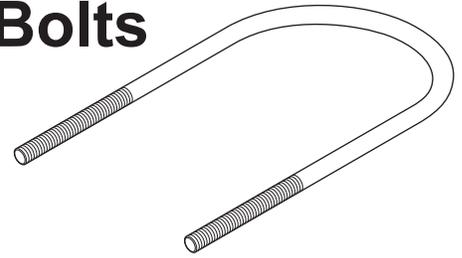


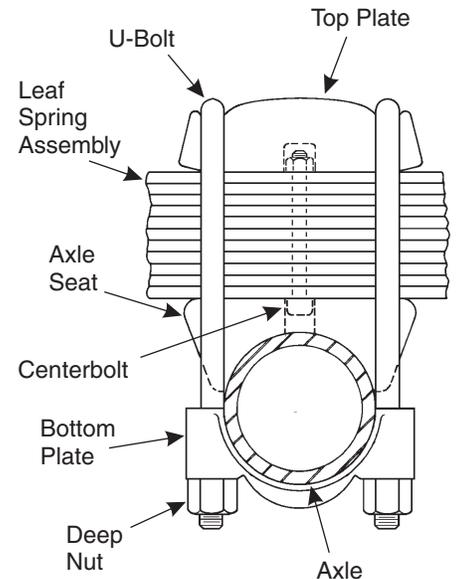
U-Bolts



What does a U-bolt do?

A U-bolt serves in four critical and related roles:

- Primarily, the U-bolt provides the force required to clamp the leaf spring and related components firmly together. In addition to the leaf spring, these components include the top plate, axle seat, axle and bottom plate.
- The properly installed U-bolt eliminates any flexing of the leaf spring in the area between the U-bolts. This is particularly critical since the hole for the centerbolt in each leaf acts as a stress concentration which would lead to rapid leaf breakage if spring flexing was not totally eliminated by the U-bolt clamping force.
- By firmly clamping the spring to the axle seat the horizontal forces acting on the centerbolt are greatly reduced which in turn prevents shearing of the centerbolt.
- Proper clamping of the spring by the U-bolts provides the desired spring stiffness and contributes to maintaining the vehicle ride height and handling characteristics as originally specified for the vehicle.

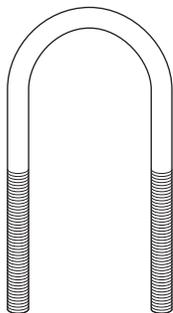


Types of U-bolts

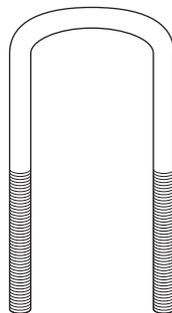
Three basic types of bends are used on U-bolts depending on the suspension design and the shape of the mating parts:

1. Round Bend
2. Semi-Round Bend
3. Square Bend

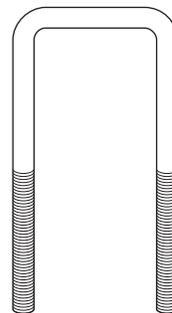
Additionally, each of these bend types may use forged material. This is used primarily where additional clearance is required between the U-bolts and, for example, the frame.



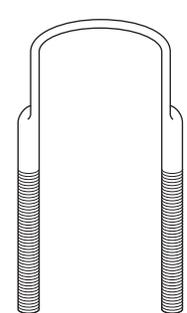
Round Bend



Semi-Round Bend



Square Bend



Forged Top
Semi-Round Bend

U-Bolts

Technical Information

U-Bolt Grades

The U-bolt grade is a measure of the material's strength. Grades 5 and 8 are the most commonly used with grade 8 material offering an increase in yield strength of over 40% better than that of grade 5 material. This allows for higher torque levels, and thereby, improved spring clamping.

Available in 5/8" through 1 1/4" diameters, grade 8 is the recommended choice for all applications except in four spring trailer suspensions where grade 5 has been determined to provide adequate strength. If the original grade or the application is unknown, grade 8 material is always the safest choice.

U-Bolt Torque and Clamping Force

As explained on page 1 the primary function of the U-bolt is to provide the clamping force required to rigidly clamp the spring to the axle assembly. From a practical standpoint it is not possible to directly measure the clamping force when installing a U-bolt. Therefore, torque specifications are relied on as an indirect measure of the clamping force.

The formula for the relationship between torque and clamping force is:

$$\text{Clamping Force} = \frac{\text{Torque}}{K \times \text{Diameter}}$$

The importance of this formula is in how the clamping force is influenced by "K" which is a measure of the friction between the nut and the U-bolt threads and washer. The higher the friction, the less clamping force that is developed with the same torque.

Example: (Assuming 1" rod and 500 ft-lbs. of Torque)

K = 0.20 ***(New U-bolt and nut with lubricated threads)***
Clamping force = 30,000 lbs.

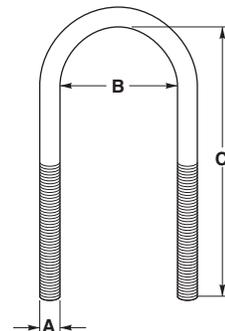
K = 0.45 ***(Reused U-bolt with dry and damaged threads)***
Clamping force = 13,300 lbs.

Clamping force is reduced by over 55% even though the reading on the torque wrench is identical. The importance of using new U-bolts and nuts with lubricated threads is essential to maintain required clamping forces.

How to measure a U-bolt

Regardless of the bend type, all U-bolts are measured in the same manner as shown here. The U-bolt size is given as Diameter (A) x Distance Between Legs (B) x Leg Length (C). Additionally the bend type must also be specified; either round, semi-round or square. See the additional information given on page 3 to avoid problems in specification of semi-round bend shapes.

Forged top U-bolts are best ordered by application and leg length since the type of forging is usually unique to the particular application and must be maintained to provide proper fit and clearance. Refer to Dayton's Threaded Rod and U-bolt Catalog (2T), Leaf Springs - Taper and Multileaf Catalog (215), or Suspension Components Catalog (211) for assistance in forged U-bolt selection.



How to Measure a U-Bolt

Technical Information *(continued)*

Semi-Round U-bolt Fit

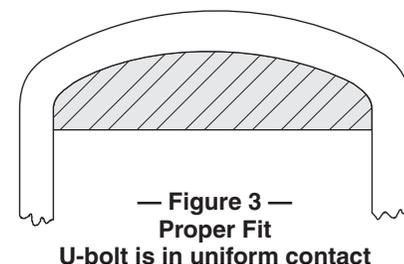
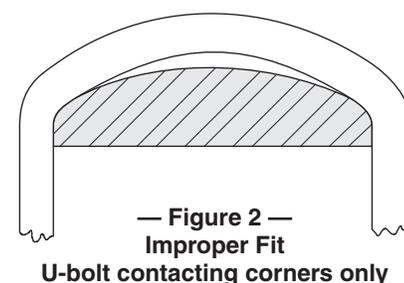
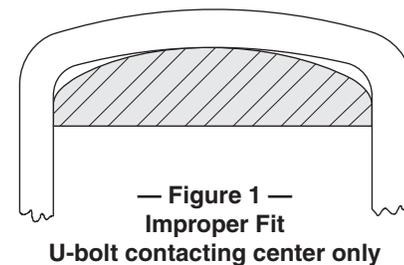
An often overlooked cause of failure to maintain proper U-bolt clamping force is the potential for mismatch between the shape of the semi-round U-bolt and its mating part, the top plate. Unlike either square or round bend U-bolts where the shapes from one manufacturer to another usually do not vary significantly, semi-round bend shapes are usually unique to a particular vehicle or suspension manufacturer. The following three figures show what can happen when using semi-round U-bolts.

In **figure 1** the U-bolt has been formed with a shape that causes all the pressure to be concentrated at the center of the top plate. As the spring flexes under normal use the U-bolt will tend to work into the top plate which will lead to loose U-bolts and possibly premature spring failure.

In **figure 2** the shape mismatch is causing the pressure to be concentrated at the corners of the top plate. Again, deformation of the top plate will occur, clamping force will be lost and premature spring failure could result.

In **figure 3** the proper U-bolt fit has been achieved. Note how the shape of the U-bolt closely matches that of the top plate thereby ensuring that the pressure from the U-bolt is evenly distributed along the width of the top plate. With the load evenly distributed, the possibility of the U-bolt working loose is greatly reduced.

When working on an application using semi-round U-bolts, visually inspect for proper match between the U-bolt and top plate before attempting installation. By ordering semi-round U-bolts by application rather than just by the general description of "semi-round" this type of problem can be avoided. **See catalogs - 2T, 215, or 211 for specific application details.**



Service Recommendations

By following the service tips outlined below, many of the common problems associated with U-bolts can be avoided.

Do not reuse U-bolts

- Used U-bolts will have rusted and damaged threads from the previous installation.
- A previously torqued U-bolt will suffer from distorted threads from the engagement of the deep nut. Deep nuts should be tightened once and retorqued, never loosened and retightened.
- A used U-bolt may have suffered from fatigue as well excessive stress since achieving accurate torque with commonly used impact wrenches is very difficult.

As previously explained, the primary function of the U-bolt is to maintain the clamping force on the spring assembly and related parts. Since clamping force is a function of the condition of the U-bolt, the damaged threads of the used U-bolt will make reaching this force very difficult. Considering that reusing U-bolts can lead to premature spring failure and other suspension damage it is clear that U-bolts should never be reused.

Inspect for signs of loose U-bolts

Virtually all leaf spring failures through the center hole are caused by inadequate U-bolt clamping. Also look for signs of movement within the area between the U-bolts. Worn or polished surfaces on axle seats or top plates are sure indicators that unwanted movement has occurred. Closely inspect and if necessary replace each damaged component.

Retorque the U-bolts

Retighten U-bolts after the first 500 to 1,000 miles. As new or repaired springs wear in, some settling of the spring stack will occur. Even a minor amount of this settling can cause a dramatic reduction in U-bolt clamping force. If possible, retorquing of U-bolts should be done with the vehicle under load.

U-Bolts

Service Recommendations *(continued)*

Use recommended torque specifications

Compared to other fasteners, recommended torque levels for U-bolts are significantly lower. This is due mainly to the stress concentration effect of the U-bolt bend itself, the dynamic loading that the spring transmits to the U-bolt and the difficulty of achieving even stress on both legs of a U-bolt.

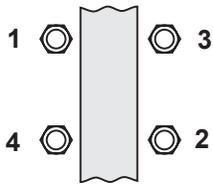
Recommended torque levels from the vehicle or suspension manufacturer should always be used where possible. If these specifications are unknown, the following chart can be used as a guide.

Suggested Torque Values for U-bolts

Grade 5		Grade 8	
Size (Diameter x Thread)	Torque (Ft. lbs.)	Size (Diameter x Thread)	Torque (Ft. lbs.)
3/8-24	30	5/8-18	170
7/16-20	45	3/4-16	300
1/2-20	65	7/8-14	480
9/16-18	90	1-14	740
		11/8-14	1300
		11/4-14	1780

Torque U-bolts Evenly

Follow these guidelines when installing U-Bolts:



- Lubricate U-Bolts and washers with oil or anti-seize compound to reduce nut friction.
- Tighten all U-Bolts until they are snug only.
- Tighten in the sequence shown to approximately 1/3 of recommended torque.
- Repeat, using the same sequence, gradually increasing the torque through a second and third stage until the recommended final torque is attained.



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