KRAH™
krah-pipes.com PIPES

Large diameter pressure pipes

up to DN/ID 5000 mm

Reliable

and designed according to YOUR requirements

Krah pressure pipes

Today‘s demand for large diameter pressure pipes made out of thermoplastics is steadily increasing. Especially for the transport of drinking water or piping systems of water treatment- and power plants, the market is strongly looking for corrosion resistant and cost-efficient solutions.

For decades the traditional pressure pipe producers have been using helically extruded Krah Pipes for fabrication of fittings, especially stub ends and T-branches. The KRAH technology is the most efficient and smartest way for manufacturing pipes, fittings, manholes, tanks etc. in large dimensions. Any requested wall thickness according to the application requirements can be produced without sagging or frozen stresses.

Due to the market developements of the past years, KRAH officially entered the large diameter pressure pipes market.

Significant increase of the production output, the KRAH Comtruder®-technology, the advanced developments of the cross winding process and other innovations convince pipe manufacturers and customers as well.

Solid wall pressure pipes made by the KRAH technology are available until DN/ID 5000 mm in standardized and customized pressure classes. No matter if Krah Pipes made of pure high density Polyethylene PE100 or of glass fibre reinforced Polyethylene, you always have a reliable and sustainable product solution.

Krah helical extruded pressure pipe fittings

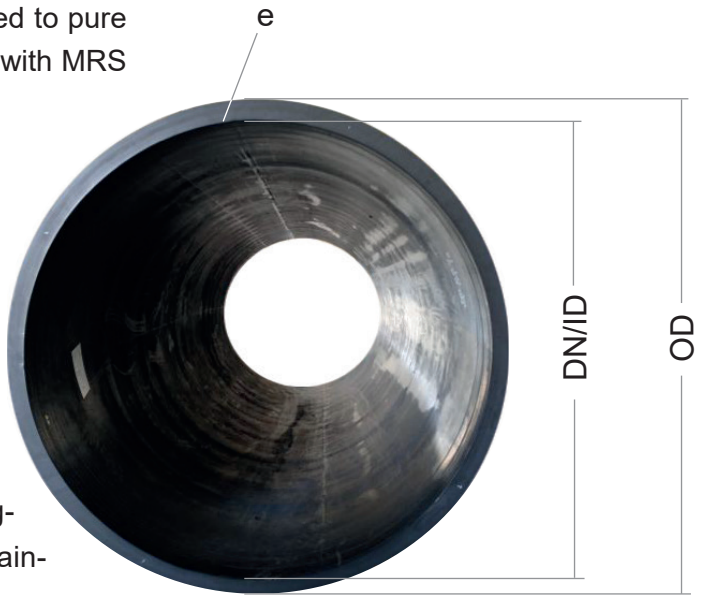
General specification and properties

Material

Polyethylene PE100 and glass-fiber reinforced Polyethylene PE-GF200 have excellent properties for the application of water supply, as well as for the fabrication of containers for liquids and solid materials. All the materials are environmentally friendly.

- High density Polyethylene (PE100)
- Glass-fiber reinforced Polyethylene (PE-GF200)

PE-GF200 is a compound of PE 100 and glass fibres and has a minimum MRS value of 20N/mm², compared to pure PE80 with an MRS value of 8N/mm² and PE100 with MRS of 10N/mm².



Pipe diameter

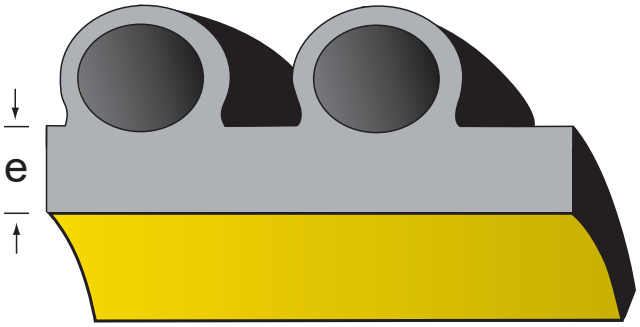
Krah pressure pipes can be produced with internal diameters (ID) from DN/ID 300mm to DN/ID 5000mm. The nominal diameter (DN) is equal to the internal diameter (ID). In case of any change in the design, the wall thickness can be increased or reduced while the internal diameter remains the same. This ensures that the designated hydraulic capacity for the installation is maintained.

Property	Standard	Unit	PE100	PE-GF200
MRS class	ISO 12162	N/mm²	10	20
Density	ISO 1183	g/cm³	0.96	1,02-1,09
melt index ; MFR 190/5	ISO 1133	g/10 min	0,25	depends from recipe
Tensile modulus (1 min)	ISO 178	N/mm²	1100	2500
Tensile strength at yield (in Extrusion-direction)	ISO 527-2	N/mm²	> 23	> 35
Tensile strain at yield (in Extrusion-direction)	ISO 527-2	%	>8	> 4
Notch resistance / Slow crack growth behavior	EN 12814-3	80°C,4 MPa, Arkopal N100	> 300	>1000 h
Thermal expansion	DIN 53752	1/°C	1.8×10^{-4}	$< 0,5 \times 10^{-4}$ *
Colour			black/yellow/blue	black/yellow/blue

**** Consider the extremely low thermal expansion of PE-GF.***

Wall structure

Krah pressure pipes are typically produced as solid wall pipes with a smooth inner and outer surface. But the pipes can also be manufactured with an additional outer profile to increase the pipe stiffness. That makes especially sense for low pressure classes or challenging installation conditions.



Shematic illustration of profiled pressure pipe including outer profile acc. to DIN 16961.

Pipe lengths

The standard length of a Krah pressure pipe is six meters, because in this way they are easy to handle, store and transport. In addition it is possible to continuously produce any length between one and six meters. Moreover it is possible to deliver the pipes already jointed, whereby the installation time on site can be reduced significantly. Lengths of up to 18 m consisting of 3 pipe sections are common.

Surface

The internal and the external surface of the Krah solid wall pressure pipes are smooth. The inner and the outer surfaces can be also produced of electro- conductive or coloured material. In case of necessary profiled pipes, the outer surface is structured accordingly.

Weldability

Due to the properties of thermoplastic material, the pipes can be fused together which ensures that the whole pipe system builds one homogenous unit and is absolutely safe against in- and exfiltrations. For jointing the Krah pressure pipes we recommend either the proven KRAH electro-fusion technology or the traditional butt-fusion process.

Chemical resistance

Due to the excellent material properties of Polyethylene, KRAH pipe systems assure an optimum safety against chemical attacks. That is especially important for all industrial applications and acidic soil conditions.

Impact resistance

The high impact resistance, even at low temperatures, ensures a robust pipe, resistant against impacts during transport, installation on site and during the whole service life.

Recycling

Polyethylene can be recycled to 100 %. This material has the property to be reworkable without the structure of the material having to be modified dramatically. For this reason all waste material of Polyethylene pipes can be led back into the production cycle. Only for potable water it is recommended to use 100 % virgin material.

Hydraulics

For the flow characteristic and the pressure loss in pipe systems the roughness is essential. Krah Pipes provides very low roughness in comparison to conventional pipes, under operation conditions values between 0,01 and 0,1 are realistic. The low roughness and the kind of waxy surface can also avoid incrustrations, which is another point to reduce pressure-loss.

UV-resistance

Black Polyethylene pipes are permanently resistant against atmospheric corrosion and UV radiation. Thus the pipes can be used for exposed pipe installation and stored outside without the pipe material being damaged. No aging effect will occur.

Norms and standards

The KRAH piping system is designed to meet the requirements of present applicable international norms and standards. KRAH is a member of the major standardization committees to guarantee that the pipes are corresponding to the standards, but also that the standards are corresponding to the pipes.

The Krah pressure pipe corresponds to the following international standards:

PE-GF 200:	DIN SPEC 19674
	JIS K 6799
	ISO NP 22101
	ASTM F 2720
PE 100:	DIN 16961
	DIN PAS 1065
	acc. ISO 4427

Production technology

The production principle is based on the proven KRAH spiral wound pipe production technology, where an extruded band will be helically wound around a heated mandrel. To produce standard PE 100 pressure pipes a regular single screw extruder plus coextruder for functional layers is used. Homogenous pipes can be produced in any requested wall thickness. No matter which wall thickness is required, the winding process avoids sagging totally, a big advantage against conventional pipe extrusion. The integrated coextrusion process provides the possibility of producing functional layers like an inspection friendly light inner surface.

For the production of PE-GF 200 pipes the KRAH Comtruder® technology is used. By the special inline compounding process, different kinds of materials can be homogenously mixed and extruded directly. Especially for the well distribution and adequate orientation of the glass-fibers the KRAH cross winding and Comtruder® technology is essentially needed and provides an additional safety. The KRAH PE-GF 200 pipes will always be produced with a coextruded virgin Polyethylene layer on the inner and outer surface. By the way, all Krah Pipes can also be produced with an integrated electrofusion-socket.

Pipe design

The KRAH pressure pipe system can withstand a working pressure of up to 10 bar, depending on the thickness of the homogenous solid wall (e). Equivalent to ISO 4427 the hoop stress formula can be used with solid wall thickness.

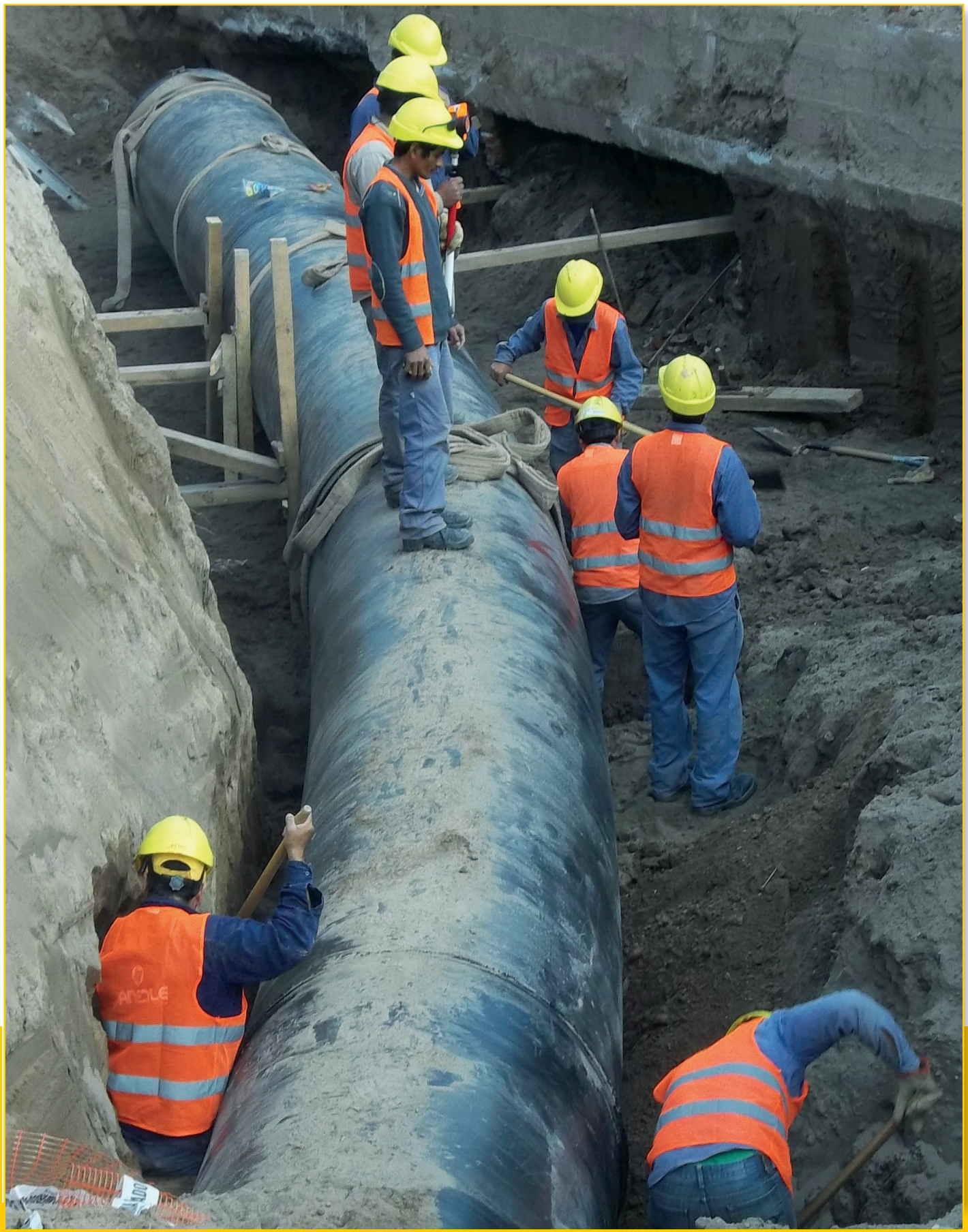
$$e = \frac{p \cdot d_i}{20 \cdot \sigma_s - p} \qquad \sigma_s = \frac{MRS}{c}$$

e = minimum wall thickness [mm]
p = internal pressure [bar]
di = internal diameter [mm]
σ = design stress [MPa]
MRS = Minimum Required Strength
c = design coefficient [-]

Standard Inside dimension ratio (SIDR)

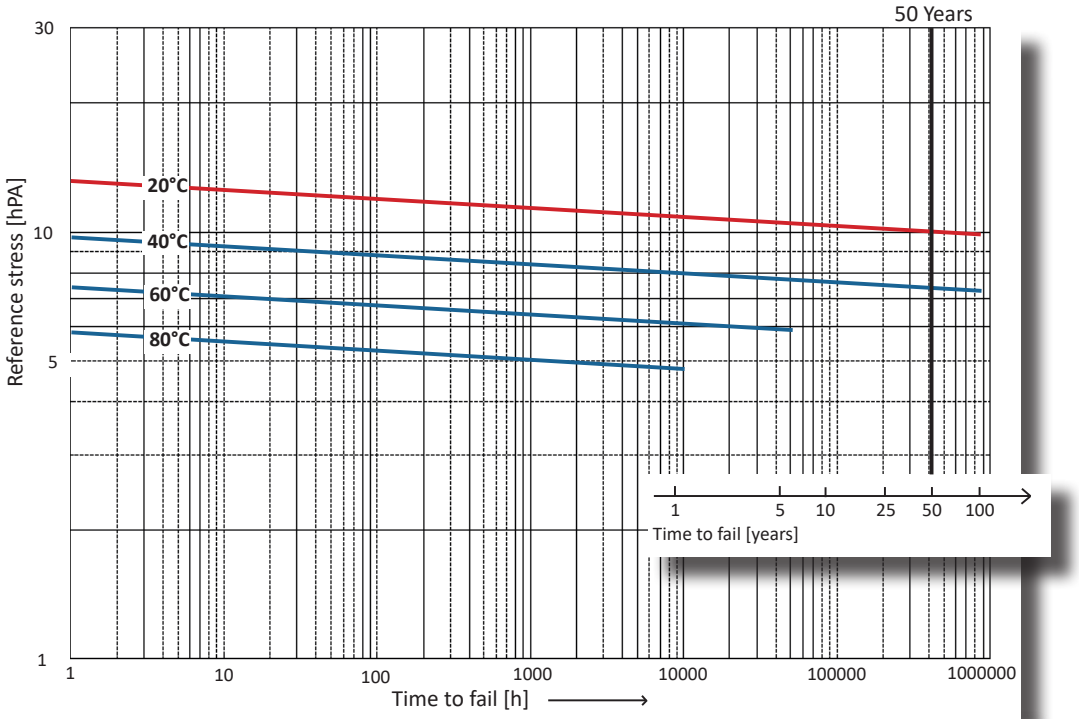
Traditionally the standard dimension ratio was used for accurate description of Polyethylene pressure pipes. SDR is the relation between the outside diameter and the wall thickness. For inside calibrated pipes, like Krah Pipes, it is more useful to specify the SIDR – the standard Inside Dimension Ratio. SIDR is the relation between the inner diameter and the wall thickness.

$$SIDR = \frac{di}{e} \; ; \; SIDR = SDR\text{-}2$$

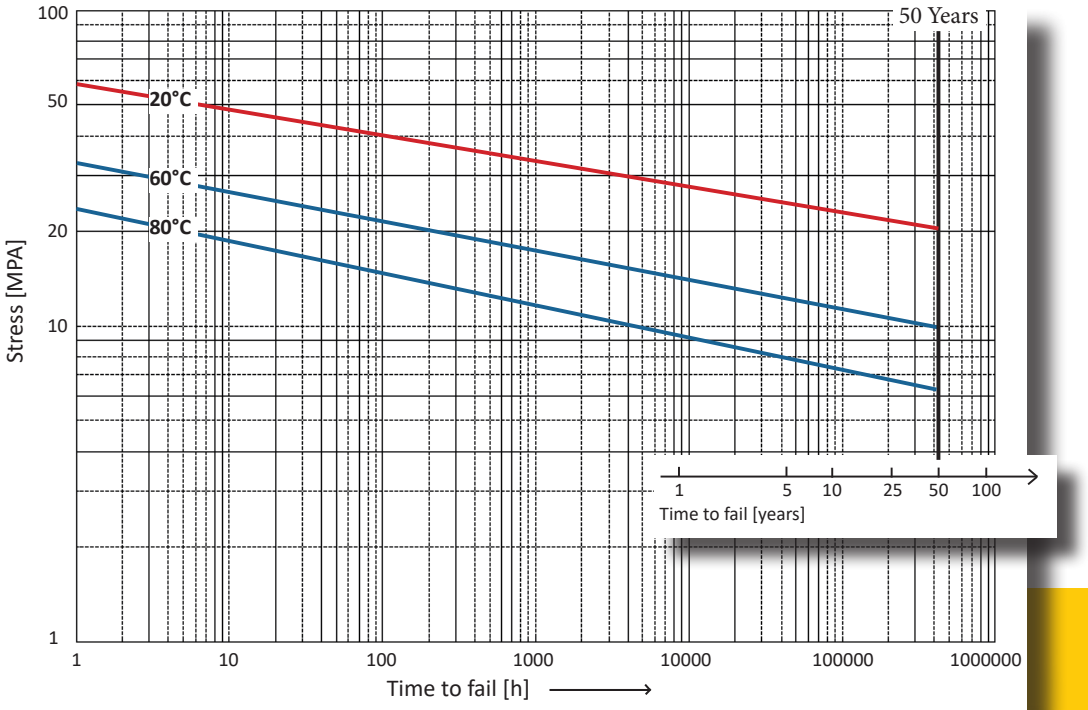


Krah pressure pipes, made of PE 100, during installation.

Hydrostatic strength of PE100 and PE-GF200



*Reference curves for hydrostatic strength for Krah PE100 pipes, according to DIN 16961-2**



*Reference curves for hydrostatic strength for Krah PE-GF 200 pressure pipes, according to DIN SPEC 19674. Full scala tested according to ISO9080 by independent plastic institute**

*** For design calculations the original testing/standardization documents have to be considered. For source reference please contact Krah Pipes.***

Dimensions

PE 100 pressure pipes according to DIN 16961

	PN 2,5		PN 4		PN 6,3		PN 8		PN 10		PN 16	
	SIDR 63 / SDR 65		SIDR 39 / SDR 41		SIDR 24 / SDR 26		SIDR 19 / SDR 21		SIDR 15 / SDR 17		SIDR 9 / SDR 11	
Inner Diameter	e	Weight	e	Weight	e	Weight	e	Weight	e	Weight	e	Weight
DN/ID	[mm]	[kg/m]	[mm]	[kg/m]	[mm]	[kg/m]	[mm]	[kg/m]	[mm]	[kg/m]	[mm]	[kg/m]
500	8,0	12,3	12,9	20,0	20,9	32,9	26,4	42,0	33,4	53,8	55,6	93,2
600	9,6	17,7	15,4	28,6	25,0	47,2	31,6	60,2	40,0	77,3	66,7	134,2
700	11,2	24,1	18,0	39,0	29,2	64,3	36,9	82,1	46,7	105,2	77,8	182,6
800	12,7	31,2	20,6	51,0	33,4	84,0	42,2	107,2	53,4	137,5	88,9	238,4
900	14,3	39,5	23,1	64,4	37,5	106,1	47,4	135,5	60,0	173,8	100,0	301,6
1000	15,9	48,8	25,7	79,6	41,7	131,1	52,7	167,4	66,7	214,6	111,2	372,7
1100	17,5	59,0	28,3	96,4	45,9	158,7	57,9	202,2	73,4	259,8	122,3	450,9
1200	19,1	70,3	30,8	114,4	50,0	188,5	63,2	240,8	80,0	308,9	on request	
1300	20,7	82,5	33,4	134,4	54,2	221,4	68,5	282,8	86,7	362,6		
1400	22,3	95,7	35,9	155,5	58,4	256,9	73,7	327,6	93,4	420,7		
1500	23,9	109,9	38,5	178,7	62,5	294,6	79,0	376,3	100,0	482,6		
1600	25,4	124,6	41,1	203,5	66,7	335,3	84,3	428,3	106,7	549,3		
1800	28,6	157,8	46,2	257,3	75,0	424,2	94,8	541,8	120,0	694,9		
2000	31,8	194,9	51,3	317,4	83,4	524,1	105,3	668,6	on request			
2200	35,0	236,0	56,5	384,6	91,7	633,8	115,8	808,8				
2400	38,1	280,2	61,6	457,4	100,0	754,0	on request					
2600	41,3	329,0	66,7	536,5	108,4	885,5						
2800	44,5	381,8	71,8	621,9	116,7	1026,6						
3000	47,7	438,5	77,0	714,6	125,0	1178,1						
…					on request							
3500	55,6	596,3	89,8	972,3								
…												
4000	63,5	778,3	102,6	1269,5								

Standard pressure classes and related wall thicknesses acc. to DIN 16961-2, considering design coefficient C = 1,25 acc. to ISO 12162.

Generally our pipes can be produced with a wall thickness of 5 m

If requested, the inner surface can ha

All Krah Pipes can be produc

PE-GF200 pressure pipes according to DIN SPEC 19674

	PN 6		PN 8		PN 10		PN 12,5		PN 16		PN 20	
	SIDR 39		SIDR 30		SIDR 24		SIDR 19		SIDR 14,5		SIDR 14,5	
Inner Diameter	e	Weight	e	Weight	e	Weight	e	Weight	e	Weight	e	Weight
DN/ID	[mm]	[kg/m]	[mm]	[kg/m]	[mm]	[kg/m]	[mm]	[kg/m]	[mm]	[kg/m]	[mm]	[kg/m]
500	12,8	22,5	16,7	29,6	20,8	37,1	26,3	47,4	34,5	63,2	43,5	81,0
600	15,4	32,5	20,0	42,5	25,0	53,6	31,6	68,4	41,4	91,0	52,2	116,6
700	17,9	44,1	23,3	57,8	29,2	73,0	36,8	92,9	48,3	123,8	60,9	158,7
800	20,5	57,6	26,7	75,6	33,3	95,1	42,1	121,5	55,2	161,7	69,6	207,3
900	23,1	73,1	30,0	95,6	37,5	120,4	47,4	153,8	62,1	204,6	78,3	262,4
1000	25,6	90,0	33,3	117,9	41,7	148,8	52,6	189,6	69,0	252,6	87,0	323,9
1100	28,2	109,0	36,7	142,9	45,8	179,8	57,9	229,6	75,9	305,7	95,7	391,9
1200	30,8	129,9	40,0	169,9	50,0	214,1	63,2	273,4	82,8	363,8	104,3	465,9
1300	33,3	152,1	43,3	199,2	54,2	251,4	68,4	320,6	89,7	426,9	113	546,8
1400	35,9	176,6	46,7	231,4	58,3	291,2	73,7	372,0	96,6	495,1	121,7	634,2
1500	38,5	202,9	50,0	265,4	62,5	334,5	78,9	426,6	103,4	567,8	on request	
1600	41,0	230,4	53,3	301,8	66,7	380,7	84,2	485,7	110,3	646,0		
1800	46,2	292,1	60,0	382,2	75,0	481,6	94,7	614,7	124,1	817,7		
2000	51,3	360,4	66,7	472,1	83,3	594,3	105,3	758,9	on request			
2200	56,4	435,8	73,3	570,7	91,7	719,7	115,8	918,4				
2400	61,5	518,4	80,0	679,4	100,0	856,1	on request					
2600	66,7	609,1	86,7	797,7	108,3	1004,4						
2800	71,8	706,1	93,3	924,4	116,7	1165,6						
3000	76,9	810,3	100,0	1061,6	125,0	1337,7						
…					on request							
3500	89,8	1103,9	116,7	1445,4								
…			on request									
4000	102,6	1441,4										

Standard pressure classes and related wall thicknesses acc. to DIN SPEC 19674, considering design coefficient C = 1,60. The pipes can be also produced with other design coefficient acc. to JIS K 6799 (C = 1,25) or acc. to ASTM F2720.

mm up to 250 mm. The complete wall thickness is homogenous.
ave a co-extruded alternative colour.
ced also in inch dimensions.

Get more information from your local Krah Pipe producer:

KRAH™ krah-pipes.com PIPES

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