
PIPE CULVERTS**PART 1 - GENERAL****1.01 SECTION INCLUDES**

- A. Pipe Culverts
- B. Pipe Aprons and Beveled Ends
- C. Footings for Concrete Pipe Aprons
- D. Pipe Apron Guards

1.02 DESCRIPTION OF WORK

Construct pipe culverts, beveled ends, pipe aprons, and associated appurtenances.

1.03 SUBMITTALS

Comply with Division 1 - General Provisions and Covenants.

1.04 SUBSTITUTIONS

Comply with Division 1 - General Provisions and Covenants.

1.05 DELIVERY, STORAGE, AND HANDLING

Comply with Division 1 - General Provisions and Covenants.

1.06 SCHEDULING AND CONFLICTS

Comply with Division 1 - General Provisions and Covenants.

1.07 SPECIAL REQUIREMENTS

None.

1.08 MEASUREMENT AND PAYMENT**A. Pipe Culverts:****1. Trenched:**

- a. **Measurement:** Each type and size of pipe installed in a trench will be measured in linear feet from end of pipe to end of pipe along the centerline of pipe, exclusive of aprons. Lengths of elbows and tees will be included in length of pipe measured.
- b. **Payment:** Payment will be made at the unit price of each type and size of pipe.
- c. **Includes:** Unit price includes, but is not limited to, trench excavation; dewatering; furnishing and installing pipe; furnishing, placing, and compacting bedding and backfill material; connectors; testing; and inspection.

2. Trenchless:

- a. **Measurement:** Each type and size of pipe installed by trenchless methods will be measured in linear feet along the centerline of the casing pipe.
- b. **Payment:** Payment will be made at the unit price for each type and size of pipe.
- c. **Includes:** Unit price includes, but is not limited to, furnishing and installing pipe; trenchless installation materials and equipment; pit excavation, dewatering, and placing and compacting backfill material; pipe connections; testing; and inspection.

1.08 MEASUREMENT AND PAYMENT (Continued)**B. Pipe Aprons:**

1. **Measurement:** Each type and size of pipe apron will be counted.
2. **Payment:** Payment will be made at the unit price for each type and size of pipe apron.
3. **Includes:** Unit price includes, but is not limited to, trench excavation; dewatering; furnishing and installing pipe; furnishing, placing, and compacting bedding and backfill material; connectors; and other appurtenances.

C. Footings for Concrete Pipe Aprons:

1. **Measurement:** Each footing installed on a concrete pipe apron will be counted.
2. **Payment:** Payment will be made at the unit price for each footing.
3. **Includes:** Unit price includes, but is not limited to, excavation; dewatering; reinforcing steel; concrete; furnishing and installing apron; furnishing, placing and compacting bedding and backfill material.

D. Pipe Apron Guards:

1. **Measurement:** Each pipe apron guard will be counted.
2. **Payment:** Payment will be made at the unit price for each pipe apron guard.

PART 2 - PRODUCTS**2.01 PIPE CULVERTS**

- A. Roadway Pipe Culverts:** All storm sewer pipe materials specified for use in right-of-way in [Section 4020](#) may be used within right-of-way as a roadway pipe culvert.
- B. Entrance Pipe Culverts:** The following pipe culvert types described in [Section 4020](#) may be used within right-of-way as entrance pipe culverts:
1. Reinforced Concrete Pipe (RCP).
 2. Reinforced Concrete Arch Pipe (RCAP).
 3. Reinforced Concrete Elliptical Pipe (RCEP).
 4. Reinforced Concrete Low Head Pressure Pipe (RCPP).
 5. Corrugated Metal Pipe (CMP).
 6. Spiral Rib Pipe.
 7. Coated Corrugated Metal Pipe.
 8. Corrugated Metal Arch Pipe.
- C. Structural Plate Culverts:** Structural plate culverts may be used in the right-of-way as roadway or entrance pipe culverts.
1. Use a galvanized steel structural plate complying with AASHTO M 167.
 2. Use bolts and nuts complying with ASTM A 449 and galvanized per ASTM A 153, Class C.
 3. Assemble the structure according to the manufacturer's recommendations. Tighten the bolts using an applied torque of between 100 and 300 foot-pounds.
 4. Install the structure according to the contract documents, the manufacturer's recommendations, and AASHTO Standard Specifications for Highway Bridges, Division II, Section 26.
 5. Conform the gage of the structure to [Iowa DOT Standard Road Plan DR-104](#) or as specified in the contract documents.
- D. Aluminum Structural Plate Culverts:** Aluminum structural plate culverts may be used in the right-of-way as roadway or entrance pipe culverts.
1. Comply with AASHTO M 219.
 2. Use a corrugation profile of 9 inches by 2 1/2 inches.
 3. Use aluminum complying with ASTM B 209.
 4. Use a minimum thickness of 0.100 inch. Gage of structure complying with manufacturer's requirements.
 5. Use bolts and nuts meeting ASTM A 307 or ASTM A 449 and galvanize per ASTM A 153.

2.01 PIPE CULVERTS (Continued)

6. Assemble the structure according to the manufacturer's recommendations. Tighten the bolts using an applied torque of between 100 and 300 foot-pounds.
7. Install the structure according to the contract documents, the manufacturer's recommendations, and AASHTO Standard Specifications for Highway Bridges, Division II, Section 26.
8. Meet or exceed the AASHTO Standard Specifications for Highway Bridges, Division I, Section 12.8 for HS 20 loading.

2.02 PIPE APRONS

Comply with the requirements of [Section 4020, 2.01](#) and [Section 4030, 2.01](#) for the pipe material of which the apron is constructed. Supply concrete pipe aprons according to [Figure 4030.222](#) and [Figure 4030.223](#). Supply CMP pipe aprons according to [Figure 4030.225](#).

2.03 APRON FOOTINGS

Comply with the requirements of [Figure 4030.221](#) and [Section 6010](#) for reinforcing steel and structural concrete used in apron footings.

2.04 APRON GUARD

Use smooth or deformed steel bars, ASTM A 615, Grade 40 or merchant quality, in the construction of the apron guard. Hot dip galvanize the apron guard according to ASTM A 123.

PART 3 - EXECUTION**3.01 PIPE CULVERT INSTALLATION****A. Trenched:**

1. Install pipe in a trench per [Section 4020](#).
2. For culvert pipe installed in embankment, pipe may be installed at the Contractor's option per the contract documents and the following Iowa DOT Specifications sections:
 - a. Reinforced Concrete Pipe (circular, arched, and elliptical): [Section 2416](#).
 - b. Corrugated Metal and Corrugated Plastic Pipe: [Section 2417](#).
 - c. Structural Plate Culverts: [Section 2420](#).

B. Trenchless: For trenchless installations, comply with [Section 3020](#).

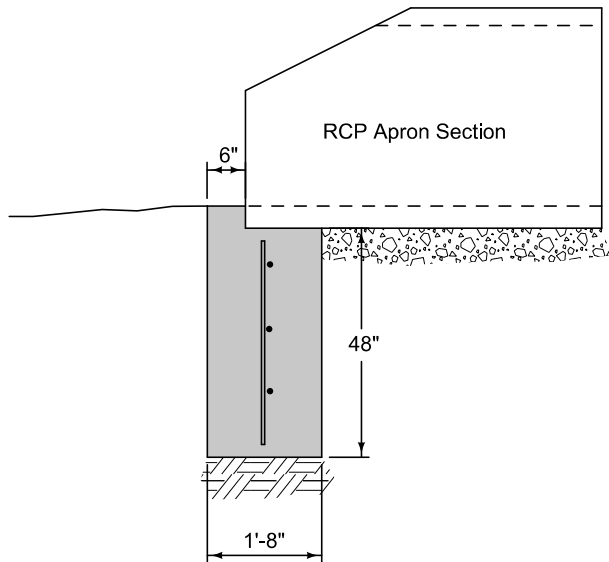
3.02 APRONS

- A. Install pipe aprons where specified in the contract documents. Use the same installation methods as used on the pipe to which the apron is being attached. Dewater area as necessary to prevent installing the apron in water or on saturated soil or bedding. Do not allow water to rise around the apron prior to backfilling the area.
- B. Install apron footings where specified. Construct per [Section 6010](#) and the contract documents. Dewater area as necessary to prevent installing the apron footing in water or on saturated soil or bedding. Do not allow water to rise around the apron footing prior to backfilling the area.
- C. Anchor the last three concrete pipe sections and the apron together with two pipe connections per joint. Comply with [Iowa DOT Standard Road Plan DR-121](#).
- D. Attach corrugated metal aprons to the culvert pipe with a manufacturer's approved bolt, weld, or clamp to fasten directly to the culvert.
- E. Install apron guard where specified. Construct according to [Figure 4030.224](#) or [4030.225](#). Repair any damage to the galvanized coating that occurs due to storage, handling, or installation.

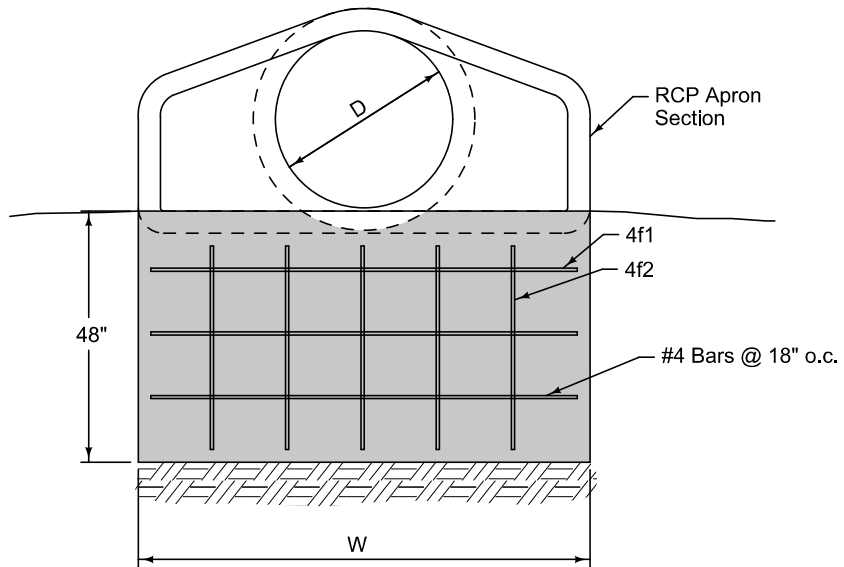
3.03 CLEANING, INSPECTION, AND TESTING

Clean, inspect, and test culverts per [Section 4060](#).

END OF SECTION



TYPICAL SECTION




ELEVATION

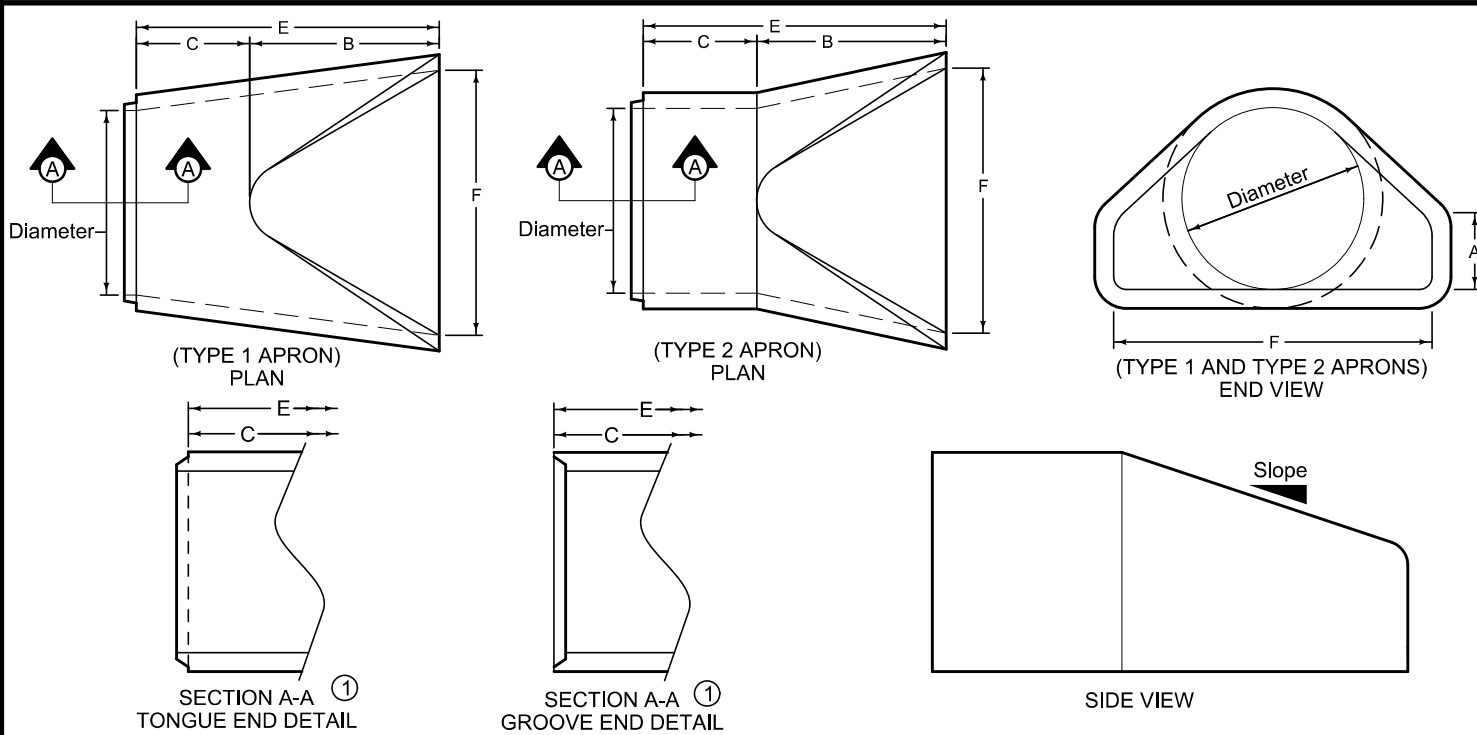
REINFORCING BAR LIST

D	W	Mark	Size	Length	Count
12"	2'-4"	4f1	4	2'-0"	3
		4f2	4	3'-8"	2
15"	2'-10 1/2"	4f1	4	2'-6 1/2"	3
		4f2	4	3'-8"	2
18"	3'-5"	4f1	4	3'-1"	3
		4f2	4	3'-8"	3
24"	4'-6"	4f1	4	4'-2"	3
		4f2	4	3'-8"	3
30"	5'-7"	4f1	4	5'-3"	3
		4f2	4	3'-8"	4
36"	6'-8"	4f1	4	6'-4"	3
		4f2	4	3'-8"	5
42"	7'-3"	4f1	4	6'-11"	3
		4f2	4	3'-8"	5

D	W	Mark	Size	Length	Count
48"	7'-10"	4f1	4	7'-6"	3
		4f2	4	3'-8"	6
54"	8'-5"	4f1	4	8'-1"	3
		4f2	4	3'-8"	6
60"	8'-11"	4f1	4	8'-7"	3
		4f2	4	3'-8"	6
66"	8'-11"	4f1	4	8'-7"	3
		4f2	4	3'-8"	6
72"	10'-0"	4f1	4	9'-8"	3
		4f2	4	3'-8"	7
78"	10'-7"	4f1	4	10'-3"	3
		4f2	4	3'-8"	7
84"	11'-1"	4f1	4	10'-9"	3
		4f2	4	3'-8"	8

FIGURE 4030.221 SHEET 1 OF 1

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	SUDAS 4030.221
	SHEET 1 of 1
SUDAS Standard Specifications	
RCP APRON SECTION FOOTING	




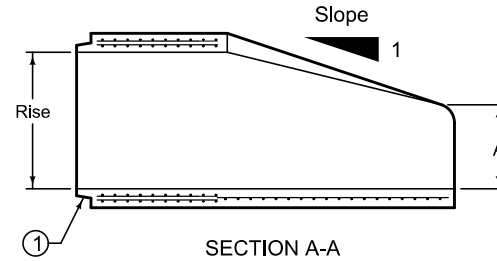
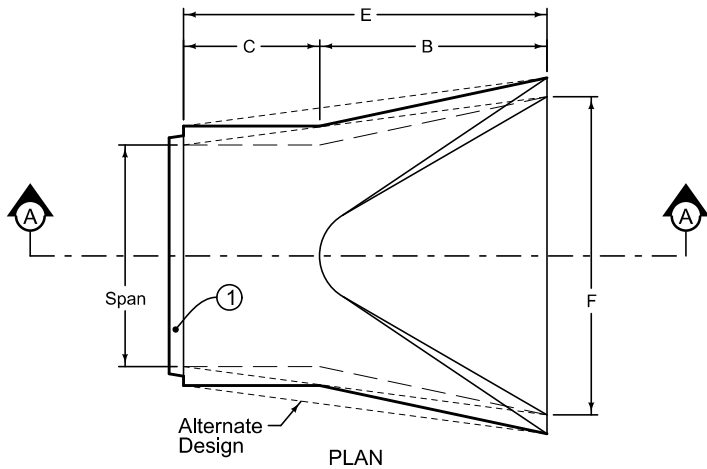
Dimension 'E' shown is the minimum and is considered the design length. Adjust for any difference between the actual length of concrete apron installed and the length indicated below for the length of concrete culvert pipe furnished.

- ① Tongue end used on inlet end section. Groove end used on outlet end section.

TYPE 1 APRONS						
DIAM.	SLOPE	A	B	MINIMUM		F
				C	E	
12"	2.4:1	4"	2'-0"	4'- $\frac{7}{8}$ "	6'- $\frac{7}{8}$ "	2'-0"
15"	2.4:1	6"	2'-3"	3'-10"	6'-1"	2'-6"
18"	2.3:1	9"	2'-3"	3'-10"	6'-1"	3'-0"
21"	2.4:1	9"	3'-0"	3'-1 $\frac{1}{2}$ "	6'-1 $\frac{1}{2}$ "	3'-5"
24"	2.5:1	9 $\frac{1}{2}$ "	3'-7 $\frac{1}{2}$ "	2'-6"	6'-1 $\frac{1}{2}$ "	4'-0"
27"	2.5:1	10 $\frac{1}{2}$ "	4'-1"	2'-0"	6'-1 $\frac{1}{2}$ "	4'-4"
30"	2.5:1	12"	4'-6"	1'-7 $\frac{3}{4}$ "	6'-1 $\frac{3}{4}$ "	5'-0"
36"	2.5:1	15"	5'-3"	2'-9"	8'-0"	6'-0"
42"	2.5:1	21"	5'-3"	2'-9"	8'-0"	6'-6"
48"	2.5:1	24"	6'-0"	2'-0"	8'-0"	7'-0"
54"	1.8:1	27"	5'-0"	3'-0"	8'-0"	7'-6"
60"	1.6:1	29 $\frac{1}{2}$ "	5'-0"	3'-0"	8'-0"	8'-0"
66"	1.7:1	30"	6'-0"	2'-3"	8'-3"	8'-0"
72"	1.6:1	30"	6'-6"	1'-9"	8'-3"	9'-0"
78"	1.8:1	36"	7'-6"	1'-9"	9'-3"	9'-6"
84"	1.3:1	29 $\frac{1}{2}$ "	6'-9"	2'-6 $\frac{1}{2}$ "	9'-3 $\frac{1}{2}$ "	10'-0"

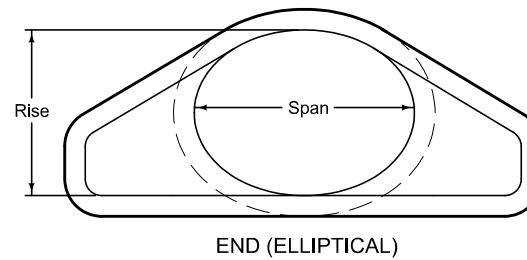
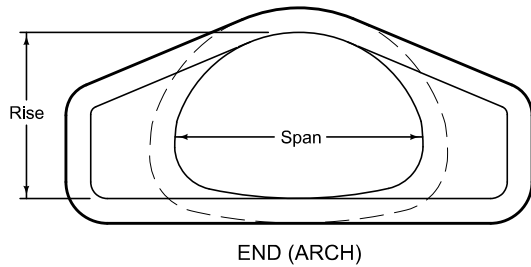
TYPE 2 APRONS						
DIAM.	SLOPE	A	B	MINIMUM		F
				C	E	
12"	2.4:1	4"	2'-0"	4'- $\frac{7}{8}$ "	6'- $\frac{7}{8}$ "	2'-0"
15"	2.4:1	6"	2'-3"	3'-10"	6'-1"	2'-6"
18"	2.3:1	9"	2'-3"	3'-10"	6'-1"	3'-0"
21"	2.4:1	9"	3'-0"	3'-1 $\frac{1}{2}$ "	6'-1 $\frac{1}{2}$ "	3'-5"
24"	2.5:1	9 $\frac{1}{2}$ "	3'-7 $\frac{1}{2}$ "	2'-6"	6'-1 $\frac{1}{2}$ "	4'-0"
27"	2.5:1	10 $\frac{1}{2}$ "	4'-1"	2'-0"	6'-1 $\frac{1}{2}$ "	4'-4"
30"	2.5:1	12"	4'-6"	1'-7 $\frac{3}{4}$ "	6'-1 $\frac{3}{4}$ "	5'-0"
36"	2.5:1	15"	5'-3"	2'-9"	8'-0"	6'-0"
42"	2.5:1	21"	5'-3"	2'-9"	8'-0"	6'-6"
48"	2.5:1	24"	6'-0"	2'-0"	8'-0"	7'-0"
54"	1.9:1	24 $\frac{1}{2}$ "	5'-5"	2'-7"	8'-0"	7'-6"
60"	1.4:1	24 $\frac{1}{2}$ "	5'-0"	3'-0"	8'-0"	8'-0"
66"	1.7:1	30"	6'-0"	2'-3"	8'-3"	8'-0"
72"	1.4:1	24"	6'-6"	1'-9"	8'-3"	9'-0"
78"	1.8:1	36"	7'-6"	1'-9"	9'-3"	9'-6"
84"	1.5:1	23 $\frac{1}{2}$ "	7'-6 $\frac{1}{2}$ "	1'-9"	9'-3 $\frac{1}{2}$ "	10'-0"

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	SUDAS Standard Specifications
	CIRCULAR CONCRETE APRONS



Dimension 'E' shown is the minimum and is considered the design length. Adjust for any difference between the actual length of concrete apron installed and the length indicated below for the length of concrete culvert pipe furnished.

① Tongue end used on inlet end section. Groove end used on outlet end section.




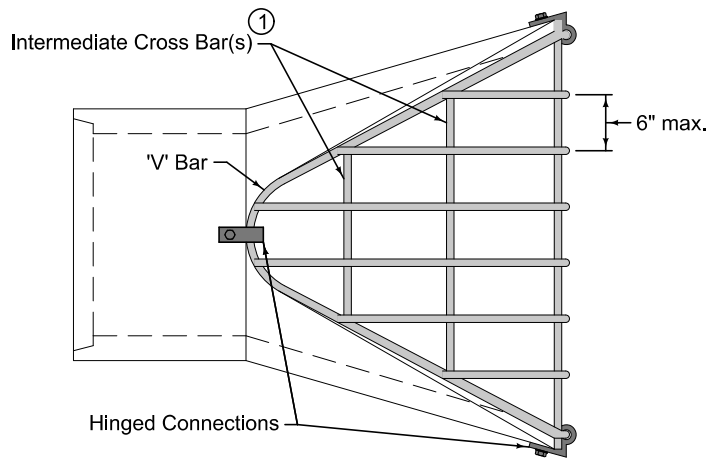
EQUIVALENT DIAMETER Inches	SLOPE	APPROXIMATE DIMENSIONS Inches				
		A	B	C	E	F
18	3:1	7	27	45	72	36
24	3:1	8 $\frac{1}{2}$	39	33	72	48
30	3:1	9 $\frac{1}{2}$	50	46	96	60
36	3:1	11 $\frac{3}{8}$	60	36	96	72
42	3:1	15 $\frac{3}{16}$	60	36	96	78
48	3:1	21	60	36	96	84
54	3:1	25 $\frac{1}{2}$	60	36	96	90
60	3:1	31	60	36	96	96
72	2:1	31	60	39	99	120
84	2:1	21 $\frac{3}{2}$	83	19	102	144

ARCH PIPE

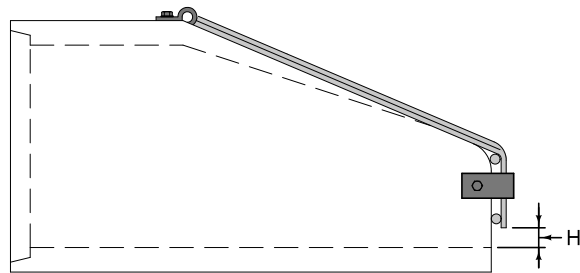
EQUIVALENT DIAMETER Inches	SLOPE	APPROXIMATE DIMENSIONS Inches				
		A	B	C	E	F
18	3:1	7 $\frac{1}{2}$	27	45	72	36
24	3:1	8 $\frac{3}{2}$	39	33	72	48
30	3:1	9 $\frac{1}{2}$	54	18	72	60
36	2.5 to 1	11 $\frac{1}{8}$	60	24	84	72
42	2.5 to 1	15 $\frac{3}{4}$	60	36	96	78
48	2.5 to 1	21	60	36	96	84
54	2.5 to 1	25 $\frac{1}{2}$	60	36	96	90
60	2.5 to 1	30	60	36	96	96
72	2.5 to 1	36	63	33	96	108
90	1.6 to 1	36 $\frac{1}{2}$	58	38	96	113

ELLIPTICAL PIPE

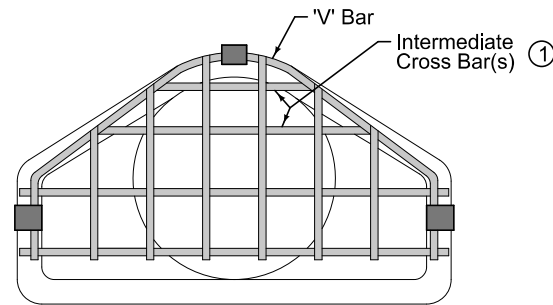
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ARCH AND ELLIPTICAL CONCRETE PIPE APRONS	



PLAN



PROFILE



FRONT


Provide guard dimensions to fit with type of apron provided. Ensure 'V' Bar completely rests on apron.

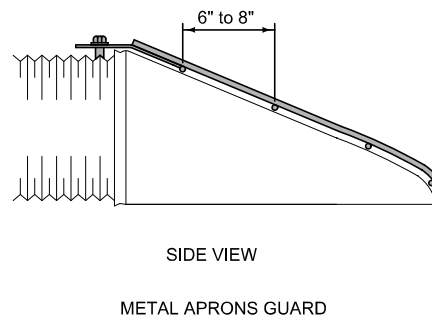
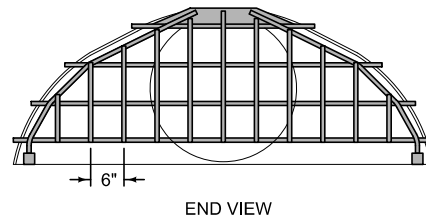
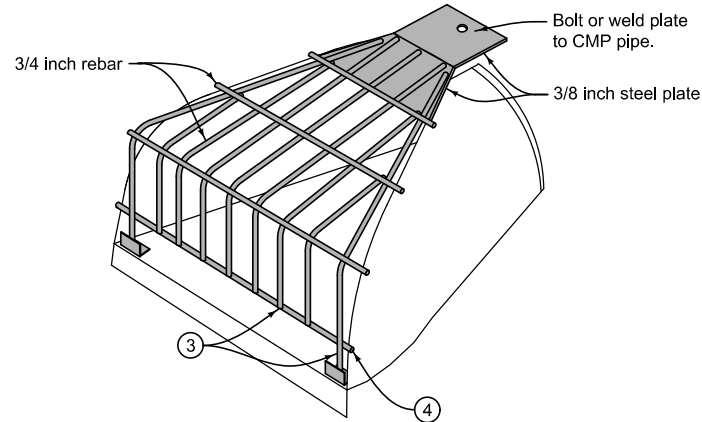
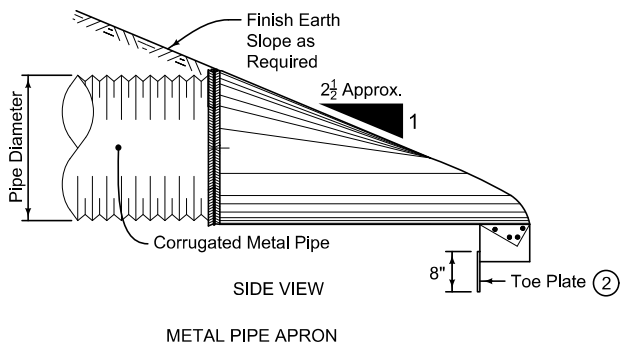
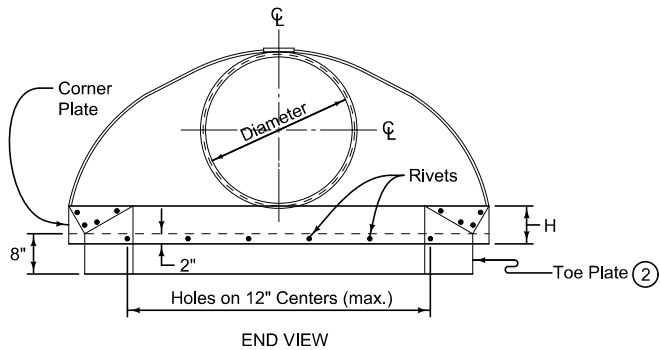
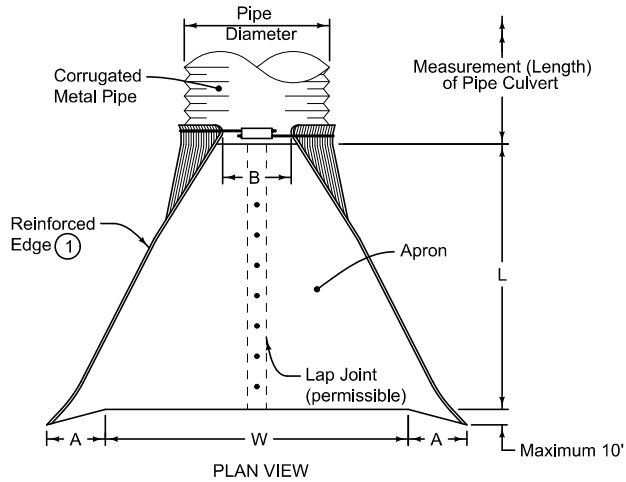
- ① All guards must include at least one intermediate cross bar. If pipe diameter, or equivalent diameter, is 60 inches or greater, use two intermediate cross bars equally spaced.

ROUND		ARCH		ELLIPTICAL	
PIPE SIZE	H	EQUIVALENT DIAMETER	H	EQUIVALENT DIAMETER	H
12"	2½"	18" to 24"	4"	18"	3"
15"	3"	30" to 36"	5"	24"	4"
18" - 24"	4"	42" to 54"	6"	30" to 36"	5"
27" - 36"	5"	60" to 72"	7"	42" to 54"	6"
42" - 54"	6"			60"	7"
60" - 72"	7"				
78" - 90"	8"				

BAR SIZES				
	PIPE SIZE (DIA. or EQUIV.)	HOLE DIA. REQ'D.	BOLT DIA.	BAR SIZE
ROUND	12" - 24"	¾"	⅝"	¾"
	27" - 48"	7/8"	¾"	1"
ARCH	54" - 90"	1 1/8"	1"	1 1/4"
	up to 24" eq.	¾"	⅝"	¾"
	30" to 48"	7/8"	¾"	1"
ELLIPTICAL	54" to 72"	1 1/8"	1"	1 1/4"
	up to 24" eq.	¾"	⅝"	¾"
	30" to 48"	7/8"	¾"	1"
	54" to 60"	1 1/8"	1"	1 1/4"

BOLT LENGTH = PIPE WALL THICKNESS + 2½"

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CONCRETE PIPE APRON GUARD	



- ① On sizes 60 inches and larger, supplement the reinforced edge with a galvanized stiffener angle attached with bolts.
- ② Install a galvanized toe plate (of the same gage metal as apron) on all aprons 24 inch diameter and larger.
- ③ Hold inside bars up 3 inches off bottom of apron. Extend outside bars to bottom of apron and attach to 2 inch by 2 inch by 1/4 inch steel angle.
- ④ When specified, extend bottom cross bar through apron.

DIMENSIONS					
PIPE DIAM.	A (±1")	B MAX.	H (±1")	L (±1 1/2")	W (±2")
6"	4 1/2"	1"	3"	8 3/4"	12"
8"	5 7/8"	3"	4"	14 1/4"	16"
10"	7 1/2"	6"	6"	21"	24"
12"	4 3/4"	6"	6"	21"	24"
15"	6"	8"	6"	26"	30"
18"	7"	9"	6"	31"	36"
21"	8 1/2"	11"	6"	36"	42"
24"	9 1/2"	12"	6"	42"	48"
30"	12"	15"	7 1/2"	52 1/2"	60"
36"	14"	18"	9"	63"	72"
42"	16"	21"	10 1/2"	73 1/2"	84"
48"	18"	27"	12"	84"	90"
54"	18"	30"	12"	84"	102"
60"	18"	33"	12"	87"	114"
66"	18"	36"	12"	87"	120"
72"	18"	39"	12"	87"	126"
78"	18"	42"	12"	87"	132"
84"	18"	45"	12"	87"	138"
90"	24"	37"	11"	87"	144"
96"	25"	35"	12"	87"	150"

FIGURE 4030.225 SHEET 1 OF 1

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SUDAS Standard Specifications

METAL PIPE APRONS AND APRON GUARDS

