Ostendorf OSMA®

PVC®

KG System

ISSUED 07/2019

TRIO SYSTEM SN4 - SN8

100% RECYCLABLE

CIRCULAR STIFFNESS SN4 - SN10

60°C TEMPERATURE RESISTANCE

ISO 9001

- **HIGH STRENGTH**
- **FLEXIBILITY**
- **LONG-TERM STABILITY**
- **LIFESPAN OF UP TO 100 YEARS**
- **CHEMICAL STABILITY**
- **RESISTANCE TO ABRASION**
- **TOLERANCE TO SUBSIDENCE**
- **EXCELLENT HYDRAULIC PROPERTIES**
- **100% LEAK TIGHTNESS**
- **NO ROOTS CAN PENETRATE THE JOINTS**
- **IMPROVED SECURITY**
- **MOUNTING DEPTHS: up to 4 m (SN 4), up to 7 m (SN 8)**
- **WIDE RANGE OF PISSIBLE APPLICATIONS**
- **EASY INSPECTIONS**
- **QUICK INSTALLATION**
- **EASY LAYING**
- **ECONOMICAL CONSTRUCTION**

TRIO - We learn from nature

The basis for the production of KG-System (PVC)® innovative pipes and shaped pieces is the unique co-extrusion technology. This technology enables us to make products with structures similar to that of large bones found in the animal kingdom.

Material – PVC

During the development of the TRIO technology, a great emphasis was placed on maximizing the possibilities offered by unplasticized plyvinyl chloride (PVC-U), i. e. by an advanced and well-tested raw material. The results are drainage pipes and shaped pieces featuring perfectly smooth and abrasion-resistant inner walls, tough outer layer resistance to all materials generally used for pipe gravel pack, as well as a flexible core capable of resisting pressures from inside the earth and vehicle wheels.

Sealing elements

Leak tightness of joints is ensured with durable rubber sealing elements located in the pipe faucet notches. The leak tightness remains preserved even in case of pipe deformation or displacement.

Reinforced walls

The KG-System (PVC)® pipes and shaped pieces are produced in compliance with applicable European standards ČSN EN 1401-1 and ČSN EN 13 476-2.

Wide variety

KG-System (PVC)® is a complete system offering a wide range of elements – pipes with SN 4 and SN 8 circular stiffness enabling later insertion of elements and connection of other systems (such as e.g. sewer manholes).

Easy installation

This leightweight system enables easy handling even for pipes of 5 m in length. The pipe faucet featuring a sealing element ensures a quick and easy connection. A smaller number of joints are required than with previous components made from heavy materials.

KG-System (PVC)® SN 4

Drainage pipes and shaped pieces

Description

Unplasticized polyvinyl chloride drainage system, class SN 4 circular stiffness, produced in compliance with the ČSN EN 1401-1 and ČSN EN 13 476-2 standards.

Field of application

The properties are designed for application as conducting drains under buildings, sewer connections and sewage systems with installation depths up to 4 m.

DN(OD)	s [mm]	D [mm]	t [mm]	kg/m
110	3,2	127	66	1,29
125	3,2	144	68	1,48
160	4,0	182	84	2,27
200	4,9	225	106	3,54
250	6,2	287	128	6,68
315	7,7	355	162	11,02
400	9,8	445	194	20,75
500	12,3	567	219	34,50

KG-System (PVC)® SN 10 Vollwand

Drainage pipes and shaped pieces

Description

Sewer System of rigid PVC, ring stiffness SN 10, manufactured in accordance with DIN EN 1401-1.

Field of application

For drainage networks under non-standard installation conditions (extreme dynamic stress, installation depth greater than 8 m).

DN(OD)	s [mm]	D [mm]	t [mm]
110	3,2	127	66
160	4,7	184	84
200	5,9	227	106
250	7,3	289	128
315	9,2	358	162
400	11,7	449	194
500	14,6	572	219

KG-System (PVC)® SN 8

Drainage pipes and shaped pieces

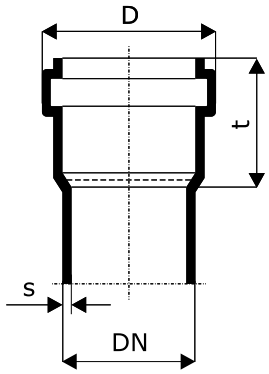
Description

Unplasticized polyvinyl chloride drainage system, class SN 8 increased circular stiffness, produced in compliance with the ČSN EN 1401-1 and ČSN EN 13 476-2 standards.

Field of application

For drainage networks under non-standard installation conditions (extreme dynamic stress, installation depth of 8 m).

DN(OD)	s [mm]	D [mm]	t [mm]	kg/m
160	4,7	184	84	2,67
200	5,9	227	106	4,26
250	7,3	289	128	7,86
315	9,2	358	162	13,17
400	11,7	449	194	24,78
500	14,6	572	219	40,95



THE SYMBOLS AND ABBREVIATIONS USED IN THE CATALOG	
D	maximum outer diameter
DN	nominal dimension
s	Pipe wall thickness
t	faucet depth (insertion length of free faucet)

As the materials are mostly supplied by multiple manufacturers, the weight and dimension parameters must be understood as for information purposes only.

Our technical consultancy services are based on both experience and calculations. Since we do not know and cannot influence the conditions of use of the products we offer, all information must be regarded as recommendations.

In the event of use other than that as recommended by us, potential risks must be taken into consideration.

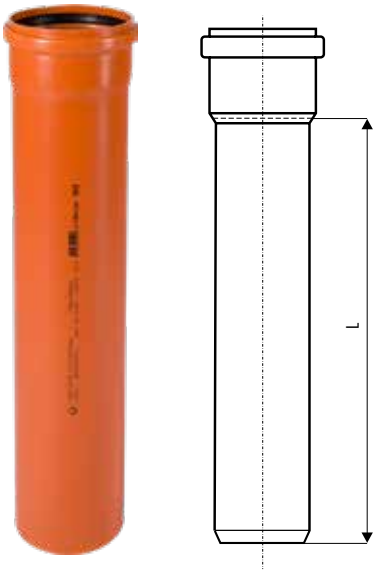
Typographic errors reserved.

KGEM – Pipe with Socket SN 4

EAN CODE	EAN	DN	L (mm)	PACKING	PALLETE
4052836200006	220000	110	500	1	96
4052836200105	220010	110	1000	1	86
4052836200204	220020	110	2000	1	86
4025075203701	20370	110	3000	1	86
4052836200501	220050	110	5000	1	86
4052836210005	221000	125	500	1	70
4052836210104	221010	125	1000	1	60
4052836210203	221020	125	2000	1	60
4025075204708	20470	125	3000	1	60
4052836210500	221050	125	5000	1	60
4052836220004	222000	160	500	1	45
4052836220103	222010	160	1000	1	40
4052836220202	222020	160	2000	1	40
4025075205705	20570	160	3000	1	40
4052836220509	222050	160	5000	1	40
4052836230003	223000	200	500	1	25
4052836230102	223010	200	1000	1	25
4052836230201	223020	200	2000	1	25
4025075206702	20670	200	3000	1	25
4052836230508	223050	200	5000	1	25
4052836240101	224010	250	1000	1	16
4052836240200	224020	250	2000	1	16
4052836240507	224050	250	5000	1	16
4052836250100	225010	315	1000	1	9
4052836250209	225020	315	2000	1	9
4052836250506	225050	315	5000	1	9
4052836260109	226010	400	1000	1	6
4052836260208	226020	400	2000	1	6
4052836260505	226050	400	5000	1	6
4052836270108	227010	500	1000	1	4
4052836270207	227020	500	2000	1	4
4052836270504	227050	500	5000	1	4

KGEM – Pipe with Socket SN 8

EAN CODE	EAN	DN	L (mm)	PACKING	PALLETE
4052836201706	220170	110	1000	1	40
4052836201805	220180	110	3000	1	40
4052836201904	220190	110	5000	1	40
4052836221704	222170	160	1000	1	40
4052836221803	222180	160	3000	1	40
4052836221902	222190	160	5000	1	40
4052836231703	223170	200	1000	1	25
4052836231802	223180	200	3000	1	25
4052836231901	223190	200	5000	1	25
4052836241702	224170	250	1000	1	16
4052836241207	241200	250	2000	1	16
4052836241900	224190	250	5000	1	16
4052836251701	225170	315	1000	1	9
4052836251206	251200	315	2000	1	9
4052836251800	225180	315	3000	1	9
4052836251909	225190	315	5000	1	9
4052836261700	226170	400	1000	1	6
4052836261205	261200	400	2000	1	6
4052836261809	226180	400	3000	1	6
4052836261908	226190	400	5000	1	6
4052836271709	227170	500	1000	1	4
4052836271907	227190	500	5000	1	4



KGEM – Pipe with Socket SN 10 VOLLWAND

EAN CODE	EAN	DN	L (mm)	PACKING	PALLETE
4052836200655	220065	110	500	1	86
4052836201102	220110	110	1000	1	86
4052836201300	220130	110	3000	1	86
4052836201607	220160	110	6000	1	86
4052836221100	222110	160	1000	1	40
4052836221308	222130	160	3000	1	40
4052836221605	222160	160	6000	1	40
4052836231109	223110	200	1000	1	25
4052836231307	223130	200	3000	1	25
4052836231604	223160	200	6000	1	25
4052836241108	224110	250	1000	1	16
4052836241306	224130	250	3000	1	16
4052836241603	224160	250	6000	1	16
4052836251107	225110	315	1000	1	9
4052836251305	225130	315	3000	1	9
4052836251602	225160	315	6000	1	9
4052836261106	226110	400	1000	1	6
4052836261304	226130	400	3000	1	6
4052836261601	226160	400	6000	1	6
4052836271105	227110	500	1000	1	4
4052836271303	227130	500	3000	1	4
4052836271600	227160	500	6000	1	4

KGB – Bend 15°

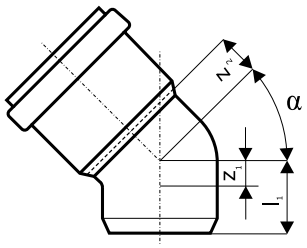
EAN CODE	EAN	DN	z_1 (mm)	z_2 (mm)	l_1 (mm)	PACKING	PALLETE
4052836202000	220200	110	9	14	69	1	300
4052836212009	221200	125	10	15	77	1	230
4052836222008	222200	160	13	19	94	1	110
4052836232007	223200	200	15	23	114	1	50
4052836242006	224200	250	19	30	153	1	24
4052836252005	225200	315	23	38	167	1	12
4052836262004	226200	400	29	48	184	1	8
4052836272003	227200	500	37	59	215	1	2

KGB – Bend 30°

EAN CODE	EAN	DN	z_1 (mm)	z_2 (mm)	l_1 (mm)	PACKING	PALLETE
4052836202109	220210	110	17	21	77	1	270
4052836212108	221210	125	19	23	86	1	200
4052836222107	222210	160	24	30	105	1	100
4052836232106	223210	200	30	38	129	1	50
4052836242105	224210	250	37	49	171	1	24
4052836252104	225210	315	47	61	191	1	12
4052836262103	226210	400	59	78	214	1	5
4052836272102	227210	500	74	97	252	1	2

KGB – Bend 45°

EAN CODE	EAN	DN	z_1 (mm)	z_2 (mm)	l_1 (mm)	PACKING	PALLETE
4052836202208	220220	110	25	29	85	1	270
4052836212207	221220	125	28	33	95	1	175
4052836222206	222220	160	36	42	117	1	90
4052836232205	223220	200	46	54	145	1	45
4052836242204	224220	250	57	69	191	1	24
4052836252203	225220	315	72	86	216	1	12
4052836262202	226220	400	91	110	246	1	6
4052836272201	227220	500	114	137	292	1	2



KGB – Bend 67°

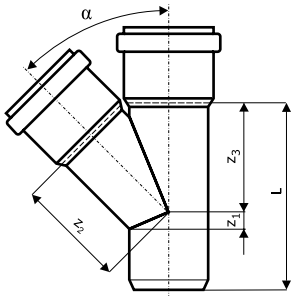
EAN CODE	EAN	DN	z_1 (mm)	z_2 (mm)	l_1 (mm)	PACKING	PALLETE
4052836202307	220230	110	40	44	100	1	225
4052836212306	221230	125	46	50	113	1	150
4052836222305	222230	160	58	64	139	1	75
4052836232304	223230	200	72	80	171	1	40

KGB – Bend 87°

EAN CODE	EAN	DN	z_1 (mm)	z_2 (mm)	l_1 (mm)	PACKING	PALLETE
4052836202406	220240	110	57	61	117	1	200
4052836212405	221240	125	65	70	132	1	140
4052836222404	222240	160	83	89	164	1	70
4052836232403	223240	200	105	113	204	1	30
4052836242402	224240	250	132	143	266	1	18
4052836252401	225240	315	166	180	310	1	9
4052836262400	226240	400	211	229	366	1	4
4052836272409	227240	500	263	286	441	1	1

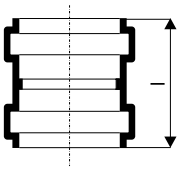
KGEA – Branch Pipe 45°

EAN CODE	EAN	DN	z_1 (mm)	z_2 (mm)	z_3 (mm)	L (mm)	PACKING	PALLETE
4052836203007	220300	110/110	25	134	134	219	1	100
4052836213105	221310	125/110	18	144	141	226	1	70
4052836213006	221300	125/125	28	152	152	247	1	70
4052836223203	222320	160/110	2	168	159	242	1	51
4052836223104	222310	160/125	12	176	169	262	1	45
4052836223005	222300	160/160	36	194	194	311	1	36
4052836233301	223330	200/110	-17	195	179	261	1	30
4052836233202	223320	200/125	-7	203	190	282	1	32
4052836233103	223310	200/160	18	221	215	332	1	25
4052836233004	223300	200/200	45	242	242	386	1	20
4052836243409	224340	250/110	-37	288	206	303	1	18
4052836243300	224330	250/125	-27	236	217	324	1	16
4052836243201	224320	250/160	-3	254	241	372	1	14
4052836243102	224310	250/200	24	274	268	426	1	12
4052836243003	224300	250/250	20	265	292	485	1	8
4052836253507	225350	315/110	-66	272	240	318	1	10
4052836253408	225340	315/125	-56	279	251	339	1	10
4052836253309	225330	315/160	-33	297	275	386	1	10
4052836253200	225320	315/200	-5	318	302	441	1	8
4052836253101	225310	315/250	28	344	335	507	1	5
4052836253002	225300	315/315	72	378	378	594	1	4
4052836263605	226360	400/110	-105	340	360	510	1	5
4052836263506	226350	400/125	-94	400	400	550	1	5
4052836263407	226340	400/160	-70	355	319	404	1	5
4052836263308	226330	400/200	-43	375	346	458	1	5
4052836263209	226320	400/250	-10	480	450	660	1	3
4052836263100	226310	400/315	34	540	500	780	1	2
4052836263001	226300	400/400	91	550	500	850	1	1
4052836273604	227360	500/110	-150	440	435	550	1	2
4052836273505	227350	500/160	-115	420	370	600	1	2
4052836273406	227340	500/200	-88	470	510	650	1	2
4052836273307	227330	500/250	-55	550	530	680	1	1
4052836273208	227320	500/315	-11	560	583	810	1	1
4052836273109	227310	500/400	47	580	550	840	1	1
4052836273000	227300	500/500	114	650	680	880	1	1



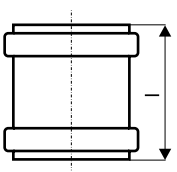
KGMM – double-Socket Sleeve

EAN CODE	EAN	DN	l (mm)	PACKING	PALLETE
4052836205100	220510	110	122	1	360
4052836215109	221510	125	138	1	240
4052836225108	222510	160	172	1	110
4052836235107	223510	200	212	1	60
4052836245106	224510	250	250	1	32
4052836255105	225510	315	293	1	16



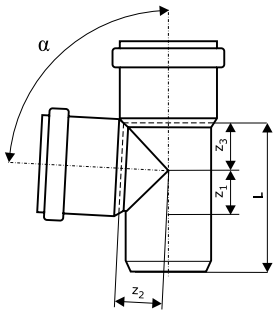
KGU – Sleeve

EAN CODE	EAN	DN	l (mm)	PACKING	PALLETE
4052836205001	220500	110	122	1	360
4052836215000	221500	125	138	1	240
4052836225009	222500	160	172	1	115
4052836235008	223500	200	212	1	60
4052836245007	224500	250	250	1	32
4052836255006	225500	315	293	1	16
4052836265005	226500	400	324	1	8
4052836275004	227500	500	362	1	4



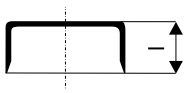
KGEA – Branch Pipe 87°

EAN CODE	EAN	DN	z_1 (mm)	z_2 (mm)	z_3 (mm)	L (mm)	PACKING	PALLETE
4052836204004	220400	110/110	59	62	62	197	1	120
4052836214102	221410	125/110	59	70	63	204	1	100
4052836214003	221400	125/125	66	70	70	218	1	88
4052836224200	222420	160/110	60	87	65	225	1	60
4052836224101	222410	160/125	67	87	72	239	1	45
4020826213503	222400	160/160	84	89	89	273	1	45
4052836224002	222400	200/110	61	106	67	248	1	41
4052836234308	223430	200/125	69	106	75	264	1	38
4052836234209	223420	200/160	86	108	91	297	1	32
4052836234100	223410	200/200	105	111	111	336	1	24
4052836234001	223400	250/110	64	160	130	330	1	20
4052836244406	224440	250/125	72	170	130	360	1	20
4052836244307	224430	250/160	88	165	135	390	1	18
4052836244208	224420	250/200	107	160	160	420	1	14
4052836244109	224410	250/250	131	160	180	460	1	10
4052836244000	224400	315/110	67	200	130	390	1	10
4052836254504	225450	315/125	74	200	130	420	1	10
4025075244803	24480	315/160	90	200	160	440	1	10
4052836254306	225430	315/200	110	170	180	490	1	7
4052836254207	225420	315/250	134	220	210	540	1	6
4052836254108	225410	315/315	166	260	220	550	1	6
4052836254009	225400	400/110	70	250	100	470	1	6
4052836264602	226460	400/160	95	210	150	510	1	5
4052836264404	226440	400/200	114	230	200	560	1	5
4052836264305	226430	400/250	139	230	220	610	1	4
4052836264206	226420	400/315	114	300	220	630	1	4
4052836264107	226410	400/400	210	310	240	650	1	3
4052836264008	226400	500/160	100	220	280	550	1	2
4052836274502	227450	500/200	118	250	130	580	1	2
4052836274205	227420	500/315	175	330	300	660	1	2
4052836274106	227410	500/400	216	267	226	730	1	1
4052836274007	227400	500/500	262	270	270	780	1	1



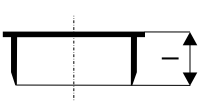
KGK – Cap

EAN CODE	EAN	DN	l (mm)	PACKING	PALLETE
4052836206305	220630	110	41	24	960
4052836216304	221630	125	45	18	756
4052836226303	222630	160	53	10	430
4052836236302	223630	200	65	8	224
4052836246301	224630	250	93	1	150
4052836256300	225630	315	97	1	74
4052836266309	226630	400	107	1	40
4052836276308	227630	500	118	1	19



KGM – Socket Stopper

EAN CODE	EAN	DN	l (mm)	PACKING	PALLETE
4052836206206	220620	110	38	20	1000
4052836216205	221620	125	42	20	600
4052836226204	222620	160	49	8	368
4052836236203	223620	200	59	8	240
4052836246202	224620	250	89	1	96
4052836256201	225620	315	92	1	60
4052836266200	226620	400	95	1	34
4052836276209	227620	500	98	1	14



KGBD – Bend 2M

EAN CODE	EAN	DN	DEGREE	H (mm)	t_1 (mm)	t_2 (mm)	L (mm)	PACKING	PALLETE
4052836280701	228070	110	15°	129	58	58	174	1	180
4052836280756	228075	110	30°	144	58	58	196	1	180
4052836280800	228080	110	45°	164	58	58	213	1	180

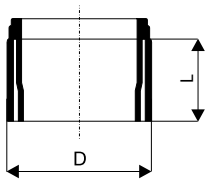
KGBD – Bend SW

EAN CODE	EAN	DN	DEGREE	H (mm)	t_1 (mm)	t_2 (mm)	L (mm)	PACKING	PALLETE
4052836280886	228088*	110	87°	225	57	57	225	1	120
4052836280855	228085**	110	87°	235	58	58	235	1	120

* Bend with one neck ** Bend with two necks

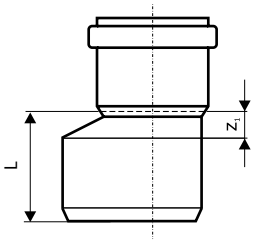
KGUSM – Reducer PVC/Stoneware

EAN CODE	EAN	DN	D (mm)	L (mm)	PACKING	PALLETE
4052836208408	220840	110	132	73	1	455
4052836218407	221840	125	160	73	1	320
4052836228406	222840	160	187	73	1	226
4052836238405	223840	200	242	73	1	120
4052836248404	224840	250	298	73	1	30
4052836258403	225840	315	354	73	1	20



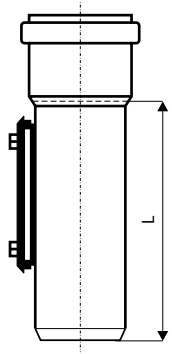
KGR –abaxial Reduction

EAN CODE	EAN	DN	z_1 (mm)	L (mm)	PACKING	PALLETE
4052836217004	221700	125/110	15	82	1	300
4052836227003	222700	160/110	34	115	1	250
4052836227102	222710	160/125	27	108	1	240
4052836237002	223700	200/160	31	130	1	130
4052836247001	224700	250/200	38	172	1	54
4052836257000	225700	315/250	50	194	1	30
4052836267009	226700	400/315	64	219	1	12
4052836277008	227700	500/400	76	254	1	4



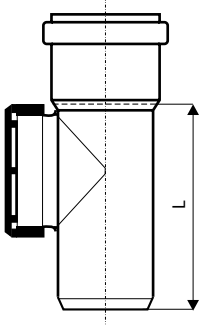
KGRE – Purging Fitting (rectangular Cover)

EAN CODE	EAN	DN	L (mm)	PACKING	PALLETE
4052836206008	220600	110	359	1	102
4052836216007	221600	125	365	1	90
4052836226006	222600	160	394	1	44
4052836236005	223600	200	494	1	22



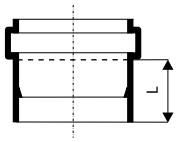
KGRE – Purging Fitting (round Cover)

EAN CODE	EAN	DN	L (mm)	PACKING	PALLETE
4052836206404	220640	110	-	1	102
4052836216403	221640	125	-	1	90
4052836226402	222640	160	-	1	44
4052836236401	223640	200	-	1	22
4052836246004	824600	250	351	1	11
4052836256003	825600	315	492	1	6
4052836266002	826600	400	573	1	4



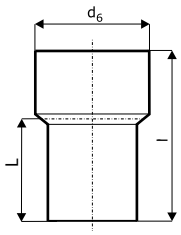
KGAM – individual Socket (stick-on)

EAN CODE	EAN	DN	L (mm)	PACKING	PALLETE
4052836208101	220810	110	76	1	450
4052836218100	221810	125	82	1	336
4052836228109	222810	160	100	1	180
4052836238108	223810	200	120	1	100



KGUG – Reducer Cast-iron/PVC

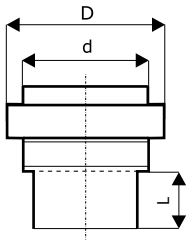
EAN CODE	EAN	DN	d_6 (mm)	l (mm)	L (mm)	PACKING	PALLETE
4052836208200	220820	110	124	146	65	1	600
4052836218209	221820	125	151	181	96	1	360
4052836228208	222820	160	176	200	102	1	210
4052836238207	223820	200	226	252	132	1	90



KGUS – Reducer Stoneware/PVC

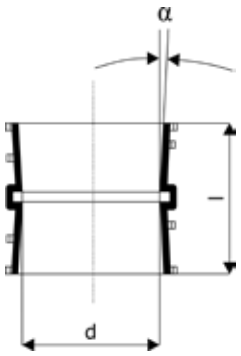
EAN CODE	EAN	DN	d (mm)	D (mm)	L (mm)	PACKING	PALLETE
4052836208309	220830	110	138	163	105	1	288
4052836218308	221830	125	164	193	120	1	180
4052836228307	222830	160	194	225	140	1	100
4052836238306	223830	200	250	288	175	1	48
4052836248305	224830	250*	335	352	180	1	36
4052836258304	225830	315*	390	430	225	1	18

* tvarovka z PU



KGF – Shaft Cartridge

EAN CODE	EAN	DN	α(°)	d(mm)	l (mm)	PACKING
4025075293504	29350	110	3	110,4	110	1
4025075293603	29360	110	3	110,4	240	1
4025075294501	29450	125	3	125,4	110	1
4025075294600	29460	125	3	125,4	240	1
4025075295508	29550	160	3	160,5	110	1
4025075295607	29560	160	3	160,5	240	1
4025075296505	29650	200	3	200,6	110	1
4025075296604	29660	200	3	200,6	240	1
4025075297502	29750	250	3	250,8	110	1
4025075297601	29760	250	3	250,8	240	1
4025075298509	29850	315	3	316,0	110	1
4025075298608	29860	315	3	316,0	240	1
4025075299506	29950	400	3	401,2	110	1
4025075298653	29865	400	3	401,2	240	1
4025075299605	29960	500	3	501,5	240	1



KG – spare O-ring

EAN CODE	EAN	DN	PACKING
4052836800602	880060	110	29
4052836800756	880075	125	25
4052836800909	880090	160	23
4052836801005	880100	200	20
4052836801104	880110	250	1
4052836801203	880120	315	1
4052836801302	880130	400	1
4052836801401	880140	500	1

KG NBR – Oil O-ring

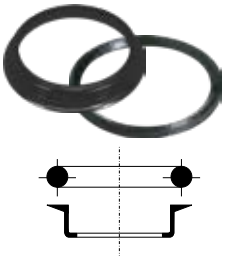
EAN CODE	EAN	DN	PACKING
4052836802606	880260	110	44
4052836802750	880275	125	38
4052836802903	880290	160	34
4052836803009	880300	200	31
4052836803108	880310	250	1
4052836803207	880320	315	1
4052836803306	880330	400	1
4052836803405	880340	500	1

KG – GA Sealing Cuff

EAN CODE	EAN	DN	PACKING
4052836810250	881025	110	16

KG – GA set, Sealing for KGUG (transition piece Cast-iron/PVC)

EAN CODE	EAN	DN	PACKING
4052836810304	881030	125	10
4052836810403	881040	160	15
4052836810502	881050	200	14



KG – spare Sealing Cuff for KGUS

EAN CODE	EAN	DN	PACKING
4052836811004	881100	110	144
4052836811103	881110	125	90
4052836811202	881120	160	50
4052836811301	881130	200	24
4052836811400	881140	250	15
4052836811509	881150	315	15

The outstanding hydraulic characteristics of the KG-System (PVC)® pipes and shaped pieces are determined by the possibility of producing inner walls with extremely low roughness (<0.01 mm). This is as much as ten times less compared to other products (made of materials other than plastics.

SEWAGE WATER DRAINAGE

Sewage water drainage should be continuous depending on the amount of inflowing water. The amount of sewage water is determined by the water consumption in a specific location. If there are no exact data available, we can use the ČSN 75 6101 and applicable directives to determine the water amount. The amount of rainwater is determined by the intensity of nominal rainfall and characteristics of the drained area. While we use rational methods (ČSN 75 6101) for smaller areas, we recommend that some of the available simulation programs be used to rate larger areas. We can use the relation from ČSN 75 6101 Imin=1631/Di to determine the minimum slope as an orientation value (decidedly on the safety side for plastic pipelines). When designing (dimensioning) sewage pipelines, we compare the anticipated amount of sewage water to be drained Q (l/s) to hydraulic tables.

HYDRAULIC TABLES

The hydraulic tables are based on physical and experimental data accoring to Colebrook-Whitea and Darcy-Weisbacha:

v … average liquid flow velocity, completely filled (m/s)
Q … discharge capacity, completely filled (l/s)

$$v = \sqrt{2gDI}\ \left(-2\log\left(\frac{2{,}51v}{D\sqrt{2gDI}}\right) + \frac{K_b}{3{,}71\ D}\right)$$

$$Q = \frac{\pi D^2}{4}\sqrt{2gDI}\ \left(-2\log\left(\frac{2{,}51v}{D\ 2gDI} + \frac{K_b}{3{,}71\ D}\right)\right)$$

Parameters entering the equation
g … gravitational acceleration (9.86066 m/s^2)
I … slope
D … inner pipe diameter (m)
v … kinematic water viscosity
(for 10 °C equal to 1.31 . 10^{-6} m^2/s)
K_b … service roughness
- 0.040 mm for straight sewage pipelines
- 0.067 mm for straight sewage pipelines with connections
- 0.125 mm for drainlines (separation fo shafts no greater than 50 m)

Maximum flow rate and flow velocity in KG System(PVC)® SN 4 pipes, completely filled (K_b = 0.04)

DN/OD (mm)			110	125	160	200	250	315	400	500
DN/ID (mm)			103,6	118,6	152,0	190,2	237,6	299,6	380,4	475,6
Slope (‰)	110	Q(l/s)	28,60	40,80	78,40	141,30	253,20	464,60	867,10	1552,90
		v(m/s)	3,39	3,69	4,32	4,97	5,71	6,59	7,63	8,74
	120	Q(l/s)	31,40	44,90	86,20	155,30	278,20	510,20	952,00	1704,60
		v(m/s)	3,73	4,06	4,75	5,46	6,27	7,24	8,38	9,60
	140	Q(l/s)	34,00	48,60	93,30	168,10	301,10	552,20	1030,10	1844,10
		v(m/s)	4,04	4,40	5,14	5,92	6,79	7,83	9,06	10,38
	160	Q(l/s)	36,50	52,10	100,00	180,10	322,50	591,30	1102,80	1974,00
		v(m/s)	4,33	4,72	5,51	6,34	7,27	8,39	9,70	11,11
	180	Q(l/s)	38,80	55,40	106,30	191,30	342,60	628,00	1171,10	2096,10
		v(m/s)	4,60	5,01	5,86	6,73	7,73	8,91	10,30	11,80
	200	Q(l/s)	41,00	58,50	112,20	202,00	361,60	662,80	1235,80	2211,50
		v(m/s)	4,86	5,29	6,18	7,11	8,16	9,40	10,87	12,45
	220	Q(l/s)	43,10	61,40	117,90	212,10	379,70	695,80	1297,30	2321,40
		v(m/s)	5,11	5,56	6,50	7,47	8,56	9,87	11,41	13,07
	240	Q(l/s)	45,00	64,30	123,30	221,80	397,00	727,40	1356,10	2426,30
		v(m/s)	5,34	5,82	6,79	7,81	8,95	10,32	11,93	13,66
	260	Q(l/s)	46,90	67,00	128,40	231,10	413,60	757,80	1412,40	2527,00
		v(m/s)	5,57	6,06	7,08	8,13	9,33	10,75	12,43	14,22
	280	Q(l/s)	48,80	69,60	133,40	240,00	429,50	786,90	1466,70	2623,90
		v(m/s)	5,79	6,30	7,35	8,45	9,69	11,16	12,91	14,77
	315	Q(l/s)	50,50	72,10	138,20	248,70	444,90	815,10	1519,00	2717,40
		v(m/s)	6,00	6,53	7,62	8,75	10,03	11,56	13,37	15,30

Maximum flow rate and flow velocity of KG System(PVC)® SN 4 pipes, completely filled (K_b = 0.04)

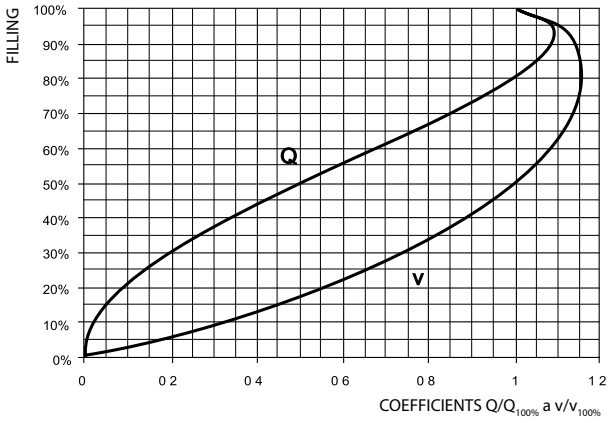
DN/OD (mm)			110	125	160	200	250	315	400	500
DN/ID (mm)			103,6	118,6	152,0	190,2	237,6	299,6	380,4	475,6
Slope (‰)	2	Q(l/s)	3,50	5,00	9,70	17,60	31,90	59,00	111,20	200,70
		v(m/s)	0,41	0,45	0,53	0,62	0,72	0,84	0,98	1,13
	3	Q(l/s)	4,30	6,20	12,10	22,00	39,70	73,50	138,20	249,30
		v(m/s)	0,51	0,56	0,67	0,77	0,90	1,04	1,22	1,40
	4	Q(l/s)	5,10	7,30	14,10	25,70	46,40	85,80	161,20	290,50
		v(m/s)	0,60	0,66	0,78	0,90	1,05	1,22	1,42	1,64
	5	Q(l/s)	5,70	8,20	16,00	29,00	52,30	96,70	181,60	327,00
		v(m/s)	0,68	0,75	0,88	1,02	1,18	1,37	1,60	1,84
	6	Q(l/s)	6,3	9,10	17,60	32,00	57,70	106,60	200,10	360,20
		v(m/s)	0,75	0,82	0,97	1,13	1,30	1,51	1,76	2,03
	7	Q(l/s)	6,90	9,90	19,20	34,80	62,70	115,70	217,10	390,70
		v(m/s)	0,81	0,89	1,06	1,22	1,41	1,64	1,91	2,20
	8	Q(l/s)	7,40	10,60	20,60	37,40	67,30	124,20	233,00	419,20
		v(m/s)	0,88	0,96	1,14	1,31	1,52	1,76	2,05	2,36
	9	Q(l/s)	7,90	11,30	21,90	39,80	71,70	132,20	248,00	446,00
		v(m/s)	0,94	1,03	1,21	1,40	1,62	1,88	2,18	2,51
	10	Q(l/s)	8,40	12,00	23,20	42,10	75,80	139,80	262,10	471,40
		v(m/s)	0,99	1,09	1,28	1,48	1,71	1,98	2,31	2,65
	15	Q(l/s)	10,40	14,90	28,70	52,20	94,00	173,20	324,40	582,90
		v(m/s)	1,24	1,35	1,59	1,84	2,12	2,46	2,85	3,28
	20	Q(l/s)	12,20	17,40	33,60	60,90	109,40	201,40	377,10	677,20
		v(m/s)	1,44	1,58	1,85	2,14	2,47	2,86	3,32	3,81
	25	Q(l/s)	13,70	19,60	37,90	68,50	123,10	226,40	423,60	760,40
		v(m/s)	1,62	1,78	2,09	2,40	2,78	3,21	3,73	4,28
	30	Q(l/s)	15,10	21,60	41,70	75,40	135,40	249,00	465,80	835,80
		v(m/s)	1,79	1,96	2,30	2,65	3,05	3,53	4,10	4,70
	35	Q(l/s)	16,40	23,50	45,30	81,70	146,80	269,90	504,60	905,20
		v(m/s)	1,95	2,13	2,49	2,88	3,31	3,83	4,44	5,10
	40	Q(l/s)	17,60	25,20	48,60	87,70	157,40	289,30	540,80	969,90
		v(m/s)	2,09	2,81	2,67	3,08	3,55	4,10	4,76	5,46
	45	Q(l/s)	18,80	26,80	51,60	93,20	167,40	307,50	574,70	1030,60
		v(m/s)	2,23	2,43	2,85	3,28	3,77	4,36	5,06	5,80
	50	Q(l/s)	19,80	28,40	54,60	98,50	176,80	324,80	606,90	1088,10
		v(m/s)	2,35	2,57	3,00	3,47	3,99	4,61	5,34	6,12
	55	Q(l/s)	20,90	29,80	57,40	103,50	185,80	341,20	637,50	1142,80
		v(m/s)	2,47	2,70	3,16	3,64	4,19	4,84	5,61	6,43
	60	Q(l/s)	21,80	31,20	60,10	108,40	194,40	357,00	666,80	1195,10
		v(m/s)	2,59	2,83	3,31	3,81	4,38	5,06	5,87	6,73
	65	Q(l/s)	22,80	32,60	62,60	113,00	202,60	372,00	694,90	1245,30
		v(m/s)	2,70	2,95	3,45	3,97	4,57	5,28	6,11	7,01
	70	Q(l/s)	23,70	33,80	65,10	117,40	210,60	386,60	721,90	1293,60
		v(m/s)	2,81	3,06	3,59	4,13	4,75	5,48	6,35	7,28
	75	Q(l/s)	24,60	35,10	67,50	121,70	218,20	400,60	748,00	1340,20
		v(m/s)	2,91	3,18	3,72	4,28	4,92	5,68	6,58	7,54
	80	Q(l/s)	25,40	36,30	69,80	125,80	225,60	414,10	773,20	1385,30
		v(m/s)	3,01	3,29	3,85	4,43	5,09	5,87	6,80	7,80
	85	Q(l/s)	26,20	37,50	72,00	129,90	232,80	427,30	797,70	1429,00
		v(m/s)	3,11	3,39	3,97	4,57	5,25	6,06	7,02	8,04
	90	Q(l/s)	27,00	38,60	74,20	133,80	239,80	440,10	821,40	1471,40
		v(m/s)	3,20	3,49	4,09	4,71	5,41	6,24	7,23	8,28
	95	Q(l/s)	27,80	39,70	76,30	137,60	246,60	452,50	844,50	1512,70
		v(m/s)	3,30	3,59	4,21	4,84	5,56	6,42	7,43	8,51
	100	Q(l/s)	28,60	40,80	78,40	141,30	253,20	464,60	867,10	1552,90
		v(m/s)	3,39	3,69	4,32	4,97	5,71	6,59	7,63	8,74

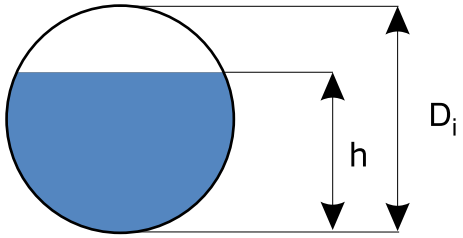
PARTIAL FILLING

To determine partial filling, it is necessary to multiply the flow rate (velocity) determined from the previous two tables with the $Q/Q_{100\%}$ and $v/v_{100\%}$ coefficients given in the following table and chart.

$$Q = Q_{100\%} \cdot Q/Q_{100\%}$$
$$v = v_{100\%} \cdot v/v_{100\%}$$

FILLING	COEFFICIENTS	
	$Q/Q_{100\%}$	$v/v_{100\%}$
5%	0,004	0,184
10%	0,017	0,333
15%	0,043	0,457
20%	0,080	0,565
25%	0,129	0,661
30%	0,188	0,748
35%	0,256	0,821
40%	0,332	0,889
45%	0,414	0,948
50%	0,500	1,000
55%	0,589	1,045
60%	0,678	1,083
65%	0,766	1,113
70%	0,850	1,137
75%	0,927	1,152
80%	0,994	1,159
85%	1,048	1,157
90%	1,082	1,142
95%	1,087	1,108
100%	1,000	1,000





D_i … inner diameter (mm)
h … filling height (mm)
h/D_i x100 … filling (%)
$Q_{100\%}$ … flow rate, completely filled (l/s)
$V_{100\%}$ … flow velocity, completely filled (m/s)

SOLID VS. FLEXIBLE PIPING

Solid piping takes on a considerable amount of load when buried in soil. In the event of overloading (e. g. due to variation in packing characteristics, low-quality installation, subsoil settlement etc.) permanent (inflexible) deformation, surface discontinuity and thus also loss of water-tightness occur. When imposed to load from soil, plastic piping is flexible, allowing for the load to be transferred to the surrounding earth material (packing). In the event of overloading, plastic piping reacts with flexible (i. e. reversible) deformation causing no surface discontinuity or loss of function.

DEFORMATION

Deformation limits are determined based on a number of criteria (e. g. retention of shape, bond resistance and leak-proofness, deformation caracteristics – flexible, inflexible etc.). If no exact deformation requirements are placed by the employer – sewer user, the plastic pipe deformation should not exceed 10%.

CIRCULAR STIFFNESS

Expresses a relation between geometric data and the elastic properties of materials. Generally, the greater the circular stiffness, the greater the stiffness of the piping; however, this only applies to comparisons under the same loading conditions! The circular stiffness values themselves can only tell us a little about the reactions of pipes under real conditions. At this point, further design parameters have to be taken into account when deciding

on the use of a specific pipe system. These are:

- BED SHAPE
- COMPACTION
- SOIL CHARACTERISTICS
- GROUND SURFACE LOAD

COMPACTION

- none
- normal (85%<D<95%; 0.7<ID<0.8)
- careful, supervised (D>95%; ID>0.8)

D … compaction parameter determined using standard Proctor test (for cohesive soils)
ID … relative density (for non-cohesive soils where the maximum volume density cannot be determined with the Proctor test)

The more careful the compaction, the deeper the pipeline cover may be with minimum pipe deformation.

SOIL CHARACTERISTICS FOR PACK AND BACKFILL

- sandy loams (non-cohesive, fast consolidating)
- loamy sands (most common, with medium consolidation speed)
- clay loams (slow consolidating)

GROUND SURFACE LOAD

- class A roads (with extreme model vehicle wheel pressure of 120 kN)
- open ground (under consideration of accidental wheel pressure of 30 kN)

OPTIMUM BURYING CONDITIONS

- pack and backfill with fine-grained soil, group F3,

MS symbol (internal friction angle 24°, g = 18 kN/m3)

- carefully treated bed
- careful, supervised compaction

$$SN = E \cdot I / D_m3$$

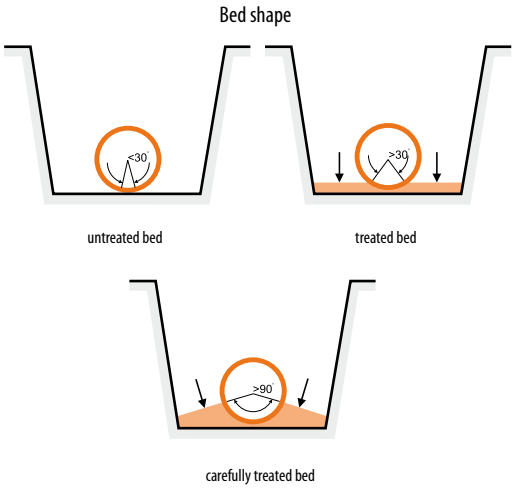
E ..... modulus of elasticity
I ..... pipe wall intertia moment
Dm . diameter related to pipe wall centre line

DESIGN PARAMETERS

BED SHAPE

- untreated bed (angle of installation less than 30°)
- treated bed (angle of installation between 30°and 90°)
- carefully treated bed (angle of installation greater than 90°)

The greater the angle of installation, the deeper the pipeline cover may be with minimum pipe deformation. It is not recommended to design untreated beds.



MAXIMUM DEPTHS OF PIPELINE COVERS UNDER OPTIMUM BURYING CONDITIONS (m).

SN 4		
DN	Open ground	Class A roads
110	5,85	5,35
125	4,00	3,65
160	3,30	3,05
200	3,35	3,10
250	4,35	4,00
315	4,45	4,10
400	4,55	4,25
500	4,60	4,35
Decisive criterion: Deformtion<10%		
SN 8		
DN	Open ground	Class A roads
250	6,50	6,10
315	6,60	6,20
400	6,70	6,20
500	6,75	6,25
Decisive criterion: Deformtion<10%		

1. SCOPE OF VALIDITY

This Installation Manual includes rules and procedures created on the basis of installation experience from a number of different countries. With respect to its universality, the guidelines must only be regarded as recommended and not binding. When installing the KG-System (PVC)® it is necessary to base the installation on technical data specified by a given project (soil type, compactness type, depth of pipeline cover etc.). It is also highly recommended to respect standards applicable to the construction of drainage networks.

This Manual describes transport and storage conditions, as well as installation procedures for the construction of drainage networks from the KG-System (PVC)®. It includes excavation work, pipe installation, packing and backfill, repairs, and maintenance instructions. Special attention is to be paid to work in frozen earth and to work at places with high levels of groundwater. It also regulates transport, handling and storage conditions. This Manual describes installation under average conditions. In special cases it is necessary to contact a specialised designing office or the OSMA Technical Department.

2. TRANSPORT, HANDLING, STORAGE

The pipes and shaped pieces must be transported on suitable transport means with a clean cargo bed with no screws or bolts protruding from the cargo bed area. The pipes and shaped pieces must rest on the cargo bed with all their length to prevent unwanted pipe bending. This does not apply to transport in genuine factory packing, i. e. transport in bundles. In this case it is only necessary to observe the maximum pile height which must not exceed 3 meters.

Despite their low weight, the KG-System (PVC)® pipes and shaped pieces are very durable, making their handling much easier. Adherence to the following points helps prevent any damage to the pipes:

a) Use textile belts to move the pipes with a crane.

b) Handling tools should always be made from materials softer than plastics – wood is the best choice.

c) Do not unload the pipes from transport means by simply tilting the cargo bed – if you transport "pipes in pipes", it is always necessary to remove the inner pipes first before unloading the rest.

d) Please note that the lower the ambient temperature, the lower also the PVC notch resistance – i. e. the higher pipe fragility. We recommend proceeding with extreme caution in ambient temperatures below -5 °C.

The KG-System (PVC)® pipes and shaped pieces may be stored on open areas with a flat surface. Maximum storage time on open areas, however, is limited to 2 years. Oterwise, it is necessary to protect the products from UV radiation. The pipes must be stored in such a manner as to protect them from any deformation. The pipes must be stored loose to prevent deformation of faucets. When stored in piles, the pile height must not exceed 2 m. When stored in piles using the genuine (factory) packing, 4 batches may be stored on top of each other in case of DN 110 - 200 and 3 batches in case of DN 250 - 500.

3. CONSTRUCTION - EXCAVATION

The excavation work should not be finished long before the piping is installed. The trenches should be then filled in immediately after and, if possible, on the same day on which the pipes are installed. In frosty weather the trench bed must be protected from freezing through.

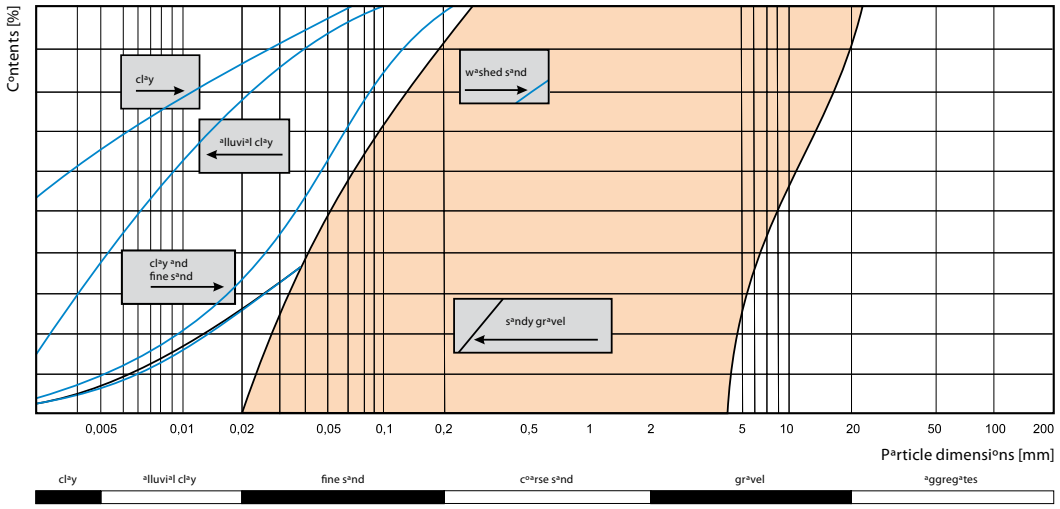
The trench bottom width must provide enough space for workmen, make correct soil compaction possible and should not decrease the positive influence of natural ground on pipe laying. Recommended trench widths: see tables below.

MINIMUM TRENCH WIDTH DEPENDING ON PIPE DIAMETER			
DN	Minimum trench width D + x		
	Supported trench	Unsupported trench	
		β* >60	β* ≤60
< 225	D+0,40	D+0,40	
>225 to 350	D+0,50	D+0,50	D+0,40
>350 to 550	D+0,70	D+0,70	D+0,40

*) Maximum depths of pipeline cover under optimum burying condition

MINIMUM TRENCH WIDTH DEPENDING ON DITCH DEPTH	
Trench depth [m]	Minimum width [m]
< 1,0	not specified
≥1,00 to ≤1,75	0,80
>1,75 to ≤4,05	0,90
>4,00	1,00

Graphic chart of pack and backfill distribution



KG System PVC®

The minimum depth of cover above the pipeline top should be 1 m below roads and 0.7 m below free grounds. This, however, does not apply to horizontal drainlines below buildings. The trench must make it possible to create the required bed. Manual labour (floatation, filling of cavities) and careful construction supervision are essential for bed treatment.

4. CONSTRUCTION - BED AND PACK

Bed and pack are layers of earth material up to 30 cm above the pipeline top.

BED AND PACK MATERIAL

The excavated material can be used for bed and pack if it consists of particles corresponding to the beige area in the graphic chart below. The size of the greatest particle must not exceed 1/10 DN or 30 mm for DN>250. If the excavated material cannot be used, it is advisable to use graded sand or sand-gravel (earth containing no sharp particles) with the greatest particle size not exceeding 1/10 DN or 30 mm.
The bearing stratum should protect the pipes from unevenness and provide for even support of the pipeline along its entire length. The pipeline installation angle is influenced by static earth-pipe composite action (the greater the installation angle, the deeper the pipeline cover may be).

PIPE INSTALLATION

Before the actual pipe installation, it is necessary to check each pipe for the corectness of the faucets and sealing, and any potential damage. Then install the pipes so that no uneven conditions are created around faucet joints. Pipe faucets with greater diameters can be slightly recessed. Each pipe and shaped piece must be installed under consideration of slope according to the design. A direct and continuous course in the prescribed slope must be preserved. In exceptional cases the DN 110 - 200 pipeline may be installed according to the image below. However, the values given in the tables must not be exceeded.

VALUES hm_{ax} FOR INDIVIDUAL NOMINAL DIAMETERS AND SECTIONS (I)				
I	DN 110	DN 125	DN 160	DN 200
8 m	0,24 m	0,21 m	0,17 m	0,13 m
12 m	0,54 m	0,48 m	0,38 m	0,30 m
16 m	0,97 m	0,85 m	0,67 m	0,53 m

MINIMUM RADIUS OF BENDING (R)				
DN	110	125	160	200
R	33 m	38 m	47 m	61 m

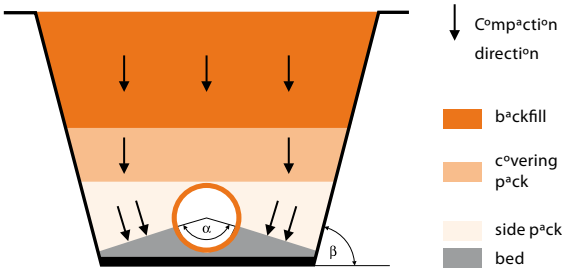
5. CONSTRUCTION - PACK, BACKFILL, COMPACTION

Once the pipeline has been installed and tested in the prescribed manner, you can start filling in the pack. Both pack and compaction must be done on both sides simultaneously (see Figure 1) preventing any cavities to be created under the drains. The area between the pipelineand the trench wall must be compacted evenly. Side pack (see Figure 1) should be as high as the pipeline top edge. Create the pack by means of gradual filling and compacting thin layers of the prescribed material until the required height has been reached. It is advisable to leave the pipeline top edge uncovered. Covering pack (see Figure 1) should exceed the pipeline top edge by 0.3 m and should be compacted with a rammer on both sides of the pipe. Never use the rammer directly above the pipeline!!!

Never fill the trench with other materials than those prescribed, as long as the above-mentioned layer is not created.

The excavated material can be used for backfill. The backfill must be compacted along the entire trench width. We do not recommend using frozen earth or earth containing particles greater than 150 mm for the backfill. At locations with higher levels of groundwater, it is necessary to pack, backfill and compact faster to prevent the pipeline from floating. The trench reinforcement is to be removed simultaniously as the backfill and compaction advance.

Figure 1 Pack and backfill structure



6. CONSTRUCTION - CONCRETE ENCASEMENT

Although the KG-Systemu (PVC)® is designed predominantly for buried installation without any concrete incasement being necesarry, a concrete encasement can still be (in certain situations) used. However, make always sure the following measures and requirements are met:
a) The gap between the faucet and the pipe must be protected against cement laitance penetration: a piece of adhesive tape is the best choice.
b) The pipeline must be secured against uplift (floating) - the anchoring should prevent any unwanted bends.
c) Thermal linear expansion of the pipes must be taken into account: wrap the faucet joints and leave them free.

7. CONNECTING THE PIPES

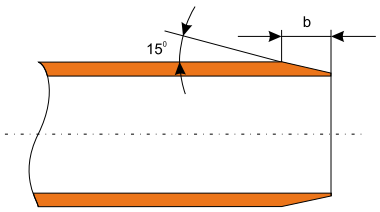
The KG-System (PVC)® pipes are connected by means of socket faucets with tight connection to even pipe ends with lipped O-rings. The gluing of pipes or shaped pieces is not reccomended. Single pipes and shaped pieces are always fitted with a faucet and an O-ring at one end. Other pipes with no faucets can be connected via sleeves, double foucet sleeves, and individual faucets.

In some cases, the pipes and shaped pieces need to be shortened. This is done with a special plastic pipe cutter that creates the required bevel angle at the same time. If no cutter is available, a hand-saw with fine teeth can be used that is directed inside two cuttings in a trough (see Figure 2).

Figure 2 Pipe cutting with a hand-saw

Clean off the cut and use a rasper to create a bevel according to the figure and table below.

Figure 3 Bevel of pipe cut subsequently



BEVEL DIMENSIONS								
DN	110	125	160	200	250	315	400	500
b[mm]	6	6	7	9	9	12	15	18

8. CONNECTING PIPES AND SHAPED PIECES

a) Clean the faucet and the flat end of the pipe from any resudues.

b) Check that the O-ring has been inserted correctly and tightly.

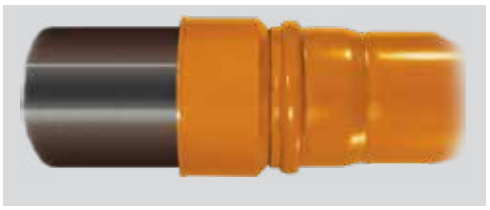
c) On the flat end apply the original mounting lubricant supplied with the system.

d) Insert the pipe flat end completely into the faucet. Mark the end of the faucet on the flat end of the pipe (e. g. with a marker or a pencil). Move the flat end out from the faucet by 3 mm for each 1 m of pipe structural length, by a minimum of 10 mm.

9. CONNECTING PIPES OF OTHER MATERIALS

Connection of faucet of cast-iron pipeline (PVC/cast-iron transition)

A multiple O-ring (KG – GA set) is used.
Connection to the cast-iron flat end
(transition piece cast-iron/PVC)



A multiple O-ring (KG – GA set) and cast-iron/PVC transition piece (KGUG) are used.

Connection to stoneware pipe faucet
(transition piece PVC/stoneware)

A PVC/stoneware (KGUSM) transition piece is inserted into the stoneware pipe faucet which is fitted with a rubber sealing sleeve. In case the stoneware is not fitted with a sealing, it is necessary classic caulking or polyurethane binding agents.

Connection to the stoneware pipe flat end
(transition piece stoneware/PVC)

A transition piece stoneware/PVC (KGUS) fitted with a sealing sleeve is used. The connection is made by simple insertion as shown in the figure below.

10. LEAK TEST

Two leak test types are possible:

a) "wet" – using water column;

b) "dry" – using compressed air.

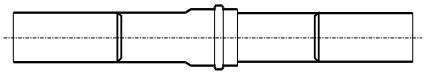
The leak test type may be selected by the client. The ČSN EN 1610 is recommended to be used as the methodological procedure.

11. PIPELINE REPAIRS

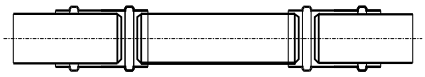
Predominantly, sleeves (KGU) are used for repairs. Fist, it is necessary to locate the faulty spot. Then, the damaged part is to be cut out and replaced with a spare part of pipeline using two sleeves (see Figure 4).

Figure 4 Repair of damaged pipeline with sleeves

1. a) cutting the spare part
   b) creating a bevel
   c) cutting out the damaged part



2. inserting the spare pipe part and sliding the sleeve



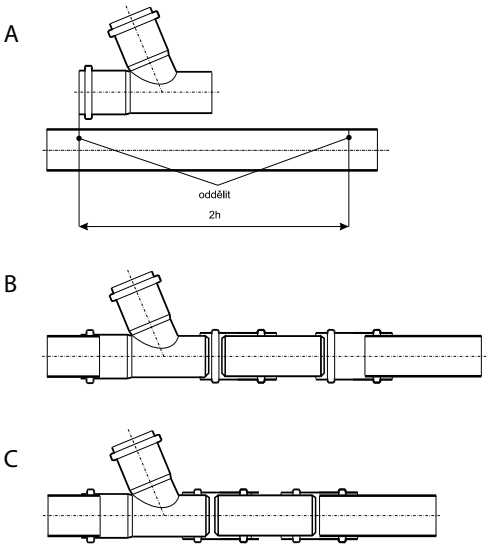
3. closing the pipeline with sleeves

12. SUBSEQUENT INSERTION OF BRANCH

Connection using two sleeves
(current pipeline cannot be tilted)

In case of subsequent insertion of a branch line, a sufficiently long piece (2 times the shaped piece length - 2xh) is cut out of the pipeline – see Figure 5. Then, clean the pipe ends and described in paragraph 7. The branch (KGEA) is inserted on one end of the pipeline prepared in this manner, and the sleeves (KGU) are inserted in the second end fitted with the inserted pipe piece. In the end, slide the sleeves to close the entire pipeline.

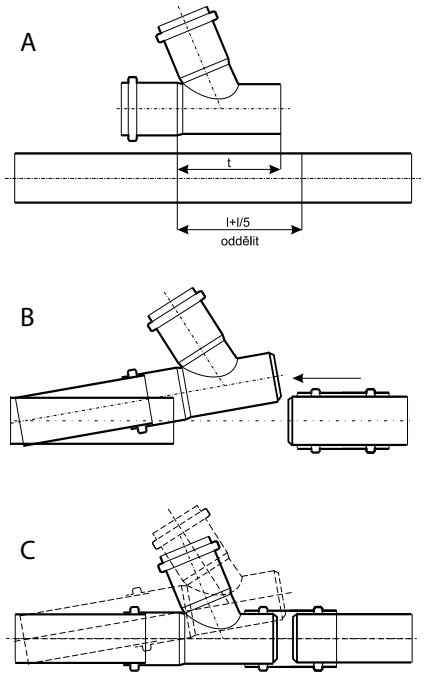
Figure 5 Subsequent connection – procedure I



Connection using one sleeve
(current pipeline can be tilted)

A piece is cut out of the pipeline corresponding to the constructional branch lengh (l + l/5) – see Figure 6. Then, clean the ends as described in paragraph 7. Slide the sleve (KGU) over one pipe end, then carefully tilt the second end and insert the branch (KGEA). Move the part with the branch inserted in its original position and slide the sleeve to close the pipeline.

Figure 6 Subsequent connection – procedure II



Polypropylene chemical stability

COMPOUND	Concentration [%]	Temperature [°C]		
		20	40	60
acetone	100	+	SDgr	
gaseous ammonia	100	+	+	
ammonium, hydrous sol.	concd. soln.	+	+	
ammonium, hydrous sol.	10	+	+	
amyl alcohol, pure		+	+	
acetanhydride	100	+		
benzenamine	100	+		+*
benzaldehyde	100	+		
benzaldehyde, sol. aq.	sat.	+		
benzine	(see "Technical liquids")			
benzole	100	-*	-	
liquid bromide	100	-		
bromide fumes	high	-	-	
bromide fumes	dil.	SDgr	-	
bromide water	sat.	-	-	
liquid butane	100	+		
butane gas	100	+	+	
butyl acetane	100	+	SDgr	
cyclohexane	100	+		
cyclohexanol	100	+	+	
cyclohexanone	100	+	-	
dibutylphthalate	(see "Technical liquids")			
diethyl ether	100	SDgr		
potassium dichromate, sol. aq.	sat.	+	+	+
dimethylformamide	100	+		
1.4-dioxan	100	+	SDgr	-
ammonium nitrate, hydrous	all	+	+	+
potassium nitrate, sol. aq.	sat.	+	+	
sodium nitrate, sol. aq.	sat.	+	+	
calcium nitrate, sol. aq.	sat.	+	+	+
ethyl acetate	100	SDgr	SDgr	
ethyl alcohol	100	+		
ethyl alcohol, sol. aq.	96	+	+	
ethyl alcohol, sol. aq.	50	+	+	
ethyl alcohol, sol. aq.	10	+	+	
ethyl-benzene	100	SDgr	-	
ethylene chloride	100	SDgr	-*	
2-ethoxyethanol	100	+		
ethyl chloride	100	-		
ethyl ether see "diethyl ether"				
phenol	sat.	+	+	
formaldehyde, sol. aq.	40	+	+	
formaldehyde, sol. aq.	30	+	+	
formaldehyde, sol. aq.	10	+	+	
triammonium phosphate, hydrous	all	+	+	+
sodium phosphate, sol. aq.	sat.	+	+	+
glycerine	100	+	+	
glycerine, sol. aq.	high	+	-	-
glycerine, sol. aq.	dil.	+	-	-
glycol	100	+	+	
glycol, sol. aq.	high	+	+	
glycol, sol. aq.	dil.	+	+	+
heptane	100	+	SDgr	
hexane	100	+	SDgr	
aluminium salts	all	+	+	+
hydrogen sulphite sodium, sol. aq.	sat.	+	+	
sodium bicarbonate, sol. aq.	sat.	+	+	+
potassium hydroxide	50	+	+	
potassium hydroxide	25	+	+	
potassium hydroxide	10	+	+	

COMPOUND	Concentration [%]	Temperature [°C]		
		20	40	60
sodium hydroxide	100	+	+	
liquid chlorine	100	-		
chlorine gas, anhydrous	100	-	-	-
chlorine gas, humid	10	SDgr	-	-
chlorbenzene	100			
sodium chlorate, sol. aq.	5	+		
ammonium chloride, sol. aq.	all	+	+	+
tin dichloride	sat.	+	+	
potassium chloride, aq.	sat.	+	+	+
sodium chloride, sol. aq.	sat.	+	+	+
calcium chloride, hydrous	sat.	+	+	+
sodium perchlorate, sol. aq.	5	+	+	
potassium hypochlorite, sol. aq.	sat.	+	+	
sodium hypochlorite, sol. aq.	25	+	+	
chloroform	100	-*	-	
chlorine water	sat.	SDgr	-	
muriatic acid gas	high	+	+	
iso-octane	100	+	SDgr	
isopropyl alcohol	100	+	+	
potassium iodide, hydrous	sat.	+	+	
hydroxytoluene	100	+	SDgr	
hydroxytoluene, sol. aq.	sat.	+	SDgr	
benzenecarboxylic acid	100	+	+	
benzenecarboxylic acid, sol. aq.	sat.	+	+	+
boracic acid	100	+	+	
boracic acid, hydrous	sat.	+	+	
citric acid, sol. aq.	sat.	+	+	+
nitric acid	50	SDgr	-	
nitric acid	25	+	+	
nitric acid	10	+	+	
fluorohydric acid	40	+	+	
orthophosphoric acid	sat.	+	SDgr	
orthophosphoric acid	50	+	+	
orthophosphoric acid	10	+	+	+
hydrochloric acid	sat.	+	+	
chlorosulphonic acid	100	-	-	
chromic acid	sat.	+	-	
chromic acid	20	+	SDgr	
butanedioic acid, sol. aq.	sat.	+	+	
lactacid, sol. aq.	90	+	+	
lactacid, sol. aq.	50	+	+	
lactacid, sol. aq.	10	+	+	+
methanoic acid	98	+	SDgr	
methanoic acid	90	+		
methanoic acid	50	+	+	
methanoic acid	10	+	+	+
glacial acetic acid	100	+	SDgr	-
acetic acid, sol. aq.	50	+	+	
acetic acid, sol. aq.	10	+	+	+
oleic acid	100	+		
sulphuric acid	96	+	SDgr	
sulphuric acid	50	+	+	
sulphuric acid	25	+	+	
sulphuric acid	10	+	+	+
stearic acid	100	+		
ethanedioic acid, sol. aq.	sat.	+	+	+
2,3-dihydroxybutandioic acid, sol. aq.	sat.	+	+	
permanganate of potassium, sol. aq.	sat.	+	+*	
methanol	100	+	+	
methanol, sol. aq.	50	+	+	

COMPOUND	Concentration [%]	Temperature [°C]		
		20	40	60
methane ethyl ketone	100	+	SDgr	
methyl chloride	100	SDgr		
mineral oils	(see "Technical liquids")			
urea, sol. aq.	sat.	+	+	
naphthalene	100	+		
naphthalene	100	-*	-	-
soda lime	50	+	+	
soda lime	25	+	+	
soda lime	10	+	+	+
n-butanol	100	+	+	
nitrobenzene	100	+*	SDgr	
ammonium acetate, sol. aq.	all	+	+	+
octane see "iso-octane"				
diphosphorus pentaoxide	100	+		
sulphur dioxide	dil.	+	+	
ozone < 0,5 ppm		+*	-*	
hydrogen dioxide, sol. aq.	90			
hydrogen dioxide, sol. aq.	30	+	SDgr	
hydrogen dioxide, sol. aq.	10	+	+	
hydrogen dioxide, sol. aq.	3	+	+	+
potassium persulphate, sol. aq.	sat.	+		
propane, liquid	100	+		
propane gas	100	+	+	
pyridine	100	+	SDgr	
mercury	100	+	+	
sulphur	100	+	+	+
ammonium sulphate, sol. aq.	all	+	+	+
potassium sulphate, sol. aq.	sat.	+	+	+
sulphate of strontium, sol. aq.	sat.	+	+	+
carbon sulphide	100	SDgr		
hydrogen sulphide	dil.	+	+	
sodium sulphite, sol. aq.	sat.	+	+	
barium salts	all	+	+	+
magnesium salts, sol. aq.	sat.	+	+	+
chromium salts 2+, 3+	sat.	+	+	
copper salts	sat.	+	+	+
nickel salts	sat.	+	+	
mercury salts, sol. aq.	sat.	+	+	
argent salts	sat.	+	+	
zinc salts, sol. aq.	sat.	+	+	
ferrum salts, sol. aq.	sat.	+	+	+
sodium sulphide, sol. aq.	sat.	+	+	
trisodium tetraborate, sol. aq.	sat.	+	+	+
tetrahydrofuran	100	SDgr	-	
tetrahydro-naphthalene	100	SDgr	-	
tetrachloroethane	100	SDgr	-	
tetrachloromethane	100	SDgr	-	
thiophene	100	SDgr	-	
sodium thiosulphate, sol. aq.	sat.	+	+	
toluene	100	SDgr	-	
chloral	100	SDgr	-*	
ammonium carbonate, sol. aq.	all	+	+	+
potassium carbonate (potash)	sat.	+	+	
carbonate of soda (soda)	sat.	+	+	
carbonate of soda (soda)	10	+	+	+
water	100	+	+	+
xylene	100	SDgr	-	
Technical liquids				
accumulator acid		+	+	
asphalt		+	SDgr	
petrol, pure		+	SDgr	
unleaded petrol		+	SDgr	

COMPOUND	Concentration [%]	Temperature [°C]		
		20	40	60
leaded petrol		+	SDgr	
super petrol		+*	SDgr	
bleaching liquor (12,5 % Cl)		SDgr	SDgr	
sodium tetraborate, sol. aq.	sat.	+	+	
pine oil		+	+*	
brake fluid		+	+	
tar		+	SDgr	
Formalin®		+	+	
photographic developer	usual	+	+	
Fridex®		+	+	
calcium hypochlorite		+	+	
chromium tanning bath		+	+	
chromium-sulphur mixture		-	-	
alumen, sat.		+	+	
shoe polish		+	SDgr	
Kresolum saponatum®		+		
anti-moth marbles		+		
Lanolin®		+	SDgr	
LITEX®		+	+	
flax-seed oil		+	+	
Lysol®		+	SDgr	
mineral oils (w/o aromates)		+	SDgr	-
engine oils		+	SDgr	-
diesel fuel		+	SDgr	
synthetic degreasers	c. u.	+	+	+
two-cycle engine oil		SDgr	SDgr	
typewriter oil		+	+*	
transformer oil		+	SDgr	
fuming sulphuric acid	all	-	-	
paraffin	100	+	+	-
paraffin oil	100	+	SDgr	-
pectose, sat.		+	+	
pectrol-ether	100	+	SDgr	
furniture polish		+	SDgr	-
laundry agents high		+	+	
Sagrotan®		+	SDgr	
kitchenware detergent		+	+	+
silicone oil		+	+*	
spruce oil		+	+*	
soda	(see "carbonate of soda")			
Solvina		+	+	
turpentine		SDgr	-	
fuel oil		+	SDgr	
graphite		+	+	
fixative bath	10	+	+	
salt water		+	+	+
aqueous glass		+	+	
floor polish		+	SDgr	
softening agent – dibutylphthalate		+	SDgr	
softening agent – dibutyl sebacate		+		
softening agent – dihexylphtalate		+		
softening agent – dinonyl-adipate		+		
softening agent – dioctyl-adipate		+		
softening agent – dioctyl-phtalate		+		
softening agent – tricresyl phosphate		+		
softening agent – trioctyl phosphate		+		
Pharmaceuticals and cosmetics				
Aspirin®		+		
Quinine		+		

COMPOUND	Concentration [%]	Temperature [°C]		
		20	40	60
iodine tincture		+		
bornyl chloride		+		
fingernail polish		+		
menthol		+		
soap and soapflakes		+		
soap solution	sat.	+	+	+
soap solution	10	+	+	+
fingernail polish remover		+	SDgr	
perfumes		+		
hair shampoo		+	+	
paraffin jelly		+	SDgr	
toothpaste		+	+	
Food and eatables				
potato salad		+		
Coca-Cola®		+		
dry sugar		+	+	+
sugar solution		+	+	+*
tea tree leaves		+	+	
tea – drink		+	+	+*
lemon pulp and peel		+		
apple pulp		+	+	+*
orange pulp and peel		+		
essential oils		+	SDgr	
gin	40	+		
mustard		+		
cocoa – drink		+	+	+
cocoa – powder		+		
coffee (beans and ground coffee)		+		
coffee – drink		+	+	+
ketchup		+	+	
cognac		+		
spices		+		
fish in vinegar		+	+	+*
pickled cabbage		+	+	+*
liqueur	all	+		
lemonade		+		
beef tallow		+	+	
mayonnaise		+		
margarine		+	+	
jam		+	+	+*
butter		+	+	
honey		+	+	
milk products		+	+	+*
milk		+	+	+*
flour		+		
vinegar	c. u.	+	+	
lemon oil		+		
coconut oil		+	+*	
peppermint oil		+		
olive oil		+	+	
palm oil		+	SDgr	
orange oil		+		
vegetable oil		+	SDgr	
soya bean oil		+	SDgr	
corn-germ oil		+	SDgr	
peanut oil		+	+*	-*
animal oil		+	SDgr	
fruit salad		+		
baked goods		+	+	+*
beer		+		
butter milk		+		
pudding		+	+	+*

COMPOUND	Concentration [%]	Temperature [°C]		
		20	40	60
rum	40	+	+	
fish oil		+		
lard		+	SDgr	
salami		+	+	
beet syrup	all	+	+	+*
herrings		+		
carbonated water		+		
salt brine		+	+	+
common salt	(see "sodium chloride")			
cheese		+		
fecula – sol. aq.	all	+	+	
whipped cream		+		
pineapple juice		+	+	
lemon juice		+	+	
grapefruit juice		+	+	
apple juice		+	+	
fruit juice		+	+	
orange juice		+	+	
tomato sauce		+	+	
roast-food sauce		+	+	+*
lemon essence		+		
bitter almond essence		+		
vinegar essence	c. u.	+	+	
rum essence		+		
vanilla essence		+	+	
cottage cheese		+		
eggs (raw and cooked)		+	+	+*
wine		+	+	
whisky	40	+		
vegetables		+	+	+*
gelatine		+	+	+*

Legend :	
+	resistance
+*	partial resistance
SDgr	conditional resistance
-*	low resistance
-	instability
no classification	not tested
all	all concentrations
concd. soln.	concentrated solution
low conc.	low concentration
c. u.	commonly used concentration
usual	usual, commercial concentration
dil.	diluted solution
sol. aq.	aqueous solution
sat.	cold-saturated solution
hot sat.	hot-saturated solution
m. a.	minute amounts

Chemical stability of unplasticized polyvinyl chloride

COMPOUND	Concentration [%]	Temp. [°C]		
		20	40	60
acetaldehyde	100			
acetaldehyde	40	°	°	
acetaldehyde+ acetic acid	90/40	°		
acetanhydride	100	-		
acetone	m. a.	-		
acetone	100	-		
allyl alcohol	96	°		
liquid ammonia	100	°	°	
gaseous ammonia	100	+	+	+
pure phenylamine	100	-		
phenylamine hydrochloride, hydrous	sat.	°		
anon	100	-		
inorganic fertilizers	up to 10	+	+	°
inorganic fertilizers	sat.	+	+	+
antiformin hydrous	2	+		
Asfluid I, liquid		-		
benzaldehyde, sol. aq.	0.1	-	-	-
benzine	100	+	+	+
benzine-benzole mixture	80/20	-	-	-
sodium benzoate, sol. aq.	up to 10	+	+	
sodium benzoate, sol. aq.	up to 36			°
benzole	100	-	-	-
bleach liquid (12.5 % active clorine)	c. u.	+	+	°
sodium tetraborate, sol. aq.	dil.	+	+	°
sodium tetraborate, sol. aq.	sat.			°
potassium borate, sol. aq.	1	+	+	°
liquid bromide	100	-		
gaseous bromide	low conc.	°		
potassium bromate, sol. aq.	dil.	+	+	°
potassium bromate, sol. aq.	dil.	+	+	°
potassium bromate, sol. aq.	sat.	+	+	+
bromide water	sat.	°	°	
butadiene	100	+	+	+
butane gas	50	+		
succinaldehyde	up to 10	+	°	-
butanol	up to 100	+	+	°
butine-diol	100		°	
butyl acetane	100	-		
butylphenol	100	°		
cellulose, sol. aq.	sat.	+	°	
cycannone	c. u.	+	+	+
cyclohexanol	100	-	-	-
cyklohexanone	100	-	-	-
tanning cellulose extracts	usual			
tanning herbal extracts	usual	+		
ammonia liquor	sat.	+	+	°
densodrine	c. u.	+	+	+
dextrine, sol. aq.	sat.	+		
dextrine, sol. aq.	18			°
potassium dichromate, sol. aq.	40	+		
ammonium nitrate, hydrous	dil.	+	+	°
ammonium nitrate, hydrous	sat.	+	+	+
potassium nitrate, sol. aq.	sat.	+	+	+
potassium nitrate, sol. aq.	dil.	+	+	°
silver nitrate, sol. aq.	up to 8	+	+	°
calcium nitrate, sol. aq.	50	+	+	+
paraffine emulsions	c. u.	+	+	
acetic ester	100	-		
ethyl-acrylate	100	-		
ethyl alcohol (inoculum)	c. u.	+	+	°
ethyl alcohol and acetic acid (fermentation mixture)	c. u.	+	°	
denaturated ethyl alcohol (2 % of toluene)	96	+	°	°
ethyl alcohol, sol. aq.	96	+	+	°
ethylene chloride	100	-		
ethylene oxide, liquid	100	-		
ethyl ether	100	-		
phenol water	up to 90	°	°	-
phenol water	1	+		

COMPOUND	Concentration [%]	Temp. [°C]		
		20	40	60
phenylhydrazine	100	-		
phenylhydrazine-hydrochloride, sol. aq.	sat.	°		
ferri-cyanide and ferro-cyanide				
potassium sol. aq.	dil.	+	+	°
potassium sol. aq.	sat.	+	+	+
ammonium fluoride, hydrous	up to 20	+		°
copper difluoride, hydrous	2	+	+	+
nitrogen fluoride, sol. aq.	up to 20	+		°
formaldehyde, sol. aq.	dil.	+	+	°
formaldehyde, sol. aq.	40	+	+	+
phosphane	100	+		
gaseous carbonyl dichloride	100	+		°
liquid carbonyl dichloride	100	-		
photoemulsion	all	+	+	
fixative	c. u.	+	+	
developing agent	c. u.	+	+	
FRIGEN®	100	+		
fructose (grape suger), sol. aq.	sat.	+	+	°
glycerine, sol. aq.	all	+	+	+
glycocoll, sol. aq.	10	+	+	+
glycol, sol. aq.	c. u.	+	+	+
hexane-triol	c. u.	+	+	+
beef tallow, sulphonate emulsion	c. u.	+		
hydrogen sulphite sodium, sol. aq.	dil.	+	+	°
hydrogen sulphite sodium, sol. aq.	sat.	+	+	+
hydroxylamine sulphate, sol. aq.	up to 12	+	+	
chlophene	c. u.	°		-
chlorine gas, anhydrous	100	°	°	-
chlorine gas, hydrous	0.5	+		
chlorine gas, hydrous	1	°		
chlorine gas, hydrous	5	°		
chlorine gas, hydrous	97	°		
liquified chlorine		-		
chloramine, sol. aq.	dil.	+	-	-
sodium chlorate, sol. aq.	up to 10	+	+	°
sodium chlorate, sol. aq.	sat.	+	+	+
ammonium chloride, hydrous	dil.	+		°
ammonium chloride, hydrous	sat.	+	+	+
antimonous chloride, hydrous	90	+	+	+
tin bichloride, hydrous	sat.	+	+	°
tin bichloride, hydrous	dil.	+	+	°
potassium chloride, sol. aq.	sat.	+	+	+
potassium chloride, sol. aq.	dil.	+	+	°
trichloride phosphorous	100	-		
aluminium trichloride, hydrous	dil.	+	+	°
aluminium trichloride, hydrous	sat.	+	+	+
magnesium chloride, hydrous	dil.	+	+	°
magnesium chloride, hydrous	sat.	+	+	+
copper chloride, hydrous	sat.	+	+	
sodium chloride	(see Common salt)			
calcium chloride, hydrous	dil.	+	+	°
calcium chloride, hydrous	sat.	+	+	+
chloride zinc, hydrous	sat.	+	+	+
chloride zinc, hydrous	dil.	+	+	°
ferric chloride	up to 10	+	+	°
ferric chloride	sat.	+	+	+
potassium perchlorate, sol. aq	1	+	+	°
sodium hypochlorite, sol. aq.	dil.	+		
chlorine water	sat.	°	°	
chlorine hydride, hydrous		+	+	
hydrogen chloride, anhydrous		+	+	+
potassium chromate, sol. aq.	40	+	+	+
chrome alume, sol. aq.	dil.	+	+	°
chrome alume, sol. aq.	sat.	+	+	+
chromium-sulphur cleaning mixture	50/15/35	+	+	°
metallic iodine and in alcaline solution		-		
hydrous alumen	dil.	+	+	°

COMPOUND	Concentration [%]	Temp. [°C]		
		20	40	60
hydrous alumen	sat.	+	+	+
carbolineum, fruit origin	c. u.	+		
acacia	c. u.	+		
hydroxytoluene, sol. aq.	up to 90	°	°	
crotonaldehyde	100	-		
colour agents	c. u.	+	+	+
potassium cyanide, sol. aq.	up to 10	+	+	°
adipinic acid	sat.	+	+	°
antraquinone-sulphone acid				
aqueous suspension		+		
arsenic acid, sol. aq.	dil.	+	+	°
arsenic acid, sol. aq.	80	+	+	°
benzenecarboxylic acid	all	+	+	°
boracic acid, sol. aq.	sat.	+	+	°
bromhydric acid, sol. aq.	48	+	+	+
bromhydric acid, sol. aq.	up to 10	+	+	°
oxychlorine acid, sol. aq.	up to 10	+	+	°
oxychlorine acid, sol. aq.	sat.	+	+	+
hypochlorous acid, sol. aq.	10	+	+	°
hypochlorous acid, sol. aq.	20	+	+	°
hypochlorous acid, sol. aq	1	+	+	°
chlorosulphonic acid	100	°		
chromic acid, sol. aq.	up to 50	+	+	°
citric acid, sol. aq.	sat.	+	+	+
citric acid, sol. aq.	up to 10	+	+	°
diethylene-glycol acid	30	+	+	°
diethylene-glycol acid	sat.	+		
nitric acid, sol. aq.	up to 50	+	+	°
nitric acid, sol. aq.	98	-		
fluorosilicic acid, sol. aq.	up to 32	+	+	+
orthophosphoric acid, sol. aq.	up to 30	+	+	°
orthophosphoric acid, sol. aq.	above 30	+	+	+
glycollic acid, sol. aq.	37	+		
2-hydroxybutanedioic acid, sol. aq.	1	+	+	
silicilic acid, sol. aq.	all	+	+	+
(Z)-butenedioic acid, sol. aq.	sat.	+	+	°
(Z)-butenedioic acid, sol. aq.	35	+	+	
butanoic acid, concd. sol.		-		
butanoic acid, sol. aq.	20	+	-	-
methanesulfone acid	100	+	+	°
methanesulfone acid, sol. aq.	up to 50	+	°	
lactacid acid, sol. aq.	90	+	°	-
lactacid acid, sol. aq.	up to 10	+	+	°
monochloroacetic acid, sol. aq.	85	+		
monochloroacetic acid, sol. aq.	100	+	+	°
methanoic acid, hydrous	100	+	°	-
methanoic acid, hydrous	up to 50	+	+	°
methanoic acid, hydrous	50	+		°
acetic acid, sol. aq.	do 25	+	+	°
glacial acetic acid	100	°	-	
acetic acid, sol. aq.	25-60	+	+	+
acetic acid, sol. aq	80	+	°	
cruce acetic acid	95		°	
(Z)-9-octadecenoic acid	c. u.	+	+	+
picrite acite	1	+		
sulphurous acid (at 8 bar)	sat.	+		
sulphuric acid, sol. aq.	do 40	+	+	°
sulphuric acid, sol. aq.	40-80	+	+	+
sulphuric acid, sol. aq.	96	+	°	
sulphuric acid, sol. aq.	80-90			
chlorhydric acid, sol. aq.	do 30	+	+	°
chlorhydric acid, sol. aq.	concd.	+	+	+
stearic acid	100	+	+	+
ethanedioic acid, sol. aq.	sat.	+	+	+
ethanedioic acid, sol. aq.	dil.	+	+	+
carbonic acid, sol. aq. (up to 8 bar)	sat.	+		
2,3-dihydroxybutandioic acid, sol. aq.	up to 10	+	+	°
2,3-dihydroxybutandioic acid, sol. aq.	sat.	+	+	+
oxygen	all.	+	+	+
spirits		+		
liqueurs		+		

COMPOUND	Concentration [%]	Temp. [°C]		
		20	40	60
caustic potash lye, sol. aq.	up to 40	+	+	°
caustic potash lye, sol. aq.	50-60	+	+	+
sodium lye, sol. aq.	up to 40	+	+	°
sodium lye, sol. aq.	50-60	+	+	+
aqua regia		°		
tallow	100	+	+	+
permanganate of potassium, sol. aq.	6	+	+	+
permanganate of potassium, sol. aq.	up to 18	+	+	
fatty acids	100	+	+	+
palm oil fatty acids	100	+	+	+
molasses	c. u.	+	+	°
molasses mixture	c. u.	+	+	+
Mersol D	c. u.	+	+	°
methanol, sol. aq.	32	°		
methanol	100	+	+	°
chloromethane	100	-		
methylene-chloride	100	+	+	°
mineral oils		+	+	+
beer wort	c. u.	+	+	
milk		+	+	+
urine		+	+	°
urea, sol. aq.	up to 10	+	+	°
urea, sol. aq.	33	+	+	+
Mowilith D	c. u.	+		
NEKAL BX ® aq.	dil.	+	+	°
nicotine, sol. aq.	c. u.	+		
nicotinic preparates, sol. aq.	c. u.	+		
nitroglycerine	dil.	°		
nitroglycol	dil.	-		
oxides of nitrogen	concd. soln.	°		
wine vinegar	c. u.	+	+	+
acetate lead, sol. aq.	sat.	+	+	+
acetate lead, sol. aq.	dil.	+	+	°
acetate lead, sol. aq.	hot sat.	+	+	
mists containing sulphuric acid (hydrous)	all	+	+	+
mists containing sulphur trioxide	all	°		
mists containing carbon dioxide	all	+	+	+
mists containing hydrogen fluoride	all	+	+	+
mists containing sulphur dioxide	low concd.	+	+	+
mists containing carbon monoxide	all	+	+	+
mists containing nitrogene oxides	all	+	+	
mists containing fuming sulphuric acid	low conc.	+	+	+
mists containing chlorine hydride	all	+	+	+
mists containing oxides of nitrogen	all	+	+	+
flax-seed oil	100	+	+	
oils and fats		+	+	+
fuming sulphuric acid	10	-		
fruit juice	c. u.	+	+	+
fruit drinks	c. u.	+	+	+
diphosphorous pentaoxide	100	+		
sulphur dioxide, anhydrous	all	+	+	+
sulphur dioxide, hydrous	50	+	+	
sulphur dioxide, liquid	100	°		
sulphur dioxide, hydrous	all	+	+	°
carbon monoxide	100	+	+	+
carbon dioxide, anhydrous	100	+	+	+
carbon dioxide, hydrous	all	+	+	°
nitrogen oxides, hydrous and anhydrous	dil.			°
nitrogen oxides, hydrous	concd soln.	-		
ozone	100	+	+	+
ozone	10	+		
paraffin alcohols	100	+	+	+
sulphuric acid fumes	higher	°		
sulphuric acid fumes	níz.	+		
hydrogen dioxide, sol. aq.	up to 30	+		
hydrogen dioxide, sol. aq	up to 20	+	+	
potassium peroxydisulphate	sat.	+	+	°
potassium peroxydisulphate	dil.	+	+	°
beer		+	+	+

COMPOUND	Concentration [%]	Temp. [°C]		
		20	40	60
potash, sol. aq.	sat.	+	+	
propane gas		+		
propane, liquid	100	+		
propargyl alcohol, sol. aq.	7	+	+	+
plant protective agents	(see carbolineum and nicotinic preparates)			
pyridine	all	-		
mercury		+	+	+
carbon sulphide	100	°		
hydrogen sulphide, anhydrous	100	+	+	+
ethyl alcohol, sol. aq.	sat.	+	+	°
ammonium sulphate, hydrous	sat.	+	+	+
ammonium sulphate, hydrous	dil.	+	+	°
magnesium sulphate, sol. aq.	sat.	+	+	+
magnesium sulphate, sol. aq.	dil.	+	+	°
cupric sulphate, sol. aq.	sat.	+	+	+
cupric sulphate, sol. aq.	dil.	+	+	°
nickel sulphate, sol. aq.	dil.	+	+	°
nickel sulphate, sol. aq.	sat.	+	+	+
sodium sulphate, sol. aq.	dil.	+	+	°
sodium sulphate, sol. aq.	sat.	+	+	+
zinc sulphate, sol. aq.	sat.	+	+	+
zinc sulphate, sol. aq.	dil.	+	+	°
mixed acids (nitric/sulphuric/water)	50/50/0	°	-	
mixed acids (nitric/sulphuric/water)	10/20/70	+	+	
mixed acids (nitric/sulphuric/water)	10/87/3	°		
mixed acids (nitric/sulphuric/water)	50/31/19	+		
mixed acids (nitric/sulphuric/water)	48/49/3	+	°	
soda solution	sat.	+	+	+
soda solution	dil.	+	+	°
sodium bisulphide, sol. aq. with carbon dioxide	sat.	+	+	+
spinner acids with CS2	200 mg/l		°	
spinner acids with CS2	100 mg/l	+	+	
spinner acids with CS2	700 mg/l		-	
spinning viscose bath liquors		+	+	+
common salt, sol. aq.	dil.	+	+	°
common salt, sol. aq.	sat.	+	+	+
lighting gas w/o benzene		+		
fecula, sol. aq.	c. u.	+	+	+
tetrachlormethane	100	°	-	
tetraethyl lead	100	+		
thionyl chloride	concd.	-		
toluene	100	-		
trichlorethylene	100	-		
trietanolamine	100	-		
trimethylpropane, sol. aq.	c. u.		°	
trimethylpropane, sol. aq.	up to 10	+	+	°
potassium carbonate (sol. aq.)	(see potash)			
sodium carbonate	(see soda)			
wine spirits of all kinds		+		
wine spirit		+	+	
vinyl acetate	100	-		
white and red wine		+	+	+
salt water		+	+	°
water in general		+	+	°
carbonated water		+	°	°
distilled water		+	+	
soap water	concd.	+		°
drinking water		+	+	
spring water		+	+	
condensed water		+	+	
waste water (also acetic w/o organic solvents)		+	+	
waste water with minute amounts of phenols and butanol				
hydrogen	100	+	+	+
higher fatty alcohols	100	+	+	+
xylol	100	-		
gelatine, sol. aq.	all	+	+	

Legend :	
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+*	partially resistant
°	conditionally resistant
-*	low resistance
-	instability
no classification	not tested
all	all concentrations
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OSMA
Plus
HT System
ISO 9001
OSMA
dB
Skolan SAFE
OSMA
Ultra dB
UdB System
ISO 9001
OSMA
PVC
KG System
ISO 9001
OSMA
Polypropylene
KG 2000
ISO 9001
OSMA
Dualcore
Magnacor
ISO 9001
OSMA
OSMA
RV System
ISO 9001