SIMONA

# tech.info

## SIMONA® Twin-Wall Sheets

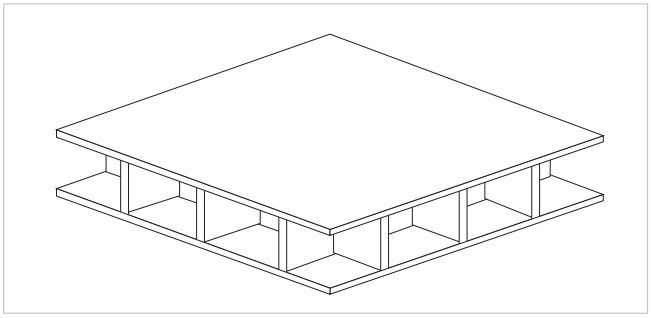
GLOBAL THERMOPLASTIC SOLUTIONS

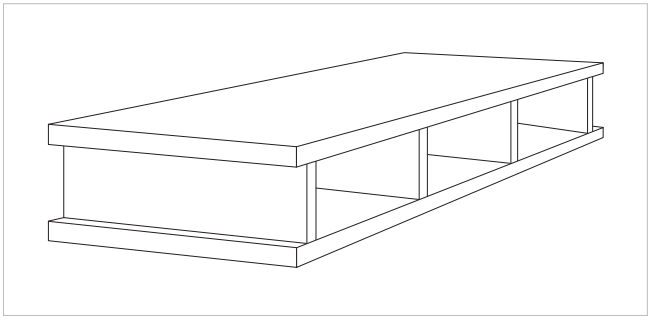
# Contents

# 1 General

## 1.1 Properties

SIMONA® Twin-Wall Sheets are innovative, versatile products. They are manufactured from PE 100, PP-H AlphaPlus® and PP-C with state-of-the-art machine technology as standard; on request they can be produced from materials such as PPs or PP-C-UV and various material combinations. They combine high rigidity, low specific weight and good thermal insulation with the benefits of efficient fabrication and machining. Twin-Wall Sheets can be processed by means of the same methods as those used for solid materials.





**SIMONA® lengthways-ribbed Twin-Wall Sheets**

SIMONA® lengthways-ribbed (i.e. longitudinally) Twin-Wall Sheets are unidirectionally reinforced. Therefore, they possess direction-dependent (anisotropic) mechanical properties. Other properties include:

- High physical strength, depending on total thickness and internal structure
- Construction of larger tanks (5 $m^2$ and more) possible without steel reinforcement
- Custom specification of outer skin thicknesses (6 and 8 mm)
- Number of webs can be varied according to requirements (10 or 19 webs/m)

**SIMONA® cross-ribbed Twin-Wall Sheets**

SIMONA® cross-ribbed Twin-Wall Sheets are a systematic enhancement of SIMONA® lengthways-ribbed Twin-Wall Sheets. Featuring an isotropic design with a cross-ribbed internal structure, they have the following properties:

- Reduced sheet thickness of 30 mm/40 mm, resulting in simplified handling, e. g. in heated-tool butt welding
- Direction-independent mechanical properties due to cross-ribbed internal structure

**Design-specific advantages**

- High rigidity and strength
- High break resistance
- Rectangular tanks possible without steel reinforcement
- Lighter weight than solid material due to cavities
- Excellent sound insulation (DIN EN ISO 140-3 certificates for lengthways-ribbed sheets available on request)
- Low thermal transmittance (k-value/U-value) based on ISO 8301, EN 1946-3
- Many different fields of application

**Plastic-specific advantages**

- High thermal insulation
- Good electrical insulation
- Good slip properties
- High wear resistance
- High chemical resistance
- Low water absorption
- Resistance to microorganisms
- Excellent fabrication capability

On account of their inherent material properties, Twin-Wall Sheets can be used for a wide range of applications:

- PE 100 is impact resistant down to –50 °C, weather resistant and offers a high level of chemical resistance.
- PP-H AlphaPlus® is impressive owing to its service temperature range of 0 °C to +100 °C, its high chemical resistance and good weldability.
- PP-C (block copolymer) is characterised by increased impact strength, even at low temperatures, and by a service temperature range of –20 °C to +80 °C.
- PPs excels when it comes to chemical resistance. In addition, the material is classified as a low-flammability construction material.

## 1.2 Areas of use

As outlined above, SIMONA® Twin-Wall Sheets are used in a very wide variety of applications within the field of apparatus and tank design as well as installation, agricultural and environmental engineering. The exceptional versatility of SIMONA® Twin-Wall Sheets is a tribute to the favourable characteristics associated with the product itself – with regard to insulation properties (sound and heat) – as well as the many different options available for customising the design of the sheets during production. Here are just a few examples of applications already implemented with the help of SIMONA® Twin-Wall Sheets:

- Rectangular tanks
- Rectangular tanks with integrated leak monitoring
- Covers for electroplating baths
- Vehicle tanks and small boat construction
- Floating pontoons for pipelines and supply lines at sea
- Storm-water retention basins
- Cooling water tanks
- Refrigerating containers
- Ice boxes
- Sound booths
- Spray booths
- Weather booths
- Safety tanks
- Water supply tanks
- Slide and anti-wear sheets in conjunction with thermal insulation
- Walk-over swimming pool floors
- Lightweight shaft bottoms or concrete-lined for floats
- Protective ducts for pipelines and supply lines
- Stone impact protection in road construction
- Sound barriers with and without infill panels
- Safety floor sheets
- Ventilation ducts
- Linings for transport stalls
- Linings for silos
- Medicinal baths for horses
- Partitions
- Biofilters
- Wastewater engineering
- Sewage sludge treatment
- Flood protection structures
- Banners in sports and leisure facilities
- Safety drip pans
- Breeding tanks for fish and marine animals

## 1.3 Product range

For detailed information on the current product range of SIMONA® Twin-Wall Sheets as well as other products, please visit www.simona.de.

Our sales team looks forward to assisting you:
Phone +49 (0) 6752 14-0
Fax +49 (0) 6752 14-211
sales@simona.de

# 2 Technical information

## 2.1 Material specifications

SIMONA® Twin-Wall Sheets feature a welded design and are made from SIMONA® standard products. Therefore, in this case the material specifications relating to basic sheets apply.

**Material specifications**

| | | SIMONA® PE 100 black | SIMONA® PP-H AlphaPlus® | SIMONA® PP-C | SIMONA® PPs |
|---|---|---|---|---|---|
| Density, g/cm³, DIN EN ISO 1183 | | 0.96 | 0.91 | 0.91 | 0.95 |
| Yield stress, MPa, DIN EN ISO 527 | | 23 | 33 | 26 | 32 |
| Elongation at yield, %, DIN EN ISO 527 | | 9 | 8 | 7 | 8 |
| Tensile modulus of elasticity, MPa, DIN EN ISO 527 | | 1,100 | 1,700 | 1,200 | 1,600 |
| Impact strength, kJ/m², DIN EN ISO 179 | | no break | no break | no break | no break |
| Notched impact strength, kJ/m², DIN EN ISO 179 | | 25 | 9 | 45 | 6 |
| Ball indentation hardness, MPa, DIN EN ISO 2039-1 | | 40 | – | 50 | 70 |
| Shore hardness D, DIN EN ISO 868 | | 64 | 72 | 67 | 72 |
| Mean coefficient of linear thermal expansion, $K^{-1}$, ISO 11359-2 | | $1.8 \times 10^{-4}$ | $1.6 \times 10^{-4}$ | $1.6 \times 10^{-4}$ | $1.6 \times 10^{-4}$ |
| Fire behaviour, DIN 4102 | | B2 normal flammability * | B2 normal flammability * | B2 normal flammability * | B1 low flammability: 3 – 20 mm |
| Dielectric strength, kV/mm, DIN IEC 60243-1 | | 47 | – | 52 | 22 |
| Specific surface resistance, ohms, DIN IEC 60093 | | $10^{14}$ | $10^{14}$ | $10^{14}$ | $10^{14}$ |
| Temperature range, °C | | –50 to +80 | 0 to +100 | –20 to +80 | 0 to +100 |
| Chemical resistance | | Very good in contact with many acids, alkalis and solvents | | | |
| Physiologically safe | BfR | ✔ | ✔ | ✔ | |
| | EU | ✔ | ✔ | | |
| | FDA | | ✔ | ✔ | |

* Own assessment without test certificate

All specifications are deemed to be approximate values in respect of the specific material and may vary depending on the processing methods used. In general, data specified applies to average values measured on extruded sheets with a thickness of 4 mm. In the case of sheets manufactured by means of pressing, testing is generally performed on sheets with a thickness of 20 mm. Deviations from the values specified are possible if the sheets in this thickness are not available. In the case of backed sheets, all technical specifications relate to the non-backed base sheets. Information presented herein is not necessarily applicable to other products (e.g. pipes, solid rods) of the same material or products that have undergone downstream processing. Suitability of materials for a specific field of application must be assessed by the party responsible for processing or the end-user. All technical specifications presented herein are designed merely to provide assistance in terms of project planning. They do not constitute a guarantee of specific properties or qualities. For further information, please contact our Technical Service Centre at tsc@simona.de.

## 2.2 Thermal transmittance

Thermal transmittance, referred to as the U-value (in construction physics also referred to as the k-value), is a measure of the heat transfer through a solid body such as a plastic sheet. U-values are required for calculating the primary energy demand or transmission heat loss.

Thermal transmittance is a specific characteristic value of construction materials and components. The lower the thermal transmittance, the better its thermal insulation properties.

Air inclusions in foamed materials or twin-wall materials can reduce the thermal transmittance factor. Although heat transfer is not a quality requirement of our Twin-Wall Sheets, measurements have been conducted for this product on a spot-check basis; they are listed in the following tables.

| **Type** | **Total material thickness** in mm | **Outer skin thickness** in mm | **Web spacing** in mm | **U-value** W/m²K |
|---|---|---|---|---|
| Lengthways-ribbed | 54 | 6 | 54 | 2.1 |
| Lengthways-ribbed | 58 | 8 | 54 | 2.0 |
| Cross-ribbed | 40 | 6 | 50 x 50 | 2.9 |

Table 1: Statistical, averaged U-values of SIMONA® PE Twin-Wall Sheets

| **Type** | **Total material thickness** in mm | **Outer skin thickness** in mm | **Web spacing** in mm | **U-value** W/m²K |
|---|---|---|---|---|
| Lengthways-ribbed | 54 | 6 | 54 | 1.9 |
| Lengthways-ribbed | 58 | 8 | 54 | 1.8 |
| Cross-ribbed | 40 | 6 | 50 x 50 | 2.5 |

Table 2: Statistical, averaged U-values of SIMONA® PP Twin-Wall Sheets

Depending on the distribution of webs (e.g. after cutting to size) or, in the case of lengthways-ribbed Twin-Wall Sheets, depending on possible convection in the space between the webs, the aforementioned U-value may be different. Filling materials (e.g. XPS) can be used to actively reduce the U-value.

## 2.3 Fire behaviour

According to DIN 4102, the original semi-finished products used for Twin-Wall Sheets, SIMONA® PE 100 and SIMONA® PP-H AlphaPlus®, are normal-flammability construction materials (B2) (own assessment without test certificate).

- Oxygen index approx. 18 %

The original semi-finished products in thicknesses from 3 mm to 20 mm for the Twin-Wall Sheet SIMONA® PPs are classified by DIN 4102 as low-flammability construction materials (B1) [as of 2018]. As the Twin-Wall Sheets have maximum wall/web thicknesses of 8 mm, it may be assumed that Twin-Wall Sheets made from SIMONA® PPs meet the requirements for B1 low-flammability construction materials conforming to DIN 4102.

- Oxygen index approx. 28 %

## 2.4 Performance in outdoor use

Owing to the fact that SIMONA® PE 100, a semi-finished product used for PE Twin-Wall Sheets, is specially stabilized for outdoor use, PE Twin-Wall Sheets are rated in the same way. Twin-Wall Sheets made of SIMONA® PP AlphaPlus® and PP-C are not generally designed for outdoor use.

## 2.5 Physiological safety

According to Recommendation III by the German "Federal Institute for Risk Assessment" (BfR, previously BgVV) there are no reservations about using SIMONA® Twin-Wall Sheets (made of PE 100, PP-H AlphaPlus® and PP-C) for manufacturing commodities as defined by Section 2, paragraph 6, no. 1 of the German Food, Commodities and Feedstuffs Act (LFGB, as amended by an Announcement on 26 April 2006 in the German Federal Gazette I, p.945).

All the monomers and additives used are listed in European Directive 2002/72/EC and addenda.

Furthermore, SIMONA® PP-H AlphaPlus® and SIMONA® PP-C Twin-Wall Sheets are manufactured from raw materials that meet the requirements of the "Food and Drug Administration" (FDA) in the United States (Code of Federal Regulations, title 21, chapter 1, part 177.1520) for contact with foods. The raw materials used for SIMONA® PP-H AlphaPlus® and for SIMONA® PE 100 also meet the specifications of EU Regulation No. 10/2011 for plastic materials that come into contact with food.

## 2.6 Drinking water approval

SIMONA® PE 100 and SIMONA® PP-H AlphaPlus® Twin-Wall Sheets are manufactured from raw materials for which there are drinking water approval certificates conforming to KTW and DVGW Worksheet W 270.

## 2.7 Chemical resistance

Owing to the non-polar nature of SIMONA® PE 100, SIMONA® PP-H AlphaPlus® and SIMONA® PP-C, SIMONA® Twin-Wall Sheets manufactured from these materials have a high level of chemical resistance to a wide range of chemicals.

You will find detailed information in SIMCHEM, a database on the chemical resistance of our materials (www.simchem.de).

## 2.8 Water absorption

SIMONA® Twin-Wall Sheets absorb negligible quantities of water, so they do not swell when immersed in water.

## 2.9 Temperature range

The service temperature ranges of SIMONA® Twin-Wall Sheets are as follows*:

**Temperature ranges**

| | PE 100 | PP-H Alpha-Plus® | PP-C | PPs |
|---|---|---|---|---|
| Temperature range | –50 °C to +80 °C | 0 °C to +100 °C | –20 °C to +80 °C | 0 °C to +100 °C |
| Crystalline melting temperature | approx. +130 °C | approx. +160 °C | approx. +160 °C | approx. +160 °C |

* The above figures do not apply to applications in tanks – such cases are subject to special design rules that have to be agreed on an individual basis.

## 2.10 Resistance to microorganisms

SIMONA® Twin-Wall Sheets do not constitute a source of nutrition for:

- Microorganisms
- Bacteria
- Fungi
- Spores
- Gnawing insects
- Rodents

## 2.11 Health aspects

As far as their chemical composition is concerned, SIMONA® PE/PP Twin-Wall Sheets are essentially only made of carbon and hydrogen. When they burn, virtually the only substances that develop are carbon dioxide, carbon monoxide and water, accompanied by very small quantities of soot and low-molecular-weight volumes of the relevant plastics. The ratio of carbon dioxide to carbon monoxide largely depends on the circumstances of burning – temperature, ventilation and an unobstructed supply of atmospheric oxygen. Consequently, burning fumes develop that resemble those of wood or stearin.

In the debate about the potential toxicity of fumes from burning plastics the fact that all burning fumes have a toxic effect is often overlooked. Therefore, any claim that plastics exposed to fire develop particularly toxic gases is incorrect.

The most suitable extinguishant to combat burning Twin-Wall Sheets is water.

# 3 Processing information

## 3.1 Machining

SIMONA® Twin-Wall Sheets can be processed by means of various methods. These include drilling, milling and sawing; in this case, a distinction must be made between circular sawing and band-sawing. For further information, please refer to our work.info “Machining”.

## 3.2 Welding

### 3.2.1 General

The term plastic welding means the permanent joining of thermoplastics by applying heat and pressure, with or without the use of an additional substance. All welding processes take place when the materials in the boundary areas of the surfaces being joined are in a ductile state. That is where the threadlike molecules of the parts being joined and pressed together link up and entwine themselves to form a homogeneous material bond. Only plastics of the same kind, e. g. PP and PP, and within these types only those with the same or a similar/adjacent molecular weight and the same density, can be welded to one another; colour does not have to be taken into account.

Pipework components and sheets made from PE with an MFR (Melt Flow Rate) 190/5 of 0.2 to 1.7 g/10 min are suitable for being welded to one another. This means that when the materials are heated the fusion properties are very similar. This is outlined in DVS 2207 Part 1 and has also been confirmed by DVGW (German Gas and Water Association). For PP-H and PP-C, weldability is confirmed within the Melt Flow Rate (MFR 190/5) ranging from 0.4 to 1.0 g/10 min. These details can be found in DVS 2207 Part 11.

The Melt Flow Rates of SIMONA® Twin-Wall Sheets and the other semi-finished products, pipes and fittings made from SIMONA® PE 100, SIMONA® PP-H AlphaPlus® and SIMONA® PP-C are within the said MFR ranges. The products are therefore ideal for welding.

### 3.2.2 Welding preparation

Directly before welding the surfaces to be connected, the adjacent areas and any damaged surfaces (especially if there are weather or chemical influences) must be machined down to intact zones. Dirt, grease, hand sweat and oxide layers must be removed by machining in order to obtain a high welding factor. Detergents that attack or alter the plastic surface must not be used.

### 3.2.3 Hot gas draw welding

For further preparatory welding – to connect the bottom of a tank to a Twin-Wall Sheet wall by extrusion welding, for example – we recommend a hot gas draw weld using a round rod of 3 mm thickness. This ensures that no cavity sinks occur between the webs during extrusion welding and that the join is of the best possible quality. Furthermore, it is possible to introduce a welding rod capable of dissipating static so as to be able to check the weld seam with a high electric voltage at a later stage.

It is essential that the sheet and rod surfaces to be welded are cleaned by means of machining. Welding with a tacking nozzle serves to keep the parts in position. Fusion is performed with hot air but without any additional rod.

### 3.2.4 Extrusion welding

Extrusion welding is suitable for making the join between the floor and walls of a tank (for preparation, see 3.2.2).

The recommended figures for air temperature, mass temperature and air flow are as follows:

**Recommended figures**

| | PE-TWS | PP-TWS |
|---|---|---|
| Masse temperature, °C | 210 – 230 | 210 – 240 |
| Air temperature, °C | 250 – 300 | 250 – 300 |
| Air flow, l/min | ≥ 300 | ≥ 300 |

### 3.2.5 Heated-tool butt welding

Heated-tool butt welding is the method of choice when it comes to making butt joints between Twin-Wall Sheets. In the case of cross-ribbed Twin-Wall Sheets only heated-tool butt welding can be used to weld both the outer skins and the webs, thus maximising the welded area.

Warming is performed by a coated (PTFE) heated tool. Owing to the direct contact, the transmission of heat is far more intense than with hot gas draw welding or extrusion welding; the distribution of heat over the cross-section of the material is more efficient. Thus, there is no zone in the material which is subjected to a higher thermal load than that required for welding. That means the stress to which the joints are subjected is very low. In heated-tool butt welding the welding process takes place when the heated surfaces of contact are brought together at a specific pressure and allowed to cool down under pressure. Modern devices have a data collection feature that makes it possible to store welding parameters and print out welding records.

The quality of seams depends on the following criteria:

- The cleanliness of the parts to be joined by welding and of the heated tool itself is of paramount importance in heated-tool butt welding.
- Teflon films or coatings facilitate the cleaning of heating surfaces and prevent plastics from clinging to the heated element when warming up.

Semi-finished products with a large wall thickness usually call for relatively low temperatures – within tolerances – and suitably longer exposure time. A heated tool height of at least 70 mm and a clamping distance of 60 mm are to be recommended for Twin-Wall Sheets of 54 to 60 mm thickness because a relatively uniform temperature distribution can thus be guaranteed.

To be able to enter the necessary height and thickness of the sheet being welded on the automatic welder, the figures must first be calculated on the basis of the aggregate areas to be welded, consisting of webs and outer skins. In the case of lengthways-ribbed Twin-Wall Sheets there are two welding directions:

- **Direction of the webs** (Figure 1) Calculation formula:
  Thickness D = d
  Length L = 2 x l
  Area A = L x D
- **At right angles to the direction of the webs** (Figure 2)
  Calculation formula:
  Thickness D = d
  Length L = 2 x l + n x h
  Area A = L x D

D = sheet thickness to be entered (mm)
d = outer skin thickness (mm)
L = length to be entered (mm)
l = one sheet length (mm)
n = number of webs
h = web height (mm)
A = welded area ($mm^2$)

With cross-ribbed Twin-Wall Sheets the welded area has to be considered and determined irrespective of direction, as shown in Figure 2. We always recommend making a weld at the ends of the webs. The webs should meet on welding. Welding over the entire surface longitudinally in relation to the web is never to be recommended.

In applications where the sheet is not subjected to mechanical loads the webs can be welded at offset points in relation to one another. Welding parameters have to be determined as shown in Figure 1.

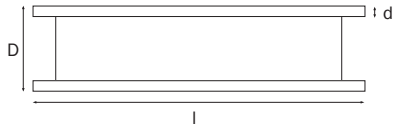


Figure 1

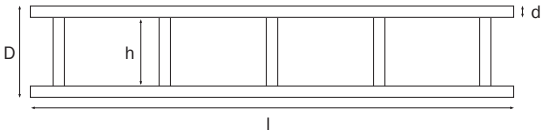


Figure 2

**Examples of calculations**

| **Area equivalents** | **TWS lengthways-ribbed 6 mm / 10 webs 54 mm thick** | **TWS lengthways-ribbed 6 mm / 19 webs 54 mm thick** | **TWS lengthways-ribbed 8 mm / 19 webs 58 mm thick** | **TWS cross-ribbed 5 mm / 50 x 50 30 mm thick** | **TWS cross-ribbed 6 mm / 50 x 50 40 mm thick** |
|---|---|---|---|---|---|
| Twin-Wall Sheet, 1,000 mm wide<br><br>Welding **in the direction** of the webs | Outer skin sheets:<br>d = 6 mm<br>l = 1,000 mm<br><br>Webs: n = 10<br>h = 41 mm<br><br>**D = 6 mm**<br>**L = 2,000 mm**<br>(A = 12,000 mm²) | Outer skin sheets:<br>d = 6 mm<br>l = 1,000 mm<br><br>Webs: n = 19<br>h = 41 mm<br><br>**D = 6 mm**<br>**L = 2,000 mm**<br>(A = 12,000 mm²) | Outer skin sheets:<br>d = 8 mm<br>l = 1,000 mm<br><br>Webs: n = 19<br>h = 41 mm<br><br>**D = 8 mm**<br>**L = 2,000 mm**<br>(A = 16,000 mm²) | Outer skin sheets:<br>d = 5 mm<br>l = 1,000 mm<br><br>Webs: n = 20<br>h = 20 mm | Outer skin sheets:<br>d = 6 mm<br>l = 1,000 mm<br><br>Webs: n = 20<br>h = 28 mm |
| Hohlkammerplatte, 1,000 mm lang<br><br>Welding **at right angles to the direction** of the webs | **Total: D = 6 mm**<br>**L = 2,410 mm**<br>(A = 14,460 mm²) | **Total: D = 6 mm**<br>**L = 2,779 mm**<br>(A = 16,674 mm²) | **Total: D = 8 mm**<br>**L = 2,779 mm**<br>(A = 22,232 mm²) | **Total: D = 5 mm**<br>**L = 2 x 1,000 mm**<br>**+ 20 x 20 mm**<br>**= 2,400 mm**<br>(A = 12,000 mm²) | **Total: D ≈ 6 mm**<br>**L = 2 x 1,000 mm**<br>**+ 20 x 28 mm**<br>**= 2,560 mm**<br>(A ≈ 15,360 mm²) |

Under normal workshop conditions we recommend the process parameter values in the following table:

**Process parameters for PE-TWS**

| | | **PE-TWS lengthways-ribbed 6 mm / 10 webs 54 mm thick** | **PE-TWS lengthways-ribbed 6 mm / 19 webs 54 mm thick** | **PE-TWS lengthways-ribbed 8 mm / 19 webs 58 mm thick** | **PE-TWS cross-ribbed 5 mm / 50 x 50 30 mm thick** | **PE-TWS cross-ribbed 6 mm / 50 x 50 40 mm thick** |
|---|---|---|---|---|---|---|
| Temperature, °C | | 215 | 215 | 215 | 215 | 215 |
| Alignment p ≈ 0.15 N/mm² bead height, mm | | 1.0 | 1.0 | 1.5 | 1.0 | 1.0 |
| Heating-up p ≈ 0.01 N/mm² time, s | | 60 | 60 | 80 | 50 | 60 |
| Change-over Max. time, s | | < 3 | < 3 | < 3 | < 3 | < 3 |
| Joining p ≈ 0.15 N/mm² | Joining pressure build-up time, s | 5.5 | 5.5 | 6.5 | 5.5 | 5.5 |
| | Cooling time under joining pressure, min | 8.5 | 8.5 | 11 | 8.5 | 8.5 |

**Process parameters for PP-TWS**

| | | **PP-TWS lengthways-ribbed 6 mm / 10 webs 54 mm thick** | **PP-TWS lengthways-ribbed 6 mm / 19 webs 54 mm thick** | **PP-TWS lengthways-ribbed 8 mm / 19 webs 58 mm thick** | **PP-TWS cross-ribbed 5 mm / 50 x 50 30 mm thick** | **PP-TWS cross-ribbed 6 mm / 50 x 50 40 mm thick** |
|---|---|---|---|---|---|---|
| Temperature, °C | | 215 | 215 | 215 | 215 | 215 |
| Alignment p ≈ 0.1 N/mm² bead height, mm | | 0.5 | 0.5 | 1.0 | 0.5 | 0.5 |
| Heating-up p ≈ 0.01 N/mm² time, s | | 160 | 160 | 190 | 160 | 160 |
| Change-over Max. time, s | | < 3 | < 3 | < 3 | < 3 | < 3 |
| Joining p ≈ 0.15 N/mm² ± 0.01 | Joining pressure build-up time, s | 6 – 7 | 6 – 7 | 7 – 11 | 6 – 7 | 6 – 7 |
| | Cooling time under joining pressure, min | 6.5 – 9.5 | 6.5 – 9.5 | 9.5 – 15 | 6.5 – 9.5 | 6.5 – 9.5 |

For further information, please refer to our work.info "Welding".

# 4 Design-specific details

## 4.1 Bowing

The lengthways-ribbed version of the Twin-Wall Sheet provides excellent rigidity at right angles to the webs. For this reason the webs in a tank should always be vertical in order to ensure maximum utilisation of product material. Another benefit of the product is the cavity available in the Twin-Wall Sheet. It offers sufficient space for a steel section with an outside dimension of 40 mm. With this material combination it is possible to design structures, e. g. a tank cover, effectively and with a space-saving configuration. However, such measures are never to be recommended for the purpose of increasing the rigidity of a tank wall.

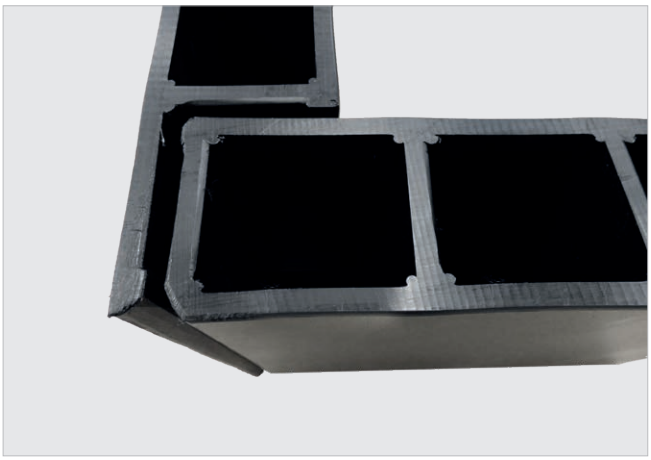
Furthermore, the cavity between the webs can, for example, be used as a leak trap or for extraction by suction.

The cross-ribbed version of the Twin-Wall Sheet provides equal rigidity in both directions. This property makes the product attractive especially for applications subject to dynamic loads or for structures subject to pressure. The maximum thickness of the product is 40 mm so the cross-ribbed version of the Twin-Wall Sheet can be welded on most conventional heated-tool butt welding machines, which enhances the processing capability of the product substantially.

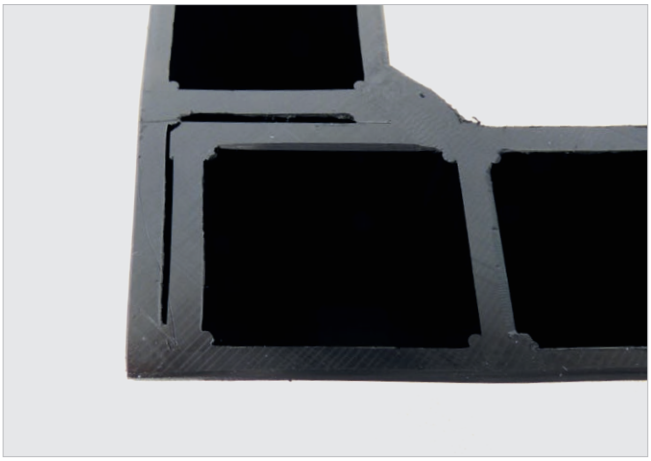
As already mentioned in Section 3.2.5, when Twin-Wall Sheets are to be welded, heated-tool butt welding is always preferable to extrusion welding. Corner elements of SIMONA® Twin-Wall Sheets are available in a version that is compatible with heated-tool butt welding.

Nevertheless, extrusion welding may be unavoidable with regard to specific structures. The following section presents possible solutions.

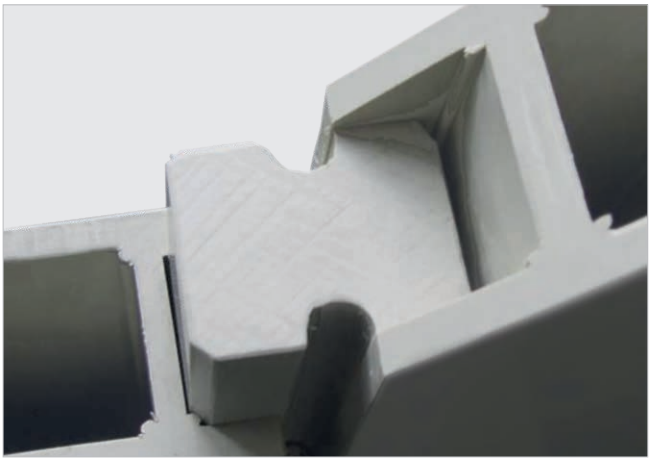
## 4.2 Solutions for extrusion welding



To make an extrusion-welded corner on a lengthways-ribbed Twin-Wall Sheet, the first step is to prefabricate the individual sheets as shown in the figure on the left.

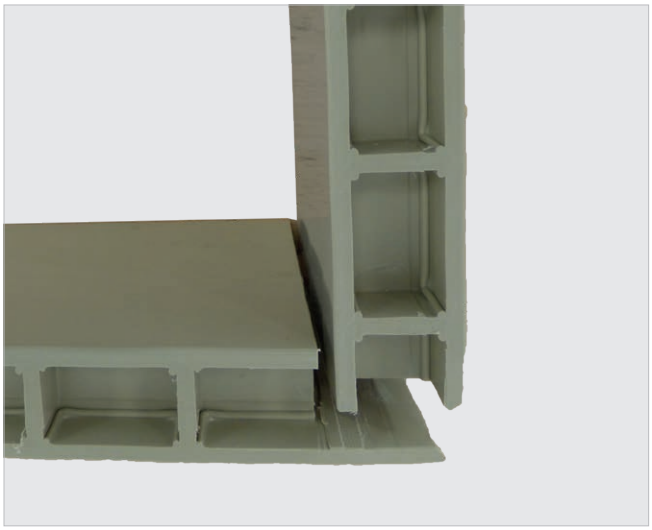


Then the sheets can be immobilised, aligned and welded with the extruder.

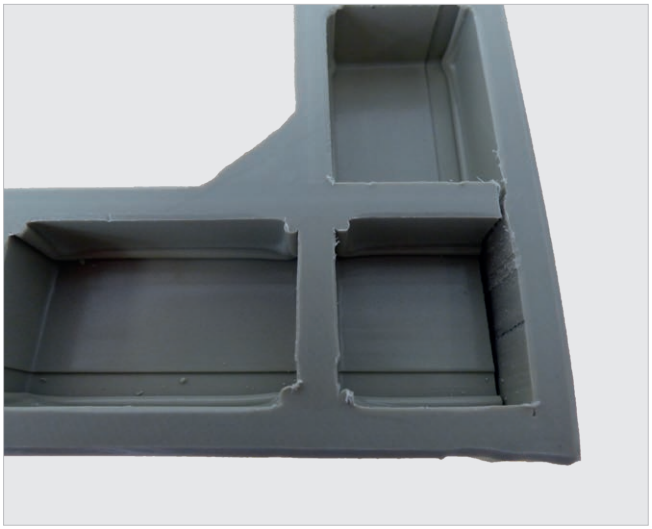


If there is to be a butt interface between two lengthways-ribbed Twin-Wall Sheets, it is advisable to insert a connection strip prior to extrusion welding.

This connection strip prevents the outer skin sheets heated by hot air from being pressed inwards by the welding pressure being applied. Consequently, the pressure required to ensure the quality of the weld seam joint is applied effectively and in a material-saving manner.



Before extrusion welding, cross-ribbed sheets have to be prepared in a similar way to lengthways-ribbed sheets.



Then the corner can be welded together.

For assistance with tank analyses, the enquiries channel is similar to the familiar procedure for DVS tanks. Please send the application form on page 19 to our Technical Service Centre (tsc@simona.de).

# 5 Storage

## General information about the storage of SIMONA® semi-finished plastic parts

- The storage of SIMONA® semi-finished plastic parts should always take place in a building devoid of moisture, sudden temperature fluctuations and direct sunlight.
- Packaging straps should, if possible, be removed after transport. In the event of repackaging it is better not to use steel straps.
- One-sided heating by a heat source should be avoided.
- PVC products, welding rods and electrically conductive plastics should be protected against moisture.
- Non-UV-stabilised materials should be protected against direct sunlight.
- In storage it is advisable to use plastic film for dust protection.
- Sheets should be stored on a stable, flat pallet that provides adequate support and is at least as large as the sheet itself. Individual sheets should be stored flat.
- It is recommended that an intermediate liner (e. g. cardboard) be placed between the pallet and the semi-finished plastic product.
- In block storage with multiple pallets stacked on top of one another we recommend using a pallet upside down as an intermediate liner in each case in order to ensure a better distribution of load.
- Special caution is required in block storage if the items are relatively thin sheets and/or foamed material.

# 6 Legal note and advice

## Legal note

Upon publication of a new edition all previous editions shall become void. The authoritative version of this publication can be found on our website at www.simona.de.

All information furnished in this publication reflects our current scope of knowledge on the date of publication and is designed to provide details of our products and potential fields of application (errors and omissions excepted, including typographical mistakes). This shall not be deemed as constituting the provision of legally binding guarantees or warranties as to specific properties of the products or their suitability for specific areas of application.

We provide warranty for the faultless quality of our products solely within the framework of our Standard Terms and Conditions of Business and only within the scope specified therein.

We shall assume no liability for the application, utilisation, processing or other use of this information or of our products. Furthermore, we shall assume no liability for any consequences related thereto. The purchaser is obliged to examine the quality and properties of these products; he shall be responsible in full for selecting, applying, utilising and processing said products as well as applying any information relating thereto, which shall also include all consequences associated with such actions. Third-party property rights shall be observed accordingly.

Any reproduction of this publication or any unconnected use of specific content taken from this publication are strictly prohibited; legal action will be taken in the event of an infringement. Exceptions hereto will require our prior approval in writing.

## Advice

Our applied technical advice is given according to our best knowledge and is based on the information you have provided and the state of the art known to us at the time such advice is furnished. The advice shall not constitute a guarantee or warranty of specific characteristics or qualities and shall not establish an independent contractual legal relationship.

We shall only be liable for cases of intent or gross negligence. Under no circumstances shall we be held liable for the correctness or completeness of information you have provided or the advisory/consulting services rendered by us on the basis of such information. Any information provided by us shall not release you from your obligation to conduct your own assessments and evaluations.

We reserve the right to update information without notice as part of our continuous research and development programme.

Our staff at the Technical Service Centre and Customer Service will be pleased to advise you on the processing and use of semi-finished thermoplastic products and the availability of our products.

Technical Service Centre
Phone +49 (0) 67 52 14-587
tsc@simona.de

Customer Service
Phone +49 (0) 67 52 14-926
sales@simona.de

# 7 Analysis form for tanks with Twin-Wall Sheets

Fax +49 (0) 67 52 14-302

SIMONA AG
Technical Service Centre
Teichweg 16
55606 Kirn

Phone
+49 (0) 67 52 14-252 or -587
Fax
+49 (0) 67 52 14-302

**Customer**

**Address line 1**

**Address line 2**

**Phone** **Fax**

The information in **bold face** is absolutely essential for the analysis. All the other questions are only necessary so that we can make recommendations for wall thickness and geometry and must be coordinated with your intentions as far as possible.

**Geometries in mm**

L = W = H =

Maximum filling height in mm FH =

**Density of medium in g/cm³**

**Material**

**Service temperatures**

Maximum service temperature (°C)/time share (%)*

/

Minimum service temperature (°C)/time share (%)*

/

* to determine mean temperature according to Miner operating conditions

**Operating conditions**

- ☐ Static load at constant temperature
- ☐ Static load at changing temperatures and filling heights
- ☐ Changing load under rugged operating conditions

Risk to persons possible in the event of an accident?

☐ Yes ☐ No

**Welding processes**

- ☐ Heated elment butt welding
- ☐ Extrusion welding
- ☐ Hot gas draw welding

**Chemical stress**

| Medium | Concentration (%) | Proportion (%) |
|---|---|---|
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

Remarks

If possible, enclose a sketch or engineering drawing.

**Date/signature**

# 8 EC Safety Data Sheet

According to 1907/2006/EG Article 31

Trade names: SIMONA® PE 100 black/SIMONA® PP-H AlphaPlus®/SIMONA® PP-C/SIMONA® PPs

### 1. Identification of substance/preparation and company

- Manufacturer details:
  SIMONA AG
  Teichweg 16
  55606 Kirn
  Germany
  Phone +49 (0) 67 52 14-0
  Fax +49 (0) 67 52 14-211

### 2. Hazards identification

- none known

### 3. Composition/Information on ingredients

- Chemical characteristics:
  SIMONA® PE 100: polymer of ethylene
  SIMONA® PP-H AlphaPlus®: polymer of propylene
  SIMONA® PP-C: copolymer of propylene
  SIMONA® PPs: polymer of propylene with flame protection
- CAS number: not applicable

### 4. First-aid measures

- General comment: medical aid is not necessary
- First-aid measures: none
- Routes of exposure: none
- Symptoms/effects: none

### 5. Firefighting measures

- Suitable firefighting appliance: water fog, foam, fire fighting powder, carbon dioxide
- Hazard warning notice: not applicable

### 6. Accidental release measures

- Person-related measures: none
- Environmental protection measures: not applicable
- Cleaning equipment: not applicable
- Unsuitable cleaning products: not applicable

### 7. Handling and storage

- Handling: no special regulations to be observed
- Storage: storable for an unlimited period

### 8. Exposure controls/Personal protection

- Special design of techn. processing facilities: not required
- Tolerance levels: none
- Exposure assessment: none
- Respiratory protection: none
- Eye protection: none
- Body protection: none

### 9. Physical and chemical properties

**Physical and chemical properties**

| | PE 100 black | PP-H AlphaPlus® | PP-C | PPs |
|---|---|---|---|---|
| Physical state | semi-finished product, solid state | semi-finished product, solid state | semi-finished product, solid state | semi-finished product, solid state |
| Colour | black | grey | grey, natural, black, white | white, grey |
| Odour | not applicable | not applicable | not applicable | not applicable |
| Crystaline melting range | – | 160 – 165 °C | 160 – 164 °C | 160 – 165 °C |
| Flash point | not applicable | not applicable | not applicable | not applicable |
| Density | 0.96 g/cm³ | 0.91 g/cm³ | 0.91 g/cm³ | 0.95 g/cm³ |

### 10. Stability and reactivity

- Thermal decomposition: above appr. 300 °C
- Hazardous decomposition products:
  - SIMONA® PE 100: Besides carbon black also carbon dioxide and water as well as low molecular parts of PE will develop during the burning process. In case of incomplete burning also carbon monoxide may arise.
  - SIMONA® PP-H AlphaPlus® /SIMONA® PP-C: Besides carbon black also carbon dioxide and water as well as low molecular parts of PP will develop during the burning process. In case of incomplete burning also carbon monoxide may arise.
  - SIMONA® PPs: At excessive temperatures the material develops hydrogen halides. Besides carbon black also carbon dioxide and water as well as low molecular parts of PP will develop during the burning process. In case of incomplete burning also carbon monoxide may arise.
- Use of stabilisers: none
- Exothermic reactions: none
- Notices regarding state of aggregation: none
- Conditions to be avoided: none
- Substances/media to be avoided: none

### 11. Toxicological information

No hazardous effects on health were observed over several years of usage.

### 12. Ecological information

No biodegradation, no solubility in water, no hazardous effects on the environment are to be expected.

- Mobility: not applicable
- Accumulation: not applicable
- Eco-toxicity: not applicable

### 13. Disposal considerations

- Can be recycled or can be disposed of together with household rubbish (acc. to local regulations).
- Waste key for the unused product: EAK-Code 120 105
- Waste name: waste of polyolefins

### 14. Transport information

- No dangerous product in respect of/according to transport regulations
- Notice/symbol transport containers: none
- Special marking for containers: none

### 15. Regulatory information

- Marking according to GefStoffV/EG: no obligation for marking
- Water danger class: class 0 (self classification)
- Domestic requirements to be observed: none

### 16. Other information

This information solely describes the safety requirements of the product(s) and is based on our current state of knowledge. It does not give any assurance concerning the product(s) described within the meaning of statutory warranty regulations.

# SIMONA worldwide

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55606 Kirn
Germany

**Plant III**
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77975 Ringsheim
Germany

**SIMONA Plast-Technik s.r.o.**
U Autodílen č.p. 23
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**Boltaron Inc.**
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**07/2018** - GB