

Fastener Drive System Quality Must Not Be Ignored In Inspection



By Joe Greenslade

Fastener drive system (recesses, slots, hexes, etc.) quality can have a major impact on assembly efficiency and end product integrity. The thread quality may be perfect, but if the recess, slot or hex shapes are improperly formed the fasteners may not install at all or install so poorly that they may be only partially tightened when driven in. When fasteners do not drive correctly assembly rates can be slowed, hurting efficiency. This is particularly a significant problem when automatic assembly equipment is used. Improperly tightened parts can come loose when the end product is put into service, creating service and possibly even liability problems.

Following are some frequently asked questions about fastener drive system quality:

Question — If parts do not drive correctly in assembly is it always a fastener problem?

Answer — No. Actually a fastener "drive system" in relation to the assembly operation consists of the power driver being used, the driving tool, and the fastener driving configuration in or on the part.

Driving problems can be related to

any or all three of these areas. For optimum fastener assembly attention needs to be given to all of them. Power drivers can be too slow, too fast, too powerful, too weak or inconsistent in output. For example, self drilling screws are designed to perform best when driven at 1800 to 2500 RPM. If they are driven at 4000 RPM, instead of being driven faster, as is often thought, the points frequently burn up. If air pressure varies on the assembly line parts may not be seated consistently. In many cases the fasteners are blamed instead of the drivers.

Driving tools (bits and sockets) which are the wrong size, wrong style, or worn cause problems which are blamed on the

fasteners. Sometimes assemblers try to use #2 Phillips driver bits to drive Pozidriv recesses. Sometimes they try to drive #3 recesses with #2 bits. Cases have been recorded of metric hex cap screws being driven with inch hex sockets and the screws being blamed because the corners rounded off the heads.

When receiving a line complaint, fastener suppliers need to evaluate the entire "drive system" to make sure that the real cause of the problem is detected and corrected. It may or may not be a fastener problem as is usually first assumed.

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

Answer — Yes, there are proper gages and methods for inspecting fastener drives.

1. Slots:

Slots have requirements for slot width and slot depth. There are slot width and depth gages available for inspecting these quickly and effectively.

2. Phillips, Pozidriv and Frearson Recesses:

This group is referred to as cruciform (cross) recesses. These designs are to be inspected for total recess depth, penetration depth and wobble. It is most critical to inspect these for both penetration depth and wobble to insure that these fasteners will drive properly.

Penetration gages measure penetration depth (see Figure 1.), which indicates whether or not the correct recess shape is

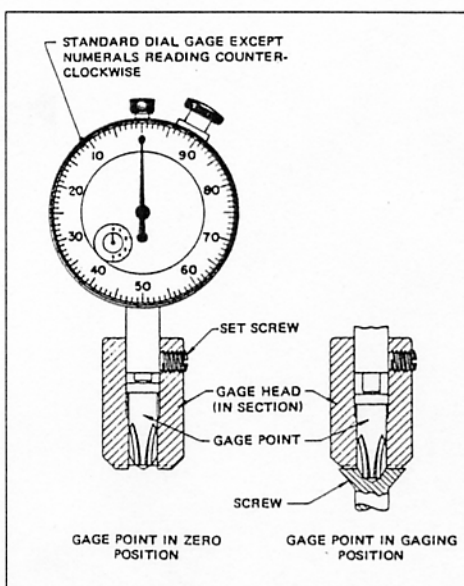


Figure 1.

Penetration Gaging — Type I Recess

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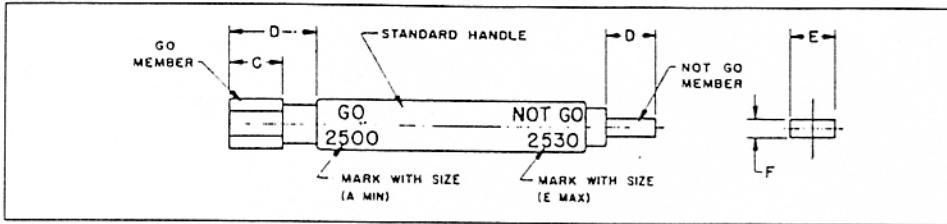


Figure 2.

Gages and Gaging For Hexagon and Spline Sockets

deep enough for proper driving in a part. The wobble gage measures how tight that shape is. A part can be correct on penetration depth but have too much wobble and the recesses will ream out or create other problems, preventing the parts from driving.

3. Hex Socket Recesses:

These need to be inspected with Go and NoGo hex recess plug gages to insure proper size, and should be inspected for key engagement depth with a hex depth gage or Go plug and optical comparator (see Figure 2.).

4. Hex and Hex Washer Heads:

These should be measured for their across flats, across corners dimensions and for the across corners minimum height (see Figure 3.). The across corners and across flats are fairly easy to measure with micrometers or calipers. A critical yet infrequently measured characteristic is the minimum height of the across corners dimension. This is measured using a gaging ring at the exact minimum size of the across corners dimension placed on top of the hex and measured on a protrusion-height gage to determine how high up the hex exhibits that minimum dimension. If

this dimension is below the specifications, it means that the corners are too rounded and the drivers may spin on the heads, causing installation problems.

Question — Is checking wobble in crossed recesses really necessary?

Answer — Yes. Total recess depth and penetration depth on crossed recesses may be within specification but the parts may not drive because the recess is too loose. This degree of looseness is called wobble. There is a precisely made gaging plug for each recess style and size for measuring wobble. The parts are held in a gage fixture which is used for all parts. The correct wobble plug is placed into the recess and slight pressure is applied side to side and the degree of wobble is measured in degrees on the top of the gage fixture (see Figure 4. on page 00). After gaging in one direction the fastener must be rotated 90 degrees and measured again. A recess can be acceptable in one direction and rejectable in another. If recesses are too loose when the parts are driven the point

at which the driver intersects the screw will “wobble” back and forth frequently throwing the bit out of the fastener head before the part is driven. This is the biggest problem when driving parts which are driven without pilot holes such as drillscrews, piercing screws, drywall screws and particle board screws. Generally longer parts are affected more by this problem than shorter screws.

Question — Can you use drivers to determine if recesses are good?

Answer — No. Recess gages are made to much closer tolerances than driving bits or sockets are. Just because a bit fits a recess it does not mean that a gage will accept the recess nor that another drive will even pass the same parts.

Question — If we check the screw recesses and know they are good, how do we know that the drivers are good?

Answer — Driving tools have specifications just like fasteners do. When there is a problem the drivers should be inspected. Slotted and hex drivers and sockets are fairly easy to measure with calipers and micrometers. There are Go and NoGo gages available for inspecting Phillips and Pozidriv bits.

Question — How are square recesses measured?

Answer — Square recesses can be measured either with a single end plug gage which has Go and NoGo lines on it or with square recess depth gages similar to a Phillips penetration gage.

Question — How are TORX recesses measured and where can we obtain the gages?

Answer — TORX recesses are properly measured with Go and NoGo plug gages for recess size and with a TORX penetration gage for recess depth. The TORX Drive System was developed and patented by Camcar-Textron. The patent recently expired but the trademark will be in force for a long time. Camcar is the only source for gages presently. My understanding is that they only sell gages to fastener manufacturers previously holding licenses. End users and distributors must buy gages

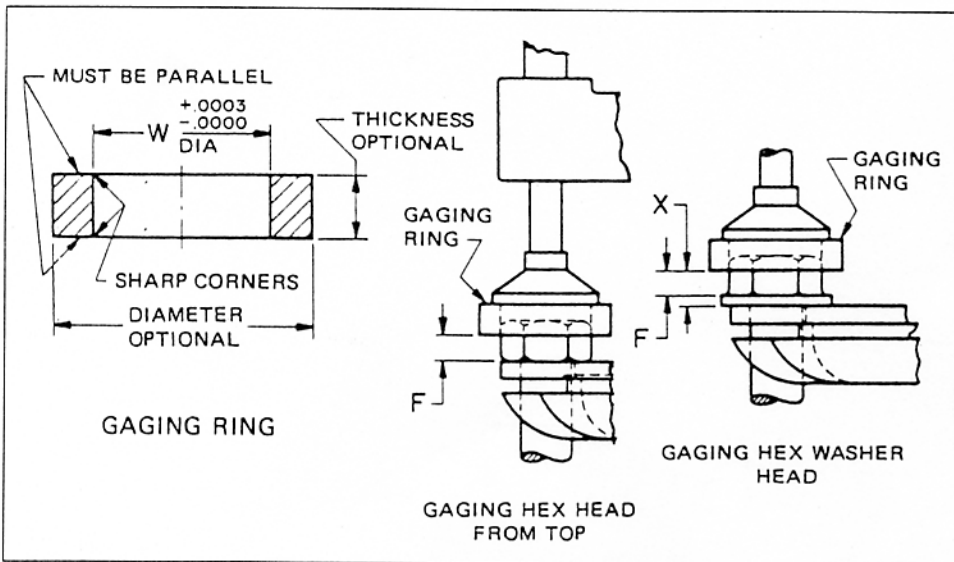


Figure 3.

Across Corners Gaging of Hex Heads

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Inspection (Continued from page 21)

through these authorized manufacturers.

In conclusion, please remember that a fastener drive system can have a major impact on assembly quality. Do not, however, always assume when there is a driving problem that it must be a fastener problem. It may be, and that is why all suppliers must inspect the recesses, slots and hexes before shipping parts, but do not forget that the "system" includes the power drivers and the driving tools. If all three elements are not correct problems can occur. Make sure that the true causes of problems are remedied and not just their symptoms. □

Joe Greenslade is President of Fastener Inspection Products, Greenslade and Company, and Tarant Machinery Exchange, Inc. He has held positions in sales, applications engineering, research and development, management and has authored several articles and a book on fastener-related topics.

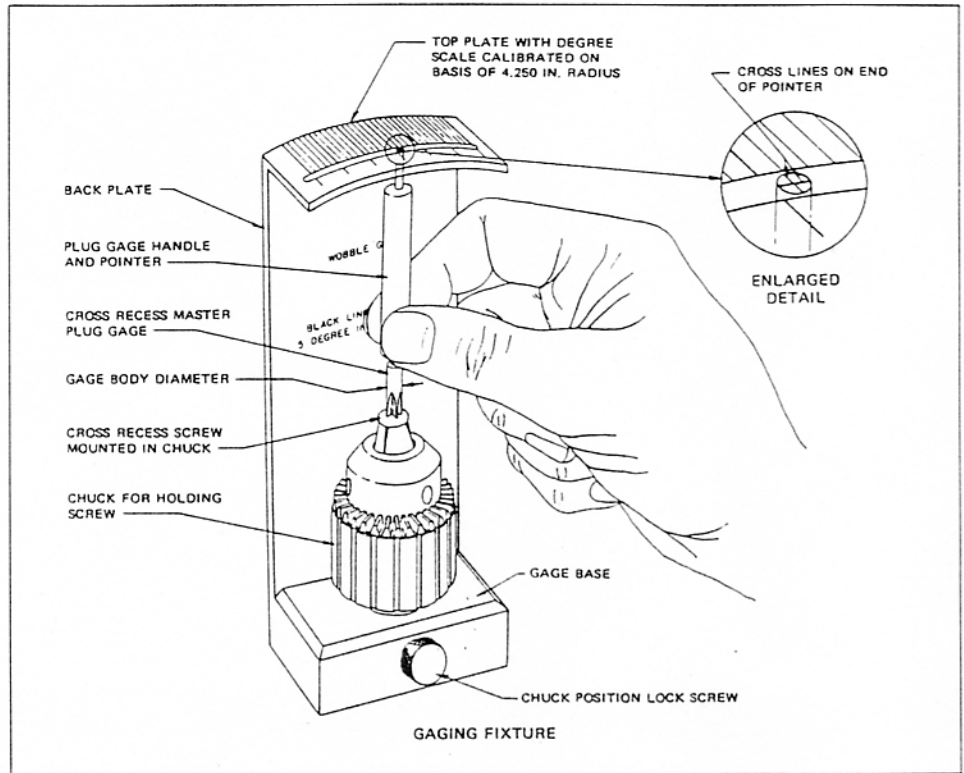


Figure 4.
Wobble Gaging of Recessed Heads

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