

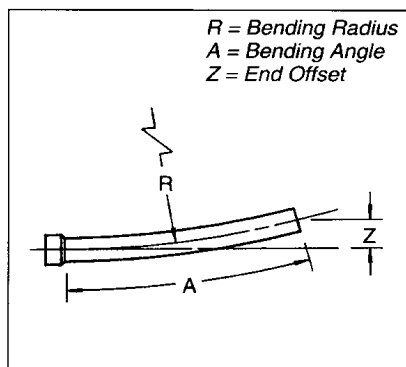
DESIGN**TB-D4**

February 2000

LONGITUDINAL BENDING OF PVC PIPE

PWPipe pipe and conduit products are made from unplasticized polyvinyl chloride (PVC) compounds, which allow these products to flex without breaking. Consequently, PWPipe pipe and conduit products can be purposely curved along their length a certain amount without adversely affecting their pressure-carrying or load-carrying ability.

Figure 1 Longitudinally Curved Pipe



Curving a pipe along its length is commonly referred to as longitudinal bending. See Figure 1 for an illustration of a pipe that has been longitudinally bent.

There are two important limitations to the longitudinal bending of PWPipe products 1) the bending stresses that are induced in the pipe due to the bending, and 2) the axial deflection of gasketed pipe joints. These limitations are discussed below.

Bending Stresses

For a pipe of a given material, the stresses that are induced in the pipe when it is bent depend upon the radius of bending curvature and the diameter of the pipe. Smaller bending radii cause greater stresses in pipe walls. Also, larger diameter pipes will be stressed more than smaller diameter pipes for a given

bending radius. Wall thickness is not a consideration for bending stresses.

PWPipe recommends the following guides for determining the minimum bending radii of our pipe and conduit products

Pressure Rated Pipe (ASTM D 1785, ASTM D 2241, AWWA C905)	200 x OD
Pressure Class Pipe (AWWA C900)	250 x OD
Non-Pressure Sewer and Drain Pipe (ASTM D 3034, ASTM D 2729, ASTM F 679)	160 x OD
Electrical Conduit and Utility Duct	160 x OD
OD = Outside Diameter of Pipe in Inches	

The minimum Bending Radius (R), and maximum End Offset (Z), for each PWPipe product can be found in the tables on the back of this sheet.

Longitudinal bending of PWPipe products by mechanical means must be controlled to prevent excessive loading and/or damage to the pipe. In many cases, bending of PVC pipe can and should be accomplished manually. Pipes with large diameters and/or thick walls may be very difficult to properly bend, so fittings may be required to achieve directional changes in these cases.

WATER / IRRIGATION PRESSURE PIPES

IPS-Sized - 20' Lengths

SIZE (in)	OD (in)	R (ft)	Z (ft)
½	0.840	14.0	17.3
¾	1.050	17.5	12.9
1	1.315	21.9	9.8
1¼	1.660	27.7	7.6
1½	1.900	31.7	6.5
2	2.375	39.6	5.2
2½	2.875	47.9	4.2
3	3.500	58.3	3.5
4	4.500	75.0	2.7
5	5.563	92.7	2.2
6	6.625	110.4	1.8
8	8.625	143.8	1.4
10	10.750	179.2	1.1
12	12.750	212.5	0.9

PIP-Sized - 20' Lengths

SIZE (in)	OD (in)	R (ft)	Z (ft)
6	6.140	102.3	2.0
8	8.160	136.0	1.5
10	10.200	170.0	1.2
12	12.240	204.0	1.0
15	15.300	255.0	0.8
18	18.701	311.7	0.6
21	22.047	367.5	0.5
24	24.803	413.4	0.5

IP-Sized - 20' Lengths

SIZE (in)	OD (in)	R (ft)	Z (ft)
18	18.360	306.0	0.7
20	20.400	340.0	0.6

C900 - 20' Lengths

SIZE (in)	OD (in)	R (ft)	Z (ft)
4	4.800	100.0	2.0
6	6.900	143.8	1.4
8	9.050	188.5	1.1
10	11.100	231.3	0.9
12	13.200	275.0	0.7

C905 - 20' Lengths

SIZE (in)	OD (in)	R (ft)	Z (ft)
14	15.300	255.0	0.8
16	17.400	290.0	0.7
18	19.500	325.0	0.6
20	21.600	360.0	0.6
24	25.800	430.0	0.5

GRAVITY SEWER PIPES

20' Lengths

SIZE (in)	OD (in)	R (ft)	Z (ft)
4	4.215	56.2	3.6
6	6.275	83.7	2.4
8	8.400	112.0	1.8
10	10.500	140.0	1.4
12	12.500	166.7	1.2
15	15.300	204.0	1.0
18	18.701	249.3	0.8
21	22.047	294.0	0.7
24	24.803	330.7	0.6

13' Lengths

SIZE (in)	OD (in)	R (ft)	Z (ft)
4	4.215	56.2	1.5
6	6.275	83.7	1.0
8	8.400	112.0	0.8
10	10.500	140.0	0.6
12	12.500	166.7	0.5
15	15.300	204.0	0.4
18	18.701	249.3	0.3
21	22.047	294.0	0.3
24	24.803	330.7	0.3

ELECTRICAL CONDUITS/DUCTS

20' Lengths

SIZE (in)	OD (in)	R (ft)	Z (ft)
½	0.840	11.2	24.8
¾	1.050	14.0	17.3
1	1.315	17.5	12.8
1¼	1.660	22.1	9.7
1½	1.900	25.3	8.3
2	2.375	31.7	6.5
2½	2.875	38.3	5.3
3	3.500	46.7	4.4
3½	4.000	53.3	3.8
4 C	4.350	58.0	3.5
4	4.500	60.0	3.4
5	5.563	74.2	2.7
6	6.625	88.3	2.3

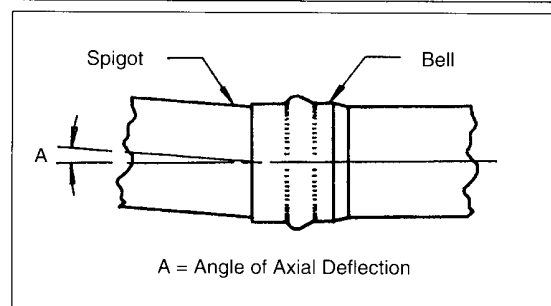
10' Lengths

SIZE (in)	OD (in)	R (ft)	Z (ft)
½	0.840	11.2	4.8
¾	1.050	14.0	3.7
1	1.315	17.5	2.9
1¼	1.660	22.1	2.3
1½	1.900	25.3	2.0
2	2.375	31.7	1.6
2½	2.875	38.3	1.3
3	3.500	46.7	1.1
3½	4.000	53.3	0.9
4C	4.350	58.0	0.9
4	4.500	60.0	0.8
5	5.563	74.2	0.7
6	6.625	88.3	0.6

Gasketed Joint Axial Deflection

PWPipe gasketed joints are not specifically designed to accommodate axial deflection.

Figure 2 Axial Deflection of Gasketed Joint



Note: Joint Deflection Shown Exaggerated For Demonstration Purposes

See Figure 2 for a diagram of axial joint deflection. PWPipe recommends for design purposes no axial gasketed joint deflection. In the field, PWPipe recommends a maximum of one degree of axial gasketed joint deflection. If greater curvature or joint deflection is desired than what is recommended, fittings should be used. There are many fittings for PVC pipe available for this purpose.

It is difficult to longitudinally bend gasketed pipe without causing axial deflection at the joints. For this reason, PWPipe gasketed pipe joints must be restrained from excessive axial deflection if the pipe is to be longitudinally bent. It is sometimes possible to accomplish this by backfilling over the joint before bending the pipe body.