University of Nevada, Reno

Best Practice Manual for Circular Rebar Cage Assembly with U-bolt Connectors

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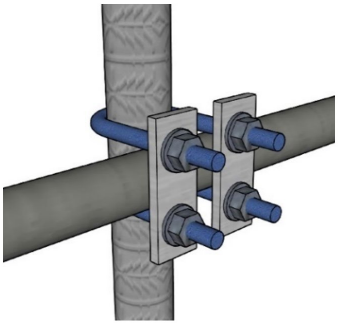
This Best Practice Manual has been prepared based on the recommendations outlined in the document titled "Guidelines for Circular Rebar Cage Assembly with U-bolt Connectors." Its purpose is to provide practical examples of a conservative and safe design approach for determining the number of U-bolt connectors to be used in circular rebar cages in cases where engineering calculations for rebar cage deflection are unavailable. Note that this manual is specifically applicable to single longitudinal to transverse rebar connections and does not cover double longitudinal configurations, such as bundled rebar. For the given examples, a pick-up span of $l = 24'$ is assumed. It is essential to assemble the U-bolt connectors in a symmetric pattern on each tied-hoop. Also, rebar cages should be lifted and suspended from the locations where hoops are connected with U-bolts. The research performed in this project was limited to analysis of a two-point pick. Many rebar cages require multiple pick-up points to maintain acceptable deflection and stability. For larger rebar cages, typically those with a length of 55 feet or more, three or more pick-up points will be required, and it is recommended to employ a rigging analysis conducted by a qualified engineer to ensure safety and proper execution. For definition and further details, please refer to the "Guidelines for Circular Rebar Cage Assembly with U-bolt Connectors."

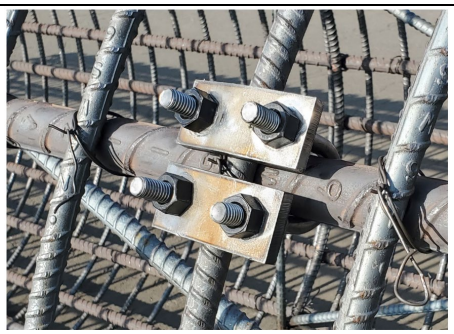
Cage Dia. (ft)	Typical Cage Detail Example	Example Cage Weight (lbs.)	# of Hoops with U-Bolts (Tied-Hoops)	# of U-Bolts per Tied-Hoop
8	64#11 x 40 ft long	20,400	6	10
	64#11 x 64 ft long	32,600	9	
	64#11 x 88 ft long	44,800	12	
7	48#11 x 40 ft long	15,400	6	8
	48#11 x 64 ft long	24,600	9	
	48#11 x 88 ft long	33,800	12	
6	32#11 x 40 ft long	10,500	6	6
	32#11 x 64 ft long	16,800	9	
	32#11 x 88 ft long	23,100	12	
5	24#11 x 40 ft long	7,800	6	4
	24#11 x 64 ft long	12,400	9	
	24#11 x 88 ft long	17,000	12	
4	16#11 x 40 ft long	5,100	6	4
	16#11 x 64 ft long	8,200	9	
	16#11 x 88 ft long	11,300	12	

Proper Arrangement and Tightening of U-bolt Connections

A pair of U-bolts with two saddle plates rotated 90 degrees are to be used as demonstrated below.



Schematic view of appropriate U-bolt connection



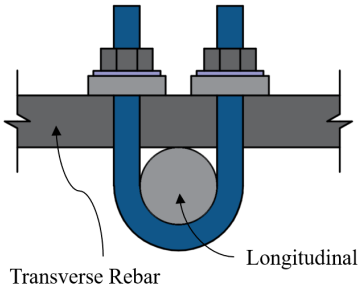
An assembled U-bolt connection on a cross-bar connection in a rebar cage

U-bolts shall be tightened properly and consistently until the plates bend for approximately 5 degrees to ensure proper connection strength, as demonstrated below.

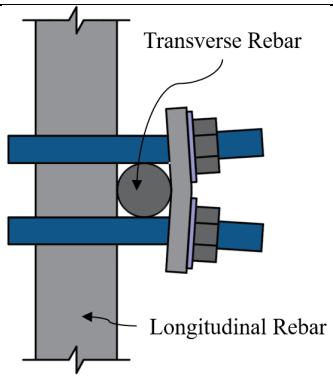
Bending of the U-bolt connector plates in a tight-fit connection

U-bolt Tightening Protocol

1. Assemble the U-bolt and finger-tighten all four nuts to keep the saddle plates in place.
2. Snug-tight all four nuts using a regular or impact wrench until they are just snug, but not fully tightened.
3. To ensure that the load is evenly distributed, gradually increase the torque on each bolt in a diagonal pattern. Repeat this process until they are all tightened to the desired level (equal to 75 ft-lb. torque).
4. To check if the U-bolt is properly tightened, inspect the saddle plates for a slight bend of approximately 5 degrees. This indicates that the U-bolt is properly tightened.



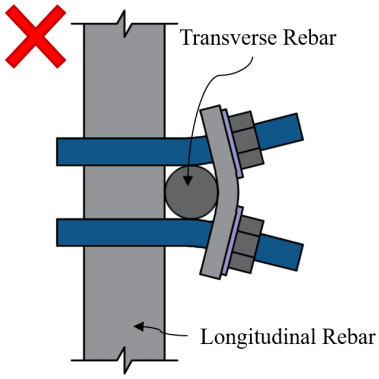
Top view



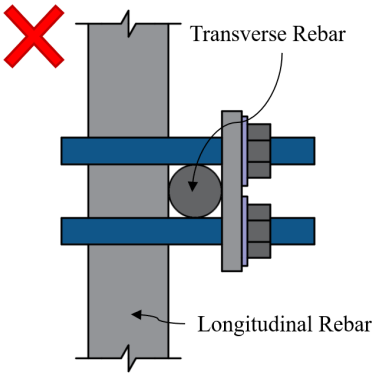
Side view

Proper bending in the saddle plates, approximately 5 degrees.

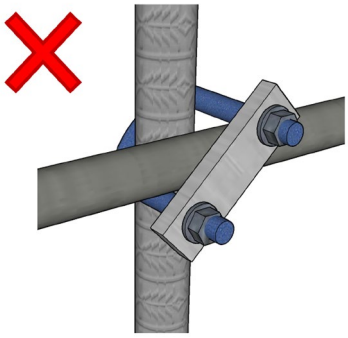
The use of a diagonal U-bolt to connect longitudinal to transverse rebars is not permitted.



Plates bent too much - Overstressed U-bolts



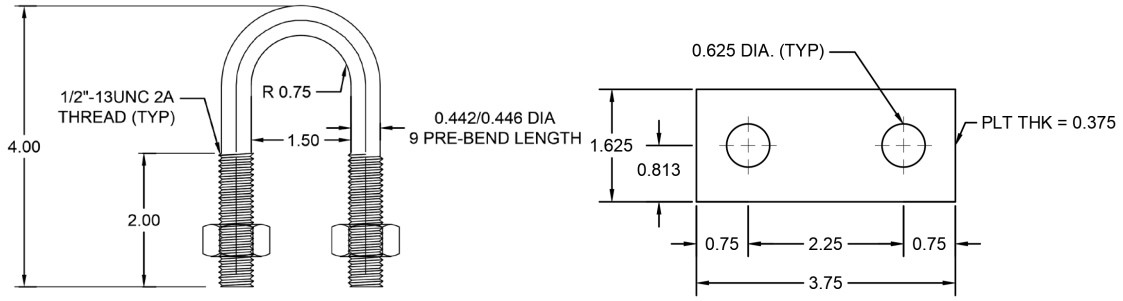
Insufficient torque on bolts – Reduced capacity



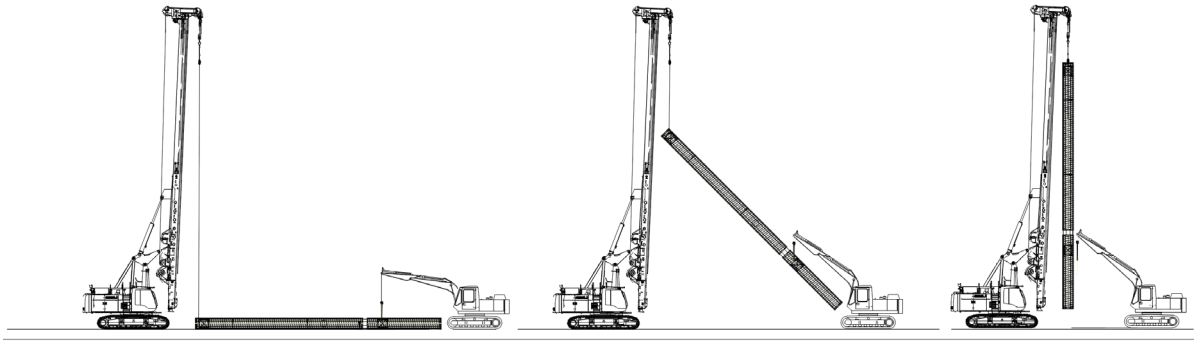
Diagonal saddle plate/U-bolt - Unstable arrangement without reliable load carrying capacity

Improper installation of U-bolt connectors.

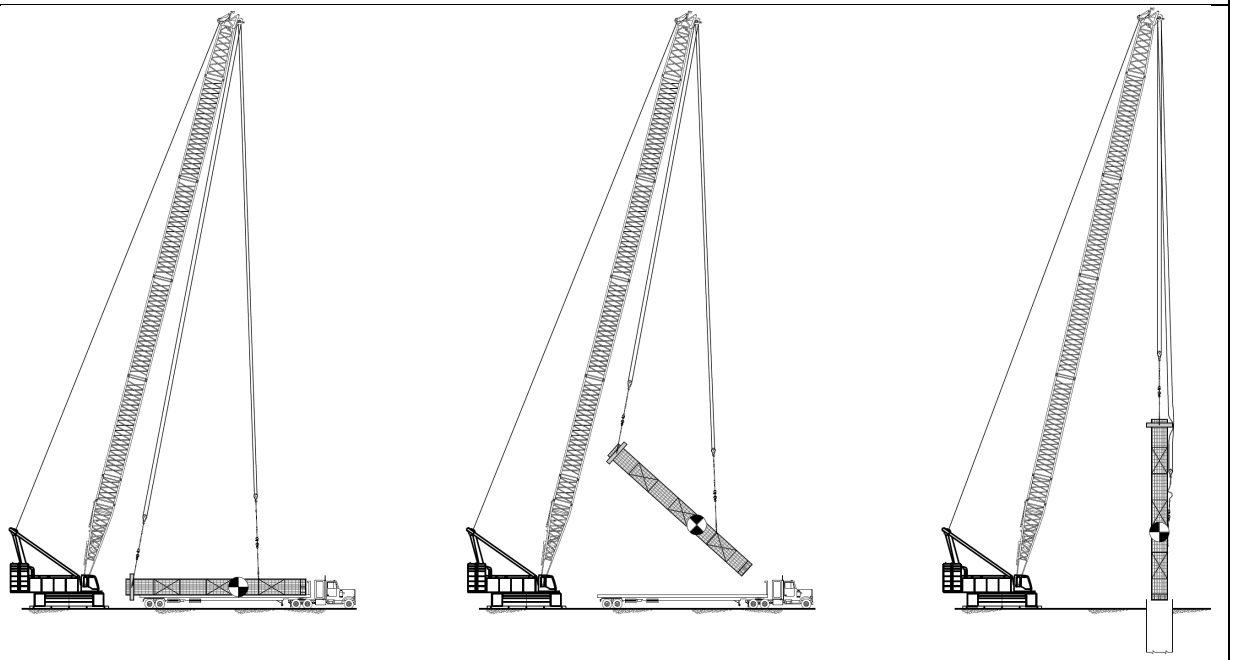
5° Bending for visualization



Example dimensions of U-bolt & plate compatible with #11 longitudinal rebar



Example graphics of upending procedure - Two pick-up points with a drill rig and an excavator



Example graphics of upending procedure - Two pick-up points with one crane