All Tapping Screws with Recessed Heads Should Be Inspected for Recess Wobble

The installation of many tapping screws involves the screws piercing or drilling their own holes into assembly components. A firm, positive fit between the driving tool bit and the screw's recess is extremely important to achieve the proper installation performance of these types of screws.

If there is looseness between the driver bit and the recess the screw "wobbles" on the bit and in many cases disengages from the bit entirely, thus failing to drive into the assembly. Only if the driving bit and recess create a ridged, non-wobbling connection will the screws drive into the assemblies as intended.

Piercing and driving screws are most adversely affected by recess wobble.
Many operators drive piercing and drilling screws very rapidly on assembly lines or construction sites. If the screws fail to drive into the assemblies properly a great deal of production can be lost. In many cases when the bits completely wobble out of the recess the surfaces of the assembly are marred or otherwise damaged by the disengaged driver bit. These problems make screw users extremely unhappy and in most cases result in the return of the screws to the supplier.

Wobble gaging has been a part of the American Society of Mechanical Engineers (ASME) standard B18.6.4 for over 25 years, but some manufacturers of recessed screws continue to ignore this requirement. Many suppliers are under the mistaken impression that if they measure the recess's penetration depth and it is correct the recess is good. This is not necessarily true. The incorrect forming of the screw's first blow (upset) can cause the material around the recess to splash outwardly instead of hugging the recess punch's shape in the final forming blow. In these cases the recess penetration depth can be correct, but the recess is oversized on its width and/or diameter. These conditions cause the recess not to fit tightly on driver bits and results in screw wobble.

Wobble testing is simple.
Measuring for recess wobble can be performed quickly and the results are easy to interpret. The screw is placed in the drill chuck on the fixture. With the thumb screw below the chuck loosened the chuck is positioned so that when the gaging plug is placed in the recess the end of the plug gage opposite the recess is level with the top of the fixture and the "+" on the end of the plug gage is oriented as show in the illustration. The thumbscrew is then tightened. The "+" is aligned with the wings on the recess portion of the plug gage in the case of Type I (Phillips) and Type IA (POZIDRIV®) recesses. In the case of Type III (square) recesses the "+" is oriented so that each end of the "+" points to the center of one the recess's flats.

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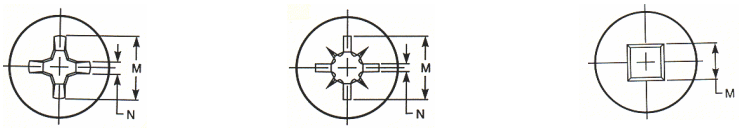
After the screw and plug are in the correct position slight pressure is applied first to one side of the plug and then the other. The inspector observes the total number of degrees the plug moves side to side and determines if the movement of the end of the plug is within the allowable number of degrees based of the recess's type and size. This determination is very easy to make because a tight recess will exhibit a very positive stop when pressed to the side and a loose recess will usually allow the plug to drop entirely to the extreme side of the fixture.

After the inspection is performed in one orientation the thumbscrew holding the chuck is loosened and the chuck is rotated 90 degrees. The thumbscrew is then tightened again so that the end of the plug gage is level with the top of the fixture. The test is then performed exactly as described above again.

The test must be performed in both orientations because it is not unheard of for a recess to be acceptably tight in one orientation and unacceptable in the other.

Total Side-to-Side Recess Wobble Tolerance in Degrees



Recess Size	Type I	Type IA	Type III *
1	15	12	6
2	12	10	4
3	10	8	4
4	10	8	4
* Type III limits are not specified by ASME. These limits are recommended by the author.			

Plating thicker than .0003 inches should be stripped before doing wobble testing.
This test is dependable when conducted on plain parts and those having plating or coating up to .0003 inches thick. Beyond that thickness the parts may have to be stripped of their plating or coating to make a valid judgment on recess wobble acceptability.

Some combination recesses should not be wobble tested.
Recess wobble testing is not applicable to all combination style recesses. Combination recesses are continually becoming more popular. The most commonly seen are combination Type I/slot (Phillips/slot) and Type I/Type III (Phillips/square) recesses.

The Type I/slot should not be used on piercing or drilling screws and these recesses should not be wobble tested because this recess style cannot be expected to meet the wobble requirements for total side movement when the slot is oriented parallel to the back of the wobble fixture. This is because the slotted area of the recess does not provide any material to interfer with the wobble plug to stop its side movement. When testing in this orientation the wobble plug will fall to the extreme side of the fixture in every test. Wobble cannot be consistently eliminated when driving this style of recess.

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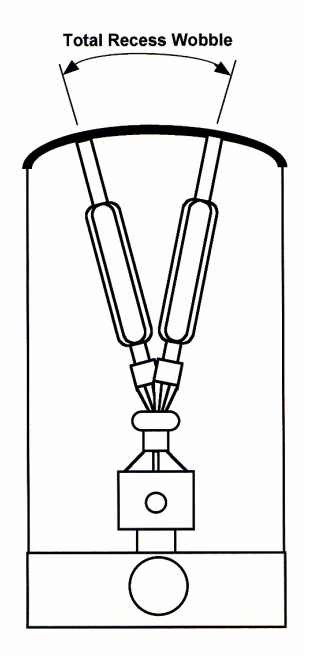
In the Type I/Type III combination recess it is intended that the square portion of the recess will be used for the initial production installation of the screws and the Type I portion of the recess is present for use only during servicing. The square portion of the recess takes away so much of the Type I core area that it can be hard to eliminate wobble from the Type I part of the recess. In this combination design recess the Type III (square) part of the recess should be subjected to the wobble test to assure that the screws will drive properly, without wobble at the point of initial assembly.

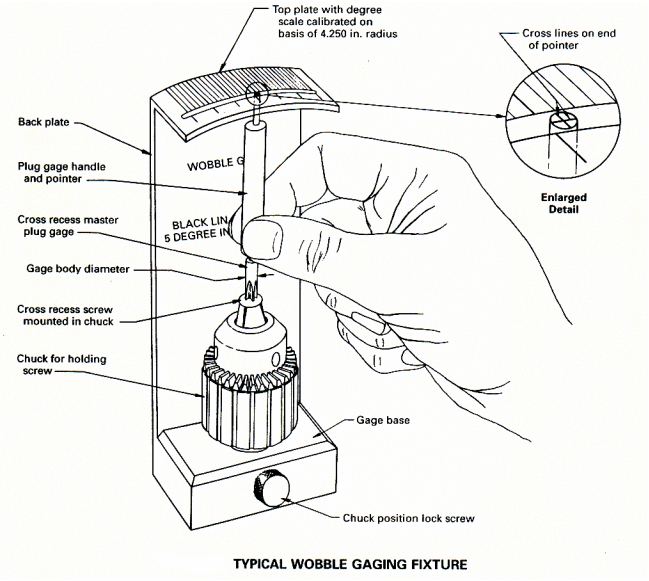
Use Type 1A wobble limits when testing Type III screws.

Recommended wobble limits for Type III (square) recesses:
The ASME standards do not yet specify the acceptable wobble limits for Type III recesses, but they are working on them for future revisions of the tapping screw standards. I recommend that until ASME does publish wobble limits that fastener suppliers should use the same limits for Type III recesses as are now specified for Type 1A recesses.

Conclusion:

Excessive wobble between screw recesses and their mating driver bits can, and do cause serious installation problems. The proper way to avoid these problems is to perform the wobble test on all recessed head tapping screws during the cold heading operation and at final inspection.





TYPICAL WOBBLE GAGING FIXTURE

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Wobble Gaging
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