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Product Information

PVC-T

05/97

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Contents

1. General information

- 1.1 Characteristic properties
- 1.2 Examples of application

2. Product range

3. Technical information

- 3.1 Material characteristics
- 3.2 Behaviour in fire
- 3.3 Behaviour in external use
- 3.4 Physiological admissibility
- 3.5 Chemical resistance
- 3.6 Water absorption
- 3.7 Application temperature range

4. Processing

- 4.1 Machining
- 4.2 Shaping
- 4.3 Welding
- 4.4 Thermoforming
- 4.5 Bonding
- 4.6 Surface treatment

5. Advice

6. Safety data sheet

1. General information

SIMONA® PVC-T has been specially formulated for the domestic and commercial building industry, for door infill panels, conservatory panels and architectural flat panel cladding etc.

1.1 Characteristic properties

- especially high weatherability
- high rigidity
- flame-retardancy
- low coefficient of thermal expansion
- excellent electric insulation properties
- universal application
- easy to process, it can be
 - machined
 - welded
 - thermoformed
 - vacuum formed
 - bonded
 - it is suitable for glass-fibre backed sandwich constructions
 - perfectly printable

In accordance to DIN 16 927, SIMONA® PVC-T is a rigid PVC with increased impact strength, together with especially high weathering protection. When comparing PVC-T with grades possessing normal impact strength, PVC-T offers the benefit of flexibility — even at low temperatures.

1.2 Examples of application

PVC-T can be used wherever a smooth surface is required, together with flame retardancy and a high resistance to atmospheric conditions with either subtle colouring or brilliant white tones.

- residential exterior doors
- architectural panels and cladding
- exhibition stand construction
- signs
- advertisement supports

2. Product range

Extruded sheets 2,000 x 1,000 x 1.5 — 2 mm / 3,000 x 1,220 / 3,000 x 800
white, protected one side with formable polyethylene film
on request

Besides sheets with a smooth, brilliant or semimatt surface, we as well deliver sheets with grain. Further specifications on request.

3. Technical information

3.1 Characteristic properties

	Test method DIN	Unit	SIMONA® PVC-T
Density	53479	g/cm ³	1,41
Yield stress	53455	N/mm ²	53
Elongation at yield	53455	%	4
Elongation at break	53455	%	15
Tensile-E-modulus	53457	N/mm ²	2900
Impact strength	53453	kJ/m ²	without break
Notched impact strength	53453	kJ/m ²	7
Ball indentation hardness	53456	N/mm ²	132
Shore hardness D	53505	—	81
Vicat distortion temperature	53460	K(°C)	351 (78)
Average thermal coefficient of elongation	53752	K ⁻¹	0,8 · 10 ⁻⁴
Behaviour in fire	4102	—	B1
Dielectric strength*	53481	kV/mm	>30
Volume resistivity	53482	Ohm · cm	>10 ¹⁵
Surface resistance	53482	Ohm	10 ¹³
Tracking resistance	53480	V	>550
Dielectric constant	53483	—	
at 300 Hz - 1000 Hz			>3,2
at 3 x 10 ⁵ Hz			>3,0
Dielectric loss factor	53483	—	
at 300 Hz			0,03
at 1000 Hz			0,02
at 3 x 10 ⁵ Hz			0,03
Water absorption	53495	%/24h	<0,1
Application temperature range		°C	ca. -10 bis +60
External use		—	yes
Physiological admissibility	acc. to recommendations of BgVV		no
Chemical resistance (see also SIMONA catalogue "Chemical resistance")	8061 insert 1	—	aqueous acids, aqueous lyes, aqueous salt- solutions, alcohols, aliphatic com- pounds

* measured at test specimen of 1 mm thickness

name of moulding: PVC-U, EDLP, 078-08-28

The data specified here are guide values and may vary depending on the processing method and how the test pieces are made. Unless specified otherwise, these are the average values of measurements made on extruded panels, 4 mm thick. These figures cannot be automatically transferred to finished components. The processor or user is responsible for checking the aptitude of our material for a specific application.

3.2 Behaviour in fire

PVC is a flame-retardant thermoplastic, i. e., it extinguishes itself after the source of the flame has been removed.

In accordance to DIN 4102, part 1, SIMONA® PVC-T (approval PA-III 2.2359) can be classified as flame-retardant material group B1.

In the case of a fire with temperatures exceeding 400 °C the molecule breakdown will produce hydrogen chloride, carbon dioxide, soot, moisture as well as low-molecular polymers. If PVC combustion gases are inhaled, a doctor has to be consulted.

The oxygen index stands at 40 %, the ignition temperature is 390 °C and above.

3.3 Behaviour in external use

SIMONA® PVC-T is stabilized for outdoor use to the largest possible extent by means of non-polluting systems which do contain neither cadmium nor lead.

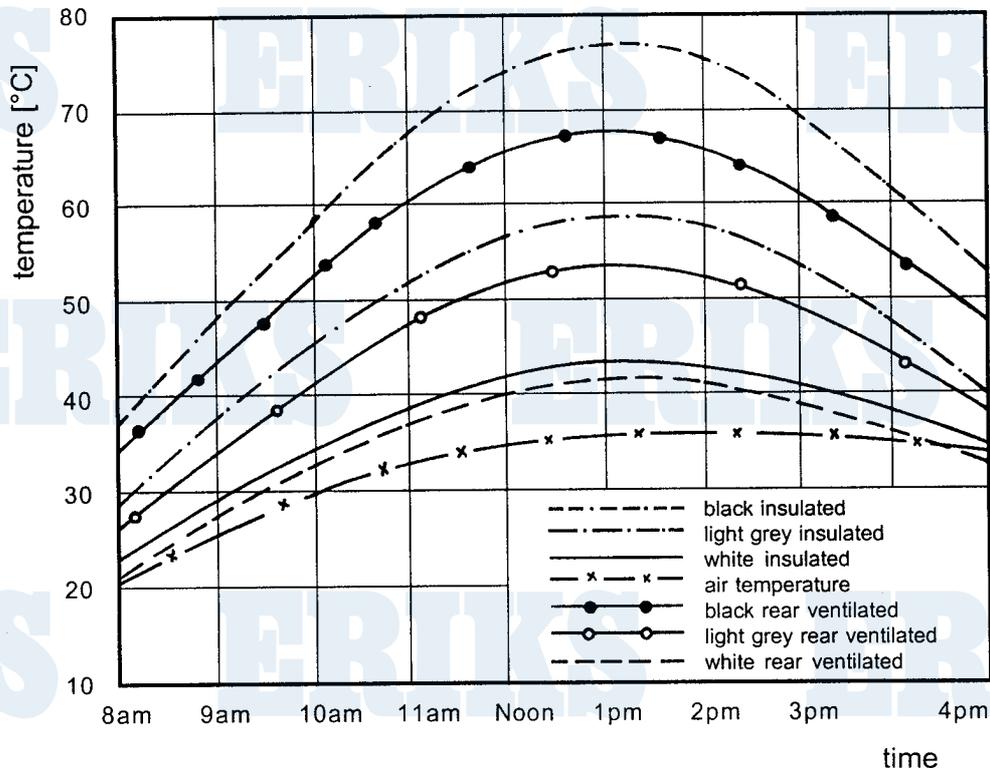
The following counts for Central European climatic zones (north of the Alps up to 1,500 m sea level): The thermal limit load of PVC — 60 °C — will not be exceeded during very summery weather at white or light colour shades. However, temperatures can go up far beyond 60 °C at grey, dark and black colour shades which results in a loss of functioning of the material. This remark not only counts for dyed but also for printed sheets. In respect to sheets being backed with dark foils, the functioning is determined by the choice of the adhesive.

Effect of rear ventilation and colour in external use

The use of PVC is not recommended without some reservation in southern countries with essentially more intensive sun irradiation and higher temperatures, however in addition the chosen colour has a considerable influence on the life time.

Dark colours absorb heat to a much greater extent than light ones. Even in the Central European climate zone sheet temperatures twice as high as the actual outside temperatures can be reached. For this reason dark-coloured PVC sheets should not be used out of doors. A renowned raw-material manufacturer has made a contribution by carrying out measurements of the temperature progression caused by sun irradiation.

Test conditions: 3 — 4 mm thick PVC sheets, some rear ventilated, some insulated. The measurements were taken on a hot day in July. As expected the insulated sheets showed a higher heat absorption than the rear ventilated ones (see diagram). The figures measured at 1pm give information on the heat absorption of the individual colours.



Temperature readings of the uPVC sheets
depending on colour and rear ventilation
sheet thickness 3-4 mm, sun irradiation, max. air temp. 36 °C

Due to reduced heat absorption the light-coloured semi-finished products have the following advantages:

- lower sheet temperature
- lower thermal expansion
- longer life

The light and weathering resistance is defined as follows: After 4,000 h of accelerated weathering in the QUV-device of Messrs. Q-Panel (test following DIN 53 384, test cycles: 4 h UV-A-lamp 340 at 50 °C, afterwards 4 h condensation phase dark at 40 °C), the colour did not change more than $\Delta E^* = 8$ CIELAB-units (L^* , a^* , b^* -system) in comparison to the non-weathered original colour sample.

The lifespan of deep-drawn parts made of PVC-T (doors, architectural panels and claddings) in external use depends on the following factors:

1. Forming conditions: a mild, longer heating of the deep-drawing machine has a positive effect on the lifespan; whereas short, very hot heating damages the surface
2. Installed position of the finished parts in respect to direction
3. Stability of the sandwich compound. The adhesive must be able to absorb (eliminate) the thermal coefficient of elongation of $0.8 \cdot 10^{-4} \text{ K}^{-1}$.
4. Heat transmission of contiguous materials, e. g. aluminium
5. Other conditions, the manufacturer of semi-finished products has no influence on.

Assembly instructions

SIMONA® PVC semi-finished products expand in heat and contract as the temperature. Therefore, when fastening PVC sheets, e. g. by screwing, the drilling holes have to be about 10 % larger than the diameter of the screw used. To prevent unacceptable stresses being transferred to the PVC sheets when the screws are tightened the use of elastomer washers is very much recommended. Under no circumstances should so-called snap rings or metal washers be used.

3.4 Physiological admissibility

SIMONA® PVC-T does not meet the requirements of the food- and commodity goods law.

3.5 Chemical resistance

SIMONA® PVC is not only chemically resistant against many diluted and concentrated acids, lyes and salts, but also against alcohol, aliphatic compounds and various oils.

Aromatic compounds and halogenated hydrocarbons, ester and ketone slightly dissolve PVC which however, does not — depending on the duration of exposure — lead to a decomposition of the material. On the other hand, this bears some advantages when choosing the corresponding solvents for screen printing.

Detailed information can be taken out of our catalogue “Chemical Resistance” or through enquiries with our Technical Application Department.

3.6 Water absorption

Rigid PVC can absorb moisture to a low extent which appears during vacuum forming by development of bubbles. Drying can be effected in a circulating air oven at approx. 55 °C. The time depends on the quantity of moisture and sheet thickness. As a rule, predrying is not necessary, if the sheets are stored in a moisture protected packing.

3.7 Application temperature range

Generally SIMONA® PVC can be used up to a temperature of approx. +60 °C, whereas PVC-T — with an increased impact strength — can also be used at moderate minus temperatures.

4. Processing

SIMONA® PVC-T can be easily processed. Nearly all processing and forming methods which are generally used for the treatment of thermoplastics can be carried out.

4.1 Machining

SIMONA® PVC-T can be excellently machined. The guide values for sawing and drilling are identical to the ones for rigid PVC as described in our technical application leaflet "Machining".

4.2 Shaping

Stamping

A die-cutting of thinner sheets is possible with the usual stamping machines. The wedge angle of the stamping tool should be between 40° and 55° in order to avoid tensions. PVC-T can be stamped up to 3 mm thickness. During the cold weather, the material should be stored for a sufficient period of time at room temperature so that a certain flexibility is reached especially before stamping or cutting with guillotine shears.

Guillotine shears

SIMONA® PVC-T can be cut without a problem by means of guillotine shears.

4.3 Welding

SIMONA® PVC-T can be welded with all normal welding procedures.

4.4 Thermoforming

Also PVC-T can — like all PVC-types — be perfectly deep-drawn resp. thermoformed or bent. Please refer to the information leaflet "Vacuumforming, thermoforming, bending" from the Technical Application Department. SIMONA® PVC-T has to be treated as equivalent — with regard to deep-drawing — to PVC-DS described therein.

4.5 Bonding

Due to the polarity of the material, SIMONA® PVC-T can be bonded relatively easy and with high adhesion.

Nevertheless, the instructions of the adhesive manufacturer regarding the pretreatment of surfaces to be joined must always be observed.

Solvent adhesives

This adhesives are only suitable for bonding PVC-T and other PVC-materials with each other and produce transparent joints.

The following adhesives may, for example, be used:

Tangit und Dytex (Messrs. Henkel, Henkelstr. 67, 40589 Düsseldorf)
Cosmofen Plus (Messrs. Weiss, 35708 Haiger 1)

On top of this, Messrs. Weiss manufacture a white coloured adhesive called "Cosmofen Plus white".

2-Pack reaction adhesives

These are mainly based on epoxy resin (EP), acrylate (PMMA) or polyurethane (PUR). PUR-based 2-pack adhesives are generally stronger than EP or PMMA-based adhesives and produce very strong joints. This type of adhesive is ideal for joining PVC with different materials such as stone, metal, ceramic, wood, etc.. The bonded joints are visually-improved as the 2-pack reaction adhesive usually has an inherent colour.

1-Pack reaction adhesives

Usually based on cyano-acrylate. These reaction adhesives produce joints which achieve their final strength within a very short time. The bonding joints are transparent.

Adhesive tapes

Adhesive tapes produce joints which are not that strong and are mainly used as an assembly aid. As a rule, adhesive tapes are not transparent.

Further detailed information is contained in our leaflet "Bonding" from our Technical Application Department.

4.6 Surface treatment

Screen printing

Screen printing inks have to be specially formulated for the material to be printed. The solvents and diluting agents shall help in this respect to dissolve the surface of the PVC in order to fasten the ink and at the same time control the evaporating speed, evtl. in conjunction with the addition of restrainers.

Screen printing inks for rigid PVC generally are physically drying, i. e. the solvents evaporate and the colour film remains.

When choosing solvents today, one attaches more and more importance to those bearing no health risks for the employees.

The choice from the variety of products available from manufacturers on the market is directed by a series of requirements:

- brilliance degree (matt, silk gloss, brilliant, high gloss)
- further processing (deep-drawing, welding etc.)
- internal and external use
- particular properties (chemical resistance, food admissibility, fastness to perspiration and spittle)

Characteristics of the internal company's equipment such as tunnel or air drying, pressure techniques, constitution of screen and other criterion ensue.

It is recommended to seek the advice of the corresponding printing ink manufacturers when choosing colours.

Cleaning

The material SIMONA® PVC-T is composed in such a way that a cleaning by the printer can be left aside as much as possible. Our sheets have been checked by leading screen printing ink manufacturers with regard to their printing properties, including adhesion and scratch resistance. Due to the different demands made of modern screen inks, the positive results obtained indicate that the user must always carry out his own preliminary tests.

Lacquering

The composition of colours for the injection application and painting mainly differs from screen printing inks only by the diluting degree. The varnish industries deliver corresponding injection diluents. After a sufficient cleaning of the PVC-surface, the adhesion and scratch resistance is as easily achieved as with screen printing. Advice by the colour manufacturer is also recommended in this respect.

5. Advice

Our sales personnel and our applications technologists have had many years of experience in the use of the processing of thermoplastic semi-finished products. We shall be pleased to advise you.

CEE-Safety Data Sheet according to 91/155/EWG

Page 1 of 2

Trade name: **SIMONA® PVC-D / PVC-DS / PVC-DS-TW /
SIMONA® PVC-HSV / PVC-MZ / PVC-T / PVC-TF**

11/2000

1. Indications to the manufacturer

SIMONA AG
Teichweg 16
D-55606 Kirn

Phone (0 67 52) 14-0
Fax (0 67 52) 14-211

2. Composition / Indications to components

Chemical characteristics: polymer of vinylchloride
CAS-number: not necessary

3. Possible dangers

unknown

4. First-aid measures

General comment: medical aid is not necessary

5. Fire-fighting measures

In case of fire please use gas mask and breathing equipment independent of circulating air.
Fire residues must be disposed of according to the local instructions.

Suitable fire-fighting appliance: water fog, foam, fire fighting powder, carbon dioxide

6. Measures in case of unintended release

not applicable

7. Handling and storage

Handling: no special regulations must be observed

Storage: unlimited good storage property

8. Limitation of exposition

Personal protective equipment: not necessary

CEE-Safety Data Sheet according to 91/155/EWG

Page 2 of 2

Trade name: **SIMONA® PVC-D / PVC-DS / PVC-DS-TW /
SIMONA® PVC-HSV / PVC-MZ / PVC-T / PVC-TF**

11/2000

9. Physical and chemical characteristicsPhenotype:form: semi-finished product
colour: different
smell: not distinguishableChange of state:crystallite melting point: 80 °C
fire point: FIT 390 (values indicated
inflammation temperature: SIT 455 in literature)
density: 1.40 – 1.43 g/cm³**10. Stability and reactivity**

Thermal decomposition: above appr. 200 °C

Dangerous decomposition products:

Besides hydrochloric acid also carbon dioxide and water will develop during the burning process. In case of incomplete burning also carbon monoxide and traces of phosgene may arise.

11. Toxic indications

During several years of usage no effects being harmful for the health were observed.

12. Ecological indications

No biodegradation, no solubility in water, no effects being harmful to the environment must be expected.

13. Waste-disposal indications

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 polyvinylchloride

14. Transport indications

No dangerous product in respect to / according to transport regulations

15. Instructions

Marking according to GefStoffV/EG: no obligation for marking

Water danger class: class 0 (self classification)

16. Further indications

The indications are based on our today's knowledge. They are meant to describe our products in respect to safety requirements. They do not represent any guarantee the described product in the sense of the legal guarantee regulations.