2 Material properties of PE

2.1 General material properties of polyethylene (PE)

Thermoplastics are sub-divisible into two groups: amorphous and semi-crystalline thermoplastics. Polyethylene is a polyolefin, which forms a separate group among the semi-crystalline thermoplastics. Polyethylene, abbreviated PE, is an umbrella term for a group on individually distinctive PE types.
In specific, the following PE types are distinguished:
- PE-LD (Density: 0.9 - 0.91 g/cm^3)
- PE-LLD (Density: 0.91 - 0.93 g/cm^3)
- PE-MD (Density: 0.93 - 0.94 g/cm^3)
- PE-HD (Density: 0.94 - 0.965 g/cm^3)

It is PE-HD that is of primary interest for use in plastic pipe construction, although PE-MD is also used in the gas-pipe sector. The characteristics of PE-MD will, however, not be further detailed in this Specification Manual.
PE-HD (high density) has a high density with an average molar mass (MM) between 40,000 and 400,000 g/mol (depending on the manufacturing process and the process parameters). In comparison, PE-LD (low density) has a lower density and therefore a molar mass of up to 600,000 g/mol. PE-HD is manufactured as a polymer either by using a medium pressure procedure (Phillips) or a low pressure procedure (Ziegler). Polymers based on ethylene offer semi-finished product manufacturers a great deal of latitude in making modifications. For pipe and fitting manufacture, it is the mechanical properties of PE that are foregrounded (elastic stiffness).
As mentioned at the beginning of this chapter, PE is to be understood as an umbrella term for a thermoplastic group. For instance, PE includes the substance PE100.

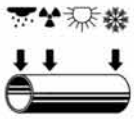
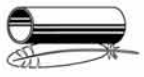
More attention will be paid to the significance of the numerical values (e.g. PE100) in the course of chapter 4. For the sake of simplification, the label "PE" will be used throughout the rest of this manual to designate PE-HD. PE is resistant to acids, bases, saline solutions, water, alcohol and oil. Under 60°C, it is practically insoluble in nearly all organic solvents. PE can readily withstand ionised rays if they are not too strong and will not become radioactive itself. It is furthermore readily weldable, although there are problems involved in gluing and decorating PE. The surfaces will allow imprinting or painting to adhere only after physical or chemical pre-treatment. Bonding can only be done with the help of contact glue, although such adhesive bonds cannot be subject to very high mechanical loads.

2.2 Properties of PE100

	Unit	Test method	Value
Density at 23°C	g/cm^3	ISO 1183	0.958
Elasticity modulus	N/mm^2	ISO 527	900
Tensile creep modulus	N/mm^2	ISO 899	850
Bending creep modulus	N/mm^2	DIN 54852-Z4	1200
Tensile strength at 23°C	N/mm^2	ISO 527	23
Elongation at break	%	ISO R 527	>600
Linear expansion coefficient	mm/mK	DIN 53752	0.13 - 0.19
Indentation hardness	N/mm^2	ISO 2039	36 - 46
Ignition temperature	°C	-	~350
Thermal conductivity	W/m . K	DIN 52612	0.23
Shore hardness		ISO 868	65
Crystallite melting range	°C		~130
Operational temperature range	°C	-	-40 - +100
Melt flow rate MFR 190/5	g/10min	ISO 1133	0.43

Table 2.1

Material properties of PE

	Properties PE	Benefits
	Impact-resistant and tough	Unbreakable at temperatures > 5°C
	Elastic	Suitable for underground pipes through adjustment to local ground movement
	Thermal resistant	Application possible between -40°C and 100°C
	Smooth internal wall	Low blockage risk due to low deposit/residue effects
	Wear resistant	Lower costs due to relatively long life
	Weather-resistant / UV resistant	Application in open air unrestricted through colouring with carbon black
	Chemical Resistance	Suitable for the transport of polluted waste water
	Poor heat conductivity	No condensation during short periods of cooling
	Non-toxic	Environmentally friendly
	Insulating	Non-conductive
	Highly suitable for welding	Easy installation using butt welding and electrofusion techniques
	Homogeneous welded joints	End load resistant and leak proof
	Prefabrication	Reduces on-site installation times
	Light in weight	Cost-saving in transport and handling

Tabel 2.2

2.3 Chemical resistance

Table 2.3 indicates the chemical resistance of PE to various media at a number of temperatures.

In transporting chemicals, consideration needs to be given to the following factors:
- the medium
- concentration of the medium
- temperature
- duration of the load
- flow volume

The elastomer resistance list is intended as an aid for determining the suitability of a given seal. The indicated values refer to the volume of swelling for the rubber compound, which is only one of the indications concerning resistance. Chemical damage to the polymer chain can also lead to changes in mechanical properties such as tensile strength, elasticity at break, etc. The most commonly indicated values are measured at a temperature of 20°C. A longer exposure to a higher temperature can create more aggressive conditions that reduce the life-span of elastomers.

Explanation of symbols used for PE pipes and fittings:	
+	Resistant: based on performed tests, PE is in general a suitable material for this application
/	Limited resistance: further research required
-	Non-resistant

Empty field = The material has not been tested on this medium at this temperature.

1 Little of no effect: volume change <10%, the elastomer can display slight swelling and/or loss of physical characteristics under heavy conditions.
2 Possible change of physical qualities: volume change of 10 - 20%, the elastomer can display swelling and a change of physical characteristics, can be suitable for structural applications.
3 Substantial change in physical characteristics: the elastomer displays a substantial change in volume and physical qualities.
4 Excessive change: elastomer is unsuitable.

Empty field = The elastomer has not been tested on this medium.

Abbreviations used:
PE = polyethylene
NBR = acrylonitrile butadiene
EPDM = ethylene propylene
FPM = fluorocarbon
SBR = styrol butadiene

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Material properties of PE

Component			Concentration	Pipe and fittings			Elastomeric seals			
				HDPE			NBR	EPDM	FPM	SBR
Name	Formula	Remark		°C			°C	°C	°C	°C
				20	40	60	20	20	20	20
Acetaldehyde	CH_3CHO	Aqueous solution	40%	+	+	/	4	2	4	3
Acetaldehyde	CH_3CHO	Technically pure	100%	+	/	/	4	2	4	3
Acetic Acid	CH_3COOH	Aqueous solution	10%	+	+	+	4	3/4	4	4
Acetic Acid	CH_3COOH	Aqueous solution	30%	+	+	+	4	4	4	4
Acetic Acid	CH_3COOH	Aqueous solution	60%	+	+	+	4	4	4	4
Acetic Acid	CH_3COOH	Aqueous solution	80%	/	/	-	4	4	4	4
Acetic Acid	CH_3COOH	Technically pure	100%	+	+	/	4	4	4	4
Acetic Acid Anhydride	$(CH_3CO)_2O$	Technically pure	100%	+	/		4	2	4	2
Acetone	CH_3COCH_3	Aqueous solution	10%	+	+	+	4	1	4	2/3
Acetone	CH_3COCH_3	Technically pure	100%	/	/		4	1	4	2/4
Acetophenone	$CH_3COC_6H_5$	Technically pure	Indetermined	+	+	+	4	1	4	4
Acrylonitrile	CH_2=CH-CN	Technically pure	100%	+	+	+	4	4	4	3
Adipic Acid	$HOOC(CH_2)_4COOH$	Aqueous solution	Saturated	+	+	+	1	1	1	1
Alcohol			40%	+						
Alcoholic Spirits			Comm. Comp.	+	+					
Allyl Alcohol	CH_2=CH-CH_2OH	Aqueous solution	96%	+	+	+				
Alum	$Al_2(SO_4)_3K_2SO_4\ _4H_2O$	Aqueous solution	Solution	+	+	+	2	1	1	1
Alum	$Al_2(SO_4)_3K_2SO_4\ _4H_2O$	Aqueous solution	Saturated	+	+	+	2	1	1	1
Aluminium Acetate	$(CH_3COO)_3Al$	Aqueous solution	Saturated	+	+	+	2	1	4	4
Aluminium Bromide	$AlBr_3$	Aqueous solution	Saturated	+	+	+	1	1	1	1
Aluminium Chloride	$AlCl_3$	Aqueous solution	All	+	+	+	2	1	1	1
Aluminium Fluoride	AlF_3	Aqueous solution	Saturated	+	+	+	2	1	1	1
Aluminium Nitrate	$Al(NO_3)_3$	Aqueous solution	Saturated	+			1	1	1	1
Aluminium Sulfate	$Al_2(SO_4)_3$	Aqueous solution	10%	+	+	+	2	1	1	1
Aluminium Sulfate	$Al_2(SO_4)_3$	Aqueous solution	Saturated	+	+	+	2	1	1	1
Ammonia	NH_3	Aqueous solution	Solution	+	+	+	2	1	3	2
Ammonia Gas	NH_3	Aqueous solution	Saturated	+	+	+	2	1	3	2
Ammonia Gas	NH_3	Technically pure	100%	+	+	+	2	1	3	2
Ammonium Acetate	CH_3COONH_4	Aqueous solution	Saturated	+	+	+				
Ammonium Bifluoride	NH_4FHF	Aqueous solution	Saturated	+	+	+				
Ammonium Carbonate	$(NH_4)_2CO_3$	Aqueous solution	100%	+	+	+	2	1	2	2
Ammonium Chloride	NH_4Cl	Aqueous solution	Saturated	+	+	+	1	1	1	1
Ammonium Fluoride	NH_4F	Aqueous solution	25%	+	+	+	1	1	1	1
Ammonium Fosfate	$(NH_4)_3PO_4$ X H_2O		All	+	+	+	1	1	1	1
Ammonium Hydroxide	NH_4OH	Aqueous solution	Solution	+	+	+	4	1	2	4
Ammonium Hydroxide	NH_4OH	Aqueous solution	Saturated	+	+	+	4	1	2	4
Ammonium Nitrate	NH_4NO_3	Aqueous solution	Saturated	+	+	/	2	1	1	1
Ammonium Sulfate	$(NH_4)_2SO_4$	Aqueous solution	All	+	+	+	1	1	1	1
Ammonium Sulfhydrate	$NH_4OH(NH_4)_2SO_4$	Aqueous solution	Solution	+						
Ammonium Sulfhydrate	$NH_4OH(NH_4)_2SO_3$	Aqueous solution	Saturated	+						
Ammonium Sulfide	$(NH_4)_2S$	Aqueous solution	10%	+	+	+	1	1	1	1
Ammonium Sulfide	$(NH_4)_2S$	Aqueous solution	Saturated	+	+	+	1	1	1	1
Amyl Acetate	$CH_3COO(CH_2)_4CH_3$	Technically pure	100%	+	+	+	4	2	4	3
Amyl Alcohol	$CH_3(CH_2)_3CH_2OH$		100%	+	+	/	2	2	2	1
Amyl Chloride	$CH_3(CH_2)_4Cl$	Technically pure	100%	-				4	1	4
Aniline	$C_6H_5NH_2$	Technically pure	100%	/			4	2/3	1	3
Aniline Chlorhydrate	$C_6H_5NH2HCl$	Aqueous solution	Saturated	/	/	/	2	2	1	1
Anthraquinone Sulfonic Acid			Solution	+						
Antimony Trichloride	$SbCl_3$	Aqueous solution	90%	+	+	+	1	1	1	1
Aqua Regia	$_3HCl+_1HNO_3$		100%	-	-	-	4	4	2/3	4
Arsenic Acid	H_3AsO_4		Saturated	+	+					
Barium Carbonate	$BaCO_3$	Aqueous solution	All	+	+	+				
Barium Chloride	BaCl2	Aqueous solution	All	+	+	+	1	1	1	1
Barium Hydroxide	$Ba(OH)_2$	Aqueous solution	Saturated	+	+	+	1	1	1	1
Barium Nitrate	$Ba(NO_3)_2$	Aqueous solution	Saturated	+	+	+				
Barium Sulfate	$BaSO_4$	Aqueous solution	Saturated	+	+	+	1	1	1	1
Barium Sulfide	BaS	Aqueous solution	Saturated	+	+	+	1	1	1	2
Beer			100%	+	+	+	1	1	1	1
Benzaldehyde	C_6H_5CHO	Aqueous solution	Saturated	+	+	+	4	2	4	3
Benzene	C_6H_6	Technically pure	100%	/	-	-	4	4	3	4
Benzene + Benzine			20/80%	/	-	-	2/3	4	2	4

Material properties of PE

Component			Concentration	Pipe and fittings			Elastomeric seals			
				HDPE			NBR	EPDM	FPM	SBR
Name	Formula	Remark		°C			°C	°C	°C	°C
				20	40	60	20	20	20	20
Benzene Sulfonic Acid	$C_6H_5SO_3H$	Aqueous solution	10%	-			4	4	1	4
Benzine (Free Of Pb And Aromatic)	$C_5H_{12}÷C_{12}H_{26}$	Technically pure	100%	+	+	/	4	4	1	4
Benzoic Acid	C_6H_5COOH	Aqueous solution	Saturated	+	+	+	4	4	1	4
Benzyl Alcohol	$C_6H_5CH_2OH$	Technically pure	100%	+	+	/	4	1	1	4
Bleaching Lye	NaClO+NaCl		12,5% Cl	/	/		4	1	1	4
Borax	$Na2B_4O_7$	Aqueous solution	All	+	+	+	1	1	1	1
Boric Acid	H_3BO_3	Aqueous solution	Saturated	+	+	+	1	1	1	1
Brine			Comm. Comp.	+						
Bromic Acid	$HBrO_3$		10%	+	+	+	4	1	1	4
Bromine,Liquid	Br_2	Technically pure	100%	-			4	3	2	4
Bromine,Liquid	Br_2		High	-			4	4	1	4
Butadiene	CH_2=CH-CH=CH_2	Gas	100%	+			3	4	2	4
Butane Gas	$CH_3CH_2CH_2CH_3$		100%	+	+	+	2	4	2	4
Butanediol	$OHCH_2CH_2CH_2CH_2OH$	Aqueous solution	10%	+	+	+				
Butanediol	$OHCH_2CH_2CH_2CH_2OH$	Aqueous solution	Concentrated	/	-	-				
Butyl Acetate	$CH_3COOCH_2CH_2CH_2CH_3$	Technically pure	100%	/	/	/	4	2	4	4
Butyl Alcohol	$CH_3(CH_2)_3OH$	Technically pure	100%	+	+	+	1	2	1	1
Butyl Ether	$(CH_3(CH_2)_3)2O$	Technically pure	100%	/	-	-	4	3	4	4
Butyl Phenol	$C_4H_9C_6H_4OH$	Technically pure	100%	-			4	4	2	4
Butyl Phthalate	$HOOCC_6H_4COOC_4H_9$	Technically pure	100%	+	/	/				
Butylene	CH_2=CH-CH_2CH_4	Liquid	100%	-			2	4	1	4
Butylene Glycol	$OHCH_2$-CH=CH-CH_2OH	Technically pure	100%	+	+	+	1	1	1	1
Butylene	CH_2=CH-CH_2CH_3	Technically pure	100%	-			2	4	1	4
Butyric Acid	$CH_3CH_2CH_2COOH$	Aqueous solution	20%	+	+	/				
Butyric Acid	$CH_3CH_2CH_2COOH$	Technically pure	100%	+	+	/				
Calcium Acetate	$Ca(CH_3COO)_2$	Aqueous solution	Saturated	+	+	+	2	1	4	4
Calcium Bisulfite	$Ca(HSO_3)_2$	Aqueous solution	Saturated	+	+	+	2	1	2	2
Calcium Carbonate	$CaCO_3$	Aqueous solution	All	+	+	+	1	1	1	1
Calcium Chlorate	$Ca(ClO_3)_2$	Aqueous solution	Saturated	+	+	+	1	1	1	1
Calcium Chloride	$CaCl_2$	Aqueous solution	All	+	+	+	1	1	1	1
Calcium Hydroxide	$Ca(OH)_2$	Aqueous solution	All	+	+	+	1	1	1	1
Calcium Hypochloride	$Ca(ClO)_2$	Aqueous solution	Saturated	+	+	+	4	1	1	4
Calcium Nitrate	$Ca(NO_3)_2$	Aqueous solution	50%	+	+	+	1	1	1	1
Calcium Sulfate	$CaSO_4$	Aqueous solution	Saturated	+	+	+				
Calcium Sulfide	CaS	Aqueous solution	Saturated	/	/	/	1	1	1	2
Camphor Oil			Comm. Comp.	-	-					
Carbon Dioxide	CO_2+H_2O	Aqueous solution	Indetermined	+	+	+	1	1	1	1
Carbon Dioxide	CO_2	Gas	100%	+	+	+	1	1	1	1
Carbon Disulfide	CS_2	Technically pure	100%	/	-		4	4	1	4
Carbon Monoxid	CO	Gas	100%	+	+	+	2	2	1	2
Carbon Tetrachloride	CCl_4	Technically pure	100%	-						
Carbonic Acid	H_2CO_3	Aqueous solution	Saturated	+	+	+				
Chloramine	$C_6H_5SO_2NNaCl$	Aqueous solution	Solution	+						
Chloric Acid	$HClO_3$	Aqueous solution	20%	/						
Chlorine	Cl_2	Wet	All	/	-		4	3	1	4
Chlorine	Cl_2	Gas	100%	/	/	-	4	2	4	4
Chlorine	Cl_2	Technically pure	100%	-						
Chlorine Water	Cl_2+H_2O		Saturated	/	/					
Chloro Benzene	C_6H_5Cl	Technically pure	100%	/	-	-				
Chloro Sulfonic Acid	$HClSO_3$	Technically pure	100%	-	-	-				
Chloroform	$CHCl_3$	Technically pure	100%	-			4	4	2	4
Chrome Alum	$KCr(SO_4)_2$	Aqueous solution	Saturated	+	+	+				
Chrome Alum	$KCr(SO_4)_2$		Indetermined	+	+	+				
Chromic Acid	CrO_3+H_2O	Aqueous solution	10%	/	-	-	4	2/3	1	4
Chromic Acid	CrO_3+H_2O	Aqueous solution	30%	/	-	-	4	2/3	1	4
Chromic Acid	CrO_3+H_2O	Aqueous solution	50%	/	-	-	4	2/3	1	4
Citric Acid	$C_3H_4(OH)(COOH)_3$	Aqueous solution	50%	+	+	+	2	1	1	2
Compressed Air with Oil			100%	+	+					
Copper Acetate	$Cu(COOCH_3)_2$		Saturated	+			2	1	4	4
Copper Chloride	$CuCl_2$	Aqueous solution	Saturated	+	+	+	1	1	1	1
Copper Fluoride	CuF_2	Aqueous solution	All	+	+	+	2	1	1	1
Copper Nitrate	$Cu(NO_3)_2$	Aqueous solution	Indetermined	+	+	+	2	1	1	1

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Material properties of PE

Component			Concentration	Pipe and fittings			Elastomeric seals			
				HDPE			NBR	EPDM	FPM	SBR
Name	Formula	Remark		°C			°C	°C	°C	°C
				20	40	60	20	20	20	20
Copper Sulfate	$CuSO_4$	Aqueous solution	Solution	+	+	+	1	1	1	1
Copper Sulfate	$CuSO_4$	Aqueous solution	Saturated	+	+	+	1	1	1	1
Cresol	$CH_3C_6H_4OH$	Aqueous solution	>=90%	+	+	/				
Cresol	$CH_3C_6H_4OH$	Aqueous solution	Solution	+	+	/				
Croton Aldehyde	CH_3-CH=CH-CHO	Technically pure	100%	/						
Cryolite	Na_3AlF_6	Aqueous solution	Saturated	/	/	-				
Cyclohexane	C_6H12	Technically pure	100%	+	+	+	2	4	1	4
Cyclohexanol	C_6H11OH	Technically pure	100%	+	/	/	2	4	2	3
Cyclohexanone	$C_6H_{10}O$	Technically pure	100%	+	/	/	4	3	4	4
Decalin (Decahydronaf-talene)	$C_{10}H_{18}$	Technically pure	100%	+	/	/				
Detergents		Aqueous solution	Comm. Comp.	+	+	+				
Dextrine			Comm. Comp.	+	+	+				
Dextrose	$C_6H_{12}O_6$	Aqueous solution	All	+	+	+				
Dextrose	$C_6H_{12}O_6$	Aqueous solution	Saturated	+	+	+				
Dextrose	$C_6H_{12}O_6$	Aqueous solution	All	+	+	+	1	1	1	1
Dibutyl Phthalate	$C_6H_4(COOC_4H_9)_2$	Technically pure	100%	-			4	2	2	4
Dibutyl Sebacate	$C8H_{16}(COOC_4H_9)_2$	Technically pure	100%	+			4	2	2	4
Dichloro Benzene	$C_6H_4Cl_2$	Technically pure	100%	/			4	4	2	4
Dichloroacetic Acid	$Cl_2CHCOOH$	Aqueous solution	50%	+	+	+	2	2	2	2
Dichloroacetic Acid	$Cl_2CHCOOH$	Technically pure	100%	+	+	/	3	2	3	3
Dichloroacetic Acid Methyl Ester	$Cl_2CHCOOCH_3$	Technically pure	100%	+	+	+				
Dichloroethylene	CHCl=CHCl	Technically pure	100%	-			2		2	4
Diesel Oil			100%	+	/	/	1	4	1	4
Diethylether	$C_2H_5OC2H_5$	Technically pure	100%	-	-		4	4	4	4
Diglycolic Acid	$HOOCCH_2OCH_2COOH$	Aqueous solution	Saturated	+						
Di-Isobutyl Ketone	$(CH_3)_2CHCH_2COCH_2CH(CH_3)_2$	Technically pure	100%	+	/	-	4	2	4	2/3
Dimethyl Amine	$(CH_3)_2NH$	Technically pure	100%	/	-					
Dimethyl Formamide	$HCON(CH_3)_2$	Technically pure	100%	+	+	/	4	2	4	3
Dioctyl Phthalate	$C_6H_4(COOC_8H_{17})_2$	Technically pure	100%	+	/	/	4	2	2	4
Dioxane	$(CH_2)_4O2$	Technically pure	100%	+	+	+	4	2/3	4	4
Ethyl Acetate	$CH_3COOCH_2CH_3$	Technically pure	100%	+	/	-	4	2/3	4	4
Ethyl Alcohol	CH_3CH_2OH	Aqueous solution	96%	+	+	/	2	1	2	1
Ethyl Benzene	$C_6H_5C_2H_5$	Technically pure	100%	/	/	/	4	4	2	4
Ethyl Chloride	CH_3CH_2Cl	Technically pure	100%	/	-		2/3	4	2	4
Ethyl Ether	$CH_3CH_2OCH_2CH_3$	Technically pure	100%	/			3	3	4	4
Ethylene Chlorohydrin	$ClCH_2CH_2OH$	Technically pure	100%	+	+	/	4	2	2	2
Ethylene Diamina	$NH_2CH_2CH2NH_2$	Technically pure	100%	-	-	-	2	1	4	2
Ethylene Dichloride	CH_2ClCH_2Cl	Technically pure	100%	/	/		4	4	2/3	4
Ethylene Glycol	$HOCH_2$-CH_2OH	Technically pure	100%	+	+	+	1	1	1	1
Ethylene Oxide	C_2H_4O	Technically pure	100%	-			3	3	4	4
Exhaust fumes			Traces	+	+	+				
Fatty Acids	$R>C_6$	Technically pure	100%	+	+	/				
Ferric Chloride	$FeCl_3$	Aqueous solution	Saturated	+	+	+	2	1	1	2
Ferric Nitrate	$Fe(NO_3)_3$		Indetermined	+	+	+				
Ferric Sulfate	$Fe_2(SO_4)_3$	Aqueous solution	Saturated	+	+	+				
Ferrous Chloride	$FeCl_2$	Aqueous solution	Saturated	+	+	+	2	1	1	2
Ferrous Nitrate	$Fe(NO_3)_2$	Aqueous solution	Saturated	+	+	+				
Ferrous Sulfate	$FeSO_4$	Aqueous solution	Saturated	+	+	+	2	1	1	2
Fertilizer Salts		Aqueous solution	10%	+	+	+				
Fertilizer Salts		Aqueous solution	Saturated	+	+	+				
Fluoboric Acid	HBF_4	Technically pure	100%	+	+	+	1	1		1
Fluorine Gas Dry	F_2		100%	-			4		1	4
Fluosilicic Acid	H2SiF6	Aqueous solution	32%	+	+	+				
Formaldehyde	CH_2O	Aqueous solution	37%	+	+	+	1	1	1	1
Formamide	$HCONH_2$	Technically pure	100%	+	+	+	2	2	1	1
Formic Acid	HCOOH	Aqueous solution	50%	+	+	+	4	2	4	2
Formic Acid	HCOOH	Technically pure	100%	+	+	+	4	2	4	2
Freon F-12	CCl_2F_2	Technically pure	100%	-			2	2/3	2	4
Fruit pulp and juice			Comm. Comp.	+						
Furfuryl Alcohol	$C_5H_6O_2$	Technically pure	100%	+	+	/	4	2		4

Material properties of PE

Component			Concentration	Pipe and fittings			Elastomeric seals			
					HDPE		NBR	EPDM	FPM	SBR
Name	Formula	Remark			°C		°C	°C	°C	°C
				20	40	60	20	20	20	20
Gelatine			100%	+	+	+	1	1	1	1
Glycerine	$C_3H_5(OH)_3$	Aqueous solution	All	+	+	+	1	1	2	1
Glycocoll	NH_2CH_2COOH	Aqueous solution	10%	+	+					
Glycolic Acid	$HOCH_2COOH$	Aqueous solution	37%	+	+	+				
Gas containing:										
- Carbon Dioxide	CO_2	Gas	All	+	+	+				
- Carbon Monoxid	CO	Gas	All	+	+	+				
- Hydrochloric Acid	HCL	Gas	All	+	+	+				
- Hydrochloric Acid	HCL	Gas	All	+	+	+				
- Hydrofluoric Acid	HF	Gas	< 0,1 %	+	+	+				
- Nitrous Vapours	NO, NO_2, $N2O_3$, NOx	Gas	< 0,1 %	+	+	+				
- Nitrous Vapours	NO, NO_2, $N2O_3$, NOx	Gas	5%	+	+	+				
- Oleum	$H_2SO_4 + SO_3$	Gas	< 0,1 %	-	-	-				
- Oleum	$H_2SO_4 + SO_3$	Gas	5%	-	-	-				
- Sulphur Dioxide Liquid	SO_2	Gas	All	+	+	+				
- Sulphur Trioxide	SO_3	Gas	< 0,1 %	-	-	-				
- Sulphuric Acid	H_2SO_4	Gas	All	+	+	+				
Heptane	C_7H_{16}	Technically pure	100%	+	/	-	1	4	1	4
Hexane	C_6H_{14}	Technically pure	100%	+	/	/	1	4	1	4
Hydrazine Hydrate	NH_2-NH_2 H_2O	Aqueous solution	Solution	+	+	+	2	1	1	
Hydrobromic Acid	HBr		10%	+	+	+	3	2	1	3
Hydrobromic Acid	HBr		48%	+	+	+	4	1	1	4
Hydrochloric Acid	HCl	Aqueous solution	10%	+	+	+				
Hydrochloric Acid	HCl	Aqueous solution	30%	+	+	+	2/3	1	2	2/3
Hydrochloric Acid	HCl	Aqueous solution	5%	+	+	+				
Hydrochloric Acid	HCl	Aqueous solution	Saturated	+	+	+				
Hydrocyanic Acid	HCN	Aqueous solution	Solution	+	+	+	2	2	1	2
Hydrocyanic Acid	HCN	Technically pure		+	+	+	2	2	1	2
Hydrofluoric Acid	HF	Aqueous solution	10%	+	+	/	4	3	2/3	3
Hydrofluoric Acid	HF	Aqueous solution	40%	+	/	/	4	3	2/3	3
Hydrofluoric Acid	HF	Aqueous solution	70%	+	/	/	4	3	2/3	3
Hydrogen Gas	H_2		100%	+	+	+	2	1	1	4
Hydrogen Peroxide	H_2O_2	Aqueous solution	10%	+	+	+	2	1	1	2
Hydrogen Peroxide	H_2O_2	Aqueous solution	50%	+	+	/	2	1	1	2
Hydrogen Peroxide	H_2O_2	Aqueous solution	90%	+	-	-	2	1	1	2
Hydrogen Sulfide	H_2S	Aqueous solution	Saturated	+	+	+				
Hydrogen Sulfide	H_2S		100%	+	+	/				
Hydroquinone	$C_6H_4O_2$	Aqueous solution	Saturated	+	+	+	3	4	2	4
Hydroxylamine Sulphate	$(NH_2OH)_2$-H_2SO_4	Aqueous solution	All	+	+	+				
Iodine Dry And Wet	I_2		3%	/	-		1	2	1	1
Iso-Octane	C_8H_{18}		100%	/	/	-	1	4	1	4
Isopropyl Alcohol	$(CH_3)_2CHOH$	Technically pure	100%	+	+	+	2	1	1	2
Isopropyl Ether	$(CH_3)_2CHOCH(CH_3)_2$	Technically pure	100%	/	-	-	2/3	3	4	4
Lactic Acid	$CH_3CHOHCOOH$	Aqueous solution	<=28%	+	+	+	2	1	1	3
Lanoline			Comm. Comp.	+	+	+	1	4	1	4
Lard Oil			Comm. Comp.	+						
Lead Acetate	$Pb(CH_3COO)_2$	Aqueous solution	Saturated	+	+	+	1	1	4	4
Lead Chloride	$PbCl_2$	Aqueous solution	Saturated	+	+					
Lead Nitrate	$Pb(NO_3)_2$	Aqueous solution	Saturated	+			1	1	1	1
Lead Sulfate	$PbSO_4$	Aqueous solution	Saturated	+	+	+				
Linseed Oil			Comm. Comp.			/	1	3	1	4
Lubricating Oils			Comm. Comp.	-			2	4	1	4
Lubricating Oils,Free Of Aromatic			Comm. Comp.	+	+	/	1	4	1	4
Magnesium Carbonate	$MgCO_3$	Aqueous solution	All	+	+	+	1	1	1	1
Magnesium Chloride	$MgCl_2$	Aqueous solution	Saturated	+	+	+	2	1	1	1
Magnesium Nitrate	$Mg(NO_3)_2$	Aqueous solution	Indetermined	+	+	+				
Magnesium Sulfate	$MgSO_4$		Saturated	+	+	+	2	1	1	1
Maize Oil			Comm. Comp.	+	+	/	1	1	1	4
Maleic Acid	HOOC-CH=CH-COOH	Aqueous solution	Saturated	+	+	+	1	1	1	1
Malic Acid	$HOOCCH_2CHOHCOOH$	Aqueous solution	Saturated	+			1	4	1	2
Mercuric Chloride	$HgCl_2$	Aqueous solution	Saturated	+	+	+	1	1	1	1

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Material properties of PE

Component			Concentration	Pipe and fittings			Elastomeric seals			
				HDPE			NBR	EPDM	FPM	SBR
Name	Formula	Remark		°C			°C	°C	°C	°C
				20	40	60	20	20	20	20
Mercuric Cyanide	$Hg(CN)_2$	Aqueous solution	All	+	+	+				
Mercuric Sulfate	$HgSO_4$	Aqueous solution	Saturated	+	+	+				
Mercurous Nitrate	$HgNO_3$	Aqueous solution	Saturated	+	+	+				
Mercury	Hg	Technically pure	100%	+	+	+	1	1	1	1
Methane	CH_4		100%	+			1	3	1	3
Methanesulfonic Acid	CH_3SO_3H	Aqueous solution	50%	/	/					
Methanesulfonic Acid	CH_3SO_3H	Technically pure	100%	-	-					
Methyl Acetate	CH_3COOCH_3	Technically pure	100%	+			4	2	4	4
Methyl Alcohol	CH_3OH	Technically pure	100%	+	+	+				
Methyl Amine	CH_3NH_2	Aqueous solution	32%	/			4	1	4	2
Methyl Bromide	CH_3Br	Technically pure	100%	/			4	4	1	4
Methyl Chloride	CH2Cl	Technically pure	100%	/			4	3	1	4
Methyl Ethyl Ketone	$CH_3COCH2CH_3$		100%	+	/	-	4	2	4	4
Methylene Chloride	CH_2Cl_2		100%	/			4	4	3	4
Milk			100%	+	+	+	1	1	1	1
Mineral oil			Comm. Comp.	/	/	-	1	4	1	4
Mixed Acids (Chromic, Sulphuric)	$H_2CrO_4/H_2SO_4/H_2O$		50/15/35%	-						
Mixed Acids (Sulphuric, Nitric)	$H_2SO_4/HNO_3/H_2O$		10/20/70%	/	/	/				
Mixed Acids (Sulphuric, Nitric)	$H_2SO_4/HNO_3/H_2O$		48/49/3	-	-	-				
Mixed Acids (Sulphuric, Nitric)	$H_2SO_4/HNO_3/H_2O$		50/50%	-	-	-				
Mixed Acids (Sulphuric, Phosphoric)	$H_2SO_4/H_3PO_4/H_2O$		30/60/10%	+	/					
Molasses			Comm. Comp.	+	/	/	1	1	1	1
Monochloracetic Acid	$ClCH_2COOH$	Aqueous solution	50%	+	/	/	4	2		4
Monochloroacetic Acid Ethyl Ester	$ClCH_2COOCH_2CH_3$	Technically pure	100%	+	+	+				
Naphthalene	C10H8	Technically pure	100%	+	/	/				
Nickel Chloride	$NiCl_2$	Aqueous solution	All	+	+	+	1	1	1	1
Nickel Nitrate	$Ni(NO_3)_2$	Aqueous solution	Saturated	+	+	+				
Nickel Sulfate	$NiSO_4$	Aqueous solution	Solution	+	+	/	1	1	1	1
Nickel Sulfate	NiSO4	Aqueous solution	Saturated	+	+	+	1	1	1	1
Nicotine	$C_{10}H1_4N_2$		Indetermined	+	+	+				
Nitric Acid	HNO_3	Aqueous solution	20%	+	/	/	4	4	2/3	4
Nitric Acid	HNO_3	Aqueous solution	40%	/	-	-	4	4	2/3	4
Nitric Acid	HNO_3	Aqueous solution	70%	-	-	-	4	4	2/3	4
Nitric Acid	HNO_3	Technically pure	100%	-			4	4	2/3	4
Nitrobenzene	$C_6H_5NO_2$		100%	+	/	/				
Nitroethane	$CH_3CH_2NO_2$	Technically pure	100%	+	/	/	4	2	4	2
Nitromethane	CH_3NO_2	Technically pure	100%	+	/	/	4	2	4	2
Nitrotoluene	$CH_3C_6H_4NO_2$	Technically pure	100%	+	+	/				
Nitrous Gases	NOx	Anhydrous	Solution	+	+	+	1	1	1	1
Oleic Acid	$C_{17}H_{33}COOH$	Technically pure	100%	+	+	/	2	3	1	4
Oleum	$H_2SO_4+SO_3$		10%	-			4	4	1	4
Oleum	$H_2SO_4+SO_3$		High	-			4	4	1	4
Oleum	$H_2SO_4+SO_3$		Traces	-			4	4	1	4
Olive Oil			Comm. Comp.	+	+	/	1	4	1	4
Oxalic Acid	HOOCCOOH	Aqueous solution	10%	+	+	+	1	1	1	1
Oxalic Acid	HOOCCOOH	Aqueous solution	Saturated	+	+	+	1	1	1	1
Oxygen	O_2		All	+	+	/	2	1	1	4
Ozone Gas	O_3	Aqueous solution	Saturated	/	-		4	1	1	4
Ozone Gas	O_3		>2%	/	-		4	1	1	4
Palmitic Acid	$CH_3(CH_2)1_4COOH$		70%	/	-	-				
Paraffin Emulsion		Water-emulsie	Comm. Comp.	/	/	/	1	4	1	4
Paraffin Oil			Comm. Comp.	+	+	+	1	4	1	4
Peanut Oil			Comm. Comp.	+			1	3	1	4
Perchloric Acid	$HClO_4$	Aqueous solution	10%	+	+	+	4	1	1	4
Perchloric Acid	$HClO_4$	Aqueous solution	70%	+	/	-	4	1	1	4
Perchloric Acid	$HClO_4$	Aqueous solution	10%	+	+		4	1	2	4

Material properties of PE

Component			Concentration	Pipe and fittings			Elastomeric seals			
					HDPE		NBR	EPDM	FPM	SBR
Name	Formula	Remark			°C		°C	°C	°C	°C
				20	40	60	20	20	20	20
Petroleum		Technically pure	100%	+	+	/	1	4	1	4
Petroleum Ether		Technically pure	100%	+	/	/	1	4	1	4
Phenol	C_6H_5OH	Aqueous solution	1%	+	/		4	4	2	4
Phenol	C_6H_5OH	Aqueous solution	90%	+	+		4	4	1	4
Phenylhydrazine	$C_6H_5NHNH_2$	Technically pure	100%	/	/	/	3	3	2	4
Phenylhydrazine Hydrochloride	$C_6H_5NHNH_2HCl$	Aqueous solution	Saturated	+						
Phosphoric Acid	H_3PO_4	Aqueous solution	25%	+	+	+	1	1	1	1
Phosphoric Acid	H_3PO_4	Aqueous solution	50%	+	+	+	1	1	1	1
Phosphoric Acid	H_3PO_4	Aqueous solution	85%	+	+	/	1	1	1	1
Phosphorous Penta-Trichloride	PCl_5-PCl_3	Technically pure	100%	+	/	/				
Phosphorous Pentoxide	P_2O_5	Technically pure	100%	+	+	+				
Photographic Developer			Comm. Comp.	+			1	2	1	2
Photographic Emulsion			Comm. Comp.	+	+					
Phthalic Acid	$C_6H_4(COOH)_2$	Aqueous solution	50%	+	+	+				
Picric Acid	$C_6H_2(OH)(NO_2)_3$	Aqueous solution	1%	+	+	/	2	1	1	2
Potassium Acetate	CH_3COOK	Aqueous solution	Saturated	+	+	+	1	1	2	4
Potassium Bicarbonate	$KHCO_3$	Aqueous solution	Saturated	+	+	+	1	1	1	1
Potassium Bichromate	$K_2Cr_2O_7$	Aqueous solution	Saturated	+	+		2	1	1	2
Potassium Bisulfate	$KHSO_4$	Aqueous solution	Indetermined	+	+	+	1	1	1	1
Potassium Borate	K_3BO_3	Aqueous solution	Saturated	+	+	+				
Potassium Bromate	$KBrO_3$	Aqueous solution	Saturated	+	+	/	1	1	1	1
Potassium Bromide	KBr	Aqueous solution	Saturated	+	+	+	1	1	1	1
Potassium Carbonate	K_2CO_3	Aqueous solution	Saturated	+	+	+	1	1	1	1
Potassium Chlorate	$KClO_3$	Aqueous solution	Saturated	+	+	+	4	1	1	2
Potassium Chloride	KCl	Aqueous solution	Saturated	+	+	+	1	1	1	1
Potassium Chromate	K_2CrO_4	Aqueous solution	Saturated	+	+		2	1	1	2
Potassium Cyanide	KCN	Aqueous solution	Saturated	+	+	+	1	1	1	1
Potassium Ferricyanide	$K_4Fe(CN)_{63}H_2O$	Aqueous solution	Saturated	+	+	+				
Potassium Fluoride	KF	Aqueous solution	Saturated	+	+	+				
Potassium Hydroxide	KOH	Aqueous solution	<=60%	+	+	+	2	1	2/3	1
Potassium Hypochlorite	KClO	Aqueous solution	Indetermined	+	/	/				
Potassium Iodide	KI	Aqueous solution	Saturated	+	+	+				
Potassium Nitrate	KNO_3	Aqueous solution	Saturated	+	+	+	1	1	1	1
Potassium Perborate	KBO_3	Aqueous solution	Indetermined	+	+	+				
Potassium Perchlorate	$KClO_4$	Aqueous solution	Saturated	+	+	+	3	1	1	3
Potassium Permanganate	$KMnO_4$	Aqueous solution	10%	+	+	+				
Potassium Permanganate	$KMnO_4$	Aqueous solution	Saturated	+	+	/				
Potassium Persulfate	K_2S_2O8	Aqueous solution	Saturated	+	+	+				
Potassium Phosphates Acids	K_2HPO_4 KH_2PO_4	Aqueous solution	All	+	+	+				
Potassium Sulfate	K_2SO_4	Aqueous solution	Saturated	+	+	+	1	1	1	1
Propane Gas	$CH_3CH_2CH_3$		100%	+			1	4	1	4
Propane Gas	$CH_3CH_2CH_3$		100%	+			1	4	1	4
Propionic Acid	CH_3CH_2COOH	Aqueous solution	50%	+	+	+	2	4	1	4
Propyl Alcohol	C_3H_7OH	Aqueous solution	97%	+	+	+				
Propylene Glycol	$CH_3CHOHCH_2OH$	Technically pure	100%	+	+	+	2	1	1	1
Propylene Oxid		Technically pure	100%	+			4	1	4	4
Pyridine	C_5H_5N	Technically pure	100%	+	/	/	4	4	4	4
Silicic Acid	H_2SiO_3	Aqueous solution	All	+	+	+				
Silicone Oil			Comm. Comp.	+	+	/	1	1	1	1
Silver Cyanide	AgCN	Aqueous solution	All	+	+	+				
Silver Nitrate	$AgNO_3$	Aqueous solution	Saturated	+	+	+	1	1	1	1
Silver Sulfate	Ag_2SO_4	Aqueous solution	Saturated	+	+	+				
Soap		Aqueous solution	All	+	+	+	1	1	1	2
Sodium Acetate	CH_3COONa	Aqueous solution	Saturated	+	+	+	2	1	4	4
Sodium Alum	$NaAl(SO_4)_2$	Aqueous solution	Saturated	+	+	+				
Sodium Benzoate	C_6H_5COONa		Saturated	+	+	+				
Sodium Bicarbonate	$NaHCO_3$	Aqueous solution	Saturated	+	+	+	2	1	1	1
Sodium Bichromate	Na_2Cr_2O7	Aqueous solution	Saturated	+	+	+				

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Material properties of PE

Component			Concentration	Pipe and fittings			Elastomeric seals			
				HDPE			NBR	EPDM	FPM	SBR
Name	Formula	Remark		°C			°C	°C	°C	°C
				20	40	60	20	20	20	20
Sodium Bisulfate	$NaHSO_4$	Aqueous solution	10%	+	+	+	1	1	1	2
Sodium Bisulfite	$NaHSO_3$	Aqueous solution	100%	+	+	+	1	1	1	2
Sodium Bromate	$NaBrO_3$	Aqueous solution	All	+	/					
Sodium Bromide	NaBr	Aqueous solution	Saturated	+	+	+				
Sodium Carbonate (Soda)	Na_2CO_3	Aqueous solution	Saturated	+	+	+	2	1	1	1
Sodium Chlorate	$NaClO_3$	Aqueous solution	All	+	+	+	2/3	2	1	4
Sodium Chloride	NaCl	Aqueous solution	Solution	+	+	+	1	1	1	1
Sodium Chloride	NaCl	Aqueous solution	Saturated	+	+	+	1	1	1	1
Sodium Chromate	Na_2CrO_4	Aqueous solution	Solution	+						
Sodium Cyanide	NaCN	Aqueous solution	All	+	+	+	2	1	1	1
Sodium Disulphite	$Na_2S_2O_5$	Aqueous solution	All	+			1	1	1	2
Sodium Ferrocyanide	Na_4FeCN_6	Aqueous solution	Saturated	+	+					
Sodium Fluoride	NaF	Aqueous solution	Saturated	+						
Sodium Hydroxide	NaOH	Aqueous solution	10%	+	+	+	3	1	2	2
Sodium Hydroxide	NaOH	Aqueous solution	30%	+	+	+	4	1	3	2
Sodium Hydroxide	NaOH	Aqueous solution	50%	+	+	+	1	1	3	2
Sodium Hypochlorite	NaClO	Aqueous solution	12,50%	/	-		4	1	1	4
Sodium Hypochlorite	NaClO	Aqueous solution	3%	+	/	/	4	1	1	4
Sodium Iodide	NaI	Aqueous solution	All	+						
Sodium Metasilicate	Na_2SiO_3	Aqueous solution	<5%	+	+	+				
Sodium Metasilicate	Na_2SiO_3	Aqueous solution	Saturated	+	+	+	1	1	1	1
Sodium Nitrate	$NaNO_3$	Aqueous solution	Saturated	+	+	+	1	1	1	1
Sodium Nitrite	$NaNO_2$	Aqueous solution	Saturated	+						
Sodium Oxalate	$Na_2C_2O_4$	Aqueous solution	Saturated	+						
Sodium Perborate	$NaBO_3$	Aqueous solution	All	+			2	1	1	2
Sodium Perchlorate	$NaClO_4$	Aqueous solution	Indetermined	+						
Sodium Peroxide	Na_2O_2		Solution	+			2	1	1	2
Sodium Persulphate	Na_2S_2O8	Aqueous solution	Saturated	+	+	+				
Sodium Phosphate	Na_3PO_4	Aqueous solution	Saturated	+	+	+	1	1	1	1
Sodium Phosphate Monoacid	Na_2HPO_4	Aqueous solution	Saturated	+	+		1	1	1	
Sodium Sulfate	Na_2SO_4	Aqueous solution	Saturated	+	+	+	1	1	1	1
Sodium Sulfide	Na_2S	Aqueous solution	Solution	+	+	+	2	1	1	3
Sodium Sulfide	Na_2S	Aqueous solution	Saturated	+	+	+	2	1	1	3
Sodium Sulfite	Na_2SO_3	Aqueous solution	Saturated	+	+	+				
Sodium Thiocyanate	NaSCN	Aqueous solution	Indetermined	+	+	+				
Sodium Thiosulphate	$Na_2S_2O_3$	Aqueous solution	Saturated	+	+	+	3	1	1	2
Stannic Chloride	$SnCl_4$	Aqueous solution	Saturated	+	+	+	1	1	1	2
Stannous Chloride	$SnCl_2$	Aqueous solution	Saturated	+	+	+	1	1	1	1
Stearic Acid	$C_{17}H_{35}COOH$	Technically pure	100%	+		/	1	1	1	1
Styrene	$C_6H_5CH=CH_2$		100%	/	-	-	4	4	1	4
Sugar Syrup			Saturated	+	+	+	1	1	1	1
Sulfamic Acid	HSO_3NH_2	Aqueous solution	20%	-						
Sulphur	S		100%	+	+	+				
Sulphur Dioxide Liquid	SO_2	Aqueous solution	Saturated	+	+	+				
Sulphur Dioxide Liquid	SO_2	Technically pure	100%	-						
Sulphur Dioxide Liquid	SO_2	Technically pure	100%	+	+	+				
Sulphur Trioxide	SO_3		100%	-						
Sulphuric Acid	H_2SO_4	Aqueous solution	10%	+	+	+	2	1	2	2
Sulphuric Acid	H_2SO_4	Aqueous solution	50%	+	+	+	4	1	2	4
Sulphuric Acid	H_2SO_4	Aqueous solution	80%	+	+	/	4	2	2	4
Sulphuric Acid	H_2SO_4	Aqueous solution	90%	/	/	-				
Sulphuric Acid	H_2SO_4	Aqueous solution	96%	-	-	-	4	4	2	4
Sulphuric Acid	H_2SO_4	Aqueous solution indetermined	98%	-	-	-				
Sulphuric Acid	H_2SO_4	Technically pure	100%	-	-	-				
Sulphurous Acid	H_2SO_3	Aqueous solution	Saturated	+	+	+	2	2	1	2
Tallow Emulsion			Comm. Comp.	+	/	/	2	2	1	4
Tannic Acid	$C_{76}H_{52}O_{46}$	Aqueous solution	All	+	+	+	2	2	2	2
Tartaric Acid	$COOH(CHOH)_2COOH$	Aqueous solution	All	+	+	+				
Tetrachloroethane	$CHCl_2CHCl_2$		100%	/	-		4	4	1	4

Material properties of PE

Component			Concentration	Pipe and fittings			Elastomeric seals			
					HDPE		NBR	EPDM	FPM	SBR
Name	Formula	Remark			°C		°C	°C	°C	°C
				20	40	60	20	20	20	20
Tetrachloroethylene	$Cl_2C=CCl_2$		100%	/	-		4	4	2	4
Tetraethyl Lead	$Pb(C_2H_5)_4$	Technically pure	100%	+			2	4	1	4
Tetrahydrofurane	$(CH_2)_4O$		100%	/	-		4	4	4	4
Tetrahydronaphthalene	$C_{10}H_{12}$		100%	/						
Thionyl Chloride	$SOCl_2$	Technically pure	100%	-			2/3	1	1	2/3
Thiophene	C_4H_8S		100%	/	/	/	4	4	4	4
Toluene	$C6H_5CH_3$	Technically pure	100%	/	-	-	4	4	2	4
Toluic Acid	CH_3C6H_4COOH		50%	/						
Transformer Oil			Comm. Comp.	+	/	/	2	4	2	4
Tributylphosphate	$(C_4H_9)_3PO_4$	Technically pure	100%	+	+	+	4	2	3	4
Trichlorethylene	$ClCH=CCl_2$	Technically pure	100%	-	-	-	4	4	2	4
Trichloroacetic Acid	CCl_3COOH	Aqueous solution	50%	+	/	/	2	2	4	4
Trichloroacetic Acid	CCl_3COOH	Technically pure	100%	+	/	-	2	2	4	4
Trichloroethane	CH_3CCl_3	Technically pure	100%	/			4	4	1	4
Tricresylphosphate	$(CH_3C6H_4O)_3PO_4$	Technically pure	100%	+	+	+	4	2	2	4
Triethanolamine	$N(CH_2CH_2OH)_3$	Technically pure	100%	+	+	/	3	1	4	2
Trioctylphosphate	$(C_8H_{17})_3PO_4$	Technically pure	100%	/			4	1	2	4
Turpentine Oil		Technically pure	100%	/	-	-	2	4	1	4
Urea	NH_2CONH_2	Aqueous solution	<=10%	+	+	+	1	1	1	1
Urea	NH_2CONH_2	Aqueous solution	33%	+	+	+	1	1	1	1
Urine			Indetermined	+	+	+				
Vaseline Oil			Comm. Comp.	+	+	/	1		1	4
Vegetable Oils and fats			Comm. Comp.	+	/		1	4	1	3
Water	H_2O		100%	+	+	+	1	1	1	1
Water	H_2O		100%	+	+	+	1	1	1	1
Water	H_2O		100%	+	+	+	1	1	1	1
Water	H_2O		100%	+	+	+	2	1	2	2
Water	H2O		100%	+	+	+	2	1	2	2
Water, Rain	H_2O		100%	+	+	+	1	1	1	1
Water, Salt	H_2O+NaCl		Saturated	+	+	+	1	1	1	1
Water, Sea			100%	+	+	+	1	1	1	1
Wine			Comm. Comp.	+	+	+	1	1	1	1
Wine Vinegar		Technically pure	Comm. Comp.	+	+	+				
Xylene	$C_6H_4(CH_3)_2$		100%	-			4	4	2	4
Zinc Acetate	$Zn(CH_3COO)_2$		Indetermined	+	+	+	2	1	4	4
Zinc Chloride	$ZnCl_2$	Aqueous solution	Solution	+	+	+	2	1	1	2
Zinc Chloride	$ZnCl_2$	Aqueous solution	Saturated	+	+	+	2	1	1	2
Zinc Chromate	$ZnCrO_4$	Aqueous solution	Indetermined	+	+	+				
Zinc Cyanide	$Zn(CN)_2$	Aqueous solution	All	+	+	+				
Zinc Nitrate	$Zn(NO_3)_2$	Aqueous solution	Indetermined	+	+	+				
Zinc Sulfate	$ZnSO_4$	Aqueous solution	Solution	+	+	+	1	1	1	1
Zinc Sulfate	$ZnSO_4$	Aqueous solution	Saturated	+	+	+	1	1	1	1

Table 2.3 Chemical resistance. The data is based on the latest knowledge. When in doubt please contact Technical Support.

Material properties of PE

2.4 Health assessment of PE

Physiological assessment

General product safety
The European General Product Safety Directive (GPSD) has been incorporated in the Netherlands Commodities Act and the General Product Safety (Commodities Act) Decree. The core of the GPSD is the obligation of companies only to sell safe products.

Legislation on hygiene
New European legislation on food and feed hygiene came into effect on 1 January 2006. The EC General Food Law (GFL) lays the groundwork for food safety. Further elaboration occurs in an EC Food Hygiene Regulation, an EC Feed Hygiene Regulation and a Control Regulation for government. Within this hygiene package, the Netherlands Food and Consumer Product Safety Authority (Voedsel en Waren Autoriteit, abbreviated VWA) has a central role. The VWA is the governmental organisation that investigates and monitors the safety of food and consumer products.

Packaging and Consumer Product Regulation
The Netherlands Packaging and Consumer Product (Commodities Act) Regulation (Regeling Verpakkingen en Gebruiksartikelen, abbreviated RVG) consists of a list of authorised materials that may be used to produce and package foodstuffs. The authorised RVG list gives values to a number of substances indicating the quantities that may be present in the end product as long as Article 2 Paragraph 1 Item c RVG (Commodities Act) is complied with. In addition, the regulation contains a large number of (migration) limits for the end product. Polyolefins, such as PE, are frequently used as packaging material.

National regulation of the water supply in the Netherlands
The Netherlands Water Supply Act (Waterleidingwet) has the principle role in protecting public health against the risk associated with the delivery or supply of tap water. Formulated in 1980, the first European Drinking Water Directive imposed very strict requirements on the quality of the water meant for human consumption. This EU directive was implemented in the Netherlands in the Water Supply Decree (Waterleidingbesluit), which stipulates that tap water must meet certain legal quality requirements. Materials used in obtaining, preparing, treating, storing, transporting or distributing tap water may not have adverse consequences for public health.

Certificate for toxicological elements
An important instrument for protecting the quality of drinking water in the Netherlands is the Water Supply (Materials and Chemicals) Regulation (Regeling materialen en chemicaliën leidingwatervoorziening). This regulation imposes requirements on the materials and chemicals used in the preparation and distribution of drinking water and that therefore come into contact with the drinking water. Under this regulation, products that satisfy the stated requirements are given an official quality certificate by the Minister of Housing, Spatial Development and the Environment: the KIWA ATA (Certificate for Toxicological Elements).
The requirements governing the quality of drinking water in the Netherlands are laid down in the Water Supply Decree. To enable testing of all the materials and chemicals used in the drinking water sector, KIWA has established Authorised Lists containing precise statements of the requirements that chemicals and materials must satisfy to be toxicologically permissible. There is an Authorised List for all plastic pipe materials, such as PE100 and rubber products.

2.5 Chapter summary

Polyethylene	Polyethylene is abbreviated "PE". PE is a semi-crystalline thermoplastic belonging to the polyolefin group. Depending on the average molar mass, the compound produced may be PE-LD (low density PE), PE-LLD (linear low density PE), PE-MD (medium density PE) and PE-HD (high density PE).
Health assessment of PE	The health assessment of plastic is laid down in food legislation and differs from country to country, making it necessary for manufacturers to inquire further.In the Netherlands, regulations have been established to govern substance quantities that can be present in end products. Authorised Lists have been formulated containing the materials that meet imposed requirements. PE is found on these Authorised Lists.