

Topic No.	Rev. Level	Topic Date	Group No.	
98T2-13	–	01-Sep-1998	02	
Expiration Date (U.S. and Canada): –		Expiration Date (International): –		
Engine Family	Fuel System	Plant	Build Date	
			From	To
4B, B3.9	All	Default	01-Jan-1986	31-Dec-9999
6B, ISB, QSB5.9, B5.9	All	Default	01-Jan-1986	31-Dec-9999
Design Application		Market Application		
All		All		

B Cylinder Head Capscrew - Torque Plus Angle (T594)

This Service Parts Topic pertains to the new Cylinder Head Capscrew - Torque Plus Angle procedure. This service parts topic supersedes 91T2-9A. Remove 91T2-9A from your files.

The purpose of this service parts topic is to revise the torque plus angle procedure. This procedure has been revised due to cylinder head gasket relaxation and to obtain proper cylinder head capscrew torque.

NOTE

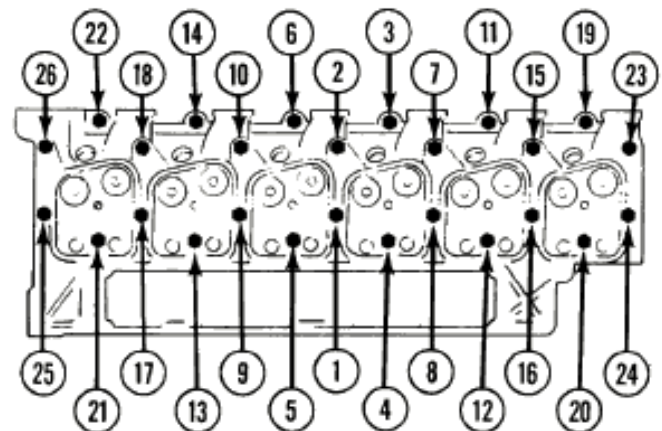
Recommended Service Tools:

Cylinder head capscrew length gauge, Part No. 3823921
Torque angle gauge for 1/2-inch drive, Part No. 3823878
Torque angle gauge for 3/4-inch drive, Part No. 3823879
Torque wrench validator, Part No. 3824532.

Cylinder Head Capscrew Removal Sequence

18 mm

Remove the cylinder head capscrews in the sequence shown.



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⚠ WARNING ⚠

The component weighs 23 kg [50 lb] or more. To avoid personal injury, use a hoist or get assistance to lift the component.

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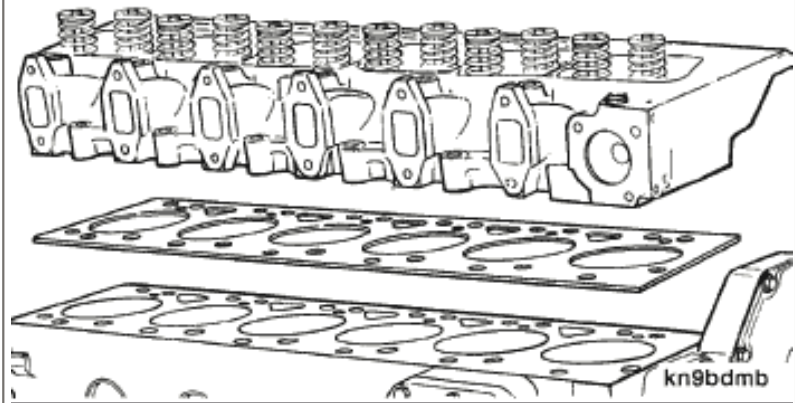
Remove the cylinder head from the block.

Cylinder head weight:

Four Cylinder - 36 kg [80 lb]

Six Cylinder - 51.3 kg [114 lb]

NOTE: Inspect the coolant passages. A large buildup of rust and lime will require removal of the cylinder block for cleaning in a hot tank.



Previous Step

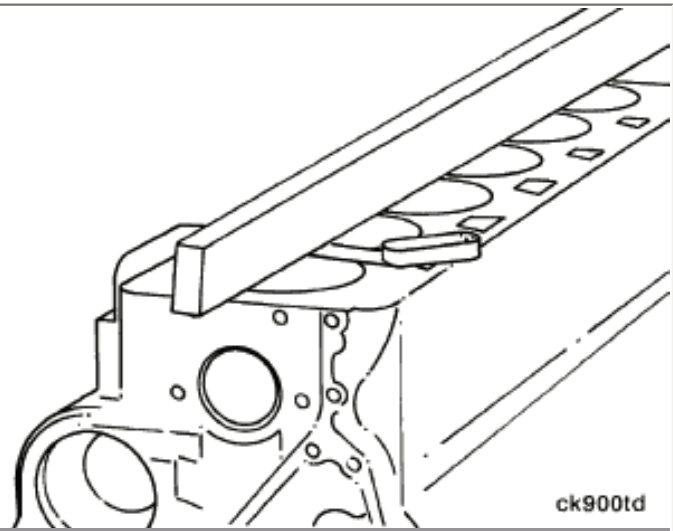
Next Step

Straightedge and Feeler Gauge

Use a straightedge and feeler gauge to measure the overall flatness of the cylinder block. The overall flatness end-to-end and side-to-side **must not** exceed 0.075 mm [0.003 in].

Inspect the combustion deck for any localized dips or imperfections. If present, the cylinder block head deck **must** be ground.

Refer to the alternate repair manual for regrinding/milling procedures and limits.

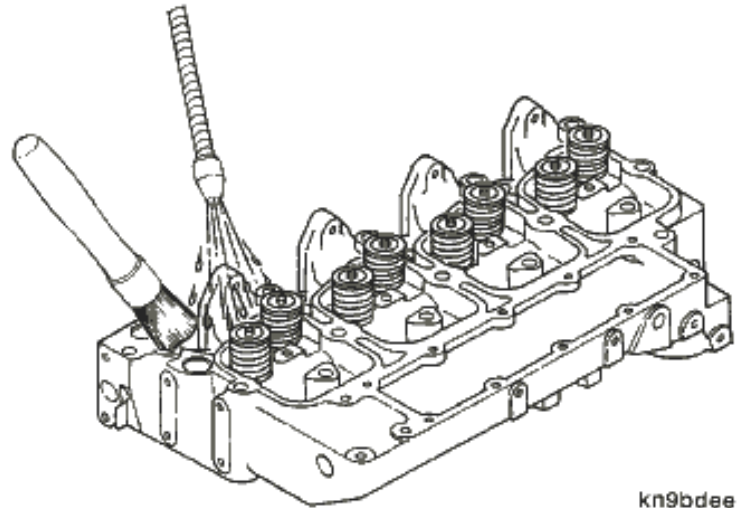


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Cylinder Head - Precheck

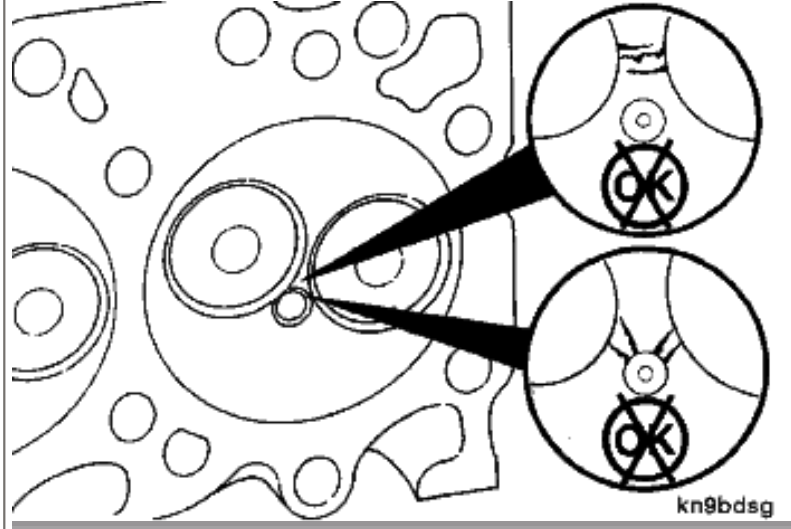
Clean the cylinder head with solvent.



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Next Step

Inspect the cylinder head for obvious damage that would prohibit reuse. Check for cracks and damage to the deck surface that would result in loss of sealing.



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⚠ CAUTION ⚠

Do **not** use caustic or acidic solutions to clean the cylinder head capscrews. The use of these solutions can damage the capscrew.



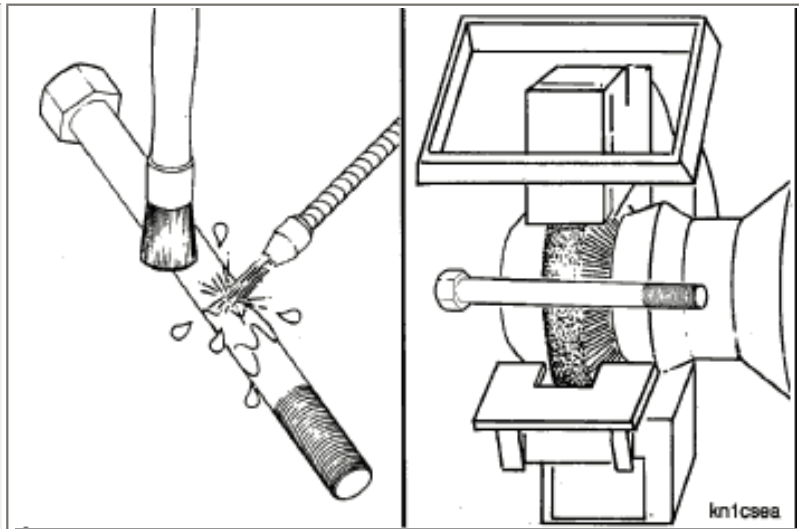
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Cylinder Head Capscrews

Use a petroleum-based solvent to clean the capscrews.

Clean the capscrews thoroughly with a wire brush, a soft wire wheel, or use a nonabrasive bead blast to remove deposits from the shank and threads.

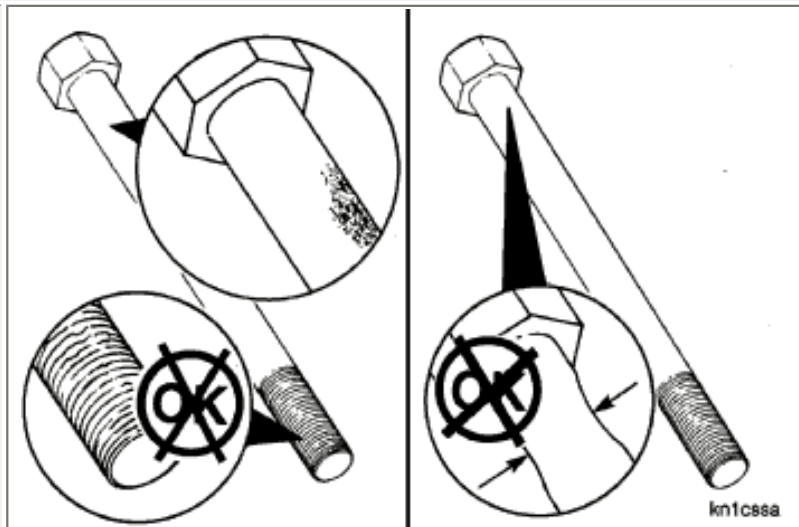


Previous Step

Next Step

Inspect the cylinder head capscrews for damaged threads, corroded surfaces, or a reduced diameter (due to stretching).

NOTE: Do **not** reuse a capscrew that has damaged threads or a reduced diameter from having been stretched.

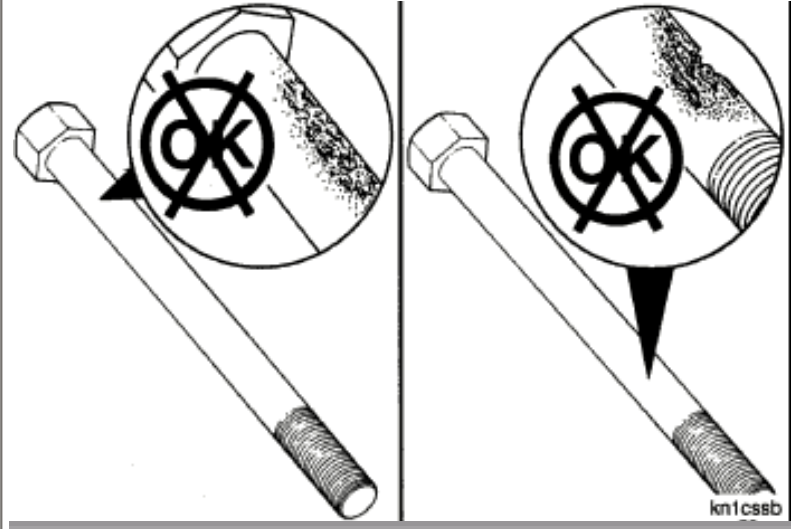


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Do **not** use cylinder head capscrews under the following conditions:

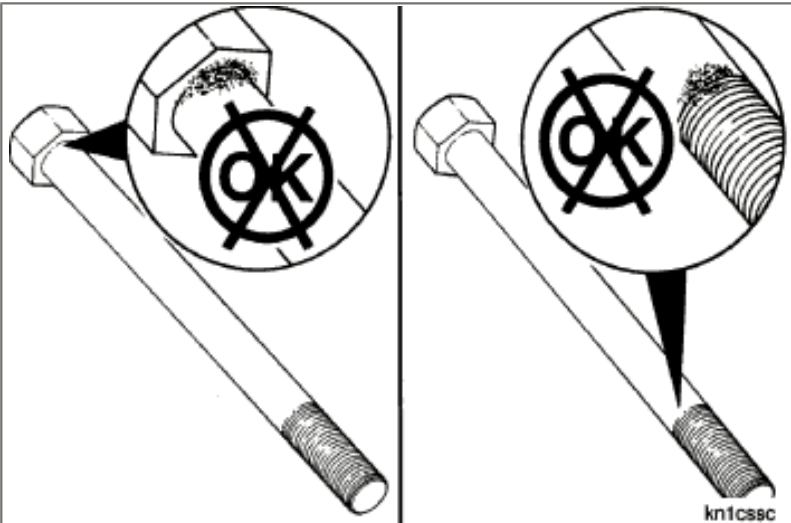
1. Corrosion or pitting exceeds 1 sq cm [0.155 sq in] in area.
2. Acceptable = $\frac{3}{8} \times \frac{3}{8}$ inch
3. Unacceptable = $\frac{1}{2} \times \frac{1}{2}$ inch
4. Corrosion or pitting exceeds 0.12 mm [0.005 in] in depth.



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5. Corrosion or pitting is located within 3.2 mm [$\frac{1}{8}$ in] of the fillet.
6. Corrosion or pitting is located within 3.2 mm [$\frac{1}{8}$ in] of the threads.
7. Stretched beyond “free length” maximum. Refer to the measurement procedure below.



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Cylinder Head Capscrew Reuse Guidelines

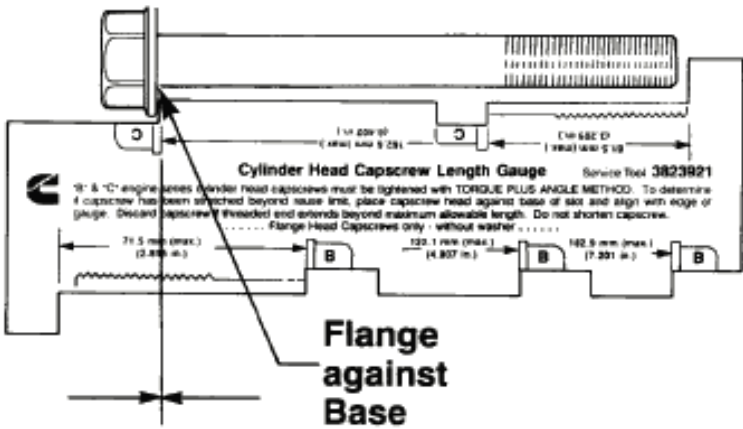
Service Tool Part No. 3823921

Free-Length Measurement

To check the capscrew free length, place the head of the capscrew in the appropriate slot with the flange against the base of the slot.

NOTE: If the capscrews are **not** damaged, they can be reused throughout the life of the engine unless the specified **free length** is exceeded.

Capscrew Free Length		
	mm	in
Short	71.5	2.815
Medium	122.1	4.807
Long	182.9	7.201



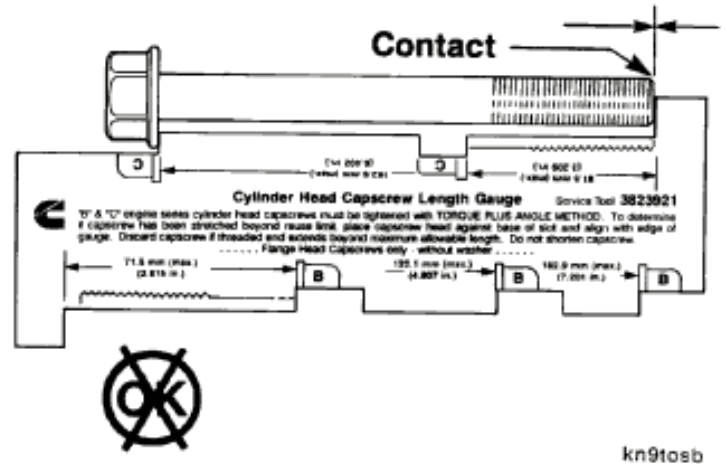
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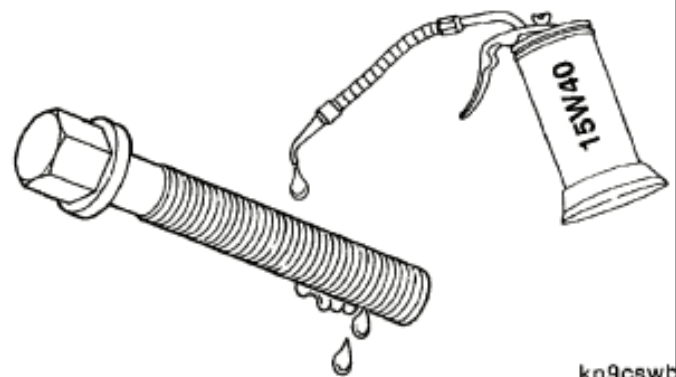
Next Step

If the end of the capscrew touches the foot of the gauge, the capscrew is too long and **must** be discarded.

NOTE: Do **not** use any cylinder head capscrews that are cracked, pitted, or rusted in the shank or the threaded areas.


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Immediately after cleaning and inspecting, apply a film of clean lubricating oil to the capscrews that are to be used again.



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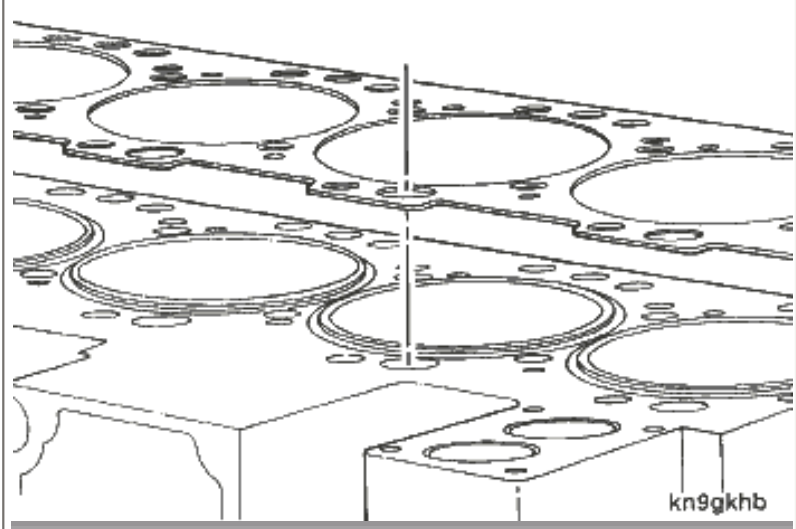
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Installation

NOTE: Make sure the head gasket is correctly aligned with the holes in the cylinder block.

The cylinder block and head **must** be clean and dry.

Position the gasket onto the dowels.



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Do **not** drop the cylinder head on the cylinder head gasket. The gasket material can be damaged.

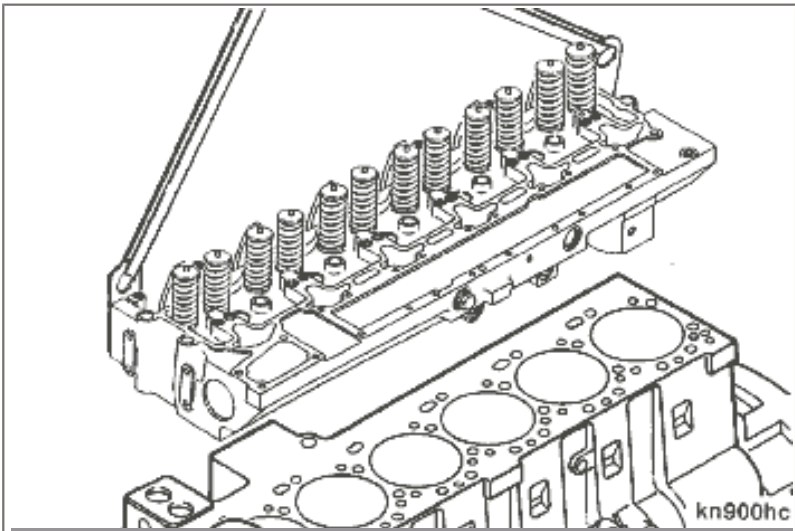


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Carefully install the cylinder head onto the gasket and cylinder block.

NOTE: Make sure the cylinder head is installed onto the dowels in the cylinder block.

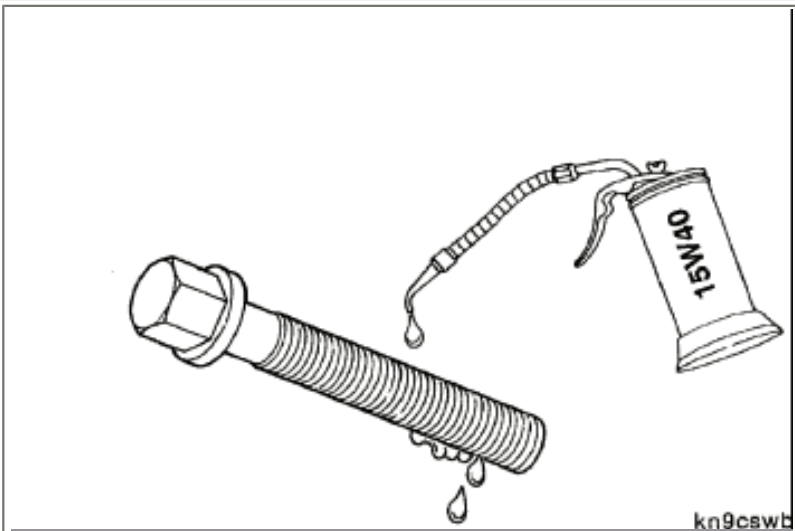


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Use clean 15W-40 oil to coat the cylinder head capscrew threads and underneath the head flange.

Allow excess oil to drain from the capscrew threads.

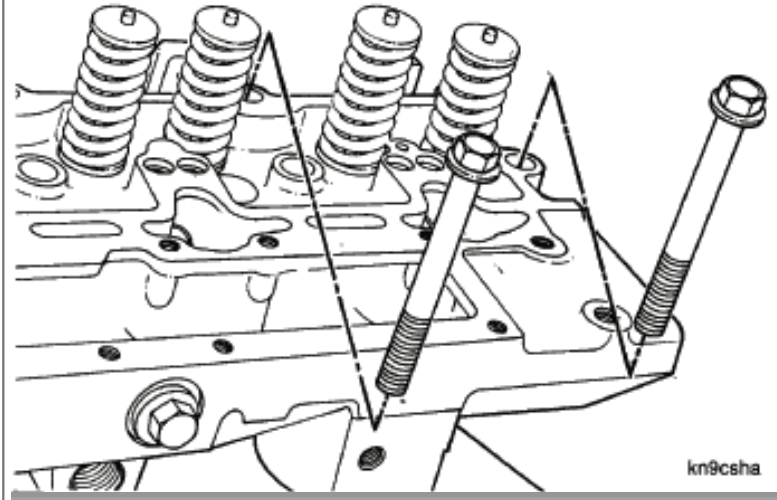


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Install capscrews in the cylinder head.

NOTE: Be sure to install the six capscrews into the holes underneath the injectors.

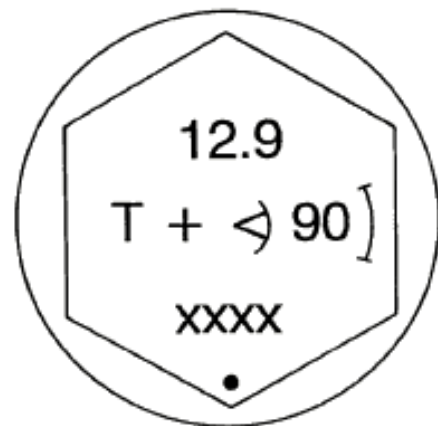


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NOTE: The top of the cylinder head capscrew is identified with an angle marking. The cylinder head capscrews **must** be tightened by using the three-step “torque plus angle” method, described as follows:

Lubricate the threads and under the capscrew head of the cylinder head capscrews with clean engine oil.



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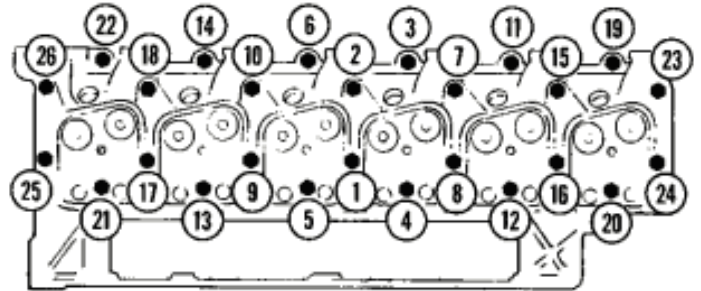
Previous Step

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1. Follow the numbered sequence, and tighten all the capscrews:

Follow the numbered sequence, and recheck the torque on all the capscrews.

Torque Value: (Step one) 90 N•m [66 ft-lb]



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Previous Step

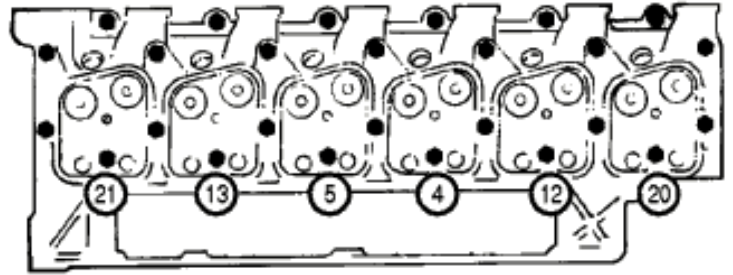
Next Step

2. Follow the numbered sequence, and tighten **only** the six long capscrews.

Follow the numbered sequence and check again the torque on the six long capscrews.

Torque Value: (Step two) 120 N•m [90 ft-lb]

3. Repeat steps 1 and 2 because of cylinder head relaxation and to obtain proper cylinder head torque requirements.



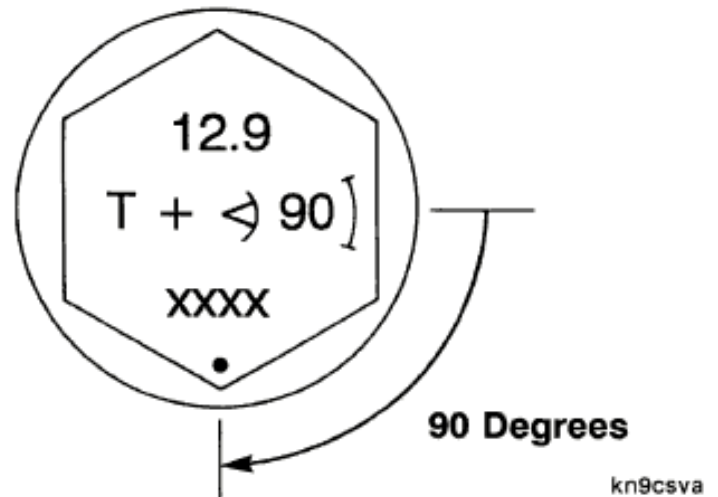
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4. Follow the numbered sequence, and turn the capscrew 90 degrees as indicated on the capscrew head.

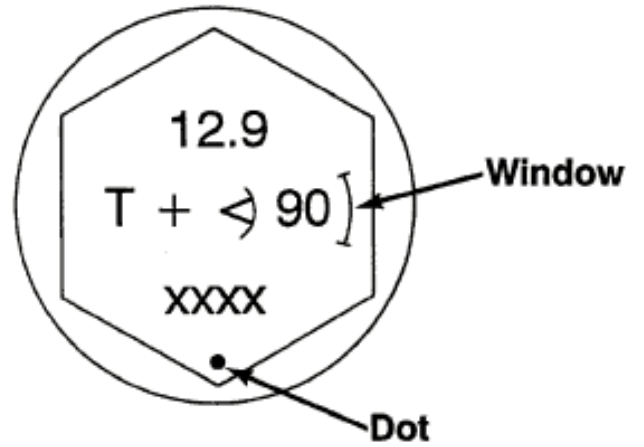


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To turn the capscrew to the desired angle accurately, align the capscrew with the small “dot” and “window” that are marked on the capscrew head, or use recommended service tool, Part No. 3823878, torque angle gauge for 1/2-inch drive and/or Part No. 3823879, torque angle gauge for 3/4-inch drive.

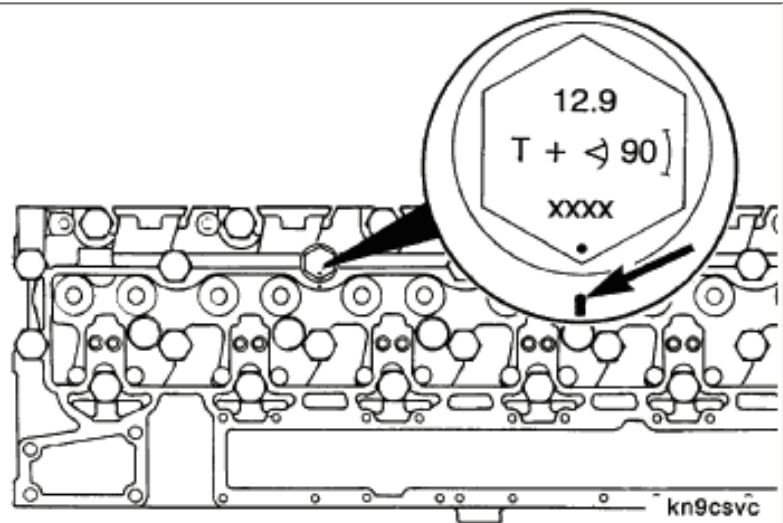


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Previous Step

Next Step

Mark the cylinder head adjacent to the dot on the capscrew head. This mark will serve as an indexing aid.

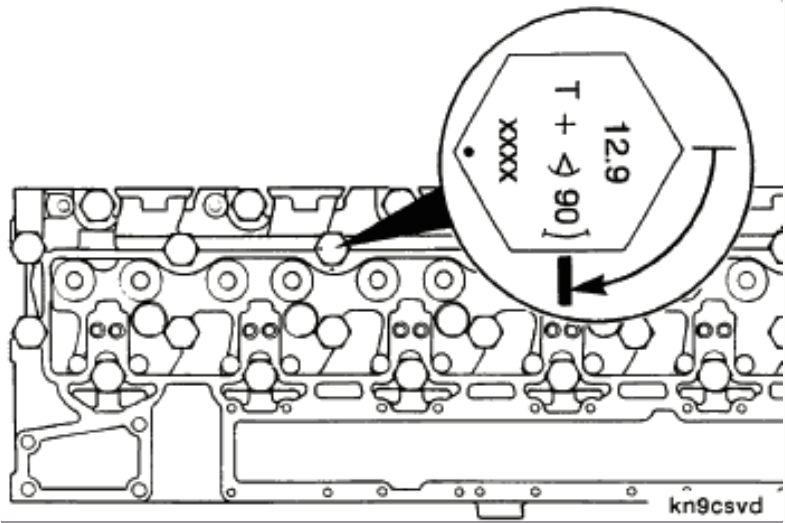


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Next Step

Rotate the capscrew until the mark that has been made on the cylinder head falls into the window on the capscrew head.

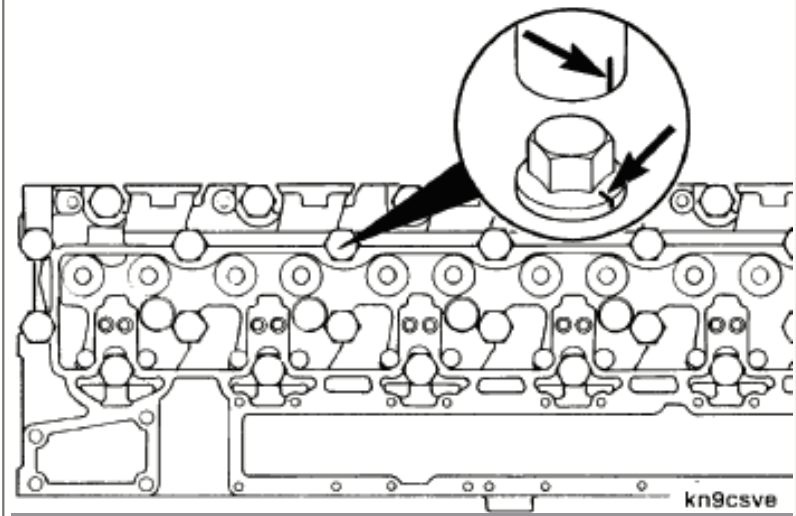


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Service Tip:

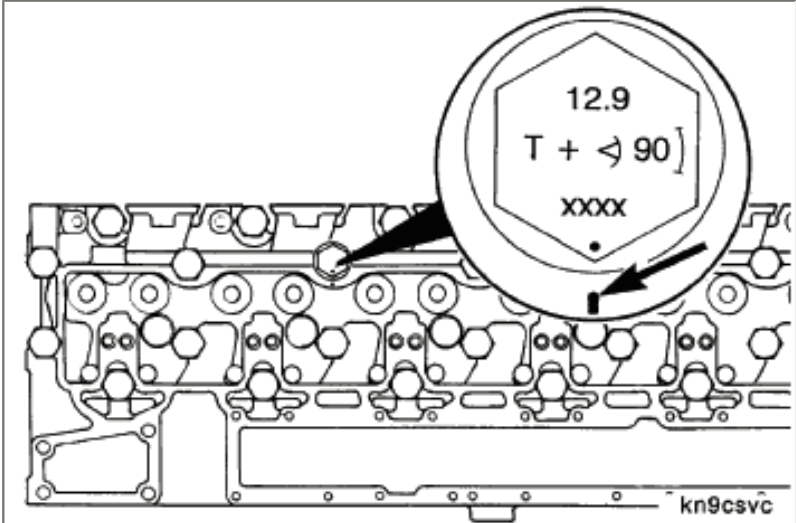
Use a permanent marker to mark the socket corresponding to one of the flats of the socket hex.



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Next Step

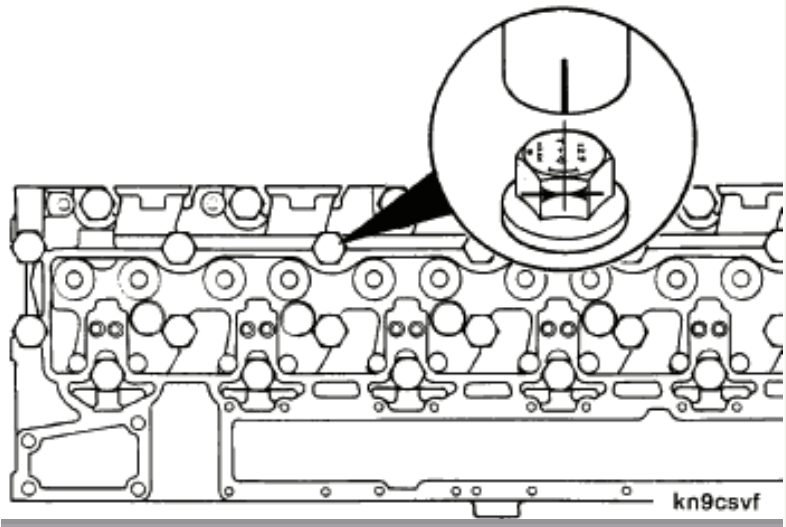
After the torque has been applied, mark the cylinder head at the location of the dot.



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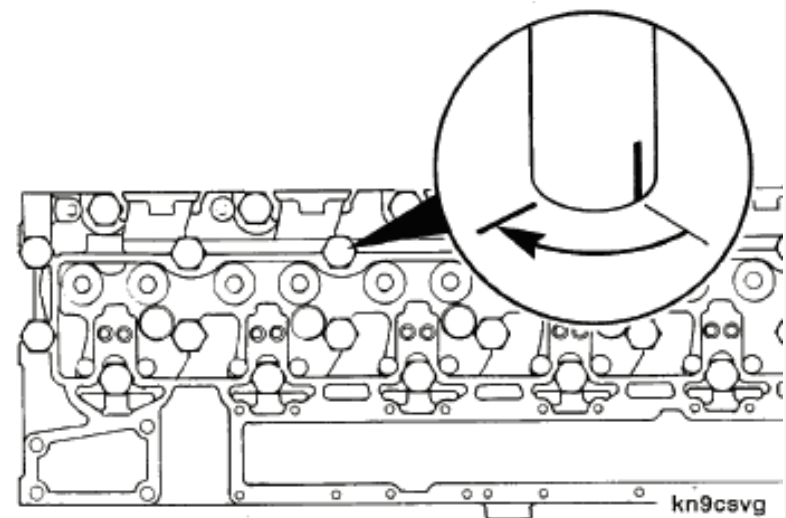
Position the socket on the capscrew such that the mark on the socket is at the same point as the window on the capscrew.



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Turn the socket until the mark on the socket aligns with the mark on the cylinder head.



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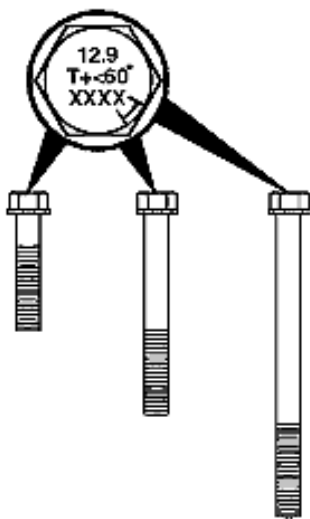
Cylinder Head Capscrew Information for B Series Engines

Each capscrew has been marked with symbols and an angle specification to simplify the tightening procedure. The capscrew part numbers can be identified by inspecting the marks on the capscrew head. Below is a list of the pre-'91 capscrews and capscrews with the identifying marks on the head.

NOTE

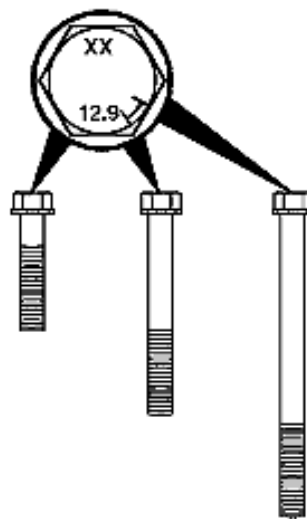
Do **not** use pre-'91 cylinder head capscrews in a '91 engine. The '91 cylinder head capscrews can be used in a pre-'91 engine.

Pre-'91 Capscrew Part No.	Length	New '91 Capscrew Part No.	Length
3903938	Short	3920779	Short
3903839	Medium	3920780	Medium
3903940	Long	3920781	Long



1991B Series

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Pre-91B Series

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Topic No.	Rev. Level	Topic Date		Group No.
98T2-13S1	–	01-Nov-1998		02
Expiration Date (U.S. and Canada): –		Expiration Date (International): –		
Engine Family	Fuel System	Plant	Build Date	
			From	To
6B, ISB, QSB5.9, B5.9	All	Default	01-Jan-1986	31-Dec-9999
Design Application		Market Application		
All		All		

Cylinder Head Bolt Torque Addendum for B Series Engines (T657)

This service parts topic is an addendum to the cylinder head bolt torque plus turn procedure for the B Series engines.

B Series

All B Series engines (including pre-'91 certification levels) need to use the new torque plus turn procedure defined in topic 98T2-13.

Capscrews for the '91 and later certification level engines are the same overall length but have a longer threaded area.



Do **not** use pre-'91 B certification level engine capscrews in a '91 B or later certification level engine because pre-'91 capscrews do **not** have enough threads to provide adequate thread engagement in the '91 and later certification engines.

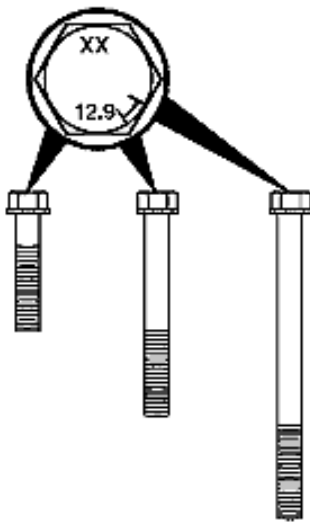


B Series only: Capscrews for a '91 B or later certification level engine can be used in a pre-'91 certification level engine because '91 and later capscrews have enough threads to provide adequate engagement in all certification level engines.

Each '91 and later certification capscrew has been marked with symbols and an angle specification. The capscrew type can be identified by inspecting the marks on the capscrew head.

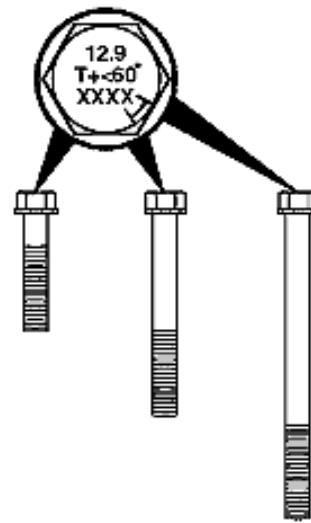
Pre-'91 Capscrew Part No.	Length	'91 Capscrew Part No.	Length
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3903938	Short	3920779	Short
3903939	Medium	3920780	Medium
3903940	Long	3920781	Long



Pre-'91 B Series

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'91 B Series

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