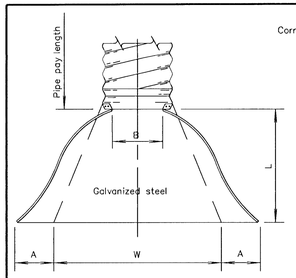
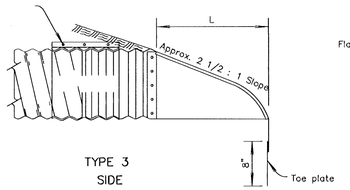
FHWA REGION NO.	STATE	PROJECT NO.	YEAR	SHEET NO.	TOTAL SHEETS
7	KANSAS			14	46

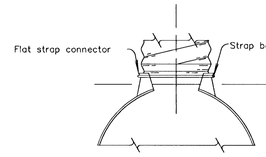


PLAN

(Illustrated with Type #3 Connection)

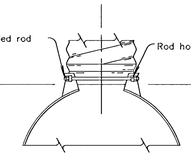


TYPE 3
SIDE



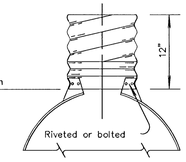
TYPE 1

Available in sizes 12" through 24" only.



TYPE 2

Available in sizes 30" and 36" Round and 17"x13" through 57"x38" Pipe-Arches.



TYPE 3

Available in sizes 42" through 96" Round and 60"x46" through 81"x59" Pipe-Arches.

Note: Type #3 connection may be furnished instead of Types #1 & #2 for smaller sizes of pipe and pipe arches.

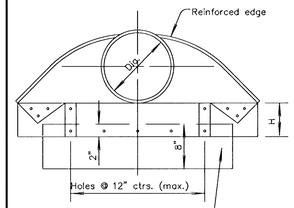
NOTE: Toe plate, where specified, to be punched to match holes in apron lip. 3/8 " Dia. galvanized bolts to be furnished. The length of toe plate to be as follows:

W + 10" for 12" to 30" diameter pipes inclusive.
W + 20" for 36" to 84" diameter pipes inclusive.
W + 10" for pipe-arches with a rise of 13" to 29" inclusive.
W + 20" for pipe-arches with a rise of 33" to 59" inclusive.

Apron section for 12" to 24" diameter pipe inclusive, and pipe-arches with rise of 13" to 24" inclusive, to be made from one sheet. Apron sections for 30" to 42" diameter pipe inclusive, and pipe-arches with rise of 29" to 33" inclusive, may be made from up to two sheets joined by riveting or bolting on the centerline apron section. Apron section for 48" to 72" diameter pipe inclusive, and pipe -arches with rise of 38" to 63" inclusive, may be made from up to three sheets joined by riveting or bolting at equal distances from centerline. Apron sections for 78" diameter pipe and above and pipe-arches with rise 67" and above may be made from up to four sheets joined by riveting or bolting.

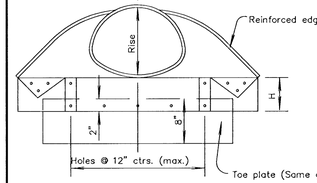
Corner sections, corner plate and toe plate to be same gauge as apron and each to be galvanized in accordance with the specifications.

Other approved designs may be used in lieu of type shown.



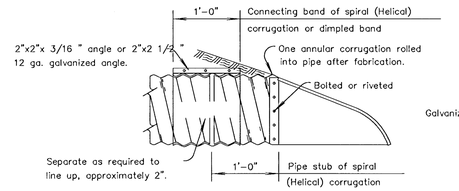
FRONT

Toe plate (Same gauge as apron)



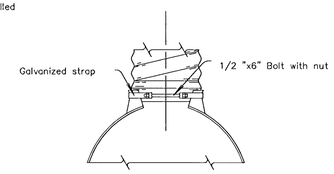
FRONT

Toe plate (Same gauge as apron)



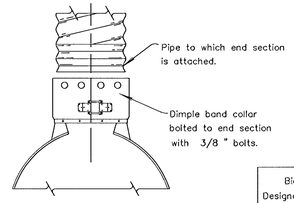
SPIRAL (HELICAL) CORRUGATION

For all sizes of round and arch culvert pipes having Spiral (Helical) corrugations, the end sections and connecting bands shall be as shown above.



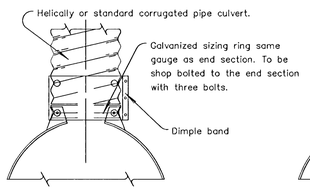
ALTERNATE TYPE 1

For 12" through 24" only.



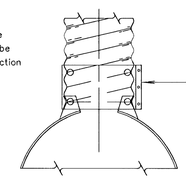
TYPE 5

Available for all Round and equivalent Pipe-Arch sizes, (Type 1 and Type 2 connections are recommended for the smaller sizes with annular ends).



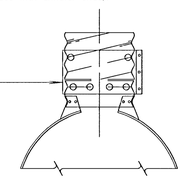
ALTERNATE TYPE D CONNECTION
with Sizing Ring

Available in sizes 12" through 36" and 17"x13" through 57"x38" Pipe-Arches.



TYPE D

Available in sizes 12" through 36" and 17"x13" through 57"x38" Pipe-Arches.

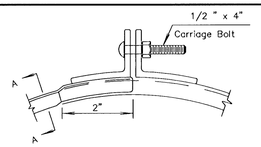


TYPE 3

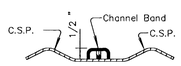
Available in sizes 42" and 96" Round and 60"x46" through 81"x59" Pipe-Arches.

Bid Designation Sq. Ft.	Nom. W.W. Area Sq. Ft.	Pipe Arch Span (In.)	Pipe Arch Rise (In.)	Min. Gauge End Sect.	Dimensions in Inches A 1" Tol.	B Max.	H 1" Tol.	L 1 1/2 "	W ±2" Tol.	No. Apron Panels	Slope
1.0	1.1	17	13	16	7	9	6	19	30	1	2 1/2
1.5	1.6	21	15	16	7	10	6	23	36	1	2 1/2
2.0	2.2	24	18	16	8	12	6	28	42	1	2 1/2
2.5	2.8	28	20	16	9	14	6	32	48	1	2 1/2
Sizes below with alternate dimensions											
3.0 or 4.0	4.4	35	24	14	10	16	6 & 8	39	60	1	2 1/2
5.0 or 6.0	6.4	42	29	14	12	18	8 & 9	46	75	2	2 1/2
7.0 or 8.5	8.7	49	33	12	13	21	9 & 12	53	85	2	2 1/2
10.0 or 11.0	11.4	57	38	12	18	26	12	63	90	2	2 1/2
12.5 or 14.0	15.6	60	46	12	18	30 & 34	12	70	102	2	2 : 1
16.5	19.3	66	51	12 & 10	18	33	12	77	114 &116	3	1 1/2
21.0	23.2	73	55	12 & 10	18	36	12	77	126	3	1 1/2
25.0	27.4	81	59	12 & 10	18	39	12	77	138	3	1 1/2
32.0	32.1	87	63	12 & 10	22	38	12	77	148	3	1 1/2
36.0	37.0	95	67	12 & 10	22	34	12	77	162	3	1 1/2
42.0	42.4	103	71	12 & 10	22	38	12	77	174	3	1 1/2
47.0	48.0	112	75	12 & 10	24	40	12	77	174	3	1 1/2

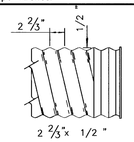
Pipe Dia. (In.)	Min. Gauge Ends	Dimensions in Inches A 1" Tol.	B Max.	H 1" Tol.	L 1 1/2 "	W ±2" Tol.	No. Apron Panels	Slope
12"	16	6	6	6	21	24	1	2 1/2 : 1
15"	16	7	8	6	26	30	1	2 1/2 : 1
18"	16	8	10	6	31	36	1	2 1/2 : 1
21"	16	9	12	6	36	42	1	2 1/2 : 1
24"	16	10	13	6	41	48	1	2 1/2 : 1
30"	14	12	16	8	51	60	1	2 1/2 : 1
36"	14	14	19	9	60	72	2	2 1/2 : 1
42"	12	16	22	11	69	84	2	2 1/2 : 1
48"	12	18	27	12	78	90	2	2 1/4 : 1
54"	12	18	30	12	84	102	2	2 1/4 : 1
60"	12 & 10	18	33	12	87	114	3	2: 1
66"	12 & 10	18	36	12	87	120	3	2: 1
72"	12 & 10	18	39	12	87	126	3	2: 1
78"	12 & 10	18	42	12	87	132	3	1 1/2 : 1
84"	12 & 10	18	45	12	87	138	3	1 1/2 : 1
90"	12 & 10	18 & 24	37 & 45	11 & 12	87	138 &144	3	1 1/2 : 1
96"	12 & 10	18 & 25	35 & 45	12	87	138 &150	3	1 1/2 : 1



CHANNEL BAND DETAILS



SECTION
"A-A"



Reformed to accept Channel, Annular, Dimple and Hugger Bands .

Channel band couplers shall:

1. Be of two piece design.
2. Be fabricated from galvanized steel stock.
3. Be 14 ga. thickness for pipe 12 ga. or lighter. (A= 3/4 ")
4. Be 12 ga. thickness for pipe 10 ga. or heavier. (A= 1")
5. Have 2" x 2" x 3/16 " angles securely fastened to the band ends to allow for proper tightening.

Pipe Dia. Inches	✳ Minimum Gauge of Pipe 2 2/3"x 1/2 " Corr. Steel	Alum.	3"x 1" Corr. Steel ▲	6"x 2" Corr. Steel	6"x 1" Corr. Alum.
12"	16	16			
15"	16	16			
18"	16	16			
21"	16	16			
24"	14	14			
30"	14	12			
36"	14	12			16
42"	12	12	14		16
48"	12	10	14		16
54"	12	10	14		16
60"	10	8	14	12	16
66"	10	8	14	12	16
72"	10	6	14	12	14
78"	8		14	12	12
84"			12	12	12
90"			12	12	
96"			12	12	
102"			12	12	
108"			10	12	
114"			10	12	
120"			10	12	

Bid Designation Sq. Ft.	Pipe Dimension Span & Rise	Sq. Ft.	✳ Min. Gauge of Pipe 2 2/3"x 1/2 " Corr. Steel	Alum.	3"x 1" Corr. Steel ▲
1.0	17" x 13"	1.1	16	16	
1.5	21" x 15"	1.6	16	16	
2.0	24" x 18"	2.2	16	16	
2.5	28" x 20"	2.8	14	14	
3.0 or 4.0	35" x 24"	4.4	14	12	
5.0 or 6.0	42" x 29"	6.4	14	12	
7.0 or 8.5	49" x 33"	8.7	12	12	
10.0 or 11.0	57" x 38"	11.4	12	10	
12.5 or 14.0	60" x 46"	15.6		10	14
16.5	66" x 51"	19.3		8	14
21.0	73" x 56"	23.2			12
25.0	81" x 59"	27.4			12
32.0	87" x 63"	32.1			12
36.0	96" x 67"	37.0			12
42.0	103" x 71"	42.4			12
47.0	112" x 75"	48.0			12
54.0	117" x 79"	54.2			10
60.0	128" x 83"	60.5			10
67.0	137" x 87"	67.4			10
74.0	142" x 91"	74.5			10

Note: The culverts listed on this sheet may not indicate that the culvert installed will be steel, aluminum or reinforced concrete.

✳ For gauge above minimum requirements see summary of culverts.

Connection of end sections by welding will not be permitted.

All 3 piece apron sections shall have 12 gauge sides and 10 gauge center panels. Multiple panel apron sections shall have lap seams which are to be tightly jointed by galvanized rivets or bolts at equal distances from center line.

For 60" to 120" diameter pipe apron sections, reinforced edges to be supplemented by hot dipped galvanized stiffener. angles. The angles to be attached by galvanized nuts and bolts.

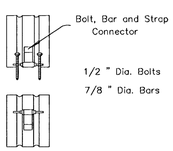
For 73"x55" and larger pipe-arch sections, reinforced edges to be supplemented by hot dipped galvanized stiffener angles. The angles to be attached by galvanized bolts and nuts.

Angle reinforcement shall be placed under the center panel seams on 73"x55" and larger pipe arch apron sections.

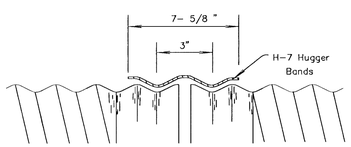
All references to galvanized metal refer to steel only.

Gain in pipe length due to fit of pipe at connecting band shall not be paid for.

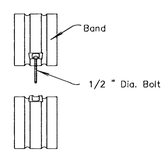
When Hugger Bands are used the H-7 Hugger Band may be used on circular pipes 36" diameter and smaller and pipe arches 42"x29" and smaller. The H-10 Hugger Band is required for larger size pipes.



ALTERNATE CONNECTION DETAIL

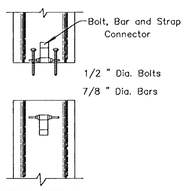


UNIVERSAL REFORMED END with H-7 HUGGER BAND

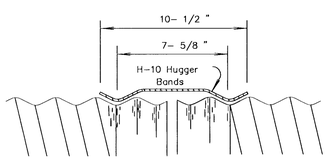


STANDARD CONNECTION DETAIL

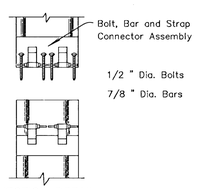
DETAILS FOR H-7 HUGGER BANDS (16 ga.)



CONNECTION DETAIL
SINGLE HARNESS



UNIVERSAL REFORMED END with
H-10 HUGGER BAND



CONNECTION DETAIL
DOUBLE HARNESS

DETAILS FOR H-10 HUGGER BANDS (16 ga.)

▲ Note: At the Contractor's option, 5"x1" corrugated steel pipe of equal gauge may be substituted for the 3"x1" corrugated steel pipe listed in the table with the following restrictions:

1. Fill height over top of pipe shall be less than 25 ft.
2. Pipe shall be fabricated with helical corrugations and lock seams or continuous welded seams.

PIPE CULVERT SUMMARY

Station	Location	Type	Size or Bid Designation Sq. Ft.	Crown Grade Elev.	Flow Line Lt.	Flow Line Rt.	Horizontal Roadway Lt.	Horizontal Roadway Rt.	Degree of Rotation	Length of Pipe Lt.	Length of Pipe Rt.	Lin. Ft. of Pipe	End Sections Type I Lt.	Type I Rt.	Type III Lt.	Type III Rt.

NO.	DATE	REVISIONS	BY	APP'D
1	4-27-98	Added pipe corrugation option note	R.J.S.	J.O.B.

KANSAS DEPARTMENT OF TRANSPORTATION

METAL END SECTION FOR ROUND & ARCH METAL CULVERTS (TYPE I) & PIPE GAUGE TABLES

RD660

FHWA APPROVAL	6-15-98	APP'D. James O. Brewer	
DESIGNED	DETAILED	QUANTITIES	TRACED Bowser
DESIGN CK.	DETAIL CK.	QUAN.CK.	TRACE CK. Seitz