

PART 2

CORRUGATED METAL DRAINAGE PRODUCTS (CM)

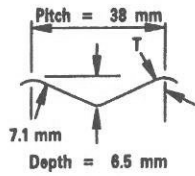
Design information for corrugated metal pipe may be obtained from Division I, Section 12 of the American Association of State Highway & Transportation Officials' (AASHTO) *Standard Specifications for Highway Bridges*.

Additional design information on CSP may be obtained from the American Iron & Steel Institute's *Handbook of Steel Drainage & Highway Construction Products*.

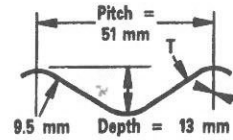
Additional design information on CORRUGATED ALUMINUM PIPE may be obtained from the Aluminum Association's *Aluminum Drainage Products Manual*.

SECTION CMC—SHAPES

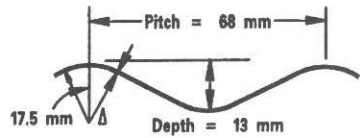
Corrugated Steel Pipe—Type 1 Standard Corrugations	CMCS-1-96	39
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Corrugated Steel Pipe—Type 1R 191-mm Spiral Rib Configuration	CMCS-3-96	41
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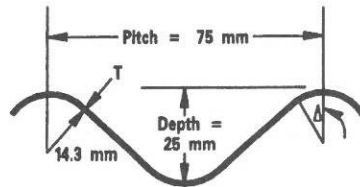
38x6.5 mm Corrugations (Helical)



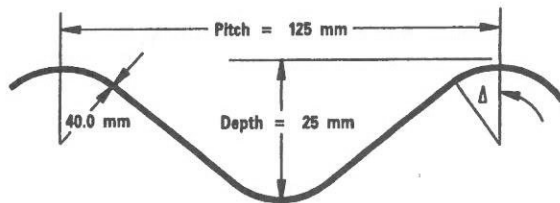
51x13 mm Corrugations (Helical)



68x13 mm Corrugations (Annular or Helical)



75x25 mm Corrugations (Annular or Helical)



125x25 mm Corrugations (Helical)

APPLICABLE SPECIFICATIONS

1. Corrugated Steel Pipe shall conform to the requirements of:
 AASHTO M 36M & M 218 (Galvanized Steel)
 AASHTO M 36M & M 274 (Aluminum Coated (type 2))
 AASHTO M 36M & M 289 (Aluminum-Zinc Alloy Coated)
 AASHTO M 245M & M 246M (Polymer Coated Steel)
 AASHTO M 190 (Bituminous Coated)
 AASHTO M 36M & ASTM A 885 (Fiber Bonded)
2. The corrugations shall form smooth and continuous tangents. The corrugations may be annular, spiral, or a combination of annular and spiral.
3. Type 1 pipe is round pipe.

INTENDED USE

Pipe for culverts, underdrains and storm sewers

CORRUGATIONS & STANDARD THICKNESS

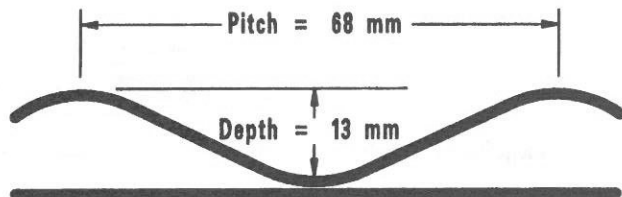
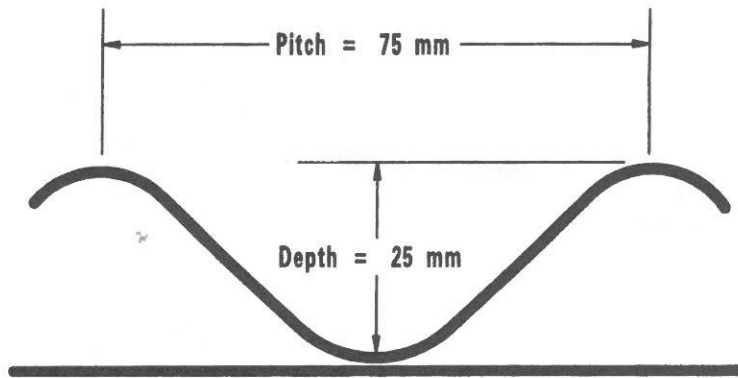
38 x 6.5	51 x 13	68 x 13	75 x 25	127 x 25
1.32	1.32	1.32	1.32	2.01
1.63	1.63	1.63	1.63	2.77
	2.01	2.01	2.01	3.51
	2.77	2.77	2.77	
	3.51	3.51	3.51	
	4.27	4.27	4.27	

*Standard Thicknesses are in millimeters and include the base steel plus the zinc or aluminized coating on both sides. It does not include the thickness of polymer or bituminous coatings.

**CORRUGATED STEEL PIPE—TYPE 1
STANDARD CORRUGATIONS**

AASHTO-AGC-ARTBA
TF-13 DRAWING

CMCS-1-96



APPLICABLE SPECIFICATIONS

- Smooth lined corrugated steel pipe shall conform to the requirements of:
 - AASHTO M 36M & M 218 (Galvanized Steel)
 - AASHTO M 36M & M 274 (Aluminum Coated (Type 2))
 - AASHTO M 36M & M 289 (Aluminum-Zinc Alloy Coated)
 - AASHTO M 245M & M 246M (Polymer Coated Steel)
 - AASHTO M 190 (Bituminous Coated)
 - ASTM A 796
- The corrugations shall form smooth and continuous tangents. The corrugations shall be spiral (helical) with a smooth liner integrally attached at the lockseams spaced not more than 762 mm apart and extending from end to end of each length of pipe.
- Type 1A pipe is round pipe with a smooth liner and helically corrugated shell.

INTENDED USES

Pipe for storm drains

STANDARD THICKNESS

EQUIVALENT TYPE 1 PIPE	TYPE A SMOOTH LINER	CORR. SHELL
1.63	1.02	1.32
2.01	1.02	1.32
2.77	1.02	2.01
3.51	1.02	2.77
4.27	1.02	3.51

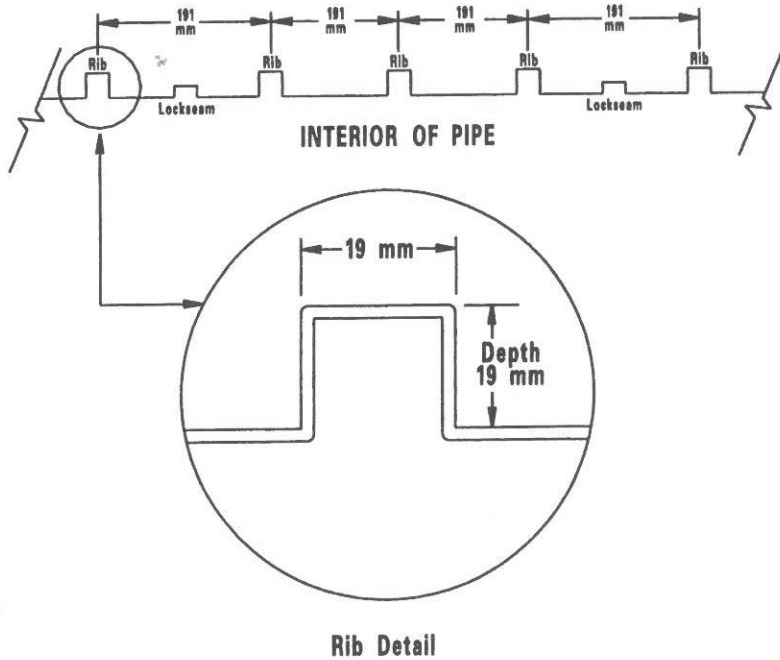
NOTE: All dimensions shown are in millimeters.

CORRUGATED STEEL PIPE—TYPE 1A STANDARD CORRUGATIONS

AASHTO-AGC-ARTBA
TF-13 DRAWING

CMCS-2-96

**LONGITUDINAL SECTION
SPIRAL RIB CONFIGURATION**



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Note: All dimensions are in millimeters

APPLICABLE SPECIFICATIONS

1. Spiral Ribbed steel pipe shall conform to the requirements of:
 AASHTO M 36M & M 218 (Galvanized Steel)
 AASHTO M 36M & M 274 (Aluminum Coated (Type 2))
 AASHTO M 36M & M 289 (Aluminum-Zinc Alloy Coated)
 AASHTO M 245M & M 246M (Polymer Coated Steel)
 AASHTO M 190 (Bituminous Coated)
 ASTM A 849

2. The pipe is fabricated from a single thickness of smooth sheet with helical spaced ribs projecting outwardly.

3. Type 1R pipe is round pipe.

INTENDED USES

Pipe for storm drains which require the hydraulic efficiency of smooth interior wall pipe. Polymer or Bituminous coatings may be required in addition to metallic coatings.

STANDARD THICKNESS*

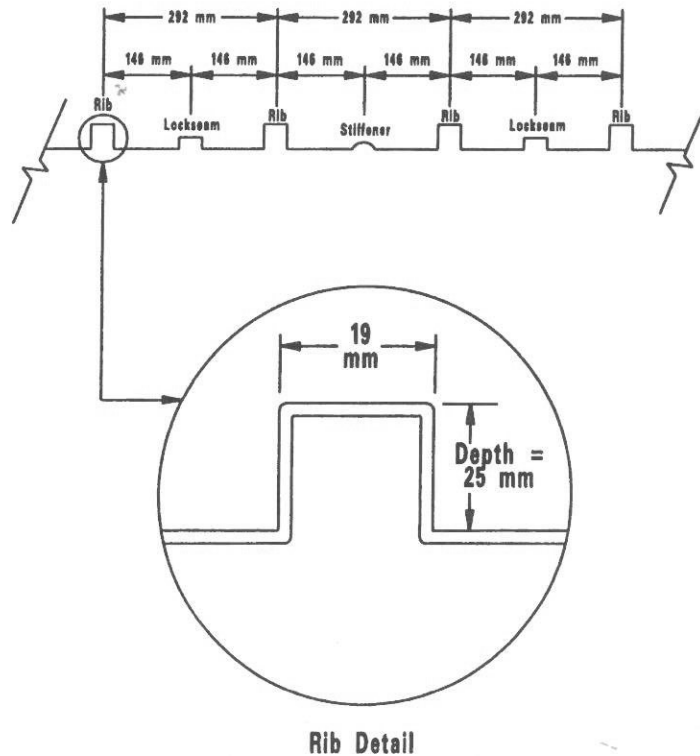
- 1.63
- 2.01
- 2.77
- 3.51

NOTE: Standard thickness includes the base steel plus the metallic coating on both sides. It does not include the thickness of the polymer or bituminous coatings.

**CORRUGATED STEEL PIPE—TYPE 1R
191-mm SPIRAL RIB CONFIGURATION**

**AASHTO-AGC-ARTBA
TF-13 DRAWING**

CMCS-3-96



APPLICABLE SPECIFICATIONS

1. Spiral Ribbed steel pipe shall conform to the requirements of:
 AASHTO M 36M & M 218 (Galvanized Steel)
 AASHTO M 36M & M 274 (Aluminum Coated (Type 2))
 AASHTO M 36M & M 289 (Aluminum-Zinc Alloy Coated)
 AASHTO M 245M & M 246M (Polymer Coated Steel)
 AASHTO M 190 (Bituminous Coated)
2. The pipe is fabricated from a single thickness of smooth sheet with helical spaced ribs projecting outwardly.
3. Type 1R pipe is round pipe.

INTENDED USES

Pipe for storm drains which require the hydraulic efficiency of smooth interior wall pipe. Polymer or Bituminous coatings may be required in addition to metallic coatings.

STANDARD THICKNESS*

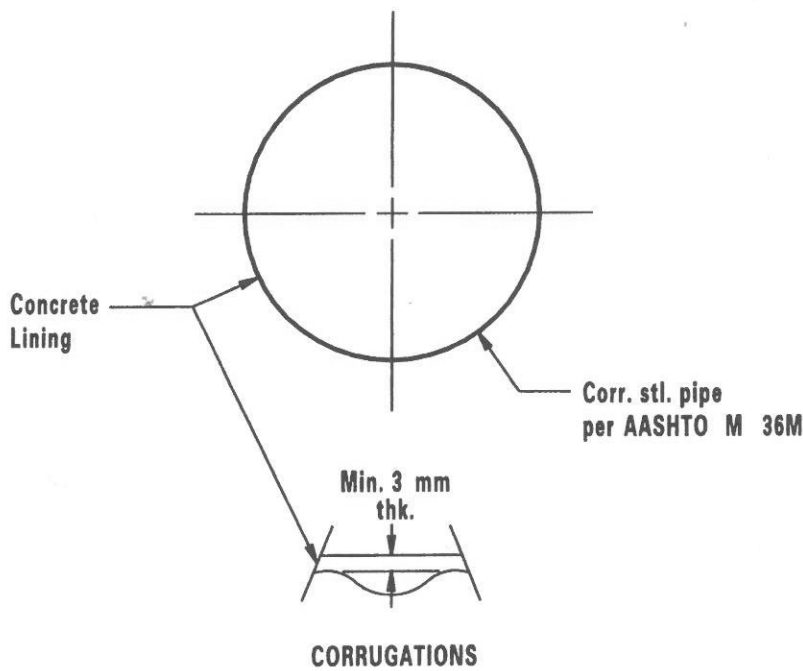
1.63
2.01
2.77
3.51

NOTE: Standard thickness includes the base steel plus the metallic coating on both sides. It does not include the thickness of the polymer or bituminous coatings.

CORRUGATED STEEL PIPE—TYPE 1R
292-mm SPIRAL RIB CONFIGURATION

AASHTO-AGC-ARTBA
 TF-13 DRAWING

CMCS-4-96



APPLICABLE SPECIFICATIONS

1. Corrugated Steel Pipe shall conform to the requirements of:
 AASHTO M 36M & M 218 (Galvanized Steel)
 AASHTO M 36M & M 274 (Aluminum Coated (Type 2))
 AASHTO M 36M & ASTM A 885 (Fiber Bonded)

2. Lining shall conform to ASTM A 849.

INTENDED USES

Pipe for storm sewer.

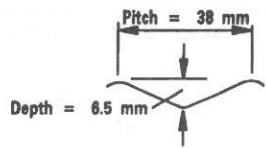
CORRUGATIONS	STANDARD THICKNESS (mm)	STANDARD DIAMETERS (mm)
68 x 13	1.63, 2.01, 2.77, 3.50, 4.27	300, 375, 450, 525, 600, 750, 900, 1050, 1200, 1350, 1500, 1650, 1800, 1950, 2100, 2250, 2400
75 x 25	1.63, 2.01, 2.77, 3.50, 4.27	1350, 1500, 1650, 1800, 1950, 2100, 2250, 2400, 2550, 2700, 2850
125 x 25	1.63, 2.01, 2.77, 3.50, 4.27	1400, 1500, 1650, 1800, 2000, 2200, 2250, 2400, 2550, 2700, 2850, 3000

CONCRETE LINED—CORRUGATED STEEL PIPE

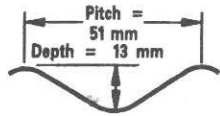
Note: All dimensions in millimeters

AASHTO-AGC-ARTBA
TF-13 DRAWING

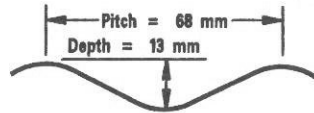
CMCS-5-96



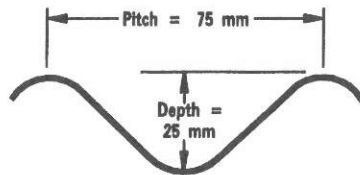
38x6.5 mm Corrugations (Helical)



51x13 mm Corrugations (Helical)



68x13 mm Corrugations (Annular or Helical)



75x25 mm Corrugations (Annular or Helical)

APPLICABLE SPECIFICATIONS

1. Corrugated aluminum pipe shall conform to the requirements of:
 AASHTO M 196M & M 197M (Aluminum)
 AASHTO M 190 (Bituminous Coated)
2. The corrugations shall form smooth and continuous tangents. The corrugations may be annular, spiral, or a combination of annular and spiral.
3. Type 1 pipe is round pipe.

INTENDED USES

Pipe for culverts, underdrains and storm sewers

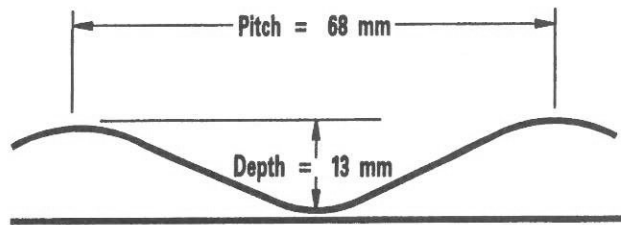
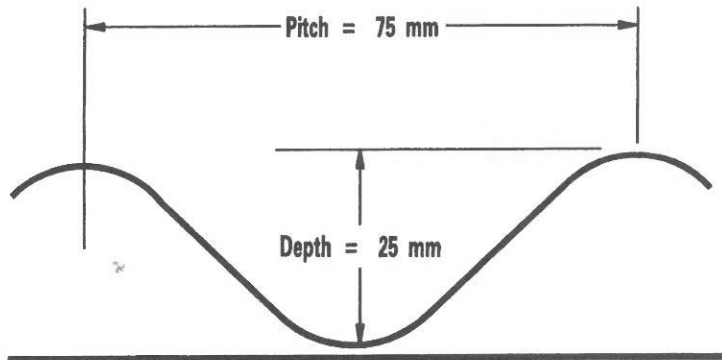
CORRUGATIONS & STANDARD THICKNESS

38x6.5 mm	51x13 mm	68x13 mm	75x25 mm
1.22	1.22	1.22	1.52
1.52	1.52	1.52	1.91
	1.91	1.91	2.67
	2.67	2.67	3.43
	3.43	3.43	4.17
	4.17	4.17	

CORRUGATED ALUMINUM PIPE—TYPE 1 STANDARD CORRUGATIONS

AASHTO-AGC-ARTBA
TF-13 DRAWING

CMCA-6-96



APPLICABLE SPECIFICATIONS

1. Smooth lined corrugated aluminum pipe shall conform to the requirements of:
 AASHTO M 196M & M 197M (Aluminum)
 AASHTO M 190 (Bituminous Coated)
2. The corrugations shall form smooth and continuous tangents. The corrugations shall be spiral (helical) with a smooth liner integrally attached at the lockseams spaced not more than 760 mm apart and extending from end to end of each length of pipe.
3. Type 1A pipe is round pipe with a smooth liner and helically corrugated shell.

INTENDED USES

Pipe for storm drains.

STANDARD THICKNESS

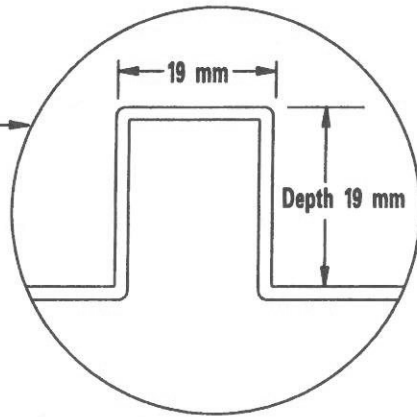
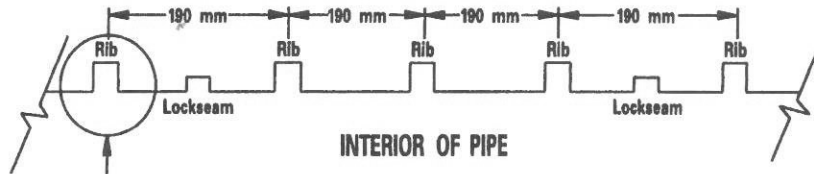
EQUIVALENT TYPE 1 PIPE	TYPE A SMOOTH LINER	CORRUGATED SHELL
1.52 mm	0.91 mm	1.22 mm
1.91	0.91	1.22
2.67	0.91	1.91
3.43	0.91	2.67
4.17	0.91	3.43

**CORRUGATED ALUMINUM PIPE—TYPE 1A
STANDARD CORRUGATIONS**

AASHTO-AGC-ARTBA
TF-13 DRAWING

CMCA-7-96

**LONGITUDINAL SECTION
SPIRAL RIB CONFIGURATION**



Rib Detail

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APPLICABLE SPECIFICATIONS

1. Spiral Ribbed aluminum alloy pipe shall conform to the requirements of: AASHTO M 196M & M 197M.
2. The pipe is fabricated from a single thickness of smooth sheet with helical spaced ribs projecting outwardly.
3. Type 1R pipe is round pipe.

INTENDED USES

Pipe for storm drains which require the hydraulic efficiency of smooth interior wall pipe.

STANDARD THICKNESS

- 1.52 mm
- 1.91
- 2.67
- 3.43

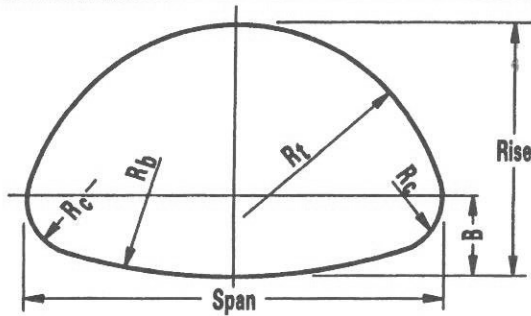
**CORRUGATED ALUMINUM ALLOY PIPE—TYPE 1R
SPIRAL RIB CORRUGATIONS**

**AASHTO-AGC-ARTBA
TF-13 DRAWING**

CMCA-8-96

SECTION CMF—PIPE ARCH DIMENSIONS
& FITTINGS, CIRCULAR PIPE FITTINGS

Corrugated Steel Pipe Arch (Type II, IIA)	CMFS-1-96	48
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Circular CMP Cross Fittings	CMF-5-96	53
Circular CMP Lateral Fittings	CMF-6-96	54
Circular CMP Wye Fittings	CMF-7-96	55
Circular CMP 10° - 45° Elbows	CMF-8-96	56
Circular CMP 50° - 90° Elbows	CMF-9-96	57
Circular CMP 3-Piece 90° Elbow	CMF-10-96	58
Circular CMP Reducer	CMF-11-96	59



Pipe Arches - 68 mm x 13 mm Corrugations

Pipe Arch Size mm	Equiv. Diam. mm	Span mm	Rise mm	Min. Corner Radius mm	Max. B mm
430 x 330	375	430	330	75	135
530 x 380	450	530	380	75	155
610 x 460	525	610	460	75	185
710 x 510	600	710	510	75	205
780 x 560	675	780	560	75	225
885 x 610	750	870	630	75	240
970 x 690	825	970	690	75	255
1060 x 740	900	1060	740	90	265
1240 x 840	1050	1240	840	100	290
1440 x 970	1200	1440	970	130	345
1620 x 1100	1350	1620	1100	155	380
1800 x 1200	1500	1800	1200	180	420
1950 x 1320	1650	1950	1320	205	460
2100 x 1450	1800	2100	1450	230	510

Pipe Arches -75 x 25 and 125 x 25 Corrugations

Pipe Arch Size mm	Equiv. Diam. mm	Span mm	Rise mm	Min. Corner Radius mm
1010 x 790	900	1010 - 45	790 + 45	130
1160 x 920	1050	1160 - 55	920 + 55	155
1340 x 1050	1200	1340 - 60	1050 + 60	180
1520 x 1170	1350	1520 - 70	1170 + 70	205
1670 x 1300	1500	1670 - 75	1300 + 75	230
1850 x 1400	1650	1850 - 85	1400 + 85	305
2050 x 1500	1800	2050 - 95	1500 + 95	355
2200 x 1620	1950	2200 - 110	1620 + 110	355
2400 x 1720	2100	2400 - 120	1720 + 120	410
2600 x 1820	2250	2600 - 130	1820 + 130	410
2840 x 1920	2400	2840 - 145	1920 + 145	460
2970 x 2020	2550	2970 - 150	2020 + 150	460
3240 x 2120	2700	3240 - 165	2120 + 165	460
3470 x 2220	2850	3470 - 175	2220 + 175	460
3600 x 2320	3000	3600 - 180	2320 + 180	460

SPECIFICATIONS

- Corrugated steel pipe arch shall conform to the requirements of:
 - AASHTO M 36M & M 218 (Galvanized Steel)
 - AASHTO M 36M & M 274 (Aluminum Coated (Type 2))
 - AASHTO M 36M & M 289 (Aluminum-Zinc Alloy Coated)
 - AASHTO M 245M & M 246M (Polymer Coated)
 - AASHTO M 190 (Bituminous Coated)
 - AASHTO M 36M & ASTM A 885 (Fiber Bonded)
- A tolerance of plus or minus 25 mm or 2 percent of equivalent circular diameter, whichever is greater, will be permissible in span and rise.
- "B" is defined as the vertical dimension from a horizontal line across the widest portion of the arch to the lowest portion of the base.
- All dimensions are measured from the inside crests of all corrugations.
- Type II and IIA pipe are of the pipe arch shape.

INTENDED USES

Pipe for culverts, underdrains and storm sewers where the vertical allowable height is restricted.

STANDARD THICKNESS

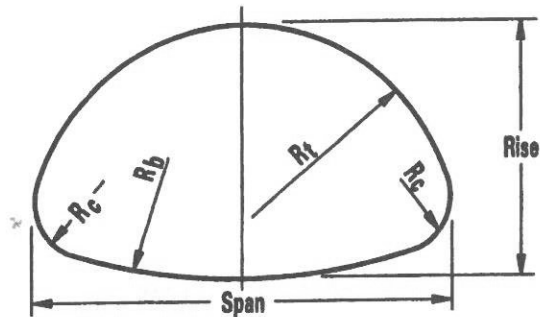
Corrugation	Type	Standard Thicknesses
68 x 13	II, IIA	1.63, 2.01, 2.77, 3.51, 4.27
75 x 25	II, IIA	2.01, 2.77, 3.51, 4.27
125 x 25	II, IIA	2.77, 3.51, 4.27

Equiv. Type IA Pipe	Smooth Liner	Corrugated Shell
1.63	1.02	1.32
2.01	1.02	1.32
2.77	1.02	2.01
3.51	1.02	2.77
4.27	1.02	3.51

CORRUGATED STEEL PIPE ARCH (Type II, IIA)

AASHTO-AGC-ARTBA
TF-13 DRAWING

CMFS-1-96



19 x 19 x 191 or 19 x 25 x 292 mm
Corrugations

Pipe Arch Size mm	Equivalent Diameter mm	Span mm	Rise mm	Minimum Corner Radius mm
500 x 410	450	500 - 25	410 + 25	130
590 x 490	525	580 - 25	490 + 25	130
680 x 540	600	680 - 40	540 + 40	130
750 x 620	675	750 - 40	620 + 40	130
830 x 670	750	830 - 40	670 + 40	130
900 x 750	825	900 - 45	750 + 45	130
1010 x 790	900	1010 - 45	790 + 45	130
1160 x 920	1050	1180 - 55	920 + 55	155
1340 x 1050	1200	1340 - 60	1050 + 60	180
1520 x 1170	1350	1520 - 70	1170 + 70	205
1670 x 1300	1500	1670 - 75	1300 + 75	230
1850 x 1400	1650	1850 - 85	1400 + 85	305
2050 x 1500	1800	2050 - 95	1500 + 95	355

SPECIFICATIONS

- Corrugated steel pipe arch shall conform to the requirements of:
 AASHTO M 36M & M 218 (Galvanized Steel)
 AASHTO M 36M & M 274 (Aluminum Coated (Type 2))
 AASHTO M 36M & M 289 (Aluminum-Zinc Alloy Coated)
 AASHTO M 245M & M 246M (Polymer Coated)
 AASHTO M 190 (Bituminous Coated)
 AASHTO M 36M & ASTM A 885 (Fiber Bonded)
- Negative and positive numbers listed with span and rise dimensions are negative and positive tolerances, no tolerances in opposite direction.
- All dimensions are measured from the inside crests of all corrugations.
- Type IIR pipe is of the pipe arch shape.

INTENDED USES

Pipe for culverts, underdrains and storm sewers where the vertical allowable height is restricted.

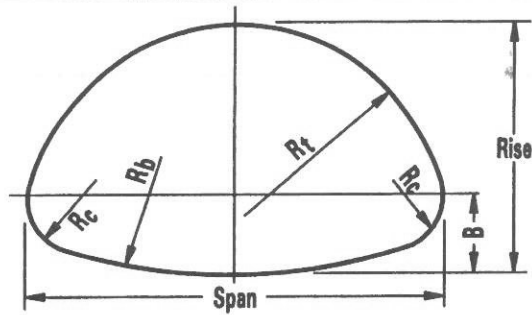
STANDARD THICKNESS

Corrugation	Type	Standard Thicknesses
19 x 19 x 191	IIR	1.63, 2.01, 2.77, 3.51
19 x 25 x 292	IIR	1.63, 2.01, 2.77, 3.51

CORRUGATED STEEL PIPE ARCH (Type IIR)

AASHTO-AGC-ARTBA
TF-13 DRAWING

CMFS-2-96



Pipe Arches - 68 mm x 13 mm Corrugations

Pipe Arch Size mm	Equiv. Diam. mm	Span mm	Rise mm	Min. Corner Radius mm	Max. B mm
430 x 330	375	430	330	75	135
530 x 380	450	530	380	75	155
610 x 460	525	610	460	75	185
710 x 510	600	710	510	75	205
780 x 560	675	780	560	75	225
885 x 610	750	870	630	75	240
970 x 690	825	970	690	75	255
1060 x 740	900	1060	740	90	265
1240 x 840	1050	1240	840	100	290
1440 x 970	1200	1440	970	130	345
1620 x 1100	1350	1620	1100	155	380
1800 x 1200	1500	1800	1200	180	420
1950 x 1320	1650	1950	1320	205	460
2100 x 1450	1800	2100	1450	230	510

Pipe Arches - 75 mm x 25 mm Corrugations

Pipe Arch Size mm	Equiv. Diam. mm	Span mm	Rise mm	Min. Corner Radius mm
1340 x 1050	1200	1340 - 60	1050 + 60	180
1520 x 1170	1350	1520 - 70	1170 + 70	205
1670 x 1300	1500	1670 - 75	1300 + 75	230
1850 x 1400	1650	1850 - 85	1400 + 85	305
2050 x 1500	1800	2050 - 95	1500 + 95	355
2200 x 1620	1950	2200 - 110	1620 + 110	355
2400 x 1720	2100	2400 - 120	1720 + 120	410
2600 x 1820	2250	2800 - 130	1820 + 130	410
2840 x 1920	2400	2840 - 145	1920 + 145	460
2970 x 2020	2550	2970 - 150	2020 + 150	460
3240 x 2120	2700	3240 - 165	2120 + 165	460
3470 x 2220	2850	3470 - 175	2220 + 175	460
3800 x 2320	3000	3600 - 180	2320 + 180	460

SPECIFICATIONS

1. Corrugated aluminum pipe arch shall conform to the requirements of: AASHTO M 196M & M 197M (Aluminum) AASHTO M 190 (Bituminous Coated)
2. For the 68 mm x 13 mm Corrugation Table a tolerance of plus or minus 25 mm or 2 percent of equivalent circular diameter, whichever is greater, will be permissible in span and rise.
3. "B" is defined as the vertical dimension from a horizontal line across the widest portion of the arch to the lowest portion of the base.
4. Negative and positive numbers listed with span and rise dimensions are negative and positive tolerances, zero tolerance in opposite direction.
5. All dimensions are measured from the inside crests of the corrugations.
6. Type II pipe is of the pipe arch shape.

INTENDED USES

Pipe for culverts, underdrains and storm sewers where the vertical allowable height is restricted.

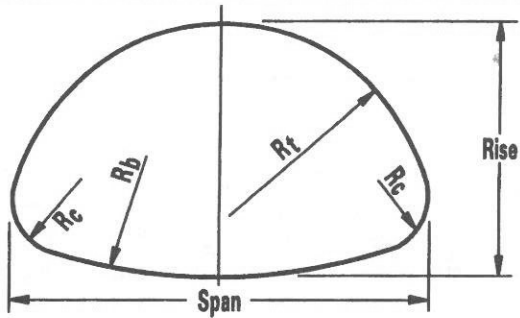
STANDARD THICKNESS

Corrugation	Type	Standard Thicknesses
68 x 13	II, IIA	1.22,1.52,1.91,2.67,3.43,4.19
75 x 25	II, IIA	1.52,1.91,2.67,3.43,4.19

CORRUGATED ALUMINUM PIPE ARCH (Type II, IIA)

AASHTO-AGC-ARTBA
TF-13 DRAWING

CMFA-1-86



Pipe Arches
19 x 19 x 190 mm and 19 x 25 x 292 mm Rib Corrugations

Pipe Arch Size mm	Equiv. Diam. mm	Span mm	Rise mm	Min. Corner Radius mm
500 x 410	450	500 - 25	410 + 25	130
580 x 490	525	580 - 25	490 + 25	130
680 x 540	600	680 - 40	540 + 40	130
830 x 670	750	830 - 40	670 + 40	130
1010 x 790	900	1010 - 45	790 + 45	130
1160 x 920	1050	1160 - 55	920 + 55	155
1340 x 1050	1200	1340 - 60	1050 + 60	180
1520 x 1170	1350	1520 - 70	1170 + 70	205
1670 x 1300	1500	1670 - 75	1300 + 75	230
1850 x 1400	1650	1850 - 85	1400 + 85	305
2050 x 1500	1800	2050 - 95	1500 + 95	355

SPECIFICATIONS

1. Corrugated aluminum pipe arch shall conform to the requirements of: AASHTO M 196M & M 197M (Aluminum) AASHTO M 190 (Bituminous Coated)
2. Negative and positive numbers listed with span and rise dimensions are negative and positive tolerances, zero tolerance in opposite direction.
3. All dimensions are measured from the inside surface of the corrugations.
4. Type IIR pipe is of the pipe arch shape.

INTENDED USES

Pipe for culverts, underdrains and storm sewers where the vertical allowable height is restricted.

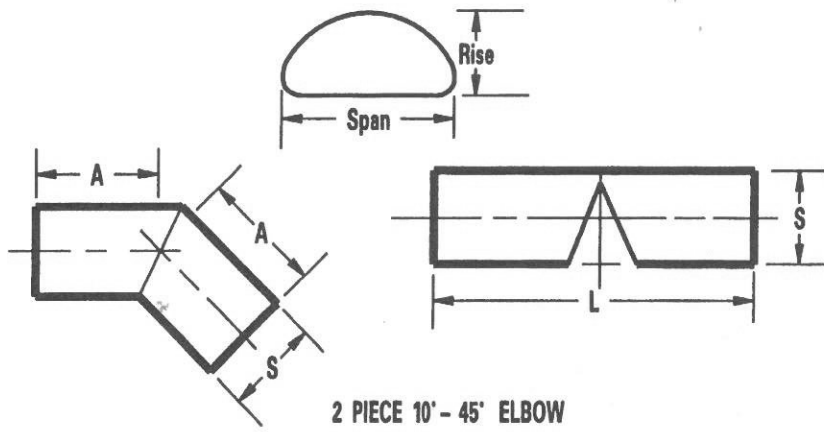
STANDARD THICKNESS

Corrugation	Type	Standard Thicknesses
19 x 19 x 190	IIR	1.22,1.52,1.91,2.67,3.43,4.19
19 x 25 x 292	IIR	

CORRUGATED ALUMINUM PIPE ARCH (Type IIR)

AASHTO-AGC-ARTBA
TF-13 DRAWING

CMFA-2-96



2 PIECE 10' - 45' ELBOW

SPECIFICATIONS

- Fittings shall meet the applicable requirements of:
 AASHTO M 36M & M 218 (Galvanized Steel)
 AASHTO M 196M (Aluminum)
 AASHTO M 36M & M 274 (Aluminum Coated (Type 2))
 AASHTO M 36M & M 289 (Aluminum-Zinc Alloy Coated)
 AASHTO M 245M & M 246M (Polymer Coated Steel)
 AASHTO M 190 (Bituminous Coated)
 AASHTO M 36M & ASTM A 885 (Fiber Bonded)
- Welding shall be in accordance with drawings and specifications as supplied by the manufacturer and approved by the purchaser.
 After completion of welding on galvanized or aluminum coated steel fittings, all welds and immediate surfaces of metal adjoining welds shall be repaired in accordance with AASHTO M 36M.
 When polymeric precoated pipe is specified, the polymeric coating only shall be repaired by the application of a coating meeting the performance requirements of AASHTO M 246M or a coal-tar base protective coating conforming to AASHTO M 243.
- When specified, bituminous coating after fabrication shall conform to the requirements of AASHTO M 190, Type A or AASHTO M 243. Invert paved pipe or fully paved pipe shall conform to the requirements of AASHTO M 190, Type B, C, or D as specified.

INTENDED USES

- Culvert or storm sewer where change in alignment or grade occur or for intersecting lines of pipe.
- Underdrain and Recharge Patterns:
 - Highway
 - Airport
 - Railroad
 - Flood Protection
 - Structures (abutments, walls, etc.)

EQUIV. DIAM.	CORRUGATIONS				45° ELBOW 2 PIECE	
	75 x 25 & 125 x 25		68 x 13			
	SPAN ^A S	RISE ^A R	SPAN ^B S	RISE ^B R	A mm	L m
mm	mm	mm	mm	mm		
375			430	330		
450			530	380		
525			610	460	508	1.22
600			710	510	508	1.22
675			780	560	483	1.22
750			870	630	457	1.22
825			970	690	406	1.22
900	1010 - 45	790 + 45	1060	740	685	1.83
1050	1160 - 55	920 + 55	1240	840	635	1.83
1200	1340 - 60	1050 + 60	1440	970	610	1.83
1350	1520 - 70	1170 + 70	1620	1100	864	2.44
1500	1670 - 75	1300 + 75	1800	1200	838	2.44
1650	1850 - 85	1400 + 85	1950	1320	1092	3.05
1800	2050 - 95	1500 + 95	2100	1450	1067	3.05

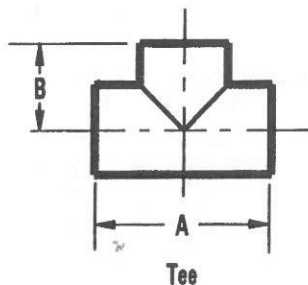
^ANegative and positive numbers listed with span and rise dimensions are negative and positive tolerances, no tolerance in opposite direction.

^BA tolerance of 25 mm or 2% of equivalent diameter, whichever is greater, will be permissible in span and rise.

PIPE ARCH CMP ELBOW FITTINGS

AASHTO-AGC-ARTBA
TF-13 DRAWING

CMF-3-96



DIA.	A	B	L
mm	meters		
150	0.61	0.61	1.22
200	0.61	"	1.22
250	0.61	"	1.22
300	1.22	"	1.83
375	"	"	"
450	"	"	"
525	"	"	"
600	"	"	"
675	"	"	"
750	1.22	0.61	1.83
825	1.83	1.22	3.05
900	"	"	"
1050	"	"	"
1200	"	"	"
1350	1.83	"	3.05
1500	2.44	"	3.66
1650	2.44	"	3.66
1800	2.44	1.22	3.66
1950	3.05	1.83	4.88
2100	"	"	"
2250	"	"	"
2400	3.05	1.83	4.88

L = Lineal Meters Pipe to Make Fitting
Stub Diameter Same As Main or Less

APPLICABLE SPECIFICATIONS

- Fittings shall meet the applicable requirements of:
 - AASHTO M 36M & M 218 (Galvanized Steel)
 - AASHTO M 196M (Aluminum)
 - AASHTO M 36M & M 274 (Aluminum Coated (Type 2))
 - AASHTO M 36M & M 289 (Aluminum-Zinc Alloy Coated)
 - AASHTO M 245M & M 246M (Polymer Coated Steel)
 - AASHTO M 190 (Bituminous Coated)
 - AASHTO M 36M & ASTM A 885 (Fiber Bonded)
- Welding shall be in accordance with drawings and specifications as supplied by the manufacturer and approved by the purchaser. After completion of welding on galvanized or aluminum coated steel fittings, all welds and immediate surfaces of metal adjoining welds shall be repaired in accordance with AASHTO M 36M. When polymeric precoated pipe is specified, the polymeric coating only shall be repaired by the application of a coating meeting the performance requirements of AASHTO M 246M or a coal-tar base protective coating conforming to AASHTO M 243.
- When specified, bituminous coating after fabrication shall conform to the requirements of AASHTO M 190, Type A or AASHTO M 243. Invert paved pipe or fully paved pipe shall conform to the requirements of AASHTO M 190, Type B, C, or D as specified.

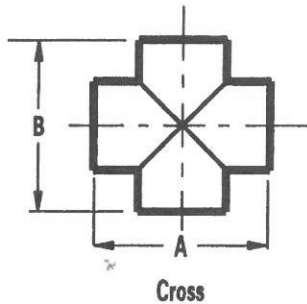
INTENDED USE

- Culvert or storm drains where change in alignment or grade occur or for intersecting lines of pipe.
- Underdrain and Recharge Patterns:
 - Highway
 - Airport
 - Railroad
 - Flood Protection
 - Structures (abutments, walls, etc.)

CIRCULAR CMP TEE FITTING

AASHTO-AGC-ARTBA
TF-13 DRAWING

CMF-4-96



DIA.	A	B	L
mm	meters		
150	0.61	0.61	1.22
200	0.61	0.61	1.22
250	0.61	0.61	1.22
300	1.22	1.22	2.44
375	"	"	"
450	"	"	"
525	"	"	"
600	"	"	"
675	"	"	"
750	1.22	1.22	2.44
825	1.83	1.83	3.66
900	"	"	"
1050	"	"	"
1200	"	"	"
1350	1.83	1.83	3.66
1500	2.44	2.44	4.88
1650	2.44	2.44	4.88
1800	2.44	2.44	4.88
1950	3.05	3.05	6.10
2100	"	"	"
2250	"	"	"
2400	3.05	3.05	6.10

Stub Diameter Same As Main or Less

L = Lineal Meters Pipe to Make Fitting

APPLICABLE SPECIFICATIONS

- Fittings shall meet the applicable requirements of:
 - AASHTO M 36M & M 218 (Galvanized Steel)
 - AASHTO M 196M (Aluminum)
 - AASHTO M 36M & M 274 (Aluminum Coated (Type 2))
 - AASHTO M 36M & M 289 (Aluminum-Zinc Alloy Coated)
 - AASHTO M 245M & M 246M (Polymer Coated Steel)
 - AASHTO M 190 (Bituminous Coated)
 - AASHTO M 36M & ASTM A 885 (Fiber Bonded)
- Welding shall be in accordance with drawings and specifications as supplied by the manufacturer and approved by the purchaser. After completion of welding on galvanized or aluminum coated steel fittings, all welds and immediate surfaces of metal adjoining welds shall be repaired in accordance with AASHTO M 36M. When polymeric pre-coated pipe is specified, the polymeric coating only shall be repaired by the application of a coating meeting the performance requirements of AASHTO M 246M or a coal-tar base protective coating conforming to AASHTO M 243.
- When specified, bituminous coating after fabrication shall conform to the requirements of AASHTO M 190, Type A or AASHTO M 243. Invert paved pipe or fully paved pipe shall conform to the requirements of AASHTO M 190, Type B, C, or D as specified.

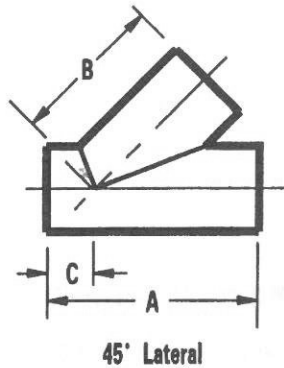
INTENDED USES

- Culvert or storm drains where change in alignment or grade occur or for intersecting lines of pipe.
- Underdrain and Recharge Patterns:
 - Highway
 - Airport
 - Railroad
 - Flood Protection
 - Structures (abutments, walls, etc.)

CIRCULAR CMP CROSS FITTINGS

AASHTO-AGC-ARTBA
TF-13 DRAWING

CMF-5-96



Stub Diameter Same As Main or Less

L = Lineal Meters Pipe to Make Fitting

DIA.	A	B	C	L
mm	meters		mm	meters
150	0.61	0.61	203	1.22
200	0.61	"	203	1.22
250	1.22	"	432	1.83
300	"	0.61	432	1.83
375	"	1.22	457	2.44
450	1.22	"	330	2.44
525	1.83	"	559	3.05
600	"	"	584	"
675	"	"	508	"
750	"	1.22	533	3.05
825	1.83	1.83	483	3.66
900	2.44	1.83	483	4.27
1050	2.44	1.83	533	4.27
1200	3.05	2.44	711	5.49
1350	3.05	2.44	584	5.49
1500	3.66	3.05	762	6.71
1650	3.66	"	813	6.71
1800	4.27	"	1143	7.32
1950	4.27	3.05	1168	7.32
2100	4.88	3.66	1194	8.53
2250	4.88	3.66	1245	8.53
2400	4.88	3.66	1270	8.53

APPLICABLE SPECIFICATIONS

- Fittings shall meet the applicable requirements of:
 - AASHTO M 36M & M 218 (Galvanized Steel)
 - AASHTO M 196M (Aluminum)
 - AASHTO M 36M & M 274 (Aluminum Coated (Type 2))
 - AASHTO M 36M & M 289 (Aluminum-Zinc Alloy Coated)
 - AASHTO M 245M & M 246M (Polymer Coated Steel)
 - AASHTO M 190 (Bituminous Coated)
 - AASHTO M 36M & ASTM A 885 (Fiber Bonded)
- Welding shall be in accordance with drawings and specifications as supplied by the manufacturer and approved by the purchaser. After completion of welding on galvanized or aluminum coated steel fittings, all welds and immediate surfaces of metal adjoining welds shall be repaired in accordance with AASHTO M 36M. When polymeric precoated pipe is specified, the polymeric coating only shall be repaired by the application of a coating meeting the performance requirements of AASHTO M 246M or a coal-tar base protective coating conforming to AASHTO M 243.
- When specified, bituminous coating after fabrication shall conform to the requirements of AASHTO M 190, Type A or AASHTO M 243. Invert paved pipe or fully paved pipe shall conform to the requirements of AASHTO M 190, Type B, C, or D as specified.

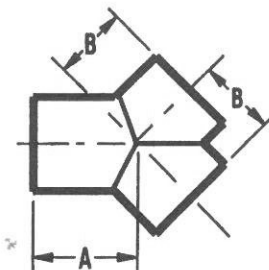
INTENDED USES

- Culvert or storm drains for intersecting lines of pipe.
- Underdrain and Recharge Patterns:
 - Highway
 - Airport
 - Railroad
 - Flood Protection
 - Structures (abutments, walls, etc.)

CIRCULAR CMP LATERAL FITTINGS

AASHTO-AGC-ARTBA
TF-13 DRAWING

CMF-6-96



45° Wye

DIA.	A	B	L
mm	meters		
150	0.61	0.61	1.83
200	"	"	"
250	"	"	"
300	"	"	"
375	"	"	"
450	"	"	"
525	"	"	"
600	"	"	"
675	"	"	"
750	0.61	0.61	1.83
825	0.61	0.91	2.44
900	"	"	"
1050	"	"	"
1200	0.61	0.91	2.44
1350	1.22	1.22	3.66
1500	"	"	"
1650	"	"	"
1800	"	1.52	4.27
1950	"	"	"
2100	"	"	"
2250	"	1.52	4.27
2400	1.22	1.83	4.88

Stub Diameter Same As Main or Less

L = Lineal Meters Pipe to Make Fitting

APPLICABLE SPECIFICATIONS

- Fittings shall meet the applicable requirements of:
 - AASHTO M 36M & M 218 (Galvanized Steel)
 - AASHTO M 196M (Aluminum)
 - AASHTO M 36M & M 274 (Aluminum Coated (Type 2))
 - AASHTO M 36M & M 289 (Aluminum-Zinc Alloy Coated)
 - AASHTO M 245M & M 246M (Polymer Coated Steel)
 - AASHTO M 190 (Bituminous Coated)
 - AASHTO M 36M & ASTM A 885 (Fiber Bonded)
- Welding shall be in accordance with drawings and specifications as supplied by the manufacturer and approved by the purchaser. After completion of welding on galvanized or aluminum coated steel fittings, all welds and immediate surfaces of metal adjoining welds shall be repaired in accordance with AASHTO M 36M. When polymeric precoated pipe is specified, the polymeric coating only shall be repaired by the application of a coating meeting the performance requirements of AASHTO M 246M or a coal-tar base protective coating conforming to AASHTO M 243.
- When specified, bituminous coating after fabrication shall conform to the requirements of AASHTO M 190, Type A or AASHTO M 243. Invert paved pipe or fully paved pipe shall conform to the requirements of AASHTO M 190, Type B, C, or D as specified.

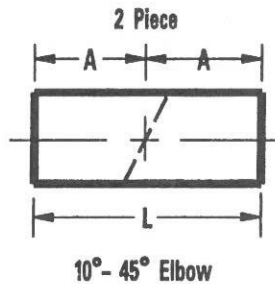
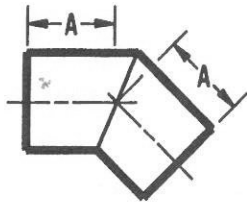
INTENDED USES

- Culvert or storm drain where change in alignment or grade occur or for intersecting lines of pipe.
- Underdrain and Recharge Patterns:
 - Highway
 - Airport
 - Railroad
 - Flood Protection
 - Structures (abutments, walls, etc.)

CIRCULAR CMP WYE FITTINGS

AASHTO-AGC-ARTBA
TF-13 DRAWING

CMF-7-96



L = Lineal Meters of CMP Required
to Fabricate Fitting

All Dimensions Nominal

DIA. mm	A m	L m
150-450	0.30	0.61
525-1200	0.61	1.22
1350-2400	0.91	1.83

APPLICABLE SPECIFICATIONS

- Fittings shall meet the applicable requirements of:
 - AASHTO M 36M & M 218 (Galvanized Steel)
 - AASHTO M 196M (Aluminum)
 - AASHTO M 36M & M 274 (Aluminum Coated (Type 2))
 - AASHTO M 36M & M 289 (Aluminum-Zinc Alloy Coated)
 - AASHTO M 245M & M 246M (Polymer Coated Steel)
 - AASHTO M 190 (Bituminous Coated)
 - AASHTO M 36M & ASTM A 885 (Fiber Bonded)
- Welding shall be in accordance with drawings and specifications as supplied by the manufacturer and approved by the purchaser. After completion of welding on galvanized or aluminum coated steel fittings, all welds and immediate surfaces of metal adjoining welds shall be repaired in accordance with AASHTO M 36M. When polymeric precoated pipe is specified, the polymeric coating only shall be repaired by the application of a coating meeting the performance requirements of AASHTO M 246M or a coal-tar base protective coating conforming to AASHTO M 243.
- When specified, bituminous coating after fabrication shall conform to the requirements of AASHTO M 190, Type A or AASHTO M 243. Invert paved pipe or fully paved pipe shall conform to the requirements of AASHTO M 190, Type B, C, or D as specified.

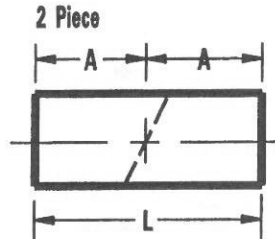
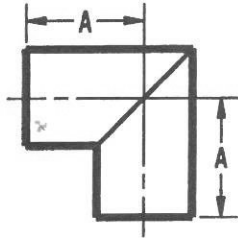
INTENDED USES

- Culvert or storm drain where change in alignment or grade occur or for intersecting lines of pipe.
- Underdrain and Recharge Patterns:
 - a. Highway
 - b. Airport
 - c. Railroad
 - d. Flood Protection
 - e. Structures (abutments, walls, etc.)

CIRCULAR CMP 10° - 45° ELBOWS

AASHTO-AGC-ARTBA
TF-13 DRAWING

CMF-8-96



50°-90° Elbow

L = Lineal Meters of CMP Required
to Fabricate Fitting

All Dimensions Nominal

DIA. mm	A m	L m
150-250	0.30	0.61
300-675	0.61	1.22
750-1050	0.91	1.83
1200-1650	1.22	2.44
1800-2100	1.52	3.05
2250-2400	1.83	3.66

APPLICABLE SPECIFICATIONS

- Fittings shall meet the applicable requirements of:
 - AASHTO M 36M & M 218 (Galvanized Steel)
 - AASHTO M 196M (Aluminum)
 - AASHTO M 36M & M 274 (Aluminum Coated (Type 2))
 - AASHTO M 36M & M 289 (Aluminum-Zinc Alloy Coated)
 - AASHTO M 245M & M 246M (Polymer Coated Steel)
 - AASHTO M 190 (Bituminous Coated)
 - AASHTO M 36M & ASTM A 885 (Fiber Bonded)
- Welding shall be in accordance with drawings and specifications as supplied by the manufacturer and approved by the purchaser. After completion of welding on galvanized or aluminum coated steel fittings, all welds and immediate surfaces of metal adjoining welds shall be repaired in accordance with AASHTO M 36M. When polymeric precoated pipe is specified, the polymeric coating only shall be repaired by the application of a coating meeting the performance requirements of AASHTO M 246M or a coal-tar base protective coating conforming to AASHTO M 243.
- When specified, bituminous coating after fabrication shall conform to the requirements of AASHTO M 190, Type A or AASHTO M 243. Invert paved pipe or fully paved pipe shall conform to the requirements of AASHTO M 190, Type B, C, or D as specified.

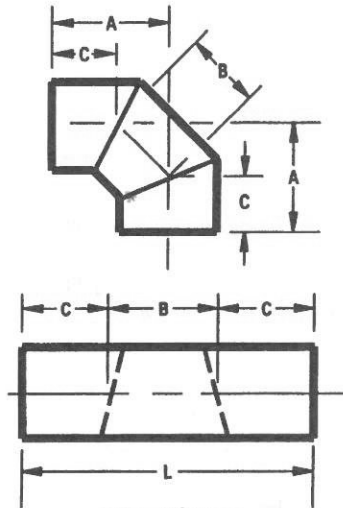
INTENDED USES

- Culvert or storm drain where change in alignment or grade occur or for intersecting lines of pipe.
- Underdrain and Recharge Patterns:
 - a. Highway
 - b. Airport
 - c. Railroad
 - d. Flood Protection
 - e. Structures (abutments, walls, etc.)

CIRCULAR CMP 50° - 90° ELBOWS

AASHTO-AGC-ARTBA
TF-13 DRAWING

CMF-9-96



3 Piece 90° Elbow

L=Total meters of CMP required to fabricate fitting

All dimensions nominal

Diam. mm	A	B	C	L
	mm			m
150	343	203	203	0.61
200	356	229	191	0.61
250	356	254	178	0.61
300	648	279	470	1.22
375	673	305	457	1.22
450	686	356	432	1.22
525	686	381	419	1.22
600	699	406	406	1.22
675	699	432	394	1.22
750	1016	483	673	1.83
825	1016	508	660	1.83
900	1029	533	648	1.83
1050	1041	584	622	1.83
1200	1359	660	889	2.44
1350	1372	711	864	2.44
1500	1384	787	826	2.44
1650	1372	838	800	2.44
1800	1715	914	1067	3.05
1950	1727	991	1029	3.05
2100	1740	1041	1003	3.05
2250	1778	1168	940	3.05
2400	2083	1188	1245	3.66

APPLICABLE SPECIFICATIONS

- Fittings shall meet the applicable requirements of:
 - AASHTO M 36M & M 218 (Galvanized Steel)
 - AASHTO M 196M (Aluminum)
 - AASHTO M 36M & M 274 (Aluminum Coated (Type 2))
 - AASHTO M 36M & M 289 (Aluminum-Zinc Alloy Coated)
 - AASHTO M 245M & M 246M (Polymer Coated Steel)
 - AASHTO M 190 (Bituminous Coated)
 - AASHTO M 36M & ASTM A 885 (Fiber Bonded)
- Welding shall be in accordance with drawings and specifications as supplied by the manufacturer and approved by the purchaser. After completion of welding on galvanized or aluminum coated steel fittings, all welds and immediate surfaces of metal adjoining welds shall be repaired in accordance with AASHTO M 36M. When polymeric pre-coated pipe is specified, the polymeric coating only shall be repaired by the application of a coating meeting the performance requirements of AASHTO M 246M or a coal-tar base protective coating conforming to AASHTO M 243.
- When specified, bituminous coating after fabrication shall conform to the requirements of AASHTO M 190, Type A or AASHTO M 243. Invert paved pipe or fully paved pipe shall conform to the requirements of AASHTO M 190, Type B, C, or D as specified.

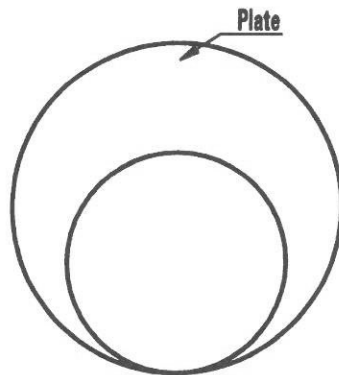
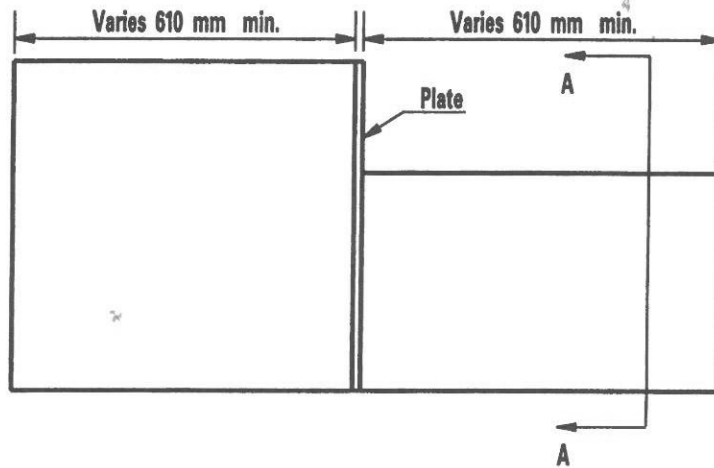
INTENDED USES

- Culvert or storm drain where change in alignment or grade occur or for intersecting lines of pipe.
- Underdrain and Recharge Patterns:
 - a. Highway
 - b. Airport
 - c. Railroad
 - d. Flood Protection
 - e. Structures (abutments, walls, etc.)

CIRCULAR CMP 3-PIECE 90° ELBOW

AASHTO-AGC-ARTBA
TF-13 DRAWING

CMF-10-96



SECTION A-A

APPLICABLE SPECIFICATIONS

1. Fittings shall meet the applicable requirements of:
 - AASHTO M 36M & M 218 (Galvanized Steel)
 - AASHTO M 196M (Aluminum)
 - AASHTO M 36M & M 274 (Aluminum Coated (Type 2))
 - AASHTO M 36M & M 289 (Aluminum-Zinc Alloy Coated)
 - AASHTO M 245M & M 246M (Polymer Coated Steel)
 - AASHTO M 190 (Bituminous Coated)
 - AASHTO M 36M & ASTM A 885 (Fiber Bonded)
2. Welding shall be in accordance with drawings and specifications as supplied by the manufacturer and approved by the purchaser. After completion of welding on galvanized or aluminum coated steel fittings, all welds and immediate surfaces of metal adjoining welds shall be repaired in accordance with AASHTO M 36M. When polymeric precoated pipe is specified, the polymeric coating only shall be repaired by the application of a coating meeting the performance requirements of AASHTO M 246M or a coal-tar base protective coating conforming to AASHTO M 243.
3. When specified, bituminous coating after fabrication shall conform to the requirements of AASHTO M 190, Type A or AASHTO M 243. Invert paved pipe or fully paved pipe shall conform to the requirements of AASHTO M 190, Type B, C, or D as specified.
4. Reinforcement as determined by the engineer.

INTENDED USES

1. Culvert or storm drain where change in pipe size occurs.
2. Underdrain and Recharge Patterns:
 - a. Highway
 - b. Airport
 - c. Railroad
 - d. Flood Protection
 - e. Structures (abutments, walls, etc.)

CIRCULAR CMP REDUCER

AASHTO-AGC-ARTBA
TF-13 DRAWING

CMF-11-96

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Sloped End Section—Type C Cross Drainage Structure with Safety Bars	CME-7-96	67
Sloped End Section—Type C Parallel Drainage Structure with Safety Bars	CME-8-96	68
Sloped End Section—Type C Pipe Arch Cross Drainage Structure with Safety Bars	CME-9-96	69
Sloped End Section—Type C Pipe Arch Parallel Drainage Structure with Safety Bars	CME-10-96	70

APPLICABLE SPECIFICATIONS

1. The material used in the fabrication of End Sections shall conform to the applicable requirements of:

AASHTO M 218 (Galvanized Iron or Steel Sheets)
 AASHTO M 274 (Aluminum Coated-Type 2)
 AASHTO M 289 (Aluminum-Zinc Alloy Coated)
 AASHTO M 197M (Aluminum Alloy Sheets)
 AASHTO M 246M (Precoated Galvanized Steel Sheets)
 AASHTO M 243 (When Specified-Field Applied Coating)
 ASTM A 885 (Fiber Bonded)

2. All 3 piece bodies to have 2.77 mm sides and 3.51 mm center panels. Multiple panel bodies to have seams which are to be tightly joined by galvanized rivets or bolts for steel units and aluminum rivets or bolts for aluminum units.

3. For 1500 mm through 2100 mm sizes reinforced edges to be supplemented with galvanized or aluminized stiffener angles. The angles to be attached by galvanized nuts and bolts for steel units or aluminum nuts and bolts for aluminum units.

4. Galvanized Steel, Aluminized Steel or Aluminum toe plate to be available as an accessory, when specified, and will be the same thickness as the End Section.

5. Galvanized Steel, Aluminized Steel or Aluminum lifting lug available as an accessory, when specified.

6. End Sections can be used with any pipe or pipe arch wall thickness specified.

INTENDED USES

End Sections attached to the inlet and outlet ends of pipe and pipe arch:

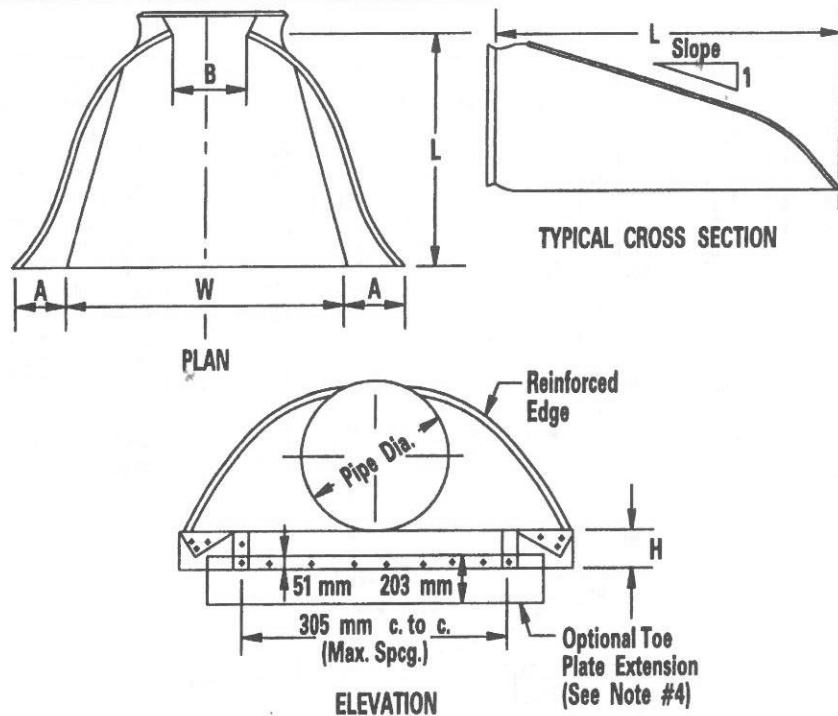
1. Prevent scour and undermining.
2. Prevent piping and burrowing.
3. Facilitates slope maintenance.
4. Aesthetically finishes ends of conduit.

NOTE: Thickness includes the base steel plus the zinc or aluminized coating on both sides. It does not include the thickness of polymer or bituminous coatings.

END SECTIONS FOR CIRCULAR PIPE
 75 x 25, 68 x 13, 125 x 25, 19 x 19 x 190
 and 19 x 25 x 292 CORRUGATIONS

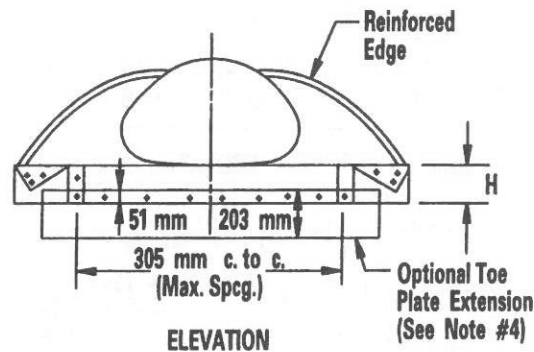
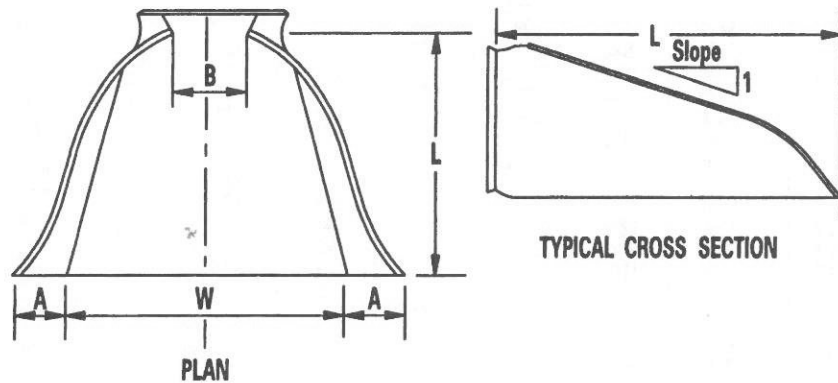
AASHTO-AGC-ARTBA
 TF-13 DRAWING

CME-1-96



Pipe Diameter (mm)	Specified Thickness (mm)	A Min. (mm)	B Max. (mm)	H Min. (mm)	F Min. (mm)	L ± 2 (mm)	W Max Width (mm)	Approximate Average End Section Slope ^a
150	1.32	76	25	76	254	203	610	1 : 1.75
200	1.32	127	127	102	356	356	813	1 : 2.38
250	1.32	127	152	152	457	356	991	1 : 2.00
300	1.32	127	178	152	559	533	1118	1 : 2.25
375	1.63	152	203	152	711	660	1321	1 : 2.25
450	1.63	178	254	152	864	787	1473	1 : 2.13
525	1.63	203	305	152	1016	914	1676	1 : 2.13
600	1.63	229	330	152	1168	1041	1829	1 : 2.13
750	2.01	279	406	203	1397	1295	2235	1 : 2.13
900	2.01	330	483	229	1778	1524	2667	1 : 2.00
1050	2.77	381	635	254	2083	1524	3099	1 : 2.13
1200	2.77	432	737	305	2235	1981	3327	1 : 2.00
1350	2.77	432	838	305	2540	2134	3632	1 : 2.00
1500	2.77	432	914	305	2845	2210	3988	1 : 1.88
1650	2.77	432	991	305	2997	2210	4115	1 : 1.63
1800	2.77	432	1118	305	3048	2210	4267	1 : 1.50
1950	2.77	432	1219	305	3302	2210	4521	1 : 1.38
2100	2.77	432	1321	305	3454	2210	4674	1 : 1.33
2250	2.77	432	1473	305	3607	2210	4775	1 : 1.25
2400	2.77	432	1473	305	3658	2210	5004	1 : 1.13

^aFill slope need not match the end section slope. Fill can be shaped at each site to fit.
 1. Some larger sizes may require field assembly.
 2. Optional toe plates may be provided to depths specified.



Span x Rise (mm)	Equiv/Round (mm)	THICKNESS		A Min. (mm)	B Max. (mm)	H Min. (mm)	F Min. (mm)	L ± 50 (mm)	W Max Width (mm)	Approximate Average End Section Slope*
		GALV. STEEL	ALUM.							
430 x 330	375	1.63	1.52	127	229	152	711	508	1321	1 : 2.125
530 x 380	450	1.63	1.52	152	279	152	864	610	1473	1 : 2
610 x 460	525	1.63	1.52	178	305	152	1016	711	1600	1 : 2.125
710 x 510	600	1.63	1.52	178	406	152	1168	813	1778	1 : 2
885 x 610	750	2.01	1.91	229	406	152	1473	991	2159	1 : 1.875
1060 x 740	900	2.01	1.91	279	457	178	1854	1168	2642	1 : 1.875
1240 x 840	1050	2.77	2.67	305	533	229	2083	1346	2972	1 : 1.75
1440 x 970	1200	2.77	2.67	406	660	305	2235	1575	3353	1 : 1.875
1620 x 1100	1350	2.77	2.67	432	762	305	2540	1753	3658	1 : 1.875
1800 x 1200	1500	2.77	2.67	432	914	305	2845	1956	3962	1 : 1.875
1950 x 1320	1650	2.77	2.67	432	914	305	3150	1956	4242	1 : 1.625
2100 x 1450	1800	2.77	2.67	432	1118	305	3302	1956	4496	1 : 1.5

*Fill slope need not match the end section slope. Fill can be shaped at each site to fit.

1. Some larger sizes may require field assembly.
2. Optional toe plates may be provided to depths specified.

APPLICABLE SPECIFICATIONS

1. The material used in the fabrication of End Sections shall conform to the applicable requirements of:

- AASHTO M 218 (Galvanized Iron or Steel Sheets)
- AASHTO M 274 (Aluminum Coated-Type 2)
- AASHTO M 289 (Aluminum-Zinc Alloy Coated)
- AASHTO M 197M (Aluminum Alloy Sheets)
- AASHTO M 246M (Precoated Galvanized Steel Sheets)
- AASHTO M 243 (When Specified-Field Applied Coating)
- ASTM A 885 (Fiber Bonded)

2. All 3 piece bodies to have 2.77 mm thick sides and 3.51 mm thick center panels. Multiple panel bodies to have seams which are to be tightly joined by galvanized rivets or bolts for steel units and aluminum rivets or bolts for aluminum units.

3. For the 1950 mm x 1320 mm and 2100 mm x 1450 mm size, reinforced edges to be supplemented with galvanized or aluminum stiffener angles. The angles to be attached by galvanized nuts and bolts for steel units and aluminum nuts and bolts for aluminum units.

4. Angle reinforcements will be placed under the center panel seams on the 1950 mm x 1320 mm and 2100 mm x 1450 mm sizes.

5. Galvanized steel, Aluminized Steel or Aluminum toe plate to be available as an accessory, when specified, and will be the same thickness as the End Section.

6. Galvanized Steel, Aluminized Steel or Aluminum lifting lug available as an accessory, when specified.

7. End Sections can be used with any pipe or pipe arch wall thickness specified.

INTENDED USES

End Sections attached to the inlet and outlet ends of pipe and pipe arch:

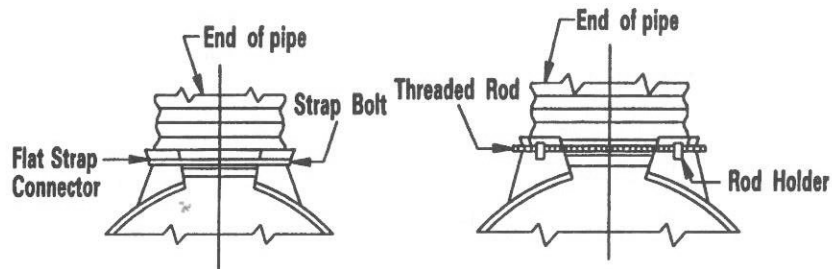
1. Prevent scour and undermining.
2. Prevent piping and burrowing.
3. Facilities slope maintenance.
4. Aesthetically finishes ends of conduit.

NOTE: Thickness includes the base steel plus the zinc or aluminized coating on both sides. It does not include the thickness of polymer or bituminous coatings.

END SECTIONS FOR PIPE ARCH 75 x 25, 125 x 25 and 68 x 13 CORRUGATIONS

AASHTO-AGC-ARTBA
TF-13 DRAWING

CME-2-96

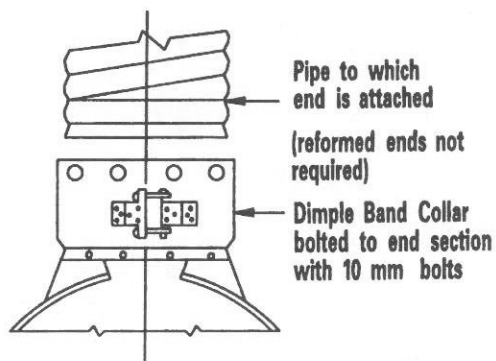


TYPE #1

TYPE #2

Available in Sizes 300 mm Through
600 mm Round and 430 mm x 330 mm
Through 710 mm x 510 mm Pipe-Arches

Available in Sizes 750 mm Through 900 mm
Round and 885 mm x 610 mm Through
1440 mm x 970 mm Pipe-Arches



TYPE #3

Available For All Round and Pipe-Arch Sizes Shown
(Type 1 and Type 2 Conditions are Recommended for the Smaller Sizes with Annular Ends)

SPECIFICATIONS

1. The material used in the fabrication of end sections shall conform to the applicable requirements of:

- AASHTO M 218 (Galvanized Iron or Steel Sheets)
- AASHTO M 274 (Aluminum Coated-Type 2)
- AASHTO M 289 (Aluminum-Zinc Alloy Coated)
- AASHTO M 197M (Aluminum Alloy Sheets)
- AASHTO M 246M (Precoated Galvanized Steel Sheets)
- AASHTO M 243 (When Specified-Field Applied Coating)
- ASTM A 885 (Fiber Bonded)

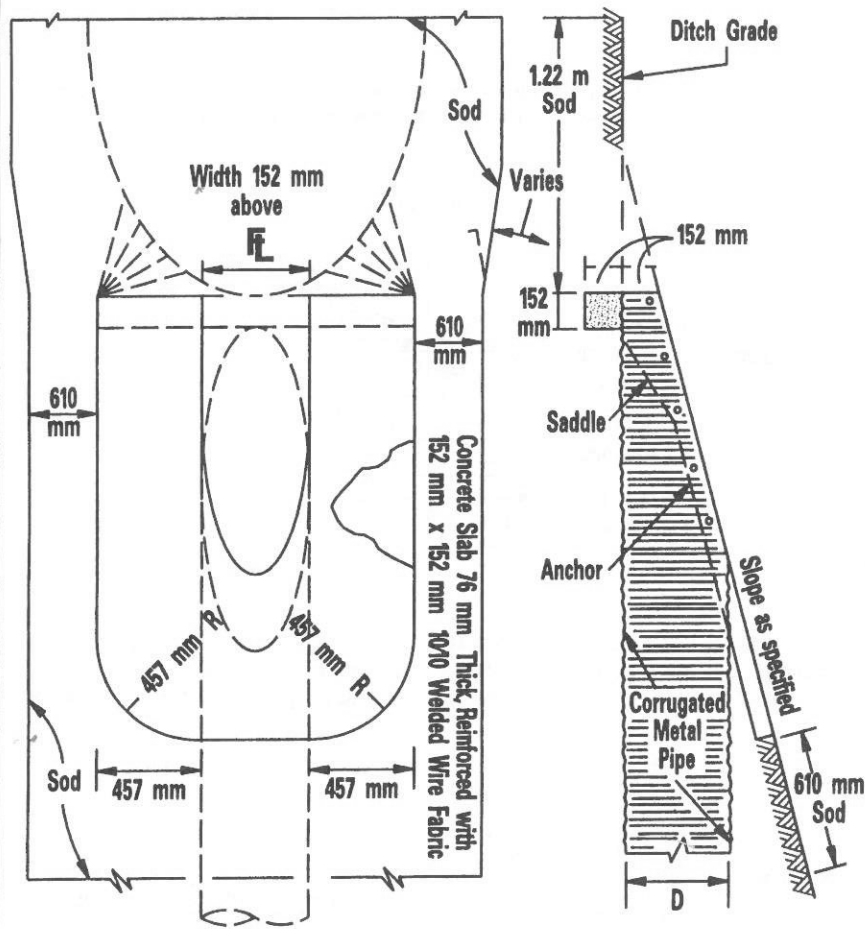
INTENDED USES

Connecting end sections to circular pipe and pipe arch shapes.

**END SECTION CONNECTIONS
CIRCULAR AND ARCH SHAPES**

AASHTO-AGC-ARTBA
TF-13 DRAWING

CME-3-96



TOP VIEW - SINGLE PIPE

SECTION

SPECIFICATIONS

- The material used in the fabrication of Sloped End Sections shall conform to the applicable requirements of:
 - AASHTO M 218 (Galvanized Iron or Steel Sheets)
 - AASHTO M 274 (Aluminum Coated-Type 2)
 - AASHTO M 289 (Aluminum-Zinc Alloy Coated)
 - AASHTO M 197M (Aluminum Alloy Sheets)
 - AASHTO M 248M (Precoated Galvanized Steel Sheets)
 - ASTM A 885 (Fiber Bonded)
- Sloped End Sections shall be fabricated from full circular pipe, may be formed into pipe arches when specified, and shall meet all requirements for corrugations, thickness and other applicable fabrication requirements.
- Seams in the beveled portion of the end sections should be tack welded to provide proper handling and installation strength.
- All cut edges shall be cleaned, deburred and coated with approved compound as recommended by the sheet manufacturer.
- Type A sloped end sections shall be securely anchored to a concrete slope pavement and the toe cut-off foundation to prevent slope scouring and hydraulic uplift.
- Sloped ends are typically used to reduce hazard of culvert end to errant vehicles. Grates or other devices may also be required to effect this end.

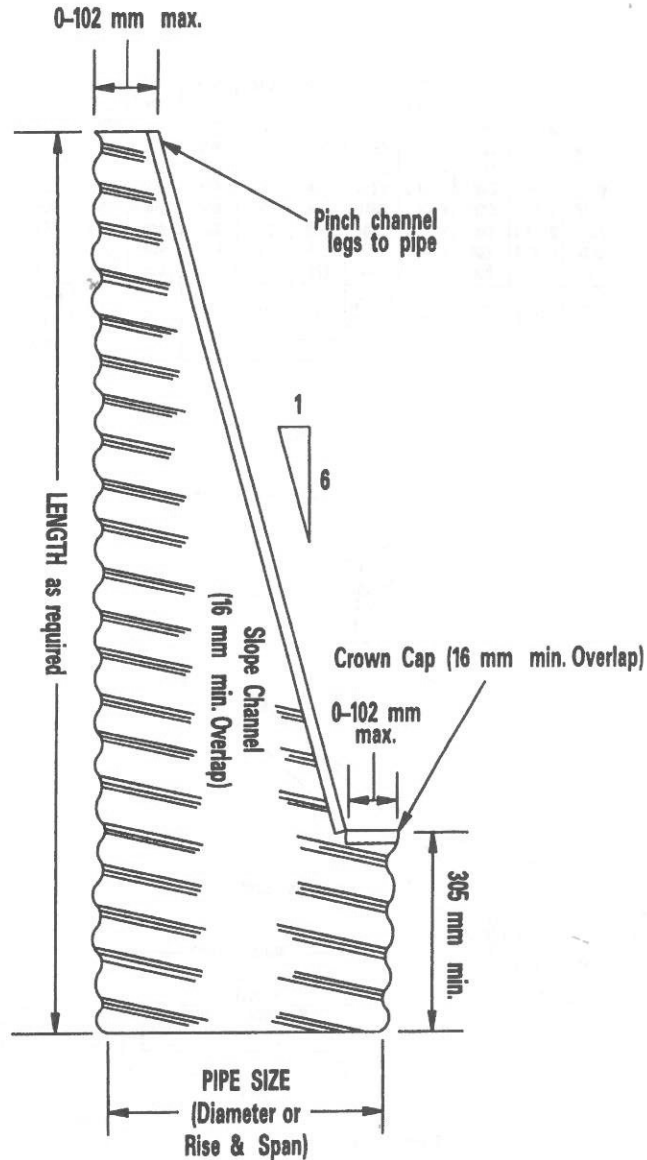
INTENDED USES

To provide end finish to a line of pipe conforming to embankment contour. Various slopes may be specified.

SLOPED END SECTION—TYPE A

AASHTO-AGC-ARTBA
TF-13 DRAWING

CME-4-96



SPECIFICATIONS

1. The material used in the fabrication of Sloped End Sections shall conform to the applicable requirements of:
 - AASHTO M 218 (Galvanized Iron or Steel Sheets)
 - AASHTO M 274 (Aluminum Coated—Type 2)
 - AASHTO M 289 (Aluminum—Zinc Alloy Coated)
 - AASHTO M 197M (Aluminum Alloy Sheets)
 - AASHTO M 256 (Polymer Coated Steel)
 - ASTM A 885 (Fiber Bonded)
2. Sloped End Sections shall be formed from full circle pipe, may be formed into pipe arches when specified, and shall meet all requirements for corrugations, thickness and other fabrication requirements.
3. The exposed edge cut on the top (0-102 mm) shall be covered with a protective cap overlapping the top of the arch by not less than 16 mm. The 1 to 6 bevel shall be encased with a protective cap overlapping each side of the cut edge by not less than 16 mm. The protective cap is to the same material as the pipe and the same or larger thickness. Protective caps shall be welded with 13 mm welds alternating from side to side of the cap at 305 mm intervals. Welds shall be at the ends of all caps, regardless of spacing. Weld spatter and flux shall be removed prior to repair with compounds recommended by the sheet manufacturer.
4. Sloped ends are typically used to reduce hazard of culvert end to errant vehicles. Grates or other devices may also be required to effect this end.

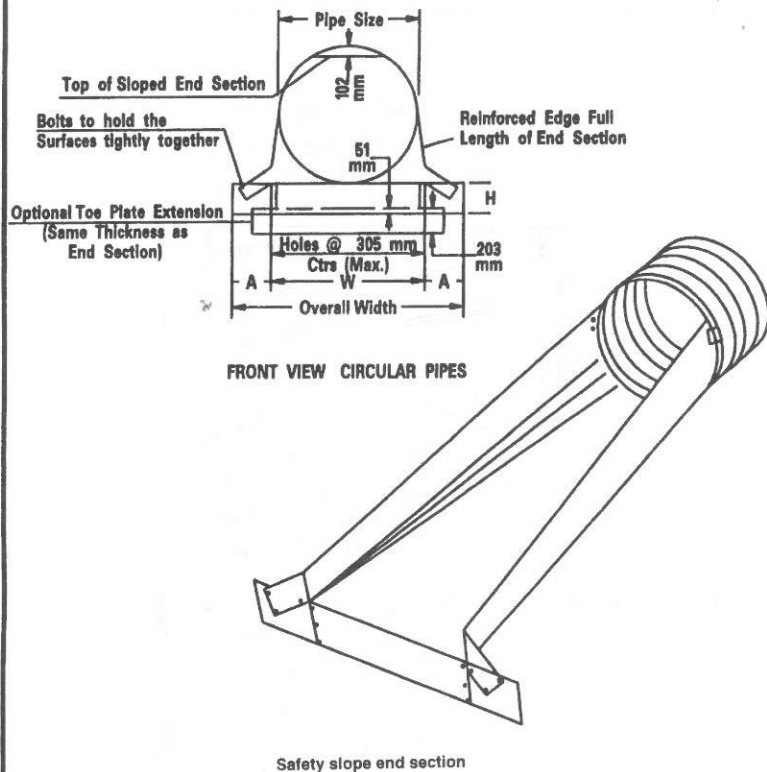
INTENDED USES

To provide end finish to a line of pipe conforming to embankment contour. Various slopes may be specified.

SLOPED END SECTION—TYPE B

AASHTO-AGC-ARTBA
TF-13 DRAWING

CME-5-96



Pipe Dia. (mm)							Slope	Length (mm)	Slope	Length (mm)
	mm	Gage	A	H	W	Overall Width				
375	1.83	406	203	152	533	940	1 to 4	508	1 to 6	762
450	1.83	406	203	152	610	1016	1 to 4	813	1 to 6	1219
525	1.63	406	203	152	686	1092	1 to 4	1118	1 to 6	1676
600	1.83	406	203	152	762	1168	1 to 4	1422	1 to 6	2134
750	2.77	305	305	229	914	1524	1 to 4	2032	1 to 6	3048
900	2.77	305	305	229	1067	1676	1 to 4	2642	1 to 6	3962
1050	2.77	305	406	305	1219	2032	1 to 4	3251	1 to 6	4877
1200	2.77	305	406	305	1372	2184	1 to 4	3861	1 to 6	5791
1350	2.77	305	406	305	1524	2337	1 to 4	4470	1 to 6	6706
1500	2.77	305	406	305	1676	2489	1 to 4	5080	1 to 6	7620

SPECIFICATIONS

- The material used in the fabrication of Sloped End Sections shall conform to the applicable requirements of:
 - AASHTO M 218 (Galvanized Iron or Steel Sheets)
 - AASHTO M 274 (Aluminum Coated-Type 2)
 - AASHTO M 289 (Aluminum-Zinc Alloy Coated)
 - AASHTO M 197M (Aluminum Alloy Sheets)
 - AASHTO M 256 (Polymer Coated Steel)
 - ASTM A 885 (Fiber Bonded)

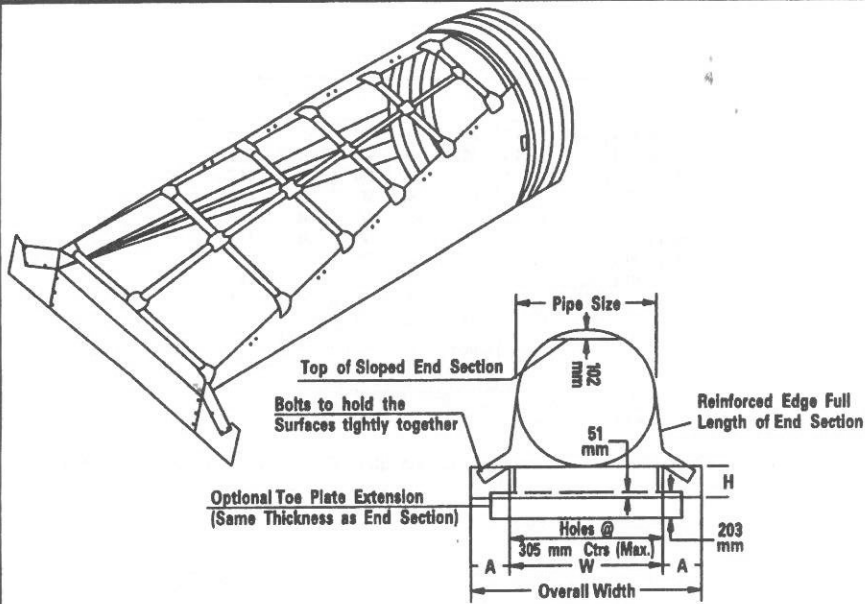
INTENDED USES

To provide end finish to a line of pipe conforming to embankment contour.

**SLOPED END SECTION—TYPE B
WITHOUT SAFETY BARS**

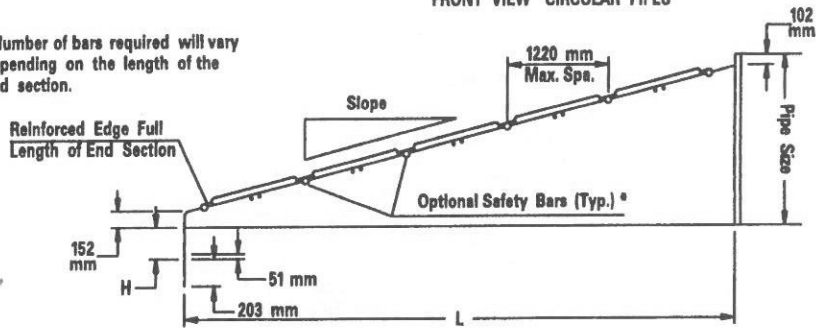
AASHTO-AGC-ARTBA
TF-13 DRAWING

CME-6-96



FRONT VIEW CIRCULAR PIPES

*Number of bars required will vary depending on the length of the end section.



SIDE ELEVATION FOR CROSS DRAINAGE STRUCTURE

Dimensions of Galvanized Safety Slope End Sections for Round Pipe

Pipe Dia. (mm)	Dimensions (mm)						Slope		Length (mm)	
	mm	Gage	A	H	W	Overall Width	Slope	Length (mm)	Slope	Length (mm)
375	1.63	16	203	152	533	940	1 to 4	508	1 to 6	762
450	1.63	16	203	152	610	1016	1 to 4	813	1 to 6	1219
525	1.63	16	203	152	686	1092	1 to 4	1118	1 to 6	1676
600	1.63	16	203	152	762	1168	1 to 4	1422	1 to 6	2134
750	2.77	12	305	229	914	1524	1 to 4	2032	1 to 6	3048
900	2.77	12	305	229	1067	1676	1 to 4	2642	1 to 6	3962
1050	2.77	12	406	305	1219	2032	1 to 4	3251	1 to 6	4877
1200	2.77	12	406	305	1372	2184	1 to 4	3861	1 to 6	5791
1350	2.77	12	406	305	1524	2337	1 to 4	4470	1 to 6	6706
1500	2.77	12	406	305	1676	2489	1 to 4	5080	1 to 6	7620

SPECIFICATIONS

- The material used in the fabrication of Sloped End Sections shall conform to the applicable requirements of:
 - AASHTO M 218 (Galvanized Steel)
 - AASHTO M 274 (Aluminum Coated-Type 2)
 - AASHTO M 289 (Aluminum-Zinc Alloy Coated)
 - AASHTO M 197M (Aluminum)
 - AASHTO M 256 (Polymer Coated Steel)
 - ASTM A 885 (Fiber Bonded)

INTENDED USES

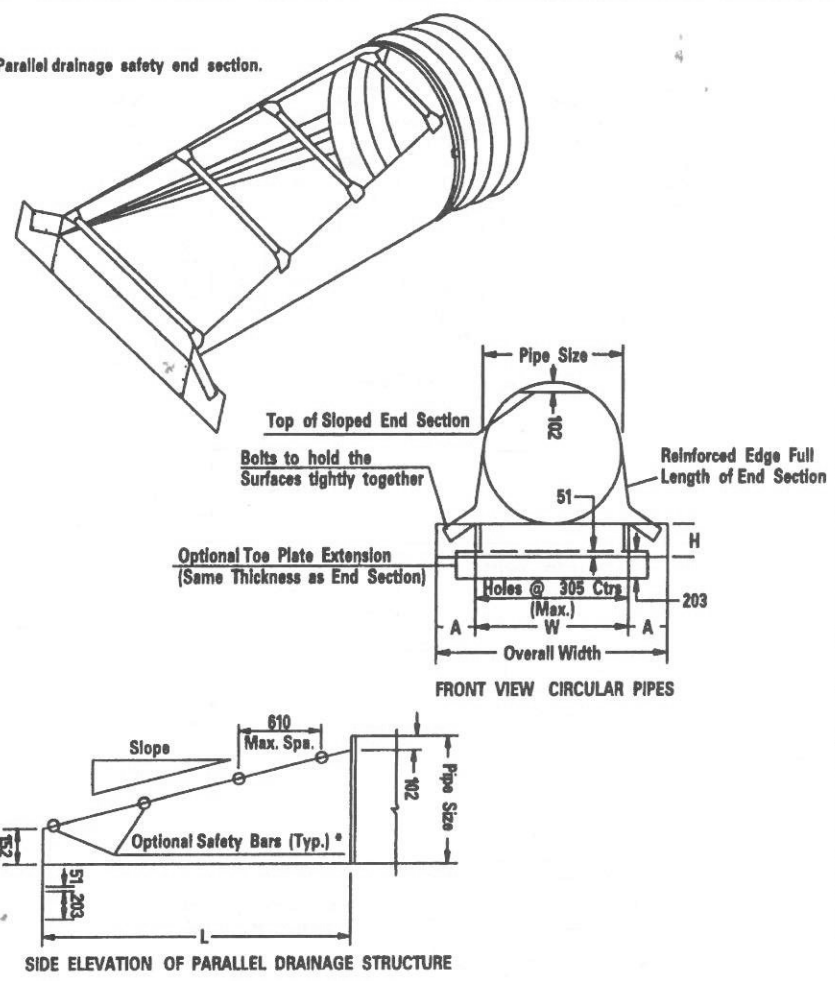
To provide end finish to a line of pipe conforming to embankment contour.

**SLOPED END SECTION—TYPE C
CROSS DRAINAGE STRUCTURE WITH SAFETY BARS**

AASHTO-AGC-ARTBA
TF-13 DRAWING

CME-7-96

Parallel drainage safety end section.



Dimensions of Galvanized Safety Slope End Sections for Round

Pipe Dia. (mm)	Min. Thick (mm)	Dimensions (mm)				L Dimensions			
		A	H	W	Overall Width	Slope	Length (mm)	Slope	Length (mm)
375	1.63	203	152	533	940	1 to 4	508	1 to 6	762
450	1.63	203	152	610	1016	1 to 4	813	1 to 6	1219
525	1.63	203	152	686	1092	1 to 4	1118	1 to 6	1676
600	1.63	203	152	762	1168	1 to 4	1422	1 to 6	2134
750	2.77	305	229	914	1524	1 to 4	2032	1 to 6	3048
900	2.77	305	229	1067	1676	1 to 4	2642	1 to 6	3962
1050	2.77	406	305	1219	2032	1 to 4	3251	1 to 6	4877
1200	2.77	406	305	1372	2184	1 to 4	3861	1 to 6	5791
1350	2.77	406	305	1524	2337	1 to 4	4470	1 to 6	6706
1500	2.77	406	305	1676	2489	1 to 4	5080	1 to 6	7620

NOTE: All dimensions shown are in millimeters.

SPECIFICATIONS

- The material used in the fabrication of Sloped End Sections shall conform to the applicable requirements of:
 - AASHTO M 218 (Galvanized Steel)
 - AASHTO M 274 (Aluminum Coated-Type 2)
 - AASHTO M 289 (Aluminum-Zinc Alloy Coated)
 - AASHTO M 256 (Polymer Coated Steel)
 - AASHTO M 197M (Aluminum)
 - ASTM A 885 (Fiber Bonded)

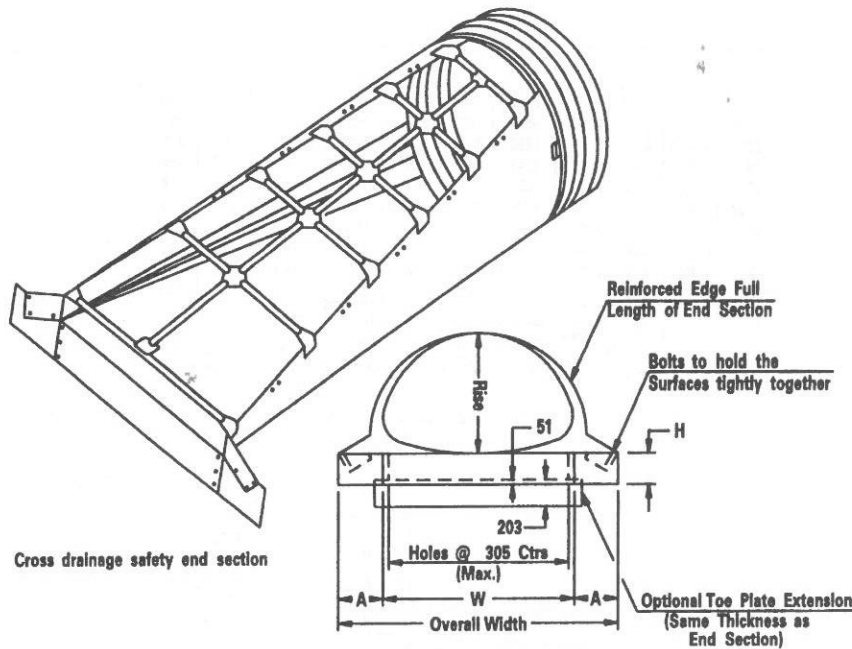
INTENDED USES

To provide end finish to a line of pipe conforming to embankment contour.

**SLOPED END SECTION—TYPE C
PARALLEL DRAINAGE STRUCTURE WITH SAFETY BARS**

AASHTO-AGC-ARTBA
TF-13 DRAWING

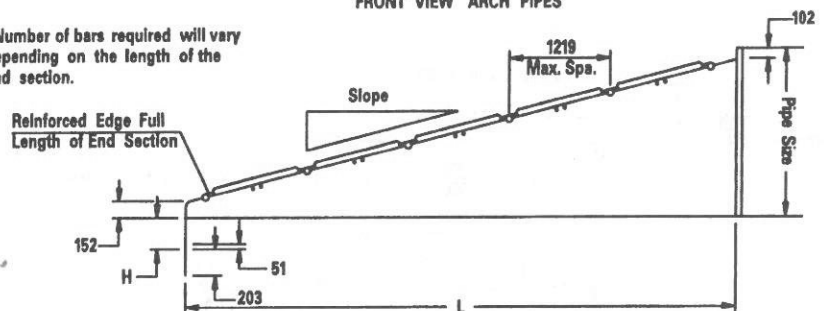
CME-8-96



Cross drainage safety end section

FRONT VIEW ARCH PIPES

*Number of bars required will vary depending on the length of the end section.



SIDE ELEVATION FOR CROSS DRAINAGE STRUCTURE

Dimensions of Galvanized Safety Slope End Sections for Arch-Pipe

Dia. (mm)	Span (mm)	Rise (mm)	Thickness (mm)	A min. (mm)	H min. (mm)	W (mm)	Overall Width	Slope	Length (mm)	Slope	Length (mm)
450	530	380	1.63	203	152	686	1092	1 to 4	508	1 to 6	763
525	610	460	1.63	203	152	762	1168	1 to 4	613	1 to 6	1219
600	710	510	1.63	203	152	864	1270	1 to 4	1016	1 to 6	1524
750	885	610	2.01	305	229	1041	1651	1 to 4	1422	1 to 6	2134
900	1060	740	2.77	305	229	1219	1829	1 to 4	1930	1 to 6	2696
1050	1240	840	2.77	406	305	1397	2210	1 to 4	2337	1 to 6	3505
1200	1440	970	2.77	406	305	1600	2413	1 to 4	2845	1 to 6	4267
1350	1620	1100	2.77	406	305	1778	2591	1 to 4	3353	1 to 6	5029
1500	1800	1200	2.77	406	305	1956	2769	1 to 4	3759	1 to 6	5639
1800	2100	1450	2.77	406	305	2261	3073	1 to 4	4775	1 to 6	7163

NOTE: All dimensions shown are in millimeters.

SPECIFICATIONS

- The material used in the fabrication of Sloped End Sections shall conform to the applicable requirements of:
 - AASHTO M 218 (Galvanized Iron or Steel Sheets)
 - AASHTO M 274 (Aluminum Coated-Type 2)
 - AASHTO M 289 (Aluminum-Zinc Alloy Coated)
 - AASHTO M 197M (Aluminum Alloy Sheets)
 - AASHTO M 256 (Polymer Coated Steel)
 - ASTM A 885 (Fiber Bonded)

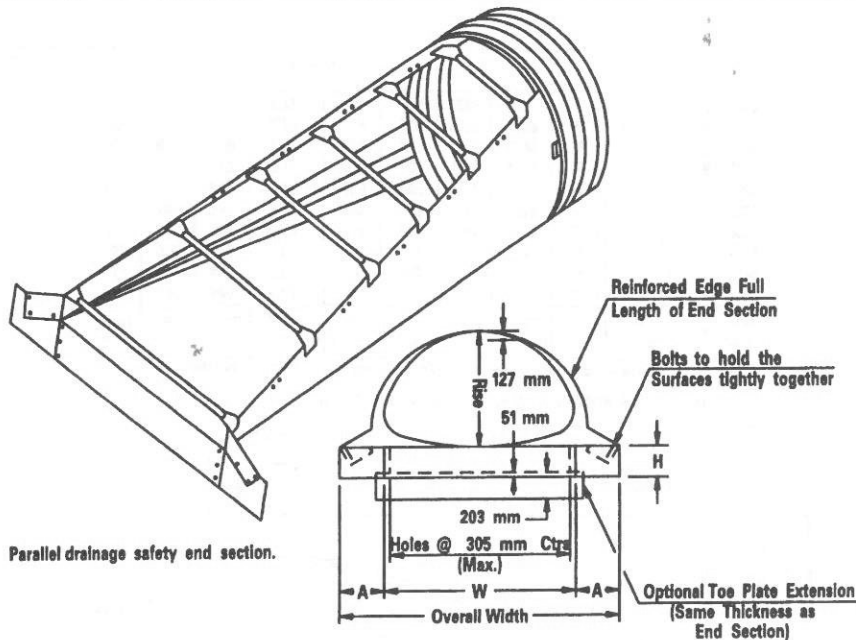
INTENDED USES

To provide end finish to a line of pipe conforming to embankment contour.

**SLOPED END SECTION—TYPE C
PIPE ARCH CROSS DRAINAGE STRUCTURE WITH SAFETY BARS**

AASHTO-AGC-ARTBA
TF-13 DRAWING

CME-9-96



Parallel drainage safety end section.

FRONT VIEW ARCH PIPES

SIDE ELEVATION OF PARALLEL DRAINAGE STRUCTURE

Dimensions of Galvanized Safety Slope End Sections for Arch-Pipe

Dia. (mm)	Span (mm)	Rise (mm)	Thickness (mm)	A (mm)	H min. (mm)	W (mm)	Overall Width (mm)	Slope	Length (mm)	Slope	Length (mm)
450	530	380	1.63	203	152	688	1092	1 to 4	508	1 to 6	763
525	610	460	1.63	203	152	762	1168	1 to 4	613	1 to 6	1219
600	710	510	1.63	203	152	864	1270	1 to 4	1016	1 to 6	1524
750	885	610	2.01	305	229	1041	1651	1 to 4	1422	1 to 6	2134
900	1060	740	2.77	305	229	1219	1829	1 to 4	1930	1 to 6	2896
1050	1240	840	2.77	406	305	1397	2210	1 to 4	2337	1 to 6	3505
1200	1440	870	2.77	406	305	1600	2413	1 to 4	2845	1 to 6	4267
1350	1620	1100	2.77	406	305	1778	2591	1 to 4	3353	1 to 6	5029
1500	1800	1200	2.77	406	305	1956	2769	1 to 4	3759	1 to 6	5639
1800	2100	1450	2.77	406	305	2261	3073	1 to 4	4775	1 to 6	7183

NOTE: All dimensions shown are in millimeters.

SPECIFICATIONS

- The material used in the fabrication of Sloped End Section shall conform to the applicable requirements of:
 - AASHTO M 218 (Galvanized Steel)
 - AASHTO M 274 (Aluminum Coated-Type 2)
 - AASHTO M 289 (Aluminum-Zinc Alloy Coated)
 - AASHTO M 256 (Polymer Coated Steel)
 - AASHTO M 197M (Aluminum)
 - ASTM A 885 (Fiber Bonded)

INTENDED USES

To provide end finish to a line of pipe conforming to embankment contour.

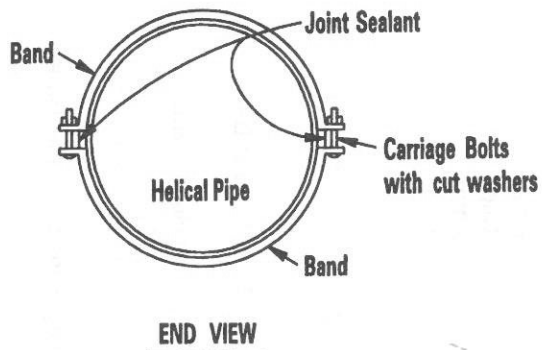
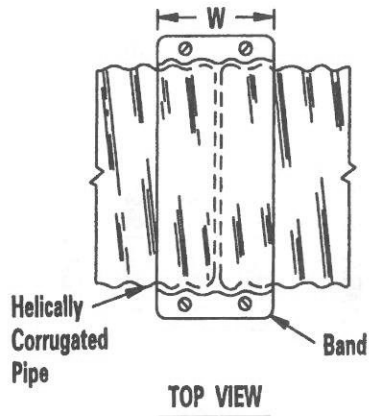
SLOPED END SECTION—TYPE C
PIPE ARCH PARALLEL DRAINAGE STRUCTURE WITH SAFETY BARS

AASHTO-AGC-ARTBA
TF-13 DRAWING

CME-10-96

SECTION CMB-COUPLING BANDS

Corrugated Steel Coupling Band 2-Piece Integral Band	CMBS-1-96	72
Corrugated Steel Coupling Band Annular Band	CMBS-2-96	73
Corrugated Steel Coupling Band Helical Band	CMBS-3-96	74
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Corrugated Steel Coupling Band Coupling Details	CMBS-11-96	82
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51 x 54 x 2.77 mm "SCAFCO" Angle Clip		
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Coupling Band Hardware	CMB-15-96	86
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SPECIFICATIONS

1. Coupling bands shown meet the performance requirements of the AASHTO *Standard Specifications for Highway Bridges*, Division 2 Section 23.
2. All Coupling bands shall be galvanized in conformance with AASHTO M 218, M 289 and M 274 and, if specified, coated in accordance with AASHTO M 190, M 245M or M 243.
3. For pipe arches use the same width band as for circular pipe of equal periphery.
4. Band thickness shall not be less than 1.32 mm and shall not be less than 3 standard thicknesses lighter than the thickness of the pipe.

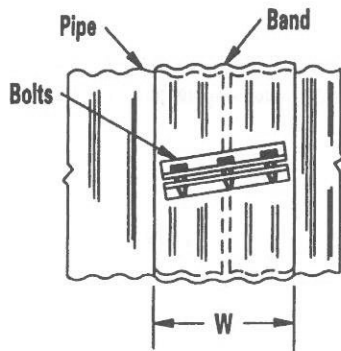
INTENDED USES

Coupling of corrugated steel pipe sections or appurtenances

**CORRUGATED STEEL COUPLING BAND
2-PIECE INTEGRAL BAND**

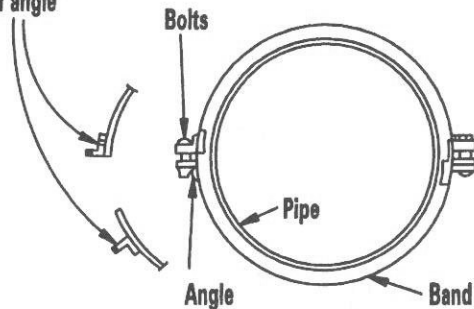
AASHTO-AGC-ARTBA
TF-13 DRAWING

CMBS-1-96



SIDE VIEW

Rivet, Spotweld, or Fillet
weld at crest of corrugation
at heel and toe of angle



END VIEW

NOTE: second angle connection optional to
1050 mm diam., required above 1050 mm diam.

SPECIFICATIONS

1. Coupling bands shown meet the performance requirements of the AASHTO *Standard Specifications for Highway Bridges*, Division 2 Section 23.
2. All Coupling bands shall be galvanized in conformance with AASHTO M 218, M 289 and M 274 and, if specified, coated in accordance with AASHTO M 190, M 245M or M 243 or ASTM A 885.
3. For pipe arches use the same width band as for circular pipe of equal periphery.
4. Band thickness shall not be less than 1.32 mm and shall not be less than 3 standard thicknesses lighter than the thickness of the pipe.
5. Use 32 mm thick line dimensions on attached angle leg for rivets and spot welds.
6. In lieu of spot welds or rivets, as shown, fillet welds of equivalent strength may be used at the heel and toe of connection angles, with prior approval of the Engineer.
7. Dimensions shown are minimums.
8. Spot welds to develop minimum required strength of strap.

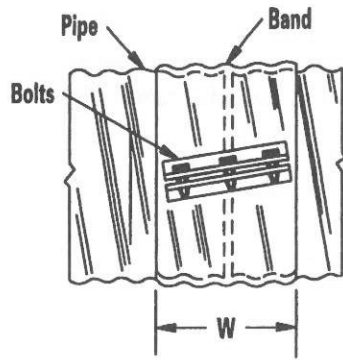
INTENDED USES

Coupling of corrugated steel pipe sections or appurtenances.

**CORRUGATED STEEL COUPLING BAND
ANNULAR BAND**

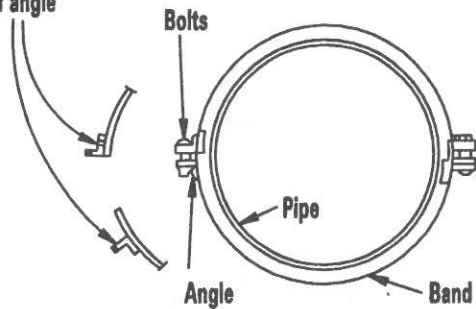
AASHTO-AGC-ARTBA
TF-13 DRAWING

CMBS-2-96



SIDE VIEW

Rivet, Spotweld, or Fillet weld at crest of corrugation at heel and toe of angle



END VIEW

NOTE: second angle connection optional to 1050 mm diam., required above 1050 mm diam.

SPECIFICATIONS

1. Coupling bands shown meet the performance requirements of the AASHTO *Standard Specifications for Highway Bridges*, Division 2 Section 23.
2. All Coupling bands shall be galvanized in conformance with AASHTO M 218, M 289 and M 274 and, if specified, coated in accordance with AASHTO M 190, M 245M or M 243.
3. For pipe arches use the same width band as for circular pipe of equal periphery.
4. Band thickness shall not be less than 1.32 mm and shall not be less than 3 standard thicknesses lighter than the thickness of the pipe.
5. Use 32 mm thick line dimensions on attached angle leg for rivets and spot welds.
6. In lieu of spot welds or rivets, as shown, fillet welds of equivalent strength may be used at the heel and toe of connection angles, with prior approval of the Engineer.
7. Dimensions shown are minimums.
8. For helically corrugated coupling bands, the connection angles may be oriented parallel to the pipe axis, providing connecting holes are slotted lengthwise sufficiently to allow adjustment for the helix angle.

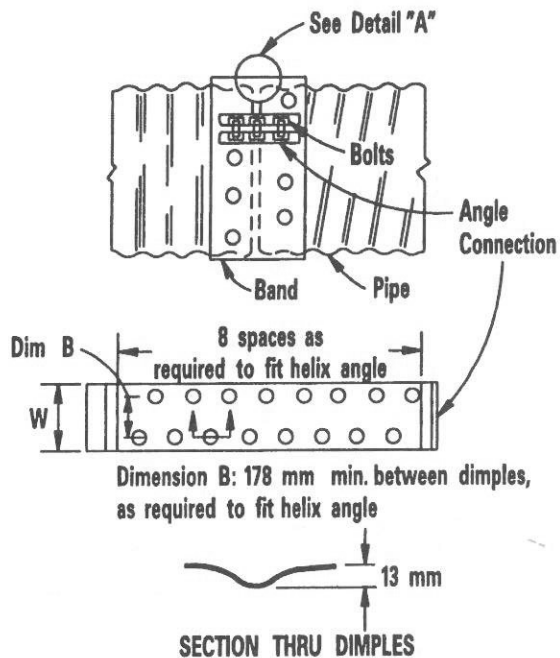
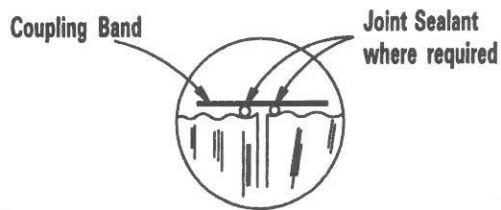
INTENDED USE

Coupling of corrugated steel pipe sections or appurtenances

**CORRUGATED STEEL COUPLING BAND
HELICAL BAND**

AASHTO-AGC-ARTBA
TF-13 DRAWING

CMBS-3-96



SPECIFICATIONS

1. Coupling bands shown meet the performance requirements of the AASHTO *Standard Specifications for Highway Bridges*, Division 2 Section 23.
2. All Coupling bands shall be galvanized in conformance with AASHTO M 218, M 289 and M 274 and, if specified, coated in accordance with AASHTO M 190, M 245M or M 243.
3. For pipe arches use the same width band as for circular pipe of equal periphery.
4. Band thickness shall not be less than 1.32 mm and shall not be less than 3 standard thicknesses lighter than the thickness of the pipe.
5. Use 32 mm thick line dimensions on attached angle leg for rivets and spot welds.
6. In lieu of spot welds or rivets, as shown, fillet welds of equivalent strength may be used at the heel and toe of connection angles, with prior approval of the Engineer.
7. Dimensions shown are minimums.
8. May be used with annular rolled ends.

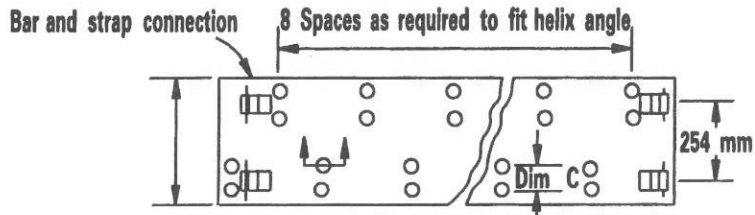
INTENDED USES

Coupling field cut pipe end(s) on helically corrugated pipe-wrap with geotextile as necessary to ensure soil tightness.

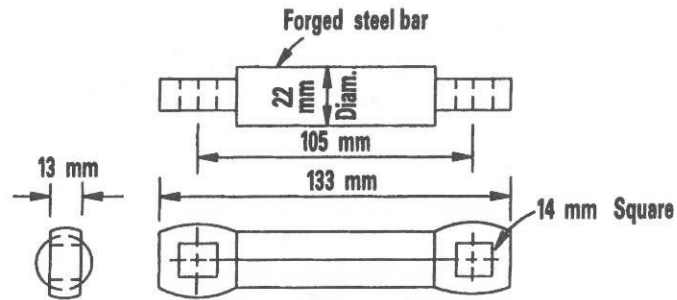
**CORRUGATED STEEL COUPLING BAND
UNIVERSAL BAND—ANGLE CONNECTION**

AASHTO-AGC-ARTBA
TF-13 DRAWING

CMBS-4-96



* Dimension C: as required to fit helix angle, 68 mm min.
One place band optional on 1050 mm diameter, two piece band required above 1050 mm diameter.

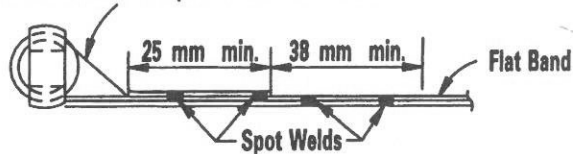


Left Side View

Front View

BAR DETAIL

Bolt Bar Tension Strap, 57 x 203 mm Galv.



NOTE: minimum of two spot welds per connection

STRAP DETAIL

SPECIFICATIONS

1. Coupling bands shown meet the performance requirements of the AASHTO *Standard Specifications for Highway Bridges*, Division 2 Section 23.
2. All Coupling bands shall be galvanized in conformance with AASHTO M 218, M 289 and M 274 and, if specified, coated in accordance with AASHTO M 190, M 245M or M 243.
3. For pipe arches use the same width band as for circular pipe of equal periphery.
4. Band thickness shall not be less than 1.32 mm and shall not be less than 3 standard thicknesses lighter than the thickness of the pipe.
5. Dimensions shown are minimums.
6. Spot welds to develop minimum required strength of strap. In lieu of spot welds or rivets, as shown, fillet welds of equivalent strength may be used with prior approval of the Engineer.
7. May be used with annular rolled ends.

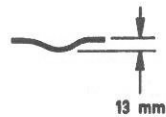
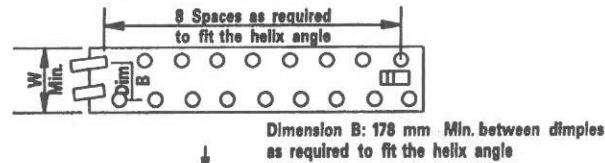
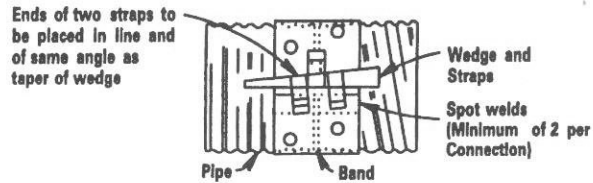
INTENDED USES

Coupling of corrugated steel pipe sections or appurtenances.

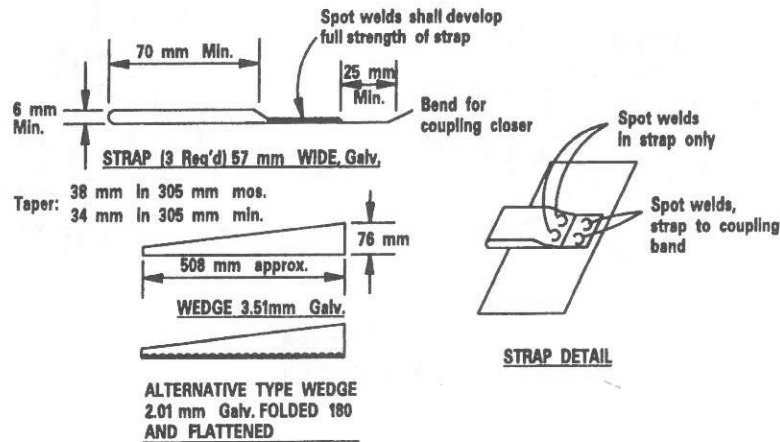
CORRUGATED STEEL COUPLING BAND
UNIVERSAL BAND—BAR AND STRAP CONNECTION

AASHTO-AGC-ARTBA
TF-13 DRAWING

CMBS-5-96



SECTION THRU DIMPLES



SPECIFICATIONS

1. Coupling bands shown meet the performance requirements of the AASHTO *Standard Specifications for Highway Bridges*, Division 2 Section 23.
2. All Coupling bands shall be galvanized in conformance with AASHTO M 218, M 289 and M 274 and, if specified, coated in accordance with AASHTO M 190, M 245M or M 243.
3. For pipe arches use the same width band as for circular pipe of equal periphery.
4. Band thickness shall not be less than 1.32 mm and shall not be less than 3 standard thicknesses lighter than the thickness of the pipe.
5. In lieu of spot welds or rivets, as shown, fillet welds of equivalent strength may be used with prior approval of the Engineer.
6. Dimensions shown are minimums.
7. Spot welds to develop minimum required strength of strap.
8. May be used with annular rolled ends.

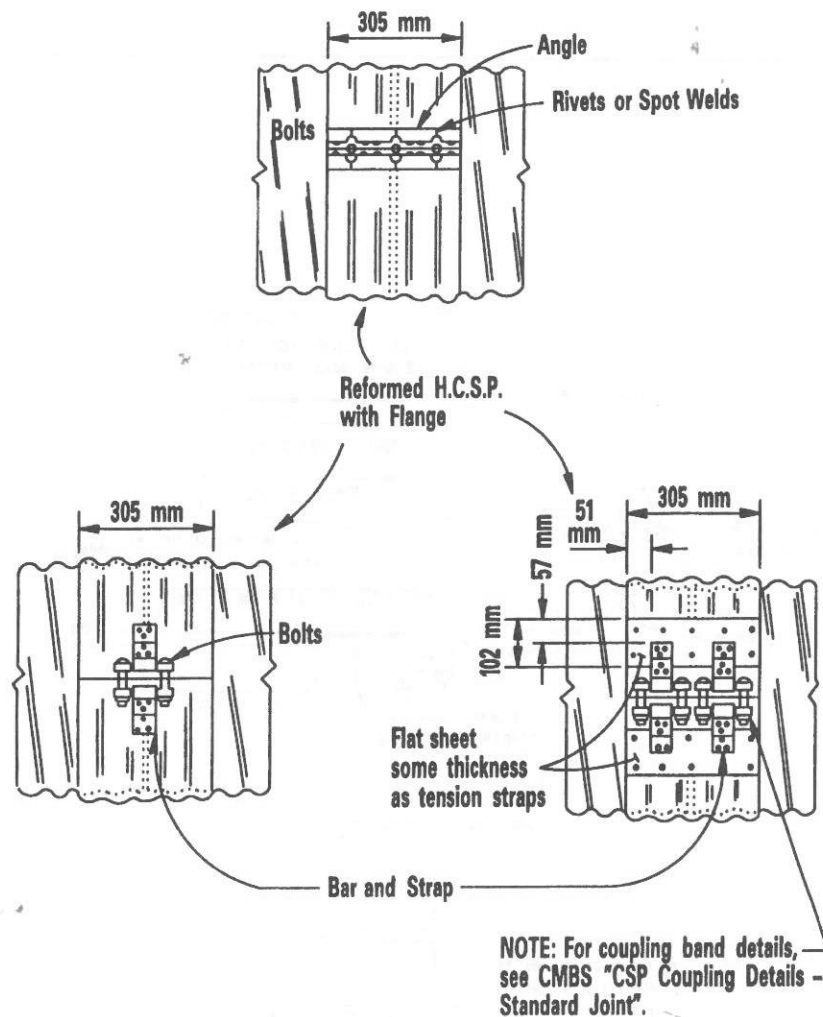
INTENDED USES

Coupling field cut Pipe end(s) on helically corrugated Pipe-wrap with geotextile as necessary to ensure soil tightness.

CORRUGATED STEEL COUPLING BAND UNIVERSAL BAND—WEDGE AND STRAP CONNECTION

AASHTO-AGC-ARTBA
TF-13 DRAWING

CMBS-6-96



SPECIFICATIONS

1. Coupling bands shown meet the performance requirements of the AASHTO *Standard Specifications for Highway Bridges*, Division 2 Section 23.
2. All Coupling bands shall be galvanized in conformance with AASHTO M 218, M 289 and M 274 and, if specified, coated in accordance with AASHTO M 190, M 245M or M 243.
3. For pipe arches use the same width band as for circular pipe of equal periphery.
4. Band thickness shall not be less than 1.32 mm and shall not be less than 3 standard thicknesses lighter than the thickness of the pipe.
5. In lieu of spot welds or rivets, as shown, fillet welds of equivalent strength may be used at the heel and toe of the connection angles, with prior approval of the Engineer.
6. Dimensions shown are minimums.
7. Spot welds to develop minimum required strength of strap.

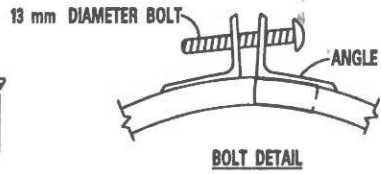
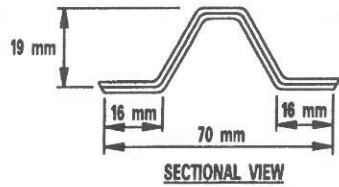
INTENDED USE

Coupling of corrugated steel pipe sections or appurtenances.

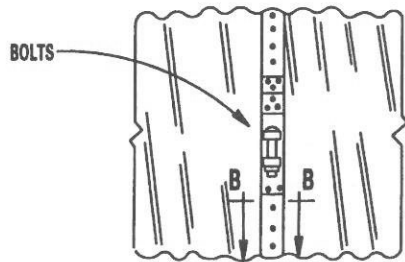
CORRUGATED STEEL COUPLING BAND
FOR REFORMED HELICAL PIPE

AASHTO-AGC-ARTBA
TF-13 DRAWING

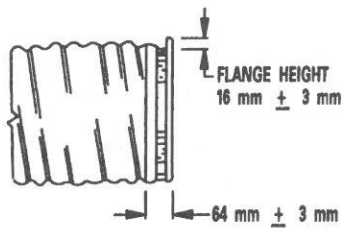
CMBS-7-96



HAT BAND COUPLER
ANGLE CONNECTOR SHOWN



SECTION B-B



SIDE VIEW
FLANGE DETAILS

SPECIFICATIONS

1. Coupling bands shown meet the performance requirements of the AASHTO *Standard Specifications for Highway Bridges*, Division 2 Section 23.
2. Hat material shall meet the requirements of AASHTO M 218, M 289 and M 274.
3. Hat band thickness shall be a minimum of 1.6 mm.
4. Hat bands shall be 70 mm wide.

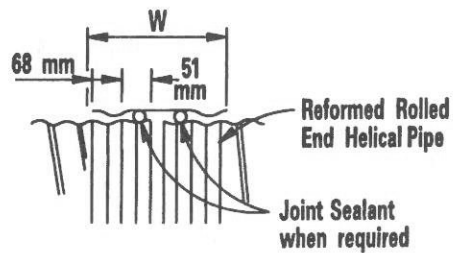
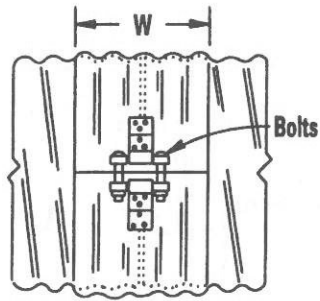
INTENDED USE

Coupling of corrugated steel pipe sections or appurtenances.

CORRUGATED STEEL COUPLING BAND
HAT BAND FOR FLANGED END PIPE

AASHTO-AGC-ARTBA
TF-13 DRAWING

CMBS-8-96



JOINT CROSS SECTION

SPECIFICATIONS

1. Coupling bands shown meet the performance requirements of the AASHTO *Standard Specifications for Highway Bridges*, Division 2 Section 23.
2. All Coupling bands shall be galvanized in conformance with AASHTO M 218, M 289 and M 274 and, if specified, coated in accordance with AASHTO M 190, M 245M or M 243.
3. For pipe arches use the same width band as for circular pipe of equal periphery.
4. Band thickness shall not be less than 1.32 mm and shall not be less than 3 standard thicknesses lighter than the thickness of the pipe.
5. Dimensions shown are minimums.
6. For hugger coupling band, a 2 piece band is required for pipe greater than 1050 mm diameter.
7. Spot welds to develop minimum required strength of strap.

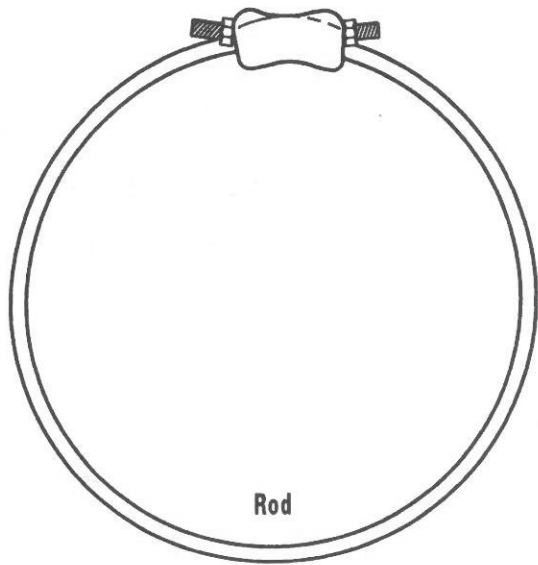
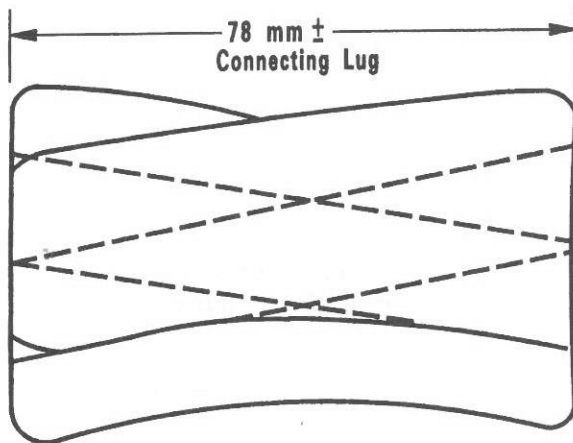
INTENDED USE

Coupling of corrugated steel pipe sections or appurtenances.

**CORRUGATED STEEL COUPLING BAND
HUGGER BAND FOR ANNULAR OR REFORMED END HELICAL PIPE**

AASHTO-AGC-ARTBA
TF-13 DRAWING

CMBS-9-96



Rod & Lug Details

SPECIFICATIONS

1. Rods shall be of hot rolled carbon steel curved and threaded on the ends to receive a standard 13 mm hex nut. Rods and cast steel lugs shall be galvanized in accordance with AASHTO M 232.

INTENDED USES

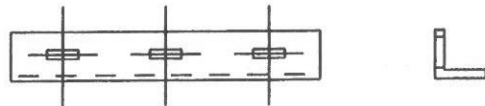
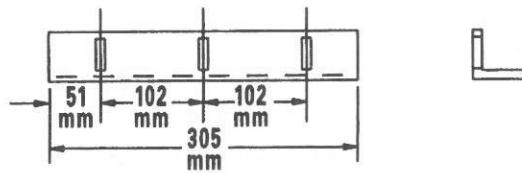
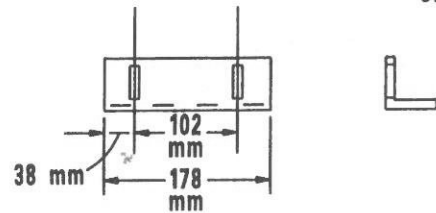
Rods and lugs are curved to conform to the pipe diameter specified. They supplement the standard connectors when positive circumferential clamping is desired.

CORRUGATED STEEL COUPLING BAND
ROD AND LUG DETAILS

AASHTO-AGC-ARTBA
TF-13 DRAWING

CMBS-10-96

SLOT DIMENSION 14 X 29



HORIZONTAL SLOTS USED FOR
HELICAL BANDS ONLY

Note: All dimensions are in millimeters

SPECIFICATIONS

1. Angle clips for coupling bands shall be galvanized in accordance with AASHTO M 232.

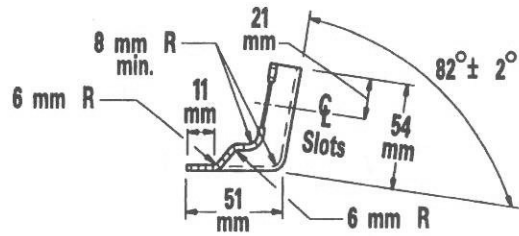
INTENDED USES

Connectors for coupling bands.

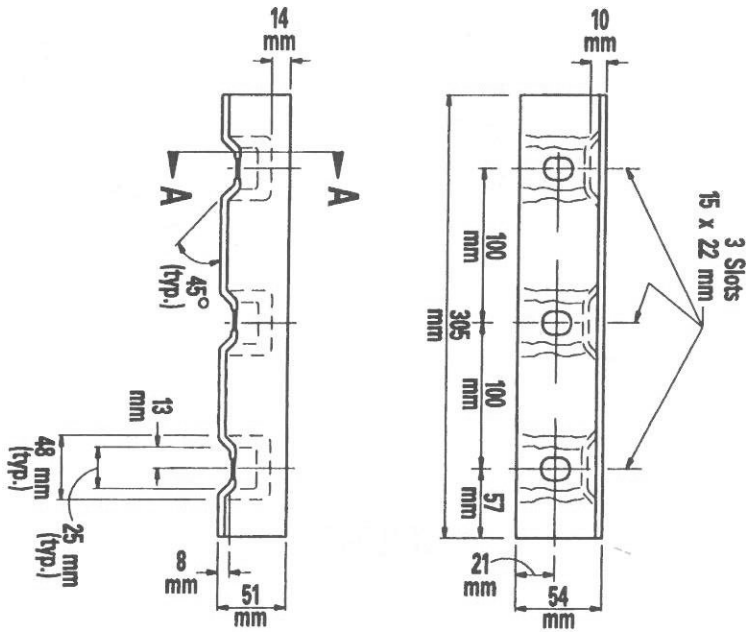
CORRUGATED STEEL COUPLING BAND
COUPLING DETAILS—51 x 51 x 5 mm ANGLE CLIPS

AASHTO-AGC-ARTBA
TF-13 DRAWING

CMBS-11-96



SECTION A-A



305 mm BAND ANGLE

SPECIFICATIONS

1. Angle clips for coupling bands shall be galvanized in accordance with AASHTO M 232.

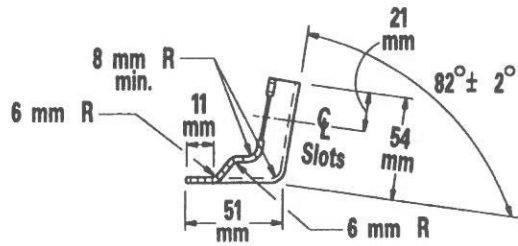
INTENDED USES

Connectors for coupling bands.

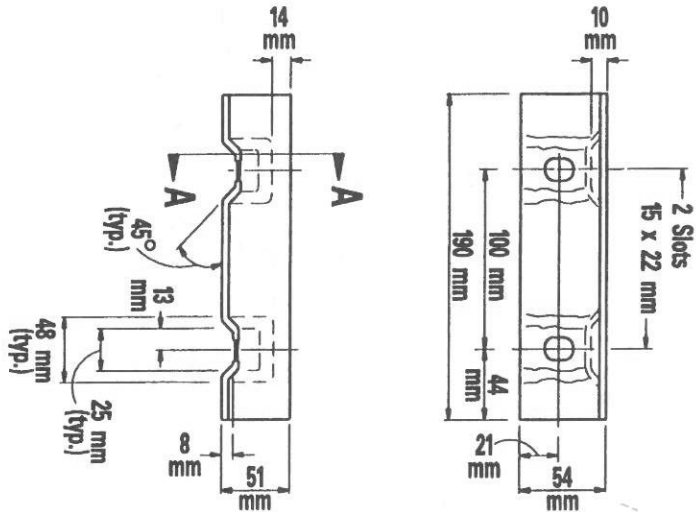
**CORRUGATED STEEL COUPLING BAND—305 mm
51 x 54 x 2.77 mm "SCAFCO" ANGLE CLIP**

**AASHTO-AGC-ARTBA
TF-13 DRAWING**

CMBS-12-96



SECTION A-A



178-mm BAND ANGLE

SPECIFICATIONS

1. Angle clips for coupling bands shall be galvanized in accordance with AASHTO M 232.

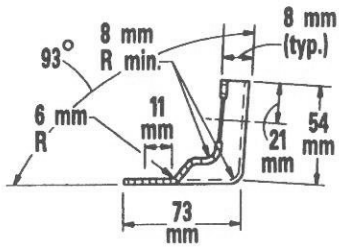
INTENDED USES

Connectors for coupling bands.

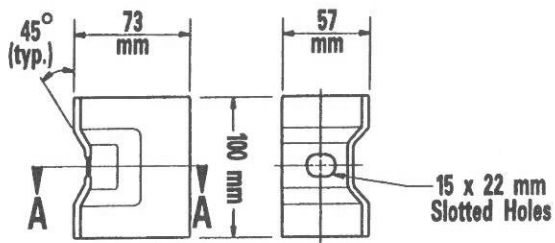
**CORRUGATED STEEL COUPLING BAND—178 mm
51 x 54 x 2.77 mm "SCAFCO" ANGLE CLIP**

**AASHTO-AGC-ARTBA
TF-13 DRAWING**

CMBS-13-96



SECTION A-A



100 mm BAND ANGLE

SPECIFICATIONS

1. Angle clips for coupling bands shall be galvanized in accordance with AASHTO M 232.

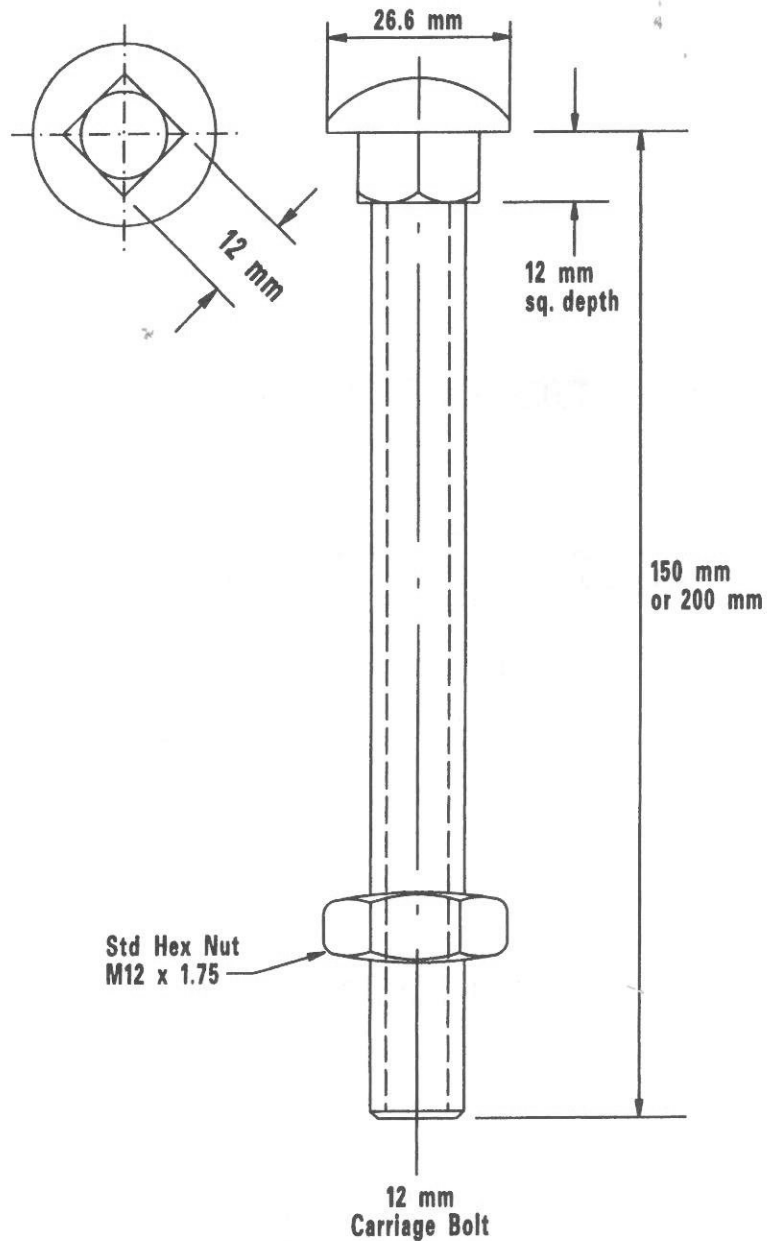
INTENDED USES

Connectors for coupling bands.

**CORRUGATED STEEL COUPLING BAND—100 mm
51 x 73 x 2.77 mm "SCAFCO" ANGLE CLIP**

**AASHTO-AGC-ARTBA
TF-13 DRAWING**

CMBS-14-96



APPLICABLE SPECIFICATIONS

1. Bolt—ANSI B 18.5.2.2M
Metric Round Head, ASTM F 568M
Square Neck Bolts, Property Class 4.6
M 12 x 1.75 x 150
M 12 x 1.75 x 200
2. Nut—ANSI B 18.2.4.1M
Metric Hex Nuts, Style 1
ASTM A 563M, Class 5.
3. Galvanized—AASHTO M 232
4. Aluminum—ASTM B 211M Alloy 6061-T6
Bolts and nuts used with aluminum coupling bands may be aluminum coated steel in lieu of galvanizing.

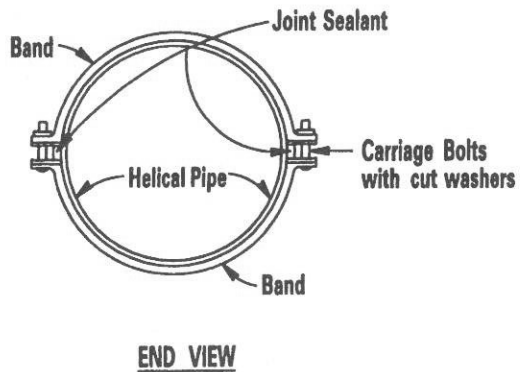
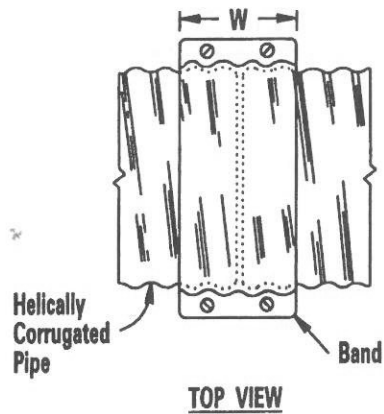
INTENDED USE

Connectors for coupling bands.

COUPLING BAND HARDWARE

AASHTO-AGC-ARTBA
TF-13 DRAWING

CMB-15-96



SPECIFICATIONS

1. Coupling bands shall conform to the requirements of AASHTO Specifications M 196M.
2. Band thickness shall not be less than 1.22 mm and shall not be less than 2 standard thicknesses lighter than the thickness of the pipe.
3. For pipe arches use the same width band as for circular pipe of equal periphery.
4. If W equals 300 mm use 3 bolts per flange in lieu of two shown as required for 180 mm width. The 180 mm width shall not be used when positive joint condition is specified.
5. Provide 50 mm x 300 mm x 3.81 mm strip on each flange under bolt heads or nuts when positive joint condition is specified.

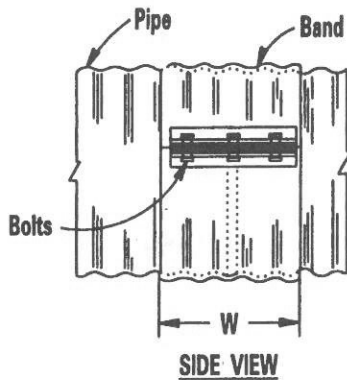
INTENDED USES

Coupling of corrugated aluminum pipe sections or appurtenances.

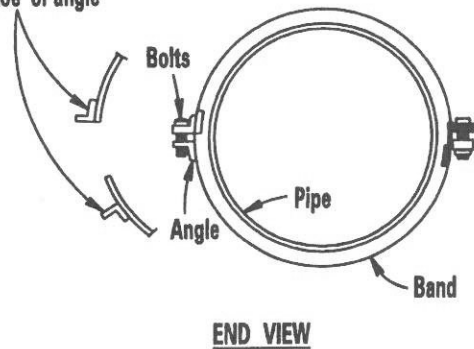
**CORRUGATED ALUMINUM COUPLING BAND
2-PIECE INTEGRAL FLANGE BAND**

AASHTO-AGC-ARTBA
TF-13 DRAWING

CMBA-16-96



Rivet, Spotweld, or Fillet
weld at crest of corrugation
at heel and toe of angle



NOTE: second angle connection optional to
1050 mm diam., required above 1050 mm diam.

SPECIFICATIONS

1. Coupling bands shall conform to the requirements of AASHTO Specifications M 196M.
2. Band thickness shall not be less than 1.22 mm and shall not be less than 2 standard thicknesses lighter than the thickness of the pipe.
3. For pipe arches use the same width band as for circular pipe of equal periphery.
4. Annular coupling band with angle connections may be supplied as one piece (one pair of angles) or two pieces (two pair of angles, as shown).

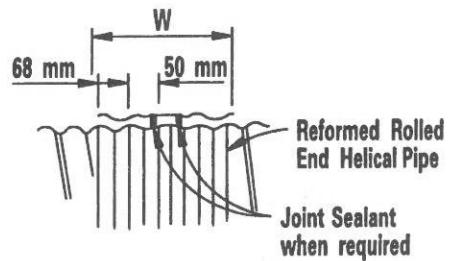
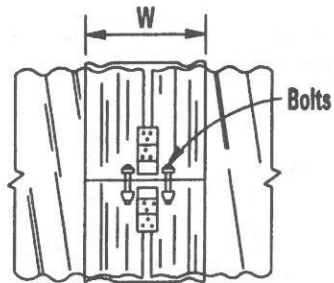
INTENDED USES

Coupling of corrugated aluminum pipe sections or appurtenances.

**CORRUGATED ALUMINUM COUPLING BAND
ANNULAR BAND**

AASHTO-AGC-ARTBA
TF-13 DRAWING

CMBA-17-96



SPECIFICATIONS

1. Coupling bands shall conform to the requirements of AASHTO Specifications M 196M.
2. Band thickness shall not be less than 1.22 mm and shall not be less than 2 standard thicknesses lighter than the thickness of the pipe.
3. For pipe arches use the same width band as for circular pipe of equal periphery.
4. Annular coupling band with angle connections may be supplied as one piece (one pair of angles) or two pieces (two pair of angles, as shown).

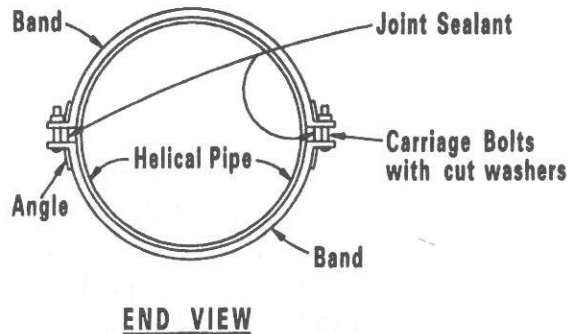
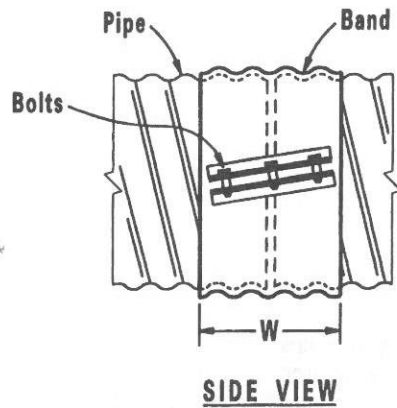
INTENDED USE

Coupling of corrugated aluminum pipe sections or appurtenances.

**CORRUGATED ALUMINUM COUPLING BAND
HUGGER BAND FOR ANNULAR OR REFORMED END HELICAL PIPE**

AASHTO-AGC-ARTBA
TF-13 DRAWING

CMBA-18-96



NOTE: second angle connection optional to 1050 mm diam., required above 1050 mm diam.

SPECIFICATIONS

1. Coupling bands shall conform to the requirements of AASHTO Specifications M 196M.
2. Band thickness shall not be less than 1.22 mm and shall not be less than 2 standard thicknesses lighter than the thickness of the pipe.
3. For pipe arches, use the same width band as for circular pipe of equal periphery
4. Helical coupling bands with angle connections may be supplied as one piece (one pair of angles) or two pieces (two pair of angles as shown).
5. Corrugated band sheet may be produced as a corrugated and curved strip or cut from helical pipe. If band is cut from helical pipe, it may be produced from oversize pipe or a flap of some pipe configuration may be used if "lapping joint" is required.

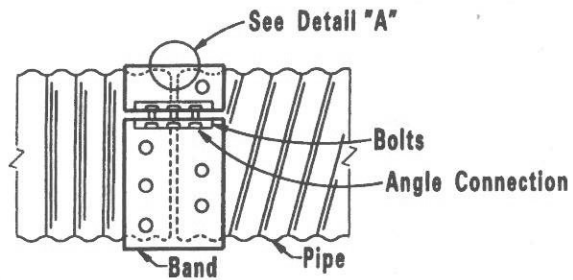
INTENDED USE

Coupling of corrugated aluminum pipe sections or appurtenances.

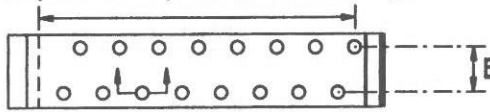
**CORRUGATED ALUMINUM COUPLING BAND
HELICAL BAND**

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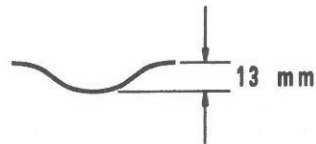
8 spaces as required to fit helix angle



Dimension B: 178 mm min. between dimples, as required to fit helix angle.



DETAIL "A"



SECTION THRU DIMPLES

SPECIFICATIONS

1. Coupling bands shall conform to the requirements of AASHTO Specifications M 196M.
2. Band thickness shall not be less than 1.22 mm and shall not be less than 2 standard thicknesses lighter than the thickness of the pipe.
3. For pipe arches, use the same width band as for circular pipe of equal periphery

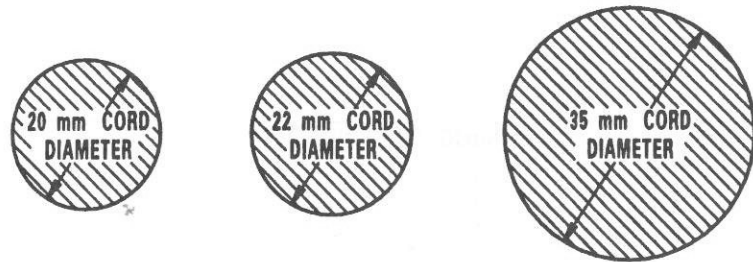
INTENDED USE

Coupling of field cut pipe end(s) on helical corrugations. Pre-wrap with geotextile as necessary to ensure soil tightness.

**CORRUGATED ALUMINUM COUPLING BAND
UNIVERSAL BAND**

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O-RING GASKET CROSS SECTION

SPECIFICATIONS

1. Ring gaskets used on corrugated metal pipe shall be in accordance with AASHTO M 198.
2. 20-mm cord diameter is used on 68 mm x 13 mm corrugation for either reformed ends of helical pipe or riveted pipe.
3. 22-mm cord diameter is used on 75 mm x 25 mm or 125 mm x 25 mm corrugations for reformed ends of helical pipe.
4. 35-mm cord diameter is used on 75 mm x 25 mm corrugation riveted pipe.
5. AASHTO M 198A (O-Ring) Gasket is used on round pipe shapes.
6. AASHTO M 198B (plastic) gasket may be used on round pipe or pipe arch shapes.

INTENDED USES

Use with annular type band couplers when watertight joints are required.

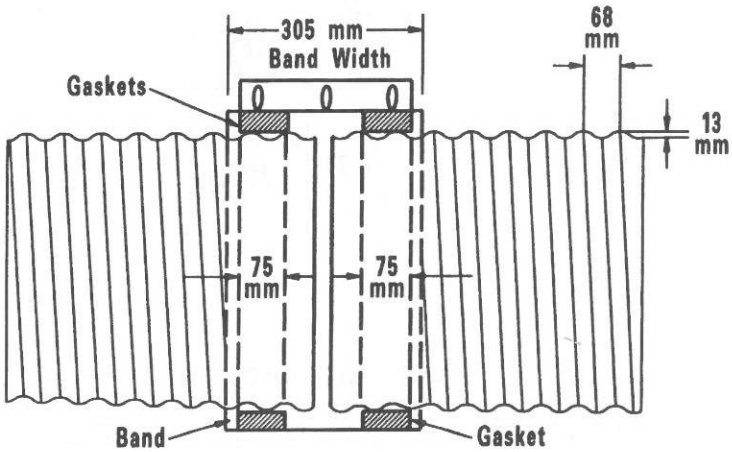
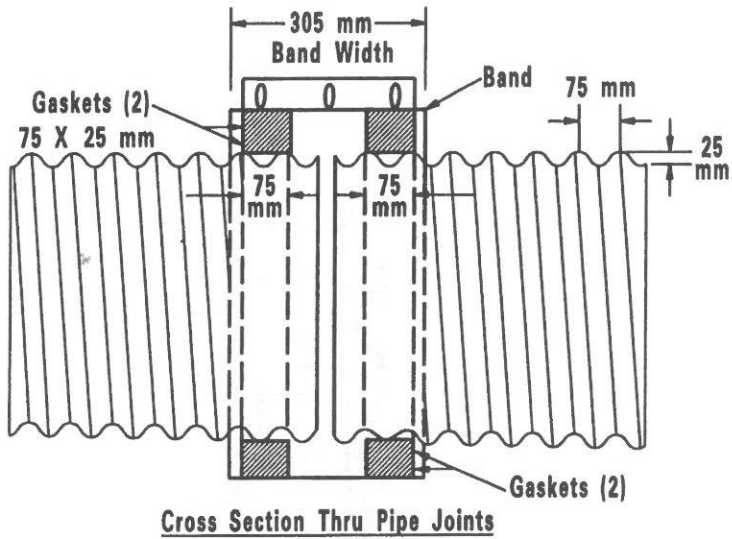
CORRU-GATION	68 X 13 mm	68 X 13 mm	125 X 25 mm	75 X 25 mm
CORD DIA.	20 mm	22 mm	22 mm	35 mm
NOMINAL PIPE I.D.	300 375 450 525 600 675 750 825 900	1050 1200 1350 1500 1650 1800 1950 2100 2250 2400	1350 1500 1650 1800 1950 2100 2250 2400 2550 2700 2850 3000	900 1050 1200 1350 1500 1650 1800 1950 2100 2250 2400 2550 2700 2850 3000

Note: All dimensions are in millimeters

RING GASKETS

AASHTO-AGC-ARTBA
TF-13 DRAWING

CMBS-21-96



General purpose- ASTM D 1056, RE41 closed cell neoprene gasket showing 2 /side 75 mm wide x 25 mm thick continuous

75 x 25 mm Corrugation

General purpose- ASTM D 1056, Type RE41 75 mm x 25 mm continuous closed cell neoprene gasket showing 1 /side

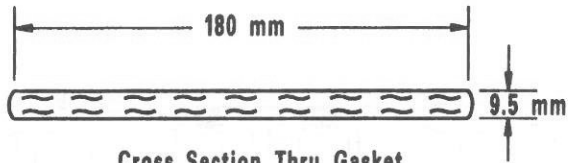
68 x 13 mm Corrugation

FLAT BANDS & GASKETS

Note: All measurements are in millimeters

AASHTO-AGC-ARTBA
TF-13 DRAWING

CMBS-22-96



Cross Section Thru Gasket

NOMINAL PIPE DIAMETER	GASKET LENGTH (mm)
375	1118
450	1359
525	1600
600	1829
675	2032
750	2286
825	2464
900	2718
1050	3200
1200	3658
1350	4064
1500	4547
1650	5029
1800	5436
1950	5893
2100	6299
2250	6782
2400	7264

SPECIFICATIONS

Gaskets shall be closed cell neoprene, skinned all four sides and meeting the requirements of ASTM specification D 1056 Grade SCE-43L. Gaskets shall be of 1-piece continuous construction.

INTENDED USES

Use with corrugated or flat band couplers when watertight joints are required.

SLEEVE GASKETS

AASHTO-AGC-ARTBA
TF-13 DRAWING

CMBS-23-96