CompoSIDE

## Technical Report

# Bill of Material Report

Report generated in BoMGen powered by CompoSIDE

| | |
|---|---|
| **Document:** | Webinar report |
| **Product Name:** | Geodesic Dome |
| **Author:** | Aleksandra Dziekonska |
| **Circulation:** | |

## Issues and Amendments:

| Issue | Issue Log | Issued by | Approved by | Issue Date |
|---|---|---|---|---|
| P1 | P1 | Aleksandra Dziekonska | Aleksandra Dziekonska | 29/09/2015 13:35 |

## Disclaimer:

1. This document is intended for estimation purposes only and is not to be used for materials order.
2. This document should be used as a guide to tendering only. It remains the responsibility of the builder to satisfy himself as to the final selection of materials and the quantities required.
3. Some of the laminates are based on limited information and previous experience.
4. The laminates will be subject to change as the design evolves.
5. The "Weight Estimate" is exclusive of “wastage factors” (i.e. weights as designed) but includes "usage factor" (i.e. core resin consumption etc.).
6. The "Bill of Materials (BoM)" estimate includes ‘‘wastage and usage factors’’
7. Product BoM factors are specified in the Appendix to this document or if specific for component in the document section outlining component BoM.
8. It is the builder responsibility to verify the appropriateness of the “wastage factors” and "usage factors" applied.

# 1. Introduction

| | |
|---|---|
| **Product:** | Geodesic Dome |
| **Product Type:** | |
| **Keywords:** | Bill of Materials |

# 2. Product Summary

## 2.1 BoM - Summary

| | | Summary | | |
|---|---|---|---|---|
| **Type** | **Material / Component** | **Total Areal Quantity [1] [$m^2$]** | **Total Weight Quantity [1] [kg]** | **Total Material Cost [1] [€]** |
| | Total | | 1790.42 | 44,365.59 € |
| Cores | 15 mm FC115 | 27.99 | 48.02 | 720.32 € |
| | 30 mm FC115 | 123.58 | 424.12 | 6,361.74 € |
| | 35 mm FC115 | 39.66 | 158.81 | 2,382.12 € |
| Plies | QC-1200-E-PP | 77.62 | 144.06 | 3,104.68 € |
| | UC-HEC300-E-PP | 74.9 | 34.75 | 1,112.00 € |
| | XC-300-E-PP | 9.5 | 4.75 | 236.00 € |
| | XC-400-E-V | 29.17 | 22.94 | 655.50 € |
| | XC-600-E-PP | 967.33 | 897.69 | 29,020.01 € |
| | XG-E300-E-PP | 103.46 | 45.21 | 672.51 € |
| Formulated Products | EpoxyAdhesive | | 10.07 | 100.73 € |

Core Weights include Resin Weight due to core resin consumption.
Areal and weight quantities include wastage and usage factors.
For core sheet size please refer to section 4. "Material Details"

**Formulated Products**

| **Material** | **As Designed Weight [2] [kg]** | **Total Weight [1] [kg]** |
|---|---|---|
| EpoxyAdhesive | 8.97 | 10.07 |

**Resin Weight Summary (included in ply weight)**

| **Material** | **Resin Type** | **Total Resin Weight [1] [kg]** |
|---|---|---|
| Epoxy W | Epoxy | 11.09 |

Included in plies and cores listed in table above.

## 2.2 BoM - Cost

| | | Component (Material Cost) [€] | |
|---|---|---|---|
| **Type** | **Material / Component** | **Floor** | **Outer Shell** |
| | Total | 6,289.80 € | 38,075.79 € |
| Cores | 15 mm FC115 | 104.51 € | 615.80 € |
| | 30 mm FC115 | - | 6,361.74 € |
| | 35 mm FC115 | 2,382.12 € | - |
| Plies | QC-1200-E-PP | 3,104.68 € | - |
| | UC-HEC300-E-PP | 236.75 € | 875.25 € |
| | XC-300-E-PP | 236.00 € | - |
| | XC-400-E-V | 184.61 € | 470.89 € |
| | XC-600-E-PP | - | 29,020.01 € |
| | XG-E300-E-PP | - | 672.51 € |
| Formulated Products | EpoxyAdhesive | 41.12 € | 59.60 € |

Core Weights include Resin Weight due to core resin consumption.
Areal and weight quantities include wastage and usage factors.
For core sheet size please refer to section 4. "Material Details"

## 2.3 Weight Estimate

| # | Component | As Designed Weight[2] [kg] |
|---|---|---|
| 1 | Floor | 297.39 |
| 2 | Outer Shell | 1296.86 |

# 3. Components Summary

## 3.1 Floor (incl. Sub-components details)

Quantity: **1** (Including parent component quantity)

### 3.1.1 Floor Unique Material List (Total quantities)

| # | Material Name | Type | As Designed Area [2] [m²] | Total Area [1] [m²] | As Designed Weight [2] [kg] | Total Weight [1] [kg] | Total Resin Weight [1] [kg] | Total Fibre Weight [1] [kg] | Total Price [€] | Price per Kg [€] |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | QC-1200-E-PP | Ply | 69.08 | 77.62 | 126.94 | 144.06 | 0 | 0 | 3,104.68 € | 21.55 € |
| 2 | UC-HEC300-E-PP | Ply | 14.19 | 15.95 | 6.52 | 7.4 | 0 | 0 | 236.75 € | 32.00 € |
| 3 | XC-300-E-PP | Ply | 8.46 | 9.5 | 4.19 | 4.75 | 0 | 0 | 236.00 € | 49.68 € |
| 4 | XC-400-E-V | Ply | 7.18 | 8.22 | 5.37 | 6.46 | 3.12 | 3.29 | 184.61 € | 28.57 € |
| 5 | 15 mm FC115 | Core | 3.45 | 4.06 | 6.33 | 6.97 | 0 | 0 | 104.51 € | 15.00 € |
| 6 | 35 mm FC115 | Core | 33.7 | 39.66 | 144.37 | 158.81 | 0 | 0 | 2,382.12 € | 15.00 € |
| 7 | EpoxyAdhesive | Homogen | 0 | 0 | 3.66 | 4.11 | 0 | 0 | 41.12 € | 10.00 € |

Core Weights include Resin Weight due to core resin consumption.

**Floor Subcomponents:**

| # | Name | Type | Unit Area / Unit Length [m²] / [mm] | Unit Subcomponent Weight (Factored)[2] [kg] | Unit Quantity | Quantity (including component quantity) |
|---|---|---|---|---|---|---|
| 1 | Floor Panel | Surface Element | 33.7 / - | 268.48 | 1 | 1 |
| 2 | Floor Support Beams | Beam | - / 3450 | 2.91 | 5 | 5 |
| 3 | Bonding | Bonding | - / 3450 | 0.9 | 10 | 10 |
| 4 | Local Reinforcement | Reinforcement | - / 4500 | 2.37 | 1 | 1 |

### 3.1.2 Floor Stacking

#### 3.1.2.1 Floor Panel StackUp (Surface Element)

Area: **33.7** [m²]  Component Area Percentage: **100** [%]

| | Material | α [°] | Area / Cov. [m²] / [%] | Comment |
|---|---|---|---|---|
| 1 | QC-1200-E-PP | 0 | 33.7 / 100 | |
| 2 | 35 mm FC115 | 0 | 33.7 / 100 | |
| 3 | QC-1200-E-PP | 0 | 33.7 / 100 | |

#### 3.1.2.2 Floor Support Beams StackUp (Beam)

Subcomponent Quantity: **5**, Length: **3450** [mm]

| | Material | α [°] | Width / Leng. / Cov. [mm] / [mm] / [%] | Comment | Capping Reinforcement | Web ShearWeb |
|---|---|---|---|---|---|---|
| 1 - 15 | 15 x UC-HEC300-E-PP | 0 | 40 / 3450 / 100 | | ☑ | ☐ |
| 16 | XC-300-E-PP | 45 | 200 / 3450 / 100 | | ☐ | ☑ |
| 17 | 15 mm FC115 | 0 | 200 / 3450 / 100 | | ☐ | ☑ |
| 18 | XC-300-E-PP | 45 | 200 / 3450 / 100 | | ☐ | ☑ |
| | Element Quantity | | [-] | | 1 | 1 |
| | Single Element Thickness | | [mm] | | 4.5 | 15.68 |
| | Average Lap Distance | | [mm] | | | |
| | Bonding Tape Radius (Radius used for bonding plies width calculation) | | [mm] | | | |

#### 3.1.2.3 Bonding StackUp (Bonding)

Subcomponent Quantity: **10**, Length: **3450** [mm]

| Material | | α | Width / Leng. / Cov. | Comment | Bonding |
|---|---|---|---|---|---|
| | | [°] | [mm] / [mm] / [%] | | Bonding |
| 1 | R20 EpoxyAdhesive | 0 | 3450 / 100 | | ☑ |
| 2 - 3 | 2 x XC-400-E-V | 45 | 100 / 3450 / 100 | | ☑ |
| | Element Quantity | | [-] | | 1 |
| | Single Element Thickness | | [mm] | | 1 |

#### 3.1.2.4 Local Reinforcement StackUp (Reinforcement)

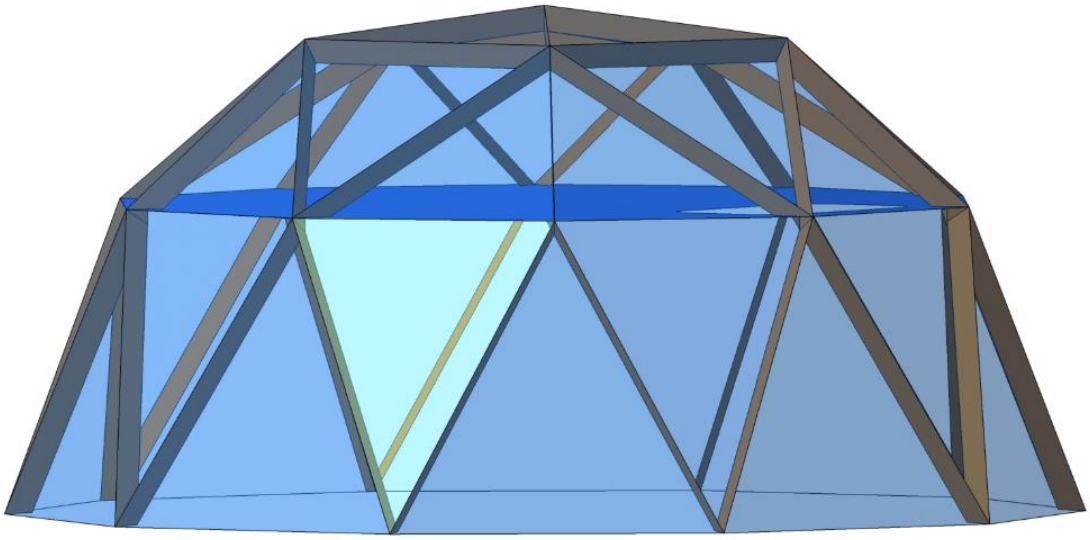
Subcomponent Quantity: **1**, Length: **4500** [mm]

| Material | | α | Width / Leng. / Cov. | Comment | Local Reinforcement |
|---|---|---|---|---|---|
| | | [°] | [mm] / [mm] / [%] | | Reinforcement |
| 1 | XC-300-E-PP | 45 | 150 / 4500 / 100 | | ☑ |
| 2 - 11 | 10 x UC-HEC300-E-PP | 0 | 80 / 4500 / 100 | | ☑ |
| 12 | XC-300-E-PP | 45 | 150 / 4500 / 100 | | ☑ |
| | Element Quantity | | [-] | | 1 |
| | Single Element Thickness | | [mm] | | 3.68 |

## 3.2 Outer Shell (incl. Sub-components details)

Quantity: **1** (Including parent component quantity)

Outer shell of the Goedesic Dome



### 3.2.1 Outer Shell Unique Material List (Total quantities)

| # | Material Name | Type | As Designed Area [2] [$m^2$] | Total Area [1] [$m^2$] | As Designed Weight [2] [kg] | Total Weight [1] [kg] | Total Resin Weight [1] [kg] | Total Fibre Weight [1] [kg] | Total Price [€] | Price per Kg [€] |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | UC-HEC300-E-PP | Ply | 52.47 | 58.96 | 24.1 | 27.36 | 0 | 0 | 875.25 € | 32.00 € |
| 2 | XC-400-E-V | Ply | 18.3 | 20.96 | 13.71 | 16.48 | 7.97 | 8.38 | 470.89 € | 28.57 € |
| 3 | XC-600-E-PP | Ply | 861 | 967.33 | 791.02 | 897.69 | 0 | 0 | 29,020.01 € | 32.33 € |
| 4 | XG-E300-E-PP | Ply | 92.09 | 103.46 | 39.84 | 45.21 | 0 | 0 | 672.51 € | 14.87 € |
| 5 | 15 mm FC115 | Core | 20.33 | 23.93 | 37.32 | 41.05 | 0 | 0 | 615.80 € | 15.00 € |
| 6 | 30 mm FC115 | Core | 105 | 123.58 | 385.56 | 424.12 | 0 | 0 | 6,361.74 € | 15.00 € |
| 7 | EpoxyAdhesive | Homogen | 0 | 0 | 5.3 | 5.96 | 0 | 0 | 59.60 € | 10.00 € |

Core Weights include Resin Weight due to core resin consumption.

**Outer Shell Subcomponents:**

| # | Name | Type | Unit Area / Unit Length [$m^2$] / [mm] | Unit Subcomponent Weight (Factored)[2] [kg] | Unit Quantity | Quantity (including component quantity) |
|---|---|---|---|---|---|---|
| 1 | Outer Shell Laminate | Surface Element | 105 / - | 1169.02 | 1 | 1 |
| 2 | Bottom Beams | Beam | - / 2830 | 2.92 | 20 | 20 |
| 3 | Mid Beams | Beam | - / 1995 | 1.87 | 15 | 15 |
| 4 | Top Beams | Beam | - / 2015 | 1.42 | 10 | 10 |
| 5 | Dome Panel Overlaminate | Bonding | - / 38000 | 5.92 | 1 | 1 |
| 6 | Dome Stiffner Bonding | Bonding | - / 25000 | 6.55 | 2 | 2 |

### 3.2.2 Outer Shell Stacking

#### 3.2.2.1 Outer Shell Laminate StackUp (Surface Element)

Area: **105** [$m^2$] Component Area Percentage: **100** [%]

| Material | | α [°] | Area / Cov. [$m^2$] / [%] | Comment |
|---|---|---|---|---|
| 1 | XC-600-E-PP | 0 | 105 / 100 | |

| Material | | α | Area / Cov. | Comment |
|---|---|---|---|---|
| | | [°] | [m²] / [%] | |
| 2 | XC-600-E-PP | 45 | 105 / 100 | |
| 3 | XC-600-E-PP | 90 | 105 / 100 | |
| 4 | XC-600-E-PP | -45 | 105 / 100 | |
| 5 | 30 mm FC115 | 0 | 105 / 100 | |
| 6 | XC-600-E-PP | -45 | 105 / 100 | |
| 7 | XC-600-E-PP | 90 | 105 / 100 | |
| 8 | XC-600-E-PP | 45 | 105 / 100 | |
| 9 | XC-600-E-PP | 0 | 105 / 100 | |

#### 3.2.2.2 Bottom Beams StackUp (Beam)

Subcomponent Quantity: **20**, Length: **2830** [mm]

| Material | | α | Width / Leng. / Cov. | Comment | Shear Web | Reinforcement |
|---|---|---|---|---|---|---|
| | | [°] | [mm] / [mm] / [%] | | ShearWeb | Reinforcement |
| 1 - 2 | 2 x XG-E300-E-PP | 45 | 240 / 2830 / 100 | | ☑ | ☐ |
| 3 | 15 mm FC115 | 0 | 200 / 2830 / 100 | | ☑ | ☐ |
| 4 - 5 | 2 x XG-E300-E-PP | 45 | 200 / 2830 / 100 | | ☑ | ☐ |
| 6 - 20 | 15 x UC-HEC300-E-PP | 0 | 40 / 2830 / 100 | Capping | ☐ | ☑ |
| Element Quantity | | | [-] | | 1 | 1 |
| Single Element Thickness | | | [mm] | | 15.92 | 4.5 |
| Average Lap Distance | | | [mm] | | | |
| Bonding Tape Radius (Radius used for bonding plies width calculation) | | | [mm] | | | |

#### 3.2.2.3 Mid Beams StackUp (Beam)

Subcomponent Quantity: **15**, Length: **1995** [mm]

| Material | | α | Width / Leng. / Cov. | Comment | Shear Web | Reinforcement |
|---|---|---|---|---|---|---|
| | | [°] | [mm] / [mm] / [%] | | ShearWeb | Reinforcement |
| 1 - 2 | 2 x XG-E300-E-PP | 45 | 240 / 1995 / 100 | | ☑ | ☐ |
| 3 | 15 mm FC115 | 0 | 200 / 1995 / 100 | | ☑ | ☐ |
| 4 - 5 | 2 x XG-E300-E-PP | 45 | 200 / 1995 / 100 | | ☑ | ☐ |
| 6 - 15 | 10 x UC-HEC300-E-PP | 0 | 40 / 1995 / 100 | Capping | ☐ | ☑ |
| Element Quantity | | | [-] | | 1 | 1 |
| Single Element Thickness | | | [mm] | | 15.92 | 3 |
| Average Lap Distance | | | [mm] | | | |
| Bonding Tape Radius (Radius used for bonding plies width calculation) | | | [mm] | | | |

#### 3.2.2.4 Top Beams StackUp (Beam)

Subcomponent Quantity: **10**, Length: **2015** [mm]

| Material | | α | Width / Leng. / Cov. | Comment | Shear Web | Reinforcement |
|---|---|---|---|---|---|---|
| | | [°] | [mm] / [mm] / [%] | | ShearWeb | Reinforcement |
| 1 - 2 | 2 x XG-E300-E-PP | 45 | 190 / 2015 / 100 | | ☑ | ☐ |
| 3 | 15 mm FC115 | 0 | 150 / 2015 / 100 | | ☑ | ☐ |
| 4 - 5 | 2 x XG-E300-E-PP | 45 | 150 / 2015 / 100 | | ☑ | ☐ |
| 6 - 12 | 7 x UC-HEC300-E-PP | 0 | 40 / 2015 / 100 | Capping | ☐ | ☑ |
| Element Quantity | | | [-] | | 1 | 1 |
| Single Element Thickness | | | [mm] | | 15.92 | 2.1 |
| Average Lap Distance | | | [mm] | | | |
| Bonding Tape Radius (Radius used for bonding plies width calculation) | | | [mm] | | | |

#### 3.2.2.5 Dome Panel Overlaminate StackUp (Bonding)

Subcomponent Quantity: **1**, Length: **38000** [mm]

| Material | | α | Width / Leng. / Cov. | Comment | Dome Stiffner Bonding |
|---|---|---|---|---|---|
| | | [°] | [mm] / [mm] / [%] | | Bonding |
| 1 - 2 | 2 x XC-400-E-V | 45 | 100 / 38000 / 100 | Bonding plies lap 30+20mm | ☑ |
| | Element Quantity | | [-] | | 1 |
| | Single Element Thickness | | [mm] | | 1 |

#### 3.2.2.6 Dome Stiffner Bonding StackUp (Bonding)

Subcomponent Quantity: **2**, Length: **25000** [mm]

| Material | | α | Width / Leng. / Cov. | Comment | Dome Stiffner Bonding |
|---|---|---|---|---|---|
| | | [°] | [mm] / [mm] / [%] | | Bonding |
| 1 | R20 EpoxyAdhesive | 0 | 25000 / 100 | Structural fillet | ☑ |
| 2 - 3 | 2 x XC-400-E-V | 45 | 100 / 25000 / 100 | Bonding plies lap 30+20mm | ☑ |
| | Element Quantity | | [-] | | 1 |
| | Single Element Thickness | | [mm] | | 1 |

# 4. BoM Material Details

## Cores

| Name | $t_{pp}$ [mm] | ρ [kg/m$^3$] | $A_m$ [g/m$^2$] | Sheet Width Sheet Length [mm] | Core Preprocessing Type | Paper/Film Type | Cell Shape / Grade | Price per m$^2$ € |
|---|---|---|---|---|---|---|---|---|
| 15 mm FC115 | 15 | 120 | 1800 | | Plain (PL) | - | - / - | |
| 30 mm FC115 | 30 | 120 | 3600 | | Plain (PL) | - | - / - | |
| 35 mm FC115 | 35 | 120 | 4200 | | Plain (PL) | - | - / - | |

## Plies

| Name | $t_{pp}$ [mm] | $A_m$ [g/m$^2$] | FVF | RWF | Material Type | Reinforcement Type | Matrix Type | Processing Type | Price per m$^2$ € |
|---|---|---|---|---|---|---|---|---|---|
| QC-1200-E-PP | 1.2 | 1856 | 0.56 | 0.353 | Quadraxials | Carbon | Epoxy | Prepreg | |
| UC-HEC300-E-PP | 0.3 | 464 | 0.56 | 0.353 | UD | HEC | Epoxy | Prepreg | |
| XC-300-E-PP | 0.34 | 500 | 0.52 | 0.4 | Biaxials | HSC | Epoxy | Prepreg | |
| XC-400-E-V | 0.5 | 700 | 0.46 | 0.429 | Biaxials | HSC | Epoxy | Hand layup Vacuum | |
| XC-600-E-PP | 0.6 | 928 | 0.56 | 0.353 | Biaxials | Carbon | Epoxy | Prepreg | |
| XG-E300-E-PP | 0.23 | 437 | 0.51 | 0.314 | Biaxials | E-glass | Epoxy | Prepreg | |

## Formulated Products

| Name | ρ [kg/m$^3$] | Price per Kg € |
|---|---|---|
| Epoxy W | 1180 | |
| EpoxyAdhesive | 1200 | 10 |

## Material Description

| Type | Name | Description |
|---|---|---|
| Cores | 15 mm FC115 | PET foam. |
| | 30 mm FC115 | PET foam. |
| | 35 mm FC115 | PET foam. |
| Plies | QC-1200-E-PP | |
| | UC-HEC300-E-PP | F: HEC (Mod235GPa, Strength >4.8GPa) M: Generic epoxy |
| | XC-300-E-PP | F: Generic 12K fibre Mod 230GPa, Strength >3.4 M: Generic Epoxy |
| | XC-400-E-V | F: Generic 12K fibre Mod 230GPa, Strength >3.4 M: Generic Epoxy |
| | XC-600-E-PP | |
| | XG-E300-E-PP | F: Generic WE, M: Generic Epoxy |
| Formulated Products | Epoxy W | Epoxy Wet |
| | EpoxyAdhesive | THis is generic Structural Epoxy adhesive |

# 5. Appendix

## 5.1 BoM Settings

**Wastage factors**

| Property | Value | Unit |
|---|---|---|
| Wastage Scale Factor | 1 | |
| Finished Part Offcut | 7 | % |
| Cores Offcut | 10 | % |
| Secondary Bonding Adhesive Wastage | 5 | % |

| | Hand Layup Vacuum | Prepreg |
|---|---|---|
| Fabric Offcut [%] | 7 | 5 |
| Resin Application Wastage [%] | 5 | 0 |

Included in Usage and Wastage Quantities accordingly.

**Usage factors**

| Property | Value | Unit |
|---|---|---|
| Usage Scale Factor | 1 | |
| Secondary Bonding Adhesive Usage | 3 | % |

| | Hand Layup Vacuum | Prepreg |
|---|---|---|
| General Resin Usage [%] | 7 | 0 |
| Resin Bleed-Out [%] | 0 | 1 |

Included in Usage and Wastage Quantities accordingly.

**Overlap Factors (Wastage & Usage)**

Overlap Factors (Percentage of ply total area)

| | Hand Layup Vacuum | Prepreg |
|---|---|---|
| Multiaxial Overlap [%] | 4 | 2.5 |
| UD Overlap [%] | 2 | 1.75 |

Included in Usage and Wastage Quantities accordingly.

**Core Resin Consumption Factors**

Core Resin Consumption varies and depends on Core Preprocessing (i.e. Core Cut Type) and Laminate Processing Type (i.e. Infusion).

Defined according to STRUCTeam Internal Knowledge.

## 5.2 Tables Header Notes

[1] Including Wastage & Usage Factors

[2] Including Usage Factors

[3] Laminates are compliant with the ISO 12215 Category A and ABS guidelines