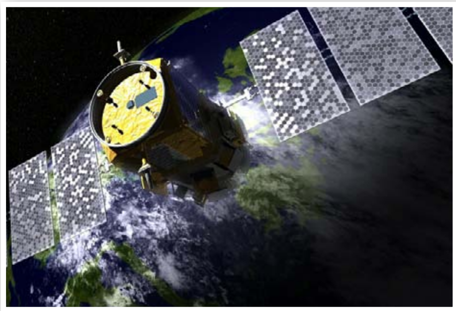
Understanding Aerospace Fastener Descriptions and Markings

by Laurence Claus

A great deal of manufactured fasteners are "standards". This means that they conform to a set of instructions that have been established by industry experts to provide uniform and consistent product. Although one finds "standards" in all industry segments, the aerospace fastener segment seems to have a higher percentage than most others.

In fact, over 40% of the aerospace fastener consumption can be classified as "standards". Although the word standard lends itself to suggesting simplicity, in reality many parts considered "aerospace standards" are, in reality, very sophisticated, highly engineered parts. Unfortunately, because of the vast assortment of standards and the complexity level that some are achieving, navigating and understanding aerospace standards can sometimes be a challenge. This article is intended to demystify and explain some of the nuances of aerospace standard part description and marking practices.



First of all, one might ask what standards are considered to define common aerospace fasteners. For the purpose of this article we will reduce the answer to that question down to only the standards produced by consensus and government standard organizations. This means that even though they may have their own brand of "standard" parts, we will exclude individual companies such as Boeing or Lockheed from this discussion. Instead we will answer this as the standards created by the National Aerospace Standards Committee (NASC), US Government agencies such as the Department of Defense, the US Air Force, or NASA, and SAE Aerospace Standards.

The National Aerospace Standards Committee is an operating entity of the Aerospace Industries Association (AIA). As such its members consist of prominent aerospace OEM and supplier companies. To enhance its technical input to the standards it creates and maintains, this committee encourages participation of other interested and knowledgeable parties outside of AIA membership by enabling a process to recruit "Technical Advisors". The NASC develops and maintains four different families of standards, NAS, NASM, NA, and NAM. The most predominant series are the NAS standards and reflect inch products derived and used across both commercial and military aircraft. The NASM series are inch products that began as military standards but were subsequently transferred to NASC oversight for continuing maintenance and development. NA standards are the NAS counterparts in metric while the NAM are metric counterparts to NASM parts.

There are a variety of US Government standards that are utilized by the aerospace industry. The most common are MS and AN standards. These tend to be product standards or ones that define how to actually produce a part. There are others, however, such as MIL and FED standards that are also commonly used. The difference, however, is that these standards generally define a system or a component subset technology such as screw threads, head marking, or packaging.

Whereas the NASC standards generally define the product, there must exist a set of standards for the materials. These are SAE's AMS or Aerospace Material Standards. These generally describe a specific raw material such as specific alloy or corrosion resistant steel grades (for example 8740 or A286) or a material process such as cadmium or zinc electroplating.

Once the right standard has been identified the next challenge is to understand how to interpret the desired part relative to the written standard. Unfortunately, because different standards apply different conventions, understanding one standard does not necessarily guaranty that the same understanding can be applied to a different standard. For example, one standard may incorporate only a single part number with different codes to describe a variety of part diameters , while another standard may describe each part diameter with a different part number. Take for example NAS1189, a different "dash number" is used to describe diameters from a #2 all the way to 3/8". On the other hand, NAS624 through NAS644 (a single standard) gives a different NAS part number for each diameter starting at ¼" and going all the way to 1 ½" in diameter.

In addition to describing the diameter, the standard must also describe various lengths, both overall and grip length (for those that apply). This is also accomplished with a "dash number". The "dash number" gets its name from the fact that it follows the baseline part number with a dash. One can see how this can get confusing quickly, however, especially if one part number uses a dash number to describe diameter and length while another one only describes length.

This is further complicated in that there may be "dash number" codes that distinguish other important, descriptive information about a part such as its base material recess style, locking feature, and surface finish. The same part, for example, may be available in an alloy steel, corrosion resistant steel (CRES), and titanium all in the same standard. The only way to separate these is to include the code in the part number/description. Additionally, where the standard has multiple choices for other features such as locking features, recess styles, and surface finishes, a set of codes must be established and utilized.

Reviewing a couple of examples:

Suppose a part has the description NAS1189-V06T8A- what does it mean?

If one received a request for this part or was given a part to identify, reviewing the standard would show that this to be a #6 diameter x ½" long NAS1189 part made of titanium with an offset cruciform recess and aluminum coating. In this case the part number breaks down as follows:

- **NAS1189= Basic Part Family/Number**
- **V= Titanium material**
- **06= Diameter (in this case a #6)**
- **T= Recess style (in this case an offset cruciform)**
- **8= Length (in this case in 1/16" increments so, 8/16 or ½")**
- **A= Surface finish (in this case aluminum)**

It should be noted that one must be very careful and possess a good working knowledge of how to interpret these standards. Take for example, the part number NAS1189-V6T8A. With one minor change a completely different part emerges. In the original example the part number describes a #6 (0.1380") diameter part, as denoted by the '06' designation while the second example is a 3/8 in. (0.375") diameter part described only by '6'.

Looking at a different example, take NAS628-40.

In this standard the material, strength, and plating are fixed with single options. Therefore, the only dash number needed is for length. In this example the NAS628 part number identifies it as a ½" diameter part and the '40' identifies a total length of 3.241" for total length and 2.500" for grip length. Although this part is much more straight forward, it, too, can hold a couple of tricky points. When one consults Table III in the standard one finds that all the dash numbers are even. How does one interpret an odd number? For example, what if the part description above replaces the '40' with a '41'? To answer this one has to consult the standard and find out what the default length increment is. In this instance it is 0.062" for each dash number increment. Therefore, a part with a

'41' dash number would have a grip length of 2.562" and an overall length of 3.303" or exactly 00.062 in. longer than the previous dash number length.

To be accomplished at understanding these standards one must also be able to recognize the codes given for different part component features. In many cases the authors of the standards have to describe a proprietary type of technology. In an effort to be as inclusive as possible, however, the specific trade names are converted into generic terms. For example, individuals in the aerospace industry readily identify the unique geometry of a Torq-set® recess, but in the standards it is simply known as an offset cruciform. Table 1 provides a listing of the many more commonly applied generic terms and the tradenames they are recognized in the industry by.

Generic Term	Trade Name
Offset Cruciform	Torq-set®
Offset Cruciform with ribs	Torq-set® ACR®
Cruciform	Phillips®
Cruciform with ribs	Phillips® ACR®
Six Lobe	Torx®
Dovetail Slot	Hi-Torque®
Tri-Slot	Tri-Wing®
Nickel-Copper	Monel®
Nickel Alloy	Inconel®

One of the unique and frankly more impressive aspects about aerospace fasteners is the ability of the manufacturer to get much of the normal part number crisply and clearly imprinted on the head. **Figures 1, 2,** and **3** illustrate different examples of aerospace head markings. Much can be gleaned about the part from the head marking and a quick visual examination of the part. Figure 1 shows an example of NAS1580-V5-9. From this, one immediately knows that the part belongs to the NAS1580 family of parts. Although this may require someone not skilled with aerospace fasteners to use the other marking clues to figure out the part is Titanium (denoted by the V) and 9/16 in (0.5625 in) long (denoted by the '9' dash number. The '5' denotes the diameter, which is 5/16 in. (0.3125 in.) This is an example of a part family where the dash numbers are needed to tell both the diameter and the length. Figure 2 shows NAS6306-18D. Again, one can quickly see that the part is from the NAS6306 family of parts, 1 1/8 in. long (denoted by the '18' dash number) and drilled shank (denoted by the 'D'). Unlike the example in Figure 1, this is an example of a part family where all parts in the family are the same diameter, in this case 3/8-24. Figure 3 shows NAS1802-6-30. This is a particularly interesting case because the standard only requires the first dash number on the marking. In this case, the '6' denotes a 3/8 in. (0.3750 in.) part diameter.

In these examples, the information gleaned by the head markings is basically the diameter, length, and material. The part itself serves to define some of the other information such as recess style and plating type. In addition to the actual marking, each head will


Figure 1: NAS 1580-V5-9


Figure 2: NAS6306-18D


Figure 3: NAS 1802-6

be marked with a manufacturer's identification. These are represented by the black boxes in these pictures.

There is a great deal to learn about interpreting aerospace fastener standards, However, for anyone working with aerospace fasteners, this skill is a prerequisite. Although studying a guide like this is likely helpful, nothing replaces good, old-fashioned practical experience and practice. The more time one invests in studying the standards and delving into the detail, the easier this task becomes.