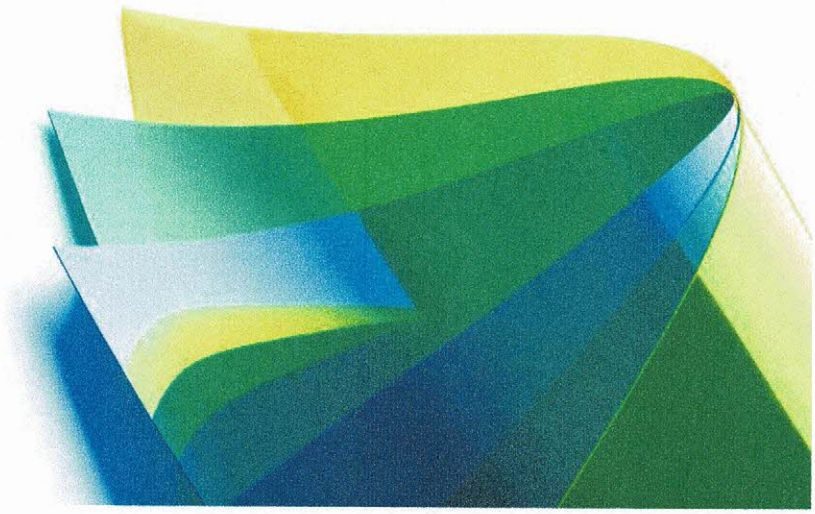
Superstrong, ultra-light sandwich panels



JAG Plastix' composite sheet

Compoform®

Properties

Introduction of JAG Plastix

JAG Plastix is a young, dynamic company based in Belgium. We represent several producers of plastics, who don't have field sales in the area. Although JAG Plastix is a young company, there is over 20 years of experience. Thanks to this experience JAG Plastix realised projects for Tarkett, Philips and supplied sheet for the wind industry in Denmark to mention a few.

JAG Plastix focuses on industrial users, distribution and projects.

Apart from Compoform composite sheet, JAG Plastix has a wide and inspiring range of products in sheet:

XT (extruded acrylic) – PC (Polycarbonate) – SPC (Structured Polycarbonate) PET- G – HIPS (High Impact Polystyrene) – SAN – ABS – PC/ABS (blend) – HDPE – PP (Polypropylene) – PVC.

Recycled products: ABS – HDPE – PP – HIPS.

If you like to know more about our products and possibilities, please contact JAG Plastix:

Mail: info@jagplastix.com

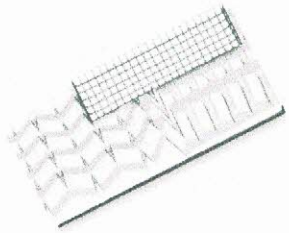
Phone: (++32) (0)470 512064

Contact form: see www.jagplastix.com

Contents

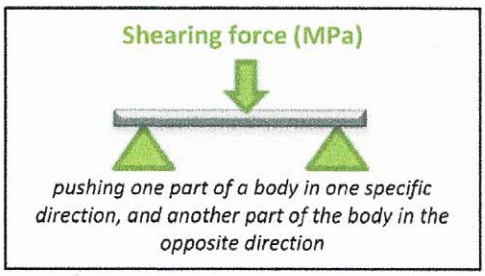
Panel components

Comfodeck® is a fiber-reinforced thermoplastic sandwich panel. The glass fibers are unidirectional arranged, flattened into a sheet and locked in place because of their polypropylene matrix. Depending on the need for strength, different sheets are positioned in a 90° angle on top of each other, forming a so called cross-ply skin. Core of the Comfodeck® is a 100% polypropylene honeycomb. Core and skin are joined in an irreversible melting process which makes delamination impossible.



Sandwich

The Comfodeck® sandwich panel consists of two superstrong yet relatively thin, symmetrical cross-ply skins and a relatively thick, but lightweight, honeycomb core. The skins takes up the normal stress applied and gives the sandwich panel a robust surface. The honeycomb core absorbs the shear forces, distributing between the skins and spreading them over a larger area, while maintaining the skin at a fixed distance. In addition the honeycomb core can absorb high levels of energy without lasting panel deformation like dents or damaged surface occurs.



pushing one part of a body in one specific direction, and another part of the body in the opposite direction

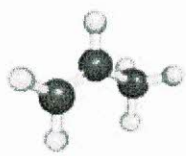
Comfodeck® has an improved bending strength and stiffness compared to monolithic materials. Doubling the core thickness, will hardly increase weight, while rigidity is multiplied by a factor 4 and overall strength is doubled.

Panel size

Compoform panels are made to order. Maximum dimensions are 2.750x10.000mm Thickness can vary between 10 and 50mm. Standard tolerances: L± 2 W± 2 H± 1, minimum L± 0,5 W± 0,5 H± 0,5.

Surface

Comfodeck® is standard finished with two different sides. Top side has robust anti-skid surface, fully integrated in the polypropylene skin and therefore long lasting. Bottom side is smooth. Upon request the panels can be fitted with as smooth or rough surface as required. The polypropylene surface provides easy cleaning, is antibacterial, without odor or taste.



Polypropylene $(C_3H_6)_n$

Safety risks

Comfodeck® presents no serious health risks in everyday use, it is not classifiable as a human carcinogen. However, sanding, cutting, chopping, sawing or trimming Comfodeck® panels, can cause short term irritation. Always take precaution and respect 'Compoform health and safety' instructions.

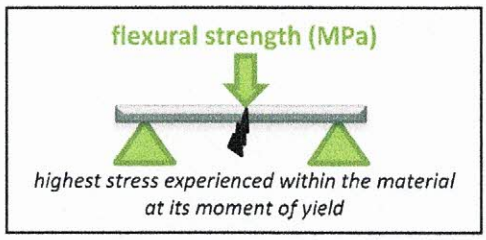
Compoform Properties

Applicable for all standard Compoform products

based upon literature, testing and experience

Strength

Comfodeck® can be produced as strong as necessary, up to bullet resistant. Variables which influence strength are: number of layers crossply in skin, orientation of fibers in crossply, percentage of glass in skin, thickness, cellsize and density of the core. Always consult one of our experts in determining the correct type of panel.



highest stress experienced within the material at its moment of yield

Maximum load is valid for short and medium term loading. When the load lasts longer than several weeks, The creep behaviour of PP should be taken in account. Allowable loads should then be reduced e.g. 50% of the values below.

	Comfodeck® standard 10mm*	Comfodeck® heavy duty 15mm**	Comfodeck® heavy duty 25mm**
E-modulus	7200 N/mm²	4500 N/mm²	4500 N/mm²
Max. flexural strength	66 N/mm²	50 N/mm²	50 N/mm²
Maximum load	1800 N/m²	3500 N/m²	7000 N/m²
Strain at max. load	12,5 mm	15 mm	20 mm

*** 3-point flexural test, ASTM C393**

Specimen: 300x100x10mm | all radii 5mm | support separation 250mm | test speed 5 mm/min | temperature 23°C

**** 3-point flexural test, ASTM C393**

Specimen: 600x200mm | all radii 5mm | support separation 500mm | test speed 10 mm/min | temperature 23°C

**** compression test, ISO 844**

Specimen: 100x100mm | all radii 5mm | test speed 2,5 mm/min | temperature 23°C

Compressive Strength

Depending on the distribution of the load and support of the panels, maximum values below apply.

	Comfodeck® ultra light	Comfodeck® standard	Comfodeck® heavy duty
Uniformly distributed	1,5 N/mm²	2,4 N/mm²	2,8 N/mm²
Local load 50x50 mm²	2,3 N/mm²	2,9 N/mm²	4,1 N/mm²

Impact Strength

Testing showed the honeycomb core can absorb high levels of energy. Temperature of the panel will compromise some of the values.

temperature	Comfodeck® standard
20°C	>250 J/m²
-20°C	110 J/m²

Weather resistance

Temperature Compoform panels are designed and tested for permanent use in temperatures ranging from -40°C to +80°C

Decomposition All Compoform material cannot rot, rust or decompose. Full recycling is possible through the Compoform recycling program.

Water Panels are moist- and waterproof, resistant to salt water, water absorption is <1,5%

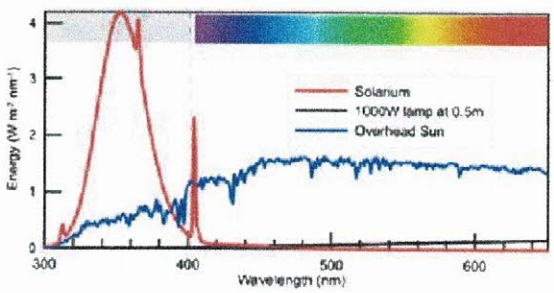
UV-protection

The sun radiation energy is usually expressed in kLy (Kilolangely) units. A conversion to other energy units is possible, the conversion into other units can be done as follows:

1 kLy = 1000 Ly (Langely)
1 kLy = 4187,5 J/cm2 = 4,19 kJ/cm2
1 kLy = 1,11632 Wh/cm2 = 11,63 kWh/m2

normal sun radiation values	
area	KLY
Scandinavia	60-80
Central Europe	100-120
Southern Europe	120-160
Northern Africa	160-180
Russia North	80
Russia South	140
Australia	180-200

Fluorescent UV lamps simulate narrow UV radiation under specific conditions. They do not cause heating effects through visible or infrared light. The comparison to service lifetime performance or correlation to outdoor exposures is not possible. However, testing according ISO4892-2:2006, simulating 10 years of oxidative thermal degradation, proved standard Compoform black face sheets provide excellent UV-protection. Change in mechanical properties in relation to the respective reference piece was less than 2%.



In practical use and testing, no important signs of aging compared to similar plastic materials were found. No surface cracks at intensive UV-irradiation appear. Only visible results from UV exposure is little fading in colour and little loss of shine.

Considering the results above, Compoform panels coloured black and any other colour of panels which are provided with UV-protection, are guaranteed not to change in mechanical properties for 15.000 hours, equal to 8-10 years, of direct sunlight exposure in areas with KLY 60-180.

Panel weight

Please respect the following weight features in kg/m³.

Comfodeck® ultra light In kg/m²					
core skin	10mm	15mm	20mm	25mm	30mm
2-layer	2,496	2,896	3,296	3,696	X
3-layer	3,344	3,744	4,144	4,544	X
4-layer	X	X	X	X	X
5-layer	X	X	X	X	X

Comfodeck® standard In kg/m²					
core skin	10mm	15mm	20mm	25mm	30mm
2-layer	2,696	3,196	3,696	4,196	4,696
3-layer	3,544	4,044	4,544	5,044	5,544
4-layer	4,392	4,892	5,392	5,892	6,392
5-layer	5,240	5,740	6,240	6,740	7,240

Comfodeck® heavy duty In kg/m²					
core skin	10mm	15mm	20mm	25mm	30mm
2-layer	X	X	X	X	X
3-layer	3,944	4,644	5,344	6,044	6,744
4-layer	4,792	5,492	6,192	6,892	7,592
5-layer	5,640	6,340	7,040	7,740	8,440

Colour: any other colour than black or white will add 0,22 kg/m²
PET-film: outside skin of PET-film will add 0,073 kg/m²
UV-protection: protective skin in PP will add 0,12 kg/m²
Paint: standard paint weights approximately 65 g/m²

Thermal insulation

The values are indicative and will not vary drastically for a different number of face sheets.

Compoform panels		
thickness	Thermal Coefficient U-value [W/(m²·K)]	Thermal Resistance R-value [(m²·K)/W]
10 mm	4	
14 mm	3,5	1,6 (0,29)
20 mm	3	
25 mm	2,5	2,3 (0,4)
30 mm	2,2	2,6 (0,46)
35 mm	2	
50 mm	1,5	

U-value is calculated according DIN-4108

Thermal Expansion

Calculated coefficient α of thermal expansion of Compoform Panels is about 32; [10^{-6}m/(m·K)]

To calculate expansion of a specific panel use: $dl = L_0 \cdot \alpha \cdot (t_1 - t_0)$

dl = change in object length (m)
L_0 = initial length of object (m)
α = linear expansion coefficient (m/m°C)
t_0 = initial temperature (°C)
t_1 = final temperature (°C)

Painting

Compoform panels can be painted, however pre-treatment of the surface is absolutely necessary.

Burn Behaviour

Uncoated Compoform panels are classified: "normally flammable" B2 or in some cases B3 "easily flammable" according to DIN 4102

Flame retarding option provides classification **B_{fl}-s1, d0** according to EN ISO 9239-1

Independent EN ISO 9239-1 (Flooring Radiant Panel) testresults:

Sample number	1	2	3
Spread of flame			
Distance [mm]	Time [s]		
50	177	185	184
100	243	246	287
150	559	-	-
Maximum spread of flame			
Distance [mm]	170	140	130
Time [s]	1336	1350	1210
Critical heat flux(CHF)			
CHF [kW/m^2]	10.1		
Heat flux (HF) after x minutes			
Time [min]		HF [kW/m^2]	
10	10.1	10.6	10.8
20	10.1	10.6	10.8
30	10.1	10.6	10.8
Light attenuation (LA)			
Max. LA [%]	144	22	22
Total LA [%.min]	1800	1800	1800

Characteristics Compoform panels burn without activator. Flame is light yellow with a blue core. The panels will swell when burning, fibers wil curl out and over time the panel will start to drip. Smell of a burning panel is comparable to burning oil.

Melting point Untreated panels wil start to melt between 160°C and 166°C

Ignition point Standard Compoform panels will start spontaneously burning when heated up to around 400°C. Flashpoint is around 355°C.

Bonding

Compoform panels are made of a glass fibre and polypropylene composite.
In the past Low Surface Energy plastics (LSE), such as Polypropylene had to be mechanically attached or solvent welded since true adhesive bonding did not work well with LSE. However, in the past years there is invested a lot in research and development of new adhesives. This allows us to take advantage of the benefits of using adhesives including design flexibility, stress distribution, bond dissimilar materials, use lighter/thinner materials as well as clean final bond appearance.

Successful long term bonding of Compoform panels to itself and to other substrates, requires careful preparation and matching of the adhesive being used with the differing materials involved. Compoform has carefully tested suppliers and selected Saba as a partner for adhesive bonding of our material. Saba products are among the few available that can be used to bond Compoform panels to substrates with another coefficient of expansion in harsh environments and long term deployment without debonding.

Other substrates to which Compoform panels can be bonded include UHMW, Delrin, fluoropolymers, rubber, polypropylene, polyethylene, polyolefin, polyurethane, silicone, thermoplastics, thermoset, urethane, ceramics, glass, fiberglass, wood, metals, stone, aggregate and concrete.

Bonding instructions

1. Clean surface from larger particals
2. Clean surface with Saba cleaner 48
3. Prepare surface with Saba 4518 primer
4. Bond with Sabatack® 750 adhesive

Cleaning the surface from dust, grease and other containment is essential. Always use a cleaner when bonding.

Instructions are based upon Compoform experience and are to be considered guidelines not provisions. Other suppliers can provide similar adhesive systems, results may vary.

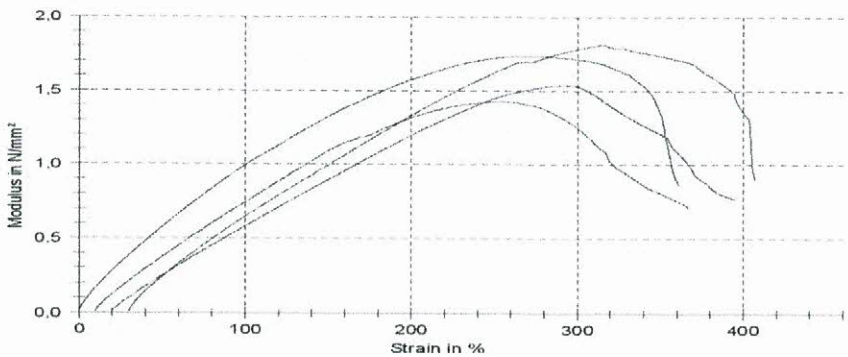
Surface treatment

Surface treatment of the Compoform panels is very effective in maximizing bonding results. Possible helpful treatments are painting, plasma-, flaming-, coronatreatment and fluorination. Always seek advice from specialized companies concerning surface treatment.

Test statistics

Bonding two standard Compoform panels to each other using Sabatack® 750

Compoform panel n=4	F break N/mm²	Strain at break %	Fmax. N/mm²	Strain at Fmax
X	0,81	367,53	1,63	267,71
S	0,09	9,98	0,18	17,73
V	10,75	2,71	10,79	6,62
min	0,71	357,02	1,43	243,82
max	0,90	376,86	1,81	286,57



Testresults

Bondingtest, using peeltesting after normklima and kataplasma

surface	product	treatment				normklima	kathaplasma
		cleaning	sanding	cleaning	activator/primer	result	result
Compoform panel	*Sabatack® 750*	48	N/A	N/A	4518	1	1

1. Good bonding, >95% cohesive break
2. Fair bonding, >75% cohesive break
3. Low bonding, >95% cohesive break
4. Insufficient bonding, >95% cohesive break

Normklima:
The sample is stored during 7 days at ≈50% relative humidity and ≈23°C

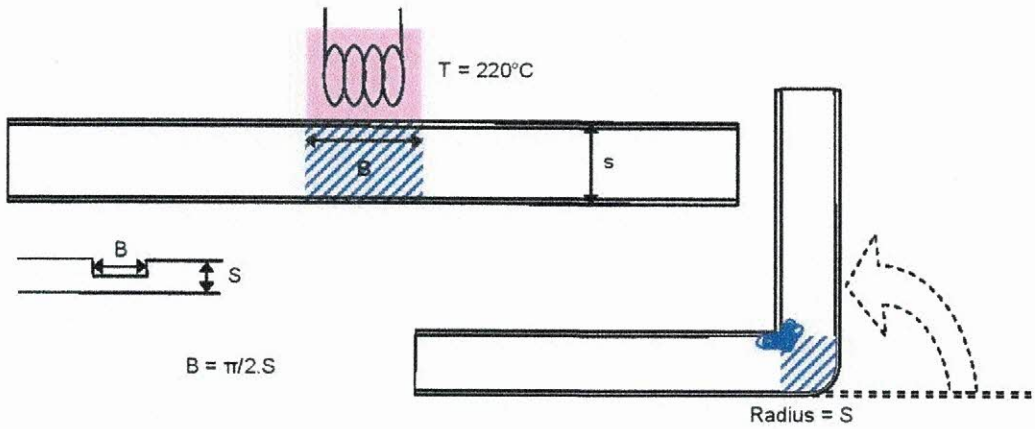
Kataplasma:
The sample is stored during 7 days in wet towels and a watertight container at ≈70°C, after which the sample is stored for 16 hours at ≈-20°C, after which the sample is stored for 24 hours at ≈50% relative humidity and ≈23°C.

For exact test results please refer to original Saba testingreport, available upon request.

Bending

Compoform panels are classified as a "thermoplastic". Thermoplastic materials become liquid at their melting point (roughly 130 degrees Celsius in this case). A major useful attribute about thermoplastics is that they can be heated to their melting point, cooled, and reheated again without significant degradation. This property is particularly useful in shaping.

Shaping, like bending, is achieved with heating a localised strip of skin material. This heated strip is lightly pressed down and will disappear into the core when the panel is bent. In the ideal situation,this excessive skin material will strengthen the panel in the bending area.



Alternatively to heating the skin and pressing it into the core, it can be removed by milling. The width of inside skin and honeycomb to be removed is the same as the thickness of the panel, the outside skin needs to remain and function as a hinge. The panel can be bent until the inner cut-out sides meet. The sides can then be welded together to create a strong profile. Without welding the shaped panel will fold back.

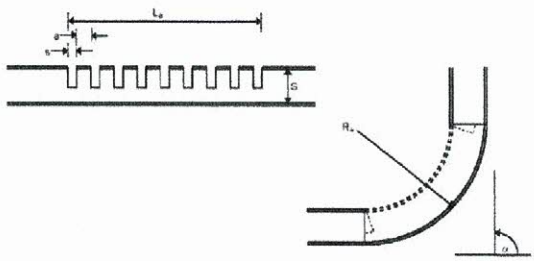
Large radius:

Bending a large radius can be done by cutting many small slits on the inside face-sheet. By choosing the right combination of the number and width of slits, the desired radius can be achieved. The following tables and diagram show the preparation of bending:

Starting data			Calculated data		
Outside radius	Ra	100mm	Outside curve length	La	La=Ra·π/2
Panel thickness	S	30mm	e.g.	La=100·π/2=157,1mm	
Bending angle	α	π/2 (90°)	Total cutting width	ls	ls=S.π/2
			e.g.	ls=30·π/2=47,1mm	

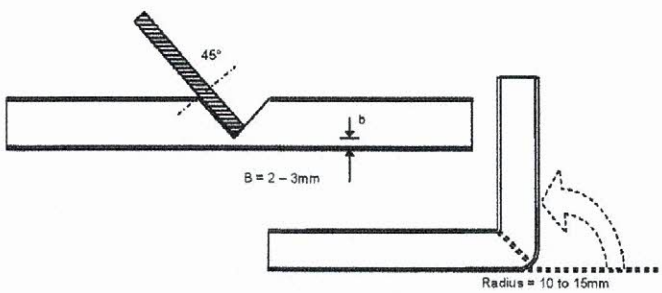
Parameter of choice		Resulting parameter			
Number of slits	n	10	Slit width	s	s=ls/n
or			e.g.	s=47,1/10=4,7mm	
Slit width	s	5mm	Number of slits	n	n=ls/S
			e.g.	n=47,1/5=9,4 rounded: 9	

Resulting calculation		
Material width between slits	a	a=(Ra.π/2-s)(n-1)-s
	e.g.	a=(157,1-5)/(9-1)-5=14mm



Small radius:

For a small radius, bending the form is best done by milling the face-sheet off. A wedge is cut in the panel and the face-sheet and core material are removed as shown in the sketch. One should be careful with painted panels, the paint may crack. The inside can be strengthened by welding or by mounting a corner profile.



Forming and Fastening

Shaping Compoform panels can be shaped using their thermoplastic properties. The panels need to be heated, formed and cooled again. Shaping is limited trough fiber orientation in the skin.

Welding Welding is an easy method of joining panels. It is fast, extremely strong and makes the joints water-tight. Welding is done with a hand-held polymer extruder and a polypropylene welding rod.

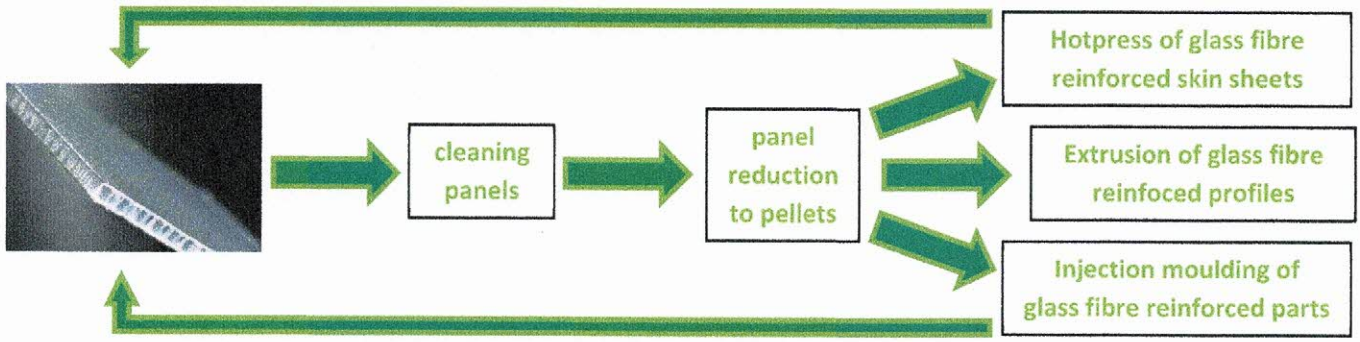
Inserts Potted inserts can be used anywhere a fastener is desired, particularly where blind holes that do not pass all the way through the panel are needed or where inserts must be "flush" with the panel skin. Once the hole is drilled and insert installed, adhesive bonding is added to hold it in place.

Rivetting All types of rivets can be used. It is advised to use rivets for shear loads, although tension loads can be supported through rivetting, other fastening will perform better.

Recycling

Using Compoform panels contributes to a better world. Compoform has a fully integrated circular production process with recycled products. Compoform recycles all production waste and panels presented after end of life. All energy used for production is certified green energy. Compoform is also shredding excess material and extruding the material into profiles and other products.

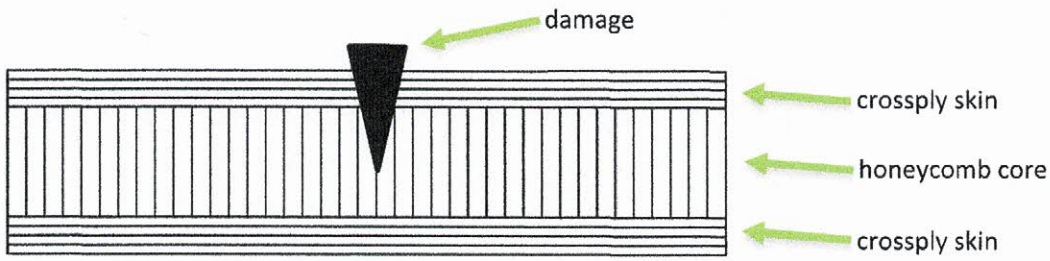
We use renewable energy



Repair

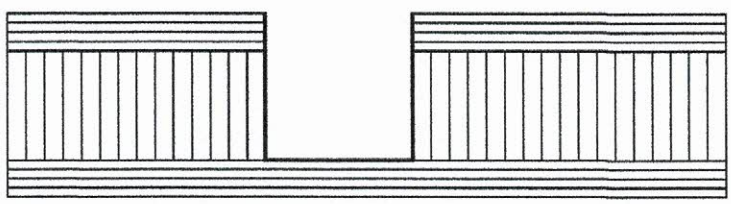
Although Compoform panels are superstrong, a panel can be damaged. Different simple methods of repair are available depending on the damage.

Compoform panels are classified as a "thermoplastic". Thermoplastic materials become liquid at their melting point (roughly 130 degrees Celsius in this case). A major useful attribute about thermoplastics is that they can be heated to their melting point, cooled, and reheated again without significant degradation. This property is particularly useful in repair.



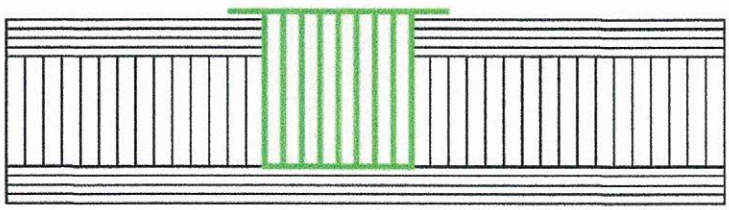
Comfodeck® panel

First step is removing the damage by milling away the damaged part in a circular or square opening. Do not remove the undamaged skin opposing the damage.



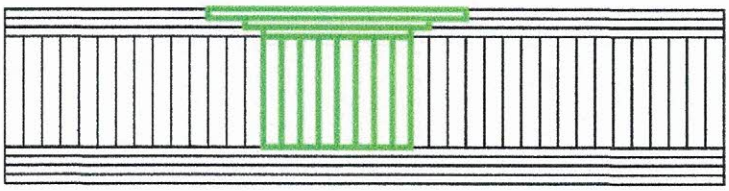
Repair option 1 (non-supportive parts)

1. Pre-treatment of opening with Compoform approved adhesive
2. Fill opening with Compoform replacement insert.
3. Cover insert with Compoform glass-PP sheet, using same fiber direction as top skin.
4. Weld sheet to panel and insert using Compoform surface protection mat and iron



Repair option 2 (supportive parts)

1. Mill progressive away skin in damaged panel
2. Mill away honeycomb leaving the undamaged skin
3. Pre-treatment of opening with Compoform approved adhesive
4. Fill opening with Compoform replacement insert.
5. Cover insert with Compoform glass-PP crossply, using same fiber orientation as skin.
6. Weld components together using Compoform surface protection mat and iron.



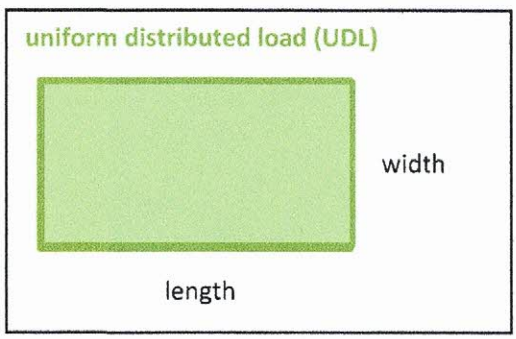
Load class scaffolding

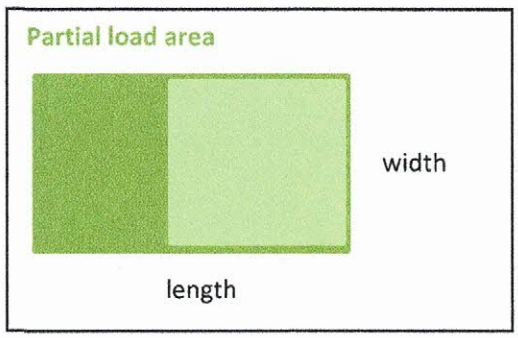
Compoform panels can be deployed as floorboards in scaffolding frames. According to EN-12811-1 and EN-1004 norm, Compoform panels are classified in different load classes. Please refer to your Compoform contact for load class of a particular panel.

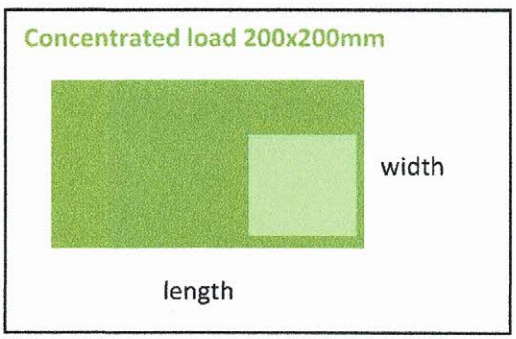
CEN European Committee for Standardization

Please note the load specified in EN norms is a minimum load capacity. Compoform panels maximum load exceeds the load specified in CEN standardisation..

Minimum load capacity according to: EN-12811-1 *(acces and working scaffolds)* **and EN-1004** *(mobile access and working towers)*					
load class	UDL (KN/m²)	concentrated load (KN/500x500mm)	concentrated load (KN/200x200mm)	partial load area (KN/m²)	partial load factor
1	0,75	1,5	1	-	-
2	1,5	1,5	1	-	-
3	2,0	1,5	1	-	-
4	3,0	3,0	1	5,0	0,4
5	4,5	3,0	1	7,5	0,4
6	6,0	3,0	1	10,0	0,5

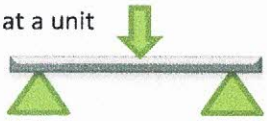






E-modulus in bending: ultra-light

The values for the E-modulus in bending are determined for three-point-bending at a unit load of 1N per mm panel width. The given values are calculated values and not experimental data. The data has been created with great care. However, they can only be used as an indication.

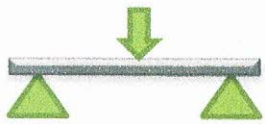


Span length	Bending deformation	Shear deformation	Total deformation	
mm	mm	mm	mm	N/mm²
10mm Comfodeck® ultra-light				
230	0,68	0,41	1,09	2786
300	1,52	0,53	2,05	3294
600	12,13	1,07	13,20	4092
1000	56,16	1,78	57,93	4315
15mm Comfodeck® ultra-light				
230	0,29	0,27	0,56	1600
300	0,64	0,36	1,00	2000
600	5,15	0,71	5,86	2730
1000	23,83	1,19	25,02	2960
1500	80,44	1,78	82,22	3040
20mm Comfodeck® ultra-light				
230	0,16	0,21	0,36	1043
300	0,35	0,27	0,62	1358
600	2,83	0,54	3,37	2005
1000	13,11	0,89	14,00	2232
1500	44,24	1,34	45,57	2314
25mm Comfodeck® ultra-light				
230	0,10	0,16	0,26	735
300	0,22	0,21	0,44	987
600	1,79	0,43	2,22	1560
1000	8,28	0,71	8,99	1780
1500	27,93	1,07	29,00	1862
2000	66,21	1,43	67,64	1892
2500	129,32	1,78	131,10	1907
30mm Comfodeck® ultra-light				
230	0,07	0,14	0,21	546
300	0,15	0,18	0,33	752
600	1,23	0,36	1,59	1260
1000	5,70	0,59	6,29	1472
1500	19,23	0,89	20,12	1553
2000	45,57	1,19	46,76	1584
2500	89,00	1,49	90,49	1599

These values are calculated for Comfodeck® with an ultra-light honeycomb core.

E-modulus in bending: standard

The values for the E-modulus in bending are determined for three-point-bending at a unit load of 1N per mm panel width. The given values are calculated values and not experimental data. The data has been created with great care. However, they can only be used as an indication.

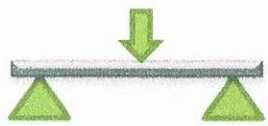


Span length	Bending deformation	Shear deformation	Total deformation	
mm	mm	mm	mm	N/mm²
15mm Comfodeck®				
230	0,20	0,27	0,47	1912
300	0,44	0,36	0,80	2510
600	3,53	0,71	4,24	3771
1000	16,35	1,18	17,54	4224
1500	55,19	1,78	56,97	4389
20mm Comfodeck®				
230	0,11	0,20	0,31	1215
300	0,24	0,27	0,51	1665
600	1,92	0,53	2,45	2753
1000	8,88	0,89	9,77	3199
1500	29,96	1,34	31,30	3370
2000	71,03	1,78	72,81	3434
25mm Comfodeck®				
230	0,07	0,16	0,23	840
300	0,15	0,21	0,36	1186
600	1,20	0,43	1,63	2121
1000	5,56	0,71	6,28	2549
1500	18,78	1,07	19,85	2720
2000	44,52	1,43	45,94	2786
2500	86,94	1,78	88,73	2818
30mm Comfodeck®				
230	0,05	0,14	0,18	615
300	0,10	0,18	0,28	889
600	0,82	0,36	1,18	1695
1000	3,81	0,59	4,41	2102
1500	12,86	0,89	13,75	2272
2000	30,49	1,19	31,68	2338
2500	59,55	1,49	61,03	2370

These values are calculated for Comfodeck® with a normal honeycomb core.

E-modulus in bending: heavy duty

The values for the E-modulus in bending are determined for three-point-bending at a unit load of 1N per mm panel width. The given values are calculated values and not experimental data. The data has been created with great care. However, they can only be used as an indication.



Span length	Bending deformation	Shear deformation	Total deformation	
mm	mm	mm	mm	N/mm²
20mm Comfodeck® heavy duty				
230	0,09	0,20	0,29	1312
300	0,19	0,27	0,46	1850
600	1,52	0,53	2,05	3294
1000	7,02	0,89	7,91	3952
1500	23,69	1,33	25,02	4215
2000	56,16	1,78	57,93	4315
2500	109,68	2,22	111,90	4364
25mm Comfodeck® heavy duty				
230	0,05	0,16	0,22	897
300	0,12	0,21	0,33	1303
600	0,94	0,43	1,37	2521
1000	4,37	0,71	5,08	3149
1500	14,75	1,07	15,82	3414
2000	34,96	1,42	36,38	3518
2500	68,27	1,78	70,05	3569
30mm Comfodeck® heavy duty				
230	0,04	0,14	0,17	652
300	0,08	0,18	0,26	967
600	0,64	0,36	1 ,00	2000
1000	2,98	0,59	3,57	2591
1500	10,06	0,89	10,95	2855
2000	23,83	1,19	25,02	2960
2500	46,55	1,49	48,04	3012
35mm Comfodeck® heavy duty				
230	0,03	0,12	0,14	495
300	0,06	0,15	0,21	746
600	0,47	0,31	0,77	1631
1000	2,16	0,51	2,67	2184
1500	7,29	0,76	8,06	2443
2000	17,29	1,02	18,30	2548
2500	33,76	1,27	35,03	2601

These values are calculated for Comfodeck® with a heavy duty honeycomb core.

Chemical resistance

The following list shows the particular resistance of Compoform panels against various chemicals. Surface coatings can alter the chemical resistance.

Compoform panels			
chemical	resistance	chemical	resistance
Acetic acid <40%	+	Fluorocarbon	o
Acetone	+	Formic acid 10%	+
Ammonia (aqueous)	+	Heptane	-
Benzene	o	Hexene	+
Butane	+	Hydrochloric acid <30%	+
Butatonic acid 10%	+	Hydrogen peroxide (solid) <28%	+
Butyl acelate	o	Isooctane	+
Carbon dioxide	+	Kerosene	+
Carbon disulphide	+	Lyes (aqueous)	+
Carbon Tetrachloride	-	Methanol 5%	+
Chlorbenzene	+	Methyl Alcohol	+
Chlorine (aqueous)	+	Mineral oil / grease	+
Chloroform	o	N-hexane	o
Chromic Acid 40%	+	Neopentane	+
Cottonseed oil	+	Nitric acid <30%	+
Cresol	+	Nitric acid 40-50%	o
Cyclohexane	+	Oleic acid	+
Cyclohexanone	o	Oxygen	+
Decalin	-	Pentane	o
Detergent solution	+	Perchloric acid (2N) 20%	+
Dichlormethane	o	Petrol / gasoline	o
Diesel / fuel oil	+	Petroleum ether	o
Diethyl ether	+	Phenol Solution 5%	+
Dimethyl formamide	+	Sodium carbonate (solid) <20%	+
Distilled water	+	Sodium chloride (solid) 10%	+
Dioxane	+	Sodium hydroxide (solid) <60%	+
Ethyl acetate	o	Sulphuric acid <96%	+
Ethyl alcohol <95%	+	Tetralin	-
Ethyl benzene	-	Toluene	o
Ethyl chloride gas	-	Transformer oil	+
Ethyl ether	+	Trichlorethylene	-
Ethylene dichloride	+	Turpentine	+
Ethylene glycol	+	Water	+
Ethylene oxide	+	Xylene	-

+ resistant | o limited resistant | - not resistant | samples tested at temperature of 20°C

Compoform urges to predefine and verify chemical resistance in every specific case. This valuation is based on testing and bibliographical reference and therefore not binding.

Safety risks

Common names for the Compoform composite are fiberglass, glass-reinforced plastic (GRP), glass-fiber reinforced plastic (GFRP) or GFK (from German: Glasfaserverstärkter Kunststoff). Because glass fiber itself is sometimes referred to as "fiberglass", the Compoform composite is also called "fiberglass reinforced plastic". Compoform adopts the convention that "fiberglass" refers to the complete glass fiber reinforced composite material, rather than only to the glass fiber within it.

Fiberglass will irritate the eyes, skin, and the respiratory system. Potential symptoms include irritation of eyes, skin, nose, throat, dyspnea (breathing difficulty); sore throat, hoarseness and cough.[8] Scientific evidence demonstrates that fiberglass is safe to manufacture, install and use when recommended work practices are followed to reduce temporary mechanical irritation.[9]

The American Conference of Governmental Industrial Hygienists as well as the International Agency for Research on Cancer (IARC) say glass fiber is in group A4: "Not classifiable as a human carcinogen".[1] Dutch Health Organisation (Nederlandse Gezondheidsraad) declared glass fiber non-carcinogen but restricted safe working conditions to maximum two respirable fibers per cm^3

The Occupational Safety and Health Administration (OSHA) has set the legal limit (permissible exposure limit) for fiberglass exposure in the workplace as 15 mg/m^3 total and 5 mg/m^3 in respiratory exposure over an 8-hour workday. The National Institute for Occupational Safety and Health (NIOSH) has set a recommended exposure limit (REL) of 3 $fibers/cm^3$ (less than 3.5 micrometers in diameter and greater than 10 micrometers in length) as a time-weighted average over an 8-hour workday, and a 5 mg/m^3 total limit.[3]
The European Union and Germany classify synthetic vitreous fibers as possibly or probably carcinogenic, but fibers can be exempt from this classification if they pass specific tests. Evidence for these classifications is primarily from studies on experimental animals and mechanisms of carcinogenesis. Glass wool epidemiology studies have been reviewed by a panel of international experts convened by the IARC. These experts concluded: "Epidemiologic studies published during the 15 years since the previous IARC monographs review of these fibers in 1988 provide no evidence of increased risks of lung cancer or mesothelioma (cancer of the lining of the body cavities) from occupational exposures during the manufacture of these materials, and inadequate evidence overall of any cancer risk."[2] Similar reviews of the epidemiology studies have been conducted by the Agency for Toxic Substances and Disease Registry (ATSDR),[4] the National Toxicology Program,[5] the National Academy of Sciences[6] and Harvard's Medical and Public Health Schools[7] which reached the same conclusion as IARC that there is no evidence of increased risk from occupational exposure to glass fibers.

Precaution

Handling continuous fiberglass filament before it is bonded into the matrix does not usually generate sufficient dust or airborne fibres to cause even short term irritation.

When workers sand, cut, chop, saw or trim fiberglass, it produces dust that contains fibers[10]. These fibers can come into contact with the skin and get into the eyes. Supervisors should ensure that workers know how to protect themselves from these risks.

Appropriate personal protective equipment helps employees to protect themselves from fiberglass exposure. Safety glasses or goggles will prevent the fibers from entering the eyes. Masks that cover the nose and mouth can prevent workers from inhaling or swallowing the fibers. Wearing gloves reduces skin contact with the fiberglass and may prevent irritation. Workers regularly exposed to this type of dust should wear masks with respirators, which contain filters that prevent dust and other particles from entering the mouth and respiratory system.

Selecting the right clothes can help minimize contact with the fibers, reducing the risk for irritation and injury. Workers should wear pants and long-sleeve shirts when working with this material. The fabric will prevent fiberglass dust from irritating the skin and reduce the risk of fibers becoming embedded in the skin.

Workers should wash their skin daily to reduce the risk of skin irritation. If fiberglass dust enters the eyes, the worker should immediately rinse the affected eye with large amounts of water. While irrigating the eyes, the worker should occasionally lift the upper and lower eyelid to ensure the water washes away any fibers. Larger fiberglass splinters that have become embedded in the skin can be removed using tweezers.

One way to prevent inhalation is to work in well-ventilated areas. Opening a window or door helps reduce dust levels. Workers should also use a shop vacuum to remove fiberglass dust from the work area. Any clothing worn while working with fiberglass should be laundered separately from other clothing items. The washing machine should be rinsed before washing other types of clothing.

1. *"13th Report on Carcinogens". National Toxicology Program. US Dept HHS. 2011. Retrieved 5 Feb 2013.*
2. *"IARC Monographs Programme Re-evaluates Carcinogenic Risks from Airborne Man-Made Vitreous Fibres" (Press release). IARC. 24 Oct 2001.*
3. *"CDC – NIOSH Pocket Guide to Chemical Hazards – Fibrous glass dust". www.cdc.gov. Retrieved 2015-11-03.*
4. *Agency for Toxic Substances and Disease Registry (September 2004). "Toxicological Profile for Synthethic Vitreous Fibers" (PDF). US Dept HHS. pp. 5, 18.*
5. Charles William Jameson, "Comments on the National Toxicology Program's Actions In Removing Biosoluble Glass Wool Fibers From The Report On Carcinogens," September 9, 2011.
6. NRC Subcommittee on Manufactured Vitreous Fibers. 2000. Review of the U.S. Navy's Exposure Standard for Manufactured Vitreous Fibers. National Academy of Sciences, National Research Council, Washington, D.C.: National Academy Press.
7. *Lee, I-Min; Hennekens, Charles H.; Trichopoulos, Dimitrios; Buring, Julie E. (June 1995). "Man-made vitreous fibers and risk of respiratory system cancer: a review of the epidemiologic evidence" (PDF). JOEM. 37 (6): 725–38. PMID 7670920.*
8. *"Fibrous Glass Dust". OSHA. U.S. Department of Labor.*
9. *"Insulation Facts #62 "Health and Safety Facts for Fiber Glass", Pub. No. N040" (PDF). North American Insulation Manufacturers Association ("NAIMA"). May 2012. Archived from the original (PDF) on 2015-02-04.*
10. Türschmann, V.; Jakschik, C.; Rother, H.-J. (March 2011) White Paper, Topic: "Clean Air in the Manufacture of Glass Fibre Reinforced Plastic (GRP) Parts". GRP Technique & Service

Technical Datasheet 2/3

Properties

Thermal Properties

Compoform panels are designed for permanent use in temperatures ranging from -40°C to +80°C

Melting point:	160°C	ISO 11357-1
Flame point:	>355°C	ISO 11357-1
Decomposition temperature:	>300°C	ISO 11357-1
Flash temperature:	>400°C	ISO 11357-1
Thermal expansion:	32; [10^{-6}m/(m·K)]	ASTM D696-16
Thermal Coefficient U-value at 14mm:	3,5; [W/(m²·K)]	DIN 4108
Thermal Resistance R-value at 14mm:	1,6 (0,29); [(m²·K)/W]	ASTM E1461
Fire rating:	B1, normal flammable	DIN 4102

Strength

Comfodeck® can be produced as strong as necessary, up to bullet resistant. Variables which influence strength are: number of face sheets in skin, orientation of fibers in crossply, percentage of glass in skin, thickness, cellsize and density of the core.
Maximum load is valid for short and medium term loading. When the load lasts longer than several weeks, The creep behaviour of PP should be taken in account.

Decomposition:

All Compoform material cannot rot, rust or decompose. The Compoform panel is resistant against most chemicals, oils and agents. The resistance correlates with the properties of polypropylene and glass. Full recycling is possible through the Compoform recycling program.

Water:

Panels are moist- and waterproof, resistant to salt water, water absorption is <1,5%, solubility in water is nihil.

Configuration:

Compoform panels are made to order and available in different configurations:

1. Core density: Ultra-light / standard / heavy-duty
2. Skin face sheets: 2/3/4/5
3. Thickness: 10/15/20/25/30mm

Area weight: 2,5-7 kg/m² Other configurations and fiber orientation are available upon request.
It should be noted that the choice of material, tooling and configuration will greatly dictate processing conditions and technical performance. Always consult one of our experts in determining the correct configuration of panel per individual deployment.

Delivery Conditions:

Max dimensions:	10.000x2.750mm
Standard tolerance:	L± 2 W± 2 H± 1
Minimum tolerance:	L± 0,5 W± 0,5 H± 0,5

General Disclaimer

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Technical Datasheet 1/3

Company and product information

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The Netherlands

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E: info@compoform.com
W: www.compoform.com

Product Identification: Comfodeck®
Compoform panel

panel structure

Comfodeck® is a fiber-reinforced thermoplastic sandwich panel. The glass fibers are unidirectional arranged, flattened into a sheet and locked in place because of their polypropylene matrix. Depending on the need for strength, different sheets are positioned in a 90° angle on top of each other, forming a so called cross-ply skin. Core of the Comfodeck® is a 100% polypropylene honeycomb. Core and skin are joined in an irreversible melting process which makes delamination impossible.

Face sheets:

Standard face sheets have unidirectional arranged glass fibers and are positioned identical on both top and bottom side of the panel.

Colour	Thickness	Weight	Fiber type	Fiber content	Matrix	Tensile strength
black	0,25mm	0,424 kg/m^2	E-glass	70% by Wt.	Polypropylene	1.200 MPa at 0°
natural	0,25mm	0,424 kg/m^2	E-glass	70% by Wt.	Polypropylene	1.200 MPa at 0°

Honeycomb:

Standard honeycomb is made from 100% polypropylene and available in standards below. Other cores are available upon request.

Standard	Material	Density	Colour	Compressive strength
Ultra-light	Polypropylene	80 kg/m^3	Natural	1,2 MPa
Standard	Polypropylene	100 kg/m^3	Natural	2,4 MPa
Heavy-duty	Polypropylene	140 kg/m^3	Natural	3,5 MPa

Colour:

Different colours other than white or black are available by adding a layer of coloured PP in the production process. Properties are equal for every even colour other than print.

Colour	Material	Weight	Thickness	UV-resistance
any	Polypropylene	0,20 kg/m^2	200 µ	15.000 hours

Impact strength:

For Compoform standard panels.

temperature	impact strenght
20°C	>250 J/m^2
-20°C	110 J/m^2

Technical Datasheet 3/3

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