



FUTURE PIPE INDUSTRIES

**Wavistrong™ Engineering guide summary
(US-inch units)**

Epoxy pipe systems

Future Pipe Industries, Inc.
Gulfport, MS

www.futurepipe.com/usa

07 - 2006

Table II-b GRE pipe data for EST series (US-inch units)

Total wall thickness = Reinforced wall + Reinforced liner (20 mil) + exterior resin rich layer (12 mil)

Series	Nominal inner diameter	Actual inner diameter	Reinforced wall thickness	Linear mass of the pipe	Structural wall area	Linear moment of inertia	Bore area
PN	ND	ID	T _E	G _B	A	I _z	A _B
	inch	inch	inch	lb/foot	inch ²	inch ⁴	inch ²
EST 8 (115 psig)	14	13.8	0.11	5.0	4.82	117.0	149.1
	16	15.7	0.13	6.3	6.29	199.4	194.8
	18	17.8	0.14	7.8	7.97	319.1	247.6
	20	19.8	0.16	9.5	9.84	486.1	308.0
	24	23.8	0.19	13.2	14.17	1,006.9	444.1
	28	27.6	0.22	17.6	19.27	1,864.1	596.5
	30	29.5	0.24	20.1	22.12	2,455.8	684.8
	32	31.5	0.26	23.0	25.56	3,229.2	779.1
	36	35.4	0.29	28.7	32.29	5,161.4	986.1
	40	39.4	0.32	35.0	39.8	7,853.1	1217.4
	48	47.2	0.38	49.6	57.18	16,241.8	1753.0
	56	55.1	0.44	66.6	77.72	30,033.9	2386.0
EST 12.5 (175 psig)	10	9.8	0.10	3.3	3.08	38.4	76.09
	12	11.8	0.12	4.5	4.45	79.5	109.6
	14	13.8	0.14	6.0	6.05	147.1	149.1
	16	15.7	0.16	7.6	7.89	250.7	194.8
	18	17.8	0.18	9.4	9.98	401.3	247.6
	20	19.8	0.20	11.6	12.57	623.8	308.0
	24	23.8	0.24	16.3	18.03	1,287.9	444.1
	28	27.6	0.28	21.8	24.47	2,378.5	596.5
	30	29.5	0.30	24.8	28.07	3,130.5	684.8
	32	31.5	0.32	28.0	31.91	4,048.2	779.1
	36	35.4	0.36	35.1	40.33	6,472.6	986.1
	40	39.4	0.40	42.9	49.72	9,850.8	1217.4

Table II-b GRE pipe data for EST series (US-inch units)

Total wall thickness = Reinforced wall + Reinforced liner (20 mil) + exterior resin rich layer (12 mil)

Series	Nominal inner diameter	Actual inner diameter	Reinforced wall thickness	Linear mass of the pipe	Structural wall area	Linear moment of inertia	Bore area
PN	ND	ID	T _E	G _B	A	I _z	A _B
	inch	inch	inch	lb/foot	inch ²	inch ⁴	inch ²
EST 16 (225 psig)	8	7.9	0.10	2.6	2.48	19.9	48.7
	10	9.8	0.13	4.0	3.97	49.6	76.1
	12	11.8	0.15	5.4	5.64	101.5	109.6
	14	13.8	0.17	7.2	7.61	186.4	149.1
	16	15.7	0.20	9.3	10.09	322.3	194.8
	18	17.8	0.22	11.5	12.68	512.3	247.6
	20	19.8	0.25	14.0	15.56	776.1	308.0
	24	23.9	0.30	19.9	22.52	1,616.6	450.0
	28	27.6	0.35	26.8	30.77	3,004.5	596.5
	30	29.5	0.37	30.5	35.19	3,942.9	684.8
32	31.5	0.40	34.5	39.9	5,085.5	779.1	
EST 20 (300 psig)	6	5.9	0.094	1.9	1.8	8.2	27.4
	8	7.9	0.13	3.3	3.29	26.6	48.7
	10	9.8	0.16	4.9	5.1	64.2	76.1
	12	11.8	0.19	6.8	7.3	132.4	109.6
	14	13.8	0.22	9.1	9.9	244.1	149.1
	16	15.7	0.26	11.6	12.9	415.1	194.8
	18	17.8	0.29	14.5	16.29	663.1	247.6
	20	19.8	0.32	17.6	20.09	1,008.6	308.0
24	23.9	0.39	25.2	29.16	2,107.5	450.0	

Table II-b GRE pipe data for EST series (US-inch units)

Total wall thickness = Reinforced wall + Reinforced liner (20 mil) + exterior resin rich layer (12 mil)

Series	Nominal inner diameter	Actual inner diameter	Reinforced wall thickness	Linear mass of the pipe	Structural wall area	Linear moment of inertia	Bore area
PN	ND	ID	T _E	G _B	A	I _z	A _B
	inch	inch	inch	lb/foot	inch ²	inch ⁴	inch ²
EST 25 (350 psig)	4	3.9	0.094	1.3	1.21	2.5	12.2
	6	5.9	0.12	2.3	2.33	10.7	27.4
	8	7.9	0.16	3.9	4.09	33.4	48.7
	10	9.8	0.20	5.9	6.36	80.9	76.1
	12	11.8	0.24	8.3	9.13	166.8	109.6
	14	13.8	0.28	11.0	12.38	307.7	149.1
	16	15.7	0.32	14.4	16.34	530.3	194.8
	18	17.8	0.36	17.9	20.62	846.3	247.6
	20	19.8	0.40	21.9	25.39	1,286.1	308.0
24	23.8	0.48	31.1	36.43	2,655.0	444.1	
EST 32 (450 psig)	3	3.1	0.094	1.0	0.98	1.3	7.8
	4	3.9	0.10	1.3	1.32	2.7	12.2
	6	5.9	0.15	2.8	2.87	13.3	27.4
	8	7.9	0.20	4.8	5.12	42.1	48.7
	10	9.8	0.25	7.2	8.03	103	76.1
	12	11.8	0.30	10.2	11.58	213.8	109.6
	14	13.8	0.35	13.8	15.78	396.4	149.1
16	15.7	0.41	17.8	20.63	676.6	194.8	
EST 40 (575 psig)	2	2.0	0.071	0.5	0.47	0.2	3.0
	3	3.1	0.10	1.1	1.05	1.4	7.8
	4	3.9	0.13	1.7	1.67	3.5	12.2
	6	5.9	0.20	3.6	3.8	17.9	27.4
	8	7.9	0.26	6.0	6.67	55.8	48.7
	10	9.8	0.33	9.2	10.48	136.7	76.1
	12	11.8	0.39	12.9	14.99	281	109.6
	14	13.8	0.46	17.5	20.48	522.2	149.1
16	15.7	0.52	22.6	26.63	885.9	194.8	

Table II-b GRE pipe data for EST series (US-inch units)

Total wall thickness = Reinforced wall + Reinforced liner (20 mil) + exterior resin rich layer (12 mil)

Series	Nominal inner diameter	Actual inner diameter	Reinforced wall thickness	Linear mass of the pipe	Structural wall area	Linear moment of inertia	Bore area
PN	ND	ID	T _E	G _B	A	I _z	A _B
	inch	inch	inch	lb/foot	inch ²	inch ⁴	inch ²
EST 50 (725 psig)	1	1.0	0.071	0.3	0.25	0.00	0.8
	1.5	1.6	0.071	0.4	0.37	0.1	1.9
	2	2.0	0.08	0.6	0.54	0.3	3.0
	3	3.1	0.13	1.3	1.35	1.9	7.8
	4	3.9	0.17	2.1	2.15	4.6	12.2
	6	5.9	0.25	4.4	4.82	23.2	27.4
	8	7.9	0.33	7.4	8.46	71.9	48.7
	10	9.8	0.41	11.4	13.24	175.5	76.1
	12	11.8	0.49	16.2	19.08	363.9	109.6
	14	13.8	0.57	21.9	25.99	674.2	149.1
16	15.7	0.66	28.5	33.96	1,150.1	194.8	

Table II-b GRE Pipe data for series EST (Metric units)

Total wall thickness = Reinforced wall + Reinforced liner (0.5 mm) + exterior resin rich layer (0.3 mm)

Series	Inner diameter	Reinforced wall thickness	Linear mass of the pipe	Structural wall area	Linear moment of inertia	Radius of inertia	Bore area	Moment of resistance to bending
PN	ID (mm)	T _E (mm)	G _B (kg-/m)	A *10 ² (mm ²)	I _Z *10 ⁴ (mm ⁴)	I _R *10 (mm)	A _B *10 ² (mm ²)	W _B *10 ³ (mm ³)
EST 8 (115 psig)	350	2.8	7.4	31.1	4,870	12.5	962.1	273.1
	400	3.2	9.4	40.6	8,299	14.3	1256.6	407.4
	451	3.6	11.6	51.4	13,282	16.1	1597.5	579.8
	503	4	14.1	63.5	20,231	17.9	1987.1	794.9
	604	4.8	19.7	91.4	41,910	21.4	2865.3	1372.7
	700	5.6	26.3	124.3	77,588	25	3848.4	2178.8
	750	6	29.9	142.7	102,218	26.8	4417.9	2679.4
	800	6.5	34.3	164.9	134,409	28.6	5026.5	3302.4
	900	7.3	42.8	208.3	214,832	32.1	6361.7	4692.7
	1000	8.1	52.2	256.8	326,870	35.7	7854.0	6426.9
	1200	9.7	73.9	368.9	676,035	42.8	11309.7	11078.9
1400	11.3	99.3	501.4	1,250,107	49.9	15393.8	17562.6	
EST 12.5 (175 psig)	250	2.5	4.9	19.9	1,600	9	490.9	125
	300	3	6.7	28.7	3,310	10.7	706.9	215.6
	350	3.5	8.9	39	6,124	12.5	962.1	342.1
	400	4	11.3	50.9	10,436	14.3	1256.6	510.3
	451	4.5	14	64.4	16,702	16.1	1597.5	726.2
	503	5.1	17.3	81.1	25,965	17.9	1987.1	1015.8
	604	6.1	24.3	116.3	53,606	21.5	2865.3	1748.4
	700	7.1	32.5	157.9	99,002	25	3848.4	2768.5
	750	7.6	37	181.1	130,303	26.8	4417.9	3401.3
	800	8.1	41.8	205.9	168,498	28.6	5026.5	4123.8
	900	9.1	52.4	260.2	269,409	32.2	6361.7	5861.8
1000	10.1	64	320.8	410,022	35.7	7854.0	8030.2	

Table II-b GRE Pipe data for series EST (Metric units)

Total wall thickness = Reinforced wall + Reinforced liner (0.5 mm) + exterior resin rich layer (0.3 mm)

Series	Inner diameter	Reinforced wall thickness	Linear mass of the pipe	Structural wall area	Linear moment of inertia	Radius of inertia	Bore area	Moment of resistance to bending
PN	ID (mm)	T _E (mm)	G _B (kg-/m)	A *10 ² (mm ²)	I _Z *10 ⁴ (mm ⁴)	I _R *10 (mm)	A _B *10 ² (mm ²)	W _B *10 ³ (mm ³)
EST 16 (225 psig)	200	2.5	3.9	16	828	7.2	314.2	80.3
	250	3.2	5.9	25.6	2,065	9	490.9	160.4
	300	3.8	8.1	36.4	4,226	10.8	706.9	273.9
	350	4.4	10.7	49.1	7,758	12.6	962.1	431.2
	400	5.1	13.9	65.1	13,415	14.4	1256.6	652.5
	451	5.7	17.2	81.8	21,325	16.1	1597.5	922.4
	503	6.3	20.9	100.4	32,304	17.9	1987.1	1258
	604	7.6	29.7	145.3	67,288	21.5	2865.3	2184
	700	8.9	40	198.5	125,058	25.1	3848.4	3479.6
	750	9.5	45.5	227	164,115	26.9	4417.9	4262.7
800	10.1	51.4	257.4	211,676	28.7	5026.5	5155.3	
EST 20 (300 psig)	150	2.4	2.8	11.6	340	5.4	176.7	43.7
	200	3.3	4.9	21.2	1,105	7.2	314.2	106.5
	250	4.1	7.3	32.9	2,674	9	490.9	206.3
	300	4.9	10.1	47.1	5,509	10.8	706.9	354.5
	350	5.7	13.5	63.9	10,161	12.6	962.1	560.8
	400	6.5	17.3	83.2	17,277	14.4	1256.6	834.6
	451	7.3	21.6	105.1	27,602	16.2	1597.5	1185.7
	503	8.1	26.3	129.6	41,982	18	1987.1	1623.4
604	9.8	37.6	188.1	87,719	21.6	2865.3	2826.9	
EST 25 (350 psig)	100	2.4	1.9	7.8	104	3.7	78.5	19.7
	150	3.1	3.5	15	446	5.4	176.7	56.7
	200	4.1	5.8	26.4	1,390	7.3	314.2	132.9
	250	5.1	8.8	41	3,365	9.1	490.9	257.7
	300	6.1	12.3	58.9	6,941	10.9	706.9	443.2
	350	7.1	16.4	79.9	12,809	12.7	962.1	701.5
	400	8.2	21.4	105.4	22,073	14.5	1256.6	1057.6
	451	9.2	26.7	133	35,226	16.3	1597.5	1500.9
	503	10.2	32.7	163.8	53,531	18.1	1987.1	2053.4
	604	12.2	46.3	235	110,509	21.7	2865.3	3534

Table II-b GRE Pipe data for series EST (Metric units)

Total wall thickness = Reinforced wall + Reinforced liner (0.5 mm) + exterior resin rich layer (0.3 mm)

Series	Inner diameter	Reinforced wall thickness	Linear mass of the pipe	Structural wall area	Linear moment of inertia	Radius of inertia	Bore area	Moment of resistance to bending
PN	ID (mm)	T _E (mm)	G _B (kg-/m)	A *10 ² (mm ²)	I _Z *10 ⁴ (mm ⁴)	I _R *10 (mm)	A _B *10 ² (mm ²)	W _B *10 ³ (mm ³)
EST 32 (450 psig)	80	2.4	1.5	6.3	55	2.9	50.3	12.8
	100	2.6	2	8.5	114	3.7	78.5	21.4
	150	3.8	4.1	18.5	554	5.5	176.7	69.8
	200	5.1	7.1	33	1,754	7.3	314.2	166.1
	250	6.4	10.8	51.8	4,289	9.1	490.9	325.2
	300	7.7	15.2	74.7	8,901	10.9	706.9	562.6
	350	9	20.5	101.8	16,500	12.7	962.1	894.3
	400	10.3	26.5	133.1	28,161	14.7	1256.6	1335.9
EST 40 (575 psig)	50	1.8	0.8	3	10	1.9	19.6	3.8
	80	2.6	1.6	6.8	60	3	50.3	13.9
	100	3.3	2.5	10.8	147	3.7	78.5	27.4
	150	5	5.3	24.5	746	5.5	176.7	92.7
	200	6.6	8.9	43	2,321	7.3	314.2	216.7
	250	8.3	13.7	67.6	5,688	9.2	490.9	425.1
	300	9.9	19.3	96.7	11,695	11	706.9	729.1
	350	11.6	26.1	132.1	21,737	12.8	962.1	1161.9
400	13.2	33.7	171.8	36,873	14.7	1256.6	1725.4	
EST 50 (725 psig)	25	1.8	0.4	1.6	2	1	4.9	1
	40	1.8	0.6	2.4	6	1.5	12.6	2.5
	50	2.1	0.9	3.5	12	1.9	19.6	4.5
	80	3.3	2	8.7	78	3	50.3	17.8
	100	4.2	3.1	13.9	192	3.7	78.5	35.2
	150	6.3	6.5	31.1	965	5.6	176.7	117.9
	200	8.3	11.1	54.6	2,993	7.4	314.2	275.1
	250	10.4	17	85.4	7,306	9.2	490.9	537.6
	300	12.5	24.2	123.1	15,149	11.1	706.9	929.4
	350	14.6	32.7	167.7	28,062	12.9	962.1	1476.2
400	16.7	42.5	219.1	47,870	14.8	1256.6	2204	

Table II-h Hydrostatic properties

Property	Test method	Winding angle (ω)				Winding angle (ω)			
		55°	63°	73°		55°	63°	73°	
Bi-axial: (R = 0.5)									
Ultimate hoop stress (rupture)		650	500	-	N/mm ²	psi	94,276	72,520	-
Ultimate hoop stress (weeping)	ASTM D 1599	250	200	-	N/mm ²	psi	36,260	29,008	-
Ultimate Elastic Wall Stress (UEWS)	FPI	160	140	-	N/mm ²	psi	23,206	20,306	-
Hydrostatic Design Basis HDB (50 years)	ASTM D 2992 B	125	100	-	N/mm ²	psi	18,130	14,504	-
Hydrostatic Design Stress HDS (50 years)	ASTM D 2992 B	63	50	-	N/mm ²	psi	9,138	7,252	-
Uni-axial: (R = 0.25)									
Ultimate hoop stress (rupture)	ASTM D 2992 B	-	1000	800	N/mm ²	psi	-	145,040	116,032
Ultimate hoop stress (weeping)	ASTM D 1599	-	450	370	N/mm ²	psi	-	65,268	53,665
Hydrostatic Design Basis HDB (50 years)	ASTM D 2992 B	-	200	160	N/mm ²	psi	-	29,008	23,206
Hydrostatic Design Stress HDS (50 years) HDS = HDB * Sf	ASTM D 2992 B	-	80	100	N/mm ²	psi	-	11,603	14,504
☒ Maximum service (design) factor S _f = 0.5.									
Volumetric E-modulus E _v (N/mm ²)		22,775	24,515	26,965	N/mm ²	psi	3,303,286	3,555,656	3,911,004

Table II-j Mechanical properties

Property		Test Method	Winding angle (ω)			
			55°	63°	73°	
Axial tensile stress	E _x	ASTM D 2105	75	55	40	N/mm ²
		ASTM D 2105	10,878	7,977	5,802	psi
Axial tensile modulus		ASTM D 2105	12,000	11,500	11,500	N/mm ²
		ASTM D 2105	1,740,480	1,667,960	1,667,960	psi
Hoop tensile stress		ASTM D 2290	210	260	400	N/mm ²
		ASTM D 2290	30,458	37,710	58,016	psi
Hoop tensile modulus		ASTM D 2290	20,500	27,500	37,000	N/mm ²
		ASTM D 2290	2,973,320	3,988,600	5,366,480	psi
Shear modulus	E _s		11,500	9,500	7,000	N/mm ²
			1,667,960	1,377,880	1,015,280	psi
Axial bending stress			80	65	50	N/mm ²
			11,603	9,428	7,252	psi

Property		Test Method	Winding angle (ω)			
			55°	63°	73°	
Axial bending modulus	E_x	ASTM D 2925	12,000	11,500	11,500	N/mm ²
		ASTM D 2925	1,740,480	1,667,960	1,667,960	psi
Hoop bending stress		ASTM D2412	90	120	160	N/mm2
		ASTM D2412	13,054	17,405	23,206	psi
Hoop bending (flexural) modulus	E_H	ASTM D2412	20,500	27,500	37,000	N/mm2
		ASTM D2412	2,973,320	3,988,600	5,366,480	psi
Poissons ratio axial/hoop	N_{xy}		0.65	0.62	0.47	
Possons ratio hoop/axial	N_{yx}		0.38	0.26	0.15	

Table II-k Temperature correction factor R_E for Moduli of elasticity

Correction Factor $R_E (-)$		Winding Angle (ω)	Temperature $(^{\circ} F)$						
R_E - Axial	R_E - Hoop		68	104	140	176	212	230	
R_{E1}		55°	1	0.92	0.82	0.72	0.60	0.53	
R_{E2}		63°	1	0.92	0.82	0.72	0.60	0.53	
R_{E3}		73°	1	0.92	0.82	0.72	0.60	0.53	
		R_{E4}	55°	1	0.95	0.90	0.83	0.75	0.70
		R_{E5}	63°	1	0.97	0.94	0.90	0.85	0.82
		R_{E6}	73°	1	0.99	0.98	0.97	0.95	0.94

Correction Factor $R_E (-)$		Winding Angle (ω)	Temperature $(^{\circ} C)$						
R_E - Axial	R_E - Hoop		20	40	60	80	100	110	
R_{E1}		55°	1	0.92	0.82	0.72	0.60	0.53	
R_{E2}		63°	1	0.92	0.82	0.72	0.60	0.53	
R_{E3}		73°	1	0.92	0.82	0.72	0.60	0.53	
		R_{E4}	55°	1	0.95	0.90	0.83	0.75	0.70
		R_{E5}	63°	1	0.97	0.94	0.90	0.85	0.82
		R_{E6}	73°	1	0.99	0.98	0.97	0.95	0.94

Table II-L Physical properties

Property		Test method		
Coefficient of linear thermal expansion	Υ_L	ASTM D 696	$2 * 10^{-5}$	mm/mm-°C
			$1.11 * 10^{-5}$	in/in - °F
Thermal conductivity			0.29	W/m.K
			0.168	BTU/Hr Ft F
Specific heat			921	J/kg.K
			0.220	BTU/lb F
Glass content (by mass)		ASTM D 2584	70 +/- 5	%
Glass content (by volume)		ASTM D 2584	52 +/- 7	%
Specific gravity (density) of the laminate	S_L		1850	kg/m ³
			115.5	lbs/ft ³
Barcol hardness		ASTM D 2583	35	-
Hazen Williams 'C' factor			150	
Wall roughness	k		0.01 - 0.02	
Surface resistance (Series C..)		ASTM D 257	$< 10 * 10^6$	Ω/m

Table II- Allowable axial stress S_{XT} , psi

	Winding angle (ω)		
R (-)	55°	63°	73°
0.25	-	4642	3626
0.5	5802	4642	-

R = Axial stress / Hopp stress

Table II-n Bending radius R_b (m) at 20°C for series EST

Table II-n Bending radius R_b (feet) at 68°F for series EST

Series	ID (mm)	Operating pressure (P)						Series	ND inch	Operating pressure (P)					
		1 * P _N	0.8 * P _N	0.6 * P _N	0.4 * P _N	0.2 * P _N	0 * P _N			1 * P _N	0.8 * P _N	0.6 * P _N	0.4 * P _N	0.2 * P _N	0 * P _N
EST 8	350	297	170	120	92	75	63	115 psig	14	974.4	557.7	393.7	301.8	246.1	206.7
	400	339	195	137	105	86	72		16	1,112.2	639.8	449.5	344.5	282.1	236.2
	450	381	219	154	118	96	81		18	1,250.0	718.5	505.2	387.1	315.0	265.7
	500	424	243	171	131	107	90		20	1,391.1	797.2	561.0	429.8	351.0	295.3
	600	508	292	205	158	128	108		24	1,666.6	958.0	672.6	518.4	419.9	354.3
	700	593	340	239	184	150	126		28	1,945.5	1,115.5	784.1	603.7	492.1	413.4
	750	635	365	256	197	160	135		30	2,083.3	1,197.5	839.9	646.3	524.9	442.9
	800	641	379	269	209	170	144		32	2,103.0	1,243.4	882.5	685.7	557.7	472.4
	900	725	428	303	235	192	162		36	2,378.6	1,404.2	994.1	771.0	629.9	531.5
	1000	810	476	337	261	213	180		40	2,657.4	1,561.7	1,105.6	856.3	698.8	590.5
	1200	978	573	405	314	256	216		48	3,208.6	1,879.9	1,328.7	1,030.2	839.9	708.7
	1400	1147	670	474	366	298	252		56	3,763.1	2,198.1	1,555.1	1,200.8	977.7	826.8
	1600	1316	767	542	418	341	288		64	4,317.5	2,516.4	1,778.2	1,371.4	1,118.8	944.9
EST 12.5	250	178	102	72	55	45	38	175 psig	10	584.0	334.6	236.2	180.4	147.6	124.7
	300	214	122	86	66	54	45		12	702.1	400.3	282.1	216.5	177.2	147.6
	350	250	143	100	77	63	53		14	820.2	469.2	328.1	252.6	206.7	173.9
	400	285	163	114	88	71	60		16	935.0	534.8	374.0	288.7	232.9	196.8
	450	321	183	128	99	80	68		18	1,053.1	600.4	419.9	324.8	262.5	223.1
	500	332	197	140	109	89	75		20	1,089.2	646.3	459.3	357.6	292.0	246.1
	600	403	238	169	131	107	90		24	1,322.2	780.8	554.5	429.8	351.0	295.3
	700	474	279	197	153	125	105		28	1,555.1	915.3	646.3	502.0	410.1	344.5
	750	509	299	211	164	133	113		30	1,669.9	981.0	692.2	538.1	436.3	370.7
	800	545	319	226	175	142	120		32	1,788.0	1,046.6	741.5	574.1	465.9	393.7
	900	616	360	254	196	160	135		36	2,021.0	1,181.1	833.3	643.0	524.9	442.9
1000	687	400	283	218	178	150	40	2,253.9	1,312.3	928.5	715.2	584.0	492.1		
EST 16	200	159	86	59	45	36	30	225 psig	8	521.6	282.1	193.6	147.6	118.1	98.4
	250	180	103	72	55	45	38		10	590.5	337.9	236.2	180.4	147.6	124.7
	300	225	125	87	66	54	45		12	738.2	410.1	285.4	216.5	177.2	147.6
	350	271	148	102	78	63	53		14	889.1	485.6	334.6	255.9	206.7	173.9
	400	292	165	115	88	72	60		16	958.0	541.3	377.3	288.7	236.2	196.8
	450	337	188	130	99	81	68		18	1,105.6	616.8	426.5	324.8	265.7	223.1
	500	383	210	145	111	90	75		20	1,256.5	689.0	475.7	364.2	295.3	246.1
	600	450	250	173	133	107	90		24	1,476.4	820.2	567.6	436.3	351.0	295.3
	700	517	290	201	154	125	105		28	1,696.2	951.4	659.4	505.2	410.1	344.5
	750	562	313	217	166	134	113		30	1,843.8	1,026.9	711.9	544.6	439.6	370.7
	800	607	335	232	177	143	120		32	1,991.4	1,099.1	761.1	580.7	469.2	393.7

Table II-n Bending radius R_b (m) at 20°C for series EST

Table II-n Bending radius R_b (feet) at 68°F for series EST

Series	ID (mm)	Operating pressure (P)						Series	ND inch	Operating pressure (P)					
		1 * P _N	0.8 * P _N	0.6 * P _N	0.4 * P _N	0.2 * P _N	0 * P _N			1 * P _N	0.8 * P _N	0.6 * P _N	0.4 * P _N	0.2 * P _N	0 * P _N
EST 20	150	110	62	43	33	27	23	300 psig	6	360.9	203.4	141.1	108.3	88.6	75.5
	200	131	79	56	44	36	30		8	429.8	259.2	183.7	144.4	118.1	98.4
	250	167	99	70	55	45	38		10	547.9	324.8	229.7	180.4	147.6	124.7
	300	203	120	85	66	53	45		12	666.0	393.7	278.9	216.5	173.9	147.6
	350	239	140	99	77	62	53		14	784.1	459.3	324.8	252.6	203.4	173.9
	400	276	161	113	88	71	60		16	905.5	528.2	370.7	288.7	232.9	196.8
	450	312	181	128	99	80	68		18	1,023.6	593.8	419.9	324.8	262.5	223.1
	500	348	202	142	109	89	75		20	1,141.7	662.7	465.9	357.6	292.0	246.1
	600	406	239	169	131	107	90	24	1,332.0	784.1	554.5	429.8	351.0	295.3	
EST 25		1 * P _N	0.8 * P _N	0.6 * P _N	0.4 * P _N	0.2 * P _N	0 * P _N	350 psig		1 * P _N	0.8 * P _N	0.6 * P _N	0.4 * P _N	0.2 * P _N	0 * P _N
	150	99	59	42	33	27	23		6	324.8	193.6	137.8	108.3	88.6	75.5
	200	136	80	57	44	36	30		8	446.2	262.5	187.0	144.4	118.1	98.4
	250	172	100	71	55	45	38		10	564.3	328.1	232.9	180.4	147.6	124.7
	300	209	121	85	66	54	45		12	685.7	397.0	278.9	216.5	177.2	147.6
	350	246	142	100	77	62	53		14	807.1	465.9	328.1	252.6	203.4	173.9
	400	271	159	113	87	71	60		16	889.1	521.6	370.7	285.4	232.9	196.8
	450	307	180	127	98	80	68		18	1,007.2	590.5	416.7	321.5	262.5	223.1
	500	344	201	142	109	89	75	20	1,128.6	659.4	465.9	357.6	292.0	246.1	
	600	417	242	170	131	107	90	24	1,368.1	794.0	557.7	429.8	351.0	295.3	
EST 32	80	39	27	21	17	14	12	450 psig	3	128.0	88.6	68.9	55.8	45.9	39.4
	100	72	41	29	22	18	15		4	236.2	134.5	95.1	72.2	59.1	49.2
	150	119	64	44	33	27	23		6	390.4	210.0	144.4	108.3	88.6	75.5
	200	154	85	58	44	36	30		8	505.2	278.9	190.3	144.4	118.1	98.4
	250	189	105	73	55	45	38		10	620.1	344.5	239.5	180.4	147.6	124.7
	300	225	125	87	66	54	45		12	738.2	410.1	285.4	216.5	177.2	147.6
	350	260	146	101	77	63	53		14	853.0	479.0	331.4	252.6	206.7	173.9
	400	296	166	115	88	72	60		16	971.1	544.6	377.3	288.7	236.2	196.8
EST 40	50	27	18	13	11	9	8	575 psig	2	88.6	59.1	42.7	36.1	29.5	26.2
	80	59	33	23	18	14	12		3	193.6	108.3	75.5	59.1	45.9	39.4
	100	70	41	29	22	18	15		4	229.7	134.5	95.1	72.2	59.1	49.2
	150	101	60	42	33	27	23		6	331.4	196.8	137.8	108.3	88.6	75.5
	200	139	81	57	44	36	30		8	456.0	265.7	187.0	144.4	118.1	98.4
	250	170	100	71	55	45	38		10	557.7	328.1	232.9	180.4	147.6	124.7
	300	208	121	85	66	54	45		12	682.4	397.0	278.9	216.5	177.2	147.6
	350	239	140	99	76	62	53		14	784.1	459.3	324.8	249.3	203.4	173.9
	400	277	161	113	88	71	60	16	908.8	528.2	370.7	288.7	232.9	196.8	

Table II-n Bending radius R_b (m) at 20°C for series EST

Table II-n Bending radius R_b (feet) at 68°F for series EST

Series	ID (mm)	Operating pressure (P)						Series	ND inch	Operating pressure (P)					
		1 * P_N	0.8 * P_N	0.6 * P_N	0.4 * P_N	0.2 * P_N	0 * P_N			1 * P_N	0.8 * P_N	0.6 * P_N	0.4 * P_N	0.2 * P_N	0 * P_N
EST 50	25	7	6	5	5	4	4	725 psig	1	23.0	19.7	16.4	16.4	13.1	13.1
	40	22	15	11	9	7	6		1.5	72.2	49.2	36.1	29.5	23.0	19.7
	50	34	20	14	11	9	8		2	111.5	65.6	45.9	36.1	29.5	26.2
	80	58	33	23	18	14	12		3	190.3	108.3	75.5	59.1	45.9	39.4
	100	67	40	28	22	18	15		4	219.8	131.2	91.9	72.2	59.1	49.2
	150	101	60	42	33	27	23		6	331.4	196.8	137.8	108.3	88.6	75.5
	200	140	81	57	44	36	30		8	459.3	265.7	187.0	144.4	118.1	98.4
	250	173	101	71	55	45	38		10	567.6	331.4	232.9	180.4	147.6	124.7
	300	206	120	85	66	54	45		12	675.8	393.7	278.9	216.5	177.2	147.6
	350	240	140	99	77	62	53		14	787.4	459.3	324.8	252.6	203.4	173.9
400	273	160	113	87	71	60	16	895.7	524.9	370.7	285.4	232.9	196.8		

Table II-p-q-r Wave velocity constants c1, c2 for series EST

Pipe data for series EST

f1, c1 System anchored upstream; i.e. loaded bi-axially.
 f2, c2 System anchored completely to prevent axial displacement

Series	Inner diameter	Nominal diameter	Reinforced wall thickness	Reinforced wall thickness	Linear mass of the pipe	
PN	ID	ND	T _E	T _E	G _B	
	(mm)	inch	(mm)	(inch)	(kg-/m)	
EST 8 (115 psig)	350	14	2.8	0.110	7.4	
	400	16	3.2	0.126	9.4	
	452	18	3.6	0.142	11.6	
	503	20	4	0.157	14.1	
	604	24	4.8	0.189	19.7	
	700	28	5.6	0.220	26.3	
	750	30	6	0.236	29.9	
	800	32	6.5	0.256	34.3	
	900	36	7.3	0.287	42.8	
	1000	40	8.1	0.319	52.2	
PN	1200	48	9.7	0.382	73.9	
	1400	56	11.3	0.445	99.3	
	PN	ID	ND	T _E	G _B	
		(mm)	inch	(mm)	(kg-/m)	
	EST 12.5 (175 psig)	250	10	2.5	0.098	4.9
		300	12	3	0.118	6.7
		350	14	3.5	0.138	8.9
		400	16	4	0.157	11.3
		452	18	4.5	0.177	14
		503	20	5.1	0.201	17.3
604		24	6.1	0.240	24.3	
700		28	7.1	0.280	32.5	
750		30	7.6	0.299	37	
800		32	8.1	0.319	41.8	
900	36	9.1	0.358	52.4		
1000	40	10.1	0.398	64		

1,000 Sv	kg/m3	62.40 lb/ft ³
2,050 Kv	N/mm2	297,327 psi
22,775 Ev	N/mm3	3,303,234 psi
1.1265 f1		
0.7530 f2		
55 deg (ω)		

Ev	Volumetric E modulus	
Kv	Compression modulus of fluid	
Kv	2,050	N/mm2
Ev	24,515	N/mm2
f1	1.1694	
f2	0.8388	
(ω)	63 deg	

$$\Delta P = c * \Delta v * 0.442 / g$$

Δ P psi

Δ v ft/s
 g 32.174 ft/s²

Wave velocity m/s

Wave velocity ft/s

	c 1	c 2	c 1	c 2
63 ø	394	458	1292	1503
63 ø	394	458	1292	1503
63 ø	393	457	1289	1500
63 ø	393	457	1288	1499
63 ø	393	457	1288	1499
63 ø	394	458	1292	1503
63 ø	394	458	1292	1503
63 ø	397	461	1301	1513
63 ø	396	461	1300	1512
63 ø	396	461	1299	1511
63 ø	396	460	1298	1510
63 ø	395	460	1297	1509
55 ø	429	513	1407	1684
55 ø	429	513	1407	1684
55 ø	429	513	1407	1684
55 ø	429	513	1407	1684
55 ø	428	512	1405	1681
55 ø	432	516	1416	1694
55 ø	431	516	1414	1692
55 ø	432	517	1417	1695
55 ø	432	516	1416	1694
55 ø	431	516	1415	1693
55 ø	431	516	1414	1692
55 ø	431	516	1414	1692

Table II-p-q-r Wave velocity constants c1, c2 for series EST

Pipe data for series EST

f1, c1 System anchored upstream; i.e. loaded bi-axially.
 f2, c2 System anchored completely to prevent axial displacement

Series	Inner diameter	Nominal diameter	Reinforced wall thickness	Reinforced wall thickness	Linear mass of the pipe
PN	ID	ND	T _E	T _E	G _B
	(mm)	inch	(mm)	(inch)	(kg-/m)
EST 16 (225 psig)	200	8	2.5	0.098	3.9
	250	10	3.2	0.126	5.9
	300	12	3.8	0.150	8.1
	350	14	4.4	0.173	10.7
	400	16	5.1	0.201	13.9
	452	18	5.7	0.224	17.2
	503	20	6.3	0.248	20.9
	604	24	7.6	0.299	29.7
	700	28	8.9	0.350	40
	800	32	10.1	0.398	51.4
EST 20 (300 psig)	150	6	2.4	0.094	2.8
	200	8	3.3	0.130	4.9
	250	10	4.1	0.161	7.3
	300	12	4.9	0.193	10.1
	350	14	5.7	0.224	13.5
	400	16	6.5	0.256	17.3
	452	18	7.3	0.287	21.6
	604	24	9.8	0.386	37.6
EST 25 (350 psig)	100	4	2.4	0.094	1.9
	150	6	3.1	0.122	3.5
	200	8	4.1	0.161	5.8
	250	10	5.1	0.201	8.8
	300	12	6.1	0.240	12.3
	350	14	7.1	0.280	16.4
	400	16	8.2	0.323	21.4
	452	18	9.2	0.362	26.7
	503	20	10.2	0.402	32.7
	604	24	12.2	0.480	46.3

1,000 Sv	kg/m3	62.40 lb/ft ³
2,050 Kv	N/mm2	297,327 psi
22,775 Ev	N/mm3	3,303,234 psi
1.1265 f1		
0.7530 f2		
55 deg (ω)		

Ev	Volumetric E modulus	
Kv	Compression modulus of fluid	
Kv	2,050	N/mm2
Ev	24,515	N/mm2
f1	1.1694	
f2	0.8388	
(ω)	63 deg	

$$\Delta P = c * \Delta v * 0.442 / g$$

Δ P psi

Δ v ft/s
 g 32.174 ft/s²

	Wave velocity m/s		Wave velocity ft/s	
	c 1	c 2	c1	c2
55 ø	474	565	1556	1854
55 ø	479	571	1573	1872
55 ø	477	568	1565	1864
55 ø	476	566	1560	1858
55 ø	479	570	1570	1869
55 ø	476	567	1562	1860
55 ø	475	565	1558	1855
55 ø	476	567	1561	1859
55 ø	478	569	1568	1867
55 ø	477	568	1565	1864
55 ø	476	567	1563	1861
55 ø	529	626	1734	2053
55 ø	536	634	1757	2078
55 ø	534	632	1753	2073
55 ø	533	631	1750	2070
55 ø	533	630	1747	2068
55 ø	532	630	1746	2066
55 ø	531	628	1741	2061
55 ø	530	627	1739	2058
55 ø	532	629	1745	2064
55 ø	626	732	2055	2402
55 ø	589	692	1933	2271
55 ø	587	690	1926	2264
55 ø	586	689	1922	2259
55 ø	585	688	1920	2257
55 ø	585	687	1918	2255
55 ø	587	690	1926	2264
55 ø	585	688	1921	2257
55 ø	585	687	1918	2254
55 ø	584	686	1915	2251

Table II-p-q-r Wave velocity constants c1, c2 for series EST

Pipe data for series EST

f1, c1 System anchored upstream; i.e. loaded bi-axially.

f2, c2 System anchored completely to prevent axial displacement

Series	Inner diameter	Nominal diameter	Reinforced wall thickness	Reinforced wall thickness	Linear mass of the pipe
PN	ID	ND	T _E	T _E	G _B
	(mm)	inch	(mm)	(inch)	(kg-/m)
EST 32 (464 psig)	80	3.2	2.4	0.094	1.5
	100	4	2.6	0.102	2
	150	6	3.8	0.150	4.1
	200	8	5.1	0.201	7.1
	250	10	6.4	0.252	10.8
	250	10	6.4	0.252	10.8
	300	12	7.7	0.303	15.2
	350	14	9	0.354	20.5
EST 40 (575 psig)	400	16	10.3	0.406	26.5
	50	2	1.8	0.071	0.8
	80	3.2	2.6	0.102	1.6
	100	4	3.3	0.130	2.5
	150	6	5	0.197	5.3
	200	8	6.6	0.260	8.9
	250	10	8.3	0.327	13.7
	300	12	9.9	0.390	19.3
EST 50 (725 psig)	350	14	11.6	0.457	26.1
	400	16	13.2	0.520	33.7
	25	1	1.8	0.071	0.4
	40	1.6	1.8	0.071	0.6
	50	2	2.1	0.083	0.9
	80	3.2	3.3	0.130	2
	100	4	4.2	0.165	3.1
	150	6	6.3	0.248	6.5
200	8	8.3	0.327	11.1	
250	10	10.4	0.409	17	
300	12	12.5	0.492	24.2	
350	14	14.6	0.575	32.7	
400	16	16.7	0.657	42.5	

1,000 Sv	kg/m3	62.40 lb/ft ³
2,050 Kv	N/mm2	297,327 psi
22,775 Ev	N/mm3	3,303,234 psi
1.1265 f1		
0.7530 f2		
55 deg (w)		

Ev Volumetric E modulus
 Kv Compression modulus of fluid
 Kv 2,050 N/mm2
 Ev 24,515 N/mm2 3,555,600 psi

$$\Delta P = c * \Delta v * 0.442 / g$$

Δ P psi

Δ v ft/s
 g 32.174 ft/s²

Wave velocity m/s

Wave velocity ft/s

	c 1	c 2	c 1	c 2
55 ø	684	793	2245	2602
55 ø	647	754	2122	2473
55 ø	640	747	2100	2450
55 ø	642	749	2106	2456
55 ø	643	750	2109	2460
55 ø	643	750	2109	2460
55 ø	644	750	2111	2462
55 ø	644	751	2113	2464
55 ø	644	751	2114	2465
55 ø	733	743	2404	2437
55 ø	705	715	2314	2346
55 ø	709	719	2328	2360
55 ø	712	722	2336	2368
55 ø	709	719	2328	2360
55 ø	711	721	2333	2365
55 ø	709	719	2328	2360
55 ø	711	720	2331	2363
55 ø	709	719	2328	2360
55 ø	923	932	3027	3059
55 ø	794	804	2604	2637
55 ø	775	785	2542	2575
55 ø	770	780	2526	2559
55 ø	775	785	2542	2575
55 ø	775	785	2542	2575
55 ø	772	782	2531	2564
55 ø	772	782	2534	2566
55 ø	773	783	2535	2568
55 ø	773	783	2536	2569
55 ø	773	783	2537	2569

Table 2s-1 Pipe stiffness (PS) for series EST at 20°C (68°F)

Series EST					
Series	ID	ND	STIS	SF	PS
	(mm)	inch	(N/m ²)	(in ² lb/in)	(psi)
EST 8 115 psig	350	14	1150	450	9
	400	16	1150	660	9
	451	18	1150	950	9
	503	20	1150	1300	9
	604	24	1150	2240	9
	700	28	1150	3560	9
	750	30	1150	4380	9
	800	32	1200	5570	9
	900	36	1190	7890	9
	1000	40	1190	10780	9
	1200	48	1180	18510	9
	1400	56	1180	29260	9
	1600	64	1170	43530	9
EST 12.5 175 psig	250	10	1660	240	13
	300	12	1660	410	13
	350	14	1660	650	13
	400	16	1660	970	13
	451	18	1660	1380	13
	503	20	1760	2010	14
	604	24	1740	3430	14
	700	28	1730	5410	13
	750	30	1720	6640	13
	800	32	1720	8030	13
	900	36	1710	11390	13
	1000	40	1710	15570	13

Series EST					
Series	ID	ND	STIS	SF	PS
	(mm)	inch	(N/m ²)	(in ² lb/in)	(psi)
EST 25 350psig	100	4	21990	210	171
	150	6	14180	450	110
	200	8	13850	1040	108
	250	10	13650	2010	106
	300	12	13520	3430	105
	350	14	13430	5410	105
	400	16	13850	8330	108
	451	18	13740	11770	107
	503	20	13650	16040	106
604	24	13520	27450	105	
EST 32 450 psig	80	3	42210	210	329
	100	4	27800	270	216
	150	6	25770	830	201
	200	8	26270	2010	204
	250	10	26570	3960	207
	300	12	26770	6900	208
	350	14	26920	11020	210
400	16	27030	16520	210	
EST 40 575 psig	50	2	71680	90	558
	80	3	53280	270	415
	100	6	55690	540	434
	150	5	57340	1890	446
	200	8	55690	4350	434
	250	10	56680	8640	441
	300	12	55690	14670	434
	350	14	56400	23590	439
	400	16	55690	34770	434

Table 2s-1 Pipe stiffness (PS) for series EST at 20°C (68°F)

Series EST					
Series	ID	ND	STIS	SF	PS
	(mm)	inch	(N/m ²)	(in ² lb/in)	(psi)
EST 16 225 psig	200	8	3210	240	25
	250	10	3450	500	27
	300	12	3340	830	26
	350	14	3270	1290	25
	400	16	3410	2010	27
	451	18	3340	2800	26
	503	20	3290	3780	26
	604	24	3340	6640	26
	700	28	3380	10660	26
	750	30	3340	12960	26
800	32	3310	15570	26	
EST 20 300 psig	150	6	6670	210	52
	200	8	7310	540	57
	250	10	7180	1040	56
	300	12	7090	1780	55
	350	14	7030	2800	55
	400	16	6980	4150	54
	451	18	6950	5880	54
	503	20	6920	8030	54
604	24	7090	14230	55	

Series EST					
Series	ID	ND	STIS	SF	PS
	(mm)	inch	(N/m ²)	(in ² lb/in)	(psi)
EST 50 725 psig	25	1	517590	90	4029
	40	1.5	136410	90	1062
	50	2	111870	140	871
	80	3	106210	540	827
	100	4	111870	1120	871
	150	5	111870	3780	871
	200	8	108080	8640	841
	250	10	108830	17000	847
	300	12	109330	29520	851
	350	14	109690	47040	854
400	16	109960	70400	856	

PS Pipe Stiffness (ASTM D2412) $EI / 0.149 r^3$
 $I = t^3 / 12$

SF Stiffness Factor EI

STIS Specific Tangential Initial Stiffness EI / D^3

STES Specific Tangential end Stiffness
 $= STIS * A_c * \beta$ ($A_c * \beta = \text{creep factor} = 0.9$)

Table 2-t Static buckling pressure P_b for series EST at 20° C (68° F)

Service factor (SF = 0.75) Buckling pressure = External pressure - internal pressure

Series	Inner diameter	Inner diameter	Reinforced wall thickness	Reinforced wall thickness	Pipe Length	Pipe Length	Buckling pressure @	Buckling pressure @
PN	ID (mm)	ID inch	T_E (mm)	T_E inch	L (mm)	L feet	20° C P_b Bars	68° F P_b psi
EST 8 (115 psig)	350	13.8	2.8	0.110	12000	39.4	0.2	2.9
	400	15.7	3.2	0.126	12000	39.4	0.2	2.9
	451	17.8	3.6	0.142	12000	39.4	0.2	2.9
	503	19.8	4	0.157	12000	39.4	0.2	2.9
	604	23.8	4.8	0.189	12000	39.4	0.2	2.9
	700	27.6	5.6	0.220	12000	39.4	0.2	3.0
	750	29.5	6	0.236	12000	39.4	0.2	3.0
	800	31.5	6.5	0.256	12000	39.4	0.2	3.1
	900	35.4	7.3	0.287	12000	39.4	0.2	3.1
	1000	39.4	8.1	0.319	12000	39.4	0.2	3.1
	1200	47.2	9.7	0.382	12000	39.4	0.2	3.0
1400	55.1	11.3	0.445	12000	39.4	0.2	3.5	

Table 2-t Static buckling pressure P_b for series EST at 20° C (68° F)

Service factor (SF = 0.75) Buckling pressure = External pressure - internal pressure

Series	Inner diameter	Inner diameter	Reinforced wall thickness	Reinforced wall thickness	Pipe Length	Pipe Length	Buckling pressure @ 20° C	Buckling pressure @ 68° F
PN	ID (mm)	ID inch	T_E (mm)	T_E inch	L (mm)	L feet	Pb Bars	Pb psi
EST 12.5 (175 psig)	250	9.8	2.5	0.098	12000	39.4	0.4	5.7
	300	11.8	3	0.118	12000	39.4	0.4	5.7
	350	13.8	3.5	0.138	12000	39.4	0.4	5.7
	400	15.7	4	0.157	12000	39.4	0.4	5.7
	451	17.8	4.5	0.177	12000	39.4	0.4	5.7
	503	19.8	5.1	0.201	12000	39.4	0.4	6.0
	604	23.8	6.1	0.240	12000	39.4	0.4	5.9
	700	27.6	7.1	0.280	12000	39.4	0.4	6.0
	750	29.5	7.6	0.299	12000	39.4	0.4	6.0
	800	31.5	8.1	0.319	12000	39.4	0.4	5.9
	900	35.4	9.1	0.358	12000	39.4	0.4	5.9
1000	39.4	10.1	0.398	12000	39.4	0.4	5.9	

Table 2-t Static buckling pressure P_b for series EST at 20° C (68° F)

Service factor (SF = 0.75) Buckling pressure = External pressure - internal pressure

Series	Inner diameter	Inner diameter	Reinforced wall thickness	Reinforced wall thickness	Pipe Length	Pipe Length	Buckling pressure @ 20° C	Buckling pressure @ 68° F
PN	ID (mm)	ID inch	T_E (mm)	T_E inch	L (mm)	L feet	P_b Bars	P_b psi
EST 16 (225 psig)	200	7.9	2.5	0.098	6000	19.7	0.8	11.0
	250	9.8	3.2	0.126	12000	39.4	0.8	11.9
	300	11.8	3.8	0.150	12000	39.4	0.8	11.5
	350	13.8	4.4	0.173	12000	39.4	0.8	11.3
	400	15.7	5.1	0.201	12000	39.4	0.8	11.8
	451	17.8	5.7	0.224	12000	39.4	0.8	11.5
	503	19.8	6.3	0.248	12000	39.4	0.8	11.2
	604	23.8	7.6	0.299	12000	39.4	0.8	11.3
	700	27.6	8.9	0.350	12000	39.4	0.8	11.7
	750	29.5	9.5	0.374	12000	39.4	0.8	11.6
800	31.5	10.1	0.398	12000	39.4	0.8	11.4	

Table 2-t Static buckling pressure P_b for series EST at 20° C (68° F)

Service factor (SF = 0.75) Buckling pressure = External pressure - internal pressure

Series	Inner diameter	Inner diameter	Reinforced wall thickness	Reinforced wall thickness	Pipe Length	Pipe Length	Buckling pressure @ 20° C	Buckling pressure @ 68° F
PN	ID (mm)	ID inch	T_E (mm)	T_E inch	L (mm)	L feet	P_b Bars	P_b psi
EST 20 (300 psig)	150	5.9	2.4	0.094	6000	19.7	1.6	22.8
	200	7.9	3.3	0.130	6000	19.7	1.7	25.1
	250	9.8	4.1	0.161	12000	39.4	1.7	24.7
	300	11.8	4.9	0.193	12000	39.4	1.7	24.4
	350	13.8	5.7	0.224	12000	39.4	1.7	24.2
	400	15.7	6.5	0.256	12000	39.4	1.7	24.1
	451	17.8	7.3	0.287	12000	39.4	1.6	23.8
	503	19.8	8.1	0.319	12000	39.4	1.6	23.5
	604	23.8	9.8	0.386	12000	39.4	1.7	24.0

Table 2-t Static buckling pressure P_b for series EST at 20° C (68° F)

Service factor (SF = 0.75) Buckling pressure = External pressure - internal pressure

Series	Inner diameter	Inner diameter	Reinforced wall thickness	Reinforced wall thickness	Pipe Length	Pipe Length	Buckling pressure @ 20° C	Buckling pressure @ 68° F
PN	ID (mm)	ID inch	T_E (mm)	T_E inch	L (mm)	L feet	P_b Bars	P_b psi
EST 25 (350 psig)	100	3.9	2.4	0.094	6000	19.7	5.2	75
	150	5.9	3.1	0.122	6000	19.7	3.3	48
	200	7.9	4.1	0.161	6000	19.7	3.3	48
	250	9.8	5.1	0.201	12000	39.4	3.2	47
	300	11.8	6.1	0.240	12000	39.4	3.2	47
	350	13.8	7.1	0.280	12000	39.4	3.2	46
	400	15.7	8.2	0.323	12000	39.4	3.3	48
	451	17.8	9.2	0.362	12000	39.4	3.2	47
	503	19.8	10.2	0.402	12000	39.4	3.2	46
604	23.8	12.2	0.480	12000	39.4	3.2	46	

Table 2-t Static buckling pressure P_b for series EST at 20° C (68° F)

Service factor (SF = 0.75) Buckling pressure = External pressure - internal pressure

Series	Inner diameter	Inner diameter	Reinforced wall thickness	Reinforced wall thickness	Pipe Length	Pipe Length	Buckling pressure @	Buckling pressure @
PN	ID (mm)	ID inch	T_E (mm)	T_E inch	L (mm)	L feet	20° C P_b Bars	68° F P_b psi
EST 32 (450 psig)	80	3.1	2.4	0.094	6000	19.7	9.8	143
	100	3.9	2.6	0.102	6000	19.7	6.5	94
	150	5.9	3.8	0.150	6000	19.7	6.1	88
	200	7.9	5.1	0.201	6000	19.7	6.2	90
	250	9.8	6.4	0.252	12000	39.4	6.3	91
	300	11.8	7.7	0.303	12000	39.4	6.4	92
	350	13.8	9	0.354	12000	39.4	6.4	93
	400	15.7	10.3	0.406	12000	39.4	6.4	93
EST 40 (575 psig)	50	2.0	1.8	0.071	12000	39.4	16.5	239
	80	3.1	2.6	0.102	6000	19.7	12.4	180
	100	3.9	3.3	0.130	6000	19.7	13.0	189
	150	5.9	5	0.197	6000	19.7	13.5	196
	200	7.9	6.6	0.260	6000	19.7	13.2	191
	250	9.8	8.3	0.327	12000	39.4	13.4	195
	300	11.8	9.9	0.390	12000	39.4	13.2	192
	350	13.8	11.6	0.457	12000	39.4	13.4	194
	400	15.7	13.2	0.520	12000	39.4	13.2	192

Table 2-t Static buckling pressure P_b for series EST at 20° C (68° F)

Service factor (SF = 0.75) Buckling pressure = External pressure - internal pressure

Series	Inner diameter	Inner diameter	Reinforced wall thickness	Reinforced wall thickness	Pipe Length	Pipe Length	Buckling pressure @ 20° C	Buckling pressure @ 68° F
PN	ID (mm)	ID inch	T_E (mm)	T_E inch	L (mm)	L feet	P_b Bars	P_b psi
EST 50 (725 psig)	25	1.0	1.8	0.071	3000	9.8	114.5	1660
	40	1.6	1.8	0.071	3000	9.8	31.0	450
	50	2.0	2.1	0.083	3000	9.8	25.7	373
	80	3.1	3.3	0.130	3000	9.8	24.8	359
	100	3.9	4.2	0.165	6000	19.7	26.2	380
	150	5.9	6.3	0.248	6000	19.7	26.4	383
	200	7.9	8.3	0.327	6000	19.7	25.6	371
	250	9.8	10.4	0.409	12000	39.4	25.8	374
	300	11.8	12.5	0.492	12000	39.4	26.0	376
	350	13.8	14.6	0.575	12000	39.4	26.1	378
400	15.7	16.7	0.657	12000	39.4	26.2	379	

Allowable static buckling pressure (bar) at 20 Deg C.

Allowable static buckling pressure (psi) at 68 Deg F.

Series	ID (mm)	Pipe length L (m) between stiff ends								ND (inch)	Pipe length L (feet) between stiff ends								Series
		1	2	2.5	3	3.3	5	6	10		3.3	6.6	8.25	10	11	16.5	20	33	
EST 12.5 175 psi	250	1.1	0.5	0.4	0.4	0.4	0.4	0.4	0.4	10	16.0	7.3	5.8	5.8	5.8	5.8	5.8	5.8	EST 12.5 175 psi
	300	1.3	0.6	0.5	0.4	0.4	0.4	0.4	0.4	12	18.9	8.7	7.3	5.8	5.8	5.8	5.8	5.8	
	350	1.5	0.7	0.6	0.5	0.5	0.4	0.4	0.4	14	21.8	10.2	8.7	7.3	7.3	5.8	5.8	5.8	
	400	1.7	0.9	0.7	0.6	0.5	0.4	0.4	0.4	16	24.7	13.1	10.2	8.7	7.3	5.8	5.8	5.8	
	451	1.9	1.0	0.8	0.6	0.6	0.4	0.4	0.4	18	27.6	14.5	11.6	8.7	8.7	5.8	5.8	5.8	
	503	2.2	1.1	0.9	0.7	0.7	0.4	0.4	0.4	20	31.9	16.0	13.1	10.2	10.2	5.8	5.8	5.8	
	604	2.7	1.3	1.1	0.9	0.8	0.5	0.4	0.4	24	39.2	18.9	16.0	13.1	11.6	7.3	5.8	5.8	
	700	3.1	1.5	1.2	1.0	0.9	0.6	0.5	0.4	28	45.0	21.8	17.4	14.5	13.1	8.7	7.3	5.8	
	750	3.3	1.7	1.3	1.1	1.0	0.7	0.6	0.4	30	47.9	24.7	18.9	16.0	14.5	10.2	8.7	5.8	
	800	3.5	1.8	1.4	1.2	1.1	0.7	0.6	0.4	32	50.8	26.1	20.3	17.4	16.0	10.2	8.7	5.8	
900	4.0	2.0	1.6	1.3	1.2	0.8	0.7	0.4	36	58.0	29.0	23.2	18.9	17.4	11.6	10.2	5.8		
1000	4.4	2.2	1.8	1.5	1.3	0.9	0.7	0.4	40	63.8	31.9	26.1	21.8	18.9	13.1	10.2	5.8		
EST 16 225 psi	200	1.5	0.8	0.8	0.8	0.8	0.8	0.8	0.8	8	21.8	11.6	11.6	11.6	11.6	11.6	11.6	11.6	EST 16 225 psi
	250	2.0	1.0	0.8	0.8	0.8	0.8	0.8	0.8	10	29.0	14.5	11.6	11.6	11.6	11.6	11.6	11.6	
	300	2.3	1.1	0.9	0.8	0.8	0.8	0.8	0.8	12	33.4	16.0	13.1	11.6	11.6	11.6	11.6	11.6	
	350	2.6	1.3	1.1	0.9	0.8	0.8	0.8	0.8	14	37.7	18.9	16.0	13.1	11.6	11.6	11.6	11.6	
	400	3.1	1.6	1.2	1.0	0.9	0.8	0.8	0.8	16	45.0	23.2	17.4	14.5	13.1	11.6	11.6	11.6	
	451	3.5	1.7	1.4	1.2	1.0	0.8	0.8	0.8	18	50.8	24.7	20.3	17.4	14.5	11.6	11.6	11.6	
	503	3.8	1.9	1.5	1.3	1.1	0.8	0.8	0.8	20	55.1	27.6	21.8	18.9	16.0	11.6	11.6	11.6	
	604	4.6	2.3	1.8	1.5	1.4	0.9	0.8	0.8	24	66.7	33.4	26.1	21.8	20.3	13.1	11.6	11.6	
	700	5.4	2.7	2.2	1.8	1.6	1.1	0.9	0.8	28	78.3	39.2	31.9	26.1	23.2	16.0	13.1	11.6	
	750	5.8	2.9	2.3	1.9	1.7	1.2	1.0	0.8	30	84.1	42.1	33.4	27.6	24.7	17.4	14.5	11.6	
800	6.1	3.0	2.4	2.0	1.8	1.2	1.0	0.8	32	88.5	43.5	34.8	29.0	26.1	17.4	14.5	11.6		
EST 20 300 psi	150	2.0	1.6	1.6	1.6	1.6	1.6	1.6		6	29.0	23.2	23.2	23.2	23.2	23.2	23.2	-	EST 20 300 psi
	200	2.9	1.7	1.7	1.7	1.7	1.7	1.7	1.7	8	42.1	24.7	24.7	24.7	24.7	24.7	24.7	24.7	
	250	3.6	1.8	1.7	1.7	1.7	1.7	1.7	1.7	10	52.2	26.1	24.7	24.7	24.7	24.7	24.7	24.7	
	300	4.3	2.2	1.7	1.7	1.7	1.7	1.7	1.7	12	62.4	31.9	24.7	24.7	24.7	24.7	24.7	24.7	
	350	5.0	2.5	2.0	1.7	1.7	1.7	1.7	1.7	14	72.5	36.3	29.0	24.7	24.7	24.7	24.7	24.7	
	400	5.7	2.8	2.3	1.9	1.7	1.7	1.7	1.7	16	82.7	40.6	33.4	27.6	24.7	24.7	24.7	24.7	
	451	6.4	3.2	2.5	2.1	1.9	1.7	1.7	1.7	18	92.8	46.4	36.3	30.5	27.6	24.7	24.7	24.7	
	503	7.1	3.5	2.8	2.4	2.1	1.6	1.6	1.6	20	103	50.8	40.6	34.8	30.5	23.2	23.2	23.2	
	604	8.6	4.3	3.5	2.9	2.6	1.7	1.7	1.7	24	125	62.4	50.8	42.1	37.7	24.7	24.7	24.7	
EST 25 350 psi	100	5.1	5.1	5.1	5.1	5.1	5.1	5.1		4	74.0	74.0	74.0	74.0	74.0	74.0	74.0	-	EST 25 350 psi
	150	3.8	3.3	3.3	3.3	3.3	3.3	3.3		6	55.1	47.9	47.9	47.9	47.9	47.9	47.9	-	
	200	5.0	3.3	3.3	3.3	3.3	3.3	3.3	3.3	8	72.5	47.9	47.9	47.9	47.9	47.9	47.9	47.9	
	250	6.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	10	89.9	46.4	46.4	46.4	46.4	46.4	46.4	46.4	
	300	7.4	3.7	3.2	3.2	3.2	3.2	3.2	3.2	12	107	53.7	46.4	46.4	46.4	46.4	46.4	46.4	
	350	8.6	4.3	3.4	3.2	3.2	3.2	3.2	3.2	14	125	62.4	49.3	46.4	46.4	46.4	46.4	46.4	
	400	10.1	5.0	4.0	3.3	3.3	3.3	3.3	3.3	16	146	72.5	58.0	47.9	47.9	47.9	47.9	47.9	
	451	11.3	5.6	4.5	3.8	3.4	3.3	3.3	3.3	18	164	81.2	65.3	55.1	49.3	47.9	47.9	47.9	
	503	12.5	6.2	5.0	4.2	3.8	3.2	3.2	3.2	20	181	89.9	72.5	60.9	55.1	46.4	46.4	46.4	
	604	14.9	7.4	5.9	5.0	4.5	3.2	3.2	3.2	24	216	107	85.6	72.5	65.3	46.4	46.4	46.4	

Table II-d Linear Mass of the pipe content G_v (lb/ft)

ND	Density of the fluid S_v (lb/ft ³)						
	50.0	62.4	74.9	87.4	99.9	112.4	124.9
1	0.26	0.33	0.40	0.46	0.53	0.59	0.66
1.5	0.68	0.84	1.01	1.18	1.35	1.52	1.69
2	1.06	1.32	1.58	1.85	2.11	2.38	2.64
3	2.70	3.38	4.05	4.73	5.41	6.08	6.76
4	4.22	5.28	6.33	7.39	8.45	9.50	10.56
6	9.5	11.9	14.3	16.6	19.0	21.4	23.8
8	16.9	21.1	25.3	29.6	33.8	38.0	42.2
10	26.4	33.0	39.6	46.2	52.8	59.4	66.0
12	38.0	47.5	57.0	66.5	76.0	85.5	95.0
14	51.7	64.7	77.6	90.5	103.5	116.4	129.3
16	67.6	84.5	101.3	118.2	135.1	152.0	168.9
18	85.9	107.4	128.8	150.3	171.8	193.3	214.7
20	106.8	133.6	160.3	187.0	213.7	240.4	267.1
24	154.1	192.6	231.1	269.6	308.1	346.6	385.1
28	206.9	258.7	310.4	362.1	413.8	465.6	517.3
30	237.5	296.9	356.3	415.7	475.1	534.5	593.8
32	270.3	337.8	405.4	473.0	540.5	608.1	675.7
36	342.1	427.6	513.1	598.6	684.1	769.6	855.1
40	422.3	527.9	633.4	739.0	844.6	950.1	1055.7
48	608.1	760.1	912.1	1064.2	1216.2	1368.2	1520.2

Linear Mass of the pipe content G_v (kg/m)

ID	Density of the fluid S_v (kg/m ³)						
	800	1000	1200	1400	1600	1800	2000
25	0.39	0.49	0.59	0.69	0.79	0.88	0.98
40	1.01	1.26	1.51	1.76	2.01	2.26	2.51
50	1.57	1.96	2.36	2.75	3.14	3.53	3.93
80	4.02	5.03	6.03	7.04	8.04	9.05	10.05
100	6.28	7.85	9.42	11.00	12.57	14.14	15.71
150	14.1	17.7	21.2	24.7	28.3	31.8	35.3
200	25.1	31.4	37.7	44.0	50.3	56.5	62.8
250	39.3	49.1	58.9	68.7	78.5	88.4	98.2
300	56.5	70.7	84.8	99.0	113.1	127.2	141.4
350	77.0	96.2	115.5	134.7	153.9	173.2	192.4
400	100.5	125.7	150.8	175.9	201.1	226.2	251.3
451	127.8	159.8	191.7	223.7	255.6	287.6	319.5
503	159.0	198.7	238.5	278.2	317.9	357.7	397.4
604	229.2	286.5	343.8	401.1	458.4	515.7	573.1
700	307.9	384.8	461.8	538.8	615.8	692.7	769.7
750	353.4	441.8	530.1	618.5	706.9	795.2	883.6
800	402.1	502.7	603.2	703.7	804.2	904.8	1005.3
900	508.9	636.2	763.4	890.6	1017.9	1145.1	1272.3
1000	628.3	785.4	942.5	1099.6	1256.6	1413.7	1570.8
1200	904.8	1131.0	1357.2	1583.4	1809.6	2035.8	2261.9

Table III-a Specific gravity correction factor R_s

	Density of the fluid S_v (kg/m ³)						
	0	600	800	900	1000	1100	1250
	Density of the fluid S_v (lb/ft ³)						
	0.0	37.4	49.9	56.2	62.4	68.6	78.0
R_s	1.55	1.25	1.07	1.03	1.00	0.95	0.90

The final support distance (L_F) can be derived from the following equation:

$$L_F = L' * R_s * R_T \quad (\text{Eq. III.11.})$$

L_F = final support distance (ft)

L' = support distance at operating temperature (T) and -pressure (P) (table III-c, III-d, III-e) (ft)

R_s = specific gravity correction factor (table III-a) (-)

R_T = temperature change correction factor (table III-b) (-)

Table III-b Temperature change correction factor R_T

Temperature change ΔT (°F)										
ND (inch)	18	36	54	72	90	108	126	144	162	180
1	0.73	0.58	0.49	0.44	0.39	0.36	0.34	0.32	0.30	0.28
1.5	0.81	0.69	0.6	0.54	0.49	0.45	0.42	0.40	0.38	0.36
2	0.85	0.73	0.65	0.59	0.54	0.5	0.47	0.44	0.42	0.40
3	0.90	0.81	0.74	0.69	0.64	0.6	0.57	0.54	0.51	0.49
4	0.92	0.85	0.79	0.74	0.69	0.66	0.62	0.59	0.57	0.54
6	0.92	0.85	0.8	0.75	0.72	0.68	0.66	0.63	0.61	0.59
8	0.94	0.89	0.84	0.81	0.77	0.75	0.72	0.70	0.68	0.66
10	0.95	0.91	0.87	0.84	0.81	0.79	0.76	0.74	0.72	0.70
12	0.96	0.92	0.89	0.87	0.84	0.82	0.80	0.78	0.76	0.74
14	0.96	0.93	0.91	0.88	0.86	0.84	0.82	0.80	0.79	0.77
16	0.97	0.94	0.92	0.89	0.87	0.85	0.83	0.82	0.80	0.79
18	0.97	0.95	0.92	0.9	0.88	0.87	0.85	0.83	0.82	0.80
20	0.97	0.95	0.93	0.91	0.9	0.88	0.86	0.85	0.83	0.82
24	0.98	0.96	0.94	0.93	0.91	0.9	0.88	0.87	0.86	0.85
28	0.99	0.98	0.97	0.96	0.95	0.94	0.93	0.92	0.91	0.91
30	0.99	0.98	0.97	0.96	0.95	0.94	0.94	0.93	0.92	0.91
32	0.99	0.98	0.97	0.96	0.95	0.95	0.94	0.93	0.93	0.92
36	0.99	0.98	0.98	0.97	0.96	0.96	0.95	0.94	0.94	0.93
40	0.99	0.98	0.98	0.97	0.97	0.96	0.96	0.95	0.94	0.94
48	0.99	0.99	0.98	0.98	0.97	0.97	0.96	0.96	0.95	0.95

Temperature change ΔT (°C)										
ID (mm)	10	20	30	40	50	60	70	80	90	100
25	0.73	0.58	0.49	0.44	0.39	0.36	0.34	0.32	0.30	0.28
40	0.81	0.69	0.6	0.54	0.49	0.45	0.42	0.40	0.38	0.36
50	0.85	0.73	0.65	0.59	0.54	0.5	0.47	0.44	0.42	0.40
80	0.90	0.81	0.74	0.69	0.64	0.6	0.57	0.54	0.51	0.49
100	0.92	0.85	0.79	0.74	0.69	0.66	0.62	0.59	0.57	0.54
150	0.92	0.85	0.8	0.75	0.72	0.68	0.66	0.63	0.61	0.59
200	0.94	0.89	0.84	0.81	0.77	0.75	0.72	0.70	0.68	0.66
250	0.95	0.91	0.87	0.84	0.81	0.79	0.76	0.74	0.72	0.70
300	0.96	0.92	0.89	0.87	0.84	0.82	0.80	0.78	0.76	0.74
350	0.96	0.93	0.91	0.88	0.86	0.84	0.82	0.80	0.79	0.77
400	0.97	0.94	0.92	0.89	0.87	0.85	0.83	0.82	0.80	0.79
451	0.97	0.95	0.92	0.9	0.88	0.87	0.85	0.83	0.82	0.80
503	0.97	0.95	0.93	0.91	0.9	0.88	0.86	0.85	0.83	0.82
604	0.98	0.96	0.94	0.93	0.91	0.9	0.88	0.87	0.86	0.85
700	0.99	0.98	0.97	0.96	0.95	0.94	0.93	0.92	0.91	0.91
750	0.99	0.98	0.97	0.96	0.95	0.94	0.94	0.93	0.92	0.91
800	0.99	0.98	0.97	0.96	0.95	0.95	0.94	0.93	0.93	0.92
900	0.99	0.98	0.98	0.97	0.96	0.96	0.95	0.94	0.94	0.93
1000	0.99	0.98	0.98	0.97	0.97	0.96	0.96	0.95	0.94	0.94
1200	0.99	0.99	0.98	0.98	0.97	0.97	0.96	0.96	0.95	0.95

Table III-c Support distance L' in feet for series EST, P = 1 * PN

Series EST	ND (inch)	T=68° F		T=104° F		T=140° F		T= 175° F		T=212 ° F		T=230 °F	
		L _S FEET	L _C FEET	L _S FEET	L _C FEET	L _S FEET	L _C FEET	L _S FEET	L _C FEET	L _S FEET	L _C FEET	L _S FEET	L _C FEET
300 psi (20 bar)	6	12.5	15.1	12.5	15.1	12.5	15.1	12.5	15.1	11.9	15.1	11.5	15.1
	8	15.5	18.7	15.5	18.7	15.5	18.7	15.5	18.7	14.5	18.7	13.8	18.7
	10	17.1	21.0	17.1	21.0	17.1	21.0	17.1	21.0	16.8	21.0	16.1	21.0
	12	18.4	22.7	18.4	22.7	18.4	22.7	18.4	22.7	18.4	22.7	18.1	22.7
	14	20.1	24.3	20.1	24.3	20.1	24.3	20.1	24.3	20.1	24.3	20.1	24.3
	16	21.4	26.0	21.4	26.0	21.4	26.0	21.4	26.0	21.4	26.0	21.4	26.0
	18	22.4	27.6	22.4	27.6	22.4	27.6	22.4	27.6	22.4	27.6	22.4	27.6
	20	23.7	28.9	23.7	28.9	23.7	28.9	23.7	28.9	23.7	28.9	23.7	28.9
24	26.3	32.2	26.3	32.2	26.3	32.2	26.3	32.2	26.3	32.2	26.3	32.2	
350 psi (25 bar)	4	12.2	18.7	11.9	18.7	11.5	18.7	10.9	18.7	10.2	17.4	9.9	16.8
	6	14.8	18.1	14.8	18.1	14.2	18.1	13.5	18.1	12.8	18.1	12.2	18.1
	8	16.8	20.4	16.8	20.4	16.8	20.4	16.4	20.4	15.5	20.4	14.8	20.4
	10	18.4	22.7	18.4	22.7	18.4	22.7	18.4	22.7	18.1	22.7	17.4	22.7
	12	20.1	24.6	20.1	24.6	20.1	24.6	20.1	24.6	20.1	24.6	19.4	24.6
	14	21.7	26.6	21.7	26.6	21.7	26.6	21.7	26.6	21.7	26.6	21.7	26.6
	16	23.7	28.9	23.7	28.9	23.7	28.9	23.7	28.9	23.7	28.9	23.7	28.9
	18	25	30.6	25.0	30.6	25.0	30.6	25.0	30.6	25.0	30.6	25.0	30.6
20	26.3	32.2	26.3	32.2	26.3	32.2	26.3	32.2	26.3	32.2	26.3	32.2	
24	28.6	35.1	28.6	35.1	28.6	35.1	28.6	35.1	28.6	35.1	28.6	35.1	
450 psi (32 bar)	1	6.6	11.2	6.3	10.9	6.3	10.5	6.0	10.2	5.6	9.6	5.3	9.2
	1.5	7.9	13.5	7.6	13.2	7.3	12.5	6.9	12.2	6.6	11.5	6.3	10.9
	2	8.6	14.8	8.2	14.2	7.9	13.8	7.6	13.2	7.3	12.5	6.9	11.9
	3	11.2	18.1	10.9	18.1	10.5	17.8	9.9	17.1	9.6	16.1	8.9	15.5
	4	12.5	15.5	12.2	15.5	11.5	15.5	11.2	15.5	10.5	15.5	10.2	15.5
	6	14.8	21.0	17.4	21.0	17.4	21.0	17.4	21.0	16.4	21.0	15.8	21.0
	8	17.4	21.0	17.4	21.0	17.4	21.0	17.4	21.0	16.4	21.0	15.8	21.0
	10	19.4	24.0	19.4	24.0	19.4	24.0	19.4	24.0	19.4	24.0	18.4	24.0
12	21.7	26.3	21.7	26.3	21.7	26.3	21.7	26.3	21.7	26.3	21.0	26.3	

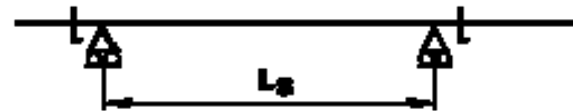


Table III-d Support distance for series EST , $P = 0.75 * P_N$

Support Distance L' (ft) for series EST, $P = 0.75 * P_N$ (psig)													
Series PN (psig)	ND (in)	T=68° F		T=104° F		T=140° F		T=175° F		T=212° F		T=230° F	
		L _S	L _C	L _S	L _C	L _S	L _C	L _S	L _C	L _S	L _C	L _S	L _C
115 psi (8 bar)	14	17.7	21.6	17.7	21.6	17.7	21.6	17.4	21.6	16.4	21.6	15.7	21.6
	16	19.0	23.3	19.0	23.3	19.0	23.3	19.0	23.3	18.0	23.3	17.4	23.3
	18	20.0	24.6	20.0	24.6	20.0	24.6	20.0	24.6	19.4	24.6	18.7	24.6
	20	21.3	25.9	21.3	25.9	21.3	25.9	21.3	25.9	21.0	25.9	20.0	25.9
	24	23.3	28.5	23.3	28.5	23.3	28.5	23.3	28.5	23.3	28.5	22.6	28.5
	28	25.3	30.8	25.3	30.8	25.3	30.8	25.3	30.8	25.3	30.8	25.3	30.8
	30	25.9	31.8	25.9	31.8	25.9	31.8	25.9	31.8	25.9	31.8	25.9	31.8
	32	27.6	33.5	27.6	33.5	27.6	33.5	27.6	33.5	27.6	33.5	27.6	33.5
	36	28.9	35.4	28.9	35.4	28.9	35.4	28.9	35.4	28.9	35.4	28.9	35.4
	40	30.5	37.4	30.5	37.4	30.5	37.4	30.5	37.4	30.5	37.4	30.5	37.4
48	33.5	41.0	33.5	41.0	33.5	41.0	33.5	41.0	33.5	41.0	33.5	41.0	
175 psi (12.5 bar)	10	17.1	22.3	16.4	22.3	16.1	22.3	15.1	22.3	14.4	22.3	13.8	22.3
	12	19.4	24.6	18.7	24.6	18.0	24.6	17.4	24.6	16.1	24.6	15.4	24.6
	14	21.3	26.6	20.7	26.6	20.0	26.6	19.0	26.6	18.0	26.6	17.4	26.6
	16	23.0	28.2	22.6	28.2	21.6	28.2	21.0	28.2	19.7	28.2	18.7	28.2
	18	24.6	30.2	24.6	30.2	23.6	30.2	22.6	30.2	21.3	30.2	20.3	30.2
	20	26.6	32.5	26.6	32.5	25.6	32.5	24.3	32.5	23.0	32.5	22.0	32.5
	24	28.9	35.4	28.9	35.4	28.9	35.4	27.6	35.4	25.9	35.4	24.9	35.4
	28	31.2	38.0	31.2	38.0	31.2	38.0	30.5	38.0	28.5	38.0	27.6	38.0
	30	32.1	39.4	32.1	39.4	32.1	39.4	31.8	39.4	30.2	39.4	28.9	39.4
	32	33.1	40.7	33.1	40.7	33.1	40.7	33.1	40.7	31.5	40.7	30.2	40.7
36	35.1	43.0	35.1	43.0	35.1	43.0	35.1	43.0	33.8	43.0	32.5	43.0	
40	37.1	45.3	37.1	45.3	37.1	45.3	37.1	45.3	36.4	45.3	34.8	45.3	
225 psi (16 bar)	8	15.7	21.6	15.4	21.6	14.8	21.6	14.1	21.6	13.1	21.6	12.8	21.6
	10	18.4	24.9	18.0	24.9	17.4	24.9	16.4	24.9	15.4	24.9	14.8	24.9
	12	20.7	27.2	20.0	27.2	19.4	27.2	18.7	27.2	17.4	27.2	16.7	27.2
	14	23.0	28.9	22.3	28.9	21.3	28.9	20.7	28.9	19.4	28.9	18.7	28.9
	16	25.3	31.5	24.6	31.5	23.6	31.5	22.6	31.5	21.3	31.5	20.3	31.5
	18	27.2	33.1	26.6	33.1	25.6	33.1	24.3	33.1	23.0	33.1	22.0	33.1
	20	28.5	34.8	28.2	34.8	27.2	34.8	26.2	34.8	24.6	34.8	23.6	34.8
	24	31.5	38.4	31.5	38.4	30.8	38.4	29.5	38.4	27.9	38.4	26.6	38.4
	28	34.1	41.7	34.1	41.7	34.1	41.7	32.8	41.7	30.8	41.7	29.5	41.7
	30	35.1	43.0	35.1	43.0	35.1	43.0	34.1	43.0	32.1	43.0	30.8	43.0
32	36.1	44.3	36.1	44.3	36.1	44.3	35.8	44.3	33.8	44.3	32.1	44.3	

Table III-d Support distance for series EST , $P = 0.75 * P_N$

Support Distance L' (ft) for series EST, $P = 0.75 * P_N$ (psig)													
Series EST	ND (in)	T=68° F		T=104° F		T=140° F		T=175° F		T=212° F		T=230° F	
		L _S	L _C	L _S	L _C	L _S	L _C	L _S	L _C	L _S	L _C	L _S	L _C
300 psi (20 bar)	6	14.1	21.3	13.8	21.3	13.1	21.3	12.5	21.3	11.8	20.3	11.5	19.4
	8	17.1	25.6	16.7	25.6	16.1	25.6	15.4	25.6	14.4	24.6	13.8	23.6
	10	20.0	28.5	19.4	28.5	18.7	28.5	17.7	28.5	16.7	28.5	16.1	27.6
	12	22.3	31.2	22.0	31.2	21.0	31.2	20.0	31.2	19.0	31.2	18.0	31.2
	14	24.9	33.5	24.3	33.5	23.3	33.5	22.3	34.4	21.0	33.5	20.0	33.5
	16	27.2	35.8	26.6	35.8	25.6	35.8	24.3	35.8	23.0	35.8	22.0	35.8
	18	29.5	37.7	28.5	37.7	27.6	37.7	26.2	37.7	24.9	37.7	23.6	37.7
	20	31.5	39.7	30.5	39.7	29.5	39.7	28.2	39.7	26.6	39.7	25.6	39.7
24	35.8	44.0	34.8	44.0	33.5	44.0	31.8	44.0	30.2	44.0	28.9	44.0	
350 psi (25 bar)	4	12.1	20.7	11.8	20.0	11.5	19.4	10.8	18.7	10.2	17.4	9.8	16.7
	6	15.1	24.3	14.8	24.3	14.1	24.3	13.4	23.3	12.8	22.0	12.1	21.0
	8	18.4	27.9	17.7	27.9	17.1	27.9	16.4	27.9	15.4	26.6	14.8	25.3
	10	21.3	31.2	20.7	31.2	20.0	31.2	19.0	31.2	18.0	30.8	17.4	29.5
	12	23.9	34.1	23.3	34.1	22.6	34.1	21.6	34.1	20.3	34.1	19.4	33.1
	14	26.6	36.7	25.9	36.7	24.9	36.7	23.9	36.7	22.3	36.7	21.6	36.7
	16	29.2	39.7	28.5	39.7	27.2	39.7	26.2	39.7	24.6	39.7	23.6	39.7
	18	31.5	42.0	30.8	42.0	29.5	42.0	28.2	42.0	26.6	42.0	25.6	42.0
20	33.8	44.3	32.8	44.3	31.8	44.3	30.2	44.3	28.5	44.3	27.6	44.3	
24	38.0	48.2	37.1	48.2	35.8	48.2	34.1	48.2	32.1	48.2	30.8	48.2	
450 psi (32 bar)	1	6.6	11.2	6.2	10.8	6.2	10.5	5.9	10.2	5.6	9.5	5.2	9.2
	1.5	7.9	13.4	7.5	13.1	7.2	12.5	6.9	12.1	6.6	11.5	6.2	10.8
	2	8.5	14.8	8.2	14.1	7.9	13.8	7.5	13.1	7.2	12.5	6.9	11.8
	3	11.2	19.0	10.8	18.4	10.5	17.7	9.8	17.1	9.5	16.1	8.9	15.4
	4	12.5	21.3	12.1	20.7	11.5	19.7	11.2	19.0	10.5	18.0	10.2	17.1
	6	16.1	25.9	15.7	25.9	15.1	25.9	14.4	24.6	13.8	23.3	13.1	22.3
	8	19.7	30.2	19.0	30.2	18.4	30.2	17.7	30.2	16.4	28.2	15.7	27.2
	10	23.0	33.8	22.3	33.8	21.3	33.8	20.3	33.8	19.4	32.8	18.4	31.5
12	25.9	37.1	25.3	37.1	24.3	37.1	23.3	37.1	21.6	37.1	21.0	35.8	

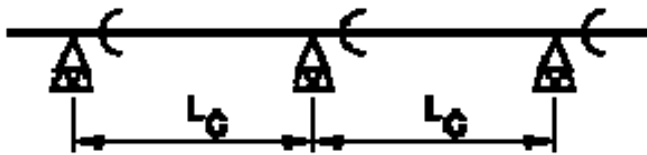


Table III-e Support distance for series EST , $P = 0.5 * P_N$

Support Distance L' (ft) for series EST, $P = 0.5 * P_N$ (psig)													
Series PN (psig)	ND (in)	T=68° F		T=104° F		T=140° F		T=175° F		T=212° F		T=230° F	
		L_S	L_C	L_S	L_C	L_S	L_C	L_S	L_C	L_S	L_C	L_S	L_C
115 psi (8 bar)	14	19.7	26.2	19.0	26.2	18.4	26.2	17.4	26.2	16.4	26.2	15.7	26.2
	16	21.3	28.2	20.7	28.2	20.0	28.2	19.0	28.2	18.0	28.2	17.4	28.2
	18	23.3	29.8	22.6	29.8	21.6	29.8	20.7	29.8	19.4	29.8	18.7	29.8
	20	24.9	31.5	24.3	31.5	23.3	31.5	22.3	31.5	21.0	31.5	20.0	31.5
	24	27.9	34.4	27.2	34.4	26.2	34.4	25.3	34.4	23.6	34.4	22.6	34.4
	28	30.5	37.4	30.2	37.4	29.2	37.4	27.9	37.4	26.2	37.4	25.3	37.4
	30	31.5	38.7	31.5	38.7	30.5	38.7	29.2	38.7	27.6	38.7	26.2	38.7
	32	32.8	40.3	32.8	40.3	31.8	40.3	30.5	40.3	28.9	40.3	27.6	40.3
	36	34.8	42.6	34.8	42.6	34.4	42.6	33.1	42.6	31.2	42.6	29.8	42.6
	40	36.7	44.9	36.7	44.9	36.7	44.9	35.4	44.9	33.5	44.9	32.1	44.9
48	40.3	49.2	40.3	49.2	40.3	49.2	40.0	49.2	37.7	49.2	36.1	49.2	
175 psi (12.5 bar)	10	17.1	27.2	16.4	27.2	16.1	27.2	15.1	25.9	14.4	24.6	13.8	23.6
	12	19.4	29.8	18.7	29.8	18.0	29.8	17.4	29.5	16.1	27.6	15.4	26.6
	14	21.3	32.1	20.7	32.1	20.0	32.1	19.0	32.1	18.0	30.8	17.4	29.5
	16	23.3	34.4	22.6	34.4	21.6	34.4	21.0	34.4	19.7	33.5	18.7	32.1
	18	25.3	36.7	24.6	36.7	23.6	36.7	22.6	36.7	21.3	36.4	20.3	34.8
	20	27.2	39.0	26.6	39.0	25.6	39.0	24.3	39.0	23.0	39.0	22.0	37.7
	24	30.8	43.0	29.8	43.0	28.9	43.0	27.6	43.0	25.9	43.0	24.9	42.6
	28	34.1	46.2	33.1	46.2	31.8	46.2	30.5	46.2	28.5	46.2	27.6	46.2
	30	35.8	47.9	34.8	47.9	33.5	47.9	31.8	47.9	30.2	47.9	28.9	47.9
	32	37.1	49.2	36.1	49.2	34.8	49.2	33.5	49.2	31.5	49.2	30.2	49.2
36	40.3	52.2	39.0	52.2	37.7	52.2	36.1	52.2	33.8	52.2	32.5	52.2	
40	43.0	55.1	42.0	55.1	40.3	55.1	38.7	55.1	36.4	55.1	34.8	55.1	
225 psi (16 bar)	8	15.7	26.6	15.4	26.2	14.8	25.3	14.1	23.9	13.1	22.6	12.8	21.6
	10	18.4	30.5	18.0	30.5	17.4	29.5	16.4	28.2	15.4	26.6	14.8	25.6
	12	20.7	33.1	20.0	33.1	19.4	33.1	18.7	31.8	17.4	29.8	16.7	28.5
	14	23.0	35.8	22.3	35.8	21.3	35.8	20.7	35.1	19.4	33.1	18.7	31.8
	16	25.3	38.4	24.6	38.4	23.6	38.4	22.6	38.4	21.3	36.4	20.3	34.8
	18	27.2	40.7	26.6	40.7	25.6	40.7	24.3	40.7	23.0	39.0	22.0	37.7
	20	29.2	42.6	28.2	42.6	27.2	42.6	26.2	42.6	24.6	42.0	23.6	40.3
	24	32.8	46.9	32.1	46.9	30.8	46.9	29.5	46.9	27.9	46.9	26.6	45.6
	28	36.4	50.8	35.4	50.8	34.1	50.8	32.8	50.8	30.8	50.8	29.5	50.5
	30	38.4	52.5	37.1	52.5	35.8	52.5	34.1	52.5	32.1	52.5	30.8	52.5
32	40.0	54.1	38.7	54.1	37.4	54.1	35.8	54.1	33.8	54.1	32.1	54.1	

Table III-e Support distance for series EST , $P = 0.5 * P_N$

Support Distance L' (ft) for series EST, $P = 0.5 * P_N$ (psig)													
Series EST	ND (in)	T=68° F		T=104° F		T=140° F		T=175° F		T=212° F		T=230° F	
		L _S	L _C	L _S	L _C	L _S	L _C	L _S	L _C	L _S	L _C	L _S	L _C
300 psi (20 bar)	6	14.1	23.9	13.8	23.3	13.1	22.3	12.5	21.3	11.8	20.3	11.5	19.4
	8	17.1	29.2	16.7	28.5	16.1	27.6	15.4	26.2	14.4	24.6	13.8	23.6
	10	20.0	34.1	19.4	33.1	18.7	31.8	17.7	30.5	16.7	28.5	16.1	27.6
	12	22.3	37.7	22.0	37.4	21.0	36.1	20.0	34.4	19.0	32.5	18.0	31.2
	14	24.9	40.7	24.3	40.7	23.3	39.7	22.3	38.0	21.0	35.8	20.0	34.4
	16	27.2	43.3	26.6	43.3	25.6	43.3	24.3	41.7	23.0	39.0	22.0	37.7
	18	29.5	45.9	28.5	45.9	27.6	45.9	26.2	44.9	24.9	42.3	23.6	40.7
	20	31.5	48.2	30.5	48.2	29.5	48.2	28.2	48.2	26.6	45.6	25.6	43.6
24	35.8	53.5	34.8	53.5	33.5	53.5	31.8	53.5	30.2	51.5	28.9	49.5	
350 psi (25 bar)	4	12.1	20.7	11.8	20.0	11.5	19.4	10.8	18.7	10.2	17.4	9.8	16.7
	6	15.1	25.9	14.8	25.3	14.1	24.3	13.4	23.3	12.8	22.0	12.1	21.0
	8	18.4	31.5	17.7	30.5	17.1	29.5	16.4	28.2	15.4	26.6	14.8	25.3
	10	21.3	36.4	20.7	35.4	20.0	34.1	19.0	32.5	18.0	30.8	17.4	29.5
	12	23.9	41.0	23.3	40.0	22.6	38.4	21.6	36.7	20.3	34.8	19.4	33.1
	14	26.6	44.6	25.9	44.3	24.9	42.6	23.9	40.7	22.3	38.4	21.6	36.7
	16	29.2	48.2	28.5	48.2	27.2	46.9	26.2	44.6	24.6	42.0	23.6	40.3
	18	31.5	50.8	30.8	50.8	29.5	50.5	28.2	48.5	26.6	45.6	25.6	43.6
20	33.8	53.8	32.8	53.8	31.8	53.8	30.2	51.8	28.5	48.9	27.6	46.9	
24	38.0	58.7	37.1	58.7	35.8	58.7	34.1	58.4	32.1	55.1	30.8	52.8	
450 psi (32 bar)	1	6.6	11.2	6.2	10.8	6.2	10.5	5.9	10.2	5.6	9.5	5.2	9.2
	1.5	7.9	13.4	7.5	13.1	7.2	12.5	6.9	12.1	6.6	11.5	6.2	10.8
	2	8.5	14.8	8.2	14.1	7.9	13.8	7.5	13.1	7.2	12.5	6.9	11.8
	3	11.2	19.0	10.8	18.4	10.5	17.7	9.8	17.1	9.5	16.1	8.9	15.4
	4	12.5	21.3	12.1	20.7	11.5	19.7	11.2	19.0	10.5	18.0	10.2	17.1
	6	16.1	27.6	15.7	26.9	15.1	25.9	14.4	24.6	13.8	23.3	13.1	22.3
	8	19.7	33.5	19.0	32.8	18.4	31.5	17.7	30.2	16.4	28.2	15.7	27.2
	10	23.0	39.0	22.3	38.0	21.3	36.4	20.3	35.1	19.4	32.8	18.4	31.5
12	25.9	44.3	25.3	43.0	24.3	41.3	23.3	39.7	21.6	37.1	21.0	35.8	

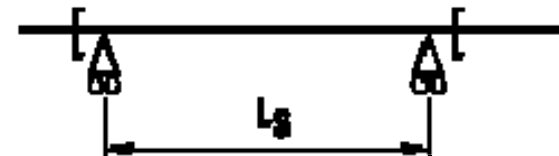
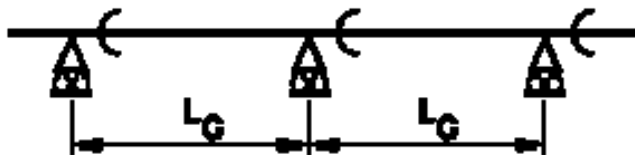
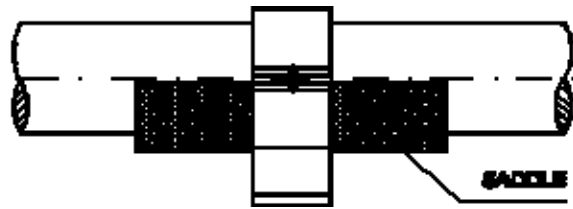


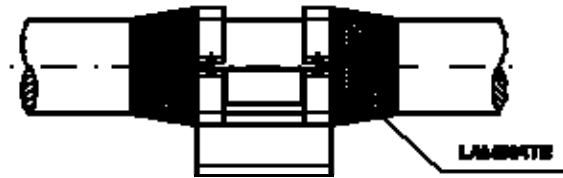
Table III-f

Anchor Load P _A (N) for series EST at 20° C and ΔT= 10° C							Anchor Load P _A (lb _f) for series EST at 68° F and ΔT= 18° F						
ID (mm)	8	12.5	16	20	25	32	ND (in)	115 psi	175 psi	225 psi	300 psi	350 psi	450 psi
25						541	1						121.6
40						835	1.5						187.7
50						1031	2						231.8
80						2007	3						451.2
100					2490	2651	4					560	596
150				3696	4525	5362	6				831	1017	1205
200			5058	6309	7570	9159	8			1137	1418	1702	2059
250		6302	7660	9417	11384	13963	10		1417	1722	2117	2559	3139
300		8704	10564	13138	15966	19771	12		1957	2375	2954	3589	4445
350	9198	11487	13926	17472	21318		14	2068	2582	3131	3928	4792	
400	11677	14650	18056	22418	27754		16	2625	3293	4059	5040	6239	
451	14447	18194	22373	27977	34683		18	3248	4090	5030	6290	7797	
503	17508	22505	27146	34149	42381		20	3936	5059	6103	7677	9528	
604	24505	31574	38533	48800	60085		24	5509	7098	8663	10971	13508	
700	32667	42166	51905				28	7344	9479	11669			
750	37185	48033	59045				30	8360	10798	13274			
800	42583	54281	66643				32	9573	12203	14982			
900	53149	67919					36	11948	15269				
1000	64881	83080					40	14586	18677				
1200	91840						48	20647					



A. Adhesive bonded saddle

Adhesive bonded saddles can be fixed on the bottom of the pipe on each side of a pipe clamp.



B. Laminate build-ups

On each side of a pipe clamp a laminate can be wrapped.

Table III-g End play and angular deflection of the RSLJ and RSJ

End play and angular deflection of the RSLJ and RSJ

ID (mm)	End play (mm)		End play (inch)		Angular deflection		ND inch
	RSLJ	RSJ	RSLJ	RSJ	RSLJ	RSJ	
80	2.5	32.5	0.10	1.28	1° 30'	3°	3
100	3	33	0.12	1.30	1° 30'	3°	4
150	6	36	0.24	1.42	1° 30'	3°	6
200	8	38	0.31	1.50	1° 30'	3°	8
250	9	39 (59) [Ⓜ]	0.35	1.53 (2.3)	1° 30'	3°	10
300	10	60	0.39	2.36	1° 30'	3°	12
350	11	61	0.43	2.40	1° 30'	3°	14
400	13	63	0.51	2.48	1° 30'	3°	16
451	14	64	0.55	2.52	1° 30'	3°	18
503	16	66	0.63	2.60	1° 30'	3°	20
604	19	69	0.75	2.72	1° 30'	2°	24
700	16	66	0.63	2.60	1°	2°	28
750	17	67	0.67	2.64	1°	2°	30
800	19	69	0.75	2.72	1°	2°	32
900	21	71	0.83	2.80	1°	2°	36
1000	23	73	0.91	2.87	1°	2°	40
1200	27	77	1.06	3.03	1°	1°	48
1400	32	82	1.26	3.23	1°	1°	56

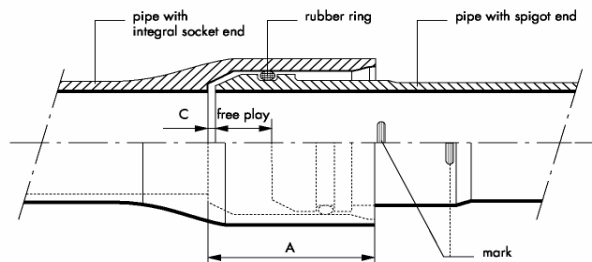


Table IV-j Predicted pipe vertical deflection in good, firm and stable native soil

Soil weight: 125 lbs/ft³ (2000 kg/m³) E' backfill = 1000 psi (6.9 N/mm²) Bedding angle= 90° Defl. Lag factor= 1.5
 granular backfill (type GW, GP, GM, SW, SP, SM) with moderate compaction (85+ %)

Predicted vertical deflection Δy (%) at P_N for buried series EST at 68° F																		
Wheel Load (lbs) >>		0				11,000 lbs				16,500 lbs				22,000 lbs				
		Burial depth (ft)				Burial depth (ft)				Burial depth (ft)				Burial depth (ft)				
Pipe class	DN inch	1.6	3.3	8.2	16.4	1.6	3.3	8.2	16.4	1.6	3.3	8.2	16.4	1.6	3.3	8.2	16.4	
EST 8 115 psi	14	0.4	0.9	2.2	4.3	2.8	1.7	2.3	4.3	4.0	2.0	2.4	4.4	N.R	2.4	2.4	4.4	
	16	0.4	0.9	2.2	4.3	2.8	1.6	2.3	4.3	4.0	2.0	2.4	4.4	N.R	2.4	2.4	4.4	
	18	0.4	0.9	2.2	4.3	2.7	1.6	2.3	4.3	3.9	2.0	2.4	4.4	5.0	2.4	2.4	4.4	
	20	0.4	0.9	2.2	4.3	2.7	1.6	2.3	4.3	3.8	2.0	2.4	4.4	4.9	2.4	2.4	4.4	
	24	0.4	0.9	2.2	4.3	2.5	1.6	2.3	4.3	3.6	2.0	2.4	4.4	4.6	2.4	2.4	4.4	
	28	0.4	0.9	2.2	4.3	2.4	1.6	2.3	4.3	3.4	2.0	2.4	4.4	4.4	2.3	2.4	4.4	
	30	0.4	0.9	2.2	4.3	2.3	1.6	2.3	4.3	3.3	2.0	2.4	4.4	4.2	2.3	2.4	4.4	
	32	0.4	0.9	2.2	4.3	2.3	1.6	2.3	4.3	3.2	1.9	2.4	4.4	4.1	2.3	2.4	4.4	
	36	0.4	0.9	2.2	4.3	2.2	1.6	2.3	4.3	3.0	1.9	2.4	4.4	3.9	2.2	2.4	4.4	
	40	0.4	0.9	2.2	4.3	2.0	1.5	2.3	4.3	2.8	1.9	2.4	4.4	3.7	2.2	2.4	4.4	
48	0.4	0.9	2.2	4.3	1.9	1.5	2.3	4.3	2.6	1.8	2.4	4.4	3.3	2.1	2.4	4.4		
EST 12.5 175 psi	10	0.4	0.9	2.2	4.3	2.9	1.6	2.3	4.3	4.1	2.0	2.3	4.3	N.R	2.4	2.4	4.3	
	12	0.4	0.9	2.2	4.3	2.9	1.6	2.3	4.3	4.1	2.0	2.3	4.3	N.R	2.4	2.4	4.3	
	14	0.4	0.9	2.2	4.3	2.8	1.6	2.3	4.3	4.0	2.0	2.3	4.3	N.R	2.4	2.4	4.3	
	16	0.4	0.9	2.2	4.3	2.7	1.6	2.3	4.3	3.9	2.0	2.3	4.3	N.R	2.4	2.4	4.3	
	18	0.4	0.9	2.2	4.3	2.7	1.6	2.3	4.3	3.8	2.0	2.3	4.3	4.9	2.4	2.4	4.3	
	20	0.4	0.9	2.2	4.3	2.6	1.6	2.3	4.3	3.7	2.0	2.3	4.3	4.8	2.4	2.4	4.3	
	24	0.4	0.9	2.2	4.3	2.5	1.6	2.3	4.3	3.5	2.0	2.3	4.3	4.6	2.3	2.4	4.3	
	28	0.4	0.9	2.2	4.3	2.4	1.6	2.3	4.3	3.3	1.9	2.3	4.3	4.3	2.3	2.4	4.3	
	30	0.4	0.9	2.2	4.3	2.3	1.6	2.3	4.3	3.2	1.9	2.3	4.3	4.2	2.3	2.4	4.3	
	32	0.4	0.9	2.2	4.3	2.2	1.6	2.3	4.3	3.2	1.9	2.3	4.3	4.1	2.3	2.4	4.3	
36	0.4	0.9	2.2	4.3	2.1	1.5	2.3	4.3	3.0	1.9	2.3	4.3	3.8	2.2	2.4	4.3		
40	0.4	0.9	2.2	4.3	2.0	1.5	2.3	4.3	2.8	1.9	2.3	4.3	3.6	2.2	2.4	4.3		
EST 16 225 psi	8	0.4	0.8	2.1	4.2	2.8	1.6	2.2	4.2	4.1	2.0	2.3	4.3	N.R	2.3	2.3	4.3	
	10	0.4	0.8	2.1	4.2	2.8	1.6	2.2	4.2	4.0	2.0	2.3	4.2	N.R	2.3	2.3	4.3	
	12	0.4	0.8	2.1	4.2	2.8	1.6	2.2	4.2	3.9	2.0	2.3	4.3	N.R	2.3	2.3	4.3	
	14	0.4	0.8	2.1	4.2	2.7	1.6	2.2	4.2	3.9	2.0	2.3	4.3	5.0	2.3	2.3	4.3	
	16	0.4	0.8	2.1	4.2	2.6	1.6	2.2	4.2	3.8	1.9	2.3	4.2	4.9	2.3	2.3	4.3	
	18	0.4	0.8	2.1	4.2	2.6	1.6	2.2	4.2	3.7	1.9	2.3	4.3	4.8	2.3	2.3	4.3	
	20	0.4	0.8	2.1	4.2	2.5	1.6	2.2	4.2	3.6	1.9	2.3	4.3	4.7	2.3	2.3	4.3	
	24	0.4	0.8	2.1	4.2	2.4	1.5	2.2	4.2	3.4	1.9	2.3	4.3	4.4	2.3	2.3	4.3	
	28	0.4	0.8	2.1	4.2	2.3	1.5	2.2	4.2	3.2	1.9	2.3	4.2	4.2	2.2	2.3	4.3	
	30	0.4	0.8	2.1	4.2	2.2	1.5	2.2	4.2	3.1	1.9	2.3	4.3	4.0	2.2	2.3	4.3	
32	0.4	0.8	2.1	4.2	2.2	1.5	2.2	4.2	3.0	1.9	2.3	4.3	3.9	2.2	2.3	4.3		

Table IV-j Predicted pipe vertical deflection in good, firm and stable native soil

Soil weight: 125 lbs/ft³ (2000 kg/m³) E' backfill = 1000 psi (6.9 N/mm²) Bedding angle= 90° Defl. Lag factor= 1.5
 granular backfill (type GW, GP, GM, SW, SP, SM) with moderate compaction (85+ %)

Predicted vertical deflection Δy (%) at P _N for buried series EST at 68° F																	
Wheel Load (lbs) >>		0				11,000 lbs				16,500 lbs				22,000 lbs			
		Burial depth (ft)				Burial depth (ft)				Burial depth (ft)				Burial depth (ft)			
Pipe class	DN inch	1.6	3.3	8.2	16.4	1.6	3.3	8.2	16.4	1.6	3.3	8.2	16.4	1.6	3.3	8.2	16.4
EST 20 300 psi	6	0.4	0.8	2.0	4.1	2.7	1.5	2.1	4.1	3.8	1.8	2.1	4.1	5.0	2.2	2.2	4.1
	8	0.4	0.8	2.0	4.0	2.6	1.5	2.1	4.1	3.7	1.8	2.1	4.1	4.9	2.2	2.1	4.1
	10	0.4	0.8	2.0	4.0	2.6	1.5	2.1	4.1	3.7	1.8	2.1	4.1	4.8	2.2	2.2	4.1
	12	0.4	0.8	2.0	4.0	2.6	1.5	2.1	4.1	3.6	1.8	2.1	4.1	4.7	2.2	2.2	4.1
	14	0.4	0.8	2.0	4.1	2.5	1.5	2.1	4.1	3.6	1.8	2.1	4.1	4.6	2.2	2.2	4.1
	16	0.4	0.8	2.0	4.1	2.5	1.5	2.1	4.1	3.5	1.8	2.1	4.1	4.5	2.1	2.2	4.1
	18	0.4	0.8	2.0	4.1	2.4	1.5	2.1	4.1	3.4	1.8	2.1	4.1	4.4	2.1	2.2	4.1
	20	0.4	0.8	2.0	4.1	2.4	1.5	2.1	4.1	3.3	1.8	2.1	4.1	4.3	2.1	2.2	4.1
	24	0.4	0.8	2.0	4.0	2.2	1.4	2.1	4.1	3.2	1.8	2.1	4.1	4.1	2.1	2.2	4.1
EST 25 350 psi	4	0.3	0.6	1.5	3.5	2.1	1.2	1.6	3.5	3.0	1.4	1.7	3.5	3.9	1.7	1.7	3.5
	6	0.3	0.7	1.7	3.8	2.3	1.3	1.8	3.8	3.3	1.6	1.9	3.8	4.3	1.9	1.9	3.8
	8	0.3	0.7	1.7	3.8	2.3	1.3	1.8	3.8	3.3	1.6	1.9	3.8	4.3	1.9	1.9	3.8
	10	0.3	0.7	1.7	3.8	2.3	1.3	1.8	3.8	3.3	1.6	1.9	3.8	4.3	1.9	1.9	3.8
	12	0.4	0.7	1.8	3.8	2.3	1.3	1.8	3.8	3.2	1.6	1.9	3.8	4.2	1.9	1.9	3.8
	14	0.4	0.7	1.8	3.8	2.2	1.3	1.8	3.8	3.2	1.6	1.9	3.8	4.1	1.9	1.9	3.8
	16	0.3	0.7	1.7	3.8	2.2	1.3	1.8	3.8	3.1	1.6	1.9	3.8	4.0	1.9	1.9	3.8
	18	0.3	0.7	1.7	3.8	2.1	1.3	1.8	3.8	3.0	1.6	1.9	3.8	3.9	1.9	1.9	3.8
	20	0.3	0.7	1.7	3.8	2.1	1.3	1.8	3.8	2.9	1.6	1.9	3.8	3.8	1.9	1.9	3.8
24	0.3	0.7	1.7	3.8	2.0	1.3	1.8	3.8	2.8	1.6	1.9	3.8	3.6	1.9	1.9	3.8	
EST 32 450 psi	1	0.0	0.1	0.2	1.4	0.3	0.2	0.2	1.4	0.4	0.2	0.2	1.4	0.5	0.2	0.2	1.4
	1.5	0.1	0.2	0.6	2.1	0.8	0.4	0.6	2.1	1.1	0.6	0.6	2.1	1.5	0.7	0.7	2.1
	2	0.2	0.4	0.9	2.6	1.2	0.7	1.0	2.6	1.8	0.8	1.0	2.6	2.3	1.0	1.0	2.6
	3	0.2	0.5	1.2	3.0	1.6	0.9	1.3	3.1	2.3	1.1	1.3	3.1	3.0	1.3	1.3	3.1
	4	0.3	0.6	1.4	3.4	1.9	1.1	1.5	3.4	2.7	1.3	1.5	3.4	3.6	1.6	1.6	3.4
	6	0.3	0.6	1.5	3.4	2.0	1.1	1.5	3.4	2.8	1.4	1.6	3.4	3.6	1.6	1.6	3.4
	8	0.3	0.6	1.4	3.4	1.9	1.1	1.5	3.4	2.7	1.3	1.5	3.4	3.6	1.6	1.6	3.4
	10	0.3	0.6	1.4	3.4	1.9	1.1	1.5	3.4	2.7	1.3	1.5	3.4	3.5	1.6	1.6	3.4
	12	0.3	0.6	1.4	3.4	1.8	1.1	1.5	3.4	2.6	1.3	1.5	3.4	3.4	1.6	1.6	3.4