,87	kg			round area, 130mm diameter	0,013	0,080	2712	1	\$ 12,06
												Sub Total	\$ 12,06

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and Remove	Setup for turning	\$ 1,30	Unit	1		1	\$ 1,30
20	Machining	Turning	\$ 0,04	cm^3	652,3	Material - Aluminium	1	\$ 26,09
30	Machining Setup, Change	Change the turning setup	\$ 0,65	Unit	1		1	\$ 0,65
40	Machining	Turning	\$ 0,04	cm^3	63,5	Material - Aluminium	1	\$ 2,54
50	Machining Setup, Change		\$ 0,65	Unit	1		1	\$ 0,65
60	Machining	Milling	\$ 0,04	cm^3	149	Material - Aluminium	1	\$ 5,96
70	Machining Setup, Change		\$ 0,65	Unit	1		1	\$ 0,65
80	Threading, Internal (machining)	For wheel studs	\$ 0,10	cm	6	Material - Aluminium	1	\$ 0,60
100	EDM - Wire	For tripod housing	\$ 0,20	cm	7,9	Material - Aluminium	1	\$ 1,58
Sub Total								\$ 40,02





Comment : Drawing before the EDM process for spline at the center

<b>University</b>	Ecole Centrale de Lyon			<a href="#">Back to BOM</a>		<b>Car #</b> 81		<b>Part Cost</b> \$ 3,97	
<b>System</b>	Wheels & Tires	<b>FileLink1</b>	<a href="#">Drawing</a>			<b>FileLink1</b>		<b>Qty</b> 1	
<b>Assembly</b>	<a href="#">Rear Hubs</a>	<b>FileLink2</b>				<b>FileLink2</b>			
<b>Part</b>	Wheel bearing spacer	<b>FileLink3</b>				<b>FileLink3</b>		<b>Extended Cost</b> \$ 3,97	
<b>P/N Base</b>	WT 03002								
<b>Suffix</b>	AA								
<b>Details</b>	Part to let a space between the hub and the first bearing								

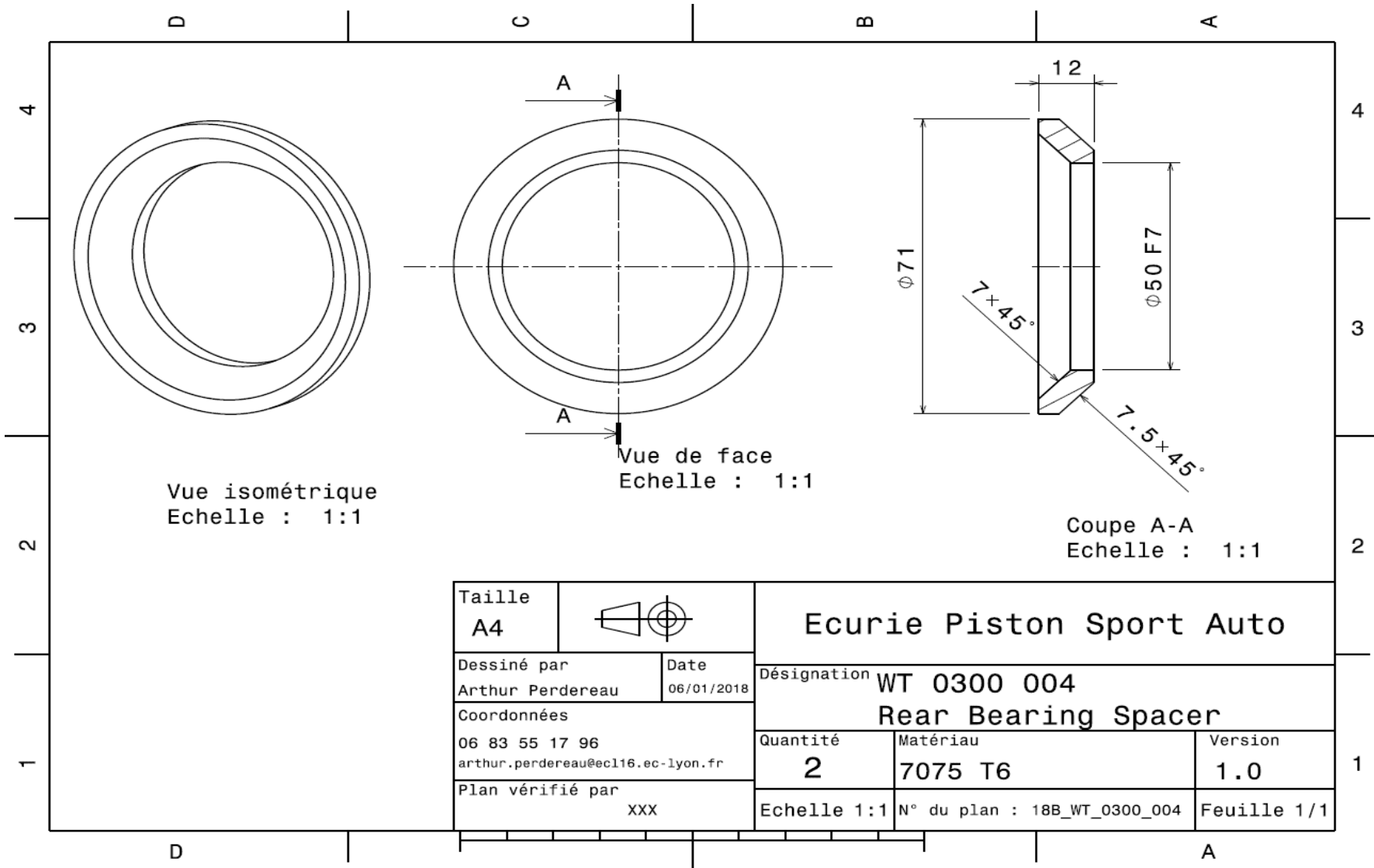
  

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Aluminium, Premium		\$ 4,20	0,16	kg			round area, 55mm diameter	0,004	0,014	2712	1	\$ 0,67
												<b>Sub Total</b> \$ 0,67	

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and Remove	Setup for turning	\$ 1,30	Unit	1		1	\$ 1,30
20	Machining	Turning	\$ 0,04	cm^3	28,3	Material - Aluminium	1	\$ 1,13
30	Machining Setup, Change	Change the turning setup	\$ 0,65	Unit	1		1	\$ 0,65
40	Machining	Turning	\$ 0,04	cm^3	5,5	Material - Aluminium	1	\$ 0,22
							<b>Sub Total</b>	\$ 3,30





University

System

Assembly

Part

P/N Base

Suffix

Details

Ecole Centrale de Lyon  
Wheels & Tires  
[Rear Hubs](#)  
Rear Wheel Spacer  
WT 03003  
AA  
Part to position the wheel on the good position relative to the hub and upright assembly

FileLink1

FileLink2

FileLink3

[Drawing](#)

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Car #

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Part Cost

\$

21,67

Qty

1

Extended Cost

\$

21,67


FileLink1

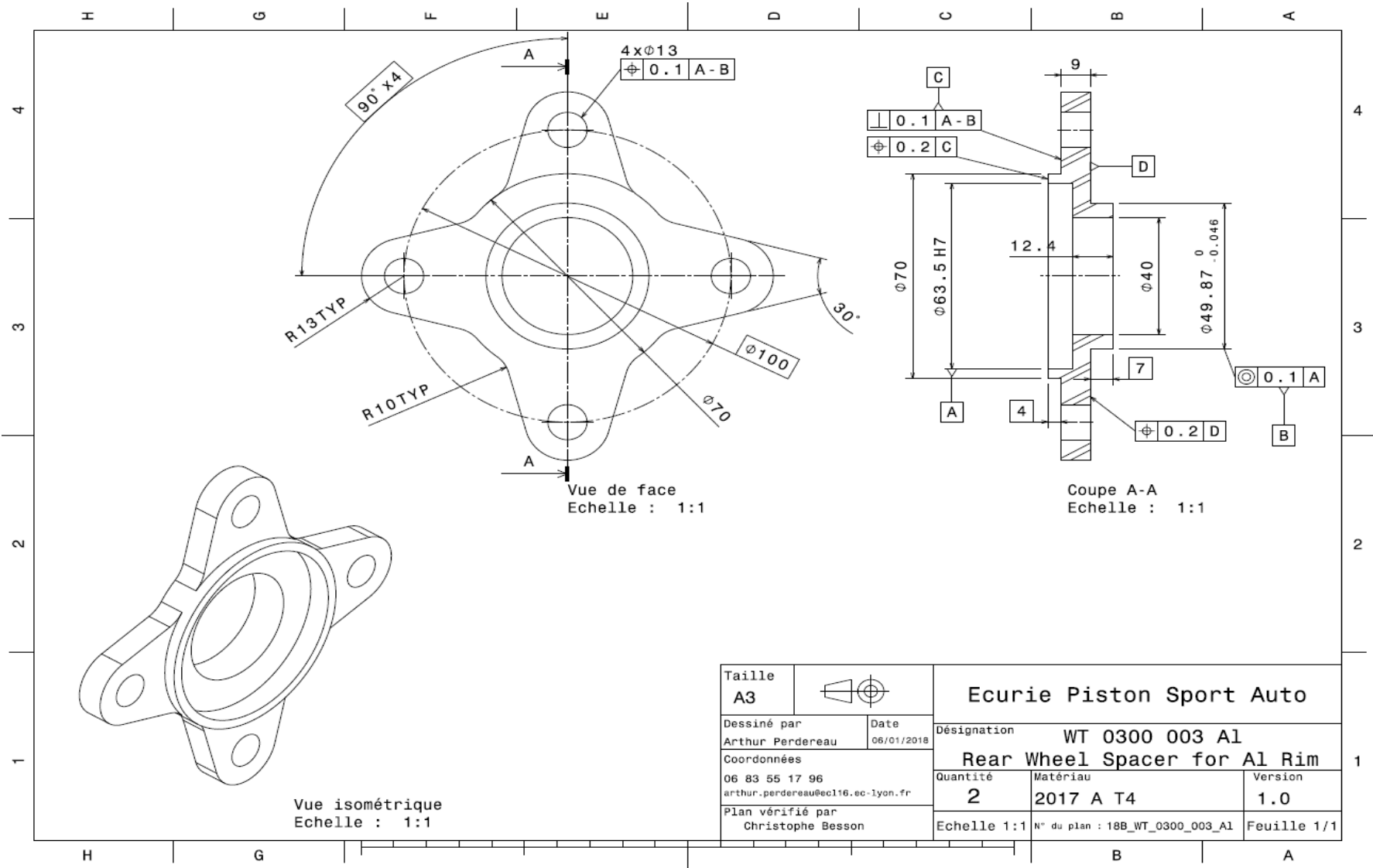
FileLink2

FileLink3

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Aluminium, Premium		\$ 4,20	0,86	kg			round area, 130mm diameter	0,013	0,024	2712	1	\$ 3,63
												Sub Total	\$ 3,63

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and Remove	Setup for turning	\$ 1,30	Unit	1		1	\$ 1,30
20	Machining	Turning	\$ 0,04	cm^3	135	Material - Aluminium	1	\$ 5,40
30	Machining Setup, Change	Change the turning setup	\$ 0,65	Unit	1		1	\$ 0,65
40	Machining	Turning	\$ 0,04	cm^3	102	Material - Aluminium	1	\$ 4,08
50	Machining Setup, Change		\$ 0,65	Unit	1		1	\$ 0,65
60	Machining	Milling	\$ 0,04	cm^3	149	Material - Aluminium	1	\$ 5,96
							Sub Total	\$ 18,04







University

Ecole Centrale de Lyon

System

Wheels & Tires

Assembly

[Rear Hubs](#)

Part

Tripod housing spacer

P/N Base

WT 03004

Suffix

AA

Details

Part to allow the tripod housing to be used as locknut to prestress the bearings. Also used to separate the speedsensor disc from the upright

FileLink1

[Drawing](#)

FileLink2

FileLink3

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Car #

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Part Cost

\$ 3,90

Qty

1

Extended Cost

\$ 3,90

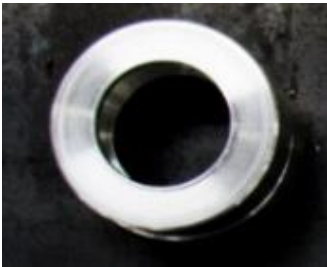
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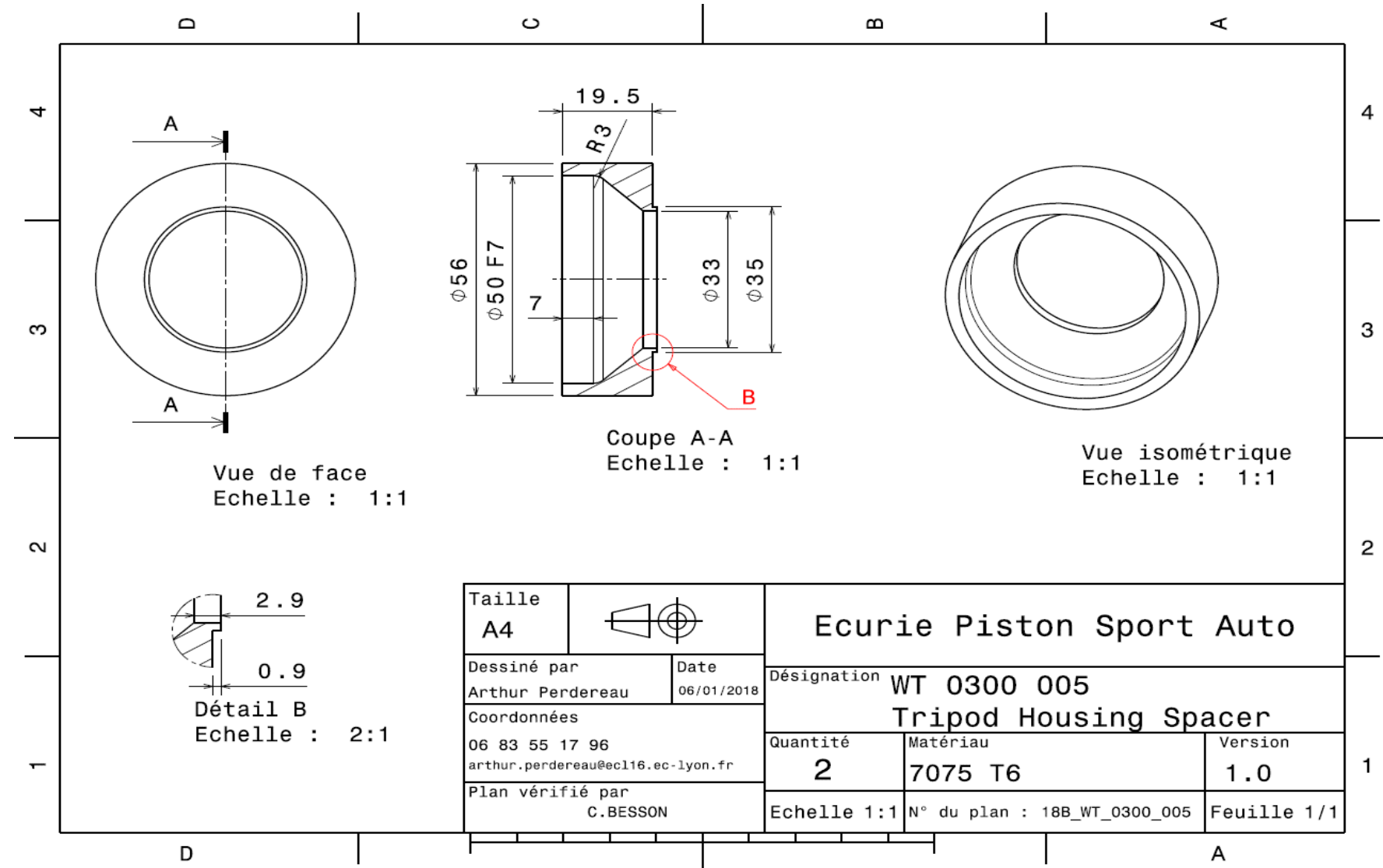
FileLink2

FileLink3

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Aluminium, Premium		\$ 4,20	0,16	kg			round area, 130mm diameter	0,003	0,022	2712	1	\$ 0,66
												Sub Total	\$ 0,66

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and Remove	Setup for turning	\$ 1,30	Unit	1		1	\$ 1,30
20	Machining	Turning	\$ 0,04	cm^3	27,7	Material - Aluminium	1	\$ 1,11
30	Machining Setup, Change	Change the turning setup	\$ 0,65	Unit	1		1	\$ 0,65
40	Machining	Turning	\$ 0,04	cm^3	4,6	Material - Aluminium	1	\$ 0,18
							Sub Total	\$ 3,24





University

System

Assembly

Part

P/N Base

Suffix

Details

Ecole Centrale de Lyon  
Wheels & Tires  
[Rear Hubs](#)  
Speed Sensor Disc  
WT 03005  
AA  
Disc use in combination with a sensor to obtain the speed of a wheel

FileLink1

FileLink2

FileLink3

[Drawing](#)

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Car #

81

Part Cost

\$

7,69

Qty

1

Extended Cost

\$

7,69

FileLink1

FileLink2

FileLink3

ItemOrder	Material	Use	UnitCost	Size1	Unit1	Size2	Unit2	Area Name	Area	Length	Density	Quantity	Sub Total
10	Steel, Mild		\$ 2,25	0,15	kg			rectangular area, 160mm*160mm	0,020	0,001	7 850	1,00	\$ 0,35
												Sub Total	\$ 0,35

ItemOrder	Process	Use	UnitCost	Unit	Quantity	Multiplier	Mult. Val.	Sub Total
10	Machining Setup, Install and Remove	Setup for turning	\$ 1,30	Unit	1	one setup for 2 pieces	0,5	\$ 0,65
20	Laser cut		\$ 0,01	cm	223	Material - steel	3	\$ 6,69
							Sub Total	\$ 7,34



