



PPB PIPE

**TOTAL SOLUTION PROVIDER
FOR PP PIPE**



creativity inspired
HYOSUNG

Polypropylene



Underground drainage & sewerage pipe applications

- Plastic is major material for gravity pipe.
- Small-diameter pipe under 300mm are mainly made by plastic. But large-diameter pipe over 500mm are mainly made by concrete.
- From Europe to worldwide, PVC pipe lost its share because of the difficulty in recycling PVC waste, the problems in managing PVC materials and emission of toxic substances in case of heat.
- In the same diameter with same ring stiffness, PP pipe has thinner wall. Usage of PP can save 27% of material than that of PE.

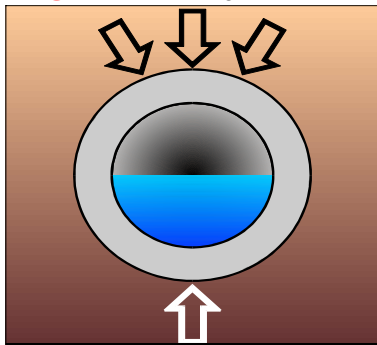
Features of High Modulus PPB PP-HM

- Excellent chemical resistance
- Excellent mechanical properties over a wide temperature range
 - Good impact strength and stiffness balances
- Low weight per meter pipe
 - Economics, safety, easy handling and installation
- Long life time
 - Expected lifetime of almost 50 years
- Environmentally sound solution
- Complete systems / Good processing properties
 - Pipes, fittings and inspection chambers made of the same material

Flexibility

- Ring flexibility is very important in sewage & drainage pipe systems.
- PP pipe shows good flexibility and it has track-records over 30 years.

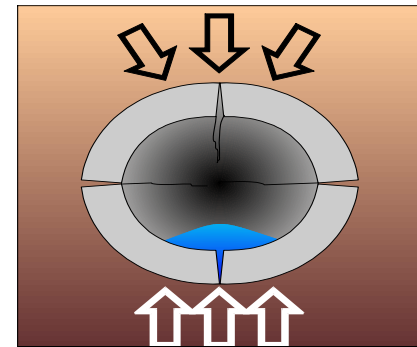
Rigid pipe systems



Load!

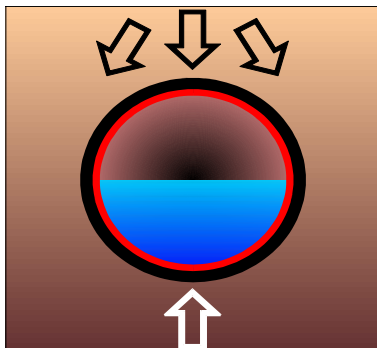
The pipe is stiffer than the surrounded soil so it has to take over all the existing load ...

... until it breaks!



Crack!

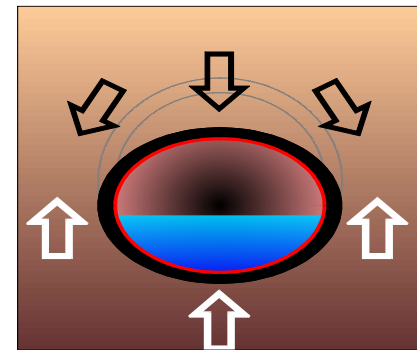
Flexible pipe systems



The pipe avoids the load by deflection! The surrounded soil takes over all the load.

The stiffness of the soil is about 10-200 higher than the stiffness of the pipe.

The soil determinates the stiffness!



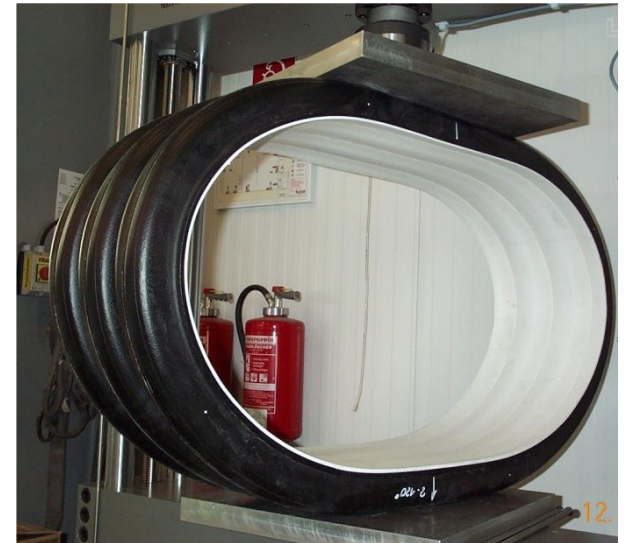
Flexible!



The Destruction of Concrete Pipes

ISO 21138-1/2/3
Ring Flexibility Test
30% deflection of
outer diameter

The Deflection of PP pipes



PP Pipe Track Records

PP-B materials have a track record of over 25 years for underground drainage and sewerage (at Plastic Pipe Conference 2006)

DURABILITY TESTING FOR 100 YEAR LIFETIME FOR BURIED NON-PRESSURE PLASTIC PIPES

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[Plastic Pipe Conference 2006]

Polypropylene block co-polymers, PP-B, are commonly used in Europe for underground drainage and sewerage applications, in-house soil and waste systems, cable protection and ducting pipe systems. PP-B materials have a track record of over 25 years for underground drainage and sewerage (17). In 2001 a CEN standard was also introduced for high modulus PP – PP-B (PP-HM) materials with a modulus of 1700 MPa or higher (5) and PP-HM is also included in other ISO and CEN documents (3, 4). The particular PP-HM grade used in this investigation was first introduced in 1997 and is now used for a wide range of structured-wall pipe systems and in large diameter spirally wound pipe (17-19).

[17] C. –G. Ek, Plastic Pipe X II, Munich, 3-6, Sept. 2001, p.491-500

PP Pipe Track Records

These pipes did not show any damage after they have been used for more than 21 years.....
(at Plastic Pipe Conference 2008)

Experience with Polypropylene Pipes Used in Steel Mills

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[Plastic Pipe Conference 2008]



Fig. 1: Investigated samples: (a) Pipe-1/Fitting-1 operated with H_2SO_4 and (b) Pipe-2/Fitting-2 operated with $CoCl_2$.

Furthermore, information about PP pipes that were used to transport cobalt chloride ($CoCl_2$; 18 %) is reported. These pipes did not show any damage after they have been used for more than 21 years.

Despite minor surface damages all pipes and fittings were still in quite a good condition and no indications for a reduced life-time were found. Thus it can be concluded that PP pipes are suitable for both reported applications and can very well be used again in the future.

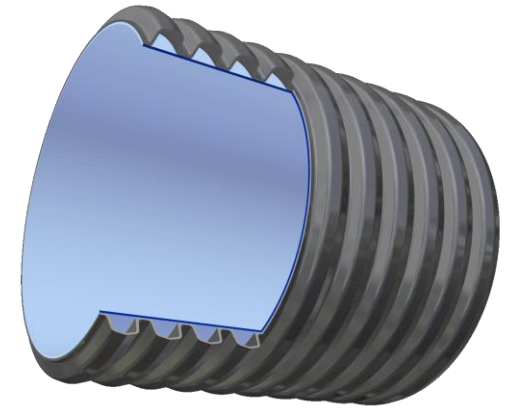
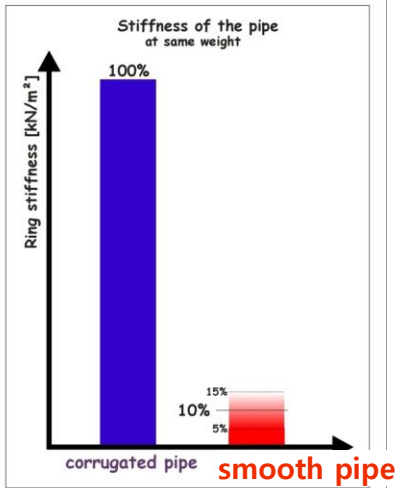
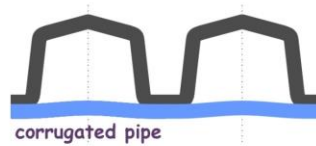
Solid Wall

- The stiffness of the pipe (ring stiffness) is most important; resistance to soil pressure
- Ring stiffness depends on material stiffness (FM) + wall thickness
- SN4 is preferred stiffness class for drainage pipes
- SN8 is preferred stiffness class for sewage pipes.

Class	FM	Pipe Class & Dimension	Visual Ex.	Hyosung Grade
Conventional PP-B SN 2, 4 and 8	> 12,500	110 X 4.7 mm		HB240P FM > 15,000
PP-HM SN 8 EN 1852 (2001)	≥ 17,000	110 X 4.7 mm		HB242P FM > 18,000

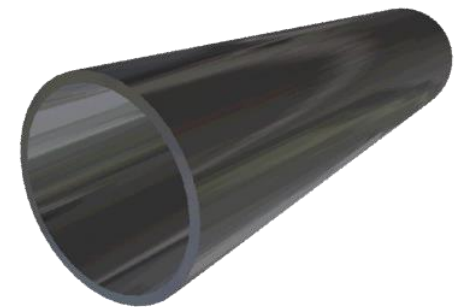
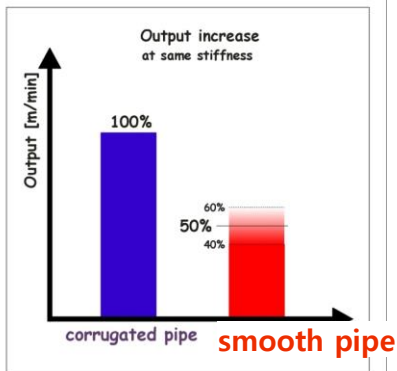
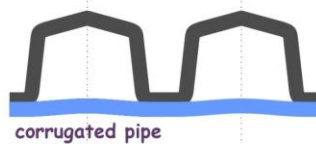
Corrugated type

*Higher
Ring stiffness*



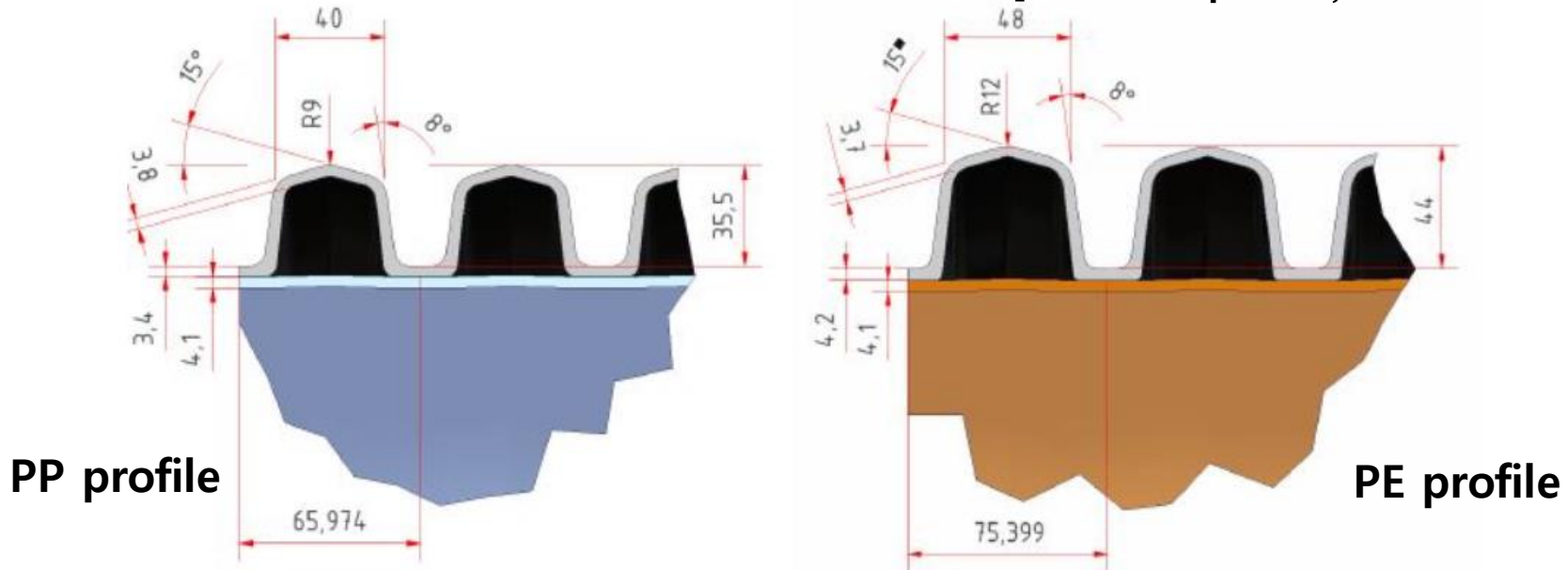
corrugated pipe

Output increase



smooth pipe

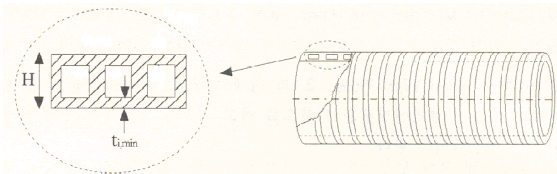
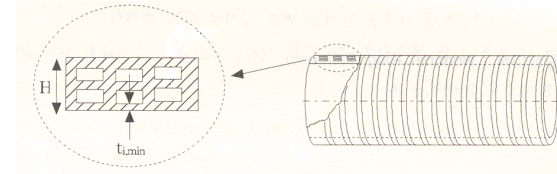
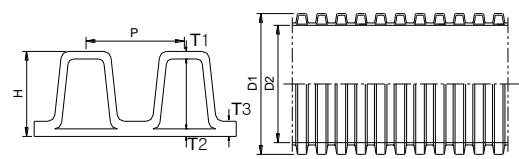
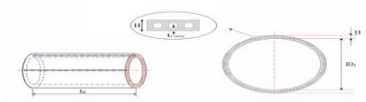
[Plastic Pipe XVI, Conference 2012]



- Due to the high modulus of PP-B material, PP profiles are usually smaller than PE profiles in the same ring stiffness.
- PP corrugated pipes can also be produced by PE corrugator machines. In the same design of profile by PE corrugator machine, PP-B corrugated pipes can reach much higher ring stiffness than PE corrugated pipes because of its higher modulus.

Korea Standards – Correspond with ISO 21138-1/2/3

- Correspond with PP materials & pipe properties in ISO
- Pipe size (ID/OD) corresponds with Korean association standards

Structured-Wall PP Pipes for Non-Pressure Underground Drainage and Sewage		Drawings
KS M 3700-1	Part 1 : Double-Wall Pipe	
KS M 3700-2	Part 2 : Multiple-Wall Pipe	
KS M 3700-3	Part 3 : Corrugated Pipe	
KS M 3700-4	Part 4 : Seamless Pipe	

China Standards – Correspond with ISO 21138-1/2/3 and KS M 3700-1~4

			KS	ISO	GB (China, on going)
Material	Density	g/cm ³	0.90±0.01	0.90	
	Melt Flow Rate	g/10min (230℃, 2.16kg)	≤ 0.40	≤ 1.5	≤ 1.5
	Flexural Modulus	Mpa	PP-B : 1,250~1,700 PP-HM : ≥ 1,700	1,250 ~ 1,900 ※ High Modulus ≥ 1,700	≥ 1,500
	OIT	Minute (200℃)	≥ 8	≥ 8	≥ 8
Straight Pipe	Pressure Resistant	140 hours	80℃, 4.2 Mpa	80℃, 4.2 Mpa	80℃, 4.2 MPa
		1,000 hours	95℃, 2.5 Mpa	95℃, 2.5 Mpa	95℃, 2.5 Mpa
Pipe	Ring Flexibility	30% deflection of outer diameter	no decrease of force no cracking no wall delamination no permanent buckling	no decrease of force no cracking no wall delamination no permanent buckling	no decrease of force no cracking no wall delamination no permanent buckling
	Impact Strength		- Defined Weight 3.2 kg - Temperature : 0℃ - Height : 2m	- Defined Weight d ≤ 100 mm 0.5 kg 100 < d ≤ 125 mm 0.8 kg 125 < d ≤ 160 mm 1.0 kg 160 < d ≤ 200 mm 1.6 kg 200 < d ≤ 250 mm 2.0 kg 250 < d ≤ 315 mm 2.5 kg 315 < d 3.2 kg - Temperature : 0℃ - Height : d≤110 1.6m d >110 2m	- Defined Weight d ≤ 110 mm 0.5 kg 110 < d ≤ 125 mm 0.8 kg 125 < d ≤ 160 mm 1.0 kg 160 < d ≤ 200 mm 1.6 kg 200 < d ≤ 250 mm 2.0 kg 250 < d ≤ 300 mm 2.5 kg 300 < d 3.2 kg - Temperature : 0℃ - Height : d≤110 1.6m d >110 2m

China Standards – Correspond with ISO 21138-1/2/3 and KS M 3700-1~4

- Correspond with PP materials & pipe properties in ISO
- Pipe size (ID/OD) corresponds with existing Korea standards

Class	SN8	SN10	(SN12.5)	SN16
Ring stiffness/(kN/m ²)	8	10	(12.5)	16

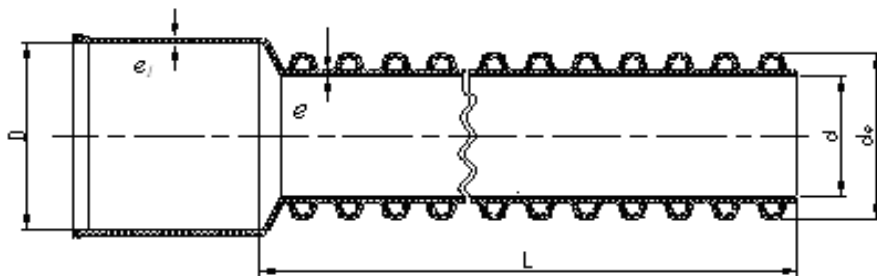


图1 管材结构示意图
Figure 1. A pipe Schematic diagram

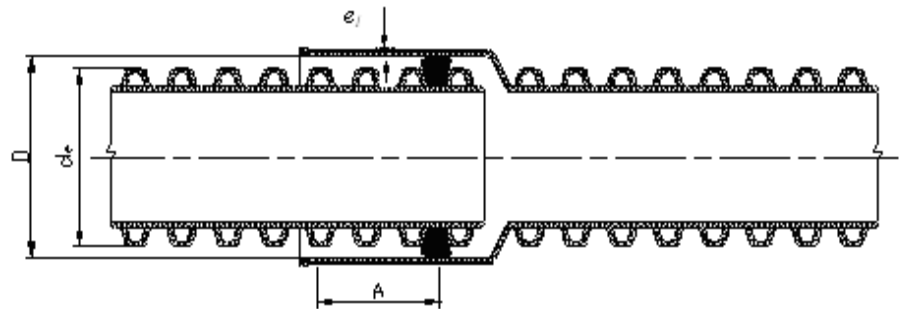


图2 典型的管材连接示意图
Figure 2. A typical pipe connection diagram

China Standards – Correspond with ISO 21138-1/2/3 and KS M 3700-1~4

- Correspond with PP materials & pipe properties in ISO
- Pipe size (ID/OD) corresponds with existing Korea standards

No.	Items	Requirements	Testing method
1	Resistance to internal pressure (80°C, hoop stress 4.2MPa, 140h) ^{a)}	No damage	GB/T 6111, Using a type sealing head
	Resistance to internal pressure (95°C, hoop stress 2.5MPa, 1,000h) ^{a)}	No leakage	
2	Melt Flow Rate (2.16kg , 230°C), g/10min	MFR≤1.5	GB/T 3682
3	Thermal stability (Oxidation Induction Time, 200°C), min	≥8	GB/T 19466.6
4	Flexural Modulus, MPa	≥1500	GB/T 9341
5	Tensile strength, MPa	≥25	GB/T 1040.2

* a) This test shall be carried out in the form of an extruded sample in solid-wall pipe form made from the relevant material.

Topilene PP-B grades

Items	Unit	HB240P	HB242P
Melt Flow Rate	g/10min	0.30	0.30
Tensile Strength	MPa	31	31
Flexural Modulus	MPa	1,515	1,785
Notched Izod Impact Strength (23°C)	kJ/m ²	N.B	N.B
Application	Drainage pipe, Sewage pipe (Solid wall and structured wall non-pressure pipes)		

Topilene® PPB grades are advanced impact copolymer produced with Hypol process. It has high stiffness and impact strength balance with excellent processability. Topilene® PPB grades are suitable for the production of both solid and structured wall pipes.

Topilene® PPB HB242P is a High Modulus PP impact copolymer. It shows very high stiffness and a good impact strength providing superior processing characteristics.



Topilene[®]

PP TOTAL SOLUTION PROVIDER
ALWAYS BY YOUR SIDE

www.r200p.com

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