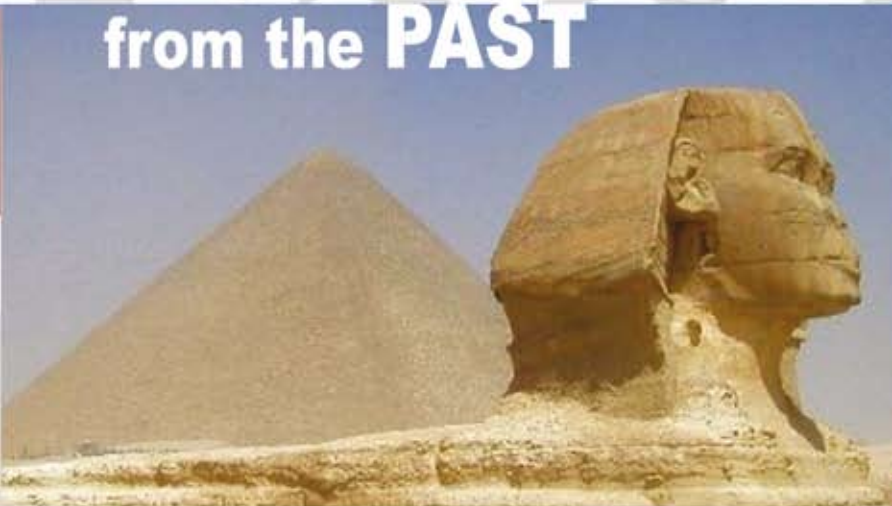




from the **PAST**



to the **FUTURE**



$$v = \chi \sqrt{R \cdot i}$$



CENTRAL TUBI
tradition - perfection - innovation

Plastic Pipe System **SGK**

DN from 1000 to 2000 mm with integrated Electro – Fusion joint.

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SYSTEM GROUP (Italy) and **KRAH AG** (Germany) gave birth to **KRAH ITALIA S.r.l.**, in which they realize technical and commercial synergies for the production and distribution conduit and manifests derived in polyethylene (PE) e polypropylene (PP) constructed with KRAH technology, capable to exceed the limits of traditional materials.

The major capacity for having a system out of **SGK** consents in proposing it as a new reference standard for its considerable improvement of the cost - benefit ratio.

KRAH ITALIA S.r.l. works within the productive unit of **CENTRALTUBI S.p.A.**, which dedicates for the promotion and sales of **SGK** products.





pipes, fittings, manholes & special fitting for underground sewerage, treatment plant for water on first rain PE and PP

Today you think of big diameter conduit, of long duration, resistant to the aggressive environment, easy and quick laying process, resistant to the intervention of hydro-mechanic maintenance, with high number of available solutions, capable of generating complete systems, personalised (tailored), with a perfect tightness between all elements.



SGK is the pipelines system in polyethylene e polypropylene produced by CENTRALTUBI S.p.A. capable of supplying definitive solutions for the realization of:

SGK <i>Sewer</i>	Underground sewer conduit
SGK <i>Outfalls</i>	Underwater sewer conduit
SGK <i>Tanks</i>	Tanks
SGK <i>EcoTanks</i>	Lamination tanks
SGK <i>Weir</i>	Treatment plant for water of first rain
SGK <i>Special</i>	Weir
SGK <i>Tunnel</i>	technological burrows
SGK <i>MH</i>	Inspection manholes, height manholes etc.
SGK <i>Ventilation</i>	Ventilation
SGK <i>AHN</i>	Automated Hydraulic Node
SGK <i>Drain</i>	Drainage
SGK <i>Silo</i>	Silo
SGK <i>Solid</i>	Smooth pipe conduit

The general requirement for large size water pipeline is normally limited to cement based pipes and occasionally in GRP, Ductile iron, Clay or steel. Each of these materials have specific characteristics and generally higher cost. (also excessive) against greater reliability in comparison to the aforesaid application, they also present some limits (mainly brittleness, heaviness, reduced chemical, electrical and biological inactivity and, for some, also scarce reliability of joints tightness) these limits their installations expectations of durability and efficiency.



PE & PP PIPES

Polyethylene and **polypropylene** are thermoplastics with excellent properties for the application of water and sewer, as well as for the fabrication of containers for liquids and solid materials. Polyethylene and polypropylene are resistant to many chemicals and very suitable for conveying and storing various liquids. (see ISO/TR10358).

■ Weld ability

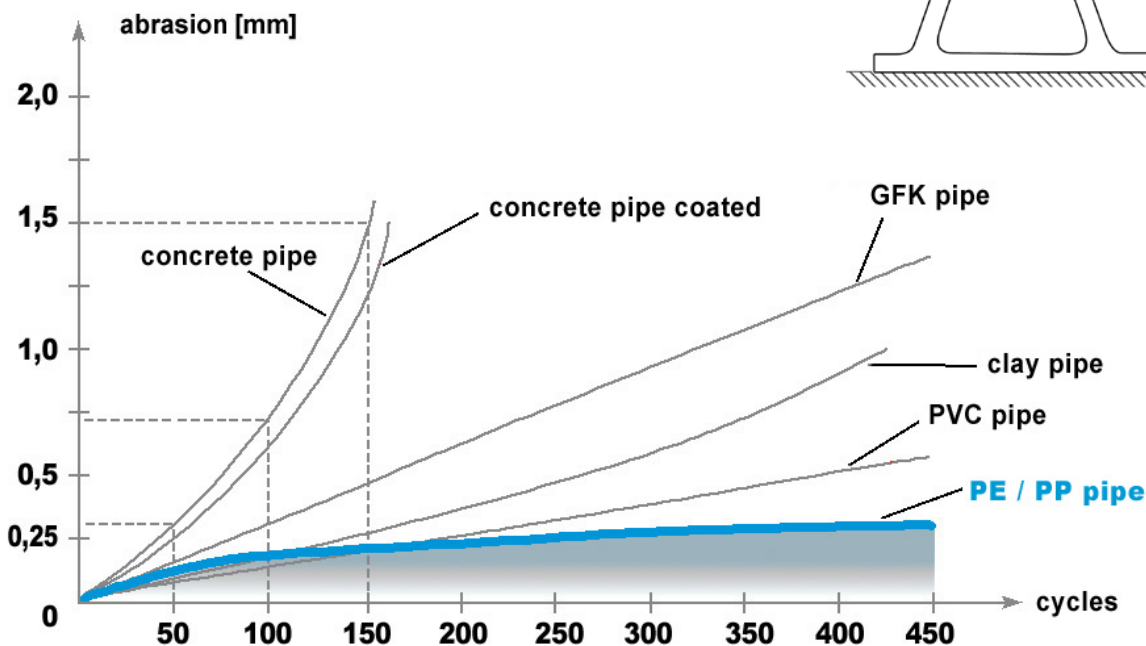
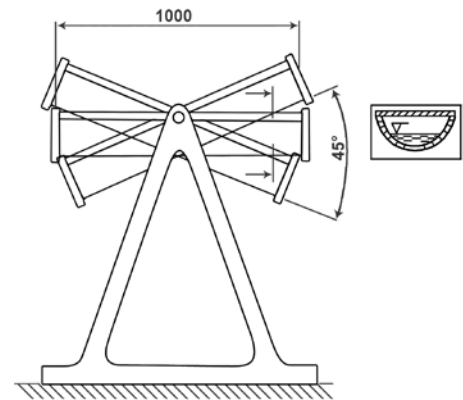
Polyethylene and polypropylene can be welded, so it is possible to realize homogenous pipeline systems, is absolutely safe against losses or unwanted in- and ex-filtrations.

■ Good chemical resistance

For buried pipelines the biogenous sulphuric acid corrosion plays a key role regarding the longevity of the system. The biogenous sulphuric acid corrosion only takes place above the water level and therefore only occurs in partly filled pipes. **SGK** pipeline systems guarantee optimum security and resistance.

■ Abrasion proof

Polyethylene and polypropylene pipes are among the most abrasion proof pipes. The reference to the test is EN 295-3 and the results are shown in the below diagram and confirm the quality of **SGK** pipes. Thank to their high abrasion resistance are particularly indicated suitable where abrasive material is necessary, such as mud or dredge of sand and gravel.



Abrasion diagram of various pipe material according to Darmstadt (D) procedure

The standards UNI 10968 and EN 13476 consider pipelines respective to those standards abrasive resistance.

■ Impact Resistance

High Impact resistance, even at low temperatures, which characterizes Polyethylene and Polypropylene ensures the compactness and robustness of the products manufactured entirely with these materials. The reference method for the characterization of resistance is the EN744.

■ Recycling

Polyethylene and polypropylene materials can be recycled to 100%. They belong to the group of thermoplastics having the property to be refusable without the structure of the material being modified dramatically. For this reason they are nature friend and can be put back into the production cycle for products were expressly allowed the employment of such material.

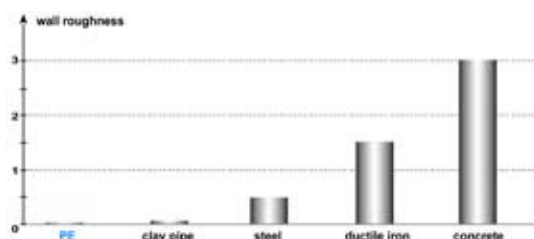


■ Resistant to micro-organisms, rodents and termites

The smooth round surface of plastic pipes does not give the teeth of rodents sufficient hold to cause damage. Moreover even in termite-affected countries no damage to PE pipelines by termites has ever been occurred. PE and PP are not a nutrient medium for bacteria, fungi and spores, so that the material is resistant to all forms of microbial attack as well as to both sulphurous acid and sulfates.

■ Very good hydraulics of the pipes

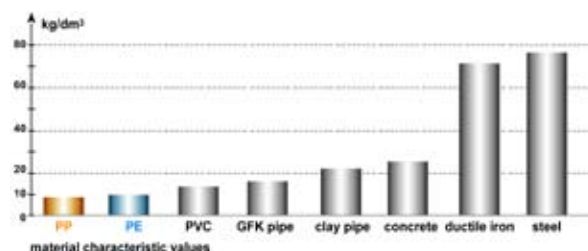
Inner diameter and hydraulic properties of **SGK** pipes will remain constant regardless of the wall thickness or the profiles due to the smooth anti adhesive inner pipe surface. The nominal diameter (DN) corresponds to the respective inner diameter according to the standard of reference.



■ UV - resistance

Black polyethylene pipes are permanently resistant to atmospheric corrosion and UV radiation. Thanks to the additive of lost carbon black uniformly spread in the polymeric matrix, thus the pipes can be used and stored outside without the pipe material being damaged.

■ Density





Material

■ Properties

The materials from which the **SGK** pipes are produced have the following properties:

Material specification					
Property	Standard	Unit	PE a.d.	PE 100	PP
Density	ISO 1183:1987	g/cm ³	0,945	0,96	0,935
Melt flow index MFR	ISO 1133	g/10 min	0,45 (190 °C – 5 kg)	0,25 (190 °C – 5 kg)	0,3 (230 °C – 2,16 kg)
Tensile modulus	ISO 178	MPa	1000	1200	1700
Yield stress	ISO 527	MPa	23	25	30
Tensile strength		W/m K	0,4	0,4	0,2
Coefficient of linear thermal expansion		1/K	17 x 10 ⁻⁵	17 x 10 ⁻⁵	14 x 10 ⁻⁵
Specific heat capacity		J/kg K	2500	2500	2000

* indicative data not utilize as specific values. For specific data you must refere to single standard in reference.

Since the latest developments, high tensile modulus polypropylene can be used which is able to sensitively raise the performances of the pipelines in terms of stiffness, to parity of such value, to be able to subsequently reduce the weight.





Why profiled pipes?

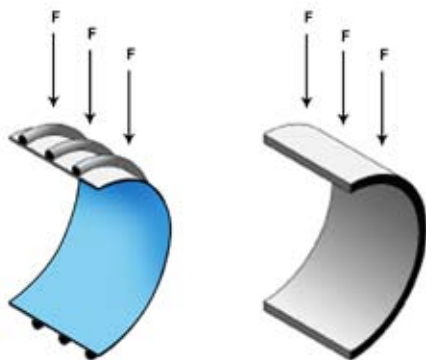
Since the people have begun to found towns and cities, transport facilities for water and sewage water have been needed. Pipes were constructed and gained more and more in importance. With the growing demand and modified requirements again and again the people looked for alternative production methods and materials for the pipes. With the proceeding industrialisation also plastics came into question and thus, decades ago, the people started to produce pipes with all different kinds of plastic materials and made use of the advantages of this kind of material.

CENTRALTUBI s.p.A. has benefited from the properties and advantages of the plastics for the pipe production (especially PE and PP). With **SGK** system has reached the most modern and optimized way of improvement of the existing processes of production respecting various standard in force, the results of these developments are the profile types VW, PR, SP, ST and SQ.

The aim was to be in a position to offer the customers an ideal solution of a total pipe system, so that they are able to serve the requirements of the projects with pipes and fittings of vast range of diameters and solutions.

The practical experience showed us, that it is necessary to be in a position to offer pipes, which are applicable for all kinds of conditions. Therefore different kinds of pipe wall profiles have been developed, which are combinable with nearly all kinds of diameters optimizing also the cost. Also the flexible production of which SGK system enjoys because of the adoption of advanced technology and is considered to allow the producer the capacity to serve in line with the real need of the work sites.

During the long period of development, begun many years ago, that KRAH technology has brought today as evident important advantages, we have always considered very important the respect of all the demand requisitions of the national and international various standards of reference. The elevated flexibility and quality of the systems of pipelines **SGK** allows to have products entirely in conformity with products to the standard DIN 16961 (Germany), EN 13476 (Europe), JIS K 6780 (Japan), ASTM F894 (USA) and NBR 7373 (Brazil).



By using profiled pipes we can save weight up to 65% compared to equivalent solid wall pipes with the same static capacity.

An important point is the design of the pipe wall. In former times very big wall thicknesses for pipes had to be used in order to maintain loads which influence the pipe. The results were heavy and very expensive pipes. In order to solve this problem the profile pipes have been developed, a profile is added to the minimum required basic wall, the profile is connected to this wall.

This profile which is calculated by a special software produces a significantly higher moment of inertia and thus the loads can be carried. For comparison, a solid wall pipe of the same material with the respective moment of inertia would weight three times more.



Delivery program

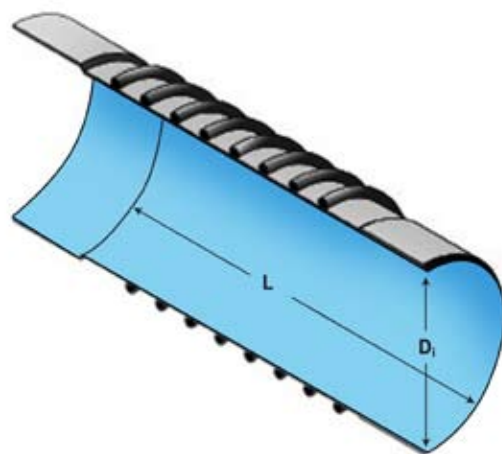
■ Materials

Widely is used high density polyethylene material. With latest developments in the plastic materials used for sewer conduit the polypropylene is considered high tensile modulus.

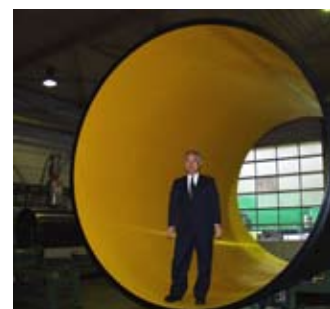
■ Pipe lengths

The standard length (L) of the **SGK** pipes is six meters. In addition it is possible to produce continuously any lengths between one and six meters. Upon request it's possible to connect standard produced pipes together in-house (ex. 12m + joint)

SGK Pipes	
Standard and recommendations	
General Requirements	EN 476
Underground pipeline design	EN 1295-1-2 prEN 1295-3
Pipe	DIN 16961 parte 1 e 2 EN 13476 (may 2007)
<i>Upon request</i>	ASTM F 894 NBR 7373 JIS K 6780
Static calculation	ATV A 127 Marston Spangler
Hydraulic calculation	EN 752 ATV A110
Laying	ENV 1046
Commissioning	EN 1610
Pipe welding	DVS 2207-4 UNI 10520 (PE80) UNI 10967 (PE100)
Electro fusion socket	Specific manufacturer
Performances	chemical resist. ISO 10358 abrasion resist. EN 295-3



D_i = internal diameter (mm)
L = length (mm)



■ Pipe dimensions

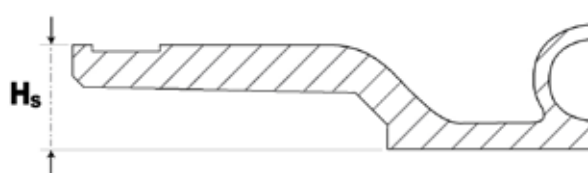
Standard and special lengths are produced with internal diameters (D_i).

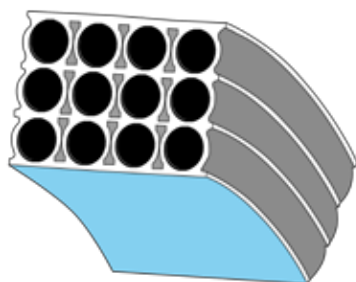
Internal diameter mm	
possible	SGK program
300	
400	
500	
600	
700	
800	
900	
1000	1000
1100	
1200	1200
1300	
1400	1400
1500	1500
1600	1600
1700	1700
1800	1800
1900	
2000	2000
2100	
2200	
2300	
2400	
2500	
2600	
2700	
2800	
2900	
3000 ↓	

The **SGK** programme foresees dimensions from DN 1000 mm to DN 2000 mm, however upon request its possible to produce dimensions from DN 300 mm to DN 4000 mm, for pipes, manholes and special pieces.

Varies the wall thickness to maintain different stiffness values, while the internal diameter is always the same with the same hydraulic capacity.

SOCKET HEIGHT H_s	
DN [mm]	mm
300 → 1200	49
1300 → 1600	59
1700 → 2000	69





■ Wall thickness and profile type

Depending on the application, profiled and solid/smooth-wall pipes with wall thickness up to 280 mm can be produced.

STRUCTURED WALL THICKNESSES AND MAIN PROFILES			
Pipes			
properties	profile	name	applications
<ul style="list-style-type: none"> • solid pipe • solid pipe with possibility of maximum wall thickness 280 mm • smooth inside & outside 		VW + ST	<ul style="list-style-type: none"> • pressure pipes • tanks • fittings • special pieces
<ul style="list-style-type: none"> • structured system • smooth inside • structured outside • possibility to realize stiffness up to 200 kN/m² 		PR	<ul style="list-style-type: none"> • sewer • drainage • storm water • ventilation
<ul style="list-style-type: none"> • smooth inside & outside • structured inside • one or more structured layer 		SQ + SP	<ul style="list-style-type: none"> • silos • pipes of big diameters with elevated stiffness

■ Profile and Stiffness

With the structured profiles it is possible to reach the values of necessary stiffness, calculated each time, using light pipelines. The great variety of geometries and realizable thickness with the program **SGK** allows to get optimized profile at moment of inertia for every specific demand. The stiffness of the pipe is the result of:

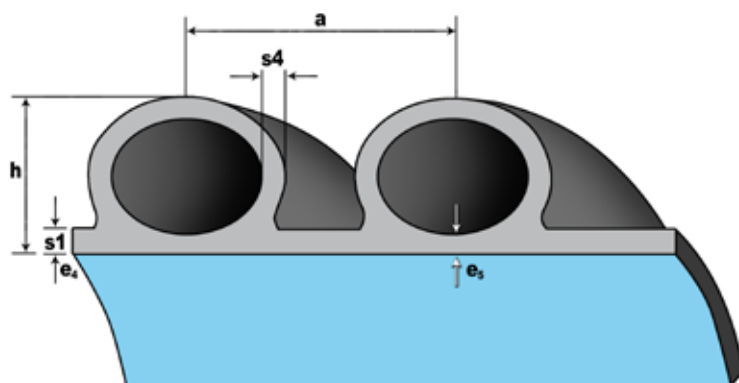
- tensile modulus [N/mm²] of the respective material (PE - PP)
- moment of inertia of the geometry of the profile [mm⁴/mm] referred to the diameter of the pipe.

The **SGK** pipelines are realizable in any stiffness class, optimizing the choice of the class in base to the conditions of load.

STIFFNESS			
standard of reference	formula	Symbols	
DIN 16961	$S_{R24} = \frac{E_{24} \cdot I_x}{(r + e)^3} \text{ [N/mm}^2\text{]}$	E_{24} = tensile modulus after 24 h [N/mm ²] I_x = moment of inertia [mm ⁴ /mm] r = internal radius ($D_i / 2$) [mm] e = distance of inertia [mm]	
EN ISO 9969	$SN = \frac{E_k \cdot I_x}{(D_i + e)^3} \text{ [N/mm}^2\text{]}$	E_k = tensile modulus after 1 minute [N/mm ²] D_i = Internal diameter [mm]	

DIN 16961-2*								EN ISO 9969*				
CL	1	2	3	4	5	6	7	SN	2	4	8	16
S _{R24} [kN/m²]	2	4	8	16	31,5	63	125	S [kN/m²]	2	4	8	16

* The stiffness ring S_{R24} of din 16961 standard don't correspond to the stiffness ring SN of EN ISO 9969 standard since the two standards use different calculation methods.



- a** = profile distance (mm)
- s1 - e4** = waterway thickness (mm)
- e5** = waterway thickness under empty section
- s4** = coating thickness (mm)
- h** = profile height (mm)

Minimum Wall Thicknesses PE e PP

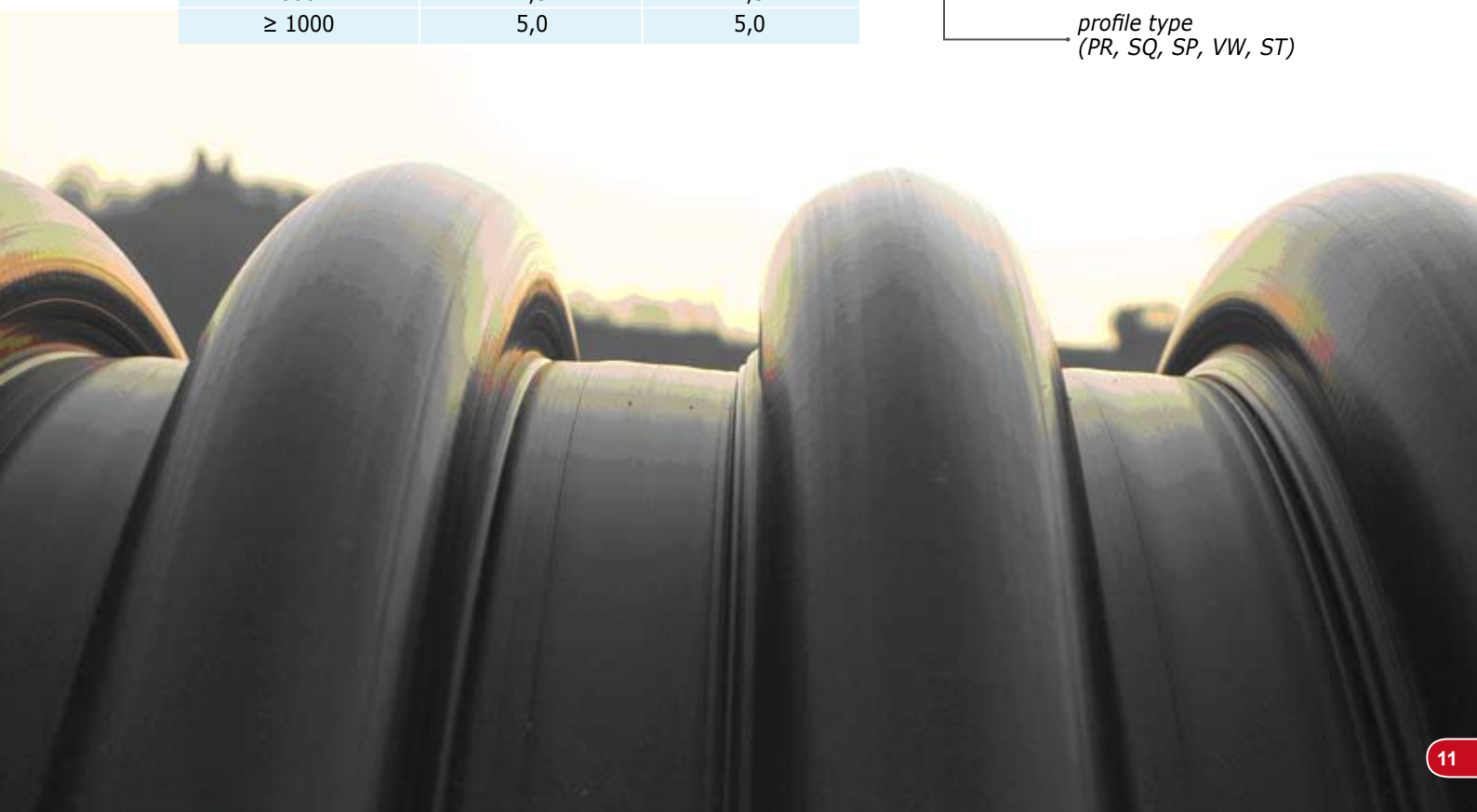
According to EN 13476

nominal diameter pipes mm	$e_{4 \text{ min}} (s1)$ mm	$e_{5 \text{ min}}$ mm
300	2,0	1,7
400	2,5	2,3
500	3,0	3,0
600	3,5	3,5
800	4,5	4,5
≥ 1000	5,0	5,0

Explanation of the profile name

PR 50-8.50

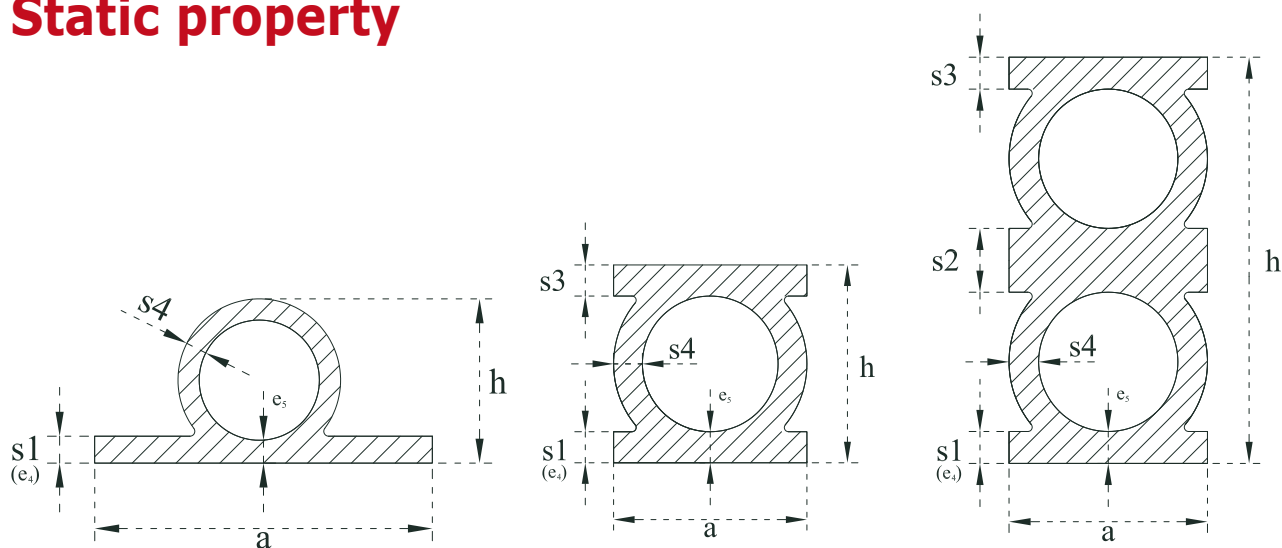
- I_x moment of inertia
- diameter of the core pipe in the profile (25, 32, 40, 50 o 63)
- profile type (PR, SQ, SP, VW, ST)



static property



Static property



Example of Profile PR 50-13.7171

■ Dimensions

	symbol	value	m.u.
Wall thickness of smooth layer	[s1]	11,0	mm
Covering thickness "core pipe"	[s4]	10,0	mm
Profile Height	[h]	68,0	mm
Profile Distance	[a]	90,0	mm
Diameter (DN) core pipe	[sd]	50,0	mm

■ Profile Geometry

parameter	symbol	value	m.u.
Moment of inertia	[I]	13.714	mm ⁴ /mm
Distance of inertia	[e]	26,7	mm
Equivalent thickness	[se]	54,8	mm

■ Results

DN	STIFFNESS		Exercise Pressure*
mm	DIN 16961-2 kN/m ² (S _{R24})	EN ISO 9969 kN/m ²	bar
1000	38,48	11,73	0,72
1400	14,65	4,47	0,52
1800	7,07	2,15	0,4

* the admissible exercise pressure is calculated based of materials with MRS 8,0 [N/mm²] e C = 1,25



■ Profile Structure

The standard EN 13476-1 point out the possibility for Spiral pipes to insert a support profile of polymeric materials.

Based on the matured experience of **CENTRALTUBI S.p.A.** and **KRAH AG** in the whole world pipe markets, for the construction of the **SGK** pipes has been selected a support profile constituted of corrugated Polypropylene pipe, called "core pipe", that has the followings main advantages:

- correspondence to the normative prescriptions
- lightness
- environmental compatibility (recyclable)
- analogous behaviour between PE and PP to middle and long term of elasticity module characteristics
- analogous behaviour of thermal expansion between PE and PP to medium and long term
- analogous behaviour between PE and PP to medium and long term of creep characteristics
- elimination of break phenomenon to medium and long term of walls for difference in behaviour between PE or PP and reinforcement materials with elevated rigidity
- possibility of direct intervention on the conduit (cut, insertion, production of special pieces etc.) without jeopardizing the rest of the structure (es. oxidation of the metallic materials)
- insensibility to movement irritations, transport, laying etc. (accidental peeling of external surface)



Example of realizing derivation on **SGK** pipe with insertion gasket

■ Structure Security

The profiles are wound to spiral on special mandrels that defines the internal diameter of the pipes. The mandrels are sized to produce the nominal diameter (DN/ID) declared. They bear the dimensional profile of the sockets on which the spiralling begins. Therefore the sockets are produced directly with the pipe without the problem of continuity, forming one whole compact that improves the resistance to accidental impact.

The union among the various profiles happens exactly under the position of the structured profile, allowing a sensitive increase in the traction resistance on the line of junction among the spiral (EN 1979)



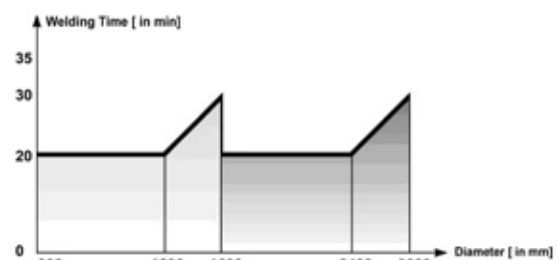
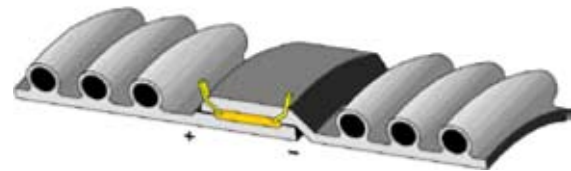
Minimum resistance at traction between junctions according to EN 13479	
DN [mm]	minimum traction force [N]
≤375	380
400 ≤ DN ≤ 560	510
600 ≤ DN ≤ 710	760
≥ 800	1020

Various measures of wall thicknesses can be produced water way It is also possible to have reduced wall thicknesses with a good stability and homogeneity of walls.

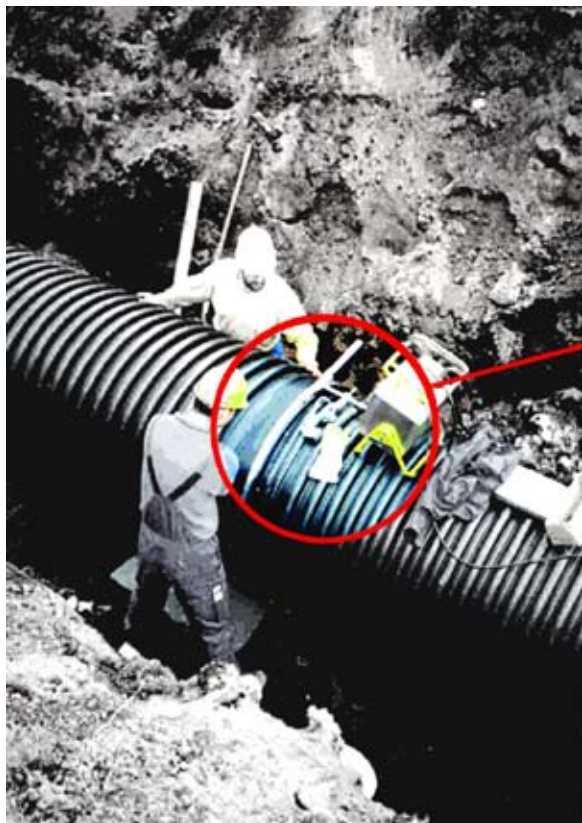


Jointing systems

All **SGK** pipes can be delivered with different jointing systems. The pipe ends are equipped accordingly and integrated directly in the pipe.



Welding time depends on pipe diameter



Electro-fusion system

The advantages at a glance:

- quick welding
- welding device at reasonable price
- welding possible in narrow trench
- welding of bigger pipes possible from inside
- quick assembly by using several welding devices at the same time
- tensile strength
- resistant at the base
- 100% permanent tight joint
- printed welding record
- it is possible to use the Electro-Fusion welding device again immediately, even the pipe is still cooling



■ Welding procedure

Generally the Electro-Fusion socket and the spigot are already prepared for the welding. After taking of the plastic foil, which serves as protection. Now the welding area is cleaned with a special polyethylene cleaner. The connection of the welding wire should be at the top of the pipes as this facilitates the later welding. Now the spigot can be shifted into the socket. The pipe is justified, the inside support ring is put into the right position and the outer tensile band is tightened. The welding adapter is screwed on the ends of the welding wire. Now it can be connected to the welding device. On the pipe is a barcode, which includes all necessary information for the welding. With the help of a barcode reader this information is read and the welding can be started. After having finished the welding a certain cooling time which depends on several factors, has to be respected. Only after this cooling time the inside support ring and the outer tensile band can be completely detached.

For a faster laying in trench it is possible to effect one or more electro – fusion junctions or of head out of the trench, for then to perform a one operation with long monolithic elements constituted from more pipes, thanks to their lightness.

■ Software

The welding device "Tiny Data" has the capacity to record any individual welding. These welding records are saved in the device and can be read out by the computer. The software which is needed for this is called "Krahcode". With this software two things can be done: On the one hand the data of the welding device can be read and administrated and on the other hand the barcodes for the welding of the pipes can be made.



Other jointing possibilities

In addition to our unique integrated Electro-Fusion jointing technique **SGK** pipes can also be produced with the following jointing techniques:

■ V seam extrusion welding

Pipes and fittings are jointed with the help of a welding extruder. The outside of the ends are chamfered. Thus a welding seam is produced which looks like a V. Normally no socket-spigot connection is used. The welding has to be done according to DVS 2207-4.



■ Extrusion welding

The pipes and/or fittings which shall be connected are jointed by a socket and spigot joint.

Thus the two pipe ends are jointed with a extrusion welding device. The jointing method can be carried out inside or/and outside of the pipe. This jointing is most suitable for low pressure gravity pipes and manholes. According to DVS 2207- 4.



■ Heat element butt welding

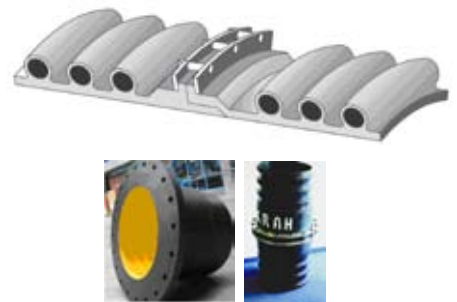
The pipes and fittings are jointed with the help of a heating element butt welding machine.

The ends of the pipes and fittings are butt-welded. This kind of jointing method is only recommended for pipes and fittings with a maximum wall thickness of 150 mm and with diameters from 300 mm to 2500 mm. According to UNI 10520 (PE80), UNI 10967 (PE100) and/or DVS 2207- 1.



■ Flange connection

The ends of the pipes and fittings are jointed with the help of a steel flange and a rubber gasket. Depending on the type of pipe the flange adapters are completely manufactured with the pipe, or the flanges are available as separate fitting. This kind of jointing method is mostly used for open sea discharge application and for tank connections. The greatest advantage of this connection is the facility of disjoining.



■ Gasket connection

This type of junction is widely used for the simplicity and speed of execution. The SGK pipes with gasket joining system, has at the spigot end of the pipe two specially shaped gaskets housing, which allows the fixing of gasket. Gaskets are always supplied for this type of jointing, of which should be positioned in the correct way (see fig. below "joints and gaskets") on the gasket housing close to the spigot end, then it is applied special lubricant on the inside surface of the socket and the gasket to ease the complete insertion of the spigot end. In case of using the second gasket, an additional option to be asked separately at purchasing, this second gasket is inserted first following the same steps described above. Every gasket is produced in accordance with EN 681 – 1 standard.



electrofusion jointing



gasket jointing

Please note

A complete pipe system is always just as good as its weakest component. The weakest component of the pipe is the joint. Therefore it is important to choose the most suitable and permanent joint. The most preferred joint system is the Electro-Fusion welding, as the whole pipe system becomes a homogenous unit, with simple, easy and speed of laying.

SGK profile types

The types of profiles that **CENTRALTUBI s.p.A.** capable of offering today is as follows:



Profile type PR

This profile type is manufactured in the winding process. The main properties of this profile is the smooth inside and, of course, the profiled outside. (type B according to EN 13476). The low weight and the high stiffness are significant. The fields of application for this kind of profiles are sewer conduit of white, black and mixed water, drain, ventilation etc. With this profile type there are 70 standard combination possibilities, follows are some:

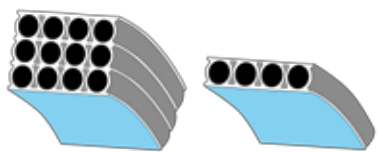


profile	I_x	e	se	profile height
n.	mm ⁴ /mm	mm	mm	mm
PR 25 - 00.49	486,0	7,2	18,0	31
PR 25 - 00.6	604	8,2	19,3	31
PR 32 - 00.85	848	9,1	21,7	37
PR 32 - 01.48	1.484	11,7	26,1	39
PR 32 - 01.98	1.975	12,9	28,7	41
PR 40 - 01.44	1.445	11,5	25,9	44
PR 40 - 02.3	2.296	13,9	30,2	46
PR 40 - 03.01	3.008	15,3	33	48
PR 40 - 04.08	4.077	17,2	36,6	50
PR 50 - 03.6	3.597	16,7	35,1	56
PR 50 - 04.1	4.096	17,9	36,6	56
PR 50 - 04.65	4.651	18,1	38,2	58
PR 50 - 08.53	8.530	22,9	46,8	62
PR 50 - 13.71	13.714	26,7	54,8	68
PR 63 - 07.61	7.606	22,2	45	71
PR 63 - 08.47	8.475	23,6	46,7	71
PR 63 - 09.37	9.374	23,7	48,3	73
PR 63 - 10.42	10.424	25,1	50,0	73
PR 63 - 11.26	11.262	25,0	51,3	75
PR 63 - 12.5	12.503	26,5	53,1	75
PR 63 - 13.28	13.276	26,3	54,2	77
PR 63 - 15.42	15.422	27,5	57,0	79
PR 63 - 17.7	17.075	29,1	59,0	79
PR 63 - 17.71	17.705	28,7	59,7	81
PR 63 - 19.58	19.580	30,3	61,7	81
PR 63 - 22.24	22.240	31,5	64,4	83
PR 63 - 22.71	22.707	31,1	64,8	85
PR 63 - 26.13	26.133	32,8	67,9	86
PR 63 - 27.21	27.208	32,8	68,9	87
PR 63 - 30.46	30.458	36,4	71,5	90

I_x = inertia moment

e = inertia distance

se = equivalent solid wall thickness



Profile type SQ

This profile pipe has a smooth walls inside and outside (type A2 according to EN 13476), including internal profiles with one (SQ1) or more layers (SQ2 – SQ3). This profile has a very high long-term stiffness therefore it is very suitable for extremely high loads and big diameters. The external smooth wall facilitates the manual welding among the elements, allowing therefore to be able to them for the realization of various special pieces, wells etc.

With this profile type there numerous combination possibilities, follows are some:



profile	I_x	e	se	profile height
n.	mm ⁴ /mm	mm	mm	
SQ1 32-007.85	7.773	22,7	45,4	48
SQ1 32-019.36	19.179	31,9	61,3	63
SQ1 50-016.60	16.603	32,3	58,4	62
SQ1 50-026.09	26.093	39,9	67,9	72
SQ1 50-034.200	34.200	40,7	74,3	77
SQ2 32-034.75	34.425	41,3	74,5	85
SQ2 32-044.45	44.044	46,1	80,9	90
SQ2 32-054.38	53.875	50,4	86,5	95
SQ2 32-055.17	54.657	46,6	86,9	95
SQ2 50-081.69	81.687	58,5	99,3	114
SQ2 50-136	13.579	67,4	117,7	129
SQ3 32-092.86	92.004	60,0	103,4	123
SQ3 32-132.57	13.134	69,6	116,4	133
SQ3 32-157	15.541	69,9	123,1	138
SQ3 50-230.42	23.041	84,6	140,4	166
SQ3 50-297.48	29.747	93,5	152,8	176
SQ3 50-341	34.128	93,8	160,0	181

I_x = inertia moment

e = inertia distance

se = equivalent solid wall thickness



Profile type SP

Should a standard profile not be sufficient due to the effect of all different kinds of loads, the **SGK** pipe system is in a position to combine different kinds of profiles in order to achieve the required effects. For example you can add a PR profile to a SQ profile or a solid wall pipe without any problems. With this technique, both profiles can be statically added whereby a stronger pipe is produced and a profile will be added to the otherwise smooth surface, which has advantages in connection with the anchoring of the pipes in the soil and this is advantageous for the axial deformation through the extension.



profile type	I_x	e	se
n.	mm ⁴ /mm	mm	mm
Upon request	-	-	-

I_x = inertia moment

e = inertia distance

se = equivalent solid wall thickness

Solid wall pipes

This pipe type has a smooth inner surface and a slight uneven outer surface. The pipes are produced homogenously. Moreover this solid wall pipes are tempered, which means that there are no frozen stresses.

Basic calculation for solid wall pipes:

Unit weight

$$W = \frac{\pi (D_i + s) \cdot s \cdot \rho}{1.000} \text{ [kg/m]}$$

W = weight [kg/m]
D_i = internal diameter [mm]
s = solid wall thickness [mm]
ρ = specific density [kg/dm³]

Specific weight of thermoplastics

PE **ρ** = 0,95 [kg/dm³]
PPH **ρ** = 0,935 [kg/dm³]

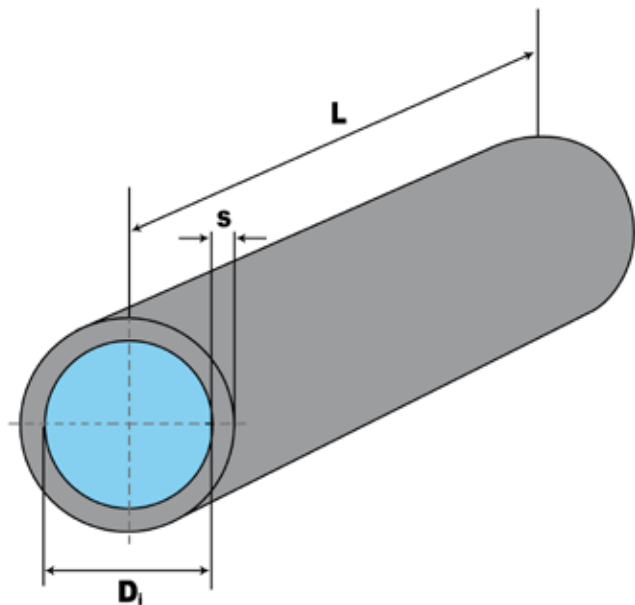
Calculation of solid wall pipes

$$I_x = \frac{s^3}{12} \text{ [mm}^4\text{/mm]}$$

$$e = \frac{s}{2} \text{ [mm]}$$

I_x = inertia moment

e = inertia distance





Profile type VW

The type VW is a homogeneous solid pipe with smooth inside and outside surface. These kind of pipes can have the different jointing techniques of **SGK** system. In addition, these pipes can be used for internal working pressure.

The resistance to the pressure of the PE pipes with solid wall is determined by the formula:

Solid wall thickness calculation

$$s = \frac{D_i \cdot P}{2\sigma - P} \text{ [mm]}$$

D_i = internal diameter [mm]
 P = pressure [bar]
 σ = circumferential tension [kg/cm²]

circumferential Tension in function to PE

PE	MRS N/mm ²	σ (C=1,25) N/mm ² kg/cm ²
PE 80	8	6,3 63
PE 100	10	8,0 80



Weight of pipes

s \ D _i	5	6	7	8	9	10	11	12	13	14	15	18	20	25	30
	kg/m														
1000	15,2	18,2	21,3	24,3	27,4	30,5	33,5	36,6	39,7	42,8	45,9	55,3	61,5	77,3	93,2
1200	18,2	21,8	25,5	29,1	32,8	36,5	40,2	43,9	47,6	51,3	55	66,1	73,6	92,4	111,3
1400	21,2	25,4	29,7	34	38,2	42,5	46,8	51,1	55,4	59,7	64	77	85,6	107,4	129,4
1500	22,7	27,3	31,8	36,4	41	45,5	50,1	54,7	59,3	63,9	68,5	82,4	91,7	115	138,4
1600	24,2	29,1	33,9	38,8	43,7	48,6	53,4	58,3	63,2	68,1	73,1	87,8	97,7	122,5	147,5
1700	25,7	30,9	36	41,2	46,4	51,6	56,8	62	67,2	72,4	77,6	93,3	103,7	130,1	156,5
1800	27,2	32,7	38,1	43,6	49,1	54,6	60,1	65,6	71,1	76,6	82,1	98,7	109,8	137,6	165,6
2000	30,2	36,3	42,4	48,4	54,5	60,6	66,7	72,8	78,9	85	91,2	109,5	121,8	152,7	183,7

s = solid wall thickness in [mm]

Other dimensions and materials on request

Weights without socket and spigot.

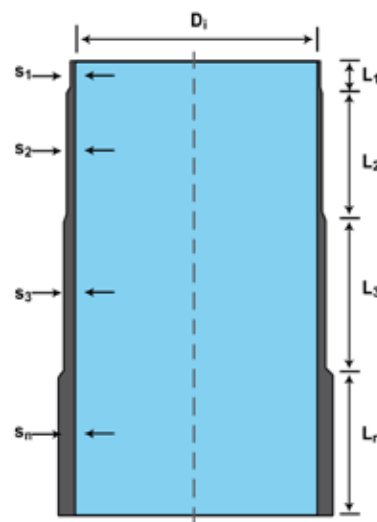


Profile type ST

Pipes with the profile type ST are specially made for vertical tanks, where different wall thickness in one pipe are required to save material. The calculation method is according to DVS 2205.

Technical data of stepped pipes

Stepped pipes	minimum	maximum
nominal width (D _i)	1000 [mm]	2000 [mm]
number of step (n.)	2	6
length of step (L)	200 [mm]	pipe length
wall thickness of step (s)	5 [mm]	300 [mm] x PE 150 [mm] x PP
variation distance	5 [mm]	

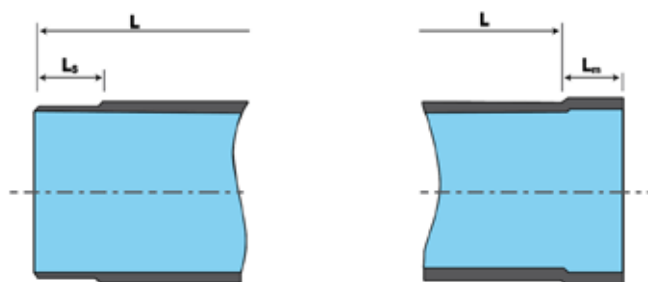


fittings



Fittings

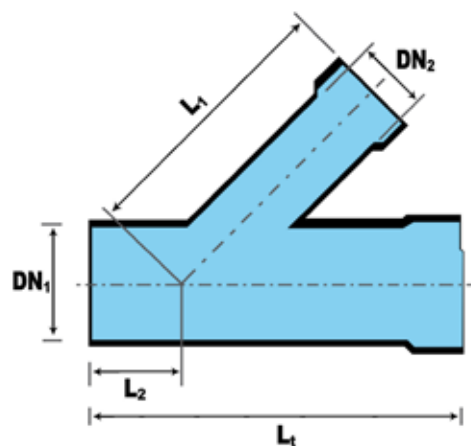
All fittings are manufactured from pipes with profile VW or SQ. Generally the fittings are designed in accordance to the required ring stiffness and welding. The fittings can be produced from any type of **SGK** pipe profile and can be connected with any type of SGK jointing system, including electro-fusion sockets.



Branches

Branches can be manufactured and delivered in every type and form. The angle can be adapted individually from 30° to 90° as well as the ends and the respective segment lengths.

BRANCHE DIMENSIONS (DIN 16961)				
DN ₁ [mm]	DN ₂ [mm]	L _t [mm]	L ₁ [mm]	L ₂ [mm]
1000	125/160/200/250/315	2000	500	1600
1200		2100	500	1800
1400				
1500				
1600				
1700				
1800				
2000				
≥ 2100	as projected			

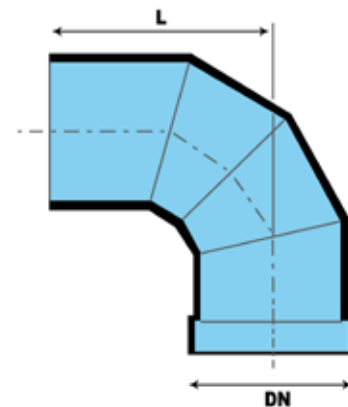




Bends

Bends can be manufactured and segmented in different angles and the related radius of the bend to pipe diameter can be selected independently.

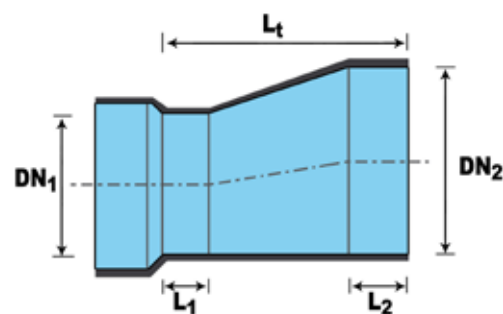
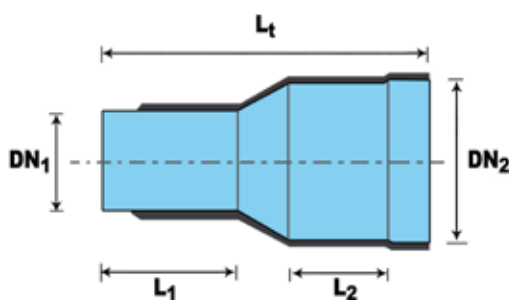
BEND DIMENSIONS (DIN 16961)						
DN [mm]	2 $\alpha = 15^\circ$	2 $\alpha = 30^\circ$	3 $\alpha = 45^\circ$	3 $\alpha = 60^\circ$	4 $\alpha = 75^\circ$	4 $\alpha = 90^\circ$
1000	240	380	520	680	870	1100
1200	270	430	600	800	1020	1300
1400	330	490	680	920	1180	1500
1500	360	520	720	980	1260	1600
1600	390	650	760	1040	1340	1700
1700	390	650	760	1040	1340	1700
1800	420	580	800	1100	1420	1800
≥ 2100	as projected					



Reducers

Reducers can be made both centric and eccentric so that the reducers will always meet the requirements.

REDUCER DIMENSIONS (DIN 16961)				
DN ₁ [mm]	DN ₂ [mm]	L _t [mm]	L ₁ [mm]	L ₂ [mm]
	1000	1800	500	500
900 → 2000	1000 - 2000	as projected		



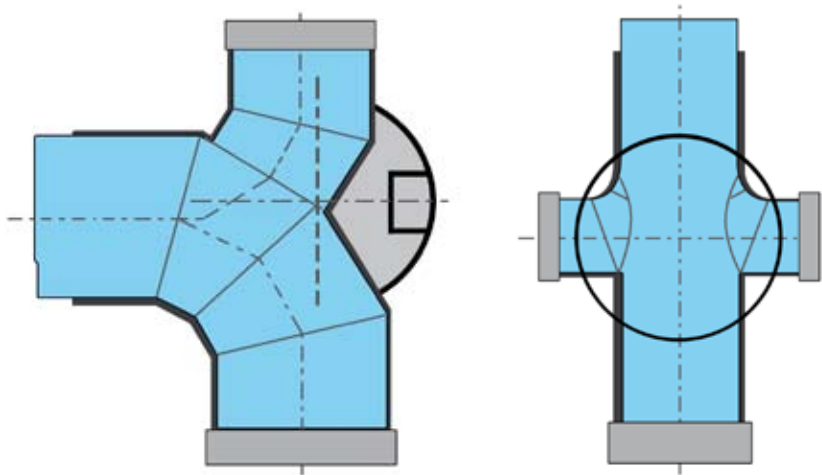
manholes



Manholes

Manholes are an important part of the pipeline system. The homogeneity of manhole characteristics and those of the conduit determine a more elevated ability to have a system, therefore a greater system efficiency and smaller maintenance interventions.

To offer the possibility to control and maintain pipe systems regularly, **SGK** manholes are integrated in the system. **SGK^{MH}** can be also installed at the positions of bends, reduction or branches. The manholes are made of the same material as the pipes and are also connected to the system with similar jointing system. The special advantage is that a homogenous system of the same material is produced. With preference, profile types like SQ and VW are used for the production of the manholes.





Marking

The marking is an important requisite and foreseen by the standards of construction and testing pipelines. It allows tracking of the manufacturer and production, therefore it is integral part of the quality system of production of the manufacturer. The pipelines are externally marked on the circumference during the production, with superior frequency to minimum allowed by the standards allowing a best tracking in any position in which the product is found.

Marking frequency	
DIN 16961	EN 13476
at least once on each pipe	marking at maximum intervals of 2 mt at least once on each pipe

SGK pipelines satisfy all minimum requisite of marking foreseen by the standards.

Example of marking for pipe DN 1200 mm

Minimum requests of marking		
DIN 16961	SGK	EN 13476
standard number	DIN 16961-2 EN 13476	standard number
nominal dimension	DN ID	nominal dimension
internal pipe diameter	1200	internal pipe diameter
manufacturer name/mark	CENTRALTUBI SGK	manufacturer name/mark
stiffness class	CL 3 SN 2	stiffness class
	RF30	flexibility
material	PE HD	material
MFR (group)	005	
	U	code of application
year of production	GG MM AA	year and month of production

■ Additional marking

Pipes and fittings that conforms to more than a standard, can be marked with the elements foreseen by all the considered standards. Can be added also other information, as for instance possible marks of product quality.

Internal wall colour

The pipelines are producer in black colour. Generally **SGK** pipes have coloured internal wall (blue for PE, yellow for PP) to allow a best visual inspection and with video cameras, facilitating the job of the maintenance. Upon its possible to personalized the colours, both of the internal and external wall.



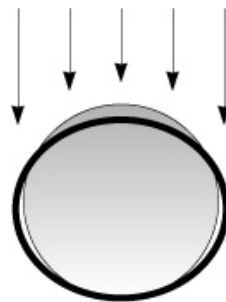


Laying

The laying techniques of **SGK** pipelines are the same ones of those prescribed for the flexible type pipelines in general. It is always necessary to refer to a standard, recommendations and national or international codes. A valid guide is held from standard ENV 1046: "Transport systems of water and sewer outside the buildings - Recommendations for underground installation and above ground". Such standard classify for covering and the compactness of the ground.

The pipes produced in PE and PP have considerable advantages in respect to other materials as concrete, steel, ductile iron etc. One of these advantages is the elevated flexibility. In areas subject to earthquakes or sensitive entity, the **SGK** pipes have a notably better behaviour in respect to those built with other materials. The flexible reaction to the loads in general, typical of the plastic pipes, allow the advantage to be able to succeed in maintaining the operation of the pipeline, contrarily of those rigid that break.

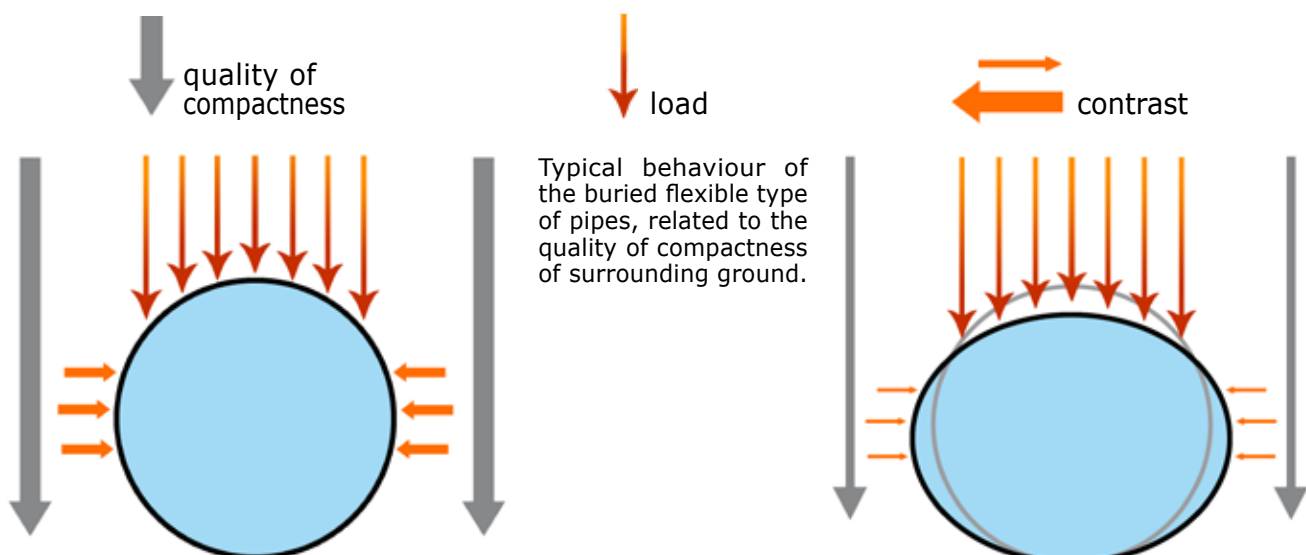
The flexibility characteristic of **SGK** pipe and their elevated ability to bear loads, for which they fit also for road applications, motorway, railway etc.



Transmission of loads on flexible pipes

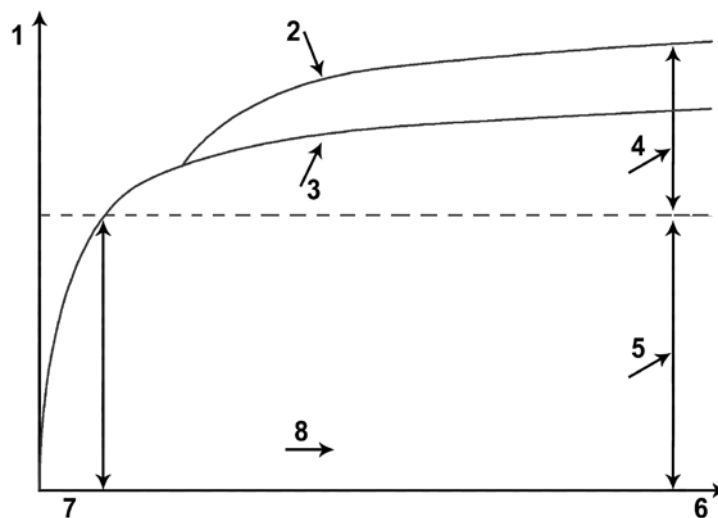
Principle

The flexible pipes can adapt to changes in their environment. Thanks to their deformation, the loads are directly distributed on the surrounding ground and the strengths agents on the pipeline decrease. The ovality stops when the area around the pipeline is totally compacted, preventing in fact the progression of the deformation.





The final deflection is reached quicker if the pipe is subject to traffic loads. The variation in the deflection after the installation depends above all on the assessment and consolidation of the surrounding ground (ENV 1046).



- 1 Pipe deflection
- 2 with traffic
- 3 without traffic
- 4 Buckling from assessment
- 5 Buckling from installation
- 6 Time after installation
- 7 Phase 1 (installation)
- 8 Phase 2 (assessment)

The external structures of **SGK** pipelines contribute to fix the pipes in the ground, therefore extensions of the pipeline would not take place or they will be extremely reduced. SGK pipes are almost exempt from variations due to temperature

Since flexible type pipes interact with the surrounding environment, the principal parameters to take into consideration for a long term correct static evaluation, essentially are geotechnical:

- natural ground characteristics
- Ground of support material characteristics
- compactness degree for the supporting ground material (*Proctor* density)
- covering ground characteristics
- covering height (distance between the highest point of the pipe in the trench and the ground level)
- width trench
- height of eventual underground water above the pipeline
- of heavy dynamic loads (traffic , railway, airport etc.)



SGK system advantages at a glance

■ Durability

Low investment costs and a service life over 100 years reduce the operating costs.

■ Time Saving

Considerable time saving when laying the long, light and flexible pipes, not to mention the ease and speed of installation of manholes and special pieces.

■ Maintenance

The smooth inner surface, the compactness and the elevated electric, chemical and biological inertia reduces the maintenance and cleaning costs considerably

■ Hydraulics

Due to the very good hydraulic properties, smaller pipe diameters can be used compared to current traditional pipe materials

■ Tightness

100% tight joints: No infiltration or ex-filtration, no root penetration due to welded system

■ Lengths

The standard lengths of 6 m reduces number of joints

■ Security

Lightness, minor number of junctions and special pieces considerably reduce the permanence of workers in the trench, increasing safety and reducing relative costs





Tecnical specification for engeneers

HIGH DENSITY POLYETHYLENE (PEHD) PIPELINES WITH STRUCTURED WALL PROFILE SPIRALLED TYPE FOR UNDERGROUND NON PRESSURE SEWER

Supply and laying of Polyethylene high density (PEHD) pipelines for underground non pressure sewer, with structured wall profile of spiralled type, in conformity with DN 16961, extruded by UNI EN ISO 9001:2000 certified producer. The internal wall profile has to be smooth and light coloured to allow a better visual or tele-camera inspection, the external wall structure should be capable of guarantying the necessary moment of inertia to obtain the foreseen ring stiffness. The pipes should have on the external surface, the marking indicated by the reference standard; the joints of the elements will be executed through a special polyethylene sockets continuously coiling on mandrel without continuity solution, with the pipe having a special internal resistance for the realization of Electro-fusion with the successive male element.

The ring stiffness would be equal to $SN \text{ (} \frac{KN}{m^2} \text{)}$, measured in accordance to EN ISO 9969 standard.

The ring flexibility must be verified according to EN 1446 standard with deformation equal to 30% of the external diameter of the pipe (RF30 to be brought in marking).

The abrasion resistance of the used material must be verified according to EN295-3.

The minimum tensile stress resistance on jointing seam between the spirals will be superior to 1020 N when verified according to EN 1979 Method.

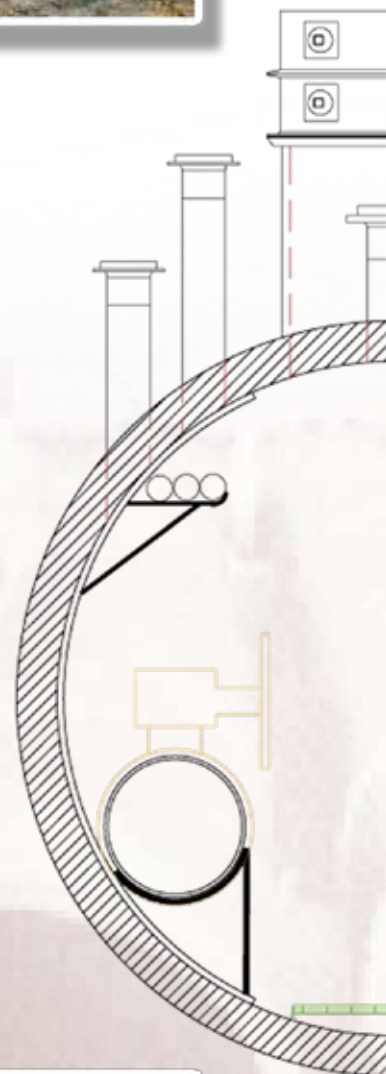
*SN" (2KN/m2) – SN4 (4KN/m2)

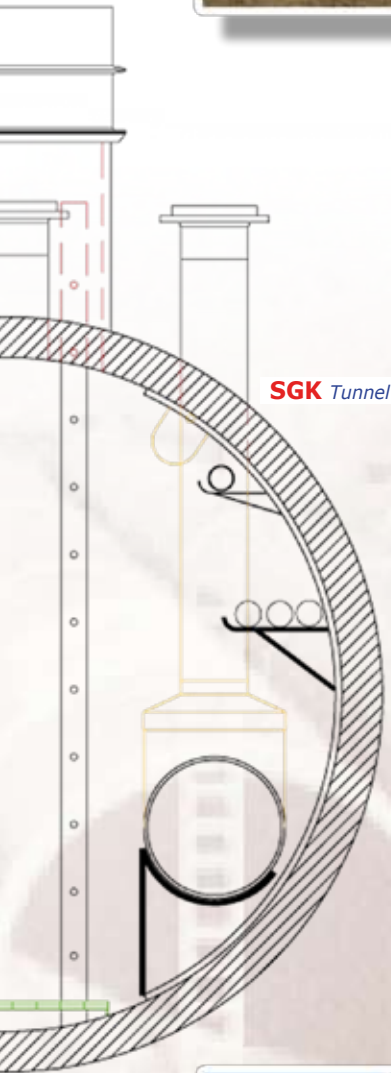
N/B: It is possible to prescribe other types of joining (socket and gasket, head to head welding, etc)



applications

SGK products, thanks to the elevated versatility of production, numerous profile solutions, dimensions and weldability of PE and PP, many applications are found for various solutions. The principal applications concern the construction of buried underground sewer pipelines, but the excellent characteristics allow the realization of articles, to overcome the limits of the traditional products exploiting the characteristics of lightness, facility and speed on site, chemical inertia, water proof etc.





SYSTEM GROUP has a technical department for the development of applications and products of all the firms under the same group. The technical department gives support to Technicians, Project Managers and Clients to projected solutions, managerial and installation issues, further to standard consultation. Softwares are available for hydraulic calculations, static verifications, analysis of supply and laying costs, laying disciplinary, technical designs etc.

**CENTRALTUBI S.p.A. guarantee the production of polyethylene pipes in conformity
UNI EN ISO 9001:2000 standard certification n. 027**



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