SIMONA

Product Information
PE-HML / PE-HMG

Contents

1. General information

1.1 Characteristic properties

The properties of polyethylene are mainly determined by the degree of polymerisation, i. e. the chain length.

In comparison to the standard polyethylenes SIMONA® PE-HWU and PE-HWST (M = 250,000 g/mol), SIMONA® PE-HML 500 and PE-HMG 1000 have a higher molecular weight (M), which can be determined by various methods. The viscosimetric method indicates a value of about 1.2 Mio g/mol for SIMONA® PE-HMG 1000. The light scattering test method shows, with identical material, four times this value. Today, the molecular weight is oftenly indicated as a calculated molecular weight following the Margolies-equation $M = 5.37 \cdot 10^4 \cdot [\eta]^{1.49}$ which is based on viscosimetric measures:

material	molecular weight
SIMONA® PE-HMG 1000	4.4 - 7.3 millions
SIMONA® PE-HML 500	500,000

In international terms, PE-HML 500 is called PE-HMW (high molecular weight), and PE-HMG 1000 is called PE-UHMW (ultra high molecular weight).

With a higher molecular weight a range of properties of the high molecular PE-types increase, as, for example, notched impact strength, stress cracking resistance, life span. A decrease of rigidity as well as of abrasion also depends on the increasing chain length, generally the electrical properties and the chemical resistance are independent of the molecular weight. Excellent properties result from the high molecular weight of SIMONA® PE-HML 500 and SIMONA® PE-HMG 1000.

In addition to the general properties of the standard PE-HD

- good resistance against stress cracks
- no water absorption
- foodstuff authorized
- very good electrical and dielectrical properties
- good processing abilities

SIMONA® PE-HML 500 and SIMONA® PE-HMG 1000 show properties such as:

- high impact and notched impact strength
- high resistance to tear and elongation at break
- excellent long-term behaviour
- good gliding properties, prevents caking
- very low abrasion
- high tenacity, also at low temperatures
- can also be used at very low temperatures

SIMONA

1.2 Examples of application

Machine construction
- Abrasion lining strips
- Rollers
- Pumps and pump parts
- Filter table coatings for the paper industry
- Bearing shells and toothed wheels
- Couplings

Plants for bulk material and mining
Linings of
- Bunkers
- Silos
- Conveying troughs
- Slides

The application of SIMONA® PE-HML 500 or SIMONA® PE-HMG 1000 minimizes operating disturbances such as caking or freezing of the bulk material. The good gliding properties considerably improve the flow behaviour.

Chemical apparatus construction, galvano technics
- Toothed wheel metering pumps
- Helix metering pumps
- Valves, current meters
- Galvanising drums

Food and packing industry
- Machine parts which get in contact with foodstuffs

Sports and leisure
- Toboggan-runs
- Lanes
- Artificial ice-rinks
- Ski coatings
- Skids for gliders
- Runners for sledges

Other applications
- Borders for snow removers

2. Delivery programme

2.1 Product range [1)]

	Dimensions	SIMONA® PE-HML 500 natural	SIMONA® PE-HMG 1000 natural [3)]
	Length x width mm	Sheet thickness mm	
sheets extruded	2000 x 1000 3000 x 1500	3 - 20 4 - 12	1 - 8 [4)] ——
sheets pressed	2000 x 1000 4120 x 2010 [2)]	10 - 120 15 - 80	10 - 120 15 - 80 [5)]
	Length mm	Diameter mm	
solid rods ramextruded / extruded	2000 1000 500	30 - 160 30 - 200 250 - 500 [2)]	20 - 120 20 - 300 350 - 500 [2)]
welding rod round	1000/roll	3 4 [2)]	——

1) on stock, see also brochures "Sheets, Profiles, Welding rod", "Solid rods" and "Sheets and Solid Rods made from high molecular weight polyethylene"
2) on request
3) PE-HMG 1000
solid rods ramextruded — natural — up to 200 mm Ø
solid rods extruded — grey — more than 200 mm Ø
4) skived sheets
5) green: 20 to 50 mm on stock

2.2 Technical delivery terms

DIN 16972 (1995-03)	high density polyethylene, pressed sheets (PE-UHMW, PE-HMW, PE-HD)
DIN 16925 (1987-06)	high density polyethylene, extruded sheets (PE-HD)
DIN 16980 (1987-05)	thermoplastic materials, solid rods
DIN 16985 (1989-06)	thermoplastic materials, semi-finished products
DIN 16776 (1984-12)	plastic moulding materials, polyethylene
ISO 1872 (1993-12)	thermoplastic materials, polyethylene and ethylene-copolymere
DIN 16783 (1991-04)	ultra high molecular polyethylene
ISO 11542 (1994-12)	(PE-UHMW)-moulding materials

3. Technical information

3.1 Material characteristics

	Test norm DIN	Dimension	SIMONA® PE-HML 500 natural	SIMONA® PE-HMG 1000*** natural
Density, method C	53479	g/cm^3	0.95	0.94
Yield stress, test specimen 3	53455	N/mm^2	28	22
Elongation at yield stress	53455	%	8	10
Elongation at tear	53455	%	300	350
Tensile-E-modulus	53457	N/mm^2	850	800
Impact strength (normal small rod)	53453	kJ/m^2	without break	without break
Notched impact strength (U-notch)	53453	kJ/m^2	50	without break
Ball indentation hardness H 132/30	53456	N/mm^2	45	40
Shore hardness D	53505		66	64
Crystallite melting range calorimetric	52328	K (°C)	399-403 (126-130)	
Vicat distortion temperature	ISO 306	K (°C)	353 (80)	
Average thermal coefficient of elongation	53752	K^{-1}	$1.8 \cdot 10^{-4}$	
Thermostability	53461/ISO 75	K (°C)	315 (42)	
Thermal conductivity*	52612	W/mK	0.38	
Dielectric strength**	VDE 0303-21	kV/mm	44	
Specific volume resistance annular electrode	IEC 93	Ohm	$>10^{14}$	
Surface resistance electrode A		Ohm	10^{14}	
Creep resistance method KC	IEC 112	V	600	
Dielectric constant at 300 - 1000 Hz at $3 \cdot 10^5$ Hz	53483 VDE 0303-4	——	 2.3 2.3	
Dielectric loss factor at 300 Hz at 1000 Hz at $3 \cdot 10^5$ Hz		——	 $< 3 \cdot 10^{-4}$ $< 1 \cdot 10^{-4}$ $< 3 \cdot 10^{-4}$	
Physiological safety	BgVV		yes	

* measured at test specimen of 10 mm thickness
** measured at test specimen of 1 mm thickness
*** values measured at pressed sheets

The figures indicated are guide values and may vary according to the processing method and the method used to make the test specimen.
Unless specified otherwise these are average values obtained from measurements on extruded or pressed sheets 4 mm thick. These values cannot be automatically used for finished parts. The manufacturer/user should check the suitability of our materials for a specific application.

Moulding compound designation

PE-HML extruded:	FM	DIN 16776 -	PE, EN, 50 G 022
PE-HML pressed:	FM	DIN 16776 -	PE, QN, 50 G 022
PE-HMG extruded:	FM	DIN 16776 -	PE, EN, 40-2-2
PE-HMG pressed:	FM	DIN 16776 -	PE, QN, 40-2-2

3.2 Combustion behaviour

SIMONA® PE-HML 500 and PE-HMG 1000 are classified as normally inflammable materials (B 2) according to DIN 4102. The ignition temperature amounts to approximately 350 °C. Polyethylene continues burning after the source of fire has been removed and drips burning.

3.3 Behaviour in outdoor use

SIMONA® PE-HML 500 and SIMONA® PE-HMG 1000 natural, are not especially stabilised for outdoor use and therefore only intended for indoor application.

In case of SIMONA® PE-HML 500 (black) the light and UV resistance can be increased very effectively by adding special carbon blacks. In addition to the recipe also the processing method, processing conditions as well as the shape of the fittings have a considerable influence on the life span. Here special attention must be paid to the tensions in the part.

3.4 Physiological safety

According to the law concerning food and consumer goods § 5, chapter 1, SIMONA PE-HML/HMG natural can be used for the production of goods which get in contact with food. Accordingly they will neither be affected as regards to smell nor to taste (see information No. 187 of the Federal Health Department BgVV, sheet 34/1991). Even the Health Department of the USA, Food and Drug Administration (FDA) allows SIMONA® PE-HML/PE-HMG for the contact with food. Furthermore SIMONA® PE-HML/PE-HMG fulfil the requirements of the "European Pharmacopeia" (edition 1990, VI.I.2.2.2: Manufacture of containers for preparation for parenteral use and their closures). If coloured sheets are used please contact our technical application department.

Due to its excellent skin compatibility PE is often used as material for protheses and ortheses (support apparatus).

3.5 Chemical resistance

Caused by the non-polar structure polyethylene shows an unusually high resistance to chemicals. SIMONA® PE-HML/PE-HMG are resistant to nearly all aqueous solutions of salts, acids and alkalis. Generally even aromatic and halogenated hydrocarbons only cause a swelling of SIMONA® PE-HML's/HMG's surface. These indications refer to DIN 8075, insert 1.

3.6 Water absorption

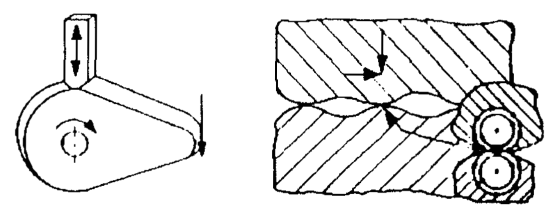
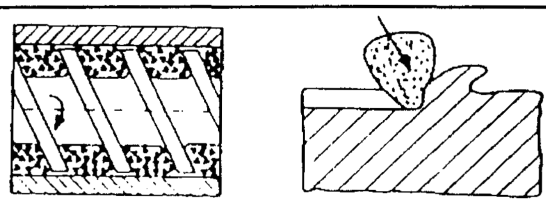
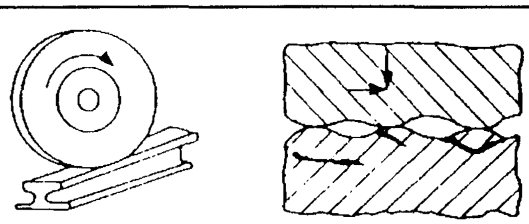
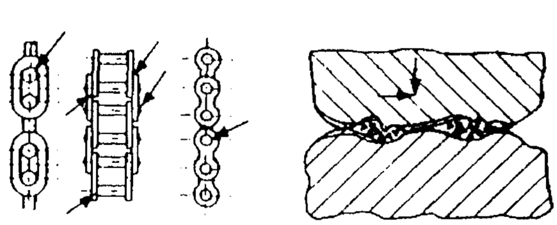
Like other polyethylene SIMONA® PE-HML/PE-HMG reject water and show no signs of swelling. The properties of SIMONA® PE-HML/PE-HMG are not dependent on the humidity of the surroundings.

3.7 Service temperature range

Due to their high toughness SIMONA® PE-HMG 1000 can be used continuously from -260 °C to +70 °C and SIMONA® PE-HML from -100 °C to +65 °C. An increase of the upper application temperature by approx. 10 % is possible if the finished parts are not considerably charged in the mechanical field.

3.8 Gliding and wear behaviour

Considerable wear of construction elements and hence functional and financial problems are caused by certain kind of loads in many branches of industry:

Figure 1: Types of wear	
adhesion (gliding abrasion)	
abrasion (groove abrasion)	
surface fatigue (rolling abrasion)	
tribochemical reaction (oscillating abrasion)	

SIMONA® PE-HML/PE-HMG are characterised by their very good gliding behaviour (low friction coefficient due to anti-adhesive properties) and consequently are used wherever low friction or low wear are demanded.

SIMONA

The friction behaviour of SIMONA® PE-HMG is fundamentally determined by the type and surface roughness of the counterrotating partner, surface pressure and gliding speed. The friction coefficient μ is a measure to characterise the gliding properties of a material. In comparison with polished steel, the mean value could be set at

0.10 - 0.25	for dry running
0.05 - 0.10	at water lubrication
0.05 - 0.08	at oil lubrication.

The friction behaviour of PE-HMG depends on the parameters surface pressure and gliding speed which explains the influence of the operating conditions on abrasion.

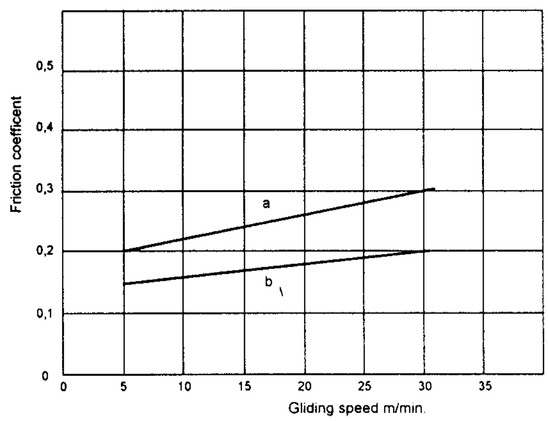


Figure 2: Surface pressure P_m
a: 1.26 N/mm^2; b: 0.25 N/mm^2
peak-to-valley height of steel 2 μm
Source: Fein, Kunz: Neue Konstruktionsmöglichkeiten mit Kunststoffen, Band 2, Teil 9, Kapitel 18, Mai 91, Weka-Fachverlage, D8901 Kissing

The wear of a sliding element can also be indicated as the wear per distance. Please always take care for a sufficient heat dissipation (temperature ≤ 40 °C) when using SIMONA® PE-HMG 1000 for bearing shells.

Average surface pressure N/mm^2	Gliding abrasion ratio μm/km	
	PE-HMG 1000	PE-HML 500
3	0.7	1.5
6	1.4	3.0
9	2.2	4.5
12	2.9	6.1
15	3.6	7.7
18	4.4	9.3

gliding speed
v = 0.5 m/sec
gliding surface temperature
s ≤ 40 °C
gliding partner
polished steel
peak-to-valley height
approx. 2 μm

Following DIN 50320, „Abrasion" is defined as (progressive) material loss out of a solid surface by means of mechanical causes. Various test methods are used to determine the „abrasion resistance" of materials (e. g. Taber-abrasion, steel abrasion method). The Sand-Slurry method proved to be the most appropriate one to enable differentiation in the material sector „plastics", especially of the polyethylenes.

The materials tested differ considerably in their density. Therefore, indications are made as „relative volumetric wear". Here, the abrasion value of Hostalen GUR 412 has been set to 100 arbitrarily and all further indications have been related to this.

Material	Density g/cm^3	relative volumetric wear value Sand-Slurry* 24 h, RT, 1200 rpm	wear value Taber** mm^3/ 1000 rpm
SIMONA® PE-HMG 1000	0,94	90	
Hostalen GUR 412	0,94	100	
Polyamide-cast	1,14	150	
Polyamide 6/6	1,13	160	
ST 37	7,45	160	
Polyamide 12	1,02	260	
SIMONA® PE-HML 500	0,95	310	
SIMONA® PE-HWST/HWU	0,95	450	60
PTFE	2,26	530	400
E-CTFE	1,69		5
Polyethyleneterephthalate	1,40	610	
Polyoxymethylene	1,42	700	
SIMONA® PP-C-DWST/DW	0,92	700	180
SIMONA® PVDF	1,78	700	5
SIMONA® PP-DWST/DWU	0,91	850	
Polyvinylchloride			
normally impact-resistant	1,33	920	300
high impact-resistant	1,42	1000	
PMMA	1,31	1800	
Pertinax (Phenol resin)	1,40	2500	
Beech wood	0,83	2700	
Epoxid resin/Quartz powder 1:1	1,53	3400	

* Method acc. to J. Berzen, Hoechst AG, Oberhausen
** Method acc. to Taber acc. to DIN 53754

The relative wear of SIMONA® PE-HMG/PE-HML decreases at increasing temperature, as both materials show a (rubber-) elastic behaviour, thus aggravating a removal of particles.

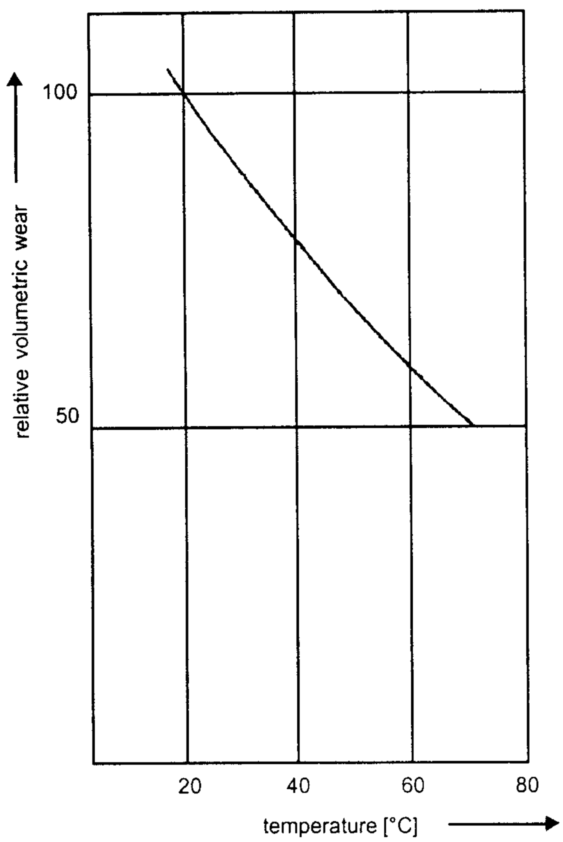


Figure 3: Relative wear of SIMONA® PE-HMG 1000 following Sand-Slurry, 24 h, 1200 rpm

Abrasion measures following the Sand-Slurry test indicate an excellent abrasion resistance of SIMONA® PE-HML/PE-HMG, also in comparison to other materials. As this value depends on several factors, lab tests can only give limited evidence. A trial under practical conditions provides an exact picture of the suitability of use (see 5.4), because of the variety of parameters.

4. Processing

4.1 Machining

Semi-finished products out of SIMONA® PE-HML/PE-HMG can excellently be processed with the normal machining processing methods such as sawing, turning, milling, planing, and drilling. Therefore the machines for wood and metal processing can be used. We recommend high cutting speeds, a slight advance and, of course, sharp tools. The rate of cut should amount to more than 0.3 mm.

SIMONA

Sawing	
Cutting speed	3000 - 4000 m/min
Advance	band saw 0.2 - 0.8 mm
Material	HSS
Tip angle φ	circular saw 5 - 8°
	band saw 3 - 6°
Clearance angle α	SS 30 - 40°
	HSS or HM 10 - 15°
Planing	
Cutting speed	250 - 450 m/min
Advance	0.1 - 0.3 mm/revolution
Material	HSS, HM or SS
Tip angle φ	20°
Clearance angle α	5 - 30°
Drilling	
Cutting speed	40 - 70 m/min
Advance	0.2 - 0.5 mm/revolution
Material	SS or HM
Tip angle φ	3 - 5°
Twist angle β	12 - 16°
Clearance angle α	10 - 13°
Rake angle γ	60 - 90°
Milling	
Cutting speed	200 - 800 m/min
Advance	0.1 - 0.5 mm/revolution
Material	SS, HSS or HM
Tip angle φ	5 - 15°
Clearance angle α	5 - 15°

SS	high speed steel
HM	carbide
HSS	high speed carbide

If the finished parts are subject to high requirements concerning accuracy to size and draft stability, the semi-finished products can be tempered. For this, the parts are heated up to 120 - 125 °C with a speed of 15 - 20 °C/h and this temperature is kept for 1 h each per 10 mm thickness. Cooling down slowly the semi-finished products/ moulded blanks to 30 °C (10 °C/h) will result in parts of low tension.

4.2 Lacquering and bonding

Because of its non-polar character polyethylene, unlike PVC, has a high resistance also against solvents, for example. This means that further processing like for example printing, lacquering, bonding is not possible without pre-treatment. However, one cannot expect, even at careful treatment, an adhesion as good as with other materials.

In order to prepare the polyethylene surface for the above further processing one could, for example, use the following methods:

1. Burning with a Bunsen burner; at one-sided heating one can expect warpage.
2. Corona treatment by electrical discharge; molecular components are produced, which form a relativeley stable compound with colourings and adhesives.
3. Chemical pre-treatment, e. g. with hot chromic-sulphuric acid mixture; by this method polar groups which have a corresponding adhesion mechanism are produced on the surface.

The application of water-drops is a simple method to distinguish between treated and non-treated PE surfaces or to see the effect of the pre-treatment. If they drip off, the pre-treatment has not been finished yet.

Before bonding it is possible, as another method, to roughen up with a long gauze. This increase of surface results in an additional anchoring of the adhesive.

It is only to mention in passing that one should always use clean surfaces - i. e. without dust, hand sweat or grease.

You can obtain information on the further treatment from the corresponding producers of lacquers, screen printing inks and adhesives. On request we can furnish you the addresses.

4.3 Welding

SIMONA® PE-HML 500 can be butt welded by means of hot gas as well as of heating elements. Due to its high viscosity SIMONA® PE-HMG 1000 should be connected by heating element butt welding under especially high welding pressures.

Heat element welding		SIMONA® PE-HML 500	SIMONA® PE-HMG 1000
temperature	°C	190 - 210	190 - 210
aligning height of bead pressure	 mm N/mm²	 1 0.15	 1 0.5
heating up time pressure	 sec N/mm²	Sheet thickness in mm · 15 0.01	 0.05
reconverting	sec	< 5	< 5
time for total pressure build-up	sec	Sheet thickness in mm	
cooling pressure	 N/mm²	 > 0.3	 > 1.0
time	min	Sheet thickness in mm · 15	

Hot gas string-bead welding and hot gas welding by extrusion of filler material of ultra high molecular PE can be conducted by using high molecular PE as welding rod or extrusion filler (Patent DE 3630294C2, Hoechst AG, Oberhausen).

The following parameters can be given as guide values for SIMONA® PE-HMG 1000/ PE-HML 500:

Hot gas string-bead welding with rapid nozzle		SIMONA® PE-HML 500	SIMONA® PE-HMG 1000
welding rod		SIMONA® PE-HML 500	
air temperature	°C	270 — 300	300 — 330
quantity of air at 0.5 bar	l/min	60 — 70	
speed round wire 3 mm 4 mm	cm/min	 25 — 30 20 — 25	

Hot gas welding by extrusion of filler material		SIMONA® PE-HML 500	SIMONA® PE-HMG 1000
welding rod		SIMONA® PE-HML 500	
temperature of extrusion material	°C	210 - 240	
air temperature (if individually variable)	°C	210 - 240	220 - 250
quantity of air at 0.5 bar	l/min	350 - 400	410 - 430

Extrusion welding of PE-HMG with PE-HML may also be carried out with a higher air temperature (300 - 350 °C) at reduced air current (270 - 340 l/min), depending on the geometric structure of the preheating nozzle.

Based on the tests conducted up to now, SIMONA® PE-HMG 1000 can be hot gas string-bead welded up to a wall thickness of 6 mm or extrusion welded up to a thickness of about 15 mm. The strength of the weld seams - when being perfectly worked - can almost reach the short term values usually obtained at PE-HD weldings.

A welded connection of PE-HMG with PE-HD as welding filler is quite difficult due to the large differences in molecular weight and melt viscosity and can therefore not be recommended.

Because of the multitude of processing parameters to be observed when using welded SIMONA® PE-HMG 1000 semi-finished products in the chemical industry, e. g. tank construction, we recommend to contact our Technical Application Department at any rate.

To complete the picture it should be mentioned that turned symmetry parts may also be connected by means of friction welding for the two PE grades. The manufacturer Hoechst AG gives the following parameters as basis:

peripherical speed	150 - 200 m/min
heating pressure	appr. 0.3 N/mm^2
jointing pressure (at sufficient plastification)	0.8 - 1.2 N/mm^2

Our product information „Welding“ contains further information regarding joining techniques for plastics.

5. Application bunker and silo construction

For bulk material like coal, salt, gravel, plaster, etc. bunkers and silos are the simplest and most economic way of storage. However, by caking and bridging - even at the best shaping - the carry out process can be disturbed. Normally the bulk material flows through the whole bunker cross-section (mass flow, see figure 4).

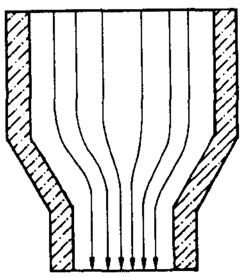


Figure 4

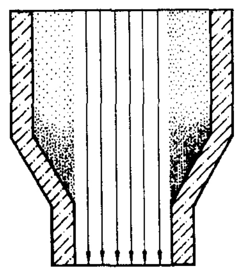


Figure 5

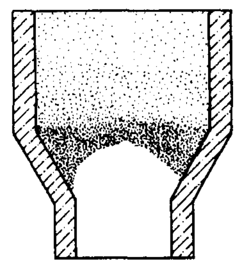


Figure 6

Due to narrowing of the cross-section and an unfavourable friction relation the mass flow is changed into a kernel flow (see figure 5).

The material which continues to flow compresses and forms a vault sitting on the bunker slope (bridge, see figure 6).

The consequences of such disturbances are very inconvenient, the removal of the material bridge is very time-consuming, furthermore there is the danger of dust explosions.

5.1 Lining

Lining the bunker or the silo with SIMONA® PE-HML 500/PE-HMG 1000 helps to avoid these disturbances (see figure 7). Preference is given to sheets of 6 - 10 mm thickness in the standard size 2000 x 1000 mm. You will find other sizes in our product range. Especially favourable for you is - with bigger objects - that our extruded sheets out of SIMONA® PE-HML 500 can be supplied in any length and in a width of up to 1500 mm. Hence the sheet size can be adapted to the object.

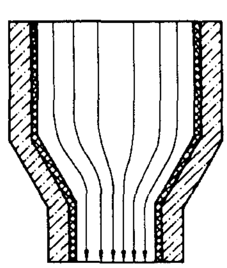


Figure 7

The costs for the lining pay for themselves within a short period of time by the considerably improved flow of material. In this connection the life span of the lining is in general considerably higher than the amortisation time, as due to the very high abrasion resistance of the high molecular polyethylene sheets, the wear is small.

When filling the bunker, one side of the wall is often more charged than the others. In order to get an approximately equal life span of the complete lining, the wall thickness of this side is increased by up to 5 mm.

5.2 Arrangement of the sheets

The sheets are arranged horizontally from below towards the top. We recommend to stagger the vertical joints of the sheets and to mill the horizontal edges of the sheets in an angle of 45°. This spares an overlapping of the sheets in the flow direction of the bulk material and prevents an infiltration by the filling material. The top row of sheets is protected by an end border out of stainless steel against infiltration by the filling material (see figure 8 and 9).

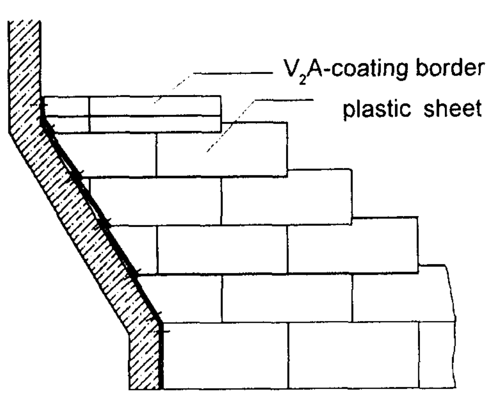


Figure 8

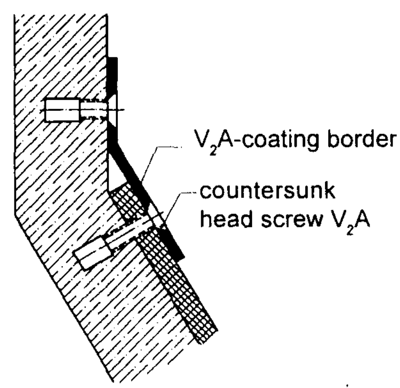


Figure 9

If possible, the edges should be rounded, as sharp angles bear the risk of caking. Before bending the sheets are heated up by a gas flame. For bigger wall thicknesses experienced firms offer pre-fabricated round arches (see figure 10).

A coating of the upper edge with stainless steel protects the bunker saddles against damage by striking filling material (see figure 11).

SIMONA

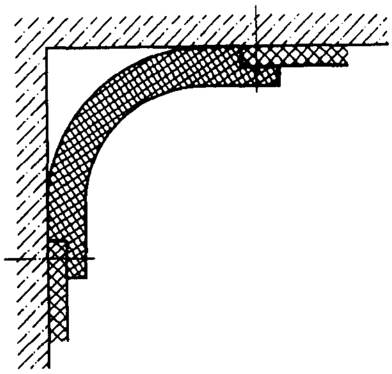


Figure 10

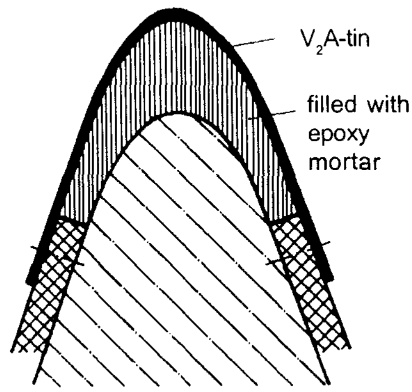
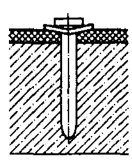
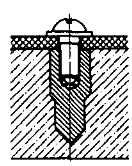
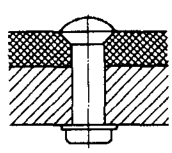
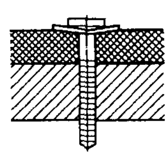
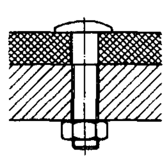
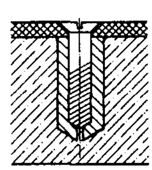


Figure 11

5.3 Fastening of the sheet

The fastening material should always be made of rustproof steel.

Figure 12: Comparison steel - concrete

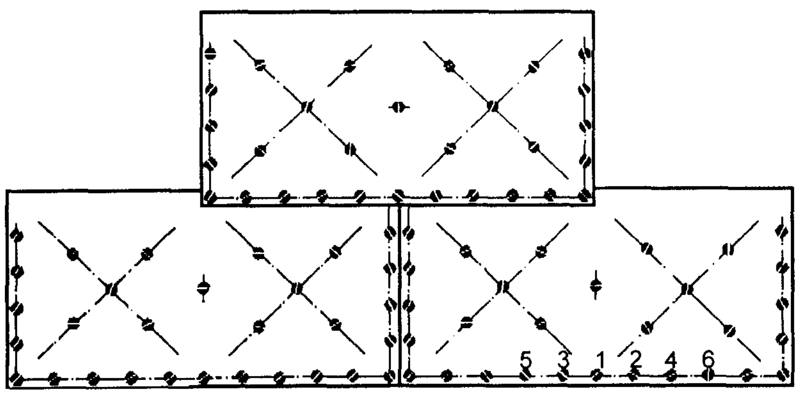
Steel bunker:	Concrete bunker:
Concretion with head pins is most time-saving. Generally we recommend K8/60 (60 mm long). 	 Fastening with internal screw thread pins out of rustproof material is mostly used with concrete bunkers.
Riveting 	 Concretion with head pins K8/30 is only recommendable at good, regular condition of the concrete, which has to be tested before.
Fastening with carriage bolts and countersunk head screws 	 Fastening in brass straddling dowels

SIMONA

The number and distribution of the fastening materials depend on the requirements. As a rule, for concrete approximately 25 fixing points/m^2 are estimated and for steel about 20 fixing points/m^2.

The most suitable distribution is schematically shown in the following diagram. One has to take care that there is a distance of a maximum of 30 mm from the margin of the plastic sheet, the distance of the margin drilling should amount to approximately 200 mm.

Figure 13: Fastenings



Sequence of the fastenings

A mechanical preparation of the lining material is recommended for obtaining an optimum fastening of thicker sheets with bolts:

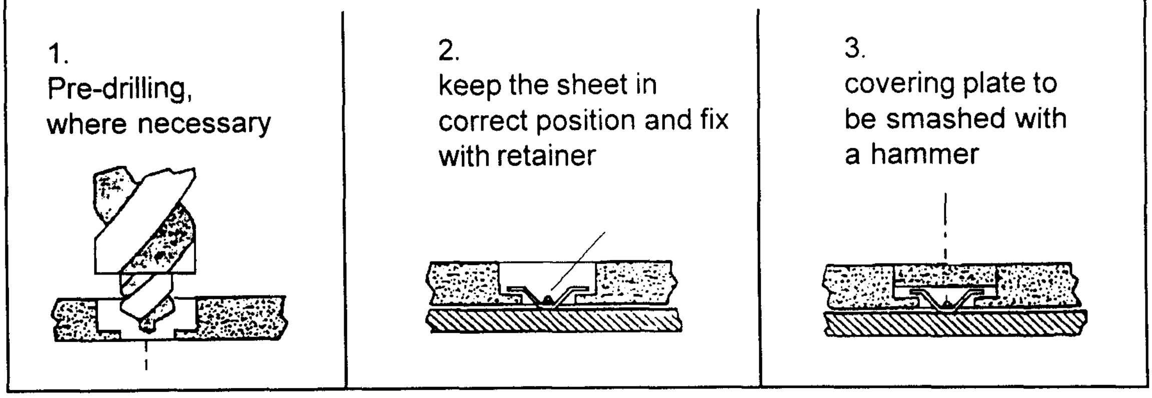
Sheet thickness	Preparation of sheets	Head bolts	Cartridge	Remarks
<6 mm	not necessary	16 mm		straight bolt guidance
8 — 15 mm	sinking with d ~bolt head	22 mm	Bore 6.3 mm	
20 — 30 mm	drilling with d ~bolt shaft	32 mm		penetration depth of bolt up to approx. 1/3 sheet thickness

Trials conducted by means of blasting PE-HMG 1000 to 10 mm steel

If warm/hot (bulk) materials are stored or transported, PE-HMG/PE-HML will expand at increasing temperature just like almost all other currently used materials. In order to avoid a plane arching because of thermal stress, a provision of tolerance space for the fixing points is recommended (figure 14.3).

In addition, an entirely smooth PE-HMG/PE-HML surface may be necessary in some cases (figure 14.1 - 14.3).

Figure 14



5.4 Criterion for material selection

An abrasive wear of installation parts occurs when gaining, transporting, comminuting and finishing of solid, granular goods. This process mainly takes place in the „microsector". A whole team of influencing factors determines the extent of this abrasion.

As a rule, PE-HML/HMG can be applied as follows::

SIMONA® PE-HML 500 is mainly used for solving gliding problems. Whereas, for extremely sharp-edged coarse grains the use of SIMONA® PE-HMG 1000 is given preference.

The great number of influencing factors require a close analysis of the occurring abrasion problem.

In practice, linings of tanks should be regularly controlled, in order to determine a possible change of the requirements profile or the progress of wear.

6. Advice

Our sales staff and application engineers have had many years experience in the use and processing of thermoplastic semi-finished products. We will be pleased to give you any further advice. Hereto you may also fill in the attached questionnaire and return it to us.

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

Trade name: **SIMONA® PE-HWST / PE-HWV / PE-HWVM / SIMONA® 2000 / PE-HML 500 / PE-HMG 1000**

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 ethylene
CAS-number: not necessary

3. Possible dangers

unknown

4. First-aid measures

General comment: medical aid is not necessary

5. Fire-fighting measures

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

9. Physical and chemical characteristics

Phenotype:		Change of state:	
form:	semi-finished product	crystallite melting point:	126 - 130 °C
colour:	different	fire point:	not applicable
smell:	not distinguishable	inflammation temperature:	appr. 350 °C (value indicated in literature)
		density:	0.94 - 0.95 g/cm³

10. Stability and reactivity

Thermal decomposition: above appr. 300 °C
Dangerous decomposition products:
Besides carbon black also carbon dioxide and water as well as low molecular parts of PE will develop during the burning process. In case of incomplete burning also carbon monoxide may arise.

---

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 polyolefine

---

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 todays 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.

SIMONA AG
Anwendungstechnische Abteilung
Postfach 133, 55602 Kirn
Tel.: (0 67 52) 14-396 • Fax-Nr.: (0 67 52) 14-211

SIMONA

Questionnaire for lining of bulk material or hoisting plants

1. Client ____________________
   Address ____________________
   ____
   ____

   Person in charge ________ Telephone ________ Date ________

2. Description of project ____________________
   ____
   ____

Loading area of truck	❐	rocking conveyor	❐
Silo: round	❐	distributing device	❐
square	❐	funnel	❐
rectangulare	❐	shutting clack	❐
opening/outlet	❐	lining of digger though	❐
non-symmetrical	❐	chute	❐
		freight car	❐

Others ____________________

3. Geometry

Length	________	mm	Incline of admission	________	°
Width	________	mm	(to vertical)		
Height	________	mm	Incline of outlet	________	°
Diameter	________	mm	(to vertical)		
Filling height max.	________	mm			

4. Operating conditions

Outdoor use		❐	Internal load		❐	
Loading:	continuous	❐	Unloading:	continuous	❐	
	discontinuous	❐		discontinuous	❐	
Flow rate	________	t/h	Falling height	________		mm

Height of material remaining in bunker on loading ❐ approx. ______ mm
Impact wear of various parts or zones ❐
Risk of explosion because of fiery dust ❐
Operating temp. min ________ °C max ________ °C

5. Specification on construction and malfunction

Construction material
- Steel ☐
- Concrete ☐
- Aluminium ☐
- ______________ ☐

Wall thickness ________ mm

Malfunction of plant
- Caking ☐
- Bridging ☐
- Freezing solid ☐
- Corrosion ☐
- ______________ ☐

6. Characterisation of bulk material

Designation / chem. composition ______________________________

Grain size			Part	
min	_______	mm	________	%
max	_______	mm	________	%

Water content __________ %

Density __________ g/cm³

Grain hardness (following Mohs) __________

Grain structure
- round ☐
- cristalline ☐
- sharp-edged ☐
- cuboid-shaped ☐
- arbitrary ☐

internal coefficient of friction of bulk material μ __________

7. Remarks

____

____

____

____

____

____

____

____

____

Please add a sketch or technical drawing, if possible.