

# How Place Bolts Work

by Ian Pinchback, Tim Pinchback and Robert Lemons

The asymmetric place bolt is a one-piece, free-spinning, all-metal, self-locking hex bolt. Its unique head design provides the locking action. This is a very important feature because not only does it provide the bolt more elasticity, it also serves to produce up to seven times the vibration life of conventional hex cap screws. These cold-formed fasteners are not only strong and durable but reusable as well.

The type "B" and "BH" five-slot asymmetric place bolts are listed in military specification drawing MS35763 and MS35764. These products are often used in such varied military and commercial applications as diesel engine flywheels, cylinder heads, transmission covers, flex plates, torque converter members, ring gears, drive wheel sprockets, track assemblies, tank race rings and compressor mountings.

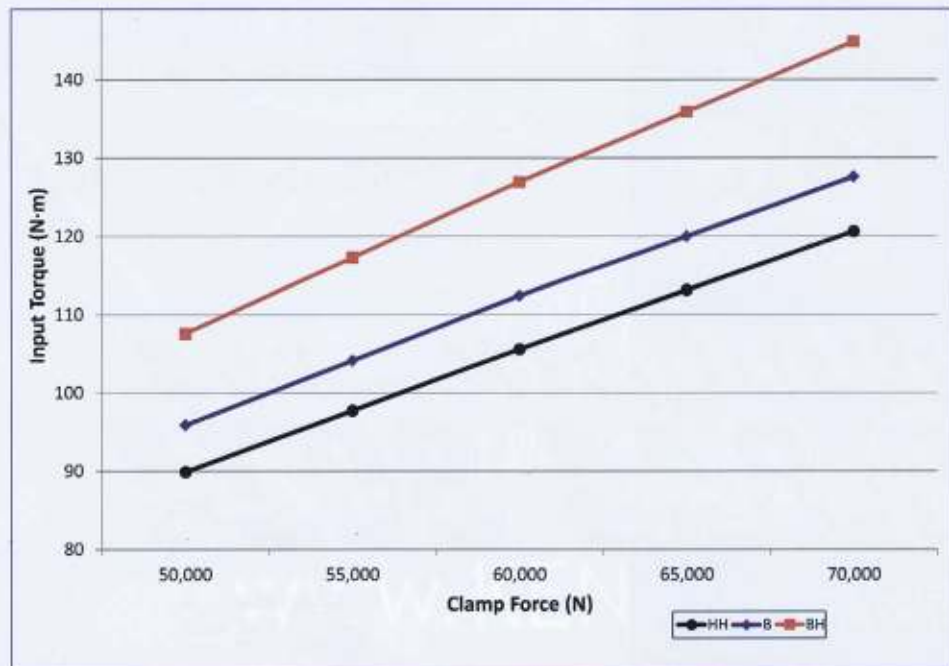
The asymmetric place bolt features in its head design two important factors: asymmetric form and elastic diaphragm action. The asymmetric design with five slots in the top of the head moves the center of mass away from the center line of the bolt. This

provides a powerful force that resists rotational loosening. Type "BH" bolts are one hex size larger than type "B" bolts, thus moving the center of mass even further from the axis of the bolt and increasing the locking force.

When tightening the bolt, a diaphragm action furnishes additional elastic elongation. The asymmetric recess under the head, adjacent to the shank, places the load on the outer surface of the seating face, causing the elastic diaphragm to act as a controlled spring element. Under equal load, the stress and strain on the low mass side of the head is greater. This generates more elastic flexing and extension on the low mass side. The

self-locking action is derived from the greater tightening torque required for the same axial load as a conventional hex head cap screw, the extra work being absorbed by elastic movement in the slotted asymmetric head.

## THE ASYMMETRIC PLACE BOLT FEATURES IN ITS HEAD DESIGN TWO IMPORTANT FACTORS: ASYMMETRIC FORM AND ELASTIC DIAPHRAGM ACTION



The combination of the asymmetric slot design and bearing surface allows the bolt to compress and absorb tensile shock force in a way that a conventional hex head screw cannot. Typical torque tension characteristics are shown for a metric size M12 in the data tables here.

Several years ago, a leading manufacturer of transmissions, and longtime client, wanted to improve an application in which there was a hex head cap screw with an adhesive patch being used on a flex plate assembly. These 3/8-24 bolts were put through a series of torque tension tests along with an asymmetric place bolt MS-35764-1312. The results showed a 17 percent greater torque and clamp load for the asymmetric place bolt at 75 percent yield. The second phase of the test showed the results were the same at yield. Based upon these

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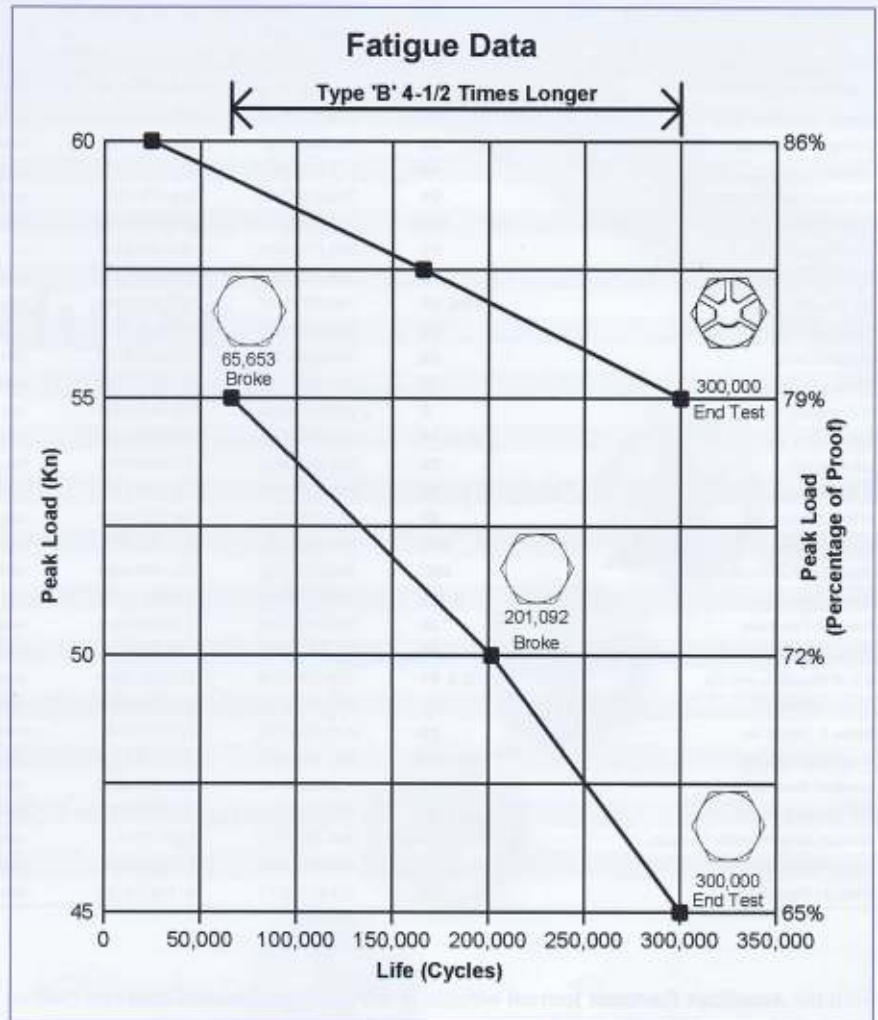


results, the customer decided to replace the traditional hex head cap screw with the asymmetric place bolt. They did, and they have been using it ever since.

Asymmetric place bolts are also produced in metric sizes. They are listed in a number of commercial and military specifications, including DOD-B-70331. Over the past few years, a major automotive manufacturer has specified M10 and M11 sizes for flex plate and flywheel bolts. Another longtime client and top transmission producer uses M8 through M16 sizes on a variety of applications.

A major automotive maker and client ran an interesting fatigue test with M12x1.75 G10.9 cap screws and type "B" place bolts. Test samples were tightened to 110 N-M on an aluminum engine block. The set-up was placed on a Skidmore machine and run at a test frequency of 35HZ. The base load was 35Kn. Tests were run at increasing peak load increments of 5Kn. These tests ran up to 300,000 cycles, or bolt failure, whichever came first. At a peak test load of 55Kn, hex head cap screws broke at about 66,000 cycles. The type "B" place bolts ran out the entire 300,000 cycles (4-1/2 times longer) and did not break. The test engineer called our company to report the results, and he stated: "The damn things work."

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### AUTHOR BIOS

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