

ERRATA-November 2019

Manual of Standard Practice

29th Edition, 4th Printing, 2019

The following pages supersede the versions currently shown in the CRSI's *Manual of Standard Practice*, and should be referenced as such. This errata applies to the 29th Edition, specifically noted as the "First Edition Printed 2018." Includes previous *Errata–April 2018* content.

Updates and/or corrections have been made to the following:

Chapter 7; pages 7-7, 7-11, 7-12, 7-17, 7-21, 7-22, 7-23

References to ASTM A967 and A380 requirements for cleaning stainless steel reinforcing bar processes were deleted; pages 7-28, 7-29, 8-1, D-1, G-15



Figure 7-1 Typical Bend Shapes (cont.).





- 4. "H" dimension for stirrup hooks to be shown only where necessary to fit within concrete.
- 5. Where bars are to be bent more accurately than standard fabricating tolerances permit, the affected bending dimensions should be individually identified as "Critical Dimensions".
- 6. For recommended diameter "D," of bends and hooks, see Tables 7-1 and 7-2.
- 7. Bend Series 200, 300 and 400 apply to bar sizes #3 through #8.
- 8. Unless otherwise noted, diameter "D" is the same for all bends and hooks on a bar (except for Bend Shapes 111, 113, 132, 133, 138 and 303).

Figure 7-1 Typical Bend Shapes (cont.).



ENLARGED VIEW SHOWING BAR BENDING DETAILS



Table 7-2 Standard Stirrup/Tie Hooks

90° Stirrup/Tie Hooks

St		90°	
irru	Bar Size	D, (in.)	A or G, (ft-in)
р &	#3	2"	4 ¹ /2"
Tie	#4	2 ¹ /2"	4 ³ / ₄ "
Ho	#5	3 ¹ /4"	6"
oks	#6	4 ¹ /2"	1' — 0"
	#7	5 ¹ /4"	1' – 2"
	#8	6"	1' – 4"

Notes:

D = Finished bend diameter

All grades and coatings (except galvanized)



135° Stirrup/Tie Hooks

St		135°						
rrup 8	Bar Size	D, (in.)	A or G, (ft-in)	H, (ft-in) ^{**}	Hook Length [*]			
Ĩ	#3	2"	4 ¹ /2"	2 ³ /4"	4 ¹ /4"			
Н	#4	2 ¹ /2"	5"	3"	4 ³ /4"			
ok	#5	3 ¹ /4"	6"	3 ³ /4"	6"			
S	#6	4 ¹ /2"	8"	4 ¹ /2"	7 ³ /4"			
	#7	5 ¹ /4"	9"	5 ¹ /4"	8 ³ /4"			
	#8	6"	10 ¹ /2"	6"	10"			

Notes:

D = Finished bend diameter

All grades and coatings (except galvanized)



180° Stirrup/Tie Hooks

St			180°		
irrup 8	Bar Size	D, (in.)	A or G, (ft-in)	J, (ft-in) ^{**}	Hook Length [*]
E Tie	#3	2"	5"	2 ³ /4"	3 ³ /4"
Н	#4	2 ¹ /2"	5 ¹ /2"	3 ¹ /2"	4 ¹ /4"
ok	#5	3 ¹ /4"	6 ¹ /2"	4 ¹ /2"	4 ³ /4"
0	#6	4 ¹ /2"	8 ¹ /4"	6"	6"
	#7	5 ¹ /4"	9 ³ /4"	7"	7"
	#8	6"	11"	8"	8"

Notes:

D = Finished bend diameter

All grades and coatings (except galvanized)

A or G dimensions for 180° hooks shown in Table 7-2 are **minimum** allowable lengths. Not all bend tooling can safely produce bends with these minimum A or G dimensions. For safety reasons, it is acceptable for A or G dimensions and hook lengths to be longer than values shown in the Table.





Table 7-2 Standard Stirrup/Tie Hooks (cont.) 90° Stirrup/Tie Hooks (Galvanized)^{*}

St		90°	
irru	Bar Size	D, (in.)	A or G, (ft-in)
%	#3	2 ¹ / ₄ "	4 ¹ /2"
Tie	#4	3"	5"
Но	#5	3 ³ /4"	6 ¹ /4"
oks	#6	4 ¹ /2"	1' — 0"
	#7	7"	1' – 3"
	#8	8"	1' — 5"

Notes:

D = Finished bend diameter

Galvanized only, all grades

*Bend diameters larger than ACI 318 Code are shown with shading



135° Stirrup/Tie Hooks (Galvanized)*

St			135°		
irrup 8	Bar Size	D, (in.)	A or G, (ft-in)	H, (ft-in) ^{**}	Hook Length [*]
Ĩ	#3	2 ¹ /4"	4 ¹ /2"	2 ³ /4"	4 ¹ /2"
Н	#4	3"	5"	3"	5"
ok	#5	3 ³ /4"	6 ¹ /2"	3 ³ /4"	6 ¹ /4"
S	#6	4 ¹ /2"	8"	4 ¹ /2"	7 ³ /4"
	#7	7"	10"	5 ¹ /2"	9 ³ /4"
	#8	8"	11 ¹ /2""	6 ¹ /2"	11"

Notes:

D = Finished bend diameter

Galvanized only, all grades

*Bend diameters larger than ACI 318 Code are shown with shading



180° Stirrup/Tie Hooks (Galvanized)*

St					
rrup 8	Bar Size	D, (in.)	A or G, (ft-in)	J, (ft-in) ^{**}	Hook Length [*]
Tie	#3	2 ¹ /4"	5 ¹ /4"	3"	4"
Н	#4	3"	6"	4"	4 ¹ /2"
ok	#5	3 ³ /4"	7"	5"	5"
00	#6	4 ¹ /2"	8 ¹ /4"	6"	6"
	#7	7"	1' – 0"	8 ³ /4"	8"
	#8	8"	1' — 2"	10"	9"

Notes:

D = Finished bend diameter

Galvanized only, all grades

*Bend diameters larger than ACI 318 Code are shown with shading

A or G dimensions for 180° hooks shown in Table 7-2 are **minimum** allowable lengths. Not all bend tooling can safely produce bends with these minimum A or G dimensions. For safety reasons, it is acceptable for A or G dimensions and hook lengths to be longer than values shown in the Table.





Bar Size	Nominal	Minimum Finished Bend Diameter					
	Diameter	ASTM	A767 – Grade 60,	75 and 80 Galva	nized		
		Stan	dard	Stirrup/Tie			
#3	0.375	6	2.25	6	2.25		
#4	0.500	6	3.00	6	3.00		
#5	0.625	6	3.75	6	3.75		
#6	0.750	6	4.50	6	4.50		
#7	0.875	8	7.00	8	7.00		
#8	1.000	8	8.00	8	8.00		
#9	1.128	8	9.024	8	9.024		
#10	1.270	8	10.16	8	10.16		
#11	1.410	8	11.28	8	11.28		
#14	1.693	10	16.93	10	16.93		
#18	2.257	10	22.57	10	22.57		
Value	inches	bar dia.	inches	bar dia.	inches		

Table 7-4 ASTM A767 Minimum Finished Bend Diameters*

*Bend diameters larger than ACI 318 Code are shown with shading

Note: This is the only ASTM specification that defines a minimum finished bend diameter for each bar size. All other specifications define the pin size for bend tests. Based on the values contained in ASTM A767, the standard hooks for certain bar sizes of galvanized bars are different than uncoated bars.

Certain bar sizes of galvanized coated bars should be inspected to ensure that the finished bend diameter is equal to or larger than the minimum finished bend diameter required by ASTM A767 (see Section 7.4.3 for more information).

7.5 Typical Measuring Points

See Figure 7-2 for typical measuring points. These measuring points are described for bend conditions, not individual bend shapes and are to be applied to the typical bend shapes previously described. Special bend shapes should follow the same recommendations.



Figure 7-2 Measuring Points.







Table 7-5b Stirrup / Tie Pin Bending Tolerances



^{*}Dimensions are to be within tolerance shown but are not to differ from the opposite parallel dimension more than 1/2".

Condition	Bar Size	≤18"	>18" ≤30"	>30" ≤48"	>48" ≤66"	>66" ≤84"	>84" ≤102"	>102"
Round spiral diameter	#3	± ¹ /2"	±1/2"		Not Recommended			
	#4	± ¹ /2"	± ¹ /2"	+1", -0"				
	#5	± ¹ /2"	± ¹ /2"	+1", -0"	+2", -0"	+3", -0"	+4", -0"	+5", -0"
	#6		± ¹ /2"	+1", -0"	+2", -0"	+3", -0"	+4", -0"	+5", -0"
	#7	Not	Availabla	+1", -0"	+2", -0"	+3", -0"	+4", -0"	+5", -0"
	#8	NOL /	HVallable		+2", -0"	+3", -0"	+4", -0"	+5", -0"

Condition	Illustration	#3 ·	#5	#6 - #8
Square spiral leg length		Total Length <12' – 0" ± ¹ /2"	Total Length ≥ 12' – 0" ±1"	±1"



Condition	Illustration	#3 -	#5	#6 - #8
Length of leg / dimension with adjacent		Total Length <12' — 0"	Total Length ≥12' — 0"	
both ends	¦∎₽{	± ¹ /2"	±1"	±1"
Angular de- viation on 90° hooks and 90° bent legs		Maximu per foot (v	m of ±2 ¹ /2° o whichever is g min ± ¹ /2"	r ± ¹ / ₂ " greater),
Rise of a con- fined or free sloping leg		± ¹ /2"	±1"	±1"
Hoop diameter		± ¹ /2"	± ¹ /2"	± ¹ /2"
Standard 90° hook length		± ¹ /2"	± ¹ /2"	± ¹ /2"
Standard 135° hook width		± ¹ /2"	± ¹ /2"	± ¹ /2"
Standard 180° hook depth J		± ¹ /2"	± ¹ /2"	± ¹ /2"
Lap length (with or without hooks present)	+	-1"	-1"	-1"
Opposite parallel leg lengths / dimensions	*	± ¹ /2"	±1"	±1"

Table 7-5b Stirrup / Tie Pin Bending Tolerances (cont.)

*Leg lengths / dimensions are to be within tolerance shown but are not to differ from the opposite parallel length / dimension by more than 1/2". This applies to all stirrups and ties, open and closed, with or without hooks present.

Example:

When looking at the fabricating tolerances for a Type 102 bar, here is how the standard tolerances would be applied:



At each end of the B leg, there is a standard 90° hook. The tolerance for the B leg would be described using the "Length of leg with adjacent leg on one or both ends" condition.

Condition	Illustration	#3 - #11	#14	#18
Length of leg / dimension with adjacent leg on one or both ends		±1"	±2 ¹ /2"	±3 ¹ /2"

The tolerance for the hooks themselves would be described using the "Standard 90° hook length" condition.

Condition	Illustration	#3 - #11	#14	#18
Standard 90° hook length		±1"	±2 ¹ /2"	±3 ¹ /2"

7.7 Bend Curvature

Even when bars are bent properly to achieve a finished bend diameter that is equal to or larger than the minimum bend diameter required by ACI 318 Code, the bend may not be a perfect circle. These imperfections with bend diameter and the resulting variance in the curvature of the bend (out-ofroundness) can be attributed to a number of variables including, but not limited to:



- 1. Lack of perfect circularity / perfectly cylindrical surface with bending pins
- 2. Lack of perfect circularity / perfectly cylindrical with reinforcing bars
- 3. Wear on bending equipment
- 4. Bending equipment setup
- 5. Type of reinforcing bar being bent
- 6. Position of the reinforcing bar's rib with respect to the bending pin
- 7. Variance in the reinforcing bar's deformation height
- 8. Permissible angular deviation (see fabrication tolerances for more information)

If inspecting finished bends with a "disc-style" template (which must be sized to match the ACI minimum bend diameter), consider the following:

- If the bar is bent using the correct diameter, the disc should fit inside the bend.
- If the disc does not fit inside the bend, that indicates that the bend has been fabricated with a bend diameter smaller than the specified ACI minimum.
- If the disc fits, but a small gap is present, this gap is most likely caused by a small variance in the curvature of the bend as discussed above. As long as the finished bend diameter is equal to or larger than the minimum bend diameter required by ACI 318 Code, the gap shall not be cause for rejection.

7.8 Special Bend Shapes

The typical bar bends discussed in this chapter represent only the most common shapes encountered in normal reinforced concrete construction. It is possible that other shapes will be required. Other shapes, referred to as special bend shapes, are both necessary and acceptable provided they follow the guidelines for typical bend shapes discussed in this chapter.

7.9 Bending

Reinforcing bars should be fabricated accurately to the dimensions shown on the bending details, within the tolerances given in this chapter. Bars should be bent cold, unless otherwise authorized, and should not be bent or straightened in a manner that will damage the material. All standard hooks should conform to the dimensions defined as "Standard Hooks" in this chapter.

7.10 Quality and Inspection

Reinforcing bars with rust, mill scale, or a combination of both should be considered as satisfactory, provided the minimum dimensions, including height of deformations, and weight of a hand-wire-brushed test specimen are not less than the applicable ASTM specification requirements.

For more information, see CRSI Technical Note CTN-M-2: *Field Guide for Rust on Reinforcing Bars.*

Inspections authorized by parties other than the Seller for quality of reinforcing steel and related materials are to be made at the rolling mill or fabricating shop prior to cutting or fabrication for shipment. The total cost of fabrication, including any expense for testing, is borne by the Buyer. Certified mill test reports are supplied on request.

7.11 Typical Bundling and Tagging

7.11.1 Bundles

A bundle should consist of one size, length, or mark (bent) of reinforcing bars with the following exceptions:

- 1. Multiple bundles consisting of small quantities of bars may be master lift bundled together for convenience.
- 2. Groups of varying bar lengths, sizes, or marks (bent) that will be placed together as a specific entity of work may be bundled together.

7.11.2 Lifts

Lifts are classified in two categories: shop lifts and field lifts. Shop lifts generally are units of reinforcing bars as loaded for shipment. Field lifts generally are units of reinforcing bars as required for field handling by the Contractor. A field lift may consist of single bundles or two or more smaller bundles tied together. A shop lift may consist of one or more bundles, the same as field lifts or consist of two or more field lifts. Straight and bent bars may be combined into the same lift.

7.11.3 Weights of Bundles or Lifts

Maximum weight of bundles or lifts is dependent on regional practices and jobsite conditions, but should not exceed the weight of a local stock mill bundle.

7.11.4 Ties

Bundles and lifts should be securely tied; gage and spacing of ties should be as follows: minimum No. 9 gage wire for large bundles and/or lifts; minimum No. 12 gage wire for small bundles. Ties are generally spaced 10 to 15 feet on centers, but all bundles must have a minimum of 1 tie at each end of the bundle (total of 2 ties per bundle). Ties are not intended for use in lifting bundles.

7.11.5 Tags

Tags should be made of durable and waterproof material and marked in a legible manner with waterproof markings; one tag per bundle, attached by wire. Identification tags should show the grade of steel, number of pieces, size, and mark or length of bars.

It should be recognized that the legibility of markings on tags has a finite life. When bundles of reinforcing bars are stored outdoors for a long period of time, fading of the markings on non-metallic tags, or oxidation of the markings on metal tags can be expected to occur.



