

# Technical Report

## Section Properties Report

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<b>Document:</b>	Engine Girder Report
<b>Section Name:</b>	Longitudinal_Outside
<b>Section Type:</b>	Thin walled
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### Issues & Amendments:

Issue	Issue Log	Issued by	Approved by	Issue Date
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## 1. Section Properties

### 1.1 Basic Section Properties

Section Name: Longitudinal_Outside		
Property	Value	Unit
Price per meter with plating	0	€/m
Price per meter without plating	0	€/m
Weight per meter with plating	2.4783	kg/m
Weight per meter without plating	2.4783	kg/m

### 1.2 Coordinate Dependent Section Properties

#### 1.2.1 Global

Coordinate System: Global		
Property	Value	Unit
Area	12499.3	mm <sup>2</sup>
Width	192.14	mm
Height	326.45	mm
[Min Y, Min Y]	[-99.6, 92.5]	mm
[Min Z, Max Z]	[-80.8, 245.7]	mm
Elastic Center [y, z]	[11.5, 96.8]	mm
Shear Center [y, z]	[6.3, -14.2]	mm
Mass Center [y, z]	[3.6, 34.7]	mm
I <sub>yy</sub>	1.033e+08	mm <sup>4</sup>
I <sub>zz</sub>	2.197e+07	mm <sup>4</sup>
J	1.253e+08	mm <sup>4</sup>
EA	3.003e+07	N
EI <sub>yy</sub>	5.414e+11	Nmm <sup>2</sup>

Elzz	2.706e+10	Nmm2
Elyz	4.058e+10	Nmm2
GAyy	6.710e+06	Nmm2
GAzz	2.963e+06	Nmm2
GJyz	6.804e+09	Nmm2

Principal Coord. Orientation	-1.7	°
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Mlyy	2.048e+01	kg mm2
MIzz	4.356e+00	kg mm2
Mlyz	-2.818e-01	kg mm2

Principal Mass Coord. Orientation	2.6	°
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### 1.2.2 Global Elastic Center

Coordinate System: Global Elastic Center		
Property	Value	Unit
Area	12499.3	mm2
Width	192.14	mm
Height	326.45	mm

[Min Y, Min Z]	[-111.1, 81]	mm
[Min Z, Max Z]	[-177.6, 148.9]	mm

Elastic Center [y, z]	[0, 0]	mm
Shear Center [y, z]	[-5.2, -111]	mm
Mass Center [y, z]	[3.6, 34.7]	mm

Iyy	1.363e+08	mm4
Izz	2.260e+07	mm4
J	1.589e+08	mm4

EA	3.003e+07	N
Elyy	2.599e+11	Nmm2
Elzz	2.309e+10	Nmm2
Elyz	7.143e+09	Nmm2
GAyy	6.710e+06	Nmm2
GAzz	2.963e+06	Nmm2
GJyz	6.804e+09	Nmm2

Principal Coord. Orientation	-1.7	°
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Mlyy	2.703e+01	kg mm2
MIzz	4.481e+00	kg mm2
Mlyz	6.342e-01	kg mm2

Principal Mass Coord. Orientation	-3.4	°
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### 1.2.3 Global Shear Center

Coordinate System: Global Shear Center		
Property	Value	Unit
Area	12499.3	mm <sup>2</sup>
Width	192.14	mm
Height	326.45	mm
[Min Y, Min Y]	[-105.8, 86.3]	mm
[Min Z, Max Z]	[-66.6, 259.8]	mm
Elastic Center [y, z]	[5.2, 111]	mm
Shear Center [y, z]	[0, 0]	mm
Mass Center [y, z]	[3.6, 34.7]	mm
I <sub>yy</sub>	1.181e+08	mm <sup>4</sup>
I <sub>zz</sub>	2.190e+07	mm <sup>4</sup>
J	1.400e+08	mm <sup>4</sup>
EA	3.003e+07	N
E <sub>lyy</sub>	6.299e+11	Nmm <sup>2</sup>
E <sub>lzz</sub>	2.392e+10	Nmm <sup>2</sup>
E <sub>lyz</sub>	2.464e+10	Nmm <sup>2</sup>
G <sub>Ayy</sub>	6.710e+06	Nmm <sup>2</sup>
G <sub>Azz</sub>	2.963e+06	Nmm <sup>2</sup>
G <sub>Jyz</sub>	6.804e+09	Nmm <sup>2</sup>
Principal Coord. Orientation	-1.7	°
M <sub>Iyy</sub>	2.343e+01	kg mm <sup>2</sup>
M <sub>Izz</sub>	4.343e+00	kg mm <sup>2</sup>
M <sub>Iyz</sub>	-9.150e-01	kg mm <sup>2</sup>
Principal Mass Coord. Orientation	3.4	°

#### 1.2.4 Global Mass Center

Coordinate System: Global Mass Center		
Property	Value	Unit
Area	12499.3	mm <sup>2</sup>
Width	192.14	mm
Height	326.45	mm
[Min Y, Min Y]	[-103.1, 89]	mm
[Min Z, Max Z]	[-115.5, 210.9]	mm
Elastic Center [y, z]	[7.9, 62.1]	mm
Shear Center [y, z]	[2.7, -48.9]	mm
Mass Center [y, z]	[3.6, 34.7]	mm
I <sub>yy</sub>	8.821e+07	mm <sup>4</sup>
I <sub>zz</sub>	2.181e+07	mm <sup>4</sup>
J	1.100e+08	mm <sup>4</sup>

EA	3.003e+07	N
Elyy	3.756e+11	Nmm2
Elzz	2.499e+10	Nmm2
Elyz	2.195e+10	Nmm2
GAyy	6.710e+06	Nmm2
GAzz	2.963e+06	Nmm2
GJyz	6.804e+09	Nmm2

Principal Coord. Orientation	-1.7	°
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Mlyy	1.749e+01	kg mm2
MIzz	4.325e+00	kg mm2
Mlyz	-5.879e-01	kg mm2

Principal Mass Coord. Orientation	1	°
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### 1.2.5 Principal Mass Center

Coordinate System: Principal Mass Center		
Property	Value	Unit
Area	12499.3	mm2
Width	189.02	mm
Height	329.21	mm

[Min Y, Min Y]	[-103.8, 85.2]	mm
[Min Z, Max Z]	[-118.6, 210.6]	mm

Elastic Center [y, z]	[10.7, 61.6]	mm
Shear Center [y, z]	[0.8, -50.2]	mm
Mass Center [y, z]	[3.6, 34.7]	mm

Iyy	8.834e+07	mm4
Izz	2.168e+07	mm4
J	1.100e+08	mm4

EA	3.003e+07	N
Elyy	3.729e+11	Nmm2
Elzz	2.763e+10	Nmm2
Elyz	3.745e+10	Nmm2
GAyy	6.403e+06	Nmm2
GAzz	3.050e+06	Nmm2
GJyz	6.804e+09	Nmm2

Principal Coord. Orientation	-4.3	°
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Mlyy	1.752e+01	kg mm2
MIzz	4.299e+00	kg mm2
Mlyz	-2.919e-04	kg mm2

Principal Mass Coord. Orientation	-1.1	°
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### 1.2.6 Principal Elastic Center

Coordinate System: Principal Elastic Center		
Property	Value	Unit
Area	12499.3	mm <sup>2</sup>
Width	194.04	mm
Height	324.98	mm
[Min Y, Min Y]	[-108.6, 85.4]	mm
[Min Z, Max Z]	[-175.6, 149.4]	mm
Elastic Center [y, z]	[0, 0]	mm
Shear Center [y, z]	[-2.1, -110.2]	mm
Mass Center [y, z]	[3.6, 34.7]	mm
I <sub>yy</sub>	1.364e+08	mm <sup>4</sup>
I <sub>zz</sub>	2.251e+07	mm <sup>4</sup>
J	1.589e+08	mm <sup>4</sup>
EA	3.003e+07	N
E <sub>lyy</sub>	2.601e+11	Nmm <sup>2</sup>
E <sub>lzz</sub>	2.288e+10	Nmm <sup>2</sup>
E <sub>lyz</sub>	4.421e+06	Nmm <sup>2</sup>
G <sub>Ayy</sub>	6.915e+06	Nmm <sup>2</sup>
G <sub>Azz</sub>	2.902e+06	Nmm <sup>2</sup>
G <sub>Jyz</sub>	6.804e+09	Nmm <sup>2</sup>
Principal Coord. Orientation	0	°
M <sub>lyy</sub>	2.705e+01	kg mm <sup>2</sup>
M <sub>lzz</sub>	4.463e+00	kg mm <sup>2</sup>
M <sub>lyz</sub>	-4.548e-02	kg mm <sup>2</sup>
Principal Mass Coord. Orientation	-2.1	°

## 2. Section Elements Definition

### 2.1 Layered Section Elements

#### 2.1.1 Element\_001

Layered Section Element Basic Info		
Name	Element_001	
Element Type	ShearWeb	
Group	-	
Used Geometry	Bottom Left, Bottom Right	
Element Stack		
#	Material Name	Alpha [°]
TOP		
1	1 x XC-SM400-EP-PP	45
2-4	3 x XC-SM300-EP-PP	45

Element Stack		
#	Material Name	Alpha [°]
5	1 x 34mm C70.130	0
6-8	3 x XC-SM300-EP-PP	45
BOTTOM		

### 2.1.2 Element\_002

Layered Section Element Basic Info	
Name	Element_002
Element Type	ShearWeb
Group	-
Used Geometry	Shear Web

Element Stack		
#	Material Name	Alpha [°]
TOP		
1-2	2 x XC-SM400-EP-PP	0
3	1 x 20mm C70.75	0
4	1 x XC-SM400-EP-PP	0
BOTTOM		

### 2.1.3 Element\_003

Layered Section Element Basic Info	
Name	Element_003
Element Type	ShearWeb
Group	-
Used Geometry	Capping

Element Stack		
#	Material Name	Alpha [°]
TOP		
1-2	2 x UC-SM300-EP-PP	0
BOTTOM		

\* Orange layer marks core

\* Green layer marks layered material

## 2.2 Uniform Section Elements

No uniform section elements for this section

## 3. Section Loads

### 3.1 Manual Loads

#### 3.1.1 FS Load (Generated Beam) 2:39 PM\_001

Allowable Load Info	
Name	FS Load (Generated Beam) 2:39 PM_001
Coordinate System	Global Elastic Center
Load Scale Factor	1
Deviatoric moment	Disabled

Allowable Load Info	
Input/Output Load Levels	Working/Working
Internal Forces (output) [Nx, Ny, Nz] [kN]	[0.00, 0.00, -7.32]
Internal Moments (output) [Mx, My, Mz] [kNm]	[-0.01, 5.24, 0.00]

### 3.2 Allowable Loads

No allowable loads for this section

## 4. RF Results

### 4.1 FS Load (Generated Beam) 2:39 PM\_001

Section Minimum RF	
Minimum Reserve Factor	1.525 (11TR)
Failure Criteria	MaxStrain3D
Failure Mode	Resin Micro-Cracking

Element Minimum RF		
Name	Ply	RF
Element_002	XC-SM400-EP-PP @0   #1	1.525 (MaxStrain3D/11TR)
Element_003	UC-SM300-EP-PP @0   #1	2.782 (MaxStrain3D/11TR)
Element_001	XC-SM300-EP-PP @45   #1	3.543 (MaxStrain3D/33T)