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INSPECTING SCREW AND BOLT STRAIGHTNESS by Larry Borowski *President*

When a screw or bolt's length exceeds eight times its body diameter (example: 1/2-13 X 4") straightness becomes a concern for many end users. If a long screw or bolt is not sufficiently straight it can create significant assembly problems for the end user, which can then result in customer complaints or rejects for the fastener supplier.

When measuring bolt straightness, any area containing swell under the head should be avoided. ASME B18.5 states; The length of any permissible swell on the body under the head or neck of bolts should be excluded from checks for shank straightness. A good rule of thumb is to hang about 1 times the shank diameter outside of the jaws when performing this check.

Straightness gages in ASME standards

Several of the American Society of Mechanical Engineers (ASME) B18 standards appendices contain an attribute type of gage for determining part straightness. The pictured gage consists of a base plate with one stationary side rail and one adjustable side rail. The gap between the rails is set with a pair of micrometer heads. This style of gage is quite versatile and cost effective, as it will accommodate a range of diameters and lengths.

Most of the ASME standards are consistent in their straightness specifications. Screws and bolts up to and including 12 inches in length can be bowed .006 inches per inch of length. Parts exceeding 12 inches can be bowed .008 inches per inch of length. If a user's application requires a part straighter than these limits, they must specify their required straightness limits on their print and/or purchase order.

In the case of our 1/2-13 x 4" long example, the maximum allowable bow would be .024" (4" length x .006" per linear inch). When using this attribute type gage, you would add the allowable bow (.024") to the basic diameter (.500") of the bolt, and set the gage in the jaws at .524".

You would then rotate the fastener 360° in between the jaws. If the part binds, you have exceeded your maximum bow or camber. If it rotates freely, you are within your allowable bow or camber.

The camber gage illustrated in the ASME standards and shown in this article is an attribute gage. It will only indicate to the user whether or not the part being inspected is within the specified limits for straightness, but will not indicate the exact magnitude of the camber or bow in the part.



Indicating gage for measuring the amount of screw or bolt camber

To determine the extent of the bow in a part used for either gathering statistical process control (SPC) data or for final inspection documentation, an indicating, variable type of gage such as the CamberChek® is needed.

The CamberChek® gage is similar to the rail-type gage illustrated in the ASME standards except the non-stationary side rail slides on two precision bearings instead of a fixed position. The gage is designed so that gravity provides a constant closing pressure against the sliding rail. A digital indicator contacts the outside of the sliding rail for indicating the exact amount of bow in the parts being inspected by the gage.

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To determine the exact amount of camber or bow, the part is placed between the rails so that the sliding rail is at its closest position to the stationary rail. To find this spot, the bolt would be rotated 360° to determine the lowest indicator reading. The indicator is then “zeroed out”.



The part is then rotated until the maximum indicator reading is achieved. The reading on the indicator is the exact amount of camber or bow in the measured part. Unlike the fixed jaw style of gage, you do not add the screw diameter to the allowable bow. Using this style of

bolts can cause their users major assembly problems. When supplying screws and bolts that have lengths greater than eight times their body diameter, suppliers should inspect them for straightness to avoid potential customer complaints and/or rejects. ⚙

gage and our 1/2-13 x 4” fastener, you cannot exceed the .024” max allowable bow in screw or bolt to determine if it is within the acceptable straightness limits of the standard

Inspect straightness to avoid complaints

Bent screws and