ABOVE-GROUND INSTALLATION
OF THERMOPLASTIC PIPING

SUPPORT SPACING OF PLASTIC PIPE
When thermoplastic piping systems are installed above-ground, they must be properly supported to avoid unnecessary stresses and possible sagging.

Horizontal runs require the use of hangers spaced approximately as indicated in tables for individual material shown below. Note that additional support is required as temperatures increase. Continuous support can be accomplished by the use of a smooth structural angle or channel.

Where the pipe is exposed to impact damage, protective shields should be installed.

Tables are based on the maximum deflection of a uniformly loaded, continuously supported beam calculated from:

$$y = .00541 \frac{wL^4}{EI}$$

Where:

- y = Deflection or sag, in.
- w = Weight per unit length, lb./in.
- L = Support spacing, in.
- E = Modulus of elasticity at given temp. lb./in.^{2}
- I = Moment of inertia, in.^{4}

If 0.100 in. is chosen arbitrarily as the permissible sag (y) between supports, then:

$$L^4 = 18.48 \frac{EI}{W}$$

Where:
W = Weight of Pipe + Weight of Liquid, lb./in.

For a pipe $I = \frac{\pi}{64}(Do^4 - Di^4)$

Where:
Do = Outside diameter of the pipe, in.
Di = Inside diameter of the pipe, in.

Then:

$$L = .907 \frac{E}{W}(Do^4 - Di^4)^{1/4} = .976 \frac{E}{W}(Do^4 - Di^4)^{1/4}$$

Table 1

SUPPORT SPACING "L" (FT.) - PVC

TEMP °F	NOMINAL PIPE SIZE											
	1/2	3/4	1	1-1/4	1-1/2	2	3	4	6	8	10	12
SCHEDULE 40 PVC												
60	4-1/4	4-1/2	5	5-1/2	5-3/4	6-1/4	7-1/2	8-1/4	9-1/2	10-1/2	11-1/2	12-1/2
100	4	4-1/4	4-3/4	5-1/4	5-1/2	6	7	7-3/4	9	10	11	11-3/4
140	3-3/4	4	4-1/2	5	5-1/4	5-3/4	6-3/4	7-1/2	8-1/2	9-3/4	10-1/2	11-1/4
SCHEDULE 80 PVC												
60	4-1/2	4-3/4	5-1/4	5-3/4	6	6-1/2	8	8-3/4	10-1/2	11-1/2	12-3/4	14
100	4	4-1/2	5	5-1/2	5-3/4	6-1/4	7-1/2	8-1/4	10	11	12-1/4	13-1/4
140	3-3/4	4-1/4	4-3/4	5-1/4	5-1/4	6	7	8	9-1/2	10-1/2	11-1/2	12-1/2

Table 2

SUPPORT SPACING "L" (FT.) - CPVC Schedule 80

TEMP °F	NOMINAL PIPE SIZE											
	1/2	3/4	1	1-1/4	1-1/2	2	3	4	6	8	10	12
73	4	4-1/2	5	5-1/2	5-3/4	6-1/2	7-3/4	8-1/2	10-1/4	11-1/4	12-1/2	13-3/4
100	4	4-1/2	5	5-1/2	5-3/4	6-1/4	7-1/2	8-1/4	10	11	12-1/2	13-1/4
120	4	4-1/4	4-3/4	5-1/4	5-1/2	6-1/4	7-1/2	8-1/4	9-3/4	10-1/2	12	13
140	4	4-1/4	4-3/4	5-1/4	5-1/2	6	7-1/4	8	9-1/2	10-1/2	11-3/4	12-3/4
160	3-3/4	4-1/4	4-1/2	5	5-1/4	5-3/4	7	7-3/4	9-1/4	10-1/4	11-1/2	12-1/2
180	3-3/4	4	4-1/2	5	5-1/4	5-3/4	7	7-1/2	9	10-1/4	11-1/4	12-1/4
210	3-1/2	4	4-1/4	4-3/4	5	5-1/2	6-1/2	7-1/4	8-3/4	9-3/4	10-3/4	11-3/4

ABOVE-GROUND INSTALLATION

OF THERMOPLASTIC PIPING

Table 3

SUPPORT SPACING "L" (FT.) - Polypro Schedule 80

TEMP °F	NOMINAL PIPE SIZE											
	1/2	3/4	1	1-1/4	1-1/2	2	3	4	6	8	10	12
73	3-3/4	4	4-1/2	4-3/4	5	5-1/2	6-1/2	7-1/4	8-1/2	9-1/2	10-1/2	11-1/4
120	3-1/2	3-3/4	4	4-1/2	4-3/4	5	6	6-3/4	8	8-3/4	9-3/4	10-1/2
140	3	3-1/2	3-3/4	4	4-1/4	4-1/2	5-1/2	6	7-1/4	8	8-3/4	9-1/2
160	3	3	3-1/2	3-3/4	4	4-1/4	5-1/4	5-3/4	6-3/4	7-1/2	8-1/4	9
180	2-3/4	3	3-1/4	3-1/2	3-3/4	4	5	5-1/2	6-1/2	7	7-3/4	8-1/2
200	2-1/2	2-3/4	3	3-1/2	3-1/2	4	4-3/4	5-1/4	6	6-3/4	7-1/2	8
212	2-1/2	2-3/4	3	3-1/4	3-1/4	3-3/4	4-1/2	5	5-3/4	6-1/2	7-1/4	7-3/4

Support spacing subject to change with SDR piping systems and different manufacturers' resins. See manufacturers support spacing guide prior to installation.

Table 4

SUPPORT SPACING "L"(FT.) - Proline & Super Proline

PIPE SIZE (IN.)	TEMPERATURE						
	68°F/ 20°C	86°F/ 30°C	104°F/ 40°C	122°F/ 50°C	140°F/ 60°C	158°F/ 70°C	176°F/ 80°C
1/2	3.0	2.5	2.5	2.0	2.0	2.0	2.0
3/4	3.0	3.0	2.5	2.5	2.5	2.5	2.0
1	3.5	3.0	3.0	3.0	3.0	2.5	2.5
1-1/2	4.0	3.5	3.0	3.0	3.0	3.0	3.0
2	4.5	4.0	4.0	3.5	3.0	3.0	3.0
2-1/2	5.0	4.5	4.0	4.0	3.5	3.0	3.0
3	5.5	5.0	4.0	4.0	4.0	3.5	3.5
4	6.0	5.0	5.0	4.0	4.0	4.0	4.0
6	7.0	6.0	6.0	5.0	5.0	4.5	4.5
8	7.5	7.0	6.0	6.0	5.5	5.0	5.0
10	8.5	7.5	7.0	6.5	6.0	6.0	5.5
12	9.5	8.5	8.0	7.0	7.0	6.5	6.0
14	10.0	8.5	8.0	7.5	7.0	6.5	6.5
16	10.5	9.5	8.5	8.0	7.5	7.0	6.5
18	11.5	10.0	9.0	8.5	8.0	7.5	7.0
20	12.0	10.5	9.5	8.5	8.5	8.0	7.5
24	13.5	11.5	10.0	9.5	8.5	8.0	7.5

This support spacing chart shows spans for polypropylene (PP) SDR 11, PP SDR 17.6, and PVDF pipes. For PP SDR 32, multiply span times .55 for the reduced value.

The support spacing chart shown above is based on liquids with a specific gravity of 1.0. Spacing should be reduced by 10% for liquids having 1.5 specific gravity, 15% for 2.0 s.g., and 20% for 2.5 s.g.

Table 5

SUPPORT SPACING "L" (FT.) - PVDF Schedule 80

TEMP °F	NOMINAL PIPE SIZE											
	1/2	3/4	1	1-1/4	1-1/2	2	3	4	6	8	10	12
68	3-1/2	3-3/4	4-1/4	4-1/2	4-3/4	5-1/4	6-1/2	7	8-1/2	9-1/2	10-1/2	11-1/4
120	3	3-1/4	3-3/4	4	4-1/4	4-3/4	5-3/4	6-1/4	7-1/2	8-1/4	9-1/4	10
160	2-3/4	3	3-1/2	3-3/4	4	4-1/4	5-1/4	5-3/4	6-3/4	7-1/2	8-1/2	9
200	2-1/2	2-3/4	3	3-1/2	3-1/2	4	4-3/4	5-1/4	6-1/4	7	7-3/4	8-1/4
240	2-1/4	2-1/2	2-3/4	3	3-1/4	3-1/2	4-1/4	4-3/4	5-1/2	6-1/4	7	7-1/2
260	2-1/4	2-1/2	2-3/4	3	3-1/4	3-1/2	4	4-1/2	5-1/2	6	6-3/4	7-1/4
280	2	2-1/4	2-1/2	2-3/4	3	3-1/4	4	4-1/4	5-1/4	5-3/4	6-1/2	7

Support spacing subject to change with SDR piping systems and different manufacturers' resins. See manufacturers support spacing guide prior to installation.

NOTE: All tables shown are based in .100 inch SAG between supports.

CORR TECH INCORPORATED

BELOW-GROUND INSTALLATION
OF THERMOPLASTIC PIPING

WIDTH

The width of the trench should be sufficient to provide adequate room for “snaking” the pipe from side to side along the bottom, as described below, and for placing and compacting the side fills. The trench width can be held to a minimum with most pressure piping materials by joining the pipe at the sur-face and then lowering it into the trench after adequate joint strength has been obtained.

BEDDING

The bottom of the trench should provide a firm, continuous bearing surface along the entire length of the pipe run. It should be relatively smooth and free of rocks. Where hardpan, ledge rock or bounders are present, it is recommended that the trench bottom be cushioned with at least four (4) inches of sand or compacted fine-grained soils.

SNAKING

To compensate for thermal expansion and contraction, the snaking technique of offsetting the pipe with relation to the trench center line is recommended.

Example:

Snaking is particularly Important when laying small diameter pipe in hot weather. For example, a 100-foot length of PVC Type I pipe will expand or contract about ¾” for each 20°F temperature change. On a hot summer day, the direct rays of the sun on the pipe can drive the surface temperature up to 150°F. At night, the air temperature may drop to 70°F. In this hypothetical case, the pipe would undergo a temperature change of 80°F—and every 100 feet of pipe would contract 3". This degree of contraction would put such a strain on newly cemented pipe joints that a poorly made joint might pull apart.

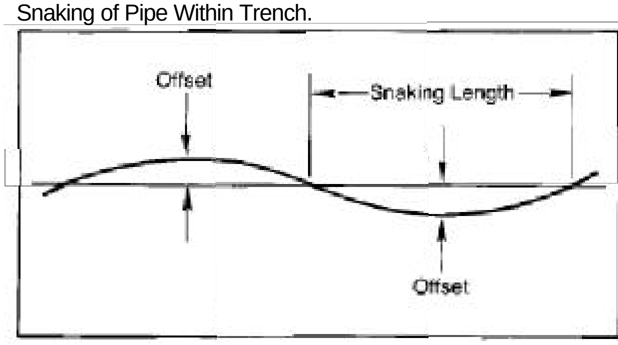
Installation:

A practical and economical method is to cement the line together at the side of the trench during the normal working day. When the newly cemented joints have dried, the pipe is snaked from one side of the trench to the other in gentle alternate curves. This added length will compensate for any con-traction after the trench is backfilled. See Figure 1.

Figure 1

The illustration shown below gives the required loop length, in feet, and offset in inches, for various temperature variations.

Snaking of Pipe Within Trench.



Snaking of thermoplastic pipe within trench to compensate for thermal expansion and contraction.

Table 1

SNAKING LENGTH VS. OFFSET (IN.) TO COMPENSATE FOR THERMAL CONTRACTION

SNAKING LENGTH (FT.)	MAXIMUM TEMPERATURE VARIATION (°F) BETWEEN TIME OF CEMENTING AND FINAL BACKFILLING									
	10°	20°	30°	40°	50°	60°	70°	80°	90°	100°
	LOOP OFFSET (IN.)									
20	2.5	3.5	4.5	5.20	5.75	6.25	6.75	7.25	7.75	8.00
50	6.5	9.0	11.0	12.75	14.25	15.50	17.00	18.00	19.25	20.25
100	13.0	18.0	22.0	26.00	29.00	31.50	35.00	37.00	40.00	42.00

DETERMINING SOIL LOADING FOR FLEXIBLE PLASTIC PIPE, SCHEDULE 80

Underground pipes are subjected to external loads caused by the weight of the backfill material and by loads applied at the surface of the fill. These can range from static to dynamic loads.

Static loads comprise the weight of the soil above the top of the pipe plus any additional material that might be stacked above ground. An important point is that the load on a flexible pipe will be less than on a rigid pipe buried in the same manner. This is because the flexible conduit transfers part of the load to the surrounding soil and not the reverse. Soil loads are minimal with narrow trenches until a pipe depth of 10 feet is attained.

Dynamic loads are loads due to moving vehicles such as trucks, trains and other heavy equipment. For shallow burial conditions live loads should be considered and added to static loads, but at depths greater than 10 feet, live loads have very little effect.

Soil load and pipe resistance for other thermoplastic piping products can be calculated using the following formula.

$$Wc' = \frac{\Delta x(EI + .061\ E'r^3)80}{r^3}$$

Wc' = Load Resistance of the Pipe, lb./ft.
Δx = Deflection in Inches @ 5%(05 x I.D.)
E = Modulus of Elasticity
t = Pipe Wall Thickness, in.
r = Mean Radius of Pipe (O.D. - t)/2
E' = Modulus of Passive Soil Resistance, psi
H = Height of Fill Above Top of Pipe, ft.
I = Moment of Inertia $\frac{t^3}{12}$

Table 2

LIVE LOAD FOR BURIED FLEXIBLE PIPE (LB/LIN.FT)

PIPE SIZE	H20 WHEEL LOADS FOR VARIOUS DEPTHS OF PIPE (LB./LIN.FT.)				
	2	4	6	8	10
2	309	82	38	18	16
3	442	118	56	32	21
4	574	154	72	42	27
6	837	224	106	61	40
8	1102	298	141	82	53
10	1361	371	176	101	66
12	1601	440	210	120	78

NOTE: H20 wheel load is 16,000 lb./wheel

BELOW-GROUND INSTALLATION

OF THERMOPLASTIC PIPING

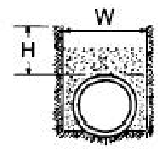
Table 3

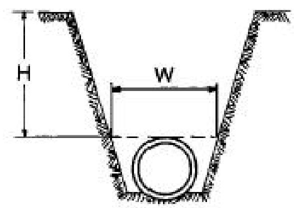
SOIL LOAD AND PIPE RESISTANCE FOR FLEXIBLE THERMOPLASTIC PIPE
PVC Schedule 40 and 80 Pipe

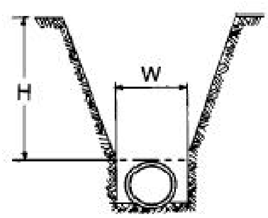
NOM. SIZE (IN.)	Wc' = LOAD RESISTANCE OF PIPE (LB./FT.) SCHEDULE 40 PIPE		SCHEDULE 80 PIPE		H (FT)	Wc = SOIL LOADS AT VARIOUS TRENCH WIDTHS AT TOP OF PIPE (LB./FT.)			
	E'=200	E'=700	E'=200	E'=700		2 FT	3 FT	4 FT	5 FT
1-1/2	1084	1282	2809	2993	10	106	125	136	152
					20	138	182	212	233
					30	144	207	254	314
					40	—	214	269	318
2	879	1130	2344	2591	10	132	156	170	190
					20	172	227	265	291
					30	180	259	317	392
					40	—	267	337	398
2-1/2	1344	1647	3218	3502	10	160	191	210	230
					20	204	273	321	352
					30	216	306	377	474
					40	—	323	408	482
3	1126	1500	2818	3173	10	196	231	252	280
					20	256	336	392	429
					30	266	266	384	469
					40	—	394	497	586
3-1/2	1021	1453	2591	3002	10	223	266	293	320
					20	284	380	446	490
					30	300	426	524	660
					40	—	450	568	670
4	969	1459	2456	2922	10	252	297	324	360
					20	328	432	540	551
					30	342	493	603	743
					40	—	506	639	754
5	896	1511	2272	2861	10	310	370	407	445
					20	396	529	621	681
					30	417	592	730	918
					40	—	625	790	932
6	880	1620	2469	3173	10	371	437	477	530
					20	484	636	742	812
					30	503	725	888	1093
					40	—	745	941	1110
8	911	1885	2360	3290	10	483	569	621	690
					20	630	828	966	1067
					30	656	945	1156	1423
					40	—	970	1225	1445
10	976	2198	2597	3764	10	602	710	774	860
					20	785	1032	1204	1317
					30	817	1177	1405	1774
					40	—	1209	1527	1801
12	1058	2515	2909	4298	10	714	942	919	1020
					20	931	1225	1429	1562
					30	969	1397	1709	2104
					40	—	1434	1811	2136

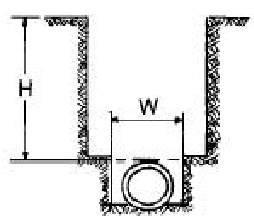
NOTE 1: Figures are calculated from minimum soil resistance values (E' = 200 psi for uncompacted sandy clay loam) and compacted soil (E' = 700 for side-fill that is compacted to 90% or more of Proctor Density for distance of two pipe diameters on each side of the pipe). If Wc' is less than Wc at a given trench depth and width, then soil compaction will be necessary.

NOTE 2: These are soil loads only and do not include live loads.









Note: H = Height of fill above top of pipe, ft.
W = Trench width at top of pipe, ft.

HEAVY TRAFFIC

When plastic pipe is installed beneath streets, railroads, or other surfaces that are subjected to heavy traffic and resulting shock and vibration, it should be run within a protective metal or concrete casing.