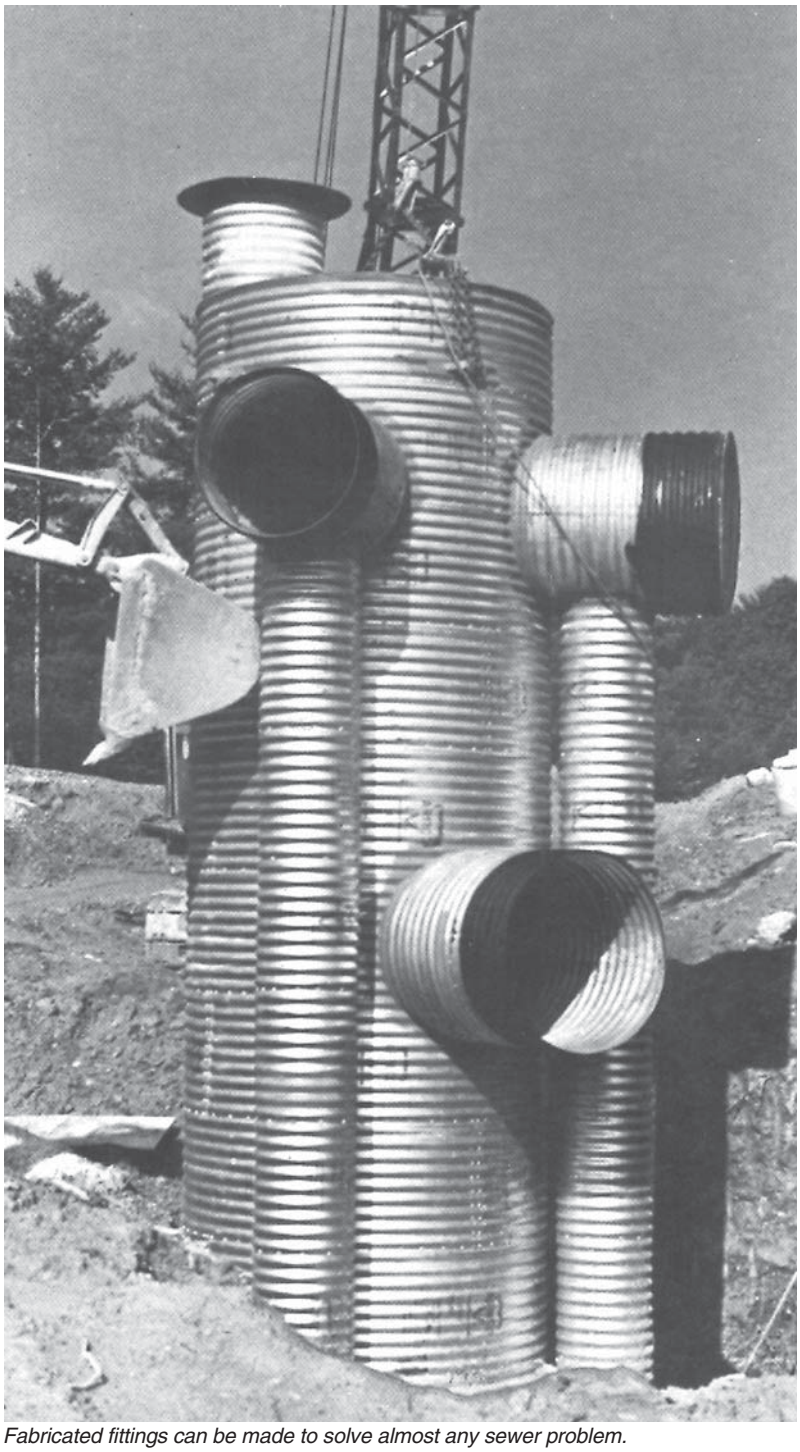


Fabricated fittings can be made to solve almost any sewer problem.

CHAPTER 1 Steel Sewer Products

Introduction

Corrugated steel pipe (CSP) provides a strong, durable, economical selection for the construction of sewer systems. Introduced by a city engineer in 1896, countless miles of CSP now provide reliable service throughout the highway system, and in large and small municipalities across the North American continent.

The sewer designer can select from a wide range of CSP products to meet exacting job requirements. Factory made pipe, in sizes large enough to accommodate most needs is available with a variety of corrugation profiles that provide optimal strength. For larger structures, structural plate pipe can be furnished for bolted assembly in the field. Shop fabricated fittings; long lightweight sections; reliable and positive coupling systems—all contribute to speed and economy in field installation. In addition, a range of protective coatings is available to meet rigorous service demands.

CORRUGATED STEEL PIPE AND STRUCTURAL PLATE PIPE DATA

CORRUGATED STEEL PIPE

There are basically two types of corrugated steel pipe: helical and annular.

Helical CSP, where the corrugations and seams run helically around the pipe is fabricated by:

a) lockseam method,

b) continuous welding of the seams,

c) integrally attaching at the lockseam a helically corrugated steel sheet with a smooth inner steel lining (smooth lined pipe).

Reformed annular ends for joining are available.

Annular CSP, where the corrugations run annularly around the pipe is fabricated by:

a) riveting the seams,

b) bolting the seams,

c) resistance spot welding the seams.

A wide variety of geometrical shapes are available in corrugated steel pipe to satisfy requirements such as low headroom or greater hydraulic efficiency. See Tables 1.7, 1.8, 1.9, 1.10 and 1.11.

Table 1.1 illustrates the sizes, corrugation profiles, steel thickness and shapes available for the various types of steel pipe.

Handling weights for CSP are shown in Tables 1.2, 1.3, 1.4, 1.5 and 1.6. Tables 1.7 and 1.8 show the design details for corrugated steel pipe-arches.

STRUCTURAL PLATE PIPE

For larger structures requiring field assembly, structural plate pipe is available. Structural plate pipe is fabricated from hot-dip galvanized plates and is assembled by bolting individual plates together to form large pipes, pipe-arches and a variety of other shapes.

Standard sizes of structural plate are indicated in Table 1.1.

Sizes and layout details for circular pipe, pipe-arches and arches are illustrated in Tables 1.9, 1.10 and 1.11.

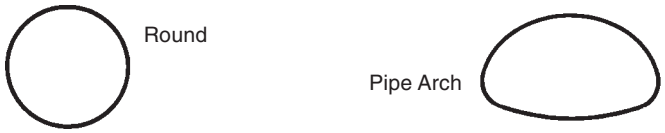


Table 1.1
Sizes, corrugation profiles, thickness and shapes available for various types of steel pipe

Type of Pipe	Size (Diameter or Span)	Corrugation Profile	Specified Thickness Range	Shape
Corrugated Steel Pipe (Helical and Annular Pipe)	150 - 250	38 x 6.5	1.3 - 1.6	Round
	300 - 2400	68 x 13	1.3 - 4.2	Round
	1200 - 3600	76 x 25	1.6 - 4.2	Round
	1200 - 3600	125 x 26*	1.6 - 4.2	Round
	450 - 2130	68 x 13	1.6 - 4.2	Pipe Arch
	1330 - 2010	76 x 25	1.6 - 4.2	Pipe Arch
	1330 - 2010	125 x 26	1.6 - 3.5	Pipe Arch
Spiral Rib Pipe	450 - 2600	19 x 19 rib at 190	1.6 - 2.8	Round
Structural Plate Pipe	1500 thru 8020 and larger	152 x 51	3.0 - 7.0	Round, Pipe Arch Elliptical, Arch and Other Special Shapes

*Available only in helical pipe. Note: All dimensions are in millimetres.

Table 1.2
Corrugated Steel Pipe (CSP) - round standard diameters, end areas, and handling weights (38 mm x 6.5 mm)
Estimated average weights - not for specification use

			Approximate Kilograms per Linear Metre (Weights will vary slightly with fabrication method)	
Inside Diameter (mm)	End Area (m^2)	Specified Thickness (mm)	Metallic Coated*	Full Bituminous Coated
150	0.018	1.3	5.9	7.2
		1.6	7.2	8.5
200	0.031	1.3	7.7	9.4
		1.6	9.5	11.0
250	0.049	1.3	9.6	12.0
		1.6	12.0	14.0

Note: perforated sub-drains will weigh slightly less
*Metallic coated: Galvanized or Aluminum Type 2

Table 1.3
Corrugated Steel Pipe (CSP) - round standard diameters, end areas, and handling weights (68 mm x 13 mm)
Estimated average weights - not for specification use*

			Approximate Kilograms Per Linear Metre**			
Inside Diameter (mm)	End Area (m^2)	Specified Thickness (mm)	Metallic Coated	Full Bituminous Coated	Full Bituminous Coated and Invert Paved	Full Bituminous Coated and Full Paved
300	0.07	1.3	12	15	17	22
		1.6	14	17	19	24
		2.0	18	21	23	28
400	0.13	1.3	16	20	22	30
		1.6	19	23	25	33
		2.0	24	28	30	38
500	0.2	1.3	19	24	27	36
		1.6	24	29	32	41
		2.0	30	35	38	47
		2.8	41	46	49	58
600	0.28	1.3	23	28	32	44
		1.6	28	33	37	49
		2.0	35	40	44	56
		2.8	49	54	58	70
700	0.38	1.6	33	39	44	57
		2.0	41	47	52	65
		2.8	57	63	68	81
800	0.5	1.6	37	44	49	64
		2.0	47	54	59	74
		2.8	65	72	77	92
900	0.64	1.6	42	50	56	73
		2.0	53	61	67	84
		2.8	73	81	87	104
		3.5	90	98	104	121
		4.2	108	116	122	139
1000	0.79	1.6	47	56	62	81
		2.0	58	67	73	92
		2.8	81	90	96	115
		3.5	100	109	115	134
		4.2	120	129	135	154
1200	1.13	1.6	56	66	74	97
		2.0	70	80	88	111
		2.8	97	107	115	138
		3.5	120	130	138	161
		4.2	144	154	162	185
1400	1.54	2.0	81	93	102	129
		2.8	113	125	134	161
		3.5	140	152	161	188
		4.2	168	180	189	216
1600	2.01	2.0	93	107	117	148
		2.8	130	144	154	185
		3.5	160	174	184	215
		4.2	192	206	216	247
1800	2.54	2.8	146	162	174	208
		3.5	179	195	206	241
		4.2	215	231	242	277
2000	3.14	2.8	162	179	192	230
		3.5	199	216	229	267
		4.2	239	256	269	307
2200	3.8	3.5	219	238	252	294
		4.2	263	282	296	338
2400	4.52	4.2	287	308	323	369

*Lock seam construction only; weights will vary with other fabrication practices
**For other coatings or linings the weights may be interpolated
Note: Pipe arch weights will be the same as the equivalent round pipe
For example, for 1030 mm x 740 mm, 68 mm x 13 mm in Pipe Arch,
refer to 800 mm diameter pipe weight

Table 1.4
Corrugated Steel Pipe (CSP) - round standard diameters, end areas, and handling weights (76 mm x 25 mm)
Estimated average weights - not for specification use*

			Approximate Kilograms Per Linear Metre**			
Inside Diameter (mm)	End Area (m^2)	Specified Thickness (mm)	Metallic Coated	Full Bituminous Coated	Full Bituminous Coated and Invert Paved	Full Bituminous Coated and Full Paved
1200	1.13	1.6	65	77	90	130
		2.0	81	93	106	146
		2.8	112	124	137	177
1400	1.54	1.6	75	89	104	151
		2.0	94	108	124	170
		2.8	131	145	160	207
		3.5	161	175	190	237
1600	2.01	1.6	86	102	120	173
		2.0	107	123	141	194
		2.8	149	165	183	236
		3.5	184	200	218	271
		4.2	221	237	255	308
1800	2.54	1.6	96	114	134	194
		2.0	120	138	158	218
		2.8	167	185	205	264
		3.5	206	224	244	304
		4.2	248	266	286	346
2000	3.14	1.6	107	127	149	215
		2.0	133	153	175	241
		2.8	186	206	228	294
		3.5	229	249	271	337
		4.2	275	295	317	383
2200	3.8	1.6	117	139	163	236
		2.0	147	169	193	266
		2.8	204	226	250	323
		3.5	252	274	298	371
		4.2	302	324	348	421
2400	4.52	1.6	128	152	178	258
		2.0	160	184	210	290
		2.8	221	245	272	351
		3.5	274	298	324	404
		4.2	329	353	380	459
2700	5.73	1.6	144	171	201	290
		2.0	179	206	236	325
		2.8	250	277	307	396
		3.5	308	335	365	454
		4.2	370	397	427	516
3000	7.07	2.0	199	229	262	362
		2.8	278	308	341	440
		3.5	342	372	405	504
		4.2	411	441	474	574
3300	8.55	2.8	305	338	374	484
		3.5	376	409	445	555
		4.2	451	484	520	630
3600	10.18	3.5	410	446	486	605
		4.2	492	528	568	687

*Lock seam construction only; weights will vary with other fabrication practices
**For other coatings or linings the weights may be interpolated
Note: Pipe arch weights will be the same as the equivalent round pipe
For example, for 1550 mm x 1200 mm, 76 mm x 25 mm in Pipe Arch,
refer to 1400 mm diameter pipe weight

Table 1.5
Corrugated Steel Pipe (CSP) - round standard diameters, end areas, and handling weights (125 mm x 26 mm)
Estimated average weights - not for specification use*

			Approximate Kilograms Per Linear Metre**			
Inside Diameter (mm)	End Area (m^2)	Specified Thickness (mm)	Metallic Coated	Full Bituminous Coated	Full Bituminous Coated and Invert Paved	Full Bituminous Coated and Full Paved
1200	1.13	1.6	57	68	82	123
		2.0	71	82	96	137
		2.8	100	111	124	166
1400	1.54	1.6	66	79	95	143
		2.0	83	96	112	160
		2.8	116	129	145	193
		3.5	144	157	173	221
1600	2.01	1.6	76	90	108	163
		2.0	95	109	127	182
		2.8	132	147	165	220
		3.5	165	179	198	252
		4.2	197	211	230	284
1800	2.54	1.6	85	101	122	184
		2.0	106	122	143	205
		2.8	148	165	185	247
		3.5	185	201	222	284
		4.2	221	237	258	320
2000	3.14	1.6	94	112	136	204
		2.0	118	136	159	228
		2.8	165	183	206	274
		3.5	205	223	246	315
		4.2	245	263	286	355
2200	3.8	1.6	104	123	149	224
		2.0	129	149	175	250
		2.8	181	201	226	302
		3.5	225	246	270	346
		4.2	269	289	314	390
2400	4.52	1.6	113	135	162	245
		2.0	141	163	190	273
		2.8	197	219	247	329
		3.5	245	267	295	377
		4.2	293	316	343	425
2700	5.73	1.6	127	151	183	275
		2.0	159	183	214	307
		2.8	222	246	277	370
		3.5	276	300	331	424
		4.2	330	354	385	478
3000	7.07	2.0	176	203	238	340
		2.8	246	273	307	410
		3.5	306	333	368	470
		4.2	366	393	428	530
3300	8.55	2.8	270	300	338	451
		3.5	336	366	404	517
		4.2	402	432	470	583
3600	10.18	3.5	367	389	440	564
		4.2	438	470	511	635

*Lock seam construction only; weights will vary with other fabrication practices
**For other coatings or linings the weights may be interpolated
Note: Pipe arch weights will be the same as the equivalent round pipe

PERFORATED PIPE

Corrugated steel pipe is available with perforations for collection or dissemination of water underground. Most fabricators are equipped to furnish 10 mm round holes. Other sizes and configurations are available.

The most common standard pattern is 320 - 10 mm round holes per square metre of pipe surface. See Chapter 6 for design requirements.

Table 1.6
End areas and handling weights of spiral rib pipe
(19 mm x 19 mm rib at 190 mm)
Estimated average weights - not for specification use*

			Approximate Kilograms Per Linear Metre**		
Inside Diameter (mm)	End Area (m^2)	Specified Thickness (mm)	Metallic Coated	Full Bituminous Coated	Full Bituminous Coated and Invert Paved
450	0.16	1.6	22	28	30
		2.0	27	33	34
525	0.22	1.6	25	31	33
		2.0	31	37	39
		2.8	43	49	49
600	0.28	1.6	30	37	39
		2.0	36	43	44
		2.8	54	61	63
750	0.44	1.6	37	46	49
		2.0	46	55	58
		2.8	63	71	74
900	0.64	1.6	45	55	58
		2.0	55	65	68
		2.8	74	85	88
1050	0.87	1.6	52	64	67
		2.0	64	76	79
		2.8	86	98	101
1200	1.13	1.6	60	74	77
		2.0	73	88	91
		2.8	100	115	118
1350	1.43	1.6	67	83	86
		2.0	82	98	101
		2.8	112	128	131
1500	1.77	1.6	74	92	95
		2.0	91	109	112
		2.8	124	141	144
1650	2.14	2.0	100	119	122
		2.8	137	156	159
1800	2.54	2.0	109	129	134
		2.8	149	170	174
2100	3.46	2.0	106	131	135
		2.8	173	198	202
2400	4.52	2.8	198	228	234
2600	5.31	2.8	210	243	249

*Lock seam construction only
**For other coatings or linings the weights may be interpolated

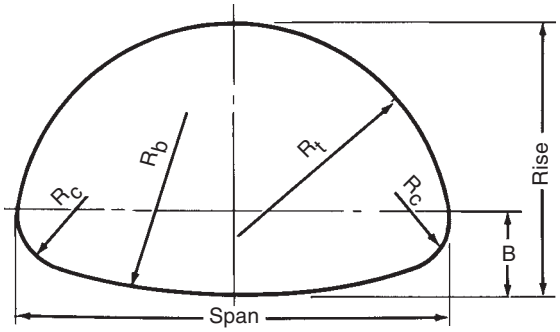


Table 1.7
Sizes and layout details - CSP pipe arches
(68 mm x 13 mm corrugation)

Equiv. Diameter (mm)	Span (mm)	Rise (mm)	Waterway Area (m^2)	Layout Dimensions			
				B (mm)	R_c (mm)	R_t (mm)	R_b (mm)
400	450	340	0.11	130	110	225	440
500	560	420	0.19	165	135	285	555
600	680	500	0.27	190	165	340	740
700	800	580	0.37	220	190	400	900
800	910	660	0.48	255	220	460	1040
900	1030	740	0.61	285	245	525	1190
1000	1150	820	0.74	310	270	585	1405
1200	1390	970	1.06	375	325	715	1730
1400	1630	1120	1.44	430	380	845	2205
1600	1880	1260	1.87	500	435	990	2510
1800	2130	1400	2.36	560	495	1140	2955

Dimensions shown are not for specification purposes, subject to manufacturing tolerances

Table 1.8
Sizes and layout details - CSP pipe arches
(125 mm x 25 mm and 76 mm x 25 mm corrugation)

Equiv. Diameter (mm)	Span (mm)	Rise (mm)	Waterway Area (m^2)	Layout Dimensions
				R_c (mm)
800	1000	700	0.61	150
1000	1100	850	0.74	150
1200	1330	1030	1.09	175
1400	1550	1200	1.48	175
1600	1780	1360	1.93	250
1800	2010	1530	2.44	300
2000	2230	1700	2.97	400
2200	2500	1830	3.44	400
2400	2800	1950	4.27	400
2700	3300	2080	5.39	400
3000	3650	2280	6.60	400
3300	3890	2690	8.29	450
3600	4370	2870	9.76	450

Dimensions shown are not for specification purposes, subject to manufacturing tolerances

Table 1.9
Size and layout details - structural plate circular pipe
(152 mm x 51 mm corrugation profile)

Inside Diameter (mm)	Waterway Area (m^2)	Periphery Total N
1500	1.77	20
1660	2.16	22
1810	2.58	24
1970	3.04	26
2120	3.54	28
2280	4.07	30
2430	4.65	32
2590	5.26	34
2740	5.91	36
3050	7.32	40
3360	8.89	44
3670	10.61	48
3990	12.47	52
4300	14.49	56
4610	16.66	60
4920	18.99	64
5230	21.46	68
5540	24.08	72
5850	26.86	76
6160	29.79	80
6470	32.87	84
6780	36.10	88
7090	39.48	92
7400	43.01	96
7710	46.70	100
8020	50.53	104

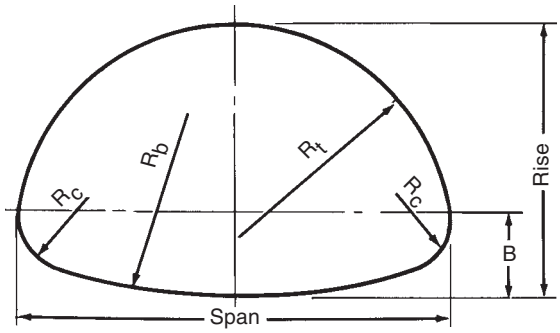


Table 1.10
Sizes and layout details - structural plate pipe-arches
(152 mm x 51 mm corrugation profile)

Dimensions		Waterway Area	Layout Dimensions				Periphery
Span (mm)	Rise (mm)	(m^2)	B (mm)	R_t (mm)	R_b (mm)	R_c (mm)	Total N
2060	1520	2.49	700	1130	1875	660	24
2240	1630	2.90	680	1205	3370	660	26
2440	1750	3.36	730	1305	2995	685	28
2590	1880	3.87	735	1355	4420	710	30
2690	2080	4.49	815	1380	4050	785	32
3100	1980	4.83	790	1695	3850	685	34
3400	2010	5.28	840	2000	3510	660	36
3730	2290	6.61	900	2055	4045	710	40
3890	2690	8.29	915	1975	6015	815	44
4370	2870	9.76	1035	2265	4895	815	48
4720	3070	11.38	1015	2425	6430	815	52
5050	3330	13.24	1040	2570	7430	840	56
5490	3530	15.10	1095	2790	7575	840	60
5890	3710	17.07	1150	3020	7755	840	64
6250	3910	19.18	1120	3175	9630	840	68
7040	4060	22.48	1660	4090	9650	1370	74
7620	4240	25.27	1750	4570	9650	1370	79

Dimensions are to inside crests and are subject to manufacturing tolerances. N = 3 Pi = 244 mm

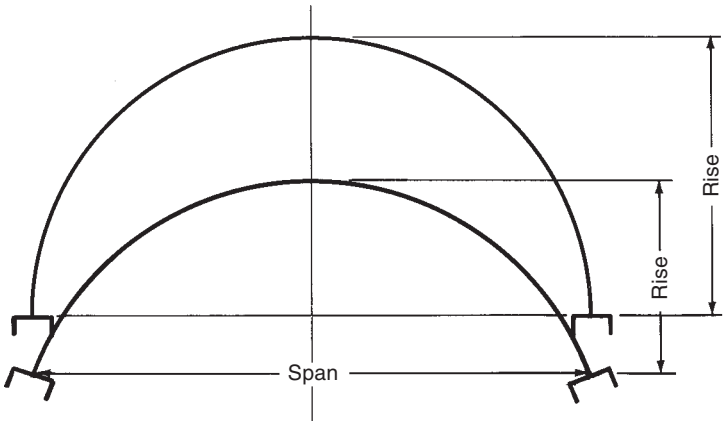


Table 1.11 Representative sizes of structural plate arches

Inside Dimensions*					
Span (mm)	Rise (mm)	End Area** (m^2)	Rise over Span	Radius (mm)	Periphery (Hole Spaces) N
1520	810	0.98	0.53	760	10
1830	840	1.16	0.46	930	11
	970	1.39	0.53	910	12
2130	860	1.39	0.40	1090	12
	1120	1.86	0.53	1070	14
2440	1020	1.86	0.42	1230	14
	1270	2.42	0.52	1220	16
2740	1180	2.46	0.43	1400	16
	1440	3.07	0.53	1370	18
3050	1350	3.16	0.44	1540	18
	1600	3.81	0.52	1520	20
3350	1360	3.44	0.41	1710	19
	1750	4.65	0.52	1680	22
3660	1520	4.18	0.42	1850	21
	1910	5.48	0.52	1830	24
3960	1680	5.02	0.42	2010	23
	2060	6.50	0.52	1980	26
4270	1840	5.95	0.43	2160	25
	2210	7.43	0.52	2130	28
4570	1870	6.41	0.41	2340	26
	2360	8.55	0.52	2290	30
4880	2030	7.43	0.42	2480	28
	2520	9.75	0.52	2440	32
5180	2180	8.55	0.42	2620	30
	2690	11.06	0.52	2590	34
5490	2210	9.01	0.40	2820	31
	2720	11.71	0.50	2740	35
5790	2360	10.22	0.41	2950	33
	2880	13.01	0.50	2900	37
6100	2530	11.52	0.41	3100	35
	3050	14.59	0.50	3050	39

*Dimensions are to inside crests and are subject to manufacturing tolerances
**End area under soffit above spring line

ARCH CHANNELS

For arch seats, galvanized unbalanced channels with anchor lugs are available. See Figure 1.1 below.

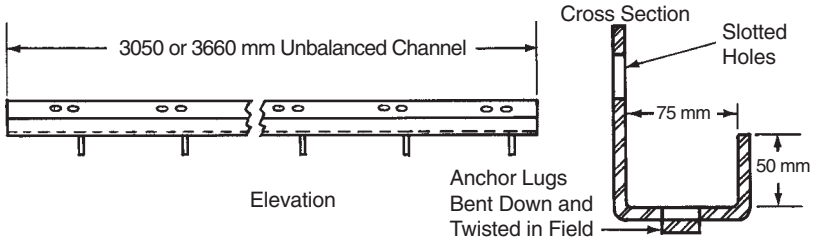


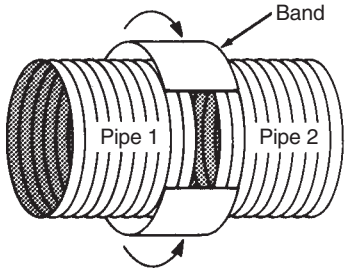
Figure 1.1 General dimensions of unbalanced channels for structural plate arches

CSP COUPLING SYSTEMS

A wide variety of pipe joints are available for field connecting lengths of corrugated steel pipe. The following drawings illustrate and define the standard joints which are tabulated in Table 1.12.

CSP FIELD JOINTS

Type - Band Coupling

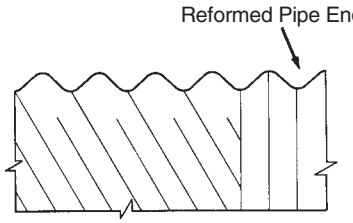


Typical Band Coupling

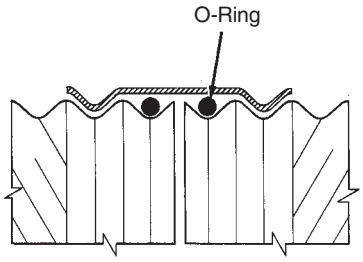
1. The most common CSP joint uses a band around the pipe joint.
2. The band is drawn and secured on the pipe by connection devices.
3. The pipe ends may be identical to the rest of the pipe barrel (plain ends), or in the case of helical pipe, the pipe ends may be reformed to an annular corrugation or flange (reformed ends).
4. Gaskets of three types are used according to band type; o-ring, sleeve type or mastic.

Table 1.12 Coupling bands for corrugated steel pipe

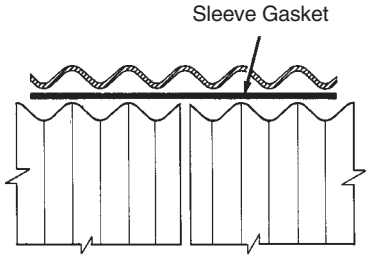
Type Of Band	X-Section	Angles	Bar, Bolt & Strap	Wedge Lock	Gaskets: O Ring	Gaskets: Sleeve or Strip	Gaskets: Mastic	Pipe End: Annular Plain	Pipe End: Helical Plain	Pipe End: Helical Reformed
Universal Dimple		X	X	X		X	X	X	X	X
Corrugated		X	X	X		X	X	X	X	X
Hugger		X	X	X	X		X	X		X
Flat		X	X	X	X	X	X	X	X	X



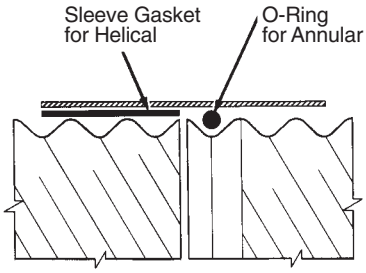
Standard CSP Band Types



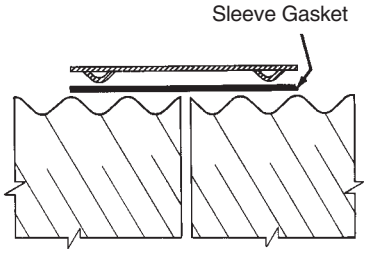
Hugger Type



Corrugated



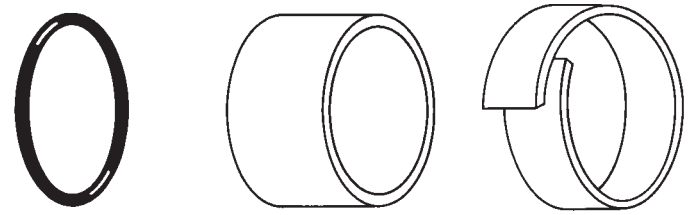
Flat Type



Universal Type

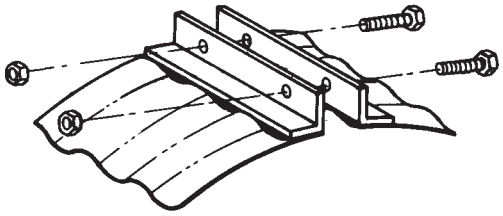
When gaskets are required, they are placed as shown.

Standard CSP Gaskets

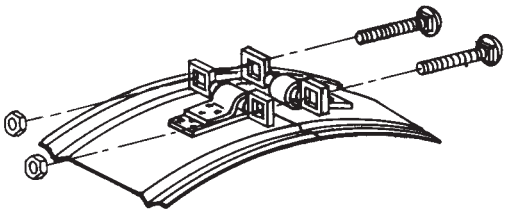


O-Ring Gasket Sleeve Gasket Strip Gasket

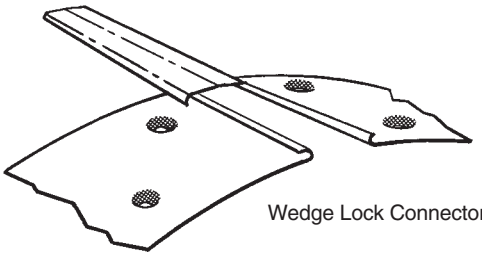
Standard CSP Band Connectors



Band Angle Connector



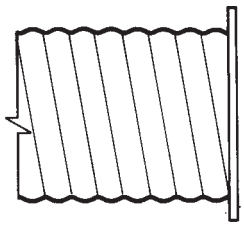
Bar & Strap Connector



Wedge Lock Connector

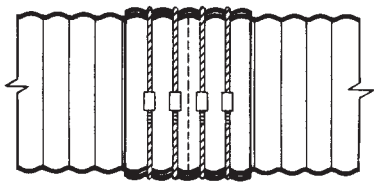
CSP FIELD JOINTS (Cont'd)

For unusual conditions, (i.e. high pressures, extreme disjointing forces, threading pipe inside existing pipe, jacking or boring pipe, and deep vertical drop inlets) a variety of special designs are available or a new special joint may be designed by the manufacturer to meet a new requirement.



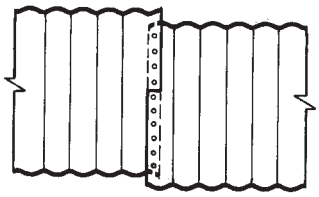
Flange Joint

Bolted flanges are attached to pipe ends



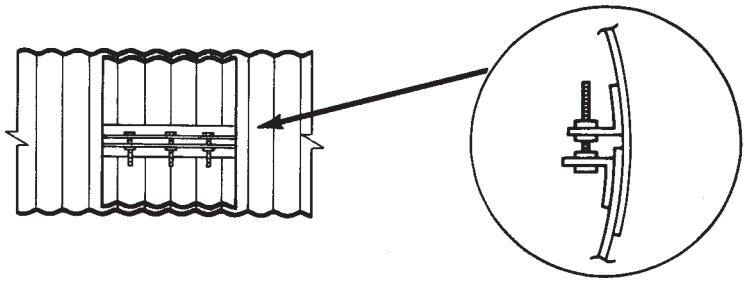
Rod & Lug

Band is secured by rod around band connected by lugs



Open Lap Joint

Used in stab type joints for boring and jacking pipe. May be bolted if required.



Internal Type

CSP FITTINGS AND SEWER APPURTENANCES

An important feature of corrugated steel pipe sewers is the wide range of fittings and appurtenances which can be employed. The nature of the material makes possible almost any special fitting which can be designed. When possible it is generally most economical to use the most commonly produced or "standard" fittings. To guide the designer, presented herein are the typical fittings and appurtenances fabricated throughout the country.

Sewer system hardware such as grates, manhole covers, ladders and steps are easily incorporated in corrugated steel manholes or inlets. The following pages illustrate how this hardware is used in corrugated steel structures.

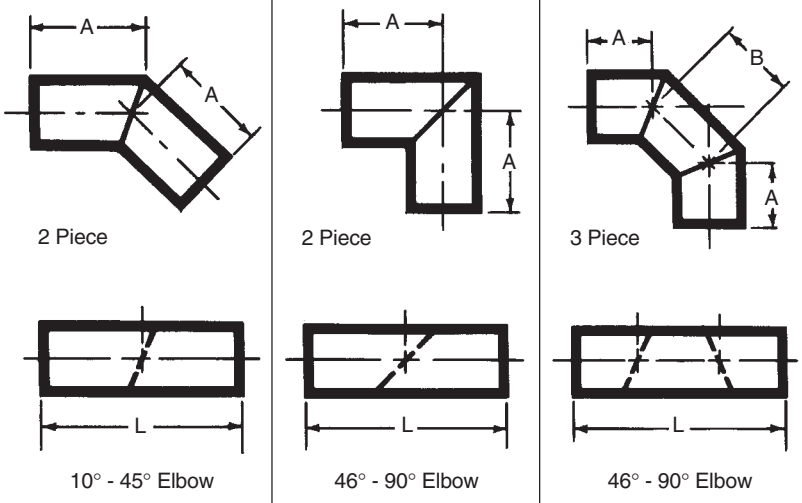
FITTINGS

Tables l.l3, 1.14, and 1.15, list the standard, or minimum dimensions of common fittings and elbows. Note that these are minimum dimensions. It may be most practical in some cases to fabricate fittings with longer legs than those shown here. It is ordinarily best to let the contractor and supplier work out such details. However, it may be useful for the designer to have these minimum dimensions in laying out turns or intersections where precision is required.

Pipe sizes larger than those shown in these tables should be individually designed. The larger sizes can require longer leg dimensions depending on wall thickness and type of pipe fabrication.

Common manifold eliminates costly junction box used with other storm drain materials.

Table 1.13 Minimum dimensions for elbows for round CSP (mm) all corrugations



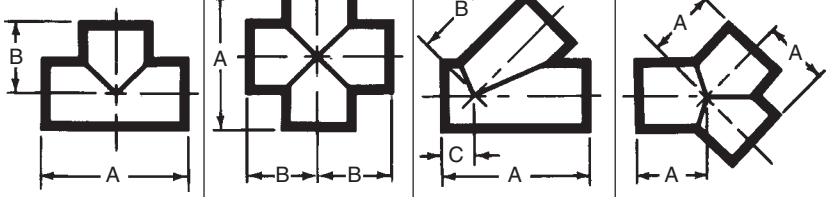
Pipe Diameter	A	Total Length
150 - 600	300	600
700 - 1400	600	1200
1600 - 2400	900	1800

Pipe Diameter	A	Total Length
150 - 250	300	600
300 - 800	600	1200
900 - 1200	900	1800
1400 - 1600	1200	2400
1800 - 2400	1500	3000

Pipe Diameter	A	B	Total Length
150	200	200	600
200	185	230	600
250	175	250	600
300	460	280	1200
400	450	300	1200
500	425	350	1200
600	410	380	1200
700	400	400	1200
800	360	480	1200
900	600	600	1800
1000	610	580	1800
1200	570	660	1800
1400	750	900	2400
1600	780	840	2400
1800	750	900	2400
2000	1000	1000	3000
2200	950	1100	3000
2400	925	1150	3000

NOTE: The total length (mm) and pipe diameter (mm) listed are minimum requirements for fitting fabrication. Fittings with other dimensions to satisfy specific needs are also available. All dimensions are nominal. All dimensions are in millimetres.

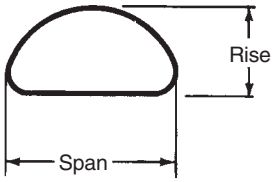
Table 1.14 Minimum dimensions for CSP round fittings (mm)

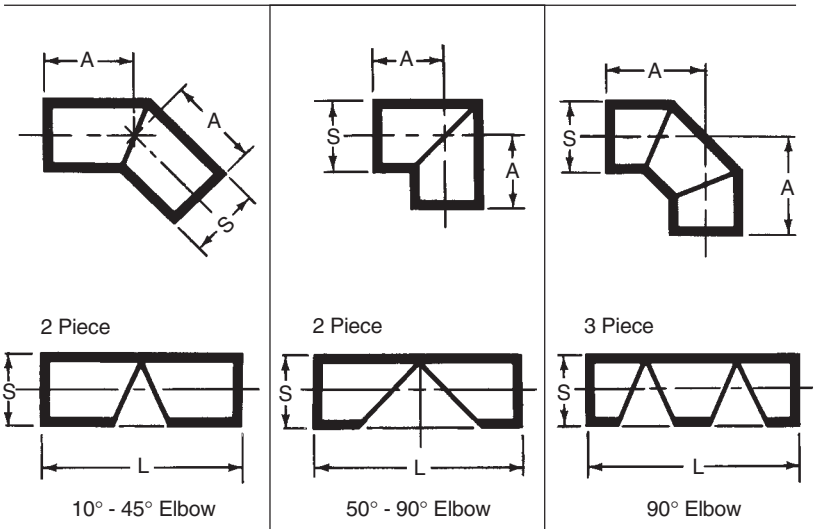


Main Diam.	Stub Same or Smaller Than Main Diameter										Same Diam.	
	Tee			Cross			45° Lateral				45° Wye	
(mm)	A	B	TL	A	B	TL	A	B	C	TL	A	TL
150	600	300	900	600	300	1200	900	600	300	1500	300	900
200	600	300	900	600	300	1200	900	600	300	1500	300	900
250	600	300	900	600	300	1200	900	600	300	1500	300	900
300	800	400	1200	1200	600	2400	1200	600	400	1800	600	1800
400	1200	600	1800	1200	600	2400	1200	900	400	2100	600	1800
500	1200	600	1800	1200	600	2400	1500	900	450	2400	600	1800
600	1200	600	1800	1200	600	2400	1500	900	500	2400	600	1800
700	1200	600	1800	1200	600	2400	1800	1200	600	3000	600	1800
800	1800	900	2700	1800	900	3600	2400	1500	660	3900	900	2700
900	1800	900	2700	1800	900	3600	2400	1500	660	3900	900	2700
1000	1800	900	2700	1800	900	3600	2400	1500	760	3900	900	2700
1200	1800	900	2700	1800	900	3600	3000	1800	810	4800	900	2700
1400	2400	1200	3600	2400	1200	4800	3600	2100	1100	5700	1200	3600
1600	2400	1200	3600	2400	1200	4800	3600	2400	1200	6000	1200	3600
1800	3000	1500	4500	3000	1500	6000	4200	2700	1250	6900	1500	4500
2000	3000	1500	4500	3000	1500	6000	4800	3000	1400	7800	1500	4500
2200	3000	1800	4500	3000	1500	6000	4800	3300	1500	8100	1500	4500
2400	3000	1800	5400	3600	1800	7200	4800	3300	1550	8100	1800	5400

TL - total net length needed to fabricate fitting
Note: All dimensions are in millimetres

Table 1.15 Minimum dimensions for CSP pipe arch elbow fittings



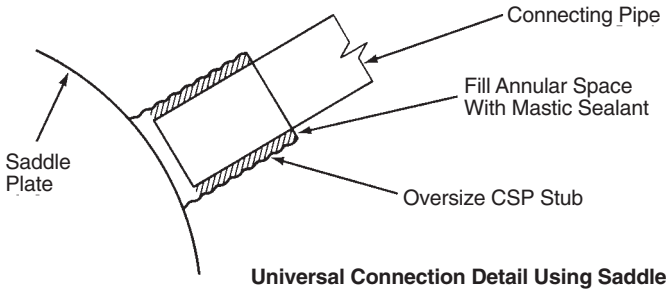


Equivalent Round Diameter	Span S	Rise R	45° Elbow 2 Piece		90° Elbow 2 Piece		90° Elbow 3 Piece	
(mm)	(mm)	(mm)	A(mm)	L(mm)	A(mm)	L(mm)	A(mm)	L(mm)
500	560	420	500	1200	650	1850	750	1850
600	680	500	450	1200	850	2450	700	1850
700	800	580	400	1200	800	2450	800	2000
800	910	660	400	1200	750	2450	950	2450
900	1030	740	700	1850	950	3050	900	2450
1000	1150	820	650	1850	900	3050	1150	3050
1200	1390	970	600	1850	1100	3650	1050	3050
1400	1630	1120	850	2450	1300	4250	1300	3660
1600	1880	1260	850	2450	1500	4900	1550	4250
1800	2130	1400	1050	3050	1400	5500	1800	4900

Dimensions - nominal L - length for fabrication

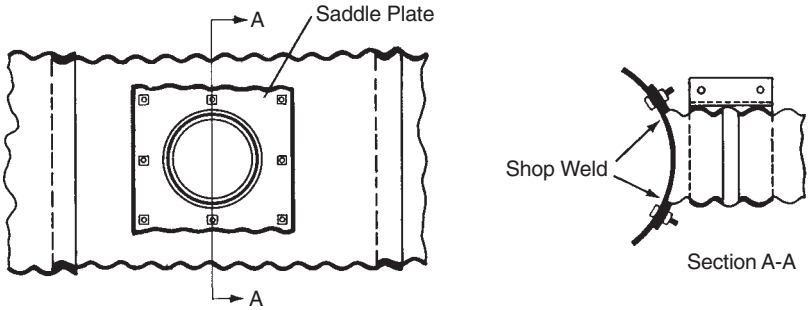
SADDLE BRANCH

Saddle branches are used to connect smaller branch lines to the main. Saddles make it practical to accurately tie in connections after the main line is laid. Or, new connections can be effectively made on old lines with saddles. Saddles can be used to connect almost any type of pipe to a CSP main. A common "universal" type of saddle branch stub to do this is shown below.



Universal Connection Detail Using Saddle Branch

Typical pre-fabricated CSP saddle branch fitting used in connecting house laterals or incoming pipe from catch basins.



Side View of Sewer with Saddle Branch in Place

Figure 1.2 Saddle branch, bolted to main sewer on the job or at the plant, enables laterals and house connections to join the sewer

TRANSITIONS

Changes in pipe diameter should be accomplished in junction structures. However, there are circumstances when a pipe reducer or enlarger section is desired.

A simple, instant size change can be done as shown in Figure 1.3.

Tapered transitions may be fabricated in smooth steel for helical pipe systems as shown in Figure 1.4. Reinforcement may be required.

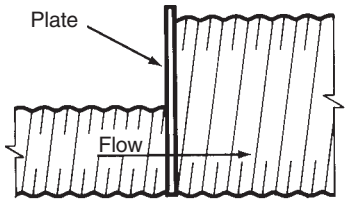


Figure 1.3 Enlarger

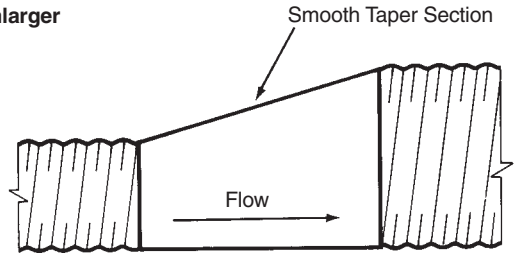
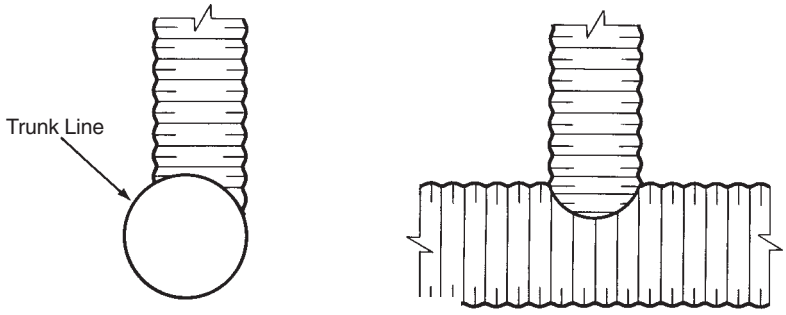


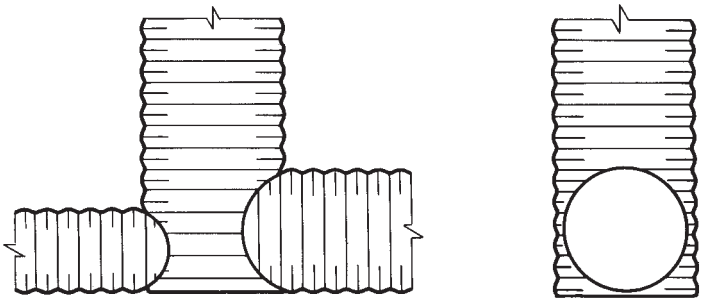
Figure 1.4 Eccentric Transition

Saddle branch manhole is bolted to sewer conduit while riser extension is being lowered and coupled.

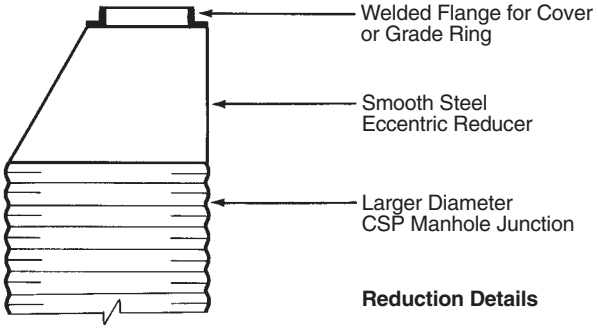
MANHOLES AND CATCH BASINS



Riser Type Manhole



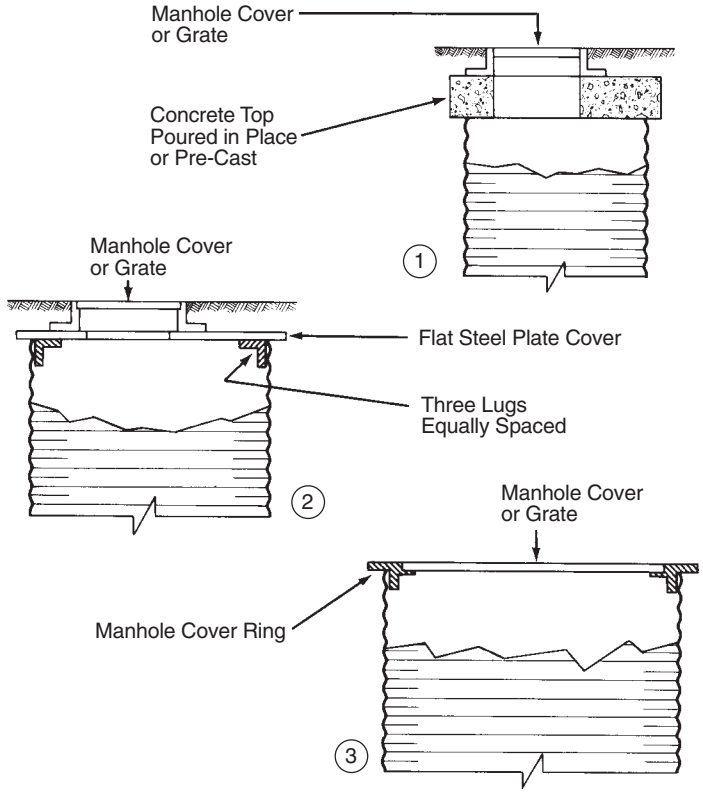
Vertical Shaft Type Manhole



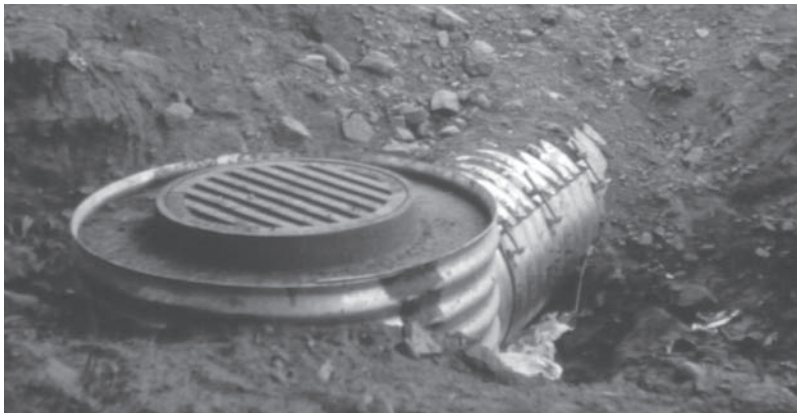
Reduction Details

Manholes are available in corrugated pipe construction in two basic types as shown above. The riser type of manhole is the simpler of the two and quite economical. It is only feasible for trunk lines of 900mm diameter or greater. When junctions of smaller diameters are involved it is possible to use a vertical shaft of larger diameter CSP to connect the sewers. However, when the shaft is greater than 900mm in diameter, some reduction detail must be used to suit the cover. Typical reduction details are shown.

MANHOLE AND CATCH BASIN TOPS

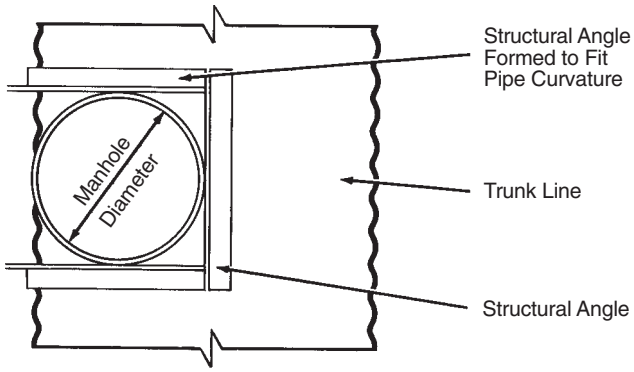


Detail (1) can be used with almost any type of surface cover or grate. Concrete grade ring may be augmented with brick to raise cover elevation in the future. Alternatively, added concrete may be poured. Direct connections of cast or fabricated plates or rings as in (2) and (3) are particularly suitable for grated inlet openings.



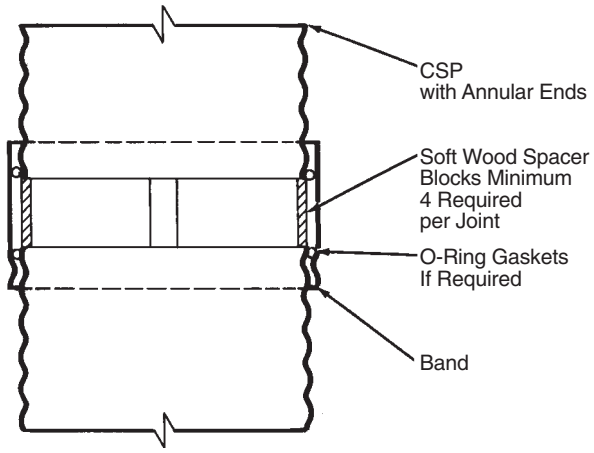
Standard cast iron covers and/or steel grates are used with CSP manholes and catch basins.

MANHOLE REINFORCING



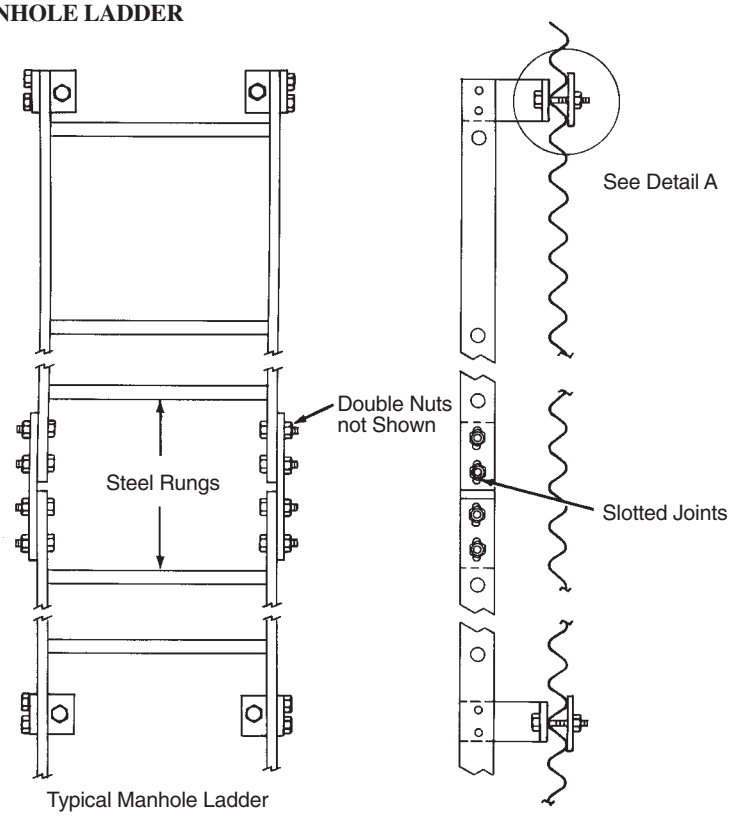
Use of manhole reinforcing is recommended when trunk line sewer pipe size is 1600 mm diameter and larger.

MANHOLE SLIP JOINTS

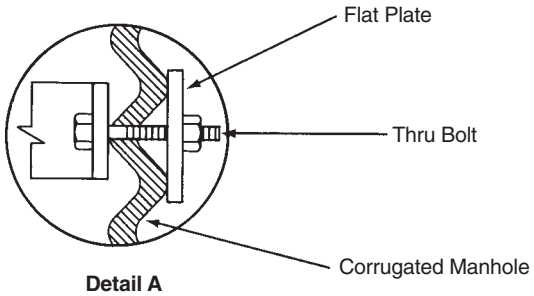


Heavily loaded manholes sometimes make slip joints desirable. Shown above is one method of providing a slip joint which allows settlement in the riser.

MANHOLE LADDER



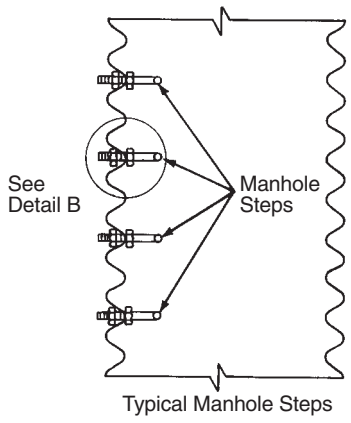
Typical Manhole Ladder



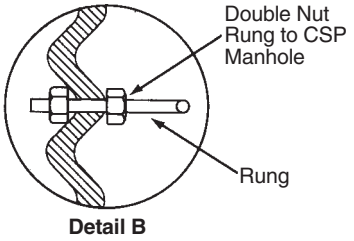
Detail A
Typical Ladder Bracket Attachment

1. Ladder may be constructed in one length.
2. Use bolts with double nuts to connect splice plate at ladder joint to allow vertical movement.
3. Hot-dip galvanizing of all ladder components is recommended.

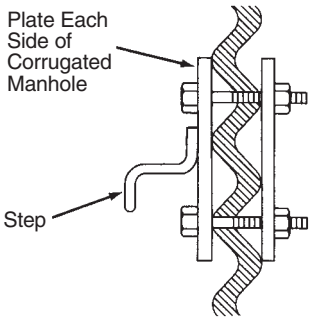
MANHOLE STEPS

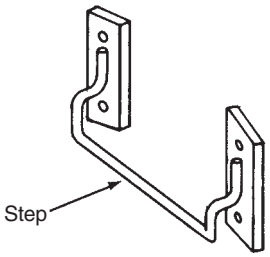


Typical Manhole Steps

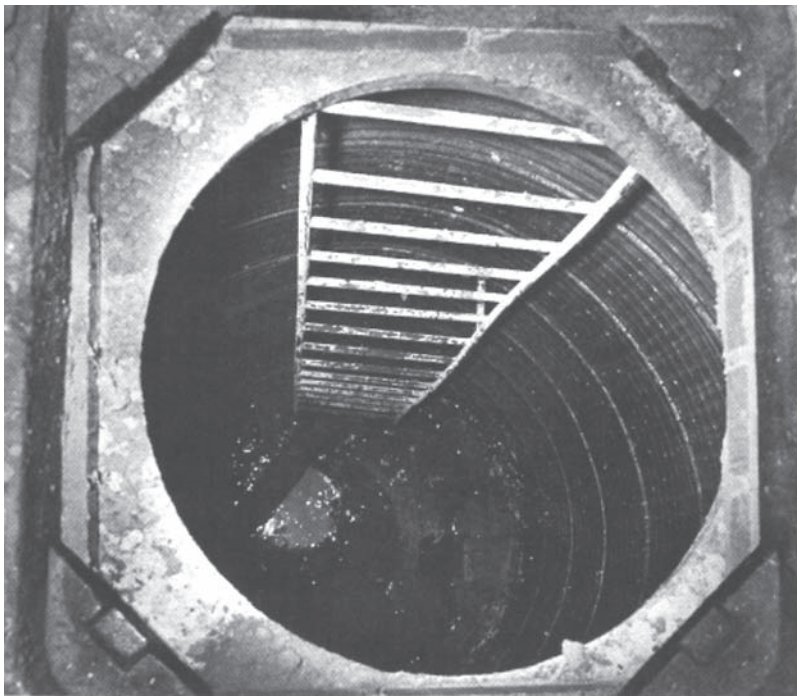


Detail B





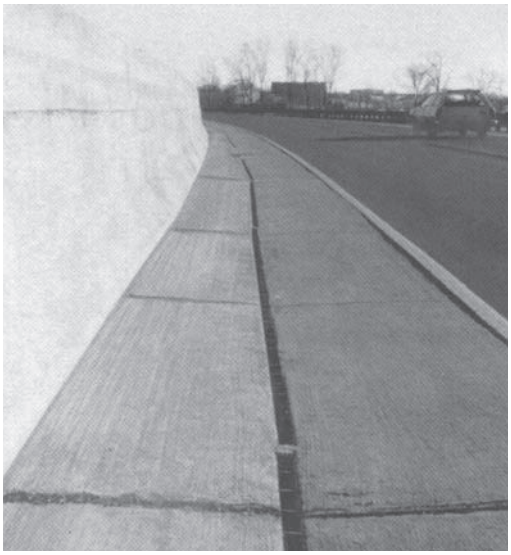
Alternate Methods for
Attaching Manhole Steps



CPS catch basin with concrete slab and standard cast-iron frame and cover.

CSP SLOTTED DRAIN INLETS

By welding a narrow section of grating in the top of a corrugated steel pipe, a continuous grate inlet is achieved. Originally conceived to pick up sheet flow in roadway medians, parking lots, airports, etc., this product has proven even more useful in curb inlets.



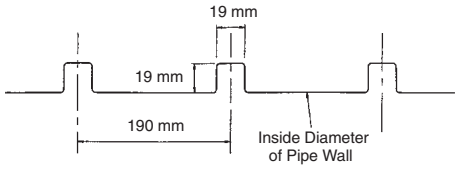
Slotted drain eliminates hazardous dips in grade, while adding to drainage efficiency.

Slotted drain carries water away from parking area.

SPIRAL RIB STEEL PIPE

Spiral rib pipe is manufactured from a continuous strip of metallic coated steel passed through a forming line that forms the external ribs and prepares the edges. The formed section is then helically wound into pipe and the edges are joined by lock seaming. The finished product has the structural characteristics needed for installation and a smooth interior for improved hydraulics.

Spiral rib pipe installation.



Corrugation Profile

Lengths of pipe arch are easily moved into position.

PROTECTIVE COATINGS, LININGS AND PAVINGS

SHEETS AND COILS

Corrugated steel pipe is fabricated from steel sheets or coils conforming to national specifications. The base metal is mill coated with one of several metallic or non-metallic coatings or a combination thereof.

(a) Metallic Coatings
Most CSP sheets and coils have a zinc coating. Other metallic coatings using aluminum or aluminum-zinc alloys are also available.

(b) Non-Metallic Coatings
Sheets and coils are available mill coated with non-metallic coatings. (1) Various polymer films or liquids are applied to one or both sides of the metal. (2) Fibers are embedded in the molten metallic coating.

PIPE

Fabricated pipe may be bituminous coated, bituminous coated and invert paved, bituminous coated and fully paved. The pipe may be fully lined with bituminous material or specially fabricated smooth with external ribs.

Placing coated CSP sewer section. Fabric sling protects pipe coating.

Table 1.16 Material description and specifications

		Specifications		
Material	Description	AASHTO	ASTM	CSA
Zinc Coated Sheets & Coils	Steel base metal* with 610 g/m^2 zinc coating	M-218	A444M	CAN3-G401
Polymer Coated Sheets and Coils	Polymer coatings applied to sheets* and coils* as follows: a) one side only, 0.25 mm b) 0.25 mm one side, 0.07 mm the other side; c) special ordered combination	M-246	A742M	CAN3-G401
Aluminum Coated Coils	Steel base metal* coated with 305 g/m^2 of pure aluminum	M-274	A819	CAN3-G401
Aluminum-Zinc Coated Coils	Steel base metal* coated with 214 g/m^2 of an aluminum-zinc alloy	M-289	A806M	–
Sewer and Drainage pipe	Corrugated pipe fabricated from any of the above sheets or coils. Pipe is fabricated by corrugating continuous coils into helical form with lockseam or welded seam, or by rolling annular corrugated mill sheets and riveting seams.			
	1. Galvanized corrugated steel pipe	M-36	A760M	CAN3-G401
	2. Polymeric pre-coated sewer and drainage pipe	M-245	A762M	CAN3-G401
	3. Aluminized corrugated steel pipe	M-36	A760M	CAN-G401
	4. Aluminum-Zinc alloy coated corrugated steel pipe	–	A760M	–
	5. Structural plate pipe	M-167	A761M	CAN-G401
Asphalt Coated Steel Sewer Pipe	Corrugated steel pipe of any of the types shown above with a 1.3 mm, high purity asphalt cover	M-190	A849	CAN-G401
Invert Paved Steel Sewer Pipe	Corrugated steel pipe of any one of the types shown above with an asphalt pavement poured in the invert to cover the corrugation by 3.2 mm	M-190	A849	CAN-G401
Fully Lined Steel Sewer Pipe	Corrugated steel pipe of the types shown above			
	a. with an internal asphalt lining centrifugally spun in place; or,	M-190	A849	CAN-G401
	b. corrugated steel pipe with a single thickness of smooth sheet fabricated with helical ribs projected outward	M-36	A760M	–
Cold Applied Bituminous Coatings	Fibrated mastic or coal tar base coatings of various viscosities for field or shop coating of corrugated pipe or structural plate	M-243	A849	–
Gaskets and Sealants	1. Standard O-ring gaskets	–	D1056	–
	2. Sponge neoprene sleeve gaskets			
	3. Gasketing strips, butyl or neoprene	–	C361	–
	4. Mastic sealant			

*Yield point - 230MPa min.; tensile strength - 310MPa min.; elongation (50mm) - 20% min.