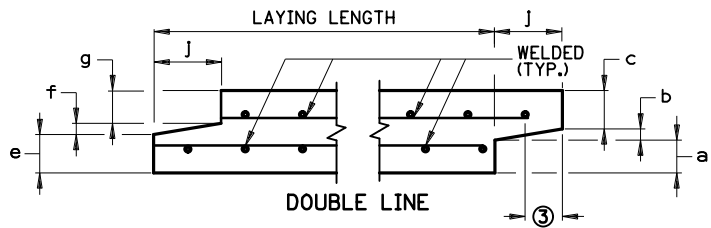
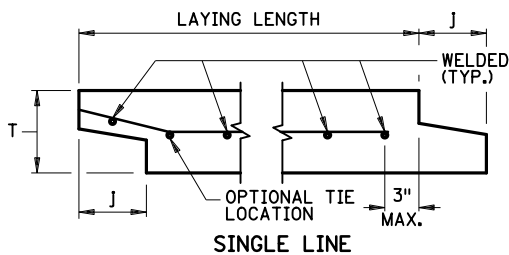


TABLE OF DIMENSIONS															
NOMINAL SPAN	EQUIVALENT DIAMETER ①	WATER AREA	RISE	SPAN	MIN. WALL THICKNESS (T)	DIMENSION REQUIREMENTS IN INCHES									APPROX. WT./FT.
						a	b	c	j	e	f	g	E ②	LB.	
22	18	1.7	13½	22	2½	1⅜	⅜	¾	2	1⅛	⅜	1	6	170	
28	24	2.8	18	28½	3½	1⅝	½	1⅜	3	1⅜	½	1⅝	5⅝	315	
36	30	4.4	22½	36¼	4	1⅜	⅝	1⅞	3½	1⅞	⅝	1⅜	7⅞	445	
44	36	6.4	26⅝	43¾	4½	2	¾	1¾	4	1¾	¾	2	8⅞	595	
51	42	8.8	31⅝	51⅞	4½	2	¾	1¾	4	1¾	¾	2	10⅞	685	
58	48	11.4	36	58½	5	2¼	¾	2	5	2	¾	2¼	11⅝	875	
65	54	14.0	40	65	5½	2½	¾	2¼	5	2¼	¾	2½	13	1065	
73	60	17.7	45	73	6	3⅝	¾	1⅝	5	2¾	¾	2½	14⅞	1305	
88	72	25.6	54	88	7	3⅜	1	2⅜	6	3¼	1	2¾	17	1820	
102	84	34.6	62	102	8	4⅞	1	2⅞	6	3½	1	3½	18⅞	2410	
115	90	44.5	72	115½	8½	4¼	1	3¼	7	3¾	1	3¾	22⅞	2915	
122	96	51.7	77½	122⅝	9	4½	1	3½	7	4	1	4	23⅞	3290	
138	108	66.0	87⅞	138½	10	5	1	4	7	4½	1	4½	25⅞	4125	
154	120	81.8	96⅞	154	11	5½	1	4½	7	5	1	5	29¼	5055	
169	132	99.1	106½	168¾	10	5	1	4	7	4½	1	4½	32⅝	4975	



LONGITUDINAL SECTION

NOTES:


- ① EQUIVALENT DIAMETER EQUALS DIAMETER OF CIRCULAR PIPE WITH APPROXIMATELY EQUIVALENT CROSS-SECTION AREA.
- ② SPRINGLINE DIMENSION, SEE SHEET 2 OF 3.
- ③ MAXIMUM END COVER ON LAST CIRCUMFERENTIAL REINFORCEMENT WIRE IS LESSER OF HALF THE LENGTH OF THE JOINT OR 3". MINIMUM END COVER TO THE LAST CIRCUMFERENTIAL REINFORCEMENT WIRE IS ½" IN THE GROOVE END AND ¼" IN THE TONGUE END.

LAYING LENGTH IS DEFINED AS THE TOTAL PIPE SECTION LENGTH MINUS THE TONGUE LENGTH J. THE MINIMUM LAYING LENGTH IS 6' FOR SPANS OF 122" OR LESS, EXCEPT THAT TWO 4' LENGTHS ARE PERMITTED IN A LINE OF PIPE TO MAKE A REQUIRED LENGTH. THE MINIMUM LAYING LENGTH IS 4' FOR SPANS GREATER THAN 122". FOR ALL SPANS OF PIPE, ONE SECTION OF ANY ODD LENGTH GREATER THAN 4' IS PERMITTED IN EACH LINE OR REACH OF PIPE TO MAKE THE REQUIRED LENGTH. PLACE PIPE SECTIONS SHORTER THAN THE NOMINAL LENGTH NEAR THE MIDDLE OF THE LINE OR AS REQUIRED BY THE ENGINEER.

SEE MnDOT DRAINAGE MANUAL FOR ALLOWABLE FILL HEIGHTS.  
 SEE STANDARD PLATE 3014 SHEET 2 OF 3 FOR CROSS SECTION SKETCH.  
 SEE STANDARD PLATE 3007 FOR ADDITIONAL DETAILS.

BASIS OF DESIGN:

CONCRETE STRENGTHS AND REINFORCEMENT REQUIREMENTS ARE IN ACCORDANCE WITH AASHTO M 206. FOR PIPE SIZES AND CLASSES THAT ARE NOT INCLUDED IN M 206, A CUSTOM DESIGN WAS PERFORMED IN ACCORDANCE WITH THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, 8TH EDITION, SECTION 12.10.4.2, WITH HL-93 LIVE LOAD EXCLUDING LANE LOAD. ASSUMED SOIL UNIT WEIGHT OF 120 PCF.

APPROVED 09-30-2022  
  
 STATE DESIGN ENGINEER

STATE OF MINNESOTA  
 DEPARTMENT OF TRANSPORTATION  
**REINFORCED CONCRETE PIPE ARCH**  
 GENERAL NOTES AND DIMENSIONS

SPECIFICATION REFERENCE  
 2501, 2503

STANDARD PLATE NO.  
**3014L**  
 1 OF 3

TABLE OF REINFORCEMENT REQUIREMENTS																				
NOMINAL SPAN	EQUIVALENT DIAMETER ①	CONCRETE 4000 PSI ⑤																		
		As, CONTINUOUS BASIC REINFORCEMENT						As, ADDITIONAL REINFORCEMENT									SINGLE LINE REINFORCEMENT			
		INNER CAGE			OUTER CAGE			U - INNER CAGE			V - OUTER CAGE			IIA	IIIA	IVA				
		IIA	IIIA	IVA	IIA	IIIA	IVA	DIMENSION	IIA	IIIA	IVA	DIMENSION	IIA				IIIA	IVA		
IN.	IN.																			
22	18	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.11	0.14	0.26
28	24	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.16	0.21	0.32
36	30	0.09	0.12	0.18	0.07	0.09	0.14	13"	0.09	0.12	0.18	29"	0.07	0.09	0.13	0.18	0.24	0.36		
44	36	0.11	0.15	0.22	0.09	0.12	0.17	15"	0.11	0.15	0.22	34"	0.09	0.12	0.16	0.21	0.30	0.44		
51	42	0.13	0.18	0.27	0.10	0.14	0.21	17"	0.13	0.18	0.27	39"	0.10	0.14	0.22	0.26	0.36	0.54		
58	48	0.15	0.22	②	0.12	0.17	②	22"	0.15	0.21	②	48"	0.12	0.17	②	0.30	0.44	②		
65	54	0.18	0.24	②	0.14	0.19	②	24"	0.18	0.24	②	54"	0.14	0.19	②	0.36	0.48	②		
CONCRETE 5000 PSI																				
73	60	0.21	0.28	②	0.17	0.21	②	28"	0.21	0.27	②	60"	0.17	0.21	②	0.42	0.56	②		
88	72	0.26	0.36	0.57③	0.20	0.27	0.43③	33"	0.26	0.36	0.57③	72"	0.20	0.27	0.43③	0.52	0.72	—		
102	84	0.32	0.44	0.67③	0.24	0.34	0.50③	39"	0.32	0.44	0.67③	84"	0.24	0.34	0.50③	0.64	0.88	—		
CONCRETE 6000 PSI																				
115	90	0.39	0.52③	0.82③	0.30	0.39③	0.62③	43"	0.39	0.52③	0.82③	96"	0.30	0.39③	0.62③	—	—	—		
122	96	0.42	0.55③	0.88③	0.32	0.41③	0.66③	46"	0.42	0.55③	0.88③	102"	0.32	0.41③	0.66③	—	—	—		
138	108	0.49④	0.64③	②	0.37④	0.48③	②	52"	0.49④	0.64③	②	114"	0.37④	0.48③	②	—	—	②		
154	120	0.55④	0.74③	②	0.41④	0.55③	②	58"	0.55④	0.74③	②	126"	0.41④	0.55③	②	—	②	②		
169	132	0.79④	②	②	0.59④	②	②	62"	0.79④	②	②	132"	0.59④	②	②	—	②	②		

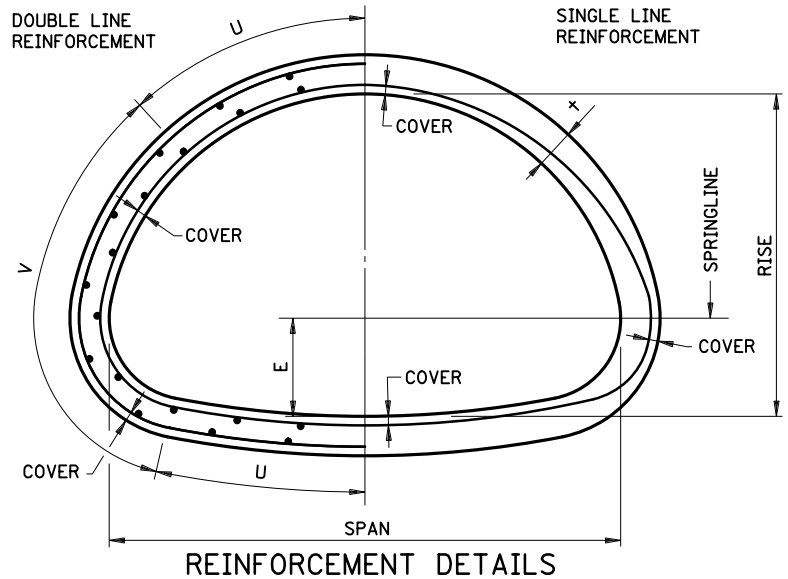
As = CIRCUMFERENTIAL REINFORCEMENT AREA IN SQUARE INCHES PER LINEAR FOOT OF PIPE BARREL IN EACH CONTINUOUS BASIC CAGE AND SUPPLEMENTAL REINFORCEMENT DESIGNATED "U" AND "V".

U = HALF BAR OR WELDED WIRE REINFORCEMENT LENGTH MEASURED ALONG CENTERLINE OF PIPE WALL FROM VERTICAL CENTERLINE OF PIPE.

V = FULL BAR OR WELDED WIRE REINFORCEMENT LENGTH MEASURED ALONG CENTERLINE OF PIPE WALL AND POSITIONED EQUIDISTANT WITH RESPECT TO ENDS OF "U" REINFORCEMENT.

D-LOADS FOR THREE-EDGE-BEARING TEST		
CLASS	0.01-IN CRACK	ULTIMATE
IIA	1000	1500
IIIA	1350	2000
IVA	2000	3000

NOTE: TEST LOAD IN POUNDS PER LINEAR FOOT EQUALS D-LOAD x INSIDE SPAN IN FEET. REFER TO SPEC. 3236 FOR ADDITIONAL LOAD BEARING TEST REQUIREMENTS.



**NOTES:**

IF REINFORCEMENT BARS ARE USED IN LIEU OF WELDED WIRE REINFORCEMENT, USE REINFORCEMENT BARS IN CONFORMANCE WITH SPEC. 3301, fy = 60 KSI, AND INCREASE THE REQUIRED REINFORCEMENT BY 8%.

THE MINIMUM COVER FOR REINFORCEMENT IS 3/4" AND THE MAXIMUM IS 1" + 10% OF THE WALL THICKNESS, OR 1/2", WHICHEVER IS GREATER.

DO NOT EXCEED A SPACING OF 4 INCHES FOR THE CENTER-TO-CENTER SPACING OF ADJACENT RINGS OF CIRCUMFERENTIAL REINFORCEMENT FOR 30" EQUIVALENT DIAMETER AND SMALLER PIPE; DO NOT EXCEED THE WALL THICKNESS OR 6 INCHES, WHICHEVER IS LESS, FOR LARGER PIPE. DO NOT DESTROY THE CONTINUITY OF THE CIRCUMFERENTIAL REINFORCEMENT DURING THE MANUFACTURE OF THE PIPE.

REFER TO AASHTO M 206 FOR ADDITIONAL PIPE DIMENSIONS AND GEOMETRY.

- ① EQUIVALENT DIAMETER = DIAMETER OF CIRCULAR PIPE WITH APPROXIMATELY EQUIVALENT CROSS-SECTION AREA.
- ② NOT AVAILABLE IN THIS SIZE/CLASS COMBINATION.
- ③ NOMINAL SPANS OF 115 INCHES OR GREATER FOR CLASS IIIA PIPE AND 88 INCHES OR GREATER FOR CLASS IVA PIPE ARE SPECIAL DESIGNS IN ACCORDANCE WITH SPEC. 3236 AND REQUIRE SHEAR REINFORCEMENT. SEE SHEET 3 OF 3.
- ④ NOMINAL SPANS OF 138 INCHES OR GREATER FOR CLASS IIA PIPE ARE SPECIAL DESIGNS IN ACCORDANCE WITH SPEC. 3236. NOTIFY THE ENGINEER PRIOR TO THE START OF PRODUCTION.
- ⑤ THE REQUIRED STRENGTH INCREASES FOR LARGER SIZE PIPE, SEE BELOW.

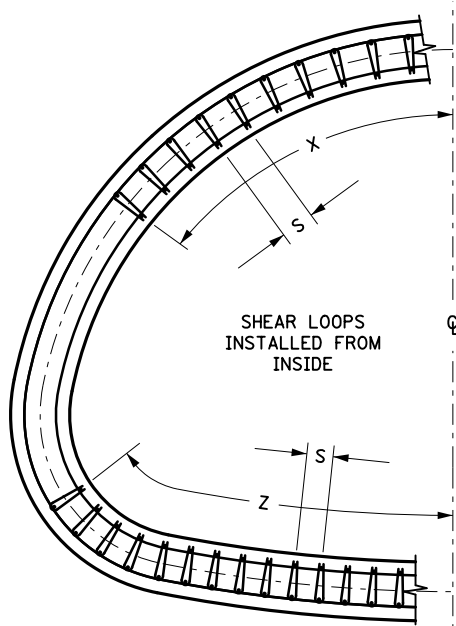
APPROVED 09-30-2022  
  
 STATE DESIGN ENGINEER

STATE OF MINNESOTA  
 DEPARTMENT OF TRANSPORTATION  
**REINFORCED CONCRETE PIPE ARCH**  
 REINFORCEMENT

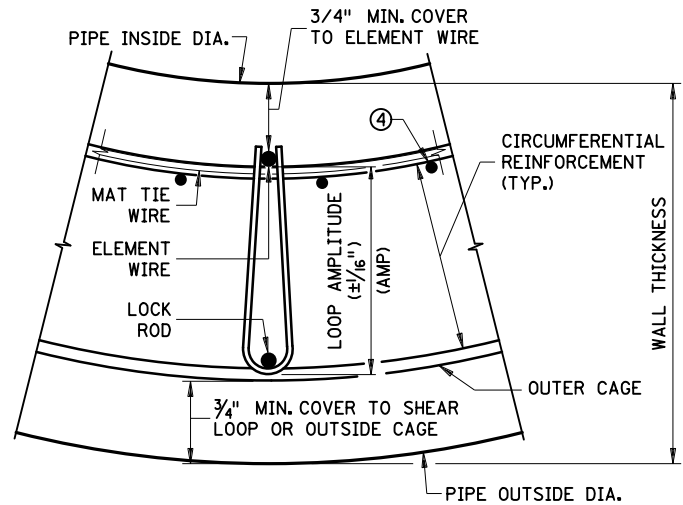
SPECIFICATION REFERENCE  
 2501  
 2503

STANDARD PLATE NO.  
**3014L**  
 2 OF 3

SHEAR REINFORCEMENT REQUIREMENTS ③												
NOMINAL SPAN	EQUIVALENT DIAMETER ①	WALL THICKNESS	AMPLITUDE (AMP)	TOP				BOTTOM				
				S	X	A <sub>r</sub>		S	Z	A <sub>r</sub>		
						IIIA	IVA			IIIA	IVA	
IN.	IN. ①	IN.	IN.	IN.	IN.			IN.	IN.			
88	72	7"	5"	3.5	36	—	0.39	3.5	42	—	0.27	
102	84	8"	6"	4.5	42	—	0.39	4.5	49	—	0.26	
115	90	8½"	6½"	4.5	48	—	0.40	4.5	54	0.09	0.27	
122	96	9"	7"	5	52	—	0.39	5	55	0.09	0.26	
138	108	10"	8"	5.5	60	—	②	5.5	62	0.10	②	
154	120	11"	9"	6	66	—	②	6	70	0.10	②	
169	132	10"	8"	5.5	71	②	②	5.5	74	②	②	



SHEAR LOCK MAT  
(INSTALLED FROM INSIDE)



SHEAR LOCK MAT DETAIL  
(PINNED ON INSIDE)

**NOTES:**

SHEAR LOCK MATS MUST BE INSTALLED FROM INSIDE OF PIPE AS SHOWN ON THIS SHEET.

AMP = SHEAR LOOP AMPLITUDE MEASURED FROM FACE OF ELEMENT WIRE TO TIP OF LOOP WIRE (INCHES)

A<sub>r</sub> = MINIMUM RADIAL REINFORCEMENT REQUIRED IN SQUARE INCHES PER SQUARE FOOT OF PIPE MEASURED AT THE INNER CAGE OVER MINIMUM ARC LENGTHS X AND Z AT THE TOP AND BOTTOM OF THE PIPE, RESPECTIVELY.

X & Z = MINIMUM LENGTH OF STIRRUPS MEASURED AT INNER CAGE (INCHES).

S = MAXIMUM SPACING OF ROWS OR RADIAL REINFORCEMENT AT INNER CAGE (INCHES).

S IS BASED ON ARTICLE 12.10.4.2.6 OF THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, 8TH EDITION, WHERE S SHALL NOT EXCEED  $0.75 \times d \times \phi_v$ , WHERE  $\phi_v$  IS 0.9 AS SPECIFIED IN AASHTO ARTICLE 12.5.5. THE MAXIMUM SPACING HAS BEEN ROUNDED UP FROM THE CALCULATED VALUE TO THE NEAREST ½ INCH.

PIN ALL SHEAR REINFORCEMENT. PROVIDE ELEMENT BAR WITH A MINIMUM DIAMETER OF 0.19" AND A LOCK ROD OF THE SAME DIAMETER.

SECURE LOCK RODS PLACED ON THE INSIDE OF THE OUTER CAGE NO MORE THAN 6" FROM END OF EACH LOCK ROD, AT 12" MAXIMUM SPACING.

SET INSIDE CIRCUMFERENTIAL REINFORCEMENT COVER BY USING A 1" CHAIR FOR THE CIRCUMFERENTIAL REINFORCEMENT.

① EQUIVALENT DIAMETER EQUALS DIAMETER OF CIRCULAR PIPE WITH APPROXIMATELY EQUIVALENT CROSS-SECTION AREA.

② NOT AVAILABLE IN THIS SIZE/CLASS COMBINATION.

③ SEE STANDARD PLATE 3007 FOR SHEAR REINFORCEMENT OPTIONS AND ADDITIONAL DETAILS AND INFORMATION.

④ WHEN SHEAR LOCK MAT ALTERNATE IS USED, LOCATE THE LONGITUDINAL REINFORCEMENT ON THE INNER CAGE AS SHOWN.

APPROVED 09-30-2022  
*Rom S*  
STATE DESIGN ENGINEER

STATE OF MINNESOTA  
DEPARTMENT OF TRANSPORTATION  
**REINFORCED CONCRETE PIPE ARCH**  
SPECIAL DESIGN - SHEAR REINFORCEMENT  
INSTALLED FROM INSIDE

SPECIFICATION  
REFERENCE  
2501  
2503

STANDARD  
PLATE  
NO.  
**3014L**  
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