Inspecting Countersunk Screw Heads

By Joe Greenslade

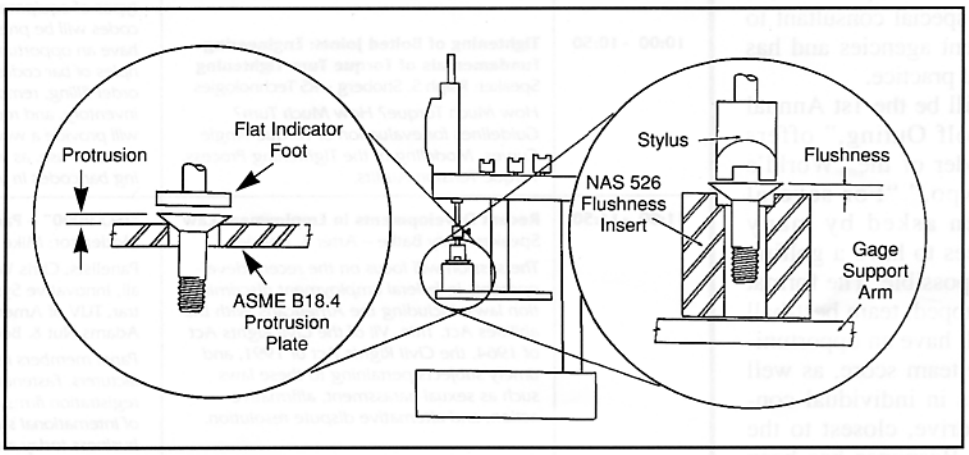
Part of the continuing confusion in the fastener industry comes from the fact that more than one term is used for the same type or style of product. One such area is the designation of screw heads with countersunk designs. These products have the same configuration, but in the commercial fastener market they are called "flat heads" and in the aerospace market they are called "flush heads."

The purpose of the countersunk head design is to provide a fastening joint in which the screw does not interfere with anything above the surface of the assembly. In the commercial fastener market, the criterion for product acceptance is whether the "flat head" screw's head will "protrude" an appropriate amount above a gaging ring diameter. In the aerospace fastener market, the criterion for acceptance is whether the "flush head" screw's head is within the tolerance of flushness above a gaging ring diameter.

"Protrusion" and "flushness" are simply two different terms for the same characteristic. There are two gage design differences between gaging for protrusion and gaging for flushness. According to ASME B18.6.3 and B18.6.4, flat head screws are measured for protrusion using a gaging ring with a straight inside diameter and an indicating devise with a flat indicator foot. According to NAS 526, flush head screws are measured using a gaging insert having a two step inside diameter and an indicating device having a fork-type foot called a stylus.

Commercial flat head screws are measured for protrusion by placing them in a straight sided gaging ring until the angled underside of the head contacts the top edge of the gaging ring. The gaging ring has a specific inside diameter for each screw diameter; these are different for 100 and 82 degree heads. An indicator having a flat foot larger than the screw's head is set to zero when resting on the top surface of the gaging ring. When the foot is then placed on top of the screw's head the indicator shows how high the top of the screw's head is above the gage's top surface. This is the screw's protrusion height.

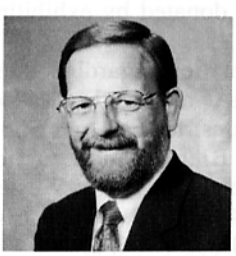
According to NAS 526, the flush head screw is to be placed in a gaging insert having two steps in its inside diameter. The large inside diameter is that which comes in contact with the underside of the screw's head. The insert's smaller diameter is slightly larger than the screw's grip diameter. The smaller diameter is intended to restrict the screw's shank position to assure that the head flushness is measured perpendicularly to the axis of the screw's shank. The stylus on the indicator is placed in contact with the top of the gaging insert and the indicator is set to zero. The stylus is then placed on top of the screw's head, so that it does not contact the screw's recess or head markings, to determine the flushness height of the head.



Digital Protrusion/Flushness Gage

Different sized insert inside diameters and stylus sizes are required to measure different size screws. Unlike commercial protrusion gages that have one given gaging diameter for each screw diameter, NAS flushness gaging diameters vary depending upon the screw's specific NAS number.

Do not be confused. "Flat head" and "flush head" are two ways of referring to screws with a countersunk head design. "Protrusion" and "flushness" are interchangeable terms referring to the amount a screw's countersunk head stands above a defined gaging ring diameter. The amount of "protrusion" or "flushness" on countersunk screw head fasteners is generally critical to their proper performance in their intended application. This inspection characteristic has been widely ignored by suppliers for years. This needs to stop. Particularly in the case of aerospace countersunk screws, the correctness of the head's flushness is much more critical to aircraft performance than even the quality of the threads. Fastener suppliers should properly inspect all countersunk screws for protrusion/flushness to assure that finished products assemble and perform properly. ❑



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Joe is an inventor, author, and lecturer. He holds eleven U.S. Patents, has written over 80 technical articles for industrial trade journals, and has spoken frequently at trade association meetings and technical conferences on issues related to industrial quality for the past ten years.

He is an Associate Member of the Industrial Fastener Institute and a member of the American Society of Mechanical Engineers B1 Thread Specification Committee. In 1992, Joe was recognized for his technical and innovative contributions to the fastener industry when, at age 44, he became the youngest person to be inducted into the National Industrial Fastener Show "Hall of Fame."