

Automotive Engines Theory and Servicing

Ninth Edition

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Theory and Servicing

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Chapter 3

Fasteners and Thread Repair

ALWAYS LEARNING

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OBJECTIVES

- 3.1 Identify bolts and explain the strength ratings of threaded fasteners.
- 3.2 Discuss the purpose of nuts, taps, dies, and washers.
- 3.3 Discuss how snap rings and clips are used.
- 3.4 Explain how to avoid broken fasteners.
- 3.5 Compare the different types of thread repair inserts.

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THREADED FASTENERS

- The fastener threads must match the threads in the casting or nut.
- The threads may be measured either in fractions of an inch or in metric units.
- The size is measured across the outside of the threads.

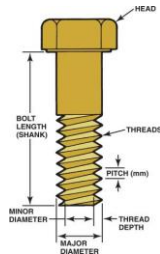


FIGURE 3-1 The dimensions of a typical bolt showing where sizes are measured. The major diameter is called the crest.

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METRIC BOLTS

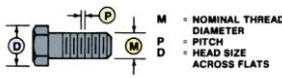
- The size of a metric bolt is specified by the letter M followed by the diameter in millimeters (mm) across the outside (crest) of the threads.
- Typical metric sizes would be M8 and M12.
- Fine metric threads are specified by the thread diameter followed by X and the distance between the threads measured in millimeters (M8 X 1.5).

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FIGURE 3-4 The metric system specifies fasteners by diameter, length, and pitch.

METRIC HEXAGON HEAD CAP SCREWS
ALL MEASUREMENTS IN MILLIMETERS



M	P	D	M	P	D	M	P	D
1.6	0.35	3.2	10	1.00	17	20	1.50	30
1.7	0.35	3.5	10	1.25	17	20	2.50	30
2	0.40	4	10	1.50	17	22	1.50	32
2.3	0.40	4.5	12	1.25	19	22	2.50	32
2.5	0.45	5	12	1.50	19	24	2.00	36
3	0.50	5.5	12	1.75	19	24	3.00	36
3.5	0.50	6	14	1.50	22	27	3.00	41
4	0.70	7	14	2.00	22	30	3.50	46
5	0.80	8	16	1.50	24	33	3.50	50
6	1.00	10	16	2.00	24	36	4.00	55
7	1.00	11	18	1.50	27	39	4.00	60
8	1.00	13	18	2.50	27	42	4.50	65
8	1.25	13	18			45	4.50	70

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GRADES OF BOLTS (1 OF 2)

- Bolts are made from many different types of steel, and for this reason some are stronger than others.
- The strength or classification of a bolt is called the grade.
- The bolt heads are marked to indicate their grade strength.

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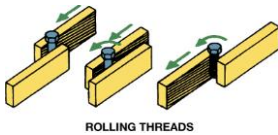
GRADES OF BOLTS (2 OF 2)

- Graded bolts are commonly used in the suspension parts of the vehicle but can be used almost anywhere in the vehicle.

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FIGURE 3-5 Stronger threads are created by cold-rolling a heat-treated bolt blank instead of cutting the threads using a die.



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TENSILE STRENGTH

- What is tensile strength?
- Metric bolt tensile strength property class is shown on the head of the bolt as a number, such as 4.6, 8.8, 9.8, and 10.9
 - The higher the number, the stronger the bolt

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FIGURE 3-6 Metric bolt (cap screw) grade markings and approximate tensile strength.



METRIC CLASS	APPROXIMATE MAXIMUM POUND FORCE PER SQUARE INCH
4.6	60,000
8.8	120,000
9.8	130,000
10.9	150,000

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NUTS (1 OF 2)

- Most nuts used on cap screws have the same hex size as the cap screw head.
- Metric nuts are often marked with dimples to show their strength.
 - More dimples indicate stronger nuts.

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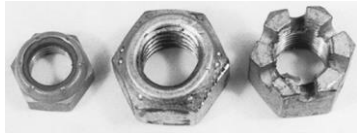
NUTS (2 OF 2)

- Some nuts and cap screws use interference fit threads to keep them from accidentally loosening.
- Nuts can also be kept from loosening with a nylon washer fastened in the nut or with a nylon patch or strip on the threads.

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FIGURE 3-7 Types of lock nuts. On the left, a nylon ring; in the center, a distorted shape; and on the right, a castle for use with a cotter key.



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TAPS AND DIES (1 OF 3)

- Taps and dies are used to cut threads.
 - Taps are used to cut threads in holes drilled to an exact size depending on the size of the tap.
 - A die is used to cut threads on round rods or studs.

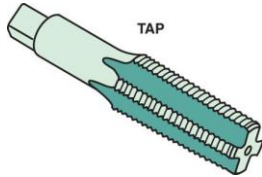


FIGURE 3-8 A typical bottoming tap used to create threads in holes that are not open, but stop in a casting, such as an engine block.

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TAPS AND DIES (2 OF 3)

- Most taps and dies come as a complete set for the most commonly used fractional and metric threads.
 - Taps
 - Taper Tap
 - Bottoming Tap

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TAPS AND DIES (3 OF 3)

- Dies
- Proper Use of Taps and Dies
 - Tap Usage
 - Die Usage

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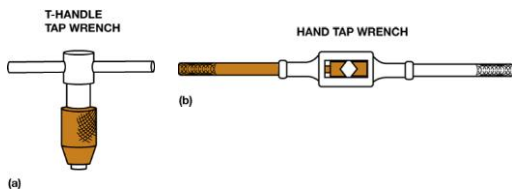
FIGURE 3-10 A die is used to cut threads on a metal rod.



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FIGURE 3-11 (a) A T-handle is used to hold and rotate small taps. (b) A tap wrench is used to hold and drive larger taps.



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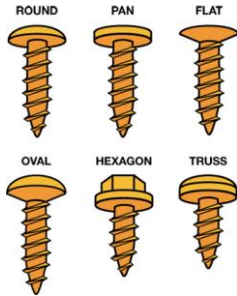
SHEET METAL SCREWS

- What are sheet metal screws?
- How can you reinstall self-tapping screws?

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FIGURE 3–15 Sheet metal screws come with many head types.



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WASHERS

- Washers are often used under cap screw heads and under nuts.



FIGURE 3–16 Various types of nuts (top) and washers (bottom) serve different purposes and all are used to secure bolts or cap screws.

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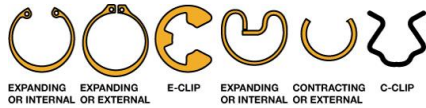
SNAP RINGS AND CLIPS

- Snap Rings
 - Constructed of spring steel
 - Used to attach parts without a threaded fastener
- Door Panel Clips
- Pins
- Rivets
- Locking Nuts

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FIGURE 3-17 Some different types of snap rings. An internal snap ring fits inside of a housing or bore, into a groove. An external snap ring fits into a groove on the outside of a shaft or axle. An E-clip fits into a groove in the outside of a shaft. A C-clip shown is used to retain a window regulator handle on its shaft.



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BROKEN FASTENER REMOVAL

- Try not to break, strip, or round off fasteners
- Don't force fasteners loose
- Left-handed threads
- Penetrating oil
- Proper tightening

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THREAD REPAIR INSERTS (1 OF 2)

- Thread repair inserts are used to replace the original threaded hole when it has become damaged beyond use.
- The original threaded hole is enlarged and tapped for threads and a threaded insert is installed to restore the threads to the original size.
 - Helical Inserts

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THREAD REPAIR INSERTS (2 OF 2)

- Threaded Inserts
- Self-tapping Inserts
- Solid-bushing Inserts
- Key-locking Inserts

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FIGURE 3–24 Helical inserts look like small, coiled springs. The outside is a thread to hold the coil in the hole, and the inside is threaded to fit the desired fastener.



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SUMMARY (1 OF 3)

- The most common type of fastener is a threaded one often referred to as a bolt.
- A nut or threaded hole is used at the end of a bolt to fasten two parts together.
- The size of threaded fasteners includes the diameter, length, and pitch of the threads, as well as the shape of the head of the bolt.

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SUMMARY (2 OF 3)

- The diameter across the threads of metric bolts is in millimeters followed by the distance between the threads measured in millimeters.
- Graded bolts are hardened and are capable of providing more holding force than nongraded bolts.

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SUMMARY (3 OF 3)

- Many nuts are capable of remaining attached to the bolt regardless of vibration. These types of nuts are often called prevailing torque nuts.
- Threads can be repaired using a Heli-Coil® or threaded insert.

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