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Product Information

PVC-TF

09/96

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9/94 d

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This product information replaces all former editions.

1. General information

SIMONA® PVC-TF has been specially formulated for thermoforming applications which require extreme deep drawing ratios.

1.1 Characteristic properties

- excellent formability, for homogeneous distribution of wall thickness and faultless surfaces
- especially high weatherability without lead or cadmium stabilizers
- high rigidity
- self-extinguishing
- high chemical resistance
- low coefficient of thermal expansion
- excellent electric insulation properties
- good energy balance compared to other PVC grades, the whole cycle can be shortened by lower heating and cooling times, thereby reducing the power consumption
- universal application
- easy to process, it can be
 - vacuum formed
 - machined
 - bonded
 - printable
 - welded

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

1.2 Examples of application

PVC-TF can be used wherever formed components with a smooth surface, together with flame retardancy and a high resistance to atmospheric conditions are required in a range of muted colours.

2. Product range

Extruded sheets 2,000 x 1,000 x 1 - 10 mm
 3,000 x 1,500 x 2 - 6 mm

Other dimensions on request

Colours: white, light grey, dark grey, black, red, green, blue, yellow

3. Technical information

3.1 Characteristic properties

	Test method	Unit	SIMONA® PVC-TF
Density	53479	g/cm ³	1,43
Yield stress	53455	N/mm ²	53
Elongation at yield	53455	%	3
Elongation at break	53455	%	20
E-Modulus	53457	N/mm ²	3000
Impact strength	53453	kJ/m ²	without break
Notched impact strength	53453	kJ/m ²	8
Ball indentation hardness	53456	N/mm ²	132
Shore hardness D	53505	—	80
Vicat distortion temperature	53460	K(°C)	351 (78)
Average thermal coefficient of elongation	53752	K ⁻¹	0,8 · 10 ⁻⁴
Behaviour in fire		—	self-extinguishing
Water absorption	53495	%/24h	<0,1
Application temperature range		°C	approx. -10 to +60
External use		—	yes
Physiological admissibility	acc. to recommend. of BGA		no
Chemical resistance (please refer to PVC-CAW in our catalogue "Chemical resistance")	8061 insert 1	—	aqueous acids, aqueous lyes, aqueous salt- solutions, alcohols, aliphatic compounds

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 Reaction to fire

PVC is a flame-retardant thermoplastic, i. e., it extinguishes itself after the source of the flame has been removed. This is certified by tests carried out by Underwriters Laboratories. The examination acc. to UL 94 V = 0, the most severe test, was passed. The "yellow card" is available.

In the case of a fire with temperatures exceeding 400 °C the molecular 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-TF is stabilized for outdoor use to the maximum possible extent by means of a non-polluting system which contains neither cadmium or lead.

Within the Central European climatic zones (north of the Alps up to 1,500 m sea level): The thermal limit load for PVC — +60 °C — should not be exceeded during very summery weather with white or light colour shades. However, temperatures can go up far beyond 60 °C with dark colour shades which results in a gradual loss of rigidity of the material. This includes printed sheets as well as pigmented material.

Accelerated tests in the UV-B test equipment definitely indicate advantages in the long-term behaviour of SIMONA® PVC-TF. Due to evaluations of the change in elongation and strength behaviour a long life span of SIMONA® PVC-TF can be expected, also in comparison with other types of hard PVC.

3.4 Physiological admissibility

SIMONA® PVC-TF cannot be used in direct contact with foodstuffs.

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 bears some advantages when choosing the corresponding solvents for screen printing and bending.

Further detailed information can be gained from our catalogue „Chemical Resistance“ (see PVC-CAW) or through enquiries with our Technical Application Department.

3.6 Water absorption

Rigid PVC can absorb moisture to a low extent and this may lead to the development of bubbles during vacuum forming. Drying can be effected in a circulating air oven at approx. 55 °C. However, the drying 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 +60 °C, whereas PVC-TF — with its increased impact strength — can also be used at moderate minus temperatures.

4. Processing

SIMONA® PVC-TF 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-TF 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

The 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-TF 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-TF can be cut (up to thickness of 3 mm) without problems by means of guillotine shears.

4.3 Welding

SIMONA® PVC-TF can be welded using all normal welding procedures.

4.4 Vacuum forming (deep drawing)

SIMONA® PVC-TF is suitable for vacuum forming. To prevent visual defects, caused by surface defects on the tools used, we recommend the use of sand-blasted aluminium moulds.

The vacuum holes should have a diameter of approximately 1 mm.

max. drawing ratio (surface sheet : surface piece)	1 : 4 to 1 : 5
Shrinkage* with positive moulding with negative moulding	0,5 - 1,0 % > 1 %
Tool temperature	approx. 60 °C
Working temperature of deep-drawing machine	approx. 180 °C

* depends also on process, machine, tool geometry and personnel.

The use of separating agents, e. g. talc, may have a positive effect on the visual quality of the finished parts. PVC may absorb some moisture if stored for any length of time; this can be recognised by the formation of tiny blisters on the surface of the vacuum formed part. This can be remedied by drying the sheets first for 12 hours at approximately 55 °C.

In order to achieve uniform vacuum forming results, the sections should always have the same direction of extrusion.

Additional stresses introduced by vacuum forming may cause a certain embrittlement of the material which may adversely affect the finished part, particularly for stamping and machining. One possible remedy is to change the vacuum forming parameters (increasing the heating time, lower heating temperature and slower cooling) or machining at a higher temperature.

Heating time of modern deep-drawing machines with twin heaters is approx. 20 sec/mm at sheet thicknesses of up to 5 mm.

Example for the adjustment of heater:

Top heater	position 1 (outside) 550 °C position 2 520 °C position 3 (inside) 490 °C
Bottom heater	400 °C

For further information please refer to our Product Information „Vacuumforming, Thermoforming, Bending“. The cycle time of SIMONA® PVC-TF is lower than that of PVC-DS described therein.

4.5 Bonding

Due to the polarity of the material, SIMONA® PVC-TF 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

These adhesives are only suitable for bonding PVC-TF and other PVC-materials to each other and produce transparent joints.

The following adhesives may, for example, be used:

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

In addition to 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.

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

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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 of the described product in the sense of the legal guarantee regulations.