

Product Information
PVC-C

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1 General

1.1 Classification

PVC-C is a post-chlorinated PVC which is used primarily in the chemical industry for chlorine electrolysis, in electroplating and in the paper industry.

1.2 Product Types

PVC-C CORZAN FM 4910 and PVC-C CORZAN FM 4910 G2 are post-chlorinated, low-flammability PVCs and are listed by Factory Mutual (FM) as materials providing increased fire protection. They are deployed in the semiconductors industry and in cleanroom engineering.

PVC-C CORZAN Industrial Grade is a post-chlorinated PVC-C featuring extreme chemical resistance.

1.3 Explanation

PVC is a homopolymer with scarcely branched macromolecular chains and a molar mass of 40,000 to 150,000. The material normally used in industrial applications is PVC-U (unplasticized PVC or rigid PVC).

Post-chlorinated polyvinyl chloride (PVC-C) is a variant of PVC-U. To a certain extent, it can be more difficult to process than PVC-U. However, it has a higher heat distortion temperature, close to 100 °C, and is particularly resistant to chlorine attack.

1.4 Properties

Special properties:

- Low flammability (PVC-C CORZAN FM 4910 and PVC-C CORZAN FM 4910 G2 certified to FM 4910)
- High heat distortion temperature
- Excellent impact strength
- Chemical resistance
- Excellent processing capability

1.5 Approvals

PVC-C CORZAN FM 4910 and PVC-C CORZAN FM 4910 G2 are low-flammability materials in accordance with Factory Mutual (FM) 4910. PVC-C CORZAN Industrial Grade, PVC-C CORZAN FM 4910 and PVC-C CORZAN FM 4910 G2 achieve normal flammability according to DIN 4102.

1.6 Areas of Use

- Chemical industry
- Chlorine electrolysis
- Paper and cellulose processing
- Semiconductor industry (PVC-C CORZAN FM 4910 and PVC-C CORZAN FM 4910 G2)
- Cleanroom technology (PVC-C CORZAN FM 4910 and PVC-C CORZAN FM 4910 G2)
- Pharmaceutical industry
- Metal processing
- Mining
- Textile industry
- Pharmaceutical industry (PVC-C CORZAN FM 4910 and PVC-C CORZAN FM 4910 G2)
- Electronics
- Hot water supply
- Electroplating

1.7 Supplementary Product Groups

SIMONA® PVC-CAW

SIMONA® PVDF

2 Product Range

2.1 SIMONA® PVC-C CORZAN Industrial Grade

Sheets:

extruded; light grey, grey; protective film on one side
Thicknesses: 3.2 mm to 12.7 mm
Format: 2,440 mm x 1,220 mm

Solid rods:

extruded; grey
Lengths: 1,525 mm, 3,050 mm
Diameters: 6.4 mm to 101.6 mm
extruded; light grey
Lengths: 1,000 mm, 2,000 mm
Diameters: 8 mm to 300 mm

Welding rods:

extruded; round; light grey
Diameters: 3 mm and 4 mm

2.2 SIMONA® PVC-C CORZAN FM 4910

Sheets:

extruded; white; protective film on one side
Thicknesses: 3.2 mm to 25.4 mm
Formats: 2,440 mm x 1,220 mm

Welding rods:

extruded; round; white
Diameters: 3 mm and 4 mm

2.3 SIMONA® PVC-C CORZAN FM 4910 G2

Sheets:

extruded; white; protective film on one side
Thicknesses: 3.2 mm to 25.4 mm
Formats: 2,440 mm x 1,220 mm and
3,048 mm x 1,524 mm

Welding rods:

extruded; round; white
Diameters: 3 mm and 4 mm

3 Technical Information

3.1 Material Specifications

	PVC-C CORZAN Industrial Grade	PVC-C CORZAN FM 4910	PVC-C CORZAN FM 4910 G2
Moulding compound standard extruded	DIN EN ISO 1163, Part 1	DIN EN ISO 1163, Part 1	DIN EN ISO 1163, Part 1
Moulding compound extruded	PVC-C, EGP, 122-05-T23	PVC-C, EGP, 114-05-T28	PVC-C, EGP, 114-05-T28
Density, g/cm ³ ISO 1183	1,520	1,560	1,540
Yield stress, MPa DIN EN ISO 527	60	57	54
Elongation at yield, % DIN EN ISO 527	5	4	4
Elongation at break, % DIN EN ISO 527	35	30	30
Tensile modulus of elasticity, MPa DIN EN ISO 527	2400	2600	2500
Impact strength, kJ/m ² DIN EN ISO 179	no break	no break	no break
Notched impact strength, kJ/m ² DIN EN ISO 179	≥ 7	13	10
Ball indentation hardness, MPa/mm ² DIN EN ISO 2039-1	110	100	100
Shore hardness, D, ISO 868	80	82	72
Mean coefficient of linear thermal expansion, K ⁻¹ DIN 53752	0,8 x 10 ⁻⁴	0,7 x 10 ⁻⁴	0,7 x 10 ⁻⁴
Fire behaviour DIN 4102	normal flammability	FM 4910 certified	FM 4910 certified
Spec. surface resistivity, ohms DIN IEC 60093	10 ¹⁵	10 ¹⁵	10 ¹⁵
Temperature range, °C	-40 to +95	-40 to +95	-40 to +85
Physiologically safe according to German Federal Institute for Risk Valuation "BfR"	no	no	no

3.2 Fire Behaviour

SIMONA® PVC-C is self-extinguishing. This characteristic is associated with the minimum oxygen concentration necessary for combustion. This so-called oxygen index is well above the proportion of oxygen in the air. The oxygen index for the various products is listed below.

For SIMONA® PVC-C CORZAN FM 4910: 60%

For SIMONA® PVC-C CORZAN FM 4910 G2: 60%

For SIMONA® PVC-C CORZAN Industrial Grade: 60%

PVC-C CORZAN FM 4910 and PVC-C CORZAN FM 4910 G2 are low-flammability materials in accordance with Factory Mutual (FM) 4910.

PVC-C CORZAN Industrial Grade, PVC-C CORZAN FM 4910 and PVC-C CORZAN FM 4910 G2 have normal flammability in accordance with DIN 4102.

3.3 Performance in Outdoor Use

SIMONA® PVC-C features best-possible stability for outdoor use.

3.4 Physiological Behaviour

SIMONA® PVC-C does not meet the requirements issued by the German Federal Institute for Risk Assessment (BfR).

3.5 Chemical Resistance

SIMONA® PVC-C is chemically resistant to many diluted and concentrated acids, alkalis and salts. The same applies to alcohols, aliphatic compounds and various oils.

Aromatic compounds, halogenated hydrocarbons, esters and ketones tend to etch the material.

PVC-C is not resistant to very strong oxidants; there is a risk of tension cracks forming at welding seams and in cold-formed and thermoformed areas.

For detailed information, please contact our Applications Technology Department.

3.6 Processing Instructions

SIMONA® PVC-C CORZAN	
Industrial Grade:	-40 to +95 °C
SIMONA® PVC-C CORZAN	
FM 4910:	-40 to +95 °C
SIMONA® PVC-C CORZAN	
FM 4910 G2:	-40 to +85 °C

3.7 Water Absorption

SIMONA® PVC-C may absorb a small amount of moisture. In vacuum thermoforming this may manifest itself in blistering. In such cases, drying should be performed in a forced-air oven or air expulsion oven at approx. 55 °C. Drying time depends on the level of moisture and sheet thickness. As a rough guide, we recommend approx. 1 h per mm.

4 Processing Instructions

SIMONA® PVC-C can be processed with maximum efficiency. Virtually all methods of processing and forming usually associated with thermoplastics can be applied accordingly.

4.1 Mechanical Processing

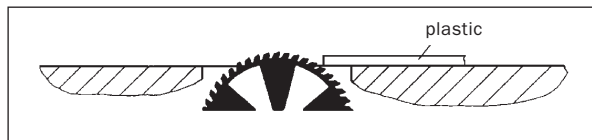
The sheet temperature before mechanical processing should be at least 25 °C.

Sawing

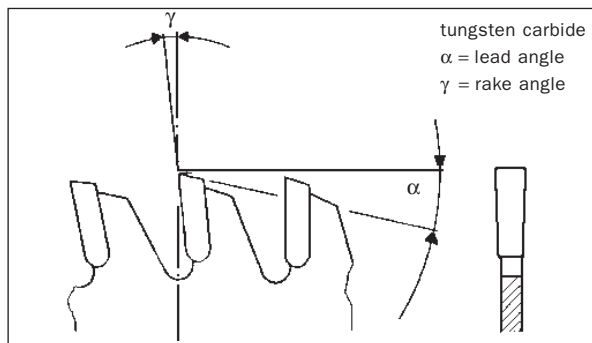
SIMONA® PVC-C is very easy to machine by chip-forming processes. Using blunt tools can cause untidy edges and microcracks due to the increase in temperature.

Circular-sawing

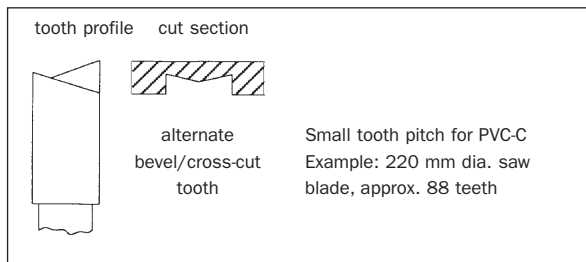
To achieve neat surfaces, the saw blade should only project slightly beyond the plastic sheet being cut. Sheets should only be cut with relief-ground saw blades.



Use of carbide-tipped saw blades improves cutting performance and quality, while also considerably extending the tool life of the saw blade.



Tooth profiles for circular saws (carbide-tipped)



Assessment of tooth profile for PVC-C

Parameters for circular-sawing of plastics:

Circular-sawing			PVC-C
Tungsten carbide (TC)			
α	lead angle	°	5–10
γ^k	rake angle	°	0–5
t	tooth pitch*	mm	3–5
v	cutting speed	m/min	2,500–4,000

* For brittle materials, select a small tooth pitch

In practice, sawing operations are influenced not only material-specific parameters but also by commercial considerations and permissible peripheral speeds (product of rpm and blade diameter).

Maximum permitted rpm for saws = 100 m/s cutting speed

Band-sawing

In this case, heat dissipation is more efficient owing to the rotating saw band. Band saws are suitable for cutting pipes, blocks, thick sheets and curves. The saw bands have to be sharp and set correctly (± 1 mm) in order to ensure a clean cut.

Parameters for band-sawing plastics:

Band-sawing		PVC-C
High speed steel (HSS)		
α	lead angle °	30–40
γ^B	rake angle °	0–5
t	tooth pitch* mm	2–5
v	cutting speed m/min	to 2,000

* For brittle materials, select a small tooth pitch

Water-jet cutting

SIMONA® PVC-C is suitable for water-jet cutting.

Cutting (guillotine shears)

Up to a thickness of 4 mm, SIMONA® PVC-C can be cut using guillotine shears without any problems.

Well sharpened, undamaged blades and a maximum play of ± 0.1 mm between the moving blade and the stationary blade will produce satisfactory cutting results.

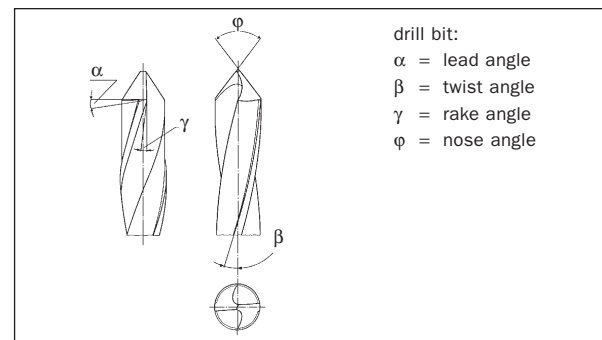
Die-cutting

Die-cutting of thin sheets can be performed on standard presses without any difficulty. To prevent stresses occurring, the wedge angle of the die-cutting tool should be between 40° and 55° . SIMONA® PVC-C can be die-cut up to a sheet thickness of about 3 mm. In cold conditions, PVC-C should be stored at room temperature for a sufficient period prior to die-cutting and cutting with guillotine shears so that a certain amount of flexibility is achieved.

Drilling

Holes can be drilled in thermoplastic semi-finished products using standard twist drills. Generally speaking, no specific grinding is required. Drill bits should have relief-ground cutting edges and a small twist angle. If the rake angle of the bit has been negatively ground for drilling holes, this prevents the bit from jamming and the material from breaking. This is to be recommended up to a drill-hole depth of approx. 15 mm. If the drillhole is longer than $5 \times d$, it is advisable to withdraw the bit from the hole a number of times in order to extract the shavings efficiently. If the drillhole diameter is in excess of 10 mm, pre-drilling is to be recommended.

Drillholes exceeding a diameter of 20 mm can be created more efficiently using double-edged bits with a pilot, whilst drillholes exceeding a diameter of 40 mm are best made with circle cutters.



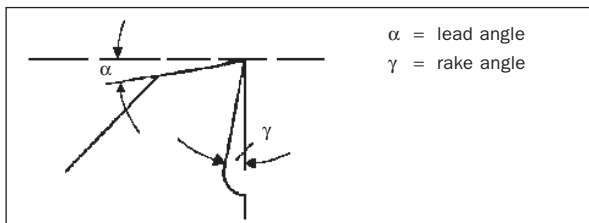
Parameters for drilling holes in plastics:

Drilling		PVC-C
α	lead angle °	6–10
β	twist angle °	12–16
γ_1	rake angle °	3–6
ϕ	nose angle °	80–120
v	cutting speed m/min	30–80
s	forward feed mm/U	0.1–0.5

Cutting speed and forward feed depend on the depth of the drillhole. The thermoplastic material must not smear (high cutting speed for thin-walled workpieces).

Milling

All standard milling machines used in metal machining and designed for high speeds are suitable. High cutting speeds and a small depth of cut are advantageous.

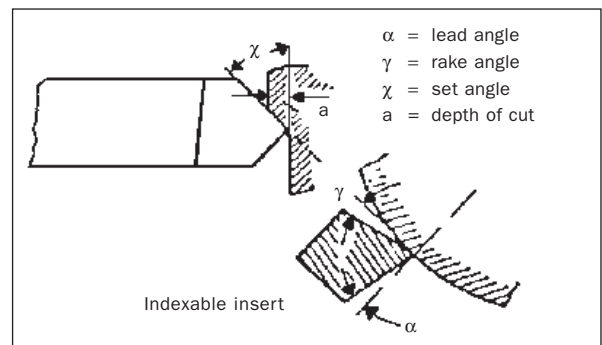


Parameters for milling plastics:

Milling		PVC-C
α	lead angle	° 5–10
γ	rake angle	° 5–20
v	cutting speed	m/min 300–1,000
s	forward feed	mm/rev 0.1–0.5

Turning

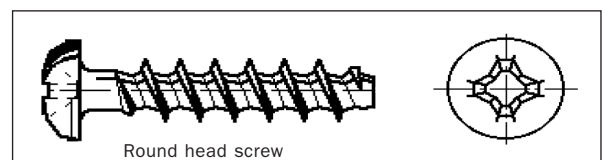
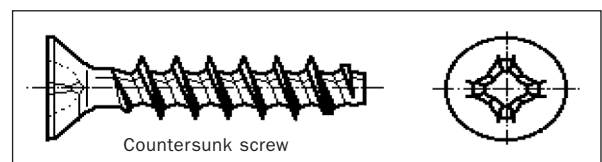
Semi-finished thermoplastics should be turned at a low rate of forward feed and with a large depth of cut. As in the case of metal processing, the cutting tip should have a small radius (e.g. aluminium machine tools). If these precautions are taken accordingly, the surface should be relatively score-free.



In many cases, the use of so-called indexable inserts with various cutting profiles allows efficient chip removal – with a soft cut and reduced costs.

Screw fixing

For fixing PVC-C with screws, we recommend pre-drilling of holes. The drillhole diameter should be the same as the shank diameter of the screw. If the screw connection has to be undone frequently, we recommend using metal inserts.



4.2 Welding

In the case of SIMONA® PVC-C, all standard welding methods can be used.

Hot-gas string bead welding

	air l/min	air tem- perature °C	speed cm/min			
			circular nozzle		high-speed welding nozzle	
			Ø 3 mm	Ø 4 mm	Ø 3 mm	Ø 4 mm
PVC-C	40–50	370–380	15–20	approx. 15	35–40	30–35

Heated tool butt welding

	tem- perature °C	adjust- ment pressure N/mm ²	warming		change- over time sec	joining	
			pressure N/mm ²	time sec		pressure N/mm ²	time min
PVC-C	220–230	0.1	0.01	45–300	< 1.5	0.4–0.6	5–20

For more detailed information, please contact our Applications Technology Department.

4.3 Glueing

On account of their polar behaviour, SIMONA® PVC-C sheets are relatively easy to glue – with high levels of bond strength achieved. Within this context, it is always particularly important to observe the instructions issued by the adhesive manufacturer, especially with regard to the occupational exposure limits (maximum workplace concentration). From experience, the occupational exposure limits are not reached with small glued surfaces, provided that ventilation is adequate, e.g. when glueing edges.

For satisfactory glueing results, it is essential to prepare the surface properly prior to glueing. In addition to a dust-free, grease-free surface, the cloths with which the surfaces are rubbed down should be changed frequently. Otherwise there is a risk of the surfaces becoming soiled.

Method

Solvent-based adhesives

These adhesives are solely used for glueing PVC materials to one another; they produce transparent joins.

SIMONA® PVC-C reacts sensitively to solvents, which makes this a particularly effective method. The following list is provided as an example of suitable adhesives – usually based on tetrahydrofuran (TFH) or methylene chloride:

- Tangit PVC-C (Henkel, Düsseldorf/DE)
- Cosmofen Plus (Weiss Chemie + Technik, Haiger/DE)
- Griffon (Bison, Netherlands)

Two-pack adhesives

These largely consist of epoxy resin (EP), acrylic (PMMA) or polyurethane (PUR). PUR two-part adhesives are generally tougher than those made of EP or PMMA, and they produce high-strength bonds. This type of adhesive is ideal for joining PVC-C to different materials such as stone, metal, ceramics, wood, etc. The joints are visible because two-part adhesives usually have their own colour.

One-part adhesives

They are usually based on cyanoacrylate (e.g. instant adhesive). These reaction adhesives produce adhesive bonds which reach their ultimate strength within a very short space of time. The joints are transparent.

Adhesive tapes

These produce bonds with a low level of strength; they are mainly used for assembly purposes. Adhesive tapes are not normally transparent.

4.4 Forming

Thermoforming/warm bending

SIMONA® PVC-C is ideal for thermoforming and warm bending. For detailed information on these techniques, please contact our Applications Technology Department.

4.5 Tempering

The balance of stresses and strains may be disturbed, in particular, when the material is subjected to machining from one side. In such cases, deformations may occur – e.g. bending or twisting of the workpiece.

One remedy is to perform heat treatment beforehand: stress-relieving tempering.

To achieve the best possible results, a number of influencing variables should be taken into account because the heat treatment temperature has to be selected according to the material.

Amorphous materials such as PVC-C are tempered above glass transition temperature, whilst partially crystalline thermoplastics are tempered at approx. 10 °C to 20 °C below the crystalline melting point. Tempering time, which is defined as the sum of heating time, dwell time and cooling time, is determined by the

- maximum thickness of the object being tempered
- position of the stress profile in the wall cross-section.

The parts to be tempered must be positioned in the tempering oven in such a way that the surfaces coming into contact with the requisite temperature are as large as possible. A forced-air oven with temperature control as uniform as possible is suitable for this purpose.

For wall thicknesses of < 10 mm, heat treatment times of 1 h are generally sufficient at maximum temperature. To prevent any new internal stresses arising because rates of cooling vary in terms locality and time, it is important to keep the rate of cooling as low as possible. The general rule is: the higher the temperature, the lower the recommended rate of cooling.

5 Storage

There are no special rules to be observed as regards handling and storage. However, it is advisable to store SIMONA® PVC-C in a clean, cool and dry place. SIMONA® PVC-C can be stored for an unlimited period.

6 Safety Data Sheets

SIMONA[®] PVC-CORZAN FM 4910 G2
CEE-Safety Data Sheet according to 91/155/EWGRev. 11/2005

1. Identification of substance / preparation and company

SIMONA AG	Telefon:	+49 (0) 67 52 – 14 0
Teichweg 16	Fax:	+49 (0) 67 52 – 14 211
D – 55606 Kirn	Email:	mail@simona.de

2. Composition / Indications to components

Chemical characterisation:	chlorinated polyvinyl chloride
CAS number:	0068648-82-8

3. Possible dangers:

- At ambient temperatures no effects on health are known or expected.
 - Molten material causes skin burns.
 - At high temperatures this product may release smoke gases and vapours, causing irritations of the respiratory passages and/or skin (possibly of serious nature).
-

4. First-aid measures:

General information:

- After inhalation:

If a person has inhaled an excessive amount of smoke, provide fresh air and – if necessary – perform artificial respiration.

- After skin contact:

Wash the affected area thoroughly with plenty of soap and water. After contact with molten product, cool the skin quickly with cold water or ice. Do not peel solidified product off the skin.

- After eye contact:

Rinse eyes with running water, keeping the person's eyelids open.

Consult a doctor in all such cases.

5. Fire-fighting measures:

- Suitable extinguishants:
Foam, solid extinguishing agents or water mist.
 - Unsuitable extinguishants:
In the event of large fires carbon dioxide may have no effect owing to a lack of cooling capacity and may thus lead to re-ignition.
 - Special hazard due to the material, its combustion products or developing gases:
Combustion, ignition and decomposition cause the release of irritant or toxic gases. Hydrogen chloride has a corrosive effect on a large number of metals.
 - Special safety equipment:
Use of portable positive-pressure breathing apparatus or self-contained breathing apparatus and the usual safety equipment for fighting fires is recommended.
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6. Measures in case of unintended release:

- Personal measures:
No special safety equipment required.
 - Environmental protection measures:
No special measures
 - Procedure for cleaning/collection:
Collect (e.g. with sweeping devices) and recover material if possible, or dispose of it according to local rules and regulations. Do not sweep or wash into the sewer or waterways.
-

7. Handling and storage:

- Handling:
Measures during which smoke gases and vapours are released should be performed with good ventilation. Do not expose the product to high temperatures for any lengthy period because it can decompose and release dangerous gases. Do not store or consume food in the processing area. Dust and fine particles of dust may develop during processing. Powder, dust and/or fine dust can constitute the risk of a dust explosion.
- Storage:
Avoid excess heat. Do not store near combustible agents. Storage rooms with sprinklers are recommended.

8. Limitation of exposition:

- Technical measures (in processing):
Always ensure there is effective ventilation and – where necessary – a local extraction system in order to keep away any smoke gases, vapours and/or dust.
 - Personal safety equipment:
Breathing masks: If ventilation is adequate, there is no need to wear a breathing mask. Small particles of this product may form during processing. If it is not possible to avoid inhaling particles, a breathing mask must be worn to protect against dust.
Hand protection: No special safety equipment required. If material is hot, protective gloves must be worn for handling.
Eye protection/body protection: No special safety equipment required.
-

9. Physical and chemical characteristics:

Form:	semi-finished product (solid)
Colour:	white
Odour:	odourless
Processing temperature:	177 – 225 °C
Ignition temperature:	480 °C
Solubility in water:	insoluble
Density:	1.540 g/cm ³

10. Stability and reactivity:

- Conditions to be avoided:
Avoid overheating.
 - Hazardous decomposition products:
Volatile compounds may form in the event of overheating, combustion or decomposition. Decomposition products may include carbon monoxide, carbon dioxide, hydrogen chloride, organic tin compounds and hydrocarbons. Repeated and prolonged exposure to high concentrations can cause damage to the eyes and respiratory passages.
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11. Toxic indications:

No toxicity tests have been performed for this material. No harm to health was observed over a period spanning several years.

12. Ecological indications:

No environmental compatibility tests have been performed for this product.

13. Waste-disposal indications:

Waste must be recycled or incinerated at approved facilities or disposed of at refuse tips in accordance with federal, state and local regulations.

Waste code for unused product: EAC code 120 105

Name of waste: PVC

14. Transport indications:

This product is not subject to any regulations as far as national or international transport is concerned.

15. Instructions:

EC:

According to European Community directives 67/548 and 88/379, this material is not subject to classification.

USA:

All parts of this product are included either on the list of chemicals in the U.S. Poison Control Act or meet TSCA regulations (U.S. TOXIC SUBSTANCES ACT → TSAC)

Water hazard class: 0 (self-classification)

16. Further indications:

Traces of contamination: Less than 0.01% (< 100 ppm) residues of chloroform (CAS 67-66-3) and less than 0.005% (< 50 ppm) residues of carbon tetrachloride (CAS 56-23-5) can remain fixed in the polymer. MWC (Maximum Workplace Concentration) identifies this chemical as having carcinogenic potential (III B). The MWC level for both substances is 10 ppm. The presence of these residual chemicals in the polymer is not regarded as hazardous. At a workplace which is well ventilated the potential concentration of carbon tetrachloride remains far below the established limits. Monitoring of production lines indicates that the chloroform levels in workplace air are less than 0.00003% (< 0.3 ppm) and the carbon tetrachloride levels are less than 0.00005% (< 0.5 ppm). Production staff are not obliged to wear special breathing masks.

By providing the above information, which constitutes the current state of our knowledge and experience, we wish to describe our product with regard to possible safety requirements. However, we do not imply any guaranteed properties.

It is the responsibility of product recipients to observe current legislation and regulations.

SIMONA[®] PVC-CORZAN Industrial Grade
CEE-Safety Data Sheet according to 91/155/EWGRev. 11/2005

1. Identification of substance / preparation and company

SIMONA AG	Telefon:	+49 (0) 67 52 – 14 0
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4. First-aid measures:

General information:

- After inhalation:

If a person has inhaled an excessive amount of smoke, provide fresh air and – if necessary – perform artificial respiration.

- After skin contact:

Wash the affected area thoroughly with plenty of soap and water. After contact with molten product, cool the skin quickly with cold water or ice. Do not peel solidified product off the skin.

- After eye contact:

Rinse eyes with running water, keeping the person's eyelids open.

Consult a doctor in all such cases.

5. Fire-fighting measures:

- Suitable extinguishants:
Foam, solid extinguishing agents or water mist.
 - Unsuitable extinguishants:
In the event of large fires carbon dioxide may have no effect owing to a lack of cooling capacity and may thus lead to re-ignition.
 - Special hazard due to the material, its combustion products or developing gases:
Combustion, ignition and decomposition cause the release of irritant or toxic gases. Hydrogen chloride has a corrosive effect on a large number of metals.
 - Special safety equipment:
Use of portable positive-pressure breathing apparatus or self-contained breathing apparatus and the usual safety equipment for fighting fires is recommended.
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6. Measures in case of unintended release:

- Personal measures:
No special safety equipment required.
 - Environmental protection measures:
No special measures
 - Procedure for cleaning/collection:
Collect (e.g. with sweeping devices) and recover material if possible, or dispose of it according to local rules and regulations. Do not sweep or wash into the sewer or waterways.
-

7. Handling and storage:

- Handling:
Measures during which smoke gases and vapours are released should be performed with good ventilation. Do not expose the product to high temperatures for any lengthy period because it can decompose and release dangerous gases. Do not store or consume food in the processing area. Dust and fine particles of dust may develop during processing. Powder, dust and/or fine dust can constitute the risk of a dust explosion.
- Storage:
Avoid excess heat. Do not store near combustible agents. Storage rooms with sprinklers are recommended.

8. Limitation of exposition:

- Technical measures (in processing):
Always ensure there is effective ventilation and – where necessary – a local extraction system in order to keep away any smoke gases, vapours and/or dust.
 - Personal safety equipment:
Breathing masks: If ventilation is adequate, there is no need to wear a breathing mask. Small particles of this product may form during processing. If it is not possible to avoid inhaling particles, a breathing mask must be worn to protect against dust.
Hand protection: No special safety equipment required. If material is hot, protective gloves must be worn for handling.
Eye protection/body protection: No special safety equipment required.
-

9. Physical and chemical characteristics:

Form:	semi-finished product (solid)
Colour:	lightgrey/grey
Odour:	odourless
Processing temperature:	177 – 225 °C
Ignition temperature:	480 °C
Solubility in water:	insoluble
Density:	1.520 g/cm ³

10. Stability and reactivity:

- Conditions to be avoided:
Avoid overheating.
 - Hazardous decomposition products:
Volatile compounds may form in the event of overheating, combustion or decomposition. Decomposition products may include carbon monoxide, carbon dioxide, hydrogen chloride, organic tin compounds and hydrocarbons. Repeated and prolonged exposure to high concentrations can cause damage to the eyes and respiratory passages.
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11. Toxic indications:

No toxicity tests have been performed for this material. No harm to health was observed over a period spanning several years.

12. Ecological indications:

No environmental compatibility tests have been performed for this product.

13. Waste-disposal indications:

Waste must be recycled or incinerated at approved facilities or disposed of at refuse tips in accordance with federal, state and local regulations.

Waste code for unused product: EAC code 120 105

Name of waste: PVC

14. Transport indications:

This product is not subject to any regulations as far as national or international transport is concerned.

15. Instructions:

EC:

According to European Community directives 67/548 and 88/379, this material is not subject to classification.

USA:

All parts of this product are included either on the list of chemicals in the U.S. Poison Control Act or meet TSCA regulations (U.S. TOXIC SUBSTANCES ACT → TSAC)

Water hazard class: 0 (self-classification)

16. Further indications:

Traces of contamination: Less than 0.01% (< 100 ppm) residues of chloroform (CAS 67-66-3) and less than 0.005% (< 50 ppm) residues of carbon tetrachloride (CAS 56-23-5) can remain fixed in the polymer. MWC (Maximum Workplace Concentration) identifies this chemical as having carcinogenic potential (III B). The MWC level for both substances is 10 ppm. The presence of these residual chemicals in the polymer is not regarded as hazardous. At a workplace which is well ventilated the potential concentration of carbon tetrachloride remains far below the established limits. Monitoring of production lines indicates that the chloroform levels in workplace air are less than 0.00003% (< 0.3 ppm) and the carbon tetrachloride levels are less than 0.00005% (< 0.5 ppm). Production staff are not obliged to wear special breathing masks.

By providing the above information, which constitutes the current state of our knowledge and experience, we wish to describe our product with regard to possible safety requirements. However, we do not imply any guaranteed properties.

It is the responsibility of product recipients to observe current legislation and regulations.

7 Product Liability Clause

We shall only be liable for deliberate and grossly negligent acts on the part of our company's corporate bodies, officers and executives or vicarious agents/persons employed to perform an obligation, and we hereby exclude any liability for acts of other vicarious agents (as defined by German law). *Vis-à-vis* non-merchants (as defined by German law), liability shall be limited to intent or gross negligence on the part of corporate bodies/officers or vicarious agents. Moreover, we do not accept any compensation claims resulting from negligence during contractual negotiations, from violation of ancillary duties of care, from tortious acts or collateral contract duties (e.g. providing advice or explanations concerning characteristics, possible areas of application, maintenance requirements, etc.). We only accept liability for advice provided by us if a fee has been specified in writing. *Vis-à-vis* non-merchants (as defined by German law), our vicarious agents shall not be held liable in the case of slight negligence, whilst in other circumstances they can only be held liable for intent.

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