Volume III: PVC Solvent Weld BDS™ Sewer & Drain Piping Systems

Mechanical Technical Manual Series

SECOND EDITION

PVC SOLVENT WELD PIPE & FITTINGS

- Sanitary drain & building storm drain
- Sewer & building storm sewer
- Sewer lateral or stub line

We build tough products for tough environments®

IPEX
Committed to Excellence

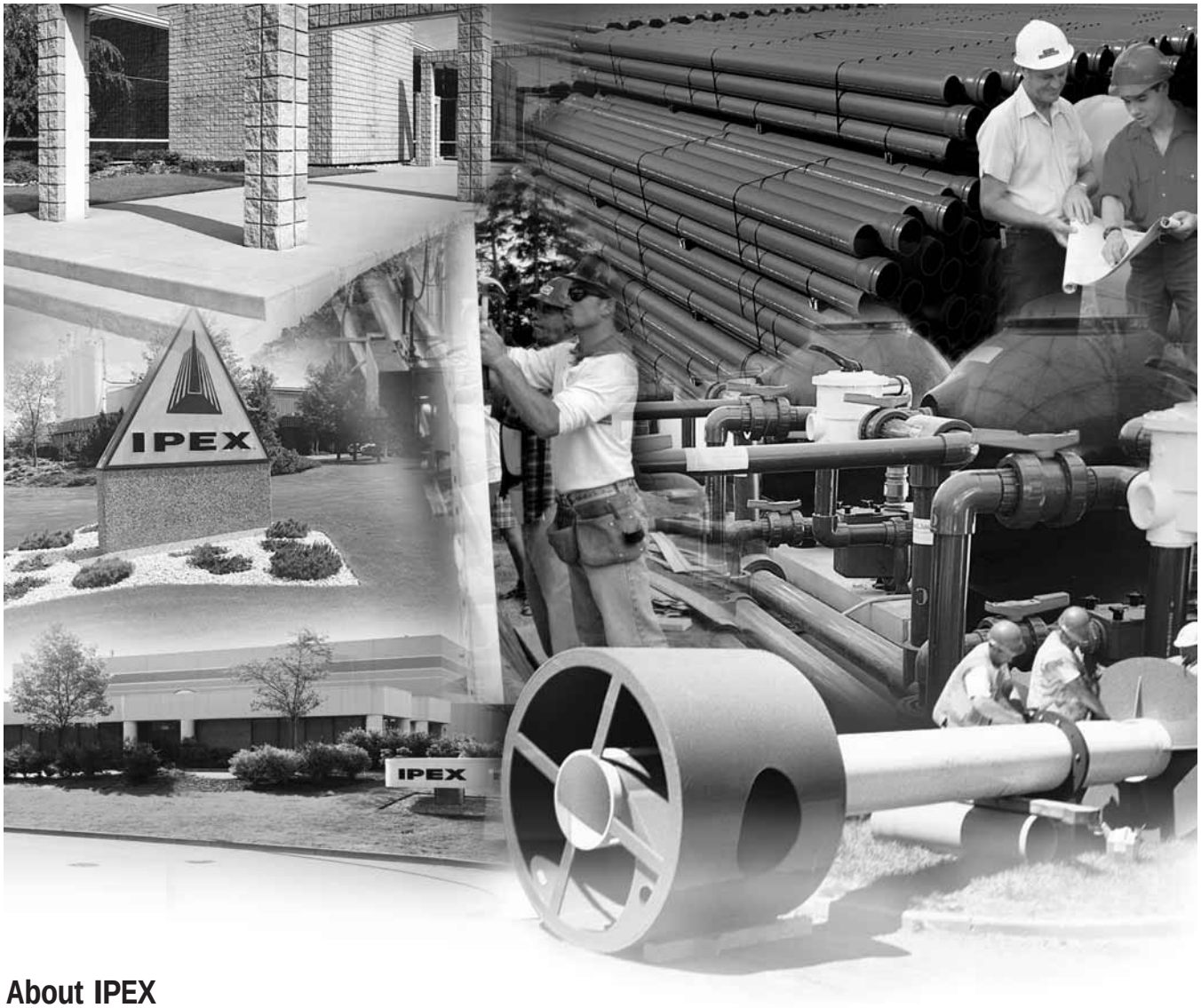
IPEX PVC Solvent Weld BDS™ Sewer & Drain Piping Systems

Mechanical Technical Manual Series

Volume III, 2nd Ed.

LITERATURE & WEBSITE DISCLAIMER

The information contained here within is based on current information and product design at the time of publication and is subject to change without notification. IPEX does not guarantee or warranty the accuracy, suitability for particular applications, or results to be obtained therefrom.



About IPEX

At IPEX, we have been manufacturing non-metallic pipe and fittings since 1951. We formulate our own compounds and maintain strict quality control during production. Our products are made available for customers thanks to a network of regional stocking locations throughout North America. We offer a wide variety of systems including complete lines of piping, fittings, valves and custom-fabricated items.

More importantly, we are committed to meeting our customers' needs. As a leader in the plastic piping industry, IPEX continually develops new products, modernizes manufacturing facilities and acquires innovative process technology. In addition, our staff take pride in their work, making available to customers their extensive thermoplastic knowledge and field experience. IPEX personnel are committed to improving the safety, reliability and performance of thermoplastic materials. We and are involved in several standards committees and are members of and/or comply with the organizations listed on this page.

For specific details about any IPEX product, contact our customer service department.

CONTENTS

SECTION ONE: APPLICATIONS

Building Sanitary Drain & Building Storm Drain

For the collection of domestic wastes and storm water under the concrete slab.

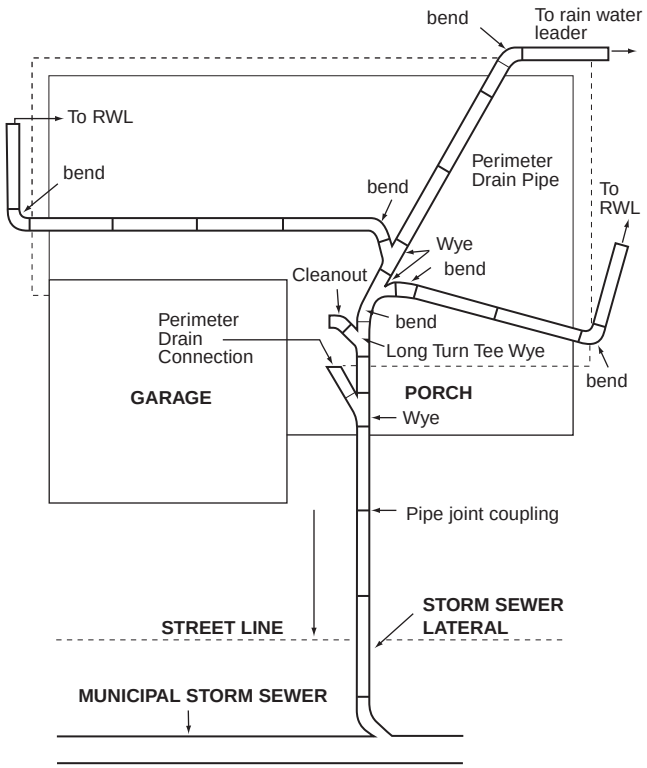
Building Sewer & Building Storm Sewer

For the collection of domestic wastes and storm water from the building sanitary drain and the building storm drain for transfer from the foundation to the sewer lateral or stub line.

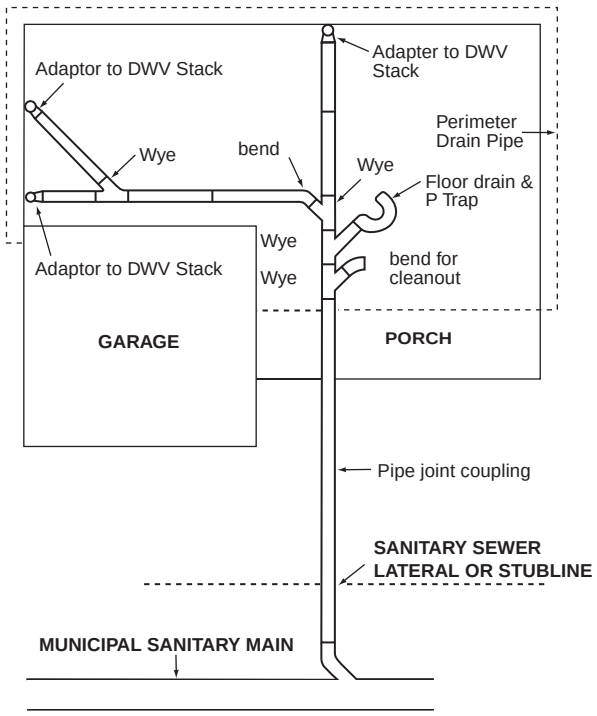
Sewer Lateral or Stub Line

For the collection of domestic wastes and storm water from the building sewer and building storm sewer for transfer from the property line to the municipal sewer main and municipal storm sewer.

Typical Building Storm Drain & Sewer Using IPEX PVC Sewer Pipe and Fittings



Typical Building Sanitary Drain & Sewer Using IPEX PVC Sewer Pipe and Fittings



NOTES

SECTION TWO: FEATURES & BENEFITS

The physical characteristics for plastic pipe in general are superior to any other material. IPEX PVC pipe offers high impact resistance, flexible pipe design, bottle tight joints, smooth non-wetting inner wall surface and high corrosion resistance. Its smooth inner wall, long lengths and tight joints result in a greater hydraulic efficiency and manning flow coefficient of N=0.009.

No other pipe approaches IPEX BDS plastic pipe in terms of low weight per foot ratio to strength.

Because of these features IPEX BDS pipe:

A. Minimizes breakage and has greater field handling damage resistance.

B. Flexibility eliminates shear-type failures and absorbs settling and considerable earth movement.

C. Bottle tight joining method minimizes infiltration, exfiltration and root infestation problems.

D. Smooth non-wetting surface eliminates build up of slime, slime bulk, sand contaminates and bacteria which improves efficiency flow and discharge over traditional materials of equivalent size for the life of the sewer.

E. High corrosion resistance eliminates replacement costs caused by corrosion due to aggressive soil conditions, bore build up, rot, galvanic conditions and rust.

F. Light weight sections reduce manpower needs, reduce equipment handling costs, handling and freight cost.

G. Costs less to operate and maintain because it has greater flow capacity per given size and it is not affected by sewer gases or sulfuric acid created as by-products of the hydrogen sulfide cycle or from aggressive soil conditions.

H. The economic life cycle of a PVC sewer system is projected at more than 50 years.

Comparison of "N" Value and Discharge on a 6" Pipe

Material	Manning "N" Value	Full Flow Discharge (GPM)
PVC	0.009	208
Asbestos-Cement	0.013	136
Vitrified Clay	0.013	136

SECTION THREE: STANDARDS

IPEX BDS Sewer Pipe is available in Standard Spec or third-party certified to CSA B182.1 or BNQ 3624-050 and conforms to ASTM.

IPEX BDS fittings, made to SDR35 wall, are third party certified to CSA 182.2 and BNQ 3624-130 and conform to ASTM D2729.

NOTES

SECTION FOUR: SIZES AND DIMENSIONS

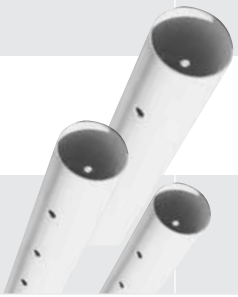
Pipe

IPEX BDS Solid Wall Sewer Pipe – Dimensions

Nominal Pipe Size (mm)	Average Outside Diameter (mm)	Standards	Minimum Wall Thickness (mm)	Minimum Stiffness (kpa)
50	57.1	CSA B182.1 - SDR35	2.06	320
75	82.5	CSA B182.1 - SDR35	2.36	320
100	107.0	CSA B182.1 - SDR35	3.06	320
150	159.4	CSA B182.1 - SDR35	4.55	320
75	82.5	CSA B182.1 - Western Canada	2.36	320
100	107.0	CSA B182.1 - Western Canada	2.92	320
150	159.4	CSA B182.1 - Western Canada	4.35	320
75	82.5	CSA B182.1-SDR38 (Nova Scotia Spec)	2.36	275
100	107.0	CSA B182.1-SDR38 (Nova Scotia Spec)	2.90	275
150	159.4	CSA B182.1-SDR38 (Nova Scotia Spec)	4.19	275
75	82.5	ASTM D2729	1.78	131
100	107.0	ASTM D2729	1.90	76
150	159.4	ASTM D2729	2.54	55
75	82.5	IPEX Standard	1.78	n/a
100	107.0	IPEX Standard	1.91	n/a
150	159.4	IPEX Standard	3.12	n/a

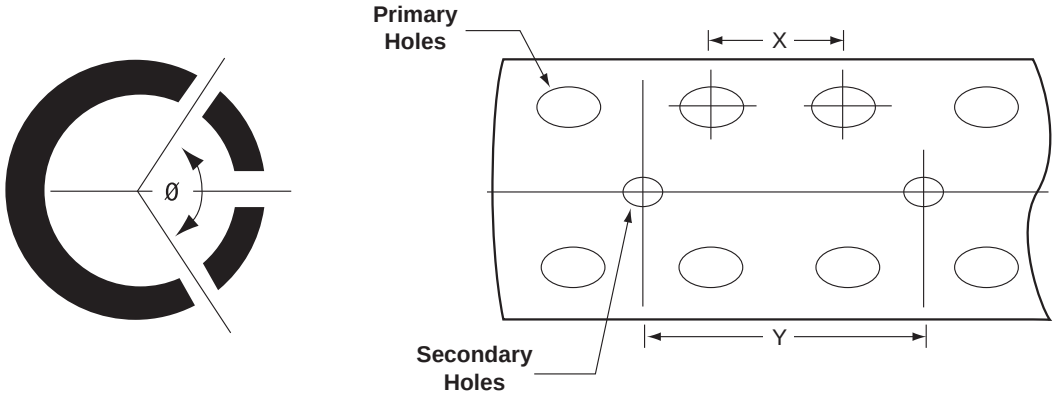
IPEX Perforated Sewer Pipe – Dimensions

Nominal Pipe Size (mm)	Average Outside Diameter (mm)	Standards	Minimum Wall Thickness (mm)	Perforation* Configuration	Minimum Stiffness (kpa)
75	82.5	CSA B182.1 Eastern Canada	2.16	A	200
100	107.0	CSA B182.1 Eastern Canada	2.36	A	200
150	159.4	CSA B182.1 Eastern Canada	3.30	A	200
75	82.5	CSA B182.1 Western Canada	2.02	B	200
100	107.0	CSA B182.1 Western Canada	2.24	B	200
150	159.4	CSA B182.1 Western Canada	2.90	B	200
100	107.0	CSA B182.1 Nova Scotia Spec	2.36	C	200
75	82.5	BNQ 3624-050	2.15	D	200
100	107.0	BNQ 3624-050	3.63	D	200
150	159.4	BNQ 3624-050	3.52	D	200
75	82.5	ASTM D2729	1.78	E	131
100	107.0	ASTM D2729	1.90	E	76
150	159.4	ASTM D2729	2.54	E	55
75	82.5	IPEX Standard	1.78	F	n/a
100	107.0	IPEX Standard	1.91	F	n/a
150	159.4	IPEX Standard	3.12	F	n/a



*See next table

IPEX Perforated Pipe Hole Dimensions



Configuration Type	Primary Hole Size (mm)	Secondary Hole Size (mm)	Dimension X (mm)	Dimension Y (mm)	Angle f (Degree)
A	16	13	127	732	120
B	16	none	127	n/a	120
C	16	13	127	3525	120
D	13	9	127	1524	120
E	13	10	127	762	120
F	16	13	118	763	120

Fittings

A complete line of Solvent Weld Fittings is available for use with IPEX BDS pipe. They are made from a tough non-corrosive proprietary compound and they are free-flowing.

Available configurations include:

- Tees
- Tee-Wyes
- Saddle Tees
- Crosses
- Cleanout Tees
- Wyes
- Saddle Wyes
- Double Wyes
- 90° Elbows
- 45° Elbows
- 22½° Elbows
- Caps
- Reducer Bushings
- Drain Grates
- Couplings
- Male Adapters
- Female Adapters
- Cleanout Adapters
- Closet Flanges
- Miscellaneous Adapters

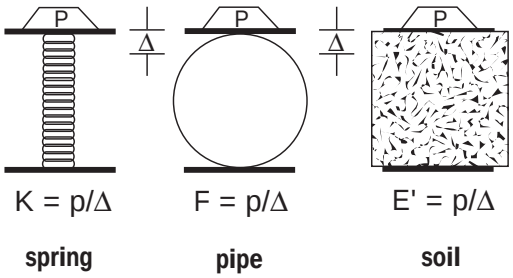
Structural Design

PVC pipes are classified as flexible conduits, which means they are designed to transfer loads to the bedding envelope surrounding the pipe by deflecting. A flexible conduit is generally defined as one that can deflect more than 2% of its diameter without damage.

Perhaps the easiest way to visualize pipe-soil interaction is to consider the spring analogy that was used by Dr. A. Moser in his authoritative textbook "Buried Pipe Design".

The ability to deflect away from vertical load is what gives PVC pipe its load carrying capability. The arching action of the soil over the pipe tends to reduce the load on the conduit, while the load that is applied is transferred to the surrounding bedding.

Flexible pipe is like a spring



High Load Carrying Capabilities Even with Marginal Bedding

The pipe-soil system formed by PVC pipe is surprisingly strong. While PVC pipes are routinely installed with depths of bury exceeding 50 feet (particularly in landfill applications), experimental work has shown that PVC pipe is capable of easily withstanding depths of bury up to 100 feet. Concrete pipe installed with identical bedding parameters collapsed. For a complete research report on this research completed at Utah State University, please contact your IPEX representative.

Deflection is Not a Bad Thing

Flexible pipes have a different failure mode than rigid pipes. Rigid pipes crack and eventually collapse under excessive load, whereas flexible pipes simply continue to deflect. PVC sewer pipes can typically deflect up to 30% of their diameter before any leakage occurs at the joints or damage to the pipe. The deflection limit for a PVC pipe is typically set at between 5% and 7.5%, which means that there is a safety factor of between 4 and 6 for deflection.

Rigid pipe manufacturers often point to deflection as a drawback when using PVC pipe, however this simply reflects a lack of understanding of the pipe-soil mechanism. Rigid pipes must also deflect slightly to carry load, but they respond to this slight deflection by cracking. As a result, while the performance limit for flexible pipe is the allowable deflection, the performance limit for concrete pipe is an allowable crack width. While concrete pipe manufacturers claim that their product can "self heal" small cracks, it is advisable to check these installations with a low pressure air test to ensure that the cracked pipe is not leaking.

Maximum Long Term Deflections of IPEX BDS PVC Sewer Pipe (SDR35)

Pipe Stiffness FDY PSI	Bedding Constant K	Modulus of Soil Reaction PSI	Height of Cover (meters / feet)								
			0.9 m 3 ft	1.5 m 5 ft	2.4 m 8 ft	3.0 m 10 ft	3.7 m 12 ft	4.3 m 14 ft	4.9 m 16 ft	5.5 m 18 ft	6.1 m 20 ft
Horizontal deflections of pipe (%)											
65	.083	200	1.3	2.1	3.4	4.3	5.0	6.0	6.8	7.7	8.5
65	.096	200	1.5	2.5	3.9	4.9	5.9	6.9	7.9	8.9	9.9
65	.110	200	1.7	2.8	4.5	5.7	6.8	7.9	9.0	10.2	11.3
65	.083	400	.8	1.4	2.2	2.7	3.3	3.8	4.4	4.9	5.5
65	.096	400	1.0	1.6	2.5	3.2	3.8	4.4	5.0	5.7	6.3
65	.110	400	1.1	1.8	2.9	3.6	4.4	5.0	5.8	6.5	7.3
65	.083	700	.5	.9	1.4	1.8	2.1	2.5	2.8	3.2	3.6
65	.096	700	.6	1.0	1.6	2.1	2.5	2.9	3.3	3.7	4.1
65	.110	700	.7	1.2	1.9	2.4	2.8	3.3	3.8	4.2	4.7

Note: It is general practice that pipe installation be designed not to exceed 7.5% deflection.

IPEX Perforated Pipe Flow

Flow of water out of pipe through perforations (in liters/minute/foot of pipe length)

Depth of Flow %	Head of Water m	Hole Configuration A (CSA B182.1)			Hole Configuration B (CSA 182.1 - West)			Hole Configuration C (Nova Scotia)	Hole Configuration D (BNQ 3624-050)		
		Pipe Size									
		75mm (3")	100mm (4")	150mm (4")	75mm (3")	100mm (4")	150mm (5")	100mm (4")	75mm (3")	100mm (4")	150mm (5")
40	0	19	21	26	17	19	24	20	12	13	16
50	0	24	27	33	22	25	31	26	15	17	21
60	0	28	32	39	26	30	36	30	18	20	24
70	0	31	36	44	29	34	41	34	20	23	28
80	0	35	40	48	33	37	45	38	22	25	31
90	0	38	43	53	35	40	49	41	24	27	33
100	0	40	46	56	38	43	53	44	26	29	36
100	0.1	66	70	77	63	66	73	67	42	44	49
100	0.2	84	87	93	80	83	88	84	54	56	59
100	0.3	99	102	107	94	96	101	98	63	65	68
100	0.4	112	115	119	106	108	113	110	72	73	76
100	0.5	124	126	130	117	119	123	121	79	80	83
100	0.6	135	136	140	127	129	133	131	86	87	89
100	0.7	144	146	150	137	138	142	140	92	93	95
100	0.8	154	155	159	146	147	150	149	98	99	101
100	0.9	162	164	167	154	155	158	157	104	105	106
100	1	171	172	175	162	163	166	165	109	110	112

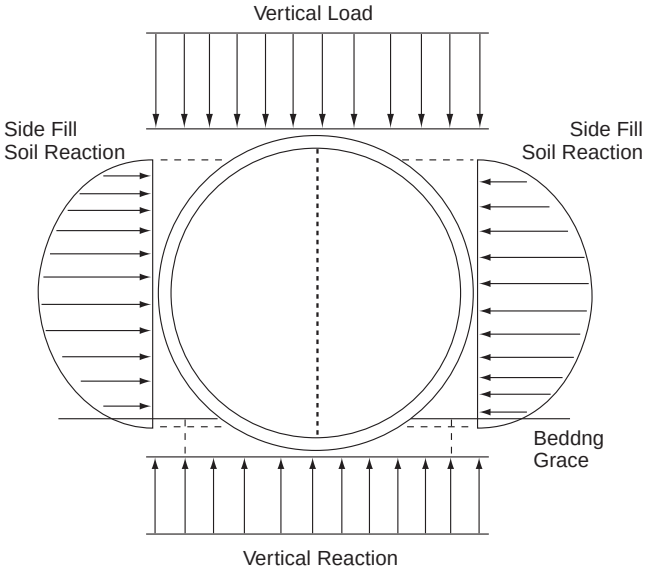
Live Loads

Live loads must at least be considered in underground pipeline installations where there is the potential for vehicle traffic. Live loads have little or no effect except in shallow burial. However, in extremely shallow installations PVC sewer pipe will react to high live loads by deflecting additionally and then will return to its original shape. Where PVC sewer pipe is installed with less than three feet of cover under roads, special design may be required.

Impact Resistance in Ft/lbs for IPEX BDS Sewer Pipe (SDR35)

Size (mm)	CSA Minimum	IPEX Typical Results		
	0ºC	23ºC	0ºC	-23ºC
100	70	160	150	140
150	110	365	340	305

Theoretical Load Distribution in Buried PVC Pipe



* where there is the potential for vehicle traffic.

NOTES

SECTION SIX: INSTALLATION

Excavation and Pipe Laying

Care should be taken during excavation of trench to provide as narrow a trench as practical at a point level with the top of the pipe. The usual is the diameter of the pipe plus 18" to 24". If it becomes necessary to construct a trench wider than usual, it is recommended that the pipe be installed in a sub-trench to minimize earth load (See Diagrams below). The pipe should be bedded true to line and grade with uniform and continuous support from a firm base. Blocking shall not be used to bring the pipe to grade. If unstable soil conditions or rock conditions are encountered the trench bottom should be over-excavated and brought to grade with suitable bedding material.

Bedding, Haunching and Initial Backfill

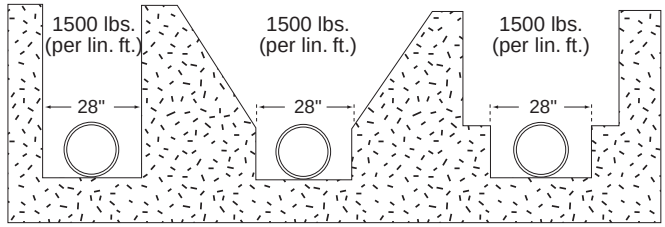
a) With installations involved on private property where the Provincial Plumbing Inspector is responsible then the local plumbing code regulation should be followed.

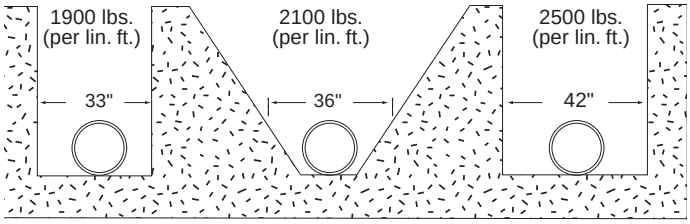
b) With installation involved on municipal property where the municipality itself is responsible then IPEX suggests that the engineer specify bedding material and installation techniques as outlined in ASTM D 2321. Recommended practice for underground installation of flexible thermoplastic sewer pipe.

Final Backfill

The material that completes the backfilling is usually placed in the trench by machine. Care should be taken, however, to avoid large stones, frozen clumps of dirt, etc. One should also ensure that the initial backfill be selected and tamped by hand and be at a minimum of 12" above the top of the pipe.

Trench Construction



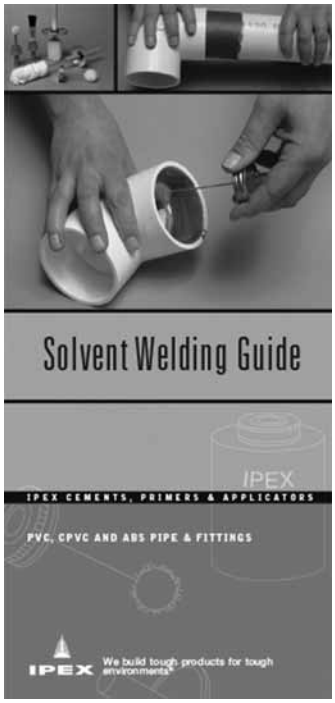


If width is increased at pipe level, the earth load on the pipe will be greater.

SECTION SEVEN: SOLVENT WELDING

The solvent welded connection in thermoplastic pipe and fittings is the last vital step in a plastic pipe installation. It can mean the success or failure of the system as a whole. Accordingly, it requires the same professional care and attention that is given to other components of the system.

For complete information on solvent welding, please consult our Solvent Welding Guide. www.ipexna.com



SECTION EIGHT: LEACHING BEDS (SEPTIC TANK SYSTEMS)

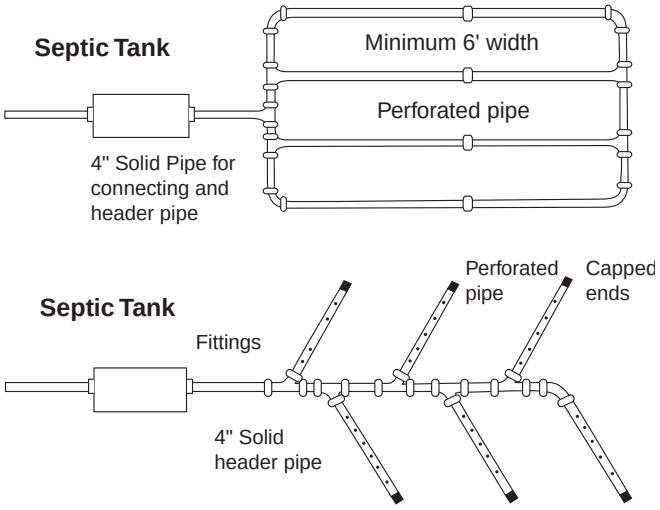
What a septic tank system does

A septic tank system returns household sewage and other liquid wastes to the soil so that they do not appear on the surface or pollute ground water. It consists of the tank itself which settles out solid wastes and prepares the sewage for absorption by the soil, plus perforated pipe which distributes effluent evenly in a series of trenches called a leaching bed.

Septic tank location is important

Local codes and standards must be consulted before siting any septic system. In general, septic tanks must be located where there is no possibility of contaminating any water supply source. Because

Typical Leaching Bed Layouts



contamination can travel a long way underground and in any direction, it is imperative that a septic tank be located downhill sufficiently far from any water supply to meet local health regulations.

Do not under any circumstances locate the septic tank any closer than five feet from a building or structure; or 50 feet from any water source-well, spring, stream, river, pond or lake.

Planning and placing the leaching bed

The series of trenches which constitute the leaching bed is intended to accommodate the distribution of pipe and absorb the effluent. The trench footage required depends upon the size of the house and the soil conditions where the bed will be located.

Choice of distribution pipe is important. It must distribute the effluent evenly along the entire length of each absorption trench. The use of field tile in absorption trenches results in early distribution, while two-hole plastic pipe has the opposite effect. In each case it means that only a small area of the leaching bed is being utilised at any given time.

The use of two-hole plastic pipe and corrugated tubing also allows secondary settlement of solid content. This can result in a serious slime build up, with the eventual sealing of all pipe perforations, section by section, and finally complete immobilization of the leaching bed.

IPEX three-hole perforated pipe has been engineered to give even distribution and thus eliminate trench failure by overloading due to early (progressive failure) or late (regressive failure) distribution of effluent from the header. The spacing of the third hole is critical. Too close will result in progressive failure, too far apart the effluent will not be distributed evenly.

Locating the leaching bed

A leaching bed should not be located any closer than 10 feet from a building, structure or property boundary; 25 feet from a building or structure where the bottom of the distribution pipe is on the same level or above the level of the lowest floor in the building or structure; 50 feet from any lake, river, pond, spring, stream, reservoir or drilled well with water-tight casing to a depth of 20 feet; or 100 feet from a dug well.

In every case, it is essential to check with local authorities for verification.

Pre-testing leaching bed location

A percolation test will determine the footage of absorption trench and distribution pipe required for the leaching bed. This is how it is done:

a) Dig a hole, where the bed is to be located, between four and 12" in diameter, and as deep as the bottom of the bed.

b) Remove all loose material and smeared clay from the bottom and sides of the hole, and cover the bottom with two inches of sand or fine gravel.

c) Pour clear water into the hole to a depth of at least 12". Add more water as needed to maintain the 12" depth until the surrounding soil becomes saturated and the water being added seeps away at a constant rate.

d) Determine the average percolation time in minutes required for the water level to drop one inch.

Estimating Distribution Pipe Required

The following table indicates the minimum length of distribution pipe required for various leaching bed areas, depending on the percolation times and the number of bedrooms in the dwelling:

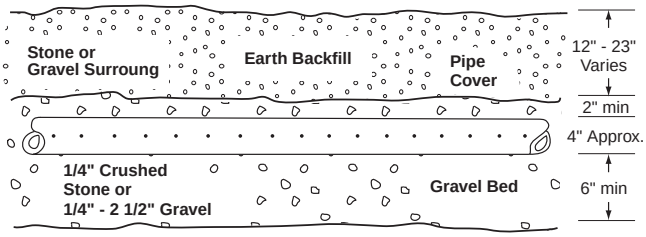
No. of Bedrooms	Percolation Time (min)	Length of Pipe (ft)
2 or less	1-5	150
3	1-5	150
4	1-5	180
2 or less	5-10	150
3	5-10	200
4	5-10	250
2 or less	10-20	180
3	10-20	300
4	10-20	350
2 or less	20-30	220
3	20-30	350
4	20-30	450
2 or less	30-40	250
3	30-40	400
4	30-40	500
2 or less	40-50	300
3	40-50	450
4	40-50	550
2 or less	50-60	350
3	50-60	500
4	50-60	650

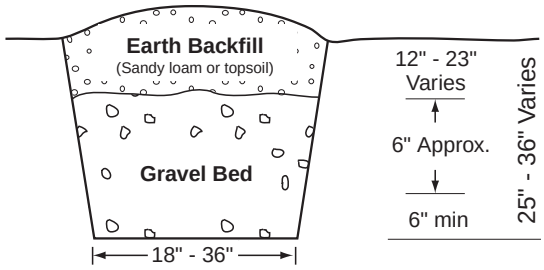
Excavating Absorption Trenches

In digging leaching bed trenches, the following rules should be observed:

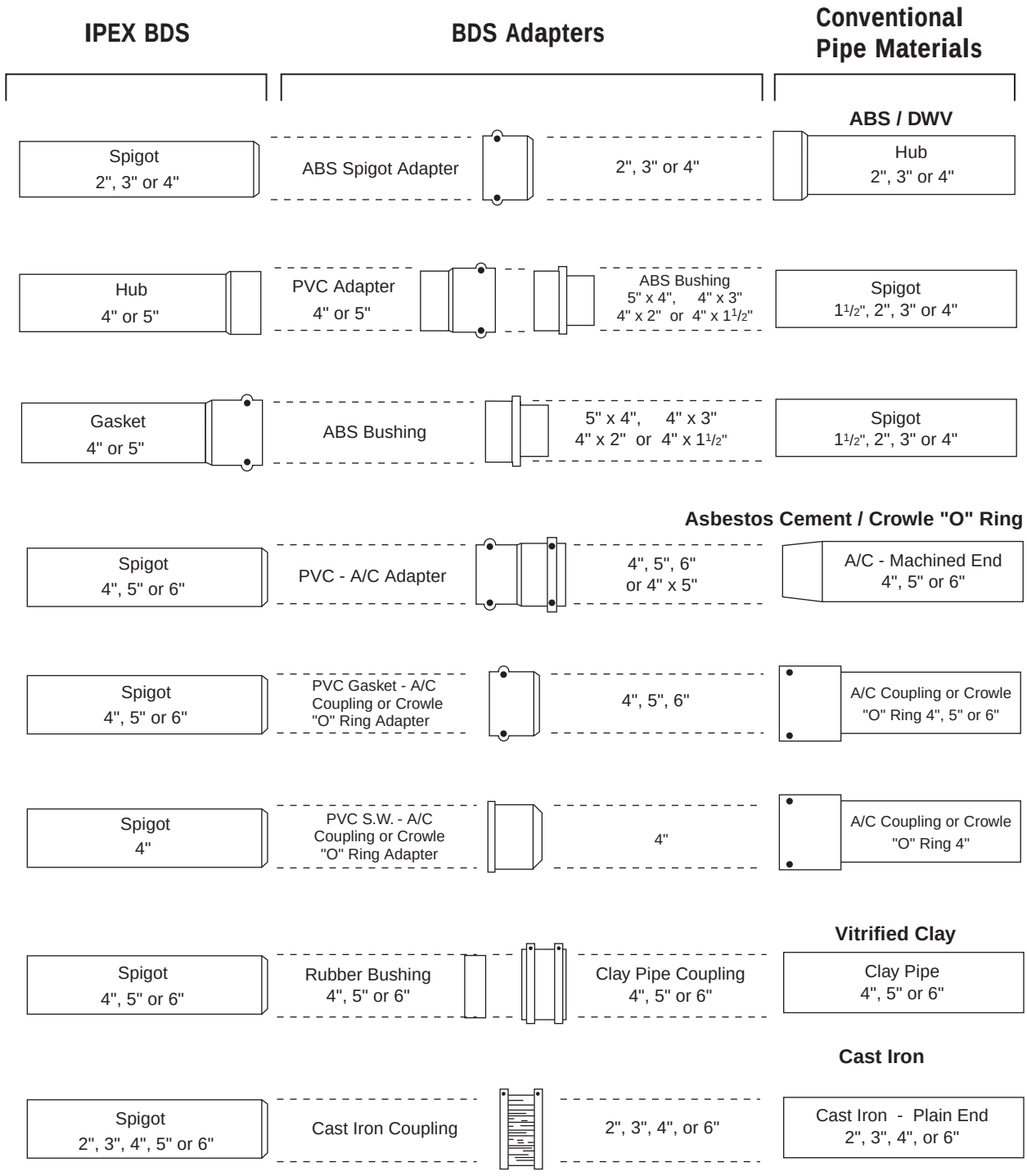
- Obtain copy of local sewage system regulations for full details on installing a septic tank system in the area.
- Make the trenches at least 18" wide and 25" to 36" deep.
- Locate distribution pipes approximately 6 feet apart.
- Provide distribution pipes with a uniform slope of not less than four inches and not more than six inches for every 100 feet of length. If a siphon or pump is used, a 3" to 4" slope will suffice.
- Fill the full width of each trench bottom with six inches of clean gravel between ¾" to 2 ½" size or crushed stone ¾" in size, free of fine material.
- When laid, cover the distribution pipes with clean, screened gravel or crushed stone to a depth of 2" above the top of the pipe.
- Lay untreated building paper, pea gravel or straw on top of the gravel covering the pipe to prevent soil from entering it.
- Backfill the distribution trenches with porous sandy loam or top soil to prevent depressions after settlement.

IPEX recommends CSA certified Pipe. The higher physical values of certified pipe as compared with non-certified pipe make the few cents per foot extra cost well worthwhile. Remember, the CSA seal is a policed specification, and your assurance of piping quality.





ADAPTER CHART TO CONVENTIONAL MATERIALS



SALES AND CUSTOMER SERVICE

Canadian Customers call IPEX Inc.
Toll Free: (866) 473-9462 (IPEX INC)
ipexna.com

About the IPEX Group of Companies

As leading suppliers of thermoplastic piping systems, the IPEX Group of Companies provides our customers with some of the largest and most comprehensive product lines. All IPEX products are backed by more than 50 years of experience. With state-of-the-art manufacturing facilities and distribution centers across North America, we have established a reputation for product innovation, quality, end-user focus and performance.

Markets served by the IPEX Group of Companies include:

- Electrical systems
- Telecommunications and utility piping systems
- Industrial process piping systems
- Municipal pressure and gravity piping systems
- Plumbing and mechanical piping systems
- PE Electrofusion systems for gas and water
- Industrial, plumbing and electrical cements
- Irrigation systems
- PVC, CPVC, PP, PVCO, ABS, PEX, FR-PVDF, NFRPP, FRPP, HDPE, PVDF and PE pipe and fittings (1/2" – 48")

Products manufactured by IPEX Inc.

IPEX

MNMEBDIP160504C