

Fastener drive systems need to be checked

By Larry Borowski, president, Greenslade & Company Inc

The quality of a fastener drive system can have a major impact on assembly efficiency and end product integrity. The quality of the threads may be perfect, but if the drive system is improperly formed, the fasteners may not install at all or may have such poor performance that they cannot be fully tightened.

When you can't drive a fastener correctly, it can affect everything from assembly rates to service, and potentially liability issues in the field. A 'drive system' is more than just the recess or the head; it includes the threads and the mechanism used to do the driving. The following are typical questions that we receive at Greenslade regarding the quality of recesses in a fastener drive system:

Are there ways of inspecting the drives on the fasteners themselves, and if so, what should be checked?

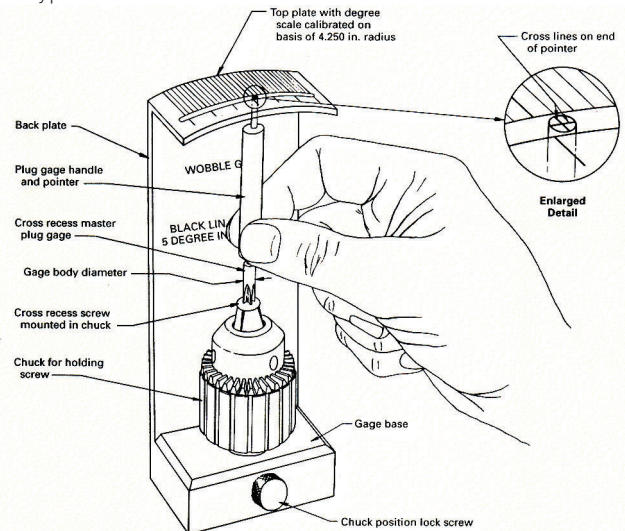
Yes, there are proper gauges and methods for inspecting all shapes and sizes of fastener drive system. Some of the most common are:

- **Slots** – Slotted drives have requirement for width and depth. There are specific gauges for inspecting both features quickly and effectively.
- **Type 1 (Phillips), Type 1A (Pozi), Type 2 (Frearson)** – This group is often referred to as the Cruciform (cross) recess. These designs are to be inspected for total recess depth, penetration depth, and wobble. Most critical are the recess penetration depth and wobble to insure that these will drive properly.
 - a. Penetration gauges will measure penetration depth to indicate whether or not the correct recess shape has the proper depth. Too deep can result in heads popping off during install, and too shallow can result in recess stripping.
 - b. Wobble gauging will measure how tight the shape is. The depth may be good, but too much wobble can result in stripped recesses during installation.
- **Hex socket recesses** – Hex recesses are to be inspected using 'GO' and 'NO-GO' Hex plug gauges to insure proper size. They should also be inspected for recess penetration depth, to insure proper key engagement.

Is checking wobble in cross recesses and square recesses really necessary?

Yes, as stated above, recess penetration depth may be within specification, however the parts may not drive properly because they are too loose or have excessive wobble. Cross recesses and square recesses are the only drives that require a wobble check. This can also be termed the 'degree of looseness'. There are precision plug gauges made specifically for checking this feature on cross recesses as well as square recesses. A typical gauge configuration is outlined in the ASME B18 standards on tapping screws, and consists of a wobble fixture and appropriate sized wobble plug. The fastener is held in the fixture, and oriented a particular way. Typically on cross recesses, the 'wings' are oriented left-right, and front-back, and on square recesses, the flats are oriented in the same manner. This is called the zero

position. The plug is then inserted into the recess, and with a slight downward pressure is 'wobbled' left to right. The total degree of movement is indicated by the position of the pointer on the opposite end of the plug relative to the degree plate on top of the fixture. The fastener is then rotated 90 degrees and the test is repeated. A recess can be acceptable in one direction, and non-conforming in the other. A sloppy recess can result in a driver bit not staying in the recess, and will ultimately affect its driving performance. This is especially problematic with longer screws of all types.



TYPICAL WOBBLE GAUGING FIXTURE

Can't I just use a driver bit to check penetration depth, fit, or wobble?

No. Although it seems like a logical functional test, recess gauges are made to much closer tolerances than driving bits are. Just because a particular drive bit appears to fit well into a recess does not mean that a gauge will accept the parts, nor that another driver bit will produce the same fit.

Well, what about the driver bits? How can I be sure those are good?

Driver bits have dimensional specifications just like fasteners do. There are a number of specific gauges outlined to inspect these tools. Not only are driver bits inspected for dimensional accuracy, they are also inspected for torsional strength to make sure they can withstand the appropriate torque to seat a screw.

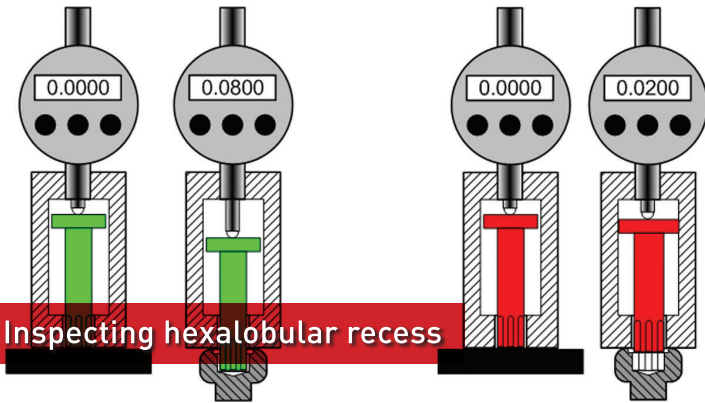
What about TORX® recesses, how are those to be inspected?

The TORX® drive system was originally developed and patented by Camcar-Textron. The patent is long expired, but the trademark name still exists, and TORX® gauges are only available through

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licensees. These drives are also referred to as hexalobe or six-lobe, etc. Whatever they are called, they all require the same gauging techniques, and most standards agree very closely as to their size, but you should still make sure to specify which standard you are working to when procuring gauges. These drives should be checked for basic size using a 'GO' and a 'NO-GO' plug gauge. In addition to size, just like most other recesses, they need to be checked for recess penetration depth. Something unique to the hexalobe recess, and a handful of others, is the 'fallaway' depth gauge. This is essentially a 'NO-GO' gauge fitted to an indicator to measure how deep it will enter the recess. There is a certain amount of taper, chamfer, or lead in allowed at the entrance of the recess, and the fallaway gauge is used to insure that it does not exceed that amount.



Inspecting hexalobular recess

In conclusion, please remember that the fastener drive system is critical to its overall performance. You need to know what you have and what specifications relate to your product. There are

many other recesses out there than what is mentioned in this article, so do your research before making assumptions. You can have perfect threads, but if the drive does not work properly, you have a fastener that will not do what it is intended to...hold things together.

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Greenslade & Company Inc is an ISO 17025 accredited provider of dimensional calibration services to suppliers of mechanical fasteners. The firm also supplies a range of fastener inspection equipment and services.

Larry Borowski has been active in the fastener industry since 2005. He holds a Bachelor's Degree in Mechanical Engineering from Syracuse University. In addition to guiding the activities of Greenslade

& Company, he is also active on the ASME B1 Committee on Screw Threads. With his expertise, he provides gauge training, and works to resolve fastener application and testing issues with his customers in the fastener industry. He is also instrumental in developing custom inspection equipment, and working through quality related issues.

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Check the Recess

Handheld RPG Gages
(Recess Penetration)

Wobble Gage Fixture
with Wobble Plugs

Recesscheker® Gage
with Recess
Penetration Elements

Recess TIR® Gage

Recess Go/NoGo
Fixed Limit Gages



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